

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 38500.1.1 (B-4726) F.A. PROJ. BRZ-1723(7)  
COUNTY CASWELL  
PROJECT DESCRIPTION BRIDGE NO. 5 OVER PANTHER BRANCH  
CREEK ON SR 1723 (JOHN OAKLEY RD.) AT -L- STATION 21+18

**INVENTORY**

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**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.

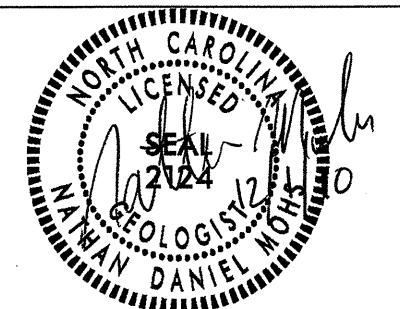
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND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

**PROJECT: 38500.1.1 ID: B-4726**

PERSONNEL  
J.I. MILKOVITS, JR.  
J.R. MATULA  
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N.D. MOHS

INVESTIGATED BY N.D. MOHS  
CHECKED BY N.T. ROBERSON  
SUBMITTED BY N.T. ROBERSON  
DATE DECEMBER 2010



DRAWN BY: T.T. WALKER

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.

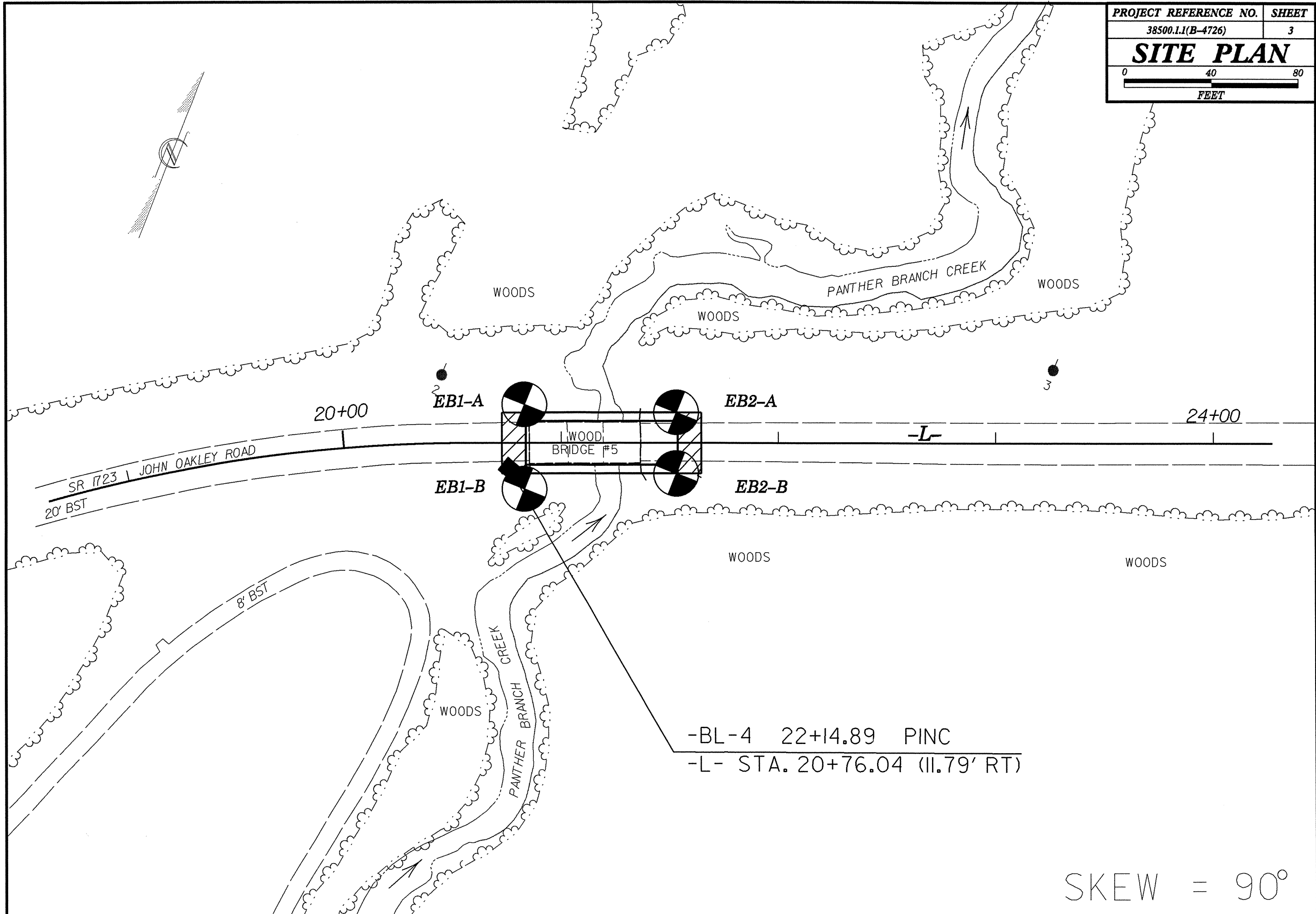
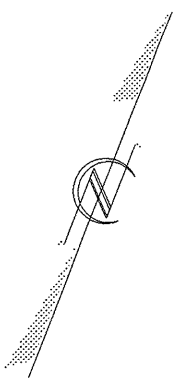
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**

