

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.61 (02-0061)	1	9

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 17BP.11.R.61 F.A. PROJ. 02-0061
COUNTY ALLEGHANY
PROJECT DESCRIPTION BRIDGE NO. 061 OVER UPPER TRIBUTARY
OF MEADOW FORK CREEK ON SR 1143
SITE DESCRIPTION _____

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PERSONNEL

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DATE MAY 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOST 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														
% PASSING	50 MX	38 MX	50 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN		
LIQUID LIMIT	6 MX	NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		
GROUP INDEX	0	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		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER			HIGHLY ORGANIC SOILS		
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD					FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE			

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.
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31
 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50
 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF 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
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	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
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ _u - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
● - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	v - VERY	

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B-___	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -N <input type="checkbox"/> -H
<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS	HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input checked="" type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST
<input type="checkbox"/>	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
<input type="checkbox"/>	<input type="checkbox"/> TRICONE _____ ' STEEL TEETH	
<input type="checkbox"/>	<input type="checkbox"/> TRICONE _____ ' TUNG.-CARB.	
<input type="checkbox"/>	<input type="checkbox"/> CORE BIT	
<input type="checkbox"/>	<input type="checkbox"/>	

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SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 DISLOADED 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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 GROUVED 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 GROUVED 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 FINGER NAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK: GPS 02, LOCALIZED PROJECT COORDINATES N= 972697.9824, E= 1347915.7720 ELEVATION: 2904.84 FT.</p>	
NOTES:			



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.61		TIP 02-0061		COUNTY ALLEGHANY		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 061 over Upper Tributary of Meadow Fork Creek on SR 1143							GROUND WTR (ft)										
BORING NO. B1		STATION N/A		OFFSET N/A		ALIGNMENT -EL-	0 HR. N/A										
COLLAR ELEV. 2,902.4 ft		TOTAL DEPTH 3.5 ft		NORTHING 972,736		EASTING 1,347,937	24 HR. N/A										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/21/14		COMP. DATE 04/21/14		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)	
2905																	
	2,902.4	0.0													2,902.4	GROUND SURFACE	0.0
	2,901.4	1.0	N/A	1	6												
2900	2,900.4	2.0	N/A	3	0												
	2,899.4	3.0	N/A	8	10												
			N/A	4	50/0.0										2,898.9	3.5	
															Boring Terminated at Elevation 2,898.9 ft Rod bouncing with each blow of the hammer at 3.5 feet.		

NCDOT BORE SINGLE BRDG020061_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.61		TIP 02-0061		COUNTY ALLEGHANY		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 061 over Upper Tributary of Meadow Fork Creek on SR 1143							GROUND WTR (ft)										
BORING NO. B2		STATION N/A		OFFSET N/A		ALIGNMENT -EL-											
COLLAR ELEV. 2,899.9 ft		TOTAL DEPTH 7.3 ft		NORTHING 972,744		EASTING 1,347,946											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/21/14		COMP. DATE 04/21/14		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)	
2900	2,899.9	0.0	N/A	11	11										2,899.9	GROUND SURFACE	0.0
	2,898.9	1.0	N/A	5	4												
	2,897.9	2.0	N/A	8	7												
	2,896.9	3.0	N/A	27	16												
2895	2,895.9	4.0	N/A	26	46												
	2,894.9	5.0	N/A	30	30												
	2,893.9	6.0	N/A	30	30												
	2,892.9	7.0	N/A	50/0.3											2,892.6		7.3
Boring Terminated at Elevation 2,892.6 ft																	
Rod bouncing with each blow of the hammer at 7.3 feet.																	

NCDOT BORE SINGLE BRDG020061_GEO_INV.GPJ NC_DOT_GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.61		TIP 02-0061		COUNTY ALLEGHANY		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 061 over Upper Tributary of Meadow Fork Creek on SR 1143							GROUND WTR (ft)										
BORING NO. B4		STATION N/A		OFFSET N/A		ALIGNMENT -EL-											
COLLAR ELEV. 2,901.1 ft		TOTAL DEPTH 4.0 ft		NORTHING 972,732		EASTING 1,347,976											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/21/14		COMP. DATE 04/21/14		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)	
2905																	
2900	2,900.1	1.0													2,901.1	GROUND SURFACE	0.0
	2,899.1	2.0	N/A	WOH	WOH												
	2,898.1	3.0	N/A	WOH	7												
	2,897.1	4.0	N/A	8	19										2,897.1		4.0
			N/A	50/0.0												Boring Terminated at Elevation 2,897.1 ft	
																Rod bouncing with each blow of the hammer at 4.0 feet.	

NCDOT BORE SINGLE BRDG020061_GEO_INV.GPJ NC_DOT.GDT 4/29/14

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.68 (04-0017)	1	9

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.11.R.68 F.A. PROJ. 04-0017
 COUNTY ASHE
 PROJECT DESCRIPTION BRIDGE NO. 017 OVER MILL CREEK ON
SR 1109

 SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
3	SITE PLAN
4-9	BORE LOG REPORTS

PERSONNEL
R. RIVENBARK

S. BUCHANAN

INVESTIGATED BY SCHNABEL ENG.

CHECKED BY R. RIVENBARK

SUBMITTED BY SCHNABEL ENG.

DATE MAY 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 POORLY GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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.

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														
% PASSING	50 MX	38 MX	50 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN		
LIQUID LIMIT	6 MX	NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		
GROUP INDEX	0	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		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER			HIGHLY ORGANIC SOILS		
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD					FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE			

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31
 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50
 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF 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
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	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					

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ _u - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
● - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	v - VERY	

SOIL MOISTURE - CORRELATION OF TERMS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B- _____	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE: <input type="checkbox"/> -B _____ <input type="checkbox"/> -N _____ <input type="checkbox"/> -H _____
<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS	HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input checked="" type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST
	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
	<input type="checkbox"/> TRICONE _____ ' STEEL TEETH	
	<input type="checkbox"/> TRICONE _____ ' TUNG-CARB.	
	<input type="checkbox"/> CORE BIT	

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 DISLOADED 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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 GROVED 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 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		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK; GPS 02, LOCALIZED PROJECT COORDINATES N 940126,5548, E 1244260,8448 ELEVATION: 3042.48 FT.</p>	
NOTES:			

PROJECT REFERENCE NO.	SHEET
17BP.11.R.68 (04-0017)	3 OF 9
SITE PLAN	



RANDY G. HARRIS AND WIFE,
PHYLLIS W. HARRIS

BM #1
N 940331, E 1244244
EL = 3051.30'
RR SPIKE IN 36" OAK

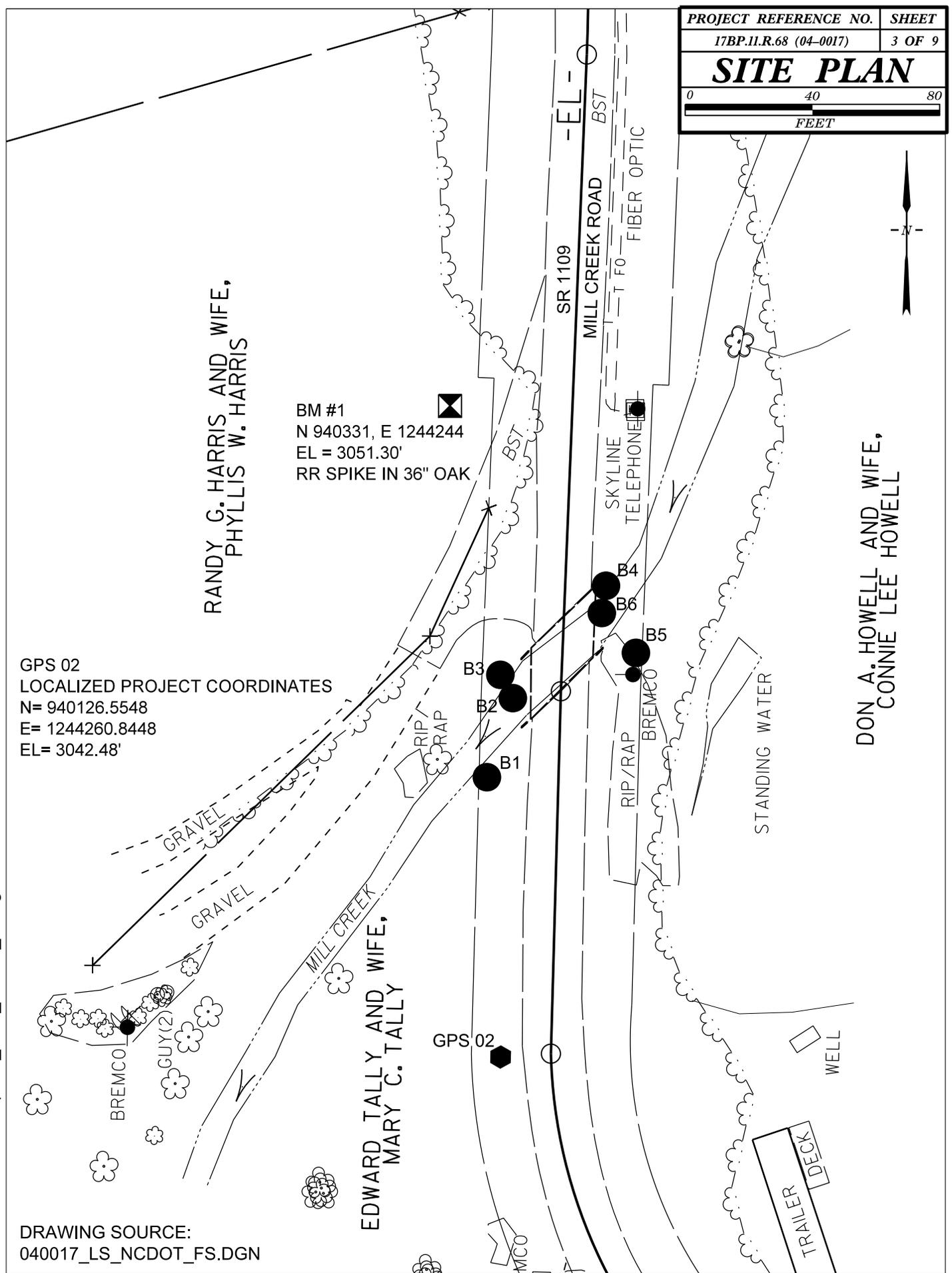
GPS 02
LOCALIZED PROJECT COORDINATES
N= 940126.5548
E= 1244260.8448
EL= 3042.48'

DON A. HOWELL AND WIFE,
CONNIE LEE HOWELL

EDWARD TALLY AND WIFE,
MARY C. TALLY

DRAWING SOURCE:
040017_LS_NCDOT_FS.DGN

C:\Users\skitts\Desktop\INC_DOT_8.5x11_TS.dgn





NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.68			TIP 04-0017			COUNTY ASHE			GEOLOGIST S. Buchanan								
SITE DESCRIPTION Bridge No. 017 over Mill Creek on SR 1109										GROUND WTR (ft)							
BORING NO. B2			STATION N/A			OFFSET N/A			ALIGNMENT -EL-								
COLLAR ELEV. 3,039.8 ft			TOTAL DEPTH 7.0 ft			NORTHING 940,239			EASTING 1,244,265								
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Rod Sounding			HAMMER TYPE N/A								
DRILLER N/A			START DATE 04/22/14			COMP. DATE 04/22/14			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)	
3040	3,039.8	0.0	N/A	5	14										3,039.8	GROUND SURFACE	0.0
	3,038.8	1.0	N/A	3	2												
	3,037.8	2.0	N/A	3	2												
	3,036.8	3.0	N/A	3	7												
3035	3,035.8	4.0	N/A	9	10												
	3,034.8	5.0	N/A	8	9												
	3,033.8	6.0	N/A	8	33												
			N/A	22	78										3,032.8	7.0	
<p>Boring Terminated at Elevation 3,032.8 ft</p> <p>Rod bouncing with each blow of the hammer at 7.0 feet.</p>																	

NCDOT BORE SINGLE BRDG040017_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.68		TIP 04-0017		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 017 over Mill Creek on SR 1109							GROUND WTR (ft)										
BORING NO. B4		STATION N/A		OFFSET N/A		ALIGNMENT -EL-											
COLLAR ELEV. 3,042.3 ft		TOTAL DEPTH 8.9 ft		NORTHING 940,275		EASTING 1,244,294											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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							
3045																	
	3,042.3	0.0													3,042.3	GROUND SURFACE	0.0
3040	3,041.3	1.0	N/A	WOH	WOH												
	3,040.3	2.0	N/A	2	3												
	3,039.3	3.0	N/A	2	3												
	3,038.3	4.0	N/A	1	1												
	3,037.3	5.0	N/A	1	14												
3035	3,036.3	6.0	N/A	10	14												
	3,035.3	7.0	N/A	15	11												
	3,034.3	8.0	N/A	14	40												
				N/A	50	50/0.4											
															3,033.4	Boring Terminated at Elevation 3,033.4 ft Rod bouncing with each blow of the hammer at 8.9 feet.	8.9

NCDOT BORE SINGLE BRDG040017_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.68		TIP 04-0017		COUNTY ASHE		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 017 over Mill Creek on SR 1109							GROUND WTR (ft)									
BORING NO. B5		STATION N/A		OFFSET N/A		ALIGNMENT -EL-										
COLLAR ELEV. 3,044.4 ft		TOTAL DEPTH 3.6 ft		NORTHING 940,254		EASTING 1,244,303										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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)
3045	3,044.4	0.0	N/A	WOH	WOH										3,044.4	0.0
	3,043.4	1.0	N/A	1	1											
	3,042.4	2.0	N/A	2	3											
	3,041.4	3.0	N/A	16	12/01										3,040.8	3.6
															Boring Terminated at Elevation 3,040.8 ft Rod bouncing with each blow of the hammer at 3.6 feet. Termination of rod sounding is likely on boulders.	

