

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33482.1.1(B-4129)	1	17

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 33482.1.1(B-4129) F.A. PROJ. BRZ-3000(3)  
COUNTY GUILFORD  
PROJECT DESCRIPTION BRIDGE NO. 226 ON -L- (SR 3000) OVER  
LITTLE ALAMANCE CREEK AT STATION -L- 16+89.5

**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: 33482.1.1**  
**ID: B-4129**

PERSONNEL

O.B. OTI

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INVESTIGATED BY K.B. MILLER

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SUBMITTED BY N.T. ROBERSON

DATE SEPTEMBER 2006



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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

PROJECT REFERENCE NO.

33482.I(KB-4129)

SHEET NO.

2

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>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HEAVY PLASTIC, A-7-6</p>		<p>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.</p> <p><b>ANGULARITY OF GRAINS</b></p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>		<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> <p>WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p> <p>CRYSTALLINE ROCK (CR) 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>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.</p> <p>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.</p>		<p><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA. <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. <b>ARTESIAN</b> - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. <b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLED IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. <b>ROCK QUALITY DESIGNATION (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. <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. <b>SILL</b> - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - NUMBER OF BLOWS (IN OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. <b>STRATA CORE RECOVERY (SRC)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. <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. <b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																									
<p><b>SOIL LEGEND AND AASHTO CLASSIFICATION</b></p> <table border="1"> <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 colspan="2">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-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> <th>A-7-5</th> <th>A-7-6</th> <th>A-7-6</th> <th>A-7-6</th> </tr> <tr> <th>GROUP CLASS.</th> <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></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>SYMBOL</th> <td>[Symbol]</td> </tr> <tr> <th>% PASSING</th> <td>10</td> </tr> <tr> <th>LIQUID LIMIT PLASTIC INDEX</th> <td>6</td> <td>NP</td> <td>10</td> </tr> <tr> <th>GROUP INDEX</th> <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-3	A-4, A-5	A-6, A-7	A-7-5	A-7-6	A-7-6	A-7-6	GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7										SYMBOL	[Symbol]	% PASSING	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	LIQUID LIMIT PLASTIC INDEX	6	NP	10	10	10	10	10	10	10	10	10	10	10	10	10	GROUP INDEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<p><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><b>COMPRESSIONIBILITY</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><b>PERCENTAGE OF MATERIAL</b></p> <table border="1"> <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> </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	<p><b>WEATHERING</b></p> <p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>MODERATELY SEVERE (MOD. SEV) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KADOLINIZATION. 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.</p> <p>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 KADOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, YIELDS SPT N VALUES &gt; 100 BPF.</p> <p>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 &lt; 100 BPF.</p> <p>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.</p>															
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<p><b>COLOR</b></p> <p>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.</p>		<p><b>INDURATION</b></p> <p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>																																																																																																																																													
<p><b>NOTES:</b></p> <p>BENCH MARK: BL-17 -L- STA. 17+43.44 93.01' LT ELEVATION: 611.9 FT.</p>																																																																																																																																															



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

LYNDO TIPPETT  
SECRETARY

September 15, 2006

STATE PROJECT: 33482.1.1 (B-4129)  
FEDERAL PROJECT: BRZ-3000 (3)  
COUNTY: Guilford  
DESCRIPTION: Bridge No. 226 on -L- (SR 3000) Over Little Alamance Creek  
SUBJECT: Geotechnical Report – Structure Inventory

**Site Description**

A three span, 175 feet long bridge with a proposed deck of 8,225 square feet and a skew angle of 65 degrees is proposed on -L- over Little Alamance creek. This project is located in the southeastern portion of Guilford county on SR 3000. The proposed bridge will replace the existing bridge at a new location downstream. Traffic will be maintained on the existing bridge during construction.

The subsurface investigation was conducted in July of 2006 using a CME-550 drill machine equipped with an automatic hammer. Six borings were advanced to crystalline rock using hollow stem augers, two borings with tri-cone bit and core barrel with N-casing. Representative soils sample were collected for visual classification in the field and for laboratory analysis by the Materials and Tests Unit. Rock core samples recovered in boring B1-A were also submitted for laboratory analysis.

**Physiography and Geology**

The structure is located in rolling terrain within the Piedmont Physiographic Province. The area is a developing suburban community with single family dwellings. Geologically the site is within the Carolina Slate Belt and contains metamorphosed granitic rocks ranging in age from Late Proterozoic to Late Cambrian.

**Soil Properties**

Foundation materials encountered at the project site include alluvial sediments, residual soils, weathered rock and crystalline rock.

Alluvial soils at the site are composed of approximately 7.0 feet of tan brown medium stiff sandy clay (A-6) and 3.3 feet of tan gray loose silty sand (A-2-4). Alluvial soils were encountered in boring B2-A and B2-B.

