SOUTH CAROLINA ELECTRIC & GAS

LOCATION RESTRICTIONS:
FAULT AREAS
& UNSTABLE AREAS

FOR THE

WILLIAMS STATION FGD POND

BERKELEY COUNTY, SOUTH CAROLINA

OCTOBER 2018

PURPOSE

The purpose of this report is to demonstrate that the Williams Station FGD Pond meets the Location Restriction requirements of the CCR Rule…

> *40 CFR Part 257 – Criteria for Classification of Solid Waste Disposal Facilities and Practices, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*

APPLICABLE REGULATIONS

§257.62 Fault Areas

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(1) For an existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.

(2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.

(3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).

(4) An owner or operator of an existing CCR surface impoundment who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (c)(1) of this section is subject to the requirements of § 257.101(b)(1).

(5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet

requirements specified in § 257.107(e).

§ 257.64 Unstable Areas

(a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

(b) The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:
   (1) On-site or local soil conditions that may result in significant differential settling;
   (2) On-site or local geologic or geomorphologic features; and
   (3) On-site or local human-made features or events (both surface and subsurface).

(c) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(d) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (d)(1) or (2) of this section.
   (1) For an existing CCR landfill or existing CCR surface impoundment, the owner or operator must complete the demonstration no later than October 17, 2018.
   (2) For a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit, the owner or operator must complete the demonstration no later than the date of initial receipt of CCR in the CCR unit.
   (3) The owner or operator has completed the demonstration required by paragraph (a) of this section when the demonstration is placed in the facility's operating record as required by § 257.105(e).
   (4) An owner or operator of an existing CCR surface impoundment or existing CCR landfill who fails to demonstrate compliance with the requirements of paragraph (a) of this section by the date specified in paragraph (d)(1) of this section is subject to the requirements of § 257.101(b)(1) or (d)(1), respectively.
   (5) An owner or operator of a new CCR landfill, new CCR surface impoundment, or any lateral expansion of a CCR unit who fails to make the demonstration showing compliance with the requirements of paragraph (a) of this section is prohibited from placing CCR in the CCR unit.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(e), the notification requirements specified in § 257.106(e), and the Internet requirements

FGD POND DESCRIPTION

Williams Station is coal-fired electric generation plant located in Goose Creek, Berkeley County, South Carolina. The FGD Pond is used to manage wastewater generated from the flue gas desulfurization scrubber system. The FGD pond was constructed in accordance with construction permit (permit 19263-IW) issued from the South Carolina Department of Health and Environmental Control (DHEC) on March 9, 2009, and placed into operation in accordance with an operation approval issued by DHEC on October 6, 2009. Effluent discharge for the FGD Pond is regulated under NPDES Permit #SC0003883.

The FGD Pond includes two settling bays, each approximately 1.0 acre.

DEMONSTRATIONS

A Geotechnical Evaluation was performed at Williams Station to demonstrate that the FGD Pond meets the criteria of the regulations. The Appendix includes the results of the geotechnical evaluation presenting and certifying that the FGD Pond at Williams Station…

a) is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time, and
b) is not located in an unstable area.

CONCLUSION

The Williams Station FGD Pond meets the requirements of CCR Rule §257.62 *Fault Areas* and §257.64 *Unstable Areas* as appropriately demonstrated in the Appendix - *Geotechnical Evaluation* which is certified by a qualified professional engineer.

APPENDIX

GEOTECHNICAL EVALUATIONS

F&ME
CONSULTANTS

October 13, 2017

Ms. Amy Bresnahan, P.E.
SCANA Corporation
220 Operation Way
Cayce, South Carolina 29033

Re.: Location Restrictions for CCR Ponds
PowerAdvocate Event 67204 : EA0003(2017)-Location Restrictions for CCR Ponds
Williams Station Power Generation Facility
Berkeley County, South Carolina
F&ME Project Number: G5739.00

Dear Ms. Bresnahan:

F&ME Consultants Inc. (F&ME) is submitting the enclosed Location Restrictions for CCR Ponds (PowerAdvocate Event 67204 : EA0003(2017)-Location Restrictions for CCR Ponds) demonstration which provides the seismic geotechnical evaluations and analysis of the existing Coal Combustion Residue (CCR) Surface Impoundments (ponds) at the SCE&G Williams Station facility in accordance with (IAW) 40 CFR 257.62, .63 and .64.

We appreciate the opportunity to provide you this requested report. Please contact us if you have any questions or need additional information.

Sincerely,

F&ME Consultants, Inc.

Michael S. Miller, P.E.
Senior Geotechnical Engineer

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 20955 MICHAEL S. MILLER

Zane W. Abernethy, P.E.
President

SOUTH CAROLINA F&ME CONSULTANTS, INC. No. 4891 CERTIFICATE OF AUTHORIZATION

3112 Devine Street Columbia, South Carolina 29205 P 803.254.4540 F 803.254.4542 www.fmecol.com

Summary of Findings

The following summarizes the method of investigations, results of our analyses, and conclusions for the Coal Combustion Residue (CCR) ponds designated as Forebay #1 (FGD #1) and Forebay #2 (FGD #2) located on the SCE&G Williams Station power generation facility.

- F&ME performed on-site visual inspections of the CCR ponds and surrounding topography to verify conditions consistent with the provided mapping.
- The CCR ponds subject of this report are located in areas defined as Seismic Impact Zones.
- The CCR ponds subject of this evaluation are not located in Fault Areas.
- The CCR ponds subject of this demonstration are not located in areas defined as Unstable Areas.
- F&ME used soil data from previous field explorations and performed additional field investigations to adequately define subsurface soil conditions for use in seismic slope stability analyses.
- F&ME utilized provided CCR pond as-built/constructed plan sets and provided topographic survey mapping for development of embankment cross-section profiles used in our seismic slope stability models.
- F&ME performed seismic stability analyses utilizing two seismic horizontal ground motion values. One value was based on SCDHEC Regulation 61-107.19 SWM: Solid Waste Landfill. The second ground motion value was based on USGS Seismic Hazard Maps and represents current industry/engineering practice.
- The results of the seismic slope stability analyses meet design requirements when using SCDHEC guideline mapping for selection of seismic maximum horizontal acceleration value.
- The results of the seismic slope stability analyses for the Williams Station CCR Ponds subject of this study did not meet design requirements when using current USGS Hazard Map seismic maximum horizontal acceleration values.
- F&ME has provided conceptual options for consideration of any future embankment stabilization/mitigation plans.

Introduction

Our scope of work is to provide the requested seismic evaluation of the following Coal Combustion Residuals (CCR) surface impoundments (ponds) located at the SCE&G Williams Station power facility:

- Forebay #1 Ash Pond C (FGD #1)
- Forebay #2 Ash Pond C (FGD #2)

Our proposal included providing SCE&G evaluations of proximity of seismic fault areas, seismic impact zones, seismic stability analysis if CCR units are classified as located in seismic impact zones, and evaluation of any unstable areas, as defined by applicable regulations, in the areas of the above listed ponds. F&ME utilized accepted industry standards, the latest field investigation and the state-of-the-art analytical tools to gather additional field subsurface data and to conduct our stability analysis.

F&ME is in receipt of the documents provided by SCE&G via the Poweradvocate Website (See Attachment A – List of Documents Provided). The information in these documents was utilized to initially develop the work plan and was used in our analysis.

