

PROJECT 33485.1.1 ID: B-4132

# STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

## STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33485.1.1 I.D. NO. B-4132  
F.A. PROJECT BRSTP-561 (11)  
COUNTY HALIFAX  
PROJECT DESCRIPTION BRIDGE NO. 97  
ON NC 561 OVER LOOKING GLASS  
SWAMP AT -L- STATION 16+47.5

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3	STRUCTURE INVENTORY REPORT
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33485.1.1 (B-4132)	1	9
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
33485.1.1	BRSTP-41 GD	P.E. CONST.	

### CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS 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, 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.

INVESTIGATED BY J.L. STONE PERSONNEL T.L.B.  
 CHECKED BY D.N. ARGENBRIGHT J.R.S.  
 SUBMITTED BY D.N. ARGENBRIGHT R.E.S.  
 DATE AUGUST 2006 T.J.W.  
L.W.D.  
E.L.D.

DRAWN BY: G.M. KENT

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 UNIT

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4132	33485.1.1	2	9

## 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 WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND 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, GRAY SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HEAVY PLASTIC, A-7-6</i></p>	<p><b>WELL GRADED:</b> 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)</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 ARE DESIGNATED BY THE TERMS: <u>ANGULAR</u>, <u>SUBANGULAR</u>, <u>SUBROUNDED</u>, OR <u>ROUNDED</u>.</p>	<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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 YIELDS SPT N VALUES &gt; 100 BLOWS PER FOOT.</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 PHYLITE, 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 WHICH 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 IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.</p> <p><b>CALCAREOUS (CALC.)</b> - SOILS WHICH 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 (F.P.)</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 SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p><b>ROCK QUALITY DESIGNATION (R.Q.D.)</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 WHICH 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, WHICH 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 B.P.F. 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 LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.</p> <p><b>STRATA CORE RECOVERY (SREC.)</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 (S.R.Q.D.)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p><b>TOPSOIL (T.S.)</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="4">GRANULAR MATERIALS (&gt;85% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (&gt;85% PASSING #200)</th> <th colspan="4">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></th> <th></th> <th></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-7-5</td> <td>A-7-6</td> <td>A-3</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>SYMBOL</td> <td></td> </tr> <tr> <td>% PASSING</td> <td>50 MX</td> <td>30 MX50 MX51 MN</td> <td>35 MX35 MX35 MX35</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td>MUCK, PEAT</td> <td></td> </tr> <tr> <td>LIQUID LIMIT</td> <td>6 MX</td> <td>N.P.</td> <td>40 MX41 MN</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>HIGHLY ORGANIC SOILS</td> <td></td> <td></td> </tr> <tr> <td>PLASTIC INDEX</td> <td></td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td></td> <td></td> <td></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></td> <td></td> <td></td> <td></td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS</td> <td>CLAYEY SOILS</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p style="text-align: center;">P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 &gt; L.L. - 30</p>	GENERAL CLASS.	GRANULAR MATERIALS (>85% PASSING #200)				SILT-CLAY MATERIALS (>85% 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				GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-7-5	A-7-6	A-3					SYMBOL														% PASSING	50 MX	30 MX50 MX51 MN	35 MX35 MX35 MX35	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT		LIQUID LIMIT	6 MX	N.P.	40 MX41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC SOILS			PLASTIC INDEX			0	0	0	0	0	0	0					GROUP INDEX	0	0	0	0	0	0	0	0	0					USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	CLAYEY SOILS									GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD			FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE					<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 30 MODERATELY COMPRESSIBLE      LIQUID LIMIT 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 SEEPAGE</p>	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>WEATHERING</b></p> <p><b>FRESH</b> - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p><b>VERY SLIGHT (V. SL.)</b> - 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.</p> <p><b>SLIGHT (SL.)</b> - 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.</p> <p><b>MODERATE (MOD.)</b> - 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.</p> <p><b>MODERATELY SEVERE (MOD. SEV.)</b> - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p> <p><b>SEVERE (SEV.)</b> - ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT, SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF</i></p> <p><b>VERY SEVERE (V. SEV.)</b> - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF</i></p> <p><b>COMPLETE</b> - 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.</p>	<p style="text-align: center;"><b>MISCELLANEOUS SYMBOLS</b></p> <p> ROADWAY EMBANKMENT WITH SOIL DESCRIPTION</p> <p> SOIL SYMBOL</p> <p> ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS</p> <p> INFERRED SOIL BOUNDARIES</p> <p> INFERRED ROCK LINE</p> <p> ALLUVIAL SOIL BOUNDARY</p> <p> DIP/DIP DIRECTION OF ROCK STRUCTURES</p> <p> SOUNDING ROD</p> <p> SPT TEST BORING</p> <p> AUGER BORING</p> <p> CORE BORING</p> <p> MONITORING WELL</p> <p> PIEZOMETER INSTALLATION</p> <p> SLOPE INDICATOR INSTALLATION</p> <p> SPT N-VALUE</p> <p> SPT REFUSAL</p> <p> SAMPLE DESIGNATIONS</p> <p><b>S</b> - BULK SAMPLE <b>SS</b> - SPLIT SPOON SAMPLE <b>ST</b> - SHELBY TUBE SAMPLE <b>RS</b> - ROCK SAMPLE <b>RT</b> - RECOMPACTED TRIAXIAL SAMPLE <b>CBR</b> - CBR SAMPLE</p>												
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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 LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.</p> <p><b>STRATA CORE RECOVERY (SREC.)</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 (S.R.Q.D.)</b> - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.</p> <p><b>TOPSOIL (T.S.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																				
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STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201  
LYNDO TIPPETT  
SECRETARY