NCDOT BORE SINGLE BRDG040017_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.68		TIP 04-0017		COUNTY ASHE		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 017 over Mill Creek on SR 1109							GROUND WTR (ft)									
BORING NO. B6		STATION N/A		OFFSET N/A		ALIGNMENT -EL-										
COLLAR ELEV. 3,039.4 ft		TOTAL DEPTH 4.1 ft		NORTHING 940,266		EASTING 1,244,293										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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)
3040																
	3,039.4	0.0													3,039.4	0.0
	3,038.4	1.0	N/A	5	4											
	3,037.4	2.0	N/A	3	3											
	3,036.4	3.0	N/A	2	2											
	3,035.4	4.0	N/A	16	70											
			N/A	50/0.1											3,035.3	4.1
Boring Terminated at Elevation 3,035.3 ft																
Rod bouncing with each blow of the hammer at 4.1 feet.																

NCDOT BORE SINGLE BRDG040017_GEO_INV.GPJ NC_DOT.GDT 4/29/14

GEOTECHNICAL ENGINEERING REPORT

For Replacement of Bridge 040116

State Project Reference No.: 17BP.11.R.85

County: Ashe

*Description: Bridge No.040116 over Mill Creek on Zion Methodist
Church Road (SR 1110)*

Schnabel Project Number 14824004.00

August 5, 2014



SCHNABEL ENGINEERING SOUTH, P.C.



SCHNABEL ENGINEERING SOUTH, P.C.

August 5, 2014

Mr. Leonard Fletcher, PE
TGS Engineers, Inc.
804-C North Lafayette Street
Shelby, North Carolina 28150

State Project Number: 17BP.11.R.85
I.D. No: SF-040116
County: Ashe
Description: Bridge No. 040116 over Mill Creek on Zion Methodist Church Road (SR 1110)

Subject: Subsurface Investigation and Foundation Design for Replacement of Bridge No. 040116, Schnabel Engineering Project No. 14824004.00

Dear Mr. Fletcher:

SCHNABEL ENGINEERING SOUTH, PC (Schnabel) is pleased to submit our geotechnical engineering report for this project. This document includes geotechnical recommendations with relevant data collected for this study. This study was performed in accordance with our agreement dated February 26, 2014. Our services include development of foundation recommendations based on the results of subsurface exploration and field reconnaissance.

PROJECT DESCRIPTION

We understand that the existing bridge will be replaced by a 60-foot long, 20 feet and 4 inches span and 4 feet and 6 inches rise, aluminum bottomless culvert. The top of the culvert footing elevation at the centerline is 3058.4 feet. Skew of the proposed culvert to the roadway is 40 degrees.

SUBSURFACE INVESTIGATION

We performed four Standard Penetration Test (SPT) borings near the end bents of the existing bridge and rod soundings in the creek bed near the edges of the existing bridge on May 20 and 21, 2014. The logs and their location plan are included in the inventory report, which is included in Appendix A.

SUBSURFACE CONDITIONS

Subsurface conditions at the end bents consisted of roadway embankment at the top followed by the alluvial and/or residual soils before transitioning to weathered rock and rock. Roadway embankment soils consisted of silty sand. Alluvial soils consisted of clayey sand. Residual soils were silty sand. The weathered rock and rock at the project site were Gneiss. Weathered rock and rock elevations at the southern side varied between El. 3059 and 3057 ft, and 3056 and 3057 ft, respectively. Weathered rock

schnabel-eng.com

T/ 919-439-6910 F/ 919-439-7158
126 Quade Drive / Cary, NC / 27513

and rock elevations at the northern side varied between El. 3058 and 3060 ft, and 3056 and 3058 ft, respectively.

Soundings in the creek bed encountered refusal near El. 3057 ft. which potentially could indicate the presence of weathered rock or rock. Based on our visual observations, bed rock appears to be present throughout the creek bed in the vicinity of the existing bridge.

GEOTECHNICAL RECOMMENDATIONS

We based our geotechnical engineering analysis on the information developed from the subsurface exploration, design directives provided by NCDOT, and the survey report provided by TGS Engineers.

Culvert Foundation

The NCDOT Standard Specifications for Roads and Structures (Standards) requires that the spread footings of the bottomless culverts should be keyed-in at least 12-inches in non-scourable material such as weathered rock or rock. Based on this requirement and on the obtained subsurface information, the recommended minimum bearing elevation at the southern and northern sides will be 3056.0 ft and 3056.5 ft., respectively. In addition, since all or a majority of the footings will likely be located directly on top of a thin layer of weathered rock before it transitions to rock, the recommended factored bearing resistance for the strength limit state is 5.0 ksf. Since the culvert footings are directly bearing in weathered rock or rock, the settlement of the footings due to service loads will likely be acceptably small. Foundation recommendations, plan notes and comments are presented in Sheet 1.

Lateral Earth Pressures, Backfill, and Drainage

We have assumed that the proposed exterior culvert walls will be designed as non-yielding walls. Therefore, the wall design should consider the at-rest condition. We expect that most of the available on-site soils will be wet; therefore, we recommend that the culvert excavation be backfilled with Class II Select Material, as described in Standards Section 1016. Soil parameters for the backfill and subgrade are shown in the table below and may be used in the design of the culvert.

Soil Description	Use	Phi (deg)	Cohesion (psf)	Soil Unit Weight (pcf)			At-Rest Earth Pressure Coefficient
				Moist	Saturated	Submerged	
Class II Select Material	Wall Backfill	30	0	115	125	63	0.5
Class IV Select Material	Subgrade Conditioning	34	0	110	120	60	N/A

Where applicable, the design should consider surcharge loads using a rectangular earth pressure distribution. The surcharge pressure ordinate should be obtained by multiplying the surface surcharge pressure, q, by 0.5. These design parameters do not consider hydrostatic pressure. If adequate drainage is not provided, hydrostatic pressures must be included.

The contractor should place backfill material in accordance with Standards Sections 235-4 and 414-7. Only light hand-operated equipment should be used to compact backfill within 5 feet of the walls unless specified otherwise. The Structural Engineer of Record should approve the size of the compaction equipment.

The design should provide subdrainage (weep holes) through the exterior culvert walls. The weep holes should be constructed and installed in accordance with Standards Section 410-9 which requires a filter consisting of coarse and fine aggregate be placed around each weep hole to limit soil intrusion into the culvert. Where the culvert walls cannot be drained, the wall must be designed to resist the hydrostatic pressure. The hydrostatic pressure should be added to the equivalent fluid pressure and surcharge pressure provided above.

CONSTRUCTION RECOMMENDATIONS

Earthwork

All earthwork should be in accordance with the current NCDOT Standard Specifications unless otherwise specified.

The test boring data from the existing roadway shoulders indicates the presence of 2 to 5 inches of topsoil. The depth of stripping necessary to provide a suitable base for placement and compaction of earthwork or for pavement subgrade preparation may include topsoil and other softer surficial layers with or without organic matter.

Based on the preliminary project plans, most of the existing roadway fill embankment will remain in place and will be unavailable for reuse. While we did not investigate for potential borrow, we expect the on-site soils in the vicinity of the creek are wet and will be difficult to compact. Drying and reworking of the soils may be difficult except during warm, dry periods.

Foundation Construction

The contractor should exercise care during excavation for culvert foundations so that as little disturbance as possible occurs at the foundation level. Dewatering will likely be necessary. The contractor should carefully clean and prepare a level foundation bearing surface before placing concrete. In addition, the pointed and uneven bearing surfaces for foundations should be eliminated to avoid concentrated loads on the foundations.

Dewatering

The foundation will likely extend well below groundwater or creek level. Dewatering and/or diversion will likely be required to install the foundation. Proper dewatering is essential to prevent deterioration of the subgrades and to maintain a dry subgrade.

LIMITATIONS

We based the analyses and recommendations submitted in this report on the subsurface exploration performed by NCDOT. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

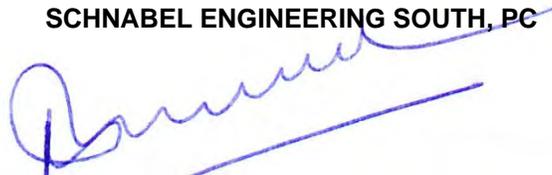
We prepared this report to aid in the evaluation of this site and to assist in the design of the project. We intend it for use concerning this specific project. We based our recommendations on information from the site and proposed construction as described in this report. Substantial changes in loads, locations, or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or any other instrument of service.

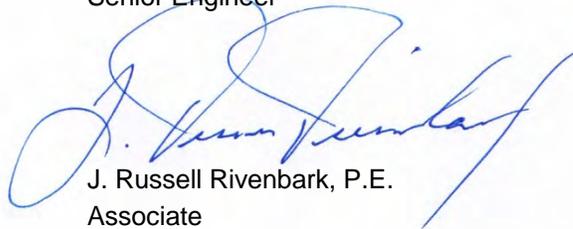
We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

SCHNABEL ENGINEERING SOUTH, PC



Mahalingam Bahiradhan (Bahi), P.E.
Senior Engineer



J. Russell Rivenbark, P.E.
Associate

Attachments: Foundation Recommendations, Foundation Notes and Comments
Appendix A: Inventory Report

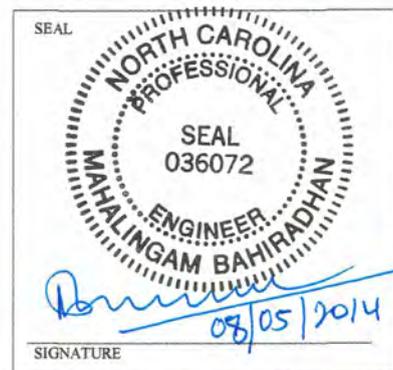
MB:JRR

FOUNDATION RECOMMENDATIONS

WBS # 17BP.11.R.85
 T.I.P. NO. SF-040116
 COUNTY Ashe
 STATION -L-13+12

DESCRIPTION Bridge No. 040116 over Mill Creek
on Zion Methodist Church Road (SR 1110)

	INITIALS	DATE
DESIGN	MB	08/04/14
CHECK	RR	08/05/14
P.M.		



	STATION	FOUNDATION TYPE	EXCAVATION DEPTH	MISCELLANEOUS DETAILS
Alluminum Bottomless Culvert 20-foot and 4 inches span, 4-foot and 6 inches rise	-L- 13+12	Spread Footing	Key-in at least 12-inches into weathered rock/rock	Culvert Length= 60± ft Culvert Skew = 40 Degrees Factored Bearing Resistance = 2.5 TSF Minimum Bearing Elevation At Southern Side = 3056.0 ft Minimum Bearing Elevation At Northern Side = 3056.5 ft

FOUNDATION RECOMMENDATIONS NOTES ON PLANS

1. THE SPREAD FOOTINGS AT BOTH SIDES ARE DESIGNED FOR A FACTORED RESISTANCE OF 2.5 TSF. CHECK FIELD CONDITIONS FOR THE REQUIRED RESISTANCE OF 5.6 TSF JUST BEFORE PLACING CONCRETE.
2. BACKFILL WITH SELECT MATERIAL, CLASS II OR BETTER MEETING THE REQUIREMENTS OF SECTION 1016 OF THE STANDARD SPECIFICATIONS.
3. (KEY or CARRY IN) SPREAD FOOTINGS AT BOTH SIDES AT LEAST 12" INTO ROCK OR WEATHERED ROCK WITH MINIMUM THICKNESS AS SHOWN ON THE PLANS.
4. TO PROVIDE PROTECTION FROM POSSIBLE SCOUR, DO NOT CONSTRUCT SPREAD FOOTINGS ON EITHER SIDES AT AN ELEVATION HIGHER THAN SHOWN ON THE PLANS.

