STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4590	1	13

REFERENCE: B-4590

PROJECT: 38420

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY NEW HANOVER

PROJECT DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 /US 117 /NC 133

SITE DESCRIPTION

CONTENTS

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 SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL 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-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME 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 SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION 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 HIMSELF 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:
1. 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

C. FUTRAL

C. ALEXANDER

D.T. CHALMERS, CWC

T. SPENCER

INVESTIGATED BY S. V. HUDSON, LG

DRAWN BY S. V. HUDSON, LG

CHECKED BY J. LEE STONE, LG

SUBMITTED BY S. V. HUDSON, LG

DATE MARCH 2018 /REV MAY 2018

CATLIN Engineers and Scientists

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V. HUDSON

DocuSigned by:

SIGNATURE 62EFD88181E445E... DATE 6/5/2018

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-4590	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

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.

GRADATION

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.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] CME-45B
- [ ] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [X] TRICONE 2 15/16" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - 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.

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 SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

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.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

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.

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 ITS LATERAL EXTENT.

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.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - 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 RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

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 THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

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 WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 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.

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.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: LOCATIONS AND ELEVATIONS OBTAINED WITH REAL TIME KINEMATICS (RTK) SURVEY GRADE GLOBAL POSTIONING SYSTEM (GPS)
ELEVATION: FEET

NOTES:

U.C.P. = UNDIVIDED COASTAL PLAIN

HCO = HYDROCARBON ODOR

DATE: 8-15-14

CATLIN
Engineers and Scientists
Wilmington, North Carolina

PROJECT REFERENCE NO.	SHEET NO.
B-4590	3

SITE PLAN

0 50 100
FEET

NC GRID
NAD 83 NA 2011

SKEW = 90°

15+00

20+00

END BENT 1

BENT 1

BENT 2

END BENT 2

SMITH CREEK

EBB

FLOOD

WOODS

EXISTING R/W

US 117 & NC 133
CASTLE HAYNE ROAD
30' BST

DEAD END

TO WILMINGTON

MCRAE STREET

WATER LINE EXPOSED
IN THIS AREA

EB1-A

B1-A

B1-B

B2-A

B2-B

EB2-B

-L-

BRIDGE # 29
(STEEL SWING BRIDGE)

PAVED OVER
CONC

CONTROL
ROOM

CONC

TO NC 133

SOIL\GR

BM #2

BS7

0 50 100
FEET
VE = 2.5

PROFILE THROUGH BORINGS PROJECTED ALONG -L-

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	4

BRIDGE NO. 29

EB1-A
17+11
8' LT

B1-B
17+78
10' RT

B2-A
18+83
9' LT

EB2-B
19+86
19' RT

MED. DENSE, ABC STONE AND CONCRETE FRAGS.. DRY. (ROAD BASE)
PAVEMENT
FIAD
29
VERY LOOSE TO LOOSE, TAN TO GRAY, SILTY, F. SAND AND F. SAND. WET TO SAT.. (ROADWAY EMBANKMENT)
5
3
2
3
V. LOOSE TO LOOSE, GRAY WITH BROWN, SAND TO SILTY, F. SAND. SAT.. (ALLUVIAL)
5
MED. STIFF, GRAY, SILT. WET.
4
3
V. SOFT TO MED. STIFF, DARK GRAY TO GRAY BROWN, LITTLE TO MOD. ORG. CLAY AND SILTY CLAY WITH WOOD FRAGS.. WET.
6
5
LOOSE, GRAY, F. SAND. SAT.
4
42
51
100
100/0.3
100/0.3
BT

WATER SURFACE ELEVATION
02/14/18

WOH
WOR
1
1
2
WOH
27
100/0.3
100/0.5
62
77
80
53
BT

VERY LOOSE, GRAY, MOD. ORG., SILTY, F. TO CSE. SAND WITH WOOD FRAGS. SAT.
V. SOFT, DARK BROWN TO GRAY, MUCK WITH WOOD FRAGS.. SAT. (ALLUVIAL)
WOH
5
WOR
37
18
44
71
89
100/0.2
INTERVAL MISSED
100/0.5
91
60
55
32
58
BT

