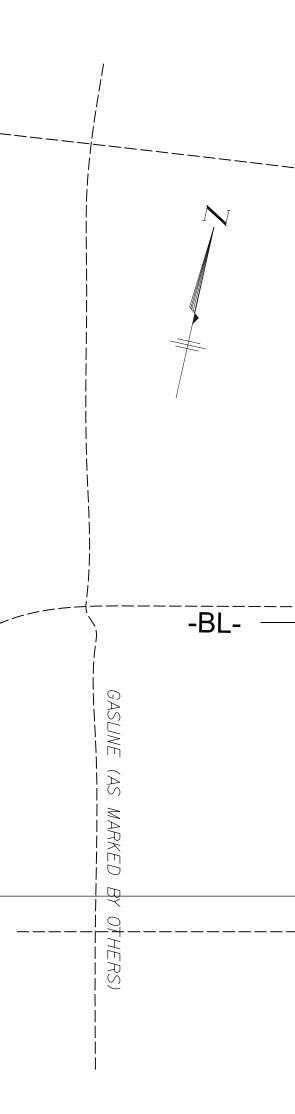
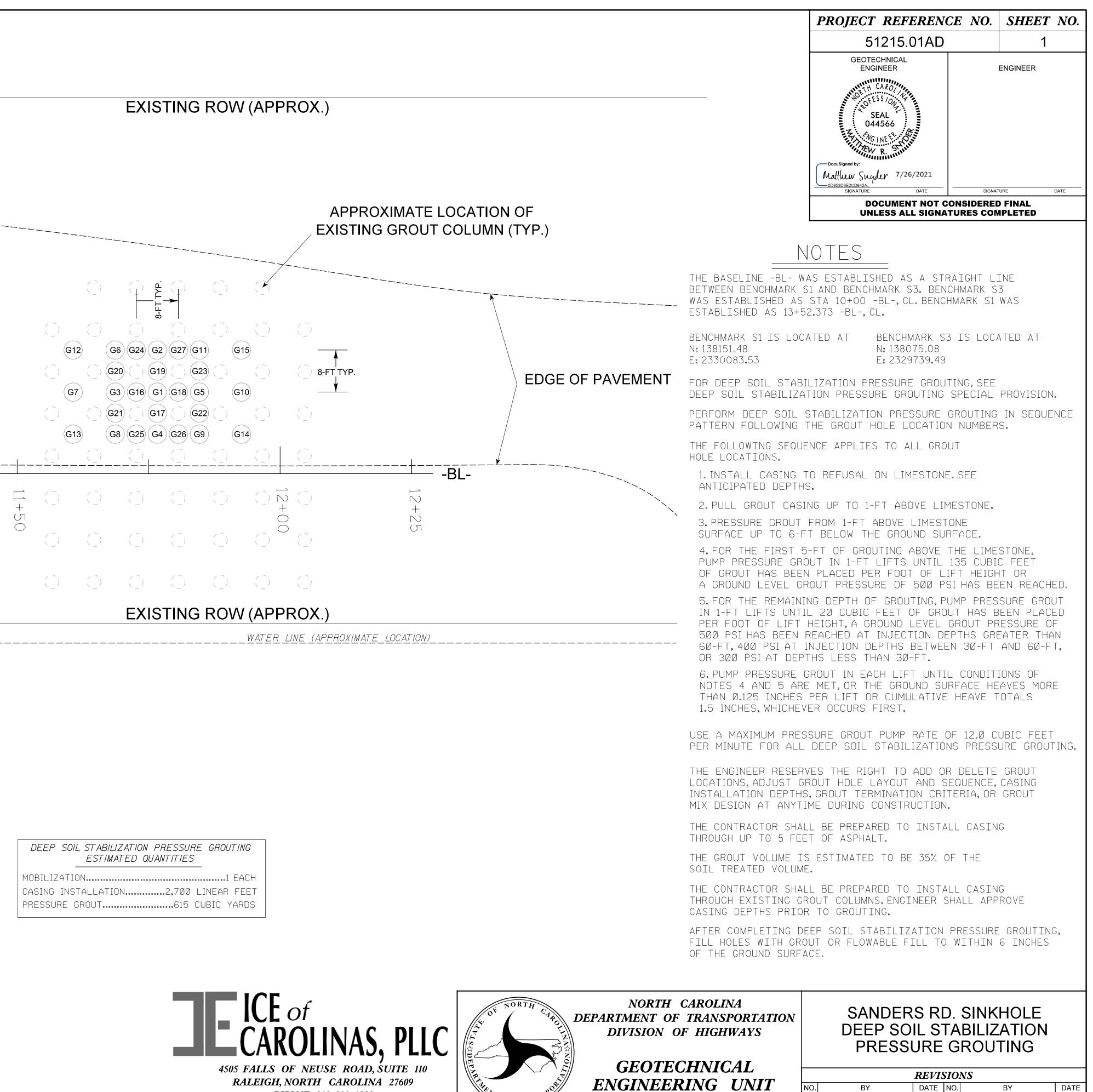
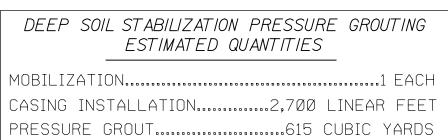
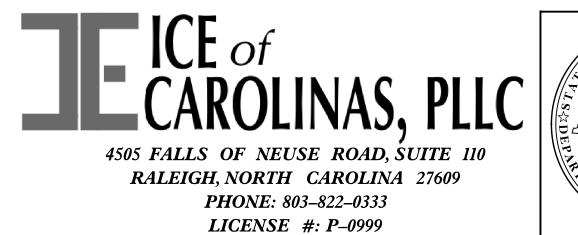
Grout Hole	Station	Offset	Anticipated Casing				
Number		(ft.)	Depth (ft.)				
G1	11+77	16 LT	103				
G2	11+77	24 LT	92				
G3	11+69	16 LT	103				
G4	11+77	8 LT	105				
G5	11+85	16 LT	97 94 94				
G6	11+69	24 LT					
G7	11+61	16 LT					
G8	11+69	8 LT	106				
G9	11+85	8 LT	97				
G10	11+93	16 LT	96				
G11	11+85	24 LT	92 94				
G12	11+61	24 LT					
G13	11+61	8 LT	106				
G14	11+93	8 LT	102 90				
G15	11+93	24 LT					
G16	11+73	16 LT	103				
G17	11+77	12 LT	103				
G18	11+81	16 LT	97				
G19	11+77	20 LT	92				
G20	11+69	20 LT	94				
G21	11+69	12 LT	103				
G22	11+85	12 LT	97				
G23	11+85	20 LT	92 89				
G24	11+73	24 LT					
G25	11+73	8 LT	105				
G26	11+81	8 LT	96				
G27	11+81	24 LT	92				

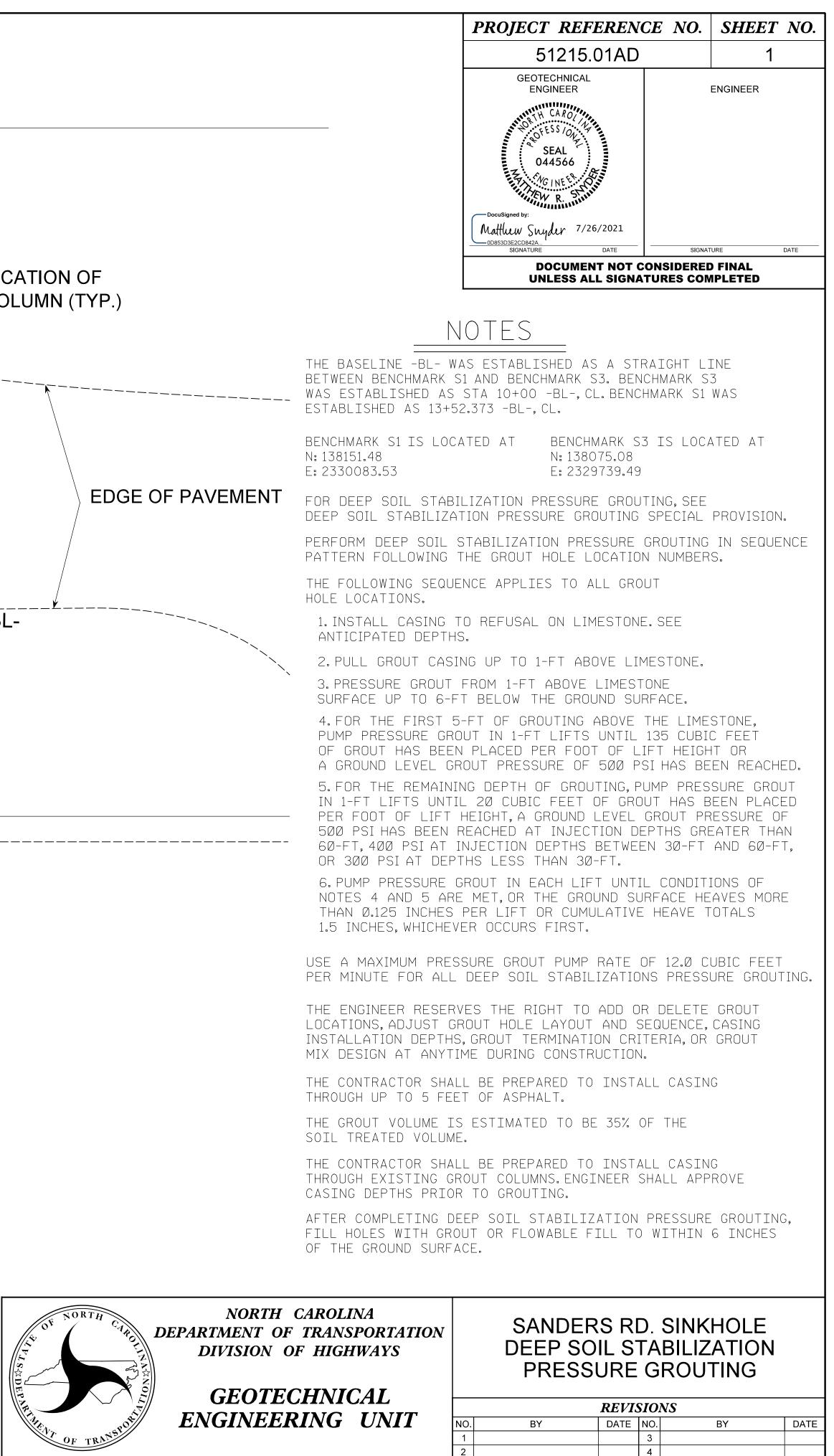


PREPARED BY:	MRS	DATE: 07/2021	
REVIEWED BY:	MDV	DATE: 07/2021	









## **GT-1.1**

## **DEEP SOIL STABILIZATION PRESSURE GROUTING**

## (SPECIAL)

## 1.0 GENERAL

The work covered by this consists of pressure grouting for stabilization and improvement of deep subsoil conditions to minimize the potential for future ground subsidence. Deep soil stabilization pressure grouting involves the injection of a medium to high-slump grout material under high pressure to reinforce the surrounding soil profile. Deep soil stabilization pressure grouting stabilizes the soils from the top of limestone up to within 6 feet from the ground surface. This work consists of furnishing all labor, equipment, and materials necessary to install grout casings through asphalt pavements, existing grout columns, and all soils to underlying limestone and inject medium to high-slump at high pressure in lifts while withdrawing casings. Monitor grout pressures, injection volumes, casing withdrawal depths, and ground heaves. Fill holes to within 6 inches of ground surface with Type 1 grout or flowable fill after completing deep soil stabilization pressure grouting.