Scope of Work

For each CCR pond listed above, F&ME has performed an evaluation of the existing dike containment systems to meet the objectives of 40 CFR Part 257 – Criteria for Classification of Solid Waste Disposal Facilities and Practices – Subpart D - Standards for the disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The specific CFR subsections addressed in this demonstration are as follows:

1. Subsection 257.62 Fault Areas;
2. Subsection 257.63 Seismic Impact Zones; and,
3. Subsection 257.64 Unstable Areas (Non-seismic related settlements)

In order to accomplish this task, F&ME performed the following:

1. A visual reconnaissance of the ponds;
2. Submit Final CPT Test Location Plan for SCE&G Approval;
3. Comparison of observed conditions with the provided topographic information;
4. Development of design cross sections based upon the provided data;
5. Obtaining additional subsurface data;
6. Determining the design earthquake intensity (per DHEC & EPA);
7. Analyzing the impact of the design earthquakes on the material strength properties of the embankment and foundation soils;
8. Determining CCR pond embankment global stability factors of safety for the various ponds physical configurations and cross sections for static and seismic loading conditions; and,

9. Comparison of the calculated slope stability safety factors with the requirements of SCDHEC regulations 61-107.19 SWM and EPA/600/R-95/051.

Site Geology

The project site is geographically located near the town of Goose Creek in Berkeley County, South Carolina and is situated on the lower Coastal Plain and lies between the Back River and the Cooper River. The Coastal Plain in this area generally consists of reworked terrestrial fine sands and clays, which are intermingled with marine deposits. This wedge of sedimentary materials overlying the crystalline rocks of the Piedmont exceeds 2,000 feet thick in the project area.

The site is situated north of the confluence of the Back and Cooper Rivers. Both rivers have influenced the recent geology of the site, and repeated meanderings of the river systems over time have deposited and scoured various sedimentary strata. The area is presently dominated by tidal marsh deposits of clays and occasional peat deposits and clayey sands and clay facies of the Ten Mile Beds. These strata are Pleistocene to Holocene aged. Underlying these materials is the Ashley Formation (commonly called "Cooper Marl"). The Cooper Marl in the vicinity is approximately 200 feet thick and functions as an aquitard limiting the downward flow of surficial waters. The Cooper Marl is considered Oligocene in age. Underlying the Cooper Marl is the Tertiary Limestone Aquifer which includes the Santee Limestone and other older, carbonate marine strata.

Site Seismicity

The records for seismic activity in the southeastern United States cover a span of about 300 years and consist mostly of non-instrumented data. The seismic activity in the southeast is also infrequent. Because of the infrequency of southeastern earthquakes and the lack of statistical data, little basis exists for development of typical seismic design response spectrums. Unlike earthquakes of California, southeastern earthquakes have not caused ground surface ruptures, which make it difficult for geologists to predict active fault locations.

The site is near the epicenter of the Charleston Earthquake of 1886. The Summerville and Charleston Faults occur approximately 15 and 10 miles west of the site.

The earthquake that occurred in 1886 in the Coastal Plain Physiographic Province near Charleston, South Carolina dominates the seismic history of the southeastern United States. It is the largest historic earthquake in the southeastern United States with an estimated moment magnitude, M_W, of 7.3 (Richter scale). The resulting earthquake damage area with a Modified Mercalli Intensity Scale of X (X being the highest degree of ground shaking and damage to structures on the Mercalli Scale) is an elliptical shape approximately 20 by 30 miles trending northeast between Charleston and Jedburg, South Carolina, including Summerville and roughly centered at Middleton Place. The intraplate (i.e. areas of the earth's crustal tectonic plates not associated with plate-to-plate tectonic boundaries) epicenter of the 1886 Charleston earthquake and its magnitude is not unique in the central and eastern United States. Other intraplate

earthquakes include those at Cape Ann, Massachusetts (1755) with a M_W of 5.9, and Madrid, Missouri (1811-1812) with M_W of at least 7.7.

US Geological Survey methodology and mapping were utilized to establish ground accelerations for our analysis. The data utilized in our analysis is discussed further in this report.

Field Exploration

Two (2) Cone Penetrometer Test (CPT) soundings, labeled CPT-1 and CPT-2, were conducted on August 23, 2017. A CME 45B trailer mounted drill rig was used to advance the cone penetrometer soundings. The approximate CPT sounding locations can be seen on test location plan (Figure 2) provided in Attachment 1. The test soundings ground surface elevations and locations were measured with Trimble R6 GPS equipment and should be considered approximate.

Soil Stratigraphy

The below soil descriptions, strata depths, and consistencies are generalized and were interpreted by F&ME based on the subsurface conditions as indicated in soundings CPT-1 and CPT-2 performed during this phase of exploration. We have included the CPT sounding logs in Attachment 1 for detailed depths and descriptions of the indicated soil conditions.

Both CPT soundings were located in the gravel access road constructed at top of existing embankment CCR pond berms and were initially drilled to bypass surface gravel layers. Following penetration of the gravel road, both soundings encountered existing embankment fill material which is indicated as being clays to silty clay soils based on soil behavior type as processed in data reduction of the collected CPT data. The existing embankment fill soil heights are estimated as being10 feet.

Below the embankment fill clay soil materials, the soundings penetrated approximately 10 feet of alluvial clay soils which were then underlain by clean to silty sands. This underlying sand soil layer thickness ranged from approximately 3 to 5 feet thick.

Below the sand layer, the Cooper Marl was encountered to the final CPT termination depth. Termination of the CPT soundings was based on maximum reaction force of the CPT sounding equipment (i.e. refusal). CPT-1 and CPT-2 soundings encountered refusal at depths of 48.2 feet and 46.3 feet, respectively, below existing ground surface.

Following completion of the CPT soundings, the CPT holes were backfilled with a bentonite/cement grout.

We would note that as with any geologic formation, the depth and thickness of the soil strata will vary across the site. Although the CPT test soundings designate strata changes at specific depths on the CPT test sounding logs, transitions between soil strata are generally gradual. Therefore, the above soil stratigraphy description and the outlined subsurface profiles shown on the CPT

sounding logs should only be considered general on-site soil conditions and should not be utilized as an absolute indicator.

FAULT AREA EVAUATION

F&ME has performed a regional seismic fault evaluation in accordance with the requirements listed in the regulations and guidance documents for the Williams Station CCR ponds subject of this demonstration. The fault area location restrictions imposed by CFR Subtitle D (257.62), in part, restrict siting of existing and new CCR surface impoundments, and all lateral extensions of CCR units must not be located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time. The Holocene time extends to approximately 10,000 to 12,000 years before present time.

Based on our review of seismological studies of seismogenesis east of the Rocky Mountains, the region of capable faults which may result in actual ground surface ruptures is excluded from Eastern United States. The current consensus is that earthquake source zones or hypocenters in the Eastern United States are related to subsurface crustal structures which occur at relatively deep depths such that surface expressions of the faulting cannot or do not result. No surface ruptures or displacements related to earthquake faulting have been identified near the Williams Station CCR pond vicinity.

SEISMIC IMPACT ZONE EVALUATION

F&ME has performed a seismic impact zone evaluation in accordance with the requirements listed in the regulations and guidance documents for the Williams Station CCR ponds subject of this report. The seismic impact zones location restrictions imposed by CFR Subtitle D (257.63), in part, restrict siting of existing and new CCR surface impoundments, and all lateral extensions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components are designed to meet the maximum horizontal acceleration in lithified earth material for the site.

The determination as to if the Williams Station CCR ponds subject of this demonstration is based on earthquake probability maps prepared by the United States Geological Survey (USGS Seismic Impact Zones, EPA, 1993). Seismic impact zones are defined in the regulations as those regions shown on this map as having a peak bedrock acceleration exceeding 0.1g based on a 90% probability of non-exceedance over a 250 year time period (approximately a 2,475-year return period event).

Review of the referenced USGS Impact Zones mapping for determination of site seismic impact zone designation, the Williams Station existing CCR ponds subject of this report are located in a seismic impact zone.

Design Analyses Methodologies

Due to the Williams Station CCR ponds located in region defined as a seismic impact zone, F&ME has performed seismic analyses in accordance with the requirements listed in the following regulations and/or guidance documents:

SCDHEC Regulation 61-107.19 SWM: Solid Waste Landfills and Structural Fill (May 23, 2008), Part V. Class Three landfills, Subpart D Design Criteria for Class 3 Landfills, 258.40 Design, Subparagraph r; and,

EPA RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Faculties (EPA/600/R-95/051 – April 1995).