STRATA REC. = 45%

PAVEMENT
3
VERY LOOSE TO LOOSE, DARK GRAY TO TAN, SILTY, F. SAND. DRY TO WET. (ROADWAY EMBANKMENT)
7
4
SOFT, DARK TAN, SANDY CLAY. WET. (U.C.P.)
02/18. LOOSE, RED BROWN, SILTY, F. SAND. WET
18
VERY STIFF, TAN, SILT. WET
22
STIFF TO V. STIFF, DARK GRAY, SILT WITH SHELL FRAGS. AND SOME CEMENTED MICRITIC LAYERS. WET TO SAT. (PEEDEE FORMATION)
100/0.6
13
DRILLER NOTED "HARD" LAYER
10
84
48
100/0.5
55
90
BT

GRAY TO DARK GRAY, SOFT TO HARD, FOSS. LIMESTONE CONSISTING OF INTERBEDDED SANDY FOSS. LIMESTONE, SANDY LIMESTONE, AND SANDSTONE WITH LAYERS DENSE TO VERY DENSE, SAND AND SILTY, F. SAND WITH LIMESTONE FRAGS. GRADES VERTICALLY TO SANDY LIMESTONE AND SANDSTONE (PEEDEE FORMATION)

GRAY, SOFT TO HARD, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH DENSE TO V. DENSE SAND LAYERS

NOTE: GROUNDLINE PROFILE ALONG -L- TAKEN FROM B4590_LS_TIN_160425.tin DATED 01-10-18

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO PROFILE.

40 20 0 -20 -40 -60 -80 -100 -120 -140

16+00 16+50 17+00 17+50 18+00 18+50 19+00 19+50 20+00 20+50 21+00

0 10 20
FEET
VE = 0.5

CROSS SECTION
BENT 1
SKEW = 90°

B1
-L-
STA. 17+83
CL

B1-A
17+69
10' LT

B1-B
17+78
10' RT

WATER SURFACE ELEVATION
02/14/18

MUDLINE

VERY SOFT, DARK BROWN TO GRAY, MUCK. SAT. (ALLUVIAL)

V. LOOSE TO MED. DENSE, GRAY, F. SAND. SAT.

V. LOOSE, GRAY, MOD. ORG. SILTY, F. TO CSE. SAND WITH WOOD FRAGS. SAT.

VERY SOFT, GRAY TO BROWN, LITTLE TO MOD. ORG. SILTY CLAY WITH WOOD FRAGS. WET.

STRATA REC. = 45%

	B1-A	B1-B
	WOH	WOH
	1	WOR
	2	1
	8	1
	32	2
	31	WOH
	53	27
A	47	A
	100/0.7	
	100/0.4	
	100/0.2	100/0.3
	100/0.6	100/0.5
	61	62
	76	77
B	78	80
	43	53
	BT	BT

A GRAY TO DARK GRAY, SOFT TO HARD, FOSS. LIMESTONE CONSISTING OF INTERBEDDED SANDY FOSS. LIMESTONE, SANDY LIMESTONE, AND SANDSTONE WITH LAYERS DENSE TO VERY DENSE, SAND AND SILTY, F. SAND WITH LIMESTONE FRAGS. GRADES VERTICALLY TO SANDY LIMESTONE AND SANDSTONE (PEEDEE FORMATION)

B GRAY, SOFT TO HARD, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH DENSE TO V. DENSE SAND LAYERS

0 10 20
FEET
VE = 0.5

CROSS SECTION
BENT 2
SKEW = 90°

B2
-L-
STA. 18+83
CL

B2-A
18+83
9' LT

B2-B
18+78
8' RT

WATER SURFACE ELEVATION
02/21/18

MUDLINE

VERY SOFT, BLACK TO DARK BROWN, MUCK. SAT. (ALLUVIAL)

INTERVAL MISSED

MED. DENSE TO DENSE, GRAY TO DARK GRAY, SILTY, F. SAND WITH SHELL FRAGS. SAT.

	B2-A	B2-B
	WOH	
	5	WOH
	WOR	52
	37	49
	18	44
	44	100/0.7
	71	90
A	89	A
	100/0.2	100/0.1
		100/0.2
	100/0.5	100/0.6
	91	99
	60	64
B	55	43
	32	40
	58	51
	BT	100/0.9
		39
		44
		32
		23
		BT

NOTE: GROUNDLINE PROFILE ALONG SECTIONS TAKEN FROM B4590_LS_TIN_160425.tin DATED 01-10-18

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO SECTIONS.