PROJECT REFERENCE NO. 38500.11 (B-4726)	SHEET NO. 2
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**SUBSURFACE INVESTIGATION**

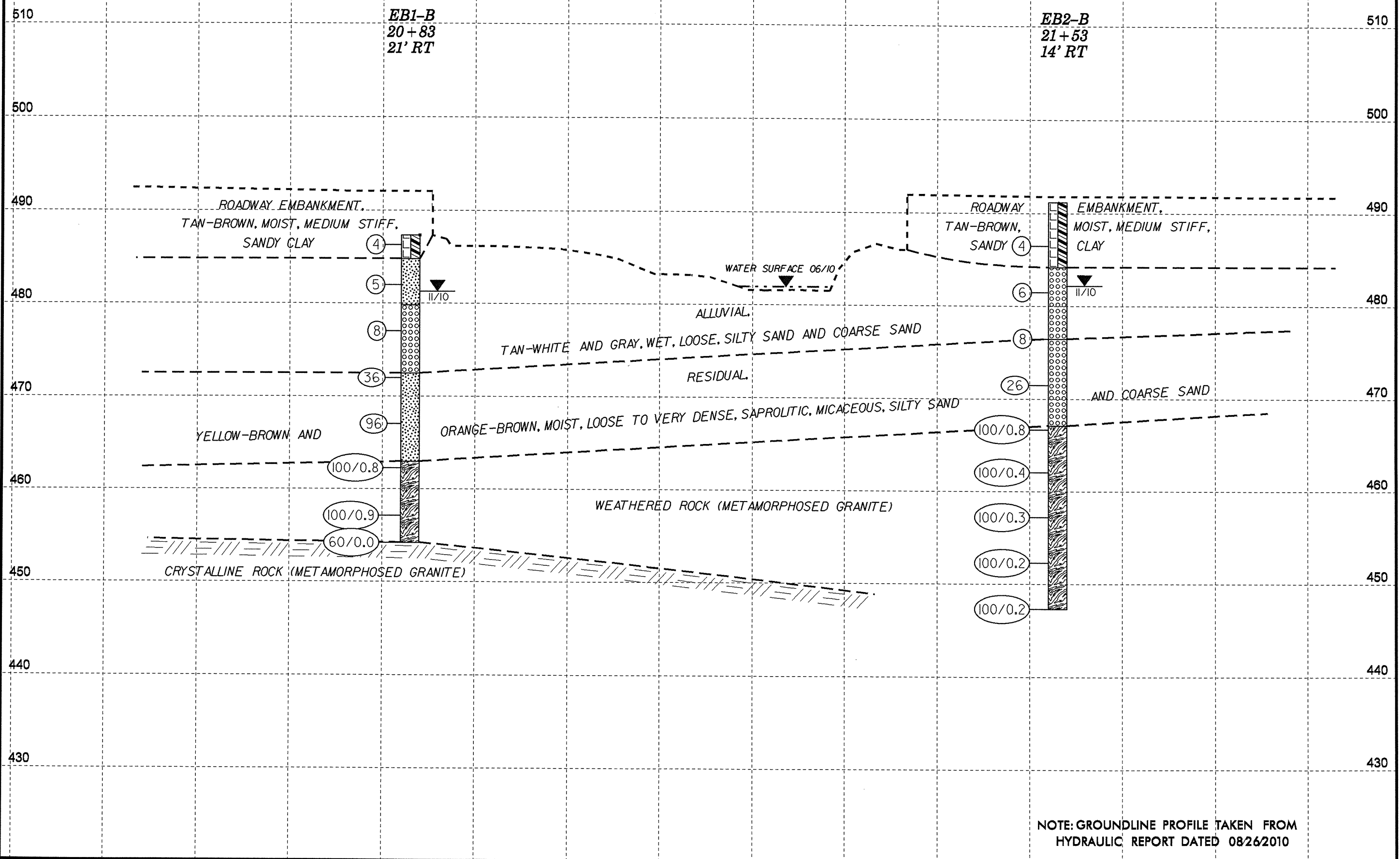
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																																																																																																																				
<p>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:</p> <p style="text-align: center;"><i>VERY STIFF, DARK, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-5</i></p>	<p><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. <b>UNIFORM</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)</p> <p><b>GAP-GRADED</b> - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p style="text-align: center;"><b>ANGULARITY OF GRAINS</b></p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: <b>ANGULAR</b>, <b>SUBANGULAR</b>, <b>SUBROUNDED</b>, OR <b>ROUNDED</b>.</p>	<p><b>HARD ROCK</b> IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> <p><b>WEATHERED ROCK (WR)</b> - NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p> <p><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.</p> <p><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.</p> <p><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.</p>	<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p><b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.</p> <p><b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p><b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.</p> <p><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.</p> <p><b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p><b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p><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.</p> <p><b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p><b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p><b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p><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.</p> <p><b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p><b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p><b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p><b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p><b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p><b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p><b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p><b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p><b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p><b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p><b>ROCK QUALITY DESIGNATION (RQD)</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.</p> <p><b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p><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.</p> <p><b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p><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.</p> <p><b>STRATA CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p><b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p><b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																																																																				
<p style="text-align: center;"><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="7">GRANULAR MATERIALS (&lt;= 35% PASSING #200)</th> <th colspan="7">SILT-CLAY MATERIALS (&gt; 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> </tr> <tr> <td>GROUP CLASS.</td> <td>A-1-a</td> <td>A-1-b</td> <td>A-2-4</td> <td>A-2-5</td> <td>A-2-6</td> <td>A-2-7</td> <td>A-7-8</td> <td>A-7-8</td> <td>A-7-8</td> <td>A-7-8</td> <td>A-1, A-2</td> <td>A-4, A-5</td> <td>A-6, A-7</td> <td>A-1, A-2</td> <td>A-4, A-5</td> <td>A-6, A-7</td> </tr> <tr> <td>SYMBOL</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>% PASSING</td> <td>50</td> <td>30</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>6</td> <td>NP</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> <td>40</td> <td>41</td> </tr> <tr> <td>PLASTIC INDEX</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>	GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)							ORGANIC MATERIALS			A-1	A-3	A-2	A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7	GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-7-8	A-7-8	A-7-8	A-7-8	A-1, A-2	A-4, A-5	A-6, A-7	A-1, A-2	A-4, A-5	A-6, A-7	SYMBOL																	% PASSING	50	30	10	10	10	10	10	10	10	10	10	10	10	10	10	10	LIQUID LIMIT	6	NP	40	41	40	41	40	41	40	41	40	41	40	41	40	41	PLASTIC INDEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	GROUP INDEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<p style="text-align: center;"><b>MINERALOGICAL COMPOSITION</b></p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p style="text-align: center;"><b>COMPRESSIBILITY</b></p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31          MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50          HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p style="text-align: center;"><b>PERCENTAGE OF MATERIAL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>&gt;10%</td> <td>&gt;20%</td> <td>HIGHLY</td> </tr> <tr> <td></td> <td></td> <td></td> <td>35% AND ABOVE</td> </tr> </table> <p style="text-align: center;"><b>GROUND WATER</b></p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p> <p style="text-align: center;"><b>MISCELLANEOUS SYMBOLS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table>	ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	HIGHLY ORGANIC	>10%	>20%	HIGHLY				35% AND ABOVE																									<p style="text-align: center;"><b>CONSISTENCY OR DENSENESS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>PRIMARY SOIL TYPE</th> <th>COMPACTNESS OR CONSISTENCY</th> <th>RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)</th> <th>RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT<sup>2</sup>)</th> </tr> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESIVE)</td> <td>VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE</td> <td>&lt;4 4 TO 10 10 TO 30 30 TO 50 &gt;50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD</td> <td>&lt;2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 &gt;30</td> <td>&lt;0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 &gt;4</td> </tr> </table> <p style="text-align: center;"><b>TEXTURE OR GRAIN SIZE</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>U.S. STD. SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.00</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CSE, SD.)</th> <th>FINE SAND (F SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td>GRAIN SIZE MM 305</td> <td>75</td> <td>2.0</td> <td>0.25</td> <td>0.05</td> <td>0.005</td> <td></td> </tr> <tr> <td>IN. 12</td> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p style="text-align: center;"><b>SOIL MOISTURE - CORRELATION OF TERMS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td>LL - LIQUID LIMIT</td> <td>- SATURATED - (SAT.)</td> <td>USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PL - PLASTIC LIMIT</td> <td>- WET - (W)</td> <td>SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td>OM - OPTIMUM MOISTURE</td> <td>- MOIST - (M)</td> <td>SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td>SL - SHRINKAGE LIMIT</td> <td>- DRY - (D)</td> <td>REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> </table> <p style="text-align: center;"><b>PLASTICITY</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NONPLASTIC</th> <th>PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> <tr> <td>LOW PLASTICITY</td> <td>0-5</td> <td>VERY LOW</td> </tr> <tr> <td>MED. 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EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.																																																																																																																																																																																																																																																																						
<p style="text-align: right;">BENCH MARK: BL-4, STA. 20+76.04, IL79' RT</p> <p style="text-align: right;">ELEVATION: 491.53 FT.</p> <p>NOTES:</p>																																																																																																																																																																																																																																																																							



