

SANTEE COOPER

Cross Generating Station Bottom Ash Pond

Periodic (5-Yr) Safety Factor Assessment

Document no. 0: CROSS-BA-PT-REP-00003



1 Sep 2026

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Synopsis

This report presents the second periodic safety factor assessment of the Cross Generating Station Bottom Ash Pond and provides the required certification by a qualified professional engineer in accordance with 40 CFR Part 257 (§257.73(e)(1)).

The Cross Generating Station Bottom Ash Pond factors of safety exceed the requirements of §257.73(e)(1).

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PROJECT 418008-00795 - CROSS-BA-PT-REP-00003: Cross Generating Station Bottom Ash Pond - Periodic (5-Yr) Safety Factor Assessment

Rev	Description	Originator	Reviewer	Worley Approver	Revision Date	Customer Approver	Approval Date
0	Issued for Use	Fletcher Wood Professional Engineer No. 35420 State of South Carolina	Yingwu Xu Professional Engineer No. 35420 State of South Carolina	Fletcher Wood Professional Engineer No. 35420 State of South Carolina	1 Sep 2026		
		F. Wood	Y. Xu	F. Wood			

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Appendix A. Calculation CROSS-0-DC-044-CE-0005

Bottom Ash Pond Periodic (5-Yr) Safety Factor Assessment Calculation



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1. Introduction

The United States Environmental Protection Agency (EPA) promulgated regulations regarding Coal Combustion Residuals (CCRs). These regulations (40 CFR Part 257) were published in the Federal Register on April 17, 2015. One of the requirements of the regulations (§257.73(e)(1)) is to conduct initial and periodic safety factor assessments on existing CCR surface impoundments and obtaining a certification from a qualified professional engineer that the requirements of this section are met. Required factors of safety are (i) 1.50 for long-term, maximum storage pool; (ii) 1.40 for maximum surcharge pool loading; (iii) 1.00 for seismic; (iv) 1.20 against liquefaction (for dikes constructed of soils susceptible to liquefaction).

Three sets of revisions to 40 CFR Part 257 have been published in the Federal Register since the 2015 CCR Rule was first published. The first set of revisions was published on July 30, 2018, the second set on November 12, 2020, and the most recent set (final legacy rule) on May 8, 2024. However, none of the revisions included any changes to the §257.73(e)(1) requirements addressing initial and periodic safety factor assessments.

§257.73(f)(3) requires that periodic safety factor assessments are completed every five years. The date of completing the initial assessment is the basis for establishing the deadline to complete the first periodic assessment, and so on for each subsequent assessment. The most recent revision of the first periodic safety factor assessment of the Bottom Ash Pond at Cross Generating Station is dated November 7, 2021. The second periodic safety factor assessment therefore must be completed and placed in the operating record on or before November 7, 2026.

This report presents the second periodic safety factor assessment of the Cross Generating Station Bottom Ash Pond and provides the required certification by a qualified professional engineer.

2. Discussion

2.1 General Information

Cross Generating Station consists of four generating units and is located between Lakes Marion and Moultrie in Pineville, South Carolina. All four units have undergone dry conversion, with bottom ash dewatered and stacked out locally in a containerized bunker adjacent to each of the four units. Prior to dry conversion, bottom ash from all four units was sluiced to the existing onsite Bottom Ash (BA) Pond.

The BA Pond is a diked CCR surface impoundment covering approximately 87 acres, with its perimeter dike comprising the CCR Unit boundary. Portions of the south and east dikes of the BA Pond are shared with the adjacent Wastewater Decant (WD) Pond, which lies outside the CCR Unit boundary.

BA Pond closure by removal of waste was initiated in August 2020. All inflows into the BA Pond were terminated at that time and the BA Pond trapezoidal weir outfall (previously located within the shared dike to convey effluent from the BA Pond to the WD Pond) was removed. As part of the weir removal, the shared dike in this area was restored to its original design elevation.

At the time of the initial safety factor assessment in 2016 [Appendix A Ref. 9], the site and operating conditions identified the critical section along the northern dike of the BA Pond. However, initiation of BA Pond closure in 2020 changed the operating condition of the CCR Unit such that the embankment height, geometry, and surface water condition that now exists at the dike shared with the WD Pond required additional analysis as part of the first periodic safety factor assessment in 2021. Since then there have not been any operational changes that require additional analysis as part of this second periodic safety factor assessment.

Engineering calculation CROSS-0-DC-044-CE-0005, originally part of the 2016 assessment and revised as part of the 2021 update (included as Appendix A to this report), includes a detailed discussion of the site geometry, embankment and foundation soil conditions, soil parameter development, liquefaction potential assessment results, and stability results, all of which have been reviewed, deemed acceptable, and verified as applicable to the present condition while the BA Pond continues to undergo closure. These items are summarized below.

2.2 Embankment Soils and Geometry

The BA Pond embankment is comprised of compacted sandy lean clay and clayey sand soils and generally have similar properties to the top several feet of existing site soils, which is consistent with the understanding that on-site borrow areas were used to obtain the fill materials used in embankment construction. The embankment soil parameters used in this analysis are consistent with those used in the initial safety factor assessment. None of the embankment soils are considered susceptible to liquefaction.



Due to the changed operating conditions at the site resulting from the initiation of closure and removal of the BA Pond outfall weir in 2020, the first periodic assessment considered different embankment geometry compared to the 2016 initial safety factor assessment. The height of the shared dike analyzed in the latter analysis is approximately 19 feet, from top near Elevation 95 down to the toe inside the BA Pond near Elevation 76. The embankment slopes are 3 horizontal to 1 vertical (3:1). The latter analysis also considers a higher long-term maximum storage pool within the adjacent WD Pond. These conditions are still applicable today.

2.3 Foundation Soils

The site subsurface exploration performed by Terracon in October 2015 indicated predominately sandy lean clay and clayey sand overlying weathered Santee Limestone. Depths to the weathered limestone layer ranged from approximately 29 to 47 feet below the top of the Bottom Ash Pond dike. Below a depth of about four feet into the in-situ soils underlying the embankment, there was a general decrease in both SPT N-value and peak undrained shear strength. This lower layer of soil typically had higher fines content and moisture contents closer to the liquid limit than the plastic limit. Soil classifications were predominately sandy lean clay and fat clay with sand.

The initial safety factor assessment located the critical section along the northern BA Pond dike due to the greater depth to limestone in this area as well as the lower shear strengths indicated by the subsurface data. The first periodic assessment evaluated a section through the dike shared between the BA Pond and WD Pond to account for the changed operating condition after closure was initiated in 2020, despite the more favorable soil conditions in this area.

2.4 Liquefaction Evaluation

The liquefaction analyses performed as part of the 2016 assessment (and summarized in the 2021 update) were reviewed as part of this 2026 periodic plan update to verify that the dike soils are not liquefiable. This review included consideration for a conservative 50% increase in the peak ground acceleration above the 0.55g originally assumed, to account for the evolution of the seismic hazard over time. This review confirmed that the dike soils are not susceptible to liquefaction and, as such, §257.73(e)(1)(iv) does not apply.

2.5 Method of Analysis and Results

The stability analyses were performed using limit equilibrium methods with the computer program Slide 6.0. The analysis methods used were Bishop simplified and Janbu simplified. The calculated factors of safety are summarized in Table 1 for the critical section located with the dike shared with the WD Pond. Refer to Appendix A for a detailed discussion of the analysis and results, including a summary comparison of the 2016 initial safety factor assessment results.

Table 2-1: Calculated Factors of Safety

CCR Rule Reference	Analysis Condition	Circular Factor of Safety	Block Factor of Safety	Required Factor of Safety
257.73(e)(1)(i)	Maximum Storage	1.53	1.58	1.50
257.73(e)(1)(ii)	Maximum Surcharge	1.53	1.58	1.40
257.73(e)(1)(iii)	Seismic	1.58	1.50	1.00
257.73(e)(1)(iv)	Liquefaction	Not Applicable		1.20



3. Conclusions

The results of the periodic safety factor assessment indicate that the perimeter embankment of the Bottom Ash Pond at Cross Generating Station has factors of safety that exceed the requirements of the CCR rule (§257.73(e)) for the current site and operational conditions. Embankment soils are not considered to be liquefiable.



4. Certification

I, the undersigned Professional Engineer registered in good standing in the State of South Carolina, do hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I certify, for the Cross Generating Station Bottom Ash Pond CCR impoundment, that the periodic safety factor assessment as specified in Section 40 CFR §257.73(e)(1) was conducted in accordance with the requirements of the section.



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Printed Name of Professional Engineer



Appendix A. Calculation CROSS-0-DC-044-CE-0005

Bottom Ash Pond Periodic (5-Yr) Safety Factor Assessment Calculation

Project Details

Customer		Santee Cooper										
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Calculation Objective

The purpose of this calculation is to perform the first periodic (5-Yr) safety factor assessment of the Bottom Ash Pond at the Cross Generating Station with respect to EPA's CCR rule (40 CFR Part 257.73(e)(1)).

Calculation Method

Contained in body of calculation.

Assumptions

N/A

Software Used

Title:	Version:	Validation: (Y / N / N/A)
Slide	6.0	N/A

References

Contained in the body of calculation.

Conclusions

The embankment soils are not liquefiable. The factors of safety calculated for the various loading conditions exceed the requirements of the CCR rule.

Related to a Safety Critical System? **No** Status of Supplier Data used **N/A**

HOLDS

N/A

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This Calculation represents the work of Worley performed to recognized engineering principles and practices appropriate for the terms of reference provided by Worley contractual Customer. This Calculation is confidential and prepared solely for the use of the Customer. The contents of this Calculation may not be disclosed to or relied upon by any party other than the Customer, and neither Worley, its subconsultants nor their respective employees assume any liability for any reason, including, but not limited to, negligence, to any other party for any information or representation herein.

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Please check boxes for all applicable items checked or mark as "N/A" if not appropriate:

Calculations:

Originator	Checker	
☒	☒	Calculation number assigned and registered.
☒	☒	All required information on Cover Sheet provided.
☐	☐	Revision history box complete and signed.
☒	☒	Table of Contents.
☒	☒	Appropriate stamp for preliminary issues.
☒	☒	Source of input data stated (with revision number and date if relevant).
☒	☒	Customer's requirements included/addressed.
☒	☒	Approach used is appropriate for problem being solved.
☒	☒	Method clear and easy to follow.
☒	☒	Input data correct.
☒	☒	Calculation is arithmetically correct, OR software previously verified
☒	☒	Calculation result within expected limits.
☐	☐	Calculation tolerances stated if significant.
☒	☒	Units used as required by customer. Unit conversions correctly performed.
☒	☒	Appropriate cross-references.
☒	☒	Sketches included and clearly labeled, where required.
☒	☒	Appendices included and referenced, as required.
☒	☒	Considered design reviews, HAZOP actions, Customer input, safety and environmental issues, etc.
☒	☒	Safety in Design (SID) and Sustainable Design are addressed. Refer relevant SID Discipline Standard.
☒	☒	Conclusions and recommendations are appropriate.

Checking records:

☒	☒	Checked and annotated copy of calculation filed (use "Doc Check Print" stamp).
☒	☒	Corrections made as required and calculation dated and signed on cover sheet by checker.
☐	☐	Alternative method calculation and/or representative check performed and filed, as required.

Revisions:

☐	☐	Changes clouded, tracked or highlighted.
☐	☐	Revision history block updated.
☐	☐	Calculation re-checked if required.

Project Details

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- Appendix B. 2015 Terracon Subsurface Exploration
- Appendix C. July 2014 Potentiometric Map
- Appendix D. Slope Stability Output



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PURPOSE

The purpose of this calculation is to perform the periodic (5-yr) safety factor assessments of the Bottom Ash Pond at Cross Generating Station in accordance with 40 CFR 257.73(e)(1) (CCR Rule). These analyses are based on current site conditions and operational procedures. Required factors of safety are (i) 1.50 for long-term, maximum storage pool; (ii) 1.40 for maximum surcharge pool loading; (iii) 1.00 for seismic; (iv) 1.20 against liquefaction (for dikes constructed of soils susceptible to liquefaction).

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1. BA-117-S0004, Rev. 1, Bottom Ash Pond Expansion Monitoring Well Location Plan, Gilbert/Commonwealth, Inc., November 21, 1995.
2. BA-117-S0002, Rev. 0, Bottom Ash Pond Expansion Sections and Details, Gilbert/Commonwealth, Inc., February 4, 1994.
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6. South Carolina Department of Transportation (SCDOT), Geotechnical Design Manual Version 1.1, 2010.
7. Stantec Consulting Services, Inc., Topographic Survey Cross Generating Plant, January 7, 2011.
8. Youd, T.L., et al., "Liquefaction Resistance of Soil: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soil," Journal of Geotechnical Engineering, ASCE, Vol. 127, No. 10, Pages 817-833, 2001.
9. WorleyParsons, Santee Cooper Cross Generating Station Bottom Ash Pond Initial Safety Factor Assessment, October 14, 2016.

CURRENT SITE CONDITIONS AND OPERATIONAL PROCEDURES

The pond complex at Cross Generating Station consists of two ponds: the Bottom Ash Pond (BA Pond) and the Wastewater Decant Pond (WD Pond). Only the BA Pond is within the CCR Unit boundary, but the two ponds share a common dike along a portion of the south and east sides of the BA Pond. The history of construction report [Ref. 5] describes several modifications that have been made to the pond complex over

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the last 40 years that aren't repeated in detail here. The most recent modification will be discussed in the context of how it affects this periodic safety factor assessment.

When the initial safety factor assessment [Ref. 9] was completed in 2016, the BA Pond and WD Pond were operationally connected by a trapezoidal weir located within the shared dike between the two ponds, with the weir functioning as the BA Pond principal spillway. The operating pool elevation in both ponds was roughly the same, with the maximum pool limited by the BA Pond top of dike elevation, which is four feet lower than the WD Pond top of dike elevation. The critical section analyzed for the initial safety factor assessment was located along the northern dike in the BA Pond and was based on the existing site and operating conditions that existed at that time.

In August of 2020, all inflows to the BA Pond were permanently terminated and closure by removal of the CCR Unit was initiated. After all inflows were terminated, the trapezoidal weir connecting the two ponds was removed, the shared dike at this weir location was restored to its original height, and the WD Pond was restored to its original operating condition, which includes a higher potential maximum pool elevation due to the higher dike elevation. This periodic safety factor assessment includes new analyses of the shared dike to account for the current site and operating conditions. Refer to Appendix A for a pond location map with critical section locations, and for details of the shared dike.

SUBSURFACE CONDITIONS

A site subsurface exploration was performed by Terracon in October 2015. Two geotechnical borings with Standard Penetration Testing (SPT) were performed along with four cone penetrometer tests (CPTs). The approximate boring and CPT locations are shown on the plan included in Appendix B. Boring logs and CPT soundings are also provided in Appendix B. This data, along with data from previous subsurface explorations completed in the pond complex area, was reviewed as part of this periodic safety factor assessment and is representative of the site conditions. No new subsurface exploration was required as part of this periodic assessment.

The boring logs indicate predominately sandy lean clay and clayey sand overlying silty sand. The silty sand represents Santee Limestone that has been highly weathered. SPT N-values in the weathered limestone were greater than 40. The subsurface conditions reported from the 2015 exploration are consistent with historical exploration data.

A summary of layer thicknesses, average SPT N-values, and material types from both the current and historical subsurface explorations at elevations below the original ground surface elevation is presented in Table 1.

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Table 1: Summary of Exploration Data below Elevation 80 Feet

Boring or CPT	Layer 1			Layer 2			Layer 3			Elev. of Rock (ft)
	Elev. (ft)	Soil Type	N- Value	Elev. (ft)	Soil Type	N- Value	Elev. (ft)	Soil Type	N- Value	
244	79 – 67	Sand	10	67 – 55	Clay	2	--	--	--	54.8
245	80 – 73	Sand	17	73 – 67	Sand	6	--	--	--	67.4
442	80 – 71	Sand	10	71 – 68	Clay	9	68 – 62	Sand	2	62.2
B-632	77 – 67	Sand	7	67 – 52	Clay	3	52 – 38	Sand	6	38.1
B-633	77 – 63	Clay	4	63 – 54	Clay	2	54 – 47	Sand	9	47.4
B-734	79 – 70	Clay	9	70 – 59	Clay	5	59 – 47	Clay	1	43.9
B-735	80 – 73	Clay	5	73 – 67	Clay	2	67 – 62	Clay	9	62.2
C823	80 – 70	Clay	10	70 – 64	Clay	5	64 – 53	Sand	15	53.1
C824	80 – 63	Clay	10	63 – 47	Sand	15	47 – 34	Sand	25	33.6
C-834	80 – 69	Clay	7	69 – 66	Clay	10	66 – 63	Sand	40	62.9
C-835	80 – 74	Clay	5	74 – 55	Clay	3	--	--	--	54.1
C-836	80 – 78	Clay	7	78 – 76	Sand	20	76 – 61	Clay	7	60.4
C-837	80 – 75	Clay	10	75 – 60	Clay	7	60 – 51	Clay	5	51.0

A plot of N_{60} values as a function of elevation is provided as Figure 1. A review of this figure yields the following conclusions:

- N-values in soil materials located above the Santee Limestone are generally less than 15.
- Above Elevation 74 feet, there is general agreement among C-834, C-835, C-836 and B-735. N-values from B-734 and C-837 tend to be 5 to 7 blows per foot higher.
- Below Elevation 74 feet, there is general agreement among C-834, C-836, and C-837. C-835 indicates N-values approximately 4 blows per foot lower.
- CPT soundings C-835 and C-837 show a general trend of decreasing N-value with depth, while soundings C-834 and C-836 are relatively constant. B-734 also shows a general decrease in N-value as a function of depth.

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- CPT sounding C-835, which is co-located with Boring B-734, generally has the lowest N-values.

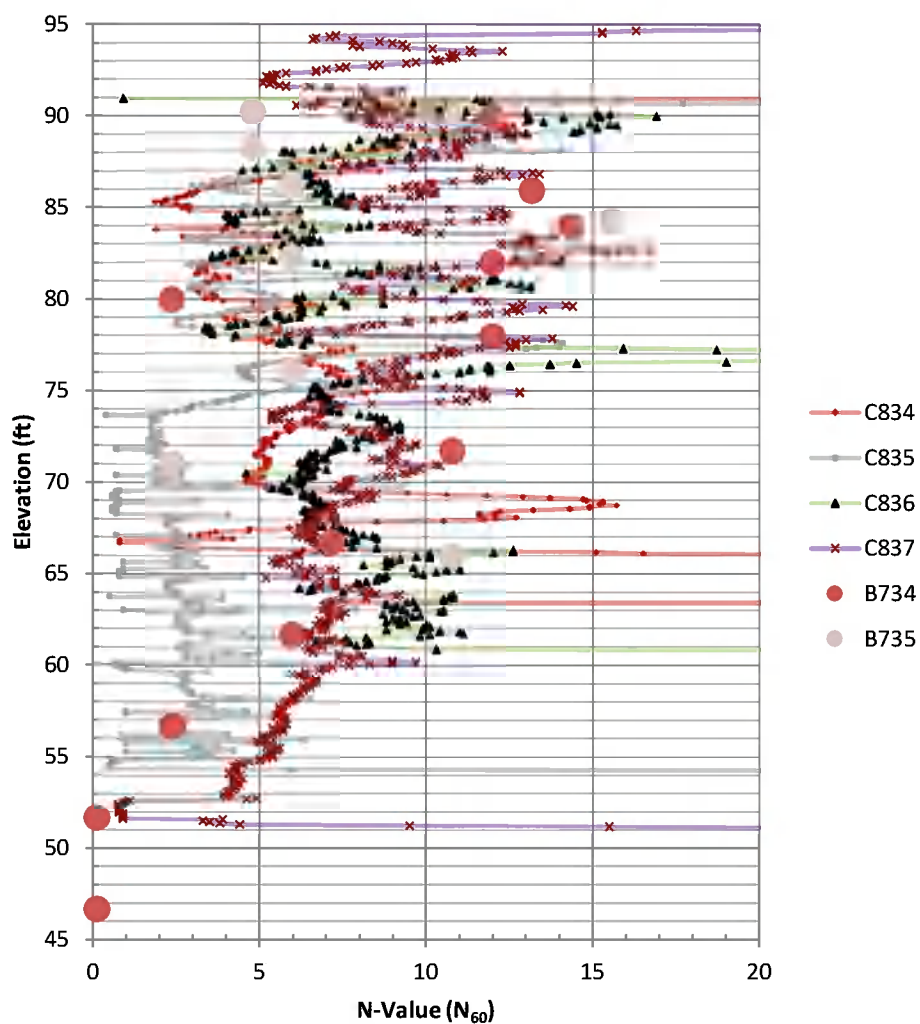


Figure 1

The plot of peak shear strength as a function of elevation is provided in Figure 2.