GEOTECHNICAL BORING REPORT
BORE LOG

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	6

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133			**GROUND WTR (ft)**
BORING NO.: EB1-A	**STATION:** 17+11	**OFFSET:** 8 ft LT	**ALIGNMENT:** -L-	**0 HR.** 11.3
COLLAR ELEV.: 13.4 ft	**TOTAL DEPTH:** 74.5 ft	**NORTHING:** 186,799	**EASTING:** 2,320,544	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC
DRILLER: Thomas Spencer	**START DATE:** 02/12/18	**COMP. DATE:** 02/12/18	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
15										
	12.5	0.9	12	18	11	29	D		13.4 GROUND SURFACE	0.0
									12.5 ASPHALT	0.9
10									10.9 **ROADWAY EMBANKMENT** BLACK, SAND, GRAVEL, AND CONCRETE FRAGS.	2.5
	7.7	5.7	2	2	3	5	W		**ROADWAY EMBANKMENT** TAN WITH TR. ORANGE MOTTLING, SILTY, F. SAND	
5	4.7	8.7								
			3	2	1	3	W			
0	-0.3	13.7							1.9 GRAY, F. SAND	11.5
			1	1	1	2	Sat.			
-5	-5.3	18.7								
			2	2	1	3	Sat.			
-10	-10.3	23.7							-8.1 **ALLUVIAL** GRAY WITH BROWN, SILTY, F. SAND	21.5
			3	2	3	5	Sat.			
-15	-15.3	28.7							-14.1 GRAY, SILT	27.5
			2	2	2	4	W			
-20	-20.3	33.7							-18.6 DARK GRAY, LITTLE TO MOD. ORGANIC CLAY INTERBEDDED WITH HIGHLY ORGANIC LAYERS	32.0
			1	1	2	3	W			
-25	-25.3	38.7								
			1	2	4	6	W			
-30	-30.3	43.7								
			WOH	2	3	5	W		-31.6 GRAY, F. SAND	45.0
-35	-35.3	48.7								
			1	2	2	4	Sat.			
-40	-40.3	53.7							-38.6 **COASTAL PLAIN** LIGHT GRAY, SEVERELY WEATHERED LIMESTONE - CONSISTS OF POORLY INDURATED LIMESTONE LAYERS INTERBEDDED WITH F. TO CSE. SAND WITH LIMESTONE FRAGS. (PEEDEE FORMATION)	52.0
			17	21	21	42	Sat.			
-45	-45.3	58.7								
			18	26	25	51	Sat.			
-50	-50.3	63.7							-48.6 LIGHT GRAY, WEATHERED LIMESTONE WITH SAND LAYERS	62.0
			35	45	55	100/1.0	Sat.			
-55	-55.3	68.7	100/0.3			100/0.3			-54.1 DARK GRAY, INTERBEDDED SANDSTONE AND LIMESTONE WITH SAND LAYERS	67.5
							Sat.			
-60	-60.3	73.7	88	100/0.3		100/0.3	Sat.		-61.1 BORING TERMINATED AT ELEVATION -61.1 ft IN INTERBEDDED SANDSTONE AND LIMESTONE WITH SAND LAYERS.	74.5

NCDOT BORE DOUBLE B4590_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 03/07/18

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133			**GROUND WTR (ft)**
BORING NO.: EB1-A	**STATION:** 17+11	**OFFSET:** 8 ft LT	**ALIGNMENT:** -L-	**0 HR.** 11.3
COLLAR ELEV.: 13.4 ft	**TOTAL DEPTH:** 74.5 ft	**NORTHING:** 186,799	**EASTING:** 2,320,544	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC
DRILLER: Thomas Spencer	**START DATE:** 02/12/18	**COMP. DATE:** 02/12/18	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line			(PEEDEE FORMATION)