August 14, 2006

STATE PROJECT: 33485.1.1 B-4132  
F.A. PROJECT: BRSTP-561 (11)  
COUNTY: Halifax  
DESCRIPTION: Bridge No. 97 on NC 561 over Looking Glass Swamp  
SUBJECT: Geotechnical Report - Bridge Foundation Investigation for  
NC 561 Looking Glass Swamp at -L- Sta. 16+47.50

**Site Description**

The proposed bridge site is located at the existing NC 561 bridge over Looking Glass Swamp, approximately 7 miles north of Scotland Neck. The replacement structure will be built along the existing alignment. Based on the proposed design, the new structure will have one span totaling 105 feet with a skew of 100 degrees.

One Standard Penetration Test (SPT) boring was made at or near each proposed bent location to provide subsurface information relative to foundation design. These borings were made with an ATV mounted CME-45B drill machine and advanced by rotary drill methods using bentonite drilling fluid.

The bridge site is located in the Coastal Plain Physiographic Province and is underlain by recent alluvial deposits and the Cretaceous deposits of the Cape Fear Formation. Topography along the project is nearly flat to gently sloping with elevations ranging from 33± feet beneath the existing structure to 50± feet along the NC 561 embankment.

Ground water was found to be at an elevation of 41± feet, whereas the surface of Looking Glass Swamp was at 39± feet.

**Soil Description**

Soils within this area have been divided into three categories, roadway embankment soils, alluvial soils, and formational soils.

Alluvial deposits are composed of 19± feet of very loose to medium dense sand and silty sand (A-1-b, A-3, A-2-4). Approximately 5± feet of soft sandy silt (A-4) was encountered at End Bent 1 at an elevation of 31± feet.

These alluvial soils are underlain by the sediments of the Cretaceous age Cape Fear Formation at an elevation of 21 to 23 feet. The Cape Fear Formation consists of 15± to 30± feet of medium dense to very dense sand and silty sand (A-1-b, A-2-4) with thin clay layers and 5± to 20± feet of very stiff silty clay (A-7-6) underlain by medium to very dense sand and silty sand (A-3, A-2-4).

Based on the proposed design, the existing grade will be raised approximately 2 feet at the bridge site. The existing embankment material primarily consists of 7± feet of soft sandy silt (A-4). The proposed end bent slopes will be mainly constructed within the existing embankment. Some additional fill will be required for construction of the end bent and side slopes. Borrow meeting Coastal Plain criteria is available in nearby areas.

