

PROJECT: 43684.3.1 ID: B-5551

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	43684.3.1 (B-5551)	1	11

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# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 43684.3.1 (B-5551) F.A. PROJ. BRSTP-0501(29)  
 COUNTY SCOTLAND  
 PROJECT DESCRIPTION BRIDGE NO. 18 OVER LEITH'S CREEK ON  
US 501

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) 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 ON-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, OR 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

E. HOWEY

M. BATTEN

B. FOWLER

A. FOWLER

M. SMITH

B. DANIEL

INVESTIGATED BY HDR, Inc.

CHECKED BY E. HOWEY

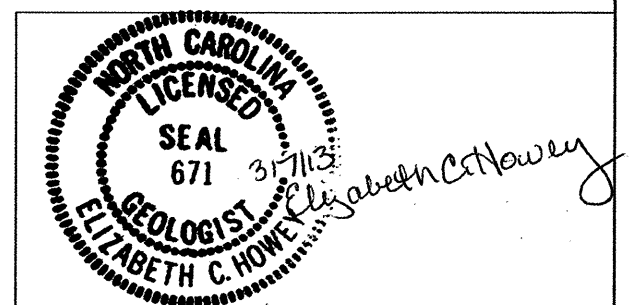
SUBMITTED BY HDR, Inc.

DATE 2/2013

DRAWN BY: M. BATTEN

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT 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.



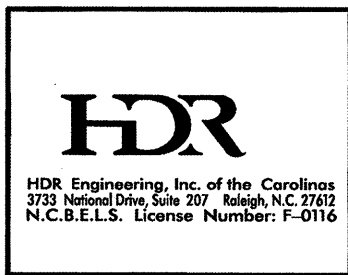
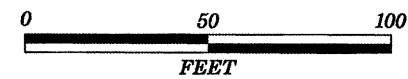
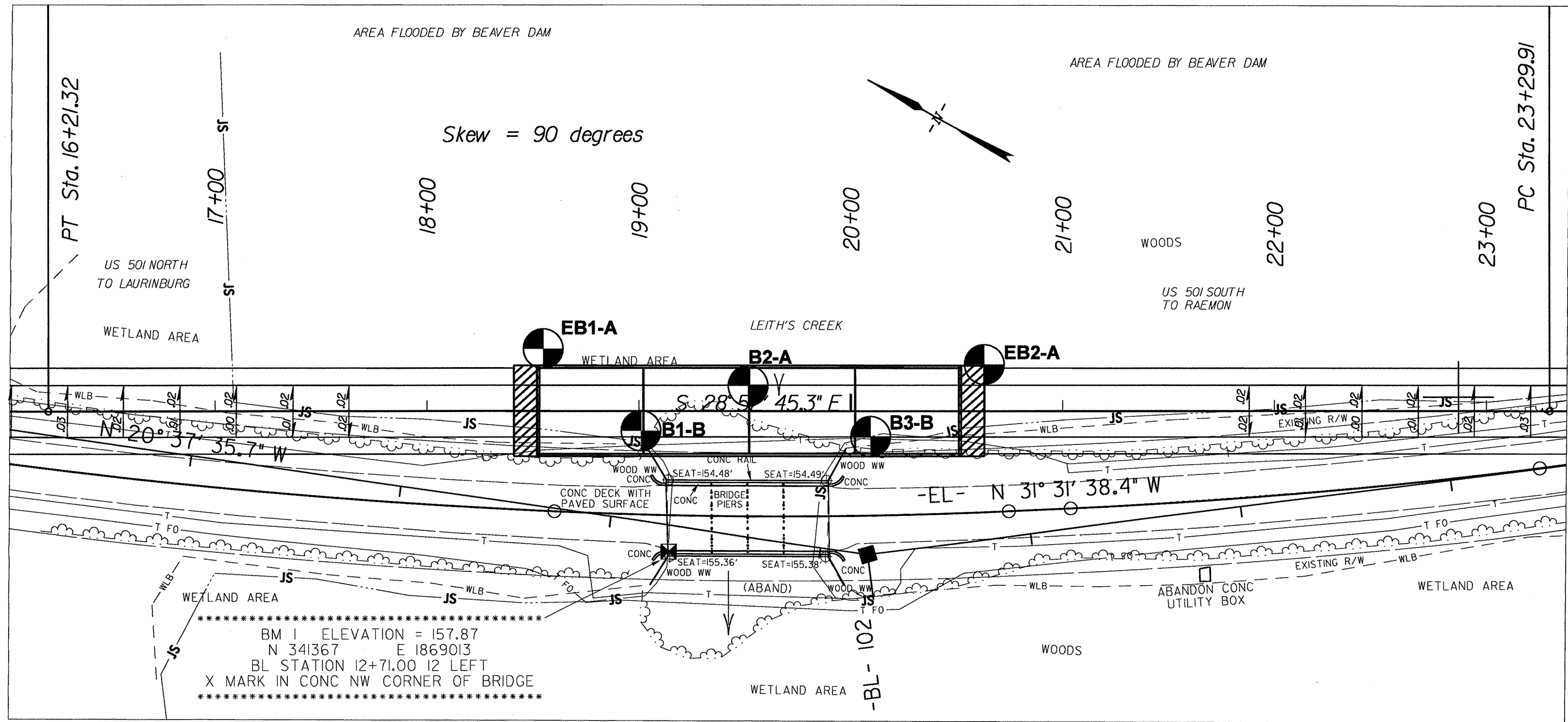
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
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PROJECT REFERENCE NO.	SHEET NO.
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**SUBSURFACE INVESTIGATION**