FOUNDATION RECOMMENDATIONS COMMENTS

1. DEWATERING AND/OR DIVERSION MAY BE REQUIRED DURING CONSTRUCTION.
2. FOUNDATION BEARING SURFACE SHOULD BE LEVEL, CLEAN AND FREE FROM UNEVEN SURFACES TO AVOID CONCENETERATED LOAD ON FOOTINGS.

APPENDIX A

INVENTORY REPORT

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.85 (04-0116)	1	17

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 17BP.11.R.85 F.A. PROJ. 04-0116
COUNTY ASHE
PROJECT DESCRIPTION BRIDGE NO. 116 OVER MILL CREEK
ON SR 1110

SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
3	SITE PLAN
4-5	BORE LOG & CORE REPORTS
6	CORE PHOTOGRAPHS
7-10	BORE LOG & CORE REPORTS
11	CORE PHOTOGRAPHS
12-16	BORE LOG REPORTS
17	SITE PHOTOGRAPHS

PERSONNEL
R. RIVENBARK

M. BAHIRADHAN

S. BUCHANAN

RED DOG DRLLG.

INVESTIGATED BY RED DOG DRLLG.

CHECKED BY M. BAHIRADHAN

SUBMITTED BY SCHNABEL ENG.

DATE JUNE 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

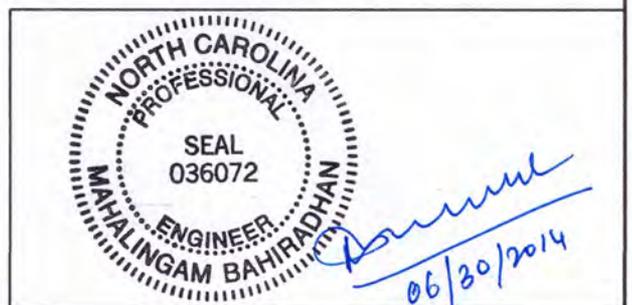
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION	GRADATION
SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. 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. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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.

SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION							
GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)				SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS				MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.				
GROUP CLASS.	A-1	A-3	A-2		A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5			COMPRESSIBILITY				
SYMBOL													SLIGHTLY COMPRESSIBLE MODERATELY COMPRESSIBLE HIGHLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31 LIQUID LIMIT EQUAL TO 31-50 LIQUID LIMIT GREATER THAN 50			
% PASSING	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX 35 MX	35 MX 35 MX	35 MX 35 MX	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT				
LIQUID LIMIT	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	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS				
GROUP INDEX	0	0	0	0	4 MX	0	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 A SUBGRADE	EXCELLENT TO GOOD				FAIR TO POOR				FAIR TO POOR	POOR	UNSATURABLE						
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30													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			
														PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA			
														SPRING OR SEEP			

CONSISTENCY OR DENSENESS				MISCELLANEOUS SYMBOLS					
PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)		ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		TEST BORING		TEST BORING W/ CORE
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A		SOIL SYMBOL		AUGER BORING		SPT N-VALUE
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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4		ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
					INFERRED SOIL BOUNDARY		MONITORING WELL		
					INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
					ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
					DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
							SOUNDING ROD		

TEXTURE OR GRAIN SIZE							ABBREVIATIONS		
U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270	AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
	4.76	2.00	0.42	0.25	0.075	0.053	BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)	CL - CLAY	MOD. - MODERATELY	γ - UNIT WEIGHT
GRAIN SIZE	MM IN.	305 12	75 3	2.0	0.25	0.05 0.005	CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ _d - DRY UNIT WEIGHT
							CSE. - COARSE	ORG. - ORGANIC	
							DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
							DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
							e - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
							F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
							FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
							FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
							FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
							HI. - HIGHLY	V - VERY	

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

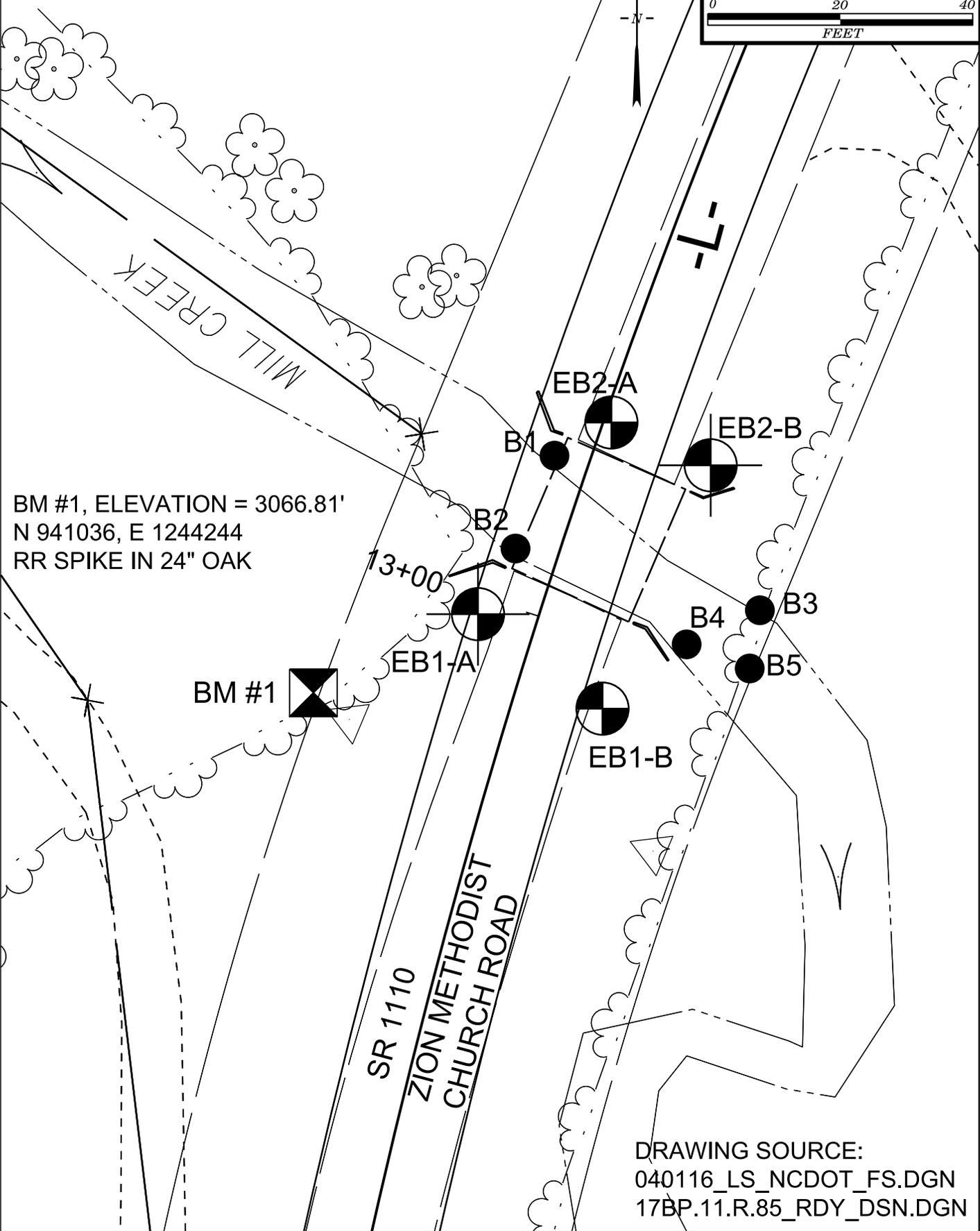
PLASTICITY		
NONPLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
LOW PLASTICITY	0-5	VERY LOW
MED. PLASTICITY	6-15	SLIGHT
HIGH PLASTICITY	16-25	MEDIUM
	26 OR MORE	HIGH
COLOR		
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.		
EQUIPMENT USED ON SUBJECT PROJECT	DRILL UNITS:	ADVANCING TOOLS:
	<input type="checkbox"/> MOBILE B-____	<input type="checkbox"/> CLAY BITS
	<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER
	<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS
	<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS
	<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS
	<input checked="" type="checkbox"/> CME 45	<input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER
		<input type="checkbox"/> TRICONE _____ ' STEEL TEETH
		<input checked="" type="checkbox"/> TRICONE 3 _____ ' TUNG.-CARB.
		<input checked="" type="checkbox"/> CORE BIT
		<input checked="" type="checkbox"/> HOLLOW STEM AUGERS
		HAMMER TYPE:
		<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
		CORE SIZE:
		<input type="checkbox"/> -B _____
		<input checked="" type="checkbox"/> -N 02
		<input type="checkbox"/> -H _____
		HAND TOOLS:
		<input type="checkbox"/> POST HOLE DIGGER
		<input type="checkbox"/> HAND AUGER
		<input checked="" type="checkbox"/> SOUNDING ROD
		<input type="checkbox"/> VANE SHEAR TEST

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 (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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 FINGER NAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
<p>BENCH MARK: BM #1, N 941036, E 1244244, RR SPIKE IN 24" OAK</p> <p align="right">ELEVATION: 3066.81 FT.</p> <p>NOTES: FIAD = FILLED IMMEDIATELY AFTER DRILLING</p>			

PROJECT REFERENCE NO.	SHEET
17BP.11.R.85 (04-0116)	3 OF 17
SITE PLAN	

APPROXIMATE SKEW OF BRIDGE
ON CURVE AT STA. 13+00: 17.7° NE



BM #1, ELEVATION = 3066.81'
N 941036, E 1244244
RR SPIKE IN 24" OAK

SR 1110
ZION METHODIST
CHURCH ROAD

DRAWING SOURCE:
040116_LS_NCDOT_FS.DGN
17BP.11.R.85_RDY_DSN.DGN

C:\Users\skitts\Desktop\INC_DOT_8.5x11_TS.dgn



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.85	TIP 04-0116	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+98	OFFSET 9 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,063.4 ft	TOTAL DEPTH 15.3 ft	NORTHING 941,049	EASTING 1,244,270
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/20/14	COMP. DATE 05/20/14	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						
3065																
	3,063.4	0.0													GROUND SURFACE	0.0
	3,061.9	1.5	3	3	3									TOPSOIL		
3060	3,060.4	3.0	7	4	6									ROADWAY EMBANKMENT	3.0	
	3,058.9	4.5	WOH	WOH	1									BROWN, SILTY FINE TO COARSE GRAINED SAND, WITH SOME FINE TO COARSE GRAINED GRAVEL	4.5	
	3,057.3	6.1	100/0.3							100/0.3				ALLUVIAL	6.1	
			60/0.0							60/0.0				GRAYISH BROWN, CLAYEY FINE GRAINED SAND, WITH TRACE ROOTS AND FINE GRAINED GRAVEL		
3055														WEATHERED ROCK (GNEISS)		
3050														CRYSTALLINE ROCK (GNEISS)		
														REC = 88%, RQD = 5%	15.3	
														Boring Terminated at Elevation 3,048.1 ft in Crystalline Rock (Gneiss)		

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan					
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)				
BORING NO. EB1-A		STATION 12+98		OFFSET 9 ft LT		ALIGNMENT -L-					
COLLAR ELEV. 3,063.4 ft		TOTAL DEPTH 15.3 ft		NORTHING 941,049		EASTING 1,244,270					
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic					
DRILLER M. Seiler		START DATE 05/20/14		COMP. DATE 05/20/14		SURFACE WATER DEPTH N/A					
CORE SIZE NQ2		TOTAL RUN 9.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
3057.34										Begin Coring @ 6.1 ft	
3055	3,057.1	6.3	5.0	0:52/0.8 1:18/1.0 1:19/1.0 1:17/1.0 1:15/1.0	(4.8) 96%	(0.0) 0%	(8.1) 88%	(0.5) 5%		3,057.3	6.1
	3,052.1	11.3		0:22/0.2 1:08/0.8 1:24/1.0 1:42/1.0 2:05/1.0 0:16/0.2	(3.3) 83%	(0.5) 13%					
3050	3,048.1	15.3	4.0							3,048.1	15.3
Boring Terminated at Elevation 3,048.1 ft in Crystalline Rock (Gneiss)											