Within seismic impact zones, the regulations, in part, require that that the waste containment systems for all existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

Seismic Design Ground Motion

Each of these regulations and/or guidance documents utilize slightly different methodologies or references in estimating the design peak ground acceleration (PGA) value for use in seismic stability analyses. F&ME has reviewed SCDHEC and EPA recommended guidance sources for estimation of seismic motions at the subject CCR pond locations and are providing the following PGA values (expressed as a percentage of gravity) in Table 1:

Table 1 – Peak Ground Acceleration (PGA) Values

Reference	Recurrence Interval	PGA[1] (g)	Site Coefficient F_{PGA}[2]	Design PGA (g)
SCDHEC – USGS Open-File Report No. 82-1033 - Plate 3 (USGS 1982)	90 Percent Probability of not being Exceeded in 250 Years (1 in ~2,500 Year Event)	0.23	1.202	0.276
USGS Hazard Map – 2015 NEHRP Provisions	2 Percent Probability of being exceeded in 50 Years (1 in ~2,500 Year Event)	1.045	1.1	1.149

[1] Rock Outcrop PGA Value (i.e. B-C Boundary)
[2] Site Coefficient based on Seismic Site Class D determination.

The design PGA was calculated as the mapped rock outcrop PGA factored by the applicable site coefficient (F_{PGA}) for the CCR pond site. The F_{PGA} was selected based on a Seismic Site Class D.

Slope Stability Evaluations

For the required slope stability analyses of FGD Ponds #1 and #2, multiple cross sections were developed to analyze CCR pond embankments and the "most critical" cross section/failure plane

was determined for FGD Pond #1 and FGD Pond #2. These cross sections were developed utilizing provided topographic and geological data (utilizing both provided and newly developed geotechnical information) at each of the selected locations for each subject CCR pond.

F&ME used the computer software program SLIDE for static and seismic stability analyses of the CCR pond embankments. Given non-lithified soil conditions extending to depths below reasonable failure plane generation, circular failure planes were defined in in evaluating global stability. The Modified Bishops method was used in calculating the factor of safety (FOS) for circular failure surfaces. We have included the SLIDE generated stability analyses output sheets in Attachment 2 of this demonstration which depicts slope/subsurface geometries, soil stratigraphy, soil unit weights and soil strength parameters used in our analyses.

For static slope stability analyses of FGD Pond #1 and FGD Pond #2, a uniform live load (LL) of two-hundred fifty (250) pounds per square foot (psf) was modeled as being applied to gravel access roads located at the top of the pond embankments. LL was neglected in all seismic slope stability analyses.

In our seismic slope stability analyses of the CCR embankments the maximum horizontal acceleration (MHA) value used in our analyses was calculated as being one-half the design PGA value as listed in Table 1. This reduction in the maximum PGA value by one half is outlined in RCRA Subtitle D seismic design guidance documents and is based on studies in which a hypothetical yield acceleration (i.e. seismic ground acceleration value resulting in a FOS = 1.0) equal to half the maximum PGA value would experience permanent seismic deformations of less than a foot. Any permanent seismic deformations resulting from the design seismic event with a calculated minimum FOS of 1.0 are considered as being within typical acceptable deformation limits used in practice in the design of geosynthetic liner systems.

Table 2 and Table 3 summarize the factor of safety (FOS) results from our static and seismic slope stability analyses of FGD Pond #1 and FGD Pond #2.

Table 2 - Static Slope Stability Results

Static Stability FOS	
FGD Pond #1	FGD Pond #2
2.75	1.98

Table 3 – Seismic Slope Stability Results

Seismic Input Reference	Design MHA (g)[1]	Seismic Stability FOS	
		FGD Pond #1	FGD Pond #2
SCDHEC – USGS Open-File Report No. 82-1033 - Plate 3 (USGS 1982)	0.138	1.39	1.48
USGS Hazard Map – 2015 NEHRP Provisions	0.575	0.48	0.62

[1]MHA = Maximum Horizontal Acceleration = 0.5 x Design PGA

Current industry standard for minimum acceptable FOS for static slope stability condition is 1.3. FGD Pond #1 and FGD Pond #2 both meet this current static slope stability design criteria.

The industry standard, as well as current seismic design/analyses minimum acceptable criteria FOS as stipulated in CFR 40, Part 257, for seismic slope stability design/analysis is 1.0. Based on the our seismic slope stability analysis the existing Williams Station CCR pond embankments, subject of this demonstration, do not meet the minimum factor of safety and will not perform without experiencing significant disruption during the design seismic event (2015 NEHRP seismic peak ground motion values).

CCR Pond Stabilization Options

F&ME presents the following conceptual options for rehabilitated/stabilizing of CCR ponds (Forebay #1 and Forebay #2). Satisfactory design analyses performance for the CCR ponds may require a combination of two or more of the following concept options:

1) Perform a Site Specific Seismic Hazard study to determine design peak ground acceleration (PGA) value for use in future slope stability analyses and embankment designs. It is F&ME's opinion that this site specific study would result in a lower design PGA value but not to the level where the existing CCR pond embankments would be considered as being satisfactory during the design seismic event with the revised PGA value.
2) Re-grading of existing embankment slopes to flatten slope grades and possible addition of toe (i.e. downstream) earth berms.
3) Demolition and reconstruction of CCR pond embankments to include installation/placement of geogrid reinforcement layers.
4) Installation of pin piles below/through CCR pond embankments to increase soil's shearing resistance during the design seismic event. Pin piles are driven piles (concrete, steel pipe, steel H-piles) that would be driven on a pattern and installed to a tip elevation in the underlying Cooper Marl. Pin pile installations may need to extend outward some distance from toe of downstream CCR pond slopes.

F&ME will be available to discuss the above options.

UNSTABLE AREA EVALUATION

F&ME has evaluated subsurface/foundation conditions in accordance with the requirements listed in the regulations and guidance documents for the Williams Station CCR ponds subject of this report for demonstrating if CCR units are located in unstable areas. The unstable area classification restrictions imposed by CFR Subtitle D (257.64), in part, restrict siting of existing and new CCR surface impoundments, and all lateral extensions of CCR units must not be located in an unstable area unless the owner or operator demonstrates that all structural components are designed to ensure the integrity of the structural components of the CCR unit will not be disrupted.

F&ME's evaluation of unstable area classification considered on-site or local soils conditions that may possibly result in significant differential settlement, on-site or local geologic or

geomorphological features, and/or on-site or local man-made features or events (both surface and subsurface) that might disrupt existing CCR units.

The Williams Station CCR units subject of this study are existing structures and any settlements (total and differential) associated with past increased vertical loadings from CCR embankment construction has already occurred. No additional settlements that might impact structural components or disrupt CCR functionality is possible given time span since original CCR pond construction.

In addition to evaluation of settlements imposed by the CCR structure itself, there are no known or documented geomorphological conditions to include karst features such as sinkholes or other subsurface dissolution cavities that would result in any significant future settlements.

