

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	41665.3A	1	11

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

**STRUCTURE  
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 41665.3A F.A. PROJ. SF-990016  
 COUNTY YANCEY  
 PROJECT DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER  
ELK FORK

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2-2A	NCDOT DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT SUBSURFACE INVESTIGATION SOIL AND ROCK LEGEND, TERMS, SYMBOLS AND ABBREVIATIONS
3	FOUNDATION RECOMMENDATIONS AND NOTES ON PLANS
4	SITE PLAN
5-8	BORING LOGS
9	CORE LOGS
10	CORE PHOTOS

PERSONNEL  
PAUL, A. S.  
TRIGON EXP  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

INVESTIGATED BY ASP  
 CHECKED BY HAMM, J. R.  
 SUBMITTED BY FALCON ENG  
 DATE JUNE 2015

**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.

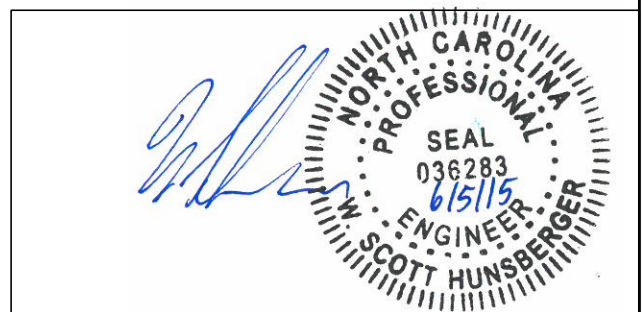
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND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



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

**SUBSURFACE INVESTIGATION**





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

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1, A-2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										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									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
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 <sup>2</sup> )										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING INFERRED SOIL BOUNDARY CORE BORING INFERRED ROCK LINE MONITORING WELL ALLUVIAL SOIL BOUNDARY PIEZOMETER INSTALLATION									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
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										UNDERCUT EXCAVATION UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC ? - 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 SD. - SAND, SANDY SS - SPLIT SPOON f - FINE SL. - SILT, SILTY SLI. - SLIGHTLY ST - SHELBY TUBE FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RS - ROCK FRAC. - FRACTURED, FRACTURES w - MOISTURE CONTENT RT - RECOMPACTED TRIAXIAL FRAGS. - FRAGMENTS HI. - HIGHLY v - VERY CBR - CALIFORNIA BEARING RATIO									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										<input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input checked="" type="checkbox"/> CME-55 <input checked="" type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER <input type="checkbox"/> CORE SIZE: <input type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> -B <input type="checkbox"/> -H <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input checked="" type="checkbox"/> -N Q2 <input type="checkbox"/> PORTABLE HOIST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE <input type="checkbox"/> STEEL TEETH <input type="checkbox"/> TRICONE <input type="checkbox"/> TUNG-CARB. <input type="checkbox"/> CORE BIT									
COLOR										HAND TOOLS:									
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.										<input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST									