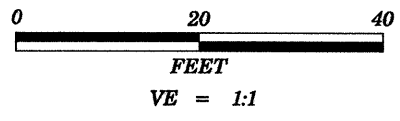
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

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 (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 LIVERS, HIGH 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 60 BLOWS PER FOOT IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED. CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, ONEISS, GABBRO, SCHIST, ETC. NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. COASTAL PLAIN SEDIMENTARY ROCK (CP) COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.		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 60 BLOWS PER FOOT. 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 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. 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. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF. 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.		SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50		FRESH VERY SLIGHT (V SL.) SLIGHT (SL.) MODERATE (MOD.) MODERATELY SEVERE (MOD. SEV.) SEVERE (SEV.) VERY SEVERE (V SEV.) COMPLETE			
<b>COMPRESSIONIBILITY</b>		<b>PERCENTAGE OF MATERIAL</b>		<b>GROUND WATER</b>							
GROUP CLASS. A-1-a, A-1-b, A-2, A-2-4, A-2-5, A-2-6, A-2-7, A-3, A-4, A-5, A-6, A-7		TRACE OF ORGANIC MATTER 2 - 3% LITTLE ORGANIC MATTER 3 - 5% MODERATELY ORGANIC 5 - 10% HIGHLY ORGANIC >10%		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							
<b>TEXTURE OR GRAIN SIZE</b>		<b>ABBREVIATIONS</b>		<b>ROCK HARDNESS</b>							
U.S. STD. SIEVE SIZE OPENING (MM) 4, 10, 40, 60, 200, 270		AR - AUGER REFUSAL, BT - BORING TERMINATED, CL - CLAY, CPT - CONE PENETRATION TEST, DMT - DILATOMETER TEST, DPT - DYNAMIC PENETRATION TEST, e - VOID RATIO, F - FINE, FOSS. - FOSSILIFEROUS, FRAC. - FRACTURED, FRACTURES, FRAGS. - FRAGMENTS, HI. - HIGHLY		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 FINGER NAIL.		DRILL UNITS: MOBILE B, BK-51, CME-45C, CME-550, PORTABLE HOIST, DIEDRICH D-25		FRACTURE SPACING TERM SPACING VERY WIDE MORE THAN 10 FEET, WIDE 3 TO 10 FEET, MODERATELY CLOSE 1 TO 3 FEET, CLOSE 0.16 TO 1 FEET, VERY CLOSE LESS THAN 0.16 FEET		BEDDING TERM THICKNESS VERY THICKLY BEDDED > 4 FEET, THICKLY BEDDED 1.5 - 4 FEET, THINLY BEDDED 0.16 - 1.5 FEET, VERY THINLY BEDDED 0.03 - 0.16 FEET, THICKLY LAMINATED 0.008 - 0.03 FEET, THINLY LAMINATED < 0.008 FEET	
<b>SOIL MOISTURE - CORRELATION OF TERMS</b>		<b>EQUIPMENT USED ON SUBJECT PROJECT</b>		<b>INDURATION</b>							
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION		ADVANCING TOOLS: 3-7/8" & 2-7/8" Dr. aug Bit, 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		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.		BENCH MARK: BM-1 - X MARK IN CONCRETE NORTHWEST CORNER OF BRIDGE ELEVATION: 157.87 FT.					
<b>PLASTICITY</b>		<b>INDURATION</b>									
NONPLASTIC 0-5, LOW PLASTICITY 6-15, MED. PLASTICITY 16-25, HIGH PLASTICITY 26 OR MORE											
<b>COLOR</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.											