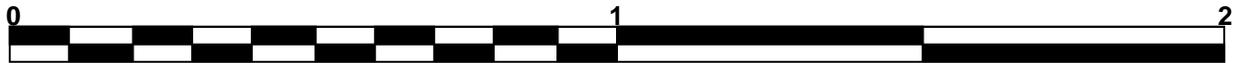
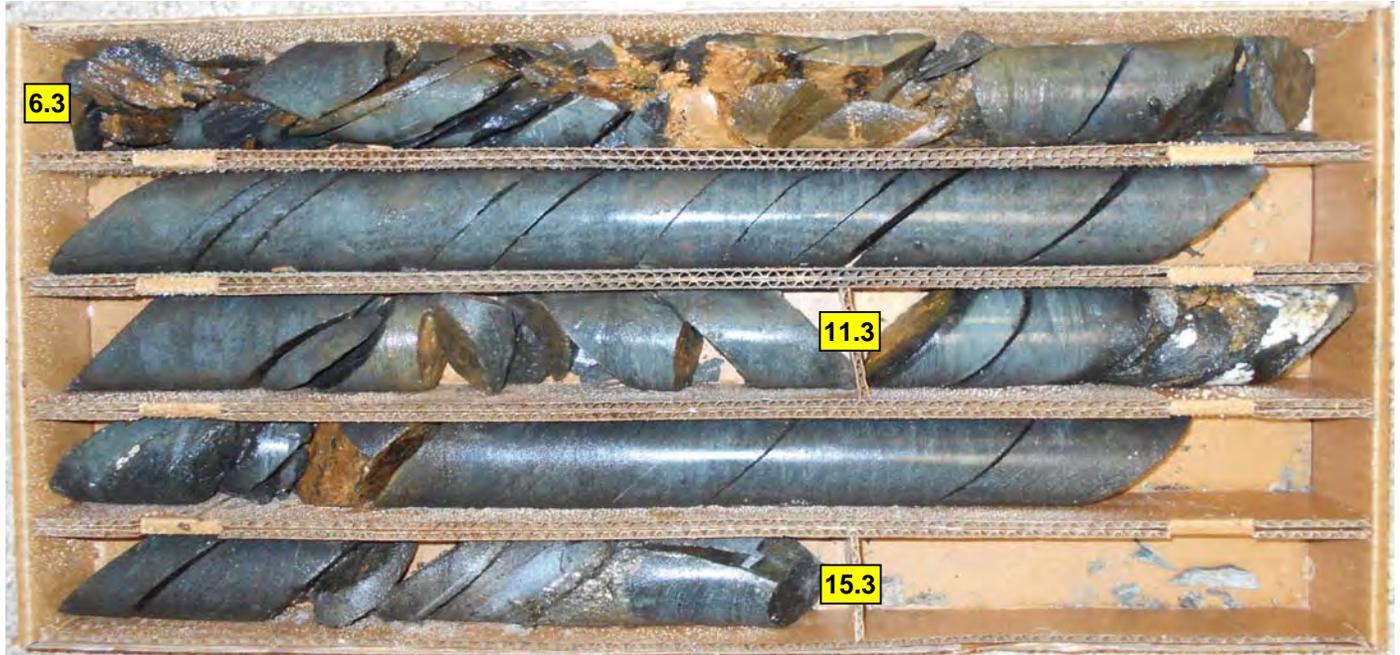
NCDOT CORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

CORE PHOTOGRAPHS

BRIDGE NO. 116 OVER MILL CREEK ON SR 1110

EB1-A

BOX 1: 6.3 - 15.3 FEET



APPROXIMATE SCALE IN FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.85	TIP 04-0116	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110			GROUND WTR (ft)
BORING NO. EB2-A	STATION 13+31	OFFSET 1 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,064.6 ft	TOTAL DEPTH 8.3 ft	NORTHING 941,078	EASTING 1,244,290
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/21/14	COMP. DATE 05/21/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					ELEV. (ft)
3065														GROUND SURFACE	0.0
	3,063.6	1.0												ARTIFICIAL FILL ASPHALT	0.4
	3,062.1	2.5	5	3	3									ROADWAY EMBANKMENT	
3060	3,060.6	4.0	3	3	1									ORANGISH BROWN AND GRAY, SILTY FINE TO COARSE GRAINED SAND, WITH LITTLE ROCK FRAGMENTS	5.0
	3,059.1	5.5	1	1	1										6.0
	3,057.6	7.0	3	4	11									ALLUVIAL	7.0
	3,056.3	8.3												GRAY AND BROWN, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH TRACE WOOD FRAGMENTS	8.3
			100/0.5											RESIDUAL	
			60/0.0											BLACKISH GRAY AND BROWN, SILTY FINE TO COARSE GRAINED SAND, WITH TRACE ROCK FRAGMENTS	
														WEATHERED ROCK (GNEISS)	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 3,056.3 ft on Crystalline Rock (Gneiss)	

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.85	TIP 04-0116	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+30	OFFSET 17 ft RT	ALIGNMENT -L-
COLLAR ELEV. 3,064.7 ft	TOTAL DEPTH 15.2 ft	NORTHING 941,071	EASTING 1,244,305
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/21/14	COMP. DATE 05/21/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
3065	3,064.7	0.0	2	1	2									GROUND SURFACE	0.0
	3,063.2	1.5	1	1	1									TOPSOIL	0.3
	3,061.7	3.0	2	2	3									ROADWAY EMBANKMENT	
3060	3,060.2	4.5	1	8	92/0.3									ORANGISH BROWN AND GRAY, SILTY FINE TO COARSE GRAINED SAND, WITH TRACE ROOTS AND ROCK FRAGMENTS	4.0
	3,058.4	6.3												ALLUVIAL	5.0
														GRAY, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH TRACE WOOD FRAGMENTS	6.3
3055														WEATHERED ROCK (GNEISS)	
3050														CRYSTALLINE ROCK (GNEISS)	
														REC = 99%, RQD = 25%	15.2
														Boring Terminated at Elevation 3,049.5 ft in Crystalline Rock (Gneiss)	

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

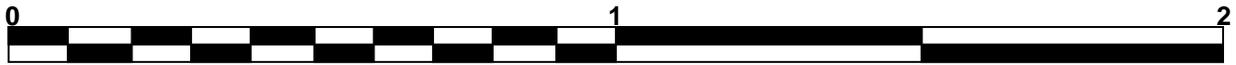
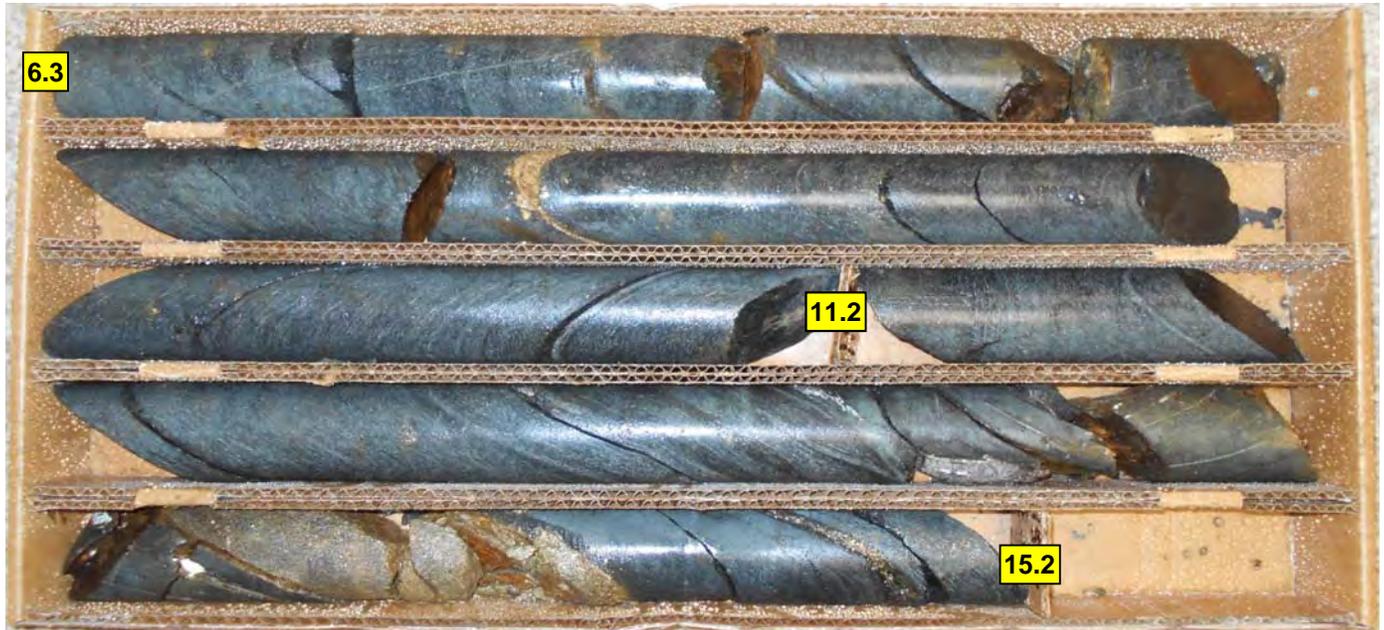
WBS 17BP.11.R.85				TIP 04-0116				COUNTY ASHE				GEOLOGIST S. Buchanan			
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110												GROUND WTR (ft)			
BORING NO. EB2-B				STATION 13+30				OFFSET 17 ft RT				ALIGNMENT -L-			
COLLAR ELEV. 3,064.7 ft				TOTAL DEPTH 15.2 ft				NORTHING 941,071				EASTING 1,244,305			
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic			
DRILLER M. Seiler				START DATE 05/21/14				COMP. DATE 05/21/14				SURFACE WATER DEPTH N/A			
CORE SIZE NQ2				TOTAL RUN 8.9 ft											
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS				
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %		ELEV. (ft)	DEPTH (ft)			
3058.4	3,058.4	6.3	4.9	1:38/1.0 1:50/1.0 1:39/1.0 1:26/1.0 1:47/0.9	(4.9) 100%	(1.2) 24%		(8.8) 99%	(2.2) 25%		3,058.4	6.3			
3055	3,053.5	11.2													
			4.0	1:48/1.0 1:48/1.0 1:33/1.0 1:35/1.0	(3.9) 98%	(1.0) 25%									
3050	3,049.5	15.2										3,049.5	15.2		
												Begin Coring @ 6.3 ft			
												CRYSTALLINE ROCK			
												DARK GREENISH GRAY, FRESH TO VERY SLIGHT WEATHERED, HARD, CLOSE TO VERY CLOSE FRACTURED 30 TO 60 DEGREE FRACTURES WITH IRON-STAIN INFILLING			
												AT 14.0FT TO 14.6FT: MODERATE WEATHERED AND MEDIUM HARD TO SOFT ZONE, WITH A 70 DEGREE FRACTURE WITH IRON-STAIN INFILLING			
												Boring Terminated at Elevation 3,049.5 ft in Crystalline Rock (Gneiss)			

NCDOT CORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

CORE PHOTOGRAPHS BRIDGE NO. 116 OVER MILL CREEK ON SR 1110

EB2-B

BOX 1: 6.3 - 15.2 FEET



APPROXIMATE SCALE IN FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)									
BORING NO. B1		STATION 13+24		OFFSET 5 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 3,057.9 ft		TOTAL DEPTH 1.0 ft		NORTHING 941,073		EASTING 1,244,281										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 05/21/14		COMP. DATE 05/21/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
3060																
	3,057.9	0.0													GROUND SURFACE	0.0
	3,056.9	1.0	N/A	2	4											1.0
			N/A	60/0.0											Boring Terminated at Elevation 3,056.9 ft	

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)										
BORING NO. B2		STATION 13+09		OFFSET 6 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 3,058.2 ft		TOTAL DEPTH 1.5 ft		NORTHING 941,059		EASTING 1,244,275											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/21/14		COMP. DATE 05/21/14		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)	
3060																	
	3,058.2	0.0													3,058.2	GROUND SURFACE	0.0
	3,057.2	1.0	N/A	4	9										3,056.7		1.5
			N/A	14	60/0.0											Boring Terminated at Elevation 3,056.7 ft	

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)										
BORING NO. B3		STATION 13+11		OFFSET 32 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 3,057.6 ft		TOTAL DEPTH 1.0 ft		NORTHING 941,049		EASTING 1,244,312											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/21/14		COMP. DATE 05/21/14		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)	
3060																	
	3,057.6	0.0													3,057.6	GROUND SURFACE	0.0
	3,056.6	1.0	N/A	1	1	2									3,056.6	Boring Terminated at Elevation 3,056.6 ft	1.0

