PROJECT: 33451.1.1 ID: B-4093

STATE	STATE PROJECT REFERENCE NO.		SHEET NO.	TOTAL SHEETS
N.C.	33451.1.1		1	23
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION		
33451.1.1		P.E.		
		CONST.		

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33451.1.1 I.D. NO. B-4093

F.A. PROJECT BRZ-1728(1)

COUNTY CUMBERLAND

PROJECT DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE ROAD) OVER GUM LOG CREEK

SITE DESCRIPTION

CONTENTS:

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 (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.

For Letting

INVESTIGATED BY C. BRUINSMA PERSONNEL P. ZHANG

CHECKED BY B. KEANEY, P.E. M. KORN

SUBMITTED BY TIERRA, INC.

DATE DEC, 2004

NORTH CAROLINA PROFESSIONAL SEAL 023916 ENGINEER BRIAN D. KEANEY

SEAL

12/17/04

SIGNATURE

DRAWN BY: E. WAGNER

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.

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-4093	33451.1.1	2	23

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤35% PASSING #200)							SILT-CLAY MATERIALS (>35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	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-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	N/A
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12"	3"				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT- CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.
- STATIC WATER LEVEL AFTER 24 HOURS.
- PW — PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA
- SPRING OR SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- ● - SOUNDING ROD
- SPT CPT OPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

SAMPLE DESIGNATIONS
S- BULK SAMPLE
SS- SPLIT SPOON SAMPLE
ST- SHELBY TUBE SAMPLE
RS- ROCK SAMPLE
RT- RECOMPACTED TRIAXIAL SAMPLE
CBR - CBR SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45
- ☐ CME-550
- ☐ PORTABLE HOIST
- ☒ OTHER D-50
- ☐ OTHER ___

ADVANCING TOOLS:
- ☐ CLAY BITS
- ☐ 6" CONTINUOUS FLIGHT AUGER
- ☐ 8" HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☒ CASING ☐ W/ ADVANCER
- ☒ TRICONE 3 " STEEL TEETH
- ☐ TRICONE ___ " TUNG.-CARB.
- ☐ CORE BIT
- ☐ OTHER ___

HAMMER TYPE:
- ☒ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B___
- ☐ -N___
- ☐ -H___

HAND TOOLS:
- ☐ POST HOLE DIGGER
- ☐ HAND AUGER
- ☐ SOUNDING ROD
- ☐ VANE SHEAR TEST
- ☐ OTHER ___

ROCK DESCRIPTION

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 FOLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
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.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V. SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

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 IS 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 OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (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 INTRUDED ROCKS

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N 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.

BENCH MARK: BM #80, -BL- STA. 14+60.47, 52.26' RT.

ELEVATION: 82.79'

NOTES:

December 16, 2004

N.C. Department of Transportation
Geotechnical Engineering Unit
1589 Mail Service Center
Raleigh, North Carolina 27699-1589

Attn: Mr. Njoroge W. Wainaina, PE.

Ref: Geotechnical Structure Subsurface Investigation Report

State Project No.:	33451.1.1
Tip No.:	B-4093
County:	Cumberland County
Description:	Bridge # 81 on SR 1728 (Middle Rd) over Gum Log Creek
Tierra, Inc. Project No.:	6211-04-051

Dear Mr. Wainaina,

As authorized, Tierra, Inc has completed the geotechnical subsurface investigation of the proposed structure along a new alignment for SR 1728 over Gum Log Creek located in Cumberland County, North Carolina. The purpose of this report is to present subsurface conditions and general notes to the designer to consider during design of the planned structure. Field and laboratory test results, site and boring location plans, and profile/cross sections depicting subsurface conditions may be found in the appendix of this report.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty expressed or implied is made. Tierra, Inc. appreciates this opportunity to provide you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely,
TIERRA, INC.

Matthew A. Korn, E.I.
Staff Professional

Brian D. Keaney, P.E.
Geotechnical Services Manager

NORTH CAROLINA PROFESSIONAL SEAL 023916 ENGINEER BRIAN D. KEANEY 12/17/04

Margaret A. Robertson, L.G.
Contract Manager

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1.0 PROJECT DESCRIPTION

Based on information obtained from the North Carolina Department of Transportation (NCDOT) Bridge Survey & Hydraulic Design Report dated July 28, 2004, a 3-span structure is proposed to replace the existing 6-span, 7-bent, concrete girder bridge. The proposed structure is a 125 feet long by 46 feet wide, prestressed girder bridge. This proposed structure will be located along the existing alignment. The proposed skew angle for all bents is 90 degrees. There are no proposed grade changes along the centerline.

2.0 SITE DESCRIPTION AND GEOLOGY

The project site is located along SR 1728 (Middle Road) in a residential area just outside the city limits of East Fayetteville, North Carolina in Cumberland County. Gum Log Creek flows southwest beneath Middle Road into the Cape Fear River approximately 2 miles downstream.

Topographically, the site exhibits moderate relief, becoming steeper along the south side of the creek, as it approaches existing End Bent 1. Gum Log Creek is approximately 30 feet wide and 0.5 to 1.5 feet deep during our investigation. The existing floodplain is approximately 200 feet wide. Floodplain cover consists of shrubs, grass, and moderate to old growth trees. Across the entire upstream portion of the channel a wood debris dam exists.

The project site is located in the Coastal Plain Physiographic Province of North Carolina, in East Fayetteville, North Carolina. ***The Geologic Map of North Carolina*** (1985) shows the bridge site to be located within the Cape Fear Formation (**Kc**). The Cretaceous materials of this formation typically consist of sandstone, mudstone and continuous beds of micaceous and feldspar rich sands and blocky mottled red and yellow clays. Soils encountered at the bridge site are a majority of gray and red mottled clays interbedded with green and gray clayey sands.

3.0 FIELD EVALUATION PROCEDURE

Subsurface conditions were evaluated for the proposed structure by soil test borings. A total of (8) soil test borings were drilled near proposed bent centerlines in October and November of 2004. Soil test borings were drilled utilizing a track-mounted Diedrich D-50 track rig with an automatic hammer. Borings were drilled using a 3-inch tricone mud rotary method. Standard penetration tests were performed at regular intervals, in accordance with American Association of State Highway Transportation Officials (AASHTO T-206-03), and North Carolina Department of Transportation (NCDOT) latest Geotechnical Guidelines and Procedures Manual.

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Gum Log Creek to determine scour impact for foundation design purposes. The field scour report was electronically submitted November 24, 2004.

Groundwater measurements were recorded within each borehole utilizing a weighted 100-feet tape from a survey reference location at the top of each boring. Readings were recorded immediately after boring termination and after a 24-hour waiting period.

4.0 LABORATORY TESTING

Representative split-spoon samples were selected from soil test borings to verify visual field classification and determine soil index properties. Sixteen split-spoon samples were analyzed in our laboratory for Atterberg limits, and grain size with hydrometer analysis. Seven samples were analyzed for natural moisture. Four alluvium samples were analyzed for grain size determination to assist the NCDOT in theoretical scour elevations. All testing was performed in accordance with the following American Society for Testing and Materials (ASTM), NCDOT Modified and/or AASHTO procedures:

- AASHTO T-88-00 (As Modified) "Particle Size Analysis of Soil"
- AASHTO T-89-02 (As Modified) "Determining the Liquid Limits of Soil"
- AASHTO T-90-00 "Determining the Plastic Limit and Plasticity of Soils"
- AASHTO T-265-93 (2000) "Laboratory Determination of Moisture Content of Soils"
- ASTM D 1140-97 "Amount of Material in Soils Finer than the #200 Sieve"

5.0 SUBSURFACE AND GROUNDWATER CONDITIONS

5.1 End Bents

Soils beneath End Bent 1 consist of roadway embankment, alluvium and Coastal Plain material. Roadway embankment soils consist of 4.5 to 8.7 feet of very loose to loose silty sand (A-3, A-2-4). Alluvial deposits encountered beneath the bent line, at approximately 75 feet Mean Sea Level (MSL), consist of an average of 4.7 feet of very loose to medium dense silty gravelly sand (A-1-b) and very soft sandy clay (A-7-5). Alluvium deposits directly overlie Coastal Plain soils at an approximate elevation of 70 feet (MSL). These soils consist of very stiff to hard sandy clay (A-6, A-7-6) and clayey silty sand (A-2-4, A-2-6). No rock was penetrated.

Soils beneath End Bent 2 consist of roadway embankment, alluvium and Coastal Plain material. Roadway embankment soils consist of 6.5 to 7.5 feet of very loose to loose silty sand (A-2-4) and soft sandy clay (A-6). Alluvial deposits encountered along the bent line, at an approximate elevation of 75 feet (MSL), consist of an average of 3.8 feet of soft to medium stiff sandy silty clay (A-7-5). Alluvium deposits directly overlie Coastal Plain soils at an approximate elevation of 71 feet (MSL). These soils consist of dense to very dense clayey sand (A-2-6) interbedded with medium stiff to hard sandy silt and clay (A-6, A-4). No rock was penetrated.

5.2 Interior Bents

Soils beneath Bent 1 consist of alluvial and Coastal Plain materials. Alluvial deposits consist of very loose silty sand (A-1-b) and stiff silty clay (A-7-6) to depths of 2.5 feet. Alluvium deposits directly overlie Coastal Plain soils of the Cape Fear Formation at an approximate elevation of 66 feet (MSL). These soils consist of medium dense to very dense silty and clayey sand (A-2-4, A-2-6) and very stiff to hard sandy silts and clays (A-4, A-5, A-6, A-7-6). No rock was penetrated.

Soils beneath Bent 2 consist of alluvial and Coastal Plain materials. Alluvial deposits consist of very loose silty sand (A-1-b). Alluvium deposits directly overlie Coastal Plain soils at an approximate elevation of 65 feet (MSL). These soils consist of medium dense to dense silty and clayey sand (A-2-4, A-2-6, A-1-b) and very stiff to hard sandy clay (A-6, A-7-5). No rock was penetrated.

