



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

ERIC BOYETTE
SECRETARY

October 27, 2021

MEMORANDUM TO: Preston Hunter, P.E.
Division 2 Engineer

ATTENTION: Jeff Cabaniss, P.E.
Division Project Development Engineer

FROM:  David Hering, L.G., P.E.
Assistant State Geotechnical Engineer - Eastern Region

STATE PROJECT: 45569.1.2 (B-5614)
COUNTY: BEAUFORT

DESCRIPTION: Bridge #9 on SR 1112 (Mouth of the Creek Rd) over Blount Creek

SUBJECT: Structure Foundation Recommendations

The Geotechnical Engineering Unit has reviewed and presents the subsurface investigation and foundation recommendations prepared by Schnabel Engineering for the above referenced project.

- ☒ Structure Inventory (19) pages
- ☒ Foundation Design Recommendation (3) pages
- ☒ Design Scour Memo (2) pages
- ☒ Geotechnical Foundation Table (1) page

Please call Thein T. Zan, PE or James R. Batts, P.E. at (919) 662-4710 if there are any questions concerning this memorandum.

Attachment

FOUNDATION RECOMMENDATIONS

PROJECT 45569.1.2

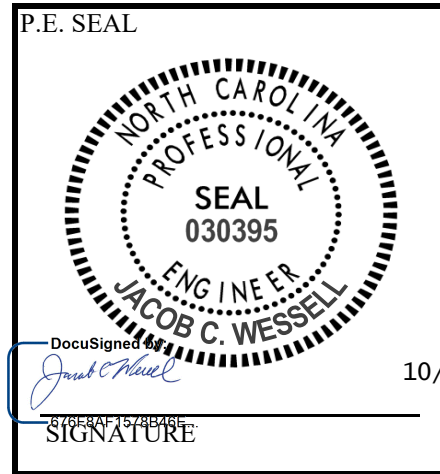
TIP NO. B-5614

COUNTY Beaufort

STATION 22+57.00 -L-

DESCRIPTION Bridge 9 over Blounts Creek on
SR 1112 (Mouth of the Creek Rd)

	INITIALS	DATE
DESIGN	JCW	10/26/21
CHECK	SJN	10/26/21



	BENT STATION	FOUNDATION TYPE	FACTORED RESISTANCE	ADDITIONAL INFORMATION
END BENT 1	17+75.88 -L-	Cap on HP 12 x 53 Steel H-Piles	110 Tons/Pile	Bottom of Cap Elev. = 6.29 ft Average Estimated Pile Length = 70 ft Number of Piles/Cap = 7
BENT 1	18+97.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 9.21 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -49 ft Tip No Higher Than Elev. = -98 ft Number of Piers/Cap = 2
BENT 2	20+17.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 11.25 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -50 ft Tip No Higher Than Elev. = -104 ft Number of Piers/Cap = 2
BENT 3	21+37.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 12.36 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -46 ft Tip No Higher Than Elev. = -91 ft Number of Piers/Cap = 2
BENT 4	22+57.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 12.53 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -50 ft Tip No Higher Than Elev. = -96 ft Number of Piers/Cap = 2

BENT 5	23+77.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 11.78 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -49 ft Tip No Higher Than Elev. = -97 ft Number of Piers/Cap = 2
BENT 6	24+97.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 10.09 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -49 ft Tip No Higher Than Elev. = -97 ft Number of Piers/Cap = 2
BENT 7	26+17.00 -L-	Column on 54" Diameter Drilled Pier	655 Tons/Pier	Bottom of Cap Elev. = 7.47 ft Top of Drilled Pier Elev. = 1.0 ft Point of Fixity Elev. = -50 ft Tip No Higher Than Elev. = -103 ft Number of Piers/Cap = 2
END BENT 2	27+38.13 -L-	Cap on HP 12 x 53 Steel H-Piles	110 Tons/Pile	Bottom of Cap Elev. = 3.99 ft Average Estimated Pile Length = 65 ft Number of Piles/Cap = 7

(SEE NOTES ON PLANS AND COMMENTS ON FOLLOWING PAGES.)

FOUNDATION RECOMMENDATIONS NOTES ON PLANS

1. FOR DRILLED PIERS, SEE SECTION 411 OF THE STANDARD SPECIFICATIONS.
2. DO NOT DEWATER DRILLED PIER EXCAVATIONS AT BENT NOS. 1 THROUGH 7. CLEAN THE BOTTOM OF EXCAVATIONS WITH A SUBMERSIBLE PUMP OR AN AIRLIFT. WET PLACEMENT OF CONCRETE IS REQUIRED.
3. SLURRY CONSTRUCTION IS REQUIRED FOR DRILLED PIERS AT BENT NOS. 1 THROUGH 7.
4. OBSERVE A THREE (3) MONTH WAITING PERIOD AFTER CONSTRUCTING THE EMBANKMENT, END BENT AND REINFORCED BRIDGE APPROACH FILL, IF APPLICABLE, BEFORE BEGINNING APPROACH SLAB CONSTRUCTION AT END BENT NO. 1. FOR BRIDGE WAITING PERIODS, SEE ROADWAY PLANS AND SECTION 235 OF THE STANDARD SPECIFICATIONS.
5. FOR PILES, SEE PILES PROVISION AND SECTION 450 OF THE STANDARD SPECIFICATIONS.

