

PROJECT: 38068.1.1 ID: R-3622A

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE	STATE PROJECT REFERENCE NO.	SHEET	TOTAL SHEETS
N.C.	R-3622A	1	36
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
38068.1.1	N/A	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.

STATE PROJECT 38068.1.1 I.D. NO. R-3622A

F.A. PROJECT N/A

COUNTY CHEROKEE

PROJECT DESCRIPTION NC 294 ROADWAY

IMPROVEMENTS AND BRIDGE REPLACEMENT FROM

WEST OF SR 1130(SUNNY POINT ROAD) TO EAST OF

SR 1309 (OAK GROVE ROAD)

SITE DESCRIPTION BRIDGE No. 190050 OVER

PERSIMMON CREEK ON NC 294 AND CULVERT

EXTENSION FOR TRIBUTARY TO CHEROKEE

LAKE ON NC 294

CONTENTS:

- 1) NCDOT LEGEND SHEET(SHEET 2)
- 2) GEOTECHNICAL REPORT OF SUBSURFACE EXPLORATION (SHEETS 3-8)
- 3) SITE VICINITY MAP (DRAWING No. 1, SHEET 9)
- 4) BRIDGE BORING IDENTIFICATION DIAGRAM (DRAWING No. 2, SHEET 10)
- 5) BRIDGE SUBSURFACE PROFILE AND CROSS-SECTIONS (DRAWING Nos. 3-7, SHEETS 11-15)
- 6) BRIDGE FINAL BORING LOGS, CORING LOGS, AND CORE PHOTOGRAPHS (SHEETS 16-26)
- 7) CULVERT BRIDGE ROD SOUNDING IDENTIFICATION DIAGRAM (DRAWING No. 8, SHEET 27)
- 8) CULVERT SOUNDING OBSERVATION SUMMARIES (SHEETS 28-29)
- 9) SUMMARY OF SOIL LABORATORY TEST DATA (SHEET 30)
- 10) SUMMARY OF ROCK LABORATORY TEST DATA (SHEET 30)
- 11) SCOUR REPORT AND GRAIN SIZE CURVES (SHEETS 31-34)
- 12) SITE PHOTOGRAPHS (SHEETS 35-36)

INVESTIGATED BY T. WELLS PERSONNEL D. KITCHEN

CHECKED BY J. VINSON A. HAYES

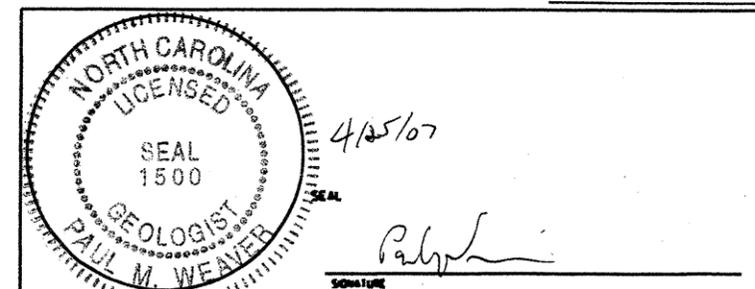
SUBMITTED BY P. WEAVER W. DUGGINS

DATE 4/25/07 K. HICKS

DRAWN BY: DRK

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
R-3622A	38068.1.1	2	36

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 (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 WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-5</i></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 style="text-align: center;">ANGULARITY OF GRAINS</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</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>WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.</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>ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRODUCED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR 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. STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																																																						
<p style="text-align: center;">SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (-85% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (-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>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-4</td> <td>A-5</td> <td>A-6</td> <td>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> </tr> <tr> <td>% PASSING</td> <td>100</td> </tr> <tr> <td>LIQUID LIMIT</td> <td>50</td> <td>50</td> <td>40</td> </tr> <tr> <td>PLASTIC INDEX</td> <td>0</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</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> </tr> <tr> <td>GENERAL RATING AS A SUBGRADE</td> <td colspan="4">EXCELLENT TO GOOD</td> <td colspan="4">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>POOR</td> <td>UNSATURABLE</td> </tr> </table> <p style="text-align: center;">P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > 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	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-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5	A-6, A-7	SYMBOL														% PASSING	100	100	100	100	100	100	100	100	100	100	100	100	LIQUID LIMIT	50	50	40	40	40	40	40	40	40	40	40	40	PLASTIC INDEX	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	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	CLAYEY SOILS	GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD				FAIR TO POOR				FAIR TO POOR	POOR	POOR	UNSATURABLE	<p style="text-align: center;">MINERALOGICAL COMPOSITION</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;">COMPRESSIBILITY</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;">PERCENTAGE OF MATERIAL</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>>10%</td> <td>>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;">GROUND WATER</p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. STATIC WATER LEVEL AFTER 24 HOURS. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA SPRING OR SEEPAGE</p> <p style="text-align: center;">MISCELLANEOUS SYMBOLS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td></td> <td>TEST BORING</td> <td>SAMPLE DESIGNATIONS</td> </tr> <tr> <td></td> <td></td> <td>AUGER BORING</td> <td>S - BULK SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>CORE BORING</td> <td>SS - SPLIT SPOON SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>MONITORING WELL</td> <td>ST - SHELBY TUBE SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>PIEZOMETER INSTALLATION</td> <td>RS - ROCK SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>SLOPE INDICATOR INSTALLATION</td> <td>RT - RECOMPACTED TRIAXIAL SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>SPT N-VALUE</td> <td>CBR - CBR SAMPLE</td> </tr> <tr> <td></td> <td></td> <td>SPT REFUSAL</td> <td></td> </tr> </table> <p style="text-align: center;">ABBREVIATIONS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>AR - AUGER REFUSAL</td> <td>FRAC. - FRAGMENTS</td> </tr> <tr> <td>BT - BORING TERMINATED</td> <td>MED. - MEDIUM</td> </tr> <tr> <td>CL - CAVE IN</td> <td>N/A - NOT APPLICABLE</td> </tr> <tr> <td>CL - CLAY</td> <td>NT - NOT MEASURED</td> </tr> <tr> <td>CPT - CONE PENETRATION TEST</td> <td>SD. - SAND, SANDY</td> </tr> <tr> <td>CSE - COARSE</td> <td>SL. - SILT, SILTY</td> </tr> <tr> <td>C.T. - CORING TERMINATED</td> <td>SL. - SLIGHTLY</td> </tr> <tr> <td>DMT - DILATOMETER TEST</td> <td>TCR - TRICONE REFUSAL</td> </tr> <tr> <td>DPT - DYNAMIC PENETRATION TEST</td> <td>U - UNIT WEIGHT</td> </tr> <tr> <td>e - VOID RATIO</td> <td>U_d - DRY UNIT WEIGHT</td> </tr> <tr> <td>F. - FINE</td> <td>W - MOISTURE CONTENT</td> </tr> <tr> <td>FOSS. - FOSSILIFEROUS</td> <td>V. - VERY</td> </tr> <tr> <td>FRAC. - FRACTURED</td> <td>VST - VANE SHEAR TEST</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			TEST BORING	SAMPLE DESIGNATIONS			AUGER BORING	S - BULK SAMPLE			CORE BORING	SS - SPLIT SPOON SAMPLE			MONITORING WELL	ST - SHELBY TUBE SAMPLE			PIEZOMETER INSTALLATION	RS - ROCK SAMPLE			SLOPE INDICATOR INSTALLATION	RT - RECOMPACTED TRIAXIAL SAMPLE			SPT N-VALUE	CBR - CBR SAMPLE			SPT REFUSAL		AR - AUGER REFUSAL	FRAC. - FRAGMENTS	BT - BORING TERMINATED	MED. - MEDIUM	CL - CAVE IN	N/A - NOT APPLICABLE	CL - CLAY	NT - NOT MEASURED	CPT - CONE PENETRATION TEST	SD. - SAND, SANDY	CSE - COARSE	SL. - SILT, SILTY	C.T. - CORING TERMINATED	SL. - SLIGHTLY	DMT - DILATOMETER TEST	TCR - TRICONE REFUSAL	DPT - DYNAMIC PENETRATION TEST	U - UNIT WEIGHT	e - VOID RATIO	U _d - DRY UNIT WEIGHT	F. - FINE	W - MOISTURE CONTENT	FOSS. - FOSSILIFEROUS	V. - VERY	FRAC. - FRACTURED	VST - VANE SHEAR TEST	<p style="text-align: center;">ROCK HARDNESS</p> <p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p> <p>MEDIUM HARD CAN BE GROOVED OR GOUGED 0.85 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p> <p>SOFT CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p> <p>VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.</p>	<p>FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRODUCED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS IN OR 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. STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>
GENERAL CLASS.		GRANULAR MATERIALS (-85% PASSING #200)				SILT-CLAY MATERIALS (-85% PASSING #200)				ORGANIC MATERIALS																																																																																																																																																																																																															
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ENGINEERING CONSULTANTS, INC.

www.trigoneng.com

P.O. Box 18846 • Zip 27419-8846 • 313 Gallimore Dairy Road • Greensboro, NC 27409 • p 336.668.0093 • f 336.668.3868

Mr. David L. Wilver, P.E., Wilbur Smith Associates

NC 294 Roadway Improvements and Bridge Replacement, Cherokee County, North Carolina

Bridge No. 190050 on NC 294 over Persimmon Creek and Extension of Culvert on NC 294 for Tributary to Lake Cherokee

April 24, 2007

Trigon Project No. 071-05-014

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Appendix A (Issued Under Separate Cover)

Laboratory Results of Rock Tests

SUBMITTED TO: Wilbur Smith Associates
421 Fayetteville Street
Raleigh, North Carolina 27601

ATTENTION: Mr. David L. Wilver, P.E.

SUBMITTED BY: Trigon Engineering Consultants, Inc.
Post Office Box 18846
Greensboro, North Carolina 27419-8846
Trigon Project No. 071-05-014

DATE: April 24, 2007

STATE PROJECT: 38068.1.1

TIP : R-3622A

FEDERAL PROJECT: N/A

COUNTY: Cherokee

DESCRIPTION: NC 294 Roadway Improvements and Bridge Replacement:
Bridge No. 190050 on NC 294 Over Persimmon Creek and
Extension of Culvert on NC 294 for Tributary to Lake Cherokee

SUBJECT: Geotechnical Report of Structure Subsurface Investigation



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April 24, 2007

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in the vicinity of the proposed culvert are moderately steep. The floodplain at the location of the proposed bridge and culvert extension appears to be approximately 800 feet wide. The topography of the general site vicinity consists of steep hills and mountains.

The ground conditions at the site of the proposed bridge and culvert extension at the time of this investigation were very soft and wet. It is our understanding that this area was at one time lake bottom, and the conditions encountered appear to confirm this.

At the time of this investigation, a two-span bridge (existing Bridge No. 090050) was present approximately 50 feet south of the proposed bridge location. The existing bridge consists of a concrete deck, reinforced concrete abutments, and reinforced concrete post & beam interior bents which are cantilevered at both ends. The foundation of the existing bridge consists of spread footings bearing on crystalline rock. The existing bridge is approximately 120 feet in length and approximately 19 feet in width.

At the time of this investigation, a reinforced concrete, single-barrel boxed culvert approximately 40 feet in length was present underlying the existing NC 294 at approximately Station 60+50. The culvert transported water of a tributary to Cherokee lake and had opening dimensions of 12-foot (wide) X 7-foot (high).

The water surface elevation of Persimmon Creek surveyed by Trigon on March 23, 2007 was ± 1529 feet. The Preliminary General Drawings indicate a normal water surface elevation of ± 1529 feet and a high water surface elevation of ± 1537 feet which was recorded in the spring of 2003.

2.0 PROJECT DESCRIPTION

Proposed for construction is a new, three-span structure to replace the existing Bridge No. 190050 on NC 294 over Persimmon Creek. Also proposed is to extend the existing culvert for the tributary to Cherokee Lake to accommodate the new NC 294 roadway alignment. The proposed bridge will be located approximately 50 feet north of the existing bridge and will extend approximately from Station 53+87 to Station 55+92. The proposed culvert extension will be added to the north side of the existing culvert with the centerline of the new culvert intersecting the proposed -L- centerline at approximately Station 61+29. Information for the proposed bridge and culvert structures was obtained from the Preliminary General Drawings provided to Trigon by Wilbur Smith Associates.

STATE PROJECT: 38068.1.1

TIP : R-3622A

FEDERAL PROJECT: N/A

COUNTY: Cherokee

DESCRIPTION: NC 294 Roadway Improvements and Bridge Replacement:
Bridge No. 190050 on NC 294 Over Persimmon Creek and
Extension of Culvert on NC 294 for Tributary to Lake Cherokee

SUBJECT: Geotechnical Report of Structure Subsurface Investigation

Trigon Engineering Consultants, Inc. has completed the authorized geotechnical investigation for the above referenced project in Cherokee County, North Carolina. The purpose of this exploration was to investigate the subsurface conditions at the proposed bridge bent locations and at the proposed culvert extension, and to provide general construction considerations based on the subsurface conditions.

1.0 SITE DESCRIPTION

The project site is located in the southwest portion of Cherokee County southwest of the town of Murphy, North Carolina at the approximate location shown on the Site Vicinity Map (Drawing No. 1) attached behind this report. Topographically, the site is relatively level in the vicinity of the proposed bridge and culvert extension with relatively steep slopes down to the bridge and culvert sites from the existing roadway embankment. The creek banks in the vicinity of the proposed bridge are very steep, while the creek banks

The proposed bridge will be 205 feet in length and approximately 40 feet in width (out to out) with a clear roadway width of 37 feet. Proposed skew angles for the replacement bridge are as follows: 137°00'15" at End Bent-1, 131°32'15" at Bent-1, 126°04'15" at Bent-2, and 122°59'45" at End Bent-2. The grade along the centerline of the proposed bridge will be approximately 17 feet higher than the existing grade at the end bents, while the proposed grade along the centerline at the interior bents will remain essentially unchanged.

The extension of the boxed culvert will be approximately 95 feet in length. A single-barrel culvert matching the existing culvert in dimensions is proposed. The design high water elevation for the culvert extension will be 1539.3 feet.

The Preliminary General Drawings are in English units with feet as the primary unit of length.

3.0 SCOPE OF INVESTIGATION

3.1 FIELD TESTING - BRIDGE

Work points generally corresponding to the end of each proposed bent were surveyed-in by an NCDOT survey crew. The survey crew also placed a hub at each work point location and established an elevation for each hub. The as-drilled locations for the soil test borings were located by personnel from Trigon using the surveyed work points for reference. Elevations at the as-drilled boring locations, along the existing ground surface at the bent locations, and along the structure profile were surveyed by personnel from Trigon using the elevations established by the NCDOT survey crew for different work point hubs as reference points.

Trigon's subsurface investigation for the proposed bridge was conducted between March 8 and March 22, 2007. This exploration consisted of eight soil test borings with two borings at each proposed bent location. As-drilled soil test boring locations are shown on the Boring Identification Diagram (Drawing No. 2) following this report, and boring logs and coring logs are included following this report.

Extremely soft ground conditions were encountered throughout the majority of the proposed bridge site necessitating the offsetting of many of the borings from the proposed locations due to inaccessibility to drilling equipment at the proposed locations. In addition, the EB1-B and EB2-B borings were offset in towards the centerline due to the proposed locations being located on the slope of the existing roadway embankment. Boring EB2-A encountered auger refusal without Standard Penetration Test (SPT) refusal

bringing into question an accurate top-of-rock elevation. Therefore, an offset boring (EB2-A1) was drilled to allow the determination of a top-of-rock elevation.