Ground water across the site ranges in elevation between 77.6 and 61.9 feet. Surface water elevation within the Gum Log Creek, at the time of the investigation, was approximately 62 feet.

6.0 NOTES TO DESIGNER

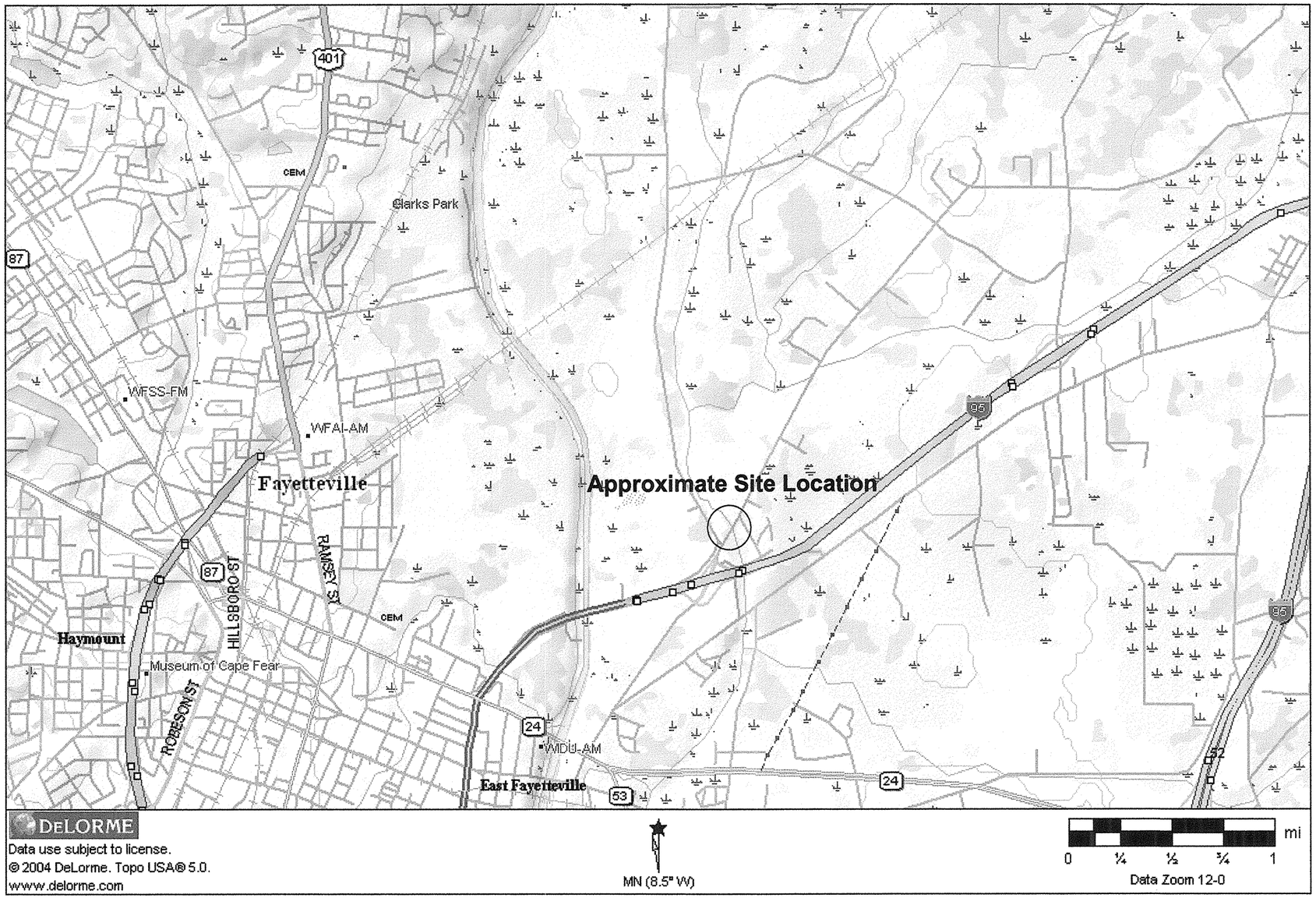
Based on our field exploration the following information may impact design and construction of the proposed structure. Therefore the designer should be aware of the following subsurface and groundwater conditions:

- The upper 4 to 9 feet of the existing roadway embankment are poorly compacted silty sands.
- Hard clays and very dense sands with SPT N values exceeding 100 blows per foot (bpf) are expected in upper Coastal Plain soils below elevation 65 feet (MSL).
- Static groundwater tables are high and were typically measured between 3 and 8.5 feet beneath existing ground surfaces.

7.0 CLOSURE

Notes to the designer and evaluations provided by Tierra, Inc. are based on the Hydraulic Design Report dated July 28, 2004, provided by NCDOT. Modifications to our report may be required if there are changes to the design or location of the proposed structure. Notes to the designer in this report are based on data obtained from soil borings. The nature and extent of variations between borings may not become evident until construction.

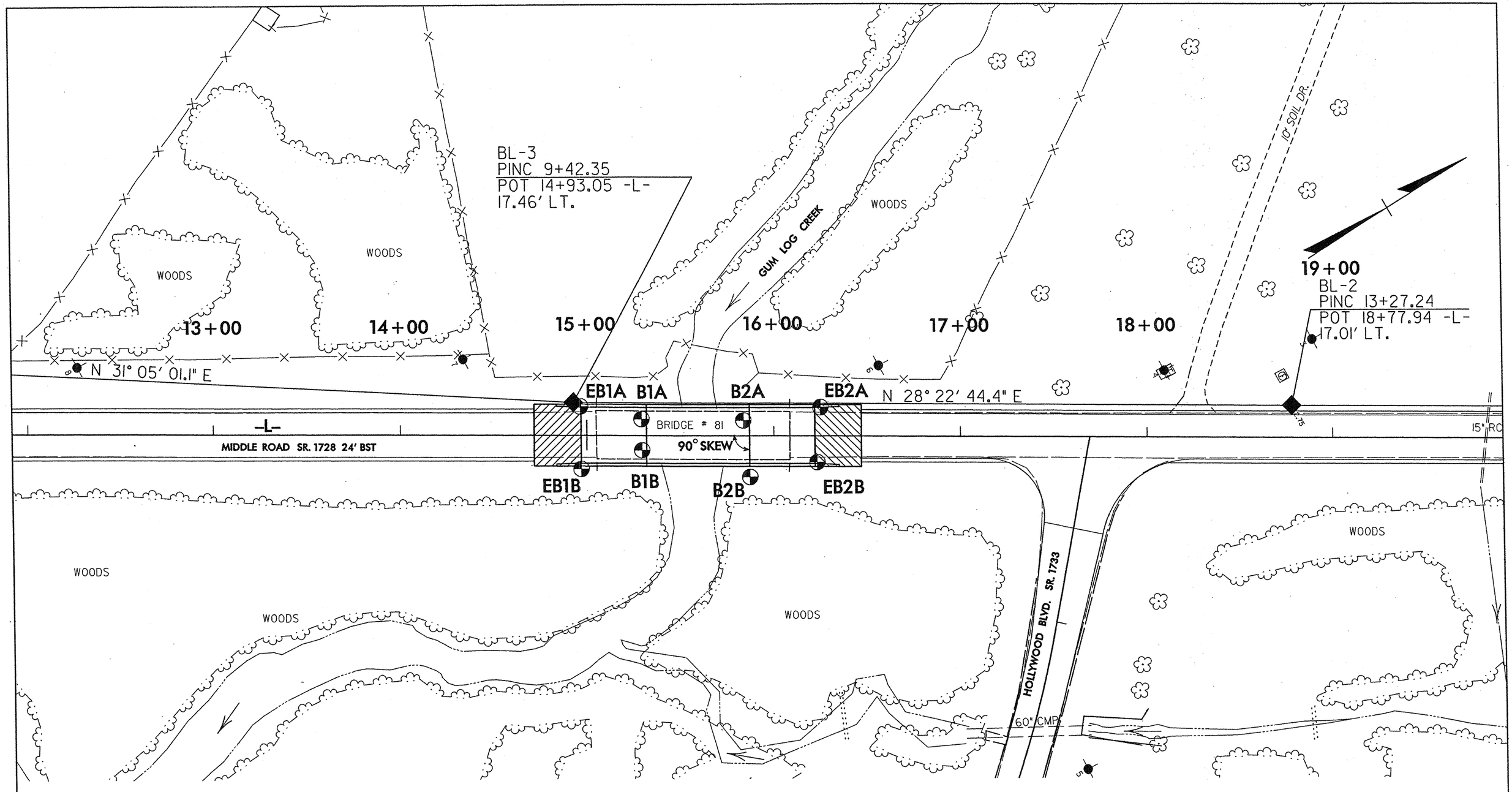
Bridge #81 on SR 1728 over Gum Log Creek *Cumberland County, NC*



North

Site Vicinity Map

Bridge No. 81 on SR 1728 (Middle Road) Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051