GEOTECHNICAL BORING REPORT
BORE LOG

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	7

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B1-A	**STATION:** 17+69	**OFFSET:** 10 ft LT	**ALIGNMENT:** -L-	**0 HR.** 23.6
COLLAR ELEV.: -1.6 ft	**TOTAL DEPTH:** 84.8 ft	**NORTHING:** 186,848	**EASTING:** 2,320,574	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 02/14/18	**COMP. DATE:** 02/14/18	**SURFACE WATER DEPTH:** 3.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
									WATER SURFACE (02/14/18)	
-1.6	-1.6	0.0	WOH	WOH	WOH	0	Sat.		GROUND SURFACE	0.0
									ALLUVIAL DARK BROWN TO GRAY, MUCK (NOTE: NO SAMPLES COLLECTED DUE TO WEIGHT OF CASING ADVANCING THROUGH SAMPLE INTERVALS)	
-15.3	-15.3	13.7	WOH	WOH	1	1	Sat.			
-20.3	-20.3	18.7	WOH	1	1	2	Sat.			
-22.7									GRAY, F. SAND	21.1
-25.3	-25.3	23.7	3	3	5	8	Sat.			
-29.1									**COASTAL PLAIN** LIGHT GRAY, SEVERELY WEATHERED LIMESTONE - CONSISTS OF POORLY INDURATED LIMESTONE LAYERS INTERBEDDED WITH F. TO CSE. SAND WITH LIMESTONE FRAGS. (PEEDEE FORMATION)	27.5
-30.3	-30.3	28.7	5	8	24	32	Sat.			
-35.3	-35.3	33.7	20	16	15	31	Sat.			
-40.3	-40.3	38.7	24	25	28	53	Sat.			
-46.1									GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE	44.5
-45.3	-45.3	43.7	39	24	23	47	Sat.			
-50.3	-50.3	48.7	30	75	25/0.2	100/0.7	Sat.			
-55.3	-55.3	53.7	58	100/0.4		100/0.4	Sat.			
-59.9	-59.9	58.3	59	100/0.2		100/0.2	Sat.			
-64.9	-64.9	63.3								

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B1-A	**STATION:** 17+69	**OFFSET:** 10 ft LT	**ALIGNMENT:** -L-	**0 HR.** 23.6
COLLAR ELEV.: -1.6 ft	**TOTAL DEPTH:** 84.8 ft	**NORTHING:** 186,848	**EASTING:** 2,320,574	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 02/14/18	**COMP. DATE:** 02/14/18	**SURFACE WATER DEPTH:** 3.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line			
			95	87	13/0.1	100/0.6	Sat.		GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE *(continued)*
-68.6										67.0
-70	-69.9	68.3	25	24	37	61	Sat.		GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS
-75	-74.9	73.3	23	26	50	76	Sat.		
-80	-79.9	78.3	23	46	32	78	Sat.		
-85	-84.9	83.3	15	23	20	43	Sat.		
-86.4									BORING TERMINATED AT ELEVATION -86.4 ft IN INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS. (PEEDEE FORMATION)
										84.8

GEOTECHNICAL BORING REPORT
BORE LOG

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	8

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 17+78	**OFFSET:** 10 ft RT	**ALIGNMENT:** -L-	**0 HR.** 16.0
COLLAR ELEV.: -3.3 ft	**TOTAL DEPTH:** 83.3 ft	**NORTHING:** 186,845	**EASTING:** 2,320,596	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 85% 08/28/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: D.T. Chalmers, Jr.	**START DATE:** 02/20/18	**COMP. DATE:** 02/21/18	**SURFACE WATER DEPTH:** 2.7ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
15										
10										
5										
0									WATER SURFACE (02/20/18)	
	-3.3	0.0							-3.3 GROUND SURFACE	0.0
-5			WOH	WOH	WOH	0	Sat.		**ALLUVIAL** GRAY TO DARK BROWN, MUCK	
-10	-10.1	6.8	WOR	WOR	WOR	0	Sat.			
-15	-15.1	11.8	WOH	WOH	1	1	Sat.		-15.8 GRAY, F. SAND	12.5
-20	-20.1	16.8	1	1	0	1	Sat.		-18.3 GRAY, SILTY, F. TO CSE. SAND WITH WOOD FRAGS.	15.0
-25	-25.1	21.8	1	1	1	2	Sat.		-25.8 GRAY TO BROWN, LITTLE TO MOD. ORGANIC SILTY CLAY WITH WOOD FRAGS.	22.5
-30	-30.1	26.8	WOH	WOH	WOH	0	Sat.		-33.3 **COASTAL PLAIN** LIGHT GRAY, SANDY WEATHERED LIMESTONE (PEEDEE FORMATION)	30.0
-35	-35.1	31.8	6	12	15	27	Sat.		-37.1 / -37.6 DARK GRAY, POORLY INDURATED SANDY LIMESTONE WITH CLAY MATRIX / BROWN GRAY, SANDY, MOLDIC FOSS. LIMESTONE. NUMEROUS EMBEDDED SHELL FRAGS. AND SOLUTION CAVITIES	33.8 / 34.3
-40									-41.6 BROWN GRAY, SANDY, FOSS. LIMESTONE. DECREASE IN EMBEDDED SHELL FRAGS. AND SOLUTION CAVITIES	38.3
-45										
-50								RS-03		
-55								RS-02		
								RS-01		
-60	-60.1	56.8	100/0.3			100/0.3			-53.1 GRAY, F. TO MED. GRAINED MOD. WELL INDURATED SANDSTONE	49.8
-65										