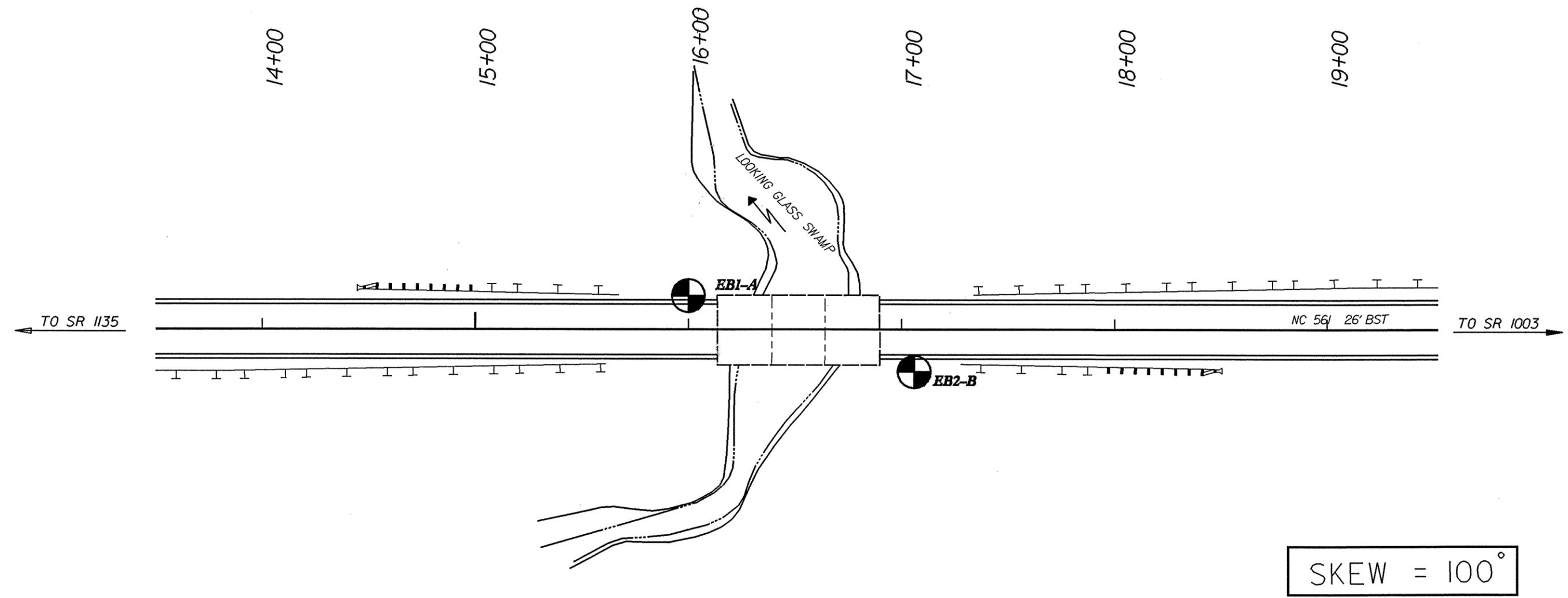
**Notice**

This Geotechnical Foundation Report is based on the Bridge Survey and Hydraulic Design Report for Looking Glass Swamp dated December 20, 2005. If significant changes are made in the design or location of the proposed structure, the subsurface information should be reviewed and modified as necessary.

