ID: X-0002CB

PROJECT: 35196.3.20

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	X-0002CB	1	35
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
35196.3.20		P.E.	
		CONST.	

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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 35196.3.20 I.D. NO. X-0002CB

COUNTY CUMBERLAND

PROJECT DESCRIPTION FAYETTEVILLE OUTER LOOP FROM 2.09 Km E. OF NC 87-210 TO US 401

SITE DESCRIPTION DUAL BRIDGES AT -L- STA. 118+17.50

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 ENGINEERING UNIT @ 1-919-250-4088. 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.

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For Letting

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.20 (X-0002CB)

INVESTIGATED BY F&R, Inc. PERSONNEL C. BALDWIN

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SUBMITTED BY F&R, Inc. M. RENZA

DATE 6/2007 D. RACEY

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DRAWN BY: D. RACEY

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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 LICENSED SEAL 671 GEOLOGIST ELIZABETH C. HOWEY

Elizabeth C. Howey

SIGNATURE ELIZABETH C. HOWEY, P.E., L.G.

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
X-0002C	35196.1.2	2	35

METRIC

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING 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 30 cm 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 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT PLASTIC INDEX	6 MX		N.P.	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
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 (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

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	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	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 DPT DMT PMT VST — TEST BORING
- AUGER BORING
- CORE BORING
- 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
CT - CORING TERMINATED
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
LT. - LIGHT
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SDY. - SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
TR - TRACE
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 CME 55 TRACK
- ☐ OTHER_____

ADVANCING TOOLS:
- ☐ CLAY BITS
- ☐ 152 mm CONTINUOUS FLIGHT AUGER
- ☒ 203 mm HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☐ CASING ☐ W/ ADVANCER
- ☐ TRICONE _____ mm STEEL TEETH
- ☐ TRICONE _____ mm TUNG.-CARB.
- ☐ CORE BIT
- ☒ OTHER MUD ROTARY

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 2.5 cm PER 50 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 30 cm.
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 2.5 cm. 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 BLOWS PER 30 cm*
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 BLOWS PER 30 cm*
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 6 mm 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 1 mm DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 25 mm 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 CENTIMETERS 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 25 mm OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 m
WIDE	1 TO 3 m
MODERATELY CLOSE	30 TO 100 cm
CLOSE	5 TO 30 cm
VERY CLOSE	LESS THAN 5 cm

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 m
THICKLY BEDDED	0.5 - 1 m
THINLY BEDDED	0.05 - 0.5 m
VERY THINLY BEDDED	10 - 50 mm
THICKLY LAMINATED	2.5 - 10 mm
THINLY LAMINATED	< 2.5 mm

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 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 10 CENTIMETERS 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) OF A 63.5 kg HAMMER FALLING 0.76 METERS REQUIRED TO PRODUCE A PENETRATION OF 30 cm INTO SOIL WITH A 5 cm OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 2.5 cm PENETRATION WITH 50 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 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: TBM: BL-15 -BL- Sta. 36+00.70 l Centerline
N: 155,479.1990 E: 618,701.8460
ELEVATION: 56.19 m

NOTES:

REVISED 09/15/00

SINCE 1881

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Facsimile: (919) 828-5751

June 22, 2007

Mr. Njoroge Wainaina, P.E.
State Geotechnical Engineer
NCDOT-Geotechnical Engineering Unit
1589 Mail Service Center
Raleigh, NC 27699-1589

Re: Structure Foundation Investigation
Project No.: 35196.1.2
TIP No.: X-0002C
FA No.: NHF-DPR-0100(002)
County: Cumberland
Description: Fayetteville Outer Loop from 2.09 km East of NC 87-210 to US 401
Dual Bridges at -L- Station 118+17.50 over Tributary to Carver's Creek
F&R Project: J66-023G

Dear Mr. Wainaina:

The Raleigh, North Carolina office of Froehling & Robertson, Inc. (F&R) is pleased to submit the accompanying Structure Foundation Investigation Report. The work was performed in general accordance with F&R's Proposal 0866-033G dated May 15, 2007. Please contact us at your earliest convenience to discuss any comments regarding this report or our services in general.

Sincerely,

Christopher R. Baldwin
Staff Geologist

Elizabeth C. Howey 6122107
Elizabeth C. Howey, L.G., P.E.
Project Geotechnical Engineer

NORTH CAROLINA LICENSED SEAL 671 GEOLOGIST ELIZABETH C. HOWEY

SINCE 1881

SITE DESCRIPTION

The Fayetteville Outer Loop is proposed to be extended on new location between NC 87-210 and US 401. Dual bridges are proposed over a tributary to Carver's Creek at -L- Station 118+17.50. The proposed structures will each contain 3 spans of 31.000 meters, 34.000 meters and 34.146 meters for an overall length of 99.146 meters. The proposed skew angles vary at each bent and range from approximately 86 to 94 degrees.

METHOD OF EXPLORATION

A subsurface investigation was conducted in May, 2007. F&R advanced nine bridge borings at the site. Eight of the borings were advanced on the outside edge of each bent location for the dual structures. One boring (B2-A EBL) was advanced at the inside of Bent 2 on the EBL structure. The bridge borings were advanced to depths of 18.28 to 24.38 meters.

The borings were advanced with a CME-55 track-mounted drill rig with a 140-pound automatic hammer, utilizing mud rotary drilling techniques. Standard Penetration Tests (SPT) were performed, in general accordance with ASTM D-1586, at all borings to aid in foundation analysis. Representative soil samples were obtained for visual classification in the field and returned to our office for potential laboratory analysis. Twenty-one (21) samples of soil were selected and subjected to grain size and Atterberg Limits testing in accordance with AASHTO T-87, T-88, T-89, and T-90 as modified by NCDOT. One sample was subjected to grain size analysis only.

A handheld GPS unit (GEO-XH) was utilized to locate the borings in the field prior to mobilization. Points on the baseline survey were then utilized to survey boring collar elevations, cross sections, and profiles.

GEOLOGY

Based on review of the *Geologic Map of North Carolina* (1985), the project site is situated in an area of Coastal Plain deposits mapped as the Middendorf Formation, with the underlying Cape Fear Formation mapped nearby. The Middendorf Formation is described as loose sand, poorly indurated

sandstone, thin layers or lenses of mudstone, poorly sorted clayey sands, and laminated layers of sand and mudstone. The Middendorf Formation is noted for its lack of homogeneity with abrupt changes in lithology both horizontally and vertically. The color is described as gray to light gray with an orange cast. The Cape Fear Formation is described as sandstone and sandy mudstone which is yellowish gray to bluish gray, mottled red to yellowish orange. The Cape Fear Formation is noted as being more laterally continuous. Both formations contain minor quantities of mica and feldspar. The soils encountered in borings advanced across the site encountered both formations. The Middendorf Formation was noted in the upper portions of our borings overlying the Cape Fear Formation encountered near the bottom of the deeper borings.

STRATIGRAPHY

Alluvial soils were encountered in all borings from the ground surface to depths of 0.6 to 3.6 meters. The alluvium consists of very loose to medium dense silty fine to coarse sand (A-2-4, A-1-b) with trace to some clay and organics.

Coastal Plain soils of the Middendorf Formation underlie the alluvial soil and consist of alternating layers of soft to hard, fine to coarse sandy clay and silty clay (A-6, A-7-6), loose to very dense, fine to coarse sand (A-1-b, A-2-4, A-2-6, and A-2-7), and stiff to very stiff, highly fine to coarse sandy silt (A-4). The soil consistencies generally increase with depth. Most of the recovered samples contained trace amounts of mica and some also contained trace feldspar. Deposits of the Middendorf formation were encountered to the boring termination depths at the end bent locations and in boring B2-B EBL; these borings did not extend below elevation 37.40 meters.

The deeper borings at the interior bent locations encountered Coastal Plain deposits of the Cape Fear Formation at elevations ranging from 38.16 to 36.23 meters. These deposits consist of very stiff to hard, silty clay (A-7-6) with trace fine to coarse sand and mica. The borings at Bent 1 encountered a layer of dense to very dense sand (A-2-6) at their boring terminations. The sand samples contained trace amounts of clay, silt, mica, and feldspar.

GROUND WATER

Ground water was not measured in the borings immediately after drilling due to the mud rotary drilling techniques utilized. The 24 hour water measurements taken indicated water was present at depths of 0.3 to 1.52 meters (elevation 54.81 to 59.19 meters). The Bridge Survey & Hydraulic Design report dated May 3, 2006 lists the natural water surface elevation as 54.81 meters. The water surface was measured at elevations 54.47 and 54.73 meters during our field investigation. Note that the higher water elevation is the result of logs in the stream causing the water to pool in the area of the WBL profile.

NOTES TO THE DESIGNER

Shallow ground water was encountered at the interior bent locations, generally 0.3 to 0.4 meters below the ground surface.

QUALIFICATIONS OF REPORT

This report has been prepared for the exclusive use of the North Carolina Department of Transportation and their assignees for specific application to the referenced property in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. The conclusions provided in this report do not reflect variations in subsurface conditions, which could exist intermediate of the boring locations, or in unexplored areas of the site. Should such variations become apparent during construction, we reserve the right to re-evaluate our conclusions based upon an on-site observation of the conditions. In the event that changes are made in the proposed construction plans, the findings presented in this report shall not be considered valid unless reviewed by our firm and conclusions of this report modified or verified in writing.

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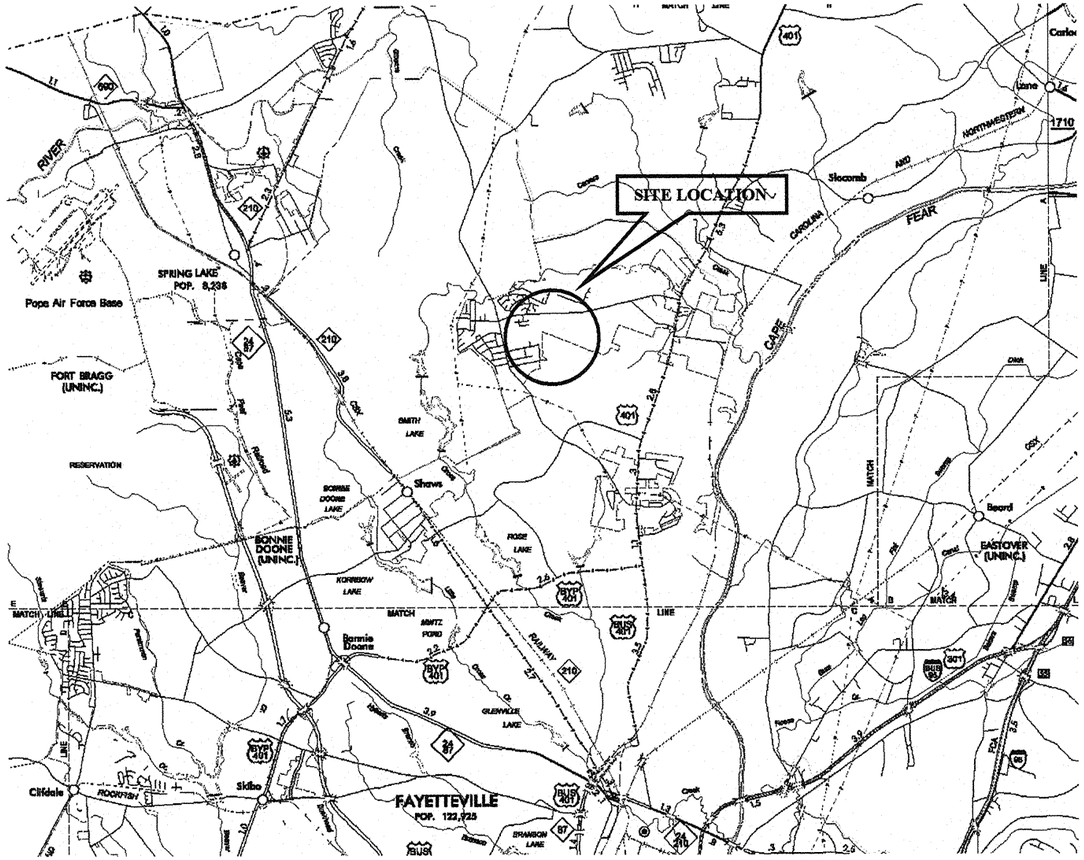
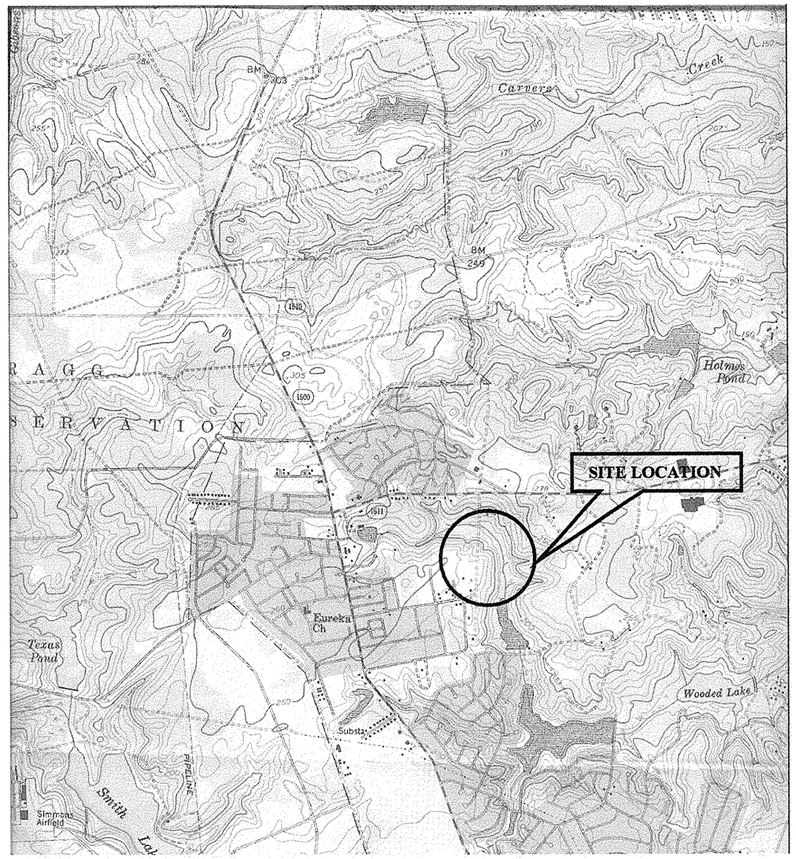
FIGURE 1



SITE VICINITY MAP

Adapted from an NCDOT Bridge Location Map of
Cumberland County, North Carolina, dated June 30, 2005.

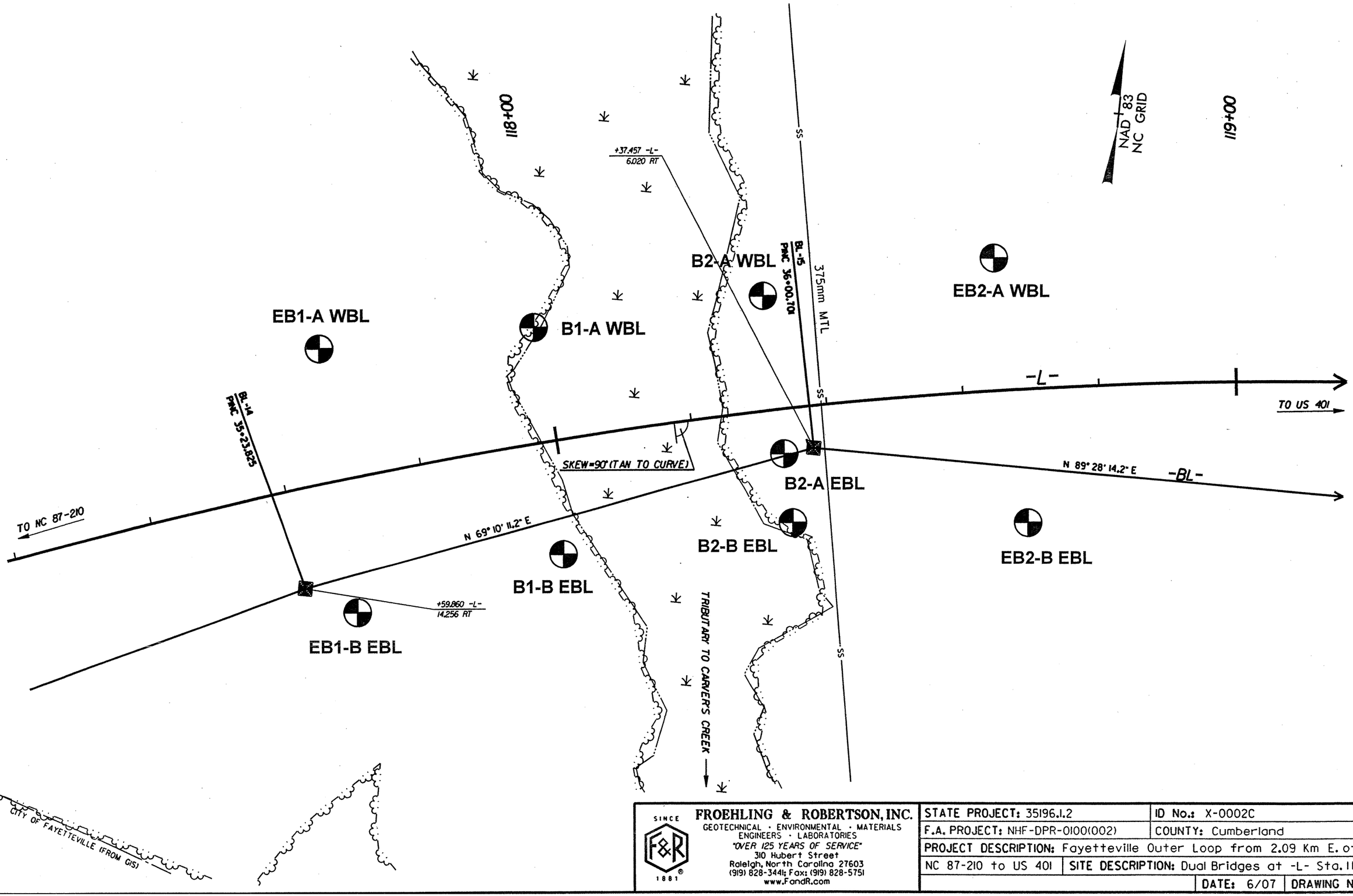
FIGURE 2



SITE LOCATION PLAN

Adapted from a USGS Quadrangle 7.5 min. Topographic Map
Titled Manchester, dated 1957, photorevised 1987

TEST SITE PLAN



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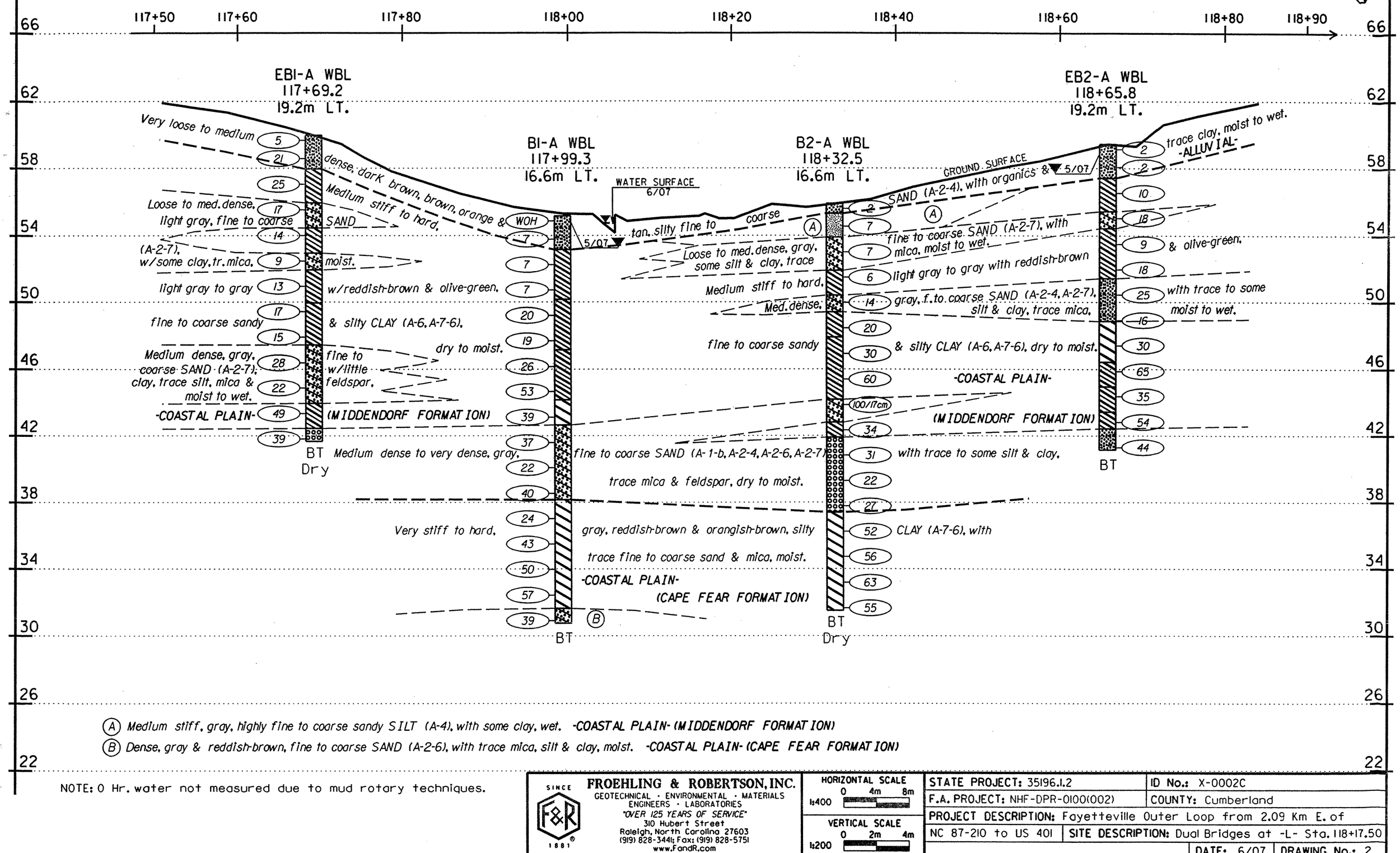
STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 — DRAWING No.: 1

WBL PROFILE 19.2m LEFT OF -L-

METRIC



(A) Medium stiff, gray, highly fine to coarse sandy SILT (A-4), with some clay, wet. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(B) Dense, gray & reddish-brown, fine to coarse SAND (A-2-6), with trace mica, silt & clay, moist. -COASTAL PLAIN- (CAPE FEAR FORMATION)

NOTE: 0 Hr. water not measured due to mud rotary techniques.