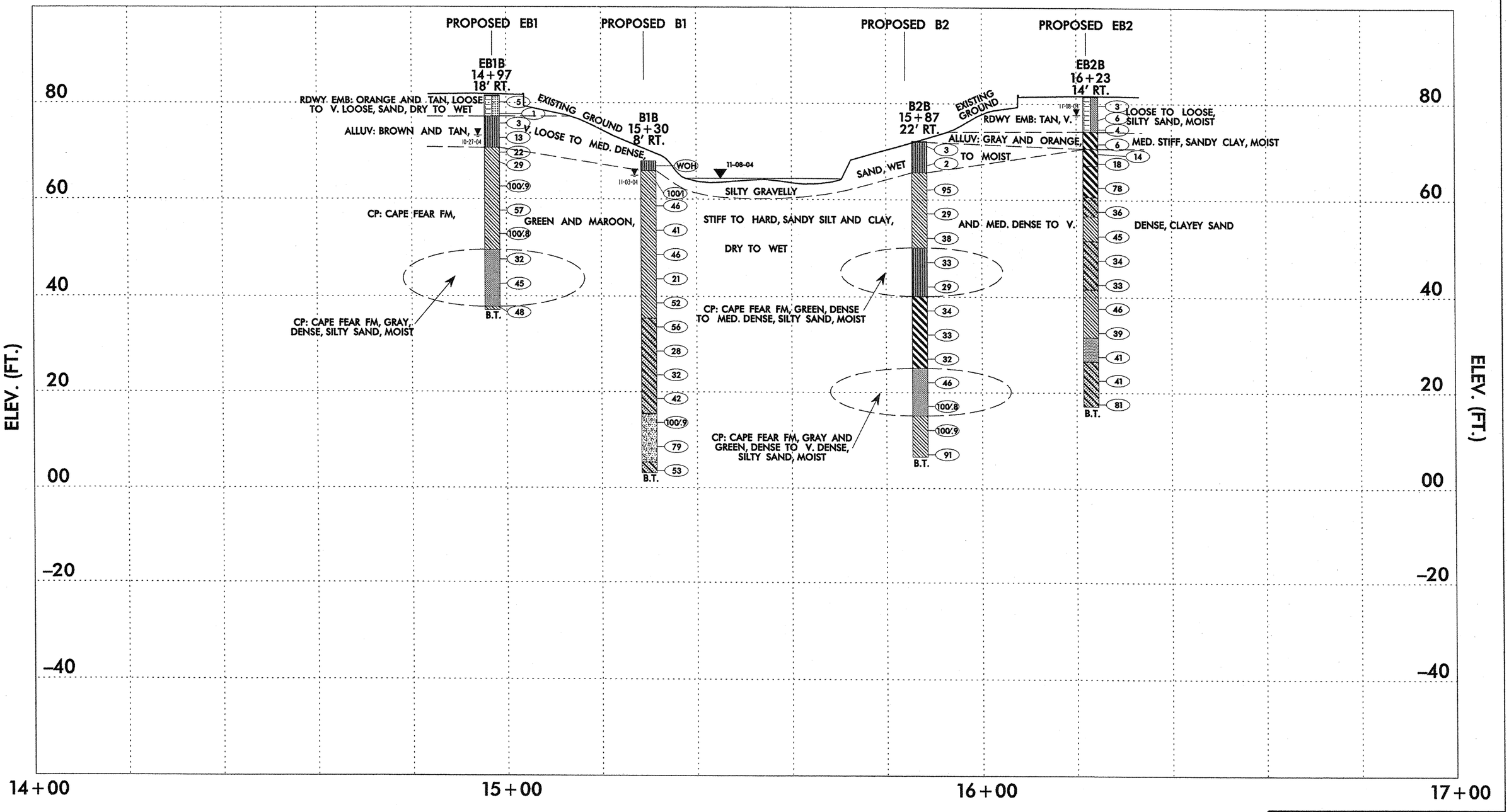
NOTES:

BENCH MARK: BM #80, –BL– STA. 14+60.47,
52.56' RT., ELEVATION 82.79'

0 50 100
FEET

BORING LOCATION PLAN

Bridge No. 81 on SR 1728 (Middle Road) Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051



BENCH MARK: BM #80, –BL– STA 14+60.47,
52.56' RIGHT, ELEVATION 82.79'

VERTICAL SCALE

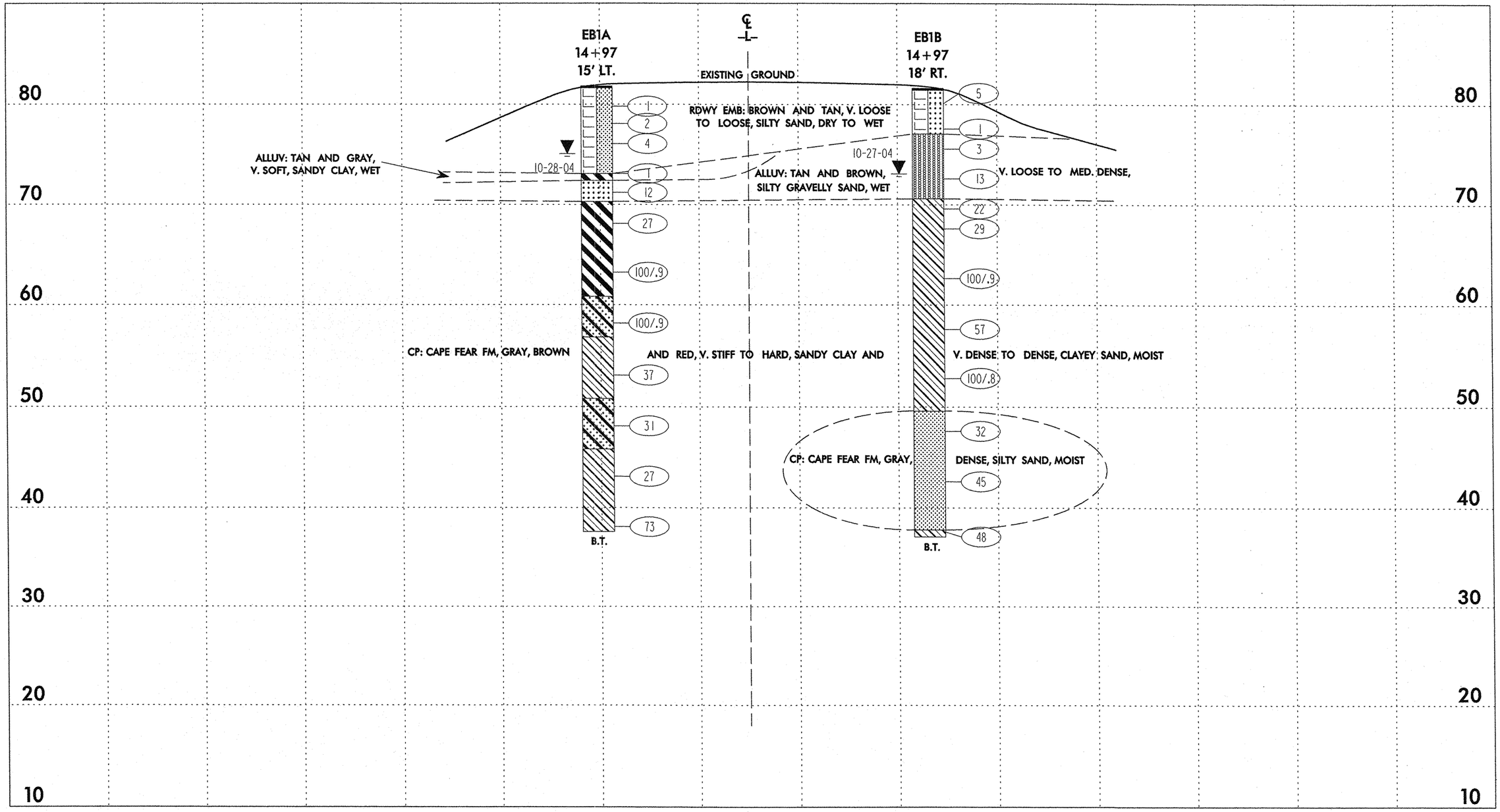
0 20 40

HORIZONTAL SCALE

0 20 40

Profile 14' Right of -L-

Bridge No. 81 on SR 1728 (Middle Road)
Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051



BENCH MARK: BM #80, –BL– STA 14+60.47,
52.56' RIGHT, ELEVATION 82.79'