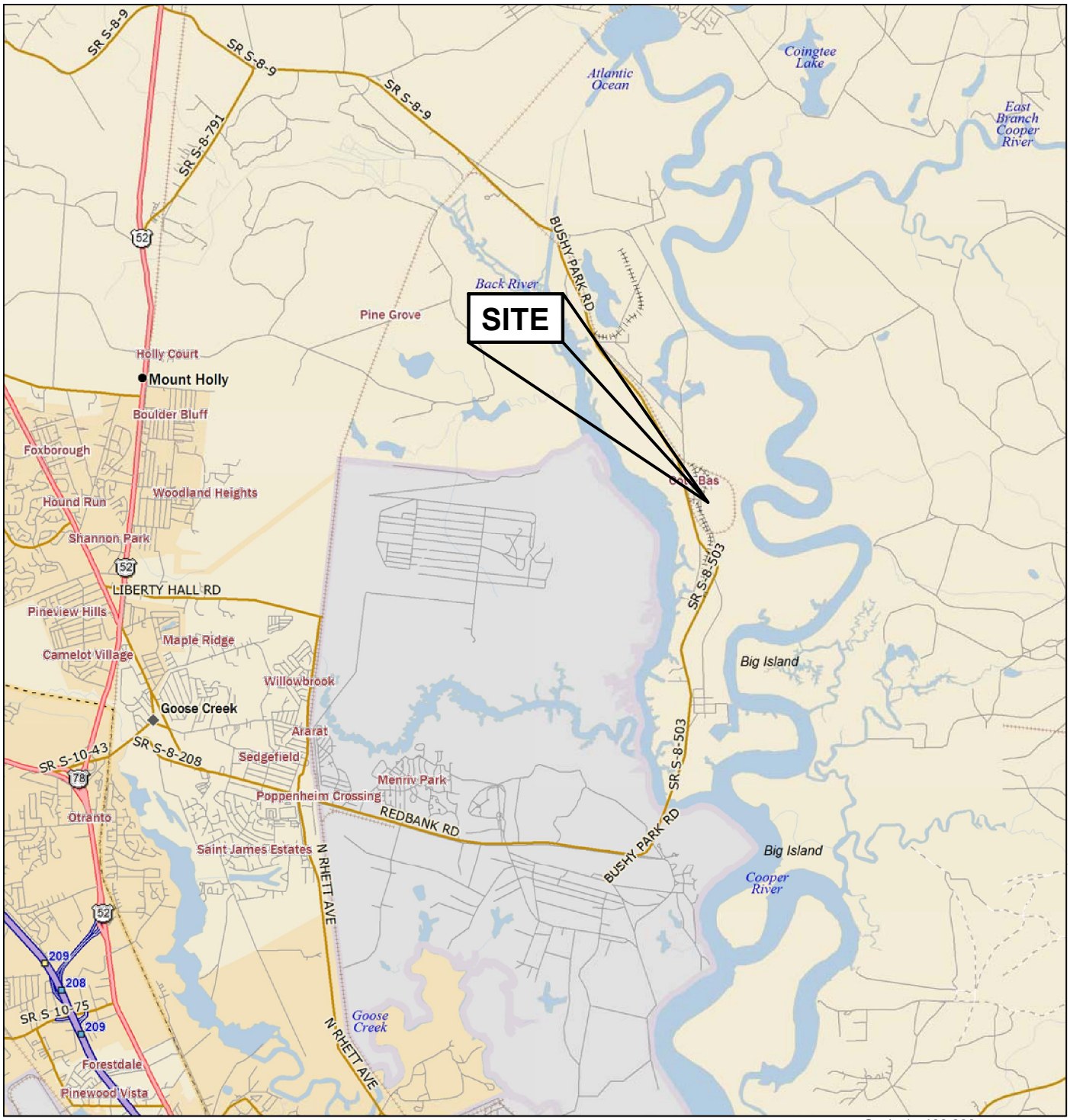
There are no known man-made surface or subsurface features such as mine tunnels (either abandoned or active), quarry pits, etc. located in or below the areas of the existing Williams Station CCR ponds subject of this study which would result in unstable conditions.

Attachment 1

Figure 1 – Site Location Map

Figure 2 – Test Sounding Location Plan

Cone Penetrometer Test Sounding Logs CPT-1 and CPT-2



TN
MN (7.8°W)

Scale 1 : 100,000
1" = 1.58 mi
Data Zoom 11-0

F&ME
CONSULTANTS
GEOTECHNICAL – ENVIRONMENTAL – MATERIALS
COLUMBIA, SOUTH CAROLINA

REV.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1			

TOPO._____ DATE _____
DWG. CTC DATE 8/15/2017 GROUP____ – _____
R/W _____ DATE _____

SCE&G WILLIAMS STATION
GOOSE CREEK, SC

SITE LOCATION MAP

F&ME JOB NO. G5739

SCALE = As Noted

FIGURE 1

Test No.	Test Type	Northing	Easting	Latitude	Longitude	Elevation (FT-MSL)
CPT-1	CPT	434257.486	2328124.608	33.022194	-79.9293730	12.3
CPT-2	CPT	434244.642	2328536.877	33.022146	-79.9280284	12.8

F&ME
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GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

