LOCATION RESTRICTIONS DEMONSTRATION

NEW FGD POND
WILLIAMS STATION
GOOSE CREEK, SOUTH CAROLINA

Prepared For:

DOMINION ENERGY SOUTH CAROLINA, INC.
COLUMBIA, SOUTH CAROLINA

Prepared By:
CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
PITTSBURGH, PENNSYLVANIA

CEC Project 306-309

MAY 2021

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1.0 OBJECTIVE

This report has been prepared for South Carolina Generating Company (SCGENCO) and Dominion Energy South Carolina, Inc. (DESC) to demonstrate that the A.M. Williams Station (Williams Station) Coal Combustion Residuals (CCR) Unit described as the New FGD Pond meets the requirements of the United States Environmental Protection Agency (USEPA) CCR Rule which was published in the Federal Register (FR) on April 17, 2015 as part of the Code of Federal Rules (CFR) Title 40, Part 257 (§257). Specifically, this report demonstrates the requirements for Location Restrictions (LR) as defined in §257.60 through §257.64 are met by the New FGD Pond. The New FGD Pond is classified as a new CCR Surface Impoundment by definition in §257.53 and is required to meet the LR for Placement Above Uppermost Aquifer (§257.60), Wetlands (§257.61), Fault Areas (§257.62), Seismic Impact Zones (§257.63), and Unstable Areas (§257.64). Each LR is addressed in this report.

2.0 BACKGROUND INFORMATION

2.1 INTRODUCTION

The Williams Station is a coal-fired power generation station located at 2242 Bushy Park Road in Goose Creek, South Carolina (refer to Figure 1) that is owned by SCGENCO and operated by DESC. The 650 MW coal-fired electric generating station is generally positioned within a small strip of lowlands between meanders of the Back River (west) and the Cooper River (east) as depicted on Figure 2. The station property is bound by Bushy Park Road to the west and tidal wetlands and/or lowlands border the remainder of the property. The Williams Station wastewater management impoundment complex, comprised of six interconnected separate ponds labeled Ponds A through E and the Coal Pile Runoff Pond, is located north of main station structures (refer to Figures 3 and 4).

Williams Station infrastructure includes a flue gas desulfurization (FGD) air quality control system that produces an FGD wastewater blowdown waste stream that is managed in an on-site FGD Pond originally constructed in 2009 in accordance with applicable South Carolina Department of Health and Environmental Control (SCDHEC) regulations and permits. This CCR Unit is also regulated as a CCR Surface Impoundment per Title 40 CFR, Part 257, Subpart D published in April 2015 (CCR Rule) by the USEPA and subsequent revisions. The CCR Rule LR compliance demonstration for the original FGD Pond dated October 2018 reported that the Williams Station FGD Pond did not satisfy the requirements of §257.63(a) – Seismic Impact Zones. As the FGD Pond is a critical operational component to Williams Station's ability to produce electricity and there were no other technically feasible on-site or off-site options to manage the FGD blowdown wastewater, DESC elected to continue operation of the FGD Pond in accordance with the alternative closure requirements identified in §257.103. Subsequently, DESC determined that the fastest technically feasible pathway to compliance was to open a new CCR impoundment within the footprint of the originally constructed FGD Pond that meets the CCR Rule's seismic impact zone location and liner design criteria. This action required a structural improvement to the FGD Pond perimeter dikes, closure of the currently operating FGD Pond in accordance with §257.102 and §257.103 for existing CCR surface impoundments, and then opening a new pond (identified

as the New FGD Pond) within the original pond footprint in accordance with the CCR Rule. This LR Demonstration provides documentation and certification that the New FGD Pond, located in the footprint of the previously closed FGD Pond, is compliant with the LR defined in §257.60 through §257.64 of the CCR Rule.

2.2 DESCRIPTION OF THE CCR UNIT

The FGD Pond is located within the boundaries of the wastewater management impoundment complex at the Williams Station facility and was originally constructed within the footprint of former Pond C in 2009. Figures 2 and 3 depict the location of the New FGD Pond in relation to Williams Station and the wastewater management impoundment complex, respectively. The New FGD Pond occupies essentially the same footprint as the former FGD Pond and is comprised of two approximate 700,000 gallon forebays (identified as Forebay 1 and Forebay 2) and approximately two acres in total. Each forebay was constructed with a composite liner system comprised of the following, from bottom to top:

- 18-inch thick compacted clay soil liner (CCL);
- 60-mil textured HDPE geomembrane liner;
- 28-ounce per square yard geotextile cushion; and,
- 6-inch thick fabric formed concrete protection layer.

The only waste stream to be placed in the New FGD Pond is wet FGD blowdown from the FGD system. The FGD blowdown contains residual gypsum solids that are discharged from the secondary hydrocyclone overflows and pumped to the operating forebay of the New FGD Pond. Each FGD forebay allows the gypsum solids to settle and provide temporary storage until removed, dewatered, and disposed in the Williams Station Highway 52 Landfill. A solids removal treatment system (i.e., Lamella clarifier with one filter press) is used to remove solids prior to discharge to the New FGD. The New FGD Pond is permitted to receive approximately 0.319 million gallons a day (MGD) of wastewater which is the same as the original FGD Pond. There will be no non-CCR waste streams discharged to or placed in the New FGD Pond. The New FGD Pond discharges to Pond D which flows into Pond E and then to the National Pollutant Discharge Elimination System

(NPDES) permitted outfall in accordance with SCDHEC NPDES Permit SC0003883 (effective January 1, 2017).

3.0 COMPLIANCE DEMONSTRATIONS

3.1 §257.60 PLACEMENT ABOVE THE UPPERMOST AQUIFER

3.1.1 §257.60 Rule Description

40 CFR 257.60(a) states:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority 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).

3.1.2 Compliance With 40 CFR §257.60 Requirements

The enclosed report within Appendix A entitled "Placement Above The Uppermost Aquifer Certification for the Williams Station FGD Pond", prepared by Garrett & Moore, dated October 18, 2018 was prepared to confirm that the separation between the originally constructed FGD Pond base liner and the uppermost aquifer meets the requirement in 40 CFR 257.60. Specifically, the referenced report (Refer to Section 6 Conclusions) stated "the normal fluctuation in groundwater elevations including seasonal high water tables do not result in an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer, and therefore, CCR Rule §257.60 is satisfied." Because the New FGD Pond is located within the footprint of the original FGD Pond without modification to the pond configuration or base liner grades, the previously demonstrated compliance with the requirements in 40 CFR 257.60 remains applicable. CEC has reviewed the groundwater elevations utilized for the Certification prepared by Garrett & Moore and compared them to the current groundwater elevations collected since the original certification was completed. The recent groundwater elevations fall within the range of elevations reviewed for the original certification. In addition, measurements taken before and after installation of the DSM indicate the embankment stabilization project did not have an effect on groundwater levels. Therefore the conclusions stated in the original certification remain valid and the New FGD Pond still complies with CCR Rule §257.60.

This demonstration will be placed in the Operating Record and the CCR Unit website, as well as a notification to SCDHEC, to meet the record keeping [§257.105(e)], notification [§257.106(e)], and the internet posting [§257.107(e)] requirements.

3.2 §257.61 WETLANDS

3.2.1 §257.61 Rule Description

40 CFR 257.61 states:

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (a)(5) of this section.

(a)(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.

(a)(2) The construction and operation of the CCR unit will not cause or contribute to any of the following:

> ***(a)(2)(i) A violation of any applicable state or federal water quality standard;***
> ***(a)(2)(ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act;***
>
> ***(a)(2)(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and,***
>
> ***(a)(2)(iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.***

(a)(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors:

> ***(a)(3)(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit;***
>
> ***(a)(3)(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;***
>
> ***(a)(3)(iii) The volume and chemical nature of the CCR;***
>
> ***(a)(3)(iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR;***

(a)(3)(v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and,

(a)(3)(vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(a)(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and,

(a)(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority 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 demonstrations 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 demonstrations 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 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).

3.2.2 Compliance With 40 CFR §257.61 Requirements

The enclosed report within Appendix B entitled "Wetlands Certification for the Williams Station FGD Pond", prepared by Garrett & Moore, dated October 18, 2018 was prepared to confirm that the FGD Pond was not located in wetlands. Because the New FGD Pond is located within the footprint of the original FGD Pond without modification to the pond location and configuration, the previously demonstrated compliance with the requirements in 40 CFR 257.61 Wetland Impacts remains applicable. CEC has reviewed the Certification prepared by Garrett & Moore and the current site information and has determined that the New FGD Pond complies with CCR Rule §257.61.

This demonstration will be placed in the Operating Record and the CCR Unit website, as well as a notification to SCDHEC, to meet the record keeping [§257.105(e)], notification [§257.106(e)], and the internet posting [§257.107(e)] requirements.

3.3 §257.62 FAULT AREAS

3.3.1 §257.62 Rule Description

40 CFR 257.62 states:

(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 or approval from the Participating State Director or approval from EPA

where EPA is the permitting authority 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).

3.3.2 Compliance With 40 CFR §257.62 Requirements

The enclosed report within Appendix C entitled "Location Restrictions: Fault Areas & Unstable Areas for the Williams Station FGD Pond", dated October 2018, and including the "Location Restrictions for CCR Ponds" by F&ME Consultants, dated October 13, 2017, was prepared to confirm that the originally constructed FGD Pond was not located within 60 meters (200 feet) of a fault that has displaced within Holocene time. Because the New FGD Pond is located within the footprint of the original FGD Pond without modification to the pond location or configuration, the previously demonstrated compliance with the requirement in 40 CFR 257.62 Fault Areas remains

applicable. CEC has reviewed the Certification prepared by F&ME and the current site information and has determined that the New FGD Pond complies with CCR Rule §257.62.

This demonstration will be placed in the Operating Record and the CCR Unit website, as well as a notification to SCDHEC, to meet the record keeping [§257.105(e)], notification [§257.106(e)], and the internet posting [§257.107(e)] requirements.

3.4 §257.63 SEISMIC IMPACT ZONES

3.4.1 §257.63 Rule Description

40 CFR 257.63 states:

(a) New CCR landfills, 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 by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority 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).

3.4.2 Information Supporting Rule Compliance

The enclosed report within Appendix D entitled "Location Restrictions: Seismic Impact Zones for the Williams Station FGD Pond", dated October 2018 identified that the originally constructed FGD Pond was located in a seismic impact zone. Further studies performed by Terracon, as reported in the Geotechnical Engineering Report, Williams Station FGD Ponds (dated January 17, 2020), identified that the seismic stability of the original FGD Pond perimeter dikes did not meet the minimum seismic stability safety factor and that foundation soil stabilization beneath the dikes was necessary to protect the pond structural components including liner system and surface water control systems. DESC selected DSM columns to improve the structural integrity of the perimeter dikes for the purpose of resisting the maximum horizontal acceleration in lithified earth material to meet the seismic stability safety factor requirements of §257.63. The design and construction of the DSM columns was reviewed and certified by Terracon as presented in "Report of Ground Improvement Installation to Satisfy CCR Rule 257.63", dated April 26, 2021 and enclosed in Appendix E.

3.4.3 Compliance With 40 CFR §257.63 Requirements

The engineering study and certification report prepared by Terracon and referenced in Section 3.4.2 confirm that the New FGD Pond is located within a seismic impact zone and demonstrate that foundation soil stabilization has been sufficiently completed to improve the structural integrity and seismic stability of the New FGD Pond perimeter dikes such that all structural components including the liner system and surface water control systems are designed

and constructed to resist the maximum horizontal acceleration in lithified earth material. Therefore, the New FGD Pond satisfies the requirements of 40 CFR 257.63 Seismic Impact Zones.

This demonstration will be placed in the Operating Record and the CCR Unit website, as well as a notification to SCDHEC, to meet the record keeping [§257.105(e)], notification [§257.106(e)], and the internet posting [§257.107(e)] requirements.

3.5 §257.64 UNSTABLE AREAS

3.5.1 §257.64 Rule Description

40 CFR 257.64 states:

(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 specified in §257.107(e).

3.5.2 Compliance With 40 CFR §257.64 Requirements

The enclosed report within Appendix C entitled "Location Restrictions: Fault Areas & Unstable Areas for the Williams Station FGD Pond", dated October 2018 and including the "Location Restrictions for CCR Ponds" by F&ME Consultants, dated October 13, 2017, was prepared to confirm that the originally constructed FGD Pond was not located in an unstable area. Because the New FGD Pond is located within the footprint of the original FGD Pond without modification to the pond location or configuration, the previously demonstrated compliance with the requirement in 40 CFR 257.64 Unstable Areas remains applicable. CEC has reviewed the Certification prepared by F&ME Consultants and the current site information and has determined that the New FGD Pond complies with CCR Rule §257.64.

This demonstration will be placed in the Operating Record and the CCR Unit website, as well as a notification to SCDHEC, to meet the record keeping [§257.105(e)], notification [§257.106(e)], and the internet posting [§257.107(e)] requirements.

4.0 CERTIFICATION

This CCR Location Restriction Demonstration confirms that the New FGD Pond complies with the LR requirements of the CCR Rule. In summary, Williams Station New FGD Pond has been designed and constructed to meet the CCR Rule LR requirements including: Placement Above Uppermost Aquifer (§257.60); Wetlands (§257.61); Fault Areas (§257.62); Seismic Impact Zones (§257.63); and, Unstable Areas (§257.64). Section 3.0 of this report provides supporting information and conclusions demonstrating that each of the LR has been met.

The following certification statement provides confirmation that this report was prepared by a qualified professional engineer and that there is sufficient information to demonstrate that the New FGD Pond meets the LR requirements stated in 40 CFR 257.60 through 257.64.

Professional Engineer's Certification

By means of this certification, I certify that I have reviewed this CCR Location Restrictions Demonstration, New FGD Pond, Williams Station, and the design and construction of New FGD Pond meets the requirements of Section 40 CFR 257.60 through 257.64.

SOUTH CAROLINA CIVIL & ENVIRONMENTAL CONSULTANTS, INC. No. 4888 CERTIFICATE OF AUTHORIZATION

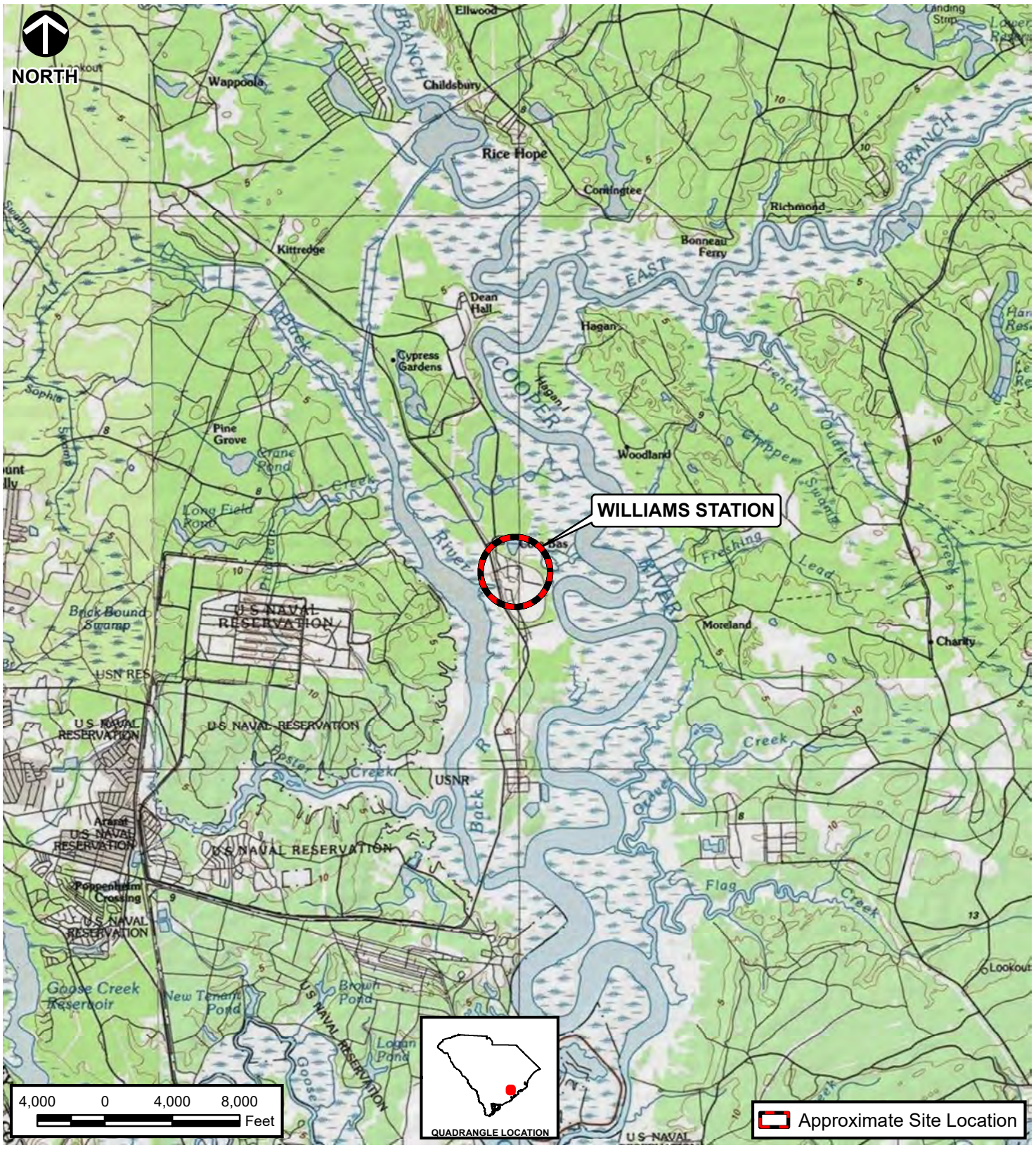
Scott L. Brown, P.E.
Printed Name of Professional Engineer

Signature

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 25687 SCOTT L. BROWN

25687	South Carolina	5-7-21
Registration No.	Registration State	Date

FIGURES



SOURCE: PORTION OF THE USGS 7.5-MINUTE SERIES TOPOGRAPHIC QUADRANGLE MAP(S): KITTREDGE, SOUTH CAROLINA, 1979.

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WILLIAMS POWER STATION
GOOSE CREEK, SOUTH CAROLINA

SITE LOCATION MAP

DRAWN BY:	CEJ	CHECKED BY:	APA	APPROVED BY:	APA*	FIGURE NO:
DATE:	APRIL 27, 2021	DWG SCALE:	1 " = 8,000 '	PROJECT NO:	306-309-AW01	1

Signature on File *

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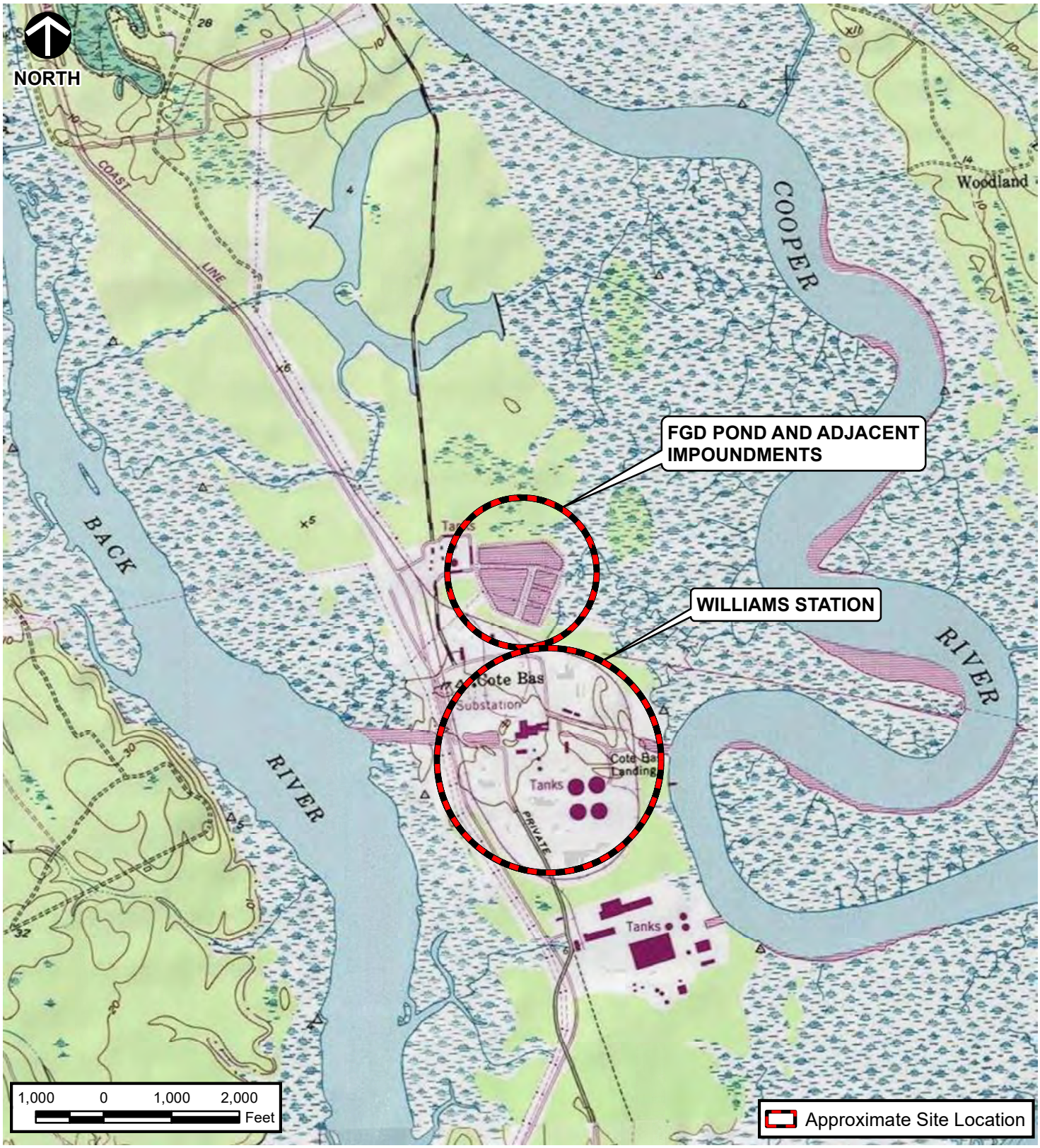

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GOOSE CREEK, SOUTH CAROLINA

SITE AND VICINITY AERIAL MAP

DRAWN BY:	CEJ	CHECKED BY:	APA	APPROVED BY:	APA*	FIGURE NO:	2
DATE:	APRIL 27, 2021	DWG SCALE:	1 " = 2,000 '	PROJECT NO:	306-309-AW01		

Signature on File *

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NEW FGD POND
WILLIAMS POWER STATION
GOOSE CREEK, SOUTH CAROLINA

WILLIAMS STATION OVERVIEW MAP

DRAWN BY:	CEJ	CHECKED BY:	APA	APPROVED BY:	APA*	FIGURE NO:	3
DATE:	APRIL 27, 2021	DWG SCALE:	1 " = 600 '	PROJECT NO:	306-309-AW01		

Signature on File *

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www.cecinc.com

DOMINION ENERGY SOUTH CAROLINA, INC.
NEW FGD POND
WILLIAMS POWER STATION
GOOSE CREEK, SOUTH CAROLINA

WILLIAMS STATION FGD POND &
ADJACENT IMPOUNDMENTS MAP

DRAWN BY:	CEJ	CHECKED BY:	APA	APPROVED BY:	APA*	FIGURE NO:	4
DATE:	APRIL 27, 2021	DWG SCALE:	1 " = 250 '	PROJECT NO:	306-309-AW01		

Signature on File *

APPENDIX A

PLACEMENT ABOVE UPPERMOST AQUIFER CERTIFICATION

SOUTH CAROLINA ELECTRIC & GAS

SCANA®
POWER FOR LIVING

PLACEMENT ABOVE THE UPPERMOST AQUIFER CERTIFICATION

FOR THE

WILLIAMS STATION FGD POND

BERKELEY COUNTY, SOUTH CAROLINA

OCTOBER 2018

SOUTH CAROLINA
GARRETT AND MOORE, INC.
No. C3371
CERTIFICATE OF AUTHORIZATION

GARRETT & MOORE
Engineering for the Power and Waste Industries

SOUTH CAROLINA
REGISTERED PROFESSIONAL ENGINEER
22411
10/12/18
STEFAN BRAY

1 OVERVIEW

The EPA Administrator, Gina McCarthy, signed the Disposal of Coal Combustion Residuals from Electric Utilities final rule on December 19, 2014, and it was published in the Federal Register (FR) on April 17, 2015. The regulations provide a comprehensive set of requirements for the safe disposal of coal combustion residuals (CCRs), commonly known as coal ash, from coal-fired power plants. The rule is administered as part of the Resource Conservation and Recovery Act [RCRA, 42 United States Code (U.S.C.) §6901 et seq.], using the Subtitle D approach.

South Carolina Electric & Gas (SCE&G) is subject to the CCR Rule. Based on SCE&G's review of the rule, the **FGD Pond** at **SCE&G Williams Station** have been determined to be existing CCR surface impoundment subject to the CCR rule requirements.

2 PURPOSE

The purpose of this report is to document that the Williams Station FGD Pond meets the requirements of CCR rule §257.60 – *Placement Above the Uppermost Aquifer.*

3 APPLICABLE REGULATIONS

CCR rule §257.60 – *Placement Above the Uppermost Aquifer* states the following:

> (a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section.

4 CCR UNIT 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 DHEC on March 9, 2009, and placed into operation in accordance with an operation approval issued by DHEC on October 6, 2009.

5 DISCUSSION OF THE POND AND THE UPPERMOST AQUIFER

Extensive work has been completed in association with hydrogeology and uppermost aquifer levels at the CCR unit including work associated with the following:

- *Groundwater Monitoring Well Installation Report, EPA CCR Rule Compliance Monitoring Wells, South Carolina Electric & Gas*, July 2016, revised January 2017, revised February 2018, for CCR facilities at Cope Station, Wateree Station and Williams Station

- *Analysis of Groundwater Flow Rate and Direction, March 2018 Monitoring Data, EPA CCR Rule Compliance Monitoring Wells, South Carolina Electric & Gas,* July 2018, for CCR facilities at Cope Station, Wateree Station and Williams Station
- *NPDES Groundwater Monitoring Data - 2005 to present*

To evaluate the separation between the base of the pond and the uppermost aquifer, the above reports and data were reviewed as well as the as-built record surveys for the pond construction. Figure 1 presents a plan view of the FGD Pond to include groundwater monitoring wells in the vicinity of the pond. Figure 2 presents a cross-section view of the FGD Pond showing existing conditions, the base of the pond liner system, and groundwater elevation levels for the uppermost aquifer for groundwater monitoring events during the period 2005 to present. The cross-section profile alignment was selected based on the general groundwater flow direction per the above reports, with the alignment consistent with the general west to east flow of groundwater under the FGD Pond. Table 1 provides a summary of the groundwater elevations data.

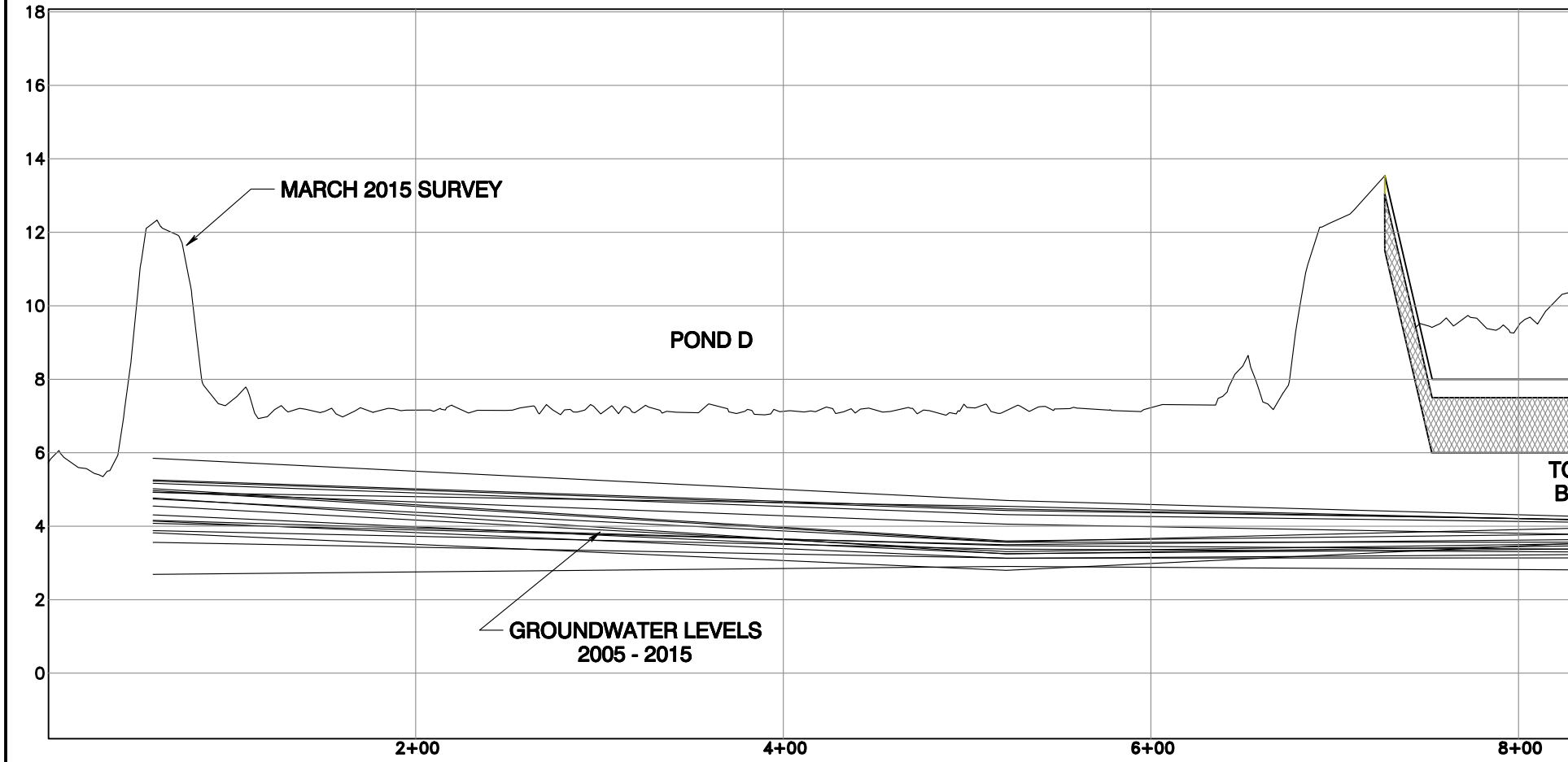
As demonstrated in Figure 2, the separation between the base of the pond and the uppermost aquifer is less than the required 1.52 meters (five feet).

The FGD Pond is located on an upland area. Based on the groundwater levels and flow direction documented in the above discussed reports and data and as shown in Figure 2, groundwater generally flows from west to east and toward the lowland Cooper River tributary area located immediately to the general east of the facility, with the topographic relief observed east of the facility serving to transition the groundwater to the nearby lower surface water elevation.

The quantity of groundwater elevation data is significant (14 years of monitoring data including summer and winter monitoring for 12 years and quarterly monitoring for 2 years) and is therefore considered representative of normal groundwater conditions and fluctuations including seasonal highs. Based on the 14 years of groundwater elevation data as shown on Figure 2, the observed normal fluctuation in groundwater elevations generally remains several feet beneath the bottom of the pond liner system, with no connection to the base of the pond.

6 CONCLUSION

Given the hydrogeologic site conditions and significant existing groundwater elevation data, the normal fluctuations in groundwater elevations including seasonal high water tables do not result in an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer, and therefore CCR rule §257.60 is satisfied.



VERTICAL EXAGGERATION
20 VERT: 1 HORIZ

Table 1
NPDES & EPA CCR Rule Compliance Monitoring Wells
Historical Groundwater Elevations
South Carolina Electric & Gas
Williams Station FGD Pond

	Northing	Easting	6/20/2005	12/13/2005	6/5/2006	11/29/2006	6/5/2007	12/11/2007	6/19/2008	12/10/2008	6/10/2009	9/24/2009	1/13/2010
			Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.
GW-01	434595.66	2328648.25	4.49	4.59	3.86	4.30	3.72	3.51	3.51	4.05	3.35	4.12	4.14
GW-02	434331.22	2328586.25	nm	4.37	3.76	3.98	3.52	4.37	3.35	3.57	2.95	3.67	3.74
GW-04	433723.22	2327914.00	3.74	3.56	3.28	3.62	3.28	2.67	2.97	3.43	nm	nm	4.94
GW-06	434132.00	2327476.50	5.27	4.97	4.55	5.02	4.31	3.82	4.14	4.74	3.92	4.88	4.92
GW-07	434789.66	2327355.50	2.78	3.32	1.82	3.16	1.22	0.62	1.41	3.61	4.41	2.94	3.89
GW-08	434836.31	2327962.25	3.60	3.59	3.35	3.57	3.22	2.97	3.33	3.74	3.67	3.75	4.02
GW-09	433370.41	2328591.00	3.12	2.99	2.72	3.19	2.80	2.26	2.47	2.94	3.38	3.56	3.01
GW-12	432769.44	2328458.00	2.96	2.77	2.43	3.00	2.55	1.79	2.18	2.60	6.26	3.63	2.74
GW-13	432444.97	2328814.75	2.38	1.98	1.79	2.39	1.97	1.40	1.67	2.05	3.05	2.50	2.23
GW-15	432687.91	2327506.00	2.47	2.32	2.04	2.78	2.15	1.36	1.85	2.27	3.29	3.36	2.38

	Northing	Easting	9/28/2010	6/7/2011	8/8/2011	10/20/2011	5/30/2012	11/12/2012	4/23/2013	3/10/2014	8/5/2014	2/11/2015	8/5/2015
			Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.
GW-01	434595.66	2328648.25	4.04	2.97	3	3.06	3.56	3.18	4.01	3.88	3.56	3.95	2.66
GW-02	434331.22	2328586.25	3.77	3.14	3.21	3.26	3.67	3.78	3.9	3.83	3.45	3.86	2.72
GW-04	433723.22	2327914.00	5.01	3.17	3.42	3.68	4.2	3.7	4.75	4.83	4.5	4.67	2.59
GW-06	434132.00	2327476.50	5.85	3.56	3.88	4.16	4.77	4.08	5.23	5.26	4.93	5.17	2.69
GW-07	434789.66	2327355.50	3.12	0.52	1.02	1.27	1.18	0.39	4.32	4.3	3.12	4.53	2.17
GW-08	434836.31	2327962.25	4.3	3.08	3.32	3.2	2	3.23	4.01	4	3.48	3.85	3.32
GW-09	433370.41	2328591.00	3.41	2.37	2.56	2.8	2.93	2.81	3.42	3.58	3.39	3.43	2.86
GW-12	432769.44	2328458.00	3.62	1.8	2.19	2.15	3.1	2.37	3.31	3.34	2.94	3.23	2.64
GW-13	432444.97	2328814.75	3.07	1.29	1.65	1.9	1.98	2.05	2.82	2.62	2.44	3.17	2.81
GW-15	432687.91	2327506.00	3.91	1.58	2.05	2.71	2.42	2.1	3.42	3.67	3.23	3.18	2.68

	Northing	Easting	5/10/2016	7/11/2016	9/12/2016	11/28/2016	1/23/2017	3/21/2017	5/22/2017	7/24/2017	9/19/2017	3/13/2018
			Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.	Groundwater Elevation, ft.
MW-FGD-16	433589.64	2327433.60	2.59	2.58	2.82	2.37	3.71	2.2	2.79	4.2	4.34	3.49
MW-FGD-17	434414.50	2328304.82	3.31	3.55	3.34	3.35	3.72	2.99	3.64	4.35	4.38	4.15
MW-FGD-18	434361.01	2328461.38	3.14	2.62	1.79	2.92	2.43	2.58	2.3	2.95	3.06	3.03
MW-FGD-19	434248.36	2328548.02	-0.94	2.37	3.93	3.28	2.25	1.7	2.58	3.75	4.88	1.9
MW-FGD-19D	434254.04	2328550.03	2.95	2.8	2.58	3.28	2.9	2.35	2.75	3.54	4.15	3.33
MW-FGD-20	434137.83	2328480.26	-3.58	-2.26	NM	1.14	1.34	1.26	1.43	1.97	2.26	NM
MW-FGD-20D	434141.58	2328482.77	2.8	2.71	2.52	3.08	2.86	2.33	2.78	3.39	4.05	NM
MW-FGD-20A	434128.30	2328509.58	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.71
MW-FGD-21	433737.35	2326861.16	NM	NM	NM	2.5	4.46	2.48	2.95	4.63	4.69	3.64

APPENDIX B

WETLANDS CERTIFICATION

SOUTH CAROLINA ELECTRIC & GAS

SCANA®
POWER FOR LIVING

WETLANDS CERTIFICATION

FOR THE

WILLIAMS STATION
FGD POND

BERKELEY COUNTY, SOUTH CAROLINA

OCTOBER 2018

SOUTH CAROLINA
GARRETT AND MOORE, INC.
No. C3371
CERTIFICATE OF AUTHORIZATION

GARRETT & MOORE
Engineering for the Power and Waste Industries

SOUTH CAROLINA
REGISTERED PROFESSIONAL ENGINEER
22411
10/12/18
J. STEFAN BRAY

1 OVERVIEW

The EPA Administrator, Gina McCarthy, signed the Disposal of Coal Combustion Residuals from Electric Utilities final rule on December 19, 2014, and it was published in the Federal Register (FR) on April 17, 2015. The regulations provide a comprehensive set of requirements for the safe disposal of coal combustion residuals (CCRs), commonly known as coal ash, from coal-fired power plants. The rule is administered as part of the Resource Conservation and Recovery Act [RCRA, 42 United States Code (U.S.C.) §6901 et seq.], using the Subtitle D approach.