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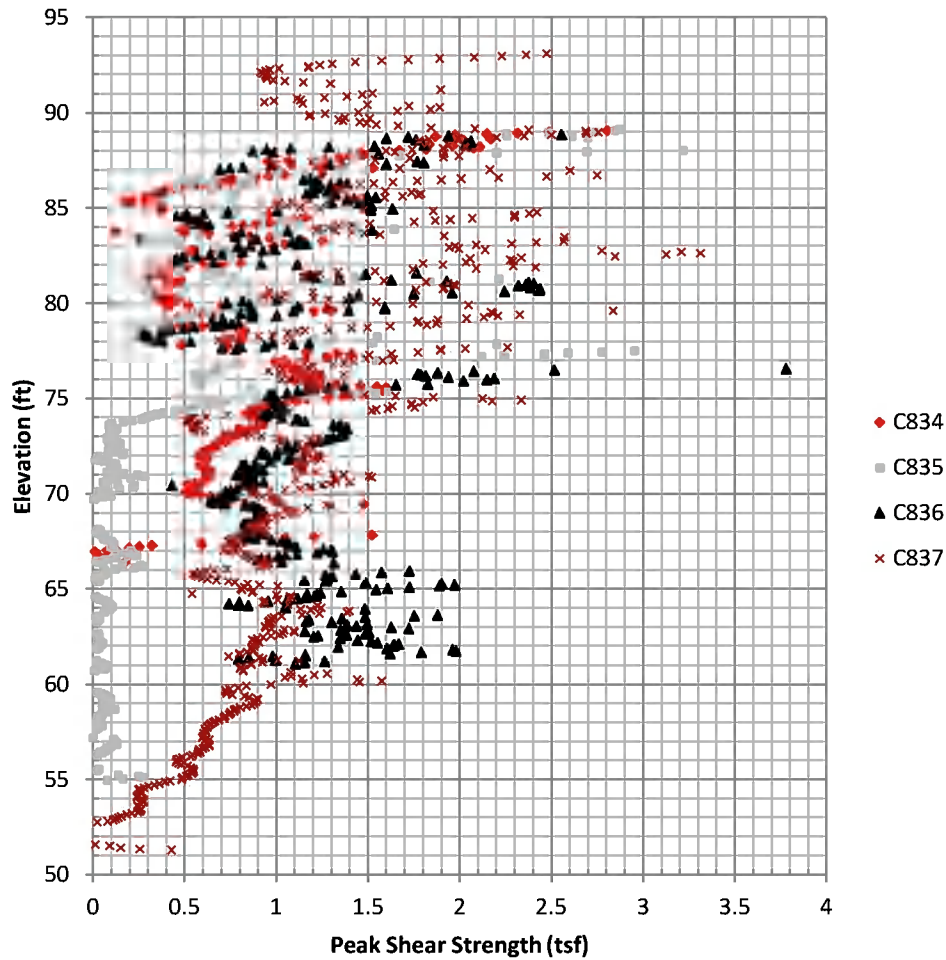


Figure 2

Based on the boring and CPT data, the location of Boring B-734 / CPT sounding C-835 was determined to be the critical cross section for the 2016 safety factor assessment [Ref. 9]. This location was selected for the following reasons:

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1. Based on review of the ash basin plan [Ref. 1] and site topographic mapping [Ref. 7], this location had the largest change in elevation from the toe to the crest of the embankment (highest slope) based on the operating conditions present at the time.
2. The depth to the limestone bedrock layer was generally greater than at the other sounding locations (deepest soils).
3. As shown in Figure 2, the CPT-derived undrained shear strength below an elevation of approximately 74 feet is lower than the shear strengths recorded at the other sounding locations (softest soils).

The critical cross section at the location of Boring B-734 / CPT C-835 was previously analyzed in the initial safety factor assessment [Ref. 9]. Detailed analyses of this section were reviewed for completeness and the results summarized herein. Refer to Ref 9 for the output files.

For this periodic (5-yr) safety factor assessment, an additional cross section near the location of Boring B-735/CPT C-837 through the shared dike between the BA Pond and the WD Pond is selected to analyze the current site and operating conditions that are present during the BA Pond closure activities. The subsurface conditions appear less critical in this area, but the embankment height and operating pool within the adjacent WD Pond has increased, necessitating an upstream analysis (relative to the BA Pond) of the shared dike.

SURFACE WATER AND GROUNDWATER CONDITIONS

Groundwater levels at the site vary seasonally from approximately Elevation 70 to Elevation 78 feet. The groundwater level in Boring B-734 after drilling was 18 feet, or Elevation 73. This elevation corresponds reasonably well to the data for well CAP-8, closest to the critical section at Boring B-734 / CPT C-835, from the July 2014 Potentiometric Map (Appendix C). This map also shows that there is minimal seepage through the lined impoundment, as water levels at the piezometers are closer in elevation to groundwater than the water level in the pond. Since the groundwater fluctuates seasonally, a groundwater elevation of 78 feet was used for the analyses of the cross section at Boring B-734 / CPT C-835. Well CAP-10 is close to the cross section at Boring B-735/CPT C-837. The groundwater level data of CAP-10 from 2015 to 2021 vary seasonally from approximately Elevation 73 to Elevation 76 feet. A groundwater elevation of 76 was used for the analyses of the cross section at Boring B-735 / CPT C-837.

Prior to the initiation of closure by removal activities, the normal pool elevation within the BA Pond was Elevation 88 feet [Ref. 2] and the maximum surcharge pool elevation was equal to the top of the embankment at Elevation 91 feet. However, during ongoing closure activities, the most conservative

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assumption when analyzing the shared dike is that the BA Pond is empty while the WD Pond is operating at a higher elevation that was previously possible.

The pool elevation within the WD Pond generally is kept very low (e.g. below Elevation 80) to provide surge capacity for site wastewater flows during large storm events. To be conservative, normal pool elevation within the WD Pond is set to Elevation 88 feet for the maximum storage pool condition. For the maximum surcharge pool elevation, the water level in the WD Decant Pond is set to Elevation 93 feet, which corresponds to the elevation of the emergency overflow structure.

ENGINEERING PROPERTIES OF SUBSURFACE MATERIALS FOR STABILITY ANALYSIS

Embankment and Near Surface Soils

The engineering properties of the embankment and near surface soils were evaluated in the initial safety factor assessment [Ref. 9]. The assessment determined that based on the laboratory test results and the understanding that the embankments for the ash basin were constructed of soils obtained from on-site borrow areas, it is reasonable to assume the soils at different locations along the embankments, as well as the near-surface soils away from the embankments, have similar characteristics, and as such, could be modeled as a single layer. The soil properties for the embankment and near surface soils are summarized in Table 2.

Table 2: Soil Properties for Embankment and Near Surface Soils

Properties	Drained	Undrained
Moist Unit Weight (pcf)	130	130
Saturated Unit Weight (pcf)	135	135
Friction Angle (deg)	30	0
Cohesion (psf)	50	1440

Underlying Soils

The engineering properties of the underlying soils in the vicinity of Boring B-734/ CPT sounding C-835 were evaluated in the initial safety factor assessment [Ref. 9]. The evaluation was based on empirical

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correlations with CPT and SPT data as well as laboratory test results on undisturbed samples from previous geotechnical explorations. The soil properties for the underlying soils in the vicinity of Boring B-734/ CPT sounding C-835 are summarized in Table 3.

Table 3: Soil Properties for Underlying Soils - Boring B-734/ CPT sounding C-835

Properties	Drained	Undrained
Moist Unit Weight (pcf)	102	102
Saturated Unit Weight (pcf)	107	107
Friction Angle (deg)	22	0
Cohesion (psf)	0	200 (Residual)

For the initial safety factor assessment, the location of critical section 1-1 was selected in part because the above underlying soils appeared to exhibit the lowest strength.

From a review of Figure 1 and Figure 2, it is obvious that the subsurface conditions at elevations below 74 feet in the location of B-735/C-837 (where critical section 2-2 is located for this periodic safety factor assessment) exhibit a higher strength than those in the location of B-734/C-835. Plasticity indices ranged from 24 to 36 for the soil samples below a depth of 14 feet in Boring B-735. According to Figure 3 [Ref. 6], the friction angles corresponding to these plasticity indices would range from approximately 28 degrees to 30 degrees. For analyses using drained strength parameters, an effective friction angle of 28 degrees was used, along with 20 psf of apparent cohesion. The cohesion of 20 psf was used primarily to prevent the model from predicting unrealistically shallow surface sloughing type failures.

Figure 4 is a plot prepared by Terracon of peak and residual undrained shear strength for CPT sounding C-837. The residual shear strength is more of a direct measurement from the CPT sleeve, and is considered more reliable for this purpose. For analysis purposes, the peak undrained shear strength was conservatively assumed equal to the residual undrained shear strength, even though in reality the peak would be greater. A conservative undrained residual shear strength of 0.2 tsf (400 psf) was used for the analyses.

The soil properties for the underlying soils in the vicinity of Boring B-735/ CPT C-837 are summarized in Table 4.

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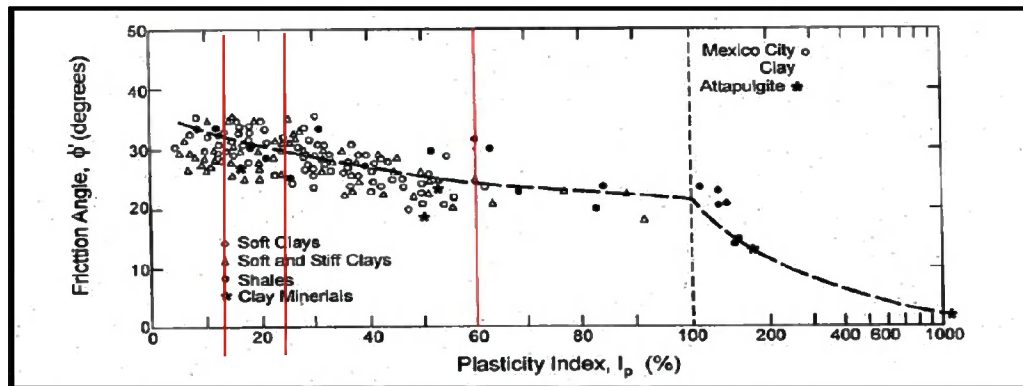


Figure 7-24, Plasticity Index versus Drained Friction Angle For NC Clays (Terzaghi, Peck, and Mesri, 1996)

Figure 3

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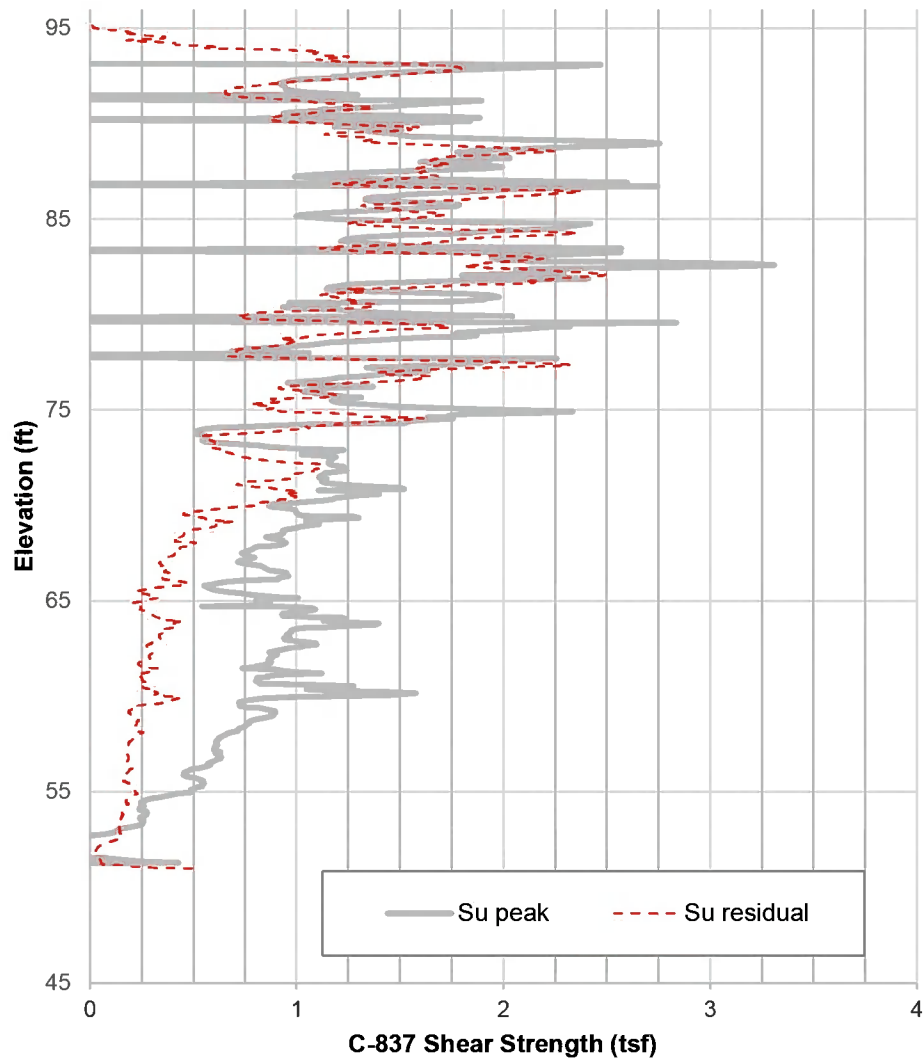


Figure 4

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Table 4: Soil Properties for Underlying Soils - Boring B-735/ CPT C-837

Properties	Drained	Undrained
Moist Unit Weight (pcf)	102	102
Saturated Unit Weight (pcf)	107	107
Friction Angle (deg)	28	0
Cohesion (psf)	20	400 (Residual)

Bottom Ash

The critical section for this periodic assessment conservatively assumes that the BA Pond is empty (of water and ash) in order to evaluate failure from the WD Pond into the BA Pond through the shared dike. Therefore, no bottom ash parameters were used in the present analysis. Refer to the initial safety factor assessment for the role of bottom ash in critical section 1-1.

LIQUEFACTION EVALUATION

The liquefaction potential of the granular subsoil was evaluated in the initial safety factor assessment [Ref. 9]. Based on a site-specific seismic evaluation performed by Garrett & Moore in 2011 [Ref. 3] for the proposed Class III landfill, a peak ground acceleration (PGA) of 0.55g was recommended. The liquefaction potential of the granular subsoil was evaluated using the procedures in Ref. 8 for the SPT and CPT data.

For the SPT based analysis, the logs for Borings B-734 and B-735 indicate granular soils at depths below 44 and 33 feet, respectively, so only those layers were evaluated. The analysis indicates the interval from 44 to 47 feet in Boring B-734 is likely to be liquefiable. However, this layer does not comprise part of the embankment soils, and therefore is not subject to the liquefaction analysis required by the CCR rule. Also, as demonstrated in the stability analyses, this layer is too deep to affect the factor of safety, as the critical failure planes pass above it.

On the basis of the CPT data (C-834, C-835, C-836, and C-837), there were six zones identified that are potentially liquefiable (see Table 5).

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Table 5: Potentially Liquefiable Soil Zones on the Basis of CPT Testing

Sounding	Depths (per foot basis)	Depths (per interval basis)	Remarks
C-834	22 - 23	21.5 - 23.3	NA - Below natural ground
C-835	1 - 4	0 - 3.3	NA - Above the water table
		12.5 - 13.9	NA - Below natural ground
	36 - 36.8		NA - Just above CPT refusal
C-836	13 - 15	13.5 - 14.4	NA - Below natural ground
C-837	44 - 44.2	43.8 - 44.2	NA - Just above CPT refusal

Two zones (one in C-835 and the other in C-837), less than one foot thick, are located just above the Santee Limestone layer, as indicated by the depths where CPT refusal occurred. These zones are too deep and too thin to affect the stability of the embankments.

The zone identified in sounding C-835, which was co-located with Boring B-734, from approximately 1 to 4 feet is in the embankment. Although the CPT sounding log assumed the water level at this location was at one foot, this zone is well above the recorded groundwater table of 13 feet, and above the normal operating level of the lined WD Pond. The adjacent boring log confirmed the greater depth to water, and also indicates sandy lean clay with uncorrected SPT N-values of 10 and 19. Therefore, this zone is not considered liquefiable.

A potentially liquefiable zone was also identified from approximately 12.5 to 13.9 feet in sounding C-835. This depth is similar to the zone identified in sounding C-836 (approximately 13 to 15 feet). These zones are below the existing ground surface elevation of approximately 80 feet, which corresponds to an approximate depth of 11 feet. Therefore, these areas also are not part of the dike. The other potentially liquefiable zone extended from approximately 21.5 to 23.3 feet in sounding C-834. This area is also below the embankment.

As stated in §257.73(e)(1)(iv) and further explained in the preamble to the CCR rule, liquefaction analysis applies only to CCR surface impoundments with dikes constructed of soils that have susceptibility to liquefaction. The bottom ash pond dike soils are not susceptible to liquefaction and, as such, §257.73(e)(1)(iv) does not apply.

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The seismic analyses performed pursuant to §257.73(e)(1)(iii) account for any seismically-induced strength loss within the foundations soils, when applicable.

STABILITY ANALYSES

Methodology

The stability analyses were performed using the Slide 6.0 software. This program was based on the principles of limit equilibrium analysis. The analysis methods used were Bishop simplified and Janbu simplified.

Cross Sections

As described in the previous section, two cross sections (see Cross Section Location Plan in Appendix A) were selected for the safety factor assessments.

Critical cross section 1-1 at the location of Boring B-734 / CPT C-835: This cross section was previously analyzed in the initial Safety Factor Assessment [Ref. 9]. These results were reviewed for completeness and accuracy, and no further evaluation of this cross section was required. It should be noted that with pond closure activities having been initiated, in reality the worst case represented by this analysis is extremely unlikely to occur during the closure period.

Cross section 2-2 near the location of Boring B-735/CPT C-837: This cross section is through the shared dike between the BA Pond and the WD Pond. The case where the WD Pond is operating and the BA Pond is cleaned out is analyzed for each failure condition.

Analyzed Conditions

Analyses were performed for the following conditions: (i) long-term, maximum storage pool; (ii) maximum surcharge pool; (iii) seismic. As demonstrated in the previous section, embankment soils are not subject to liquefaction, so no further analysis was required.

The long-term, maximum storage pool condition models the stability of the downstream slope of the embankment (upstream relative to the BA Pond) under steady-state seepage with the reservoir at the

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normal operating pool elevation. The factor of safety was calculated using effective stress shear strengths and pore water pressures corresponding to long-term conditions.

The maximum surcharge pool elevation models the effect of a flood surcharge within the pond on the stability of the downstream slope of the embankment (upstream relative to the BA Pond). As indicated in the preamble to the CCR rule, this evaluation is based on the assumption that the maximum surcharge pool loading condition exists for a length of time sufficient for steady-state seepage conditions to develop. As such, effective shear strength parameters are used for this analysis also.

Also as indicated in the preamble to the CCR rule, the seismic loading condition is based on a seismic event with a two percent probability of exceedance in 50 years, which is equivalent to a return period of 2500 years. For the analysis of the ash pond embankment at Cross, this evaluation was based on Chapter 7 of MSHA [Ref. 4]. Seismic stability was analyzed as a static (i.e. no seismic coefficient) limit-equilibrium slope stability problem, using post-earthquake shear strengths.

Susceptibility to strength loss was evaluated by first determining if the soil behavior was more like a sand or like a clay. The liquefaction evaluation indicated that most of the soils encountered were clay, consistent with the descriptions on the boring logs. The criteria for clay-like behavior includes having more than 35 percent of soil particles passing the No. 40 sieve, having more than 20 percent of the soil particles passing the No. 200 sieve, and having a Plasticity Index (PI) greater than 10. Based on MSHA methodology, soils potentially susceptible to strength loss have SPT N-values (N_{60}) of less than 6 for clay-like material. These soil layers are summarized in Table 6.

Table 6: Soils with Strength Loss Susceptibility

Boring	Depth (ft)	Soil Type	N-value	Remarks
B-734	10 - 12	Clay	2	At existing ground elevation
	33.5 - 35	Clay	2	
	38.5 - 40	Clay	0	
	43.5 - 45	Clay	0	
B-735	4 - 6	Clay	5	Above the water table
	23.5 - 25	Clay	2	

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Only two zones identified as potentially susceptible to strength loss were within the upper soil layer. The layer from 10 to 12 feet in Boring B-734 is located at the approximate elevation of the natural ground surface. The zone from 4 to 6 feet in Boring B-735 is located above the water table, and therefore would not experience strength loss. A review of the liquefaction evaluation summary in Table 5 also shows that the layer from approximately 12.5 to 13.9 feet in sounding C-835 is potentially liquefiable. This layer is slightly deeper than the layer identified in Boring B-734, located just a few feet away. Another layer from approximately 13 to 15 feet in sounding C-836 is also potentially liquefiable.

Based on these results, portions of the lower soil layer are potentially susceptible to strength loss. In lieu of performing a formal triggering analysis, it was assumed that the earthquake would trigger strength loss. For stiff clay-like materials (the embankment and upper soil layer), the peak undrained strength was used for analysis. For soft clay-like materials (the lower soil zone), a lower bound value of the residual undrained shear strength was used. Ref. 4 indicates that this assumption is probably overly conservative. Also, the entire lower soil layer was modelled using residual undrained shear strength.

Since there were a couple of locations where localized zones of softer soils were observed within the upper soil layer, a second seismic analysis was performed for the critical cross section at Boring B-734/ CPT C-835, wherein the soils between Elevations 80 and 74 feet were assigned different soil properties. A residual shear strength of 0.25 tsf (500 psf) was assigned to this layer.

The soil properties used in the stability analyses are summarized in Tables 7 and 8.

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Table 7: Soil Properties - Boring B-734/ CPT C-835

Layer	Normal Condition	Flood Condition	Seismic Condition	Lower Bound Seismic
Embankment Soil				
Moist Unit Weight (pcf)	130	130	130	130
Saturated Unit Weight (pcf)	135	135	135	135
Friction Angle (deg)	30	30	0	0
Cohesion (psf)	50	50	1440	1440
Soft Embankment Soil	Not Used	Not Used	Not Used	
Moist Unit Weight (pcf)				130
Saturated Unit Weight (pcf)				135
Friction Angle (deg)				0
Cohesion (psf)				500
Lower Soil (Clay)				
Moist Unit Weight (pcf)	102	102	102	102
Saturated Unit Weight (pcf)	107	107	107	107
Friction Angle (deg)	22	22	0	0
Cohesion (psf)	0	0	200	200
Bottom Ash				
Moist Unit Weight (pcf)	90	90	90	90
Saturated Unit Weight (pcf)	107	107	107	107
Friction Angle (deg)	0	0	0	0
Cohesion (psf)	0	0	0	0

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Table 8: Soil Properties – Critical Section 2-2 (Boring B-735/ CPT C-837)

Layer	Normal Condition	Flood Condition	Seismic Condition
Embankment Soil			
Moist Unit Weight (pcf)	130	130	130
Saturated Unit Weight (pcf)	135	135	135
Friction Angle (deg)	30	30	0
Cohesion (psf)	50	50	1440
Lower Soil (Clay)			
Moist Unit Weight (pcf)	102	102	102
Saturated Unit Weight (pcf)	107	107	107
Friction Angle (deg)	28	28	0
Cohesion (psf)	0	0	400
Bottom Ash			
Moist Unit Weight (pcf)	90	90	90
Saturated Unit Weight (pcf)	107	107	107
Friction Angle (deg)	0	0	0
Cohesion (psf)	0	0	0

Results and Discussions

The output files and plots from the slope stability analyses are provided in Appendix D. The factors of safety are summarized in Table 9. The calculated factors of safety exceed the requirements of the CCR rule. Also, there are no soils within the embankment that are considered liquefiable.