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

# SUBSURFACE INVESTIGATION

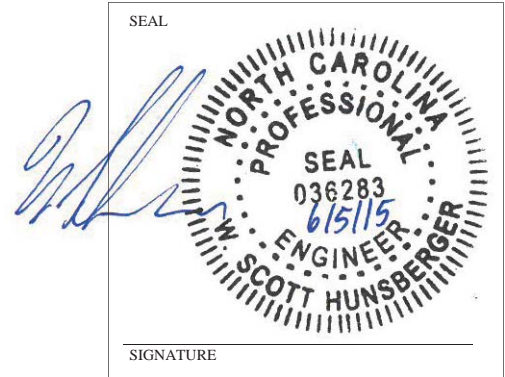
## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS																										
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>		<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.  <b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (ROD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS 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.  <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SROD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.  <b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																										
		<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>																										
WEATHERED ROCK (WR)																												
		<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>																										
CRYSTALLINE ROCK (CR)																												
		<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>																										
NON-CRYSTALLINE ROCK (NCR)																												
		<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>																										
COASTAL PLAIN SEDIMENTARY ROCK (CP)																												
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, WOULD YIELD SPT N VALUES &gt; 100 BPF</i>																											
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 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 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 FINGER NAIL.																											
FRACTURE SPACING		BEDDING																										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">TERM</th> <th style="text-align: center;">SPACING</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">VERY WIDE</td> <td style="text-align: center;">MORE THAN 10 FEET</td> </tr> <tr> <td style="text-align: center;">WIDE</td> <td style="text-align: center;">3 TO 10 FEET</td> </tr> <tr> <td style="text-align: center;">MODERATELY CLOSE</td> <td style="text-align: center;">1 TO 3 FEET</td> </tr> <tr> <td style="text-align: center;">CLOSE</td> <td style="text-align: center;">0.16 TO 1 FOOT</td> </tr> <tr> <td style="text-align: center;">VERY CLOSE</td> <td style="text-align: center;">LESS THAN 0.16 FEET</td> </tr> </tbody> </table>	TERM	SPACING	VERY WIDE	MORE THAN 10 FEET	WIDE	3 TO 10 FEET	MODERATELY CLOSE	1 TO 3 FEET	CLOSE	0.16 TO 1 FOOT	VERY CLOSE	LESS THAN 0.16 FEET	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">TERM</th> <th style="text-align: center;">THICKNESS</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">VERY THICKLY BEDDED</td> <td style="text-align: center;">4 FEET</td> </tr> <tr> <td style="text-align: center;">THICKLY BEDDED</td> <td style="text-align: center;">1.5 - 4 FEET</td> </tr> <tr> <td style="text-align: center;">THINLY BEDDED</td> <td style="text-align: center;">0.16 - 1.5 FEET</td> </tr> <tr> <td style="text-align: center;">VERY THINLY BEDDED</td> <td style="text-align: center;">0.03 - 0.16 FEET</td> </tr> <tr> <td style="text-align: center;">THICKLY LAMINATED</td> <td style="text-align: center;">0.008 - 0.03 FEET</td> </tr> <tr> <td style="text-align: center;">THINLY LAMINATED</td> <td style="text-align: center;">&lt; 0.008 FEET</td> </tr> </tbody> </table>	TERM	THICKNESS	VERY THICKLY BEDDED	4 FEET	THICKLY BEDDED	1.5 - 4 FEET	THINLY BEDDED	0.16 - 1.5 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET	THINLY LAMINATED	< 0.008 FEET
TERM	SPACING																											
VERY WIDE	MORE THAN 10 FEET																											
WIDE	3 TO 10 FEET																											
MODERATELY CLOSE	1 TO 3 FEET																											
CLOSE	0.16 TO 1 FOOT																											
VERY CLOSE	LESS THAN 0.16 FEET																											
TERM	THICKNESS																											
VERY THICKLY BEDDED	4 FEET																											
THICKLY BEDDED	1.5 - 4 FEET																											
THINLY BEDDED	0.16 - 1.5 FEET																											
VERY THINLY BEDDED	0.03 - 0.16 FEET																											
THICKLY LAMINATED	0.008 - 0.03 FEET																											
THINLY LAMINATED	< 0.008 FEET																											
INDURATION																												
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><b>BENCH MARK:</b> ELEVATIONS COLLECTED USING *.TIN' FILE</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 10%; text-align: center;">ELEVATION:</td> <td style="width: 10%; text-align: center;">FEET</td> </tr> <tr> <td colspan="3" style="height: 20px;"></td> </tr> </table>		ELEVATION:	FEET																							
	ELEVATION:	FEET																										
		<p><b>NOTES:</b></p> <p>F.I.A.D. - FILLED IMMEDIATELY AFTER DRILLING</p>																										
		DATE: 8-15-14																										

# FOUNDATION RECOMMENDATIONS

WBS # 41665.3A DESCRIPTION Bridge No. 16 on NC 197 over Elk  
 T.I.P. NO. SF-990016 Fork Creek  
 COUNTY Yancey  
 STATION 12+91.78 -L-

	INITIALS	DATE
DESIGN	WSH	06/02/15
CHECK	JRH	06/05/15
APPROVAL		



CULVERT SIZE	STATION	FOUNDATION TYPE	EXCAVATION DEPTH	MISCELLANEOUS DETAILS
Dual 8' x 4' Reinforced Concrete Box Culverts	-L- 12+91.78	12" Class VI Foundation Conditioning Material	1.0 foot below bottom of culvert	Culvert Length = 75 ft Culvert Skew = 36 degrees Centerline Invert Elevation = 3105.6 ft Slope = 6.77%

## FOUNDATION RECOMMENDATION SPECIAL NOTES ON PLANS

- EXCAVATE A MINIMUM OF 1.0 FOOT BELOW CULVERT BEARING ELEVATION AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL PER SECTION 414 OF THE STANDARD SPECIFICATIONS.
- OVEREXCAVATE LOOSE/SOFT MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL.