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)										
BORING NO. B4		STATION 13+03		OFFSET 23 ft RT		ALIGNMENT -L-	0 HR. N/A										
COLLAR ELEV. 3,056.8 ft		TOTAL DEPTH 0.8 ft		NORTHING 941,044		EASTING 1,244,301	24 HR. N/A										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/21/14		COMP. DATE 05/21/14		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)		
3060																	
	3,056.8	0.0													3,056.8	GROUND SURFACE	0.0
			N/A	5	100/0.3					100/0.3					3,056.0	Boring Terminated at Elevation 3,056.0 ft	0.8

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

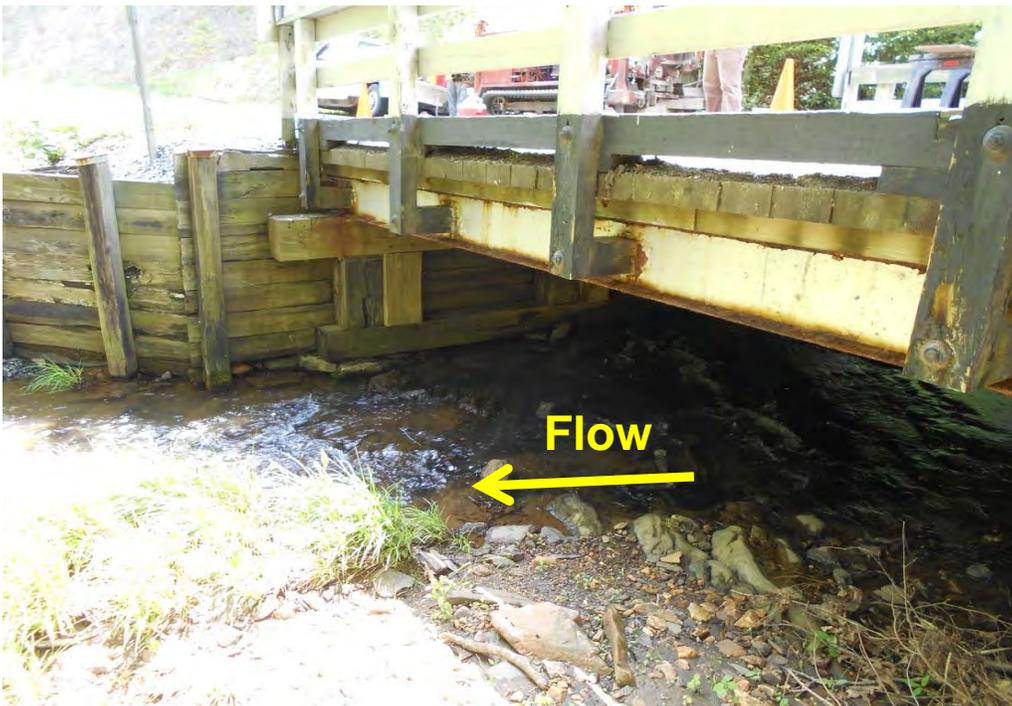
WBS 17BP.11.R.85		TIP 04-0116		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 116 over Mill Creek on SR 1110							GROUND WTR (ft)										
BORING NO. B5		STATION 13+02		OFFSET 33 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 3,057.2 ft		TOTAL DEPTH 1.0 ft		NORTHING 941,040		EASTING 1,244,311											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/21/14		COMP. DATE 05/21/14		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)	
3060																	
	3,057.2	0.0													3,057.2	GROUND SURFACE	0.0
			N/A	1	100										3,056.2		1.0
																Boring Terminated at Elevation 3,056.2 ft	

NCDOT BORE SINGLE 040116 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

SITE PHOTOGRAPHS BRIDGE NO. 116 OVER MILL CREEK ON SR 1110



View of SR 1110 looking South



View of Bridge No. 116 looking Southeast

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.67 (04-0263)	1	9

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.11.R.67 F.A. PROJ. 04-0263
 COUNTY ASHE
 PROJECT DESCRIPTION BRIDGE NO. 263 OVER RICH HILL CREEK
ON SR 1317

 SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
3	SITE PLAN
4-9	BORE LOG REPORTS

PERSONNEL

R. RIVENBARK

S. BUCHANAN

INVESTIGATED BY SCHNABEL ENG.

CHECKED BY R. RIVENBARK

SUBMITTED BY SCHNABEL ENG.

DATE MAY 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. 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															
% PASSING	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX 10 MX	35 MX 10 MX	35 MX 10 MX	35 MX 10 MX	36 MN 10 MX	36 MN 10 MX	36 MN 10 MX	36 MN 10 MX	36 MN 10 MX	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX	NP	40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 10 MX	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC SOILS	
GROUP INDEX	0	0	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 A SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR				FAIR TO POOR	POOR	UNSATURABLE		

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 RESISTANCE (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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	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
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 POORLY GRADED
 GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF 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

PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA

SPRING OR SEEP

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	γ - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ ₆ - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
● - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	v - VERY	

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B-___	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -N <input type="checkbox"/> -H
<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS	HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input checked="" type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST
	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
	<input type="checkbox"/> TRICONE ___ ' STEEL TEETH	
	<input type="checkbox"/> TRICONE ___ ' TUNG.-CARB.	
	<input type="checkbox"/> CORE BIT	
	<input type="checkbox"/> _____	
	<input type="checkbox"/> _____	

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 (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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 FINGER NAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK; GPS OI, LOCALIZED PROJECT COORDINATES N 1000742.4965, E 1230203.1400 ELEVATION: 2974.83 FT.</p>	
		<p>NOTES:</p>	

PROJECT REFERENCE NO.	SHEET
17BP.II.R.67 (04-0263)	3 OF 9
SITE PLAN	
0 40 80	
FEET	



GPS 01
 LOCALIZED PROJECT COORDINATES
 N= 1000742.4965
 E= 1230203.1400
 EL= 2974.83'

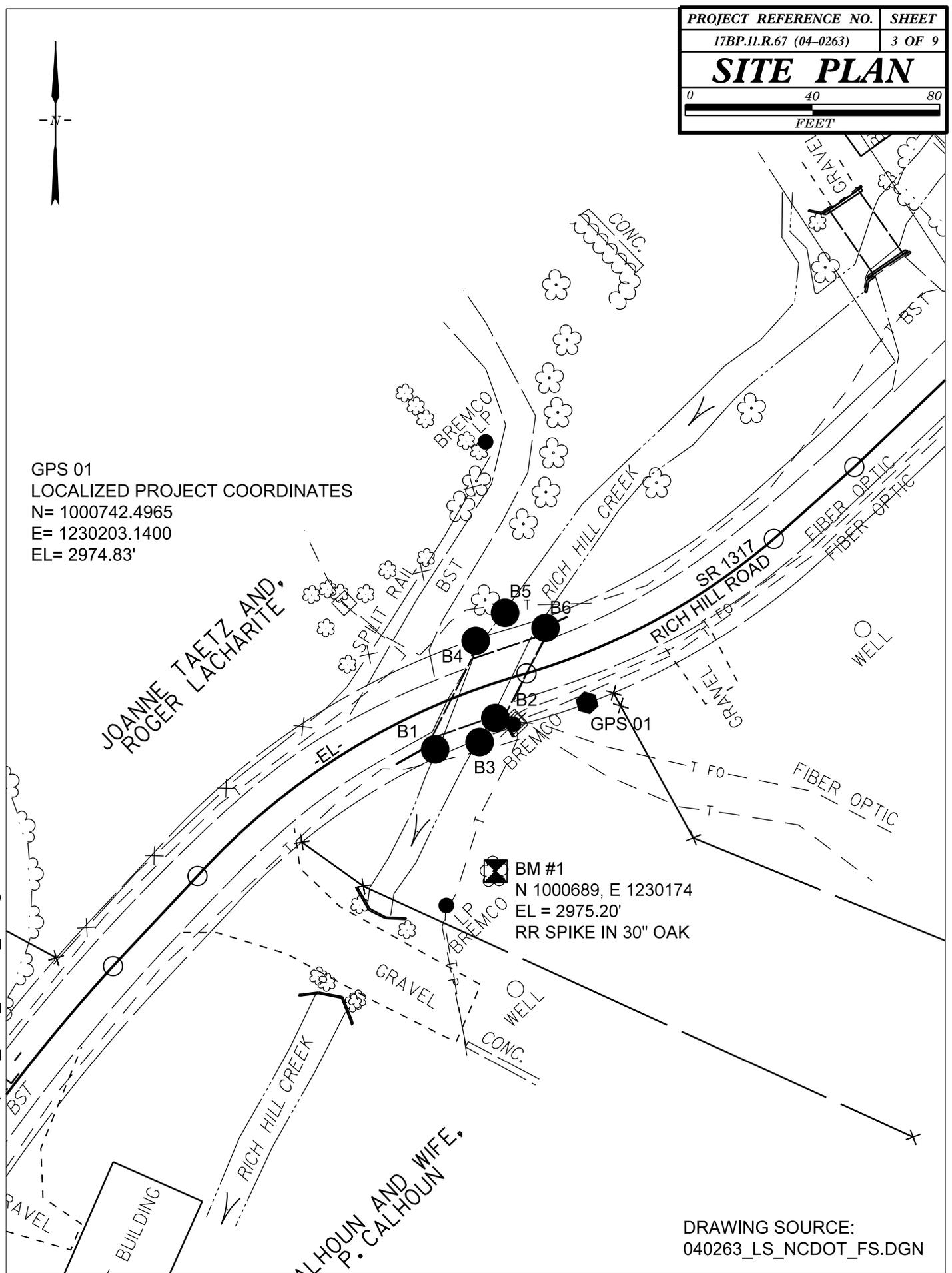
JOANNE TAETZ AND
 ROGER LACHARITE

ALHOUN AND WIFE,
 P. CALHOUN 'E,

BM #1
 N 1000689, E 1230174
 EL = 2975.20'
 RR SPIKE IN 30" OAK

DRAWING SOURCE:
 040263_LS_NCDOT_FS.DGN

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NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.67	TIP 04-0263	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 263 over Rich Hill Creek on SR 1317			GROUND WTR (ft)
BORING NO. B1	STATION N/A	OFFSET N/A	ALIGNMENT -EL-
COLLAR ELEV. 2,969.6 ft	TOTAL DEPTH 8.2 ft	NORTHING 1,000,728	EASTING 1,230,155
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding	HAMMER TYPE N/A
DRILLER N/A	START DATE 04/22/14	COMP. DATE 04/22/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
2970	2,969.6	0.0													2,969.6	0.0
	2,968.6	1.0	N/A	WOH	WOH											
	2,967.6	2.0	N/A	6	8											
	2,966.6	3.0	N/A	4	6											
2965	2,965.6	4.0	N/A	6	6											
	2,964.6	5.0	N/A	7	12											
	2,963.6	6.0	N/A	15	14											
	2,962.6	7.0	N/A	28	40											
	2,961.6	8.0	N/A	35	52											
			N/A	50/0.2											2,961.4	8.2
Boring Terminated at Elevation 2,961.4 ft																
Rod bouncing after each blow of the hammer at 8.2 feet.																

NCDOT BORE SINGLE BRDG040263_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.67		TIP 04-0263		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 263 over Rich Hill Creek on SR 1317							GROUND WTR (ft)										
BORING NO. B5		STATION N/A		OFFSET N/A		ALIGNMENT -EL-											
COLLAR ELEV. 2,968.7 ft		TOTAL DEPTH 3.8 ft		NORTHING 1,000,771		EASTING 1,230,177											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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)	
2970																	
	2,968.7	0.0													2,968.7	GROUND SURFACE	0.0
	2,967.7	1.0	N/A	4	7												
	2,966.7	2.0	N/A	20	47												
2965	2,965.7	3.0	N/A	50	37												
			N/A	50	50/0.3										2,964.9	Boring Terminated at Elevation 2,964.9 ft	3.8
																Rod bouncing after each blow of the hammer at 3.8 feet.	

