November 4, 2021

Closure Completion Notification

Big Sandy Plant

Fly Ash Pond

On October 7, 2021, the Big Sandy Plant Fly Ash Pond was transitioned to closure status in accordance with 40 CFR 257.102. The CCR unit was closed in place and has initiated the written Post Closure Plan. This notice of completion of closure is being placed in the operating record in accordance with 40 CFR 257.102(h).

Effective with the Closure Completion Notification, the following operating record documents, as applicable, are no longer required going forward:

- Hazard Potential Classification
- Emergency Action Plan
- Face to Face Meeting Documentation for EAP
- History of Construction and Revisions for Surface Impoundments
- Structural Stability Assessments
- Safety Factor Assessments
- Fugitive Dust Plan
- Inflow Design Flood System Control Plan

CLOSURE CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

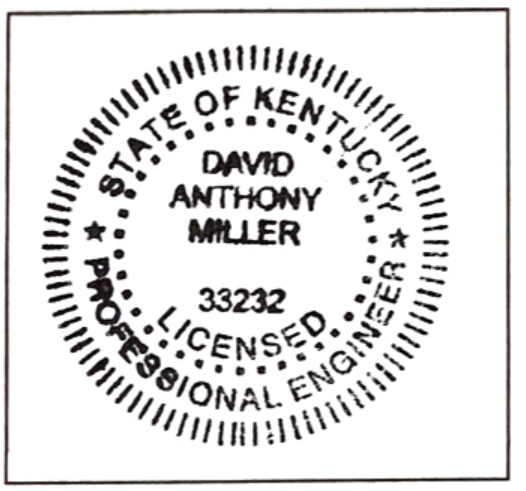
I certify that the Big Sandy Plant Fly Ash Pond (FAP) has been closed in accordance with the closure plan specified by paragraph 257.102(b) and the requirements of section 257.102.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



33232	KENTUCKY	11.04.21
License Number	Licensing State	Date

8. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

FLY ASH POND PHASE I CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky's Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Closure Construction Quality Assurance Certification Report dated November 27, 2018 is true and correct and has been prepared in accordance with the accepted practice of engineering.

PE Thomas A. Kovacic DATE October 4, 2021

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300

8. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

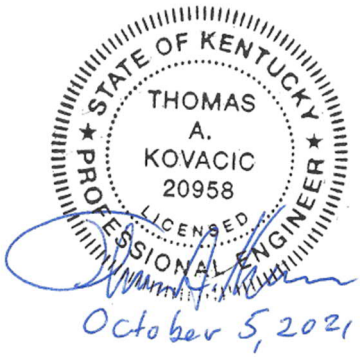
FLY ASH POND PHASE II AND PHASE III 2018 CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Phase II and Phase III 2018 Closure Construction Quality Assurance Certification Report dated January, 2020, is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE Thomas . Kovacic DATE October 5, 2021

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300



9. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

FLY ASH POND PHASE III AND PHASE IVA 2019 CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying report is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE Thomas A. Kovacic DATE October 5, 2021

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114
TELEPHONE (216)-622-2300

9. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

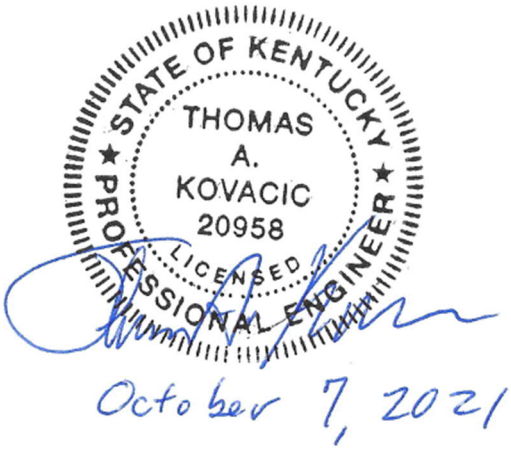
FLY ASH POND PHASE IV 2020 and 2021 AND FINAL CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Phase IV 2020-2021 and Final Closure CQA Certification Report is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE Thomas A. Kovacic DATE October 7, 2021

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300



Report of CCR Rule Stability Analyses
Big Sandy Power Plant Bottom Ash Pond Complex (BAPC), Fly Ash Pond Main Dam, and Fly Ash Pond Saddle Dam

Louisa, Lawrence County, Kentucky

Prepared for:
American Electric Power
Columbus, Ohio

Prepared by:
Stantec Consulting Services Inc.
Cincinnati, Ohio

February 16, 2016

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Executive Summary

The American Electric Power (AEP) Big Sandy Power Plant is located in Lawrence County, Kentucky approximately four miles north of Louisa. The plant is situated on the inside of an eastward to northward bend of the Big Sandy River. The Bottom Ash Pond Complex (BAPC) is approximately 500 feet northeast of the river and is comprised of four ponds, partially bounded by an earthen embankment dike system. The bottom ash pond network currently serves as a settling facility for sluiced bottom ash produced at the plant. The ponds are formed by natural grade to the north and west and a series of embankments that divide the ponds and form the south and east boundaries. The Big Sandy River lies to the south of the complex.. The four ponds are identified as the North and South Clearwater Ponds and the North and South Bottom Ash Ponds.

The Fly Ash Pond is bounded by natural topography on its west, south, and east sides. The Fly Ash Pond Main Dam forms the pond's north boundary and the Fly Ash Pond Saddle Dam forms a portion of its east boundary. The Main Dam and the Saddle Dam are located approximately 4,100 feet and 2,100 feet northwest of the plant, respectively.

In 2010, Stantec Consulting Services Inc. (Stantec) was contracted to perform a geotechnical exploration, seepage and stability analyses, and a liquefaction assessment of the dike system for the BAPC. In addition, Stantec was contracted in 2010 to perform a geotechnical exploration and instrumentation installation at the Fly Ash Pond Main Dam. One-inch diameter standpipe piezometers were installed along the upstream side of the dam crest at three locations.

In response to the Coal Combustion Residual (CCR) rules mandated in the Federal Register on April 17, 2015, AEP contracted Stantec to perform additional stability analyses for the BAPC, Fly Ash Pond Main Dam, and Fly Ash Pond Saddle Dam to estimate static, seismic, and liquefaction potential factors of safety. As a part of the CCR-related analyses, four additional borings were advanced at the plant to allow for additional data collection and material characterization.

According to Section 257.73(e)(1)(i) through (iv) of the mandate, the factor of safety assessment CCR rules are:

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

The factors of safety obtained during the analyses for static and seismic load cases were greater than those required for Section 257.73 (e)(1)(i) through (iii). The average factor of safety for each soil horizon that was susceptible to liquefaction was greater than that required in Section 257.74 (e)(1)(iv). The results of the 2015 CCR review can be found in Section 6.1 for the BAPC, Section 6.2 for the Fly Ash Pond Main Dam, and Section 6.3 for the Fly Ash Pond Saddle Dam.

1.0 INTRODUCTION

The American Electric Power (AEP) Big Sandy Power Plant is located in Lawrence County, Kentucky approximately four miles north of Louisa. The plant is situated on the inside of an eastward to northward bend of the Big Sandy River. The Bottom Ash Pond Complex (BAPC) is approximately 500 feet northeast of the river and is comprised of four ponds, partially bounded by an earthen embankment dike system. The bottom ash pond network currently serves as a settling facility for sluiced bottom ash produced at the plant. The ponds are formed by natural grade to the north and west and a series of embankments that divide the ponds and form the south and east boundaries. The Big Sandy River lies to the south of the complex. The four ponds are identified as the North and South Clearwater Ponds and the North and South Bottom Ash Ponds.

The Fly Ash Pond is bounded by natural topography on its west, south, and east sides. The Fly Ash Pond Main Dam forms the pond's north boundary and the Fly Ash Pond Saddle Dam forms a portion of its east boundary. The Main Dam and the Saddle Dam are located approximately 4,100 feet and 2,100 feet northwest of the plant, respectively.

Stantec Consulting Services Inc. (Stantec) was contracted to perform a geotechnical exploration, seepage and stability analyses, and a liquefaction assessment of the dike system for the BAPC in 2010. The intent of the project was to develop subsurface data at cross sections along the dam and to perform conventional seepage and stability analyses, assessing the performance of the dike system. The potential for liquefaction was to be evaluated according to simplified published methods. In addition, Stantec was contracted in 2010 to perform a geotechnical exploration and instrumentation installation at the Fly Ash Pond Main Dam. One-inch diameter standpipe piezometers were installed along the upstream side of the dam crest at three locations.

In response to the Coal Combustion Residual (CCR) rules mandated in the Federal Register on April 17, 2015, AEP contracted Stantec to perform updated stability analyses for the BAPC, Fly Ash Pond Main Dam, and Fly Ash Pond Saddle Dam to estimate static, seismic, and liquefaction potential factors of safety. According to Section 257.73(e)(1)(i) through (iv) of the CCR Rules, the required factors of safety are as follows:

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

Table 1 summarizes the geometric characteristics of the embankments.

Table 1 Big Sandy Facility Geometry

Facility Section	Height (feet)	Crest Width (feet)	Downstream Slope Grade	Upstream Slope Grade
BAPC Section A-A'	9	22	2.5H:1V*	1.75H:1V*
BAPC Section B-B'	16	28	2.75H:1V*	2H:1V*
BAPC Section C-C'	5	15	4.25H:1V*	2H:1V*
Fly Ash Pond Main Dam	176	30	1.75H:1V*	3H:1V*
Fly Ash Pond Saddle Dam	61	30	1.75H:1V*	2.75H:1V*

*Denotes horizontal to vertical ratio

2.0 GEOLOGY OF THE SITE

The Illustrated Physiographic Diagram of Kentucky (Kentucky Geologic Survey, 2001) indicates that the site is located in the Cumberland Plateau and Mountains physiographic region or, more commonly, the Eastern Coalfields. This region is typically described as a highly dissected area with steep valley walls and narrow, sinuous valleys. The bedrock tends to consist of shale and sandstone, and subsurface and surface coal mining has been practiced for many years.

The soil survey (United States Department of Agriculture [USDA], 2015) indicates the surficial soils at the BAPC are of the Udorthents-Urban land complex (UdC). This soil is described as a mixture of soil and rock material that has been drastically disturbed due to construction activity. The soil is found on slopes of 0 to 12 percent.

The soil survey indicates the surficial soils at the Fly Ash Main Dam are predominantly classified as Dumps (Dm) within the pond, described as mine tailings and tipples. The surficial soils on the left abutment are predominantly Vandalia-Beech complex (VaF2) and Upshur-Rarden Complex (UpF). These soils are described as silt loam, silty clay, or silty clay loam, 20 to 60 percent slope, well-drained, with a moderately low to moderately high capacity to transmit water. The right abutment is composed of Shelocta-Hazleton-Fedscreek Complex (ShF) and Upshur-Rarden Complex (UpF). These soils are described as silty clay, silty clay loam, silt loam, or channery silt

loam, 25 to 60 percent slope, well-drained, with a moderately low to high capacity to transmit water.

In addition to the Dumps (Dm) within the pond at the Fly Ash Saddle Dam, Vandalia-Beech (VaF) complex is also present within the footprint of the dam. Upshur-Rarden Complex (UpF) is located at both abutments.

The geologic map (Web Geologic Map Service, Kentucky Geologic Survey, 2015) indicates that the area of the BAPC is underlain by alluvium of the Quaternary Period. This alluvium consists of silt, sand, and gravel or unconsolidated deposits of the present drainage. The area of the Fly Ash Pond Main and Saddle Dams is underlain by bedrock from the Conemaugh Formation and Princess Formation of the Pennsylvanian Period. The Conemaugh Formation includes beds between the Upper Freeport Coal and the base of the Pittsburgh Coal seams. The area of outcrop is restricted to Lawrence and Boyd Counties in Eastern Kentucky. The thickness of the formation ranges from 450 to 600 feet, with the lower 100 feet of the formation consisting largely of sandstone. The upper part consists of heavy sandstones, shales, and limestones. The Princess Formation underlies the Conemaugh Formation and contains marketable coal and clay seams. The Princess Formation is typically comprised of limestone, coal, siltstone, and sandstone.

3.0 FIELD EXPLORATIONS AND SITE RECONNAISSANCE

3.1 BOTTOM ASH POND COMPLEX

3.1.1 2010 Geotechnical Exploration

In 2010, Stantec advanced six borings at locations requested by AEP. The boring locations are shown in Appendix A. Borings B-1 and B-2 were located south of the South Bottom Ash Pond at the crest of the dike and at the toe of the dike, respectively. Boring B-3 was positioned north of the North Bottom Ash Pond. Boring B-4 was located between the North Clear Water and North Bottom Ash Ponds, and Boring B-5 was located between the South Clear Water and South Bottom Ash Ponds. Boring B-6 was positioned along the crest of the dike south of the South Clear Water Pond.

The borings were advanced using 3¼-inch inside-diameter hollow-stem augers powered by a truck-mounted drill rig. Standard penetration tests (SPTs) were performed at 2.5-foot intervals in accordance with ASTM D 1586. Undisturbed Shelby tube samples were performed at selected intervals to obtain samples for consolidated-undrained (CU) triaxial compression (ASTM D 4767) and permeability testing (ASTM D 5084). Sample depths and recovery amounts are presented on the boring logs in Appendix B. Additionally, disturbed bag samples were collected from auger cuttings obtained from the boreholes.

A Stantec geotechnical engineer directed the drill crews, logged the subsurface materials encountered during the exploration and collected soil samples. During field logging, particular attention was given to the material's color, texture, moisture content, and consistency or relative density.

Upon completion of drilling, one-inch diameter standpipe piezometers were installed in three of the borings (Borings B-1, B-2, and B-6). In these, ten-foot long sections of polyvinyl chloride (PVC) well screen were placed in the borehole with the bottoms at approximate depths of 20 feet. PVC riser tubing was extended to the tops of the piezometers. Refer to Appendix C for piezometer installation details.

Following the field exploration, the SPT samples, Shelby tubes and bag samples were transported to Stantec's (or certified vendor's) laboratory for testing. Natural moisture content tests (ASTM D 2216) were performed on the SPT samples. Unit weight testing (ASTM D 7263) was performed on samples extruded from Shelby tubes. Classification testing, consisting of sieve and hydrometer analysis (ASTM D 422) and Atterberg limits (ASTM D 4318), were performed on representative samples of the predominant soil horizons. Consolidated-undrained (CU) triaxial compression tests (ASTM D 4767) and falling head permeability tests (ASTM D 5084) were performed on Shelby tube samples. Standard Proctor moisture-density testing (ASTM D 698) was performed on bag samples collected from the borings.

3.1.2 2015 CCR Mandate Site Reconnaissance

Representatives from Stantec visited the BAPC for a site reconnaissance on August 4, 2015. The purpose of this visit was to confirm that physical conditions at the pond, such as geometry of the embankment, pool elevations, etc. had not changed since the completion of the analysis in 2010. The crest and exterior slopes of the pond were walked by Stantec personnel, while the interior slopes were observed from the crest. Evidence of alterations to the pond since 2010 were not observed during the reconnaissance.

3.1.3 2015 Geotechnical Exploration

To further characterize the silty sand/sandy silty clay layer from approximate Elevation 565 to 550 feet, an additional boring (Boring BA-15-1) was advanced on October 27, 2015 by Triad Engineering, Inc. (Triad), logged by Stantec. Boring BA-15-1 was positioned on the crest between the North Clear Water Pond and the North Bottom Ash Pond. Starting at a depth of 10 feet (approximate Elevation 567 feet), alternating SPT and undisturbed Shelby tube samples were collected at 2.5-foot intervals to a depth of 30 feet (approximate Elevation 547 feet). The borehole was filled with cement-bentonite grout upon completion.

Following the field exploration, the SPT and Shelby tubes were transported to Stantec's laboratory for testing. Natural moisture content tests were performed on the SPT samples.

Classification testing consisting of sieve and hydrometer and Atterberg limits were performed on one SPT sample. CU triaxial and direct shear (ASTM D 3080) tests were performed on selected undisturbed and remolded samples.

3.2 FLY ASH POND MAIN DAM

3.2.1 2010 Geotechnical Exploration

In 2010, Stantec advanced four borings on the Fly Ash Pond Main Dam using 4¼ -inch inside diameter hollow stem augers powered by a truck-mounted drill rig. SPT samples were collected at five- to ten-foot intervals, and the samples were observed and logged by a geotechnical engineer with attention given to the texture, color, consistency or relative density, and natural moisture content of the material. The boreholes were checked for the presence of groundwater while drilling. The locations of the borings are provided in Appendix A of the report. Logs for the borings are provided in Appendix B.

Instrumentation was installed in each of the boreholes upon completion of drilling. One-inch diameter standpipe piezometers were installed in Borings B-1, B-2, and B-3 along the upstream side of the dam crest. PVC well screens were installed in the bottom 20 feet, backfilled with sand, and sealed with a two-foot thick bentonite plug. Well risers were installed above the screen to the surface and each annulus was backfilled with cement-bentonite grout. Slope inclinometer casing (2¾-inch diameter) was installed in Boring B-4 near the middle of the dam on the downstream side of the crest. The annulus was backfilled with cement-bentonite grout. Concrete pads, lockable steel covers, and steel-pipe bollards filled with concrete were installed at the surface at the instrumentation locations. Details of the installation are included in Appendix C.

Driving difficulty was encountered in Boring B-4 at an approximate depth of 140 feet, where the augers were unable to be advanced downward or upward. The augers were eventually worked free, and the boring was redrilled at a location 10 feet east of the original location, which is where the slope inclinometer was installed.

The SPT samples were returned to Stantec's testing laboratory, where they were subjected to natural moisture content testing, classification testing, and specific gravity testing (ASTM D 854). The specific gravity testing was performed on fly ash and bottom ash materials, while a specific gravity of 2.7 was assumed for soils. Data sheets showing the results of the laboratory testing are provided in Appendix D.

3.2.2 2015 CCR Mandate Site Reconnaissance

Representatives from Stantec visited the Fly Ash Pond Main Dam for a site reconnaissance on August 4, 2015. The purpose of this visit was to confirm that physical conditions at the dam, such as geometry of the embankment, pool elevations, etc. had not changed since the completion of the exploration in 2010. The crest and downstream slope of the dam were walked by Stantec personnel, while the upstream slope was observed from the crest. Evidence of alterations to the dam since 2010 was not observed during the reconnaissance.

3.2.3 2015 Geotechnical Exploration

To further characterize the random rock fill zone on the downstream portion of the dam, an additional boring (Boring FA-15-1) was advanced from the downstream bench that is at an approximate surface elevation of 590 feet. The boring was completed by Triad, logged by Stantec on November 2, 2015. Starting at a depth of 5 feet (approximate Elevation 585 feet), alternating SPT and undisturbed Shelby tube samples were obtained at 2.5-foot intervals to a depth of 30 feet (approximate Elevation 560 feet). The borehole was filled with cement-bentonite grout upon completion.

Following the field exploration, the SPT and Shelby tubes were transported to Stantec's laboratory for testing. Natural moisture content tests were performed on the SPT samples. Classification testing consisting of sieve and hydrometer and Atterberg limits were performed on selected SPT samples. CU triaxial testing was performed on selected undisturbed samples.

3.3 FLY ASH POND SADDLE DAM

3.3.1 2015 CCR Mandate Site Reconnaissance

Geotechnical explorations similar to those performed at the BAPCs and Fly Ash Pond Main Dam were not performed by Stantec on the Fly Ash Pond Saddle Dam in 2010. Representatives from Stantec visited the Fly Ash Pond Saddle Dam for a site reconnaissance on August 4, 2015. The purpose of this visit was to confirm that physical conditions at the dam, such as geometry of the embankment, pool elevations, etc. were the same as those used for the analysis sections developed in "Big Sandy Plant: Fly Ash Retention Dam Stage 3 Raising Engineering Report" (AEP, 1993). The crest, downstream slope, and upstream slope of the pond were walked by Stantec personnel. Alterations to the dam since 1993 were not noticeable during the reconnaissance.

3.3.2 2015 Geotechnical Exploration

To further characterize the foundation conditions of the dam, two additional borings (Borings SD-15-1 and SD-15-2) were advanced from the crest of the saddle dam (approximate Elevation 711 feet). The borings were performed by Triad and logged by Stantec on October 30 and

November 2, 2015. SPT and occasional undisturbed Shelby tube samples were obtained at 5-foot intervals until bedrock was encountered at a depth of approximately 75 to 80 feet. The boreholes were filled with cement-bentonite grout upon completion.

Following the field exploration, the SPT and Shelby tubes were transported to Stantec's laboratory for testing. Natural moisture content tests were performed on the SPT samples. Classification testing consisting of sieve and hydrometer and Atterberg limits were performed on selected SPT samples. CU triaxial testing was performed on selected undisturbed samples.

4.0 RESULTS OF EXPLORATIONS

4.1 BOTTOM ASH POND COMPLEX

Logs of borings are provided in Appendix B. Results of natural moisture content tests and SPTs are provided on the logs adjacent to the appropriate sample. Details of the piezometers installations are shown in Appendix C. Summaries of engineering classification tests are provided in Appendix D.

4.1.1 Boring B-1

Boring B-1 was positioned along the southern crest of the South Bottom Ash Pond, and 0.5 feet of gravel was observed at the surface. The surface elevation of this boring was 579.9 feet. Below the gravel, sandy lean clay (fill) was encountered to a depth of 10.0 feet (Elevation 569.9 feet). This soil was described as yellowish brown to grayish brown, moist, and stiff to very stiff. Natural moisture contents varied from 14 to 15 percent, and SPT N-values ranged from 13 to 15 blows per foot (bpf). Below the sandy lean clay (fill), additional sandy lean clay was encountered to a depth of 21.5 feet (Elevation 558.4 feet). This soil was described as yellowish brown to grayish brown, moist, and stiff. Natural moisture contents varied from 16 to 21 percent, and SPT N-values ranged from 10 to 11 blows per foot. Another strata of sandy lean clay was observed to a depth of 36.5 feet (Elevation 543.4 feet). This sandy lean clay was described as reddish brown, moist to wet, and very soft to medium stiff. Natural moisture contents ranged from 22 to 33 percent, and SPT N-values varied from 2 to 8 blows per foot. Below the sandy lean clay to the boring termination depth of 61.5 feet (Elevation 518.4 feet), well-graded sand with silt was observed. This material was described as light yellowish brown, damp to wet, and loose to medium dense. Natural moisture contents ranged from 5 to 21 percent, and SPT N-values varied from 9 to 29 blows per foot. Groundwater was observed at a depth of 57.0 feet (Elevation 522.9 feet) during drilling. Bedrock was not encountered.

4.1.2 Boring B-2

Boring B-2 was located at the toe of the slope south of the southern crest of the South Bottom Ash Pond. Gravel was observed at the surface to a depth of 0.5 feet. The surface elevation of the boring was 567.8 feet. Sandy lean clay was encountered below the gravel to a depth of 13.0 feet (Elevation 554.8 feet) and was described as yellowish to grayish brown, moist, and stiff. Natural moisture contents ranged from 19 to 26 percent and SPT N-values varied from 9 to 15 blows per foot. Additional sandy lean clay was observed to a depth of 23.0 feet (Elevation 544.8 feet). This material was described as reddish brown, moist to wet, and very soft to medium stiff. The natural moisture contents ranged from 22 to 30 percent and SPT N-values varied from 1 to 7 blows per foot. Well-graded sand with silt was observed below the sandy lean clay to the boring termination depth of 31.5 feet (Elevation 536.3 feet). This sand was described as light yellowish brown, wet, and loose to medium dense. Natural moisture contents ranged from 7 to 11 percent, and SPT N-values varied from 9 to 13 blows per foot. Groundwater was observed at a depth of 20.0 feet (Elevation 547.8 feet) during drilling. Bedrock was not encountered.

4.1.3 Boring B-3

Boring B-3, located north of the North Bottom Ash Pond (surface elevation of 578.7 feet), encountered 0.5 feet of gravel at the surface underlain by sandy lean clay to a depth of 8.0 feet (Elevation 570.7 feet). The sandy lean clay was described as yellowish brown to grayish brown, moist, and medium stiff to stiff. Natural moisture contents ranged from 17 to 19 percent and SPT N-values varied from 8 to 13 blows per foot. Additional sandy lean clay was encountered to a depth of 17.0 feet (Elevation 561.7 feet). The soil was described as yellowish brown to grayish brown, moist, and medium stiff to stiff. Natural moisture contents ranged from 18 to 21 percent and SPT N-values varied from 6 to 12 blows per foot. Underlying the sandy lean clay, a layer of silty sand was encountered to a depth of 21.5 feet (Elevation 557.2 feet). The silty sand was described as light yellowish brown, moist, and loose. Natural moisture contents ranged between 25 and 26 percent and SPT N-values varied between 6 and 9 blows per foot. Well-graded sand with silt was encountered to a depth of 36.0 feet (Elevation 542.7 feet). This material was described as damp to wet and loose to medium dense. The natural moisture contents ranged from 7 to 26 percent and SPT N-values varied from 5 to 22 blows per foot.

Weathered sandstone was encountered beneath the sand with silt to a depth of 42.0 feet (Elevation 536.7 feet). Upon encountering bedrock, rock coring techniques were used to advance the boring. The sandstone was described as yellowish brown to gray, moderately hard, and medium bedded. The sandstone was underlain by alternating layers of weathered shale and coal to a depth of 47.2 feet (Elevation 531.5 feet), where the boring was terminated. The weathered shale was described as gray to dark gray, soft, and thin bedded. The coal was described as black, soft, and very thin bedded. The coal seam was approximately 2 inches

thick. Rock quality designation (RQD) percentages ranged from 0 to 50 percent, and core recovery percentages ranged from 55 to 100 percent.

Groundwater was observed at a depth of 35.0 feet (Elevation 543.7 feet) during the drilling, prior to the introduction of coring water.

4.1.4 Boring B-4

Boring B-4 was positioned along the crest of the dike separating the North Bottom Ash Pond and the North Clearwater Pond. The surface elevation of the boring was 577.6 feet, and 0.5 feet of gravel was observed at the surface. The gravel was underlain by sandy lean clay (fill) to a depth of 8.0 feet (Elevation 569.6 feet). This sandy lean clay was described as yellowish brown, damp to moist, and stiff. Natural moisture contents ranged between 13 to 26 percent and an SPT N-value of 11 bpf was recorded. Additional sandy lean clay was encountered to a depth of 12.0 feet (Elevation 565.6 feet). This sandy lean clay was described as yellowish brown to grayish brown, damp to moist, and soft. Natural moisture contents ranged from 15 to 16 percent and an SPT N-value of 4 bpf was recorded. A layer of silty sand was encountered beneath the sandy lean clay to a depth of 21.5 feet (Elevation 556.1 feet). This silty sand was described as light yellowish brown, moist to wet, and very loose to loose. Natural moisture contents ranged from 18 to 61 percent and SPT N-values varied from 2 to 6 blows per foot.

Beneath the silty sand, well-graded sand with silt was observed to a depth of 40.0 feet (Elevation 537.6 feet). This soil was described as light yellowish brown, damp to wet, and very loose to dense. Natural moisture contents ranged from 9 to 27 percent, and SPT N-values varied from 1 to 33 blows per foot. Silty clay with sand, was encountered below the silty sand to the boring termination depth of 56.5 feet (Elevation 521.1 feet). This material was further described as gray, moist to wet, and very soft to medium stiff. Natural moisture contents ranged from 23 to 29 percent, and SPT N-values varied from 1 to 8 blows per foot. Bedrock was not encountered in the boring. Although high moisture contents were observed from a depth of 15 to 30 feet, no free water was observed in the borehole subsequent to drilling.

4.1.5 Boring B-5

Boring B-5 (surface elevation of 577.3 feet) was located along the crest of the dike between the South Clearwater and South Bottom Ash Ponds. Under a 0.5-foot thick layer of gravel at the surface, sandy lean clay (fill) was encountered to a depth of 9 feet (Elevation 568.3 feet). The sandy lean clay was described as yellowish brown to grayish brown, damp, and medium stiff to stiff. Natural moisture contents varied from 14 to 16 percent, and SPT N-values ranged from 6 to 12 blows per foot. Additional sandy lean clay was encountered to a depth of 20.5 feet (Elevation 556.8 feet). The sandy lean clay was described as yellowish brown to grayish brown, damp, and medium stiff. Natural moisture contents ranged from 11 to 19 percent, and SPT N-

values varied from 5 to 8 blows per foot. Silt with sand, was observed underlying the sandy lean clay to a depth of 35.0 feet (Elevation 542.3 feet). This soil was described as reddish brown to gray, moist to wet, and very soft to soft. Natural moisture contents ranged from 26 to 33 percent and SPT N-values varied from 1 to 4 blows per foot. Poorly graded sand with silt was encountered below the silt with sand to the boring termination depth of 56.5 feet (Elevation 520.8 feet). This material was described as moist to wet and loose to medium dense. The natural moisture contents ranged from 6 to 28 percent and SPT N-values varied from 4 to 30 blows per foot. Neither groundwater nor bedrock was encountered in the boring.

4.1.6 Boring B-6

Boring B-6 was positioned along the crest of the dike south of the South Clear Water Pond at a surface elevation of 573.1 feet. Approximately 0.5 feet of gravel was observed at the surface of the boring. Sandy lean clay (fill) was encountered to a depth of 6.0 feet (Elevation 567.1 feet) and was described as yellowish brown to grayish brown, damp, and stiff. The natural moisture content was 15 percent and the SPT N-value was 9 blows per foot. Additional sandy lean clay was encountered to a depth of 29.0 feet (Elevation 544.1 feet) and described as yellowish brown to grayish brown, damp to wet, and very soft to stiff. Natural moisture contents ranged from 15 to 35 percent and SPT N-values varied from 1 to 9 blows per foot. A five-foot thick layer of silt with sand was encountered below the sandy lean clay to a depth of 34.0 feet (Elevation 539.1 feet). This material was described as gray, wet, and very loose to loose. Natural moisture contents ranged from 16 to 33 percent and SPT N-values ranged from 6 to 9 blows per foot. Poorly-graded sand with silt was observed to the boring termination depth of 46.5 feet (Elevation 526.6 feet). This soil was further described as light yellowish brown, damp, and medium dense. Natural moisture contents ranged from 5 to 7 percent, and SPT N-values varied from 13 to 30 blows per foot. Groundwater was observed at a depth of 23.0 feet (Elevation 550.1 feet). Bedrock was not encountered.

4.1.7 Instrumentation

Piezometers were installed in Borings B-1, B-2, and B-6. Details of piezometer installations are shown in Appendix C. Borings B-1 and B-6 were drilled from the crests of the dikes, and ten-foot long piezometer screens were installed near the bottom of the embankment material. No groundwater was detected in Borings B-1 and B-6 during the first reading on January 13, 2010, while groundwater was observed five inches above the bottom of the piezometer at Boring B-2. Table 2 shows piezometer top and tip elevations and readings taken on January 13, 2010 by AEP personnel. Readings since the initial measurements have been coordinated by AEP personnel.

Table 2 BAPC Piezometer Elevations

Boring No.	Top of PZ Elevation (feet)	Tip of PZ Elevation (feet)	Piezometric Elevation (feet)*
B-1	582.1	562.4	Dry
B-2	570.1	547.8	548.2
B-6	575.4	558.1	Dry

*Piezometer reading conducted on 01/13/2010

4.1.8 Boring BA-15-1 (2015 Exploration)

Gravel was encountered at the surface of Boring BA-15-1 to a depth of 0.5 feet. The ground surface elevation was not surveyed, but was estimated to be approximately 578 feet based on the elevation of Boring B-4. Below the gravel, sandy lean clay was observed to depth of 14.5 feet (approximate Elevation of 565.5 feet). The sandy lean clay was described as fill to a depth of 8.0 feet and further described as yellowish brown to grayish brown, damp to moist, and medium stiff. Natural moisture contents ranged from 10 to 18 percent and an SPT N-value of 5 bpf was recorded. Silty sand was observed in the boring to a depth of 24.5 feet (approximate Elevation 553.5 feet). The silty sand was described as gray, moist to wet, and very loose to loose. Natural moisture contents ranged from 18 to 71 percent and SPT N-values varied from 2 to 7 blows per foot. To the boring termination depth of 30.0 feet (approximate Elevation 548 feet), sandy silty clay described as brown, wet, and very soft was observed. Natural moisture contents ranged from 24 to 26 percent and an SPT N-value of 2 bpf was recorded.

4.2 FLY ASH POND MAIN DAM

Logs of borings are provided in Appendix B. Results of natural moisture content tests and SPTs are provided on the logs adjacent to the appropriate sample. Details of the piezometer installations are shown in Appendix C. Summaries of engineering classification tests are provided in Appendix D.

4.2.1 Boring Summary (2010 Exploration)

The borings were positioned on the upstream side of the crest, as shown on the site plan in Appendix A. Table 3 shows the ground surface, groundwater, and top of rock elevations for the borings.

Table 3 Fly Ash Pond Main Dam Boring Elevations

Boring No.	Top of Ground Elevation, feet	Groundwater Elevation, feet	Top of Bedrock Elevation, feet
B-1	712.2	Dry	N/A
B-2	712.4	559.7	N/A
B-3	712.7	613.6	N/A
B-4	712.5	Dry	503.2

A layer of dense gravel was encountered at the ground surface, extending to a depth of 1.0 to 1.5 feet (Elevation 710.7 to 711.5 feet). Below the gravel, sandy lean clay or sandy lean clay with gravel described as light brown or brown, damp, and stiff was encountered to a depth of 9.1 to 10.0 feet (Elevation 702.4 to 703.1 feet). The natural moisture content tested in samples from this stratum ranged from 8 to 17 percent, and the SPT N-values varied from 12 to 26 blows per foot. The liquid limit of representative samples ranged from 33 to 39 percent and plasticity indices ranged from 16 to 21 percent. These representative samples classified as CL, sandy lean clay or sandy lean clay with gravel, according to the Unified Soil Classification System (USCS) and as A-6 (5 to 10) according to the American Association of State Highway Transportation Officials' (AASHTO) method.

Beneath the sandy lean clay, bottom ash described as dry to moist and dense, was encountered to a depth of 65.0 to 80.3 feet (Elevation 632.2 to 647.2 feet). Natural moisture contents varied from 9 to 32 percent and SPT N-values ranged from 9 to 49 blows per foot. Representative samples from this horizon tested as non-plastic. These samples typically classified as ML or SM (sandy silt or silty sand, respectively) according to the USCS and as A-1-b (0), A-2-4 (0), or A-4 (0) according to the AASHTO method.

Light brown, dry to damp, medium dense to very dense, silty sand or silty sand with rock fragments and/or gravel was encountered underlying the bottom ash to the boring termination depth of 100.0 to 101.0 feet (Elevation 611.7 to 612.2 feet) in Borings B-1 and B-3, as well as to a depth of 99.5 feet (Elevation 613.0 feet) in Boring B-4 and 140.0 feet (Elevation 572.4 feet) in Boring B-2. Natural moisture contents ranged from 1 to 11 percent and SPT N-values varied from 15 bpf to refusal. Representative samples from this horizon tested as non-plastic. These samples classified as SM, silty sand or silty sand with gravel, according to the USCS and as A-1-b (0) or A-2-4 (0) according to the AASHTO method.

A 1.5-foot thick layer of gray, dry, dense, well-graded sand with silt and gravel was encountered beneath the silty sand with gravel in Boring B-4 from 139.5 to 141.0 feet. A representative sample

tested as non-plastic and classified as SW-SM, well-graded sand with silt and gravel, according to the USCS and A-1-a (1) according to the AASHTO method.

Beneath the light brown silty sand with gravel in B-2, gray silty sand with gravel and/or rock fragments was encountered from a depth of 159.5 to 179.5 feet (Elevation 552.9 to 573.0 feet). This material is further described as brown or gray; dry to damp, and dense to very dense. Natural moisture contents ranged from 6 to 20 percent and SPT N-values varied from 33 bpf to refusal. Representative samples from this horizon tested as non-plastic. Three samples classified as SM, silty sand with gravel, according to the USCS and A-2-4 (0) or A-4 (0) according to the AASHTO method.

Brown and gray, damp to moist, very stiff, lean clay with rock fragments was encountered beneath the silty sand with gravel to a depth of 189.5 to 190.5 feet (Elevation 522.0 to 522.9 feet). Natural moisture contents ranged from 15 to 19 percent and SPT N-values varied from 43 to 70 blows per foot. Representative samples from this horizon yielded a liquid limit of 33 to 36 percent and a plasticity index of 17 to 18 percent. These samples classified as CL, lean clay, according to the USCS and A-6 (13) according to the AASHTO method.

Beneath the lean clay with rock fragments in B-2, silty sand with rock fragments was encountered to the boring termination depth of 201.0 feet (Elevation 511.4 feet). This material is further described as gray, damp to moist, and dense to very dense. Natural moisture contents ranged from 14 to 16 percent and SPT N-values ranged from 40 to 88 blows per foot. Representative samples from this horizon tested as non-plastic. These samples classified as SM, silty sand, according to the USCS and A-2-4 (0) according to the AASHTO method.

Beneath the lean clay with rock fragments in B-4, lean clay with sand or sandy lean clay was encountered to the depth of 204.1 feet (Elevation 508.4 feet). This material is further described as gray to dark gray, damp to moist, and very stiff. Natural moisture contents ranged from 14 to 20 percent and SPT N-values varied from 75 to 78 blows per foot. Representative samples tested on this material yielded a liquid limit in the range of 25 to 32 percent and a plasticity index of 8 to 15 percent. This sample classified as CL, lean clay with sand or sandy lean clay, according to the USCS and A-4 (3) or A-6 (10) according to the AASHTO method.

Bedrock was not encountered in Borings B-1, B-2, or B-3 during drilling operations. Weathered bedrock was encountered in Boring B-4 at a depth of 204.1 feet (Elevation 508.4 feet) to a boring termination depth of 209.3 feet (503.2 feet). This bedrock was described as sandstone, fine-grained, thick-bedded, and hard. Groundwater was encountered in Boring B-2 at a depth of 152.7 feet (Elevation 559.7 feet) and in Boring B-3 at a depth of 99.1 feet (Elevation 712.4 feet).

4.2.2 Boring FA-15-1 (2015 Exploration)

Boring FA-15-1 was advanced at the downstream bench that is at an approximate elevation of 586 feet to collect samples from the random rock fill zone of the dam. Gravel and sand were observed from the surface of the boring to a depth of 7.0 feet (approximate Elevation 579.0 feet). The descriptor "rock fill" was been maintained from the 1993 Report throughout this document and associated analyses, however, the material collected during sampling displayed soil-like properties. The random rock fill was described as lean clay with sand from a depth of 7.0 to 21.5 feet (approximate Elevation 579.0 to 564.5 feet). The lean clay with sand was described as brown and gray, moist, and stiff. Natural moisture contents ranged from 12 to 18 percent and SPT N-values of 10 bpf were recorded in this material. From a depth of 21.5 to 30.0 feet (approximate Elevation 564.5 to 556.0 feet), the random rock fill was described as sity sand, brown and gray, damp, and dense to very dense. Natural moisture contents of 6 and SPT N-values ranging from 25 to 53 bpf were recorded in this material.

4.2.3 Instrumentation

Piezometers (one-inch diameter standpipes) were installed in Borings B-1, B-2, and B-3 at the completion of drilling. Details of piezometers installations are shown in Appendix C. Well screens were installed in the bottom 20 feet, backfilled with sand, and sealed with a two-foot thick bentonite plug. Well risers were installed above the screens to the surface and the annuluses were backfilled with cement-bentonite grout. Slope inclinometer casing (2.75-inch diameter) was installed in Boring B-4 near the middle of the dam on the downstream side of the crest. The annulus was backfilled with cement-bentonite grout. Concrete pads, lockable covers, and steel-pipe bollards filled with concrete were installed at the surface at the instrumentation locations. Table 4 shows piezometer top and tip elevations.

Table 4 Fly Ash Pond Main Dam Instrument Elevations

Boring No.	Top of PZ/SI Elevation (feet)	Tip of PZ/SI Elevation (feet)	Piezometric Elevation (feet)**
B-1	714.7	613.4	Dry
B-2	714.9	513.3	562.2
B-3	715.1	613.7	616.0
B-4*	715.4	504.0	N/A

*Slope Inclinometer Casing

**Piezometric reading conducted on 02/22/2010

4.3 FLY ASH POND SADDLE DAM

Borings SD-15-1 and SD-15-2 were advanced from the crest of the saddle dam, with SD-15-1 positioned on the downstream side and SD-15-2 located on the upstream side. These borings were advanced as a part of the 2015 geotechnical exploration. The approximate surface elevation of these borings was 711 feet.

Gravel was observed from the surface to a depth of 2.0 feet (approximate Elevation 709.0 feet) in Boring SD-15-1. From a depth of 2.0 to 8.0 feet (approximate Elevation 709.0 to 703.0 feet), lean clay with sand was encountered that was further described as brown and gray, moist, and stiff. A natural moisture content of 16 percent and an SPT N-value of 13 bpf were recorded in this material. Bottom ash described as gray, damp, and medium dense to dense sand was observed from a depth of 8.0 to 38.0 feet (approximate Elevation 703.0 to 673.0 feet). The bottom ash exhibited natural moisture contents ranging from 12 to 21 percent and SPT N-values varying from 19 to 51 blows per foot. Below the bottom ash to a depth of 68.0 feet (approximate Elevation 643.0 feet), clay soils identified as lean clay with sand or sandy lean clay were encountered. These soils were further described as gray to reddish brown, moist, and very stiff. Natural moisture contents ranged from 12 to 19 percent and SPT N-values varied from 18 to 28 blows per foot. Clayey sand was observed from a depth of 68.0 to 81.0 feet (approximate Elevation of 643.0 to 630.0 feet), which was further described as brown and gray, moist to wet, and loose to medium dense. Natural moisture contents varied from 15 to 20 percent and SPT N-values varied from 7 to 11 blows per foot. Bedrock consisting of gray weathered shale was encountered at a depth of 81.0 feet (approximate Elevation 630.0 feet).

In Boring SD-15-2, gravel was observed from the surface to a depth of 1.0 feet (approximate Elevation 710.0 feet). Below the gravel, lean clay with sand was encountered to a depth of 16.0 feet (approximate Elevation 695.0 feet) that was described as brown and gray, moist, and very stiff. A natural moisture content of 15 percent and a SPT N-value of 17 bpf were recorded in this material. Bottom ash described as gray, moist, and loose sand was observed from a depth of 16.0 to 23.0 feet (approximate Elevation 695.0 to 688.0 feet). The bottom ash exhibited a natural moisture content of 17 percent and an SPT N-value of 10 blows per foot. From a depth of 23.0 to 68.0 feet (approximate Elevation 688.0 to 643.0 feet), cohesive soils identified as lean clay with gravel, sandy lean clay, and lean clay with sand were encountered. These soils were described as gray to reddish brown, moist, and stiff to very stiff. Natural moisture contents varied from 15 to 20 percent and SPT N-values ranged from 11 to 27 blows per foot. Clayey sand was observed from a depth of 68.0 to 74.8 feet (approximate elevation 643.0 to 636.2 feet), which was further described as brown and gray, moist to wet, and loose. A natural moisture content of 19 percent and an SPT N-value of 9 bpf were recorded in the clayey sand. Bedrock consisting of weathered sandstone was encountered at a depth of 74.8 feet (approximate Elevation 636.2 feet).

5.0 LABORATORY TESTING

Results of natural moisture content testing are shown adjacent to the samples on the boring logs in Appendix B. Classification testing, including sieve and hydrometer and Atterberg limits, is provided in Appendix D. The results from additional testing are summarized in the following sections.

5.1 CONSOLIDATED-UNDRAINED (CU) TRIAXIAL COMPRESSION TESTING

Three CU triaxial compression tests were performed by GeoTesting Express at its Atlanta, Georgia laboratory on undisturbed Shelby tube samples collected from the borings completed in 2010. These tests were performed in accordance with ASTM D 4767, and detailed results of the tests are provided in Appendix E. Effective cohesions ranged from 20 to 140 pounds per square foot (psf), and effective angles of internal friction varied from 32.8 to 36.0 degrees. Table 5 shows a summary of the CU triaxial tests performed.

Nine additional single point CU triaxial tests were performed in 2015 by Stantec. Two points were performed on undisturbed samples taken from the boring completed at the BAPC, two points were performed from the borings completed at the Fly Ash Pond Saddle Dam, and five points were performed from the boring completed at the Fly Ash Pond Main Dam. The material strength derivations through the p-q and p'-q' plots for these tests are included in Appendix K.

Table 5 Summary of CU Triaxial Compression Tests

Facility	Boring No.	Depth (feet)	Soil Description	Effective Cohesion, c' (psf)	Effective Friction Angle, ϕ' (deg.)	Total Cohesion, c (psf)	Total Friction Angle, ϕ (deg.)
BAPC (2010)	B-1, B-4	5.5-8.0	Sandy Lean Clay - Embankment	30	32.8	-	-
BAPC (2010)	B-6	7.5-11.7	Sandy Lean Clay - Embankment	20	35.0	-	-
BAPC (2010)	B-1	15.0-16.7	Sandy Lean Clay - Embankment	140	36.0	-	-
BAPC (2015)	BA-15-1	12.5-13.0	Sandy Lean Clay with Gravel - Embankment	0	35.0	0	35.0
Main Dam (2015)	FA-15-1	5.9-19.1	Gravelly Lean Clay – Embankment	320	26.0	540	22.0
Saddle Dam (2015)	SD-15-2	30.0-31.0	Lean Clay with Gravel - Embankment	340	20.0	660	13.0

5.2 PERMEABILITY TESTING

Four permeability tests (ASTM D 5084, Falling-Head, Method C, Rising Tail Water) were performed by GeoTesting Express on undisturbed Shelby tube samples collected in 2010. Detailed data sheets showing the results of the tests are provided in Appendix F. Hydraulic conductivities ranged from 5.1×10^{-8} to 8.4×10^{-8} centimeters per second. The samples were generally described as sandy lean clay. Table 6 summarizes the results of the permeability tests.

Table 6 Summary of 2010 Permeability Tests

Facility	Boring No.	Depth (feet)	Soil Description	Hydraulic Conductivity, (cm/s)
BAPC	B-1	27.9-28.0	Sandy Lean Clay - Embankment	$8.4x10^{-8}$
BAPC	B-4	5.1-5.4	Sandy Lean Clay - Embankment	$5.1x10^{-8}$
BAPC	B-6	5.2-5.4	Sandy Lean Clay - Embankment	$8.2x10^{-8}$
BAPC	B-6	22.6-22.8	Sandy Lean Clay - Embankment	$6.2x10^{-8}$

5.3 MOISTURE-DENSITY TESTING

Two Standard Proctor moisture-density tests (ASTM D 698) were performed on bag samples taken from auger cuttings in 2010. The data sheets for these tests are provided in Appendix G. Maximum dry densities of 115.5 and 121.6 pounds per cubic foot (pcf) and optimum moisture contents of 14.4 and 12.4 percent, respectively, were determined for these samples. Table 7 summarizes the results of the tests.

Table 7 Summary of 2010 Standard Proctor Moisture-Density Tests

Facility	Boring No.	Depth (feet)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
BAPC	B-1	10.0 +/- 2	Sandy Lean Clay - Embankment	115.5	14.4
BAPC	B-4	7.5 +/- 2	Sandy Lean Clay - Embankment	121.6	12.4

These moisture-density tests were performed to compare with the natural moisture contents and unit weights of the in-situ soils. Within the embankment soils of the BAPC, natural moisture contents varied from 13 to 22 percent with an average of 17 percent. Dry densities of the embankment soil ranged from 104 to 120 pcf, with an average of 109 pounds per cubic foot. The results of these tests indicate that the average natural moisture content of the embankment soil is 3 to 5 percent above optimum moisture and that the percent compaction of the embankment soils is on the order of 90 to 95 percent of the standard Proctor maximum density.

One unit weight test performed on embankment material was not included in the range discussed above. A test performed from Boring B-4 at a depth from 5.0 to 5.5 feet yielded a dry unit weight of 99.4 pcf and a natural moisture content of 26.1 percent, which would indicate a compaction of 80 to 86 percent. This sample did not appear to be representative by comparison with the other tests performed within this material and was considered an outlier.

5.4 DIRECT SHEAR TESTING

Direct shear testing was performed on loosely remolded samples of sandy lean clay taken from Boring BA-15-1 in 2015. The first test was performed on a soil sample taken from a depth of 12.5 to 14.5 feet (approximate Elevation 565.5 to 563.5 feet) in the boring. This test resulted in an effective internal angle of friction of 36 degrees with an effective cohesion of 360 pounds per square foot. The second test was performed on a sample taken from a depth of 22.5 to 24.5 feet (approximate Elevation 555.5 to 553.5 feet). This test resulted in an effective internal angle of friction of 37 degrees with an effective cohesion of 1,152 pounds per square foot. The laboratory data sheets for the direct shear tests are located in Appendix H.

6.0 ENGINEERING ANALYSES

6.1 BOTTOM ASH POND COMPLEX

Based on the review of available information, results of the geotechnical exploration, and results of laboratory testing; Stantec performed engineering analyses of the BAPC in 2010. This included seepage and slope stability analyses of three cross sections of the system. Two of the cross sections (A-A' and C-C') were located on external dikes and one cross section (B-B') was located on an internal dike that separates two of the ponds.

In response to the mandated Coal Combustion Residuals (CCR) Final Rule from the Environmental Protection Agency (EPA), published on April 17, 2015, Stantec performed updated analyses for the BAPC. These analyses address the periodic safety factor assessments of Section 257.73 (e)(1)(i-iv) of the mandate:

- (i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50. [This was determined using drained strength parameters].

- (ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40. [This was determined using drained strength parameters with the design storm event modeled as a steady-state condition].

- (iii) The calculated seismic factor of safety must equal or exceed 1.00. (The horizontal acceleration of 0.065g for the seismic analysis was supplied via email from AEP). [This was determined by using undrained strength parameters].

- (iv) For dikes constructed of soils that have a susceptibility to liquefaction, the calculated factor of safety must equal or exceed 1.20.

Sections A-A' and B-B' from the 2010 analysis were revisited as part of the CCR Mandate, as they were determined to be the critical cross-sections within the dike system. The results of the analyses that address the CCR Mandate are presented in Section 6.1.2.

6.1.1 Engineering Analyses Performed in 2015 as Part of CCR Mandate

6.1.1.1 Liquefaction Analysis

The liquefaction analysis conducted in 2010 was revisited as part of the CCR Mandate. The details for this analysis are contained in Appendix I. Similar to the analysis performed in 2010, a screening process was used to determine if the cohesive material encountered in the borings has the potential for liquefaction. The screening process was conducted for nine samples, five of which had liquid limits below 37 percent. According to the Seed et al and Bray and Sancio plots supplied in Appendix I, none of the samples were susceptible to liquefaction.

The remaining cohesionless material encountered in the critical cross-sections was tested for liquefaction as a coarse–grained analysis similar to the one conducted in 2010. According to the CCR Mandate, for dikes constructed of soils that have a susceptibility to liquefaction, the calculated factor of safety must equal or exceed 1.20. Test data from Boring Nos. B-1 and B-2, representative of cross-section A-A' and Boring Nos. B-4 and BA-15-1, representative of cross-section B-B', was used. Soil characteristics (grain size, plasticity, etc.) from SPT and Shelby tube samples were summarized to assess liquefaction potential. The copies of the spreadsheets used for the calculations appear in Appendix I and provide the soil, test data, and calculations used in the assessment.

It was assumed during the screening process for potential liquefaction that the steady-state water elevation consistent with that developed during the stability analysis would be used as the groundwater elevation. Unsaturated soils above this elevation were considered not liquefiable. Also the dike embankment materials, consisting of engineered fill were not considered liquefiable.

Factors of safety against liquefaction were estimated for soil layers predicted to be potentially liquefiable during the screening process. As a result of recent industry publications that attempted to update certain correlations with larger uncertainty that are used in the calculations for the factor of safety, slight differences in the factors of safety were obtained than those reported in 2010. Inputs such as depth, material properties, etc. have not been altered.

The horizontal seismic coefficient has been adjusted from 0.08 to 0.065 per direction received from AEP. Ranges and averages of these factors of safety for the potentially liquefiable soil layers are summarized in Table 8.

Table 8 Liquefaction Factor of Safety for Potentially Liquefiable Soils in the BAPC, CCR Mandate

Boring No.	Depth (feet)	Elevation (feet)	Unified Soil Classification	Liquefaction FS, Range	Liquefaction FS, Average
B-1*	36.5 – 61.5	543.4 – 518.4	SW-SM	1.56 – 10.00	2.30
B-2	21.5 – 31.5	546.3 – 536.3	SW-SM	1.63 – 2.37	1.88
B-4	12.0 – 21.5	565.6 – 556.1	SM	1.53 – 3.20	2.24
B-4	21.5 – 39.0	556.1 – 538.6	SW-SM	0.81 – 10.00	3.75
BA-15-1	14.5 – 24.5	563.5 – 553.5	SW-SM	10.00	10.00

*Typical FS range is 1.27 to 2.89, with an average of 1.97.

Samples from Boring B-4 between the depths of 21.5 and 30.0 (Elevation 547.6 to 556.1 feet) and 34.0 to 39.0 feet (Elevation 538.6 to 543.6 feet) have factors of safety against liquefaction of less than the CCR requirement of 1.20, however, the average of the stratum is greater than the requirement.

6.1.1.2 Seepage Analysis

The seepage analysis conducted in 2010 was reviewed as part of the CCR Mandate. The seepage models used in the SEEP/W product were calibrated to recent piezometric data and visual field operations. Changes to the material properties developed in Appendix K of this report were not deemed necessary. The piezometric line established for the 2010 analysis was maintained for the 2015 review. The seepage analyses conducted at the critical cross-sections of A-A' and B-B' were reviewed.

The results of the seepage analysis were used to revise the stability cross-sections.

6.1.1.3 Stability Analysis

The stability analysis conducted in 2010 was reviewed as part of the CCR Mandate, using the results of the seepage analysis review in Section 6.1.2.2. Similar to 2010, SLOPE/W was the software used during the analysis. The drained shear strength parameters developed in 2010, located in Appendix K, were maintained for the updated analysis, with the exception of the Sand with Silt and Silty Clay with Sand layers in the BAPC. The friction angle of these layers was

increased to 35 degrees based on the results of laboratory testing performed after the drilling operations in October 2015. Undrained shear strength parameters were not derived in 2010. These parameters are used for the stability cases when seismic loading is introduced. The parameters were determined by either consolidated undrained (CU) test data or direct shear test data for the Embankment Fill, Stiff Sandy Lean Clay, Soft Sandy Lean Clay, Sand with Silt, and Silty Clay with Sand layers. Typical values from published tables were used to determine the undrained shear strength parameters of the Silty Clay with Sand. Undrained shear strength parameters for cohesionless materials were taken to be identical to the drained shear strength parameters.

Table 9 summarizes the drained and undrained shear strength parameters used in the analyses.

Table 9 Shear Strength Parameters for CCR Mandate Review

		Drained Shear Strengths		Undrained Shear Strengths	
Material	**Unit Weight (pcf)**	**Effective Cohesion (psf)**	**ϕ' (deg.)**	**Cohesion (psf)**	**ϕ (deg.)**
Embankment Fill	125	30	30	200	18
Stiff Sandy Lean Clay	125	144	35	2,200	20
Soft Sandy Lean Clay	125	23	30	2,200	6
Sand with Silt	130	0	35	0	35
Bottom Ash	115	0	25	0	25
Rip Rap	140	0	35	0	35
Silty Sand	130	0	35	0	35
Silty Clay with Sand	120	100	25	1,000	10

The upstream and downstream slopes of each cross-section were analyzed, incorporating the auto locate and entry/exit search routines to locate the critical slip surface. Once the potential failure surface with the lowest factor of safety was identified, the optimization routine was executed.

When the surface slope is composed of a material with low effective cohesion, an infinite slope failure (shallow sliding parallel to the surface) will be critical. A minimum failure depth of ten feet was specified for each section, to eliminate the evaluation of surficial sloughing and erosional types of instability.

For this review, SLOPE/W was used to investigate the following pool elevations:

- Operating pool elevation of 564 feet when there is no ash in the basin.
- Operating pool elevation of 575 feet when there is ash in the basin.
- The design storm event pool elevation of 576.6 feet, applied as a steady-state condition.

When a cell is taken out of service for cleaning and the pool is lowered to an elevation of 564 feet, bottom ash is still present in the basin. When the cell is brought back into service, the pool is raised slowly to an elevation of 575 without bottom ash.

Using the drained and undrained strength parameters listed in Table 9, the existing dike was analyzed at the two critical cross sections selected for the CCR review.

Due to the elevation of the bottom ash in the basin being close to that of the crest of the embankment for Section B-B', slope stability for this section in the upstream direction was not investigated when the basin contained bottom ash. A summary of the factors of safety are presented in Table 14 and printouts of the GeoStudio runs are presented in Appendix J. The factors of safety obtained for each load case scenario met or exceeded the requirements of the CCR Mandate.

6.2 FLY ASH POND MAIN DAM

Based on the review of available information from "Kentucky Power Big Sandy Plant Fly Ash Retention Dam, Final Raising Design Report" (AEP, 1993) and in response to the mandated CCR Final Rule from the EPA, Stantec performed updated analyses for the Fly Ash Pond Main Dam. The original analysis was conducted in 1993 by AEP. The safety factors presented in Section 6.1 of this report that summarize Section 257.73 (e)(1)(i-iv) are the requirements for the dam.

The critical cross-section chosen for analysis is at the midpoint length of the dam. See Appendix A for a plan view of the dam. The results of the analyses that address the CCR Mandate are presented in Section 6.2.1.

6.2.1 Engineering Analyses Performed in 2015 as Part of CCR Mandate

6.2.1.1 Liquefaction Analysis

An original liquefaction analysis was not conducted as part of the AEP report published in 1993. As a result, information obtained from geotechnical borings performed by Stantec in 2010 was used to perform the current liquefaction analysis. The details for this analysis are contained in Appendix I.

A screening process was used to determine if the cohesive material encountered in the borings has the potential for liquefaction. The screening process was conducted for nine samples, seven of which had liquid limits below 37 percent. According to the Seed et al and Bray and Sancio plots supplied in Appendix I, none of the samples were susceptible to liquefaction.

The remaining cohesionless material encountered was screened for liquefaction as a coarse–grained analysis. According to the CCR Mandate, for dikes constructed of soils that have a susceptibility to liquefaction, the calculated factor of safety must equal or exceed 1.20.

Data from three borings (B-2, B-4, and FA-15-1) were used to assess liquefaction potential. Copies of the spreadsheets used for the calculations appear in Appendix I and provide the soil, test data, and calculations used in the assessment. Ranges and averages of these factors of safety for the potentially liquefiable soil layers are summarized in Table 10. The values obtained for the liquefaction factor of safety were equal to or greater than 10.00 for each location. A value of 10.00 is the maximum value possible within the calculation formula.

It was assumed during the screening process for potential liquefaction that the steady-state water elevation consistent with that developed during the stability analysis would be used as the groundwater elevation. Unsaturated soils above this elevation were considered not liquefiable.

Table 10 Liquefaction Factor of Safety for Potentially Liquefiable Soils in the Fly Ash Pond Main Dam, CCR Mandate

Boring No.	Depth (feet)	Elevation (feet)	Unified Soil Classification	Liquefaction FS, Range	Liquefaction FS, Average
B-2	138.0 – 158.0	574.4 – 554.4	SM	10.00	10.00
B-2	188.0 – 200.3	524.4 – 512.1	SM	10.00	10.00
B-4	138.0 – 143.0	574.5 – 569.5	SW-SM	10.00	10.00
B-4	143.0 – 175.0	569.5 – 537.5	SM	10.00	10.00
FA-15-1	21.5 – 30.0	564.5 – 556.0	SM	10.00	10.00

6.2.1.2 Seepage Analysis

The seepage parameters developed by AEP in 1993 were reviewed as part of the CCR Mandate. Casagrande's solution for the different levels of water throughout the construction and operation of the dam was employed to develop flow nets. As long as the water elevation inside the reservoir remains at or below Elevation 675 feet, the seepage line will meet a vertical chimney drain.

The piezometric lines developed by AEP in 1993 were compared with current instrumentation data on the dam. Data from current instrumentation did not indicate a need to adjust the piezometric line from the previous analysis. The results of the seepage analysis were used to revise the stability cross-sections.

6.2.1.3 Stability Analysis

The stability analysis conducted in 1993 was reviewed as part of the CCR Mandate, using the results of the seepage analysis review from Section 6.2.1.2. The drained and undrained shear strength parameters developed in 1993, located in Appendix K, were maintained for the updated analysis, with the exception of the Bottom Ash and Random Rockfill layers. AEP directed the friction of the Bottom Ash layer be increased to 41 degrees based on laboratory testing completed in the material in 1993. The updated strength parameters for the Random Rockfill layer were derived from laboratory testing on samples obtained from the 2015 drilling.

Table 11 summarizes the drained and undrained shear strength parameters used in the analysis.

Table 11 Shear Strength Parameters for the Fly Ash Pond Main Dam for CCR Mandate Review

		Drained Shear Strengths		Undrained Shear Strengths	
Material	**Unit Weight (pcf)**	**ϕ' (deg.)**	**Effective Cohesion (psf)**	**ϕ (deg.)**	**Cohesion (psf)**
Clay and Weathered Shale	135	23	1,000	16	2,200
Embankment – 1976 Raise	135	25	0	20	1,600
Original Embankment	130	25	0	20	1,600
Random Rockfill	110	26	320	22	540
Bottom Ash	70	41	0	41	0
Overburden A	135	25	0	18	1,200
Overburden B	135	23	1,000	16	2,200
Clay	135	20	340	13	660
Fly Ash	104	30	0	30	0

The upstream and downstream slopes of the cross-section were analyzed, incorporating the auto locate and entry/exit search routines to locate the critical slip surface. Once the potential failure surface with the lowest factor of safety was identified, the optimization routine was run.

When the surface slope is composed of a material with low effective cohesion, an infinite slope failure (shallow sliding parallel to the surface) will be critical. A minimum failure depth of ten feet was specified for each section, to eliminate the evaluation of surficial sloughing and erosional types of instability.

For this review, SLOPE/W was used to investigate two pool elevations:

- Current operating pool level of 675 feet. This is the highest the reservoir is anticipated to be as a result of the plant being decommissioned.

- Probable Maximum Flood (PMF) pool level of 682 feet is applied as a steady-state load within SLOPE/W. The PMF level was determined by linear interpolation of the data that appears in a table in Section 6.2 "Basin Characteristics" of the 1993 AEP report, with knowledge of the storage capacity increase needed for a rise of 5.5 feet in elevation from 705 (original operating pool level) to 710.5 feet (original PMF pool level). It was assumed that the storage capacity increase would be the same at both operating pool levels to attain the PMF pool level.

Using the drained and undrained strength parameters listed in Table 11, the existing dam was analyzed at the critical cross section selected for the CCR review. An additional run was performed using drained conditions, forcing the failure surface through an area where slope inclinometers may indicate movement. The factor of safety for this run was 1.91.

A summary of the factors of safety are presented in Table 15 and printouts of the GeoStudio runs are presented in Appendix J.

6.3 FLY ASH POND SADDLE DAM

Based on the review of available information from "Kentucky Power Big Sandy Plant Fly Ash Retention Dam, Final Raising Design Report" (AEP, 1993) and in response to the mandated CCR Final Rule from the EPA, Stantec performed updated analyses for the Fly Ash Pond Saddle Dam. The original analysis was conducted in 1993 by AEP. The safety factors presented in Section 6.1 of this report that summarize Section 257.73 (e)(1)(i-iv) are the requirements for the dam.

The critical cross-section chosen for analysis is at the maximum height of the dam. See Appendix A for a plan view of the dam. The results of the analyses that address the CCR Mandate are presented in Section 6.3.1.

6.3.1 Engineering Analyses Performed in 2015 as Part of CCR Mandate

6.3.1.1 Liquefaction Analysis

An original liquefaction analysis was not conducted as part of the AEP report published in 1993. Geotechnical boring data was not available for the dam and laboratory testing was only available for a small number of samples from the borings. An N-value of 10 (correlates to a loose cohesionless material) was assumed for all testing intervals, with soil index properties extrapolated to all soil samples based on the soil classifications supplied. Information from the borings performed in 2015 was added to the liquefaction calculations.

A screening process was used to determine if the cohesive material encountered in the borings has the potential for liquefaction. The screening process was conducted for twelve samples and is exhibited in Appendix I. According to the Seed et al and Bray and Sancio plots, none of the samples tested were susceptible to liquefaction.

The remaining cohesionless material encountered in the critical cross-section was screened for liquefaction as a coarse–grained analysis. According to the CCR Mandate, for dikes constructed of soils that have a susceptibility to liquefaction, the calculated factor of safety must equal or exceed 1.20.

Data from the three borings (BSFD-11, SD-15-1, and SD-15-2) was used to assess liquefaction potential of the foundation material of the dam while assumed parameters were used for the embankment material. Copies of the spreadsheets used for the calculations appear in Appendix I and provide the soil, test data, and calculations used in the assessment. Ranges and averages of these factors of safety for the potentially liquefiable soil layers are summarized in Table 12, which display factors of safety for each stratum above the required 1.20.

It was assumed during the screening process for potential liquefaction that the steady-state water elevation consistent with that developed during the stability analysis would be used as the groundwater elevation. Unsaturated soils above this elevation were considered not liquefiable.

Table 12 Liquefaction Factor of Safety for Potentially Liquefiable Soils in the Fly Ash Pond Saddle Dam, CCR Mandate

Boring No.	Depth (feet)	Elevation (feet)	Unified Soil Classification	Liquefaction FS, Range	Liquefaction FS, Average
BSFD-11	54.0 – 56.0	757.0 – 755.0	SC-SM	4.20	4.20
SD-15-1	68.0 – 81.5	643.0 – 629.5	SC	3.70 – 7.30	5.20
SD-15-2	68.0 – 74.8	643.0 – 636.2	SC	10.00	10.00

6.3.1.2 Seepage Analysis

The seepage parameters developed by AEP in 1993 were reviewed as part of the CCR Mandate. Casagrande's solution for the different levels of water throughout the construction and operation of the dam was employed to develop flow nets.

Piezometric data was not available at the saddle dam; as a result, calibration to existing conditions was not possible. The piezometric lines established in the 1993 analysis were used in the current analysis. The results of the seepage analysis were used to review the stability cross-sections.

6.3.1.3 Stability Analysis

The stability analysis conducted in 1993 was reviewed as part of the CCR Mandate, using the results of the seepage analysis review. The drained and an undrained shear strength parameters developed in 1993, located in Appendix K, were updated for the Clay Layer in the current analysis based on laboratory testing on samples from the 2015 drilling. The friction angle for the Bottom Ash Layer was increased to 41 degrees per direction received from AEP.

Table 13 summarizes the drained and undrained shear strength parameters used in the analysis.

Table 13 Shear Strength Parameters for the Fly Ash Pond Saddle Dam CCR Mandate Review

		Drained Shear Strengths		Undrained Shear Strengths	
Material	**Unit Weight (pcf)**	**ϕ' (deg.)**	**Effective Cohesion (psf)**	**ϕ (deg.)**	**Cohesion (psf)**
Bottom Ash	70	41	0	41	0
Overburden	135	34	0	25	800
Clay	135	20	340	13	660

The upstream and downstream slopes of the cross-section were analyzed, incorporating the auto locate and entry/exit search routines to locate the critical slip surface. Once the potential failure surface with the lowest factor of safety was identified, the optimization routine was performed.

When the surface slope is composed of a material with low effective cohesion, an infinite slope failure (shallow sliding parallel to the surface) will be critical. A minimum failure depth of ten feet was specified for each section, to eliminate the evaluation of surficial sloughing and erosional types of instability.

For this review, SLOPE/W was used to investigate three pool elevations:

- Current operating pool level of 675 feet. This is the highest the reservoir is anticipated to be as a result of the plant being decommissioned.

- PMF pool level of 682 feet is applied as a steady-state load within SLOPE/W. The PMF level was determined by linear interpolation of the data that appears in a table in Section 6.2 "Basin Characteristics" of the 1993 AEP report, with knowledge of the storage capacity increase needed for a rise of 5.5 feet in elevation from 705 (original operating pool level) to 710.5 feet (original PMF pool level). It was assumed that the storage capacity increase would be the same at both operating pool levels to attain the PMF pool level.

Using the drained and undrained strength parameters listed in Table13, the existing dam was analyzed at the critical cross section selected for the CCR review.

A summary of the factors of safety are presented in Table 16 and printouts of the GeoStudio runs are presented in Appendix J. The factors of safety for each of the load cases specified were equal to or greater than the minimum requirement specified within the CCR mandate.

Table 14 Summary of Computed Factors of Safety for the Bottom Ash Pond Complex with Ash in Basin, 2015 CCR Mandate

Headwater Pool with Ash in Basin	Drainage	Incipient Motion	Seismic Load Case	Acceptance Criteria	Section A-A'	Section B-B'
Current Pool Elevation (575 feet)	Drained	Downstream	No	1.50	2.67	1.64
Current Pool Elevation (575 feet)		Upstream		1.50	3.87	N/A
Design Storm Surcharge (576.6 feet)		Downstream		1.40	2.55	1.49
Design Storm Surcharge (576.6 feet)		Upstream		1.40	4.39	N/A
Current Pool Elevation (575 feet)	Undrained	Downstream	Yes	1.00	2.22	1.39
Current Pool Elevation (575 feet)		Upstream		1.00	2.95	N/A

Table 15 Summary of Computed Factors of Safety for the Bottom Ash Pond Complex without Ash in Basin, 2015 CCR Mandate

Headwater Pool without Ash in Basin	Drainage	Incipient Motion	Seismic Load Case	Acceptance Criteria	Section A-A'	Section B-B'
Current Pool Elevation (564 feet)	Drained	Downstream	No	1.50	3.41	1.93
Current Pool Elevation (564 feet)		Upstream		1.50	2.33	1.90
Design Storm Surcharge (576.6 feet)		Downstream		1.40	2.71	1.51
Design Storm Surcharge (576.6 feet)		Upstream		1.40	2.95	2.52
Current Pool Elevation (564 feet)	Undrained	Downstream	Yes	1.00	2.87	1.63
Current Pool Elevation (564 feet)		Upstream		1.00	2.08	1.64

Table 16 Summary of Computed Factors of Safety for the Fly Ash Pond, 2015 CCR Mandate

Headwater Pool	Drainage	Incipient Motion	Seismic Load Case	Acceptance Criteria	Main Dam	Saddle Dam
Current Pool Elevation (675 feet)	Drained	Downstream	No	1.50	1.56	1.52
Current Pool Elevation (675 feet)		Upstream		1.50	1.67	1.95
PMF Elevation Surcharge (682 feet)		Downstream		1.40	1.56	1.52
PMF Elevation Surcharge (682 feet)		Upstream		1.40	1.68	1.88
Current Pool Elevation (675 feet)	Undrained	Downstream	Yes	1.00	1.45	1.39
Current Pool Elevation (675 feet)		Upstream		1.00	1.38	1.64
Current Pool Elevation (675 feet)*	Drained	Downstream	No	1.50	1.92	N/A

*Stability analysis to model movement in the dam measured through slope inclinometer readings

7.0 CONCLUSION

7.1 PE CERTIFICATION

I, Don Fuller II, being a Professional Engineer in good standing in the State of Kentucky, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification is prepared in accordance with the accepted practice of engineering. I certify that pursuant to 40 CFR 257.73(e)(2), the safety factor assessment for the AEP Big Sandy Power Plant's Bottom Ash Pond Complex, Fly Ash Pond Main Dam, and Fly Ash Pond Saddle Dam demonstrates compliance with the factors of safety specified in 40 CFR 257.73(e)(1)(i) through (iv).

SIGNATURE 

DATE 2/16/2016

ADDRESS: Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington, Kentucky 40511-2024

TELEPHONE: (859) 422-3000

7.2 GENERAL

The analyses presented herein are based on information gathered (from various sources) using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. Subsurface profiles are generally based on straight-line interpolation between borings and no warranties can be made regarding the continuity of subsurface conditions between the borings.

The boring logs and related information presented in this report depict approximate subsurface conditions only at the specific boring locations noted and at the time of drilling. Conditions at other locations may differ from those occurring at the boring locations. This report may not be applicable if the facility is modified from what is described in this report or if the site conditions are altered. This report may require updating to reflect the different, modified facility specifics and/or the altered site conditions.

8.0 REFERENCES

1. Kentucky Department of Natural Resources and Environmental Protection, Department for Environmental Protection, Division of Water (401 KAR 4:030), 1999

2. US Department of the Interior, Bureau of Reclamation, Design of Small Dams, Second Edition, 1973

3. ASCE, Foundation Engineering Handbook, Design and Construction with the 2006 International Building Code, Robert W. Day, 2005

4. USACE, EM 1110-2-1902 Engineering and Design - Slope Stability, 2003

5. Earthquake Engineering Research Center, Recent Advances in Soils Liquefaction Engineering: A Unified and Consistent Framework, R.B. Seed, K.O. Cetin, R.E.S Moss, A.M. Kammerer, J. Wu, J.M. Pestana, M.F. Riemer, R.B. Sancio, J.D. Bray, R.E. Kayen, A. Faris, 2003

6. NAVFAC DM 7.2 - NAVFAC DM7-02 Foundations and Earth Structures, Table 1: Typical Properties of Compacted Soils (Page 39) September 1986

7. Virginia Polytechnic Institute and State University, Virginia Tech Center For Geotechnical Practice and Research, Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice October 1998

8. STANTEC, Freeboard Analysis AEP Big Sandy Power Plant / Unit 1-2 Bottom Ash Pond Draft Report, February 2010

9. Kentucky Power Co., Big Sandy Plant, Big Sandy Kentucky; Bottom Ash Storage Area. Drawings: Dwg. 12-3642-6, April 27, 1961

10. Kentucky Power Co., Big Sandy Plant, Fly Ash Retention Dam, Final Raising Design Report, March 1993

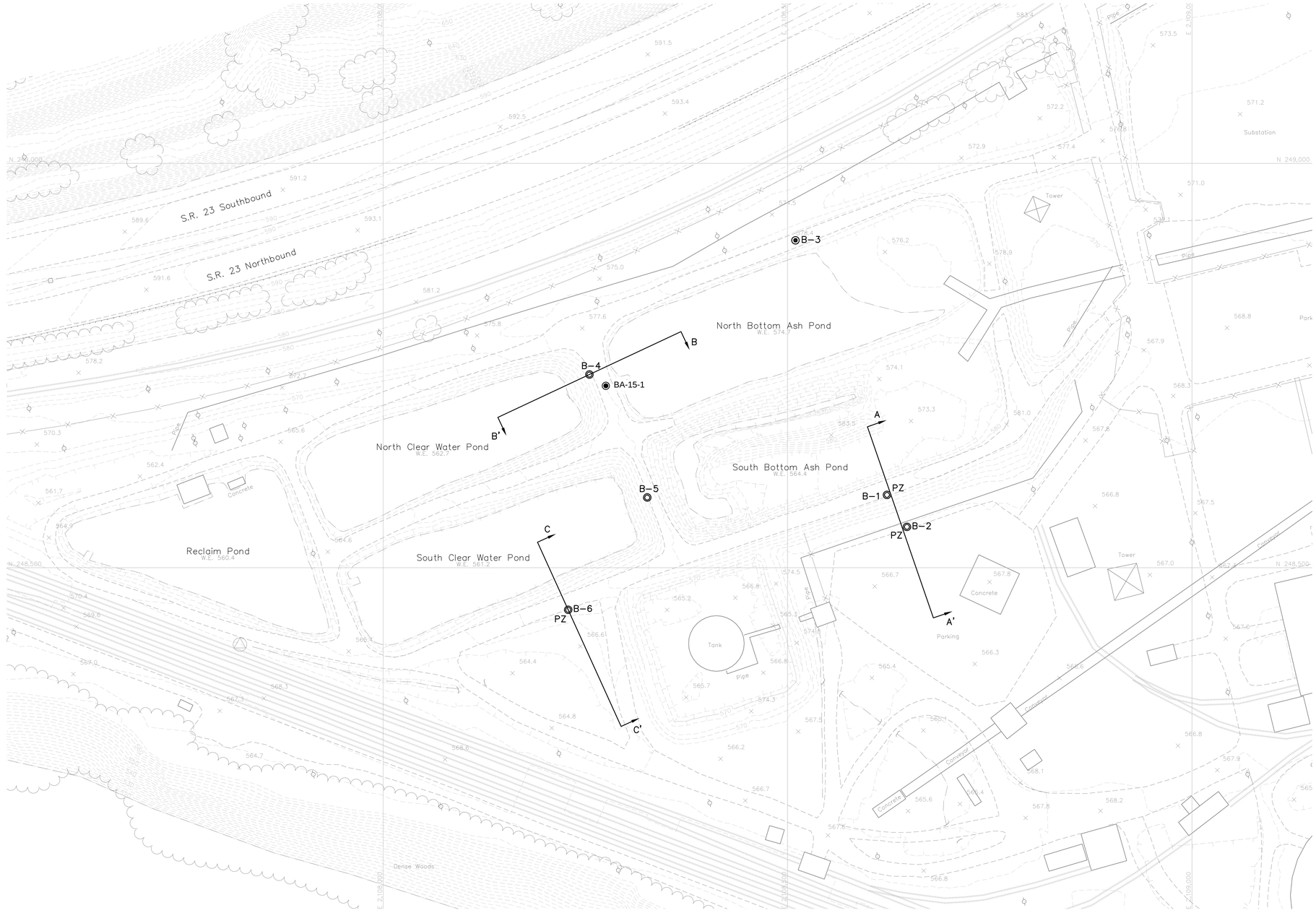
11. National Archives and Records and Administration, Federal Register, Part II: Environmental Protection Agency, Volume 80, Number 74, April 17, 2015

APPENDIX A

SITE PLANS

BOTTOM ASH POND COMPLEX

DWG. NO.



BORING LAYOUT
SCALE: 1"=50'

25 0 50 100 FEET
GRAPHIC SCALE

LEGEND

- ◎ Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- ◉ Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core
- PZ Piezometer Installed in Borehole
- X–X' Stability Analysis Cross Section

NOTES

REFERENCE DRAWINGS

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

INDIANA – KENTUCKY ELECTRIC CO.

BIG SANDY

LOUISA KENTUCKY

GEOTECHNICAL EXPLORATION
BORING LAYOUT

DWG. NO.

SCALE:	CIVIL ENGINEERING DIVISION
DR:	
CH:	
ARCH:	
ENGR:	
DATE:	

APPROVED BY

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SCALE: AS SHOWN	
DR: CW	
CH: EMK	
ENGR: CN	
DATE: JUNE, 2010	

Stantec

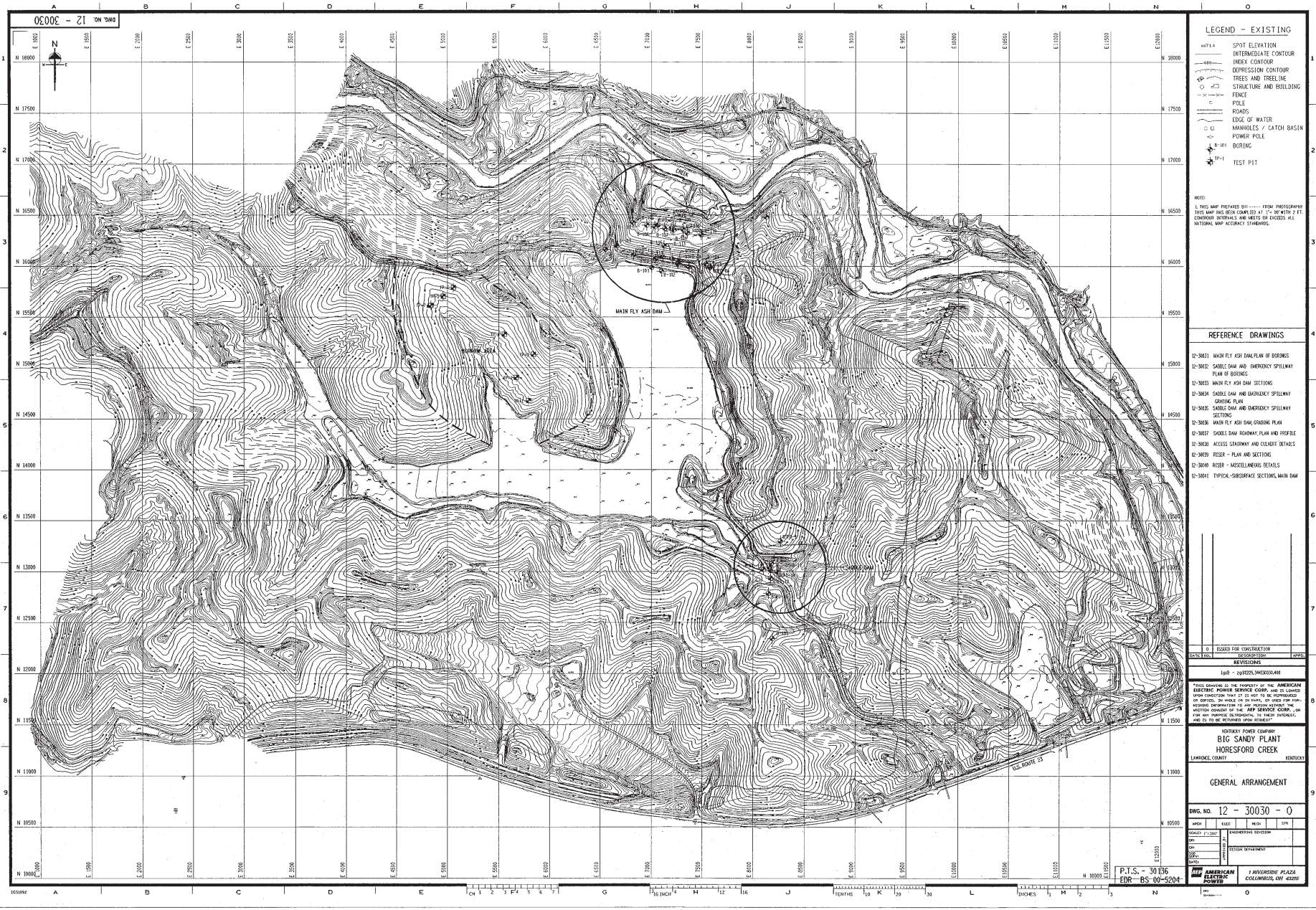
Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241
513-842-8200
www.stantec.com

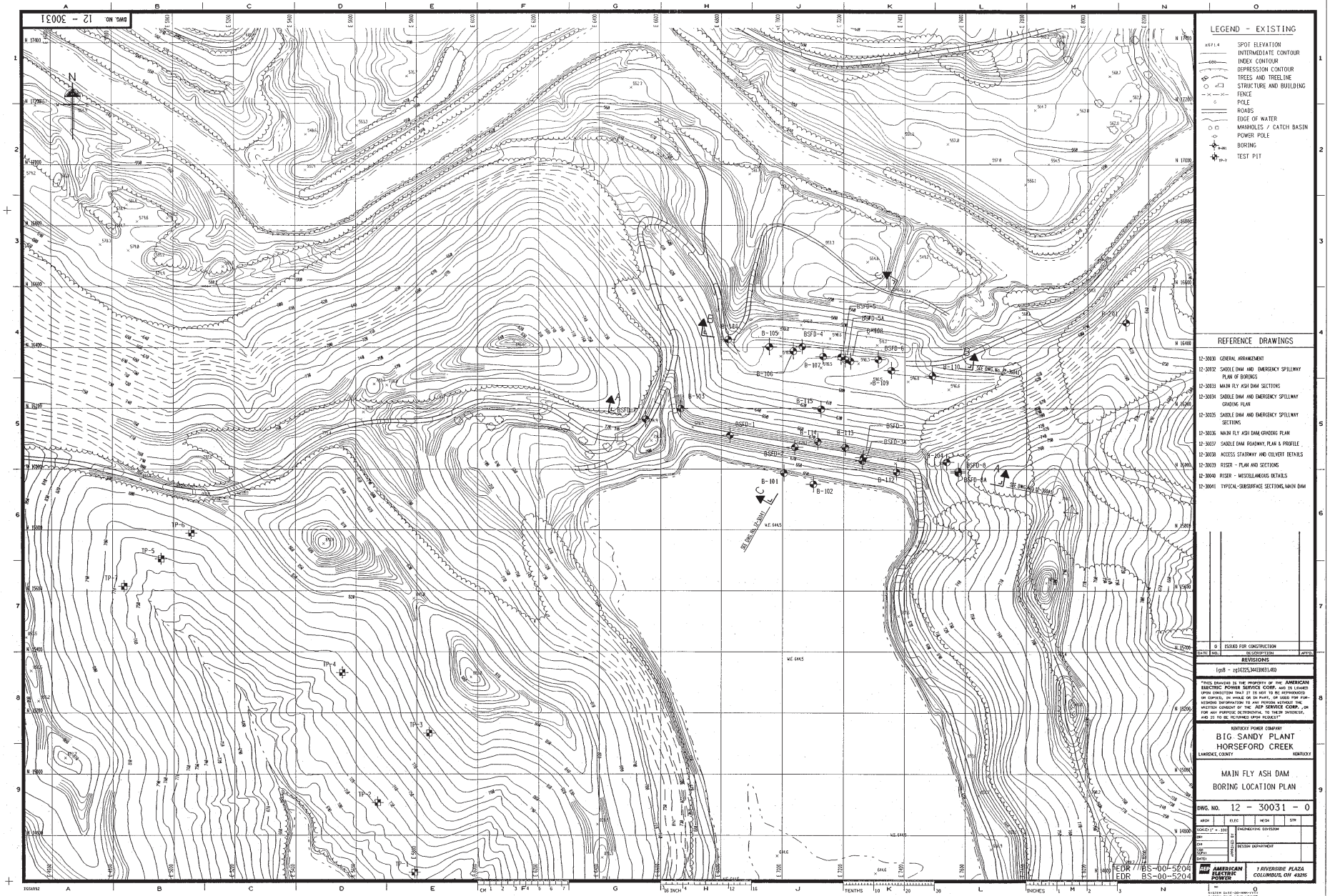
PLOT DATE: 06/17/2010 USER: MITHERS, CHERYENE
PLOT NAME: M:\CINCINNATI\GEOTECH\DRAWING_MXD\B-101-BL1.DWG

105094

CM 1 2 3 4 5 6 7 — 16 INCH 4 8 12 16 — TENTHS 10 20 30 — INCHES 1 2 3

FLY ASH POND MAIN DAM





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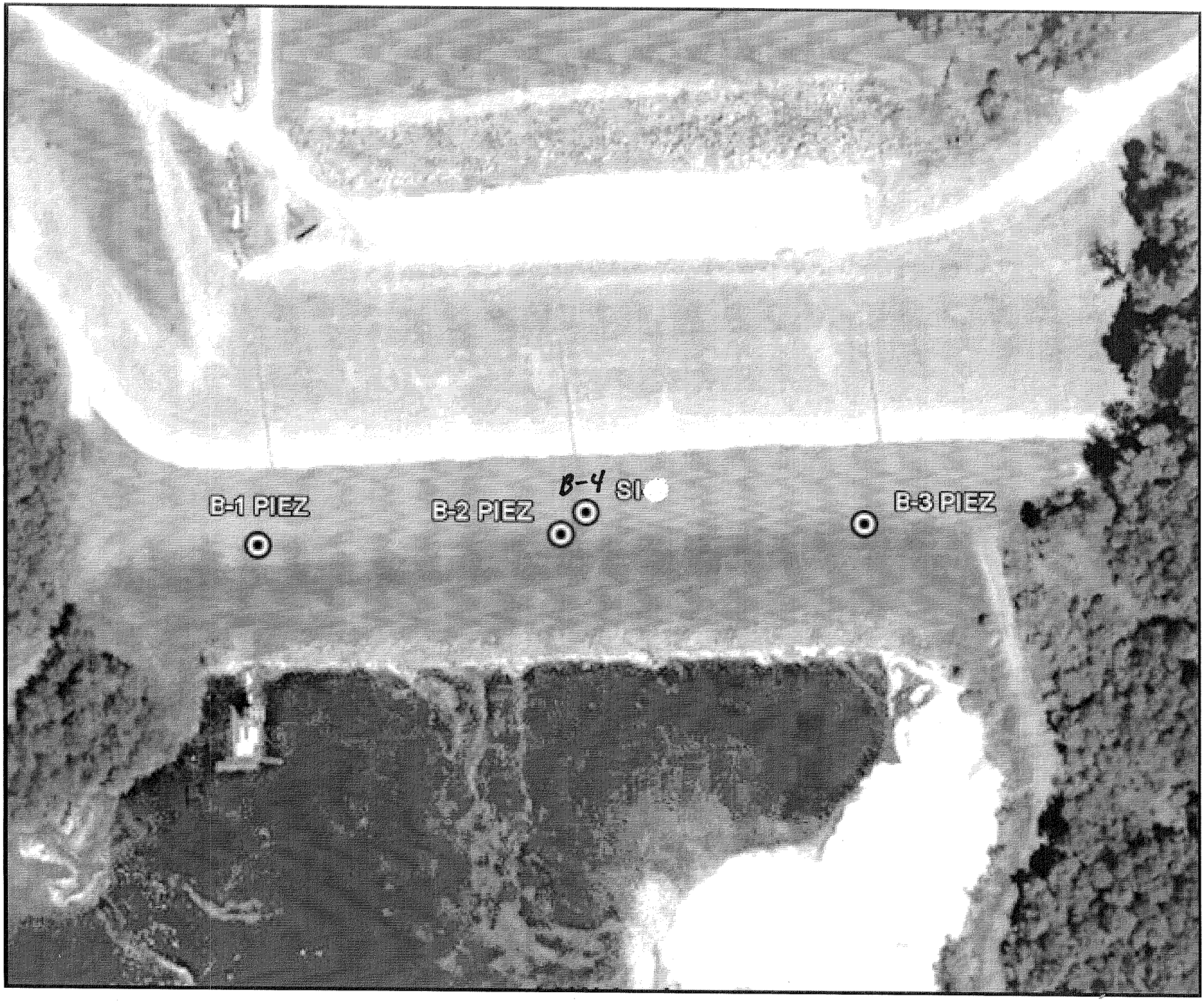


BIG SANDY PLANT - FAD
PIEZOMETERS & INCLINOMETER

DATUM: NAD83 KY N - PLANT VERT. **Surveyed: 2/22/10**

Point	North	East	Elevation	Description
B-1	254128.88	2105032.31	714.67	TOP PIPE
			712.43	TOP OF PAD
			712.23	GROUND
			714.45	TOP PROTECTOR (OPEN)
			714.97	TOP PROTECTOR (CLOSED)
				DEPTH 101.2' TO BOTTOM (DRY)
B-2	254147.60	2105331.79	714.92	TOP PIPE
			712.45	TOP OF PAD
			712.35	GROUND
			714.65	TOP PROTECTOR (OPEN)
			715.17	TOP PROTECTOR (CLOSED)
				DEPTH 152.65' TO WATER
B-3	254165.80	2105631.13	715.11	TOP PIPE
			712.78	TOP OF PAD
			712.68	GROUND
			714.83	TOP PROTECTOR (OPEN)
			715.35	TOP PROTECTOR (CLOSED)
				DEPTH 99.11' TO WATER
B-4	254169.90	2105355.94	715.37	TOP PIPE
			712.81	TOP OF PAD
			712.51	GROUND
			715.45	TOP PROTECTOR (OPEN)
			715.97	TOP PROTECTOR (CLOSED)

AEP-DOLAN CIVIL LAB

BS PLANT - FAD WELL CONVERSIONS

26 February 2010

INPUT	OUTPUT
State Plane, NAD83 1601 - Kentucky North, U.S. Feet	Geographic, NAD83

B-1 PIEZ

1/4

Northing/Y: 254128.88
Easting/X: 2105032.31

Latitude: 38 11 11.94325
Longitude: 82 38 00.37292

Convergence: 1 00 20.19944
Scale Factor: 0.999974007

B-2 PIEZ

2/4

Northing/Y: 254147.60
Easting/X: 2105331.79

Latitude: 38 11 12.07631
Longitude: 82 37 56.61838

Convergence: 1 00 22.53501
Scale Factor: 0.999974004

B-3 PIEZ

3/4

Northing/Y: 254165.80
Easting/X: 2105631.13

Latitude: 38 11 12.20421
Longitude: 82 37 52.86571

Convergence: 1 00 24.86943
Scale Factor: 0.999974000

B-4 SI

4/4

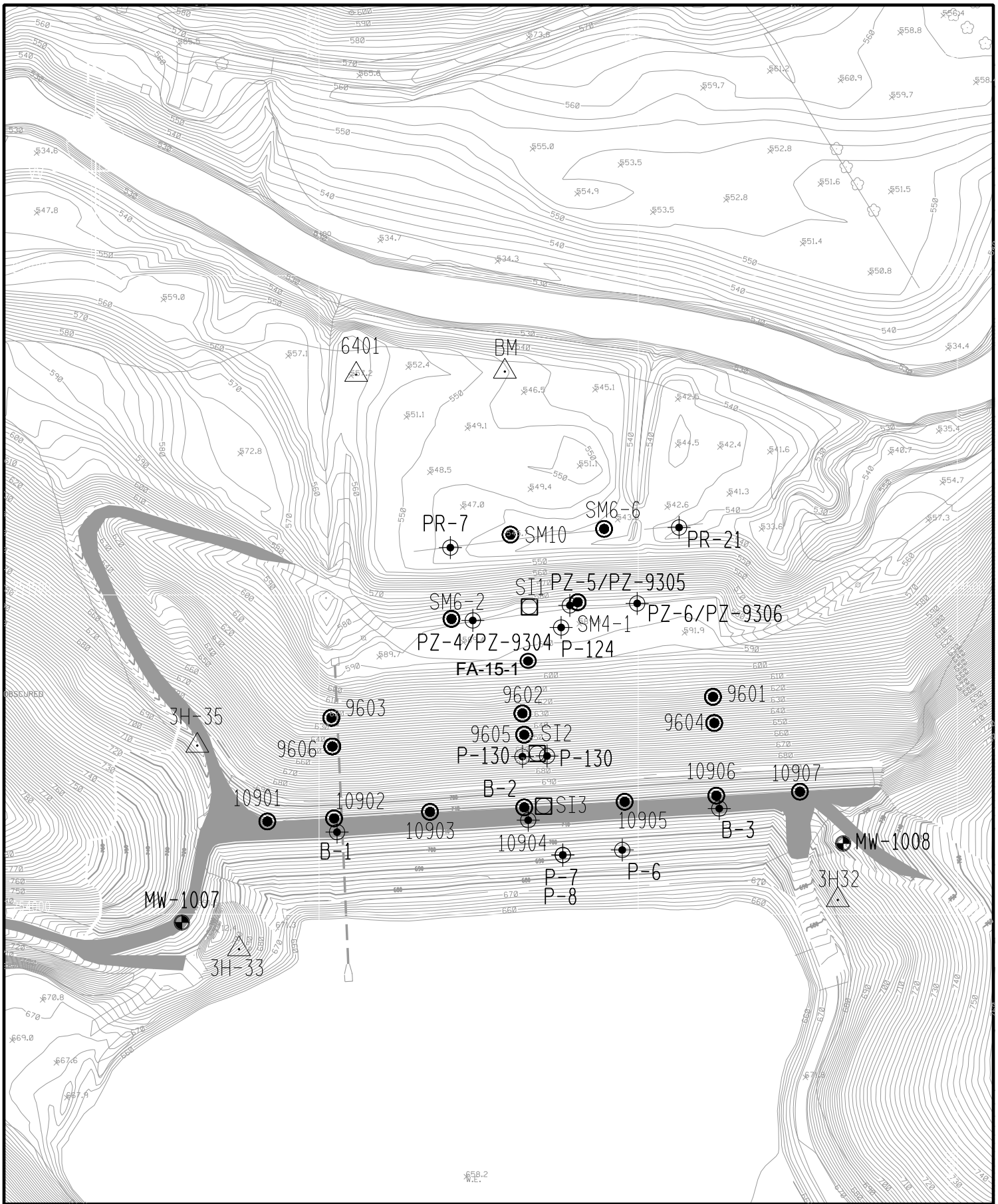
Northing/Y: 254169.90
Easting/X: 2105355.94

Latitude: 38 11 12.29253
Longitude: 82 37 56.31104

Convergence: 1 00 22.72620
Scale Factor: 0.999973998

Remark:

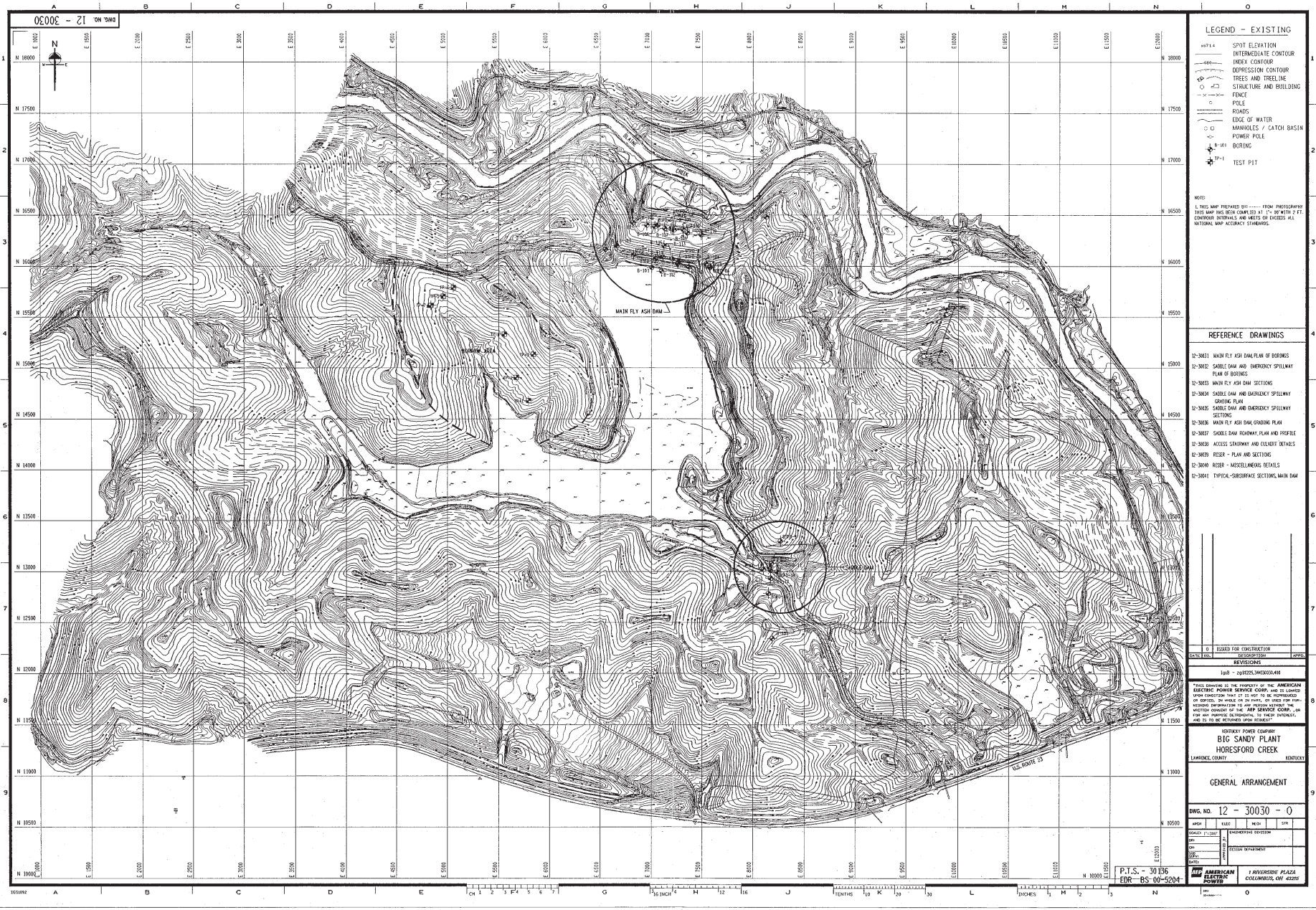
Corpscon v6.0.1, U.S. Army Corps of Engineers

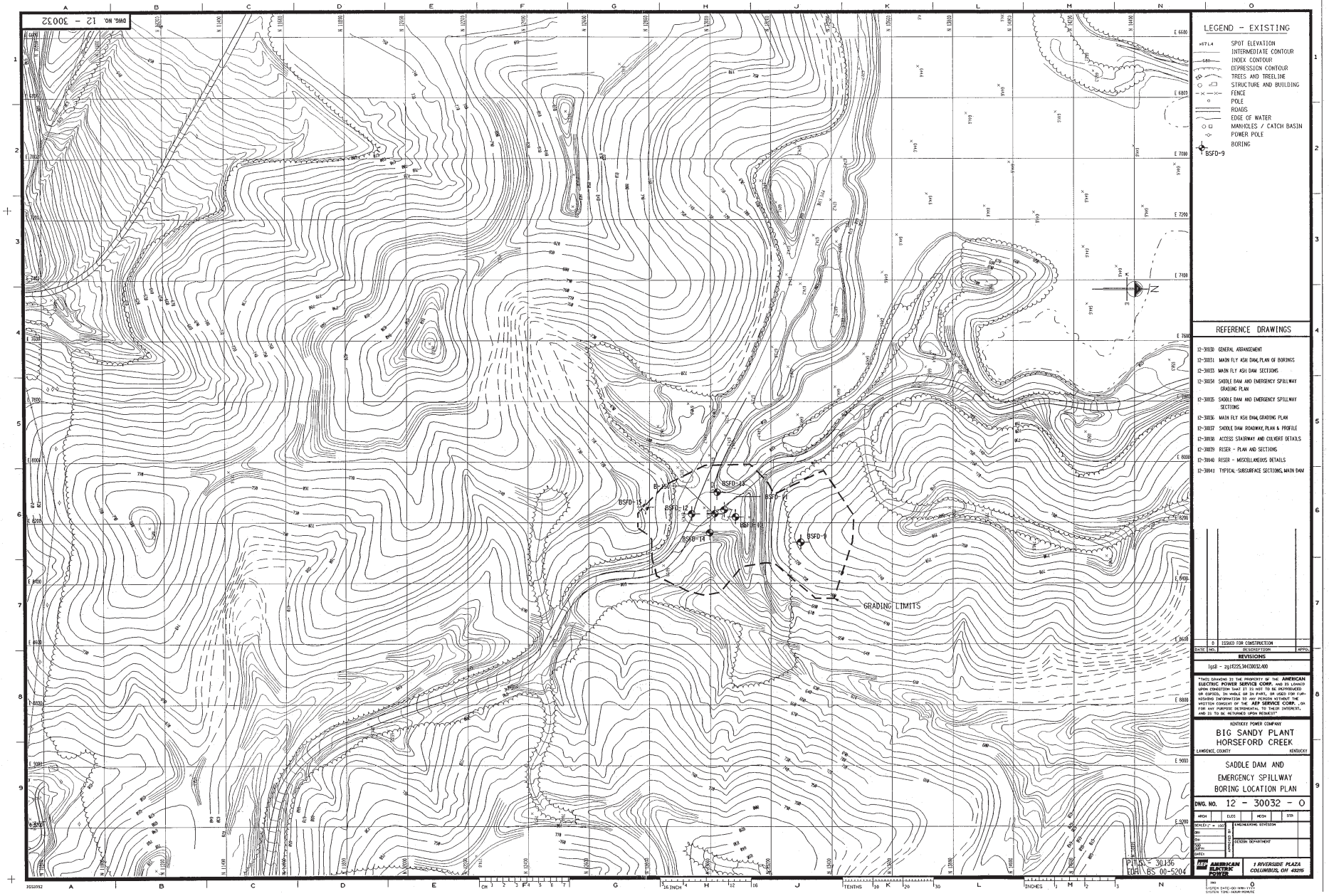


DRN BY:	BIG SANDY POWER STATION	DWG NO: FIGURE 2 rev 1
DATE:	SHEET 2 of 3	AEP AMERICAN ELECTRIC POWER
SCALE: 1"=200'	FLY ASH DAM	AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

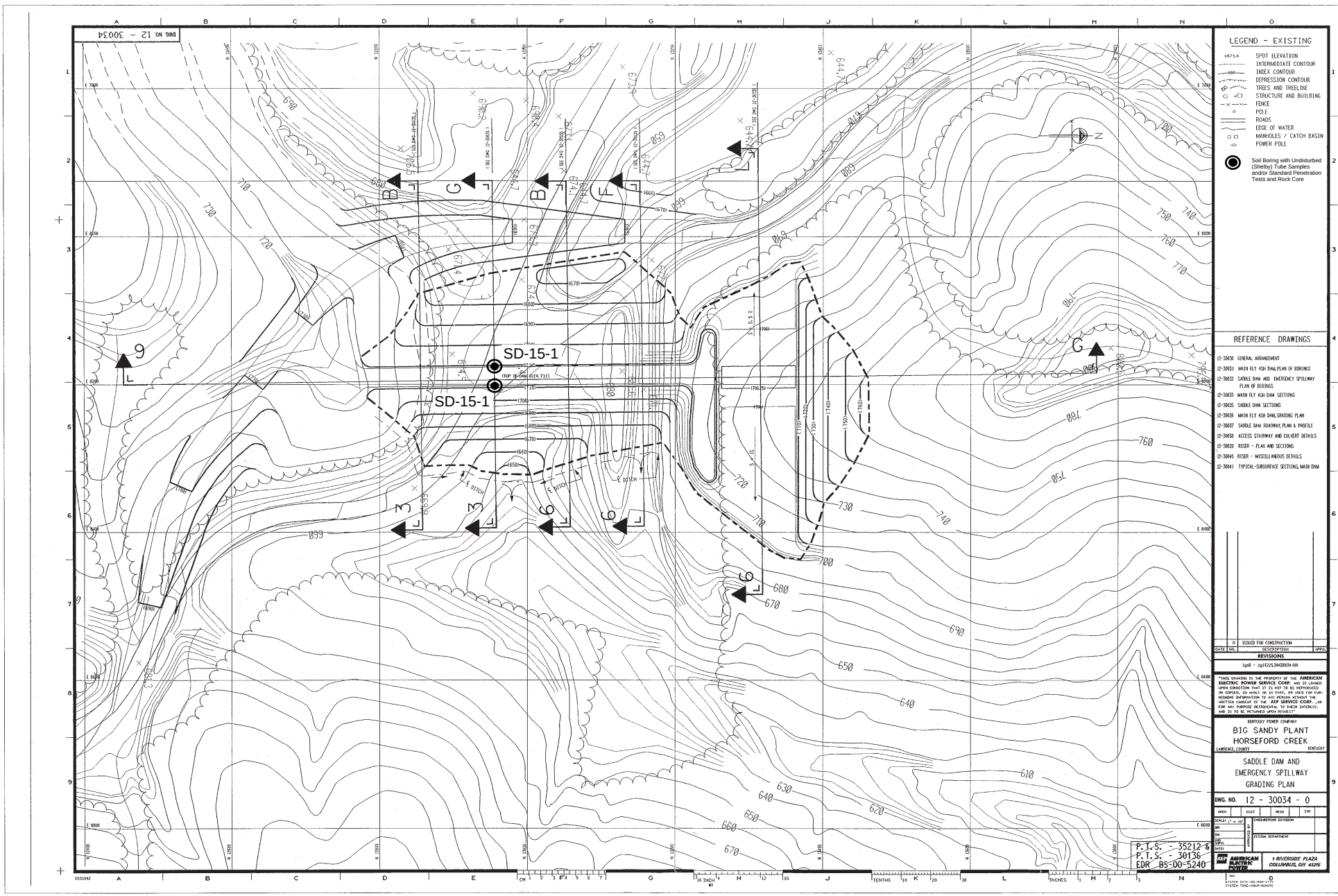
PLOT DATE: 10/23/2012
PLOT TIME: 9:02:56 AM BY: s182642

FLY ASH POND SADDLE DAM





AEPBSP-001326



APPENDIX B

BORING LOGS

BOTTOM ASH POND COMPLEX, 2010

SUBSURFACE LOG

Project Number	175539021	Location	Crest; South Bottom Ash Pond
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-1**
County	Lawrence, KY	Surface Elevation	579.9 ft
Project Type	Geotechnical Exploration	Date Started	10/28/09
Supervisor	C. Nisingizwe	Driller	M. Wethington
Logged By	C. Nisingizwe	Depth to Water	N/A

Total Depth: 61.5 ft | Completed: 10/28/09 | Depth to Water: 57.0 ft | Date/Time: 10/28/09 | Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
579.9'	0.0'	Top of Hole							
579.4'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown to grayish brown, moist, stiff to very stiff, Fill		SPT-1	2.5 - 4.0	0.6	10-6-9	15	N = 15
				ST-2	5.0 - 7.0	2.0		15	
				SPT-3	7.5 - 9.0	1.3	5-6-7	14	N = 13
569.9'	10.0'								
		Sandy Lean Clay, yellowish brown to grayish brown, moist, stiff		SPT-4	10.0 - 11.5	1.2	4-5-6	16	N = 11
				SPT-5	12.5 - 14.0	1.1	4-5-6	21	N = 11
				ST-6	15.0 - 17.0	2.0		21	
				SPT-7	17.5 - 19.0	1.5	3-4-6	19	N = 10
558.4'	21.5'			SPT-8	20.0 - 21.5	1.5	4-4-7	21	N = 11
		Sandy Lean Clay, reddish brown, moist to wet, very soft to medium stiff		SPT-9	22.5 - 24.0	1.5	2-3-5	22	N = 8
				SPT-10	25.0 - 26.5	1.5	1-2-3	22	N = 5
				ST-11	27.5 - 29.5	2.0		31	
				SPT-12	30.0 - 31.5	1.5	0-1-1	33	N = 2
				SPT-13	32.5 - 34.0	1.0	1-1-1	26	N = 2

SUBSURFACE LOG

Project Number 175539021 | Location Crest; South Bottom Ash Pond

Project Name AEP Big Sandy / Unit 1 - 2 | Boring No. **B-1** | Total Depth 61.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
543.4'	36.5'			SPT-14	35.0 - 36.5	1.5	1-2-2	30	N = 4
		Sand With Silt, light yellowish brown, damp to wet, loose to medium dense		SPT-15	37.5 - 39.0	0.3	3-4-5	11	N = 9
				SPT-16	40.0 - 41.5	0.5	3-3-10	10	N = 13
				SPT-17	42.5 - 44.0	0.6	4-6-11	5	N = 17
				SPT-18	45.0 - 46.5	0.8	7-7-4	5	N = 11
				SPT-19	47.5 - 49.0	0.7	5-6-9	8	N = 15
				SPT-20	50.0 - 51.5	1.0	9-8-9	7	N = 17
				SPT-21	52.5 - 54.0	1.1	3-6-10	6	N = 16
				SPT-22	55.0 - 56.5	1.5	5-14-15	7	N = 29
				SPT-23	57.5 - 59.0	1.5	3-4-10	18	N = 14
518.4'	61.5'			SPT-24	60.0 - 61.5	1.5	11-11-9	21	N = 20
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539021	Location	Toe; South Bottom Ash Pond		
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-2**	Total Depth	31.5 ft
County	Lawrence, KY	Surface Elevation	567.8 ft		
Project Type	Geotechnical Exploration	Date Started	10/29/09	Completed	10/29/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	20.0 ft	Date/Time	10/29/09
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
567.8'	0.0'	Top of Hole							
567.3'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown to grayish brown, moist, stiff		SPT-1	2.5 - 4.0	1.3	3-7-8	19	N = 15
				SPT-2	5.0 - 6.5	1.2	3-5-5	24	N = 10
				ST-3	7.5 - 9.5	2.0		21	
				SPT-4	10.0 - 11.5	1.5	3-4-5	26	N = 9
554.8'	13.0'								
		Sandy Lean Clay, reddish brown, moist to wet, very soft to medium stiff		SPT-5	12.5 - 14.0	1.5	4-4-3	22	N = 7
				SPT-6	15.0 - 16.5	1.5	2-1-3	26	N = 4
				ST-7	17.5 - 19.5	0.0		--	
				SPT-8	20.0 - 21.5	1.5	1-0-1	30	N = 1
544.8'	23.0'								
		Sand With Silt, light yellowish brown, wet, loose to medium dense, well-graded		SPT-9	22.5 - 24.0	0.6	2-4-5	8	N = 9
				SPT-10	25.0 - 26.5	0.7	2-4-6	11	N = 10
				SPT-11	27.5 - 29.5	0.8	2-3-6	8	N = 9
536.3'	31.5'			SPT-12	30.0 - 31.5	0.9	7-6-7	7	N = 13
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539021	Location	Crest; North Bottom Ash Pond
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-3**
County	Lawrence, KY	Surface Elevation	578.7 ft
Project Type	Geotechnical Exploration	Date Started	10/27/09
Supervisor	C. Nisingizwe	Driller	M. Wethington
Logged By	C. Nisingizwe	Depth to Water	N/A

Total Depth: 47.2 ft
Completed: 10/27/09
Depth to Water: 35.0 ft
Date/Time: 10/27/09
Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
578.7'	0.0'	Top of Hole							
578.2'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown to grayish brown, moist, medium stiff to stiff, Fill		SPT-1	2.5 - 4.0	1.3	5-5-8	17	N = 13
				SPT-2	5.0 - 6.5	1.3	3-3-5	19	N = 8
570.7'	8.0'								
		Sandy Lean Clay, yellowish brown to grayish brown, moist, medium stiff to stiff		ST-3	7.5 - 9.5	2.0		18	
				SPT-4	10.0 - 11.5	1.1	5-3-3	19	N = 6
				SPT-5	12.5 - 14.0	1.5	2-3-7	21	N = 10
				SPT-6	15.0 - 16.5	1.2	3-5-7	20	N = 12
561.7'	17.0'								
		Silty Sand, light yellowish brown, moist, loose		SPT-7	17.5 - 19.0	1.3	3-4-5	26	N = 9
557.2'	21.5'			SPT-8	20.0 - 21.5	1.4	3-3-3	25	N = 6
		Sand With Silt, light yellowish brown, damp to wet, loose to medium dense, well-graded		SPT-9	22.5 - 24.0	1.1	5-10-12	7	N = 22
				SPT-10	25.0 - 26.5	0.7	2-6-8	8	N = 14
				SPT-11	27.5 - 29.0	1.1	3-4-5	12	N = 9
				SPT-12	30.0 - 31.5	1.5	2-2-3	17	N = 5
				SPT-13	32.5 - 34.0	1.3	1-1-5	26	N = 6

SUBSURFACE LOG

Project Number 175539021 | Location Crest; North Bottom Ash Pond

Project Name AEP Big Sandy / Unit 1 - 2 | Boring No. **B-3** | Total Depth 47.2 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
542.7'	36.0'			SPT-14	35.0 - 36.0	0.6	19-12-50+	20	N = 50+ Began Core
		Sandstone, yellowish brown to gray, moderately hard, medium bedded, weathered							
536.7'	42.0'			43	6.0	3.3	55	42.0	
534.7'	44.0'	Shale, gray to dark gray, soft, very thin bedded, weathered		50	2.0	1.8	90	44.0	
534.5'	44.2'			0	0.2	0.2	100	44.2	
		Coal, black, soft, very thin bedded							
531.5'	47.2'	Shale, gray, soft, very thin bedded, weathered		40	3.0	2.0	67	47.2	
		Bottom of Hole							
		Top of Rock = 36.0' Elevation (542.7')							

SUBSURFACE LOG

Project Number	175539021	Location	Crest; N. Bottom Ash /Clearwater Ponds
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-4** Total Depth 56.5 ft
County	Lawrence, KY	Surface Elevation	577.6 ft
Project Type	Geotechnical Exploration	Date Started	10/29/09 Completed 10/29/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	Dry Date/Time 10/29/09
Logged By	C. Nisingizwe	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
577.6'	0.0'	Top of Hole							
577.1'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown to grayish brown, damp to moist, stiff, Fill		SPT-1	2.5 - 4.0	0.3	6-7-4	13	N = 11
				ST-2	5.0 - 7.0	1.2		26	
569.6'	8.0'								
		Sandy Lean Clay, yellowish brown to grayish brown, damp to moist, soft		SPT-3	7.5 - 9.0	1.0	1-2-2	16	N = 4
				ST-4	10.0 - 12.0	1.0		15	
565.6'	12.0'								
		Silty Sand, light yellowish brown, moist to wet, very loose to loose		SPT-5	12.5 - 14.0	1.0	3-3-3	18	N = 6
				SPT-6	15.0 - 16.5	1.0	1-1-2	35	N = 3
				ST-7	17.5 - 19.5	2.0		65	
556.1'	21.5'			SPT-8	20.0 - 21.5	1.3	1-1-1	61	N = 2
		Sand With Silt, light yellowish brown to reddish brown, damp to wet, very loose to dense, well-graded		SPT-9	22.5 - 24.0	1.0	2-2-2	24	N = 4
				SPT-10	25.0 - 26.5	1.5	0-1-0	27	N = 1
				SPT-11	27.5 - 29.0	1.3	0-1-0	27	N = 1
				SPT-12	30.0 - 31.5	0.6	6-15-18	9	N = 33
				SPT-13	32.5 - 34.0	0.7	8-12-14	9	N = 26

SUBSURFACE LOG

Project Number 175539021 | Location Crest; N. Bottom Ash /Clearwater Ponds

Project Name AEP Big Sandy / Unit 1 - 2 | Boring No. **B-4** | Total Depth 56.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Sand With Silt, light yellowish brown to reddish brown, damp to wet, very loose to dense, well-graded *(Continued)*		SPT-14	35.0 - 36.5	0.7	3-6-7	19	N = 13
				SPT-15	37.5 - 39.0	1.5	2-2-2	24	N = 4
537.6'	40.0'								
		Silty Clay With Sand, gray, moist to wet, very soft to medium stiff		SPT-16	40.0 - 41.5	1.5	1-2-2	24	N = 4
				SPT-17	42.5 - 44.0	0.4	1-2-2	25	N = 4
				SPT-18	45.0 - 46.5	1.2	3-3-5	23	N = 8
				SPT-19	47.5 - 49.0	1.5	1-1-1	27	N = 2
				SPT-20	50.0 - 51.5	1.5	1-0-1	27	N = 1
				SPT-21	52.5 - 54.0	1.5	0-1-1	26	N = 2
521.1'	56.5'			SPT-22	55.0 - 56.5	1.5	0-1-1	29	N = 2
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539021	Location	Crest; S. Bottom Ash /Clearwater Ponds		
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-5**	Total Depth	56.5 ft
County	Lawrence, KY	Surface Elevation	577.3 ft		
Project Type	Geotechnical Exploration	Date Started	10/29/09	Completed	10/29/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	Dry	Date/Time	10/29/09
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
577.3'	0.0'	Top of Hole							
576.8'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown to grayish brown, damp, medium stiff to stiff, Fill		SPT-1	2.5 - 4.0	0.7	6-5-7	16	N = 12
				SPT-2	5.0 - 6.5	1.0	3-3-3	14	N = 6
568.3'	9.0'			ST-3	7.5 - 9.5	0.9		11	
		Sandy Lean Clay, yellowish brown to grayish brown, damp, medium stiff		SPT-4	10.0 - 11.5	0.7	2-2-6	14	N = 8
				SPT-5	12.5 - 14.0	0.6	4-3-3	10	N = 6
				SPT-6	15.0 - 16.5	1.0	1-2-3	19	N = 5
				ST-7	17.5 - 19.5	2.0		16	
556.8'	20.5'			SPT-8	20.0 - 21.5	0.7	1-1-3	26	N = 4
		Silt With Sand, reddish brown with gray, moist to wet, very soft to soft		SPT-9	22.5 - 24.0	1.5	1-0-1	30	N = 1
				SPT-10	25.0 - 26.5	1.5	1-1-2	30	N = 3
				ST-11	27.5 - 29.5	2.0		33	
				SPT-12	30.0 - 31.5	1.2	0-0-1	31	N = 1
				SPT-13	32.5 - 34.0	1.3	1-1-1	28	N = 2
542.3'	35.0'								

SUBSURFACE LOG

Project Number 175539021 | Location Crest; S. Bottom Ash /Clearwater Ponds

Project Name AEP Big Sandy / Unit 1 - 2 | Boring No. **B-5** | Total Depth 56.5 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Sand With Silt, light yellowish brown, moist to wet, loose to medium dense, poorly-graded		SPT-14	35.0 - 36.5	1.1	2-7-12	28	N = 19
				SPT-15	37.5 - 39.0	1.0	2-4-6	10	N = 10
				SPT-16	40.0 - 41.5	0.8	4-5-5	8	N = 10
				SPT-17	42.5 - 44.0	1.2	4-9-10	6	N = 19
				SPT-18	45.0 - 46.5	1.1	11-13-9	7	N = 22
				SPT-19	47.5 - 49.0	1.2	3-2-3	14	N = 5
				SPT-20	50.0 - 51.5	1.1	3-2-2	20	N = 4
				SPT-21	52.5 - 54.0	1.1	9-13-17	6	N = 30
520.8'	56.5'			SPT-22	55.0 - 56.5	1.2	5-7-10	14	N = 17
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539021	Location	Crest; South Clearwater Pond		
Project Name	AEP Big Sandy / Unit 1 - 2	Boring No.	**B-6**	Total Depth	46.5 ft
County	Lawrence, KY	Surface Elevation	573.1 ft		
Project Type	Geotechnical Exploration	Date Started	10/28/09	Completed	10/28/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	23.0 ft	Date/Time	10/28/09
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
573.1'	0.0'	Top of Hole							
572.6'	0.5'	Gravel, white							
		Sandy Lean Clay, yellowish brown, damp, stiff, Fill		SPT-1	2.5 - 4.0	0.6	4-4-5	15	N = 9
567.1'	6.0'			ST-2	5.0 - 7.0	0.9		15	
		Sandy Lean Clay, yellowish brown to grayish brown, damp to wet, very soft to stiff		SPT-3	7.0 - 8.5	1.5	4-4-5	18	N = 9
				SPT-4	8.5 - 10.0	1.5	3-3-5	20	N = 8
				ST-5	10.0 - 12.0	2.0		21	
				SPT-6	12.5 - 14.0	1.5	3-3-4	24	N = 7
				SPT-7	15.0 - 16.5	1.5	3-3-5	25	N = 8
				SPT-8	17.5 - 19.5	1.5	1-2-2	20	N = 4
				SPT-9	20.0 - 21.5	1.5	1-3-2	30	N = 5
				ST-10	22.5 - 24.0	2.0		31	
				SPT-11	25.0 - 26.5	1.5	1-1-1	34	N = 2
544.1'	29.0'			SPT-12	27.5 - 29.5	1.5	0-1-0	35	N = 1
		Silt With Sand, gray, wet, very loose to loose		SPT-13	30.0 - 31.5	1.5	1-3-3	33	N = 6
539.1'	34.0'			SPT-14	32.5 - 34.0	0.6	3-4-5	16	N = 9

SUBSURFACE LOG

Project Number 175539021 | Location Crest; South Clearwater Pond

Project Name AEP Big Sandy / Unit 1 - 2 | Boring No. **B-6** | Total Depth 46.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Sand With Silt, light yellowish brown, damp, medium dense to dense, poorly-graded *(Continued)*		SPT-15	35.0 - 36.5	0.6	3-9-21	7	N = 30
				SPT-16	37.5 - 39.0	1.0	6-7-7	7	N = 14
				SPT-17	40.0 - 41.5	1.2	5-6-7	6	N = 13
				SPT-18	42.5 - 44.0	1.3	6-8-9	6	N = 17
526.6'	46.5'			SPT-18	45.0 - 46.5	1.2	8-11-11	5	N = 22
		No Refusal / Bottom of Hole							

175539021 AEP Big Sandy Plant
Unit 1-2 Bottom Ash Pond Geotechnical Exploration
Summary of Unit Weight Tests

Boring No.	Depth	Soil Indentification	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Natural Moisture Content (%)
B-1	5.5-6.0	1	126.1	107.7	17.1
B-1	6.1-6.6	1	135.7	119.8	13.2
B-1	15.0-15.5	1	128.8	106.6	20.9
B-1	15.6-16.1	1	130.4	107.9	21.2
B-1	27.8-28.3	1	120.8	92.3	30.9
B-2	7.5-8.0	2	125.5	102.9	21.9
B-2	8.1-8.6	1	128.1	105.9	21.0
B-3	7.5-8.0	1	125.8	104.3	20.6
B-3	8.1-8.6	1	131.2	114.1	15.1
B-4	5.0-5.5	1	125.3	99.4	26.1
B-4	10.1-10.6	1	135.0	117.6	14.8
B-4	17.5-19.3	4	--	--	65.0
B-5	7.5-8.0	1	131.8	118.7	11.1
B-5	17.5-18.0	1	133.4	118.5	12.6
B-5	18.1-18.6	1	135.7	113.7	19.3
B-5	27.5-28.0	6	121.0	91.1	32.8
B-6	5.0-7.0	1	--	--	15.1
B-6	10.0-10.5	1	131.1	107.5	22.0
B-6	10.6-11.1	1	130.2	107.4	21.2
B-6	11.2-11.7	1	127.8	107.4	18.9
B-6	22.5-23.0	1	122.4	93.6	30.7
B-6	23.1-23.6	1	121.8	93.0	30.9
AVERAGES			**128.4**	**106.5**	**22.8**
MINIMUM			**120.8**	**91.1**	**11.1**
MAXIMUM			**135.7**	**119.8**	**65.0**

BOTTOM ASH POND COMPLEX, 2015

SUBSURFACE LOG

Project Number	175553023	Location	Bottom Ash Pond Complex
Project Name	Big Sandy AEP	Boring No.	**BA-15-1** Total Depth 30.0 ft
County	Lawrence, KY	Surface Elevation	578 (Approximate)
Project Type	Geotechnical Exploration	Date Started	10/27/15 Completed 10/27/15
Supervisor	JRS Driller Triad	Depth to Water	Dry Date/Time 10/27/15
Logged By	JRS	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
578 (Approximate)	0.0	Top of Hole							
	0.5	Gravel							
		Sandy Lean Clay, yellowish brown to grayish brown, damp to moist, (fill)							
	8.0								
		Sandy Lean Clay With Gravel, yellowish brown to grayish brown, damp to moist, medium stiff		SPT-1	10.0 - 11.5	0.2	1-2-3	10	
				ST-2	12.5 - 14.5	2.0		18	PP = 2.5 tsf
	14.5								
		Silty Sand, gray, moist to wet, very loose to loose		SPT-3	15.0 - 16.5	0.9	3-3-4	18	
				ST-4	17.5 - 19.5	0.0		--	
				SPT-5	20.0 - 21.5	0.5	2-1-1	71	
				ST-6	22.5 - 24.5	2.0		37	
	24.5								
		Sandy Silty Clay, brown, wet, very soft		SPT-7	25.0 - 26.5	1.5	2-1-1	26	
				ST-8	27.5 - 29.5	0.3		24	
	30.0								
		No Refusal / Bottom of Hole							

FLY ASH POND MAIN DAM, 2010

SUBSURFACE LOG

Project Number	175539024	Location	West End of Dam
Project Name	AEP Big Sandy, Main Dam Instru.	Boring No.	**B-1**
County	Lawrence, KY	Surface Elevation	712.2 ft
Project Type	Geotechnical Exploration	Date Started	12/7/09
Supervisor	J. Musselman	Driller	G. Thompson
Logged By	J. Musselman		

Total Depth: 100.0 ft
Completed: 12/8/09
Depth to Water: Dry
Date/Time: 12/8/09
Depth to Water: N/A
Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
712.2'	0.0'	Top of Hole							
710.7'	1.5'	DGA							
		(CL) Light brown, sandy lean clay, damp, stiff		SPT-1	3.5 - 5.0	1.1	4-8-9	8	
703.1'	9.1'			SPT-2	8.5 - 10.0	1.5	6-8-10	10	
		(SM) Bottom Ash, damp to moist, dense		SPT-3	13.5 - 15.0	1.5	8-8-10	9	
				SPT-4	18.5 - 20.0	1.5	7-16-19	15	
				SPT-5	23.5 - 25.0	1.5	8-8-10	20	little clay present
				SPT-6	28.5 - 30.0	1.5	7-10-14	18	
				SPT-7	33.5 - 35.0	1.5	10-10-16	19	

Project Number 175539024 Location West End of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-1** Total Depth 100.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		(SM) Bottom Ash, damp to moist, dense *(Continued)*		SPT-8	38.5 - 40.0	1.5	14-10-13	16	
				SPT-9	43.5 - 45.0	1.5	13-11-15	15	
				SPT-10	48.5 - 50.0	1.5	16-15-18	14	
				SPT-11	53.5 - 55.0	1.5	7-18-20	21	
				SPT-12	58.5 - 60.0	1.5	10-11-13	21	
647.2'	65.0'			SPT-13	63.5 - 65.0	1.5	12-5-11	15	
		(SM) Light brown, silty sand with gravel, dry to damp, dense to very dense		SPT-14	68.5 - 70.0	1.2	20-32-30	7	
				SPT-15	73.5 - 75.0	1.5	14-17-24	6	

SUBSURFACE LOG

Project Number 175539024 | Location West End of Dam

Project Name AEP Big Sandy, Main Dam Instru. | Boring No. **B-1** | Total Depth 100.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Light brown, silty sand with gravel, dry to damp, dense to very dense *(Continued)*		SPT-16	78.5 - 80.0	1.2	10-22-33	8	
				SPT-17	83.5 - 85.0	1.1	11-19-24	8	
				SPT-18	88.5 - 90.0	1.3	21-31-42	3	
				SPT-19	93.5 - 95.0	0.8	22-33-50	8	
612.2'	100.0'			SPT-20	98.5 - 100.0	1.5	16-25-24	1	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BIG SANDY MAIN DAM.GPJ FMSM-GRAPHIC LOG.GDT 2/26/10

2/26/10

SUBSURFACE LOG

Project Number	175539024	Location	Center of Dam
Project Name	AEP Big Sandy, Main Dam Instru.	Boring No.	**B-2**
County	Lawrence, KY	Surface Elevation	712.4 ft
Project Type	Geotechnical Exploration	Date Started	12/10/09
Supervisor	J. Musselman	Driller	G. Thompson
Logged By	J. Musselman		

Total Depth	201.0 ft									
Completed	12/15/09									
Depth to Water	152.7 ft	Date/Time	2/22/10							
Depth to Water	N/A	Date/Time	N/A							

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
712.4'	0.0'	Top of Hole							
711.4'	1.0'	DGA							
		(CL) Light brown, sandy lean clay, damp, stiff		SPT-1	4.5 - 6.0	0.0	8-14-12	12	Took sample of auger cuttings
702.4'	10.0'								
		(SM) Bottom Ash, dry to damp, dense		SPT-2	9.5 - 11.0	1.0	5-9-11	13	
				SPT-3	14.5 - 16.0	1.4	5-8-12	15	
				SPT-4	19.5 - 21.0	1.5	7-7-12	11	
				SPT-5	24.5 - 26.0	1.5	10-11-9	28	
				SPT-6	29.5 - 31.0	1.5	10-11-8	10	
				SPT-7	34.5 - 36.0	1.5	8-10-12	15	

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-2** Total Depth 201.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		(SM) Bottom Ash, dry to damp, dense *(Continued)*							
				SPT-8	39.5 - 41.0	1.5	6-13-18	11	
				SPT-9	44.5 - 46.0	1.5	9-15-15	12	
				SPT-10	49.5 - 51.0	1.4	6-6-15	11	
				SPT-11	54.5 - 56.0	1.5	11-16-15	18	
				SPT-12	59.5 - 61.0	1.5	12-12-11	12	
				SPT-13	64.5 - 66.0	1.5	7-11-10	21	
641.3'	71.1'			SPT-14	69.5 - 71.0	1.4	7-11-11	7	
		(SM) Light brown, silty sand with gravel, dry to damp, medium to very dense							
				SPT-15	74.5 - 76.0	1.0	1-7-8	1	

SUBSURFACE LOG

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-2** Total Depth 201.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Light brown, silty sand with gravel, dry to damp, medium to very dense *(Continued)*		SPT-16	79.5 - 81.0	1.1	8-13-28	8	
				SPT-17	84.5 - 86.0	1.2	8-38-23	7	
				SPT-18	89.5 - 91.0	1.4	3-3-34	6	Moist from 90' to 90.7'
				SPT-19	94.5 - 96.0	1.5	9-23-18	8	
				SPT-20	99.5 - 101.0	1.0	12-15-21	6	
				SPT-21	104.5 - 106.0	0.3	50/0.3	8	
				SPT-22	109.5 - 111.0	1.0	15-16-30	5	
				SPT-23	114.5 - 116.0	1.2	11-36-50	8	

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-2** Total Depth 201.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Light brown, silty sand with gravel, dry to damp, medium to very dense *(Continued)*		SPT-24	119.5 - 121.0	1.5	13-35-35	7	
				SPT-25	124.5 - 126.0	1.5	11-23-26	6	
				SPT-26	129.5 - 131.0	1.3	13-22-28	7	
				SPT-27	134.5 - 136.0	1.4	26-22-22	7	
572.4'	140.0'								Began using drilling mud
		(SM) Gray, silty sand with gravel, damp, dense (possible bottom ash)		SPT-28	139.5 - 141.0	1.2	8-18-22	17	
567.9'	144.5'								
		(SM) Gray, silty sand with gravel and rock fragments, damp, very dense		SPT-29	144.5 - 146.0	1.4	12-31-24	7	
				SPT-30	149.5 - 151.0	1.4	18-46-22	6	
				SPT-31	154.5 - 156.0	1.0	12-17-22	20	Used cathead and safety hammer for remainder of samples
552.9'	159.5'								

SUBSURFACE LOG

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-2** Total Depth 201.0 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
		(CL) Brown and gray, lean clay, rock fragments present, damp to moist, very stiff *(Continued)*		SPT-32	159.5 - 161.0	1.0	12-21-22	15	
				SPT-33	164.5 - 166.0	1.5	15-25-45	18	
				SPT-34	169.5 - 171.0	1.5	16-21-26	18	
				SPT-35	174.5 - 176.0	1.5	14-19-30	19	
				SPT-36	179.5 - 181.0	1.5	16-23-32	18	
				SPT-37	184.5 - 186.0	1.5	15-17-26	19	
522.9'	189.5'								
		(SM) Gray, silty sand with rock fragments, damp to moist, dense to very dense		SPT-38	189.5 - 191.0	1.5	17-24-23	14	
				SPT-39	194.5 - 196.0	1.2	20-38-50	16	
511.4'	201.0'			SPT-40	199.5 - 201.0	1.0	15-15-25	14	

SUBSURFACE LOG

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-2** Total Depth 201.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539024	Location	East End of Dam		
Project Name	AEP Big Sandy, Main Dam Instru.	Boring No.	**B-3**	Total Depth	101.0 ft
County	Lawrence, KY	Surface Elevation	712.7 ft		
Project Type	Geotechnical Exploration	Date Started	12/9/09	Completed	12/10/09
Supervisor	J. Musselman Driller G. Thompson	Depth to Water	99.1 ft	Date/Time	2/22/10
Logged By	J. Musselman	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
712.7'	0.0'	Top of Hole							
711.2'	1.5'	DGA							
		(CL) Light brown, sandy lean clay, damp, stiff		SPT-1	4.5 - 6.0	1.2	2-4-8	11	
702.7'	10.0'								
		(ML, SM) Bottom Ash, damp, dense		SPT-2	9.5 - 11.0	1.5	3-6-7	12	
				SPT-3	14.5 - 16.0	1.5	6-11-12	13	
				SPT-4	19.5 - 21.0	1.5	4-8-10	14	
				SPT-5	24.5 - 26.0	1.2	4-5-4	31	Layers of finer material
				SPT-6	29.5 - 31.0	1.5	8-9-11	24	
				SPT-7	34.5 - 36.0	1.5	7-12-8	17	

SUBSURFACE LOG

Project Number 175539024 | Location East End of Dam

Project Name AEP Big Sandy, Main Dam Instru. | Boring No. **B-3** | Total Depth 101.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(ML, SM) Bottom Ash, damp, dense *(Continued)*							
				SPT-8	39.5 - 41.0	1.5	5-9-14	14	
				SPT-9	44.5 - 46.0	1.5	9-15-16	15	
				SPT-10	49.5 - 51.0	1.5	9-15-23	10	
				SPT-11	54.5 - 56.0	1.5	5-9-16	18	
				SPT-12	59.5 - 61.0	1.5	6-8-11	20	Moist seams
				SPT-13	64.5 - 66.0	1.5	8-15-11	12	
642.7'	70.0'								
		(SM) Light brown,silty sand with gravel, rock fragments present, damp to moist, dense to very dense		SPT-14	69.5 - 71.0	1.5	12-10-15	3	
				SPT-15	74.5 - 76.0	1.0	8-16-18	8	

SUBSURFACE LOG

Project Number 175539024 | Location East End of Dam

Project Name AEP Big Sandy, Main Dam Instru. | Boring No. **B-3** | Total Depth 101.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Light brown,silty sand with gravel, rock fragments present, damp to moist, dense to very dense *(Continued)*		SPT-16	79.5 - 81.0	1.0	20-33-25	5	
				SPT-17	84.5 - 86.0	1.1	20-25-30	6	
				SPT-18	89.5 - 91.0	1.0	11-20-27	7	Some gray
				SPT-19	94.5 - 96.0	1.4	24-20-20	7	
611.7'	101.0'			SPT-20	99.5 - 101.0	1.3	20-14-16	5	Some gray
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175539024	Location	Center of Dam
Project Name	AEP Big Sandy, Main Dam Instru.	Boring No.	**B-4**
County	Lawrence, KY	Surface Elevation	712.5 ft
Project Type	Geotechnical Exploration	Date Started	12/16/09
Supervisor	J. Musselman	Driller	G. Thompson
Logged By	J. Musselman		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
712.5'	0.0'	Top of Hole								
711.5'	1.0'	DGA								
		(CL) Brown, sandy lean clay with gravel, damp, stiff		SPT-1	4.5 - 6.0	1.0	4-5-10	17		
702.5'	10.0'									
		(SM) Bottom Ash, dry to damp, dense		SPT-2	9.5 - 11.0	1.5	8-15-15	18		
				SPT-3	14.5 - 16.0	1.5	6-11-15	15		
				SPT-4	19.5 - 21.0	1.5	12-12-12	14		
				SPT-5	24.5 - 26.0	1.5	8-12-13	32		
				SPT-6	29.5 - 31.0	1.5	9-16-12	16		
				SPT-7	34.5 - 36.0	1.5	9-15-21	13		

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-4** Total Depth 209.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		(SM) Bottom Ash, dry to damp, dense *(Continued)*							
				SPT-8	39.5 - 41.0	1.5	15-16-16	15	
				SPT-9	44.5 - 46.0	1.5	11-12-12	14	
				SPT-10	49.5 - 51.0	1.5	11-6-9	12	
				SPT-11	54.5 - 56.0	1.5	18-22-24	20	
				SPT-12	59.5 - 61.0	1.5	12-14-17	16	
				SPT-13	64.5 - 66.0	1.5	12-20-15	16	
				SPT-14	69.5 - 71.0	1.5	16-13-16	14	
				SPT-15	74.5 - 76.0	1.5	20-20-29	15	

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-4** Total Depth 209.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
632.2'	80.3'	(SM) Bottom Ash, dry to damp, dense *(Continued)*		SPT-16	79.5 - 81.0	1.5	21-12-19	9	
		(SM) Light brown, silty sand, dry to damp, dense to very dense		SPT-17	84.5 - 86.0	1.0	12-16-12	8	
				SPT-18	89.5 - 91.0	1.5	11-17-30	10	
				SPT-19	94.5 - 96.0	0.4	50/0.4	5	Large rock fragments in sample
613.0'	99.5'								
		(SM) Light brown, silty sand with gravel, dry to damp, dense to very dense		SPT-20	99.5 - 101.0	1.5	10-11-9	9	Some gray, increased fines content
				SPT-21	104.5 - 106.0	1.5	17-14-19	8	
				SPT-22	109.5 - 111.0	1.5	16-45-38	7	
				SPT-23	114.5 - 116.0	1.5	20-24-50/0.2	11	

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SUBSURFACE LOG

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-4** Total Depth 209.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Light brown, silty sand with gravel, dry to damp, dense to very dense *(Continued)*		SPT-24	119.5 - 121.0	0.9	40-50/0.4	8	
				SPT-25	124.5 - 126.0	0.2	50/0.2	7	Large rock fragments in sample
				SPT-26	129.5 - 131.0	0.4	50/0.4	7	
				SPT-27	134.5 - 136.0	1.5	35-50-30	9	
573.0'	139.5'								
571.5'	141.0'	(SW-SM) Gray, well graded sand with silt and gravel, dry, dense		SPT-28	139.5 - 141.0	1.1	30-25-21	2	Possible old roadbed material
		(SM) Brown, silty sand with gravel, dry to damp, dense to very dense							Unable to free augers, possibly hung on manmade debris
				SPT-29	149.5 - 151.0	1.2	27-32-50/0.2	13	Restarted hole 10' east to continue sampling and install Inclinometer

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Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-4** Total Depth 209.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		(SM) Brown, silty sand with gravel, dry to damp, dense to very dense *(Continued)*		SPT-30	159.5 - 161.0	1.5	27-20-13	10	
543.0'	169.5'								
		(SM) Brown and gray, silty sand with gravel and stone fragements, damp, very dense		SPT-31	169.5 - 171.0	1.5	37-38-23	10	
533.0'	179.5'								
		(CL) Brown, lean clay, moist, very stiff		SPT-32	179.5 - 181.0	1.3	20-28-26	19	
522.0'	190.5'			SPT-33	189.5 - 191.0	1.5	15-34-44	20	
		(CL) Dark gray, lean clay with sand, moist, very stiff							
512.5'	200.0'								
				SPT-34	199.5 - 201.0	1.5	22-36-39	14	

SUBSURFACE LOG

Project Number 175539024 Location Center of Dam

Project Name AEP Big Sandy, Main Dam Instru. Boring No. **B-4** Total Depth 209.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
508.4'	204.1'	(CL) Gray, sandy lean clay, damp, very stiff *(Continued)*							
503.2'	209.3'	Gray sandstone, fine grained, thick bedded, hard		SPT-35	209.0 - 209.3	0.1	50/0.1	8	
		No Refusal / Bottom of Hole Top of Rock = 204.1' Elevation (508.4')							

FLY ASH POND MAIN DAM, 2015

SUBSURFACE LOG

Project Number	175553023	Location	Fly Ash Pond Main Dam
Project Name	Big Sandy AEP	Boring No.	**FA-15-1** Total Depth 30.0 ft
County	Lawrence, KY	Surface Elevation	586 (Approximate)
Project Type	Geotechnical Exploration	Date Started	11/2/15 Completed 11/2/15
Supervisor	JRS Driller Triad	Depth to Water	Dry Date/Time 11/2/15
Logged By	JRS	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
586	0.0	Top of Hole							
(Approximate)	1.0	Gravel							
		Sand, gray, wet		ST-1	5.0 - 7.0	1.8		19	
	7.0								
		Lean Clay With Sand, brown and gray, moist, stiff		ST-2	7.5 - 9.5	1.4		13	
				SPT-3	10.0 - 11.5	0.7	3-4-6	18	PP = 3.5 tsf
				ST-4	12.5 - 14.5	1.8		16	PP = 3.5 tsf
				SPT-5	15.0 - 16.5	0.9	3-4-6	12	PP = 4.5+ tsf
				ST-6	17.5 - 19.5	2.0		14	PP = 4.5+ tsf
	21.5			SPT-7	20.0 - 21.5	1.1	5-8-17	12	PP = 4.0 tsf
		Silty Sand, brown and gray, damp, dense to very dense		SPT-8	22.5 - 24.0	1.2	19-31-22	6	
				SPT-9	25.0 - 26.5	0.6	13-23-24	6	
				SPT-10	27.5 - 29.0	0.8	15-23-23	6	
	30.0								
		No Refusal / Bottom of Hole							

FLY ASH POND SADDLE DAM, 2015

SUBSURFACE LOG

Project Number	175553023	Location	Fly Ash Pond Saddle Dam
Project Name	Big Sandy AEP	Boring No.	**SD-15-1** Total Depth 81.5 ft
County	Lawrence, KY	Surface Elevation	711 (Approximate)
Project Type	Geotechnical Exploration	Date Started	10/30/15 Completed 10/30/15
Supervisor	JRS Driller Triad	Depth to Water	Dry Date/Time 10/30/15
Logged By	JRS	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
711 (Approximate)	0.0	Top of Hole							
	2.0	Gravel							
		Lean Clay With Sand, brown and gray, moist, stiff		SPT-1	5.0 - 6.5	0.8	5-6-7	16	PP = 2.0 tsf
	8.0	Sand, gray, damp, medium dense to dense, (Bottom Ash)		SPT-2	10.0 - 11.5	1.0	14-14-19	12	Very dense from 13.0' to 18.0'
				SPT-3	15.0 - 16.5	1.2	22-28-23	12	
				SPT-4	20.0 - 21.5	1.0	8-9-10	20	
				SPT-5	25.0 - 26.5	1.0	10-17-19	15	
				SPT-6	30.0 - 31.5	1.0	11-15-10	13	Moist beginning at 33.0'
				SPT-7	35.0 - 36.5	1.0	10-14-14	21	

SUBSURFACE LOG

Project Number 175553023 | Location Fly Ash Pond Saddle Dam

Project Name Big Sandy AEP | Boring No. **SD-15-1** | Total Depth 81.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	38.0								
		Lean Clay With Sand, brown and gray, moist, very stiff		SPT-8	40.0 - 41.5	0.9	6-8-11	19	PP = 3.25 tsf
				SPT-9	45.0 - 46.5	1.3	7-11-15	15	PP = 2.5 tsf
	49.0								
		Sandy Lean Clay, reddish brown to brown, moist, very stiff		SPT-10	50.0 - 51.5	1.2	9-12-16	13	
				SPT-11	55.0 - 56.5	1.1	22-12-16	13	PP = 3.5 tsf
	58.5			SPT-12	57.0 - 58.5	0.8	18-11-14	12	Gravel from 57.0' to 57.3' PP = 3.0 tsf
		Lean Clay With Sand, brown and gray, moist, very stiff, wood fragments (fill)		SPT-13	60.0 - 61.5	1.2	7-9-10	14	PP = 2.5 tsf
	63.0								
		Sandy Lean Clay, reddish brown to brown, moist, very stiff		SPT-14	65.0 - 66.5	1.2	6-8-10	17	PP = 2.25 tsf
	68.0								
		Clayey Sand, brown and gray, moist to wet, loose to medium dense		SPT-15	70.0 - 71.5	1.5	4-5-6	17	PP = 1.0 tsf
				SPT-16	75.0 - 76.5	1.5	3-3-4	20	PP = 0.5 tsf

SUBSURFACE LOG

Project Number	175553023	Location	Fly Ash Pond Saddle Dam
Project Name	Big Sandy AEP	Boring No.	**SD-15-1** Total Depth 81.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	81.0	Clayey Sand, brown and gray, moist to wet, loose to medium dense *(Continued)*		SPT-17	80.0 - 81.5	1.5	WOH-12-50/0.5'	15	
	81.5	Weathered Gray Shale							
		Auger Refusal / Bottom of Hole							

SUBSURFACE LOG

Project Number	175553023	Location	Fly Ash Pond Saddle Dam
Project Name	Big Sandy AEP	Boring No.	**SD-15-2** Total Depth 75.2 ft
County	Lawrence, KY	Surface Elevation	711 (Approximate)
Project Type	Geotechnical Exploration	Date Started	10/28/15 Completed 10/29/15
Supervisor	JRS Driller Triad	Depth to Water	Dry Date/Time 10/29/15
Logged By	JRS	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
711	0.0	Top of Hole							
(Approximate)	1.0	Gravel							
		Lean Clay With Sand, brown and gray, moist, very stiff		ST-1	5.0 - 7.0	0.0		--	
				SPT-2	10.0 - 11.5	0.5	6-7-10	15	PP = 3.0 tsf
	16.0			ST-3	15.0 - 17.0	1.8		14	
		Coarse Sand, gray, moist, loose, (Bottom Ash)		SPT-4	20.0 - 21.5	0.8	7-6-4	17	
	23.0								
		Lean Clay With Gravel, brown, moist, stiff		SPT-5	25.0 - 26.5	0.8	3-5-6	20	PP = 2.5 tsf
				ST-6	30.0 - 32.0	1.8		19	PP = 3.5 tsf
				SPT-7	35.0 - 36.5	1.3	5-6-8	15	PP = 2.0 tsf

SUBSURFACE LOG

Project Number 175553023 | Location Fly Ash Pond Saddle Dam

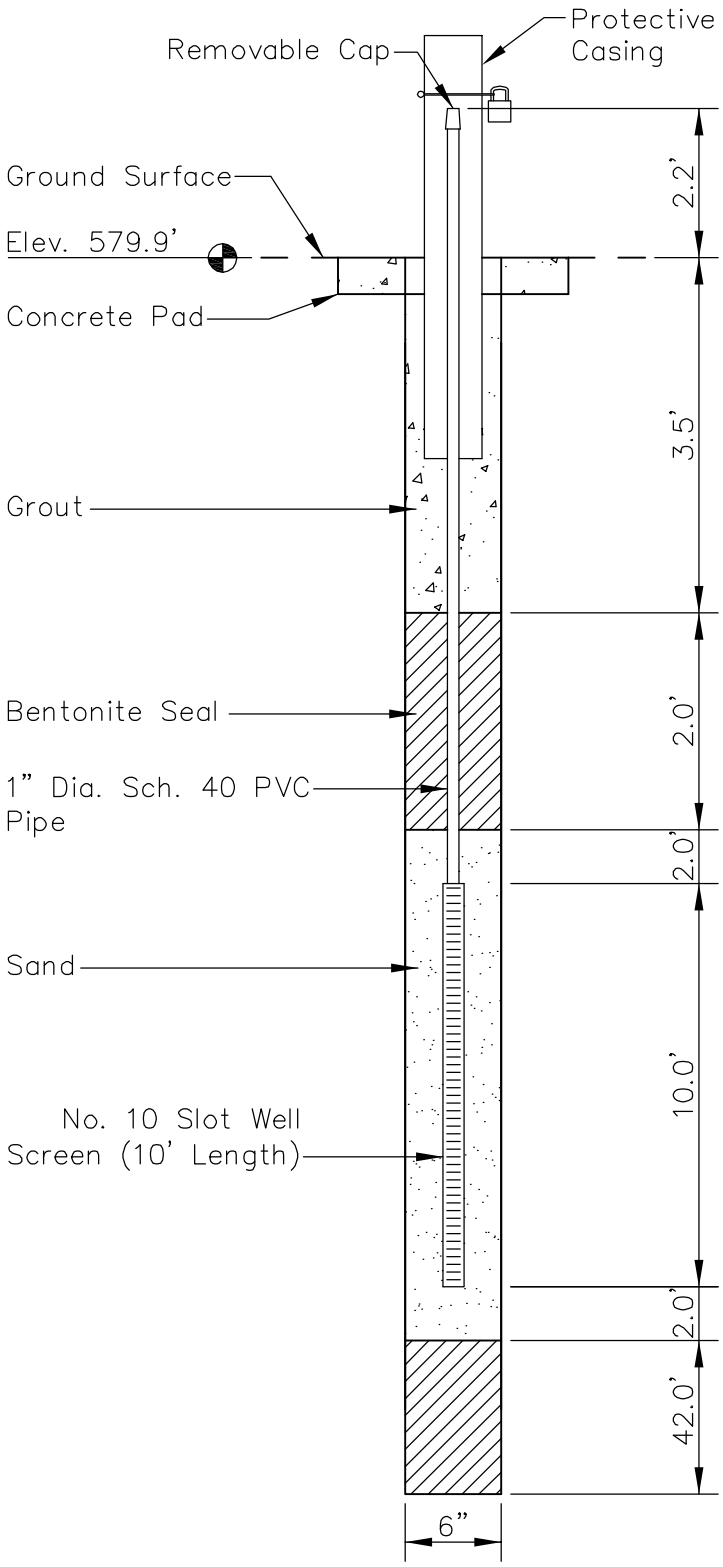
Project Name Big Sandy AEP | Boring No. **SD-15-2** | Total Depth 75.2 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	38.0								
		Sandy Lean Clay, brown and gray, moist, very stiff							Gravel from 38.0' to 42.0'
				SPT-8	40.0 - 41.5	1.3	6-7-11	15	PP = 4.5+ tsf
				SPT-9	45.0 - 46.5	1.3	8-9-12	15	PP = 2.5 tsf
				SPT-10	50.0 - 51.5	1.2	7-10-10	15	PP = 3.0 tsf
				SPT-11	55.0 - 56.5	1.5	8-12-15	15	PP = 3.0 tsf
	57.3								Gravel from 57.0' to 57.3'
		Lean Clay With Sand, brown and gray, moist, very stiff							
				SPT-12	60.0 - 61.5	1.3	8-11-14	15	PP = 2.5 tsf
	63.0								
		Sandy Lean Clay, reddish brown and gray, moist, very stiff							
				SPT-13	65.0 - 66.5	1.5	9-12-13	15	PP = 4.5+ tsf
	68.0								
		Clayey Sand, brown and gray, moist to wet, loose							
				SPT-14	70.0 - 71.5	1.5	4-4-5	19	PP = 0.5-1.0 tsf
	74.8								
	75.2	Weathered Sandstone		SPT-15	75.0 - 75.2	0.2	50/0.2'	8	
		Auger Refusal / Bottom of Hole							

APPENDIX C

PIEZOMETER DETAILS

BOTTOM ASH POND COMPLEX



NOTES:

1. Installed on 10/28/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

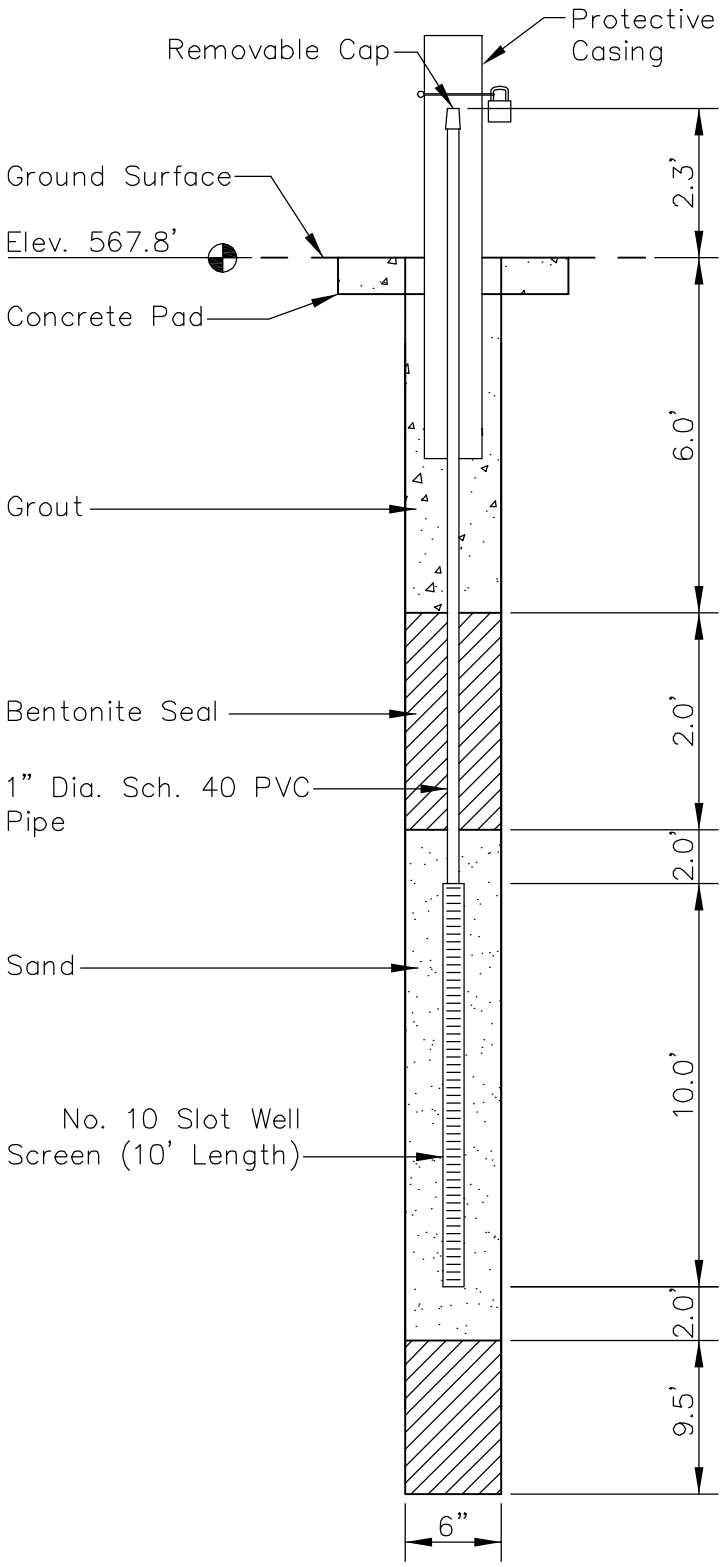
LOCATION:
Northing: 248,590.56
Easting: 2,108,627.16
Ground Elevation: 579.9'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

PIEZOMETER 1
SOUTH BOTTOM ASH POND
BIG SANDY

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	CW	DATE	FEB., 2010	REVISED	SHEET
CHECKED BY	CN	PROJ. NO.	175539021	1. 3.	1 OF 1
CHECKED BY	EMK	SCALE	NTS	2. 4.	



NOTES:

1. Installed on 10/29/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

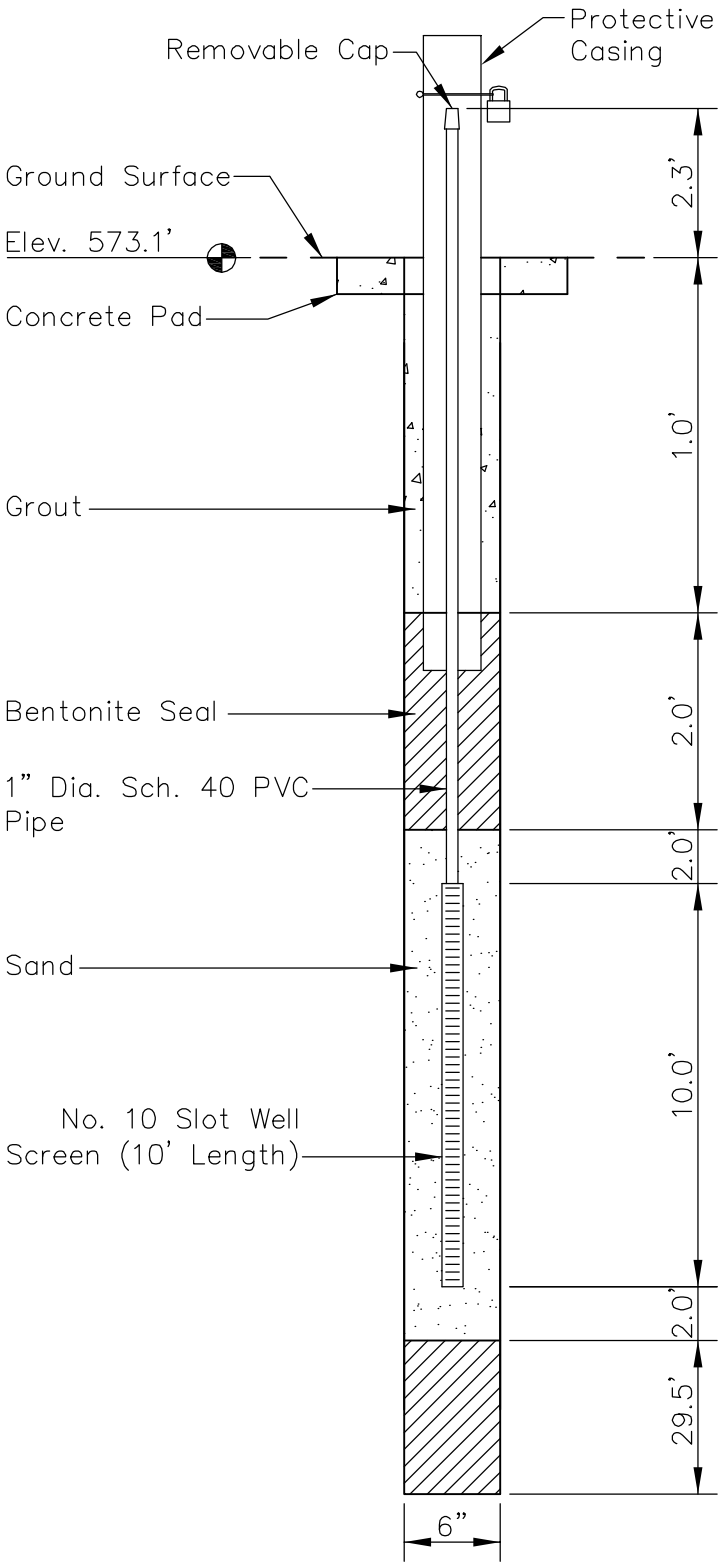
Northing: 248,551.11
Easting: 2,108,651.85
Ground Elevation: 567.8'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

PIEZOMETER 2
SOUTH BOTTOM ASH POND
BIG SANDY

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	CW	DATE	FEB., 2010	REVISED	SHEET
CHECKED BY	CN	PROJ. NO.	175539021	1. 3.	1 OF 1
CHECKED BY	EMK	SCALE	NTS	2. 4.	



NOTES:

1. Installed on 10/28/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:
Northing: 248,448.54
Easting: 2,108,233.05
Ground Elevation: 573.1'

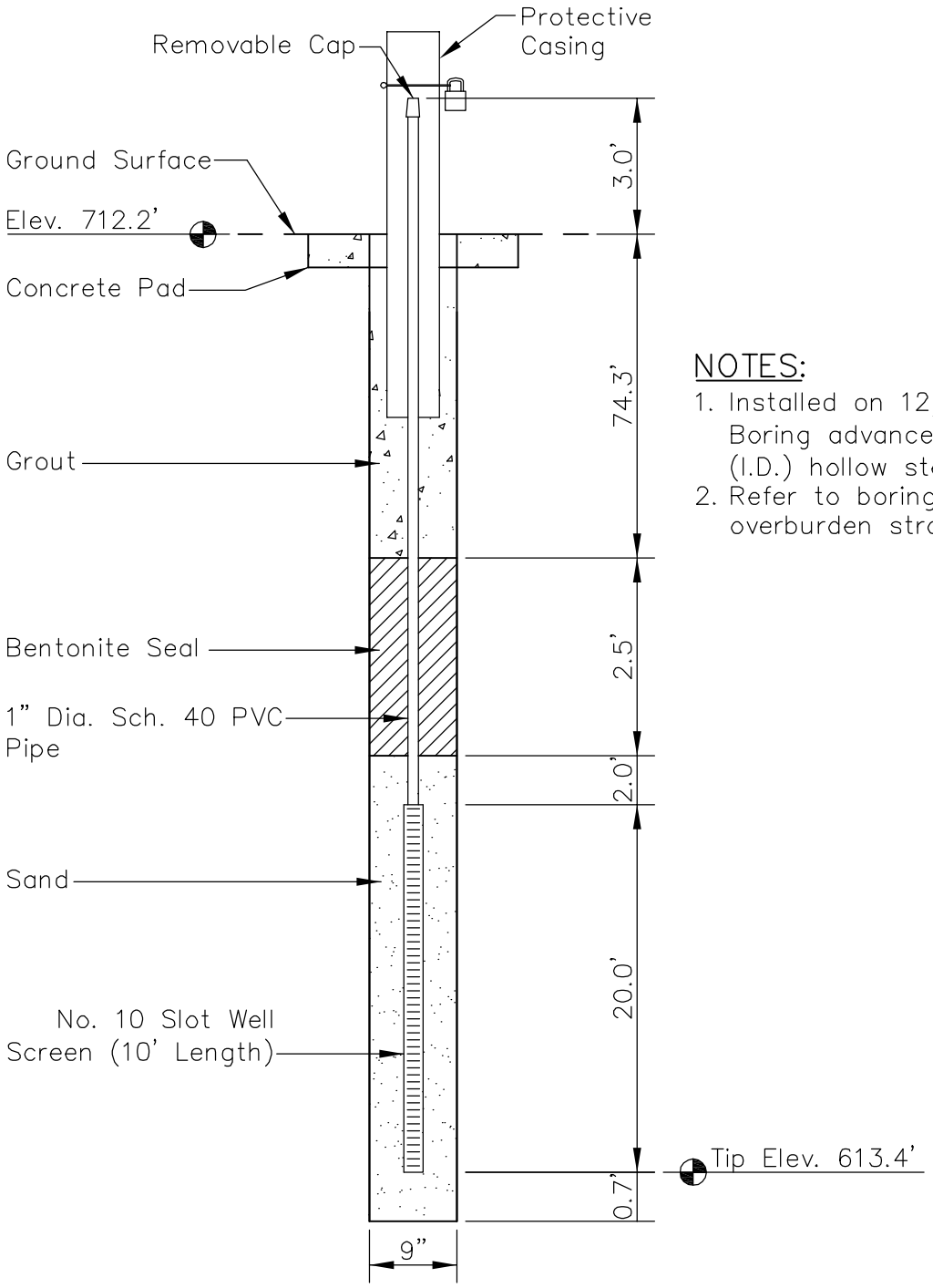
Horizontal Datum: NAD83
Vertical Datum: NAVD88

PIEZOMETER 6
SOUTH CLEAR WATER POND
BIG SANDY

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	CW	DATE	FEB., 2010	REVISED	SHEET
CHECKED BY	CN	PROJ. NO.	175539021	1. 3.	1 OF 1
CHECKED BY	EMK	SCALE	NTS	2. 4.	

FLY ASH POND MAIN DAM



NOTES:

1. Installed on 12/08/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

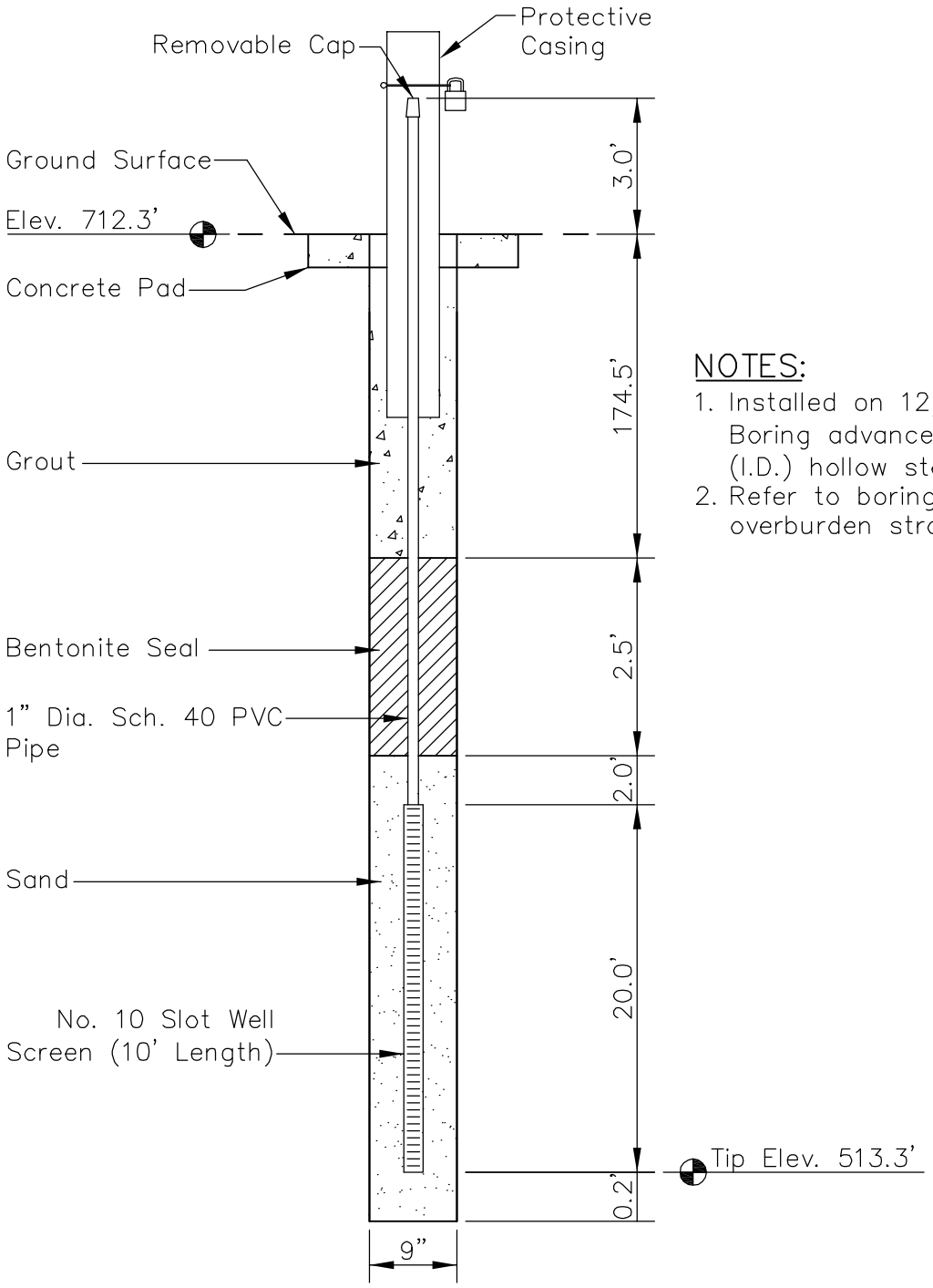
Northing: 254,128.88
Easting: 2,105,032.31
Ground Elevation: 712.2'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

B-1 PIEZOMETER
BIG SANDY POWER PLANT
MAIN FLY ASH POND DAM

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE MARCH, 2010	REVISED		SHEET
CHECKED BY	CN	PROJ. NO. 175539024	1.	3.	1 OF 1
CHECKED BY	EMK	SCALE NTS	2.	4.	