FOUNDATION RECOMMENDATIONS SPECIAL NOTES ON PLANS

1. INSTALL PERMANENT STEEL CASINGS AT INTERIOR BENTS BY VIBRATING, SCREWING OR DRIVING PERMANENT CASINGS BEFORE EXCAVATING OR DISTURBING ANY MATERIAL BELOW ELEVATIONS -40 FT (BENT NOS. 3, 4, AND 5), -41 FT (BENT NOS. 1, 6, AND 7), AND -43 FT (BENT NO. 2).

FOUNDATION RECOMMENDATIONS COMMENTS

1. BRIDGE END BENT SLOPES OF 1½:1 (H:V) ARE OK WITH SLOPE PROTECTION.
2. A SINGLE ROW WITH 5 PLUMB PILES AND 2 BRACE PILES ARE PROVIDED FOR BOTH END BENTS.
3. THE DESIGN SCOUR ELEVATIONS ARE -15.2 FT AT BENT NO. 1, -23.9 FT AT BENT NO. 2, -21.3 FT AT BENT NO. 3, -21.4 FT AT BENT NO. 4, -19.0 FT AT BENT NO. 5, -17.8 FT AT BENT NO. 6, AND -16.3 FT AT BENT NO. 7.
4. A RESISTANCE FACTOR OF 0.75 WAS USED TO REDUCE REQUIRED DRIVING RESISTANCE BASED ON THE REQUIREMENTS FOR PDA TESTING IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATION.

SUMMARY OF PILE INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) ## (e.g., "Bent 1, Piles 1-5")	Factored Resistance per Pile TONS	Pile Cut-Off (Top of Pile) Elevation FT	Estimated Pile Lenth per Pile FT	Scour Critical Elevation FT	Driven Piles			Predrilling for Piles*			Drilled-In Piles		
					Min Pile Tip (Tip No Higher Than) Elev FT	Required Driving Resistance (RDR)** per Pile TONS	Total Pile Redrives Quantity EACH	Predrilling Length per Pile Lin FT	Predrilling Elevation (Elev Not To Predrill Below) FT	Maximum Predrilling Dia INCHES	Pile Excavation (Bottom of Hole) Elev FT	Pile Exc Not In Soil per Pile Lin FT	Pile Exc In Soil per Pile Lin FT
End Bent 1, Piles 1-7	110	7.29	70			165	7						
End Bent 2, Piles 1-7	110	4.99	65			150							

*Predrilling for Piles is required for end bents/bents with a predrilling length and at the Contractor's option for end bents/bents with predrilling information but no predrilling length.

**RDR =
$$\frac{\text{Factored Resistance} + \text{Factored Downdrag Load} + \text{Factored Dead Load}}{\text{Dynamic Resistance Factor}} + \text{Nominal Downdrag Resistance} + \frac{\text{Nominal Scour Resistance}}{\text{Scour Resistance Factor}}$$

PILE DESIGN INFORMATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) ## (e.g., "Bent 1, Piles 1-5")	Factored Axial Load per Pile TONS	Factored Downdrag Load per Pile TONS	Factored Dead Load* per Pile TONS	Dynamic Resistance Factor	Nominal Downdrag Resistance per Pile TONS	Nominal Scour Resistance per Pile TONS	Scour Resistance Factor (Default = 1.00)
End Bent 1, Piles 1-7	110	8		0.75	6		1.00
End Bent 2, Piles 1-7	110			0.75			1.00

*Factored Dead Load is factored weight of pile above the ground line.

SUMMARY OF DRILLED PIER INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) ## (e.g., "Bent 1, Piers 1-3")	Factored Resistance per Pier TONS	Minimum Pier Tip (Tip No Higher Than) Elevation FT	Required Tip Resistance per Pier TSF	Scour Critical Elevation FT	Minimum Drilled Pier Penetration Into Rock per Pier Lin FT	Drilled Pier Length per Pier Lin FT	Drilled Pier Length Not In Soil per Pier Lin FT	Drilled Pier Length In Soil per Pier Lin FT	Permanent Steel Casing Required? YES or MAYBE	Permanent Steel Casing Tip Elevation (Elev Not To Extend Casing Below) FT	Permanent Steel Casing Length* per Pier Lin FT
Bent 1, Piers 1-2	655	-98	5	-18	0.0	99			YES	-41.0	42.0
Bent 2, Piers 1-2	655	-104	10	-26	0.0	105			YES	-43.0	44.0
Bent 3, Piers 1-2	655	-91	5	-24	0.0	92			YES	-40.0	41.0
Bent 4, Piers 1-2	655	-96	10	-24	0.0	97			YES	-40.0	41.0
Bent 5, Piers 1-2	655	-97	10	-21	0.0	98			YES	-40.0	41.0
Bent 6, Piers 1-2	655	-97	5	-20	0.0	98			YES	-41.0	42.0
Bent 7, Piers 1-2	655	-103	5	-19	0.0	104			YES	-41.0	42.0

*Permanent Steel Casing Length equals the difference between the ground line or top of drilled pier elevation, whichever is higher, and the permanent casing tip elevation.