Residual soils range from 6.0 to 17.5 feet of tan brown soft to hard, sandy silt (A-4), sandy clay (A-6) and tan gray brown, loose to dense, coarse sand and silty sand (A-1-b, A-2-4).

**Rock Properties**

Weathered rock was encountered in all borings at elevations ranging from 590.0 to 598.0 feet. All borings yielded SPT and/or hollow stem auger refusal except boring B2-A which was terminated in weathered rock. The rock fragments recovered from the hollow stems were granite.

Core borings were performed at B1-B and B2-A to evaluate rock type and competency. Top of crystalline rock ranges from 591.4 to 591.2 feet in elevation. Core Recovery (REC) ranges from 60% to 100% with an average of 87%. Rock Quality Designation (RQD) ranges from 26% to 76% with an average of 47%. A moderately to slightly weathered zone was noted in the core from elevation 585.6 to 581.9 feet in boring B1-B. Rock samples submitted for testing indicate a compressive strength from 15.28 ksi to 18.18 ksi and a unit weight ranging from 164.3 lb/ft<sup>3</sup> to 165.1 lb/ft<sup>3</sup>. More detailed descriptions may be found in the Core Boring Report.

**Groundwater**

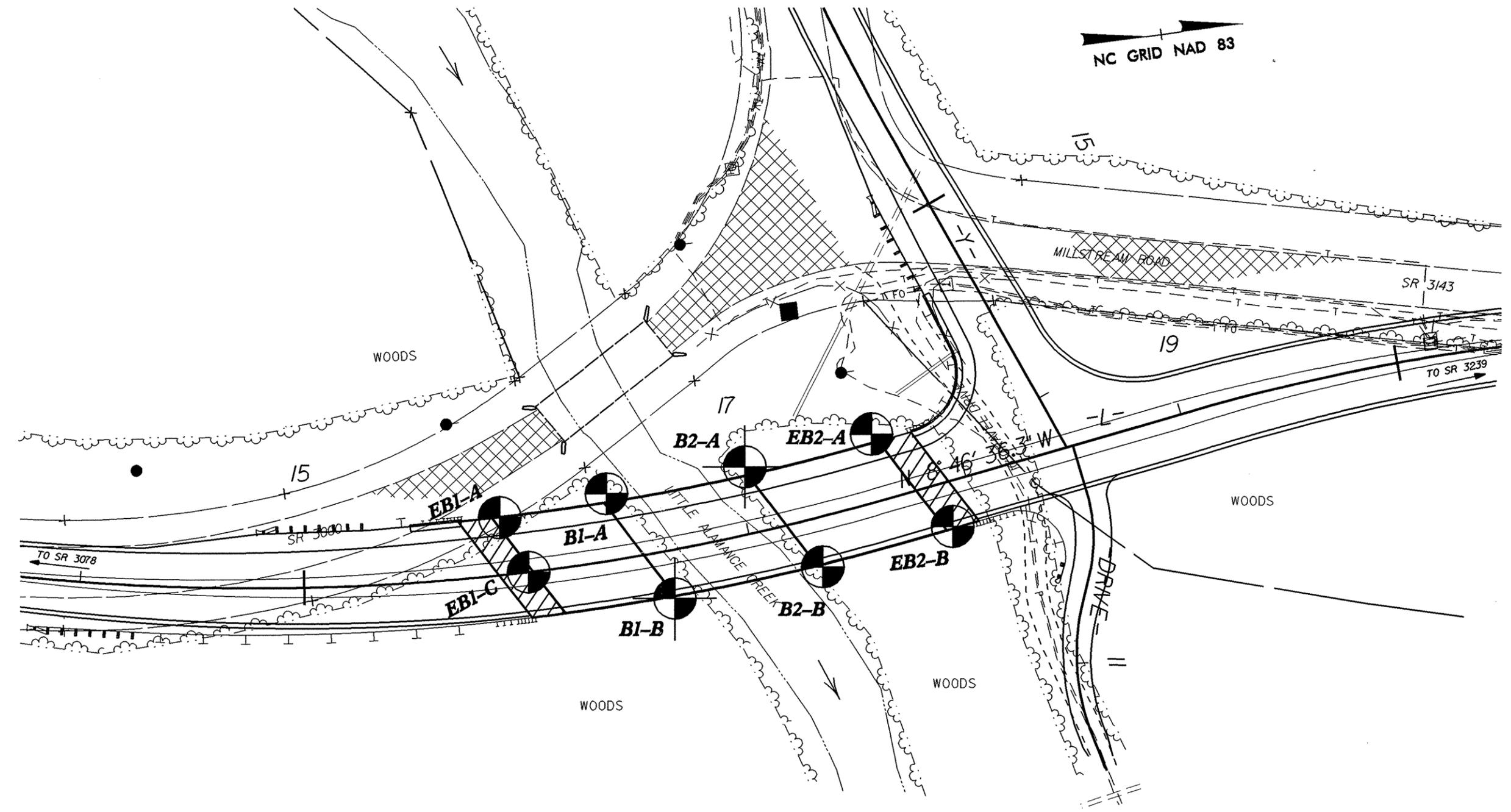
Groundwater elevations at the site ranged from 602.5 to lower than 590.1 feet at the time of the investigation. The Hydraulics Unit noted the surface water elevation of Little Alamance Creek at 594.9 feet in June 2005. Ground water fluctuation is expected to be high during times of heavy rainfall and flooding.