All of the borings for this project were drilled using an ATV-mounted Mobile B-57 drilling machine equipped with a 140-pound manual hammer. The end bent borings were advanced utilizing 0.5-foot (O.D.) continuous-flight hollow-stem auger techniques, while the interior bent borings were advanced utilizing wash-drilling and NQ coring techniques. The coring utilized an NQ-size hollow double-tube core barrel with creek water alone used as the drilling fluid, and was performed in order to evaluate the nature of the weathered rock/crystalline rock. The cored weathered rock/crystalline rock was returned to our laboratory for further classification and possible testing.

Standard Penetration Tests were performed in the soil test borings in general accordance with NCDOT guidelines. In conjunction with this testing, split-barrel soil and weathered rock samples were recovered for visual classification and potential laboratory testing.

3.2 FIELD TESTING - CULVERT

The steep embankment slopes and extremely soft ground conditions adjacent to the proposed culvert extension prevented access to the area of the proposed culvert extension with drilling equipment. Therefore, bridge sounding rods were utilized to evaluate the subsurface conditions along the proposed culvert extension. A total of three bridge-rod soundings (CB-1 through CB-3) were performed on the east bank of the tributary along the centerline of the proposed culvert extension, and a total of eight bridge-rod probes were performed along the centerline of the proposed culvert extension in the bottom of the existing tributary. The bridge-rod soundings were performed utilizing ½-inch steel rods driven to refusal using an approximately 16-pound hammer with a 24-inch drop. Sounding Observation Summaries are attached behind this report.

3.3 LABORATORY TESTING

Laboratory soil testing was performed on fifteen representative split-barrel samples to aid in the assessment of AASHTO soil classification and to provide data for evaluation of engineering properties. The laboratory testing on the samples consisted of natural moisture content, Atterberg limit, and grain size analysis with hydrometer. In addition, four unconfined compressive strength (Qu only) tests were performed on selected

samples of the recovered rock core. Laboratory tests were performed in general accordance with AASHTO and NCDOT specifications. The results of the soil and rock laboratory tests are included on Sheet 30 located behind this report. Laboratory results of the rock testing are also included under separate cover in Appendix A.

3.4 SITE GEOLOGY

The site of the proposed project is located within the Blue Ridge Belt of the Blue Ridge physiographic province. Blue Ridge Belt rocks are comprised of metamorphosed sedimentary and volcanic rocks intruded by a variety of plutons, and contain "well-exposed Middle Proterozoic basement gneisses, Later Proterozoic plutons, Later Proterozoic metavolcanic and metasedimentary rift sequences, and thick early Paleozoic rifted continental margin and platform deposits. These rocks were involved in foreland thrusting along the western flank of the Appalachian orogen and are a record of multiple periods of Paleozoic deformation associated with development of the southern Appalachian orogen" (*Geology of the Carolinas*, Horton, Zullo, 1991).

According to the 1985 Geologic Map of North Carolina, the site is located in an area generally consisting of Metasandstone, Metagraywacke, Metasiltstone, and Mica Schist. The crystalline rock encountered in our test borings generally consisted of moderately severely weathered to fresh Metasandstone ranging in quality from very poor to very good. The overlying residual soils at the site are the product of the physical and chemical weathering of the underlying crystalline rock.

3.5 FOUNDATION MATERIALS - BRIDGE

The generalized subsurface conditions at the proposed bridge site as indicated by the borings are described below. For soil descriptions and general stratification at a particular boring location, the respective Boring Log should be reviewed. For rock descriptions and stratification at a particular boring location, the respective Coring Log should be reviewed. The Boring Identification Diagram, Boring Logs, Coring Logs, and Core Photographs are located behind this report. Representative subsurface cross-sections at each bent location and a subsurface profile along the right side of the proposed structure are also included behind this report. The subsurface properties for the project site are described below.

Foundation materials encountered included roadway embankment fill, alluvial soils, residual soils, weathered rock, and crystalline rock.

Roadway embankment fill was encountered beginning at the existing ground surface at Boring EB1-B. The roadway embankment fill extends to a depth of 2.5 feet (Elevation 1526.5 feet) and consists of medium dense, clayey, silty, coarse to fine sand and gravel (A-2-4). The Standard Penetration Resistance value within the roadway embankment fill was 15 blows per foot (bpf).

Alluvial soil was encountered underlying the roadway embankment fill at Boring EB1-B, and beginning at the existing ground surface at the remaining borings. The alluvial soil extends to depths of ± 9 feet to ± 10 feet (Elevations ± 1521 feet to ± 1519 feet) at the End Bent-1 borings, to depths of ± 11 feet to ± 14 feet (Elevations ± 1520 feet to ± 1517 feet) at the Bent-1 borings, to depths of ± 13 feet to ± 8 feet (Elevations ± 1518 feet to ± 1523 feet) at the Bent-2 borings, and to depths of ± 8 feet to ± 6 feet (Elevations ± 1522 feet to ± 1524 feet) at the End Bent-2 borings. The alluvial materials generally consists of very loose to loose, variably silty, coarse to fine sand (A-2-4); and very soft to stiff, variably clayey, coarse to fine sandy silt (A-4), and coarse to fine sandy, silty clay (A-6 and A-7-6). A ± 1 feet thick zone of gravel and cobbles (A-1-a) was encountered within the alluvium at Boring B2-A between ± 11 feet and ± 12 feet (Elevations ± 1519 feet and ± 1518 feet) and at Boring B2-B between ± 5 feet and ± 6 feet (Elevations ± 1526 feet and ± 1525 feet). Standard Penetration Resistance values within the alluvial soil ranged from Weight-of-Hammer to 10 bpf.

Residual soil was encountered underlying the alluvium at seven of the eight bridge borings with the exception being Boring B1-B in which weathered rock was encountered directly underlying the alluvium. The residuum extends to depths of ± 10 feet to ± 22 feet (Elevations ± 1520 feet to ± 1507 feet) at the End Bent-1 borings, to a depth of ± 16 feet (Elevation ± 1515 feet) at Boring B1-A, to depths of ± 16 feet to ± 11 feet (Elevations ± 1515 feet to ± 1520 feet) at the Bent-2 borings, and to depths of ± 17 feet to ± 13 feet (Elevations ± 1513 feet to ± 1517 feet) at the End Bent-2 borings. The residuum generally consists loose to very dense, variably clayey, variably silty, coarse to fine sand with varying amounts of rock fragments (A-1-b and A-2-4). A 0.5-foot thick zone of weathered rock was encountered within the residual soil at Boring EB2-B between depths of 9.0 feet and 9.5 feet (Elevations 1520.7 feet and 1520.4). Standard Penetration Resistance values within the residual soil ranged from 8 to 63 bpf.

Weathered rock was encountered underlying the alluvium at Boring B1-B, and underlying the residual soil in the remaining borings drilled at the proposed bridge site. The weathered rock generally consists of Metasandstone. The weathered rock was encountered at the following depths and elevations: 10.0 feet and 22.0 feet (Elevations 1519.6 feet and 1507.0 feet) at Borings EB1-A and EB1-B, respectively; 15.5 feet and 14.0 feet (Elevations 1515.4 feet and 1516.6 feet) at Borings B1-A and B1-B, respectively; 16.0 feet and 11.0 feet (Elevations 1514.6 feet and 1519.7 feet) at Borings B2-A and B2-B, respectively; and 17.0 feet and 13.0 feet (Elevations 1512.9 feet and 1516.9 feet) at Borings EB2-A and EB2-B, respectively. As previously noted, there is a 0.5-foot thick zone of weathered rock within the residual soil at Boring EB2-B between depths of 9.0 feet and 9.5 feet (Elevations 1520.7 feet and 1520.4). Boring EB2-A was terminated within weathered rock.

Crystalline rock was encountered directly underlying the weathered rock at all of the bridge borings with the exception of Boring EB2-A. The crystalline rock generally consists of Metasandstone. The top of the crystalline rock was encountered at the following depths and elevations: 17.1 feet and 22.4 feet (Elevations 1512.5 feet and 1506.6 feet) at Borings EB1-A and EB1-B, respectively; 19.6 feet and 16.6 feet (Elevations 1511.3 feet and 1514.0 feet) at Borings B1-A and B1-B, respectively; 19.0 feet and 12.5 feet (Elevations 1511.6 feet and 1518.2 feet) at Borings B2-A and B2-B, respectively; and 18.7 feet and 19.1 feet (Elevation 1510.8 feet) at Borings EB2-A1 and EB2-B, respectively.

A maximum of 26 feet of weathered rock/crystalline rock was cored at the interior bent borings. None of the cored weathered rock was recovered. In general, the cored crystalline rock is moderately severely weathered to fresh, medium hard to very hard Metasandstone with very close to wide fracture spacing. Strata (REC) values and strata Rock Quality Designation (RQD) values within the crystalline rock ranged from 0 to 100 percent.

3.6 FOUNDATION MATERIALS - CULVERT

The generalized subsurface conditions at the proposed culvert site as indicated by the bridge-rod sounding are described below. Sounding Observation Summaries for the bridge-rod sounding and probes performed along the proposed culvert extension are attached behind this report. The subsurface properties for the project site are described below.

Foundation materials encountered included alluvial soils and weathered rock/crystalline rock.

Alluvial soil was encountered beginning at the existing ground surface/tributary bottom at all of the bridge-rod soundings/probes performed for the proposed culvert extension. The alluvial soil on the banks of the tributary (approximately the northern half of the extension) extends to depths of ± 3 feet to ± 4 feet (Elevation ± 1528 feet) while the alluvial soil in the stream bed (approximately the southern half of the culvert extension) extends to a maximum depth of ± 1 foot (Elevation ± 1528 feet).

Weathered and/or crystalline rock was encountered underlying the alluvium at the site of culvert extension at an elevation of ± 1528 feet at all locations where bridge-rod soundings were performed based on bridge-rod refusal. Even though bridge-rod refusal may occur on gravel and boulder material, the consistent elevation of refusal at all test locations within the area of the proposed culvert extension indicates that the refusal materials are most likely hard weathered rock or crystalline rock.

3.7 GROUNDWATER

Groundwater was encountered at all of the borings drilled for this bridge investigation project. The groundwater elevation ranged from ± 1530 feet to ± 1529 feet. The water surface elevation of Persimmon Creek surveyed by Trigon on March 23, 2007 was ± 1529 feet. The Preliminary General Drawings indicate a normal water surface elevation of ± 1529 feet and a high water surface elevation of ± 1537 feet which was recorded in the spring of 2003.

4.0 CONSTRUCTION CONSIDERATIONS

Gravel is common within the alluvium present at the site, and rock fragments are common within the residuum at the site. Gravel and cobble layers were encountered within the alluvium at Borings B2-A, and B2-B, and are likely to be present elsewhere across the proposed bridge site.

The ground conditions within the area of the proposed bridge and culvert extension are extremely soft and wet. Great difficulty was encountered when attempting to move drilling equipment throughout the area with the result of equipment becoming deeply stuck in the mire numerous times.

5.0 CLOSURE

The geotechnical investigation, analysis, and general construction considerations included in this report are based on the Preliminary General Drawings and the data obtained from our field and laboratory-

testing program. If the proposed location and geometry, or finished grades are changed or are different from those outlined above, or if subsurface conditions are encountered during construction which differ from those indicated by our borings, we will require the opportunity to review these changed conditions and make any necessary modifications to the general conditions presented in this report.

Cross-sections and profiles are a generalized interpretation of soil conditions between borings and should not be considered accurate other than at the boring locations. Subsurface conditions between boring locations or elsewhere on the site may vary, and subsurface anomalies may exist which were not detected.

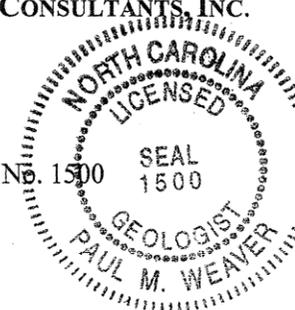
Trigon Engineering Consultants, Inc. appreciates the opportunity to be of service to Wilbur Smith Associates and the NCDOT on this project. Should you have any questions concerning this report, please feel free to contact the undersigned.

Respectfully submitted,

TRIGON ENGINEERING CONSULTANTS, INC.