**N.C. DEPT. OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENG. UNIT-WRO**

- ACCEPTED
- ACCEPTED AS NOTED
- RETURNED FOR CORRECTIONS
- SEE LETTER

BY: Charles A. Gove, P.E.

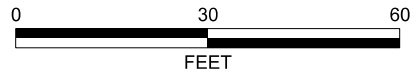
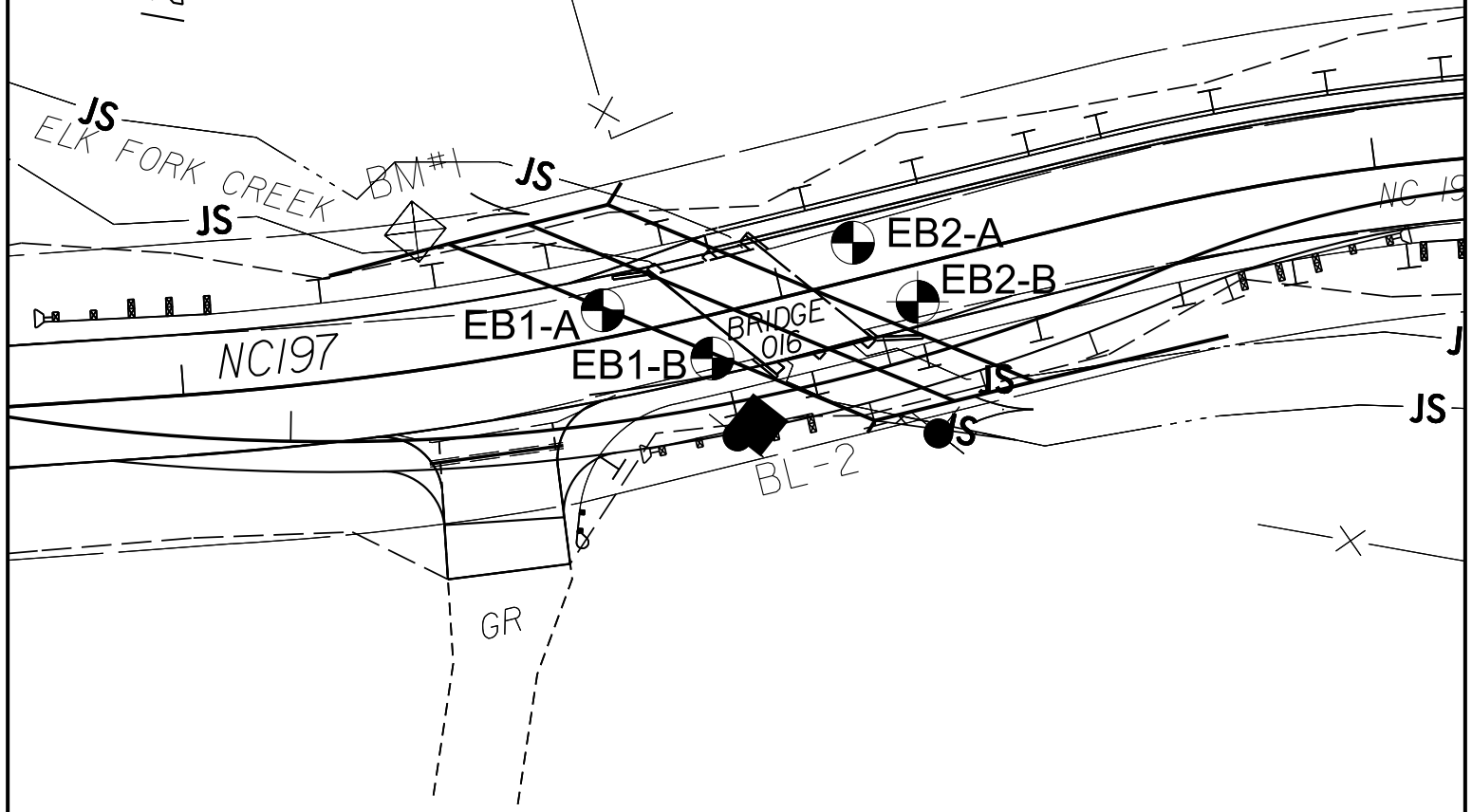
DATE: June 19, 2015