NCDOT BORE DOUBLE B4590_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 03/07/18

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 17+78	**OFFSET:** 10 ft RT	**ALIGNMENT:** -L-	**0 HR.** 16.0
COLLAR ELEV.: -3.3 ft	**TOTAL DEPTH:** 83.3 ft	**NORTHING:** 186,845	**EASTING:** 2,320,596	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 85% 08/28/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: D.T. Chalmers, Jr.	**START DATE:** 02/20/18	**COMP. DATE:** 02/21/18	**SURFACE WATER DEPTH:** 2.7ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line			
	-65.1	61.8	100/0.5			100/0.5			-66.8 GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS — 63.5
-70	-70.1	66.8	30	37	25	62			
-75	-75.1	71.8	39	31	46	77			
-80	-80.1	76.8	20	38	42	80			
-85	-85.1	81.8	15	27	26	53			-86.6 BORING TERMINATED AT ELEVATION -86.6 ft IN INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS. (PEEDEE FORMATION) — 83.3

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral		
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**	
BORING NO.: B1-B	**STATION:** 17+78	**OFFSET:** 10 ft RT	**ALIGNMENT:** -L-	**0 HR.**	16.0
COLLAR ELEV.: -3.3 ft	**TOTAL DEPTH:** 83.3 ft	**NORTHING:** 186,845	**EASTING:** 2,320,596	**24 HR.**	N/A
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 85% 08/28/2017		**DRILL METHOD:** Mud Rotary		**HAMMER TYPE:** AUTOMATIC	
DRILLER: D.T. Chalmers, Jr.	**START DATE:** 02/20/18	**COMP. DATE:** 02/21/18	**SURFACE WATER DEPTH:** 2.7ft		
CORE SIZE NQ	**TOTAL RUN** 23.0 ft				

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
-37.1											Begin Coring @ 33.8 ft
	-37.1	33.8	3.0	0:16 0:40 0:25	(0.6) 20%	(0.0) 0%		(0.4) 80%			ELEV. (ft) -37.1 DEPTH (ft) 33.8 DARK GRAY, POORLY INDURATED SANDY LIMESTONE WITH CLAY MATRIX
-40	-40.1	36.8									-37.6 34.3 BROWN GRAY, SANDY, MOLDIC FOSS. LIMESTONE. NUMEROUS EMBEDDED SHELL FRAGS. AND SOLUTION CAVITIES
			5.0	0:11 0:44 0:29 0:40 0:40	(3.0) 60%	(0.0) 0%		(1.8) 45%			-41.6 38.3
-45	-45.1	41.8						(5.0) 43%			BROWN GRAY, SANDY, FOSS. LIMESTONE. DECREASE IN EMBEDDED SHELL FRAGS. AND SOLUTION CAVITIES
			5.0	0:20 0:20 0:14 0:32 0:24	(2.0) 40%	(0.0) 0%	RS-03				
-50	-50.1	46.8									
			5.0	0:30 0:37 0:33 1:31 0:33	(3.0) 60%	(0.3) 7%					-53.1 49.8 GRAY, F. TO MED. GRAINED MOD. WELL INDURATED SANDSTONE
-55	-55.1	51.8					RS-02	(3.2) 23%			
			5.0	1:31 2:00 2:10 0:34 2:18	(1.8) 36%	(0.7) 14%	RS-01				
-60	-60.1	56.8									
				N=100/0.3							
-65				*N=100/0.5*							-66.8 63.5 GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS
-70				*N=62*							
-75				*N=77*							
-80				*N=80*							
-85				*N=53*							-86.6 83.3 BORING TERMINATED AT ELEVATION -86.6 ft IN INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS. (PEEDEE FORMATION)