NCDOT BORE SINGLE BRDG040263_GEO_INV.GPJ NC_DOT.GDT 4/29/14

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.63 (04-0264)	1	18

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.11.R.63 F.A. PROJ. 04-0264
 COUNTY ASHE
 PROJECT DESCRIPTION BRIDGE NO. 264 OVER RICH HILL CREEK
ON SR 1317

 SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
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7	CORE PHOTOGRAPHS
8-9	BORE LOG & CORE REPORTS
10	CORE PHOTOGRAPHS
11-17	BORE LOG REPORTS
18	SITE PHOTOGRAPHS

PERSONNEL

R. RIVENBARK
M. BAHIRADHAN
S. BUCHANAN
RED DOG DRLLG.

INVESTIGATED BY RED DOG DRLLG.
 CHECKED BY M. BAHIRADHAN
 SUBMITTED BY SCHNABEL ENG.
 DATE JUNE 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

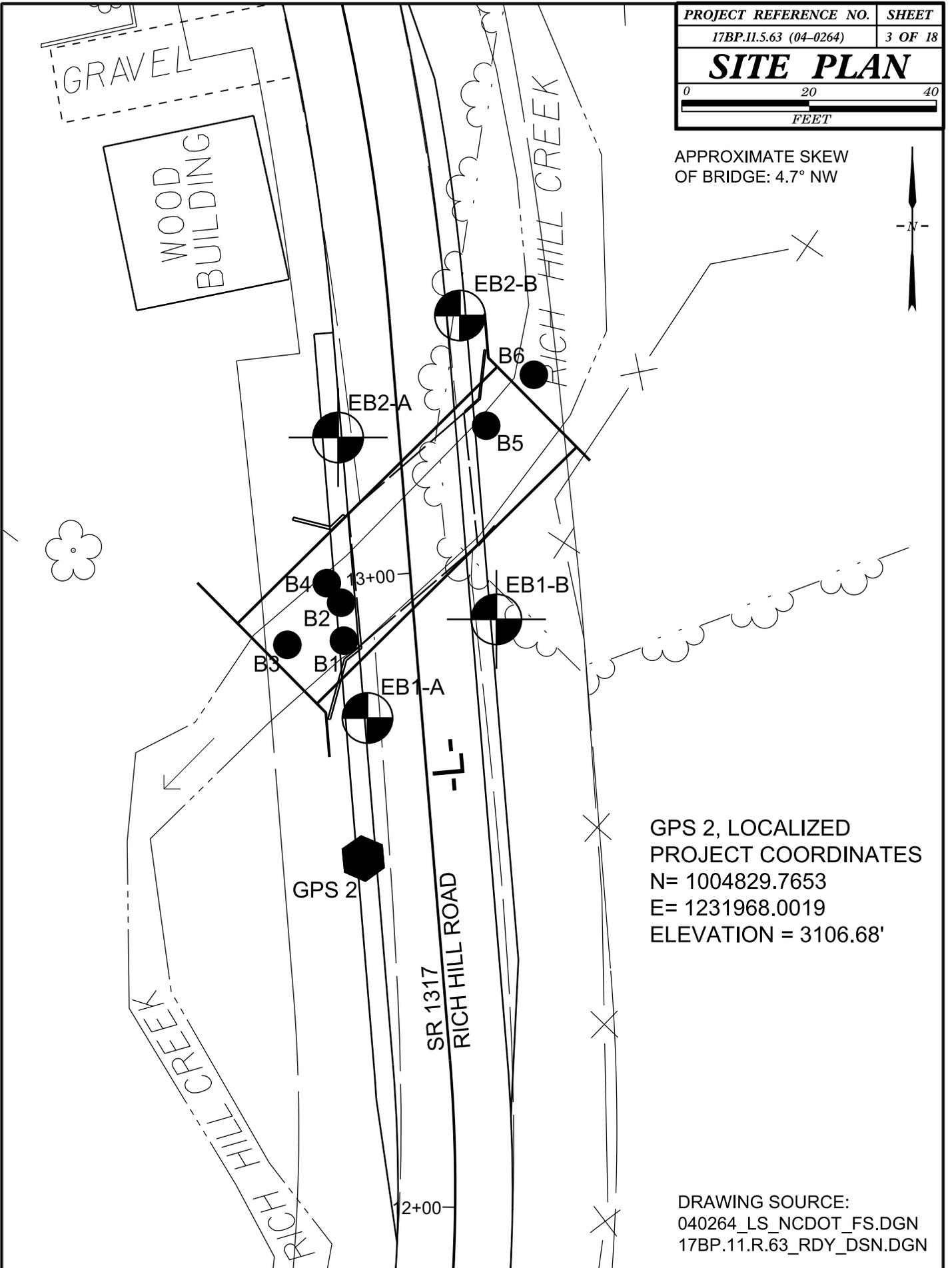
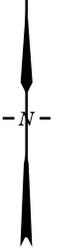
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 (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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 GROUDED 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 GROUDED 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		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK: GPS 2, LOCALIZED PROJECT COORDINATES, N= 1004829.7653, E= 1231968.0019 ELEVATION: 3106.68 FT.</p>	
		<p>NOTES: FIAD = FILLED IMMEDIATELY AFTER DRILLING</p>	

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PROJECT REFERENCE NO.	SHEET
17BP.11.5.63 (04-0264)	3 OF 18
SITE PLAN	
0 20 40 FEET	

APPROXIMATE SKEW
OF BRIDGE: 4.7° NW



GPS 2, LOCALIZED
PROJECT COORDINATES
N= 1004829.7653
E= 1231968.0019
ELEVATION = 3106.68'

DRAWING SOURCE:
040264_LS_NCDOT_FS.DGN
17BP.11.R.63_RDY_DSN.DGN



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63	TIP 04-0264	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+78	OFFSET 9 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,108.2 ft	TOTAL DEPTH 12.4 ft	NORTHING 1,004,852	EASTING 1,231,969
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/19/14	COMP. DATE 05/19/14	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				
3110	3,108.2	0.0											GROUND SURFACE	0.0
3105	3,106.7	1.5	2	3	2							M	TOPSOIL	0.6
	3,105.2	3.0	3	12	5							M	ROADWAY EMBANKMENT	1.0
	3,103.7	4.5	3	4	8							W	BLACK, SILTY FINE TO COARSE GRAINED SAND, WITH SOME FINE TO COARSE GRAINED GRAVEL	3.0
	3,102.2	6.0	2	32	30							M	ROADWAY EMBANKMENT	5.0
3100	3,100.7	7.5	28	11	7							W	BROWN, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH TRACE ROOTS	8.5
	3,099.2	9.0	7	26	74/0.2								ROADWAY EMBANKMENT	
	3,095.8	12.4	100/0.4										LIGHT PINKISH BROWN AND WHITE, SILTY FINE TO COARSE GRAINED SAND, WITH LITTLE ROCK FRAGMENTS	12.4
			60/0.0										ALLUVIAL	
													BROWN, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH TRACE FINE TO COARSE GRAINED QUARTZ ROCK FRAGMENTS	
													RESIDUAL	
													ORANGISH BROWN AND WHITE, SILTY FINE TO COARSE GRAINED SAND, WITH LITTLE ROCK FRAGMENTS	
													WEATHERED ROCK (GNEISS)	
													Boring Terminated with Standard Penetration Test Refusal at Elevation 3,095.8 ft on Crystalline Rock (Gneiss)	

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63	TIP 04-0264	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317			GROUND WTR (ft)
BORING NO. EB1-B	STATION 12+92	OFFSET 13 ft RT	ALIGNMENT -L-
COLLAR ELEV. 3,108.8 ft	TOTAL DEPTH 15.0 ft	NORTHING 1,004,867	EASTING 1,231,989
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD SPT Core Boring	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/19/14	COMP. DATE 05/19/14	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					
3110	3,108.8	0.0												GROUND SURFACE	0.0
	3,107.3	1.5	2	3	5									TOPSOIL	
	3,105.8	3.0	6	4	2									ROADWAY EMBANKMENT	
3105	3,104.3	4.5	3	2	2									BROWN, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH TRACE ROOTS AND FINE TO COARSE GRAINED QUARTZ ROCK FRAGMENTS	5.0
	3,102.8	6.0	2	26	74/0.4										
	3,101.3	7.5	51	49/0.4						100/0.9				WEATHERED ROCK (GNEISS)	7.5
3100	3,099.8	9.0	26	27	23					100/0.9					
	3,098.8	10.0	15	100/0.4						100/0.4				RESIDUAL	9.5
			60/0.0							60/0.0				ORANGISH BROWN AND WHITE, SILTY FINE TO COARSE GRAINED SAND, WITH LITTLE FINE GRAINED QUARTZ ROCK FRAGMENTS	10.0
3095														WEATHERED ROCK (GNEISS)	
														CRYSTALLINE ROCK (GNEISS)	15.0
														REC = 100%, RQD = 100%	
														Boring Terminated at Elevation 3,093.8 ft in Crystalline Rock (Gneiss)	

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

CORE BORING REPORT

WBS 17BP.11.R.63				TIP 04-0264				COUNTY ASHE				GEOLOGIST S. Buchanan			
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317												GROUND WTR (ft)			
BORING NO. EB1-B				STATION 12+92				OFFSET 13 ft RT				ALIGNMENT -L-			
COLLAR ELEV. 3,108.8 ft				TOTAL DEPTH 15.0 ft				NORTHING 1,004,867				EASTING 1,231,989			
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45								DRILL METHOD SPT Core Boring				HAMMER TYPE Automatic			
DRILLER M. Seiler				START DATE 05/19/14				COMP. DATE 05/19/14				SURFACE WATER DEPTH N/A			
CORE SIZE NQ2				TOTAL RUN 5.0 ft											
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)			
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %						
3098.83	3,098.8	10.0	1.7	1:45/1.0	(1.7)	(1.7)		(5.0)	(5.0)		3,098.8	10.0			
	3,097.1	11.7	3.3	1:02/0.7	100%	100%		100%	100%		CRISTALLINE ROCK				
3095				1:22/1.0	(3.3)	(3.3)					GREENISH GRAY, FRESH WEATHERED, VERY HARD, WIDE FRACTURED, GNEISS				
	3,093.8	15.0		1:31/1.0	100%	100%									
				1:32/1.0							3,093.8	15.0			
				0:30/0.3							Boring Terminated at Elevation 3,093.8 ft in Crystalline Rock (Gneiss)				

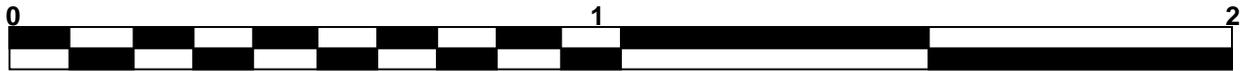
NCDOT CORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

CORE PHOTOGRAPHS

BRIDGE NO. 264 OVER RICH HILL CREEK ON SR 1317

EB1-B

BOX 1: 10.0 - 15.0 FEET



APPROXIMATE SCALE IN FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

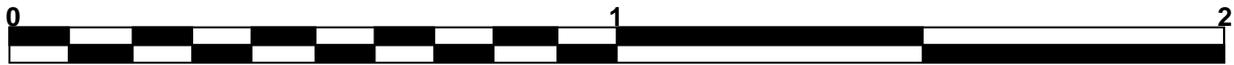
WBS 17BP.11.R.63		TIP 04-0264		COUNTY ASHE		GEOLOGIST S. Buchanan					
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317							GROUND WTR (ft)				
BORING NO. EB2-A		STATION 13+22		OFFSET 10 ft LT		ALIGNMENT -L-					
COLLAR ELEV. 3,109.5 ft		TOTAL DEPTH 15.1 ft		NORTHING 1,004,896		EASTING 1,231,964					
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic					
DRILLER M. Seiler		START DATE 05/20/14		COMP. DATE 05/20/14		SURFACE WATER DEPTH N/A					
CORE SIZE NQ2		TOTAL RUN 6.8 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
3101.29											
3100	3,101.29	8.3	3.8	1:50/1.0 2:10/1.0 1:50/1.0 1:06/0.8	(3.5) 92%	(1.0) 26%	(6.4) 93%	(1.0) 14%		3,101.3	8.2
	3,097.4	12.1	3.0	1:36/1.0 1:40/1.0	(2.9) 97%	(0.0) 0%					
3095	3,094.4	15.1		1:40/1.0						3,094.4	15.1
Boring Terminated at Elevation 3,094.4 ft in Crystalline Rock (Gneiss)											