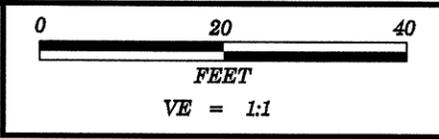
**Notice**

This report is based on the bent locations provided in the Preliminary General Drawing dated April 24, 2006 and the Bridge Survey and Hydraulic Design Report dated November 3, 2005. If significant changes are made in the design and/or location of the proposed structure the subsurface information should be reviewed and modified as necessary.

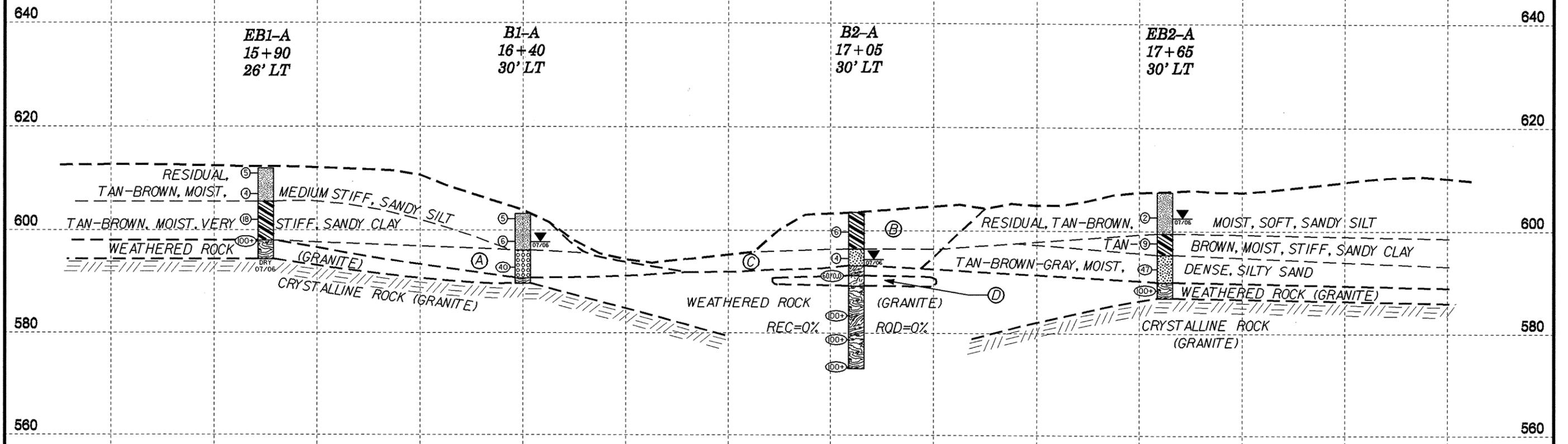
Prepared by:

Onuoha B. Oti  
Engineering Geologist II





<b>PROJECT REFERENCE NO.</b>	<b>SHEET</b>
33482.1.I(B-4129)	5
<b>PROFILE 30' LT OF -L-</b>	



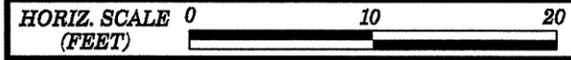
- (A) RESIDUAL, TAN-GRAY, MOIST, DENSE SAND
- (B) ALLUVIAL, TAN-BROWN, MOIST, MEDIUM STIFF, SANDY CLAY
- (C) ALLUVIAL, TAN-BROWN, WET, LOOSE, SILTY SAND
- (D) CRYSTALLINE ROCK, GRAY-WHITE, MODERATELY WEATHERED,  
CLOSELY FRACTURED GRANITE  
REC=100% RQD=60%

