

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

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# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33202.1.2 (B-3656) F.A. PROJ. BRSTP-0019(28)  
 COUNTY HAYWOOD  
 PROJECT DESCRIPTION BRIDGE No. 419 ON US-1923/74  
OVER PIGEON RIVER

SITE DESCRIPTION \_\_\_\_\_

**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) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

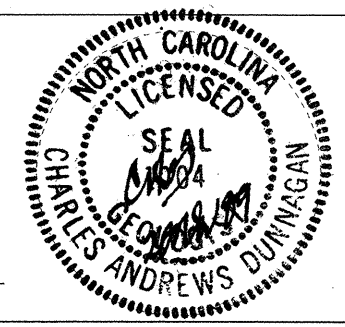
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND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

PERSONNEL

- M H HAGER
- G K ROSE
- R D CHILDERS
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INVESTIGATED BY C A DUNNAGAN  
 CHECKED BY W D FRYE, Jr  
 SUBMITTED BY W D FRYE, Jr  
 DATE NOVEMBER 2009



*C A Dunnagan*

**PROJECT: 33202.1.2 ID: B-3656**

DRAWN BY: C A DUNNAGAN

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.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

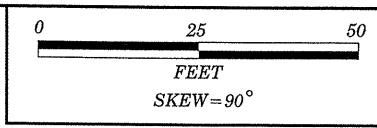
SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