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Table 9: Calculated Factors of Safety

CCR Rule Reference	Analysis Condition	Cross Section	Circular Factor of Safety	Block Factor of Safety	Required Factor of Safety
257.73(e)(1)(i)	Maximum Storage	Boring B-734/ CPT C-835 (1-1)	1.78	1.72	1.50
		Boring B-735/ CPT C-837 (2-2)	1.53	1.58	
257.73(e)(1)(ii)	Maximum Surcharge	Boring B-734/ CPT C-835 (1-1)	1.75	1.60	1.40
		Boring B-735/ CPT C-837 (2-2)	1.53	1.58	
257.73(e)(1)(iii)	Seismic	Boring B-734/ CPT C-835 (1-1)	1.66	2.64	1.00
		Boring B-735/ CPT C-837 (2-2)	1.58	1.50	
257.73(e)(1)(iii)	Seismic (Lower Bound)	Boring B-734/ CPT C-835 (1-1)	1.22	1.78	1.00
257.73(e)(1)(iv)	Liquefaction	Not Applicable			1.20

CONCLUSIONS

The embankment soils are not liquefiable. The factors of safety calculated for the various loading conditions exceed the requirements of the CCR rule.

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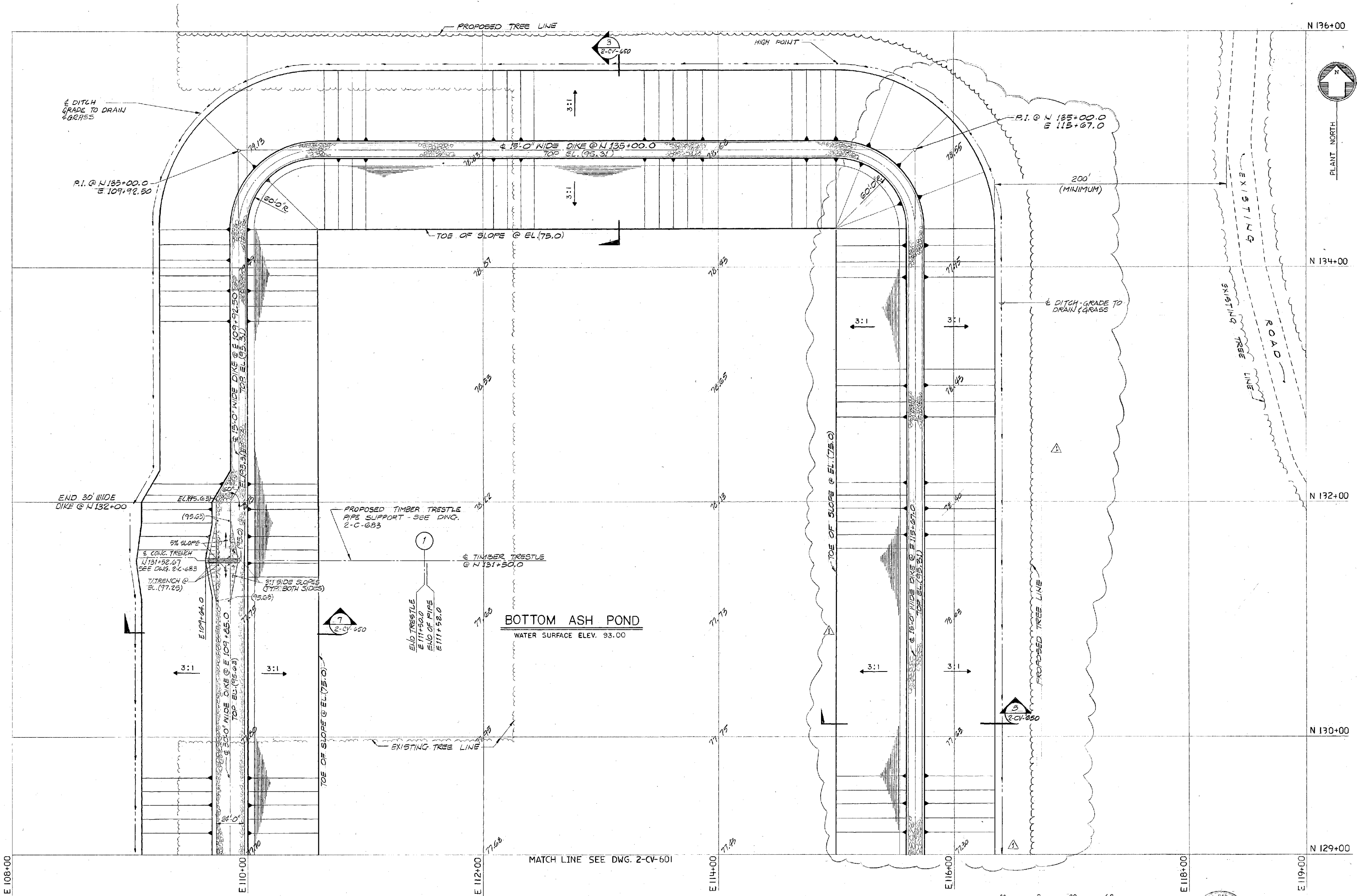
Appendix A. Site Plans and Cross Sections

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Project Details

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1. 3/25/88 VISE LOCATION OF POND D & E
 0.14 ISSUED FOR CONSTRUCTION CONTRACT
 0.14 ISSUED FOR BIDS (COUNT 284)

REVISION
 by ck. appr. no. date

drawn by G.A.
 dept. ck.
 dept. appr.
 coord. ck.
 p.m. appr.
 by ck. appr. B&R appr. 9/1/88

BURNS AND ROE, INC.
 ENGINEERS AND CONSTRUCTORS
 ORADELL, N. J. WOODBURY, N. Y. LOS ANGELES, CALIF. JACKSONVILLE, FLA.
LOCKWOOD GREENE
 ARCHITECTS • ENGINEERS
 SPARTANBURG, S.C.

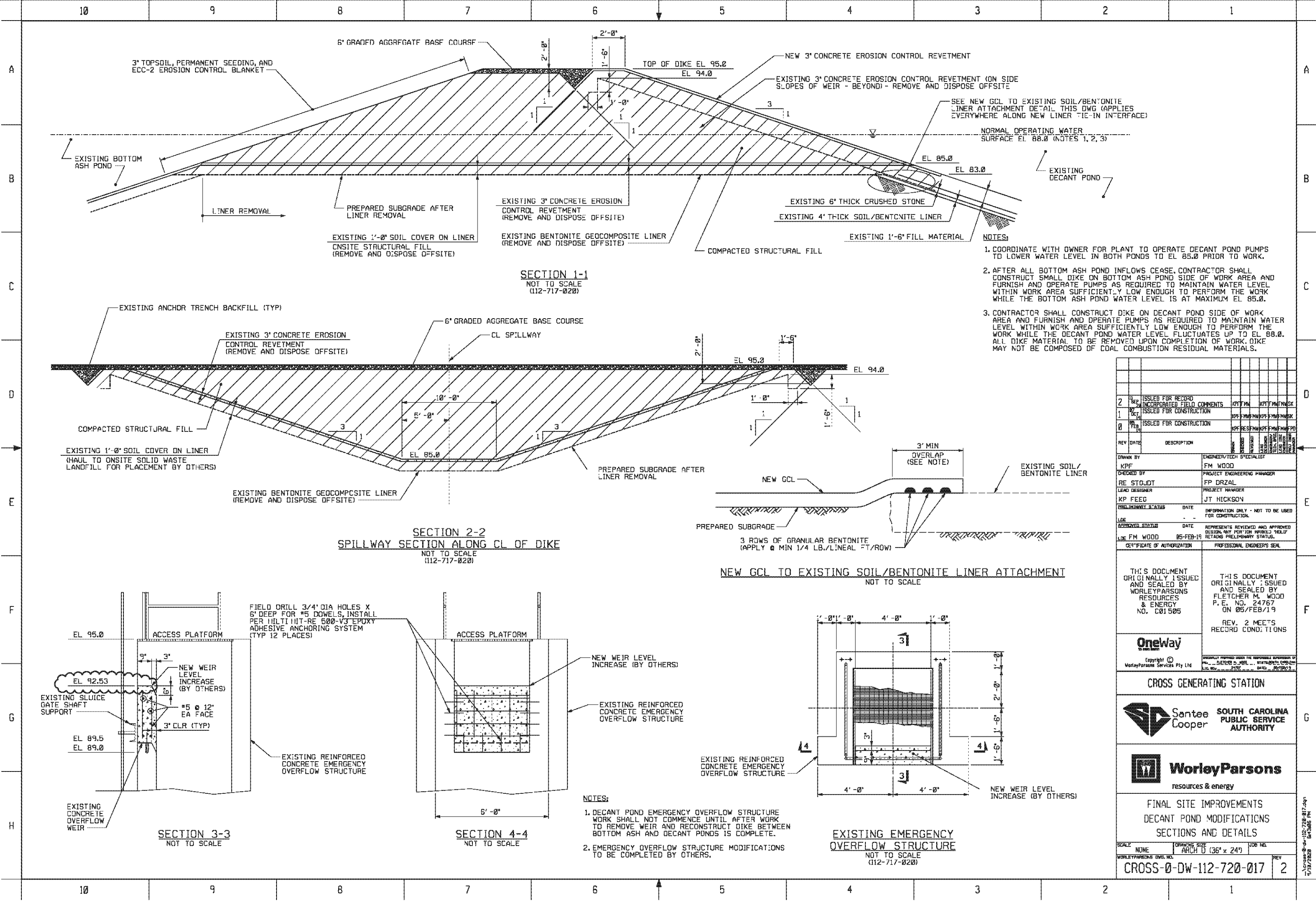
job name
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 CROSS GENERATING STATION UNIT 2
 CROSS, SOUTH CAROLINA

sheet title
 B&R # 200-00-0425
 LAYOUT, GRADING AND DRAINAGE PLAN



scale
 1" = 30'
 date
 8-3-81

284 CONSTR. 3-2842 1
 284 BID 1-482 0
 PKG. ISSUE DATE REV.
 L-G JOB NO. 78271.01
 B&R N.O. NO. 3446.02
 2-CV-602



- NOTES:
1. COORDINATE WITH OWNER FOR PLANT TO OPERATE DECANT POND PUMPS TO LOWER WATER LEVEL IN BOTH PONDS TO EL 85.0 PRIOR TO WORK.
 2. AFTER ALL BOTTOM ASH POND INFLOWS CEASE, CONTRACTOR SHALL CONSTRUCT SMALL DIKE ON BOTTOM ASH POND SIDE OF WORK AREA AND FURNISH AND OPERATE PUMPS AS REQUIRED TO MAINTAIN WATER LEVEL WITHIN WORK AREA SUFFICIENTLY LOW ENOUGH TO PERFORM THE WORK WHILE THE BOTTOM ASH POND WATER LEVEL IS AT MAXIMUM EL 85.0.
 3. CONTRACTOR SHALL CONSTRUCT DIKE ON DECANT POND SIDE OF WORK AREA AND FURNISH AND OPERATE PUMPS AS REQUIRED TO MAINTAIN WATER LEVEL WITHIN WORK AREA SUFFICIENTLY LOW ENOUGH TO PERFORM THE WORK WHILE THE DECANT POND WATER LEVEL FLUCTUATES UP TO EL 88.0. ALL DIKE MATERIAL TO BE REMOVED UPON COMPLETION OF WORK. DIKE MAY NOT BE COMPOSED OF COAL COMBUSTION RESIDUAL MATERIALS.

REV	DATE	DESCRIPTION	BY	CHKD	APPD
2	11/12/19	ISSUED FOR RECORD	KPF	FM	WOOD
1	10/10/19	INCORPORATED FIELD COMMENTS	KPF	FM	WOOD
0	08/19/19	ISSUED FOR CONSTRUCTION	KPF	FM	WOOD

DRAWN BY	KPF	ENGINEER/TECH SPECIALIST	FM WOOD
DESIGNED BY	RE STOJOT	PROJECT ENGINEERING MANAGER	FP DRZAL
LEAD DESIGNER	KP FEED	PROJECT MANAGER	JT HICKSON
PRELIMINARY STATUS	DATE	INFORMATION ONLY - NOT TO BE USED FOR CONSTRUCTION	
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.	
DATE	05-FEB-19		
BY	FM WOOD		

CERTIFICATE OF AUTHORIZATION	PROFESSIONAL ENGINEER'S SEAL
THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY WORLEYPARSONS RESOURCES & ENERGY NO. C01505	THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY FLETCHER M. WOOD P.E. NO. 24767 ON 05/FEB/19
REV. 2 MEETS RECORD CONDITIONS	
Oneway	
Copyright © 2019 WorleyParsons Services Pty Ltd	

CROSS GENERATING STATION

Santee Cooper SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

WorleyParsons resources & energy

FINAL SITE IMPROVEMENTS
DECANT POND MODIFICATIONS
SECTIONS AND DETAILS

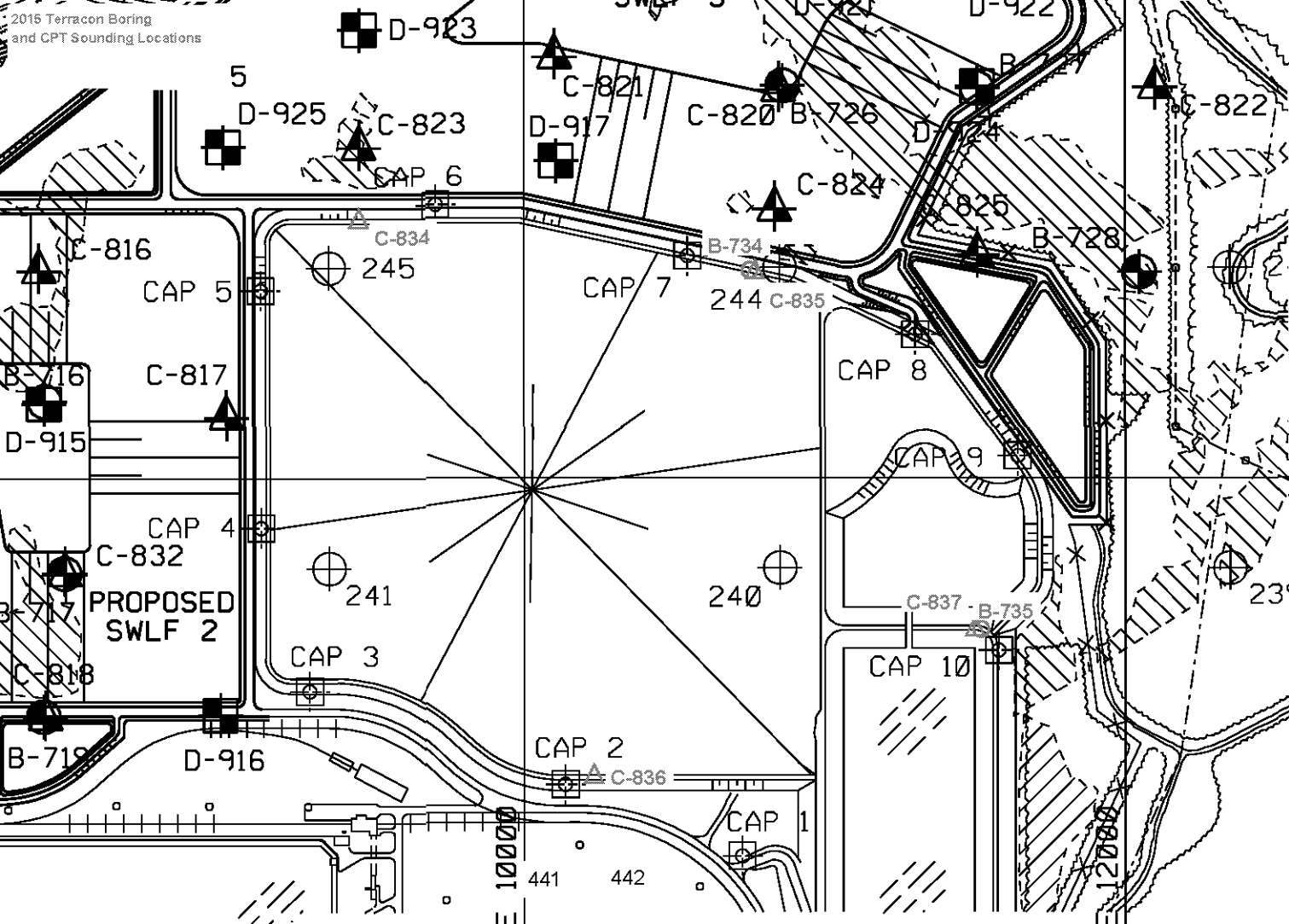
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Appendix B. 2015 Terracon Subsurface Exploration

(7 total pages)



BORING LOG NO. B-734

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.377012° Longitude: -80.10171° Northing: 14692 Easting: 10701 Surface Elev.: 90.9 (Ft.)	DEPTH (FL.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
						TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)			LL-PL-PI		
	DEPTH ELEVATION (FL.)												
	SANDY LEAN CLAY (CL) , tan to brown, stiff to very stiff -Shelby tube taken in offset boring between 2 to 4 feet	6.0 85	5		3-4-6-8 N=10								
	CLAYEY SAND (SC) , tan, soft -Shelby tube taken in offset boring between 6 to 8 feet	12.0 79	10		8-9-10-10 N=19				17		44-12-32	62	
	SANDY LEAN CLAY (CL) , reddish brown to gray, stiff		15		2-2-9-10 N=11				20				
			20		4-6-6-7 N=12				23		42-18-24	49	
			25		2-4-6-7 N=10				22				
	SANDY LEAN CLAY (CL) , reddish brown to gray, stiff	21.0 70	30		1-1-1-1 N=2				15		36-13-23		
			35		3-4-6-8 N=10								
	FAT CLAY WITH SAND (CH) , gray, medium stiff		40		3-3-6 N=9				17		29-14-15		
			45		2-2-4 N=6				31		57-17-40		
	FAT CLAY WITH SAND (CH) , gray, medium stiff	32.0 59	50		1-2-3 N=5				44		74-22-52	81	
			55		1-1-1 N=2				50		44-18-26	69	
	SANDY LEAN CLAY (CL) , gray to tan, soft to medium-stiff	38.0 53	55		WOH-WOH-WOH N=0				64		84-20-64	67	
	SANDY FAT CLAY (CH) , gray, soft	44.0 47	55		WOH-WOH-WOH N=0				42		43-32-11	35	
	SILTY SAND (SM) , trace gravel, gray	47.0 44	55		13-28-15 N=43								
	SILTY SAND (SM) , gray, dense to very dense, strong cementation, (Weathered Santee Limestone)	55.0 36	55		26-50/2" N=100								
	Boring Terminated at 55 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic
SPT energy 71.9%

Advancement Method:
mud rotary

See Exhibit A-3 for description of field procedures.

Notes:

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

13.4 ft after casing removed
18 ft at end of day

after boring completion

Terracon
1450 5th Street West
North Charleston, South Carolina

Boring Started: 10/8/2015

Boring Completed: 10/8/2015

Drill Rig: CME-45

Driller: J. Pawless

Project No.: EN131025

Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/9/15

BORING LOG NO. B-735

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond Dikes

CLIENT: Santee Cooper
Moncks Corner

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (FL)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
	Latitude: 33.373027° Longitude: -80.101761° Northing: 13447 Easting: 11565	Surface Elev.: 95.2 (Ft.)					DEPTH	ELEVATION (FL)	TEST TYPE			COMPRESSIVE STRENGTH (tsf)	STRAIN (%)	
	<u>SANDY LEAN CLAY (CL)</u> , reddish brown, very stiff					9-8-12-9 N=20								
	4.0	91				7-9-11-12 N=20			17		44-15-29			
	<u>CLAYEY SAND (SC)</u> , with silt, brown, soft to medium-stiff -Shelby tube taken in offset boring between 4 to 6 feet -Shelby tube taken in offset boring between 8 to 10 feet		5			3-2-2-2 N=4			27		50-19-31	45		
						2-2-2-2 N=4			32					
	<u>SANDY LEAN CLAY (CL)</u> , gray to brown, medium stiff		10			3-3-2-2 N=5			18		37-15-22	46		
	12.0	83				4-4-9-10 N=13			12					
	<u>SANDY LEAN CLAY (CL)</u> , gray to brown, medium stiff		15			2-2-3-3 N=5			22		30-11-19	55		
	<u>FAT CLAY (CH)</u> , gray, whit to tan, loose		20			2-2-3-3 N=5			22		47-16-31			
	22.0	73												
	<u>SANDY LEAN CLAY (CL)</u> , gray, whit to tan		25			1-1-1-1 N=2			37		56-20-36	91		
	28.0	67												
	<u>SANDY LEAN CLAY (CL)</u> , gray, whit to tan		30			3-4-5 N=9			25		39-15-24			
	33.0	62												
	<u>SILTY SAND (SM)</u> , gray, dense to very dense, strong cementation, (Weathered Santee Limestone)		35			5-19-27 N=46								
			40			16-20-26 N=46								
			45			8-15-26 N=41								
			50			28-32-50/2" N=100					NP			
	50.0	45												
Boring Terminated at 50 Feet														

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic
SPT energy 71.9%

Advancement Method:
mud rotary

See Exhibit A-3 for description of field procedures.