REV.	BY	DATE	DESCRIPTION OF REVISION
4			
3			
2			
1	AMA	8/25	UPDATED COORDINATES

TOPO._____ DATE _____
DWG. CTC DATE 8/15/2017 GROUP___ – _____
R/W _____ DATE _____

SCE&G WILLIAMS STATION
GOOSE CREEK, SC

ELECTRO-PIEZOCONE SOUNDING LOCATION PLAN

F&ME PROJECT NO. G5739.00

SCALE = NTS | FIGURE 2

F&ME CONSULTANTS

Williams Station
Goose Creek, South Carolina
Project Number :G5739

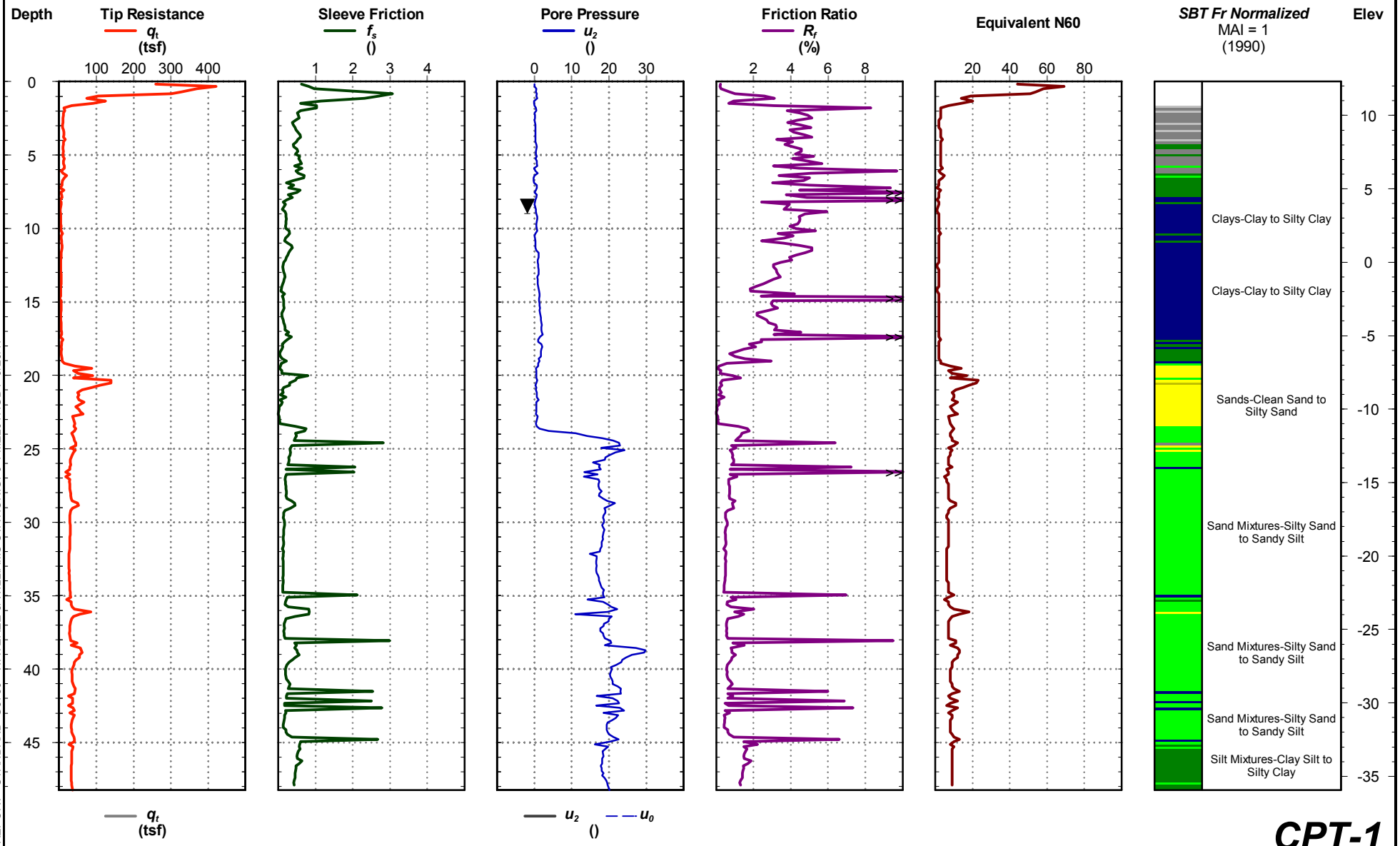
Cone Penetration Test

CPT-1

Date: Aug. 23, 2017
Estimated Water Depth: 9 ft
Rig/Operator: C. Piercy

Latitude: 33.0221935
Longitude: -79.9293730
Elevation: 12.3 MSL

Total Depth: 48.2
Termination Criteria: Maximum Reaction Force
Cone Size:



CPT REPORT - STANDARD G5739 - WATEREE & WILLIAMS STATION.GPJ FME2017.GDT 9/20/17

CPT-1

Electronic File Name: G5739 Williams Station CPT-1.cpt

F&ME CONSULTANTS

Williams Station
Goose Creek, South Carolina
Project Number :G5739

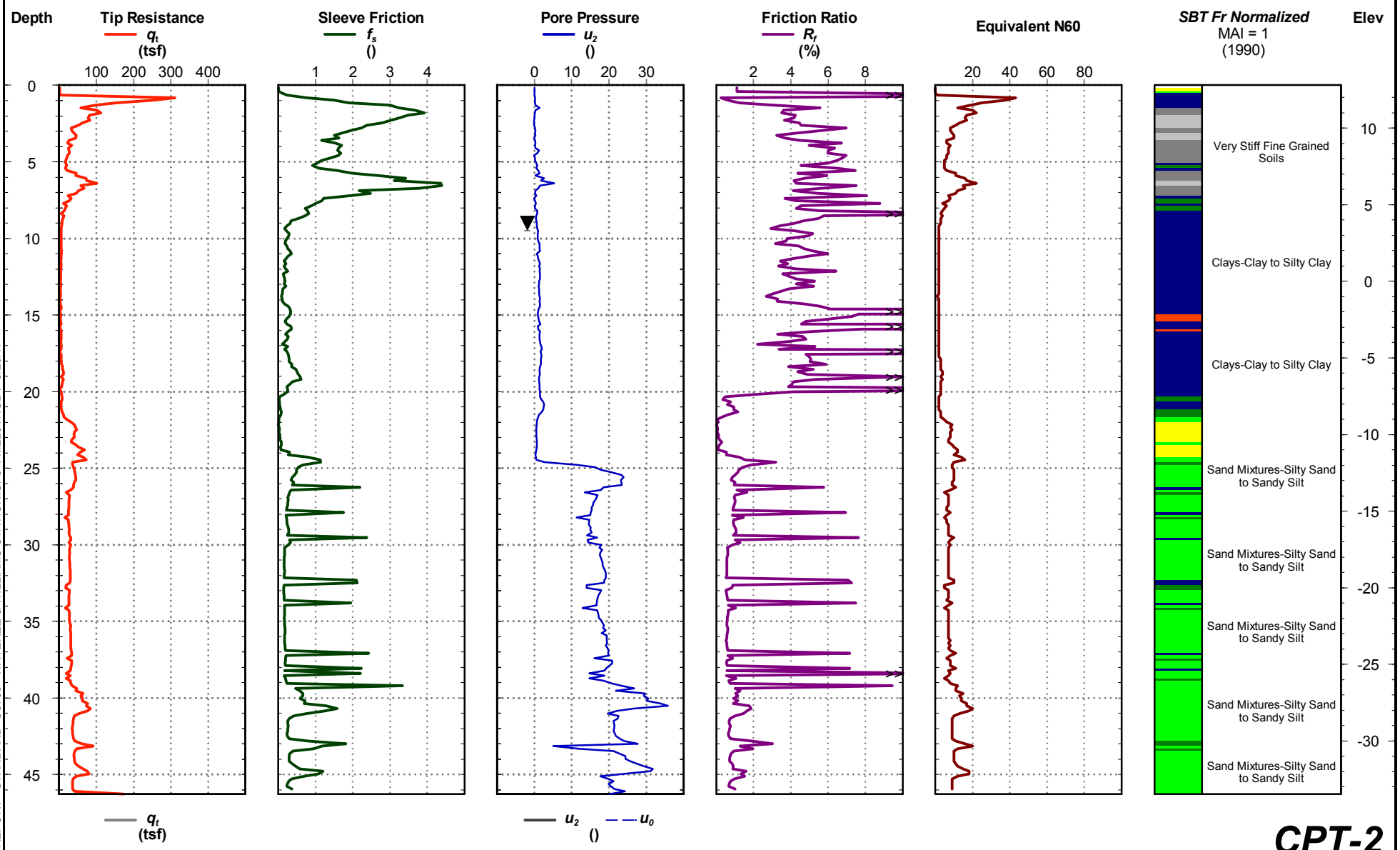
Cone Penetration Test

CPT-2

Date: Aug. 23, 2017
Estimated Water Depth: 9.5 ft
Rig/Operator: C. Piercy

Latitude: 33.0221464
Longitude: -79.9280284
Elevation: 12.8 MSL

Total Depth: 46.3
Termination Criteria: Maximum Reaction Force
Cone Size:

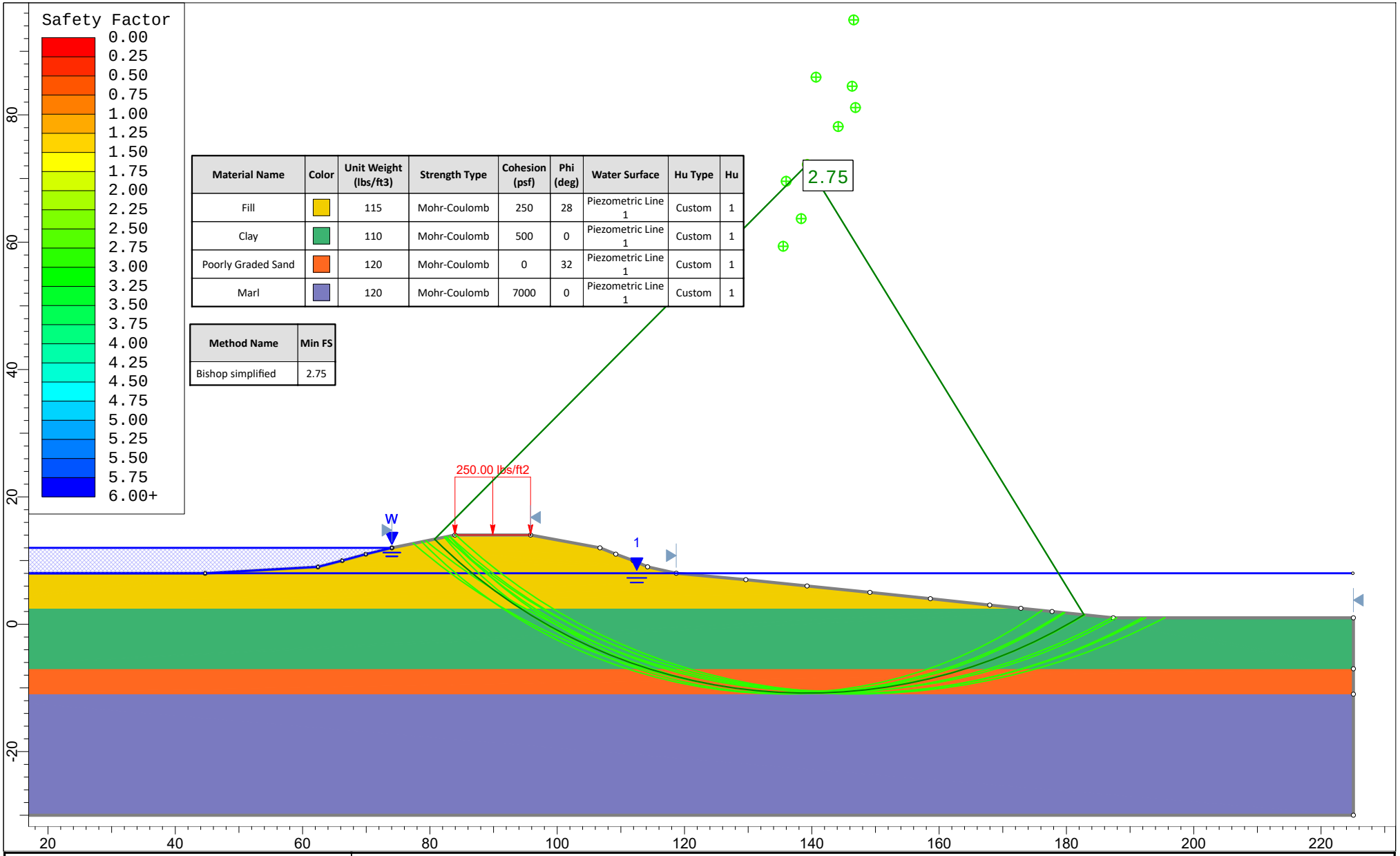


CPT-2

Electronic File Name: G5739 Williams Station CPT-2.cpt

Attachment 2

SLIDE Output Sheets



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	2.75

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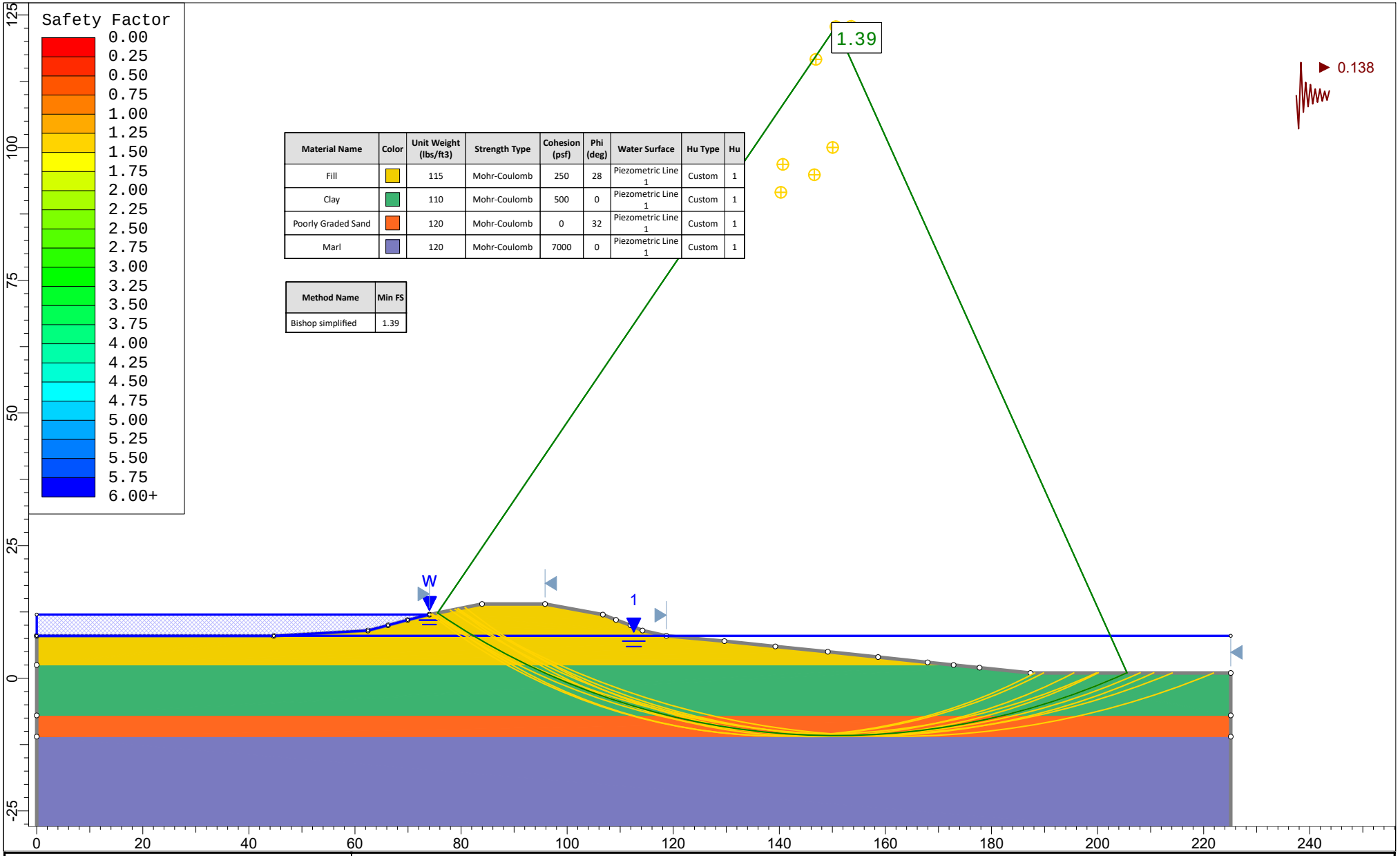
SLIDEINTERPRET 7.026

Project	Williams Station - Forebay #1 Ash Pond C		
Analysis Description	Static Loading		
Drawn By	WAP	*Scale* 1:250	*Company* F&ME
Date	9/20/2017	*File Name*	CPT-1 Static Loading.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	1.39