### BORING LOCATION PLAN

<b>PROJECT REFERENCE NO.</b>		<b>COUNTY: Scotland</b>	
<b>WBS Element No. 43684.3.1</b>		<b>SITE DESCRIPTION: Bridge No. 18 (-L-) over Leith's Creek on US 501</b>	
<b>TIP No.: B-5551</b>			
<b>Drawn By:</b>	<b>M. Batten</b>	<b>2-4-13</b>	<b>FIGURE</b> <b>1</b>
<b>Checked By:</b>	<b>B. Howey</b>	<b>2-20-13</b>	

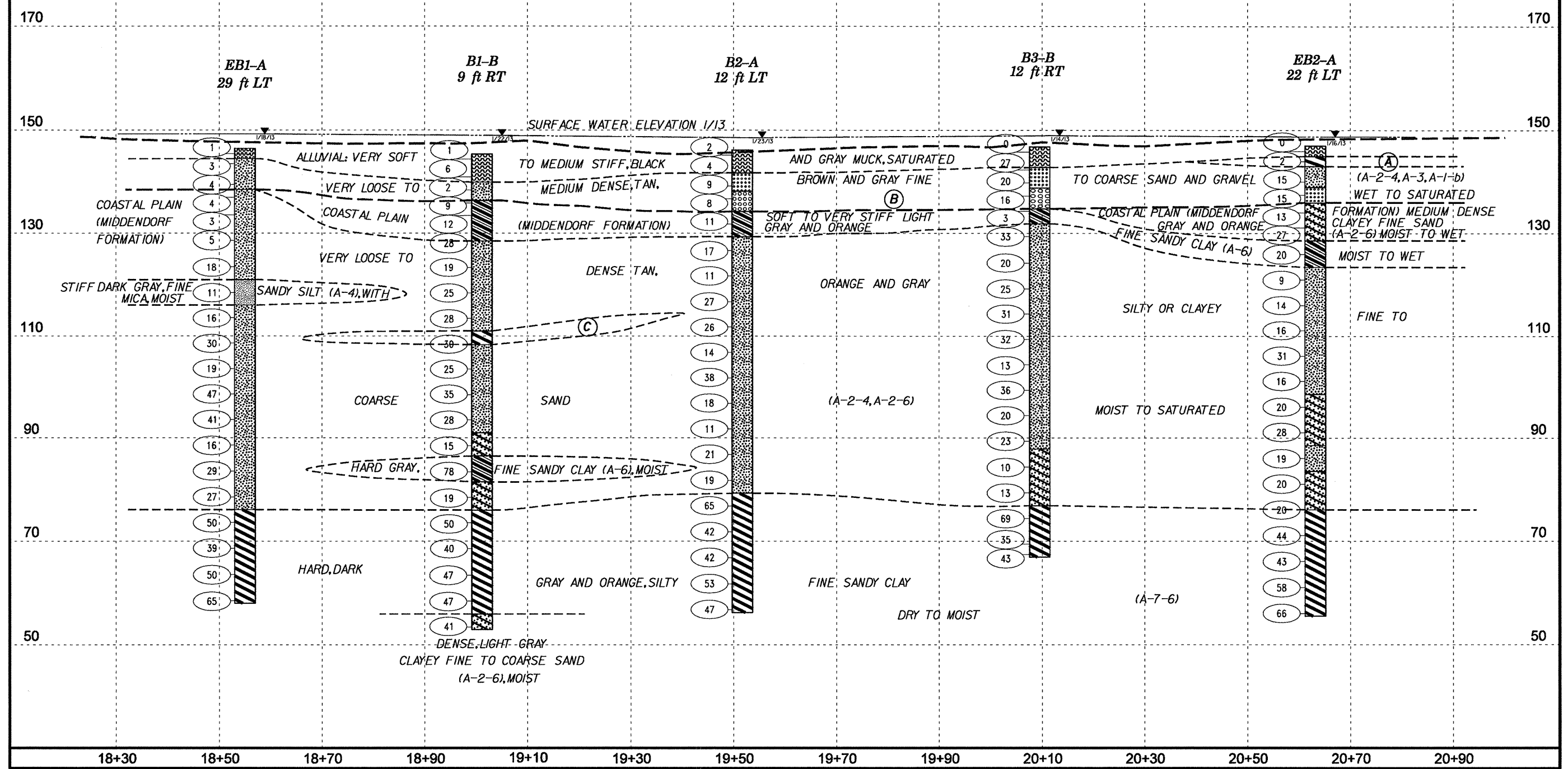


<b>PROJECT REFERENCE NO.</b>	<b>SHEET</b>
43684.3.1 (B-5551)	4
<b>BRIDGE NO. 18 OVER LEITH'S CREEK ON US 501</b>	

- (A) ALLUVIAL; SOFT DARK GRAY SILTY FINE SANDY CLAY (A-7-6) WITH ORGANICS, WET
- (B) ALLUVIAL; LOOSE TO MEDIUM DENSE TAN AND BROWN COARSE SAND AND GRAVEL (A-1-b)
- (C) COASTAL PLAIN (MIDDENDORF FORMATION); VERY STIFF DARK GRAY, SILTY FINE SANDY CLAY (A-7-6), WET

NOTES: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE GROUNDLINE SECTION AT THE PROPOSED PROFILE LOCATION OBTAINED FROM THE ROADWAY PLANS AS OF 2/12/13

BENT SKEW ANGLE = 90°







# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)									
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)								
BORING NO. B1-B		STATION 19+01		OFFSET 9 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 143.7 ft		TOTAL DEPTH 92.5 ft		NORTHING 341,405		EASTING 1,869,056									