SUMMARY OF PDA/PILE ORDER LENGTHS

(Blank entries indicate item is not applicable to structure)

Pile Driving Analyzer (PDA)				Pile Order Lengths	
End Bent/ Bent No	PDA Testing Required? YES or MAYBE	PDA Test Pile Length FT	Total PDA Testing Quantity EACH	End Bent/ Bent No(s)	Pile Order Length Basis* EST or PDA
End Bent 1, Piles 1-7	YES	75	2		
End Bent 2, Piles 1-7	YES	70			

*EST = Pile order lengths from estimated pile lengths; PDA = Pile order lengths based on PDA testing. For groups of end bents/bents with pile order lengths based on PDA testing, the first end bent/bent no. listed for each group is the representative end bent/bent with the PDA.

SUMMARY OF PILE ACCESSORIES

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) ## (e.g., "Bent 1, Piles 1-5")	Pipe Pile Plates Required? YES or MAYBE	Steel Pile Points			Steel Pile Tips Required? YES
		Pipe Pile Cutting Shoes Required? YES	Pipe Pile Conical Points Required? YES	H-Pile Points Required? YES	
End Bent 1, Piles 1-7				YES	
End Bent 2, Piles 1-7				YES	
TOTAL QTY:				14	

SUMMARY OF DRILLED PIER TESTING

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) ## (e.g., "Bent 1, Piers 1-3")	Standard Penetration Test (SPT) Required? YES or MAYBE	Crosshole Sonic Logging (CSL) Required?* YES or MAYBE	Total CSL Tube Length (For All Tubes) per Pier Lin FT	Shaft Inspection Device (SID) Required? YES or MAYBE	Pile Integrity Test (PIT) Required? MAYBE
Bent 1, Piers 1-2	YES	MAYBE	503	YES	
Bent 2, Piers 1-2	YES	MAYBE	533	YES	
Bent 3, Piers 1-2	YES	MAYBE	468	YES	
Bent 4, Piers 1-2	YES	MAYBE	493	YES	
Bent 5, Piers 1-2	YES	MAYBE	498	YES	
Bent 6, Piers 1-2	YES	MAYBE	498	YES	
Bent 7, Piers 1-2	YES	MAYBE	528	YES	
TOTAL QTY:		14	7	3518	14

*CSL Tubes are required if CSL Testing is or may be required. The number of CSL Tubes per drilled pier is equal to one tube per foot of design pier diameter with at least 4 tubes per pier. The length of each CSL Tube is equal to the drilled pier length plus 1.5 ft.

PROJECT NO. B-5614 (45569.1.2)

BEAUFORT COUNTY

STATION: 22+57 -L-

NOTES:

- The Pile and Drilled Pier Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer (Jacob Wessell, P.E., NC PE 030395) on 10-26-2021.
- Total Pile Driving Equipment Setup quantity (not shown in Pile Foundation Tables) equals the number of driven piles, i.e., the number of piles with a Required Driving Resistance.
- The Engineer will determine the need for CSL Testing when these items may be required.



SIGNATURE DATE

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SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

PILE AND DRILLED PIER
FOUNDATION
TABLES

REVISIONS

NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO.

TOTAL
SHEETS

REFERENCE: B-5614

PROJECT: 45569.1.2

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE
5-16	BORE LOGS, CORE LOGS & CORE PHOTOGRAPHS
17	SOIL TEST RESULTS
18	ROCK TEST RESULTS
19	SITE PHOTOGRAPHS

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY BEAUFORT

PROJECT DESCRIPTION BRIDGE NO.9 OVER
BLOUNTS CREEK ON SR1112 (MOUTH OF THE
CREEK RD)

SITE DESCRIPTION _____

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5614	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 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

J. WESSELL

J. HOLLAND

A. STRICKLAND

MID-ATLANTIC DRILLING

INVESTIGATED BY J. HOLLAND

DRAWN BY A. STRICKLAND

CHECKED BY J. WESSELL

SUBMITTED BY SCHNABEL ENG.

DATE APRIL 2021



DocuSigned by: Jacob C. Wessell 10/27/2021

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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-4, A-5	
SYMBOL	A-1-a	A-1-b	A-2-4		A-2-5		A-2-6		A-2-7						A-7-5, A-7-6		A-3	
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	6 MX	50 MX 30 MX 15 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MX	36 MN	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 11 MN	40 MX 10 MX	41 MN 11 MN	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

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
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY

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 DMT VST PMT TEST BORING

AUGER BORING

CORE BORING

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
HL - 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

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)

CRYSTALLINE ROCK (CR)

NON-CRYSTALLINE ROCK (NCR)

COASTAL PLAIN SEDIMENTARY ROCK (CP)

NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.

FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.

FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.

COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH
VERY SLIGHT (V SLI.)
SLIGHT (SLI.)
MODERATE (MOD.)
MODERATELY SEVERE (MOD. SEV.)
SEVERE (SEV.)
VERY SEVERE (V SEV.)
COMPLETE

ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
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.
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.
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.
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*
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*
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*
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
HARD
MODERATELY HARD
MEDIUM HARD
SOFT
VERY SOFT

CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
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.
CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
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.
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
VERY WIDE
WIDE
MODERATELY CLOSE
CLOSE
VERY CLOSE

SPACING
MORE THAN 10 FEET
3 TO 10 FEET
1 TO 3 FEET
0.16 TO 1 FOOT
LESS THAN 0.16 FEET

BEDDING

TERM
VERY THICKLY BEDDED
THICKLY BEDDED
THINLY BEDDED
VERY THINLY BEDDED
THICKLY LAMINATED
THINLY LAMINATED

THICKNESS
4 FEET
1.5 - 4 FEET
0.16 - 1.5 FEET
0.03 - 0.16 FEET
0.008 - 0.03 FEET
< 0.008 FEET

INDURATION

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

FRIABLE
MODERATELY INDURATED
INDURATED
EXTREMELY INDURATED

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

TERMS AND DEFINITIONS

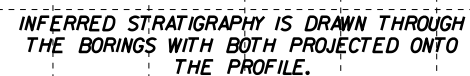
ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION 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 DISLOOGED 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 (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 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 (SROD) - 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: N/A

ELEVATION: N/A FEET

NOTES:
FIAD = FILLED IN AFTER DRILLING
TOP OF BORING ELEVATIONS OBTAINED FROM SURVEY-GRADE GPS SUB-CM ACCURACY DATED MARCH 10, 2021 - MARCH 24, 2021

DATE: 4-1-21



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST Argenbright, D. N.						
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)						
BORING NO. EB1-A			STATION 17+68			OFFSET 10 ft LT			ALIGNMENT -L-			0 HR. N/A			
COLLAR ELEV. 4.5 ft			TOTAL DEPTH 69.4 ft			NORTHING 618,530			EASTING 2,604,026			24 HR. 3.4			
DRILL RIG/HAMMER EFF./DATE GFO0075 CME-45C 89% 08/19/2019						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER Smith, R. E.			START DATE 06/10/20			COMP. DATE 06/10/20			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)
5															
	4.5	0.0	6	6	4	10								4.5	0.0
														3.5	1.0
														ARTIFICIAL FILL	
														BROWN SAND WITH GRAVEL, MOIST	
0	0.5	4.0	3	2	3	5								UNDIVIDED COASTAL PLAIN	
														TAN AND GRAY SAND, MOIST TO SATURATED (UNDIVIDED COASTAL PLAIN)	
	-3.4	7.9	5	7	2	9									
-5														-4.7	9.2
														BROWN SILTY CLAY, WET	
	-8.4	12.9	1	0	0	0								-9.4	13.9
-10														-11.5	16.0
														-14.5	19.0
-15	-13.4	17.9	2	2	2	4								COASTAL PLAIN	
														GRAY SILT WITH SHELL FRAGMENTS, WET (YORKTOWN FORMATION)	
	-18.4	22.9	2	2	2	4								-21.5	26.0
-20														GRAY SANDY CLAY WITH SHELL FRAGMENTS, WET	
	-23.4	27.9	2	3	3	6								-26.5	31.0
-25														GRAY SAND, SATURATED	
	-28.2	32.7	15	20	20	40									
-30															
	-33.4	37.9	19	22	20	42									
-35															
	-38.4	42.9	7	21	12	33								-38.9	43.4
-40														-39.4	43.9
														-40.4	44.9
	-43.4	47.9	34	50	38	88								COASTAL PLAIN SEDIMENTARY ROCK	
														LIGHT GRAY LIMESTONE, SATURATED (CASTLE HAYNE FORMATION)	
-45														COASTAL PLAIN	
														GRAY SAND WITH SHELL FRAGMENTS, SATURATED	
	-48.4	52.9	28	15	11	26								COASTAL PLAIN SEDIMENTARY ROCK	
														LIGHT GRAY LIMESTONE, SATURATED	
-50															
	-53.4	57.9	10	11	12	23									
-55															
	-58.4	62.9	36	17	8	25								-59.4	63.9
-60														-61.5	66.0
	-63.4	67.9	12	8	11	19								-64.9	69.4
														Boring Terminated at Elevation -64.9 ft in Very Soft Limestone	

NCDOT BORE DOUBLE B-5614 GEO BRDG009.040221 - COPY.GPJ NC DOT.GDT 4/7/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45569.1.2			TIP B-5614		COUNTY BEAUFORT		GEOLOGIST J. Holland								
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK										GROUND WTR (ft)					
BORING NO. B1-B			STATION 19+06			OFFSET 14 ft RT			ALIGNMENT -L-		0 HR. FIAD				
COLLAR ELEV. -3.4 ft			TOTAL DEPTH 99.7 ft			NORTHING 618,498			EASTING 2,604,162		24 HR. N/A				
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER T.J. Strickland			START DATE 03/12/21			COMP. DATE 03/15/21			SURFACE WATER DEPTH 3.0ft						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)
0															

