

## **BRIDGE FOUNDATION DESIGN RECOMMENDATIONS**

**BRIDGE No. 490065 ON SR 1300 (PUMPKINTOWN ROAD)  
OVER SAVANNAH CREEK**

**WBS No.: 17BP.14.R.148**

**TIP No.: N/A**

**COUNTY: JACKSON**

**ECS PROJECT NO. 08-11778-E**

**NOVEMBER 30, 2016**



November 30, 2016

Mr. Hardy Willis, P.E.  
Vaughn & Melton Consulting Engineers  
1318-F Patton Avenue  
Asheville, North Carolina 28806

Reference: **Bridge Foundation Design Recommendations**  
**Bridge No. 490065 on SR 1300 (Pumpkintown Road) over Savannah Creek**  
WBS Number: 17BP.14.R.148  
TIP Number: N/A  
County: Jackson  
ECS Project No.: 08-11778-E

Dear Mr. Willis:

ECS Carolinas, LLP (ECS) is pleased to submit the attached Bridge Foundation Design Recommendations Report associated with the construction of Structure No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek in Jackson County, North Carolina. This work was performed in general accordance with Task Order 4 (Limited Services Agreement, Contract No. 7000016122, dated November 4, 2015) between Vaughn & Melton and ECS.

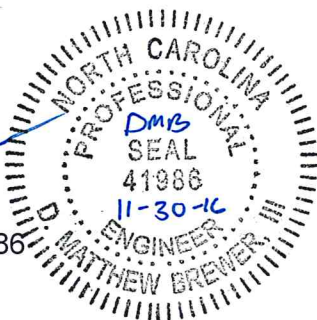
Our design is based on using NCDOT standard loads and project information provided to us by Vaughn & Melton. This report contains the foundation recommendations, Structure Subsurface Inventory, and supporting calculations.


ECS Carolinas, LLP appreciates the opportunity to assist you during this phase of the project. If you have questions concerning this report, please contact our office at 704-525-5152.

Respectfully,

**ECS CAROLINAS, LLP**

  
D. Matthew Brewer, P.E.  
Senior Project Engineer  
NC Registration No. 041986



  
Michael J. Walko, P.E.  
Principal Engineer

# FOUNDATION RECOMMENDATIONS

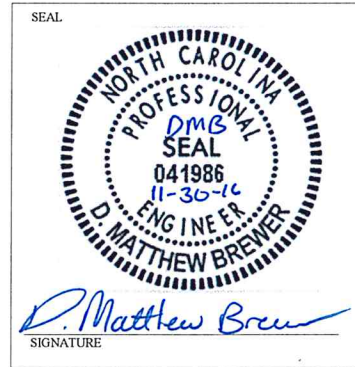
WBS # 17BP.14.R.148 DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road)  
over Savannah Creek

T.I.P. NO. N/A

COUNTY Jackson

STATION 13+20.50 -L-

	INITIALS	DATE
DESIGN	DMB	11/29/16
CHECK	MJW	11/30/16
APPROVAL		



	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT NO. 1	12+84.20 -L-	Cap on HP 12X53 Steel Piles	100 Tons/Pile	Bottom of Cap Elevation = 2,443.5 ft +/- Average Estimated Pile Length = 35 ft (LT), 20 ft (RT) 5 vertical piles @ 9'-6" spacing
END BENT NO. 2	13+56.81 -L-	Cap on HP 12X53 Steel Piles	100 Tons/Pile	Bottom of Cap Elevation = 2,443.1 ft +/- Average Estimated Pile Length = 30 ft (LT), 20 ft (RT) 5 vertical piles @ 9'-6" spacing

(SEE NOTES ON PLANS AND COMMENTS ON FOLLOWING PAGES)

**FOUNDATION RECOMMENDATION NOTES ON PLANS**

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- 1) FOR PILES, SEE GEOTECHNICAL SPECIAL PROVISIONS AND SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 2) PILES AT END BENT NO. 1 AND END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 100 TONS PER PILE.
- 3) DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 170 TONS PER PILE.
- 4) STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT NO. 1 AND END BENT NO. 2. FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 5) IF NECESSARY, PREDRILL PILE LOCATIONS AT END BENT NO. 1 (LT) TO ELEVATION 2,430 FT WITH EQUIPMENT THAT WILL RESULT IN A MAXIMUM PREDRILLING DIAMETER OF 12 INCHES. FOR PREDRILLING FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 6) INSTALL PILES AT END BENT NO. 1 (LT) TO A TIP ELEVATION NO HIGHER THAN 2,425 FT.
- 7) TESTING PILES WITH THE PDA DURING DRIVING, RESTRIKING OR REDRIVING MAY BE REQUIRED. THE ENGINEER WILL DETERMINE THE NEED FOR PDA TESTING. FOR PDA TESTING, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
- 8) IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 20,000 TO 30,000 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2. THIS ESTIMATED ENERGY RANGE DOES NOT RELEASE THE CONTRACTOR FROM PROVIDING DRIVING EQUIPMENT IN ACCORDANCE WITH SUBARTICLE 450-3(D)(2) OF THE STANDARD SPECIFICATIONS.