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HORIZONTAL SCALE 1:400 — 0, 4m, 8m

VERTICAL SCALE 1:200 — 0, 2m, 4m

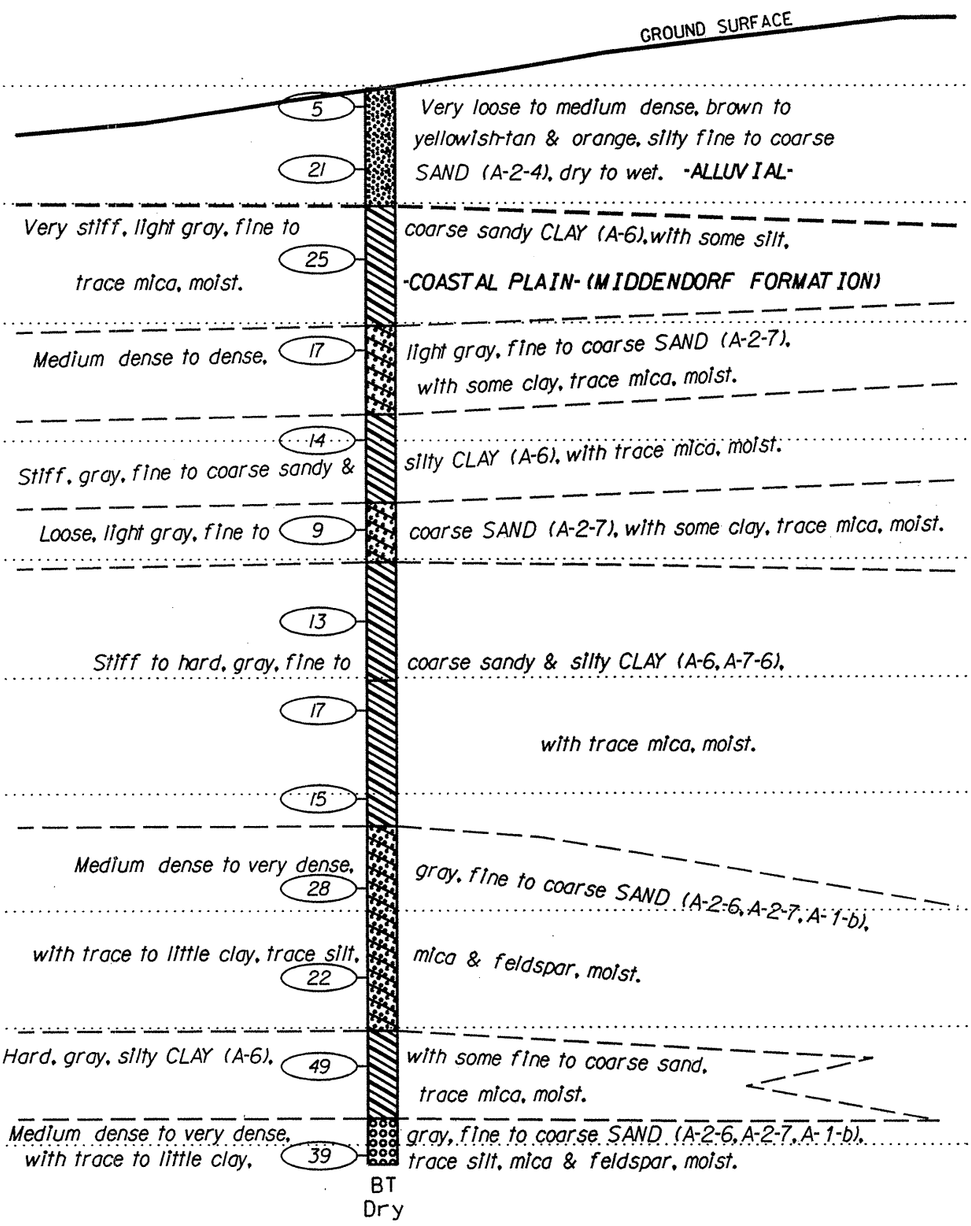
STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 — DRAWING No.: 2

SECTION THROUGH END BENT 1 WBL

METRIC

EBI-A WBL
117+69.2
19.2m LT.

℄ SURVEY
-L-



NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 8 OF 35

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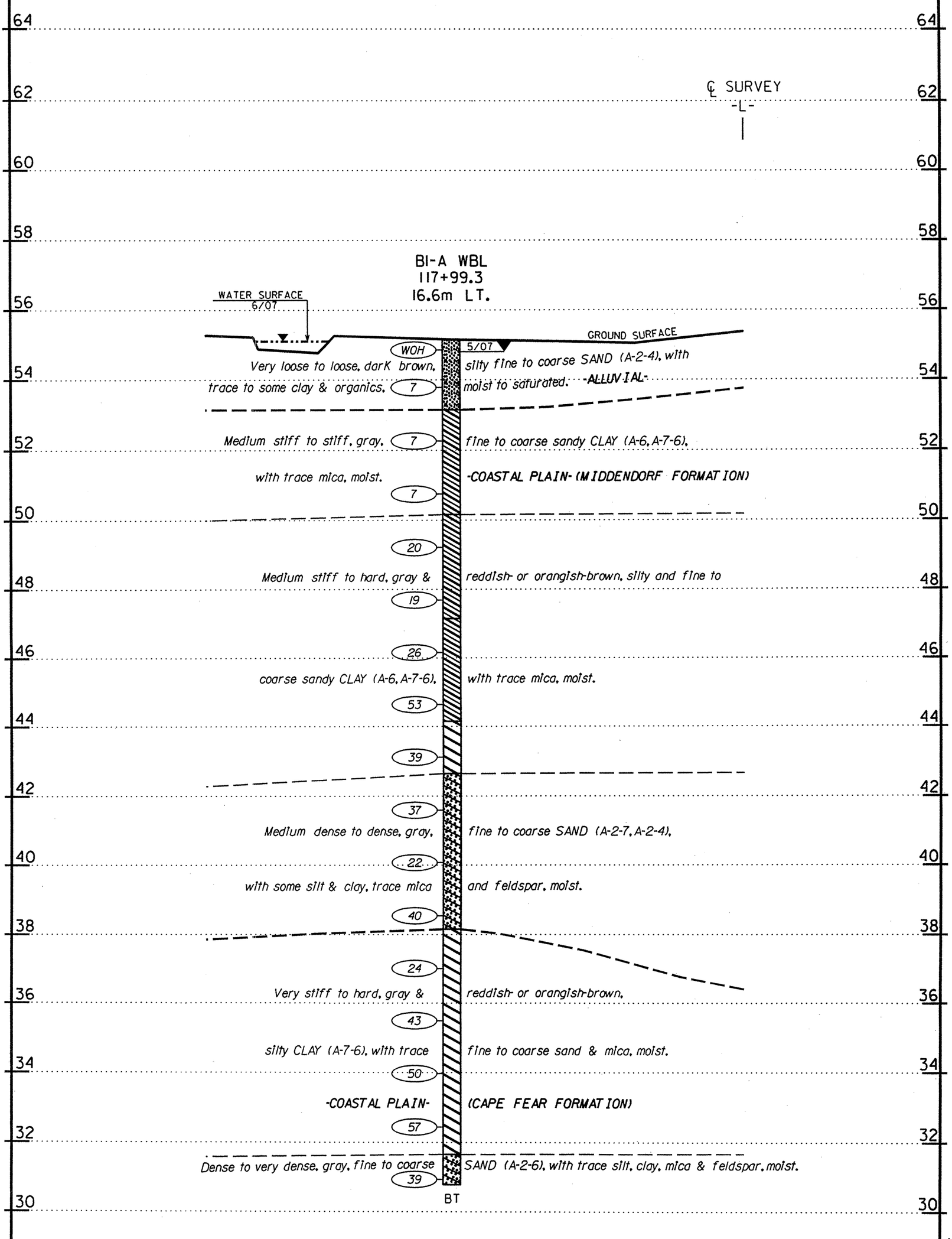
HORIZONTAL SCALE 1:200 (0, 2m, 4m)
VERTICAL SCALE 1:100 (0, 1m, 2m)

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 / DRAWING No.: 3

SECTION THROUGH BENT 1 WBL

METRIC



NOTE: 0 Hr. water not measured due to mud rotary techniques.

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HORIZONTAL SCALE
0 2m 4m
1:200

VERTICAL SCALE
0 1m 2m
1:100

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 DRAWING No.: 4

SECTION THROUGH BENT 2 WBL

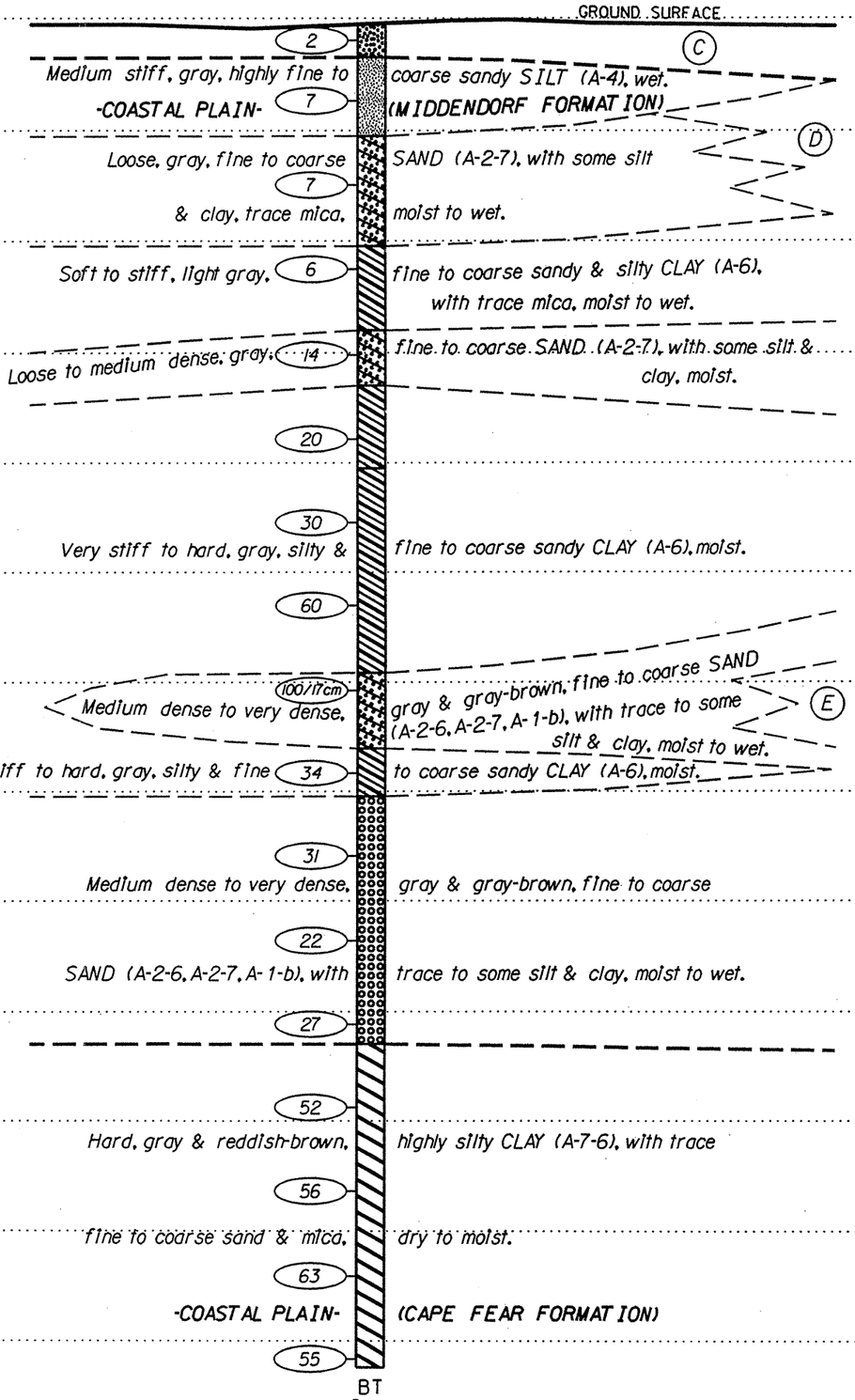
METRIC

64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28

℄ SURVEY
-L-

B2-A WBL
118+32.5
16.6m LT.

GROUND SURFACE



(C) Very loose, orangish-brown & dark brown, silty fine to coarse SAND (A-2-4), with some clay & organics, moist to wet. -ALLUVIAL-

(D) Soft to stiff, light gray, fine to coarse sandy & silty CLAY (A-6), with trace mica, moist to wet. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(E) Hard, gray with brown, silty CLAY (A-7-6), moist. -COASTAL PLAIN- (MIDDENDORF FORMATION)

NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 10 OF 35

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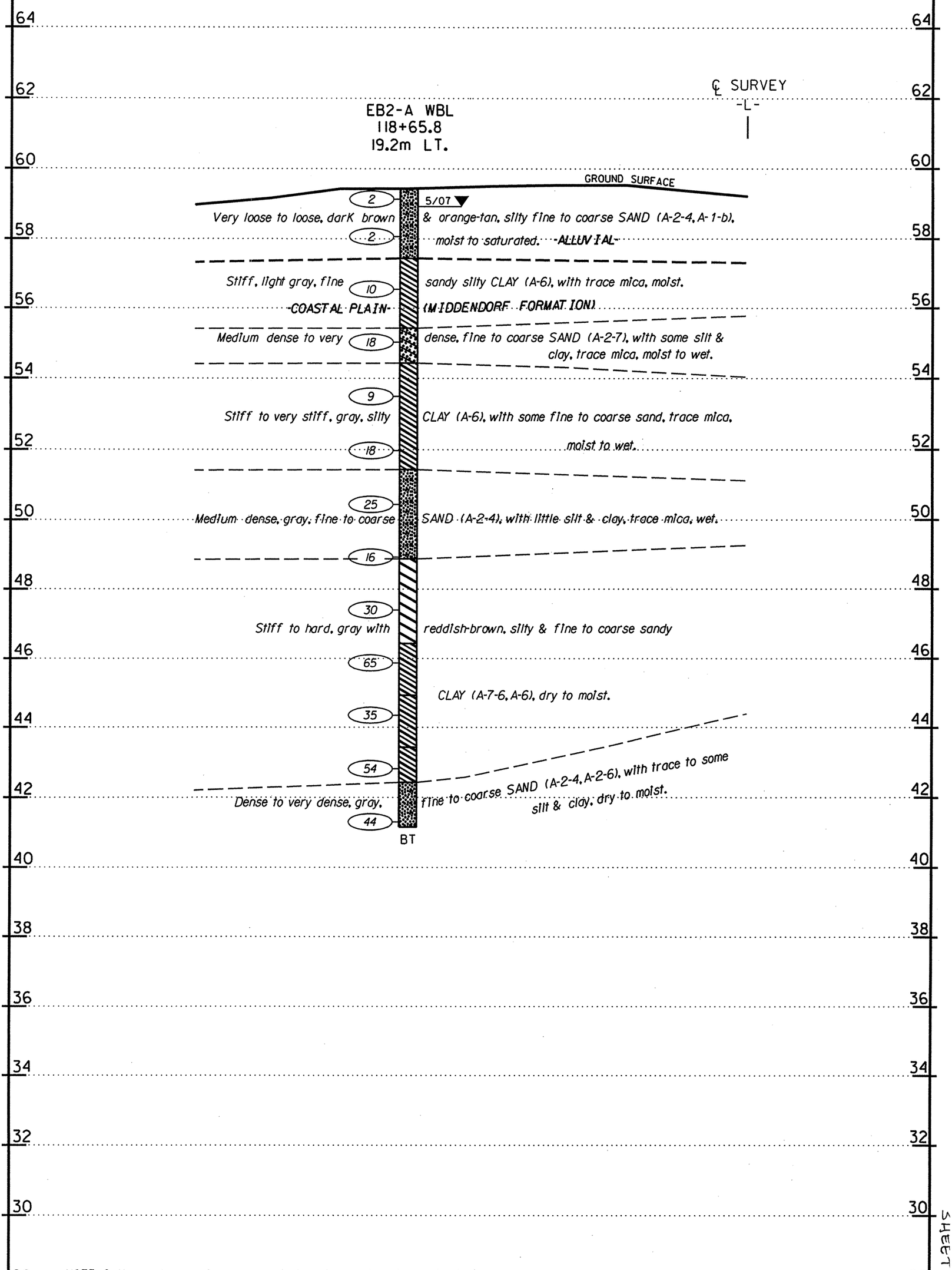
HORIZONTAL SCALE 0 2m 4m 1:200
VERTICAL SCALE 0 1m 2m 1:100

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 DRAWING No.: 5

SECTION THROUGH END BENT 2 WBL

METRIC



NOTE: 0 Hr. water not measured due to mud rotary techniques.

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HORIZONTAL SCALE
0 2m 4m
1:200

VERTICAL SCALE
0 1m 2m
1:100

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 / DRAWING No.: 6

SHEET 11 OF 35

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

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB1-A WBL	**BORING LOCATION** 117+69.2	**OFFSET** 19.2m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 59.95 m	**NORTHING** 155,486.5	**EASTING** 618,628.6		**24 HR.** Dry/0.65m
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/31/07	**COMPLETED** 5/31/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
59.95					Ground Surface				59.95 0.00
59.95	0.00	1	1	4	5		M		**-ALLUVIAL-** Loose to medium dense, brown, tan & orange, silty fine to coarse SAND (A-2-4), with trace clay.
58.88	1.07	8	9	12	21		W		57.95 2.00
57.36	2.59	5	9	16	25		M		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Very stiff, light gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
55.84	4.11	5	7	10	17		M		55.95 4.00 Medium dense, light gray, fine to coarse SAND (A-2-7), with some clay, trace mica.
54.31	5.64	4	6	8	14		M		54.45 5.50 Stiff, light gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
52.79	7.16	3	4	5	9		M		52.95 7.00 Loose, light gray, fine to coarse SAND (A-2-7), with some clay, trace mica.
51.26	8.69	3	5	8	13		M		51.95 8.00 Stiff, light gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
49.74	10.21	3	7	10	17	SS-111	19.8%		49.95 10.00 Stiff to very stiff, gray, highly silty CLAY (A-6(13)), with some fine to coarse sand, trace mica.
48.22	11.73	3	6	9	15		M		47.45 12.50 Medium dense, gray, fine to coarse SAND (A-2-7(0)), with little clay, trace silt, mica & feldspar.
46.69	13.26	9	11	17	28	SS-113	17.9%		
45.17	14.78	9	10	12	22		W		43.95 16.00 Hard, gray, silty CLAY (A-6), with some fine to coarse sand, trace mica.
43.64	16.31	12	19	30	49		M		42.45 17.50 Dense, gray, fine to coarse SAND (A-1-b), with trace silt, clay, feldspar & mica.
42.12	17.83	10	19	20	39		M		41.67 18.28

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/22/07

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BORING LOG

SHEET 12 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB1-A WBL	**BORING LOCATION** 117+69.2	**OFFSET** 19.2m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 59.95 m	**NORTHING** 155,486.5	**EASTING** 618,628.6		**24 HR.** Dry/0.65m
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/31/07	**COMPLETED** 5/31/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
41.67					Continued from previous page				Boring terminated at Elevation 41.67m in SAND (COASTAL PLAIN-MIDDENDORF FORMATION)

NOTES:

1) 0 Hr. water not measured due to mud rotary techniques.
2) The depth shown in the 24 Hr. groundwater is the cave-in depth.

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BORING LOG

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B1-A WBL	**BORING LOCATION** 117+99.3	**OFFSET** 16.6m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.16 m	**NORTHING** 155,492.5	**EASTING** 618,659.3		**24 HR.** 0.35
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/30/07	**COMPLETED** 5/30/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.16					Ground Surface				55.16 0.00
55.16	0.00	WOH	WOH	WOH	0		M		**-ALLUVIAL-** Very loose to loose, dark brown, silty fine SAND (A-2-4), with organics, trace clay.
54.09	1.07	2	3	4	7				53.16 2.00
52.57	2.59	WOH	3	4	7		M		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Medium stiff, light gray to gray, fine to coarse sandy CLAY (A-6), with some silt.
51.05	4.11	3	3	4	7		M		50.16 5.00
49.52	5.64	4	9	11	20	SS-78	19.7%		Very stiff, gray, highly silty CLAY (A-6(12)), with some fine to coarse sand, trace mica.
48.00	7.16	4	8	11	19		M		47.16 8.00
46.47	8.69	6	11	15	26	SS-80	21.1%		Very stiff to hard, gray, highly fine to coarse sandy CLAY (A-6(5)), with some silt, trace mica.
44.95	10.21	11	19	34	53		M		44.16 11.00
43.43	11.73	15	14	25	39		M		Hard, gray & orangish-brown, silty CLAY (A-7-6), with some fine to coarse sand, trace mica.
41.90	13.26	19	17	20	37				42.66 12.50
40.38	14.78	8	10	12	22	SS-84	17.6%		Dense to medium dense, gray, fine to coarse SAND (A-2-7(0)), with little silt, trace clay, mica & feldspar.
38.85	16.31	11	19	21	40		M		38.16 17.00
37.33	17.83	6	8	16	24		M		**-COASTAL PLAIN- (CAPE FEAR FORMATION)** Very stiff to hard, gray, orangish-brown & reddish-brown, silty CLAY (A-7-6), with trace fine to coarse sand, mica.

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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BORING LOG SHEET 13 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B1-A WBL	**BORING LOCATION** 117+99.3	**OFFSET** 16.6m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.16 m	**NORTHING** 155,492.5	**EASTING** 618,659.3		**24 HR.** 0.35
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/30/07	**COMPLETED** 5/30/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36.16					Continued from previous page				
35.81	19.35	12	19	24	43		M		**-COASTAL PLAIN- (CAPE FEAR FORMATION)** Very stiff to hard, gray, orangish-brown & reddish-brown, silty CLAY (A-7-6), with trace fine to coarse sand, mica. *(continued)*
34.28	20.88	12	19	31	50		M		
32.76	22.40	23	22	35	57		M		
31.23	23.93	13	19	20	39		M		31.66 23.50 Dense, gray & reddish-brown, fine to coarse SAND (A-2-6), with trace mica, silt & clay. 30.78 24.38 Boring Terminated at Elevation 30.78 m in SAND (COASTAL PLAIN-CAPE FEAR FORMATION)

NOTES:

1) 0 Hr. water not measured due to mud rotary techniques.

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/22/07

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

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-A WBL	**BORING LOCATION** 118+32.5	**OFFSET** 16.6m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.90 m	**NORTHING** 155,500.3	**EASTING** 618,692.4		**24 HR.** Dry/1.04m
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/23/07	**COMPLETED** 5/23/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.90					Ground Surface				55.90 0.00
55.90	0.00	WOH	1	1	2		M		**-ALLUVIAL-** Very loose, orangish-brown, silty fine to coarse SAND (A-2-4), with some clay. 55.30 0.60
54.83	1.07	2	5	2	7	SS-15	18.7%		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Medium stiff, gray, highly fine to coarse sandy SILT (A-4(0)), with some clay. 53.90 2.00
53.31	2.59	2	3	4	7		M/W		Loose, gray, fine to coarse SAND (A-2-7), with some silt & clay, trace mica. 51.90 4.00
51.79	4.11	2	2	4	6		M		Medium stiff, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica. 50.40 5.50
50.26	5.64	4	6	8	14		M		Medium dense, gray, fine to coarse SAND (A-2-7), with some silt & clay, trace mica. 49.40 6.50
48.74	7.16	5	9	11	20	SS-19	17.3%		Very stiff, gray, highly silty CLAY (A-6(10)), with some fine to coarse sand, trace mica. 47.90 8.00
47.21	8.69	7	12	18	30		M		Hard, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
45.69	10.21	19	26	34	60		M		
44.17	11.73	30	82	18/2cm	100/17cm		M		Very dense, gray, fine to coarse SAND (A-2-6), with trace silt, clay, mica & feldspar. 42.80 13.10
42.64	13.26	8	12	22	34		M		Hard, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica & feldspar. 41.90 14.00
41.12	14.78	9	14	17	31		M		Dense to medium dense, gray, fine to coarse SAND (A-1-b(0)), with trace silt, clay, mica & feldspar.
39.59	16.31	7	10	12	22	SS-25	M		
38.07	17.83	8	12	15	27		M		37.40 18.50

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 14 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-A WBL	**BORING LOCATION** 118+32.5	**OFFSET** 16.6m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.90 m	**NORTHING** 155,500.3	**EASTING** 618,692.4		**24 HR.** Dry/1.04m
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/23/07	**COMPLETED** 5/23/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36.90					Continued from previous page				
36.55	19.35	16	22	30	52		M		**-COASTAL PLAIN- (CAPE FEAR FORMATION)** Hard, reddish-brown & gray, highly silty CLAY (A-7-6(19)), with trace fine to coarse sand & mica. *(continued)*
35.02	20.88	12	23	33	56	SS-28	21.0%		
33.50	22.40	19	34	29	63		M		
31.97	23.93	16	28	27	55		M		31.52 24.38
									Boring Terminated at Elevation 31.52 m in CLAY (COASTAL PLAIN-CAPE FEAR FORMATION)

NOTES:

1) Driller indicates softer drilling at a depth of 13.10m (elev. 42.80m).
2) 0 Hr. water not measured due to mud rotary techniques.
3) The depth shown in the 24 Hr. groundwater is the cave-in depth.