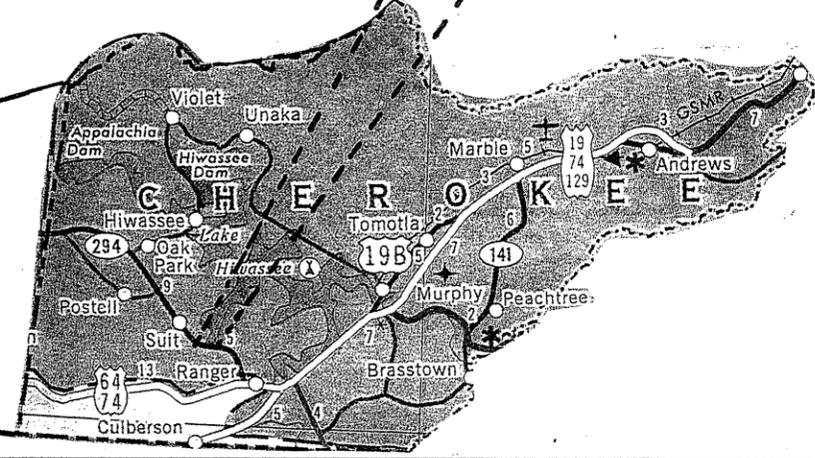
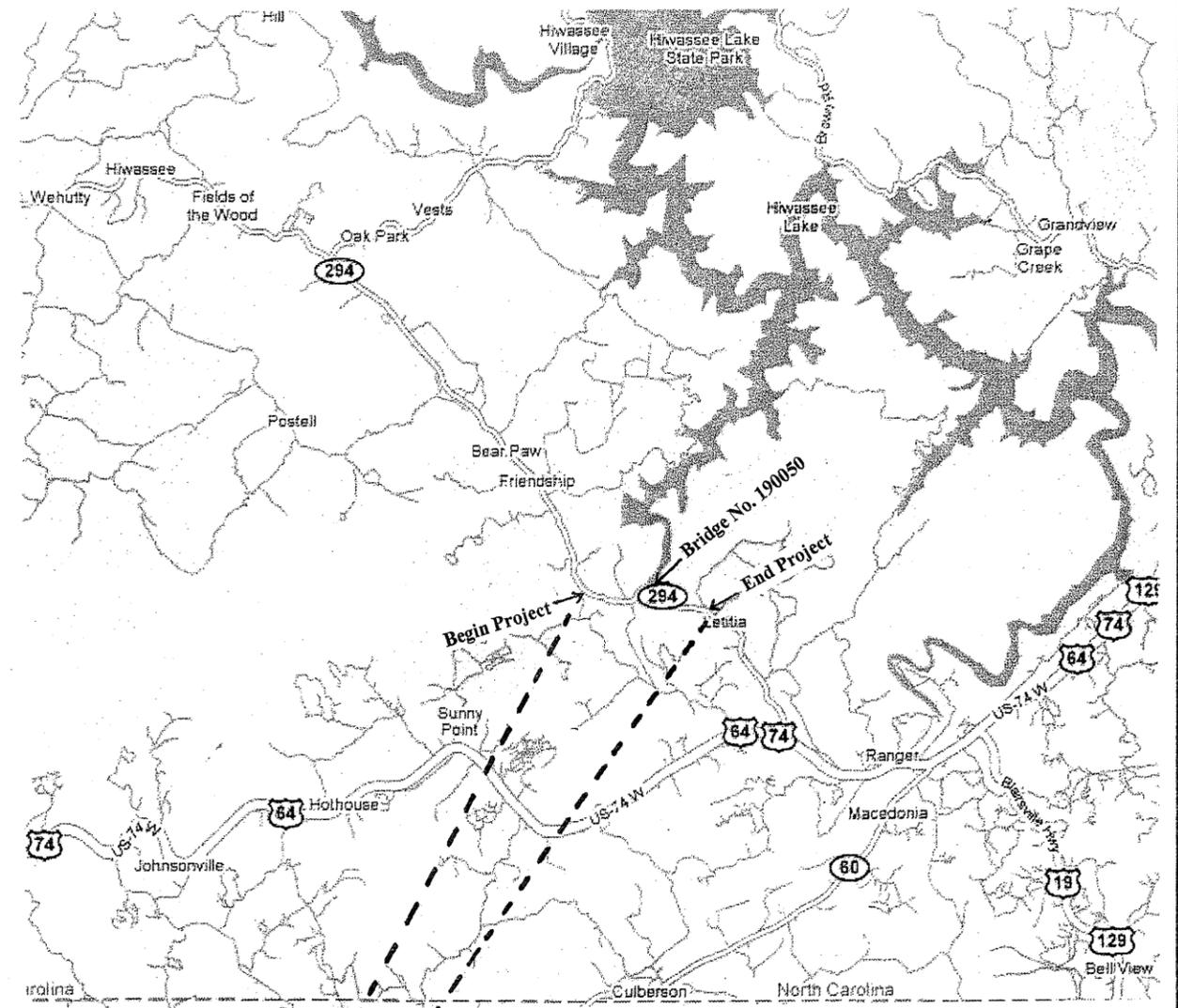
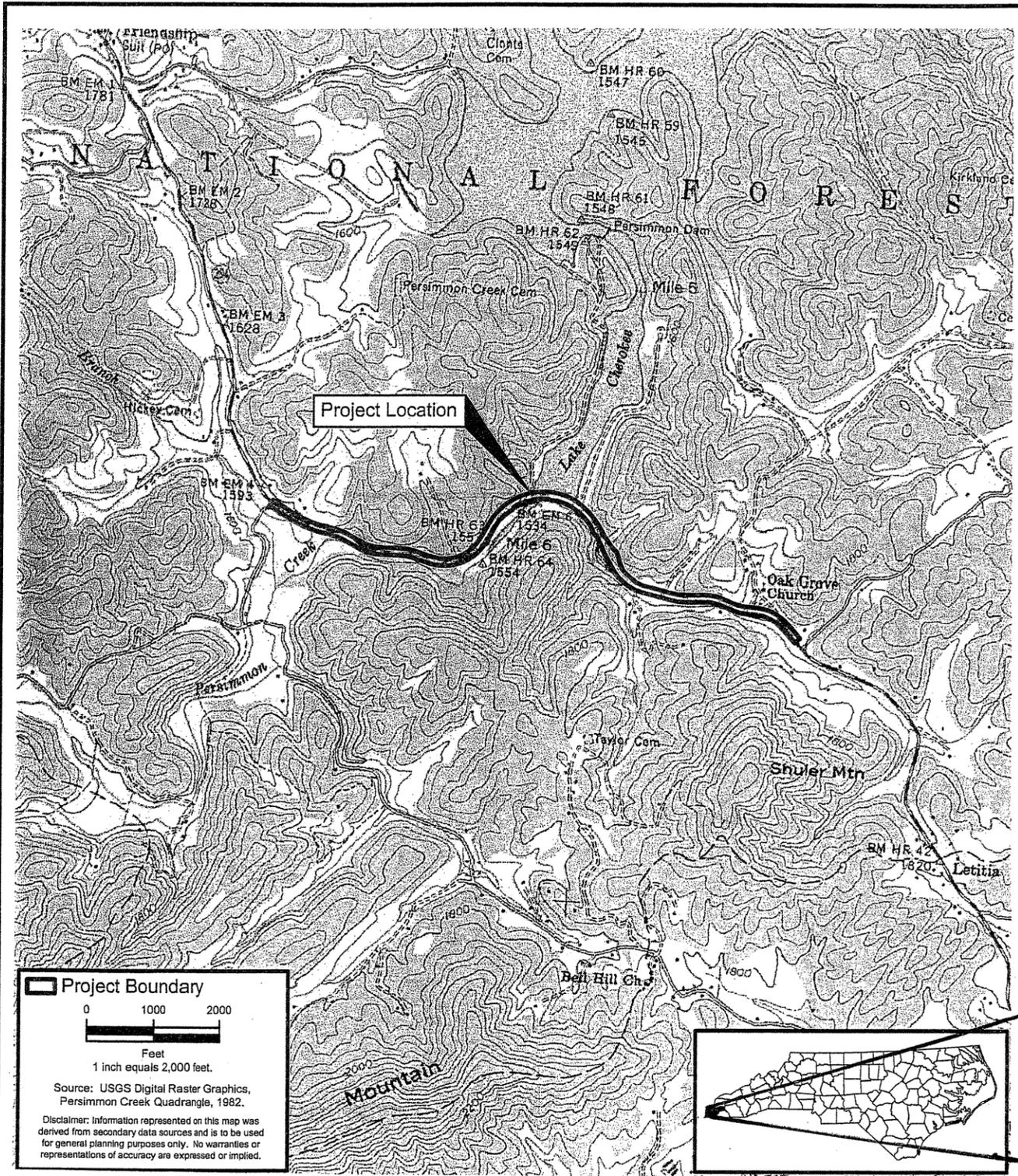
Paul M. Weaver, P.G.
Registered North Carolina No. 1500



Jeffrey R. Vinson, P.G.
Senior Project Manager

PMW/JRV:pmw
Attachments

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Project Boundary

0 1000 2000
Feet
1 inch equals 2,000 feet.

Source: USGS Digital Raster Graphics, Persimmon Creek Quadrangle, 1982.

Disclaimer: Information represented on this map was derived from secondary data sources and is to be used for general planning purposes only. No warranties or representations of accuracy are expressed or implied.



Trigon Engineering Consultants, Inc.
Greensboro North Carolina

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Not to Scale

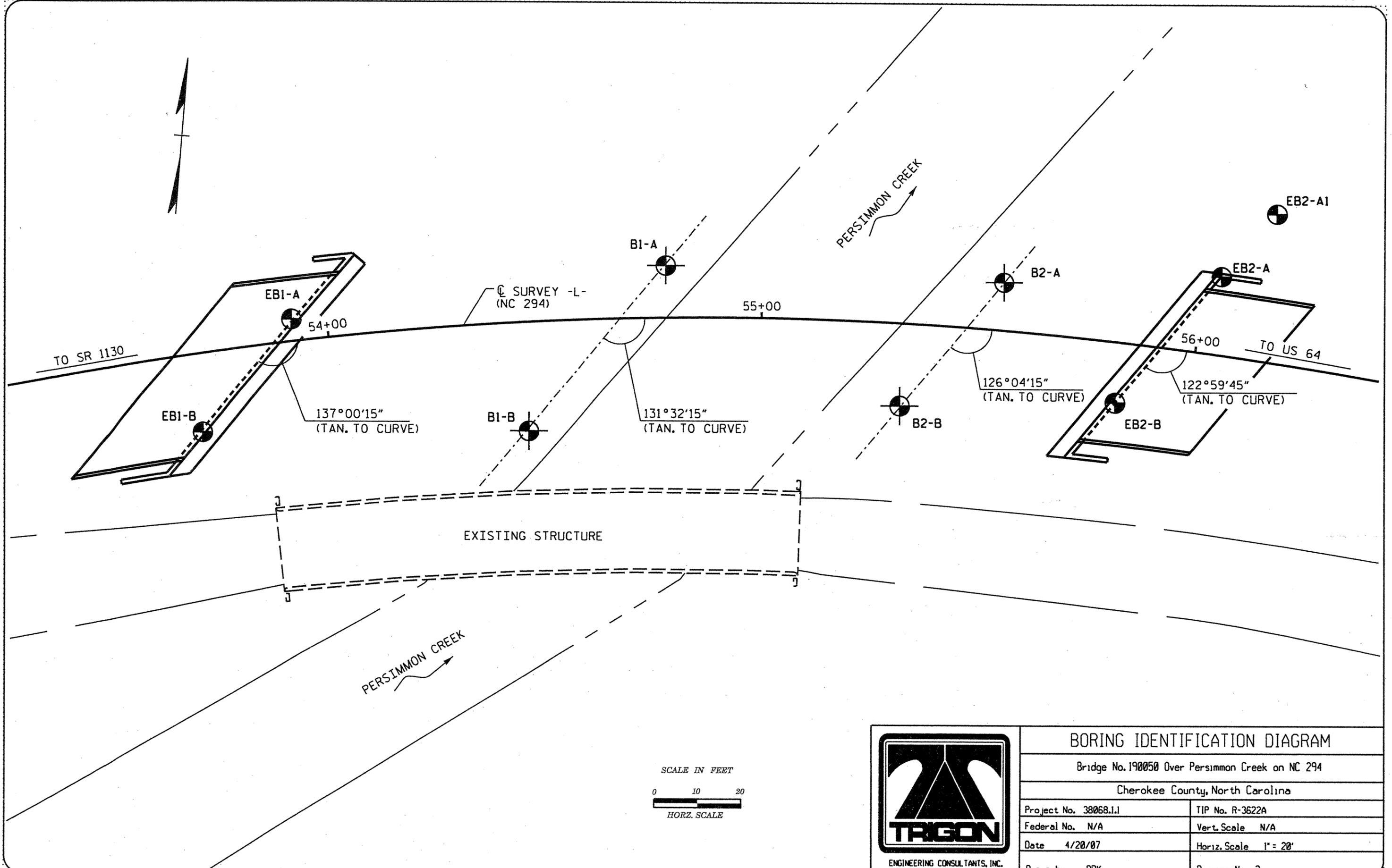
DATE:
4/16/07

STATE PROJECT NO.
38068.1.1

TIP NO.:
R-3622A

SITE VICINITY MAP
Bridge No. 190050 on NC 294 over Persimmon Creek, Cherokee County, North Carolina

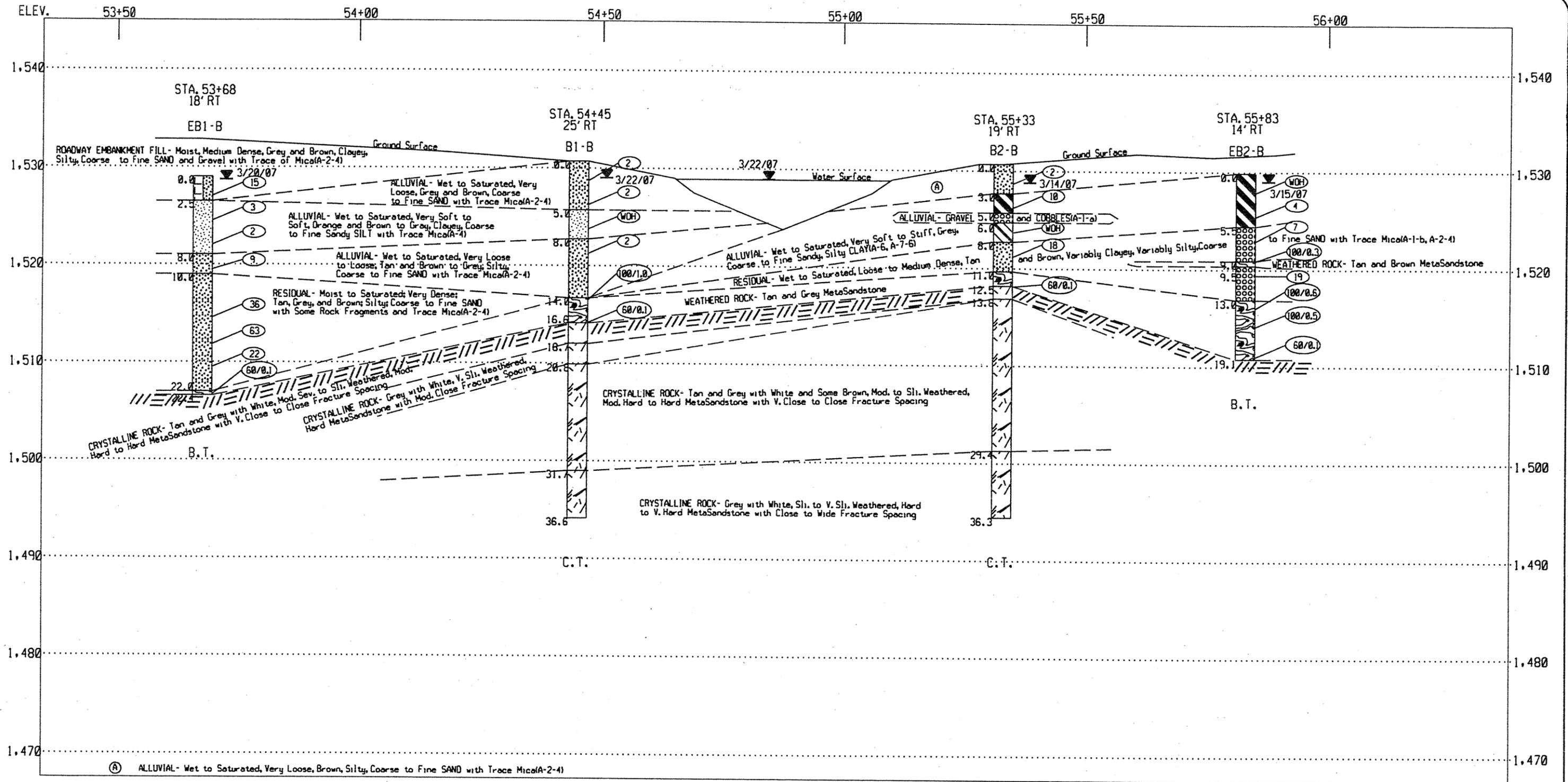
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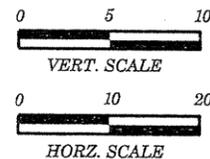
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 HORZ. SCALE