12

13

14



**NOTES:**

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED JUNE 2015.
- BRIDGE SKEW: 36°



FALCON ENGINEERING, INC.  
 1210 TRINITY ROAD, SUITE 110  
 RALEIGH, NC 27607  
 PHONE: 919.871.0800  
 FAX: 919.871.0803

**BORING LOCATION PLAN**

BRIDGE NO. 16 ON NC 197  
 OVER ELK FORK CREEK  
 YANCEY COUNTY, NC  
 TIP NO.: SF-990016 PROJ. NO.: 41665.3A

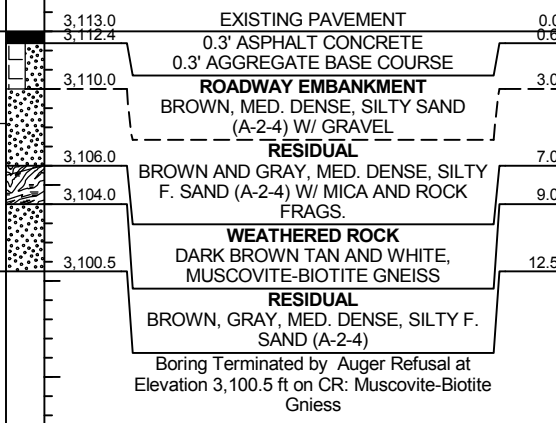


# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 41665.3A	TIP SF-990016	COUNTY Yancey	GEOLOGIST Paul, A. S.
SITE DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER ELK FORK CREEK			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+71	OFFSET 5 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,113.0 ft	TOTAL DEPTH 12.5 ft	NORTHING 772,934	EASTING 1,013,143
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 93% 12/08/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 12/03/13	COMP. DATE 12/03/13	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			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
3115																	
	3,112.0	1.0	22	6	7											3,113.0	0.0
	3,109.5	3.5	15	11	12											3,112.4	0.6
3110	3,107.0	6.0	24	100/0.5												3,110.0	3.0
	3,104.5	8.5	57	13	12											3,106.0	7.0
3105	3,100.5	12.5	60/0.0													3,104.0	9.0
																3,100.5	12.5



NCDOT BORE SINGLE\_GEO\_BRDG0016.GPJ NC\_DOT.GDT 6/5/15

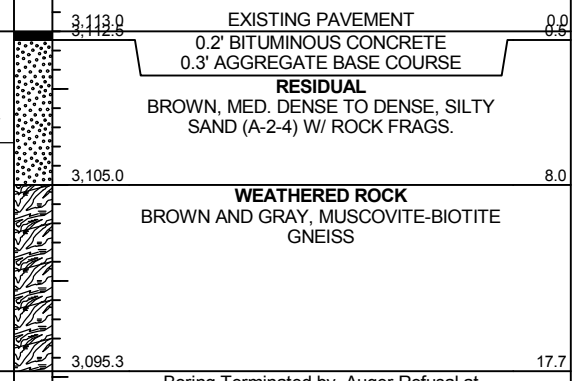


# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 41665.3A	TIP SF-990016	COUNTY Yancey	GEOLOGIST Paul, A. S.
SITE DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER ELK FORK CREEK			
BORING NO. EB1-B	STATION 12+87	OFFSET 7 ft RT	ALIGNMENT -L-
COLLAR ELEV. 3,113.0 ft	TOTAL DEPTH 17.7 ft	NORTHING 772,939	EASTING 1,013,162
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 93% 12/08/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 12/03/13	COMP. DATE 12/03/13	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						
3115																
	3,112.0	1.0	24	9	9											
3110	3,109.5	3.5	7	4	20											
	3,107.0	6.0	15	19	23											
3105	3,104.5	8.5	100/0.8													
	3,099.5	13.5	100/0.5													
3100	3,095.3	17.7	60/0.0													