16+00

17+00

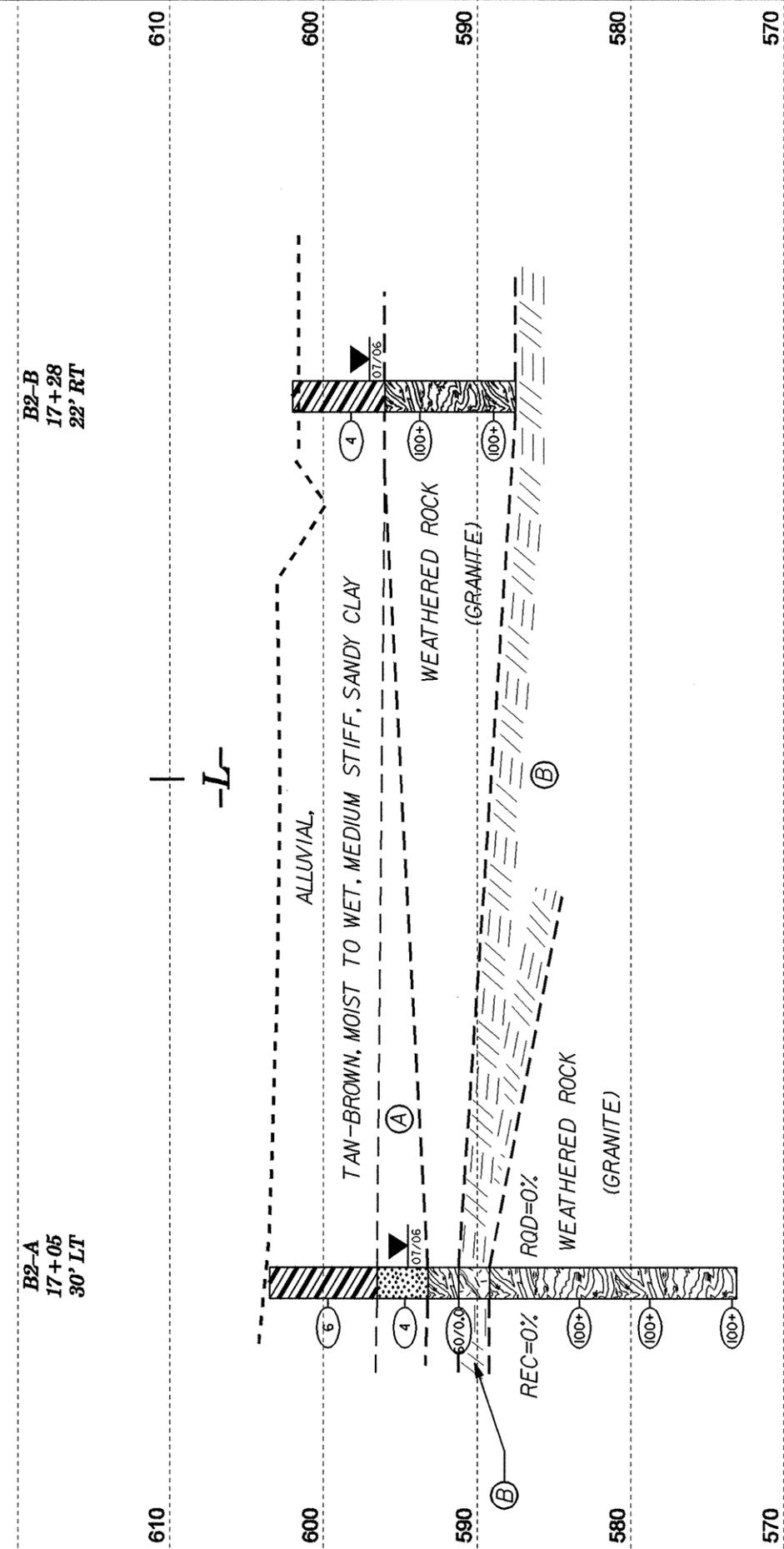
18+00



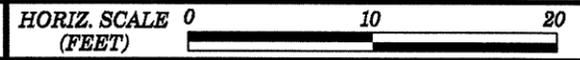


VE = 1:1

CROSS SECTION THROUGH BENT 2

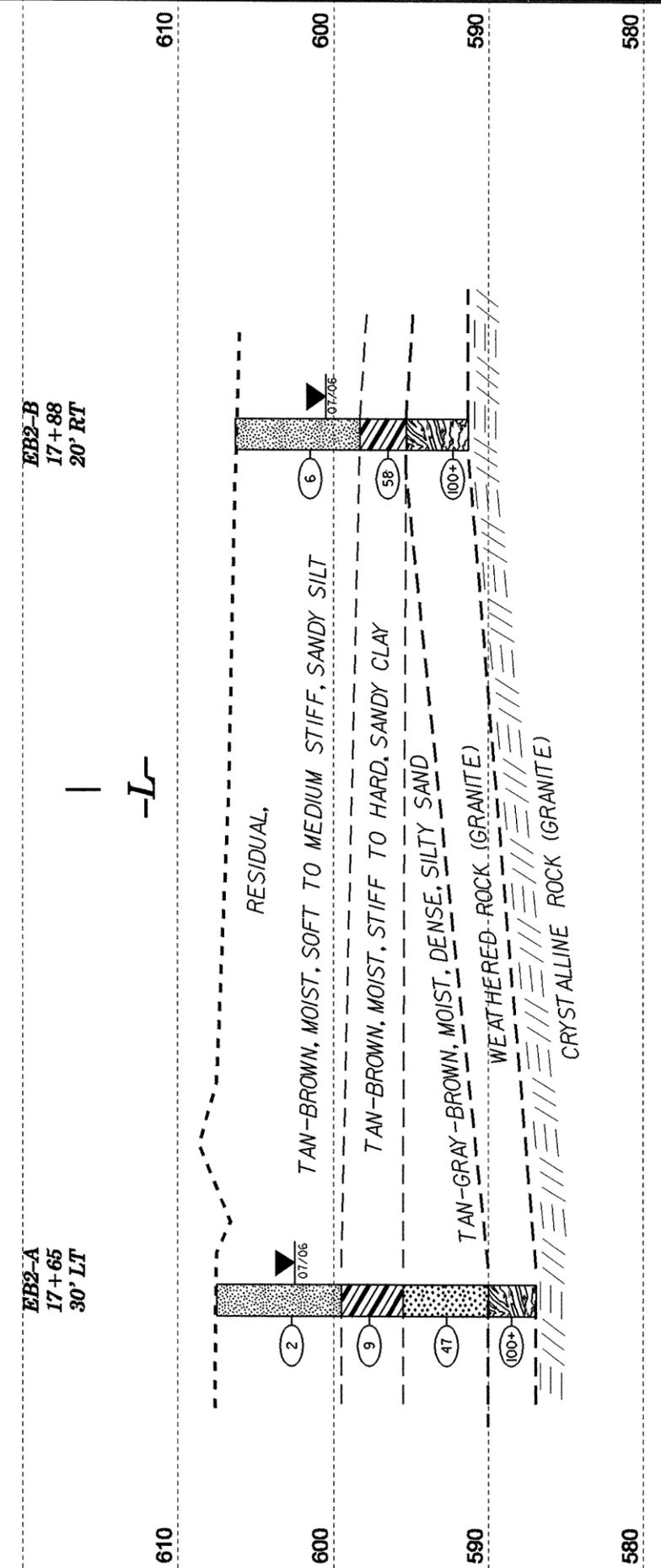


- (A) ALLUVIAL, TAN-BROWN, MOIST TO WET, LOOSE, SILTY SAND
- (B) CRYSTALLINE ROCK, GRAY-WHITE, MODERATELY WEATHERED, CLOSELY FRACTURED GRANITE REC=100% RQD=60%



VE = 1:1

CROSS SECTION THROUGH END BENT 2



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 GEOTECHNICAL UNIT BORING LOG

PROJECT NO. 33482.1.1	ID. B-4129	COUNTY GUILFORD	GEOLOGIST O.B. OTI
SITE DESCRIPTION BRIDGE NO. 226 ON -L- (SR 3000) OVER LITTLE ALAMANCE CREEK			GROUND WATER
BORING NO. EBI-A	BORING LOCATION 15+90	OFFSET 26' LT	ALIGNMENT -L-
COLLAR ELEVATION 612.0'	NORTHING 835356'	EASTING 1803330'	0 HR. DRY 24 HR. DRY

TOTAL DEPTH 17.6'	DRILL MACHINE CME-550	DRILL METHOD H.S. AUGERS	HAMMER TYPE AUTOMATIC
START DATE 7/12/06	COMPLETION DATE 7/12/06	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 17.6'

ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT					SAMPLE NUMBER	MOL.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5'	0.5'	0.5'		0	25	50	75	100						
612.0	0.0	2	3	2	1.0											
610.0	4.0	3	2	2	1.0									SS-1	M	RESIDUAL, TAN-BROWN, SANDY SILT
605.0	9.0	5	8	10	1.0									SS-2	M	TAN-BROWN, SANDY CLAY
600.0	14.0	100			0.4											WEATHERED ROCK (GRANITE)
595.0	HOLLOW STEM REFUSAL AT ELEVATION 594.4 FEET ON CRYSTALLINE ROCK (GRANITE)															
590.0																
585.0																
580.0																
575.0																
570.0																
565.0																
560.0																
555.0																
550.0																
545.0																
540.0																
535.0																
530.0																

PROJECT NO. 33482.1.1	ID. B-4129	COUNTY GUILFORD	GEOLOGIST O.B. OTI
SITE DESCRIPTION BRIDGE NO. 226 ON -L- (SR 3000) OVER LITTLE ALAMANCE CREEK			GROUND WATER
BORING NO. EBI-C	BORING LOCATION 16+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEVATION 608.7'	NORTHING 835365'	EASTING 1803356'	0 HR. DRY 24 HR. DRY