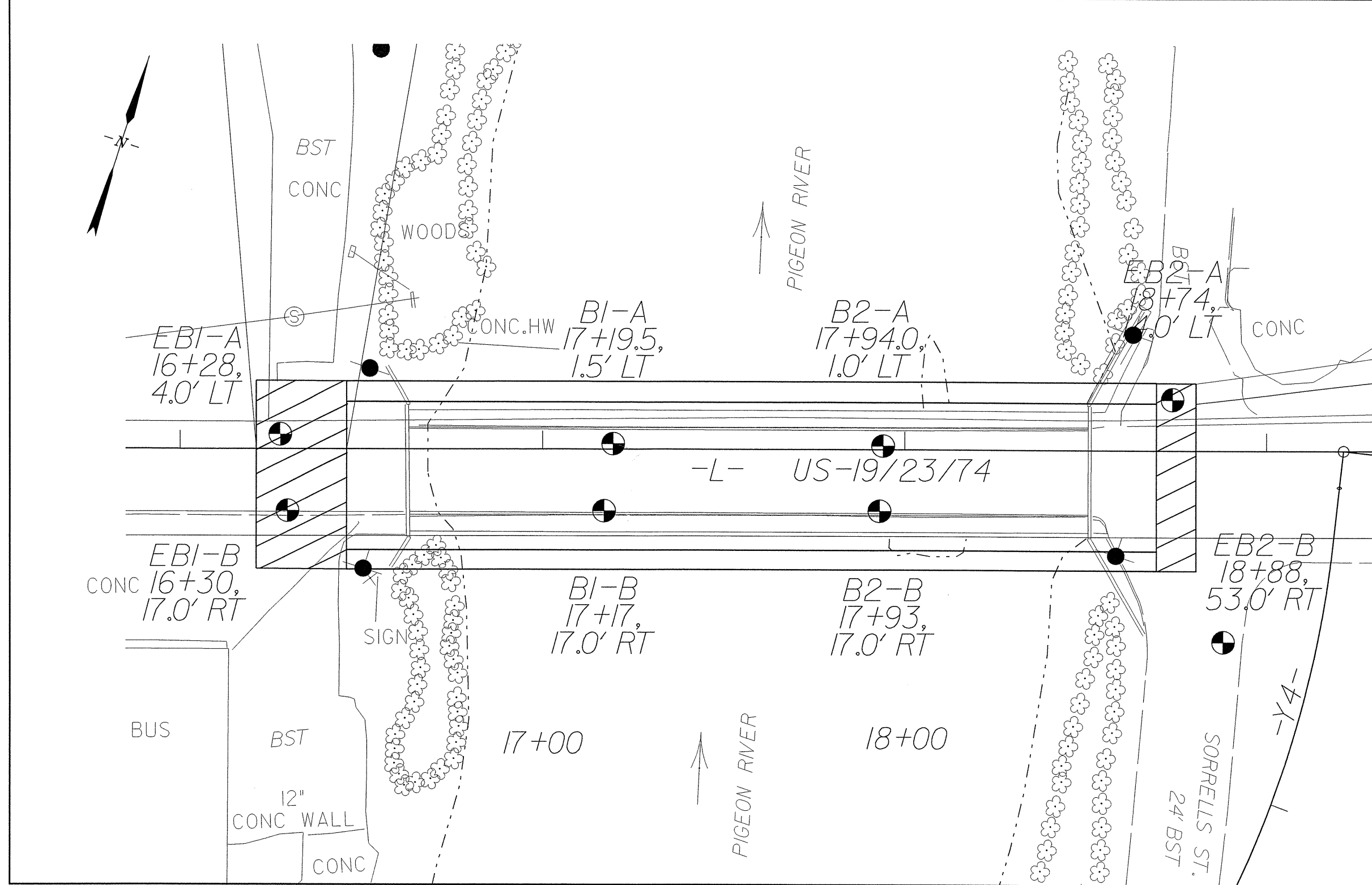
PROJECT REFERENCE NO. 33202.1.2 (B-3656)	SHEET NO. 2/11
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SOIL DESCRIPTION		GRADATION		ROCK DESCRIPTION		TERMS AND DEFINITIONS							
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED 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, MOST 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. <b>ANGULARITY OF GRAINS</b> THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.		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: <b>WEATHERED ROCK (WR)</b> NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. <b>CRYSTALLINE ROCK (CR)</b> FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. <b>NON-CRYSTALLINE ROCK (NCR)</b> 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. <b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b> COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.		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 (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (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.							
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>		<b>MINERALOGICAL COMPOSITION</b>		<b>WEATHERING</b>									
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.		FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (V SLI.) ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SLI.) ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL. SEVERE (SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, YIELDS SPT N VALUES > 100 BPF. 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. 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ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE. SLIGHT (SLI.) ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE (MOD.) SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK. MODERATELY SEVERE (MOD. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. 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<b>COMPACTNESS OR DENSENESS</b>		<b>MISCELLANEOUS SYMBOLS</b>		<b>ROCK HARDNESS</b>									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F <sup>2</sup> )		ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES SOUNDING ROD		SPT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION SPT N-VALUE SPT REFUSAL		VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE 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.		GENERAL GRANULAR MATERIAL (NON-COHESIVE) VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE GENERALLY SILT-CLAY MATERIAL (COHESIVE) VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/F <sup>2</sup> ) N/A <0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4		VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE 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.		BENCH MARK: BM*2- CHISELED SQUARE IN CONCRETE WALL 41 FEET LEFT OF -BL- STA 15+56 ELEVATION: 2586.67 FT.	
<b>TEXTURE OR GRAIN SIZE</b>		<b>ABBREVIATIONS</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>							
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		AR - AUGER REFUSAL HI - HIGHLY BT - BORING TERMINATED MED. - MEDIUM CL - CLAY MICA - MICACEOUS CPT - CONE PENETRATION TEST MOD. - MODERATELY CSE - COARSE NP - NON PLASTIC DMT - DILATOMETER TEST ORG. - ORGANIC DPT - DYNAMIC PENETRATION TEST PMT - PRESSUREMETER TEST e - VOID RATIO SAP. - SAPROLITIC f - FINE SD. - SAND, SANDY FOSS. - FOSSILIFEROUS SL. - SILT, SILTY FRAC. - FRACTURED, FRACTURES SLI. - SLIGHTLY FRAGS. - FRAGMENTS TCR - TRICONE REFUSAL		MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST CLAY BITS 6" CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG-CARB. CORE BIT		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.							
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>FRACATURE SPACING</b>		<b>BEDDING</b>									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION		TERM SPACING TERM THICKNESS		TERM THICKNESS									
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		VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FEET VERY CLOSE LESS THAN 0.16 FEET		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									
<b>PLASTICITY</b>		<b>INDURATION</b>											
NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH		FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.											
<b>COLOR</b>		<b>FRACATURE SPACING</b>		<b>BEDDING</b>									
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.		VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FEET VERY CLOSE LESS THAN 0.16 FEET		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									