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/22/07

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

SHEET 1 OF 2

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB2-A WBL	**BORING LOCATION** 118+65.8	**OFFSET** 19.2m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 59.43 m	**NORTHING** 155,509.1	**EASTING** 618,725.5		**24 HR.** 0.51
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/24/07	**COMPLETED** 5/24/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
59.43					Ground Surface				59.43 0.00
59.43	0.00	WOH	2	0	2		W		**-ALLUVIAL-** Very loose, dark brown, silty fine SAND (A-2-4), with organics, roots & small wood fragments.
58.36	1.07	1	1	1	2		M/W		57.43 2.00
56.84	2.59	2	3	7	10		M		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Stiff, light gray, fine sandy silty CLAY (A-6), with trace mica.
55.32	4.11	6	7	11	18		M		55.43 4.00 Medium dense, light gray, fine to coarse SAND (A-2-7), with some silt & clay, trace mica.
53.79	5.64	3	3	6	9		M		54.43 5.00 Stiff to very stiff, gray, silty CLAY (A-6(9)), with some fine to coarse sand, trace mica.
52.27	7.16	3	7	11	18	SS-49	14.0%		
50.74	8.69	9	10	15	25	SS-50	W		51.43 8.00 Medium dense, gray, fine to coarse SAND (A-2-4(0)), with trace to little silt & clay, trace mica.
49.22	10.21	6	6	10	16		D/M		48.87 10.56 Very stiff to hard, gray with reddish-brown, silty CLAY (A-7-6), with some fine to coarse sand.
47.70	11.73	9	11	19	30		D/M		46.43 13.00 Hard, gray, silty CLAY (A-6), with some fine to coarse sand.
46.17	13.26	9	19	46	65		D/M		44.93 14.50 Hard, gray, highly fine to coarse sandy CLAY (A-6), with some silt.
44.65	14.78	9	15	20	35		D/M		43.43 16.00 Hard, gray with olive-green, silty & fine sandy CLAY (A-6), with trace mica.
43.12	16.31	18	22	32	54		D/M		42.43 17.00 Very dense, gray, fine to coarse SAND (A-2-4), with some silt & clay, trace mica & feldspar.
41.60	17.83	10	16	28	44		D/M		41.15 18.28

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG SHEET 15 OF 35

SHEET 2 OF 2

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB2-A WBL	**BORING LOCATION** 118+65.8	**OFFSET** 19.2m LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 59.43 m	**NORTHING** 155,509.1	**EASTING** 618,725.5		**24 HR.** 0.51
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 5/24/07	**COMPLETED** 5/24/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
41.15					Continued from previous page				Boring Terminated at Elevation 41.15m in SAND (COASTAL PLAIN-MIDDENDORF FORMATION)

NOTES:

1) Geologist indicates strata break in split spoon at a depth of 10.56m (elev. 48.87m).
2) 0 Hr. water not measured due to mud rotary techniques.

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: X-0002C
DESCRIPTION: Dual Bridges on Fayetteville Outer Loop at -L- Station 118+17.50 **WBL Structure**

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 35196.1.2
DATE SAMPLED: May, 2007
SAMPLED FROM: -L-
SUBMITTED BY: E.C. Howey, L.G., P.E.

COUNTY: Cumberland
RECEIVED: 5/07 and 6/07
REPORTED: June, 2007
BY: D. Jenks

TEST RESULTS

PROJ. SAMPLE NO.	SS-111	SS-113	SS-78	SS-80	SS-84	SS-15	SS-19	SS-25	SS-28	SS-49	SS-50						
BORING NO.	EB1-A WBL	EB1-A WBL	B1-A WBL	B1-A WBL	B1-A WBL	B2-A WBL	B2-A WBL	B2-A WBL	B2-A WBL	EB2-A WBL	EB2-A WBL						
Retained #4 Sieve %	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0						
Passing #10 Sieve %	100.0	99.8	100.0	99.9	96.9	99.7	99.9	97.4	100.0	99.9	100.0						
Passing #40 Sieve %	94.0	45.6	96.6	96.1	45.5	90.5	93.9	40.8	98.7	91.7	92.2						
Passing #200 Sieve %	73.7	20.0	82.8	50.3	22.3	39.6	76.9	12.4	95.2	72.6	25.4						
SOIL MORTAR - 100%																	
Coarse Sand Ret - #60 %	9.4	71.4	5.8	9.6	67.4	19.3	8.9	72.9	1.8	12.8	21.5						
Fine Sand Ret - #270 %	25.7	10.6	17.1	46.6	12.8	51.4	20.7	16.6	6.8	21.9	57.8						
Silt 0.053 - 0.010 mm %	46.7	7.4	59.3	26.3	10.2	8.0	54.4	4.3	61.2	26.5	10.7						
Clay < 0.010 mm %	18.2	10.6	17.8	17.5	9.6	21.3	16.0	6.2	30.2	38.8	10.0						
L.L.	38	42	39	37	42	18	35	35	42	31	19						
P.L.	19	17	25	20	24	NP	20	32	24	15	NP						
P.I.	19	25	14	17	18	NP	15	3	18	16	NP						
AASHTO Classification	A-6(13)	A-2-7(0)	A-6(12)	A-6(5)	A-2-7(0)	A-4(0)	A-6(10)	A-1-b(0)	A-7-6(19)	A-6(9)	A-2-4(0)						
Station	117+69.2	117+69.2	117+19.3	117+19.3	117+19.3	118+32.5	118+32.5	118+32.5	118+32.5	118+65.8	118+65.8						
Offset	19.2m Lt.	19.2m Lt.	16.6m Lt.	16.6m Lt.	16.6m Lt.	16.6m Lt.	16.6m Lt.	16.6m Lt.	16.6m Lt.	19.2m Lt.	19.2m Lt.						
Depth (m)	10.21	13.26	5.64	8.69	14.78	1.07	7.16	16.31	20.88	7.16	8.69						
to	10.66	13.71	6.19	9.14	15.23	1.52	7.61	16.76	21.33	7.61	9.14						
Moisture Content (%)	19.8	17.9	19.7	21.1	17.6	18.7	17.3	NR	21.0	14.0	NR						

NP=Not plastic
NR=Not Reported

E.C. Howey, L.G., P.E.
Soils Engineer

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 35196.1.2 TIP: X-0002C COUNTY: Cumberland WBL Structure

DESCRIPTION(1): Fayetteville Outer Loop - Dual Structures at -L- Station 118+17.50 over Tributary to Carver's Creek

EXISTING BRIDGE

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

Bridge No.: N/A Length: N/A Total Bents: N/A Bents in Channel: N/A Bents in Floodplain: N/A
Foundation Type: The proposed bridge is on new location, no structure is in place at this time

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: N/A

Interior Bents: N/A

Channel Bed: None

Channel Bank: None

EXISTING SCOUR PROTECTION

Type(3): N/A

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): Fallen trees/logs are located in the stream near the proposed WBL structure

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 theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): Silty, fine to coarse sand

Channel Bank Material(8): Silty, fine to coarse sand and fine to coarse sandy silt
Shelby tube obtained for EFA testing at -L- Station 118+00.8, 16.6m Left

Channel Bank Cover(9): Grasses

Floodplain Width(10): Approximately 200 meters

Floodplain Cover(11): Grasses, Vines, Trees

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): West

Observations and Other Comments: ____

Reported by: Chris Baldwin / ECH **Date:** 6/1/2007
Chris Baldwin

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters X

	BENTS	
	Bent 1	**Bent 2**
WBL 100 YR	54.61	54.6
WBL 500 YR	54.51	54.5

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the scour calculations on the Bridge Survey and Hydraulic Report dated 5/3/2006 at Bent 1. DSE is higher at all other locations.

DSE determined by: ____ **Date:** 7/11/2007
C. M. Whalen

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bank
Sample No.	SS-15
Retained #4	0.2
Passed #10	99.7
Passed #40	90.5
Passed #200	39.6
Coarse Sand	19.3
Fine Sand	51.4
Silt	8
Clay	21.3
LL	18
PI	NP
AASHTO	A-4 (0)
Station	118+32.5
Offset	16.6m Lt.
Depth	1.07 - 1.52

SITE PHOTOGRAPHS

Photograph No. 1: WBL Profile view from behind EB1-A WBL, looking east

Photograph No. 2: Cross-section view of End Bent 1 WBL, from -L- looking north

Photograph No. 3: Cross-section view of Bent 1 WBL, from -L- looking north

Photograph No. 4: Cross-section view of Bent 2 WBL, from -L- looking north

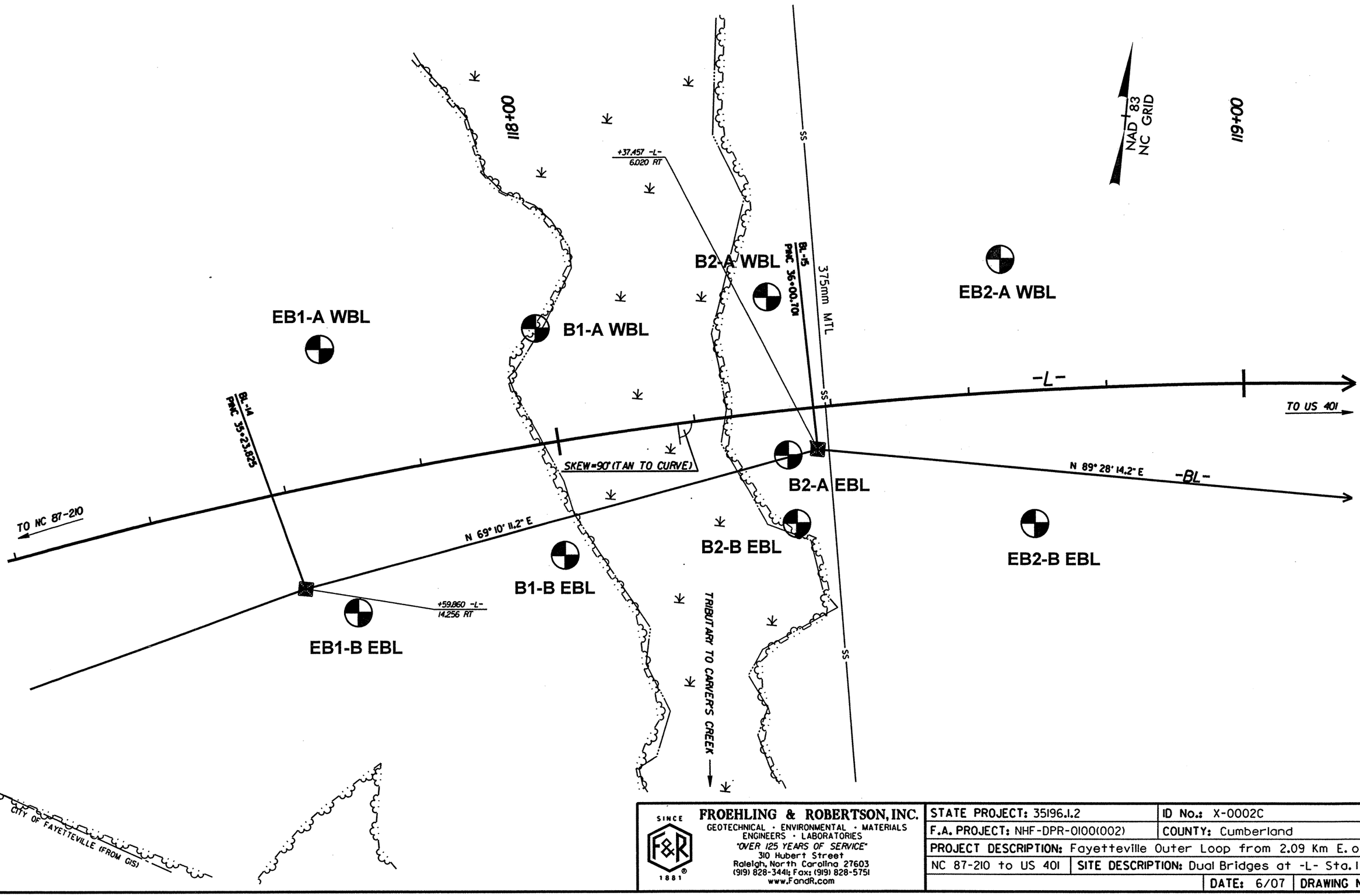
SITE PHOTOGRAPHS

Photograph No. 5: Cross-section view of End Bent 2 WBL, from -L- looking north

Photograph No. 6: WBL Profile from ahead of EB2-A WBL, looking West

⊕ Approximate Boring Location

TEST SITE PLAN



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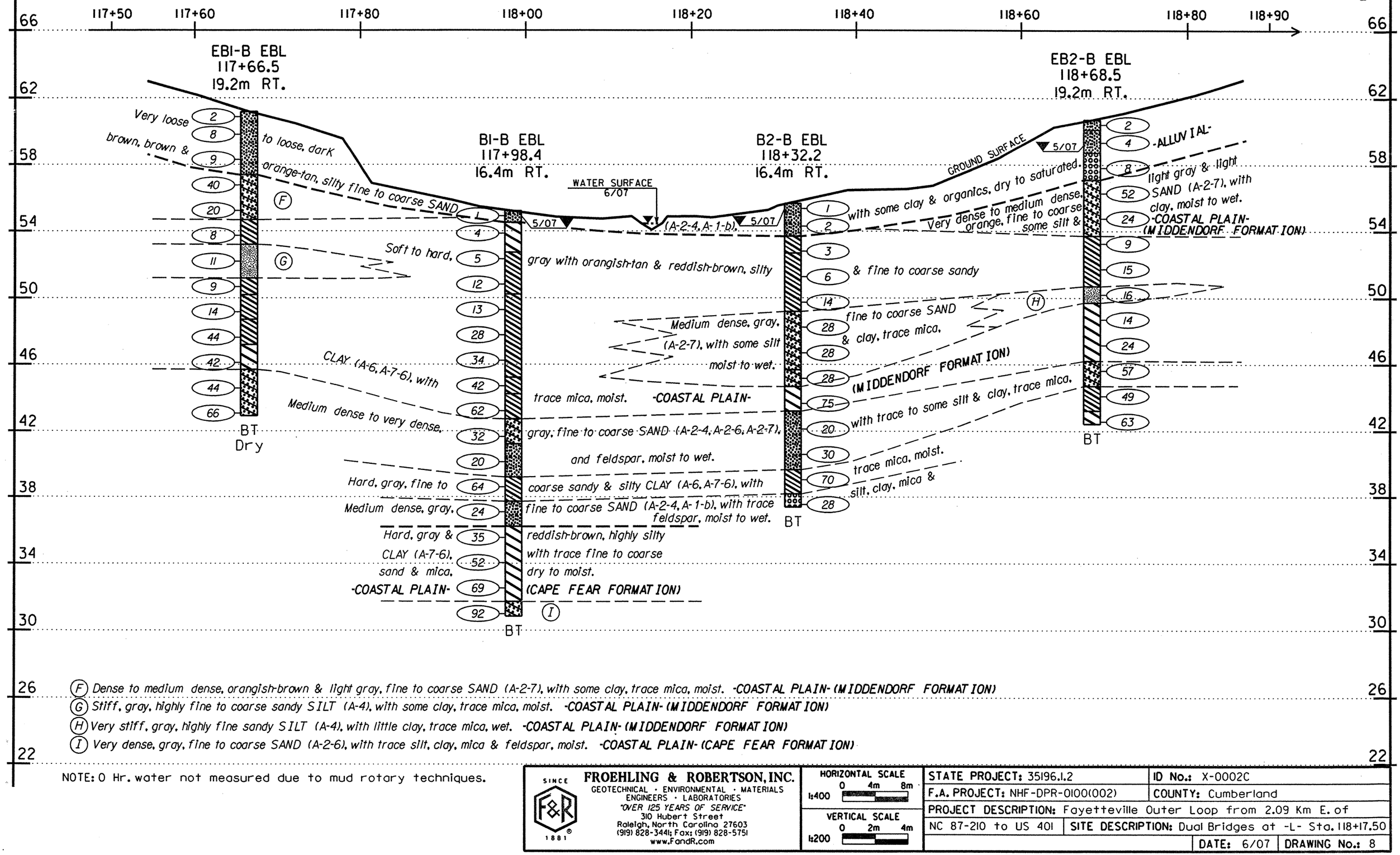
STATE PROJECT: 35196.1.2	**ID No.:** X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	**COUNTY:** Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of	
NC 87-210 to US 401	**SITE DESCRIPTION:** Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 — **DRAWING No.:** 7

METRIC

EBL PROFILE 19.3m RIGHT OF -L-



(F) Dense to medium dense, orangish-brown & light gray, fine to coarse SAND (A-2-7), with some clay, trace mica, moist. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(G) Stiff, gray, highly fine to coarse sandy SILT (A-4), with some clay, trace mica, moist. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(H) Very stiff, gray, highly fine sandy SILT (A-4), with little clay, trace mica, wet. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(I) Very dense, gray, fine to coarse SAND (A-2-6), with trace silt, clay, mica & feldspar, moist. -COASTAL PLAIN- (CAPE FEAR FORMATION)

NOTE: 0 Hr. water not measured due to mud rotary techniques.

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HORIZONTAL SCALE
0 4m 8m
1:400

VERTICAL SCALE
0 2m 4m
1:200

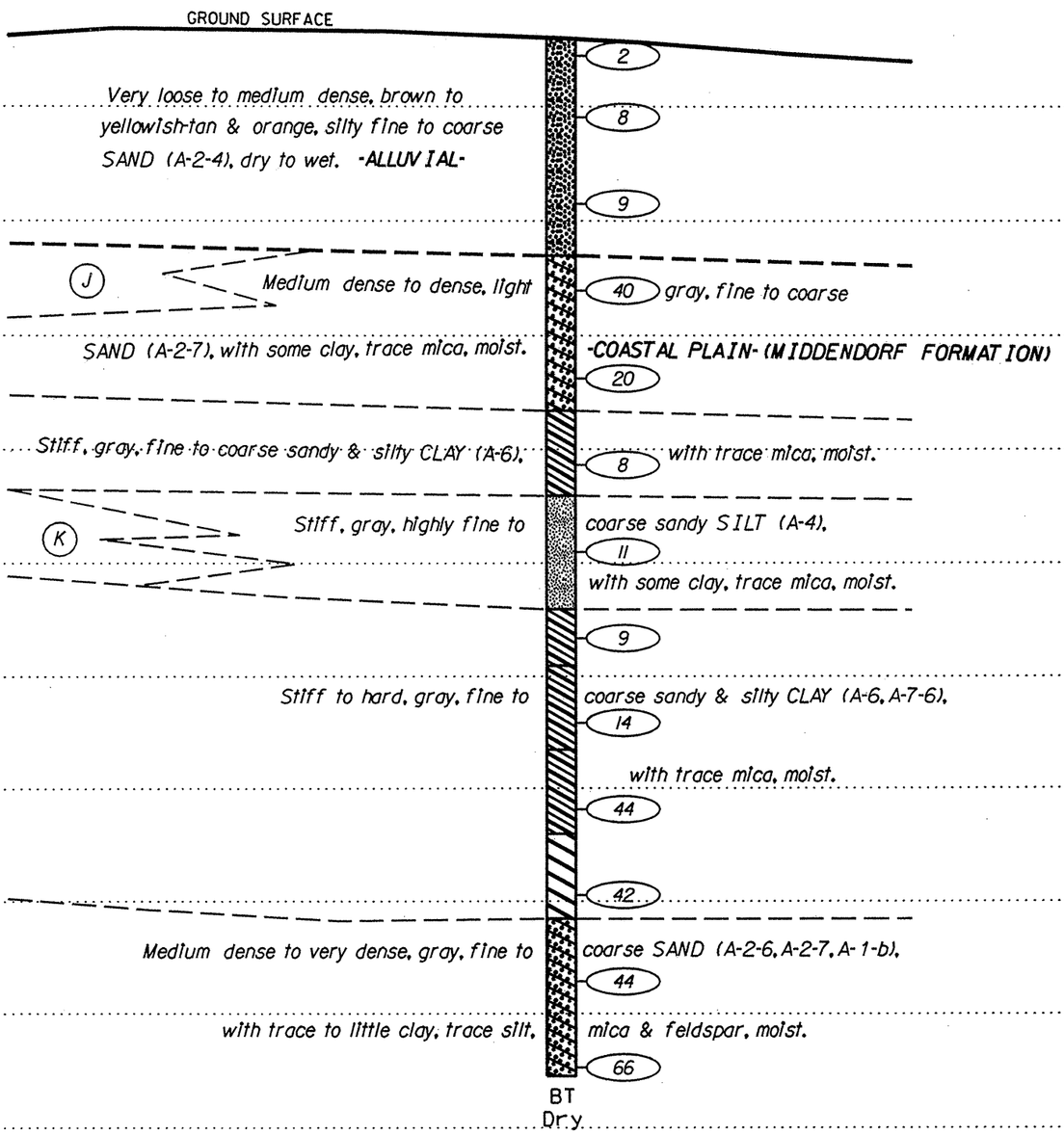
STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 — DRAWING No.: 8

SECTION THROUGH END BENT 1 EBL

METRIC

℄ SURVEY
-L-

EBI-B EBL
117+66.5
19.2m RT.