South Carolina Electric & Gas (SCE&G) is subject to the CCR Rule. Based on SCE&G's review of the rule, the **FGD Pond** at **SCE&G Williams Station** have been determined to be existing CCR surface impoundment subject to the CCR rule requirements.

2 PURPOSE

The purpose of this report is to document that the Williams Station FGD Pond meets the requirements of CCR rule §257.61 – *Wetlands.*

3 APPLICABLE REGULATIONS

CCR rule §257.61 – *Wetlands* states the following:

§ 257.61 WETLANDS

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in § 232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.

(2) The construction and operation of the CCR unit will not cause or contribute to any of the following:

> *(i) A violation of any applicable state or federal water quality standard;*
>
> *(ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act;*
>
> *(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and (iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.*

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors:

(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit;

(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;

(iii) The volume and chemical nature of the CCR; (iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR; (v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and (vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and

(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section.

With regards to § 257.61(a) above, 40 CFR § 232.2 defines wetlands as *"those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

4 CCR UNIT 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 DHEC on March 9, 2009, and placed into operation in accordance with an operation approval issued by DHEC on October 6, 2009.

5 WETLAND DISCUSSION

Prior to the development of the FGD pond (in 2009), the area where the FGD Pond is located was a man-made wastewater treatment basin (referred to as 'Pond C') that had operated since the early 1970's for the sole purpose of industrial wastewater treatment in support of Williams Station power generating operations in accordance with William Station's NPDES permit (current permit #SC0003883) which included periodic maintenance for basin dewatering and excavation and removal of accumulated settled waste solids. Development of the FGD Pond was achieved entirely within the limits of the former Pond C

basin. Prior to the development of the FGD pond, the area where the FGD Pond is located was not jurisdictional wetlands.

6 CONCLUSION

The CCR unit is not located in wetlands and therefore CCR rule §257.61 is satisfied.

APPENDIX C

FAULT AREAS & UNSTABLE AREAS

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.

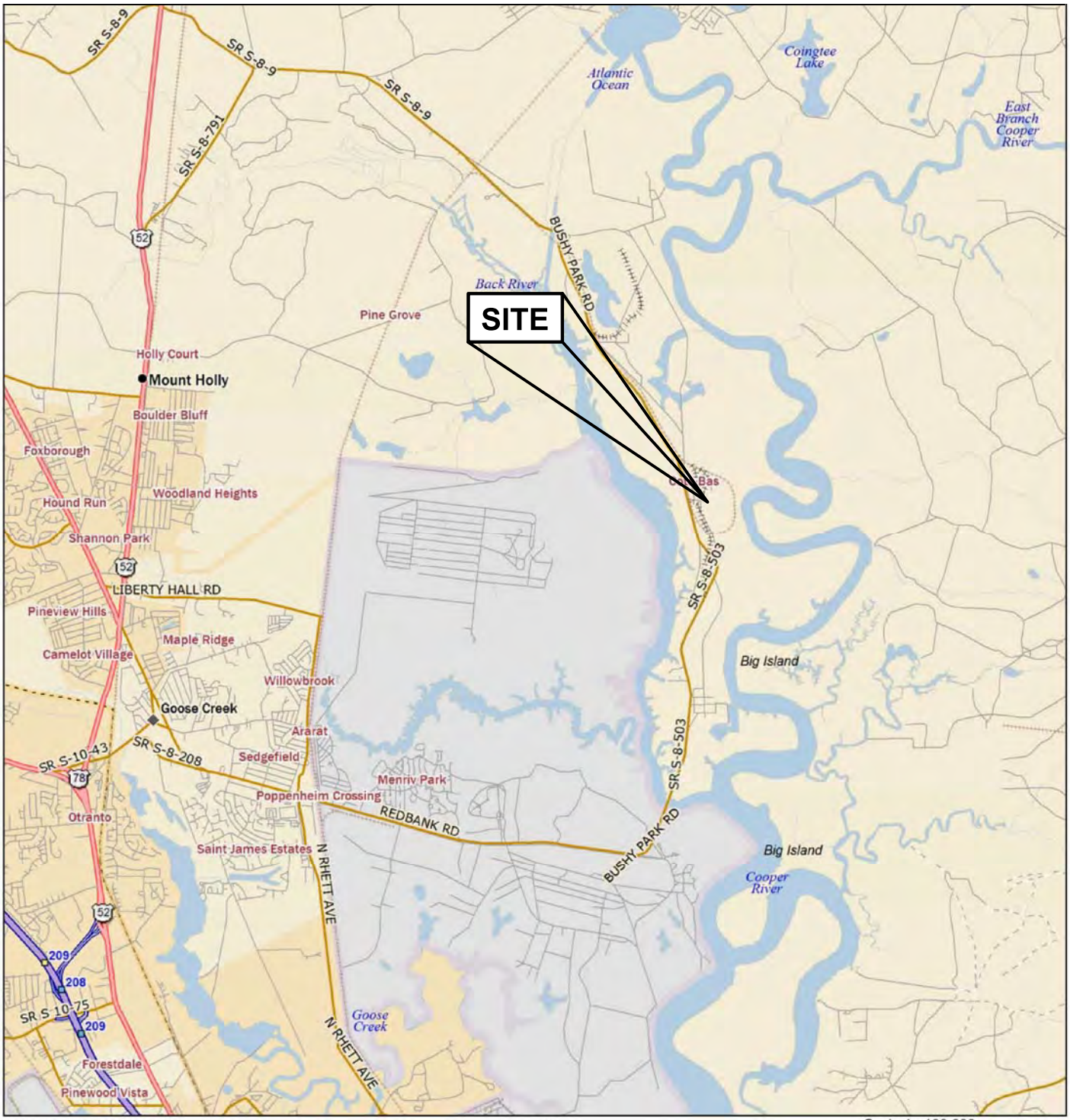
There are no known man-made surface or subsurface features such as mine tunnels (either abandoned or active), quarry pits, etc. located in or below the areas of the existing Williams Station CCR ponds subject of this study which would result in unstable conditions.

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 CONSULTANTS

Williams Station
Goose Creek, South Carolina
Project Number :G5739

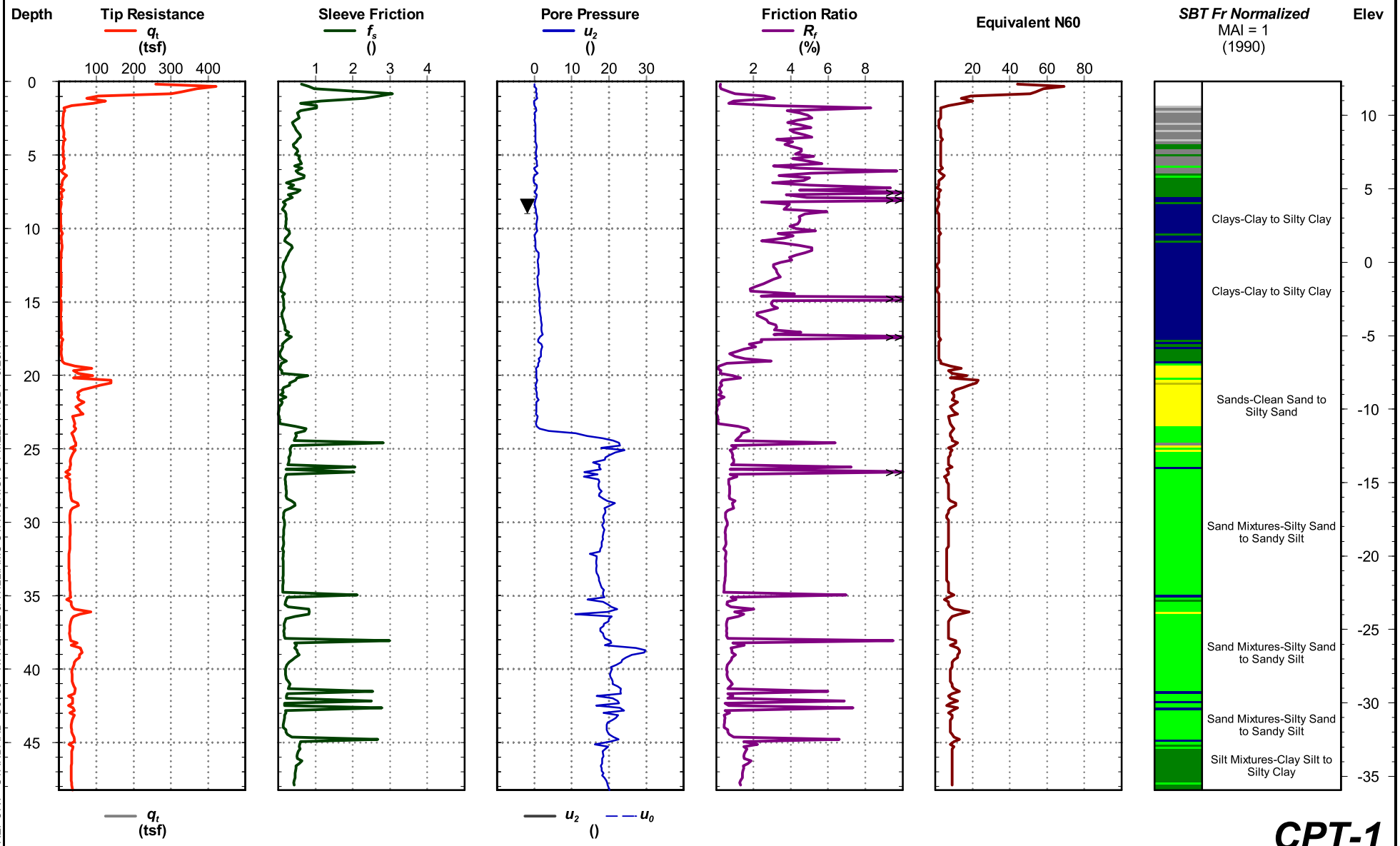
Cone Penetration Test

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

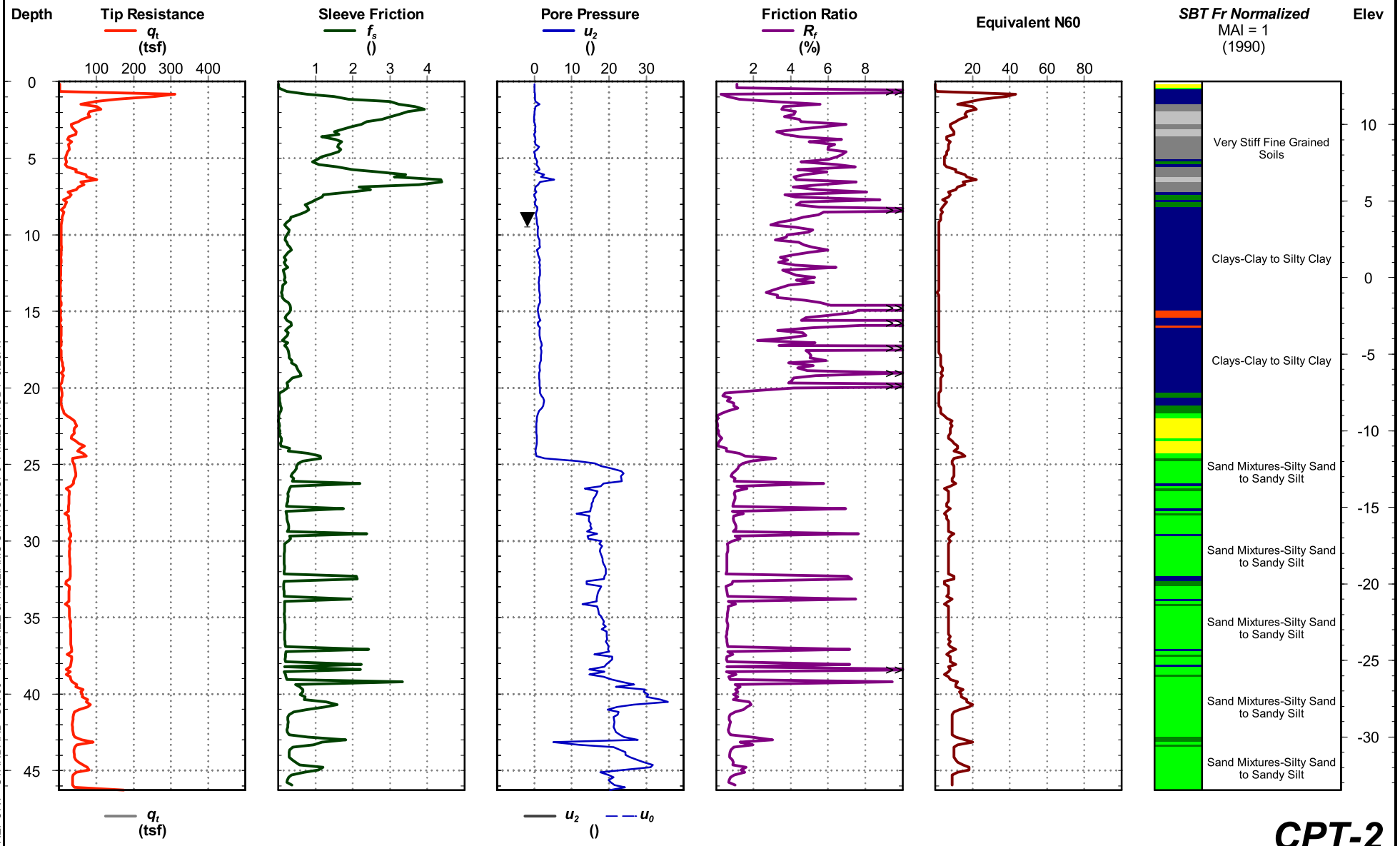
Cone Penetration Test

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:



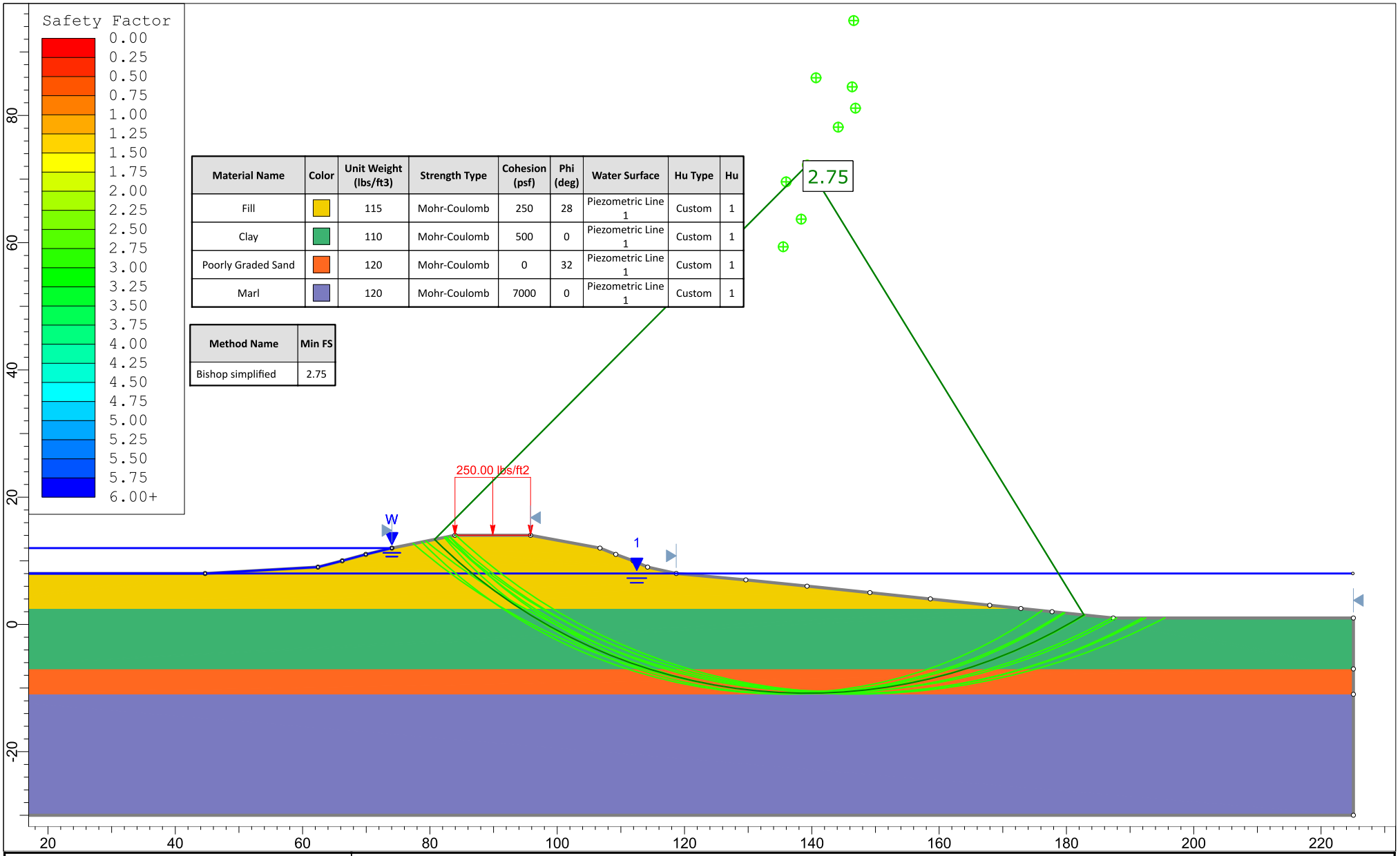
CPT-2

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

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

Attachment 2

SLIDE Output Sheets



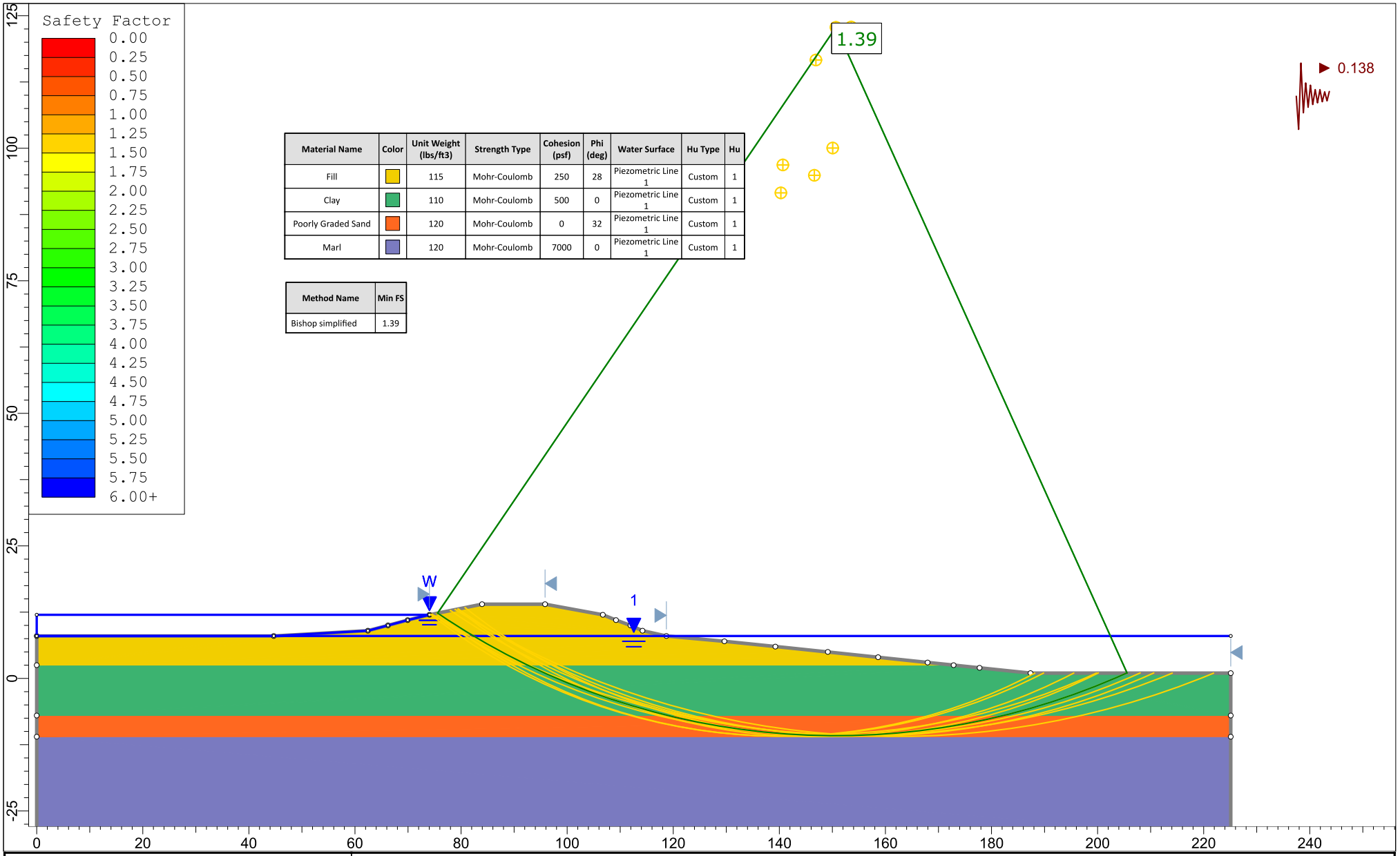
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120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

Method Name	Min FS
Bishop simplified	2.75

rocscience

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



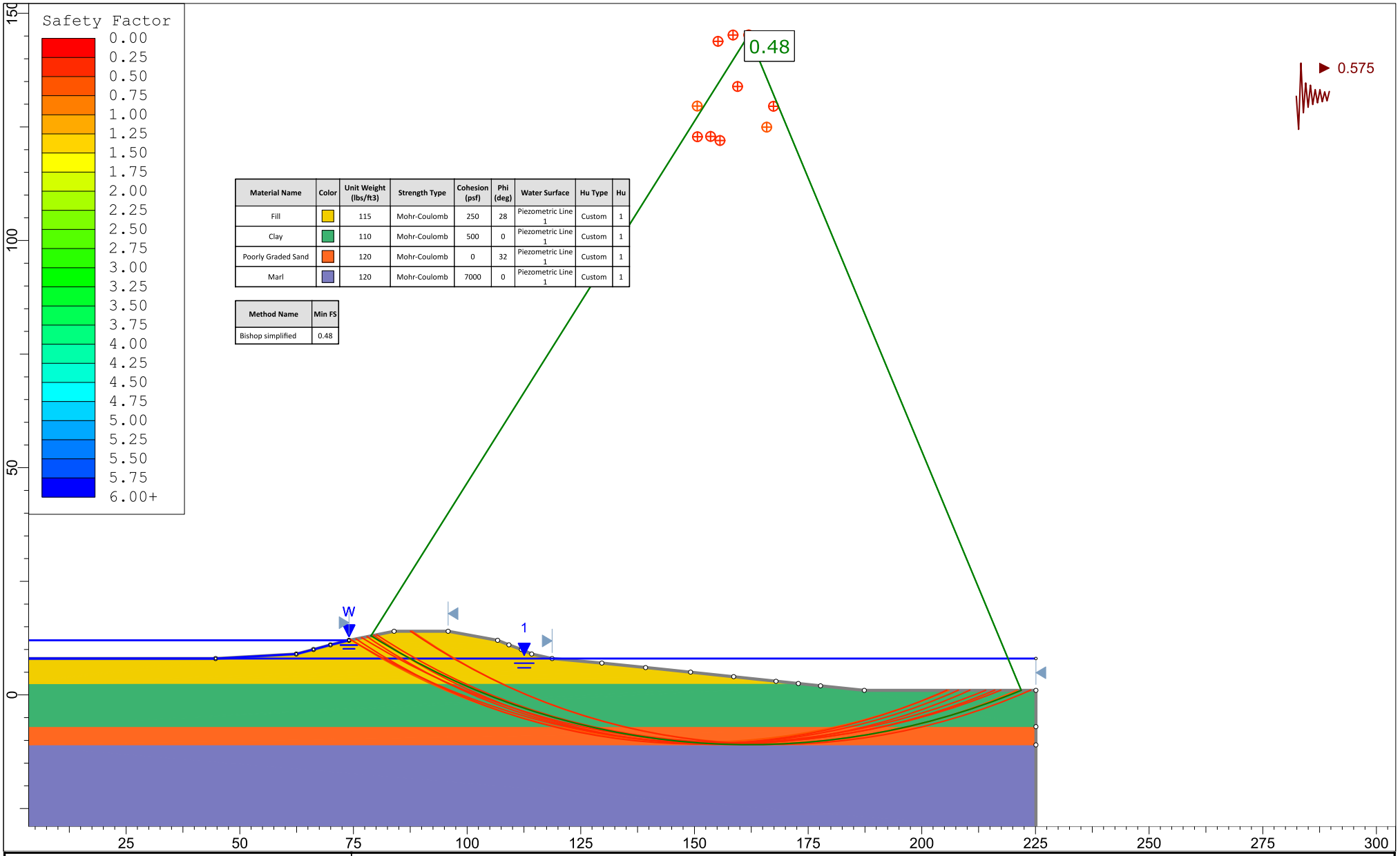
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120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

Method Name	Min FS
Bishop simplified	1.39

rocscience

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



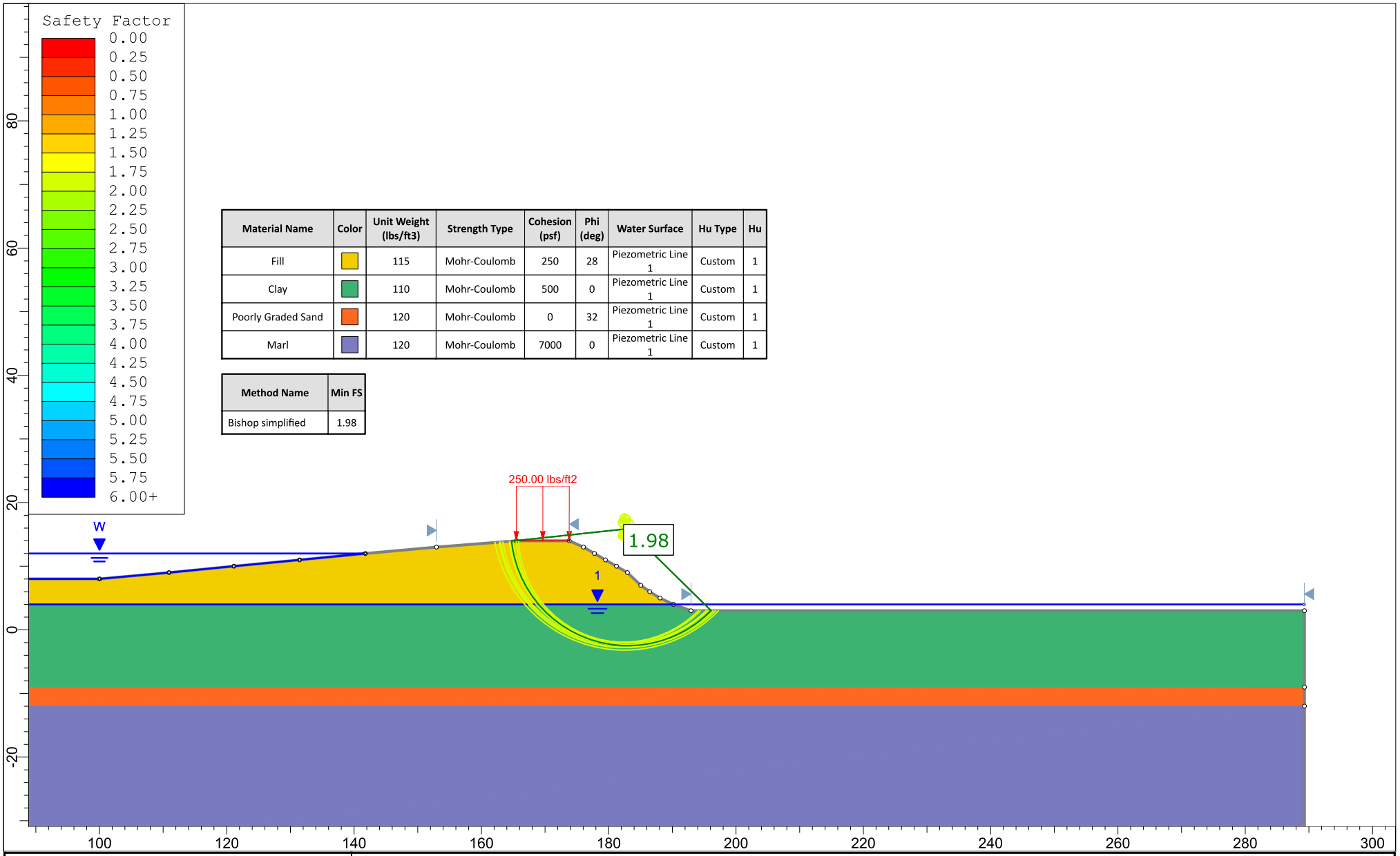
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120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

Method Name	Min FS
Bishop simplified	0.48

rocscience

SLIDEINTERPRET 7.026

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

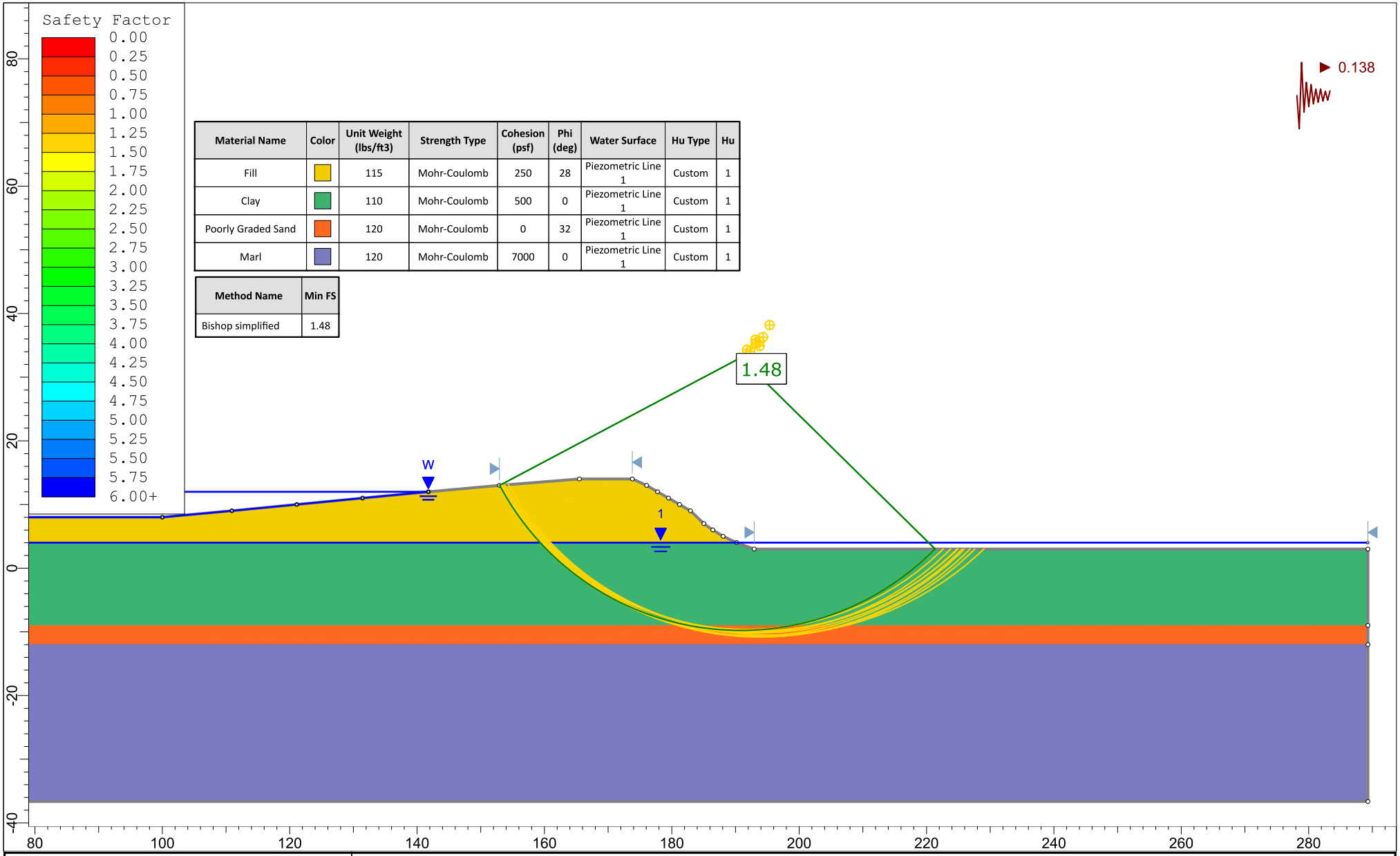


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120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

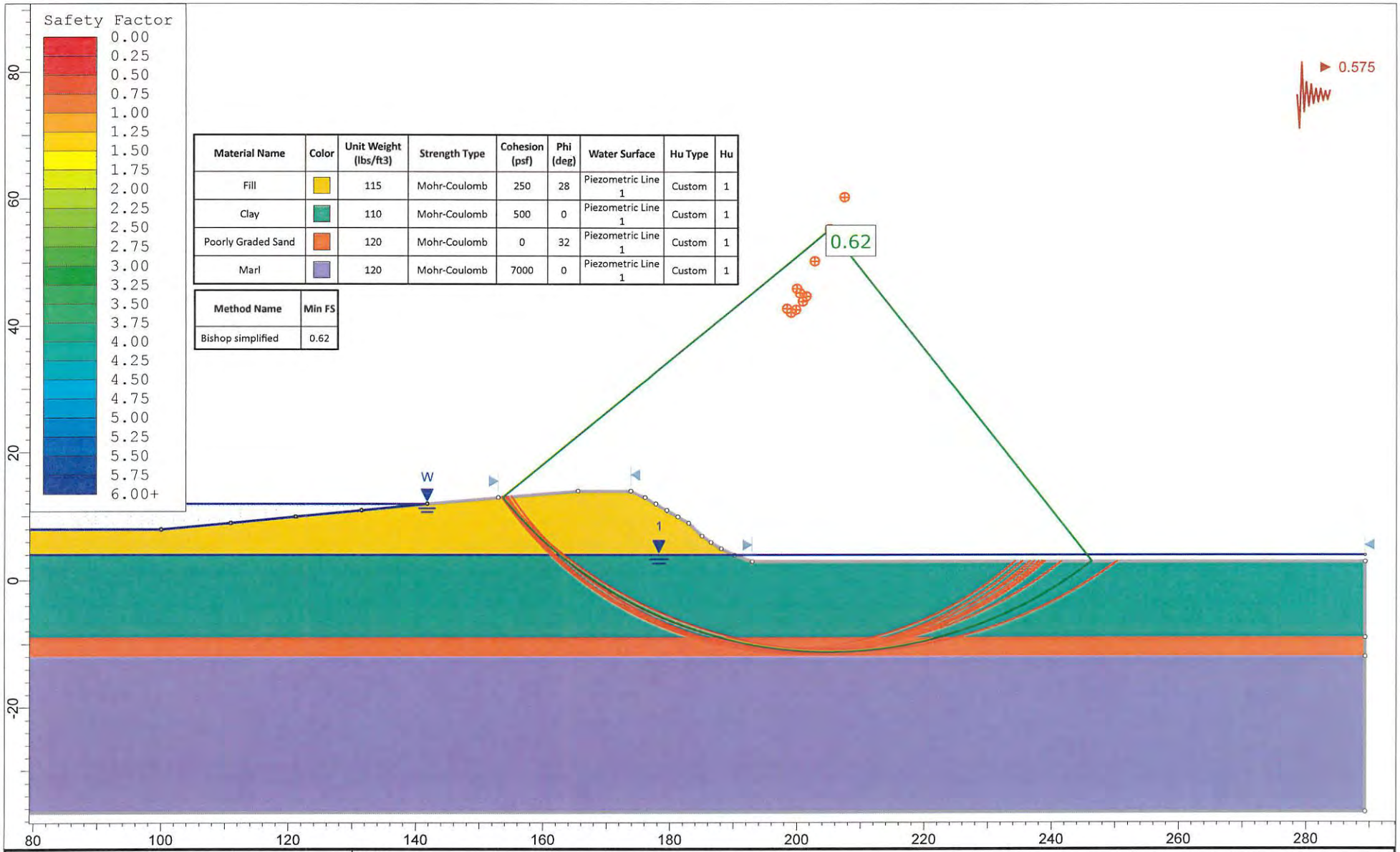


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	250	28	Piezometric Line 1	Custom	1
Clay		110	Mohr-Coulomb	500	0	Piezometric Line 1	Custom	1
Poorly Graded Sand		120	Mohr-Coulomb	0	32	Piezometric Line 1	Custom	1
Marl		120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

Method Name	Min FS
Bishop simplified	1.48

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

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	0.62

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

SLIDEINTERPRET 7.026

APPENDIX D

SEISMIC IMPACT ZONES

SOUTH CAROLINA ELECTRIC & GAS

LOCATION RESTRICTIONS:
SEISMIC IMPACT ZONES

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

§ 257.63 Seismic Impact Zones

(a) New CCR landfills, 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 by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(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).