# BRIDGE No. 419 ON US-19/23/74 OVER PIGEON RIVER



PROJECT REFERENCE NO.	SHEET
33202.1.2 (B-3656)	-
<b>SITE PLAN</b>	









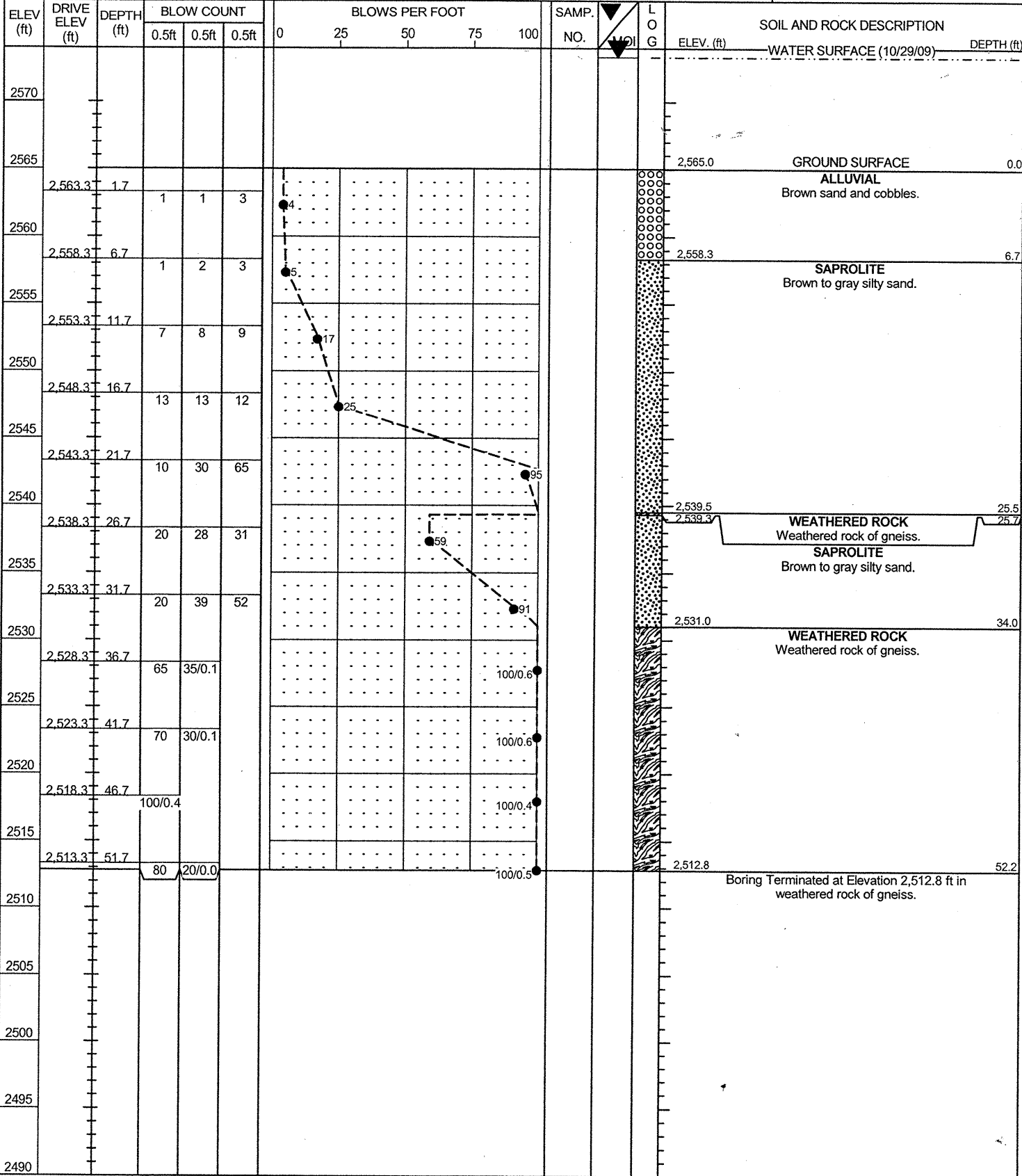
PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.										
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 16+28		OFFSET 4ft LT		ALIGNMENT -L-										
COLLAR ELEV. 2,587.6 ft		TOTAL DEPTH 61.5 ft		NORTHING 670,519		EASTING 857,033										
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT			HAMMER TYPE Automatic											
START DATE 10/28/09		COMP. DATE 10/28/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2590															2,587.6	0.0
2585															GROUND SURFACE ROADWAY EMBANKMENT Brown silty sand.	
2580	2,582.6	5.0	1	2	3											
2575	2,577.6	10.0	3	2	2										2,577.9	9.7
2570	2,572.6	15.0	2	3	2										ALLUVIAL Gray and brown silty sand with lenses of sandy silt and trace amounts of organic matter.	
2565	2,566.6	21.0	12	16	21										2,566.4	21.2
2560	2,562.6	25.0	12	7	3										ALLUVIAL Brown gravel with sand and mica.	
2555	2,557.6	30.0	3	4	8										2,559.6	28.0
2550	2,552.6	35.0	3	14	17										SAPROLITE Brown silty sand.	
2545	2,547.6	40.0	4	11	12											
2540	2,542.6	45.0	25	32	68/0.4										2,542.1	45.5
2535	2,537.6	50.0	29	43	37										WEATHERED ROCK Weathered rock of gneiss.	
2530	2,532.6	55.0	19	50	50/1.0										2,537.6	50.0
2525	2,527.6	60.0	20	30	41										2,532.1 2,531.1	55.5 56.5
2520															WEATHERED ROCK Weathered rock of gneiss. SAPROLITE Brown silty sand.	
2515															2,526.1	61.5
2510															Boring Terminated at Elevation 2,526.1 ft in very dense saprolite.	