-BL-4 22+14.89 PINC  
 -L- STA. 20+76.04 (11.79' RT)

SKEW = 90°



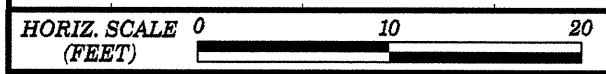
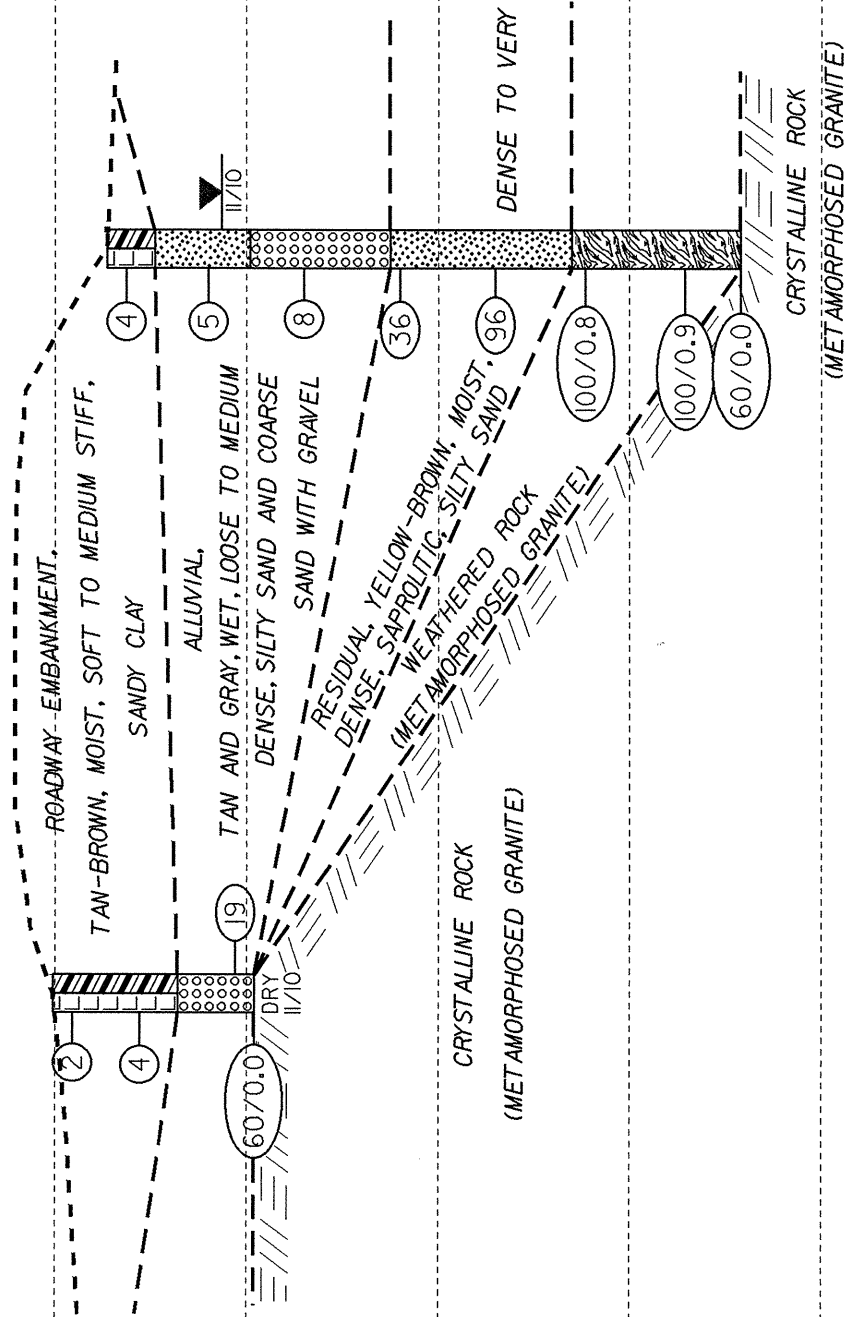
NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC REPORT DATED 08/26/2010