Notes:

Abandonment Method:
Borings backfilled with cement-bentonite grout upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

13 ft after casing removed
17.6 ft at end of day

after boring completion

Terracon
1450 5th Street West
North Charleston, South Carolina

Boring Started: 10/8/2015

Boring Completed: 10/8/2015

Drill Rig: CME-45

Driller: J. Pawless

Project No.: EN131025

Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/16/15

CPT LOG NO. C-834

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond
Dikes

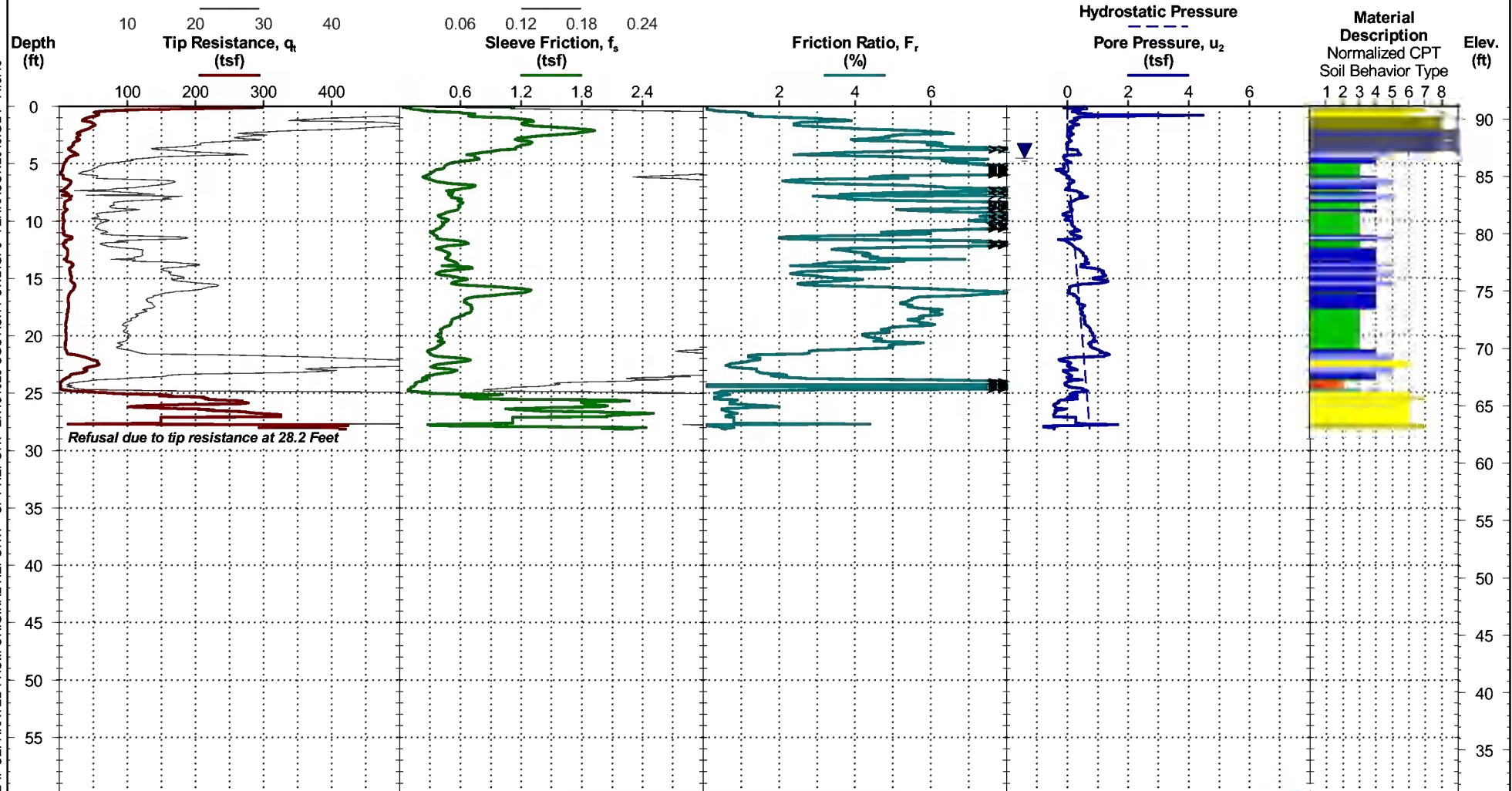
CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2

SITE: Cross Generating Station
Pineville, South Carolina

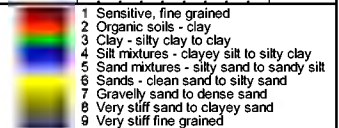
WorleyParsons

Surface Elev.: 91.1 ft
LL: 33.3796°,-80.10488°
NE: 14899,9355



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.



WATER LEVEL OBSERVATION

4.5 ft estimated water depth
(used in normalizations and correlations;
see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015

Rig: Pagani TG73-200

Project No.: EN131025

CPT Completed: 10/9/2015

Operator: J. Bandle

Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/9/15

CPT LOG NO. C-835

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond
Dikes

CLIENT: Santee Cooper
Moncks Corner

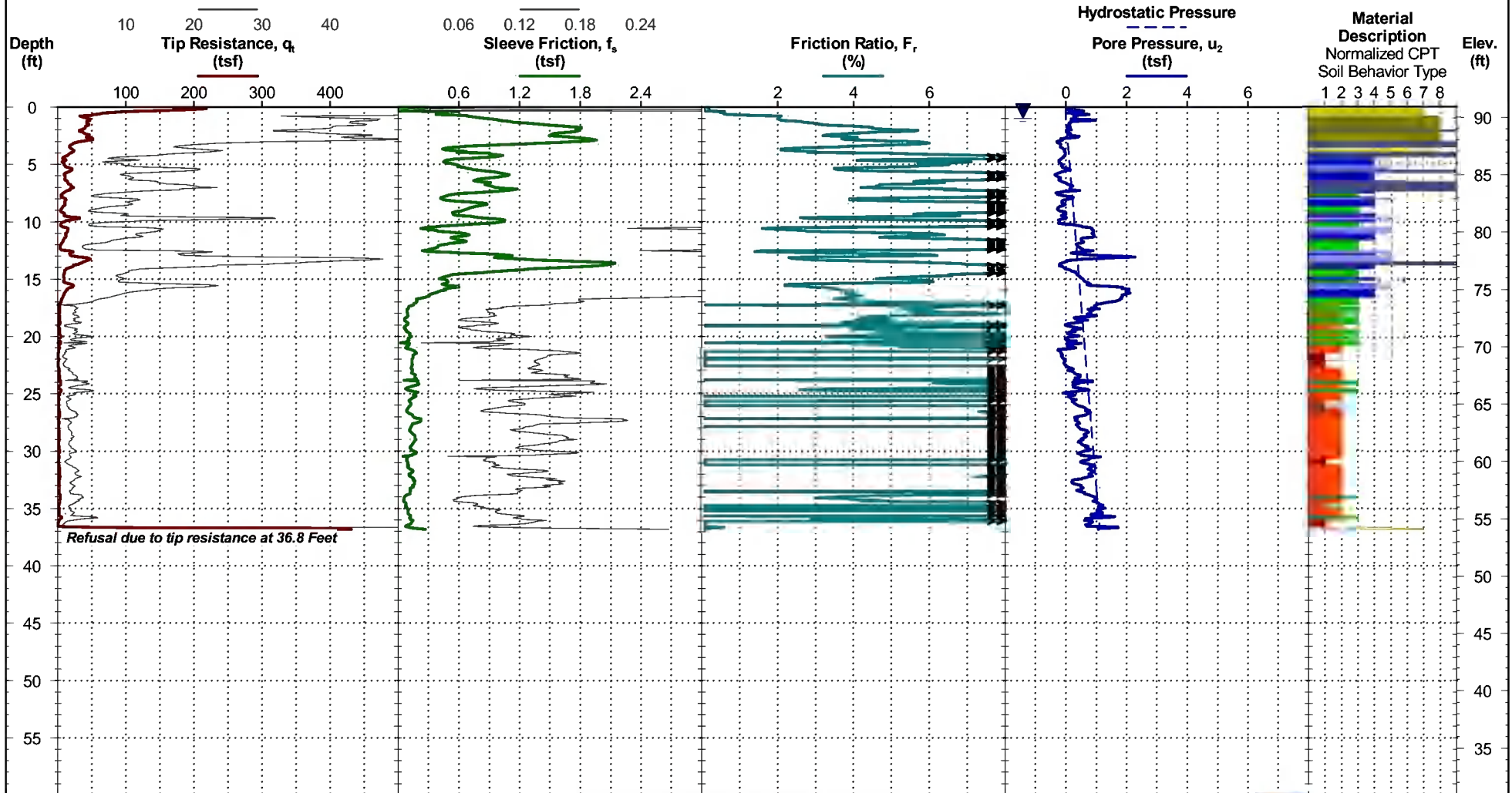
TEST LOCATION: See Exhibit A-2

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

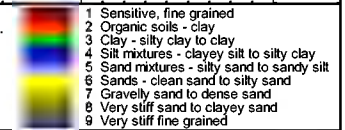
Surface Elev.: 90.9 ft
LL: 33.37689°, -80.10157°
NE: 14692,10701

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/9/15



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.



WATER LEVEL OBSERVATION

1 ft estimated water depth
(used in normalizations and correlations;
see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015

Rig: Pagani TG73-200

Project No.: EN131025

CPT Completed: 10/9/2015

Operator: J. Bandle

Exhibit: A-2

CPT LOG NO. C-836

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond
Dikes

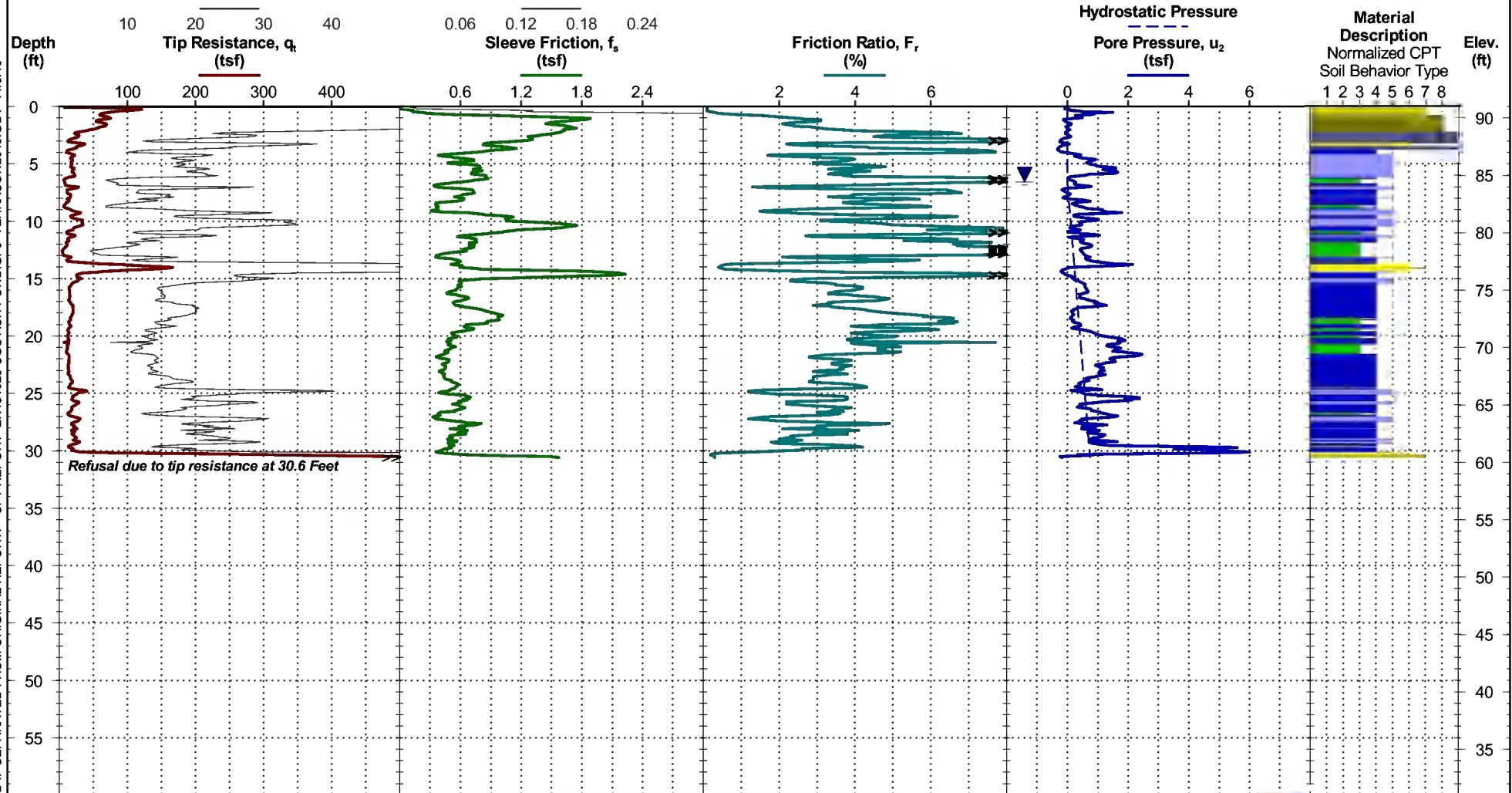
CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

Surface Elev.: 91.0 ft
LL: 33.374°,-80.10619°
NE: 12993,10212



See Exhibit A-3 for description of field procedures.

See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.



WATER LEVEL OBSERVATION

6.6 ft estimated water depth
(used in normalizations and correlations;
see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015

Rig: Pagani TG73-200

Project No.: EN131025

CPT Completed: 10/9/2015

Operator: J. Bandle

Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/9/15

CPT LOG NO. C-837

Page 1 of 1

PROJECT: Cross Generating Station- Ash Pond
Dikes

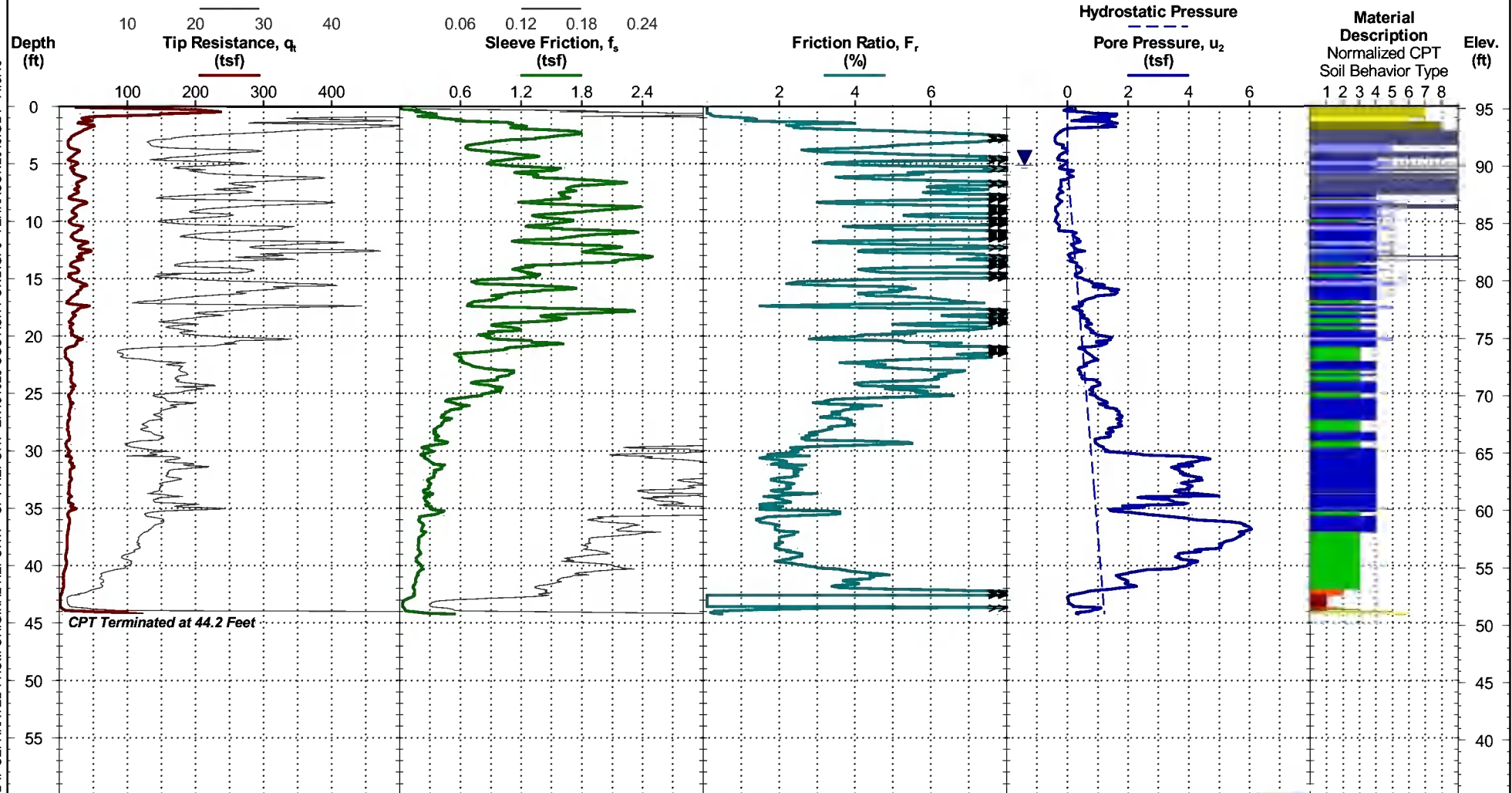
CLIENT: Santee Cooper
Moncks Corner

TEST LOCATION: See Exhibit A-2

SITE: Cross Generating Station
Pineville, South Carolina

WorleyParsons

Surface Elev.: 95.2 ft
LL: 33.37303°, -80.10186°
NE: 13447, 11565



See Exhibit A-3 for description of field procedures.

See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.



WATER LEVEL OBSERVATION

5.1 ft estimated water depth
(used in normalizations and correlations;
see Appendix C)

Probe no. 4675 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 10/22/2015
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 10/9/2015

Rig: Pagani TG73-200

Project No.: EN131025

CPT Completed: 10/9/2015

Operator: J. Bandle

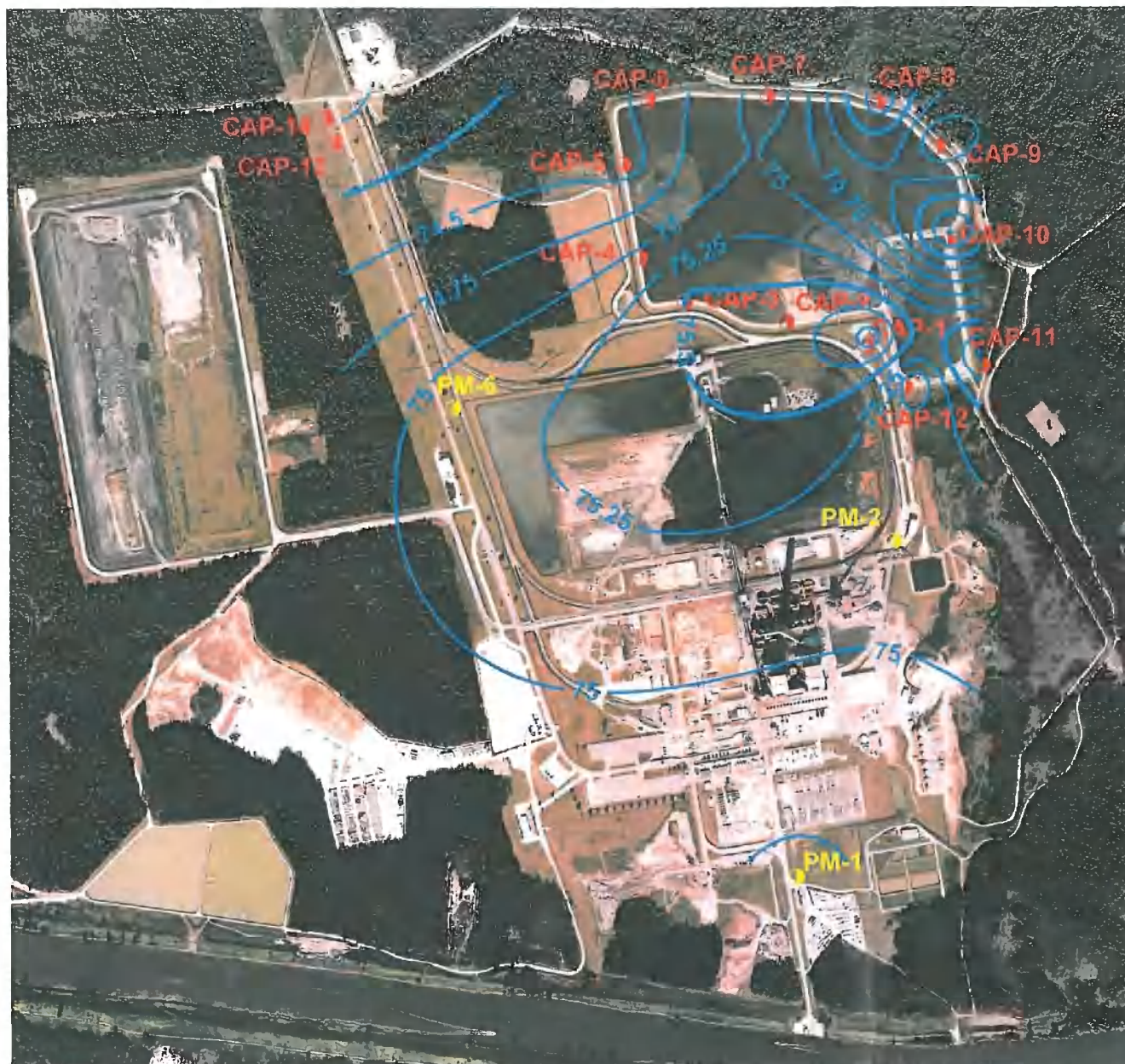
Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT EN131025 CGS ASH POND.GPJ TERRACON2015.GDT 11/9/15