NCDOT BORE SINGLE BORE\_CORELOGS.GPJ NC\_DOT.GDT 11/19/09

PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.										
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 16+30		OFFSET 17ft RT		ALIGNMENT -L-										
COLLAR ELEV. 2,587.6 ft		TOTAL DEPTH 70.1 ft		NORTHING 670,500		EASTING 857,042										
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT			HAMMER TYPE Automatic											
START DATE 11/13/09		COMP. DATE 11/16/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
2590															2,587.6	0.0
2585															GROUND SURFACE ROADWAY EMBANKMENT Brown silty sand with gravel.	
2580	2,582.8	4.8	3	2	4											
2575	2,577.8	9.8	2	2	3										2,579.8	7.8
2570	2,572.8	14.8	1	1	2										ALLUVIAL Gray-brown silty sand with trace of mica.	
2565	2,567.8	19.8	9	12	16										2,567.6	20.0
2560	2,562.8	24.8	4	3	5										ALLUVIAL Brown gravel with silty sand matrix.	
2555	2,557.8	29.8	4	5	8										2,563.6	24.0
2550	2,552.8	34.8	3	8	13										SAPROLITE Brown silty sand with trace of mica.	
2545	2,547.8	39.8	13	22	24											
2540	2,542.8	44.8	15	26	39											
2535	2,537.8	49.8	26	31	69/0.5										2,538.6	49.0
2530	2,532.8	54.8	11	14	20										WEATHERED ROCK Weathered rock of gneiss. SAPROLITE Brown silty sand with trace of mica.	
2525	2,527.8	59.8	11	11	31										2,536.3	51.3
2520	2,522.8	64.8	31	48	35											
2515	2,517.8	69.8													2,520.1	67.5
2510															WEATHERED ROCK Weathered rock of gneiss.	
															2,517.5	70.1
															Boring Terminated at Elevation 2,517.5 ft in weathered rock of gneiss.	