NCDOT BORE SINGLE\_GEO\_BRDG0016.GPJ NC\_DOT.GDT 6/5/15



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 41665.3A	TIP SF-990016	COUNTY Yancey	GEOLOGIST Paul, A. S.
SITE DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER ELK FORK CREEK			GROUND WTR (ft)
BORING NO. EB2-A	STATION 13+13	OFFSET 6 ft LT	ALIGNMENT -L-
COLLAR ELEV. 3,111.0 ft	TOTAL DEPTH 6.1 ft	NORTHING 772,968	EASTING 1,013,168
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 93% 12/08/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 12/04/13	COMP. DATE 12/04/13	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
3115															
3110	3,110.0	1.0												3,111.0 EXISTING PAVEMENT	0.0
			100/0.9											3,110.1 0.3' BITUMINOUS CONCRETE	0.9
	3,107.5	3.5												3,109.8 0.7' AGGREGATE BASE COURSE	1.2
			100/0.7											<b>RESIDUAL</b> BROWN, SANDY SILT (A-4)	
3105	3,105.0	6.0												3,105.0 <b>WEATHERED ROCK</b>	6.0
			60/0.1											3,104.9 BROWN AND GRAY, MUSCOVITE-BIOTITE GNEISS	6.1
														<b>CRYSTALLINE ROCK</b> GRAY, MUSCOVITE-BIOTITE GNEISS	
														Boring Terminated with Standard Penetration Test Refusal at Elevation 3,104.9 ft in CR: Muscovite-Biotite Gneiss	