(J) Very stiff, light gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica, moist. -COASTAL PLAIN- (MIDDENDORF FORMATION)

(K) Loose, light gray, fine to coarse SAND (A-2-7), with some clay, trace mica, moist. -COASTAL PLAIN- (MIDDENDORF FORMATION)

NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 22 OF 35

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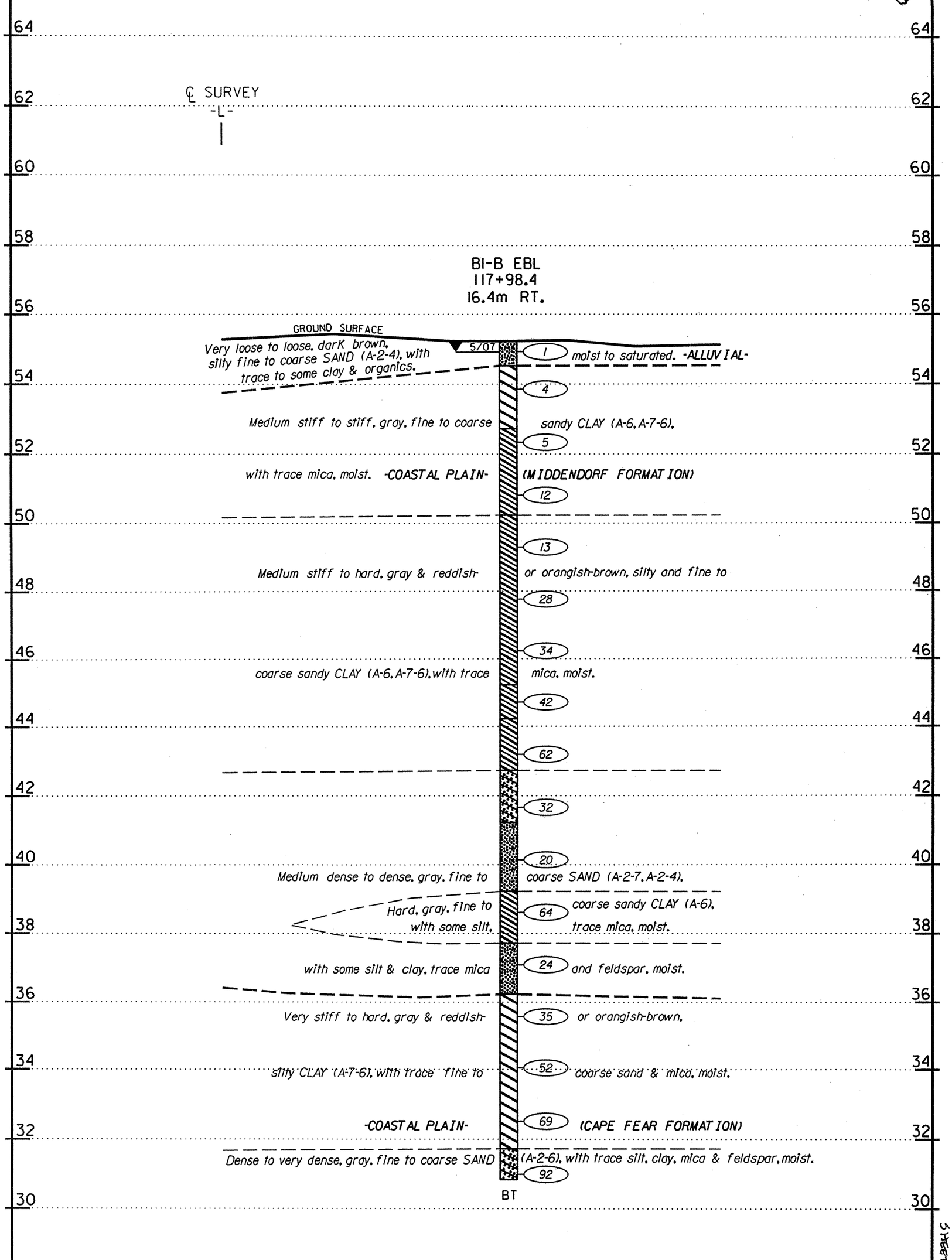
HORIZONTAL SCALE
0 2m 4m
1:200

VERTICAL SCALE
0 1m 2m
1:100

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 / DRAWING No.: 9

SECTION THROUGH BENT 1 EBL

METRIC



NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 23 OF 35

SINCE F&R 1881

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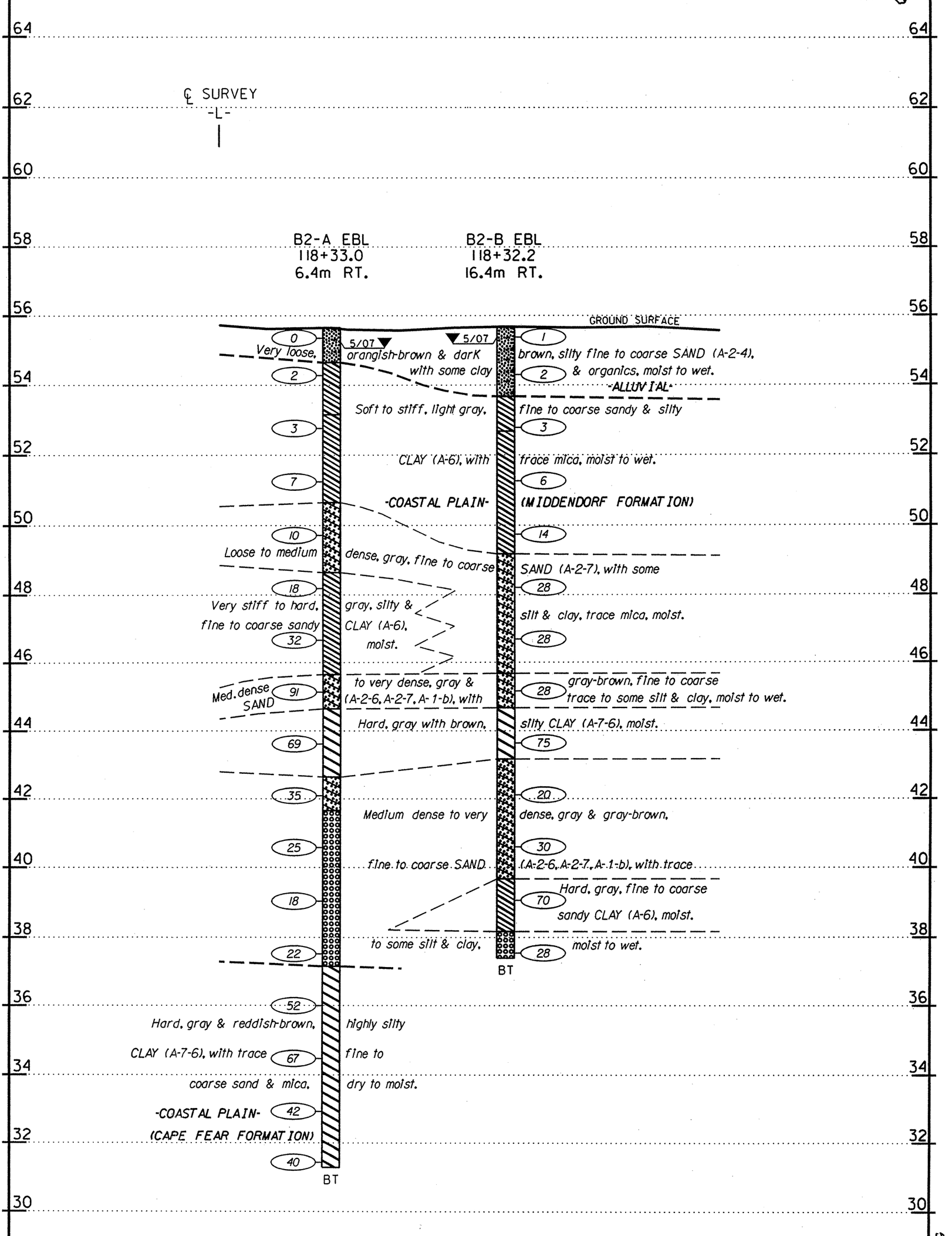
HORIZONTAL SCALE 1:200 (0, 2m, 4m)
VERTICAL SCALE 1:100 (0, 1m, 2m)

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 — DRAWING No.: 10

SECTION THROUGH BENT 2 EBL



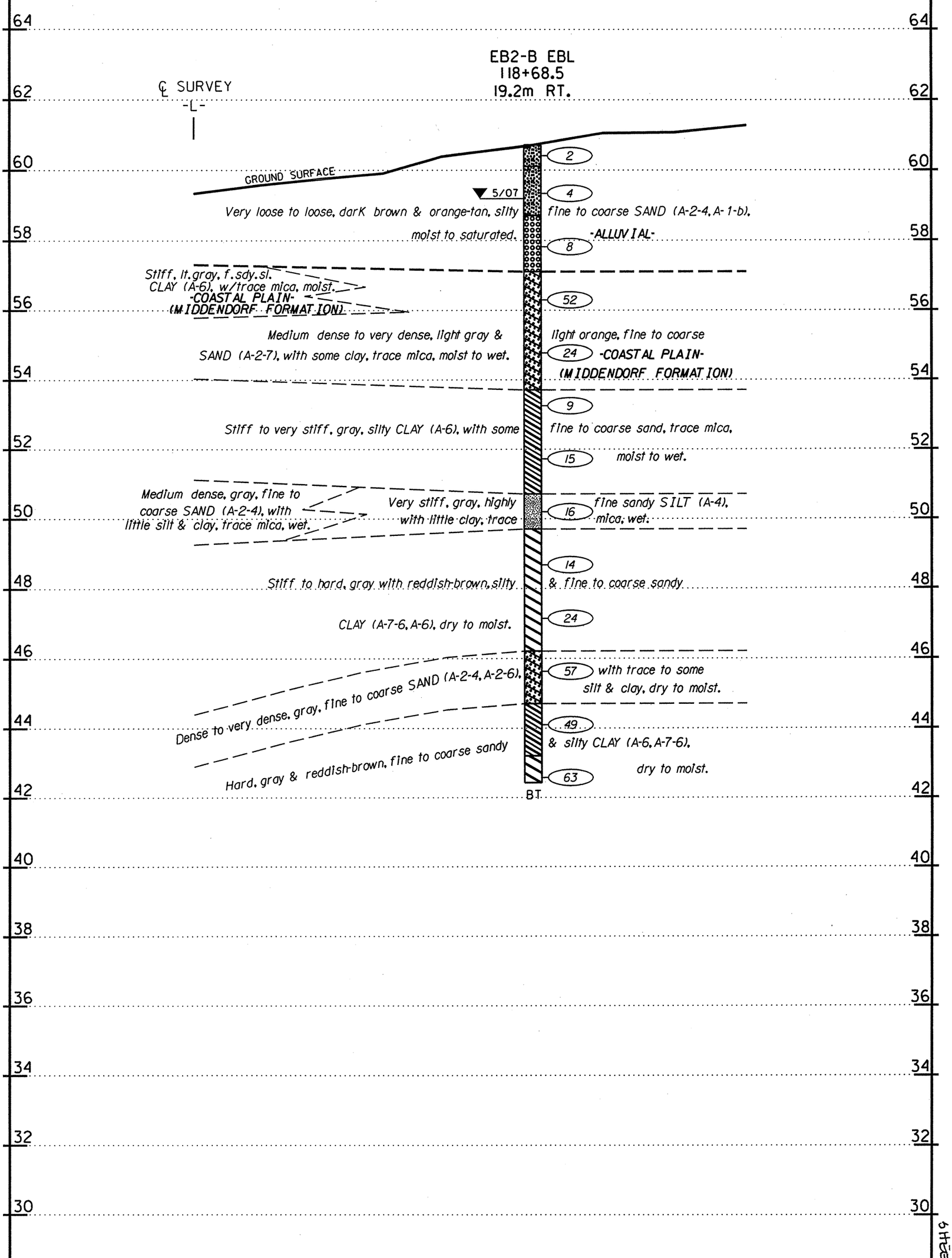
NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 24 OF 35

FROEHLING & ROBERTSON, INC. GEOTECHNICAL · ENVIRONMENTAL · MATERIALS ENGINEERS · LABORATORIES "OVER 125 YEARS OF SERVICE" 310 Hubert Street Raleigh, North Carolina 27603 (919) 828-3441; Fax: (919) 828-5751 www.FandR.com	HORIZONTAL SCALE 0 2m 4m 1:200 VERTICAL SCALE 0 1m 2m 1:100	STATE PROJECT: 35196.1.2	ID No.: X-0002C
		F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
		PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
			DATE: 6/07 / DRAWING No.: 11

SECTION THROUGH END BENT 2 EBL

METRIC



NOTE: 0 Hr. water not measured due to mud rotary techniques.

SHEET 25 OF 35

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HORIZONTAL SCALE 0 2m 4m 1:200
VERTICAL SCALE 0 1m 2m 1:100

STATE PROJECT: 35196.1.2	ID No.: X-0002C
F.A. PROJECT: NHF-DPR-0100(002)	COUNTY: Cumberland
PROJECT DESCRIPTION: Fayetteville Outer Loop from 2.09 Km E. of NC 87-210 to US 401	SITE DESCRIPTION: Dual Bridges at -L- Sta. 118+17.50
	DATE: 6/07 DRAWING No.: 12

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

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB1-B EBL	**BORING LOCATION** 117+66.5	**OFFSET** 19.2m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 61.19 m	**NORTHING** 155,449.2	**EASTING** 618,637.8	**24 HR.** Dry/0.70m
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/31/07	**COMPLETED** 5/31/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
61.19					Ground Surface				61.19 0.00
61.19	0.00	1	1	1	2		D		**-ALLUVIAL-** Very loose to loose, brown, yellowish-tan, orange & tan, silty fine to coarse SAND (A-2-4), with organics, little to trace clay.
60.12	1.07	4	4	4	8		M/W		
58.60	2.59	1	5	4	9		W		57.39 3.80
57.08	4.11	10	16	24	40		M		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Dense to medium dense, orangish-brown & light gray, fine to coarse SAND (A-2-7(2)), with some clay, trace mica.
55.55	5.64	5	9	11	20	SS-95	17.1%		54.69 6.50
54.03	7.16	2	3	5	8		M/W		Stiff, gray, silty CLAY (A-6), with some fine to coarse sand, trace mica.
52.50	8.69	3	3	8	11	SS-97	13.0%		53.19 8.00
50.98	10.21	3	3	6	9		M		Stiff, gray, highly fine to coarse sandy SILT (A-4(2)), with some clay, trace mica.
49.46	11.73	4	5	9	14		M		51.19 10.00
47.93	13.26	13	18	26	44		M		Stiff, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
46.41	14.78	9	16	26	42		M		50.19 11.00
44.88	16.31	11	17	27	44	SS-102	16.4%		Stiff, gray & reddish-brown, silty CLAY (A-6), with some fine to coarse sand, trace mica.
43.36	17.83	21	27	39	66		M		48.69 12.50
									Hard, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
									47.19 14.00
									Hard, gray & reddish-brown, silty CLAY (A-7-6), with trace fine to coarse sand.
									45.69 15.50
									Dense to very dense, gray, fine to coarse SAND (A-2-6(0)), with trace silt, clay & mica.
									42.91 18.28

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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BORING LOG SHEET 26 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB1-B EBL	**BORING LOCATION** 117+66.5	**OFFSET** 19.2m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 61.19 m	**NORTHING** 155,449.2	**EASTING** 618,637.8	**24 HR.** Dry/0.70m
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/31/07	**COMPLETED** 5/31/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
42.91					Continued from previous page				Boring Terminated at Elevation 42.91m in SAND (COASTAL PLAIN-MIDDENDORF FORMATION)

NOTES:

1) Driller indicates harder drilling at a depth of 3.80m (elev. 57.39m).
2) 0 Hr. water not measured due to mud rotary techniques.
3) The depth shown in the 24 Hr. groundwater is the cave-in depth.

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BORING LOG

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B1-B EBL	**BORING LOCATION** 117+98.4	**OFFSET** 16.4m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.23 m	**NORTHING** 155,460.4	**EASTING** 618,666.7		**24 HR.** 0.31
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 6/1/07	**COMPLETED** 6/1/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.23					Ground Surface				
55.23	0.00	1	0	1	1		Sat.		**-ALLUVIAL-** Very loose, dark brown, silty fine to coarse SAND (A-2-4), with organics, some clay. 0.70
54.53									**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Medium stiff, gray & orangish-brown, fine sandy CLAY (A-7-6(12)), with trace coarse sand, silt & mica.
54.16	1.07	1	1	3	4	SS-118	26.5%		
52.64	2.59	1	2	3	5		M		2.50
52.73									Medium stiff to stiff, light gray to gray, highly fine to coarse sandy CLAY (A-6), with some silt, trace mica.
51.12	4.11	4	5	7	12		M		
50.23	5.00								5.00
49.59	5.64	4	6	7	13		M		Stiff to hard, gray & reddish-brown, highly silty CLAY (A-6), with some fine to coarse sand, trace mica.
48.07	7.16	8	11	17	28		M		
46.54	8.69	8	17	17	34		M		
45.23	10.00								10.00
45.02	10.21	10	18	24	42	SS-124	13.4%		Hard, gray, highly fine to coarse sandy CLAY (A-6(3)), with some silt, trace mica.
44.23	11.00								11.00
43.50	11.73	11	24	38	62		M		Hard, gray & orangish-brown, silty CLAY (A-6), with some fine to coarse sand, trace mica.
42.73	12.50								12.50
41.97	13.26	10	14	18	32		M		Dense, gray, fine to coarse SAND (A-2-7), with some clay, trace mica.
41.23	14.00								14.00
40.45	14.78	7	9	11	20		W		Medium dense, gray, fine to coarse SAND (A-2-4), with some silt & clay, trace mica.
39.23	16.00								16.00
38.92	16.31	14	25	39	64		M		Hard, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
37.73	17.50								17.50
37.40	17.83	7	10	14	24		M/W		Medium dense, gray, fine to coarse SAND (A-2-4), with trace silt, clay, mica & feldspar.
36.23	19.00								19.00

NCDOT BORE SINGLE 166-023.GPJ NC_DOT.GDT 6/21/07

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BORING LOG SHEET 27 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B1-B EBL	**BORING LOCATION** 117+98.4	**OFFSET** 16.4m RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 55.23 m	**NORTHING** 155,460.4	**EASTING** 618,666.7		**24 HR.** 0.31
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DATE STARTED 6/1/07	**COMPLETED** 6/1/07	**SURFACE WATER DEPTH** N/A		

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36.23					Continued from previous page				
35.88	19.35	7	12	23	35		D/M		**-COASTAL PLAIN- (CAPE FEAR FORMATION)** Hard, gray & reddish-brown, highly silty CLAY (A-7-6), with trace fine to coarse sand, trace mica.
34.35	20.88	14	24	28	52		D/M		
32.83	22.40	18	28	41	69		M		
31.73									23.50
31.30	23.93	24	38	54	92		M		Very dense, gray, fine to coarse SAND (A-2-6), with trace silt, clay, mica & feldspar.
30.85									24.38
									Boring Terminated at Elevation 30.85 m in SAND (COASTAL PLAIN-CAPE FEAR FORMATION)

NOTES:

1) 0 Hr. water not measured due to mud rotary techniques.

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BORING LOG

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-A EBL	**BORING LOCATION** 118+33.0	**OFFSET** 6.4m RT	**ALIGNMENT** -L- **0 HR.** N/A
COLLAR ELEV. 55.65 m	**NORTHING** 155,477.9	**EASTING** 618,697.6	**24 HR.** 0.40
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/25/07	**COMPLETED** 5/25/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.65					Ground Surface				55.65 0.00
55.65	0.00	1	0	0	0				**-ALLUVIAL-** Very loose, dark brown, silty fine SAND (A-2-4), with some clay & organics.
54.58	1.07								54.65 1.00
		2	1	1	2		Sat.		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Soft, light gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
53.06	2.59								53.15 2.50
		1	1	2	3		W		Soft to medium stiff, light gray, silty CLAY (A-6), with some fine to coarse sand, trace mica.
51.54	4.11								
		2	3	4	7		W		
50.01	5.64								50.65 5.00
		5	4	6	10		M		Loose to medium dense, gray, fine to coarse SAND (A-2-7), with some silt & clay, trace mica.
48.49	7.16								48.65 7.00
		4	7	11	18		M		Very stiff to hard, gray, silty CLAY (A-6), with some fine to coarse sand, trace mica.
46.96	8.69								
		10	13	19	32		M		
45.44	10.21								45.95 9.70
		17	41	50	91		M		Very dense, gray-brown, fine to coarse SAND (A-2-6), with trace silt, clay & mica.
43.92	11.73								44.65 11.00
		16	25	44	69		M		Hard, gray with olive-brown, silty CLAY (A-7-6), with some fine to coarse sand.
42.39	13.26								42.65 13.00
		10	14	21	35		M		Very dense, gray, silty fine to coarse SAND (A-2-6), with trace clay, silt & mica.
40.87	14.78								41.65 14.00
		9	12	13	25		M/W		Medium dense, gray, fine to coarse SAND (A-1-b), with trace clay, silt, mica & feldspar.
39.34	16.31								
		6	7	11	18		M/W		
37.82	17.83								
		11	10	12	22		M/W		37.15 18.50

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BORING LOG SHEET 28 OF 35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-A EBL	**BORING LOCATION** 118+33.0	**OFFSET** 6.4m RT	**ALIGNMENT** -L- **0 HR.** N/A
COLLAR ELEV. 55.65 m	**NORTHING** 155,477.9	**EASTING** 618,697.6	**24 HR.** 0.40
TOTAL DEPTH 24.38 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/25/07	**COMPLETED** 5/25/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36.65					Continued from previous page				
36.30	19.35								
		14	23	29	52		D/M		**-COASTAL PLAIN- (CAPE FEAR FORMATION)** Hard, gray & reddish-brown, highly silty CLAY (A-7-6), with trace fine to coarse sand & mica. *(continued)*
34.77	20.88								
		15	29	38	67		D/M		
33.25	22.40								
		13	19	23	42		D/M		
31.72	23.93								
		15	19	21	40		D/M		
									31.27 24.38 Boring Terminated at Elevation 31.27 m in CLAY (COASTAL PLAIN-CAPE FEAR FORMATION)

NOTES:

1) Driller indicates harder drilling at a depth of 9.70m (elev. 45.95m).
2) 0 Hr. water not measured due to mud rotary techniques.

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BORING LOG

SHEET 1 OF 2

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-B EBL	**BORING LOCATION** 118+32.2	**OFFSET** 16.4m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 55.68 m	**NORTHING** 155,468.2	**EASTING** 618,699.8	**24 HR.** 0.30
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/21/07	**COMPLETED** 5/22/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
55.68					Ground Surface				55.68 0.00
55.68	0.00	WOH	WOH	1	1		W		**-ALLUVIAL-** Very loose, dark brown, silty fine SAND (A-2-4), with some clay & organics.
54.61	1.07	WOH	1	1	2	SS-2			53.68 2.00
53.09	2.59	1	1	2	3	SS-3	25.3%		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Soft, gray & orangish-brown, silty CLAY (A-6(14)), with little fine to coarse sand, trace mica. 52.68 3.00
51.57	4.11	1	2	4	6	SS-4	21.5%		Medium stiff to stiff, gray, highly fine to coarse sandy CLAY (A-6(5)), with some silt, trace mica.
50.04	5.64	3	6	8	14		M		49.18 6.50
48.52	7.16	5	11	17	28		M		Medium dense, gray, fine to coarse SAND (A-2-7), with some silt & clay, trace mica.
46.99	8.69	9	12	16	28		M		45.68 10.00
45.47	10.21	8	11	17	28		W		Medium dense, gray, fine to coarse SAND (A-2-6), with trace silt, clay & mica.
43.95	11.73	14	28	47	75	SS-9	20.6%		44.68 11.00 Hard, gray & orangish-brown, highly silty CLAY (A-7-6(15)), with some fine to coarse sand.
42.42	13.26	5	9	11	20		W		43.18 12.50 Medium dense to dense, gray, fine to coarse SAND (A-2-6), with trace silt, clay & mica.
40.90	14.78	9	11	19	30		M		39.68 16.00
39.37	16.31	24	34	36	70		M		Hard, gray, fine to coarse sandy CLAY (A-6), with some silt, trace mica.
37.85	17.83	9	13	15	28		M		38.18 17.50 Medium dense, gray, fine to coarse SAND (A-1-b), with trace silt, clay, mica & feldspar.
									37.40 18.28

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BORING LOG SHEET 29 OF 35

SHEET 2 OF 2

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** C. Baldwin
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. B2-B EBL	**BORING LOCATION** 118+32.2	**OFFSET** 16.4m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 55.68 m	**NORTHING** 155,468.2	**EASTING** 618,699.8	**24 HR.** 0.30
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/21/07	**COMPLETED** 5/22/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
37.40					Continued from previous page				Boring terminated at Elevation 37.40m in SAND (COASTAL PLAIN-MIDDENDORF FORMATION)

NOTES:

1) 0 Hr. water not measured due to mud rotary techniques.