510  
500  
490  
480  
470  
460  
450

**EB1-B**  
20+83  
21' RT

**EB1-A**  
20+83  
18' LT

510  
500  
490  
480  
470  
460  
450



VE = 1:1

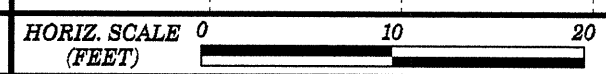
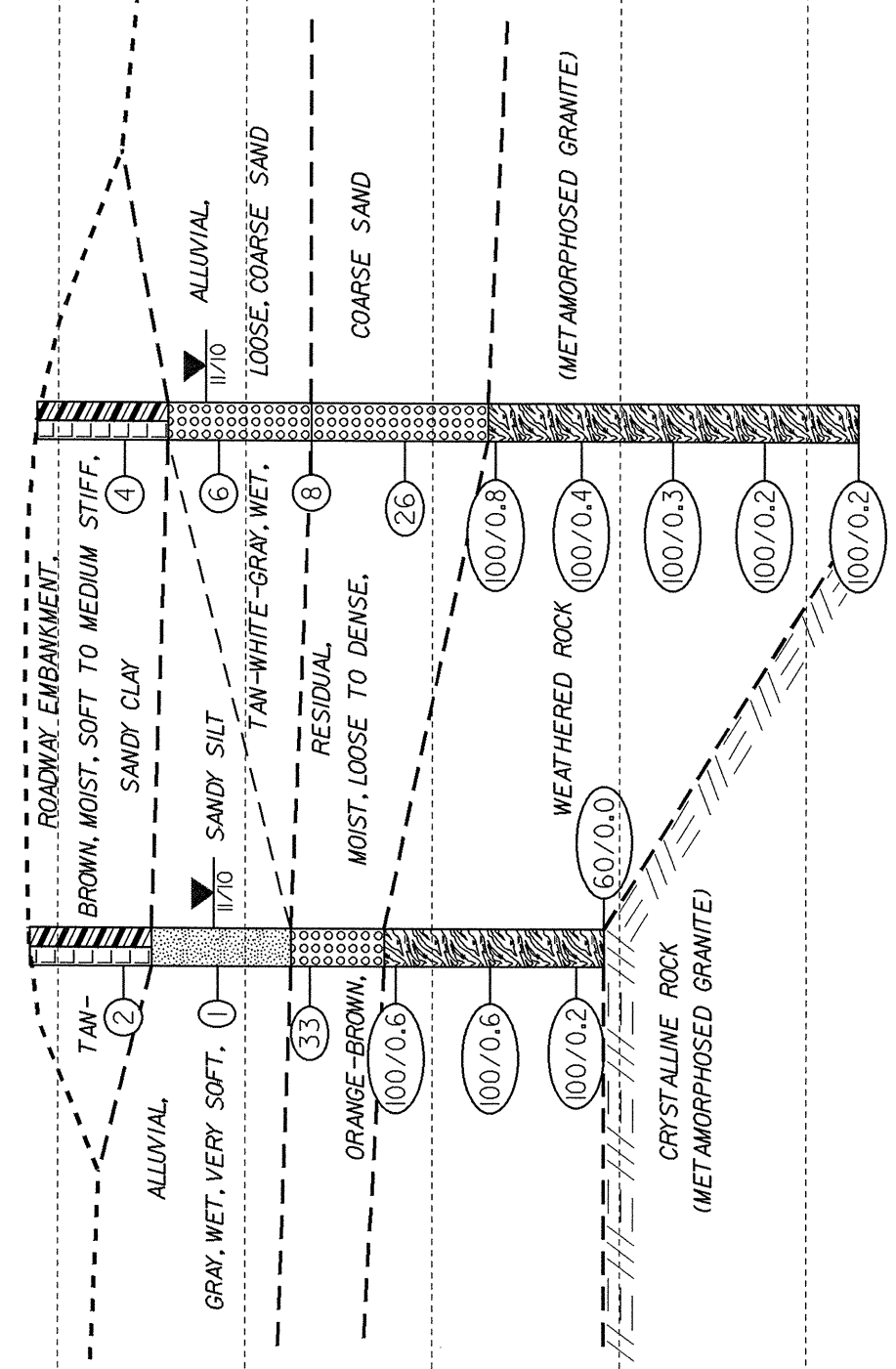
CROSS SECTION THROUGH END BENT 1

510  
500  
490  
480  
470  
460  
450

**EB2-B**  
21+53  
14' RT

**EB2-A**  
21+53  
14' LT

510  
500  
490  
480  
470  
460  
450  
440



VE = 1:1

CROSS SECTION THROUGH END BENT 2



**NCDOT GEOTECHNICAL ENGINEERING UNIT**  
**BORELOG REPORT**

WBS 38500.1.1	TIP B-4726	COUNTY CASWELL	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE NO. 5 OVER PANTHER BRANCH CREEK ON SR 1723 (JOHN OAKLEY RD.) AT -L- STA. 21+18			GROUND WTR (ft)
BORING NO. EB1-A	STATION 20+83	OFFSET 18 ft LT	ALIGNMENT -L-
COLLAR ELEV. 490.1 ft	TOTAL DEPTH 10.5 ft	NORTHING 939,762	EASTING 1,938,522
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 11/09/10	COMP. DATE 11/09/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
495																
490	490.1	0.0													490.1	GROUND SURFACE
485	486.6	3.5	1	2	2										483.6	ROADWAY EMBANKMENT TAN-BROWN, SANDY CLAY
480	481.6	8.5	5	6	13										479.6	ALLUVIAL GRAY, COARSE SAND
475	479.6	10.5													479.6	Boring Terminated with Standard Penetration Test Refusal at Elevation 479.6 ft on CRYSTALLINE ROCK (METAMORPHOSED GRANITE)