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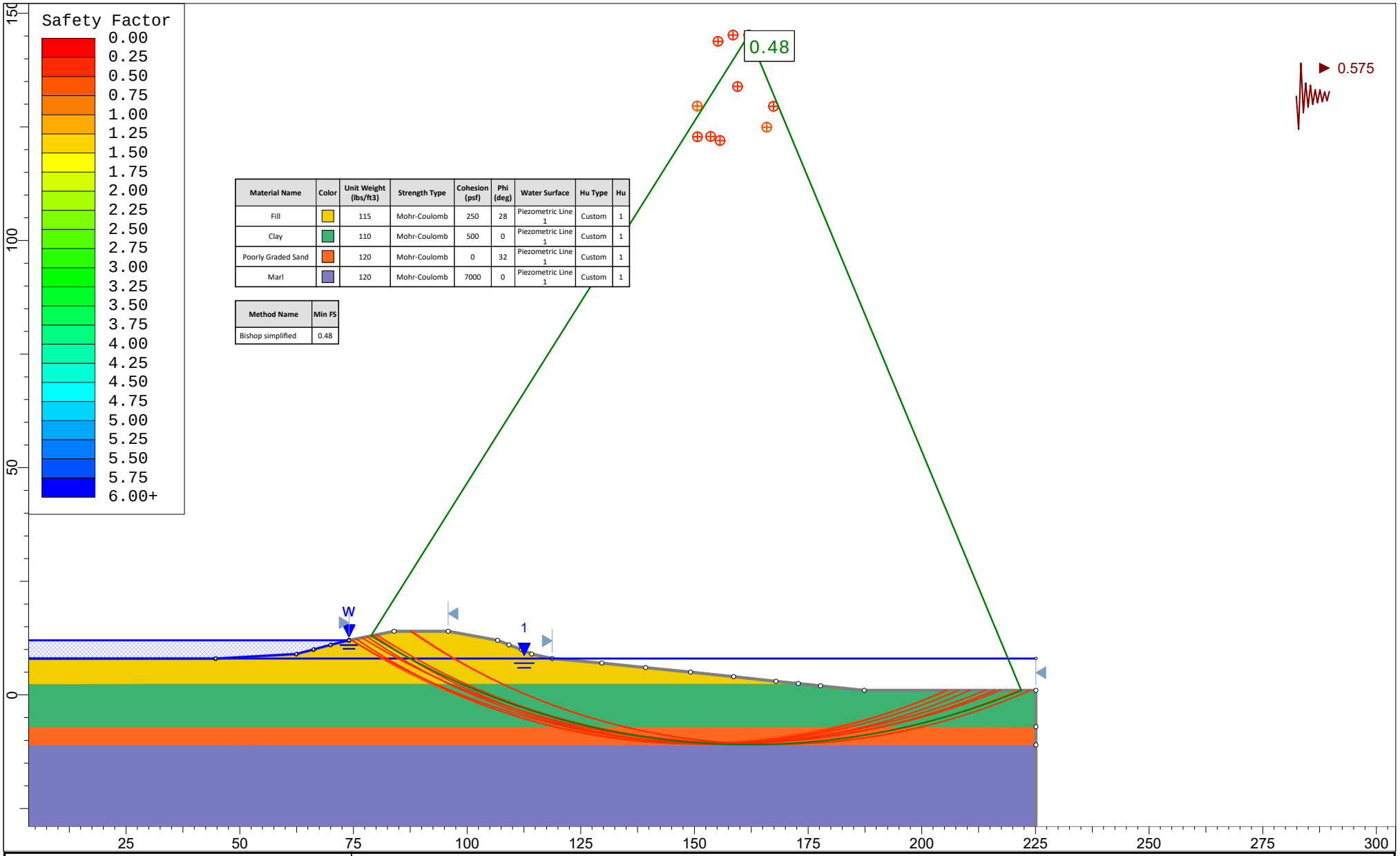
SLIDEINTERPRET 7.026

Project	Williams Station - Forebay #1 Ash Pond C		
Analysis Description	Seismic Loading PGA-0.276 (SCDHEC Method)		
Drawn By	WAP	*Scale* 1:300	*Company* F&ME
Date	9/20/2017	*File Name*	CPT-1 Seismic Loading.slim

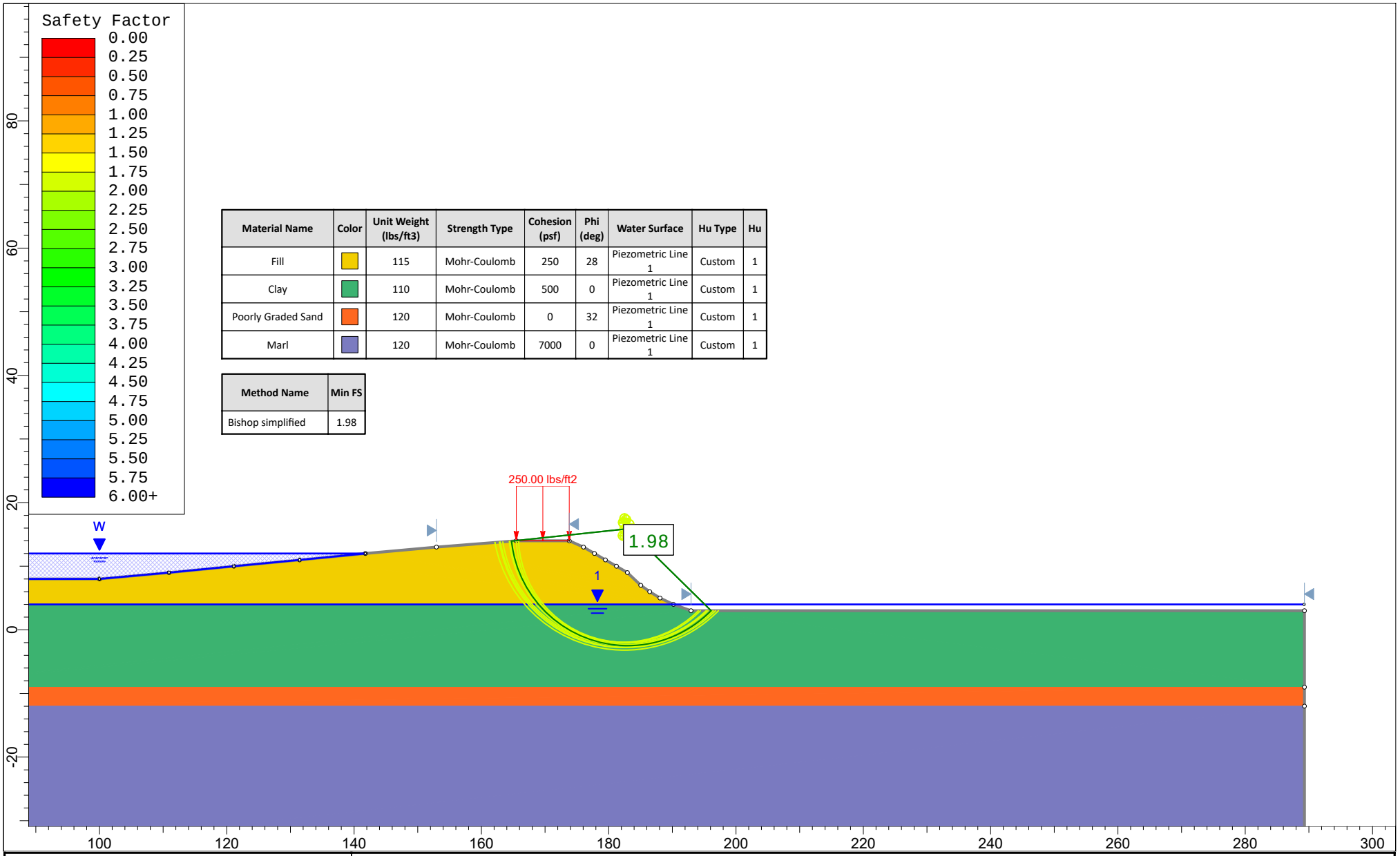


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	0.48

Project	Williams Station - Forebay #1 Ash Pond C		
Analysis Description	Seismic Loading PGA-1.149 (USGS Method)		
Drawn By	WAP	*Scale* 1:350	*Company* F&ME
Date	9/20/2017		*File Name* CPT-1 Seismic Loading.slim