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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BORING LOG

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB2-B EBL	**BORING LOCATION** 118+68.5	**OFFSET** 19.2m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 60.71 m	**NORTHING** 155,471.7	**EASTING** 618,734.2	**24 HR.** 1.52
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/24/07	**COMPLETED** 5/24/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
60.71					Ground Surface				
60.71	0.00	1	1	1	2		M		**-ALLUVIAL-** Very loose, dark brown, silty fine SAND (A-2-4).
60.11	0.60								
59.64	1.07	2	2	2	4		W		Loose, orange-tan, fine to coarse SAND (A-2-4), with some silt & clay.
58.71	2.00								
58.12	2.59	4	5	3	8		Sat.		Loose, orange-tan, fine to coarse SAND (A-1-b), with little silt.
57.11	3.60								
56.60	4.11	14	24	28	52		M		**-COASTAL PLAIN- (MIDDENDORF FORMATION)** Very dense to medium dense, light gray & light orange, fine to coarse SAND (A-2-7), with some silt & clay, trace mica.
55.07	5.64	9	12	12	24		M/W		
53.71	7.00								
53.55	7.16	2	4	5	9		M/W		Stiff to very stiff, light gray, silty CLAY (A-6), with some fine sand & mica.
52.02	8.69	5	6	9	15		M		
50.71	10.00								
50.50	10.21	5	6	10	16	SS-38	22.4%		Very stiff, gray, highly fine sandy SILT (A-4(0)), with little clay & trace mica.
49.71	11.00								
48.98	11.73	5	5	9	14		M		Stiff to very stiff, gray with reddish-brown, silty CLAY (A-7-6), with some fine to coarse sand, trace mica.
47.45	13.26	8	10	14	24		D/M		
46.21	14.50								
45.93	14.78	12	24	33	57		M		Very dense, gray, fine to coarse SAND (A-2-6), with trace silt & clay.
44.71	16.00								
44.40	16.31	15	19	30	49	SS-42	16.7%		Hard, gray, highly fine to coarse sandy CLAY (A-6(5)), with some silt.
43.21	17.50								
42.88	17.83	16	27	36	63		D/M		Hard, gray & red-brown, silty CLAY (A-7-6), with some fine to coarse sand.
42.43	18.28								

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/21/07

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BORING LOG SHEET 300F35

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** D. Racey
SITE DESCRIPTION Fayetteville Outer Loop from 2.09Km E. of NC 87-210 to US 401			**GROUND WATER (m)**
BORING NO. EB2-B EBL	**BORING LOCATION** 118+68.5	**OFFSET** 19.2m RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 60.71 m	**NORTHING** 155,471.7	**EASTING** 618,734.2	**24 HR.** 1.52
TOTAL DEPTH 18.28 m	**DRILL MACHINE** CME 55 Track	**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DATE STARTED 5/24/07	**COMPLETED** 5/24/07	**SURFACE WATER DEPTH** N/A	

ELEV. (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
42.43					Continued from previous page				
									Boring Terminated at Elevation 42.43m in SAND (COASTAL PLAIN-MIDDENDORF FORMATION)

NOTES:

1) 0 Hr. water not measured due to mud rotary techniques.
2) Driller indicates harder drilling at a depth of 3.60m (elev. 57.11m).

NCDOT BORE SINGLE J66-023.GPJ NC_DOT.GDT 6/22/07

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: X-0002C
DESCRIPTION: Dual Bridges on Fayetteville Outer Loop at -L- Station 118+17.50 **EBL Structure**

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 35196.1.2 COUNTY: Cumberland
DATE SAMPLED: May 2007 RECEIVED: 5/07 and 6/07
SAMPLED FROM: -L- REPORTED: June 2007
SUBMITTED BY: E.C. Howey, L.G., P.E. BY: D. Jenks

TEST RESULTS

PROJ. SAMPLE NO.	SS-95	SS-97	SS-102	SS-118	SS-124	SS-3	SS-4	SS-9	SS-38	SS-42							
BORING NO.	EB1-B EBL	EB1-B EBL	EB1-B EBL	B1-B EBL	B1-B EBL	B2-B EBL	B2-B EBL	B2-B EBL	EB2-B EBL	EB2-B EBL							
Retained #4 Sieve %	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
Passing #10 Sieve %	97.2	99.9	97.9	100.0	99.7	99.9	100.0	100.0	100.0	99.2							
Passing #40 Sieve %	38.4	88.4	45.6	97.5	79.9	96.0	96.4	94.7	99.6	81.2							
Passing #200 Sieve %	28.2	61.5	13.7	60.6	45.0	80.0	64.6	82.2	41.0	52.1							

MINUS #10 FRACTION

SOIL MORTAR - 100%																	
Coarse Sand Ret - #60 %	67.1	18.6	70.5	5.6	34.0	6.2	6.8	8.4	0.7	28.7							
Fine Sand Ret - #270 %	0.9	29.4	17.7	40.9	26.0	13.7	41.4	13.2	67.0	23.3							
Silt 0.053 - 0.010 mm %	0.0	20.7	5.2	6.5	22.8	25.4	25.9	47.3	19.8	26.7							
Clay < 0.010 mm %	32.0	31.3	6.6	47.0	17.2	54.7	25.9	31.1	12.5	21.3							
L.L.	71	22	35	45	30	38	29	43	22	32							
P.L.	26	13	20	21	14	19	18	26	21	16							
P.I.	45	9	15	24	16	19	11	17	1	16							
AASHTO Classification	A-2-7(2)	A-4(2)	A-2-6(0)	A-7-6(12)	A-6(3)	A-6(14)	A-6(5)	A-7-6(15)	A-4(0)	A-6(5)							
Station	117+66.5	117+66.5	117+66.5	117+98.4	117+98.4	118+32.2	118+32.2	118+32.2	118+68.5	118+68.5							
Offset	19.2m Rt.	19.2m Rt.	19.2m Rt.	16.4m Rt.	16.4m Rt.	16.4m Rt.	16.4m Rt.	16.4m Rt.	19.2m Rt.	19.2m Rt.							
Depth (m)	5.64	8.69	16.31	1.07	10.21	2.59	4.11	11.73	10.21	16.31							
to	6.09	9.14	16.76	1.52	10.66	3.04	4.56	12.18	10.66	16.76							
Moisture Content (%)	17.1	13.0	16.4	26.5	13.4	25.3	21.5	20.6	22.4	16.7							

NP=Not plastic

E.C. Howey, L.G., P.E.
Soils Engineer

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 35196.1.2 TIP: X-0002C COUNTY: Cumberland EBL Structure

DESCRIPTION(1): Fayetteville Outer Loop - Dual Structures at -L- Station 118+17.50 over Tributary to Carver's Creek

EXISTING BRIDGE

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

Bridge No.: N/A Length: N/A Total Bents: N/A Bents in Channel: N/A Bents in Floodplain: N/A
Foundation Type: The proposed bridge is on new location, no structure is in place at this time

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: N/A

Interior Bents: N/A

Channel Bed: None

Channel Bank: None

EXISTING SCOUR PROTECTION

Type(3): N/A

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): None

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 theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): Silty, fine to coarse sand

Channel Bank Material(8): Silty, fine to coarse sand and fine to coarse sandy clay

Channel Bank Cover(9): Grasses

Floodplain Width(10): Approximately 200 meters

Floodplain Cover(11): Grasses, Vines, Trees

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): West

Observations and Other Comments: ____

Reported by: Chris Baldwin / ECH (Chris Baldwin) **Date:** 6/1/2007

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters X

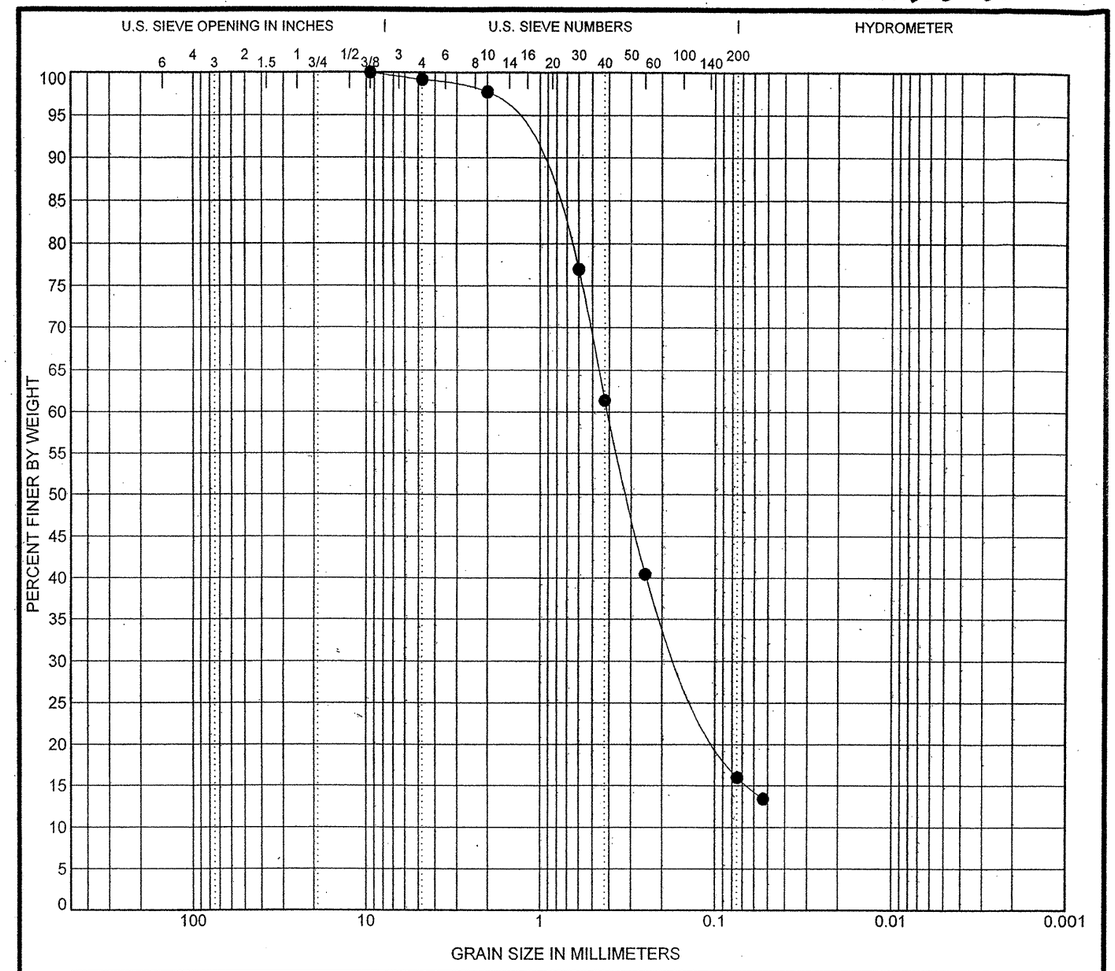
	BENTS											
	Bent 1	B2-A	B2-B									
EBL 100 YR	54.38	54.49	54.38									
EBL 500 YR	54.32	54.43	54.28									

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the scour calculations on the Bridge Survey and Hydraulic Report dated 5/3/2006 at B2-B EBL. DSE is higher at all other locations.

DSE determined by: C. M. Whalen **Date:** 7/11/2007

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	Bank	Bank					
Sample No.	SS-118	SS-2					
Retained #4	0	0.8					
Passed #10	100	97.8					
Passed #40	97.5	61.4					
Passed #200	60.6	16					
Coarse Sand	5.6						
Fine Sand	40.9						
Silt	6.5						
Clay	47						
LL	45						
PI	21						
AASHTO	A-7-6 (12)	A-2-4					
Station	117+98.4	118+32.2					
Offset	16.4m Rt.	16.4m Rt.					
Depth	1.07 - 1.52	1.07 - 1.52					



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth	Classification	LL	PL	PI	Cc	Cu
●	B2-B EBL	1.07 - 1.52	Dark Brown, SILTY SAND (A-2-4)					

	Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B2-B EBL	1.07 - 1.52	9.5	0.41	0.149		0.8	83.2	16.0	

US GRAIN SIZE DOT LAB TEMPLATE.GPJ F&R.GDT 6/14/07

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GRAIN SIZE DISTRIBUTION

Report No.: J66-023
Client: NCDOT
Project: X-0002C Cumberland Co.
Location: Cumberland Co. NC
Date: May 24, 2007

SITE PHOTOGRAPHS

Photograph No. 1: EBL Profile view from behind EB1-B EBL, looking east

Photograph No. 2: Cross-section view of End Bent 1 EBL, from -L- looking south

Photograph No. 3: Cross-section view of Bent 1 EBL, from right of B1-B EBL, looking north

Photograph No. 4: Cross-section view of Bent 2 EBL, from –L- looking south

SITE PHOTOGRAPHS

Photograph No. 5: Cross-section view of End Bent 2 EBL, from -L- looking south

Photograph No. 6: EBL Profile from ahead of EB2-B EBL, looking West

⊕ Approximate Boring Location

ID: X-0002CB

PROJECT: 35196.3.20

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02	NCDOH GEOTECHNICAL ENGINEERING UNIT SOIL AND ROCK CLASSIFICATION SHEET
03	SITE VICINITY MAP
04	SITE PLAN
05	PROFILE
06	CROSS SECTIONS - EB1 & B1
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08	CROSS SECTIONS - B4 & B5
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO.: 35196.3.20 (X-0002CB)

COUNTY: Cumberland

PROJECT DESCRIPTION: Bridge No. 381 and Bridge No. 382 on -L- over US 401

SITE DESCRIPTION:

CATLIN ENGINEERS and SCIENTISTS — Wilmington, NC — 208-010 — METRIC

PROJ. NO.:	35196.3.20
T.I.P. NO.:	(X-0002CB)
COUNTY:	Cumberland
SHEET NO:	01
TOTAL SHEET:	30
R/W SHEET NO:	

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For Letting

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.20 (X-0002CB)

PERSONNEL:

THOMAS STETLER

JUSTIN HETER

MICHAEL D. MASON

BOBBIE D FOWLER

INVESTIGATED BY: CATLIN ENGINEERS AND SCIENTISTS

CHECKED BY: STEVEN V. HUDSON, LG

SUBMITTED BY: STEVEN V. HUDSON, LG

DATE: MAY 02, 2008

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V HUDSON

5/5/08

SEAL

SIGNATURE

DRAWN BY: STEVEN V. HUDSON, LG

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

CATLIN ENGINEERS and SCIENTISTS — WILMINGTON, NORTH CAROLINA — 208-010

METRIC

PROJ. NO.:	35196.1.2	SHEET NO.:	02
T.I.P. NO.:	X-0002C	TOTAL SHEETS:	30
F.A. NO.:	DPR-0100 (002)	R/W SHEET NO.:	
COUNTY:	Cumberland		

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												GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
= 10	50 MX													
= 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				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	6 MX		N.P.	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 RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1 1 TO 2 2 TO 4 >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 GRATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT-CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	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
- 25/25 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT 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
BLS - BELOW LAND SURFACE
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FIAD - FILLED IMMEDIATELY AFTER DRILLING
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
NA - NOT APPLICABLE
NE - NOT ENCOUNTERED
NM - NOT MEASURED
PMT - PRESSUREMETER TEST
SAA - SAME AS ABOVE
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
U.C.P. - UNDIFFERENTIATED COASTAL PLAIN
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] DIEDRICH D-50
- [ ] DIEDRICH D-25
- [X] CME-45B ATV
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] AMS POWER PROBE
- [ ] OTHER _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ADVANCER
- [X] TRICONE 2 7/8" STEEL TEETH
- [ ] TRICONE __" TUNG.-CARBIDE
- [ ] CORE BIT
- [ ] OTHER _____

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] - B_____ [ ] - H_____
- [ ] - N_____ [ ] - _____

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 AS FOLLOWS:

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 YIELD 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 PIECES 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	> 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 3 FEET
VERY CLOSE	< 0.16 FEET

BEDDING

TERM	SPACING
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.

DIRECT PUSH - ADVANCEMENT OF SAMPLE TOOLING UTILIZING DIRECT PUSH METHODOLOGY (ex. GEOPROBE)

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.

HYDRAULIC PUSH (HP) - ADVANCEMENT OF SAMPLING TOOLS UTILIZING MECHANICAL/HYDRAULIC DOWN-FORCE OF DRILLING MACHINE.

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: Survey grade GPS used for survey. Calibrated to local NCDOT monuments.
ELEVATION:

NOTES:

ADAPTED FROM NCDOT FILE "RdwyTitle&LegendE_spb_v02b.tsf"

DESCRIPTION:
BRIDGE NO. 381 AND
BRIDGE NO. 382
ON -L- OVER US 401

PREPARED BY:
CATLIN
ENGINEERS AND SCIENTISTS
CAD-206-128_SHT-02
WILMINGTON, NORTH CAROLINA 208-010

METRIC

100m 0 200m

CONST.REV.

R/W REV.

PROJ. NO.:	35196.1.2	SHEET NO.	03
T.I.P. NO.:	X-0002C	TOTAL SHEETS:	30
F.A. NO.:	DPR-0100(002)	R/W SHEET NO.:	
COUNTY:	Cumberland		

ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

SITE LOCATION

MAP OBTAINED FROM TOPOZONE.COM
SCALE 1:24,000
CONTOUR INTERVAL = 5 FEET
DATUM IS MEAN SEA LEVEL

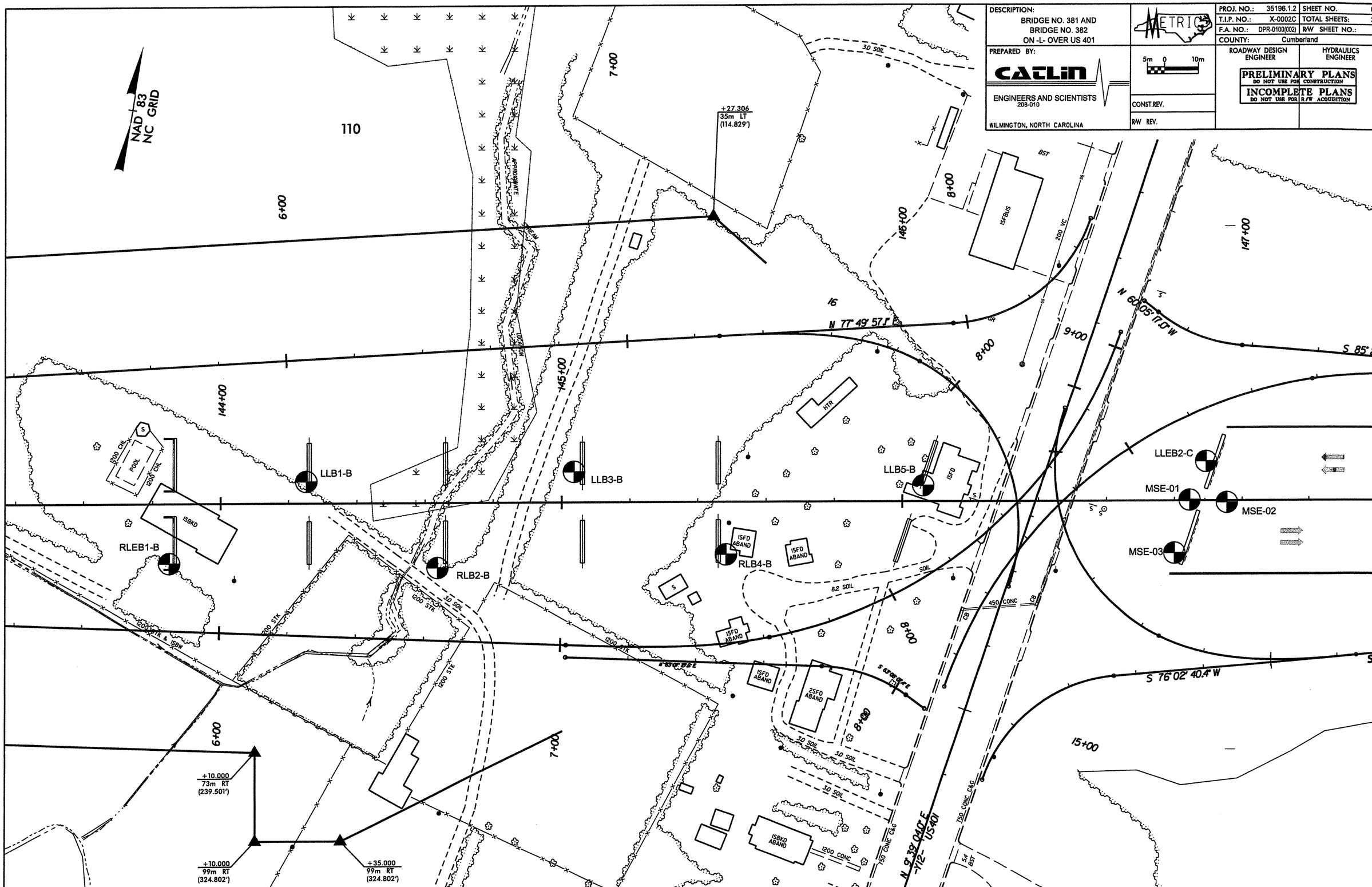
1 MILE 1/2 MILE 0 1 MILE

2000 0 1000 2000
FEET

N.C.
QUADRANGLE LOCATION

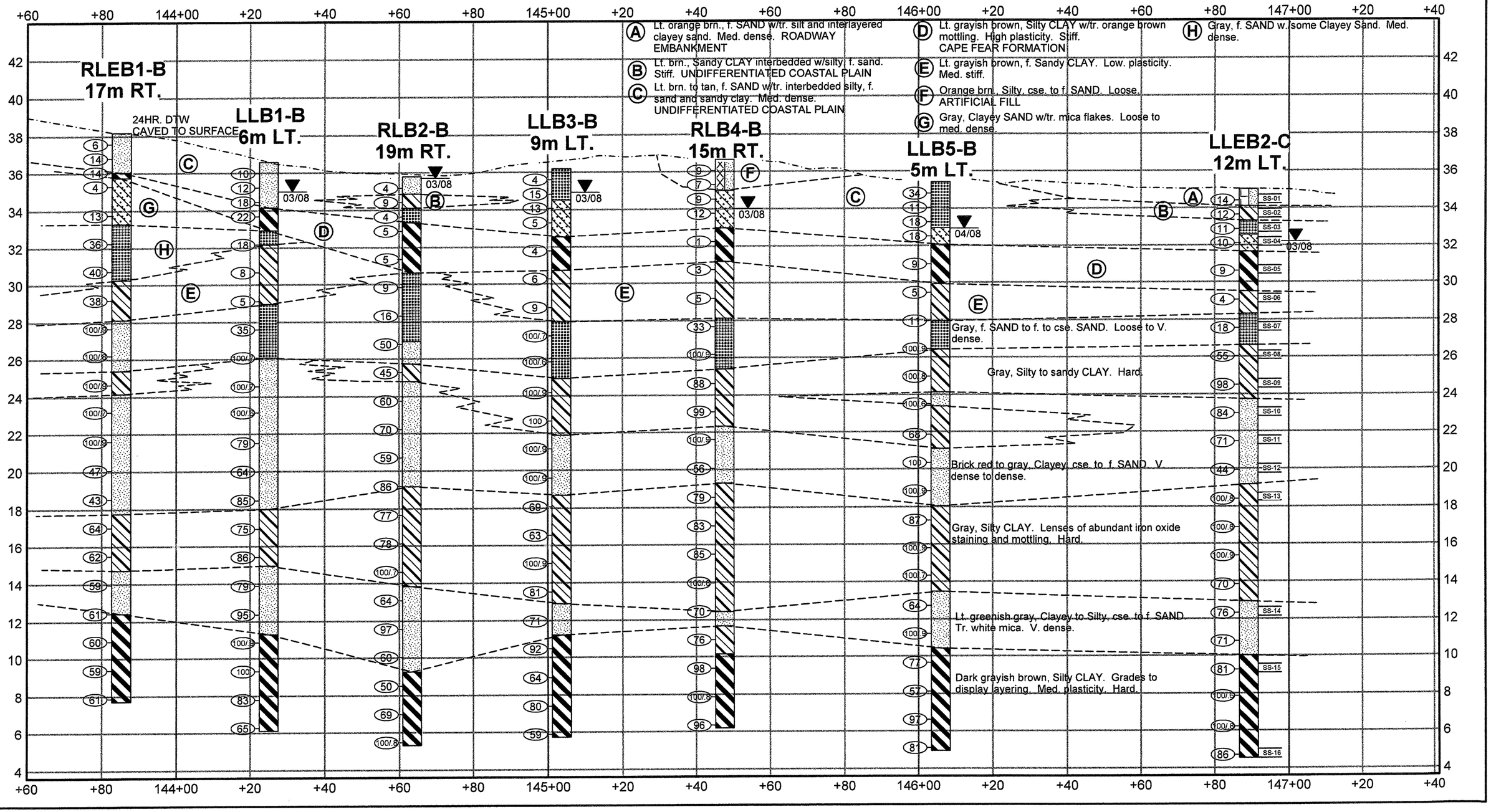
N

1000 0 500 1000
METERS


DESCRIPTION:
BRIDGE NO. 381 AND
BRIDGE NO. 382
ON -L- OVER US 401
PREPARED BY:
CATLIN
ENGINEERS AND SCIENTISTS
208-010
WILMINGTON, NORTH CAROLINA
METRIC
5m 0 10m
CONST.REV.
R/W REV.
PROJ. NO.: 35196.1.2
SHEET NO. 04
T.I.P. NO.: X-0002C
TOTAL SHEETS: 30
F.A. NO.: DPR-0100(002)
R/W SHEET NO.:
COUNTY: Cumberland
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
NAD 83
NC GRID
110
6+00
7+00
8+00
9+00
15+00
16
144+00
145+00
146+00
147+00
+27.306
35m LT
(114.829')
N 77° 49' 57.1" E
N 60° 05' 17.0" W
S 85° 29
S 76° 02' 40.4" W
N 9° 39' 04.0" E
-Y12- US401
LLB1-B
LLB3-B
LLB5-B
LLEB2-C
MSE-01
MSE-02
MSE-03
RLEB1-B
RLB2-B
RLB4-B
ISFBUS
ISFD
ISFD ABAND
2SFD ABAND
ISBKD
ISBKD ABAND
HTR
POOL
1200 CHL
1200 STK
1200 STK & ISBW
1200 CONC
750 CONC C&G
450 CONC
200 VC
3.0 SOIL
8.2 SOIL
+10.000
73m RT
(239.501')
+10.000
99m RT
(324.802')
+35.000
99m RT
(324.802')

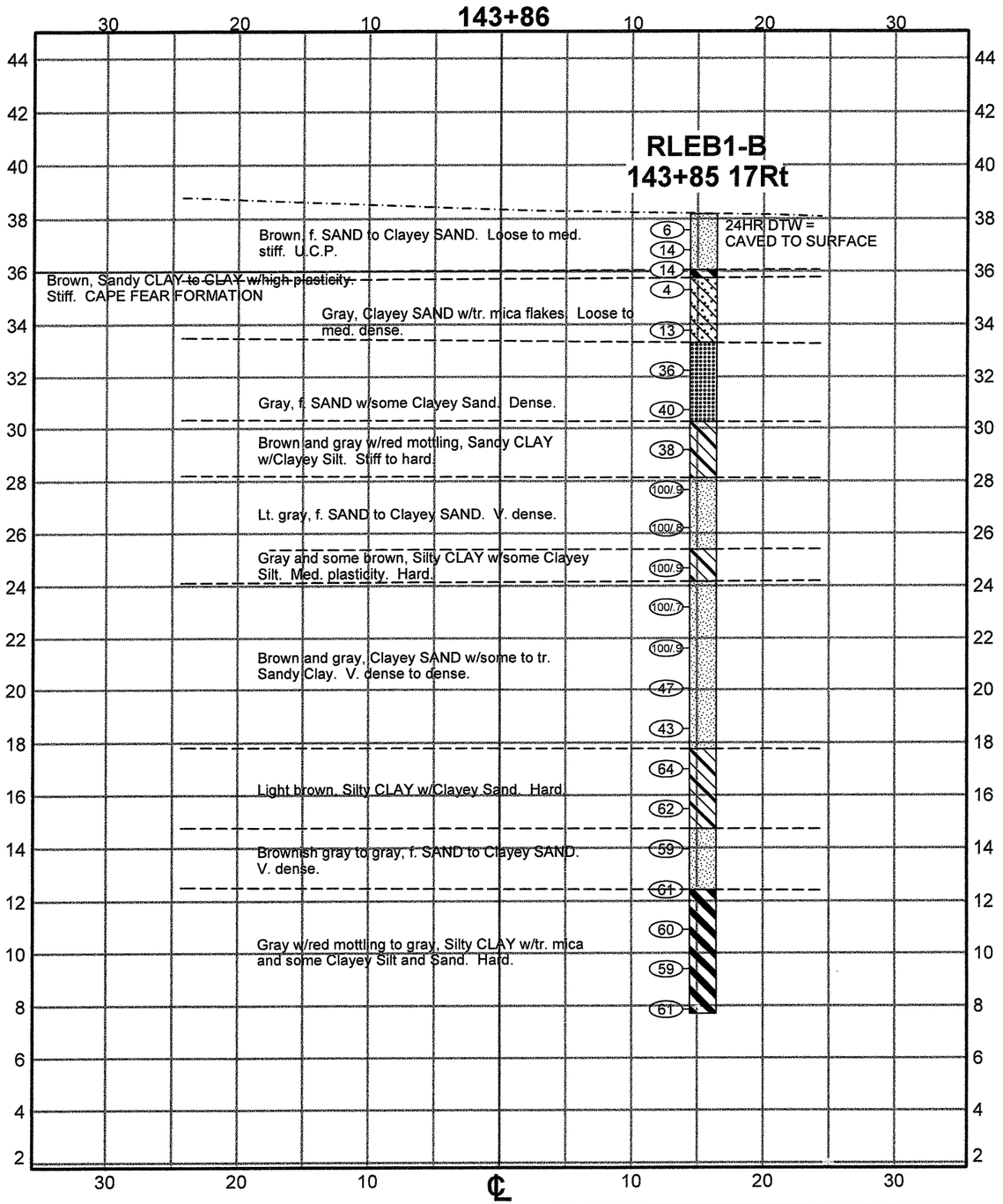
CATLIN ENGINEERS and SCIENTISTS Wilmington, NC	208-010	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 05
			T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:
			COUNTY: Cumberland	

PROFILE ALONG -L-



CATLIN ENGINEERS and SCIENTISTS Wilmington, NC	208-010	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 06
			T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:
			COUNTY: Cumberland	

CROSS SECTION THROUGH END BENT 1



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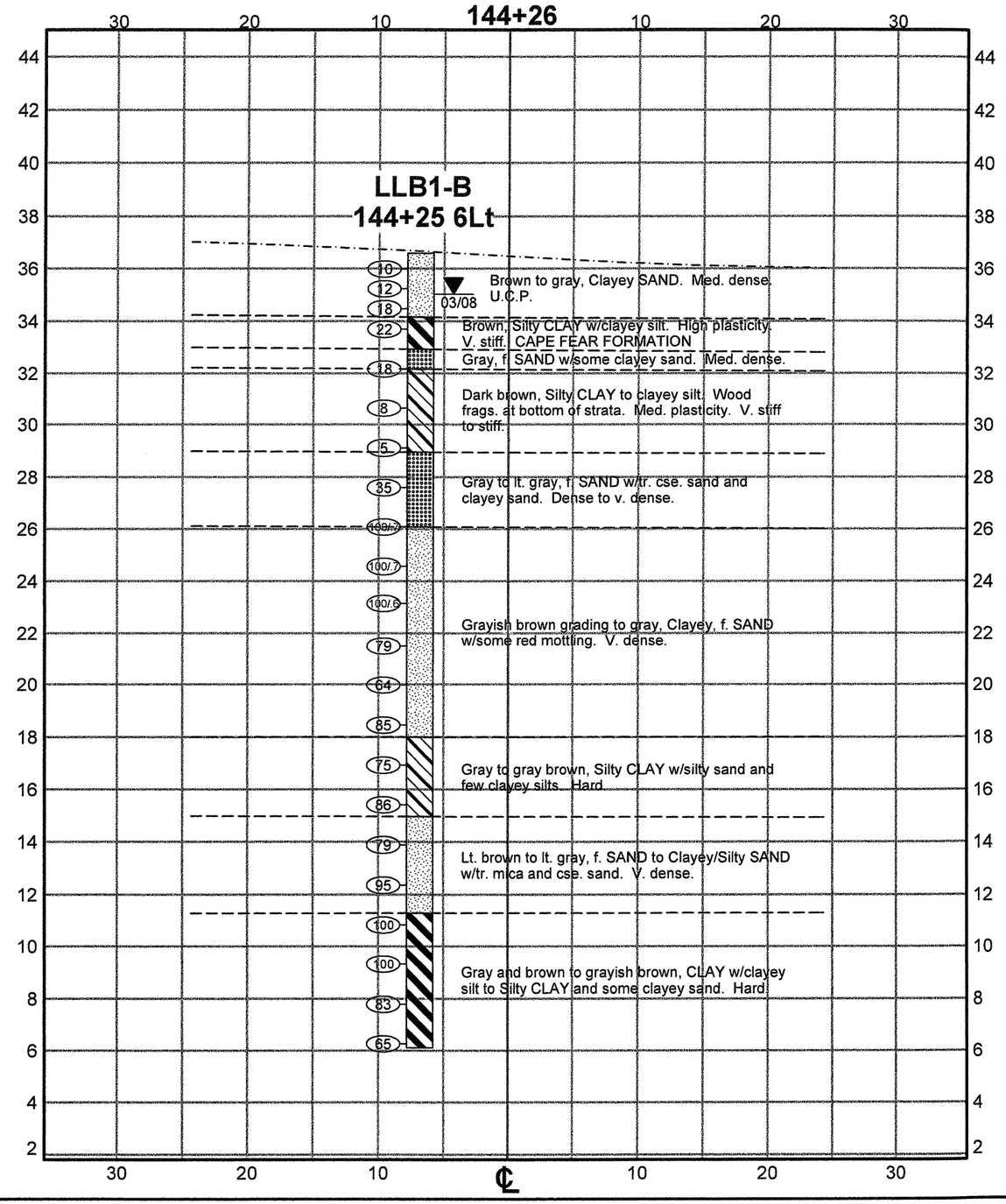

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			T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:
			COUNTY: Cumberland	

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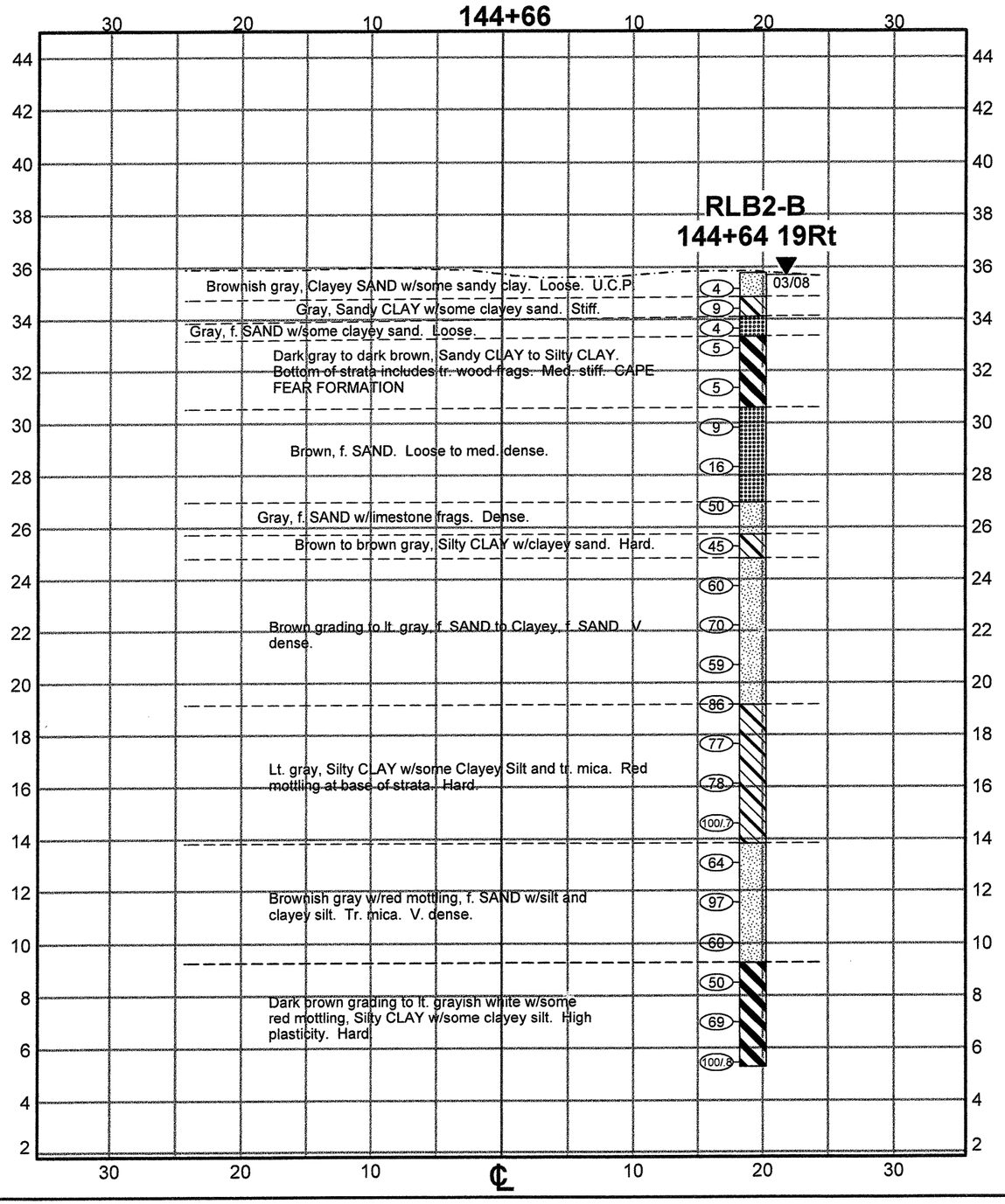

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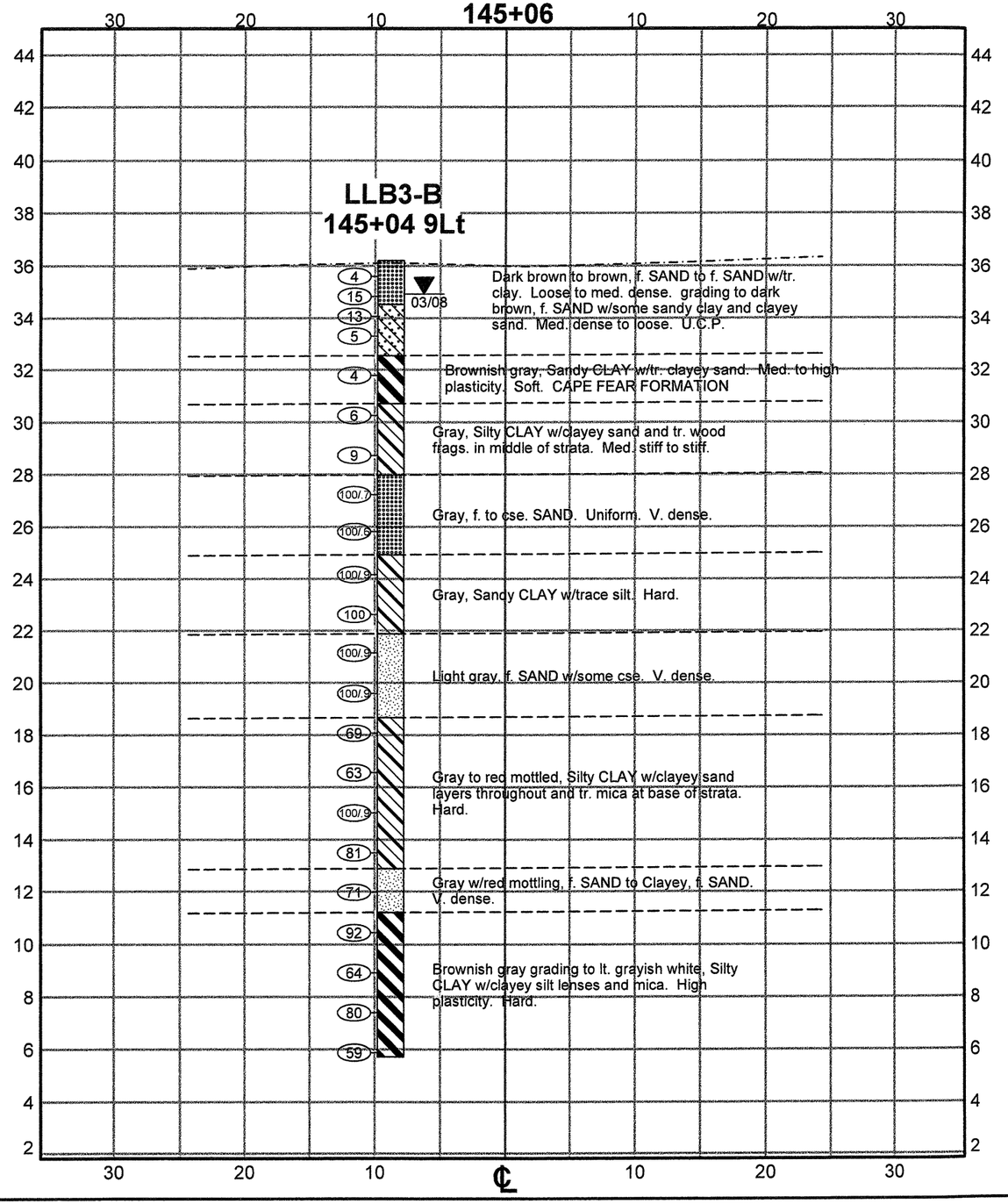
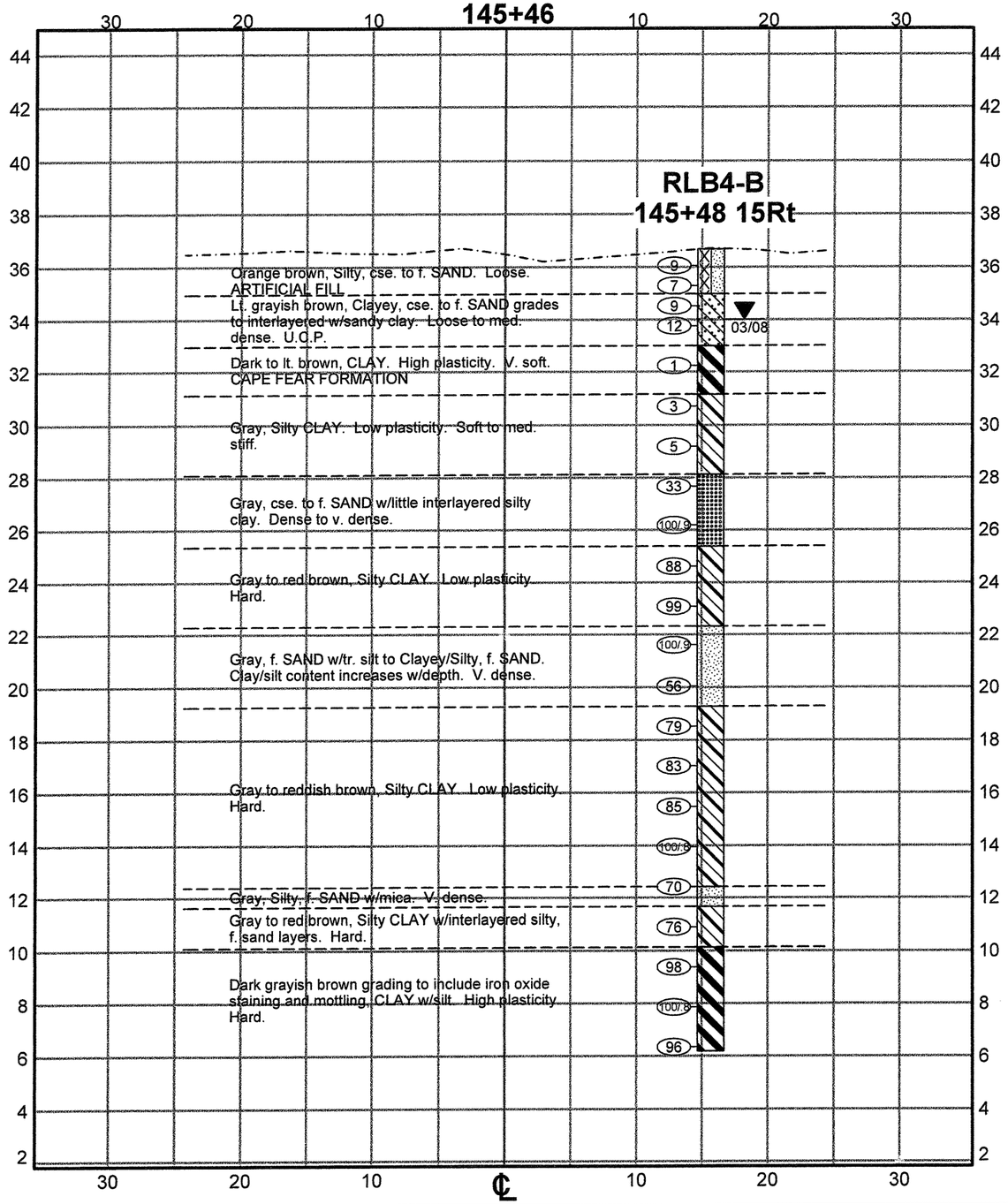