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST J. Holland					
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)					
BORING NO. B1-B			STATION 19+06			OFFSET 14 ft RT			ALIGNMENT -L-			0 HR. FIAD		
COLLAR ELEV. -3.4 ft			TOTAL DEPTH 99.7 ft			NORTHING 618,498			EASTING 2,604,162			24 HR. N/A		
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER T.J. Strickland			START DATE 03/12/21			COMP. DATE 03/15/21			SURFACE WATER DEPTH 3.0ft					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
-80						Match Line								COASTAL PLAIN SEDIMENTARY ROCK LIGHT GRAY AND GREENISH GRAY LIMESTONE WITH SAND LAYERS, SATURATED (continued)
-85	-81.7	78.3	4	33	44							Sat.		
-90	-86.6	83.2	53	80	20/0.3									
-95	-91.6	88.2	11	11	16									
-100	-96.6	93.2	14	13	15									
	-101.6	98.2	13	31	43									
														-103.1 99.7
Boring Terminated at Elevation -103.1 ft in Soft Limestone														
Other Samples: ST-01 (20.1 - 22.1)														

NCDOT BORE DOUBLE B-5614 GEO BRDG009.040221 - COPY.GPJ NC DOT.GDT 4/7/21

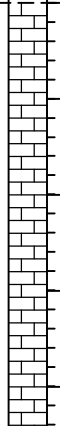
NC DOT BORE DOUBLE B-5614 GEO BRDG009 040221 - COPY.GPJ NC DOT.GDT 4/7/21

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST J. Holland				
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)				
BORING NO. B2-A			STATION 20+13			OFFSET 12 ft LT			ALIGNMENT -L-		0 HR. FIAD		
COLLAR ELEV. -11.5 ft			TOTAL DEPTH 101.1 ft			NORTHING 618,518			EASTING 2,604,270		24 HR. N/A		
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic				
DRILLER T.J. Strickland			START DATE 03/11/21			COMP. DATE 03/11/21			SURFACE WATER DEPTH 11.0ft				
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			
-90	-90.7	79.2											
-95	-95.7	84.2	25	12	15								COASTAL PLAIN SEDIMENTARY ROCK LIGHT GRAY AND GREENISH GRAY LIMESTONE WITH SAND LAYERS,SATURATED (continued)
-100	-101.7	90.2	15	12	13								
-105	-106.7	95.2	21	20	13								
-110	-111.8	100.3	24	45	47								
			25	100/0.3									
													Boring Terminated at Elevation -112.6 ft in Soft Limestone

NC DOT BORE DOUBLE B-5614 GEO BRDG009 040221 - COPY.GPJ NC DOT.GDT 4/7/21

[illegible]

NCDOT BORE DOUBLE B-5614 GEO BRDG009 040221 - COPY.GPJ NC DOT.GDT 4/7/21

WBS 45569.1.2		TIP B-5614		COUNTY BEAUFORT		GEOLOGIST J. Holland										
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK							GROUND WTR (ft)									
BORING NO. B4-A		STATION 22+55		OFFSET 12 ft LT		ALIGNMENT -L-		0 HR. FIAD								
COLLAR ELEV. -8.6 ft		TOTAL DEPTH 98.9 ft		NORTHING 618,504		EASTING 2,604,512		24 HR. N/A								
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER T.J. Strickland		START DATE 03/17/21		COMP. DATE 03/17/21		SURFACE WATER DEPTH 8.7ft										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
-85						Match Line								COASTAL PLAIN SEDIMENTARY ROCK LIGHT GRAY LIMESTONE WITH SAND LAYERS, SATURATED (continued)		
	-86.4	77.8				•65						Sat.				
-90	-91.1	82.5	100/0.4			100/0.4•										
-95	-96.1	87.5		12	15	13	•28									
-100	-101.0	92.4		14	18	16	•34									
-105	-106.0	97.4		17	37	48	•85									
															-107.5	98.9

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST J. Holland							
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)							
BORING NO. B5-B			STATION 23+84			OFFSET 12 ft RT			ALIGNMENT -L-			0 HR. FIAD				
COLLAR ELEV. -8.3 ft			TOTAL DEPTH 100.7 ft			NORTHING 618,473			EASTING 2,604,639			24 HR. N/A				
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic							
DRILLER T.J. Strickland			START DATE 03/18/21			COMP. DATE 03/18/21			SURFACE WATER DEPTH 7.1ft							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
-5																
	-8.3	0.0	WOR	WOR	WOR	0								-8.3	GROUND SURFACE	0.0
-10	-11.8	3.5	WOR	WOR	WOR	0									ALLUVIAL DARK GRAY SILTY CLAY WITH SHELL FRAGMENTS, WITH WOOD FRAGMENTS, SATURATED	
-15	-16.8	8.5	WOH	0	0	0										
-20	-22.8	14.5	WOH	0	0	0										
-25	-27.8	19.5	1	3	1	4										
-30	-32.7	24.4	3	2	2	4										
-35	-37.6	29.3	2	3	4	7										
-40	-42.6	34.3	38	41	48										COASTAL PLAIN DARK GRAY SAND AND SILTY SAND WITH TRACE CLAY, WITH WOOD FRAGMENTS, WITH SHELL FRAGMENTS, SATURATED (YORKTOWN FORMATION)	
-45	-47.6	39.3	20	14	11											
-50	-52.6	44.3	15	12	9											
-55	-57.5	49.2	7	9	7											
-60	-62.5	54.2	5	6	6											
-65	-67.4	59.1	13	12	10											
-70	-72.4	64.1	6	10	11											
-75	-77.4	69.1	5	5	7											
-80	-82.4	74.1	14	16	20											
-85																