## 2.0 MATERIALS

Refer to the Standard Specifications.

Item	Section
Type 1 Grout	1003
Flowable Fill, Excavatable	1000

## 3.0 CONTRACTOR QUALIFICATIONS AND SUBMITTALS

The Contractor who performs deep soil stabilization pressure grouting shall have at least five (5) years of experience in deep pressure grouting above 200 psi and shall show evidence of at least ten (10) projects completed within the last three (3) years including project description and contact/reference information. The Contractor's superintendent who performs this work shall have at least five (5) years of experience in deep pressure grouting above 200 psi and shall show evidence of at least five (5) projects completed in the last three (3) years including project description and contact/reference information. Do not perform work until the Contractor and superintendent are approved by the Engineer. Submit the items listed below a minimum of 10 working days before beginning work.

- A. Provide a list of major components to be used, such as pumps, hoses, pipes, fittings and casing installation equipment, manufacturers' data on size, type, pressure rating, capacity, and other critical characteristics for each item prior to the commencement of work.
- B. Provide a work schedule outlining mobilization, drilling (sequence and location), grouting and demobilization.
- C. Provide a description of the program for monitoring the work, including means of grout pressure measurement, grout flow volumes, and ground heave detection. Include certification(s) of grout pressure gauges and volume meters.
- D. Provide of listing of personnel to perform the work that includes the experience and qualification of key personnel.
- E. Submit copies of drilling and grouting report forms for approval by the Engineer.

## 4.0 **PRECONSTRUCTION MEETING**

Before starting deep soil stabilization pressure grouting, hold a preconstruction meeting to discuss the construction and inspection of the pressure grouting. If this meeting occurs before all submittals have been accepted, additional preconstruction meetings may be required before beginning construction. The Resident or County Maintenance Engineer, Geotechnical Operations Engineer, Contractor and Grouting Superintendent will attend preconstruction meetings.

## 5.0 GROUT MIX AND TESTING

A. Grout Mix

The mixture used for grouting shall be a creamy consistency which will permit the grout to flow. The measured slump of the grout shall be between five (5) and seven (7) inches. The slump may be varied throughout the grouting operations at the discretion of the Engineer. The follow mixture shall be used with minor variations of constituents permitted to meet the above requirements.

For one (1) cubic yard batch:

- Portland Cement (Section 1024-1) = 250 lb
- Fly Ash (Section 1024-5) = 750 lb
- Water (Section 1024-4) = 400 lb
- Sand (Section 1014-1) = 2,275 lb
- Air Entrainment (Section 1024-3) = 2 to 4%
- Water Reducing Admixture = 19.0 oz

B. Slump Testing

The Engineer will perform slump sampling and testing in accordance with Section 420-6.

C. Grout Placement Time Limit

The maximum allowable time between initial introduction of water to the grout mix and injecting the grout in-place is 90 minutes. This time may be extended at the discretion of the Engineer.

D. Grout Mixing and Placement

If on-site mixing is used, facilities and measuring devices shall be provided for accurately measuring the ingredients in each batch of grout to within +/- 1% of the mix design. The equipment and measuring devices used shall allow the Engineer to verify the appropriate ingredient quantities throughout the mixing process. If at any time the ingredient quantities are found to be out of tolerance, or if the Engineer cannot verify the appropriate ingredient quantities, all mixing operations shall cease until the Engineer determines that the appropriate measures have been taken to accurately produce the grout mixture and verify that it is within tolerance. The ingredients shall be thoroughly mixed and immediately pumped to the grout pipes through a flexible hose not more than 250 feet long.

## 6.0 CONSTRUCTION METHODS

## A. Equipment

Provide an on-site volumetric mixer to batch grout. Provide a mixer of sufficient production capacity to supply the grout pump at its required rate.

Provide a pump of sufficient capacity to deliver grout having a slump of five to seven inches at pressures up to 600 psi, at flow rates ranging from 0.1 to 12.0 cubic feet per minute.

Provide gauges at the pump and the grout pipe head to measure pressure. Verify pump stroke volume accuracy at the site by filling a container of known volume prior to beginning grouting.

Provide grout hose with a uniform minimum inside diameter of 3 inches with non-restrictive full flow couplings.

## B. Grout Pipe Installation

Provide flush joint steel casing with uniform minimum inside diameter of 3 inches. Provide steel casings with adequate strength to maintain the hole and to withstand the required casing installation, withdrawal, and pumping pressures. Use casing installation equipment and techniques to install casings through overlying soils, pavements, and existing grout columns to limestone at anticipated depths as shown on the plans. The Contractor shall be prepared to install casing through at least 5 feet of asphalt. If encountered, the Contractor shall be prepared to install casing through existing grout columns. The casing installation technique shall be capable of confirming casing refusal on limestone. The Contractor shall be prepared to install casings to depths at least 20-ft deeper than the deepest casing depth shown on the plans. The Engineer shall approve grout casing depths prior to grouting.

If drilling is used, the drilling method to be used must be capable of simultaneously drilling the hole and advancing the casing to prevent collapsing of the hole. Install the casing to provide intimate contact between the casing and the surrounding soil in order to prevent grout leakage and/or premature upward movement of the casing during injection of high-pressure grout. Install all grout pipes to within three degrees of vertical, or as directed by the Engineer. Provide riser elbow with a minimum 1-foot radius curve to minimize the potential for grout blockage.

C. Grout Injection Procedures.

Inject grout at locations, sequencing, and to grout lift termination criteria as shown on the plans. The Engineer reserves the right to move, add or delete grout locations.

Continuously monitor grouting pressure and flow rates at the grout pipe head with gauges suitably protected to prevent grout clogging or damage from handling, vibration, or shock.

Unless otherwise directed by the Engineer, pumping shall cease, if an injection pipe takes 60 cubic yards of grout. If this excessive pumping occurs, the grout pipe shall be raised and flushed to prevent the pipe from being cemented in place. Pumping can then proceed to another grout pipe location. Pumping may resume at the excessive grout location and depth after a period of 12 hours has passed. The grout pipe shall be re-installed to within 1 foot of the depth grouting was terminated unless otherwise directed by the Engineer.

Replace any holes lost due to failure of grouting or drilling equipment at no charge to the Project.

Monitor the existing pavement and/or adjacent structures continuously during grouting operations. Terminate grouting immediately if upward heave movement exceeds per lift limitations shown on the plans of sudden grout pressure loss is observed indicated hydraulic fracturing.

Fill holes to within 6 inches of ground surface with Type 1 grout or flowable fill after completing pressure grouting.

D. Records

The Contractor is responsible for preparation of casing installation reports which contain at least the following information: Name of driller, type of casing installation method being used, date started, date completed, type of flushing, location of hole, depth of hole, and type of depth of material encountered. Submit casing installation reports to the Engineer at the end of each working day.

The Contractor is responsible for preparation of grouting reports which contain at least the following information: Name of grouting technician, constituents and proportions of grout, log of quantity injected per grout lift for hole, date, rate of pumping, grouting pressure at the hole, type of pump, refusal criteria, and movements detected in the monitoring system. Submit grouting reports to the Engineer at the end of each working day.

E. Protection and Cleanup. The contractor is fully responsible for removing all equipment and unused materials from the job site.

## 7.0 MEASUREMENT AND PAYMENT

*Mobilization* will be measured and paid at the contract lump sum price. Such payment will be considered full compensation for mobilization materials, labor, equipment, and incidentals to the site needed to perform the work of this special provision and pressure grouting plan sheet.

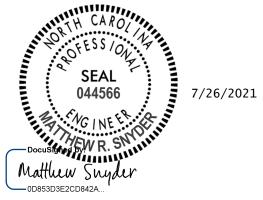
*Casing Installation* will be measured and paid for as the actual number of feet of grout pipe installed on the project. Such payment will be full compensation for all items required to install and remove grout pipe, including but not limited to supplying and installing material, tools, equipment, cleanup and incidentals necessary to complete this work.

*Pressure Grout* will be measured and paid for as the actual number of cubic yards of grout installed on the project. Such payment will be full compensation for all items required to install grout, including but not limited to supplying and installing material, tools, equipment, cleanup and incidentals necessary to complete this work. Type 1 or flowable fill used to fill holes to within 6" of ground surface will be measured and paid for as *Pressure Grout*.