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Fowler, B.		START DATE 01/22/13		COMP. DATE 01/22/13		SURFACE WATER DEPTH 3.5ft									
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					
145	143.7	0.0	1	WOH	1								W	GROUND SURFACE	0.0
140	140.2	3.5		WOH	4	2							W	ALLUVIAL Black and gray MUCK	
	137.7	6.0	1	1	1								W	Brown-gray, fine SAND (A-2-4), contains wood fragments	5.5
135	135.2	8.5	2	3	6								W	Gravel seam from 8.5'-9.0'	9.0
	132.7	11.0	3	5	7								M	COASTAL PLAIN Middendorf Formation: Light gray, fine sandy CLAY (A-6) (5), with some silt	
130	127.7	16.0	10	11	17								W		17.0
125	122.7	21.0	6	9	10								W	Gray, fine to coarse SAND (A-2-4), with clay seams	
120	117.7	26.0	7	9	16								W		
115	112.7	31.0	11	14	14								W		
110	107.7	36.0	9	13	17								W	Dark gray, silty fine sandy CLAY (A-7-6)	34.5
105	102.7	41.0	6	10	15								W	Gray to light gray, fine to coarse SAND (A-2-4), with clay seams	37.2
100	97.7	46.0	12	15	20								W		
95	92.7	51.0	12	14	14								W		
90	87.7	56.0	4	5	10								W	Gray, fine to coarse clayey SAND (A-2-6), contains wood fragments	54.5
85	82.7	61.0	10	28	50								M	Gray, fine sandy CLAY (A-6)	59.0
80	77.7	66.0	8	11	8								W	Gray, clayey fine to coarse SAND (A-2-6)	64.0
75	72.7	71.0	11	20	30								M		69.5
70	67.7	76.0	10	17	23								M	Dark gray to gray and orange, silty fine sandy CLAY (A-7-6)	