NOTES:

1. Installed on 12/15/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

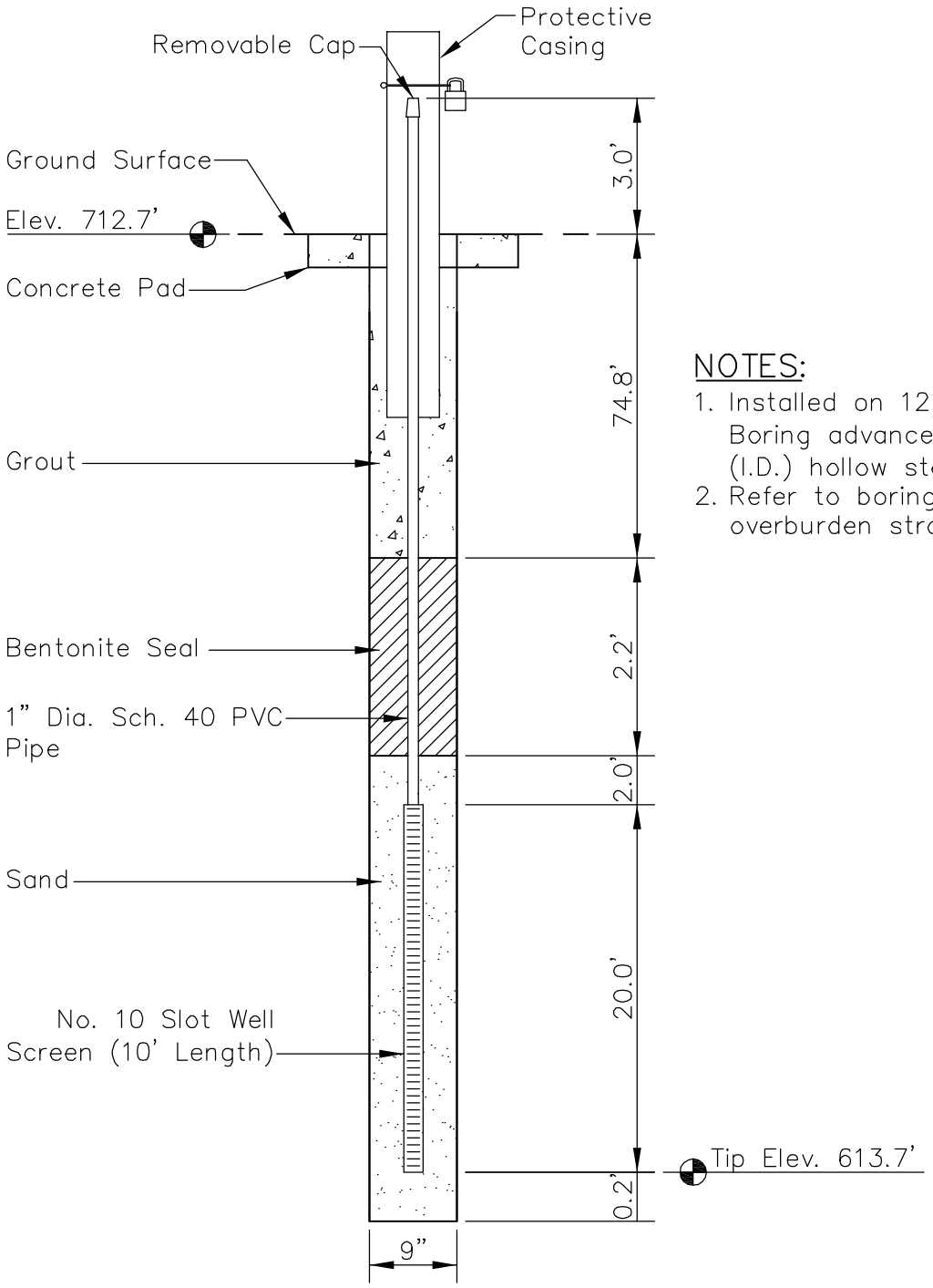
Northing: 254,147.60
Easting: 2,105,331.79
Ground Elevation: 712.3'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

B-2 PIEZOMETER
BIG SANDY POWER PANT
MAIN FLY ASH POND DAM

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE MARCH, 2010	REVISED		SHEET
CHECKED BY	CN	PROJ. NO. 175539024	1.	3.	1 OF 1
CHECKED BY	EMK	SCALE NTS	2.	4.	



NOTES:

1. Installed on 12/10/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

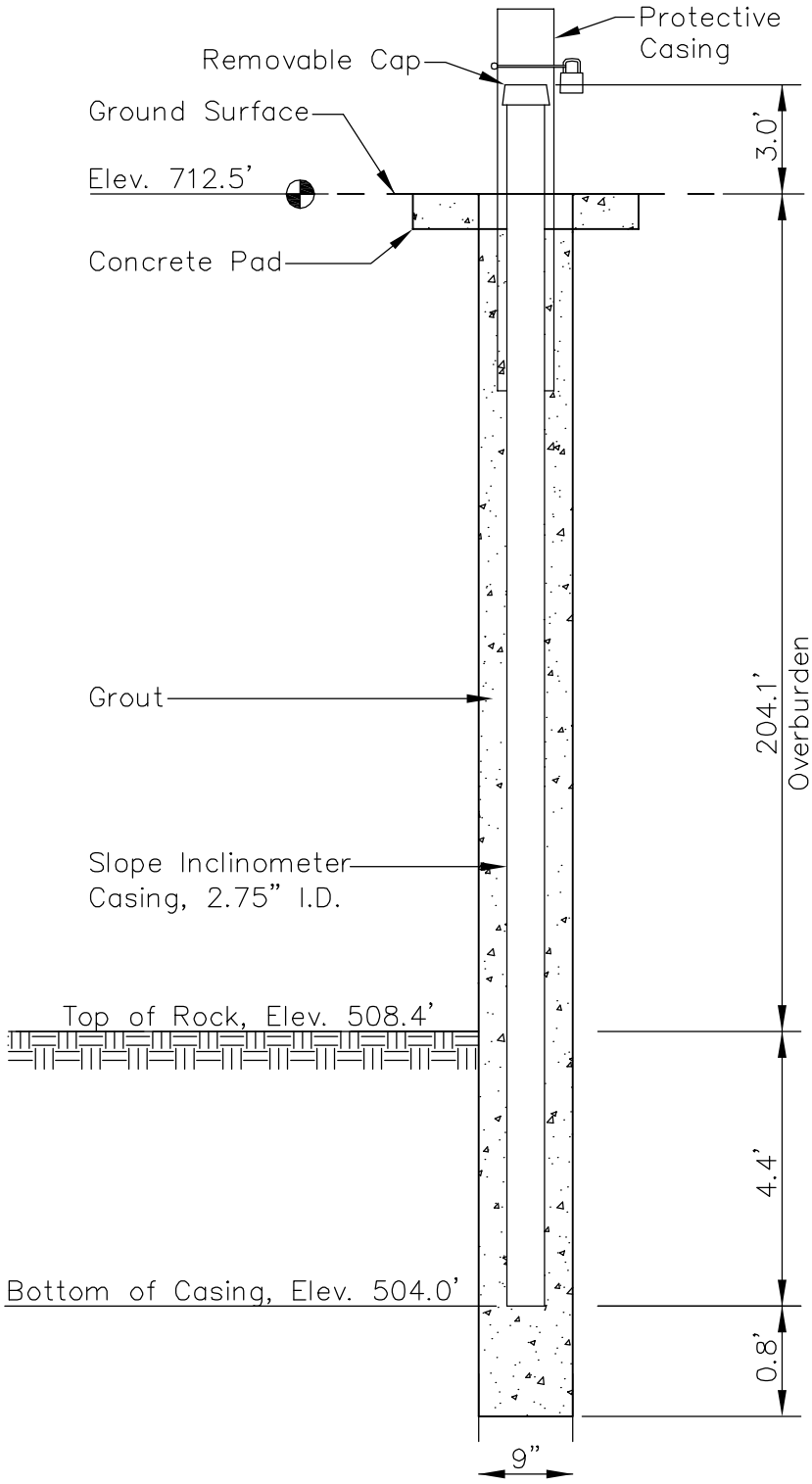
Northing: 254,165.80
Easting: 2,105,631.13
Ground Elevation: 712.7'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

B-3 PIEZOMETER
BIG SANDY POWER PLANT
MAIN FLY ASH POND DAM

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE MARCH, 2010	REVISED		SHEET
CHECKED BY	CN	PROJ. NO. 175539024	1.	3.	1 OF 1
CHECKED BY	EMK	SCALE NTS	2.	4.	



NOTES:

1. Installed on 01/06/2010. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

LOCATION:
Northing: 254,169.90
Easting: 2,105,355.94
Ground Elevation: 712.5'

Horizontal Datum: NAD83
Vertical Datum: NAVD88

B-4 SLOPE INCLINOMETER
BIG SANDY POWER PLANT
MAIN FLY ASH POND DAM

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200
www.stantec.com

DRAWN BY	MJ	DATE MARCH, 2010	REVISED		SHEET
CHECKED BY	CN	PROJ. NO. 175539024	1.	3.	1 OF 1
CHECKED BY	EMK	SCALE NTS	2.	4.	

PLOT DATE: 03/01/2010 USER: JENNINGS, MATTHEW
V:\1755\ACTIVE\175539024\GEOTECHNICAL\DRAWING\INSTRUMENTS\B-4SI.DWG

APPENDIX D

SOIL CLASSIFICATION SUMMARIES

BOTTOM ASH POND COMPLEX, 2010

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-1, 7.5'-9.0', 10.0'-11.5'	Lab ID	3
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-5-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 14.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	93.9
No. 4	4.75	92.5
No. 10	2	91.8
No. 40	0.425	76.1
No. 200	0.075	56.6
	0.02	42.9
	0.005	26.2
	0.002	17.6
estimated	0.001	12.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	7.5	8.2
Coarse Sand	0.7	15.7
Medium Sand	15.7	---
Fine Sand	19.5	19.5
Silt	30.4	39.0
Clay	26.2	17.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 29
Plastic Limit: 15
Plasticity Index: 14
Activity Index: 0.78

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-6 (5)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-1, 7.5'-9.0', 10.0'-11.5'	Lab ID	3

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RG
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	93.9
No. 4	92.5
No. 10	91.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

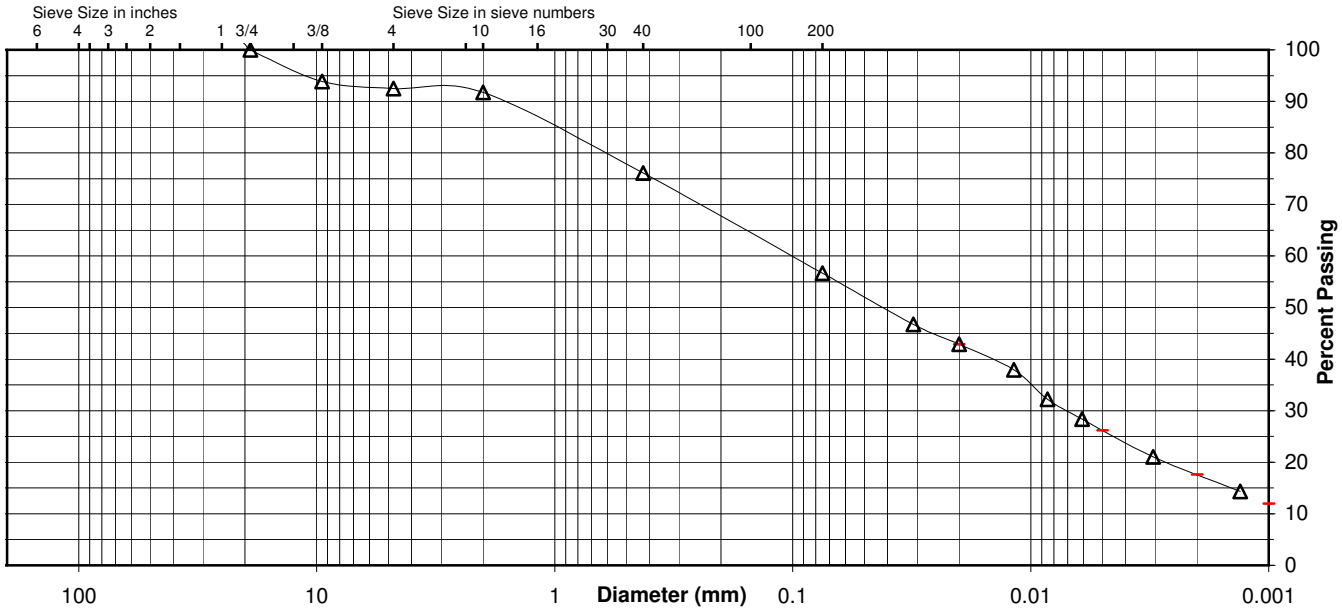
Specific Gravity 2.69

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	76.1
No. 200	56.6
0.02 mm	42.9
0.005 mm	26.2
0.002 mm	17.6
0.001 mm	12.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	7.5	0.7	15.7	19.5	30.4	26.2
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	8.2			15.7	19.5	39.0	17.6



Comments

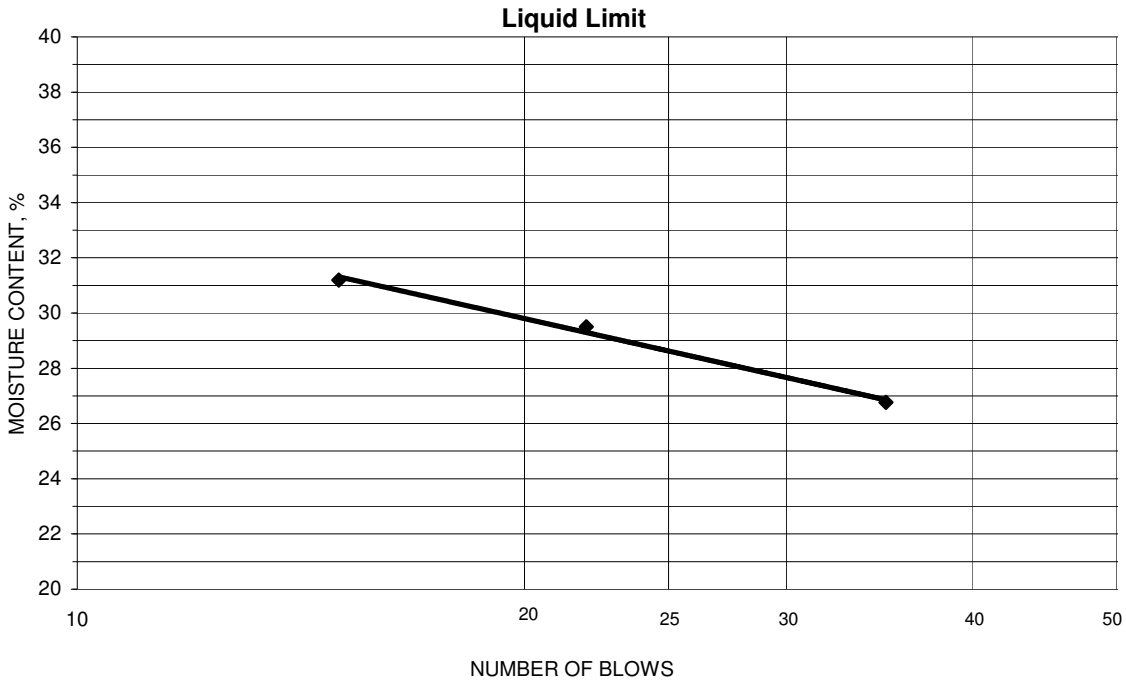
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-1, 7.5'-9.0', 10.0'-11.5'			Lab ID	3
				% + No. 40	24
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-04-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
26.48	23.85	15.42	15	31.2	
26.38	23.95	14.87	35	26.8	
26.57	24.00	15.29	22	29.5	29



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
26.87	24.74	11.01	15.5	15	14
29.44	26.99	10.98	15.3		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-1, 22.5'-24.0', 25.0'-26.5'	Lab ID	10
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	99.6
No. 200	0.075	65.1
	0.02	33.6
	0.005	21.2
	0.002	15.8
estimated	0.001	13.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.4
Medium Sand	0.4	---
Fine Sand	34.5	34.5
Silt	43.9	49.3
Clay	21.2	15.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	29
Plastic Limit:	20
Plasticity Index:	9
Activity Index:	0.56

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.72

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-4 (4)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-1, 22.5'-24.0', 25.0'-26.5'	Lab ID	10

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RG
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

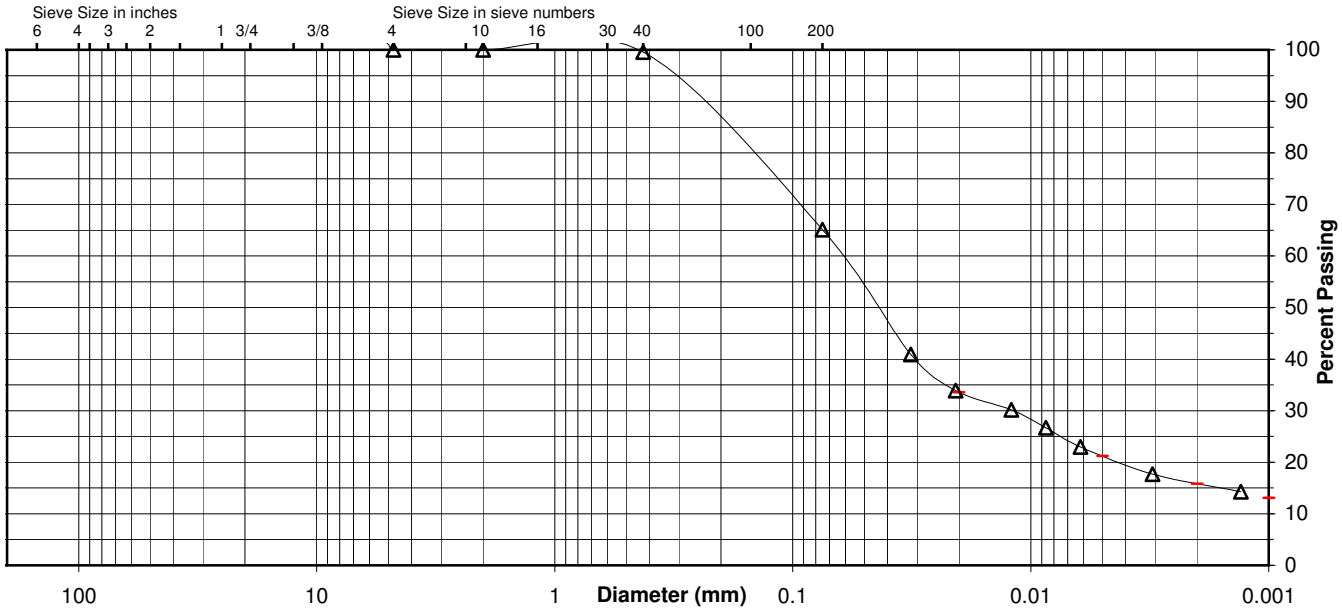
Specific Gravity 2.72

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.6
No. 200	65.1
0.02 mm	33.6
0.005 mm	21.2
0.002 mm	15.8
0.001 mm	13.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.4	34.5	43.9	21.2
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.0			0.4	34.5	49.3	15.8



Comments

Reviewed By

File: frm_175539021_sum_10 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

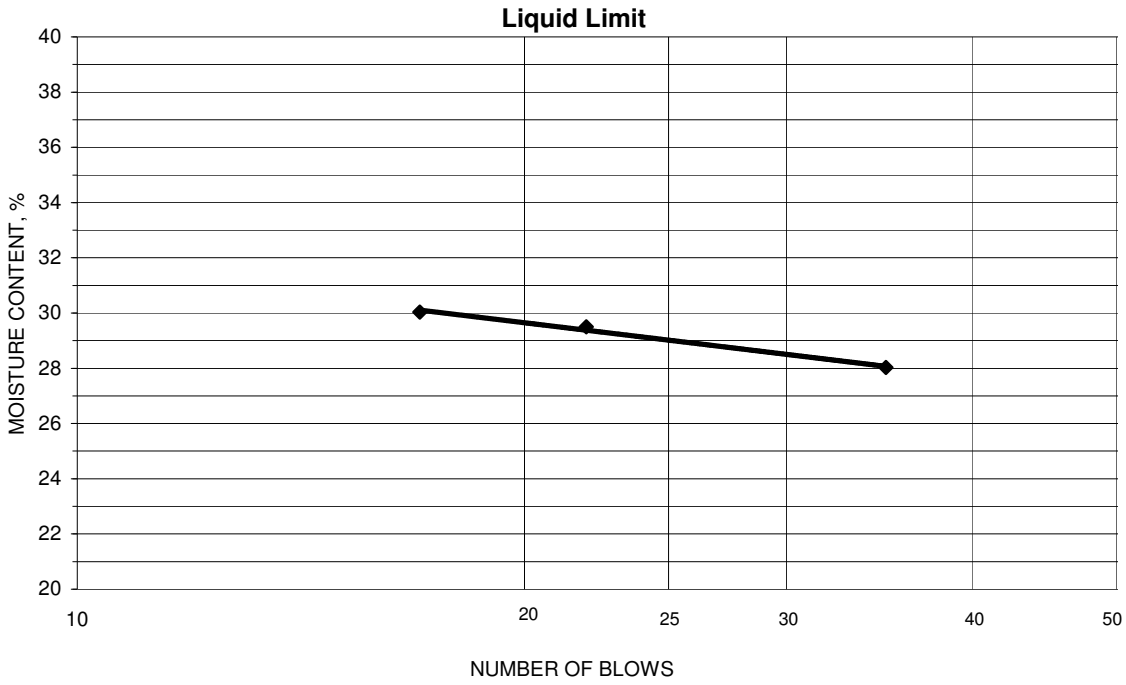
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-1, 22.5'-24.0', 25.0'-26.5'			Lab ID	10
				% + No. 40	0
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-04-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
25.81	22.50	10.69	35	28.0	
24.13	21.13	11.14	17	30.0	
26.68	23.14	11.14	22	29.5	29



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
38.75	35.22	17.52	19.9	20	9
41.70	38.58	22.87	19.9		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-2, 25.0'-26.5', 27.5'-29.0'	Lab ID	36
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 9.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.8
No. 10	2	99.6
No. 40	0.425	48.0
No. 200	0.075	10.3
	0.02	5.9
	0.005	3.4
	0.002	2.4
estimated	0.001	2.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.2	0.4
Coarse Sand	0.2	51.6
Medium Sand	51.6	---
Fine Sand	37.7	37.7
Silt	6.9	7.9
Clay	3.4	2.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.66

Classification

Unified Group Symbol: SW-SM
Group Name: Well-graded sand with silt

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-2, 25.0'-26.5', 27.5'-29.0'	Lab ID	36

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	RG
Test Date:	11-03-2009
Date Received	11-02-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.8
No. 10	99.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.66

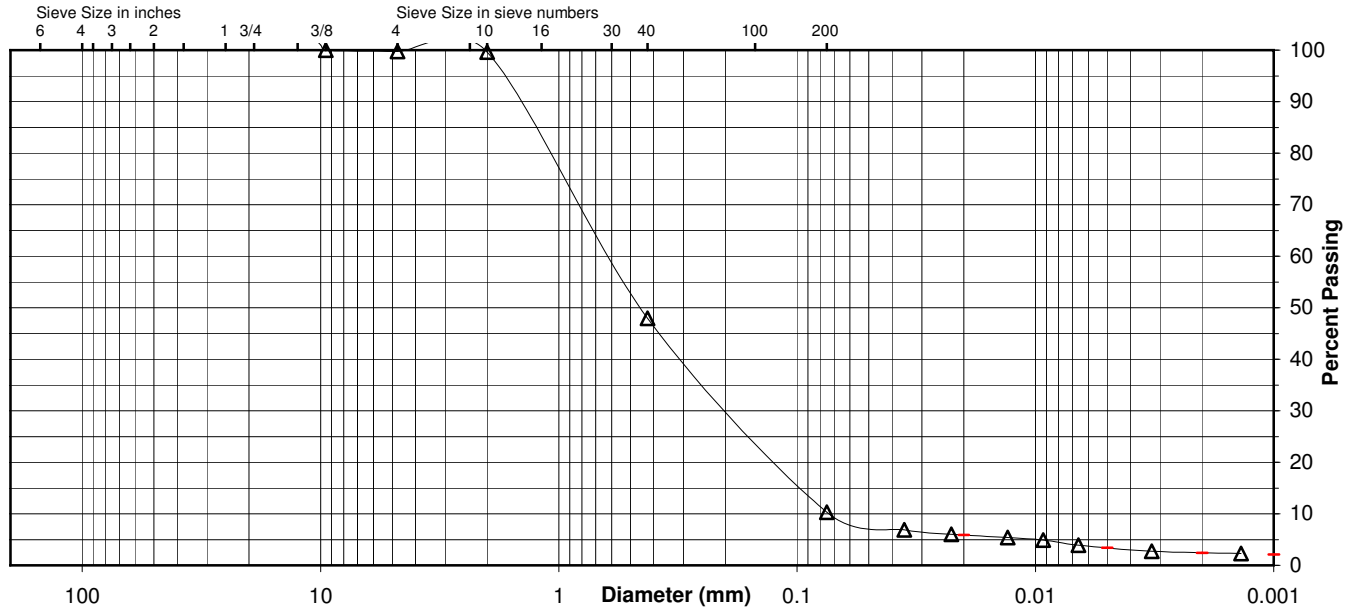
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	48.0
No. 200	10.3
0.02 mm	5.9
0.005 mm	3.4
0.002 mm	2.4
0.001 mm	2.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.2	0.2	51.6	37.7	6.9	3.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.4	51.6	37.7	7.9	2.4



Comments

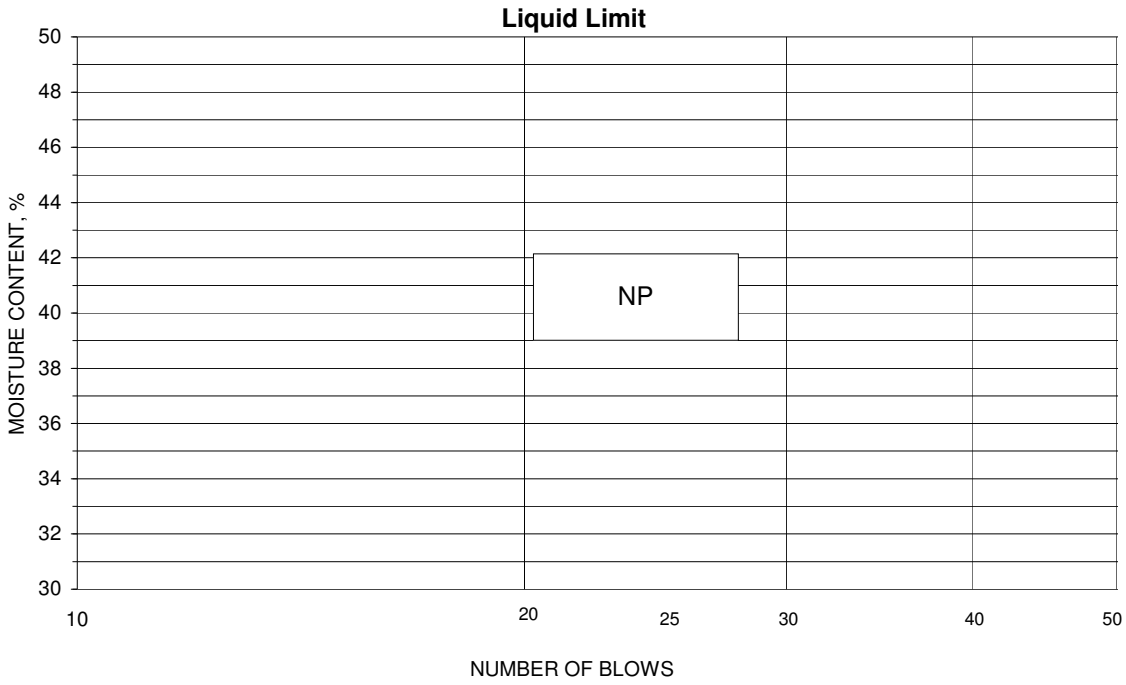
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-2, 25.0'-26.5', 27.5'-29.0'			Lab ID	36
				% + No. 40	52
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-03-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-3, 17.5'-19.0', 20.0'-21.5'	Lab ID	46
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 25.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.5
No. 200	0.075	48.0
	0.02	26.9
	0.005	19.3
	0.002	14.6
estimated	0.001	12.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.5
Medium Sand	0.5	---
Fine Sand	51.5	51.5
Silt	28.7	33.4
Clay	19.3	14.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-3, 17.5'-19.0', 20.0'-21.5'	Lab ID	46

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: KR
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

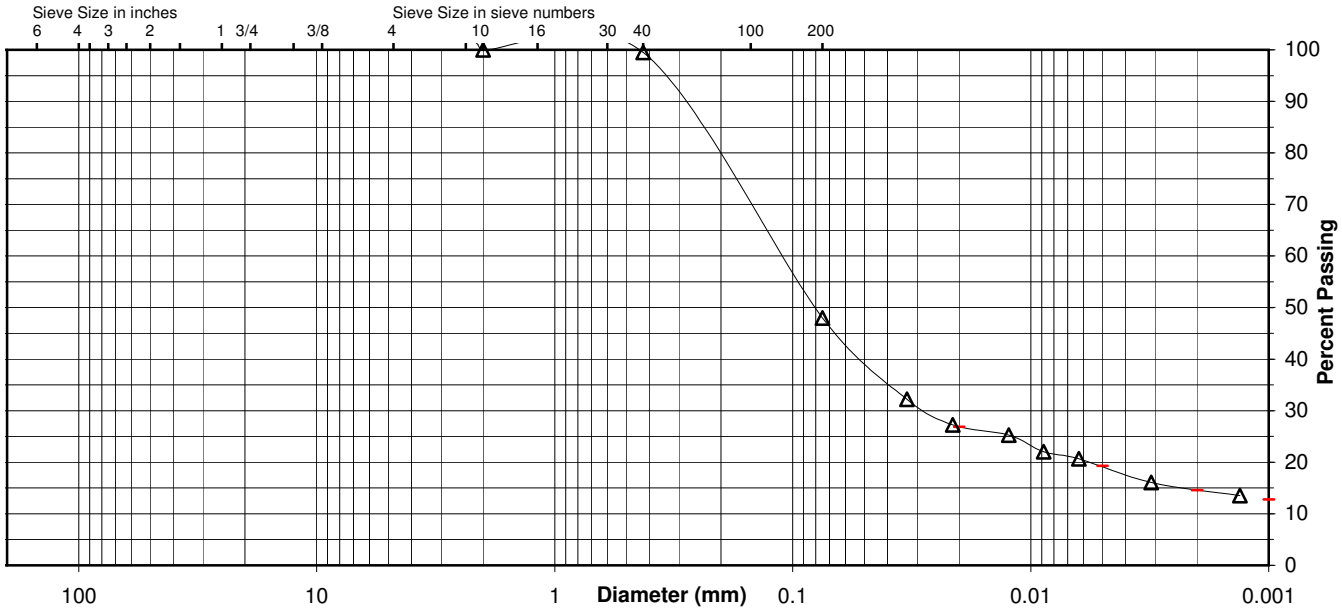
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	48.0
0.02 mm	26.9
0.005 mm	19.3
0.002 mm	14.6
0.001 mm	12.8

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.5	51.5	28.7	19.3

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.5	51.5	33.4	14.6



Comments

Reviewed By

File: frm_175539021_sum_46 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

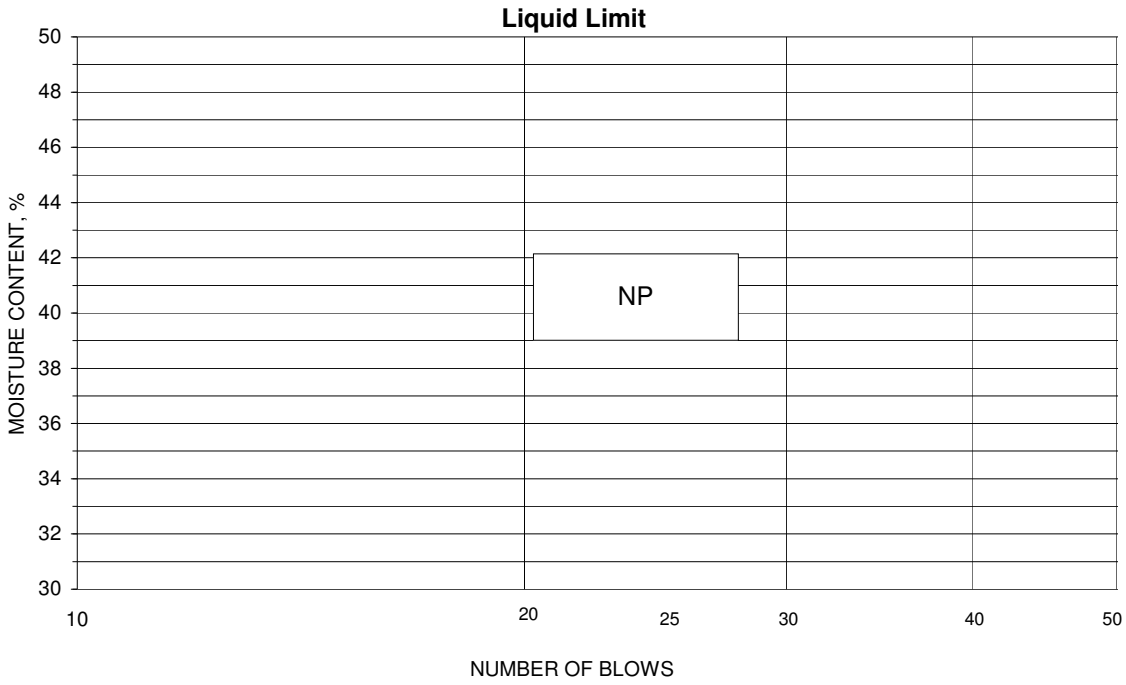
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-3, 17.5'-19.0', 20.0'-21.5'			Lab ID	46
				% + No. 40	1
Tested By	RG	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-04-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-4, 12.5'-14.0', 15.0'-16.5'	Lab ID	59
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 26.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	96.7
No. 4	4.75	90.4
No. 10	2	81.8
No. 40	0.425	48.1
No. 200	0.075	18.1
	0.02	8.5
	0.005	3.3
	0.002	2.1
estimated	0.001	1.4

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	9.6	18.2
Coarse Sand	8.6	33.7
Medium Sand	33.7	---
Fine Sand	30.0	30.0
Silt	14.8	16.0
Clay	3.3	2.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.17

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-4, 12.5'-14.0', 15.0'-16.5'	Lab ID	59

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RG
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	96.7
No. 4	90.4
No. 10	81.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.17

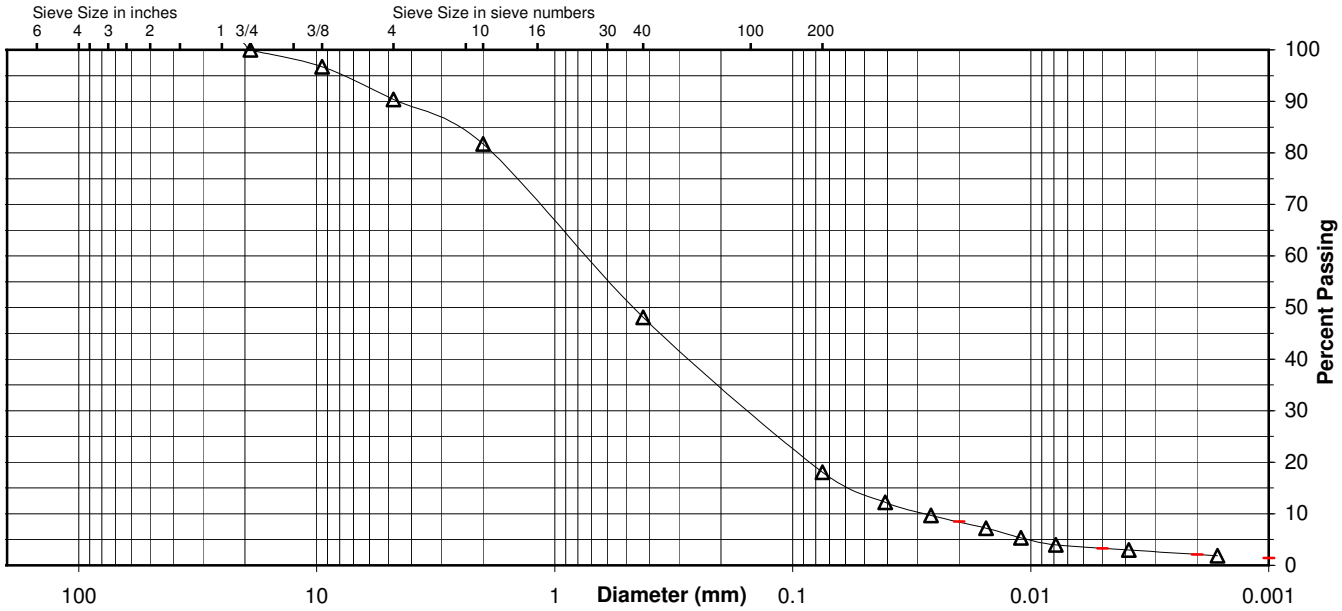
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	48.1
No. 200	18.1
0.02 mm	8.5
0.005 mm	3.3
0.002 mm	2.1
0.001 mm	1.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	9.6	8.6	33.7	30.0	14.8	3.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	18.2	33.7	30.0	16.0	2.1



Comments

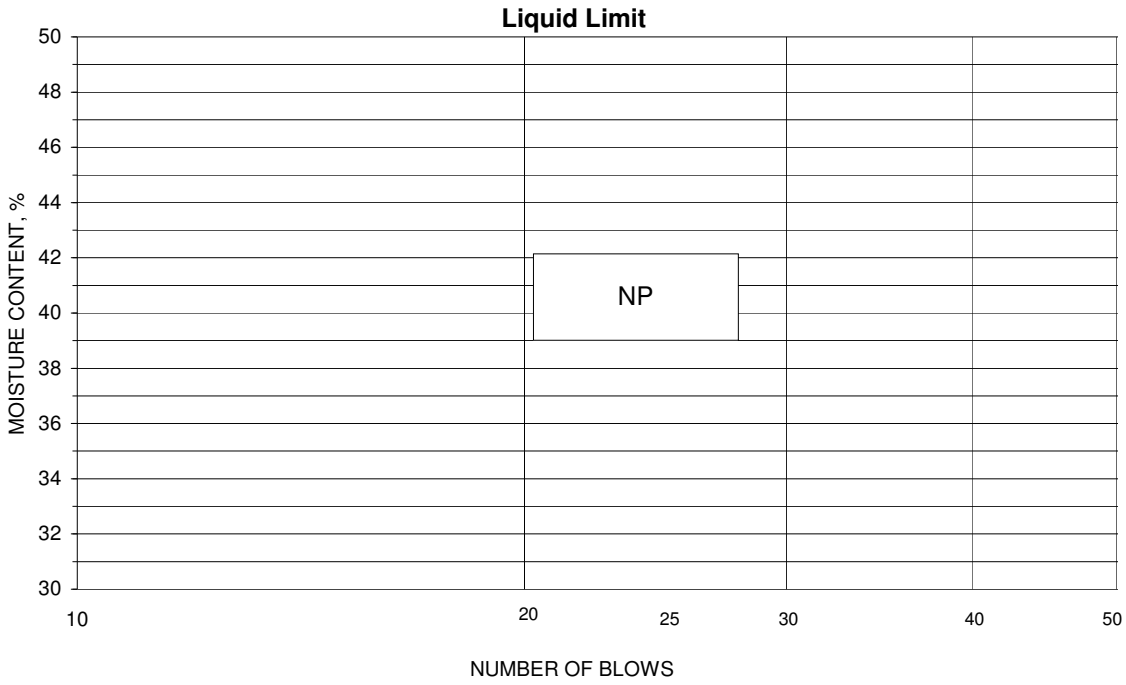
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-4, 12.5'-14.0', 15.0'-16.5'			Lab ID	59
				% + No. 40	52
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-03-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-4, 47.5'-49.0', 50.0'-51.5'	Lab ID	74
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 26.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.8
No. 4	4.75	99.8
No. 10	2	99.8
No. 40	0.425	99.5
No. 200	0.075	84.6
	0.02	47.8
	0.005	23.5
	0.002	15.4
estimated	0.001	11.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.2	0.2
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	14.9	14.9
Silt	61.1	69.2
Clay	23.5	15.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	26
Plastic Limit:	21
Plasticity Index:	5
Activity Index:	0.33

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.69

Classification

Unified Group Symbol: CL-ML

Group Name: Silty clay with sand

AASHTO Classification: A-4 (3)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-4, 47.5'-49.0', 50.0'-51.5'	Lab ID	74

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RG
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.8
No. 4	99.8
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

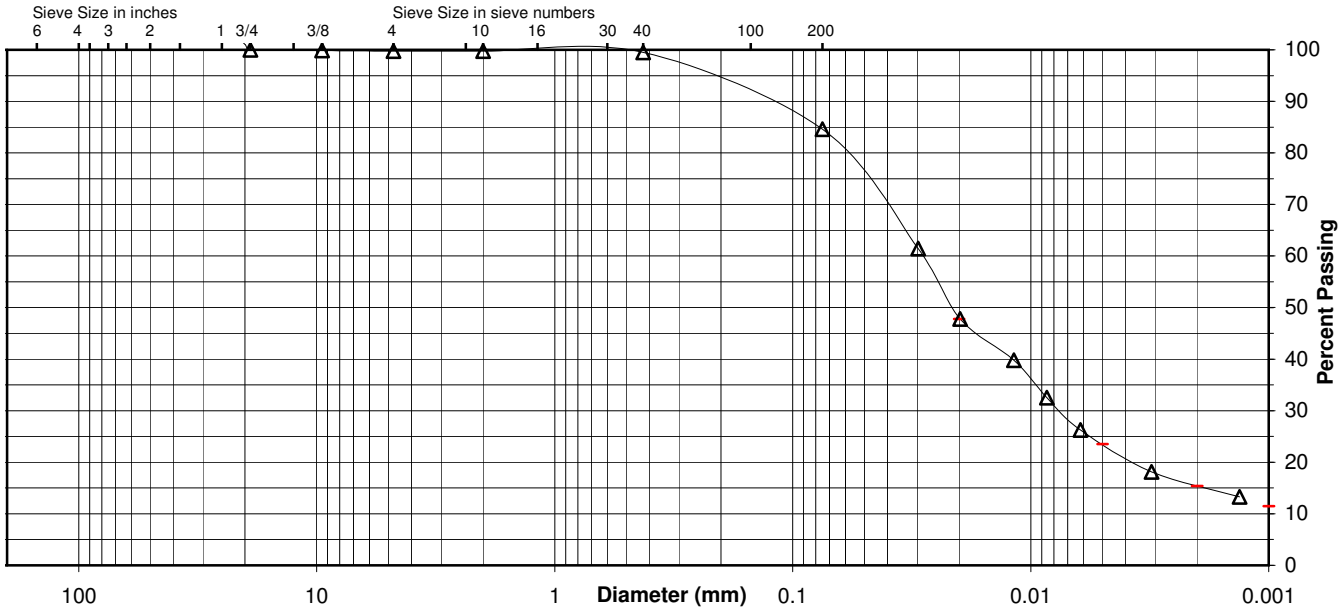
Specific Gravity 2.69

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	84.6
0.02 mm	47.8
0.005 mm	23.5
0.002 mm	15.4
0.001 mm	11.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.2	0.0	0.3	14.9	61.1	23.5
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.2			0.3	14.9	69.2	15.4



Comments

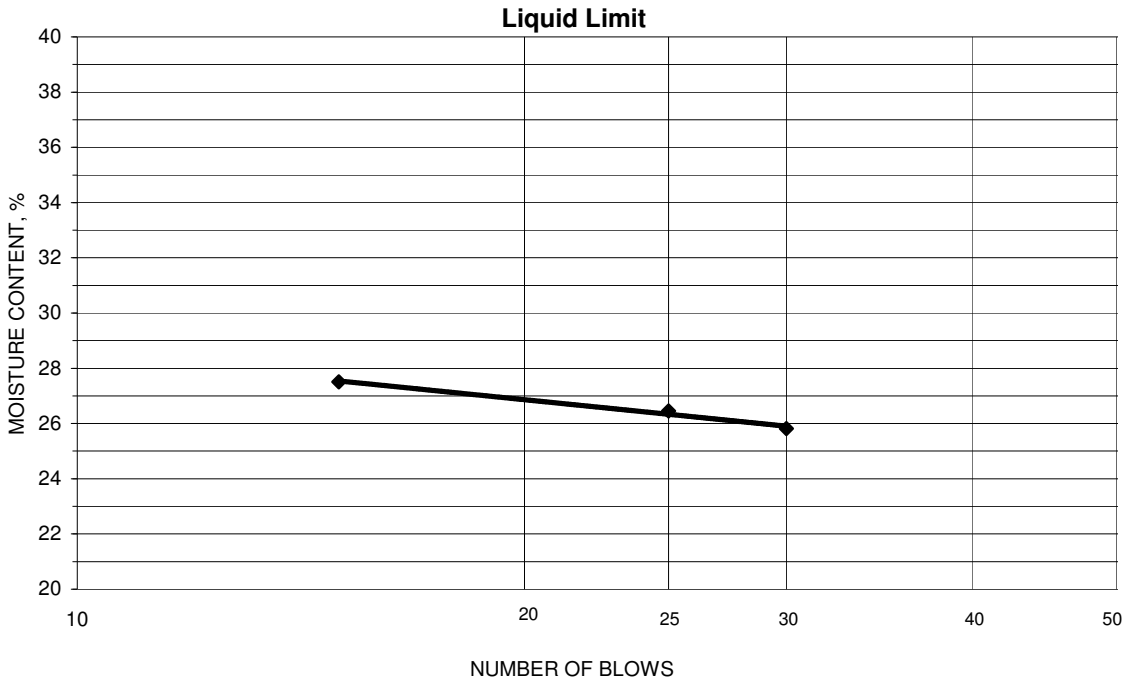
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-4, 47.5'-49.0', 50.0'-51.5'			Lab ID	74
				% + No. 40	0
Tested By	RG	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-04-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.72	20.27	10.78	30	25.8	
24.76	21.72	10.67	15	27.5	
23.61	20.88	10.56	25	26.5	26



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
31.28	27.73	10.61	20.7	21	5
33.21	29.43	11.08	20.6		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-5, 22.5'-24.0', 25.0'-26.5'	Lab ID	87
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 30.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.8
No. 200	0.075	77.1
	0.02	41.2
	0.005	24.0
	0.002	17.7
estimated	0.001	13.3

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.2
Medium Sand	0.2	---
Fine Sand	22.7	22.7
Silt	53.1	59.4
Clay	24.0	17.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 30
Plastic Limit: 23
Plasticity Index: 7
Activity Index: 0.39

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.63

Classification

Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (4)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-5, 22.5'-24.0', 25.0'-26.5'	Lab ID	87

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: KR
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.63

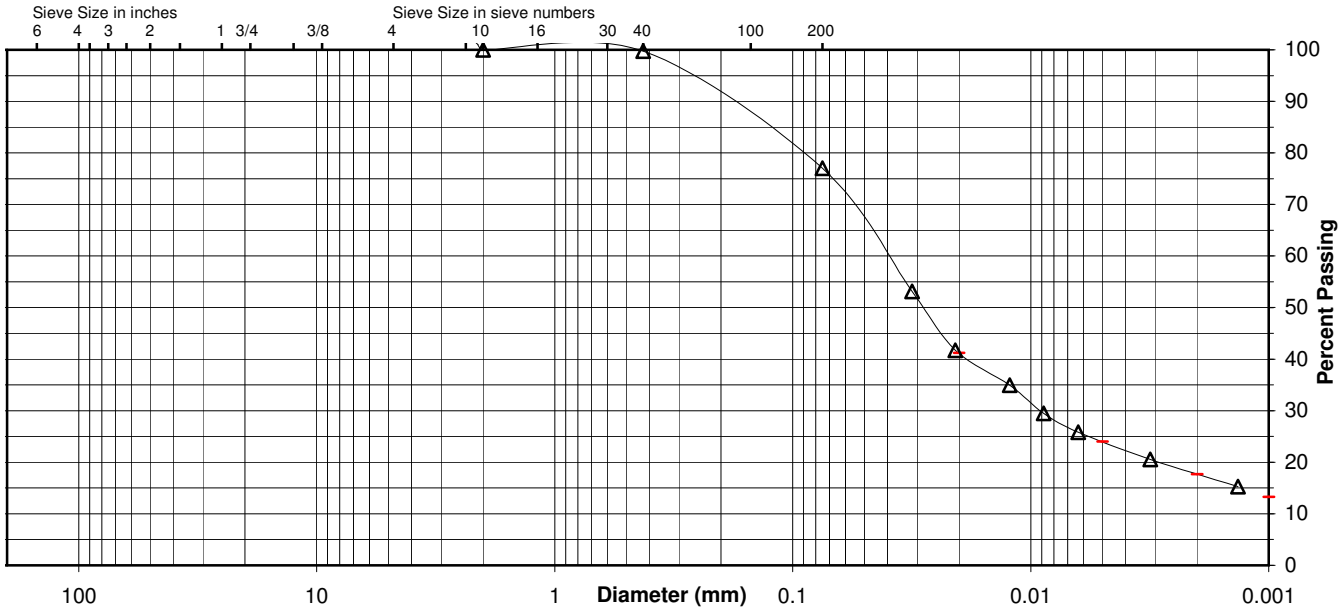
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	77.1
0.02 mm	41.2
0.005 mm	24.0
0.002 mm	17.7
0.001 mm	13.3

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	0.2	22.7	53.1	24.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	0.2	22.7	59.4	17.7



Comments

Reviewed By

File: frm_175539021_sum_87 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

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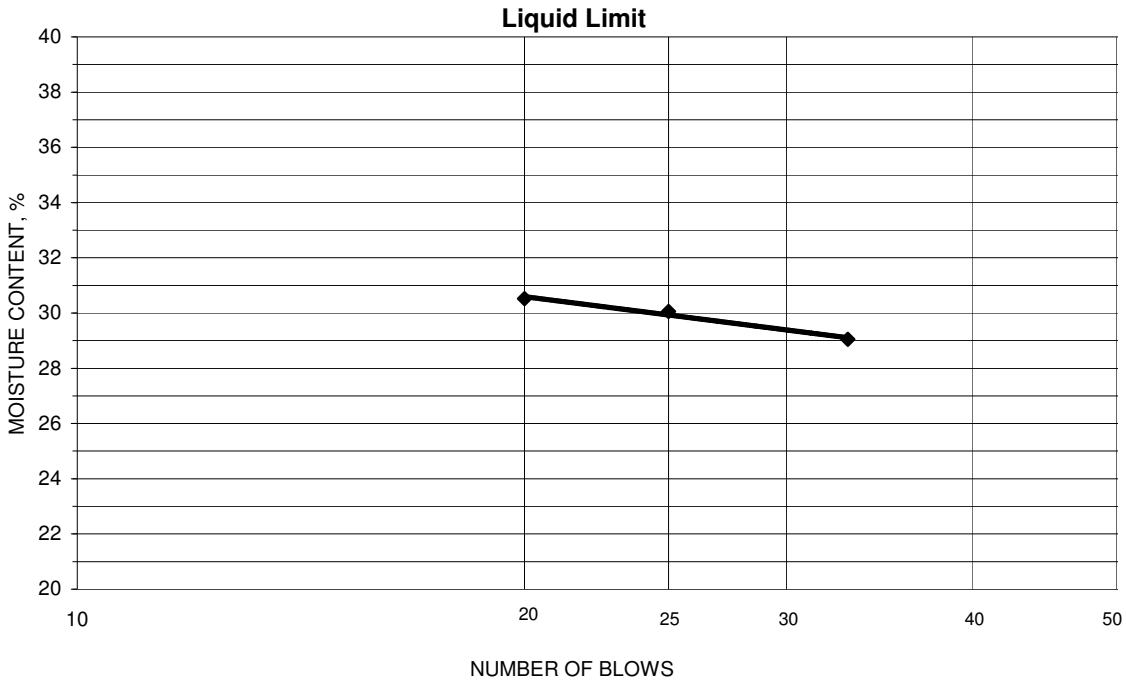
ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-5, 22.5'-24.0', 25.0'-26.5'			Lab ID	87
				% + No. 40	0
Tested By	RG	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-04-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
23.44	20.60	11.15	25	30.1	
23.36	20.51	10.70	33	29.1	
23.90	20.82	10.73	20	30.5	30



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
31.66	27.76	10.98	23.2	23	7
32.49	28.47	10.95	22.9		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-6, 40.0'-41.5', 42.5'-44.0'	Lab ID	118
County	Lawrence, KY	Date Received	11-2-09
Sample Type	SPT Comp	Date Reported	11-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 6.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	99.2
3/8"	9.5	97.8
No. 4	4.75	96.6
No. 10	2	96.5
No. 40	0.425	57.8
No. 200	0.075	10.0
	0.02	6.1
	0.005	3.6
	0.002	2.7
estimated	0.001	2.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.4	3.5
Coarse Sand	0.1	38.7
Medium Sand	38.7	---
Fine Sand	47.8	47.8
Silt	6.4	7.3
Clay	3.6	2.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	---
Plastic Limit:	Non Plastic
Plasticity Index:	---
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.65

Classification

Unified Group Symbol: SP-SM

Group Name: Poorly graded sand with silt

AASHTO Classification: A-3 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy : Bottom Ash Subsurface investigation analysis	Project Number	175539021
Source	B-6, 40.0'-41.5', 42.5'-44.0'	Lab ID	118

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RG
Test Date: 11-03-2009
Date Received 11-02-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	99.2
3/8"	97.8
No. 4	96.6
No. 10	96.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.65

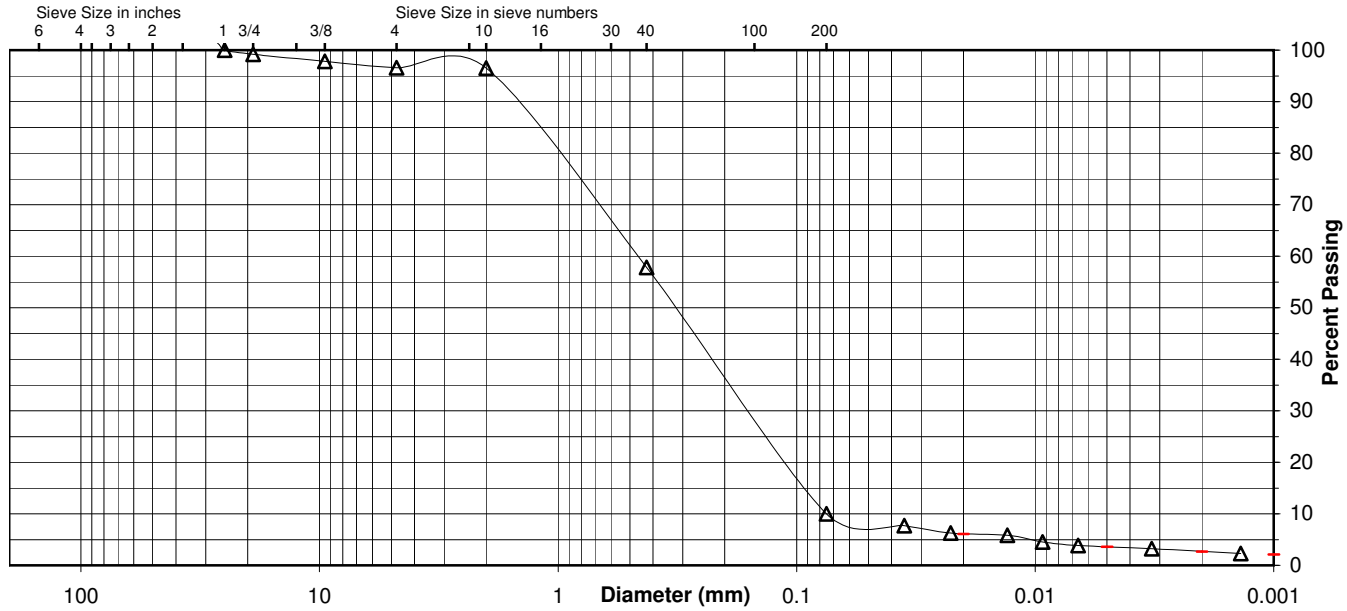
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	57.8
No. 200	10.0
0.02 mm	6.1
0.005 mm	3.6
0.002 mm	2.7
0.001 mm	2.1

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.8	2.6	0.1	38.7	47.8	6.4	3.6

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	3.5	38.7	47.8	7.3	2.7



Comments

Reviewed By

File: frm_175539021_sum_118 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

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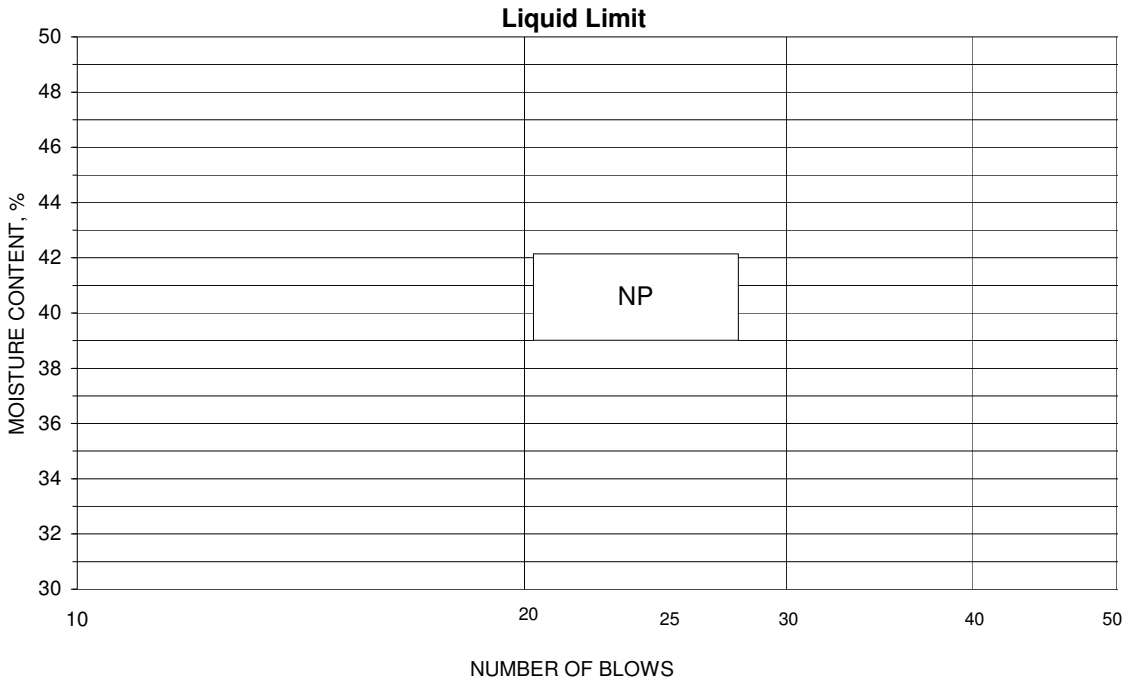
ATTERBERG LIMITS

Project	Big Sandy : Bottom Ash Subsurface investigation analysis			Project No.	175539021
Source	B-6, 40.0'-41.5', 42.5'-44.0'			Lab ID	118
				% + No. 40	42
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	11-02-2009
Test Date	11-03-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: _____

Reviewed By _____

BOTTOM ASH POND COMPLEX, 2015

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	BA-15-1, 25.0'-26.5'	Lab ID	7
Sample Type	SPT	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 25.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
No. 10	2	100.0
No. 40	0.425	99.8
No. 200	0.075	66.3
	0.02	35.4
	0.005	18.7
	0.002	13.6
estimated	0.001	12.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.2
Medium Sand	0.2	---
Fine Sand	33.5	33.5
Silt	47.6	52.7
Clay	18.7	13.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	26
Plastic Limit:	20
Plasticity Index:	6
Activity Index:	0.43

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL-ML
Group Name:	Sandy silty clay
AASHTO Classification:	A-4 (2)

Comments:

Reviewed By 

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	BA-15-1, 25.0'-26.5'	Lab ID	7

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	N/A
Particle Hardness:	N/A
Tested By	MC
Test Date	11-11-2015
Date Received	11-04-2015

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

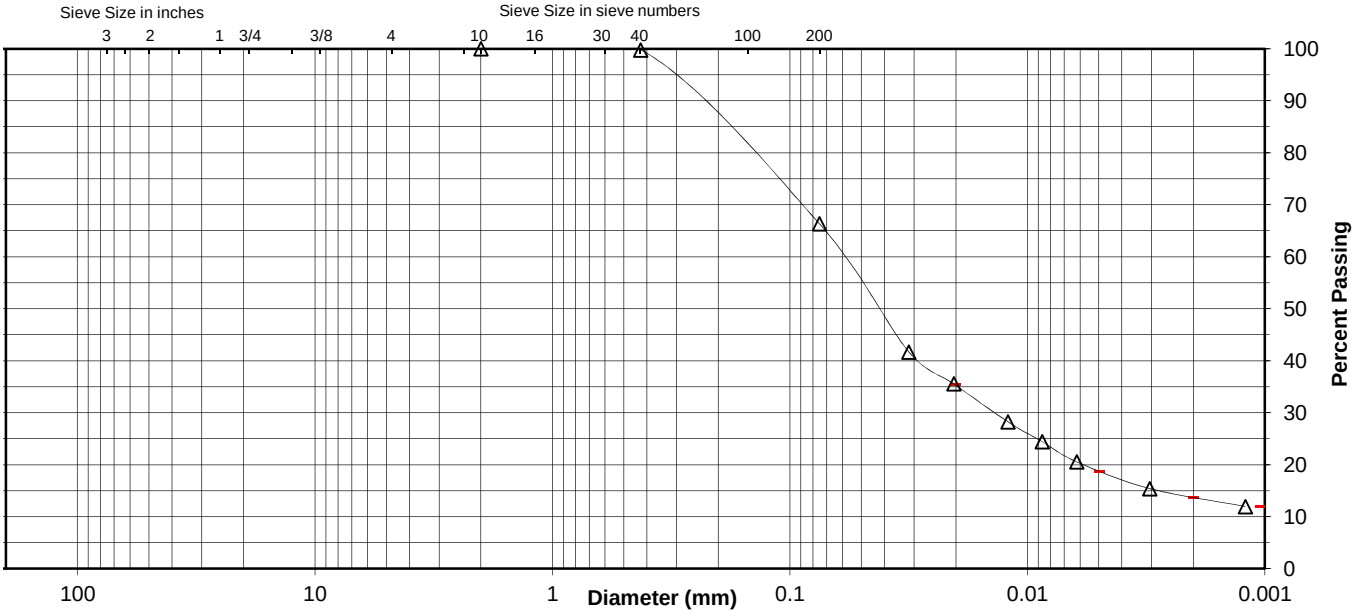
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	66.3
0.02 mm	35.4
0.005 mm	18.7
0.002 mm	13.6
0.001 mm	12.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.2	33.5	47.6	18.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.2	33.5	52.7	13.6



Comments

Reviewed By RJ

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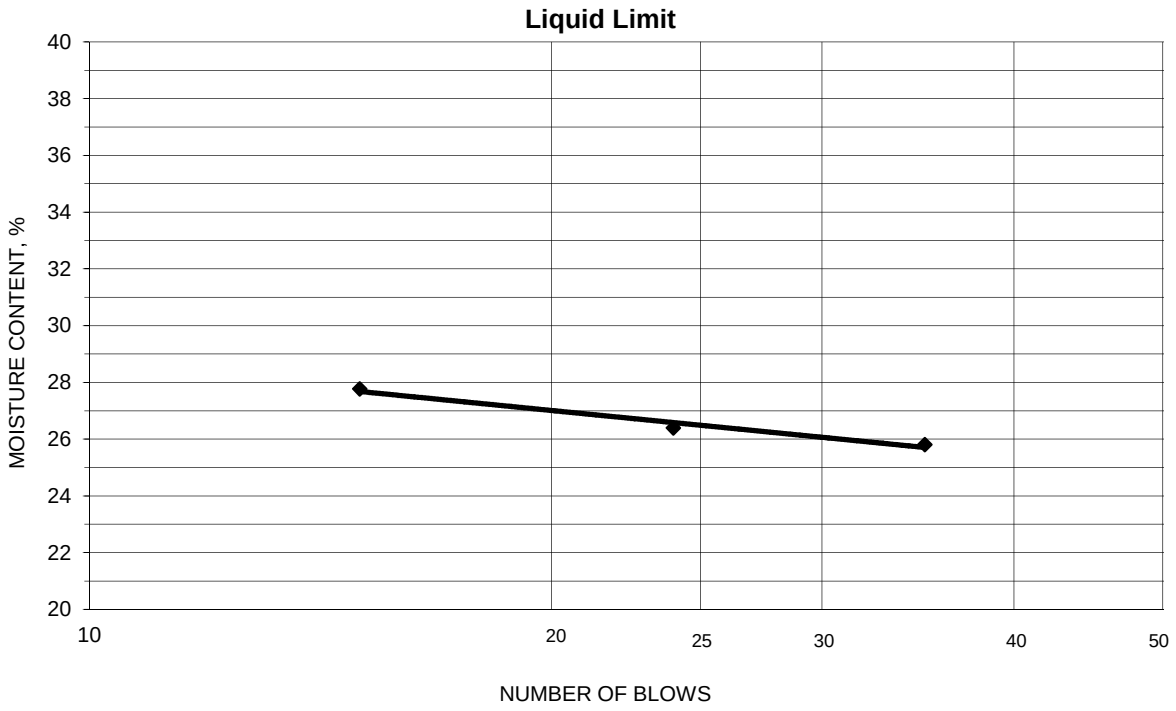
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	BA-15-1, 25.0'-26.5'			Lab ID	7
				% + No. 40	0
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-12-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.95	18.12	11.03	35	25.8	
19.46	17.66	10.84	24	26.4	
22.33	19.87	11.01	15	27.8	26



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.31	17.13	11.16	19.8	20	6
17.92	16.75	11.02	20.4		

Remarks: _____

Reviewed By RJ

FLY ASH POND MAIN DAM, 2010

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 3.5'-5.0'	Lab ID	1
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 7.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.0
No. 4	4.75	96.6
No. 10	2	93.4
No. 40	0.425	80.8
No. 200	0.075	61.9
	0.02	47.7
	0.005	33.4
	0.002	25.0
estimated	0.001	20.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.4	6.6
Coarse Sand	3.2	12.6
Medium Sand	12.6	---
Fine Sand	18.9	18.9
Silt	28.5	36.9
Clay	33.4	25.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 38
Plastic Limit: 17
Plasticity Index: 21
Activity Index: 0.84

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-6 (10)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Big Sandy Unit 12 Main Dam Instrumentation
Project Number: 175539024
Source: B-1, 3.5'-5.0'
Lab ID: 1

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.0
No. 4	96.6
No. 10	93.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

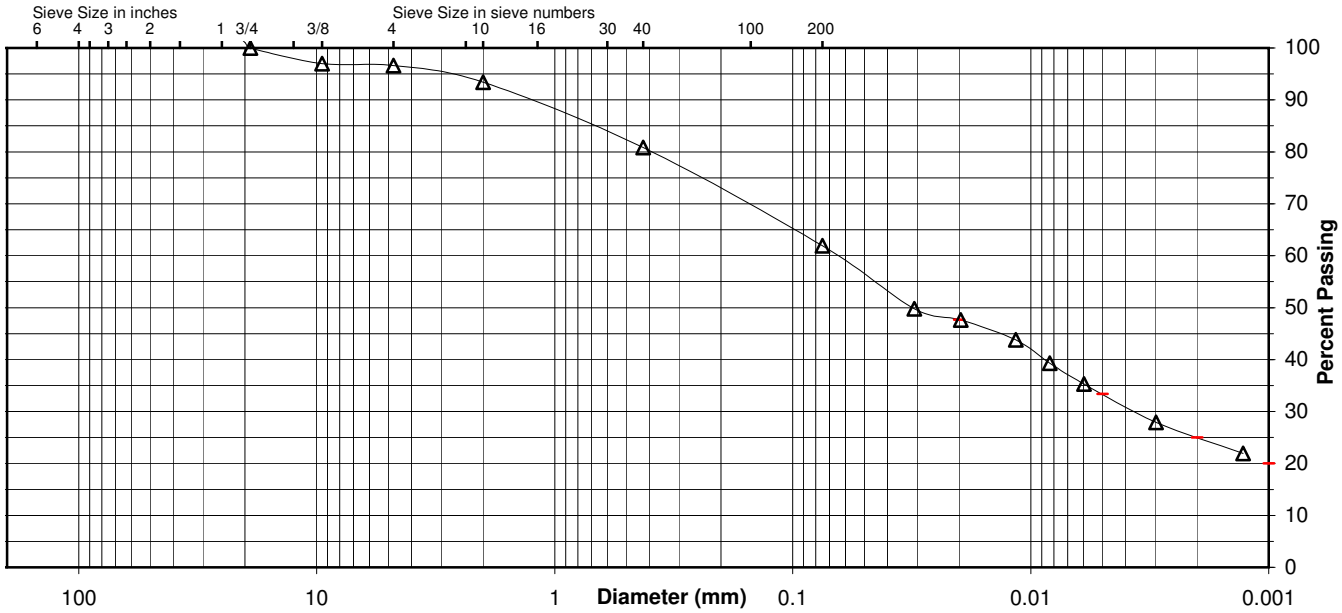
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	80.8
No. 200	61.9
0.02 mm	47.7
0.005 mm	33.4
0.002 mm	25.0
0.001 mm	20.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	3.4	3.2	12.6	18.9	28.5	33.4
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	6.6			12.6	18.9	36.9	25.0



Comments

Reviewed By

File: frm_175539024_sum_1 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

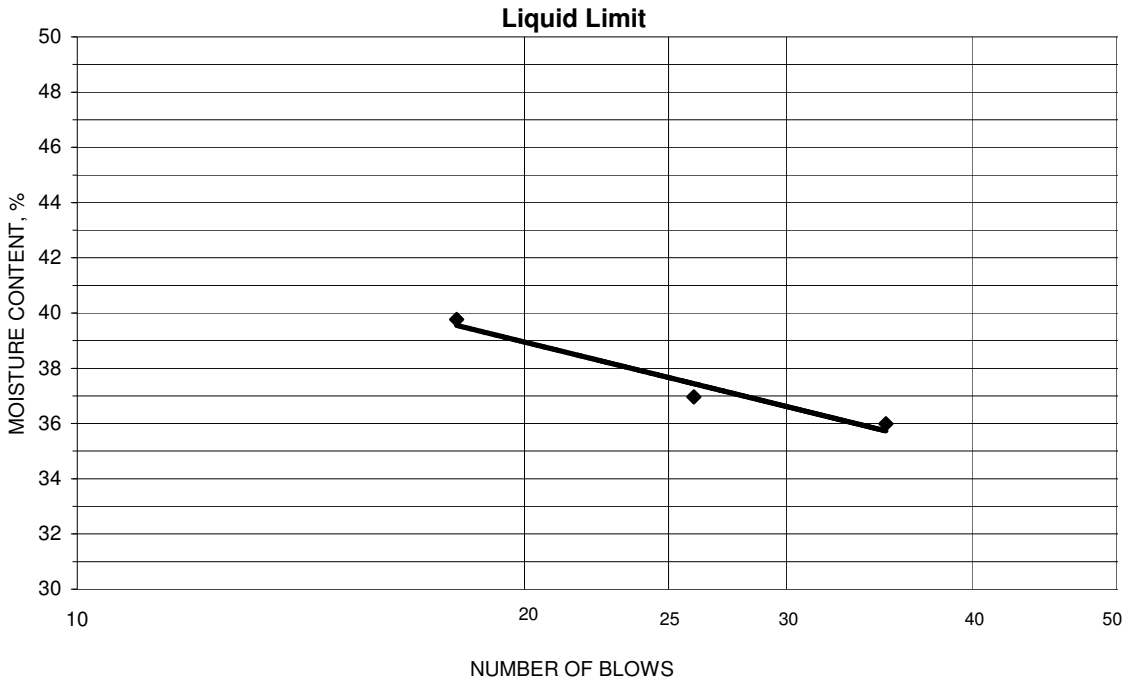
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 3.5'-5.0'			Lab ID	1
				% + No. 40	19
Tested By	KAF	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	01-06-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
34.66	27.84	10.69	18	39.8	
34.82	28.27	10.55	26	37.0	
34.20	28.07	11.04	35	36.0	38



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
28.22	25.72	11.01	17.0	17	21
29.12	26.49	10.91	16.9		

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 13.5'-15.0'	Lab ID	3
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 8.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.5
No. 4	4.75	93.3
No. 10	2	85.5
No. 40	0.425	61.1
No. 200	0.075	29.5
	0.02	10.0
	0.005	3.0
	0.002	1.7
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	6.7	14.5
Coarse Sand	7.8	24.4
Medium Sand	24.4	---
Fine Sand	31.6	31.6
Silt	26.5	27.8
Clay	3.0	1.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.14

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 13.5'-15.0'	Lab ID	3

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.5
No. 4	93.3
No. 10	85.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.14

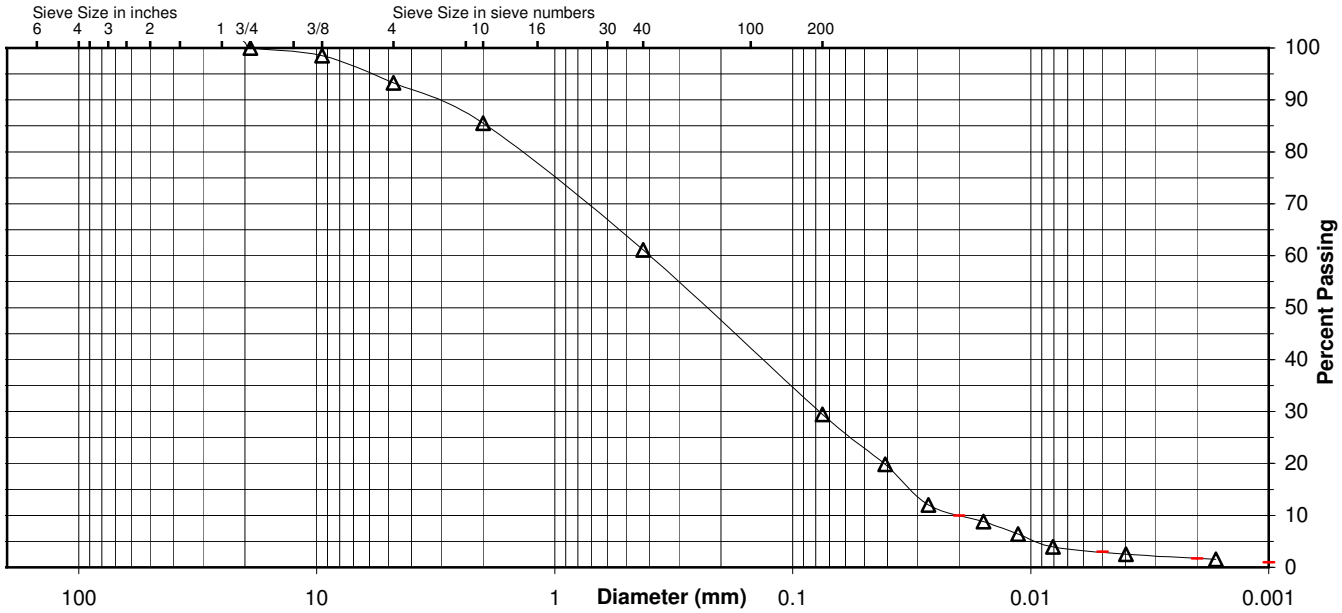
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	61.1
No. 200	29.5
0.02 mm	10.0
0.005 mm	3.0
0.002 mm	1.7
0.001 mm	1.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	6.7	7.8	24.4	31.6	26.5	3.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	14.5	24.4	31.6	27.8	1.7



Comments

Reviewed By

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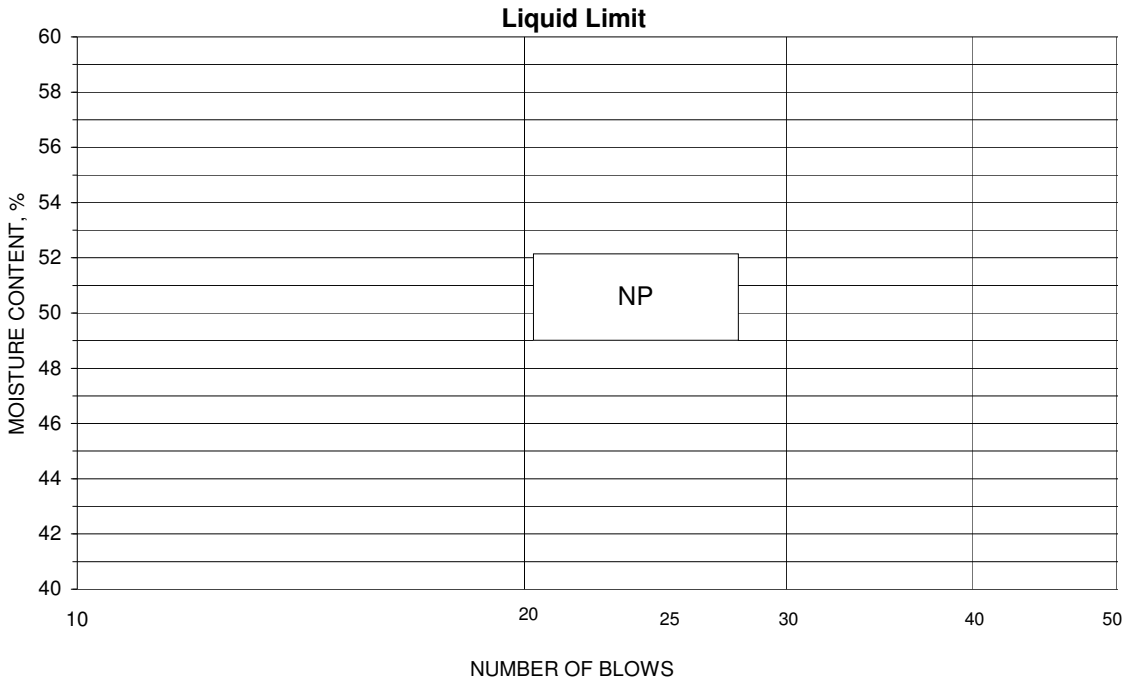
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 13.5'-15.0'			Lab ID	3
				% + No. 40	39
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 48.5'-50.0'	Lab ID	10
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 13.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.9
No. 4	4.75	90.8
No. 10	2	78.8
No. 40	0.425	61.3
No. 200	0.075	31.1
	0.02	10.1
	0.005	2.7
	0.002	1.4
estimated	0.001	1.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	9.2	21.2
Coarse Sand	12.0	17.5
Medium Sand	17.5	---
Fine Sand	30.2	30.2
Silt	28.4	29.7
Clay	2.7	1.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.33

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 48.5'-50.0'	Lab ID	10

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.9
No. 4	90.8
No. 10	78.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

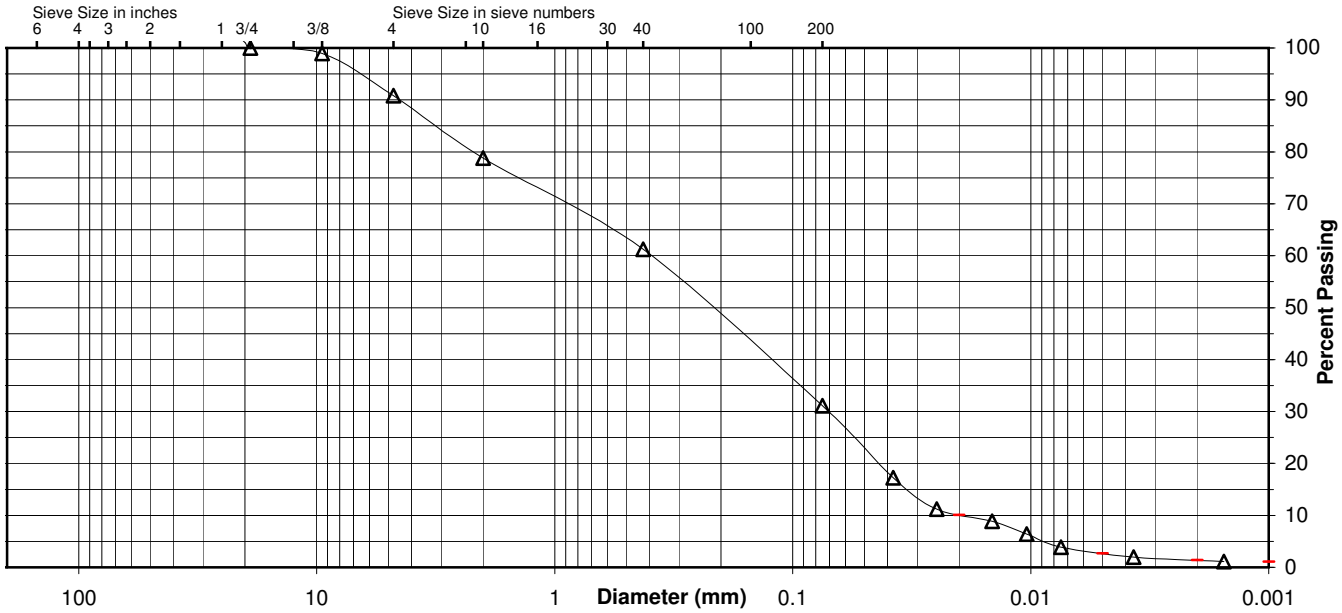
Specific Gravity 2.33

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	61.3
No. 200	31.1
0.02 mm	10.1
0.005 mm	2.7
0.002 mm	1.4
0.001 mm	1.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	9.2	12.0	17.5	30.2	28.4	2.7
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	21.2			17.5	30.2	29.7	1.4



Comments

Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 48.5'-50.0'			Lab ID	10
				% + No. 40	39
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
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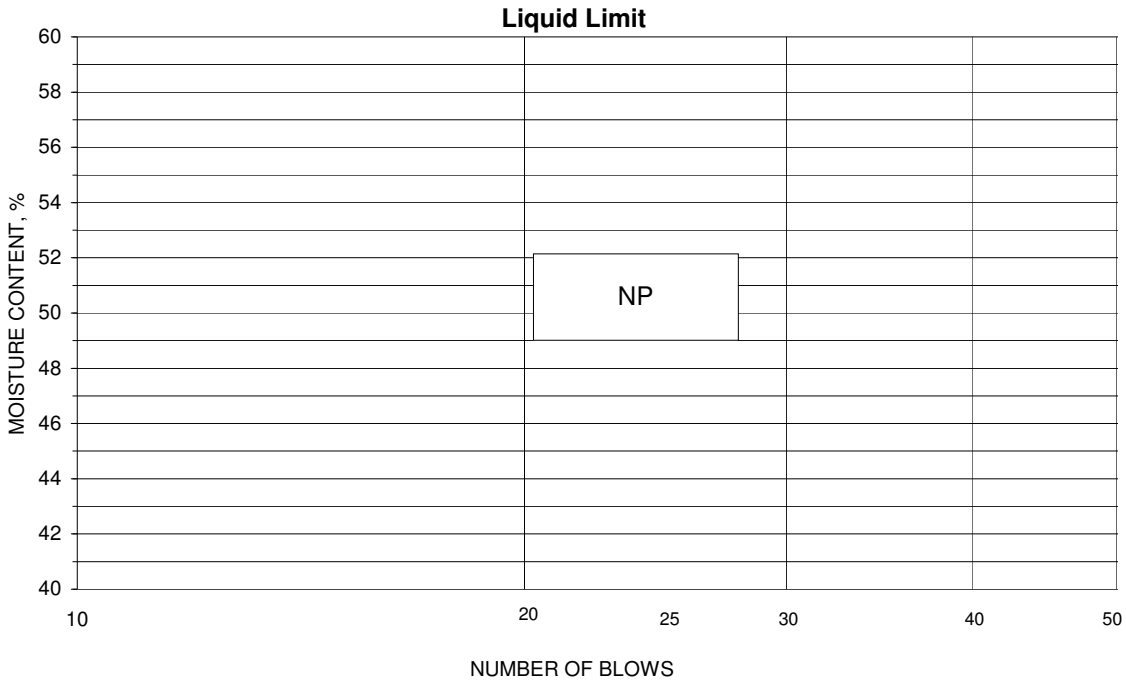


PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 58.5'-60.0'	Lab ID	12
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.9
No. 4	4.75	96.6
No. 10	2	89.8
No. 40	0.425	74.4
No. 200	0.075	32.8
	0.02	8.8
	0.005	2.2
	0.002	1.4
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.4	10.2
Coarse Sand	6.8	15.4
Medium Sand	15.4	---
Fine Sand	41.6	41.6
Silt	30.6	31.4
Clay	2.2	1.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	---
Plastic Limit:	Non Plastic
Plasticity Index:	---
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.28

Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 58.5'-60.0'	Lab ID	12

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.9
No. 4	96.6
No. 10	89.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.28

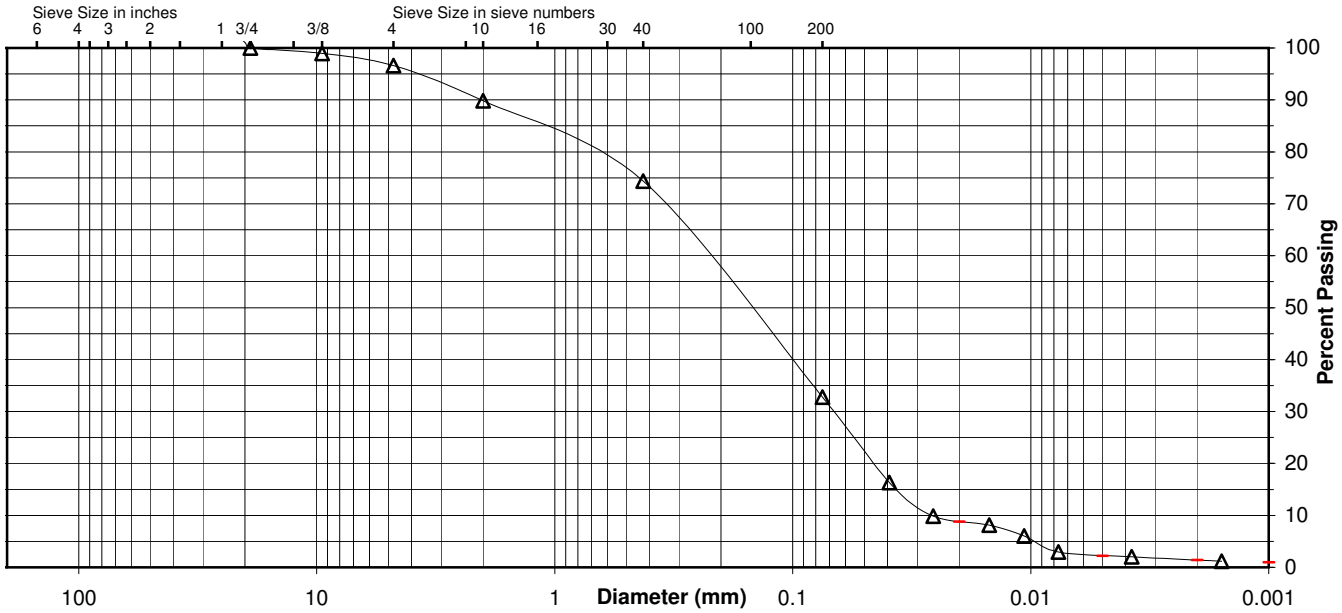
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	74.4
No. 200	32.8
0.02 mm	8.8
0.005 mm	2.2
0.002 mm	1.4
0.001 mm	1.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	3.4	6.8	15.4	41.6	30.6	2.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	10.2	15.4	41.6	31.4	1.4



Comments

Reviewed By

File: frm_175539024_sum_12 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

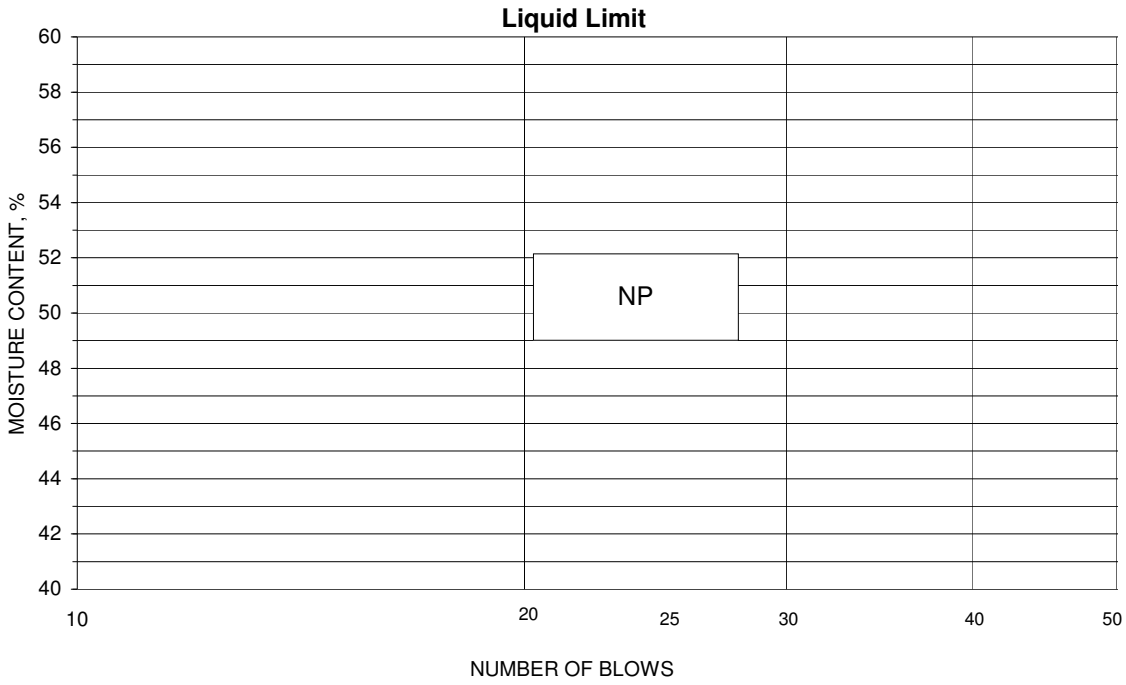
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 58.5'-60.0'			Lab ID	12
				% + No. 40	26
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 73.5'-75.0'	Lab ID	15
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 6.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	94.0
3/8"	9.5	85.9
No. 4	4.75	84.1
No. 10	2	82.6
No. 40	0.425	66.1
No. 200	0.075	24.5
	0.02	14.0
	0.005	7.7
	0.002	4.5
estimated	0.001	1.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	15.9	17.4
Coarse Sand	1.5	16.5
Medium Sand	16.5	---
Fine Sand	41.6	41.6
Silt	16.8	20.0
Clay	7.7	4.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 73.5'-75.0'	Lab ID	15

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	94.0
3/8"	85.9
No. 4	84.1
No. 10	82.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

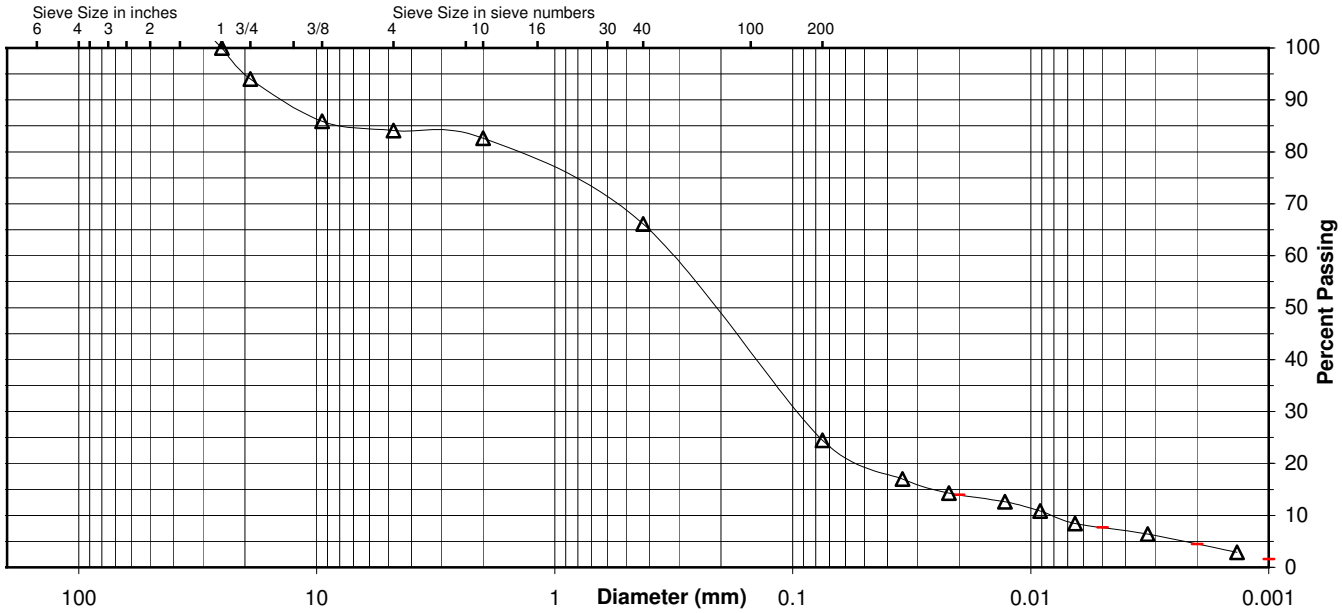
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	66.1
No. 200	24.5
0.02 mm	14.0
0.005 mm	7.7
0.002 mm	4.5
0.001 mm	1.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	6.0	9.9	1.5	16.5	41.6	16.8	7.7
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	17.4			16.5	41.6	20.0	4.5



Comments

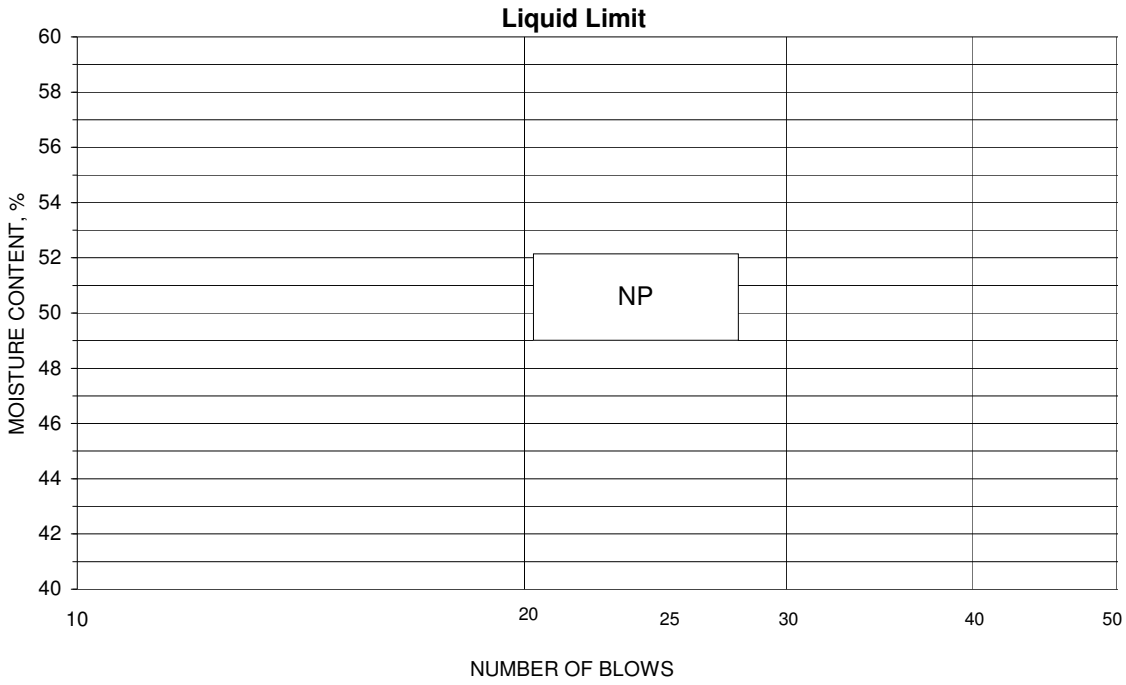
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 73.5'-75.0'			Lab ID	15
				% + No. 40	34
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 88.5'-90.0'	Lab ID	18
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 2.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	83.5
3/8"	9.5	77.5
No. 4	4.75	74.8
No. 10	2	71.7
No. 40	0.425	59.8
No. 200	0.075	24.6
	0.02	13.8
	0.005	8.9
	0.002	5.6
estimated	0.001	3.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	25.2	28.3
Coarse Sand	3.1	11.9
Medium Sand	11.9	---
Fine Sand	35.2	35.2
Silt	15.7	19.0
Clay	8.9	5.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Big Sandy Unit 12 Main Dam Instrumentation
Project Number: 175539024
Source: B-1, 88.5'-90.0'
Lab ID: 18

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	83.5
3/8"	77.5
No. 4	74.8
No. 10	71.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

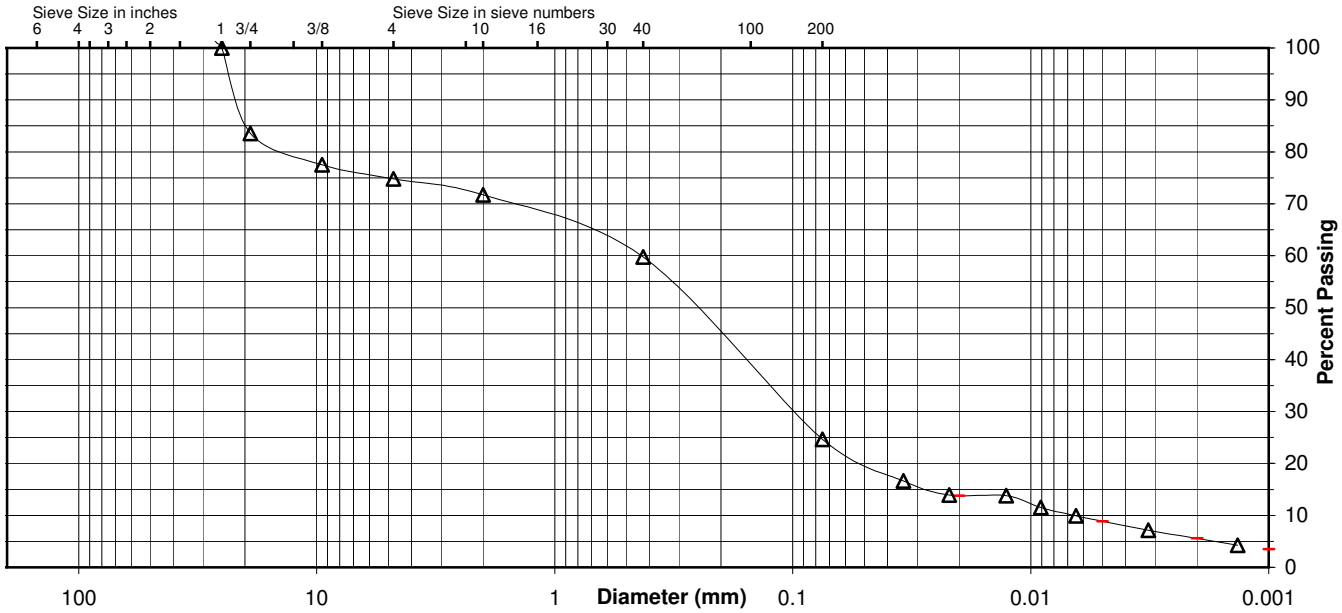
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	59.8
No. 200	24.6
0.02 mm	13.8
0.005 mm	8.9
0.002 mm	5.6
0.001 mm	3.5

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	16.5	8.7	3.1	11.9	35.2	15.7	8.9

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	28.3	11.9	35.2	19.0	5.6



Comments

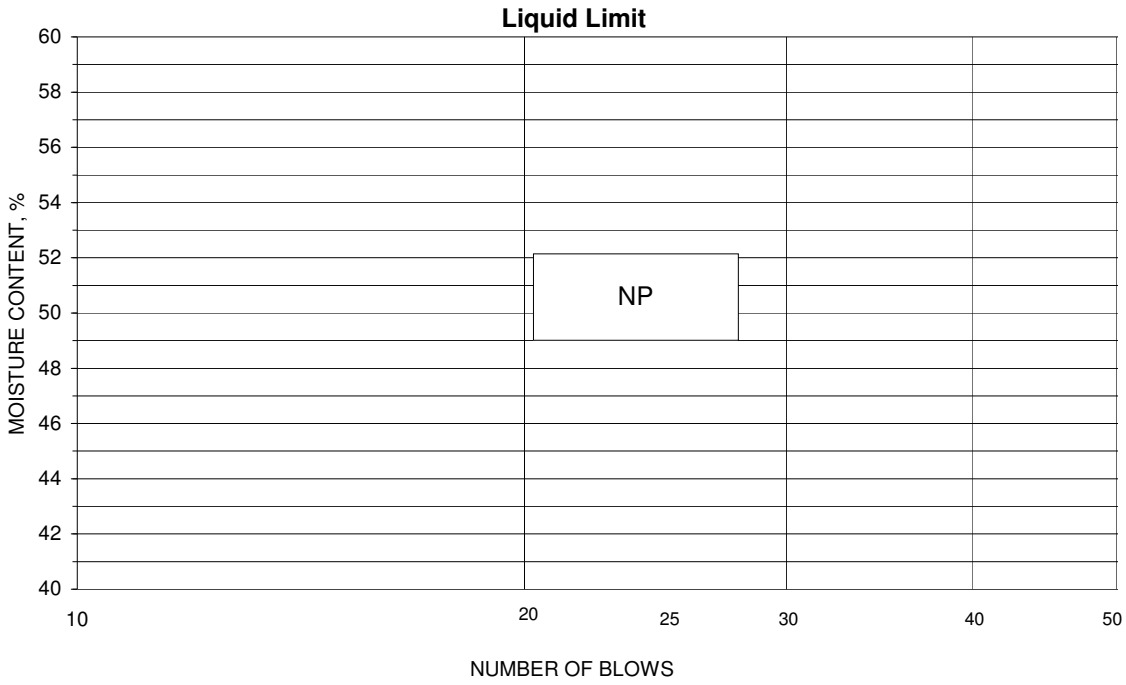
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 88.5'-90.0'			Lab ID	18
				% + No. 40	40
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 98.5'-100.0'	Lab ID	20
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 0.6

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	95.6
3/8"	9.5	83.6
No. 4	4.75	78.1
No. 10	2	71.3
No. 40	0.425	64.4
No. 200	0.075	31.4
	0.02	19.5
	0.005	11.5
	0.002	7.6
estimated	0.001	5.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	21.9	28.7
Coarse Sand	6.8	6.9
Medium Sand	6.9	---
Fine Sand	33.0	33.0
Silt	19.9	23.8
Clay	11.5	7.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-1, 98.5'-100.0'	Lab ID	20

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	95.6
3/8"	83.6
No. 4	78.1
No. 10	71.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

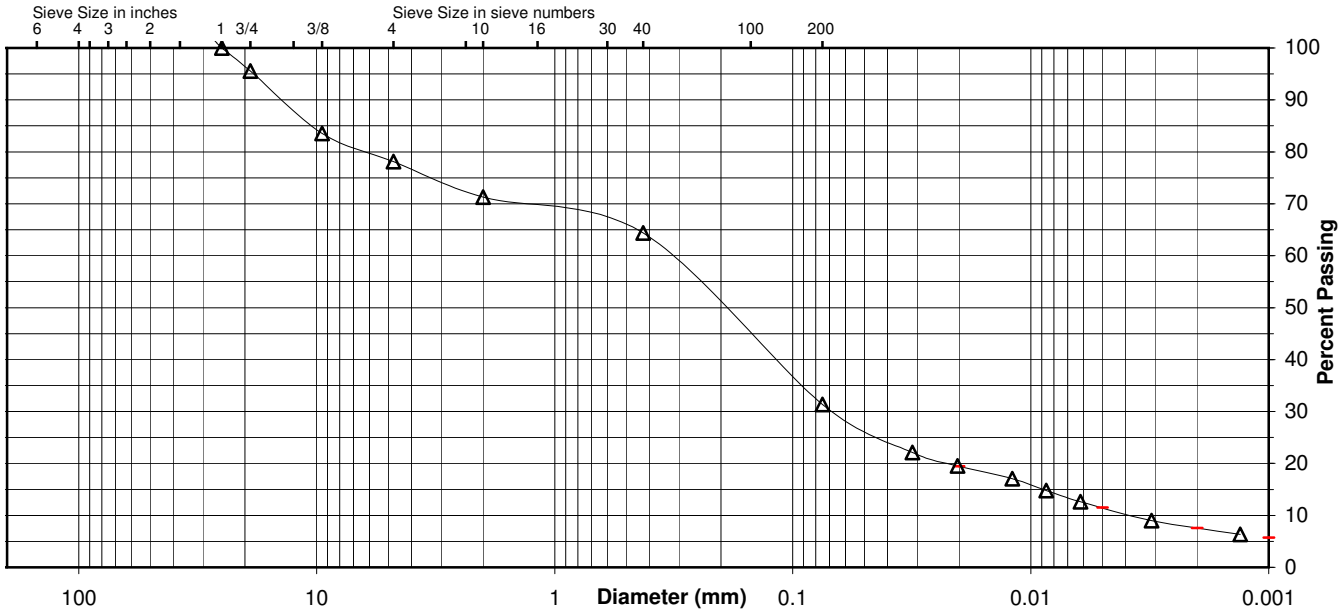
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	64.4
No. 200	31.4
0.02 mm	19.5
0.005 mm	11.5
0.002 mm	7.6
0.001 mm	5.7

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	4.4	17.5	6.8	6.9	33.0	19.9	11.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	28.7	6.9	33.0	23.8	7.6



Comments

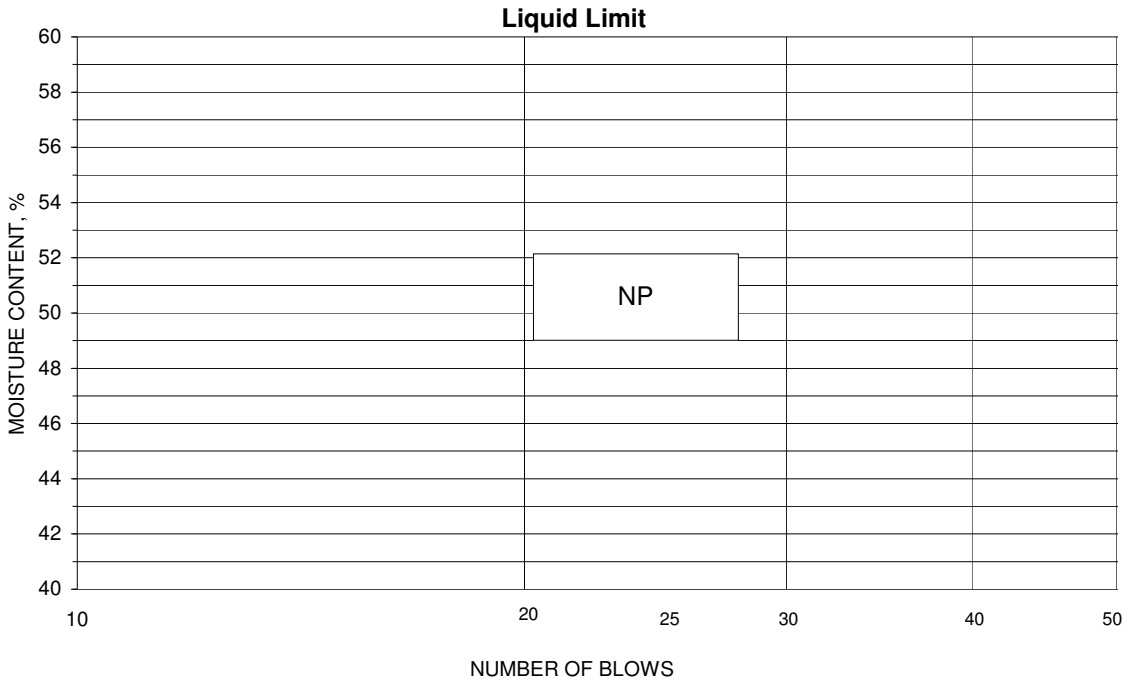
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-1, 98.5'-100.0'			Lab ID	20
				% + No. 40	36
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 4.5'-6.0'	Lab ID	21
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 11.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	93.0
3/8"	9.5	90.5
No. 4	4.75	89.2
No. 10	2	84.9
No. 40	0.425	71.5
No. 200	0.075	51.2
	0.02	38.3
	0.005	25.8
	0.002	18.6
estimated	0.001	14.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	10.8	15.1
Coarse Sand	4.3	13.4
Medium Sand	13.4	---
Fine Sand	20.3	20.3
Silt	25.4	32.6
Clay	25.8	18.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	34
Plastic Limit:	17
Plasticity Index:	17
Activity Index:	0.89

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-6 (5)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 4.5'-6.0'	Lab ID	21

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	93.0
3/8"	90.5
No. 4	89.2
No. 10	84.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

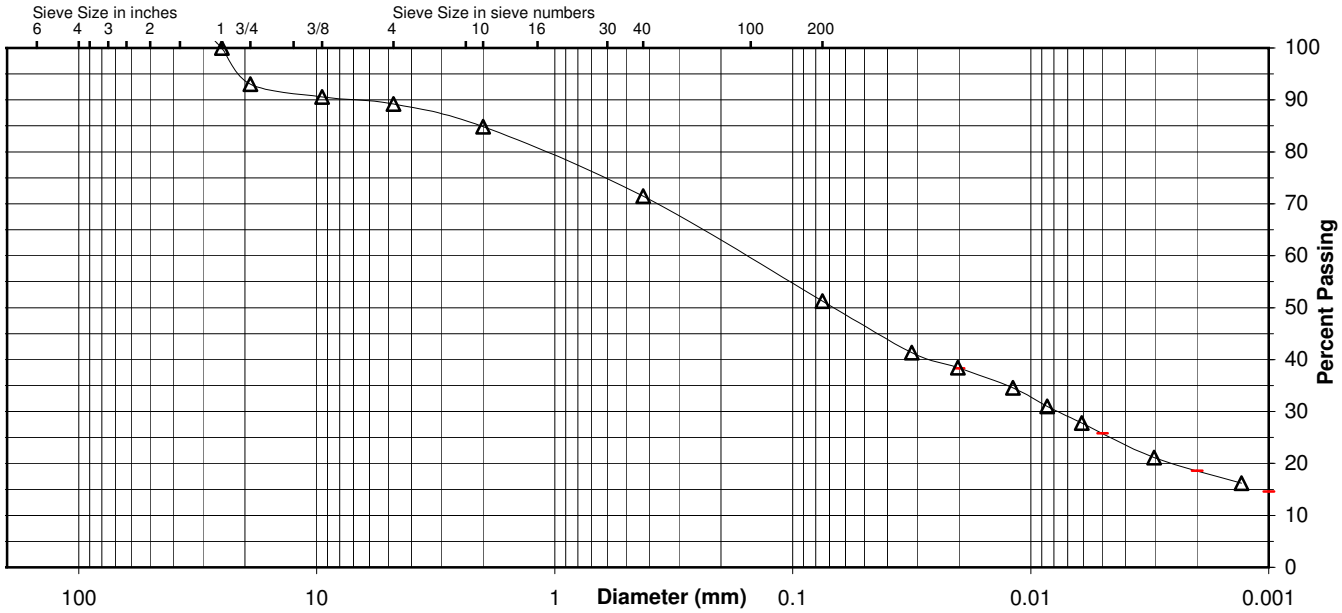
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	71.5
No. 200	51.2
0.02 mm	38.3
0.005 mm	25.8
0.002 mm	18.6
0.001 mm	14.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	7.0	3.8	4.3	13.4	20.3	25.4	25.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	15.1	13.4	20.3	32.6	18.6



Comments

Reviewed By

File: frm_175539024_sum_21 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

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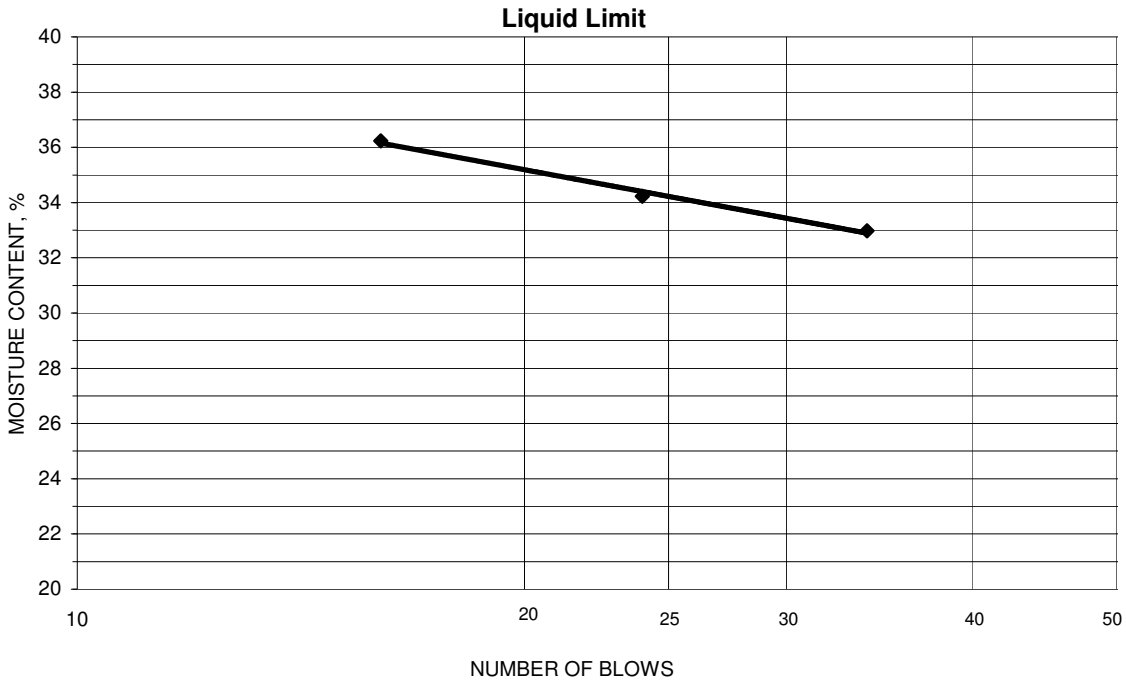
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 4.5'-6.0'			Lab ID	21
				% + No. 40	29
Tested By	KAF	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	01-06-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
36.15	29.36	10.62	16	36.2	
37.54	30.69	10.68	24	34.2	
39.08	32.19	11.30	34	33.0	34



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
28.69	26.12	10.68	16.6	17	17
30.09	27.36	11.05	16.7		

Remarks:

Reviewed By

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Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 24.5'-26.0'	Lab ID	25
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 30.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.6
No. 10	2	96.5
No. 40	0.425	86.0
No. 200	0.075	59.7
	0.02	32.7
	0.005	13.3
	0.002	8.3
estimated	0.001	5.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.4	3.5
Coarse Sand	3.1	10.5
Medium Sand	10.5	---
Fine Sand	26.3	26.3
Silt	46.4	51.4
Clay	13.3	8.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.19

Classification

Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 24.5'-26.0'	Lab ID	25

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.6
No. 10	96.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

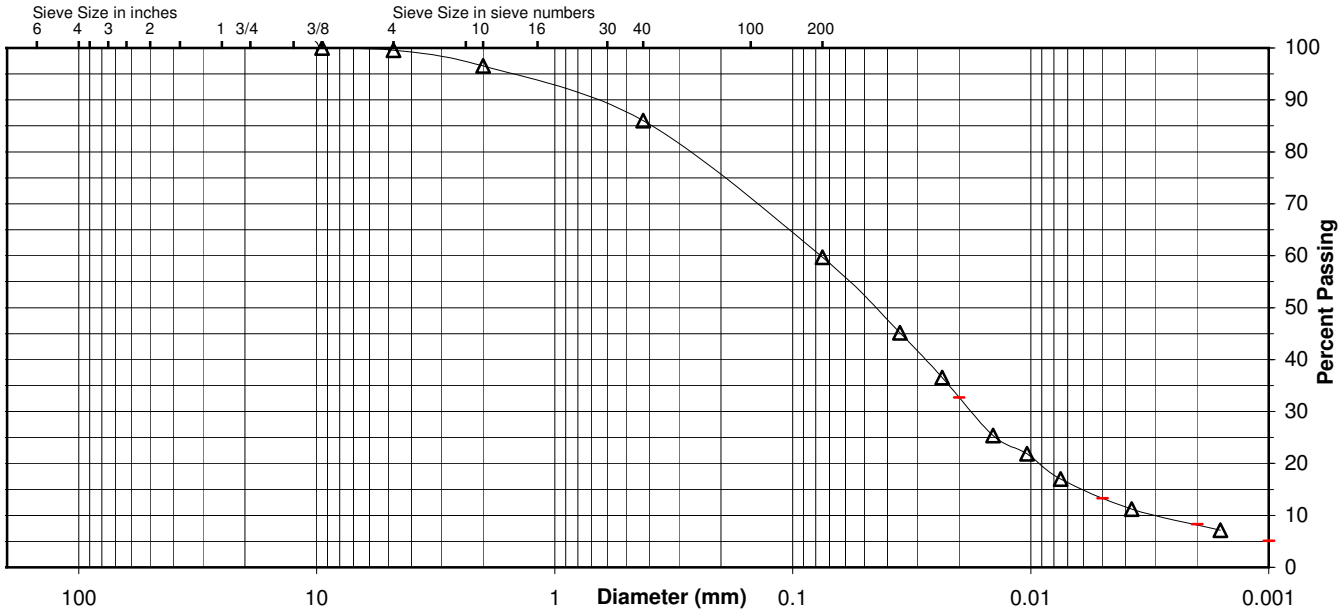
Specific Gravity 2.19

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	86.0
No. 200	59.7
0.02 mm	32.7
0.005 mm	13.3
0.002 mm	8.3
0.001 mm	5.1

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.4	3.1	10.5	26.3	46.4	13.3
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	3.5			10.5	26.3	51.4	8.3



Comments

Reviewed By

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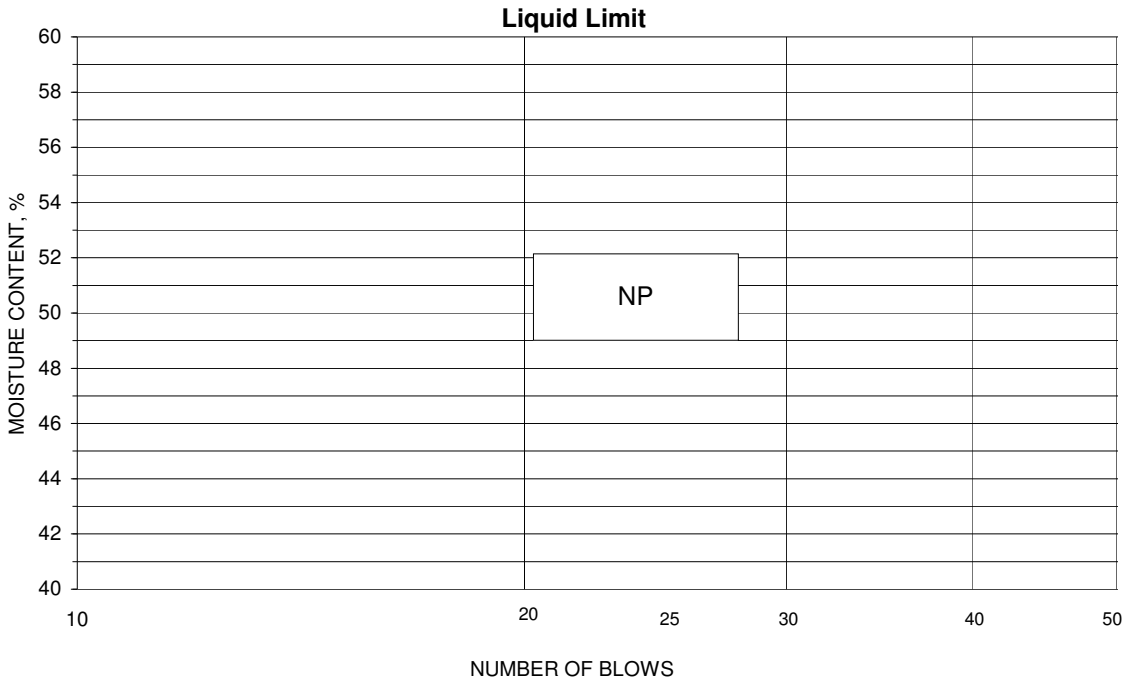
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 24.5'-26.0'			Lab ID	25
				% + No. 40	14
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 49.5'-51.0'	Lab ID	30
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 10.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	96.5
No. 4	4.75	88.7
No. 10	2	78.6
No. 40	0.425	61.4
No. 200	0.075	31.0
	0.02	10.7
	0.005	3.4
	0.002	2.1
estimated	0.001	1.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	11.3	21.4
Coarse Sand	10.1	17.2
Medium Sand	17.2	---
Fine Sand	30.4	30.4
Silt	27.6	28.9
Clay	3.4	2.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.30

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 49.5'-51.0'	Lab ID	30

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	96.5
No. 4	88.7
No. 10	78.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.3

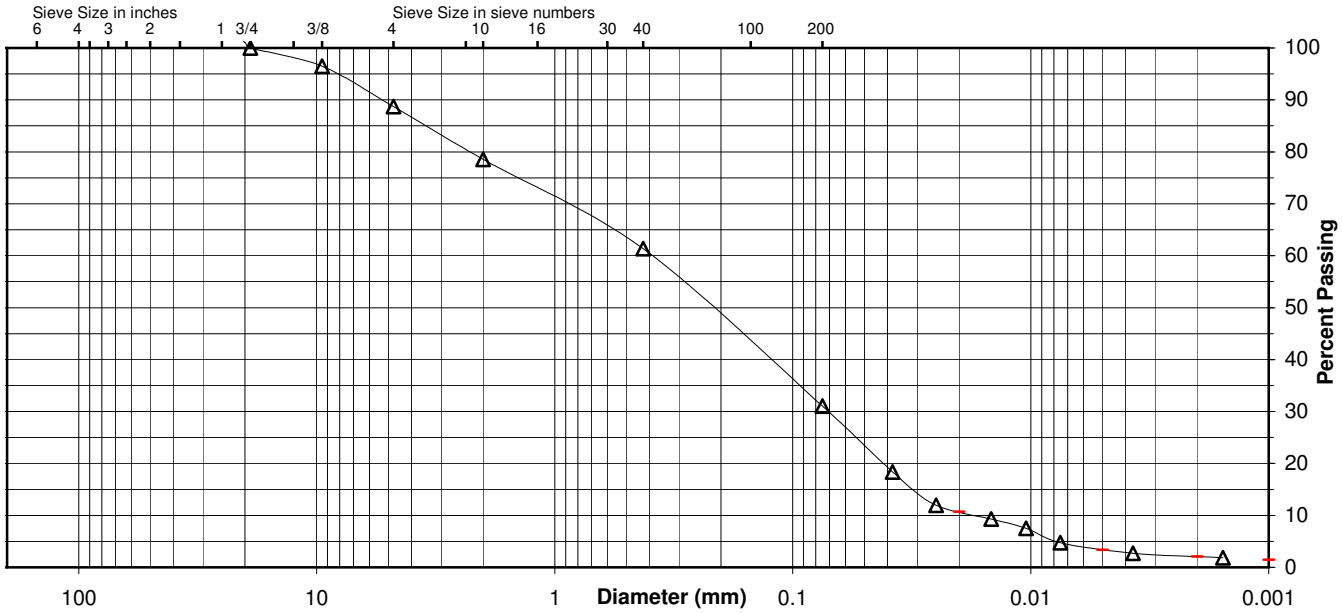
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	61.4
No. 200	31.0
0.02 mm	10.7
0.005 mm	3.4
0.002 mm	2.1
0.001 mm	1.5

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	11.3	10.1	17.2	30.4	27.6	3.4

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	21.4	17.2	30.4	28.9	2.1



Comments

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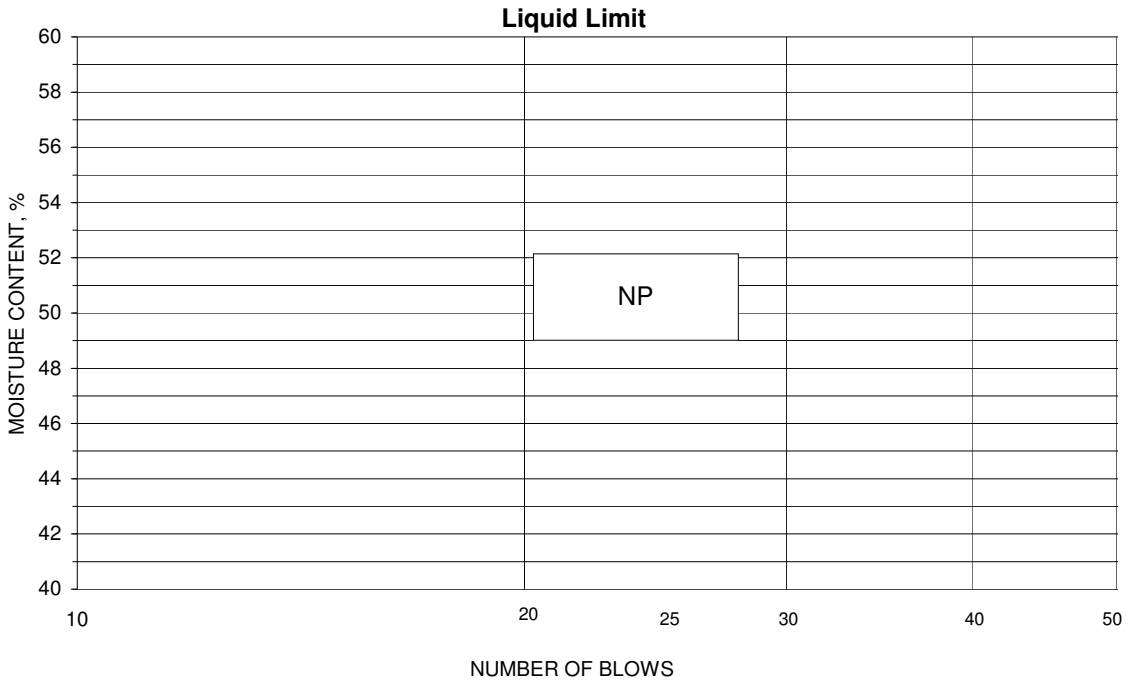
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 49.5'-51.0'			Lab ID	30
				% + No. 40	39
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-18-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 64.5'-66.0'	Lab ID	33
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 12.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.8
No. 4	4.75	91.5
No. 10	2	78.2
No. 40	0.425	56.5
No. 200	0.075	22.9
	0.02	5.5
	0.005	1.4
	0.002	1.0
estimated	0.001	0.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	8.5	21.8
Coarse Sand	13.3	21.7
Medium Sand	21.7	---
Fine Sand	33.6	33.6
Silt	21.5	21.9
Clay	1.4	1.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	---
Plastic Limit:	Non Plastic
Plasticity Index:	---
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.30

Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 64.5'-66.0'	Lab ID	33

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.8
No. 4	91.5
No. 10	78.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.3

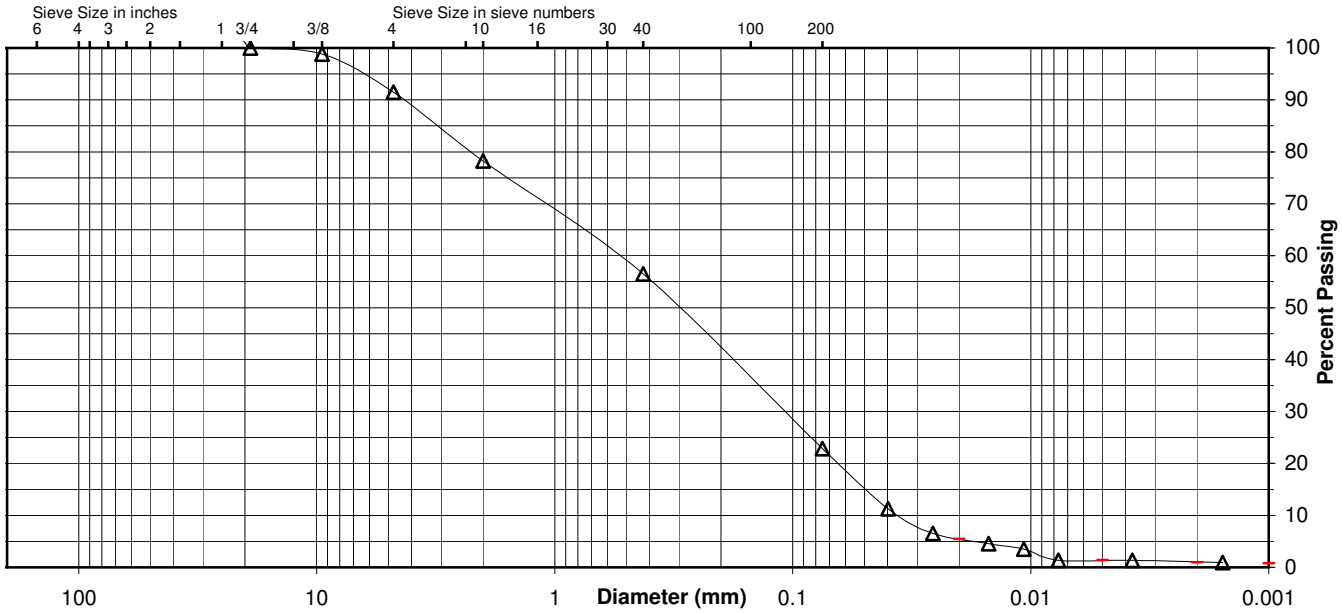
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	56.5
No. 200	22.9
0.02 mm	5.5
0.005 mm	1.4
0.002 mm	1.0
0.001 mm	0.8

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	8.5	13.3	21.7	33.6	21.5	1.4

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	21.8	21.7	33.6	21.9	1.0



Comments

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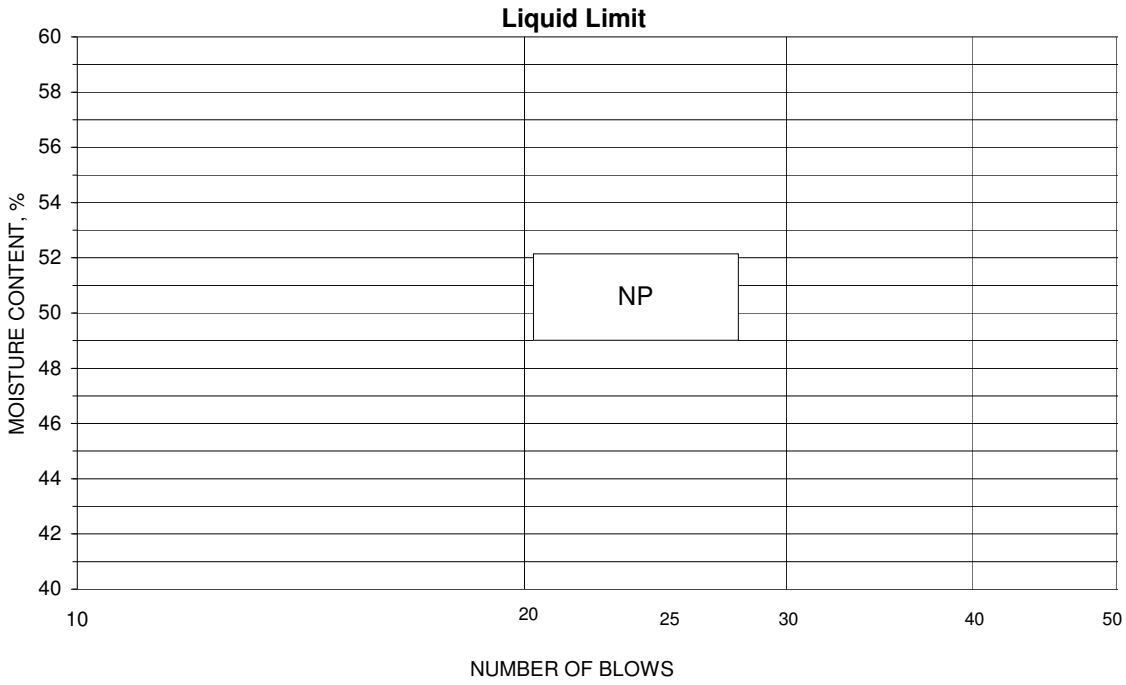
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 64.5'-66.0'			Lab ID	33
				% + No. 40	43
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 69.5'-71.0'	Lab ID	34
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 3.0

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	94.3
No. 4	4.75	92.5
No. 10	2	88.7
No. 40	0.425	65.1
No. 200	0.075	27.1
	0.02	17.4
	0.005	9.1
	0.002	5.5
estimated	0.001	3.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	7.5	11.3
Coarse Sand	3.8	23.6
Medium Sand	23.6	---
Fine Sand	38.0	38.0
Silt	18.0	21.6
Clay	9.1	5.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 69.5'-71.0'	Lab ID	34

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	94.3
No. 4	92.5
No. 10	88.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

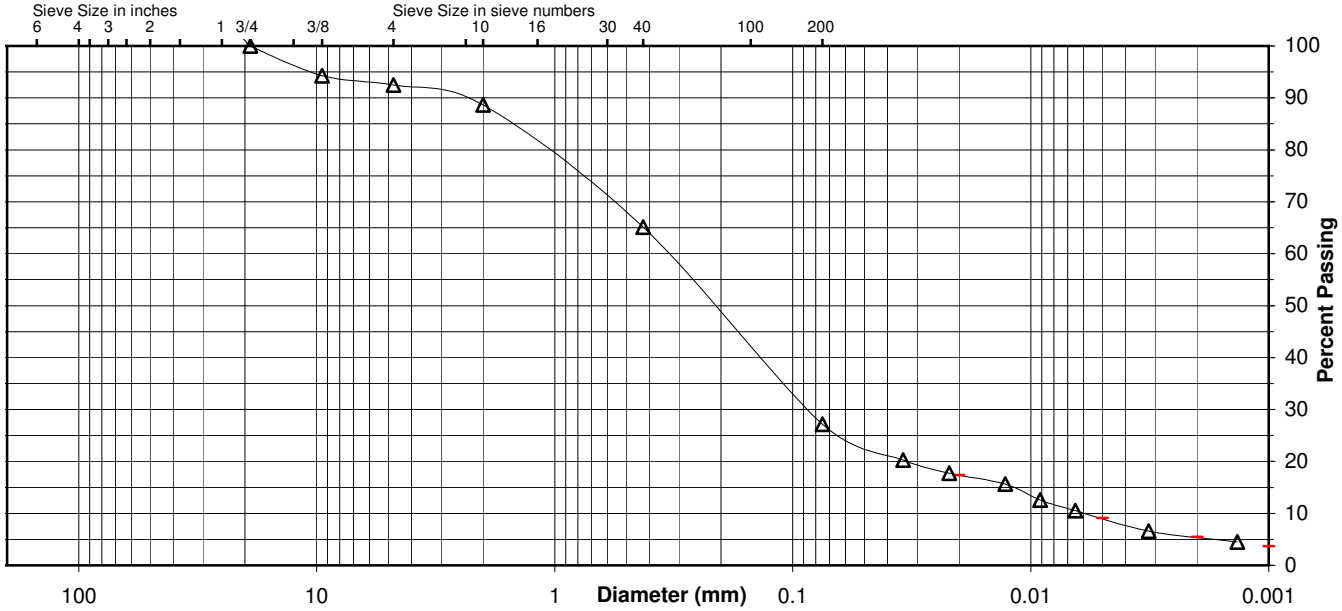
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	65.1
No. 200	27.1
0.02 mm	17.4
0.005 mm	9.1
0.002 mm	5.5
0.001 mm	3.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	7.5	3.8	23.6	38.0	18.0	9.1
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	11.3			23.6	38.0	21.6	5.5



Comments

Reviewed By

File: frm_175539024_sum_34 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

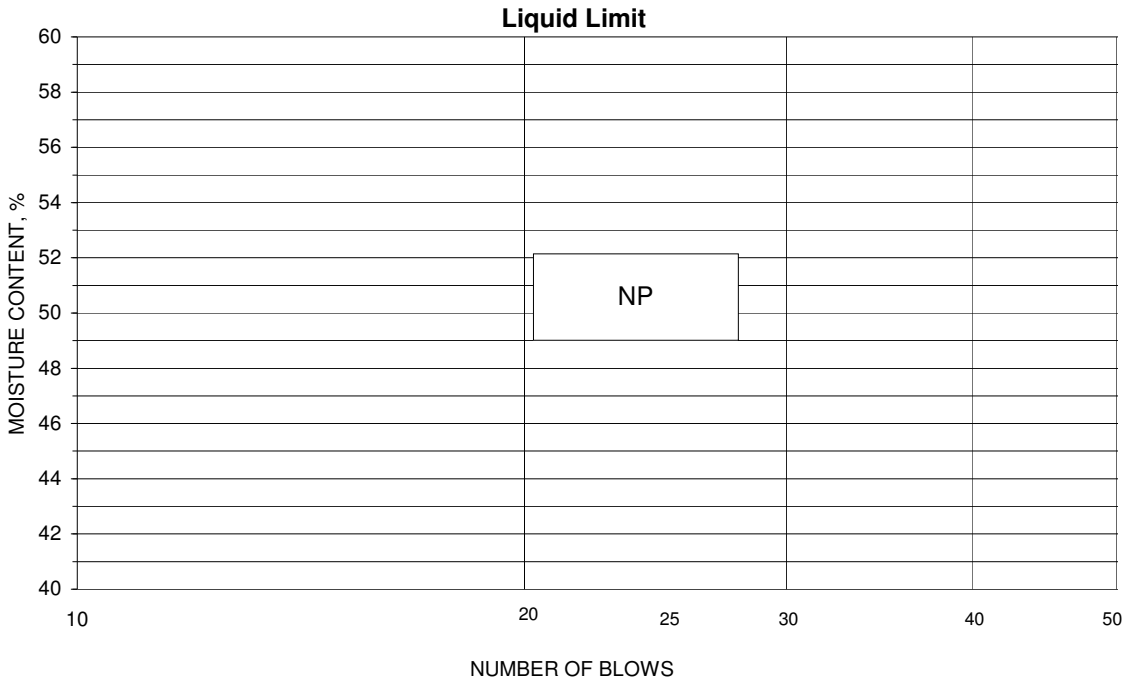
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 69.5'-71.0'			Lab ID	34
				% + No. 40	35
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 79.5'-81.0'	Lab ID	36
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 4.6

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.8
3/8"	9.5	85.9
No. 4	4.75	82.7
No. 10	2	79.7
No. 40	0.425	62.0
No. 200	0.075	22.3
	0.02	9.7
	0.005	5.5
	0.002	3.0
estimated	0.001	2.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	17.3	20.3
Coarse Sand	3.0	17.7
Medium Sand	17.7	---
Fine Sand	39.7	39.7
Silt	16.8	19.3
Clay	5.5	3.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 79.5'-81.0'	Lab ID	36

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.8
3/8"	85.9
No. 4	82.7
No. 10	79.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

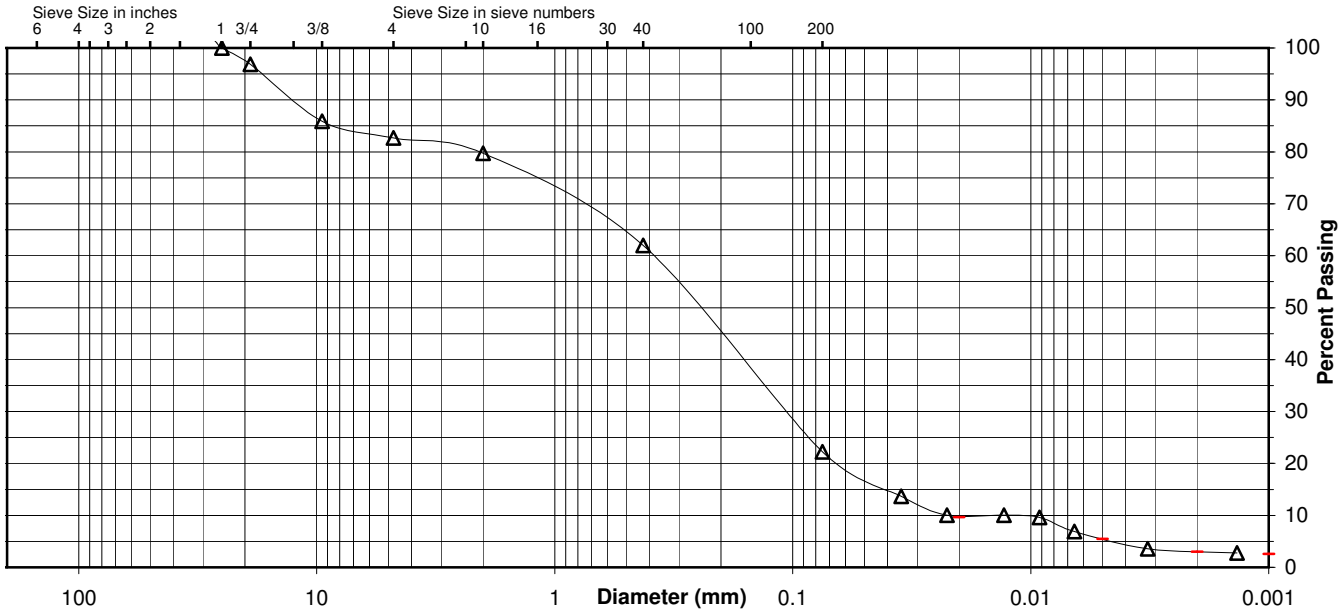
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	62.0
No. 200	22.3
0.02 mm	9.7
0.005 mm	5.5
0.002 mm	3.0
0.001 mm	2.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.2	14.1	3.0	17.7	39.7	16.8	5.5
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	20.3			17.7	39.7	19.3	3.0



Comments

Reviewed By

File: frm_175539024_sum_36 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

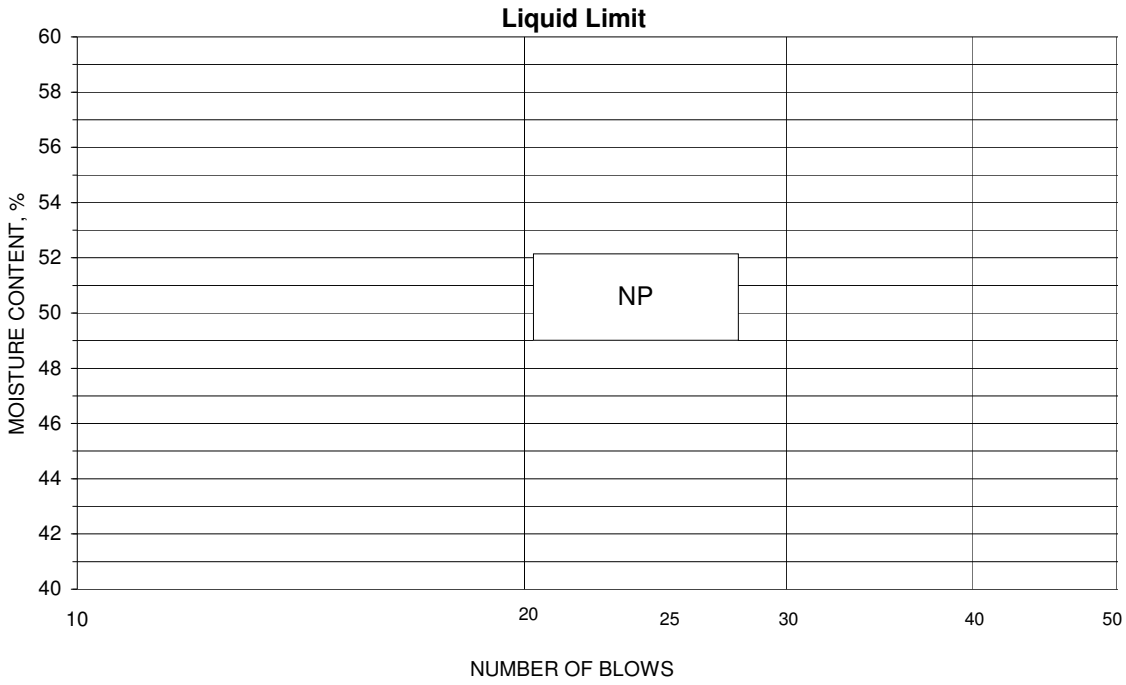
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 79.5'-81.0'			Lab ID	36
				% + No. 40	38
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 99.5'-101.0'	Lab ID	40
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 4.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.0
3/8"	9.5	79.3
No. 4	4.75	73.5
No. 10	2	68.3
No. 40	0.425	57.5
No. 200	0.075	25.0
	0.02	16.2
	0.005	10.0
	0.002	5.7
estimated	0.001	3.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	26.5	31.7
Coarse Sand	5.2	10.8
Medium Sand	10.8	---
Fine Sand	32.5	32.5
Silt	15.0	19.3
Clay	10.0	5.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-3, 99.5'-101.0'	Lab ID	40

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.0
3/8"	79.3
No. 4	73.5
No. 10	68.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

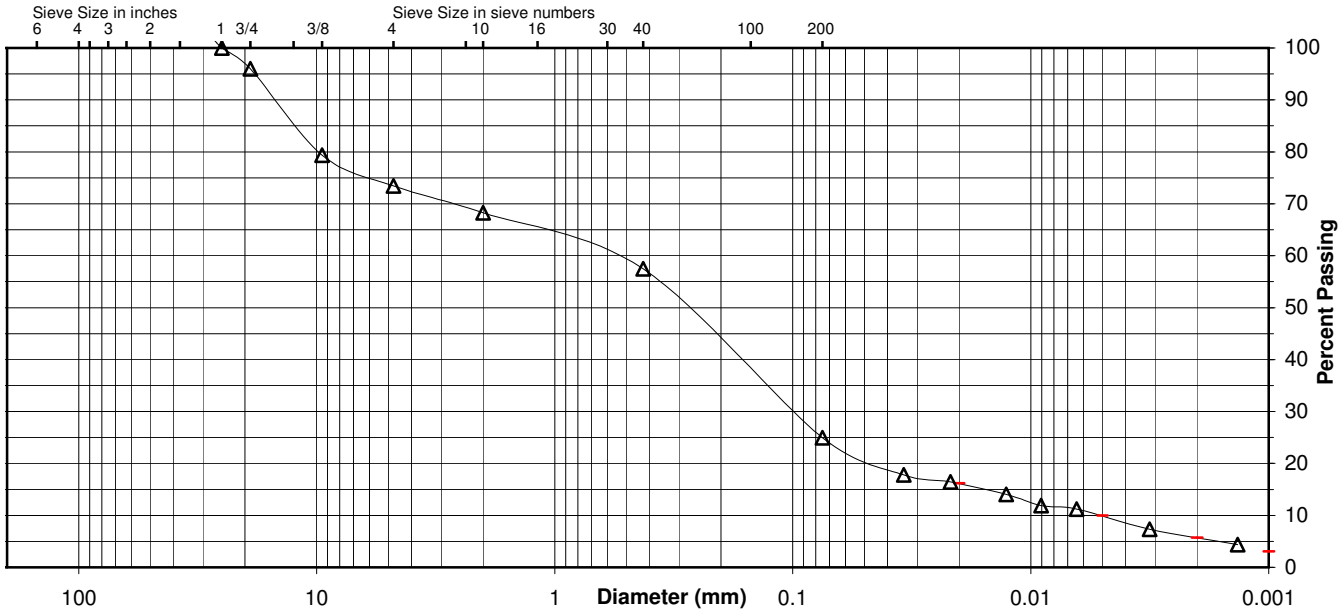
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	57.5
No. 200	25.0
0.02 mm	16.2
0.005 mm	10.0
0.002 mm	5.7
0.001 mm	3.1

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	4.0	22.5	5.2	10.8	32.5	15.0	10.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	31.7	10.8	32.5	19.3	5.7



Comments

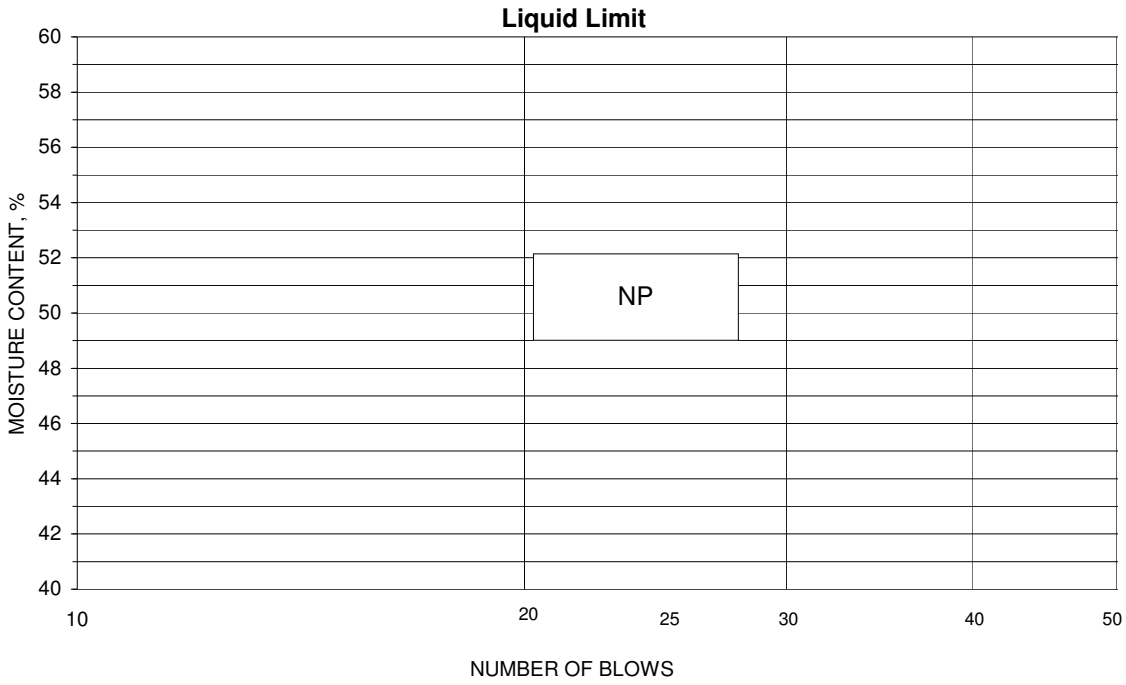
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-3, 99.5'-101.0'			Lab ID	40
				% + No. 40	42
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 4.5'-6.0'	Lab ID	41
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 12.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.5
No. 4	4.75	86.9
No. 10	2	80.4
No. 40	0.425	69.3
No. 200	0.075	51.5
	0.02	40.4
	0.005	27.7
	0.002	20.8
estimated	0.001	16.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	13.1	19.6
Coarse Sand	6.5	11.1
Medium Sand	11.1	---
Fine Sand	17.8	17.8
Silt	23.8	30.7
Clay	27.7	20.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 39
Plastic Limit: 18
Plasticity Index: 21
Activity Index: 1.00

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-6 (7)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 4.5'-6.0'	Lab ID	41

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.5
No. 4	86.9
No. 10	80.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

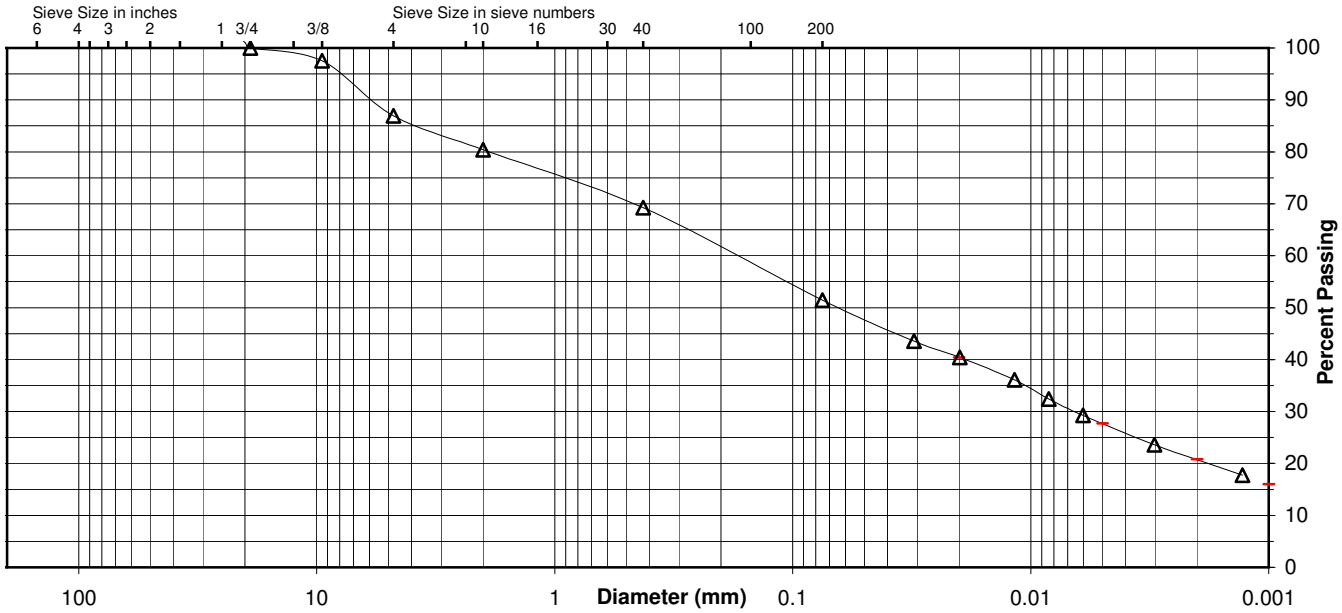
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	69.3
No. 200	51.5
0.02 mm	40.4
0.005 mm	27.7
0.002 mm	20.8
0.001 mm	16.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	13.1	6.5	11.1	17.8	23.8	27.7

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	19.6	11.1	17.8	30.7	20.8



Comments

Reviewed By

File: frm_175539024_sum_41 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

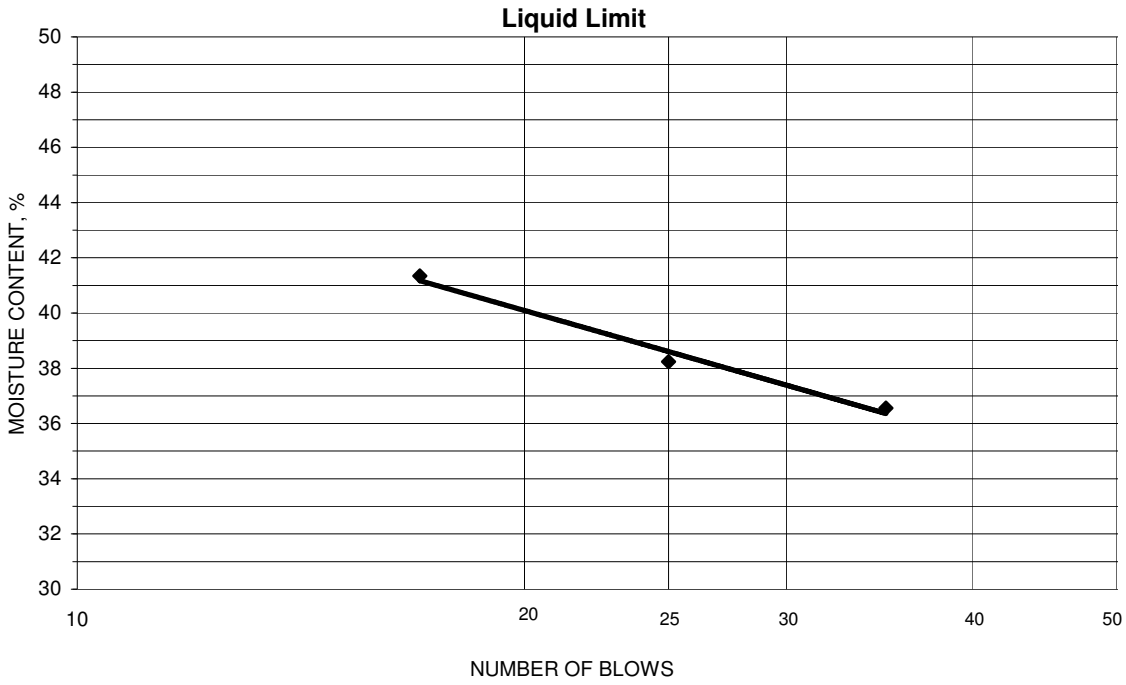
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 4.5'-6.0'			Lab ID	41
				% + No. 40	31
Tested By	KAF	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	01-06-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
34.84	27.77	10.67	17	41.3	
36.81	29.69	11.07	25	38.2	
37.06	30.11	11.10	35	36.6	39



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
31.05	27.99	11.03	18.0	18	21
30.54	27.54	10.88	18.0		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 29.5'-31.0'	Lab ID	46
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 9.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.5
No. 4	4.75	94.3
No. 10	2	86.5
No. 40	0.425	60.9
No. 200	0.075	40.5
	0.02	21.4
	0.005	5.7
	0.002	2.7
estimated	0.001	2.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	5.7	13.5
Coarse Sand	7.8	25.6
Medium Sand	25.6	---
Fine Sand	20.4	20.4
Silt	34.8	37.8
Clay	5.7	2.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.25

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 29.5'-31.0'	Lab ID	46

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.5
No. 4	94.3
No. 10	86.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.25

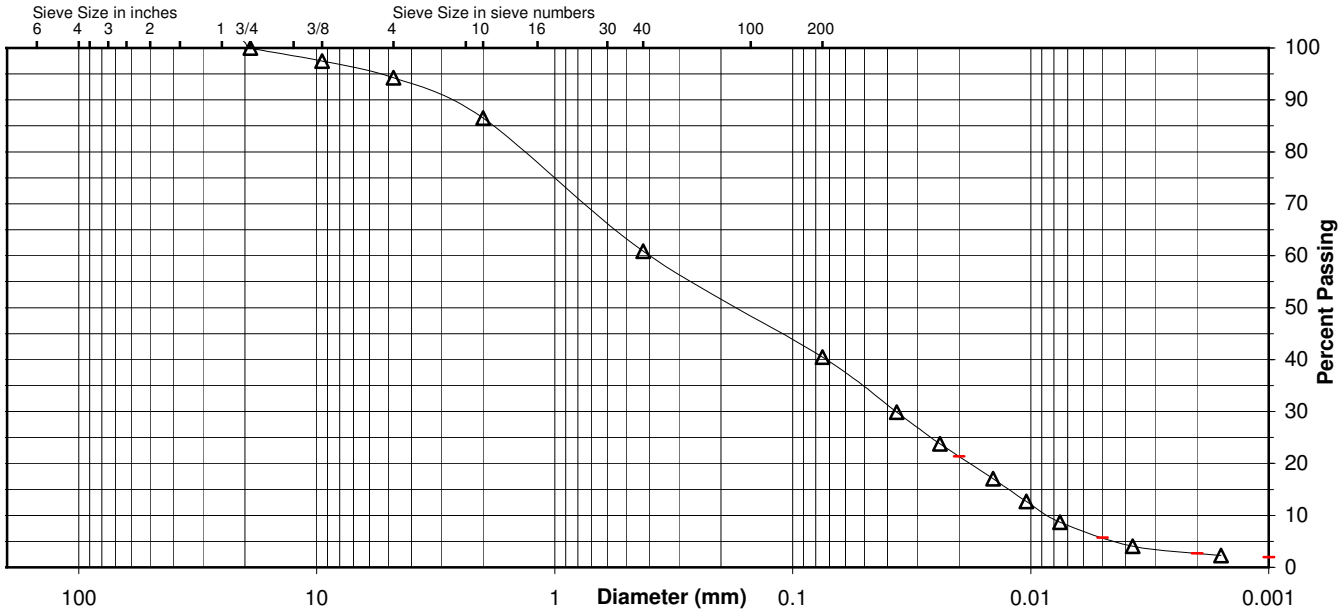
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	60.9
No. 200	40.5
0.02 mm	21.4
0.005 mm	5.7
0.002 mm	2.7
0.001 mm	2.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	5.7	7.8	25.6	20.4	34.8	5.7

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	13.5	25.6	20.4	37.8	2.7



Comments

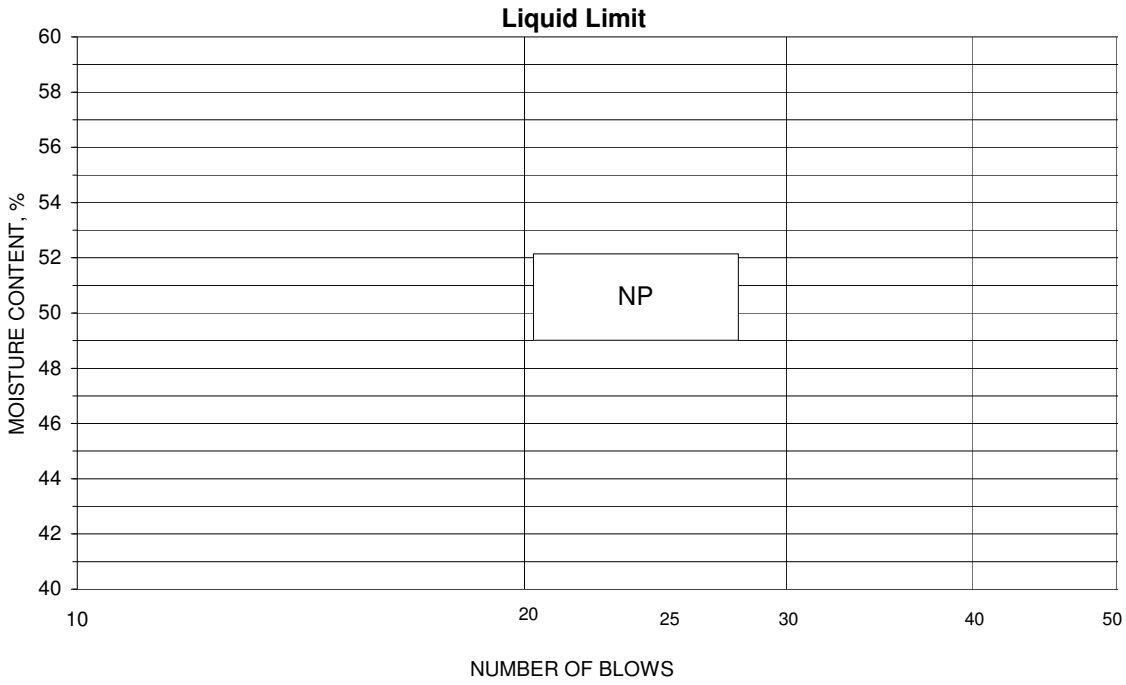
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 29.5'-31.0'			Lab ID	46
				% + No. 40	39
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 44.5'-46.0'	Lab ID	49
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 11.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.5
No. 4	4.75	94.3
No. 10	2	80.3
No. 40	0.425	48.0
No. 200	0.075	19.7
	0.02	6.5
	0.005	1.1
	0.002	0.2
estimated	0.001	0.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	5.7	19.7
Coarse Sand	14.0	32.3
Medium Sand	32.3	---
Fine Sand	28.3	28.3
Silt	18.6	19.5
Clay	1.1	0.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.32

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 44.5'-46.0'	Lab ID	49

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.5
No. 4	94.3
No. 10	80.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.32

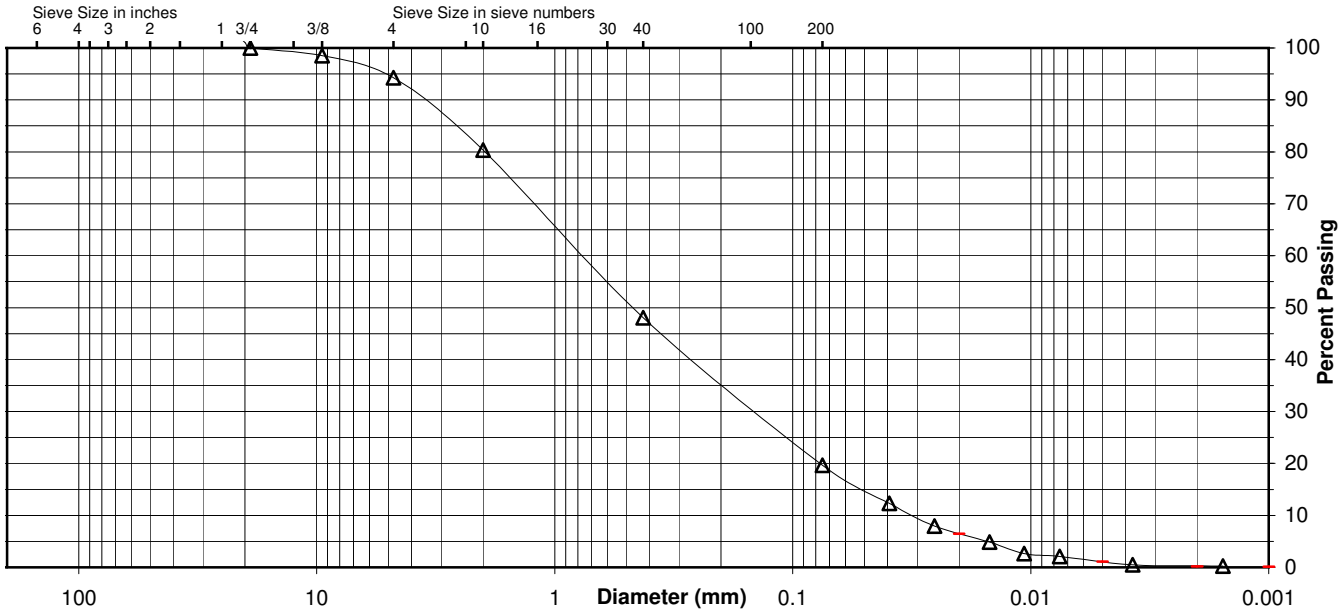
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	48.0
No. 200	19.7
0.02 mm	6.5
0.005 mm	1.1
0.002 mm	0.2
0.001 mm	0.1

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	5.7	14.0	32.3	28.3	18.6	1.1

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	19.7	32.3	28.3	19.5	0.2



Comments

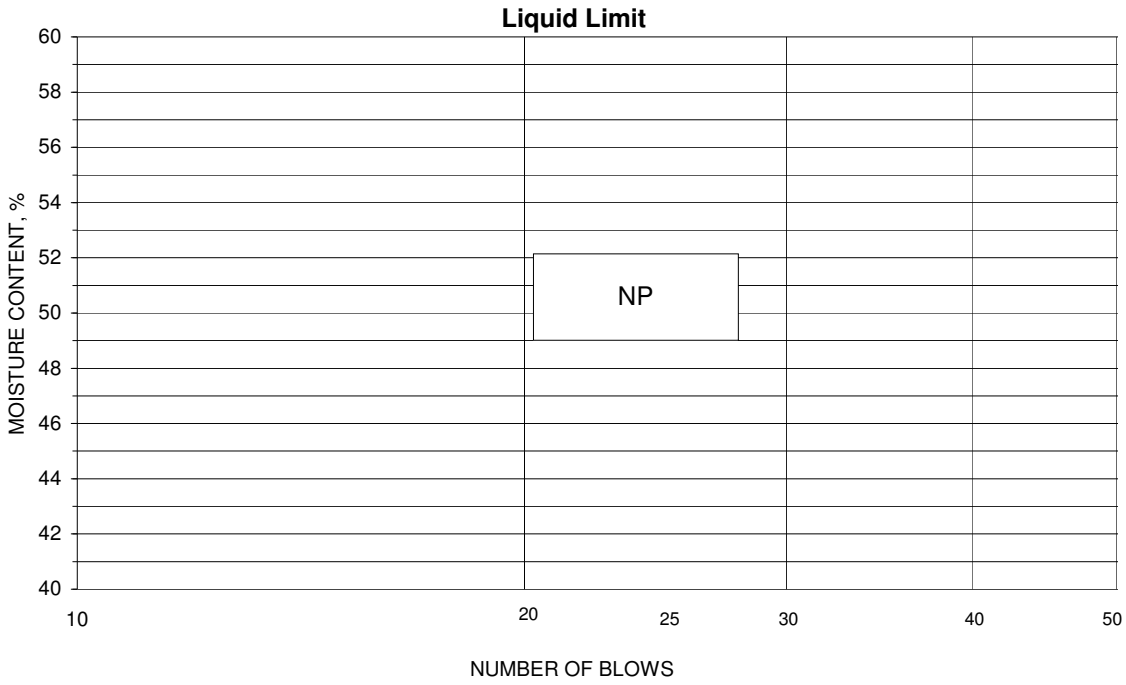
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 44.5'-46.0'			Lab ID	49
				% + No. 40	52
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 59.5'-61.0'	Lab ID	52
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 12.0

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	96.6
No. 4	4.75	92.2
No. 10	2	81.8
No. 40	0.425	59.7
No. 200	0.075	29.3
	0.02	9.2
	0.005	2.0
	0.002	1.4
estimated	0.001	1.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	7.8	18.2
Coarse Sand	10.4	22.1
Medium Sand	22.1	---
Fine Sand	30.4	30.4
Silt	27.3	27.9
Clay	2.0	1.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.28

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 59.5'-61.0'	Lab ID	52

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	96.6
No. 4	92.2
No. 10	81.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.28

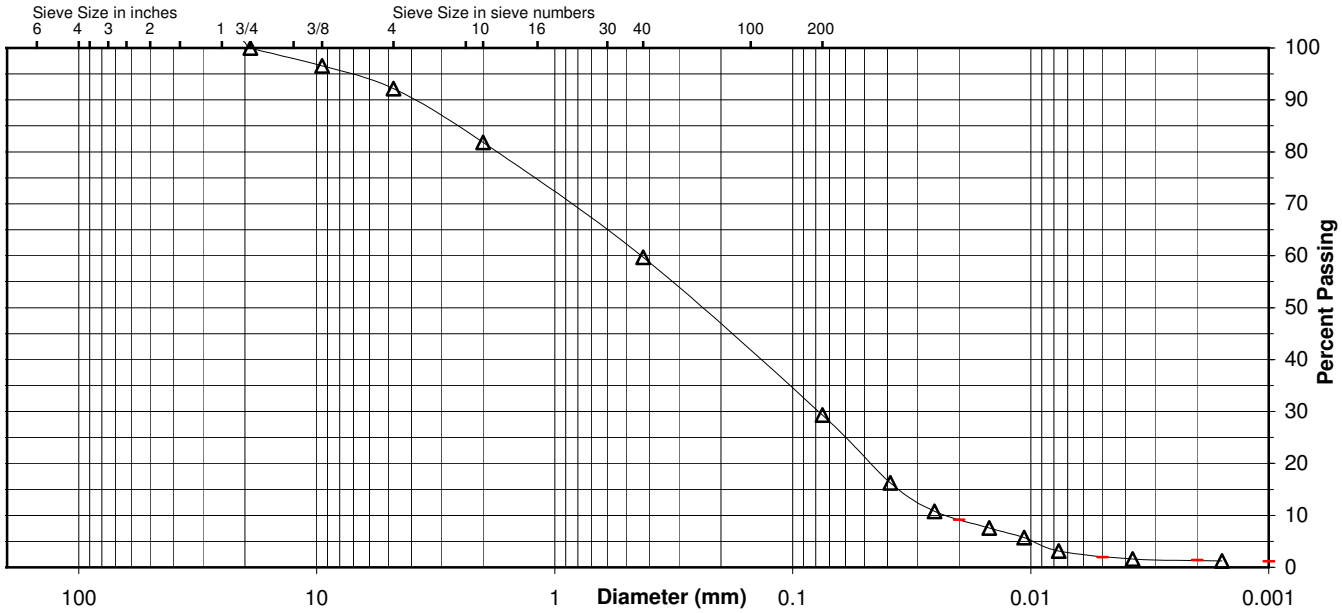
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	59.7
No. 200	29.3
0.02 mm	9.2
0.005 mm	2.0
0.002 mm	1.4
0.001 mm	1.2