SLIDEINTERPRET 7.026

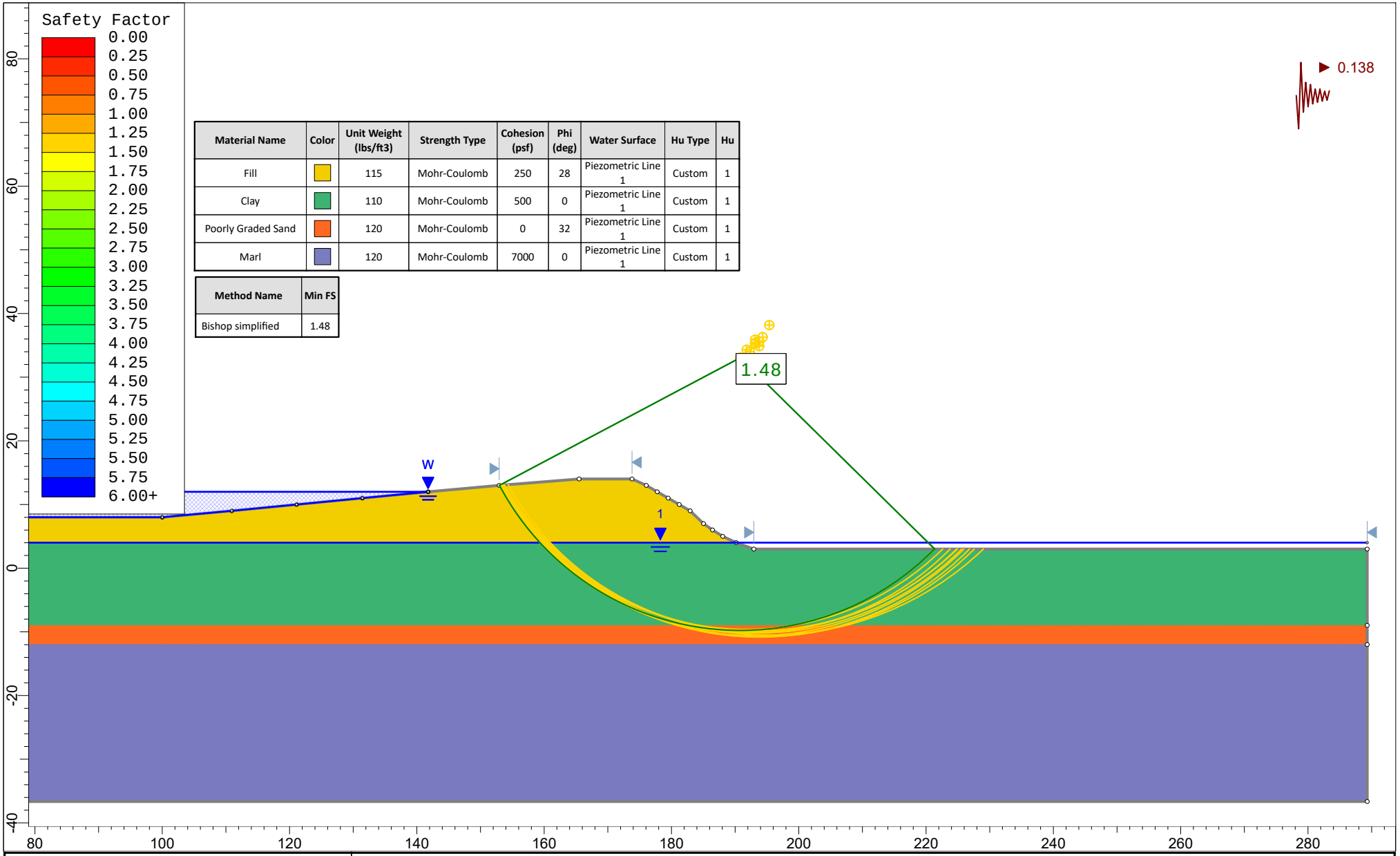


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	1.98

SLIDEINTERPRET 7.026

Project	Williams Station - Forebay #2 Ash Pond C		
Analysis Description	Static Loading		
Drawn By	WAP	*Scale* 1:250	*Company* F&ME
Date	9/20/2017	*File Name*	CPT-2 Static Loading.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	1.48

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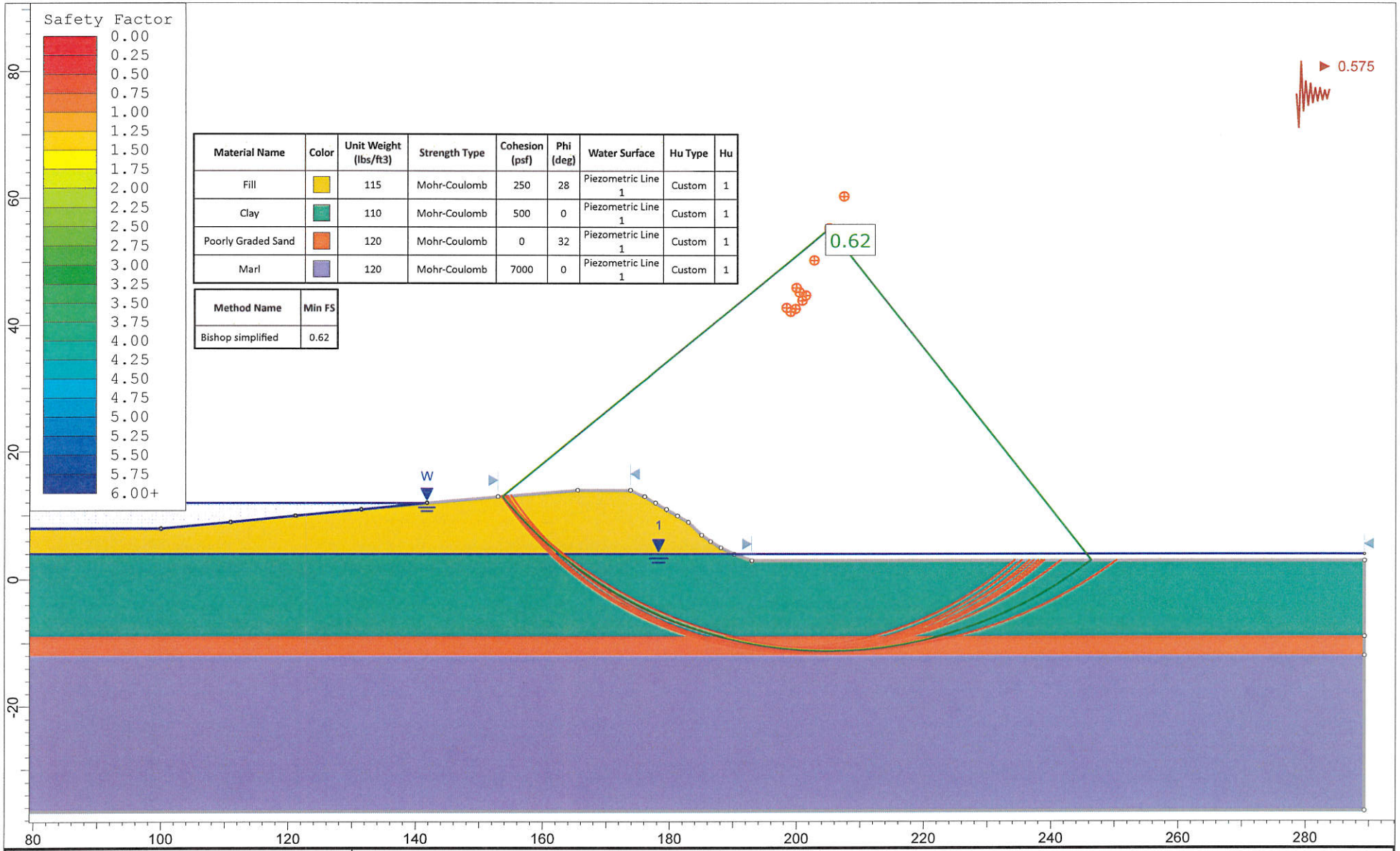
SLIDEINTERPRET 7.026

Project	Williams Station - Forebay #2 Ash Pond C		
Analysis Description	Seismic Loading PGA-0.276 (SCDHEC Method)		
Drawn By	WAP	*Scale* 1:250	*Company* F&ME
Date	9/20/2017	*File Name*	CPT-2 Seismic Loading.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120	Mohr-Coulomb	7000	0	Piezometric Line 1	Custom	1

Method Name	Min FS
Bishop simplified	0.62

rocscience

SLIDEINTERPRET 7.026

Project	Williams Station - Forebay #2 Ash Pond C		
Analysis Description	Seismic Loading PGA-1.149 (USGS Method)		
Drawn By	WAP	*Scale* 1:250	*Company* F&ME
Date	9/20/2017	*File Name*	CPT-2 Seismic Loading.slim