NCDOT CORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

CORE PHOTOGRAPHS

BRIDGE NO. 264 OVER RICH HILL CREEK ON SR 1317

EB2-A
BOX 1: 8.3 - 15.1 FEET



APPROXIMATE SCALE IN FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63	TIP 04-0264	COUNTY ASHE	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+40	OFFSET 11 ft RT	ALIGNMENT -L-
COLLAR ELEV. 3,109.8 ft	TOTAL DEPTH 6.9 ft	NORTHING 1,004,915	EASTING 1,231,983
DRILL RIG/HAMMER EFF./DATE Red Dog Drilling CME-45		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER M. Seiler	START DATE 05/20/14	COMP. DATE 05/20/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
3110	3,109.8	0.0												GROUND SURFACE	0.0
	3,108.3	1.5	5	5	5	10								TOPSOIL	0.2
	3,106.8	3.0	5	7	6	13								ROADWAY EMBANKMENT	
3105	3,105.3	4.5	9	12	10	22								BLACK AND BROWN, SILTY FINE TO COARSE GRAINED SAND, WITH SOME ROCK FRAGMENTS	4.0
	3,103.8	6.0	9	6	5	11								ALLUVIAL	5.5
	3,103.0	6.8	100/0.5											BROWN, CLAYEY FINE TO MEDIUM GRAINED SAND, WITH LITTLE FINE GRAINED ROCK FRAGMENTS	6.0
			60/0.1											RESIDUAL	6.8
														ORANGISH BROWN AND GREENISH GRAY, SILTY FINE TO COARSE GRAINED SAND, WITH SOME COARSE GRAINED ROCK FRAGMENTS	6.9
														WEATHERED ROCK (GNEISS)	
														CRYSTALLINE ROCK (GNEISS)	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 3,102.9 ft in Crystalline Rock (Gneiss)	

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63		TIP 04-0264		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317							GROUND WTR (ft)										
BORING NO. B1		STATION 12+90		OFFSET 11 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 3,103.7 ft		TOTAL DEPTH 3.2 ft		NORTHING 1,004,864		EASTING 1,231,965											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/20/14		COMP. DATE 05/20/14		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)	
3105																	
	3,103.7	0.0													3,103.7	GROUND SURFACE	0.0
	3,102.7	1.0	N/A	2	12												
	3,101.7	2.0	N/A	7	8												
	3,100.7	3.0	N/A	6	50										3,100.5		3.2
			N/A	100/0.2												Boring Terminated at Elevation 3,100.5 ft	

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63		TIP 04-0264		COUNTY ASHE		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317							GROUND WTR (ft)										
BORING NO. B2		STATION 12+96		OFFSET 11 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 3,103.8 ft		TOTAL DEPTH 1.5 ft		NORTHING 1,004,870		EASTING 1,231,965											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 05/20/14		COMP. DATE 05/20/14		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)	
3105																	
	3,103.8	0.0													3,103.8	GROUND SURFACE	0.0
	3,102.8	1.0	N/A	5	6	● 11 - - - - - 60/0.0 ●								3,102.3	Boring Terminated at Elevation 3,102.3 ft	1.5	
			N/A	3	60/0.0												

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.63		TIP 04-0264		COUNTY ASHE		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 264 over Rich Hill Creek on SR 1317							GROUND WTR (ft)									
BORING NO. B5		STATION 13+22		OFFSET 14 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 3,104.6 ft		TOTAL DEPTH 1.1 ft		NORTHING 1,004,898		EASTING 1,231,987										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 05/20/14		COMP. DATE 05/20/14		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)
3105	3,104.6	0.0	N/A	4	16										GROUND SURFACE	0.0
	3,103.6	1.0	N/A	60/0.1											Boring Terminated at Elevation 3,103.5 ft	1.1

NCDOT BORE SINGLE 040264 BORINGS AND ROD SOUNDINGS.GPJ NC_DOT.GDT 5/29/14

SITE PHOTOGRAPHS
BRIDGE NO. 264 OVER RICH HILL CREEK ON SR 1317



View of SR 1317 looking North



View of Bridge No. 264 looking South

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.82 (85-0298)	1	7

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.11.R.82 F.A. PROJ. 85-0298
 COUNTY SURRY
 PROJECT DESCRIPTION BRIDGE NO. 298 OVER UNNAMED CREEK
ON SR 1600

 SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
3	SITE PLAN
4-9	BORE LOG REPORTS

PERSONNEL

R. RIVENBARK
S. BUCHANAN

INVESTIGATED BY SCHNABEL ENG.
 CHECKED BY R. RIVENBARK
 SUBMITTED BY SCHNABEL ENG.
 DATE MAY 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOST 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														
% PASSING # 10 # 40 # 200	50 MX 38 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX 35 MX	35 MX 35 MX	35 MX 35 MX	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	GRANULAR SOILS			
LIQUID LIMIT PLASTIC INDEX	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	SILT-CLAY SOILS			
GROUP INDEX	0	0	0	0	4 MX	0	8 MX	12 MX	16 MX	No MX	MUCK, PEAT			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER			HIGHLY ORGANIC SOILS		
GEN. RATING AS A 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 RESISTANCE (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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	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
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF 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
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ _u - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
● - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	v - VERY	

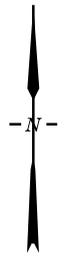
EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B-___	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -N <input type="checkbox"/> -H
<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS	HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input checked="" type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST
	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
	<input type="checkbox"/> TRICONE _____ ' STEEL TEETH	
	<input type="checkbox"/> TRICONE _____ ' TUNG.-CARB.	
	<input type="checkbox"/> CORE BIT	

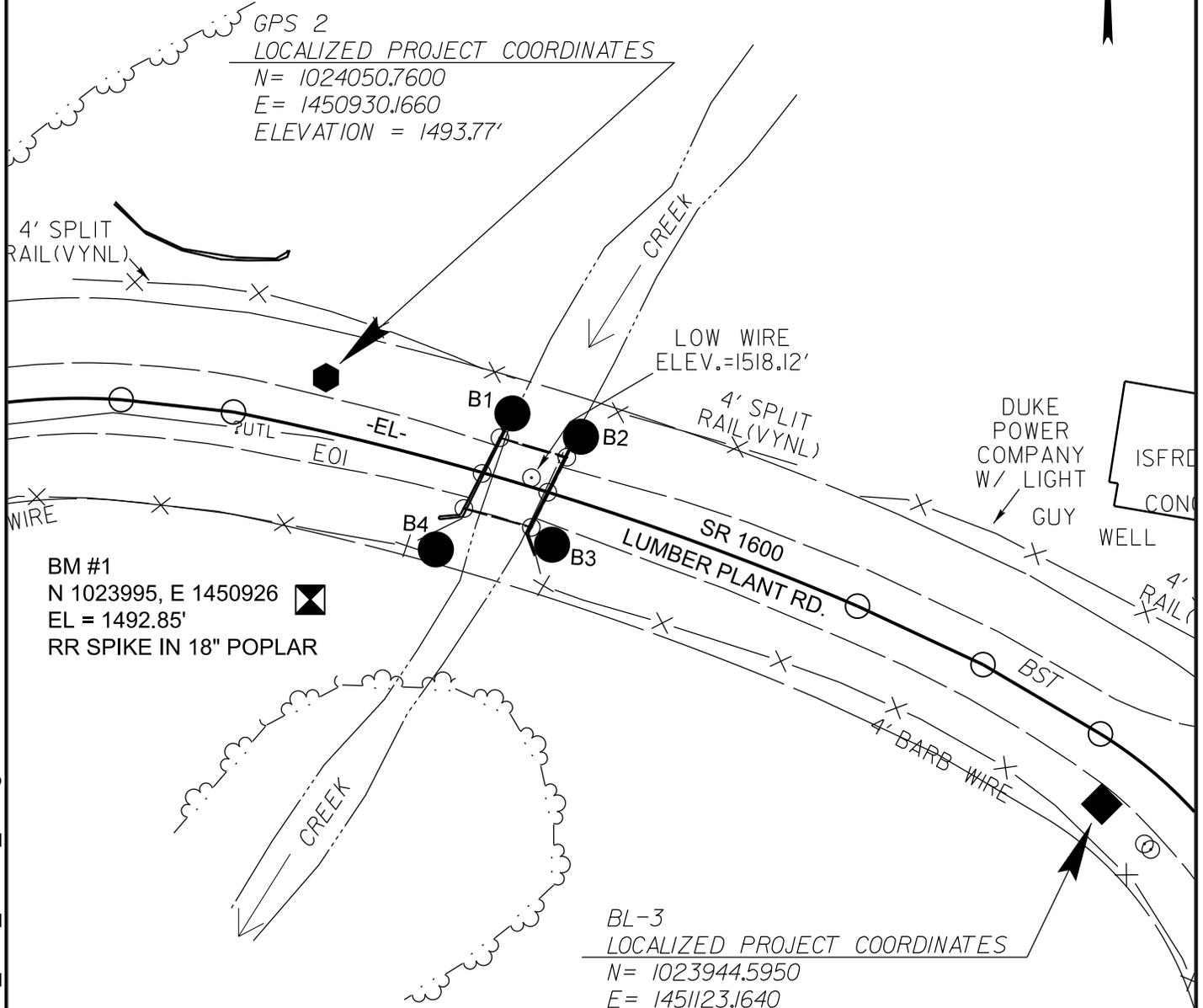
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 DISLOADED 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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 GROUVED 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 GROUVED 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		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK: GPS 2, LOCALIZED PROJECT COORDINATES N= 1024050.7600, E=1450930.1660 ELEVATION: 1493.77 FT.</p>	
NOTES:			

PROJECT REFERENCE NO.	SHEET
17BP.11.R.82 (85-0298)	3 OF 7
SITE PLAN	
0 40 80	
F E E T	



GPS 2
 LOCALIZED PROJECT COORDINATES
 N= 1024050.7600
 E= 1450930.1660
 ELEVATION = 1493.77'



BM #1
 N 1023995, E 1450926
 EL = 1492.85'
 RR SPIKE IN 18" POPLAR

BL-3
 LOCALIZED PROJECT COORDINATES
 N= 1023944.5950
 E= 1451123.1640
 ELEVATION = 1498.30'

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NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.82		TIP 85-0298		COUNTY SURRY		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 298 over Unnamed Creek on SR 1600							GROUND WTR (ft)									
BORING NO. B1		STATION N/A		OFFSET N/A		ALIGNMENT -EL-										
COLLAR ELEV. 1,489.5 ft		TOTAL DEPTH 3.7 ft		NORTHING 1,024,042		EASTING 1,450,977										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 04/21/14		COMP. DATE 04/21/14		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)
1490																
	1,489.5	0.0	N/A	2	2										1,489.5	0.0
	1,488.5	1.0	N/A	3	9											
	1,487.5	2.0	N/A	5	7											
	1,486.5	3.0	N/A	12	50/0.2										1,485.8	3.7
															Boring Terminated at Elevation 1,485.8 ft Rod bouncing after each blow of the hammer at 3.7 feet.	

NCDOT BORE SINGLE BRD6650298_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.82		TIP 85-0298		COUNTY SURRY		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 298 over Unnamed Creek on SR 1600							GROUND WTR (ft)									
BORING NO. B2		STATION N/A		OFFSET N/A		ALIGNMENT -EL-										
COLLAR ELEV. 1,491.4 ft		TOTAL DEPTH 7.1 ft		NORTHING 1,024,036		EASTING 1,450,994										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 04/21/14		COMP. DATE 04/21/14		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						
1495																
	1,491.4	0.0												1,491.4	GROUND SURFACE	0.0
1490	1,490.4	1.0	N/A	3	3	6										
	1,489.4	2.0	N/A	9	8	16										
	1,488.4	3.0	N/A	9	7	17										
	1,487.4	4.0	N/A	24	8	16										
	1,486.4	5.0	N/A	35	11	32										
1485	1,485.4	6.0	N/A	20	22	46										
	1,484.4	7.0	N/A	32	36	42								1,484.3		7.1
			N/A	50/0.1		68									Boring Terminated at Elevation 1,484.3 ft Rod bouncing after each blow of the hammer at 7.1 feet.	

NCDOT BORE SINGLE BRD6850298_GEO_INV.GPJ NC_DOT_GDT 4/29/14

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.11.R.76 (94-0020)	1	9

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.11.R.76 F.A. PROJ. 94-0020
COUNTY WATAUGA
PROJECT DESCRIPTION BRIDGE NO. 020 OVER RUBE CREEK ON
SR 1222
SITE DESCRIPTION _____

CONTENTS

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	LEGEND
3	SITE PLAN
4-9	BORE LOG REPORTS

PERSONNEL

R. RIVENBARK
S. BUCHANAN

INVESTIGATED BY SCHNABEL ENG.
CHECKED BY R. RIVENBARK
SUBMITTED BY SCHNABEL ENG.
DATE MAY 2014

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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: S. BUCHANAN

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 POORLY GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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.