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	7.8	10.4	22.1	30.4	27.3	2.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	18.2	22.1	30.4	27.9	1.4



Comments

Reviewed By

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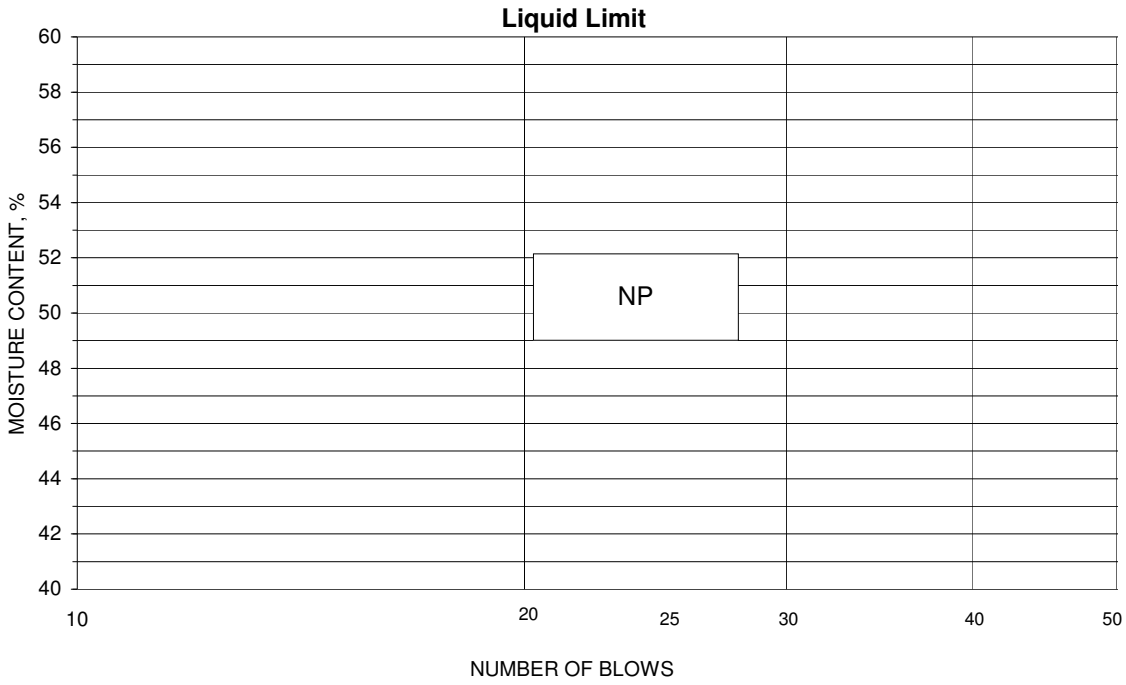
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 59.5'-61.0'			Lab ID	52
				% + No. 40	40
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 74.5'-76.0'	Lab ID	55
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 1.0

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	91.0
3/8"	9.5	90.4
No. 4	4.75	89.2
No. 10	2	87.7
No. 40	0.425	68.5
No. 200	0.075	27.6
	0.02	16.0
	0.005	9.6
	0.002	5.2
estimated	0.001	2.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	10.8	12.3
Coarse Sand	1.5	19.2
Medium Sand	19.2	---
Fine Sand	40.9	40.9
Silt	18.0	22.4
Clay	9.6	5.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 74.5'-76.0'	Lab ID	55

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	91.0
3/8"	90.4
No. 4	89.2
No. 10	87.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

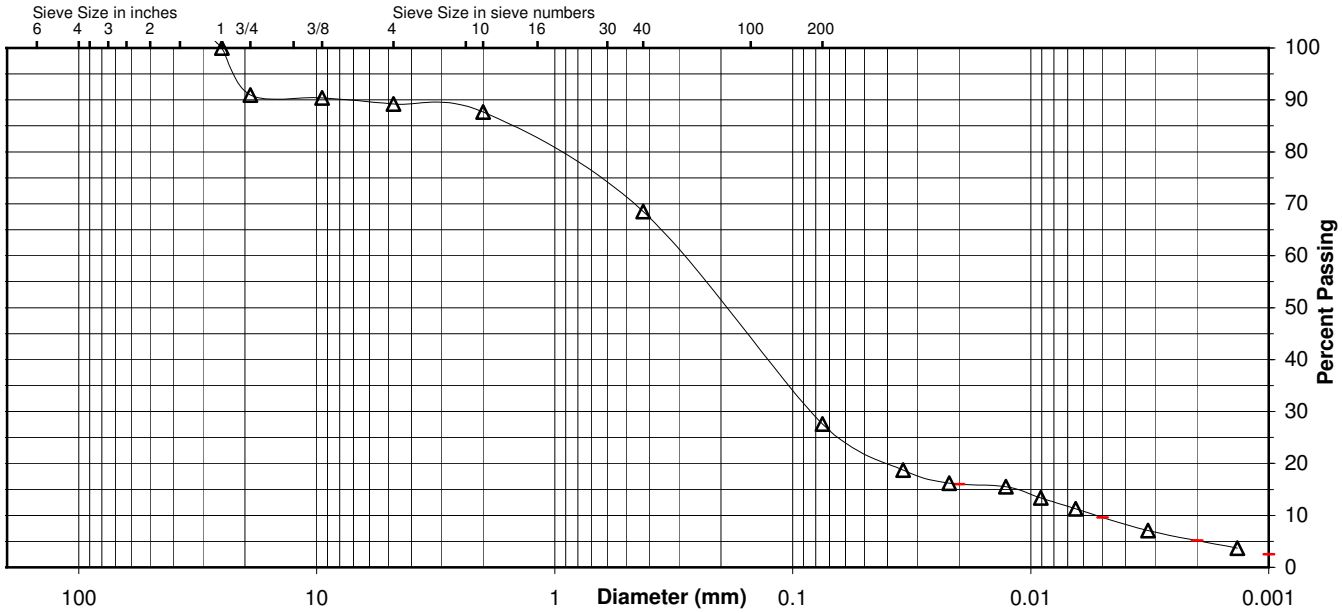
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	68.5
No. 200	27.6
0.02 mm	16.0
0.005 mm	9.6
0.002 mm	5.2
0.001 mm	2.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	9.0	1.8	1.5	19.2	40.9	18.0	9.6
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	12.3			19.2	40.9	22.4	5.2



Comments

Reviewed By

File: frm_175539024_sum_55 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

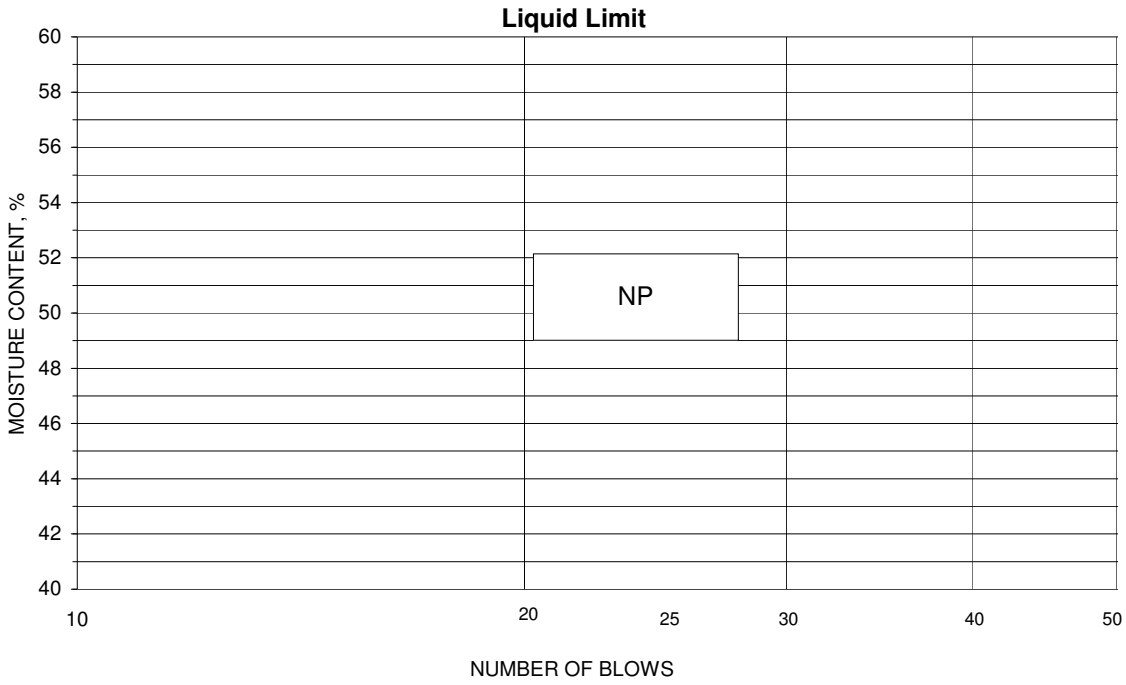
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 74.5'-76.0'			Lab ID	55
				% + No. 40	31
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 89.5'-91.0'	Lab ID	58
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 5.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.2
3/8"	9.5	93.4
No. 4	4.75	92.0
No. 10	2	87.9
No. 40	0.425	68.3
No. 200	0.075	26.7
	0.02	16.1
	0.005	9.7
	0.002	5.8
estimated	0.001	2.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	8.0	12.1
Coarse Sand	4.1	19.6
Medium Sand	19.6	---
Fine Sand	41.6	41.6
Silt	17.0	20.9
Clay	9.7	5.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 89.5'-91.0'	Lab ID	58

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.2
3/8"	93.4
No. 4	92.0
No. 10	87.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

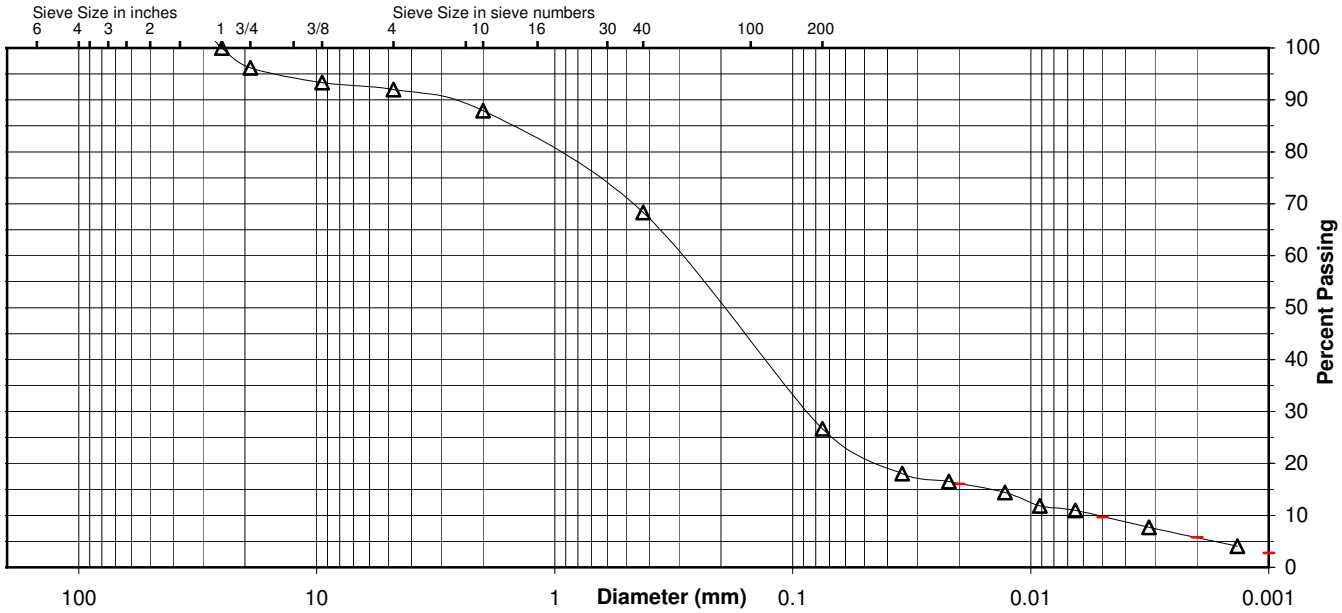
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	68.3
No. 200	26.7
0.02 mm	16.1
0.005 mm	9.7
0.002 mm	5.8
0.001 mm	2.8

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	3.8	4.2	4.1	19.6	41.6	17.0	9.7

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	12.1	19.6	41.6	20.9	5.8



Comments

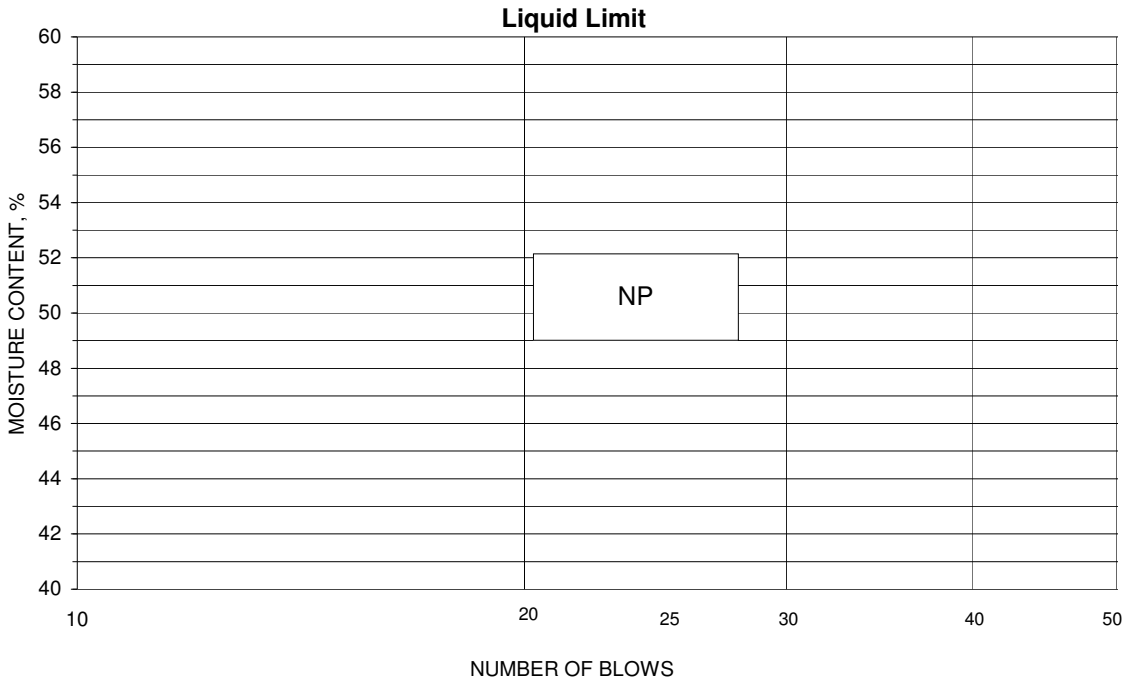
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 89.5'-91.0'			Lab ID	58
				% + No. 40	32
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 109.5'-111.0'	Lab ID	62
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 5.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	83.4
3/8"	9.5	79.6
No. 4	4.75	75.7
No. 10	2	70.0
No. 40	0.425	60.5
No. 200	0.075	27.5
	0.02	15.6
	0.005	9.6
	0.002	6.1
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	24.3	30.0
Coarse Sand	5.7	9.5
Medium Sand	9.5	---
Fine Sand	33.0	33.0
Silt	17.9	21.4
Clay	9.6	6.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 109.5'-111.0'	Lab ID	62

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	83.4
3/8"	79.6
No. 4	75.7
No. 10	70.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

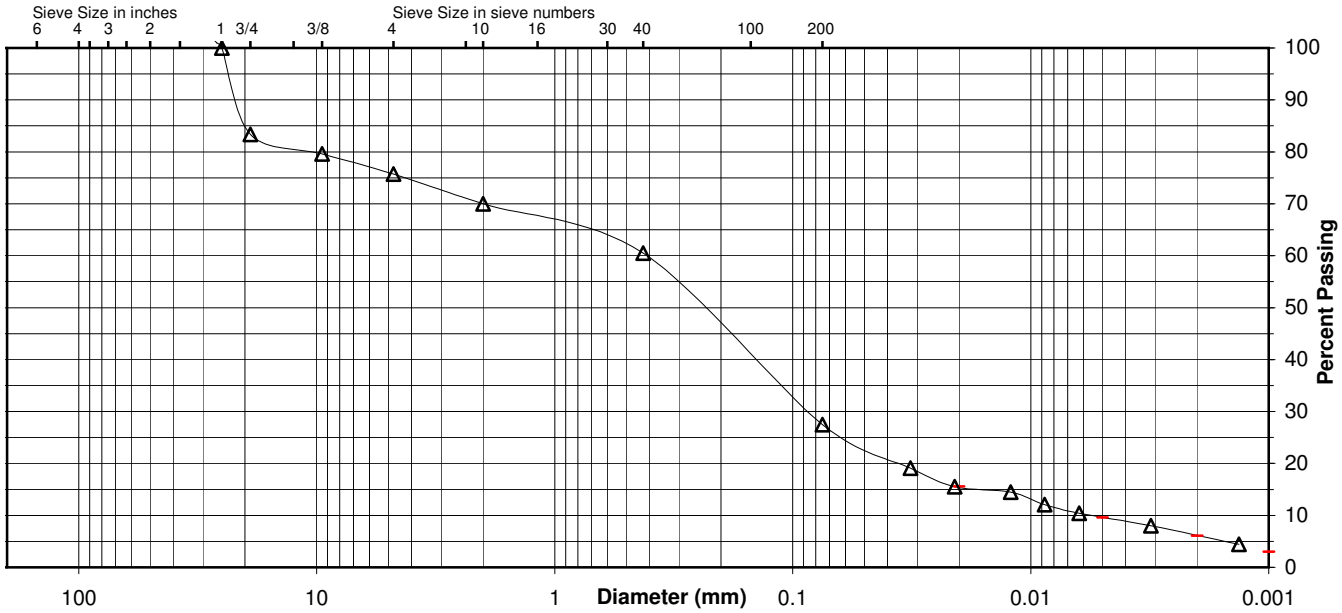
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	60.5
No. 200	27.5
0.02 mm	15.6
0.005 mm	9.6
0.002 mm	6.1
0.001 mm	3.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	16.6	7.7	5.7	9.5	33.0	17.9	9.6
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	30.0			9.5	33.0	21.4	6.1



Comments

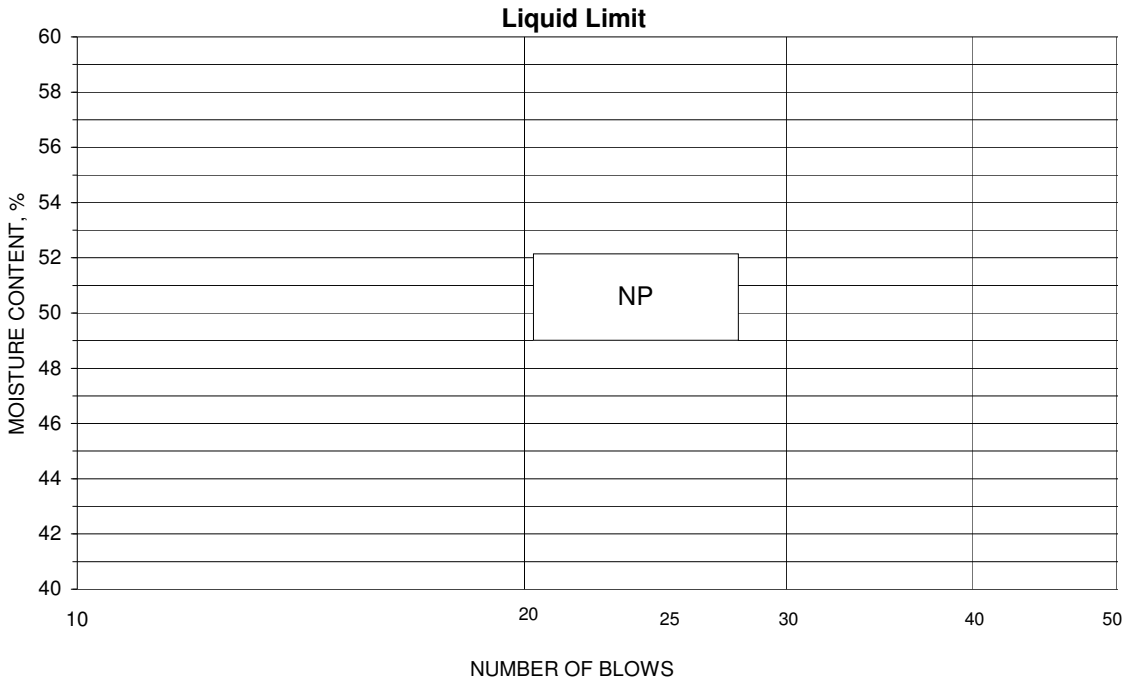
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 109.5'-111.0'			Lab ID	62
				% + No. 40	39
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 139.5'-141.0'	Lab ID	68
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	98.0
3/8"	9.5	88.6
No. 4	4.75	77.9
No. 10	2	62.1
No. 40	0.425	38.1
No. 200	0.075	19.5
	0.02	9.3
	0.005	3.2
	0.002	2.1
estimated	0.001	1.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	22.1	37.9
Coarse Sand	15.8	24.0
Medium Sand	24.0	---
Fine Sand	18.6	18.6
Silt	16.3	17.4
Clay	3.2	2.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.28

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 139.5'-141.0'	Lab ID	68

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: BB
Test Date: 12-13-2009
Date Received 12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	98.0
3/8"	88.6
No. 4	77.9
No. 10	62.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

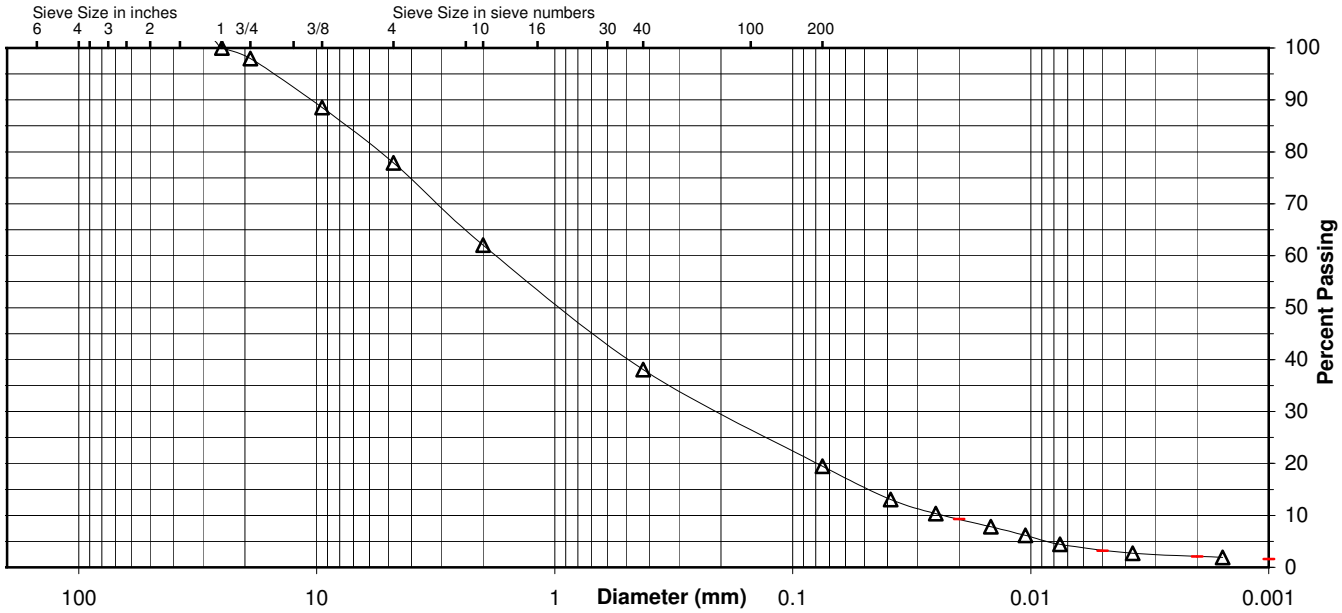
Specific Gravity 2.28

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	38.1
No. 200	19.5
0.02 mm	9.3
0.005 mm	3.2
0.002 mm	2.1
0.001 mm	1.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	2.0	20.1	15.8	24.0	18.6	16.3	3.2
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	37.9			24.0	18.6	17.4	2.1



Comments

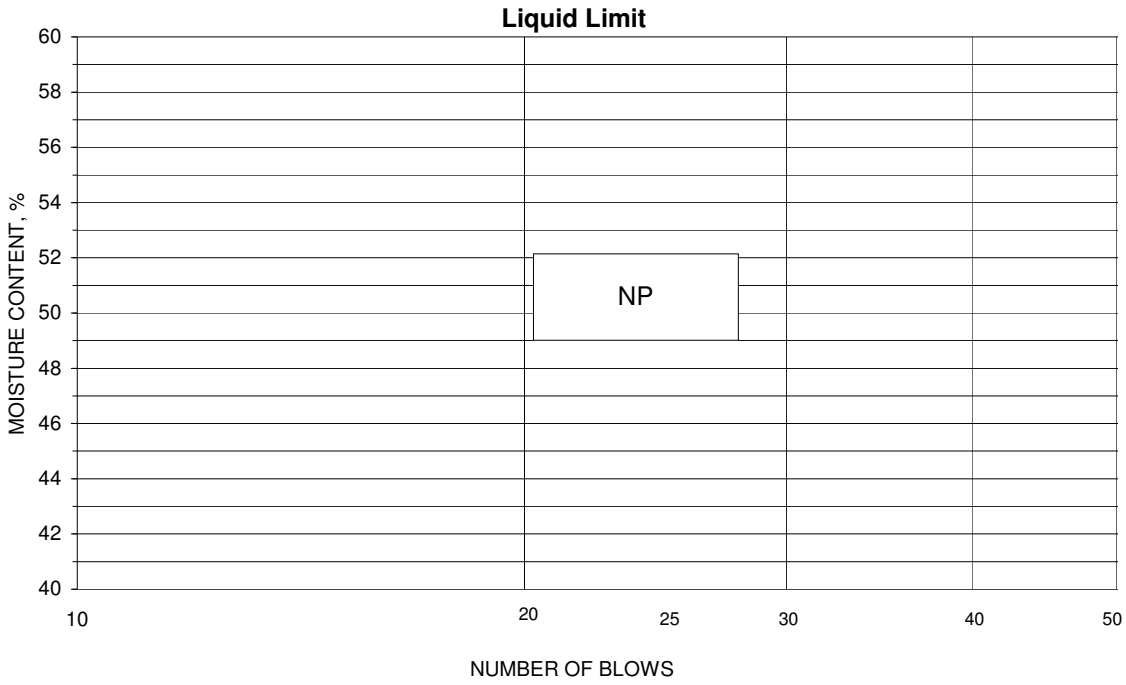
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 139.5'-141.0'			Lab ID	68
				% + No. 40	62
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 144.5'-146.0'	Lab ID	69
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 6.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	95.7
3/8"	9.5	88.4
No. 4	4.75	80.1
No. 10	2	72.2
No. 40	0.425	63.4
No. 200	0.075	36.4
	0.02	25.0
	0.005	14.9
	0.002	9.3
estimated	0.001	5.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	19.9	27.8
Coarse Sand	7.9	8.8
Medium Sand	8.8	---
Fine Sand	27.0	27.0
Silt	21.5	27.1
Clay	14.9	9.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 144.5'-146.0'	Lab ID	69

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	95.7
3/8"	88.4
No. 4	80.1
No. 10	72.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

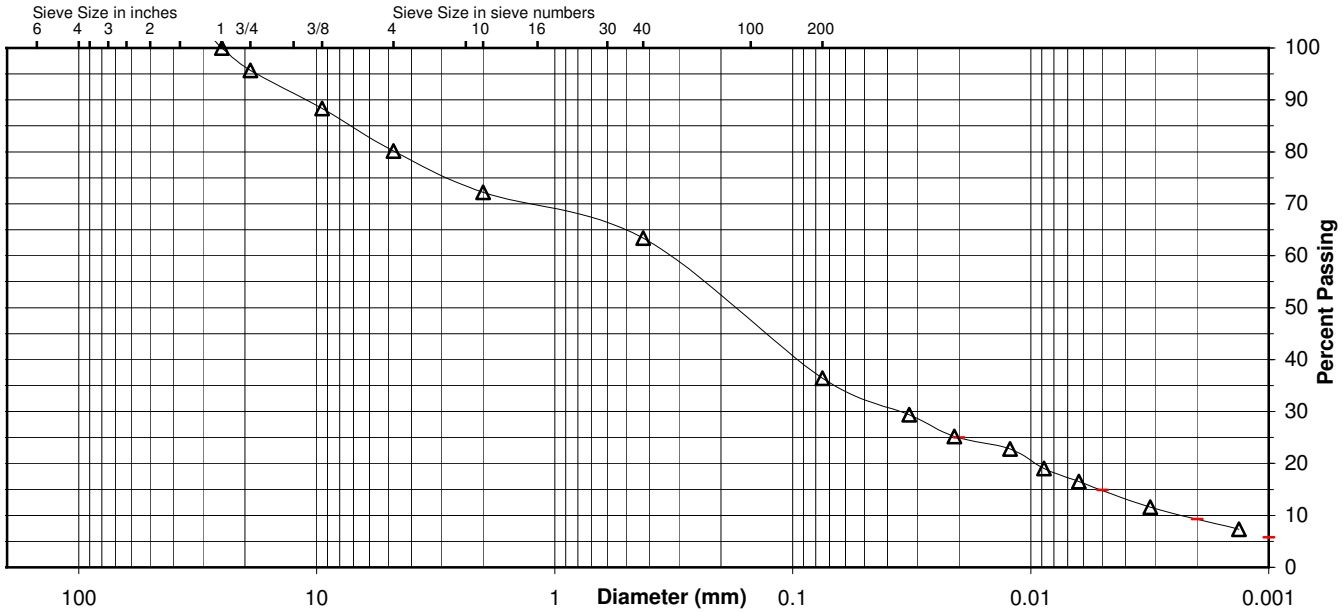
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	63.4
No. 200	36.4
0.02 mm	25.0
0.005 mm	14.9
0.002 mm	9.3
0.001 mm	5.8

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	4.3	15.6	7.9	8.8	27.0	21.5	14.9

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	27.8	8.8	27.0	27.1	9.3



Comments

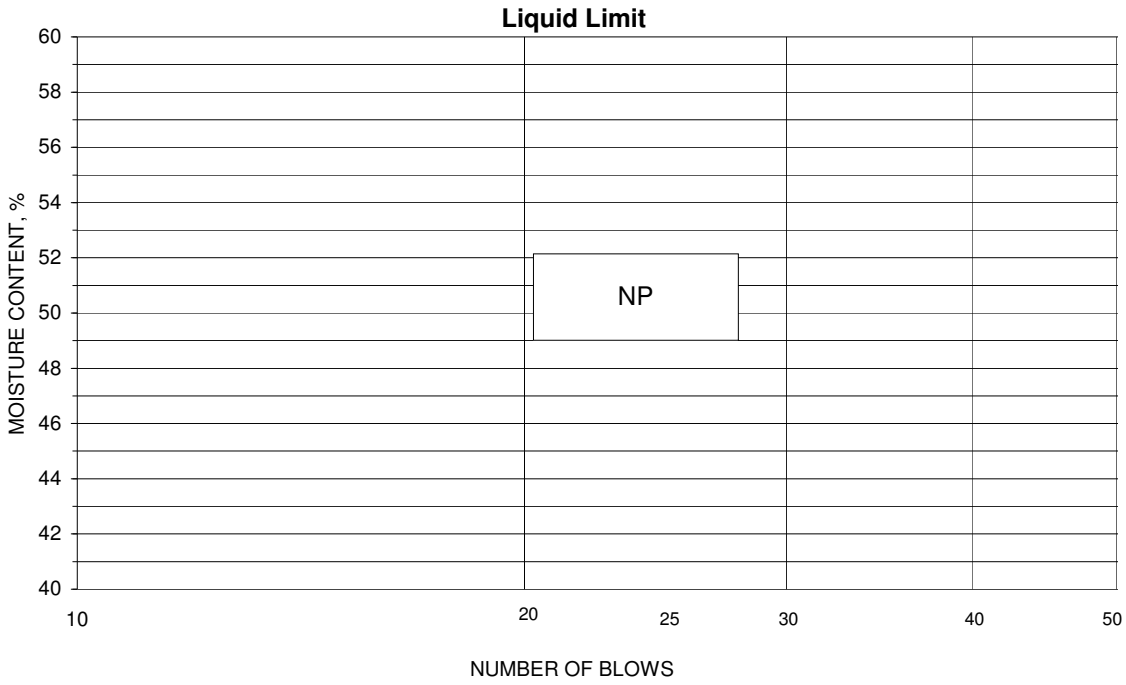
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 144.5'-146.0'			Lab ID	69
				% + No. 40	37
Tested By	KAF	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	01-06-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 149.5'-151.0'	Lab ID	70
County	Lawrence, KY	Date Received	12-11-09
Sample Type	ST	Date Reported	1-8-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 5.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	78.6
3/8"	9.5	73.3
No. 4	4.75	68.8
No. 10	2	62.1
No. 40	0.425	54.4
No. 200	0.075	24.2
	0.02	14.3
	0.005	7.4
	0.002	4.0
estimated	0.001	2.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	31.2	37.9
Coarse Sand	6.7	7.7
Medium Sand	7.7	---
Fine Sand	30.2	30.2
Silt	16.8	20.2
Clay	7.4	4.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	---
Plastic Limit:	Non Plastic
Plasticity Index:	---
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	SM
Group Name:	Silty sand with gravel
AASHTO Classification:	A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 149.5'-151.0'	Lab ID	70

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	BB
Test Date:	12-13-2009
Date Received	12-11-2009

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	78.6
3/8"	73.3
No. 4	68.8
No. 10	62.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

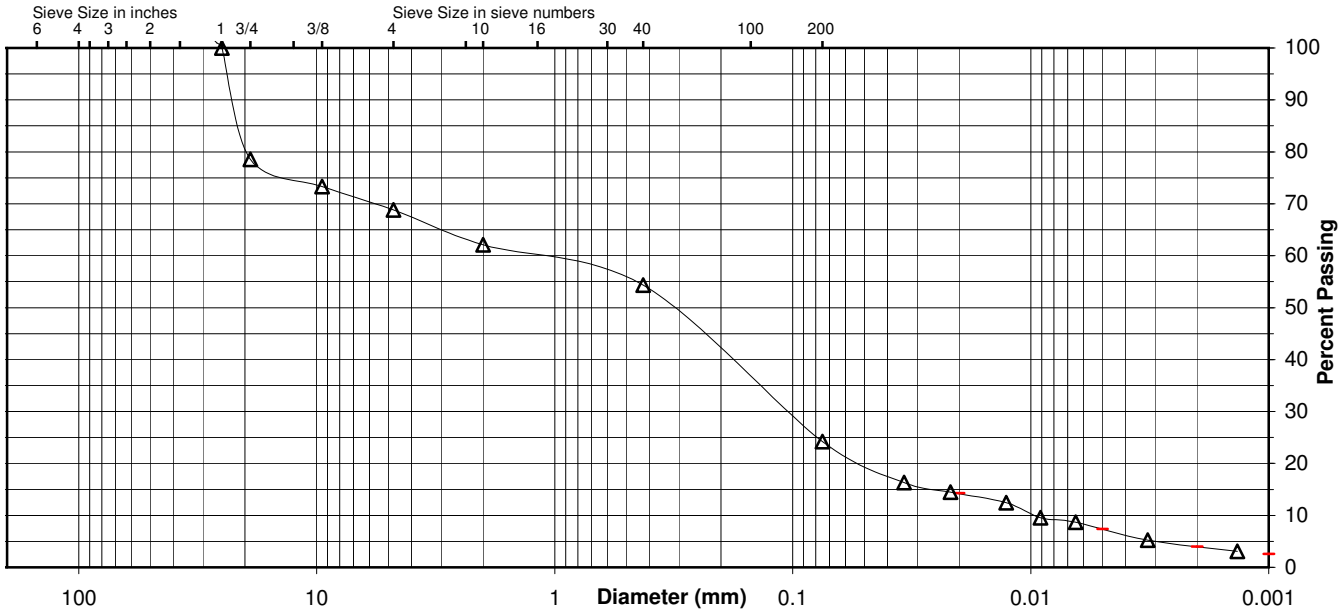
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	54.4
No. 200	24.2
0.02 mm	14.3
0.005 mm	7.4
0.002 mm	4.0
0.001 mm	2.6

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	21.4	9.8	6.7	7.7	30.2	16.8	7.4

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	37.9	7.7	30.2	20.2	4.0



Comments

Reviewed By

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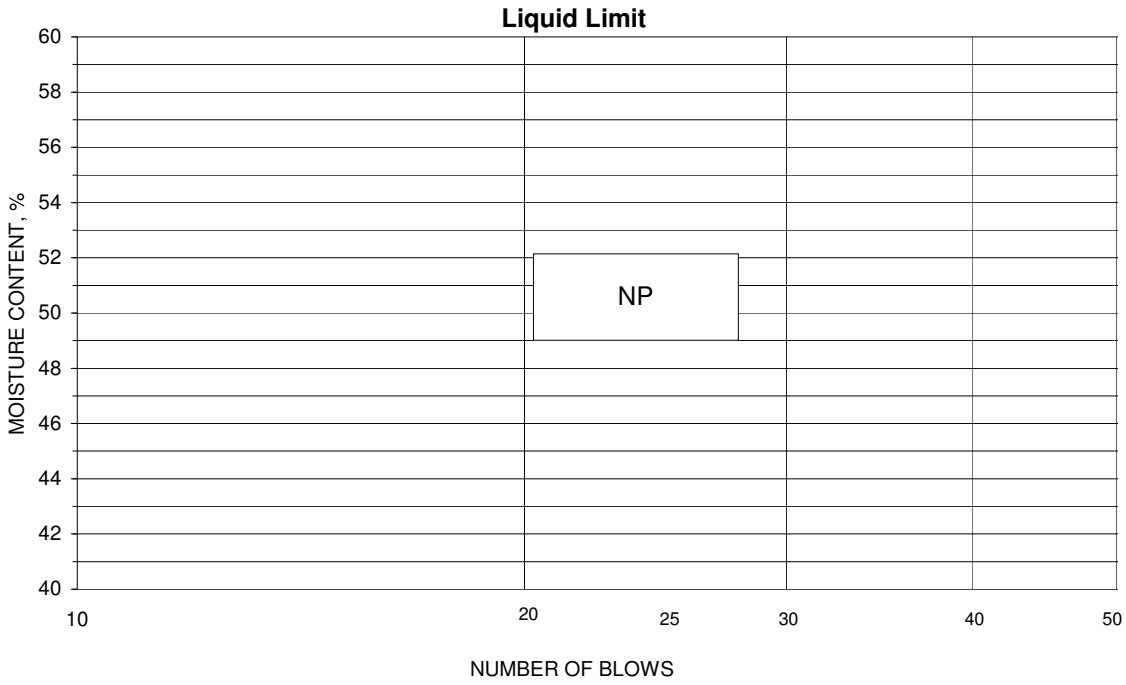
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 149.5'-151.0'			Lab ID	70
				% + No. 40	46
Tested By	BB	Test Method	ASTM D 4318 Method A	Date Received	12-11-2009
Test Date	12-17-2009	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 169.5'-171.0'	Lab ID	74
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 17.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.9
No. 4	4.75	98.9
No. 10	2	98.9
No. 40	0.425	97.7
No. 200	0.075	87.9
	0.02	61.9
	0.005	35.3
	0.002	24.0
estimated	0.001	18.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.1	1.1
Coarse Sand	0.0	1.2
Medium Sand	1.2	---
Fine Sand	9.8	9.8
Silt	52.6	63.9
Clay	35.3	24.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 33
Plastic Limit: 17
Plasticity Index: 16
Activity Index: 0.67

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (13)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 169.5'-171.0'	Lab ID	74

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.9
No. 4	98.9
No. 10	98.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

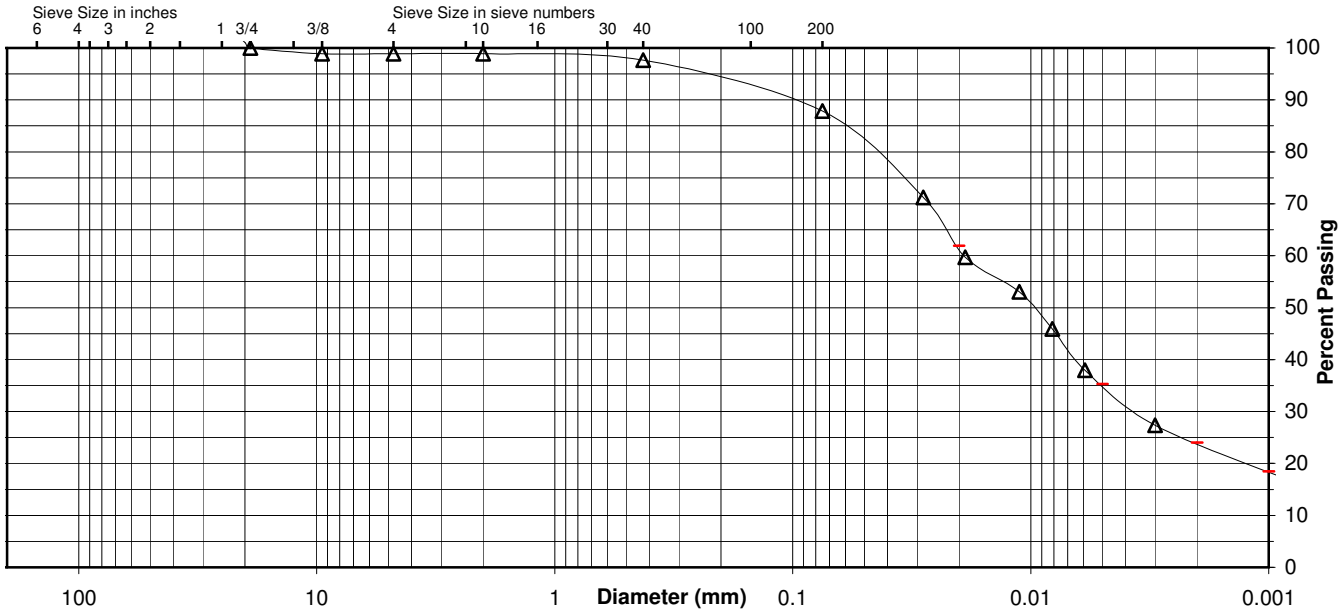
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	97.7
No. 200	87.9
0.02 mm	61.9
0.005 mm	35.3
0.002 mm	24.0
0.001 mm	18.5

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	1.1	0.0	1.2	9.8	52.6	35.3

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	1.1	1.2	9.8	63.9	24.0



Comments

Reviewed By

File: frm_175539024_sum_74 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

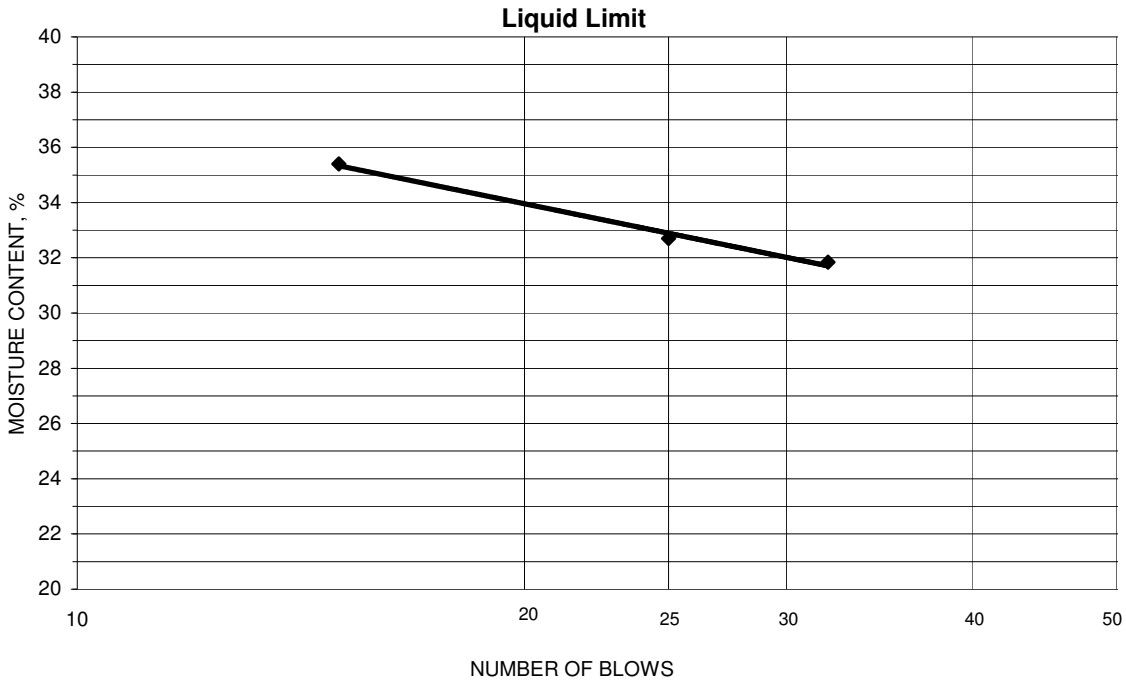
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 169.5'-171.0'			Lab ID	74
				% + No. 40	2
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
25.13	21.47	11.13	15	35.4	
21.85	19.11	10.73	25	32.7	
22.61	19.84	11.14	32	31.8	33



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
20.36	18.98	11.12	17.6	17	16
18.87	17.65	10.58	17.3		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 194.5'-196.0'	Lab ID	79
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 15.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	94.6
3/4"	19	94.6
3/8"	9.5	91.9
No. 4	4.75	89.6
No. 10	2	88.3
No. 40	0.425	63.9
No. 200	0.075	27.5
	0.02	14.0
	0.005	7.0
	0.002	5.2
estimated	0.001	3.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	10.4	11.7
Coarse Sand	1.3	24.4
Medium Sand	24.4	---
Fine Sand	36.4	36.4
Silt	20.5	22.3
Clay	7.0	5.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 194.5'-196.0'	Lab ID	79

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	94.6
3/4"	94.6
3/8"	91.9
No. 4	89.6
No. 10	88.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

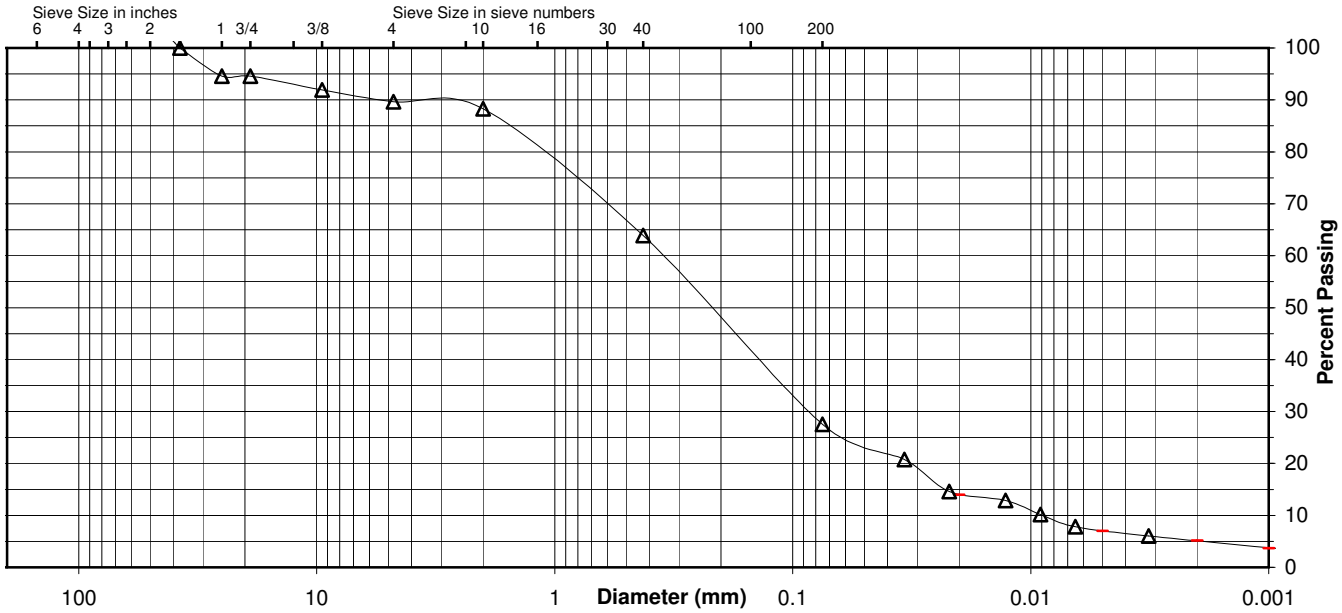
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	63.9
No. 200	27.5
0.02 mm	14.0
0.005 mm	7.0
0.002 mm	5.2
0.001 mm	3.7

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	5.4	5.0	1.3	24.4	36.4	20.5	7.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	11.7	24.4	36.4	22.3	5.2



Comments

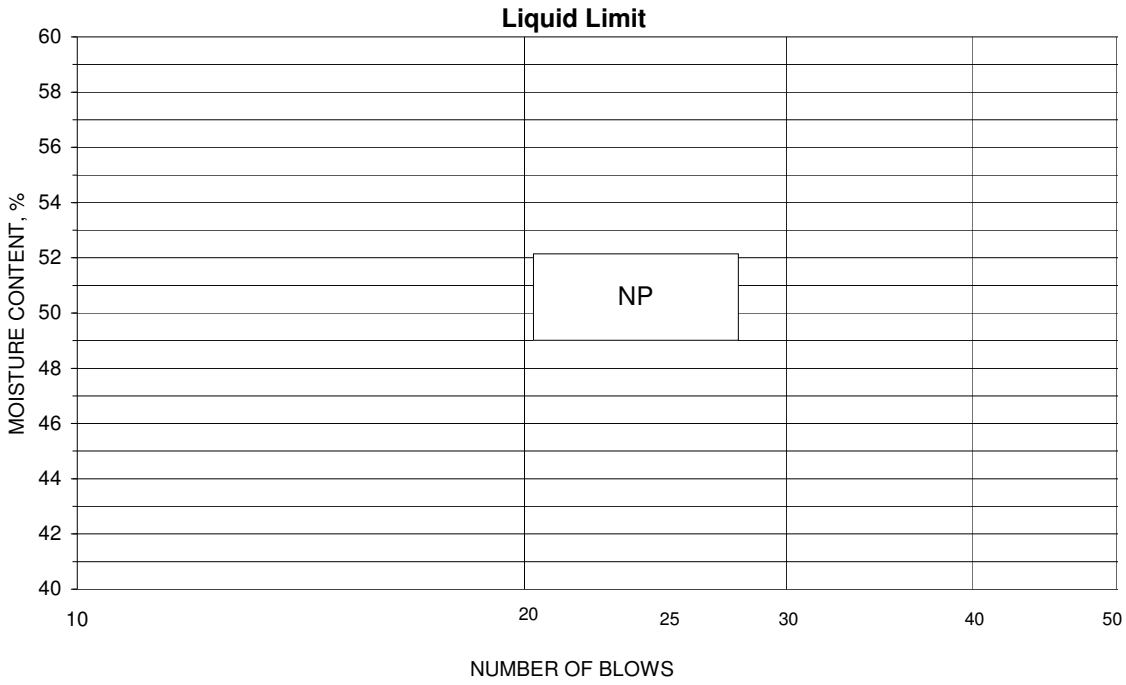
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 194.5'-196.0'			Lab ID	79
				% + No. 40	36
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 199.5'-201.0'	Lab ID	80
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 13.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.6
No. 4	4.75	96.3
No. 10	2	96.1
No. 40	0.425	73.4
No. 200	0.075	22.6
	0.02	11.6
	0.005	4.8
	0.002	3.5
estimated	0.001	2.4

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.7	3.9
Coarse Sand	0.2	22.7
Medium Sand	22.7	---
Fine Sand	50.8	50.8
Silt	17.8	19.1
Clay	4.8	3.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-2, 199.5'-201.0'	Lab ID	80

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.6
No. 4	96.3
No. 10	96.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

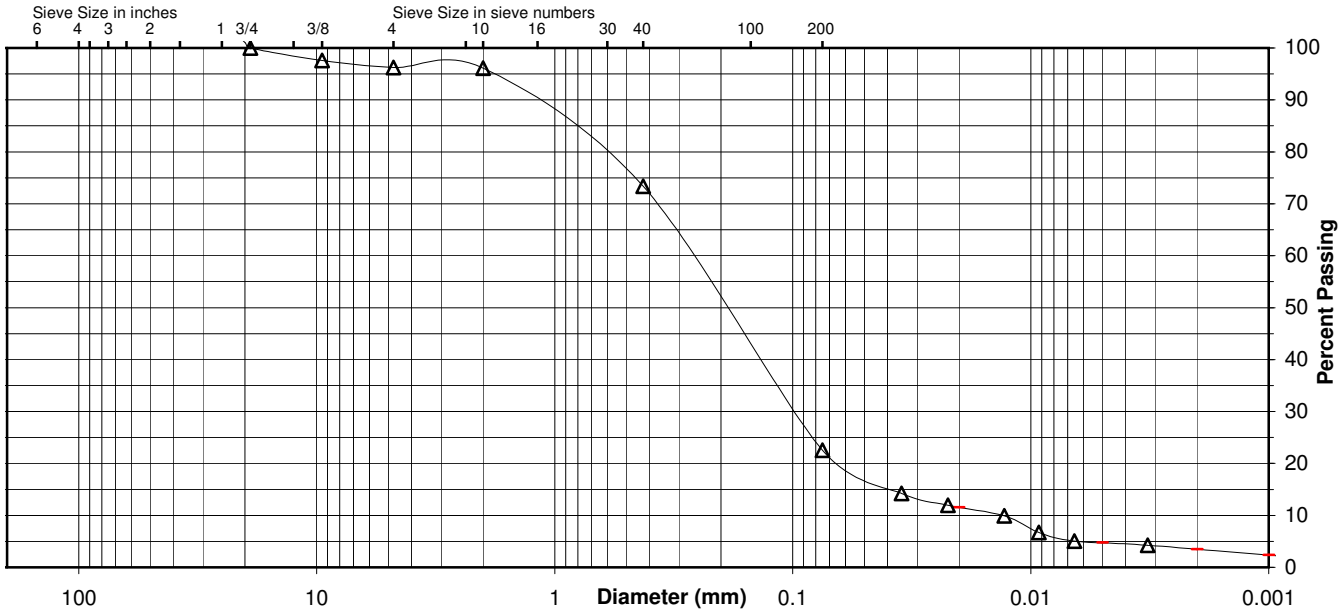
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	73.4
No. 200	22.6
0.02 mm	11.6
0.005 mm	4.8
0.002 mm	3.5
0.001 mm	2.4

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	3.7	0.2	22.7	50.8	17.8	4.8

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	3.9	22.7	50.8	19.1	3.5



Comments

Reviewed By

File: frm_175539024_sum_80 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-2, 199.5'-201.0'			Lab ID	80
				% + No. 40	27
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
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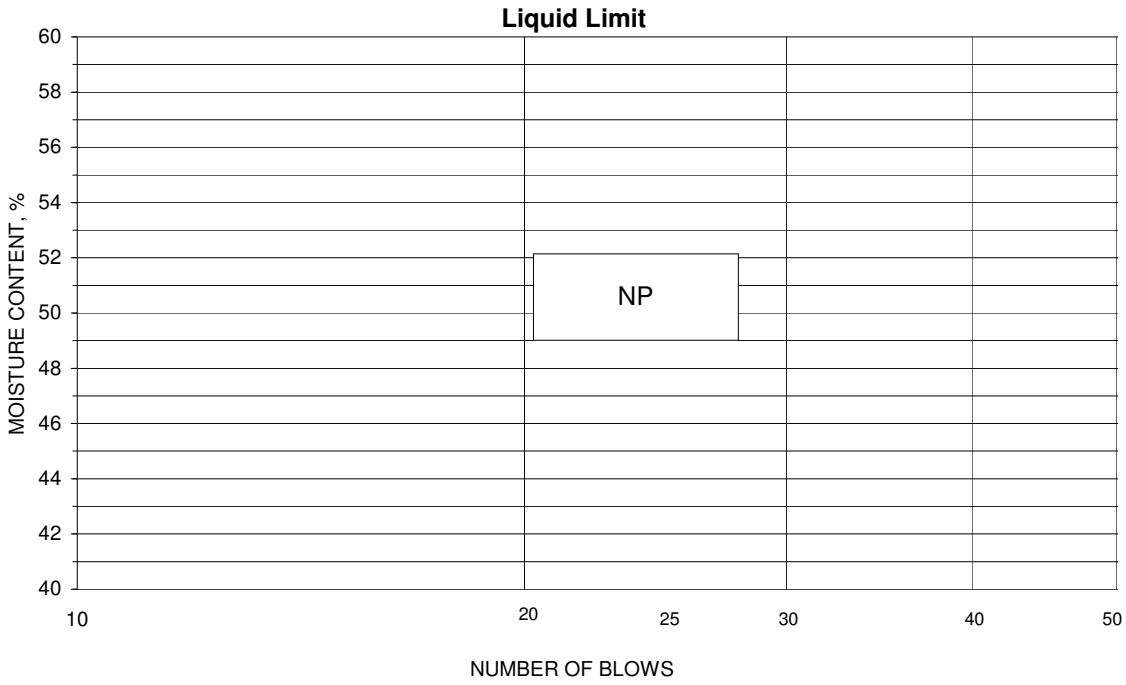


PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 4.5'-6.0'	Lab ID	81
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.6

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	82.4
3/4"	19	82.4
3/8"	9.5	81.9
No. 4	4.75	81.8
No. 10	2	81.2
No. 40	0.425	67.7
No. 200	0.075	50.9
	0.02	38.0
	0.005	23.3
	0.002	16.8
estimated	0.001	12.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	18.2	18.8
Coarse Sand	0.6	13.5
Medium Sand	13.5	---
Fine Sand	16.8	16.8
Silt	27.6	34.1
Clay	23.3	16.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 33
Plastic Limit: 17
Plasticity Index: 16
Activity Index: 0.94

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay with gravel

AASHTO Classification: A-6 (5)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 4.5'-6.0'	Lab ID	81

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	82.4
3/4"	82.4
3/8"	81.9
No. 4	81.8
No. 10	81.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

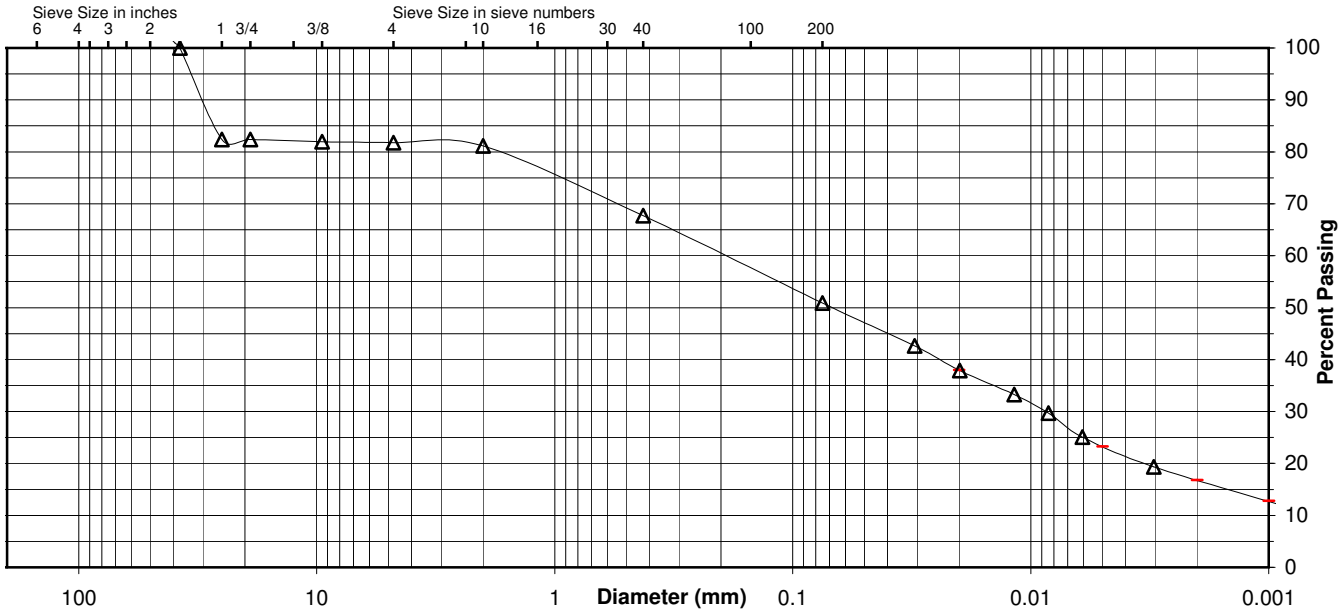
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	67.7
No. 200	50.9
0.02 mm	38.0
0.005 mm	23.3
0.002 mm	16.8
0.001 mm	12.8

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	17.6	0.6	0.6	13.5	16.8	27.6	23.3

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	18.8	13.5	16.8	34.1	16.8



Comments

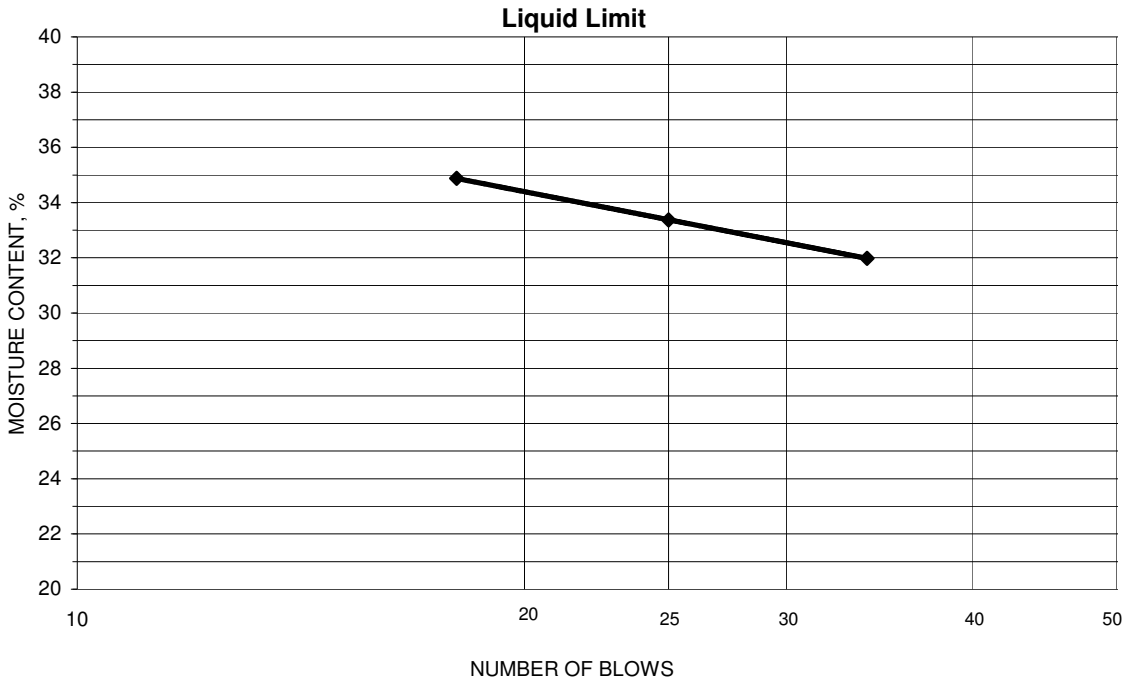
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 4.5'-6.0'			Lab ID	81
				% + No. 40	32
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-13-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.51	19.42	10.56	18	34.9	
21.35	18.79	11.12	25	33.4	
21.42	18.82	10.69	34	32.0	33



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
24.16	22.30	11.07	16.6	17	16
21.86	20.30	11.01	16.8		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 29.5'-31.0'	Lab ID	86
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 15.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.2
No. 4	4.75	93.6
No. 10	2	84.2
No. 40	0.425	46.4
No. 200	0.075	20.8
	0.02	8.0
	0.005	2.0
	0.002	0.8
estimated	0.001	0.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	6.4	15.8
Coarse Sand	9.4	37.8
Medium Sand	37.8	---
Fine Sand	25.6	25.6
Silt	18.8	20.0
Clay	2.0	0.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 29.5'-31.0'	Lab ID	86

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.2
No. 4	93.6
No. 10	84.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

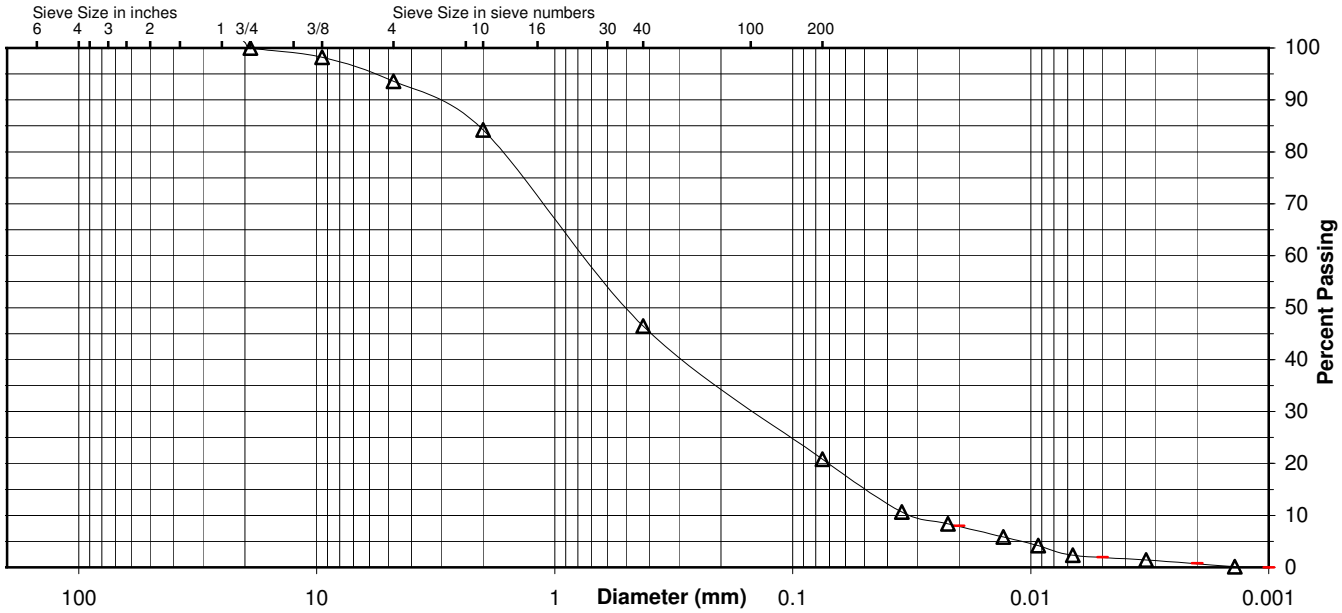
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	46.4
No. 200	20.8
0.02 mm	8.0
0.005 mm	2.0
0.002 mm	0.8
0.001 mm	0.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	6.4	9.4	37.8	25.6	18.8	2.0

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	15.8	37.8	25.6	20.0	0.8



Comments

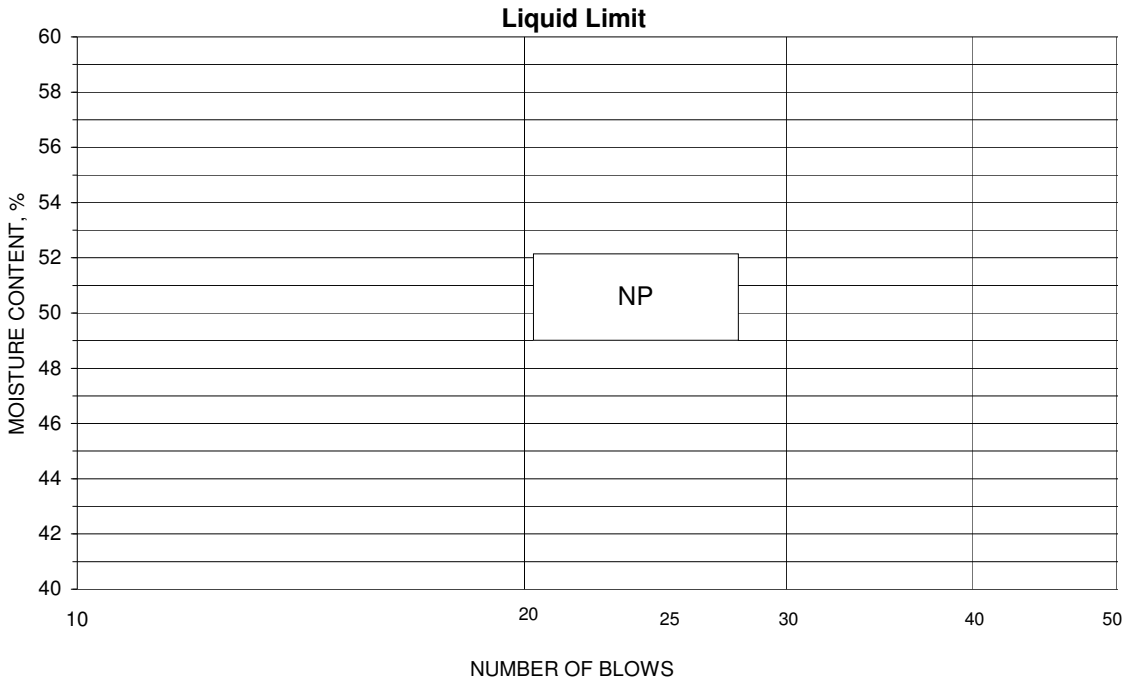
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 29.5'-31.0'			Lab ID	86
				% + No. 40	54
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 69.5'-71.0'	Lab ID	94
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 14.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.8
No. 4	4.75	95.3
No. 10	2	85.1
No. 40	0.425	54.5
No. 200	0.075	27.1
	0.02	9.1
	0.005	2.8
	0.002	1.5
estimated	0.001	0.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	4.7	14.9
Coarse Sand	10.2	30.6
Medium Sand	30.6	---
Fine Sand	27.4	27.4
Silt	24.3	25.6
Clay	2.8	1.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 69.5'-71.0'	Lab ID	94

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.8
No. 4	95.3
No. 10	85.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

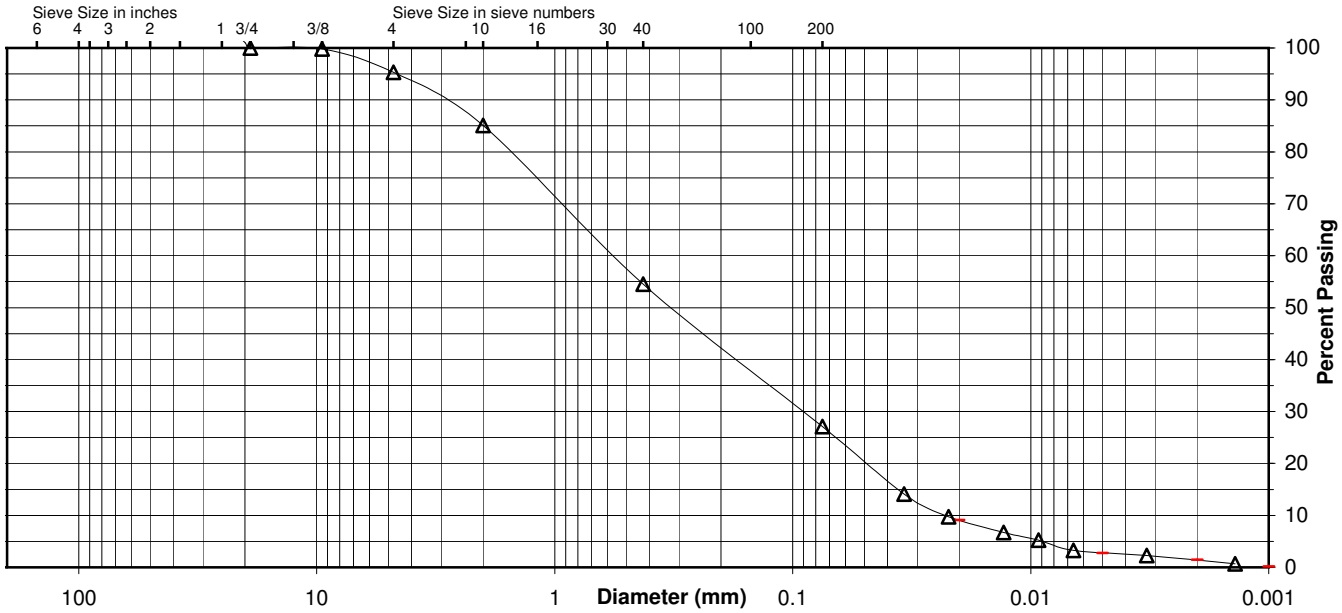
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	54.5
No. 200	27.1
0.02 mm	9.1
0.005 mm	2.8
0.002 mm	1.5
0.001 mm	0.2

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	4.7	10.2	30.6	27.4	24.3	2.8

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	14.9	30.6	27.4	25.6	1.5



Comments

Reviewed By

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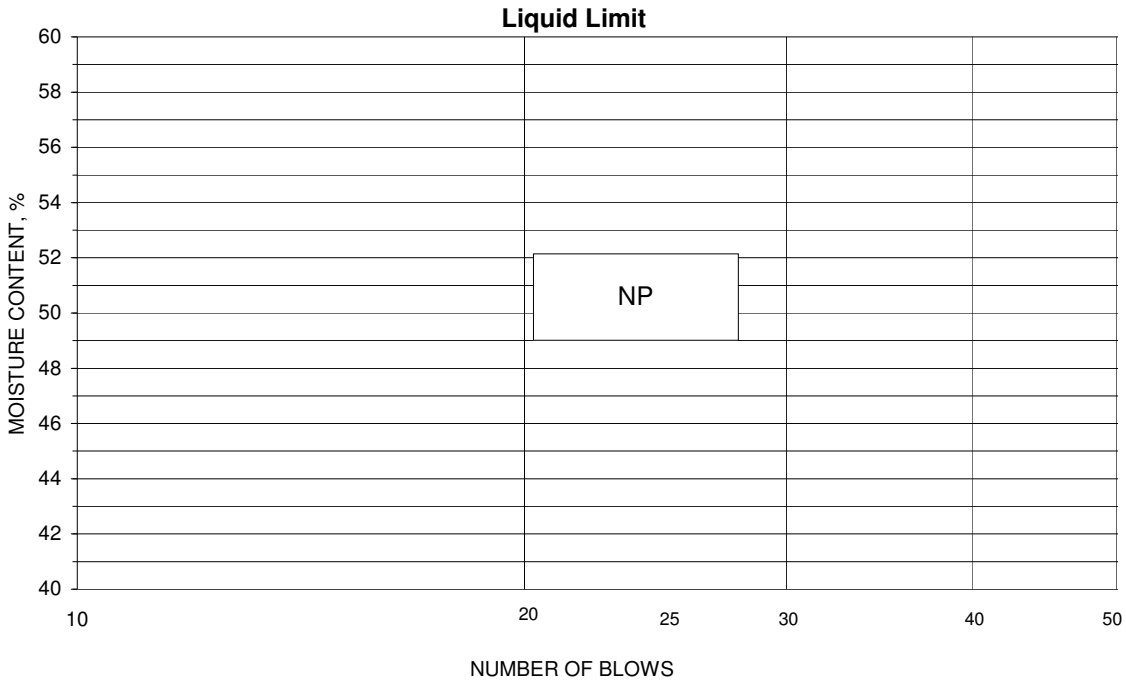
ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 69.5'-71.0'			Lab ID	94
				% + No. 40	45
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 89.5'-91.0'	Lab ID	98
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 10.2

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.5
3/8"	9.5	86.3
No. 4	4.75	85.3
No. 10	2	85.0
No. 40	0.425	69.8
No. 200	0.075	25.3
	0.02	15.0
	0.005	7.1
	0.002	3.6
estimated	0.001	0.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	14.7	15.0
Coarse Sand	0.3	15.2
Medium Sand	15.2	---
Fine Sand	44.5	44.5
Silt	18.2	21.7
Clay	7.1	3.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 89.5'-91.0'	Lab ID	98

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.5
3/8"	86.3
No. 4	85.3
No. 10	85.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

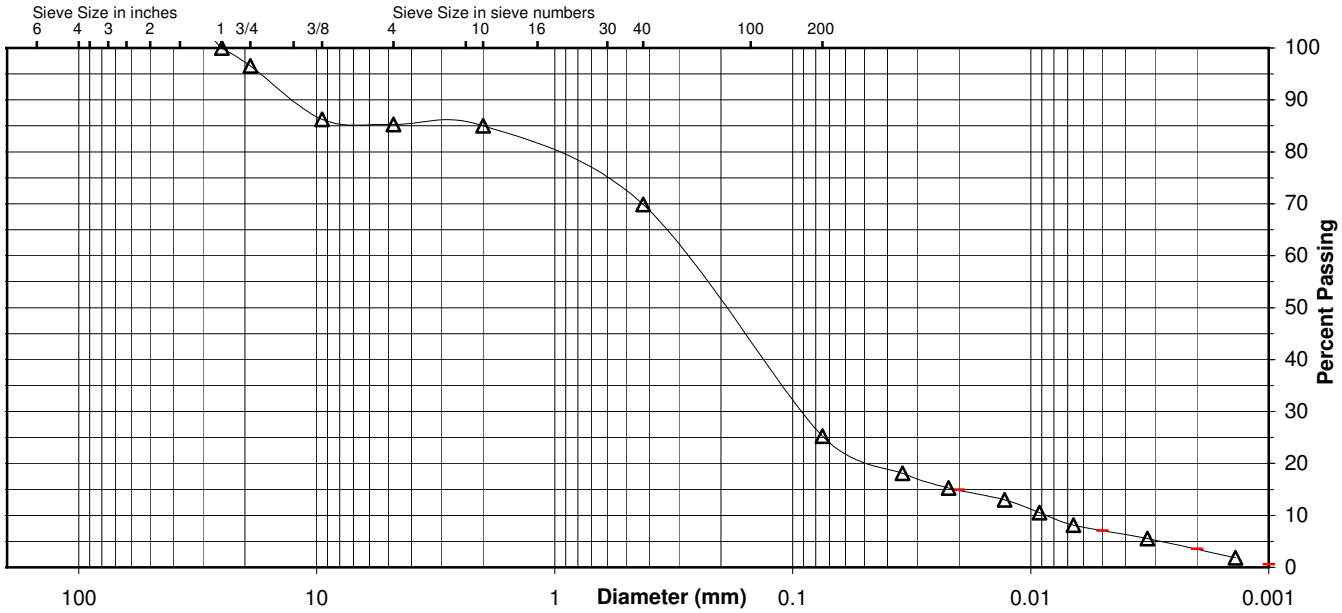
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	69.8
No. 200	25.3
0.02 mm	15.0
0.005 mm	7.1
0.002 mm	3.6
0.001 mm	0.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.5	11.2	0.3	15.2	44.5	18.2	7.1
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	15.0			15.2	44.5	21.7	3.6



Comments

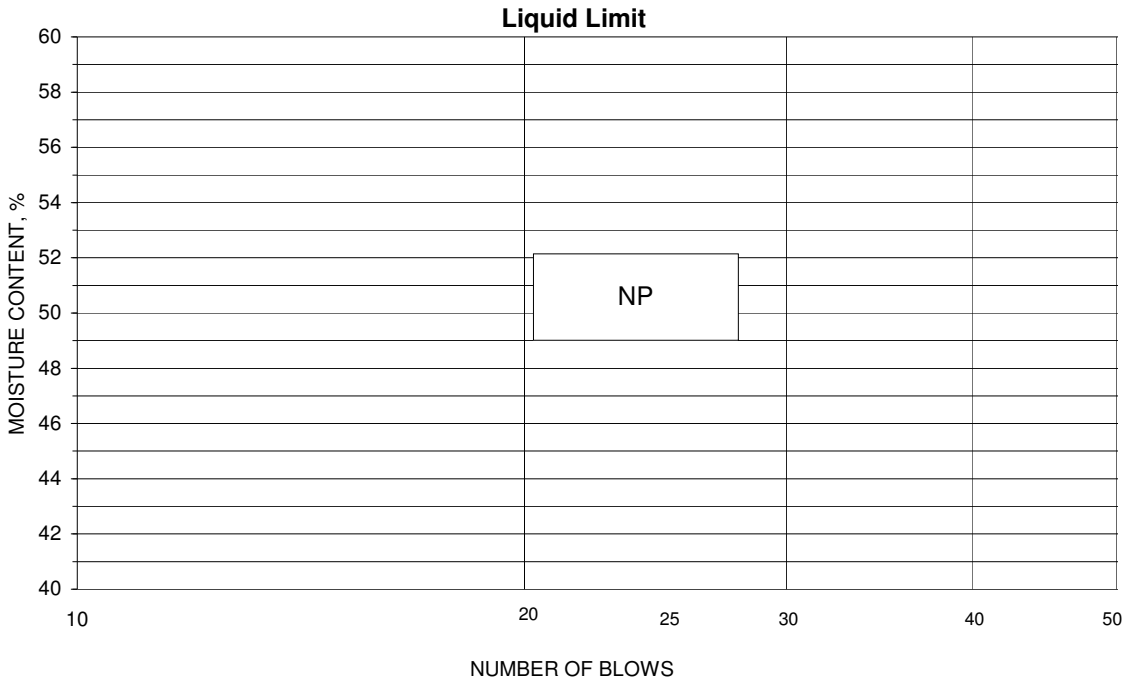
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 89.5'-91.0'			Lab ID	98
				% + No. 40	30
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 99.5'-101.0'	Lab ID	100
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 9.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	94.5
3/4"	19	92.4
3/8"	9.5	74.1
No. 4	4.75	69.4
No. 10	2	68.1
No. 40	0.425	56.1
No. 200	0.075	27.1
	0.02	17.3
	0.005	9.5
	0.002	5.6
estimated	0.001	2.9

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	30.6	31.9
Coarse Sand	1.3	12.0
Medium Sand	12.0	---
Fine Sand	29.0	29.0
Silt	17.6	21.5
Clay	9.5	5.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 99.5'-101.0'	Lab ID	100

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	94.5
3/4"	92.4
3/8"	74.1
No. 4	69.4
No. 10	68.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

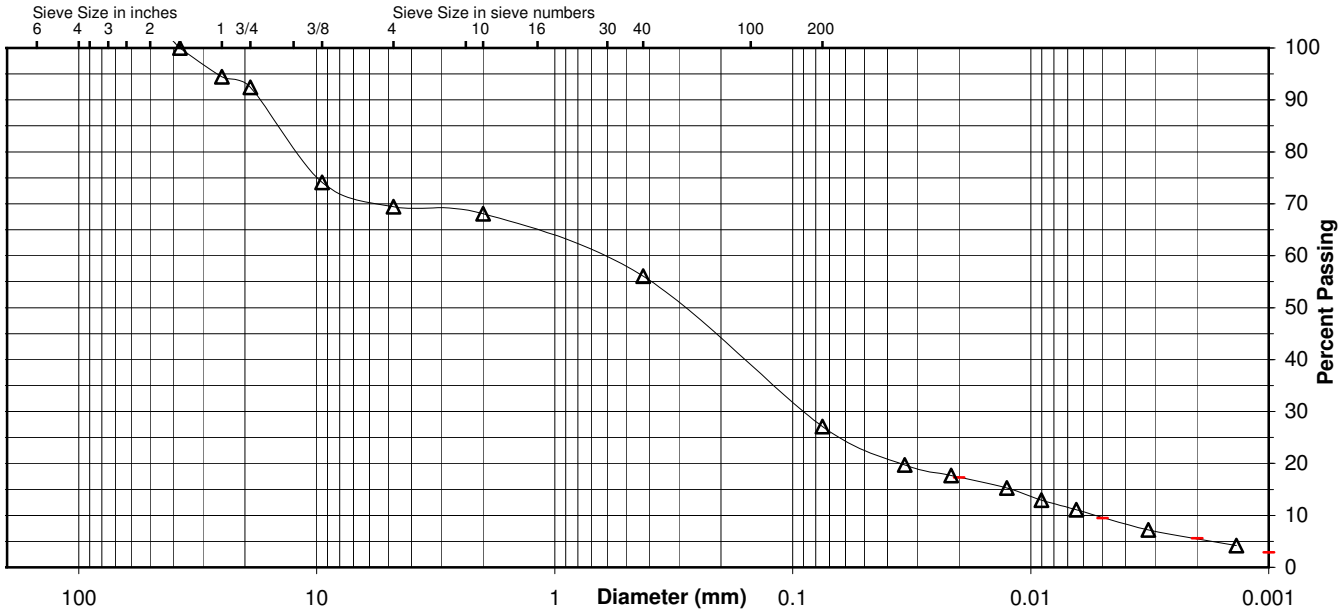
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	56.1
No. 200	27.1
0.02 mm	17.3
0.005 mm	9.5
0.002 mm	5.6
0.001 mm	2.9

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	7.6	23.0	1.3	12.0	29.0	17.6	9.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	31.9	12.0	29.0	21.5	5.6



Comments

Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 99.5'-101.0'			Lab ID	100
				% + No. 40	44
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
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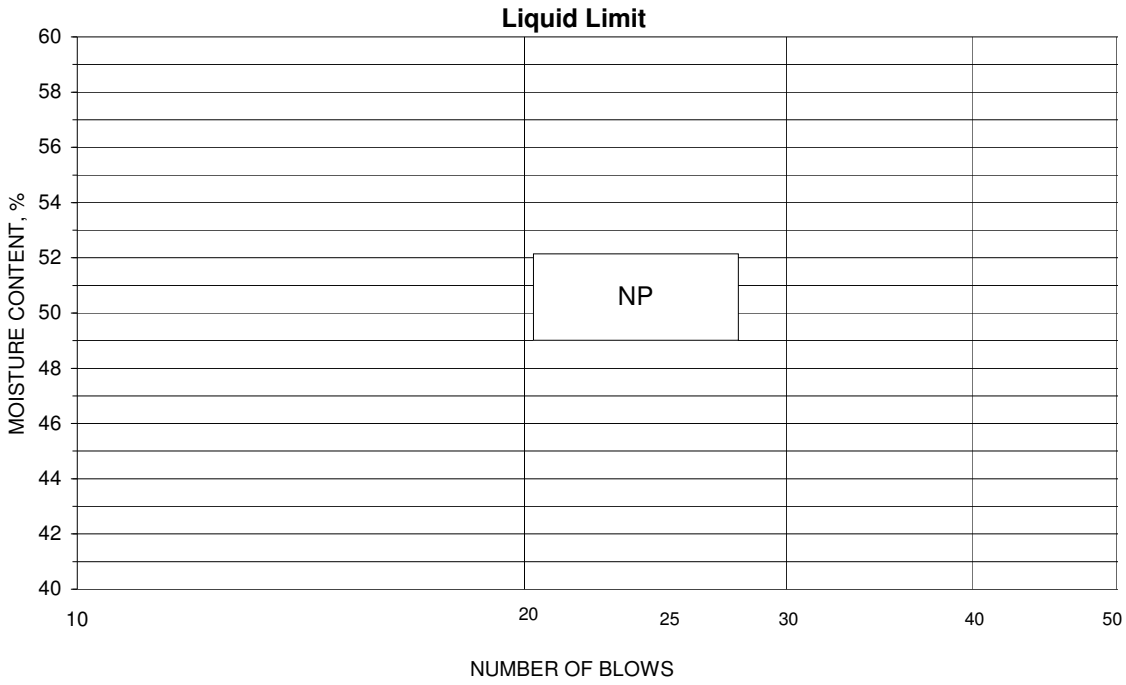


PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 134.5'-136.0'	Lab ID	107
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 8.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	94.8
3/8"	9.5	89.3
No. 4	4.75	89.3
No. 10	2	89.3
No. 40	0.425	77.9
No. 200	0.075	26.9
	0.02	16.1
	0.005	7.7
	0.002	5.0
estimated	0.001	2.9

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	10.7	10.7
Coarse Sand	0.0	11.4
Medium Sand	11.4	---
Fine Sand	51.0	51.0
Silt	19.2	21.9
Clay	7.7	5.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 134.5'-136.0'	Lab ID	107

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	94.8
3/8"	89.3
No. 4	89.3
No. 10	89.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

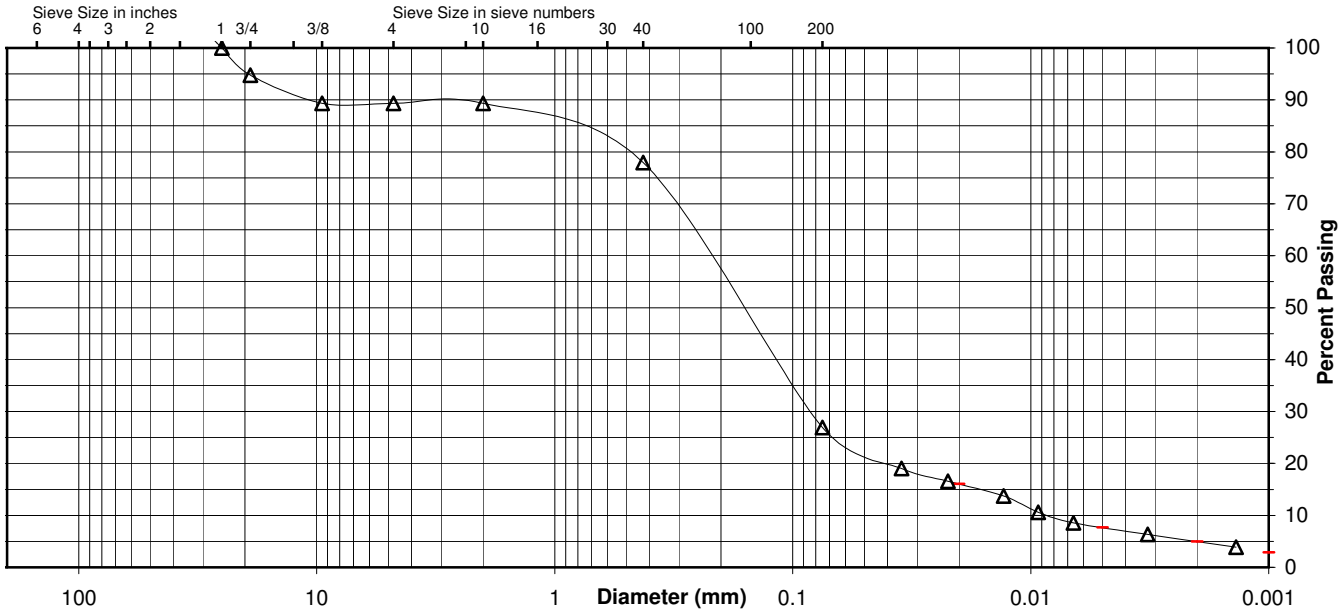
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	77.9
No. 200	26.9
0.02 mm	16.1
0.005 mm	7.7
0.002 mm	5.0
0.001 mm	2.9

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	5.2	5.5	0.0	11.4	51.0	19.2	7.7

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	10.7	11.4	51.0	21.9	5.0



Comments

Reviewed By

File: frm_175539024_sum_107 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

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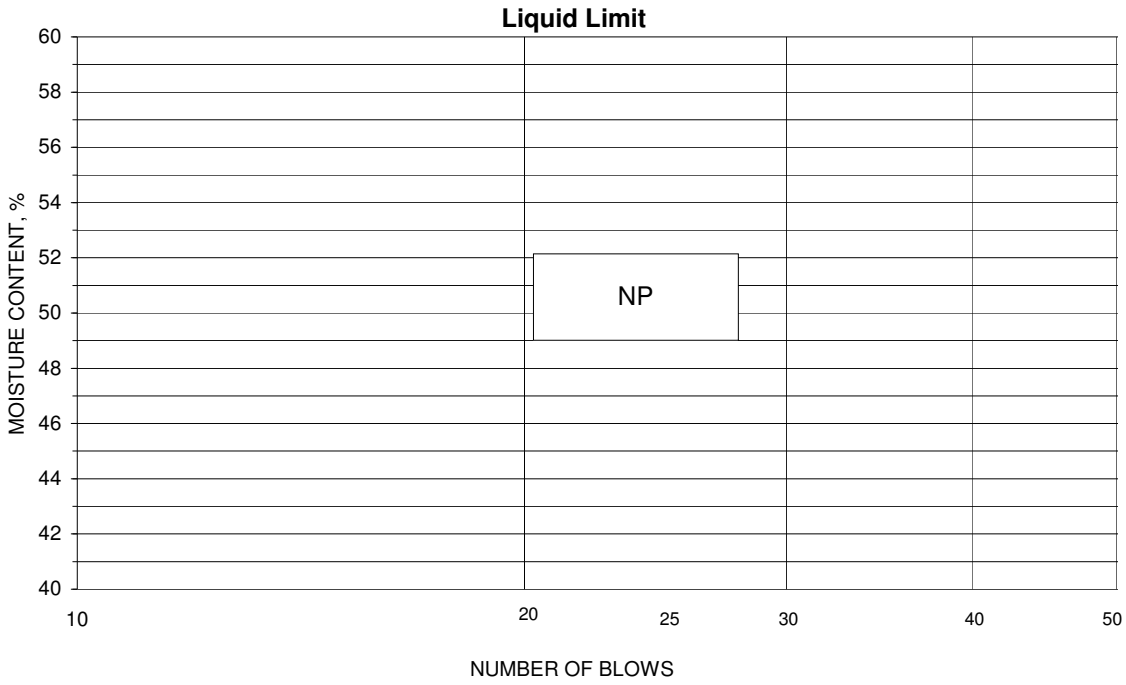
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 134.5'-136.0'			Lab ID	107
				% + No. 40	22
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 139.5'-141.0'	Lab ID	108
County	Lawrence, KY	Date Received	12-21-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 2.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	96.3
No. 4	4.75	63.8
No. 10	2	38.5
No. 40	0.425	17.5
No. 200	0.075	9.3
	0.02	5.2
	0.005	2.5
	0.002	1.5
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	36.2	61.5
Coarse Sand	25.3	21.0
Medium Sand	21.0	---
Fine Sand	8.2	8.2
Silt	6.8	7.8
Clay	2.5	1.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SW-SM
Group Name: Well-graded sand with silt and gravel

AASHTO Classification: A-1-a (1)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 139.5'-141.0'	Lab ID	108

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	12-21-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	96.3
No. 4	63.8
No. 10	38.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

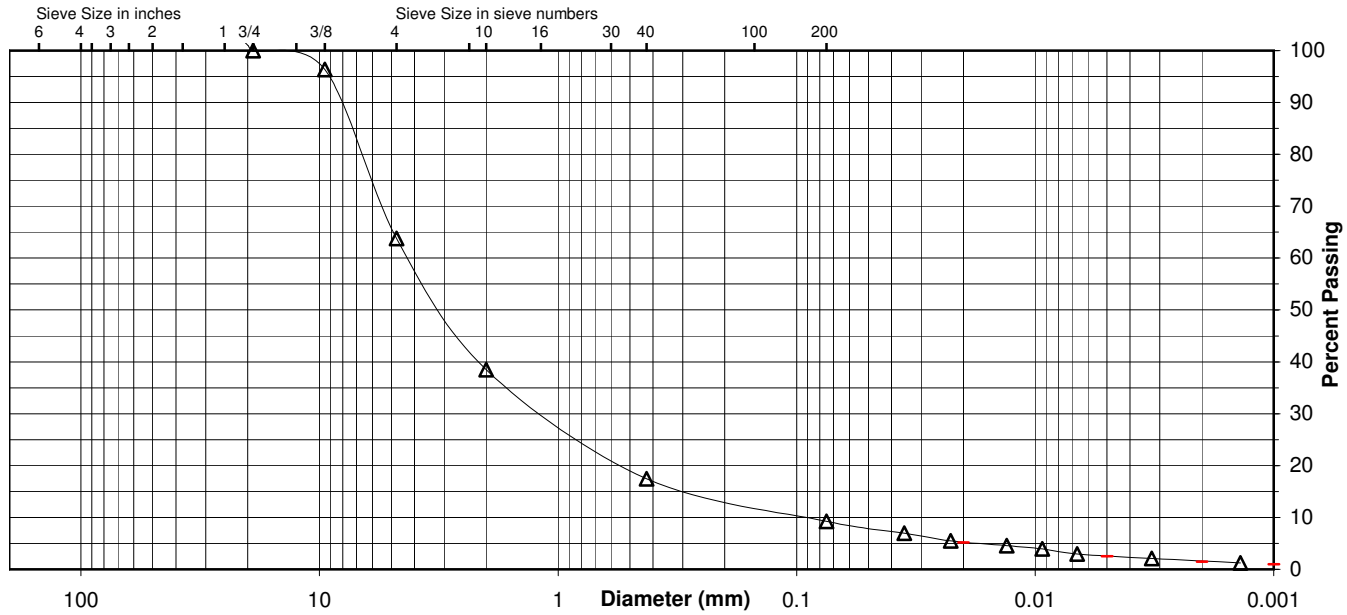
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	17.5
No. 200	9.3
0.02 mm	5.2
0.005 mm	2.5
0.002 mm	1.5
0.001 mm	1.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	36.2	25.3	21.0	8.2	6.8	2.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	61.5	21.0	8.2	7.8	1.5



Comments

Reviewed By

File: frm_175539024_sum_108 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

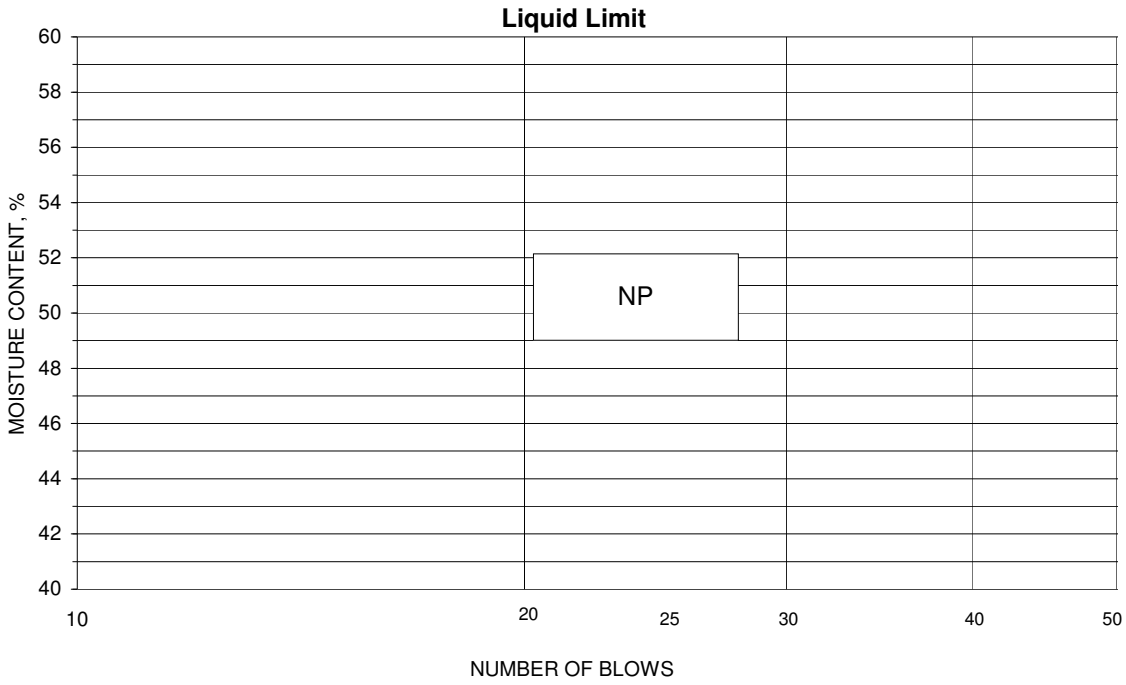
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 139.5'-141.0'			Lab ID	108
				% + No. 40	83
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	12-21-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 159.5'-161.0'	Lab ID	110
County	Lawrence, KY	Date Received	1-8-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 10.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	95.5
3/4"	19	92.7
3/8"	9.5	83.6
No. 4	4.75	80.3
No. 10	2	78.9
No. 40	0.425	66.6
No. 200	0.075	27.6
	0.02	16.8
	0.005	9.4
	0.002	6.5
estimated	0.001	4.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	19.7	21.1
Coarse Sand	1.4	12.3
Medium Sand	12.3	---
Fine Sand	39.0	39.0
Silt	18.2	21.1
Clay	9.4	6.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 159.5'-161.0'	Lab ID	110

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	01-08-2010

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	95.5
3/4"	92.7
3/8"	83.6
No. 4	80.3
No. 10	78.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

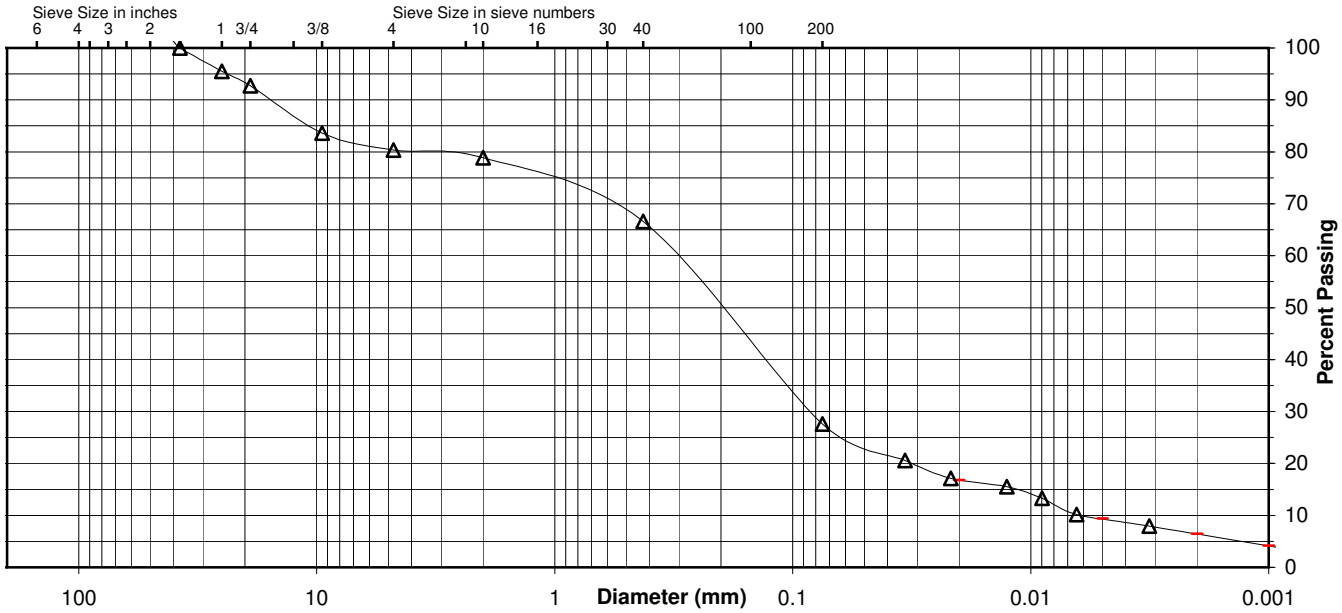
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	66.6
No. 200	27.6
0.02 mm	16.8
0.005 mm	9.4
0.002 mm	6.5
0.001 mm	4.2

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	7.3	12.4	1.4	12.3	39.0	18.2	9.4

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	21.1	12.3	39.0	21.1	6.5



Comments

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File: frm_175539024_sum_110 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

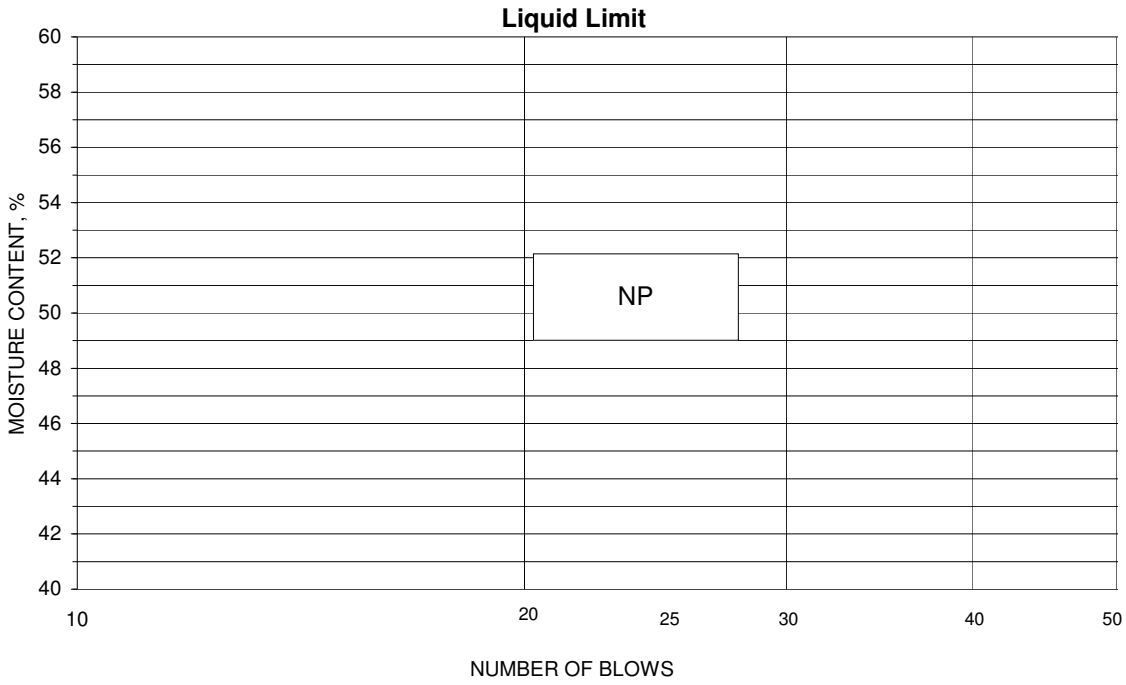
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 159.5'-161.0'			Lab ID	110
				% + No. 40	33
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	01-08-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 169.5'-171.0'	Lab ID	111
County	Lawrence, KY	Date Received	1-8-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 9.9

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	92.4
3/4"	19	86.6
3/8"	9.5	74.3
No. 4	4.75	67.2
No. 10	2	66.8
No. 40	0.425	48.7
No. 200	0.075	28.8
	0.02	16.6
	0.005	9.2
	0.002	6.4
estimated	0.001	5.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	32.8	33.2
Coarse Sand	0.4	18.1
Medium Sand	18.1	---
Fine Sand	19.9	19.9
Silt	19.6	22.4
Clay	9.2	6.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 169.5'-171.0'	Lab ID	111

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	01-08-2010

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	92.4
3/4"	86.6
3/8"	74.3
No. 4	67.2
No. 10	66.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

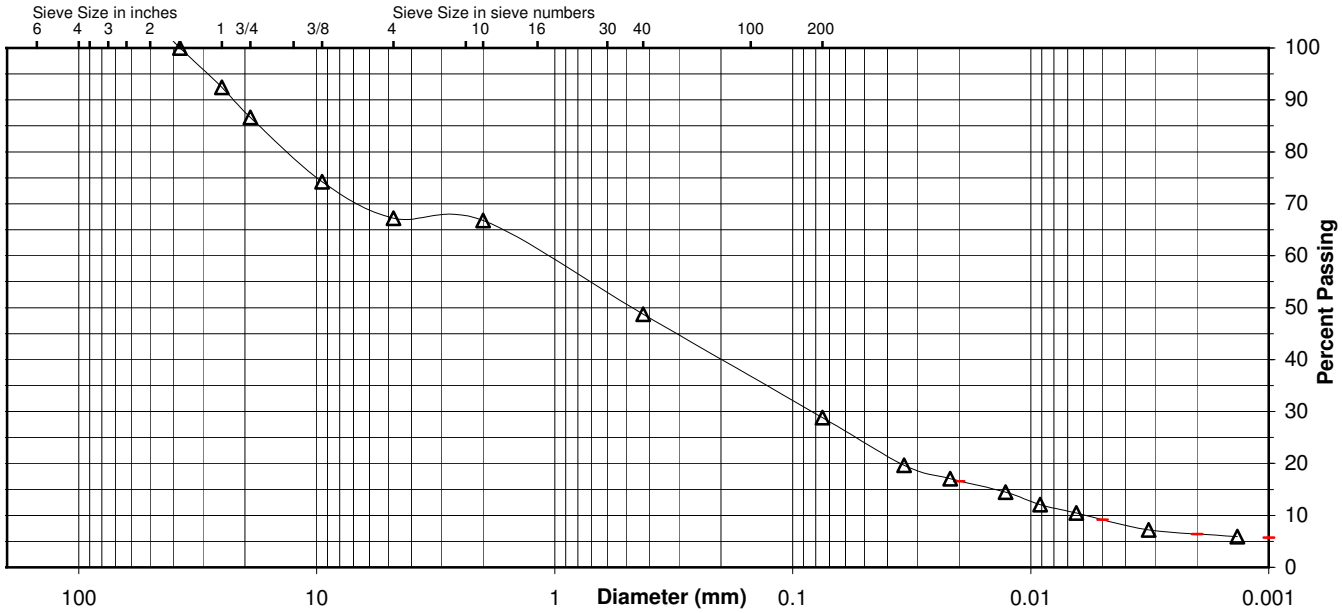
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	48.7
No. 200	28.8
0.02 mm	16.6
0.005 mm	9.2
0.002 mm	6.4
0.001 mm	5.7

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	13.4	19.4	0.4	18.1	19.9	19.6	9.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	33.2	18.1	19.9	22.4	6.4



Comments

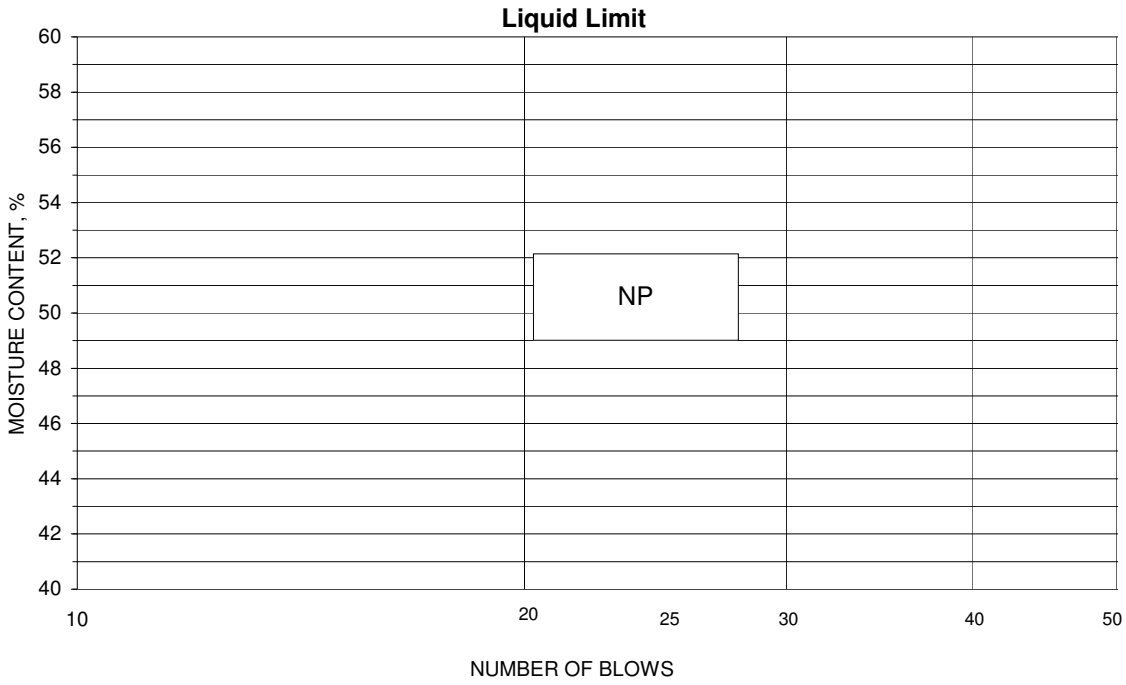
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 169.5'-171.0'			Lab ID	111
				% + No. 40	51
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	01-08-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 179.5'-181.0'	Lab ID	112
County	Lawrence, KY	Date Received	1-8-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 19.2

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	96.7
3/8"	9.5	96.7
No. 4	4.75	96.7
No. 10	2	96.7
No. 40	0.425	94.9
No. 200	0.075	87.6
	0.02	69.5
	0.005	41.2
	0.002	29.3
estimated	0.001	23.9

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.3	3.3
Coarse Sand	0.0	1.8
Medium Sand	1.8	---
Fine Sand	7.3	7.3
Silt	46.4	58.3
Clay	41.2	29.3

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 36
Plastic Limit: 18
Plasticity Index: 18
Activity Index: 0.62

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (15)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 179.5'-181.0'	Lab ID	112

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	01-08-2010

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	96.7
3/8"	96.7
No. 4	96.7
No. 10	96.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

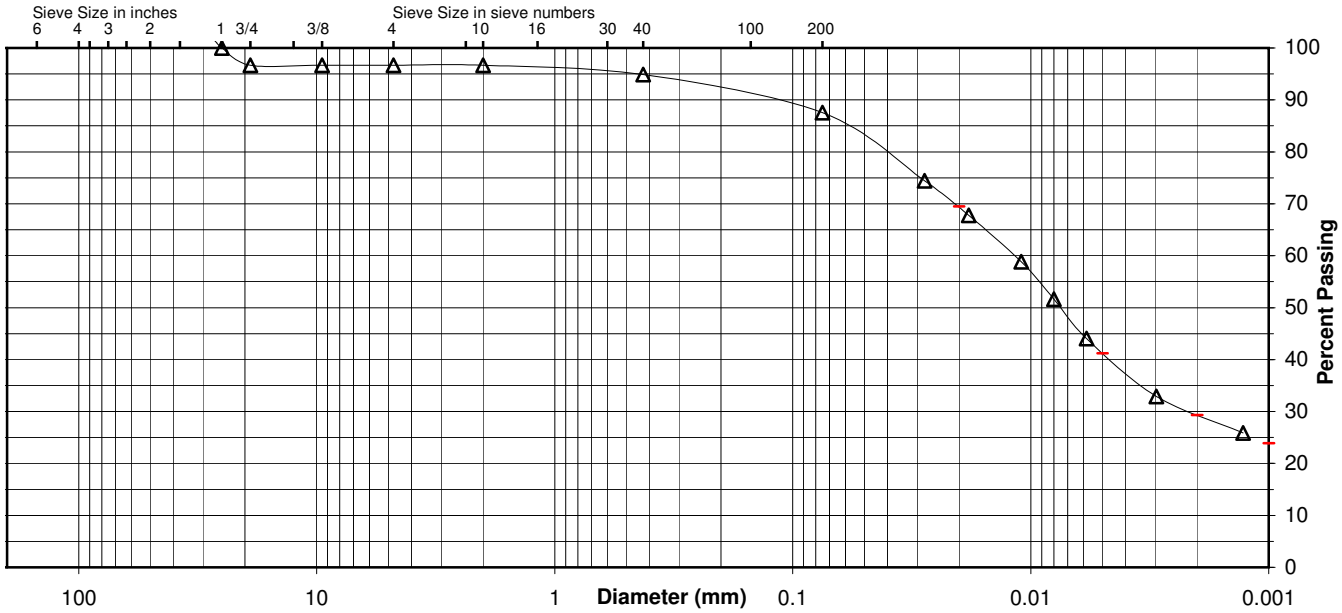
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	94.9
No. 200	87.6
0.02 mm	69.5
0.005 mm	41.2
0.002 mm	29.3
0.001 mm	23.9

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	3.3	0.0	0.0	1.8	7.3	46.4	41.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	3.3	1.8	7.3	58.3	29.3



Comments

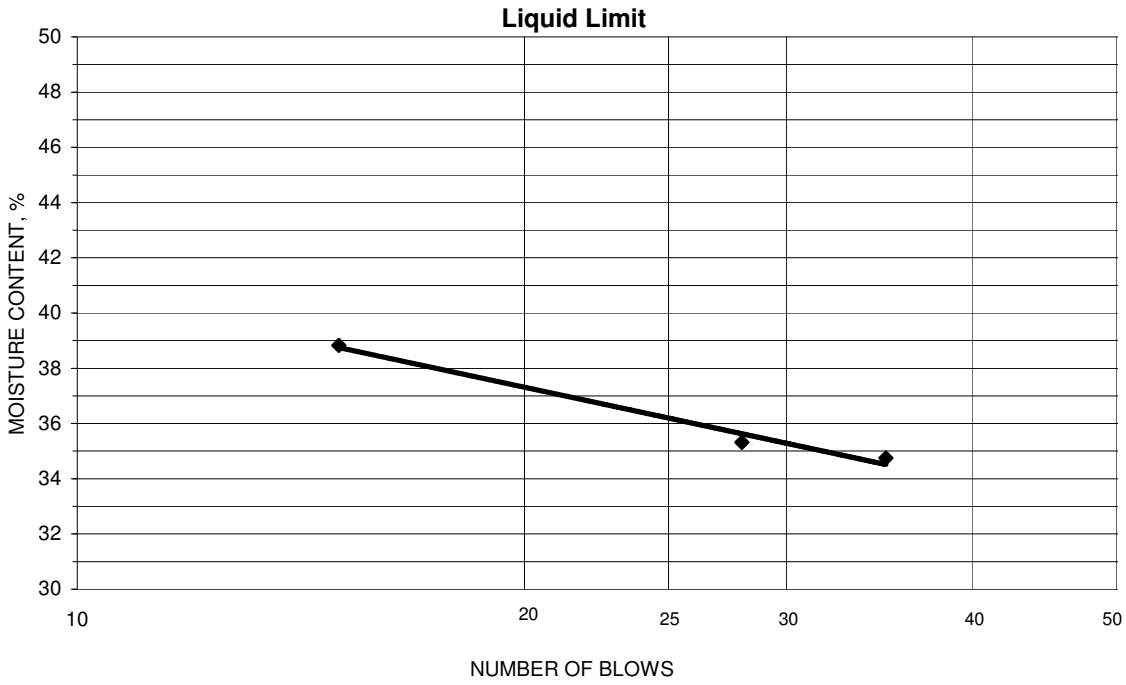
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 179.5'-181.0'			Lab ID	112
				% + No. 40	5
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	01-08-2010
Test Date	01-12-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.53	19.44	10.69	28	35.3	
23.48	20.29	11.11	35	34.7	
21.82	18.69	10.63	15	38.8	36



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
24.26	22.25	10.88	17.7	18	18
24.18	22.14	11.07	18.4		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 189.5'-191.0'	Lab ID	113
County	Lawrence, KY	Date Received	1-8-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 19.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.6
No. 4	4.75	99.1
No. 10	2	99.0
No. 40	0.425	90.1
No. 200	0.075	77.0
	0.02	60.6
	0.005	39.1
	0.002	28.6
estimated	0.001	22.9

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.9	1.0
Coarse Sand	0.1	8.9
Medium Sand	8.9	---
Fine Sand	13.1	13.1
Silt	37.9	48.4
Clay	39.1	28.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	32
Plastic Limit:	17
Plasticity Index:	15
Activity Index:	0.52

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (10)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 189.5'-191.0'	Lab ID	113

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method:	ASTM D 422
Prepared using:	ASTM D 421
Particle Shape:	Angular
Particle Hardness:	Hard and Durable
Tested By:	KAF
Test Date:	01-11-2010
Date Received	01-08-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.6
No. 4	99.1
No. 10	99.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

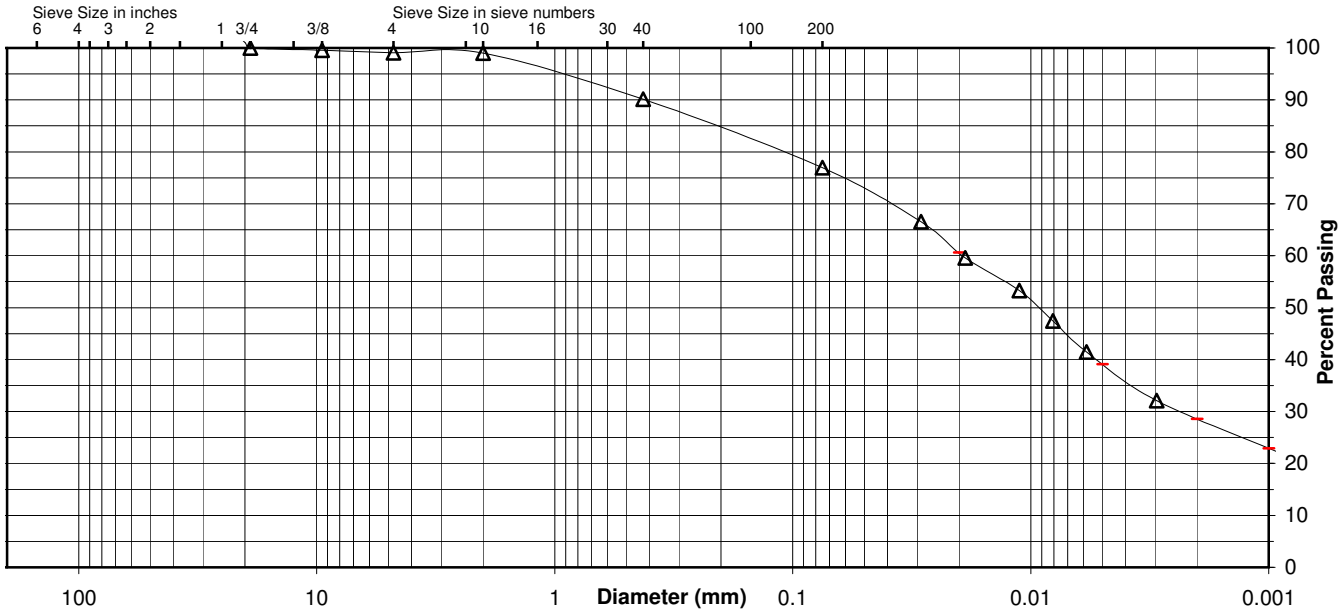
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	90.1
No. 200	77.0
0.02 mm	60.6
0.005 mm	39.1
0.002 mm	28.6
0.001 mm	22.9

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.9	0.1	8.9	13.1	37.9	39.1

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	1.0	8.9	13.1	48.4	28.6



Comments

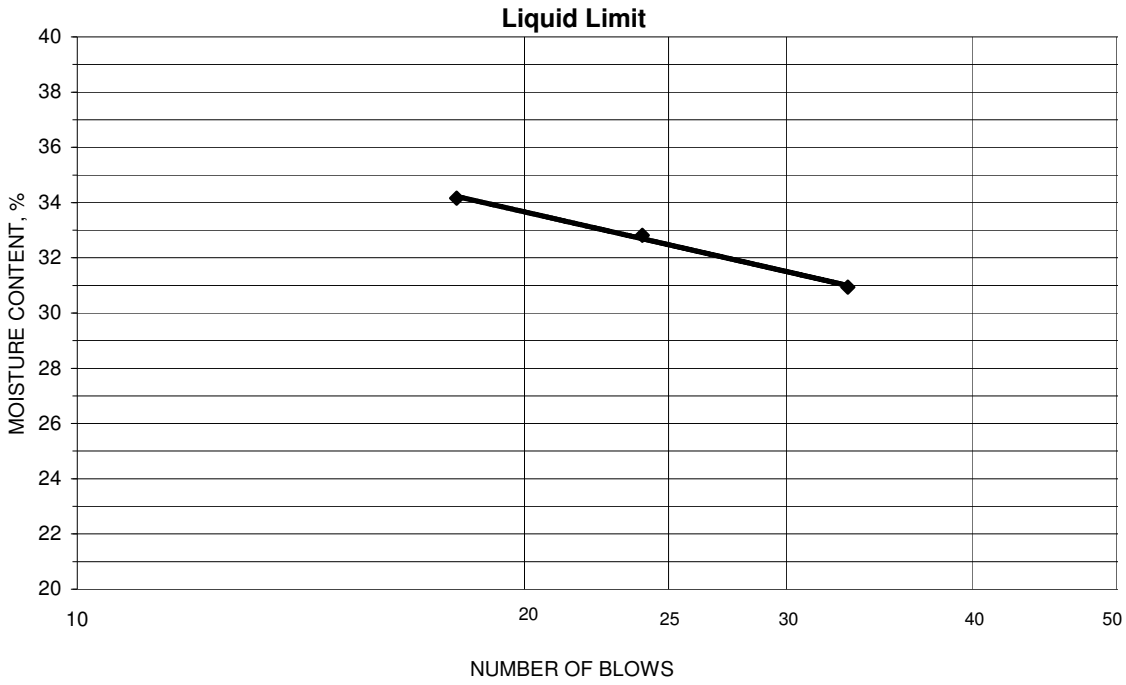
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 189.5'-191.0'			Lab ID	113
				% + No. 40	10
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	01-08-2010
Test Date	01-13-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
24.00	20.70	11.04	18	34.2	
25.66	22.10	11.25	24	32.8	
23.00	20.07	10.60	33	30.9	32



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
21.42	19.93	10.96	16.6	17	15
22.59	20.92	11.12	17.0		

Remarks: _____

Reviewed By _____

Stantec

Summary of Soil Tests

Project Name	Big Sandy Unit 12 Main Dam Instrumentation	Project Number	175539024
Source	B-4, 199.5'-201.0'	Lab ID	114
County	Lawrence, KY	Date Received	1-8-10
Sample Type	ST	Date Reported	1-18-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 14.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.4
No. 10	2	99.4
No. 40	0.425	94.6
No. 200	0.075	69.2
	0.02	39.7
	0.005	18.8
	0.002	12.9
estimated	0.001	8.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.6	0.6
Coarse Sand	0.0	4.8
Medium Sand	4.8	---
Fine Sand	25.4	25.4
Silt	50.4	56.3
Clay	18.8	12.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 25
Plastic Limit: 17
Plasticity Index: 8
Activity Index: 0.62

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-4 (3)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Big Sandy Unit 12 Main Dam Instrumentation
Project Number: 175539024
Source: B-4, 199.5'-201.0'
Lab ID: 114

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KAF
Test Date: 01-11-2010
Date Received 01-08-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.4
No. 10	99.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

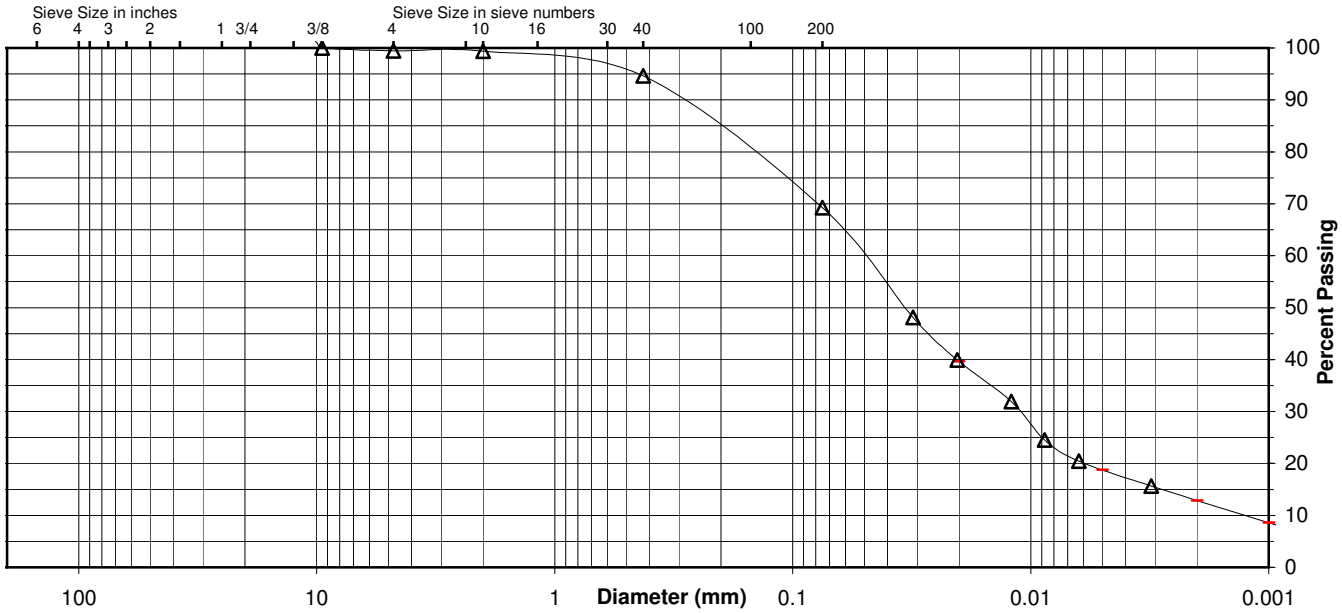
Specific Gravity 2.7

Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	94.6
No. 200	69.2
0.02 mm	39.7
0.005 mm	18.8
0.002 mm	12.9
0.001 mm	8.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.6	0.0	4.8	25.4	50.4	18.8
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.6			4.8	25.4	56.3	12.9



Comments

Reviewed By

File: frm_175539024_sum_114 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

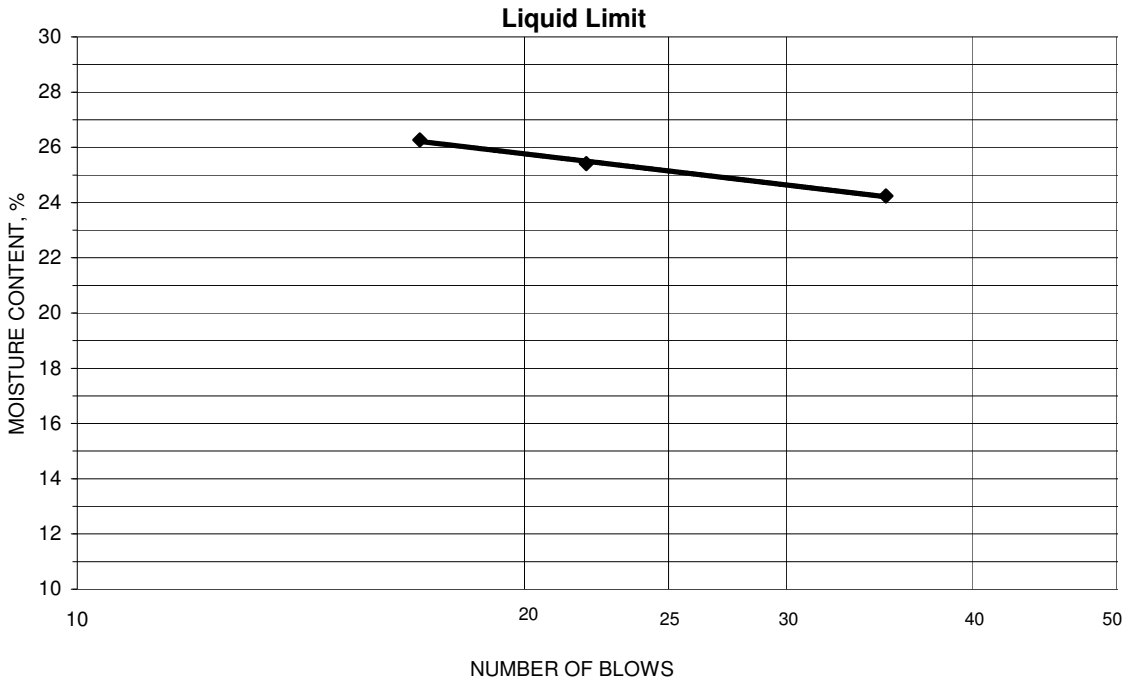
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Unit 12 Main Dam Instrumentation			Project No.	175539024
Source	B-4, 199.5'-201.0'			Lab ID	114
				% + No. 40	5
Tested By	KR	Test Method	ASTM D 4318 Method A	Date Received	01-08-2010
Test Date	01-14-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.54	20.23	11.14	22	25.4	
23.62	21.04	11.22	17	26.3	
26.95	23.83	10.96	35	24.2	25



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
24.43	22.54	11.13	16.6	17	8
22.08	20.49	11.09	16.9		

Remarks:

Reviewed By

FLY ASH POND MAIN DAM, 2015

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	FA-15-1, 13.2'-13.7'	Lab ID	50B
Sample Type	ST	Date Received	11-4-15
		Date Reported	12-9-15

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	99.6
No. 4	4.75	99.6
No. 10	2	99.5
No. 40	0.425	90.4
No. 200	0.075	80.6
	0.02	57.1
	0.005	31.8
	0.002	18.9
estimated	0.001	14.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.4	0.5
Coarse Sand	0.1	9.1
Medium Sand	9.1	---
Fine Sand	9.8	9.8
Silt	48.8	61.7
Clay	31.8	18.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	35
Plastic Limit:	20
Plasticity Index:	15
Activity Index:	0.79

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.78

Classification

Unified Group Symbol:	CL
Group Name:	Lean clay with sand
AASHTO Classification:	A-6 (11)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	FA-15-1, 13.2'-13.7'	Lab ID	50B

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Rounded and Angular
Particle Hardness:	Hard and Durable
Tested By	GW
Test Date	12-04-2015
Date Received	11-04-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	99.6
No. 4	99.6
No. 10	99.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.78

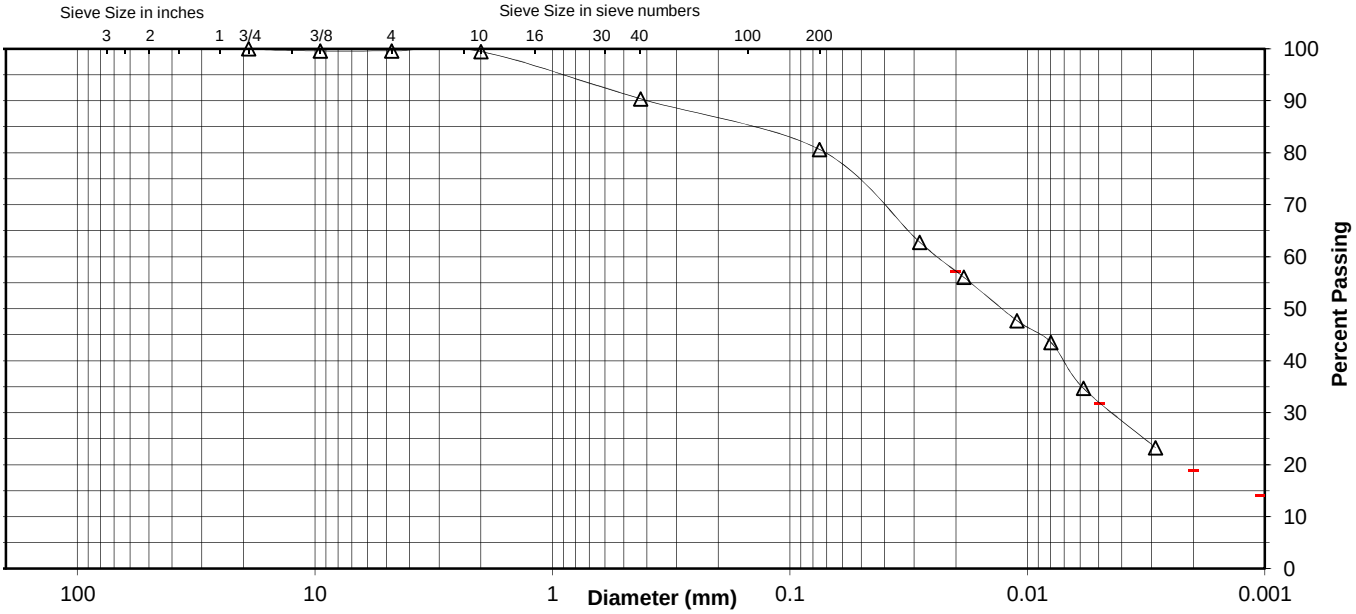
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	90.4
No. 200	80.6
0.02 mm	57.1
0.005 mm	31.8
0.002 mm	18.9
0.001 mm	14.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.4	0.1	9.1	9.8	48.8	31.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.5	9.1	9.8	61.7	18.9



Comments

Reviewed By RJ

File: frm_175553023_sum_50b.xlsm
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.
Lexington, Kentucky

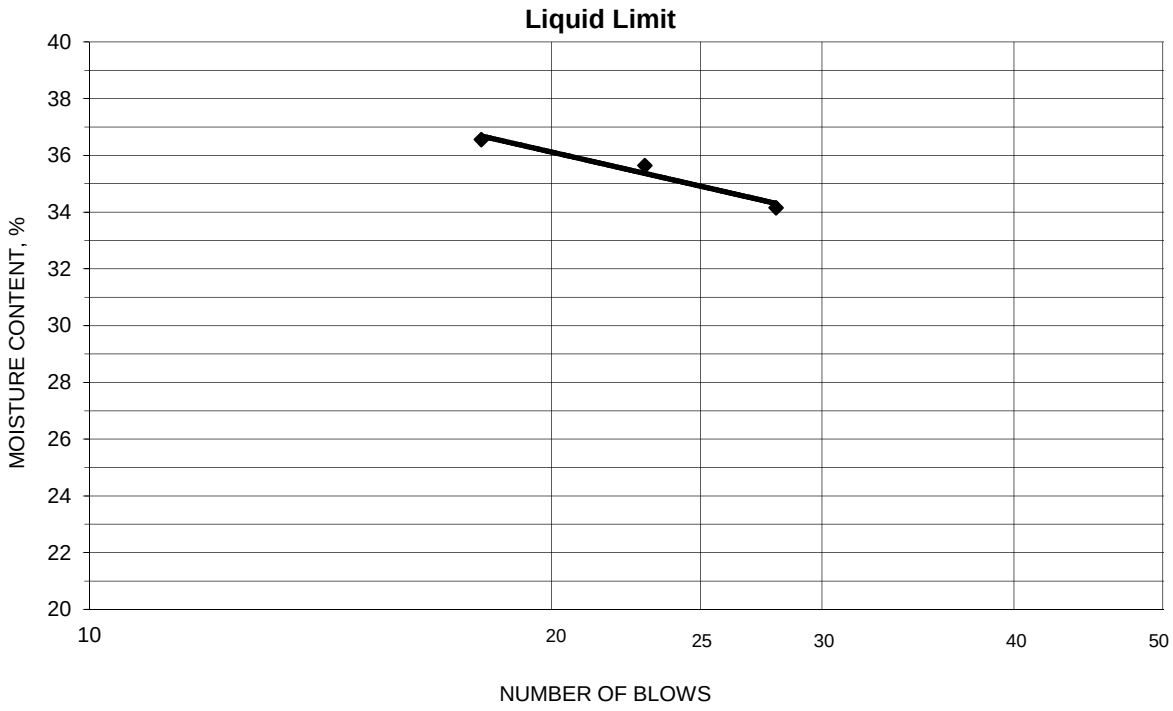
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	FA-15-1, 13.2'-13.7'			Lab ID	50B
				% + No. 40	10
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	12-07-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.30	17.21	11.09	28	34.2	
19.07	16.91	10.85	23	35.6	
20.40	18.02	11.51	18	36.6	35



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
17.62	16.52	11.13	20.4	20	15
18.51	17.37	11.75	20.3		

Remarks:

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	FA-15-1, 22.5'-24.0', 27.5'-29.0'	Lab ID	54
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
1 1/2"	37.5	100.0
	N/A	
3/4"	19	86.6
3/8"	9.5	86.6
No. 4	4.75	86.0
No. 10	2	84.8
No. 40	0.425	76.6
No. 200	0.075	25.8
	0.02	13.7
	0.005	8.1
	0.002	4.0
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	14.0	15.2
Coarse Sand	1.1	8.2
Medium Sand	8.2	---
Fine Sand	50.8	50.8
Silt	17.7	21.8
Clay	8.1	4.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	SM
Group Name:	Silty sand
AASHTO Classification:	A-2-4 (0)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	FA-15-1, 22.5'-24.0', 27.5'-29.0'	Lab ID	54

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	MC
Test Date	11-12-2015
Date Received	11-04-2015

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
1 1/2"	100.0
3/4"	86.6
3/8"	86.6
No. 4	86.0
No. 10	84.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

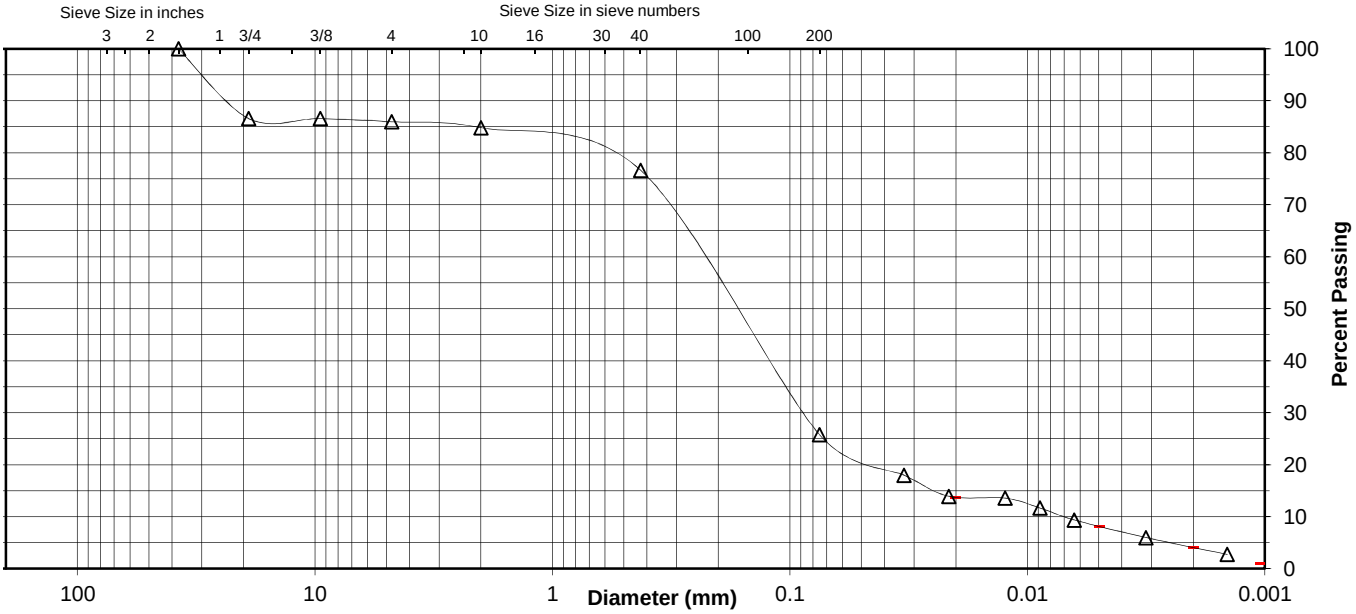
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	76.6
No. 200	25.8
0.02 mm	13.7
0.005 mm	8.1
0.002 mm	4.0
0.001 mm	1.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	13.4	0.6	1.2	8.2	50.8	17.7	8.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	15.2	8.2	50.8	21.8	4.0



Comments

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Approved BY: TLK

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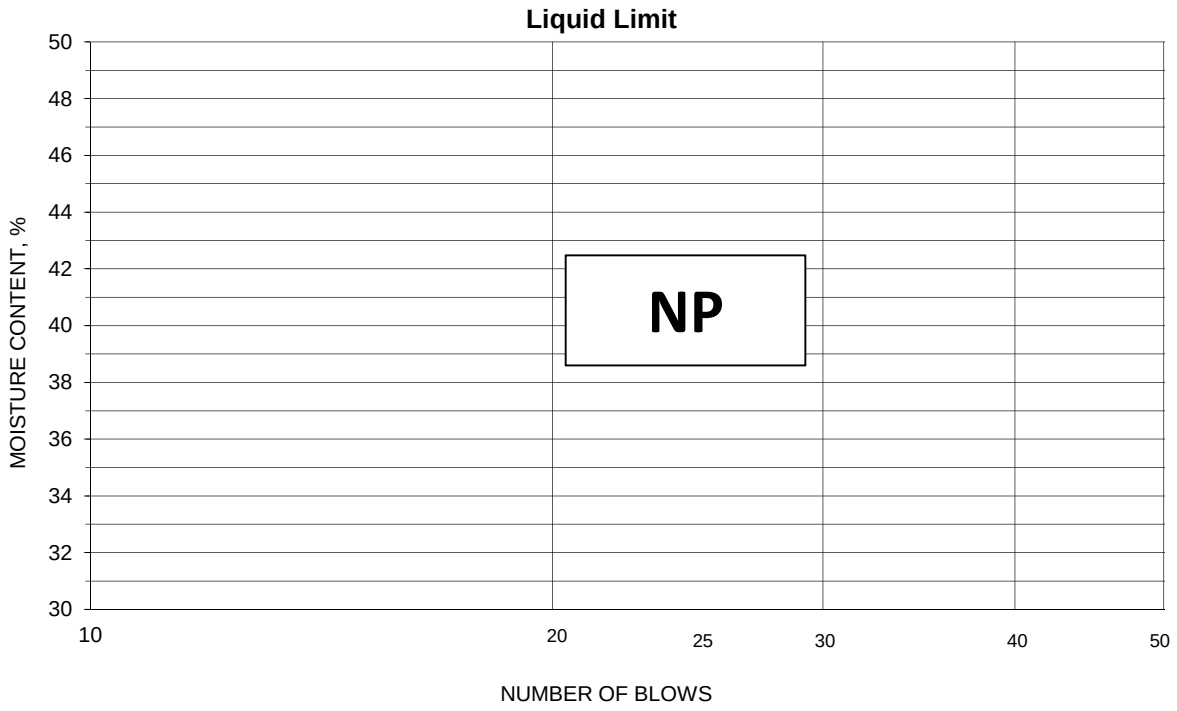
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	FA-15-1, 22.5'-24.0', 27.5'-29.0'			Lab ID	54
				% + No. 40	23
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-12-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: _____

Reviewed By RJ

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Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 40.0'-41.5', 45.0'-46.5'	Lab ID	16
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
1 1/2"	37.5	100.0
	N/A	
3/4"	19	95.6
3/8"	9.5	95.6
No. 4	4.75	95.0
No. 10	2	93.4
No. 40	0.425	87.8
No. 200	0.075	72.5
	0.02	61.0
	0.005	42.9
	0.002	29.0
estimated	0.001	20.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	5.0	6.6
Coarse Sand	1.6	5.6
Medium Sand	5.6	---
Fine Sand	15.3	15.3
Silt	29.6	43.5
Clay	42.9	29.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	37
Plastic Limit:	18
Plasticity Index:	19
Activity Index:	0.66

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL
Group Name:	Lean clay with sand
AASHTO Classification:	A-6 (12)

Comments:

Reviewed By RJ

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Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 40.0'-41.5', 45.0'-46.5'	Lab ID	16

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	MC
Test Date	11-11-2015
Date Received	11-04-2015

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
1 1/2"	100.0
3/4"	95.6
3/8"	95.6
No. 4	95.0
No. 10	93.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

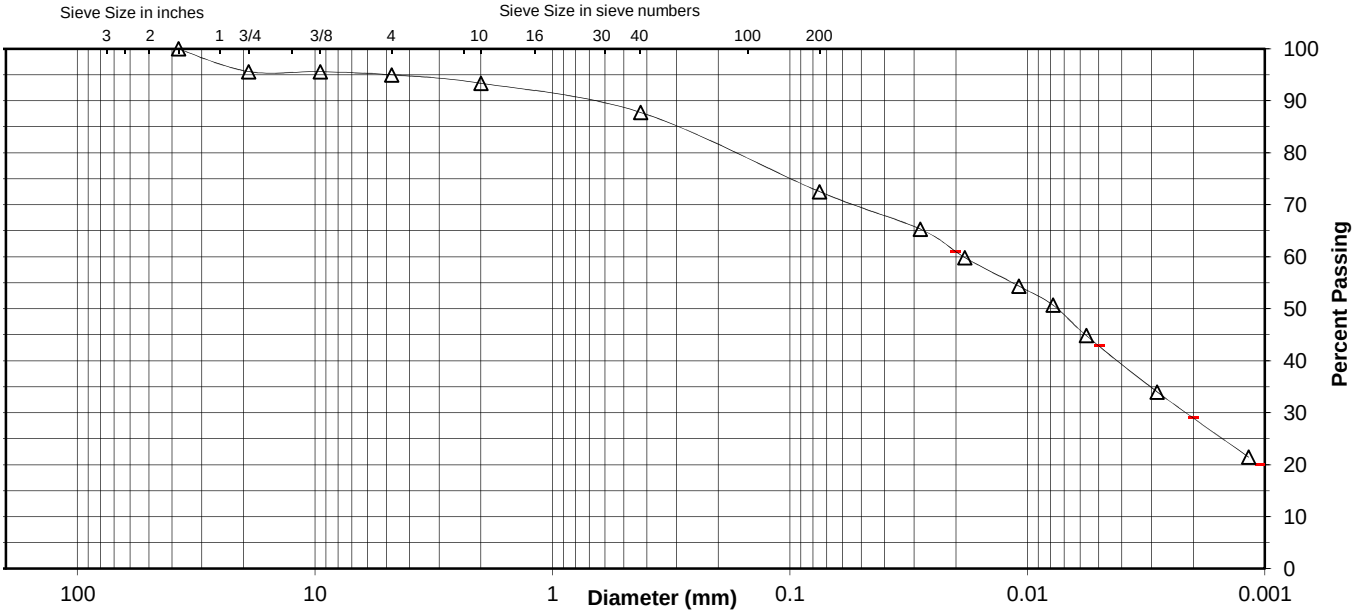
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	87.8
No. 200	72.5
0.02 mm	61.0
0.005 mm	42.9
0.002 mm	29.0
0.001 mm	20.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	4.4	0.6	1.6	5.6	15.3	29.6	42.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	6.6	5.6	15.3	43.5	29.0



Comments

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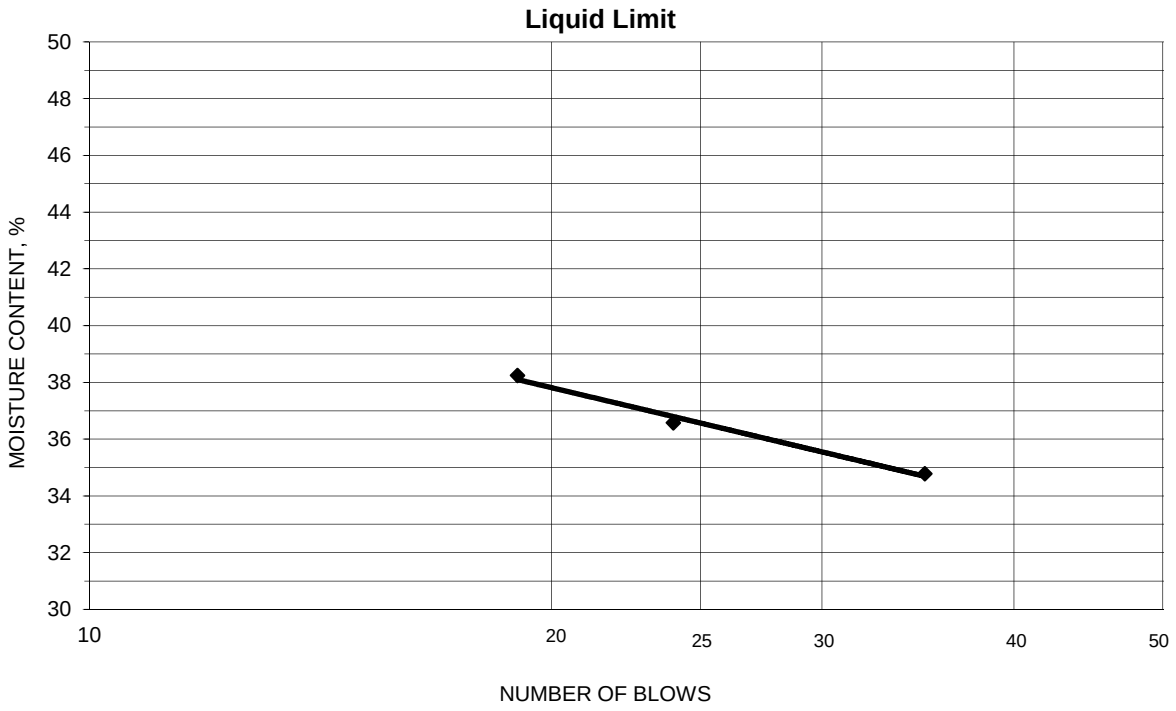
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	SD-15-1, 40.0'-41.5', 45.0'-46.5'	Lab ID	16
		% + No. 40	12
Tested By	KWS	Test Method	ASTM D 4318 Method A
Test Date	11-12-2015	Prepared	Dry
		Date Received	11-04-2015

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
18.00	16.15	10.83	35	34.8	
20.82	18.22	11.11	24	36.6	
20.60	18.08	11.49	19	38.2	37



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.55	17.45	11.47	18.4	18	19
17.83	16.75	10.93	18.6		

Remarks:

Reviewed By RJ

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Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 50.0'-51.5', 55.0'-56.5'	Lab ID	19
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
1 1/2"	37.5	100.0
	N/A	
3/4"	19	97.4
3/8"	9.5	92.8
No. 4	4.75	91.1
No. 10	2	90.0
No. 40	0.425	83.2
No. 200	0.075	56.4
	0.02	43.3
	0.005	28.8
	0.002	20.8
estimated	0.001	16.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	8.9	10.0
Coarse Sand	1.2	6.8
Medium Sand	6.8	---
Fine Sand	26.8	26.8
Silt	27.6	35.6
Clay	28.8	20.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	30
Plastic Limit:	17
Plasticity Index:	13
Activity Index:	0.62

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL
Group Name:	Sandy lean clay
AASHTO Classification:	A-6 (4)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 50.0'-51.5', 55.0'-56.5'	Lab ID	19

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	MC
Test Date	11-11-2015
Date Received	11-04-2015

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
1 1/2"	100.0
3/4"	97.4
3/8"	92.8
No. 4	91.1
No. 10	90.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

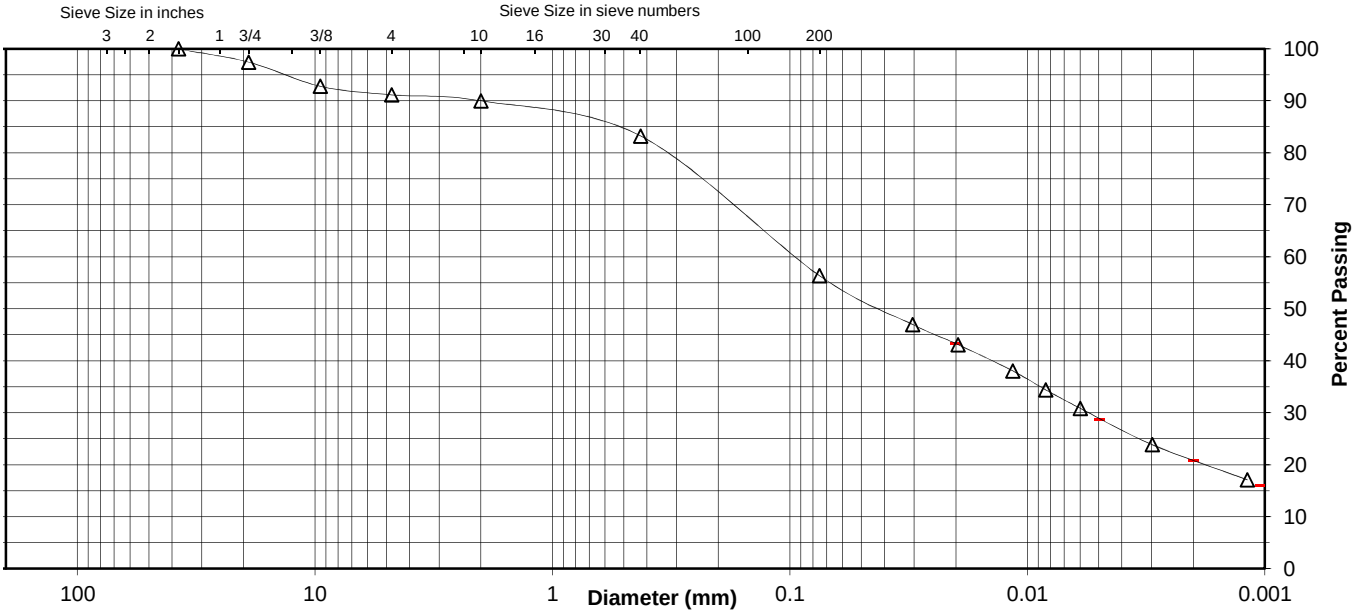
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	83.2
No. 200	56.4
0.02 mm	43.3
0.005 mm	28.8
0.002 mm	20.8
0.001 mm	16.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	2.6	6.3	1.1	6.8	26.8	27.6	28.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	10.0	6.8	26.8	35.6	20.8



Comments

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Approved BY: TLK

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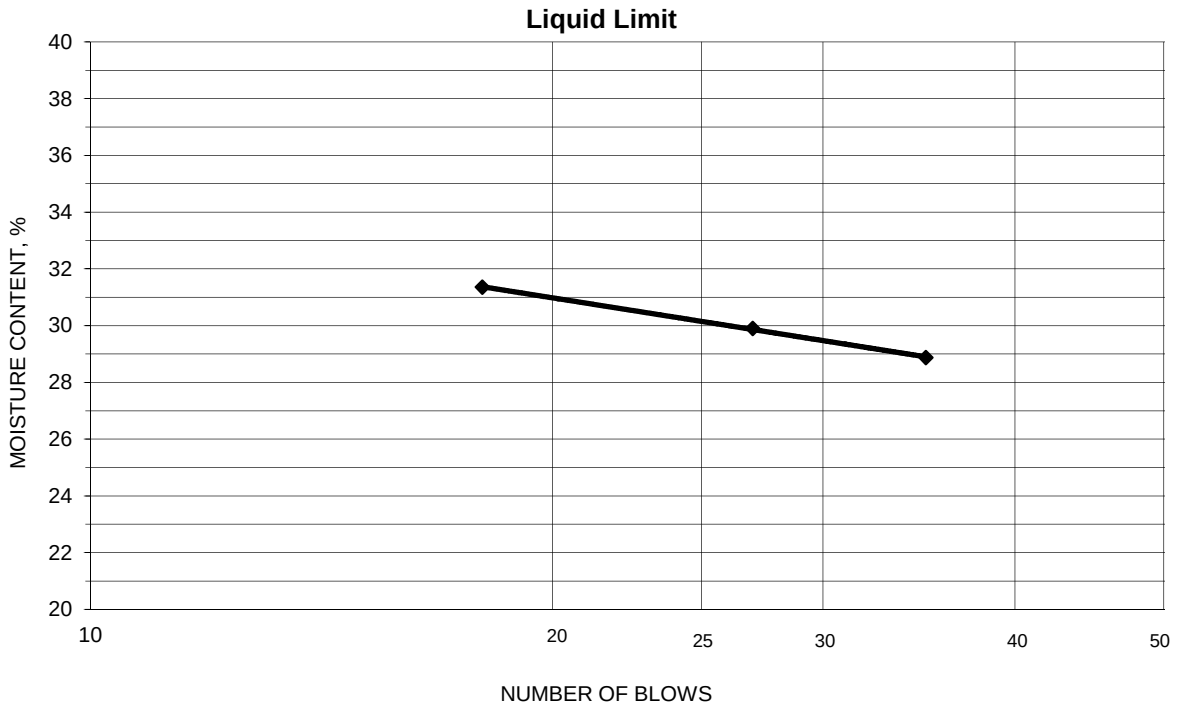
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	SD-15-1, 50.0'-51.5', 55.0'-56.5'	Lab ID	19
		% + No. 40	17
Tested By	KWS	Test Method	ASTM D 4318 Method A
Test Date	11-12-2015	Prepared	Dry
		Date Received	11-04-2015

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
21.89	19.84	12.74	35	28.9	
21.00	19.11	12.79	27	29.9	
21.45	19.39	12.82	18	31.4	30



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.71	17.65	11.51	17.3	17	13
18.64	17.62	11.49	16.6		

Remarks: _____

Reviewed By RJ

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Approved BY: TLK

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Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 60.0'-61.5' & SD-15-2, 60.0'-61.5'	Lab ID	23
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	98.4
No. 4	4.75	97.7
No. 10	2	96.6
No. 40	0.425	88.6
No. 200	0.075	74.4
	0.02	61.0
	0.005	41.7
	0.002	28.1
estimated	0.001	20.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	2.3	3.4
Coarse Sand	1.1	8.0
Medium Sand	8.0	---
Fine Sand	14.2	14.2
Silt	32.7	46.3
Clay	41.7	28.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	37
Plastic Limit:	18
Plasticity Index:	19
Activity Index:	0.68

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL
Group Name:	Lean clay with sand
AASHTO Classification:	A-6 (13)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 60.0'-61.5' & SD-15-2, 60.0'-61.5'	Lab ID	23

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	MC
Test Date	11-11-2015
Date Received	11-04-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	98.4
No. 4	97.7
No. 10	96.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

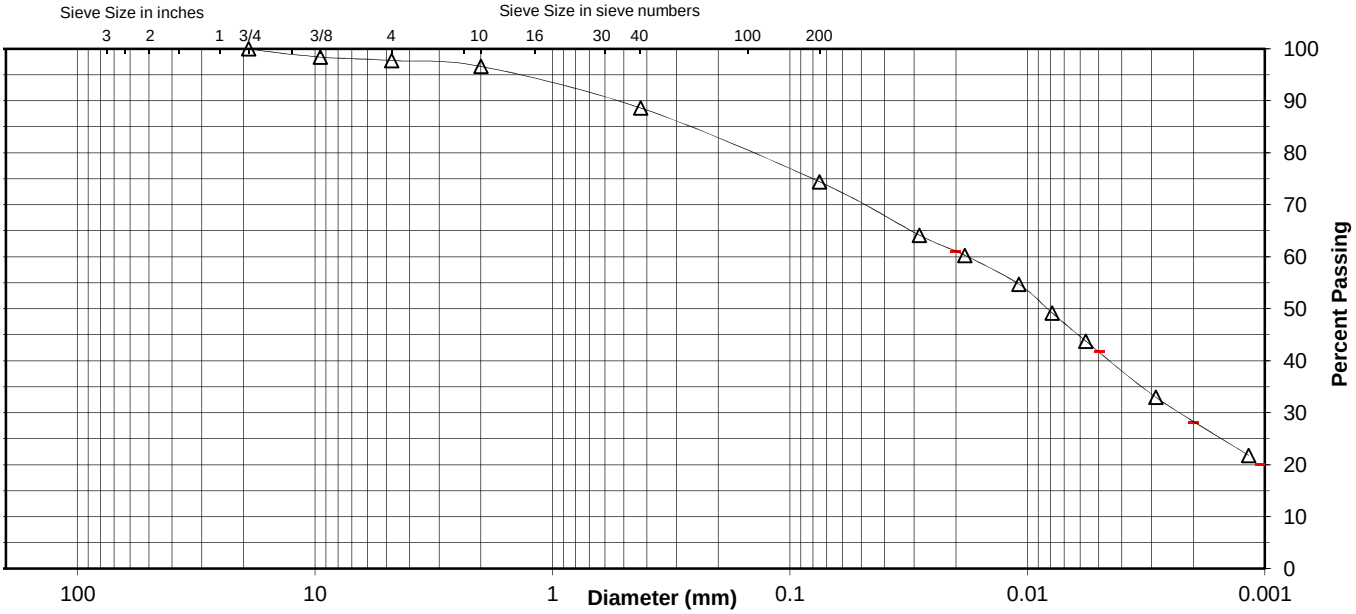
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	88.6
No. 200	74.4
0.02 mm	61.0
0.005 mm	41.7
0.002 mm	28.1
0.001 mm	20.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.3	1.1	8.0	14.2	32.7	41.7

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	3.4	8.0	14.2	46.3	28.1



Comments

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Approved BY: TLK

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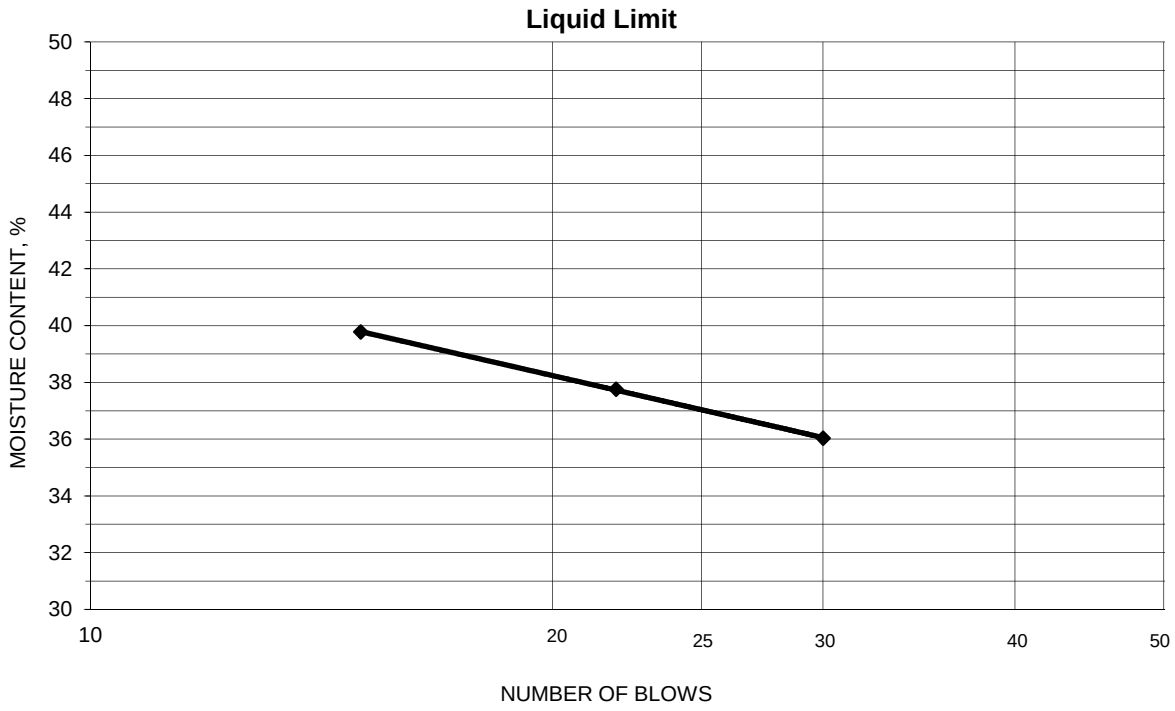
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	SD-15-1, 60.0'-61.5' & SD-15-2, 60.0'-61.5'	Lab ID	23
		% + No. 40	11
Tested By	KWS	Test Method	ASTM D 4318 Method A
Test Date	11-12-2015	Prepared	Dry
		Date Received	11-04-2015

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
17.80	16.02	11.08	30	36.0	
19.59	17.23	10.98	22	37.8	
21.47	18.63	11.49	15	39.8	37



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.27	17.22	11.45	18.2	18	19
18.28	17.26	11.54	17.8		

Remarks:

Reviewed By RJ

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Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 65.0'-66.5' & SD-15-2, 65.0'-66.5'	Lab ID	25
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
No. 4	4.75	100.0
No. 10	2	99.7
No. 40	0.425	95.3
No. 200	0.075	54.7
	0.02	37.1
	0.005	24.1
	0.002	16.1
estimated	0.001	11.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.3
Coarse Sand	0.3	4.4
Medium Sand	4.4	---
Fine Sand	40.6	40.6
Silt	30.6	38.6
Clay	24.1	16.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	24
Plastic Limit:	16
Plasticity Index:	8
Activity Index:	0.50

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL
Group Name:	Sandy lean clay
AASHTO Classification:	A-4 (2)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 65.0'-66.5' & SD-15-2, 65.0'-66.5'	Lab ID	25

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	MC
Test Date	11-11-2015
Date Received	11-04-2015

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
No. 4	100.0
No. 10	99.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

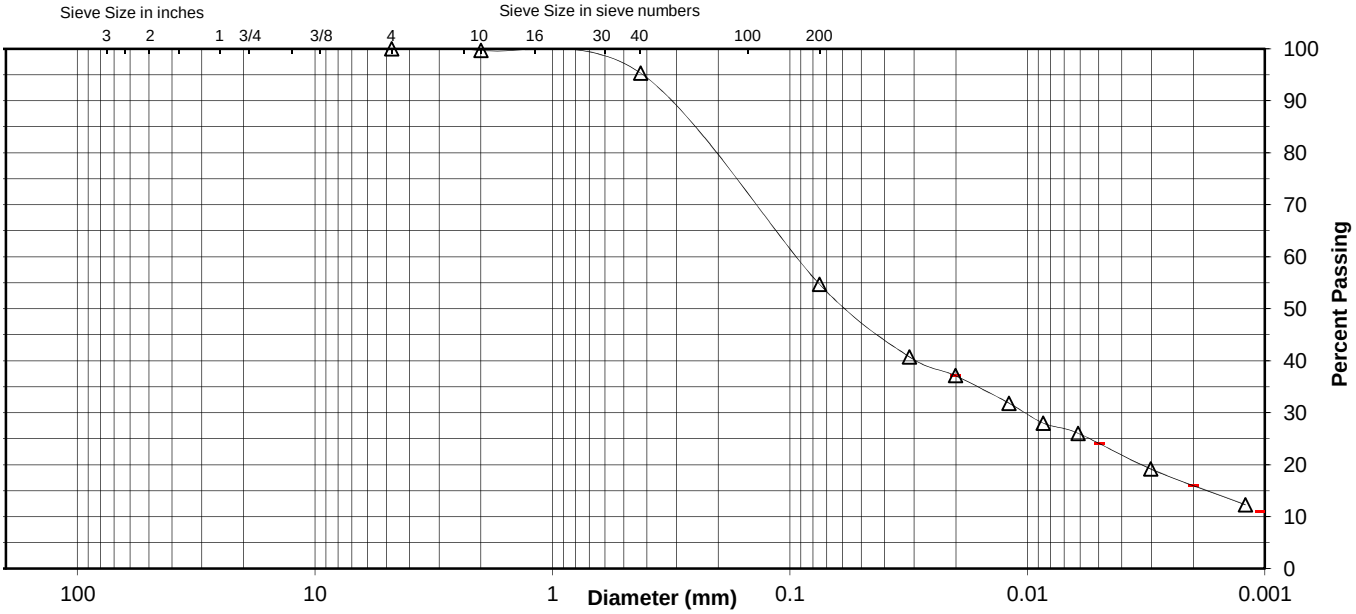
Specific Gravity 2.7

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	95.3
No. 200	54.7
0.02 mm	37.1
0.005 mm	24.1
0.002 mm	16.1
0.001 mm	11.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.3	4.4	40.6	30.6	24.1
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.3			4.4	40.6	38.6	16.1