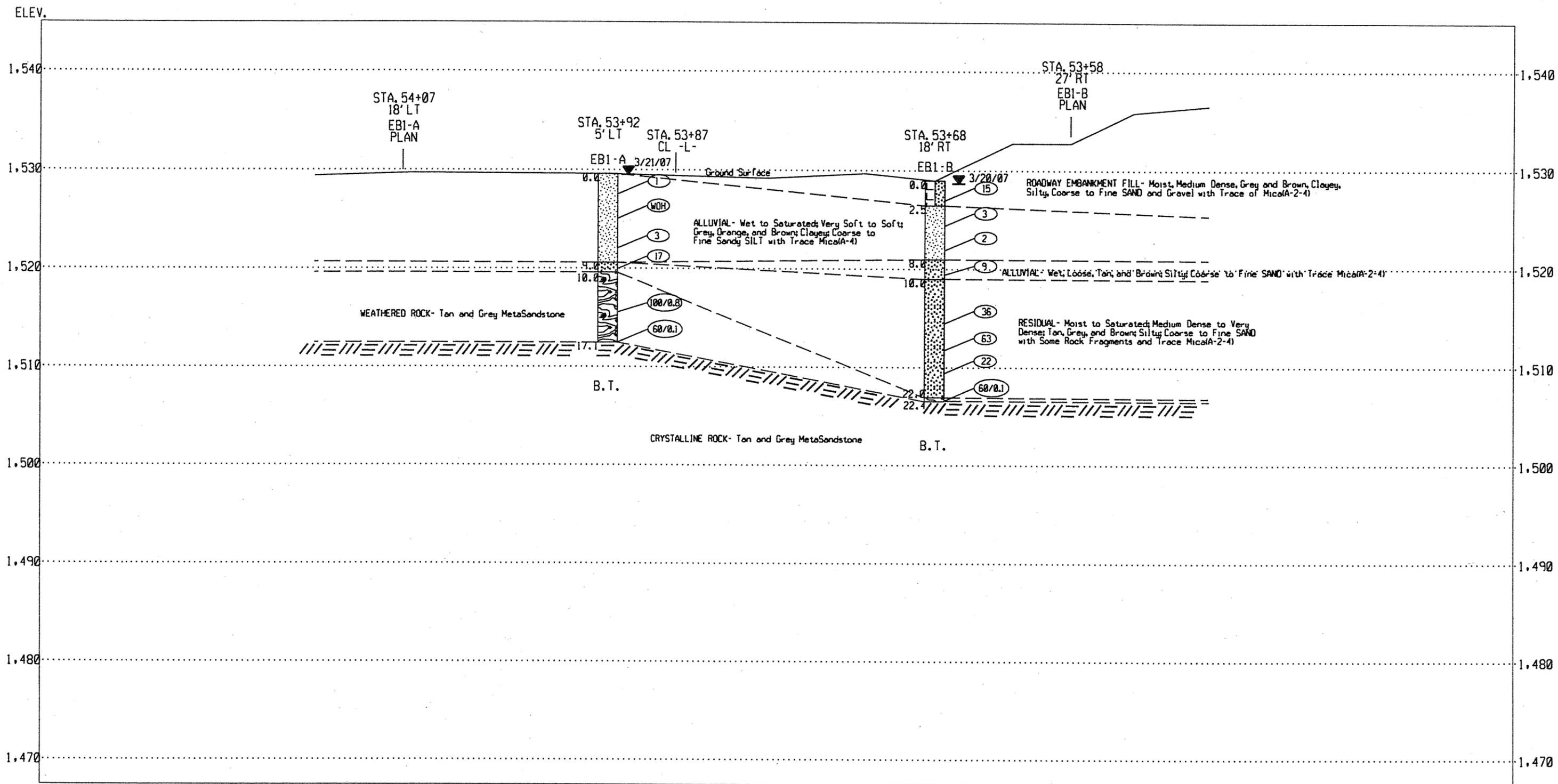
BORING IDENTIFICATION DIAGRAM	
Bridge No. 190050 Over Persimmon Creek on NC 294	
Cherokee County, North Carolina	
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale N/A
Date 4/20/07	Horiz. Scale 1" = 20'
Drawn by DRK	Drawing No. 2



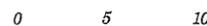
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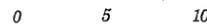
PROFILE 23' RIGHT OF -L-	
Bridge No. 190050 Over Persimmon Creek on NC 294	
Cherokee County, North Carolina	
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale 1" = 10'
Date 4/20/07	Horiz. Scale 1" = 20'
Drawn by DRK	Drawing No. 3



SCALE IN FEET



VERT. SCALE



HORZ. SCALE



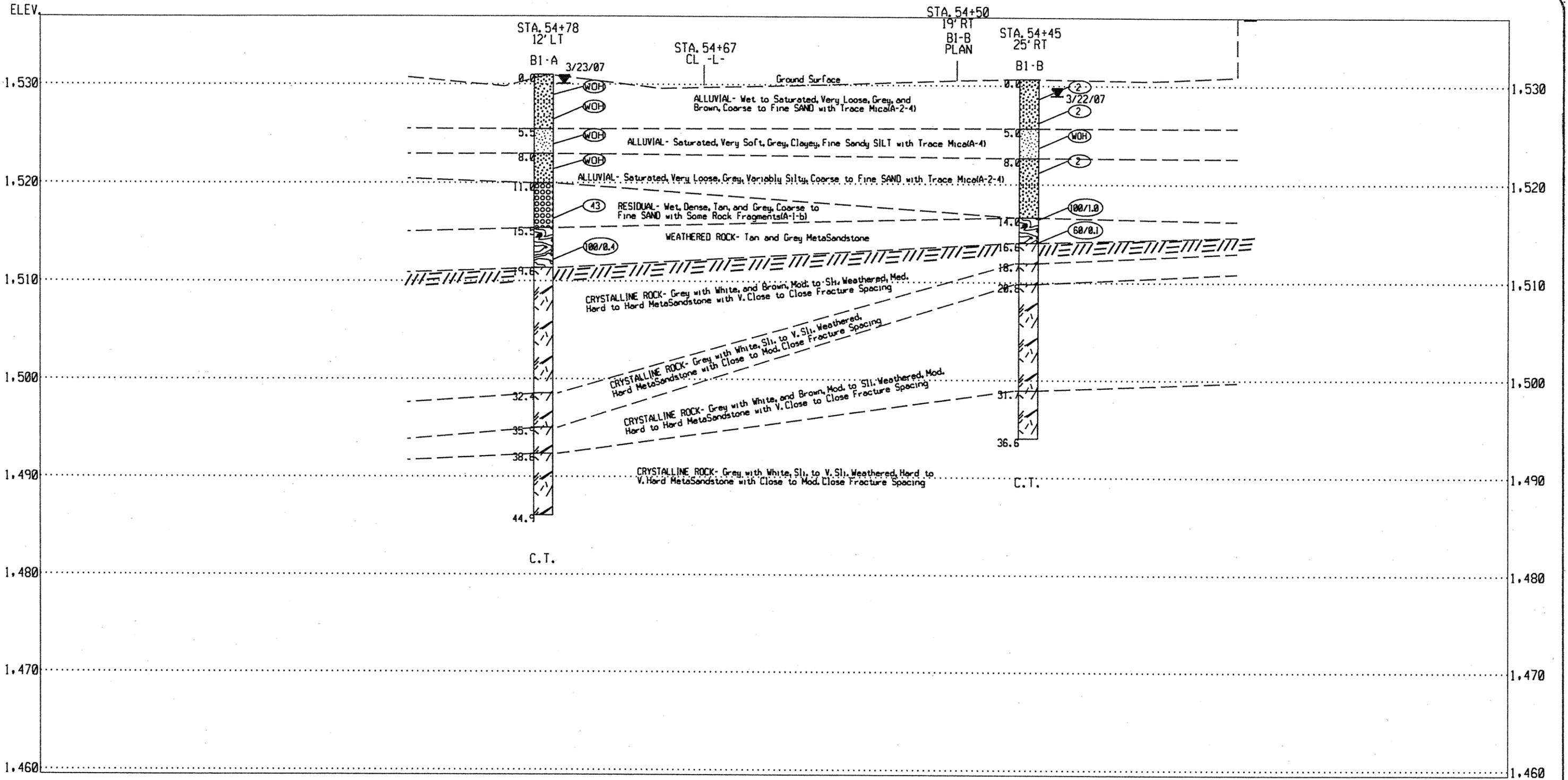
ENGINEERING CONSULTANTS, INC.

CROSS-SECTION ALONG END BENT-1

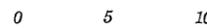
Bridge No. 190050 Over Persimmon Creek on NC 294

Cherokee County, North Carolina

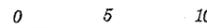
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale 1" = 10'
Date 4/20/07	Horiz. Scale 1" = 10'
Drawn by DRK	Drawing No. 4



SCALE IN FEET



VERT. SCALE



HORZ. SCALE



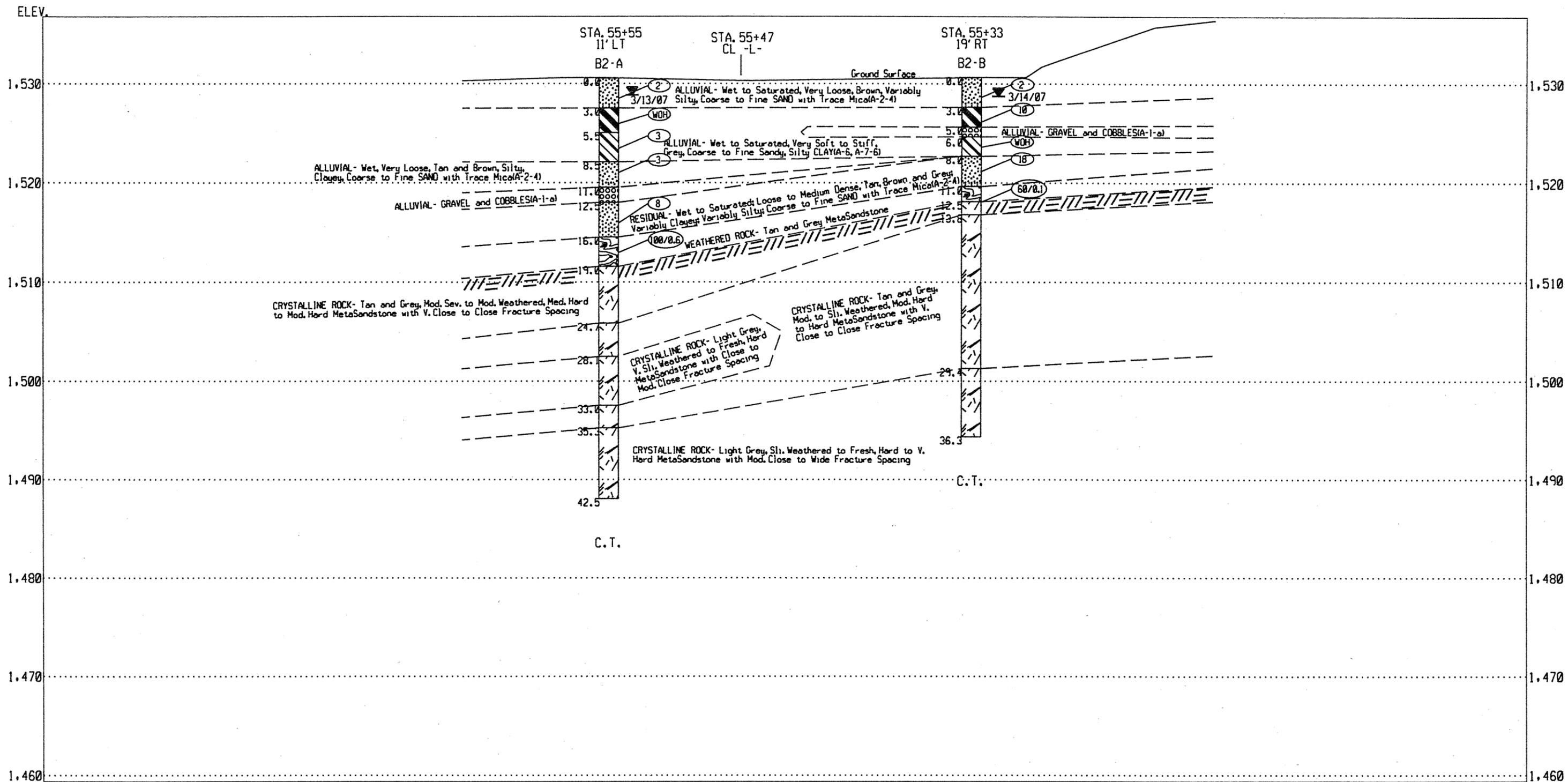
ENGINEERING CONSULTANTS, INC.

CROSS-SECTION ALONG BENT-1

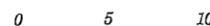
Bridge No. 190050 Over Persimmon Creek on NC 294

Cherokee County, North Carolina

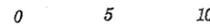
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale 1" = 10'
Date 4/20/07	Horiz. Scale 1" = 10'
Drawn by DRK	Drawing No. 5



SCALE IN FEET



VERT. SCALE



HORZ. SCALE

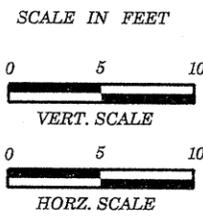
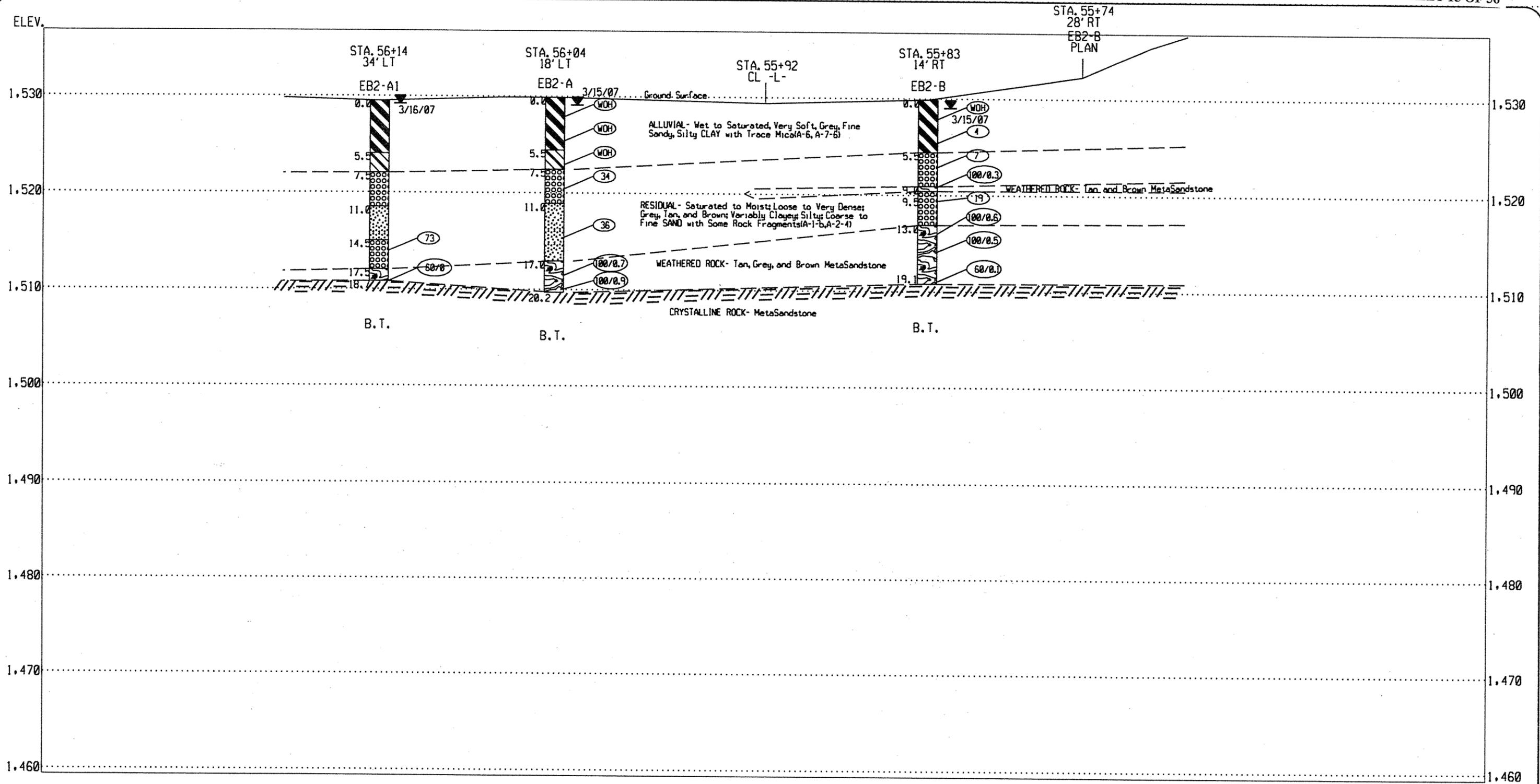