Project Details											
Customer		Santee Cooper									
Project Title		Cross Generating Station									
Calculation Title		Bottom Ash Pond Periodic (5-Yr) Safety Factor Assessment Calculation									
Calculation Number		CROSS-0-DC-044-CE-0005									
								Page	25	of	26
Rev	Date	By	Chk	Rev	Date	By	Chk	Rev	Date	By	Chk
0	14 Oct 2021	YX	FW								

Appendix C. July 2014 Potentiometric Map

(1 total pages)



Cross Generating Station NPDES Groundwater Monitoring July 14 Potentiometric Map

● CAP Well Location

● PM Well Location

Groundwater Contour Interval

77.2 Groundwater Elevation (msl)

Well ID	TOC Elevation (feet)	GW Depth (feet)	GW Elevation (feet)
CAP-1*	82.70	6.54	76.16
CAP-2	91.85	16.20	75.65
CAP-3	91.49	15.97	75.52
CAP-4	91.77	16.72	75.05
CAP-5	91.78	17.36	74.42
CAP-6	91.82	17.21	74.61
CAP-7	91.64	16.50	75.14
CAP-8	91.61	17.80	73.81
CAP-9	91.59	16.55	75.04
CAP-10	95.68	22.00	73.68
CAP-11	95.55	19.46	76.09
CAP-12	98.33	23.56	74.77
CAP-13	80.77	6.71	74.06
CAP-14	80.77	6.82	73.95
PM-1	83.24	8.53	74.71
PM-2	82.05	6.99	75.06
PM-6	84.35	9.18	75.17

Water levels were collected on July 8, 2014

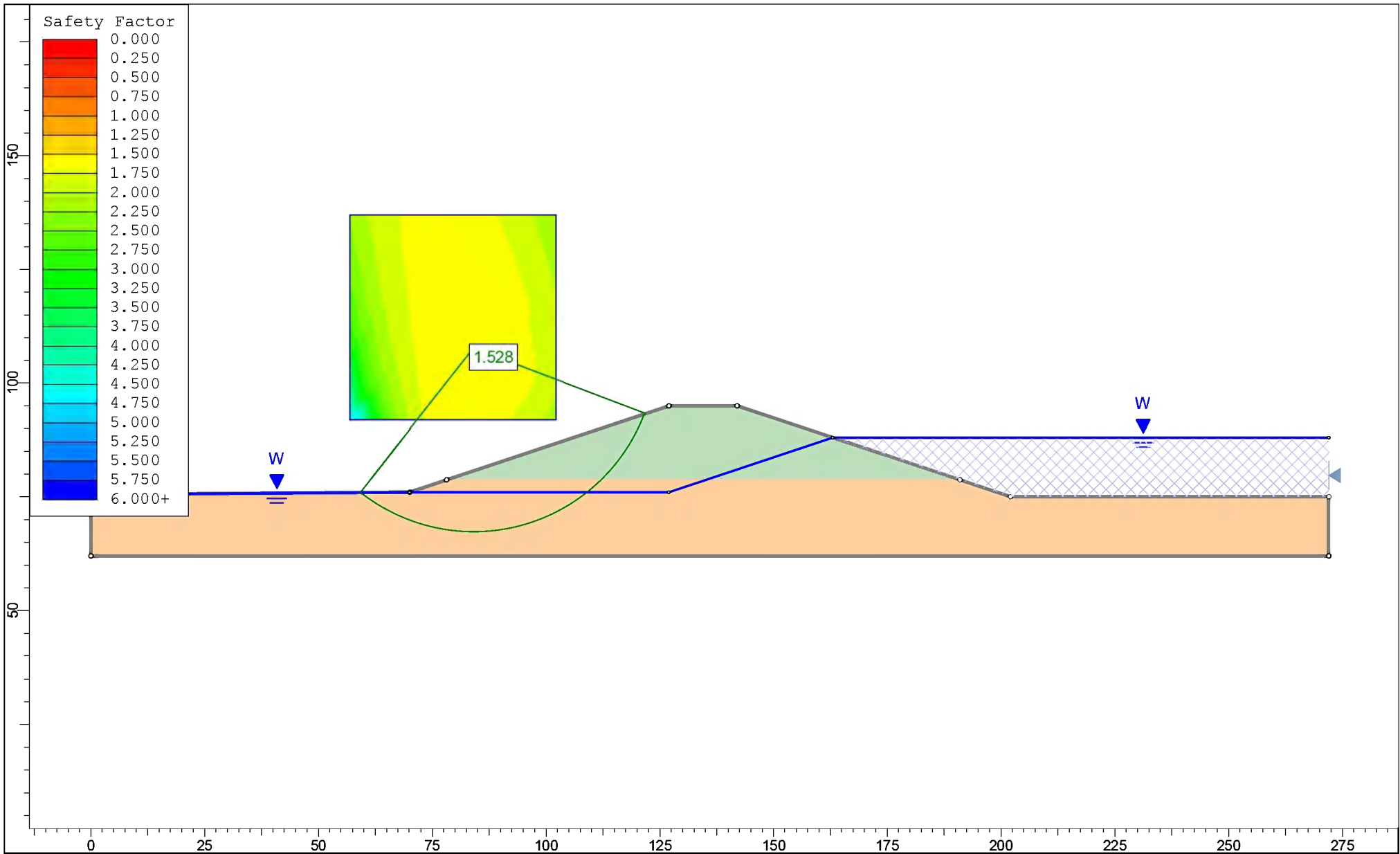


Date: 10/20/2014, MDH

Project Details											
Customer		Santee Cooper									
Project Title		Cross Generating Station									
Calculation Title		Bottom Ash Pond Periodic (5-Yr) Safety Factor Assessment Calculation									
Calculation Number		CROSS-0-DC-044-CE-0005									
								Page	26	of	26
Rev	Date	By	Chk	Rev	Date	By	Chk	Rev	Date	By	Chk
0	14 Oct 2021	YX	FW								

Appendix D. Slope Stability Output

(66 total pages)



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Circular

Drawn By

Scale

1:350

Company

Date

File Name

Cross735-MaxStorage-Circular.slim

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-MaxStorage-Circular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 - Maximum Storage - Circular

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Circular		
Drawn By		Scale		Company	
Date		File Name		Cross735-MaxStorage-Circular.slim	

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft³
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Embankment	Clay
		



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-MaxStorage-Circular.slim

Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	50	20
Friction Angle [deg]	30	28
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.704030
 Center: 81.835, 121.151
 Radius: 51.653
 Left Slip Surface Endpoint: 56.916, 75.907
 Right Slip Surface Endpoint: 126.227, 94.742
 Resisting Moment=1.67528e+006 lb-ft
 Driving Moment=983129 lb-ft
 Total Slice Area=596.374 ft2

Method: janbu simplified

FS: 1.527860
 Center: 84.091, 107.617
 Radius: 40.369
 Left Slip Surface Endpoint: 59.090, 75.922
 Right Slip Surface Endpoint: 121.826, 93.275
 Resisting Horizontal Force=28340.8 lb
 Driving Horizontal Force=18549.4 lb
 Total Slice Area=656.909 ft2



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-MaxStorage-Circular.slim

Cross735-MaxStorage-Circular.slim

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.71731	205.409	Clay	20	28	25.6753	43.7514	88.7542	44.0841	44.6701
2	2.71731	587.945	Clay	20	28	46.2419	78.7976	236.765	126.182	110.583
3	2.71731	915.998	Clay	20	28	62.9398	107.251	360.685	196.588	164.097
4	2.71731	1193.26	Clay	20	28	76.2909	130.002	462.976	256.093	206.883
5	2.71731	1426.79	Clay	20	28	87.2062	148.602	547.175	305.31	241.865
6	2.71731	1774.27	Clay	20	28	115.253	196.394	675.628	343.88	331.748
7	2.71731	2159.16	Clay	20	28	150.053	255.695	815.883	372.606	443.277
8	2.71731	2502.58	Clay	20	28	181.759	309.722	937.009	392.122	544.887
9	2.71731	2849.53	Clay	20	28	215.703	367.564	1056.27	402.598	653.672
10	2.71731	3176.59	Clay	20	28	249.062	424.409	1164.71	404.122	760.584
11	2.71731	3462	Clay	20	28	279.385	476.081	1254.47	396.706	857.762
12	2.71731	3705.46	Clay	20	28	306.759	522.726	1325.78	380.288	945.492
13	2.71731	3906.33	Clay	20	28	331.232	564.43	1378.65	354.728	1023.93
14	2.71731	4063.55	Clay	20	28	352.821	601.218	1412.91	319.802	1093.11
15	2.71731	4175.65	Clay	20	28	371.506	633.058	1428.19	275.191	1152.99
16	2.71731	4240.63	Clay	20	28	387.234	659.858	1423.86	220.468	1203.4
17	2.71731	4255.88	Clay	20	28	399.91	681.458	1399.09	155.071	1244.02
18	2.71731	4218.02	Clay	20	28	409.395	697.621	1352.7	78.2753	1274.42
19	2.71731	4126.57	Clay	20	28	412.994	703.754	1285.95	0	1285.95
20	2.71731	3988.8	Clay	20	28	390.819	665.967	1214.89	0	1214.89
21	2.99295	4059.41	Embankment	50	30	390.055	664.666	1064.63	0	1064.63
22	2.99295	3504.39	Embankment	50	30	328.946	560.534	884.27	0	884.27
23	2.99295	2789.23	Embankment	50	30	256.287	436.72	669.82	0	669.82
24	2.99295	1871.46	Embankment	50	30	170.694	290.868	417.196	0	417.196
25	2.99295	677.69	Embankment	50	30	70.3758	119.922	121.109	0	121.109

Global Minimum Query (janbu simplified) - Safety Factor: 1.52786

				Base	Base	Shear	Shear	Base	Pore	Effective
--	--	--	--	------	------	-------	-------	------	------	-----------

	Project	Santee Cooper - Cross Generating Station								
	Analysis Description	Section B-735/C-837 - Maximum Storage - Circular								
	Drawn By				Scale				Company	
	Date								File Name	Cross735-MaxStorage-Circular.slim

Number	[ft]	[lbs]	Material	Cohesion [psf]	Friction Angle [degrees]	Stress [psf]	Strength [psf]	Normal Stress [psf]	Pressure [psf]	Normal Stress [psf]
1	2.53181	252.002	Clay	20	28	36.8944	56.3695	126.447	58.0462	68.4009
2	2.53181	718.323	Clay	20	28	69.1492	105.65	326.543	165.458	161.085
3	2.53181	1114.13	Clay	20	28	94.0538	143.701	489.277	256.629	232.648
4	2.53181	1447.76	Clay	20	28	113.289	173.089	621.396	333.477	287.919
5	2.53181	1776.06	Clay	20	28	135.997	207.784	750.339	397.168	353.171
6	2.53181	2204.59	Clay	20	28	177.927	271.847	921.674	448.018	473.656
7	2.53181	2594.74	Clay	20	28	216.386	330.608	1071.85	487.683	584.171
8	2.53181	2945.89	Clay	20	28	251.416	384.129	1201.53	516.701	684.825
9	2.53181	3297.3	Clay	20	28	288.699	441.092	1327.4	535.443	791.961
10	2.53181	3612.82	Clay	20	28	322.973	493.457	1434.58	544.139	890.444
11	2.53181	3885.19	Clay	20	28	353.354	539.875	1520.63	542.894	977.741
12	2.53181	4114.33	Clay	20	28	379.998	580.584	1586	531.692	1054.31
13	2.53181	4299.66	Clay	20	28	402.992	615.716	1630.78	510.4	1120.38
14	2.53181	4440.03	Clay	20	28	422.361	645.308	1654.79	478.752	1176.03
15	2.53181	4533.67	Clay	20	28	438.062	669.298	1657.49	436.338	1221.15
16	2.53181	4578.03	Clay	20	28	449.992	687.525	1638.01	382.575	1255.43
17	2.53181	4569.63	Clay	20	28	457.968	699.711	1595.01	316.659	1278.35
18	2.53181	4503.71	Clay	20	28	461.711	705.43	1526.6	237.494	1289.11
19	2.53181	4373.78	Clay	20	28	460.816	704.062	1430.12	143.584	1286.54
20	2.53181	4171.37	Clay	20	28	454.76	694.809	1301.97	32.8377	1269.13
21	2.53181	3901.36	Clay	20	28	418.617	639.588	1165.27	0	1165.27
22	2.39187	3269.45	Embankment	50	30	391.676	598.426	949.901	0	949.901
23	2.39187	2647.18	Embankment	50	30	303.852	464.244	717.493	0	717.493
24	2.39187	1826.86	Embankment	50	30	200.331	306.078	443.539	0	443.539
25	2.39187	678.904	Embankment	50	30	77.0056	117.654	117.18	0	117.18

Interslice Data

 SLIDEINTERPRET 6.027	Project			Santee Cooper - Cross Generating Station		
	Analysis Description			Section B-735/C-837 - Maximum Storage - Circular		
	Drawn By		Scale	Company		
	Date		File Name		Cross735-MaxStorage-Circular.slim	

Global Minimum Query (bishop simplified) - Safety Factor: 1.70403

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	56.9161	75.9065	0	0	0
2	59.6334	74.513	193.417	0	0
3	62.3507	73.314	602.89	0	0
4	65.068	72.2952	1141.29	0	0
5	67.7853	71.4456	1741.85	0	0
6	70.5026	70.7566	2355.73	0	0
7	73.2199	70.2216	3030.2	0	0
8	75.9372	69.8359	3752.44	0	0
9	78.6545	69.5961	4470.82	0	0
10	81.3718	69.5001	5158.02	0	0
11	84.0892	69.5472	5779.6	0	0
12	86.8065	69.7378	6299.34	0	0
13	89.5238	70.0735	6687.52	0	0
14	92.2411	70.557	6920.45	0	0
15	94.9584	71.1929	6980.34	0	0
16	97.6757	71.9869	6855.39	0	0
17	100.393	72.9468	6540.27	0	0
18	103.11	74.0829	6036.94	0	0
19	105.828	75.4083	5356.1	0	0
20	108.545	76.9398	4508.25	0	0
21	111.262	78.7	3431.32	0	0
22	114.255	80.9393	2214.2	0	0
23	117.248	83.5483	891.177	0	0
24	120.241	86.6107	-393.418	0	0
25	123.234	90.2612	-1405.73	0	0
26	126.227	94.7423	0	0	0



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-MaxStorage-Circular.slim	

Global Minimum Query (janbu simplified) - Safety Factor: 1.52786

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	59.0904	75.9221	0	0	0
2	61.6222	74.0797	326.599	0	0
3	64.154	72.5155	1012.86	0	0
4	66.6858	71.1937	1898.3	0	0
5	69.2176	70.0887	2872.51	0	0
6	71.7494	69.1816	3898.25	0	0
7	74.2812	68.4588	5015.98	0	0
8	76.8131	67.9103	6153.13	0	0
9	79.3449	67.5288	7249.61	0	0
10	81.8767	67.3096	8273.27	0	0
11	84.4085	67.2501	9178.36	0	0
12	86.9403	67.3495	9923.95	0	0
13	89.4721	67.6091	10476.7	0	0
14	92.0039	68.032	10809.8	0	0
15	94.5357	68.6234	10903	0	0
16	97.0676	69.3914	10742	0	0
17	99.5994	70.3466	10319.3	0	0
18	102.131	71.5041	9635.48	0	0
19	104.663	72.8839	8700.78	0	0
20	107.195	74.514	7539.11	0	0
21	109.727	76.4335	6194.15	0	0
22	112.258	78.7	4615.49	0	0
23	114.65	81.2403	3141.53	0	0
24	117.042	84.297	1676.93	0	0
25	119.434	88.1113	465.487	0	0
26	121.826	93.2753	0	0	0



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-MaxStorage-Circular.slim	

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
163	88
272	88

External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5

Material Boundary

X	Y
78.1	78.7
190.9	78.7



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Circular

Drawn By

Scale

Company

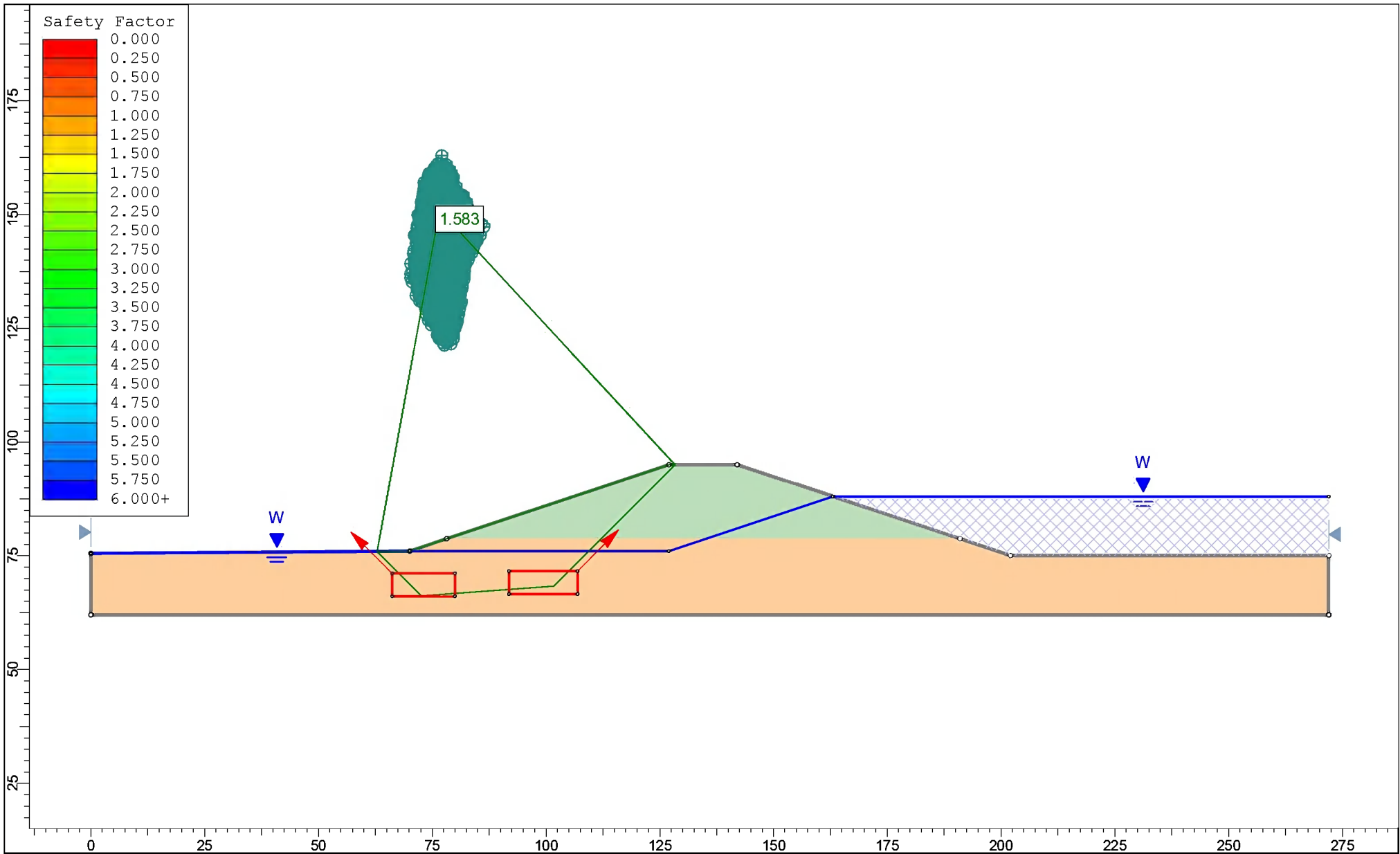
Date

File Name

Cross735-MaxStorage-Circular.slim



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Circular		
Drawn By		Scale	Company		
Date			File Name		
			Cross735-MaxStorage-Circular.slim		



 SLIDEINTERPRET 6.027	Project			Santee Cooper - Cross Generating Station		
	Analysis Description			Section B-735/C-837 - Maximum Storage - Block		
	Drawn By		Scale	1:350	Company	
	Date			File Name		
				Cross735-MaxStorage-NonCircular.slim		

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-MaxStorage-NonCircular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 - Maximum Storage - Block

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Block		
Drawn By		Scale	Company		
Date			File Name Cross735-MaxStorage-NonCircular.slim		

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft³
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Storage - Block		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-MaxStorage-NonCircular.slim	

Property	Embankment	Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	50	20
Friction Angle [deg]	30	28
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.684130
 Axis Location: 76.548, 150.971
 Left Slip Surface Endpoint: 62.850, 75.949
 Right Slip Surface Endpoint: 128.347, 95.000
 Resisting Moment=2.97022e+006 lb-ft
 Driving Moment=1.76366e+006 lb-ft
 Total Slice Area=718.073 ft2

Method: janbu simplified

FS: 1.583430
 Axis Location: 76.548, 150.971
 Left Slip Surface Endpoint: 62.850, 75.949
 Right Slip Surface Endpoint: 128.347, 95.000
 Resisting Horizontal Force=31349.8 lb
 Driving Horizontal Force=19798.7 lb
 Total Slice Area=718.073 ft2

	Project			Santee Cooper - Cross Generating Station	
	Analysis Description			Section B-735/C-837 - Maximum Storage - Block	
	Drawn By		Scale	Company	
	Date			File Name	
				Cross735-MaxStorage-NonCircular.slim	