NCDOT BORE SINGLE\_GEO\_BRDG0016.GPJ NC\_DOT\_GDT 6/5/15



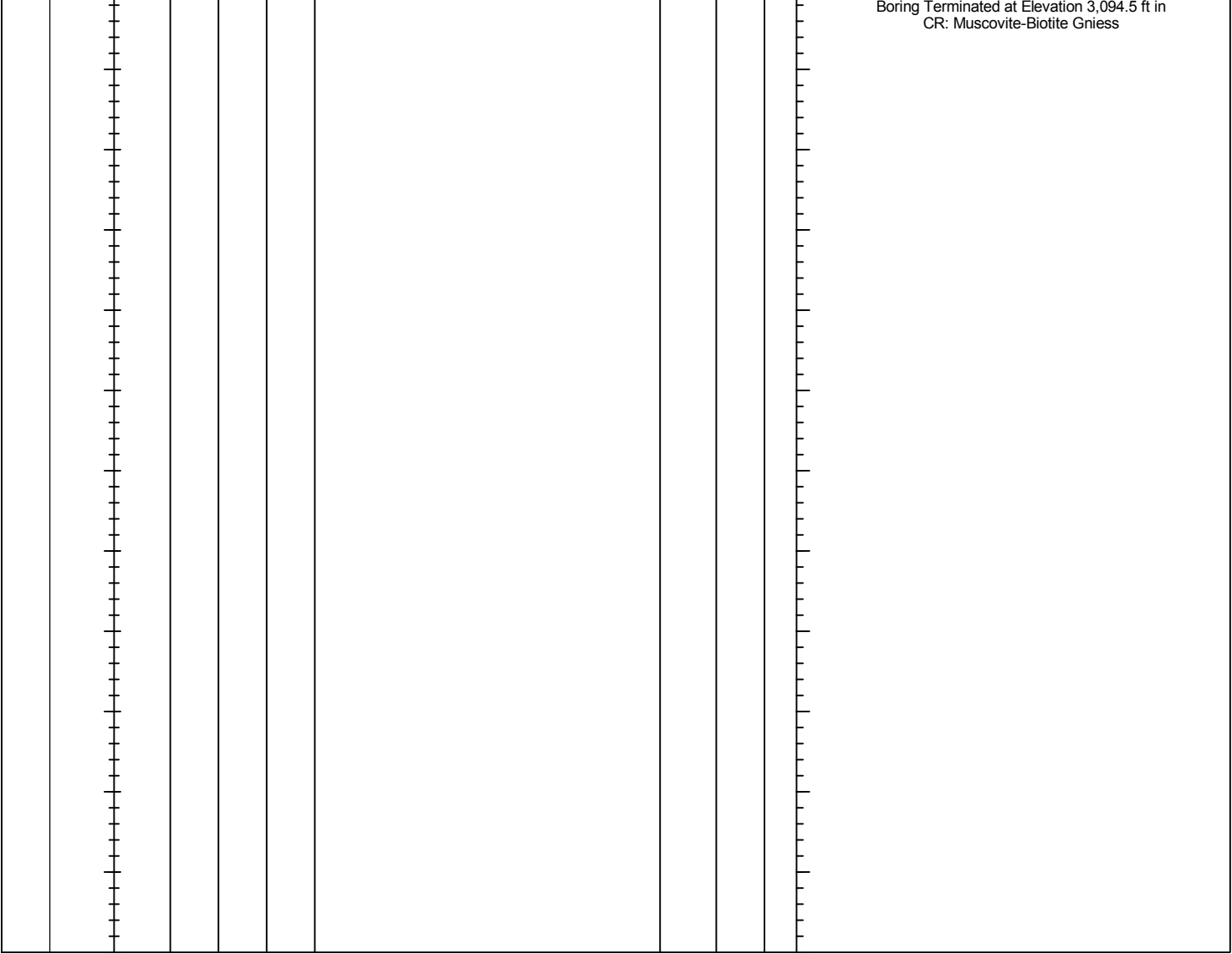


# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 41665.3A	TIP SF-990016	COUNTY Yancey	GEOLOGIST Paul, A. S.
SITE DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER ELK FORK CREEK			GROUND WTR (ft)
BORING NO. EB2-B	STATION 13+22	OFFSET 6 ft RT	ALIGNMENT -L-
COLLAR ELEV. 3,111.0 ft	TOTAL DEPTH 16.5 ft	NORTHING 772,967	EASTING 1,013,182
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 93% 12/08/2011		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 12/03/13	COMP. DATE 12/03/13	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						
3115																
3110	3,110.0	1.0	9	8	16									EXISTING PAVEMENT	0.0	
														0.3' BITUMINOUS CONCRETE	0.7	
	3,107.5	3.5	7	10	14									0.4' AGGREGATE BASE COURSE		
														<b>RESIDUAL</b>		
3105	3,105.0	6.0	22	20	19									BROWN, MED. DENSE TO V. DENSE, SILTY SAND (A-2-4) W/ ROCK FRAGS.		
	3,102.5	8.5	12	8	71											
3100	3,099.5	11.5	60/0/0													
														<b>CRYSTALLINE ROCK</b>	11.5	
														BLACK AND WHITE, MUSCOVITE-BIOTITE GNEISS		
3095																