**FOUNDATION RECOMMENDATION COMMENTS**

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- 1) BRIDGE END SLOPES OF 1.5:1 (H:V) ARE ADEQUATE WITH SLOPE PROTECTION.
- 2) NO WAITING PERIOD IS REQUIRED AT EITHER END BENT PRIOR TO CONSTRUCTION.
- 3) THE SUB-REGIONAL APPROACH FILL DETAIL SHOULD BE USED AT BOTH END BENTS.
- 4) AVERAGE PILE LENGTHS ARE BASED ON PLUMB PILES FROM THE BOTTOM OF CAP / BOTTOM OF FOOTING ELEVATION TO THE ANTICIPATED TIP ELEVATION, ROUNDED UP TO THE NEAREST 5 FEET.

# PILE PAY ITEMS

(Revised 8/11/15)

WBS ELEMENT 17BP.14.R.148

DATE 11/29/2016

TIP NO. N/A

DESIGNED BY DMB

COUNTY JACKSON

CHECKED BY MJW

STATION 13+20.50 -L-

DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek

NUMBER OF BENTS WITH PILES \_\_\_\_\_  
 NUMBER OF PILES PER BENT \_\_\_\_\_  
 NUMBER OF END BENTS WITH PILES 2  
 NUMBER OF PILES PER END BENT 5

Only required for "Predrilling  
for Piles" & "Pile  
Excavation" pay items

	<b>PILE PAY ITEM QUANTITIES</b>								
	<b>Bent # or End Bent #</b>	<b>Steel Pile Points (yes/no)</b>	<b>Pipe Pile Plates (yes/no/maybe)</b>	<b>Predrilling For Piles (per linear ft)</b>	<b>Pile Redrives (per each)</b>	<b>Pile Excavation (per linear ft)</b>		<b>PDA Testing (per each)</b>	
						<b>In Soil</b>			<b>Not In Soil</b>
End Bent No. 1	Yes	No	45 (LT), 0 (RT)	0	0	0	X		
End Bent No. 2	Yes	No	0	0	0	0			
<b>TOTALS</b>	X	X	45	0	0	0	1		

Notes:  
 Blanks or "no" represent quantity of zero.  
 If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.  
 If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.  
 Show quantity of "PDA Testing" on the plans as total only.

**17BP.14.R.148 - JACKSON COUNTY BRIDGE 065  
STRUCTURE SUBSURFACE INVESTIGATION**

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.14.R.148	1	8

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

**STRUCTURE  
SUBSURFACE INVESTIGATION**

COUNTY JACKSON  
PROJECT DESCRIPTION DIVISION 14 BRIDGES  
GROUP 1

SITE DESCRIPTION BRIDGE NO. 65 ON SR 1300  
(PUMPKINTOWN ROAD) OVER SAVANNAH CREEK

**REFERENCE: N/A**

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	BORELOGS

PERSONNEL

M. FOULKE  
HPC  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INVESTIGATED BY ECS CAROLINAS, LLP  
DRAWN BY M. BREWER  
CHECKED BY M. WALKO  
SUBMITTED BY ECS CAROLINAS, LLP  
DATE NOVEMBER 2016

**CAUTION NOTICE**

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF PREPARING THE SCOPE OF WORK TO BE INCLUDED IN THE REQUEST FOR PROPOSAL. 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.

SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. 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:

- 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.
- 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.