NCDOT CORE DOUBLE_PHOTO_B4590_GEO_BRDG_CATLIN.GPJ_CATLIN.GDT 03/01/18

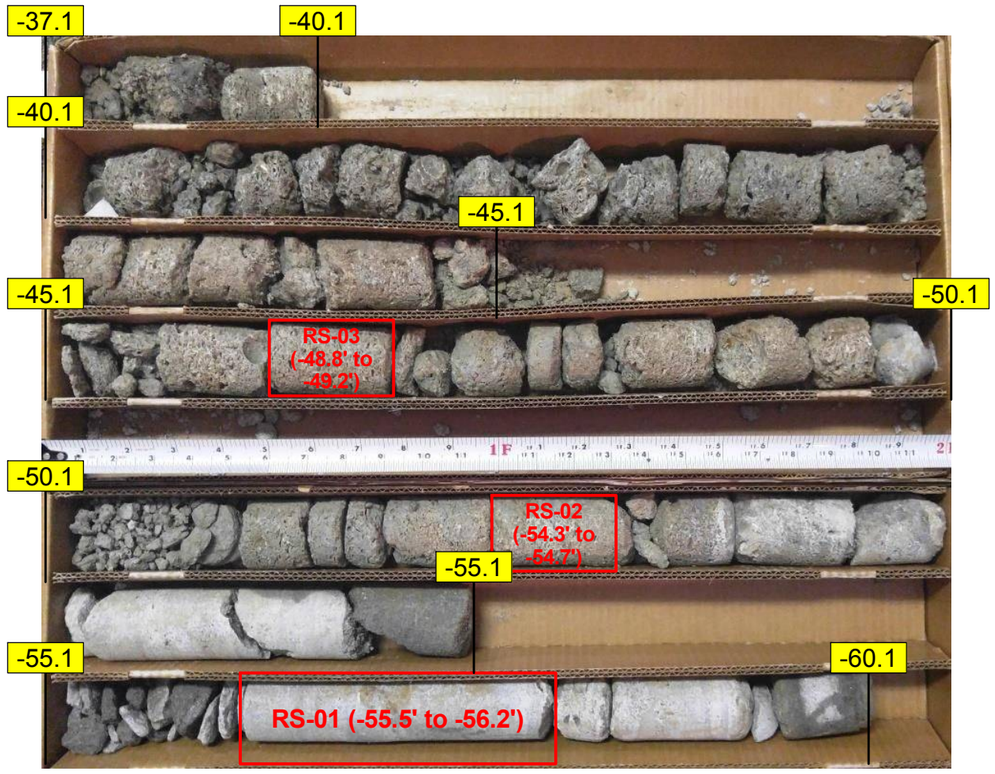
CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	9

B1-B

BOX 1 & 2 of 2

ELEV. -37.1 to -60.1 FT



0.0 1.0 2.0

SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	10

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B2-A	**STATION:** 18+83	**OFFSET:** 9 ft LT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: -16.6 ft	**TOTAL DEPTH:** 74.8 ft	**NORTHING:** 186,943	**EASTING:** 2,320,638	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary		**HAMMER TYPE:** AUTOMATIC
DRILLER: Thomas Spencer	**START DATE:** 02/14/18	**COMP. DATE:** 02/16/18	**SURFACE WATER DEPTH:** 17.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
15										
10										
5										
0										
-5										
-10										
-15										
									WATER SURFACE (02/14/18)	
-16.6		0.0							GROUND SURFACE	0.0
			WOH	WOH	WOH	0	Sat.		**ALLUVIAL** BROWN, MUCK WITH WOOD FRAGS.	
-20	-19.9	3.3	11	3	2	5	Sat.			
-25	-24.9	8.3	WOR	WOR	WOR	0	Sat.			
-28.6		12.0							**COASTAL PLAIN** LIGHT GRAY, SEVERELY WEATHERED LIMESTONE - CONSISTS OF POORLY INDURATED LIMESTONE LAYERS INTERBEDDED WITH F. TO CSE. SAND WITH LIMESTONE FRAGS. (PEEDEE FORMATION)	
-30	-29.9	13.3	3	12	25	37	Sat.			
-35	-34.9	18.3	15	10	8	18	Sat.			
-40	-39.9	23.3	15	20	24	44	Sat.			
-45	-44.9	28.3	30	18	53	71	Sat.			
-50	-49.9	33.3	32	30	59	89	Sat.			
-52.6		36.0							GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS	
-55	-54.9	38.3	100	100/0.2		100/0.2	Sat.		(SAMPLE AT 43.3FT INTERVAL MISSED)	
-60										
-65	-64.9	48.3								