NCDOT BORE SINGLE BORE\_CORELOGS.GPJ NC\_DOT.GDT 11/20/09

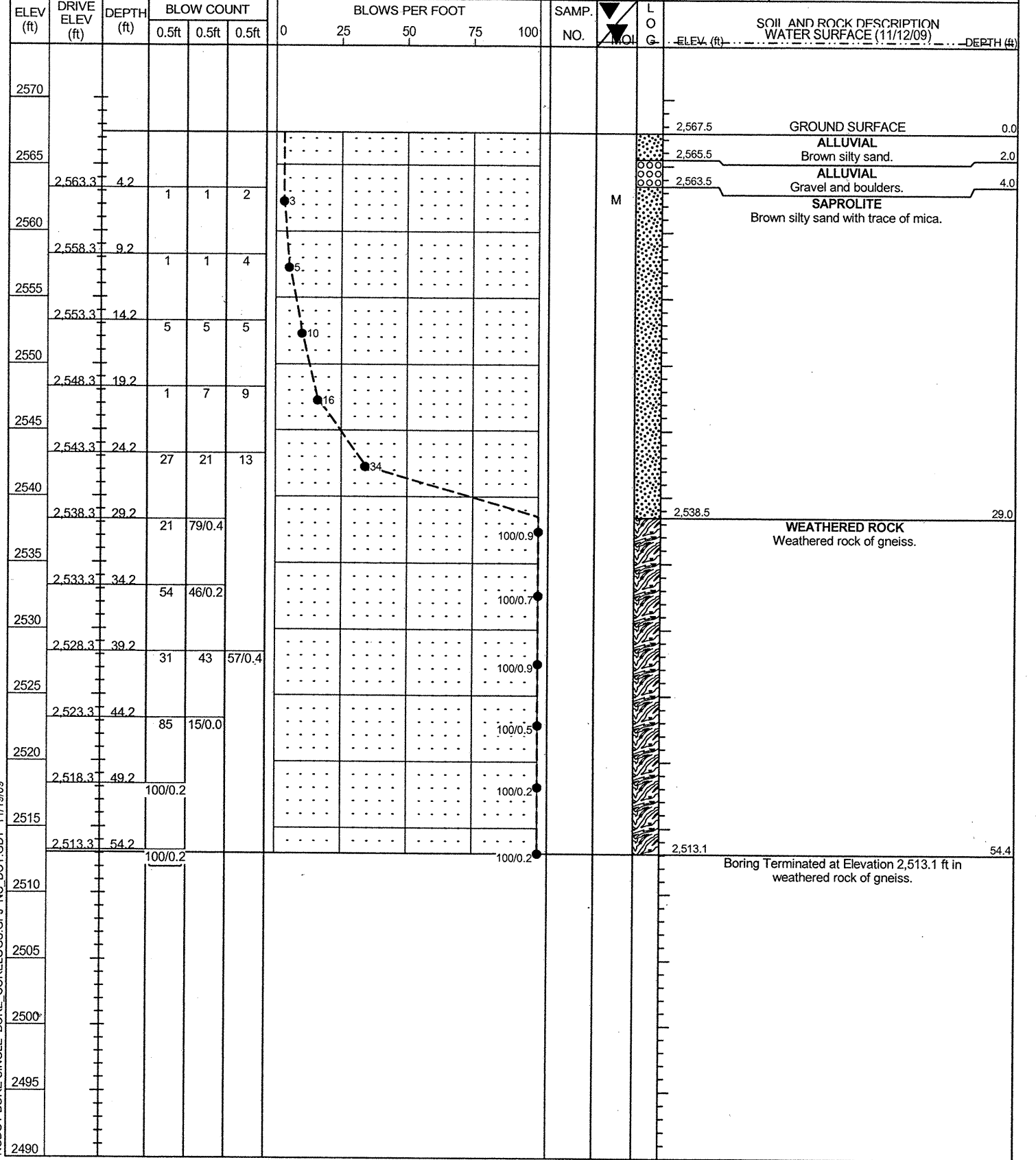
PROJECT NO. 33202.1.2	ID. B-3656	COUNTY Haywood	GEOLOGIST Hager, M. M.
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.			GROUND WTR (ft)
BORING NO. B1-A	STATION 17+20	OFFSET 2ft LT	ALIGNMENT -L-
COLLAR ELEV. 2,565.0 ft	TOTAL DEPTH 52.2 ft	NORTHING 670,546	EASTING 857,121
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ SPT	HAMMER TYPE Automatic	
START DATE 10/29/09	COMP. DATE 10/29/09	SURFACE WATER DEPTH 8.3ft	DEPTH TO ROCK N/A



NCDOT BORE SINGLE BORE CORELOGS.GPJ NC\_DOT.GDT 11/19/09

8/11

PROJECT NO. 33202.1.2	ID. B-3656	COUNTY Haywood	GEOLOGIST Hager, M. M.
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.			GROUND WTR (ft)
BORING NO. B1-B	STATION 17+17	OFFSET 17ft RT	ALIGNMENT -L-
COLLAR ELEV. 2,567.5 ft	TOTAL DEPTH 54.4 ft	NORTHING 670,527	EASTING 857,125
DRILL MACHINE CME-550	DRILL METHOD NW Casing w/ SPT	HAMMER TYPE Automatic	
START DATE 11/12/09	COMP. DATE 11/13/09	SURFACE WATER DEPTH 6.9ft	DEPTH TO ROCK N/A