Global Minimum Coordinates

Method: bishop simplified

X	Y
62.8504	75.9489
72.5786	66.2208
101.635	68.2885
128.347	95

Method: janbu simplified

X	Y
62.8504	75.9489
72.5786	66.2208
101.635	68.2885
128.347	95

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxStorage-NonCircular.slim

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.68413

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.43204	318.703	Clay	20	28	42.5841	71.7171	173.687	76.4217	97.2658
2	2.43204	956.11	Clay	20	28	93.0201	156.658	486.282	229.265	257.017
3	2.43204	1593.87	Clay	20	28	143.524	241.713	799.09	382.108	416.982
4	2.43204	2341.06	Clay	20	28	215.081	362.224	1177.97	534.344	643.629
5	2.64153	3087.69	Clay	20	28	185.928	313.127	1155.65	604.359	551.293
6	2.64153	3271.8	Clay	20	28	211.07	355.47	1223.56	592.63	630.928
7	2.64153	3482.86	Clay	20	28	239.364	403.12	1301.44	580.9	720.544
8	2.64153	3731.83	Clay	20	28	272.088	458.232	1393.37	569.171	824.196
9	2.64153	3981.07	Clay	20	28	304.843	513.396	1485.38	557.442	927.941
10	2.64153	4230.31	Clay	20	28	337.599	568.56	1577.4	545.712	1031.69
11	2.64153	4479.55	Clay	20	28	370.354	623.724	1669.42	533.983	1135.44
12	2.64153	4728.79	Clay	20	28	403.109	678.888	1761.44	522.253	1239.19
13	2.64153	4978.02	Clay	20	28	435.864	734.052	1853.46	510.524	1342.94
14	2.64153	5227.26	Clay	20	28	468.62	789.217	1945.48	498.795	1446.68
15	2.64153	5476.5	Clay	20	28	501.375	844.381	2037.5	487.065	1550.43
16	2.60289	5303.5	Clay	20	28	401.836	676.744	1635.15	399.99	1235.16
17	2.60289	4872.16	Clay	20	28	401.045	675.412	1470.22	237.57	1232.65
18	2.60289	4440.84	Clay	20	28	400.257	674.084	1305.3	75.1502	1230.15
19	2.60289	4027.67	Clay	20	28	380.206	640.317	1166.65	0	1166.65
20	2.71667	3676.5	Embankment	50	30	367.475	618.876	985.323	0	985.323
21	2.71667	3036.88	Embankment	50	30	307.388	517.682	810.05	0	810.05
22	2.71667	2397.25	Embankment	50	30	247.302	416.488	634.777	0	634.777
23	2.71667	1757.63	Embankment	50	30	187.215	315.294	459.504	0	459.504
24	2.71667	1118.01	Embankment	50	30	127.128	214.1	284.231	0	284.231



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxStorage-NonCircular.slim

25	2.71667	439.071	Embankment	50	30	63.3482	106.687	98.1841	0	98.1841
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Global Minimum Query (janbu simplified) - Safety Factor: 1.58343

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.43204	318.703	Clay	20	28	46.6232	73.8245	177.651	76.4217	101.229
2	2.43204	956.11	Clay	20	28	101.843	161.262	494.94	229.265	265.675
3	2.43204	1593.87	Clay	20	28	157.137	248.816	812.45	382.108	430.342
4	2.43204	2341.06	Clay	20	28	235.481	372.868	1197.99	534.344	663.647
5	2.64153	3087.69	Clay	20	28	197.484	312.702	1154.85	604.359	550.492
6	2.64153	3271.8	Clay	20	28	224.189	354.988	1222.65	592.63	630.021
7	2.64153	3482.86	Clay	20	28	254.241	402.573	1300.41	580.9	719.513
8	2.64153	3731.83	Clay	20	28	288.999	457.61	1392.2	569.171	823.025
9	2.64153	3981.07	Clay	20	28	323.79	512.699	1484.07	557.442	926.631
10	2.64153	4230.31	Clay	20	28	358.582	567.789	1575.95	545.712	1030.24
11	2.64153	4479.55	Clay	20	28	393.373	622.878	1667.83	533.983	1133.85
12	2.64153	4728.79	Clay	20	28	428.164	677.967	1759.71	522.253	1237.46
13	2.64153	4978.02	Clay	20	28	462.955	733.057	1851.59	510.524	1341.07
14	2.64153	5227.26	Clay	20	28	497.746	788.146	1943.47	498.795	1444.67
15	2.64153	5476.5	Clay	20	28	532.537	843.235	2035.35	487.065	1548.28
16	2.60289	5303.5	Clay	20	28	421.145	666.853	1616.54	399.99	1216.55
17	2.60289	4872.16	Clay	20	28	420.316	665.541	1451.66	237.57	1214.09
18	2.60289	4440.84	Clay	20	28	419.489	664.232	1286.77	75.1502	1211.62
19	2.60289	4027.67	Clay	20	28	398.476	630.959	1149.05	0	1149.05
20	2.71667	3676.5	Embankment	50	30	384.774	609.262	968.67	0	968.67
21	2.71667	3036.88	Embankment	50	30	321.858	509.64	796.12	0	796.12
22	2.71667	2397.25	Embankment	50	30	258.943	410.018	623.569	0	623.569
23	2.71667	1757.63	Embankment	50	30	196.028	310.396	451.019	0	451.019
24	2.71667	1118.01	Embankment	50	30	133.112	210.774	278.468	0	278.468
25	2.71667	439.071	Embankment	50	30	66.3302	105.029	95.3137	0	95.3137

	Project	Santee Cooper - Cross Generating Station	
	Analysis Description	Section B-735/C-837 - Maximum Storage - Block	
	Drawn By	Scale	Company
	Date	File Name Cross735-MaxStorage-NonCircular.slim	

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.68413

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	62.8504	75.9489	0	0	0
2	65.2825	73.5169	526.127	0	0
3	67.7145	71.0849	1935.33	0	0
4	70.1465	68.6528	4228.3	0	0
5	72.5786	66.2208	7617	0	0
6	75.2201	66.4087	7891.59	0	0
7	77.8617	66.5967	8219.93	0	0
8	80.5032	66.7847	8608.47	0	0
9	83.1447	66.9727	9066.3	0	0
10	85.7863	67.1606	9593.47	0	0
11	88.4278	67.3486	10190	0	0
12	91.0693	67.5366	10855.9	0	0
13	93.7108	67.7245	11591.1	0	0
14	96.3524	67.9125	12395.7	0	0
15	98.9939	68.1005	13269.6	0	0
16	101.635	68.2885	14212.8	0	0
17	104.238	70.8913	11004.1	0	0
18	106.841	73.4942	8222.66	0	0
19	109.444	76.0971	5868.4	0	0
20	112.047	78.7	3822.77	0	0
21	114.764	81.4167	2145.69	0	0
22	117.48	84.1333	781.297	0	0
23	120.197	86.85	-270.398	0	0



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Storage - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxStorage-NonCircular.slim

24	122.914	89.5667	-1009.4	0	0
25	125.63	92.2833	-1435.71	0	0
26	128.347	95	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.58343

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	62.8504	75.9489	0	0	0
2	65.2825	73.5169	545.405	0	0
3	67.7145	71.0849	1996.72	0	0
4	70.1465	68.6528	4354.66	0	0
5	72.5786	66.2208	7840.73	0	0
6	75.2201	66.4087	8145.14	0	0
7	77.8617	66.5967	8507.31	0	0
8	80.5032	66.7847	8934.23	0	0
9	83.1447	66.9727	9435.68	0	0
10	85.7863	67.1606	10011.7	0	0
11	88.4278	67.3486	10662.4	0	0
12	91.0693	67.5366	11387.6	0	0
13	93.7108	67.7245	12187.5	0	0
14	96.3524	67.9125	13061.9	0	0
15	98.9939	68.1005	14011	0	0
16	101.635	68.2885	15034.6	0	0
17	104.238	70.8913	11922.8	0	0
18	106.841	73.4942	9237.93	0	0
19	109.444	76.0971	6980.11	0	0
20	112.047	78.7	5026.11	0	0
21	114.764	81.4167	3439.5	0	0
22	117.48	84.1333	2150.79	0	0
23	120.197	86.85	1159.98	0	0

 SLIDEINTERPRET 6.027	Project			Santee Cooper - Cross Generating Station		
	Analysis Description			Section B-735/C-837 - Maximum Storage - Block		
	Drawn By		Scale	Company		
	Date		File Name			
			Cross735-MaxStorage-NonCircular.slim			

24	122.914	89.5667	467.076	0	0
25	125.63	92.2833	72.0672	0	0
26	128.347	95	0	0	0

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
163	88
272	88

Block Search Window

X	Y
66.107	71.197
66.107	66.087
79.988	66.087
79.988	71.197

Block Search Window

X	Y
91.8081	71.658
91.8081	66.614
106.94	66.614
106.94	71.658

	Project			Santee Cooper - Cross Generating Station		
	Analysis Description			Section B-735/C-837 - Maximum Storage - Block		
	Drawn By		Scale	Company		
	Date				File Name	Cross735-MaxStorage-NonCircular.slim
	SLIDEINTERPRET 6.027					

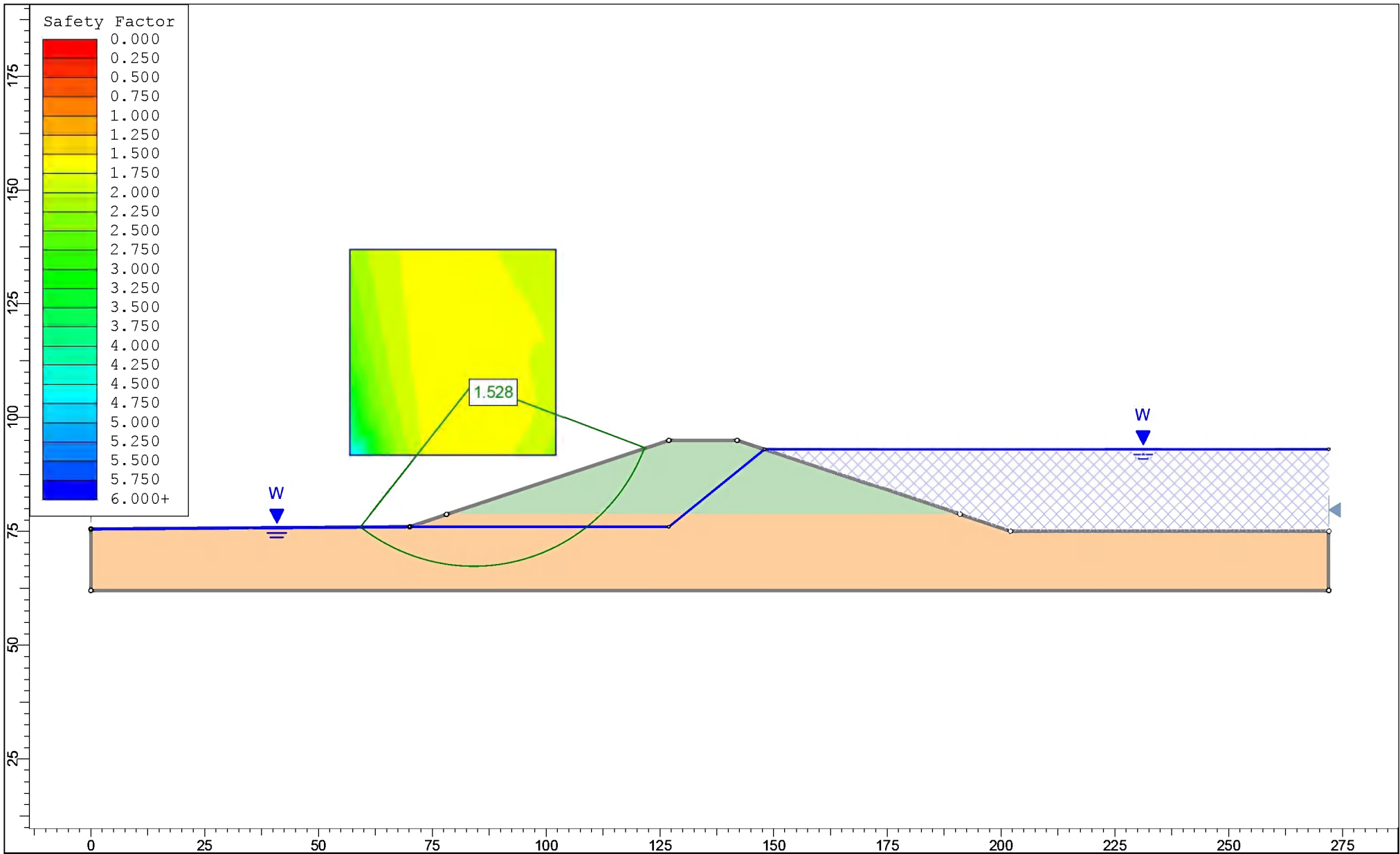
External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5

Material Boundary

X	Y
78.1	78.7
190.9	78.7

	Project			Santee Cooper - Cross Generating Station	
	Analysis Description			Section B-735/C-837 - Maximum Storage - Block	
	Drawn By		Scale	Company	
	Date			File Name	Cross735-MaxStorage-NonCircular.slim
	SLIDEINTERPRET 6.027				



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Circular

Drawn By

Scale

1:350

Company

Date

File Name

Cross735-MaxSurcharge-Circular.slim

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-MaxSurcharge-Circular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 - Maximum Surcharge - Circular

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Surcharge - Circular		
Drawn By		Scale	Company		
Date			File Name Cross735-MaxSurcharge-Circular.slim		

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft³
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Embankment	Clay
		



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-Circular.slim

Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	50	20
Friction Angle [deg]	30	28
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.704030
 Center: 81.835, 121.151
 Radius: 51.653
 Left Slip Surface Endpoint: 56.916, 75.907
 Right Slip Surface Endpoint: 126.227, 94.742
 Resisting Moment=1.67528e+006 lb-ft
 Driving Moment=983129 lb-ft
 Total Slice Area=596.374 ft2

Method: janbu simplified

FS: 1.527860
 Center: 84.091, 107.617
 Radius: 40.369
 Left Slip Surface Endpoint: 59.090, 75.922
 Right Slip Surface Endpoint: 121.826, 93.275
 Resisting Horizontal Force=28340.8 lb
 Driving Horizontal Force=18549.4 lb
 Total Slice Area=656.909 ft2



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Circular

Drawn By

Scale

Company

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File Name

Cross735-MaxSurcharge-Circular.slim

Method: bishop simplified

Error Codes:

Method: janbu simplified

Error Codes:

Error Codes

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.70403

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.71731	205.409	Clay	20	28	25.6753	43.7514	88.7542	44.0841	44.6701
2	2.71731	587.945	Clay	20	28	46.2419	78.7976	236.765	126.182	110.583
3	2.71731	915.998	Clay	20	28	62.9398	107.251	360.685	196.588	164.097
4	2.71731	1193.26	Clay	20	28	76.2909	130.002	462.976	256.093	206.883
5	2.71731	1426.79	Clay	20	28	87.2062	148.602	547.175	305.31	241.865
6	2.71731	1774.27	Clay	20	28	115.253	196.394	675.628	343.88	331.748
7	2.71731	2159.16	Clay	20	28	150.053	255.695	815.883	372.606	443.277
8	2.71731	2502.58	Clay	20	28	181.759	309.722	937.009	392.122	544.887
9	2.71731	2849.53	Clay	20	28	215.703	367.564	1056.27	402.598	653.672
10	2.71731	3176.59	Clay	20	28	249.062	424.409	1164.71	404.122	760.584
11	2.71731	3462	Clay	20	28	279.385	476.081	1254.47	396.706	857.762
12	2.71731	3705.46	Clay	20	28	306.759	522.726	1325.78	380.288	945.492
13	2.71731	3906.33	Clay	20	28	331.232	564.43	1378.65	354.728	1023.93
14	2.71731	4063.55	Clay	20	28	352.821	601.218	1412.91	319.802	1093.11
15	2.71731	4175.65	Clay	20	28	371.506	633.058	1428.19	275.191	1152.99
16	2.71731	4240.63	Clay	20	28	387.234	659.858	1423.86	220.468	1203.4
17	2.71731	4255.88	Clay	20	28	399.91	681.458	1399.09	155.071	1244.02
18	2.71731	4218.02	Clay	20	28	409.395	697.621	1352.7	78.2753	1274.42
19	2.71731	4126.57	Clay	20	28	412.994	703.754	1285.95	0	1285.95
20	2.71731	3988.8	Clay	20	28	390.819	665.967	1214.89	0	1214.89
21	2.99295	4059.41	Embankment	50	30	390.055	664.666	1064.63	0	1064.63
22	2.99295	3504.39	Embankment	50	30	328.946	560.534	884.27	0	884.27
23	2.99295	2789.23	Embankment	50	30	256.287	436.72	669.82	0	669.82
24	2.99295	1871.46	Embankment	50	30	170.694	290.868	417.196	0	417.196
25	2.99295	677.69	Embankment	50	30	70.3758	119.922	121.109	0	121.109

Global Minimum Query (janbu simplified) - Safety Factor: 1.52786

				Base	Base	Shear	Shear	Base	Pore	Effective
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	Project	Santee Cooper - Cross Generating Station								
	Analysis Description	Section B-735/C-837 - Maximum Surcharge - Circular								
	Drawn By				Scale				Company	
	Date								File Name	Cross735-MaxSurcharge-Circular.slim

Number	[ft]	[lbs]	Material	Cohesion [psf]	Friction Angle [degrees]	Stress [psf]	Strength [psf]	Normal Stress [psf]	Pressure [psf]	Normal Stress [psf]
1	2.53181	252.002	Clay	20	28	36.8944	56.3695	126.447	58.0462	68.4009
2	2.53181	718.323	Clay	20	28	69.1492	105.65	326.543	165.458	161.085
3	2.53181	1114.13	Clay	20	28	94.0538	143.701	489.277	256.629	232.648
4	2.53181	1447.76	Clay	20	28	113.289	173.089	621.396	333.477	287.919
5	2.53181	1776.06	Clay	20	28	135.997	207.784	750.339	397.168	353.171
6	2.53181	2204.59	Clay	20	28	177.927	271.847	921.674	448.018	473.656
7	2.53181	2594.74	Clay	20	28	216.386	330.608	1071.85	487.683	584.171
8	2.53181	2945.89	Clay	20	28	251.416	384.129	1201.53	516.701	684.825
9	2.53181	3297.3	Clay	20	28	288.699	441.092	1327.4	535.443	791.961
10	2.53181	3612.82	Clay	20	28	322.973	493.457	1434.58	544.139	890.444
11	2.53181	3885.19	Clay	20	28	353.354	539.875	1520.63	542.894	977.741
12	2.53181	4114.33	Clay	20	28	379.998	580.584	1586	531.692	1054.31
13	2.53181	4299.66	Clay	20	28	402.992	615.716	1630.78	510.4	1120.38
14	2.53181	4440.03	Clay	20	28	422.361	645.308	1654.79	478.752	1176.03
15	2.53181	4533.67	Clay	20	28	438.062	669.298	1657.49	436.338	1221.15
16	2.53181	4578.03	Clay	20	28	449.992	687.525	1638.01	382.575	1255.43
17	2.53181	4569.63	Clay	20	28	457.968	699.711	1595.01	316.659	1278.35
18	2.53181	4503.71	Clay	20	28	461.711	705.43	1526.6	237.494	1289.11
19	2.53181	4373.78	Clay	20	28	460.816	704.062	1430.12	143.584	1286.54
20	2.53181	4171.37	Clay	20	28	454.76	694.809	1301.97	32.8377	1269.13
21	2.53181	3901.36	Clay	20	28	418.617	639.588	1165.27	0	1165.27
22	2.39187	3269.45	Embankment	50	30	391.676	598.426	949.901	0	949.901
23	2.39187	2647.18	Embankment	50	30	303.852	464.244	717.493	0	717.493
24	2.39187	1826.86	Embankment	50	30	200.331	306.078	443.539	0	443.539
25	2.39187	678.904	Embankment	50	30	77.0056	117.654	117.18	0	117.18

Interslice Data

	Project	Santee Cooper - Cross Generating Station	
	Analysis Description	Section B-735/C-837 - Maximum Surcharge - Circular	
	Drawn By	Scale	Company
	Date	File Name Cross735-MaxSurcharge-Circular.slim	

Global Minimum Query (bishop simplified) - Safety Factor: 1.70403

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	56.9161	75.9065	0	0	0
2	59.6334	74.513	193.417	0	0
3	62.3507	73.314	602.89	0	0
4	65.068	72.2952	1141.29	0	0
5	67.7853	71.4456	1741.85	0	0
6	70.5026	70.7566	2355.73	0	0
7	73.2199	70.2216	3030.2	0	0
8	75.9372	69.8359	3752.44	0	0
9	78.6545	69.5961	4470.82	0	0
10	81.3718	69.5001	5158.02	0	0
11	84.0892	69.5472	5779.6	0	0
12	86.8065	69.7378	6299.34	0	0
13	89.5238	70.0735	6687.52	0	0
14	92.2411	70.557	6920.45	0	0
15	94.9584	71.1929	6980.34	0	0
16	97.6757	71.9869	6855.39	0	0
17	100.393	72.9468	6540.27	0	0
18	103.11	74.0829	6036.94	0	0
19	105.828	75.4083	5356.1	0	0
20	108.545	76.9398	4508.25	0	0
21	111.262	78.7	3431.32	0	0
22	114.255	80.9393	2214.2	0	0
23	117.248	83.5483	891.177	0	0
24	120.241	86.6107	-393.418	0	0
25	123.234	90.2612	-1405.73	0	0
26	126.227	94.7423	0	0	0



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Surcharge - Circular		
Drawn By		Scale	Company		
Date				File Name	
				Cross735-MaxSurcharge-Circular.slim	

Global Minimum Query (janbu simplified) - Safety Factor: 1.52786

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	59.0904	75.9221	0	0	0
2	61.6222	74.0797	326.599	0	0
3	64.154	72.5155	1012.86	0	0
4	66.6858	71.1937	1898.3	0	0
5	69.2176	70.0887	2872.51	0	0
6	71.7494	69.1816	3898.25	0	0
7	74.2812	68.4588	5015.98	0	0
8	76.8131	67.9103	6153.13	0	0
9	79.3449	67.5288	7249.61	0	0
10	81.8767	67.3096	8273.27	0	0
11	84.4085	67.2501	9178.36	0	0
12	86.9403	67.3495	9923.95	0	0
13	89.4721	67.6091	10476.7	0	0
14	92.0039	68.032	10809.8	0	0
15	94.5357	68.6234	10903	0	0
16	97.0676	69.3914	10742	0	0
17	99.5994	70.3466	10319.3	0	0
18	102.131	71.5041	9635.48	0	0
19	104.663	72.8839	8700.78	0	0
20	107.195	74.514	7539.11	0	0
21	109.727	76.4335	6194.15	0	0
22	112.258	78.7	4615.49	0	0
23	114.65	81.2403	3141.53	0	0
24	117.042	84.297	1676.93	0	0
25	119.434	88.1113	465.487	0	0
26	121.826	93.2753	0	0	0