CROSS-SECTION ALONG BENT-2

Bridge No. 190050 Over Persimmon Creek on NC 294

Cherokee County, North Carolina

Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale 1" = 10'
Date 4/20/07	Horiz. Scale 1" = 10'
Drawn by DRK	Drawing No. 6



CROSS-SECTION ALONG END BENT-2	
Bridge No. 190050 Over Persimmon Creek on NC 294	
Cherokee County, North Carolina	
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale 1" = 10'
Date 4/20/07	Horiz. Scale 1" = 10'
Drawn by DRK	Drawing No. 7



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells								
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)							
BORING NO. EB1-A		BORING LOCATION 53+92		OFFSET 5ft LT		ALIGNMENT -L-		0 HR. 0.4						
COLLAR ELEV. 1529.6 ft		NORTHING 453743.98		EASTING 516304.27				24 HR. 0.1						
TOTAL DEPTH 17.1 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD HSA		HAMMER TYPE 140lb Manual								
DATE STARTED 3/20/07		COMPLETED 3/20/07		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
1,529.6														1,529.6 0.00
1,528.6	1.0	1	1	WOH							SS-1	32.1%		ALLUVIAL: Very Soft to Soft, Grey and Brown, Clayey, Coarse to Fine Sandy SILT with Trace Mica
1,526.1	3.5	WOH	WOH	WOH								S		
1,523.1	6.5	1	1	2							SS-2	29.7%		
1,521.1	8.5	4	8	9								W		
														RESIDUAL: Medium Dense, Tan, Silty, Coarse to Fine SAND WEATHERED ROCK: Grey and Tan Metasandstone
1,516.1	13.5	40	60/0.3											
1,512.6	17.0	60/0.1												Boring Terminated w/SPT Refusal at Elevation 1512.5 ft. on Crystalline Rock: Metasandstone
														*Note Boring Offset 20' Right of Proposed Location Due to Extremely Soft Conditions Preventing Access to Drilling Equipment

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 16 OF 36

PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells								
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)							
BORING NO. EB1-B		BORING LOCATION 53+68		OFFSET 18ft RT		ALIGNMENT -L-		0 HR. 1.3						
COLLAR ELEV. 1529.0 ft		NORTHING 453725.93		EASTING 516276.58				24 HR. 0.3						
TOTAL DEPTH 22.4 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD HSA		HAMMER TYPE 140lb Manual								
DATE STARTED 3/15/07		COMPLETED 3/19/07		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80					100
1,529.0														1,529.0 0.00
1,528.0	1.0	8	7	8							SS-3			ROADWAY EMBANKMENT FILL: Medium Dense, Grey and Brown, Clayey, Silty, Coarse to Fine SAND and Gravel with Trace Mica
1,525.5	3.5	2	1	2								W		ALLUVIAL: Soft, Orange and Brown, Clayey, Coarse to Fine Sandy SILT with Trace Mica
1,523.0	6.0	WOH	WOH	2								W		
1,520.5	8.5	2	4	5								W		ALLUVIAL: Loose, Tan and Brown, Silty, Coarse to Fine SAND with Trace Mica
														RESIDUAL: Very Dense; Tan, Grey and Brown; Silty; Coarse to Fine SAND with Some Rock Fragments and Trace Mica
1,515.5	13.5	21	22	14								W		
1,512.8	16.2	40	19	44										
1,510.5	18.5	10	11	11								SS-4		
1,506.7	22.3	60/0.1												Boring Terminated with SPT Refusal at Elevation 1506.6 ft. on Crystalline Rock: Metasandstone
														WEATHERED ROCK: Tan and Grey Metasandstone

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO.		ID No.		COUNTY		GEOLOGIST							
38068.1.1		R-3622A		Cherokee		T. Wells/ P. Weaver							
SITE DESCRIPTION							GROUND WATER (ft)						
Bridge No. 190050 over Persimmon Creek on NC 294							0 HR. 0.6						
BORING NO.	BORING LOCATION		OFFSET	ALIGNMENT									
B1-A	54+78		12ft LT	-L-									
COLLAR ELEV.	NORTHING	EASTING											
1530.9 ft	453828.74	516325.00				24 HR. 0.9							
TOTAL DEPTH	DRILL MACHINE	DRILL METHOD		HAMMER TYPE									
44.9 ft	Mobile B-57 ATV	Wash/NQ Core		140lb Manual									
DATE STARTED	COMPLETED		SURFACE WATER DEPTH										
3/21/07	3/22/07		N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100			
1,530.9													1,530.9 0.00
1,529.9	1.0	WOH	WOH	WOH	WOH							W	ALLUVIAL: Very Loose, Brown and Grey, Coarse to Fine SAND with Trace Mica
1,527.4	3.5	WOH	WOH	WOH	WOH							S	
1,524.9	6.0	WOH	WOH	WOH	WOH							SS-5	ALLUVIAL: Very Soft, Grey, Clayey, Fine Sandy SILT
1,522.4	8.5	WOH	WOH	WOH	WOH							S	ALLUVIAL: Very Loose, Grey, Coarse to Fine SAND with Trace Mica
1,517.4	13.5											W	RESIDUAL: Dense, Tan and Grey, Coarse to Fine SAND with Some Rock Fragments
		18	18	25									1,515.4 15.5
1,512.4	18.5												WEATHERED ROCK: Grey Metasandstone
		100/0.4											1,511.3 19.6
1,506.5	24.4											RS-1	CRYSTALLINE ROCK: Grey with White and Brown, Moderately to Slightly Weathered, Medium to Moderately Hard Metasandstone with Very Close to Close Fracture Spacing
													1,498.5 32.4
													CRYSTALLINE ROCK: Grey with White, Slightly to Very Slightly Weathered, Hard Metasandstone with Close Fracture Spacing
													1,495.0 35.9
													CRYSTALLINE ROCK: Grey with White and Brown, Moderately to Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
													1,492.3 38.6
													CRYSTALLINE ROCK: Grey with White, Slightly to Very Slightly Weathered, Hard Metasandstone with Close to Moderately Close Fracture Spacing
													1,486.0 44.9
													Coring Terminated at Elevation 1486.0 ft. in Crystalline Rock: Metasandstone
													* Note: Creek Water Alone Used as Drilling Fluid

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07



CORE BORING REPORT
SHEET 17 OF 36

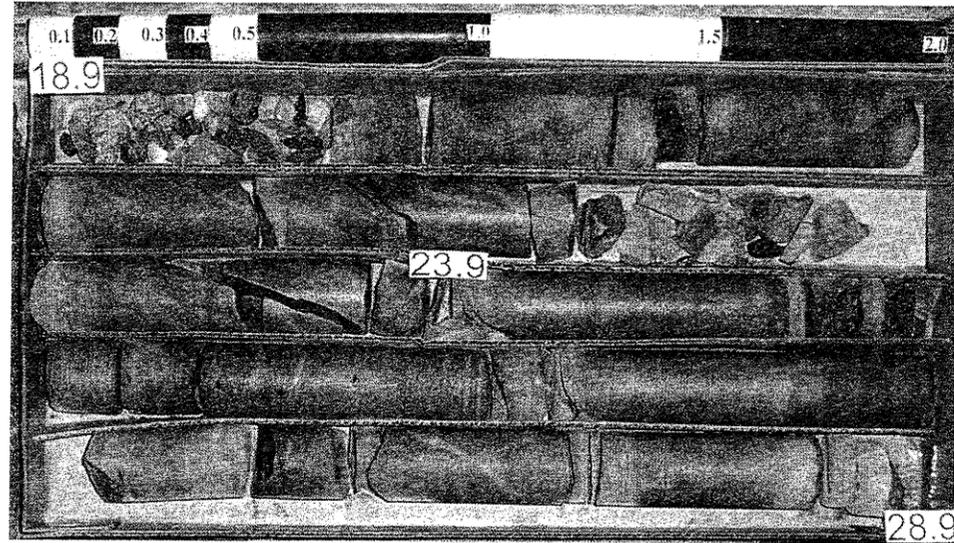
PROJECT NO.		ID No.		COUNTY		GEOLOGIST				
38068.1.1		R-3622A		Cherokee		T. Wells/ P. Weaver				
SITE DESCRIPTION							GROUND WATER (ft)			
Bridge No. 190050 over Persimmon Creek on NC 294							0 HR. 0.6			
BORING NO.	BORING LOCATION		OFFSET	ALIGNMENT						
B1-A	54+78		12ft LT	-L-						
COLLAR ELEV.	NORTHING	EASTING								
1530.9 ft	453828.74	516325.00				24 HR. 0.9				
TOTAL DEPTH	DRILL MACHINE	DRILL METHOD		HAMMER TYPE						
44.9 ft	Mobile B-57 ATV	Wash/NQ Core		140lb Manual						
DATE STARTED	COMPLETED		SURFACE WATER DEPTH							
3/21/07	3/22/07		N/A							
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 18.9 ft
1,512.0	18.9	5.0	12:45 5:30	(4.0) 80%	(1.3) 26%		(0.0) 0%	(6.3) 49%		1,511.3 WEATHERED ROCK: Grey Metasandstone (continued)
1,507.0	23.9	5.0	6:20 7:30 9:30				(12.3) 96%			CRYSTALLINE ROCK: Grey with White and Brown, Moderately to Slightly Weathered, Medium to Moderately Hard Metasandstone with Very Close to Close Fracture Spacing
			3:40 4:00 3:00 4:40	(4.8) 96%	(3.4) 68%	RS-1				Majority of Joints at 10° to 20° with Moderate to Heavy Iron Staining 8 Joints at 70° to 80° with Heavy Iron Staining Numerous Partially Healed High to Low Angle Fractures
1,502.0	28.9	5.0	4:15 3:40 3:00	(5.0) 100%	(2.9) 58%					
			4:30 9:35 5:50				(3.5) 100%	(2.2) 63%		1,498.5 CRYSTALLINE ROCK: Grey with White, Slightly to Very Slightly Weathered, Hard Metasandstone with Close Fracture Spacing
1,497.0	33.9	5.0	3:45 3:30 3:05	(4.9) 98%	(0.9) 18%		(2.6) 96%	(0.0) 0%		1,495.0 Joints at 10° to 20° with Moderate to Heavy Iron Staining Very Close Fracture Spacing 34.4 ft. to 34.6 ft.
			4:30 3:30	(5.0) 100%	(3.9) 78%		(6.2) 98%	(4.8) 76%		1,492.3 CRYSTALLINE ROCK: Grey with White and Brown, Moderately to Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
1,487.0	43.9	1.0	5:00 5:30 13:30							Majority of Joints at 10° to 20° with Heavy Iron Staining 2 Joints at 70° with Heavy Iron Staining
1,486.0	44.9		6:40 3:50	(0.9) 90%	(0.9) 90%					1,486.0 CRYSTALLINE ROCK: Grey with White, Slightly to Very Slightly Weathered, Hard Metasandstone with Close to Moderately Close Fracture Spacing
										Joints at 0° to 10° with Light to Moderate Iron Staining Coring Terminated at Elevation 1486.0 ft. in Crystalline Rock: Metasandstone

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07

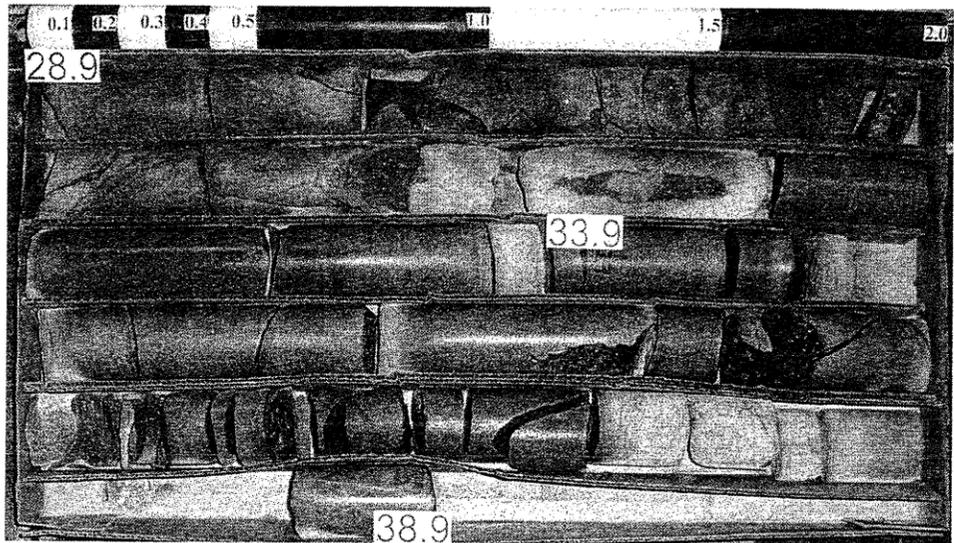
CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B1-A



Box 1 of 3

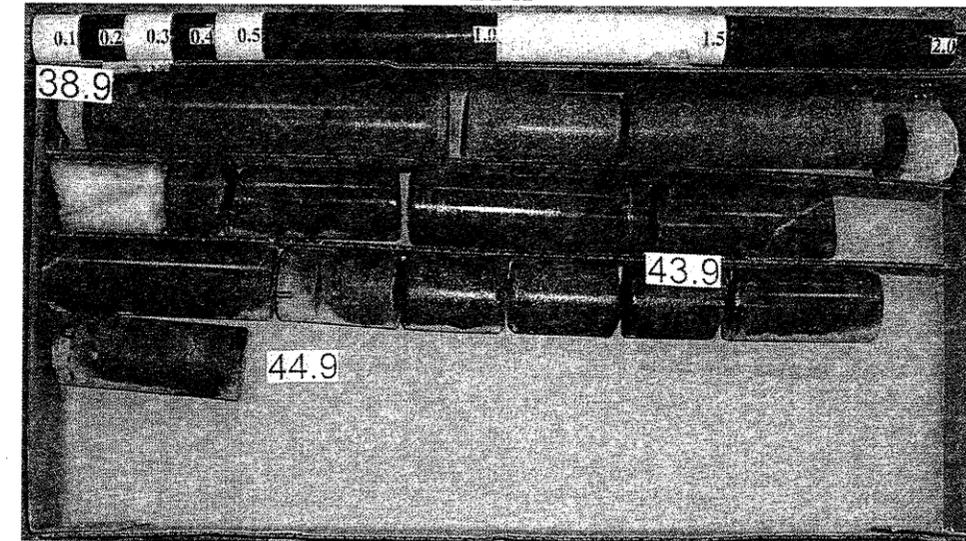


Box 2 of 3
(SCALE = 1:4)

CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B1-A



Box 3 of 3
(SCALE = 1:4)



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO.		ID No.		COUNTY		GEOLOGIST						
38068.1.1		R-3622A		Cherokee		T. Wells/ P. Weaver						
SITE DESCRIPTION							GROUND WATER (ft)					
Bridge No. 190050 over Persimmon Creek on NC 294							0 HR. 2.0					
BORING NO.	BORING LOCATION		OFFSET	ALIGNMENT								
B1-B	54+45		25ft RT	-L-								
COLLAR ELEV.	NORTHING		EASTING									
1530.6 ft	453800.80		516284.17				24 HR. 1.7					
TOTAL DEPTH	DRILL MACHINE		DRILL METHOD		HAMMER TYPE							
36.6 ft	Mobile B-57 ATV		Wash/NQ Core		140lb Manual							
DATE STARTED		COMPLETED		SURFACE WATER DEPTH								
3/20/07		3/21/07		N/A								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
1,530.6												1,530.6 0.00
1,529.6	1.0	1	1	1								SS-6
1,527.1	3.5											S
1,524.6	6.0	WOH	WOH	WOH								SS-7 63.8%
1,522.1	8.5											S
1,517.1	13.5	4	96/0.5									WEATHERED ROCK: Grey Metasandstone
1,514.1	16.5	60/0.1										1,514.0 16.6
1,512.4	18.2											RS-2
												1,511.9 18.7
												1,509.8 20.8
												1,498.9 31.7
												1,494.0 36.6
Coring Terminated at Elevation 1494.0 ft. in Crystalline Rock: Metasandstone												
* Note: Creek Water Alone Used as Drilling Fluid												

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07



CORE BORING REPORT
SHEET 19 OF 36

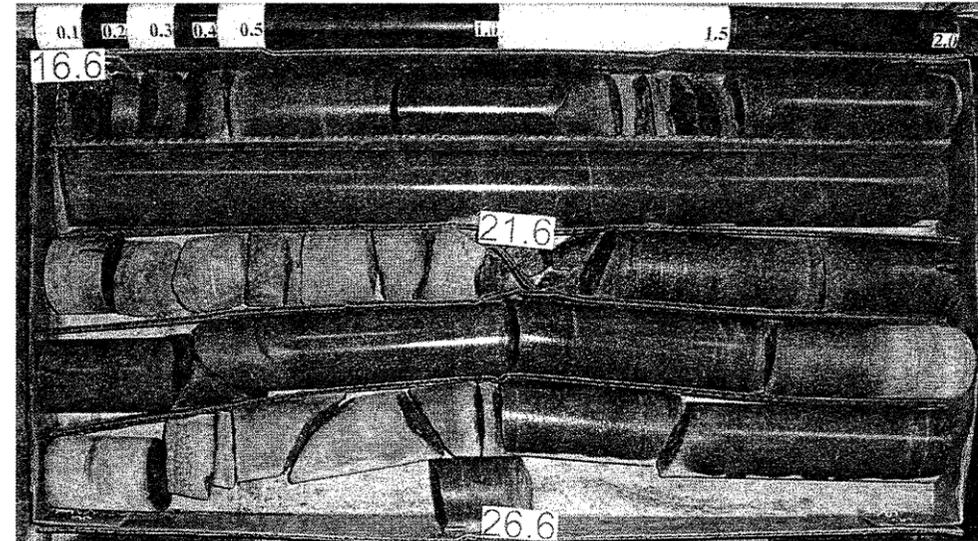
PROJECT NO.		ID No.		COUNTY		GEOLOGIST				
38068.1.1		R-3622A		Cherokee		T. Wells/ P. Weaver				
SITE DESCRIPTION							GROUND WATER (ft)			
Bridge No. 190050 over Persimmon Creek on NC 294							0 HR. 2.0			
BORING NO.	BORING LOCATION		OFFSET	ALIGNMENT						
B1-B	54+45		25ft RT	-L-						
COLLAR ELEV.	NORTHING		EASTING							
1530.6 ft	453800.80		516284.17				24 HR. 1.7			
TOTAL DEPTH	DRILL MACHINE		DRILL METHOD		HAMMER TYPE					
36.6 ft	Mobile B-57 ATV		Wash/NQ Core		140lb Manual					
DATE STARTED		COMPLETED		SURFACE WATER DEPTH						
3/20/07		3/21/07		N/A						
CORE SIZE			TOTAL RUN		DRILLER					
NQ			20.0 ft		W. Duggins					
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (%)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 16.6 ft
1,514.0	16.6	5.0	16:40 22:10 19:10 12:20 5:10	(4.9) 98%	(3.3) 66%		(2.0) 95%	(1.3) 82%		1,514.0 16.6 1,511.9 18.7 1,509.8 20.8
1,509.0	21.6		8:45 11:45 7:45 6:35 16:20	(5.0) 100%	(3.8) 76%		(10.3) 94%	(5.4) 50%	RS-2	Majority of Joints at 0° to 10° with Light to Heavy Iron Staining CRYSTALLINE ROCK: Grey with White, Very Slightly Weathered, Hard Metasandstone with Moderately Close Fracture Spacing No Natural Fractures
1,504.0	26.6	5.0	5:00 2:55 5:30 5:50 7:27	(4.4) 88%	(1.7) 34%		(4.9) 100%	(4.4) 90%		CRYSTALLINE ROCK: Grey with White and Some Brown, Moderately to Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
1,499.0	31.6	5.0	8:30 8:25 4:25 5:00 4:55	(5.0) 100%	(4.4) 88%		(4.9) 100%	(4.4) 90%		1,499.9 31.7 1,494.0 36.6
1,494.0	36.6									Majority of Joints at 10° to 20° with Moderate to Heavy Iron Staining 3 Joints at 30° with Heavy Iron Staining 1 Vertical Fracture 0.5 ft. Long with Heavy Iron Staining 2 Joints at 80° with Heavy Iron Staining Moderately Severely Weathered 20.8 ft. to 21.2 ft. CRYSTALLINE ROCK: Grey with White, Slightly to Very Slightly Weathered, Hard to Very Hard Metasandstone with Close to Moderately Close Fracture Spacing 5 Joints at 10° to 20° Very Close Fracture Spacing 32.4 ft. to 32.6 ft. and 35.9 ft. to 36.1 ft. Coring Terminated at Elevation 1494.0 ft. in Crystalline Rock: Metasandstone

NCDOT BORE SINGLE 07105014C.GPJ NC_DOT_GDT 4/24/07

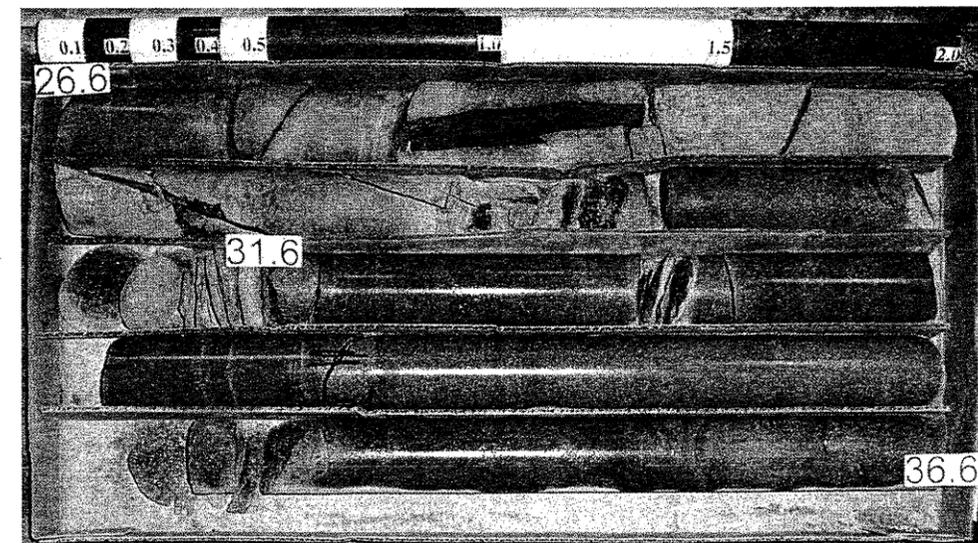
CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B1-B



Box 1 of 2



Box 2 of 2
(SCALE = 1:4)



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells/ P. Weaver						
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)					
BORING NO. B2-A		BORING LOCATION 55+55		OFFSET 11ft LT	ALIGNMENT -L-		0 HR. 1.8					
COLLAR ELEV. 1530.6 ft		NORTHING 453906.59		EASTING 516328.86			24 HR. 1.7					
TOTAL DEPTH 42.5 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD Wash/NQ Core		HAMMER TYPE 140lb Manual						
DATE STARTED 3/8/07		COMPLETED 3/12/07		SURFACE WATER DEPTH N/A								
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION
		0.5ft	0.5ft	0.5ft	0	20	40	60	80	100		
1,530.6												1,530.6 0.00
1,529.6	1.0											1,527.6 3.0
1,527.1	3.5	WOH	WOH	WOH								1,525.1 5.5
1,524.6	6.0	WOH	1	2								1,522.1 8.5
1,522.1	8.5	1	1	2								1,519.6 11.0
1,517.1	13.5	6	4	4								1,518.1 12.5
1,513.4	17.2	75	25/0.1							100/0.6		1,514.6 16.0
												1,511.6 19.0
												1,505.9 24.7
												1,502.5 28.1
1,500.8	29.8											1,497.6 33.0
												1,495.3 35.3
												1,488.1 42.5

ALLUVIAL: Very Loose, Brown, Coarse to Fine SAND
 ALLUVIAL: Very soft, Grey, Fine Sandy, Silty CLAY with Little Mica
 ALLUVIAL: Soft, Grey, Silty, Coarse to Fine Sandy CLAY with Trace Mica
 ALLUVIAL: Very Loose, Tan and Brown, Silty, Clayey, Coarse to Fine SAND with Trace Mica
 ALLUVIAL: Gravel and Cobbles
 RESIDUAL: Loose, Grey, Silty, Coarse to Fine SAND with Trace Mica
 WEATHERED ROCK: Tan and Grey Metasandstone
 CRYSTALLINE ROCK: Tan and Light Grey, Moderately Severely to Moderately Weathered, Medium Hard to Moderately Hard Metasandstone with Very Close to Close Fracture Spacing
 CRYSTALLINE ROCK: Light to Dark Grey, Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
 CRYSTALLINE ROCK: Light Grey, Very Slightly Weathered to Fresh, Hard Metasandstone with Close to Moderately Close Fracture Spacing
 CRYSTALLINE ROCK: Tan and Grey, Moderately Weathered, Hard Metasandstone with Very Close to Close Fracture Spacing
 CRYSTALLINE ROCK: Light Grey, Very Slightly Weathered to Fresh Hard to Very Hard Metasandstone with Moderately Close Fracture Spacing

* Note: Creek Water Alone Used as Drilling Fluid

NCDOT BORE SINGLE 07105014.GPJ NC_DOT_GDT 4/24/07



CORE BORING REPORT
SHEET 21 OF 36

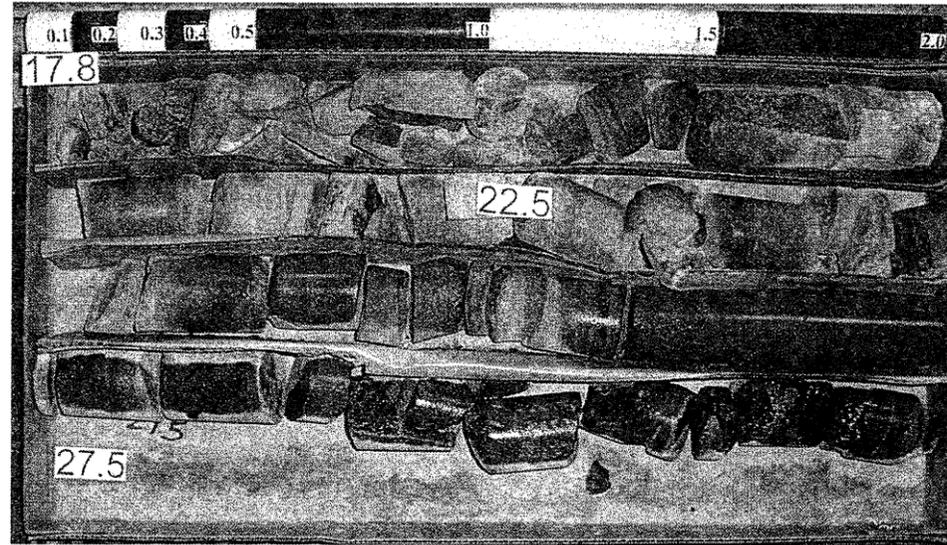
PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells/ P. Weaver				
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)			
BORING NO. B2-A		BORING LOCATION 55+55		OFFSET 11ft LT	ALIGNMENT -L-		0 HR. 1.8			
COLLAR ELEV. 1530.6 ft		NORTHING 453906.59		EASTING 516328.86			24 HR. 1.7			
TOTAL DEPTH 42.5 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD Wash/NQ Core		HAMMER TYPE 140lb Manual				
DATE STARTED 3/8/07		COMPLETED 3/12/07		SURFACE WATER DEPTH N/A						
CORE SIZE NQ		TOTAL RUN 24.7 ft		DRILLER W. Duggins						
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (%)	RQD (%)	SAMP. NO.	STRATA REC. (%)	RQD (%)	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 17.8 ft
1,512.8	17.8	4.7	5:18/0.7 17:05 32:47 7:47 13:30	(2.8) 60%	(0.3) 6%		(0.0) 0%	(N/A) (0.3) 5%		1,511.6 WEATHERED ROCK: Core Loss in Weathered Metasandstone (continued) 19.0
1,508.1	22.5	5.0	6:22 14:36 17:51 13:20	(4.7) 94%	(0.7) 14%		(4.7) 82%			CRYSTALLINE ROCK: Tan and Light Grey, Moderately Severely to Moderately Weathered, Medium Hard to Moderately Hard Metasandstone with Very Close to Close Fracture Spacing
			17:10 9:52 10:28 12:15				(3.4) 100%	(1.0) 29%		1,505.9 Majority of Joints Heavily Iron Stained Numerous Vertical Fractures to 21.5 ft. Abundant Fractures at 10° to 20° 24.7
1,503.1	27.5	5.0	13:20	(5.0) 100%	(4.5) 90%		(4.9) 100%	(4.8) 98%		1,502.5 CRYSTALLINE ROCK: Light to Dark Grey, Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing 28.1
			17:10 9:52 10:28 12:15			RS-3	(2.3) 100%	(0.0) 0%		1,497.6 16 Joints at 10° to 20° 1 Joint at 90°, 0.2 ft. Long 1 Joint at 70° 33.0
1,498.1	32.5	5.0	12:15	(5.0) 100%	(2.8) 56%		(2.3) 100%	(0.0) 0%		1,495.3 CRYSTALLINE ROCK: Light Grey, Very Slightly Weathered to Fresh, Hard Metasandstone with Close to Moderately Close Fracture Spacing 35.3
			12:30 19:38 17:30				(7.2) 100%	(7.2) 100%		6 Joints at 10° to 20° Very Close Fracture Spacing 30.4 ft. to 30.5 ft. and 31.2 ft. to 31.3 ft. CRYSTALLINE ROCK: Tan and Grey, Moderately Weathered, Hard Metasandstone with Very Close to Close Fracture Spacing
1,488.1	42.5		16:40 14:50 16:30 22:50 44:30							1,488.1 Majority of Joints Heavily Iron Stained Abundant High Angle (70° to 80°) Fractures with Intersecting Low Angle (20° to 30°) Fractures CRYSTALLINE ROCK: Light Grey, Very Slightly Weathered to Fresh, Hard to Very Hard Metasandstone with Moderately Close Fracture Spacing Several Partially Healed High Angle Fractures From 35.3 ft. to 36.6 ft. Coring Terminated at Elevation 1488.1 ft. in Crystalline Rock: Metasandstone 42.5