CATLIN ENGINEERS and SCIENTISTS Wilmington, NC	208-010	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 08
			T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:
			COUNTY: Cumberland	

CROSS SECTION THROUGH BENT 4

145+46

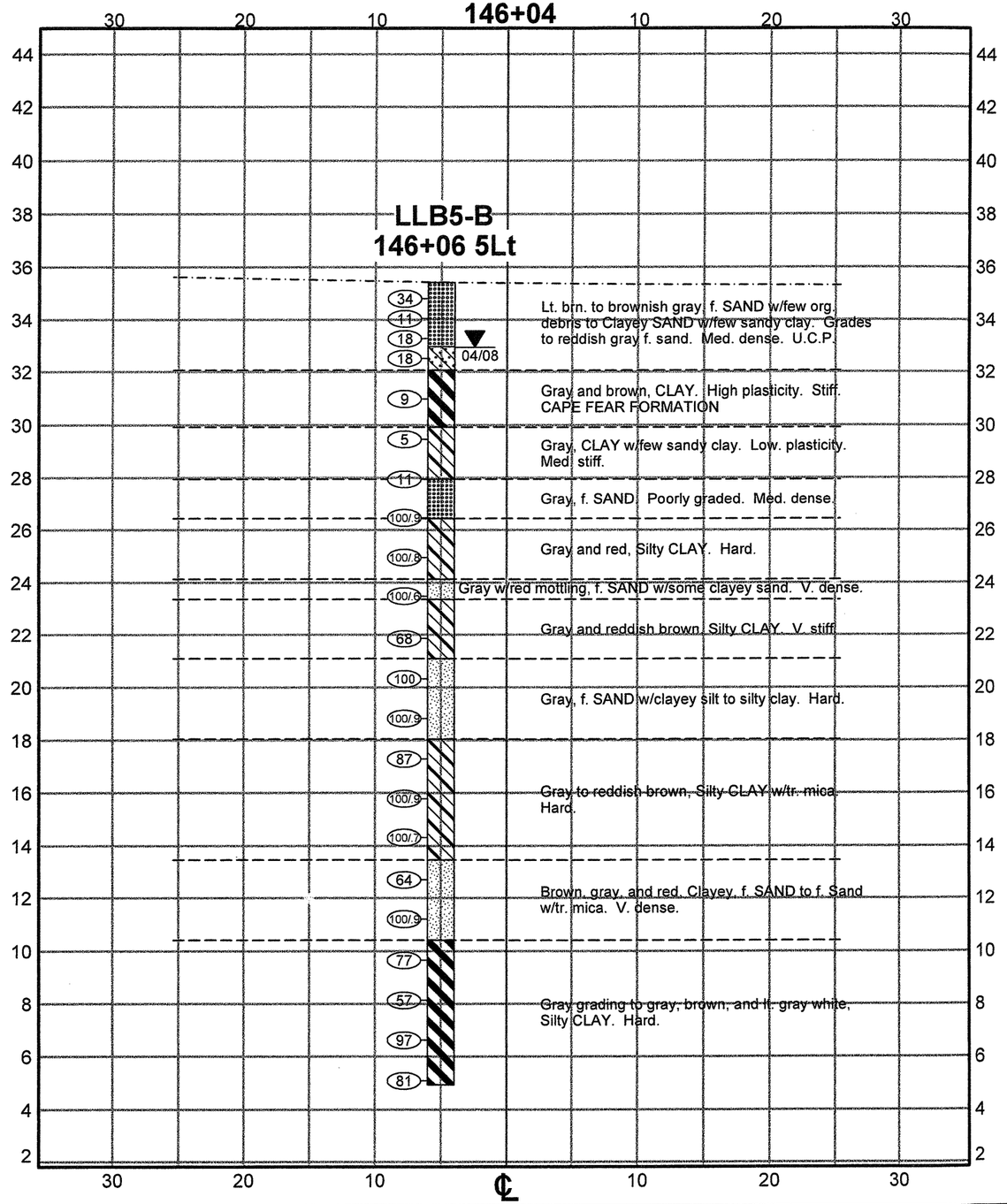
RLB4-B
145+48 15Rt



CROSS SECTION THROUGH BENT 5

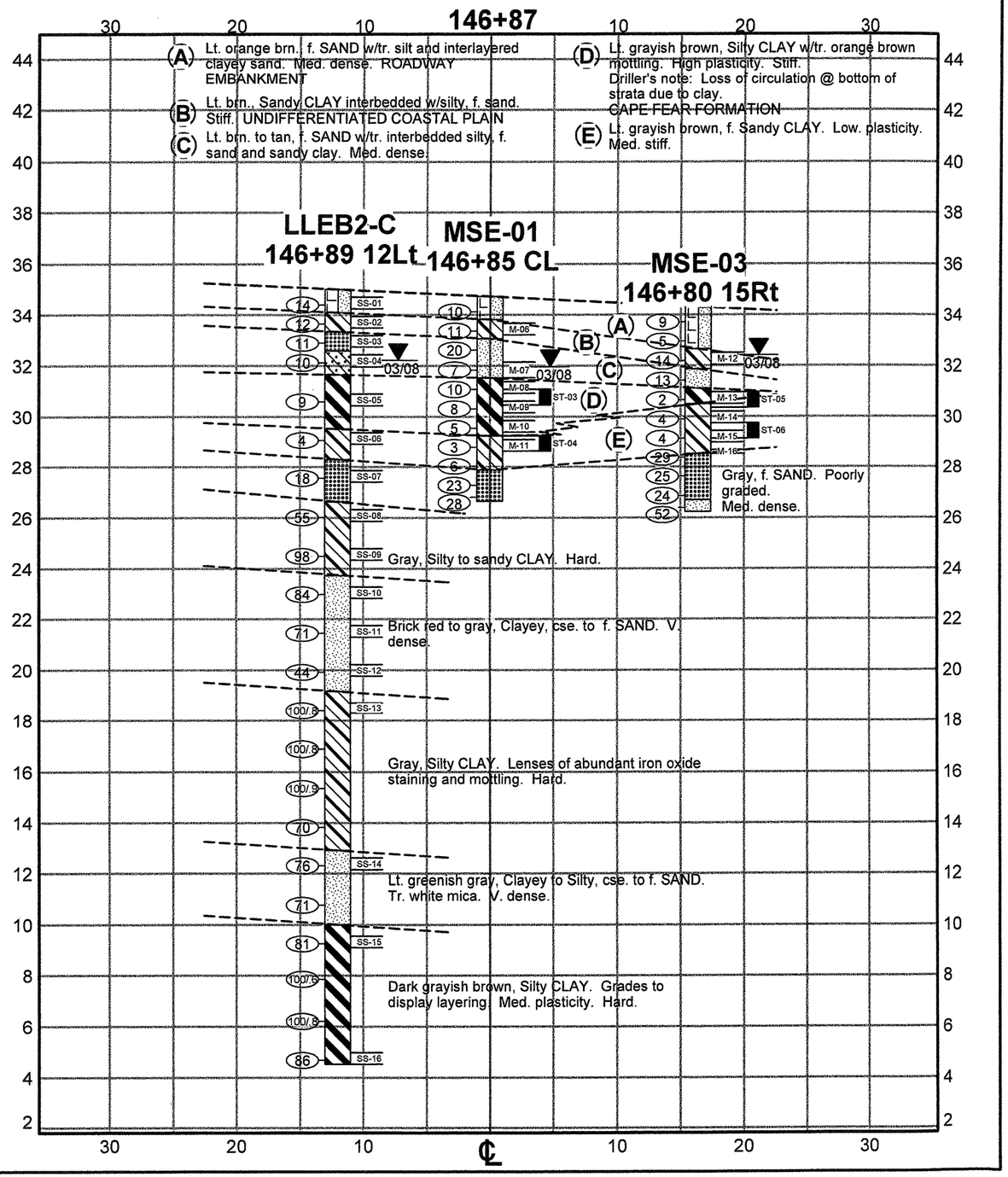
146+04

LLB5-B
146+06 5Lt



CATLIN ENGINEERS and SCIENTISTS, Wilmington, NC	208-010	METRIC	PROJ. NO.: 35196.1.2 / SHEET NO.: 09
			T.I.P. NO.: X-0002C / TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002) / R/W SHEET NO.:
			COUNTY: Cumberland

CROSS SECTION THROUGH END BENT 2



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 10		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLEB1-B	**STATION** 143+85	**OFFSET** 17m RT	**ALIGNMENT** -L- — **0 HR.** 1.83
COLLAR ELEV. 38.18 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,764	**EASTING** 621,213 — **24 HR.** Caved
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/27/08	**COMP. DATE** 03/28/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
38									38.18 0.00
37.88	0.30								UNDIFFERENTIATED COASTAL PLAIN Brown, f. SAND to Clayey SAND. Loose to med. stiff.
37.12	1.07	4	3	3	6		W		
36.35	1.83	4	7	7	14		W		
35.59	2.59	2	9	5	14		Sat.		36.05 2.13 COASTAL PLAIN Brown, Sandy CLAY to CLAY w/high plasticity. Stiff. 35.74 2.44 CAPE FEAR FORMATION
34.07	4.11	2	2	2	4		Sat.		COASTAL PLAIN Gray, Clayey SAND w/tr. mica flakes. Loose to med. dense. Note: Drilling fluid lost @ depth of 10ft. Fluid observed coming out of ground surface in vicinity of borehole.
32.54	5.64	3	4	9	13		W		
31.02	7.16	8	15	21	36		W		33.31 4.88 COASTAL PLAIN Gray, f. SAND w/some Clayey Sand. Dense.
29.50	8.69	10	19	21	40		W		30.26 7.92 COASTAL PLAIN Brown and gray w/red mottling, Sandy CLAY w/Clayey Silt. Stiff to hard.
		11	14	24	38		W		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
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COLLAR ELEV. 38.18 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,764	**EASTING** 621,213 — **24 HR.** Caved
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/27/08	**COMP. DATE** 03/28/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
28					Match Line				28.12 10.06 COASTAL PLAIN Lt. gray, f. SAND to Clayey SAND. V. dense.
27.97	10.21	24	31	69/.4	100/.9		W		
26.45	11.73	36	64/.3		100/.8		W		25.38 12.80 COASTAL PLAIN Gray and some brown, Silty CLAY w/some Clayey Silt. Med. plasticity. Hard.
24.92	13.26	38	62/.4		100/.9		W		
23.40	14.78	52	48/.2		100/.7		W		24.16 14.02 COASTAL PLAIN Brown and gray, Clayey SAND w/some to tr. Sandy Clay. V. dense to dense.
21.88	16.31	36	64/.4		100/.9		W		
20.35	17.83	10	21	26	47		W		
18.83	19.35	12	19	24	43		W		

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	11	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. RLEB1-B	**STATION** 143+85	**OFFSET** 17m RT	**ALIGNMENT** -L-	**0 HR.** 1.83
COLLAR ELEV. 38.18 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,764	**EASTING** 621,213	**24 HR.** Caved
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/27/08	**COMP. DATE** 03/28/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
18					Match Line				COASTAL PLAIN Brown and gray, Clayey SAND w/some to tr. Sandy Clay. V. dense to dense *(continued)*
									ELEV. (m) 17.76 — DEPTH (m) 20.42
17.30	20.88	18	27	37	64		W		COASTAL PLAIN Light brown, Silty CLAY w/Clayey Sand. Hard.
15.78	22.40	21	25	37	62		W		
									ELEV. (m) 14.71 — DEPTH (m) 23.47
14.26	23.93	19	34	25	59		W		COASTAL PLAIN Brownish gray to gray, f. SAND to Clayey SAND. V. dense.
12.73	25.45	14	23	38	61		W		
									ELEV. (m) 12.43 — DEPTH (m) 25.76
11.21	26.97	22	29	31	60		W		COASTAL PLAIN Gray w/red mottling to gray, Silty CLAY w/tr. mica and some Clayey Silt and Sand. Hard.
9.68	28.50	22	27	32	59		W		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. RLEB1-B	**STATION** 143+85	**OFFSET** 17m RT	**ALIGNMENT** -L-	**0 HR.** 1.83
COLLAR ELEV. 38.18 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,764	**EASTING** 621,213	**24 HR.** Caved
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/27/08	**COMP. DATE** 03/28/07	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
9					Match Line				
8.16	30.02	18	25	36	61		W		COASTAL PLAIN Gray w/red mottling to gray, Silty CLAY w/tr. mica and some Clayey Silt and Sand. Hard. *(continued)*
									ELEV. (m) 7.70 — DEPTH (m) 30.48
									Boring Terminated at Elevation 7.70 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	12	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB1-B	**STATION** 144+25	**OFFSET** 6m LT	**ALIGNMENT** -L-
COLLAR ELEV. 36.59 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,794	**EASTING** 621,249
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/26/08	**COMP. DATE** 03/27/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 2.13 **24 HR.** 1.58

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
37									36.59 0.00
36.28	0.30								UNDIFFERENTIATED COASTAL PLAIN Brown to gray, Clayey SAND. Med. dense.
		2	3	7	10		M		
35.52	1.07								
		3	4	8	12		M		
34.76	1.83								
		3	7	11	18		M		
34.00	2.59								34.15 2.44
		3	12	10	22		W		COASTAL PLAIN Brown, Silty CLAY w/clayey silt. High plasticity. V. stiff. CAPE FEAR FORMATION
32.47	4.11								32.93 3.66
		9	10	8	18		Sat.		COASTAL PLAIN Gray, f. SAND w/some clayey sand. Med. dense.
30.95	5.64								32.17 4.42
		2	3	5	8		W		COASTAL PLAIN Dark brown, Silty CLAY to clayey silt. Wood frags. at bottom of strata. Med. plasticity. V. stiff to stiff.
29.43	7.16								
		2	2	3	5		Sat.		
27.90	8.69								28.97 7.62
		6	14	21	35		Sat.		COASTAL PLAIN Gray to lt. gray, f. SAND w/tr. cse. sand and clayey sand. Dense to v. dense.

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB1-B	**STATION** 144+25	**OFFSET** 6m LT	**ALIGNMENT** -L-
COLLAR ELEV. 36.59 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,794	**EASTING** 621,249
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/26/08	**COMP. DATE** 03/27/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 2.13 **24 HR.** 1.58

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) DEPTH (m)
27					Match Line				
26.38	10.21								COASTAL PLAIN Gray to lt. gray, f. SAND w/tr. cse. sand and clayey sand. Dense to v. dense *(continued)*
		38	58	42/.2	100/.7		W		26.07 10.52
24.85	11.73								COASTAL PLAIN Grayish brown grading to gray, Clayey, f. SAND w/some red mottling. V. dense.
		37	60	40/.2	100/.7		W		
23.33	13.26								
		67	33/.1		100/.6		W		
21.81	14.78								
		23	34	45	79		W		
20.28	16.31								
		23	32	32	64		Sat.		
18.76	17.83								
		24	40	45	85		W		
17.23	19.35								18.00 18.59
		29	38	37	75		W		COASTAL PLAIN Gray to gray brown, Silty CLAY w/silty sand and few clayey silts. Hard.

NEW NCDOT BORE DOUBLE 206-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 13		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB1-B	**STATION** 144+25	**OFFSET** 6m LT	**ALIGNMENT** -L-
COLLAR ELEV. 36.59 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,794	**EASTING** 621,249
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/26/08	**COMP. DATE** 03/27/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 2.13 **24 HR.** 1.58

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
17					Match Line				
									COASTAL PLAIN Gray to gray brown, Silty CLAY w/silty sand and few clayey silts. Hard.*(continued)*
15.71	20.88	26	42	44	86		M		
14.19	22.40	36	34	45	79		M		14.95 21.64 COASTAL PLAIN Lt. brown to lt. gray, f. SAND to Clayey/Silty SAND w/tr. mica and cse. sand. V. dense.
12.66	23.93	32	55	40	95		M		
11.14	25.45	31	51	49/.4	100/.9		M		11.29 25.30 COASTAL PLAIN Gray and brown to grayish brown, CLAY w/clayey silt to Silty CLAY and some clayey sand. Hard.
9.61	26.97	27	48	52	100		W		
8.09	28.50	20	44	39	83		M		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB1-B	**STATION** 144+25	**OFFSET** 6m LT	**ALIGNMENT** -L-
COLLAR ELEV. 36.59 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,794	**EASTING** 621,249
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/26/08	**COMP. DATE** 03/27/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 2.13 **24 HR.** 1.58

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
7					Match Line				
6.57	30.02	17	24	41	65		M		COASTAL PLAIN Gray and brown to grayish brown, CLAY w/clayey silt to Silty CLAY and some clayey sand. Hard.*(continued)* 6.11 30.48 Boring Terminated at Elevation 6.11 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 14
	T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
	F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:
	COUNTY: Cumberland	

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB2-B	**STATION** 144+64	**OFFSET** 19m RT	**ALIGNMENT** -L- — **0 HR.** 0.15
COLLAR ELEV. 35.78 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,775	**EASTING** 621,291 — **24 HR.** 0.09
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/25/08	**COMP. DATE** 03/26/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36									ELEV. (m) 35.78 — DEPTH (m) 0.00
35.48	0.30	1	2	2	4		W		UNDIFFERENTIATED COASTAL PLAIN Brownish gray, Clayey SAND w/some sandy clay. Loose.
34.71	1.07	1	3	6	9		Sat.		34.87 — 0.91 UNDIFFERENTIATED COASTAL PLAIN Gray, Sandy CLAY w/some clayey sand. Stiff.
33.95	1.83	1	1	3	4		Sat.		34.10 — 1.68 UNDIFFERENTIATED COASTAL PLAIN Gray, f. SAND w/some clayey sand. Loose.
33.19	2.59	1	1	4	5		Sat.		33.34 — 2.44 COASTAL PLAIN Dark gray to dark brown, Sandy CLAY to Silty CLAY. Bottom of strata includes tr. wood frags. Med. stiff. CAPE FEAR FORMATION
31.67	4.11	1	2	3	5		Sat.		
30.14	5.64	5	4	5	9		W		30.60 — 5.18 COASTAL PLAIN Brown, f. SAND. Loose to med. dense.
28.62	7.16	8	7	9	16		Sat.		
27.09	8.69	14	22	28	50		Sat.		26.94 — 8.84 COASTAL PLAIN Gray, f. SAND w/limestone frags. Dense.

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB2-B	**STATION** 144+64	**OFFSET** 19m RT	**ALIGNMENT** -L- — **0 HR.** 0.15
COLLAR ELEV. 35.78 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,775	**EASTING** 621,291 — **24 HR.** 0.09
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/25/08	**COMP. DATE** 03/26/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
26					Match Line				
25.57	10.21	13	19	26	45		W		25.72 — 10.06 COASTAL PLAIN Brown to brown gray, Silty CLAY w/clayey sand. Hard.
24.05	11.73	23	22	38	60		W		24.81 — 10.97 COASTAL PLAIN Brown grading to lt. gray, f. SAND to Clayey, f. SAND. V. dense.
22.52	13.26	21	30	40	70		W		
21.00	14.78	20	26	33	59		Sat.		
19.47	16.31	11	26	60	86		W		19.17 — 16.61 COASTAL PLAIN Lt. gray, Silty CLAY w/some Clayey Silt and tr. mica. Red mottling at base of strata. Hard.
17.95	17.83	23	30	47	77		W		
16.43	19.35	16	35	43	78		W		

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	15	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB2-B	**STATION** 144+64	**OFFSET** 19m RT	**ALIGNMENT** -L- **0 HR.** 0.15
COLLAR ELEV. 35.78 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,775	**EASTING** 621,291 **24 HR.** 0.09
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/25/08	**COMP. DATE** 03/26/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
16					Match Line				ELEV. (m) DEPTH (m)
									COASTAL PLAIN Lt. gray, Silty CLAY w/some Clayey Silt and tr. mica. Red mottling at base of strata. Hard. *(continued)*
14.90	20.88	39	49	51/.2	100/.7		W		13.83 21.95
13.38	22.40	18	25	39	64		M		COASTAL PLAIN Brownish gray w/red mottling, f. SAND w/silt and clayey silt. Tr. mica. V. dense.
11.85	23.93	24	44	53	97		M		
10.33	25.45	14	22	38	60		M		
8.81	26.97	16	19	31	50		M		9.26 26.52
7.28	28.50	19	34	35	69		M		COASTAL PLAIN Dark brown grading to lt. grayish white w/some red mottling, Silty CLAY w/some clayey silt. High plasticity. Hard.

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB2-B	**STATION** 144+64	**OFFSET** 19m RT	**ALIGNMENT** -L- **0 HR.** 0.15
COLLAR ELEV. 35.78 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,775	**EASTING** 621,291 **24 HR.** 0.09
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/25/08	**COMP. DATE** 03/26/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
6					Match Line				
5.76	30.02	17	45	55/.3	100/.8		M		COASTAL PLAIN Dark brown grading to lt. grayish white w/some red mottling, Silty CLAY w/some clayey silt. High plasticity. Hard.*(continued)* 5.30 30.48
									Boring Terminated at Elevation 5.30 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/16/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 16		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB3-B	**STATION** 145+04	**OFFSET** 9m LT	**ALIGNMENT** -L- **0 HR.** 1.52
COLLAR ELEV. 36.20 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,809	**EASTING** 621,326 **24 HR.** 1.28
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/24/08	**COMP. DATE** 03/25/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
36									ELEV. (m) 36.20 DEPTH (m) 0.00
35.90	0.30								UNDIFFERENTIATED COASTAL PLAIN Dark brown to brown, f. SAND to f. SAND w/tr. clay. Loose to med. dense.
35.13	1.07	2	2	2	4		D		
34.37	1.83	5	8	7	15		M		34.52 1.68
33.61	2.59	3	7	6	13		M		UNDIFFERENTIATED COASTAL PLAIN Dark brown, f. SAND w/some sandy clay and clayey sand. Med. dense to loose.
32.09	4.11	4	2	3	5		M		32.54 3.66
30.56	5.64	WOH	2	2	4		W		COASTAL PLAIN Brownish gray, Sandy CLAY w/tr. clayey sand. Med. to high plasticity. Soft. CAPE FEAR FORMATION
29.04	7.16	2	3	3	6		Sat.		30.71 5.49
27.51	8.69	2	3	6	9		Sat.		COASTAL PLAIN Gray, Silty CLAY w/clayey sand and tr. wood frags. in middle of strata. Med. stiff to stiff.
		30	64	36/.2	100/.7		Sat.		27.97 8.23 COASTAL PLAIN Gray, f. to cse. SAND. Uniform. V. dense.