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Surcharge - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-MaxSurcharge-Circular.slim	

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
148	93
272	93

External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5

Material Boundary

X	Y
78.1	78.7
190.9	78.7



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Circular

Drawn By

Scale

Company

Date

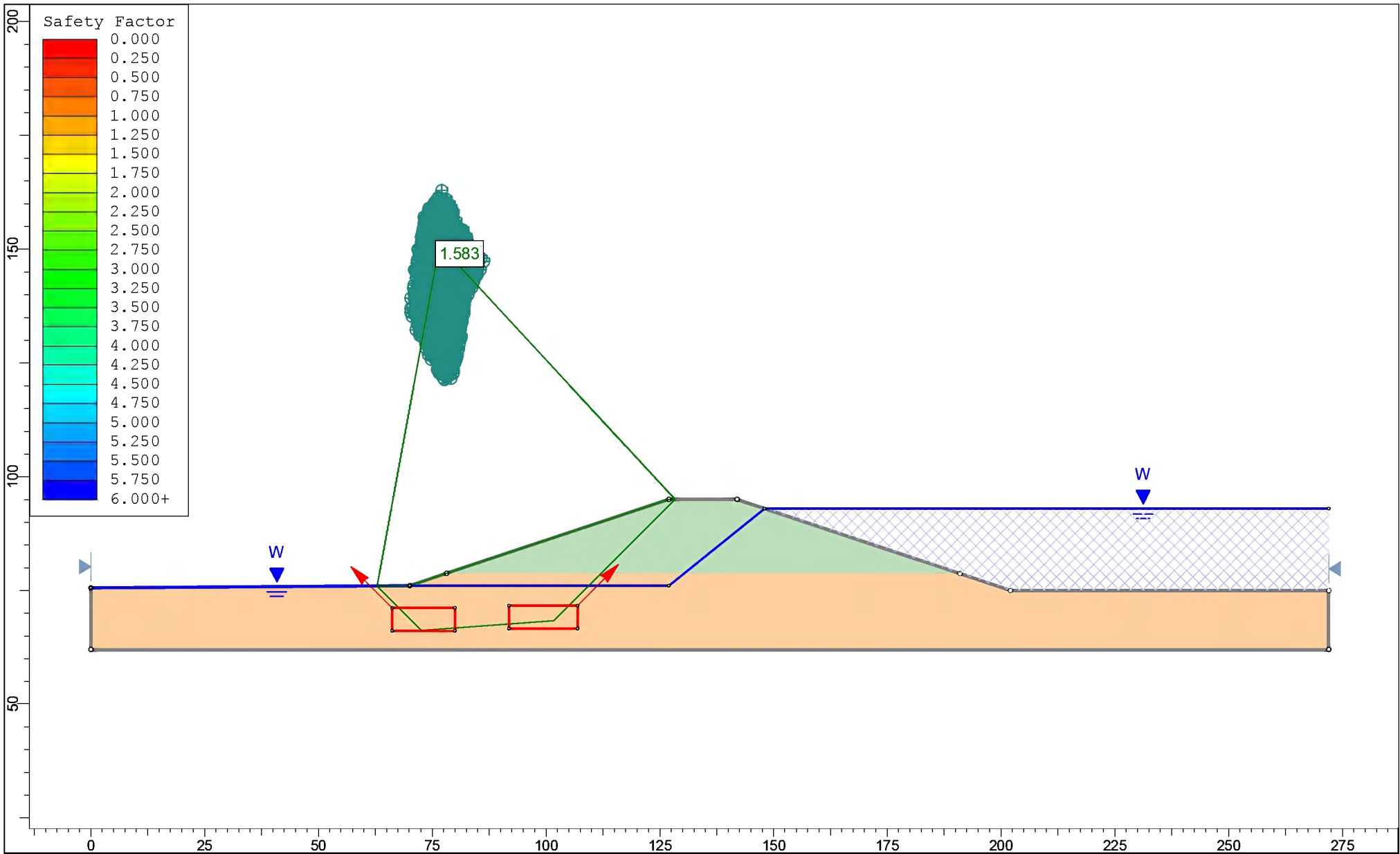
File Name

Cross735-MaxSurcharge-Circular.slim



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Surcharge - Circular		
Drawn By		Scale	Company		
Date			File Name		
			Cross735-MaxSurcharge-Circular.slim		



	Project		
	Santee Cooper - Cross Generating Station		
	Analysis Description		
	Section B-735/C-837 - Maximum Surcharge - Block		
Drawn By		Scale	Company
Date		1:350	
File Name			Cross735-MaxSurcharge-NonCircular.slim

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-MaxSurcharge-NonCircular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 - Maximum Surcharge - Block

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 - Maximum Surcharge - Block		
Drawn By		Scale		Company	
Date		File Name		Cross735-MaxSurcharge-NonCircular.slim	

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft³
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-NonCircular.slim

Property	Embankment	Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	50	20
Friction Angle [deg]	30	28
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.684130

Axis Location: 76.548, 150.971

Left Slip Surface Endpoint: 62.850, 75.949

Right Slip Surface Endpoint: 128.347, 95.000

Resisting Moment=2.97022e+006 lb-ft

Driving Moment=1.76366e+006 lb-ft

Total Slice Area=718.073 ft2

Method: janbu simplified

FS: 1.583430

Axis Location: 76.548, 150.971

Left Slip Surface Endpoint: 62.850, 75.949

Right Slip Surface Endpoint: 128.347, 95.000

Resisting Horizontal Force=31349.8 lb

Driving Horizontal Force=19798.7 lb

Total Slice Area=718.073 ft2



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-NonCircular.slim

Global Minimum Coordinates

Method: bishop simplified

X	Y
62.8504	75.9489
72.5786	66.2208
101.635	68.2885
128.347	95

Method: janbu simplified

X	Y
62.8504	75.9489
72.5786	66.2208
101.635	68.2885
128.347	95

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-NonCircular.slim

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.68413

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.43204	318.703	Clay	20	28	42.5841	71.7171	173.687	76.4217	97.2658
2	2.43204	956.11	Clay	20	28	93.0201	156.658	486.282	229.265	257.017
3	2.43204	1593.87	Clay	20	28	143.524	241.713	799.09	382.108	416.982
4	2.43204	2341.06	Clay	20	28	215.081	362.224	1177.97	534.344	643.629
5	2.64153	3087.69	Clay	20	28	185.928	313.127	1155.65	604.359	551.293
6	2.64153	3271.8	Clay	20	28	211.07	355.47	1223.56	592.63	630.928
7	2.64153	3482.86	Clay	20	28	239.364	403.12	1301.44	580.9	720.544
8	2.64153	3731.83	Clay	20	28	272.088	458.232	1393.37	569.171	824.196
9	2.64153	3981.07	Clay	20	28	304.843	513.396	1485.38	557.442	927.941
10	2.64153	4230.31	Clay	20	28	337.599	568.56	1577.4	545.712	1031.69
11	2.64153	4479.55	Clay	20	28	370.354	623.724	1669.42	533.983	1135.44
12	2.64153	4728.79	Clay	20	28	403.109	678.888	1761.44	522.253	1239.19
13	2.64153	4978.02	Clay	20	28	435.864	734.052	1853.46	510.524	1342.94
14	2.64153	5227.26	Clay	20	28	468.62	789.217	1945.48	498.795	1446.68
15	2.64153	5476.5	Clay	20	28	501.375	844.381	2037.5	487.065	1550.43
16	2.60289	5303.5	Clay	20	28	401.836	676.744	1635.15	399.99	1235.16
17	2.60289	4872.16	Clay	20	28	401.045	675.412	1470.22	237.57	1232.65
18	2.60289	4440.84	Clay	20	28	400.257	674.084	1305.3	75.1502	1230.15
19	2.60289	4027.67	Clay	20	28	380.206	640.317	1166.65	0	1166.65
20	2.71667	3676.5	Embankment	50	30	367.475	618.876	985.323	0	985.323
21	2.71667	3036.88	Embankment	50	30	307.388	517.682	810.05	0	810.05
22	2.71667	2397.25	Embankment	50	30	247.302	416.488	634.777	0	634.777
23	2.71667	1757.63	Embankment	50	30	187.215	315.294	459.504	0	459.504
24	2.71667	1118.01	Embankment	50	30	127.128	214.1	284.231	0	284.231



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-NonCircular.slim

25	2.71667	439.071	Embankment	50	30	63.3482	106.687	98.1841	0	98.1841
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Global Minimum Query (janbu simplified) - Safety Factor: 1.58343

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.43204	318.703	Clay	20	28	46.6232	73.8245	177.651	76.4217	101.229
2	2.43204	956.11	Clay	20	28	101.843	161.262	494.94	229.265	265.675
3	2.43204	1593.87	Clay	20	28	157.137	248.816	812.45	382.108	430.342
4	2.43204	2341.06	Clay	20	28	235.481	372.868	1197.99	534.344	663.647
5	2.64153	3087.69	Clay	20	28	197.484	312.702	1154.85	604.359	550.492
6	2.64153	3271.8	Clay	20	28	224.189	354.988	1222.65	592.63	630.021
7	2.64153	3482.86	Clay	20	28	254.241	402.573	1300.41	580.9	719.513
8	2.64153	3731.83	Clay	20	28	288.999	457.61	1392.2	569.171	823.025
9	2.64153	3981.07	Clay	20	28	323.79	512.699	1484.07	557.442	926.631
10	2.64153	4230.31	Clay	20	28	358.582	567.789	1575.95	545.712	1030.24
11	2.64153	4479.55	Clay	20	28	393.373	622.878	1667.83	533.983	1133.85
12	2.64153	4728.79	Clay	20	28	428.164	677.967	1759.71	522.253	1237.46
13	2.64153	4978.02	Clay	20	28	462.955	733.057	1851.59	510.524	1341.07
14	2.64153	5227.26	Clay	20	28	497.746	788.146	1943.47	498.795	1444.67
15	2.64153	5476.5	Clay	20	28	532.537	843.235	2035.35	487.065	1548.28
16	2.60289	5303.5	Clay	20	28	421.145	666.853	1616.54	399.99	1216.55
17	2.60289	4872.16	Clay	20	28	420.316	665.541	1451.66	237.57	1214.09
18	2.60289	4440.84	Clay	20	28	419.489	664.232	1286.77	75.1502	1211.62
19	2.60289	4027.67	Clay	20	28	398.476	630.959	1149.05	0	1149.05
20	2.71667	3676.5	Embankment	50	30	384.774	609.262	968.67	0	968.67
21	2.71667	3036.88	Embankment	50	30	321.858	509.64	796.12	0	796.12
22	2.71667	2397.25	Embankment	50	30	258.943	410.018	623.569	0	623.569
23	2.71667	1757.63	Embankment	50	30	196.028	310.396	451.019	0	451.019
24	2.71667	1118.01	Embankment	50	30	133.112	210.774	278.468	0	278.468
25	2.71667	439.071	Embankment	50	30	66.3302	105.029	95.3137	0	95.3137

	Project	Santee Cooper - Cross Generating Station	
	Analysis Description	Section B-735/C-837 - Maximum Surcharge - Block	
	Drawn By	Scale	Company
	Date	File Name Cross735-MaxSurcharge-NonCircular.slim	

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.68413

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	62.8504	75.9489	0	0	0
2	65.2825	73.5169	526.127	0	0
3	67.7145	71.0849	1935.33	0	0
4	70.1465	68.6528	4228.3	0	0
5	72.5786	66.2208	7617	0	0
6	75.2201	66.4087	7891.59	0	0
7	77.8617	66.5967	8219.93	0	0
8	80.5032	66.7847	8608.47	0	0
9	83.1447	66.9727	9066.3	0	0
10	85.7863	67.1606	9593.47	0	0
11	88.4278	67.3486	10190	0	0
12	91.0693	67.5366	10855.9	0	0
13	93.7108	67.7245	11591.1	0	0
14	96.3524	67.9125	12395.7	0	0
15	98.9939	68.1005	13269.6	0	0
16	101.635	68.2885	14212.8	0	0
17	104.238	70.8913	11004.1	0	0
18	106.841	73.4942	8222.66	0	0
19	109.444	76.0971	5868.4	0	0
20	112.047	78.7	3822.77	0	0
21	114.764	81.4167	2145.69	0	0
22	117.48	84.1333	781.297	0	0
23	120.197	86.85	-270.398	0	0



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 - Maximum Surcharge - Block

Drawn By

Scale

Company

Date

File Name

Cross735-MaxSurcharge-NonCircular.slim

24	122.914	89.5667	-1009.4	0	0
25	125.63	92.2833	-1435.71	0	0
26	128.347	95	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.58343

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	62.8504	75.9489	0	0	0
2	65.2825	73.5169	545.405	0	0
3	67.7145	71.0849	1996.72	0	0
4	70.1465	68.6528	4354.66	0	0
5	72.5786	66.2208	7840.73	0	0
6	75.2201	66.4087	8145.14	0	0
7	77.8617	66.5967	8507.31	0	0
8	80.5032	66.7847	8934.23	0	0
9	83.1447	66.9727	9435.68	0	0
10	85.7863	67.1606	10011.7	0	0
11	88.4278	67.3486	10662.4	0	0
12	91.0693	67.5366	11387.6	0	0
13	93.7108	67.7245	12187.5	0	0
14	96.3524	67.9125	13061.9	0	0
15	98.9939	68.1005	14011	0	0
16	101.635	68.2885	15034.6	0	0
17	104.238	70.8913	11922.8	0	0
18	106.841	73.4942	9237.93	0	0
19	109.444	76.0971	6980.11	0	0
20	112.047	78.7	5026.11	0	0
21	114.764	81.4167	3439.5	0	0
22	117.48	84.1333	2150.79	0	0
23	120.197	86.85	1159.98	0	0

	Project				
	Santee Cooper - Cross Generating Station				
	Analysis Description				
	Section B-735/C-837 - Maximum Surcharge - Block				
	Drawn By	Scale	Company		
Date			File Name		
			Cross735-MaxSurcharge-NonCircular.slim		

24	122.914	89.5667	467.076	0	0
25	125.63	92.2833	72.0672	0	0
26	128.347	95	0	0	0

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
148	93
272	93

Block Search Window

X	Y
66.107	71.197
66.107	66.087
79.988	66.087
79.988	71.197

Block Search Window

X	Y
91.8081	71.658
91.8081	66.614
106.94	66.614
106.94	71.658

 SLIDEINTERPRET 6.027	Project			
	Santee Cooper - Cross Generating Station			
	Analysis Description			
	Section B-735/C-837 - Maximum Surcharge - Block			
	Drawn By		Scale	Company
	Date		File Name	Cross735-MaxSurcharge-NonCircular.slim

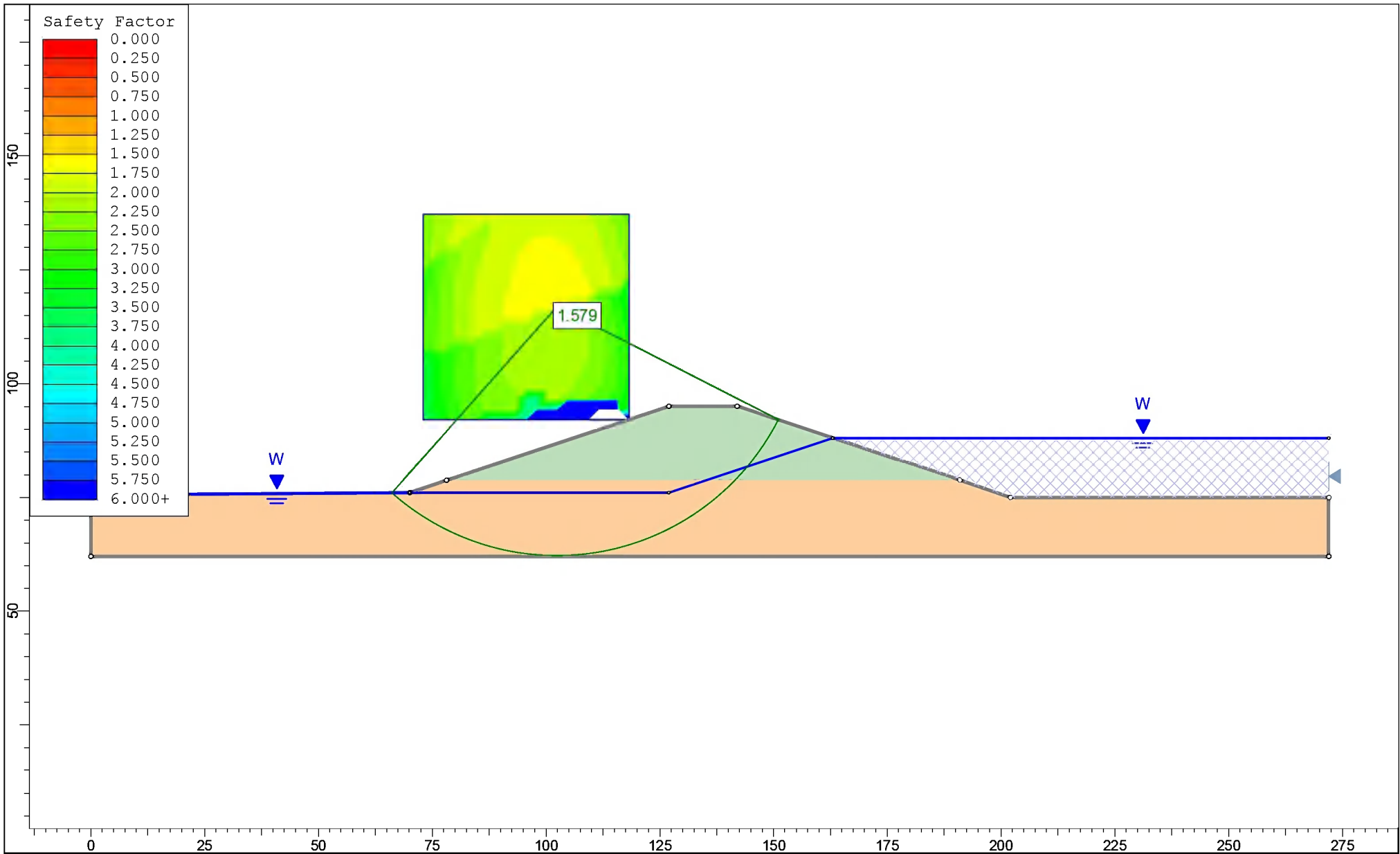
External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5

Material Boundary

X	Y
78.1	78.7
190.9	78.7

	Project			Santee Cooper - Cross Generating Station	
	Analysis Description			Section B-735/C-837 - Maximum Surcharge - Block	
	Drawn By		Scale	Company	
	Date			File Name	Cross735-MaxSurcharge-NonCircular.slim



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale	1:350	Company	
Date		File Name		Cross735-Seismic-Circular.slim	

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-Seismic-Circular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 Seismic Condition - Circular

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-Seismic-Circular.slim	

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Embankment	Clay
	☐	☐



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale	Company		
Date			File Name		
			Cross735-Seismic-Circular.slim		

Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	1440	400
Friction Angle [deg]	0	0
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.579280
 Center: 102.437, 116.887
 Radius: 54.756
 Left Slip Surface Endpoint: 66.049, 75.972
 Right Slip Surface Endpoint: 151.179, 91.940
 Resisting Moment=3.11878e+006 lb-ft
 Driving Moment=1.97481e+006 lb-ft
 Total Slice Area=1591.11 ft2

Method: janbu simplified

FS: 1.661580
 Center: 102.437, 116.887
 Radius: 54.756
 Left Slip Surface Endpoint: 66.049, 75.972
 Right Slip Surface Endpoint: 151.179, 91.940
 Resisting Horizontal Force=43933.1 lb
 Driving Horizontal Force=26440.6 lb
 Total Slice Area=1591.11 ft2



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-Seismic-Circular.slim

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1529
Number of Invalid Surfaces: 3322

Error Codes:

Error Code -103 reported for 3276 surfaces
Error Code -112 reported for 46 surfaces

Method: janbu simplified

Number of Valid Surfaces: 1297
Number of Invalid Surfaces: 3554

Error Codes:

Error Code -103 reported for 3276 surfaces
Error Code -108 reported for 232 surfaces
Error Code -112 reported for 46 surfaces

Error Codes

The following errors were encountered during the computation:

- 103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
- 108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- 112 = The coefficient $M\text{-Alpha} = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi))/F < 0.2$ for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-Seismic-Circular.slim	