TOTAL DEPTH 18.6'	DRILL MACHINE CME-550	DRILL METHOD H.S. AUGERS	HAMMER TYPE AUTOMATIC
START DATE 11/8/05	COMPLETION DATE 11/8/05	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 18.6'

ELEV. (FT.)	DEPTH (FT.)	BLOW COUNT			PEN. (FT.)	BLOWS PER FOOT					SAMPLE NUMBER	MOL.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5'	0.5'	0.5'		0	25	50	75	100						
608.7																
605.0	3.5	4	7	7	1.0									SS-10	M	RESIDUAL, TAN-BROWN, SANDY CLAY
600.0	8.5	6	9	11	1.0									SS-11	M	TAN-BROWN, SANDY SILT
595.0	13.5	26	30	35	1.0									M		WEATHERED ROCK (GRANITE)
590.0	18.5	60			0.1											
585.0	SPT REFUSAL AT ELEVATION 590.1 FEET ON CRYSTALLINE ROCK (GRANITE)															
580.0																
575.0																
570.0																
565.0																
560.0																
555.0																
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545.0																
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
**GEOTECHNICAL UNIT BORING LOG**

SHEET 9

PROJECT NO. 33482.1.1		ID. B-4129		COUNTY GUILFORD		GEOLOGIST O.B. OTI	
SITE DESCRIPTION BRIDGE NO. 226 ON -L-(SR 3000) OVER LITTLE ALAMANCE CREEK							GROUND WATER
BORING NO. BI-A		BORING LOCATION 16+40		OFFSET 30' LT		ALIGNMENT -L-	
COLLAR ELEVATION 603.3'		NORTHING 835404'		EASTING 1803325'		0 HR. 10.0'	
TOTAL DEPTH 13.6'		DRILL MACHINE CME-550		DRILL METHOD H.S. AUGERS		HAMMER TYPE AUTOMATIC	
START DATE 7/17/06		COMPLETION DATE 7/17/06		SURFACE WATER DEPTH N/A		DEPTH TO ROCK 13.6'	

ELEV.	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			
603.3	0.0	2	2	3	1.0	x 5						M	RESIDUAL, TAN-BROWN, SANDY SILT
600.0	4.4	3	3	3	1.0	x 6					SS-7	▼	
595.0	9.4	12	27	13	1.0	x 40					SS-8	M	
590.0						HOLLOW STEM REFUSAL AT ELEVATION 589.7 FEET ON CRYSTALLINE ROCK (GRANITE)						/	WEATHERED ROCK (GRANITE)
585.0													
580.0													
575.0													
570.0													
565.0													
560.0													
555.0													
550.0													
545.0													
540.0													
535.0													
530.0													









**EB1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	26' LT	15+90	4.0-5.5	A-4(2)	25	8	12.7	38.4	22.6	26.3	99	92	57	-	-
SS-2	26' LT	15+90	9.0-10.5	A-6(2)	33	11	21.2	41.6	12.9	24.2	99	91	43	-	-

**EB1-C**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-10	CL	16+00	3.5-5.0	A-6(10)	38	20	3.2	45.0	13.4	38.3	100	99	62	-	-
SS-11	CL	16+00	8.5-10.0	A-4(0)	30	7	28.9	34.5	14.4	22.2	92	75	40	-	-

**B1-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-7	30' LT	16+40	4.4-5.9	A-4(0)	24	7	30.7	34.9	14.1	20.2	95	78	38	-	-
SS-8	30' LT	16+40	9.4-10.9	A-1-b(0)	23	5	41.6	27.3	17.0	14.1	63	45	23	-	-

**B2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-9	30' LT	17+05	7.8-9.3	A-2-4(0)	21	NP	51.9	33.2	5.8	9.1	99	77	17	-	-

**B2-B**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6	22' RT	17+28	2.8-4.3	A-6(11)	37	15	3.4	25.1	41.2	30.3	100	99	79	-	-

**EB2-A**

<b>SOIL TEST RESULTS</b>															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			%	%
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-3	30' LT	17+65	3.8-5.3	A-4(0)	19	2	8.3	48.9	22.6	20.2	100	99	54	-	-
SS-4	30' LT	17+65	8.8-10.3	A-6(2)	32	13	23.0	39.0	9.7	28.3	97	87	42	-	-
SS-5	30' LT	17+65	13.8-15.3	A-2-4(0)	25	NP	42.9	27.8	22.2	7.1	96	66	33	-	-