Comments

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Lexington, Kentucky

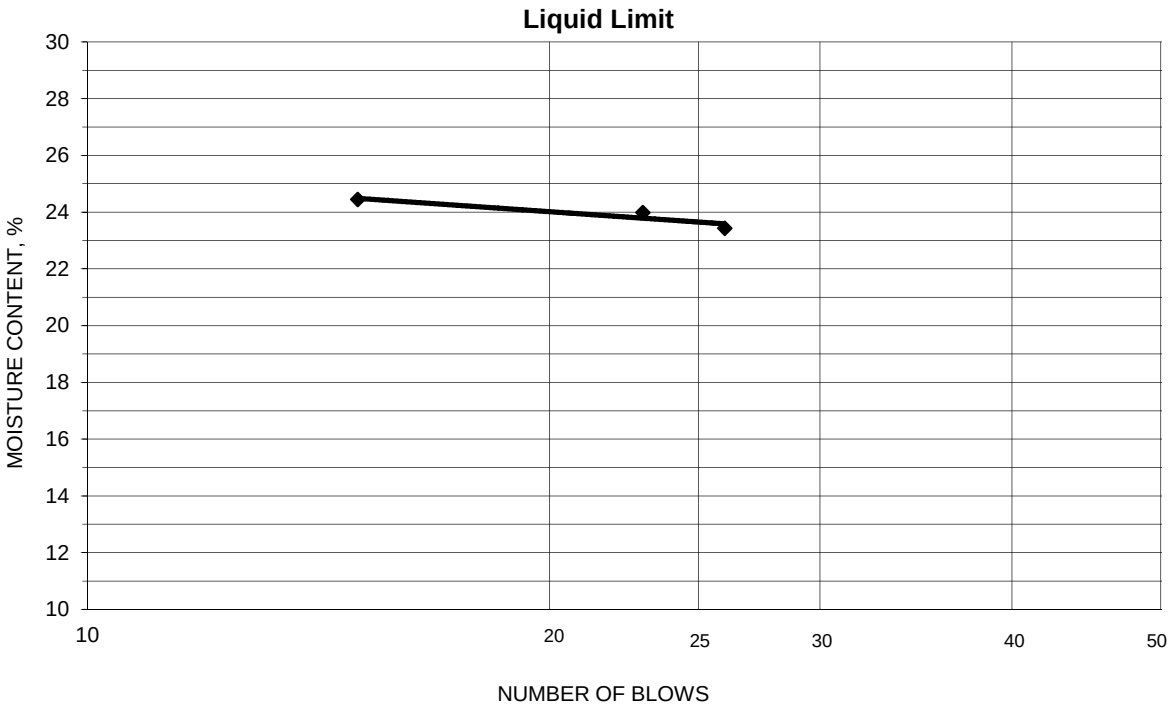
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	SD-15-1, 65.0'-66.5' & SD-15-2, 65.0'-66.5'			Lab ID	25
				% + No. 40	5
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-12-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
22.29	20.10	11.14	15	24.4	
22.83	20.53	10.94	23	24.0	
21.67	19.65	11.03	26	23.4	24



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.01	17.05	11.11	16.2	16	8
18.76	17.76	11.46	15.9		

Remarks: _____

Reviewed By RJ

File: frm_175553023_sum_25.xlsm
Preparation Date: 1998
Revision Date: 1-2008

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Lexington, Kentucky

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 70.0'-71.5', 75.0'-76.5'	Lab ID	27
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
No. 10	2	100.0
No. 40	0.425	92.7
No. 200	0.075	45.4
	0.02	33.4
	0.005	24.2
	0.002	16.7
estimated	0.001	13.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	7.3
Medium Sand	7.3	---
Fine Sand	47.3	47.3
Silt	21.2	28.7
Clay	24.2	16.7

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	25
Plastic Limit:	15
Plasticity Index:	10
Activity Index:	0.59

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	SC
Group Name:	Clayey sand
AASHTO Classification:	A-4 (1)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-1, 70.0'-71.5', 75.0'-76.5'	Lab ID	27

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	N/A
Particle Hardness:	N/A
Tested By	MC
Test Date	11-12-2015
Date Received	11-04-2015

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

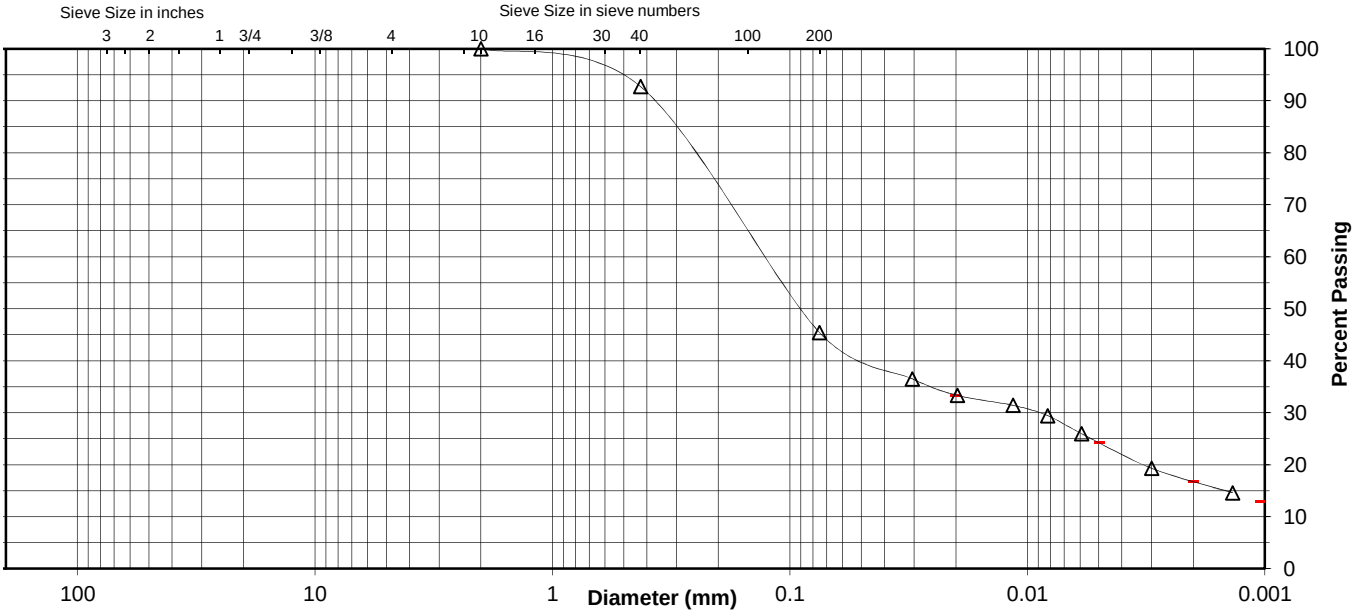
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	92.7
No. 200	45.4
0.02 mm	33.4
0.005 mm	24.2
0.002 mm	16.7
0.001 mm	13.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	0.0	7.3	47.3	21.2	24.2

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	0.0	7.3	47.3	28.7	16.7



Comments

Reviewed By RJ

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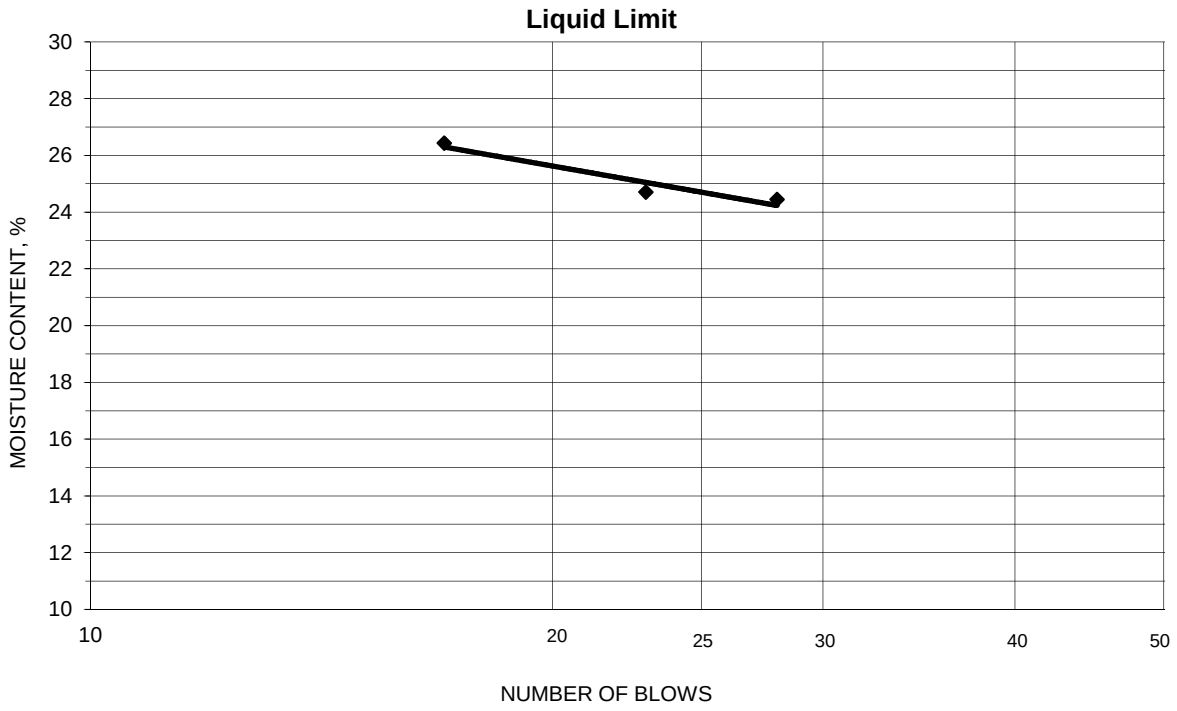
ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	SD-15-1, 70.0'-71.5', 75.0'-76.5'			Lab ID	27
				% + No. 40	7
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-13-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.90	18.93	10.87	28	24.4	
20.48	18.60	10.99	23	24.7	
21.53	19.36	11.15	17	26.4	25



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.98	18.01	11.67	15.3	15	10
18.12	17.20	11.16	15.2		

Remarks:

Reviewed By RJ

File: frm_175553023_sum_27.xlsm
Preparation Date: 1998
Revision Date: 1-2008

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Lexington, Kentucky

Laboratory Document
Prepared By: MW
Approved BY: TLK

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Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 15.0'-15.5'	Lab ID	33A
Sample Type	ST	Date Received	11-4-15
		Date Reported	12-9-15

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 17.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	98.8
No. 4	4.75	97.7
No. 10	2	94.9
No. 40	0.425	89.3
No. 200	0.075	73.5
	0.02	58.2
	0.005	42.5
	0.002	31.1
estimated	0.001	24.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	2.3	5.1
Coarse Sand	2.8	5.6
Medium Sand	5.6	---
Fine Sand	15.8	15.8
Silt	31.0	42.4
Clay	42.5	31.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	39
Plastic Limit:	20
Plasticity Index:	19
Activity Index:	0.61

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.73

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (13)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 15.0'-15.5'	Lab ID	33A

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Rounded and Angular
Particle Hardness:	Hard and Durable
Tested By	GW
Test Date	11-20-2015
Date Received	11-04-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	98.8
No. 4	97.7
No. 10	94.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.73

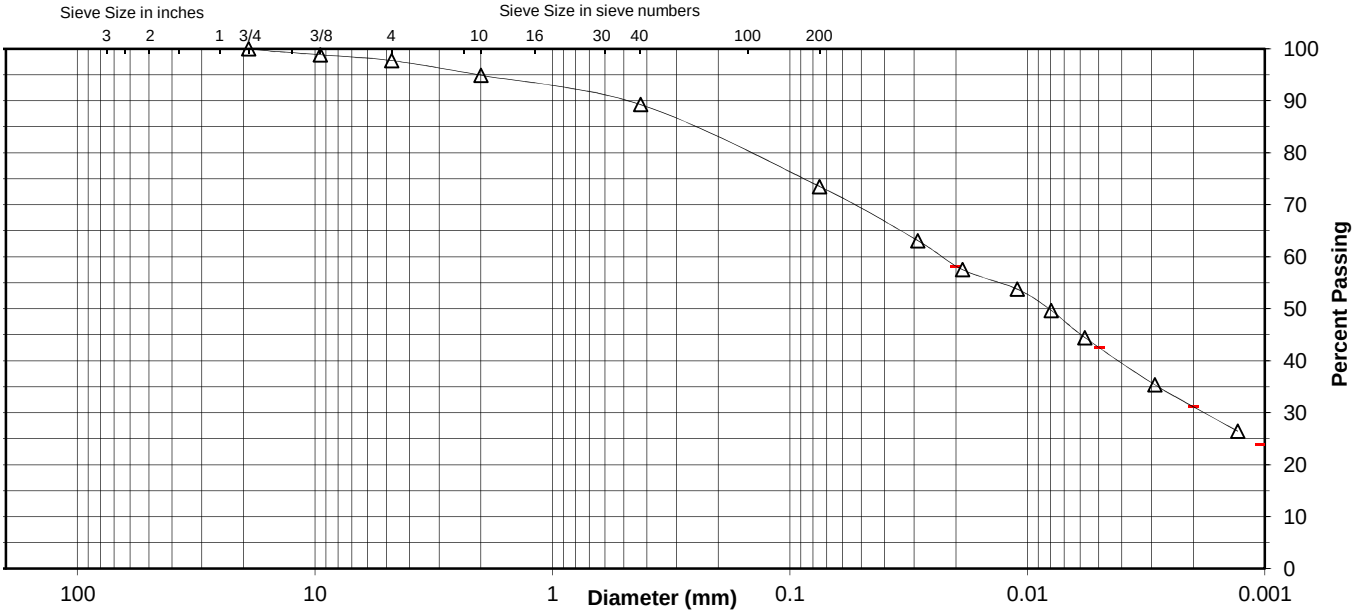
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	89.3
No. 200	73.5
0.02 mm	58.2
0.005 mm	42.5
0.002 mm	31.1
0.001 mm	24.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.3	2.8	5.6	15.8	31.0	42.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	5.1	5.6	15.8	42.4	31.1



Comments

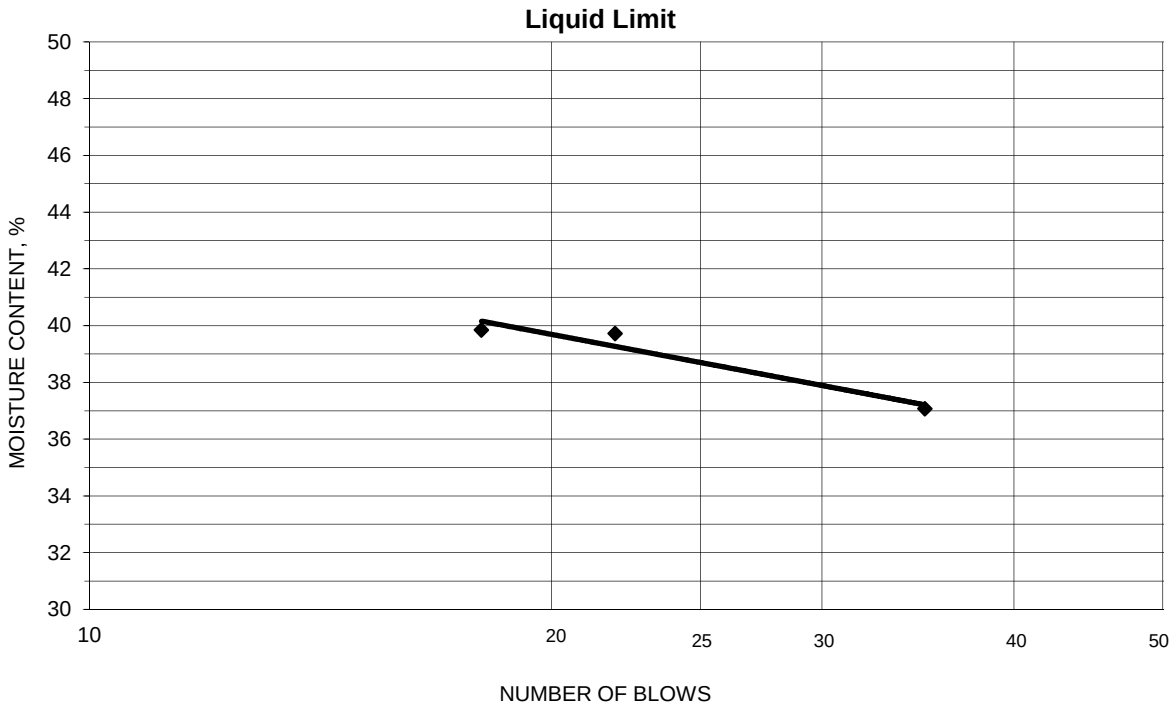
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	SD-15-2, 15.0'-15.5'			Lab ID	33A
				% + No. 40	11
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-30-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.18	17.61	11.16	18	39.8	
20.02	17.49	11.12	22	39.7	
20.64	18.16	11.47	35	37.1	39



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
17.80	16.69	10.98	19.4	20	19
18.63	17.48	11.61	19.6		

Remarks: _____

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 30.0'-30.5'	Lab ID	36A
Sample Type	ST	Date Received	11-4-15
		Date Reported	12-9-15

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 18.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
1 1/2"	37.5	100.0
	N/A	
3/4"	19	96.5
3/8"	9.5	88.2
No. 4	4.75	88.1
No. 10	2	86.2
No. 40	0.425	83.9
No. 200	0.075	76.6
	0.02	63.7
	0.005	45.0
	0.002	29.0
estimated	0.001	19.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	11.9	13.8
Coarse Sand	2.0	2.3
Medium Sand	2.3	---
Fine Sand	7.3	7.3
Silt	31.6	47.6
Clay	45.0	29.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	43
Plastic Limit:	20
Plasticity Index:	23
Activity Index:	0.79

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.76

Classification

Unified Group Symbol: CL

Group Name: Lean clay with gravel

AASHTO Classification: A-7-6 (17)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 30.0'-30.5'	Lab ID	36A

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Rounded and Angular
Particle Hardness:	Hard and Durable
Tested By	GW
Test Date	12-02-2015
Date Received	11-04-2015

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
1 1/2"	100.0
3/4"	96.5
3/8"	88.2
No. 4	88.1
No. 10	86.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.76

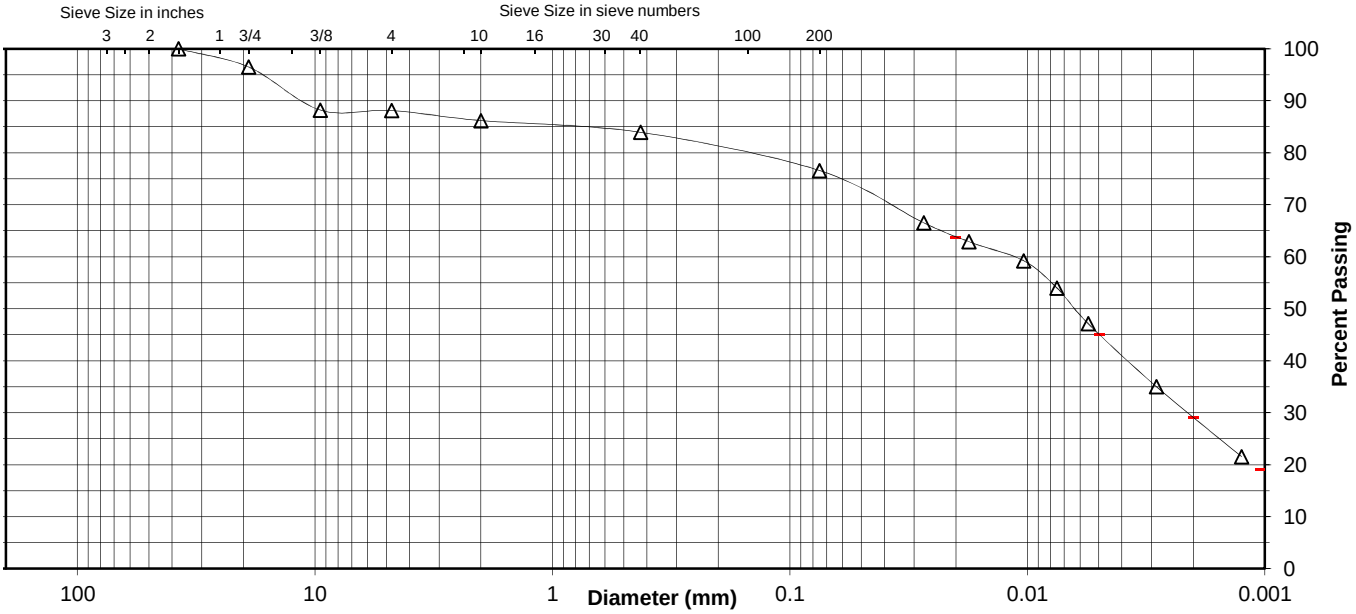
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	83.9
No. 200	76.6
0.02 mm	63.7
0.005 mm	45.0
0.002 mm	29.0
0.001 mm	19.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	3.5	8.4	1.9	2.3	7.3	31.6	45.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	13.8	2.3	7.3	47.6	29.0



Comments

Reviewed By RJ

File: frm_175553023_sum_36a.xlsm
Preparation Date: 1998
Revision Date: 1-2008

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Lexington, Kentucky

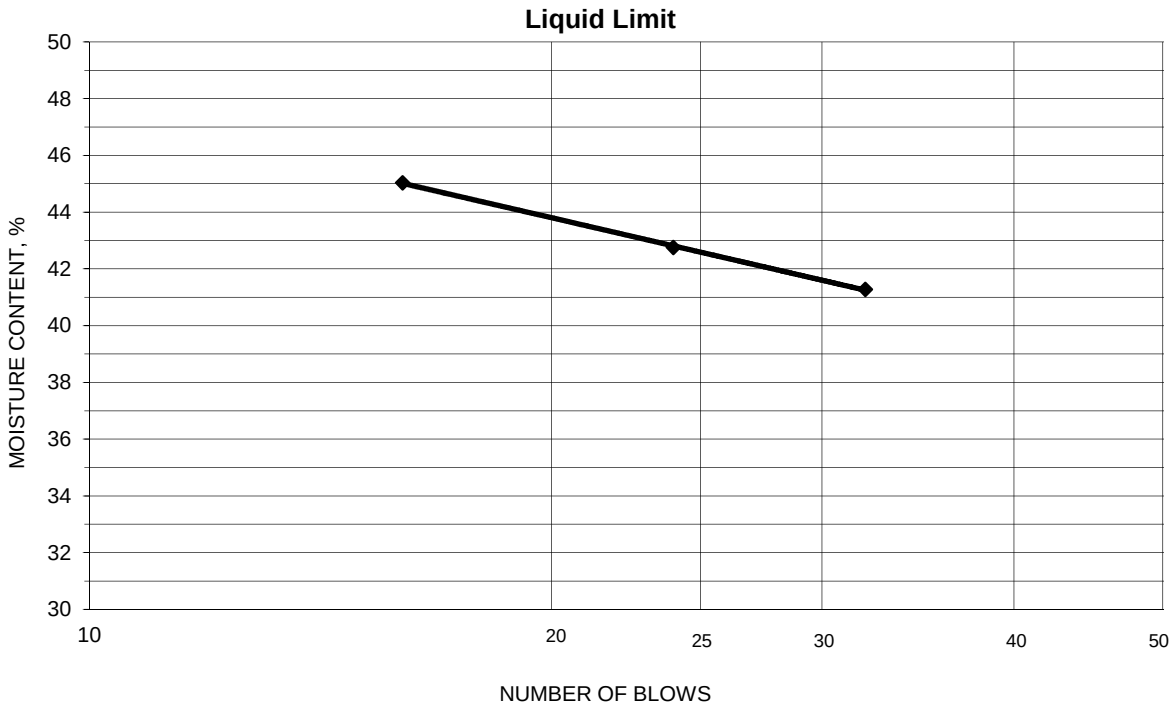
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	SD-15-2, 30.0'-30.5'			Lab ID	36A
				% + No. 40	16
Tested By	DB	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	12-03-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
19.41	17.09	11.47	32	41.3	
19.11	16.66	10.93	24	42.8	
19.11	16.66	11.22	16	45.0	43



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
17.49	16.40	10.86	19.7	20	23
17.30	16.25	10.93	19.7		

Remarks:

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 40.0'-41.5', 45.0'-46.5'	Lab ID	38
Sample Type	SPT Composite	Date Received	11-4-15
		Date Reported	12-1-15

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	95.3
No. 4	4.75	95.0
No. 10	2	91.9
No. 40	0.425	83.1
No. 200	0.075	65.2
	0.02	47.4
	0.005	32.1
	0.002	21.8
estimated	0.001	16.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	5.0	8.1
Coarse Sand	3.1	8.8
Medium Sand	8.8	---
Fine Sand	17.9	17.9
Silt	33.1	43.4
Clay	32.1	21.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	33
Plastic Limit:	19
Plasticity Index:	14
Activity Index:	0.64

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Estimated

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.70

Classification

Unified Group Symbol:	CL
Group Name:	Sandy lean clay
AASHTO Classification:	A-6 (7)

Comments:

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Big Sandy Station, CCR Rule Activities	Project Number	175553023
Source	SD-15-2, 40.0'-41.5', 45.0'-46.5'	Lab ID	38

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Rounded and Angular
Particle Hardness:	Hard and Durable
Tested By	GW
Test Date	11-12-2015
Date Received	11-04-2015

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	95.3
No. 4	95.0
No. 10	91.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

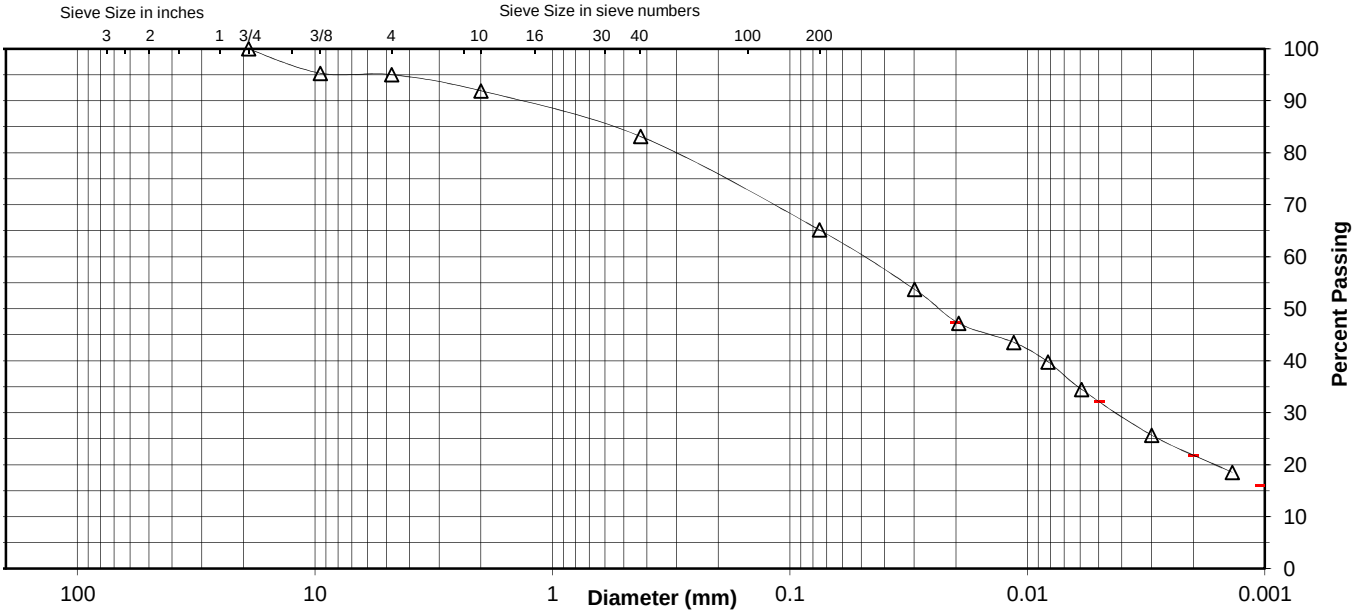
Specific Gravity 2.7

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	83.1
No. 200	65.2
0.02 mm	47.4
0.005 mm	32.1
0.002 mm	21.8
0.001 mm	16.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	5.0	3.1	8.8	17.9	33.1	32.1
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	8.1			8.8	17.9	43.4	21.8



Comments

Reviewed By RJ

File: frm_175553023_sum_38.xlsm
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Lexington, Kentucky

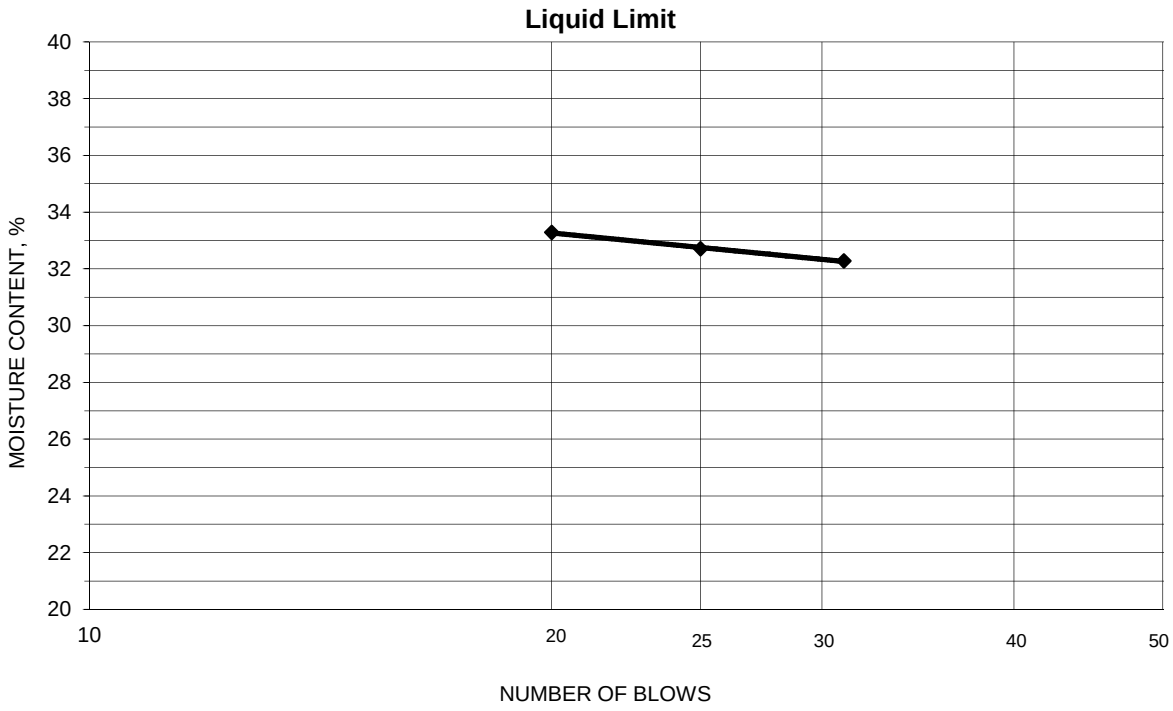
Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

ATTERBERG LIMITS

Project	Big Sandy Station, CCR Rule Activities			Project No.	175553023
Source	SD-15-2, 40.0'-41.5', 45.0'-46.5'			Lab ID	38
				% + No. 40	17
Tested By	KWS	Test Method	ASTM D 4318 Method A	Date Received	11-04-2015
Test Date	11-13-2015	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.97	18.53	11.20	20	33.3	
21.60	19.15	11.66	25	32.7	
20.05	17.90	11.24	31	32.3	33



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.00	16.87	10.84	18.7	19	14
18.10	16.96	10.84	18.6		

Remarks:

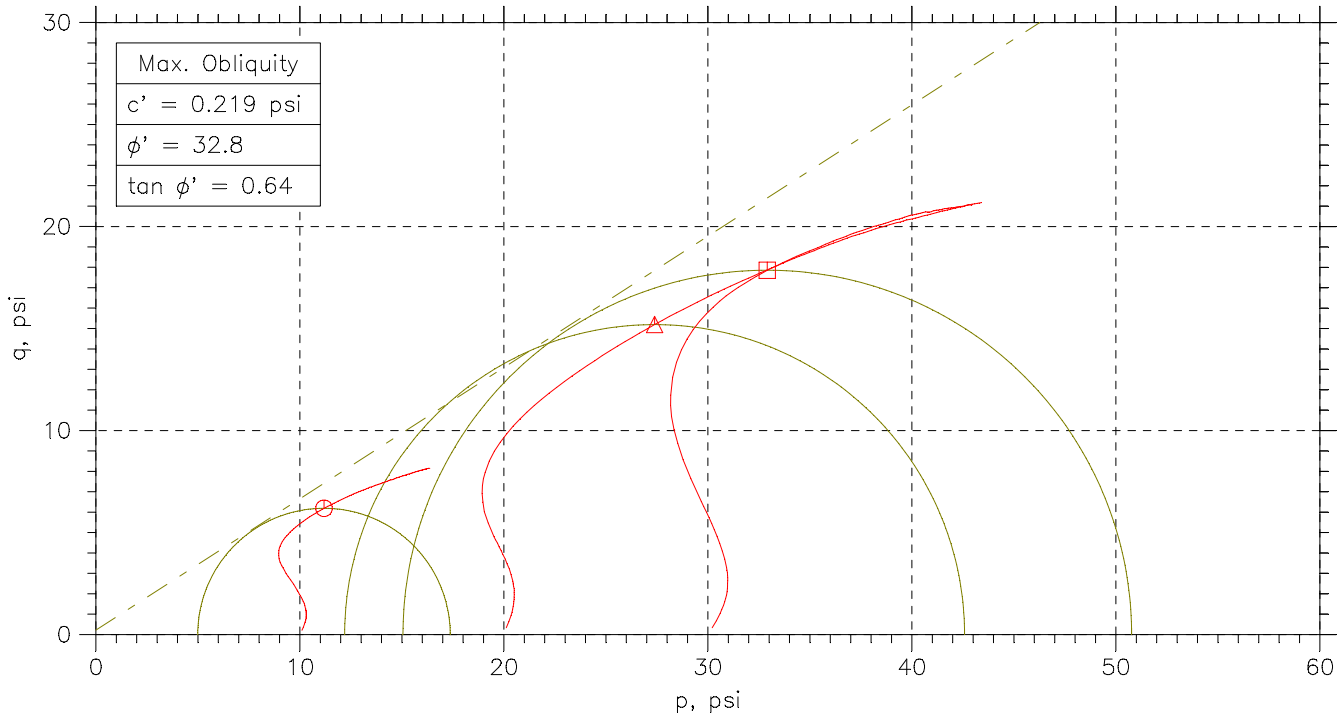
Reviewed By RJ

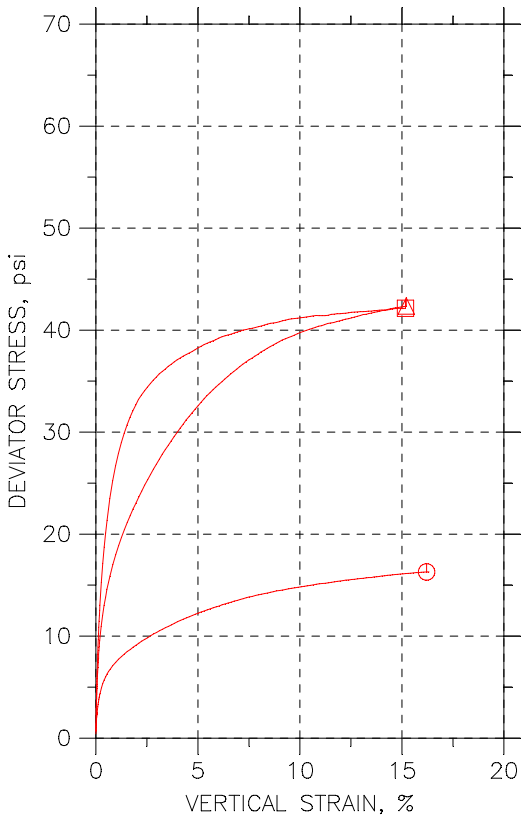
APPENDIX E

CONSOLIDATED-UNDRAINED TRIAXIAL TESTS

BOTTOM ASH POND COMPLEX, 2010

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⏲	△	⊡	
Sample No.		2-A	29-A	2-B	
Test No.		1.1	1.2	1.3	
Depth		5.5-6.0	7.5-8.0	6.1-6.6	
Initial	Diameter, in	2.851	2.849	2.856	
	Height, in	5.995	5.988	5.984	
	Water Content, %	16.2	21.0	13.9	
	Dry Density, pcf	111.7	106.5	122.4	
	Saturation, %	85.8	97.1	99.5	
	Void Ratio	0.509	0.583	0.377	
Before Shear	Water Content, %	17.2	21.7	14.3	
	Dry Density, pcf	115.	106.3	121.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.466	0.586	0.386	
	Back Press., psi	71.57	101	104.4	
Ver. Eff. Cons. Stress, psi		9.894	19.78	29.88	
Shear Strength, psi		8.145	21.18	21.07	
Strain at Failure, %		16.2	15.2	15.2	
Strain Rate, %/min		0.07	0.07	0.07	
B-Value		0.95	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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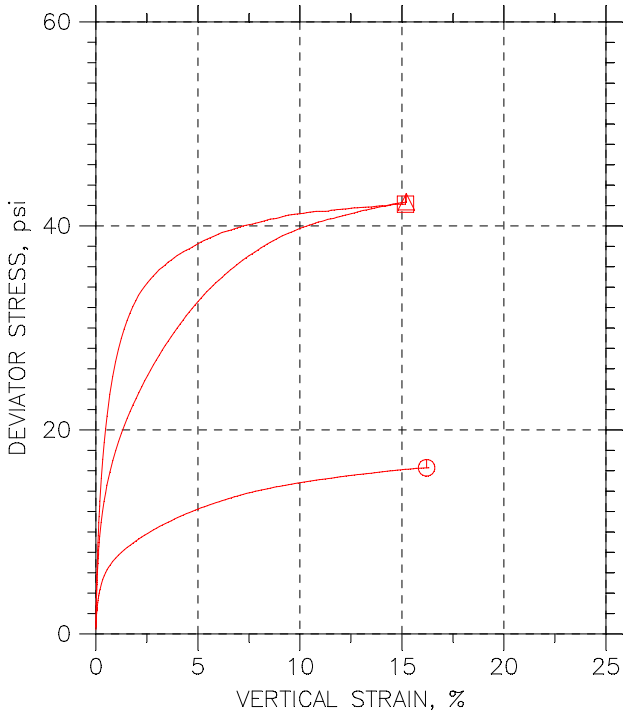
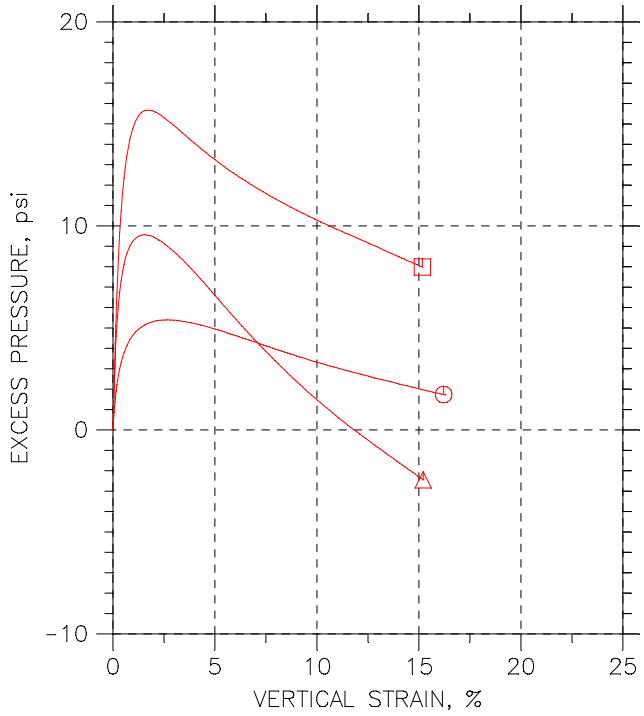
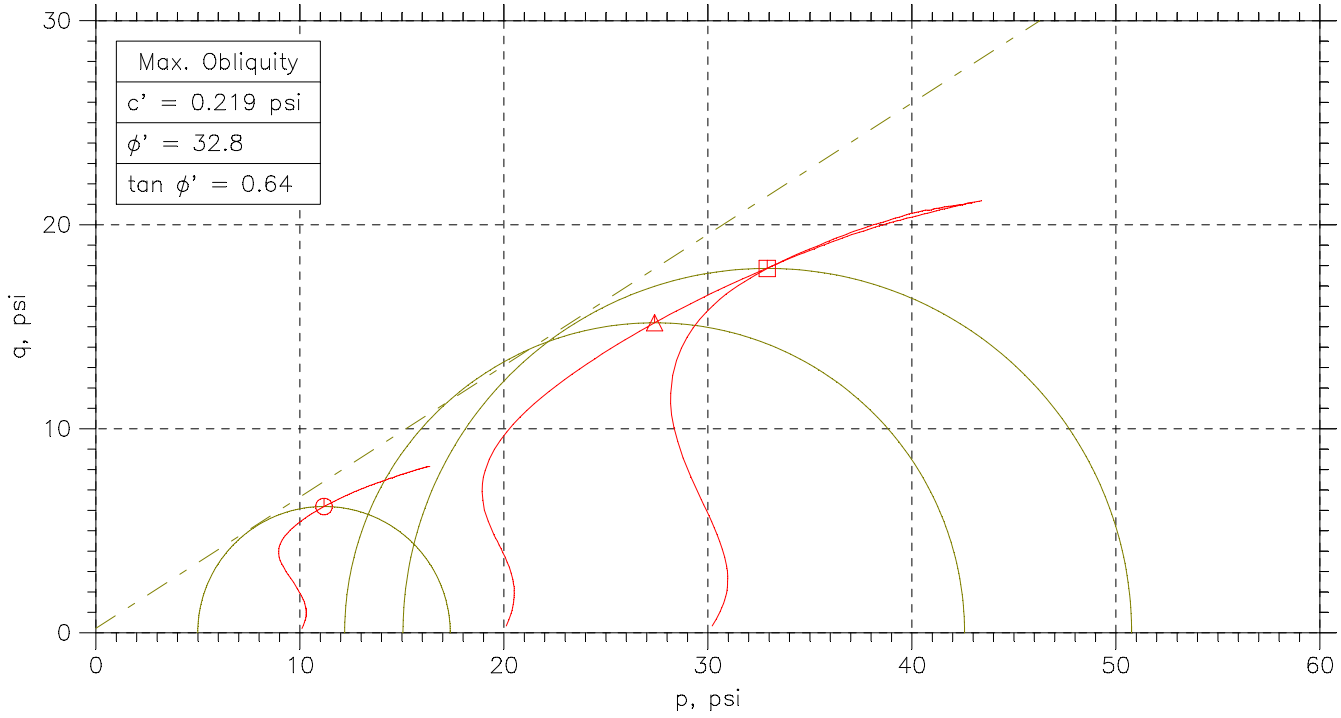
Project: Big Sandy
Location: ---
Project No.: GTX-1515
Boring No.: B-1 & B-4
Sample Type: UD
Description: Light Brown Silty lean clay with sand
Remarks: 2054

Fri, 11-DEC-2009 08:59:33

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	2-A	1.1	5.5-6.0	MM	12/1/09	GT		1515-1.1.dat
△	29-A	1.2	7.5-8.0	jm	12/2/09	mm		1515-1.2.dat
□	2-B	1.3	6.1-6.6	jm	11/30/09	mm		1515-1.3.dat

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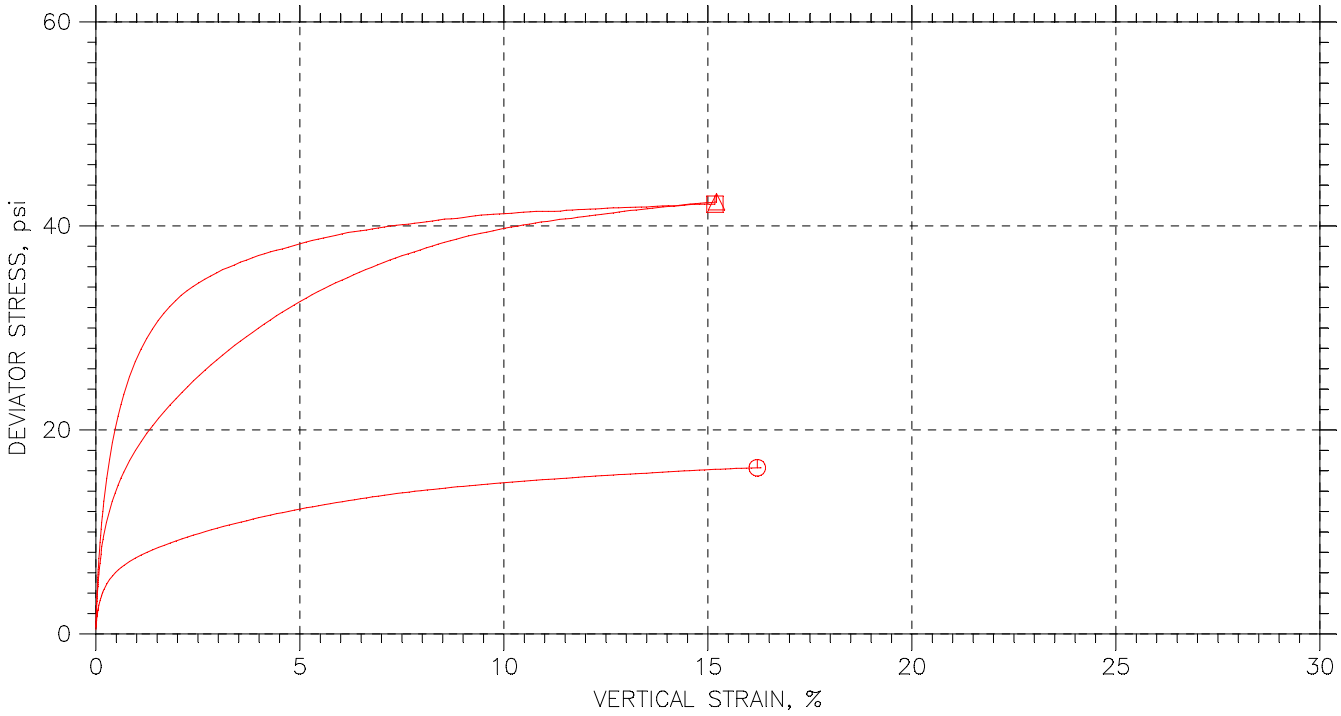
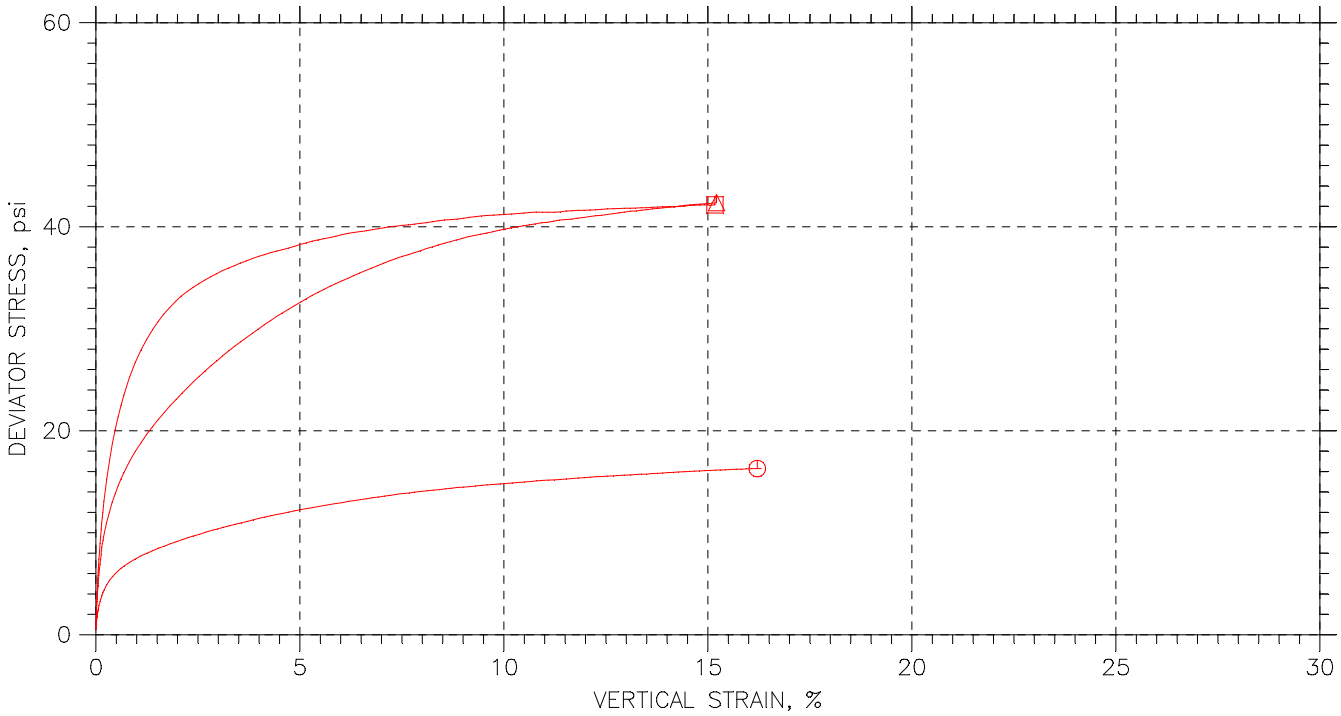
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1 & B-4	Sample Type: UD	
Description: Light Brown Silty lean clay with sand		
Remarks: 2054		

Fri, 11-DEC-2009 08:59:35

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
◷	2-A	1.1	5.5-6.0	MM	12/1/09	GT		1515-1.1.dat
△	29-A	1.2	7.5-8.0	jm	12/2/09	mm		1515-1.2.dat
◳	2-B	1.3	6.1-6.6	jm	11/30/09	mm		1515-1.3.dat

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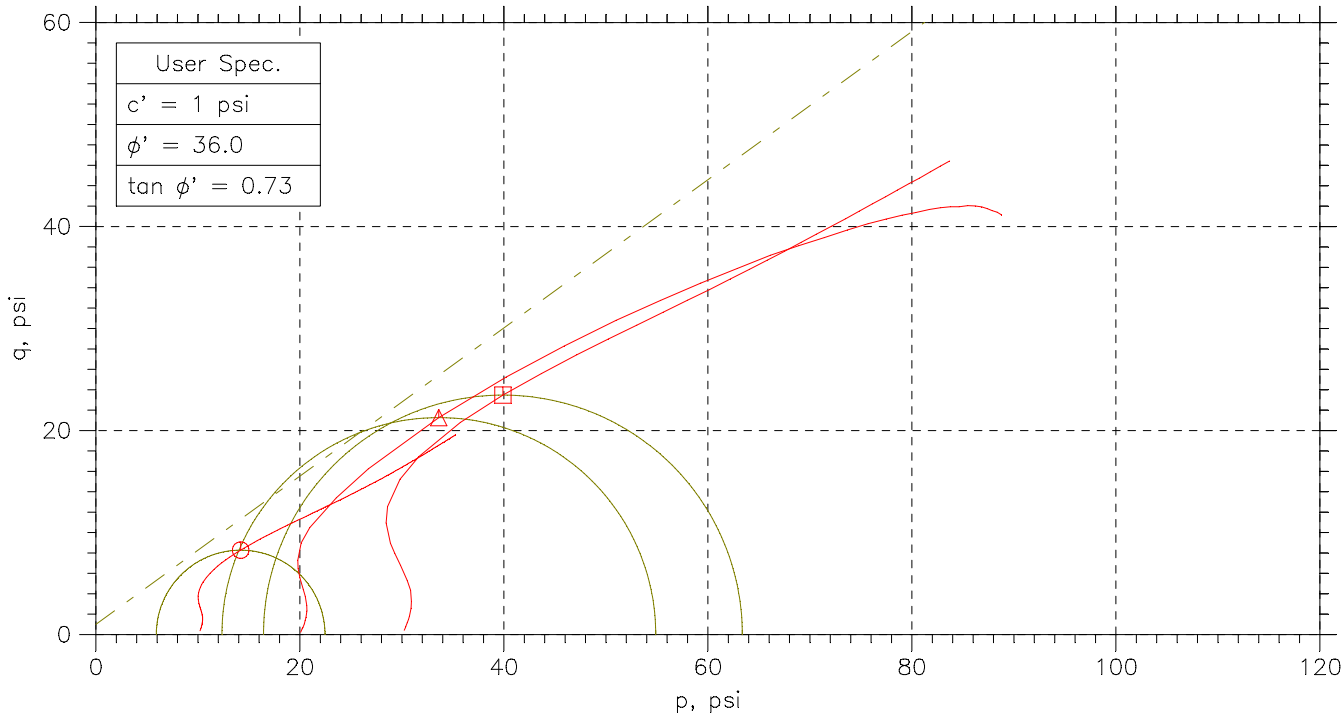
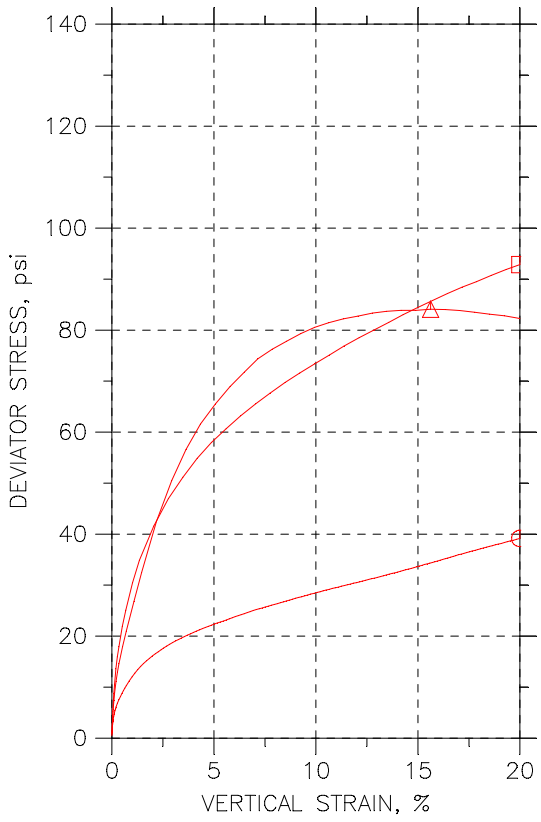
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1 & B-4	Sample Type: UD	
Description: Light Brown Silty lean clay with sand		
Remarks: 2054		

Fri, 11-DEC-2009 08:59:36

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		7A	7-B	7-c	
Test No.		2.1	2.2	2.3	
Depth		15.0-15.5	15.6-16.1	16.2-16.7	
Initial	Diameter, in	2.869	2.832	2.849	
	Height, in	5.999	6.014	5.988	
	Water Content, %	19.4	20.9	20.7	
	Dry Density, pcf	108.9	110.2	108.2	
	Saturation, %	95.7	106.9	100.4	
	Void Ratio	0.547	0.529	0.557	
Before Shear	Water Content, %	21.2	21.4	21.3	
	Dry Density, pcf	107.3	106.8	107.1	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.571	0.579	0.574	
	Back Press., psi	89.29	125.2	116.2	
Ver. Eff. Cons. Stress, psi		9.836	19.84	29.81	
Shear Strength, psi		19.58	42.04	46.42	
Strain at Failure, %		20	15.6	20	
Strain Rate, %/min		0.07	0.07	0.07	
B-Value		0.96	0.95	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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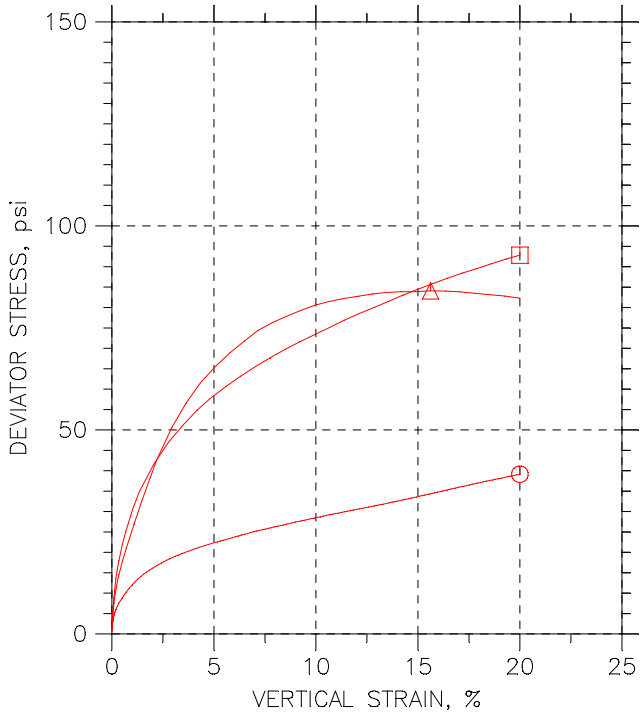
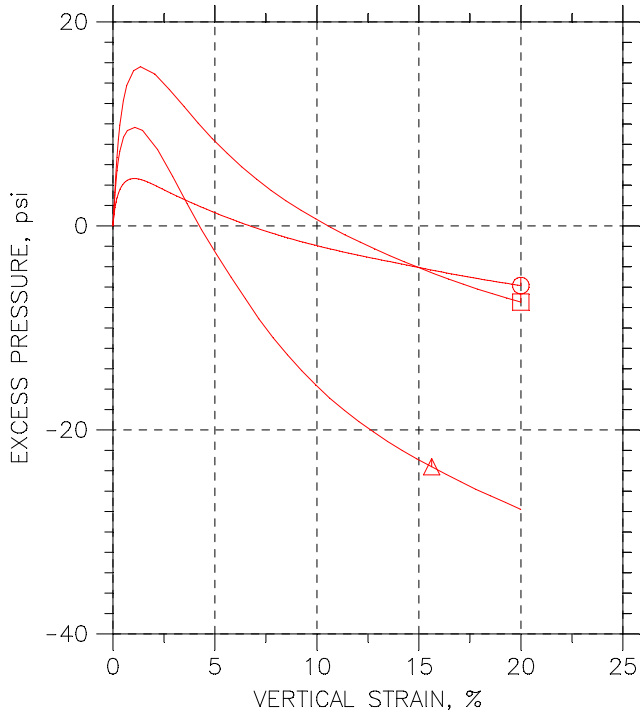
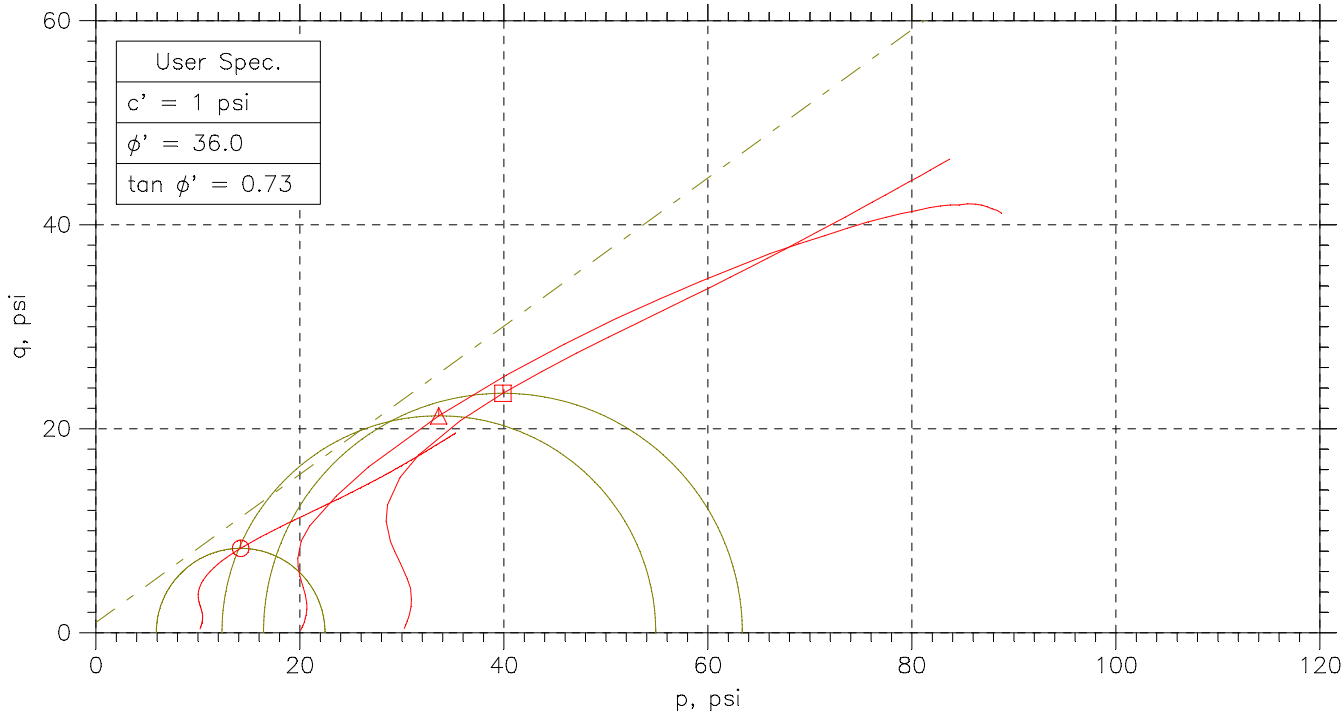
Project: Big Sandy
Location: ---
Project No.: GTX-1515
Boring No.: B-1
Sample Type: UD
Description: Light Brown Lean clay with sand
Remarks: 2054

Fri, 11-DEC-2009 09:08:42

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	7A	2.1	15.0-15.5	jm	12/1/09	mm		1515-2.1.dat
△	7-B	2.2	15.6-16.1	jm	12/2/09	mm		1515-2.2.dat
⊡	7-c	2.3	16.2-16.7	jm	11/30/09	mm		1515-2.3.dat

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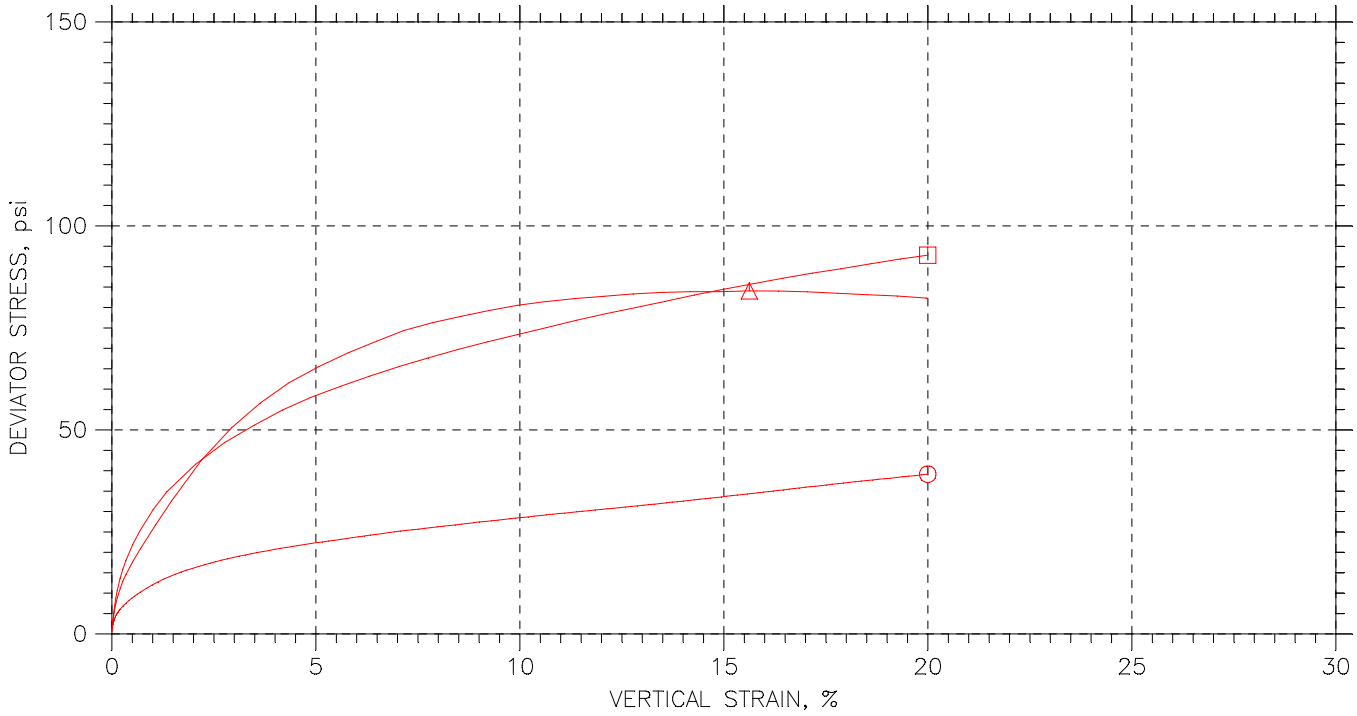
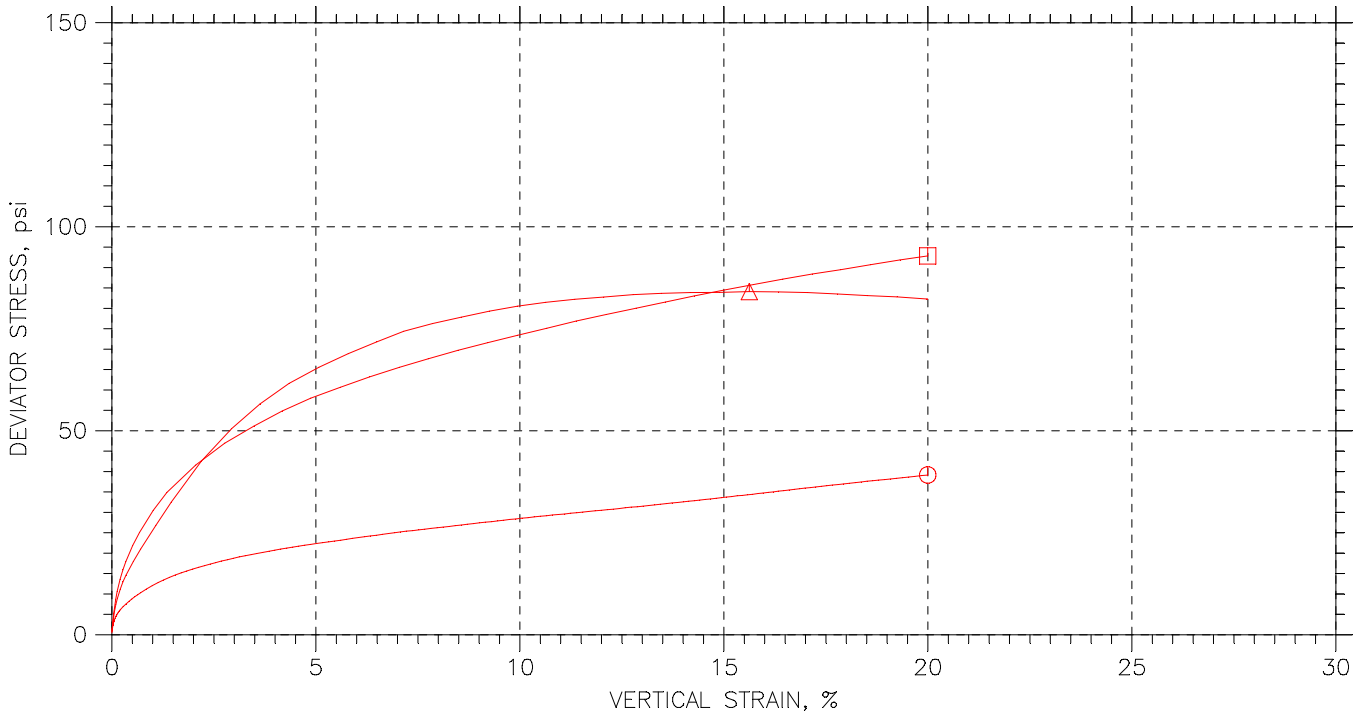
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1	Sample Type: UD	
Description: Light Brown Lean clay with sand		
Remarks: 2054		

Fri, 11-DEC-2009 09:08:43

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	7A	2.1	15.0-15.5	jm	12/1/09	mm		1515-2.1.dat
△	7-B	2.2	15.6-16.1	jm	12/2/09	mm		1515-2.2.dat
◳	7-c	2.3	16.2-16.7	jm	11/30/09	mm		1515-2.3.dat

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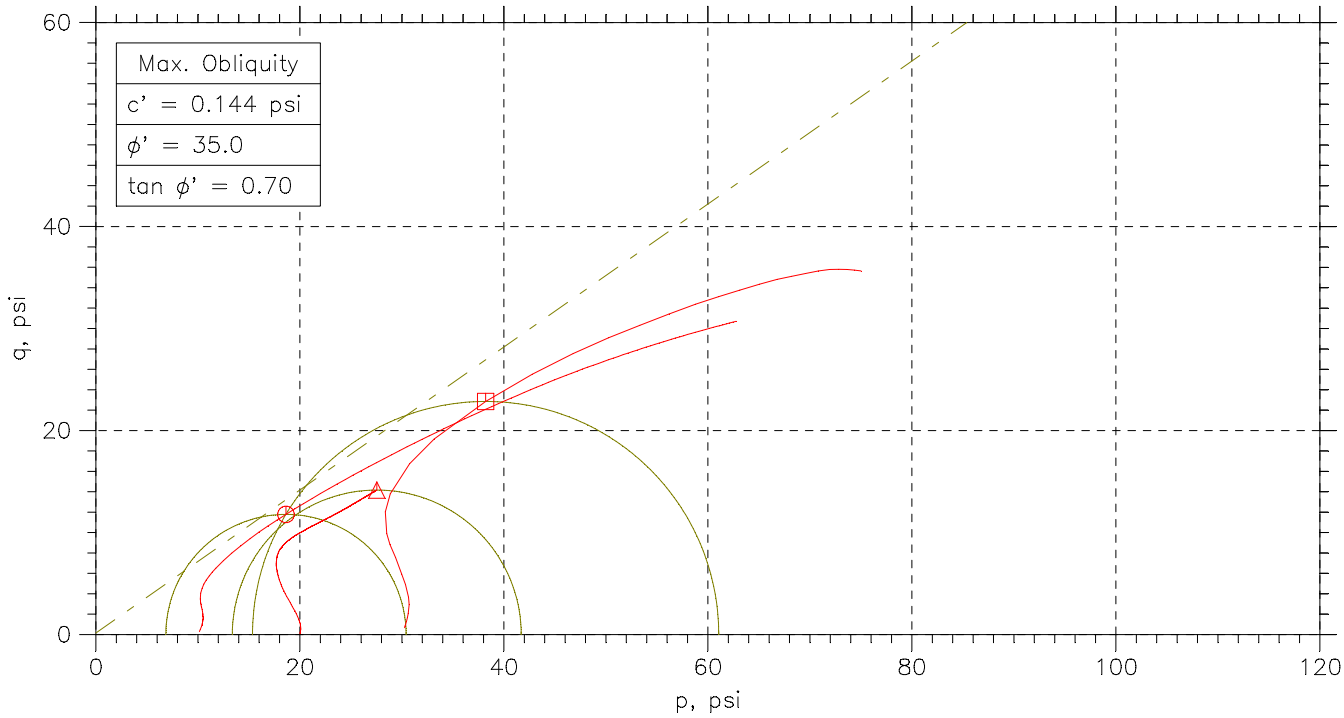
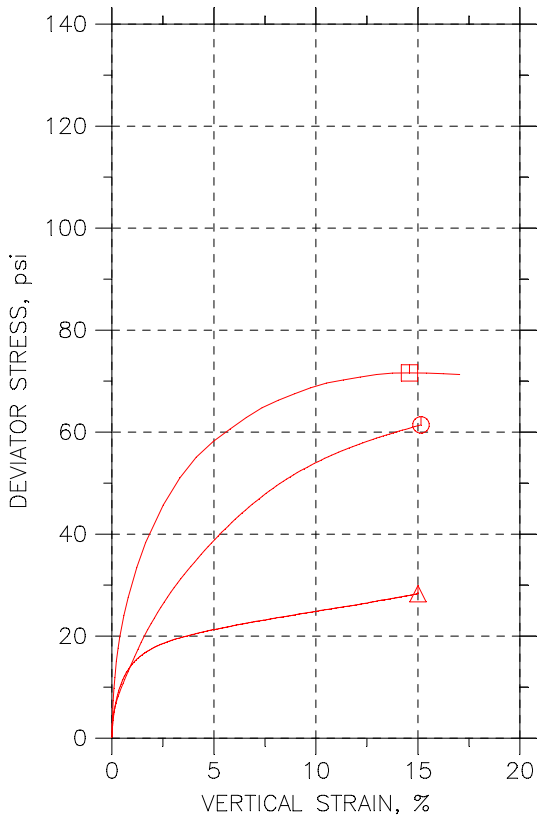
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1	Sample Type: UD	
Description: Light Brown Lean clay with sand		
Remarks: 2054		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		106-B	#81	106-C	
Test No.		3.1	3.2	3.3	
Depth		10.6-11.1	7.5-8.0	11.2-11.7	
Initial	Diameter, in	2.865	2.877	2.85	
	Height, in	5.991	6.013	6.005	
	Water Content, %	19.9	14.3	19.8	
	Dry Density, pcf	109.6	116.3	109.3	
	Saturation, %	99.9	85.8	98.8	
	Void Ratio	0.537	0.45	0.542	
Before Shear	Water Content, %	21.1	14.8	21.6	
	Dry Density, pcf	107.4	120.3	106.5	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.569	0.401	0.582	
	Back Press., psi	92.03	125.4	116.4	
Ver. Eff. Cons. Stress, psi		9.845	19.95	29.59	
Shear Strength, psi		30.7	14.16	35.81	
Strain at Failure, %		15.1	15	14.6	
Strain Rate, %/min		0.08	0.016	0.08	
B-Value		0.95	0.96	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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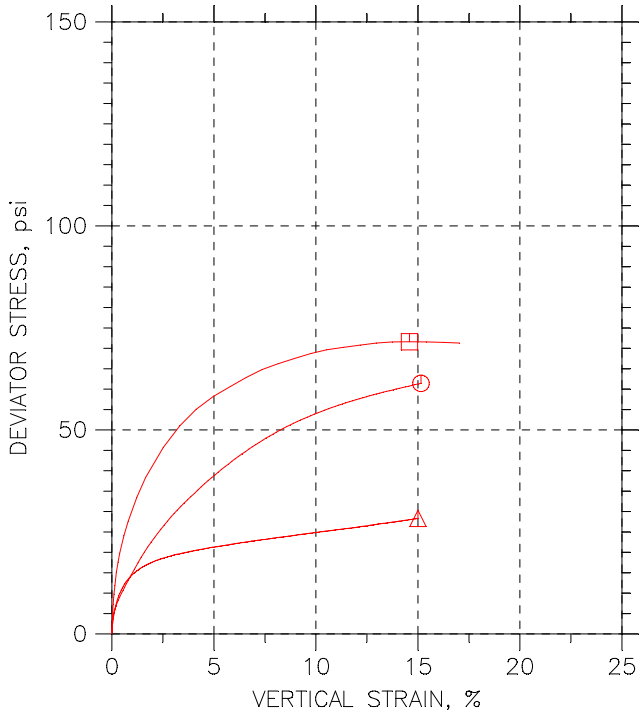
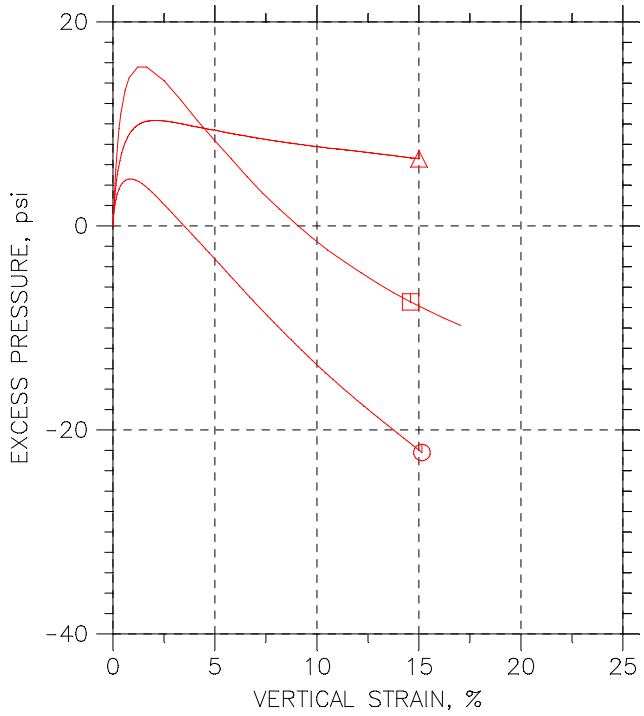
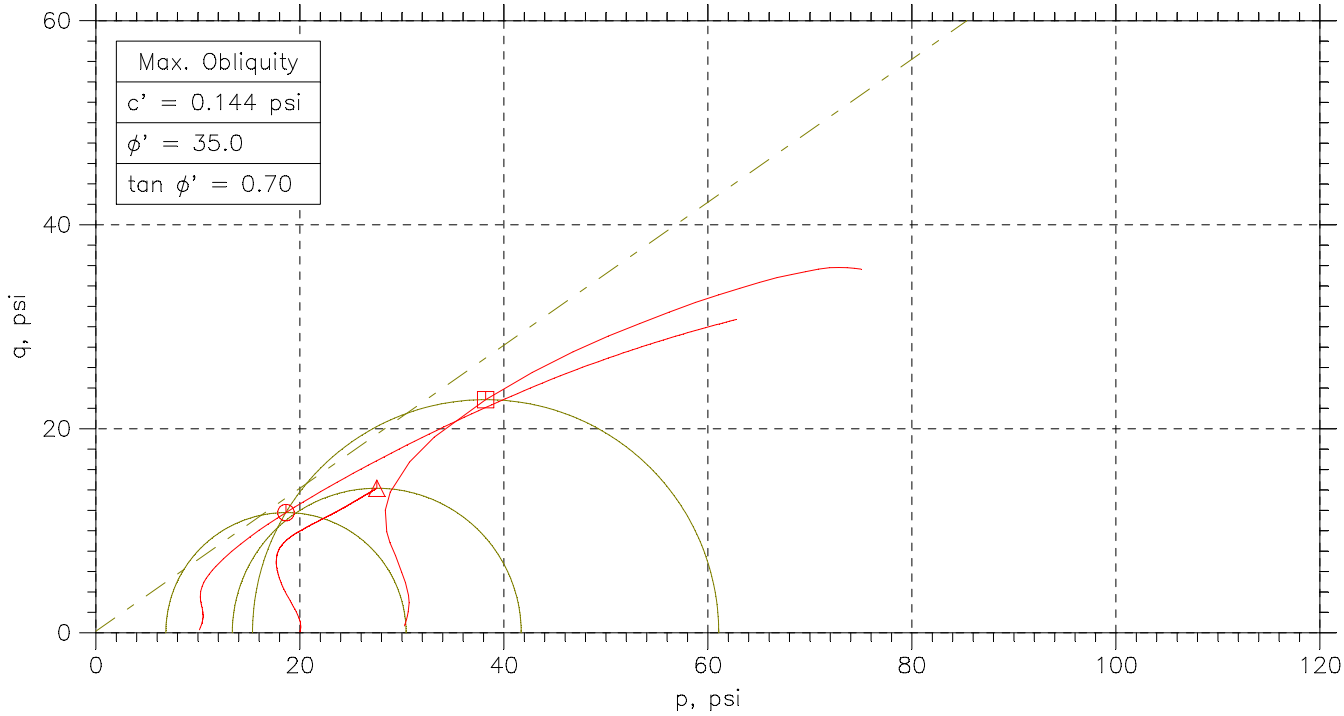
Project: Big Sandy
Location: ---
Project No.: GTX-1515
Boring No.: B-6
Sample Type: UD
Description: Brown clay
Remarks: 2054

Mon, 14-DEC-2009 08:53:47

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	106-B	3.1	10.6-11.1	jm	12/3/09	mm		1515-3.1.dat
△	#81	3.2	7.5-8.0	jm	12/7/09	mm		1515-3.2-REPLACEMENT.dat
□	106-C	3.3	11.2-11.7	jm	12/3/09	mm		1515-3.3.dat

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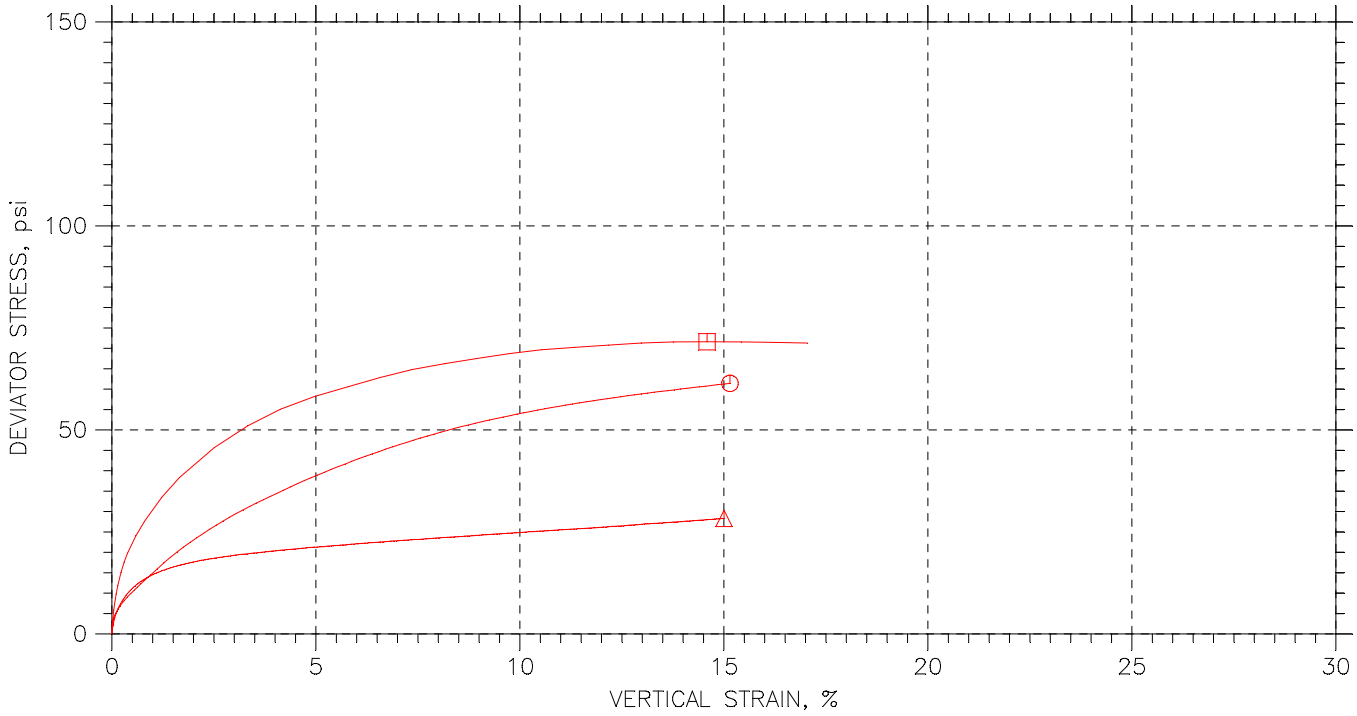
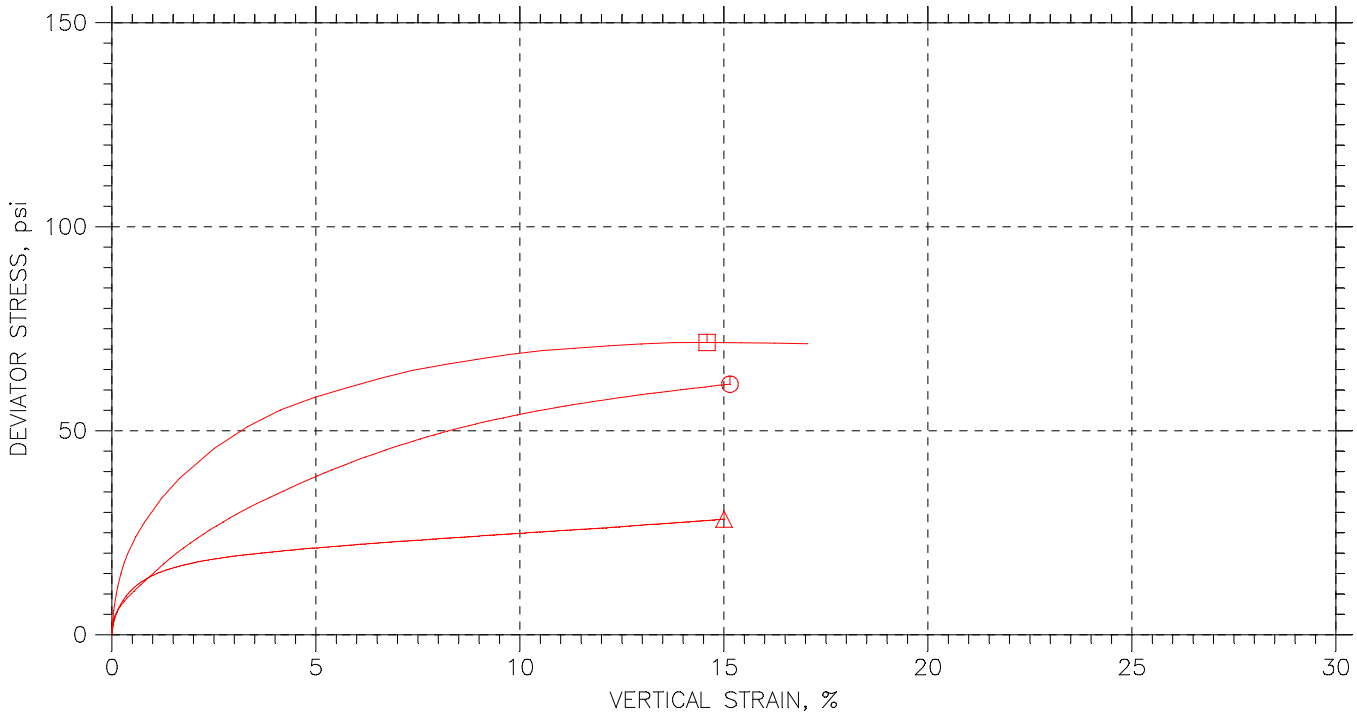
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-6	Sample Type: UD	
Description: Brown clay		
Remarks: 2054		

Mon, 14-DEC-2009 08:53:48

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
◷	106-B	3.1	10.6-11.1	jm	12/3/09	mm		1515-3.1.dat
△	#81	3.2	7.5-8.0	jm	12/7/09	mm		1515-3.2-REPLACEMENT.dat
◳	106-C	3.3	11.2-11.7	jm	12/3/09	mm		1515-3.3.dat

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Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-6	Sample Type: UD	
Description: Brown clay		
Remarks: 2054		

Mon, 14-DEC-2009 08:53:50

BOTTOM ASH POND COMPLEX, 2015

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	BA-15-1, 12.5'-13.0'	Lab ID	2A
Description	Sandy Lean Clay with Gravel (CL), brown, moist, firm	Test ID	2A-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	11/23/2015

Specific Gravity	2.72
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	80
Nominal Consolidation Pressure (psi)	10

Saturation / Consolidation Results

Pore Pressure Parameter B	0.97
Measured Effective Consol. Stress (tsf)	0.715
Time to 50% Consolidation (min)	3.40
Actual Axial Strain Rate of Test (%/min)	0.043

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	140.7
Moisture Content (%)	13.5
Dry Unit Weight (pcf)	124.0
Void Ratio	0.367
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

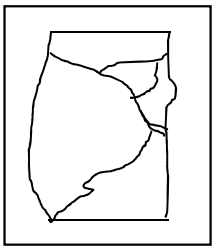
Axial Strain (%)	5.302
Deviator Stress (tsf)	1.131
Induced Pore Pressure (tsf)	0.289
Minor Effective Stress, σ_3' (tsf)	0.426
Major Effective Stress, σ_1' (tsf)	1.557
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.654
p' (tsf)	0.992
q (tsf)	0.565

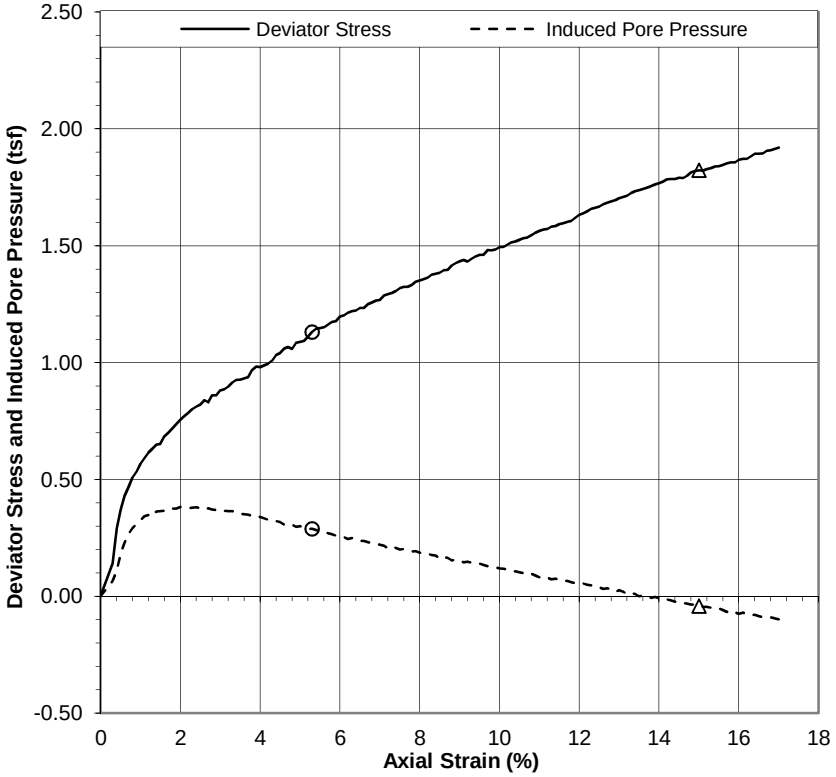
At Consolidated Undrained Failure

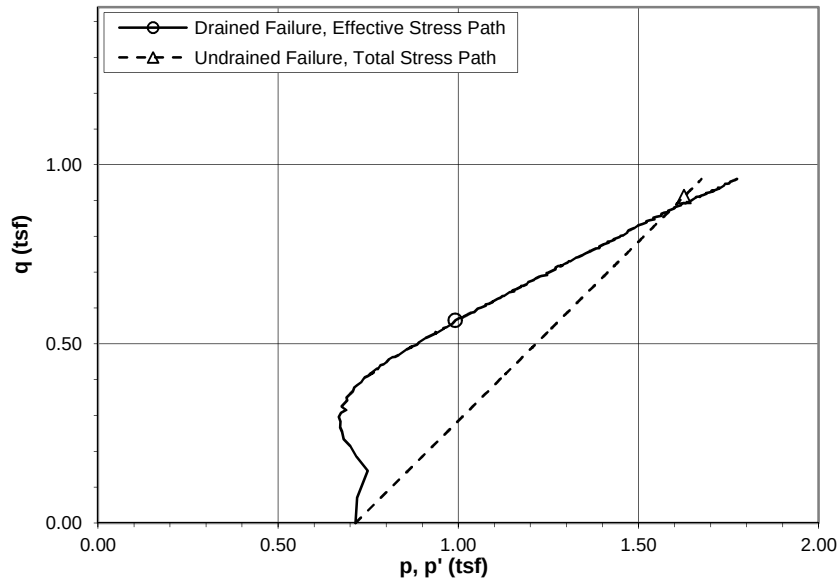
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.006
Deviator Stress (tsf)	1.823
Minor Principal Stress, σ_3 (tsf)	0.715
Major Principal Stress, σ_1 (tsf)	2.538
p (tsf)	1.626
q (tsf)	0.911

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: BA-15-1, 12.5'-13.0'
Description: Sandy Lean Clay with Gravel (CL), brown, moist, firm

Project No.: 175553023
Lab ID: 2A
Test ID: 2A-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.101	Calculated Height (in)	6.048
Average Diameter (in)	2.839	Calculated Diameter (in)	2.785
Calculated Area (in^2)	6.332	Calculated Area (in^2)	6.091
Moist Weight (lb)	3.013	Moist Weight (lb)	3.000
Moist Unit Weight (pcf)	134.8	Moist Unit Weight (pcf)	140.7
Moisture Content (%)	14.0	Moisture Content (%)	13.5
Dry Weight (lb)	2.643	Dry Weight (lb)	2.643
Dry Unit Weight (pcf)	118.2	Dry Unit Weight (pcf)	124.0
Void Ratio	0.434	Void Ratio	0.367
Degree of Saturation (%)	87.8	Degree of Saturation (%)	100.0

Specific Gravity: 2.72
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 0.715

Effective Consolidation Stress
σ_3' (tsf): 0.715

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: BA-15-1, 12.5'-13.0'								Lab ID: 2A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.091	0.000	0.000	5.765	0.000	0.715	0.715	0.715	0.715	0.715	0.000	1.000
7.4	12.0	0.018	0.30	6.109	0.141	0.141	5.831	0.066	0.856	0.790	0.649	0.785	0.719	0.070	1.217
9.6	24.8	0.024	0.40	6.115	0.292	0.291	5.876	0.111	1.006	0.894	0.604	0.860	0.749	0.145	1.482
11.9	31.5	0.030	0.50	6.122	0.371	0.369	5.947	0.182	1.084	0.902	0.533	0.900	0.718	0.185	1.693
14.2	36.6	0.036	0.60	6.128	0.430	0.428	5.994	0.229	1.143	0.915	0.486	0.929	0.701	0.214	1.880
16.5	40.0	0.042	0.70	6.134	0.470	0.468	6.032	0.267	1.183	0.916	0.448	0.949	0.682	0.234	2.045
18.8	43.5	0.049	0.80	6.140	0.511	0.509	6.057	0.292	1.224	0.932	0.423	0.969	0.677	0.254	2.202
21.1	45.8	0.055	0.90	6.146	0.536	0.534	6.075	0.310	1.249	0.939	0.405	0.982	0.672	0.267	2.319
23.5	48.6	0.061	1.00	6.152	0.569	0.566	6.090	0.325	1.281	0.956	0.390	0.998	0.673	0.283	2.453
25.7	50.7	0.067	1.10	6.159	0.593	0.590	6.107	0.342	1.305	0.964	0.373	1.010	0.668	0.295	2.582
28.0	52.9	0.073	1.20	6.165	0.618	0.615	6.113	0.348	1.330	0.982	0.367	1.022	0.674	0.307	2.674
30.3	54.4	0.079	1.30	6.171	0.634	0.631	6.107	0.342	1.346	1.004	0.373	1.030	0.689	0.316	2.691
32.6	55.9	0.085	1.40	6.178	0.652	0.648	6.128	0.363	1.363	1.000	0.352	1.039	0.676	0.324	2.842
34.8	56.3	0.091	1.50	6.184	0.655	0.651	6.129	0.364	1.366	1.003	0.351	1.041	0.677	0.326	2.855
37.2	59.2	0.097	1.60	6.190	0.689	0.685	6.131	0.366	1.400	1.034	0.349	1.057	0.692	0.343	2.961
39.5	60.6	0.103	1.70	6.196	0.704	0.700	6.140	0.375	1.415	1.040	0.340	1.065	0.690	0.350	3.058
41.7	62.3	0.109	1.80	6.203	0.724	0.719	6.140	0.375	1.434	1.059	0.340	1.075	0.700	0.360	3.114
44.0	63.9	0.115	1.90	6.209	0.741	0.736	6.141	0.376	1.451	1.076	0.339	1.083	0.707	0.368	3.171
46.4	65.7	0.121	2.00	6.215	0.761	0.756	6.147	0.382	1.471	1.089	0.333	1.093	0.711	0.378	3.269
48.7	67.0	0.127	2.10	6.222	0.776	0.771	6.145	0.380	1.486	1.106	0.335	1.100	0.720	0.385	3.299
51.0	68.4	0.133	2.20	6.228	0.791	0.786	6.142	0.377	1.501	1.124	0.338	1.108	0.731	0.393	3.327
53.4	69.9	0.139	2.30	6.234	0.807	0.801	6.144	0.379	1.516	1.137	0.336	1.116	0.737	0.401	3.386
55.7	70.9	0.145	2.40	6.241	0.818	0.812	6.146	0.381	1.527	1.147	0.334	1.121	0.741	0.406	3.429
58.0	71.7	0.151	2.50	6.247	0.827	0.820	6.141	0.376	1.535	1.159	0.339	1.125	0.749	0.410	3.423
60.3	73.5	0.157	2.60	6.254	0.846	0.839	6.135	0.370	1.554	1.185	0.345	1.135	0.765	0.420	3.430
62.5	72.8	0.163	2.70	6.260	0.837	0.830	6.141	0.376	1.545	1.169	0.339	1.130	0.754	0.415	3.453
64.8	75.5	0.169	2.80	6.266	0.868	0.861	6.137	0.372	1.576	1.204	0.343	1.145	0.774	0.430	3.507
67.1	75.6	0.176	2.90	6.273	0.867	0.860	6.133	0.368	1.575	1.207	0.347	1.145	0.777	0.430	3.478
69.4	77.4	0.182	3.00	6.279	0.888	0.880	6.136	0.371	1.595	1.224	0.344	1.155	0.784	0.440	3.560
71.7	78.0	0.188	3.10	6.286	0.894	0.886	6.130	0.365	1.601	1.236	0.350	1.158	0.793	0.443	3.535
74.0	79.1	0.194	3.20	6.292	0.905	0.897	6.129	0.364	1.612	1.249	0.351	1.164	0.800	0.449	3.555
76.2	80.8	0.200	3.30	6.299	0.923	0.915	6.129	0.364	1.630	1.266	0.351	1.173	0.808	0.458	3.610
78.4	81.8	0.206	3.40	6.305	0.934	0.926	6.126	0.361	1.641	1.279	0.354	1.178	0.816	0.463	3.617
80.7	82.0	0.212	3.50	6.312	0.935	0.927	6.119	0.354	1.642	1.288	0.361	1.178	0.824	0.463	3.566
85.4	83.2	0.224	3.70	6.325	0.948	0.938	6.114	0.349	1.653	1.304	0.366	1.184	0.835	0.469	3.565
87.6	85.9	0.230	3.80	6.331	0.977	0.968	6.108	0.343	1.683	1.340	0.372	1.199	0.856	0.484	3.604
89.9	87.4	0.236	3.90	6.338	0.993	0.983	6.100	0.335	1.698	1.363	0.380	1.206	0.871	0.491	3.587
92.1	87.3	0.242	4.00	6.345	0.991	0.981	6.105	0.340	1.696	1.356	0.375	1.206	0.866	0.491	3.617
96.6	88.9	0.254	4.20	6.358	1.006	0.996	6.093	0.328	1.711	1.383	0.387	1.213	0.885	0.498	3.572

Project: 175553023			Source: BA-15-1, 12.5'-13.0'								Lab ID: 2A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
98.9	90.1	0.260	4.30	6.365	1.020	1.009	6.093	0.328	1.724	1.396	0.387	1.219	0.891	0.505	3.608
101.2	92.4	0.266	4.40	6.371	1.044	1.033	6.087	0.322	1.748	1.426	0.393	1.231	0.910	0.517	3.628
103.4	93.1	0.272	4.50	6.378	1.051	1.040	6.083	0.318	1.755	1.437	0.397	1.235	0.917	0.520	3.619
105.7	95.0	0.278	4.60	6.385	1.071	1.060	6.072	0.307	1.775	1.468	0.408	1.245	0.938	0.530	3.599
108.0	95.7	0.284	4.70	6.391	1.078	1.067	6.077	0.312	1.782	1.470	0.403	1.248	0.937	0.533	3.645
110.3	95.1	0.290	4.80	6.398	1.070	1.058	6.072	0.307	1.773	1.467	0.408	1.244	0.937	0.529	3.591
112.6	97.5	0.296	4.90	6.405	1.096	1.084	6.062	0.297	1.799	1.502	0.418	1.257	0.960	0.542	3.596
114.9	98.0	0.303	5.00	6.412	1.101	1.088	6.065	0.300	1.803	1.503	0.415	1.259	0.959	0.544	3.623
117.3	98.5	0.309	5.10	6.418	1.105	1.093	6.058	0.293	1.808	1.514	0.422	1.261	0.968	0.546	3.592
119.5	100.4	0.315	5.20	6.425	1.125	1.113	6.053	0.288	1.827	1.540	0.427	1.271	0.984	0.556	3.603
121.8	102.2	0.321	5.30	6.432	1.144	1.131	6.054	0.289	1.846	1.557	0.426	1.280	0.992	0.565	3.654
124.1	103.5	0.327	5.40	6.439	1.158	1.144	6.049	0.284	1.859	1.576	0.431	1.287	1.003	0.572	3.653
126.4	103.9	0.333	5.50	6.445	1.161	1.147	6.042	0.277	1.862	1.586	0.438	1.289	1.012	0.574	3.617
128.6	104.4	0.339	5.60	6.452	1.165	1.151	6.040	0.275	1.866	1.591	0.440	1.291	1.015	0.576	3.619
131.0	105.6	0.345	5.70	6.459	1.177	1.163	6.036	0.271	1.878	1.607	0.444	1.296	1.026	0.581	3.616
133.3	106.6	0.351	5.80	6.466	1.187	1.173	6.031	0.265	1.888	1.623	0.449	1.301	1.036	0.587	3.610
135.5	107.2	0.357	5.90	6.473	1.192	1.178	6.024	0.259	1.892	1.633	0.456	1.304	1.044	0.589	3.584
137.9	109.1	0.363	6.00	6.480	1.212	1.197	6.025	0.260	1.912	1.653	0.455	1.314	1.054	0.599	3.631
140.2	109.7	0.369	6.10	6.487	1.218	1.203	6.019	0.254	1.918	1.664	0.461	1.316	1.063	0.601	3.608
142.5	110.8	0.375	6.20	6.494	1.229	1.213	6.011	0.246	1.928	1.683	0.469	1.322	1.076	0.607	3.586
144.9	111.6	0.381	6.30	6.501	1.236	1.220	6.014	0.249	1.935	1.686	0.466	1.325	1.076	0.610	3.617
147.3	112.0	0.387	6.40	6.507	1.239	1.223	6.007	0.242	1.938	1.697	0.473	1.327	1.085	0.612	3.584
149.6	113.2	0.393	6.50	6.514	1.251	1.234	6.002	0.237	1.949	1.713	0.478	1.332	1.095	0.617	3.582
151.9	113.2	0.399	6.60	6.521	1.250	1.234	6.002	0.237	1.949	1.712	0.478	1.332	1.095	0.617	3.579
154.2	114.9	0.405	6.70	6.528	1.267	1.250	5.996	0.231	1.965	1.734	0.484	1.340	1.109	0.625	3.584
156.5	115.7	0.411	6.80	6.535	1.274	1.257	5.991	0.226	1.972	1.746	0.489	1.344	1.117	0.629	3.574
158.8	116.6	0.418	6.90	6.542	1.283	1.266	5.991	0.226	1.981	1.755	0.489	1.348	1.122	0.633	3.587
161.1	117.0	0.424	7.00	6.549	1.286	1.269	5.986	0.221	1.983	1.762	0.494	1.349	1.128	0.634	3.569
163.4	118.9	0.430	7.10	6.557	1.305	1.288	5.982	0.217	2.003	1.786	0.498	1.359	1.142	0.644	3.586
165.8	119.5	0.436	7.20	6.564	1.310	1.293	5.971	0.206	2.008	1.802	0.509	1.361	1.155	0.646	3.540
168.1	120.1	0.442	7.30	6.571	1.316	1.298	5.978	0.213	2.013	1.800	0.502	1.364	1.151	0.649	3.586
170.4	121.0	0.448	7.40	6.578	1.324	1.306	5.972	0.207	2.021	1.814	0.508	1.368	1.161	0.653	3.569
172.7	122.3	0.454	7.50	6.585	1.337	1.318	5.965	0.200	2.033	1.833	0.515	1.374	1.174	0.659	3.560
174.9	122.9	0.460	7.60	6.592	1.343	1.324	5.968	0.203	2.039	1.836	0.512	1.377	1.174	0.662	3.584
177.3	123.1	0.466	7.70	6.599	1.343	1.324	5.962	0.197	2.039	1.842	0.518	1.377	1.180	0.662	3.557
179.6	124.1	0.472	7.80	6.606	1.352	1.333	5.957	0.192	2.048	1.856	0.523	1.381	1.189	0.666	3.548
181.9	125.4	0.478	7.90	6.613	1.366	1.346	5.958	0.193	2.061	1.868	0.522	1.388	1.195	0.673	3.581
184.2	126.1	0.484	8.00	6.621	1.371	1.351	5.951	0.186	2.066	1.880	0.529	1.391	1.204	0.676	3.556
186.4	126.8	0.490	8.10	6.628	1.377	1.357	5.948	0.183	2.072	1.889	0.532	1.393	1.210	0.679	3.553
188.7	127.6	0.496	8.20	6.635	1.385	1.364	5.947	0.182	2.079	1.897	0.533	1.397	1.215	0.682	3.560
191.0	128.8	0.502	8.30	6.642	1.396	1.376	5.942	0.177	2.091	1.914	0.538	1.403	1.226	0.688	3.557
193.3	129.4	0.508	8.40	6.650	1.401	1.380	5.939	0.174	2.095	1.921	0.541	1.405	1.231	0.690	3.553
195.5	130.0	0.514	8.50	6.657	1.406	1.385	5.925	0.160	2.100	1.939	0.555	1.407	1.247	0.692	3.497
197.8	131.2	0.520	8.60	6.664	1.417	1.396	5.934	0.168	2.111	1.942	0.546	1.413	1.244	0.698	3.554
200.1	131.5	0.526	8.70	6.671	1.419	1.397	5.929	0.164	2.112	1.948	0.551	1.414	1.250	0.699	3.536
202.4	133.4	0.532	8.80	6.679	1.438	1.416	5.918	0.153	2.131	1.978	0.562	1.423	1.270	0.708	3.521
204.7	134.4	0.539	8.90	6.686	1.447	1.425	5.923	0.158	2.140	1.982	0.557	1.428	1.269	0.713	3.560
207.1	135.4	0.545	9.00	6.694	1.456	1.434	5.919	0.154	2.149	1.995	0.561	1.432	1.278	0.717	3.554
209.4	136.0	0.551	9.10	6.701	1.461	1.439	5.910	0.145	2.154	2.009	0.570	1.434	1.289	0.719	3.525
211.7	135.6	0.557	9.20	6.708	1.456	1.433	5.913	0.148	2.148	1.999	0.567	1.431	1.283	0.716	3.529
214.0	136.9	0.563	9.30	6.716	1.468	1.445	5.909	0.144	2.160	2.016	0.571	1.437	1.293	0.722	3.530
216.3	137.9	0.569	9.40	6.723	1.477	1.454	5.903	0.138	2.169	2.031	0.577	1.442	1.304	0.727	3.519
218.6	138.7	0.575	9.50	6.730	1.484	1.460	5.904	0.139	2.175	2.036	0.576	1.445	1.306	0.730	3.537
220.9	139.0	0.581	9.60	6.738	1.485	1.462	5.900	0.134	2.176	2.042	0.580	1.446	1.311	0.731	3.518
223.2	141.0	0.587	9.70	6.745	1.505	1.481	5.894	0.129	2.196	2.067	0.586	1.456	1.327	0.741	3.527
225.5	141.1	0.593	9.80	6.753	1.505	1.480	5.894	0.128	2.195	2.067	0.586	1.455	1.327	0.740	3.524
227.8	141.7	0.599	9.90	6.760	1.509	1.485	5.890	0.125	2.200	2.075	0.590	1.457	1.333	0.742	3.516
230.1	142.8	0.605	10.00	6.768	1.519	1.494	5.884	0.119	2.209	2.090	0.596	1.462	1.343	0.747	3.507
232.5	143.1	0.611	10.10	6.775	1.520	1.495	5.883	0.118	2.210	2.093	0.597	1.463	1.345	0.748	3.503
234.9	144.2	0.617	10.20	6.783	1.530	1.505	5.879	0.114	2.220	2.106	0.601	1.467	1.353	0.752	3.504
237.3	145.3	0.623	10.30	6.791	1.541	1.515	5.874	0.109	2.230	2.121	0.606	1.472	1.364	0.757	3.499
239.6	145.9	0.629	10.40	6.798	1.545	1.519	5.873	0.108	2.234	2.127	0.607	1.475	1.367	0.760	3.501
242.0	146.7	0.635	10.50	6.806	1.552	1.525	5.868	0.103	2.240	2.137	0.612	1.478	1.374	0.763	3.495
244.4	147.5	0.641	10.60	6.813	1.559	1.533	5.864	0.099	2.248	2.149	0.616	1.481	1.382	0.766	3.488
246.7	148.0	0.647	10.70	6.821	1.562	1.535	5.857	0.092	2.250	2.159	0.623	1.483	1.391	0.768	3.462
249.0	149.0	0.653	10.80	6.829	1.571	1.544	5.861	0.096	2.259	2.163	0.619	1.487	1.391	0.772	3.495
251.3	150.3	0.659	10.90	6.836	1.583	1.555	5.854	0.089	2.270	2.182	0.626	1.493	1.404	0.778	3.483
253.7	151.3	0.666	11.00	6.844	1.592	1.564	5.845	0.080	2.279	2.199	0.635	1.497	1.417	0.782	3.465
255.9	152.0	0.672	11.10	6.852	1.597	1.569	5.851	0.085	2.284	2.199	0.629	1.500	1.414	0.785	3.493

Project: 175553023			Source: BA-15-1, 12.5'-13.0'								Lab ID: 2A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
258.3	152.5	0.678	11.20	6.859	1.600	1.572	5.845	0.080	2.287	2.208	0.635	1.501	1.421	0.786	3.475
260.6	153.6	0.684	11.30	6.867	1.610	1.582	5.838	0.073	2.297	2.224	0.642	1.506	1.433	0.791	3.465
262.9	154.0	0.690	11.40	6.875	1.612	1.584	5.841	0.075	2.299	2.224	0.639	1.507	1.432	0.792	3.477
265.2	154.9	0.696	11.50	6.883	1.621	1.592	5.835	0.070	2.307	2.237	0.645	1.511	1.441	0.796	3.467
267.5	155.6	0.702	11.60	6.890	1.626	1.597	5.830	0.065	2.312	2.247	0.650	1.513	1.449	0.798	3.456
269.8	156.3	0.708	11.70	6.898	1.632	1.603	5.831	0.066	2.318	2.251	0.649	1.516	1.450	0.801	3.471
272.1	156.9	0.714	11.80	6.906	1.636	1.607	5.825	0.060	2.322	2.262	0.655	1.518	1.458	0.803	3.454
274.4	158.4	0.720	11.90	6.914	1.650	1.620	5.822	0.057	2.335	2.278	0.658	1.525	1.468	0.810	3.461
276.6	159.8	0.726	12.00	6.922	1.662	1.632	5.824	0.059	2.347	2.288	0.656	1.531	1.472	0.816	3.490
279.0	160.7	0.732	12.10	6.930	1.670	1.640	5.820	0.055	2.355	2.300	0.660	1.535	1.480	0.820	3.485
281.3	161.6	0.738	12.20	6.937	1.677	1.647	5.814	0.049	2.362	2.313	0.666	1.539	1.489	0.824	3.474
283.5	163.0	0.744	12.30	6.945	1.689	1.659	5.811	0.046	2.374	2.328	0.669	1.544	1.498	0.829	3.481
285.9	163.5	0.750	12.40	6.953	1.693	1.663	5.810	0.045	2.378	2.333	0.670	1.546	1.501	0.831	3.482
288.2	164.3	0.756	12.50	6.961	1.699	1.668	5.804	0.039	2.383	2.344	0.676	1.549	1.510	0.834	3.466
290.4	165.4	0.762	12.60	6.969	1.709	1.678	5.797	0.032	2.393	2.361	0.683	1.554	1.522	0.839	3.456
292.7	166.3	0.768	12.70	6.977	1.716	1.684	5.800	0.035	2.399	2.364	0.680	1.557	1.522	0.842	3.476
295.1	167.0	0.774	12.80	6.985	1.721	1.689	5.794	0.029	2.404	2.375	0.686	1.560	1.530	0.845	3.463
297.4	167.7	0.781	12.90	6.993	1.727	1.695	5.783	0.018	2.410	2.392	0.697	1.562	1.544	0.847	3.432
299.7	168.8	0.787	13.00	7.001	1.736	1.704	5.791	0.026	2.419	2.393	0.689	1.567	1.541	0.852	3.472
302.1	169.6	0.793	13.10	7.009	1.742	1.709	5.784	0.019	2.424	2.405	0.696	1.570	1.550	0.855	3.458
304.4	170.3	0.799	13.21	7.017	1.747	1.715	5.774	0.009	2.430	2.421	0.706	1.572	1.563	0.857	3.428
306.6	171.6	0.805	13.30	7.026	1.759	1.726	5.780	0.015	2.440	2.426	0.700	1.578	1.563	0.863	3.463
309.0	172.6	0.811	13.40	7.034	1.767	1.733	5.774	0.009	2.448	2.439	0.706	1.582	1.572	0.867	3.457
311.3	173.2	0.817	13.50	7.042	1.771	1.737	5.766	0.001	2.452	2.452	0.714	1.584	1.583	0.869	3.432
313.6	174.0	0.823	13.61	7.050	1.778	1.744	5.770	0.005	2.459	2.454	0.710	1.587	1.582	0.872	3.454
315.9	174.8	0.829	13.70	7.058	1.783	1.749	5.764	-0.001	2.464	2.465	0.716	1.590	1.591	0.875	3.443
318.2	175.7	0.835	13.81	7.066	1.790	1.756	5.759	-0.006	2.471	2.477	0.721	1.593	1.599	0.878	3.434
320.6	176.6	0.841	13.91	7.075	1.797	1.762	5.762	-0.003	2.477	2.480	0.718	1.596	1.599	0.881	3.454
322.8	177.4	0.847	14.01	7.083	1.803	1.768	5.756	-0.009	2.483	2.493	0.724	1.599	1.609	0.884	3.441
325.1	178.2	0.853	14.10	7.091	1.810	1.775	5.750	-0.015	2.490	2.505	0.730	1.602	1.617	0.887	3.431
327.5	179.3	0.859	14.21	7.099	1.819	1.784	5.752	-0.013	2.498	2.512	0.728	1.607	1.620	0.892	3.450
329.9	179.8	0.865	14.31	7.108	1.821	1.786	5.747	-0.018	2.501	2.518	0.733	1.608	1.626	0.893	3.437
332.2	180.0	0.871	14.40	7.116	1.821	1.785	5.742	-0.023	2.500	2.524	0.738	1.608	1.631	0.893	3.418
334.6	180.8	0.877	14.51	7.124	1.828	1.792	5.742	-0.023	2.507	2.530	0.738	1.611	1.634	0.896	3.427
337.0	180.9	0.883	14.60	7.133	1.826	1.790	5.737	-0.028	2.505	2.533	0.743	1.610	1.638	0.895	3.408
339.4	182.0	0.889	14.70	7.141	1.835	1.799	5.733	-0.032	2.514	2.546	0.747	1.614	1.646	0.899	3.408
341.8	183.9	0.896	14.81	7.149	1.852	1.815	5.730	-0.035	2.530	2.565	0.750	1.622	1.657	0.907	3.420
344.1	184.6	0.901	14.90	7.158	1.857	1.820	5.730	-0.035	2.535	2.570	0.750	1.625	1.660	0.910	3.427
346.5	185.1	0.908	15.01	7.166	1.860	1.823	5.724	-0.041	2.538	2.579	0.756	1.626	1.667	0.911	3.411
348.9	185.1	0.914	15.11	7.175	1.858	1.821	5.720	-0.045	2.536	2.580	0.760	1.625	1.670	0.910	3.396
351.3	186.1	0.920	15.21	7.183	1.866	1.828	5.720	-0.045	2.543	2.588	0.760	1.629	1.674	0.914	3.406
353.7	186.8	0.926	15.31	7.192	1.870	1.832	5.716	-0.049	2.547	2.596	0.764	1.631	1.680	0.916	3.398
356.1	187.7	0.932	15.41	7.200	1.877	1.838	5.711	-0.054	2.553	2.608	0.769	1.634	1.688	0.919	3.390
358.4	188.2	0.938	15.50	7.208	1.880	1.841	5.713	-0.052	2.556	2.608	0.767	1.635	1.688	0.921	3.400
360.7	188.9	0.944	15.61	7.217	1.884	1.845	5.706	-0.059	2.560	2.619	0.774	1.638	1.697	0.923	3.384
363.0	189.9	0.950	15.71	7.226	1.892	1.853	5.698	-0.067	2.568	2.635	0.782	1.641	1.708	0.926	3.369
365.3	190.4	0.956	15.81	7.234	1.895	1.856	5.705	-0.060	2.571	2.631	0.775	1.643	1.703	0.928	3.396
367.6	190.8	0.962	15.91	7.243	1.897	1.857	5.697	-0.069	2.572	2.641	0.783	1.644	1.712	0.929	3.371
369.8	192.0	0.968	16.01	7.251	1.907	1.867	5.690	-0.075	2.582	2.657	0.790	1.649	1.724	0.934	3.363
372.1	192.8	0.974	16.11	7.260	1.912	1.872	5.695	-0.070	2.587	2.657	0.785	1.651	1.721	0.936	3.384
374.4	193.0	0.980	16.21	7.269	1.911	1.871	5.688	-0.077	2.586	2.663	0.792	1.651	1.727	0.936	3.364
376.7	194.4	0.986	16.31	7.278	1.924	1.883	5.684	-0.081	2.598	2.679	0.796	1.657	1.737	0.942	3.367
379.0	195.8	0.992	16.41	7.286	1.935	1.894	5.686	-0.079	2.609	2.688	0.794	1.662	1.741	0.947	3.386
381.2	196.0	0.998	16.51	7.295	1.934	1.893	5.681	-0.084	2.608	2.692	0.799	1.662	1.746	0.947	3.369
383.5	196.4	1.004	16.61	7.304	1.936	1.895	5.677	-0.088	2.610	2.698	0.803	1.663	1.751	0.948	3.360
385.9	197.8	1.010	16.71	7.312	1.948	1.906	5.678	-0.087	2.621	2.709	0.802	1.668	1.756	0.953	3.376
388.2	198.4	1.016	16.81	7.321	1.951	1.909	5.674	-0.091	2.624	2.715	0.806	1.670	1.760	0.955	3.370
390.6	199.1	1.022	16.91	7.330	1.956	1.914	5.671	-0.094	2.629	2.723	0.809	1.672	1.766	0.957	3.365
393.0	200.0	1.029	17.01	7.339	1.962	1.920	5.667	-0.098	2.635	2.733	0.813	1.675	1.773	0.960	3.361

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	BA-15-1, 23.8'-24.3'	Lab ID	6B
Description	Sandy Lean Clay (CL), brown, moist, firm	Test ID	6B-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	11/24/2015

Specific Gravity	2.72
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	60
Nominal Consolidation Pressure (psi)	30

Saturation / Consolidation Results

Pore Pressure Parameter B	0.99
Measured Effective Consol. Stress (tsf)	2.153
Time to 50% Consolidation (min)	4.50
Actual Axial Strain Rate of Test (%/min)	0.064

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	131.7
Moisture Content (%)	20.0
Dry Unit Weight (pcf)	109.7
Void Ratio	0.545
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

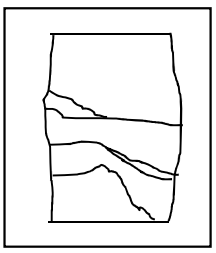
Axial Strain (%)	6.018
Deviator Stress (tsf)	3.774
Induced Pore Pressure (tsf)	0.874
Minor Effective Stress, σ_3' (tsf)	1.279
Major Effective Stress, σ_1' (tsf)	5.053
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.952
p' (tsf)	3.166
q (tsf)	1.887

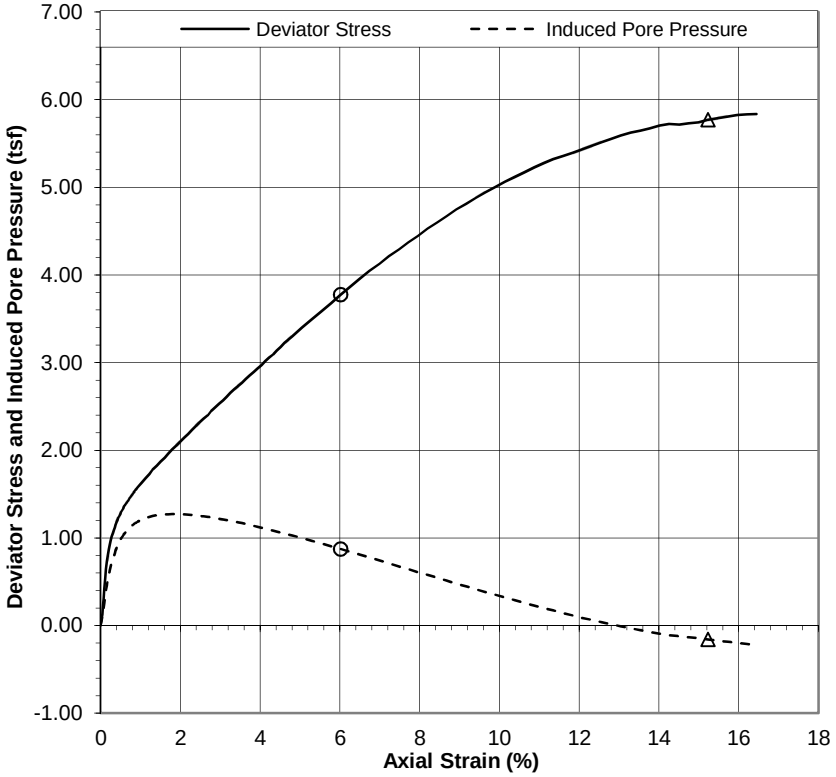
At Consolidated Undrained Failure

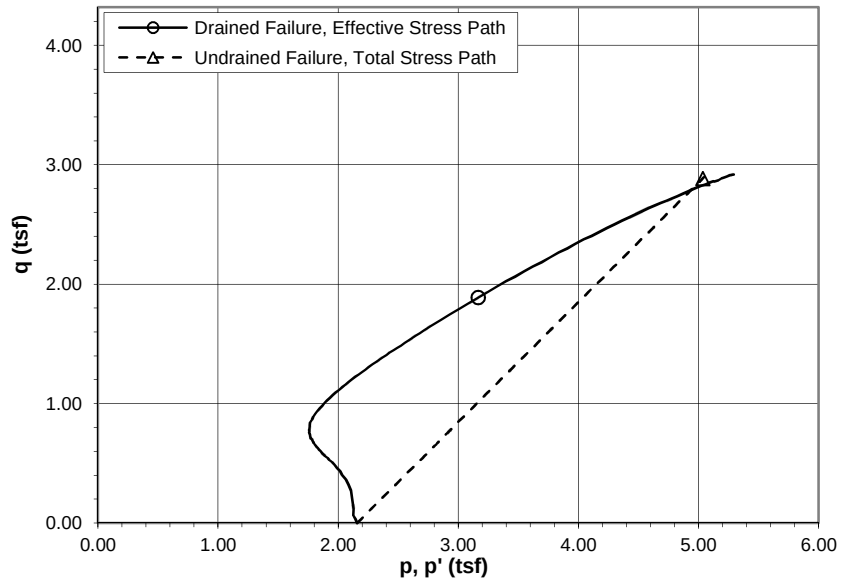
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.228
Deviator Stress (tsf)	5.771
Minor Principal Stress, σ_3 (tsf)	2.149
Major Principal Stress, σ_1 (tsf)	7.920
p (tsf)	5.035
q (tsf)	2.886

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: BA-15-1, 23.8'-24.3'
Description: Sandy Lean Clay (CL), brown, moist, firm

Project No.: 175553023
Lab ID: 6B
Test ID: 6B-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.124	Calculated Height (in)	6.057
Average Diameter (in)	2.868	Calculated Diameter (in)	2.814
Calculated Area (in^2)	6.459	Calculated Area (in^2)	6.221
Moist Weight (lb)	2.905	Moist Weight (lb)	2.872
Moist Unit Weight (pcf)	126.9	Moist Unit Weight (pcf)	131.7
Moisture Content (%)	21.4	Moisture Content (%)	20.0
Dry Weight (lb)	2.392	Dry Weight (lb)	2.392
Dry Unit Weight (pcf)	104.5	Dry Unit Weight (pcf)	109.7
Void Ratio	0.622	Void Ratio	0.545
Degree of Saturation (%)	93.7	Degree of Saturation (%)	100.0

Specific Gravity: 2.72
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 2.158

Effective Consolidation Stress
σ_3' (tsf): 2.158

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: BA-15-1, 23.8'-24.3'								Lab ID: 6B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.221	0.000	0.000	4.325	0.000	2.158	2.158	2.158	2.158	2.158	0.000	1.000
0.4	5.8	0.001	0.02	6.223	0.067	0.067	4.373	0.048	2.226	2.177	2.111	2.192	2.144	0.033	1.032
0.8	11.3	0.003	0.04	6.224	0.130	0.130	4.420	0.095	2.287	2.192	2.062	2.222	2.127	0.065	1.063
1.1	20.3	0.004	0.06	6.225	0.235	0.235	4.470	0.145	2.392	2.246	2.011	2.274	2.129	0.118	1.117
1.5	27.1	0.005	0.08	6.226	0.313	0.313	4.515	0.190	2.469	2.280	1.967	2.313	2.123	0.156	1.159
1.9	36.8	0.006	0.09	6.227	0.425	0.425	4.578	0.253	2.581	2.328	1.903	2.369	2.116	0.212	1.223
2.3	47.1	0.007	0.12	6.229	0.544	0.544	4.649	0.323	2.702	2.378	1.834	2.430	2.106	0.272	1.296
2.7	55.7	0.008	0.14	6.230	0.644	0.644	4.718	0.393	2.801	2.408	1.765	2.479	2.086	0.322	1.365
3.0	63.3	0.010	0.16	6.231	0.731	0.731	4.783	0.458	2.887	2.429	1.698	2.521	2.064	0.365	1.430
3.4	69.5	0.011	0.18	6.233	0.803	0.803	4.849	0.524	2.959	2.435	1.632	2.558	2.034	0.401	1.492
3.8	75.2	0.013	0.21	6.234	0.869	0.868	4.900	0.575	3.024	2.449	1.581	2.590	2.015	0.434	1.549
4.2	80.0	0.014	0.23	6.236	0.924	0.923	4.953	0.628	3.080	2.452	1.529	2.619	1.991	0.461	1.604
4.5	84.3	0.015	0.26	6.237	0.973	0.973	5.001	0.675	3.130	2.455	1.482	2.644	1.969	0.486	1.656
4.9	88.2	0.017	0.28	6.239	1.018	1.017	5.044	0.719	3.177	2.458	1.441	2.669	1.950	0.509	1.706
5.3	91.4	0.019	0.31	6.241	1.054	1.053	5.082	0.757	3.210	2.454	1.401	2.684	1.927	0.527	1.752
5.7	94.5	0.020	0.33	6.242	1.090	1.089	5.116	0.791	3.248	2.456	1.368	2.703	1.912	0.544	1.796
6.0	97.1	0.022	0.36	6.244	1.120	1.119	5.150	0.825	3.276	2.451	1.332	2.716	1.892	0.560	1.840
6.4	99.7	0.023	0.38	6.245	1.150	1.149	5.179	0.854	3.307	2.453	1.304	2.732	1.878	0.574	1.881
6.8	102.1	0.024	0.40	6.246	1.177	1.176	5.206	0.880	3.333	2.453	1.277	2.745	1.865	0.588	1.921
7.2	104.4	0.025	0.42	6.248	1.203	1.202	5.231	0.905	3.360	2.455	1.253	2.759	1.854	0.601	1.959
7.6	106.6	0.027	0.44	6.249	1.228	1.227	5.256	0.930	3.383	2.453	1.226	2.770	1.839	0.613	2.001
7.9	108.8	0.028	0.47	6.251	1.253	1.252	5.277	0.952	3.408	2.456	1.205	2.783	1.831	0.626	2.039
8.3	110.6	0.030	0.49	6.252	1.273	1.272	5.297	0.972	3.429	2.457	1.185	2.793	1.821	0.636	2.074
8.7	112.6	0.031	0.51	6.254	1.296	1.295	5.317	0.992	3.452	2.460	1.165	2.804	1.812	0.647	2.112
9.1	114.4	0.033	0.54	6.255	1.317	1.315	5.334	1.008	3.473	2.465	1.150	2.816	1.807	0.658	2.144
9.5	116.1	0.034	0.57	6.257	1.336	1.335	5.352	1.026	3.492	2.466	1.131	2.825	1.799	0.668	2.180
9.8	118.1	0.035	0.59	6.258	1.358	1.357	5.367	1.042	3.514	2.472	1.115	2.835	1.793	0.679	2.217
10.2	119.6	0.037	0.61	6.260	1.376	1.374	5.382	1.056	3.531	2.474	1.100	2.844	1.787	0.687	2.249
10.6	121.3	0.039	0.64	6.262	1.394	1.393	5.395	1.070	3.551	2.481	1.088	2.854	1.785	0.696	2.280
11.0	122.7	0.040	0.66	6.263	1.410	1.409	5.408	1.083	3.565	2.482	1.073	2.861	1.777	0.704	2.312
11.3	124.0	0.042	0.69	6.265	1.425	1.424	5.423	1.098	3.580	2.482	1.058	2.868	1.770	0.712	2.345
11.7	125.5	0.043	0.71	6.266	1.442	1.440	5.432	1.107	3.597	2.490	1.050	2.876	1.770	0.720	2.372
12.1	127.0	0.045	0.74	6.268	1.458	1.457	5.443	1.118	3.613	2.495	1.039	2.885	1.767	0.728	2.403
12.5	128.3	0.046	0.76	6.269	1.474	1.472	5.452	1.127	3.628	2.501	1.029	2.892	1.765	0.736	2.431
12.8	129.8	0.048	0.79	6.271	1.490	1.488	5.463	1.137	3.643	2.506	1.018	2.899	1.762	0.744	2.461
13.2	131.0	0.049	0.81	6.272	1.504	1.502	5.472	1.146	3.658	2.511	1.009	2.907	1.760	0.751	2.488
13.6	132.2	0.050	0.83	6.273	1.517	1.515	5.481	1.155	3.672	2.516	1.001	2.914	1.759	0.758	2.513
14.0	133.6	0.052	0.85	6.275	1.533	1.530	5.487	1.162	3.688	2.526	0.995	2.922	1.761	0.765	2.538
14.4	135.1	0.053	0.88	6.276	1.549	1.547	5.495	1.170	3.704	2.534	0.987	2.930	1.760	0.774	2.568

Project: 175553023			Source: BA-15-1, 23.8'-24.3'								Lab ID: 6B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
14.7	136.0	0.054	0.90	6.278	1.560	1.557	5.501	1.175	3.713	2.538	0.981	2.935	1.759	0.779	2.588
15.1	137.6	0.056	0.93	6.280	1.578	1.576	5.509	1.183	3.732	2.549	0.973	2.945	1.761	0.788	2.619
16.6	142.3	0.062	1.02	6.286	1.630	1.628	5.531	1.206	3.783	2.577	0.949	2.969	1.763	0.814	2.715
18.1	147.2	0.068	1.13	6.292	1.684	1.681	5.552	1.227	3.835	2.608	0.926	2.994	1.767	0.841	2.815
19.6	151.5	0.074	1.22	6.298	1.731	1.728	5.563	1.238	3.883	2.645	0.917	3.019	1.781	0.864	2.885
21.1	156.0	0.079	1.31	6.304	1.782	1.779	5.575	1.250	3.933	2.683	0.904	3.044	1.794	0.889	2.967
22.6	160.3	0.085	1.41	6.311	1.828	1.825	5.583	1.258	3.979	2.721	0.896	3.066	1.809	0.912	3.036
24.1	164.5	0.091	1.51	6.317	1.875	1.872	5.590	1.265	4.026	2.761	0.890	3.090	1.825	0.936	3.104
25.6	168.7	0.097	1.61	6.323	1.920	1.916	5.593	1.268	4.071	2.803	0.887	3.113	1.845	0.958	3.161
27.1	173.0	0.103	1.70	6.329	1.968	1.964	5.595	1.270	4.118	2.848	0.885	3.136	1.866	0.982	3.220
28.6	177.2	0.109	1.80	6.335	2.014	2.009	5.596	1.270	4.162	2.891	0.882	3.157	1.887	1.005	3.279
30.1	181.3	0.115	1.90	6.342	2.058	2.054	5.597	1.272	4.206	2.934	0.881	3.179	1.908	1.027	3.331
31.6	185.4	0.121	2.00	6.348	2.103	2.098	5.595	1.270	4.251	2.981	0.884	3.202	1.932	1.049	3.374
33.1	189.6	0.127	2.10	6.355	2.148	2.143	5.593	1.268	4.296	3.028	0.885	3.224	1.956	1.071	3.422
34.7	193.6	0.133	2.19	6.361	2.191	2.186	5.589	1.264	4.338	3.073	0.887	3.244	1.980	1.093	3.464
36.1	197.9	0.139	2.29	6.367	2.237	2.232	5.587	1.262	4.385	3.124	0.892	3.269	2.008	1.116	3.502
37.7	202.1	0.145	2.39	6.374	2.283	2.277	5.583	1.257	4.430	3.173	0.896	3.292	2.034	1.138	3.541
39.1	205.9	0.150	2.48	6.380	2.324	2.318	5.577	1.252	4.469	3.218	0.900	3.310	2.059	1.159	3.576
40.6	209.9	0.156	2.58	6.386	2.367	2.360	5.571	1.246	4.511	3.265	0.905	3.331	2.085	1.180	3.608
42.1	213.6	0.163	2.69	6.394	2.406	2.399	5.565	1.240	4.551	3.311	0.912	3.352	2.112	1.200	3.631
43.6	218.0	0.168	2.77	6.399	2.453	2.447	5.560	1.234	4.600	3.365	0.919	3.376	2.142	1.223	3.663
45.1	221.9	0.174	2.87	6.405	2.494	2.487	5.553	1.228	4.643	3.415	0.927	3.399	2.171	1.244	3.682
46.6	226.0	0.180	2.97	6.412	2.538	2.531	5.544	1.219	4.684	3.464	0.934	3.418	2.199	1.265	3.711
48.2	229.7	0.186	3.07	6.418	2.577	2.569	5.536	1.211	4.721	3.511	0.941	3.437	2.226	1.285	3.730
49.7	233.6	0.192	3.16	6.425	2.618	2.610	5.528	1.203	4.761	3.559	0.949	3.456	2.254	1.305	3.751
51.2	237.9	0.197	3.25	6.431	2.664	2.656	5.519	1.193	4.807	3.613	0.957	3.479	2.285	1.328	3.774
52.7	241.9	0.203	3.35	6.437	2.705	2.697	5.511	1.186	4.849	3.664	0.967	3.501	2.315	1.348	3.790
54.2	245.4	0.209	3.45	6.444	2.742	2.733	5.502	1.177	4.886	3.709	0.976	3.519	2.343	1.367	3.800
55.7	249.0	0.215	3.54	6.450	2.779	2.770	5.494	1.168	4.923	3.755	0.984	3.538	2.369	1.385	3.815
57.2	253.1	0.220	3.64	6.456	2.823	2.814	5.483	1.157	4.967	3.810	0.996	3.560	2.403	1.407	3.825
58.7	257.0	0.226	3.73	6.463	2.864	2.855	5.474	1.149	5.007	3.857	1.003	3.579	2.430	1.427	3.847
60.2	260.8	0.233	3.84	6.470	2.902	2.892	5.462	1.137	5.044	3.907	1.014	3.598	2.460	1.446	3.852
61.7	264.7	0.238	3.94	6.476	2.942	2.933	5.453	1.127	5.085	3.958	1.025	3.619	2.492	1.466	3.860
63.2	268.5	0.244	4.04	6.483	2.982	2.972	5.442	1.116	5.124	4.007	1.036	3.638	2.522	1.486	3.869
64.7	272.8	0.250	4.13	6.489	3.027	3.017	5.431	1.105	5.168	4.062	1.045	3.659	2.554	1.509	3.887
66.2	276.8	0.256	4.23	6.496	3.067	3.057	5.419	1.094	5.207	4.113	1.056	3.678	2.585	1.529	3.895
67.7	280.5	0.262	4.33	6.503	3.106	3.095	5.406	1.081	5.244	4.163	1.067	3.696	2.615	1.548	3.900
69.2	284.7	0.267	4.41	6.509	3.149	3.138	5.398	1.073	5.290	4.217	1.079	3.721	2.648	1.569	3.909
70.7	288.7	0.273	4.51	6.515	3.191	3.180	5.386	1.061	5.331	4.270	1.090	3.741	2.680	1.590	3.917
72.2	293.1	0.279	4.61	6.522	3.236	3.224	5.376	1.051	5.376	4.325	1.101	3.764	2.713	1.612	3.928
73.7	296.9	0.285	4.71	6.529	3.275	3.263	5.364	1.038	5.413	4.375	1.112	3.782	2.744	1.632	3.935
75.2	300.5	0.291	4.81	6.536	3.311	3.299	5.351	1.026	5.449	4.423	1.124	3.799	2.773	1.650	3.935
78.9	310.6	0.306	5.06	6.553	3.413	3.400	5.323	0.998	5.550	4.552	1.152	3.850	2.852	1.700	3.952
82.7	320.0	0.321	5.30	6.570	3.507	3.494	5.291	0.966	5.644	4.678	1.184	3.897	2.931	1.747	3.951
86.4	329.2	0.335	5.54	6.586	3.599	3.585	5.262	0.936	5.736	4.800	1.215	3.944	3.008	1.792	3.950
90.2	338.8	0.350	5.78	6.603	3.694	3.680	5.229	0.904	5.831	4.928	1.248	3.991	3.088	1.840	3.949
93.9	348.4	0.364	6.02	6.620	3.789	3.774	5.199	0.874	5.927	5.053	1.279	4.039	3.166	1.887	3.952
97.7	357.7	0.379	6.26	6.637	3.880	3.865	5.165	0.840	6.014	5.174	1.310	4.082	3.242	1.932	3.951
101.4	367.3	0.394	6.50	6.654	3.974	3.958	5.133	0.807	6.109	5.301	1.343	4.130	3.322	1.979	3.947
105.2	376.4	0.409	6.75	6.672	4.062	4.045	5.101	0.776	6.196	5.420	1.375	4.173	3.398	2.023	3.942
108.9	385.1	0.424	6.99	6.689	4.145	4.128	5.068	0.743	6.280	5.538	1.410	4.216	3.474	2.064	3.928
112.7	394.1	0.438	7.23	6.707	4.231	4.213	5.036	0.710	6.364	5.654	1.441	4.258	3.547	2.107	3.925
116.5	402.5	0.453	7.48	6.724	4.309	4.291	4.999	0.673	6.439	5.766	1.475	4.294	3.621	2.145	3.909
120.2	411.0	0.467	7.71	6.741	4.389	4.370	4.970	0.645	6.524	5.879	1.509	4.339	3.694	2.185	3.897
124.0	419.3	0.482	7.96	6.759	4.466	4.446	4.934	0.609	6.597	5.988	1.542	4.374	3.765	2.223	3.884
127.7	428.1	0.497	8.20	6.777	4.548	4.528	4.902	0.577	6.677	6.100	1.573	4.414	3.836	2.264	3.879
131.5	436.0	0.511	8.44	6.795	4.620	4.599	4.869	0.544	6.751	6.207	1.608	4.451	3.907	2.300	3.861
135.2	444.2	0.526	8.68	6.813	4.694	4.673	4.836	0.511	6.822	6.311	1.638	4.485	3.974	2.336	3.853
139.0	452.4	0.540	8.92	6.831	4.769	4.747	4.803	0.477	6.895	6.418	1.671	4.522	4.044	2.373	3.841
142.7	459.7	0.555	9.17	6.849	4.832	4.809	4.771	0.446	6.961	6.516	1.706	4.557	4.111	2.405	3.819
146.5	467.6	0.570	9.41	6.867	4.902	4.879	4.738	0.413	7.029	6.616	1.737	4.589	4.176	2.439	3.809
150.2	474.8	0.584	9.65	6.886	4.964	4.941	4.708	0.382	7.091	6.709	1.768	4.621	4.239	2.470	3.794
154.0	481.8	0.599	9.89	6.904	5.025	5.000	4.676	0.351	7.150	6.800	1.800	4.650	4.300	2.500	3.779
157.7	489.2	0.614	10.14	6.923	5.087	5.062	4.643	0.318	7.211	6.894	1.831	4.680	4.363	2.531	3.764
161.5	495.9	0.629	10.38	6.942	5.143	5.118	4.613	0.288	7.268	6.980	1.862	4.710	4.421	2.559	3.748
165.2	502.5	0.644	10.63	6.962	5.197	5.171	4.582	0.256	7.320	7.063	1.892	4.734	4.478	2.586	3.733
169.0	509.3	0.658	10.87	6.980	5.254	5.227	4.553	0.228	7.374	7.147	1.920	4.761	4.533	2.614	3.723
172.7	515.7	0.673	11.12	7.000	5.305	5.278	4.523	0.198	7.427	7.229	1.952	4.788	4.590	2.639	3.704
176.5	521.5	0.688	11.35	7.018	5.350	5.322	4.497	0.171	7.472	7.300	1.978	4.810	4.639	2.661	3.691

Project: 175553023			Source: BA-15-1, 23.8'-24.3'								Lab ID: 6B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
180.2	526.6	0.702	11.60	7.038	5.387	5.359	4.466	0.141	7.507	7.366	2.007	4.827	4.686	2.679	3.670
184.0	531.6	0.717	11.84	7.057	5.424	5.395	4.439	0.113	7.544	7.430	2.036	4.846	4.733	2.697	3.650
187.7	537.1	0.732	12.08	7.076	5.464	5.435	4.412	0.087	7.584	7.497	2.062	4.867	4.780	2.717	3.635
191.5	542.4	0.746	12.33	7.096	5.503	5.473	4.387	0.062	7.622	7.559	2.086	4.885	4.823	2.737	3.623
195.2	548.1	0.761	12.56	7.115	5.546	5.515	4.363	0.038	7.666	7.628	2.112	4.908	4.870	2.758	3.611
199.0	553.1	0.775	12.80	7.135	5.581	5.550	4.340	0.015	7.701	7.686	2.136	4.926	4.911	2.775	3.598
202.7	558.8	0.790	13.04	7.155	5.623	5.591	4.317	-0.008	7.738	7.746	2.155	4.943	4.951	2.795	3.594
206.5	563.7	0.805	13.29	7.175	5.656	5.624	4.293	-0.032	7.770	7.802	2.178	4.958	4.990	2.812	3.582
210.2	567.7	0.820	13.53	7.195	5.680	5.647	4.274	-0.052	7.797	7.848	2.201	4.973	5.025	2.824	3.565
214.0	571.8	0.834	13.77	7.215	5.707	5.673	4.251	-0.074	7.820	7.894	2.221	4.983	5.057	2.836	3.554
217.7	576.6	0.849	14.02	7.236	5.738	5.703	4.231	-0.094	7.850	7.944	2.241	4.999	5.093	2.852	3.545
221.5	580.1	0.863	14.26	7.256	5.757	5.722	4.212	-0.113	7.871	7.984	2.262	5.010	5.123	2.861	3.529
225.2	581.5	0.879	14.51	7.277	5.753	5.717	4.203	-0.122	7.867	7.989	2.272	5.008	5.130	2.859	3.517
229.0	584.5	0.893	14.74	7.297	5.767	5.730	4.190	-0.135	7.881	8.015	2.285	5.015	5.150	2.865	3.508
232.7	587.3	0.908	14.99	7.319	5.778	5.741	4.181	-0.145	7.891	8.035	2.294	5.020	5.165	2.870	3.502
236.5	592.1	0.922	15.23	7.339	5.809	5.771	4.168	-0.158	7.920	8.078	2.307	5.035	5.192	2.886	3.502
240.2	595.8	0.937	15.48	7.361	5.828	5.790	4.153	-0.173	7.938	8.111	2.320	5.043	5.215	2.895	3.496
244.0	599.3	0.952	15.72	7.382	5.845	5.807	4.141	-0.184	7.957	8.141	2.335	5.054	5.238	2.903	3.487
247.7	603.0	0.967	15.96	7.403	5.864	5.825	4.125	-0.200	7.972	8.173	2.348	5.060	5.260	2.912	3.481
251.5	605.5	0.981	16.20	7.424	5.872	5.832	4.114	-0.211	7.981	8.192	2.360	5.065	5.276	2.916	3.471
255.2	607.7	0.996	16.44	7.446	5.876	5.836	4.102	-0.223	7.987	8.210	2.375	5.069	5.292	2.918	3.458

FLY ASH POND MAIN DAM, 2015

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	FA-15-1, 5.9'-6.4'	Lab ID	47B
Description	Gravelly Lean Clay (CL), gray brown, moist, firm	Test ID	47B-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	11/30/2015

Specific Gravity	2.75
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	80
Nominal Consolidation Pressure (psi)	10

Saturation / Consolidation Results

Pore Pressure Parameter B	0.99
Measured Effective Consol. Stress (tsf)	0.713
Time to 50% Consolidation (min)	1.82
Actual Axial Strain Rate of Test (%/min)	0.035

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	144.7
Moisture Content (%)	11.8
Dry Unit Weight (pcf)	129.5
Void Ratio	0.323
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

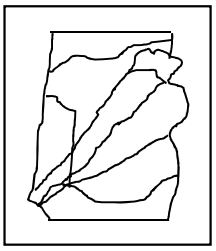
Axial Strain (%)	2.103
Deviator Stress (tsf)	1.263
Induced Pore Pressure (tsf)	0.347
Minor Effective Stress, σ_3' (tsf)	0.366
Major Effective Stress, σ_1' (tsf)	1.628
Eff. Principal Stress Ratio, σ_1'/σ_3'	4.454
p' (tsf)	0.997
q (tsf)	0.631

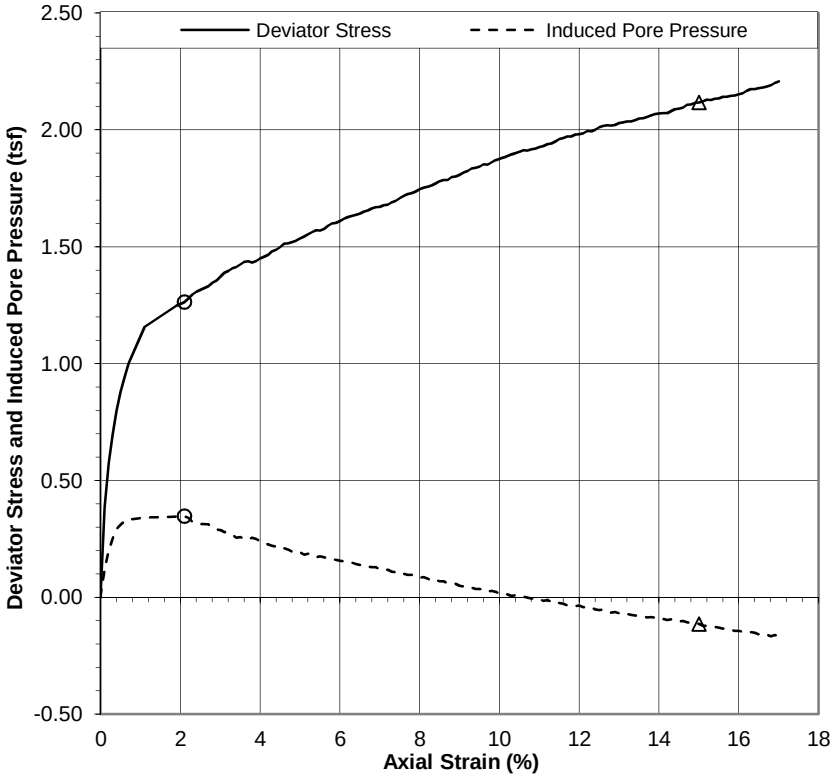
At Consolidated Undrained Failure

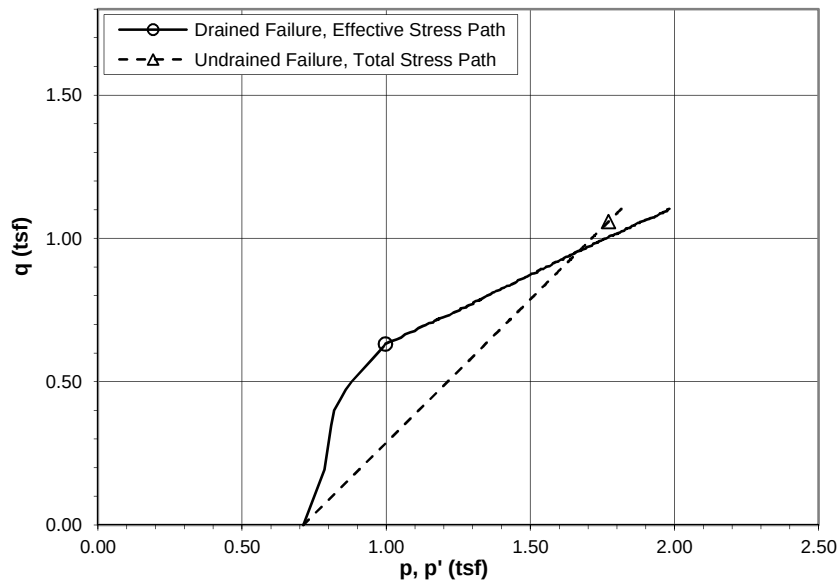
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.004
Deviator Stress (tsf)	2.117
Minor Principal Stress, σ_3 (tsf)	0.713
Major Principal Stress, σ_1 (tsf)	2.830
p (tsf)	1.771
q (tsf)	1.059

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: FA-15-1, 5.9'-6.4'
Description: Gravelly Lean Clay (CL), gray brown, moist, firm

Project No.: 175553023
Lab ID: 47B
Test ID: 47B-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.063	Calculated Height (in)	6.049
Average Diameter (in)	2.869	Calculated Diameter (in)	2.861
Calculated Area (in^2)	6.466	Calculated Area (in^2)	6.428
Moist Weight (lb)	3.247	Moist Weight (lb)	3.257
Moist Unit Weight (pcf)	143.1	Moist Unit Weight (pcf)	144.7
Moisture Content (%)	11.4	Moisture Content (%)	11.8
Dry Weight (lb)	2.914	Dry Weight (lb)	2.914
Dry Unit Weight (pcf)	128.4	Dry Unit Weight (pcf)	129.5
Void Ratio	0.334	Void Ratio	0.323
Degree of Saturation (%)	94.0	Degree of Saturation (%)	100.0

Specific Gravity: 2.75
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 0.713

Effective Consolidation Stress
σ_3' (tsf): 0.713

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: FA-15-1, 5.9'-6.4'								Lab ID: 47B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.428	0.000	0.000	5.767	0.000	0.713	0.713	0.713	0.713	0.713	0.000	1.000
2.7	34.6	0.006	0.10	6.434	0.387	0.387	5.888	0.120	1.099	0.979	0.592	0.906	0.786	0.193	1.653
5.4	51.6	0.012	0.20	6.441	0.577	0.576	5.968	0.200	1.289	1.089	0.512	1.001	0.801	0.288	2.125
8.2	62.3	0.018	0.30	6.447	0.696	0.695	6.018	0.251	1.408	1.157	0.462	1.060	0.809	0.348	2.506
11.0	71.5	0.024	0.40	6.454	0.798	0.797	6.059	0.292	1.510	1.218	0.421	1.111	0.820	0.399	2.893
13.8	79.1	0.030	0.50	6.460	0.882	0.880	6.078	0.310	1.593	1.283	0.402	1.153	0.842	0.440	3.189
16.6	85.0	0.037	0.61	6.467	0.947	0.945	6.093	0.325	1.658	1.333	0.387	1.185	0.860	0.473	3.442
19.4	90.1	0.042	0.70	6.473	1.002	1.001	6.100	0.332	1.713	1.381	0.380	1.213	0.881	0.500	3.630
30.7	104.7	0.067	1.10	6.499	1.160	1.158	6.108	0.341	1.870	1.529	0.372	1.291	0.951	0.579	4.113
52.9	113.9	0.115	1.90	6.552	1.251	1.247	6.112	0.345	1.959	1.614	0.368	1.336	0.991	0.623	4.392
58.4	115.6	0.127	2.10	6.566	1.268	1.263	6.114	0.347	1.975	1.628	0.366	1.344	0.997	0.631	4.454
61.3	117.3	0.133	2.20	6.572	1.285	1.279	6.106	0.339	1.992	1.653	0.374	1.352	1.013	0.640	4.425
64.1	118.9	0.139	2.30	6.579	1.301	1.296	6.091	0.323	2.008	1.685	0.389	1.360	1.037	0.648	4.329
66.9	120.2	0.145	2.40	6.586	1.314	1.308	6.082	0.315	2.021	1.706	0.398	1.367	1.052	0.654	4.288
75.6	122.7	0.163	2.70	6.606	1.337	1.330	6.080	0.313	2.043	1.730	0.400	1.378	1.065	0.665	4.326
78.4	124.1	0.169	2.80	6.613	1.351	1.344	6.069	0.302	2.057	1.755	0.411	1.385	1.083	0.672	4.271
81.3	125.1	0.175	2.90	6.620	1.361	1.354	6.058	0.291	2.066	1.775	0.422	1.389	1.099	0.677	4.209
84.2	127.0	0.182	3.00	6.627	1.380	1.373	6.055	0.288	2.085	1.797	0.425	1.399	1.111	0.686	4.231
87.0	128.6	0.188	3.10	6.633	1.396	1.388	6.046	0.279	2.101	1.822	0.434	1.407	1.128	0.694	4.201
89.9	129.5	0.194	3.20	6.640	1.404	1.396	6.041	0.273	2.109	1.836	0.439	1.411	1.138	0.698	4.178
92.7	130.7	0.200	3.30	6.647	1.416	1.408	6.035	0.267	2.121	1.854	0.445	1.417	1.150	0.704	4.161
95.6	131.4	0.206	3.40	6.654	1.421	1.413	6.023	0.255	2.126	1.870	0.457	1.419	1.164	0.707	4.091
98.4	132.5	0.212	3.50	6.661	1.433	1.424	6.025	0.258	2.137	1.879	0.455	1.425	1.167	0.712	4.130
101.3	133.7	0.218	3.60	6.668	1.443	1.435	6.018	0.251	2.147	1.896	0.462	1.430	1.179	0.717	4.107
104.1	134.1	0.224	3.70	6.675	1.447	1.438	6.016	0.248	2.150	1.902	0.464	1.431	1.183	0.719	4.097
106.9	133.7	0.230	3.80	6.682	1.441	1.432	6.022	0.255	2.144	1.890	0.458	1.429	1.174	0.716	4.126
109.7	134.6	0.236	3.90	6.689	1.449	1.440	6.017	0.249	2.152	1.903	0.463	1.432	1.183	0.720	4.107
112.5	135.8	0.242	4.00	6.696	1.460	1.450	6.007	0.240	2.163	1.923	0.473	1.438	1.198	0.725	4.067
115.2	136.5	0.248	4.10	6.703	1.467	1.457	6.002	0.234	2.169	1.935	0.478	1.441	1.207	0.728	4.046
118.1	137.5	0.254	4.20	6.710	1.476	1.465	5.993	0.226	2.178	1.953	0.487	1.445	1.220	0.733	4.009
121.0	139.1	0.260	4.30	6.717	1.491	1.480	5.988	0.220	2.193	1.973	0.492	1.453	1.233	0.740	4.007
123.7	139.9	0.266	4.40	6.724	1.498	1.488	5.984	0.217	2.200	1.984	0.496	1.456	1.240	0.744	3.999
126.4	141.1	0.272	4.50	6.731	1.510	1.499	5.974	0.206	2.211	2.005	0.506	1.462	1.256	0.749	3.960
129.2	142.6	0.278	4.60	6.738	1.524	1.512	5.978	0.210	2.225	2.015	0.502	1.469	1.259	0.756	4.010
131.9	143.0	0.284	4.70	6.745	1.526	1.515	5.972	0.205	2.228	2.023	0.508	1.470	1.265	0.758	3.984
134.8	143.6	0.290	4.80	6.752	1.531	1.519	5.962	0.194	2.232	2.038	0.518	1.472	1.278	0.760	3.932
137.6	144.3	0.296	4.90	6.759	1.537	1.525	5.964	0.197	2.238	2.041	0.516	1.475	1.278	0.763	3.959
140.4	145.4	0.303	5.00	6.766	1.547	1.535	5.960	0.193	2.248	2.054	0.520	1.480	1.287	0.767	3.954
143.2	146.3	0.309	5.10	6.773	1.555	1.543	5.949	0.182	2.256	2.074	0.531	1.484	1.302	0.772	3.907

Project: 175553023			Source: FA-15-1, 5.9'-6.4'								Lab ID: 47B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
146.0	147.4	0.315	5.20	6.780	1.565	1.552	5.954	0.186	2.265	2.079	0.526	1.489	1.302	0.776	3.950
148.8	148.6	0.321	5.30	6.787	1.576	1.563	5.949	0.182	2.276	2.094	0.531	1.494	1.312	0.782	3.945
151.5	149.4	0.327	5.40	6.795	1.583	1.570	5.939	0.171	2.283	2.112	0.541	1.498	1.327	0.785	3.900
154.4	149.5	0.333	5.50	6.802	1.583	1.569	5.942	0.175	2.282	2.107	0.538	1.497	1.322	0.785	3.919
157.1	150.4	0.339	5.60	6.809	1.590	1.576	5.938	0.171	2.289	2.118	0.542	1.501	1.330	0.788	3.909
160.0	151.8	0.345	5.70	6.816	1.604	1.590	5.934	0.166	2.303	2.137	0.546	1.508	1.342	0.795	3.910
162.8	152.9	0.351	5.80	6.824	1.613	1.599	5.931	0.164	2.312	2.148	0.549	1.512	1.349	0.800	3.913
165.7	153.4	0.357	5.90	6.831	1.617	1.603	5.927	0.160	2.315	2.155	0.553	1.514	1.354	0.801	3.901
168.6	154.4	0.363	6.00	6.838	1.625	1.611	5.924	0.157	2.323	2.167	0.556	1.518	1.361	0.805	3.897
171.4	155.4	0.369	6.10	6.845	1.635	1.620	5.921	0.154	2.333	2.179	0.559	1.523	1.369	0.810	3.899
174.3	156.2	0.375	6.20	6.853	1.642	1.627	5.918	0.150	2.339	2.189	0.562	1.526	1.375	0.813	3.894
177.2	157.0	0.381	6.30	6.860	1.648	1.633	5.916	0.149	2.345	2.197	0.564	1.529	1.380	0.816	3.894
180.0	157.6	0.387	6.40	6.867	1.652	1.637	5.910	0.143	2.349	2.206	0.570	1.531	1.388	0.818	3.874
182.9	158.3	0.393	6.50	6.875	1.658	1.642	5.906	0.138	2.355	2.217	0.574	1.534	1.396	0.821	3.859
185.8	159.2	0.399	6.60	6.882	1.666	1.650	5.905	0.138	2.363	2.225	0.575	1.538	1.400	0.825	3.872
188.7	160.0	0.405	6.70	6.889	1.672	1.656	5.899	0.131	2.369	2.237	0.581	1.541	1.409	0.828	3.849
191.5	160.9	0.411	6.80	6.897	1.680	1.663	5.896	0.129	2.376	2.247	0.584	1.544	1.416	0.832	3.847
194.4	161.6	0.417	6.90	6.904	1.686	1.669	5.896	0.129	2.382	2.253	0.584	1.547	1.419	0.834	3.857
197.2	162.0	0.424	7.00	6.912	1.687	1.670	5.887	0.119	2.383	2.264	0.593	1.548	1.429	0.835	3.815
200.2	162.8	0.430	7.10	6.919	1.694	1.677	5.886	0.118	2.390	2.272	0.594	1.551	1.433	0.839	3.822
203.1	163.3	0.436	7.20	6.927	1.697	1.680	5.885	0.118	2.392	2.275	0.595	1.552	1.435	0.840	3.824
205.9	164.4	0.442	7.30	6.934	1.707	1.690	5.878	0.110	2.402	2.292	0.602	1.557	1.447	0.845	3.805
208.8	165.2	0.448	7.40	6.941	1.714	1.696	5.875	0.107	2.409	2.301	0.605	1.561	1.453	0.848	3.802
211.6	166.6	0.454	7.50	6.949	1.726	1.708	5.876	0.109	2.420	2.312	0.604	1.566	1.458	0.854	3.828
214.5	167.7	0.460	7.60	6.956	1.735	1.717	5.868	0.101	2.430	2.329	0.612	1.571	1.470	0.859	3.806
217.4	168.6	0.466	7.70	6.964	1.743	1.725	5.863	0.095	2.437	2.342	0.617	1.575	1.480	0.862	3.794
220.2	169.3	0.472	7.80	6.972	1.748	1.729	5.863	0.095	2.442	2.347	0.617	1.577	1.482	0.865	3.802
223.1	170.1	0.478	7.90	6.979	1.755	1.736	5.857	0.089	2.448	2.359	0.623	1.581	1.491	0.868	3.785
225.9	171.2	0.484	8.00	6.987	1.765	1.745	5.852	0.084	2.458	2.374	0.628	1.585	1.501	0.873	3.778
228.8	172.2	0.490	8.10	6.994	1.772	1.753	5.854	0.086	2.465	2.379	0.626	1.589	1.503	0.876	3.798
231.6	172.7	0.496	8.20	7.002	1.776	1.756	5.846	0.079	2.469	2.390	0.634	1.591	1.512	0.878	3.772
234.5	173.5	0.502	8.30	7.010	1.782	1.762	5.837	0.070	2.474	2.405	0.643	1.594	1.524	0.881	3.740
237.3	174.5	0.508	8.40	7.017	1.790	1.770	5.841	0.074	2.483	2.409	0.639	1.598	1.524	0.885	3.771
240.2	175.6	0.514	8.50	7.025	1.800	1.780	5.837	0.069	2.492	2.423	0.643	1.602	1.533	0.890	3.766
243.1	176.4	0.520	8.60	7.033	1.806	1.785	5.837	0.069	2.498	2.429	0.643	1.605	1.536	0.893	3.775
246.0	176.7	0.526	8.70	7.040	1.807	1.786	5.828	0.061	2.499	2.438	0.652	1.606	1.545	0.893	3.740
248.9	178.0	0.532	8.80	7.048	1.819	1.798	5.826	0.059	2.510	2.451	0.654	1.611	1.553	0.899	3.750
251.8	178.6	0.538	8.90	7.056	1.823	1.801	5.825	0.058	2.514	2.456	0.655	1.613	1.555	0.901	3.752
254.7	179.4	0.545	9.00	7.064	1.829	1.807	5.816	0.049	2.520	2.471	0.664	1.616	1.567	0.903	3.723
257.5	180.6	0.551	9.10	7.071	1.839	1.817	5.814	0.047	2.529	2.482	0.666	1.621	1.574	0.908	3.728
260.4	181.5	0.557	9.20	7.079	1.846	1.823	5.815	0.048	2.536	2.488	0.665	1.624	1.577	0.912	3.743
263.3	182.9	0.563	9.30	7.087	1.858	1.835	5.809	0.042	2.548	2.506	0.671	1.630	1.589	0.918	3.735
266.2	183.3	0.569	9.40	7.095	1.860	1.837	5.803	0.035	2.550	2.515	0.677	1.631	1.596	0.919	3.712
269.0	184.0	0.575	9.50	7.103	1.866	1.843	5.803	0.036	2.555	2.519	0.677	1.634	1.598	0.921	3.723
272.0	185.2	0.581	9.60	7.111	1.876	1.852	5.799	0.032	2.565	2.533	0.681	1.639	1.607	0.926	3.721
274.8	185.4	0.587	9.70	7.118	1.875	1.852	5.792	0.024	2.564	2.540	0.688	1.638	1.614	0.926	3.691
277.7	186.5	0.593	9.80	7.126	1.884	1.861	5.795	0.028	2.573	2.546	0.685	1.643	1.615	0.930	3.717
280.5	187.7	0.599	9.90	7.134	1.894	1.870	5.790	0.023	2.583	2.560	0.690	1.648	1.625	0.935	3.712
283.5	188.4	0.605	10.00	7.142	1.900	1.876	5.782	0.015	2.588	2.574	0.698	1.650	1.636	0.938	3.687
286.4	189.3	0.611	10.10	7.150	1.907	1.882	5.785	0.017	2.595	2.578	0.695	1.654	1.637	0.941	3.706
289.3	190.1	0.617	10.20	7.158	1.913	1.888	5.780	0.013	2.601	2.588	0.700	1.657	1.644	0.944	3.697
292.3	191.1	0.623	10.30	7.166	1.920	1.895	5.772	0.005	2.608	2.603	0.708	1.660	1.655	0.948	3.678
295.2	191.8	0.629	10.40	7.174	1.925	1.900	5.776	0.008	2.613	2.604	0.704	1.663	1.654	0.950	3.698
298.1	192.6	0.635	10.50	7.182	1.931	1.906	5.773	0.006	2.618	2.613	0.707	1.666	1.660	0.953	3.696
301.1	193.5	0.641	10.60	7.190	1.938	1.913	5.771	0.003	2.625	2.622	0.709	1.669	1.665	0.956	3.697
304.2	193.7	0.647	10.70	7.198	1.937	1.911	5.766	-0.001	2.624	2.626	0.714	1.668	1.670	0.956	3.677
307.2	194.5	0.653	10.80	7.206	1.943	1.917	5.762	-0.006	2.630	2.635	0.718	1.671	1.677	0.958	3.669
310.2	194.9	0.659	10.90	7.214	1.946	1.919	5.764	-0.004	2.632	2.636	0.716	1.672	1.676	0.960	3.679
313.2	195.9	0.666	11.00	7.222	1.953	1.926	5.758	-0.010	2.639	2.648	0.722	1.676	1.685	0.963	3.667
316.3	196.5	0.672	11.10	7.230	1.957	1.930	5.753	-0.015	2.643	2.658	0.727	1.678	1.692	0.965	3.655
319.3	197.6	0.678	11.20	7.239	1.965	1.938	5.755	-0.012	2.651	2.663	0.725	1.682	1.694	0.969	3.675
322.3	198.2	0.684	11.30	7.247	1.970	1.942	5.748	-0.019	2.655	2.674	0.732	1.684	1.703	0.971	3.655
325.3	199.3	0.690	11.40	7.255	1.978	1.950	5.742	-0.026	2.663	2.689	0.738	1.688	1.713	0.975	3.642
328.3	200.5	0.696	11.50	7.263	1.988	1.960	5.743	-0.024	2.673	2.697	0.737	1.693	1.717	0.980	3.660
331.3	201.3	0.702	11.60	7.271	1.993	1.965	5.741	-0.027	2.678	2.705	0.739	1.695	1.722	0.983	3.659
334.3	202.3	0.708	11.70	7.279	2.001	1.972	5.732	-0.036	2.685	2.721	0.748	1.699	1.734	0.986	3.636
337.2	202.5	0.714	11.80	7.288	2.001	1.972	5.734	-0.034	2.685	2.719	0.746	1.699	1.733	0.986	3.642
340.2	203.5	0.720	11.90	7.296	2.008	1.980	5.731	-0.036	2.692	2.728	0.749	1.702	1.739	0.990	3.644
343.2	204.0	0.726	12.00	7.304	2.010	1.981	5.732	-0.035	2.694	2.729	0.748	1.703	1.739	0.991	3.649