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)									
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)								
BORING NO. B1-B		STATION 19+01		OFFSET 9 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 143.7 ft		TOTAL DEPTH 92.5 ft		NORTHING 341,405		EASTING 1,869,056									
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Fowler, B.		START DATE 01/22/13		COMP. DATE 01/22/13		SURFACE WATER DEPTH 3.5ft									
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					
65	62.7	81.0	11	20	27								M	Dark gray to gray and orange, silty fine sandy CLAY (A-7-6) (continued)	
60	57.7	86.0	11	19	28								M		
55	52.7	91.0	14	20	21								M	Light gray, clayey fine to coarse SAND (A-2-6)	89.5
													M	Boring Terminated at Elevation 51.2 ft in COASTAL PLAIN: SAND (MIDDENDORF FORMATION)	92.5

NOTES:  
 1) Break in split spoon at 9.0' in depth.  
 2) Break in split spoon at 17.0' in depth.  
 3) Break in split spoon at 37.2' in depth.

NCDOT BORE DOUBLE B-5551\_GEO\_BRD0018\_GINTBORINGLOGS.GPJ\_NC\_DOT\_GDT\_3/14/13



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)												
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)											
BORING NO. B2-A		STATION 19+52		OFFSET 12 ft LT		ALIGNMENT -L-												
COLLAR ELEV. 144.5 ft		TOTAL DEPTH 90.0 ft		NORTHING 341,371		EASTING 1,869,098												
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012		DRILL METHOD Mud Rotary		HAMMER TYPE Automatic														
DRILLER Fowler, B.		START DATE 01/23/13		COMP. DATE 01/24/13		SURFACE WATER DEPTH 2.3ft												
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								
145	144.5	0.0	WOH	1	1										144.5	GROUND SURFACE	0.0	
140	141.0	3.5	1	WOH	4													
	138.5	6.0	1	3	6													
135	136.0	8.5	3	4	4													
	131.0	13.5	3	4	7													
130	126.0	18.5	2	6	11													
	121.0	23.5	4	5	6													
125	116.0	28.5	8	12	15													
	111.0	33.5	8	11	15													
120	106.0	38.5	4	6	8													
	101.0	43.5	11	17	21													
115	96.0	48.5	6	7	11													
	91.0	53.5	2	3	8													
110	86.0	58.5	8	9	12													
	81.0	63.5	6	8	11													
105	76.0	68.5	13	25	40													
	71.0	73.5	10	17	25													
100	66.0	78.5	11	17	25													

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)												
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)											
BORING NO. B2-A		STATION 19+52		OFFSET 12 ft LT		ALIGNMENT -L-												
COLLAR ELEV. 144.5 ft		TOTAL DEPTH 90.0 ft		NORTHING 341,371		EASTING 1,869,098												
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012		DRILL METHOD Mud Rotary		HAMMER TYPE Automatic														
DRILLER Fowler, B.		START DATE 01/23/13		COMP. DATE 01/24/13		SURFACE WATER DEPTH 2.3ft												
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								
65																		
60	61.0	83.5	12	21	32													
	56.0	88.5	13	19	28													
55																		

NCDOT BORE DOUBLE B-5551\_GEO\_BRD0018\_GINTBORINGLOGS.GPJ NC\_DOT\_GDT\_3/14/13

NOTES:  
1) Break in split spoon at 4.5' in depth.



# NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)									
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)								
BORING NO. B3-B		STATION 20+09		OFFSET 12 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 145.1 ft		TOTAL DEPTH 80.0 ft		NORTHING 341,309		EASTING 1,869,106									
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER Fowler, B.		START DATE 01/14/13		COMP. DATE 01/15/13		SURFACE WATER DEPTH 2.1ft									
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					
150															
145	145.1	0.0	WOH	WOH	WOH									GROUND SURFACE	0.0
140	141.6	3.5	1	12	15									ALLUVIAL Black MUCK	
	139.1	6.0	5	9	11									Tan and light to dark gray, fine to coarse SAND (A-3)	4.0
135	136.6	8.5	6	7	9									Tan and brown, coarse SAND and GRAVEL (A-1-b)	8.0
	133.6	11.5	1	WOH	3									COASTAL PLAIN Middendorf Formation:	12.0
130	128.6	16.5	6	19	14									Orange and light gray, fine sandy CLAY (A-6)	15.0
	123.6	21.5	4	8	12									Light gray to orange and tan, silty fine to coarse SAND (A-2-4)	
125	118.6	26.5	8	11	14										
120	113.6	31.5	9	14	17										
115	108.6	36.5	7	15	17									Dark gray with clay seams from 35'-40'	
110	103.6	41.5	4	5	8										
105	98.6	46.5	12	20	16										
100	93.6	51.5	9	9	11										
95	88.6	56.5	5	12	11										
90	83.6	61.5	5	4	6										
85	78.6	66.5	5	6	7										
80	73.6	71.5	14	28	41									Dark gray, silty fine sandy CLAY (A-7-6)	70.0

NCDOT BORE DOUBLE B-5551\_GEO\_BRD0018\_GINTBORINGLOGS.GPJ NC\_DOT\_GDT\_3/14/13

WBS 43684.3.1		TIP B-5551		COUNTY SCOTLAND		GEOLOGIST Batten, M. (Field Professional)									
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501							GROUND WTR (ft)								
BORING NO. B3-B		STATION 20+09		OFFSET 12 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 145.1 ft		TOTAL DEPTH 80.0 ft		NORTHING 341,309		EASTING 1,869,106									
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER Fowler, B.		START DATE 01/14/13		COMP. DATE 01/15/13		SURFACE WATER DEPTH 2.1ft									
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					
70															
	68.6	76.5	9	15	20									Sand seam from 76.5'-77.5'	
	66.6	78.5	14	18	25									Dark gray, silty fine sandy CLAY (A-7-6) (continued)	
														Sand seam from 78.5'-79.5'	80.0
														Boring Terminated at Elevation 65.1 ft in COASTAL PLAIN: CLAY (MIDDENDORF FORMATION)	

NOTES:  
 1) Break in split spoon at 4.0' in depth.  
 2) Break in split spoon at 77.5' in depth.  
 3) Break in split spoon at 79.5' in depth.





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 43684.3.1	TIP B-5551	COUNTY SCOTLAND	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501			GROUND WTR (ft)
BORING NO. EB2-A	STATION 20+63	OFFSET 22 ft LT	ALIGNMENT -L-
COLLAR ELEV. 145.3 ft	TOTAL DEPTH 91.5 ft	NORTHING 341,278	EASTING 1,869,161
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Fowler, B.	START DATE 01/16/13	COMP. DATE 01/18/13	SURFACE WATER DEPTH 1.7ft

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				
150														
145	145.3	0.0											GROUND SURFACE	0.0
	143.3	2.0	1	1	1							W	ALLUVIAL Black MUCK	2.0
	141.3	4.0										W	Dark gray, silty fine sandy CLAY (A-7-6), contains organics	4.0
	139.3	6.0	3	6	9							W	Gray, silty fine SAND (A-2-4)	
	136.8	8.5	3	6	9							Sat.	Light gray and tan, fine to coarse SAND (A-3)	8.0
	133.3	12.0	2	4	9							Sat.	COASTAL PLAIN Middendorf Formation: Gray to gray and orange, clayey fine SAND (A-2-6)	11.0
	130.3	15.0	12	11	16							M		
	125.3	20.0	6	8	12							W	Orange and gray, fine sandy CLAY (A-6)	18.5
	120.3	25.0	3	4	5							M	Orange and gray to tan and yellow, silty fine to coarse SAND (A-2-4)	23.5
	115.3	30.0	5	8	6							W		
	110.3	35.0	10	10	6							W		
	105.3	40.0	14	13	18							W		
	100.3	45.0	4	7	9							M		
	95.3	50.0	4	9	11							W	Orange and gray to dark gray, clayey fine to coarse SAND (A-2-6)	48.5
	90.3	55.0	10	11	17							W		
	85.3	60.0	5	7	12							W	Gray, silty fine to coarse SAND (A-2-4)	58.5
	80.3	65.0	10	9	11							W	Light gray, clayey fine to coarse SAND (A-2-6)	63.5
	75.3	70.0	5	6	14							W		
	70.3	75.0										M	Dark gray, silty fine sandy CLAY (A-7-6)	71.0