NCDOT BORE SINGLE 07105014C.GPJ NC_DOT_GDT 4/24/07

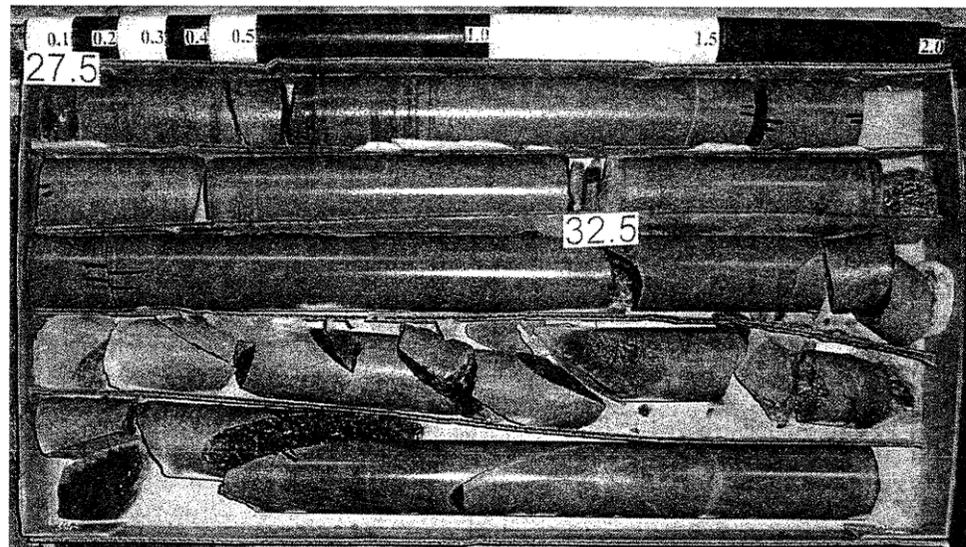
CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B2-A



Box 1 of 3



Box 2 of 3
(SCALE = 1:4)

CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B2-A



Box 3 of 3
(SCALE = 1:4)



N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells/ P. Weaver								
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)							
BORING NO. B2-B		BORING LOCATION 55+33		OFFSET 19ft RT	ALIGNMENT -L-	0 HR. 1.6	24 HR. 1.9							
COLLAR ELEV. 1530.7 ft		NORTHING 453885.34		EASTING 516298.27										
TOTAL DEPTH 36.3 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD Wash/NQ Core		HAMMER TYPE 140lb Manual								
DATE STARTED 3/13/07		COMPLETED 3/13/07		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100	
1,530.7													1,530.7 0.00	
1,529.7	1.0	WOH	1	1							SS-11		1,529.7 3.0	ALLUVIAL: Very Loose, Brown, Silty, Coarse to Fine SAND with Trace Mica
1,527.2	3.5	6	7	3							S		1,527.2 5.0	ALLUVIAL: Stiff, Grey, Fine Sandy, Silty CLAY
1,524.7	6.0	WOH	WOH	WOH									1,524.7 6.0	ALLUVIAL: Gravel and Cobbles
1,522.2	8.5	6	7	11							SS-12		1,522.2 8.0	ALLUVIAL: Very Soft, Grey, Silty, Coarse to Fine Sandy CLAY
1,518.2	12.5												1,519.7 11.0	RESIDUAL: Medium Dense, Tan and Brown, Clayey, Coarse to Fine SAND with Trace Mica
													1,518.2 12.5	WEATHERED ROCK: Tan and Grey Metasandstone
		60/0.1											1,516.9 13.8	CRYSTALLINE ROCK: Tan and Grey, Moderately Severely Weathered Metasandstone
														CRYSTALLINE ROCK: Tan and Grey, Moderately to Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
														CRYSTALLINE ROCK: Light Grey, Slightly to Very Slightly Weathered, Hard Metasandstone with Moderately Close to Wide Fracture Spacing
1,500.3	30.4										RS-4		1,501.3 29.4	
														Coring Terminated at Elevation 1494.4 ft. in Crystalline Rock: Metasandstone
														* Note: Creek Water Alone Used as Drilling Fluid

NCDOT BORE SINGLE 07105014C.GPJ NC_DOT.GDT 4/24/07



CORE BORING REPORT
SHEET 23 OF 36

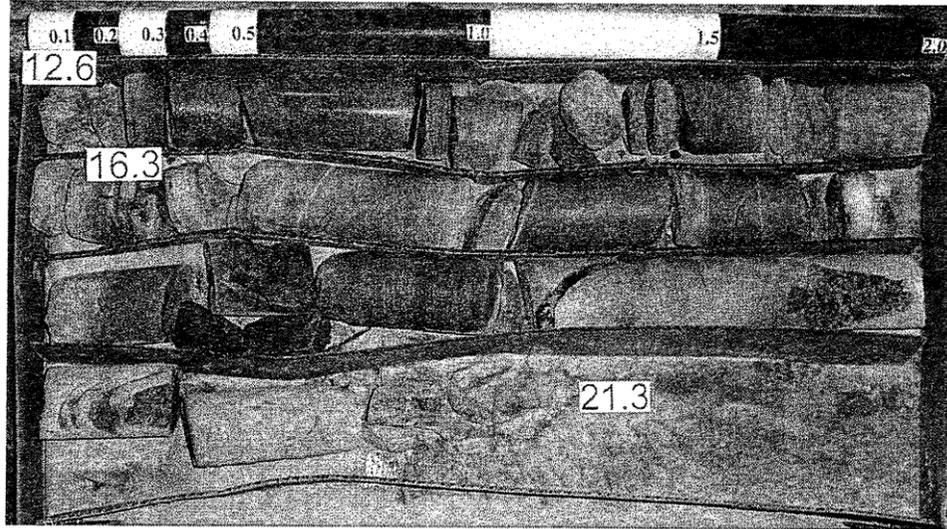
PROJECT NO. 38068.1.1		ID No. R-3622A		COUNTY Cherokee		GEOLOGIST T. Wells/ P. Weaver					
SITE DESCRIPTION Bridge No. 190050 over Persimmon Creek on NC 294							GROUND WATER (ft)				
BORING NO. B2-B		BORING LOCATION 55+33		OFFSET 19ft RT	ALIGNMENT -L-	0 HR. 1.6	24 HR. 1.9				
COLLAR ELEV. 1530.7 ft		NORTHING 453885.34		EASTING 516298.27							
TOTAL DEPTH 36.3 ft		DRILL MACHINE Mobile B-57 ATV		DRILL METHOD Wash/NQ Core		HAMMER TYPE 140lb Manual					
DATE STARTED 3/13/07		COMPLETED 3/13/07		SURFACE WATER DEPTH N/A							
CORE SIZE NQ		TOTAL RUN 23.7 ft		DRILLER W. Duggins							
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	
				REC. (%)	ROD (%)		REC. (%)	ROD (%)			
										Begin Coring @ 12.6 ft	
1,518.1	12.6	3.7	29:50 5:10 7:45	(2.2) 59%	(0.4) 11%		(0.0) 0%	(0.0) 0%		1,516.9 13.8	CRYSTALLINE ROCK: Core Loss in Tan and Grey, Moderately Severely Weathered Metasandstone (continued)
1,514.4	16.3		6:30/0.7	(4.6) 92%	(1.9) 38%		(14.0) 90%	(4.8) 31%			CRYSTALLINE ROCK: Tan and Grey, Moderately to Slightly Weathered, Moderately Hard to Hard Metasandstone with Very Close to Close Fracture Spacing
1,509.4	21.3	5.0	3:44 4:11 5:30 7:30	(4.1) 82%	(1.1) 22%						Majority of Joints Heavily Iron Stained 53 Joints at 20° to 30° 14 Joints at 70° to 80°
1,504.4	26.3	5.0	3:30 3:40 7:11 6:40 4:30 10:30	(5.0) 100%	(3.3) 66%						
1,499.4	31.3	5.0	8:10 5:20 4:40 10:30 12:55	(4.5) 90%	(4.2) 84%	RS-4	(6.4) 93%	(6.1) 88%		1,501.3 29.4	CRYSTALLINE ROCK: Light Grey, Slightly to Very Slightly Weathered, Hard Metasandstone with Moderately Close to Wide Fracture Spacing
1,494.4	36.3		15:30 8:10 10:45 11:30 3:30							1,494.4 36.3	Coring Terminated at Elevation 1494.4 ft. in Crystalline Rock: Metasandstone

NCDOT BORE SINGLE 07105014C.GPJ NC_DOT.GDT 4/24/07

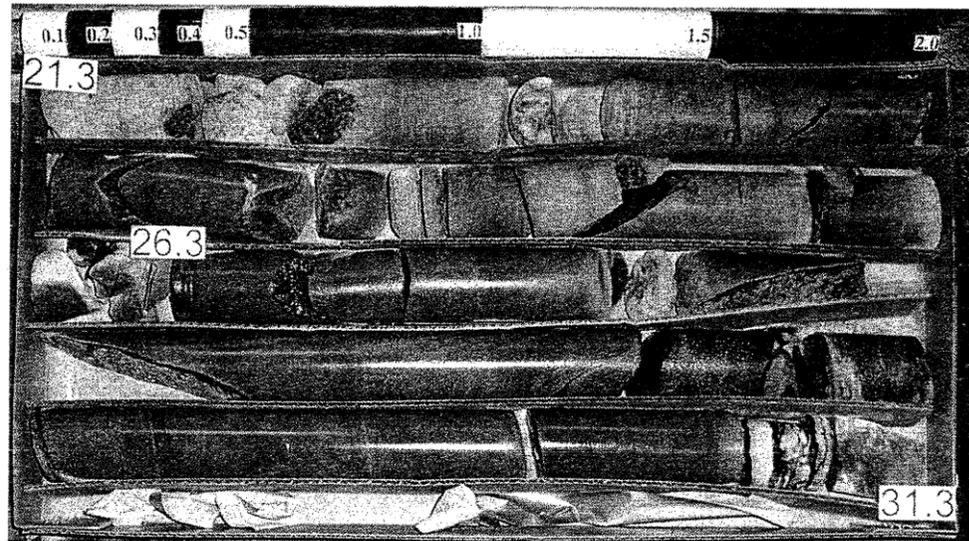
CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B2-B



Box 1 of 3

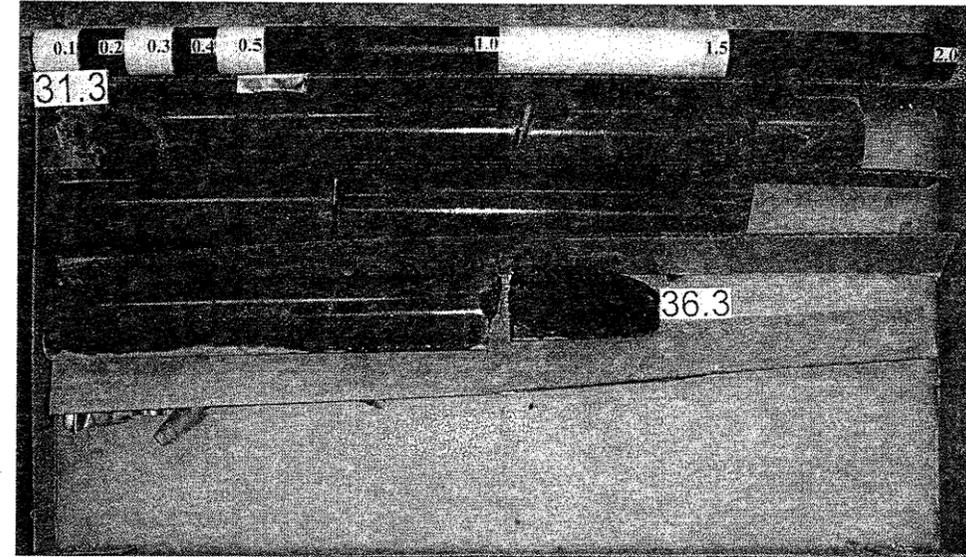


Box 2 of 3
(SCALE = 1:4)

CORE PHOTOGRAPHS

NCDOT Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 190050 over Persimmon Creek on NC 294

B2-B

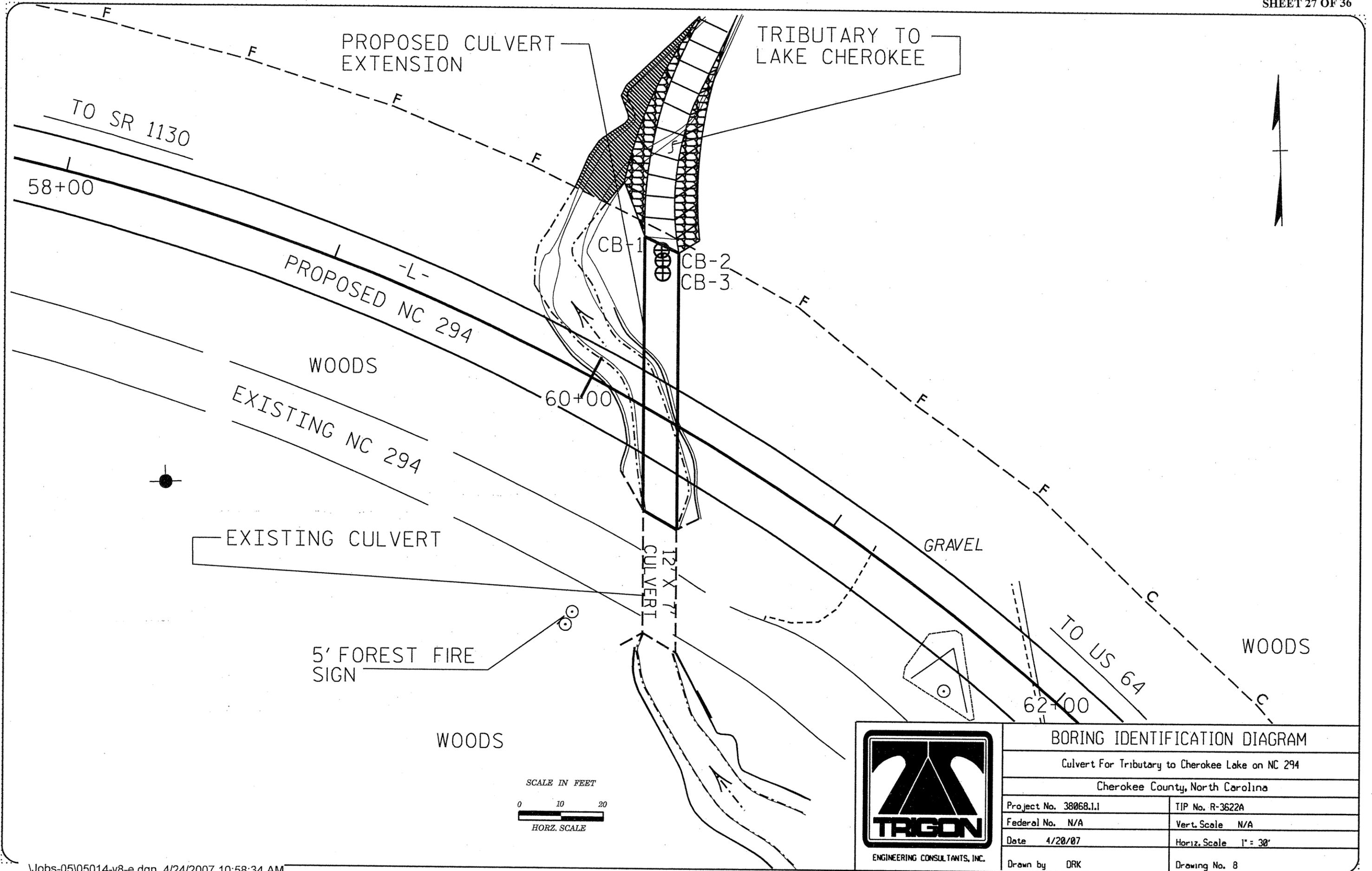


Box 3 of 3
(SCALE = 1:4)