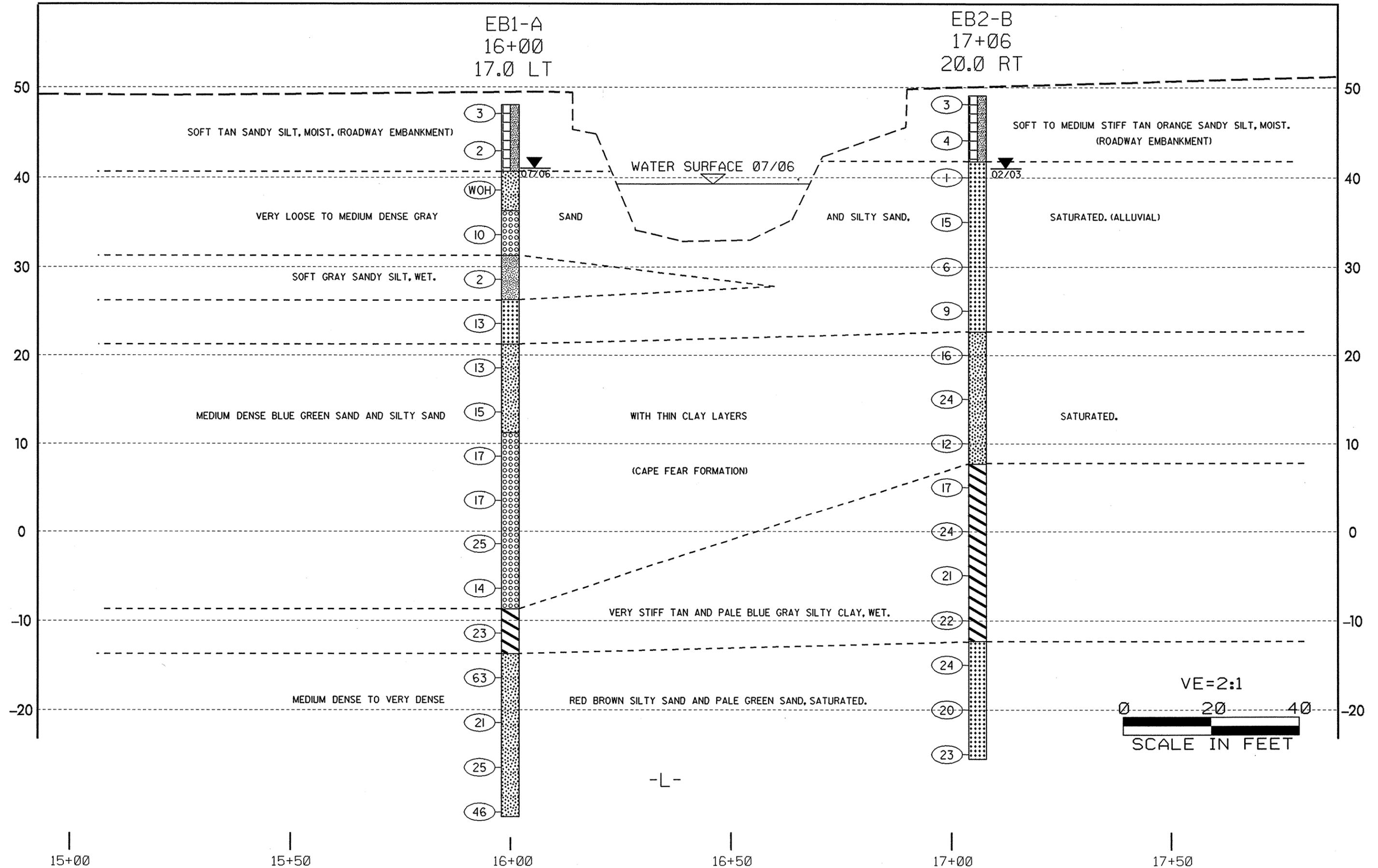
Prepared By:

Joseph L. Stone, L.G.  
Engineering Geologist II

PROJECT REFERENCE NO.	SHEET
33485.1.1 (B4132)	4
<b>SITE PLAN</b>	
FEET	



# PROFILE THROUGH BORINGS PROJECTED ALONG -L-



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33485.1.1	ID. B-4132	COUNTY HALIFAX	GEOLOGIST TL BOTTOMS
SITE DESCRIPTION BRIDGE NO. 97 ON NC 561 OVER LOOKING GLASS SWAMP			GROUND WATER
BORING NO. EBI-A	BORING LOCATION 16+00	OFFSET 17' LT	ALIGNMENT -L-
COLLAR ELEVATION 48.1'			NORTHING 900975
TOTAL DEPTH 80.0'			DRILL MACHINE CME-45B
START DATE 7/20/06			COMPLETION DATE 7/20/06