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.57928

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.43773	522.434	Clay	400	0	253.28	400	359.446	88.6259	270.82
2	3.43773	1631.01	Clay	400	0	253.28	400	650.518	252.043	398.475
3	3.43773	2840.79	Clay	400	0	253.28	400	975.708	389.851	585.857
4	3.43773	3943.17	Clay	400	0	253.28	400	1272.91	506.408	766.507
5	3.43773	5016.99	Clay	400	0	253.28	400	1564.16	604.087	960.077
6	3.43773	6003.77	Clay	400	0	253.28	400	1831.81	684.611	1147.2
7	3.43773	6896.87	Clay	400	0	253.28	400	2073.47	749.241	1324.23
8	3.43773	7701.73	Clay	400	0	253.28	400	2290.38	798.904	1491.48
9	3.43773	8422.26	Clay	400	0	253.28	400	2483.41	834.259	1649.15
10	3.43773	9061.09	Clay	400	0	253.28	400	2653.08	855.755	1797.32
11	3.43773	9619.76	Clay	400	0	253.28	400	2799.64	863.654	1935.99
12	3.43773	10098.9	Clay	400	0	253.28	400	2923.08	858.052	2065.03
13	3.43773	10498	Clay	400	0	253.28	400	3023.07	838.88	2184.19
14	3.43773	10815.7	Clay	400	0	253.28	400	3098.99	805.906	2293.08
15	3.43773	11049.6	Clay	400	0	253.28	400	3149.96	758.716	2391.24
16	3.43773	11196.1	Clay	400	0	253.28	400	3174.6	696.686	2477.92
17	3.43773	11249.9	Clay	400	0	253.28	400	3171.1	618.942	2552.16
18	3.43773	11186.1	Clay	400	0	253.28	400	3131.76	524.285	2607.48
19	3.43773	10669.7	Clay	400	0	253.28	400	2958.54	466.134	2492.41
20	3.43773	9899.56	Clay	400	0	253.28	400	2708.44	403.647	2304.79
21	3.43773	8988.21	Clay	400	0	253.28	400	2412.84	317.208	2095.64
22	3.43773	7908.37	Clay	400	0	253.28	400	2061.72	202.187	1859.53
23	3.16691	5819.56	Embankment	1440	0	911.808	1440	815.299	58.991	756.308
24	3.16691	3758.41	Embankment	1440	0	911.808	1440	-47.7239	0	-47.7239



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-Seismic-Circular.slim

25	3.16691	1329.25	Embankment	1440	0	911.808	1440	-1135.53	0	-1135.53
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Global Minimum Query (janbu simplified) - Safety Factor: 1.66158

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.43773	522.434	Clay	400	0	240.735	400	348.748	88.6259	260.122
2	3.43773	1631.01	Clay	400	0	240.735	400	641.439	252.043	389.396
3	3.43773	2840.79	Clay	400	0	240.735	400	968.008	389.851	578.157
4	3.43773	3943.17	Clay	400	0	240.735	400	1266.43	506.408	760.018
5	3.43773	5016.99	Clay	400	0	240.735	400	1558.76	604.087	954.674
6	3.43773	6003.77	Clay	400	0	240.735	400	1827.41	684.611	1142.8
7	3.43773	6896.87	Clay	400	0	240.735	400	2070	749.241	1320.76
8	3.43773	7701.73	Clay	400	0	240.735	400	2287.8	798.904	1488.9
9	3.43773	8422.26	Clay	400	0	240.735	400	2481.68	834.259	1647.42
10	3.43773	9061.09	Clay	400	0	240.735	400	2652.19	855.755	1796.43
11	3.43773	9619.76	Clay	400	0	240.735	400	2799.57	863.654	1935.92
12	3.43773	10098.9	Clay	400	0	240.735	400	2923.83	858.052	2065.78
13	3.43773	10498	Clay	400	0	240.735	400	3024.62	838.88	2185.74
14	3.43773	10815.7	Clay	400	0	240.735	400	3101.42	805.906	2295.51
15	3.43773	11049.6	Clay	400	0	240.735	400	3153.28	758.716	2394.57
16	3.43773	11196.1	Clay	400	0	240.735	400	3178.83	696.686	2482.15
17	3.43773	11249.9	Clay	400	0	240.735	400	3176.34	618.942	2557.4
18	3.43773	11186.1	Clay	400	0	240.735	400	3138.05	524.285	2613.77
19	3.43773	10669.7	Clay	400	0	240.735	400	2966.04	466.134	2499.9
20	3.43773	9899.56	Clay	400	0	240.735	400	2717.26	403.647	2313.61
21	3.43773	8988.21	Clay	400	0	240.735	400	2423.24	317.208	2106.04
22	3.43773	7908.37	Clay	400	0	240.735	400	2074.03	202.187	1871.84
23	3.16691	5819.56	Embankment	1440	0	866.645	1440	868.003	58.991	809.012
24	3.16691	3758.41	Embankment	1440	0	866.645	1440	15.9199	0	15.9199
25	3.16691	1329.25	Embankment	1440	0	866.645	1440	-1055.35	0	-1055.35

	Project	Santee Cooper - Cross Generating Station	
	Analysis Description	Section B-735/C-837 Seismic Condition - Circular	
	Drawn By	Scale	Company
	Date	File Name Cross735-Seismic-Circular.slim	

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.57928

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	66.0487	75.9718	0	0	0
2	69.4864	73.1558	1882.91	0	0
3	72.9242	70.7659	4308.23	0	0
4	76.3619	68.7388	7156.82	0	0
5	79.7996	67.0302	10202.5	0	0
6	83.2373	65.6081	13297.6	0	0
7	86.6751	64.4493	16291	0	0
8	90.1128	63.5366	19054.2	0	0
9	93.5505	62.8575	21480.1	0	0
10	96.9883	62.4034	23478.7	0	0
11	100.426	62.1686	24972.4	0	0
12	103.864	62.1502	25894.5	0	0
13	107.301	62.3481	26186.7	0	0
14	110.739	62.7647	25798.1	0	0
15	114.177	63.405	24684.5	0	0
16	117.615	64.2772	22807.8	0	0
17	121.052	65.3931	20135.9	0	0
18	124.49	66.769	16643.5	0	0
19	127.928	68.427	12321.8	0	0
20	131.366	70.3973	7363.33	0	0
21	134.803	72.7216	1938.72	0	0
22	138.241	75.4596	-3796.86	0	0
23	141.679	78.7	-9607	0	0



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Circular

Drawn By

Scale

Company

Date

File Name

Cross735-Seismic-Circular.slim

24	144.846	82.2507	-9614.3	0	0
25	148.013	86.5384	-6522.06	0	0
26	151.179	91.9402	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.66158

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	66.0487	75.9718	0	0	0
2	69.4864	73.1558	1807.9	0	0
3	72.9242	70.7659	4166.64	0	0
4	76.3619	68.7388	6954.73	0	0
5	79.7996	67.0302	9944.46	0	0
6	83.2373	65.6081	12987	0	0
7	86.6751	64.4493	15930.4	0	0
8	90.1128	63.5366	18645.5	0	0
9	93.5505	62.8575	21024.8	0	0
10	96.9883	62.4034	22977.7	0	0
11	100.426	62.1686	24426.3	0	0
12	103.864	62.1502	25303.5	0	0
13	107.301	62.3481	25550.6	0	0
14	110.739	62.7647	25116.5	0	0
15	114.177	63.405	23956.5	0	0
16	117.615	64.2772	22032	0	0
17	121.052	65.3931	19310.5	0	0
18	124.49	66.769	15766.1	0	0
19	127.928	68.427	11389	0	0
20	131.366	70.3973	6370.88	0	0
21	134.803	72.7216	880.856	0	0
22	138.241	75.4596	-4928.08	0	0
23	141.679	78.7	-10823	0	0

	Project		Santee Cooper - Cross Generating Station	
	Analysis Description		Section B-735/C-837 Seismic Condition - Circular	
	Drawn By	Scale	Company	
	Date		File Name Cross735-Seismic-Circular.slim	

24	144.846	82.2507	-11166.3	0	0
25	148.013	86.5384	-8495.82	0	0
26	151.179	91.9402	0	0	0

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
163	88
272	88

External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5



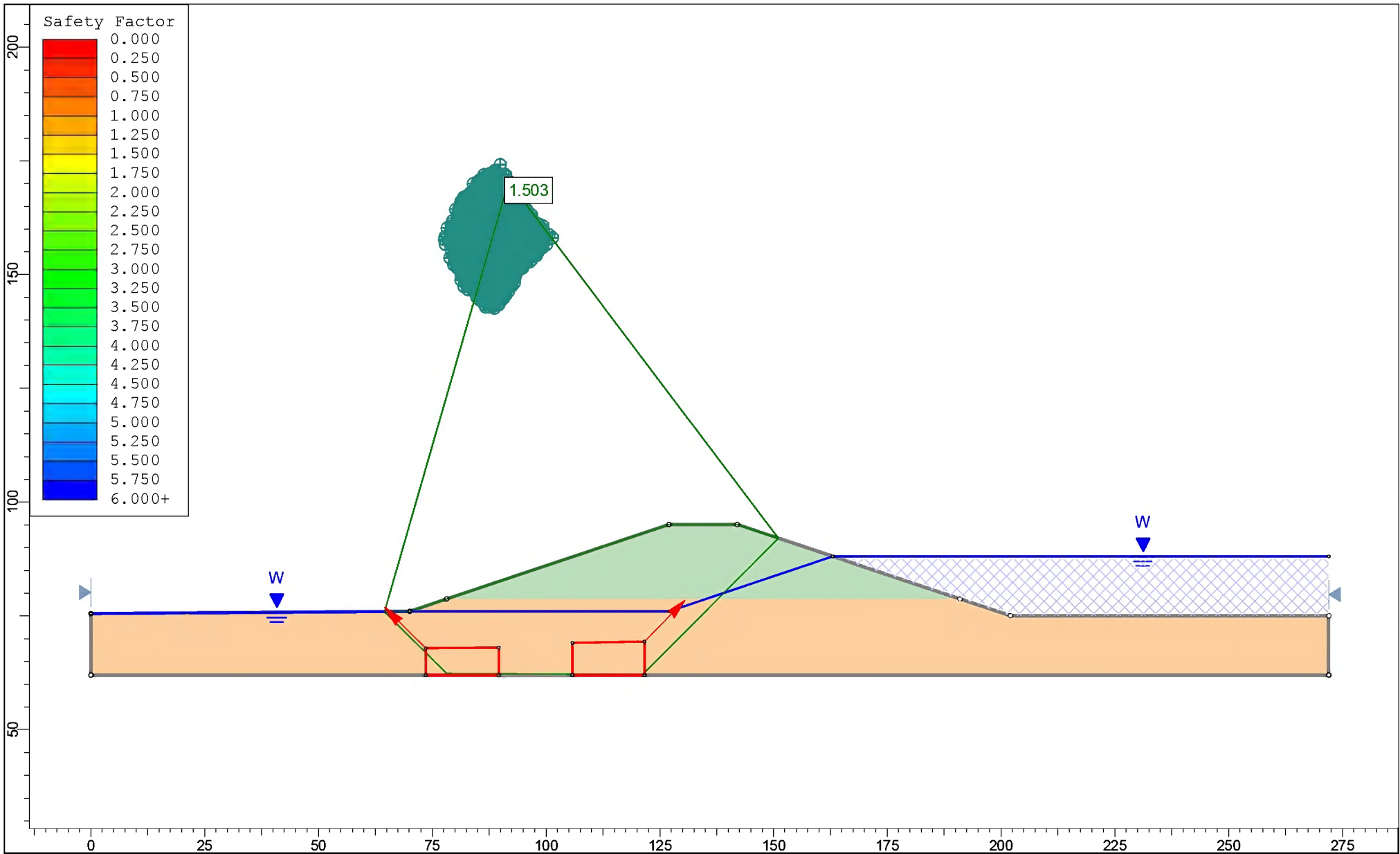
Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale	Company		
Date			File Name		
			Cross735-Seismic-Circular.slim		

Material Boundary

X	Y
78.1	78.7
190.9	78.7



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Circular		
Drawn By		Scale		Company	
Date				File Name	
				Cross735-Seismic-Circular.slim	



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Block		
Drawn By		Scale	1:350	Company	
Date		File Name		Cross735-Seismic-NonCircular.slim	

Slide Analysis Information

Santee Cooper - Cross Generating Station

Project Summary

File Name: Cross735-Seismic-NonCircular
Slide Modeler Version: 6.027
Project Title: Santee Cooper - Cross Generating Station
Analysis: Section B-735/C-837 Seismic Condition - Block

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005



SLIDEINTERPRET 6.027

Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Block		
Drawn By		Scale	Company		
Date			File Name		
			Cross735-Seismic-NonCircular.slim		

Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft³
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 135
Left Projection Angle (End Angle): 135
Right Projection Angle (Start Angle): 45
Right Projection Angle (End Angle): 45
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties



SLIDEINTERPRET 6.027

Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Block

Drawn By

Scale

Company

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File Name

Cross735-Seismic-NonCircular.slim

Property	Embankment	Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	130	102
Saturated Unit Weight [lbs/ft3]	135	107
Cohesion [psf]	1440	400
Friction Angle [deg]	0	0
Water Surface	Water Table	Water Table
Hu Value	1	1

Global Minimums

Method: bishop simplified

FS: 1.503020
 Axis Location: 91.747, 170.515
 Left Slip Surface Endpoint: 64.501, 75.961
 Right Slip Surface Endpoint: 151.043, 91.986
 Resisting Moment=6.07971e+006 lb-ft
 Driving Moment=4.045e+006 lb-ft
 Total Slice Area=1640.66 ft2

Method: janbu simplified

FS: 1.524360
 Axis Location: 91.747, 170.515
 Left Slip Surface Endpoint: 64.501, 75.961
 Right Slip Surface Endpoint: 151.043, 91.986
 Resisting Horizontal Force=48433.7 lb
 Driving Horizontal Force=31773.1 lb
 Total Slice Area=1640.66 ft2



Project			Santee Cooper - Cross Generating Station		
Analysis Description			Section B-735/C-837 Seismic Condition - Block		
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Global Minimum Coordinates

Method: bishop simplified

X	Y
64.5015	75.9607
78.1469	62.3153
121.138	62.081
151.043	91.9858

Method: janbu simplified

X	Y
64.5015	75.9607
78.1469	62.3153
121.138	62.081
151.043	91.9858

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 5000

Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 4997

Number of Invalid Surfaces: 3



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Block

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Error Codes:

Error Code -108 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.50302

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.41137	627.049	Clay	400	0	266.131	400	449.94	107.195	342.745
2	3.41137	1910.29	Clay	400	0	266.131	400	826.105	321.585	504.52
3	3.41137	3478.77	Clay	400	0	266.131	400	1285.89	534.624	751.262
4	3.41137	5119.66	Clay	400	0	266.131	400	1766.89	747.493	1019.4
5	3.58259	6521.64	Clay	400	0	266.131	400	1821.82	854.537	967.282
6	3.58259	7085.3	Clay	400	0	266.131	400	1979.15	855.755	1123.4
7	3.58259	7648.96	Clay	400	0	266.131	400	2136.49	856.973	1279.51
8	3.58259	8212.63	Clay	400	0	266.131	400	2293.82	858.191	1435.63
9	3.58259	8776.29	Clay	400	0	266.131	400	2451.16	859.409	1591.75
10	3.58259	9339.95	Clay	400	0	266.131	400	2608.49	860.627	1747.86
11	3.58259	9903.62	Clay	400	0	266.131	400	2765.82	861.845	1903.98
12	3.58259	10467.3	Clay	400	0	266.131	400	2923.15	863.062	2060.09
13	3.58259	11030.9	Clay	400	0	266.131	400	3080.49	864.28	2216.21
14	3.58259	11594.6	Clay	400	0	266.131	400	3237.83	865.498	2372.33
15	3.58259	12158.3	Clay	400	0	266.131	400	3395.15	866.716	2528.43
16	3.58259	12721.9	Clay	400	0	266.131	400	3552.49	867.934	2684.55



Project

Santee Cooper - Cross Generating Station

Analysis Description

Section B-735/C-837 Seismic Condition - Block

Drawn By

Scale

Company

Date

File Name

Cross735-Seismic-NonCircular.slim

17	3.32379	11712.7	Clay	400	0	266.131	400	3257.77	764.841	2492.93
18	3.32379	10996.5	Clay	400	0	266.131	400	3042.3	557.436	2484.87
19	3.32379	9967.04	Clay	400	0	266.131	400	2732.57	400.94	2331.63
20	3.32379	8803.35	Clay	400	0	266.131	400	2382.46	262.67	2119.79
21	3.32379	7639.67	Clay	400	0	266.131	400	2032.35	124.4	1907.95
22	3.32144	6323.99	Embankment	1440	0	958.071	1440	945.933	0	945.933
23	3.32144	4762.11	Embankment	1440	0	958.071	1440	475.692	0	475.692
24	3.32144	2868.31	Embankment	1440	0	958.071	1440	-94.4841	0	-94.4841
25	3.32144	956.102	Embankment	1440	0	958.071	1440	-670.2	0	-670.2

Global Minimum Query (janbu simplified) - Safety Factor: 1.52436

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.41137	627.049	Clay	400	0	262.405	400	446.211	107.195	339.016
2	3.41137	1910.29	Clay	400	0	262.405	400	822.376	321.585	500.791
3	3.41137	3478.77	Clay	400	0	262.405	400	1282.16	534.624	747.535
4	3.41137	5119.66	Clay	400	0	262.405	400	1763.16	747.493	1015.67
5	3.58259	6521.64	Clay	400	0	262.405	400	1821.8	854.537	967.26
6	3.58259	7085.3	Clay	400	0	262.405	400	1979.13	855.755	1123.38
7	3.58259	7648.96	Clay	400	0	262.405	400	2136.47	856.973	1279.49
8	3.58259	8212.63	Clay	400	0	262.405	400	2293.8	858.191	1435.61
9	3.58259	8776.29	Clay	400	0	262.405	400	2451.13	859.409	1591.72
10	3.58259	9339.95	Clay	400	0	262.405	400	2608.47	860.627	1747.84
11	3.58259	9903.62	Clay	400	0	262.405	400	2765.8	861.845	1903.96
12	3.58259	10467.3	Clay	400	0	262.405	400	2923.15	863.062	2060.09
13	3.58259	11030.9	Clay	400	0	262.405	400	3080.46	864.28	2216.18
14	3.58259	11594.6	Clay	400	0	262.405	400	3237.8	865.498	2372.31
15	3.58259	12158.3	Clay	400	0	262.405	400	3395.15	866.716	2528.43
16	3.58259	12721.9	Clay	400	0	262.405	400	3552.46	867.934	2684.53
17	3.32379	11712.7	Clay	400	0	262.405	400	3261.51	764.841	2496.67

	Project	Santee Cooper - Cross Generating Station								
	Analysis Description	Section B-735/C-837 Seismic Condition - Block								
	Drawn By				Scale				Company	
	Date							File Name	Cross735-Seismic-NonCircular.slim	

18	3.32379	10996.5	Clay	400	0	262.405	400	3046.03	557.436	2488.59
19	3.32379	9967.04	Clay	400	0	262.405	400	2736.3	400.94	2335.36
20	3.32379	8803.35	Clay	400	0	262.405	400	2386.19	262.67	2123.52
21	3.32379	7639.67	Clay	400	0	262.405	400	2036.08	124.4	1911.68
22	3.32144	6323.99	Embankment	1440	0	944.659	1440	959.354	0	959.354
23	3.32144	4762.11	Embankment	1440	0	944.659	1440	489.112	0	489.112
24	3.32144	2868.31	Embankment	1440	0	944.659	1440	-81.0637	0	-81.0637
25	3.32144	956.102	Embankment	1440	0	944.659	1440	-656.78	0	-656.78

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.50302

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	64.5015	75.9607	0	0	0
2	67.9128	72.5494	2442.76	0	0
3	71.3242	69.138	6168.77	0	0
4	74.7356	65.7266	11463.3	0	0
5	78.1469	62.3153	18398.6	0	0
6	81.7295	62.2957	19387.6	0	0
7	85.3121	62.2762	20379.7	0	0
8	88.8947	62.2567	21374.8	0	0
9	92.4773	62.2372	22373	0	0
10	96.0599	62.2177	23374.3	0	0
11	99.6425	62.1981	24378.6	0	0
12	103.225	62.1786	25386	0	0
13	106.808	62.1591	26396.5	0	0
14	110.39	62.1396	27410	0	0
15	113.973	62.1201	28426.7	0	0

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16	117.555	62.1006	29446.4	0	0
17	121.138	62.081	30469.1	0	0
18	124.462	65.4048	20525.5	0	0
19	127.786	68.7286	11298.1	0	0
20	131.109	72.0524	3100.17	0	0
21	134.433	75.3762	-3934.08	0	0
22	137.757	78.7	-9804.66	0	0
23	141.078	82.0214	-9764.39	0	0
24	144.4	85.3429	-8162.24	0	0
25	147.721	88.6643	-4666.29	0	0
26	151.043	91.9858	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.52436

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	64.5015	75.9607	0	0	0
2	67.9128	72.5494	2417.33	0	0
3	71.3242	69.138	6117.9	0	0
4	74.7356	65.7266	11387	0	0
5	78.1469	62.3153	18296.9	0	0
6	81.7295	62.2957	19272.5	0	0
7	85.3121	62.2762	20251.2	0	0
8	88.8947	62.2567	21233	0	0
9	92.4773	62.2372	22217.8	0	0
10	96.0599	62.2177	23205.7	0	0
11	99.6425	62.1981	24196.7	0	0
12	103.225	62.1786	25190.8	0	0
13	106.808	62.1591	26187.9	0	0
14	110.39	62.1396	27188.1	0	0
15	113.973	62.1201	28191.4	0	0

 SLIDEINTERPRET 6.027	Project			Santee Cooper - Cross Generating Station			
	Analysis Description					Section B-735/C-837 Seismic Condition - Block	
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16	117.555	62.1006	29197.7	0	0
17	121.138	62.081	30207.1	0	0
18	124.462	65.4048	20238.7	0	0
19	127.786	68.7286	10986.5	0	0
20	131.109	72.0524	2763.81	0	0
21	134.433	75.3762	-4295.22	0	0
22	137.757	78.7	-10190.6	0	0
23	141.078	82.0214	-10239.5	0	0
24	144.4	85.3429	-8726.45	0	0
25	147.721	88.6643	-5319.65	0	0
26	151.043	91.9858	0	0	0

List Of Coordinates

Water Table

X	Y
0	75.5
70	76
127	76
163	88
272	88

Block Search Window

X	Y
73.5529	67.765
73.5529	62
89.6459	62
89.6459	68.005

 SLIDEINTERPRET 6.027	Project		
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Block Search Window

X	Y
105.739	69.093
105.739	62
121.591	62
121.591	69.333

External Boundary

X	Y
0	62
272	62
272	75
202	75
190.9	78.7
142	95
127	95
78.1	78.7
70	76
0	75.5

Material Boundary

X	Y
78.1	78.7
190.9	78.7



Project		Santee Cooper - Cross Generating Station	
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