VERTICAL SCALE

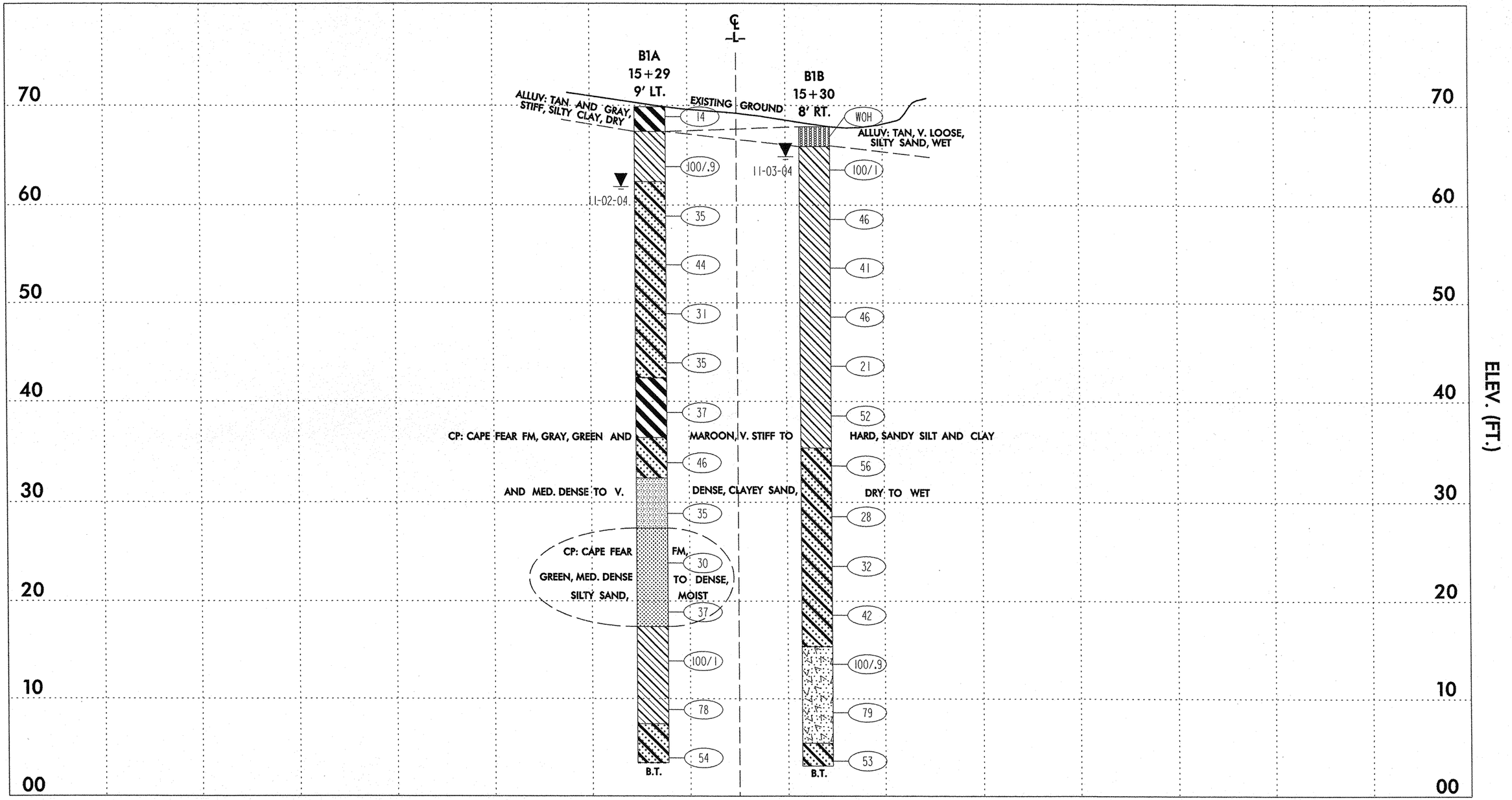
0 10 20

HORIZONTAL SCALE

0 10 20

Cross Section End Bent 1

Bridge No. 81 on SR 1728 (Middle Road)
Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051



BENCH MARK: BM #80, –BL– STA 14+60.47,
52.56' RIGHT, ELEVATION 82.79'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

Cross Section Bent 1

Bridge No. 81 on SR 1728 (Middle Road)
Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
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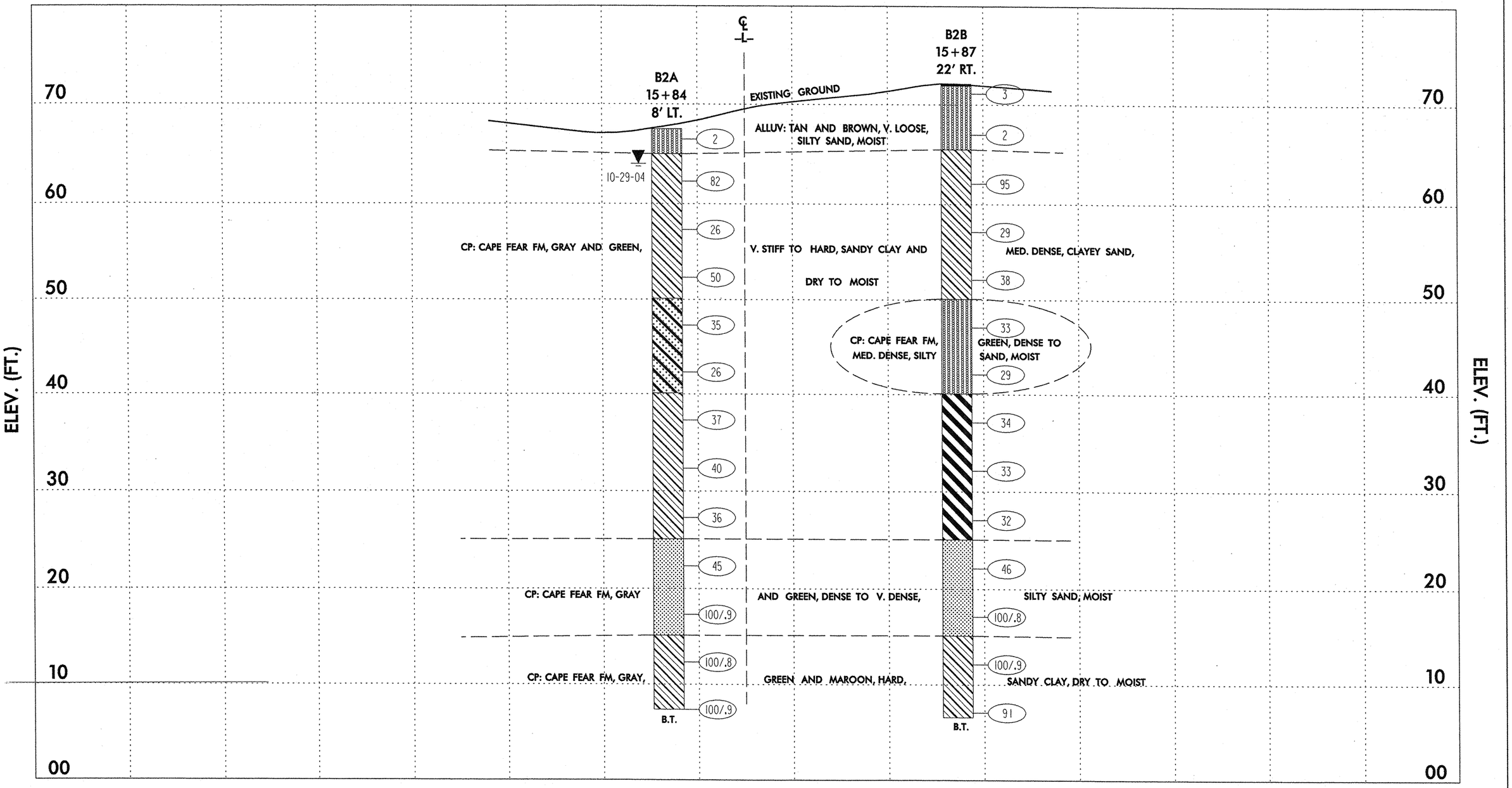


BENCH MARK: BM #80, –BL– STA 14+60.47,
52.56' RIGHT, ELEVATION 82.79'

VERTICAL SCALE

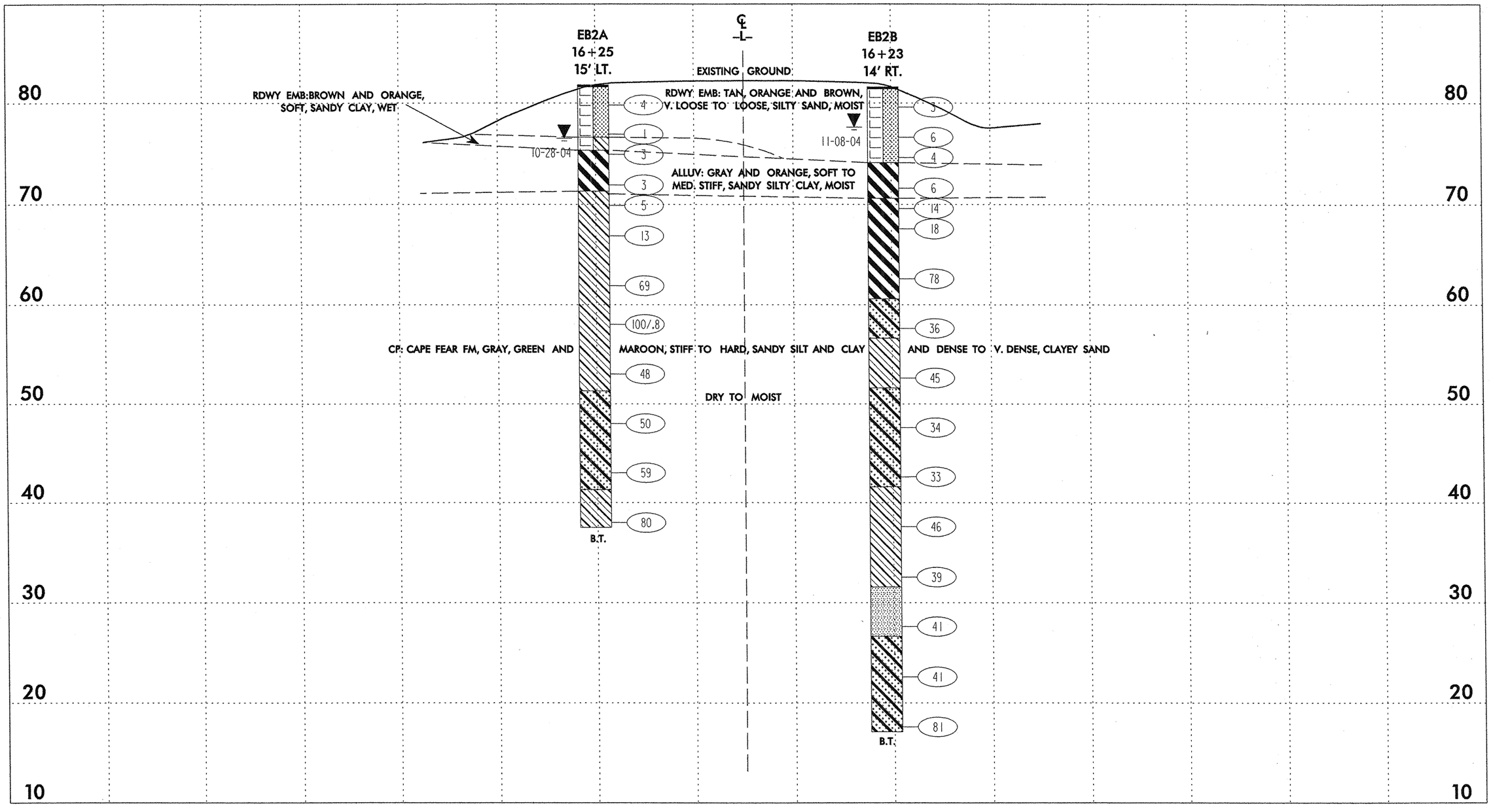
0 10 20

HORIZONTAL SCALE

0 10 20

Cross Section Bent 2

Bridge No. 81 on SR 1728 (Middle Road)
Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051