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST J. Holland					
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)					
BORING NO. B5-B			STATION 23+84			OFFSET 12 ft RT			ALIGNMENT -L-			0 HR. FIAD		
COLLAR ELEV. -8.3 ft			TOTAL DEPTH 100.7 ft			NORTHING 618,473			EASTING 2,604,639			24 HR. N/A		
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic					
DRILLER T.J. Strickland			START DATE 03/18/21			COMP. DATE 03/18/21			SURFACE WATER DEPTH 7.1ft					
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
-85														
	-87.4	79.1	8	9	14									
-90														
	-92.4	84.1	100/0.4											
-95														
	-97.5	89.2	8	18	18									
-100														
	-102.5	94.2	15	22	20									
-105														
	-107.5	99.2	19	30	38									

NCDOT BORE DOUBLE B-5614 GEO BRDG009.040221 - COPY.GPJ NC_DOT.GDT 4/7/21

WBS 45569.1.2		TIP B-5614		COUNTY BEAUFORT		GEOLOGIST J. Holland								
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK							GROUND WTR (ft)							
BORING NO. B6-A		STATION 25+00		OFFSET 8 ft LT		ALIGNMENT -L-		0 HR. FIAD						
COLLAR ELEV. -5.7 ft		TOTAL DEPTH 99.9 ft		NORTHING 618,486		EASTING 2,604,756		24 HR. N/A						
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic								
DRILLER T.J. Strickland		START DATE 03/18/21		COMP. DATE 03/23/21		SURFACE WATER DEPTH 5.9ft								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT			SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75			100	MOI	
-85						Match Line								
-90														
-95	-94.1	88.4	12	10	13						RS-01	17%	-94.1	88.4
-100	-99.1	93.4	14	14	21						SS-124			
-105	-104.1	98.4	17	22	22								-105.6	
													Boring Terminated at Elevation -105.6 ft in Very Soft Limestone	

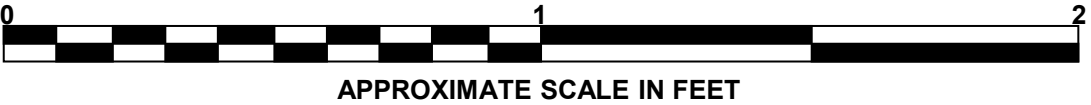
GEOTECHNICAL BORING REPORT
CORE LOG

WBS 45569.1.2				TIP B-5614				COUNTY BEAUFORT				GEOLOGIST J. Holland											
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK												GROUND WTR (ft)											
BORING NO. B6-A				STATION 25+00				OFFSET 8 ft LT				ALIGNMENT -L-				0 HR. FIAD							
COLLAR ELEV. -5.7 ft				TOTAL DEPTH 99.9 ft				NORTHING 618,486				EASTING 2,604,756				24 HR. N/A							
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic											
DRILLER T.J. Strickland				START DATE 03/18/21				COMP. DATE 03/23/21				SURFACE WATER DEPTH 5.9ft											
CORE SIZE NQ2				TOTAL RUN 10.8 ft																			
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %ROD (ft) %		SAMP. NO.	STRATA REC. (ft) %ROD (ft) %		L O G	DESCRIPTION AND REMARKS ELEV. (ft) DEPTH (ft)												
-83.3											Begin Coring @ 77.6 ft												
-85	-83.3 -84.1	77.6 78.4	0.8 5.0	1:15/0.8 1:07/1.0 :46/1.0 :34/1.0 :51/1.0 1:23/1.0	(0.4) 50% (1.1) 22%	(0.4) 50% (0.6) 12%		(2.2) 20%	(2.0) 19%		COASTAL PLAIN SEDIMENTARY ROCK LIGHT GRAY AND TAN, FRIABLE TO INDURATED LIMESTONE WITH SAND LAYERS (CASTLE HAYNE FORMATION) RS-01: 86.4'-87.1'												77.6
-90	-89.1	83.4	5.0	1:40/1.0 2:04/1.0 1:16/1.0 3:14/1.0 :57/1.0 N=23	(1.8) 36%	(1.0) 20%	RS-01				RMR= 12												
-95	-94.1	88.4					SS-124																88.4
-100				N=35																			
-105				N=44																			
											Boring Terminated at Elevation -105.6 ft in Very Soft Limestone												99.9

NCDOT CORE DOUBLE B-5614 GEO BRDG009_040221 - COPY.GPJ NC_DOT.GDT 4/7/21

CORE PHOTOGRAPH
BRIDGE NO. 9 OVER BLOUNTS CREEK ON SR 1112 (MOUTH OF CREEK RD)

B6-A
BOX 1 OF 1: 77.6 - 88.4 FEET



APPROXIMATE SCALE IN FEET

NCDOT BORE DOUBLE B-5614 GEO_BRDG009_040221 - COPY.GPJ NC_DOT.GDT 4/7/21

[illegible]