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 regulation. The analysis presents that the FGD Pond is in a Seismic Impact Zone and certain structural components including liners, leachate collection and removal systems, and surface water control systems, are not designed to resist the maximum horizontal acceleration in lithified earth material for the site.

CONCLUSION

The Williams Station FGD Pond does not satisfy the requirements of CCR Rule §257.63 *Seismic Impact Zones.*

SCE&G will explore and identify suitable options for alternative capacity for placement of CCR material to further comply with applicable regulations of the CCR Rule.

APPENDIX E

REPORT OF GROUND IMPROVEMENT INSTALLATION TO SATISFY CCR RULE 257.63

Report of Ground Improvement Installation to Satisfy CCR Rule 257.63

A.M. Williams Station
Goose Creek, South Carolina
April 27, 2021
Terracon Project No: EN195074

Prepared for:
Dominion Energy South Carolina, Inc.
Cayce, South Carolina

Prepared by:
Terracon Consultants, Inc.
North Charleston, South Carolina

April 27, 2021

Dominion Energy South Carolina, Inc.
220 Operation Way
MC A221
Cayce, South Carolina 29033

Attn: Mr. Jean-Claude Younan
M: (803) 667-1222
E: jean-claude.younan@dominionenergy.com

Re: Report of Ground Improvement Installation to Satisfy CCR Rule 257.63
A.M. Williams Station
2242 Bushy Park Road
Goose Creek, South Carolina
Terracon Project Number: EN195074

Dear Mr. Younan:

Dominion Energy South Carolina (Dominion) has completed modification of their new FGD Pond embankments to satisfy Section 257.63 of the CCR Rule at A.M. Williams Station in Goose Creek, South Carolina. Dominion (or its agents) and Terracon have completed the inspections and soilcrete compressive strength tests, respectively, to satisfy the requirements established in the Specification for Deep Soil Mixing.

Construction observations were performed by Dominion or its agent, Civil & Environmental Consultants, Inc. (CEC), for this project. The report attachments form Terracon's project records for design and installation of the Deep Soil Mixed panels. A portion of the submittals delivered by Dominion's construction contractor or its subcontractors are provided under separate cover with subject titled Seismic Stability Construction Compliance Letter dated April 5, 2021. Pre-construction submittals, design data, and DSM laboratory compressive test results identified in the Specification for Deep Soil Mixing were reviewed by Terracon; however, production submittals, certificates, and closeout submittals for the production and closeout phases of the project were not reviewed Terracon.

CCR Rule 257.63(a) states that new CCR surface impoundments must not be located in a seismic impact zone unless the owner demonstrates that all structural components are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The design to resist the maximum horizontal acceleration is demonstrated by achieving a seismic slope stability factor of safety equal or greater than 1.0. To verify compliance with the CCR Rule's seismic slope stability requirement, the independent laboratory's compressive strength test results of soilcrete samples are compared to the design compressive strength. Dominion's soil column designer considered 80% of the compressive strength test results greater than the design compressive strength to be compliant with the design. Greater than 80% of the laboratory tested 28-day samples exceeded the design strength; therefore, compliance with the CCR Rule is demonstrated.

CLOSING

Thank you for the opportunity to provide our professional services for you on this project. If you have any questions concerning this report, please contact us at (843) 884-1234.

Sincerely,
Terracon Consultants, Inc.

H. Jay Cerceo, P.E.
Senior Engineer
SC License No. 37816

Thomas C. Smoak, P.E.
Geotechnical Department Manager
SC License No. 30792

Attachments: Geotechnical Engineering Report
Specification for Deep Soil Mixing
Specification for Deep Soil Mixing – Soilcrete Compressive Strength Test Reports

cc: project files

Geotechnical Engineering Report

Williams Station FGD Sediment Ponds
Goose Creek, South Carolina
January 17, 2020
Terracon Project No. EN195074

Prepared for:
Dominion Energy SC
Cayce, South Carolina

Prepared by:
Terracon Consultants, Inc.
North Charleston, South Carolina

January 17, 2020

Dominion Energy SC
220 Operation Way
MC A221
Cayce, South Carolina 29033-3701

Attn: Ms. Amy Bresnahan, P.E.
P: (803) 217 9965
E: amy.bresnahan@scana.com

Re: Geotechnical Engineering Report
Williams Station FGD Sediment Ponds
2242 Bushy Park Road
Goose Creek, South Carolina
Terracon Project No. EN195074

Dear Ms. Bresnahan:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PEN195074 dated April 29, 2019. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning stability of the pond slopes for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

H. Jay Cerceo
Senior Geotechnical Professional

Guoming Lin, Ph.D, P.E., D.GE.
Senior Geotechnical Consultant
SC Registration No. 16696

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report
Williams Station FGD Sediment Ponds
2242 Bushy Park Road
Goose Creek, South Carolina
Terracon Project No. EN195074
January 17, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the existing Williams Station FGD Sediment Ponds located at Williams Station near 2242 Bushy Park Road in Goose Creek, South Carolina. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Slope stability analysis
- Site-specific response analysis
- Liquefaction considerations
- Ground Improvement

The geotechnical engineering scope of work for this project included a field exploration program consisting of one Seismic Cone Penetration Test (SCPT) sounding, one Cone Penetration Test (CPT) sounding, and two Soil Test Borings (STB) to depths ranging from approximately 30 to 50 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** attachments, respectively. The sounding, boring logs, laboratory test results are included in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located along 2242 Bushy Park Road in Goose Creek, South Carolina. Approximate Latitude: 33.022207º Approximate Longitude: -79.928008º See **Site Location**
Existing Improvements	The project site is currently developed as shallow detention basins.
Current Ground Cover	The project site is currently unpaved gravel.

Item	Description
Existing Topography	Currently developed as sedimentation ponds, existing topography is attached.
Geology	Subsurface conditions consist of sands with interbedded clays which overly the Cooper Marl Formation (CMF). The CMF is a well-studied, overconsolidated sandy silt to clayey silt which is the basement layer used for deep foundation design and in seismic analysis. The CMF was encountered between 26 and 30 feet below existing grade at this site.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	The client has provided a preceding consultant's report examining the existing basins' stability evaluation with respect to the EPA final rule to regulate coal combustion residuals as solid waste.
Project Description	The coal combustion residual (CCR) waste from the Flue Gas Desulfurization process at Williams Station is sluiced to two ponds which are regulated under Subtitle D of RCRA.
Slopes	The existing slopes are not expected to change as result of this study; therefore, the topography survey serves as the basis for the stability evaluations.

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are possible.

Description	Approximate Depth to Bottom of Stratum	Material Encountered[1]
Surface	1 to 2 feet	Varying amounts gravel and sand fill

Description	Approximate Depth to Bottom of Stratum	Material Encountered[1]
Stratum 1	16 feet	Fill classified as loose to medium dense clayey sand and very soft to stiff sandy clays
Stratum 2	23 feet	Medium stiff fat clays
Stratum 3	28 feet	Loose to dense silty sand with interbedded soft to medium stiff sandy clays
Stratum 4	45 feet	Stiff clayey silt to sandy silt (Cooper Marl Formation[2])

1. Material descriptions are based on visual classification from STB, HAB samples and correlations with in situ data.
2. The Cooper Marl Formation (CMF) is a well-studied and uniform soil stratum consisting of clayey to sandy silt approximately 100 to 200 feet thick in the greater Charleston area. This soil stratum is a typical bearing layer for deep foundations as well as the basis for earthquake modeling in the Charleston area.

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

At the time of our exploration, groundwater was estimated at depths ranging from approximately 8 to 11 feet below the existing ground surface. The ground water depths were determined by physical measure in the voids left by in situ testing and by estimating the hydrostatic line (height of water below the ground surface) on the penetrometer porewater pressure (U) graph in the CPT log. Groundwater was not encountered in the hand auger borings.

The water levels as observed during field exploration are summarized in the following table and noted on the attached in situ and boring logs, in **Exploration Results**.

Test	Depth to Groundwater within Voids left after CPT/STB Testing	Estimated Depth to Groundwater based on CPT Pore Pressure Data	Depth to Groundwater in Adjacent Hand Auger Boring
SCPT-3	Cave-in[5] at 10.0 ft.	8.0 ft.	NE[1]
CPT-4	Cave-in[5] at 11.5 ft.	8.0 ft.	NE[1]
STB-5	NA[4]	NA[2,3]	NA
STB-6	NA[4]	NA[2,3]	NA

1. NE- Not Encountered.
2. NA- Not Applicable.
3. Pore pressure data is only available for CPT's.
4. Not available due to the introduction of drilling fluids
5. Cave-in takes place when the soils are too weak to support the vertical borehole wall at or just above the groundwater depth.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The groundwater surface should be checked prior to construction to assess its effect on site work and other construction activities.

Groundwater levels were measured using the following criteria:

- Physical observation within hand auger boring (HAB) testing depth.
- Where not physically encountered in HABs, groundwater levels are measured using a groundwater probe within the voids left by cone penetration (CPT) or flat blade dilatometer (DMT) tests.
- Where hole collapse does not allow for measurement within CPT or DMT voids, groundwater levels are estimated using the hydrostatic line (height of water below the ground surface) on the CPT porewater pressure (U) graph shown on the CPT logs.
- Unless otherwise specified on the logs or in the report, all groundwater measurements are collected during or immediately after drilling.

SEISMIC CONSIDERATIONS

As result of the Resource Conservation and Recovery Act (RCRA) of 2015, the EPA issued the final rule to regulate the disposal of coal combustion residuals (CCR). After issuing the rule, the EPA discussed in federal register on April 17, 2015, the minimum national criteria for CCR landfills structural integrity requirements. The EPA selected the 2% annual probability of exceedance in

50-yr exposure period (i.e. a mean design earthquake return period of 2,475-year) seismic design event based on its common use in seismic design criteria throughout the engineering field.

Following the EPA guidance documents, such as ASCE 7-10, a site-specific response analysis was performed in accordance with Section 21.1 of ASCE 7-10. The site-specific analyses consisted of the following steps:

1. Generation of ground motion (acceleration time history) data at the B-C Boundary
2. Develop a generalized soil profile model to represent the subsurface conditions.
3. One dimensional non-linear wave propagation analysis using DEEPSOIL V6.1 computer program (Hashash, 2011).
4. Determination of site-specific peak ground acceleration (PGA) at the project location for use in seismic stability analyses in accordance with ASCE 7-10.

Generation of Ground Motion Time Series

The ground motion time series used as an input in the site responses analysis models were generated from historic records and scaled to correspond to the probabilistic seismic hazard having a 2 percent probability of exceedance within a 50-year period (mean return period of 2,475 years). The time histories and scaling factors used in our analyses are presented below and were obtained from the PEER NGA Strong Motion Database.

ID	Ground Motion Name	Date of Ground Motion	Scale Factor
RSN763	Loma Prieta, California	10/18/1989	1.7
RSN1161	Kocaeli, Turkey	8/17/1999	2.9
RSN1633	Manjil, Iran	6/20/1990	1.1
RSN1787	Hector Mine, California	10/16/1999	2.8
RSN4483	L'Aquila, Italy	4/6/2009	2.0

Baseline Model Parameterization

The generalized one-dimensional baseline soil profile presented below used in the site-specific analyses is based on the measured shear wave velocity using seismic cone penetration test to a depth of 49 feet below the ground surface. Shear wave velocity at greater depths were based on the publication *Guide for Estimating the Dynamic Properties of South Carolina Soils for Ground Response Analysis*, SCDOT Research Project No. 623. The New Cooper River Bridge Site is approximately 15 miles away from the project site and considered representative of South Carolina lower coastal plain deposits beyond the seismic cone penetration testing depth conducted for this project. The soil column model used in the baseline analysis is presented

below. The soil column model extended 274 ft below the ground surface to the geologically realistic firm Coastal Plain outcrop (B-C Boundary).

Generalized One-Dimensional Baseline Soil Profile

Geologic Time	Layer No.	Layer Thickness (ft)	Depth (ft)	Soil Formation	(USCS)	PI	Total Unit Weight (pcf)	V_s (ft/s)
Fill	1	3	3	Fill	SP,SM	15	115	531
Quaternary	2	4	7	Holocene and Pleistocene Sediments	CL	30	110	445
Quaternary	3	3	10	Holocene and Pleistocene Sediments	CL	30	110	474
Quaternary	4	3	13	Holocene and Pleistocene Sediments	CL	30	110	430
Quaternary	5	3	16	Holocene and Pleistocene Sediments	CL	30	110	366
Quaternary	6	4	19	Holocene and Pleistocene Sediments	CL	30	110	933
Quaternary	7	3	23	Holocene and Pleistocene Sediments	SP	0	120	2,211
Quaternary	8	3	26	Holocene and Pleistocene Sediments	SP	0	120	1,099
Tertiary	9	4	30	Cooper Marl	CL, ML	30	130	958
Tertiary	10	3	33	Cooper Marl	CL, ML	30	130	1,204
Tertiary	11	3	36	Cooper Marl	CL, ML	30	130	1,029
Tertiary	12	3	39	Cooper Marl	CL, ML	30	130	1,311
Tertiary	13	4	43	Cooper Marl	CL, ML	30	130	1,504
Tertiary	14	3	46	Cooper Marl	CL, ML	30	130	1,255
Tertiary	15	6	50	Cooper Marl	CL, ML	30	130	1,250
Tertiary	16	10	60	Cooper Marl	CL, ML	30	130	1,100
Tertiary	17	21	81	Cooper Marl	CL, ML	30	130	1,485
Tertiary	18	86	167	Cooper Marl	CL, ML	30	130	1,235
Tertiary	19	22	189	Cooper Marl	CL, ML	30	130	1,880
Tertiary	20	30	219	Cooper Marl	CL, ML	30	130	2,320
Tertiary	21	20	239	Cooper Marl	CL, ML	30	130	1,605
Tertiary	22	35	274	Coastal Plain	IGM	15	135	1,775
Tertiary	23[1]	B-C Boundary		Coastal Plain	IGM	15	135	2,500

1. Layer Thickness for B-C Boundary is not required

Sensitivity Iterations

To evaluate the impact of aleatory variability and epistemic uncertainty, Terracon varied the baseline model parameters for a total of 3 profiles. Each of the 5 ground motions were evaluated for each of the 3 profiles. The sensitivity analysis included an iteration where the shear wave velocity of 25% higher than that used in the baseline model, and another iteration used a shear wave velocity 25% lower than that used in the baseline model.

Site Specific Response Analysis Results

Overview

One-dimensional site response analyses were conducted to model the propagation of shear waves originating at the coast plain outcrop through a series of layered soil deposits to the surface of the ground. Site response analyses were conducted using the soil column models described previously. The ground motions time series described previously were applied as “outcrop” motions (accelerations time histories) at the base of the soil column model.

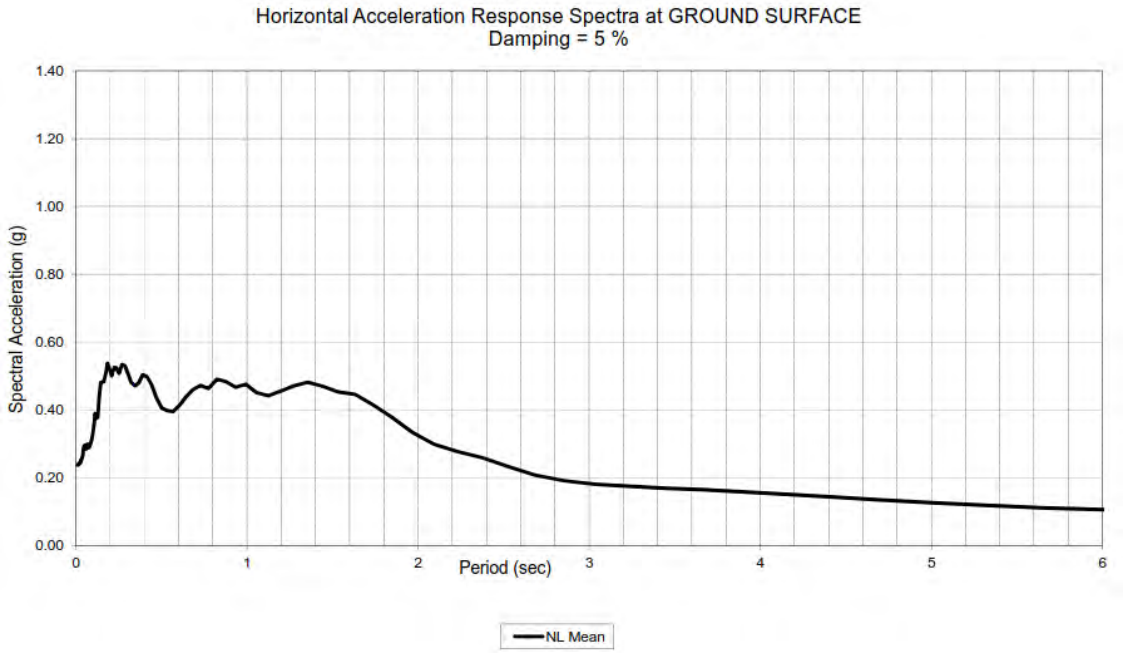
DEEPSOIL V6.1 Analysis

DEEPSOIL V6.1 is a one-dimensional site response analysis program. Site response analysis requires the definition of non-linear soil stiffness and damping behavior using modulus reduction curves and damping curves. The non-linear shear modulus and equivalent viscous damping ratio relationships for the soil layers used in the soil-column models were defined using the relationships provided in Andrus et al (2003). With the soil model and soil properties established, five input motions were used for the site-specific analysis.

Acceleration Response Spectrum (ARS)

The illustration below presents the site-specific design acceleration curve. The results of each profile with each input ground motion are included in the **Supporting Information** of this report. Since five time histories were used, Terracon determined the Acceleration Response Spectra (ARS) for each profile iteration by an arithmetic mean of the five resulting spectra at the ground surface. The site-specific acceleration response curve is the arithmetic mean ARS of profiles 1 through 3.

Site-specific Acceleration Response Spectrum



Site-specific Peak Ground Acceleration (PGA) Parameters

The PGA for a 2-percent probability of exceedance in 50 years event was 0.982g when referencing the USGS Hazard Maps – 2009 NEHRP Provisions. Under ASCE 7-10 Section 21.5.3, if a site-specific seismic site response analysis is performed and indicates the Site-Specific PGA is less than the Maximum Considered Earthquake (MCE) PGA determined under ASCE 7-10 Equation 11.8-1, the Site-Specific PGA_M may be reduced to no less than 80% of the MCE PGA_M. Given the calculated Site-Specific PGA was 0.237g, the Design PGA_M for use in the project is 0.707g per ASCE 7-10 (80% of the Design MCE PGA_M).

As outlined in RCRA Subtitle D seismic design guidance documents such as MSHA's *Engineering and Design Manual for Coal Refuse Disposal Facilities Second Edition (2009)*, the Design Maximum Horizontal Acceleration (MHA) to be used in our seismic slope stability analyses is calculated as being one-half the design PGA value as listed below. Since the Site-Specific Design PGA was determined to be lower than the MCE PGA, the Site-Specific Design PGA should be used for this calculation. The resulting Design MHA for use in seismic slope stability analyses is 0.354g. A summary of the seismic analysis parameters are shown below.

Comparison of Site-Specific ARS Parameters with MCE

Seismic Design Parameters	Site Specific	MCE (IBC 2015)
PGA_M (g)	0.237	0.982
Site Coefficient, F_{PGA}	Not Applicable	0.9
Design PGA (g)	0.707[1]	0.884
Design MHA (g)	0.354[2,3]	0.442[2]

1. 80% of the PGA_M based on the Maximum Considered Earthquake (IBC 2015) for Site Class E.
2. MHA = Maximum Horizontal Acceleration = 0.5 x Design PGA
3. To be used in seismic slope stability analyses

SLOPE STABILITY

Mechanics of Stability

Slope stability analyses take into consideration material strength, presence and orientation of weak layers, water (piezometric) pressures, surcharge loads, and the slope geometry. Mathematical computations are performed using computer-assisted simulations to calculate a Factor of Safety (FS) following Spencer's method. This method was chosen over others because it solves for both force and moment limit equilibrium. Minor changes to slope geometry, surface water flow and/or groundwater levels could result in slope instability. Reasonable FS values are dependent upon the confidence in the parameters utilized in the analyses performed, among other factors related to the project itself.

Geometric Analysis Results

Slope stability analyses were performed for the cross-section geometries obtained from the Topographic Survey drawings. Parameters for the analyses were derived from our exploratory borings, experience, and laboratory tests. Stability analyses were conducted using the computer program Slope/W Version 8.16 developed by Geo-Slope International.

Unstable or Potentially Unstable Slopes

Based on the results of our field investigation, laboratory testing program, and geotechnical analysis, development of the site is considered feasible from a geotechnical viewpoint provided the conclusions and considerations provided herein are incorporated into the design and construction of the project.

The stability of the slopes at the cross-section locations shown on the **Exploration Plan** were analyzed based on the topography survey, soil properties derived from our geotechnical exploration, laboratory test results and our experience with similar soil conditions. Peak undrained strength values were correlated using current AASHTO LRFD methods for SPT N-values and compared to CPT correlated values for similar layers encountered. Residual strength values were estimated as no more than 80% of the peak correlated value. Soil properties used in the analyses are shown below:

Material	Moist Unit Weight (pcf)	Undrained Residual Shear Strength (psf)	Undrained Residual Angle of Internal Friction (degrees)
Gravel Fill	105	0	34
Sandy Clay / Clayey Sand Fill	115	1,000	0
Clayey Sand	115	450	0
Clay	110	1,000	0
Silty Sand	120	0	10
Cooper Marl	115	2,500	0

Based on the analyses, the calculated FS for the critical surface identified in each section is shown below. The acceptable minimum FS for seismic slope stability supporting improvements is 1.0 in accordance with 40 CFR 257 Subpart D (§257.73). The slope stability results are included in the **Supporting Information** of this report.

Cross-Section	Slope	Minimum Calculated Factor-of-Safety for Slopes	
		No Ground Improvement	Ground Improved
South Pond	East Slope	0.72	1.30
South Pond	South Slope	0.57	1.36
South Pond	West Slope	0.66	1.62
North Pond	North Slope	0.64	1.48
North Pond	East Slope	0.71	1.28

GROUND IMPROVEMENT

The four surrounding slopes of the existing CCR ponds could potentially fail under earthquake loading conditions. Plausible measures to resist the event's effects include: constructing a counterweight berm or reinforcing the underlying materials. Counterweight berm would consolidate the underlying materials by increasing their effective resistance against the

earthquake loads; however, the expanse of the berm would require extension into the existing wetlands and the surrounding ponds. While this alternative may be plausible to construct, least costly and equally as reliable, it is not practical to explore by introducing additional regulatory uncertainty to disturb a wetland without exploring alternatives.

The other alternative involves reinforcing the underlying materials which differ by the construction method. The reinforcement options are equally reliable and may be constructed within the existing property limits. The options include: driving prefabricated piles, installing soil nails, stone columns, rigid inclusions (auger cast-in-place piles), drilled shafts, jet grouted columns or deep soil mixed columns. The options can be compared by the following categories.

Category	Options							
	Driven Piles	Soil Nails	Stone Columns[1]	Rigid Inclusions	Auger Cast-in-Place Piles	Drilled Shafts	Jet Grouted Columns	Deep Soil Mixed Columns
Generates Spoils	No	Marginal	Yes	Yes	Yes	Yes	Yes	Yes
Reinforcement Material Mixed onsite (like grout, soil-cement)	No	Yes	No	No	No	No	Yes	Yes
Commonly used for slope reinforcement	No	Yes	Yes[2]	No	No	Yes	Yes	Yes

1. Common for new construction slope
2. Varies if coupled with vibratory tooling

Driven Piles

Driven piles are commonly used to transfer vertical loads by bridging across weaker upper layers to deeper stronger layers and transfer shear forces to their bearing materials, especially in the Charleston area. As a sort of bench mark for comparison between different options, it may require approximately five 12-inch square precast concrete piles 30 feet long spaced five feet center-to-center down the slope and four feet center-to-center perpendicular to the slope to raise the factor of safety to 1.0. Extrapolating the section around the ponds measuring approximately 1,600 ft yields 2,000 piles as a rough order of magnitude estimate. Using this number of piles to reinforce a slope is rare. A search of published case histories using the ASCE Library database and OneMine.org returned some results, thereby demonstrating the feasibility of the option. Other options may be more efficient.

After consulting with a local pile driving contractor, they provided a rough order of magnitude estimate for this project using the information available in this report and their knowledge of the site. They estimate the project cost to range between $2,000,000 and $2,500,000 without verifying the assumptions made to develop this estimate.

Soil Nails

Soils nails are commonly used to reinforce slopes when the failure surface is shallow and steep such as when constructing a steep slope or repairing steep wall. Soil nails essentially pin up the steep surface by reinforcing the ground with tension members. As the slip surfaces become deep and long compared to the slope's length, this option requires long soil nails where they are most effective. The number of soil nails needed to raise the factor of safety above 1.0 exceeds the number of driven piles or rigid inclusions. By inspection, this option would likely be costlier than vertically installed members.

Stone Columns

Stone Columns are commonly used to improve soft ground conditions for new construction embankments. They provide less shear resistance than other options that use cement and steel. Typical spacing of these columns is 3 to 7 diameters; however, to raise the factor of safety above 1.0, the center-to-center diameter spacing is 1. In other words, the existing ground is replaced for a section length greater than 25 feet. This option should not be pursued.

Rigid Inclusions

Rigid Inclusions are drilled using hollow-stem augers pumped with ready-mixed grout as the augers are withdrawn from the hole. Auger sizes typically range between 16 and 24 inches in diameter. The number and spacing of these columns would be between the stone column and driven pile options since grout instead of stone would be used to reinforce the column. In terms of total cost, this option would likely be less than stone columns but more than driven piles. After conversations with the local specialty contractors, they were not receptive to this method without installing reinforcing steel.

Auger Cast-in-Place Piles

Auger cast-in-place piles are constructed similar to rigid inclusions except a steel reinforcing cage is inserted after the augers are removed. The number and spacing of these columns would be fewer and wider, respectively, as compared to the rigid inclusions and driven piles given the larger diameter of the columns. This option could be pursued but is likely more costly than other options.

Drilled Shafts

Drilled shafts are typically used to resist landslides. This option is applicable for the type of slope failure; however, this option is likely to be more expensive and require longer to construct than other options. This option exceeds the project's needs and should not be pursued.

Jet Grouted Columns

Jet grouted columns are constructed similarly as rigid inclusions, the main difference is that jet grouting erodes the surrounding materials and replaces them with a grout slurry and soil which the jet had eroded. This method is difficult to control the quality of the grout-soil mixture and runs the risk of escalating grout volumes as erodible soils are encountered. If the columns are spaced too close to each other, the columns may behave as a hydraulic barrier. This unintended consequence would create a ponding effect both inside and outside the barrier by restricting groundwater flow around the basins as well as raise the groundwater level within the basin. Given the possibility of such consequences, a specialty geotechnical contractor should be engaged to compare the value of this option against the others.

Deep Soil Mixed Columns

Deep soil mixed columns are an in situ mixing technique that mixes soil with cementitious grout using a line of multiple augers like rigid inclusions. This technique is efficient in that it installs multiple rigid inclusions while mixing cement with the in situ soils having to avoid ready mixed delivery. The DSM columns' material quality can be controlled, it is scalable by drilling additional panels or installing steel reinforcement within the panels. Finally, the DSM columns can be over-drilled and remixed if the material strength fails to exceed the design strength. This option should be pursued for detailed engineering design and preliminary construction cost estimating.

After consulting with a specialty geotechnical contractor, they provided a rough order of magnitude estimate for this project using the information available in this report and their knowledge of the site. They estimate the project cost to range between $2,500,000 and $3,000,000 without verifying the assumptions made to develop this estimate.

The design inputs used in the stability analyses to model the DSM columns are as follows:

- Native soil column layer thickness weighted against the native soil undrained shear strength of 660 psf,
- 60-day UCS of DSM column = 140 psi
- 28-day UCS of DSM column = 95 psi
- DSM panels are estimated to be three feet wide by twelve feet long. Panels are spaced approximately 12 feet on center,
- DSM columns are seated at least three feet into the CMF,
- Laboratory bench scale testing of soil samples mixed with various cement contents to verify the soil mixed column's design unconfined strength can be achieved,
- Construction specifications should include a method to control the soil-cement mixture quality during bench testing and production of DSM panels. The construction specifications should be reviewed by a geotechnical engineer to ensure the material quality testing procedures are satisfactory for field inspection and independent verification.

This ground improvement method is generally a proprietary system designed by licensed contractors who would provide further information regarding additional design options. The specialty geotechnical contractor should value engineer the design inputs to optimize the panel spacing, length, and cement dosage.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
2 (STB)	30	East and West Slopes
2 (CPT)	30 to 49	North and South Slopes

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained by interpolation from the Topographic Survey drawing. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted, track-mounted, ATV-mounted rotary drill rig using mud rotary. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with grout after their completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical professional. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the geotechnical professional's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Cone Penetration Testing: The soundings were performed with the appropriate ASTM Standards. The in-situ tests were advanced with a Pagani TG73-200 rig. The field exploration included observations for groundwater, which occurred during the exploration program after or as the soundings/auger borings are being advanced. No provisions have been made to collect water level data other than the observations made during the advancement of the soundings/auger

borings. The field data was reviewed and processed by the geotechnical engineer to create the final in situ sounding and hand auger boring logs.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D4767 Standard Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils

The laboratory testing program often included examination of soil samples by a technician. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan
Topographic Survey (2 pages)

Note: All attachments are one page unless noted above.

SITE LOCATION

FGD Waste Water Pond at William Station ■ Goose Creek, SC
January 17, 2020 ■ Terracon Project No. EN195074

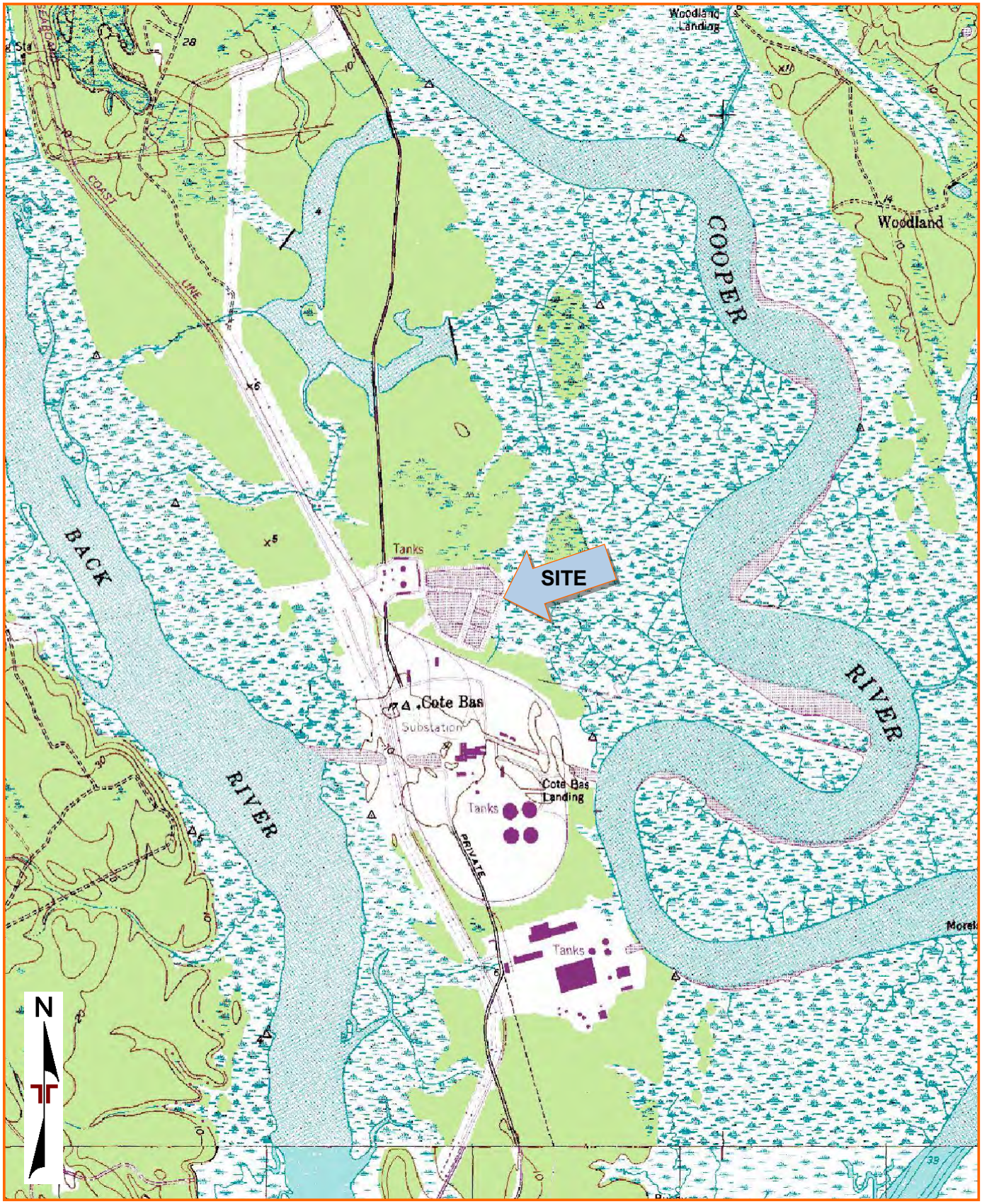


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: KITTREDGE, SC (1/1/1979) and NORTH CHARLESTON, SC (1/1/1998).