WBS 38500.1.1	TIP B-4726	COUNTY CASWELL	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE NO. 5 OVER PANTHER BRANCH CREEK ON SR 1723 (JOHN OAKLEY RD.) AT -L- STA. 21+18			GROUND WTR (ft)
BORING NO. EB1-B	STATION 20+83	OFFSET 21 ft RT	ALIGNMENT -L-
COLLAR ELEV. 487.3 ft	TOTAL DEPTH 33.1 ft	NORTHING 939,726	EASTING 1,938,537
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 11/08/10	COMP. DATE 11/08/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
495																
490	487.3	0.0													487.3	GROUND SURFACE
485	483.0	4.3	1	2	2										484.8	ROADWAY EMBANKMENT TAN-BROWN, SANDY CLAY
480	483.0	4.3	2	2	3										479.8	ALLUVIAL TAN, SILTY SAND
475	478.0	9.3	4	4	4										472.5	GRAY, COARSE SAND
470	473.0	14.3	9	15	21										472.5	RESIDUAL YELLOW-BROWN, MICACEOUS, SAPROLITIC, SILTY SAND
465	468.0	19.3	19	32	64										463.0	WEATHERED ROCK (METAMORPHOSED GRANITE)
460	463.0	24.3	40	60/0.3											454.2	Boring Terminated with Standard Penetration Test Refusal at Elevation 454.2 ft on CRYSTALLINE ROCK (METAMORPHOSED GRANITE)
455	458.0	29.3	59	41/0.4											454.2	
450	454.2	33.1													454.2	

NCDOT BORE DOUBLE B4726 GEO. BH. GPJ NC. DOT. GDT. 12/1/10



WBS 38500.1.1	TIP B-4726	COUNTY CASWELL	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE NO. 5 OVER PANTHER BRANCH CREEK ON SR 1723 (JOHN OAKLEY RD.) AT -L- STA. 21+18			GROUND WTR (ft)
BORING NO. EB2-A	STATION 21+53	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 491.5 ft	TOTAL DEPTH 30.7 ft	NORTHING 939,785	EASTING 1,938,588
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 11/09/10	COMP. DATE 11/09/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
495														
490													GROUND SURFACE ROADWAY EMBANKMENT TAN-BROWN, SANDY CLAY	0.0
485	487.5	4.0	2	1	1							M		
480	482.5	9.0	0	0	1						SS-6	W	ALLUVIAL GRAY, SANDY SILT	6.5
475	477.5	14.0	12	17	16						SS-7	M	RESIDUAL ORANGE-BROWN, COARSE SAND	14.0
470	472.5	19.0	73	27/0.1									WEATHERED ROCK (METAMORPHOSED GRANITE)	19.0
465	467.5	24.0	25	75/0.1										
460	462.5	29.0	100/0.2											
460	460.8	30.7	60/0.0										Boring Terminated with Standard Penetration Test Refusal at Elevation 460.8 ft on CRYSTALLINE ROCK (METAMORPHOSED GRANITE)	30.7
455														
450														
445														
440														
435														
430														
425														
420														
415														

WBS 38500.1.1	TIP B-4726	COUNTY CASWELL	GEOLOGIST Milkovits, J. I.
SITE DESCRIPTION BRIDGE NO. 5 OVER PANTHER BRANCH CREEK ON SR 1723 (JOHN OAKLEY RD.) AT -L- STA. 21+18			GROUND WTR (ft)
BORING NO. EB2-B	STATION 21+53	OFFSET 14 ft RT	ALIGNMENT -L-
COLLAR ELEV. 491.2 ft	TOTAL DEPTH 43.9 ft	NORTHING 939,759	EASTING 1,938,599
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Dixon, D. W.	START DATE 11/09/10	COMP. DATE 11/09/10	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
495														
490													GROUND SURFACE ROADWAY EMBANKMENT TAN-BROWN, SANDY CLAY	0.0
485	487.5	3.7	3	2	2							M		
480	482.5	8.7	2	3	3						SS-8	W	ALLUVIAL TAN-WHITE-GRAY, COARSE SAND	7.0
475	477.5	13.7	3	3	5							M	RESIDUAL ORANGE-BROWN, COARSE SAND	14.7
470	472.5	18.7	8	10	16							M	RESIDUAL ORANGE-BROWN, COARSE SAND	14.7
465	467.5	23.7	18	82/0.3									WEATHERED ROCK (METAMORPHOSED GRANITE)	24.1
460	462.5	28.7	100/0.4											
460	457.5	33.7	100/0.3											
455	452.5	38.7	100/0.2											
450	447.5	43.7	100/0.2											
445													Boring Terminated at Elevation 447.3 ft in WEATHERED ROCK (METAMORPHOSED GRANITE)	43.9
440														
435														
430														
425														
420														
415														