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 45569.1.2				TIP B-5614				COUNTY BEAUFORT				GEOLOGIST J. Holland										
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK												GROUND WTR (ft)										
BORING NO. B7-B				STATION 26+23				OFFSET 12 ft RT				ALIGNMENT -L-				0 HR. FIAD						
COLLAR ELEV. -5.0 ft				TOTAL DEPTH 99.9 ft				NORTHING 618,461				EASTING 2,604,881				24 HR. N/A						
DRILL RIG/HAMMER EFF./DATE 742018 CME-55C 90% 03/16/2021								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic										
DRILLER T.J. Strickland				START DATE 03/23/21				COMP. DATE 03/24/21				SURFACE WATER DEPTH 5.7ft										
CORE SIZE NQ2				TOTAL RUN 2.0 ft																		
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %RQD (ft) %		SAMP. NO.	STRATA REC. (ft) %RQD (ft) %		L O G	DESCRIPTION AND REMARKS											
											ELEV. (ft) DEPTH (ft)											
-44.3											Begin Coring @ 39.3 ft											
-45	-44.3	39.3	1.0	.54/1.0 N=60	(0.0) 0%	(0.0) 0%					COASTAL PLAIN											
	-45.3	40.3		N=20							GREENISH GRAY SAND WITH SHELL FRAGMENTS, WITH CEMENTED SAND AND LIMESTONE LAYERS, SATURATED											
				N=18							(continued)											
-50																						
				N=16																		
-55																						
				N=22																		
-60																						
				N=16																		
-65																						
				N=15																		
-70																						
				N=32																		
-75																						
				N=12																		
-80																						
				N=100/0.7																		
-85	-84.4	79.4		1:12/1.0 N=32	(0.0) 0%	(0.0) 0%					-82.5 COASTAL PLAIN SEDIMENTARY ROCK 77.5											
	-85.4	80.4	1.0	N=32							LIGHT GRAY, FRIABLE LIMESTONE WITH SAND LAYERS, SATURATED											
				N=100/0.9																		
-90																						
				N=32																		
-95																						
				N=34																		
-100																						
				N=30																		
											-104.9 Boring Terminated at Elevation -104.9 ft in Very Soft Limestone 99.9											
											Other Samples: ST-02 (15.0 - 17.0)											

NCDOT CORE DOUBLE B-5614 GEO BRDG009_040221 - COPY.GPJ NC_DOT.GDT 4/7/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 45569.1.2			TIP B-5614			COUNTY BEAUFORT			GEOLOGIST Argenbright, D. N.						
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK									GROUND WTR (ft)						
BORING NO. EB2-A			STATION 27+29			OFFSET 24 ft LT			ALIGNMENT -L-			0 HR. N/A			
COLLAR ELEV. 10.8 ft			TOTAL DEPTH 74.3 ft			NORTHING 618,489			EASTING 2,604,986			24 HR. 9.9			
DRILL RIG/HAMMER EFF./DATE GFO0075 CME-45C 89% 08/19/2019						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic						
DRILLER Smith, R. E.			START DATE 06/08/20			COMP. DATE 06/08/20			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	
15															
10	10.8	0.0	1	0	1	1								10.8	0.0
5	6.8	4.0	2	2	3	5									
0	3.0	7.8	3	4	3	7								2.4	8.4
-5	-2.0	12.8	3	3	3	6								-2.2	13.0
-10	-7.0	17.8	WOH	3	5	8								-5.2	16.0
-15	-12.0	22.8	3	3	4	7								-15.2	26.0
-20	-17.0	27.8	2	1	3	4								-22.3	33.1
-25	-22.0	32.8	2	3	3	6								-25.2	36.0
-30	-27.0	37.8	3	9	12	21								-30.9	41.7
-35	-32.0	42.8	7	8	10	18								-31.0	41.8
-40	-37.0	47.8	18	25	19	44								-39.7	50.5
-45	-42.0	52.8	100/0.5							100/0.5					
-50	-47.0	57.8	14	15	14	29									
-55	-52.0	62.8	12	12	11	23								-55.2	66.0
-60	-57.0	67.8	9	7	7	14									
	-62.0	72.8	5	5	5	10								-63.5	74.3
														Boring Terminated at Elevation -63.5 ft in	

WBS 45569.1.2				TIP B-5614			COUNTY BEAUFORT			GEOLOGIST Argenbright, D. N.				
SITE DESCRIPTION BRIDGE NO. 9 ON -L- (SR 1112) OVER BLOUNTS CREEK												GROUND WTR (ft)		
BORING NO. EB2-A				STATION 27+29			OFFSET 24 ft LT			ALIGNMENT -L-		0 HR. N/A		
COLLAR ELEV. 10.8 ft				TOTAL DEPTH 74.3 ft			NORTHING 618,489			EASTING 2,604,986		24 HR. 9.9		
DRILL RIG/HAMMER EFF./DATE GFO0075 CME-45C 89% 08/19/2019							DRILL METHOD Mud Rotary			HAMMER TYPE Automatic				
DRILLER Smith, R. E.				START DATE 06/08/20			COMP. DATE 06/08/20			SURFACE WATER DEPTH N/A				
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
-65						Match Line								
														Medium Dense Sand
				</										

NCDOT BORE DOUBLE B-5614 GEO BRDG009.040221 - COPY.GPJ NC DOT.GDT 4/7/21

BRIDGE NO. 9 OVER BLOUNTS CREEK ON SR 1112 (MOUTH OF CREEK RD)