EXPLORATION PLAN

FGD Waste Water Pond at William Station ■ Goose Creek, SC
January 17, 2020 ■ Terracon Project No. EN195074

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

NOTES
1) THE PROPERTY IS OWNED BY SC GENERATING CO. INC.
2) THE TMS IS 237-00-00-003.
3) ACCORDING TO FLOOD INSURANCE RATE MAP 45015C0620E DATED 12/07/18 THIS PROPERTY APPEARS TO LIE IN FLOOD ZONE X AND FLOOD ZONE AE ELEVATION 10. THE FLOOD ZONE LINES AS SHOWN ON THIS SURVEY WERE SCALED FROM THE FEMA FLOOD MAPS.
4) THE HORIZONTAL COORDINATES SHOWN ON THIS SURVEY ARE REFERENCED TO NAD 83(2011 SHIFT). THE VERTICAL COORDINATES SHOWN ON THIS SURVEY ARE REFERENCED TO NAVD 88 DATUM.

811

The South Carolina STATE LAW requires that excavators give a 72-Hour notice, (3 working days excluding weekends and holidays), for the locators to get out to mark the area. After a ticket has been processed, you will know when you are legally free to proceed with the digging work and which utilities in the area P.U.P.S. will be notifying for you. Any utilities that P.U.P.S. does not notify, you will be responsible for notifying directly. The Utility Companies ask that you leave a 2 1/2 feet margin on each side of a marked utility line. Also note that your request is good for 15 working days after it has been processed by our system.

LEGEND
TRANS – TRANSFORMER
FFE – FINISH FLOOR ELEVATION
12.0 – EXISTING GROUND ELEVATION
12.63 – EXISTING HARD SURFACE ELEVATION
△ – HORIZONTAL CONTROL POINT
Ⓜ – MONITORING WELL
○ – BOLLARD
⋈ – VALVE
Ⓑ – SOIL BORING
● – PIPE CLEANOUT
– FLOOD ZONE LINE
–E–E–E– – BURIED ELECTRIC LINE
—12— —12— – EXISTING CONTOUR LINE

– GRAVEL ROAD
– CONCRETE

STATE PLANE

48"CMP SPILLWAY
30"CMP SPILLWAY
30"CMP
PIPE FILLED WITH DIRT
RIPRAP
PIPE FILLED WITH DIRT
FLOOD ZONE X
FLOOD ZONE AE(10)
METAL BLD. FFE=10.90
SPILLWAY FILLED WITH DIRT
PIPE FILLED WITH DIRT
EDGE OF MARSH
ELEVATED DECK FOR PUMPS TOP OF DOCK=10.9'
METAL BLD. FFE=13.02
TANK
REBAR AND CAP N:434440.02 E:2328197.79 ELEV=12.15
REBAR AND CAP N:434319.25 E:2328574.34 ELEV=12.15
SOIL BORING STB-6 ELEV=10.6
SOIL BORING STB-5 ELEV=12.3
SOIL BORING STB-6 ELEV=12.0
SEDIMENT POND TOP OF WATER =6.39' SEPTEMBER 9 2019 1:20PM
SEDIMENT POND TOP OF WATER =11.40' SEPTEMBER 9 2019 1:26 PM
SEDIMENT POND TOP OF WATER =7.97' SEPTEMBER 9 2019 1:28 PM
North Pond
South Pond
West Slope
East Slope
Section views looking North
403 ft
396 ft
RIPRAP
IE=9.98
IE=10.05
IE=10.07
TOP PIPE=11.23
TOP PIPE=11.16
TOP PIPE=11.34
IE=9.87
IE=9.92
IE=9.96
TOP PIPE=10.92
TOP PIPE=10.83
TOP PIPE=10.83
TOP PIPE=11.18
TOP PIPE=11.04
EDGE OF MARSH

SHEET 1
SHEET 2

GRAPHIC SCALE
20 0 20 40
(IN FEET)
1 inch = 20 ft.

I HEREBY STATE THAT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF, THE SURVEY SHOWN HEREIN WAS MADE IN ACCORDANCE WITH THE REQUIREMENTS OF THE STANDARDS OF PRACTICE MANUAL FOR SURVEYING IN SOUTH CAROLINA, AND MEETS OR EXCEEDS THE REQUIREMENTS AS SPECIFIED THEREIN.

LEWIS SMITH MOORE, P.L.S. No. 21621

FORSBERG ENGINEERING AND SURVEYING, INC.
1587 SAVANNAH HIGHWAY SUITE B
P.O. BOX 30575
CHARLESTON, SOUTH CAROLINA 29417
(843) 571-2822 FAX (843) 571-6780
CIVIL ENGINEERING, LAND SURVEYING AND LANDSCAPE ARCHITECTURE

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
FORSBERG ENGINEERING & SURVEYING, INC.
No. C00343

TOPOGRAPHIC SURVEY
SEDIMENT POND

WILLIAMS STATION
2228 BUSHY PARK ROAD
BERKELEY COUNTY, SOUTH CAROLINA

SOUTH CAROLINA REGISTERED LAND SURVEYOR 21621 LEWIS SMITH MOORE
LEWIS S MOORE

DATE	9/19/2019
DRAWN/CHECKED	LSM/TWM
LAST REVISED	
APPROVED	LSM
SCALE	1"=20'
PROJECT NO.	5321-1
SHEET NUMBER	1 OF 2

North Pond

West Slope

East Slope

South Pond

SEDIMENT POND
TOP OF WATER =11.40'
SEPTEMBER 9 2019
1:26 PM

SEDIMENT POND
TOP OF WATER =7.97'
SEPTEMBER 9 2019
1:28 PM

SEDIMENT POND
TOP OF WATER =6.44'
SEPTEMBER 9 2019
1:24 PM

SEDIMENT POND
TOP OF WATER =6.39'
SEPTEMBER 9 2019
1:22 PM

SCPT-3

SOIL BORING
STB-5
ELEV=12.3

SOIL BORING
STB-6
ELEV=12.0

SOIL BORING
STB-3
ELEV=12.5

TOP PIPE=11.23
TOP PIPE=11.16
TOP PIPE=11.34

TOP PIPE=10.92
TOP PIPE=10.83
TOP PIPE=10.83

TOP PIPE=11.18

TOP PIPE=11.04

IE=9.87
IE=9.92
IE=9.96

IE=9.98
IE=10.02
IE=10.07

RIPRAP

SPILLWAY
FILLET WITH
DIRT

FLOOD ZONE AE(10)

FLOOD ZONE X

SHEET 1
SHEET 2

EDGE OF MARSH

STATE PLANE

NOTES
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811

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LEWIS SMITH MOORE, P.L.S. No. 21621

GRAPHIC SCALE
20 0 20 40
(IN FEET)
1 inch = 20 ft.

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1597 SAVANNAH HIGHWAY SUITE B
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CIVIL ENGINEERING, LAND SURVEYING AND LANDSCAPE ARCHITECTURE

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
FORSBERG ENGINEERING & SURVEYING, INC.
No. C00343

TOPOGRAPHIC SURVEY
SEDIMENT POND

WILLIAMS STATION
2228 BUSHY PARK ROAD
BERKELEY COUNTY, SOUTH CAROLINA

SOUTH CAROLINA REGISTERED LAND SURVEYOR 21621 LEWIS SMITH MOORE

LEWIS S MOORE

DATE	9/19/2019
DRAWN/CHECKED	LSM/TWM
LAST REVISED	
APPROVED	LSM
SCALE	1"=20'
PROJECT NO.	5321-1
SHEET NUMBER	2 OF 2

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

BORING LOG NO. STB-5

PROJECT: FGD Waste Water Pond at William Station

CLIENT: Dominion Energy
Richmond, VA

SITE: 2242 Bushy Park Rd
Goose Creek, SC

LOCATION See Exploration Plan

Latitude: 33.022207° Longitude: -79.928008°

Surface Elev.: 12.3 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0	11.5	**FILL - POORLY GRADED GRAVEL WITH SAND (GP)**, fine to coarse grained, light brown	35-18-11-9 N=29			
		FILL - LEAN CLAY WITH SAND (CL), fine grained, gray and light brown, moist	3-3-9-8 N=12			
4.0	8.5	**FILL - CLAYEY SAND (SC)**, fine grained, light brown, wet, medium dense	3-6-7-8 N=13	14	27-15-12	40
			7-8-10-12 N=18	15	31-14-17	40
8.5	4	**CLAYEY SAND (SC)**, fine grained, gray and light brown, wet, loose	8-4-3-4 N=7			
				19	26-14-12	36
			2-2-4 N=6			
				24	32-14-18	32
18.5	-6	**SANDY FAT CLAY (CH)**, fine grained, black, wet, medium stiff	3-4-3 N=7		81-21-60	
23.5	-11	**SILTY SAND (SM)**, fine grained, light brown, wet, medium dense	4-5-7 N=12	36	NP	33
28.5	-16					
30.0	-17.5	**SANDY SILT (ML)**, fine grained, light brown, moist, stiff, **COOPER MARL FORMATION**	5-7-7 N=14			
		Boring Terminated at 30 Feet				

DEPTH (Ft.): 5, 10, 15, 20, 25, 30

WATER LEVEL OBSERVATIONS

SAMPLE TYPE

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

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

Elevations were provided by Forsberg Engineering and Surverying, Inc.

Notes:

Elevations are provided by Forsberg Engineering and Surverying, Inc.
Elevations are referenced to NAVD 88.

WATER LEVEL OBSERVATIONS

Terracon
1450 Fifth St W
North Charleston, SC

Boring Started: 08-23-2019 | Boring Completed: 08-23-2019

Drill Rig: CME 55 | Driller: Brian H.

Project No.: EN195074

BORING LOG NO. STB-6

PROJECT: FGD Waste Water Pond at William Station

CLIENT: Dominion Energy
Richmond, VA

SITE: 2242 Bushy Park Rd
Goose Creek, SC

LOCATION See Exploration Plan

Latitude: 33.022178° Longitude: -79.929371°

Surface Elev.: 12.0 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0	11	**FILL - POORLY GRADED GRAVEL WITH SAND (GP)**, light brown, dry, medium dense	14-12-12-5 N=24			
		FILL - SANDY LEAN CLAY (CL), fine grained, gray and light brown, moist, medium stiff and stiff	4-4-4-5 N=8	22	34-16-18	52
			3-4-6-5 N=10	24	35-15-20	
			3-3-3-5 N=6			
			3-3-4-4 N=7	24	38-14-24	
10.5	1.5					
		FILL - CLAYEY SAND (SC), fine grained, gray and light brown, moist, loose		31	34-15-19	47
13.5	-1.5					
		FAT CLAY (CH), gray and light brown, wet, very soft	1-1-1 N=2	37	64-19-45	82
				46	37-13-24	60
18.5	-6.5					
		FAT CLAY (CH), gray, wet, stiff	3-4-3 N=7		69-17-52	
23.5	-11.5					
		SILTY SAND (SM), fine grained, gray, wet, medium dense	4-5-6 N=11	38	NP	16
28.5	-16.5					
30.0	-18	**SILT WITH SAND (ML)**, light brown, moist, stiff, **COOPER MARL FORMATION**	4-6-7 N=13			
		Boring Terminated at 30 Feet				

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

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

Elevations were provided by Forsberg Engineering and Surverying, Inc.

Notes:
Elevations are provided by Forsberg Engineering and Surverying, Inc.
Elevations are referenced to NAVD 88.

WATER LEVEL OBSERVATIONS

Terracon
1450 Fifth St W
North Charleston, SC

Boring Started: 08-23-2019 | Boring Completed: 08-23-2019

Drill Rig: CME 55 | Driller: Brian H.

Project No.: EN195074

CPT LOG NO. SCPT-3

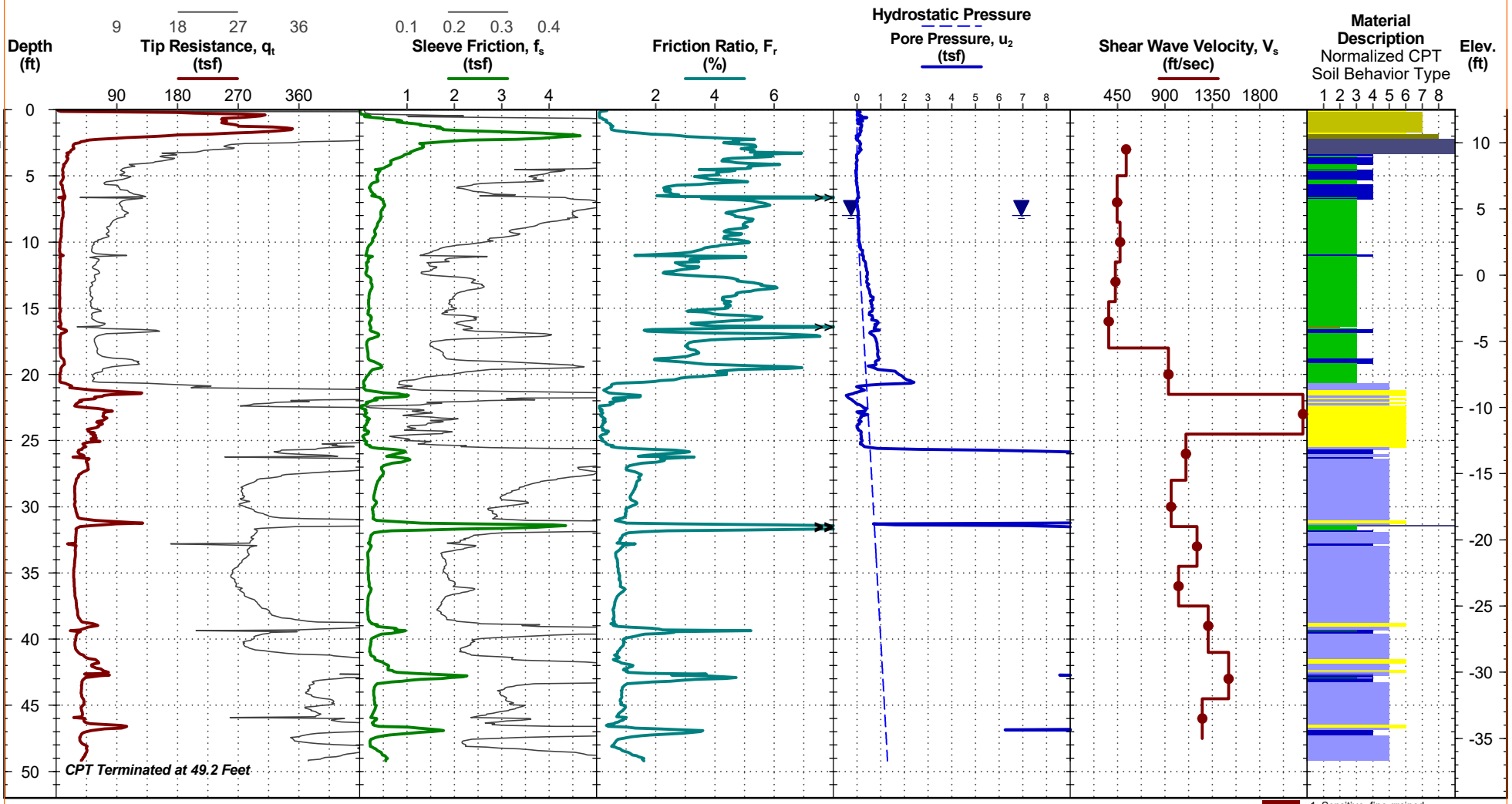
PROJECT: FGD Waste Water Pond at William Station

CLIENT: Dominion Energy
Richmond, VA

TEST LOCATION: See Exploration Plan

Surface Elev.: 12.5 ft
Latitude: 33.021718°
Longitude: -79.928301°

SITE: 2242 Bushy Park Rd
Goose Creek, SC



CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

Elevations were provided by Forsberg Engineering and Surverying, Inc.

WATER LEVEL OBSERVATION

▼ 8 ft estimated water depth
(used in normalizations and correlations)

Probe no. 5287 with net area ratio of .853
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 6/15/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 Fifth St W
North Charleston, SC

CPT Started: 8/21/2019
CPT Completed: 8/21/2019
Rig: Pagani TG73-200
Operator: J. Bandle
Project No.: EN195074

CPT LOG NO. CPT-4

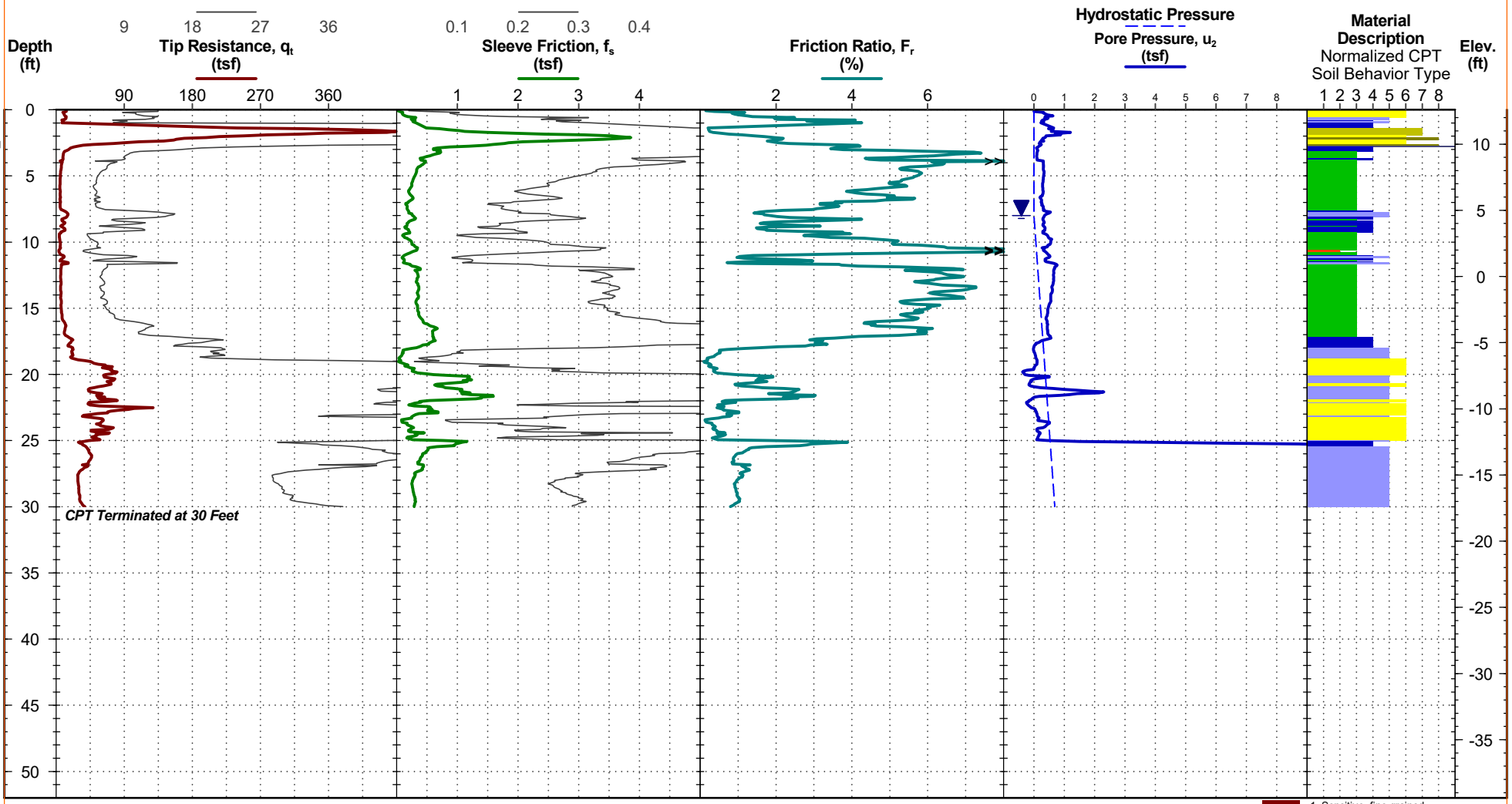
PROJECT: FGD Waste Water Pond at William Station

CLIENT: Dominion Energy
Richmond, VA

SITE: 2242 Bushy Park Rd
Goose Creek, SC

TEST LOCATION: See Exploration Plan

Surface Elev.: 12.6 ft
Latitude: 33.022627°
Longitude: -79.929096°



CPT sensor calibration reports available upon request.

Elevations were provided by Forsberg Engineering and Surverying, Inc.

WATER LEVEL OBSERVATION

▼ 8 ft estimated water depth
(used in normalizations and correlations)

Probe no. 5287 with net area ratio of .853
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 6/15/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 Fifth St W
North Charleston, SC

CPT Started: 8/21/2019
CPT Completed: 8/21/2019
Rig: Pagani TG73-200
Operator: J. Bandle
Project No.: EN195074

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Fines
STB-5	4 - 6	14	27	15	12	40.1
STB-5	6 - 8	15	31	14	17	40.1
STB-5	10 - 12	19	26	14	12	36.0
STB-5	15 - 17	24	32	14	18	32.4
STB-5	18.5 - 20		81	21	60	
STB-5	23.5 - 25	36	NP	NP	NP	33.0
STB-6	2 - 4	22	34	16	18	52.2
STB-6	4 - 6	24	35	15	20	
STB-6	8 - 10	24	38	14	24	
STB-6	10 - 12	31	34	15	19	46.8
STB-6	13.5 - 15	37	64	19	45	82.5
STB-6	15 - 17	46	37	13	24	60.4
STB-6	18.5 - 20		69	17	52	
STB-6	23.5 - 25	38	NP	NP	NP	16.0

PROJECT: FGD Waste Water Pond at William Station

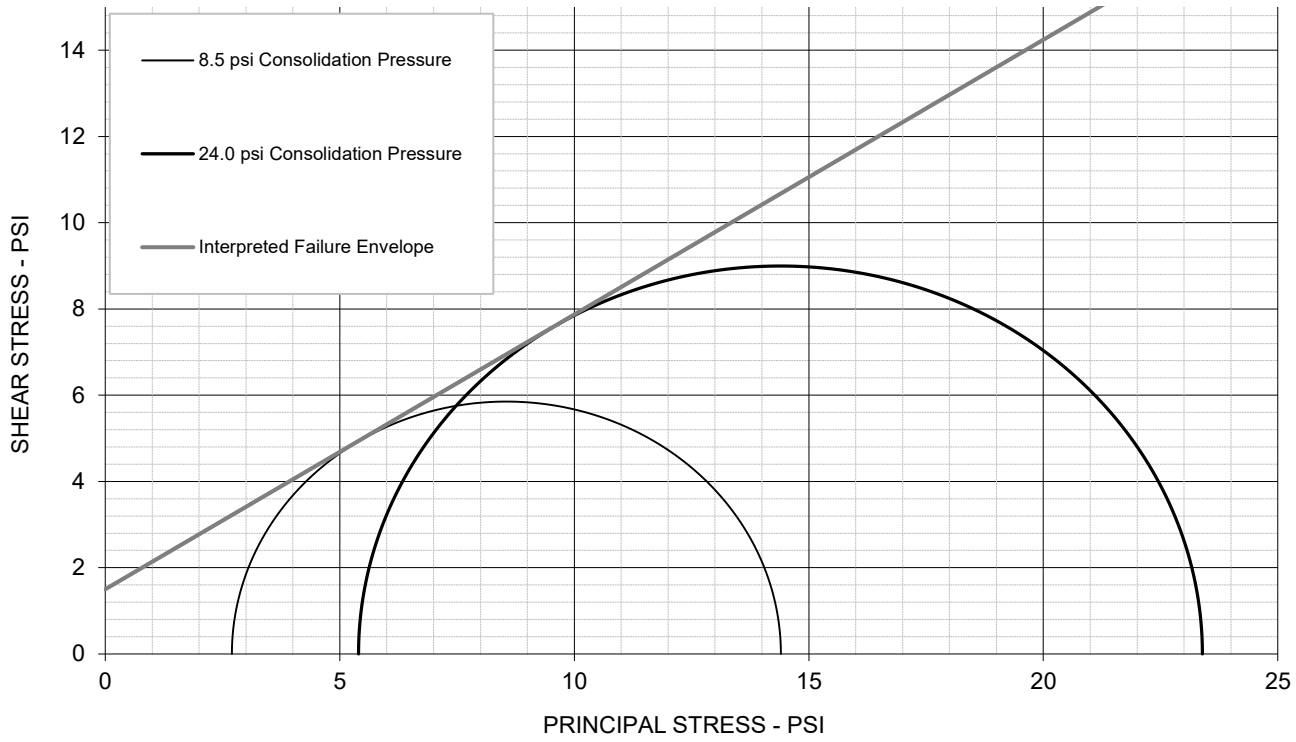
SITE: 2242 Bushy Park Rd Goose Creek, SC

Terracon
1450 Fifth St W
North Charleston, SC

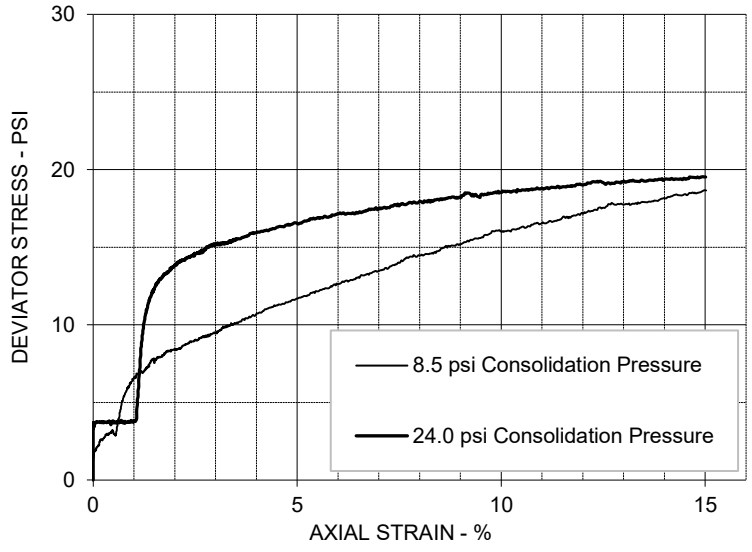
PROJECT NUMBER: EN195074

CLIENT: Dominion Energy Richmond, VA

ICU TRIAXIAL COMPRESSION TEST



EFFECTIVE STRESS PARAMETERS	ϕ' = 32.5 deg	c' = 1.5 psi



SPECIMEN NO.	1	2
INITIAL		
Moisture Content - %	19.0	23.9
Dry Density - pcf	114.8	101.8
Diameter - inches	2.85	2.85
Height - inches	6.04	6.00
AT TEST		
Final Moisture - %	17.9	19.4
Dry Density - pcf	114.8	101.8
Calculated Diameter - in.	2.85	2.85
Height - inches	6.04	6.00
Effect. Consol. Stress - psi	8.5	24.0
Failure Stress - psi	11.70	17.99
Total Pore Pressure - psi	100.7	111.9
Strain Rate - inches/min.	0.0017	0.0017
Failure Strain - %	5.0	8.1
σ_1' Failure - psi	14.40	23.39
σ_3' Failure - psi	2.70	5.40

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Clay w/ Gravel and Shells

SAMPLE: STB-5 10-12' & 15-17'

ASSUMED SPECIFIC GRAVITY: 2.65

LL: 26 PL: 14 PI: 12 Percent -200:

REMARKS: PI Samples were prepared using the Wet Method

PROJECT INFORMATION

PROJECT: FGD Waste Water Pond at William Station

LOCATION: Charleston, SC

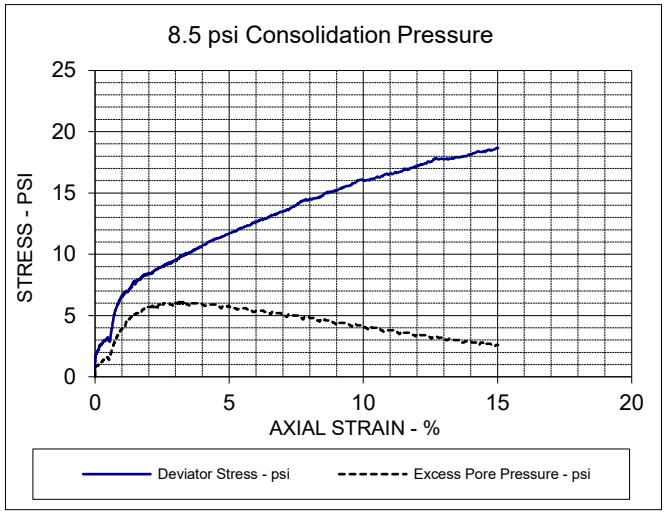
PROJECT NO: EN195074

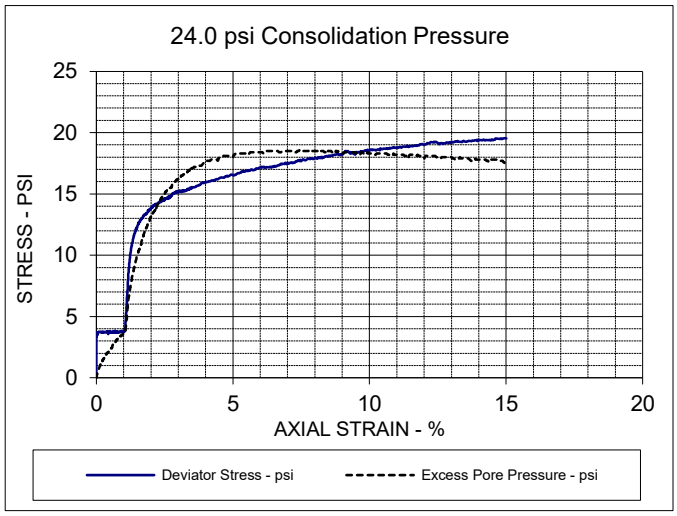
CLIENT: Dominion Energy

DATE: 08.29.19

1450 Fifth St W
North Charleston, SC

Terracon

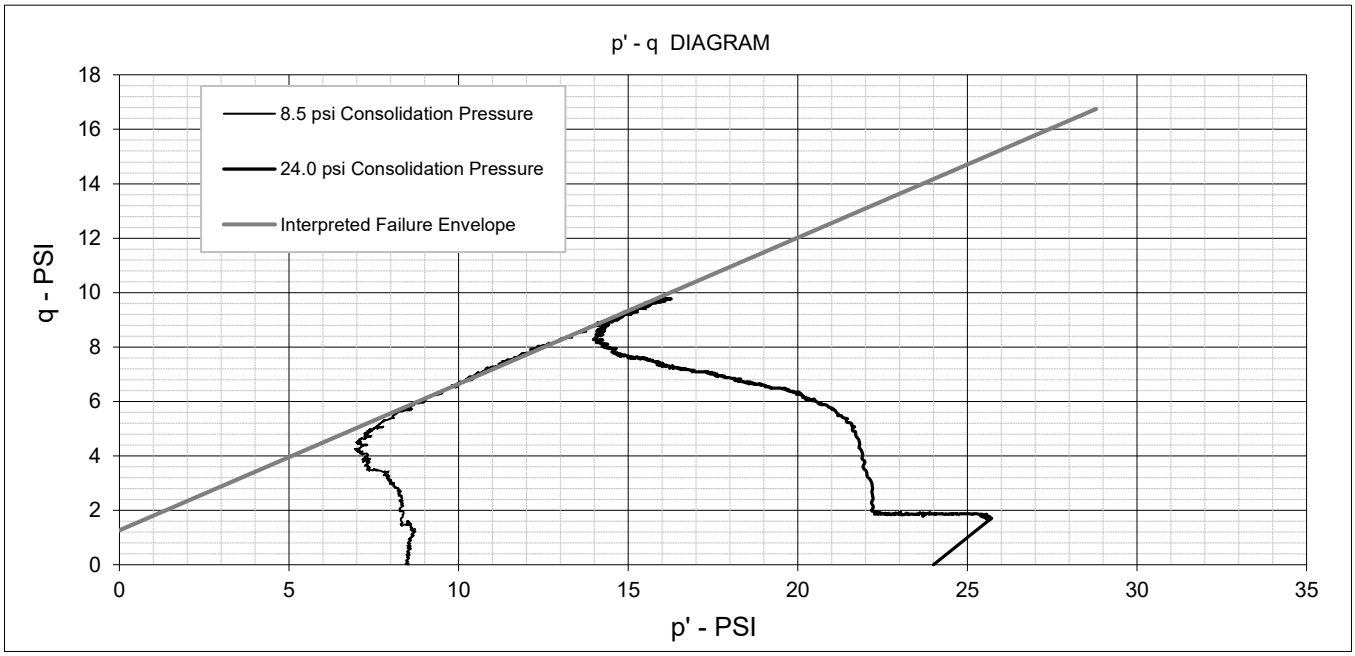




SPECIMEN FAILURE ILLUSTRATIONS

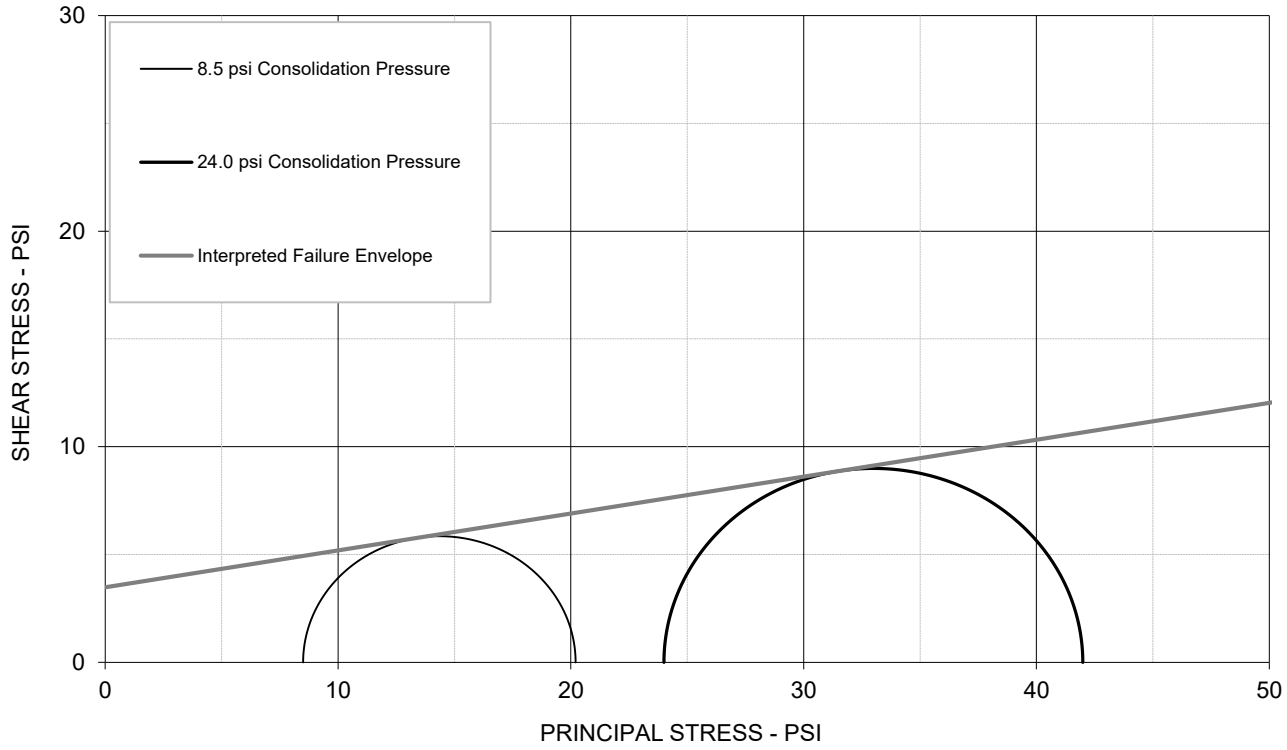
1

2

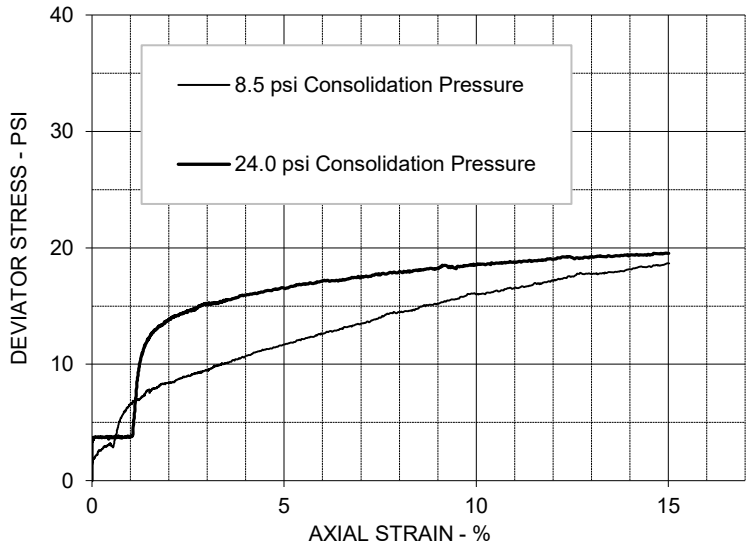


EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α = 28.3 deg	a = 1.3 psi
PROJECT: FGD Waste Water Pond at William Station		ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION	
LOCATION: Charleston, SC		CLIENT: Dominion Energy	
SAMPLE: STB-5 10-12' & 15-17'		**1450 Fifth St W**	
DESCRIPTION: Clay w/ Gravel and Shells		**North Charleston, SC**	Terracon