NCDOT BORE SINGLE BORE CORELOGS.GPJ NC\_DOT.GDT 11/19/09



PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.									
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)								
BORING NO. B2-A		STATION 17+94		OFFSET 1ft LT		ALIGNMENT -L-									
COLLAR ELEV. 2,570.4 ft		TOTAL DEPTH 67.1 ft		NORTHING 670,569		EASTING 857,192									
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic											
START DATE 11/04/09		COMP. DATE 11/04/09		SURFACE WATER DEPTH 1.0ft		DEPTH TO ROCK 66.9 ft									
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					
2575															
2570															
2565	2,568.3	2.1	9	9	12										
2560	2,563.3	7.1	1	WOH	1										
2555	2,558.3	12.1	2	3	5										
2550	2,553.3	17.1	6	7	10										
2545	2,548.3	22.1	6	10	13										
2540	2,543.3	27.1	6	12	34										
2535	2,538.3	32.1	5	9	18										
2530	2,533.3	37.1	7	15	26										
2525	2,528.3	42.1	15	26	52										
2520	2,523.3	47.1	43	57/0.4											
2515	2,518.3	52.1	100/0.4												
2510	2,513.3	57.1	36	64/0.4											
2505	2,508.3	62.1	100/0.4												
2500	2,503.3	67.1	60/0.0												

NCDOT BORE SINGLE BORE CORELOGS.GPJ NC\_DOT.GDT 11/19/09

PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.									
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)								
BORING NO. B2-B		STATION 17+93		OFFSET 17ft RT		ALIGNMENT -L-									
COLLAR ELEV. 2,569.4 ft		TOTAL DEPTH 61.6 ft		NORTHING 670,551		EASTING 857,197									
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic											
START DATE 11/06/09		COMP. DATE 11/12/09		SURFACE WATER DEPTH 3.6ft		DEPTH TO ROCK 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					
2570															
2565	2,563.3	6.1	1	2	3										
2560	2,558.3	11.1	1	1	2										
2555	2,553.3	16.1	2	4	8										
2550	2,548.3	21.1	8	14	14										
2545	2,543.3	26.1	10	10	9										
2540	2,538.3	31.1	9	10	32										
2535	2,533.3	36.1	11	46	49										
2530	2,528.3	41.1	18	41	59/0.4										
2525	2,523.3	46.1	19	81/0.4											
2520	2,518.3	51.1	25	68	32/0.1										
2515	2,513.3	56.1	23	66	34/0.2										
2510	2,508.3	61.1	100/0.5												
2505															
2500															
2495															
2490															

NCDOT BORE SINGLE BORE CORELOGS.GPJ NC\_DOT.GDT 11/19/09

PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.									
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)								
BORING NO. EB2-A		STATION 18+74		OFFSET 14ft LT		ALIGNMENT -L-									
COLLAR ELEV. 2,587.4 ft		TOTAL DEPTH 60.1 ft		NORTHING 670,606		EASTING 857,264									
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic											
START DATE 10/22/09		COMP. DATE 10/22/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 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					
2590															
2585														2,587.4	GROUND SURFACE
														2,585.4	ARTIFICIAL FILL Brown sand and gravel with asphalt and concrete.
	2,582.5	4.9		2	1	2									ALLUVIAL Brown silty sand.
2580															
	2,577.5	9.9		1	2	2									
2575															
	2,572.5	14.9		1	2	3									
2570															
	2,567.5	19.9		16	18	13								2,569.8	ALLUVIAL Brown gravel and cobbles with sand.
2565															
	2,562.5	24.9		1	WOH	2								2,563.4	SAPROLITE Blue-gray silty sand with clay.
2560															
	2,557.5	29.9		2	6	5									
2555															
	2,552.5	34.9		2	3	8									
2550															
	2,547.5	39.9		3	7	11									
2545															
	2,542.5	44.9		10	14	17									
2540															
	2,537.5	49.9		13	28	28									
2535															
	2,532.5	54.9		77	23/0.1									2,535.1	WEATHERED ROCK Weathered rock of gneiss.
2530															
	2,527.5	59.9		100/0.2										2,527.3	Boring Terminated at Elevation 2,527.3 ft in weathered rock of gneiss.
2525															
2520															
2515															
2510															