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION	
-65						Match Line				
			58	100/0.5		100/0.5	Sat.		GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS *(continued)*	
-70	-69.9	53.3	34	44	47	91	Sat.			
-73.1		56.5							GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS	
-75	-74.9	58.3	33	28	32	60	Sat.			
-80	-79.9	63.3	10	17	38	55	Sat.			
-85	-84.9	68.3	10	11	21	32	Sat.			
-90	-89.9	73.3	20	29	29	58	Sat.			
-91.4		74.8							BORING TERMINATED AT ELEVATION -91.4 ft IN INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS. (PEEDEE FORMATION)	

NCDOT BORE DOUBLE B4590_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 03/07/18

GEOTECHNICAL BORING REPORT
BORE LOG

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	11

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Corey Futral	
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133				**GROUND WTR (ft)**
BORING NO.: B2-B	**STATION:** 18+78	**OFFSET:** 8 ft RT	**ALIGNMENT:** -L-	**0 HR.** 29.4
COLLAR ELEV.: -22.6 ft	**TOTAL DEPTH:** 94.1 ft	**NORTHING:** 186,929	**EASTING:** 2,320,649	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 85% 08/28/2017		**DRILL METHOD:** Mud Rotary		**HAMMER TYPE:** AUTOMATIC
DRILLER: D.T. Chalmers, Jr.	**START DATE:** 02/19/18	**COMP. DATE:** 02/20/18	**SURFACE WATER DEPTH:** 24.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
									WATER SURFACE (02/19/18)	
-22.6		0.0	WOH	WOH	WOH	0	Sat.		GROUND SURFACE	0.0
									ALLUVIAL BLACK TO DARK BROWN, MUCK	
-27.6		5.0							**COASTAL PLAIN** GRAY, SEVERELY WEATHERED LIMESTONE - CONSISTS OF POORLY INDURATED LIMESTONE LAYERS INTERBEDDED WITH F. TO CSE. SAND WITH LIMESTONE FRAGS. (PEEDEE FORMATION)	
-29.8		7.2	4	4	48	52	Sat.			
-34.8		12.2	11	24	25	49	Sat.			
-39.8		17.2	24	27	17	44	Sat.			
-43.6		21.0							HYDROCARBON SHEEN IN DRILL PAN LIGHT GRAY TO GRAY, SANDY LIMESTONE (STRONG TO MOD. HCO THROUGH STRATUM)	
-44.8		22.2	15	57	43/0.2	100/0.7	Sat.			
-49.8		27.2	28	63	27	90	Sat.			
-54.8		32.2	100/0.1			100/0.1	Sat.			
-58.1		35.5							DARK GRAY, MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS (SLIGHT TO MODERATE HCO THROUGH STRATUM)	
-59.8		37.2	74	100/0.2		100/0.2	Sat.			
-64.8		42.2								

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line			
	-70.4	47.8	74	93	7/0.1	100/0.6	Sat.		DARK GRAY, MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS (SLIGHT TO MODERATE HCO THROUGH STRATUM) *(continued)*
-72.6		50.0	15	32	67	99	Sat.		GRAY, INTERBEDDED MOD. TO WELL INDURATED LIMESTONE AND SANDSTONE WITH SAND LAYERS
	-75.4	52.8	12	33	31	64	Sat.		
	-80.2	57.6	13	17	26	43	Sat.		
	-85.2	62.6	12	20	20	40	Sat.		
	-90.2	67.6	11	19	32	51	Sat.		
	-95.2	72.6	11	21	79/0.4	100/0.9	Sat.		
-96.6		74.0							
-97.6		75.0							GRAY, LIMESTONE GRAY TO DARK GRAY, SILTY, F. SAND WITH TR. SHELL FRAGS.
	-100.2	77.6	17	18	21	39	Sat.		
	-105.2	82.6	16	17	27	44	Sat.		
	-110.2	87.6	14	16	16	32	Sat.		
	-115.2	92.6	8	11	12	23	Sat.		
-116.7		94.1							BORING TERMINATED AT ELEVATION -116.7 ft IN SILTY, F. SAND. (PEEDEE FORMATION)