ICU TRIAXIAL COMPRESSION TEST



TOTAL STRESS PARAMETERS	ϕ = 9.7 deg	c = 3.5 psi



SPECIMEN NO.	1	2
INITIAL		
Moisture Content - %	19.0	23.9
Dry Density - pcf	114.8	101.8
Diameter - inches	2.85	2.85
Height - inches	6.04	6.00
AT TEST		
Final Moisture - %	17.9	19.4
Dry Density - pcf	114.8	101.8
Calculated Diameter (in.)	2.85	2.85
Height - inches	6.04	6.00
Effect. Consol. Stress - psi	8.5	24.0
Failure Stress - psi	11.70	17.99
Total Pore Pressure - psi	100.7	111.9
Strain Rate - inches/min.	0.0017	0.0017
Failure Strain - %	5.0	8.1
σ_1 Failure - psi	20.20	41.99
σ_3 Failure - psi	8.50	24.00

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Clay w/ Gravel and Shells

SAMPLE: STB-5 10-12' & 15-17'

ASSUMED SPECIFIC GRAVITY: 2.65

LL: 26 PL: 14 PI: 12 Percent -200:

REMARKS: PI Samples were prepared using the Wet Method

PROJECT INFORMATION

PROJECT: FGD Waste Water Pond at William Station

LOCATION: Charleston, SC

PROJECT NO: EN195074

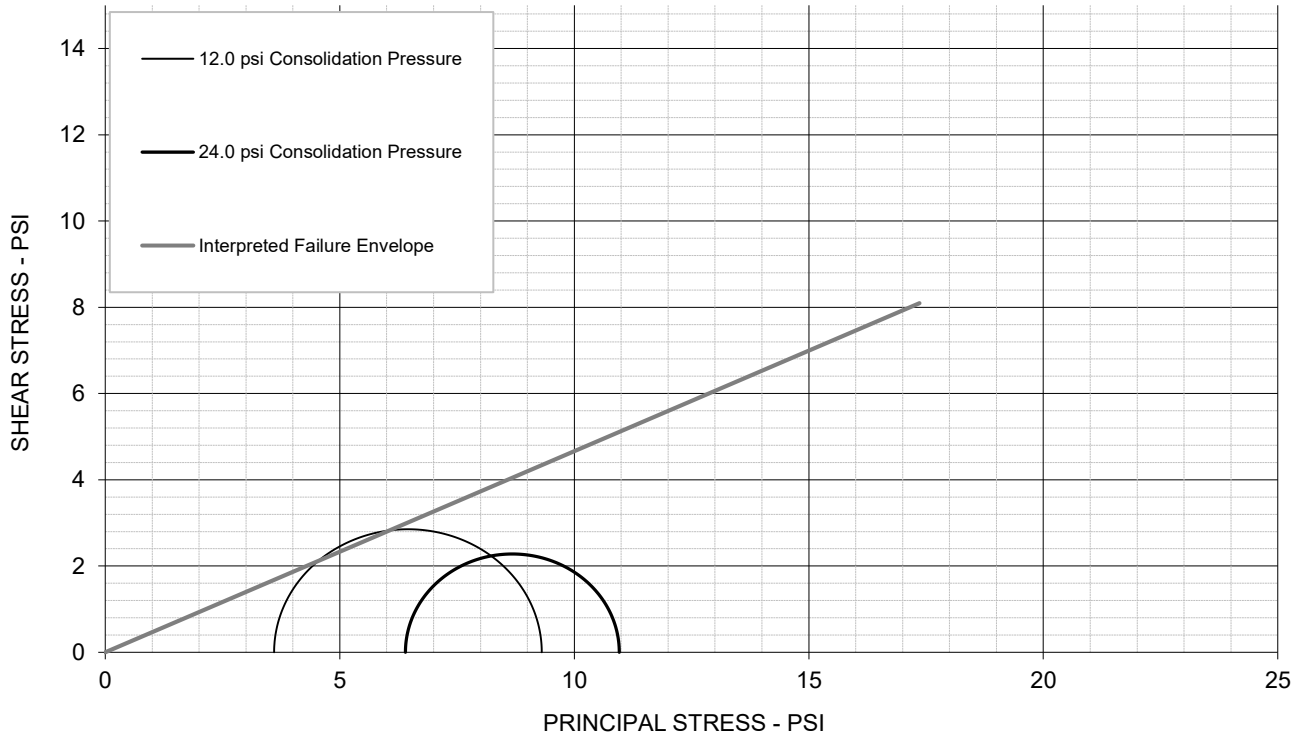
CLIENT: Dominion Energy

DATE: 08.29.19

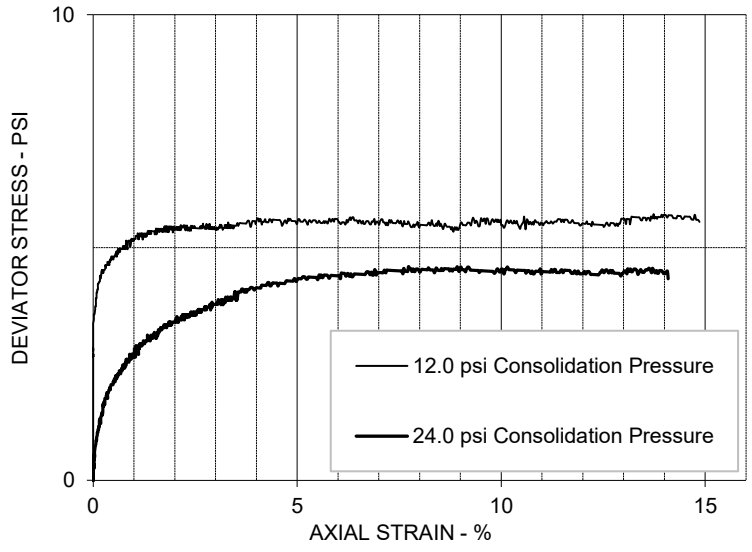
1450 Fifth St W
North Charleston, SC

Terracon

ICU TRIAXIAL COMPRESSION TEST



EFFECTIVE STRESS PARAMETERS	ϕ' = 25.0 deg	c' = 0.0 psi



SPECIMEN NO.	1	2
INITIAL		
Moisture Content - %	45.9	31.6
Dry Density - pcf	73.1	82.4
Diameter - inches	2.84	2.83
Height - inches	6.05	5.94
AT TEST		
Final Moisture - %	36.0	42.3
Dry Density - pcf	73.1	82.4
Calculated Diameter - in.	2.84	2.83
Height - inches	6.05	5.94
Effect. Consol. Stress - psi	12.0	24.0
Failure Stress - psi	5.71	4.56
Total Pore Pressure - psi	99.7	111.3
Strain Rate - inches/min.	0.0017	0.0017
Failure Strain - %	14.7	13.6
σ_1' Failure - psi	9.31	10.96
σ_3' Failure - psi	3.60	6.40

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Green-Blue & Gray CL

SAMPLE: STB-6 15-17'

ASSUMED SPECIFIC GRAVITY: 2.65

LL: 37 PL: 13 PI: 24 Percent -200:

REMARKS: PI Sample were prepared using the Wet Method

PROJECT INFORMATION

PROJECT: FGD Waste Water Pond at William Station

LOCATION: Charleston, SC

PROJECT NO: EN195074

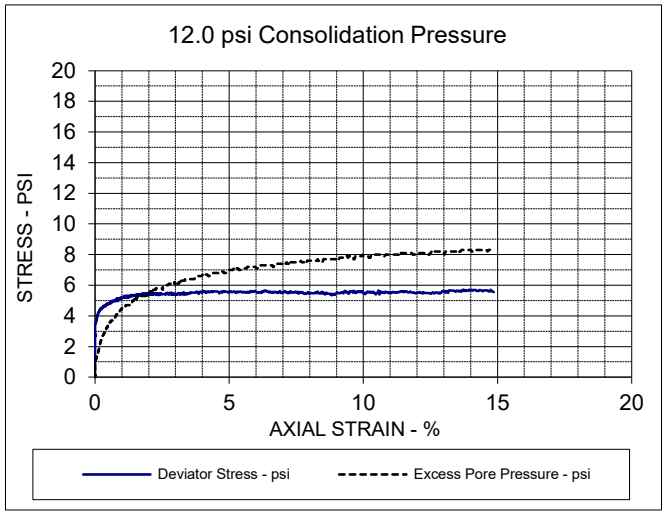
CLIENT: Dominion Energy

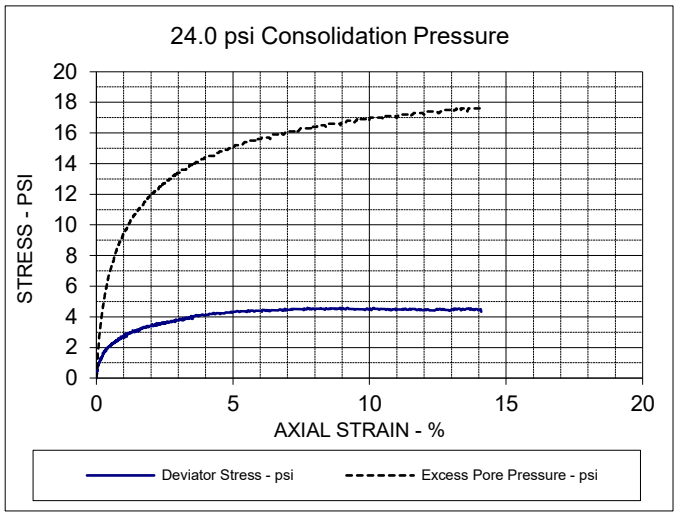
DATE: 08.29.19

1450 Fifth St W
North Charleston, SC

Terracon

STB 6 - 15'-17' - 12-24 psi

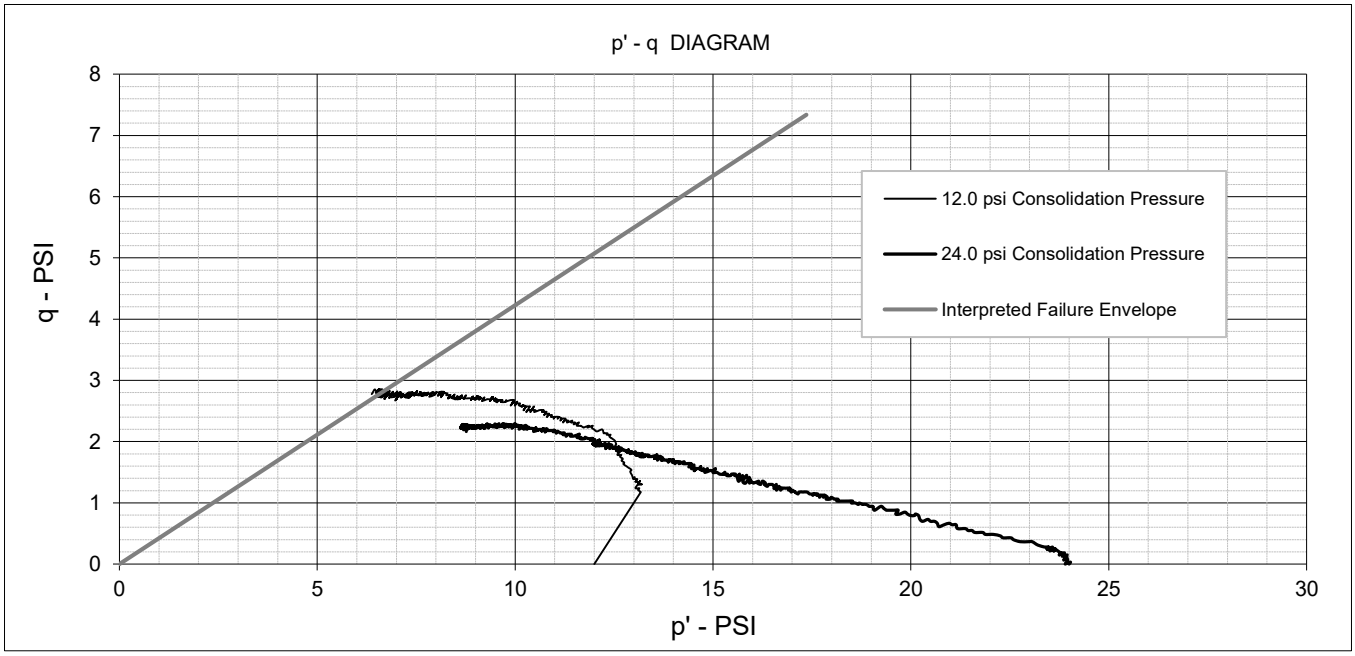




SPECIMEN FAILURE ILLUSTRATIONS

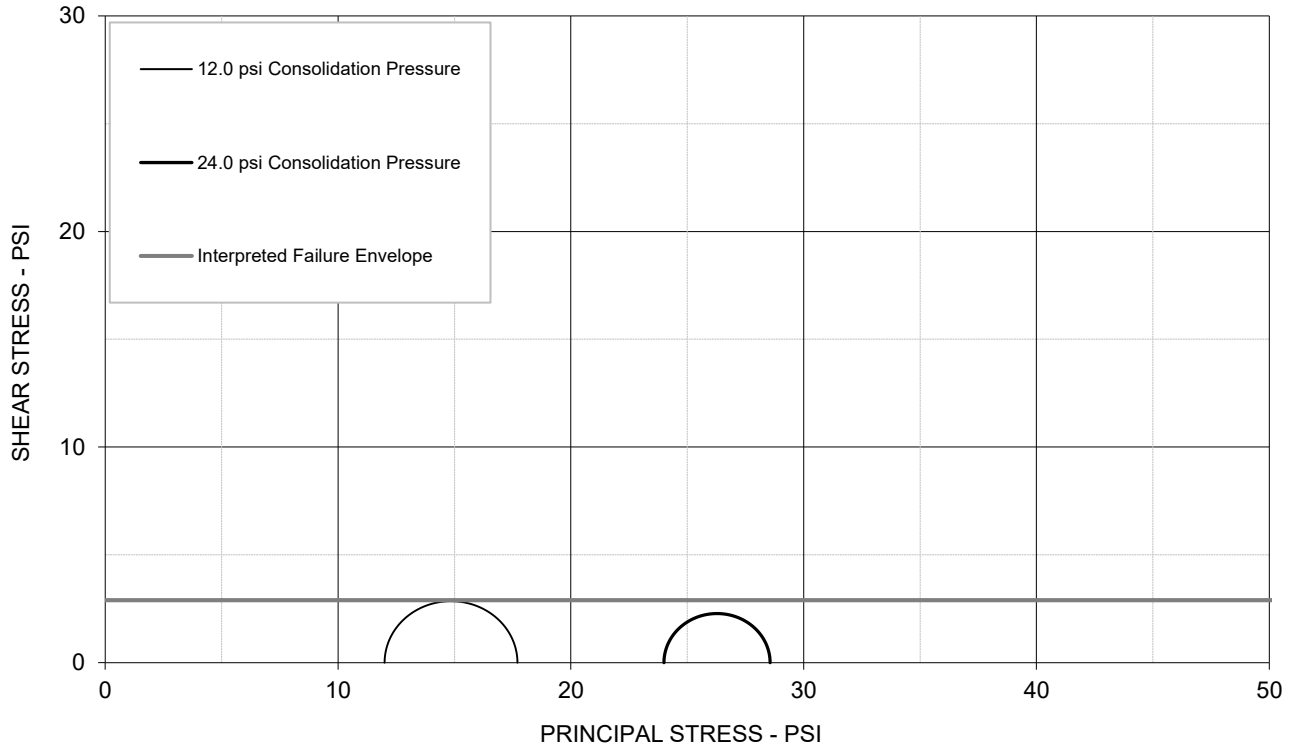
1

2

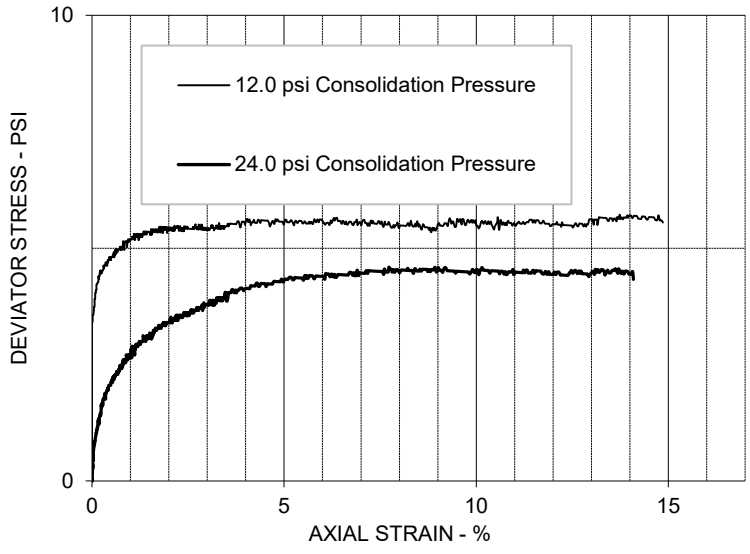


EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α = 22.9 deg	a = 0.0 psi
PROJECT: FGD Waste Water Pond at William Station		ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION	
LOCATION: Charleston, SC		CLIENT: Dominion Energy	
SAMPLE: STB-6 15-17'		**1450 Fifth St W**	
DESCRIPTION: Green-Blue & Gray CL		**North Charleston, SC**	Terracon

ICU TRIAXIAL COMPRESSION TEST



TOTAL STRESS PARAMETERS	ϕ = 0.0 deg	c = 2.9 psi



SPECIMEN NO.	1	2
INITIAL		
Moisture Content - %	45.9	31.6
Dry Density - pcf	73.1	82.4
Diameter - inches	2.84	2.83
Height - inches	6.05	5.94
AT TEST		
Final Moisture - %	36.0	42.3
Dry Density - pcf	73.1	82.4
Calculated Diameter (in.)	2.84	2.83
Height - inches	6.05	5.94
Effect. Consol. Stress - psi	12.0	24.0
Failure Stress - psi	5.71	4.56
Total Pore Pressure - psi	99.7	111.3
Strain Rate - inches/min.	0.0017	0.0017
Failure Strain - %	14.7	13.6
σ_1 Failure - psi	17.71	28.56
σ_3 Failure - psi	12.00	24.00

TEST DESCRIPTION

ISOTROPICALLY CONSOLIDATED, UNDRAINED TRIAXIAL COMPRESSION

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Green-Blue & Gray CL

SAMPLE: STB-6 15-17'

ASSUMED SPECIFIC GRAVITY: 2.65

LL: 37 PL: 13 PI: 24 Percent -200:

REMARKS: PI Sample were prepared using the Wet Method

PROJECT INFORMATION

PROJECT: FGD Waste Water Pond at William Station

LOCATION: Charleston, SC

PROJECT NO: EN195074

CLIENT: Dominion Energy

DATE: 08.29.19

1450 Fifth St W
North Charleston, SC

Terracon

STB 6 - 15'-17' - 12-24 psi

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

CPT GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

FGD Waste Water Pond at William Station ■ Goose Creek, SC

Terracon Project No. EN195074

Terracon GeoReport

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater and net area ratio effects
$q_t = q_c + u_2(1 - a)$

Where a is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85

Pore Pressure, u
Pore pressure measured during penetration
u_1 - sensor on the face of the cone
u_2 - sensor on the shoulder (more common)

Sleeve Friction, f_s
Frictional force acting on the sleeve divided by its surface area

Normalized Friction Ratio, F_r
The ratio as a percentage of f_s to q_t, accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, V_s
Measured in a Seismic CPT and provides direct measure of soil stiffness

DESCRIPTION OF GEOTECHNICAL CORRELATIC

Normalized Tip Resistance, Q_{tn}
$Q_{tn} = ((q_t - \sigma_{v0})/P_a)(P_a/\sigma'_{v0})^n$
$n = 0.381(I_c) + 0.05(\sigma'_{v0}/P_a) - 0.15$

Over Consolidation Ratio, OCR
$OCR\ (1) = 0.25(Q_{tn})^{1.25}$
$OCR\ (2) = 0.33(Q_{tn})$

Undrained Shear Strength, S_u
$S_u = Q_{tn} \times \sigma'_{v0}/N_{kt}$
N_{kt} is a soil-specific factor (shown on S_u plot)

Sensitivity, S_t
$S_t = (q_t - \sigma_{v0}/N_{kt}) \times (1/f_s)$

Effective Friction Angle, ϕ'
$\phi'\ (1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{v0}) + 0.29])$
$\phi'\ (2) = 17.6 + 11[\log(Q_{tn})]$

Unit Weight, γ
$\gamma = (0.27[\log(F_r)]+0.36[\log(q_t/atm)]+1.236) \times \gamma_{water}$
σ_{v0} is taken as the incremental sum of the unit weights

Small Strain Shear Modulus, G_0
$G_0\ (1) = \rho V_s^2$
$G_0\ (2) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$

Soil Behavior Type Index, I_c
$I_c = [(3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2]^{0.5}$

SPT N_{60}
$N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817Ic)}$

Elastic Modulus, E_s (assumes $q/q_{ultimate} \sim 0.3$, i.e. FS = 3)
$E_s\ (1) = 2.6\psi G_0$ where $\psi = 0.56 - 0.33\log Q_{tn,clean\ sand}$
$E_s\ (2) = G_0$
$E_s\ (3) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$
$E_s\ (4) = 2.5q_t$

Constrained Modulus, M
$M = \alpha_M(q_t - \sigma_{v0})$
For $I_c > 2.2$ (fine-grained soils)
$\alpha_M = Q_{tn}$ with maximum of 14
For $I_c < 2.2$ (coarse-grained soils)
$\alpha_M = 0.0188 \times 10^{(0.55Ic + 1.68)}$

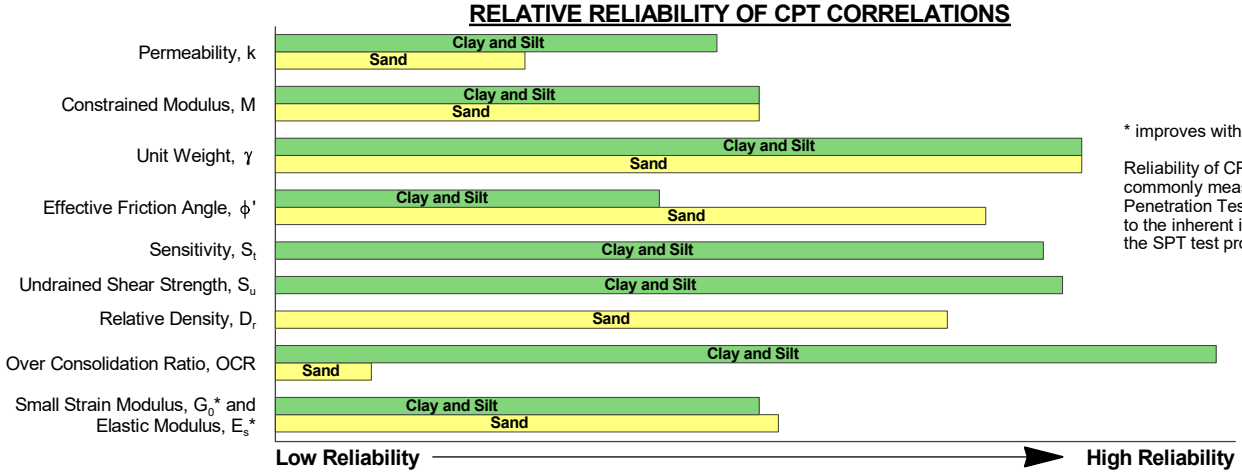
Hydraulic Conductivity, k
For $1.0 < I_c < 3.27$ $k = 10^{(0.952 - 3.04Ic)}$
For $3.27 < I_c < 4.0$ $k = 10^{(-4.52 - 1.37Ic)}$

Relative Density, D_r
$D_r = (Q_{tn} / 350)^{0.5} \times 100$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include q_t, f_s, and u. Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. To this end, more than one correlation to a given parameter may be provided. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



* improves with seismic V_s measurements

Reliability of CPT-predicted N_{60} values as commonly measured by the Standard Penetration Test (SPT) is not provided due to the inherent inaccuracy associated with the SPT test procedure.

WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

Measured - Depth to water directly measured in the field

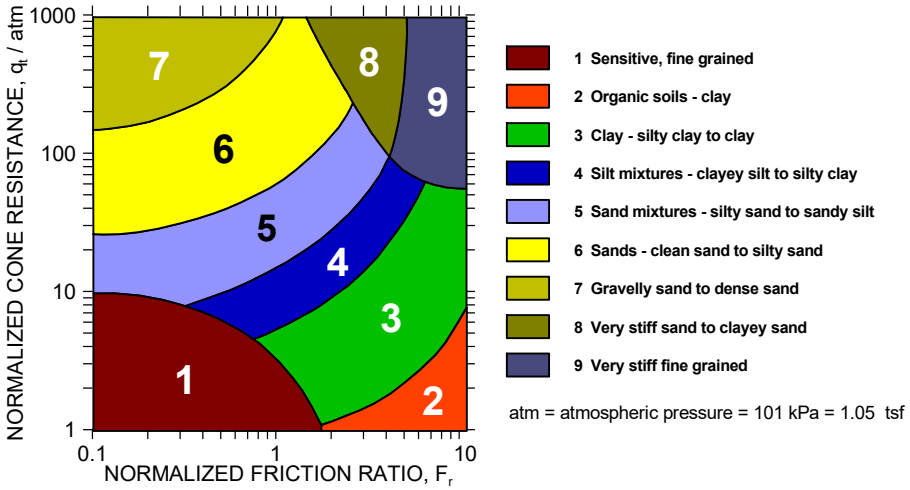
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (f_s), and porewater pressure (u_2). The normalized friction ratio (F_r) is used to classify the soil behavior type.

Typically, silts and clays have high F_r values and generate large excess penetration porewater pressures; sands have lower F_r's and do not generate excess penetration porewater pressures. The adjacent graph (Robertson *et al.*) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



atm = atmospheric pressure = 101 kPa = 1.05 tsf

REFERENCES

Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.

Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institue of Technology, Atlanta, GA.

Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.

Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

FGD Waste Water Pond at William Station ■ Goose Creek, SC

Terracon Project No. EN195074

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Shelby Tube Split Spoon	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

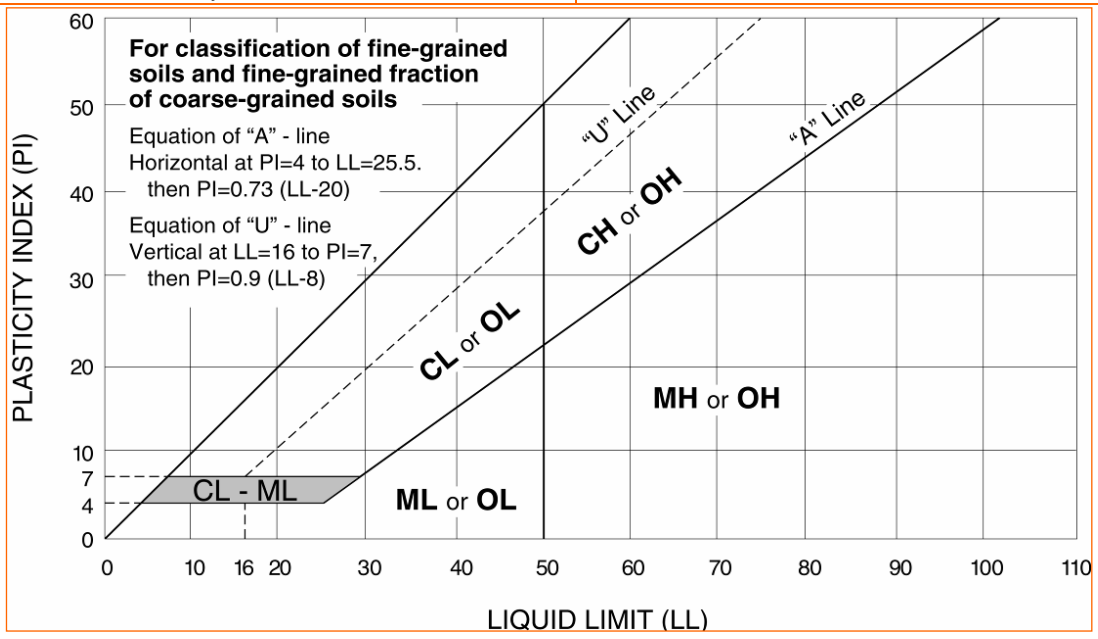
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

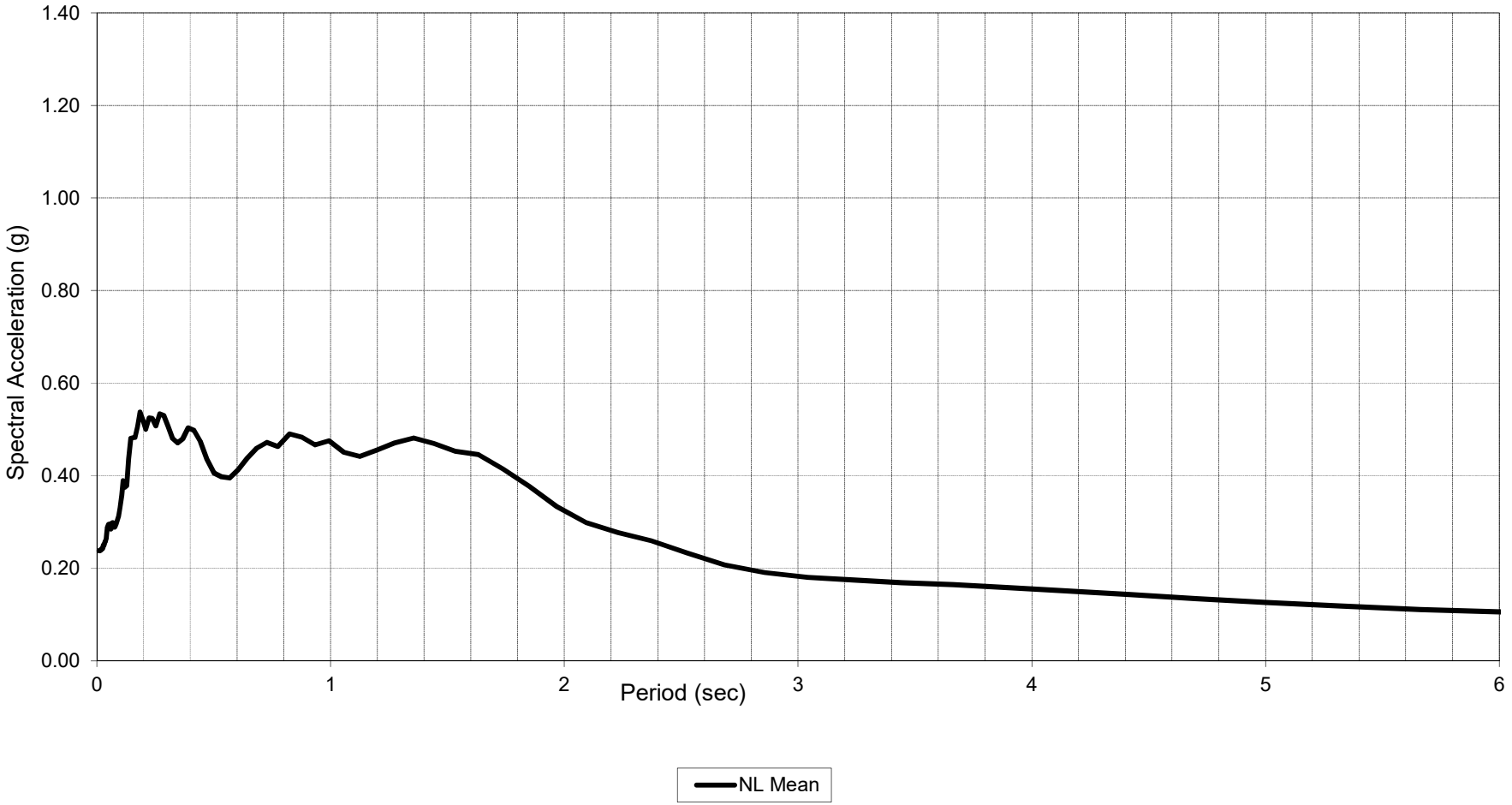
[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

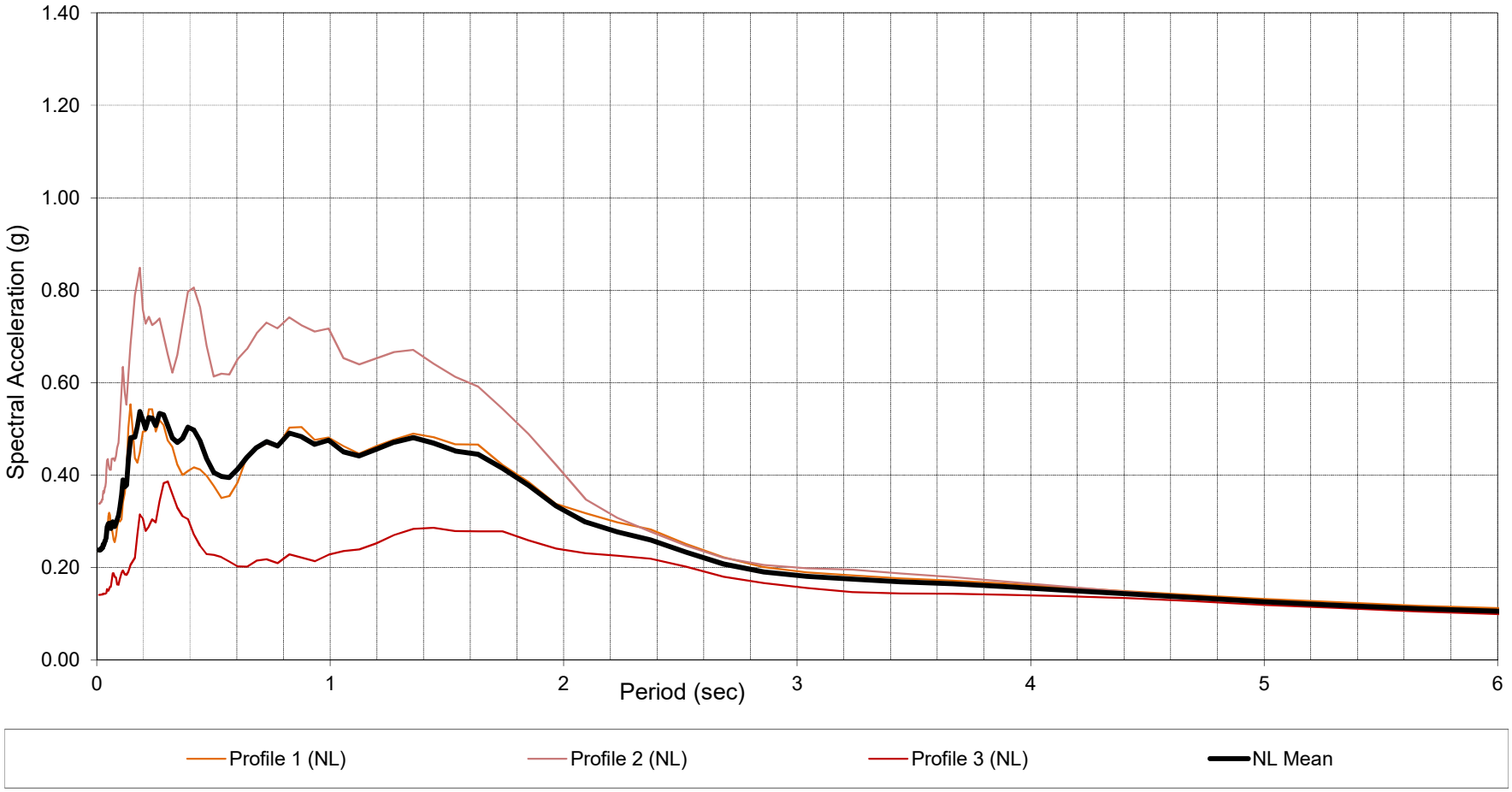
[Q] PI plots below "A" line.