Project: 175553023			Source: FA-15-1, 5.9'-6.4'								Lab ID: 47B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
346.1	204.6	0.732	12.10	7.313	2.014	1.985	5.725	-0.042	2.697	2.739	0.755	1.705	1.747	0.992	3.630
349.1	205.9	0.738	12.20	7.321	2.025	1.995	5.723	-0.044	2.708	2.752	0.757	1.710	1.754	0.998	3.637
352.0	206.0	0.744	12.30	7.329	2.024	1.994	5.724	-0.044	2.706	2.750	0.756	1.710	1.753	0.997	3.637
354.9	207.0	0.750	12.40	7.338	2.031	2.001	5.716	-0.052	2.713	2.765	0.764	1.713	1.765	1.000	3.617
357.9	208.3	0.756	12.50	7.346	2.042	2.011	5.713	-0.055	2.724	2.779	0.767	1.718	1.773	1.006	3.622
360.8	209.2	0.762	12.60	7.355	2.048	2.017	5.714	-0.054	2.730	2.784	0.766	1.721	1.775	1.009	3.632
363.8	209.7	0.768	12.70	7.363	2.051	2.020	5.708	-0.059	2.733	2.792	0.772	1.723	1.782	1.010	3.617
366.7	209.7	0.774	12.80	7.371	2.049	2.018	5.702	-0.066	2.730	2.796	0.778	1.721	1.787	1.009	3.592
369.6	210.4	0.780	12.90	7.380	2.053	2.022	5.704	-0.063	2.734	2.797	0.776	1.723	1.787	1.011	3.606
372.6	211.4	0.787	13.00	7.388	2.060	2.029	5.700	-0.068	2.741	2.809	0.780	1.727	1.795	1.014	3.600
375.5	212.0	0.793	13.10	7.397	2.063	2.032	5.693	-0.074	2.744	2.819	0.787	1.728	1.803	1.016	3.582
378.4	212.7	0.799	13.20	7.405	2.068	2.036	5.696	-0.071	2.749	2.820	0.784	1.731	1.802	1.018	3.597
381.3	213.0	0.805	13.30	7.414	2.069	2.036	5.692	-0.075	2.749	2.824	0.788	1.731	1.806	1.018	3.585
384.2	213.7	0.811	13.40	7.422	2.073	2.041	5.689	-0.078	2.754	2.832	0.791	1.733	1.811	1.021	3.581
387.1	214.8	0.817	13.50	7.431	2.081	2.049	5.687	-0.080	2.761	2.842	0.793	1.737	1.817	1.024	3.585
390.0	215.2	0.823	13.60	7.440	2.083	2.050	5.686	-0.081	2.762	2.844	0.794	1.737	1.819	1.025	3.581
393.0	216.0	0.829	13.70	7.448	2.088	2.055	5.682	-0.086	2.768	2.853	0.798	1.740	1.826	1.027	3.574
395.9	217.1	0.835	13.80	7.457	2.096	2.062	5.682	-0.085	2.775	2.860	0.798	1.744	1.829	1.031	3.585
398.9	217.8	0.841	13.90	7.466	2.101	2.067	5.679	-0.088	2.780	2.868	0.801	1.746	1.834	1.034	3.582
401.8	218.4	0.847	14.00	7.474	2.104	2.070	5.681	-0.086	2.783	2.869	0.799	1.748	1.834	1.035	3.592
404.8	218.8	0.853	14.10	7.483	2.106	2.071	5.674	-0.094	2.784	2.878	0.806	1.748	1.842	1.036	3.570
407.8	219.1	0.859	14.20	7.492	2.106	2.072	5.671	-0.097	2.784	2.881	0.809	1.748	1.845	1.036	3.560
410.8	220.3	0.865	14.30	7.500	2.114	2.080	5.672	-0.095	2.792	2.887	0.808	1.752	1.847	1.040	3.575
413.8	221.4	0.871	14.40	7.509	2.123	2.088	5.671	-0.097	2.800	2.897	0.809	1.756	1.853	1.044	3.580
416.8	222.0	0.877	14.50	7.518	2.126	2.091	5.664	-0.104	2.804	2.908	0.816	1.758	1.862	1.046	3.562
419.7	222.8	0.883	14.60	7.527	2.131	2.096	5.667	-0.101	2.808	2.909	0.813	1.760	1.861	1.048	3.576
422.6	224.3	0.889	14.70	7.536	2.144	2.108	5.661	-0.106	2.821	2.927	0.819	1.767	1.873	1.054	3.575
425.6	224.8	0.895	14.80	7.545	2.145	2.109	5.656	-0.111	2.822	2.933	0.824	1.767	1.879	1.055	3.560
428.6	225.7	0.901	14.90	7.553	2.151	2.115	5.658	-0.110	2.828	2.937	0.822	1.770	1.880	1.058	3.573
431.5	226.2	0.908	15.00	7.562	2.154	2.117	5.654	-0.114	2.830	2.944	0.826	1.771	1.885	1.059	3.562
434.5	227.1	0.914	15.10	7.571	2.159	2.123	5.646	-0.122	2.835	2.957	0.834	1.774	1.896	1.061	3.544
437.4	228.0	0.920	15.20	7.580	2.165	2.129	5.646	-0.121	2.841	2.962	0.834	1.777	1.898	1.064	3.553
440.3	228.2	0.926	15.30	7.589	2.165	2.128	5.644	-0.124	2.840	2.964	0.836	1.777	1.900	1.064	3.544
443.3	229.0	0.932	15.40	7.598	2.170	2.133	5.640	-0.127	2.846	2.973	0.840	1.779	1.906	1.067	3.541
446.3	229.5	0.938	15.50	7.607	2.173	2.135	5.637	-0.130	2.848	2.978	0.843	1.780	1.910	1.068	3.534
449.2	230.5	0.944	15.60	7.616	2.179	2.142	5.634	-0.134	2.854	2.988	0.846	1.783	1.917	1.071	3.531
452.1	230.8	0.950	15.70	7.625	2.180	2.142	5.632	-0.135	2.854	2.989	0.848	1.783	1.918	1.071	3.527
455.1	231.6	0.956	15.80	7.634	2.185	2.146	5.628	-0.140	2.859	2.999	0.852	1.786	1.926	1.073	3.518
458.0	232.0	0.962	15.90	7.643	2.185	2.147	5.624	-0.144	2.859	3.003	0.856	1.786	1.930	1.073	3.507
460.9	232.9	0.968	16.00	7.652	2.192	2.153	5.624	-0.144	2.866	3.009	0.856	1.789	1.933	1.076	3.514
463.8	233.7	0.974	16.10	7.661	2.196	2.157	5.620	-0.147	2.870	3.017	0.860	1.791	1.939	1.078	3.508
466.8	235.2	0.980	16.21	7.671	2.207	2.168	5.617	-0.150	2.881	3.031	0.863	1.797	1.947	1.084	3.513
469.7	236.1	0.986	16.31	7.680	2.214	2.174	5.619	-0.149	2.887	3.036	0.861	1.800	1.949	1.087	3.525
472.6	236.5	0.992	16.40	7.689	2.215	2.175	5.615	-0.152	2.888	3.040	0.865	1.800	1.952	1.088	3.516
475.5	237.1	0.998	16.50	7.698	2.218	2.178	5.609	-0.158	2.891	3.049	0.871	1.802	1.960	1.089	3.502
478.5	237.8	1.004	16.60	7.707	2.221	2.181	5.612	-0.156	2.894	3.049	0.868	1.803	1.959	1.091	3.511
481.4	238.5	1.010	16.70	7.717	2.226	2.185	5.607	-0.160	2.898	3.058	0.873	1.805	1.965	1.093	3.504
484.4	239.4	1.016	16.80	7.726	2.231	2.191	5.601	-0.166	2.903	3.070	0.879	1.808	1.974	1.095	3.492
487.3	240.8	1.022	16.90	7.735	2.242	2.201	5.606	-0.162	2.914	3.075	0.874	1.813	1.975	1.100	3.518
490.4	241.8	1.029	17.00	7.745	2.248	2.207	5.601	-0.166	2.919	3.085	0.879	1.816	1.982	1.103	3.512

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	FA-15-1, 7.7'-8.2'	Lab ID	48A
Description	Gravelly Lean Clay (CL), gray brown, moist, firm	Test ID	48A-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	11/30/2015

Specific Gravity	2.75
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	70
Nominal Consolidation Pressure (psi)	20

Saturation / Consolidation Results

Pore Pressure Parameter B	0.97
Measured Effective Consol. Stress (tsf)	1.438
Time to 50% Consolidation (min)	13.00
Actual Axial Strain Rate of Test (%/min)	0.018

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	145.1
Moisture Content (%)	11.5
Dry Unit Weight (pcf)	130.1
Void Ratio	0.317
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

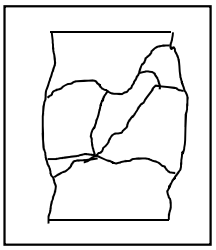
Axial Strain (%)	4.102
Deviator Stress (tsf)	1.900
Induced Pore Pressure (tsf)	0.578
Minor Effective Stress, σ_3' (tsf)	0.859
Major Effective Stress, σ_1' (tsf)	2.760
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.211
p' (tsf)	1.810
q (tsf)	0.950

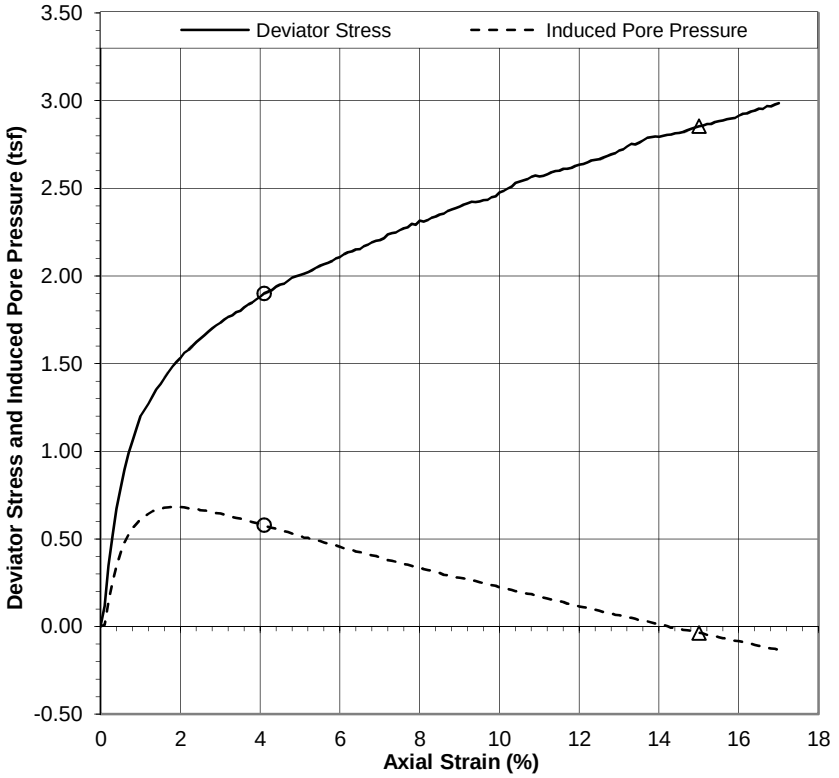
At Consolidated Undrained Failure

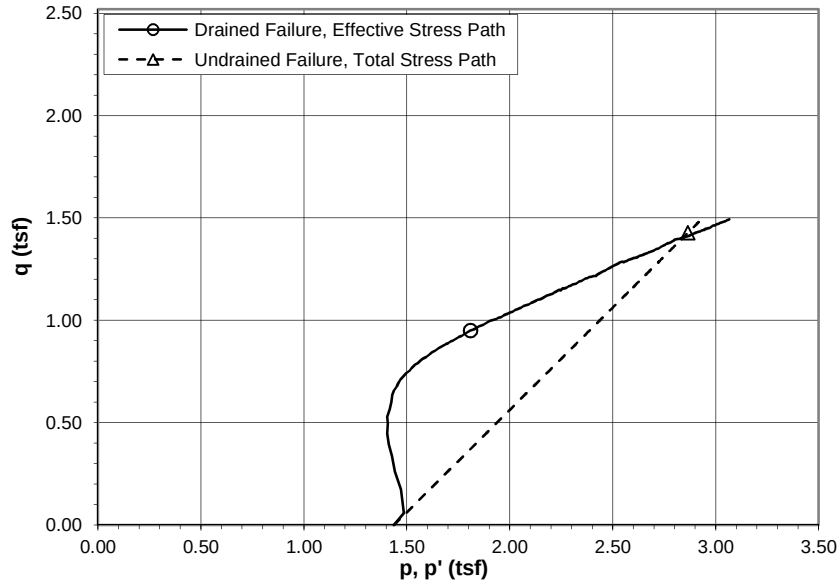
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.006
Deviator Stress (tsf)	2.855
Minor Principal Stress, σ_3 (tsf)	1.438
Major Principal Stress, σ_1 (tsf)	4.292
p (tsf)	2.865
q (tsf)	1.427

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: FA-15-1, 7.7'-8.2'
Description: Gravelly Lean Clay (CL), gray brown, moist, firm

Project No.: 175553023
Lab ID: 48A
Test ID: 48A-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.005	Calculated Height (in)	5.938
Average Diameter (in)	2.868	Calculated Diameter (in)	2.851
Calculated Area (in^2)	6.462	Calculated Area (in^2)	6.382
Moist Weight (lb)	3.201	Moist Weight (lb)	3.183
Moist Unit Weight (pcf)	142.6	Moist Unit Weight (pcf)	145.1
Moisture Content (%)	12.2	Moisture Content (%)	11.5
Dry Weight (lb)	2.854	Dry Weight (lb)	2.854
Dry Unit Weight (pcf)	127.1	Dry Unit Weight (pcf)	130.1
Void Ratio	0.348	Void Ratio	0.317
Degree of Saturation (%)	96.0	Degree of Saturation (%)	100.0

Specific Gravity: 2.75
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 1.438

Effective Consolidation Stress
σ_3' (tsf): 1.438

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: FA-15-1, 7.7'-8.2'								Lab ID: 48A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.382	0.000	0.000	5.042	0.000	1.438	1.438	1.438	1.438	1.438	0.000	1.000
3.7	10.3	0.006	0.10	6.389	0.116	0.116	5.052	0.010	1.554	1.544	1.428	1.496	1.486	0.058	1.081
9.1	30.8	0.012	0.20	6.395	0.347	0.347	5.182	0.140	1.784	1.644	1.298	1.611	1.471	0.173	1.267
14.1	46.4	0.018	0.30	6.402	0.521	0.521	5.298	0.256	1.958	1.702	1.182	1.698	1.442	0.260	1.441
19.4	60.0	0.024	0.40	6.408	0.674	0.673	5.388	0.346	2.111	1.765	1.092	1.774	1.429	0.337	1.617
24.6	70.4	0.030	0.50	6.414	0.790	0.789	5.463	0.420	2.227	1.807	1.017	1.832	1.412	0.395	1.776
29.6	79.9	0.036	0.60	6.421	0.896	0.895	5.523	0.480	2.332	1.852	0.957	1.885	1.405	0.447	1.935
34.8	88.6	0.042	0.70	6.427	0.993	0.991	5.568	0.526	2.429	1.903	0.912	1.933	1.407	0.495	2.087
39.7	94.6	0.048	0.80	6.434	1.059	1.057	5.603	0.561	2.494	1.934	0.877	1.966	1.405	0.528	2.205
44.6	101.5	0.053	0.90	6.440	1.135	1.133	5.629	0.586	2.570	1.984	0.851	2.004	1.417	0.566	2.331
49.8	107.7	0.060	1.00	6.447	1.202	1.200	5.655	0.612	2.638	2.025	0.825	2.038	1.425	0.600	2.454
59.7	114.4	0.071	1.20	6.460	1.275	1.272	5.686	0.644	2.710	2.066	0.794	2.074	1.430	0.636	2.602
64.7	118.3	0.077	1.30	6.466	1.317	1.314	5.700	0.657	2.751	2.094	0.780	2.094	1.437	0.657	2.683
69.7	122.0	0.083	1.40	6.473	1.357	1.354	5.706	0.664	2.791	2.128	0.774	2.115	1.451	0.677	2.750
74.7	124.8	0.089	1.50	6.479	1.387	1.383	5.714	0.671	2.821	2.149	0.766	2.129	1.458	0.692	2.805
79.7	128.1	0.095	1.60	6.486	1.422	1.418	5.720	0.678	2.856	2.178	0.760	2.147	1.469	0.709	2.867
84.8	131.1	0.101	1.70	6.493	1.454	1.450	5.722	0.680	2.888	2.208	0.758	2.163	1.483	0.725	2.913
90.1	134.3	0.107	1.80	6.499	1.488	1.484	5.725	0.682	2.921	2.239	0.755	2.179	1.497	0.742	2.964
95.4	136.7	0.113	1.90	6.506	1.513	1.508	5.721	0.679	2.946	2.267	0.759	2.192	1.513	0.754	2.988
100.9	139.1	0.119	2.00	6.513	1.538	1.533	5.724	0.681	2.970	2.289	0.756	2.204	1.523	0.766	3.027
106.4	141.9	0.125	2.10	6.519	1.567	1.562	5.723	0.680	3.000	2.319	0.757	2.219	1.538	0.781	3.063
111.9	143.6	0.131	2.20	6.526	1.584	1.579	5.717	0.675	3.016	2.342	0.763	2.227	1.552	0.789	3.070
117.3	145.6	0.137	2.30	6.532	1.605	1.599	5.717	0.674	3.037	2.363	0.763	2.237	1.563	0.800	3.095
122.8	148.0	0.143	2.40	6.539	1.630	1.624	5.716	0.673	3.061	2.388	0.764	2.250	1.576	0.812	3.124
128.3	149.9	0.149	2.50	6.546	1.648	1.642	5.707	0.664	3.080	2.416	0.773	2.259	1.594	0.821	3.123
133.7	151.9	0.154	2.60	6.553	1.669	1.662	5.703	0.661	3.100	2.439	0.777	2.269	1.608	0.831	3.140
139.1	153.9	0.160	2.70	6.559	1.689	1.683	5.702	0.660	3.120	2.461	0.778	2.279	1.619	0.841	3.164
144.5	155.9	0.166	2.80	6.566	1.709	1.702	5.695	0.653	3.140	2.487	0.785	2.289	1.636	0.851	3.169
149.7	157.5	0.172	2.90	6.573	1.726	1.718	5.690	0.647	3.156	2.509	0.790	2.297	1.649	0.859	3.175
155.1	159.0	0.178	3.00	6.580	1.740	1.733	5.687	0.644	3.171	2.526	0.793	2.304	1.660	0.866	3.185
160.3	160.9	0.184	3.10	6.586	1.759	1.751	5.679	0.637	3.189	2.552	0.801	2.313	1.676	0.876	3.187
165.7	162.5	0.190	3.20	6.593	1.774	1.766	5.674	0.631	3.204	2.572	0.806	2.321	1.689	0.883	3.191
171.1	163.4	0.196	3.30	6.600	1.782	1.774	5.668	0.625	3.212	2.587	0.812	2.325	1.700	0.887	3.184
176.7	165.3	0.202	3.40	6.607	1.802	1.793	5.662	0.620	3.231	2.611	0.818	2.334	1.715	0.897	3.192
182.4	166.3	0.208	3.50	6.614	1.810	1.802	5.658	0.616	3.239	2.624	0.822	2.338	1.723	0.901	3.192
188.1	168.2	0.214	3.60	6.621	1.829	1.820	5.651	0.609	3.258	2.649	0.829	2.348	1.739	0.910	3.196
193.6	169.9	0.220	3.70	6.627	1.845	1.836	5.646	0.604	3.274	2.670	0.834	2.356	1.752	0.918	3.203
199.4	171.2	0.226	3.80	6.634	1.858	1.849	5.639	0.596	3.287	2.691	0.841	2.362	1.766	0.925	3.198
205.0	173.1	0.232	3.90	6.641	1.876	1.867	5.633	0.590	3.305	2.714	0.847	2.371	1.781	0.934	3.203

Project: 175553023			Source: FA-15-1, 7.7'-8.2'								Lab ID: 48A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
210.6	174.5	0.238	4.00	6.648	1.890	1.880	5.627	0.584	3.318	2.734	0.853	2.378	1.793	0.940	3.204
216.0	176.6	0.244	4.10	6.655	1.910	1.900	5.621	0.578	3.338	2.760	0.859	2.388	1.810	0.950	3.211
221.5	177.6	0.250	4.20	6.662	1.920	1.910	5.611	0.569	3.347	2.778	0.869	2.392	1.824	0.955	3.198
227.0	178.8	0.255	4.30	6.669	1.930	1.920	5.606	0.564	3.357	2.794	0.874	2.398	1.834	0.960	3.197
232.4	180.9	0.261	4.40	6.676	1.951	1.940	5.600	0.557	3.378	2.820	0.880	2.408	1.850	0.970	3.204
237.7	182.1	0.267	4.50	6.683	1.961	1.950	5.591	0.549	3.388	2.839	0.889	2.413	1.864	0.975	3.195
243.0	182.8	0.273	4.60	6.690	1.967	1.956	5.586	0.543	3.394	2.850	0.894	2.416	1.872	0.978	3.187
248.4	184.5	0.279	4.70	6.697	1.983	1.972	5.581	0.539	3.410	2.871	0.899	2.424	1.885	0.986	3.194
253.6	186.5	0.285	4.80	6.704	2.003	1.991	5.573	0.531	3.429	2.898	0.907	2.433	1.902	0.996	3.196
258.9	187.4	0.291	4.90	6.711	2.010	1.998	5.569	0.527	3.436	2.909	0.911	2.437	1.910	0.999	3.194
264.4	188.2	0.297	5.00	6.718	2.017	2.005	5.562	0.520	3.442	2.922	0.918	2.440	1.920	1.002	3.184
269.7	189.1	0.303	5.10	6.725	2.025	2.012	5.549	0.507	3.450	2.943	0.931	2.444	1.937	1.006	3.162
275.1	190.3	0.309	5.20	6.732	2.035	2.023	5.548	0.506	3.460	2.954	0.932	2.449	1.943	1.011	3.171
280.5	191.4	0.315	5.30	6.739	2.045	2.032	5.537	0.494	3.469	2.975	0.943	2.454	1.959	1.016	3.154
285.8	193.1	0.321	5.40	6.747	2.061	2.047	5.534	0.492	3.485	2.993	0.946	2.461	1.970	1.024	3.165
291.1	194.3	0.327	5.50	6.754	2.071	2.058	5.530	0.487	3.495	3.008	0.950	2.466	1.979	1.029	3.166
296.5	195.4	0.333	5.60	6.761	2.081	2.067	5.521	0.479	3.505	3.026	0.959	2.471	1.992	1.034	3.156
301.8	196.4	0.339	5.70	6.768	2.089	2.075	5.515	0.473	3.513	3.040	0.965	2.475	2.002	1.038	3.151
307.1	197.6	0.345	5.80	6.775	2.100	2.086	5.508	0.466	3.524	3.058	0.972	2.481	2.015	1.043	3.146
312.6	199.2	0.350	5.90	6.782	2.115	2.100	5.504	0.462	3.538	3.076	0.976	2.488	2.026	1.050	3.152
318.0	200.2	0.356	6.00	6.790	2.123	2.108	5.498	0.456	3.546	3.090	0.982	2.492	2.036	1.054	3.147
323.3	201.9	0.362	6.10	6.797	2.139	2.124	5.488	0.446	3.561	3.116	0.992	2.499	2.054	1.062	3.141
328.8	203.1	0.368	6.20	6.804	2.149	2.134	5.484	0.442	3.572	3.130	0.996	2.505	2.063	1.067	3.143
334.4	204.0	0.374	6.30	6.811	2.156	2.141	5.480	0.437	3.578	3.141	1.000	2.508	2.071	1.070	3.140
339.9	205.3	0.380	6.40	6.819	2.167	2.152	5.471	0.429	3.590	3.161	1.009	2.514	2.085	1.076	3.133
345.4	205.6	0.386	6.50	6.826	2.169	2.153	5.466	0.423	3.591	3.167	1.014	2.514	2.091	1.077	3.123
350.9	207.5	0.392	6.60	6.833	2.186	2.170	5.462	0.419	3.608	3.188	1.018	2.523	2.103	1.085	3.132
356.5	208.5	0.398	6.70	6.841	2.195	2.179	5.454	0.411	3.616	3.205	1.026	2.527	2.115	1.089	3.123
362.1	210.0	0.404	6.80	6.848	2.208	2.191	5.448	0.406	3.629	3.223	1.032	2.533	2.128	1.096	3.124
367.6	211.0	0.410	6.90	6.855	2.217	2.200	5.445	0.403	3.637	3.234	1.035	2.537	2.134	1.100	3.126
373.2	211.7	0.416	7.00	6.863	2.221	2.204	5.436	0.394	3.642	3.248	1.044	2.540	2.146	1.102	3.112
378.7	212.9	0.422	7.10	6.870	2.232	2.214	5.430	0.388	3.652	3.264	1.050	2.545	2.157	1.107	3.110
384.1	215.4	0.428	7.20	6.878	2.255	2.238	5.421	0.378	3.675	3.297	1.059	2.556	2.178	1.119	3.112
389.7	216.2	0.434	7.30	6.885	2.261	2.244	5.417	0.375	3.681	3.306	1.063	2.559	2.185	1.122	3.111
395.3	216.9	0.440	7.40	6.892	2.266	2.248	5.413	0.370	3.686	3.316	1.067	2.562	2.192	1.124	3.106
400.8	218.5	0.446	7.50	6.900	2.280	2.262	5.402	0.360	3.699	3.340	1.078	2.568	2.209	1.131	3.098
406.5	219.8	0.451	7.60	6.907	2.291	2.273	5.399	0.357	3.710	3.354	1.081	2.574	2.217	1.136	3.102
412.1	220.5	0.457	7.70	6.915	2.296	2.278	5.395	0.353	3.715	3.363	1.085	2.576	2.224	1.139	3.099
417.6	222.7	0.463	7.80	6.922	2.317	2.298	5.389	0.346	3.735	3.389	1.091	2.586	2.240	1.149	3.105
423.3	222.4	0.469	7.90	6.930	2.311	2.292	5.380	0.337	3.729	3.392	1.100	2.584	2.246	1.146	3.083
428.9	224.9	0.475	8.00	6.937	2.334	2.315	5.380	0.337	3.752	3.415	1.100	2.595	2.258	1.157	3.104
434.4	224.8	0.481	8.10	6.945	2.331	2.311	5.370	0.328	3.749	3.421	1.110	2.593	2.265	1.155	3.083
440.0	225.9	0.487	8.20	6.952	2.340	2.320	5.364	0.321	3.758	3.436	1.116	2.598	2.276	1.160	3.078
445.4	227.4	0.493	8.30	6.960	2.352	2.332	5.361	0.318	3.770	3.451	1.119	2.604	2.285	1.166	3.084
450.9	228.4	0.499	8.40	6.968	2.360	2.340	5.353	0.311	3.778	3.467	1.127	2.608	2.297	1.170	3.077
456.5	229.7	0.505	8.50	6.975	2.371	2.350	5.347	0.305	3.788	3.483	1.133	2.613	2.308	1.175	3.075
462.0	230.5	0.511	8.60	6.983	2.377	2.356	5.336	0.294	3.794	3.500	1.144	2.616	2.322	1.178	3.060
467.3	232.2	0.517	8.70	6.991	2.391	2.370	5.334	0.292	3.808	3.516	1.146	2.623	2.331	1.185	3.069
472.9	233.3	0.523	8.80	6.998	2.400	2.379	5.332	0.290	3.817	3.527	1.148	2.627	2.337	1.190	3.073
478.6	234.3	0.529	8.90	7.006	2.408	2.387	5.323	0.281	3.824	3.543	1.157	2.631	2.350	1.193	3.063
483.9	235.6	0.535	9.00	7.014	2.418	2.397	5.320	0.278	3.834	3.556	1.160	2.636	2.358	1.198	3.067
489.5	236.9	0.541	9.10	7.021	2.429	2.407	5.317	0.275	3.845	3.570	1.163	2.641	2.366	1.204	3.070
495.0	237.9	0.547	9.20	7.029	2.437	2.415	5.308	0.266	3.852	3.587	1.172	2.645	2.379	1.207	3.061
500.6	239.1	0.552	9.30	7.037	2.446	2.423	5.306	0.264	3.861	3.597	1.174	2.649	2.386	1.212	3.064
505.9	239.2	0.558	9.40	7.045	2.444	2.422	5.302	0.259	3.859	3.600	1.178	2.648	2.389	1.211	3.055
511.3	239.8	0.564	9.50	7.052	2.448	2.425	5.295	0.252	3.863	3.611	1.185	2.650	2.398	1.213	3.046
516.9	240.8	0.570	9.61	7.060	2.456	2.433	5.289	0.247	3.870	3.623	1.191	2.654	2.407	1.216	3.043
522.2	241.2	0.576	9.70	7.068	2.457	2.433	5.278	0.236	3.871	3.635	1.202	2.654	2.419	1.217	3.025
527.7	243.0	0.582	9.80	7.076	2.473	2.449	5.279	0.236	3.887	3.650	1.201	2.662	2.426	1.225	3.039
533.3	243.9	0.588	9.90	7.084	2.479	2.455	5.275	0.233	3.893	3.660	1.205	2.665	2.432	1.228	3.038
538.7	246.2	0.594	10.00	7.092	2.500	2.476	5.265	0.223	3.913	3.691	1.215	2.675	2.453	1.238	3.038
544.3	247.5	0.600	10.10	7.099	2.510	2.485	5.260	0.217	3.923	3.705	1.220	2.680	2.463	1.243	3.037
549.9	249.1	0.606	10.20	7.107	2.523	2.498	5.258	0.215	3.936	3.721	1.222	2.687	2.472	1.249	3.044
555.5	250.5	0.612	10.31	7.115	2.535	2.510	5.251	0.208	3.947	3.739	1.229	2.692	2.484	1.255	3.042
561.1	252.8	0.618	10.40	7.123	2.555	2.530	5.244	0.201	3.968	3.767	1.236	2.703	2.502	1.265	3.046
578.0	256.0	0.636	10.71	7.147	2.579	2.553	5.230	0.187	3.991	3.803	1.250	2.714	2.527	1.277	3.042
583.6	257.6	0.642	10.80	7.155	2.592	2.566	5.227	0.184	4.004	3.819	1.253	2.721	2.536	1.283	3.047
589.4	258.6	0.647	10.90	7.163	2.599	2.573	5.219	0.177	4.010	3.833	1.261	2.724	2.547	1.286	3.040
595.1	258.5	0.653	11.01	7.171	2.595	2.568	5.213	0.170	4.006	3.835	1.267	2.722	2.551	1.284	3.027

Project: 175553023			Source: FA-15-1, 7.7'-8.2'								Lab ID: 48A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
600.6	259.1	0.659	11.10	7.179	2.599	2.572	5.208	0.166	4.009	3.844	1.272	2.723	2.558	1.286	3.022
606.5	260.3	0.665	11.21	7.188	2.608	2.581	5.201	0.159	4.018	3.859	1.279	2.728	2.569	1.290	3.018
612.1	261.6	0.671	11.30	7.196	2.618	2.591	5.196	0.154	4.028	3.875	1.284	2.733	2.579	1.295	3.018
617.7	262.8	0.677	11.41	7.204	2.627	2.599	5.192	0.149	4.037	3.888	1.288	2.737	2.588	1.300	3.018
623.3	263.2	0.683	11.51	7.212	2.628	2.600	5.187	0.144	4.037	3.893	1.293	2.737	2.593	1.300	3.010
629.0	264.7	0.689	11.61	7.220	2.640	2.611	5.182	0.140	4.049	3.909	1.298	2.743	2.604	1.306	3.012
634.7	265.0	0.695	11.71	7.228	2.640	2.612	5.173	0.130	4.049	3.919	1.307	2.743	2.613	1.306	2.998
640.3	265.9	0.701	11.80	7.236	2.646	2.617	5.168	0.126	4.055	3.929	1.312	2.746	2.620	1.309	2.995
646.1	267.4	0.707	11.91	7.245	2.657	2.628	5.165	0.123	4.066	3.943	1.315	2.752	2.629	1.314	2.999
651.6	268.4	0.713	12.01	7.253	2.664	2.635	5.156	0.114	4.072	3.958	1.324	2.755	2.641	1.317	2.991
657.4	269.1	0.719	12.11	7.261	2.669	2.639	5.153	0.110	4.077	3.966	1.327	2.757	2.647	1.320	2.989
663.1	270.4	0.725	12.21	7.269	2.678	2.649	5.149	0.106	4.086	3.980	1.331	2.762	2.656	1.324	2.990
668.8	271.7	0.731	12.31	7.278	2.688	2.659	5.140	0.098	4.096	3.998	1.340	2.767	2.669	1.329	2.985
674.4	272.5	0.737	12.41	7.286	2.692	2.662	5.137	0.095	4.100	4.005	1.343	2.769	2.674	1.331	2.983
680.1	273.1	0.743	12.51	7.294	2.696	2.666	5.133	0.090	4.103	4.013	1.347	2.770	2.680	1.333	2.979
685.6	274.4	0.748	12.61	7.303	2.706	2.675	5.125	0.082	4.113	4.030	1.355	2.775	2.693	1.338	2.974
691.1	275.6	0.754	12.71	7.311	2.714	2.683	5.121	0.079	4.121	4.043	1.359	2.779	2.701	1.342	2.975
696.9	277.0	0.760	12.81	7.320	2.725	2.694	5.118	0.075	4.132	4.056	1.362	2.785	2.709	1.347	2.978
702.4	278.1	0.766	12.91	7.328	2.733	2.701	5.108	0.066	4.139	4.073	1.372	2.788	2.722	1.351	2.969
708.0	279.8	0.772	13.01	7.336	2.746	2.715	5.106	0.064	4.152	4.088	1.374	2.795	2.731	1.357	2.976
713.6	281.0	0.778	13.11	7.345	2.755	2.723	5.102	0.059	4.161	4.101	1.378	2.799	2.740	1.362	2.976
719.2	283.0	0.784	13.21	7.353	2.771	2.739	5.094	0.052	4.177	4.125	1.386	2.807	2.756	1.370	2.977
724.7	284.9	0.790	13.31	7.362	2.786	2.754	5.092	0.049	4.191	4.142	1.388	2.814	2.765	1.377	2.984
730.3	284.9	0.796	13.41	7.370	2.783	2.751	5.087	0.044	4.188	4.144	1.393	2.813	2.769	1.375	2.974
736.0	286.3	0.802	13.51	7.379	2.793	2.761	5.078	0.036	4.198	4.162	1.402	2.818	2.782	1.380	2.970
741.4	288.0	0.808	13.61	7.387	2.807	2.774	5.074	0.032	4.211	4.180	1.406	2.825	2.793	1.387	2.973
746.9	289.8	0.814	13.71	7.396	2.821	2.788	5.072	0.030	4.225	4.196	1.408	2.831	2.802	1.394	2.980
758.0	291.2	0.826	13.91	7.413	2.829	2.795	5.060	0.018	4.233	4.215	1.420	2.835	2.817	1.398	2.968
763.5	291.5	0.832	14.01	7.422	2.828	2.794	5.050	0.008	4.231	4.224	1.430	2.834	2.827	1.397	2.954
769.4	292.4	0.838	14.11	7.430	2.834	2.799	5.052	0.009	4.237	4.228	1.428	2.837	2.828	1.400	2.960
775.0	293.3	0.844	14.21	7.439	2.838	2.804	5.046	0.003	4.242	4.238	1.434	2.840	2.836	1.402	2.955
780.5	293.8	0.849	14.31	7.448	2.841	2.806	5.036	-0.006	4.244	4.250	1.444	2.841	2.847	1.403	2.943
786.3	295.0	0.855	14.41	7.456	2.848	2.814	5.036	-0.006	4.251	4.257	1.444	2.844	2.851	1.407	2.949
792.0	295.7	0.861	14.51	7.465	2.852	2.817	5.032	-0.011	4.254	4.265	1.448	2.846	2.856	1.408	2.945
797.5	296.6	0.867	14.61	7.474	2.858	2.822	5.023	-0.020	4.260	4.280	1.457	2.849	2.869	1.411	2.936
803.1	297.8	0.873	14.71	7.483	2.866	2.830	5.020	-0.022	4.268	4.290	1.460	2.853	2.875	1.415	2.939
808.8	299.1	0.879	14.81	7.491	2.875	2.839	5.017	-0.025	4.277	4.302	1.463	2.857	2.882	1.420	2.941
814.6	300.3	0.885	14.91	7.500	2.883	2.847	5.009	-0.033	4.284	4.317	1.471	2.861	2.894	1.423	2.936
820.2	301.5	0.891	15.01	7.509	2.891	2.855	5.006	-0.036	4.292	4.329	1.474	2.865	2.901	1.427	2.937
826.1	302.2	0.897	15.11	7.518	2.895	2.858	5.003	-0.039	4.296	4.335	1.477	2.867	2.906	1.429	2.935
831.8	303.5	0.903	15.21	7.527	2.903	2.866	4.994	-0.048	4.304	4.352	1.486	2.871	2.919	1.433	2.929
837.5	304.0	0.909	15.31	7.536	2.905	2.867	4.990	-0.052	4.305	4.357	1.490	2.871	2.924	1.434	2.924
843.0	305.5	0.915	15.41	7.544	2.915	2.878	4.988	-0.054	4.315	4.369	1.492	2.876	2.931	1.439	2.929
848.7	306.5	0.921	15.51	7.553	2.921	2.884	4.980	-0.062	4.321	4.384	1.500	2.880	2.942	1.442	2.923
854.3	307.3	0.927	15.61	7.562	2.926	2.888	4.976	-0.066	4.325	4.392	1.504	2.882	2.948	1.444	2.920
859.9	308.4	0.933	15.71	7.571	2.933	2.895	4.974	-0.068	4.332	4.401	1.506	2.885	2.953	1.447	2.922
865.6	309.1	0.939	15.81	7.580	2.936	2.898	4.967	-0.075	4.335	4.410	1.513	2.886	2.962	1.449	2.915
871.3	309.9	0.944	15.91	7.589	2.940	2.901	4.961	-0.081	4.339	4.420	1.519	2.888	2.969	1.451	2.910
876.8	311.6	0.950	16.01	7.598	2.952	2.914	4.959	-0.084	4.351	4.435	1.521	2.894	2.978	1.457	2.915
882.5	313.2	0.956	16.11	7.608	2.964	2.925	4.954	-0.088	4.363	4.451	1.526	2.900	2.989	1.463	2.917
888.2	313.9	0.962	16.21	7.617	2.967	2.928	4.947	-0.096	4.365	4.461	1.533	2.901	2.997	1.464	2.909
893.9	315.4	0.968	16.31	7.626	2.978	2.938	4.944	-0.098	4.376	4.474	1.536	2.907	3.005	1.469	2.913
899.6	316.3	0.974	16.41	7.635	2.983	2.943	4.937	-0.106	4.381	4.486	1.543	2.909	3.015	1.472	2.907
905.4	318.0	0.980	16.51	7.644	2.995	2.955	4.932	-0.110	4.392	4.503	1.548	2.915	3.025	1.477	2.909
911.1	318.2	0.986	16.61	7.653	2.994	2.953	4.929	-0.113	4.391	4.504	1.551	2.914	3.027	1.477	2.904
916.8	320.2	0.992	16.71	7.662	3.009	2.968	4.920	-0.122	4.406	4.528	1.560	2.922	3.044	1.484	2.903
922.4	320.5	0.998	16.81	7.672	3.008	2.968	4.917	-0.125	4.405	4.530	1.563	2.921	3.047	1.484	2.899
928.2	322.0	1.004	16.91	7.681	3.019	2.978	4.916	-0.127	4.415	4.542	1.564	2.926	3.053	1.489	2.903
933.9	323.3	1.010	17.01	7.690	3.027	2.986	4.907	-0.135	4.424	4.559	1.573	2.931	3.066	1.493	2.899

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	FA-15-1, 13.2'-13.7'	Lab ID	50B
Description	Lean Clay with Sand (CL), gray brown, moist, firm	Test ID	50B-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	12/01/2015

Specific Gravity	2.78
ASTM D 854, A	
Liquid Limit	35
Plastic Limit	20
Plasticity Index	15
ASTM D 4318	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	60
Nominal Consolidation Pressure (psi)	30

Saturation / Consolidation Results

Pore Pressure Parameter B	0.98
Measured Effective Consol. Stress (tsf)	2.160
Time to 50% Consolidation (min)	14.00
Actual Axial Strain Rate of Test (%/min)	0.008

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	141.4
Moisture Content (%)	14.5
Dry Unit Weight (pcf)	123.4
Void Ratio	0.403
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

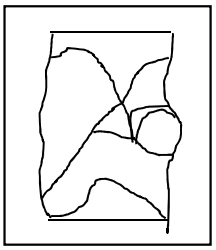
Axial Strain (%)	3.599
Deviator Stress (tsf)	2.450
Induced Pore Pressure (tsf)	1.025
Minor Effective Stress, σ_3' (tsf)	1.135
Major Effective Stress, σ_1' (tsf)	3.585
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.158
p' (tsf)	2.360
q (tsf)	1.225

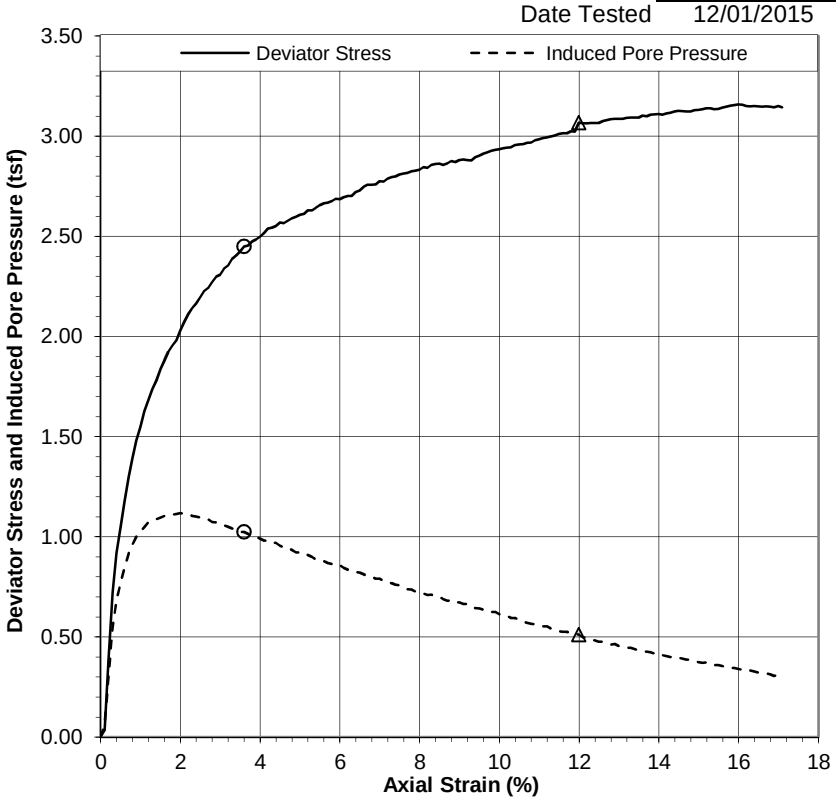
At Consolidated Undrained Failure

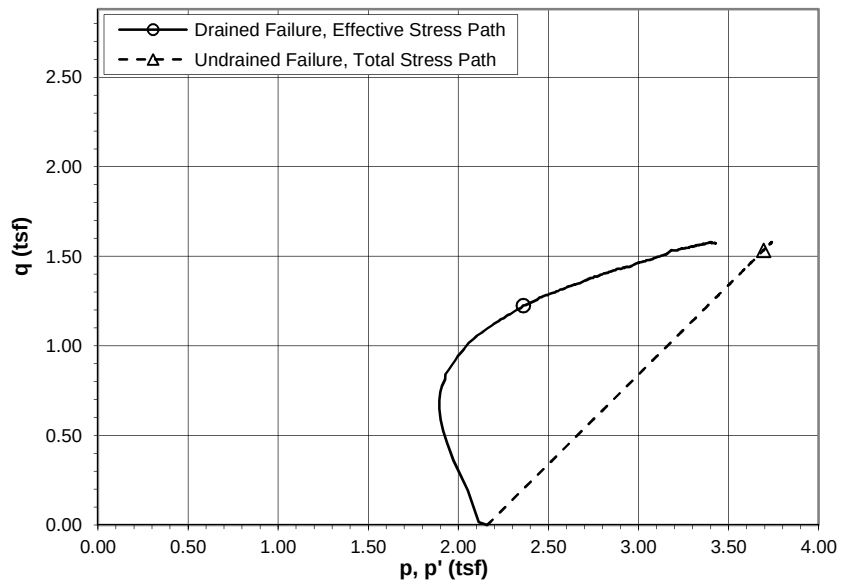
Failure Criterion: Peak Deviator Stress

Axial Strain (%)	11.993
Deviator Stress (tsf)	3.068
Minor Principal Stress, σ_3 (tsf)	2.160
Major Principal Stress, σ_1 (tsf)	5.228
p (tsf)	3.694
q (tsf)	1.534

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: FA-15-1, 13.2'-13.7'
Description: Lean Clay with Sand (CL), gray brown, moist, firm

Project No.: 175553023
Lab ID: 50B
Test ID: 50B-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.096	Calculated Height (in)	5.994
Average Diameter (in)	2.884	Calculated Diameter (in)	2.876
Calculated Area (in^2)	6.533	Calculated Area (in^2)	6.497
Moist Weight (lb)	3.183	Moist Weight (lb)	3.186
Moist Unit Weight (pcf)	138.1	Moist Unit Weight (pcf)	141.4
Moisture Content (%)	14.4	Moisture Content (%)	14.5
Dry Weight (lb)	2.782	Dry Weight (lb)	2.782
Dry Unit Weight (pcf)	120.7	Dry Unit Weight (pcf)	123.4
Void Ratio	0.435	Void Ratio	0.403
Degree of Saturation (%)	92.2	Degree of Saturation (%)	100.0

Specific Gravity: 2.78
ASTM D 854, A

Liquid Limit: 35
Plastic Limit: 20
Plasticity Index: 15
ASTM D 4318

Confining Stress
σ_3 (tsf): 2.160

Effective Consolidation Stress
σ_3' (tsf): 2.160

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: FA-15-1, 13.2'-13.7'								Lab ID: 50B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.497	0.000	0.000	4.320	0.000	2.160	2.160	2.160	2.160	2.160	0.000	1.000
4.6	3.0	0.006	0.10	6.504	0.034	0.033	4.383	0.064	2.194	2.130	2.097	2.177	2.113	0.017	1.016
27.3	34.8	0.012	0.20	6.510	0.385	0.384	4.619	0.299	2.544	2.245	1.861	2.352	2.053	0.192	1.206
48.2	65.5	0.018	0.30	6.517	0.724	0.723	4.868	0.548	2.883	2.335	1.612	2.522	1.973	0.361	1.448
66.0	83.4	0.024	0.40	6.524	0.920	0.919	5.003	0.683	3.080	2.397	1.477	2.620	1.937	0.460	1.622
82.3	95.4	0.030	0.50	6.530	1.052	1.050	5.089	0.770	3.211	2.441	1.391	2.686	1.916	0.525	1.755
99.8	106.8	0.036	0.60	6.537	1.176	1.175	5.165	0.846	3.335	2.489	1.315	2.748	1.902	0.587	1.894
120.4	118.1	0.042	0.70	6.543	1.300	1.298	5.235	0.915	3.458	2.543	1.245	2.809	1.894	0.649	2.043
139.5	126.9	0.048	0.80	6.550	1.395	1.393	5.283	0.963	3.554	2.591	1.197	2.857	1.894	0.697	2.164
159.0	135.1	0.054	0.90	6.556	1.484	1.481	5.321	1.001	3.642	2.641	1.159	2.901	1.900	0.741	2.278
177.5	141.5	0.060	1.00	6.563	1.552	1.550	5.346	1.026	3.710	2.684	1.134	2.935	1.909	0.775	2.367
197.5	148.7	0.066	1.10	6.570	1.629	1.627	5.367	1.048	3.787	2.739	1.113	2.974	1.926	0.813	2.462
219.5	154.1	0.072	1.20	6.576	1.687	1.684	5.393	1.074	3.844	2.771	1.087	3.002	1.929	0.842	2.550
241.1	159.0	0.078	1.30	6.583	1.739	1.736	5.400	1.081	3.897	2.816	1.080	3.028	1.948	0.868	2.608
262.0	163.3	0.084	1.40	6.590	1.784	1.781	5.407	1.088	3.941	2.853	1.073	3.051	1.963	0.890	2.661
282.5	168.9	0.090	1.50	6.596	1.843	1.840	5.416	1.096	4.000	2.904	1.064	3.080	1.984	0.920	2.729
305.7	172.9	0.096	1.60	6.603	1.885	1.881	5.424	1.105	4.042	2.937	1.056	3.101	1.996	0.941	2.782
326.6	176.9	0.102	1.70	6.610	1.928	1.923	5.429	1.109	4.084	2.975	1.051	3.122	2.013	0.962	2.829
348.1	180.2	0.108	1.80	6.616	1.960	1.956	5.430	1.111	4.116	3.006	1.050	3.138	2.028	0.978	2.863
365.3	182.6	0.114	1.90	6.623	1.985	1.980	5.434	1.114	4.140	3.026	1.046	3.150	2.036	0.990	2.892
387.6	187.5	0.120	2.00	6.630	2.037	2.032	5.438	1.118	4.192	3.074	1.042	3.176	2.058	1.016	2.949
404.4	191.7	0.126	2.10	6.637	2.079	2.074	5.433	1.113	4.235	3.121	1.047	3.197	2.084	1.037	2.981
418.4	195.5	0.132	2.20	6.644	2.119	2.113	5.433	1.113	4.274	3.161	1.047	3.217	2.104	1.057	3.018
431.6	198.4	0.138	2.30	6.650	2.148	2.142	5.424	1.105	4.303	3.198	1.056	3.232	2.127	1.071	3.030
446.1	200.7	0.144	2.40	6.657	2.170	2.164	5.421	1.101	4.325	3.224	1.059	3.243	2.141	1.082	3.043
460.7	203.8	0.150	2.50	6.664	2.202	2.196	5.415	1.096	4.357	3.261	1.065	3.258	2.163	1.098	3.063
475.1	207.0	0.156	2.60	6.671	2.234	2.228	5.406	1.086	4.388	3.302	1.074	3.274	2.188	1.114	3.075
488.8	208.7	0.162	2.70	6.678	2.250	2.244	5.406	1.086	4.404	3.318	1.074	3.282	2.196	1.122	3.088
502.4	211.6	0.168	2.80	6.685	2.279	2.272	5.394	1.074	4.432	3.358	1.086	3.296	2.222	1.136	3.092
515.6	214.3	0.174	2.90	6.691	2.306	2.299	5.393	1.073	4.459	3.386	1.087	3.310	2.236	1.149	3.114
529.3	215.5	0.180	3.00	6.698	2.316	2.309	5.382	1.062	4.469	3.407	1.098	3.315	2.252	1.154	3.103
543.4	218.6	0.186	3.10	6.705	2.348	2.340	5.378	1.059	4.500	3.442	1.102	3.330	2.272	1.170	3.124
557.5	220.3	0.192	3.20	6.712	2.363	2.356	5.369	1.049	4.516	3.467	1.111	3.338	2.289	1.178	3.120
570.9	223.4	0.198	3.30	6.719	2.394	2.386	5.361	1.041	4.547	3.505	1.119	3.353	2.312	1.193	3.132
584.0	225.3	0.204	3.40	6.726	2.412	2.404	5.355	1.036	4.564	3.529	1.125	3.362	2.327	1.202	3.137
596.6	227.4	0.210	3.50	6.733	2.431	2.423	5.345	1.025	4.583	3.558	1.135	3.372	2.347	1.212	3.134
609.9	230.2	0.216	3.60	6.740	2.459	2.450	5.345	1.025	4.610	3.585	1.135	3.385	2.360	1.225	3.158
622.8	230.8	0.222	3.70	6.747	2.463	2.454	5.334	1.014	4.614	3.600	1.146	3.387	2.373	1.227	3.141
635.8	233.0	0.228	3.80	6.754	2.484	2.475	5.322	1.003	4.635	3.632	1.158	3.398	2.395	1.237	3.138

Project: 175553023			Source: FA-15-1, 13.2'-13.7'								Lab ID: 50B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
648.6	234.2	0.234	3.90	6.761	2.494	2.485	5.320	1.000	4.645	3.645	1.160	3.403	2.402	1.242	3.142
661.5	235.8	0.240	4.00	6.768	2.508	2.499	5.310	0.990	4.659	3.669	1.170	3.410	2.419	1.249	3.136
673.7	237.7	0.246	4.10	6.775	2.526	2.516	5.300	0.981	4.676	3.696	1.180	3.418	2.438	1.258	3.133
686.0	240.1	0.252	4.20	6.782	2.549	2.539	5.299	0.979	4.699	3.720	1.181	3.430	2.450	1.269	3.150
698.3	240.8	0.258	4.30	6.789	2.554	2.543	5.288	0.968	4.704	3.735	1.192	3.432	2.464	1.272	3.134
710.5	241.8	0.264	4.40	6.796	2.562	2.551	5.289	0.970	4.712	3.742	1.191	3.436	2.467	1.276	3.143
723.0	243.8	0.270	4.50	6.803	2.580	2.569	5.275	0.955	4.730	3.775	1.205	3.445	2.490	1.285	3.132
735.4	243.7	0.276	4.60	6.810	2.576	2.565	5.265	0.946	4.725	3.780	1.215	3.443	2.497	1.283	3.112
747.9	245.2	0.282	4.70	6.818	2.589	2.578	5.264	0.944	4.738	3.794	1.216	3.449	2.505	1.289	3.120
760.3	246.6	0.288	4.80	6.825	2.602	2.590	5.254	0.934	4.751	3.816	1.226	3.455	2.521	1.295	3.113
772.5	247.6	0.294	4.90	6.832	2.609	2.597	5.242	0.922	4.758	3.836	1.238	3.459	2.537	1.299	3.097
784.8	248.9	0.300	5.00	6.839	2.620	2.608	5.241	0.921	4.768	3.847	1.239	3.464	2.543	1.304	3.105
797.3	249.6	0.306	5.10	6.846	2.625	2.613	5.232	0.912	4.773	3.861	1.248	3.467	2.554	1.306	3.093
810.0	251.5	0.312	5.20	6.854	2.642	2.629	5.229	0.910	4.790	3.880	1.251	3.475	2.565	1.315	3.102
822.9	251.9	0.318	5.30	6.861	2.643	2.631	5.219	0.899	4.791	3.891	1.261	3.476	2.576	1.315	3.086
835.4	253.3	0.324	5.40	6.868	2.656	2.643	5.207	0.888	4.803	3.915	1.273	3.482	2.594	1.321	3.076
848.3	254.8	0.329	5.50	6.875	2.668	2.655	5.207	0.887	4.815	3.928	1.273	3.488	2.601	1.327	3.085
861.0	256.1	0.335	5.60	6.883	2.679	2.665	5.199	0.879	4.826	3.946	1.281	3.493	2.614	1.333	3.080
873.7	256.6	0.341	5.70	6.890	2.681	2.667	5.190	0.870	4.828	3.958	1.290	3.494	2.624	1.334	3.067
886.6	257.7	0.347	5.80	6.897	2.690	2.676	5.185	0.865	4.836	3.971	1.295	3.498	2.633	1.338	3.066
898.9	259.1	0.353	5.90	6.905	2.702	2.687	5.176	0.856	4.848	3.991	1.304	3.504	2.648	1.344	3.061
911.6	259.1	0.359	6.00	6.912	2.699	2.685	5.177	0.858	4.845	3.988	1.303	3.503	2.645	1.342	3.061
924.5	260.4	0.365	6.10	6.919	2.710	2.695	5.166	0.846	4.856	4.010	1.314	3.508	2.662	1.348	3.051
937.5	261.4	0.371	6.20	6.927	2.717	2.702	5.156	0.836	4.862	4.026	1.324	3.511	2.675	1.351	3.040
950.6	261.7	0.377	6.30	6.934	2.717	2.702	5.152	0.833	4.862	4.030	1.328	3.511	2.679	1.351	3.035
964.0	263.8	0.383	6.40	6.941	2.736	2.721	5.143	0.823	4.881	4.058	1.337	3.521	2.698	1.360	3.035
977.5	264.9	0.389	6.50	6.949	2.745	2.729	5.141	0.821	4.890	4.069	1.339	3.525	2.704	1.365	3.038
991.0	266.8	0.395	6.60	6.956	2.762	2.746	5.133	0.813	4.906	4.093	1.347	3.533	2.720	1.373	3.038
1004.7	268.3	0.401	6.70	6.964	2.774	2.758	5.122	0.802	4.918	4.115	1.358	3.539	2.737	1.379	3.031
1017.8	268.6	0.407	6.80	6.971	2.774	2.758	5.121	0.801	4.918	4.117	1.359	3.539	2.738	1.379	3.029
1031.7	269.1	0.413	6.90	6.979	2.776	2.760	5.111	0.791	4.920	4.129	1.369	3.540	2.749	1.380	3.015
1045.9	270.9	0.419	7.00	6.986	2.792	2.775	5.111	0.792	4.936	4.144	1.369	3.548	2.756	1.388	3.027
1059.9	271.1	0.425	7.10	6.994	2.791	2.774	5.099	0.779	4.934	4.155	1.381	3.547	2.768	1.387	3.008
1074.0	272.8	0.431	7.20	7.001	2.806	2.788	5.090	0.771	4.949	4.178	1.390	3.554	2.784	1.394	3.007
1088.3	273.8	0.437	7.30	7.009	2.813	2.795	5.089	0.769	4.956	4.186	1.391	3.558	2.789	1.398	3.010
1102.2	274.5	0.443	7.39	7.016	2.817	2.799	5.080	0.761	4.959	4.199	1.400	3.560	2.799	1.400	3.000
1116.9	275.7	0.449	7.50	7.024	2.827	2.809	5.078	0.758	4.969	4.211	1.402	3.565	2.806	1.404	3.003
1130.4	276.5	0.455	7.59	7.031	2.832	2.813	5.069	0.749	4.974	4.224	1.411	3.567	2.818	1.407	2.994
1144.2	277.2	0.461	7.69	7.039	2.835	2.817	5.058	0.739	4.977	4.238	1.422	3.569	2.830	1.408	2.981
1158.0	278.3	0.467	7.80	7.047	2.844	2.825	5.057	0.737	4.986	4.248	1.423	3.573	2.836	1.413	2.986
1171.7	278.9	0.473	7.89	7.054	2.847	2.828	5.048	0.728	4.988	4.260	1.432	3.574	2.846	1.414	2.974
1185.4	279.7	0.479	7.99	7.062	2.851	2.832	5.046	0.727	4.992	4.266	1.434	3.576	2.850	1.416	2.975
1199.3	281.3	0.485	8.09	7.070	2.865	2.845	5.038	0.718	5.006	4.288	1.442	3.583	2.865	1.423	2.973
1212.8	281.4	0.491	8.20	7.077	2.862	2.843	5.030	0.710	5.003	4.293	1.450	3.582	2.872	1.421	2.960
1226.5	283.1	0.497	8.29	7.085	2.877	2.857	5.030	0.711	5.017	4.306	1.450	3.589	2.878	1.428	2.970
1240.2	283.9	0.503	8.40	7.093	2.882	2.862	5.021	0.702	5.022	4.320	1.459	3.591	2.889	1.431	2.962
1253.4	284.4	0.509	8.49	7.101	2.883	2.863	5.019	0.700	5.023	4.324	1.461	3.592	2.892	1.432	2.960
1266.5	284.1	0.515	8.59	7.108	2.878	2.857	5.009	0.689	5.018	4.328	1.471	3.589	2.900	1.429	2.943
1280.1	285.2	0.521	8.69	7.116	2.885	2.865	5.001	0.682	5.025	4.343	1.479	3.593	2.911	1.432	2.937
1293.3	286.6	0.527	8.79	7.124	2.896	2.875	5.002	0.682	5.035	4.353	1.478	3.598	2.916	1.438	2.945
1306.5	286.5	0.533	8.89	7.132	2.892	2.871	4.992	0.673	5.031	4.358	1.488	3.596	2.923	1.435	2.930
1320.2	287.8	0.539	8.99	7.140	2.902	2.880	4.993	0.673	5.041	4.367	1.487	3.601	2.927	1.440	2.937
1333.5	288.5	0.545	9.09	7.147	2.906	2.884	4.985	0.666	5.044	4.379	1.495	3.602	2.937	1.442	2.929
1347.3	288.4	0.551	9.19	7.155	2.902	2.880	4.984	0.665	5.040	4.376	1.496	3.600	2.936	1.440	2.925
1361.0	288.7	0.557	9.29	7.163	2.902	2.879	4.972	0.652	5.040	4.388	1.508	3.600	2.948	1.440	2.909
1374.6	290.6	0.563	9.39	7.171	2.918	2.895	4.964	0.644	5.056	4.411	1.516	3.608	2.964	1.448	2.910
1388.3	291.7	0.569	9.49	7.179	2.925	2.903	4.963	0.643	5.063	4.420	1.517	3.612	2.968	1.451	2.913
1402.4	293.0	0.575	9.59	7.187	2.935	2.912	4.956	0.636	5.072	4.437	1.524	3.616	2.980	1.456	2.910
1416.5	294.0	0.581	9.69	7.195	2.942	2.919	4.955	0.635	5.079	4.444	1.525	3.620	2.984	1.459	2.914
1430.4	295.1	0.587	9.79	7.203	2.950	2.926	4.944	0.624	5.087	4.462	1.536	3.623	2.999	1.463	2.905
1444.1	296.0	0.593	9.89	7.211	2.956	2.932	4.944	0.625	5.092	4.468	1.536	3.626	3.002	1.466	2.909
1457.9	296.6	0.599	9.99	7.219	2.959	2.935	4.934	0.614	5.095	4.481	1.546	3.628	3.014	1.467	2.898
1471.5	297.5	0.605	10.09	7.227	2.964	2.940	4.926	0.606	5.101	4.494	1.554	3.630	3.024	1.470	2.892
1485.2	298.1	0.611	10.19	7.235	2.967	2.942	4.924	0.604	5.103	4.498	1.556	3.632	3.027	1.471	2.891
1498.6	298.6	0.617	10.29	7.243	2.969	2.944	4.914	0.594	5.104	4.510	1.566	3.632	3.038	1.472	2.880
1512.4	300.1	0.623	10.39	7.251	2.980	2.955	4.915	0.595	5.115	4.520	1.565	3.638	3.043	1.477	2.888
1526.0	300.9	0.629	10.49	7.259	2.985	2.959	4.905	0.586	5.120	4.534	1.575	3.640	3.054	1.480	2.879
1539.8	301.3	0.635	10.59	7.267	2.985	2.960	4.897	0.577	5.120	4.543	1.583	3.640	3.063	1.480	2.870
1553.1	302.4	0.641	10.69	7.275	2.993	2.967	4.891	0.571	5.128	4.556	1.589	3.644	3.073	1.484	2.867

Project: 175553023			Source: FA-15-1, 13.2'-13.7'								Lab ID: 50B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
1566.9	302.9	0.647	10.79	7.284	2.994	2.968	4.885	0.566	5.128	4.563	1.595	3.644	3.079	1.484	2.861
1581.0	304.3	0.653	10.89	7.292	3.005	2.979	4.885	0.565	5.139	4.574	1.595	3.650	3.085	1.489	2.867
1594.6	305.2	0.659	10.99	7.300	3.011	2.984	4.878	0.558	5.144	4.586	1.602	3.652	3.094	1.492	2.862
1608.1	306.3	0.665	11.09	7.308	3.018	2.991	4.873	0.553	5.152	4.598	1.607	3.656	3.103	1.496	2.861
1621.4	306.9	0.671	11.19	7.316	3.020	2.994	4.872	0.553	5.154	4.601	1.608	3.657	3.104	1.497	2.862
1634.8	307.9	0.677	11.29	7.325	3.026	2.999	4.861	0.542	5.160	4.618	1.619	3.660	3.118	1.500	2.853
1648.3	308.7	0.683	11.39	7.333	3.031	3.003	4.857	0.538	5.164	4.626	1.623	3.662	3.124	1.502	2.851
1661.4	309.8	0.689	11.49	7.341	3.039	3.011	4.849	0.530	5.172	4.642	1.631	3.666	3.136	1.506	2.847
1674.7	310.6	0.695	11.59	7.349	3.043	3.015	4.846	0.526	5.175	4.649	1.634	3.668	3.142	1.508	2.845
1688.0	310.9	0.701	11.69	7.358	3.043	3.015	4.846	0.526	5.175	4.649	1.634	3.668	3.142	1.507	2.844
1701.4	312.3	0.707	11.79	7.366	3.053	3.025	4.837	0.517	5.185	4.668	1.643	3.673	3.156	1.512	2.841
1714.7	312.5	0.713	11.89	7.374	3.052	3.023	4.835	0.515	5.183	4.668	1.645	3.672	3.157	1.511	2.838
1724.6	317.5	0.719	11.99	7.383	3.096	3.068	4.831	0.512	5.228	4.716	1.649	3.694	3.182	1.534	2.861
1731.4	317.5	0.725	12.09	7.391	3.093	3.064	4.819	0.500	5.224	4.725	1.661	3.692	3.193	1.532	2.845
1738.2	317.9	0.731	12.19	7.400	3.093	3.064	4.815	0.496	5.224	4.728	1.665	3.692	3.196	1.532	2.841
1744.9	318.5	0.737	12.29	7.408	3.095	3.066	4.808	0.488	5.226	4.738	1.672	3.693	3.205	1.533	2.833
1751.6	318.8	0.743	12.39	7.416	3.095	3.065	4.803	0.483	5.226	4.743	1.677	3.693	3.210	1.533	2.828
1758.3	319.2	0.749	12.49	7.425	3.096	3.066	4.796	0.477	5.226	4.749	1.684	3.693	3.217	1.533	2.821
1765.0	320.6	0.755	12.59	7.433	3.105	3.075	4.796	0.476	5.235	4.759	1.684	3.698	3.222	1.537	2.826
1771.7	321.5	0.761	12.69	7.442	3.110	3.080	4.790	0.470	5.240	4.770	1.690	3.700	3.230	1.540	2.822
1778.4	322.4	0.767	12.79	7.450	3.116	3.085	4.782	0.463	5.246	4.783	1.698	3.703	3.240	1.543	2.817
1784.9	322.9	0.773	12.89	7.459	3.117	3.086	4.785	0.465	5.246	4.781	1.695	3.703	3.238	1.543	2.820
1791.5	323.4	0.779	12.99	7.468	3.118	3.087	4.776	0.456	5.247	4.791	1.704	3.704	3.248	1.544	2.811
1798.2	323.8	0.785	13.09	7.476	3.119	3.087	4.771	0.451	5.248	4.796	1.709	3.704	3.253	1.544	2.807
1804.9	324.7	0.791	13.19	7.485	3.123	3.091	4.765	0.446	5.252	4.806	1.715	3.706	3.260	1.546	2.803
1811.3	325.3	0.797	13.29	7.493	3.126	3.094	4.766	0.447	5.254	4.807	1.714	3.707	3.261	1.547	2.805
1818.0	325.6	0.803	13.39	7.502	3.125	3.092	4.759	0.439	5.253	4.813	1.721	3.707	3.267	1.546	2.797
1824.5	326.1	0.809	13.49	7.511	3.126	3.093	4.751	0.431	5.254	4.822	1.729	3.707	3.276	1.547	2.789
1831.0	327.5	0.815	13.59	7.519	3.136	3.103	4.748	0.428	5.263	4.835	1.732	3.712	3.284	1.552	2.791
1837.4	327.4	0.821	13.69	7.528	3.132	3.099	4.747	0.428	5.259	4.831	1.733	3.710	3.282	1.549	2.789
1843.9	328.8	0.827	13.79	7.537	3.141	3.108	4.743	0.424	5.268	4.844	1.737	3.714	3.290	1.554	2.790
1850.3	329.3	0.833	13.89	7.546	3.143	3.109	4.737	0.418	5.270	4.852	1.743	3.715	3.297	1.555	2.784
1856.8	329.8	0.839	13.99	7.554	3.144	3.110	4.739	0.419	5.271	4.851	1.741	3.715	3.296	1.555	2.786
1863.3	330.0	0.845	14.09	7.563	3.142	3.108	4.730	0.410	5.268	4.858	1.750	3.714	3.304	1.554	2.776
1870.0	331.1	0.851	14.19	7.572	3.148	3.114	4.724	0.405	5.274	4.870	1.756	3.717	3.313	1.557	2.774
1876.6	331.8	0.857	14.29	7.581	3.152	3.117	4.719	0.400	5.278	4.878	1.761	3.719	3.319	1.559	2.770
1883.2	332.9	0.863	14.39	7.590	3.158	3.123	4.723	0.403	5.284	4.880	1.757	3.722	3.318	1.562	2.778
1889.6	333.7	0.869	14.49	7.598	3.162	3.127	4.716	0.397	5.287	4.891	1.764	3.724	3.327	1.563	2.773
1896.1	333.9	0.875	14.59	7.607	3.160	3.125	4.712	0.392	5.285	4.893	1.768	3.723	3.331	1.563	2.768
1902.6	334.1	0.881	14.69	7.616	3.159	3.124	4.707	0.387	5.284	4.897	1.773	3.722	3.335	1.562	2.761
1909.2	334.6	0.887	14.79	7.625	3.160	3.124	4.706	0.387	5.284	4.898	1.774	3.722	3.336	1.562	2.761
1915.7	335.6	0.893	14.89	7.634	3.166	3.130	4.701	0.381	5.290	4.909	1.779	3.725	3.344	1.565	2.759
1922.2	336.2	0.899	14.99	7.643	3.167	3.131	4.695	0.375	5.291	4.916	1.785	3.726	3.351	1.565	2.754
1928.7	337.0	0.904	15.09	7.652	3.171	3.134	4.691	0.371	5.295	4.924	1.789	3.727	3.356	1.567	2.752
1935.1	338.0	0.910	15.19	7.661	3.176	3.140	4.692	0.373	5.300	4.927	1.788	3.730	3.358	1.570	2.756
1941.7	338.3	0.917	15.29	7.670	3.176	3.139	4.687	0.368	5.299	4.932	1.793	3.730	3.362	1.569	2.751
1948.2	338.2	0.922	15.39	7.679	3.171	3.134	4.680	0.360	5.294	4.934	1.800	3.727	3.367	1.567	2.741
1954.8	338.8	0.928	15.49	7.688	3.173	3.136	4.680	0.361	5.296	4.935	1.800	3.728	3.367	1.568	2.742
1961.6	340.1	0.934	15.59	7.697	3.181	3.143	4.675	0.355	5.304	4.948	1.805	3.732	3.377	1.572	2.741
1968.3	341.0	0.940	15.69	7.706	3.186	3.148	4.669	0.349	5.308	4.959	1.811	3.734	3.385	1.574	2.738
1974.9	341.9	0.946	15.79	7.716	3.191	3.153	4.666	0.346	5.313	4.967	1.814	3.737	3.390	1.576	2.738
1981.5	342.6	0.952	15.89	7.725	3.193	3.155	4.666	0.346	5.315	4.969	1.814	3.738	3.392	1.577	2.739
1988.2	343.4	0.958	15.99	7.734	3.196	3.158	4.660	0.341	5.318	4.978	1.820	3.739	3.399	1.579	2.736
1994.7	343.7	0.964	16.09	7.743	3.196	3.157	4.655	0.336	5.317	4.982	1.825	3.739	3.403	1.579	2.730
2001.1	343.4	0.970	16.19	7.753	3.189	3.150	4.648	0.329	5.310	4.982	1.832	3.735	3.407	1.575	2.720
2007.7	343.6	0.976	16.29	7.762	3.187	3.148	4.652	0.332	5.309	4.976	1.828	3.734	3.402	1.574	2.722
2014.4	344.3	0.982	16.39	7.771	3.190	3.150	4.647	0.327	5.311	4.983	1.833	3.735	3.408	1.575	2.719
2020.8	344.6	0.988	16.49	7.780	3.189	3.149	4.643	0.324	5.310	4.986	1.837	3.735	3.411	1.575	2.715
2027.3	344.8	0.994	16.59	7.790	3.187	3.147	4.638	0.319	5.307	4.989	1.842	3.734	3.415	1.573	2.709
2033.8	345.4	1.000	16.69	7.799	3.188	3.148	4.638	0.318	5.309	4.990	1.842	3.735	3.416	1.574	2.709
2040.5	345.6	1.006	16.79	7.808	3.187	3.147	4.633	0.313	5.307	4.994	1.847	3.734	3.420	1.573	2.703
2047.2	345.8	1.012	16.89	7.818	3.185	3.144	4.626	0.306	5.305	4.998	1.854	3.732	3.426	1.572	2.696
2053.9	346.9	1.018	16.99	7.827	3.191	3.150	4.630	0.311	5.310	4.999	1.850	3.735	3.424	1.575	2.703
2060.6	346.7	1.024	17.09	7.837	3.186	3.145	4.623	0.304	5.305	5.001	1.857	3.733	3.429	1.572	2.694

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	FA-15-1, 18.1'-18.6'	Lab ID	52B
Description	Lean Clay with Gravel (CL), gray brown, moist, firm	Test ID	52B-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	12/01/2015

Specific Gravity	2.75
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	50
Nominal Consolidation Pressure (psi)	40

Saturation / Consolidation Results

Pore Pressure Parameter B	0.95
Measured Effective Consol. Stress (tsf)	2.881
Time to 50% Consolidation (min)	21.50
Actual Axial Strain Rate of Test (%/min)	0.017

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	143.1
Moisture Content (%)	12.7
Dry Unit Weight (pcf)	127.0
Void Ratio	0.350
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

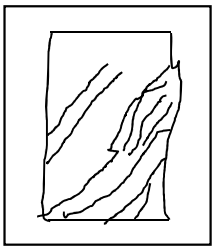
Axial Strain (%)	4.097
Deviator Stress (tsf)	3.574
Induced Pore Pressure (tsf)	1.070
Minor Effective Stress, σ_3' (tsf)	1.811
Major Effective Stress, σ_1' (tsf)	5.385
Eff. Principal Stress Ratio, σ_1'/σ_3'	2.973
p' (tsf)	3.598
q (tsf)	1.787

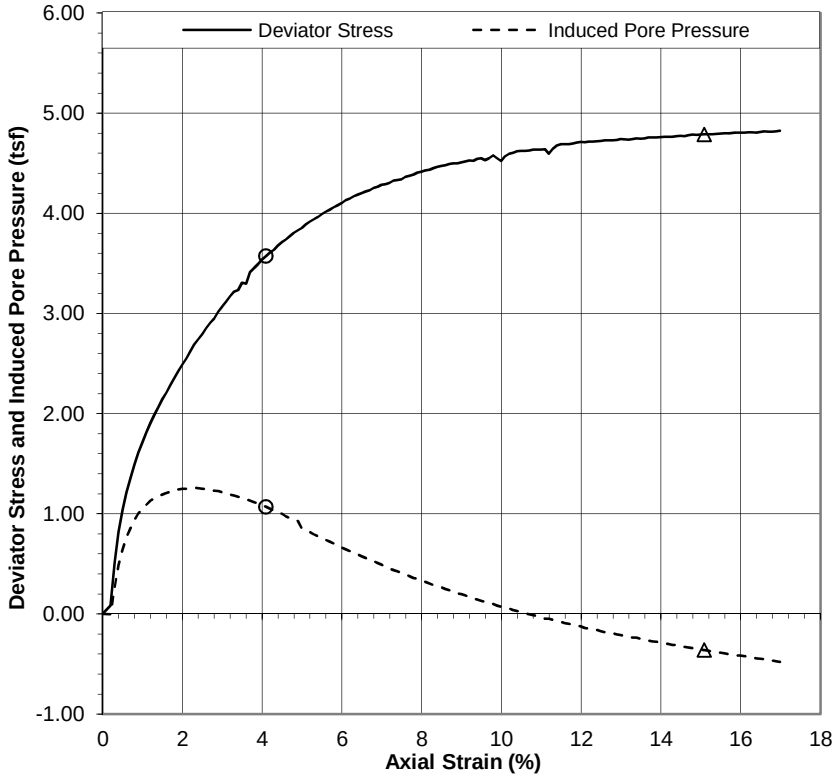
At Consolidated Undrained Failure

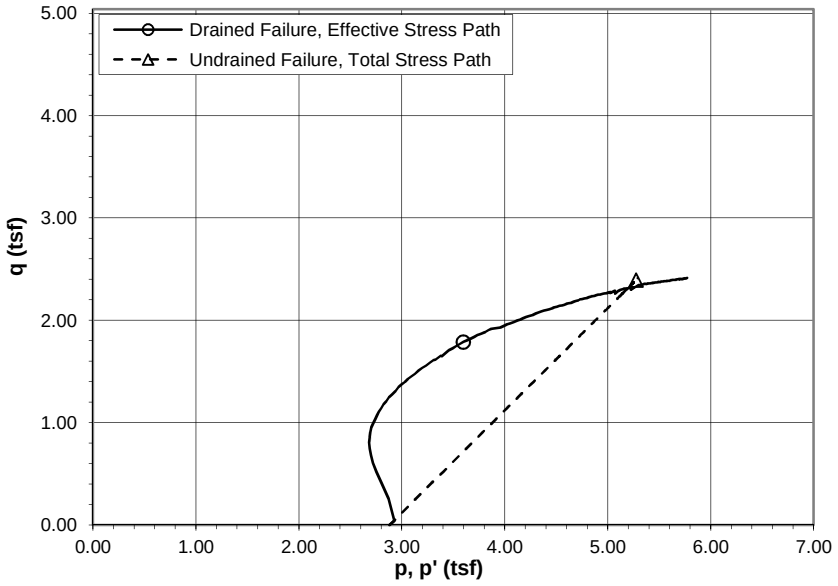
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.089
Deviator Stress (tsf)	4.789
Minor Principal Stress, σ_3 (tsf)	2.881
Major Principal Stress, σ_1 (tsf)	7.670
p (tsf)	5.275
q (tsf)	2.394

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: FA-15-1, 18.1'-18.6'
Description: Lean Clay with Gravel (CL), gray brown, moist, firm

Project No.: 175553023
Lab ID: 52B
Test ID: 52B-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.066	Calculated Height (in)	5.945
Average Diameter (in)	2.861	Calculated Diameter (in)	2.882
Calculated Area (in^2)	6.430	Calculated Area (in^2)	6.525
Moist Weight (lb)	3.213	Moist Weight (lb)	3.212
Moist Unit Weight (pcf)	142.3	Moist Unit Weight (pcf)	143.1
Moisture Content (%)	12.7	Moisture Content (%)	12.7
Dry Weight (lb)	2.850	Dry Weight (lb)	2.850
Dry Unit Weight (pcf)	126.3	Dry Unit Weight (pcf)	127.0
Void Ratio	0.357	Void Ratio	0.350
Degree of Saturation (%)	98.1	Degree of Saturation (%)	100.0

Specific Gravity: 2.75
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 2.881

Effective Consolidation Stress
σ_3' (tsf): 2.881

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: FA-15-1, 18.1'-18.6'								Lab ID: 52B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.525	0.000	0.000	3.599	0.000	2.881	2.881	2.881	2.881	2.881	0.000	1.000
12.8	7.7	0.012	0.20	6.538	0.084	0.084	3.595	-0.004	2.965	2.969	2.885	2.923	2.927	0.042	1.029
19.5	46.5	0.018	0.30	6.545	0.512	0.511	3.863	0.264	3.392	3.128	2.617	3.136	2.872	0.255	1.195
25.5	74.4	0.024	0.40	6.552	0.818	0.817	4.085	0.486	3.698	3.212	2.395	3.289	2.803	0.408	1.341
31.5	94.9	0.030	0.50	6.558	1.042	1.041	4.246	0.647	3.922	3.275	2.234	3.401	2.754	0.520	1.466
37.1	110.9	0.036	0.60	6.565	1.216	1.214	4.368	0.769	4.096	3.326	2.112	3.488	2.719	0.607	1.575
42.6	124.3	0.042	0.70	6.571	1.362	1.361	4.459	0.860	4.242	3.382	2.021	3.561	2.702	0.680	1.673
48.1	136.7	0.048	0.80	6.578	1.496	1.494	4.539	0.940	4.375	3.435	1.941	3.628	2.688	0.747	1.770
53.2	147.5	0.053	0.90	6.584	1.612	1.610	4.602	1.003	4.491	3.488	1.878	3.686	2.683	0.805	1.857
58.5	157.0	0.059	1.00	6.591	1.715	1.712	4.647	1.048	4.593	3.545	1.833	3.737	2.689	0.856	1.934
63.7	166.2	0.065	1.10	6.598	1.814	1.811	4.690	1.091	4.692	3.601	1.790	3.786	2.696	0.905	2.011
69.2	175.4	0.071	1.20	6.605	1.912	1.909	4.729	1.130	4.790	3.659	1.751	3.835	2.705	0.954	2.090
74.4	182.9	0.077	1.30	6.611	1.992	1.989	4.753	1.154	4.870	3.715	1.727	3.875	2.721	0.994	2.152
79.6	190.0	0.083	1.40	6.618	2.067	2.064	4.772	1.173	4.945	3.772	1.708	3.913	2.740	1.032	2.208
84.8	197.7	0.089	1.50	6.625	2.149	2.145	4.793	1.194	5.026	3.833	1.687	3.954	2.760	1.073	2.272
90.0	204.1	0.095	1.60	6.631	2.216	2.213	4.809	1.210	5.094	3.884	1.671	3.987	2.778	1.106	2.324
95.5	210.6	0.101	1.70	6.638	2.285	2.281	4.821	1.222	5.162	3.940	1.659	4.021	2.800	1.140	2.374
101.0	217.7	0.107	1.80	6.645	2.359	2.355	4.835	1.236	5.236	4.000	1.645	4.058	2.823	1.177	2.431
106.6	224.2	0.113	1.90	6.652	2.427	2.422	4.841	1.242	5.303	4.061	1.639	4.092	2.850	1.211	2.478
112.4	231.0	0.119	2.00	6.658	2.498	2.493	4.850	1.251	5.374	4.123	1.630	4.127	2.876	1.246	2.530
117.9	236.5	0.125	2.10	6.665	2.554	2.549	4.850	1.251	5.430	4.180	1.630	4.156	2.905	1.275	2.564
123.6	243.2	0.131	2.20	6.672	2.624	2.619	4.851	1.252	5.500	4.248	1.629	4.190	2.938	1.309	2.608
129.2	250.2	0.137	2.30	6.679	2.698	2.692	4.859	1.260	5.573	4.313	1.621	4.227	2.967	1.346	2.661
134.8	255.2	0.143	2.40	6.686	2.748	2.742	4.854	1.255	5.623	4.368	1.626	4.252	2.997	1.371	2.687
140.3	260.2	0.149	2.50	6.692	2.800	2.794	4.848	1.249	5.675	4.426	1.632	4.278	3.029	1.397	2.711
145.9	266.3	0.154	2.60	6.699	2.862	2.855	4.847	1.248	5.736	4.488	1.633	4.309	3.060	1.428	2.749
151.7	271.6	0.160	2.70	6.706	2.916	2.909	4.840	1.241	5.790	4.549	1.640	4.336	3.094	1.455	2.774
157.4	275.7	0.166	2.80	6.713	2.956	2.950	4.829	1.230	5.831	4.601	1.651	4.356	3.126	1.475	2.786
163.1	282.6	0.172	2.90	6.720	3.028	3.021	4.828	1.229	5.902	4.673	1.652	4.391	3.162	1.510	2.829
168.9	287.2	0.178	3.00	6.727	3.074	3.067	4.814	1.215	5.948	4.733	1.666	4.415	3.199	1.534	2.841
174.7	292.0	0.184	3.10	6.734	3.122	3.114	4.803	1.204	5.995	4.791	1.677	4.438	3.234	1.557	2.857
180.5	297.9	0.190	3.20	6.741	3.181	3.174	4.792	1.193	6.055	4.862	1.688	4.468	3.275	1.587	2.880
186.1	302.3	0.196	3.30	6.748	3.226	3.218	4.781	1.182	6.099	4.917	1.699	4.490	3.308	1.609	2.894
192.1	304.1	0.202	3.40	6.755	3.241	3.233	4.768	1.169	6.114	4.946	1.712	4.498	3.329	1.617	2.888
198.0	311.4	0.208	3.50	6.762	3.316	3.308	4.756	1.157	6.189	5.032	1.724	4.535	3.378	1.654	2.919
203.6	310.9	0.214	3.60	6.769	3.307	3.298	4.742	1.143	6.179	5.036	1.738	4.530	3.387	1.649	2.898
209.4	322.1	0.220	3.70	6.776	3.422	3.414	4.731	1.132	6.295	5.163	1.749	4.588	3.456	1.707	2.951
215.3	326.3	0.226	3.80	6.783	3.463	3.454	4.714	1.115	6.335	5.220	1.766	4.608	3.493	1.727	2.956
221.1	330.3	0.232	3.90	6.790	3.502	3.493	4.699	1.100	6.374	5.274	1.781	4.627	3.527	1.746	2.962

Project: 175553023			Source: FA-15-1, 18.1'-18.6'								Lab ID: 52B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
226.7	334.8	0.238	4.00	6.797	3.546	3.536	4.683	1.084	6.417	5.333	1.797	4.649	3.565	1.768	2.968
232.4	338.6	0.244	4.10	6.804	3.584	3.574	4.669	1.070	6.455	5.385	1.811	4.668	3.598	1.787	2.973
238.3	342.1	0.249	4.20	6.811	3.617	3.607	4.650	1.051	6.488	5.437	1.830	4.684	3.633	1.803	2.971
244.1	345.4	0.255	4.30	6.818	3.648	3.637	4.631	1.032	6.518	5.486	1.849	4.700	3.667	1.819	2.967
250.0	349.7	0.261	4.40	6.825	3.689	3.678	4.614	1.015	6.559	5.545	1.866	4.720	3.705	1.839	2.971
255.7	353.3	0.267	4.50	6.833	3.723	3.712	4.598	0.999	6.593	5.593	1.882	4.737	3.738	1.856	2.973
261.6	356.2	0.273	4.60	6.840	3.750	3.739	4.576	0.977	6.620	5.643	1.904	4.750	3.774	1.869	2.964
267.5	359.9	0.279	4.70	6.847	3.784	3.773	4.556	0.957	6.654	5.697	1.924	4.768	3.811	1.887	2.961
273.2	363.4	0.285	4.80	6.854	3.817	3.806	4.543	0.944	6.687	5.743	1.937	4.784	3.840	1.903	2.965
279.0	366.2	0.291	4.90	6.861	3.843	3.831	4.526	0.927	6.712	5.786	1.954	4.797	3.870	1.916	2.960
284.9	368.9	0.297	5.00	6.868	3.867	3.855	4.452	0.853	6.736	5.883	2.028	4.808	3.955	1.927	2.901
290.6	372.5	0.303	5.10	6.876	3.901	3.889	4.433	0.834	6.770	5.935	2.047	4.825	3.991	1.944	2.900
296.2	375.7	0.309	5.20	6.883	3.930	3.918	4.418	0.819	6.799	5.979	2.062	4.840	4.020	1.959	2.900
302.0	378.3	0.315	5.30	6.890	3.953	3.940	4.396	0.797	6.821	6.024	2.084	4.851	4.054	1.970	2.891
307.9	381.0	0.321	5.40	6.897	3.977	3.964	4.375	0.776	6.845	6.069	2.105	4.863	4.087	1.982	2.884
313.6	384.2	0.327	5.50	6.905	4.006	3.993	4.357	0.758	6.874	6.116	2.123	4.877	4.120	1.996	2.881
319.4	386.9	0.333	5.60	6.912	4.030	4.016	4.337	0.738	6.897	6.159	2.143	4.889	4.151	2.008	2.874
325.1	389.3	0.339	5.70	6.919	4.051	4.037	4.321	0.722	6.918	6.196	2.159	4.900	4.178	2.019	2.870
330.8	392.2	0.345	5.80	6.927	4.077	4.063	4.303	0.704	6.944	6.240	2.177	4.913	4.208	2.032	2.867
336.7	394.5	0.350	5.90	6.934	4.096	4.082	4.284	0.685	6.963	6.278	2.196	4.922	4.237	2.041	2.859
342.7	396.9	0.356	6.00	6.941	4.117	4.102	4.262	0.663	6.983	6.320	2.218	4.932	4.269	2.051	2.850
348.6	400.0	0.362	6.10	6.949	4.145	4.130	4.245	0.646	7.011	6.365	2.235	4.946	4.300	2.065	2.848
354.7	402.3	0.368	6.20	6.956	4.164	4.149	4.228	0.629	7.030	6.401	2.252	4.955	4.327	2.074	2.842
360.8	404.6	0.374	6.30	6.964	4.184	4.169	4.214	0.615	7.050	6.434	2.266	4.965	4.350	2.084	2.840
366.8	406.8	0.380	6.40	6.971	4.202	4.186	4.194	0.595	7.067	6.472	2.286	4.974	4.379	2.093	2.831
372.6	408.9	0.386	6.50	6.979	4.219	4.203	4.176	0.577	7.084	6.508	2.304	4.983	4.406	2.102	2.824
378.6	410.7	0.392	6.59	6.986	4.233	4.217	4.157	0.558	7.098	6.540	2.323	4.990	4.431	2.109	2.816
384.6	412.6	0.398	6.70	6.994	4.248	4.232	4.138	0.539	7.113	6.574	2.342	4.997	4.458	2.116	2.807
390.5	415.1	0.404	6.80	7.001	4.269	4.253	4.127	0.528	7.134	6.606	2.353	5.008	4.479	2.127	2.808
396.5	416.8	0.410	6.90	7.009	4.282	4.266	4.107	0.508	7.147	6.638	2.373	5.014	4.506	2.133	2.798
402.6	419.3	0.416	6.99	7.016	4.303	4.286	4.091	0.492	7.167	6.675	2.389	5.024	4.532	2.143	2.794
408.3	420.3	0.422	7.10	7.024	4.309	4.292	4.071	0.472	7.173	6.700	2.409	5.027	4.555	2.146	2.782
414.2	422.0	0.428	7.19	7.031	4.322	4.305	4.054	0.455	7.186	6.731	2.426	5.033	4.579	2.152	2.774
420.2	424.6	0.434	7.29	7.039	4.343	4.326	4.037	0.438	7.207	6.769	2.443	5.044	4.606	2.163	2.771
426.2	425.7	0.440	7.40	7.046	4.349	4.332	4.025	0.426	7.213	6.786	2.455	5.047	4.621	2.166	2.765
432.0	426.9	0.446	7.49	7.054	4.358	4.340	4.008	0.409	7.221	6.812	2.472	5.051	4.642	2.170	2.756
438.0	430.0	0.451	7.59	7.062	4.384	4.366	3.994	0.395	7.247	6.852	2.486	5.064	4.669	2.183	2.756
444.1	431.3	0.457	7.69	7.069	4.393	4.375	3.978	0.379	7.256	6.877	2.502	5.068	4.690	2.187	2.748
450.1	433.2	0.463	7.79	7.077	4.407	4.388	3.958	0.359	7.269	6.910	2.522	5.075	4.716	2.194	2.740
456.1	435.3	0.469	7.89	7.085	4.424	4.405	3.952	0.353	7.286	6.933	2.528	5.084	4.730	2.203	2.743
462.1	437.0	0.475	7.99	7.092	4.436	4.417	3.936	0.337	7.298	6.961	2.544	5.090	4.752	2.209	2.736
468.2	438.5	0.481	8.09	7.100	4.447	4.428	3.920	0.321	7.309	6.987	2.560	5.095	4.773	2.214	2.730
474.2	439.9	0.487	8.20	7.108	4.456	4.436	3.902	0.303	7.317	7.014	2.578	5.099	4.796	2.218	2.721
480.1	441.7	0.493	8.29	7.115	4.470	4.450	3.889	0.290	7.331	7.041	2.591	5.106	4.816	2.225	2.717
486.0	443.7	0.499	8.39	7.123	4.485	4.464	3.875	0.276	7.345	7.070	2.605	5.113	4.838	2.232	2.714
492.2	445.0	0.505	8.49	7.131	4.494	4.473	3.865	0.266	7.354	7.088	2.615	5.118	4.851	2.237	2.711
498.1	446.1	0.511	8.59	7.139	4.499	4.478	3.848	0.249	7.359	7.111	2.632	5.120	4.872	2.239	2.701
504.1	447.9	0.517	8.69	7.147	4.513	4.492	3.837	0.238	7.373	7.135	2.643	5.127	4.889	2.246	2.699
510.3	449.2	0.523	8.79	7.154	4.520	4.499	3.821	0.222	7.380	7.158	2.659	5.131	4.908	2.250	2.692
516.3	449.7	0.529	8.89	7.162	4.520	4.499	3.805	0.206	7.380	7.174	2.675	5.130	4.925	2.249	2.682
522.2	451.0	0.535	8.99	7.170	4.529	4.508	3.798	0.199	7.389	7.190	2.682	5.135	4.936	2.254	2.680
528.3	452.8	0.541	9.09	7.178	4.542	4.520	3.784	0.185	7.401	7.216	2.696	5.141	4.956	2.260	2.676
534.4	454.0	0.547	9.19	7.186	4.549	4.527	3.769	0.170	7.408	7.238	2.711	5.145	4.974	2.264	2.670
540.2	454.3	0.552	9.29	7.194	4.547	4.524	3.753	0.154	7.405	7.251	2.727	5.143	4.989	2.262	2.659
546.3	456.8	0.558	9.39	7.202	4.567	4.545	3.743	0.144	7.426	7.282	2.737	5.153	5.009	2.272	2.661
552.3	458.0	0.564	9.49	7.210	4.574	4.551	3.731	0.132	7.432	7.300	2.749	5.157	5.025	2.276	2.656
558.3	456.4	0.570	9.59	7.218	4.553	4.530	3.722	0.123	7.411	7.288	2.758	5.146	5.023	2.265	2.643
564.3	459.0	0.576	9.69	7.226	4.574	4.551	3.712	0.113	7.432	7.318	2.768	5.156	5.043	2.275	2.644
570.4	462.5	0.582	9.79	7.234	4.603	4.580	3.700	0.101	7.461	7.360	2.780	5.171	5.070	2.290	2.647
576.4	460.1	0.588	9.89	7.242	4.574	4.551	3.684	0.085	7.432	7.347	2.796	5.156	5.071	2.275	2.628
582.5	457.8	0.594	9.99	7.250	4.547	4.523	3.670	0.071	7.404	7.333	2.810	5.143	5.071	2.262	2.610
588.6	463.1	0.600	10.09	7.258	4.594	4.570	3.666	0.067	7.451	7.384	2.814	5.166	5.099	2.285	2.624
594.8	466.1	0.606	10.19	7.266	4.619	4.595	3.653	0.054	7.476	7.422	2.827	5.178	5.124	2.297	2.625
601.0	467.8	0.612	10.29	7.274	4.631	4.606	3.637	0.038	7.487	7.448	2.843	5.184	5.146	2.303	2.620
607.1	469.7	0.618	10.39	7.282	4.644	4.619	3.628	0.029	7.500	7.471	2.852	5.191	5.162	2.310	2.619
613.4	470.6	0.624	10.49	7.290	4.648	4.623	3.616	0.017	7.504	7.487	2.864	5.192	5.176	2.311	2.614
619.6	471.3	0.630	10.59	7.298	4.649	4.624	3.606	0.007	7.505	7.498	2.874	5.193	5.186	2.312	2.609
625.7	472.3	0.636	10.69	7.306	4.654	4.628	3.596	-0.003	7.509	7.512	2.884	5.195	5.198	2.314	2.605
631.9	473.6	0.642	10.79	7.315	4.662	4.636	3.586	-0.013	7.517	7.529	2.894	5.199	5.212	2.318	2.602

Project: 175553023			Source: FA-15-1, 18.1'-18.6'								Lab ID: 52B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
638.0	474.2	0.647	10.89	7.323	4.662	4.636	3.576	-0.023	7.517	7.540	2.904	5.199	5.222	2.318	2.597
644.2	474.8	0.653	10.99	7.331	4.663	4.637	3.564	-0.035	7.518	7.552	2.916	5.199	5.234	2.318	2.590
650.5	475.7	0.659	11.09	7.339	4.667	4.640	3.553	-0.046	7.521	7.567	2.927	5.201	5.247	2.320	2.586
656.6	471.6	0.665	11.19	7.348	4.621	4.594	3.553	-0.046	7.475	7.521	2.927	5.178	5.224	2.297	2.570
662.7	477.6	0.671	11.29	7.356	4.675	4.648	3.540	-0.059	7.529	7.587	2.940	5.205	5.264	2.324	2.581
668.8	481.4	0.677	11.39	7.364	4.706	4.679	3.528	-0.071	7.560	7.631	2.952	5.221	5.291	2.340	2.585
675.0	483.1	0.683	11.49	7.373	4.718	4.690	3.521	-0.078	7.571	7.650	2.959	5.226	5.304	2.345	2.585
681.2	483.7	0.689	11.59	7.381	4.718	4.690	3.508	-0.091	7.571	7.662	2.972	5.226	5.317	2.345	2.578
687.4	484.1	0.695	11.69	7.389	4.717	4.689	3.501	-0.098	7.570	7.669	2.979	5.226	5.324	2.345	2.574
693.5	485.6	0.701	11.79	7.398	4.726	4.698	3.492	-0.107	7.579	7.686	2.988	5.230	5.337	2.349	2.572
699.7	487.1	0.707	11.89	7.406	4.736	4.707	3.483	-0.116	7.588	7.704	2.997	5.235	5.350	2.354	2.571
706.0	488.3	0.713	11.99	7.414	4.741	4.713	3.474	-0.125	7.594	7.719	3.006	5.237	5.362	2.356	2.568
712.1	488.6	0.719	12.09	7.423	4.739	4.710	3.461	-0.138	7.591	7.729	3.019	5.236	5.374	2.355	2.560
718.2	489.8	0.725	12.19	7.431	4.745	4.716	3.452	-0.147	7.597	7.744	3.028	5.239	5.386	2.358	2.558
724.6	490.5	0.731	12.29	7.440	4.747	4.718	3.449	-0.150	7.599	7.749	3.031	5.240	5.390	2.359	2.557
730.7	491.4	0.737	12.39	7.448	4.750	4.720	3.439	-0.160	7.601	7.761	3.041	5.241	5.401	2.360	2.552
736.8	492.1	0.743	12.49	7.457	4.752	4.722	3.427	-0.172	7.603	7.774	3.053	5.242	5.414	2.361	2.547
743.0	493.4	0.748	12.59	7.465	4.759	4.729	3.419	-0.180	7.610	7.790	3.061	5.245	5.425	2.364	2.545
749.2	494.2	0.754	12.69	7.474	4.761	4.730	3.410	-0.189	7.611	7.800	3.070	5.246	5.435	2.365	2.541
755.4	494.7	0.760	12.79	7.482	4.760	4.729	3.407	-0.192	7.610	7.803	3.073	5.246	5.438	2.365	2.539
761.5	495.6	0.766	12.89	7.491	4.763	4.732	3.397	-0.202	7.613	7.816	3.083	5.247	5.449	2.366	2.535
767.7	497.0	0.772	12.99	7.500	4.772	4.741	3.390	-0.209	7.622	7.830	3.090	5.251	5.460	2.370	2.534
773.9	497.4	0.778	13.09	7.508	4.770	4.738	3.378	-0.221	7.619	7.840	3.102	5.250	5.471	2.369	2.527
780.1	497.8	0.784	13.19	7.517	4.768	4.737	3.370	-0.229	7.618	7.847	3.110	5.249	5.479	2.368	2.523
786.4	499.0	0.790	13.29	7.525	4.775	4.743	3.363	-0.236	7.624	7.860	3.117	5.252	5.489	2.371	2.521
792.7	500.4	0.796	13.39	7.534	4.782	4.750	3.362	-0.237	7.631	7.867	3.118	5.256	5.492	2.375	2.524
799.2	500.5	0.802	13.49	7.543	4.777	4.745	3.350	-0.249	7.626	7.875	3.130	5.254	5.503	2.373	2.516
805.2	501.6	0.808	13.59	7.552	4.782	4.750	3.342	-0.257	7.631	7.887	3.138	5.256	5.513	2.375	2.514
811.4	503.1	0.814	13.69	7.560	4.791	4.758	3.336	-0.263	7.639	7.903	3.144	5.260	5.524	2.379	2.513
817.6	503.7	0.820	13.79	7.569	4.791	4.758	3.325	-0.274	7.639	7.913	3.155	5.260	5.534	2.379	2.508
823.9	504.2	0.826	13.89	7.578	4.790	4.757	3.321	-0.278	7.638	7.916	3.159	5.259	5.538	2.378	2.506
830.2	505.3	0.832	13.99	7.587	4.796	4.762	3.314	-0.285	7.643	7.928	3.166	5.262	5.547	2.381	2.504
837.0	506.2	0.838	14.09	7.595	4.799	4.765	3.307	-0.292	7.646	7.938	3.173	5.264	5.555	2.383	2.502
843.6	506.7	0.844	14.19	7.604	4.798	4.764	3.299	-0.300	7.645	7.945	3.181	5.263	5.563	2.382	2.498
850.1	507.5	0.849	14.29	7.613	4.800	4.766	3.290	-0.309	7.647	7.955	3.190	5.264	5.573	2.383	2.494
856.8	508.5	0.855	14.39	7.622	4.804	4.769	3.289	-0.310	7.650	7.960	3.191	5.266	5.575	2.385	2.495
863.4	509.5	0.861	14.49	7.631	4.807	4.772	3.281	-0.318	7.653	7.972	3.199	5.267	5.585	2.386	2.492
870.0	510.1	0.867	14.59	7.640	4.807	4.772	3.270	-0.329	7.653	7.982	3.210	5.267	5.596	2.386	2.487
876.3	511.5	0.873	14.69	7.649	4.815	4.780	3.263	-0.336	7.661	7.996	3.217	5.271	5.606	2.390	2.486
882.9	512.7	0.879	14.79	7.658	4.821	4.785	3.257	-0.342	7.666	8.008	3.223	5.274	5.616	2.393	2.485
889.4	513.3	0.885	14.89	7.667	4.820	4.785	3.255	-0.344	7.666	8.010	3.225	5.273	5.618	2.392	2.483
895.8	514.1	0.891	14.99	7.676	4.823	4.787	3.246	-0.353	7.668	8.020	3.234	5.274	5.627	2.393	2.480
902.3	515.0	0.897	15.09	7.685	4.825	4.789	3.240	-0.359	7.670	8.029	3.240	5.275	5.635	2.394	2.478
908.8	515.8	0.903	15.19	7.694	4.827	4.791	3.231	-0.368	7.672	8.039	3.249	5.276	5.644	2.395	2.475
915.2	516.5	0.909	15.29	7.703	4.828	4.791	3.222	-0.377	7.672	8.049	3.258	5.277	5.653	2.396	2.471
921.4	517.2	0.915	15.39	7.712	4.829	4.792	3.216	-0.383	7.673	8.056	3.264	5.277	5.660	2.396	2.468
927.8	518.5	0.921	15.49	7.721	4.835	4.798	3.215	-0.384	7.679	8.063	3.265	5.280	5.664	2.399	2.469
934.2	519.4	0.927	15.59	7.730	4.838	4.800	3.206	-0.393	7.681	8.074	3.274	5.281	5.674	2.400	2.466
940.4	520.0	0.933	15.69	7.739	4.837	4.799	3.197	-0.402	7.680	8.082	3.283	5.281	5.682	2.400	2.462
946.7	521.0	0.939	15.79	7.749	4.841	4.804	3.191	-0.408	7.685	8.093	3.289	5.283	5.691	2.402	2.460
953.2	521.9	0.944	15.89	7.758	4.844	4.806	3.186	-0.413	7.687	8.100	3.294	5.284	5.697	2.403	2.459
959.5	522.5	0.950	15.99	7.767	4.843	4.805	3.184	-0.415	7.686	8.101	3.296	5.283	5.698	2.402	2.458
965.8	523.1	0.956	16.09	7.776	4.844	4.805	3.178	-0.421	7.686	8.107	3.302	5.284	5.705	2.403	2.455
972.1	524.3	0.962	16.19	7.786	4.849	4.810	3.172	-0.427	7.691	8.118	3.308	5.286	5.713	2.405	2.454
978.4	525.0	0.968	16.29	7.795	4.849	4.810	3.165	-0.434	7.691	8.125	3.315	5.286	5.720	2.405	2.451
984.8	525.1	0.974	16.39	7.804	4.844	4.805	3.156	-0.443	7.686	8.129	3.324	5.283	5.727	2.402	2.445
991.0	526.4	0.980	16.49	7.814	4.850	4.811	3.154	-0.445	7.692	8.137	3.326	5.286	5.731	2.405	2.446
997.3	528.0	0.986	16.59	7.823	4.859	4.820	3.149	-0.450	7.701	8.151	3.331	5.291	5.741	2.410	2.447
1003.8	528.2	0.992	16.69	7.832	4.856	4.816	3.141	-0.458	7.697	8.155	3.339	5.289	5.747	2.408	2.442
1010.2	528.8	0.998	16.79	7.842	4.855	4.815	3.132	-0.467	7.696	8.162	3.348	5.288	5.755	2.407	2.438
1016.5	529.9	1.004	16.89	7.851	4.860	4.819	3.127	-0.472	7.700	8.172	3.353	5.291	5.762	2.410	2.438
1022.6	531.2	1.010	16.99	7.861	4.866	4.825	3.121	-0.478	7.706	8.185	3.359	5.294	5.772	2.413	2.436

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	FA-15-1, 18.6'-19.1'	Lab ID	52C
Description	Lean Clay with Gravel (CL), brown and gray, moist, firm	Test ID	52C-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	12/03/2015

Specific Gravity	2.75
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	40
Nominal Consolidation Pressure (psi)	50

Saturation / Consolidation Results

Pore Pressure Parameter B	0.96
Measured Effective Consol. Stress (tsf)	3.601
Time to 50% Consolidation (min)	16.00
Actual Axial Strain Rate of Test (%/min)	0.018

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	141.6
Moisture Content (%)	13.7
Dry Unit Weight (pcf)	124.6
Void Ratio	0.375
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

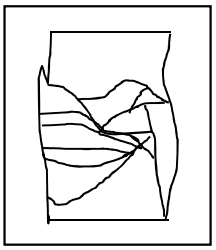
Axial Strain (%)	2.655
Deviator Stress (tsf)	3.655
Induced Pore Pressure (tsf)	1.454
Minor Effective Stress, σ_3' (tsf)	2.146
Major Effective Stress, σ_1' (tsf)	5.801
Eff. Principal Stress Ratio, σ_1'/σ_3'	2.703
p' (tsf)	3.973
q (tsf)	1.827

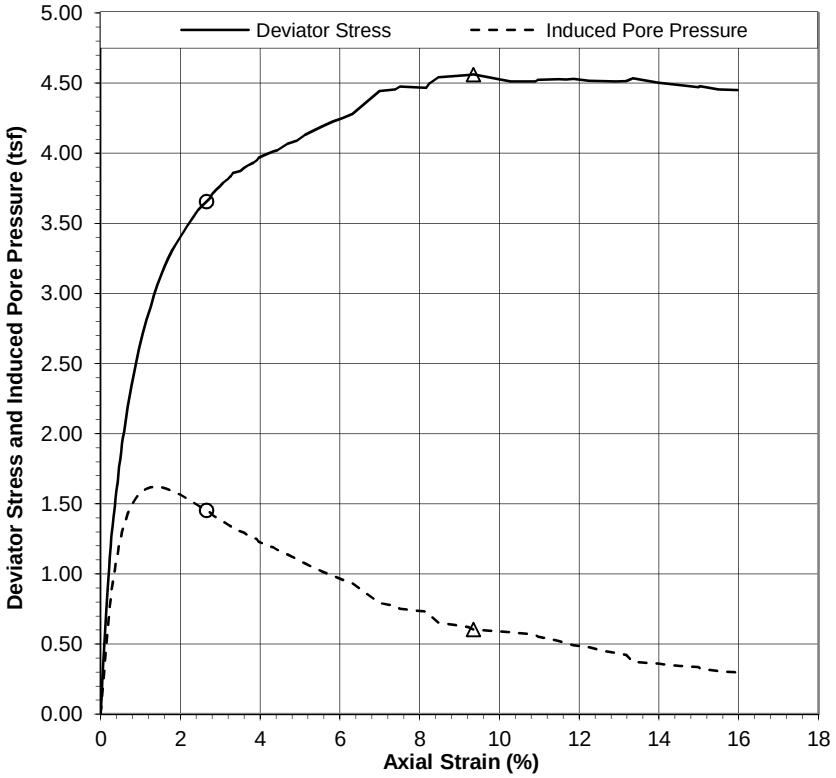
At Consolidated Undrained Failure

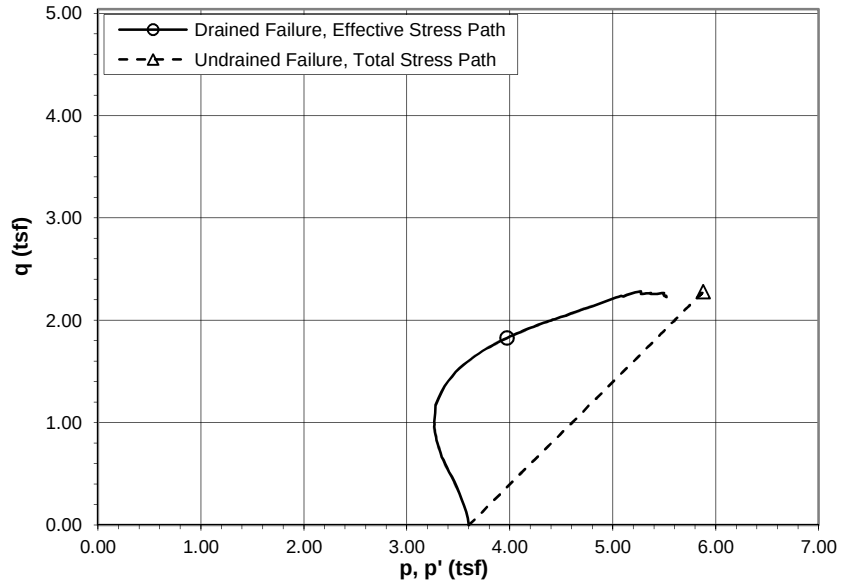
Failure Criterion: Peak Deviator Stress

Axial Strain (%)	9.349
Deviator Stress (tsf)	4.561
Minor Principal Stress, σ_3 (tsf)	3.596
Major Principal Stress, σ_1 (tsf)	8.158
p (tsf)	5.877
q (tsf)	2.281

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: FA-15-1, 18.6'-19.1'
Description: Lean Clay with Gravel (CL), brown and gray, moist, firm

Project No.: 175553023
Lab ID: 52C
Test ID: 52C-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.040	Calculated Height (in)	5.991
Average Diameter (in)	2.888	Calculated Diameter (in)	2.925
Calculated Area (in^2)	6.551	Calculated Area (in^2)	6.720
Moist Weight (lb)	3.288	Moist Weight (lb)	3.299
Moist Unit Weight (pcf)	143.6	Moist Unit Weight (pcf)	141.6
Moisture Content (%)	13.3	Moisture Content (%)	13.7
Dry Weight (lb)	2.903	Dry Weight (lb)	2.903
Dry Unit Weight (pcf)	126.8	Dry Unit Weight (pcf)	124.6
Void Ratio	0.352	Void Ratio	0.375
Degree of Saturation (%)	103.6	Degree of Saturation (%)	100.0

Specific Gravity: 2.75
ASTM D 854, A

Liquid Limit:
Plastic Limit:
Plasticity Index:

Confining Stress
σ_3 (tsf): 3.603

Effective Consolidation Stress
σ_3' (tsf): 3.603

Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: FA-15-1, 18.6'-19.1'								Lab ID: 52C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.720	0.000	0.000	2.881	0.000	3.603	3.603	3.603	3.603	3.603	0.000	1.000
1.3	12.5	0.002	0.03	6.722	0.134	0.134	2.959	0.078	3.739	3.661	3.527	3.672	3.594	0.067	1.038
2.7	23.9	0.003	0.05	6.723	0.256	0.256	3.038	0.158	3.862	3.705	3.449	3.734	3.577	0.128	1.074
4.0	35.4	0.004	0.07	6.725	0.379	0.378	3.117	0.237	3.982	3.745	3.367	3.793	3.556	0.189	1.112
5.3	46.2	0.006	0.10	6.726	0.495	0.494	3.198	0.318	4.099	3.781	3.287	3.852	3.534	0.247	1.150
6.7	57.4	0.007	0.12	6.728	0.614	0.614	3.282	0.402	4.219	3.817	3.203	3.912	3.510	0.307	1.192
8.0	68.4	0.008	0.14	6.729	0.731	0.731	3.362	0.481	4.334	3.852	3.121	3.968	3.487	0.366	1.234
9.4	78.8	0.010	0.16	6.731	0.843	0.842	3.443	0.562	4.446	3.884	3.041	4.025	3.462	0.421	1.277
10.7	88.2	0.011	0.19	6.733	0.944	0.943	3.518	0.638	4.546	3.909	2.965	4.075	3.437	0.472	1.318
12.0	96.8	0.013	0.21	6.734	1.035	1.034	3.586	0.706	4.636	3.930	2.896	4.119	3.413	0.517	1.357
13.4	104.6	0.014	0.23	6.735	1.118	1.118	3.651	0.770	4.720	3.950	2.832	4.161	3.391	0.559	1.395
14.7	111.7	0.015	0.26	6.737	1.194	1.194	3.707	0.826	4.796	3.969	2.776	4.199	3.372	0.597	1.430
16.1	118.9	0.016	0.27	6.738	1.270	1.270	3.762	0.881	4.873	3.992	2.722	4.238	3.357	0.635	1.467
17.4	125.5	0.018	0.30	6.740	1.341	1.340	3.813	0.933	4.942	4.009	2.669	4.272	3.339	0.670	1.502
18.8	132.0	0.020	0.33	6.742	1.410	1.409	3.861	0.980	5.012	4.032	2.622	4.307	3.327	0.705	1.538
20.1	138.6	0.021	0.36	6.744	1.480	1.479	3.908	1.028	5.083	4.055	2.577	4.344	3.316	0.739	1.574
21.4	144.2	0.023	0.38	6.745	1.539	1.539	3.948	1.068	5.142	4.075	2.536	4.373	3.306	0.769	1.607
22.8	149.8	0.024	0.40	6.747	1.599	1.598	3.986	1.106	5.202	4.096	2.498	4.403	3.297	0.799	1.640
24.1	155.3	0.026	0.43	6.749	1.656	1.655	4.022	1.142	5.258	4.117	2.461	4.431	3.289	0.828	1.673
25.5	160.4	0.027	0.45	6.750	1.711	1.710	4.057	1.177	5.316	4.139	2.429	4.461	3.284	0.855	1.704
26.8	165.5	0.028	0.46	6.751	1.765	1.764	4.089	1.209	5.368	4.159	2.395	4.486	3.277	0.882	1.737
28.2	170.5	0.029	0.49	6.753	1.818	1.817	4.120	1.240	5.422	4.182	2.365	4.513	3.273	0.909	1.769
29.5	175.6	0.031	0.52	6.755	1.872	1.871	4.150	1.269	5.473	4.204	2.333	4.537	3.268	0.935	1.802
30.8	180.8	0.032	0.54	6.756	1.927	1.926	4.179	1.298	5.528	4.230	2.304	4.565	3.267	0.963	1.836
32.2	185.1	0.033	0.56	6.758	1.972	1.971	4.202	1.322	5.577	4.255	2.284	4.591	3.270	0.986	1.863
33.5	189.2	0.035	0.59	6.760	2.016	2.014	4.225	1.345	5.620	4.275	2.261	4.613	3.268	1.007	1.891
38.9	206.1	0.041	0.68	6.766	2.193	2.191	4.309	1.429	5.800	4.371	2.180	4.704	3.275	1.096	2.005
44.2	220.4	0.046	0.77	6.772	2.343	2.341	4.369	1.488	5.938	4.449	2.108	4.767	3.279	1.171	2.111
49.6	233.7	0.052	0.87	6.779	2.482	2.480	4.415	1.535	6.085	4.550	2.070	4.845	3.310	1.240	2.198
54.9	245.4	0.058	0.96	6.785	2.604	2.602	4.449	1.569	6.208	4.639	2.038	4.907	3.339	1.301	2.277
60.3	256.2	0.063	1.05	6.791	2.716	2.713	4.472	1.592	6.316	4.725	2.011	4.960	3.368	1.357	2.349
65.7	266.1	0.069	1.16	6.798	2.818	2.815	4.489	1.608	6.419	4.810	1.995	5.011	3.402	1.408	2.411
71.0	274.7	0.075	1.25	6.805	2.907	2.904	4.499	1.618	6.509	4.891	1.987	5.057	3.439	1.452	2.461
76.4	282.9	0.080	1.34	6.811	2.991	2.988	4.502	1.622	6.591	4.969	1.981	5.097	3.475	1.494	2.508
81.7	290.4	0.086	1.43	6.817	3.067	3.063	4.503	1.622	6.666	5.044	1.981	5.135	3.512	1.532	2.547
87.1	297.3	0.091	1.52	6.824	3.137	3.134	4.500	1.620	6.740	5.120	1.987	5.173	3.554	1.567	2.577
92.5	303.5	0.097	1.61	6.830	3.200	3.196	4.492	1.611	6.801	5.189	1.993	5.203	3.591	1.598	2.603
97.8	309.2	0.102	1.70	6.836	3.256	3.252	4.482	1.602	6.856	5.255	2.002	5.230	3.628	1.626	2.624
103.2	314.8	0.108	1.80	6.843	3.312	3.308	4.473	1.592	6.913	5.321	2.013	5.259	3.667	1.654	2.644

Project: 175553023			Source: FA-15-1, 18.6'-19.1'								Lab ID: 52C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
108.5	319.5	0.113	1.89	6.849	3.358	3.354	4.458	1.578	6.955	5.378	2.024	5.279	3.701	1.677	2.657
113.9	324.3	0.119	1.99	6.857	3.405	3.401	4.447	1.566	7.002	5.436	2.035	5.302	3.736	1.700	2.671
119.3	328.9	0.125	2.09	6.863	3.450	3.445	4.431	1.550	7.046	5.496	2.050	5.323	3.773	1.723	2.680
124.6	333.0	0.130	2.18	6.869	3.490	3.485	4.415	1.535	7.086	5.551	2.066	5.343	3.809	1.743	2.687
130.0	336.8	0.136	2.27	6.876	3.527	3.522	4.401	1.520	7.124	5.604	2.082	5.363	3.843	1.761	2.692
135.3	340.7	0.141	2.36	6.882	3.564	3.559	4.384	1.504	7.161	5.657	2.098	5.381	3.878	1.779	2.696
140.7	344.5	0.147	2.45	6.888	3.601	3.595	4.368	1.488	7.197	5.710	2.114	5.400	3.912	1.798	2.701
146.1	347.6	0.152	2.54	6.895	3.630	3.624	4.350	1.469	7.223	5.754	2.130	5.411	3.942	1.812	2.701
151.4	351.0	0.159	2.66	6.903	3.661	3.655	4.334	1.454	7.254	5.801	2.146	5.427	3.973	1.827	2.703
156.8	354.0	0.165	2.75	6.910	3.689	3.682	4.318	1.437	7.283	5.845	2.163	5.441	4.004	1.841	2.702
162.1	357.0	0.168	2.81	6.914	3.717	3.711	4.301	1.421	7.311	5.890	2.180	5.456	4.035	1.855	2.702
167.5	360.1	0.173	2.89	6.920	3.746	3.740	4.284	1.404	7.340	5.936	2.196	5.470	4.066	1.870	2.703
172.9	362.9	0.179	2.99	6.927	3.772	3.765	4.268	1.387	7.369	5.981	2.217	5.486	4.099	1.882	2.698
178.2	365.7	0.185	3.08	6.933	3.797	3.790	4.252	1.372	7.391	6.019	2.229	5.496	4.124	1.895	2.700
183.6	368.4	0.190	3.18	6.941	3.822	3.814	4.234	1.353	7.413	6.060	2.245	5.506	4.153	1.907	2.699
188.9	371.1	0.196	3.27	6.947	3.846	3.839	4.220	1.339	7.441	6.102	2.264	5.522	4.183	1.919	2.696
194.3	373.3	0.199	3.32	6.951	3.867	3.859	4.203	1.322	7.458	6.136	2.277	5.529	4.206	1.930	2.695
199.6	375.3	0.210	3.50	6.964	3.881	3.872	4.185	1.305	7.471	6.166	2.294	5.534	4.230	1.936	2.688
205.0	378.1	0.216	3.60	6.971	3.905	3.897	4.174	1.294	7.499	6.205	2.309	5.551	4.257	1.948	2.688
210.4	379.9	0.221	3.68	6.977	3.921	3.912	4.156	1.275	7.512	6.237	2.325	5.556	4.281	1.956	2.683
215.7	382.5	0.230	3.83	6.988	3.941	3.932	4.141	1.261	7.532	6.271	2.339	5.566	4.305	1.966	2.681
221.1	384.7	0.235	3.92	6.994	3.960	3.951	4.128	1.247	7.551	6.304	2.353	5.576	4.329	1.975	2.679
226.4	386.4	0.237	3.96	6.997	3.976	3.967	4.112	1.231	7.569	6.338	2.371	5.586	4.355	1.983	2.673
231.8	388.5	0.244	4.08	7.005	3.993	3.983	4.097	1.216	7.585	6.369	2.385	5.593	4.377	1.992	2.670
237.2	390.4	0.251	4.19	7.014	4.007	3.997	4.081	1.200	7.599	6.399	2.401	5.600	4.400	1.999	2.665
242.5	392.5	0.259	4.33	7.024	4.023	4.013	4.069	1.189	7.615	6.427	2.414	5.609	4.420	2.007	2.663
247.9	393.8	0.266	4.44	7.032	4.032	4.021	4.052	1.172	7.621	6.449	2.428	5.611	4.439	2.011	2.656
261.3	399.3	0.280	4.68	7.050	4.078	4.067	4.021	1.140	7.668	6.527	2.460	5.634	4.494	2.034	2.653
274.7	402.7	0.295	4.93	7.068	4.102	4.091	3.986	1.105	7.693	6.588	2.497	5.648	4.542	2.045	2.638
288.1	407.7	0.307	5.12	7.083	4.144	4.132	3.955	1.075	7.733	6.658	2.526	5.667	4.592	2.066	2.636
301.5	411.8	0.320	5.35	7.099	4.176	4.164	3.925	1.045	7.767	6.722	2.559	5.685	4.640	2.082	2.627
314.9	416.1	0.334	5.58	7.117	4.209	4.196	3.895	1.015	7.795	6.780	2.584	5.697	4.682	2.098	2.624
328.3	420.2	0.349	5.83	7.136	4.240	4.226	3.866	0.986	7.826	6.840	2.614	5.713	4.727	2.113	2.617
341.6	424.0	0.364	6.08	7.155	4.267	4.253	3.838	0.958	7.852	6.895	2.642	5.726	4.768	2.126	2.610
355.0	427.8	0.378	6.31	7.172	4.295	4.280	3.815	0.934	7.881	6.947	2.667	5.741	4.807	2.140	2.605
435.4	447.6	0.419	6.99	7.225	4.460	4.444	3.674	0.793	8.046	7.253	2.809	5.824	5.031	2.222	2.582
448.8	450.8	0.442	7.39	7.256	4.473	4.456	3.653	0.772	8.056	7.284	2.828	5.828	5.056	2.228	2.575
462.2	453.5	0.450	7.50	7.265	4.494	4.477	3.632	0.751	8.070	7.319	2.842	5.832	5.080	2.238	2.575
475.6	455.9	0.489	8.16	7.317	4.486	4.466	3.611	0.730	8.065	7.335	2.869	5.832	5.102	2.233	2.557
489.0	459.4	0.494	8.24	7.323	4.517	4.497	3.590	0.710	8.097	7.387	2.890	5.848	5.138	2.249	2.556
529.2	465.3	0.507	8.47	7.342	4.563	4.543	3.534	0.653	8.141	7.488	2.946	5.870	5.217	2.271	2.542
556.0	470.7	0.552	9.21	7.402	4.579	4.557	3.502	0.621	8.154	7.532	2.975	5.875	5.254	2.279	2.532
569.4	471.9	0.560	9.35	7.413	4.583	4.561	3.484	0.603	8.158	7.554	2.993	5.877	5.273	2.281	2.524
582.7	471.9	0.616	10.28	7.490	4.537	4.513	3.465	0.584	8.114	7.530	3.017	5.858	5.273	2.256	2.496
596.1	475.4	0.653	10.91	7.542	4.538	4.512	3.448	0.567	8.112	7.545	3.033	5.856	5.289	2.256	2.488
609.5	476.9	0.657	10.97	7.548	4.550	4.524	3.433	0.552	8.125	7.573	3.049	5.863	5.311	2.262	2.484
622.9	478.7	0.672	11.22	7.569	4.553	4.527	3.419	0.539	8.126	7.587	3.060	5.862	5.324	2.263	2.479
636.3	480.3	0.689	11.50	7.593	4.555	4.527	3.402	0.522	8.128	7.606	3.079	5.864	5.343	2.264	2.470
649.7	481.1	0.699	11.67	7.608	4.553	4.525	3.387	0.506	8.125	7.619	3.093	5.862	5.356	2.263	2.463
663.1	482.8	0.711	11.87	7.625	4.559	4.531	3.372	0.491	8.128	7.636	3.105	5.862	5.371	2.266	2.459
676.5	483.6	0.734	12.25	7.658	4.546	4.517	3.357	0.477	8.104	7.627	3.110	5.845	5.369	2.259	2.453
703.3	485.2	0.755	12.60	7.689	4.543	4.514	3.332	0.451	8.111	7.660	3.147	5.855	5.403	2.257	2.434
716.7	487.0	0.774	12.93	7.717	4.544	4.513	3.318	0.437	8.108	7.671	3.158	5.852	5.414	2.256	2.429
730.1	488.6	0.790	13.18	7.740	4.545	4.514	3.304	0.424	8.112	7.688	3.174	5.855	5.431	2.257	2.422
770.3	491.3	0.798	13.32	7.752	4.563	4.531	3.263	0.383	8.126	7.743	3.212	5.860	5.477	2.266	2.411
783.7	491.8	0.799	13.34	7.755	4.566	4.535	3.252	0.372	8.138	7.766	3.231	5.870	5.499	2.267	2.404
797.1	492.3	0.838	13.98	7.812	4.537	4.504	3.243	0.362	8.109	7.747	3.243	5.857	5.495	2.252	2.389
810.5	492.9	0.855	14.27	7.838	4.527	4.493	3.231	0.351	8.096	7.745	3.252	5.850	5.499	2.247	2.382
823.9	493.5	0.872	14.56	7.865	4.518	4.484	3.223	0.343	8.085	7.743	3.259	5.843	5.501	2.242	2.376
837.2	494.7	0.898	14.98	7.904	4.507	4.471	3.216	0.335	8.075	7.740	3.269	5.840	5.504	2.236	2.368
850.6	495.7	0.901	15.03	7.909	4.513	4.478	3.206	0.326	8.083	7.757	3.279	5.844	5.518	2.239	2.365
877.4	496.1	0.928	15.49	7.952	4.492	4.455	3.188	0.307	8.055	7.748	3.293	5.827	5.520	2.228	2.353
890.6	498.6	0.957	15.98	7.998	4.489	4.451	3.178	0.298	8.044	7.747	3.295	5.819	5.521	2.226	2.351

FLY ASH POND SADDLE DAM, 2015

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	SD-15-2, 30.0'-30.5'	Lab ID	36A
Description	Lean Clay with Gravel (CL), brown, moist, firm	Test ID	36A-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	11/30/2015

Specific Gravity	2.72
	ASTM D 854, A
Liquid Limit	43
Plastic Limit	20
Plasticity Index	23
	ASTM D 4318

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	80
Nominal Consolidation Pressure (psi)	10

Saturation / Consolidation Results

Pore Pressure Parameter B	0.99
Measured Effective Consol. Stress (tsf)	0.717
Time to 50% Consolidation (min)	22.00
Actual Axial Strain Rate of Test (%/min)	0.013

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	132.1
Moisture Content (%)	19.7
Dry Unit Weight (pcf)	110.3
Void Ratio	0.537
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

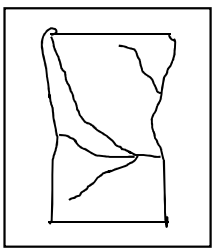
Axial Strain (%)	2.851
Deviator Stress (tsf)	0.917
Induced Pore Pressure (tsf)	0.310
Minor Effective Stress, σ_3' (tsf)	0.398
Major Effective Stress, σ_1' (tsf)	1.315
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.306
p' (tsf)	0.856
q (tsf)	0.458

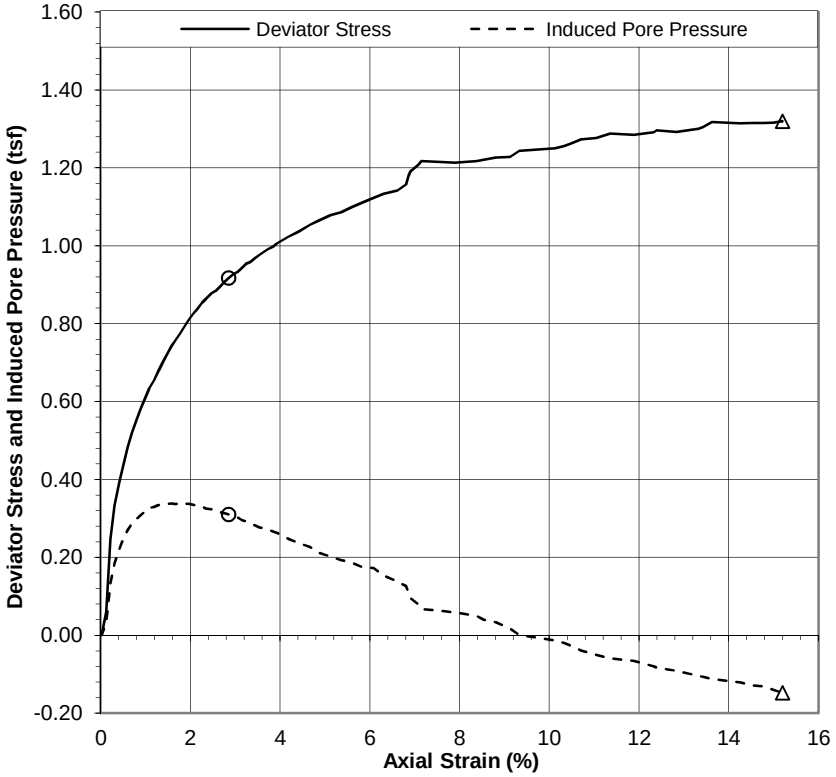
At Consolidated Undrained Failure

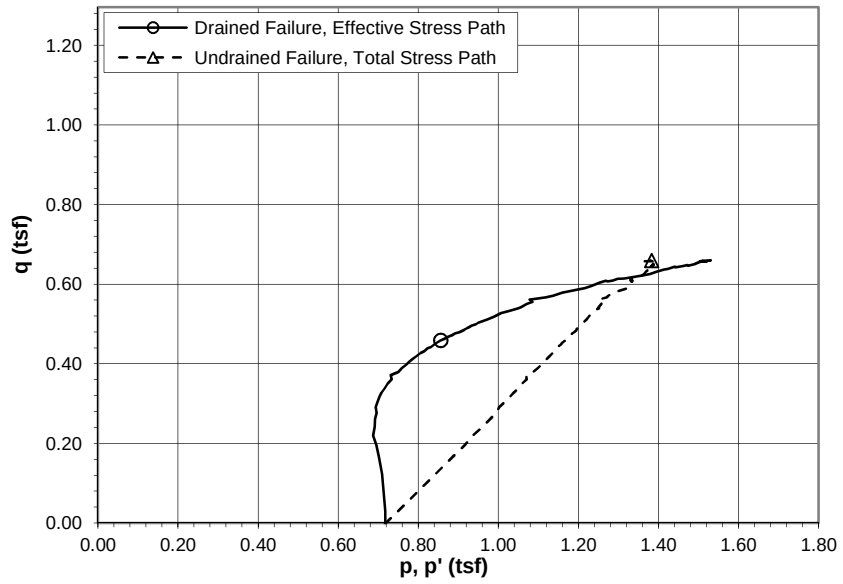
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.197
Deviator Stress (tsf)	1.320
Minor Principal Stress, σ_3 (tsf)	0.723
Major Principal Stress, σ_1 (tsf)	2.043
p (tsf)	1.383
q (tsf)	0.660

Failure Sketch







Comments

Reviewed KG

Form: tmp_cu_tva_input.xlsm
Preparation Date: 02-2013
Revision Date: N/A

Stantec Consulting Services Inc.
Lexington, Kentucky

Laboratory Document
Prepared By: JW
Approved By: TLK

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: SD-15-2, 30.0'-30.5'
Description: Lean Clay with Gravel (CL), brown, moist, firm

Project No.: 175553023
Lab ID: 36A
Test ID: 36A-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.072	Calculated Height (in)	6.043
Average Diameter (in)	2.887	Calculated Diameter (in)	2.923
Calculated Area (in^2)	6.546	Calculated Area (in^2)	6.710
Moist Weight (lb)	3.052	Moist Weight (lb)	3.099
Moist Unit Weight (pcf)	132.7	Moist Unit Weight (pcf)	132.1
Moisture Content (%)	17.9	Moisture Content (%)	19.7
Dry Weight (lb)	2.588	Dry Weight (lb)	2.588
Dry Unit Weight (pcf)	112.5	Dry Unit Weight (pcf)	110.3
Void Ratio	0.506	Void Ratio	0.537
Degree of Saturation (%)	96.2	Degree of Saturation (%)	100.0

Specific Gravity: 2.72
ASTM D 854, A

Liquid Limit: 43
Plastic Limit: 20
Plasticity Index: 23
ASTM D 4318

Confining Stress
σ_3 (tsf): 0.717

Effective Consolidation Stress
σ_3' (tsf): 0.717

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175553023			Source: SD-15-2, 30.0'-30.5'								Lab ID: 36A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.710	0.000	0.000	5.755	0.000	0.717	0.717	0.717	0.717	0.717	0.000	1.000
1.8	0.1	0.001	0.02	6.711	0.001	0.001	5.757	0.002	0.720	0.718	0.717	0.720	0.717	0.001	1.002
9.2	5.6	0.008	0.13	6.718	0.060	0.060	5.786	0.032	0.780	0.748	0.688	0.750	0.718	0.030	1.087
16.5	23.1	0.013	0.22	6.724	0.247	0.247	5.888	0.133	0.966	0.833	0.587	0.843	0.710	0.123	1.420
23.8	31.2	0.019	0.31	6.730	0.334	0.333	5.939	0.184	1.053	0.869	0.536	0.886	0.702	0.167	1.622
31.1	36.9	0.025	0.42	6.738	0.394	0.393	5.976	0.222	1.113	0.891	0.498	0.916	0.695	0.197	1.788
38.4	41.2	0.031	0.51	6.744	0.440	0.439	6.003	0.249	1.155	0.906	0.468	0.936	0.687	0.219	1.938
45.7	45.4	0.037	0.61	6.750	0.485	0.483	6.024	0.270	1.203	0.933	0.450	0.961	0.691	0.242	2.075
53.1	49.1	0.042	0.70	6.757	0.523	0.522	6.042	0.287	1.240	0.953	0.431	0.979	0.692	0.261	2.210
60.4	52.2	0.048	0.80	6.764	0.555	0.553	6.054	0.299	1.272	0.973	0.419	0.995	0.696	0.277	2.320
67.7	55.0	0.054	0.90	6.770	0.585	0.582	6.063	0.308	1.293	0.985	0.402	1.002	0.693	0.291	2.448
75.0	57.6	0.060	1.00	6.777	0.612	0.609	6.073	0.318	1.321	1.003	0.394	1.016	0.698	0.305	2.548
82.3	60.1	0.066	1.09	6.783	0.638	0.635	6.081	0.327	1.347	1.021	0.385	1.030	0.703	0.318	2.649
89.7	61.9	0.072	1.19	6.790	0.657	0.654	6.084	0.330	1.365	1.035	0.381	1.038	0.708	0.327	2.715
97.0	64.4	0.078	1.29	6.797	0.682	0.679	6.089	0.334	1.390	1.056	0.378	1.051	0.717	0.339	2.797
104.3	66.4	0.084	1.38	6.804	0.703	0.700	6.090	0.336	1.409	1.073	0.373	1.059	0.723	0.350	2.874
111.6	68.6	0.090	1.49	6.811	0.725	0.722	6.092	0.337	1.432	1.094	0.372	1.071	0.733	0.361	2.939
118.9	70.7	0.095	1.58	6.817	0.746	0.742	6.093	0.339	1.441	1.103	0.360	1.070	0.731	0.371	3.061
126.2	72.2	0.101	1.68	6.824	0.762	0.758	6.091	0.337	1.466	1.129	0.371	1.087	0.750	0.379	3.044
133.6	74.1	0.107	1.78	6.831	0.781	0.776	6.094	0.339	1.486	1.147	0.371	1.098	0.759	0.388	3.095
140.9	75.8	0.113	1.87	6.838	0.798	0.794	6.092	0.337	1.503	1.166	0.372	1.107	0.769	0.397	3.131
148.2	77.4	0.119	1.97	6.844	0.814	0.810	6.092	0.337	1.519	1.182	0.372	1.114	0.777	0.405	3.176
155.5	78.9	0.125	2.06	6.851	0.829	0.824	6.090	0.335	1.533	1.198	0.374	1.121	0.786	0.412	3.205
162.8	80.3	0.131	2.16	6.858	0.843	0.838	6.087	0.332	1.547	1.214	0.376	1.128	0.795	0.419	3.228
170.2	81.9	0.137	2.26	6.865	0.859	0.853	6.084	0.330	1.562	1.232	0.379	1.135	0.806	0.427	3.251
177.5	83.0	0.142	2.35	6.871	0.870	0.864	6.080	0.325	1.573	1.247	0.383	1.141	0.815	0.432	3.255
184.8	84.4	0.149	2.46	6.879	0.883	0.877	6.078	0.323	1.585	1.262	0.385	1.147	0.823	0.439	3.280
192.1	85.1	0.155	2.56	6.886	0.890	0.884	6.072	0.317	1.591	1.274	0.390	1.149	0.832	0.442	3.269
199.4	86.3	0.161	2.66	6.893	0.902	0.895	6.071	0.317	1.603	1.286	0.391	1.155	0.839	0.448	3.289
206.8	87.5	0.166	2.75	6.899	0.913	0.906	6.068	0.313	1.613	1.300	0.394	1.160	0.847	0.453	3.302
214.1	88.6	0.172	2.85	6.906	0.924	0.917	6.065	0.310	1.625	1.315	0.398	1.166	0.856	0.458	3.306
221.4	89.6	0.179	2.95	6.914	0.933	0.926	6.061	0.306	1.636	1.329	0.403	1.173	0.866	0.463	3.295
228.7	90.3	0.184	3.05	6.921	0.939	0.932	6.057	0.303	1.641	1.338	0.406	1.175	0.872	0.466	3.295
236.0	91.4	0.190	3.15	6.928	0.950	0.943	6.050	0.295	1.652	1.356	0.413	1.180	0.885	0.471	3.283
243.4	92.6	0.196	3.25	6.935	0.961	0.953	6.047	0.292	1.662	1.370	0.416	1.185	0.893	0.477	3.290
250.7	93.2	0.202	3.35	6.942	0.966	0.959	6.041	0.287	1.669	1.382	0.423	1.189	0.903	0.479	3.264
258.0	94.2	0.208	3.44	6.948	0.976	0.968	6.037	0.282	1.679	1.397	0.429	1.195	0.913	0.484	3.258
265.3	95.1	0.214	3.54	6.956	0.985	0.976	6.032	0.277	1.684	1.407	0.431	1.196	0.919	0.488	3.265
272.6	96.0	0.220	3.64	6.963	0.992	0.984	6.029	0.275	1.694	1.419	0.435	1.202	0.927	0.492	3.262

Project: 175553023			Source: SD-15-2, 30.0'-30.5'								Lab ID: 36A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
279.9	96.8	0.226	3.74	6.970	1.000	0.992	6.025	0.271	1.701	1.430	0.438	1.205	0.934	0.496	3.262
287.3	97.6	0.232	3.85	6.978	1.007	0.998	6.020	0.266	1.708	1.443	0.444	1.209	0.943	0.499	3.246
294.6	98.5	0.238	3.93	6.984	1.015	1.006	6.017	0.262	1.716	1.453	0.447	1.213	0.950	0.503	3.250
312.9	100.5	0.253	4.19	7.003	1.033	1.023	6.002	0.247	1.731	1.484	0.461	1.220	0.973	0.512	3.218
331.2	102.1	0.267	4.42	7.020	1.047	1.036	5.991	0.236	1.744	1.508	0.472	1.226	0.990	0.518	3.198
349.5	104.1	0.282	4.67	7.038	1.065	1.054	5.981	0.226	1.760	1.534	0.480	1.233	1.007	0.527	3.196
367.8	105.4	0.294	4.86	7.053	1.076	1.064	5.967	0.212	1.769	1.557	0.493	1.237	1.025	0.532	3.158
386.1	107.1	0.310	5.12	7.072	1.090	1.078	5.956	0.202	1.791	1.589	0.511	1.252	1.050	0.539	3.110
404.4	108.2	0.324	5.36	7.090	1.098	1.086	5.947	0.193	1.794	1.601	0.515	1.251	1.058	0.543	3.107
422.6	109.8	0.338	5.60	7.107	1.112	1.099	5.941	0.186	1.807	1.621	0.522	1.257	1.071	0.549	3.107
441.0	111.3	0.353	5.84	7.126	1.125	1.111	5.929	0.174	1.815	1.640	0.529	1.259	1.085	0.556	3.099
459.2	112.8	0.368	6.09	7.145	1.137	1.123	5.927	0.173	1.812	1.639	0.517	1.251	1.078	0.561	3.173
477.5	114.2	0.382	6.31	7.162	1.148	1.133	5.907	0.152	1.837	1.685	0.552	1.271	1.118	0.567	3.054
495.8	115.5	0.400	6.62	7.185	1.157	1.142	5.893	0.138	1.846	1.707	0.566	1.275	1.137	0.571	3.017
514.1	117.4	0.412	6.81	7.200	1.174	1.158	5.881	0.126	1.865	1.739	0.581	1.286	1.160	0.579	2.992
550.7	119.7	0.415	6.86	7.204	1.197	1.180	5.862	0.108	1.914	1.807	0.626	1.324	1.216	0.590	2.885
569.0	120.9	0.418	6.91	7.208	1.208	1.191	5.849	0.095	1.923	1.829	0.637	1.328	1.233	0.596	2.869
605.6	122.8	0.428	7.09	7.221	1.225	1.208	5.834	0.079	1.936	1.857	0.649	1.332	1.253	0.604	2.861
623.9	123.9	0.432	7.15	7.226	1.234	1.217	5.822	0.067	1.944	1.877	0.659	1.335	1.268	0.609	2.847
642.2	124.7	0.477	7.90	7.285	1.232	1.214	5.813	0.059	1.938	1.880	0.666	1.331	1.273	0.607	2.822
660.5	125.8	0.507	8.38	7.323	1.237	1.217	5.803	0.049	1.941	1.892	0.675	1.333	1.284	0.609	2.803
678.8	126.4	0.516	8.54	7.336	1.241	1.220	5.795	0.040	1.940	1.899	0.679	1.330	1.289	0.610	2.797
697.1	127.5	0.532	8.81	7.358	1.247	1.226	5.788	0.033	1.944	1.911	0.684	1.331	1.298	0.613	2.792
715.4	128.2	0.552	9.13	7.384	1.250	1.228	5.771	0.017	1.946	1.929	0.701	1.332	1.315	0.614	2.753
752.0	130.1	0.564	9.33	7.400	1.266	1.244	5.755	0.000	1.980	1.979	0.736	1.358	1.358	0.622	2.690
788.5	132.1	0.612	10.13	7.466	1.274	1.250	5.741	-0.013	1.990	2.003	0.753	1.365	1.378	0.625	2.660
806.8	133.1	0.624	10.33	7.483	1.280	1.256	5.735	-0.020	1.994	2.014	0.758	1.366	1.386	0.628	2.657
825.1	133.9	0.633	10.47	7.494	1.286	1.261	5.728	-0.026	1.999	2.025	0.764	1.368	1.394	0.631	2.652
861.7	135.5	0.648	10.72	7.515	1.299	1.273	5.715	-0.039	2.011	2.051	0.777	1.375	1.414	0.637	2.638
880.0	136.4	0.667	11.04	7.542	1.302	1.276	5.705	-0.050	2.011	2.061	0.785	1.373	1.423	0.638	2.626
916.6	138.3	0.686	11.36	7.569	1.315	1.288	5.695	-0.059	2.026	2.085	0.797	1.382	1.441	0.644	2.617
934.9	138.9	0.719	11.89	7.615	1.313	1.285	5.689	-0.066	2.019	2.085	0.800	1.377	1.442	0.643	2.607
971.5	140.3	0.745	12.33	7.653	1.320	1.291	5.675	-0.080	2.027	2.107	0.816	1.382	1.461	0.646	2.583
989.8	141.0	0.749	12.39	7.659	1.326	1.296	5.671	-0.083	2.036	2.119	0.823	1.388	1.471	0.648	2.576
1008.1	141.4	0.776	12.83	7.697	1.323	1.292	5.664	-0.091	2.029	2.120	0.828	1.383	1.474	0.646	2.561
1044.7	143.2	0.805	13.33	7.741	1.332	1.300	5.650	-0.105	2.036	2.141	0.841	1.386	1.491	0.650	2.547
1063.0	144.0	0.812	13.44	7.751	1.337	1.305	5.648	-0.107	2.041	2.148	0.843	1.389	1.495	0.653	2.549
1081.3	145.6	0.824	13.63	7.769	1.349	1.317	5.642	-0.113	2.056	2.169	0.852	1.398	1.510	0.659	2.547
1099.6	146.5	0.861	14.25	7.825	1.348	1.315	5.634	-0.121	2.050	2.171	0.856	1.393	1.514	0.657	2.535
1117.9	147.2	0.878	14.53	7.850	1.350	1.315	5.626	-0.129	2.050	2.179	0.864	1.392	1.521	0.658	2.523
1136.2	147.6	0.892	14.77	7.872	1.350	1.315	5.624	-0.131	2.049	2.179	0.864	1.391	1.522	0.657	2.521
1154.5	148.1	0.907	15.00	7.894	1.351	1.316	5.614	-0.140	2.020	2.161	0.845	1.363	1.503	0.658	2.557
1172.7	149.0	0.918	15.20	7.912	1.356	1.320	5.607	-0.147	2.043	2.190	0.870	1.383	1.530	0.660	2.517
1172.9	148.9	0.919	15.20	7.912	1.355	1.319	5.606	-0.149	2.040	2.188	0.869	1.380	1.529	0.659	2.517

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Big Sandy Station, CCR Rule Activities	Project No.	175553023
Source	SD-15-2, 30.5'-31.0'	Lab ID	36B
Description	Lean Clay with Gravel (CL), brown, moist, firm	Test ID	36B-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	11/04/2015
		Date Tested	12/01/2015

Specific Gravity	2.72
	ASTM D 854, A
Liquid Limit	43
Plastic Limit	20
Plasticity Index	23
	ASTM D 4318

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	60
Nominal Consolidation Pressure (psi)	30

Saturation / Consolidation Results

Pore Pressure Parameter B	0.97
Measured Effective Consol. Stress (tsf)	2.135
Time to 50% Consolidation (min)	33.00
Actual Axial Strain Rate of Test (%/min)	0.009

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	134.1
Moisture Content (%)	18.1
Dry Unit Weight (pcf)	113.6
Void Ratio	0.492
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

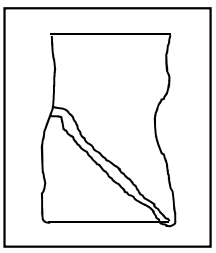
Axial Strain (%)	4.900
Deviator Stress (tsf)	1.897
Induced Pore Pressure (tsf)	0.757
Minor Effective Stress, σ_3' (tsf)	1.360
Major Effective Stress, σ_1' (tsf)	3.257
Eff. Principal Stress Ratio, σ_1'/σ_3'	2.396
p' (tsf)	2.308
q (tsf)	0.949

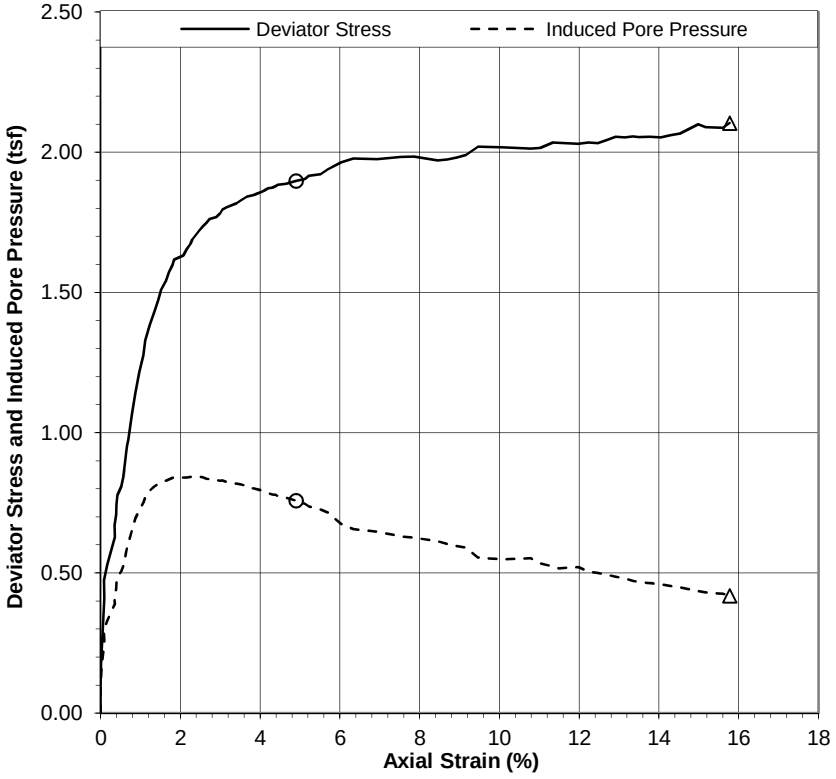
At Consolidated Undrained Failure

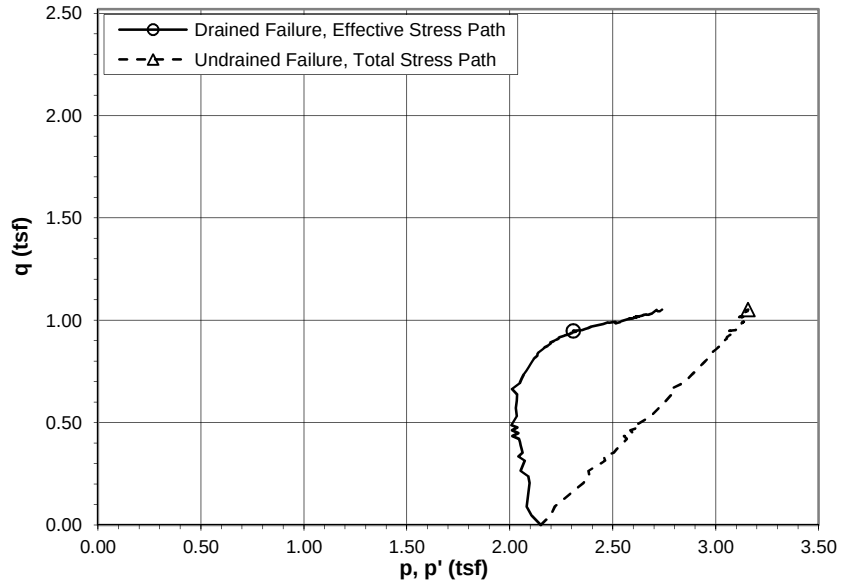
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.772
Deviator Stress (tsf)	2.104
Minor Principal Stress, σ_3 (tsf)	2.105
Major Principal Stress, σ_1 (tsf)	4.209
p (tsf)	3.157
q (tsf)	1.052

Failure Sketch







Comments

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name: Big Sandy Station, CCR Rule Activities
Source: SD-15-2, 30.5'-31.0'
Description: Lean Clay with Gravel (CL), brown, moist, firm

Project No.: 175553023
Lab ID: 36B
Test ID: 36B-A

Initial Specimen Conditions		Consolidated Specimen Conditions	
Average Height (in)	6.045	Calculated Height (in)	5.983
Average Diameter (in)	2.888	Calculated Diameter (in)	2.879
Calculated Area (in^2)	6.551	Calculated Area (in^2)	6.511
Moist Weight (lb)	3.022	Moist Weight (lb)	3.024
Moist Unit Weight (pcf)	131.9	Moist Unit Weight (pcf)	134.1
Moisture Content (%)	18.0	Moisture Content (%)	18.1
Dry Weight (lb)	2.561	Dry Weight (lb)	2.561
Dry Unit Weight (pcf)	111.7	Dry Unit Weight (pcf)	113.6
Void Ratio	0.517	Void Ratio	0.492
Degree of Saturation (%)	94.8	Degree of Saturation (%)	100.0

Specific Gravity: 2.72
ASTM D 854, A

Liquid Limit: 43
Plastic Limit: 20
Plasticity Index: 23
ASTM D 4318

Confining Stress
σ_3 (tsf): 2.150

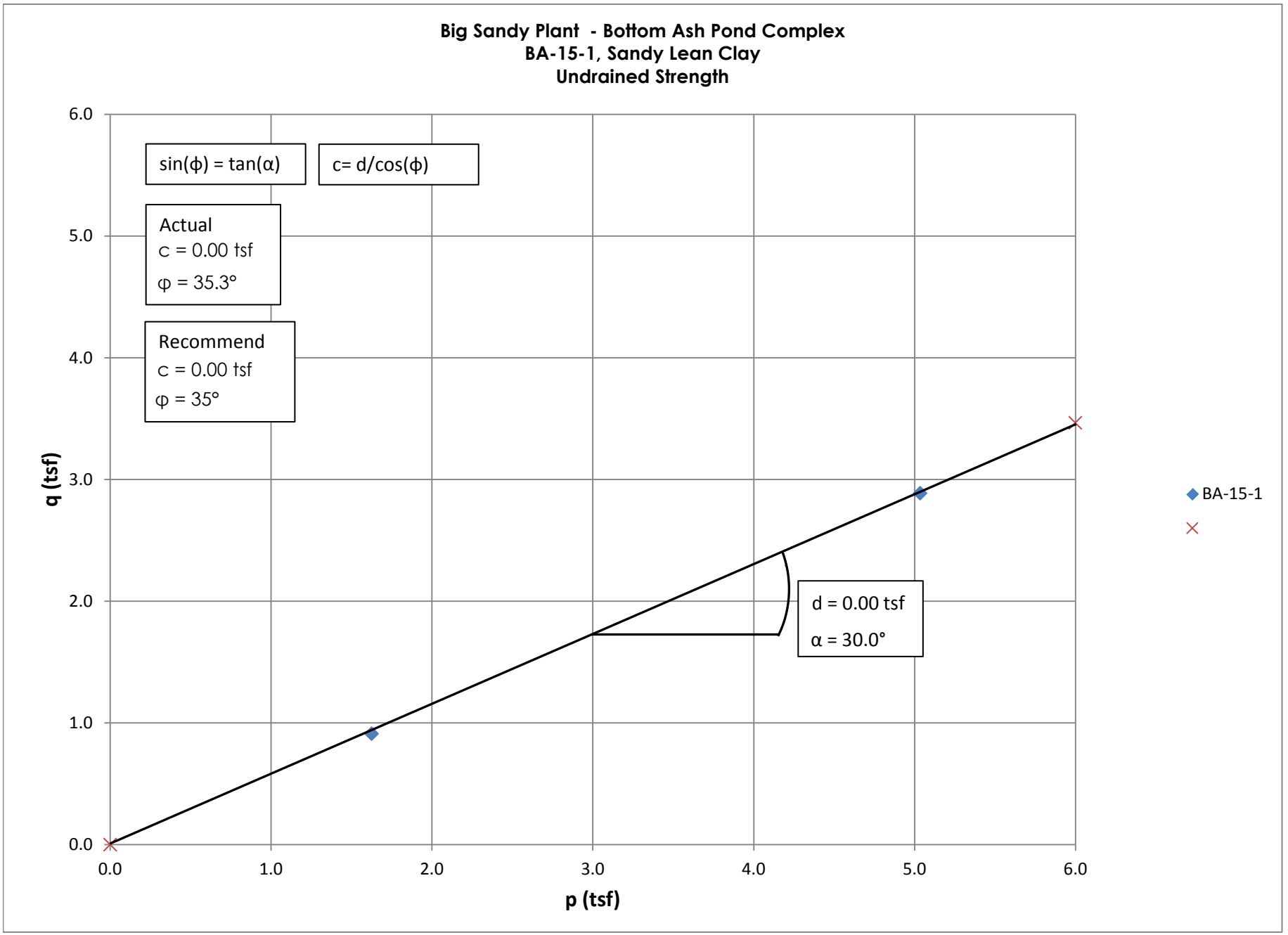
Effective Consolidation Stress
σ_3' (tsf): 2.150

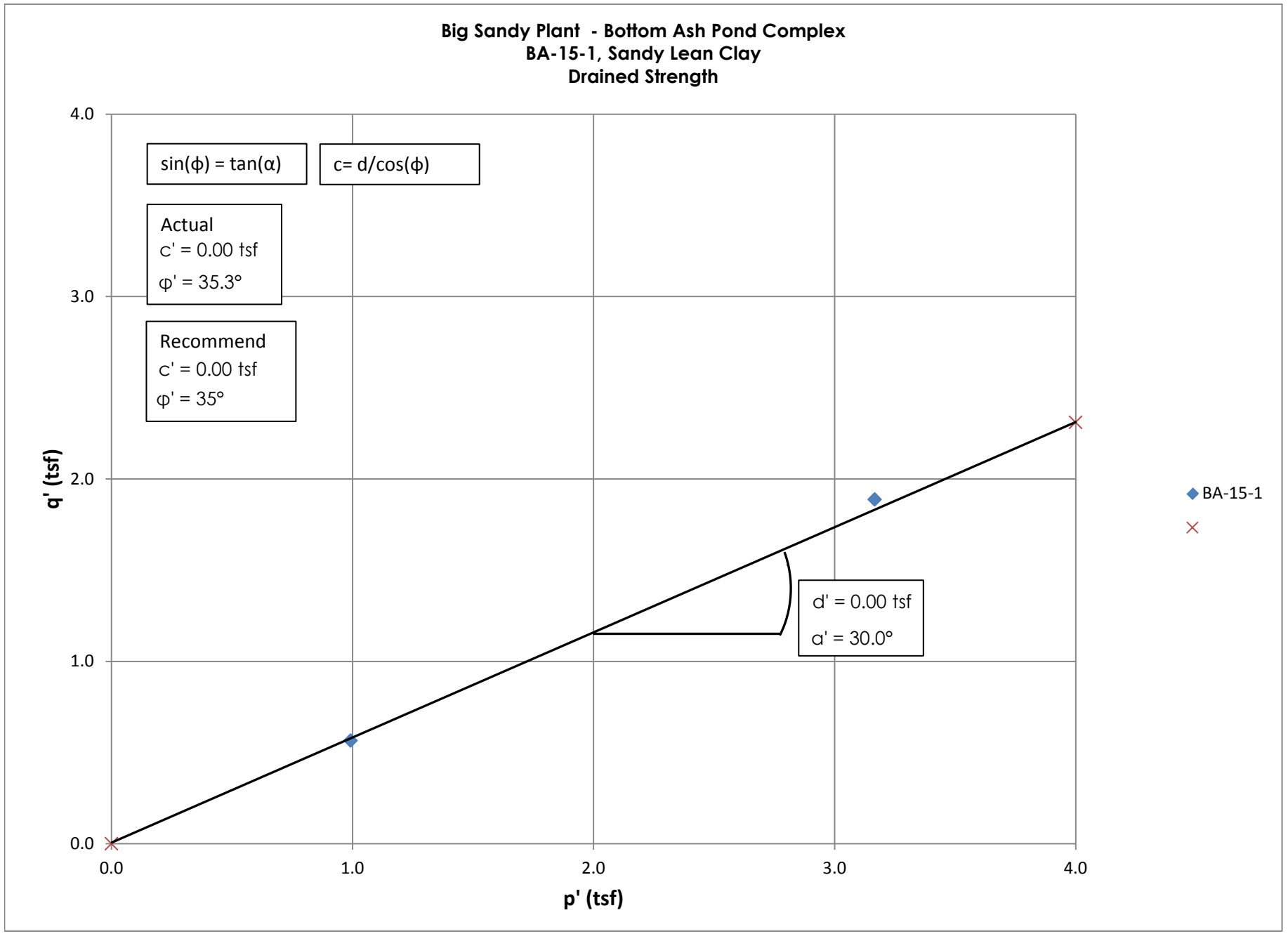
Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

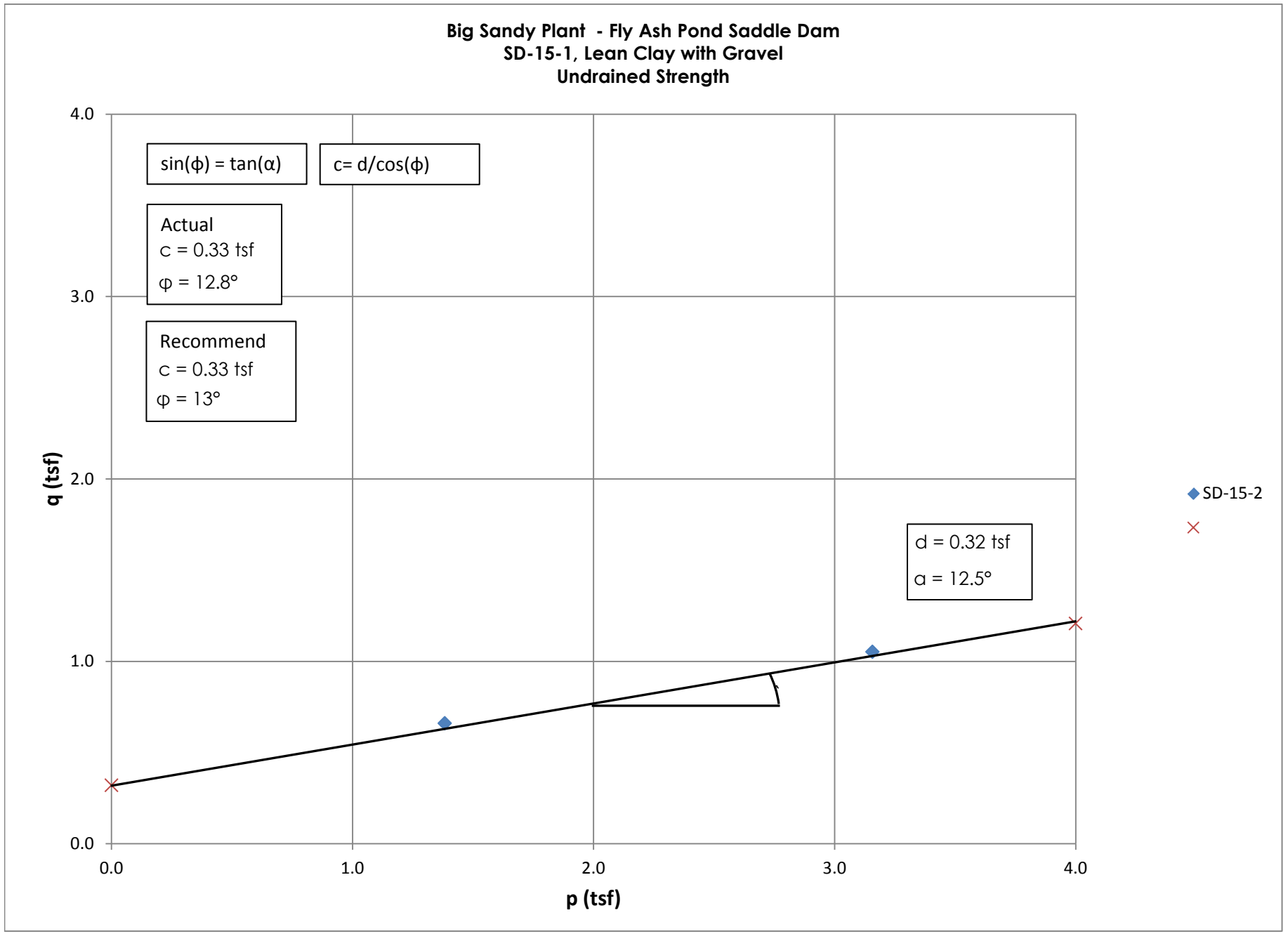
Project: 175553023			Source: SD-15-2, 30.5'-31.0'								Lab ID: 36B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.511	0.000	0.000	4.323	0.000	2.150	2.150	2.150	2.150	2.150	0.000	1.000
2.7	8.3	0.000	0.00	6.511	0.092	0.092	4.413	0.090	2.242	2.153	2.060	2.196	2.106	0.046	1.045
5.5	16.3	0.001	0.01	6.511	0.180	0.180	4.459	0.136	2.308	2.172	1.992	2.218	2.082	0.090	1.090
13.7	37.1	0.006	0.10	6.517	0.410	0.410	4.584	0.260	2.562	2.302	1.892	2.357	2.097	0.205	1.217
16.4	42.9	0.005	0.09	6.516	0.474	0.474	4.620	0.297	2.624	2.328	1.854	2.387	2.091	0.237	1.256
19.1	47.9	0.010	0.17	6.522	0.529	0.529	4.653	0.329	2.647	2.318	1.789	2.382	2.053	0.264	1.296
24.6	57.1	0.022	0.36	6.534	0.629	0.628	4.712	0.389	2.777	2.388	1.759	2.462	2.074	0.314	1.357
27.3	60.8	0.021	0.35	6.533	0.670	0.670	4.738	0.415	2.791	2.376	1.706	2.456	2.041	0.335	1.392
30.0	64.4	0.023	0.39	6.536	0.709	0.708	4.766	0.442	2.858	2.416	1.708	2.504	2.062	0.354	1.415
32.7	67.7	0.024	0.40	6.537	0.746	0.745	4.787	0.464	2.894	2.429	1.684	2.521	2.057	0.373	1.442
35.5	70.7	0.026	0.43	6.539	0.778	0.777	4.808	0.485	2.927	2.442	1.664	2.538	2.053	0.389	1.467
38.2	73.6	0.031	0.52	6.544	0.810	0.808	4.829	0.506	2.959	2.453	1.645	2.555	2.049	0.404	1.492
40.9	76.5	0.034	0.57	6.548	0.841	0.840	4.847	0.524	2.989	2.465	1.626	2.569	2.045	0.420	1.516
43.7	79.1	0.036	0.59	6.550	0.869	0.868	4.865	0.542	2.988	2.446	1.579	2.554	2.012	0.434	1.550
46.4	81.7	0.037	0.62	6.551	0.898	0.896	4.879	0.556	3.046	2.489	1.593	2.597	2.041	0.448	1.562
49.1	84.4	0.038	0.64	6.552	0.928	0.926	4.897	0.574	3.049	2.475	1.548	2.586	2.011	0.463	1.598
51.8	86.9	0.039	0.66	6.554	0.954	0.953	4.913	0.590	3.103	2.513	1.561	2.627	2.037	0.476	1.610
54.6	88.9	0.042	0.70	6.556	0.976	0.974	4.926	0.603	3.098	2.495	1.521	2.611	2.008	0.487	1.641
65.5	97.1	0.047	0.78	6.562	1.066	1.064	4.974	0.651	3.217	2.566	1.502	2.685	2.034	0.532	1.708
76.4	104.3	0.052	0.87	6.568	1.144	1.141	5.017	0.694	3.294	2.600	1.459	2.723	2.029	0.571	1.783
87.3	111.1	0.058	0.97	6.574	1.216	1.214	5.047	0.723	3.365	2.641	1.427	2.757	2.034	0.607	1.851
98.2	116.9	0.064	1.07	6.581	1.279	1.276	5.073	0.750	3.424	2.674	1.398	2.786	2.036	0.638	1.913
109.1	121.8	0.067	1.12	6.584	1.332	1.329	5.094	0.770	3.447	2.676	1.347	2.782	2.011	0.665	1.987
120.1	127.0	0.074	1.23	6.592	1.388	1.385	5.116	0.793	3.533	2.740	1.356	2.841	2.048	0.692	2.021
130.9	131.3	0.081	1.35	6.600	1.433	1.430	5.131	0.808	3.580	2.772	1.342	2.865	2.057	0.715	2.065
141.9	135.3	0.086	1.45	6.606	1.475	1.472	5.141	0.818	3.621	2.804	1.332	2.885	2.068	0.736	2.105
152.8	138.8	0.091	1.51	6.611	1.511	1.508	5.145	0.822	3.657	2.835	1.327	2.903	2.081	0.754	2.136
163.7	141.9	0.098	1.63	6.619	1.544	1.540	5.152	0.829	3.690	2.861	1.321	2.920	2.091	0.770	2.165
174.6	145.0	0.102	1.71	6.624	1.576	1.572	5.157	0.834	3.721	2.888	1.315	2.935	2.101	0.786	2.195
185.5	147.6	0.108	1.80	6.630	1.602	1.598	5.162	0.838	3.746	2.908	1.310	2.947	2.109	0.799	2.220
196.4	149.3	0.110	1.84	6.633	1.621	1.617	5.164	0.841	3.765	2.924	1.307	2.956	2.115	0.808	2.237
207.3	151.2	0.124	2.07	6.649	1.637	1.632	5.163	0.840	3.777	2.938	1.305	2.961	2.122	0.816	2.250
218.2	153.3	0.129	2.16	6.654	1.658	1.653	5.163	0.840	3.799	2.960	1.307	2.973	2.133	0.827	2.265
229.1	155.2	0.135	2.25	6.661	1.678	1.673	5.166	0.843	3.815	2.972	1.299	2.978	2.136	0.836	2.288
240.1	156.8	0.137	2.30	6.664	1.694	1.689	5.165	0.842	3.827	2.985	1.296	2.983	2.141	0.844	2.303
261.9	160.0	0.148	2.47	6.675	1.726	1.720	5.166	0.843	3.864	3.021	1.301	3.004	2.161	0.860	2.322
272.8	161.5	0.153	2.56	6.681	1.740	1.734	5.165	0.841	3.878	3.036	1.302	3.011	2.169	0.867	2.332
283.7	163.1	0.159	2.66	6.689	1.756	1.749	5.159	0.836	3.896	3.060	1.311	3.021	2.185	0.875	2.335
294.6	164.5	0.164	2.73	6.694	1.769	1.763	5.158	0.835	3.908	3.073	1.311	3.027	2.192	0.881	2.345