Payment will be made under:

Pay Item Mobilization

Casing Installation Pressure Grout



**Pay Unit** Lump Sum Linear Foot Cubic Yard

## **CONTENTS**

SHEET NO. 2 3

4-19

**DESCRIPTION** TITLE SHEET LEGEND (SOIL & ROCK) SITE PLAN CPT LOGS

## STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

# **STRUCTURE** SUBSURFACE INVESTIGATION

COUNTY NEW HANOVER PROJECT DESCRIPTION SANDERS ROAD SINKHOLE

STAT	TB.	STATE PROJECT REFERENCE NO.	SHRET NO.	TOTAL SHEETS	
$\mathbb{N}.$	C.	51215.01AD	1	19	

## CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOLI TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1991 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-FLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OSESTIGATIONS ARE AS RECORDED AT THE TIME TOF THE INVESTIGATION. THES UBSURFACE RELIEVELS OR SOLL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE SOLL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE SOLL MOISTURE CONDITIONS MAY YARY CONSIDERABLY WITH THE ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT, FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE BIDDER OR CONTRACTOR THE INVESTIGATION MADE, NOR THE INTERRETATIONS MADE, OR OPHION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HINSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES: I. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT. 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

M. SNYDER, PE

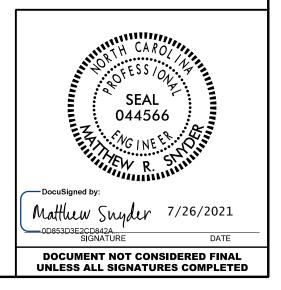
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INVESTIGATED BY <u>M. SNYDER</u>, PE DRAWN BY \_\_M. SNYDER, PE

CHECKED BY <u>N. MOHS, LG</u>

SUBMITTED BY \_\_\_\_\_M. SNYDER, PE





## NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT SUBSURFACE INVESTIGATION

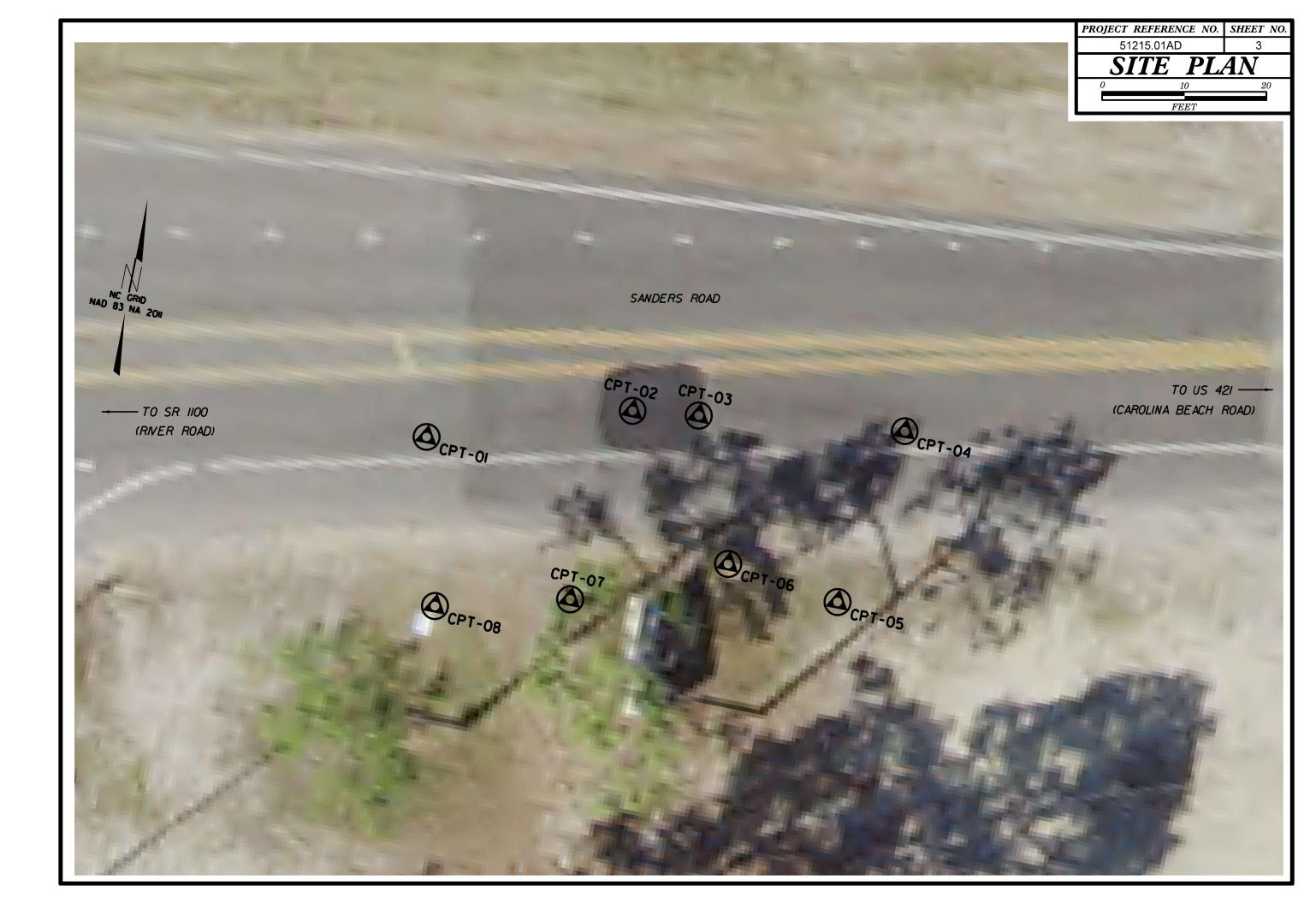
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