Prepared in the Office of:



ECS CAROLINAS, L.P.  
1812 CENTER PARK DRIVE  
SUITE D  
CHARLOTTE, NC 28217  
(704) 525-6152 (PHONE)  
(704) 357-0023 (FAX)  
NC REGISTERED  
ENGINEERING  
FIRM # F-1578



D. Matthew Brewer 11-30-16  
SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED**

**PROJECT: 17BP.14.R.148**

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

# SUBSURFACE INVESTIGATION

## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION																																																									
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, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										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.																																																									
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>										<b>ANGULARITY OF GRAINS</b>																																																									
GRANULAR MATERIALS (< 35% PASSING #200)      SILT-CLAY MATERIALS (> 35% PASSING #200)      ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.																																																									
<b>MINERALOGICAL COMPOSITION</b>										<b>COMPRESSIBILITY</b>																																																									
MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										SLIGHTLY COMPRESSIBLE      LL < 31 MODERATELY COMPRESSIBLE      LL = 31 - 50 HIGHLY COMPRESSIBLE      LL > 50																																																									
<b>PERCENTAGE OF MATERIAL</b>										<b>GROUND WATER</b>																																																									
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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 (PAGE 2 OF 2)

### 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 YIELD 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 SL.)	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 (SL.)	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. <u>IF TESTED, WOULD YIELD SPT REFUSAL</u>
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. <u>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</u>
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. <u>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</u>
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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROOVED 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

<b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.	<b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.
<b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.	<b>ARGILLACEOUS</b> - 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.
<b>ARTESIAN</b> - 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.	<b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
<b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.	<b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
<b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.	<b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
<b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.	<b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
<b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.	<b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
<b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	<b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
<b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	<b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
<b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	<b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
<b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	<b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
<b>ROCK QUALITY DESIGNATION (ROD)</b> - 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.	<b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
<b>SILL</b> - 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.	<b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
<b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.	<b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
<b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - 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.	<b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

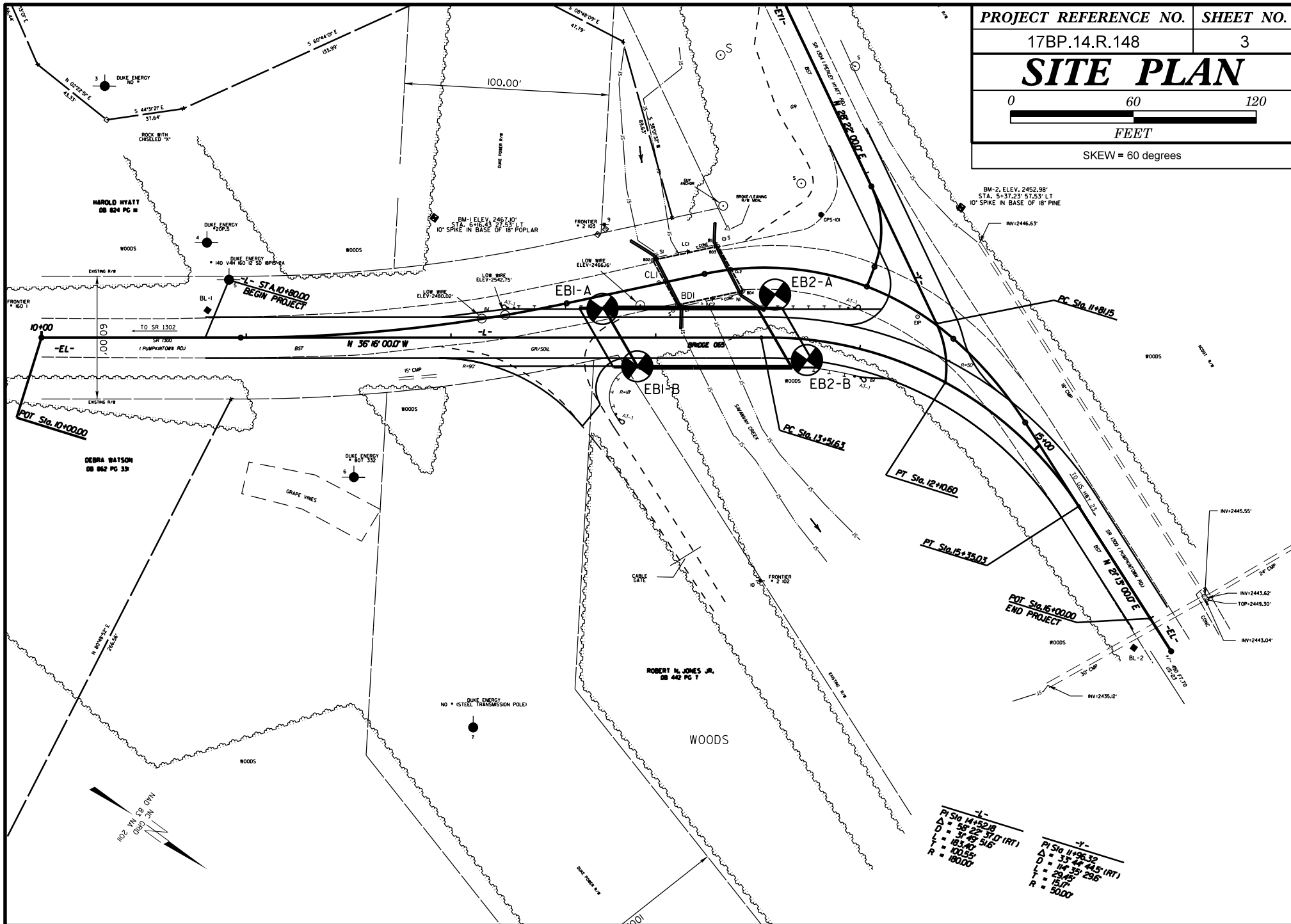
### BENCH MARK:

ELEVATION:      FEET

### NOTES:

Survey information provided by Vaughn and Melton

<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
17BP.14.R.148	3
<b>SITE PLAN</b>	
FEET	
SKEW = 60 degrees	



# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.14.R.148	TIP N/A	COUNTY JACKSON	GEOLOGIST M. Foulke
SITE DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+74	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 2,449.3 ft	TOTAL DEPTH 48.6 ft	NORTHING 582,415	EASTING 720,251
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Cain	START DATE 10/20/16	COMP. DATE 10/20/16	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
2450														GROUND SURFACE	0.0
	2,448.3	1.0	5	4	11								M	ROADWAY EMBANKMENT Red-Brown-White, Moist, Medium Dense, Silty Fine SAND (A-2-4), with gravel	
2445	2,445.8	3.5	17	11	7								M		
	2,443.3	6.0	7	14	18								M	ALLUVIAL Brown-Gray, Moist, Dense to Loose, Silty Fine SAND (A-2-4), with mica and little organics	6.0
2440	2,440.8	8.5	3	4	5								M		
	2,436.8	12.5											▽		
2435	2,435.8	13.5	11	40	60/0.3								M	Brown-Gray-White, Moist, Very Dense, Silty Fine to Coarse SAND (A-2-4), with boulders and cobbles.	15.0
	2,434.3	15.0												RESIDUAL Red-Brown, Moist to Wet, Medium Dense to Loose, Silty Fine SAND (A-2-4), with little to some mica	
2430	2,430.8	18.5	3	4	8								M		
	2,425.8	23.5	6	10	15								W		
2425	2,425.8	23.5	6	10	15										
	2,420.8	28.5	4	5	5								M		
2420	2,420.8	28.5	4	5	5										
	2,417.3	32.0												WEATHERED ROCK Red-Brown (Biotite Gneiss)	32.0
2415	2,415.8	33.5	27	73	27/0.4										
	2,413.3	36.0											W	RESIDUAL Red-Brown, Wet, Dense, Silty Fine SAND (A-2-4), little mica	36.0
2410	2,410.8	38.5	18	16	19										
	2,405.8	43.5												WEATHERED ROCK Brown-Black (Biotite Gneiss)	43.5
2405	2,405.8	43.5	100/0.5												
	2,400.8	48.5													
	2,400.8	48.5	60/0.1											CRYSTALLINE ROCK (Biotite Gneiss) Boring Terminated with Standard Penetration Test Refusal at Elevation 2,400.7 ft In Crystalline Rock (BIOTITE GNEISS)	48.5
	2,400.7	48.5													

NCDOT BORE SINGLE JACKSON 065.GPJ NC\_DOT.GDT 11/29/16

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.14.R.148	TIP N/A	COUNTY JACKSON	GEOLOGIST M. Foulke
SITE DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek			GROUND WTR (ft)
BORING NO. EB1-B	STATION 12+91	OFFSET 14 ft RT	ALIGNMENT -L-
COLLAR ELEV. 2,447.5 ft	TOTAL DEPTH 19.6 ft	NORTHING 582,445	EASTING 720,264
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Cain	START DATE 10/20/16	COMP. DATE 10/20/16	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							
2450																	
	2,446.5	1.0	8	8	5										2,447.5	GROUND SURFACE	0.0
2445	2,444.0	3.5	6	6	6										2,442.5	<b>ROADWAY EMBANKMENT</b> Brown-White, Moist, Medium Dense, Silty Fine SAND (A-2-4), with trace gravel and mica	5.0
2440	2,439.0	8.5	5	6	8										2,439.5	<b>ALLUVIAL</b> Brown-White, Moist, Very Loose, Silty Fine SAND (A-2-4)	8.0
2435	2,434.0	13.5	10	25	28											<b>RESIDUAL</b> Red-Brown, Wet to Saturated, Medium Dense to Very Dense, Silty Coarse SAND (A-2-4), with gravel	
2430	2,429.0	18.5	67	33/4											2,431.0	<b>WEATHERED ROCK</b> Brown-White (Biotite Gneiss)	16.5
	2,428.0	19.5	38	62/0.4											2,428.0	<b>CRYSTALLINE ROCK</b> (Biotite Gneiss)	19.5
			60/0.1												2,427.9	Boring Terminated with Standard Penetration Test Refusal at Elevation 2,427.9 ft In Crystalline Rock (BIOTITE GNEISS)	19.6