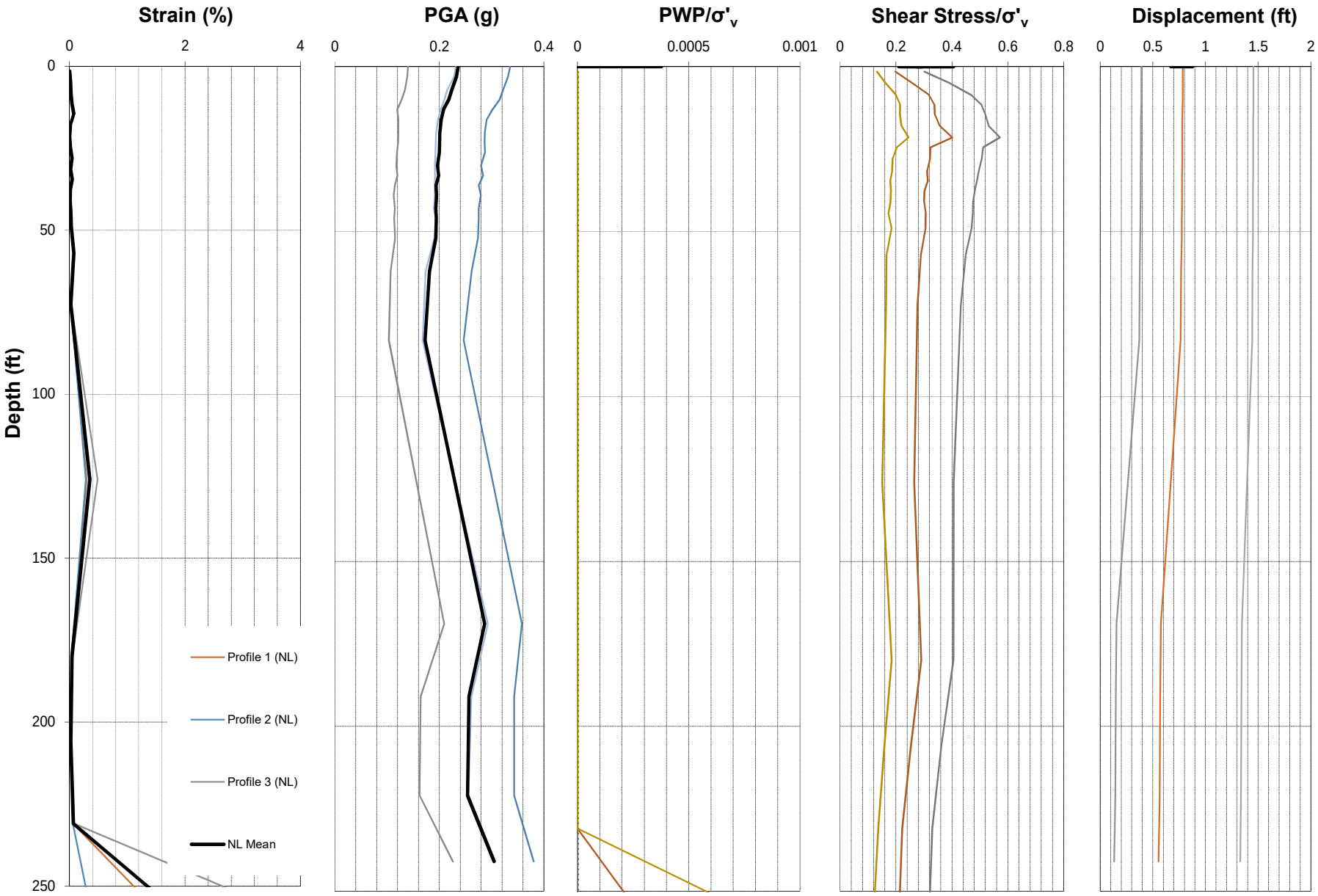
Terracon

SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS
PROFILE RESULTS - COMPILATION OF PROFILE AVERAGES
Williams FGD Waste Water Pond Seismic Eval
Goose Creek, SC
Terracon Project No: EN195074



Terracon

SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS
PROFILE RESULTS - COMPILATION OF PROFILE AVERAGES
Williams FGD Waste Water Pond Seismic Eval
Goose Creek, SC
Terracon Project No: EN195074



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS

PROFILE RESULTS - COMPILATION OF PROFILE AVERAGES

Williams FGD Waste Water Pond Seismic Ev

Goose Creek, SC

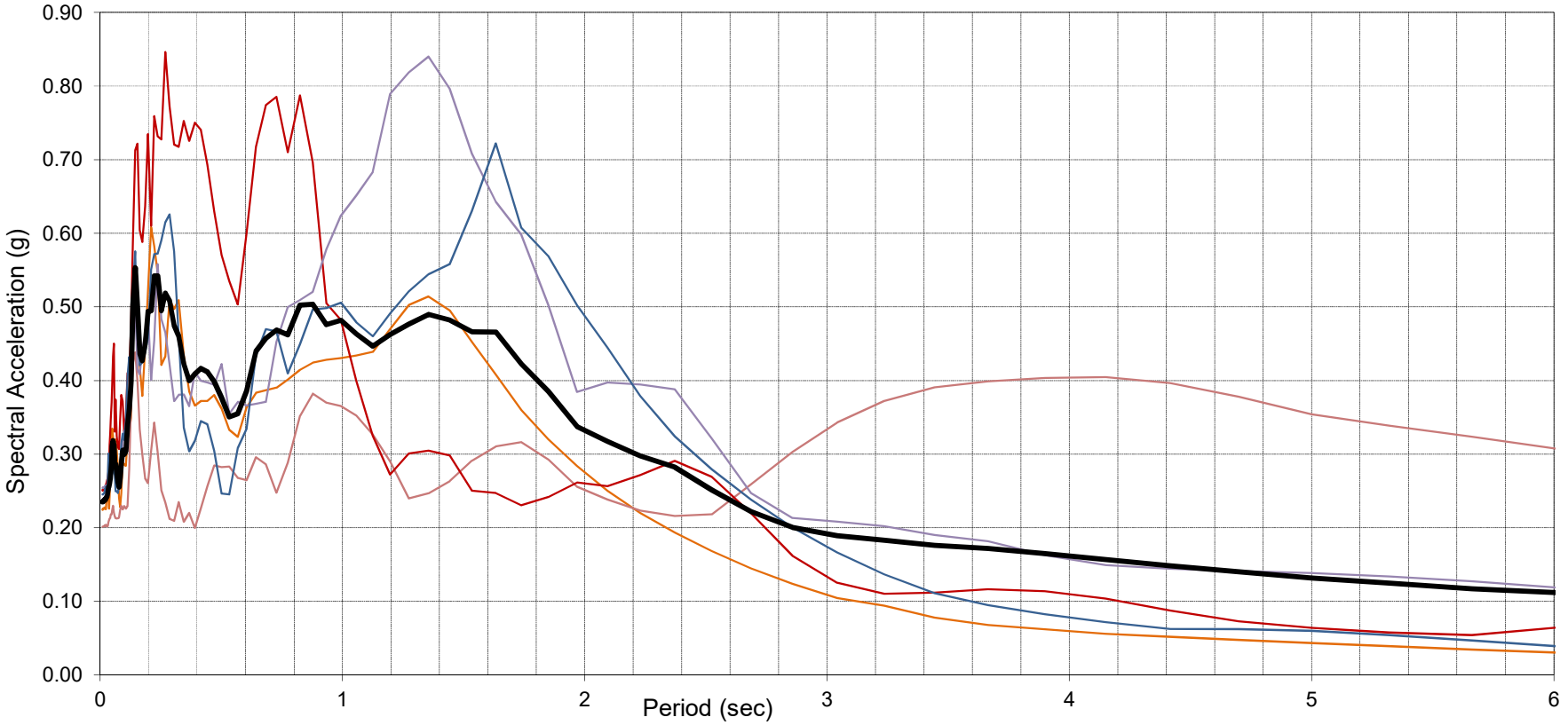
Terracon Project No: EN195074

Notes:

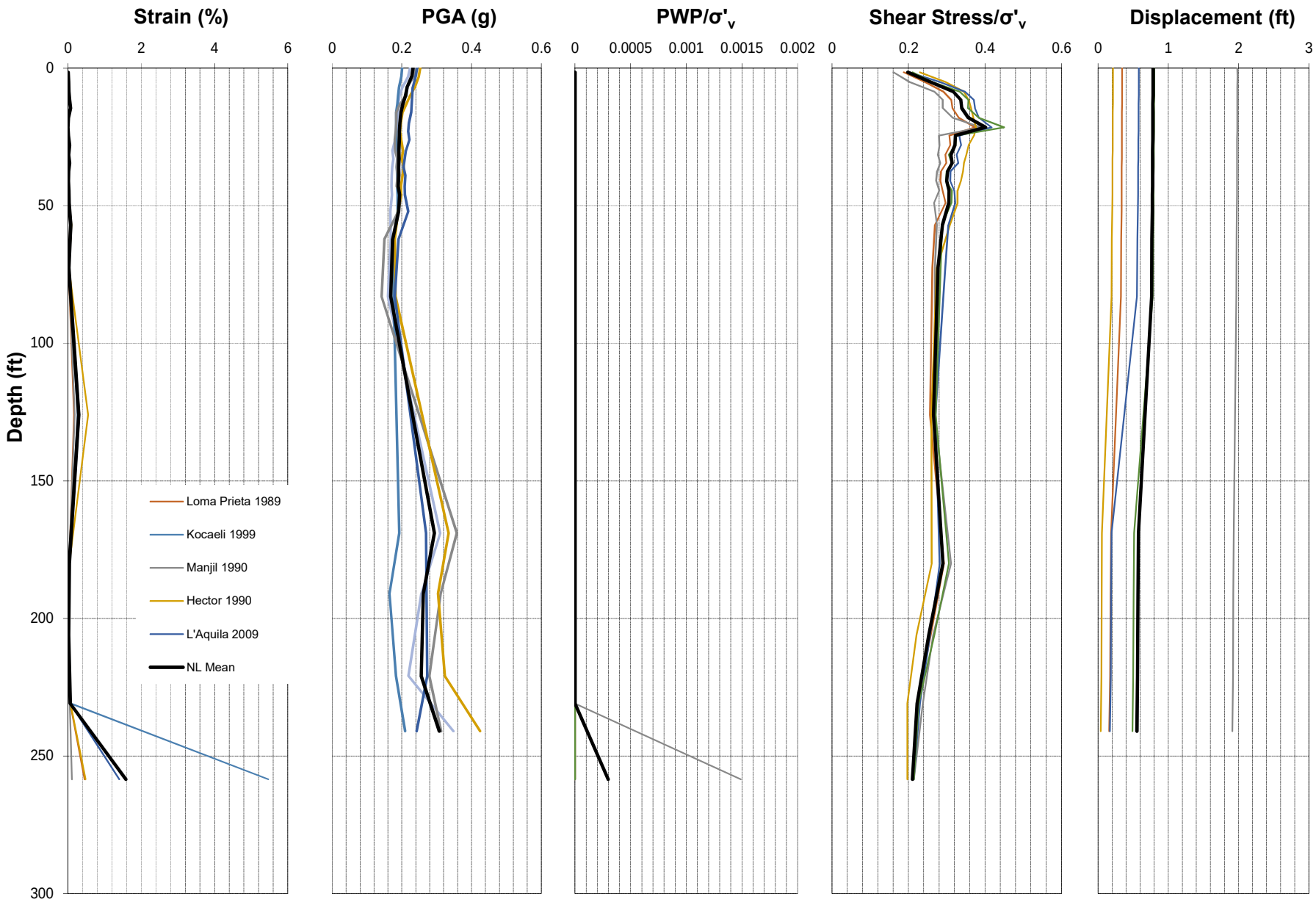
-Porewater pressure, PWP, and shear stress are normalized by initial vertical effective stress

-Displacement and shear strain plots represent maximum transient values during shaking, not necessarily permanent offset

Horizontal Acceleration Response Spectra at GROUND SURFACE
Damping = 5 %



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS
PROFILE 1 - BASELINE
Williams FGD Waste Water Pond Seismic Eval
Goose Creek, SC
Terracon Project No: EN195074



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS

PROFILE 1 - BASELINE

Williams FGD Waste Water Pond Seismic Ev

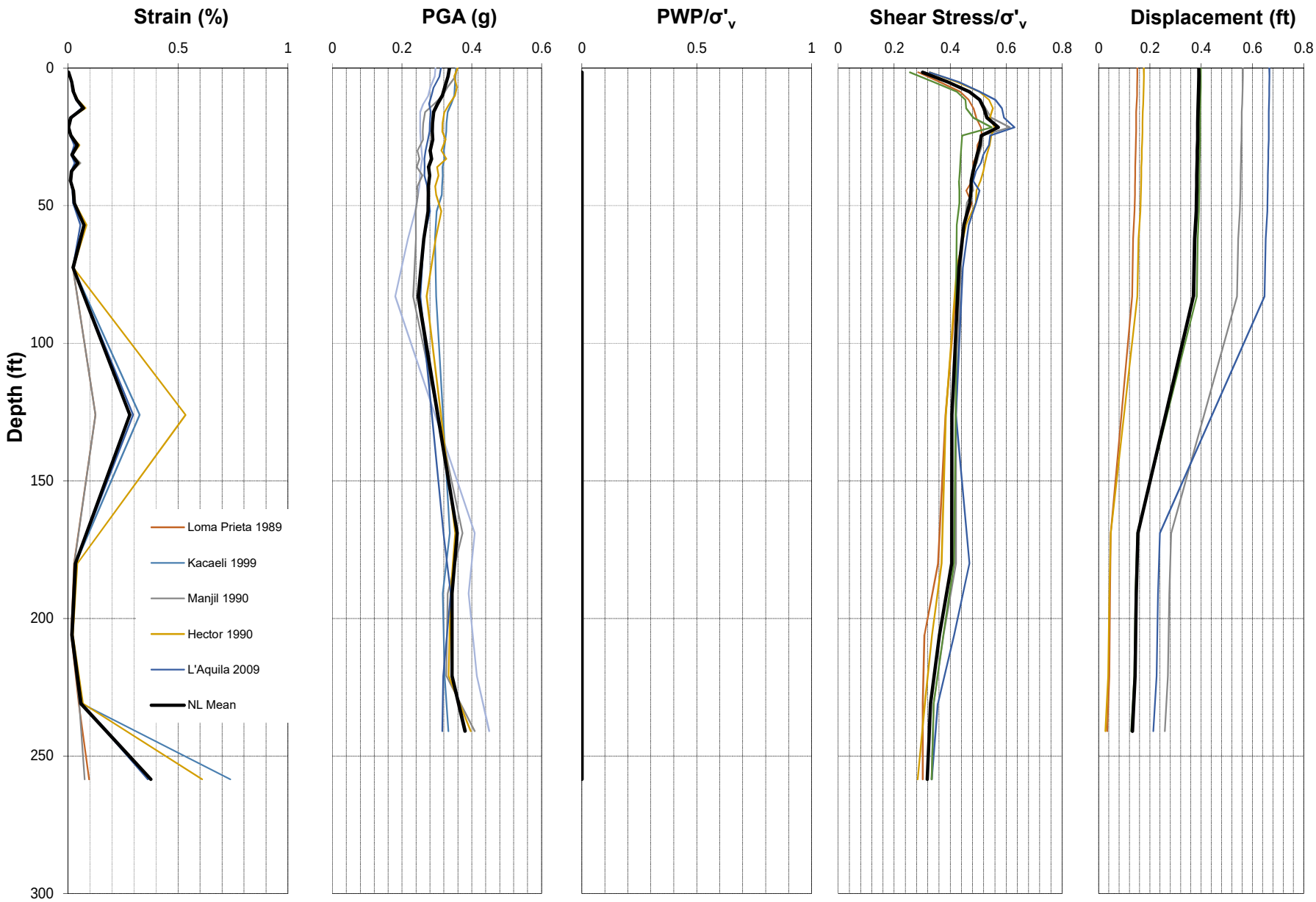
Goose Creek, SC

Terracon Project No: EN195074

Notes:

-Porewater pressure, PWP, and shear stress are normalized by initial vertical effective stress

-Displacement and shear strain plots represent maximum transient values during shaking, not necessarily permanent offset



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS

PROFILE 2 - UPPER ESTIMATE (+25% Vs)

Williams FGD Waste Water Pond Seismic Ev

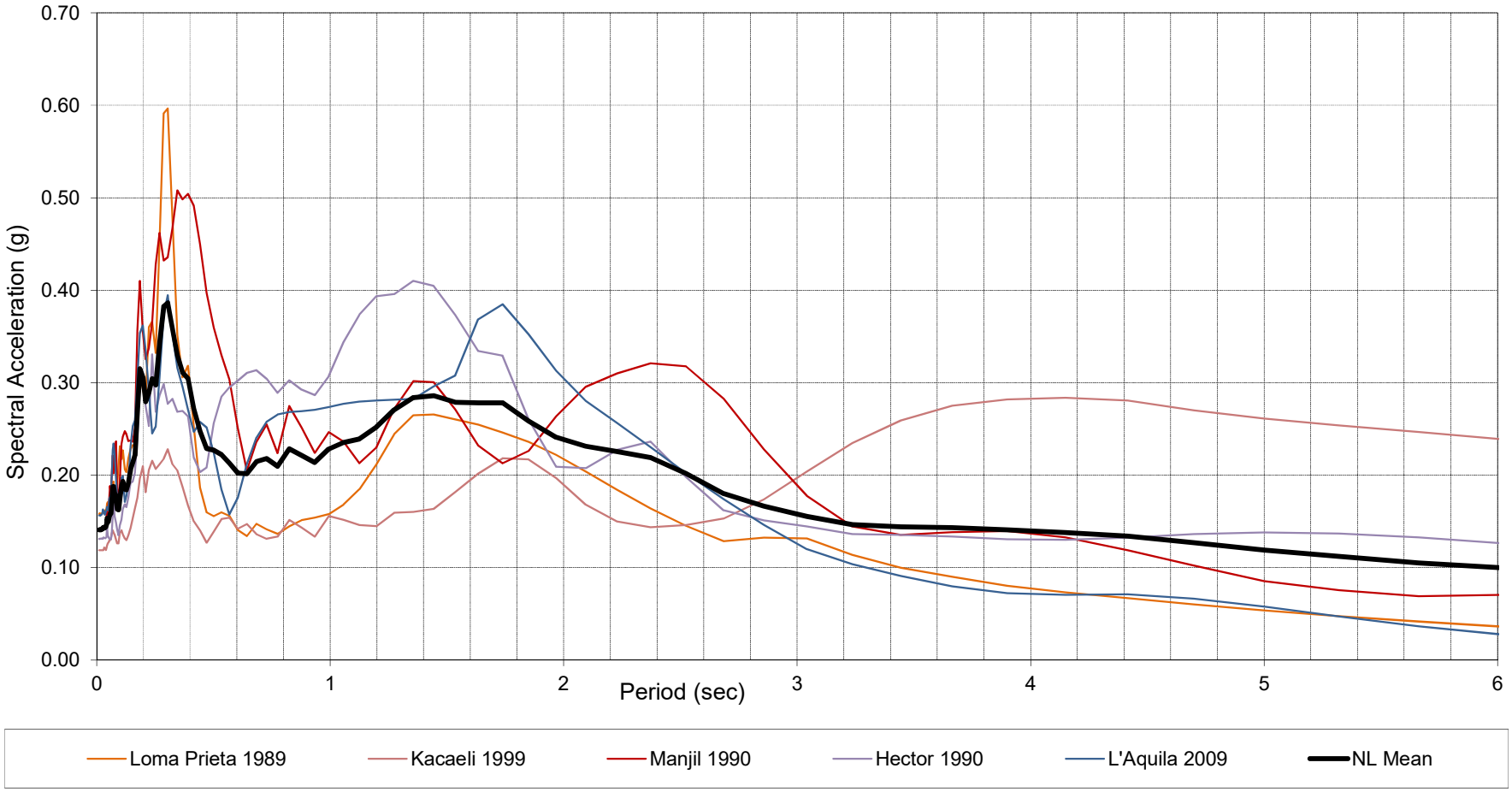
Goose Creek, SC

Terracon Project No: EN195074

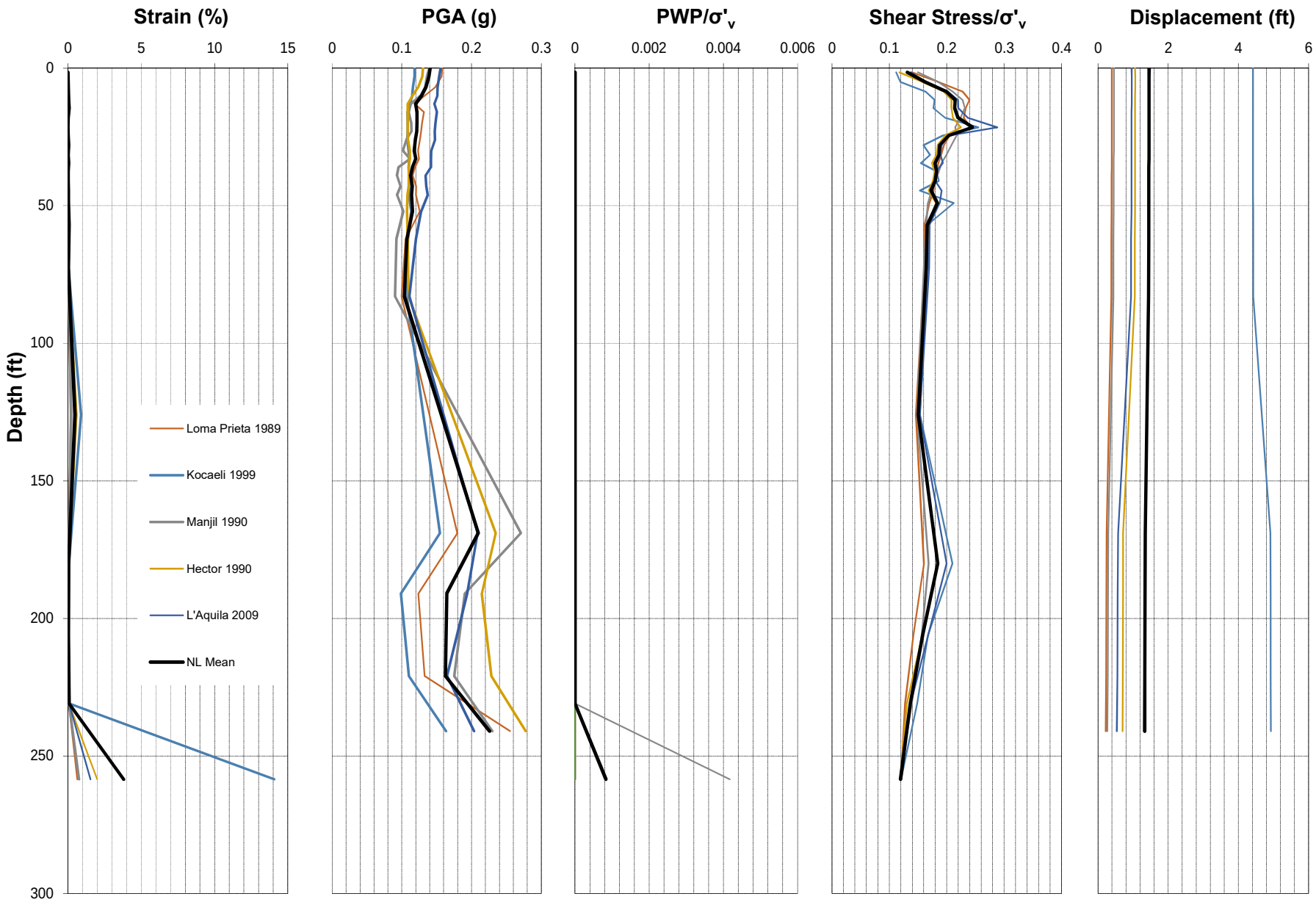
Notes:

-Porewater pressure, PWP, and shear stress are normalized by initial vertical effective stress

-Displacement and shear strain plots represent maximum transient values during shaking, not necessarily permanent offset



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS
PROFILE 3 - LOWER ESTIMATE (-25% Vs)
Williams FGD Waste Water Pond Seismic Eval
Goose Creek, SC
Terracon Project No: EN195074



SITE SPECIFIC SEISMIC RESPONSE - NONLINEAR METHODS

PROFILE 3 - LOWER ESTIMATE (-25% Vs)

Williams FGD Waste Water Pond Seismic Ev

Goose Creek, SC

Terracon Project No: EN195074

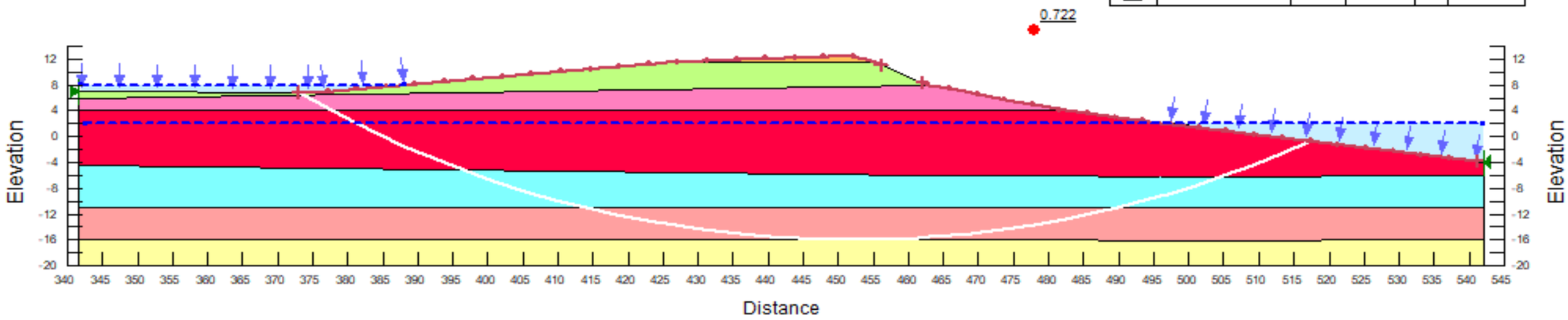
Notes:

-Porewater pressure, PWP, and shear stress are normalized by initial vertical effective stress

-Displacement and shear strain plots represent maximum transient values during shaking, not necessarily permanent offset

Title: South Pond
Name: East Embankment
Description: Earthquake Loading Condition - East Slope (Wetland Side)
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 0.722

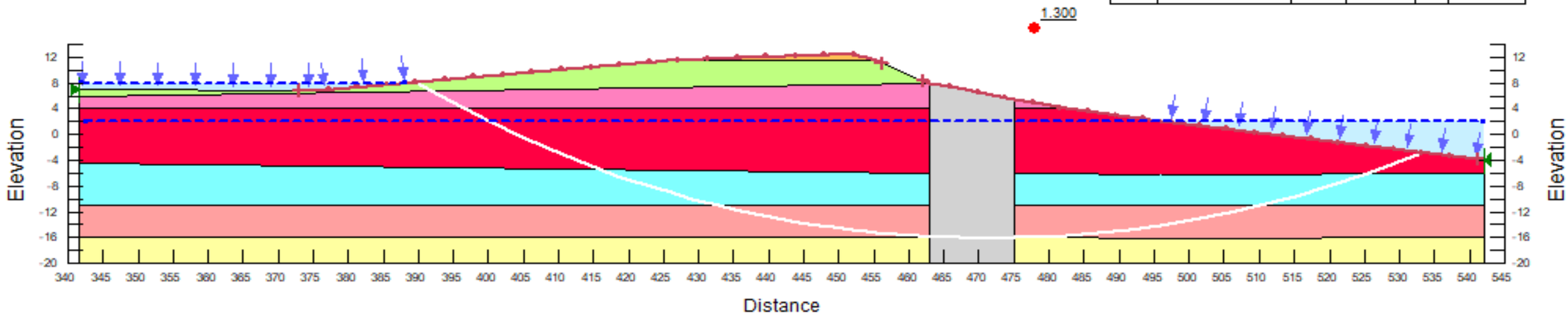
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (Fill) (SS)	115	1,000	0	2
	Clayey Sand (SS)	110	450	0	2
	Marl	115	2,500	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Sandy Fat Clay	110	1,000	0	2
	Silty Sand (SS)	120	0	10	2
	Unpaved Gravel Road	105	0	34	1



Project Mgr: HJC Drawn by: HJC Checked by: GL Approved by: GL	Terracon Project No. EN195074 Date: 11/26/2019	Terracon Consulting Engineers and Scientists 1450 Fifth Street West, North Charleston, South Carolina PH: (843) 884-1234, Fax: (843) 884-9234	**SLOPE STABILITY ANALYSIS** **SOUTH POND - EAST SLOPE** **Williams Station FGD Sediment Pond** Berkeley County, SC	**EXHIBIT**

Title: South Pond
Name: East Embankment w/ DSM
Description: Earthquake Loading - East Slope (Wetland Side) - Deep Soil Mixed Columns
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 1.300

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (Fill) (SS)	115	1,000	0	2
	Clayey Sand (SS)	110	450	0	2
	Marl	115	2,500	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Sandy Fat Clay	110	1,000	0	2
	Silty Sand (SS)	120	0	10	2
	Soil Mixed Columns	110	5,500	0	2
	Unpaved Gravel Road	105	0	34	1

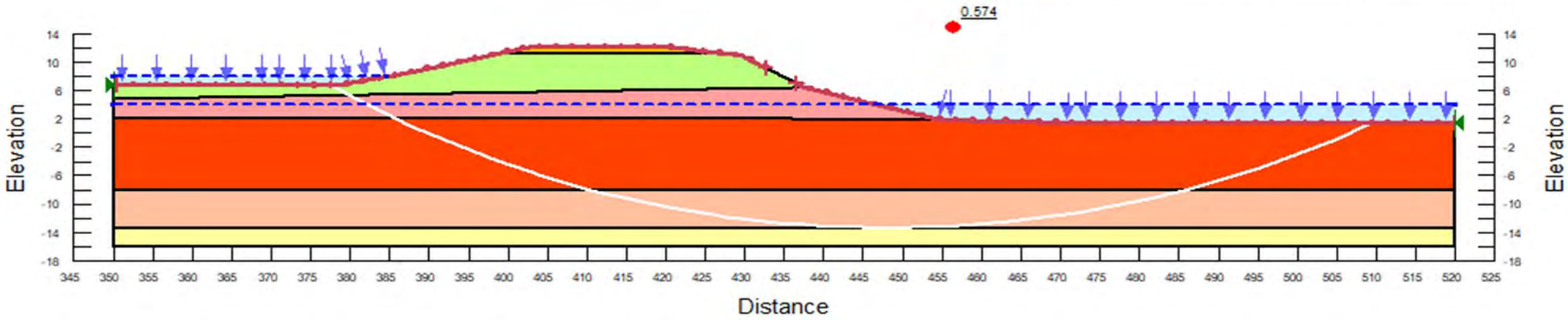


Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	**SLOPE STABILITY ANALYSIS**
Drawn by: HJC		1450 Fifth Street West, North Charleston, South Carolina	**SOUTH POND - EAST SLOPE - DSM**
Checked by: GL		PH: (843) 884-1234, Fax. (843) 884-9234	**Williams Station FGD Sediment Pond**
Approved by: GL	Date: 11/26/2019		Berkeley County, SC

EXHIBIT

Title: South Pond
Name: South Embankment
Description: Earthquake Loading - South Slope
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 0.574

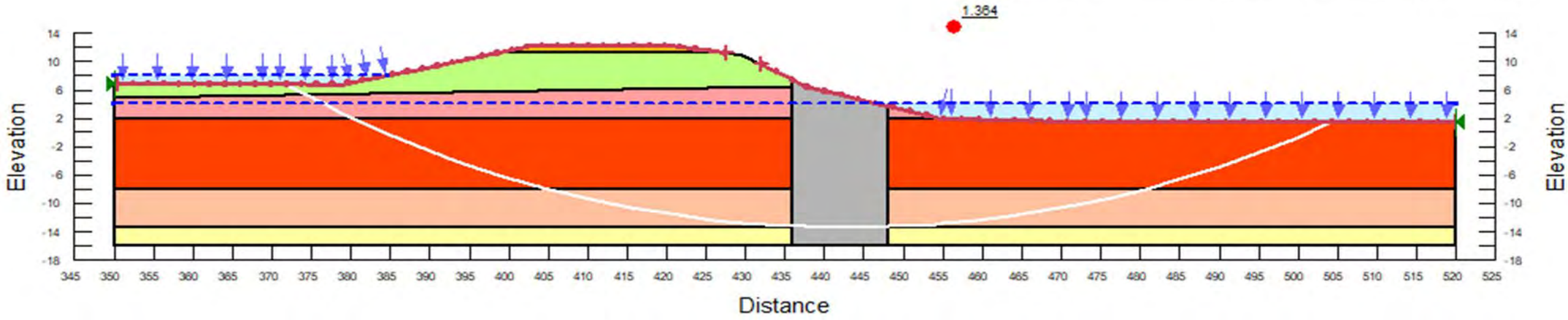
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Gravel Road	105	0	34	1
	Marl	115	2,500	0	2
	Sandy Clay	115	1,000	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Silty Sand (SS)	120	0	10	2



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	**SLOPE STABILITY ANALYSIS SOUTH POND - SOUTH SLOPE**
Drawn by: HJC		1450 Fifth Street West North Charleston, South Carolina	**Williams Station FGD Sediment Pond**
Checked by: GL		PH: (843) 884-1234 Fax: (843) 884-9234	Berkeley County, SC
Approved by: GL	Date: 11/26/2019		**EXHIBIT**

Title: South Pond
Name: South Embankment w/ DSM
Description: Earthquake Loading - South Slope - Deep Soil Mixed Columns
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 1.364