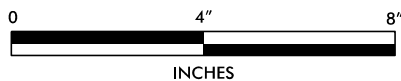
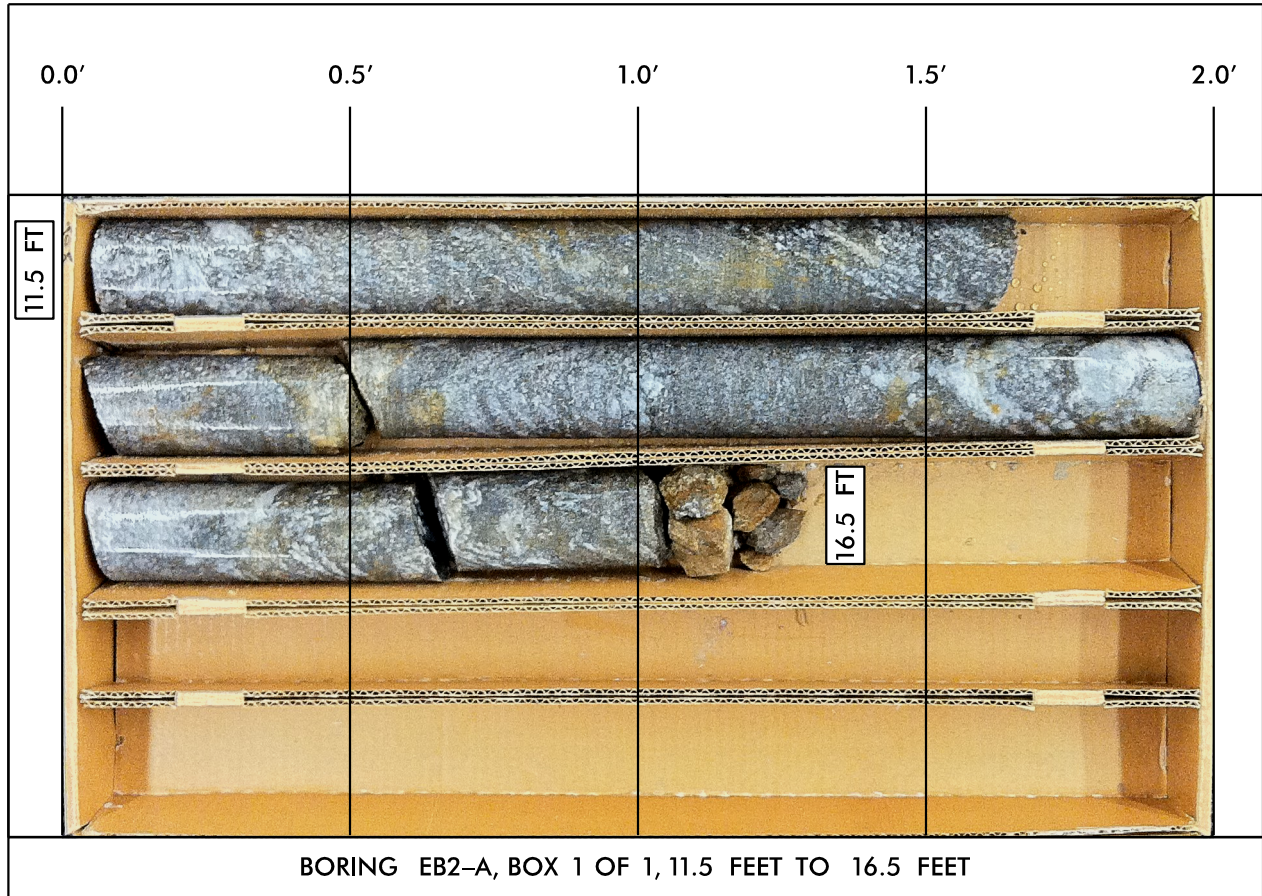
NCDOT BORE SINGLE\_GEO\_BRDG0016.GPJ NC\_DOT.GDT 6/5/15




# NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

WBS 41665.3A		TIP SF-990016		COUNTY Yancey		GEOLOGIST Paul, A. S.					
SITE DESCRIPTION BRIDGE NO. 16 ON NC 197 OVER ELK FORK CREEK									GROUND WTR (ft)		
BORING NO. EB2-B		STATION 13+22		OFFSET 6 ft RT		ALIGNMENT -L-		0 HR. 3.6			
COLLAR ELEV. 3,111.0 ft		TOTAL DEPTH 16.5 ft		NORTHING 772,967		EASTING 1,013,182		24 HR. FIAD			
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 93% 12/08/2011				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic					
DRILLER Contract Driller		START DATE 12/03/13		COMP. DATE 12/03/13		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		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
3099.5										Begin Coring @ 11.5 ft	
	3,099.5	11.5	5.0	4:00/1.0 3:30/1.0 3:15/1.0 3:00/1.0	(4.8) 96%	(4.6) 92%	(4.8) 96%	(4.6) 92%	[Hand-drawn sketch of rock texture]	3,099.5 <b>CRYSTALLINE ROCK</b> BLACK AND WHITE, V. SLI. WEATHERED, MOD. HARD TO HARD, CLOSELY TO MOD. CLOSELY FRACTURED, MUSCOVITE-BIOTITE GNEISS	11.5
3095	3,094.5	16.5							[Hand-drawn sketch of rock texture]	3,094.5 Boring Terminated at Elevation 3,094.5 ft in CR: Muscovite-Biotite Gneiss	16.5

NCDOT CORE SINGLE \_GEO\_BRDG0016.GPJ NC\_DOT.GDT 6/5/15



 <p>FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 RALEIGH, NC 27607 PHONE: 919.871.0800 FAX: 919.871.0803</p>	<b>ROCK CORE PHOTOGRAPHS</b>	
	BRIDGE NO. 16 ON NC197 OVER ELK FORK YANCEY COUNTY, NORTH CAROLINA TIP: SF-990016	
JUNE 2015	PROJECT NO.: 41665.3A	FALCON PROJ. NO.: G13067.04