NCDOT BORE DOUBLE B-5551\_GEO\_BRD0018\_GINTBORINGLOGS.GPJ NC\_DOT\_GDT 3/14/13

WBS 43684.3.1	TIP B-5551	COUNTY SCOTLAND	GEOLOGIST Batten, M. (Field Professional)
SITE DESCRIPTION Bridge No. 18 over Leith's Creek on US 501			GROUND WTR (ft)
BORING NO. EB2-A	STATION 20+63	OFFSET 22 ft LT	ALIGNMENT -L-
COLLAR ELEV. 145.3 ft	TOTAL DEPTH 91.5 ft	NORTHING 341,278	EASTING 1,869,161
DRILL RIG/HAMMER EFF./DATE MAD25152 Diedrich D-25 75% 7/16/2012		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER Fowler, B.	START DATE 01/16/13	COMP. DATE 01/18/13	SURFACE WATER DEPTH 1.7ft

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				
70														
65	65.3	80.0	11	18	26							M	Dark gray, silty fine sandy CLAY (A-7-6) (continued)	
60	60.3	85.0	13	22	36							M		
55	55.3	90.0	15	27	39							M	Boring Terminated at Elevation 53.8 ft in COASTAL PLAIN: CLAY (MIDDENDORF FORMATION)	91.5

NOTES:  
 1) ST-1 (3.5'-5.5') obtained in this boring.  
 2) Break in split spoon at 71' in depth.

North Carolina Department of Transportation  
 Division of Highways  
 Materials and Test Unit  
 Soils Laboratory

T.I.P. ID NO.: B-5551  
 DESCRIPTION: Bridge No. 18 over Leith's Creek on US 501

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 43684.3.1  
 DATE SAMPLED: 1/16/13 - 1/23/13  
 SAMPLED FROM: -L-  
 SUBMITTED BY: EC Howey, LG, PE

COUNTY: Scotland  
 RECEIVED: 1/31/13  
 REPORTED: 2/13/13  
 BY: Geotechnics (129-0411)  
Brent Daniel (129-03-0411)  
Michael Smith (129-01-0411)

*Michael P. Smith*  
 TEST RESULTS

PROJ. SAMPLE NO.	SS-4	SS-5	SS-14	SS-2										
BORING NO.	EB1-A	EB1-A	EB1-A	B1-B										
Retained #4 Sieve %	0.0	0.0	0.0	0.0										
Passing #10 Sieve %	99.8	91.4	99.2	99.8										
Passing #40 Sieve %	90.9	33.8	89.6	99.3										
Passing #200 Sieve %	20.7	12.2	25.7	66.4										

SOIL MORTAR - 100%														
Coarse Sand Ret - #60 %	39.2	78.3	28.2	2.3										
Fine Sand Ret - #270 %	40.9	9.1	47.5	38.9										
Silt 0.053 - 0.010 mm %	2.6	1.2	6.2	25.8										
Clay < 0.010 mm %	17.3	11.4	18.1	33.0										
L.L.	25	23	33	27										
P.L.	NP	18	NP	16										
P.I.	NP	5	NP	11										
AASHTO Classification	A-2-4(0)	A-2-4(0)	A-2-4(0)	A-6(5)										
Station -L-	18+55	18+55	18+55	19+01										
Offset	29' LT	29' LT	29' LT	9' RT										
Depth (ft)	8.5	12.0	57.0	9.0										
to	10.0	13.5	58.5	10.0										
Moisture Content (%)	26.5	18.6	27.1	28.1										
Organic Content (%)														

NP=Not plastic  
 NT=Not tested  
 ND = Not Determined

EC Howey, LG, PE  
 Soils Engineer