			SOIL C	ESCRI	PTIO	1			1		GF	RADATION						ROCK DE	SCRIPTION
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLICHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 2006, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING:					WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.				HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTE ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN &J BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK										
CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,							ANGULARITY OF GRAINS					REPRESENTED ROCK MATERIA			ATHERED ROCK. DIVIDED AS FOLLO	NS:			
VERY STIFF, GRAV, SILTY CLAV, MOIST WITH INTERBEDDED FINE SAND LAVERS, HIGHLY PLASTIC, A-7-6 SOIL LEGEND AND AASHTO CLASSIFICATION						THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.					WEATHERED ROCK (WR)	22		NON-COASTAL PLA 100 BLOWS PER F	IN MATERIAL THAT WOULD YIELD SPI				
GENERAL		GRANULAR MATERIA			CLAY MA			TEDIALO	MINERALOGICAL COMPOSITION						CRYSTALLINE	-	2.2		GRAIN IGNEOUS AND METAMORPHIC RO
CLASS.		≤ 35% PASSING #2		-	5% PASSIN		ORGANIC M					Z, FELDSPAR, MICA, T N THEY ARE CONSID			ROCK (CR)			WOULD YIELD SPT GNEISS, GABBRO, S	REFUSAL IF TESTED. ROCK TYPE IN CHIST, ETC.
GROUP CLASS.	A-1 A-1-a A-1-b	A-3 A-2-4 A-2-	A-2 5 A-2-6 A-2-	A-4	A-5 A	-6 A-7 A-7-5, A-Z-6	A-1, A-2 A-4, A-3 A-6,					RESSIBILITY			NON-CRYSTALL	INE		SEDIMENTARY ROC	GRAIN METAMORPHIC AND NON-COASTA K THAT WOULD YEILD SPT REFUSAL
SYMBOL					1.7.1				MODE MODE	ERATELY	OMPRESSIBLE	LE	LL < 31 LL = 31 ·	- 50	ROCK (NCR)	N			DES PHYLLITE, SLATE, SANDSTONE, ET EDIMENTS CEMENTED INTO ROCK, BUT
% PASSING *1月							SIL SIL	-	HIGH	ILY COMF	PRESSIBLE		LL > 5Ø		SEDIMENTARY (CP)				CK TYPE INCLUDES LIMESTONE, SANDS
*40	50 MX 30 MX 50 MX						GRANULAR CLA SOILS SOI				GRANULAR	GE OF MATER SILT - CLAY						WEAT	HERING
*200 MATERIAL	15 MX 25 MX	10 MX 35 MX 35 M	1X 35 MX 35 1	1X 36 MN 3	36 MN 36	MN 36 MN		-	ORGANIC MATERIAL TRACE OF ORGANIC M		<u>SOILS</u> 2 - 3%	SILT - CLAY <u>SOILS</u> 3 - 5%	<u>OTHEI</u> TRACE	<u>R MATERIAL</u> 1 - 10%			ESH, CRYSTAL		TS MAY SHOW SLIGHT STAINING, ROCK
PASSING #40	_	- 40 MV 41 h	IN 40 MX 41 M		41 101 40		SOILS WITH		LITTLE ORGANIC MAT MODERATELY ORGANIC		3 - 5% 5 - 10%	5 - 12% 12 - 20%	LITTLE SOME	10 - 20% 20 - 35%					SOME JOINTS MAY SHOW THIN CLAY C
PI	6 MX		IN 412 MX 41 M IX 11 MN 11 M				LITTLE OR MODERATE	HIGHLY	HIGHLY ORGANIC		> 10%	> 20%	HIGHLY	35% AND ABOVE			S UN A BRU YSTALLINE N		SHINE BRIGHTLY, ROCK RINGS UNDER H
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MATERIALS	Sand		. HILD SHILD	5010	5	30123	5410 TO	_	 			VEL AFTER <u>24</u> I SATURATED ZONE, OR		RING STRATA					SCOLORATION AND WEATHERING EFFECT: DULL AND DISCOLORED, SOME SHOW CLA
gen, rating As subgrade		EXCELLENT TO GOO	D	F	AIR TO P	DOR	FAIR TO POOR POOR	R UNSUITABL			ING OR SEEP		which ben				UND UNDER I ESH ROCK.	HAMMER BLOWS AND	SHOWS SIGNIFICANT LOSS OF STRENGTH
	1	PI OF A-7-5 SUBGR					▶LL - 3Ø								MODERATELY	ALL ROCK	к ехсерт о		R STAINED. IN GRANITOID ROCKS, ALL F
			SISTENC		UENS E OF ST		BANGE OF	JNCONFINED		r		NEOUS SYMBO	<u>ILS</u>		(MOD. SEV.)	and can	BE EXCAVA	TED WITH A GEOLOGI	KAOLINIZATION, ROCK SHOWS SEVERE L ST'S PICK, ROCK GIVES "CLUNK" SOUND
PRIMARY	SOIL TYPE	COMPACTN CONSIST		PENETRA		ESISTENCE	COMPRESSI	E STRENGTH /FT <sup>2</sup> )	L ROADWAY EMB			DIP & DIP DIR DIP & DIP DIR DF ROCK STRU						<u>TELD SPT REFUSAL</u>	R STAINED, ROCK FABRIC CLEAR AND E
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GENERA		VERY S			< 2 2 TO			.25 10 Ø.5		IL BOUN		- CORE BORING	•	SOUNDING ROD					F ROCK WEATHERED TO A DEGREE THAT HAIN. <u>IF TESTED, WOULD YIELD SPT N V</u>
SILT-CL	_AY	MEDIUM	STIFF		4 TO	8	Ø.5	0 1.0	INFERRED ROOM	CK LINE	- <sup>MW</sup> C	MONITORING WE	ill 🕂 🕂	_ TEST BORING WITH CORE	COMPLETE	ROCK REI	DUCED TO S	OIL, ROCK FABRIC NO	T DISCERNIBLE, OR DISCERNIBLE ONLY
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		HAR	XTURE	OR GR	> 30 ATN 9	SIZE	,	4	+	R	RECOMMEN	DATION SYMB	015					ROCK H	ARDNESS
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OPENING (M		4.	76 2.00	Ø <b>.</b> 42	Ø.2	5 Ø.Ø75	0.053	1			ISUITABLE WAS ICLASSIFIED E		USED I	TABLE, BUT NOT TO BE					NLY WITH DIFFICULTY. HARD HAMMER B
BOULDE (BLDR.)			AVEL	COARSI SAND		FINE SAND	SILT (SL.)	CLAY (CL.)			CEPTABLE DE	GRADABLE ROCK		MENT OR BACKFILL			CH HAND SPI SCRATCHED I		OUGES OR GROOVES TO Ø.25 INCHES DE
		75		(CSE, SI		(FSD.)			AR - AUGER REFUSAL			REVIATIONS	Vet	- VANE SHEAR TEST			ED BY HARD RATE BLOWS		IST'S PICK, HAND SPECIMENS CAN BE D
GRAIN MN SIZE IN		3	2.Ø		Ø <b>.</b> 2	5	0,05 0	005	BT - BORING TERMINATED	.D	MICA.	- MICACEOUS	WEA.	- WEATHERED	MEDIUM	CAN BE (	GROOVED OR	GOUGED 0.05 INCHES	S DEEP BY FIRM PRESSURE OF KNIFE C
	S	OIL MOIST	URE -	CORREI	LATIO	N OF	TERMS		CL CLAY CPT - CONE PENETRATION	IN TEST	NP - 1	MODERATELY NON PLASTIC		UNIT WEIGHT DRY UNIT WEIGHT			EXCAVATED : F A GEOLOGI		PEICES 1 INCH MAXIMUM SIZE BY HARD
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		I	- SATURA	TED -	US	UALLY LIG	UID; VERY WET,	JSUALLY	DPT - DYNAMIC PENETRA e - VOID RATIO	TION TE		SAPROLITIC SAND, SANDY	S - E SS -	BULK SPLIT SPOON		PIECES C	CAN BE BROK	KEN BY FINGER PRES	SURE.
LL _		LIMIT	(SAT.		FR	OM BELOW	THE GROUND W	ATER TABLE	F - FINE FOSS FOSSILIFEROUS		SL 9	SILT, SILTY SLIGHTLY		SHELBY TUBE ROCK	SOFT	OR MORE	IN THICKNE		CAVATED READILY WITH POINT OF PICK. BY FINGER PRESSURE, CAN BE SCRATCH
PLASTIC RANGE <			- WFT -	(W)			EQUIRES DRYING	то	FRAC FRACTURED, FRAC	CTURES	TCR -	TRICONE REFUSAL	RT -	RECOMPACTED TRIAXIAL			AIL. JRE SPA		BEDDING
(PI) PL		CLIMIT _		,	AT	TAIN OPTI	NUM MOISTURE		FRAGS FRAGMENTS HI HIGHLY		20 - M V - VE	ERY	CBR	- CALIFORNIA BEARING RATIO		KAUTU	JRE SPA	SPACING	
		M MOISTURE	- MOIST	- (M)	SO	LID;AT OR	NEAR OPTIMUM	MOISTURE		1		ON SUBJECT			VERY WIDE WIDE			THAN 10 FEET TO 10 FEET	VERY THICKLY BEDDED THICKLY BEDDED 1
SL		AGE LIMIT							DRILL UNITS:		ANCING TOOLS: CLAY BITS			TYPE: TOMATIC MANUAL	MODERATEL CLOSE	Y CLOSE	E 1	TO 3 FEET 6 TO 1 FOOT	THINLY BEDDED Ø. VERY THINLY BEDDED Ø.Ø
			- DRY -	(D)			DITIONAL WATE MUM MOISTURE	то				S FLIGHT AUGER			VERY CLOS	E		THAN Ø.16 FEET	THICKLY LAMINATED 0.00 THINLY LAMINATED <
			PI /	STICI					CME-55	IЦ	8" HOLLOW AU		CORE SIZ	ZE:				INDU	
				CITY IND			DRY STR	ENGTH	CME-55Ø	$ \overline{\Box} $	HARD FACED	FINGER BITS			FOR SEDIMENT	ARY ROC	KS, INDURA		NING OF MATERIAL BY CEMENTING, HE
	I PLASTIC GHTLY PLAS	STIC		Ø-5 6-15			VERY	_OW	VANE SHEAR TEST		TUNGCARBIC		HAND TO	01.52	FRIABLE	Ξ			FINGER FREES NUMEROUS GRAINS; BY HAMMER DISINTEGRATES SAMPLE.
MOE	DERATELY P	LASTIC	2	16-25 6 OR MOR	9E		MEDI	ML			CASING	W/ ADVANCER		ST HOLE DIGGER	MODERA	TELY IN	IDURATED	GRAINS CAN B	E SEPARATED FROM SAMPLE WITH ST
HIG	HEI ILHOII				10		Alt	•	PORTABLE HOIST			STEEL TEETH		ND AUGER					Y WHEN HIT WITH HAMMER. IFFICULT TO SEPARATE WITH STEEL
DECORTO					TIONS				X CPT (TRACK)		TRICONE	' TUNGCARB.		UNDING ROD NE SHEAR TEST	INDURAT	FED			BREAK WITH HAMMER.
	DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.											EXTREM	ELY IND	URATED		R BLOWS REQUIRED TO BREAK SAMPLE (S ACROSS GRAINS.			

## PROJECT REFERENCE NO.

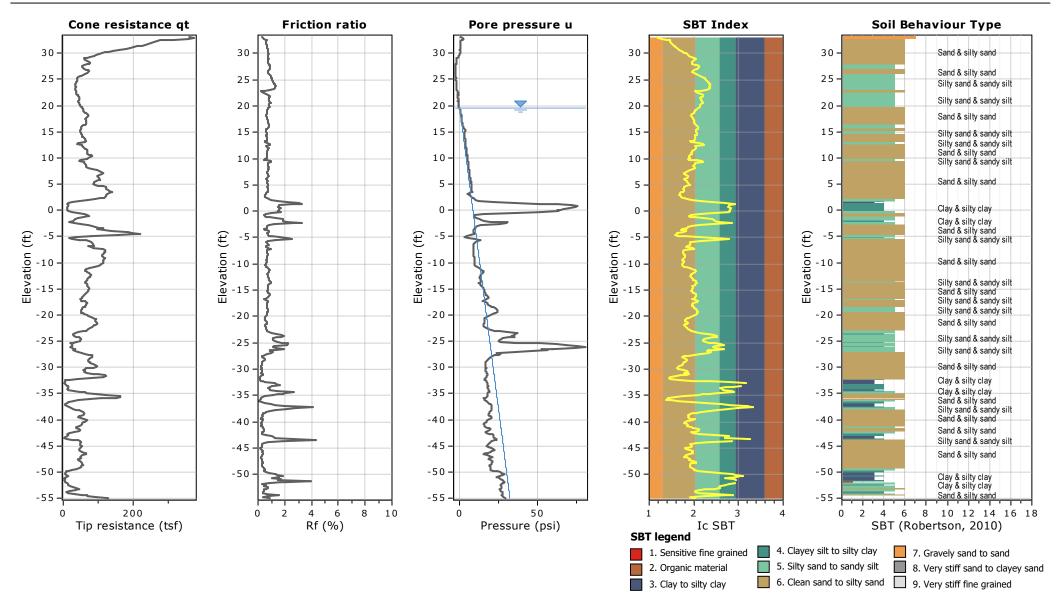
## 51215.01AD

TERMS AND DEFINITIONS TO AN INFERRED ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. ED. AN INFERRED SPT REFUSAL, 1 FOOT PER 6Ø IS OFTEN AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. <u>ARGILLACEOUS</u> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. N VALUES > ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND СК ТНАТ SURFACE. CLUDES GRANITE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. AL PLAIN IF TESTED. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. MAY NOT YIELD STONE, CEMENTED CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  $\underline{\text{DIP}}$  - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. RINGS UNDER OATINGS IF OPEN. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. AMMER BLOWS IF FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE СК ИР ТО SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FELDSPAR FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. BLOWS.  $\underline{\mathsf{FLOAT}}$  - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. S. IN Y. ROCK HAS AS COMPARED FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. FELDSPARS DULL OSS OF STRENGTH WHEN STRUCK. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO VIDENT BUT ITS LATERAL EXTENT. ARE KAOLINIZED LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. RE DISCERNIBLE PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. ONLY MINOR ALUES < 100 BPF RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. IN SMALL AND ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE S. SAPROLITE IS RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT POCK S REQUIRES  $\underline{\rm SILL}$  - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO LOWS REQUIRED THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT EEP CAN BE OR SLIP PLANE, ETACHED STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB, HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL OR PICK POINT. WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL BLOWS OF THE TO OR LESS THAN Ø.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. FRAGMENTS IT. SMALL, THIN STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. PIECES 1 INCH ED READILY BY TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. BENCH MARK: GROUND SURFACE ELEVATIONS ESTIMATED USING THICKNESS HISTORIC SURVEY DATA - NO BENCH MARK PROVIDED 4 FEET 1.5 - 4 FEET ELEVATION: N/A FEET 16 - 1.5 FEET NOTES: 3 - Ø.16 FEET 08 - Ø.Ø3 FEET 0.008 FEET AT. PRESSURE. ETC. TEEL PROBE: PROBE; DATE: 8-15-14