PROJECT NO. 33485.1.1	ID. B-4132	COUNTY HALIFAX	GEOLOGIST MM HAGER
SITE DESCRIPTION BRIDGE NO. 97 ON NC 561 OVER LOOKING GLASS SWAMP			GROUND WATER
BORING NO. EB2-B	BORING LOCATION 17+06	OFFSET 20' RT	ALIGNMENT -L-
COLLAR ELEVATION 49.1'			NORTHING 900865
TOTAL DEPTH 74.6'			DRILL MACHINE CME-45B
START DATE 2/10/03			COMPLETION DATE 2/10/03

ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT					SAMPLE NUMBER	LOG	SOIL AND ROCK DESCRIPTION	
		0.5'	0.5'	0.5'		0	25	50	75	100				
48.0	0.0	1	2	1	1.0	X3								
45.0	4.1	1	1	1	1.0	X2						SS-6	TAN SANDY SILT, MOIST. (ROADWAY EMBANKMENT)	
40.0	8.5	WOH	WOH	WOH	1.0	X0						SS-7	GRAY SAND AND SILTY SAND, SATURATED. (ALLUVIAL)	
35.0	13.5	4	5	5	1.0	X10						SS-9	GRAY SANDY SILT, WET.	
30.0	18.5	2	0	2	1.0	X2						SS-10	TAN SAND, SATURATED.	
25.0	23.5	5	6	7	1.0	X13						SS-11	BLUE GREEN SAND AND SILTY SAND WITH THIN CLAY LAYERS, SATURATED. (CAPE FEAR FORMATION)	
20.0	28.5	4	6	7	1.0	X13					14%	SS-12		
15.0	33.5	5	6	9	1.0	X15						SS-13		
10.0	38.5	7	8	9	1.0	X17						SS-14		
5.0	43.5	7	8	9	1.0	X17						SS-15		
0.0	48.5	9	10	15	1.0	X25						SS-16		
-5.0	53.5	4	5	9	1.0	X14						SS-17		
-10.0	58.5	7	9	14	1.0	X23							TAN SILTY CLAY, WET.	
-15.0	63.5	7	18	45	1.0	X63							RED BROWN SILTY SAND, SATURATED.	
-20.0	68.5	7	8	13	1.0	X21								
-25.0	73.5	9	12	13	1.0	X25								
-30.0	78.5	11	17	29	1.0	X46							BORING TERMINATED AT ELEVATION -31.9 IN DENSE SILTY SAND.	

ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT					SAMPLE NUMBER	LOG	SOIL AND ROCK DESCRIPTION	
		0.5'	0.5'	0.5'		0	25	50	75	100				
49.0	0.0	1	2	1	1.0	X3								
45.0	4.0	WOH	2	2	1.0	X4						SS-1	TAN ORANGE SANDY SILT, MOIST. (ROADWAY EMBANKMENT)	
40.0	8.1	WOH	WOH	1	1.0	X1						SS-2	GRAY SAND, SATURATED. (ALLUVIAL)	
35.0	13.1	4	7	8	1.0	X15						SS-3	BLUE GREEN SILTY SAND, SATURATED. (CAPE FEAR FORMATION)	
30.0	18.1	2	2	4	1.0	X6						SS-4	PALE BLUE GRAY SILTY CLAY, WET.	
25.0	23.1	3	4	5	1.0	X9						SS-5	PALE GREEN SAND, SATURATED.	
20.0	28.1	5	7	9	1.0	X16								
15.0	33.1	7	10	14	1.0	X24								
10.0	38.1	5	5	7	1.0	X12								
5.0	43.1	4	7	10	1.0	X17								
0.0	48.1	7	10	14	1.0	X24								
-5.0	53.1	7	10	11	1.0	X21								
-10.0	58.1	5	10	12	1.0	X22								
-15.0	63.1	7	11	13	1.0	X24								
-20.0	68.1	7	9	11	1.0	X20								
-25.0	73.1	6	9	14	1.0	X23								
-30.0													BORING TERMINATED AT ELEVATION +25.5 FEET IN MEDIUM DENSE SAND.	