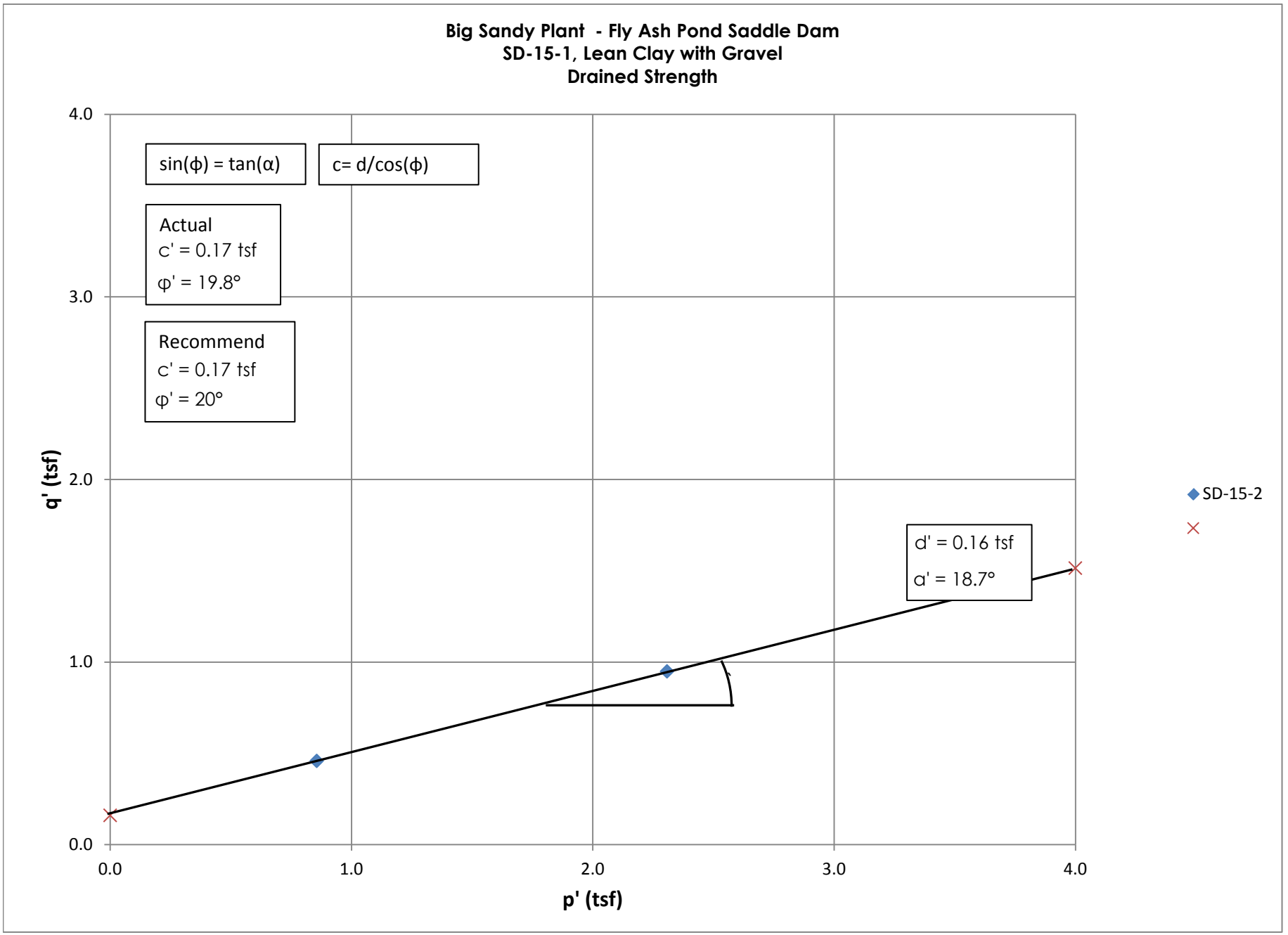
Project: 175553023			Source: SD-15-2, 30.5'-31.0'								Lab ID: 36B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
305.5	165.4	0.174	2.90	6.705	1.776	1.769	5.153	0.830	3.911	3.081	1.312	3.027	2.197	0.885	2.348
316.4	166.9	0.179	3.00	6.712	1.790	1.783	5.151	0.828	3.917	3.088	1.305	3.025	2.197	0.892	2.366
327.4	168.1	0.183	3.05	6.716	1.803	1.795	5.153	0.830	3.939	3.108	1.313	3.041	2.211	0.898	2.367
338.3	169.1	0.189	3.16	6.723	1.811	1.803	5.147	0.824	3.945	3.121	1.318	3.044	2.220	0.902	2.368
360.1	170.9	0.204	3.41	6.740	1.826	1.818	5.142	0.819	3.961	3.142	1.325	3.052	2.234	0.909	2.372
371.0	172.0	0.210	3.50	6.747	1.835	1.827	5.139	0.816	3.967	3.151	1.324	3.053	2.237	0.913	2.380
381.9	172.9	0.215	3.59	6.753	1.844	1.835	5.136	0.812	3.972	3.159	1.324	3.054	2.242	0.917	2.386
392.8	173.8	0.219	3.67	6.759	1.851	1.842	5.129	0.806	3.980	3.174	1.332	3.059	2.253	0.921	2.383
403.7	174.6	0.230	3.84	6.771	1.856	1.847	5.124	0.801	3.987	3.186	1.339	3.063	2.262	0.924	2.380
414.7	175.4	0.235	3.93	6.777	1.863	1.853	5.121	0.798	3.995	3.197	1.343	3.068	2.270	0.927	2.380
425.6	175.9	0.241	4.03	6.784	1.867	1.858	5.118	0.794	4.000	3.205	1.348	3.071	2.277	0.929	2.378
436.5	176.8	0.247	4.12	6.791	1.874	1.864	5.113	0.790	4.009	3.220	1.355	3.077	2.288	0.932	2.376
447.4	177.6	0.252	4.21	6.797	1.882	1.872	5.107	0.784	4.016	3.232	1.360	3.080	2.296	0.936	2.376
458.3	178.0	0.258	4.30	6.804	1.884	1.873	5.103	0.779	4.013	3.234	1.361	3.077	2.297	0.937	2.377
469.2	178.8	0.263	4.39	6.810	1.890	1.880	5.102	0.779	4.021	3.243	1.363	3.082	2.303	0.940	2.379
480.1	179.4	0.266	4.45	6.814	1.895	1.885	5.096	0.773	4.027	3.254	1.369	3.085	2.312	0.942	2.376
491.0	180.1	0.278	4.65	6.828	1.899	1.888	5.091	0.768	4.033	3.265	1.377	3.089	2.321	0.944	2.371
518.3	181.5	0.293	4.90	6.846	1.909	1.897	5.081	0.757	4.014	3.257	1.360	3.066	2.308	0.949	2.396
545.6	182.7	0.307	5.13	6.863	1.917	1.904	5.070	0.746	4.049	3.303	1.398	3.097	2.350	0.952	2.362
572.8	184.0	0.313	5.22	6.870	1.929	1.916	5.060	0.737	4.063	3.326	1.409	3.104	2.368	0.958	2.360
600.1	185.2	0.330	5.52	6.891	1.935	1.922	5.050	0.726	4.067	3.340	1.418	3.106	2.379	0.961	2.355
654.7	187.2	0.341	5.70	6.904	1.952	1.938	5.038	0.715	4.081	3.366	1.427	3.112	2.397	0.969	2.358
736.5	190.3	0.361	6.03	6.929	1.978	1.964	4.997	0.674	4.109	3.435	1.471	3.127	2.453	0.982	2.335
791.1	192.4	0.379	6.34	6.951	1.993	1.977	4.980	0.657	4.121	3.464	1.487	3.133	2.476	0.989	2.330
818.3	193.6	0.415	6.94	6.996	1.992	1.976	4.971	0.647	4.117	3.469	1.494	3.129	2.482	0.988	2.322
872.9	195.7	0.450	7.53	7.041	2.001	1.983	4.954	0.631	4.126	3.495	1.512	3.135	2.504	0.991	2.311
900.2	196.7	0.470	7.86	7.066	2.004	1.985	4.948	0.625	4.130	3.505	1.520	3.137	2.512	0.993	2.306
927.4	196.7	0.506	8.46	7.112	1.991	1.971	4.936	0.613	4.112	3.499	1.528	3.126	2.513	0.985	2.290
954.7	197.6	0.520	8.69	7.131	1.995	1.974	4.926	0.603	4.114	3.511	1.536	3.127	2.523	0.987	2.285
982.0	198.8	0.534	8.93	7.149	2.003	1.981	4.919	0.595	4.122	3.526	1.545	3.131	2.536	0.991	2.282
1009.3	200.3	0.548	9.16	7.167	2.012	1.990	4.913	0.590	4.127	3.537	1.547	3.132	2.542	0.995	2.286
1145.6	204.1	0.566	9.47	7.191	2.043	2.020	4.878	0.555	4.152	3.597	1.576	3.142	2.587	1.010	2.282
1172.9	205.4	0.603	10.09	7.241	2.042	2.018	4.871	0.548	4.144	3.596	1.578	3.135	2.587	1.009	2.279
1200.2	206.6	0.645	10.78	7.297	2.039	2.013	4.876	0.553	4.138	3.585	1.572	3.132	2.579	1.006	2.280
1227.4	207.5	0.659	11.02	7.317	2.042	2.016	4.857	0.534	4.136	3.602	1.586	3.128	2.594	1.008	2.271
1282.0	210.2	0.678	11.34	7.343	2.061	2.034	4.846	0.523	4.153	3.630	1.596	3.136	2.613	1.017	2.274
1309.3	210.6	0.687	11.49	7.356	2.061	2.033	4.840	0.516	4.148	3.631	1.598	3.131	2.615	1.017	2.273
1336.5	211.5	0.717	11.98	7.397	2.059	2.030	4.844	0.521	4.142	3.621	1.591	3.127	2.606	1.015	2.276
1363.8	212.7	0.732	12.23	7.418	2.064	2.035	4.828	0.505	4.148	3.644	1.609	3.131	2.626	1.017	2.265
1391.1	213.1	0.746	12.47	7.438	2.062	2.032	4.823	0.500	4.130	3.630	1.598	3.114	2.614	1.016	2.272
1418.4	214.9	0.760	12.70	7.458	2.075	2.044	4.816	0.493	4.156	3.663	1.619	3.134	2.641	1.022	2.263
1445.7	216.6	0.773	12.92	7.476	2.086	2.055	4.810	0.487	4.166	3.679	1.624	3.138	2.652	1.027	2.265
1472.9	217.0	0.786	13.14	7.495	2.085	2.053	4.804	0.481	4.160	3.679	1.626	3.133	2.652	1.027	2.263
1500.2	217.9	0.799	13.35	7.514	2.088	2.056	4.795	0.472	4.162	3.690	1.634	3.134	2.662	1.028	2.258
1527.5	218.0	0.807	13.49	7.526	2.086	2.054	4.791	0.468	4.159	3.692	1.638	3.133	2.665	1.027	2.254
1554.8	219.0	0.824	13.77	7.551	2.088	2.055	4.787	0.464	4.159	3.695	1.640	3.132	2.668	1.027	2.253
1582.0	219.5	0.840	14.05	7.575	2.087	2.053	4.783	0.459	4.161	3.701	1.648	3.134	2.674	1.027	2.246
1609.3	221.1	0.855	14.29	7.597	2.095	2.061	4.777	0.454	4.167	3.713	1.652	3.136	2.683	1.030	2.247
1636.6	222.4	0.869	14.53	7.618	2.102	2.067	4.772	0.449	4.174	3.725	1.658	3.141	2.692	1.034	2.247
1718.4	227.2	0.897	14.98	7.658	2.136	2.100	4.758	0.435	4.199	3.764	1.664	3.149	2.714	1.050	2.262
1745.7	226.6	0.907	15.17	7.675	2.125	2.089	4.754	0.431	4.193	3.763	1.674	3.149	2.718	1.044	2.248
1772.9	227.6	0.933	15.60	7.714	2.124	2.087	4.749	0.426	4.197	3.772	1.685	3.154	2.728	1.043	2.239
1800.2	230.0	0.944	15.77	7.730	2.142	2.104	4.742	0.418	4.209	3.791	1.687	3.157	2.739	1.052	2.248

P-Q AND P'-Q' PLOTS, 2015

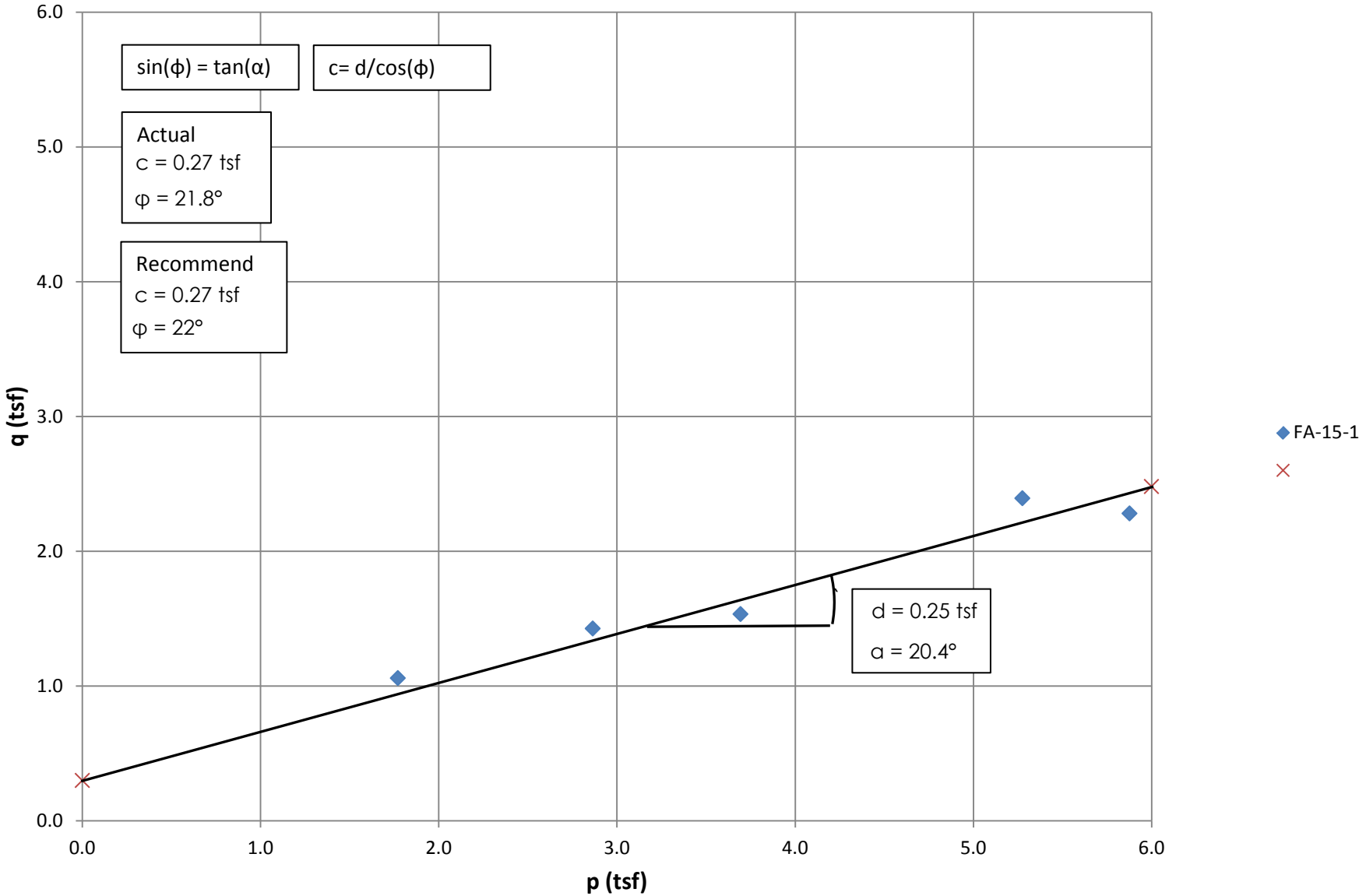


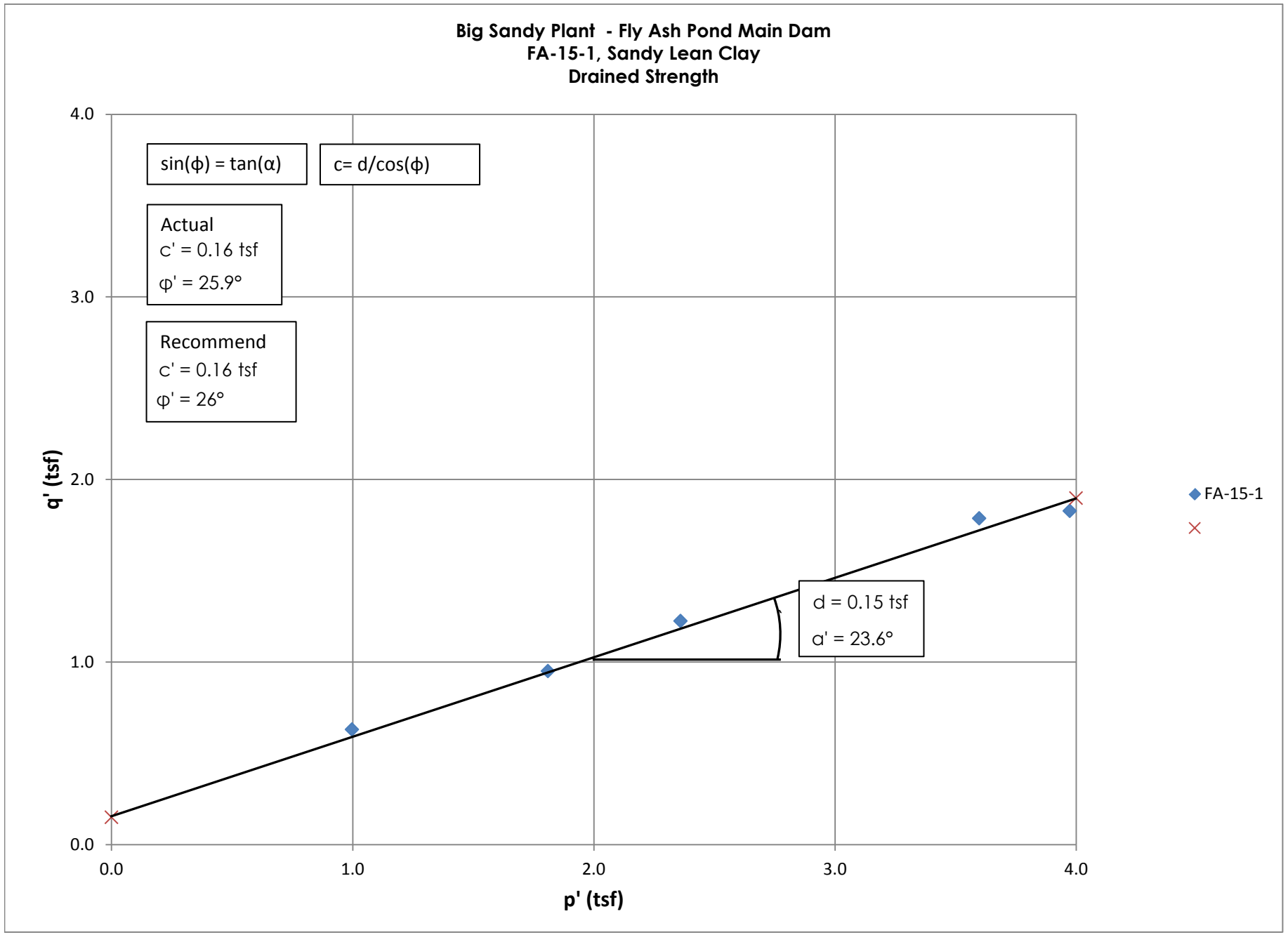






Big Sandy Plant - Fly Ash Pond Main Dam
FA-15-1, Sandy Lean Clay
Undrained Strength





APPENDIX F

PERMEABILITY TESTS

BOTTOM ASH POND COMPLEX, 2010

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1515	Tested By	JM
Project Name	AEP-Big Sandy/Unit 1-2	Test Date	12/01/09
Boring No.	B-4	Reviewed By	MM
Sample No.	58	Review Date	12/04/09
Sample Depth	5.1-5.4'	Lab No.	1
Sample Description	Brown Lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	B-15
Location 1	2.899	Location 1	2.860	Dry Soil+Pan, grams	550.21
Location 2	2.903	Location 2	2.860	Pan Weight, grams	58.98
Location3	2.902	Location 3	2.860		
Average	2.901	Average	2.860	Moisture Content, %	22.3
		Wet Soil + Tare, grams	601.01	Wet Unit Weight, pcf	122.8
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	100.4

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1200	8.2	100.5	8.40	100.3	5.1E-08	22	4.9E-08
				2300	8.2	100.5	8.60	100.1	5.4E-08	22	5.1E-08
				5400	8.2	100.5	9.10	99.5	5.5E-08	22	5.2E-08
				9200	8.2	100.5	9.70	98.8	5.5E-08	22	5.2E-08
				15000	8.2	100.5	10.70	97.9	5.4E-08	22	5.2E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	100.4	N/A	Vertical

Avg. k at 20 °C **5.1E-08** **cm/sec**

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²
Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds
H_b = final inlet head in cm
H_2 = final outlet head in cm

a =	0.16	cm²
A =	41.45	cm²
L =	7.37	cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1515***	Tested By	***JM***
Project Name	***AEP-Big Sandy/Unit 1-2***	Test Date	***12/1/2009***
Boring No.	***B-4***	Reviewed By	***MM***
Sample No.	***58***	Review Date	***12/4/2009***
Sample Depth	***5.1-5.4'***	Lab No.	***1***
Sample Description	***Brown Lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.3*
Wet Unit Weight, pcf:	*122.8*
Dry Unit Weight, pcf:	*100.4*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***5.1E-08***

Remarks: _____

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PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1515	Tested By	JM
Project Name	AEP-Big Sandy/Unit1-2	Test Date	12/02/09
Boring No.	B-6	Reviewed By	MM
Sample No.	103	Review Date	12/07/09
Sample Depth	5.2-5.4 ft	Lab No.	2
Sample Description	Brown Sandy lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	B-69
Location 1	2.210	Location 1	2.860	Dry Soil+Pan, grams	425.22
Location 2	2.200	Location 2	2.860	Pan Weight, grams	52.09
Location3	2.200	Location 3	2.860		
Average	2.203	Average	2.860	Moisture Content, %	19.9
		Wet Soil + Tare, grams	447.22	Wet Unit Weight, pcf	120.4
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	100.4

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				7200	12.0	94.2	14.30	91.9	8.6E-08	22	8.3E-08
				16000	12.0	94.2	17.00	89.2	8.8E-08	22	8.4E-08
				22000	12.0	94.2	18.70	87.5	8.7E-08	22	8.3E-08
				29000	12.0	94.2	20.50	85.8	8.6E-08	22	8.2E-08
				33000	12.0	94.2	21.40	84.9	8.4E-08	22	8.1E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	100.4	N/A	Vertical

Avg. k at 20 °C **8.2E-08** **cm/sec**

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²
Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds
H_b = final inlet head in cm
H_2 = final outlet head in cm

a =	0.16	cm²
A =	41.45	cm²
L =	5.60	cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1515***	Tested By	***JM***
Project Name	***AEP-Big Sandy/Unit1-2***	Test Date	***12/2/2009***
Boring No.	***B-19***	Reviewed By	***MM***
Sample No.	***103***	Review Date	***12/7/2009***
Sample Depth	***5.2-5.4 ft***	Lab No.	***2***
Sample Description	***Brown Sandy lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*19.9*
Wet Unit Weight, pcf:	*120.4*
Dry Unit Weight, pcf:	*100.4*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***8.2E-08***

Remarks: _____

_____

_____

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1515	Tested By	JM
Project Name	AEP-Big Sandy/Unit 1-2	Test Date	12/02/05
Boring No.	B-6	Reviewed By	MM
Sample No.	111A	Review Date	12/10/09
Sample Depth	22.6-22.8 ft	Lab No.	3
Sample Description	Brown Silty lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A-27
Location 1	2.882	Location 1	2.796	Dry Soil+Pan, grams	489.66
Location 2	2.893	Location 2	2.797	Pan Weight, grams	16.03
Location3	2.892	Location 3	2.813		
Average	2.889	Average	2.802	Moisture Content, %	22.5
		Wet Soil + Tare, grams	579.99	Wet Unit Weight, pcf	124.0
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	101.3

Remarks:

Chamber Pressure, psi	45
Back Pressure, psi	40
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				500	7.2	99.9	7.30	99.8	6.4E-08	22	6.1E-08
				1500	7.2	99.9	7.50	99.6	6.4E-08	22	6.1E-08
				4000	7.2	99.9	8.00	99.1	6.4E-08	22	6.1E-08
				5300	7.2	99.9	8.30	98.8	6.7E-08	22	6.4E-08
				8400	7.2	99.9	8.90	98.2	6.6E-08	22	6.3E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	101.3	N/A	Vertical

Avg. k at 20 °C **6.2E-08** **cm/sec**

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²
Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds
H_b = final inlet head in cm
H_2 = final outlet head in cm

a =	0.16	cm²
A =	39.78	cm²
L =	7.34	cm

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1515***	Tested By	***JM***
Project Name	***AEP-Big Sandy/Unit 1-2***	Test Date	***12/2/2005***
Boring No.	***B-6***	Reviewed By	***MM***
Sample No.	***111A***	Review Date	***12/10/2009***
Sample Depth	***22.6-22.8 ft***	Lab No.	***3***
Sample Description	***Brown Silty lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.5*
Wet Unit Weight, pcf:	*124.0*
Dry Unit Weight, pcf:	*101.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.2E-08***

Remarks: _____

_____

_____

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1515	Tested By	JM
Project Name	AEP Big Sandy/Unit 1-2	Test Date	12/04/09
Boring No.	B-1	Reviewed By	MM
Sample No.	122	Review Date	12/11/09
Sample Depth	27.9-28 ft	Lab No.	4
Sample Description	Brown silty lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	B-33
Location 1	2.998	Location 1	2.860	Dry Soil+Pan, grams	562.22
Location 2	2.993	Location 2	2.860	Pan Weight, grams	58.22
Location3	2.995	Location 3	2.860		
Average	2.995	Average	2.860	Moisture Content, %	22.9
		Wet Soil + Tare, grams	619.33	Wet Unit Weight, pcf	122.6
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	99.8

Remarks:

Chamber Pressure, psi	65
Back Pressure, psi	60
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				7200	8.0	95.7	10.00	93.7	9.5E-08	22	9.1E-08
				12400	8.0	95.7	11.20	92.5	9.0E-08	22	8.6E-08
				15600	8.0	95.7	11.80	91.9	8.5E-08	22	8.2E-08
				18500	8.0	95.7	12.50	91.3	8.5E-08	22	8.1E-08
				43000	8.0	95.7	14.20	82.6	8.5E-08	22	8.1E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	99.8	N/A	Vertical

Avg. k at 20 °C **8.4E-08** **cm/sec**

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²
Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds
H_b = final inlet head in cm
H_2 = final outlet head in cm

a =	0.16	cm²
A =	41.45	cm²
L =	7.61	cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1515***	Tested By	***JM***
Project Name	***AEP Big Sandy/Unit 1-2***	Test Date	***12/04/09***
Boring No.	***C-10A***	Reviewed By	***MM***
Sample No.	***122***	Review Date	***12/11/09***
Sample Depth	***27.9-28 ft***	Lab No.	***4***
Sample Description	***Brown silty lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.9*
Wet Unit Weight, pcf:	*122.6*
Dry Unit Weight, pcf:	*99.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***8.4E-08***

Remarks: _____

_____

_____

APPENDIX G

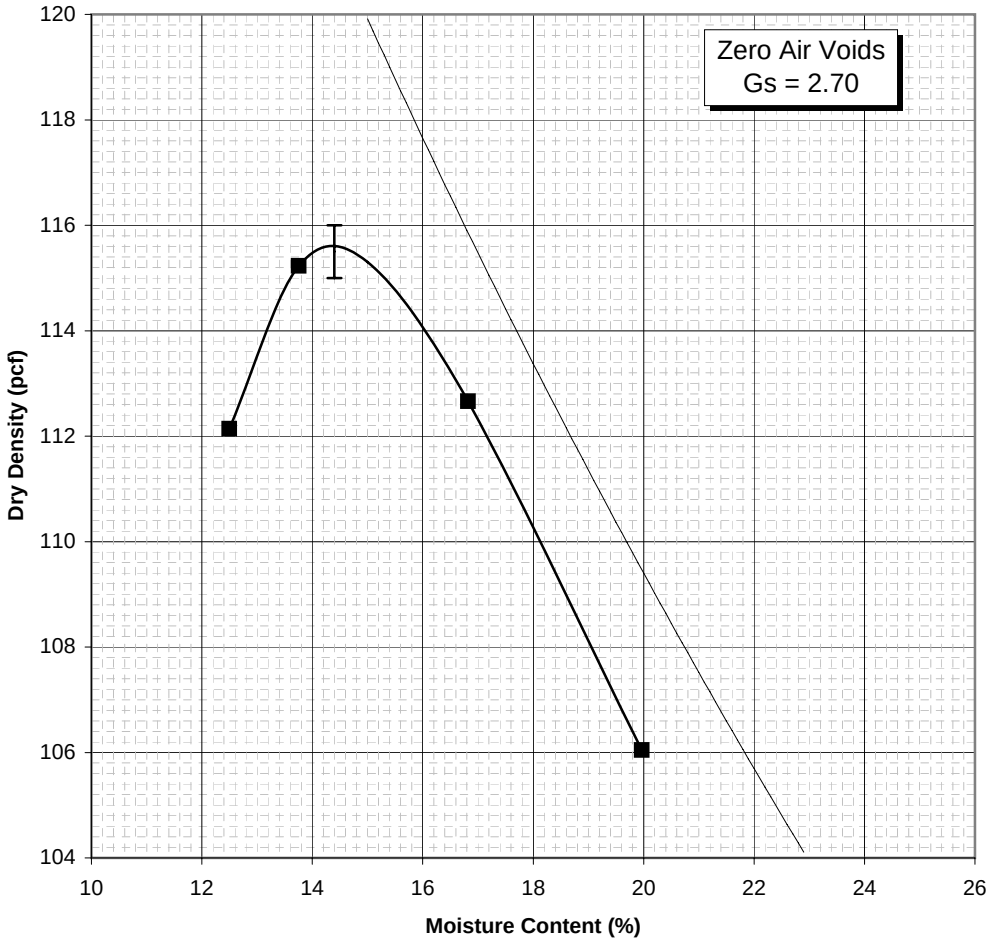
STANDARD PROCTOR MOISTURE-DENSITY TESTS

BOTTOM ASH POND COMPLEX, 2010

Moisture-Density Data Sheet

Project: AEP - Big Sandy / Unit 1-2 — Project No.: 175539021
Source: B-1, 10' — Sample No.: 1
Sample Description: light brown clay with gravel — Nmc: 15.8 %
Visual Notes: N/A — Test Method: ASTM D 698 - Method A
Prepared: Dry — Oversized Fraction: < 5 % — Rammer: Mechanical — Gs - Fines: Assumed

Mold Weight 2038 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3932	1894	336.16	307.15	75.00	12.5	112.1
4006	1968	374.92	338.57	74.26	13.8	115.2
4014	1976	388.77	343.47	74.12	16.8	112.7
3948	1910	357.94	310.82	74.81	20.0	106.0

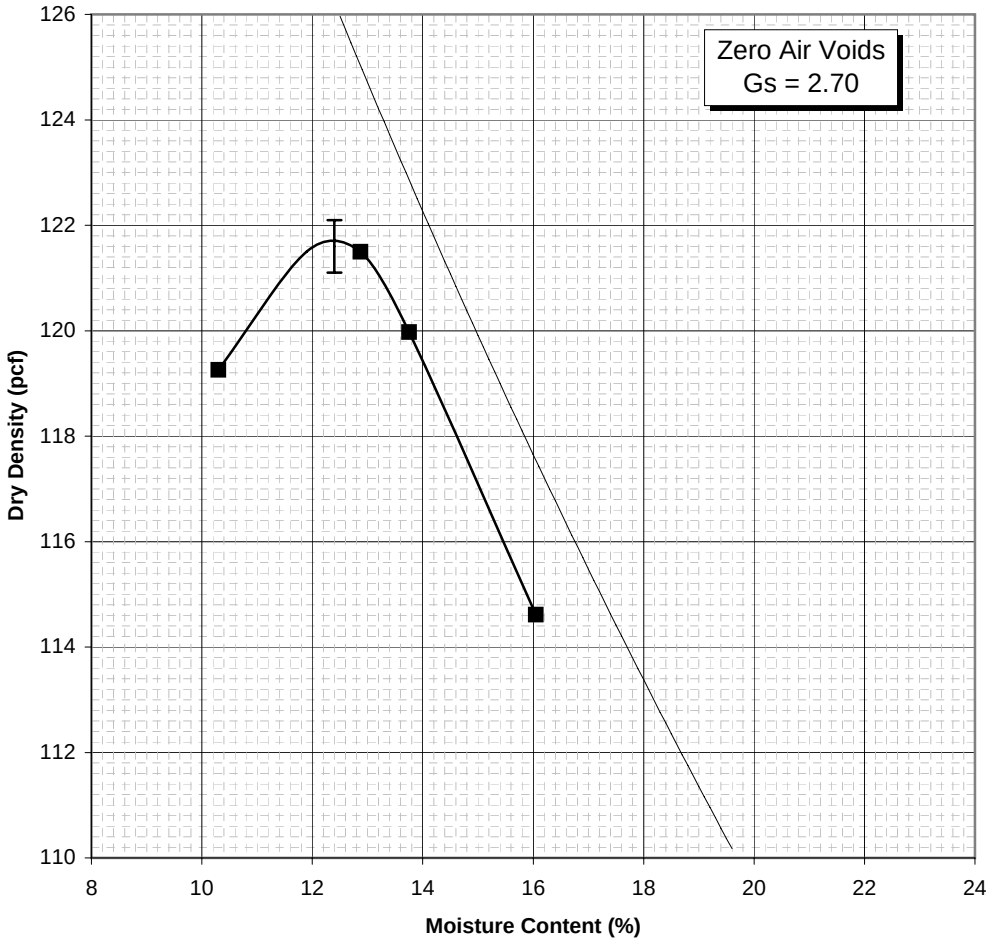


Maximum Dry Density 115.5 PCF
Optimum Moisture Content 14.4 %

Moisture-Density Data Sheet

Project: AEP - Big Sandy / Unit 1-2 — Project No.: 175539021
Source: B-4, 7.5' — Sample No.: 2
Sample Description: brown clay with gravel — Nmc: 11.7 %
Visual Notes: N/A — Test Method: ASTM D 698 - Method A
Prepared: Dry — Oversized Fraction: < 5 % — Rammer: Mechanical — Gs - Fines: Assumed

Mold Weight 2038 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
4013	1975	393.92	364.07	74.34	10.3	119.3
4097	2059	390.60	354.37	72.96	12.9	121.5
4087	2049	372.47	335.97	70.60	13.8	120.0
4035	1997	356.12	317.47	76.69	16.1	114.6



Maximum Dry Density 121.6 PCF
Optimum Moisture Content 12.4 %

APPENDIX E

DIRECT SHEAR TESTS

BOTTOM ASH POND COMPLEX, 2015

Direct Shear of Soils Under Consolidated Drained Conditions

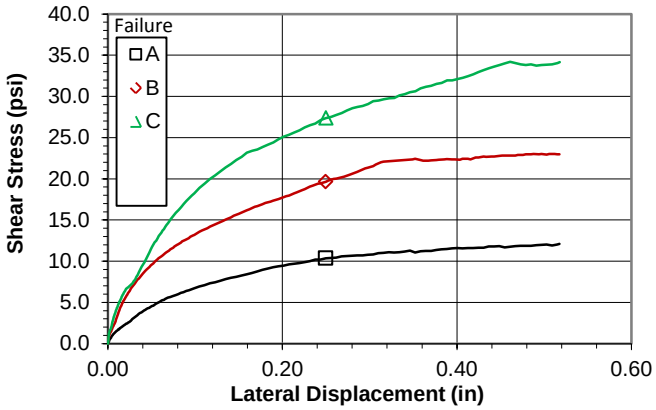
ASTM D 3080

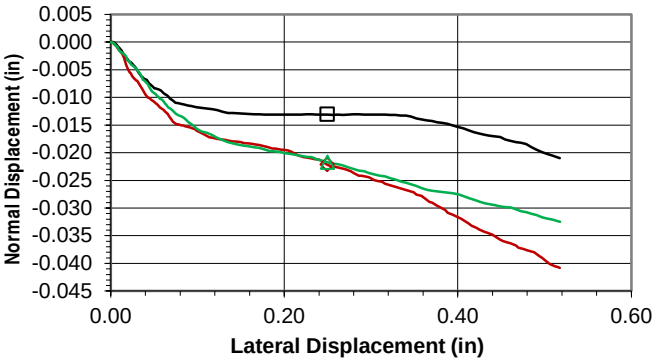
Project Name Big Sandy Station, CCR Rule Activities

Project 175553023

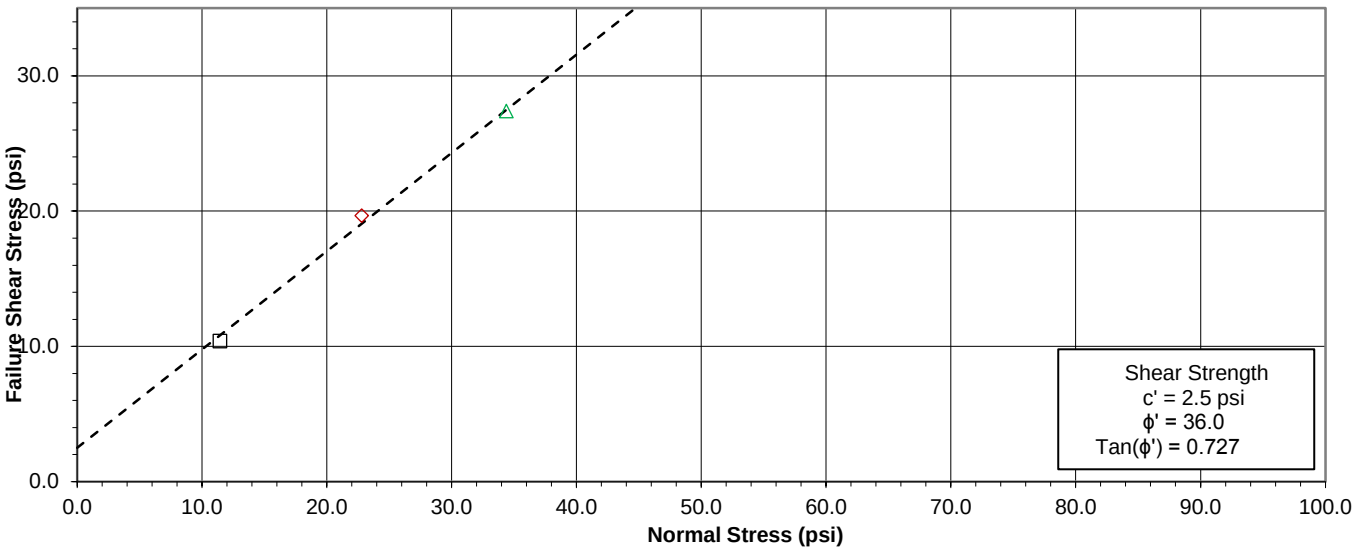
Set ID 1

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	2B	BA-15-1, 12.5'-14.5'	Poorly Graded Sand (SP), black, moist	2.19			
B	2B	BA-15-1, 12.5'-14.5'	Poorly Graded Sand (SP), black, moist	2.19			
C	2B	BA-15-1, 12.5'-14.5'	Poorly Graded Sand (SP), black, moist	2.19			





Specimen	A	B	C		
	Initial Specimen Conditions				
Height (in)	0.979	0.936	0.964		
Diameter (in)	2.501	2.501	2.501		
Moist Unit Weight (pcf)	56.7	58.3	56.9		
Moisture Content (%)	23.7	24.8	25.1		
Dry Unit Weight (pcf)	45.9	46.7	45.5		
Void Ratio	1.981	1.925	2.006		
Degree of Saturation (%)	26.2	28.2	27.4		
	Preshear Specimen Conditions				
Height (in)	0.779	0.735	0.717		
Moist Unit Weight (pcf)	85.6	86.5	89.5		
Moisture Content (%)	48.6	45.3	46.3		
Dry Unit Weight (pcf)	57.6	59.6	61.2		
Void Ratio	1.373	1.295	1.234		
Degree of Saturation (%)	77.5	76.6	82.1		
Normal Stress (psi)	9.964	19.935	29.978		
	At Failure Shear Stress				
Failure Criterion	Max. Shear Stress or 10% Displace.				
Shear Stress* (psi)	10.360	19.650	27.368		
Normal Stress* (psi)	11.456	22.807	34.403		
Lateral Displace. (in)	0.250	0.250	0.250		
Normal Displace. (in)	-0.013	-0.022	-0.022		



Direct Shear of Soils Under Consolidated Drained Conditions

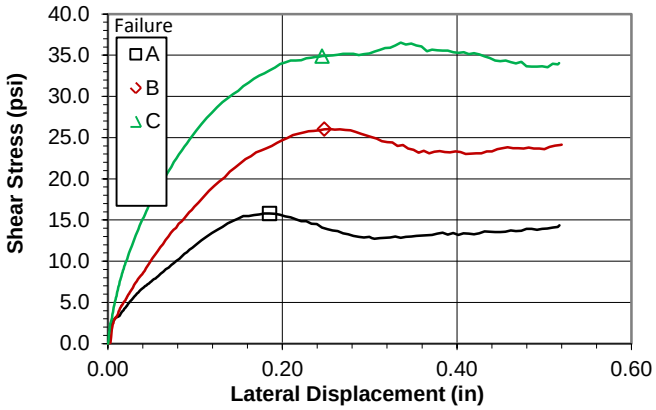
ASTM D 3080

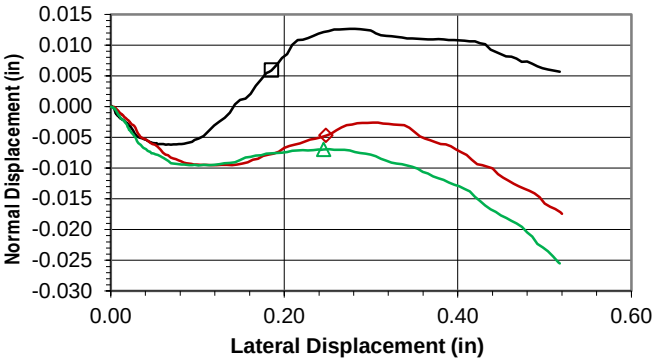
Project Name Big Sandy Station, CCR Rule Activities

Project 175553023

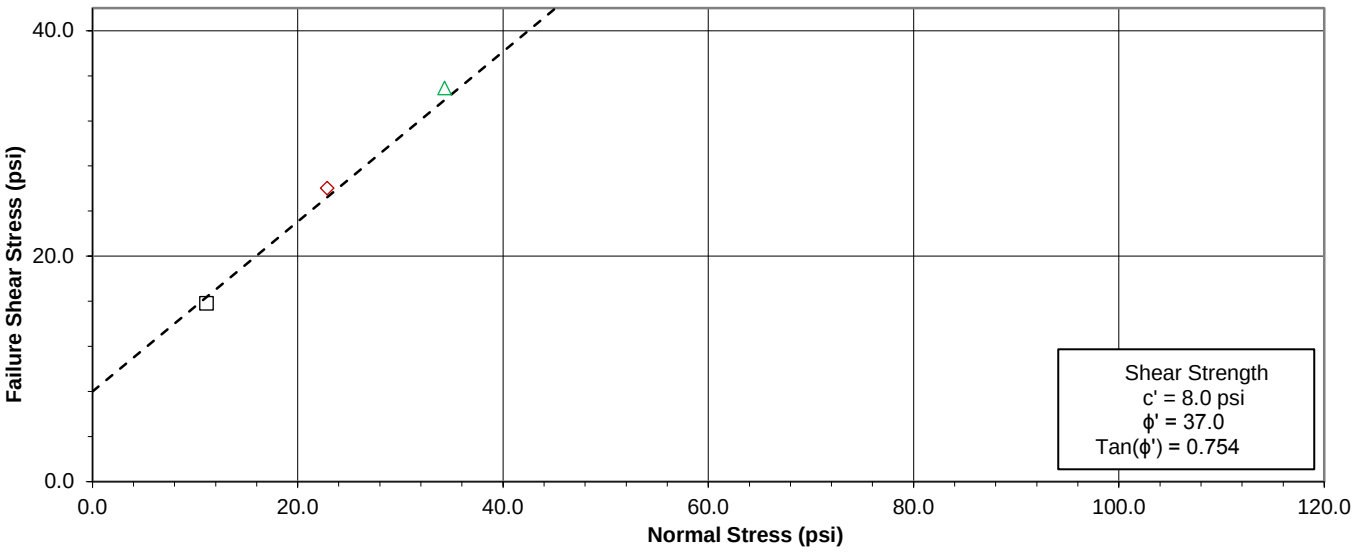
Set ID 2

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	6A	BA-15-1, 22.5'-24.5'	Poorly Graded Sand (SP), black, wet	2.09			
B	6A	BA-15-1, 22.5'-24.5'	Poorly Graded Sand (SP), black, wet	2.09			
C	6A	BA-15-1, 22.5'-24.5'	Poorly Graded Sand (SP), black, wet	2.09			





Specimen	A	B	C		
	Initial Specimen Conditions				
Height (in)	1.013	1.024	1.015		
Diameter (in)	2.501	2.501	2.501		
Moist Unit Weight (pcf)	85.3	85.6	86.5		
Moisture Content (%)	56.9	58.9	54.0		
Dry Unit Weight (pcf)	54.3	53.9	56.2		
Void Ratio	1.401	1.421	1.322		
Degree of Saturation (%)	84.9	86.6	85.4		
	Preshear Specimen Conditions				
Height (in)	0.980	0.984	0.965		
Moist Unit Weight (pcf)	85.7	85.6	88.5		
Moisture Content (%)	52.6	52.7	49.7		
Dry Unit Weight (pcf)	56.2	56.1	59.1		
Void Ratio	1.323	1.327	1.207		
Degree of Saturation (%)	83.0	83.0	86.0		
Normal Stress (psi)	9.987	19.899	29.977		
	At Failure Shear Stress				
Failure Criterion	Max. Shear Stress or 10% Displace.				
Shear Stress* (psi)	15.788	26.008	34.894		
Normal Stress* (psi)	11.123	22.885	34.312		
Lateral Displace. (in)	0.185	0.248	0.245		
Normal Displace. (in)	0.006	-0.005	-0.007		



Form: tmp_cu_tva_input.xlsm
Preparation Date: 02-2013
Revision Date: N/A

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: JW
Approved By: TLK

APPENDIX I

LIQUEFACTION ANALYSIS

BOTTOM ASH POND COMPLEX, 2015

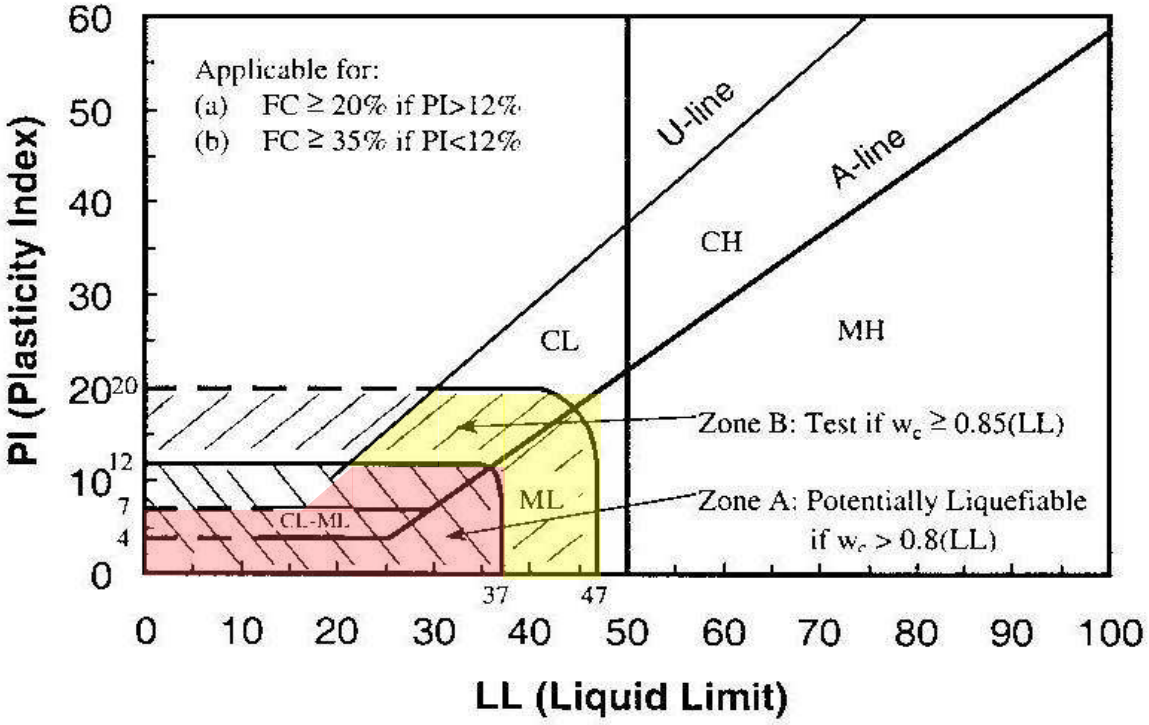
FINE-GRAINED ANALYSIS

Liquefaction Susceptibility of Fine-Grained Soils

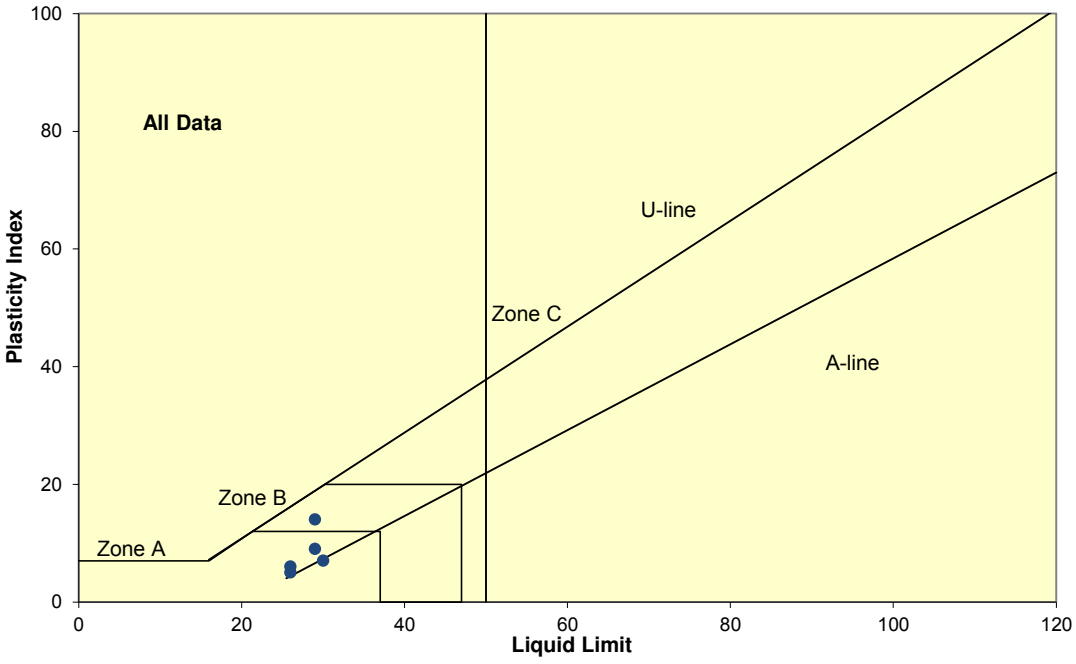
Stantec Project Number:	175553023
Project Name:	AEP Big Sandy
Site/Structure Name:	Bottom Ash Dam

Note: NP = Non-Plastic

Lab ID	Boring	Depth(s)	Soil Classification	NMC (w_c) (%)	% Passing #200	% Passing #40	LL	PI	Sand-like versus Clay-like Behavior (-1 indicates result does not meet criteria, green shading indicates result does meet criteria, no results shown for non-plastic material)												Overall Judgement based on 3 methods (sand-like or clay-like)
									Using Criteria published by Seed et al (2003)						Using Criteria published by Idriss and Boulanger (2008)		Using criteria published by MSHA (2010)				
									Meets criteria for sand-like behavior		Meets criteria for clay-like behavior				Meets criteria for sand-like behavior	Meets criteria for clay-like behavior	Meets criteria for sand-like behavior	Meets criteria for clay-like behavior	Borderline soils (treat as sand-like)		
									LL in Zone A (see plot)	PI in Zone A (see plot)	LL in Zone B (see plot)	PI in Zone B (see plot)	LL in Zone C (see plot)	PI in Zone C (see plot)	PI < 7	PI >= 7	PI <= 7	P40>=35%, P200>=20%, and PI>=10	7 < PI < 10, or does not meet P40 or P200		
3	B-1	7.5-9.0, 10.0-11.5	CL	14.9	56.6	76.1	29	14	-1	-1	29	14	-1	-1	-1	14	-1	14	-1		Clay-like
10	B-1	22.5-24.0, 25.0-26.5	CL	21.9	65.1	99.6	29	9	29	9	-1	-1	-1	-1	-1	9	-1	-1	9		Sand-like
36	B-2	25.0-26.5, 27.5-29.0	SW-SM	9.4	10.3	48	NP	NP													Sand-like
46	B-3	17.5-19.0, 20.0-21.5	SM	25.7	48	99.5	NP	NP													Sand-like
59	B-4	12.5-14.0, 15.0-16.5	SM	26.7	18.1	48.1	NP	NP													Sand-like
74	B-4	47.5-49.0, 50.0-51.5	CL-ML	26.7	84.6	99.5	26	5	26	5	-1	-1	-1	-1	5	-1	5	-1	-1		Sand-like
87	B-5	22.5-24.0, 25.0-26.5	ML	30.1	77.1	99.8	30	7	30	7	-1	-1	-1	-1	-1	7	7	-1	-1		Sand-like
118	B-6	40.0-41.5, 42.5-44.0	SP-SM	6.1	10	57.8	NP	NP													Sand-like
7	BA-15-1	25.0-26.5, 27.5-29.5	CL-ML	25.8	66.3	99.8	26	6	26	6	-1	-1	-1	-1	6	-1	6	-1	-1		Sand-like

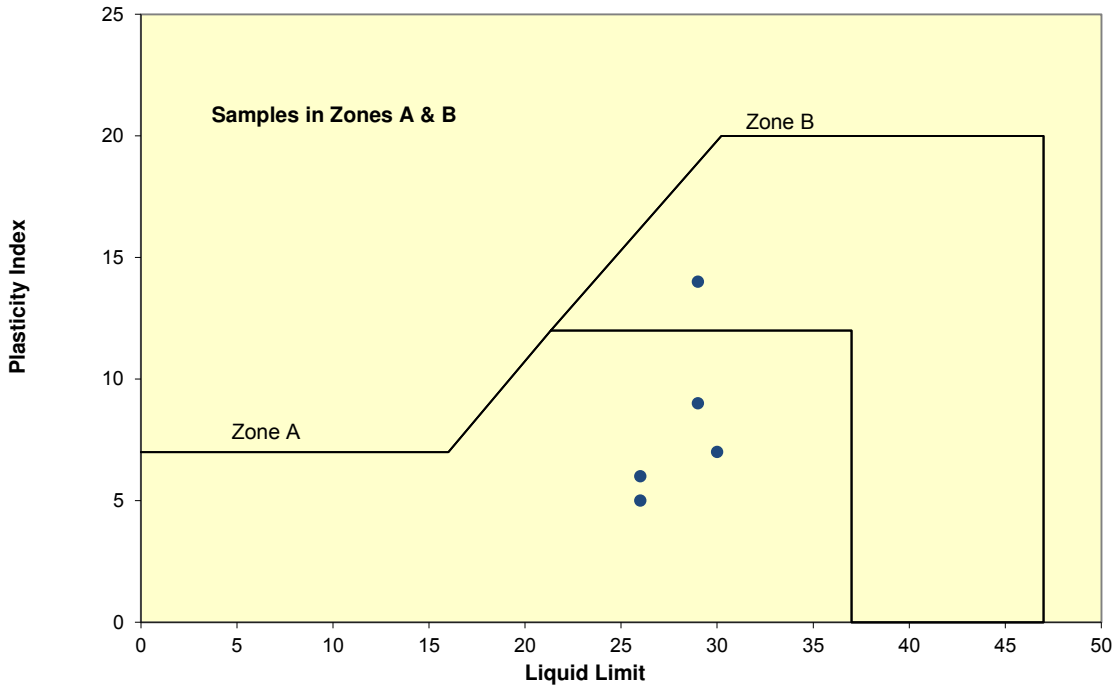


(a)



(b)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)



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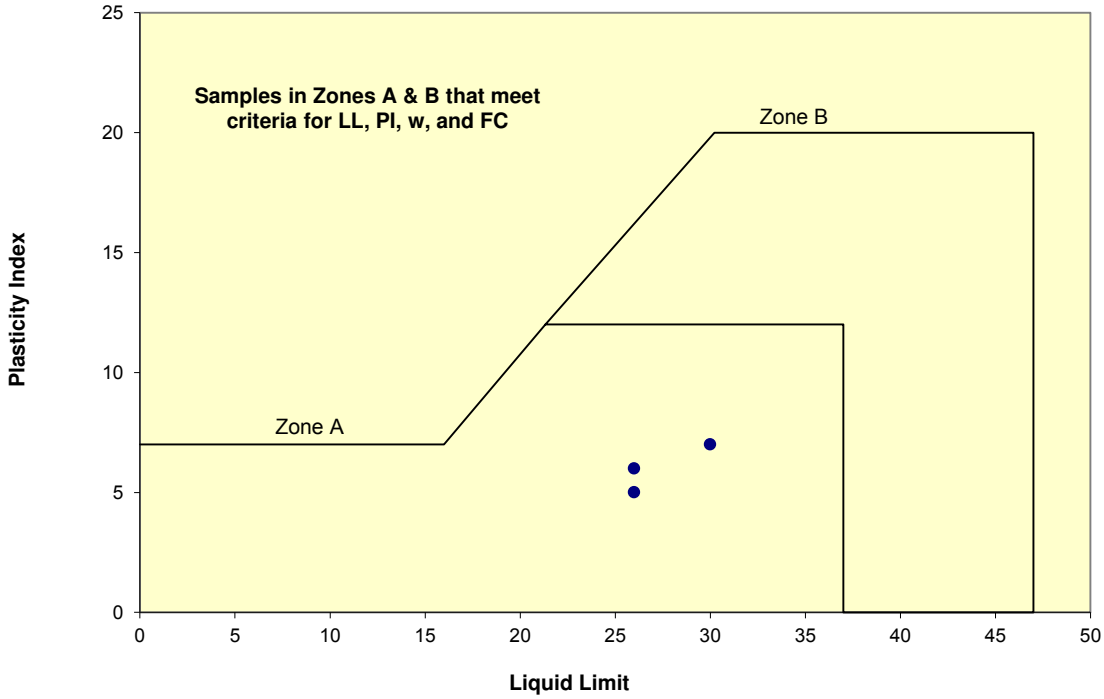
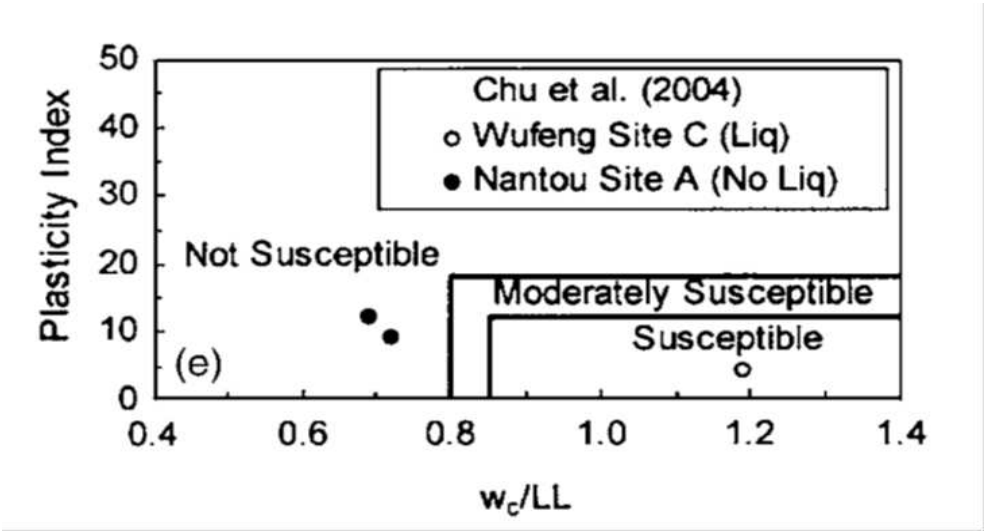
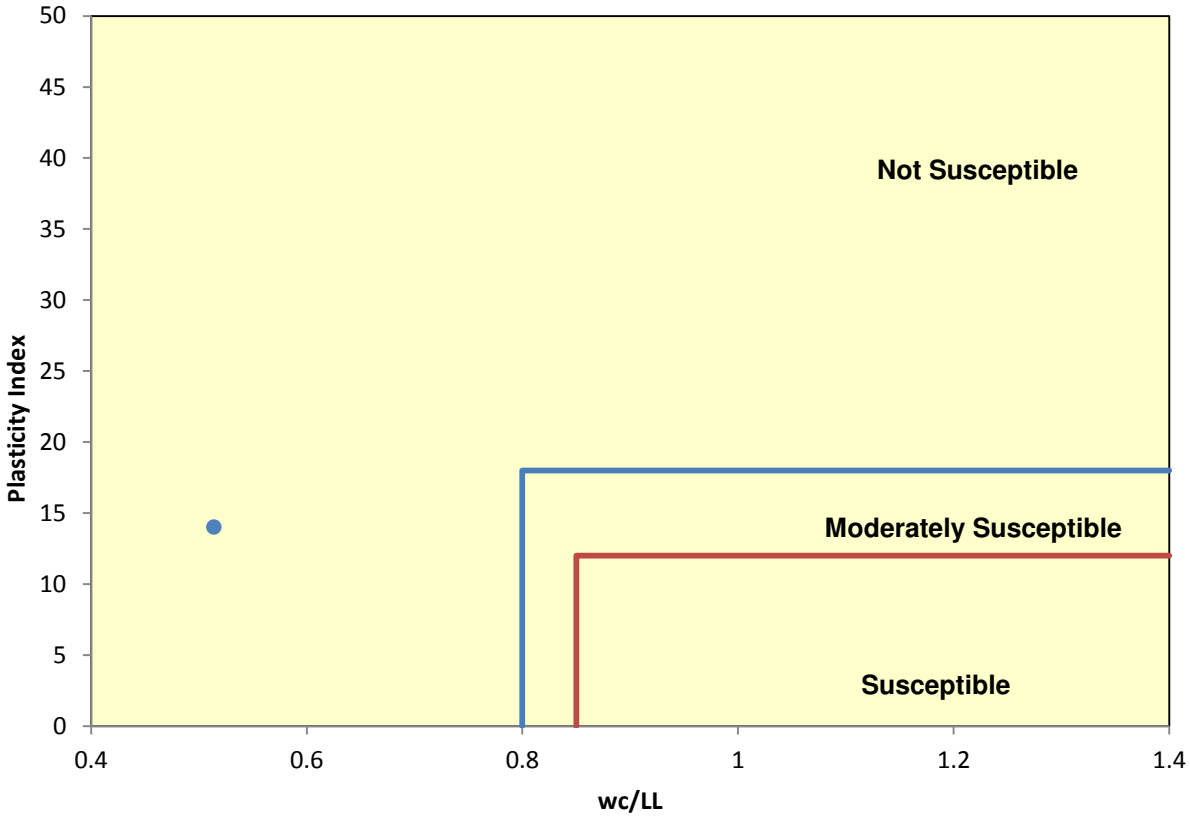


(d)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)





Screening Criteria for Assessing Liquefaction in Fine Grained Soils (Bray and Sancio 2006)

COARSE-GRAINED ANALYSIS

EQ Source: 0	a max (g): 0.065	EQ Mag (Mw): 7.7

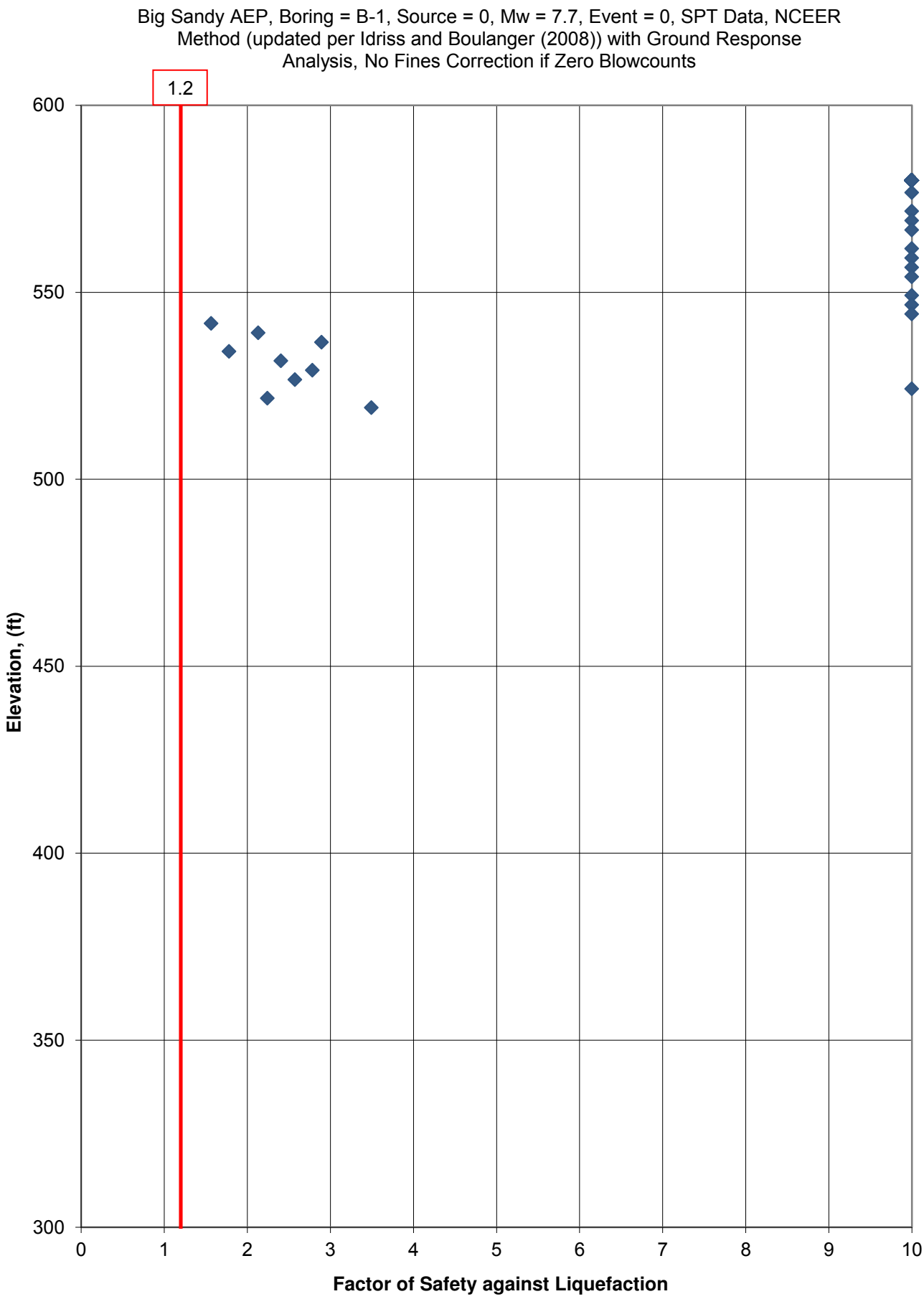
Event (MCE, OBE, etc.): 0

EQ Motion File: 0

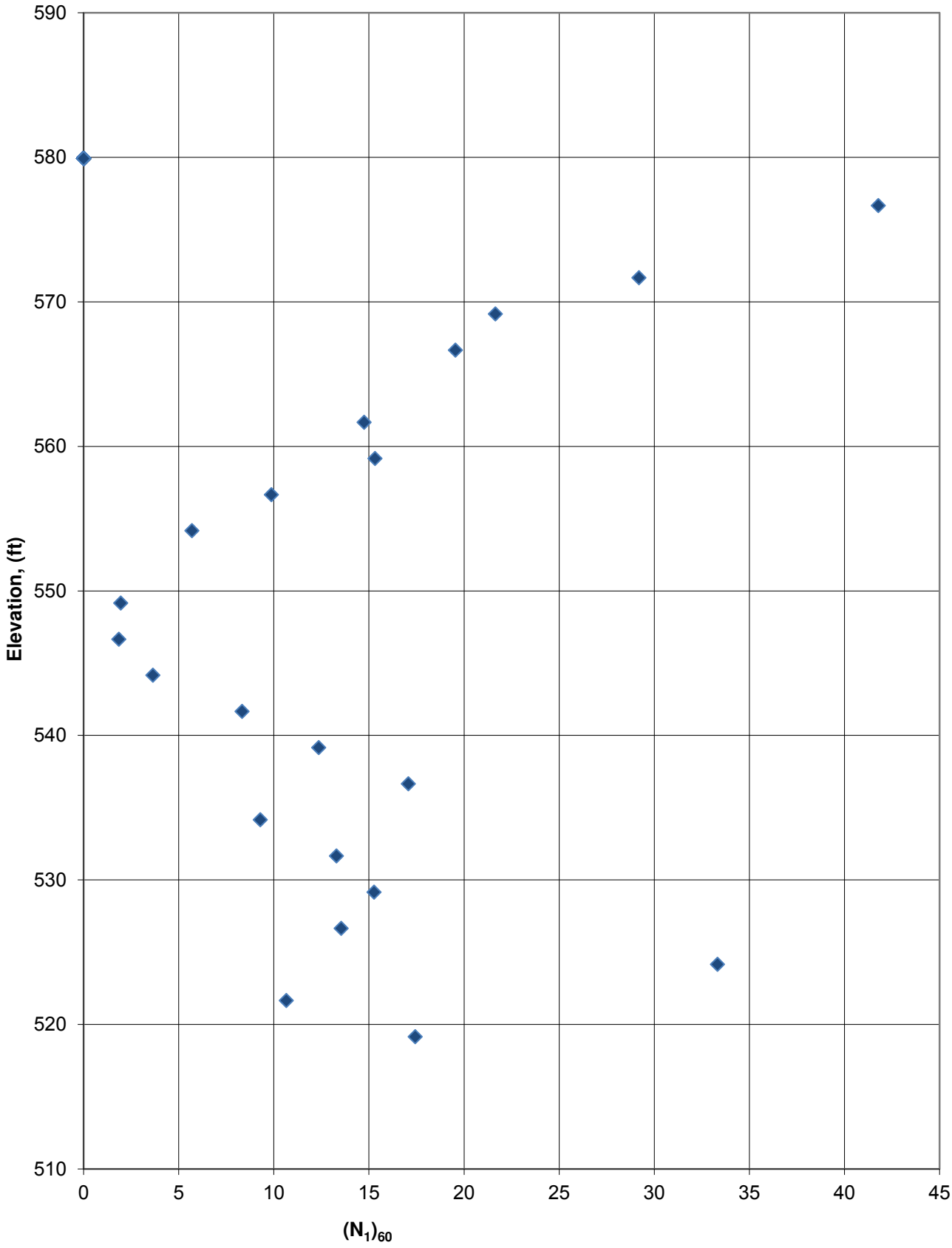
Shake Stress Curve Fit Parame
m4: 0
m3: 0
m2: 0
m1: 0

Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value			Mag. Scaling	CRR	Simplified Stress Reduction	Simplified CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60CS}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot
					Boring ID:	B-1																	
					Top of Fill Elevation:	579.9																	
					Fill Height:	0.0																	
					Fill Total Unit Weight:	125																	
					Fill Total Stress:	0.00																	
	totstr-top 0.16		u-top 0.00	effstr-top 0.16																			
3.3	0.20	0.20	0.00	0.20	0.20	NA	NA	NA	NA	NA	NA	0.95	NA	0.994	0.042	0	0	0.000	NA	10.0	NA	10.0
8.3	0.52	0.52	0.10	0.41	0.41	NA	NA	NA	NA	NA	NA	0.95	NA	0.983	0.052	0	0	0.000	NA	10.0	NA	10.0
10.8	0.67	0.67	0.18	0.49	0.49	NA	NA	NA	NA	NA	NA	0.95	NA	0.978	0.056	0	0	0.000	NA	10.0	NA	10.0
13.3	0.83	0.83	0.26	0.57	0.57	NA	NA	NA	NA	NA	NA	0.95	NA	0.972	0.060	0	0	0.000	NA	10.0	NA	10.0
18.3	1.14	1.14	0.41	0.73	0.73	NA	NA	NA	NA	NA	NA	0.95	NA	0.961	0.064	0	0	0.000	NA	10.0	NA	10.0
20.8	1.30	1.30	0.49	0.81	0.81	NA	NA	NA	NA	NA	NA	0.95	NA	0.955	0.065	0	0	0.000	NA	10.0	NA	10.0
23.3	1.45	1.45	0.57	0.88	0.88	NA	NA	NA	NA	NA	NA	0.95	NA	0.948	0.066	0	0	0.000	NA	10.0	NA	10.0
25.8	1.61	1.61	0.65	0.96	0.96	NA	NA	NA	NA	NA	NA	0.95	NA	0.939	0.066	0	0	0.000	NA	10.0	NA	10.0
30.8	1.92	1.92	0.80	1.12	1.12	NA	NA	NA	NA	NA	NA	0.95	NA	0.917	0.067	0	0	0.000	NA	10.0	NA	10.0
33.3	2.08	2.08	0.88	1.20	1.20	NA	NA	NA	NA	NA	NA	0.95	NA	0.902	0.066	0	0	0.000	NA	10.0	NA	10.0
35.8	2.23	2.23	0.96	1.27	1.27	NA	NA	NA	NA	NA	NA	0.95	NA	0.885	0.066	0	0	0.000	NA	10.0	NA	10.0
38.3	2.40	2.40	1.04	1.36	1.36	0.97	1.02	9	0.109	0.979	1.000	0.95	0.101	0.866	0.065	0	0	0.000	#DIV/0!	#DIV/0!	1.6	1.56
40.8	2.56	2.56	1.12	1.44	1.44	0.97	1.02	14	0.147	0.969	1.000	0.95	0.135	0.844	0.063	0	0	0.000	#DIV/0!	#DIV/0!	2.1	2.13
43.3	2.72	2.72	1.19	1.53	1.53	0.97	1.02	18	0.197	0.958	1.000	0.95	0.179	0.821	0.062	0	0	0.000	#DIV/0!	#DIV/0!	2.9	2.89
45.8	2.88	2.88	1.27	1.61	1.61	0.97	1.02	10	0.117	0.963	1.000	0.95	0.107	0.796	0.060	0	0	0.000	#DIV/0!	#DIV/0!	1.8	1.78
48.3	3.05	3.05	1.35	1.70	1.70	0.97	1.02	15	0.156	0.951	1.000	0.95	0.141	0.771	0.058	0	0	0.000	#DIV/0!	#DIV/0!	2.4	2.41
50.8	3.21	3.21	1.43	1.78	1.78	0.97	1.02	17	0.177	0.942	1.000	0.95	0.158	0.745	0.057	0	0	0.000	#DIV/0!	#DIV/0!	2.8	2.78
53.3	3.37	3.37	1.51	1.87	1.87	0.97	1.02	15	0.158	0.941	1.000	0.95	0.141	0.720	0.055	0	0	0.000	#DIV/0!	#DIV/0!	2.6	2.57
55.8	3.53	3.53	1.58	1.95	1.95	0.97	1.02	35	NA	0.856	1.000	0.95	NA	0.696	0.053	0	0	0.000	NA	10.0	NA	10.00
58.3	3.70	3.70	1.66	2.04	2.04	0.97	1.02	12	0.130	0.940	1.00001	0.95	0.116	0.674	0.052	0	0	0.000	#DIV/0!	#DIV/0!	2.2	2.24
60.8	3.86	3.86	1.74	2.12	2.12	0.97	1.02	19	0.201	0.920	1.00003	0.95	0.176	0.653	0.050	0	0	0.000	#DIV/0!	#DIV/0!	3.5	3.49

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.



Big Sandy AEP, Boring = B-1, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts

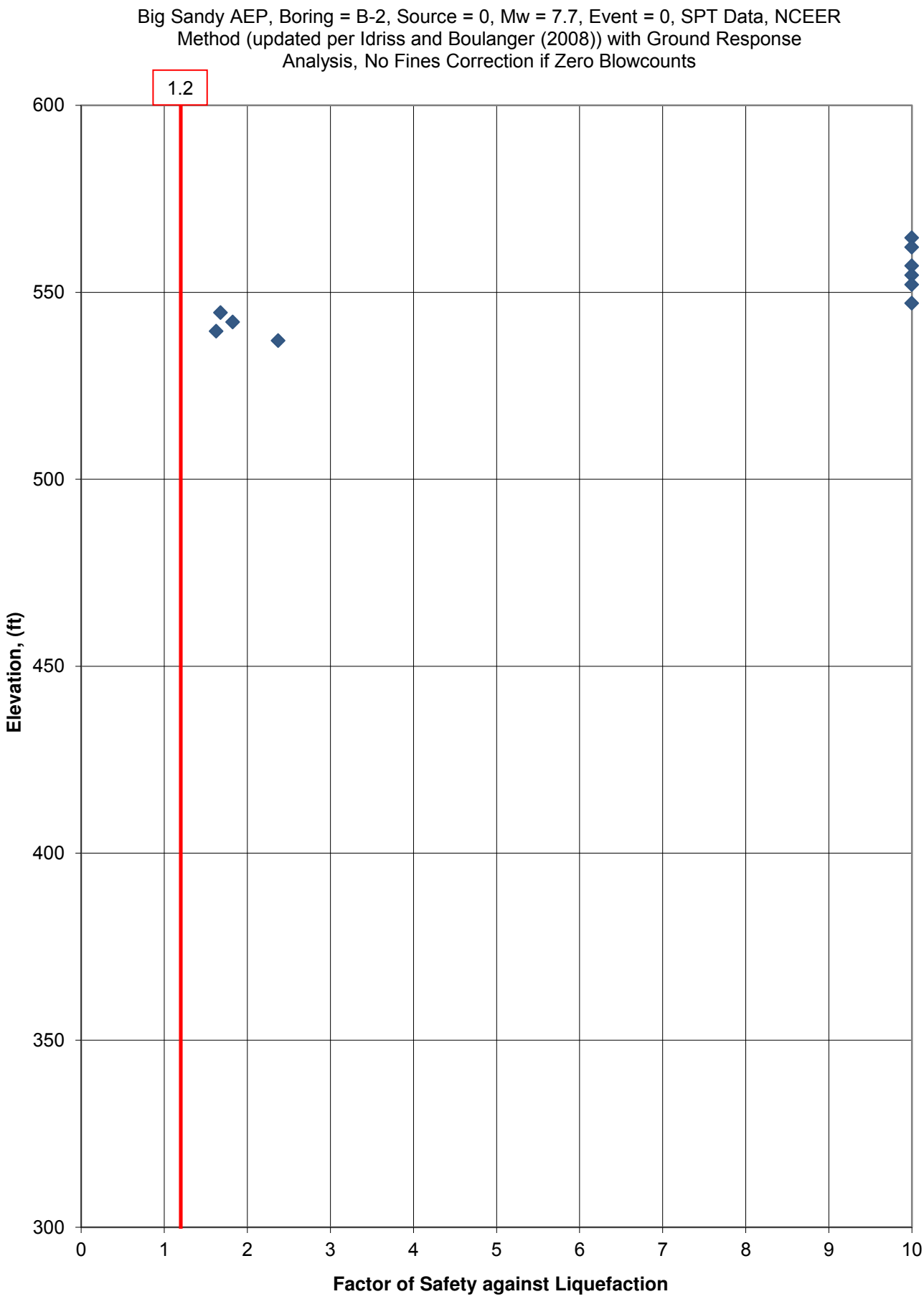


EQ Source: 0 | a max (g): 0.065 | EQ Mag (Mw): 7.7 | Event (MCE, OBE, etc.): 0 | EQ Motion File: 0

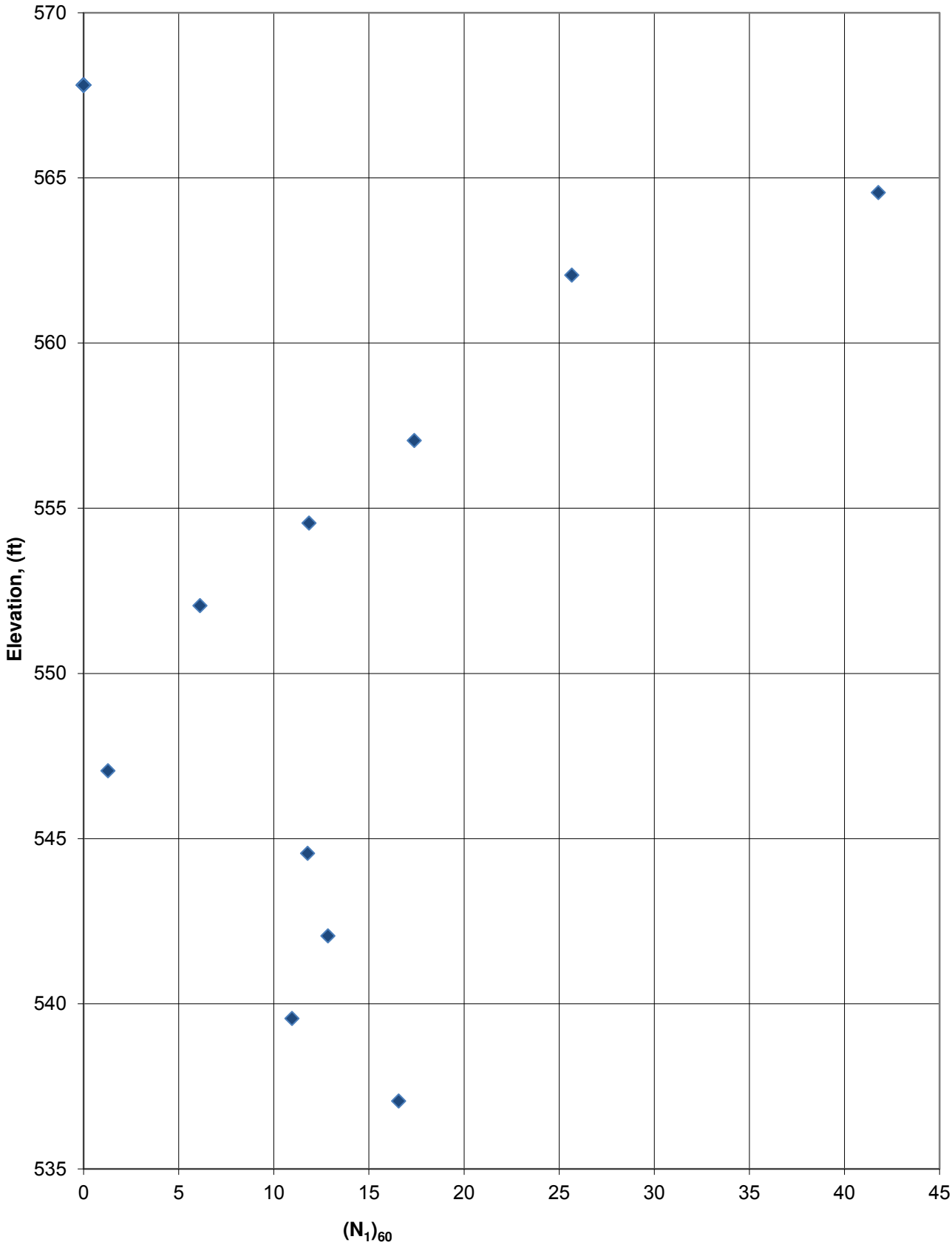
Shake Stress Curve Fit Parameters: m4: 0 | m3: 0 | m2: 0 | m1: 0

Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value			Mag. Scaling	CRR	Simplified Stress Reduction	Simplified CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	
											Factor (Cm)		Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha											
			Boring ID:	B-2																		
			Top of Fill Elevation:	567.8																		
			Fill Height:	0.0																		
			Fill Total Unit Weight:	125																		
			Fill Total Stress:	0.00																		
	totstr-top 0.16		u-top 0.08	effstr-top 0.08																		
3.3	0.20	0.20	0.10	0.10	0.10	NA	NA	NA	NA	NA	NA	0.95	NA	0.994	0.084	0	0	0.000	NA	10.0	NA	10.0
5.8	0.36	0.36	0.18	0.18	0.18	NA	NA	NA	NA	NA	NA	0.95	NA	0.989	0.083	0	0	0.000	NA	10.0	NA	10.0
10.8	0.67	0.67	0.34	0.34	0.34	NA	NA	NA	NA	NA	NA	0.95	NA	0.978	0.082	0	0	0.000	NA	10.0	NA	10.0
13.3	0.83	0.83	0.41	0.41	0.41	NA	NA	NA	NA	NA	NA	0.95	NA	0.972	0.082	0	0	0.000	NA	10.0	NA	10.0
15.8	0.98	0.98	0.49	0.49	0.49	NA	NA	NA	NA	NA	NA	0.95	NA	0.967	0.082	0	0	0.000	NA	10.0	NA	10.0
20.8	1.30	1.30	0.65	0.65	0.65	NA	NA	NA	NA	NA	NA	0.95	NA	0.955	0.081	0	0	0.000	NA	10.0	NA	10.0
23.3	1.46	1.46	0.73	0.73	0.73	0.97	1.02	13	0.141	1.000	1.000	0.95	0.134	0.948	0.080	0	0	0.000	#DIV/0!	#DIV/0!	1.7	1.68
25.8	1.62	1.62	0.80	0.82	0.82	0.97	1.02	14	0.151	1.000	1.000	0.95	0.144	0.939	0.079	0	0	0.000	#DIV/0!	#DIV/0!	1.8	1.83
28.3	1.78	1.78	0.88	0.90	0.90	0.97	1.02	12	0.133	1.000	1.000	0.95	0.126	0.929	0.078	0	0	0.000	#DIV/0!	#DIV/0!	1.6	1.63
30.8	1.95	1.95	0.96	0.99	0.99	0.97	1.02	18	0.191	1.000	1.000	0.95	0.181	0.917	0.076	0	0	0.000	#DIV/0!	#DIV/0!	2.4	2.37

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.



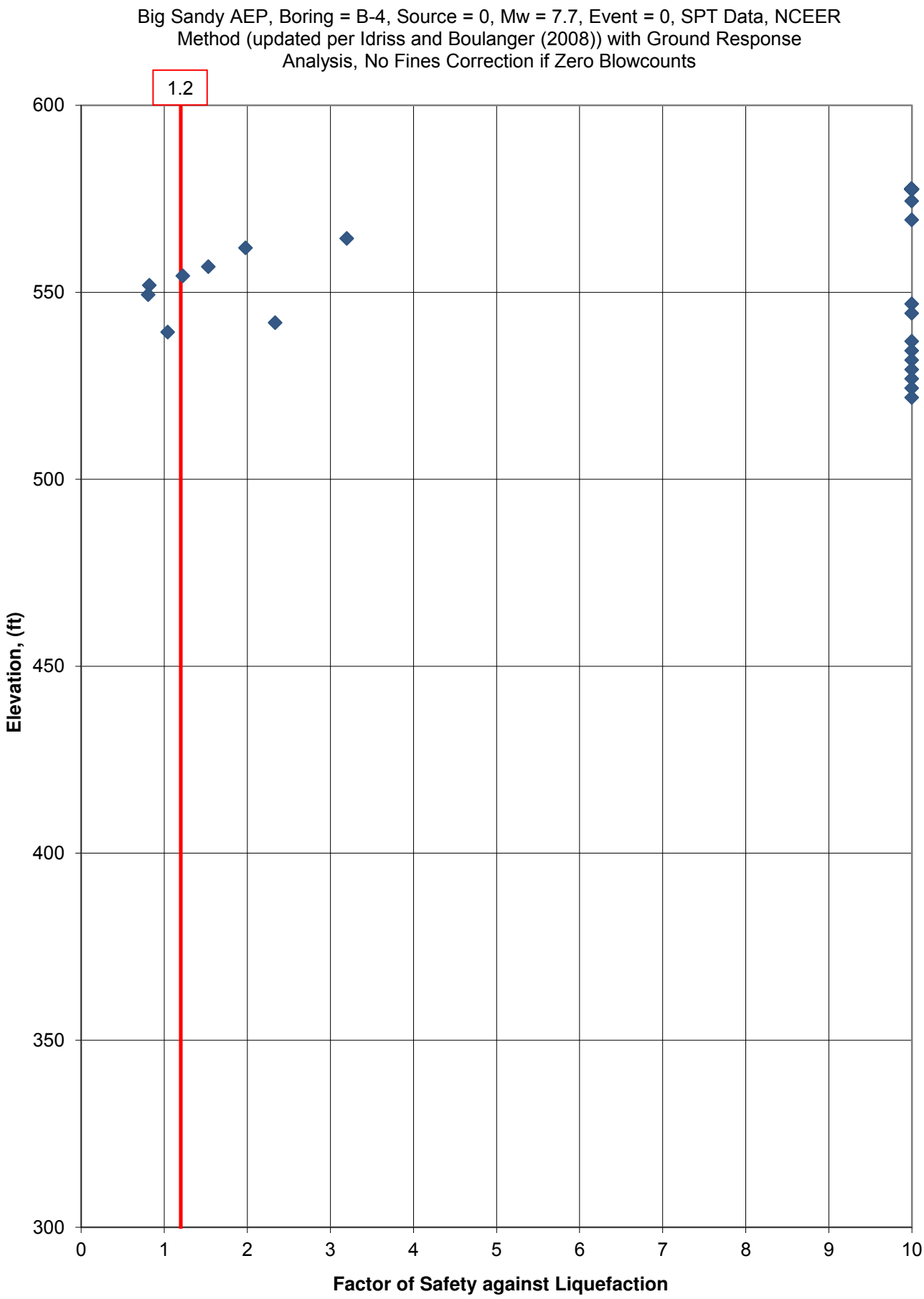
Big Sandy AEP, Boring = B-2, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts



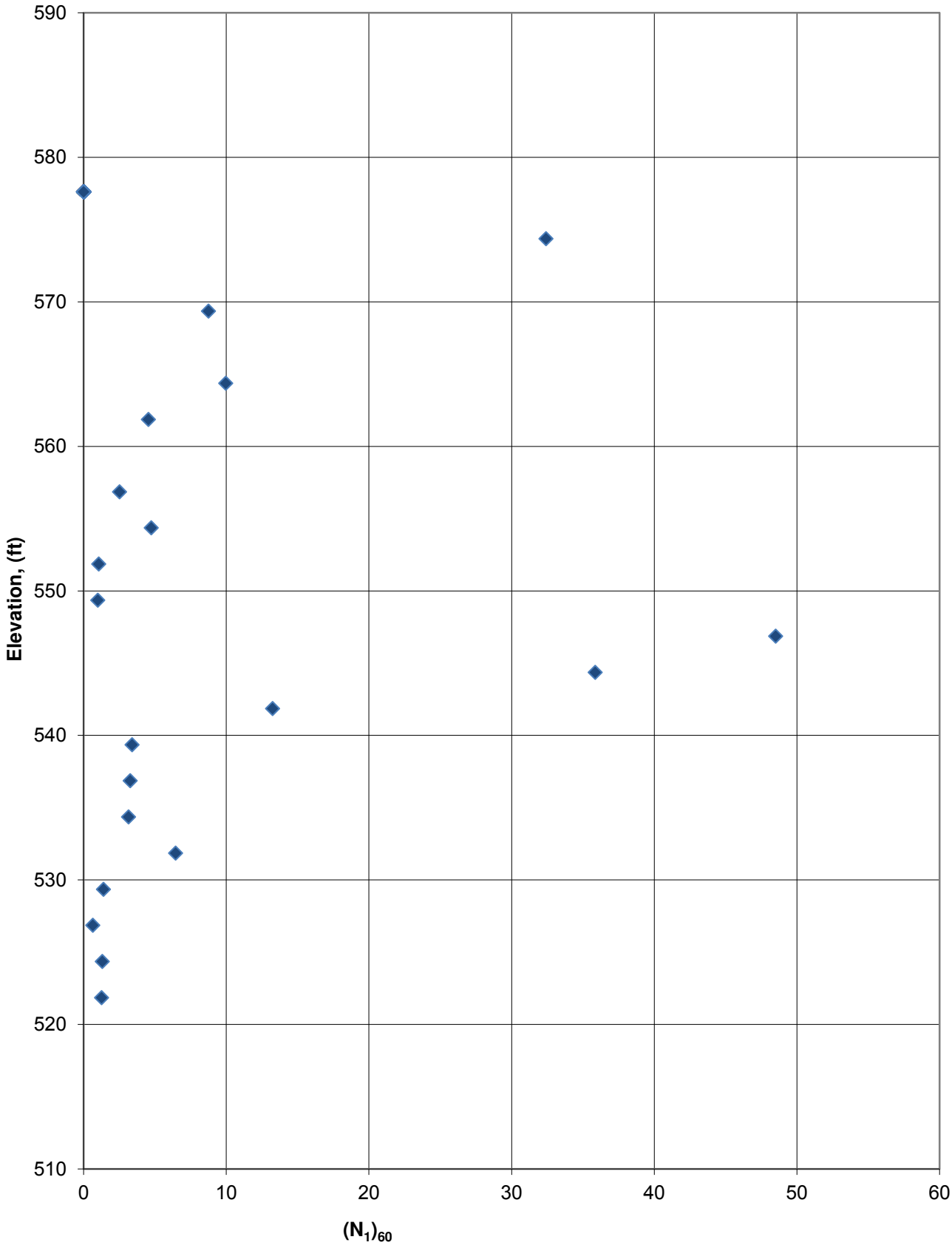
												EQ Source 0			Event (MCE, OBE, etc.) 0				Shake Stress Curve Fit Parameters	
												a max (g) 0.065							m4:	0
																			m3:	0
Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				EQ Mag (Mw) 7.7			EQ Motion File 0				m2:	0
														Simplified	Simplified			Using SHAKE Data			m1:	0
												Mag. Scaling	CRR	Stress Reduction	CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	CSR eq	FS liq	FS liq	Simplified	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	Design EQ	Design EQ	for plot	FS liq Design EQ	FS liq for plot
			Boring ID:	**B-4**																		
			Top of Fill Elevation:	577.6																		
			Fill Height:	0.0																		
			Fill Total Unit Weight:	125																		
			Fill Total Stress:	0.00																		

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.

	totstr-top 0.16		u-top 0.00	effstr-top 0.16																		
3.3	0.20	0.20	0.00	0.20	0.20	NA	NA	NA	NA	NA	NA	0.95	NA	0.994	0.042	0	0	0.000	NA	10.0	NA	10.00
8.3	0.52	0.52	0.04	0.48	0.48	NA	NA	NA	NA	NA	NA	0.95	NA	0.983	0.045	0	0	0.000	NA	10.0	NA	10.00
13.3	0.84	0.84	0.20	0.65	0.65	5.00	1.20	17	0.180	1.000	1.000	0.95	0.171	0.972	0.053	0	0	0.000	#DIV/0!	#DIV/0!	3.20	3.20
15.8	1.00	1.00	0.27	0.73	0.73	5.00	1.20	10	0.117	1.000	1.000	0.95	0.111	0.967	0.056	0	0	0.000	#DIV/0!	#DIV/0!	1.98	1.98
20.8	1.33	1.33	0.43	0.90	0.90	5.00	1.20	8	0.096	1.000	1.000	0.95	0.091	0.955	0.060	0	0	0.000	#DIV/0!	#DIV/0!	1.53	1.53
23.3	1.49	1.49	0.51	0.98	0.98	0.97	1.02	6	0.078	1.000	1.000	0.95	0.074	0.948	0.061	0	0	0.000	#DIV/0!	#DIV/0!	1.22	1.22
25.8	1.65	1.65	0.59	1.07	1.07	0.97	1.02	2	0.053	0.999	1.000	0.95	0.050	0.939	0.061	0	0	0.000	#DIV/0!	#DIV/0!	0.82	0.82
28.3	1.82	1.82	0.66	1.15	1.15	0.97	1.02	2	0.053	0.995	1.000	0.95	0.050	0.929	0.062	0	0	0.000	#DIV/0!	#DIV/0!	0.81	0.81
30.8	1.98	1.98	0.74	1.24	1.24	0.97	1.02	51	NA	0.953	1.000	0.95	NA	0.917	0.062	0	0	0.000	NA	10.0	NA	10.00
33.3	2.14	2.14	0.82	1.32	1.32	0.97	1.02	38	NA	0.942	1.000	0.95	NA	0.902	0.062	0	0	0.000	NA	10.0	NA	10.00
35.8	2.30	2.30	0.90	1.41	1.41	0.97	1.02	15	0.155	0.971	1.000	0.95	0.143	0.885	0.061	0	0	0.000	#DIV/0!	#DIV/0!	2.34	2.34
38.3	2.47	2.47	0.98	1.49	1.49	0.97	1.02	4	0.068	0.976	1.000	0.95	0.063	0.866	0.061	0	0	0.000	#DIV/0!	#DIV/0!	1.04	1.04
40.8	2.62	2.62	1.05	1.56	1.56	NA	NA	NA	NA	NA	NA	0.95	NA	0.844	0.060	0	0	0.000	NA	10.0	NA	10.00
43.3	2.77	2.77	1.13	1.63	1.63	NA	NA	NA	NA	NA	NA	0.95	NA	0.821	0.059	0	0	0.000	NA	10.0	NA	10.00
45.8	2.92	2.92	1.21	1.71	1.71	NA	NA	NA	NA	NA	NA	0.95	NA	0.796	0.057	0	0	0.000	NA	10.0	NA	10.00
48.3	3.07	3.07	1.29	1.78	1.78	NA	NA	NA	NA	NA	NA	0.95	NA	0.771	0.056	0	0	0.000	NA	10.0	NA	10.00
50.8	3.22	3.22	1.37	1.85	1.85	NA	NA	NA	NA	NA	NA	0.95	NA	0.745	0.055	0	0	0.000	NA	10.0	NA	10.00
53.3	3.37	3.37	1.44	1.92	1.92	NA	NA	NA	NA	NA	NA	0.95	NA	0.720	0.053	0	0	0.000	NA	10.0	NA	10.00
55.8	3.52	3.52	1.52	1.99	1.99	NA	NA	NA	NA	NA	NA	0.95	NA	0.696	0.052	0	0	0.000	NA	10.0	NA	10.00



Big Sandy AEP, Boring = B-4, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts

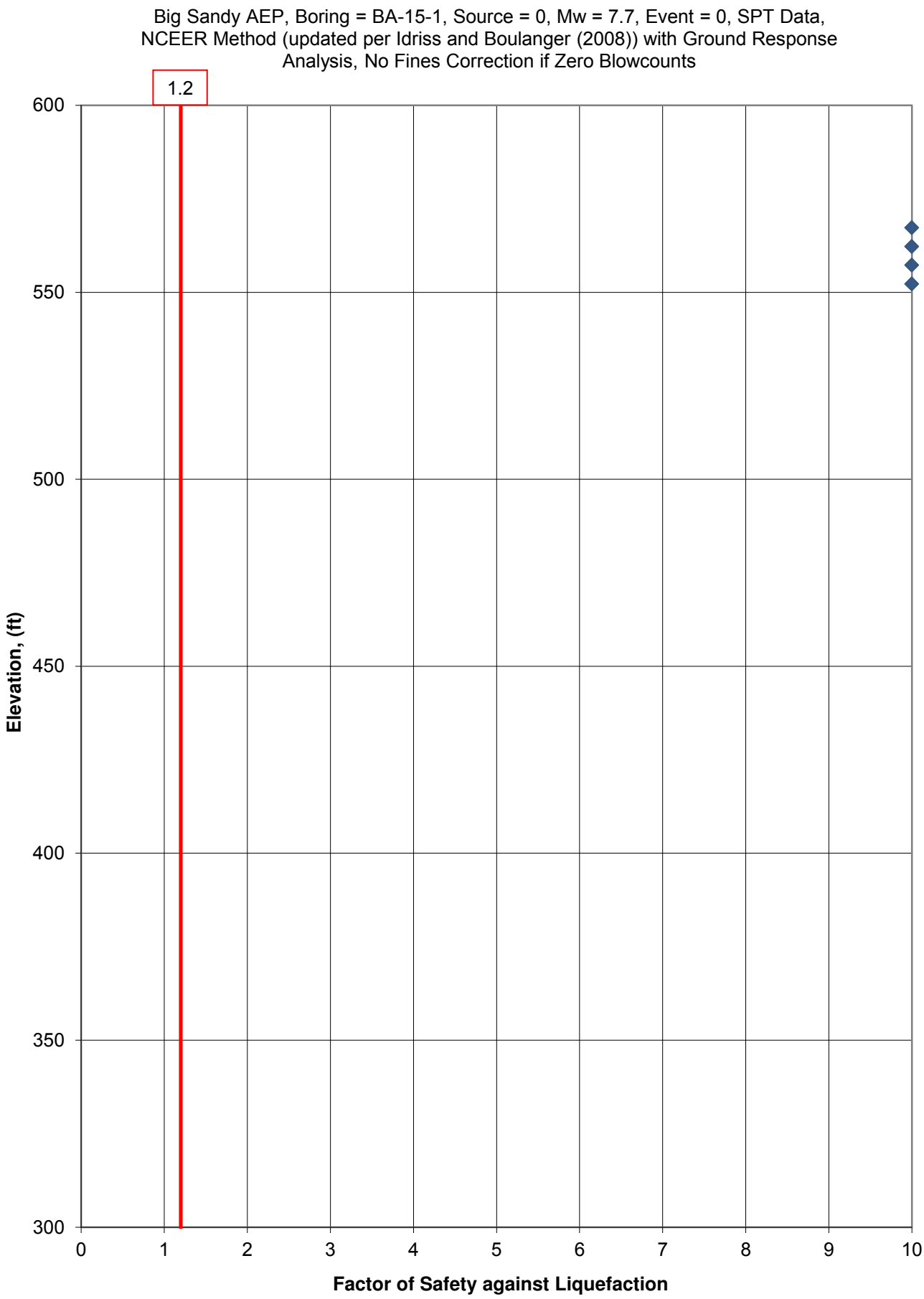


												EQ Source 0				Event (MCE, OBE, etc.) 0						Shake Stress Curve Fit Parameters	
												a max (g) 0.065										m4:	0
																						m3:	0
Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				EQ Mag (Mw) 7.7				EQ Motion File 0						m2:	0
												Mag. Scaling	CRR	Simplified Stress Reduction	Simplified CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified		m1: 0
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot	

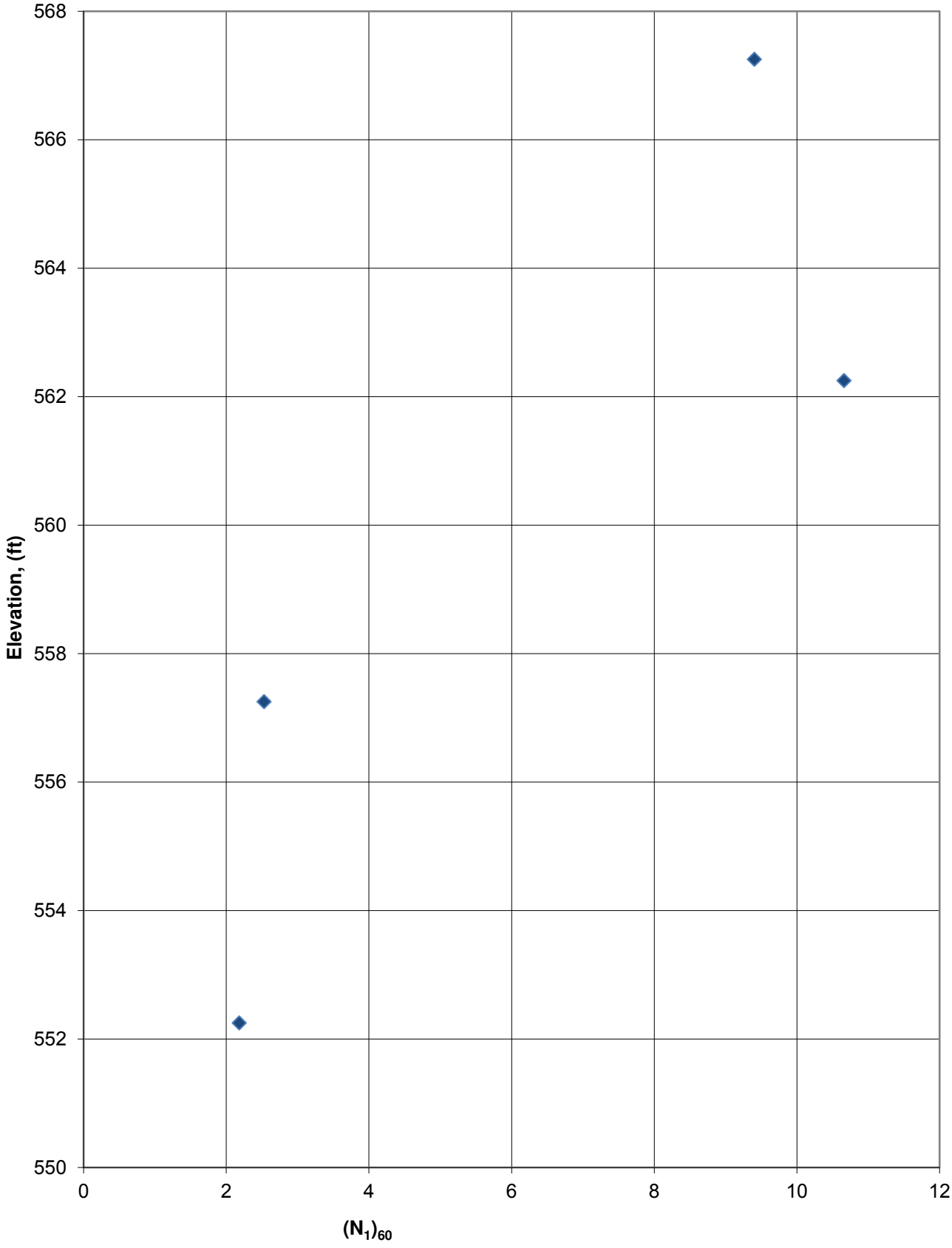
Boring ID: **BA-15-1**
Top of Fill Elevation: 578.0
Fill Height: 0.0
Fill Total Unit Weight: 125
Fill Total Stress: 0.00

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.

	totstr-top 0.63		u-top 0.00	effstr-top 0.63																		
10.8	0.67	0.67	0.00	0.67	0.67	NA	NA	NA	NA	NA	NA	0.95	NA	0.978	0.041	0	0	0.000	NA	10.0	NA	10.00
15.8	1.00	1.00	0.00	1.00	1.00	5.00	1.20	18	NA	1.000	1.000	0.95	NA	0.967	0.041	0	0	0.000	NA	10.0	NA	10.00
20.8	1.32	1.32	0.00	1.32	1.32	5.00	1.20	8	NA	0.985	1.000	0.95	NA	0.955	0.040	0	0	0.000	NA	10.0	NA	10.00
25.8	1.64	1.64	0.00	1.64	1.64	NA	NA	NA	NA	NA	NA	0.95	NA	0.939	0.040	0	0	0.000	NA	10.0	NA	10.00



Big Sandy AEP, Boring = BA-15-1, Source = 0, Mw = 7.7, Event = 0, SPT Data,
NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response
Analysis, No Fines Correction if Zero Blowcounts



FLY ASH POND MAIN DAM, 2015

FINE-GRAINED ANALYSIS

Liquefaction Susceptibility of Fine-Grained Soils

Stantec Project Number:	175553023
Project Name:	AEP Big Sandy
Site/Structure Name:	Fly Ash Pond Dam

Note: NP = Non-Plastic

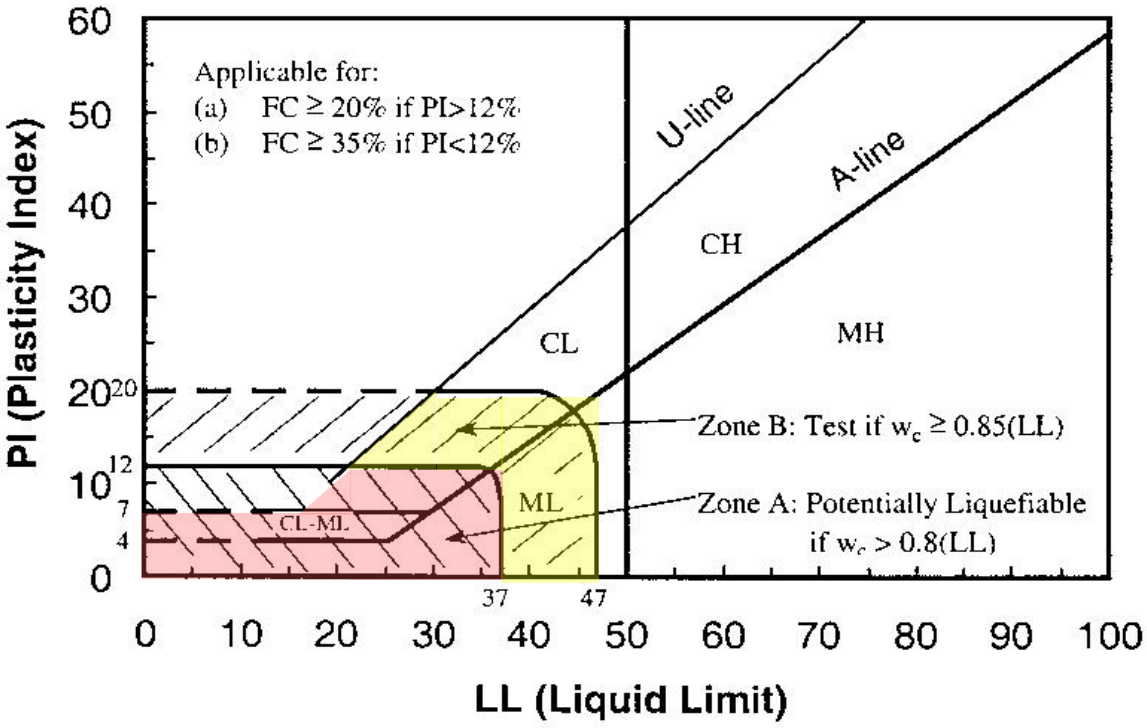
Sand-like versus Clay-like Behavior (-1 indicates result does not meet criteria, green shading indicates result does meet criteria, no results shown for non-plastic material)

Lab ID	Boring	Depth(s)	Soil Classification	NMC (w_c) (%)	% Passing #200	% Passing #40	LL	PI	Using Criteria published by Seed et al (2003): Meets criteria for sand-like behavior: LL in Zone A (see plot)	PI in Zone A (see plot)	Meets criteria for clay-like behavior: LL in Zone B (see plot)	PI in Zone B (see plot)	LL in Zone C (see plot)	PI in Zone C (see plot)	Using Criteria published by Idriss and Boulanger (2008): Meets criteria for sand-like behavior: PI < 7	Meets criteria for clay-like behavior: PI >= 7	Using criteria published by MSHA (2010): Meets criteria for sand-like behavior: PI <= 7	Meets criteria for clay-like behavior: P40>=35%, P200>=20%, and PI>=10	Borderline soils (treat as sand-like): 7 < PI < 10, or does not meet P40 or P200	Overall Judgement based on 3 methods (sand-like or clay-like)
1	B-1	3.5-5.0	CL	7.9	61.9	80.8	38	21	-1	-1	-1	-1	38	21	-1	21	-1	21	-1	Clay-like
41	B-2	4.5-6.0	CL	12.1	51.5	69.3	39	21	-1	-1	-1	-1	39	21	-1	21	-1	21	-1	Clay-like
74	B-2	169.5-171.0	CL	17.5	87.9	97.7	33	16	-1	-1	33	16	-1	-1	-1	16	-1	16	-1	Clay-like
21	B-3	4.5-6.0	CL	11.3	51.2	71.5	34	17	-1	-1	34	17	-1	-1	-1	17	-1	17	-1	Clay-like
81	B-4	4.5-6.0	CL	16.6	50.9	67.7	33	16	-1	-1	33	16	-1	-1	-1	16	-1	16	-1	Clay-like
112	B-4	179.5-181.0	CL	19.2	87.6	94.9	36	18	-1	-1	36	18	-1	-1	-1	18	-1	18	-1	Clay-like
113	B-4	189.5-191.0	CL	19.8	77	90.1	32	15	-1	-1	32	15	-1	-1	-1	15	-1	15	-1	Clay-like
114	B-4	199.5-201.0	CL	14.4	69.2	94.6	25	8	25	8	-1	-1	-1	-1	-1	8	-1	-1	8	Sand-like
50B	FA-15-1	13.2-13.7	CL	16.1	80.6	90.4	35	20	-1	-1	35	20	-1	-1	-1	20	-1	20	-1	Clay-like
		NOTE: Did not input tests with NP results																		

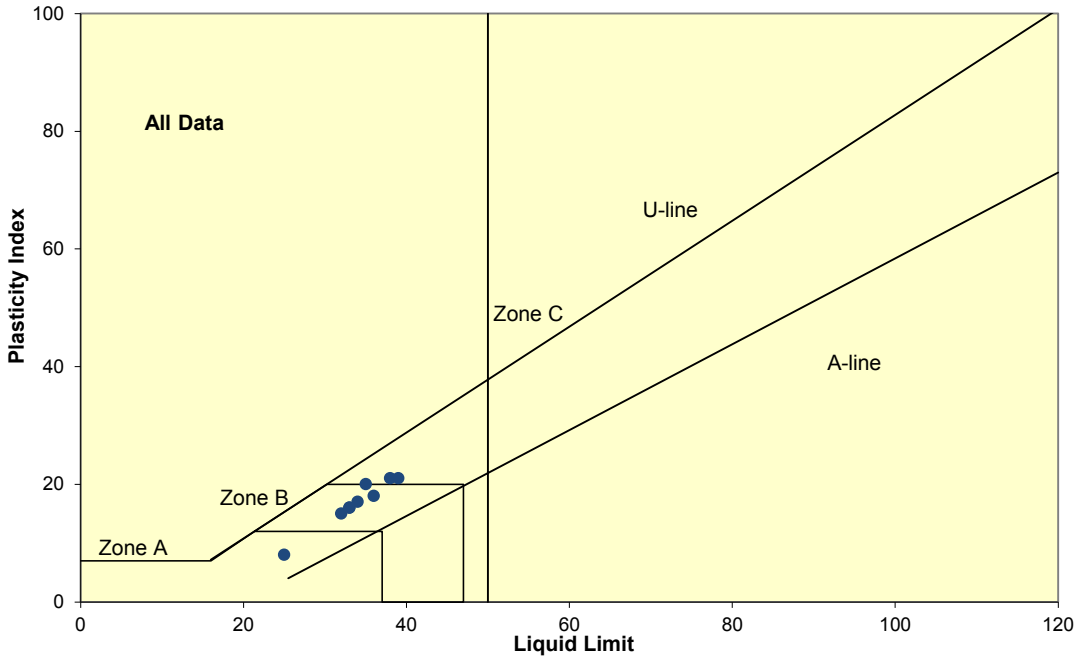
Susceptibility of Clay-like Soils to Cyclic Softening (-1 indicates result does not meet criteria, green shading indicates result does meet criteria, no results shown for Sand-like materials)

Lab ID	Boring	Depth(s)	Soil Classification	NMC (w_c) (%)	% Passing #200	% Passing #40	LL	PI	Using Criteria published by Seed et al (2003): Meets all criteria for B (clay-like and potentially liquefiable, -2 indicates zone A but susceptible, -3 indicates not applicable due to fines content): LL	PI	Using Criteria published by Bray and Sancio (2006): Clay-like soil is susceptible (must meet both): w_c/LL >= 0.85	PI <= 12	Clay-like soil is not susceptible (must meet one or both): w_c/LL < 0.80	PI > 18	Clay-like soil is moderately susceptible: Intermediate w_c/LL (see plot)	Intermediate PI (see plot)	Overall Judgement based on 2 methods (susceptibility)
1	B-1	3.5-5.0	CL	7.9	61.9	80.8	38	21	-1	-1	-1.00	-1	0.21	21	-1.00	-1	Not Susceptible
41	B-2	4.5-6.0	CL	12.1	51.5	69.3	39	21	-1	-1	-1.00	-1	0.31	21	-1.00	-1	Not Susceptible
74	B-2	169.5-171.0	CL	17.5	87.9	97.7	33	16	-1	-1	-1.00	-1	0.53	16	-1.00	-1	Not Susceptible
21	B-3	4.5-6.0	CL	11.3	51.2	71.5	34	17	-1	-1	-1.00	-1	0.33	17	-1.00	-1	Not Susceptible
81	B-4	4.5-6.0	CL	16.6	50.9	67.7	33	16	-1	-1	-1.00	-1	0.50	16	-1.00	-1	Not Susceptible
112	B-4	179.5-181.0	CL	19.2	87.6	94.9	36	18	-1	-1	-1.00	-1	0.53	18	-1.00	-1	Not Susceptible
113	B-4	189.5-191.0	CL	19.8	77	90.1	32	15	-1	-1	-1.00	-1	0.62	15	-1.00	-1	Not Susceptible
114	B-4	199.5-201.0	CL	14.4	69.2	94.6	25	8									
50B	FA-15-1	13.2-13.7	CL	16.1	80.6	90.4	35	20	-1	-1	-1.00	-1	0.46	20	-1.00	-1	

50B

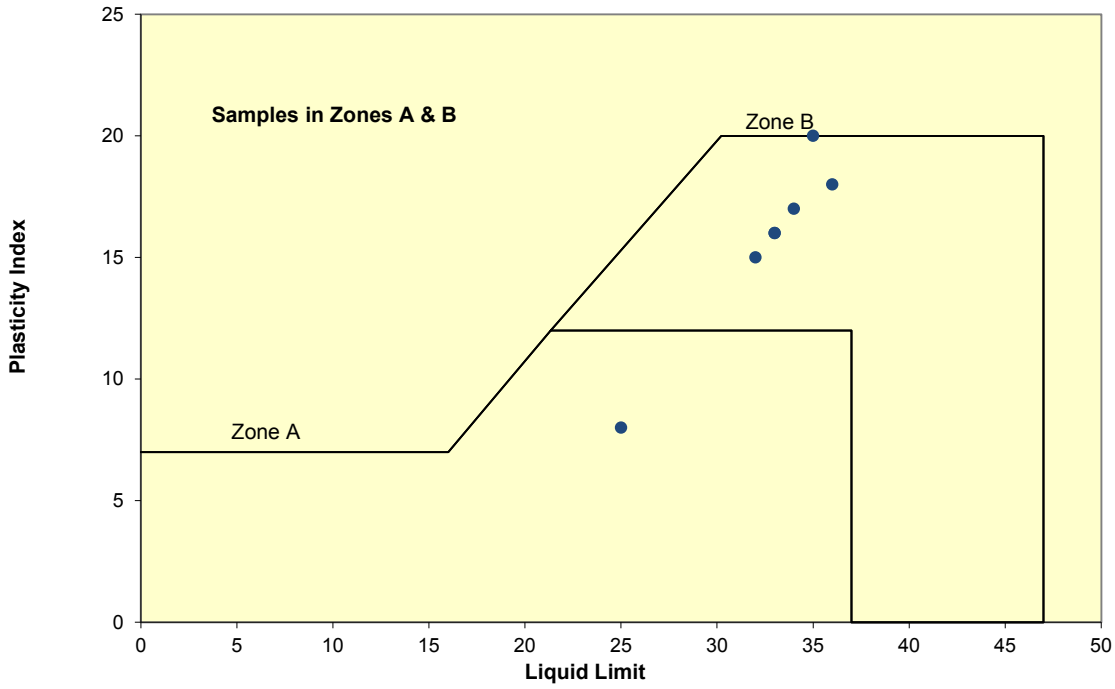


(a)

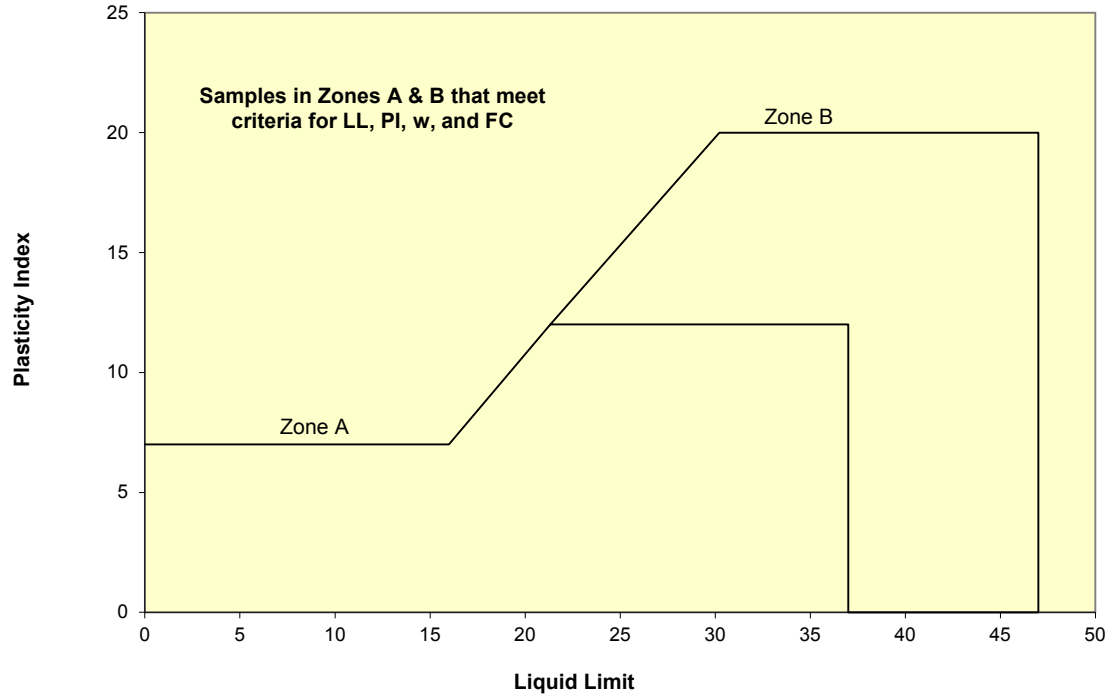


(b)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)

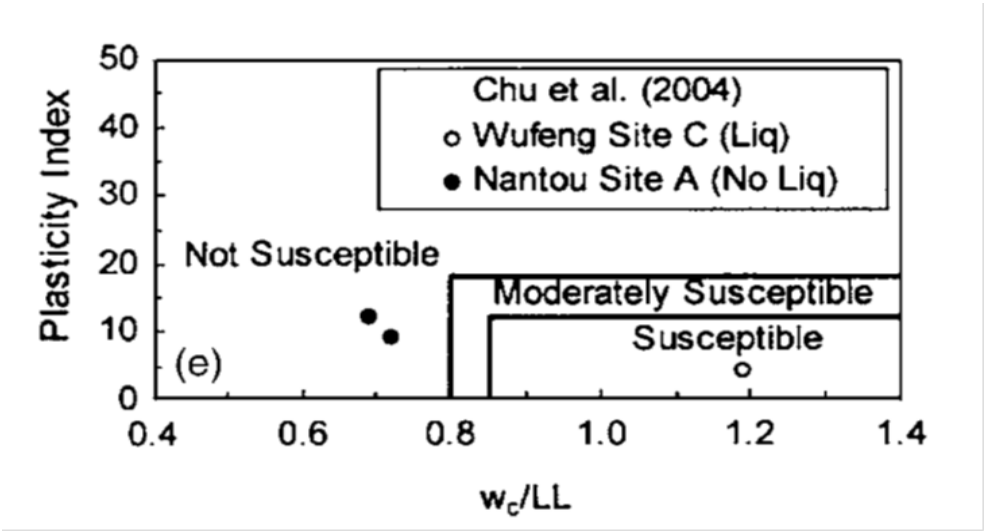


(c)

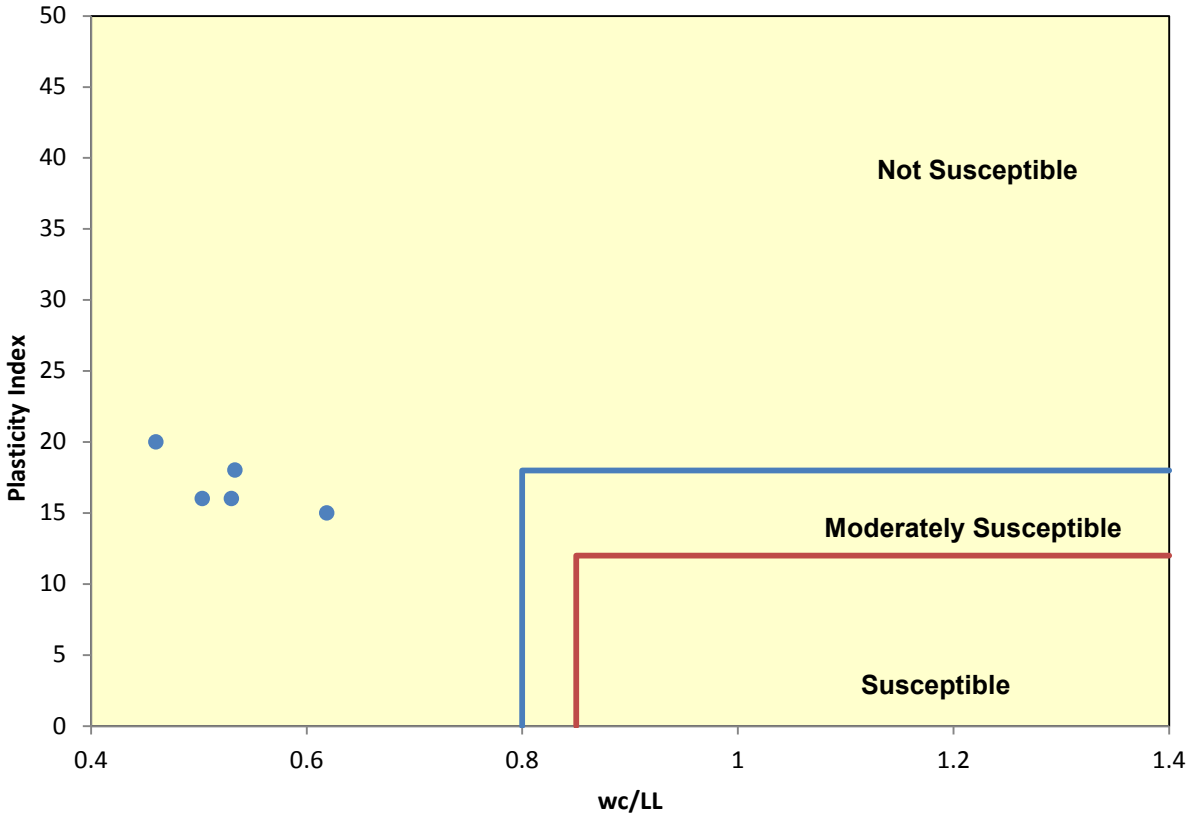


(d)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)



50B	FA-15-1	13.2-13.7	CL		16.1	80.6	90.4	35	20



Screening Criteria for Assessing Liquefaction in Fine Grained Soils (Bray and Sancio 2006)

COARSE-GRAINED ANALYSIS

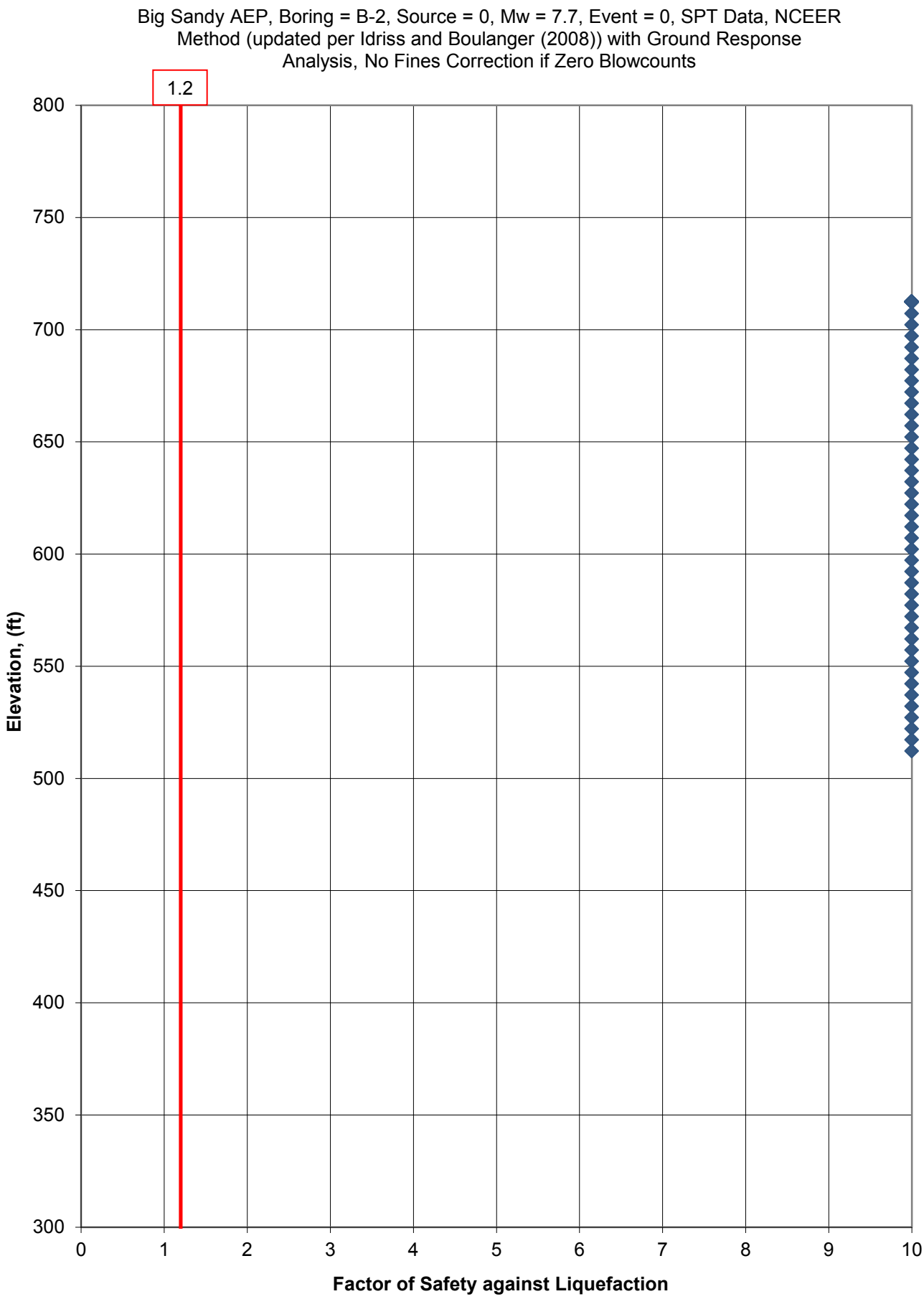
EQ Source: 0
a max (g): 0.065
EQ Mag (Mw): 7.7

Event (MCE, OBE, etc.): 0
EQ Motion File: 0

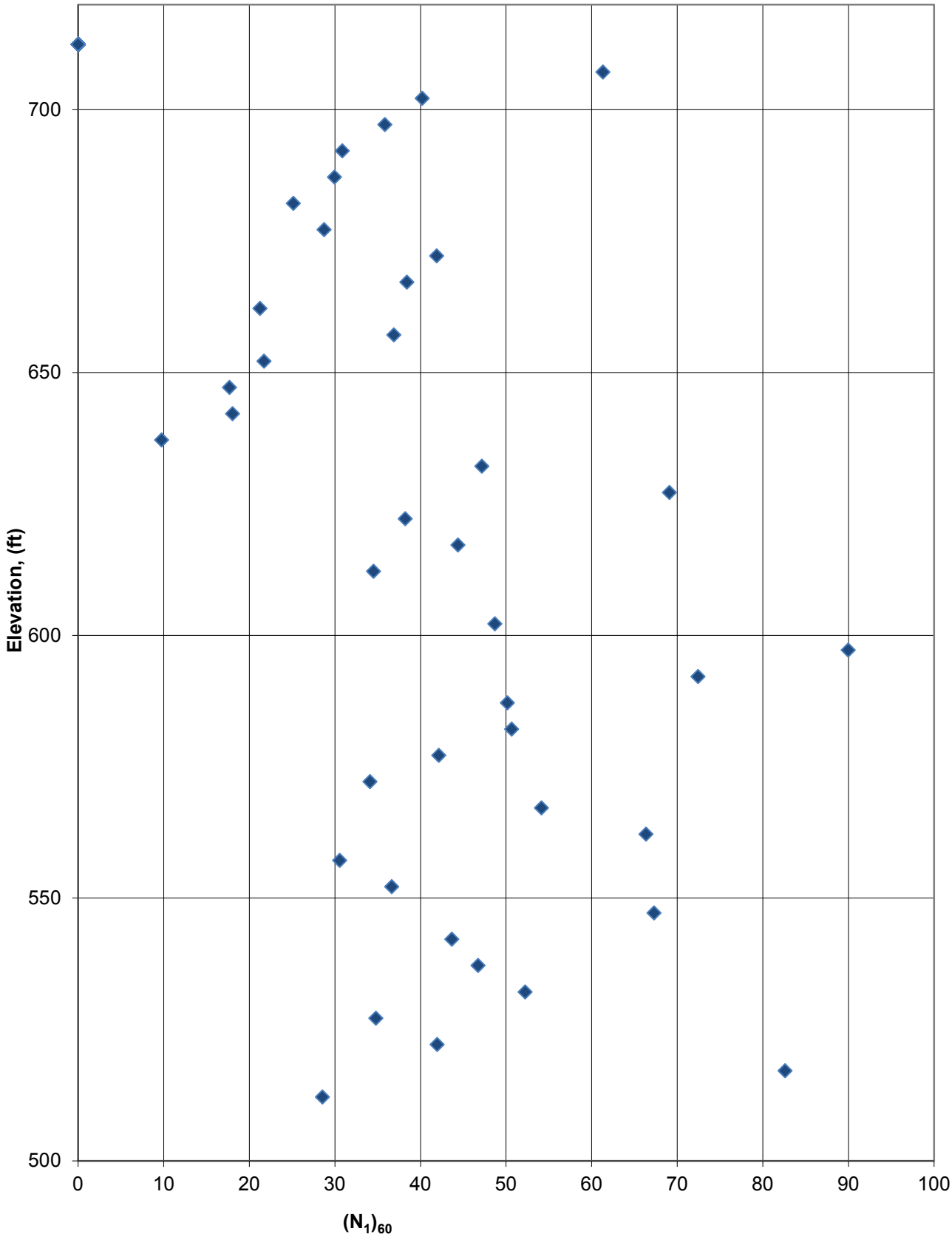
Shake Stress Curve Fit Parame
m4: 0
m3: 0
m2: 0
m1: 0

Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				Mag. Scaling	CRR	Simplified Stress Reduction	Simplified CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot
					Boring ID:	B-2																
					Top of Fill Elevation:	712.4																
					Fill Height:	0.0																
					Fill Total Unit Weight:	125																
					Fill Total Stress:	0.00																
	totstr-top		u-top	effstr-top																		
	0.28		0.00	0.28																		
5.3	0.33	0.33	0.00	0.33	0.33	NA	NA	NA	NA	NA	NA	0.95	NA	0.990	0.042	0	0	0.000	NA	10.0	NA	10.0
10.3	0.64	0.64	0.00	0.64	0.64	5.00	1.20	53	NA	1.000	1.000	0.95	NA	0.979	0.041	0	0	0.000	NA	10.0	NA	10.0
15.3	0.95	0.95	0.00	0.95	0.95	5.00	1.20	48	NA	1.000	1.000	0.95	NA	0.968	0.041	0	0	0.000	NA	10.0	NA	10.0
20.3	1.27	1.27	0.00	1.27	1.27	5.00	1.20	42	NA	0.965	1.000	0.95	NA	0.956	0.040	0	0	0.000	NA	10.0	NA	10.0
25.3	1.58	1.58	0.00	1.58	1.58	5.00	1.20	41	NA	0.923	1.000	0.95	NA	0.941	0.040	0	0	0.000	NA	10.0	NA	10.0
30.3	1.89	1.89	0.00	1.89	1.89	5.00	1.20	35	NA	0.906	1.000	0.95	NA	0.919	0.039	0	0	0.000	NA	10.0	NA	10.0
35.3	2.20	2.20	0.00	2.20	2.20	5.00	1.20	39	NA	0.870	1.000	0.95	NA	0.889	0.038	0	0	0.000	NA	10.0	NA	10.0
40.3	2.52	2.52	0.00	2.52	2.52	3.56	1.08	49	NA	0.740	1.000	0.95	NA	0.849	0.036	0	0	0.000	NA	10.0	NA	10.0
45.3	2.83	2.83	0.00	2.83	2.83	3.56	1.08	45	NA	0.709	1.000	0.95	NA	0.801	0.034	0	0	0.000	NA	10.0	NA	10.0
50.3	3.14	3.14	0.00	3.14	3.14	3.56	1.08	26	NA	0.849	1.000	0.95	NA	0.750	0.032	0	0	0.000	NA	10.0	NA	10.0
55.3	3.45	3.45	0.00	3.45	3.45	4.66	1.15	47	NA	0.689	1.000	0.95	NA	0.701	0.030	0	0	0.000	NA	10.0	NA	10.0
60.3	3.77	3.77	0.00	3.77	3.77	4.66	1.15	30	NA	0.824	1.000	0.95	NA	0.657	0.028	0	0	0.000	NA	10.0	NA	10.0
65.3	4.08	4.08	0.00	4.08	4.08	4.66	1.15	25	NA	0.845	1.000	0.95	NA	0.620	0.026	0	0	0.000	NA	10.0	NA	10.0
70.3	4.39	4.39	0.00	4.39	4.39	4.66	1.15	25	NA	0.824	1.000	0.95	NA	0.591	0.025	0	0	0.000	NA	10.0	NA	10.0
75.3	4.70	4.70	0.00	4.70	4.70	4.53	1.13	16	NA	0.867	1.000	0.95	NA	0.567	0.024	0	0	0.000	NA	10.0	NA	10.0
80.3	5.02	5.02	0.00	5.02	5.02	4.53	1.13	58	NA	0.533	1.000	0.95	NA	0.547	0.023	0	0	0.000	NA	10.0	NA	10.0
85.3	5.33	5.33	0.00	5.33	5.33	4.45	1.13	82	NA	0.515	1.000	0.95	NA	0.532	0.022	0	0	0.000	NA	10.0	NA	10.0
90.3	5.64	5.64	0.00	5.64	5.64	4.45	1.13	48	NA	0.505	1.000	0.95	NA	0.519	0.022	0	0	0.000	NA	10.0	NA	10.0
95.3	5.95	5.95	0.00	5.95	5.95	4.45	1.13	55	NA	0.482	1.000	0.95	NA	0.508	0.021	0	0	0.000	NA	10.0	NA	10.0
100.3	6.27	6.27	0.00	6.27	6.27	4.45	1.13	43	NA	0.581	1.00014	0.95	NA	0.498	0.021	0	0	0.000	NA	10.0	NA	10.0
105.3	6.58	6.58	0.00	6.58	6.58	4.52	1.13	1220	NA	0.452	1.00015	0.95	NA	0.490	0.021	0	0	0.000	NA	10.0	NA	10.0
110.3	6.89	6.89	0.00	6.89	6.89	4.52	1.13	60	NA	0.438	1.00015	0.95	NA	0.482	0.020	0	0	0.000	NA	10.0	NA	10.0
115.3	7.20	7.20	0.00	7.20	7.20	4.52	1.13	107	NA	0.425	1.00015	0.95	NA	0.475	0.020	0	0	0.000	NA	10.0	NA	10.0
120.3	7.52	7.52	0.00	7.52	7.52	4.52	1.13	87	NA	0.412	1.00015	0.95	NA	0.469	0.020	0	0	0.000	NA	10.0	NA	10.0
125.3	7.83	7.83	0.00	7.83	7.83	4.52	1.13	61	NA	0.400	1.00015	0.95	NA	0.463	0.020	0	0	0.000	NA	10.0	NA	10.0
130.3	8.14	8.14	0.00	8.14	8.14	4.52	1.13	62	NA	0.388	1.00015	0.95	NA	0.457	0.019	0	0	0.000	NA	10.0	NA	10.0
135.3	8.45	8.45	0.00	8.45	8.45	4.52	1.13	52	NA	0.377	1.00015	0.95	NA	0.451	0.019	0	0	0.000	NA	10.0	NA	10.0
140.3	8.77	8.77	0.07	8.70	8.70	3.53	1.08	40	NA	0.504	1.00012	0.95	NA	0.446	0.019	0	0	0.000	NA	10.0	NA	10.0
145.3	9.08	9.08	0.23	8.85	8.85	5.00	1.20	70	NA	0.363	1.00015	0.95	NA	0.441	0.019	0	0	0.000	NA	10.0	NA	10.0
150.3	9.39	9.39	0.38	9.01	9.01	4.20	1.11	78	NA	0.357	1.00015	0.95	NA	0.436	0.019	0	0	0.000	NA	10.0	NA	10.0
155.3	9.70	9.70	0.54	9.16	9.16	4.20	1.11	38	NA	0.582	1.00008	0.95	NA	0.431	0.019	0	0	0.000	NA	10.0	NA	10.0

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.



Big Sandy AEP, Boring = B-2, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts



EQ Source: 0
a max (g): 0.065
EQ Mag (Mw): 7.7

Event (MCE, OBE, etc.): 0
EQ Motion File: 0

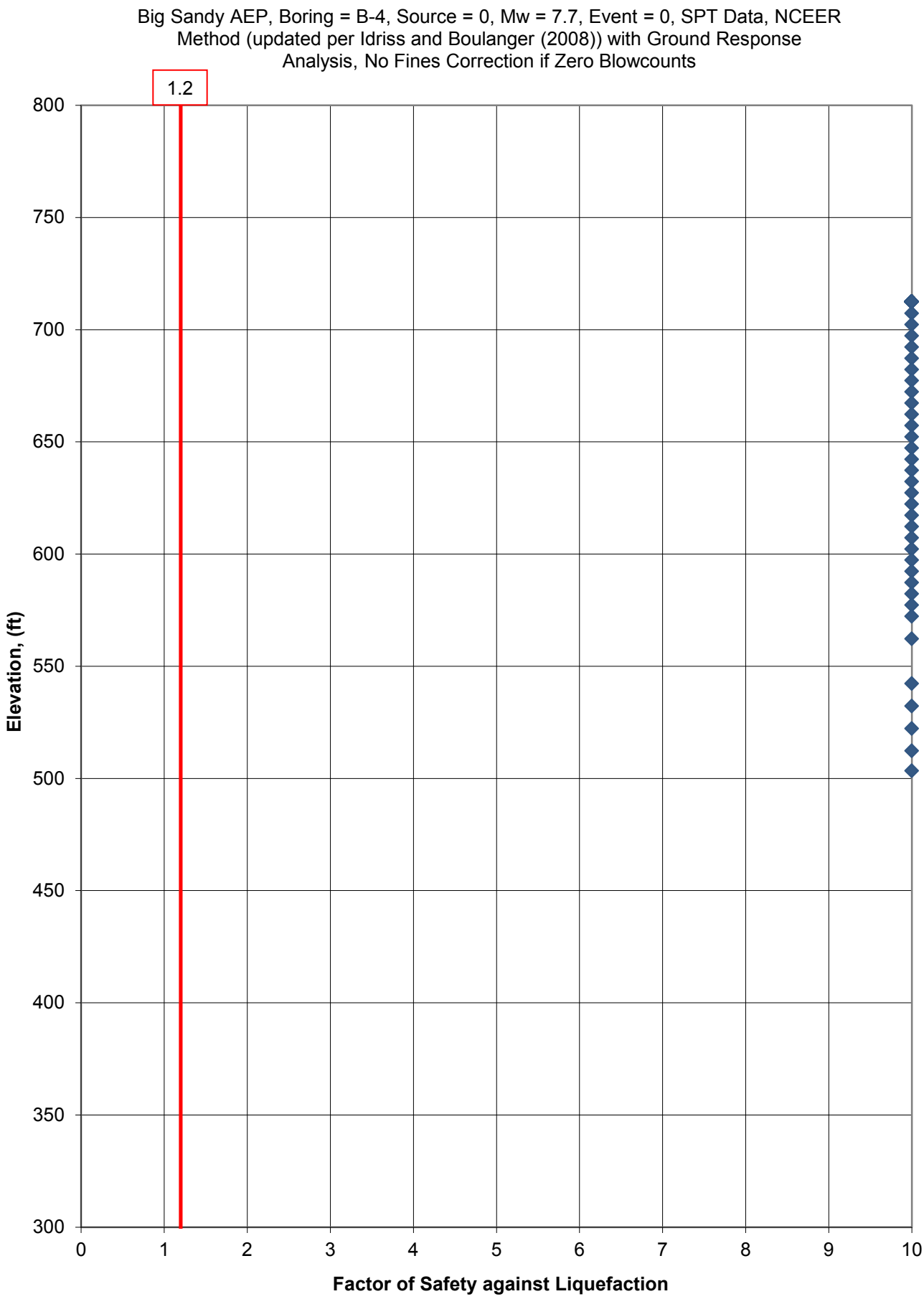
Shake Stress Curve Fit Parame
m4: 0
m3: 0
m2: 0
m1: 0

Boring ID: B-4
Top of Fill Elevation: 712.5
Fill Height: 0.0
Fill Total Unit Weight: 125
Fill Total Stress: 0.00

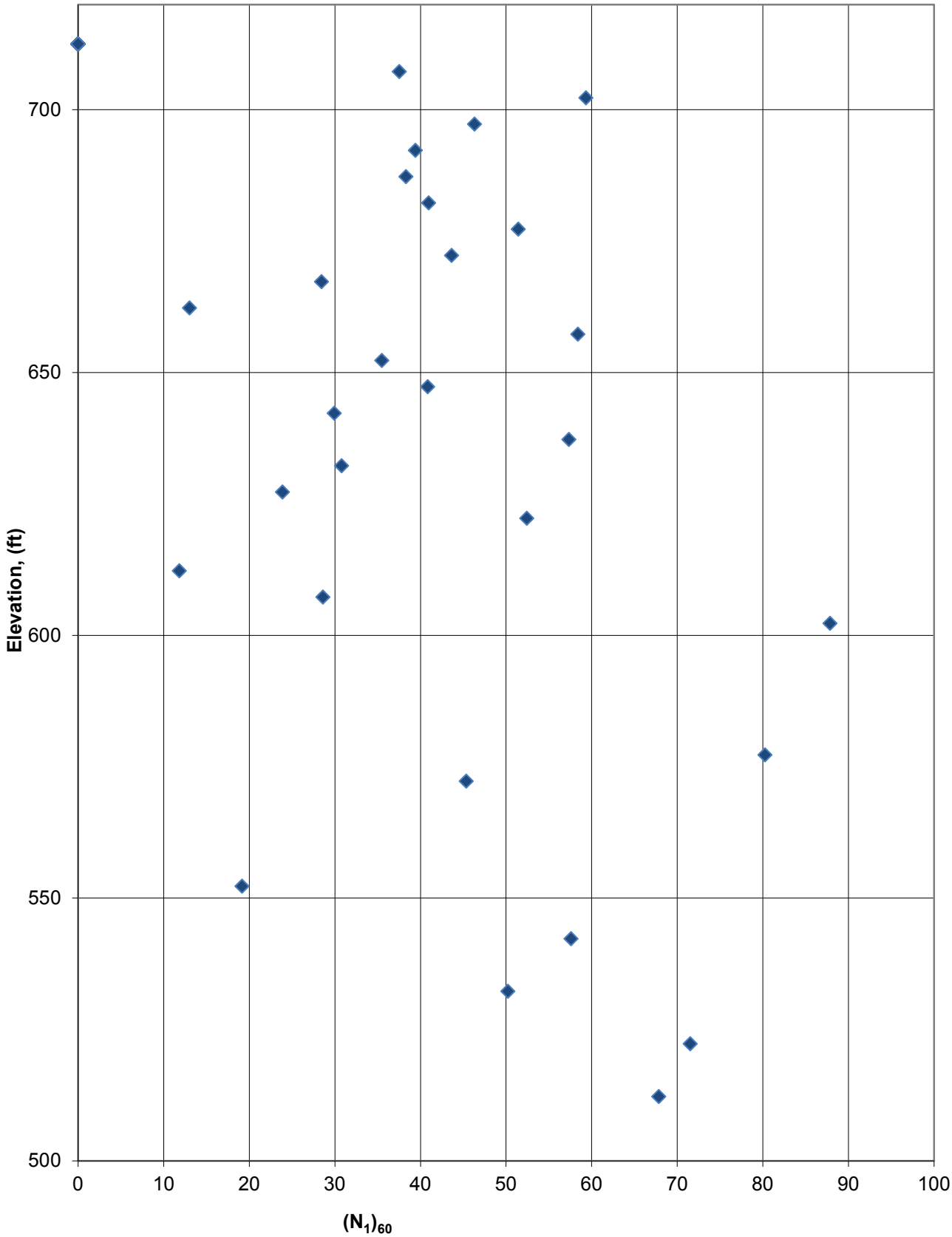
Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.

totstr-top: 0.28
u-top: 0.00
effstr-top: 0.28

Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)	Alpha I	Beta I	Equivalent Clean Sand N-Value	CRR7.5	Ksigma	Kalpha	Mag. Scaling	CRR	Simplified Stress Reduction	Simplified CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	
																		CSR eq	FS liq	FS liq	FS liq	FS liq
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$			$(N_1)_{60cs}$				Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	Design EQ	Design EQ	for plot	Design EQ	for plot
5.3	0.33	0.33	0.00	0.33	0.33	NA	NA	NA	NA	NA	NA	0.95	NA	0.990	0.042	0	0	0.000	NA	10.0	NA	10.0
10.3	0.64	0.64	0.00	0.64	0.64	3.75	1.08	68	NA	1.000	1.000	0.95	NA	0.979	0.041	0	0	0.000	NA	10.0	NA	10.0
15.3	0.95	0.95	0.00	0.95	0.95	3.75	1.08	54	NA	1.000	1.000	0.95	NA	0.968	0.041	0	0	0.000	NA	10.0	NA	10.0
20.3	1.27	1.27	0.00	1.27	1.27	3.75	1.08	47	NA	0.946	1.000	0.95	NA	0.956	0.040	0	0	0.000	NA	10.0	NA	10.0
25.3	1.58	1.58	0.00	1.58	1.58	3.75	1.08	45	NA	0.882	1.000	0.95	NA	0.941	0.040	0	0	0.000	NA	10.0	NA	10.0
30.3	1.89	1.89	0.00	1.89	1.89	3.75	1.08	48	NA	0.826	1.000	0.95	NA	0.919	0.039	0	0	0.000	NA	10.0	NA	10.0
35.3	2.20	2.20	0.00	2.20	2.20	3.75	1.08	60	NA	0.780	1.000	0.95	NA	0.889	0.038	0	0	0.000	NA	10.0	NA	10.0
40.3	2.52	2.52	0.00	2.52	2.52	3.75	1.08	51	NA	0.740	1.000	0.95	NA	0.849	0.036	0	0	0.000	NA	10.0	NA	10.0
45.3	2.83	2.83	0.00	2.83	2.83	3.75	1.08	35	NA	0.826	1.000	0.95	NA	0.801	0.034	0	0	0.000	NA	10.0	NA	10.0
50.3	3.14	3.14	0.00	3.14	3.14	3.75	1.08	18	NA	0.888	1.000	0.95	NA	0.750	0.032	0	0	0.000	NA	10.0	NA	10.0
55.3	3.45	3.45	0.00	3.45	3.45	4.49	1.13	71	NA	0.645	1.000	0.95	NA	0.701	0.030	0	0	0.000	NA	10.0	NA	10.0
60.3	3.77	3.77	0.00	3.77	3.77	4.49	1.13	45	NA	0.667	1.000	0.95	NA	0.657	0.028	0	0	0.000	NA	10.0	NA	10.0
65.3	4.08	4.08	0.00	4.08	4.08	4.49	1.13	51	NA	0.595	1.000	0.95	NA	0.620	0.026	0	0	0.000	NA	10.0	NA	10.0
70.3	4.39	4.39	0.00	4.39	4.39	4.49	1.13	38	NA	0.724	1.000	0.95	NA	0.591	0.025	0	0	0.000	NA	10.0	NA	10.0
75.3	4.70	4.70	0.00	4.70	4.70	4.49	1.13	69	NA	0.552	1.000	0.95	NA	0.567	0.024	0	0	0.000	NA	10.0	NA	10.0
80.3	5.02	5.02	0.00	5.02	5.02	4.32	1.12	39	NA	0.699	1.000	0.95	NA	0.547	0.023	0	0	0.000	NA	10.0	NA	10.0
85.3	5.33	5.33	0.00	5.33	5.33	4.32	1.12	31	NA	0.758	1.000	0.95	NA	0.532	0.022	0	0	0.000	NA	10.0	NA	10.0
90.3	5.64	5.64	0.00	5.64	5.64	4.32	1.12	63	NA	0.498	1.000	0.95	NA	0.519	0.022	0	0	0.000	NA	10.0	NA	10.0
95.3	5.95	5.95	0.00	5.95	5.95	4.32	1.12	1234	NA	0.482	1.000	0.95	NA	0.508	0.021	0	0	0.000	NA	10.0	NA	10.0
100.3	6.27	6.27	0.00	6.27	6.27	4.49	1.13	18	NA	0.836	1.00001	0.95	NA	0.498	0.021	0	0	0.000	NA	10.0	NA	10.0
105.3	6.58	6.58	0.00	6.58	6.58	4.49	1.13	37	NA	0.676	1.00008	0.95	NA	0.490	0.021	0	0	0.000	NA	10.0	NA	10.0
110.3	6.89	6.89	0.00	6.89	6.89	4.49	1.13	104	NA	0.438	1.00015	0.95	NA	0.482	0.020	0	0	0.000	NA	10.0	NA	10.0
115.3	7.20	7.20	0.00	7.20	7.20	4.47	1.13	1186	NA	0.425	1.00015	0.95	NA	0.475	0.020	0	0	0.000	NA	10.0	NA	10.0
120.3	7.52	7.52	0.00	7.52	7.52	4.47	1.13	1173	NA	0.412	1.00015	0.95	NA	0.469	0.020	0	0	0.000	NA	10.0	NA	10.0
125.3	7.83	7.83	0.00	7.83	7.83	4.47	1.13	1161	NA	0.400	1.00015	0.95	NA	0.463	0.020	0	0	0.000	NA	10.0	NA	10.0
130.3	8.14	8.14	0.00	8.14	8.14	4.47	1.13	1149	NA	0.388	1.00015	0.95	NA	0.457	0.019	0	0	0.000	NA	10.0	NA	10.0
135.3	8.45	8.45	0.00	8.45	8.45	4.47	1.13	95	NA	0.377	1.00015	0.95	NA	0.451	0.019	0	0	0.000	NA	10.0	NA	10.0
140.3	8.77	8.77	0.07	8.70	8.70	0.65	1.02	47	NA	0.368	1.00015	0.95	NA	0.446	0.019	0	0	0.000	NA	10.0	NA	10.0
150.3	9.39	9.39	0.38	9.01	9.01	4.53	1.13	1112	NA	0.357	1.00015	0.95	NA	0.436	0.019	0	0	0.000	NA	10.0	NA	10.0
160.3	10.02	10.02	0.69	9.32	9.32	4.53	1.13	26	0.320	0.720	1.00003	0.95	0.218	0.427	0.019	0	0	0.000	#DIV/0!	#DIV/0!	11.3	11.3
170.3	10.64	10.64	1.01	9.63	9.63	4.62	1.14	71	NA	0.337	1.00015	0.95	NA	0.418	0.019	0	0	0.000	NA	10.0	NA	10.0
180.3	11.27	11.27	1.32	9.95	9.95	NA	NA	NA	NA	NA	NA	0.95	NA	0.409	0.020	0	0	0.000	NA	10.0	NA	10.0
190.3	11.89	11.89	1.63	10.26	10.26	NA	NA	NA	NA	NA	NA	0.95	NA	0.401	0.020	0	0	0.000	NA	10.0	NA	10.0
200.3	12.52	12.52	1.94	10.57	10.57	NA	NA	NA	NA	NA	NA	0.95	NA	0.394	0.020	0	0	0.000	NA	10.0	NA	10.0
209.2	12.52	12.52	2.22	10.30	10.30	0.00	1.00	905	NA	0.317	1.00015	0.95	NA	0.387	0.020	0	0	0.000	NA	10.0	NA	10.0

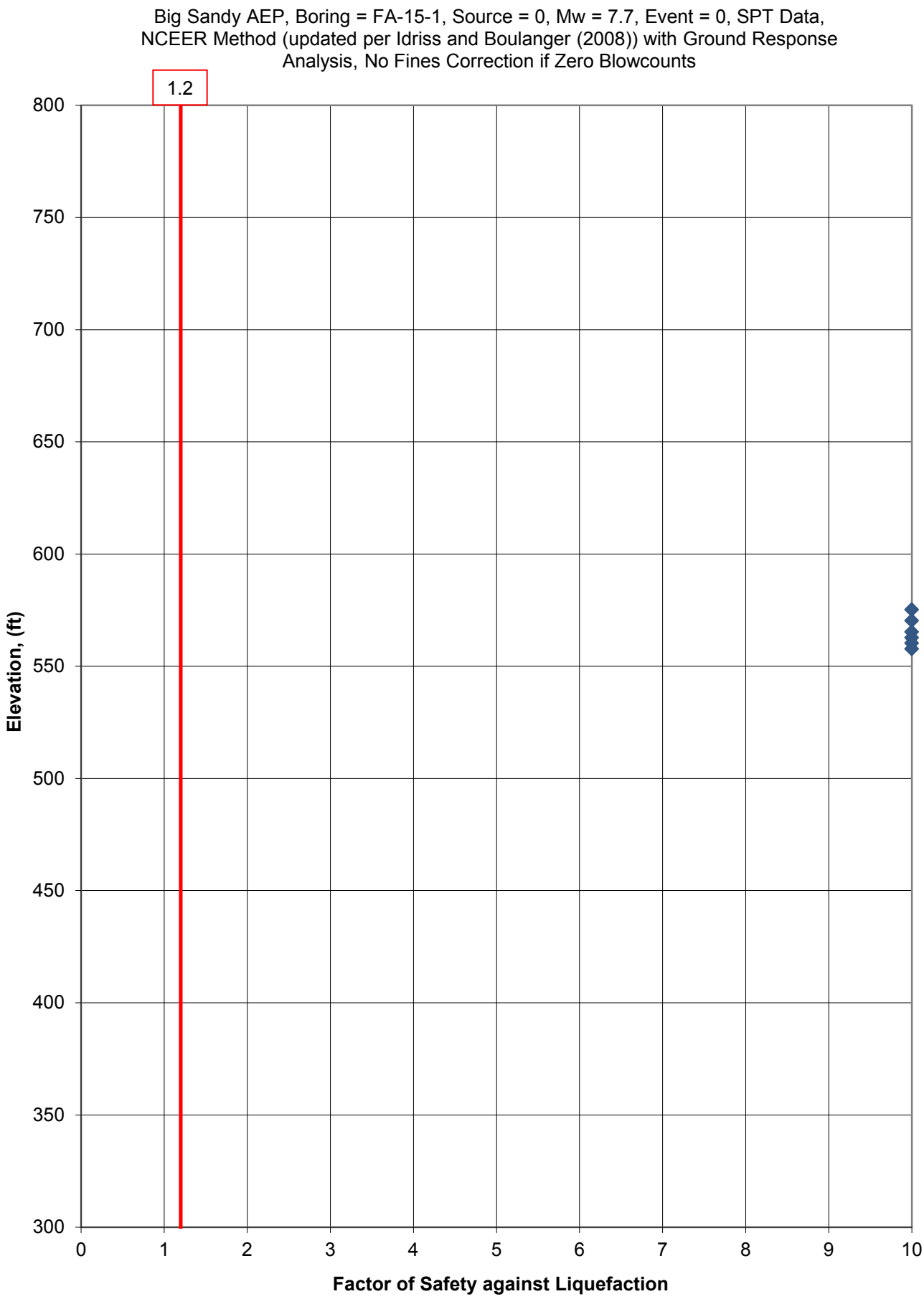


Big Sandy AEP, Boring = B-4, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts

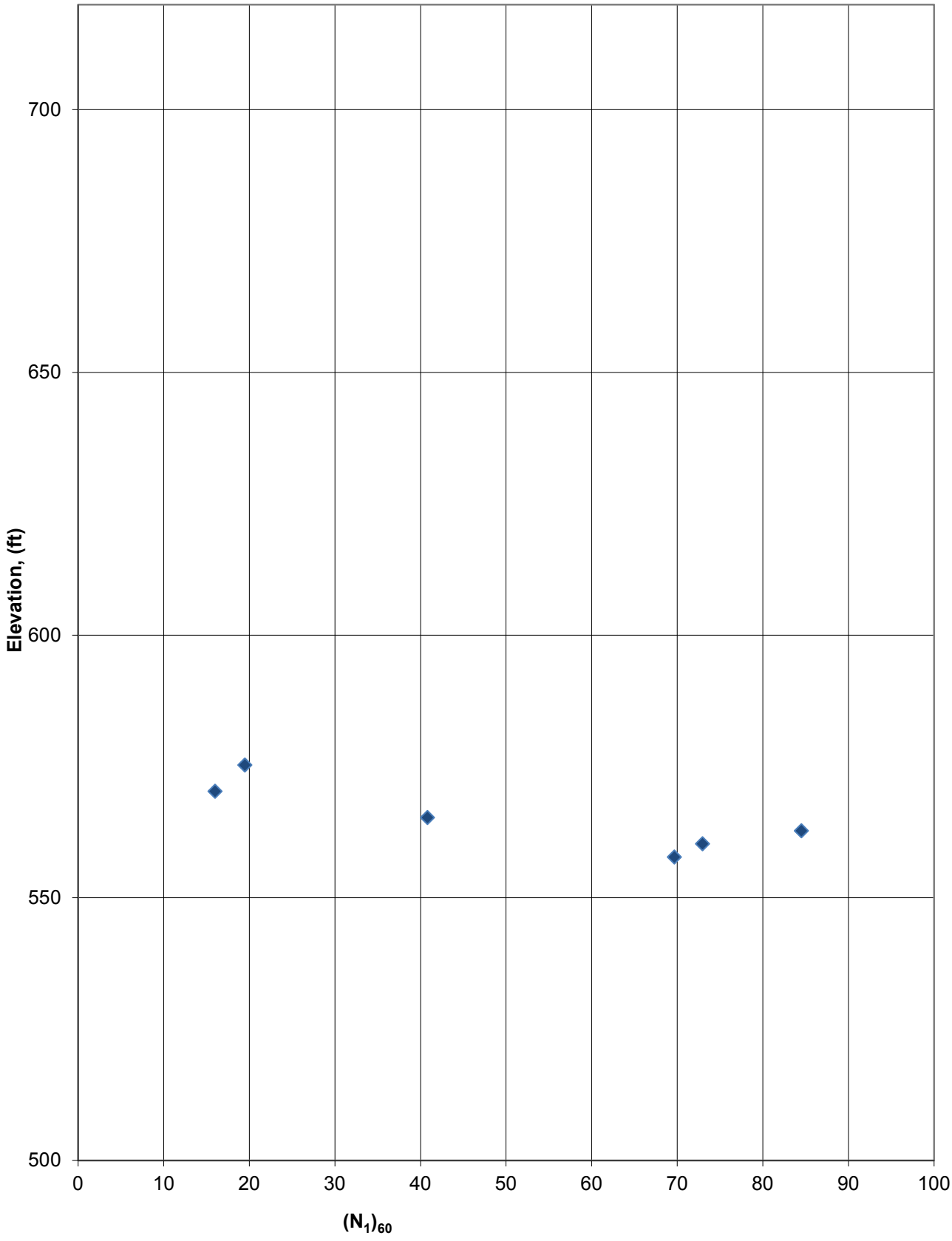


												EQ Source: 0				Event (MCE, OBE, etc.): 0					Shake Stress Curve Fit Parame	
												a max (g): 0.065									m4:	0
												EQ Mag (Mw): 7.7				EQ Motion File: 0					m3:	0
														Simplified	Simplified						m2:	0
Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				Mag. Scaling	CRR	Stress Reduction	CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot
				Boring ID:	FA-15-1																	
				Top of Fill Elevation:	586.0																	
				Fill Height:	0.0																	
				Fill Total Unit Weight:	125																	
				Fill Total Stress:	0.00																	
	totstr-top 0.31		u-top 0.00	effstr-top 0.31																		
10.8	0.67	0.67	0.00	0.67	0.67	NA	NA	NA	NA	NA	NA	0.95	NA	0.978	0.041	0	0	0.000	NA	10.0	NA	10.0
15.8	0.98	0.98	0.00	0.98	0.98	NA	NA	NA	NA	NA	NA	0.95	NA	0.967	0.041	0	0	0.000	NA	10.0	NA	10.0
20.8	1.30	1.30	0.00	1.30	1.30	4.37	1.12	50	NA	0.939	1.000	0.95	NA	0.955	0.040	0	0	0.000	NA	10.0	NA	10.0
23.3	1.45	1.45	0.00	1.45	1.45	4.37	1.12	99	NA	0.905	1.000	0.95	NA	0.948	0.040	0	0	0.000	NA	10.0	NA	10.0
25.8	1.61	1.61	0.00	1.61	1.61	4.37	1.12	86	NA	0.874	1.000	0.95	NA	0.939	0.040	0	0	0.000	NA	10.0	NA	10.0
28.3	1.77	1.77	0.00	1.77	1.77	4.37	1.12	82	NA	0.846	1.000	0.95	NA	0.929	0.039	0	0	0.000	NA	10.0	NA	10.0

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.