#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



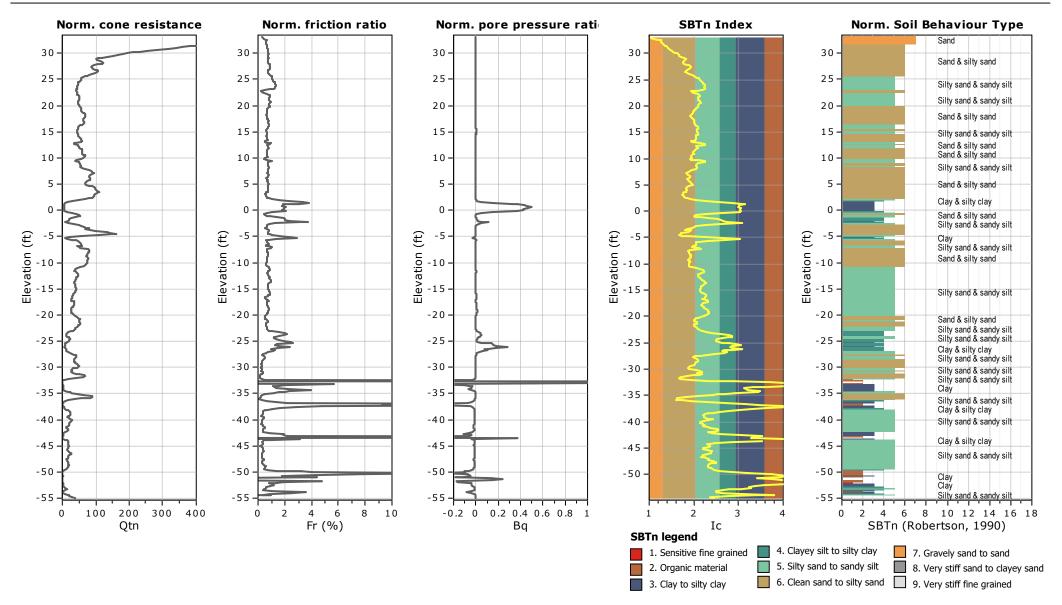
Sheet 4 of 19

## CPT-01

Total depth: 89.60 ft, Date: 7/6/2021 Surface Elevation: 34.60 ft Coords: N 138118.93, E 2329884.77 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



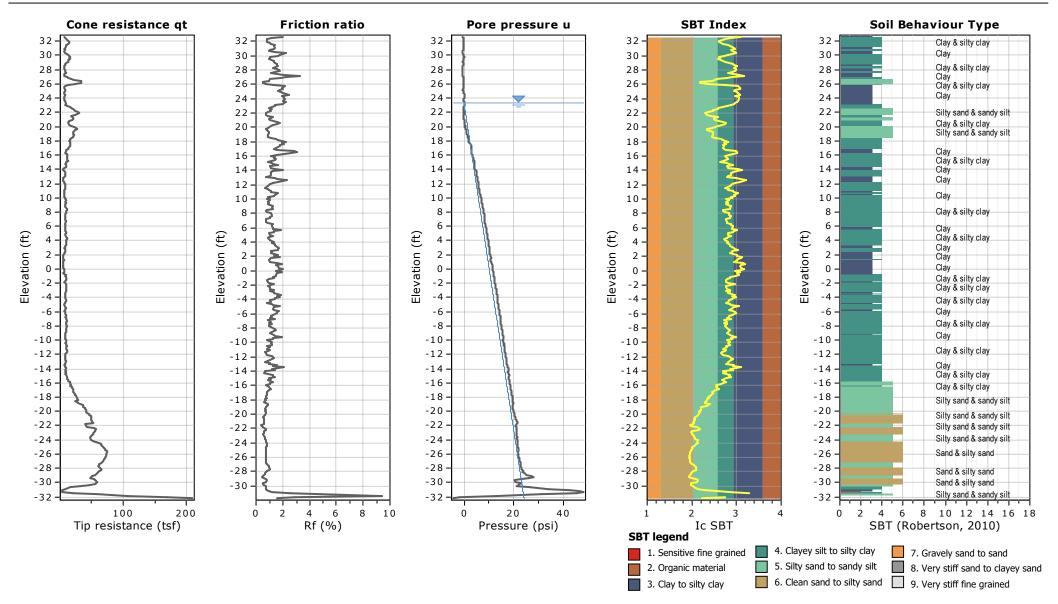
Sheet 5 of 19

## CPT-01

Total depth: 89.60 ft, Date: 7/6/2021 Surface Elevation: 34.60 ft Coords: N 138118.93, E 2329884.77 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



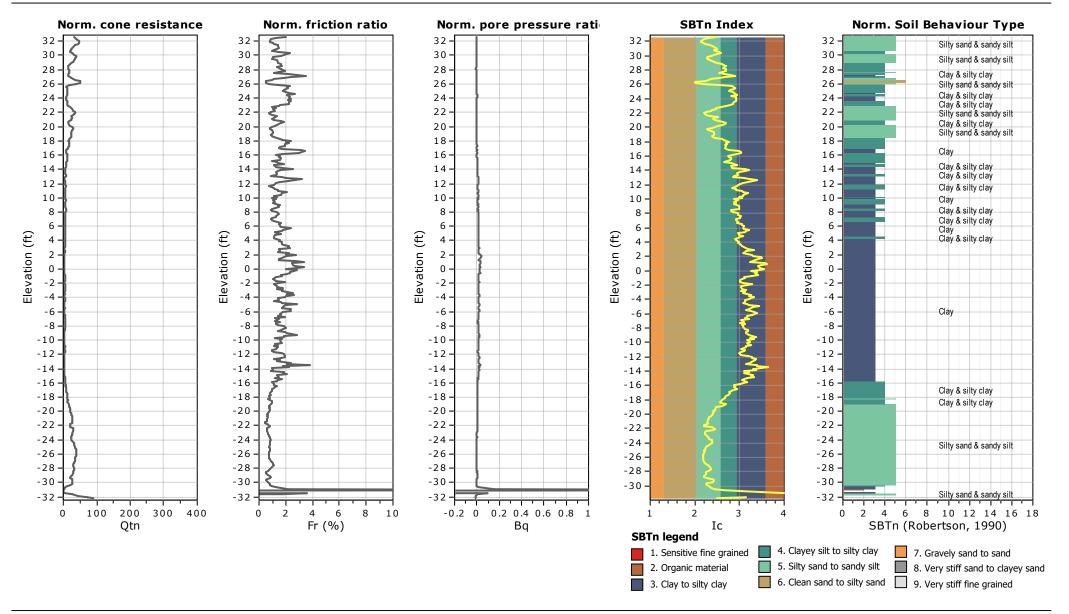
Sheet 6 of 19

CPT-02

Total depth: 66.80 ft, Date: 7/6/2021 Surface Elevation: 34.60 ft Coords: N 138127.14, E 2329909.24 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

#### Location: New Hanover Co, NC



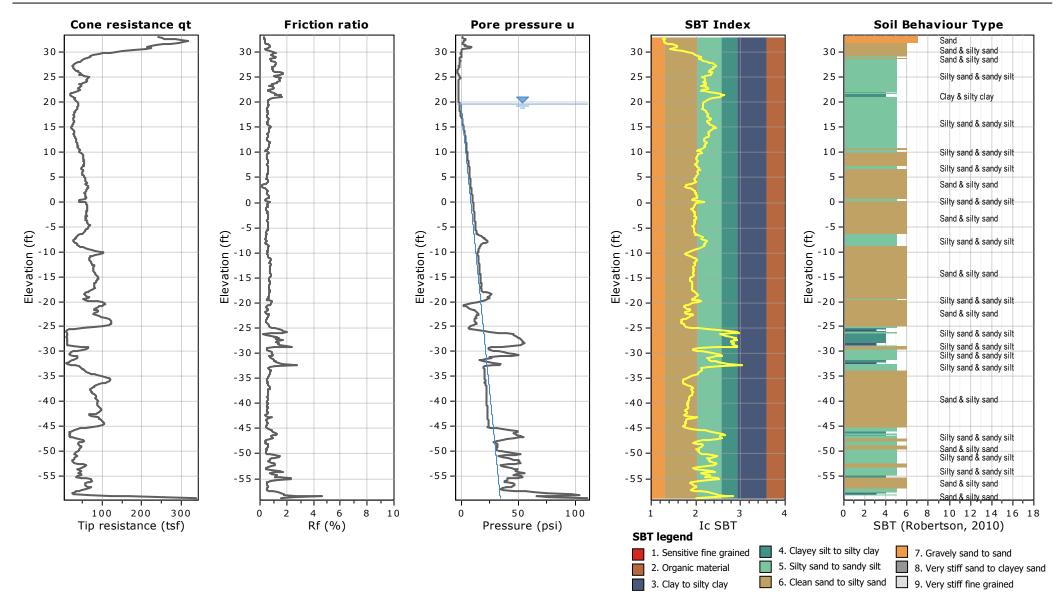
Sheet 7 of 19

CPT-02

Total depth: 66.80 ft, Date: 7/6/2021 Surface Elevation: 34.60 ft Coords: N 138127.14, E 2329909.24 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