**B-4132**  
**Bridge No. 97 on NC 561 over Looking Glass Swamp**

HOLE #	SAMPLE #	PASS 10	PASS 40	PASS 200	CSESAND	FINESAND	SI	CL	LL	PI	CLASS	DEPTH	MOIST.
<b>EB2-B</b>	SS-1	100	97	59	12.0	36.1	17.8	34.1	31	5	A-4(2)	4.0-5.5	
	SS-2	NOT	ENOUGH	SAMPLE								13.1-14.6	
	SS-3	100	94	29	29.6	47.7	11.0	11.8	30	NP	A-2-4(0)	28.1-29.6	
	SS-4	100	95	61	8.9	42.8	36.5	11.8	47	38	A-7-6(19)	48.1-49.6	
	SS-5	98	60	4	77.1	20.5	0.8	1.6	21	NP	A-3(0)	63.1-64.6	
<b>EB-1A</b>	SS-6	NOT	ENOUGH	SAMPLE								4.1-5.6	
	SS-7	100	88	22	34.4	48.8	12.8	4.0	21	NP	A-2-4(0)	8.5-10.0	
	SS-9	63	15	3	87.0	9.6	1.4	2.0	19	NP	A-1-b(0)	13.5-15.0	
	SS-10	100	82	46	37.4	20.6	26.0	16.0	25	7	A-4(0)	18.5-20.0	
	SS-11	NOT	ENOUGH	SAMPLE								23.5-25.0	
	SS-12	NOT	ENOUGH	SAMPLE								28.5-30.0	14.3
	SS-13	82	29	8	78.2	12.8	5.0	4.0	37	NP	A-1-b(0)	38.5-40.0	
	SS-14	97	44	10	78.2	13.2	6.6	2.0	36	NP	A-1-b(0)	48.5-50.0	
	SS-15	97	24	7	87.0	6.0	5.0	2.0	31	NP	A-1-b(0)	53.5-55.0	
	SS-16	100	92	49	9.8	49.8	26.4	14.0	46	26	A-7-6(9)	58.5-60.0	
	SS-17	100	98	34	7.2	66.4	18.4	8.0	46	8	A-2-5(0)	63.5-65.0	



**FIELD  
SCOUR REPORT**

WBS: 33485.1.1 TIP: B-4132 COUNTY: Halifax

DESCRIPTION(1): Bridge No. 97 on NC 561 over Looking Glass Swamp

**EXISTING BRIDGE**

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

Bridge No.: 97 Length: 75 Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2  
Foundation Type: timber piles

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: major scouring along wooden wall on south side of channel

Interior Bents: none noted

Channel Bed: none noted

Channel Bank: slumping along south bank of channel

**EXISTING SCOUR PROTECTION**

Type(3): rip rap along both end slopes, wooden end walls, wooden walls along stream bank

Extent(4): 4 feet outside edge of bridge

Effectiveness(5): appears satisfactory

Obstructions(6): debris on interior bents and on upstream 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): sand and silty sand

Channel Bank Material(8): sand and silty sand

Channel Bank Cover(9): trees and shrubs

Floodplain Width(10): 300 feet

Floodplain Cover(11): trees and shrubs

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

Channel Migration Tendency(13): moderate to the south

Observations and Other Comments: none

**DESIGN SCOUR ELEVATIONS(14)**

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

**BENTS**

	B1	B2	B3	B4						
	NA	NA	NA	NA						

Comparison of DSE to Hydraulics Unit theoretical scour:  
Geotechnical analysis agrees with a maximum theoretical scour elevation of 28 feet as outlined in the Bridge Survey and Hydraulic Report.

**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 7,  
"Soil Test Results",  
for samples:  
Channel Bank SS-2  
Channel Bed SS-7

Reported by: *James* Date: 8/11/2006

33485.1.1  
B-4132  
Halifax Co.

Bridge No. 97 on NC 561 over Looking Glass Swamp.



Looking Northwest Toward End Bent 1