Big Sandy AEP, Boring = FA-15-1, Source = 0, Mw = 7.7, Event = 0, SPT Data,
NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response
Analysis, No Fines Correction if Zero Blowcounts



FLY ASH POND SADDLE DAM, 2015

FINE-GRAINED ANALYSIS

Liquefaction Susceptibility of Fine-Grained Soils

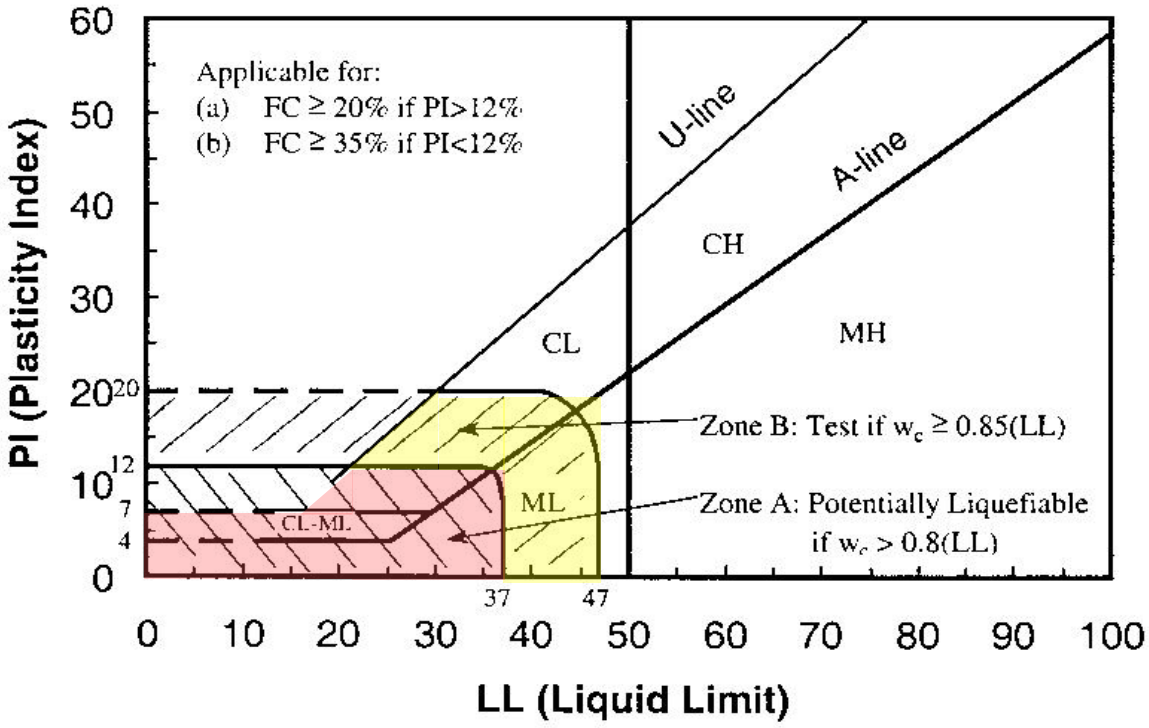
Stantec Project Number:	175553023
Project Name:	AEP Big Sandy
Site/Structure Name:	Bottom Ash Dam

Estimated water content for missing data: 20

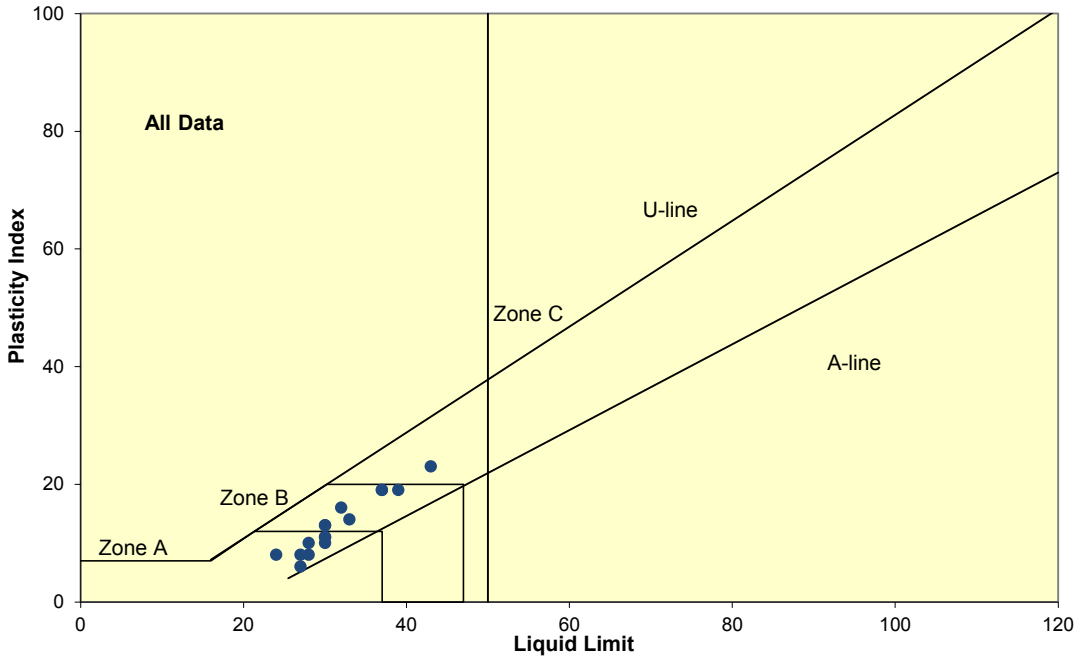
Note: NP = Non-Plastic

Lab ID	Boring	Depth(s)	Soil Classification	NMC (w_c) (%)	% Passing #200	% Passing #40	LL	PI	Sand-like versus Clay-like Behavior (-1 indicates result does not meet criteria, green shading indicates result does meet criteria, no results shown for non-plastic material)													
									Using Criteria published by Seed et al (2003)						Using Criteria published by Idriss and Boulanger (2008)		Using criteria published by MSHA (2010)			Overall Judgement based on 3 methods (sand-like or clay-like)		
									Meets criteria for sand-like behavior		Meets criteria for clay-like behavior				Meets criteria for sand-like behavior	Meets criteria for clay-like behavior	Meets criteria for sand-like behavior	Meets criteria for clay-like behavior	Borderline soils (treat as sand-like)			
									LL in Zone A (see plot)	PI in Zone A (see plot)	LL in Zone B (see plot)	PI in Zone B (see plot)	LL in Zone C (see plot)	PI in Zone C (see plot)	PI < 7	PI >= 7	PI <= 7	P40>=35%, P200>=20%, and PI>=10	7 < PI < 10, or does not meet P40 or P200			
	BFSD-6	73.4-75.4	CL	17.5	67.5	98	30	13	-1	-1	30	13	-1	-1	-1	13	-1	13	-1			Clay-like
	BFSD-6	81.4-83.4	GC-GM	20.0	48	57	27	6	27	6	-1	-1	-1	-1	6	-1	6	-1	-1			Sand-like
	BFSD-6	83.4-85.4	GC-GM	20.0	44	53	30	10	30	10	-1	-1	-1	-1	-1	10	-1	10	-1			Clay-like
	BFSD-11	15.0-17.0	CL	20.0	55	72	32	16	-1	-1	32	16	-1	-1	-1	16	-1	16	-1			Clay-like
	BFSD-11	17.0-19.0	SC-SM	20.0	47	62	28	10	28	10	-1	-1	-1	-1	-1	10	-1	10	-1			Clay-like
	BFSD-12	10.7-12.4	SC-SM	13.0	45	58	28	8	28	8	-1	-1	-1	-1	-1	8	-1	-1	8			Sand-like
	BFSD-12	12.7-14.7	CL	14.5	51	72	27	8	27	8	-1	-1	-1	-1	-1	8	-1	-1	8			Sand-like
	BFSD-14	23.5-25.5	CL	20.0	61	78	30	11	30	11	-1	-1	-1	-1	-1	11	-1	11	-1			Clay-like
	BFSD-14	25.5-26.6	CL	20.0	56	71	30	11	30	11	-1	-1	-1	-1	-1	11	-1	11	-1			Clay-like
16	SD-15-1	40.4-41.5, 45.0-46.5	CL	17.0	72.5	87.8	37	19	-1	-1	37	19	-1	-1	-1	19	-1	19	-1			Clay-like
19	SD-15-1	50.0-51.5, 55.0-56.5	CL	13.0	56.4	83.2	30	13	-1	-1	30	13	-1	-1	-1	13	-1	13	-1			Clay-like
23	SD-15-1	60.0-61.5	CL	16.0	74.4	88.6	37	19	-1	-1	37	19	-1	-1	-1	19	-1	19	-1			Clay-like
25	SD-15-1	65.0-66.5	CL	16.0	54.7	95.3	24	8	24	8	-1	-1	-1	-1	-1	8	-1	-1	8			Sand-like
33A	SD-15-2	15.0-15.5	CL	17.8	73.5	89.3	39	19	-1	-1	39	19	-1	-1	-1	19	-1	19	-1			Clay-like
36A	SD-15-2	30.0-30.5	CL	18.7	76.6	83.9	43	23	-1	-1	-1	-1	43	23	-1	23	-1	23	-1			Clay-like
38	SD-15-2	40.0-41.5, 45.0-46.5	CL	15	65.2	83.1	33	14	-1	-1	33	14	-1	-1	-1	14	-1	14	-1			Clay-like

33A
36A

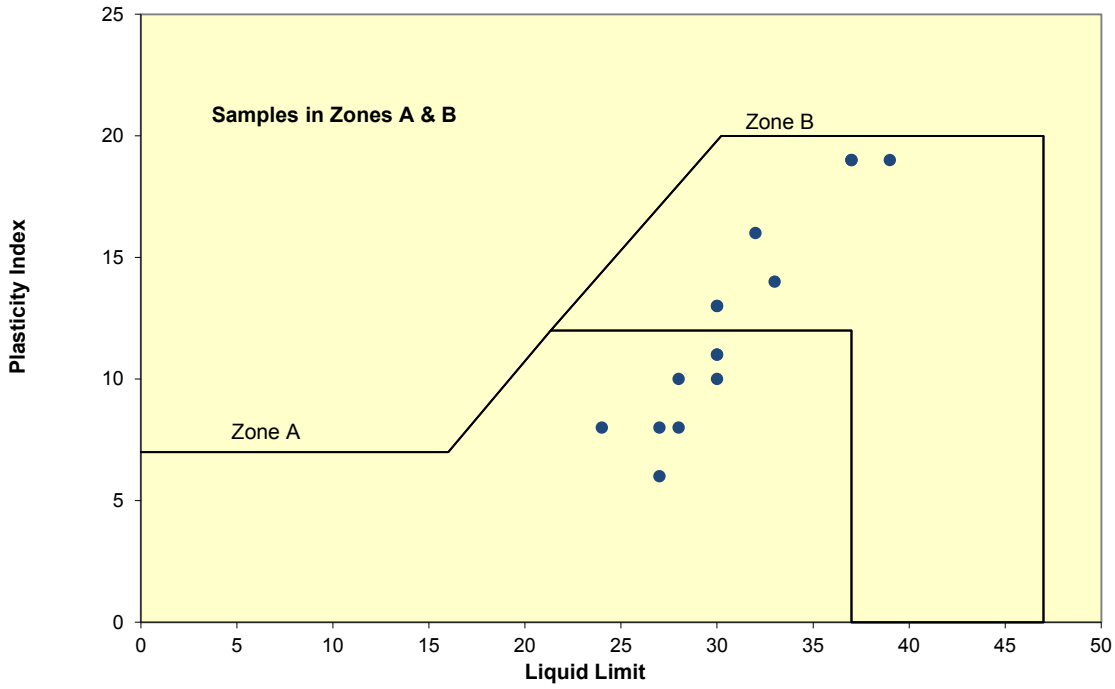


(a)



(b)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)



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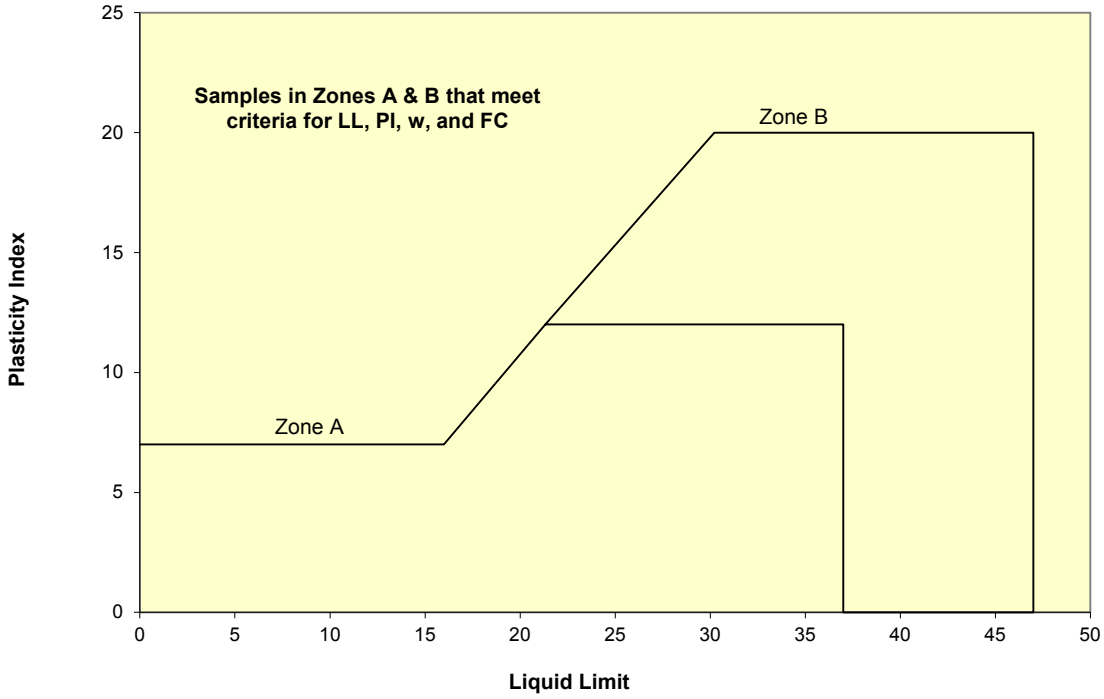
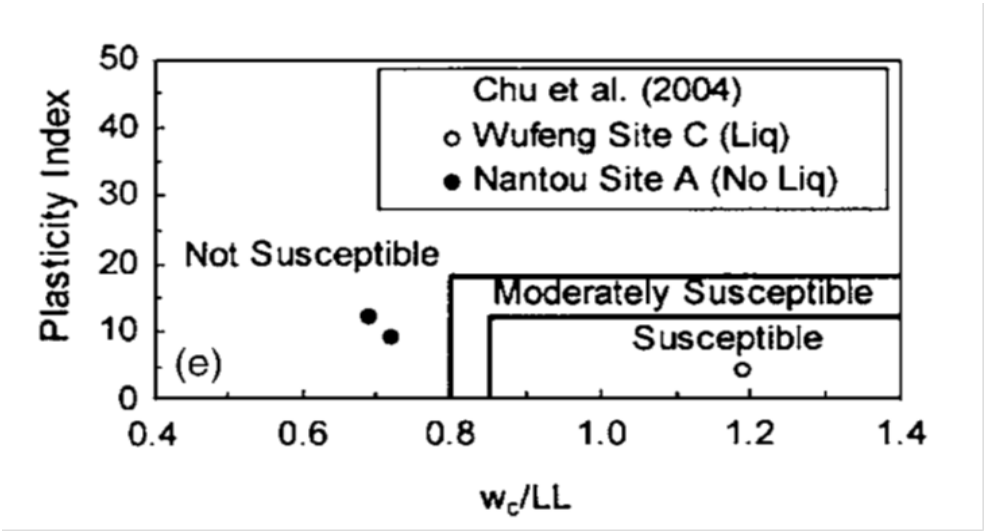
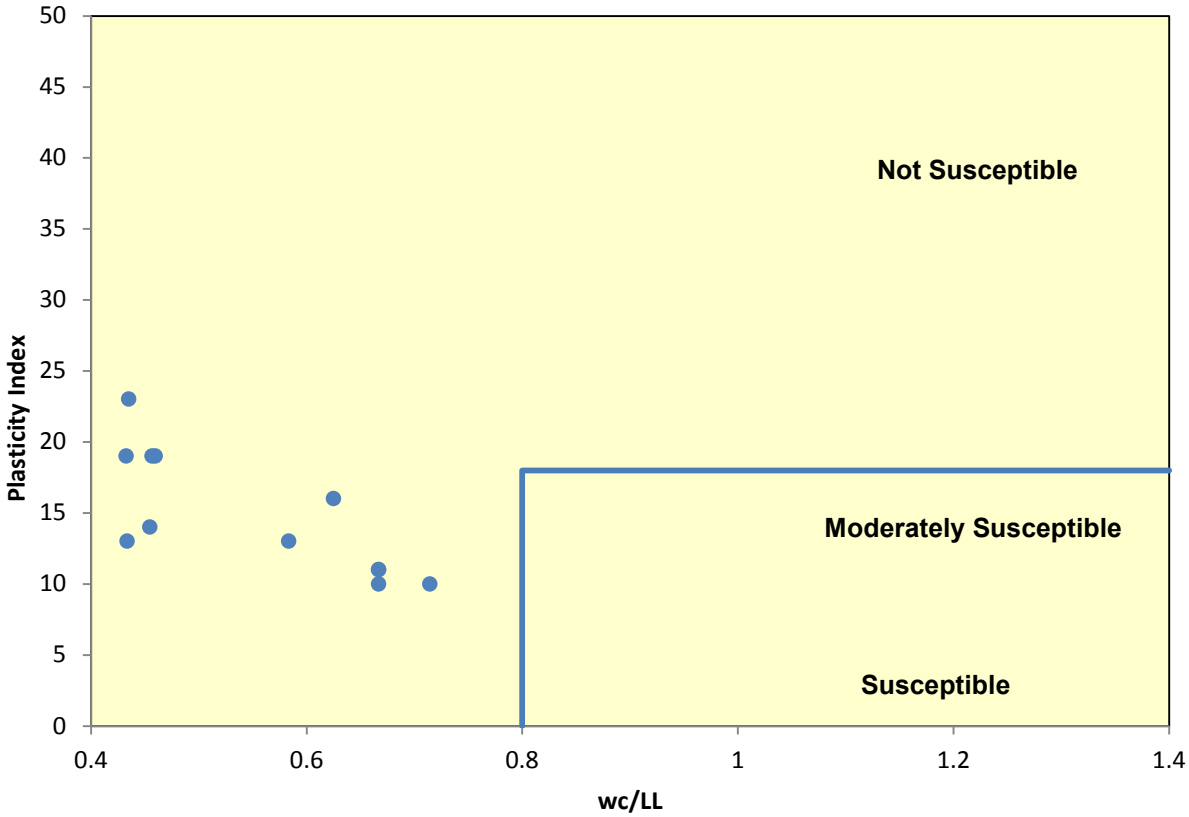


(d)

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)



16	SD-15-1	40.4-41.5,	CL	17	72.5	87.8	37	19
19	SD-15-1	50.0-51.5,	CL	13	56.4	83.2	30	13
23	SD-15-1	60.0-61.5	CL	16	74.4	88.6	37	19



Screening Criteria for Assessing Liquefaction in Fine Grained Soils (Bray and Sancio 2006)

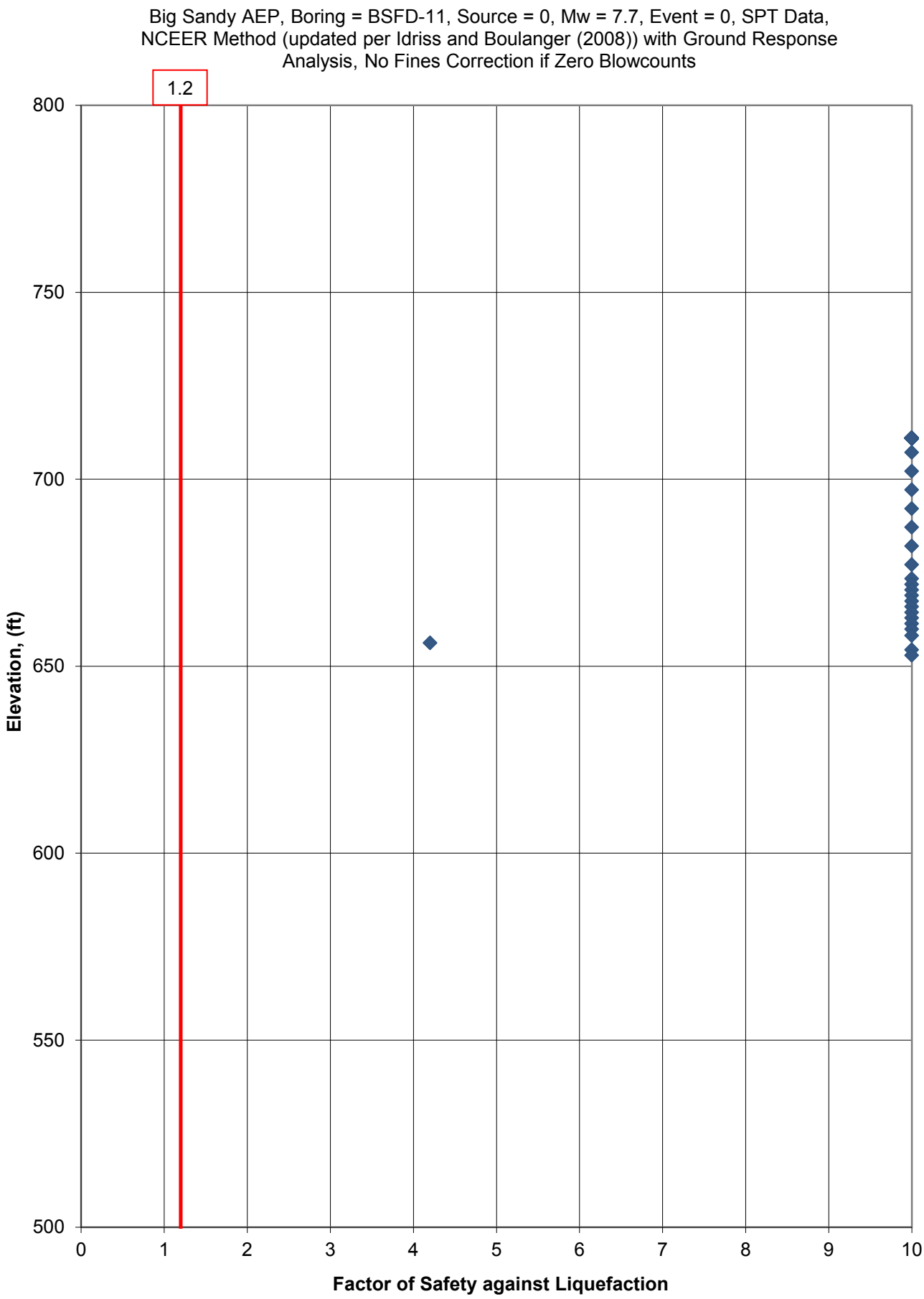
COARSE-GRAINED ANALYSIS

												EQ Source: 0				Event (MCE, OBE, etc.): 0					Shake Stress Curve Fit Parame	
												a max (g): 0.065									m4:	0
												EQ Mag (Mw): 7.7				EQ Motion File: 0					m3:	0
														Simplified	Simplified						m2:	0
Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				Mag. Scaling	CRR	Stress Reduction	CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			m1:	0
																					Simplified	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot

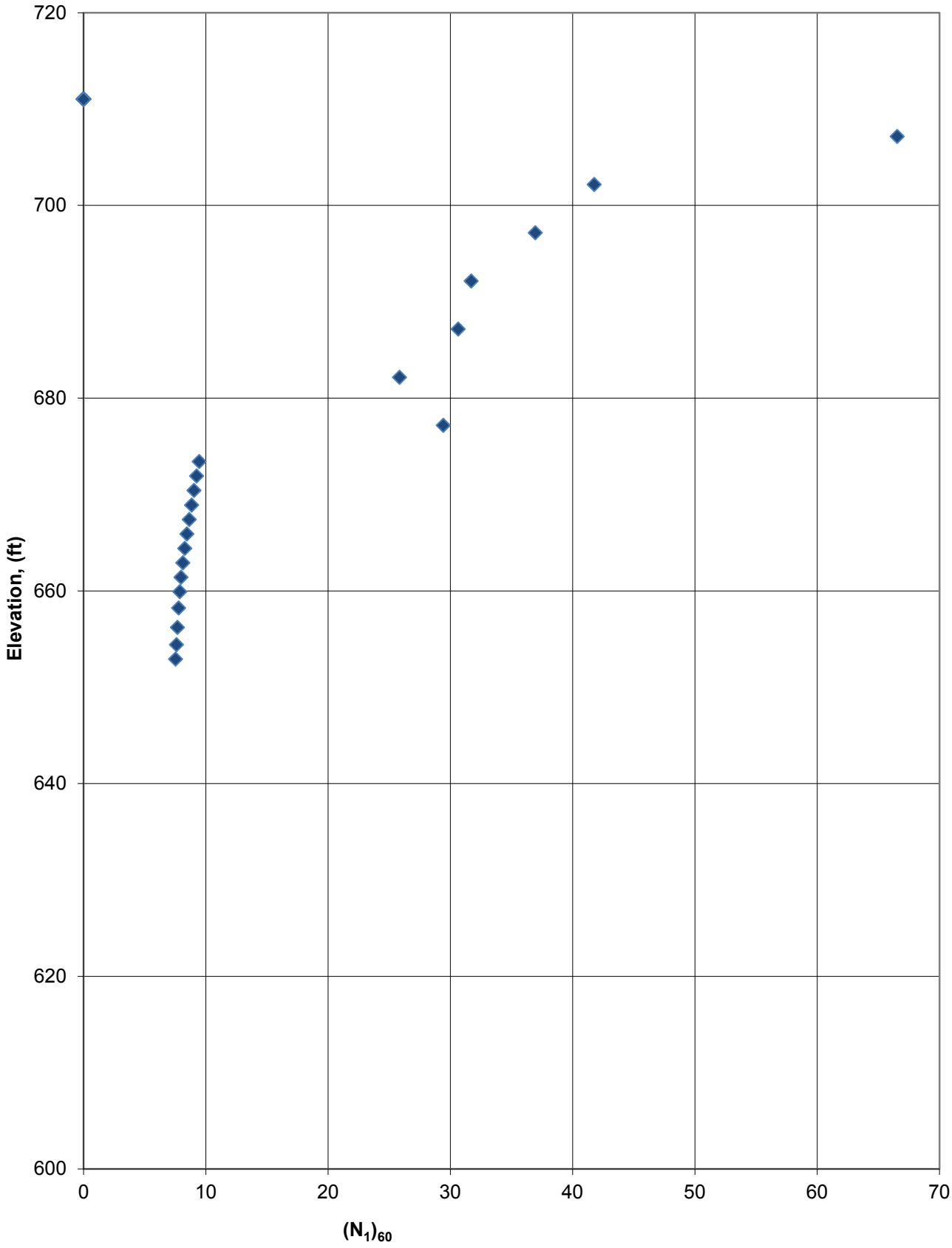
Boring ID: **BSFD-11**
Top of Fill Elevation: 711.0
Fill Height: 0.0
Fill Total Unit Weight: 125
Fill Total Stress: 0.00

Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.

	totstr-top: 0.00		u-top: 0.00	effstr-top: 0.00																		
3.9	0.24	0.24	0.00	0.24	0.24	NA	NA	NA	NA	NA	NA	0.95	NA	0.993	0.042	0	0	0.000	NA	10.0	NA	10.0
8.9	0.55	0.55	0.00	0.55	0.55	5.00	1.20	55	NA	1.000	1.000	0.95	NA	0.982	0.041	0	0	0.000	NA	10.0	NA	10.0
13.9	0.87	0.87	0.00	0.87	0.87	5.00	1.20	49	NA	1.000	1.000	0.95	NA	0.971	0.041	0	0	0.000	NA	10.0	NA	10.0
18.9	1.18	1.18	0.00	1.18	1.18	5.00	1.20	43	NA	0.977	1.000	0.95	NA	0.960	0.041	0	0	0.000	NA	10.0	NA	10.0
23.9	1.49	1.49	0.00	1.49	1.49	5.00	1.20	42	NA	0.934	1.000	0.95	NA	0.946	0.040	0	0	0.000	NA	10.0	NA	10.0
28.9	1.80	1.80	0.00	1.80	1.80	5.00	1.20	36	NA	0.913	1.000	0.95	NA	0.926	0.039	0	0	0.000	NA	10.0	NA	10.0
33.9	2.12	2.12	0.00	2.12	2.12	5.00	1.20	40	NA	0.866	1.000	0.95	NA	0.898	0.038	0	0	0.000	NA	10.0	NA	10.0
37.6	2.35	2.35	0.00	2.35	2.35	3.61	1.08	14	NA	0.929	1.000	0.95	NA	0.871	0.037	0	0	0.000	NA	10.0	NA	10.0
39.1	2.44	2.44	0.00	2.44	2.44	3.61	1.08	14	NA	0.926	1.000	0.95	NA	0.859	0.036	0	0	0.000	NA	10.0	NA	10.0
40.6	2.54	2.54	0.00	2.54	2.54	3.61	1.08	13	NA	0.922	1.000	0.95	NA	0.846	0.036	0	0	0.000	NA	10.0	NA	10.0
42.1	2.63	2.63	0.00	2.63	2.63	3.61	1.08	13	NA	0.922	1.000	0.95	NA	0.832	0.035	0	0	0.000	NA	10.0	NA	10.0
43.6	2.73	2.73	0.00	2.73	2.73	3.61	1.08	13	NA	0.919	1.000	0.95	NA	0.817	0.035	0	0	0.000	NA	10.0	NA	10.0
45.1	2.82	2.82	0.00	2.82	2.82	3.61	1.08	13	NA	0.916	1.000	0.95	NA	0.803	0.034	0	0	0.000	NA	10.0	NA	10.0
46.6	2.91	2.91	0.00	2.91	2.91	NA	NA	NA	NA	NA	NA	0.95	NA	0.787	0.033	0	0	0.000	NA	10.0	NA	10.0
48.1	3.01	3.01	0.00	3.01	3.01	NA	NA	NA	NA	NA	NA	0.95	NA	0.772	0.033	0	0	0.000	NA	10.0	NA	10.0
49.6	3.10	3.10	0.00	3.10	3.10	NA	NA	NA	NA	NA	NA	0.95	NA	0.757	0.032	0	0	0.000	NA	10.0	NA	10.0
51.1	3.19	3.19	0.03	3.16	3.16	NA	NA	NA	NA	NA	NA	0.95	NA	0.742	0.032	0	0	0.000	NA	10.0	NA	10.0
52.8	3.30	3.30	0.09	3.21	3.21	NA	NA	NA	NA	NA	NA	0.95	NA	0.725	0.031	0	0	0.000	NA	10.0	NA	10.0
54.8	3.43	3.43	0.15	3.28	3.28	5.00	1.20	14	0.152	0.905	1.000	0.95	0.131	0.705	0.031	0	0	0.000	#DIV/0!	#DIV/0!	4.2	4.2
56.6	3.54	3.54	0.21	3.33	3.33	NA	NA	NA	NA	NA	NA	0.95	NA	0.689	0.031	0	0	0.000	NA	10.0	NA	10.0
58.1	3.63	3.63	0.25	3.38	3.38	NA	NA	NA	NA	NA	NA	0.95	NA	0.675	0.031	0	0	0.000	NA	10.0	NA	10.0

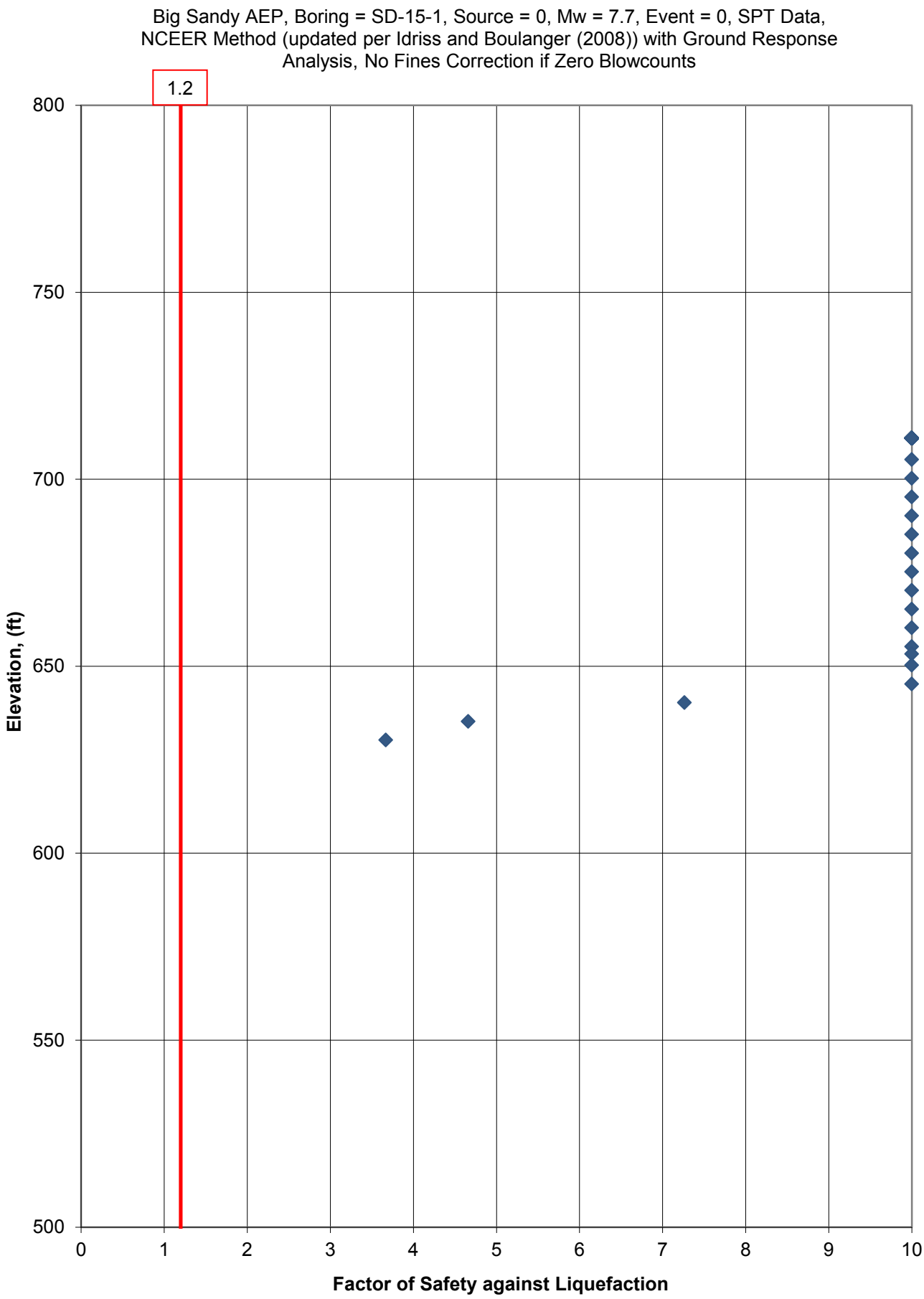


Big Sandy AEP, Boring = BSFD-11, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts

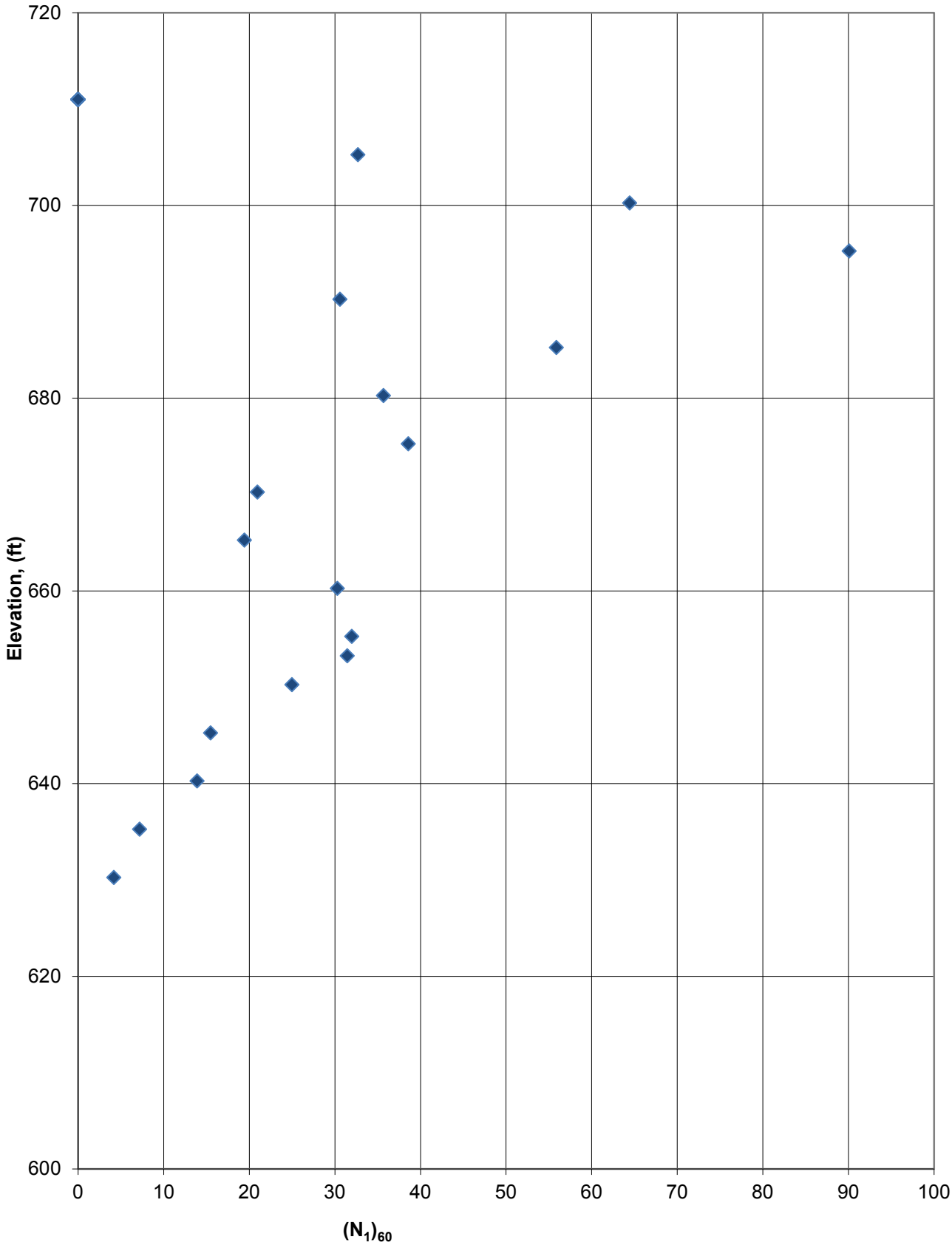


												EQ Source: 0			Event (MCE, OBE, etc.): 0					Shake Stress Curve Fit Parame	
												a max (g): 0.065								m4:	0
												EQ Mag (Mw): 7.7			EQ Motion File: 0					m3:	0
																				m2:	0
								Equivalent												m1:	0
Depth of	Vert. Total	Vert. Total	Static Pore	Vert. Eff.	Vert. Eff.			Clean Sand						Simplified	Simplified	Max. Shake	Avg. Shake	Using SHAKE Data			Simplified	
Mid. Pt.	Stress	Stress	Pressure	Stress	Stress			N-Value				Mag. Scaling	CRR	Stress Reduction	CSR eq	Stress (psf)	Stress (psf)	CSR eq	FS liq	FS liq	FS liq	FS liq
of Sample	during EQ	during EQ	during EQ	during EQ	during EQ									Coeff., r_d								
(ft.)	(tsf)	w/ Fill (tsf)	(tsf)	(tsf)	w/ Fill (tsf)																	
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ		Design EQ	Design EQ	Design EQ	Design EQ	Design EQ	for plot	Design EQ	for plot
				Boring ID:	SD-15-1																	
				Top of Fill Elevation:	711.0																	
				Fill Height:	0.0																	
				Fill Total Unit Weight:	125																	
				Fill Total Stress:	0.00																	
	totstr-top		u-top	effstr-top																		
	0.31		0.00	0.31																		
5.8	0.36	0.36	0.00	0.36	0.36	5.00	1.20	44	NA	1.000	1.000	0.95	NA	0.989	0.042	0	0	0.000	NA	10.0	NA	10.0
10.8	0.67	0.67	0.00	0.67	0.67	5.00	1.20	82	NA	1.000	1.000	0.95	NA	0.978	0.041	0	0	0.000	NA	10.0	NA	10.0
15.8	0.98	0.98	0.00	0.98	0.98	5.00	1.20	113	NA	1.000	1.000	0.95	NA	0.967	0.041	0	0	0.000	NA	10.0	NA	10.0
20.8	1.30	1.30	0.00	1.30	1.30	5.00	1.20	42	NA	0.961	1.000	0.95	NA	0.955	0.040	0	0	0.000	NA	10.0	NA	10.0
25.8	1.61	1.61	0.00	1.61	1.61	5.00	1.20	72	NA	0.874	1.000	0.95	NA	0.939	0.040	0	0	0.000	NA	10.0	NA	10.0
30.8	1.92	1.92	0.00	1.92	1.92	5.00	1.20	48	NA	0.843	1.000	0.95	NA	0.917	0.039	0	0	0.000	NA	10.0	NA	10.0
35.8	2.23	2.23	0.00	2.23	2.23	5.00	1.20	51	NA	0.779	1.000	0.95	NA	0.885	0.037	0	0	0.000	NA	10.0	NA	10.0
40.8	2.55	2.55	0.00	2.55	2.55	NA	NA	NA	NA	NA	NA	0.95	NA	0.844	0.036	0	0	0.000	NA	10.0	NA	10.0
45.8	2.86	2.86	0.00	2.86	2.86	NA	NA	NA	NA	NA	NA	0.95	NA	0.796	0.034	0	0	0.000	NA	10.0	NA	10.0
50.8	3.17	3.17	0.00	3.17	3.17	NA	NA	NA	NA	NA	NA	0.95	NA	0.745	0.031	0	0	0.000	NA	10.0	NA	10.0
55.8	3.48	3.48	0.00	3.48	3.48	NA	NA	NA	NA	NA	NA	0.95	NA	0.696	0.029	0	0	0.000	NA	10.0	NA	10.0
57.8	3.61	3.61	0.00	3.61	3.61	NA	NA	NA	NA	NA	NA	0.95	NA	0.678	0.029	0	0	0.000	NA	10.0	NA	10.0
60.8	3.80	3.80	0.00	3.80	3.80	NA	NA	NA	NA	NA	NA	0.95	NA	0.653	0.028	0	0	0.000	NA	10.0	NA	10.0
65.8	4.11	4.11	0.15	3.96	3.96	NA	NA	NA	NA	NA	NA	0.95	NA	0.617	0.027	0	0	0.000	NA	10.0	NA	10.0
70.8	4.42	4.42	0.30	4.12	4.12	5.00	1.20	22	0.237	0.860	1.000	0.95	0.194	0.588	0.027	0	0	0.000	#DIV/0!	#DIV/0!	7.3	7.3
75.8	4.73	4.73	0.46	4.27	4.27	5.00	1.20	14	0.147	0.885	1.000	0.95	0.123	0.564	0.026	0	0	0.000	#DIV/0!	#DIV/0!	4.7	4.7
80.8	5.05	5.05	0.62	4.43	4.43	5.00	1.20	10	0.113	0.896	1.000	0.95	0.096	0.546	0.026	0	0	0.000	#DIV/0!	#DIV/0!	3.7	3.7

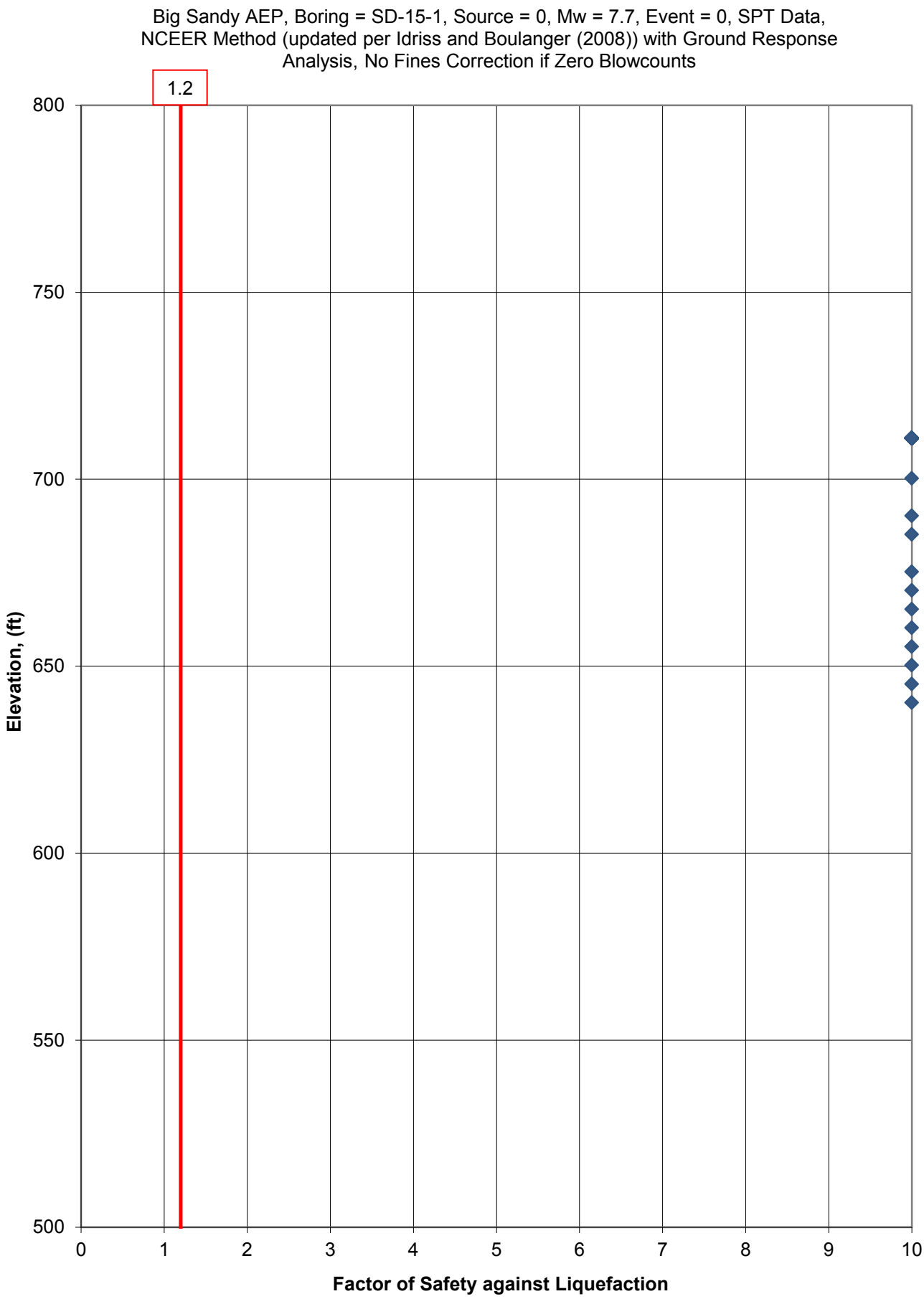
Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.



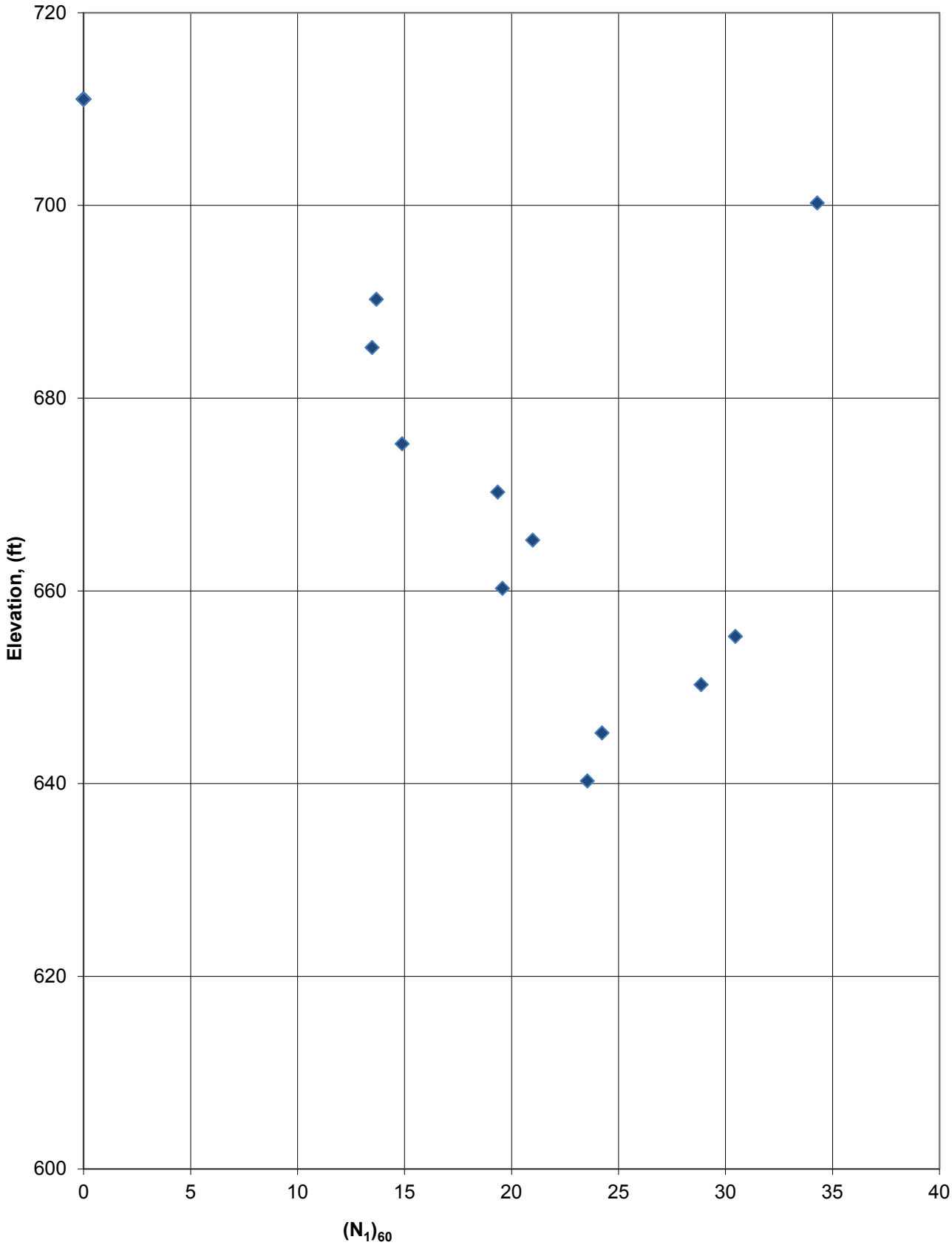
Big Sandy AEP, Boring = SD-15-1, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts



												EQ Source: 0				Event (MCE, OBE, etc.): 0					Shake Stress Curve Fit Parame	
												a max (g): 0.065									m4:	0
												EQ Mag (Mw): 7.7				EQ Motion File: 0					m3:	0
														Simplified	Simplified						m2:	0
Depth of Mid. Pt. of Sample (ft.)	Vert. Total Stress during EQ (tsf)	Vert. Total Stress during EQ w/ Fill (tsf)	Static Pore Pressure during EQ (tsf)	Vert. Eff. Stress during EQ (tsf)	Vert. Eff. Stress during EQ w/ Fill (tsf)			Equivalent Clean Sand N-Value				Mag. Scaling	CRR	Stress Reduction	CSR eq	Max. Shake Stress (psf)	Avg. Shake Stress (psf)	Using SHAKE Data			Simplified	m1: 0
z	σ_v	$\sigma_{v\ with\ fill}$	u	σ'_v	$\sigma'_{v\ with\ fill}$	Alpha I	Beta I	$(N_1)_{60cs}$	CRR7.5	Ksigma	Kalpha	Factor (Cm)	Design EQ	Coeff., r_d	Design EQ	Design EQ	Design EQ	CSR eq Design EQ	FS liq Design EQ	FS liq for plot	FS liq Design EQ	FS liq for plot
				Boring ID:	SD-15-1							*Note: A factor of safety shown as "NA" implies that the soil type is not appropriately evaluated using this methodology. This applies to soils classified as CL, CH, CL-ML and MH. These soils should be evaluated using methods for fine-grained soils. Also, "NA" implies that coarse grained soils with equivalent clean sand N-values greater than 30 are resistant to liquefaction.*											
				Top of Fill Elevation:	711.0																	
				Fill Height:	0.0																	
				Fill Total Unit Weight:	125																	
				Fill Total Stress:	0.00																	
	totstr-top 0.31		u-top 0.00	effstr-top 0.31																		
10.8	0.67	0.67	0.00	0.67	0.67	NA	NA	NA	NA	NA	NA	0.95	NA	0.978	0.041	0	0	0.000	NA	10.0	NA	10.0
20.8	1.30	1.30	0.00	1.30	1.30	5.00	1.20	21	NA	0.979	1.000	0.95	NA	0.955	0.040	0	0	0.000	NA	10.0	NA	10.0
25.8	1.61	1.61	0.00	1.61	1.61	NA	NA	NA	NA	NA	NA	0.95	NA	0.939	0.040	0	0	0.000	NA	10.0	NA	10.0
35.8	2.23	2.23	0.00	2.23	2.23	NA	NA	NA	NA	NA	NA	0.95	NA	0.885	0.037	0	0	0.000	NA	10.0	NA	10.0
40.8	2.55	2.55	0.00	2.55	2.55	NA	NA	NA	NA	NA	NA	0.95	NA	0.844	0.036	0	0	0.000	NA	10.0	NA	10.0
45.8	2.86	2.86	0.00	2.86	2.86	NA	NA	NA	NA	NA	NA	0.95	NA	0.796	0.034	0	0	0.000	NA	10.0	NA	10.0
50.8	3.17	3.17	0.00	3.17	3.17	NA	NA	NA	NA	NA	NA	0.95	NA	0.745	0.031	0	0	0.000	NA	10.0	NA	10.0
55.8	3.48	3.48	0.00	3.48	3.48	NA	NA	NA	NA	NA	NA	0.95	NA	0.696	0.029	0	0	0.000	NA	10.0	NA	10.0
60.8	3.80	3.80	0.00	3.80	3.80	NA	NA	NA	NA	NA	NA	0.95	NA	0.653	0.028	0	0	0.000	NA	10.0	NA	10.0
65.8	4.11	4.11	0.15	3.96	3.96	NA	NA	NA	NA	NA	NA	0.95	NA	0.617	0.027	0	0	0.000	NA	10.0	NA	10.0
70.8	4.42	4.42	0.30	4.12	4.12	5.00	1.20	33	NA	0.796	1.000	0.95	NA	0.588	0.027	0	0	0.000	NA	10.0	NA	10.0



Big Sandy AEP, Boring = SD-15-1, Source = 0, Mw = 7.7, Event = 0, SPT Data, NCEER Method (updated per Idriss and Boulanger (2008)) with Ground Response Analysis, No Fines Correction if Zero Blowcounts



APPENDIX J

STABILITY ANALYSIS

BOTTOM ASH POND COMPLEX, 2015

SECTION A-A' WITH ASH

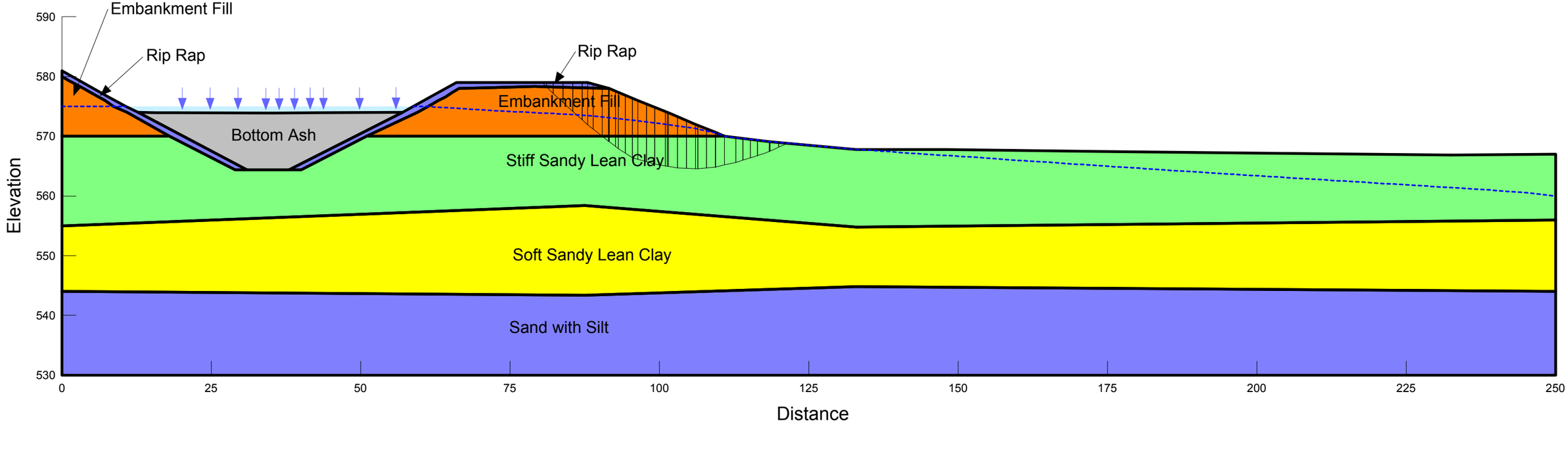
Factor of Safety = 2.67

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L01_Normal Pool with Ash, Downstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (drained)	125	30	30
Stiff Sandy Lean Clay (drained)	125	35	144
Soft Sandy Lean Clay (drained)	125	30	23
Sand With Silt (drained)	130	35	0
Bottom Ash (drained)	115	28	0
Rip Rap (drained)	140	35	0



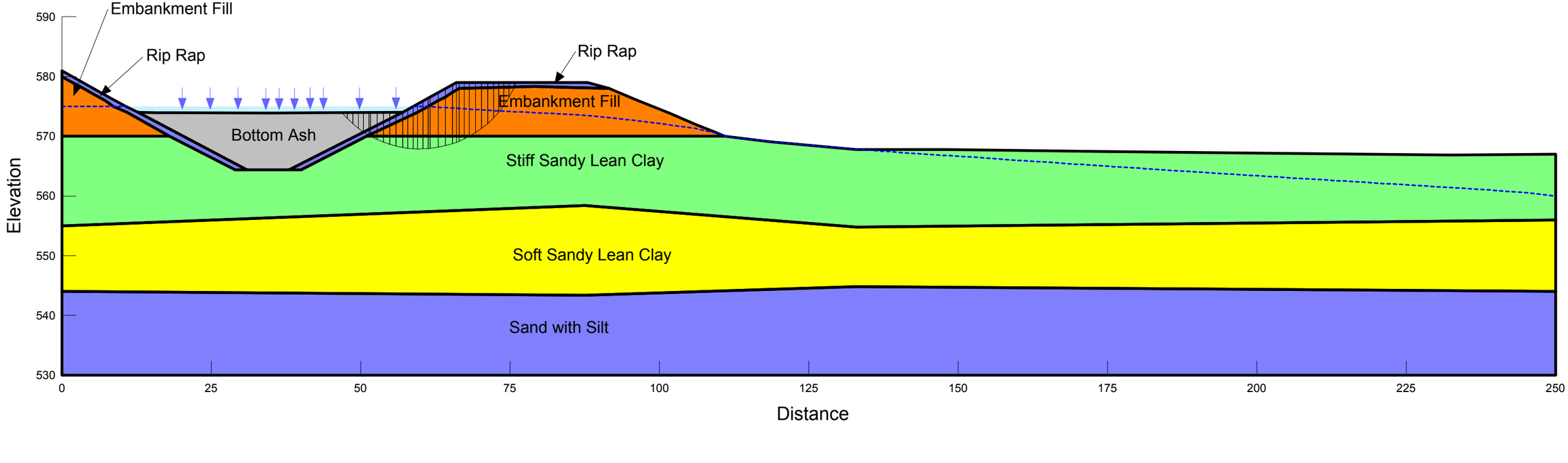
Factor of Safety = 3.87

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L02_Normal Pool with Ash, Upstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (drained)	125	30	30
Stiff Sandy Lean Clay (drained)	125	35	144
Soft Sandy Lean Clay (drained)	125	30	23
Sand With Silt (drained)	130	35	0
Bottom Ash (drained)	115	28	0
Rip Rap (drained)	140	35	0



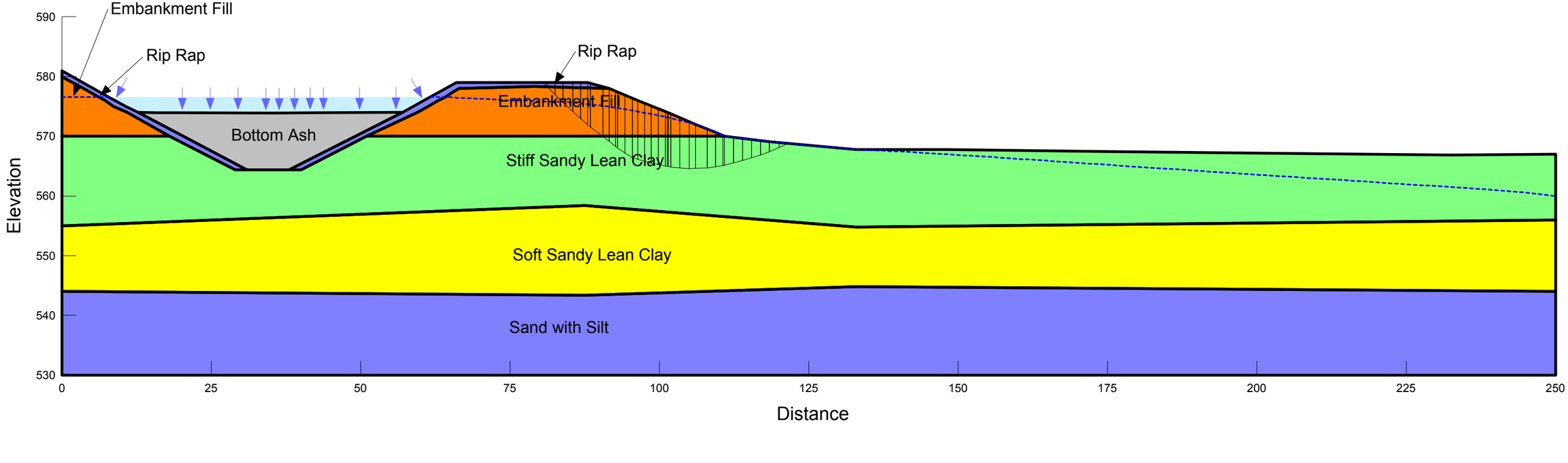
Factor of Safety = 2.55

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L03_50% PMF Surcharge Pool with Ash, Downstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (drained)	125	30	30
Stiff Sandy Lean Clay (drained)	125	35	144
Soft Sandy Lean Clay (drained)	125	30	23
Sand With Silt (drained)	130	35	0
Bottom Ash (drained)	115	28	0
Rip Rap (drained)	140	35	0



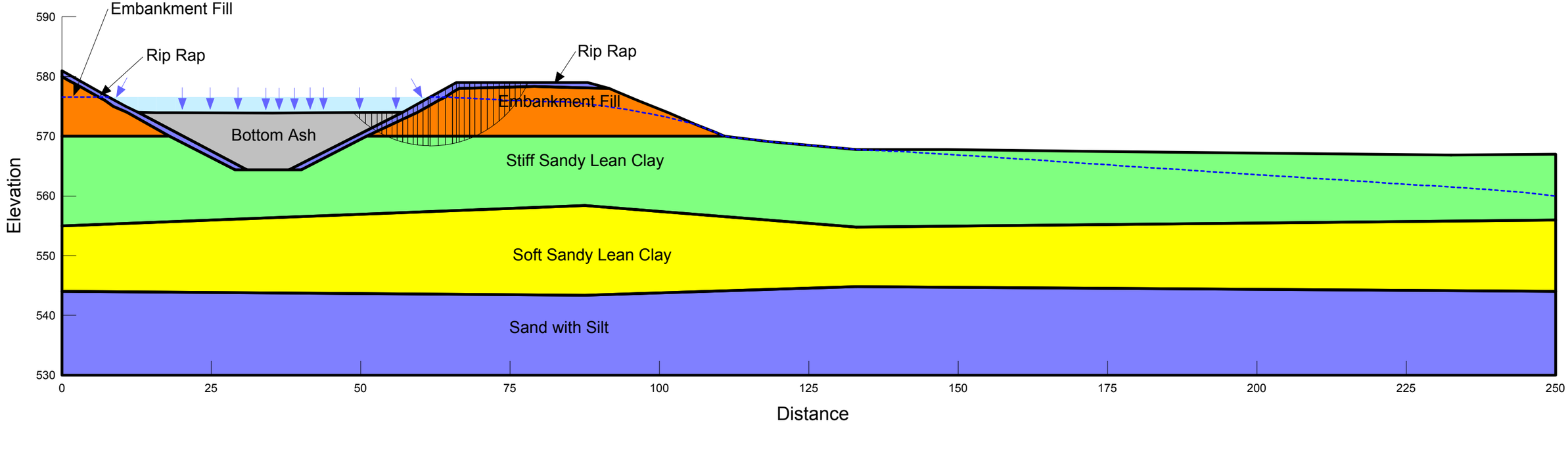
Factor of Safety = 4.39

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L04_50% PMF Surcharge Pool with Ash, Upstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (drained)	125	30	30
Stiff Sandy Lean Clay (drained)	125	35	144
Soft Sandy Lean Clay (drained)	125	30	23
Sand With Silt (drained)	130	35	0
Bottom Ash (drained)	115	28	0
Rip Rap (drained)	140	35	0



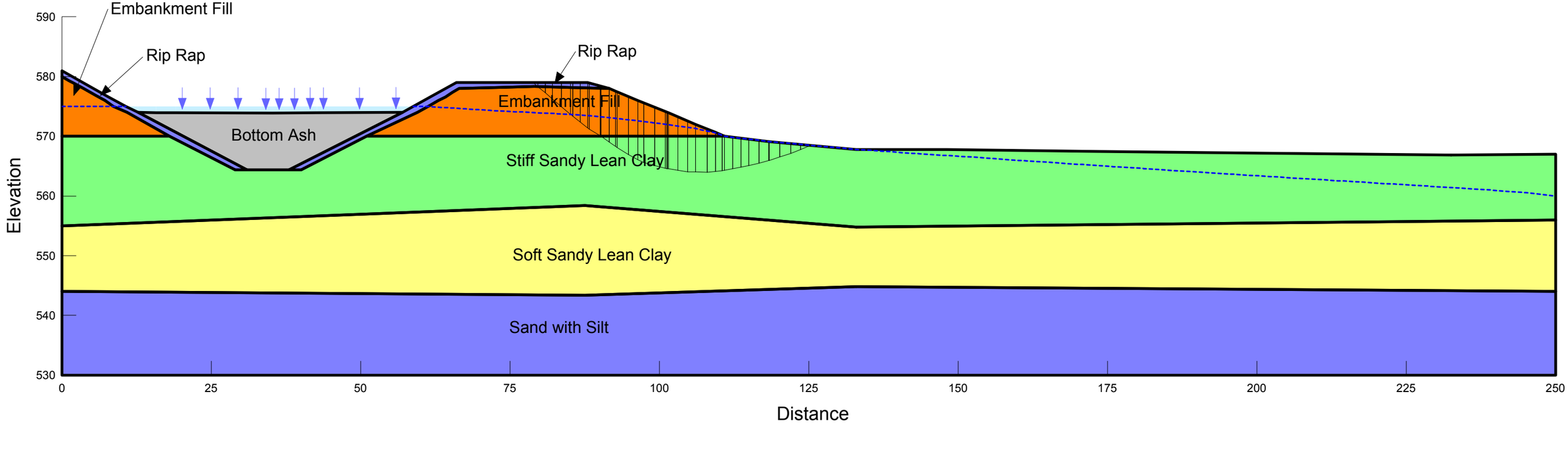
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L05_Seismic_Normal Pool with Ash, Downstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Undrained Psuedostatic Strength
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.065g
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Factor of Safety = 2.22

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (undrained seismic)	125	30	30	18	200
Stiff Sandy Lean Clay (undrained seismic)	125	35	144	20	2,200
Soft Sandy Lean Clay (undrained seismic)	125	30	23	6	2,200
Sand With Silt (undrained seismic)	130	35	0	35	0
Bottom Ash (undrained seismic)	115	28	0	28	0
Rip Rap (undrained seismic)	140	35	0	35	0



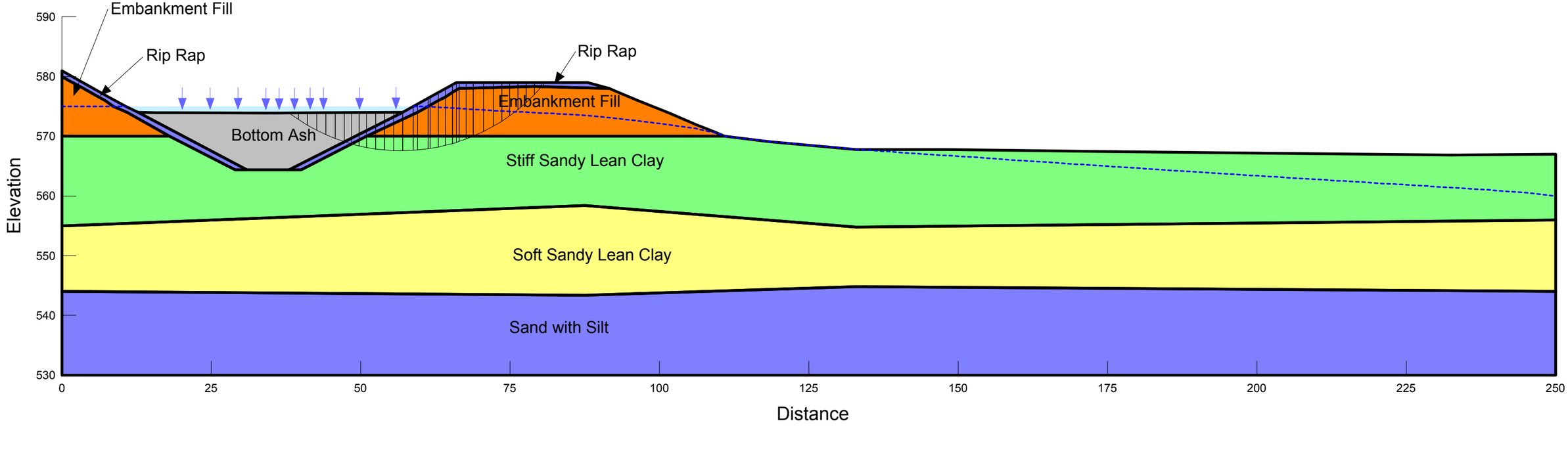
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L06_Seismic_Normal Pool with Ash, Upstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Undrained Psuedostatic Strength
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.065g
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Factor of Safety = 2.95

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (undrained seismic)	125	30	30	18	200
Stiff Sandy Lean Clay (undrained seismic)	125	35	144	20	2,200
Soft Sandy Lean Clay (undrained seismic)	125	30	23	6	2,200
Sand With Silt (undrained seismic)	130	35	0	35	0
Bottom Ash (undrained seismic)	115	28	0	28	0
Rip Rap (undrained seismic)	140	35	0	35	0



SECTION A-A', WITHOUT ASH

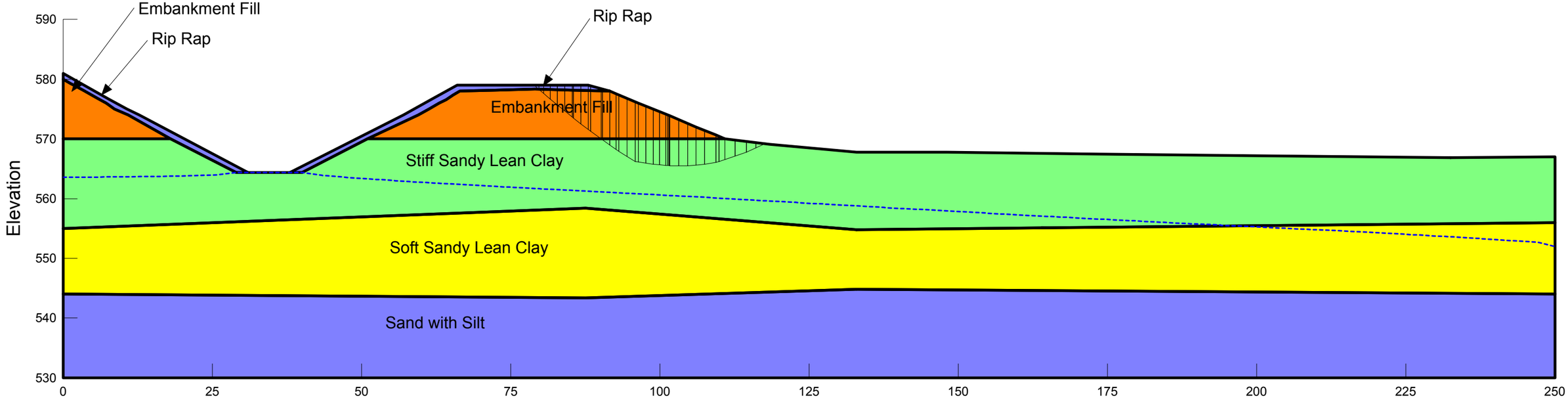
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 3.41

L01_Normal Pool without Ash, Downstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Stiff Sandy Lean Clay	125	35	144
Soft Sandy Lean Clay	125	30	23
Sand With Silt	130	35	0
Rip Rap	140	35	0



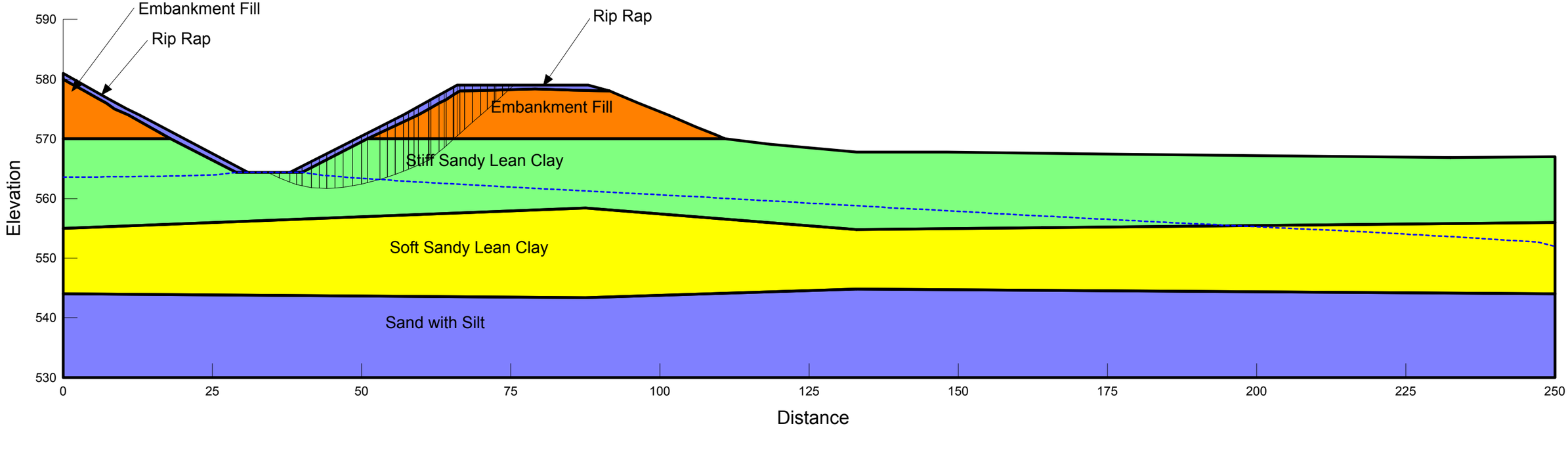
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.33

L02_Normal Pool without Ash, Upstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Stiff Sandy Lean Clay	125	35	144
Soft Sandy Lean Clay	125	30	23
Sand With Silt	130	35	0
Rip Rap	140	35	0



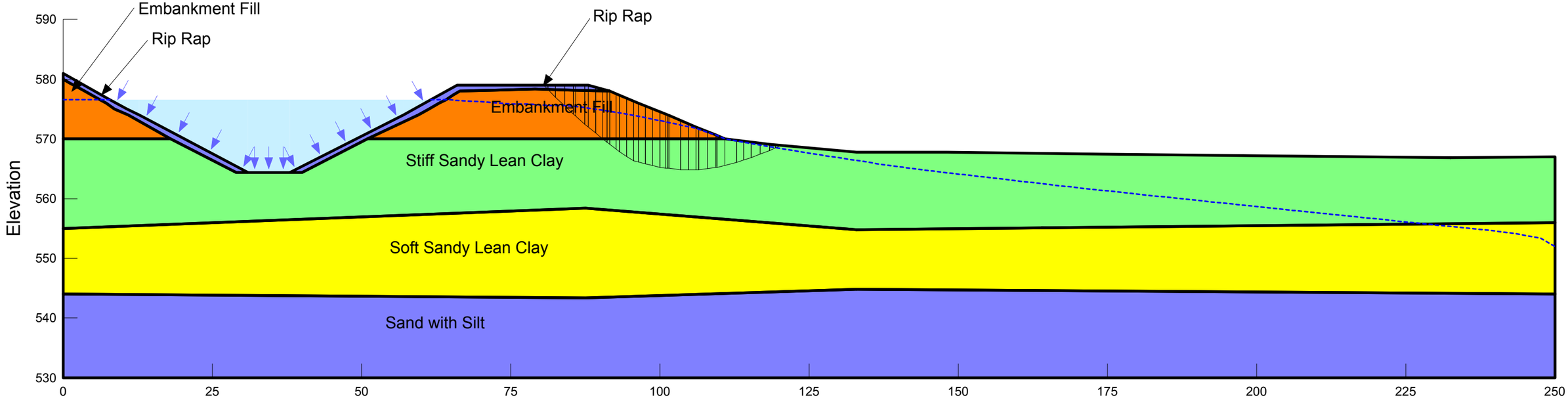
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.71

L03_50% PMF Surcharge Pool without Ash, Downstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Stiff Sandy Lean Clay	125	35	144
Soft Sandy Lean Clay	125	30	23
Sand With Silt	130	35	0
Rip Rap	140	35	0



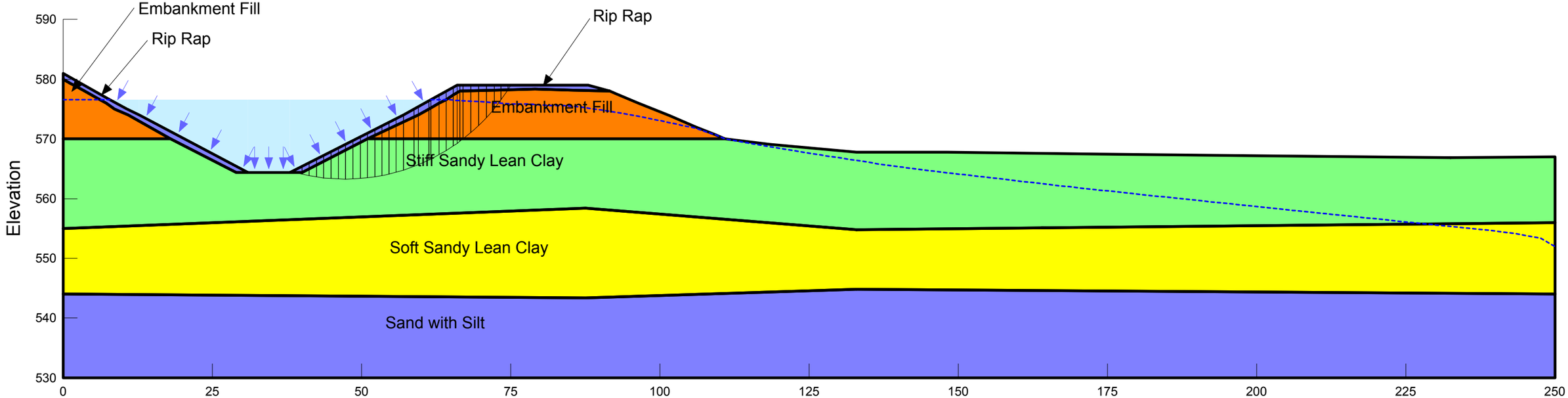
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.95

L04_50% PMF Surcharge Pool without Ash, Upstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Stiff Sandy Lean Clay	125	35	144
Soft Sandy Lean Clay	125	30	23
Sand With Silt	130	35	0
Rip Rap	140	35	0



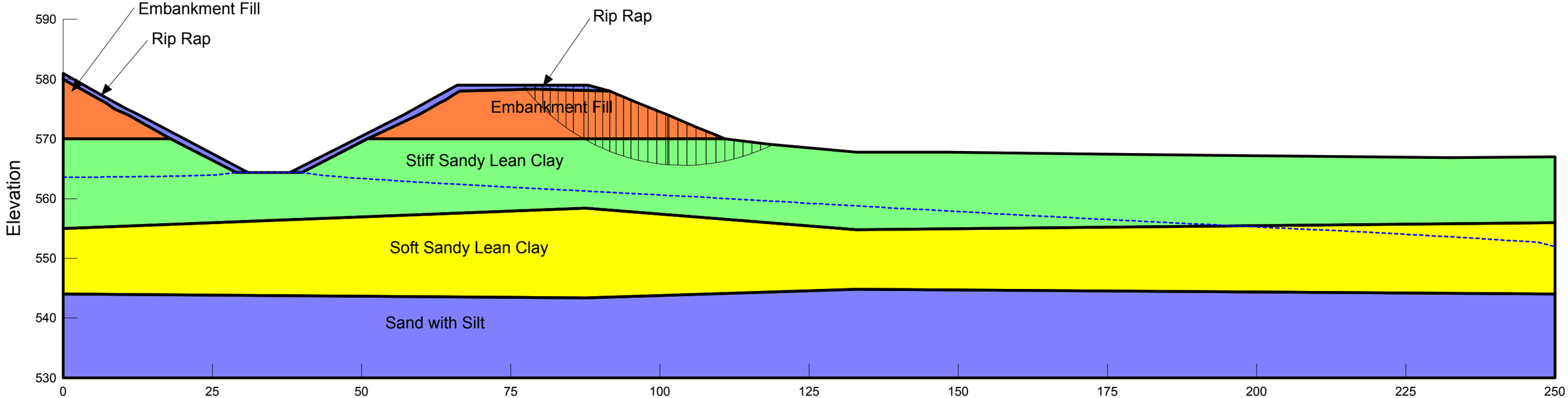
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.87

L05_Seismic_Normal Pool without Ash, Downstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Undrained Psuedostatic Strengths in the Downstream Direction
Horizontal Acc: 0.065g
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		**Undrained Strength Parameters**	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (seismic undrained)	125	30	30	18	200
Stiff Sandy Lean Clay (seismic undrained)	125	35	144	20	2,200
Soft Sandy Lean Clay (seismic undrained)	125	30	23	6	2,200
Sand With Silt (seismic undrained)	130	35	0	35	0
Rip Rap (seismic undrained)	140	35	0	35	0



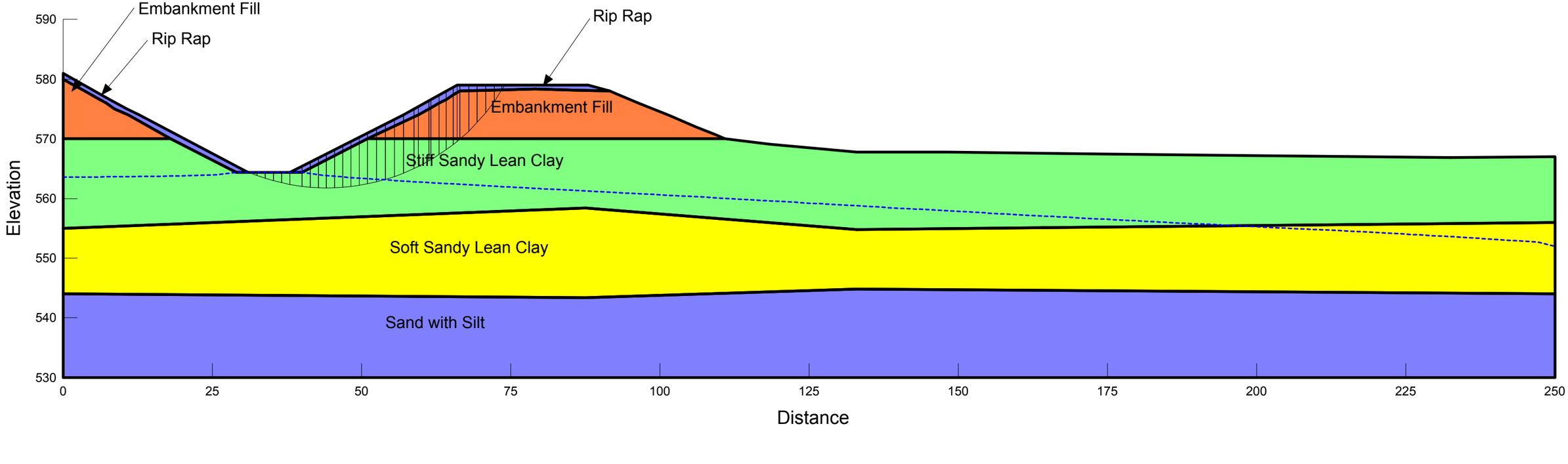
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.08

L06_Seismic_Normal Pool without Ash, Upstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Undrained Psuedostatic Strengths
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.065g
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		**Undrained Strength Parameters**	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (seismic undrained)	125	30	30	18	200
Stiff Sandy Lean Clay (seismic undrained)	125	35	144	20	2,200
Soft Sandy Lean Clay (seismic undrained)	125	30	23	6	2,200
Sand With Silt (seismic undrained)	130	35	0	35	0
Rip Rap (seismic undrained)	140	35	0	35	0



SECTION B-B', WITH ASH

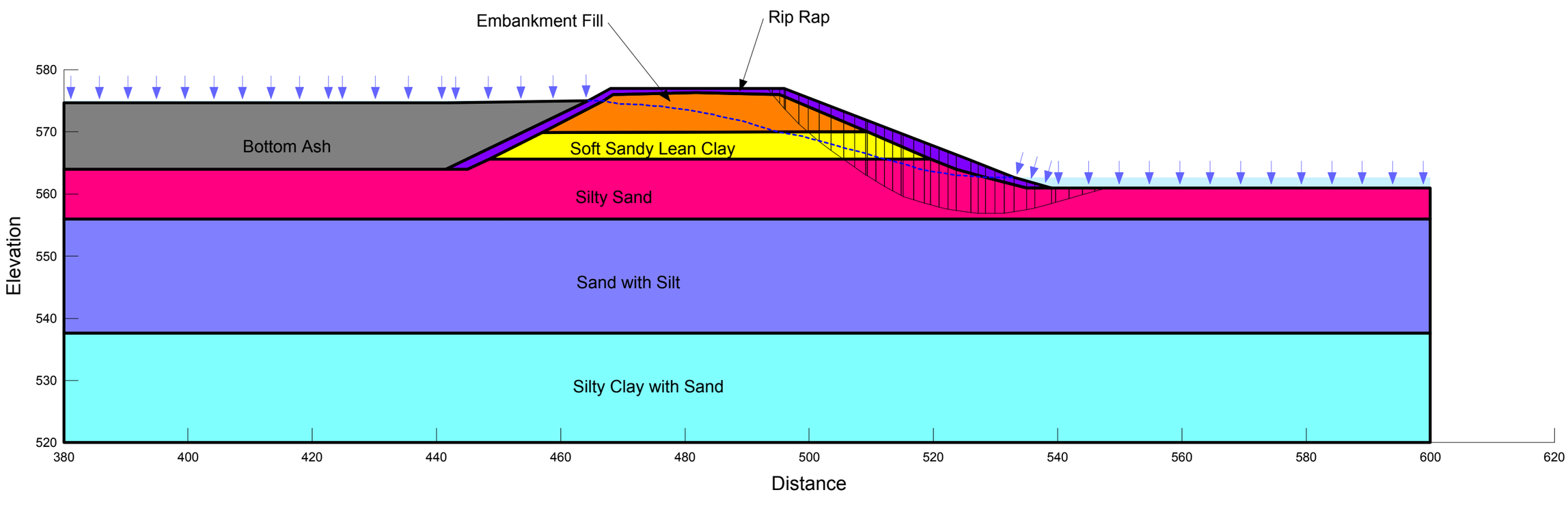
Factor of Safety = 1.64

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L01_Normal Pool with Ash, Downstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Bottom Ash	115	28	0
Rip Rap	140	35	0



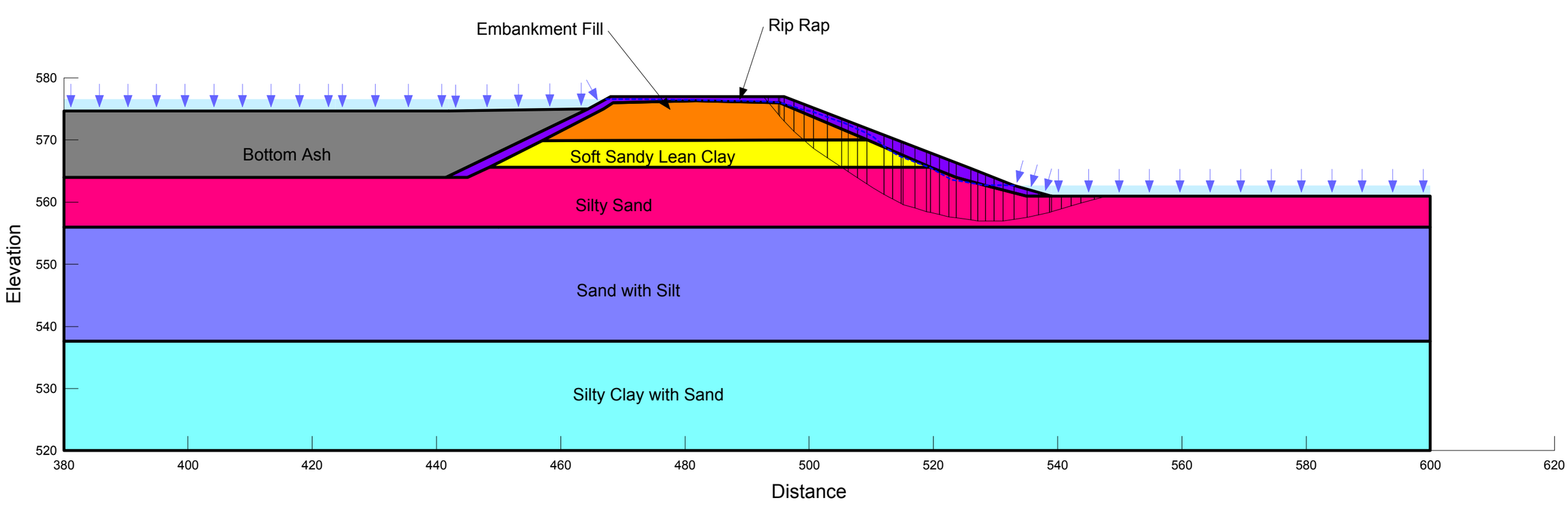
Factor of Safety = 1.49

American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L02_50% PMF Surcharge Pool with Ash, Downstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Bottom Ash	115	28	0
Rip Rap	140	35	0



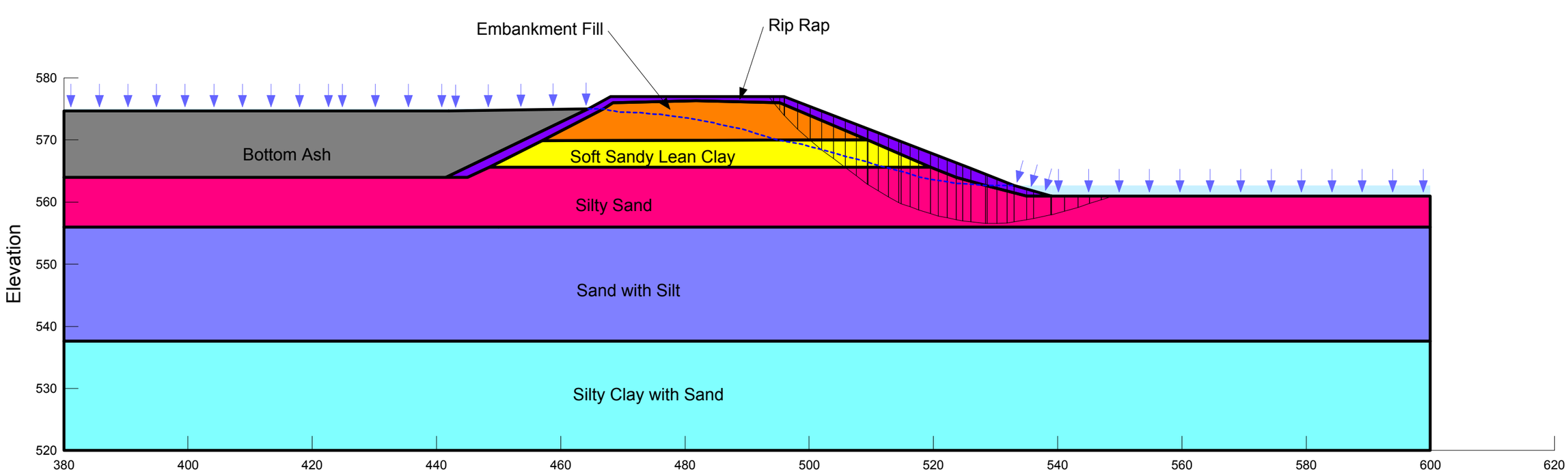
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

L03_Seismic_Normal Pool with Ash, Downstream Slope Failure
Normal Pool Elevation: 575.0 Feet
Undrained Psuedostatic Strength
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.065g
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Factor of Safety = 1.39

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (seismic undrained)	125	30	30	18	200
Soft Sandy Lean Clay (seismic undrained)	125	30	23	6	2,200
Silty Sand (seismic undrained)	130	35	0	35	0
Sand With Silt (seismic undrained)	130	35	0	35	0
Silty Clay With Sand (seismic undrained)	120	25	100	10	1,000
Bottom Ash (seismic undrained)	115	28	0	28	0
Rip Rap (seismic undrained)	140	35	0	35	0



SECTION B-B', WITHOUT ASH

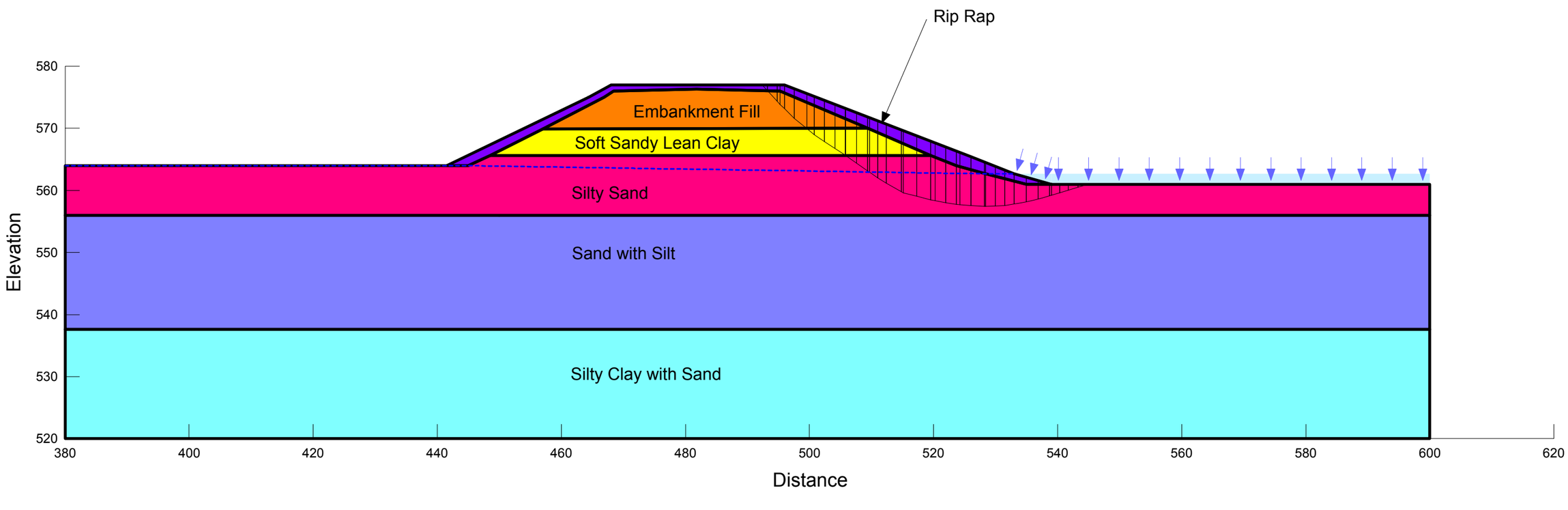
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.93

L01_Normal Pool without Ash, Downstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Rip Rap	140	35	0



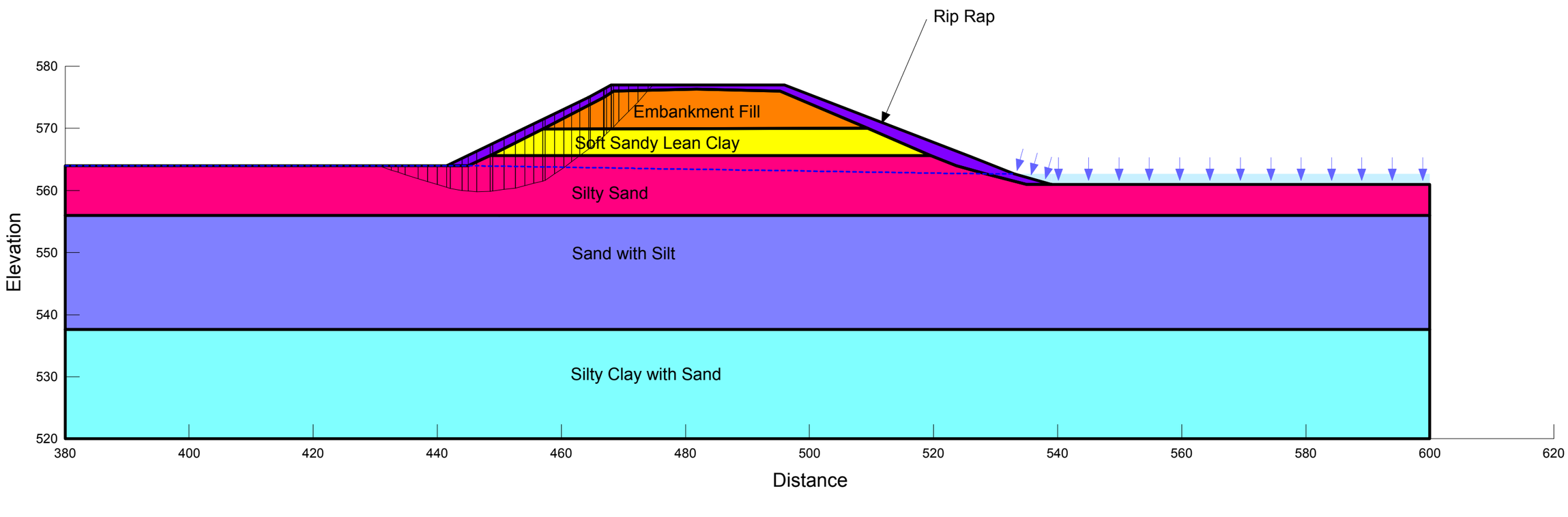
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.90

L02_Normal Pool without Ash, Upstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Rip Rap	140	35	0



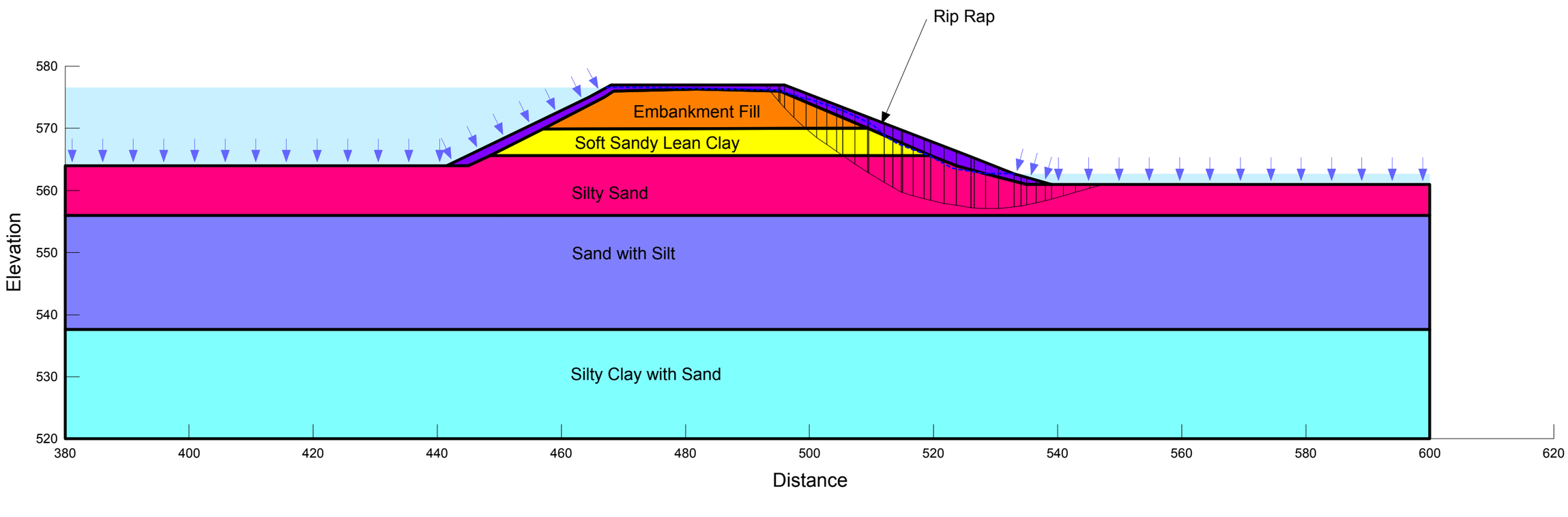
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.51

L03_50% PMF Surcharge Pool without Ash, Downstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Downstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Rip Rap	140	35	0



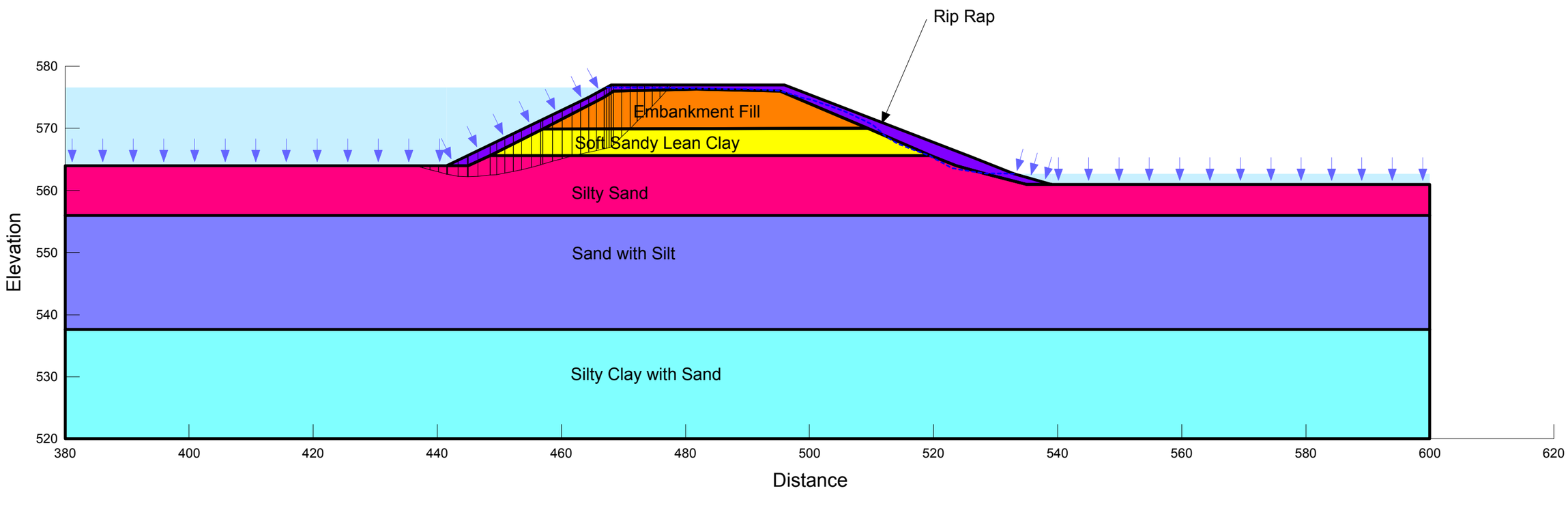
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 2.52

L04_50% PMF Surcharge Pool without Ash, Upstream Slope Failure
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Incipient Motion in the Upstream Direction
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Embankment Fill	125	30	30
Soft Sandy Lean Clay	125	30	23
Silty Sand	130	35	0
Sand With Silt	130	35	0
Silty Clay With Sand	120	25	100
Rip Rap	140	35	0



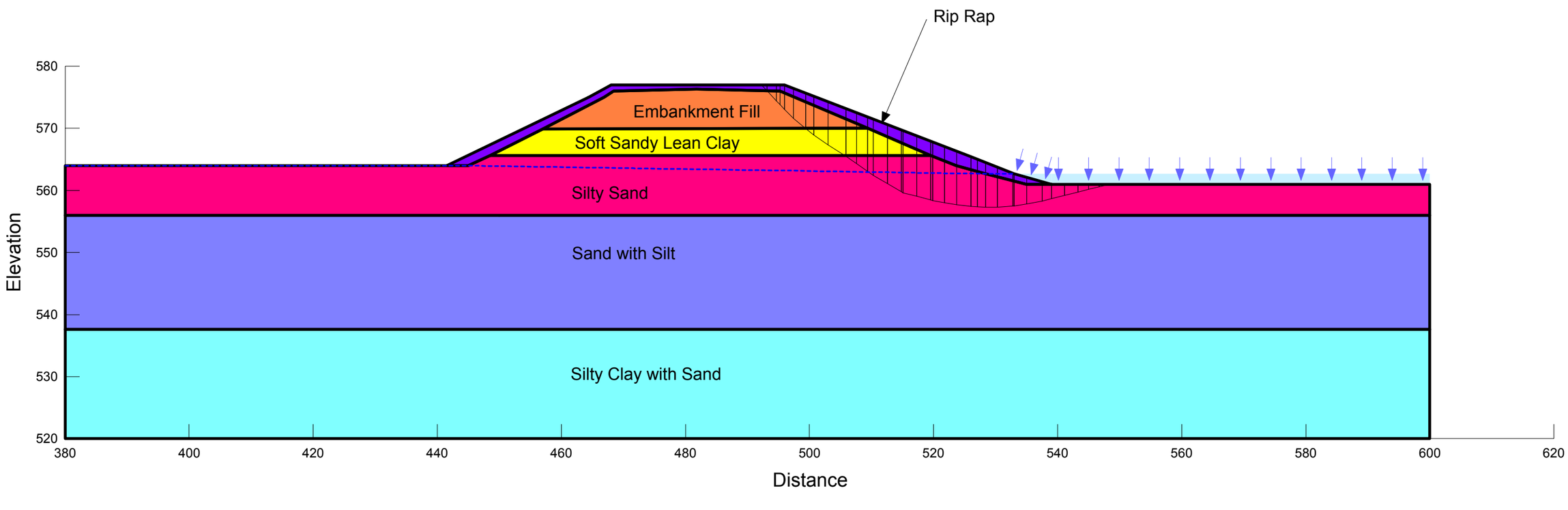
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.63

L05_Sesimic_Normal Pool without Ash, Downstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Undrained psuedostatic Strength
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.065g
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (seismic undrained)	125	30	30	18	200
Soft Sandy Lean Clay (seismic undrained)	125	30	23	6	2,200
Silty Sand (seismic undrained)	130	35	0	35	0
Sand With Silt (seismic undrained)	130	35	0	35	0
Silty Clay With Sand (seismic undrained)	120	25	100	10	1,000
Rip Rap (seismic undrained)	140	35	0	35	0



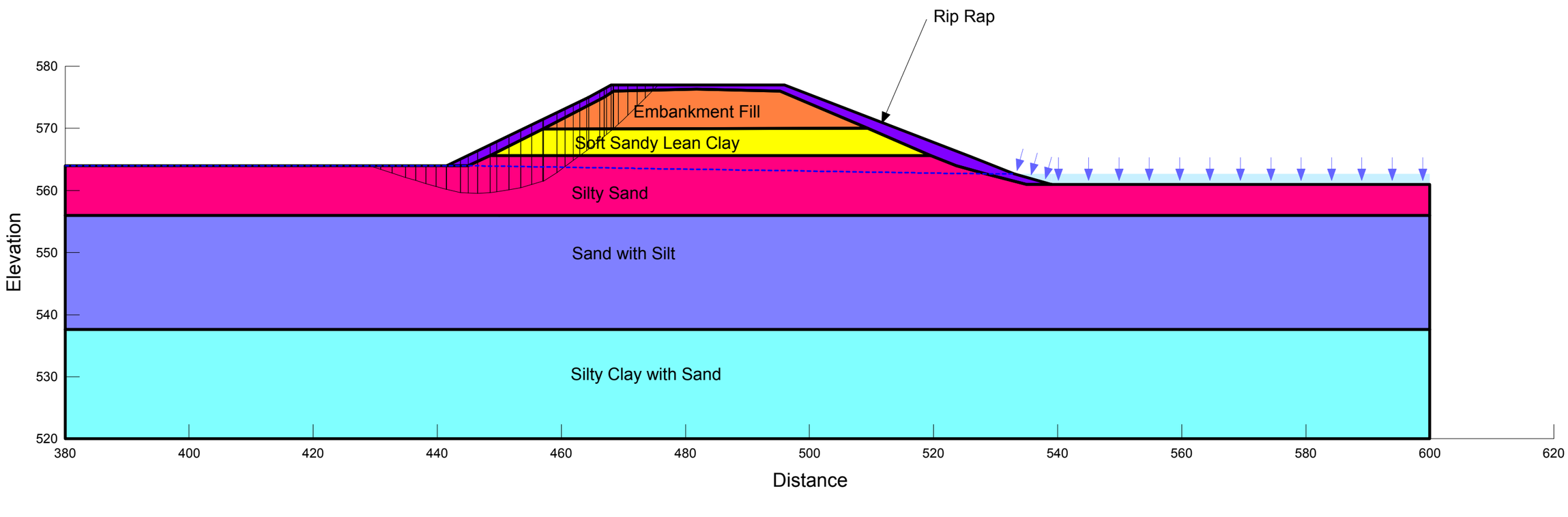
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.64

L06_Seismic_Normal Pool without Ash, Upstream Slope Failure
Normal Pool Elevation: 564.0 Feet
Undrained psuedostatic Strength
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.065g
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment Fill (seismic undrained)	125	30	30	18	200
Soft Sandy Lean Clay (seismic undrained)	125	30	23	6	2,200
Silty Sand (seismic undrained)	130	35	0	35	0
Sand With Silt (seismic undrained)	130	35	0	35	0
Silty Clay With Sand (seismic undrained)	120	25	100	10	1,000
Rip Rap (seismic undrained)	140	35	0	35	0



FLY ASH POND MAIN DAM, 2015

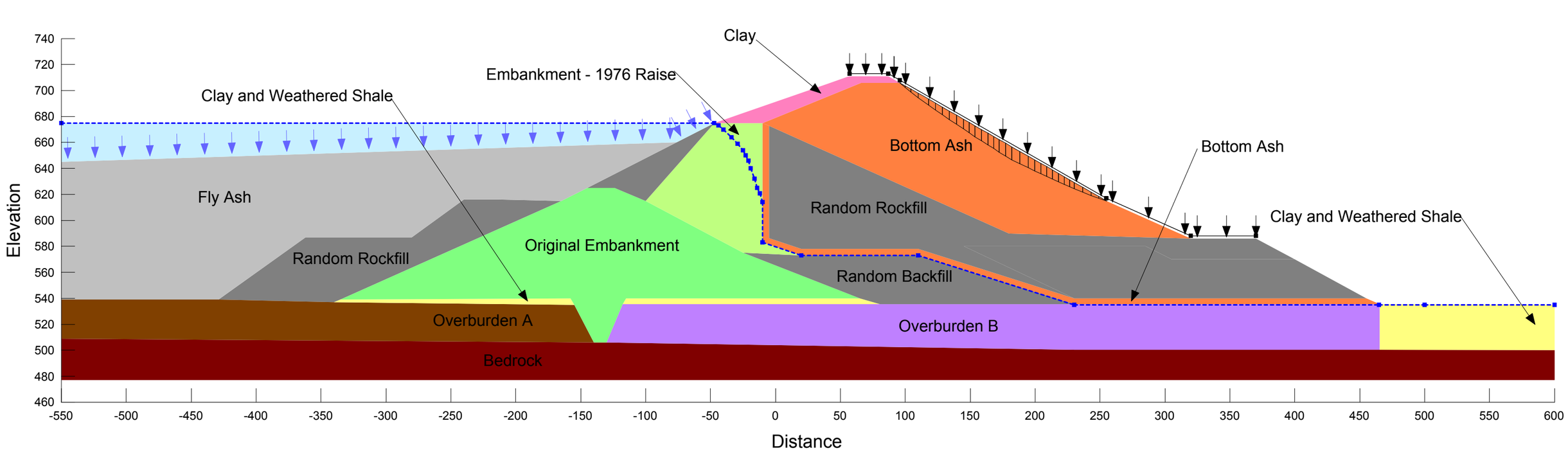
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.56

L01_Existing Pool, Downstream Slope Failure
Existing Pool Elevation: 675 Feet
Drained Static Strengths
Incipient Motion in the
Downstream Direction

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Drained)	135	23	1000
Embankment - 1976 Raise (Drained)	135	25	0
Original Embankment (Drained)	130	25	0
Random Rockfill (Drained)	110	26	320
Bottom Ash (Drained)	70	41	0
Overburden A (Drained)	135	25	0
Overbruden B (Drained)	135	23	1000
Clay (Drained)	135	20	340
Fly Ash (Drained)	104	30	0
Bedrock			



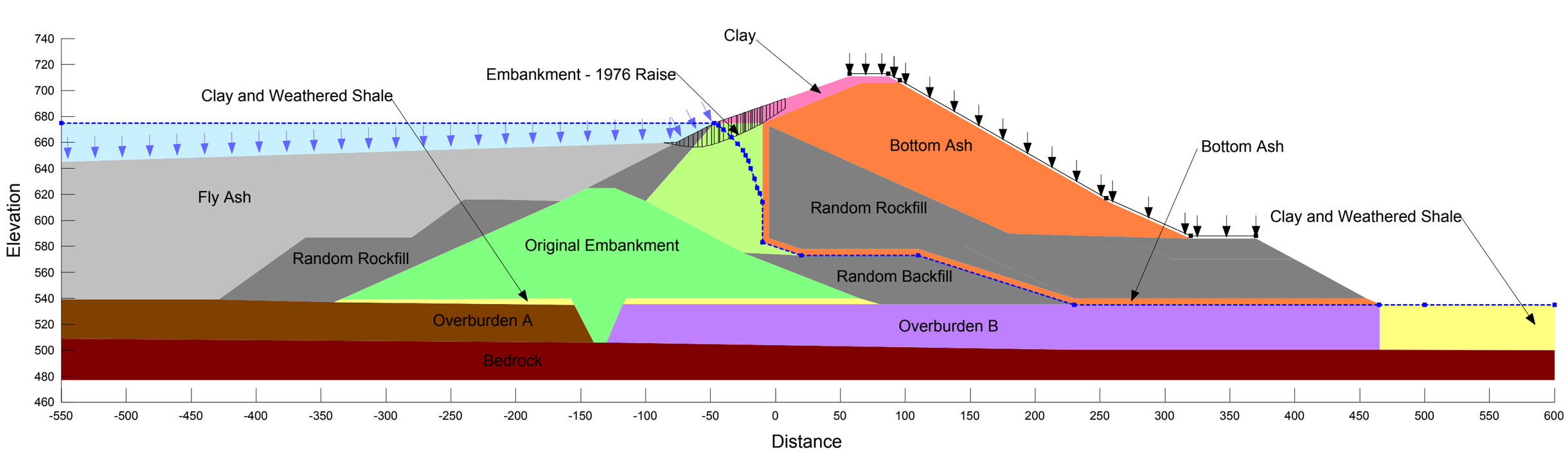
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.67

L02_Existing Pool, Upstream Slope Failure
Existing Pool Elevation: 675 Feet
Drained Static Strengths
Incipient Motion in the
Upstream Direction

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Drained)	135	23	1000
Embankment - 1976 Raise (Drained)	135	25	0
Original Embankment (Drained)	130	25	0
Random Rockfill (Drained)	110	26	320
Bottom Ash (Drained)	70	41	0
Overburden A (Drained)	135	25	0
Overbruden B (Drained)	135	23	1000
Clay (Drained)	135	20	340
Fly Ash (Drained)	104	30	0
Bedrock			



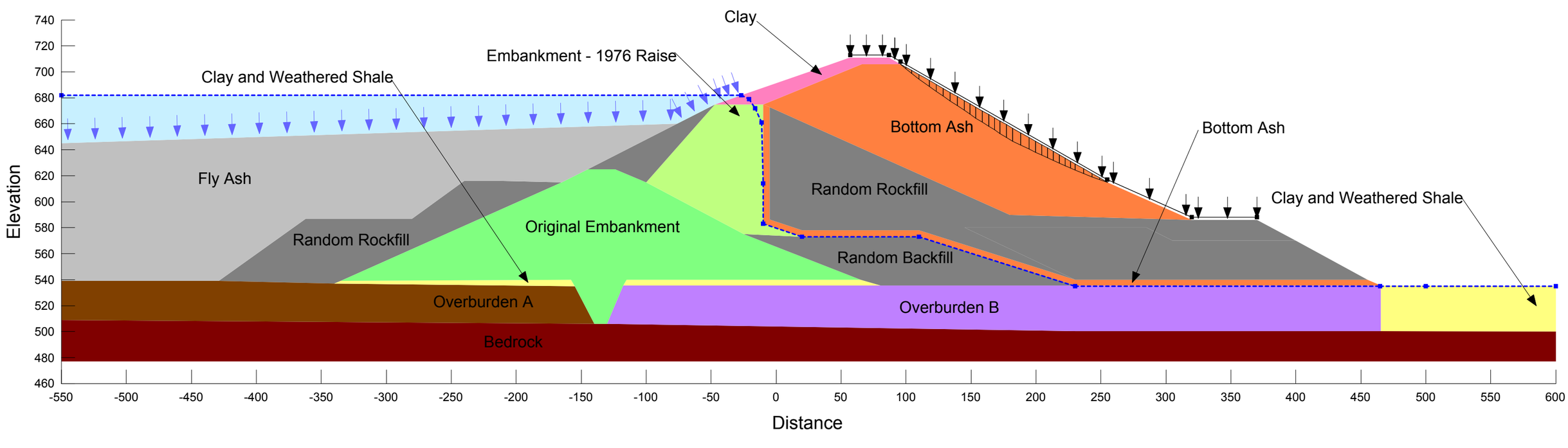
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.56

L03_PMF Surcharge, Downstream Slope Failure
PMF Pool Elevation: 710.5 Feet
Drained Static Strengths
Incipient Motion in the
Downstream Direction

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Drained)	135	23	1000
Embankment - 1976 Raise (Drained)	135	25	0
Original Embankment (Drained)	130	25	0
Random Rockfill (Drained)	110	26	320
Bottom Ash (Drained)	70	41	0
Overburden A (Drained)	135	25	0
Overbruden B (Drained)	135	23	1000
Clay (Drained)	135	20	340
Fly Ash (Drained)	104	30	0
Bedrock			



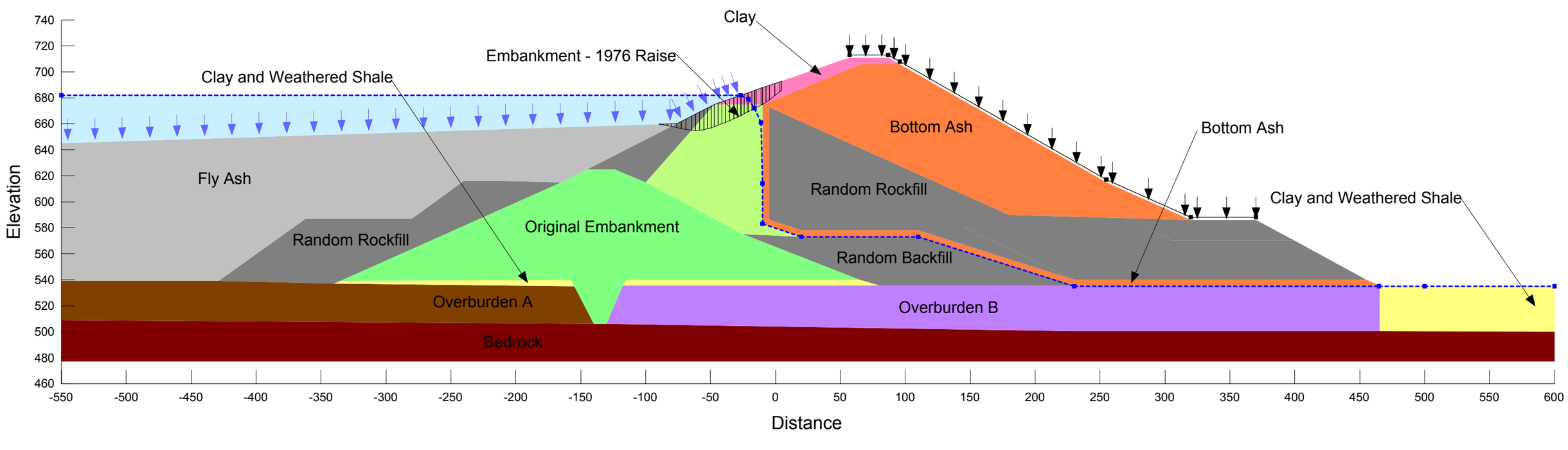
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.68

L04_PMF Surcharge, Upstream Slope Failure
PMF Pool Elevation: 710.5 Feet
Drained Static Strengths
Incipient Motion in the
Upstream Direction

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Drained)	135	23	1000
Embankment - 1976 Raise (Drained)	135	25	0
Original Embankment (Drained)	130	25	0
Random Rockfill (Drained)	110	26	320
Bottom Ash (Drained)	70	41	0
Overburden A (Drained)	135	25	0
Overbruden B (Drained)	135	23	1000
Clay (Drained)	135	20	340
Fly Ash (Drained)	104	30	0
Bedrock			



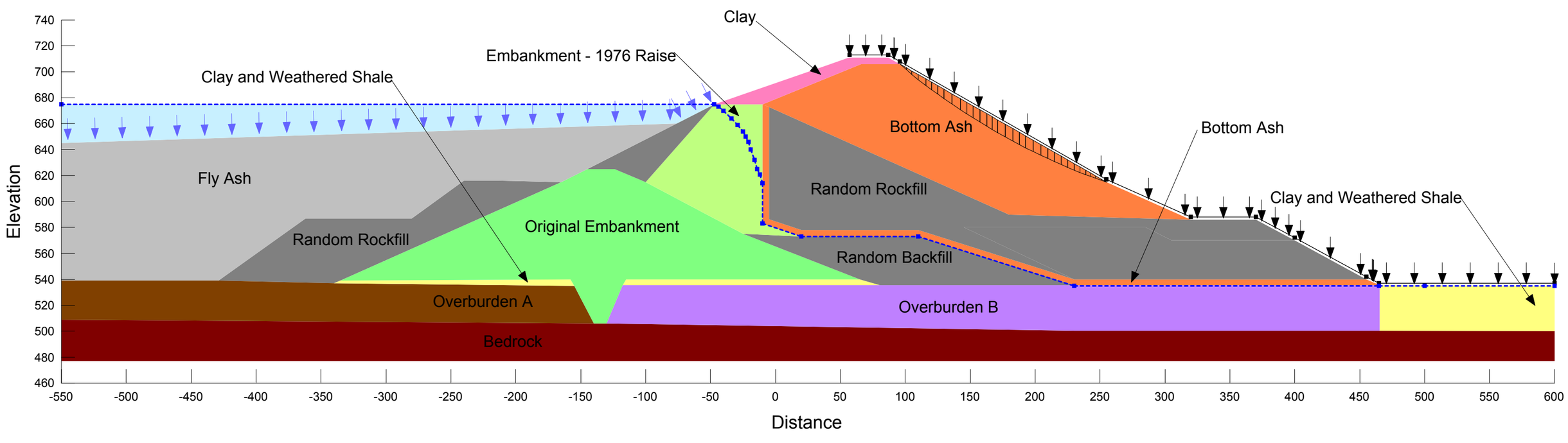
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.45

L05_Seismic_Existing Pool, Downstream Slope Failure
Existing Pool Elevation: 675 Feet
Undrained Static Strengths
Incipient Motion in the
Downstream Direction
Horizontal Acc. = 0.065g

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Undrained)	135	23	1000	16	2,200
Embankment - 1976 Raise (Undrained)	135	25	0	20	1,600
Original Embankment (Undrained)	130	25	0	20	1,600
Random Rockfill (Undrained)	110	26	320	22	675
Bottom Ash (Undrained)	70	41	0	41	0
Overburden A (Undrained)	135	25	0	18	1,200
Overbruden B (Undrained)	135	23	1000	16	2,200
Clay (Undrained)	135	20	340	13	660
Fly Ash (Undrained)	104	30	0	30	0
Bedrock					



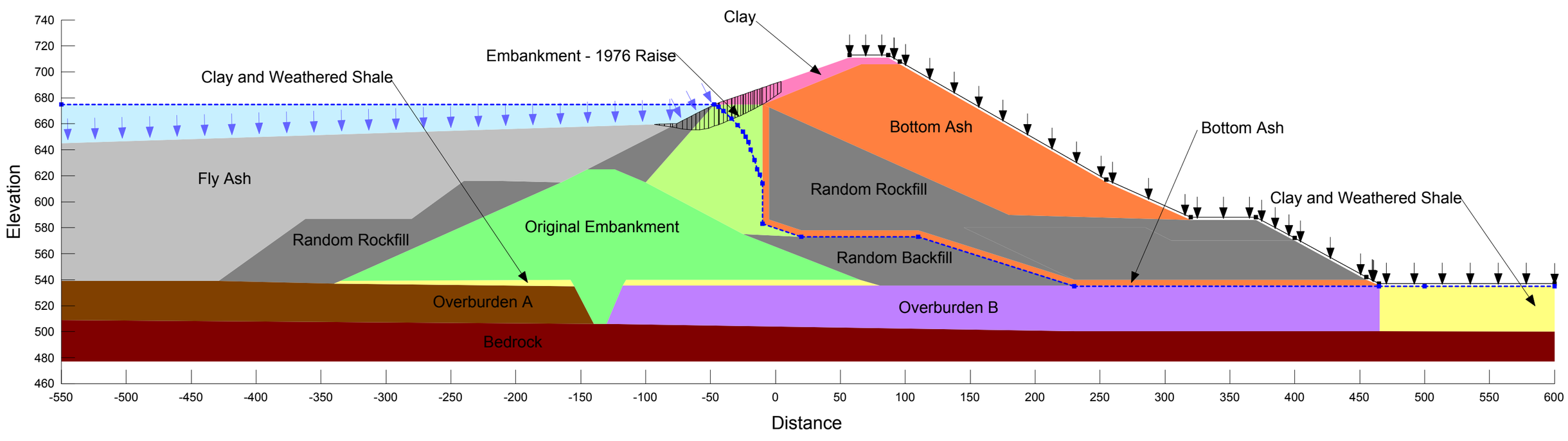
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.38

L06_Seismic, Existing Pool, Upstream Slope Failure
Existing Pool Elevation: 675 Feet
Undrained Static Strengths
Incipient Motion in the
Upstream Direction
Horizontal Acc. = 0.065g

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Undrained)	135	23	1000	16	2,200
Embankment - 1976 Raise (Undrained)	135	25	0	20	1,600
Original Embankment (Undrained)	130	25	0	20	1,600
Random Rockfill (Undrained)	110	26	320	22	675
Bottom Ash (Undrained)	70	41	0	41	0
Overburden A (Undrained)	135	25	0	18	1,200
Overbruden B (Undrained)	135	23	1000	16	2,200
Clay (Undrained)	135	20	340	13	660
Fly Ash (Undrained)	104	30	0	30	0
Bedrock					



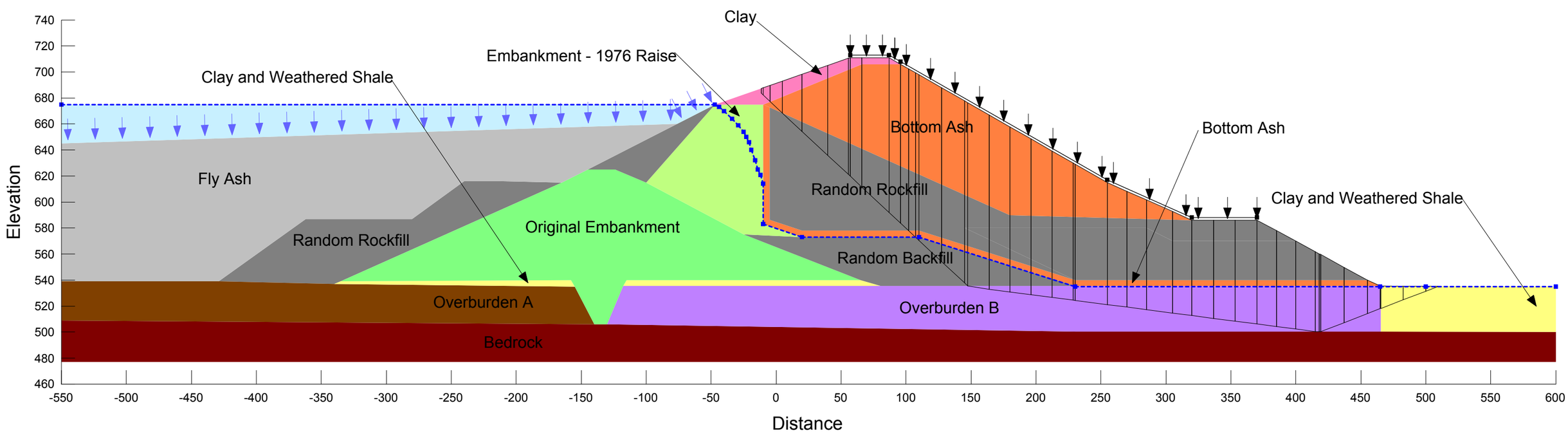
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.92

L07_Existing Pool, Downstream Slope Failure
Existing Pool Elevation: 675 Feet
Drained Static Strengths
Incipient Motion in the
Downstream Direction

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

	Drained Strength Parameters		
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay and Weathered Shale (Drained)	135	23	1000
Embankment - 1976 Raise (Drained)	135	25	0
Original Embankment (Drained)	130	25	0
Random Rockfill (Drained)	110	26	320
Bottom Ash (Drained)	70	41	0
Overburden A (Drained)	135	25	0
Overbruden B (Drained)	135	23	1000
Clay (Drained)	135	20	340
Fly Ash (Drained)	104	30	0
Bedrock			



FLY ASH POND SADDLE DAM, 2015

American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.52

L01_Existing Pool_Downstream Slope Failure
Existing Pool Elevation: 675 Feet
Drained Static Strengths
Incipient Motion in the
Downstream Direction

Material	Drained Strength Parameters		
	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay (Drained)	135	20	340
Bottom Ash (Drained)	70	41	0
Overburden (Drained)	135	34	0
Bedrock			

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.95

L02_Existing Pool_Upstream Slope Failure
Existing Pool Elevation: 675 Feet
Drained Static Strengths
Incipient Motion in the
Upstream Direction

Material	Drained Strength Parameters		
	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay (Drained)	135	20	340
Bottom Ash (Drained)	70	41	0
Overburden (Drained)	135	34	0
Bedrock			

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.52

L03_PMF Surcharge_Downstream Slope Failure
PMF Pool Elevation: 682 Feet
Drained Static Strengths
Incipient Motion in the
Downstream Direction

Material	Drained Strength Parameters		
	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay (Drained)	135	20	340
Bottom Ash (Drained)	70	41	0
Overburden (Drained)	135	34	0
Bedrock			

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

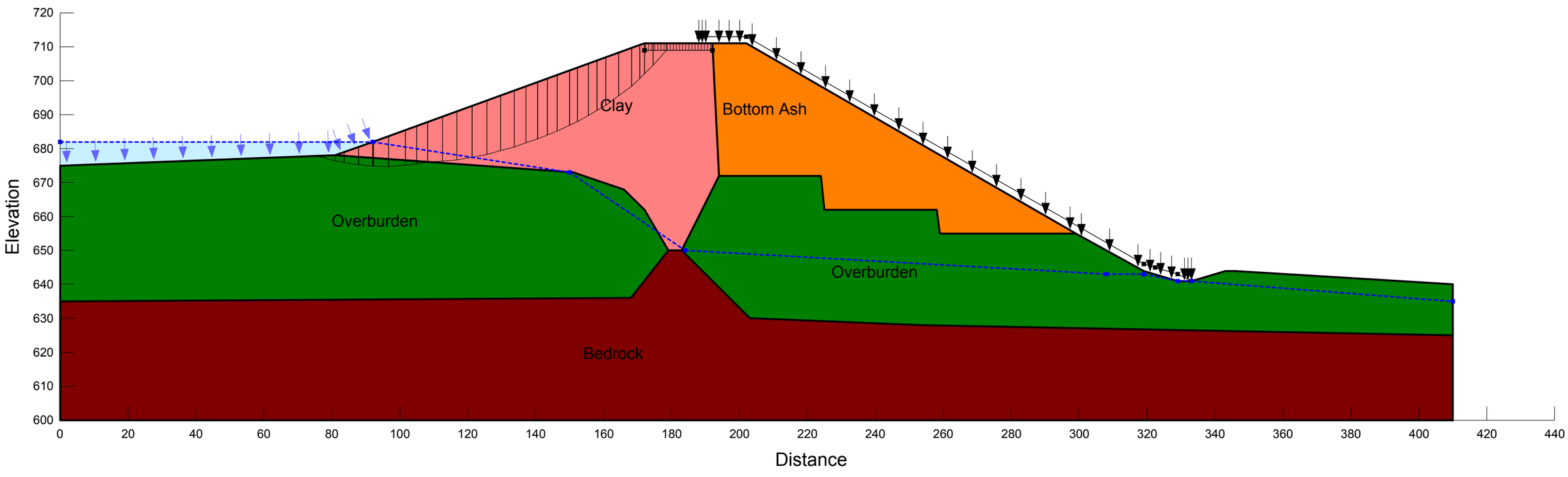
American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.88

L04_PMF Surcharge, Upstream Slope Failure
PMF Pool Elevation: 682 Feet
Drained Static Strengths
Incipient Motion in the
Upstream Direction

Material	Drained Strength Parameters		
	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
Clay (Drained)	135	20	340
Bottom Ash (Drained)	70	41	0
Overburden (Drained)	135	34	0
Bedrock			

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



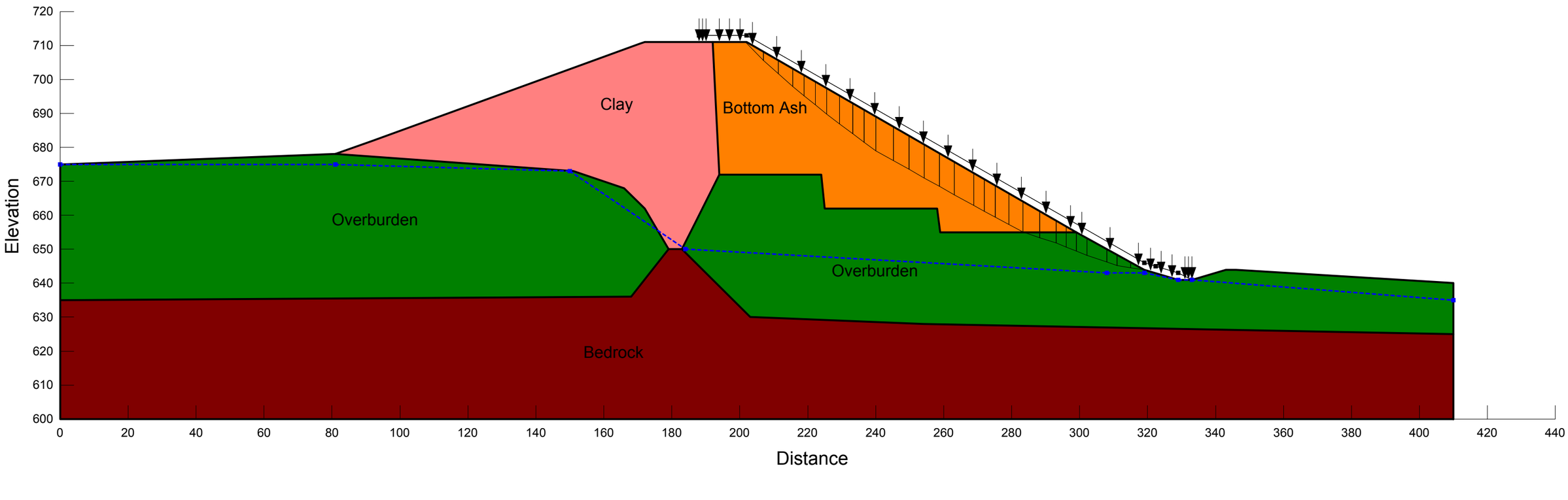
American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.39

L05_Seismic_Existing Pool, Downstream Slope Failure
Existing Pool Elevation: 675 Feet
Undrained Static Strengths
Incipient Motion in the
Downstream Direction
Horizonta Acc. = 0.065g

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Clay (Undrained)	135	20	340	13	660
Bottom Ash (Undrained)	70	41	0	41	0
Overburden (Undrained)	135	34	0	25	800
Bedrock					

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.



American Electric Power (AEP)
Big Sandy Fly Ash Saddle Dam
Louisa, Kentucky
CCR Mandate

Factor of Safety = 1.64

L06_Seismic_Existing Pool, Upstream Slope Failure
Existing Pool Elevation: 675 Feet
Undrained Static Strengths
Incipient Motion in the
Upstream Direction
Horizonta Acc. = 0.065g

		Drained Strength Parameters		Undrained Strength Parameters	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Clay (Undrained)	135	20	340	13	660
Bottom Ash (Undrained)	70	41	0	41	0
Overburden (Undrained)	135	34	0	25	800
Bedrock					

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

SEEP MODELS, 2015

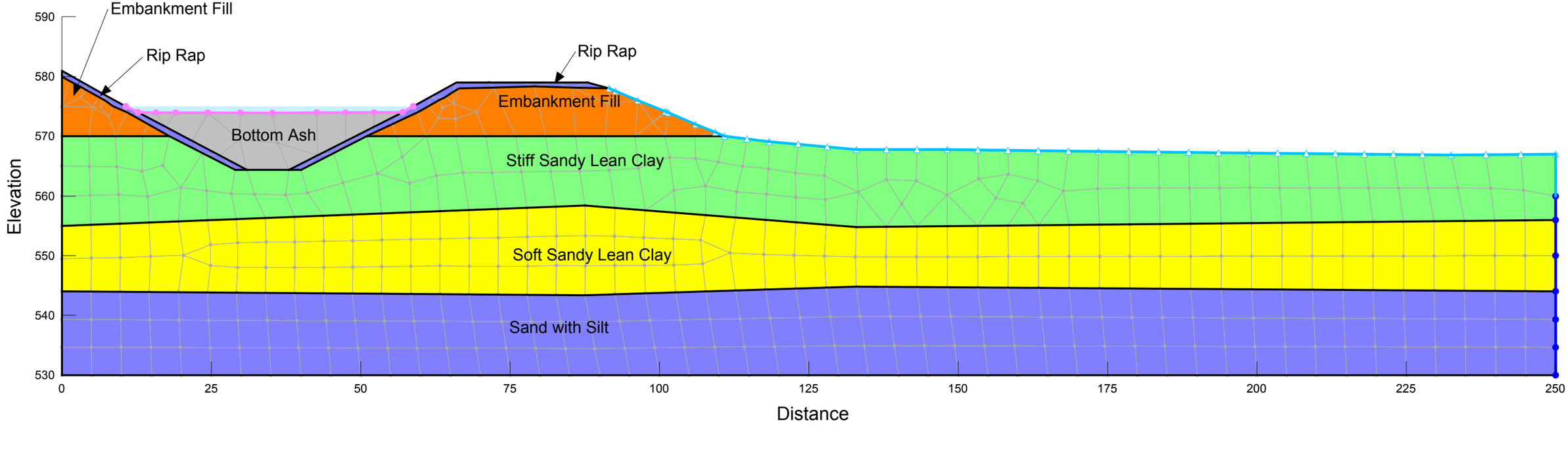
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



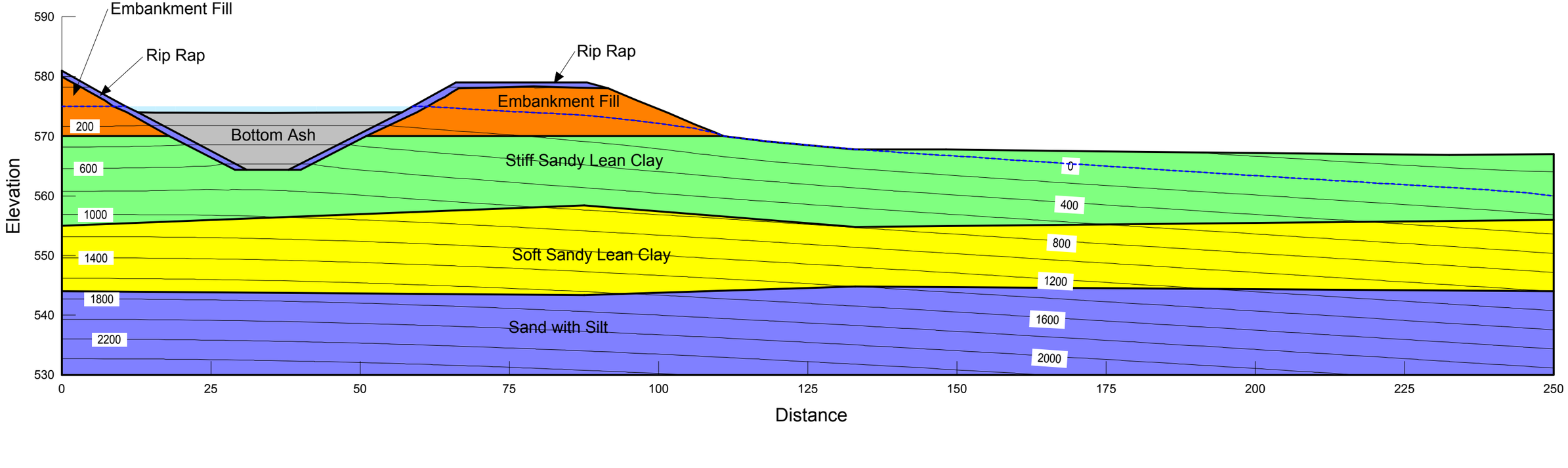
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Pore Water Pressure Contour (psf)

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



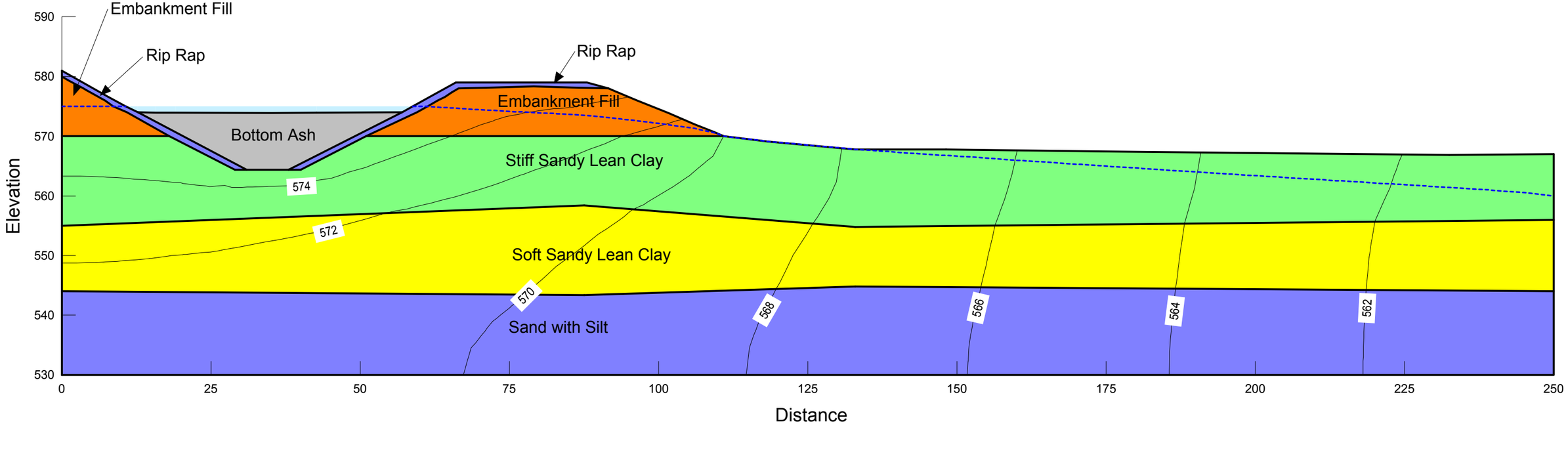
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Total Head Contour (feet)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



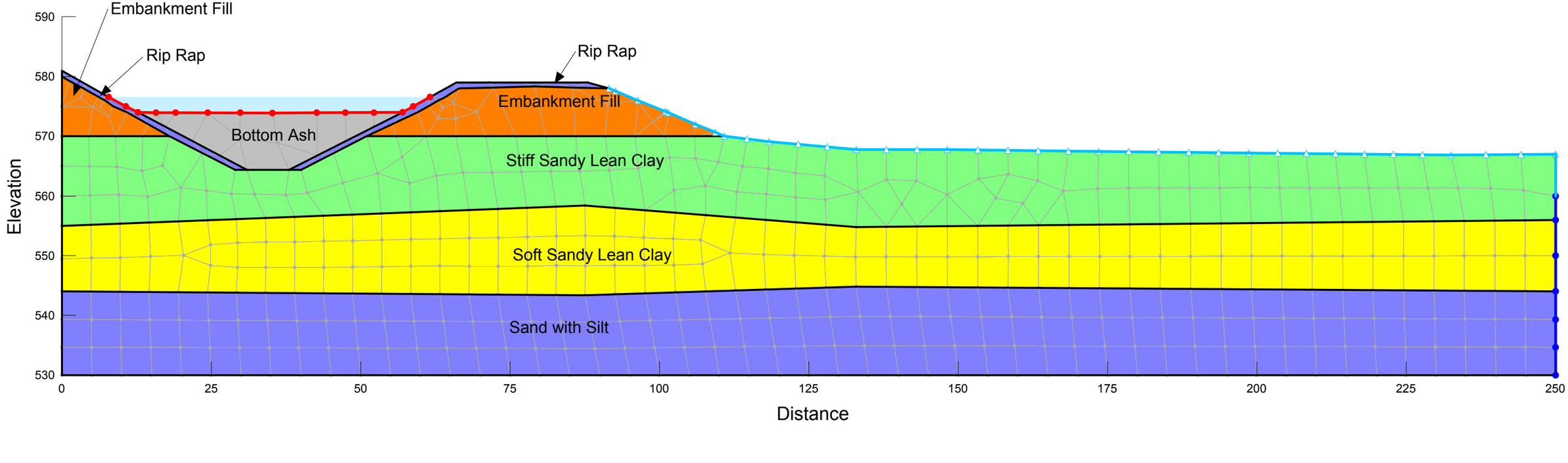
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



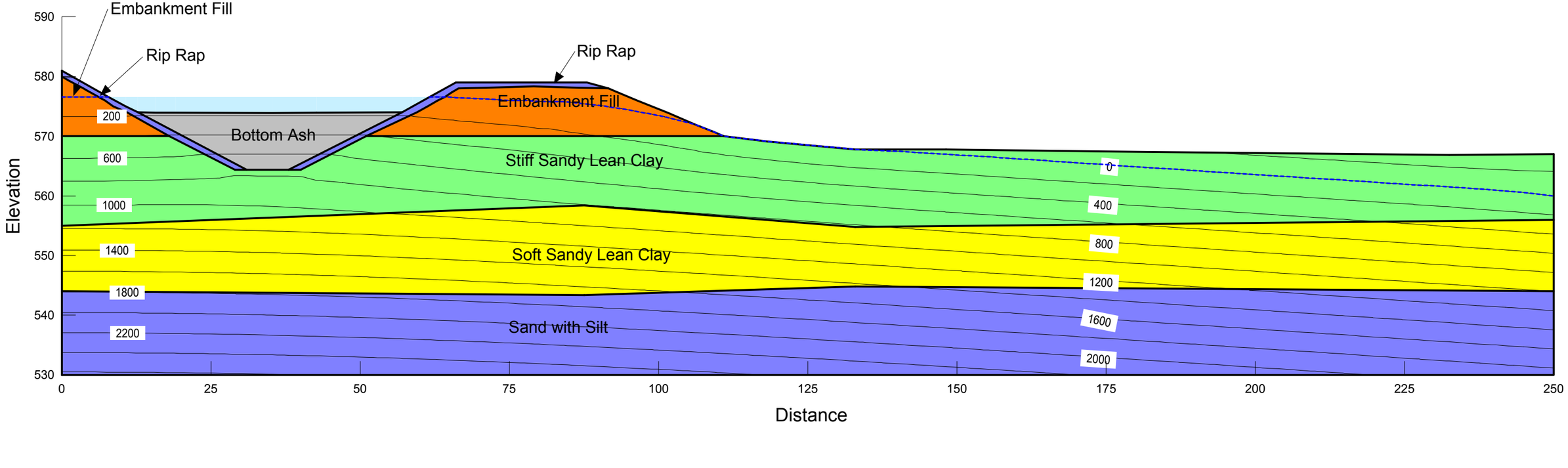
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Pore Water Pressure Contour (psf)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



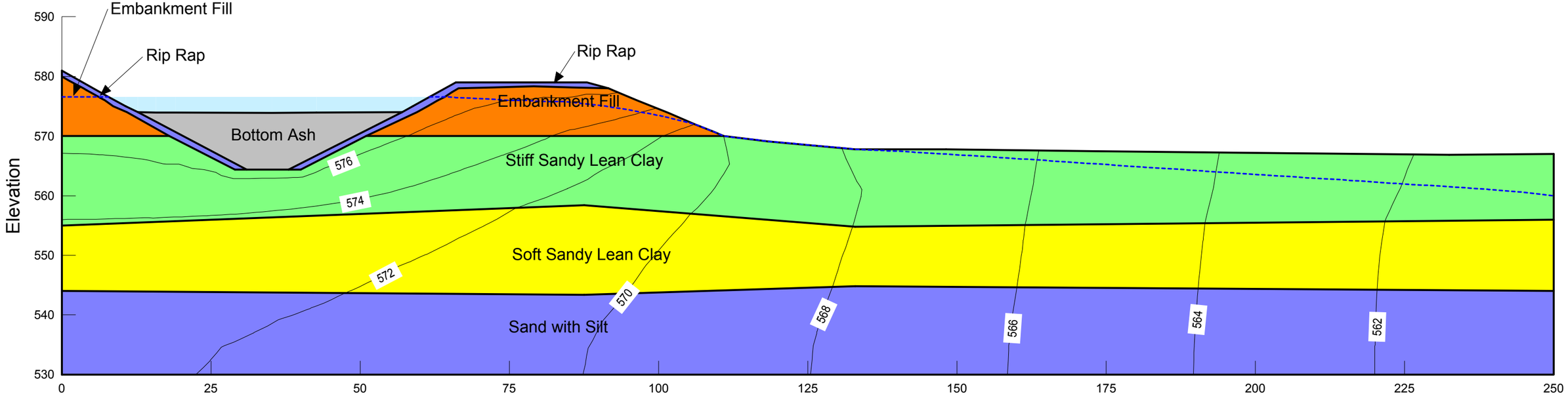
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Total Head Contour (feet)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill (drained)	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay (drained)	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay (drained)	2.8e-009	0.1	0.4	0.109
Sand With Silt (drained)	2.03e-009	0.1	0.35	0.03
Bottom Ash (drained)	3.03e-006	0.1	0.3548	0.027
Rip Rap (drained)	0.1	0.1	4	0



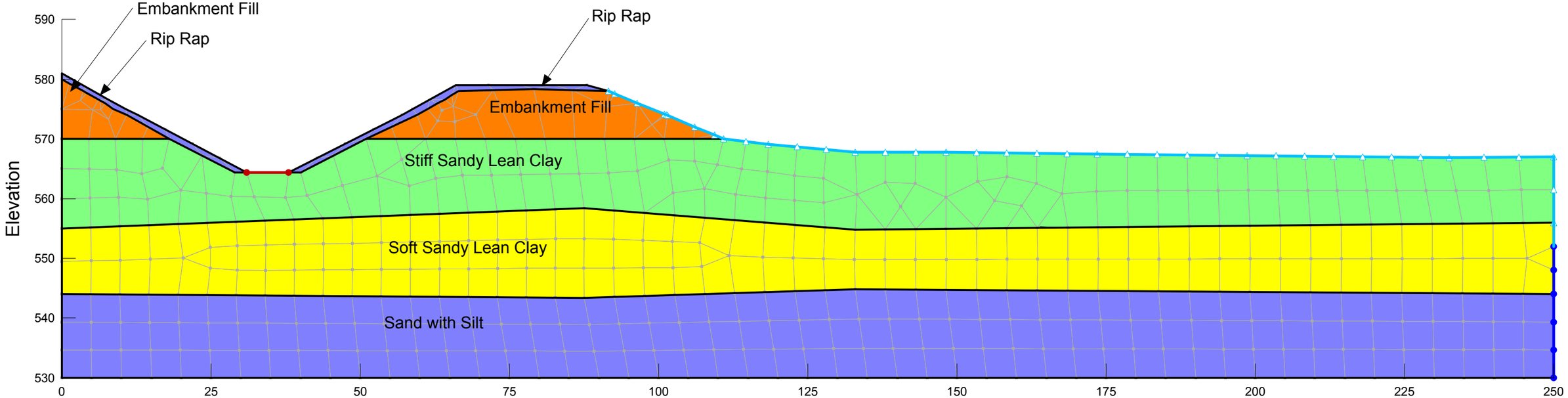
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Boundary Condition and Mesh

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



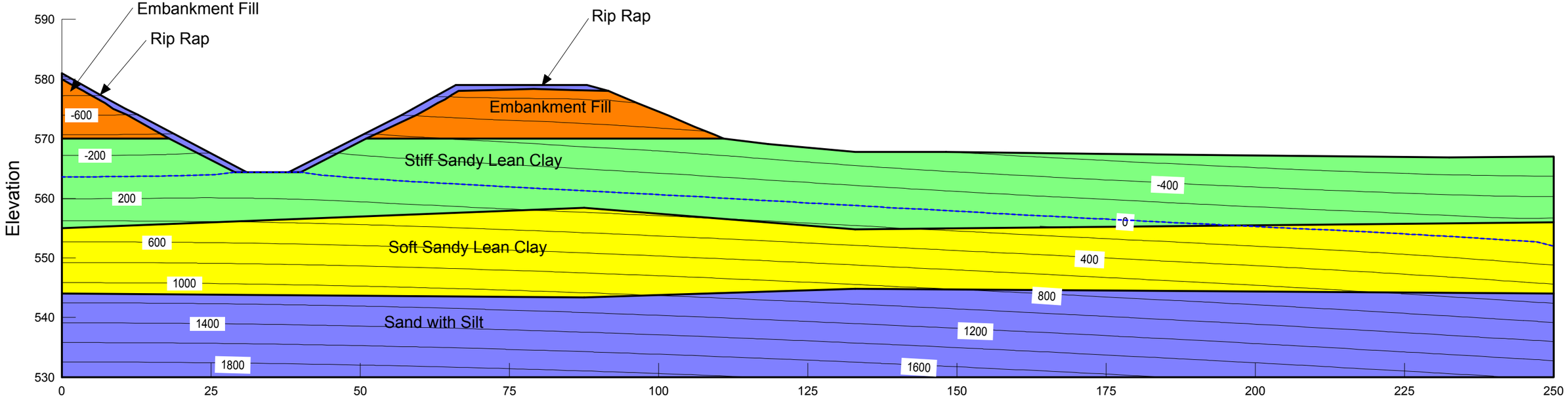
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Pore Water Pressure Contour (psf)

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



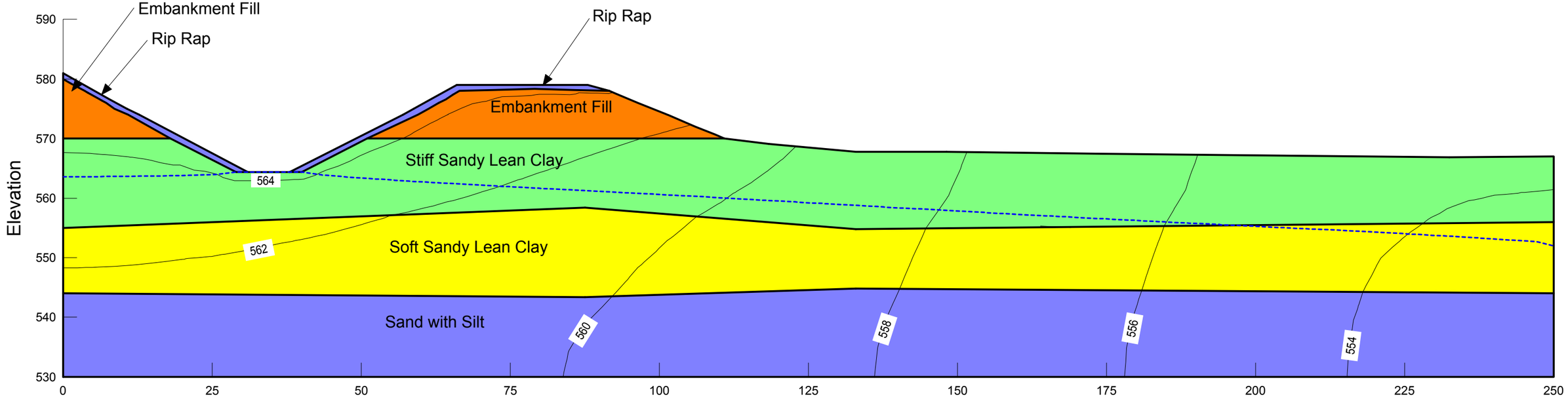
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Total Head Contour (feet)

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



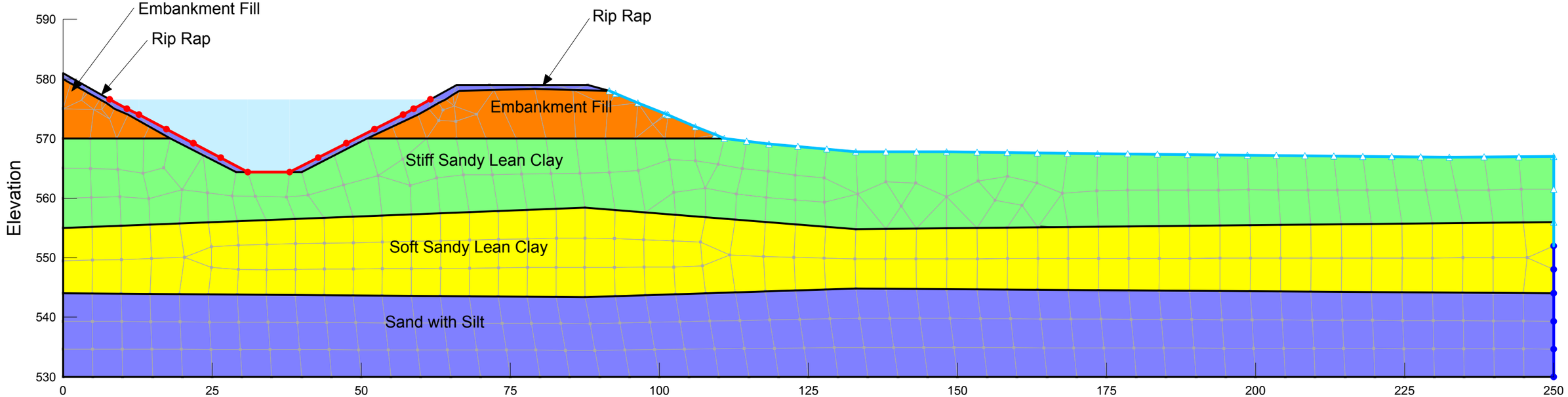
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Boundary Condition and Mesh

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



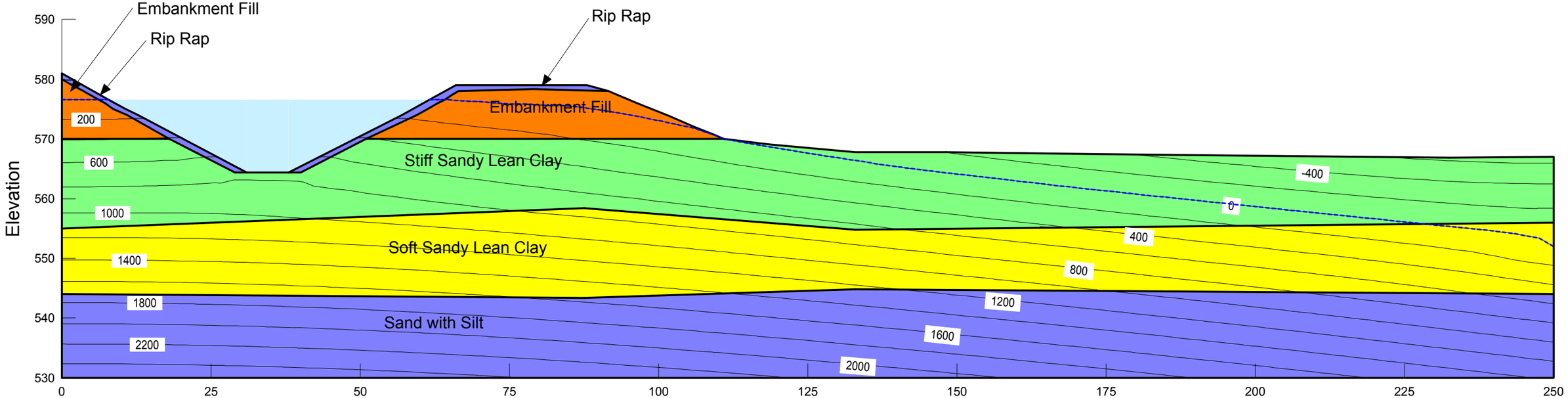
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Pore Water Pressure Contour (psf)

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



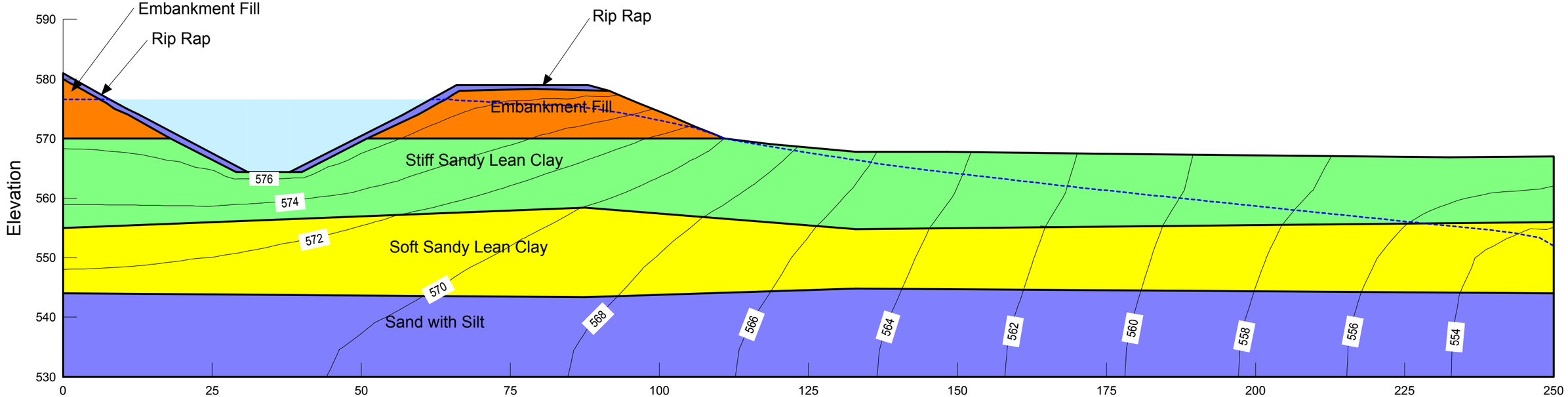
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Total Head Contour (feet)

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section A-A'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Stiff Sandy Lean Clay	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Sand With Silt	2.03e-009	0.1	0.35	0.03
Rip Rap	0.1	0.1	4	0



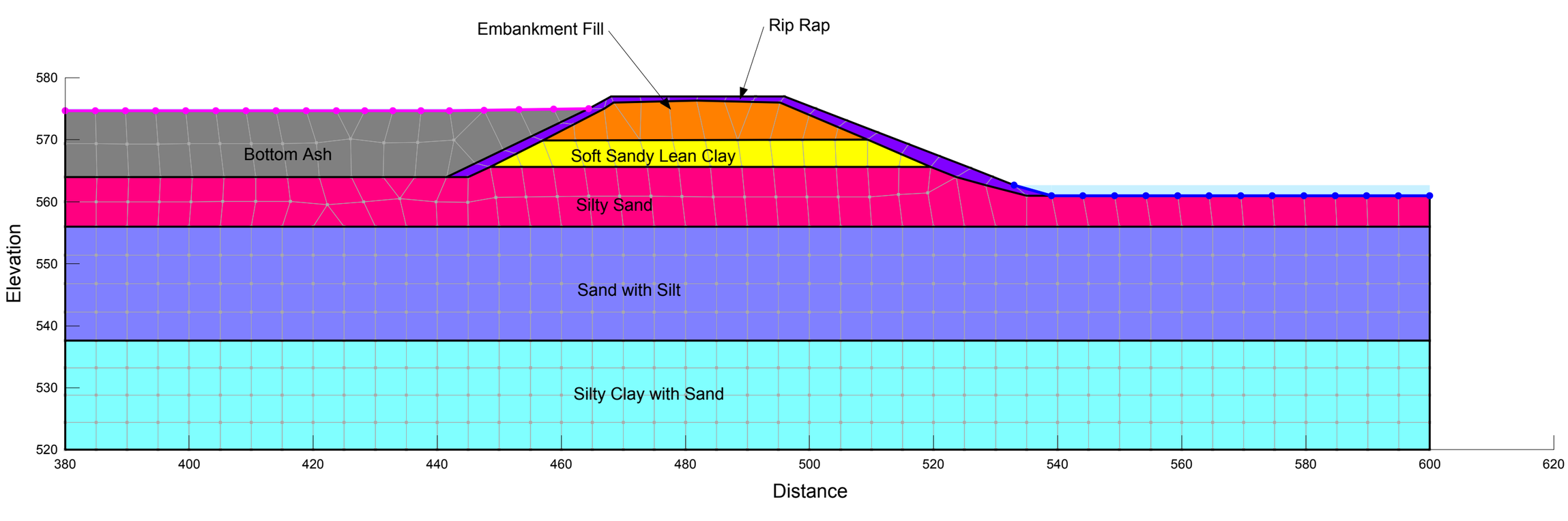
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



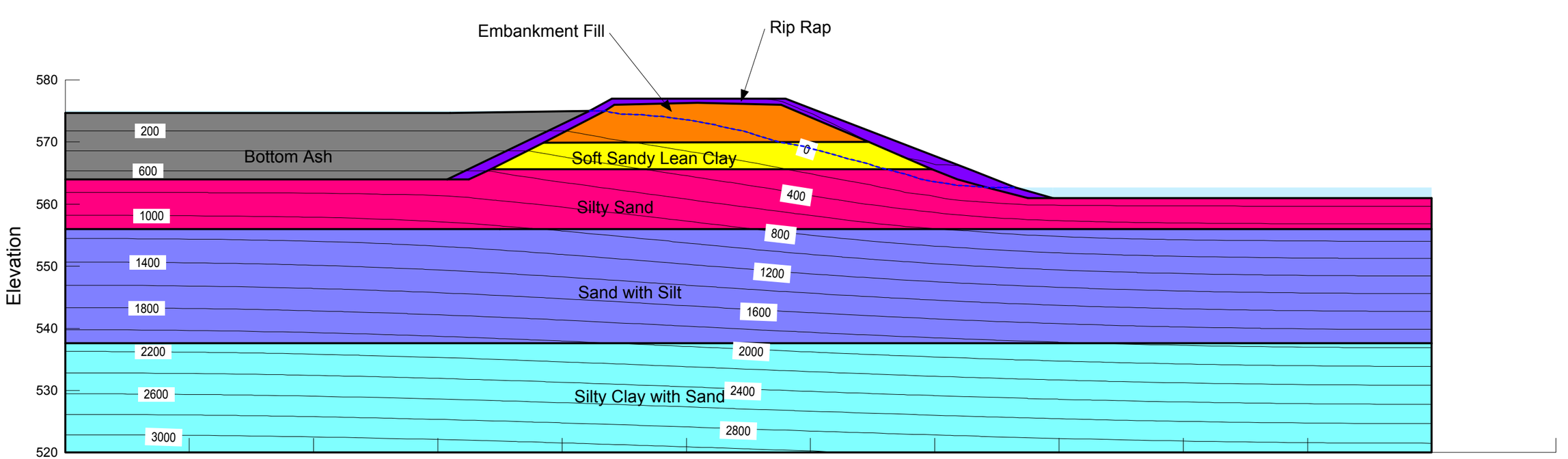
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Pore Water Pressure Contour (psf)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



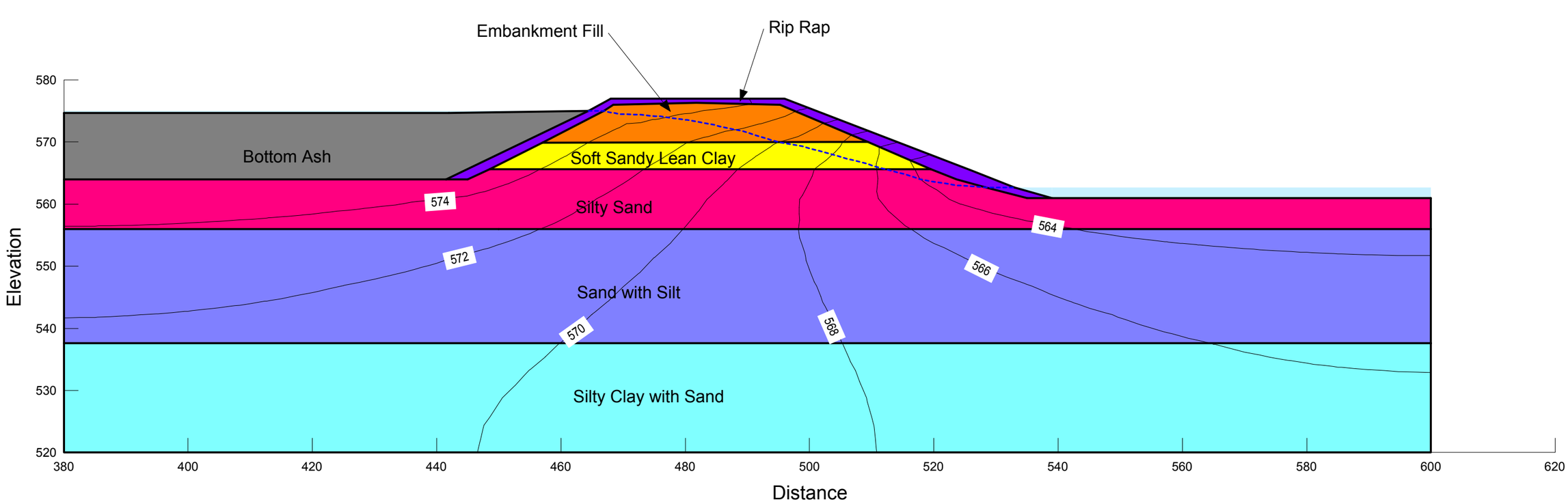
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool with Ash
Normal Pool Elevation: 575.0 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Total Head Contour (feet)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



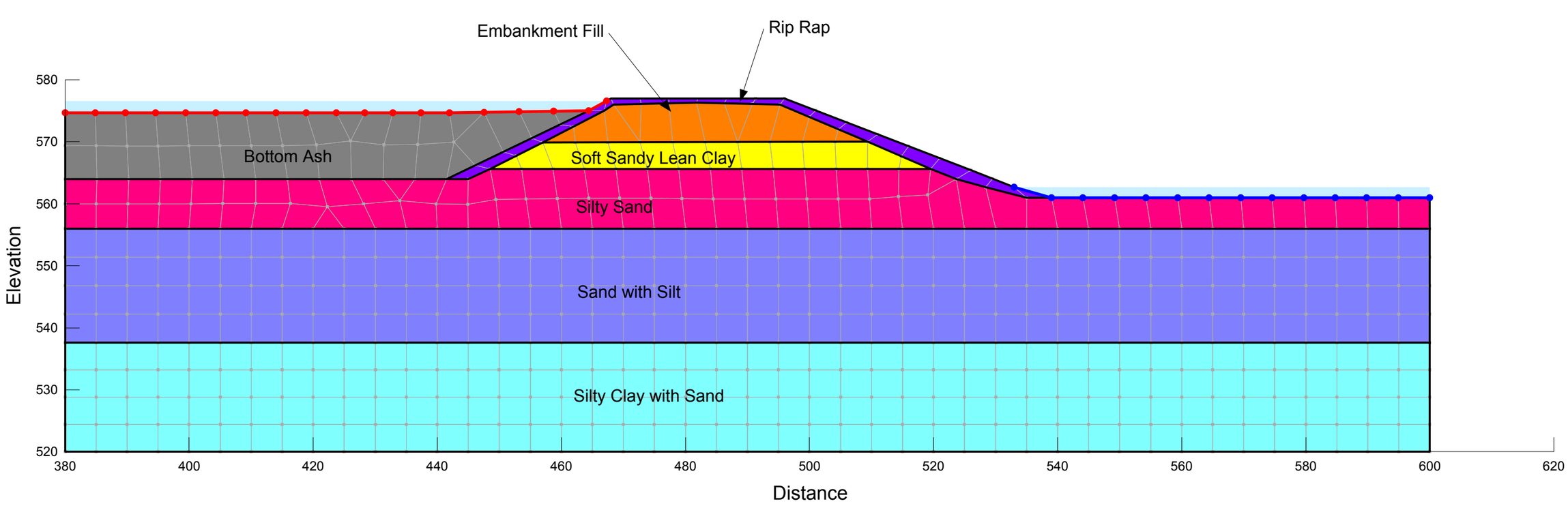
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



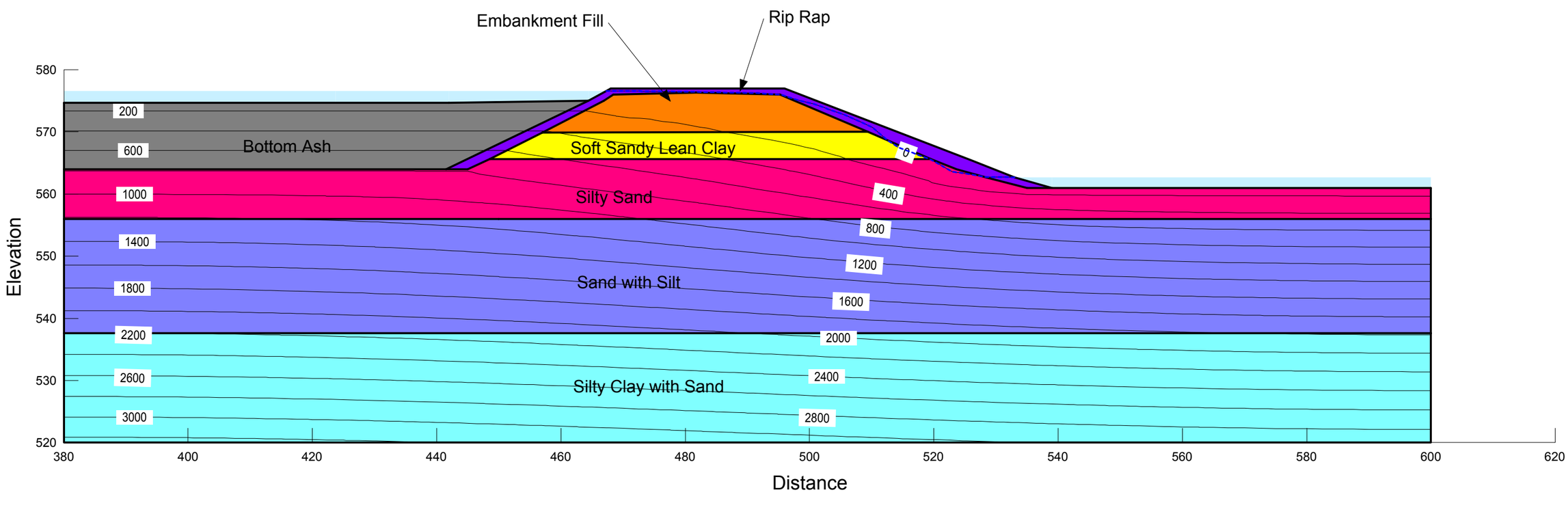
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Pore Water Pressure Contour (psf)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



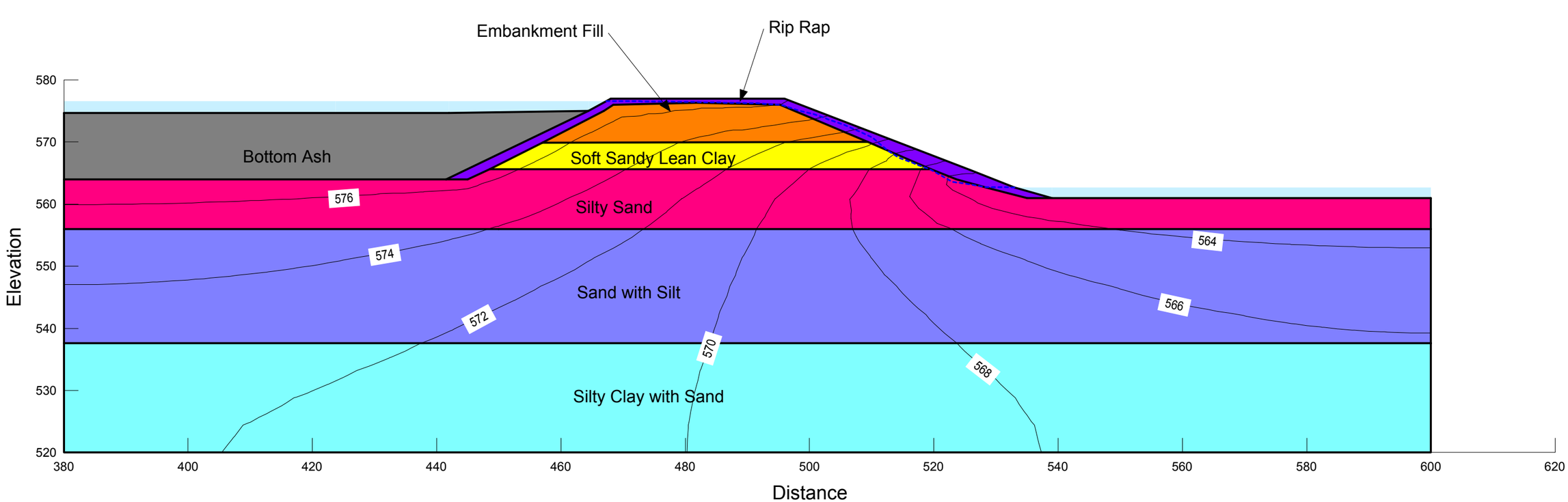
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool with Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Total Head Contour (feet)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Bottom Ash	3.03e-006	0.1	0.3548	0.027
Rip Rap	0.1	0.1	4	0



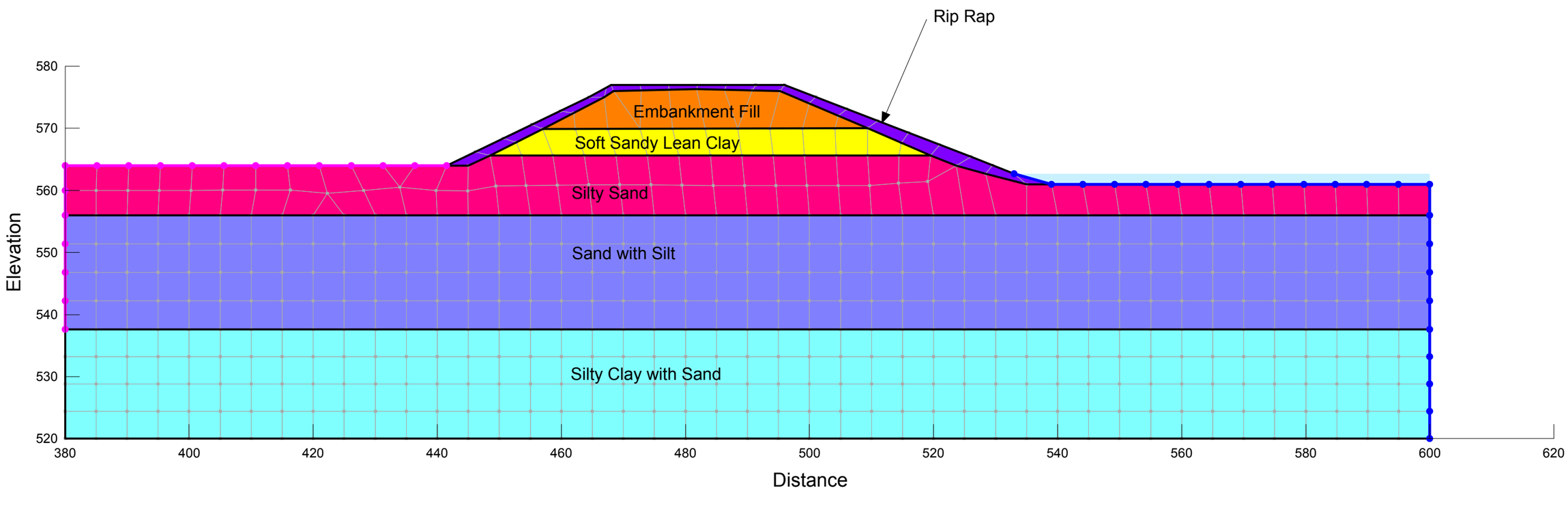
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0



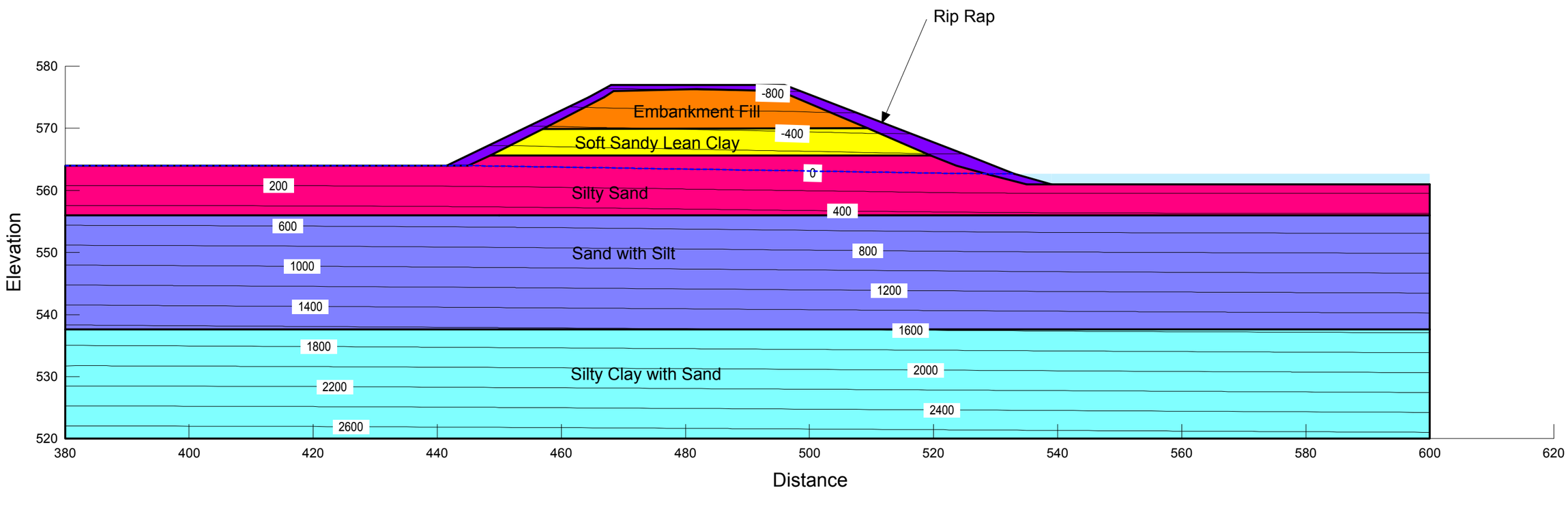
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Pore Water Pressure Contour (psf)

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0



American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Total Head Contour (feet)

SEEP Steady State Normal Pool without Ash
Normal Pool Elevation: 564.0 Feet
Drained Static Strength
Section B-B'

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
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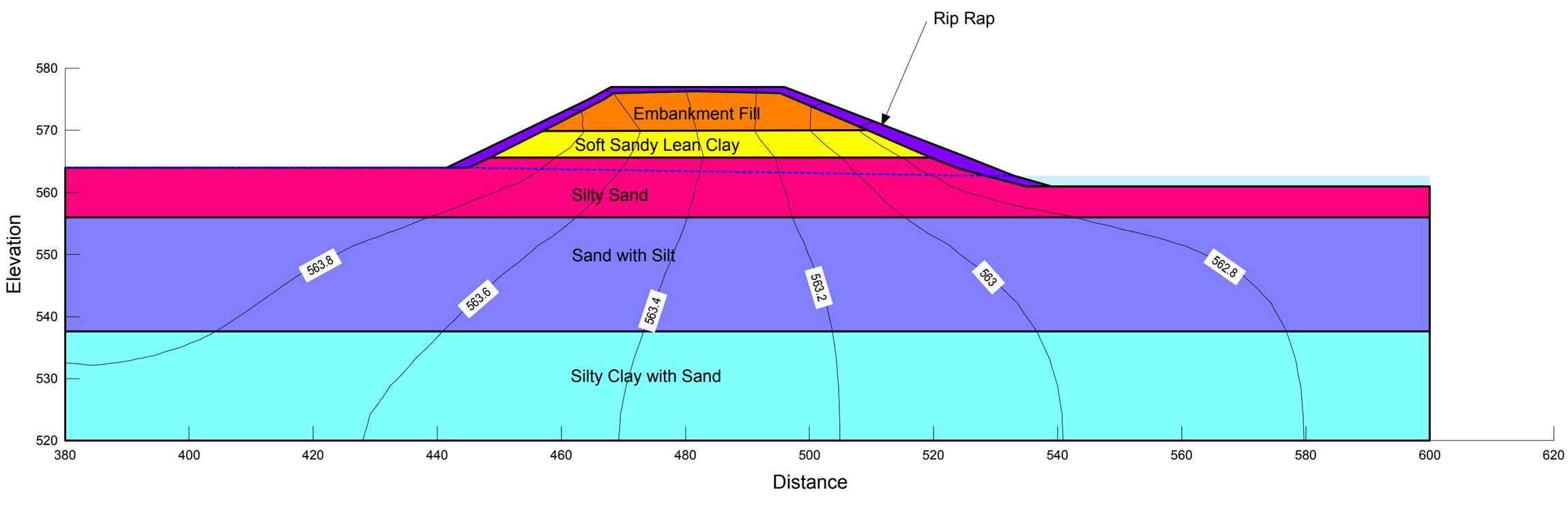


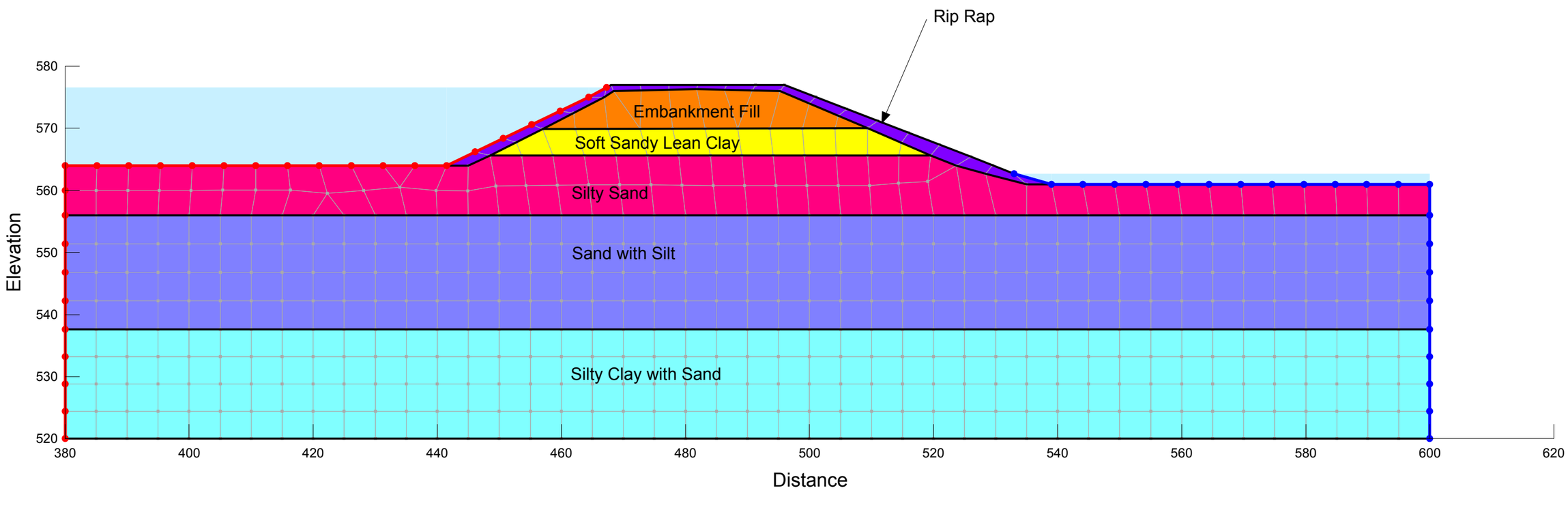
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Boundary Condition and Mesh

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0



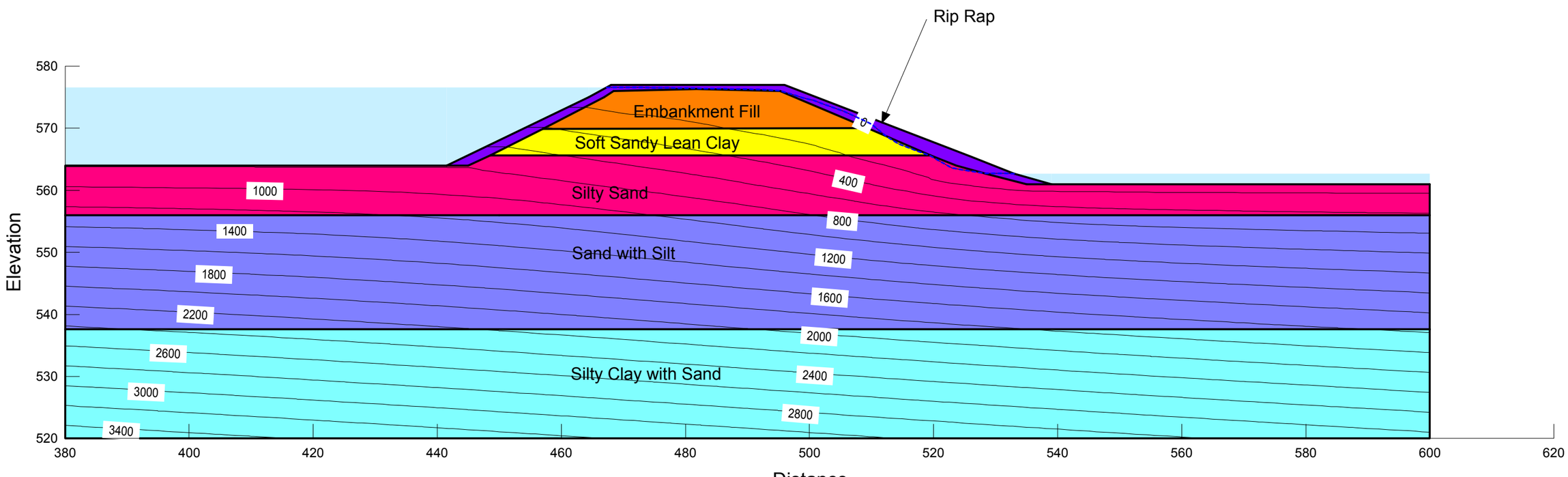
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

Seepage Analysis
Pore Water Pressure Contour (psf)

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0



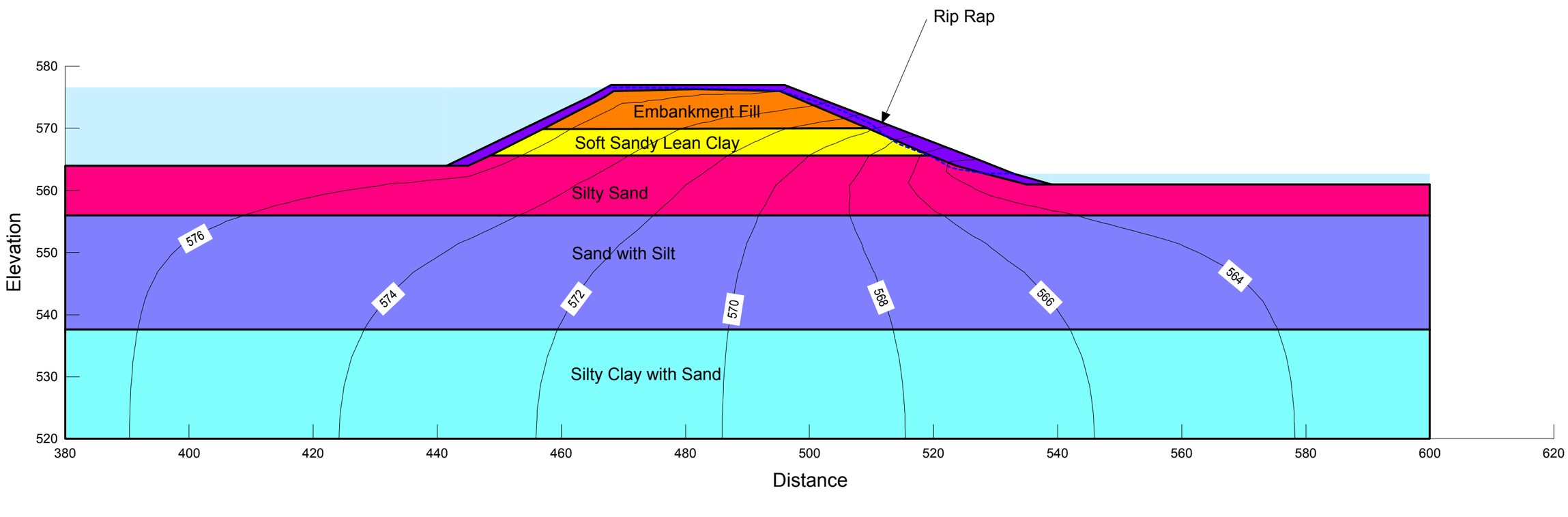
American Electric Power (AEP)
Big Sandy Ash Pond Dam
Louisa, Kentucky
CCR Mandate

SEEP Steady State 50% PMF Pool without Ash
50% PMF Pool Elevation: 576.6 Feet
Drained Static Strength
Section B-B'

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.
No warranties can be made regarding the continuity of subsurface conditions.