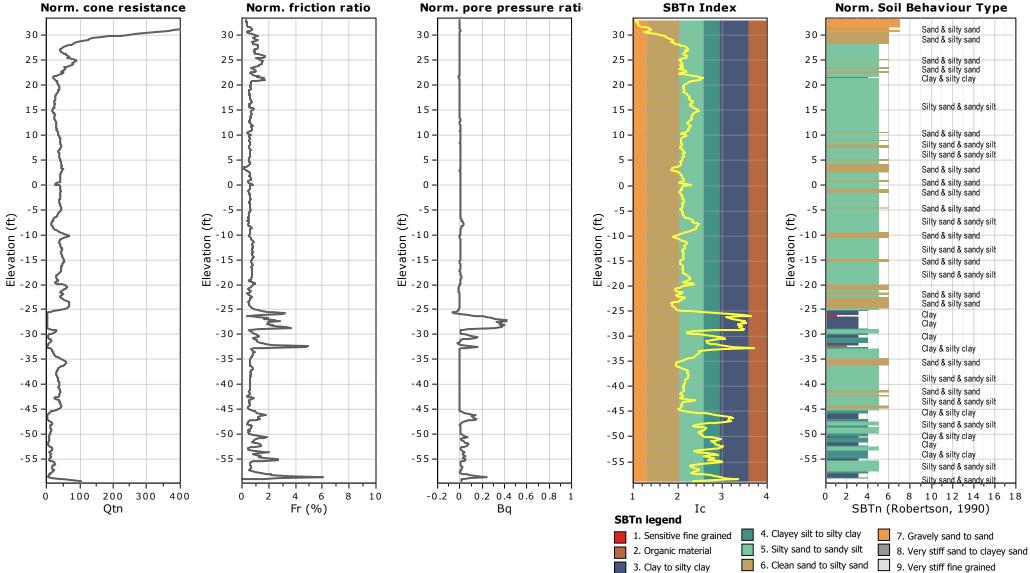
Sheet 8 of 19

### CPT-03

Total depth: 93.87 ft, Date: 7/6/2021 Surface Elevation: 34.50 ft Coords: N 138128.16, E 2329916.71 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC

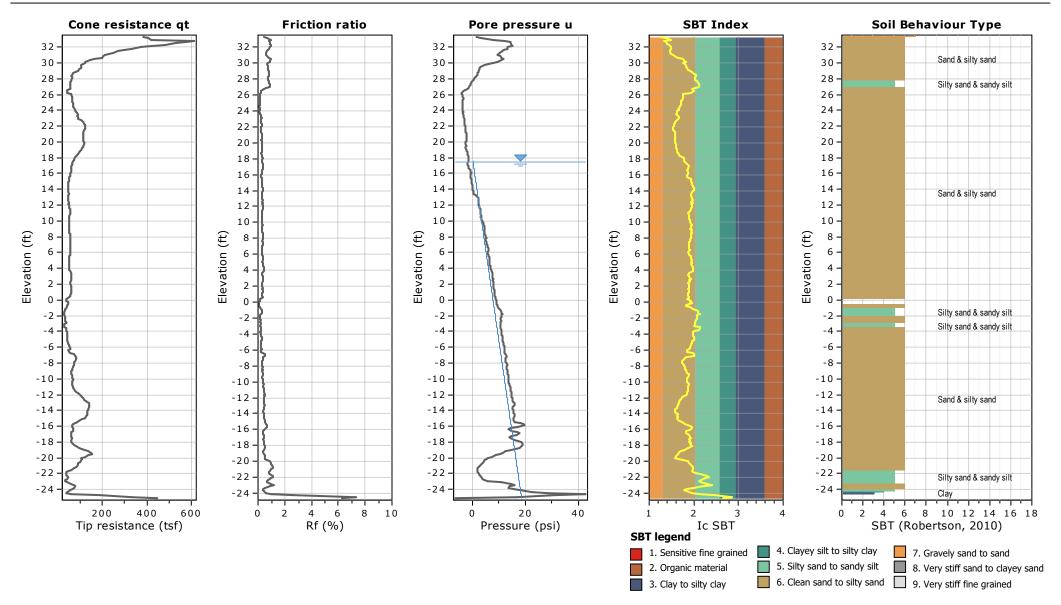


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Total depth: 93.87 ft, Date: 7/6/2021 Surface Elevation: 34.50 ft Coords: N 138128.16, E 2329916.71 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC

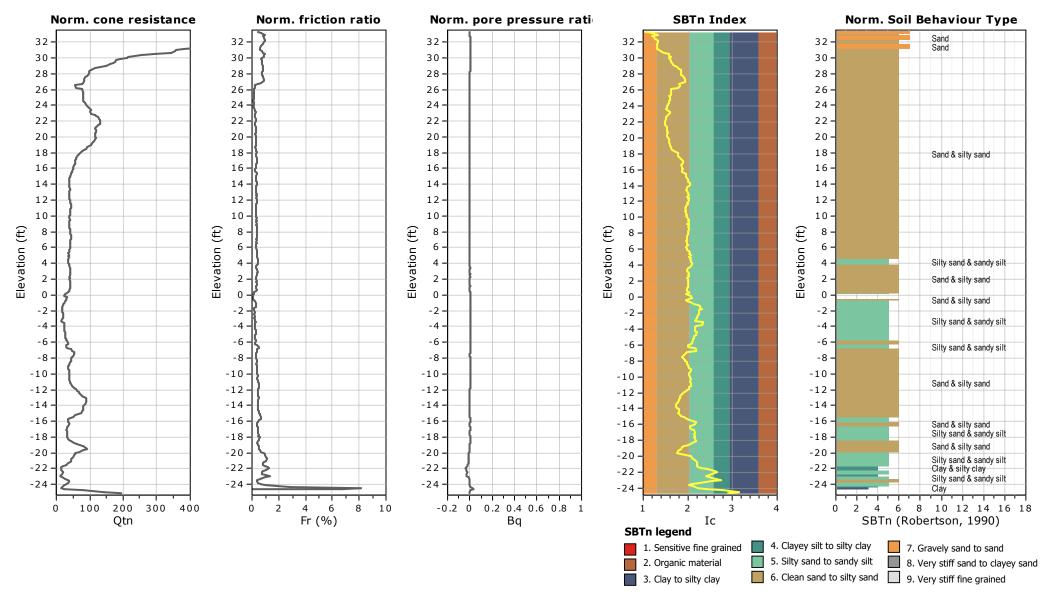


CPT-04

Total depth: 59.91 ft, Date: 7/6/2021 Surface Elevation: 34.80 ft Coords: N 138131.48, E 2329941.58 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



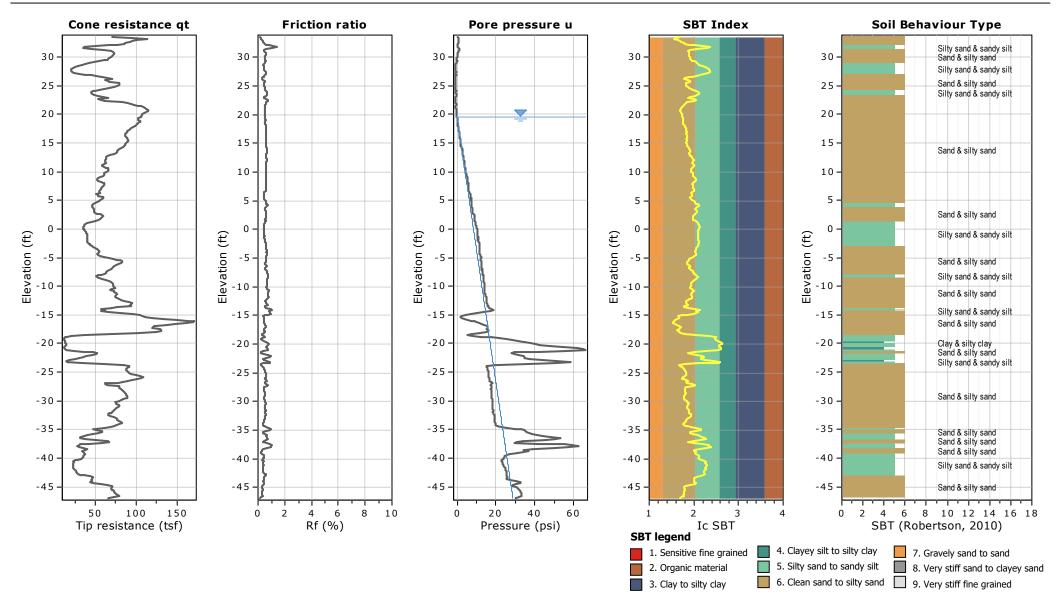
Sheet 11 of 19

#### CPT-04

Total depth: 59.91 ft, Date: 7/6/2021 Surface Elevation: 34.80 ft Coords: N 138131.48, E 2329941.58 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



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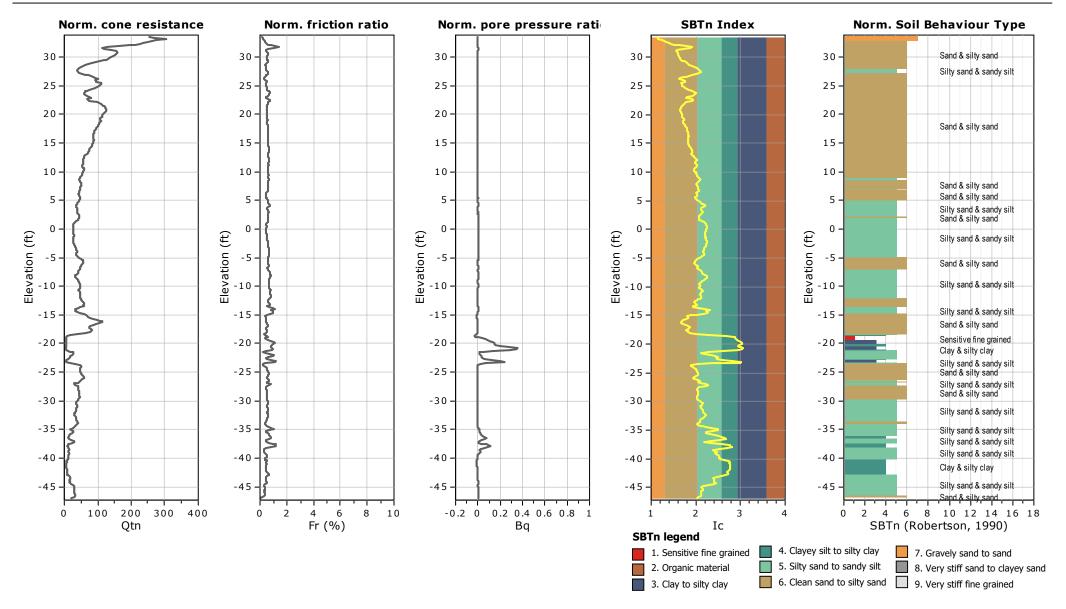
## Sheet 12 of 19

CPT-05

Total depth: 80.71 ft, Date: 7/7/2021 Surface Elevation: 33.70 ft Coords: N 138109.32, E 2329938.22 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