BENCH MARK: BM #80, –BL– STA 14+60.47,
52.56' RIGHT, ELEVATION 82.79'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

Cross Section End Bent 2

Bridge No. 81 on SR 1728 (Middle Road)
Over Gum Log Creek
Cumberland County, North Carolina
TIP No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051

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

SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. EB1A	**BORING LOCATION** 14+97	**OFFSET** 15' LT.	**ALIGNMENT** -L- **0 HR.** 3.2
COLLAR ELEV. 81.8 ft	**NORTHING** 478,463.7	**EASTING** 2,047,136.5	**24 HR.** 6.7
TOTAL DEPTH 44.2 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 10-27-04	**COMPLETED** 10-27-04	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
81.8					EXISTING GROUND				
	1.0								81.8 ROOTMAT 0.0
80	2.7	1	1	WOH	1		W		81.6 RDWY EMB: BROWN, V. LOOSE TO LOOSE, SILTY SAND (A-2-4) 0.2
	4.7	1	1	1	2	SS-1	W		
		1	2	2	4		W		
75	7.7								73.1 ALLUV: TAN AND GRAY, V. SOFT, SANDY CLAY (A-7-5) 8.7
	9.6	1	WOH	1	1		W		72.4 ALLUV: TAN, MED. DENSE, SAND (A-3) 9.4
		3	6	6	12	SS-2	W		70.3 CP: GRAY AND ORANGE, V. STIFF TO HARD, SANDY CLAY (A-7-6) 11.5
70	12.7								
		5	10	17	27	SS-3	M		
65	17.7								
		44	56/.4		100/.9		M		
60	22.7								60.8 CP: GRAY, V. DENSE, SILTY CLAYEY SAND (A-2-6) 21.0
		48	52/.4		100/.9		M		
55	27.7								56.8 CP: GRAY AND RED, HARD, SANDY CLAY (A-6) 25.0
		15	16	21	37		M		
50	32.7								50.8 CP: GRAY, DENSE, CLAYEY SAND (A-2-6) 31.0
		9	14	17	31		M		
45	37.7								45.8 CP: GRAY, BROWN AND RED, V. STIFF TO HARD, SANDY CLAY (A-6) 36.0
		12	12	15	27				
40	42.7								37.6 BORING TERMINATED AT ELEV. 37.6' IN CP: BROWN AND RED, SANDY CLAY 44.2
		19	28	45	73				

DRILLING FLUID PROPERTIES: 68.21 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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N.C.D.O.T. GEOTECHNICAL UNIT 12
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. EB1B	**BORING LOCATION** 14+97	**OFFSET** 18' RT.	**ALIGNMENT** -L- **0 HR.** 4.6
COLLAR ELEV. 81.6 ft	**NORTHING** 478,445.1	**EASTING** 2,047,165.9	**24 HR.** 8.5
TOTAL DEPTH 44.5 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 10-26-04	**COMPLETED** 10-26-04	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
81.6					EXISTING GROUND				
	0.5								81.6
80	3.0	1	2	3	5		D		81.4 ROOTMAT 0.2
	5.0	1	WOH	1	1	SS-4	W		RDWY EMB: ORANGE AND TAN, LOOSE TO V. LOOSE, SAND (A-3)
		1	1	2	3		W		77.1 4.5
75	8.0								ALLUV: BROWN AND TAN, V. LOOSE TO MED. DENSE, SILTY GRAVELLY SAND (A-1-b)
	11.0	1	3	10	13		W		
70	13.0	8	10	12	22		M		70.6 11.0
		11	16	13	29		M		CP: GRAY, ORANGE AND RED, V. STIFF TO HARD, SILTY SANDY CLAY (A-6) WITH SAND LENSES, SLI. MICACEOUS
65	18.0								
		32	49	51/.4	100/.9		M		
60	23.0								
		10	24	33	57		M		
55	28.0								
		58	42/.3		100/.8		M		
50	33.0								
		12	13	19	32	SS-5	M		49.6 32.0
45	38.0								CP: GRAY, DENSE, SILTY SAND (A-2-4) MICACEOUS
		11	15	30	45		M		
40	43.0								37.8 43.8
		9	16	32	48		M		37.1 44.5 CP: GRAY AND RED, HARD, SILTY SANDY CLAY (A-6) BORING TERMINATED AT ELEV. 37.1' IN CP: GRAY AND RED, SANDY CLAY

DRILLING FLUID PROPERTIES: 67.29 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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BORING LOG

SHEET 1 OF 1

PROJECT NO. 33451.1.1	ID. B-4093	COUNTY CUMBERLAND	GEOLOGIST P. ZHANG
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			GROUND WATER (ft)
BORING NO. B1A	BORING LOCATION 15+29	OFFSET 9' LT.	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 69.9 ft	NORTHING 478,483.4	EASTING 2,047,158.8		24 HR. 8.0
TOTAL DEPTH 66.5 ft	DRILL MACHINE D-50	DRILL METHOD MUD ROTARY	HAMMER TYPE AUTO	
DATE STARTED 11-01-04	COMPLETED 11-01-04	SURFACE WATER DEPTH N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
69.9					EXISTING GROUND				69.9 0.0
	0.0	4	6	8	14	SS-6	21.1%		ALLUV: TAN AND GRAY, STIFF, SILTY CLAY (A-7-6)
65	5.0	27	50	50/.4	100/.3		D		67.4 2.5 CP: GRAY, HARD, SANDY CLAY (A-6)
	10.0	13	17	18	35		D		62.4 7.5 CP: GRAY, DENSE, CLAYEY SAND (A-2-6) MICACEOUS
60	15.0	15	19	25	44		M		
55	20.0	10	15	16	31		M		
50	25.0	17	17	18	35		M		42.4 27.5 CP: GRAY, HARD, SILTY CLAY (A-7-6)
45	30.0	11	17	20	37	SS-7	20.4%		
40	35.0	14	20	26	46		M		36.4 33.5 CP: GRAY, DENSE, CLAYEY SAND (A-2-6)
35	40.0	12	15	20	35		D		32.4 37.5 CR: GRAY AND GREEN, HARD, SANDY SILT (A-4)
30	45.0	12	15	15	30		M		27.4 42.5 CP: GREEN, MED. DENSE TO DENSE, SILTY SAND (A-2-4) MICACEOUS
25	50.0	19	15	22	37		M		17.4 52.5 CP: GRAY, GREEN AND MAROON, HARD, SANDY CLAY (A-6)
20	55.0	17	47	53/.5	100/1		D		
15	60.0	21	33	45	78		D		7.4 62.5 CP: GREEN, V. DENSE, CLAYEY SAND (A-2-6)
10	65.0	20	21	33	54		M		3.4 66.5 BORING TERMINATED AT ELEV. 3.4' IN CP: GREEN, CLAYEY SAND
5									DRILLING FLUID PROPERTIES: 66.46 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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N.C.D.O.T. GEOTECHNICAL UNIT 13
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33451.1.1	ID. B-4093	COUNTY CUMBERLAND	GEOLOGIST P. ZHANG
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			GROUND WATER (ft)
BORING NO. B1B	BORING LOCATION 15+30	OFFSET 8' RT.	ALIGNMENT -L-	0 HR. 0.0
COLLAR ELEV. 67.9 ft	NORTHING 478,480.3	EASTING 2,047,173.2		24 HR. 3.0
TOTAL DEPTH 64.8 ft	DRILL MACHINE D-50	DRILL METHOD MUD ROTARY	HAMMER TYPE AUTO	
DATE STARTED 11-02-04	COMPLETED 11-02-04	SURFACE WATER DEPTH N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
67.9					EXISTING GROUND				67.9 0.0
	0.0	WOH	WOH	WOH	0 WOH		W		ALLUV: TAN, V. LOOSE, SILTY SAND (A-1-b)
65	3.3	25	49	51/.5	100/1		D		65.9 2.0 CP: GRAY, GREEN AND MAROON, V. STIFF TO HARD, SANDY CLAY (A-6) MICACEOUS
60	8.3	12	22	24	46		M		
55	13.3	16	20	21	41	SS-8	18.1%		
50	18.3	12	21	25	46		M		
45	23.3	8	9	12	21		M		
40	28.3	16	20	32	52		D		
35	33.3	16	26	30	56		M		35.4 32.5 CP: GREEN AND GRAY, V. DENSE TO MED. DENSE TO DENSE, CLAYEY SAND (A-2-6)
30	38.3	10	13	15	28		M		
25	43.3	14	16	16	32		W		
20	48.3	20	20	22	42		M		
15	53.3	19	46	54/.4	100/.5		D		15.4 52.5 CP: GRAY AND MAROON, HARD, SANDY SILT (A-5)
10	58.3	27	35	44	79	SS-9	22.5%		
5	63.3	21	23	30	53		M		5.4 62.5 CP: GREEN, V. DENSE, CLAYEY SAND (A-2-6)
									3.1 64.8 BORING TERMINATED AT ELEV. 3.1' IN CP: GREEN, CLAYEY SAND
									DRILLING FLUID PROPERTIES: 73.20 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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

SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** P. ZHANG
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. B2A	**BORING LOCATION** 15+84	**OFFSET** 8' LT.	**ALIGNMENT** -L-
COLLAR ELEV. 67.6 ft	**NORTHING** 478,535.9	**EASTING** 2,047,186.6	**24 HR.** 3.5
TOTAL DEPTH 60.2 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 10-28-04	**COMPLETED** 10-28-04	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
67.6					EXISTING GROUND				67.6 0.0
	0.0	1	1	1	2		M		ALLUV: BROWN, V. LOOSE, SILTY SAND (A-1-b)
65	4.3								65.1 2.5
		29	34	48	82		D		CP: GRAY, HARD TO V. STIFF TO HARD, SANDY CLAY (A-6)
	9.3								
60		9	11	15	26		M		
	14.3								
55		16	22	28	50		M		
	19.3								50.1 17.5
50		16	17	18	35		M		CP: GREEN, DENSE TO MED. DENSE, CLAYEY SAND (A-2-6)
	24.3								
45		12	12	14	26		M		
	29.3								40.1 27.5
40		11	15	22	37		D		CP: GRAY, GREEN AND MAROON, HARD, SANDY CLAY (A-6)
	34.3								
35		14	16	24	40		D		
	39.3								
30		15	15	21	36		D		
	44.3								25.1 42.5
25		16	20	25	45	SS-10	M		CP: GREEN, DENSE TO V. DENSE, SILTY SAND (A-2-4)
	49.3								
20		23	27	73/.4	100/.9		M		
	54.3								15.1 52.5
15		33	50	50/.3	100/.8		M		CP: GREEN AND MAROON, HARD, SANDY CLAY (A-6)
	59.3								
10		46	54/.4		100/.9		M		7.4 60.2
									BORING TERMINATED AT ELEV. 7.4' IN CP: GREEN AND MAROON, SANDY CLAY
									DRILLING FLUID PROPERTIES: 63.73 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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N.C.D.O.T. GEOTECHNICAL UNIT 14
BORING LOG

SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** P. ZHANG
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. B2B	**BORING LOCATION** 15+87	**OFFSET** 22' RT.	**ALIGNMENT** -L-
COLLAR ELEV. 72.1 ft	**NORTHING** 478,529.1	**EASTING** 2,047,205.7	**24 HR.** CAVE
TOTAL DEPTH 65.5 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 11-03-04	**COMPLETED** 11-03-04	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
72.1					EXISTING GROUND				72.1 0.0
	0.0	1	1	2	3		M		71.9 ROOTMAT 0.2
70	4.0								ALLUV: TAN, V. LOOSE, SILTY SAND (A-1-b)
		1	1	1	2	SS-11	M		
65	9.0								65.6 6.5
		25	36	59	95	SS-12	15.9%		CP: GRAY, HARD TO V. STIFF TO HARD, SANDY CLAY (A-6)
60	14.0								
		9	12	17	29		M		
55	19.0								
		11	18	20	38		D		
50	24.0								
		9	14	19	33		M		
45	29.0								
		10	12	17	29	SS-13	M		
40	34.0								
		12	16	18	34		M		
35	39.0								
		12	14	19	33	SS-14	25.4%		
30	44.0								
		11	13	19	32		D		
25	49.0								
		15	23	23	46		M		
20	54.0								
		29	40	60/.3	100/.8		M		
15	59.0								
		23	42	58/.4	100/.9		D		
10	64.0								
		25	40	51	91		M		

50.1 22.0
CP: GREEN, DENSE TO MED. DENSE, SILTY SAND (A-1-b)

40.1 32.0
CP: GRAY, GREEN AND MAROON, HARD, SANDY CLAY (A-7-5)

25.1 47.0
CP: GRAY AND GREEN, DENSE TO V. DENSE, SILTY SAND (A-2-4)

15.1 57.0
CP: GRAY, MAROON AND GREEN, HARD, SANDY CLAY (A-6)

6.6 65.5
BORING TERMINATED AT ELEV. 6.6' IN CP: GREEN, SANDY CLAY

DRILLING FLUID PROPERTIES: 71.33 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

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

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SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. EB2A	**BORING LOCATION** 16+25	**OFFSET** 15' LT.	**ALIGNMENT** -L-	**0 HR.** 1.1
COLLAR ELEV. 81.8 ft	**NORTHING** 478,568.5	**EASTING** 2,047,204.0		**24 HR.** 5.3
TOTAL DEPTH 44.3 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO	
DATE STARTED 10-27-04	**COMPLETED** 10-27-04	**SURFACE WATER DEPTH** N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
81.8					EXISTING GROUND				
									81.8 0.0 ROOTMAT
	1.0								81.6 0.2 RDWY EMB: TAN, ORANGE AND BROWN, LOOSE TO V. LOOSE, SILTY SAND (A-2-4)
80	3.9	3	3	1	4		M		
	5.9	1	WOH	1	1				
75	8.9	1	2	1	3		W		76.6 5.2 RDWY EMB: BROWN AND ORANGE, SOFT, SANDY CLAY (A-6)
	10.9	1	2	1	3		M		75.3 6.5 ALLUV: GRAY AND ORANGE, SOFT, SANDY SILTY CLAY (A-7-5)
70	13.9	2	2	3	5		M		71.3 10.5 CP: GRAY AND MAROON, MED. STIFF TO HARD, SANDY CLAY (A-6) WITH SAND SEAMS, MICACEOUS
	18.9	7	6	7	13		M		
65	22.8	15	23	46	69		M		
60	27.8	27	54	46/.3	100/.8		D		
55	32.8	16	22	26	48	SS-15	D		
50	37.8	17	24	26	50		M		
45	42.8	10	21	38	59		M		51.3 30.5 CP: GRAY, DENSE TO V. DENSE, CLAYEY SAND (A-2-6)
40		20	35	45	80		D		41.3 40.5 CP: GRAY AND MAROON, HARD, SANDY CLAY (A-6)
									37.5 44.3 BORING TERMINATED AT ELEV. 37.5' IN CP: GRAY AND MAROON, SANDY CLAY
									DRILLING FLUID PROPERTIES: 68.18 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

N.C.D.O.T. GEOTECHNICAL UNIT 15
BORING LOG

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SHEET 1 OF 1

PROJECT NO. 33451.1.1	**ID.** B-4093	**COUNTY** CUMBERLAND	**GEOLOGIST** P. ZHANG
SITE DESCRIPTION BRIDGE #81 ON SR 1728 (MIDDLE RD.) OVER GUM LOG CREEK			**GROUND WATER (ft)**
BORING NO. EB2B	**BORING LOCATION** 16+23	**OFFSET** 14' RT.	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 81.6 ft	**NORTHING** 478,556.6	**EASTING** 2,047,223.2		**24 HR.** 4.0
TOTAL DEPTH 64.5 ft	**DRILL MACHINE** D-50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO	
DATE STARTED 11-03-04	**COMPLETED** 11-03-04	**SURFACE WATER DEPTH** N/A		

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
81.6					EXISTING GROUND				
									81.6 0.0 ROOTMAT
	1.0								81.4 0.2 RDWY EMB: TAN, V. LOOSE TO LOOSE, SILTY SAND (A-2-4)
80	4.0	2	2	1	3		M		
	6.0	3	3	3	6		M		
75	9.0	2	2	2	4		M		74.1 7.5 ALLUV: GRAY AND ORANGE, MED. STIFF, SANDY CLAY (A-7-5)
	11.0	3	2	4	6		M		70.6 11.0 CP: GRAY AND MAROON, STIFF TO HARD, SILTY CLAY (A-7-5)
70	13.0	5	5	9	14		D		
	18.0	6	8	10	18	SS-16	27.6%		
65	23.0	29	28	50	78		D		
60	28.0	10	15	21	36		M		60.6 21.0 CP: GRAY, DENSE, CLAYEY SAND (A-2-6) MICACEOUS
55	33.0	12	18	27	45		M		56.6 25.0 CP: GRAY AND MAROON, HARD, SANDY CLAY (A-6)
50	38.0	10	14	20	34		M		51.6 30.0 CP: GREEN, DENSE, CLAYEY SAND (A-2-6)
45	43.0	11	14	19	33		M		41.6 40.0 CP: GRAY, HARD, SANDY CLAY (A-6)
40	48.0	15	18	28	46		M		
35	53.0	12	16	23	39		M		31.6 50.0 CP: GREEN AND BROWN, HARD, SANDY SILT (A-4)
30	58.0	15	18	23	41		D		26.6 55.0 CP: GREEN AND GRAY, DENSE TO V. DENSE, CLAYEY SAND (A-2-6)
25	63.0	18	20	21	41		M		
20		16	20	61	81		M		17.1 64.5 BORING TERMINATED AT ELEV. 17.1' IN CP: GREEN AND GRAY, CLAYEY SAND
									DRILLING FLUID PROPERTIES: 69.74 PCF

NCDOT_BORE_VARIABLE DEPTH 04-051 BR 81 - CUMBERLAND CO.GPJ NCDOT.GDT 12/16/04

SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
NCDOT Project No: 33451.1.1 - T.I.P. No: B-4093

CUMBERLAND COUNTY

TIERRA, INC. PROJECT NO: 6211-04-051

BORING #		SAMPLE #	TOTAL SAMPLE			MINUS 2.00 mm FRACTION				Atterberg Limits		MC
AASHTO Classification			PERCENT PASSING			PERCENT RETAINED						
STATION #	OFFSET (FEET)	DEPTH (FEET)	#10	#40	#200	Coarse Sand	Fine Sand	SILT	CLAY	LL	PI	%
EB1A		SS-1	91	61	23	57	22	10	11	18	NP	-
A-2-4												
14+97	15 LT	2.7-4.2										
EB1A		SS-2	99	55	5	45	50	3	2	16	NP	-
A-3												
14+97	15 LT	9.6-11.1										
EB1A		SS-3	100	96	89	7	9	48	36	45	21	-
A-7-6												
14+97	15 LT	12.7-14.2										
EB1B		SS-4	100	51	4	49	47	4	0	17	NP	-
A-3												
14+97	18 RT	3.0-4.5										
EB1B		SS-5	100	66	13	34	54	9	4	21	NP	-
A-2-4												
14+97	18 RT	33.0-34.5										
B1A		SS-6	100	97	90	6	6	26	62	48	19	21.1
A-7-6												
15+29	9 LT	0.0-1.5										
B1A		SS-7	100	92	72	14	19	46	21	42	18	20.4
A-7-6												
15+29	9 LT	30.0-31.5										
B1B		SS-8	100	76	42	40	22	26	12	31	12	18.1
A-6												
15+30	8 RT	13.3-14.8										
B1B		SS-9	100	94	74	9	26	54	11	42	10	22.5
A-5												
15+30	8 RT	58.3-59.8										
B2A		SS-10	100	59	17	73	13	7	7	18	NP	-
A-2-4												
15+84	8 LT	44.3-45.8										