NCDOT BORE DOUBLE B4726 GEO\_BH.GPJ NC\_DOT.GDT 12/11/10

**EB1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-5	18'LT	20+83	0.0-1.5	A-6(4)	33	11	26.7	20.0	27.1	26.3	95	78	55	-	-

**EB1-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	21' RT	20+83	0.0-1.5	A-6(9)	36	12	12.3	13.3	40.0	34.3	99	90	76	-	-
SS-2	21' RT	20+83	4.3-5.8	A-2-4(0)	24	NP	58.2	28.3	7.5	6.1	99	68	16	-	-
SS-3	21' RT	20+83	9.3-10.8	A-1-b(0)	22	NP	73.8	15.7	6.5	4.0	82	32	10	-	-
SS-4	21' RT	20+83	14.8-15.8	A-2-4(0)	27	NP	58.2	28.1	10.7	3.0	94	56	17	-	-

**EB2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6	14'LT	21+53	9.0-10.5	A-4(0)	23	4	7.7	39.0	33.1	20.2	100	99	60	-	-
SS-7	14'LT	21+53	14.0-15.5	A-1-b(0)	24	NP	57.3	26.8	11.9	4.0	77	45	15	-	-

**EB2-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-8	14'RT	21+53	8.7-10.2	A-1-b(0)	26	NP	72.1	21.2	4.6	2.0	94	43	8	-	-





## FIELD SCOUR REPORT

WBS: 38500.1.1 TIP: B-4726 COUNTY: Caswell

DESCRIPTION(1): Bridge No. 5 over Panther Branch Creek on SR 1723 (John Oakley Rd.) at -L- Station 21+18

### EXISTING BRIDGE

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

Bridge No.: 5 Length: 52' Total Bents: 4 Bents in Channel: 1 Bents in Floodplain: 3  
 Foundation Type: Timber piles and timber piles on footings

#### EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None

Interior Bents: local scouring around Bent 2 (1.0')

Channel Bed: None

Channel Bank: Steep banks have been eroded during high water

#### EXISTING SCOUR PROTECTION

Type(3): Timber abutment walls with wing walls

Extent(4): Wing walls: 9 +/- feet at each end of the bridge

Effectiveness(5): Effective

Obstructions(6): Boulders in the creek on the north side of bridge

#### 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): Alluvial, tan-white-gray, loose, coarse sand (SS-3,SS-8)

Channel Bank Material(8): Alluvial, tan, loose, silty sand (SS-2), Gray, very soft, sandy silt (SS-6)

Channel Bank Cover(9): Grass, trees and shrubs

Floodplain Width(10): 100'-200'

Floodplain Cover(11): Grass, trees and shrubs

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

Channel Migration Tendency(13): Northwest toward Bent 2

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

#### DESIGN SCOUR ELEVATIONS(14)

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

#### BENTS

EB1	EB2								
473.2'	473.2'								

Comparison of DSE to Hydraulics Unit theoretical scour:  
GASE agrees with the scour elevation indicated on the Hydraulic's Report dated August 27, 2010.

#### 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									

See Sheet 8,  
 "Soil Test Results",  
 for samples:  
 SS-2  
 SS-3  
 SS-6  
 SS-8

Reported by: *Ruth M. S.* Date: 11/2/2010

# SITE PHOTOGRAPH

Bridge No. 5 over Panther Branch Creek on SR 1723 (John Oakley Rd.) at -L- Station 21+18



Looking Northeast towards End Bent 2