**B1-B**

<b>ROCK TEST RESULTS</b>							
SAMPLE NO.	OFFSET	STATION	BORING NO.	DEPTH INTERVAL	UNIT WT. LB/FT3	UNCONFINED COMPRESSIVE STRENGTH KSI	SEC MOD @ 40% MPSI
RS-1	22' RT	16+62	B1-B	21.1-21.7	164.3	15.12	4.79
RS-2	22' RT	16+62	B1-B	28.1-28.7	165.1	17.94	5.49



**FIELD  
SCOUR REPORT**

WBS: 33482.1.1 TIP: B-4129 COUNTY: Guilford

DESCRIPTION(1): Bridge No. 226 on -L- (SR 3000) over Little Alamance Creek

**EXISTING BRIDGE**

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
Other (explain) Bridge Survey and Hydraulic Design Report

Bridge No.: 226 Length: 63 ft Total Bents: 3 Bents in Channel: 0 Bents in Floodplain: 3  
Foundation Type: Concrete Footings

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: None noted

Interior Bents: Minor contraction scour

Channel Bed: Minor contraction scour

Channel Bank: Very minor contraction and local scour

**EXISTING SCOUR PROTECTION**

Type(3): Concrete wing walls

Extent(4): 5 feet beyond edge of bridge

Effectiveness(5): Appear satisfactory

Obstructions(6): None noted

**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): Loose, tan-gray, moist, silty sand (A-2-4) SS-9

Channel Bank Material(8): Medium stiff, tan-brown, moist, sandy silt (A-4) SS-7 and medium stiff, moist to wet, sandy clay (A-6) SS-6

Channel Bank Cover(9): Grass, large and small trees

Floodplain Width(10): 120 ft

Floodplain Cover(11): Trees, Shrubs and Grass

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

Channel Migration Tendency(13): Slight tendency to the south towards End Bent 1

Observations and Other Comments: N/A

**DESIGN SCOUR ELEVATIONS(14)**

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

100 YR	BENTS													
	1	2												
	598.0	597.0												

Comparison of DSE to Hydraulics Unit theoretical scour:

No scour is anticipated beyond the end bents. The Geotechnical Engineering Unit agrees with the predicted scour in the Bridge Survey and Hydraulic Design Report dated 6/28/2006

**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 14, "Soil Test Results", for samples: SS-6 & SS-7 SS-9

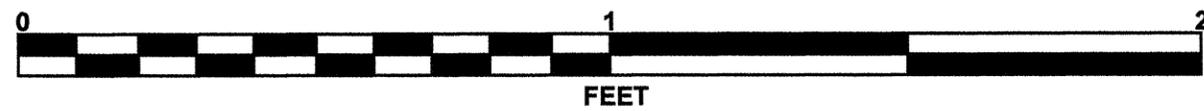
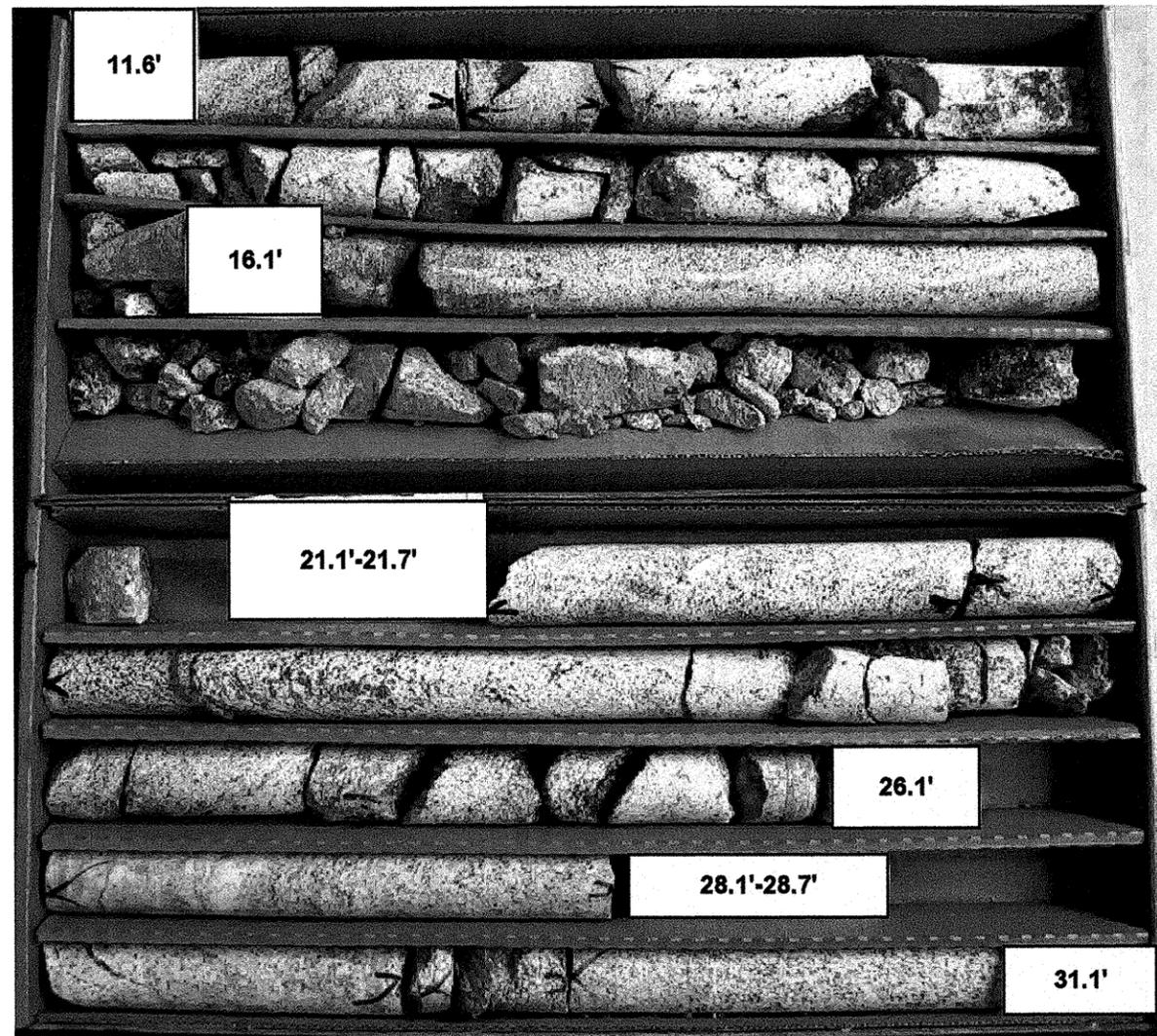
Reported by: \_\_\_\_\_ Date: \_\_\_\_\_