TIERRA, INC. 2736 ROWLAND ROAD, RALEIGH, NORTH CAROLINA 27615

SOIL CLASSIFICATION AND GRADATION SHEET

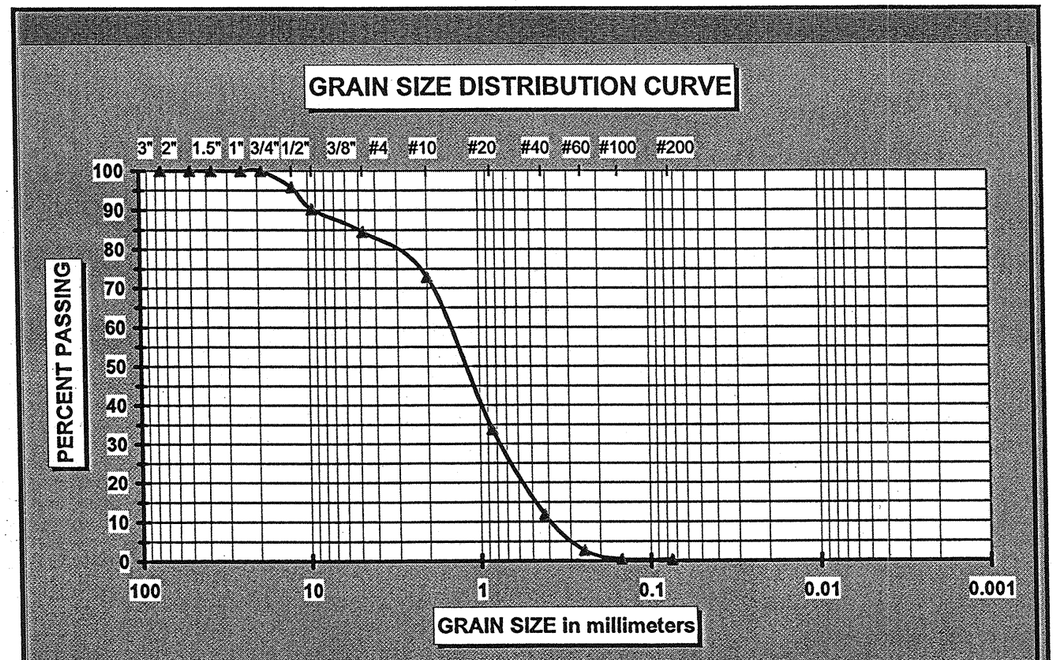
BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
NCDOT Project No: 33451.1.1 - T.I.P. No: B-4093

CUMBERLAND COUNTY

TIERRA, INC. PROJECT NO: 6211-04-051

BORING #		SAMPLE #	TOTAL SAMPLE			MINUS 2.00 mm FRACTION				Atterberg Limits		MC
AASHTO Classification			PERCENT PASSING			PERCENT RETAINED						
STATION #	OFFSET (FEET)	DEPTH (FEET)	#10	#40	#200	Coarse Sand	Fine Sand	SILT	CLAY	LL	PI	%
B2B		SS-11	98	42	2	82	17	1	0	15	NP	-
A-1-b												
15+87	22 RT	4.0-5.5										
B2B		SS-12	100	85	55	27	24	28	21	37	17	15.9
A-6												
15+87	22 RT	9.0-10.5										
B2B		SS-13	100	42	21	72	10	10	8	16	NP	-
A-1-b												
15+87	22 RT	29.0-30.5										
B2B		SS-14	100	99	82	2	27	49	22	47	12	25.4
A-7-5												
15+87	22 RT	39.0-40.5										
EB2A		SS-15	100	92	59	23	23	28	26	38	12	-
A-6												
16+25	15 LT	27.8-29.3										
EB2B		SS-16	100	97	91	5	8	67	20	48	13	27.6
A-7-5												
16+23	14 RT	13.0-14.5										
CREEK		GRAB	73	12	0	-	-	-	-	NA	NA	-
A-1-b												
15+62	25 RT	0.0-1.0										

BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
CUMBERLAND COUNTY, NORTH CAROLINA
NCDOT Project No: 33451.1.1 T.I.P B-4093



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #60	Cu = D60 / D10
			Fine Sand	< #60 and > #270	Cc = (D30)^2 / (D10 x D60)

BORING #: CREEK **SAMPLE #:** GRAB **DEPTH:** 0.0-1.0

TAN COARSE GRAVELLY SAND A-1-b

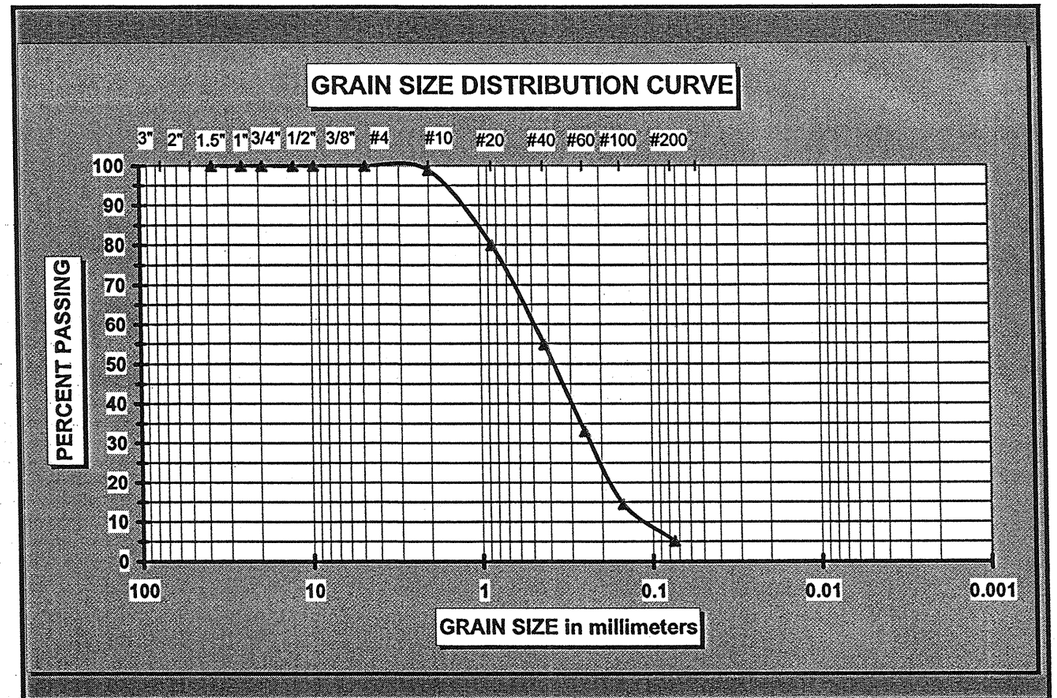
% PASSING #200 SIEVE : 0.3%

NATURAL MOISTURE CONTENT = N\A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTIC INDEX	NA

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
CUMBERLAND COUNTY
NCDOT Project No: 33451.1.1 T.I.P B-4093



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #60	Cu = D60 / D10
			Fine Sand	< #60 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: EB1A **SAMPLE #:** SS-2 **DEPTH:** 9.6-11.1

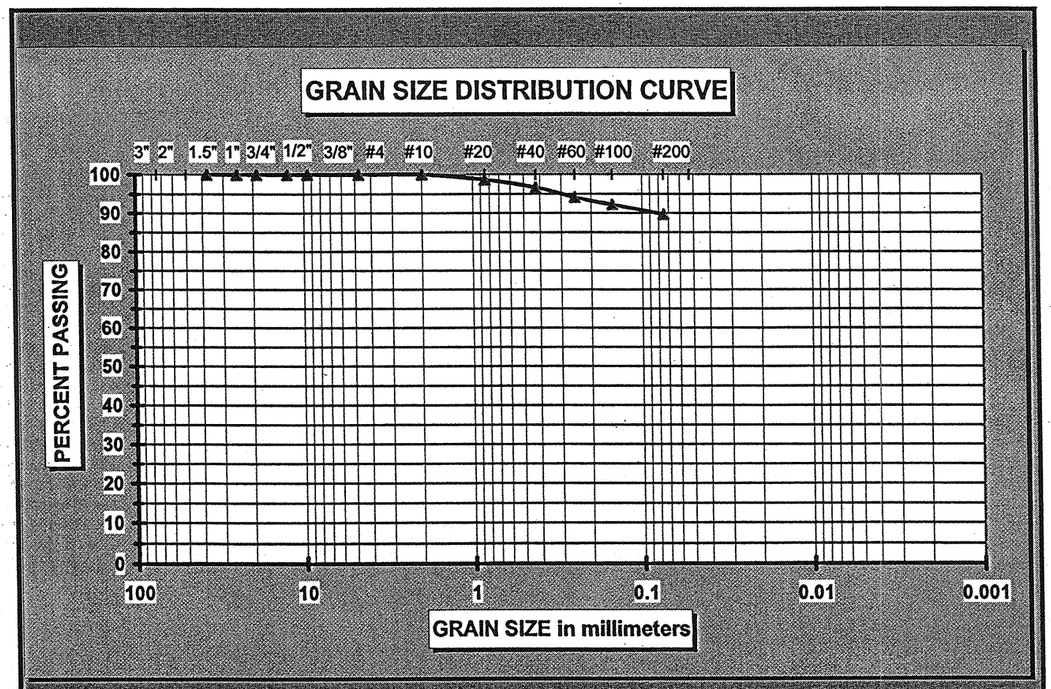
TAN SAND (A-3)