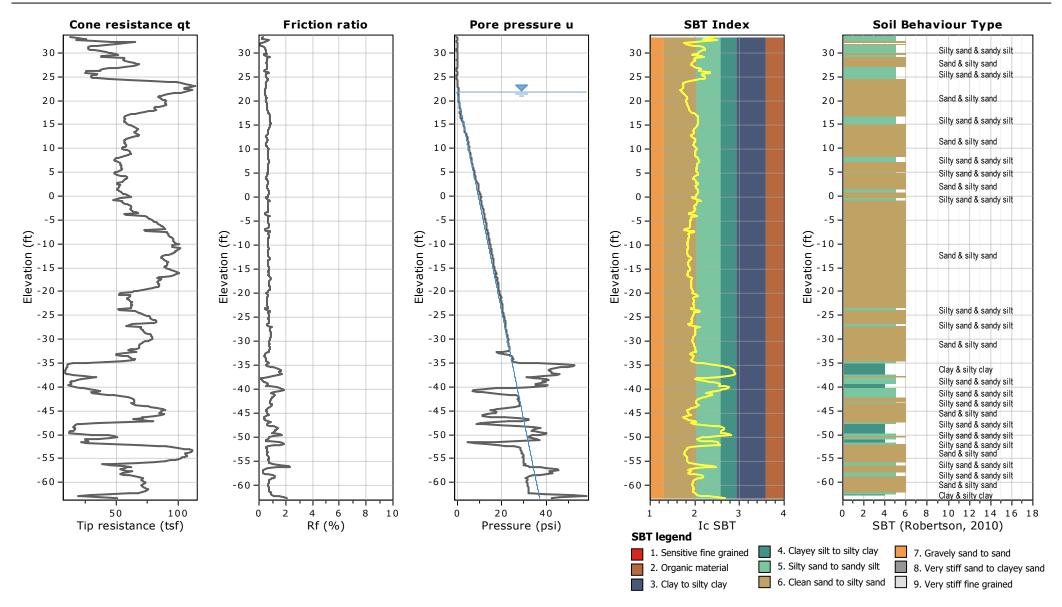
Sheet 13 of 19

CPT-05

Total depth: 80.71 ft, Date: 7/7/2021 Surface Elevation: 33.70 ft Coords: N 138109.32, E 2329938.22 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



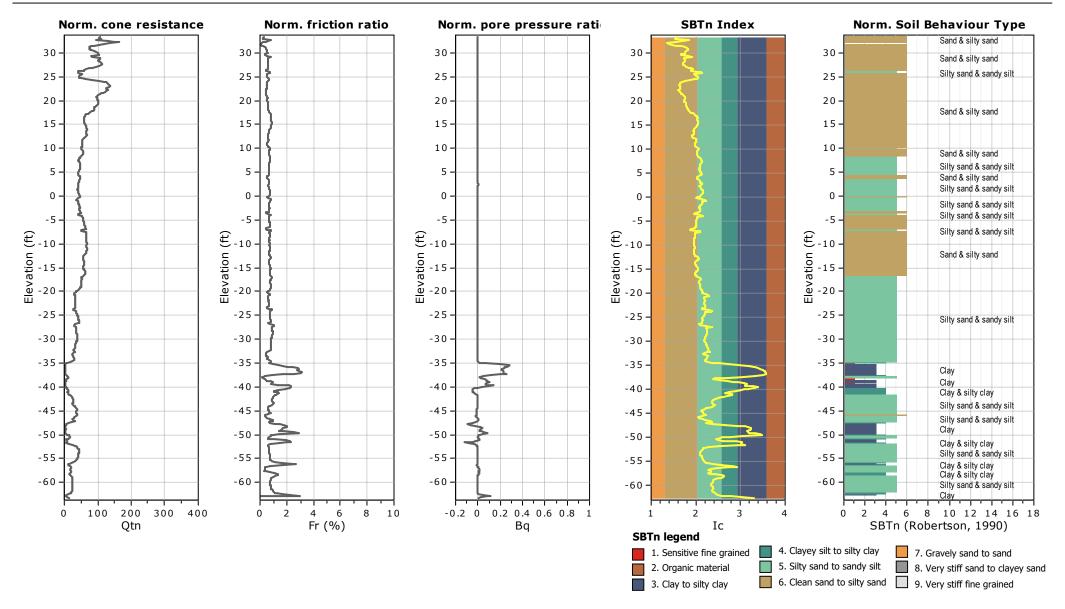
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**CPT-06** 

Total depth: 96.79 ft, Date: 7/7/2021 Surface Elevation: 33.50 ft Coords: N 138110.72, E 2329923.59 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



CPeT-IT v.3.0.3.2 - CPTU data presentation & interpretation software - Report created on: 7/12/2021, 4:01:46 PM Project file: R:\Projects\NCDOT New Hanover Co Sink Hole\Sanders Rd Sink Hole 2021\NON\_CADD\CPT Data\Sanders Rd CPT-06.cpt

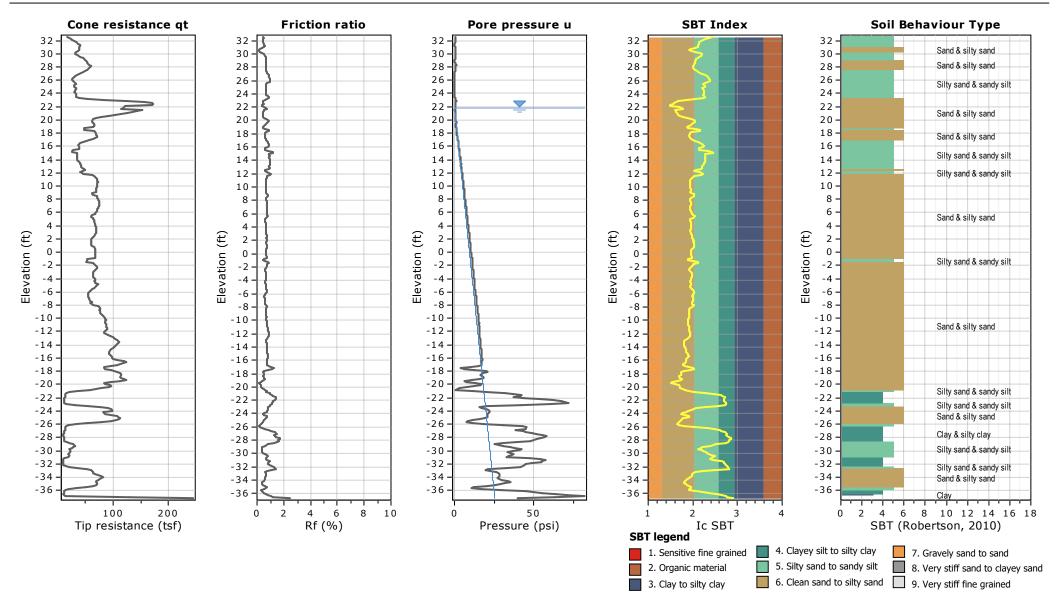
#### Sheet 15 of 19

CPT-06

Total depth: 96.79 ft, Date: 7/7/2021 Surface Elevation: 33.50 ft Coords: N 138110.72, E 2329923.59 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



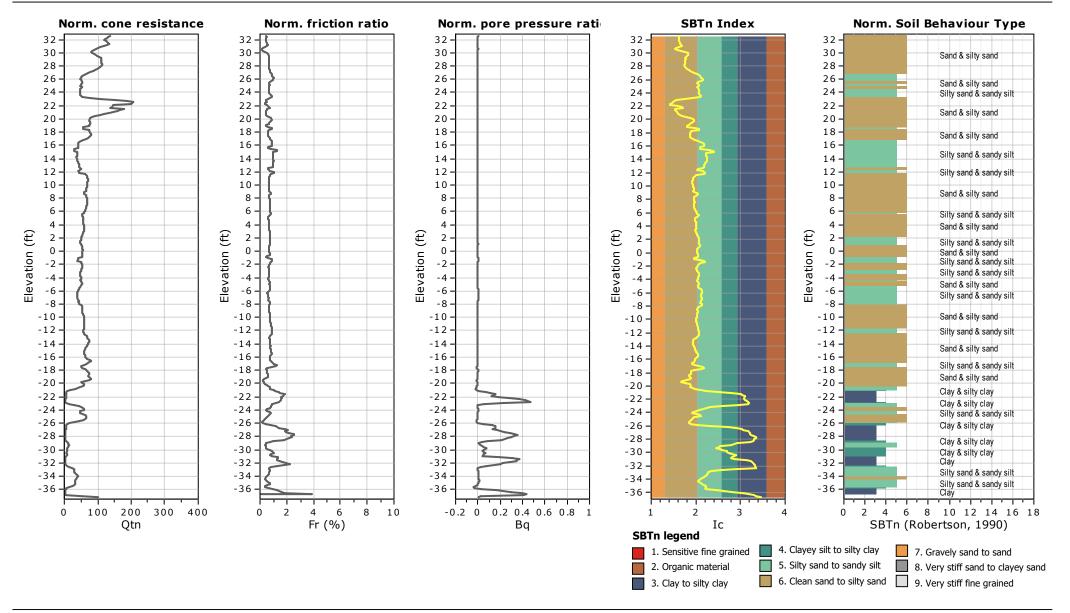
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#### Sheet 16 of 19 CPT-07

Total depth: 69.88 ft, Date: 7/7/2021 Surface Elevation: 32.70 ft Coords: N 138103.22, E 2329905.93 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