PROJECT NO. 33202.1.2		ID. B-3656		COUNTY Haywood		GEOLOGIST Hager, M. M.									
SITE DESCRIPTION Bridge No. 419 On US-19/23/74 over Pigeon River.							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 18+88		OFFSET 53ft RT		ALIGNMENT -L-									
COLLAR ELEV. 2,586.7 ft		TOTAL DEPTH 65.5 ft		NORTHING 670,547		EASTING 857,298									
DRILL MACHINE CME-550		DRILL METHOD NW Casing w/ SPT		HAMMER TYPE Automatic											
START DATE 11/17/09		COMP. DATE 11/17/09		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 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					
2590															
2585														2,586.7	GROUND SURFACE
															ALLUVIAL Gray silty sand with petroleum odor and sheen.
2580															
	2,581.6	5.1		WOH	1	2									
2575															
	2,577.6	9.1		1	1	1									
2570															
	2,571.6	15.1		13	10	13								2,573.7	ALLUVIAL Gray to white gravel with silty sand matrix.
2565															
	2,566.6	20.1		4	5	4								2,567.3	SAPROLITE Brown silty sand with trace of mica.
2560															
	2,561.6	25.1		4	2	1									
2555															
	2,556.6	30.1		1	1	3									
2550															
	2,551.6	35.1		3	6	8									
2545															
	2,546.6	40.1		3	6	9									
2540															
	2,541.6	45.1		11	15	23									
2535															
	2,536.6	50.1		86	14/0.1									2,536.7	WEATHERED ROCK Weathered rock of gneiss.
2530															
	2,531.6	55.1		6	3	7								2,533.7	SAPROLITE Brown silty sand with trace of mica.
2525															
	2,526.6	60.1		22	68	32/0.1								2,529.6	WEATHERED ROCK Weathered rock of gneiss.
2520															
	2,521.6	65.1		100/0.4										2,528.7	WEATHERED ROCK Weathered rock of gneiss.
2515															
2510															

NCDOT BORE SINGLE BORE CORELOGS.GPJ NC DOT.GDT 11/19/09

NCDOT BORE SINGLE BORE CORELOGS.GPJ NC DOT.GDT 11/19/09



# FIELD SCOUR REPORT

WBS: 33202.1.2 TIP: B-3656 COUNTY: Haywood

DESCRIPTION(1): Bridge No. 419 on US-19/23/74 over Pigeon River

### EXISTING BRIDGE

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) \_\_\_\_\_

Bridge No.: 419 Length: 315 ft Total Bents: 5 Bents in Channel: 3 Bents in Floodplain: 2  
 Foundation Type: Concrete footings (on piles?)

#### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None noted.

Interior Bents: None noted.

Channel Bed: None noted.

Channel Bank: None noted.

#### EXISTING SCOUR PROTECTION

Type(3): Concrete endbent walls and wing-walls.

Extent(4): Wing-walls extend 10 ft beyond endbent wall at EB1; 25' beyond endbent wall at EB2.

Effectiveness(5): Good.

Obstructions(6): Large, timber debris piled up against Interior Bent 3.

#### INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

### DESIGN INFORMATION

Channel Bed Material(7): Silty sand with gravel and cobbles.

Channel Bank Material(8): Silty sand.

Channel Bank Cover(9): Trees and shrubs.

Floodplain Width(10): > 100ft.

Floodplain Cover(11): Grass with trees, parking lots and buildings.

Stream is(12): Aggrading \_\_\_\_\_ Degrading  Static \_\_\_\_\_

Channel Migration Tendency(13): East.

Observations and Other Comments: \_\_\_\_\_

Reported by: C A Dunnagan Date: 10/15/2009

#### DESIGN SCOUR ELEVATIONS(14)

Feet  Meters \_\_\_\_\_

#### BENTS

B1		B2									
2759	2759.5										

Comparison of DSE to Hydraulics Unit theoretical scour:

We agree with the Hydraulics Unit's theoretical scour as reported on 10/8/09. The endbents will not be affected by scour.

DSE determined by: C A Dunnagan Date: 11/17/2009

#### SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank											
Sample No.											
Retained #4											
Passed #10											
Passed #40											
Passed #200											
Coarse Sand											
Fine Sand											
Silt											
Clay											
LL											
PI											
AASHTO											
Station											
Offset											
Depth											