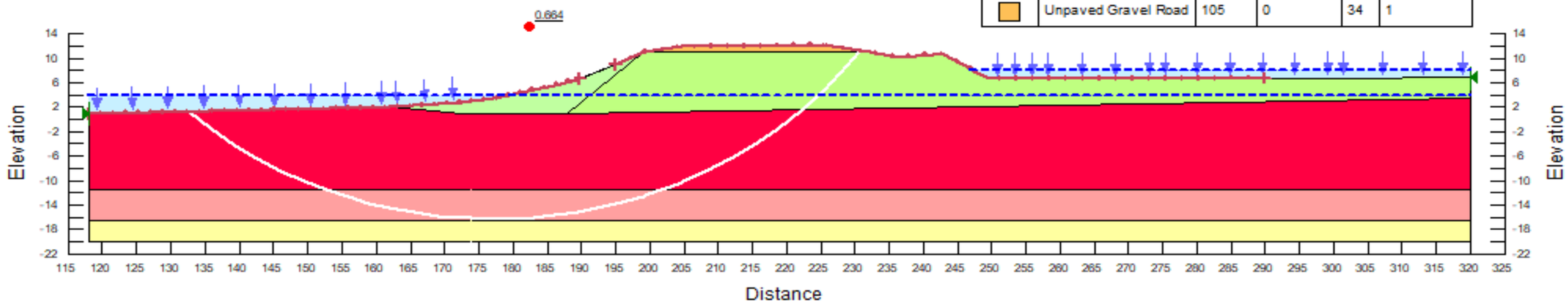
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Gravel Road	105	0	34	1
	Marl	115	2,500	0	2
	Sandy Clay	115	1,000	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Silty Sand (SS)	120	0	10	2
	Soil Mixed Columns	110	5,500	0	2



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	SLOPE STABILITY ANALYSIS SOUTH POND - SOUTH SLOPE - DSM Williams Station FGD Sediment Pond Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019	1450 Fifth Street West North Charleston, South Carolina PH: (843) 884-1234 Fax: (843) 884-9234	EXHIBIT

Title: South Pond
Name: West Embankment
Description: Earthquake Loading - West Slope
Method: Spencer
Direction of movement: Right to Left
Horz Seismic Coef.: 0.354
F of S: 0.664

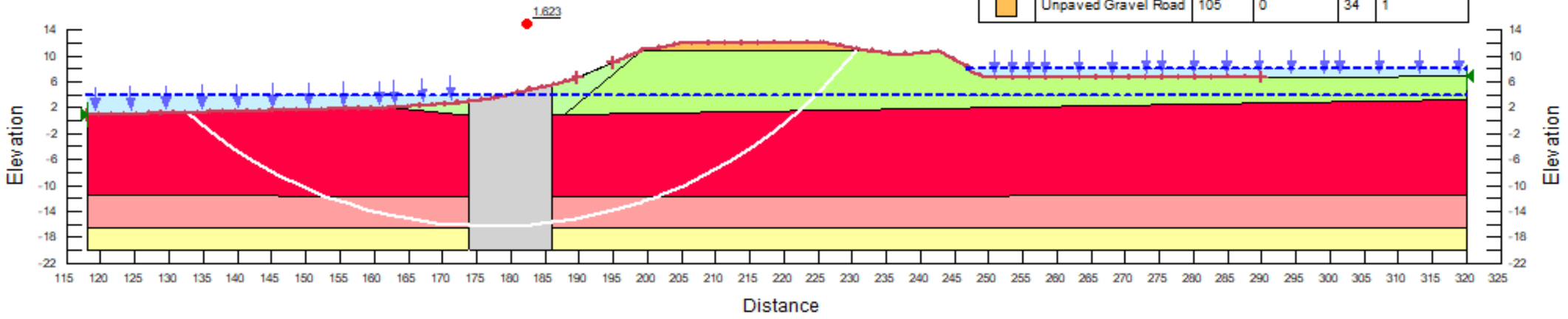
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Marl	115	2,500	0	2
	Sandy Clay (Fil)	115	1,000	0	1
	Sandy Clay (Fil) (2)	115	1,000	0	2
	Silty Sand (SS)	120	0	10	2
	Unpaved Gravel Road	105	0	34	1



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	SLOPE STABILITY ANALYSIS SOUTH POND - WEST SLOPE Williams Station FGD Sediment Pond Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019	1450 Fifth Street West, North Charleston, South Carolina PH: (843) 884-1234 Fax. (843) 884-9234	EXHIBIT

Title: South Pond
Name: West Embankment w/ DSM
Description: Earthquake Loading - West Slope - Deep Soil Mixed Columns
Method: Spencer
Direction of movement: Right to Left
Horz Seismic Coef.: 0.354
F of S: 1.623

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Marl	115	2,500	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Sandy Clay (Fill) (2)	115	1,000	0	2
	Silty Sand (SS)	120	0	10	2
	Soil Mixed Columns	110	5,500	0	2
	Unpaved Gravel Road	105	0	34	1



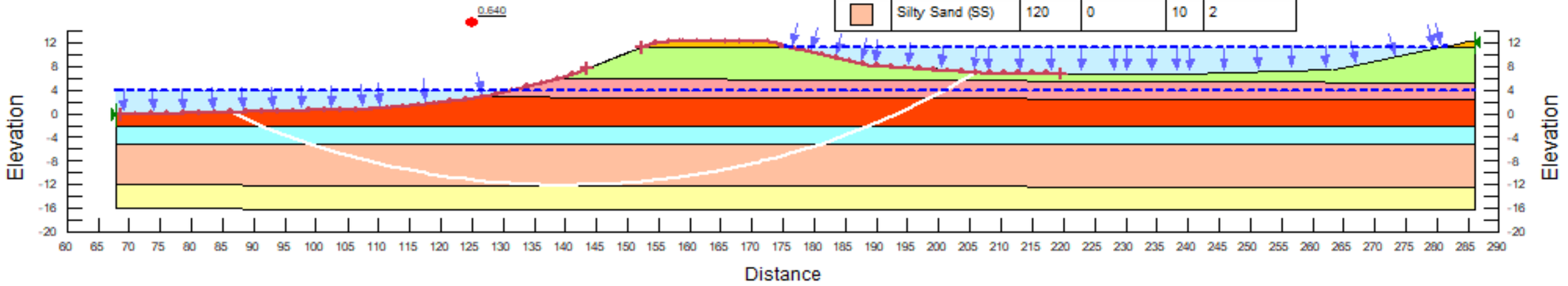
Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	SLOPE STABILITY ANALYSIS SOUTH POND - WEST SLOPE - DSM Williams Station FGD Sediment Pond Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019		

1450 Fifth Street West North Charleston, South Carolina
PH: (843) 884-1234 Fax: (843) 884-9234

EXHIBIT

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Fat Clay (SS)	110	1,000	0	2
	Gravel Road	105	0	34	1
	Marl	115	2,500	0	2
	Sandy Clay	115	1,000	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Silty Sand (SS)	120	0	10	2

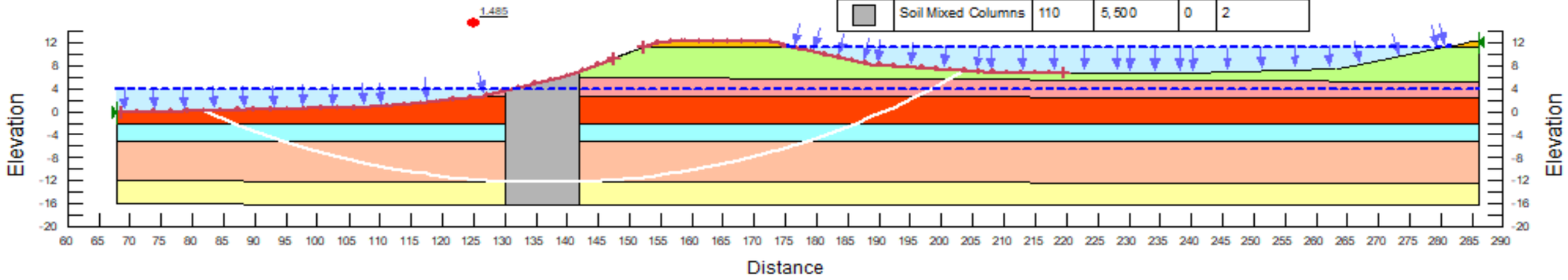
Title: North Pond
Name: North Embankment
Description: Earthquake Loading - North Slope
Method: Spencer
Direction of movement: Right to Left
Horz Seismic Coef.: 0.354
F of S: 0.640



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	**SLOPE STABILITY ANALYSIS NORTH POND - NORTH SLOPE**
Drawn by: HJC		1450 Fifth Street West North Charleston, South Carolina	**Williams Station FGD Sediment Pond**
Checked by: GL		PH: (843) 884-1234 Fax. (843) 884-9234	Berkeley County, SC
Approved by: GL	Date: 11/26/2019		**EXHIBIT**

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clayey Sand (SS)	110	450	0	2
	Fat Clay (SS)	110	1,000	0	2
	Gravel Road	105	0	34	1
	Marl	115	2,500	0	2
	Sandy Clay	115	1,000	0	2
	Sandy Clay (Fill)	115	1,000	0	1
	Silty Sand (SS)	120	0	10	2
	Soil Mixed Columns	110	5,500	0	2

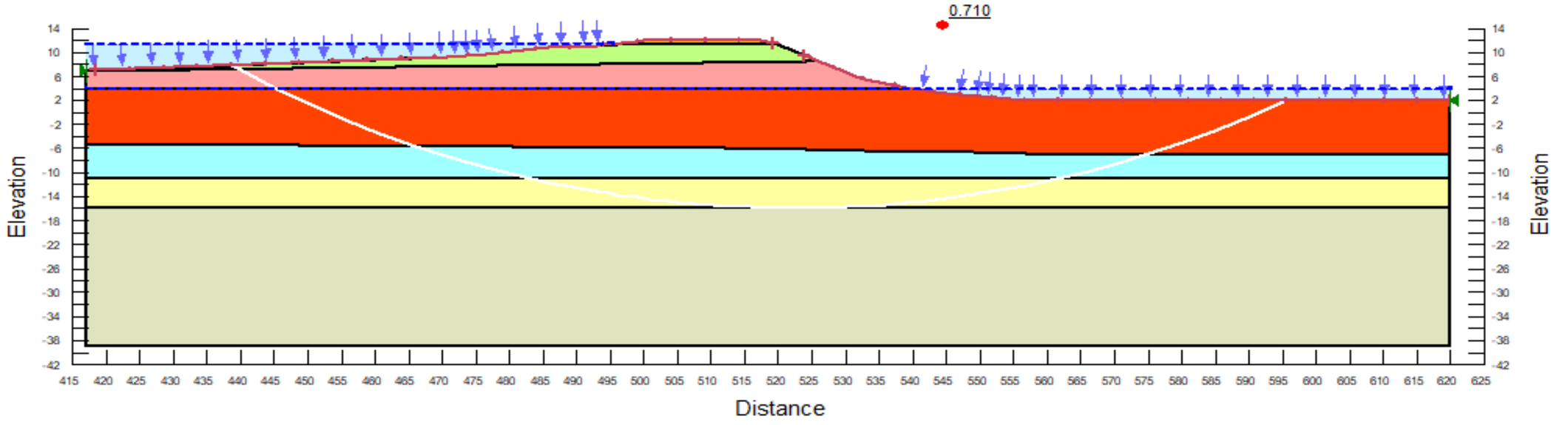
Title: North Pond
Name: North Embankment w/ DSM
Description: Earthquake Loading - North Slope - Deep Soil Mixed Columns
Method: Spencer
Direction of movement: Right to Left
Horz Seismic Coef.: 0.354
F of S: 1.485



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	**SLOPE STABILITY ANALYSIS** **NORTH POND - NORTH SLOPE - DSM** **Williams Station FGD Sediment Pond** Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019	1450 Fifth Street West North Charleston, South Carolina PH: (843) 884-1234 Fax. (843) 884-9234	**EXHIBIT**

Title: North Pond
Name: East Embankment
Description: Earthquake Loading - East Slope (Wetland Side)
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 0.710

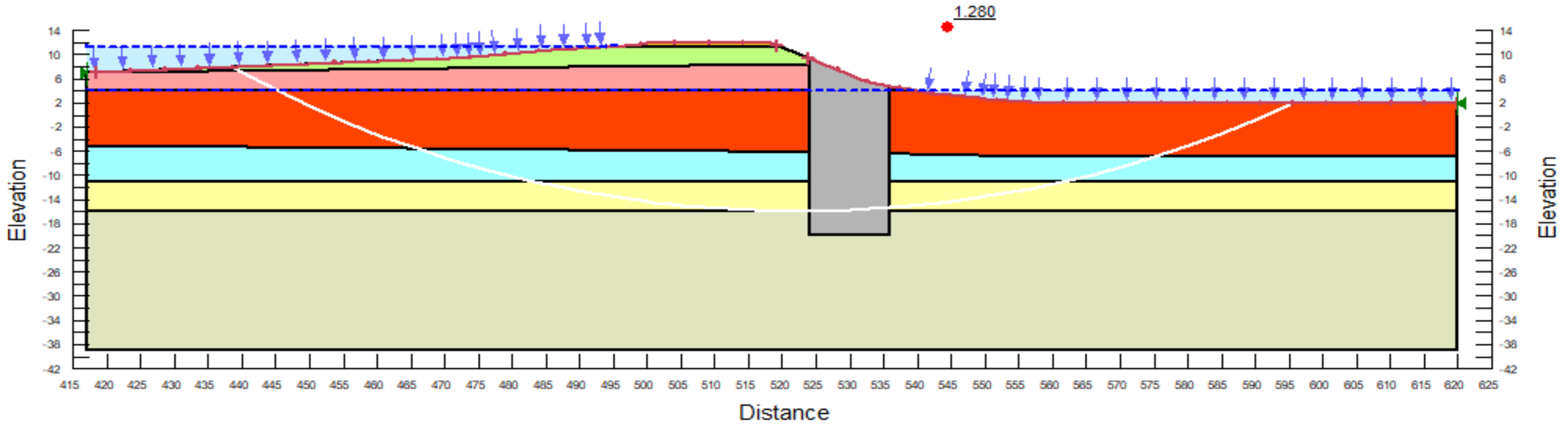
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay (Fill) (SS)	110	1,000	0	1
	Clayey Sand (Fill) (SS)	115	1,000	0	1
	Clayey Sand (SS)	115	450	0	2
	Consolidated Clay	110	1,000	0	2
	Cooper Marl (Sandy Silt)	115	2,500	0	2
	Silty Sand	120	0	10	2
	Unpaved Road Surface	105	0	34	1



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	SLOPE STABILITY ANALYSIS NORTH POND - EAST SLOPE Williams Station FGD Sediment Pond Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019	1450 Fifth Street West, North Charleston, South Carolina PH: (843) 884-1234 Fax. (843) 884-9234	EXHIBIT

Title: North Pond
Name: East Embankment w/DSM
Description: Earthquake Loading - East Slope (Wetland Side) - Deep Soil Mixed Columns
Method: Spencer
Direction of movement: Left to Right
Horz Seismic Coef.: 0.354
F of S: 1.280

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay (Fill) (SS)	110	1,000	0	1
	Clayey Sand (Fill) (SS)	115	1,000	0	1
	Clayey Sand (SS)	115	450	0	2
	Consolidated Clay	110	1,000	0	2
	Cooper Marl (Sandy Silt)	115	2,500	0	2
	Silty Sand	120	0	10	2
	Soil Mixed Columns	110	5,500	0	1
	Unpaved Road Surface	105	0	34	1



Project Mgr: HJC	Terracon Project No. EN195074	Terracon Consulting Engineers and Scientists	SLOPE STABILITY ANALYSIS NORTH POND - EAST SLOPE - DSM Williams Station FGD Sediment Pond Berkeley County, SC
Drawn by: HJC			
Checked by: GL			
Approved by: GL	Date: 11/26/2019	1450 Fifth Street West, North Charleston, South Carolina PH: (843) 884-1234 Fax: (843) 884-9234	EXHIBIT

Specification for Deep Soil Mixing

H. Jay Cerceo, P.E.
Senior Geotechnical Engineer
SC License No. 37816

Thomas C. Smoak, III, P.E.
Geotechnical Department Manager
SC License No. 30792

Guoming Lin, Ph.D, P.E., D.GE.
Senior Geotechnical Consultant
SC License No. 16696

Williams Station
Goose Creek, South Carolina

Terracon Project No. EN195074

Prepared for:
Dominion Energy
Cayce, South Carolina

Prepared by:
Terracon Consultants, Inc.
North Charleston, South Carolina

PART 1 - GENERAL

1.1 CONTENTS

1.1.1 Design and Constructing Deep Soil Mixing (DSM) test section and production columns at the locations and elevations indicated on the Contract Drawings.

1.1.2 The purpose of the DSM columns is to stabilize the subsurface soils to resist seismic loads. The stabilization plan consists of a series of DSM panels formed underground using secant DSM columns. The dimensions and layout of DSM column panels as well as preliminary DSM column strength are shown in the Geotechnical Report. These values are for the purpose of illustrating the scope of the work. Final mix design and layout is to be by the specialty geotechnical Contractor referred hereafter as the Contractor.

1.2 REFERENCES

The publications listed below form a portion of the requirements to the extent referenced herein. The publications referred heretofore by basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM C 150 Standard Specification for Portland Cement
- ASTM C 192 / C 192M Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
- ASTM D 1633 Compressive Strength of Molded Soil-Cement Cylinders
- ASTM D 2166 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
- ASTM D 4380 Standard Test Method for Density of Bentonitic Slurries
- ASTM D 4832 Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.3 DEFINITIONS

1.3.1 DSM Panel: Soil-cement columns constructed by treating soils in place by soil-cement mixing technology.

1.3.1.1 DSM column is formed by a single soil mixing shaft guided by a lead mounted to a crawler base machine.

1.3.1.2 The mixing shaft shall be driven by a power source sufficient to provide torque for the wide range of expected drilling conditions, indicated by the available soil test boring, cone penetration test logs and other test data included in the Geotechnical Report.

1.3.1.3 The mixing shaft is positioned so as to overlap a secondary or primary column to form a continuously mixed secant column panel. After withdrawal, a soil-cement column remains in the ground.

1.3.1.4 The process is then repeated to form a continuous panel of secant columns.

1.3.2 Portland cement: A dry Type I/II Portland Cement powder satisfying the requirements of ASTM C 150 for use as an admixture to unimproved soil. The purpose of the binder is to optimize mixing, and upon setting, to strengthen the in situ soil.

1.3.3 Soil-Cement Ratio: A volumetric ratio of cement to in situ soil to be mixed.

1.3.4 Cement Dosage: The amount of cement (in terms of dry weight of cement) used to treat a given initial volume of the in-place soil.

1.3.5 Preconstruction Bench Scale Testing: Testing shall consist of obtaining representative soil samples from the site and conducting laboratory mix testing of different binder types and quantities to determine the initial mix design and mixing parameters for the production deep mixing. The Contractor's QC/QA Program Plan will establish the scope of the pre-construction bench scale testing program.

1.4 SYSTEM REQUIREMENTS

1.4.1 Geometric Tolerances: DSM columns shall be installed within the following geometric tolerances:

1.4.1.1 The horizontal alignment of the columns shall be within 6 inches of the planned centerline of the columns

1.4.1.2 The vertical inclination of the columns shall not exceed 1:100 (horizontal to vertical) for the full height.

1.4.1.3 The tops of the panels shall extend up to the Elevation shown on the Contract Drawings or DSM Plan.

1.4.1.4 The bottom of the columns shall extend down at least as deep as indicated on the Contract Drawings or as modified test columns in the field and reviewed by the Engineer or their agent.

1.4.2 Compressive Strength: DSM Columns: The in situ soil / cement mixture shall achieve design strength in accordance with the drawings or for full depth wet continuous core determined as outlined in Section 3.10.2 and further detailed in ASTM D 2166 for the independent test laboratory.

1.4.3 Uniformity of Mixing: Columns as installed shall conform to the uniformity specified in Section 3.11.

1.5 SUBMITTALS

The following shall be submitted in accordance with the Owner's Document Submittal or Transmission procedure:

1.5.1 Preconstruction Submittals

1. Quality Control Program

1.5.1.1 Product Data

1. Admixtures
2. Construction Schedule
3. Equipment and Procedures (including wet core recovery or wet coring)
4. Calibration Records

1.5.1.2 Design Data

1. DSM Panel Installation Plan (or Contract Drawings)
2. Working Area Plan with Batch Plant, Haul Roads, Spoil Management and Disposal
3. Portland Cement Certified Material Test Report
4. Preconstruction bench scale testing and soil-cement mix design
5. Design Calculations
6. QC/QA Program Plan

1.5.2 Production Submittals

1. Weekly Quality Control Report (WQCR)
2. Recalibrations records submitted in the next WQCR
3. DSM Laboratory Compressive Test Results submitted in the WQCR

1.5.3 Certificates

1. Cement submitted in the WQCR
2. Contractor Qualifications

1.5.4 Closeout Submittals

1. As-Built or Record Drawings of horizontal locations and elevations (NAVD88) of the center of each installed column submitted before demobilization from the site.

1.6 GENERAL REQUIREMENTS

1.6.1 Submit certificates of compliance, test reports, and other evidence showing conformance to the specified requirements.

1.6.1.1 Cement: Certificate of compliance for each truck load delivery.

1.6.1.2 Admixtures: Submit product data, if proposed.

1.6.1.3 Soil-Cement Mix Design: Proposed mix designs including all materials and quantities and documentation of calibration of the preparation and testing equipment. Include the anticipated cement dosages to achieve the acceptance criteria outlined in Section 3.11. The resulting

compressive strength of the soil-cement mixture at 7, 14, and 28 days. The onsite testing laboratory shall conduct compressive strength testing of soil-cement sample specimens in accordance with ASTM D 1633.

1.6.1.4 Construction Schedule: Submit a detailed schedule that identifies start dates and duration of each major task in the work. The schedule should at a minimum include information regarding equipment mobilization, equipment setup, DSM test section, DSM production installation, and intermediate DSM production completion milestones.

1.6.1.5 Equipment and Procedures: Submit a detailed description of the equipment and procedures to be used during all facets of the work of this Section including construction of DSM test section columns and production panels, monitoring the quality control parameters outlined in Section 3.10, and collecting samples for laboratory confirmation testing.

1.6.1.6 Include methods for locating the columns and panels in the field and confirming that the columns are plumb.

1.6.1.7 Panel Numbering Scheme: Submit proposed column and panel numbering scheme prior to site mobilization.

1.6.1.8 Weekly Quality Control Report: Prior to construction, submit a proposed Weekly Quality Control Report (WQCR) format for approval by the Owner. Submit the WQCR at the end of the week's next working day. The report should be in conformance with Section 3.10.

1.6.1.9 Calibrations: Submit all metering equipment calibration test results including mixing systems, delivery systems, alignment systems, and mixing tool rotational and vertical speed.

1.6.1.10 DSM Laboratory Compressive Test Results: Submit all QC test results as outlined in Section 3.10.

1.6.1.11 Record Drawings: Drawings confirmed by a licensed surveyor indicating the as-built center of each DSM column in terms of project coordinates.

1.6.1.12 Quality Control Program: Submit Quality Control Program including quality control program work plans specified in Section 3.10.

1.7 CONTRACTOR QUALIFICATIONS

1.7.1 The Contractor shall submit evidence of experience and competence to construct the DSM columns for support of tanks and structures. This evidence shall show that the Contractor has a minimum of 5 years of experience in constructing the DSM systems.

1.7.2 The Contractor shall substantiate this experience with case histories of two or more projects in the past five years showing the independent and successful installation of the DSM systems equal to or greater in depth than that required of this project utilizing the techniques specified herein.

1.7.3 The Contractor shall submit qualifications of key personnel including field personnel proposed for work performed pursuant to this specification. Key personnel shall be experienced in the construction of in-situ DSM systems, and at least one of the key personnel assigned to the project shall have experience in both design and construction of DSM columns. The proposed superintendent must have completed at least one large project for the Contractor.

1.7.4 The Contractor shall retain an Engineer who has experience with the installation of deep soil mixed column construction. The Engineer shall be responsible for planning and conducting the deep soil mixing test column placement.

1.8 MEASUREMENT AND PAYMENT

1.8.1 Lump Sum

The Contractor will provide a lump sum price based on the scope of work indicated on the contract document if the actual quantity of DSM installed is different, the contract price maybe adjusted per the variation in estimated quantity clause.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Cement or Portland Cement: as defined in Section 1.3. Protect cement from moisture and contamination while in transit to and in storage at the job site. Reclaimed cement or cement containing lumps or deleterious matter shall not be used.

2.1.2 Admixtures: Admixtures such as dispersion agents, retarders or plugging or bridging agents may be added to the cement mixture to permit efficient use of materials and proper workability of the in-place soil-cement mixture. Do not use admixtures without prior approval of the Owner.

2.2 DSM EQUIPMENT REQUIREMENTS

2.2.1 Mixing equipment machines with at least one soil mixing shaft shall be used.

2.2.1.1 The mixing shafts shall have mixing augers and blades (paddles) configured in such a manner so that they are capable of thoroughly blending the in-place soils and binder.

2.2.1.2 The power source for driving the mixing equipment shall be sufficient to maintain the required revolutions per minute (RPM) and penetration rate from a stopped position at the maximum depth required.

2.2.1.3 Equipment shall be the same make and model as described in the DSM plan.

2.2.2 The DSM rig shall be equipped with electronic sensors built into the leads to determine vertical alignment in two directions: fore-aft and left-right.

2.2.2.1 The sensors shall be calibrated at the beginning of the project and the calibration data shall be provided to the Owner. The calibration shall be repeated at intervals not to exceed one month.

2.2.2.2 The output from the sensors shall be routed to a console that is visible to the operator and the Engineer or Owner or their agents during penetration. The console shall be capable of indicating the alignment angle in each plane.

2.2.3 The Contract Drawings shall indicate a minimum penetration depth for each column which can be confirmed by the DSM equipment parameter monitoring sensors. The DSM monitoring records for each installed column shall be included in the WQCR. The requirements for the WQCR are discussed in Section 3.10.5.

2.2.4 As a minimum, the cement handling and storage requirements shall be met.

2.2.4.1 The dry materials shall be transported to the project site and blown into the on-site storage tanks using a pneumatic system. Dry materials shall be stored in silos and fed to mixers for agitation and shearing.

2.2.4.2 The air evacuated from the storage tank during the loading process shall be filtered before being discharged to the atmosphere.

2.2.4.3 Calibration of mixing components shall be done at the beginning of the project and repeated at intervals not to exceed one month thereafter.

2.2.5 The DSM rig shall be equipped with sensors to monitor the mixing tool penetration / withdrawal rate, mixing tool rotation speed, and injection rate.

2.2.5.1 The output from these sensors must be visible to the operator and the Engineer or Owner or their agents during penetration and withdrawal.

2.2.5.2 The Contractor may propose alternative display/monitoring systems; however, the systems must first be reviewed and approved by the Owner prior to use.

2.2.5.3 Calibration of this equipment shall be performed at the beginning of the project and the calibration data shall be provided to the Owner. The calibration shall be repeated at intervals not to exceed one month.

2.3 SOIL-BINDER MIXING PROCEDURE

To confirm the satisfactory performance of this treatment, the Contractor should submit and prepare a demonstration program prior to starting the work and should include the following:

1. Provide an installation sequence that will be followed from drilling to mixing method on a continuous operation, ensuring the mixing will be continuous and uniform all throughout the design depth of the DSM foundation.
2. Install the deep-soil binder equipment with the same make and model of mixing, binder grout-mixing and pumping equipment, and the same materials and procedures described in the QC Plan.
3. Adjust the mix design as necessary throughout the course of the working order to achieve the requirements as initially planned. Mix design to be assessed and selected during the test panel installation and 7-day curing period without consequence to production panel installation as scheduled. Mix design can be adjusted as deemed necessary through collaboration between the Contractor and Engineer with approval from the Owner.
4. Ensure the soil-binder elements penetrate the full depth of the soils to be stabilized.
5. Upon reaching the bottom of the soil-binder element, operate at sufficient speed and duration to clean and mix all loose, soft, and otherwise unmixed soil prior to final grouting and withdrawal of the mixing tools.
6. During soil-binder mixing, introduce the grout into the soil only by injecting binder grout through the bottom of the operating mixing plant equipment.
7. Introduce grout during the initial preparation of the augers, or during subsequent down strokes of the augers, for the entire depth of the elements.
8. Continue grout injection while removing the mixing equipment from the bottom of the holes to the top.
9. After final grouting of the soil-binder mixing, obtain samples of in-situ binder in accordance with the locations and frequencies required in the QC/QA plan.

PART 3 - EXECUTION

3.1 GENERAL

3.1.1 The DSM columns shall be constructed to the lines, grades, and cross sections indicated on the Contract Drawings or the approved DSM Plan

3.1.2 The columns shall be vertical as stated in Section 1.4 for vertical inclination of columns and shall extend through the on-site soils to the elevations indicated on the Contract Drawings or the approved DSM Plan.

3.1.3 The completed columns shall be a homogeneous mixture. Mixing is to be controlled by shaft rotational speed, drilling speed, and grout injection rate.

3.1.4 The required DSM compressive strength indicated in Section 1.4 is based on panels constructed shown on the Contract Drawings or approved DSM Plan.

3.1.4.1 To accommodate variations in the Contractor's equipment dimensions, panel width may vary from that shown on the Contract Drawings or approved DSM Plan.

3.1.4.2 Once the column width is established it may not be changed without approval of the Engineer.

3.1.5 Monitoring of construction parameters and confirmation testing will be used to verify that the acceptance criteria have been satisfied.

3.1.5.1 The Contractor shall establish consistent procedures to be employed during panel construction to ensure a relatively uniform product is created.

3.1.5.2 These procedures shall be defined in the Equipment and Procedures submittal and subsequently modified, if necessary based on the results of the test sections.

3.1.6 Test Section: Prior to the beginning production panel installation, the Contractor shall construct a test section as described in Section 3.10.

3.1.6.1 The purpose of the test sections is to verify that the Contractor's proposed equipment, procedures, and mix design can uniformly mix the on-site soils and achieve the required strengths.

3.1.6.2 Based on the evaluation of completed in-place DSM panels, the Owner will determine if the test sections yield acceptable results and whether the Contractor may proceed with the production column construction.

3.1.6.3 The Portland cement-soil ratio design, equipment, installation procedures, and sampling and testing methods established during the test sections shall be used for the production column construction.

3.1.7 Changes:

3.1.7.1 The Contractor may request that the established mix design/grout-soil ratio, equipment, installation procedure, or test methods be modified: however; the Owner may require additional testing or a new test section to verify that acceptable results can be achieved.

3.1.7.2 The Contractor shall not employ modified grout mix/grout-soil ratio designs, equipment, installation procedures, or sampling or testing methods until approved by the Owner in writing.

3.2 HORIZONTAL ALIGNMENT

3.2.1 The Contractor shall accurately stake the location of the proposed DSM system shown on the Contract Drawings. For DSM column locations where permanent plant structures, systems, or components are within two feet of intersecting a DSM column, a licensed surveyor shall locate and stake the immediate panels prior to installing the immediate panels.

3.2.1.1 The columns shall be constructed within the tolerances specified in Section 1.4.

3.2.1.2 The Contractor shall provide an adequate method approved by the Owner to verify the as-built location of the columns and serve as the Record Drawings.

3.2.2 Movement of the crawler base machine shall provide the preliminary alignment of the augers and the final alignment shall be adjusted by hydraulic manipulation of the leads.

3.2.2.1 One stroke of the machine shall construct a DSM panel consisting of at least one secant columns.

3.2.2.2 The panel shall be advanced by overlapping the adjacent outside columns of the previous strokes.

3.2.3 Obstructions in the form of existing utilities are generally anticipated. The following pertain to obstructions if encountered. Contractor shall locate all underground obstructions before beginning work.

3.2.3.1 If an obstruction preventing drilling advancement is encountered, the Contractor shall investigate the location and extent of the obstruction using methods pre-approved by the Owner. The Contractor shall propose remedial measures to clear the obstructions for approval by the Owner.

3.2.3.2 While the investigation for an obstruction is underway, the Contractor shall continue to install columns in areas away from the obstruction location.

3.2.4 The Contractor will not be compensated for panels that are located outside of the geometric tolerances specified in Section 1.4.

3.2.4.1 Further, the Owner will review the location of misaligned DSM panels to determine if they interfere with the proposed structure and site improvements.

3.2.4.2 If the misaligned DSM panels interfere with the proposed structures and site improvements, the Contractor shall correct the alignment and redrill the misaligned columns or entire panel and remix them to a strength that is approximately equal to or greater than the 28-day compressive strength.

3.3 VERTICAL ALIGNMENT

3.3.1 The equipment operator shall control vertical alignment of the auger stroke. Two measures of verticality shall be monitored, longitudinal and transverse to the column alignment.

3.4 COLUMN DEPTH

3.4.1 Column depths shall extend to the line and grades shown on the Contract Drawings or approved DSM Plan.

3.4.1.1 The total depth of penetration shall be measured either by observing the length of the mixing shaft inserted below a reference point on the mast, or by subtraction of the exposed length of shaft above the reference point from the total shaft length.

3.4.1.2 The final depth of the stroke shall be noted and recorded on the WQCR by the Contractor.

3.4.1.3 If rigs with varying mixing shaft lengths are used, the shortest shafts shall extend to the minimum column depths indicated on the Contract Drawings.

3.4.2 The DSM columns bottom elevations indicated on the Contract Drawings or approved DSM Plan were estimated from the available subsurface information to provide the required minimum penetration of the columns into the Cooper Marl Formation underlying the site.

3.4.3 If the elevations of the top of competent soils are found to be different from those estimated, the Owner may direct the Contractor to shorten or deepen the columns and the Contractor will be compensated based on the decreased or increased cubic yards of the panels.

3.4.4 The Contractor shall not be compensated for any portions of the panels that are above the top elevation or below the bottom elevation shown on the Contract Drawings unless approved by the Owner.

3.5 CEMENT PREPARATION

3.5.1 A minimum mixing time of three minutes and a maximum holding time of 1½ hours will be enforced for the cement.

3.5.1.1 The specific gravity of the grout shall be determined during the design mix program for double-checking grout proportions.

3.5.1.2 The specific gravity of the grout shall be checked by the Contractor at least once per shift per rig using the methods outlined in ASTM D 4380. The specific gravity of the grout measured in the field should not deviate by more than 3 percent of the calculated specific gravity for the design water cement ratio.

3.5.1.3 The grout hold time shall be calculated from the beginning of the initial mixing. If the grout density is lower than required by the mix design, the Contractor shall recalibrate batch scales and perform additional testing at no additional cost to the Owner.

3.5.1.4 The specific gravity measurements shall be indicated on the WQCR.

3.6 SOIL-GROUT MIXING

3.6.1 Installation of each column shall be continuous without interruption. If an interruption of more than 1 hour occurs, the column shall be remixed (while injecting grout at the design mix ratio) for the entire height of the element at no additional cost to the Owner.

3.6.2 Refer to Section 3.11 for uniformity of mix requirements.

3.6.3 Soil and grout shall be mixed together in-place by auger and blades on the mixing shaft.

3.6.4 The grout shall be pumped through the mixing shaft and injected from the tip of the shaft. The shaft shall break up the soil and blend it with the grout.

3.6.5 The mixing action of the mixing equipment shall blend, circulate, and knead the soil over the length of the column while mixing it in place.

3.7 SHAFT ROTATIONAL SPEED AND PENETRATION / WITHDRAWAL RATE

3.7.1 The mixing shaft rotational speed (measured in RPMs) and penetration/withdrawal rates may be adjusted to achieve adequate mixing. The required rotational speeds and penetration/ withdrawal rates for the various soil layers encountered shall be determined during the test sections.

3.7.2 The rotational speeds and penetration/ withdrawal rates shall be recorded then reported on the WQCR.

3.7.3 The rotational speeds and penetration/withdrawal rates determined during the test section shall be used during the balance of the work. The reduction in rotational speed associated with penetration into the alluvium layer shall also be documented and subsequently used to determine final column depths during production placement.

3.8 GROUT INJECTION RATE

3.8.1 The grout injection rate per vertical foot of column shall be in accordance with the requirements of the design mix.

3.8.1.1 The required mix design and grout-soil ratio shall be determined during the test section installation and curing period but can be adjusted as discussed in Section 2.3.