Seepage Analysis
Total Head Contour (feet)

Material	Kh-sat (ft/sec)	Kratio Kv/Kh	Sat. Water Content ft^3/ft^3	Res. Water Content ft^3/ft^3
Embankment Fill	1.7e-009	0.1	0.4	0.109
Soft Sandy Lean Clay	2.8e-009	0.1	0.4	0.109
Silty Sand	2.8e-009	0.1	0.35	0.03
Sand With Silt	2.03e-009	0.1	0.35	0.03
Silty Clay With Sand	1.9e-009	0.1	0.35	0.056
Rip Rap	0.1	0.1	4	0



APPENDIX K PARAMETER DERIVATIONS , 2010

BOTTOM ASH POND COMPLEX, 2010

BIG SANDY GEOTECHNICAL ANALYSIS

PARAMETER DERIVATION

I. Subsurface Exploration Program Development:

Three cross sections across the dikes were analyzed. Section A-A' has two borings, sections B-B' and C-C' each have one boring.

II. Laboratory Testing Program:

The program was developed based on visual classifications done in the field during subsurface exploration.

- USCS Soil Classification Tests.
- CU Triaxial Compression Tests
- Permeability Tests.
- Moisture Density tests.

III. Geotechnical Analysis:

A soil tests summary was developed to select soil engineering parameters to use in the geotechnical analysis.

Engineering properties that were not directly tested were determined using typical soil parameter values from NAVFAC DM7-02 Foundations and Earth Structures (Table 1 on Page 39) and the Center For Geotechnical Practice and Research, Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice report (Figures 34 and 35 on pages 72 and 77 respectively). The two tables are attached at the end of the parameter derivation notes.

Permeability k values that were not tested in the laboratory were selected from typical values provided in the table below and those provided in NAVFAC DM7.02, table 1: Typical Properties of Compacted soils

Soil Type	k_v(cm/s)
Coarse Sand	$>10^{-1}$
Fine Sand	10^{-1} to 10^{-3}
Silty Sand	10^{-3} to 10^{-5}
Silt	10^{-5} to 10^{-7}
Clay	$<10^{-7}$

Soils from the West Bottom Ash Dam were classified into 7 main soil layers.

The following table shows how pertinent parameters were selected and which sections they were applied to.

Soil name	USCS class	Classification Samples	Shear Strength Parameters	Permeability Parameters	Section
Embankment fill	CL	B-1,(7.5-9.0)(10-11.5)	Triaxial Test 1.1 – 1.3	Test ID No. 1	A / B / C
Stiff Sandy Lean Clay	CL	B-1,(7.5-9.0)(10-11.5)	Triaxial Test 2.1 – 2.3	Typical values *	A
Soft Sandy Lean Clay	CL	B-1,(22.5-24)(25-26.5)	Triaxial Test 3.1 & 3.2	Test ID No. 4	A / B / C
Sand with Silt	SW-SM	B-2,(25-26.5)(27.5-29) & B-6,(40-41.5)(42.5-44)	Typical values *	Test ID No. 3	A / B / C
Silt With Sand	ML	B-5,(22.5-24)(25-26.5)	Typical values *	Typical values *	C
Silty Sand	SM	B-3,(17.5-19)(20-21.5) & B-4,(12.5-14)(15-16.5)	Typical values *	Typical values *	B
Silty Clay with Sand	CL-ML	B-4,(47.5-49)(50-51.5)	Typical values *	Typical values *	B

* Typical values as determined from referenced tables.

Soil name	Unit Weight	C	ϕ	kv (cm/sec)	kh/kv Typical	g
Embankment fill	125	30	30	5.2E-08	10	2.72 (ST sample)
Stiff Sandy Lean Clay	125	144	35	5.2E-08	10	2.69 (ST sample)
Soft Sandy Lean Clay	125	23	30	8.5E-08	10	2.70
Sand with Silt	130	0	30	6.2E-08	5	2.70
Silt With Sand	120	50	28	8.5E-08	5	2.70

Silty Sand	130	0	30	8.5E-08	5	2.70
Silty Clay with Sand	120	100	25	5.8E-08	5	2.70
Rip Rap	140	0	35	0.10	1	2.70
Bottom Ash	115	0	28	3.50E-01	1	2.70

1. SEEPAGE ANALYSIS.

Geoslope Seep W analysis was used to analyze the model for Seepage. Field piezometer readings were compared to the model's results. The model was calibrated to approximate field water elevations.

Residual and saturated water contents and coefficients of volume compressibility were assumed for all soil layers based on previous experiences and soils' normal values.

Water elevations used were:

- Bottom Ash Pond in use, steady state: 575 feet.
- Bottom Ash Pond empty, steady state: 564 feet.
- Bottom Ash Flood levels; 576.6 feet either empty or full.
- Clear water pond steady state: 562.7 feet
- Clear water pond flood level: 565.4 feet.
- River water elevation 518 feet.

Seepage analysis results were used in the slope stability analysis to model pore water pressures.

2. STABILITY ANALYSIS.

Geoslope Slope W was used for the slope stability analysis.

The Spencer Analysis Method was used.

Slip circle method and siding wedge method were modeled by the circular failure plane and the block specified; the circular failure plane produced lower Factors of Safety.

The peak ground acceleration used for the seismic analysis was obtained from US Geological Survey website. The PGA used is 0.08g (USGS indicates 0.07677g). The method selected to do the seismic analysis was the pseudostatic analysis per the project scope.

Loading conditions:

Static Slope Stability Loading Conditions:

- Seismic and static slope stability for steady state seepage normal pool (upstream and downstream slopes) with the bottom ash pond full of ash.
- Seismic and static slope stability for steady state seepage minimum pool (upstream and downstream slopes) with the bottom ash pond empty of ash.
- Rapid drawdown at section A-A': normal pool steady-state seepage conditions on the bottom ash pond with water drawdown from 575 feet to 564 feet. (upstream slope)
- PMF event (upstream and downstream slopes). The flood water was considered as a surcharge for both the steady state normal pool and the steady state minimum pool conditions.

3. LIQUEFACTION ANALYSIS.

Research and methodology:

- Earthquake intensity: USGS website used to determine the Peak Ground Acceleration and earthquake intensity for an earthquake event of a mean return period of 2,475 years. PGA = 0.07677g used 0.08g and M_L = 7.7.

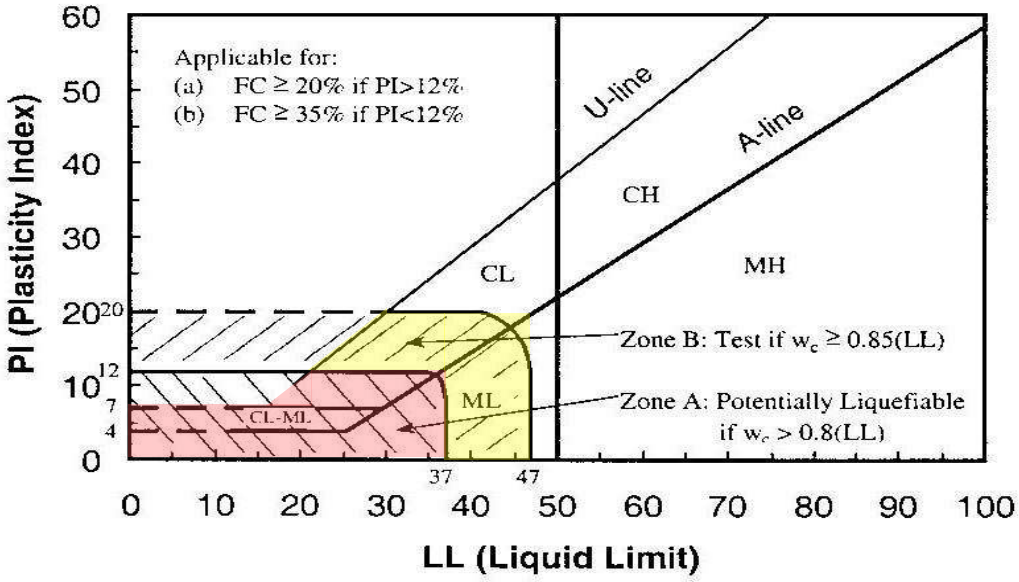
- Groundwater table: Normal (current) steady state water elevations were considered as the groundwater elevation. Unsaturated soil located above the groundwater table will not liquefy.

- Soil Type:

  The dam soil materials, being constructed of engineered fill located above the groundwater table, are not considered liquefiable.

  Cohesionless materials are considered liquefiable. The majority of cohesive soils will not liquefy. Cohesive soils susceptible to liquefaction should fall in either zone A or zone B of the following chart.

Screening Criteria for Liquefiable Fine-Grained Soils (Seed et al. 2003)



- Soil relative density (Dr): Soils in a loose relative density state are susceptible to liquefaction. Soils with an SPT-N value of 30 or higher were considered not liquefiable.

Liquefaction Assessment

To assess liquefaction potential for the WBAD, the boring logs from the geotechnical borings and laboratory test data from Shelby tubes and SPT samples were used. The boring logs include the SPT blow counts and soil lithologic descriptions with depth.

Soil characteristics (grain size, plasticity, unit weight, moisture content) from SPT and Shelby tube samples obtained from the geotechnical borings were used in the liquefaction assessment.

Method Used: Simplified Method based on using correlations to blow counts from Standard Penetration Tests (SPTs) as set forth in Youd et al (2001) and discussed in NRC (1985).

The Simplified Method requires estimating the Cyclic Stress Ratio (CSR) and Cyclic Resistance Ratio (CRR) of the soil. The CRR can be estimated using information from SPT tests, corrected to account for various effects. To use the Simplified Method, the SPT N value is normalized to an overburden pressure of approximately 100 kiloPascals (kPa) and a hammer energy ratio of 60% and procedural effects (rod length, sample configuration and borehole diameter).

The $(N_1)_{60}$ may also be corrected for the percent of fines using the relationship:

$$(N_1)_{60cs} = \alpha + \beta (N_1)_{60}$$

It is important to note that the fines correction is an approximation and is only valid for nonplastic fines and with a fines content between 0 and 35%. This correction factor, although widely used, is considered as a rough approximation only.

Once the corrected value for $(N_1)_{60}$ is found, the CRR is calculated as:

$$CRR_{7.5} = \frac{1}{34 - (N_1)_{60}} + \frac{(N_1)_{60}}{135} + \frac{50}{[10 * (N_1)_{60} + 45]^2} - \frac{1}{200}$$

Note that the value calculated is the CRR normalized to a 7.5 magnitude earthquake, hence the $CRR_{7.5}$ notation. When evaluating the liquefaction potential of soil, the $CRR_{7.5}$ must be corrected to the magnitude earthquake of interest.

The CSR is independent of soil properties and may be approximated using the equation:

$$CSR = 0.65(\frac{a_{max}}{g})(\frac{\sigma_v}{\sigma'_v})r_d$$

where:

a_{max} is the maximum ground acceleration.
g is the acceleration of gravity.
σ_v is the total vertical stress.
σ_v' is the effective vertical stress.
r_d is a stress reduction coefficient.

Liquefaction potential for a soil unit is evaluated by dividing $CRR_{7.5}$ by CSR and then correcting to the magnitude earthquake of interest, as:

$$FS = \frac{CRR_{7.5}}{CSR} * MSF$$

Field experience has shown that the Simplified Method is somewhat conservative; so many designers consider FS values close to unity as an indication of no liquefaction.

B-1

Elevation	Depth	N	Soil class	Remarks
574.8	3.25	15	CL	Not liquefiable Embankment soils, Cohesive soils don't meet liquefaction criteria
569.8	8.25	13	CL	
567.3	10.75	11	CL	
564.8	13.25	11	CL	
559.8	18.25	10	CL	
557.3	20.75	11	CL	
554.8	23.25	8	CL	
552.3	25.75	5	CL	
547.3	30.75	2	CL	Evaluated for liquefaction
544.8	33.25	2	CL	
542.3	35.75	4	CL	
539.8	38.25	9	SW-SM	
537.3	40.75	13	SW-SM	
534.8	43.25	17	SW-SM	
532.3	45.75	11	SW-SM	
529.8	48.25	15	SW-SM	
527.3	50.75	17	SW-SM	
524.8	53.25	16	SW-SM	
522.3	55.75	29	SW-SM	
519.8	58.25	14	SW-SM	
517.3	60.75	20	SW-SM	

B-2

Elevation	Depth	N-field	Soil Class	Remarks
564.8	3.25	15	CL	Not liquefiable Cohesive soils don't meet liquefaction criteria
562.3	5.75	10	CL	
557.3	10.75	9	CL	
554.8	13.25	7	CL	
552.3	15.75	4	CL	Evaluated for liquefaction
547.3	20.75	1	CL	
544.8	23.25	9	SW - SM	
542.3	25.75	10	SW - SM	
539.8	28.25	9	SW - SM	
537.3	30.75	13	SW - SM	

B-3

Elevation	Depth	N-field	Soil Class	Remarks
575.8	3.25	13	CL	Not liquefiable. Embankment and cohesive soils not liquefiable.
573.3	5.75	8	CL	
568.3	10.75	6	CL	
565.8	13.25	10	CL	
563.3	15.75	12	CL	
560.8	18.25	9	SM	Evaluated for

558.3	20.75	6	SM	liquefaction
555.8	23.25	22	SW-SM	
553.3	25.75	14	SW-SM	
550.8	28.25	9	SW-SM	
548.3	30.75	5	SW-SM	
545.8	33.25	6	SW-SM	
543.3	35.75	50	SW-SM	Not liquefiable

B-4

Elevation	Depth	N-field	Soil Class	Remarks
574.8	3.25	11	CL	Cohesive not liquefiable
569.8	8.25	4	CL	
564.8	13.25	6	SM	Evaluated for liquefaction
562.3	15.75	3	SM	
557.3	20.75	2	SM	
554.8	23.25	4	SW-SM	
552.3	25.75	1	SW-SM	
549.8	28.25	1	SW-SM	
547.3	30.75	33	SW-SM	
544.8	33.25	26	SW-SM	
542.3	35.75	13	SW-SM	
539.8	38.25	4	SW-SM	
537.3	40.75	4	CL-ML	
534.8	43.25	4	CL-ML	
532.3	45.75	8	CL-ML	
529.8	48.25	2	CL-ML	
527.3	50.75	1	CL-ML	
524.8	53.25	2	CL-ML	
522.3	55.75	2	CL-ML	

B-5

Elevation	Depth	N-field	Soil Class	Remarks
574.8	3.25	12	CL	Cohesive soils don't meet liquefaction criteria
572.3	5.75	6	CL	
567.3	10.75	8	CL	
564.8	13.25	6	CL	
562.3	15.75	5	CL	
557.3	20.75	4	ML	Evaluated for liquefaction
554.8	23.25	1	ML	
552.3	25.75	3	ML	
547.3	30.75	1	ML	
544.8	33.25	2	ML	
542.3	35.75	19	SW-SM	
539.8	38.25	10	SW-SM	
537.3	40.75	10	SW-SM	
534.8	43.25	19	SW-SM	

532.3	45.75	22	SW-SM	
529.8	48.25	5	SW-SM	
527.3	50.75	4	SW-SM	
524.8	53.25	30	SW-SM	
522.3	55.75	17	SW-SM	

B-6

Elevation	Depth	N-field	Soil Class	Remarks
568.8	3.25	9	CL	Not liquefiable. Embankment and cohesive soils not liquefiable.
564.3	7.75	9	CL	
562.8	9.25	8	CL	
558.8	13.25	7	CL	
556.3	15.75	8	CL	Evaluated for liquefaction
553.8	18.25	4	CL	
551.3	20.75	5	CL	
546.3	25.75	2	CL	
543.8	28.25	0	CL	
541.3	30.75	6	CL	
538.8	33.25	9	CL	
536.3	35.75	30	SP-SM	
533.8	38.25	14	SP-SM	
531.3	40.75	13	SP-SM	
528.8	43.25	17	SP-SM	
526.3	45.75	22	SP-SM	

TABLE 1
Typical Properties of Compacted Soils

Group Symbol	Soil Type	Range of Maximum Dry Unit Weight, pcf	Range of Optimum Moisture, Percent	Typical Value of Compression		Typical Strength Characteristics				Typical Coefficient of Permeability ft./min.	Range of CBR Values	Range of Subgrade Modulus k lbs/cu in.
				At 1.4 tsf (20 psi)	At 3.6 tsf (50 psf)	Cohesion (as compacted) psf	Cohesion (saturated) psf	ϕ (Effective Stress Envelope Degrees)	Tan ϕ			
				Percent of Original Height								
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	.....	.....	>34	>0.67	$>10^{-4}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	.....	.....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 320	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	$5 \times >10^{-5}$	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	$2 \times >10^{-6}$	5 - 30	100 - 300
SC	Clayey sands, poorly graded sand-clay-mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	$5 \times >10^{-7}$	5 - 20	100 - 300
ML	Inorganic silts and clayey silts.	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	$>10^{-5}$	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay.	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	$5 \times >10^{-7}$	.....	
CL	Inorganic clays of low to medium plasticity.	95 - 120	24 - 12	1.3	2.5	1800	270	28	0.54	$>10^{-7}$	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	$5 \times >10^{-7}$	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	$>10^{-7}$	15 or less	50 - 150
OH	Organic clays and silty clays	65 - 100	45 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	25 - 100

Notes:

1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical stength characteristics are for effective strength envelopes and are obtained from USSR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
   (..) indicates insufficient data available for an estimate.

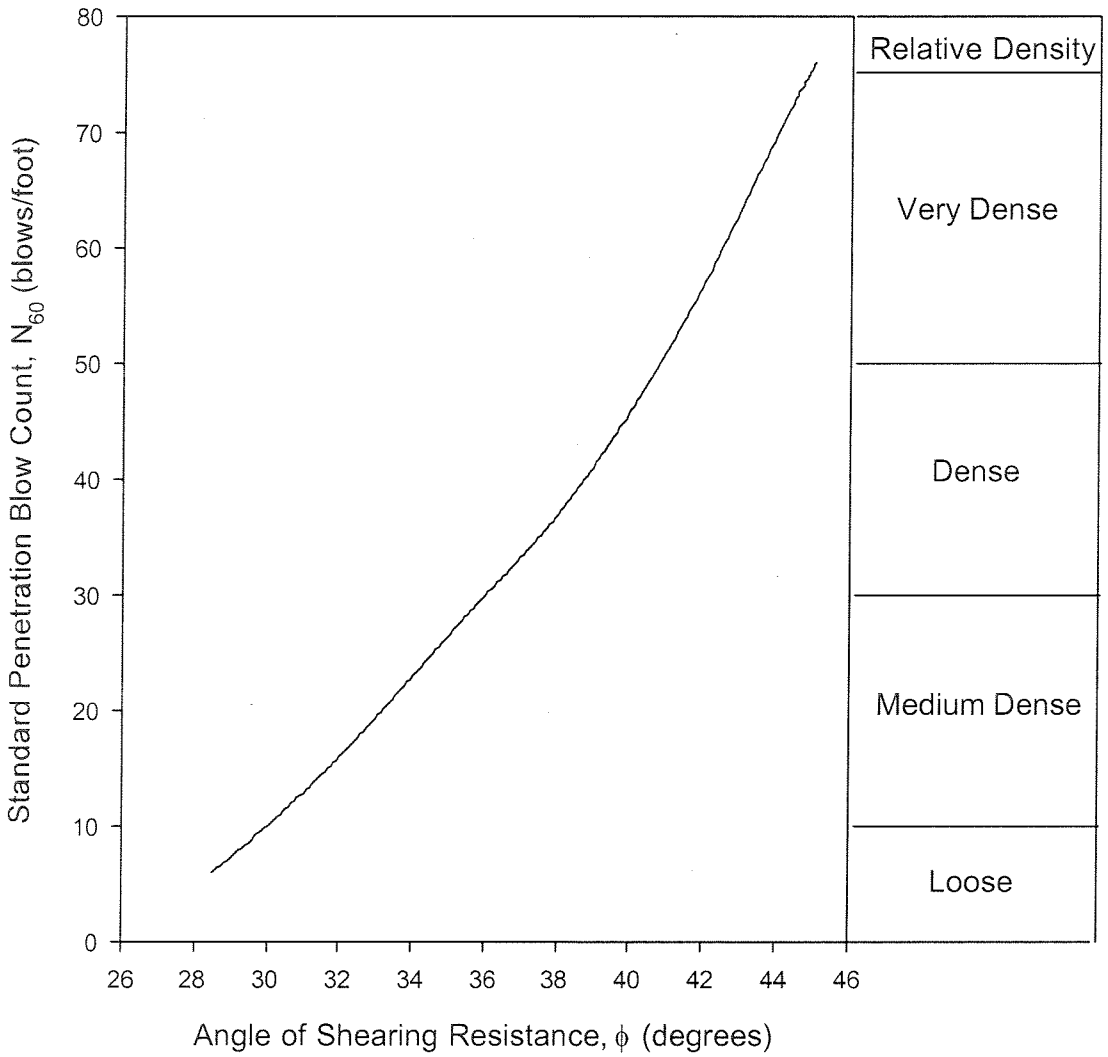


Figure 35. Estimation of the angle of shearing resistance of granular soils from standard penetration test results (Originally from Peck et al., 1974, modified by Carter and Bentley, 1991).

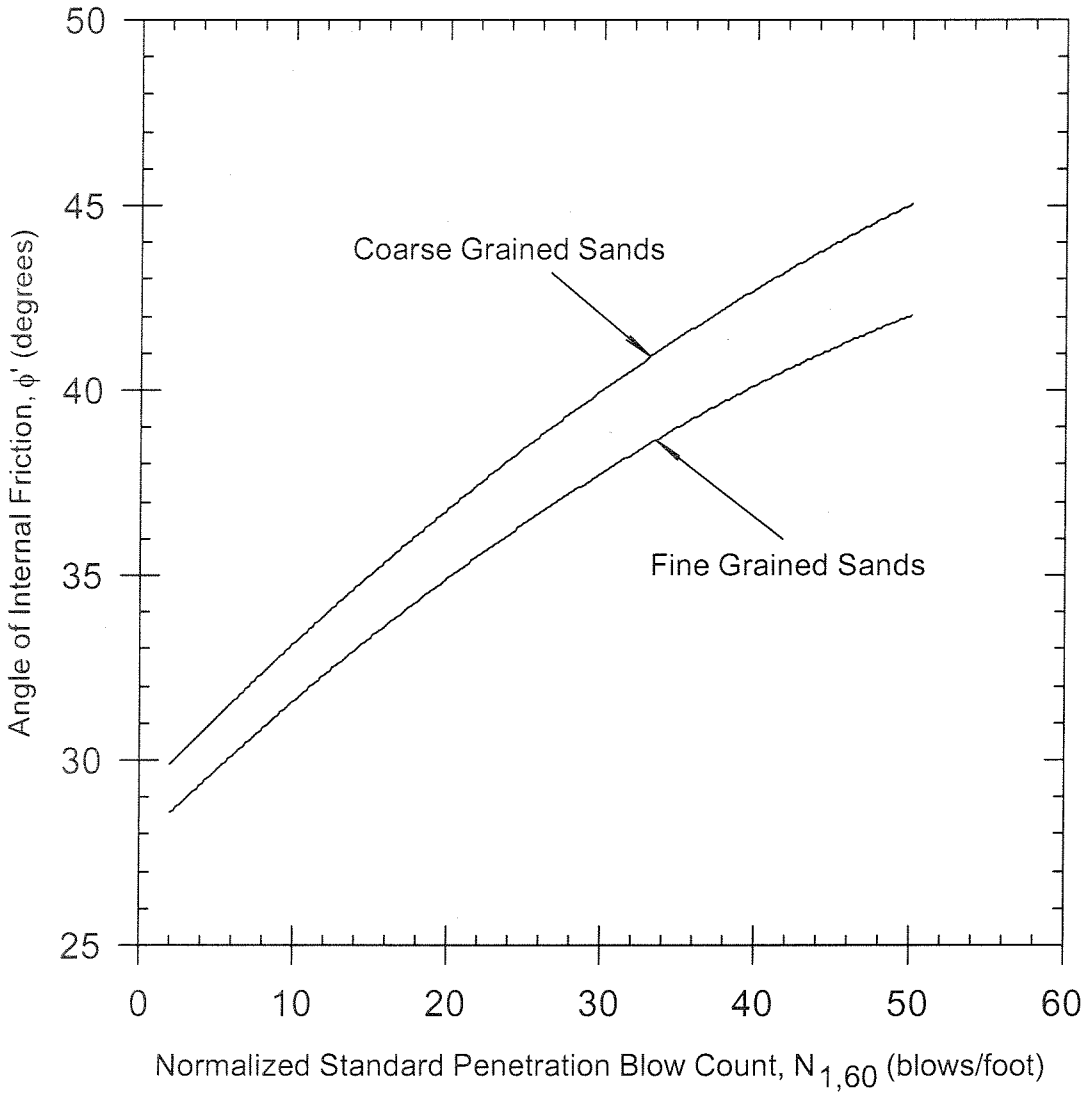


Figure 34. Empirical correlation between friction angle of sands and normalized standard penetration blow count (after Terzaghi et al., 1996)

BOTTOM ASH POND COMPLEX, 2015

PLANT: BIG SANDY
FACILITY: UNIT 1-2 BOTTOM ASH POND
MATERIAL: EMBANKMENT FILL

$\sigma_1' - \sigma_3'$ (plot) (psi)	σ_3' (table) (psi)	σ_1' (psi)	u (plot) (psi)	σ_1 (psi)	σ_3 (plot)
16.28	9.89	26.17	1.81	27.98	11.70
42.33	19.78	62.11	-2.37	59.74	17.41
42.33	29.89	72.21	8.00	80.21	37.88

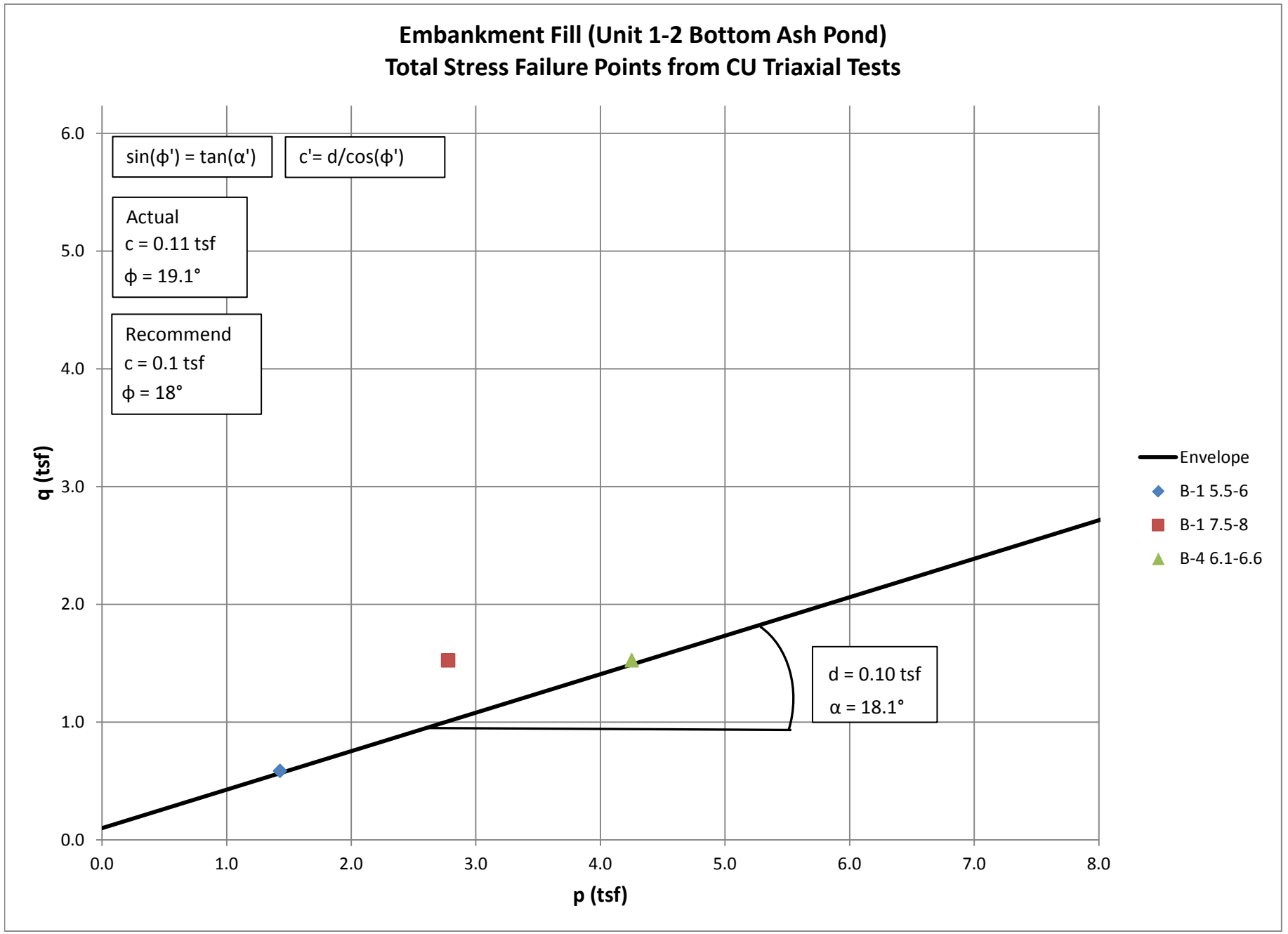
MATERIAL: STIFF SANDY LEAN CLAY

$\sigma_1' - \sigma_3'$ (plot) (psi)	σ_3' (table) (psi)	σ_1' (psi)	u (plot) (psi)	σ_1 (psi)	σ_3 (psi)
38.03	9.84	47.87	-5.85	42.02	3.99
83.78	19.84	103.62	-23.51	80.11	-3.67
92.02	29.81	121.83	-7.45	114.38	22.36

MATERIAL: SOFT SANDY LEAN CLAY

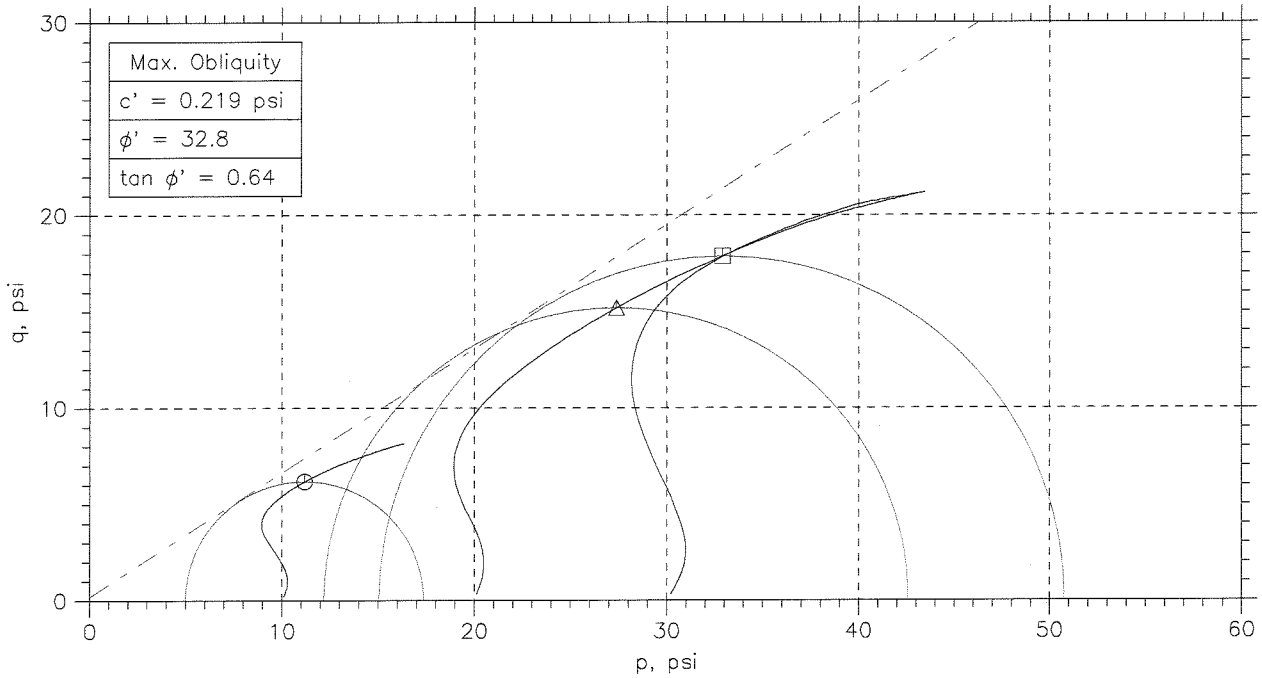
$\sigma_1' - \sigma_3'$ (plot) (psi)	σ_3' (table) (psi)	σ_1' (psi)	u (plot) (psi)	σ_1 (psi)	σ_3 (psi)
60.93	9.85	70.78	-22.30	48.48	-12.45
27.32	19.95	47.27	6.34	53.61	26.29

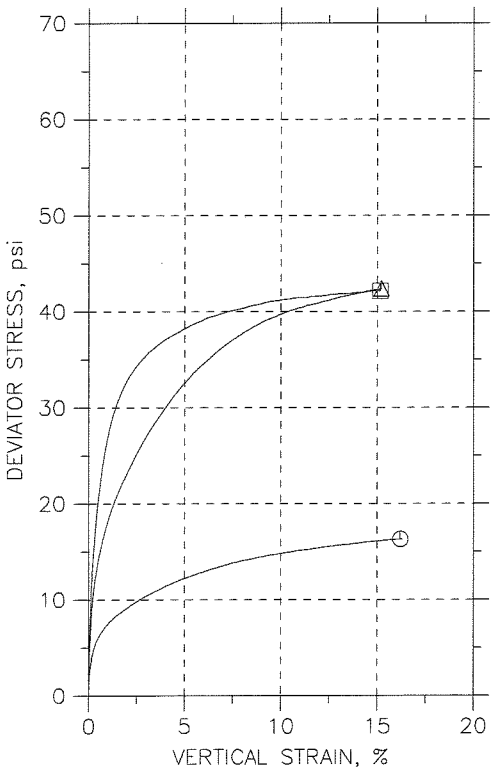
CALCULATED BY: J. SWINDLER



Unit 1-2 Bottom Ash Pond
Embankment Fill

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





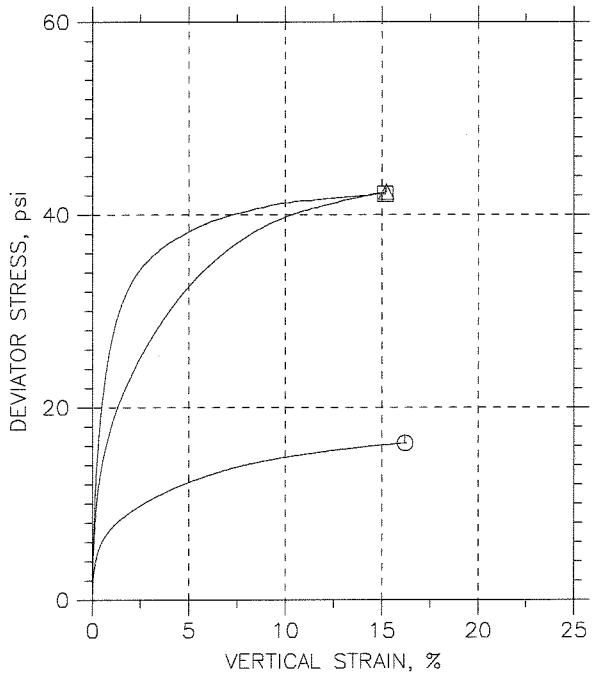
Symbol		⏲	△	⊡	
Sample No.		2-A	29-A	2-B	
Test No.		1.1	1.2	1.3	
Depth		5.5-6.0	7.5-8.0	6.1-6.6	
Initial	Diameter, in	2.851	2.849	2.856	
	Height, in	5.995	5.988	5.984	
	Water Content, %	16.2	21.0	13.9	
	Dry Density, pcf	111.7	106.5	122.4	
	Saturation, %	85.8	97.1	99.5	
	Void Ratio	0.509	0.583	0.377	
Before Shear	Water Content, %	17.2	21.7	14.3	
	Dry Density, pcf	115.	106.3	121.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.466	0.586	0.386	
	Back Press., psi	71.57	101	104.4	
Ver. Eff. Cons. Stress, psi		9.894	19.78	29.88	
Shear Strength, psi		8.145	21.18	21.07	
Strain at Failure, %		16.2	15.2	15.2	
Strain Rate, %/min		0.07	0.07	0.07	
B-Value		0.95	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

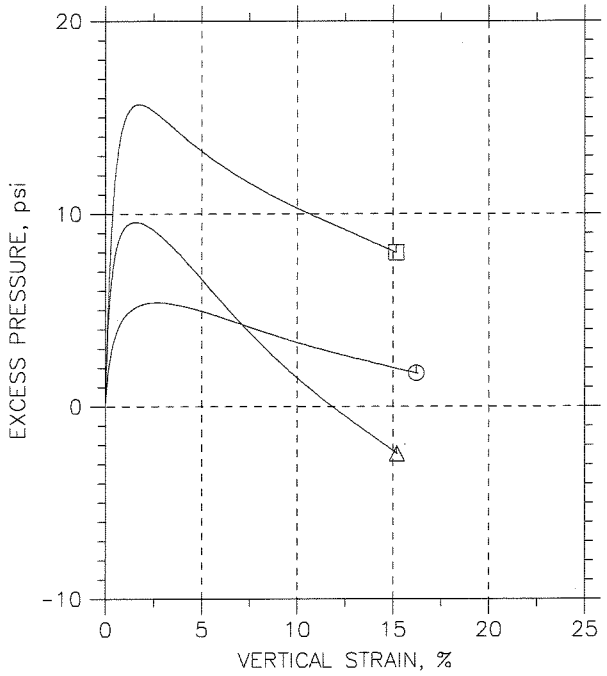
GeoTesting express
a subsidiary of Geocomp Corporation

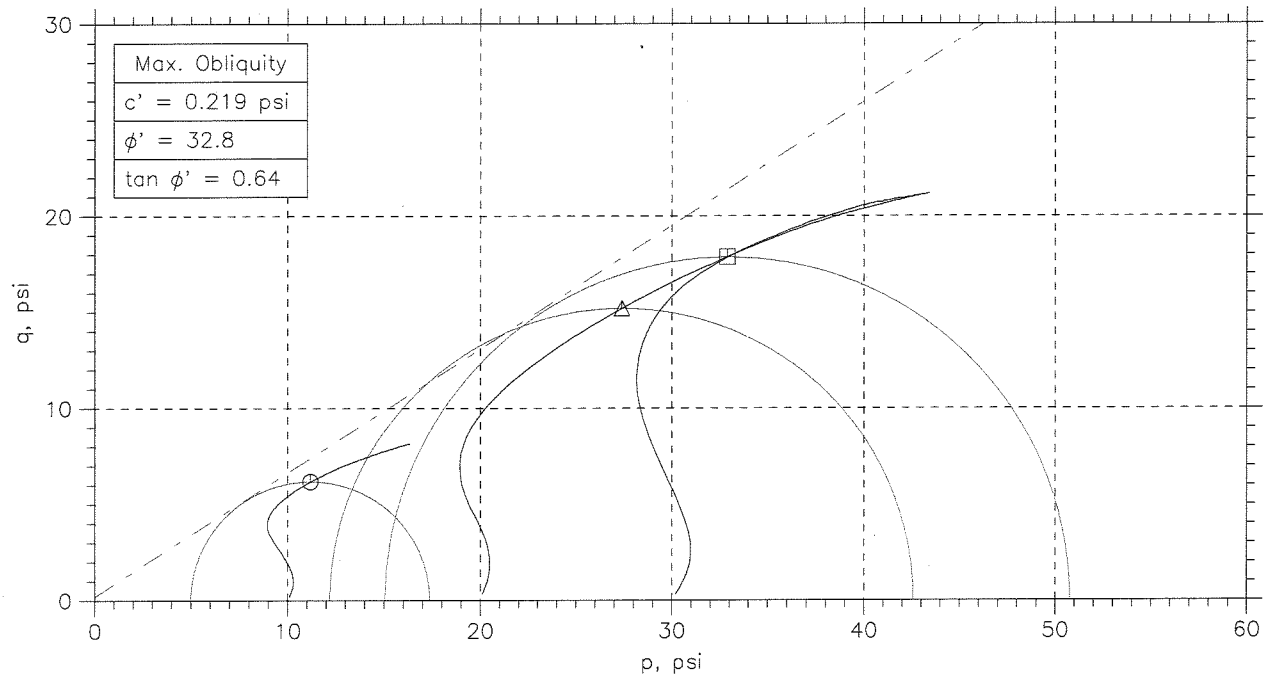
Project: Big Sandy
Location: ---
Project No.: GTX-1515
Boring No.: B-1 & B-4
Sample Type: UD
Description: Light Brown Silty lean clay with sand
Remarks: 2054

Fri, 11-DEC-2009 08:59:33

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







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□	2-B	1.3	6.1-6.6	jm	11/30/09	mm		1515-1.3.dat

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Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1 & B-4	Sample Type: UD	
Description: Light Brown Silty lean clay with sand		
Remarks: 2054		

Fri, 11-DEC-2009 08:59:35

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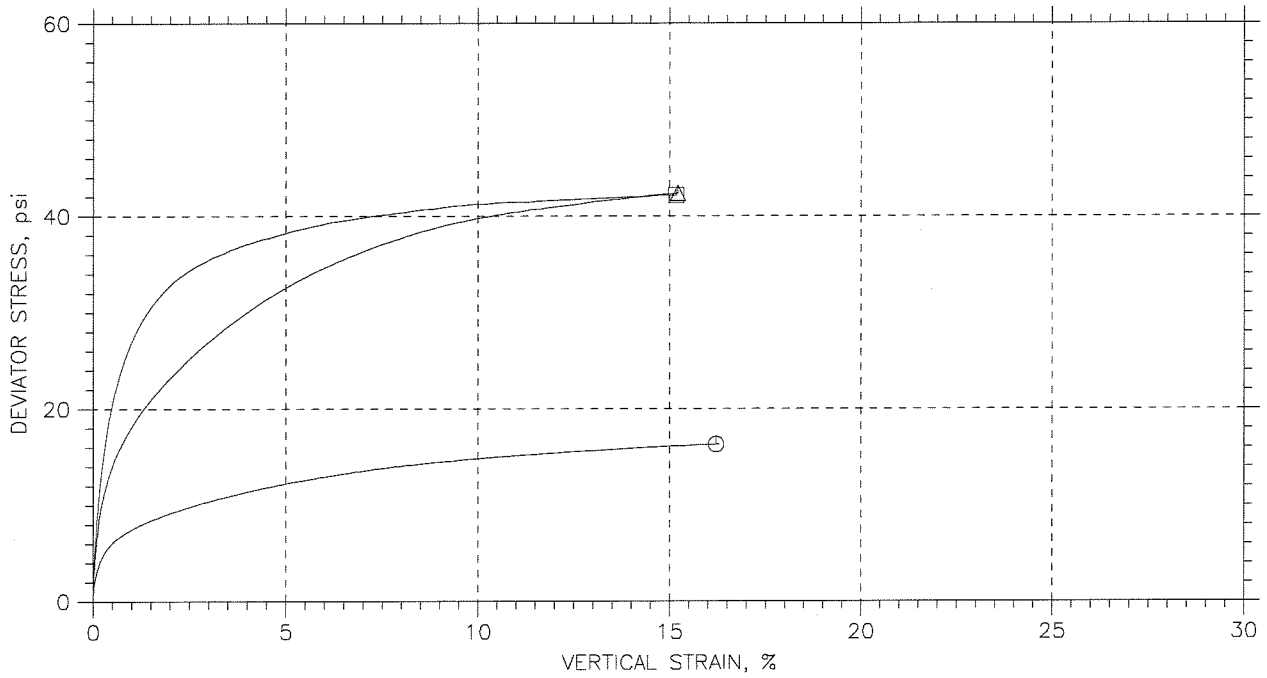

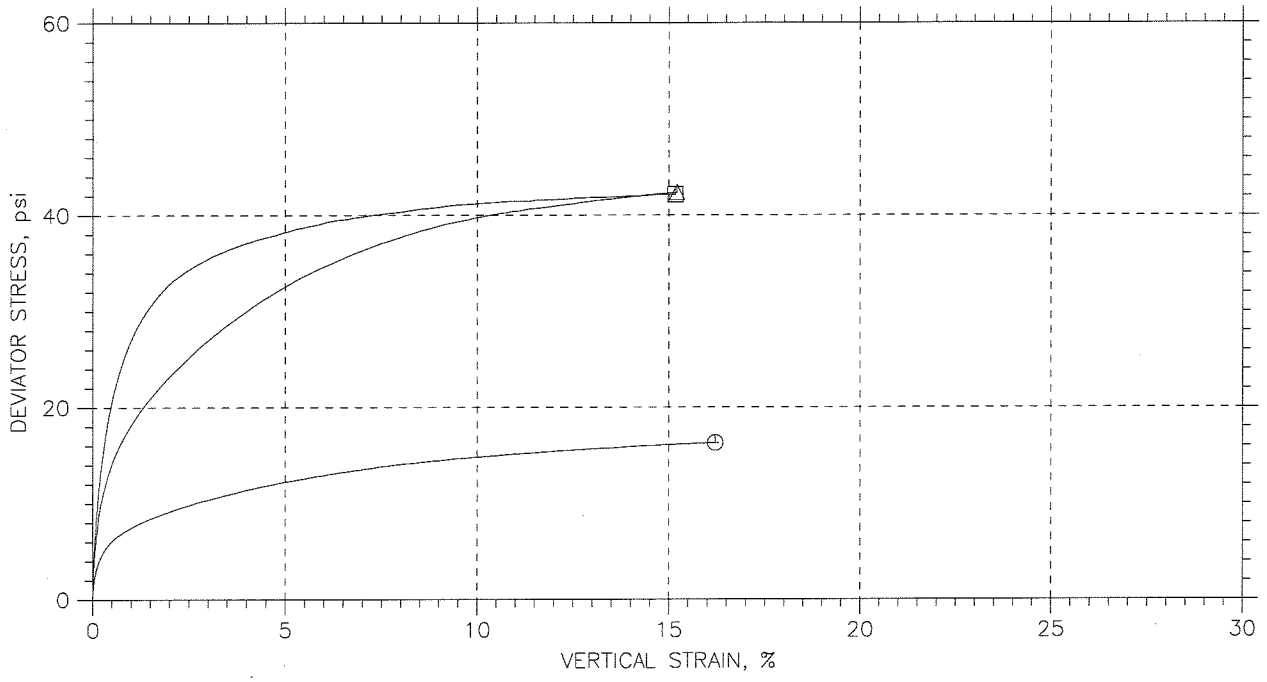

	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	2-A	1.1	5.5-6.0	MM	12/1/09	GT		1515-1.1.dat
△	29-A	1.2	7.5-8.0	jm	12/2/09	mm		1515-1.2.dat
□	2-B	1.3	6.1-6.6	jm	11/30/09	mm		1515-1.3.dat

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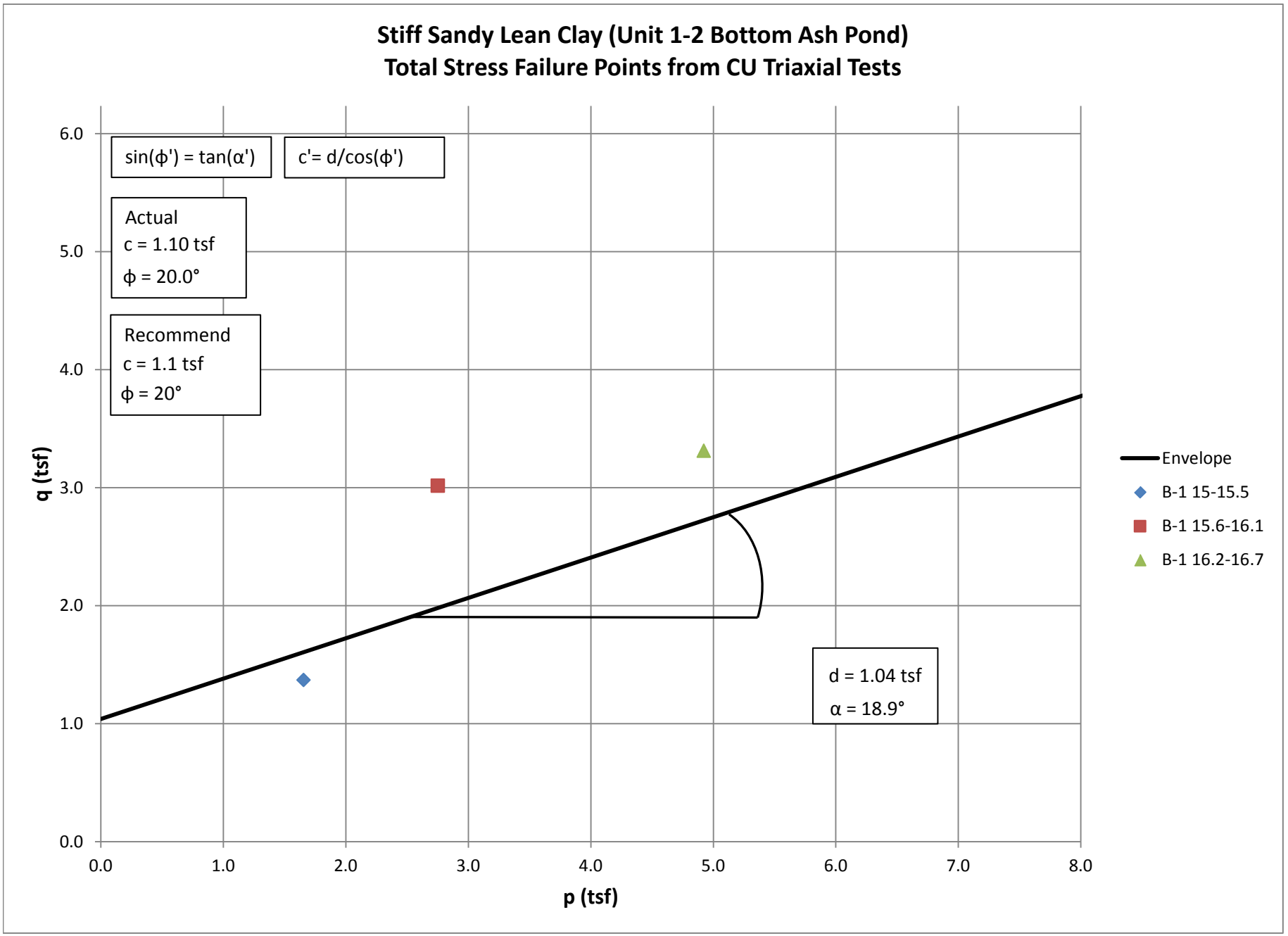
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1 & B-4	Sample Type: UD	
Description: Light Brown Silty lean clay with sand		
Remarks: 2054		

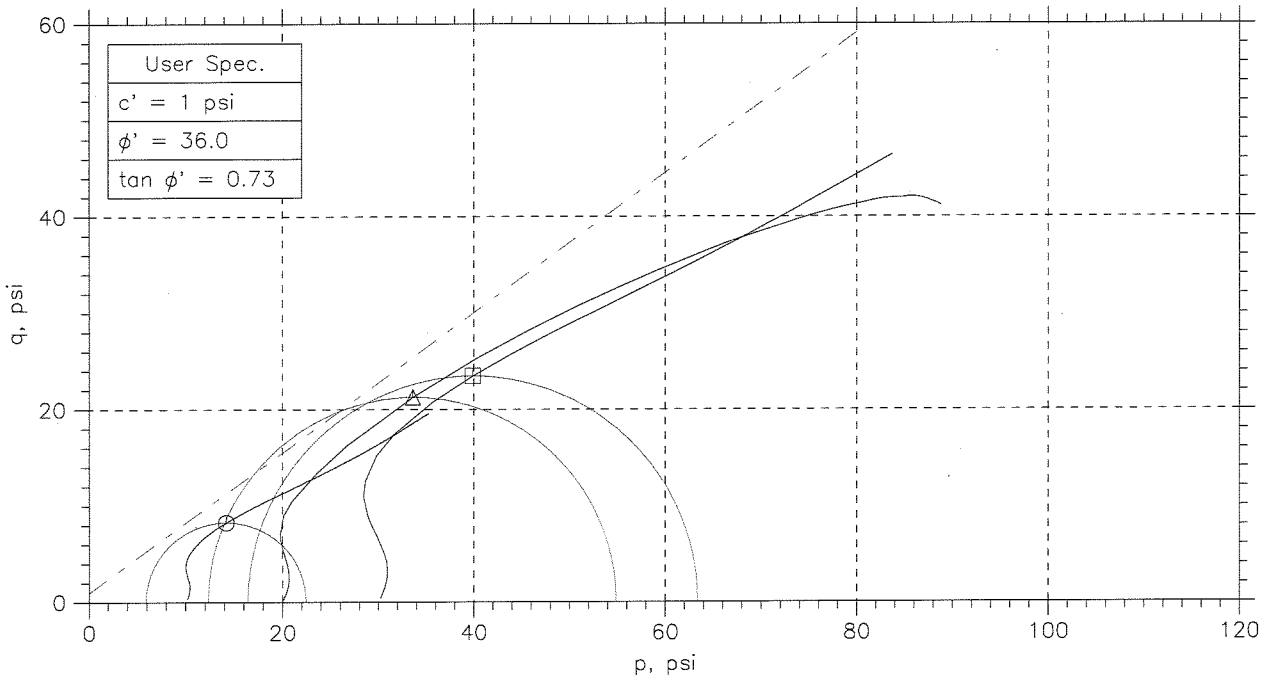
Fri, 11-DEC-2009 08:59:36

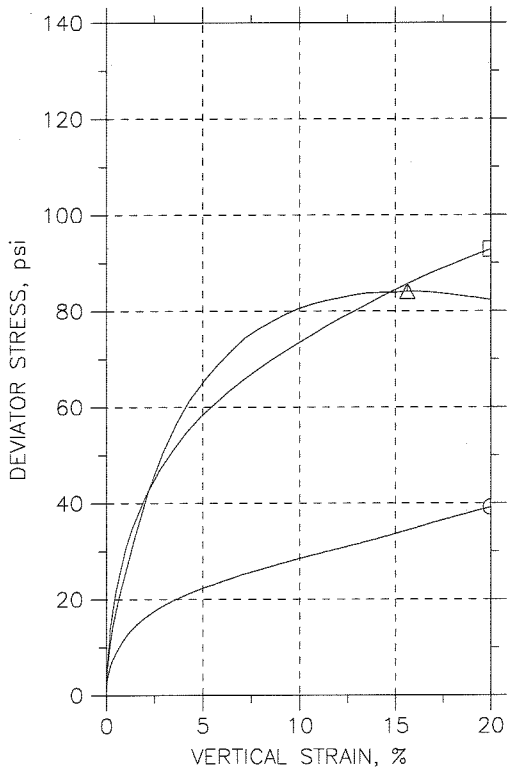


Unit 1-2 Bottom Ash Pond

Stiff Sandy Lean Clay

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⊙	△	⊡	
Sample No.		7A	7-B	7-c	
Test No.		2.1	2.2	2.3	
Depth		15.0-15.5	15.6-16.1	16.2-16.7	
Initial	Diameter, in	2.869	2.832	2.849	
	Height, in	5.999	6.014	5.988	
	Water Content, %	19.4	20.9	20.7	
	Dry Density, pcf	108.9	110.2	108.2	
	Saturation, %	95.7	106.9	100.4	
	Void Ratio	0.547	0.529	0.557	
Before Shear	Water Content, %	21.2	21.4	21.3	
	Dry Density, pcf	107.3	106.8	107.1	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.571	0.579	0.574	
	Back Press., psi	89.29	125.2	116.2	
Ver. Eff. Cons. Stress, psi		9.836	19.84	29.81	
Shear Strength, psi		19.58	42.04	46.42	
Strain at Failure, %		20	15.6	20	
Strain Rate, %/min		0.07	0.07	0.07	
B-Value		0.96	0.95	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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Project: Big Sandy

Location: ---

Project No.: GTX-1515

Boring No.: B-1

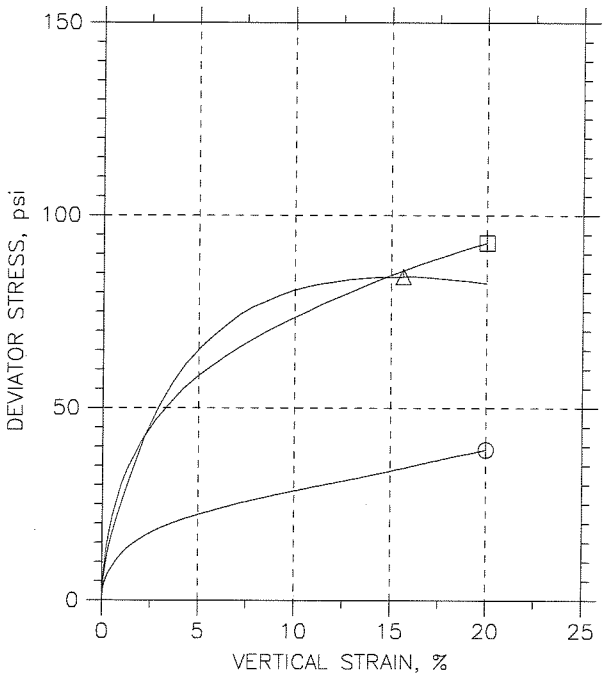
Sample Type: UD

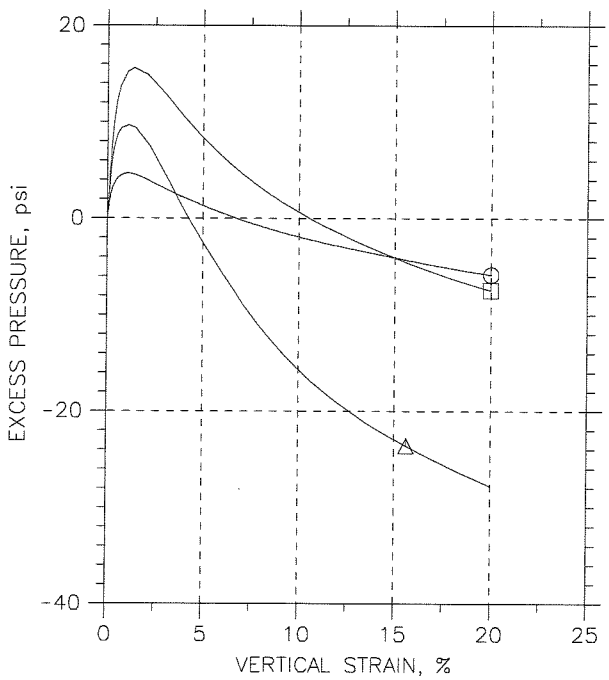
Description: Light Brown Lean clay with sand

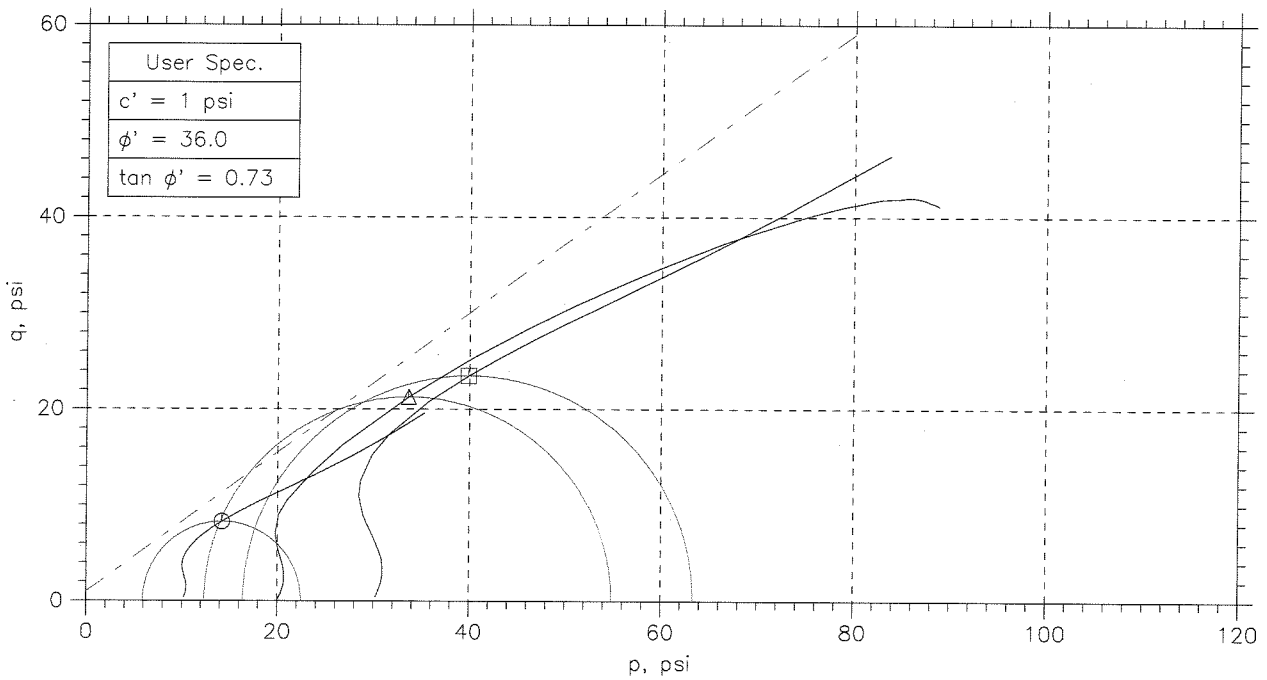
Remarks: 2054

Fri, 11-DEC-2009 09:08:42

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	7A	2.1	15.0-15.5	jm	12/1/09	mm		1515-2.1.dat
△	7-B	2.2	15.6-16.1	jm	12/2/09	mm		1515-2.2.dat
□	7-c	2.3	16.2-16.7	jm	11/30/09	mm		1515-2.3.dat

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Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1	Sample Type: UD	
Description: Light Brown Lean clay with sand		
Remarks: 2054		

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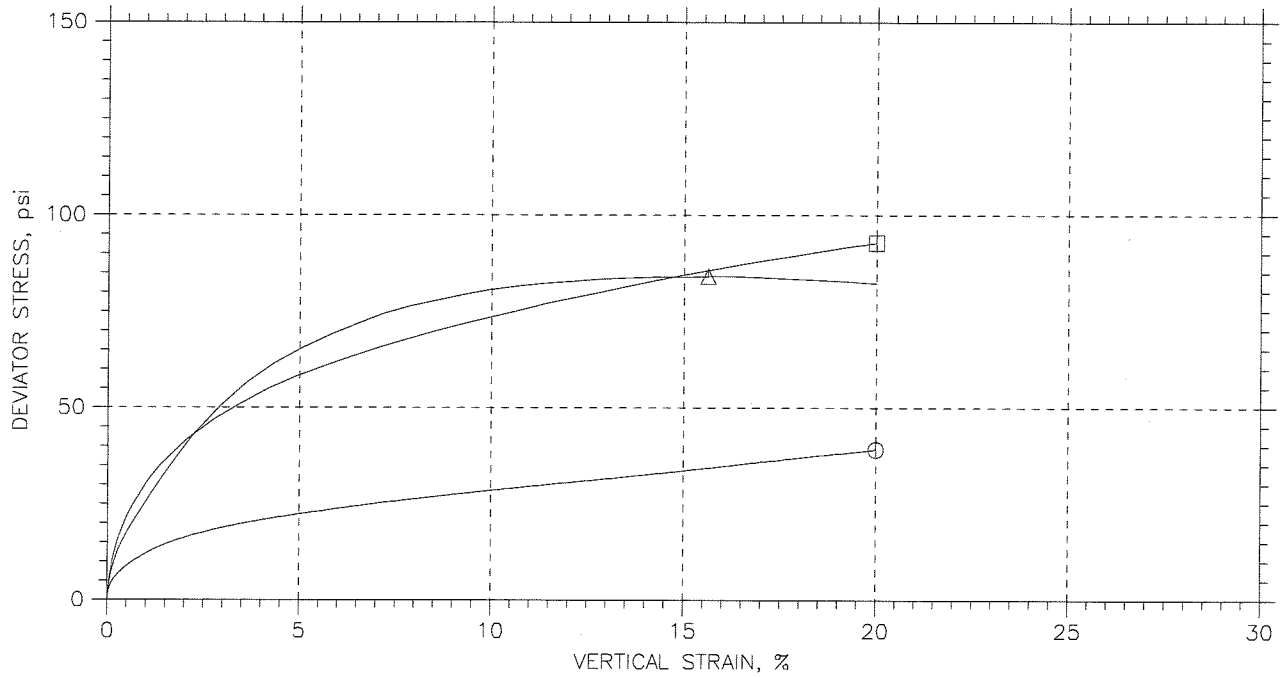
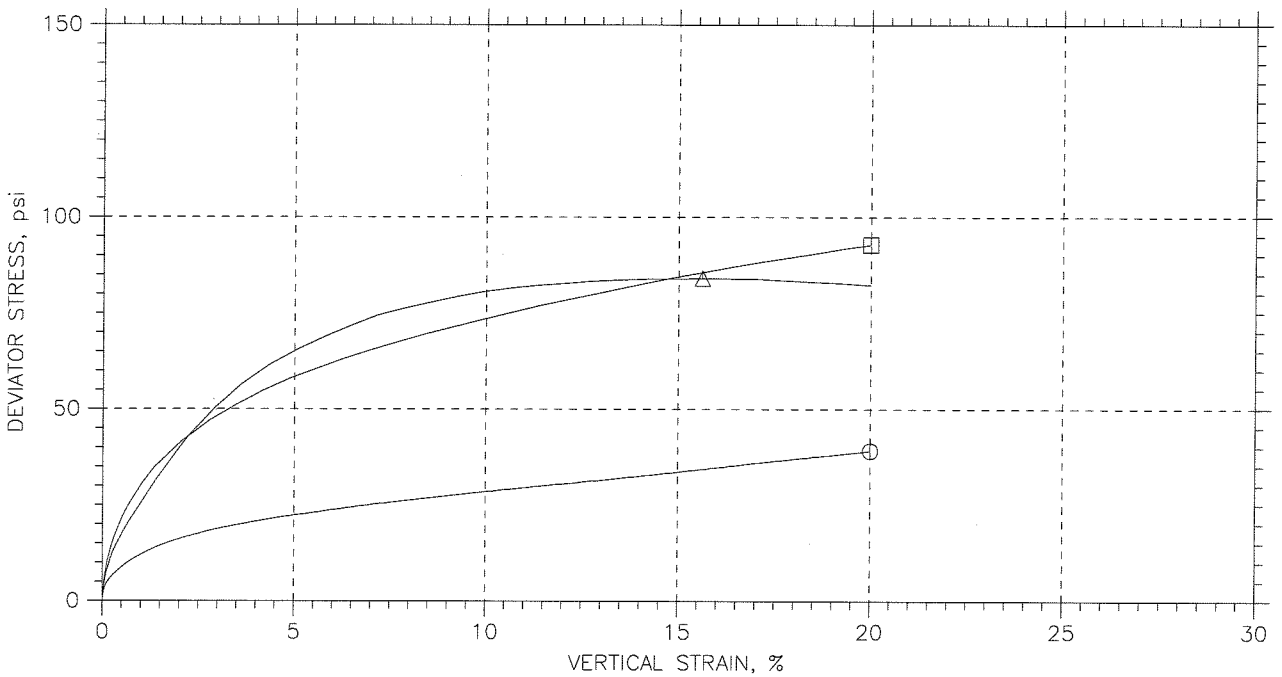
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	7A	2.1	15.0-15.5	jm	12/1/09	mm		1515-2.1.dat
△	7-B	2.2	15.6-16.1	jm	12/2/09	mm		1515-2.2.dat
□	7-c	2.3	16.2-16.7	jm	11/30/09	mm		1515-2.3.dat

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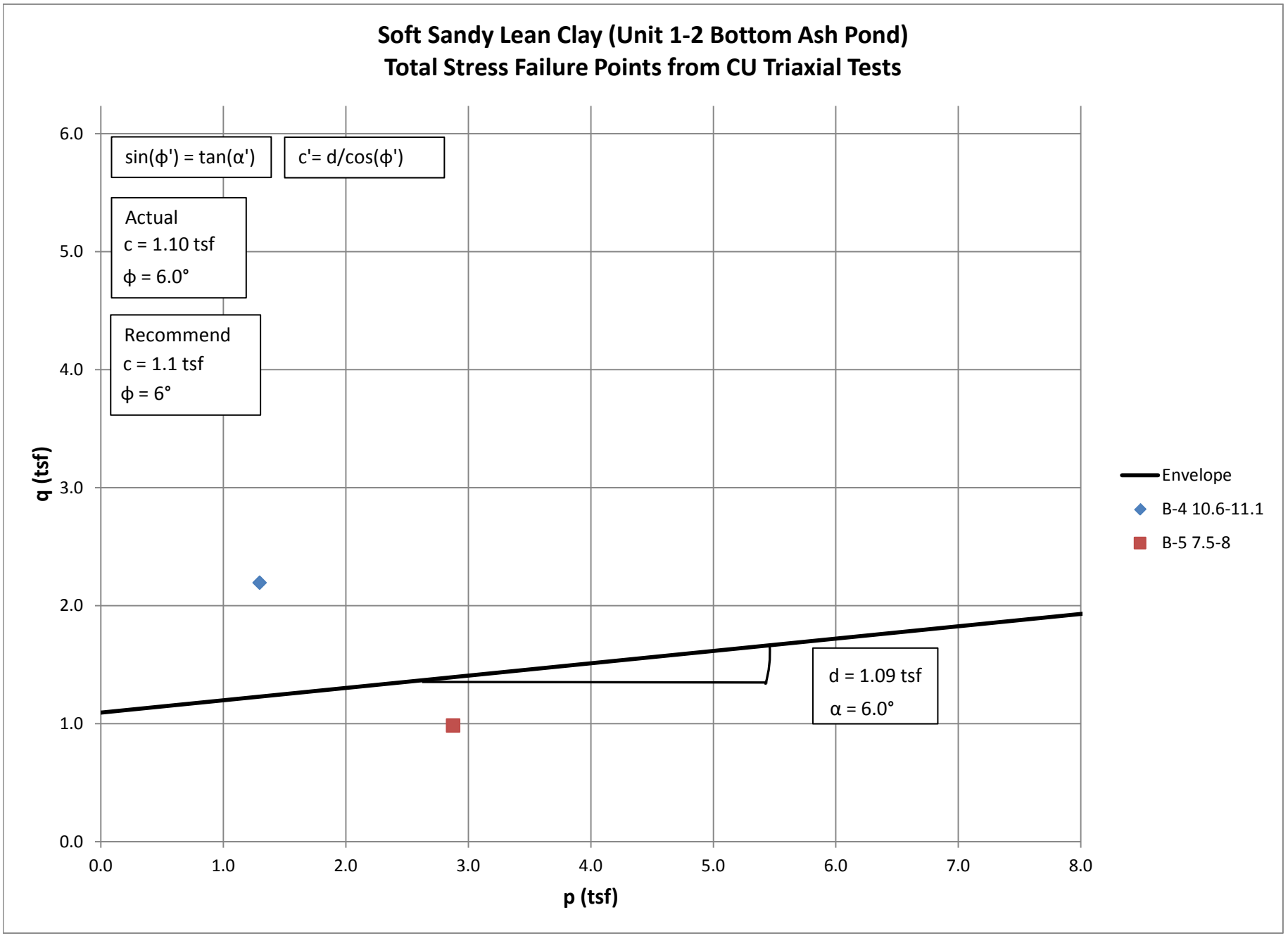
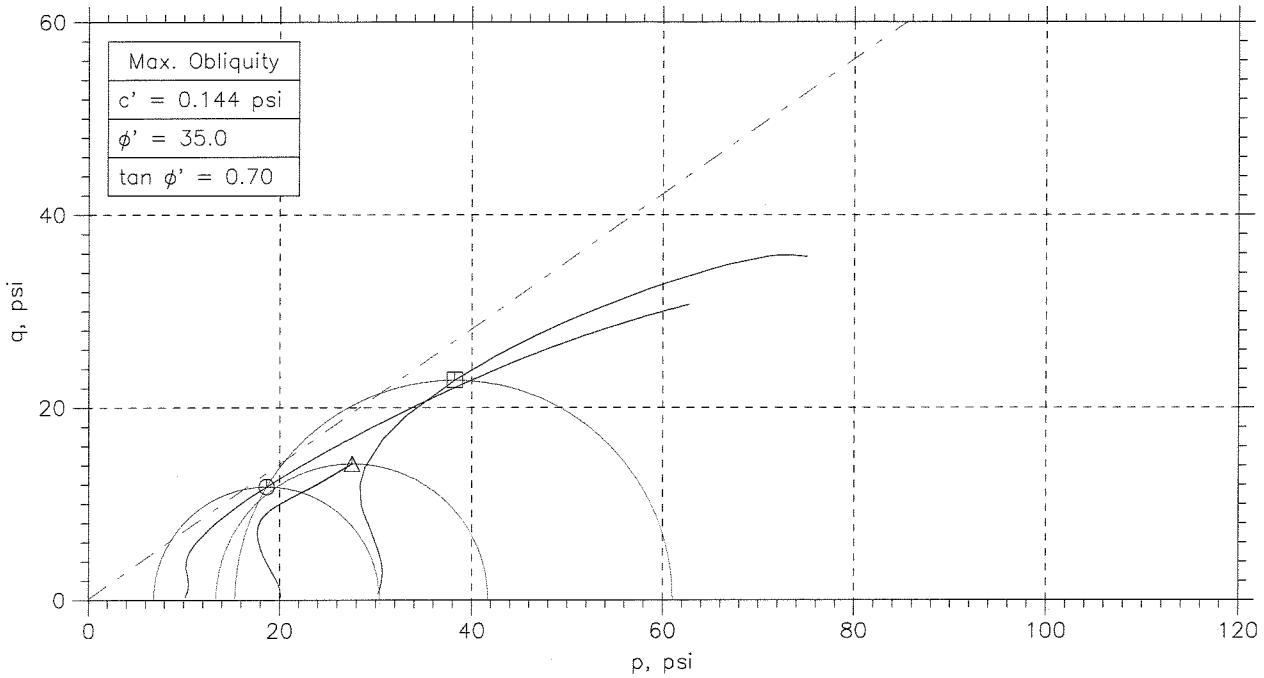
Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-1	Sample Type: UD	
Description: Light Brown Lean clay with sand		
Remarks: 2054		

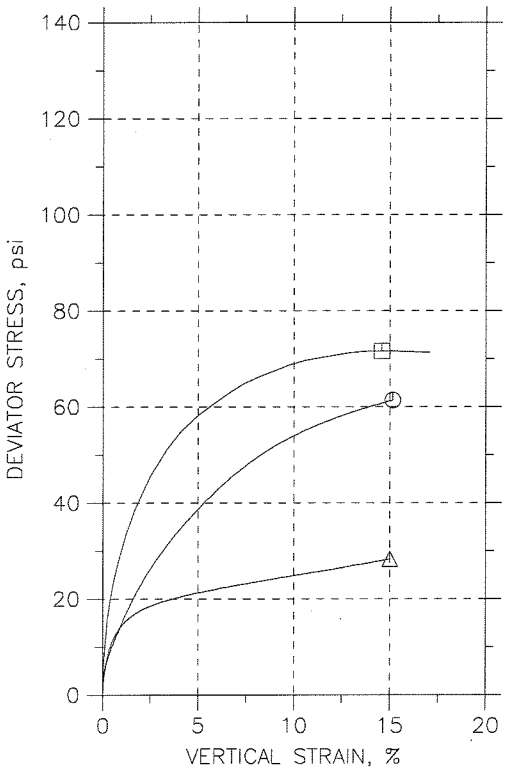
Fri, 11-DEC-2009 09:08:45



Unit 1-2 Bottom Ash Pond
Soft Sandy Lean Clay

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⏲	△	⏍	
Sample No.		106-B	#81	106-C	
Test No.		3.1	3.2	3.3	
Depth		10.6-11.1	7.5-8.0	11.2-11.7	
Initial	Diameter, in	2.865	2.877	2.85	
	Height, in	5.991	6.013	6.005	
	Water Content, %	19.9	14.3	19.8	
	Dry Density, pcf	109.6	116.3	109.3	
	Saturation, %	99.9	85.8	98.8	
	Void Ratio	0.537	0.45	0.542	
Before Shear	Water Content, %	21.1	14.8	21.6	
	Dry Density, pcf	107.4	120.3	106.5	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.569	0.401	0.582	
	Back Press., psi	92.03	125.4	116.4	
Ver. Eff. Cons. Stress, psi		9.845	19.95	29.59	
Shear Strength, psi		30.7	14.16	35.81	
Strain at Failure, %		15.1	15	14.6	
Strain Rate, %/min		0.08	0.016	0.08	
B-Value		0.95	0.96	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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Project: Big Sandy
Location: ---
Project No.: GTX-1515
Boring No.: B-6
Sample Type: UD
Description: Brown clay
Remarks: 2054

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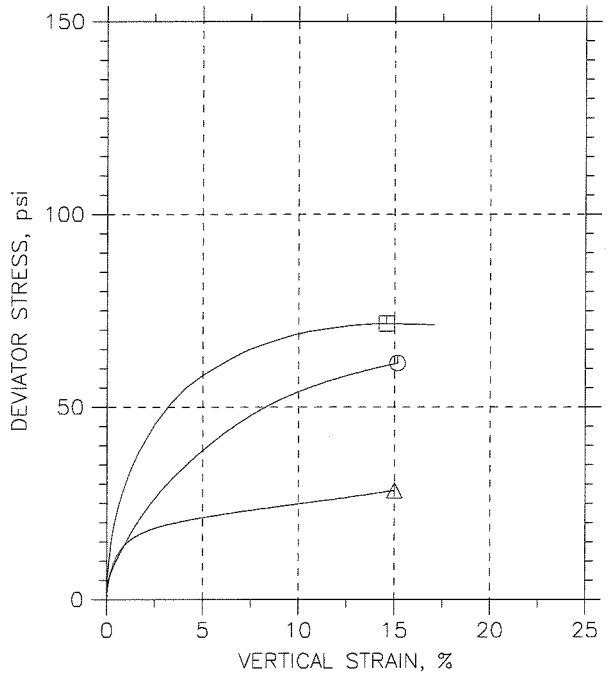
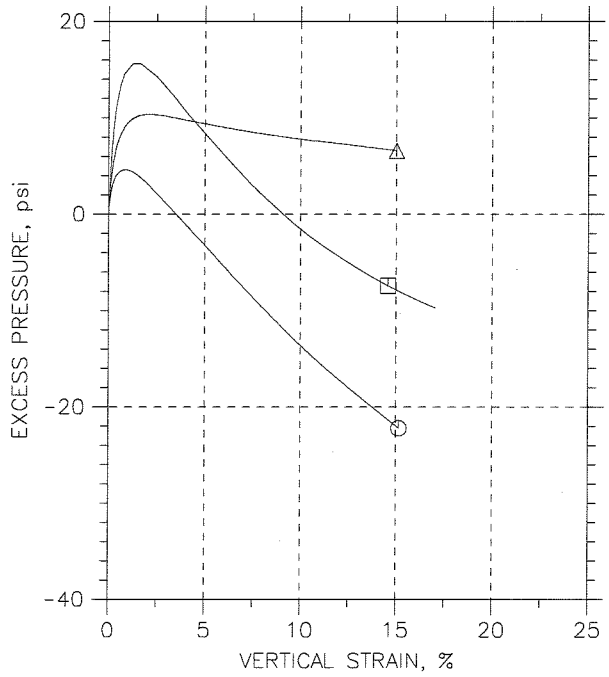
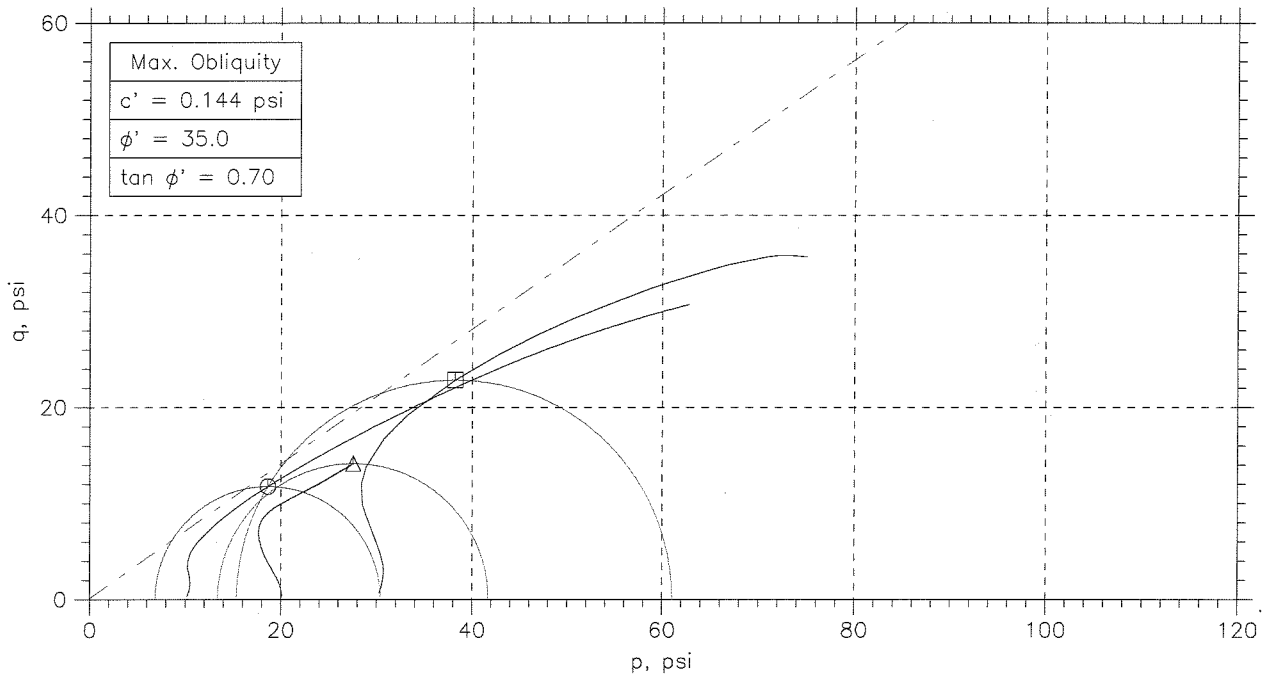
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	106-B	3.1	10.6-11.1	jm	12/3/09	mm		1515-3.1.dat
△	#81	3.2	7.5-8.0	jm	12/7/09	mm		1515-3.2-REPLACEMENT.dat
□	106-C	3.3	11.2-11.7	jm	12/3/09	mm		1515-3.3.dat

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Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-6	Sample Type: UD	
Description: Brown clay		
Remarks: 2054		

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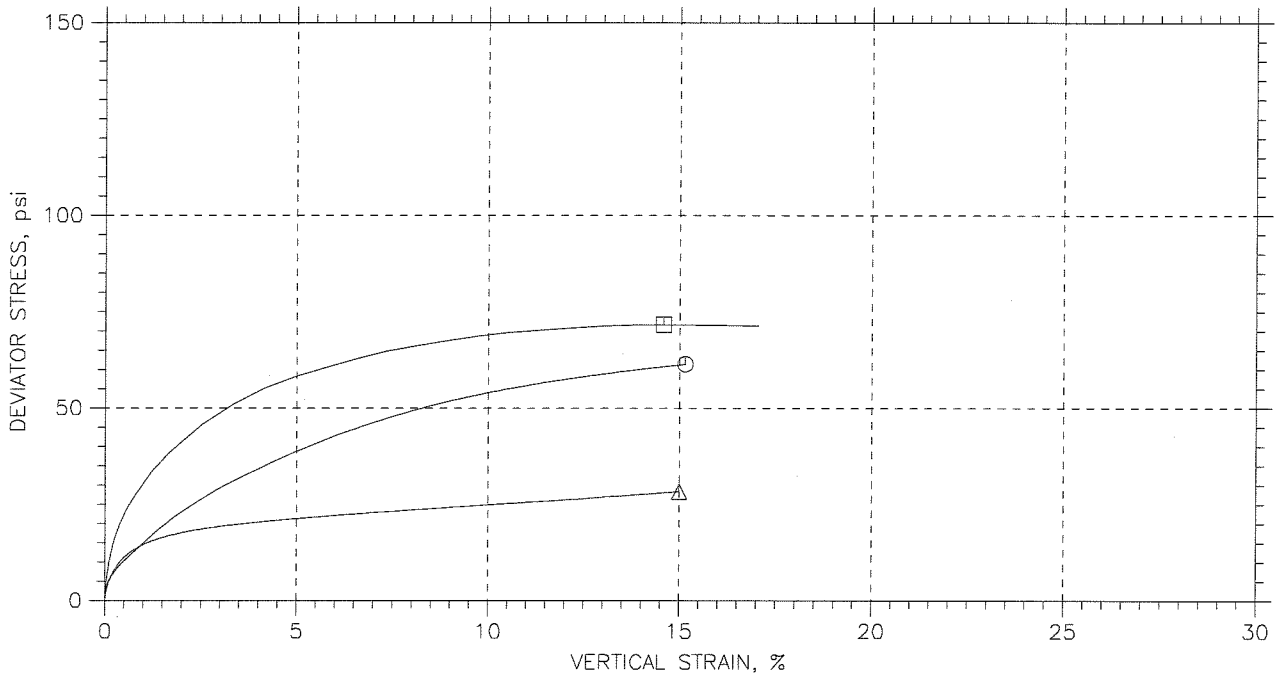

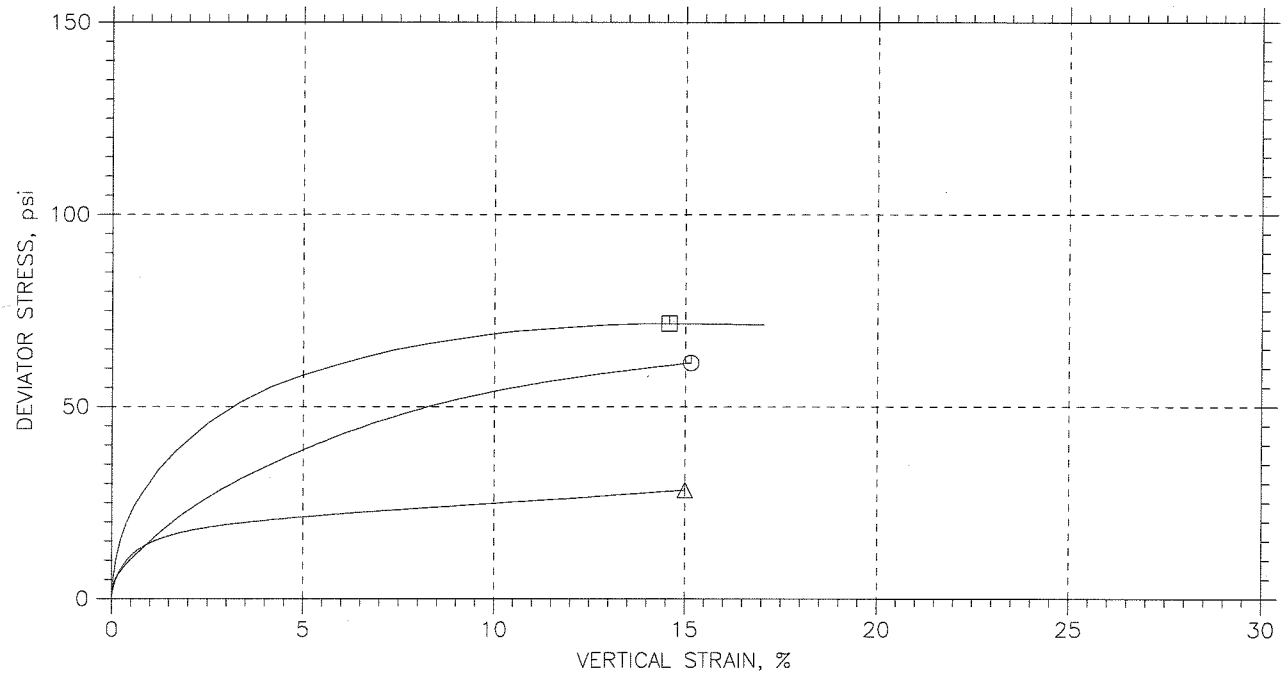

	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	106-B	3.1	10.6-11.1	jm	12/3/09	mm		1515-3.1.dat
△	#81	3.2	7.5-8.0	jm	12/7/09	mm		1515-3.2-REPLACEMENT.dat
⊡	106-C	3.3	11.2-11.7	jm	12/3/09	mm		1515-3.3.dat

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Project: Big Sandy	Location: ---	Project No.: GTX-1515
Boring No.: B-6	Sample Type: UD	
Description: Brown clay		
Remarks: 2054		

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FLY ASH POND MAIN DAM AND SADDLE DAM

TABLE 7.2

SUMMARY OF DESIGN SHEAR STRENGTHS AT MAIN DAM

CASE IV: PARTIAL POOL
CASE V: STEADY SEEPAGE WITH MAXIMUM STORAGE POOL
CASE VI: STEADY SEEPAGE WITH SURCHARGE POOL

DAM ZONE	DESIGN SHEAR STRENGTH (TSF)	COMMENTS
* FOUNDATION SOIL: UNDER EXISTING BERM UNDER EXISTING DAM*	σ' tan 25° 0.5 + σ' tan 23°	Kc=1; α = 90°
* FOUNDATION SOIL: UNDER EXISTING BERM UNDER EXISTING DAM*	σ' tan 27° 0.4 + σ' tan 23°	Kc=1; α = 45°
* FOUNDATION SOIL: UNDER EXISTING BERM UNDER EXISTING DAM*	σ' tan 30° σ' tan 30°	Kc=1.75; α =45°
* CLAY IN EXISTING DAM	σ' tan 25°	
* RANDOM ROCKFILL	σ' tan 24°	
* BOTTOM ASH	σ' tan 38°	
* COMPACTED CLAY	σ' tan 27°	Mc= -1% to+2%

* (Confining pressure $\sigma \geq 5$ tsf)

Case VII: Earthquake. Much research is in progress on the behavior of earth dams subjected to earthquake shocks, and new analytical methods for evaluating seismic effects are being developed. However, for this design, the traditional approach was used. This assumes that the earthquake imparts an additional horizontal force F_h acting in the direction of potential failure. The arc or set of planes found to be critical without earthquake loading is used with this added driving force to determine the factor of safety for Cases I, VI, V, VI. The horizontal seismic force is equal to the mass involved times the horizontal acceleration, i.e.

$$F_h = \frac{W}{g} a_h$$

The total weight of the sliding soil mass W should be based on saturated unit weights below the saturation line and moist unit weights above the line. Selection of the seismic coefficient should be based on the degree of seismic

7.2 Saddle Dam

The Geotechnical analyses considered the location of the seepage line at different water elevations in the reservoir, settlement, and the results of the strength tests in the selection of the design parameters associated with the different stability conditions for both the upstream and downstream slopes. A discussion of these items is presented in the following paragraphs.

7.2.1 Seepage

In the seepage through an earth dam, the upper boundary or uppermost flow line (known as the line of seepage) is not known, but must be found. Among the available solutions for seepage with a free surface, it has been decided to follow asagrande's solution (5) for the different levels of water during the operation of the dam. In this way, the seepage line will meet a vertical chimney drain ($\alpha = 90°$). The line of seepage, in this case, was found by using $a = 3/4\ Yo$; $Yo = (h^2 + d^2)^{½} - d$. Fig. F.36 illustrates the location of the seepage lines for several water levels of the reservoir as estimated using the above mentioned solution. Calculations associated with the solution of these equations are included in Appendix G of this report.

7.2.2 Settlement

A majority of the downstream shell of the saddle dam is founded in rock. The upstream clay core of this dam is founded on as much as 17 feet of very stiff to hard sandy clay. Settlement of the foundation soil due to the weight of the embankment have been estimated to be one inch. It is believed, therefore, that settlements associated with the proposed embankment are mostly limited to those settlements occurring within itself. In this case it is anticipated that settlements of the bottom ash shell will take place during the construction. Settlements of the upstream shell or clay core are estimated to be approximately 14 inches. Literature references (10) indicate that for this type of fill about 15% of the total settlement will occur as the fill is being placed; and that the time for all of the settlement to occur will be approximately 6½ years.

7.2.3 Design Shear Strengths

The materials used in the construction of the saddle dam will consist of bottom ash and clay from the proposed borrow area. The local overburden soil will provide the foundation soil. With the exception of the overburden soil, the design shear strength of the construction materials for the saddle dam have been presented in Section 7.1.3. Therefore, the

discussion in this section will only refer to the overburden soil.

The procedures to select the design shear strength of the overburden soil at the saddle dam closely followed the procedures discussed in Section 7.1.3 for the soils at the main dam. For the saddle dam, as for the main dam, the stability analyses considered cases I, IV, V, VI and VII. The design shear strengths of the overburden soils associated with each of these cases is presented as follows:

CASE I: END OF CONSTRUCTION - S = 1.4 tsf

CASE IV: PARTIAL POOL ELEVATION - $S = \sigma' \tan 34°$

CASE V: STEADY SEEPAGE WITH MAXIMUM STORAGE POOL
$S = \sigma' \text{ Tan } 34°$

CASE VI: STEADY SEEPAGE WITH SURCHARGE POOL-$S = \sigma' \text{Tan } 34°$

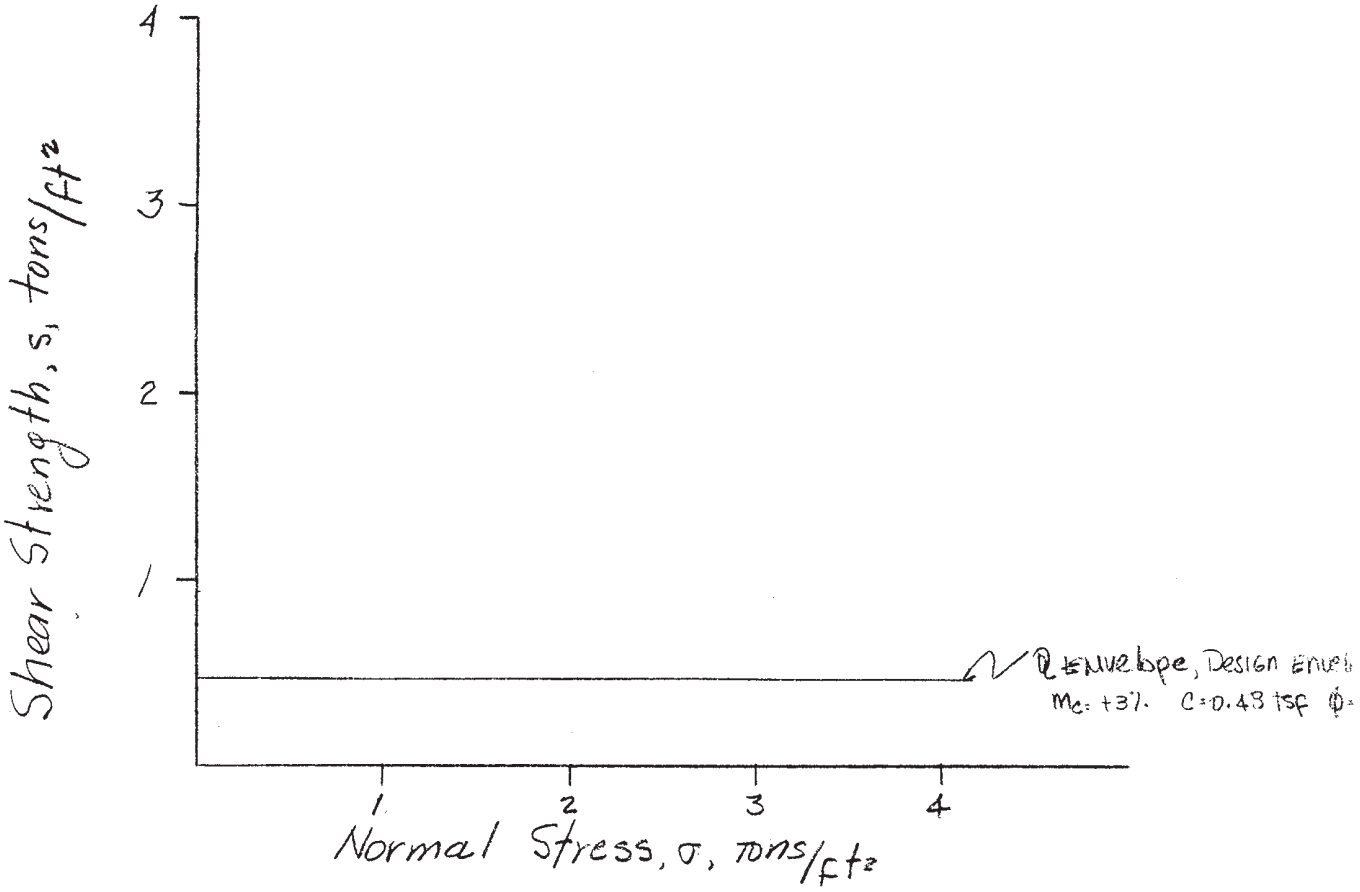
Fig. F.12 and F.19 illustrate the selection of the design shear strengths.

7.2.4 Stability Analyses

Downstream Stability

Similar to the main dam, the downstream shell of the saddle dam will be constructed using bottom ash and graded at a slope of 1-3/4 H:1V. The stability of the downstream shell was evaluated for the applicable conditions using the computer program XSTABLE. Wedge type foundation failure surfaces were analyzed using a random technique for generating sliding block failures. The active and passive portions of the sliding surfaces were generated according to the Rankine Theory. In addition, an "infinite slope" type analysis was performed to evaluate the stability of the shell with regard to shallow failures within the bottom ash material. A summary of the factors of safety associated with the different design conditions expected, is presented on Table No. 7.5. Summaries of the analyses are presented on Fig. F.38 through F.45. Data associated with the complete stability analyses of the downstream shell is submitted in Appendix F of this report.

F. Compacted Clay from proposed Borrow



H. Foundation Soils - SADDLE DAM

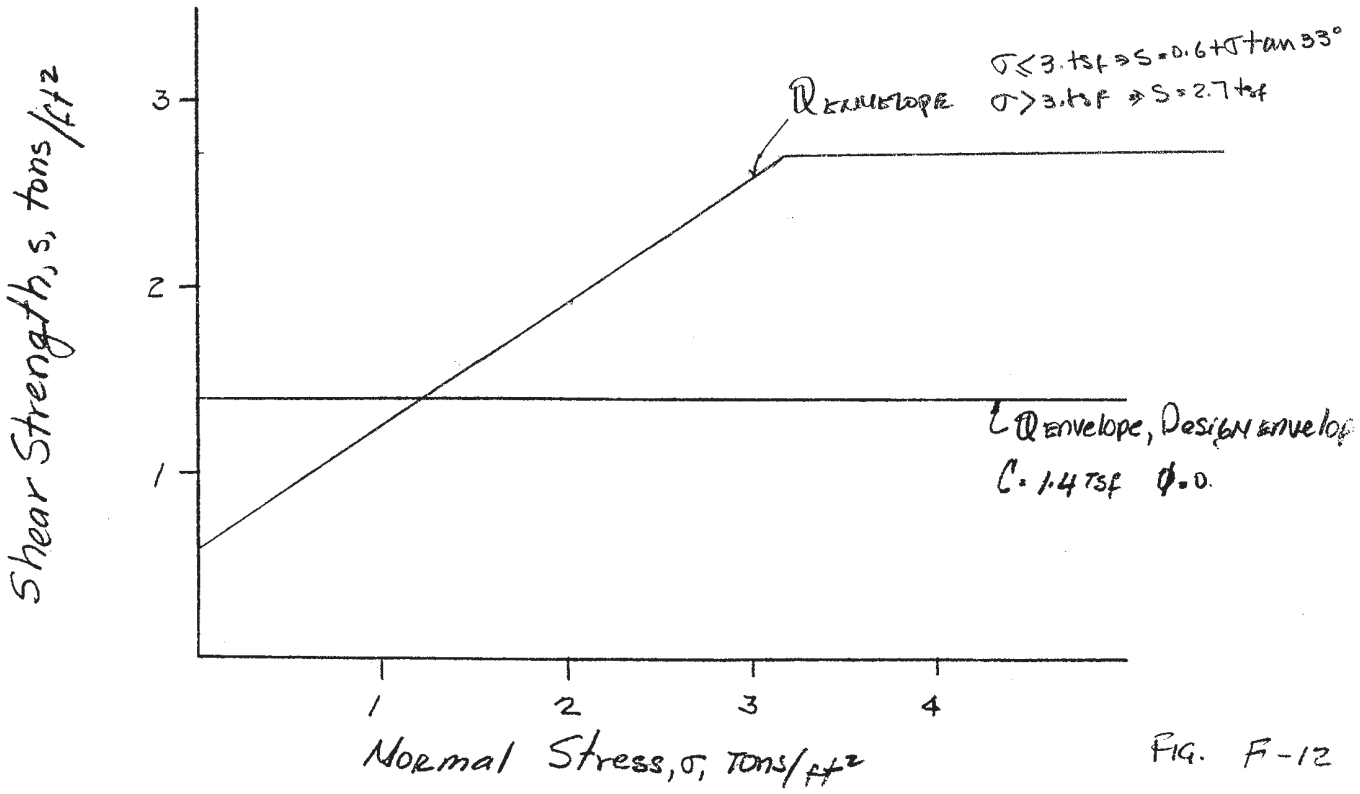
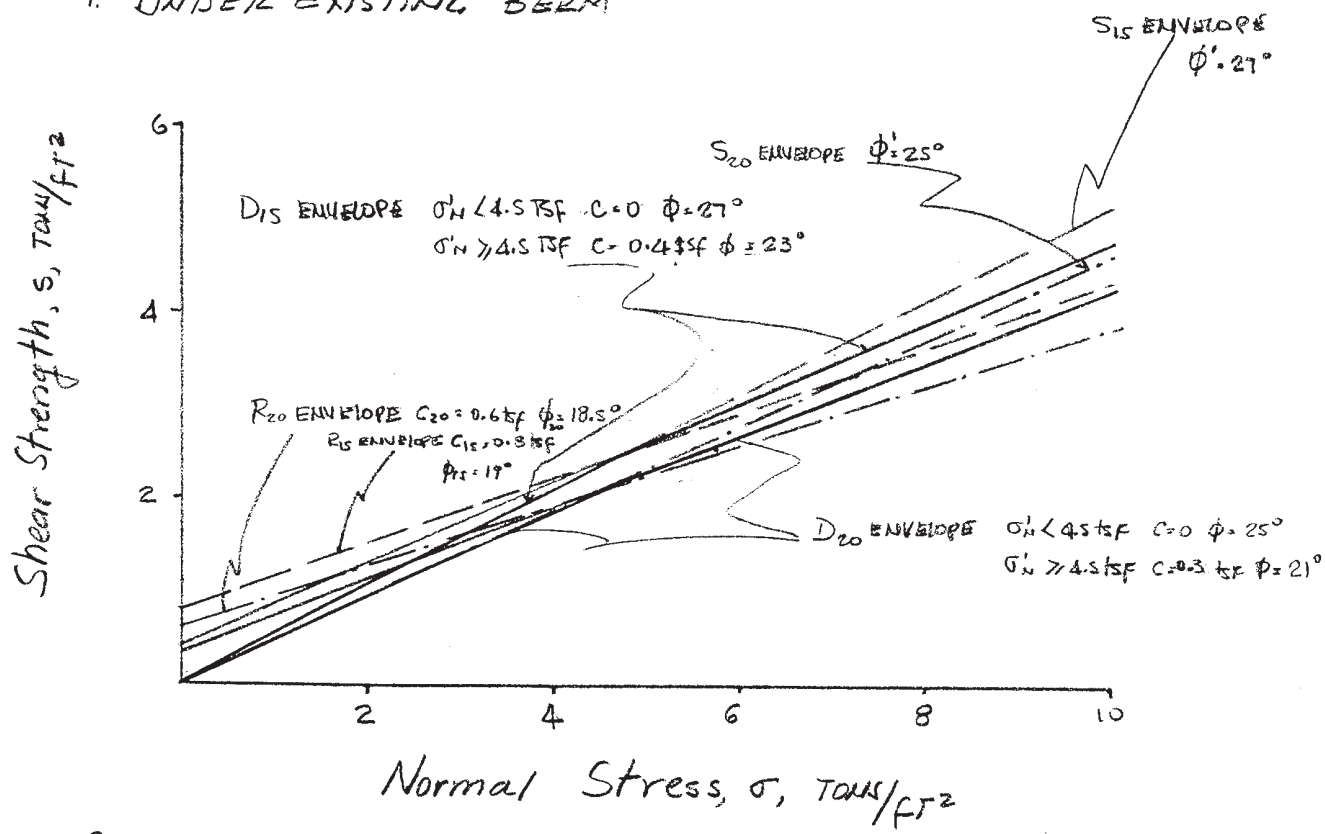


FIG. F-12

CASE IV - PARTIAL POOL WITH STEADY SEEPAGE - DESIGN ENVELOPES
CASE V - STEADY SEEPAGE WITH MAXIMUM STORAGE POOL - DESIGN ENV.
CASE VI - STEADY SEEPAGE WITH SURCHARGE POOL - DESIGN ENVELOPE

A. FOUNDATION SOILS - MAIN DAM

1. UNDER EXISTING BERM



2. UNDER EXISTING DAM

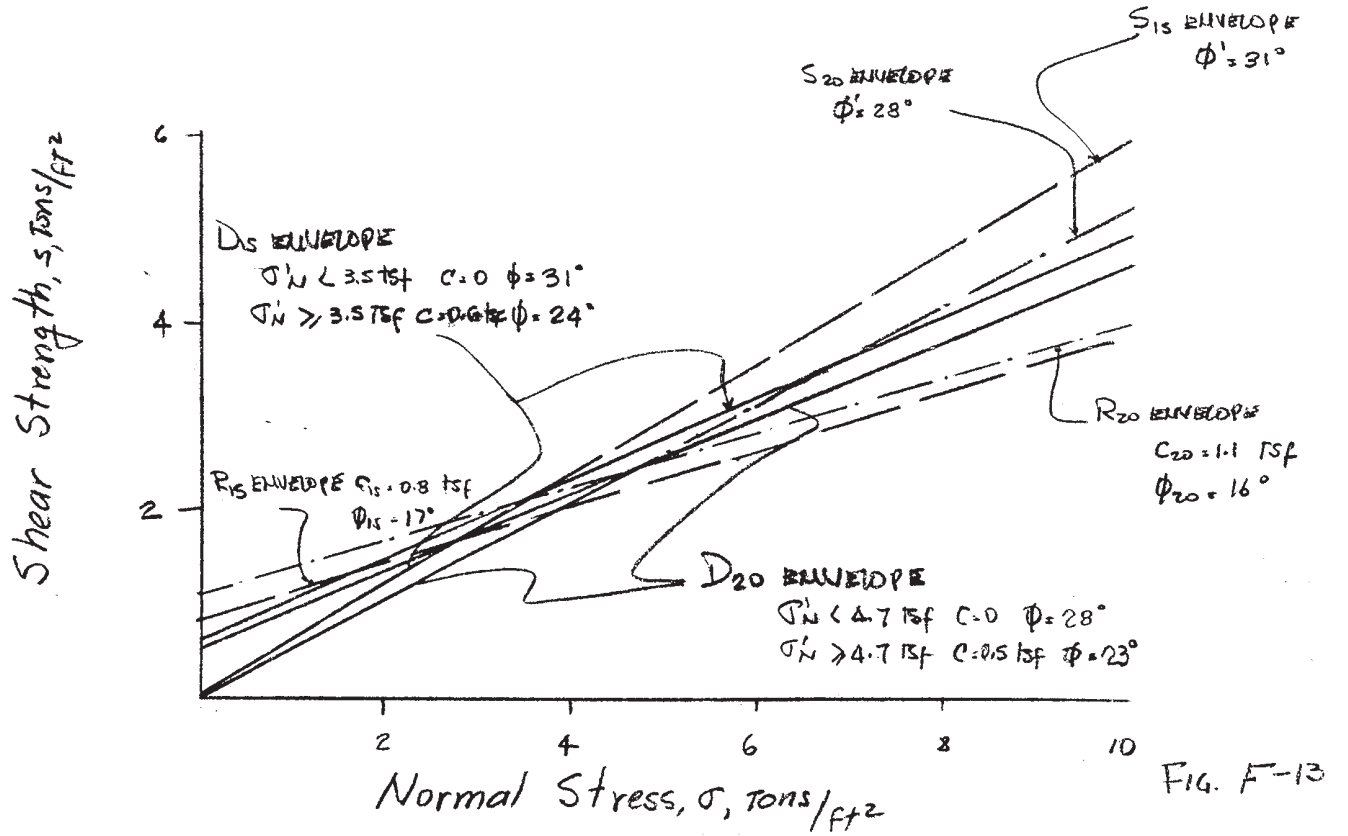


FIG. F-13

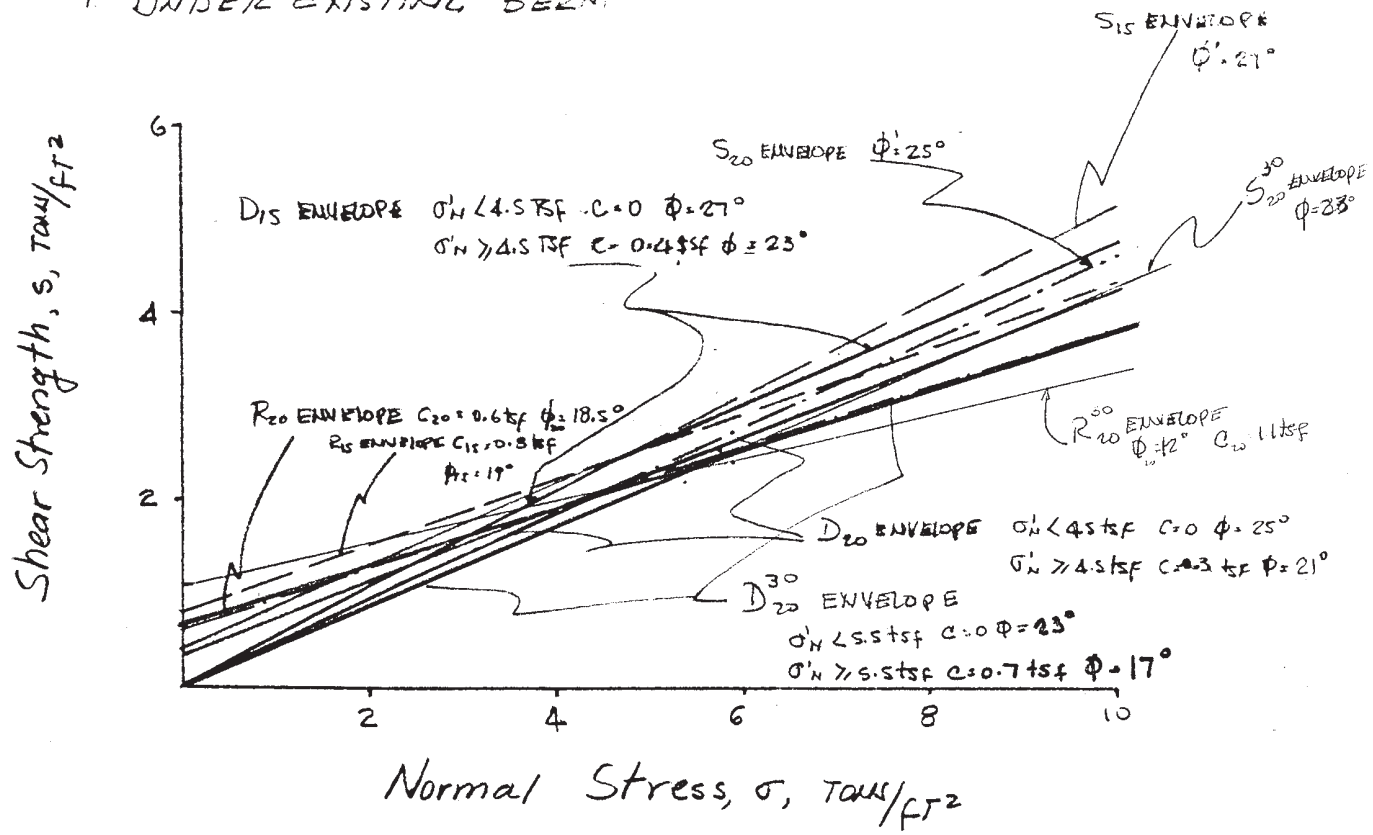
CASE IV - Partial Pool with Steady Seepage - Design Envelopes

CASE V - Steady Seepage with Maximum Storage Pool - Design Env.

CASE VI - Steady Seepage with Surcharge Pool - Design Envelope

A. Foundation Soils - Main Dam

1. Under Existing Berm



2. Under Existing Dam

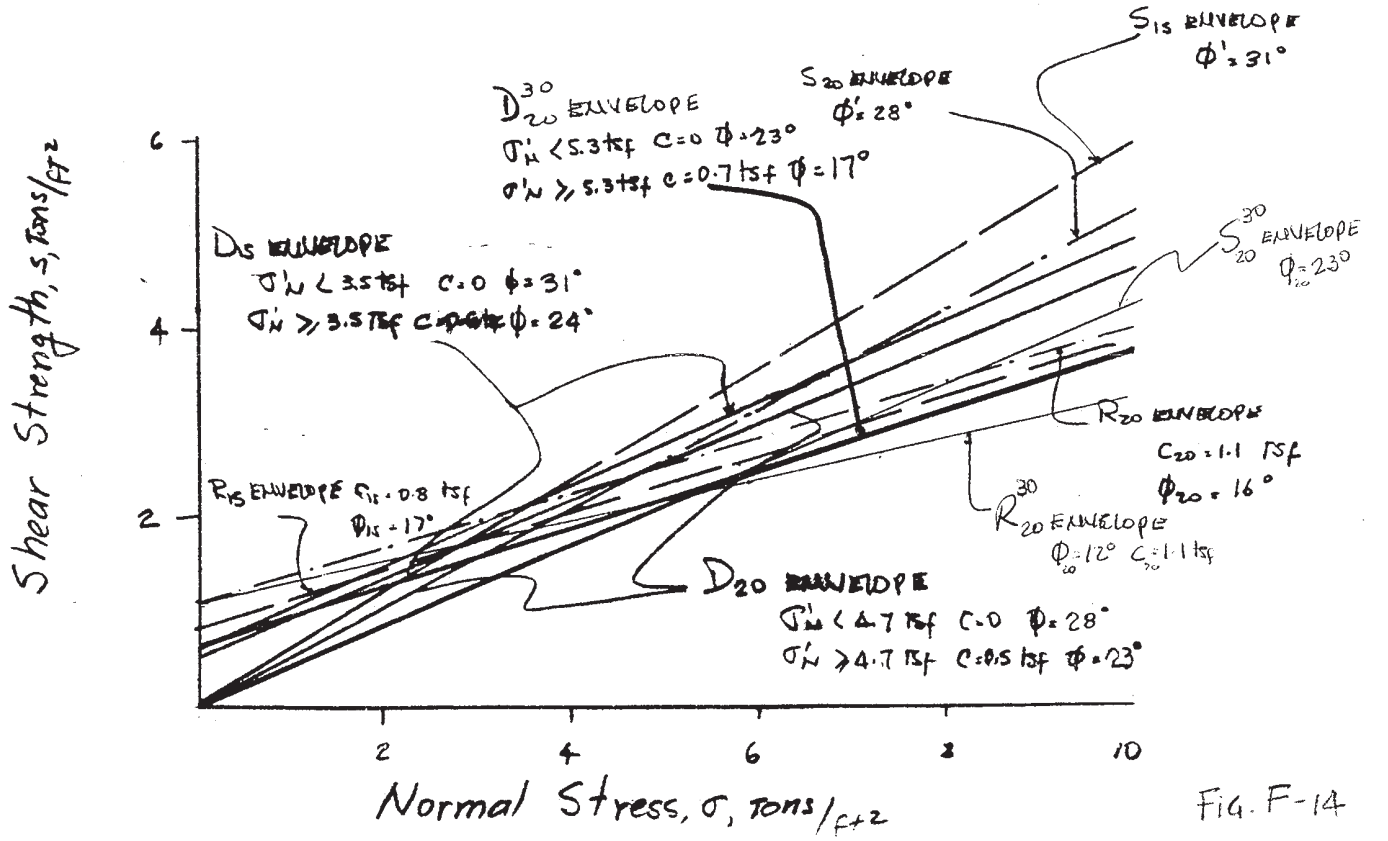


Fig. F-14

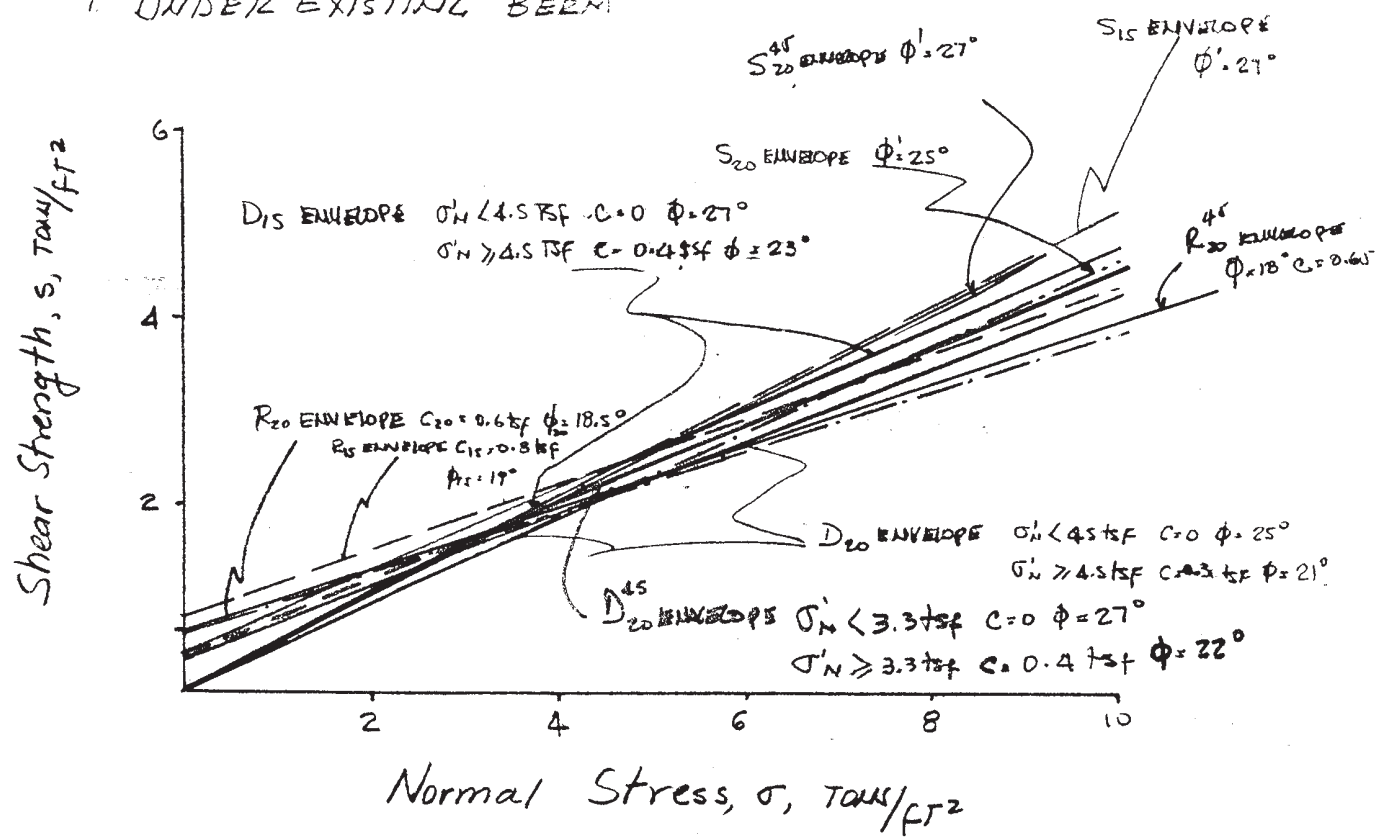
CASE IV - PARTIAL POOL WITH Steady Seepage - DESIGN ENVELOPES

CASE V - Steady Seepage with Maximum Storage Pool - DESIGN ENV.

CASE VI - Steady Seepage with Surcharge Pool - DESIGN ENVELOPE

A. Foundation Soils - MAIN DAM

1. UNDER EXISTING BERM



2. UNDER EXISTING DAM

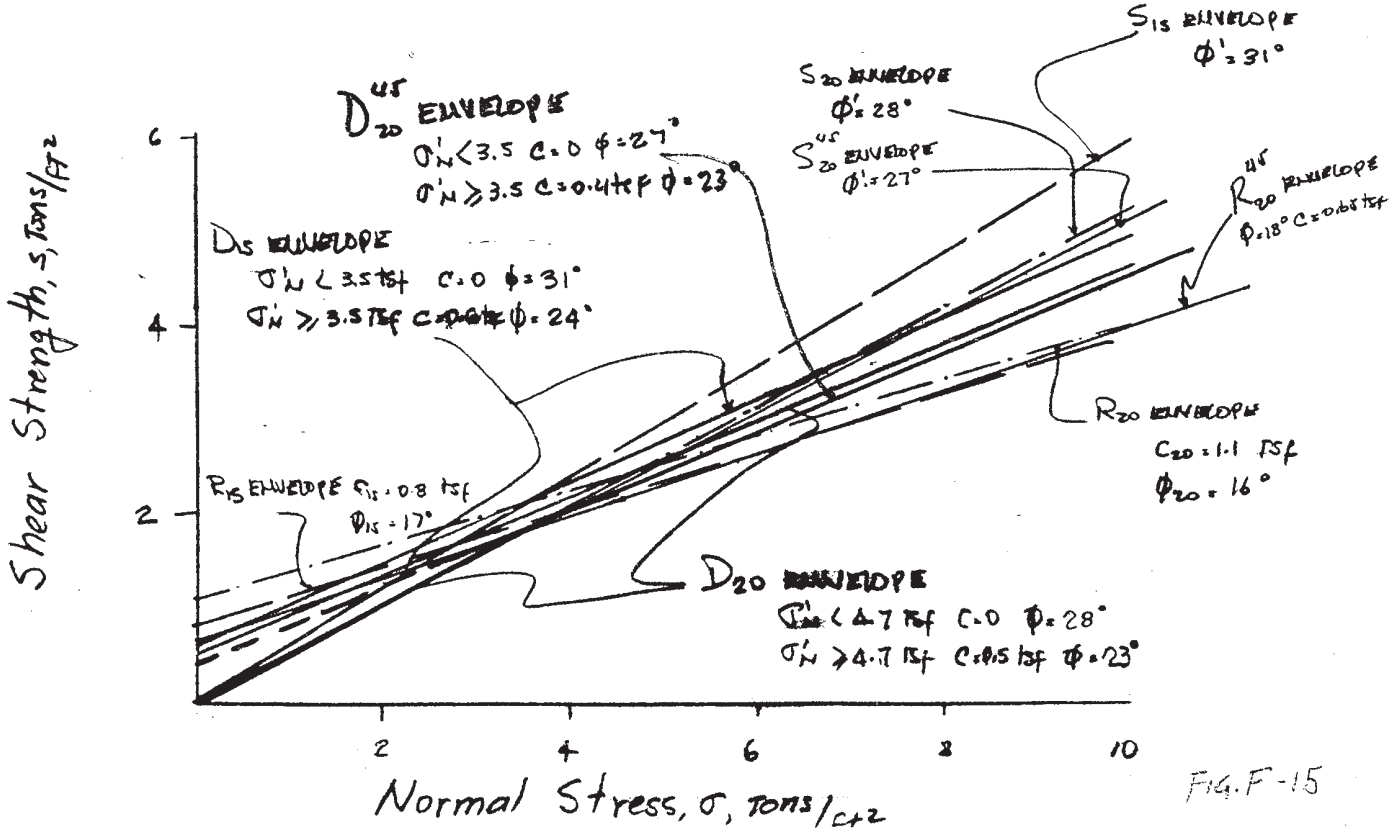
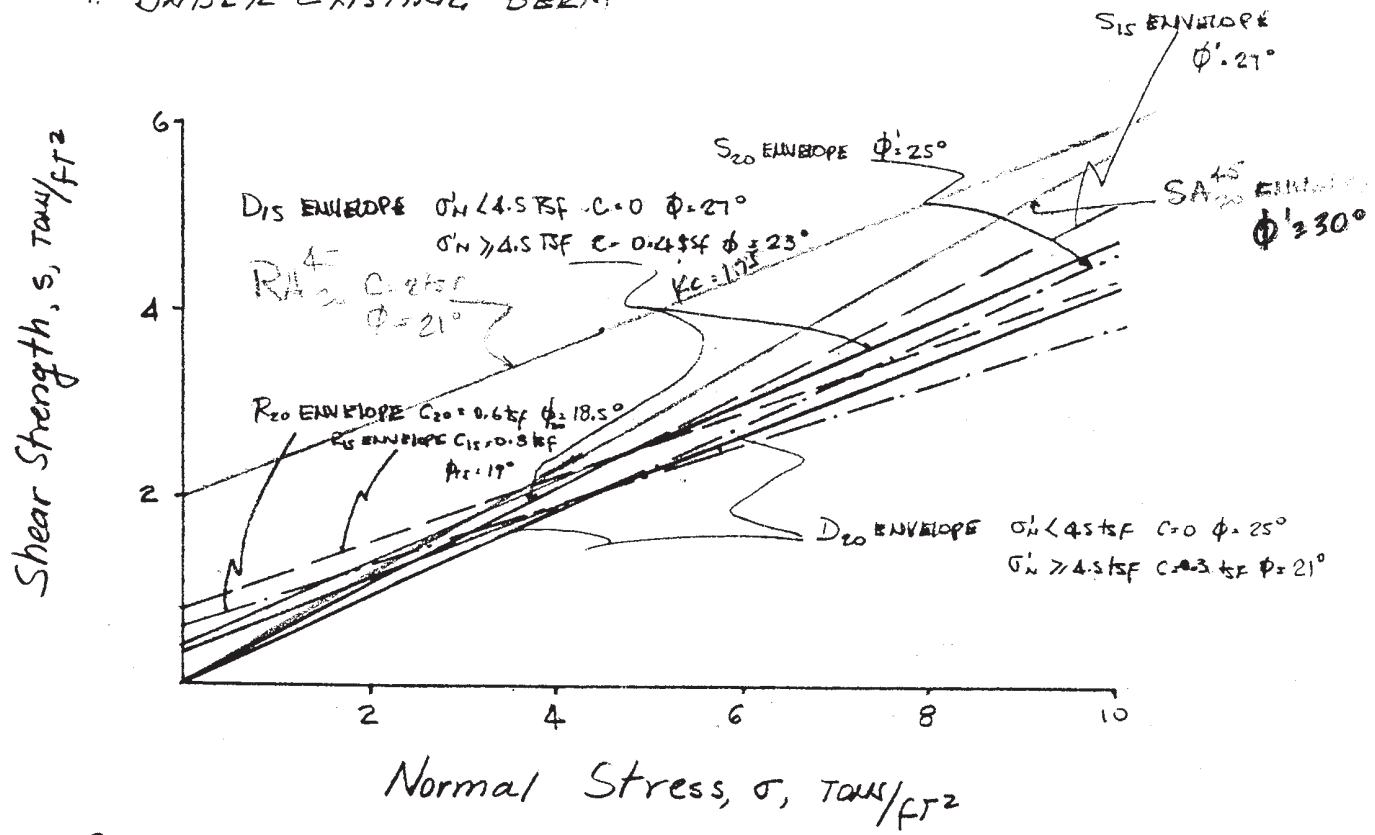


FIG. F-15

CASE IV - Partial Pool with Steady Seepage - Design Envelopes
CASE V - Steady Seepage with Maximum Storage Pool - Design Env.
CASE VI - Steady Seepage with Surcharge Pool - Design Envelope

A. Foundation Soils - Main Dam

1. Under Existing Berm



2. Under Existing Dam

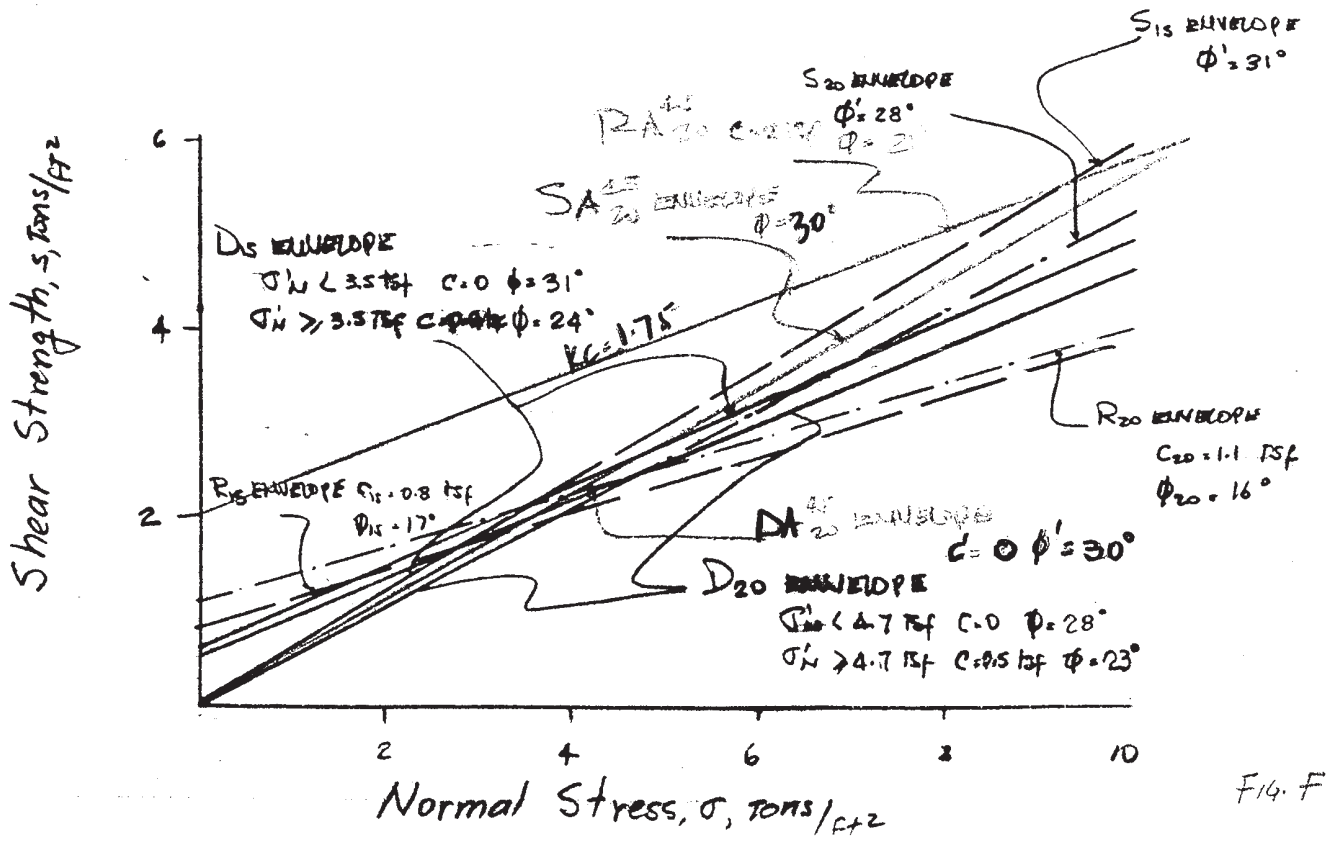


Fig. F-16

B. Clay in Existing Dam

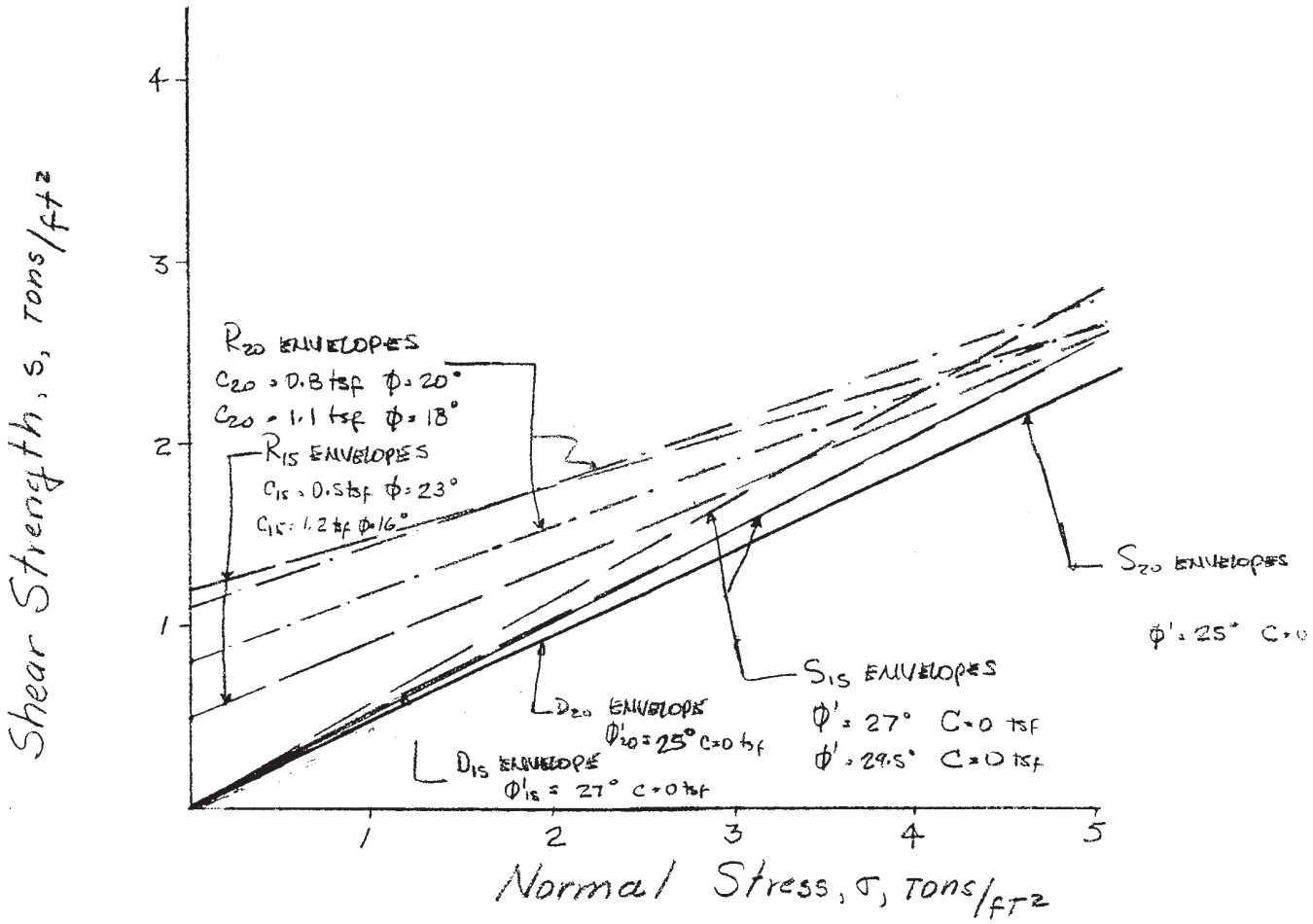
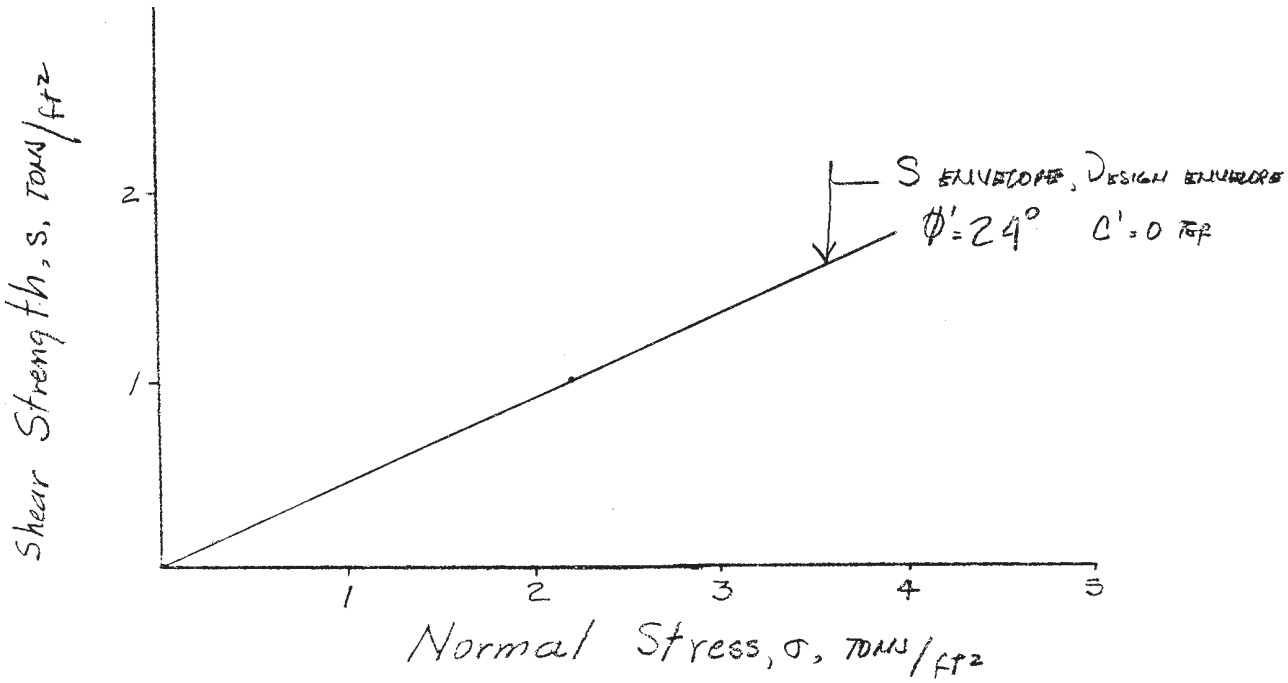


FIG. F-17

D. Randon Rockfill



E. Bottom Ash

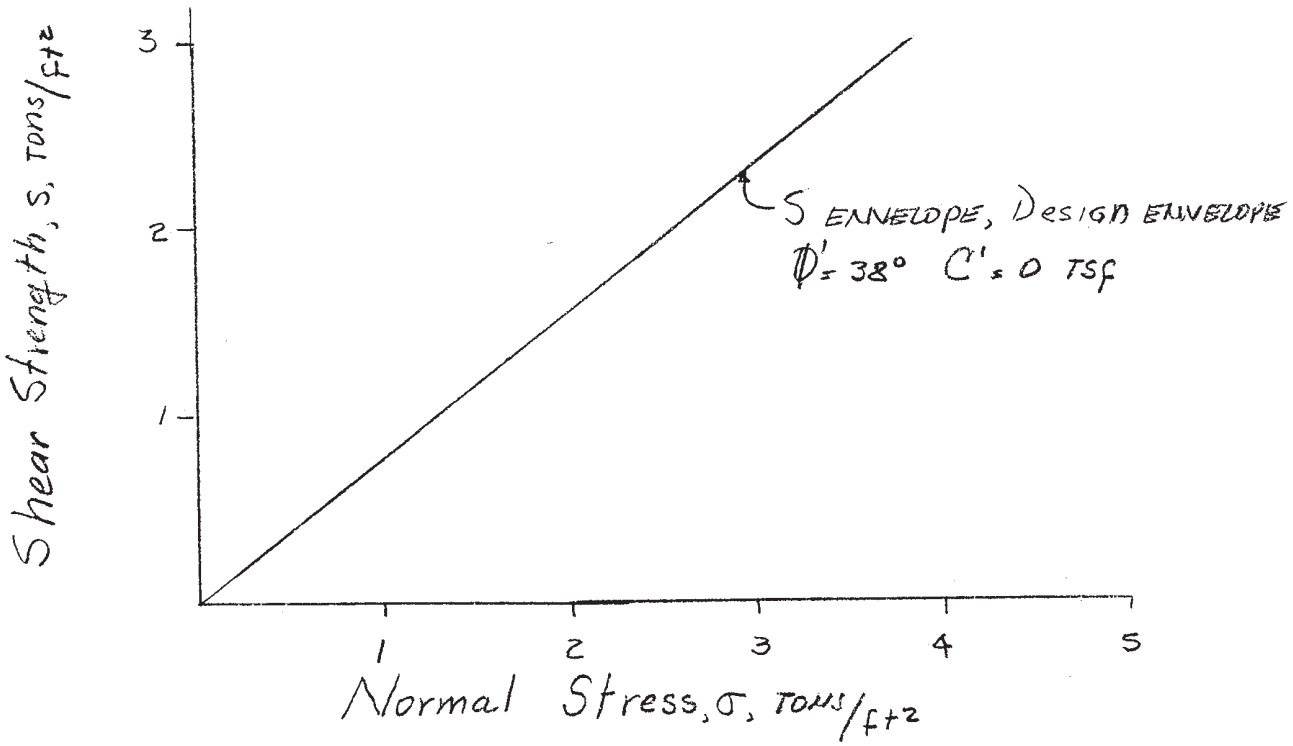
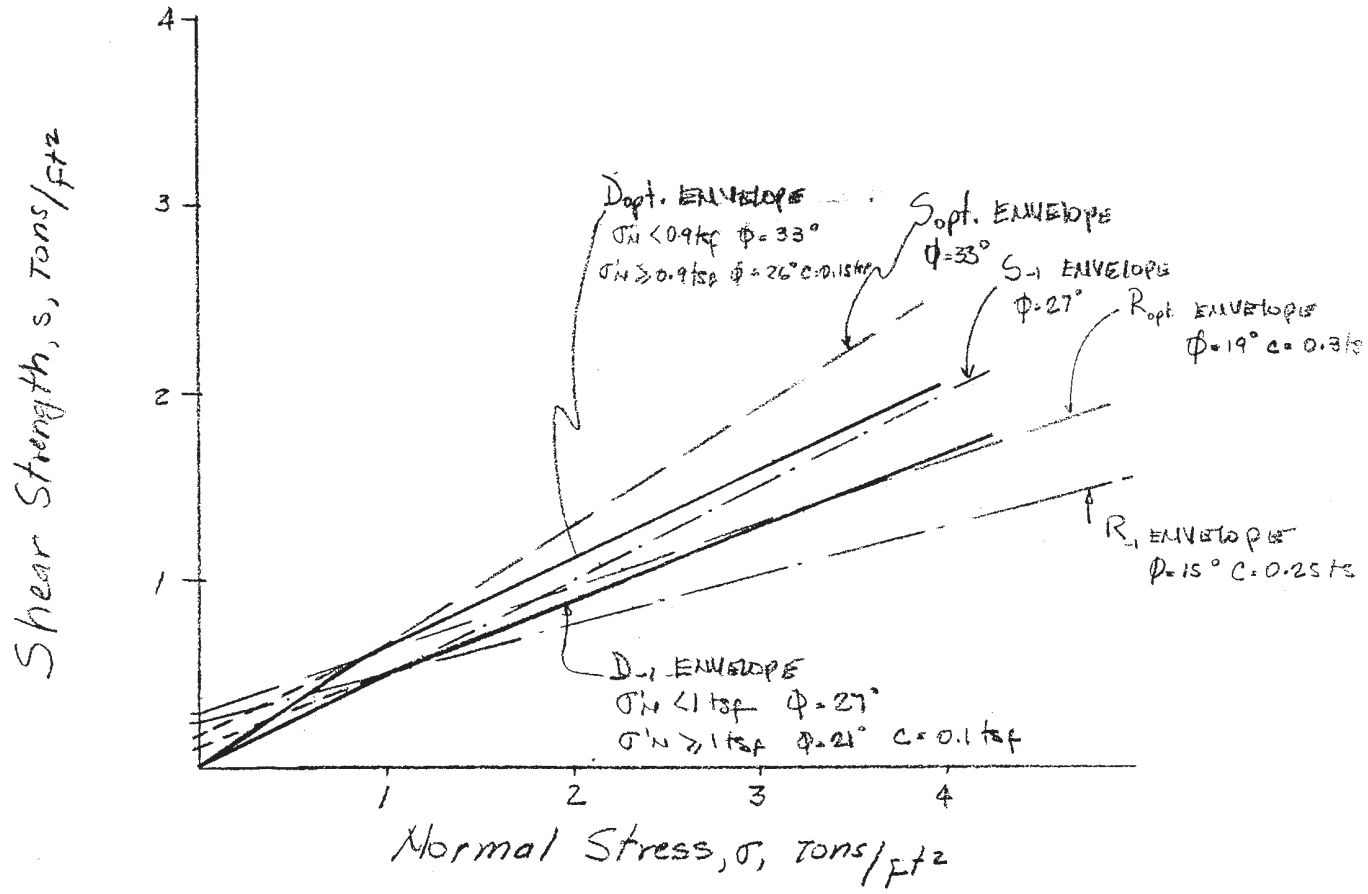


Fig. F-18

F. Compacted Clay From Proposed Borrow



H. Foundation Soils - Saddle Dam

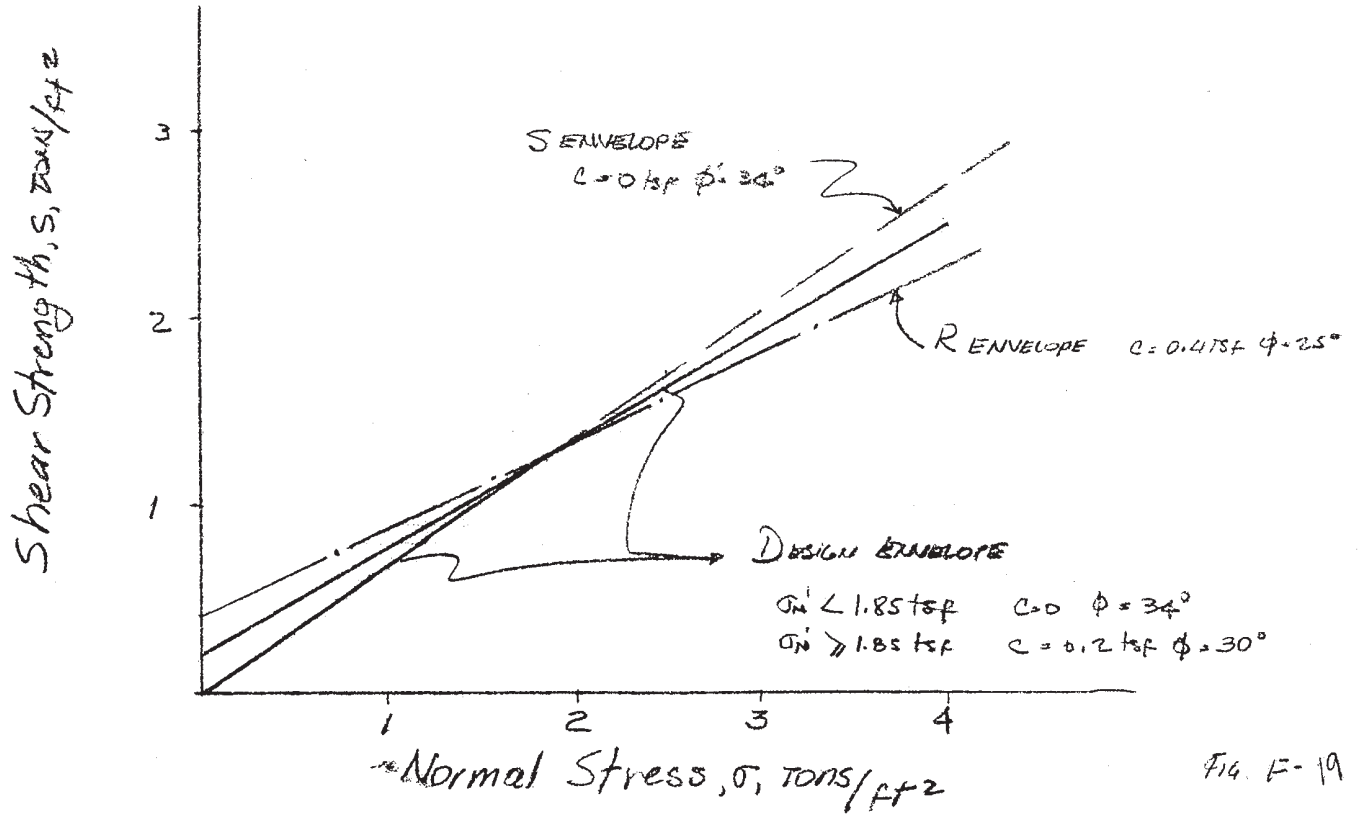


Fig. E-19