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														
% PASSING	50 MX	30 MX	50 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN		
LIQUID LIMIT	6 MX	NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		
GROUP INDEX	0	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		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER			HIGHLY ORGANIC SOILS		
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD					FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE			

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF 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
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		SPT TEST BORING		TEST BORING W/ CORE
	SOIL SYMBOL		AUGER BORING		SPT N-VALUE
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING		SPT REFUSAL
	INFERRED SOIL BOUNDARY		MONITORING WELL		
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION		
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION		
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST		
			SOUNDING ROD		

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	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					

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	YST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ _u - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
● - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLL. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	v - VERY	

SOIL MOISTURE - CORRELATION OF TERMS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B-___	<input type="checkbox"/> CLAY BITS	<input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	CORE SIZE: <input type="checkbox"/> -B___ <input type="checkbox"/> -N___ <input type="checkbox"/> -H___
<input type="checkbox"/> CME-45C	<input type="checkbox"/> 8" HOLLOW AUGERS	
<input type="checkbox"/> CME-550	<input type="checkbox"/> HARD FACED FINGER BITS	
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG-CARBIDE INSERTS	HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input checked="" type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST
	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	
	<input type="checkbox"/> TRICONE ___ ' STEEL TEETH	
	<input type="checkbox"/> TRICONE ___ ' TUNG-CARB.	
	<input type="checkbox"/> CORE BIT	

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

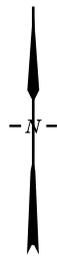
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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:</p>		<p>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, 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 DISLOADED 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 IN 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.</p>	
<p>WEATHERED ROCK (WR)</p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>		
<p>CRYSTALLINE ROCK (CR)</p> 	<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>		
<p>NON-CRYSTALLINE ROCK (NCR)</p> 	<p>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.</p>		
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p> 	<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>		
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>		
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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>		
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 FINGER NAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		<p>BENCH MARK: GPS 01, LOCALIZED PROJECT COORDINATES N 944526.2417, E 1159810.3486 ELEVATION: 2773.5926 FT.</p>	
		<p>NOTES:</p>	

PROJECT REFERENCE NO.	SHEET
17BP.II.R.76 (94-0020)	3 OF 9
SITE PLAN	
0 40 80	
FEET	

BM #1
 N 944516, E 1159905
 EL = 2768.05'
 BL STA. 3+46.00, 83' LT
 8" SPIKE IN ROOT OF
 15" WALNUT TREE



ALAN D. ZIMMERMAN
 KATHERINE S. GRAHAM

SHELBY EGGERS

GRASS

GARDEN

PICK BREECHES CREEK
 AKA RUBE CREEK

SR 1207
 STONE MOUNTAIN ROAD

SR 1222
 MOUNTAINDALE ROAD

GPS 01
 LOCALIZED PROJECT
 COORDINATES
 N= 944526.2417
 E= 1159810.3486
 EL= 2773.5926'

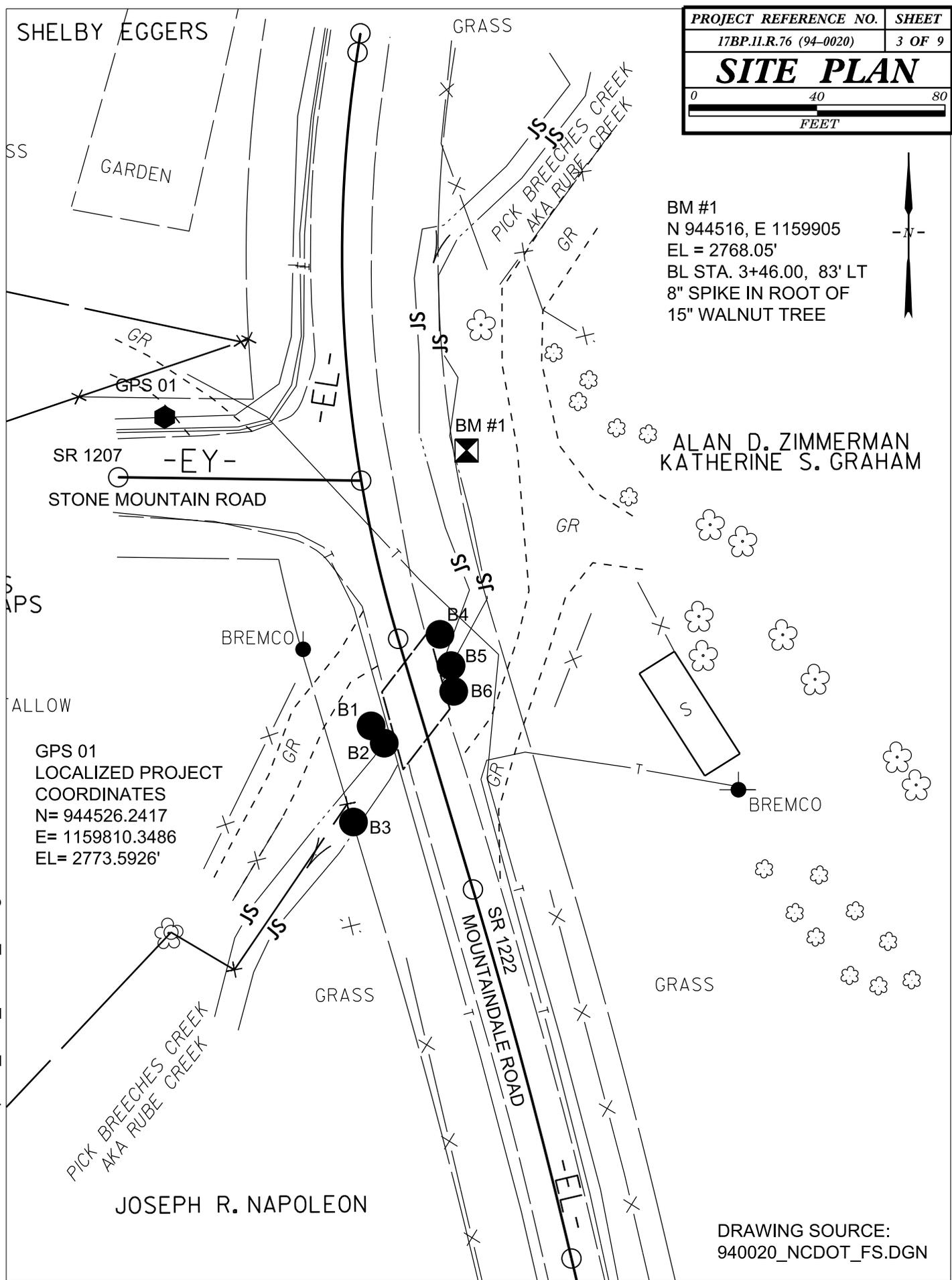
BREMCO

BREMCO

JOSEPH R. NAPOLEON

DRAWING SOURCE:
 940020_NCDOT_FS.DGN

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NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.76		TIP 94-0020		COUNTY WATAUGA		GEOLOGIST S. Buchanan										
SITE DESCRIPTION Bridge No. 020 over Rube Creek on SR 1222							GROUND WTR (ft)									
BORING NO. B1		STATION N/A		OFFSET N/A		ALIGNMENT -EL-										
COLLAR ELEV. 2,766.3 ft		TOTAL DEPTH 3.6 ft		NORTHING 944,430		EASTING 1,159,875										
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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)
2770																
2765	2,766.3	0.0	N/A	1	1									2,766.3	GROUND SURFACE	0.0
	2,765.3	1.0	N/A	WOH	WOH											
	2,764.3	2.0	N/A	3	15											
	2,763.3	3.0	N/A	29	20/0.1									2,762.7		3.6
															Boring Terminated at Elevation 2,762.7 ft Rod bouncing after each blow of the hammer at 3.6 feet. Termination of sounding is likely on boulders.	

NCDOT BORE SINGLE BRD6940020_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.76		TIP 94-0020		COUNTY WATAUGA		GEOLOGIST S. Buchanan											
SITE DESCRIPTION Bridge No. 020 over Rube Creek on SR 1222							GROUND WTR (ft)										
BORING NO. B3		STATION N/A		OFFSET N/A		ALIGNMENT -EL-											
COLLAR ELEV. 2,763.7 ft		TOTAL DEPTH 4.2 ft		NORTHING 944,400		EASTING 1,159,869											
DRILL RIG/HAMMER EFF./DATE N/A				DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 04/22/14		COMP. DATE 04/22/14		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)	
2765	2,763.7	0.0													2,763.7	GROUND SURFACE	0.0
2760	2,762.7	1.0	N/A	2	12												
	2,761.7	2.0	N/A	10	15												
	2,760.7	3.0	N/A	12	15												
	2,759.7	4.0	N/A	4	9												
			N/A	20/0.2											2,759.5		4.2
Boring Terminated at Elevation 2,759.5 ft																	
Rod bouncing after each blow of the hammer at 4.2 feet.																	

NCDOT BORE SINGLE BRD6940020_GEO_INV.GPJ NC_DOT_GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.76	TIP 94-0020	COUNTY WATAUGA	GEOLOGIST S. Buchanan
SITE DESCRIPTION Bridge No. 020 over Rube Creek on SR 1222			GROUND WTR (ft)
BORING NO. B4	STATION N/A	OFFSET N/A	ALIGNMENT -EL-
COLLAR ELEV. 2,767.5 ft	TOTAL DEPTH 5.1 ft	NORTHING 944,458	EASTING 1,159,896
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding	HAMMER TYPE N/A
DRILLER N/A	START DATE 04/22/14	COMP. DATE 04/22/14	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)	
2770																	
	2,767.5	0.0													2,767.5	GROUND SURFACE	0.0
	2,766.5	1.0	N/A	WOH	WOH	0											
2765	2,765.5	2.0	N/A	5	8	0											
	2,764.5	3.0	N/A	9	16	0											
	2,763.5	4.0	N/A	25	12	0											
	2,762.5	5.0	N/A	30	33	0									2,762.4		5.1
			N/A	20/0.1												Boring Terminated at Elevation 2,762.4 ft Rod bouncing after each blow of the hammer at 5.1 feet.	

NCDOT BORE SINGLE BRD6940020_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 17BP.11.R.76			TIP 94-0020			COUNTY WATAUGA			GEOLOGIST S. Buchanan								
SITE DESCRIPTION Bridge No. 020 over Rube Creek on SR 1222										GROUND WTR (ft)							
BORING NO. B5			STATION N/A			OFFSET N/A			ALIGNMENT -EL-								
COLLAR ELEV. 2,764.6 ft			TOTAL DEPTH 2.0 ft			NORTHING 944,449			EASTING 1,159,900								
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Rod Sounding			HAMMER TYPE N/A								
DRILLER N/A			START DATE 04/22/14			COMP. DATE 04/22/14			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)	
2765	2,764.6	0.0	N/A	12	30										2,764.6	GROUND SURFACE	0.0
	2,763.6	1.0	N/A	26	25										2,762.6		2.0
																Boring Terminated at Elevation 2,762.6 ft Rod bouncing after each blow of the hammer at 2.0 feet. Termination of sounding is likely on boulders.	

NCDOT BORE SINGLE BRD6940020_GEO_INV.GPJ NC_DOT.GDT 4/29/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.11.R.76			TIP 94-0020			COUNTY WATAUGA			GEOLOGIST S. Buchanan							
SITE DESCRIPTION Bridge No. 020 over Rube Creek on SR 1222										GROUND WTR (ft)						
BORING NO. B6			STATION N/A			OFFSET N/A			ALIGNMENT -EL-							
COLLAR ELEV. 2,764.8 ft			TOTAL DEPTH 7.0 ft			NORTHING 944,440			EASTING 1,159,901							
DRILL RIG/HAMMER EFF./DATE N/A						DRILL METHOD Rod Sounding			HAMMER TYPE N/A							
DRILLER N/A			START DATE 04/22/14			COMP. DATE 04/22/14			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						
2765	2,764.8	0.0	N/A	3	2									2,764.8	GROUND SURFACE	0.0
2760	2,763.8	1.0	N/A	10	11	5										
	2,762.8	2.0	N/A	10	11	21										
	2,761.8	3.0	N/A	15	30											
	2,760.8	4.0	N/A	13	27											
	2,759.8	5.0	N/A	12	50											
	2,758.8	6.0	N/A	50	30									2,757.8		7.0
			N/A	30	70										Boring Terminated at Elevation 2,757.8 ft Rod bouncing after each blow of the hammer at 7.0 feet.	

NCDOT BORE SINGLE BRD6940020_GEO_INV.GPJ NC_DOT.GDT 4/29/14