ONUOHA B. OTI  
Engineering Geologist II

# CORE PHOTOGRAPHS

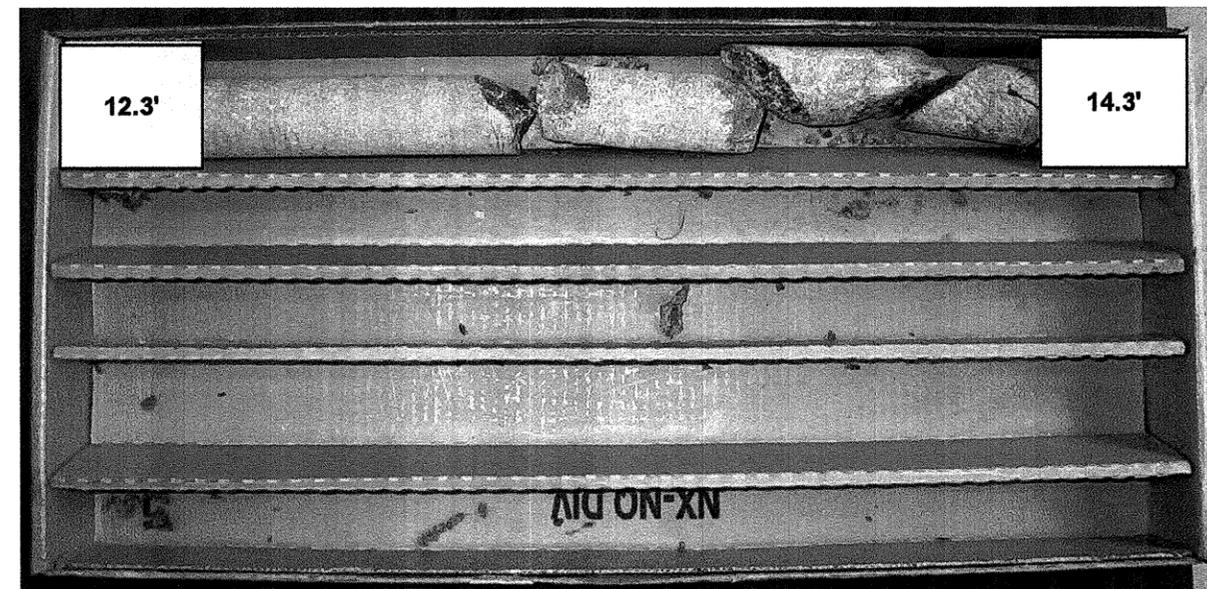
## B1-B

BOXES 1 & 2: 11.6 - 31.1 FEET



## B2-A

BOX 1: 12.3 - 14.3 FEET



# SITE PHOTOGRAPH

Bridge No. 226 on -L- (SR 3000) over Little Alamance Creek



Looking northwest towards End Bent 2