#### Location: New Hanover Co, NC



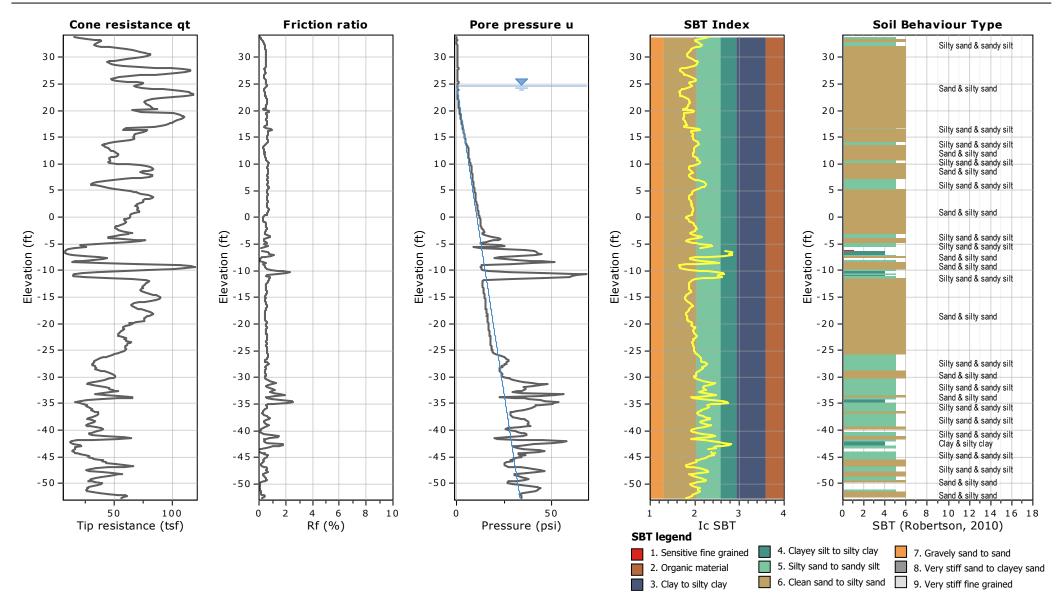
Sheet 17 of 19

#### CPT-07

Total depth: 69.88 ft, Date: 7/7/2021 Surface Elevation: 32.70 ft Coords: N 138103.22, E 2329905.93 Cone Operator: E. Swain

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC



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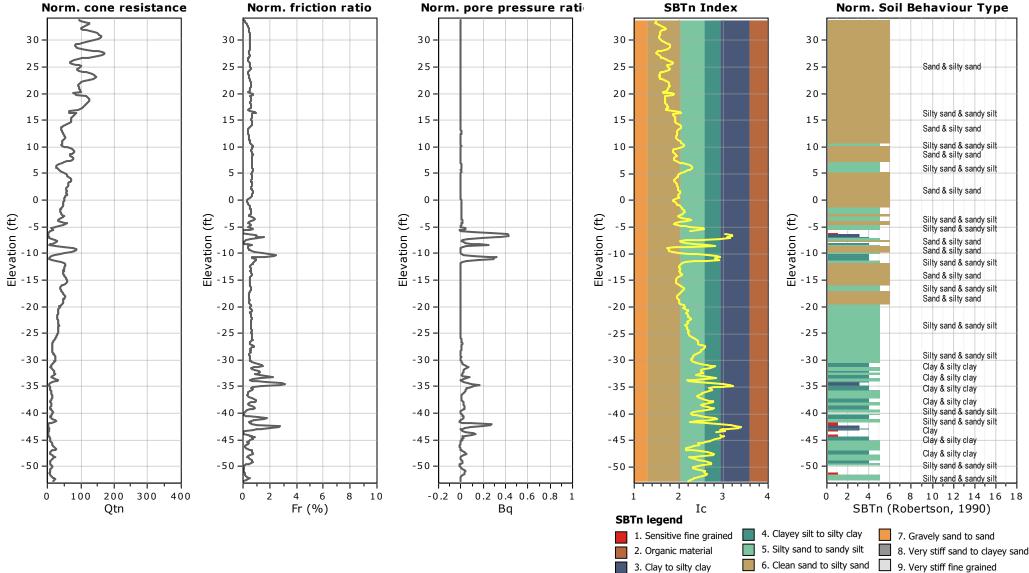
## CPT-08

Total depth: 86.78 ft, Date: 7/7/2021 Surface Elevation: 34.00 ft Coords: N 138099.31, E 2329889.83 Cone Operator: E. Swain

**ICE of Carolinas, PLLC** ICE of Carc 4505 Falls of CAROLINAS, PLLC Raleigh, NC 4505 Falls of Neuse Rd., Suite 110 www.ice-eng.com

#### Project: Sanders Road Sinkhole

Location: New Hanover Co, NC

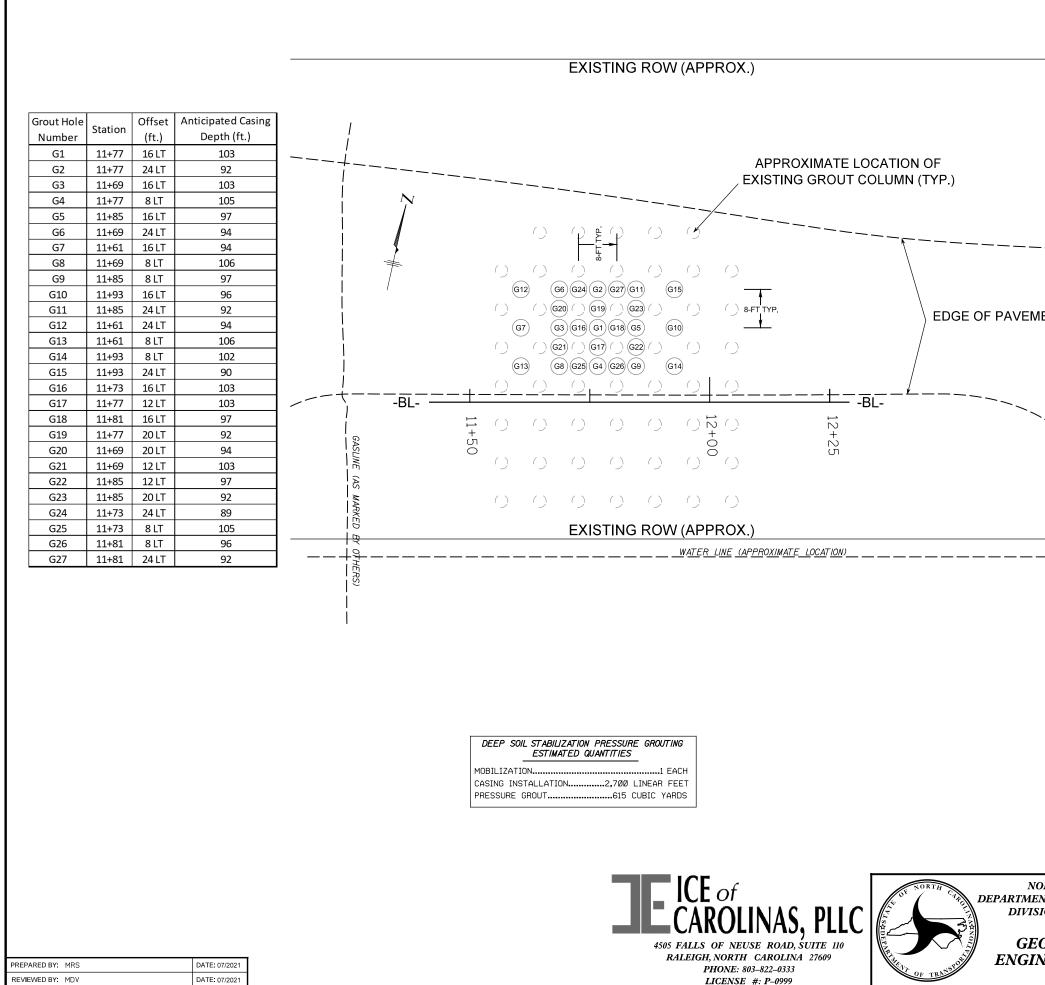


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Sheet 19 of 19

#### **CPT-08**

Total depth: 86.78 ft, Date: 7/7/2021 Surface Elevation: 34.00 ft Coords: N 138099.31, E 2329889.83 Cone Operator: E. Swain



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		WAS ESTABLISHED AS A STR S1 AND BENCHMARK S3. BENG							
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ENT		BILIZATION PRESSURE GROUT ATION PRESSURE GROUTING							
		STABILIZATION PRESSURE THE GROUT HOLE LOCATION							
		JENCE APPLIES TO ALL GROU							
	HOLE LOCATIONS.								
	ANTICIPATED DEPT	TO REFUSAL ON LIMESTONE HS.	SEE						
$\sim$		SING UP TO 1-FT ABOVE LIM							
		FROM 1-FT ABOVE LIMEST FT BELOW THE GROUND SUF							
		5-FT OF GROUTING ABOVE							
	OF GROUT HAS BEE	ROUT IN 1-FT LIFTS UNTIL EN PLACED PER FOOT OF LI	FT HEIGHT OR						
		GROUT PRESSURE OF 500 PS NING DEPTH OF GROUTING,PU							
	IN 1-FT LIFTS UNI	IL 20 CUBIC FEET OF GROU HEIGHT, A GROUND LEVEL	UT HAS BEEN PLACED						
	500 PSI HAS BEEN	REACHED AT INJECTION DE INJECTION DEPTHS BETWEE	PTHS GREATER THAN						
	OR 300 PSIAT DE	PTHS LESS THAN 30-FT.							
	NOTES 4 AND 5 A	GROUT IN EACH LIFT UNTIL RE MET,OR THE GROUND SU	RFACE HEAVES MORE						
		S PER LIFT OR CUMULATIVE EVER OCCURS FIRST.	HEAVE TOTALS						
	USE A MAXIMUM PRE	SSURE GROUT PUMP RATE C	DE 12.0 CUBIC FEET						
		L DEEP SOIL STABILIZATION							
		RVES THE RIGHT TO ADD OF GROUT HOLE LAYOUT AND SI							
	INSTALLATION DEPTH	IS, GROUT TERMINATION CRITICAL CONSTRUCTION,	TERIA, OR GROUT						
		ALL BE PREPARED TO INSTA							
	THROUGH UP TO 5 FE								
	THE GROUT VOLUME SOIL TREATED VOLUM	IS ESTIMATED TO BE 35% C ME.	F THE						
		ALL BE PREPARED TO INSTA							
	THROUGH EXISTING ( CASING DEPTHS PRIC	GROUT COLUMNS.ENGINEER S DR TO GROUTING.	HALL APPROVE						
		DEEP SOIL STABILIZATION							
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	RTH CAROLINA T. OF TRANSPORTATION SANDERS RD. SINKHOLE								
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