SOIL TEST RESULTS																
BORING	SAMPLE			DEPTH INTERVAL	AASHTO	LIQUID	PLASTICITY	% BY WEIGHT				% PASSING (SIEVES)			%	%
NO.	NO.	STATION	OFFSET	(FEET)	CLASS.	LIMIT	INDEX	GRAVEL	C.SAND	F.SAND	SILT & CLAY	10	40	200	MOISTURE	ORGANIC
B1-B	SS-050	19+06	14' RT	28.6-30.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	58.0	-
B1-B	SS-059	19+06	14' RT	73.3-74.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33.0	-
B2-A	SS-026	20+13	12' LT	15.5-17.0	A-4	23	5	0.00	0.20	50.11	49.70	100.00	99.80	49.70	24.7	-
B2-A	SS-028	20+13	12' LT	25.5-27.0	A-1-B	0	0	3.31	50.27	40.19	6.23	96.69	46.42	6.23	38.6	-
B3-B	SS-004	21+45	10' RT	13.5-15.0	A-2-4	0	0	0.00	0.41	82.00	17.58	100.00	99.59	17.58	23.1	-
B4-A	SS-069	22+55	12' LT	17.9-19.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	23.8	-
B4-A	SS-071	22+55	12' LT	27.9-29.4	A-1-B	0	0	0.15	55.45	35.15	9.25	99.85	44.40	9.25	26.0	-
B5-B	SS-100	23+84	12' RT	69.1-70.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	23.5	-
B6-A	SS-112	25+00	8' LT	23.5-25.0	A-6	30	14	0.00	0.41	37.63	61.96	100.00	99.59	61.96	47.3	-
B6-A	SS-113	25+00	8' LT	26.8-28.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24.6	-
B6-A	SS-124	25+00	8' LT	88.4-89.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.9	-
B7-B	SS-134	26+23	12' RT	32.8-34.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.8	-
B1-B	ST-01	19+06	14' RT	20.1-22.1	A-2-4	0	0	0.00	0.46	73.76	25.78	100.00	99.54	25.78	28.2	-
B7-B	ST-02	26+23	12' RT	15.0-17.0	A-2-6	29	11	0.48	37.86	43.10	18.57	99.52	61.66	18.57	27.7	-

BRIDGE NO. 9 ON SR 1112 OVER BLOUNTS CREEK (MOUTH OF CREEK RD)

ROCK TEST RESULTS												
BORING	SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL (ft)	LENGTH (in.)	DIAMETER (in.)	AREA (sq. in.)	VOLUME		UNIT WEIGHT (pcf)	COMPRESSIVE	TESTING METHOD
								(in. ³)	(cf)		STRENGTH (psi)	
B6-A	RS-01	25+00	8FT LT	86.4 - 87.1	4.94	1.95	2.97	14.7	0.01	106.9	400	ASTM D-7012-14 METHOD C

SITE PHOTOGRAPHS
BRIDGE NO. 9 OVER BLOUNTS CREEK ON SR 1112 (MOUTH OF CREEK ROAD)



View of SR 1112 looking northeast.



View of proposed SR 1112 looking east.



View of Blounts Creek looking northwest.

April 5, 2021

Memorandum to: J. L. Pilipchuk, L.G., P.E.
State Geotechnical Engineer

WBS Element: 45569.1.2
TIP: B-5614
County: BEAUFORT
Description: Bridge 9 over Blounts Creek on SR 1112 (Mouth of the Creek Rd)

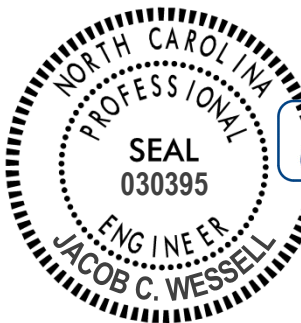
Subject: Design Scour Elevations

After a review of site flooding history, historical scour depth, and geologic conditions encountered at the site, Schnabel Engineering, has determined the design scour elevations (DSE), and presents the following:

Location	Theoretical Scour Elevation	Historical Scour Elevation	Design Scour Elevation	Does DSE impact end bents?
Bent 1	-15.2 feet	-23.4 feet	-15.2 feet	No
Bent 2	-23.9 feet	-24.5 feet	-23.9 feet	No
Bent 3	-21.3 feet	-22.1 feet	-21.3 feet	No
Bent 4	-21.4 feet	-24.6 feet	-21.4 feet	No
Bent 5	-19.0 feet	-25.3 feet	-19.0 feet	No
Bent 6	-17.8 feet	-21.7 feet	-17.8 feet	No
Bent 7	-16.3 feet	-17.0 feet	-16.3 feet	No

The Theoretical Scour Elevation is from the Bridge Survey and Hydraulic Design Report dated 2/5/2021. The Design Scour Elevation is the same as the Theoretical Scour Elevation. The subsurface investigation revealed Alluvial materials consisting of silty/sandy clay and clayey sand generally extending deeper than the Theoretical Scour Elevations at each bent. These materials are not resistant to scour.

Jacob C. Wessell, P.E.
Senior Engineer



DocuSigned by:



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10/27/2021