3.8.1.2 The cement injection rate shall be constantly monitored and controlled.

3.8.1.3 The Contractor shall record the weight of cement injected for every 4 vertical feet of each column on the WQCR.

3.8.2 If the weight of cement injected per vertical foot of column is less than the amount required to meet the cement-soil ratio established during the test sections, the columns shall be remixed and cement injected (at the design cement-soil ratio) to a depth at least 3 feet into the Cooper Marl Formation at no additional cost to the Owner.

3.9 CONTROL OF SPOILS

3.9.1 The Contractor shall control and process all spoils created during the panel construction in a location as designated by the Owner.

3.9.1.1 The areas designated by the Owner shall be used for disposal of any spoils.

3.10 QUALITY CONTROL PROGRAM

3.10.1 General

3.10.1.1 The DSM Quality Control Program shall be the responsibility of the Contractor and shall include, as a minimum, the following components:

1. Construction of a test section(s) by the Contractor.
2. Field monitoring by the Contractor of construction parameters during panel construction.
3. Sample collection including full depth continuous coring or wet coring, and wet sampling, along with testing performed by the Contractor (the Contractor will log the core, evaluate uniformity, and select specimens for testing),
4. Reporting of the field monitoring, sampling, and strength testing performed by the Contractor.

3.10.1.2 The Contractor shall provide all the personnel and equipment necessary to implement the Quality Control Program.

1. The Contractor's QC agent will observe DSM panel construction on a full-time basis and will verify that the placement submittals and Quality Control Program is being properly implemented.
2. Prior to site mobilization, the Contractor shall submit a detailed work plan for the Quality Control Program for review by the Engineer and approval by the Owner.
3. The work plan shall include, as a minimum, a description of all procedures to be implemented, parameters to be monitored, tolerances for the parameters monitored, and the names of any subcontractors used for testing.

3.10.1.3 Following the test sections, the Contractor may revise the Quality Control Program, if approved by the Owner. Also, based on the results of the test sections, the Quality Control Program may be revised.

1. The established quality control procedures shall be maintained throughout the production column installation to ensure consistency the DSM panel installation and to verify that the work complies with all requirements indicated in the Contract Documents.

3.10.2 Sample Collection and Testing

3.10.2.1 The acceptance of the work will be based on demonstrating that the in-place grout mix together with the soils has achieved the strength and uniformity requirements defined in Section 3.11.

1. Verification that the strength and uniformity requirements have been satisfied will be determined based on the results of discrete wet sampling and strength testing of samples as described below.

3.10.2.2 Confirmation that the strength and uniformity requirements have been satisfied will be determined by a series of tests performed on samples. Confirmation sample collection and testing shall include:

1. Sampling includes wet sampling or full-depth continuous coring or wet coring performed by the Contractor, recovered by the Contractor, and laboratory testing conducted by the Contractor or an independent testing laboratory.

2. Specific Gravity of the cement slurry shall be measured and recorded by the Contractor a minimum of once every four (4) hours during the production cycle using methods described in ASTM D4380 or other approved methods.
3. The Contractor shall obtain a minimum of two wet samples of deep-mixed material per rig shift. Vary the vertical location of the samples over successive days to obtain samples from the bottom, middle and top of the columns. The wet sample shall be passed through a ¾-in sieve prior to cylinder molding. Mold and cure 3 inch by 6 inch cylinders in accordance with ASTM D4832. Mold a minimum of 6 cylinders from each sample for unconfined compressive strength testing. The Contractor shall cap the cylinders and store them in a climate controlled environment at the site for a minimum of 48 hours. After 48 hours they can be transported to the testing laboratory for curing and testing.
4. Unconfined compressive strength tests shall be conducted on material cylinders molded from the wet samples of the DSM columns in accordance with ASTM D1633. Unconfined compressive strength tests on core samples shall be run in accordance with ASTM D2166. The number and frequency of unconfined compressive strength tests to be performed are outlined in the approved QC/QA Program Plan.
5. Additional confirmation testing: In addition to confirmation tests performed by the Contractor, other confirmation tests may be performed as directed by the Owner on samples collected by the Contractor. The required strengths shall be demonstrated by the Contractor's testing prior to acceptance of the work.

3.10.2.3 Remedial Full-Depth Coring, Sampling and Testing: At locations designated by the Contractor and reviewed by the Engineer and approved by the Owner, continuous coring, vibra-coring or thin-walled tube sampling shall be performed for the full depth of suspected columns or panels which do not achieve laboratory tested design strength. The frequency of full depth continuous core sampling is specified in Section 3.10.3 for test sections and Section 3.10.4 for production column construction.

1. Full-depth core samples obtained by the Contractor shall have a diameter of at least 2 inches. A minimum of 12 samples shall be retrieved from locations as shown on the drawings.

- Unless otherwise directed, the full-depth core samples shall be obtained along an essentially vertical alignment located one-fourth of a column diameter from the column center.
- The Contractor shall notify the Owner 24 hours prior to performing all full-depth core sampling.

2. Full-depth core samples shall be retrieved using standard continuous coring techniques . The Contractor shall determine the time interval between column installation and coring except that the interval shall be no longer than required to conduct 28-day strength testing.
3. Each core run shall be at least 5 feet in length and contain at least four test specimens with a length to diameter ratio of 2, or greater.

- A minimum recovery of 70 percent for each 5 foot long core run or recovered by wet coring shall be achieved. During coring, the elevation of the bottom of the holes shall be measured after each core run in order to verify the core recovery.

4. Upon retrieval, the full-depth core samples shall be logged and test specimens selected.

- Field logging will be performed by the Contractor to determine if the uniformity and recovery criteria have been satisfied and this information will be supplied to the Engineer.
- Following logging, the Contractor will collaborate with the Owner when selecting specimens from each full-depth core sample recovered for strength testing.
- Following logging and test specimen selection, the entire full-depth core sample, including the designated test specimens, shall be immediately sealed in plastic wrap to prevent drying and transported to the laboratory by the Contractor. Disintegration of the samples while in transport is the responsibility of the Contractor.
- All core holes shall be filled with cement grout that will obtain a 28-day strength equal to or greater than the design strength.

5. Strength testing shall be conducted by an Owner approved independent testing laboratory retained by the Contractor.

- The samples shall be stored in a moist environment in accordance with ASTM C 192/C 192M until the test date.
- Testing for 28-day unconfined compressive strength shall be conducted in accordance with ASTM D 2166.
- In the event that the unconfined compressive strength falls below the specified strength, the Engineer may elect, at his discretion, to test an additional core sample obtained in the same 5-ft (1.5 m) core run. If the second test passes, the first test will not be included in the strength evaluation.
- The remaining portions of the full-depth core samples that are not tested shall be retained by the Contractor, until completion and acceptance of all DSM panels, for possible inspection and confirmation testing.

3.10.3 Test Section

3.10.3.1 Prior to construction of the production DSM system, a test section(s) shall be prepared by the Contractor to verify that the required geometric tolerances and design strengths can be achieved and that the installation methods provide adequate mixing and penetration for the existing field conditions at the project site. The Contractor must construct at test section(s) using proposed mixing design.

3.10.3.2 The test section(s) shall be installed at the location indicated on the Contract Drawings.

1. The test section shall consist of columns arranged in the indicated pattern and constructed to the depths shown on the Contract Drawings.

3.10.3.3 The following procedures shall be used initially in the test section(s) unless other procedures are proposed by the Contractor, reviewed by the Engineer and approved by the Owner.

1. The augers shall advance during the penetration stroke at a rate as proposed by the Contractor which will result in uniform mixing not exceeding 4 feet per minute.

3.10.3.4 The Contractor shall obtain samples from the test section and submit them to a local independent or onsite laboratory for strength testing.

1. Sampling and testing shall be performed in accordance with the requirements in Section 3.10.2. For each test section, a minimum of six wet samples shall be collected from the entire column length at locations approved by the Engineer.
2. The Contractor may propose other sampling techniques to obtain representative samples of the DSM columns which, if approved by the Owner, may be substituted.

3.10.4 Production Column Construction

3.10.4.1 The Contractor shall conduct sampling and testing of the production columns using the same methods employed during the test sections and in accordance with the requirements listed in Section 3.10.2.

3.10.5 Weekly Quality Control Report (WQCR)

3.10.5.1 The Contractor shall submit Weekly Quality Control Reports to the Owner. The WQCR shall document the progress of panel construction, present the results of the QC parameter monitoring, present the results of the strength testing, and clearly indicate if the columns have met the acceptance criteria.

3.10.5.2 The WQCR shall include as a minimum the results of the following QC parameter monitoring for each column:

- Rig number
- Type of mixing tool
- Date and time (start and finish) of column construction
- Column number and reference drawing number
- Column diameter
- Column top and bottom elevations
- Grout mix design designation
- Slurry specific gravity measurements
- Description of obstructions, interruptions, or other difficulties during installation and how they were resolved

3.10.5.3 Weekly Quality Control Reports shall also include the following parameters recorded automatically or manually for each column at intervals no greater than 3 feet and submitted in the form of either tables of figures:

- Elevation in feet vs. real time
- Shaft rotation speed in RPMs vs. real time
- Penetration and withdrawal rates in feet per minute vs. real time
- Grout Injection rate vs. real time
- The average quantity of grout in gallons per foot injected per vertical foot of column vs. depth

3.11 ACCEPTANCE CRITERIA

3.11.1 The Contractor QC will make the determination as to whether the test results indicate that the acceptance criteria have been satisfied. The in-place grout/soil mixture comprising the DSM panels shall meet the following acceptance criteria:

3.11.1.1 Geometric Tolerances: Panels shall be installed within the geometric tolerances specified in Section 1.4.

3.11.1.2 Compressive Strength: Compressive strength shall meet the requirements specified in Section 1.4.

1. The average strength shall be computed by summing all individual unconfined compressive strength tests and dividing by the number of tests of the same cured age. The average strength for any 5 foot full-depth core sample is the sum of the cylinders' unconfined compressive strengths and divided by the number of tests.

3.11.1.3 Uniformity of Mixing: Uniformity of mixing will be evaluated by the Contractors QC based on the wet samples recovered by the Contractor from the columns.

1. Lumps of unimproved soils shall not amount to more than 20 percent of the total volume of any 5 foot section of column.
2. In addition, full-depth continuous wet core recovery shall be at least 70 percent over any 5 foot core run. For evaluating the volume of unimproved lumps of soil, all unrecovered core length shall be assumed to be unimproved soil.

3.11.2 If the acceptance criteria specified herein are not achieved for production columns, the failed section of columns will be rejected, reviewed by the Engineer and remediated based on the Engineer's recommendation.

3.11.2.1 Unless otherwise determined by the Engineer, the failed section of panels shall be considered to include all panels constructed during all rig shifts that occurred between the times of construction when passing tests were achieved.

3.11.2.2 The Contractor may conduct additional sampling and testing to better define the limits of the failed area.

1. The Contractor shall submit a proposed plan for constructing a new panel to replace a defective panel that is not found to satisfy the uniformity of mixing criteria herein.

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/13/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions: Rainy
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 1 (Depth27')
Placement Location: Test Column 20A- Depth -27'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	02/16/21	02/20/21	7	2,835	400	2	
1	2	3.00	7.07	02/16/21	02/20/21	7	2,305	330	2	
							Average (7 days)	**360**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 2 (Depth 22')
Placement Location: Test Column 20A- Depth -22'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
2	1	3.00	7.07	02/16/21	03/16/21	28	5,193	730	2	MGP
2	2	3.00	7.07	02/16/21	03/16/21	28	4,778	680	2	MGP
						Average (28 days)		**710**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
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Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 3 (Depth17')
Placement Location: Test Column 20A- Depth -17'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
3	1	3.00	7.07	02/16/21	03/16/21	28	1,688	240	2	MGP
3	2	3.00	7.07	02/16/21	03/16/21	28	2,929	410	2	MGP
							Average (28 days)	**330**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

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Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 4 (Depth13')
Placement Location: Test Column 20A- Depth -13'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
4	1	3.00	7.07	02/16/21	02/23/21	7	2,261	320	3	JMM
4	2	3.00	7.07	02/16/21	02/23/21	7	2,763	390	3	JMM
							Average (7 days)	**360**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

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Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 5 (Depth 9")
Placement Location: Test Column 20A- Depth -9'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
5	1	3.00	7.07	02/16/21	03/16/21	28	4,396	620	2	MGP
5	2	3.00	7.07	02/16/21	03/16/21	28	3,916	550	3	MGP
							Average (28 days)	**590**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

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Client

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Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Test Column 20 A Sample 6 (Depth 5')
Placement Location: Test Column 20A- Depth -5'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
6	1	3.00	7.07	02/16/21	03/16/21	28	5,437	770	2	MGP
6	2	3.00	7.07	02/16/21	03/16/21	28	5,591	790	2	MGP
							Average (28 days)	**780**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0001
Service Date: 02/16/21
Report Date: 03/16/21 Revision 3 - 28-day results
Task: Soil Crete

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843-884-1234

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Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Civil and Environmental Consultants, Inc
Concrete Contractor: Keller
Concrete Placement: Pier
Observation Location(s): South side Column 20A
Concrete Type: 106 PSI concrete
Method of Placement: Soilcrete
Method of Consolidation: Rodding
Tests Performed: Not performed
Test Specimens Fabricated: A total of 12 compressive strength specimens [Set No(s).: 6] were fabricated during today's concrete activities.
Weather Protection: Onsite cooler
Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.
Comments: Samples were fabricated on Saturday 2/13/21 by Keller, and picked up from site on 2/16/21 by Terracon. Samples were taken at sample Column location but various depths.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
Report Date: 03/16/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 25'
Placement Location: Column24A Depth 25'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	02/18/21	03/16/21	28	6,231	880	2	MGP
1	2	3.00	7.07	02/18/21	03/16/21	28	6,339	900	4	MGP
							Average (28 days)	**890**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
Report Date: 03/16/21 Revision 1 - 28-day results
Task: Soil Crete

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Client

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Attn: Jean-Claude Younan
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Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 20'
Placement Location: Column24A Depth 20'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
2	1	4.00	12.57	02/18/21	02/23/21	7	1,800	140	2	
2	2	4.00	12.57	02/18/21	02/23/21	7	2,313	180	2	
							Average (7 days)	**160**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
Report Date: 03/16/21 Revision 1 - 28-day results
Task: Soil Crete

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Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 16'
Placement Location: Column24A Depth 16'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
3	1	3.00	7.07	02/18/21	03/16/21	28	6,891	970	2	MGP
3	2	3.00	7.07	02/18/21	03/16/21	28	5,912	840	2	MGP
							Average (28 days)	**910**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
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FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 12'
Placement Location: Column24A Depth 12'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
4	1	4.00	12.57	02/18/21	02/23/21	7	2,288	180	2	JMM
4	2	4.00	12.57	02/18/21	02/23/21	7	2,554	200	2	JMM
							Average (7 days)	**190**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
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(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
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Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: No PM Assigned
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 8'
Placement Location: Column24A Depth 8'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
5	1	3.00	7.07	02/18/21	03/16/21	28	7,520	1,060	2	MGP
5	2	3.00	7.07	02/18/21	03/16/21	28	5,738	810	2	MGP
							Average (28 days)	**940**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
Report Date: 03/16/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/16/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Sample 1- Column24A Depth 4'
Placement Location: Column24A Depth 4'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
6	1	4.00	12.57	02/18/21	02/23/21	7	2,664	210	2	JMM
6	2	4.00	12.57	02/18/21	02/23/21	7	2,084	170	2	JMM
							Average (7 days)	**190**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**
Sampled by Joel Velez with Keller

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0002
Service Date: 02/17/21
Report Date: 03/16/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By:	Jim with Civil & Environmental Consultants Inc
Concrete Contractor:	Keller
Concrete Placement:	Pier
Observation Location(s):	Column 24A
Subgrade Review:	The subgrade consisted of light brown sandy clay and was observed to be firm and stable.
Concrete Type:	106 PSI concrete
Method of Placement:	Soilcrete
Method of Consolidation:	Mechanical Vibrator
Tests Performed:	Not performed
Test Specimens Fabricated:	A total of 12 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.
Weather Protection:	Onsite cooler
Summary:	Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0003
Service Date: 02/17/21
Report Date: 03/19/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil Crete
Supplier:
Batch Time: 1645 **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/17/21 **Sample Time:** 1700
Sampled By: Mellissa Lambert
Weather Conditions: Cloudy
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 19A at 10' Depth
Placement Location: Column 19A at 10' Depth

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):	70	
Ambient Temp. (F):	52	
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	02/19/21	02/20/21	3	1,545	120	2	
1	2	4.00	12.57	02/19/21	02/20/21	3	1,588	130	2	
						Average (3 days)		**120**		
1	3	4.00	12.57	02/19/21	02/24/21	7	3,523	280	2	
1	4	4.00	12.57	02/19/21	02/24/21	7	3,134	250	2	
						Average (7 days)		**260**		
1	5	4.00	12.57	02/19/21	03/03/21	14	5,929	470	2	MGP
1	6	4.00	12.57	02/19/21	03/03/21	14	4,452	350	4	MGP
						Average (14 days)		**410**		
1	7	4.00	12.57	02/19/21	03/17/21	28	4,279	340	2	MGP
1	8	4.00	12.57	02/19/21	03/17/21	28	7,071	560	2	MGP
						Average (28 days)		**450**		
1	9			02/19/21		Hold				
1	10			02/19/21		Hold				

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0003
Service Date: 02/17/21
Report Date: 03/19/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0003
Service Date: 02/17/21
Report Date: 03/19/21 Revision 3 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 19A at depth 10 feet.

Concrete Type: 106 PSI concrete

Method of Placement: Tube

Method of Consolidation: Mechanical Vibrator

Tests Performed: Temperature of soilcrete was taken and was observed at 70 degrees Fahrenheit. PH was measured to be 11.7. Specific gravity was recorded at 1.67.

Test Specimens Fabricated: A total of 10 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0004
Service Date: 02/22/21
Report Date: 04/26/21 Revision 2 -
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** on site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/21/21 **Sample Time:**
Sampled By: No PM Assigned
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 13A Depth13'
Placement Location: Column 13A Depth13'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	02/22/21	02/28/21	7	2,553	200	1	BCR
1	2	4.00	12.57	02/22/21	02/28/21	7	3,663	290	1	BCR
						Average (7 days)		**250**		
1	3	4.00	12.57	02/22/21	03/21/21	28	6,480	520	1	SKT
1	4	4.00	12.57	02/22/21	03/21/21	28	6,353	510	1	SKT
						Average (28 days)		**510**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Note: Reported air content does not include Aggregate Correction Factor (ACF).
Sampled by Chris with C&E C

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0004
Service Date: 02/22/21
Report Date: 04/26/21 Revision 2 -
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** on site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/22/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 13A Depth10'
Placement Location: Column 13A Depth10'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
2	1	4.00	12.57	02/22/21	03/01/21	7	3,322	260	3	
2	2	4.00	12.57	02/22/21	03/01/21	7	3,226	260	3	
						Average (7 days)		**260**		
2	3	3.00	7.07	02/22/21	03/22/21	28	5,092	720	2	MGP
2	4	3.00	7.07	02/22/21	03/22/21	28	4,126	580	2	MGP
						Average (28 days)		**650**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Note: Reported air content does not include Aggregate Correction Factor (ACF).
Sampled by Chris with CE&C

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0004
Service Date: 02/22/21
Report Date: 04/26/21 Revision 2 -
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 13A

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 8 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:

Martin Posberry III
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0005
Service Date: 02/24/21
Report Date: 03/23/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/22/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions: Sunny
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 11A Depth 6'
Placement Location: Column 11A Depth 6'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
2	1	4.00	12.57	02/27/21	03/01/21	7	4,437	350	3	
2	2	4.00	12.57	02/27/21	03/01/21	7	3,719	300	3	
						Average (7 days)		**320**		
2	3	3.00	7.07	02/27/21	03/22/21	28	6,809	960	2	MGP
2	4	3.00	7.07	02/27/21	03/22/21	28	7,281	1,030	2	MGP
						Average (28 days)		**1,000**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Chris with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0005
Service Date: 02/24/21
Report Date: 03/23/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 11A

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 8 compressive strength specimens [Set No(s).: 2] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:

Martin Posberry III
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0006
Service Date: 02/24/21
Report Date: 03/23/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/23/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method: Other (Please see Comments)
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 26A 10' depth
Placement Location: Column 26A 10' depth

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	02/27/21	03/02/21	7	3,983	320		MGP
1	2	4.00	12.57	02/27/21	03/02/21	7	3,801	300		MGP
						Average (7 days)		**310**		
1	3	3.00	7.07	02/27/21	03/23/21	28	4,579	650	5	MGP
1	4	3.00	7.07	02/27/21	03/23/21	28	5,668	800	5	MGP
						Average (28 days)		**720**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by Chris with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0006
Service Date: 02/24/21
Report Date: 03/23/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 26A

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:

Martin Posberry III
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0007
Service Date: 02/26/21
Report Date: 03/24/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soil crete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/

Sample Information

Sample Date: 02/24/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 31A at 13' depth
Placement Location: Column 31A at 13' depth

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	02/27/21	03/03/21	7	3,612	290	2	MGP
1	2	4.00	12.57	02/27/21	03/03/21	7	3,549	280	2	MGP
						Average (7 days)		**280**		
1	3	4.00	12.57	02/27/21	03/24/21	28	4,825	380	1	MGP
1	4	4.00	12.57	02/27/21	03/24/21	28	4,990	400	2	MGP
						Average (28 days)		**390**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Chris with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0007
Service Date: 02/26/21
Report Date: 03/24/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 31A

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:

Martin Posberry III
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0008
Service Date: 02/26/21
Report Date: 03/26/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 02/25/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 37A at 5' depth
Placement Location: Column 37A at 5' depth

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	02/27/21	03/04/21	7	4,239	340	4	MGP
1	2	4.00	12.57	02/27/21	03/04/21	7	4,249	340	2	MGP
						Average (7 days)		**340**		
1	3	4.00	12.57	02/27/21	03/25/21	28	6,318	500	2	MGP
1	4	4.00	12.57	02/27/21	03/25/21	28	5,867	470	1	MGP
						Average (28 days)		**480**		

Initial Cure: Covered with Plastic **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sampled by Chris with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Martin Fosberry III
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0008
Service Date: 02/26/21
Report Date: 03/26/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 37A

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:

Martin Posberry III
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0009
Service Date: 03/03/21
Report Date: 03/30/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** n/a
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/01/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 44A Depth 10'
Placement Location: Column 44A Depth 10'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	03/02/21	03/08/21	7	4,637	370	5	MGP
1	2	4.00	12.57	03/02/21	03/08/21	7	4,679	370	2	MGP
						Average (7 days)		**370**		
1	3	4.00	12.57	03/02/21	03/29/21	28	6,181	490	2	MGP
1	4	4.00	12.57	03/02/21	03/29/21	28	6,661	530	2	MGP
						Average (28 days)		**510**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by Chris with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0009
Service Date: 03/03/21
Report Date: 03/30/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 44A at 10’ depth.

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0019
Service Date: 04/27/21
Report Date: 04/27/21 Revision 1 - Distribute
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength:

Mix ID:
Supplier:
Batch Time: **Plant:**
Truck No.: **Ticket No.:**

Sample Information

Sample Date: 03/02/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 48A. Comprised mix from 5'10". 15'
Placement Location: Column 48A. Comprised mix from 5'10". 15'

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57		03/09/21	7	4,749	380		
1	2	4.00	12.57		03/09/21	7	4,448	350		
						Average (7 days)		**370**		
1	3	4.00	12.57		03/30/21	28	8,563	680		
1	4	4.00	12.57		03/30/21	28	8,946	710		
						Average (28 days)		**700**		

Initial Cure: Moist Room **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**
Note: Reported air content does not include Aggregate Correction Factor (ACF).
Samples Created by Chris with CEC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Martin Fosberry III
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0019
Service Date: 04/27/21
Report Date: 04/27/21 Revision 1 - Distribute
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Chris with CEC

Concrete Contractor: CEC

Concrete Placement: Soil-Crete column panels

Observation Location(s): Column 48A

Additional Comments: Information in this report is what is in report EN1915074.0010. The report was not able to be distributed through our reporting system. This is a duplicate report.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Martin Fosberry III
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0011
Service Date: 03/04/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/03/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 51A at 15' depth
Placement Location: Column 51A at 15' depth

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	03/05/21	03/10/21	7	2,138	170	2	MGP
1	2	4.00	12.57	03/05/21	03/10/21	7	1,718	140	2	MGP
						Average (7 days)		**150**		
1	3	4.00	12.57	03/05/21	03/31/21	28	3,454	270	2	MGP
1	4	4.00	12.57	03/05/21	03/31/21	28	3,434	270	4	MGP
						Average (28 days)		**270**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by Chris with E&EC.

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0011
Service Date: 03/04/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 51A depth 15'.

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0012
Service Date: 03/05/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength:

Mix ID:
Supplier:
Batch Time: **Plant:**
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/04/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 57A at 10' depth
Placement Location: Column 57A at 10' depth

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	03/08/21	03/11/21	7	4,436	630	2	MGP
1	2	3.00	7.07	03/08/21	03/11/21	7	4,669	660	2	MGP
						Average (7 days)		**640**		
1	3	4.00	12.57	03/08/21	04/01/21	28	7,315	580		MGP
1	4	4.00	12.57	03/08/21	04/01/21	28	7,582	600		MGP
						Average (28 days)		**590**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Not tested for plastic unit weight.**
Samples made by CJ with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0012
Service Date: 03/05/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 57A at 10’ depth.

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0013
Service Date: 03/08/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** n/a
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/05/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions: Sunny
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 60A depth 8'
Placement Location: Column 60A depth 8'

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	03/09/21	03/12/21	7	3,716	530	2	MGP
1	2	3.00	7.07	03/09/21	03/12/21	7	3,665	520	2	MGP
						Average (7 days)		**520**		
1	3	4.00	12.57	03/09/21	04/02/21	28	5,077	400	2	MGP
1	4	4.00	12.57	03/09/21	04/02/21	28	5,316	420	2	MGP
						Average (28 days)		**410**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sample created by CJ with E&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0013
Service Date: 03/08/21
Report Date: 04/06/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 60A depth 8’

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0014
Service Date: 03/09/21
Report Date: 04/06/21
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** on site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/06/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 61B Depth 12'
Placement Location: Column 61B Depth 12'

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	03/08/21	04/03/21	28	3,488	280	4	MGP

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Sample made by CJ with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0014
Service Date: 03/09/21
Report Date: 04/06/21
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By:	Jim with Civil & Environmental Consultants Inc
Concrete Contractor:	Keller
Concrete Placement:	Pier
Observation Location(s):	Column 61B depth 12’
Subgrade Review:	The subgrade consisted of light brown sandy clay and was observed to be firm and stable.
Concrete Type:	106 PSI concrete
Method of Placement:	Soilcrete
Method of Consolidation:	Mechanical Vibrator
Tests Performed:	Not performed
Test Specimens Fabricated:	A total of 1 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.
Weather Protection:	Onsite cooler
Summary:	Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.
Comments:	Sample was not large enough for full set, only one cylinder was created. Per Jim with C&EC will break at 28 days.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0015
Service Date: 03/12/21
Report Date: 04/06/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/08/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 66A Depth 15'
Placement Location: Column 66A Depth 15'

Field Test Data

Test	Result	Specification

Air Content (%):
Concrete Temp. (F):
Ambient Temp. (F):
Plastic Unit Wt. (pcf):
Yield (Cu. Yds.):

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	03/09/21	03/15/21	7	4,918	700	2	MGP
1	2	3.00	7.07	03/09/21	03/15/21	7	4,667	660	2	MGP
						Average (7 days)		**680**		
1	3	4.00	12.57	03/09/21	04/05/21	28	6,643	530	1	MGP
1	4	4.00	12.57	03/09/21	04/05/21	28	7,035	560	2	MGP
						Average (28 days)		**540**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by CJ with E&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By:
Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0015
Service Date: 03/12/21
Report Date: 04/06/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 66A at depth 15’

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0016
Service Date: 03/12/21
Report Date: 04/07/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/09/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 69B Depth 8'
Placement Location: Column 69B Depth 8'

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	3.00	7.07	03/10/21	03/16/21	7	6,374	900	2	MGP
1	2	3.00	7.07	03/10/21	03/16/21	7	7,450	1,050	2	MGP
						Average (7 days)		**980**		
1	3	4.00	12.57	03/10/21	04/06/21	28	10,250	820	1	SKT
1	4	4.00	12.57	03/10/21	04/06/21	28	9,307	740	1	SKT
						Average (28 days)		**780**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by CJ with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0016
Service Date: 03/12/21
Report Date: 04/07/21 Revision 2 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 69B at depth 8’

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 4 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0017
Service Date: 03/12/21
Report Date: 04/07/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Material Information

Specified Strength: 106 psi @ 28 days

Mix ID: Soilcrete
Supplier:
Batch Time: **Plant:** On site
Truck No.: n/a **Ticket No.:** n/a

Sample Information

Sample Date: 03/10/21 **Sample Time:**
Sampled By: Mellissa Lambert
Weather Conditions:
Accumulative Yards: **Batch Size (cy):**
Placement Method:
Water Added Before (gal):
Water Added After (gal):
Sample Location: Column 2A Depth 5'
Placement Location: Column 2A Depth 5'

Field Test Data

Test	Result	Specification
Air Content (%):		
Concrete Temp. (F):		
Ambient Temp. (F):		
Plastic Unit Wt. (pcf):		
Yield (Cu. Yds.):		

Laboratory Test Data

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Age at Test (days)	Maximum Load (lbs)	Compressive Strength (psi)	Fracture Type	Tested By
1	1	4.00	12.57	03/11/21	03/17/21	7	5,615	450	2	MGP
1	2	4.00	12.57	03/11/21	04/07/21	28	7,747	620	2	MGP
1	3	4.00	12.57	03/11/21	04/07/21	28	7,897	630	1	MGP
						Average (28 days)		**620**		

Initial Cure: Onsite Cooler **Final Cure:** Water Storage Tank

Comments: **Average compressive strength of 28 day cylinders complies with the specified strength. Not tested for plastic unit weight.**
Samples made by CJ with C&EC

Samples Made By: Terracon
Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.
Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:
(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Test Methods: ASTM C 31, ASTM C39, ASTM C143, ASTM C172, ASTM C231, ASTM C1064, ASTM C1231

CONCRETE COMPRESSIVE STRENGTH TEST REPORT

Report Number: EN195074.0017
Service Date: 03/12/21
Report Date: 04/07/21 Revision 1 - 28-day results
Task: Soil Crete

Terracon
1450 Fifth St W
North Charleston, SC 29405-2326
843-884-1234

Client

Dominion Energy South Carolina Inc
Attn: Jean-Claude Younan
220 Operation Way
MC A221
Cayce, SC 29033

Project

FGD Waste Water Pond at Williams Station
2242 Bushy Park Rd
Goose Creek, SC

Project Number: EN195074

Services Requested By: Jim with Civil & Environmental Consultants Inc

Concrete Contractor: Keller

Concrete Placement: Pier

Observation Location(s): Column 2A at depth 5’

Subgrade Review: The subgrade consisted of light brown sandy clay and was observed to be firm and stable.

Concrete Type: 106 PSI concrete

Method of Placement: Soilcrete

Method of Consolidation: Mechanical Vibrator

Tests Performed: Not performed

Test Specimens Fabricated: A total of 3 compressive strength specimens [Set No(s).: 1] were fabricated during today's concrete activities.

Weather Protection: Onsite cooler

Summary: Based on our observations, cast-in-place concrete construction activities at the above-referenced locations appeared to be completed in general accordance with the project plans and specifications.

Services: Sample fresh concrete at the placement locations, perform required field tests and cast compressive strength samples. *C-31 measurements were not recorded unless indicated in the data report.

Terracon Rep.: Mellissa Lambert
Reported To:
Contractor:
Report Distribution:

(1) Dominion Energy South Carolina Inc, Jean-Claude Younan
(1) Civil & Environmental Consultants Inc, Tony Amicon
(1) Terracon Consultants, Inc., Jay Cerceo
(1) Civil & Environmental Consultants Inc, Jim Haines
(1) Keller North America Inc, Zach Williams

Reviewed By: Thomas Smoak
Project Manager

Project Name: FGD Waste Water Pond at Williams tation ` ***Project #:*** EN195074
Date: 3.20.21 ***Tested by:*** Morgan Pownall, Colby Poplin, Brianna Rice

10B (Cast 2.15.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
9.2-9.8	5.97	3.21	347
11.2-11.8	6.14	3.22	209
16.5-17.0	6.21	3.24	763
17.4-18.0	6.16	3.22	298
24.2-24.7	6.32	3.23	420
24.7-25.3	6.13	3.23	440

13B (Cast 2.15.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
4.2-4.8	7.16	3.27	201
5.1-5.7	7.01	3.25	252
14.2-14.8	7.45	3.27	379
15.1-15.7	6.37	3.28	327
26.9-27.5	6.76	3.27	121
27.5-28.0	6.63	3.27	204

15B (Cast 2.15.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
4.2-4.8	7.39	3.29	591
5.1-5.7	6.96	3.27	469
14.2-14.8	6.97	3.23	530
15.1-15.7	7.16	3.26	313
26.9-27.5	7.13	3.26	307
27.5-28.0	6.04	3.25	326

20B (Cast 2.15.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
7.2-7.8	6.94	3.26	557
7.8-8.4	6.97	3.26	348
12.0-12.6	6.41	3.22	316
12.6-13.2	6.09	3.25	290
23.1-23.7	6.18	3.24	253
24.3-24.9	5.99	3.23	279

22A (Cast 2.15.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
5.7-6.3	6.94	3.26	220
6.3-6.9	6.78	3.25	155
14.9-15.5	7.15	3.23	180
15.5-16.1	7.12	3.22	169
19.5-20.1	7.26	3.25	202
20.9-21.5	6.91	3.28	198

24A (Cast 2.16.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
5.1-5.7	7.48	3.26	567
6.2-6.8	7.10	3.26	404
13.9-14.5	6.95	3.27	449
14.7-15.3	6.20	3.29	460
20.3-20.9	7.09	3.26	598
21.5-22.1	7.01	3.27	357

11B (Cast 2.16.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
9.8-10.4	6.84	3.24	355
10.4-11.0	6.95	3.24	190
14.0-14.6	7.04	3.24	424
17.3-17.9	6.88	3.24	204
24.0-24.6	6.13	3.24	93
28.1-28.7	6.96	3.25	101

35B (Cast 2.17.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
5.6-6.2	7.21	3.29	589
6.8-7.4	7.34	3.19	591
14.4-15.0	7.02	3.29	181
15.0-15.6	7.01	3.25	345
23.5-24.2	7.01	3.28	386
24.2-24.8	7.03	3.27	393

28B (Cast 2.17.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
5.5-6.1	6.78	3.24	284
6.5-7.1	7.14	3.25	193
14.2-14.8	6.55	3.26	201
14.8-15.2	7.09	3.26	219
23.4-24.0	7.03	3.25	199
24.0-24.6	6.90	3.25	221

17A/B (Cast 2.18.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
4.9-5.5	6.33	2.47	497
5.5-6.1	6.29	2.47	662
18.0-18.6	6.15	2.53	247
18.9-19.5	6.48	2.48	264
25.5-26.1	6.21	2.45	384
26.1-26.7	5.96	2.48	357

34B (Cast 2.19.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
8.1-8.7	7.17	3.22	436
8.7-9.3	6.79	3.25	614
10.9-11.5	6.82	3.22	559
16.0-16.6	6.83	3.25	231
27.8-28.3	6.56	3.29	376
28.5-29.1	6.67	3.27	475

9A (Cast 2.20.21)			
Depth (ft)	**Average Length (in)**	**Average Diameter (in)**	**Compressive Strength (psi)**
5.7-6.3	6.40	3.28	891
6.3-6.9	6.38	3.27	495
12.3-12.9	6.51	3.28	211
13.0-13.6	5.36	3.27	303
26.6-27.2	6.48	3.25	196
27.2-27.8	6.50	3.25	388