NCDOT BORE DOUBLE B4590_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 03/07/18

GEOTECHNICAL BORING REPORT
BORE LOG

WBS: 38420.1.2	**TIP:** B-4590	**COUNTY:** NEW HANOVER	**GEOLOGIST:** Chris Alexander
SITE DESCRIPTION REPLACE BRIDGE NO. 29 OVER SMITH CREEK ON SR 2812 / US 117 / NC 133			**GROUND WTR (ft)**
BORING NO.: EB2-B	**STATION:** 19+86	**OFFSET:** 19 ft RT	**ALIGNMENT:** -L-	**0 HR.** 12.6
COLLAR ELEV.: 13.5 ft	**TOTAL DEPTH:** 60.2 ft	**NORTHING:** 187,013	**EASTING:** 2,320,718	**24 HR.** 10.1
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 76% 07/10/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC
DRILLER: Thomas Spencer	**START DATE:** 02/19/18	**COMP. DATE:** 02/19/18	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
15										
	13.5	0.0	1	1	2	3	D		13.5 GROUND SURFACE	0.0
10									**ROADWAY EMBANKMENT** DARK GRAY TO TAN, SILTY, F. SAND WITH SOME BRICK FRAGS.	
	8.7	4.8	4	4	3	7	W		5.5	8.0
5	4.7	8.8	1	3	1	4	W		4.0 **ALLUVIAL** DARK TAN, SANDY CLAY	9.5
0	-0.3	13.8							RED BROWN TO TAN, SILTY, F. SAND	
			8	8	10	18	W		1.0 TAN, SILT	12.5
-5	-5.3	18.8							-4.0 **COASTAL PLAIN** DARK GRAY, SILT AND SANDY SILT WITH SHELL FRAGS. (PEEDEE FORMATION)	17.5
			6	11	11	22	M			
-10	-10.3	23.8								
			5	5	95/0.1	100/0.6	Sat.		-11.3 (DRILLER NOTED HARD LAYER) -12.2	24.8 25.7
-15	-15.3	28.8								
			3	5	8	13	Sat.			
-20	-20.3	33.8								
			3	4	6	10	Sat.			
-25	-25.2	38.7							-24.3 GRAY, SEVERELY WEATHERED LIMESTONE - CONSISTS OF POORLY INDURATED LIMESTONE LAYERS INTERBEDDED WITH F. TO CSE. SAND WITH LIMESTONE FRAGS.	37.8
			15	31	53	84	Sat.			
-30	-30.2	43.7							-29.0 DARK GRAY, INTERBEDDED MOD. INDURATED TO FRIABLE LIMESTONE AND SANDSTONE WITH SAND LAYERS	42.5
			28	20	28	48	Sat.			
-35	-35.2	48.7								
			100/0.5			100/0.5	Sat.			
-40	-40.2	53.7								
			15	27	28	55	Sat.			
-45	-45.2	58.7								
			27	40	50	90	Sat.		-46.7 BORING TERMINATED AT ELEVATION -46.7 ft IN INTERBEDDED MOD. INDURATED TO FRIABLE LIMESTONE AND SANDSTONE WITH SAND LAYERS. (PEEDEE FORMATION)	60.2

NCDOT BORE DOUBLE B4590_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 03/07/18

CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-0585
218007

PROJECT REFERENCE NO.	SHEET
B-4590	12

PROJECT REFERENCE NO.	SHEET NO.
B–4590	13

ROCK TEST RESULTS

SAMPLE NO.	*OFFSET*	*STATION*	*DEPTH INTERVAL*	*ROCK TYPE*	*DRY UNIT WEIGHT (lb/ft³)*	*UNIAXIAL COMPRESSIVE STRENGTH (psi)*
RS–03	***10' RT***	***17 + 78***	***45.5'–45.9'***	***LIMESTONE***	***108.7***	***420***
RS–02	***10' RT***	***17 + 78***	***51.0'–51.4'***	***LIMESTONE***	***117.0***	***1,020***
RS–01	***10' RT***	***17 + 78***	***52.2'–52.9'***	***LIMESTONE***	***158.1***	***6,960***

DATE: 9-15-14