PROJECT NO.		ID No.		COUNTY		GEOLOGIST										
38068.1.1		R-3622A		Cherokee		T. Wells										
SITE DESCRIPTION							GROUND WATER (ft)									
Bridge No. 190050 over Persimmon Creek on NC 294							0 HR.	1.8								
BORING NO.	BORING LOCATION		OFFSET	ALIGNMENT												
EB2-B	55+83		14ft RT	-L-												
COLLAR ELEV.		NORTHING		EASTING		24 HR.										
1529.9 ft		453934.62		516303.87		0.9										
TOTAL DEPTH		DRILL MACHINE		DRILL METHOD		HAMMER TYPE										
19.1 ft		Mobile B-57 ATV		HSA		140lb Manual										
DATE STARTED		COMPLETED		SURFACE WATER DEPTH												
3/14/07		3/14/07		N/A												
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION				
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100			
1,529.9													1,529.9	0.00		
1,528.9	1.0										SS-14	W			ALLUVIAL: Very Soft to Soft, Grey, Fine Sandy, Silty CLAY Moisture Content at 1.0' = 59.7%	
1,526.4	3.5	1	2	2								W				
1,523.9	6.0	1	3	4								W			RESIDUAL: Loose, Tan and Brown, Silty, Clayey, Coarse to Fine SAND	
1,521.4	8.5	7	100/0.3									W				
1,520.4	9.5	21	14	5							SS-15				WEATHERED ROCK: Tan and Brown Metasandstone	
1,516.4	13.5	53	47/0.1												RESIDUAL: Medium Dense, Tan and Brown, Silty, Coarse to Fine SAND and Rock Fragments	
1,514.4	15.5	100/0.5													WEATHERED ROCK: Tan and Grey Metasandstone	
1,511.4	18.5	31	60/0.1													
																Boring Terminated with SPT Refusal at Elevation 1510.8 ft. on Crystalline Rock: Metasandstone

NCDOT BORE SINGLE 07105014.GPJ, NC_DOT_GDT_4/24/07



BORING IDENTIFICATION DIAGRAM	
Culvert For Tributary to Cherokee Lake on NC 294	
Cherokee County, North Carolina	
Project No. 38068.1.1	TIP No. R-3622A
Federal No. N/A	Vert. Scale N/A
Date 4/20/07	Horiz. Scale 1" = 30'
Drawn by DRK	Drawing No. 8



**FIELD
 SCOUR REPORT**

WBS: 38068.1.1 TIP: R-3622A COUNTY: Cherokee

DESCRIPTION(1): Bridge No. 190050 on NC 294 Over Persimmon Creek

EXISTING BRIDGE

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

Bridge No.: 50 Length: 120 Total Bents: 3 Bents in Channel: 2 Bents in Floodplain: 1
 Foundation Type: Spread Ftg.s.; RC Backwalls at Abutments 1 & 2; RCP&B @ interior bents cantilevered @ both end

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: none evident

Interior Bents: none evident

Channel Bed: none evident

Channel Bank: none evident

EXISTING SCOUR PROTECTION

Type(3): Rip rap at abutments

Extent(4): surrounds the abutments wrapping around sides

Effectiveness(5): very

Obstructions(6): none evident

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

DESIGN INFORMATION

Channel Bed Material(7): Water was too deep to determine definitively; assume alluvial silt and sand overlying crystalline rock

Channel Bank Material(8): silty, coarse to fine SAND (A-2-4); coarse to fine sandy, silty CLAY (A-6 and A-7-6); and clayey, fine sandy SILT (A-4)

Channel Bank Cover(9): hardwood, grass, and weeds

Floodplain Width(10): approximately 800 feet

Floodplain Cover(11): mostly grass and weeds

Stream is(12): Aggrading _____ Degrading Static _____

Channel Migration Tendency(13): towards the west

Observations and Other Comments: Remnants of previous bridge structure is present in front of upstation abutment; stream is very slow moving

Reported by: Paul M. Weaver, Trigon Engineering Date: 4/11/2007

DESIGN SCOUR ELEVATIONS(14)

Feet Meters _____

BENTS

	EB1	B1	B2	EB2						

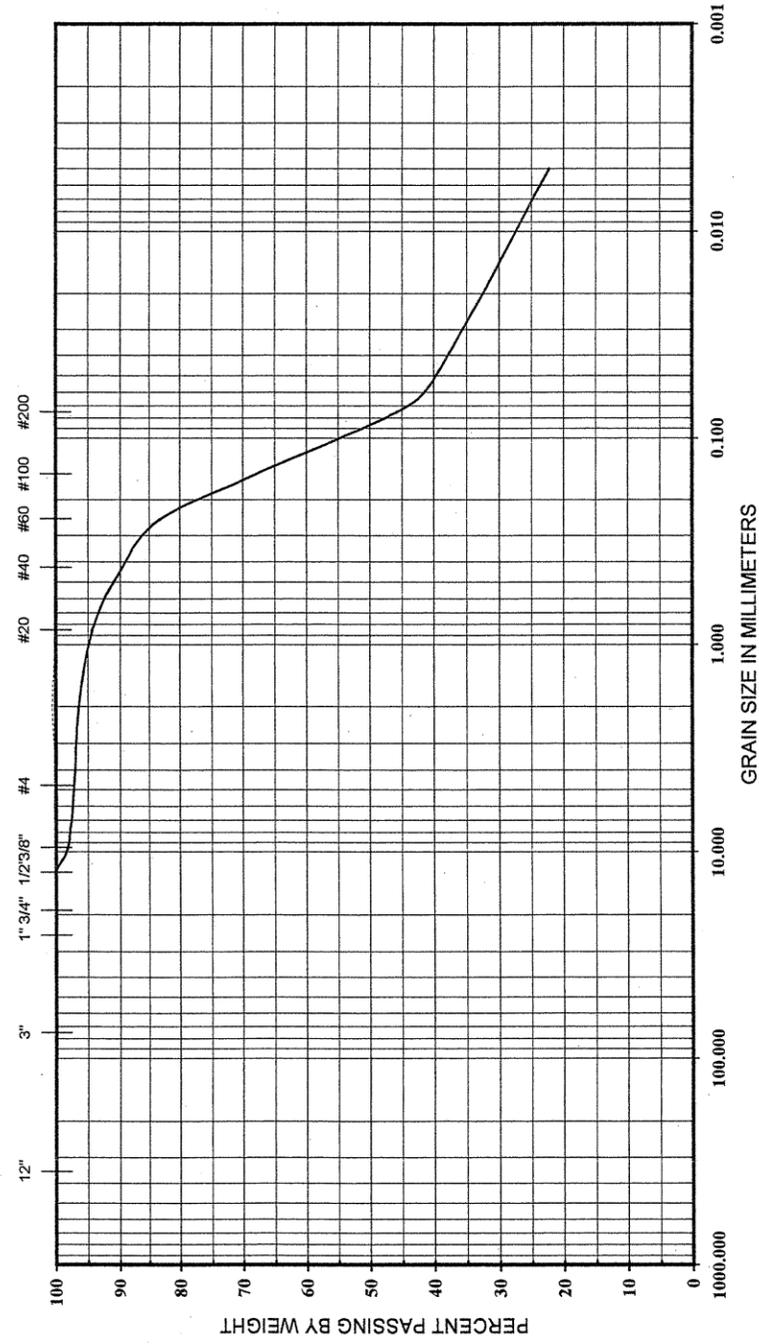
Comparison of DSE to Hydraulics Unit theoretical scour:

DSE determined by: _____ Date: _____

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	BANK	BANK	BANK	BANK	BANK	BANK
Sample No.	SS-5	SS-6	SS-7	SS-8	SS-9	SS-11
Retained #4	0	0	0	0	3	0
Passed #10	100	100	100	100	96	100
Passed #40	99	96	98	98	90	98
Passed #200	48	16	74	74	46	34
Coarse Sand	3	25	2	3	14	7
Fine Sand	57	64	32	32	45	66
Silt	26	5	48	46	18	19
Clay	14	6	18	19	23	8
LL	24	14	39	41	31	24
PI	NP	NP	NP	15	14	NP
AASHTO	A-4	A-2-4	A-4	A-7-6	A-6	A-2-4
Station	54+78	54+45	54+45	55+55	55+55	55+33
Offset	12' LT	25' RT	25' RT	11' LT	11' LT	19' RT
Depth	6.0-7.5	1.0-2.5	6.0-7.5	3.5-5.0	6.0-7.5	1.0-2.5

U S STANDARD SIEVE SIZES



BOULDERS	COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND FINE	SILT	CLAY
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BORING NO.	SAMPLE NO.	ELEVATION OR DEPTH	NMC %	LL	PL	PI	CLASSIFICATION
B2-A	SS-9	6.0-7.5	27.2	31	17	14	ALLUVIAL: Silty, Coarse to Fine Sandy CLAY (A-6)

GRAIN SIZE DISTRIBUTION

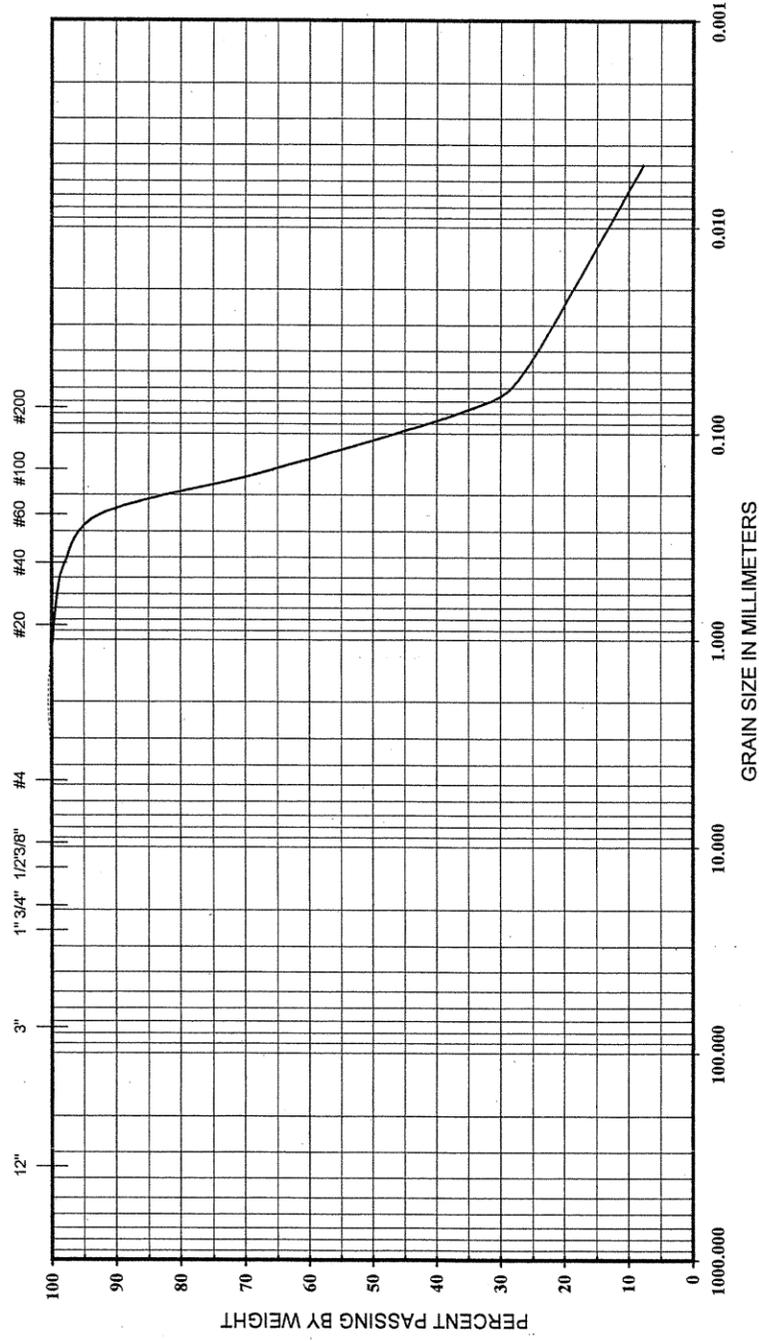
NC 294 Bridge Replacement

071-05-014

4/11/2007



U S STANDARD SIEVE SIZES



BOULDERS	COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND FINE	SILT	CLAY
----------	---------	------------------	----------------	----------------	--------------	------	------

BORING NO.	SAMPLE NO.	ELEVATION OR DEPTH	NMC %	LL	PL	PI	CLASSIFICATION
B2-B	SS-11	1.0-2.5	-	24	NP	NP	ALLUVIAL: Silty, Coarse to Fine SAND (A-2-4)

GRAIN SIZE DISTRIBUTION

NC 294 Bridge Replacement

071-05-014

4/11/2007



SITE PHOTOGRAPHS
State Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 50 Over Persimmon Creek on NC 294
Cherokee County, North Carolina
Page 1 of 4



Photograph 1 – View of Existing Bridge and Roadway Looking West

SITE PHOTOGRAPHS
State Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 50 Over Persimmon Creek on NC 294
Cherokee County, North Carolina
Page 2 of 4



Photograph 3 – View From Existing Bridge Looking Downstream



Photograph 2 – View of Existing Bridge Looking Upstream



Photograph 4 – View Approximately 23' Right of -L- Looking Downstation From End Bent-2

SITE PHOTOGRAPHS
State Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 50 Over Persimmon Creek on NC 294
Cherokee County, North Carolina
Page 3 of 4



Photograph 5 – View Looking Right to Left Across End Bent-1



Photograph 6 – View Looking Right to Left Across Bent-1

SITE PHOTOGRAPHS
State Project No. 38068.1.1 TIP No. R-3622A
Bridge No. 50 Over Persimmon Creek on NC 294
Cherokee County, North Carolina
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Photograph 7 – View Looking Right to Left Across Bent-2



Photograph 8 – View Looking Right to Left Across End Bent-2