NCDOT BORE SINGLE JACKSON 065.GPJ NC\_DOT.GDT 11/29/16

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.14.R.148	TIP N/A	COUNTY JACKSON	GEOLOGIST M. Foulke
SITE DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek			GROUND WTR (ft)
BORING NO. EB2-A	STATION 13+58	OFFSET 21 ft LT	ALIGNMENT -L-
COLLAR ELEV. 2,447.4 ft	TOTAL DEPTH 27.3 ft	NORTHING 582,479	EASTING 720,195
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Cain	START DATE 10/21/16	COMP. DATE 10/21/16	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				ELEV. (ft)	DEPTH (ft)	
2450																
	2,447.4	0.0														GROUND SURFACE
	2,447.0	0.4														Asphalt (5")
2445	2,446.4	1.0	6	4	3											<b>ROADWAY EMBANKMENT</b>
	2,443.9	3.5	0	0	1											Brown-Gray, Moist, Loose, Silty Fine to Coarse SAND (A-2-4), with gravel
	2,441.4	6.0	3	2	3											Red-Brown, Wet, Very Loose, Silty Clayey Fine SAND (A-2-6)
2440	2,438.9	8.5	16	20	13											<b>RESIDUAL</b>
	2,435.4	12.0	6	10	13											Red-Brown, Wet, Very Loose, Silty Fine SAND (A-2-4), with gravel
2435	2,433.9	13.5														White-Gray, Moist, Dense, Fine to Coarse Sandy GRAVEL (A-1-a)
2430	2,429.4	18.5	2	3	6											Red-Brown, Moist, Medium Dense, Silty Coarse SAND (A-2-4), with gravel
2425	2,423.9	23.5	7	3	2											Red-Brown-Black, Moist, Stiff to Medium Stiff, Fine Sandy SILT (A-4)
	2,420.2	27.2														CRYSTALLINE ROCK (Biotite Gneiss)
	2,420.1	27.3														Boring Terminated with Standard Penetration Test Refusal at Elevation 2,420.1 ft In Crystalline Rock (BIOTITE GNEISS)

NCDOT BORE SINGLE JACKSON 065.GPJ NC\_DOT.GDT 11/29/16

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 17BP.14.R.148	TIP N/A	COUNTY JACKSON	GEOLOGIST M. Foulke
SITE DESCRIPTION Bridge No. 065 on SR 1300 (Pumpkintown Road) over Savannah Creek			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+75	OFFSET 10 ft RT	ALIGNMENT -L-
COLLAR ELEV. 2,444.1 ft	TOTAL DEPTH 18.5 ft	NORTHING 582,510	EASTING 720,212
DRILL RIG/HAMMER EFF./DATE HPC2473 CME-550 92% 12/09/2015		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER J. Cain	START DATE 10/20/16	COMP. DATE 10/21/16	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2445														2,444.1	GROUND SURFACE	0.0
	2,443.1	1.0	4	8	6										<b>ROADWAY EMBANKMENT</b> Brown-Red, Moist, Stiff, Fine Sandy SILT (A-4), with gravel	
2440	2,440.6	3.5	2	4	5											
	2,438.1	6.0	2	5	8										<b>ALLUVIAL</b> Dark Brown, Wet, Medium Dense, Clayey Fine SAND (A-2-6), with trace mica	6.0
2435	2,435.6	8.5	22	15	19											
	2,433.1														<b>RESIDUAL SAND (A-2-4)</b> Dark Brown, Saturated, Dense, Silty Coarse SAND (A-1-b)	11.0
2430	2,430.6	13.5	13	87/0.4												
	2,425.6	18.5													<b>WEATHERED ROCK</b> Red-Brown-Black (Biotite Gneiss)	18.5
															Boring Terminated with Standard Penetration Test Refusal at Elevation 2,425.6 ft On Crystalline Rock (BIOTITE GNEISS)	
															1) Surficial Organic Laden Soil (0.1')	

NCDOT BORE SINGLE JACKSON 065.GPJ NC\_DOT.GDT 11/29/16