% PASSING #200 SIEVE: 5%

NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	16
PLASTIC LIMIT	-
PLASTIC INDEX	NP

BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
CUMBERLAND COUNTY
NCDOT Project No: 33451.1.1 T.I.P B-4093



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #60	Cu = D60 / D10
			Fine Sand	< #60 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: B1A **SAMPLE #:** SS-6 **DEPTH:** 0.0-1.5

TAN SANDY CLAY (A-7-6)

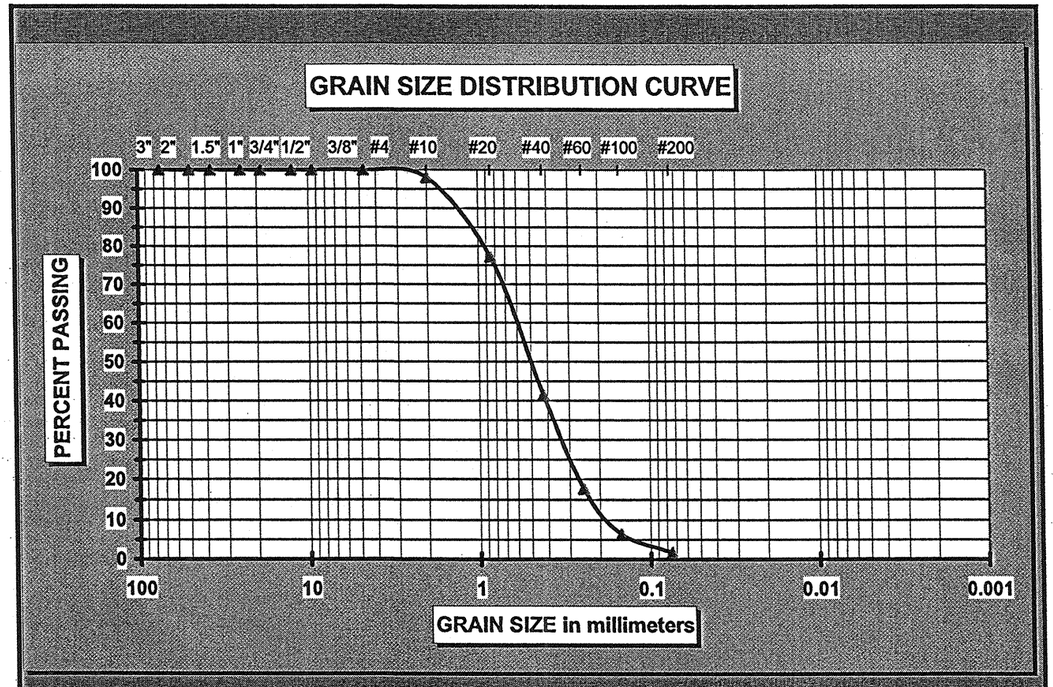
% PASSING #200 SIEVE: 90%

NATURAL MOISTURE CONTENT = 21.1%

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	48
PLASTIC LIMIT	29
PLASTIC INDEX	19

TIERRA, INC. 2736 ROWLAND ROAD, RALEIGH, NORTH CAROLINA 27615

BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK
CUMBERLAND COUNTY, NORTH CAROLINA
NCDOT Project No: 33451.1.1 T.I.P B-4093



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #60	Cu = D60 / D10
			Fine Sand	< #60 and > #270	Cc = (D30)^2 / (D10 x D60)

BORING #: B2B **SAMPLE #:** SS-11 **DEPTH:** 4.0-5.5

TAN COARSE TO FINE SAND A-1-b

% PASSING #200 SIEVE : 2%

NATURAL MOISTURE CONTENT = N\A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	15
PLASTIC LIMIT	-
PLASTIC INDEX	NP

GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 33451.1.1 ID: B-4093 COUNTY: CUMBERLAND

DESCRIPTION(1): BRIDGE # 81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK

INFORMATION ON EXISTING BRIDGES Information obtained from: x field inspection
___ microfilm(Reel: ___ Pos: ___)
x other hydro report

COUNTY BRIDGE NO. 81 BRIDGE LENGTH 104 NO. BENTS IN: CHANNEL 1 FLOOD PLAIN 6

FOUNDATION TYPE: TIMBER PILES ON SPREAD FOOTINGS, TIMBER BEAMS WITH CONCRETE DECK

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: NO SCOUR EVIDENT

INTERIOR BENTS: SCOUR ON UPSTREAM OF BENT 5, DOWNSTREAM SIDE BENT 1, BENT 4 IN CHANNEL
MODERATE SCOUR TO COASTAL PLAIN MATERIALS IN SOME AREAS

CHANNEL BED: NE PORTION OF CHANNEL ALONG BENT 4, DOWNSTREAM NEAR SW BANK

CHANNEL BANKS: DOWNSTREAM SOUTHWEST BANK

EXISTING SCOUR PROTECTION:

TYPE(3): RIP RAP

EXTENT(4): UPSTREAM OF BRIDGE ON SOUTHWEST BANK FOR 75' UPSTREAM

EFFECTIVENESS(5): EFFECTIVE

OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): ENTIRE UPSTREAM PORTION ACROSS CHANNEL & AGAINST
BRIDGE HAS EXTENSIVE DEBRIS DAM (CONSISTS OF LOGS, TREES, BRUSH, ETC)

DESIGN INFORMATION

CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED): SAND AND GRAVEL, EXCEPTION SOUTHWEST
CHANNEL AND BANK CONSISTS OF HARD COASTAL PLAIN CLAYS

CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED): ALLUVIAL SANDS AND COASTAL PLAIN CLAYS

FOUNDATION BEARING MATERIAL(9): HARD CLAYS OF THE CAPE FEAR FORMATION

CHANNEL BANK COVER(10): GRASS, SHRUBS AND SMALL TREES

FLOOD PLAIN WIDTH(11): APPROXIMATELY 200 FT

FLOOD PLAIN COVER(12): GRASS, SHRUBS AND MODERATE TO OLD GROWTH TREES

DESIGN INFORMATION CONT.

STREAM IS x DEGRADING ___ AGGRADING (13)

OTHER OBSERVATIONS AND COMMENTS: VERY LITTLE ALLUVIAL MATERIAL, SOME DEPOSITION DOWNSTREAM OF BENT 3. DAM IS CAUSING RESTRICTED FLOW AND ALTERING LOCATION OF SCOUR

CHANNEL MIGRATION TENDENCY (14): SOUTHWEST TO SOUTH

REPORTED BY: CRAMER DATE: 10/27/2004
TIERRA, INC

GEOTECHNICALLY ADJUSTED SCOUR ELEVATION (15):

Boring	100 year	200 year
B1-A	67.4	67.4
B1-B	65.9	65.9
B2-A	65.1	65.1
B2-B	68.8	68.2

REPORTED BY: Brad D Wood DATE: 12-21-04
NCDOT GEOTECHNICAL UNIT

INSTRUCTIONS

(1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED.
(2) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS, DEGRADATIONS, ETC.)
(3) NOTE ANY EXISTING SCOUR PROTECTION (RIP RAP, ETC.)
(4) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
(5) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.
(6) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
(7) DESCRIBE THE CHANNEL BED MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(8) DESCRIBE THE CHANNEL BANK MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(9) DESCRIBE THE FOUNDATION BEARING MATERIAL,
(10) DESCRIBE THE BANK COVERING (GRASS, TREES, RIP RAP, NONE, ETC.
(11) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
(12) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
(13) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING
(14) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS).
(15) GIVE THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. THE GEOTECHNICALLY ADJUSTED SCOUR ELEVEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE; PERCENTAGE RQD; DIFFERENTIAL WEATHERING, SHEAR STRENGTH; OBSERVATIONS AT EXISTING STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

PROJECT #: 33451.1.1

COUNTY: CUMBERLAND

DESCRIPTION: BRIDGE #81 ON SR 1728 (MIDDLE RD) OVER GUM LOG CREEK

	CHANNEL BED MATERIAL			CHANNEL BANK MATERIAL			
SAMPLE #	Channel			EB1A	B1A	B2B	
RETAINED #4	15.4			0	0	0	
PASSING #10	73.0			99.0	100.0	98.0	
PASSING #40	11.9			54.9	96.6	41.5	
PASSING #200	0.3			5.2	89.7	1.7	
COARSE SAND	70.3			65.8	5.8	80.3	
FINE SAND	2.4			28.0	4.5	16.0	
SILT/CLAY	0.3			5.2	89.7	1.7	
LL	N/A			16	48	15	
PL	N/A			-	29	-	
PI	N/A			NP	19	NP	
AASHTO CLASSIFICATION	A-1-b			A-3	A-7-6	A-1-b	
STATION	15+62			14+97	15+29	15+87	
OFFSET	25 RT			15 LT	9 LT	22 RT	
DEPTH	0.0-1.0			9.6-11.1	0.0-1.5	4.0-5.5	

A view of B-2, looking from B-2B to B-2A.

A view of End Bent 2, looking from EB-2A to EB-2B.

Site Photos

Bridge 81 on SR 1728 (Middle Road) Over Gum Log Creek
Cumberland County, North Carolina
T.I.P. No: B-4093 State Project: 33451.1.1
Tierra Project: 6211-04-051

Gum Log Creek, looking upstream.

Gum Log Creek, looking downstream.

Site Photos

Bridge 81 on SR 1728 (Middle Road) Over Gum Log Creek
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Profile A-Side, looking upstation.

Site Photos

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