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB3-B	**STATION** 145+04	**OFFSET** 9m LT	**ALIGNMENT** -L- **0 HR.** 1.52
COLLAR ELEV. 36.20 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,809	**EASTING** 621,326 **24 HR.** 1.28
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/24/08	**COMP. DATE** 03/25/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
26					Match Line				
25.99	10.21	42	58/.1		100/.6		Sat.		COASTAL PLAIN Gray, f. to cse. SAND. Uniform. V. dense. *(continued)*
24.47	11.73	27	41	59/.4	100/.9		W		24.92 11.28 COASTAL PLAIN Gray, Sandy CLAY w/trace silt. Hard.
22.94	13.26	18	32	68	100		W		
21.42	14.78	39	61/.4		100/.9		W		21.88 14.33 COASTAL PLAIN Light gray, f. SAND w/some cse. V. dense.
19.89	16.31	18	30	70/.4	100/.9		W		
18.37	17.83	20	31	38	69		M		18.68 17.53 COASTAL PLAIN Gray to red mottled, Silty CLAY w/clayey sand layers throughout and tr. mica at base of strata. Hard.
16.85	19.35	15	24	39	63		M		

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	17	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. LLB3-B	**STATION** 145+04	**OFFSET** 9m LT	**ALIGNMENT** -L-	**0 HR.** 1.52
COLLAR ELEV. 36.20 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,809	**EASTING** 621,326	**24 HR.** 1.28
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/24/08	**COMP. DATE** 03/25/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
17					Match Line				ELEV. (m) DEPTH (m)
									COASTAL PLAIN Gray to red mottled, Silty CLAY w/clayey sand layers throughout and tr. mica at base of strata. Hard. *(continued)*
15.32	20.88	24	43	57/.4	100/.9		M		
13.80	22.40	26	33	48	81		M		12.88 23.32 COASTAL PLAIN Gray w/red mottling, f. SAND to Clayey, f. SAND. V. dense.
12.27	23.93	21	39	32	71		M		
10.75	25.45	42	45	47	92		M		11.21 24.99 COASTAL PLAIN Brownish gray grading to lt. grayish white, Silty CLAY w/clayey silt lenses and mica. High plasticity. Hard.
9.23	26.97	17	28	36	64		M		
7.70	28.50	16	30	50	80		M		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. LLB3-B	**STATION** 145+04	**OFFSET** 9m LT	**ALIGNMENT** -L-	**0 HR.** 1.52
COLLAR ELEV. 36.20 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,809	**EASTING** 621,326	**24 HR.** 1.28
DRILL MACHINE CME 45B ATV	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/24/08	**COMP. DATE** 03/25/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
7					Match Line				
6.18	30.02	13	24	35	59		M		COASTAL PLAIN Brownish gray grading to lt. grayish white, Silty CLAY w/clayey silt lenses and mica. High plasticity. Hard. *(continued)* 5.72 30.48 Boring Terminated at Elevation 5.72 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/16/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	18	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB4-B	**STATION** 145+48	**OFFSET** 15m RT	**ALIGNMENT** -L-
COLLAR ELEV. 36.66 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,792	**EASTING** 621,374
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/08	**COMP. DATE** 03/20/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 3.78 **24 HR.** 2.65

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (m) / DEPTH (m))
37									36.66 / 0.00
36.35	0.30								ARTIFICIAL FILL Orange brown, Silty, cse. to f. SAND. Loose.
35.59	1.07	4	5	4	9		M		
34.83	1.83	4	3	4	7		M		34.98 / 1.68
34.07	2.59	4	4	5	9		M		UNDIFFERENTIATED COASTAL PLAIN Lt. grayish brown, Clayey, cse. to f. SAND grades to interlayered w/sandy clay. Loose to med. dense.
32.54	4.11	5	5	7	12		M		33.00 / 3.66
31.02	5.64	WOH	WOH	1	1		W		COASTAL PLAIN Dark to lt. brown, CLAY. High plasticity. V. soft. CAPE FEAR FORMATION
29.50	7.16	WOH	2	1	3		M		31.17 / 5.49
27.97	8.69	3	2	3	5		M		COASTAL PLAIN Gray, Silty CLAY. Low plasticity. Soft to med. stiff.
		5	13	20	33		Sat.		28.12 / 8.53
									COASTAL PLAIN Gray, cse. to f. SAND w/little interlayered silty clay. Dense to v. dense.

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB4-B	**STATION** 145+48	**OFFSET** 15m RT	**ALIGNMENT** -L-
COLLAR ELEV. 36.66 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,792	**EASTING** 621,374
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/08	**COMP. DATE** 03/20/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 3.78 **24 HR.** 2.65

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (m) / DEPTH (m))
27					Match Line				25.38 / 11.28
26.45	10.21	35	65/.4		100/.9		D		COASTAL PLAIN Gray, cse. to f. SAND w/little interlayered silty clay. Dense to v. dense.*(continued)*
24.92	11.73	27	42	46	88		D		22.33 / 14.33
23.40	13.26	26	43	56	99		D		COASTAL PLAIN Gray to red brown, Silty CLAY. Hard.
21.88	14.78	43	57/.4		100/.9		M		19.28 / 17.37
20.35	16.31	11	27	29	56		M		COASTAL PLAIN Gray, f. SAND w/tr. silt to Clayey/Silty, f. SAND. Clay/silt content increases w/depth. V. dense.
18.83	17.83	28	37	42	79		M		
17.30	19.35	28	38	45	83		M		

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 19		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB4-B	**STATION** 145+48	**OFFSET** 15m RT	**ALIGNMENT** -L- **0 HR.** 3.78
COLLAR ELEV. 36.66 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,792	**EASTING** 621,374 **24 HR.** 2.65
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/08	**COMP. DATE** 03/20/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (m) / DEPTH (m))
17					Match Line				
									COASTAL PLAIN Gray to reddish brown, Silty CLAY. Low plasticity. Hard. *(continued)*
15.78	20.88	28	43	42	85		M		
14.26	22.40	30	39	61/.3	100/.8		M		
12.73	23.93	33	34	36	70		M		12.43 / 24.23 COASTAL PLAIN Gray, Silty, f. SAND w/mica. V. dense.
11.21	25.45	31	38	38	76		M		11.66 / 24.99 COASTAL PLAIN Gray to red brown, Silty CLAY w/interlayered silty, f. sand layers. Hard.
9.68	26.97	24	39	59	98		D		10.14 / 26.52 COASTAL PLAIN Dark grayish brown grading to include iron oxide staining and mottling, CLAY w/silt. High plasticity. Hard.
8.16	28.50	54	46/.3		100/.8		M		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. RLB4-B	**STATION** 145+48	**OFFSET** 15m RT	**ALIGNMENT** -L- **0 HR.** 3.78
COLLAR ELEV. 36.66 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,792	**EASTING** 621,374 **24 HR.** 2.65
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/20/08	**COMP. DATE** 03/20/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
7					Match Line				
6.64	30.02	37	37	59	96		M		COASTAL PLAIN Dark grayish brown grading to include iron oxide staining and mottling, CLAY w/silt. High plasticity. Hard. *(continued)* 6.18 / 30.48 Boring Terminated at Elevation 6.18 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/16/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	20
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:	
COUNTY: Cumberland		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB5-B	**STATION** 146+06	**OFFSET** 5m LT	**ALIGNMENT** -L- — **0 HR.** 0.76
COLLAR ELEV. 35.41 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,821	**EASTING** 621,428 — **24 HR.** 2.47
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 04/01/08	**COMP. DATE** 04/02/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
35										35.41	0.00
35.10	0.30						D		UNDIFFERENTIATED COASTAL PLAIN Lt. brn. to brownish gray, f. SAND w/few org. debris. Med. dense.	32.97	2.44
34.34	1.07	12	16	18	34		M		UNDIFFERENTIATED COASTAL PLAIN Gray, Clayey SAND w/few sandy clay. Grades to reddish gray f. sand. Med. dense.	32.06	3.35
33.58	1.83	5	6	5	11		M		COASTAL PLAIN Gray and brown, CLAY. High plasticity. Stiff. CAPE FEAR FORMATION	29.92	5.49
32.82	2.59	7	7	11	18		Sat.		COASTAL PLAIN Gray, CLAY w/few sandy clay. Low. plasticity. Med. stiff.	27.94	7.47
31.29	4.11	4	9	9	18		M		COASTAL PLAIN Gray, f. SAND. Poorly graded. Med. dense.	26.42	8.99
29.77	5.64	3	4	5	9		M		COASTAL PLAIN Gray and red, Silty CLAY. Hard.		
28.25	7.16	WOH	1	4	5		W				
26.72	8.69	2	2	9	11		M				
		43	57/.4		100/.9		M				

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB5-B	**STATION** 146+06	**OFFSET** 5m LT	**ALIGNMENT** -L- — **0 HR.** 0.76
COLLAR ELEV. 35.41 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,821	**EASTING** 621,428 — **24 HR.** 2.47
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 04/01/08	**COMP. DATE** 04/02/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
26					Match Line					24.13	11.28
25.20	10.21	45	55/.3		100/.8		M		COASTAL PLAIN Gray and red, Silty CLAY. Hard *(continued)*	23.37	12.04
23.67	11.73	80	20/.1		100/.6		M		COASTAL PLAIN Gray w/red mottling, f. SAND w/some clayey sand. V. dense.	21.08	14.33
22.15	13.26	22	32	36	68		M		COASTAL PLAIN Gray and reddish brown, Silty CLAY. V. stiff.	18.04	17.37
20.63	14.78	33	47	53	100		W		COASTAL PLAIN Gray, f. SAND w/clayey silt to silty clay. Hard.		
19.10	16.31	18	82/.4		100/.9		M		COASTAL PLAIN Gray to reddish brown, Silty CLAY w/tr. mica. Hard.		
17.58	17.83	24	38	49	87		M				
16.05	19.35	41	59/.4		100/.9		M				

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/4/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 21		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB5-B	**STATION** 146+06	**OFFSET** 5m LT	**ALIGNMENT** -L-
COLLAR ELEV. 35.41 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,821	**EASTING** 621,428
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 04/01/08	**COMP. DATE** 04/02/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 0.76 **24 HR.** 2.47

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) / DEPTH (m)
16					Match Line				COASTAL PLAIN Gray to reddish brown, Silty CLAY w/tr. mica. Hard. *(continued)*
14.53	20.88	26	67	33/.2	100/.7		M		13.46 / 21.95
13.01	22.40	21	28	36	64		M		COASTAL PLAIN Brown, gray, and red, Clayey, f. SAND to f. Sand w/tr. mica. V. dense.
11.48	23.93	33	53	47/.4	100/.9		M		
9.96	25.45	24	35	42	77		M		10.42 / 24.99
8.43	26.97	15	28	29	57		W		COASTAL PLAIN Gray grading to gray, brown, and lt. gray white, Silty CLAY. Hard.
6.91	28.50	32	44	53	97		M		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Justin Heter
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLB5-B	**STATION** 146+06	**OFFSET** 5m LT	**ALIGNMENT** -L-
COLLAR ELEV. 35.41 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,821	**EASTING** 621,428
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 04/01/08	**COMP. DATE** 04/02/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

0 HR. 0.76 **24 HR.** 2.47

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) / DEPTH (m)
6					Match Line				COASTAL PLAIN Gray grading to gray, brown, and lt. gray white, Silty CLAY. Hard.*(continued)*
5.39	30.02	21	38	43	81		M		4.93 / 30.48
									Boring Terminated at Elevation 4.93 m in hard Silty CLAY. Cape Fear Formation

Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-210 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 22		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLEB2-C	**STATION** 146+89	**OFFSET** 12m LT	**ALIGNMENT** -L-
COLLAR ELEV. 35.01 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,841	**EASTING** 621,509
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/19/08	**COMP. DATE** 03/19/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
35											
34.70	0.30								ARTIFICIAL FILL (ENGINEERED) Lt. orange brn., f. SAND w/tr. silt and interlayered clayey sand. Med. dense.	35.01	0.00
33.94	1.07	8	7	7	14	SS-01	M			34.09	0.91
33.18	1.83	3	5	7	12	SS-02	M		UNDIFFERENTIATED COASTAL PLAIN Lt. brn., Sandy CLAY interbedded w/silty, f. sand. Stiff.	33.33	1.68
32.42	2.59	5	5	6	11	SS-03	M		UNDIFFERENTIATED COASTAL PLAIN Lt. brn. to tan, f. SAND w/tr. interbedded silty, f. sand. Med. dense.	32.57	2.44
		4	5	5	10	SS-04	W		UNDIFFERENTIATED COASTAL PLAIN Lt. brn., interlayered cse. to f. SAND and Sandy Clay. Med. dense.	31.65	3.35
30.89	4.11										
29.37	5.64	3	4	5	9	SS-05	M		COASTAL PLAIN Lt. grayish brown, Silty CLAY w/tr. orange brown mottling. High plasticity. Stiff. Driller's note: Loss of circulation @ bottom of strata due to clay. CAPE FEAR FORMATION	29.52	5.49
		3	2	2	4	SS-06	M		COASTAL PLAIN Lt. grayish brown, f. Sandy CLAY. Low. plasticity. Med. stiff.	28.30	6.71
27.84	7.16										
		2	8	10	18	SS-07	Sat.		COASTAL PLAIN Gray, f. SAND. Poorly graded. Med. dense.	26.62	8.38
26.32	8.69										
		24	26	29	55	SS-08	M		COASTAL PLAIN Gray, Silty to sandy CLAY. Hard.		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLEB2-C	**STATION** 146+89	**OFFSET** 12m LT	**ALIGNMENT** -L-
COLLAR ELEV. 35.01 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,841	**EASTING** 621,509
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/19/08	**COMP. DATE** 03/19/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (m)	DEPTH (m)
25					Match Line						
24.80	10.21	43	48	50	98	SS-09	D		COASTAL PLAIN Gray, Silty to sandy CLAY. Hard *(continued)*	23.73	11.28
23.27	11.73	37	31	53	84	SS-10	M		COASTAL PLAIN Brick red to gray, Clayey, cse. to f. SAND. V. dense.	21.75	13.26
21.75	13.26	21	29	42	71	SS-11	M				
20.22	14.78	16	19	25	44	SS-12	M			19.16	15.85
18.70	16.31	38	52	48/.3	100/.8	SS-13	M		COASTAL PLAIN Gray, Silty CLAY. Lenses of abundant iron oxide staining and mottling. Hard.		
17.18	17.83	35	54	46/.3	100/.8		M				
15.65	19.35	29	50	50/.4			M				

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.: 23		
T.I.P. NO.: X-0002C	TOTAL SHEETS: 30		
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLEB2-C	**STATION** 146+89	**OFFSET** 12m LT	**ALIGNMENT** -L- — **0 HR.** 3.41
COLLAR ELEV. 35.01 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,841	**EASTING** 621,509 — **24 HR.** 2.80
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/19/08	**COMP. DATE** 03/19/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
15					Match Line				
					100/.9				COASTAL PLAIN Gray, Silty CLAY. Lenses of abundant iron oxide staining and mottling. Hard *(continued)*
14.13	20.88	21	24	46	70		M		
12.60	22.40	30	35	41	76	SS-14	M		12.91 / 22.10 COASTAL PLAIN Lt. greenish gray, Clayey to Silty, cse. to f. SAND. Tr. white mica. V. dense.
11.08	23.93	25	27	44	71		M		
9.56	25.45	21	34	47	81	SS-15	M		10.01 / 24.99 COASTAL PLAIN Dark grayish brown, Silty CLAY. Grades to display layering. Med. plasticity. Hard.
8.03	26.97	72	28/.1		100/.6		D		
6.51	28.50	41	46	54/.3	100/.8		D		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. LLEB2-C	**STATION** 146+89	**OFFSET** 12m LT	**ALIGNMENT** -L- — **0 HR.** 3.41
COLLAR ELEV. 35.01 m	**TOTAL DEPTH** 30.48 m	**NORTHING** 155,841	**EASTING** 621,509 — **24 HR.** 2.80
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/19/08	**COMP. DATE** 03/19/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
5					Match Line				
4.98	30.02	21	30	56	86	SS-16	D		COASTAL PLAIN Dark grayish brown, Silty CLAY. Grades to display layering. Med. plasticity. Hard. *(continued)* 4.53 / 30.48 Boring Terminated at Elevation 4.53 m in hard Silty CLAY. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	24	
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30	
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:		
COUNTY: Cumberland			

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. MSE-01	**STATION** 146+85	**OFFSET** 0m CL	**ALIGNMENT** -L-	**0 HR.** 0.98
COLLAR ELEV. 34.73 m	**TOTAL DEPTH** 8.08 m	**NORTHING** 155,829	**EASTING** 621,506	**24 HR.** 2.77
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/18/08	**COMP. DATE** 03/18/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) / DEPTH (m)
35									34.73 / 0.00
34.42	0.30								ARTIFICIAL FILL (ENGINEERED) Lt. brown, f. SAND w/tr. silt. Med. dense.
		3	4	6	10		M		33.81 / 0.91
33.66	1.07								UNDIFFERENTIATED COASTAL PLAIN Lt. brown gray, Silty to f. Sandy CLAY. Low plasticity. Stiff.
		4	5	6	11	M-06	M 18%		33.05 / 1.68
32.90	1.83								UNDIFFERENTIATED COASTAL PLAIN Lt. brown to orange brown, Silty SAND w/tr. clay and interlayered sandy clay. Med. dense to loose.
		8	9	11	20		M		
32.14	2.59								
		3	4	3	7	M-07	W 31%		31.53 / 3.20
31.38	3.35								COASTAL PLAIN Lt. brownish gray, CLAY w/tr. silt and orange brown mottling. High plasticity. Stiff to med. stiff. CAPE FEAR FORMATION
		3	4	6	10	M-08	M 26%		
30.61	4.11					ST-03			
		3	3	5	8	M-09	M 37%		
29.85	4.88								
		2	2	3	5	M-10	M 27%		
29.09	5.64								
		WOH	WOH	3	3	ST-04 M-11	M 27%		29.24 / 5.49
28.33	6.40								COASTAL PLAIN Gray, Silty CLAY to f. Sandy CLAY w/Sandy Silt. Sand increases w/depth. Soft to med. stiff.
		2	1	5	6		W		
27.57	7.16								27.87 / 6.86
		6	10	13	23		Sat.		COASTAL PLAIN Gray, f. SAND. Poorly graded. Med. dense.
27.11	7.62								
		5	8	20	28		Sat.		26.65 / 8.08
									Boring Terminated at Elevation 26.65 m in med. dense f. SAND to Silty/Clayey f. SAND. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler	
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.				**GROUND WTR (m)**
BORING NO. MSE-02	**STATION** 146+96	**OFFSET** 1m RT	**ALIGNMENT** -L-	**0 HR.** 2.50
COLLAR ELEV. 34.69 m	**TOTAL DEPTH** 8.38 m	**NORTHING** 155,830	**EASTING** 621,517	**24 HR.** 2.38
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual	
START DATE 03/17/08	**COMP. DATE** 03/17/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
									ELEV. (m) / DEPTH (m)
35									34.69 / 0.00
34.39	0.30								ROADWAY EMBANKMENT Brown to tan, Silty, f. SAND w/little clayey sand. Med. dense to loose.
		5	13	12	25		M		
33.93	0.76						W		33.02 / 1.68
		4	4	5	9				UNDIFFERENTIATED COASTAL PLAIN Lt. brown, Clayey, f. SAND w/little wood frags. Med. dense.
32.86	1.83								
		5	7	7	14		Sat.		32.25 / 2.44
32.10	2.59								UNDIFFERENTIATED COASTAL PLAIN Lt. brownish gray, Clayey, f. SAND w/Sandy Clay. Loose. Note: Loss of circulation at bottom of strata.
		2	2	1	3	M-01	M 27%		31.49 / 3.20
31.34	3.35								COASTAL PLAIN Lt. brownish gray, high plasticity CLAY w/tr. silt. Stiff to med. stiff. CAPE FEAR FORMATION
		3	5	6	11	M-02	M 25%		
30.58	4.11					ST-01			
		4	5	6	11	M-03	M 25%		
29.82	4.88								
		2	3	3	6	M-04	M 28%		
29.05	5.64								29.11 / 5.58
		WOH	1	1	2	ST-02 M-05	W 28%		COASTAL PLAIN Lt. brown to gray, Silty CLAY to Clayey Silt. Soft.
28.29	6.40								
		2	4	8	12		Sat.		28.14 / 6.55
27.53	7.16								COASTAL PLAIN Gray, f. SAND. Grain size increases w/depth. Med dense.
		7	8	9	17		Sat.		
26.77	7.92								26.92 / 7.77
		20	22	56	78		M		COASTAL PLAIN Gray, Silty and f. grained Sandy CLAY. Hard.
									26.31 / 8.38
									Boring Terminated at Elevation 26.31 m in hard, f. grained Sandy CLAY w/silt. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE 208-010 NCDOT FAYETTEVILLE BRIDGES.GPJ CATLIN.GDT 4/18/08

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

METRIC

PROJ. NO.: 35196.1.2	SHEET NO.:	25
T.I.P. NO.: X-0002C	TOTAL SHEETS:	30
F.A. NO.:DPR-0100 (002)	R/W SHEET NO.:	
COUNTY: Cumberland		

PROJECT NO. 35196.1.2	**ID.** X-0002C	**COUNTY** Cumberland	**GEOLOGIST** Tom Stetler
SITE DESCRIPTION Bridge No. 381 and Bridge No. 382 on -L- over US 401.			**GROUND WTR (m)**
BORING NO. MSE-03	**STATION** 146+80	**OFFSET** 15m RT	**ALIGNMENT** -L-	**0 HR.** 1.52
COLLAR ELEV. 34.31 m	**TOTAL DEPTH** 8.08 m	**NORTHING** 155,813	**EASTING** 621,504	**24 HR.** 1.92
DRILL MACHINE Diedrich D-50	**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Manual
START DATE 03/18/08	**COMP. DATE** 03/18/08	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A

ELEV (m)	DEPTH (m)	BLOW COUNT 15cm	15cm	15cm	BLOWS PER 30 CM 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (m) / DEPTH (m)
34									34.31 / 0.00
34.01	0.30								ARTIFICIAL FILL (ENGINEERED) Dark brown to brown, Silty, f. SAND w/tr. wood frags. Loose.
33.25	1.07	6	4	5	9		M		
32.49	1.83	4	1	4	5		M		32.64 / 1.68
31.72	2.59	4	6	8	14	M-12	M 14%		UNDIFFERENTIATED COASTAL PLAIN Lt. brown gray, Sandy CLAY w/Clayey, f. Sand. Low plasticity. Stiff. 31.88 / 2.44
30.96	3.35	6	6	7	13		Sat.		UNDIFFERENTIATED COASTAL PLAIN Lt. brown to tan, cse. to f. SAND w/tr. Silty Sand. Med. dense. 31.11 / 3.20
30.20	4.11	1	1	1	2	M-13 ST-05	M 31%		COASTAL PLAIN Lt. brown to gray, high plasticity CLAY w/tr. sand. Soft. Note: Loss of circulation @ base of strata. 30.50 / CAPE FEAR FORMATION / 3.81
29.44	4.88	1	2	2	4	M-14 ST-06	M 24%		COASTAL PLAIN Gray, med. to low plasticity CLAY w/tr. silt, and plant frags. along layering. Sharp contact w/strata below. Soft.
28.68	5.64	WOH	2	2	4	M-15	M 24%		
27.91	6.40	4	10	19	29	M-16	24% W		28.52 / 5.79 COASTAL PLAIN Gray, f. SAND w/tr. Silt at top of strata. Med. dense.
27.15	7.16	12	12	13	25		W		
26.69	7.62	8	10	14	24		Sat.		26.69 / 7.62
		16	25	27	52		M		COASTAL PLAIN Gray, Clayey to Silty, f. SAND. V. dense. 26.24 / 8.08 Boring Terminated at Elevation 26.24 m in V. dense Clayey to Silty, f. SAND. Cape Fear Formation Note: Field logs recorded in English units (ft.) and converted to Meters (0.3038 M/ft)

NEW NCDOT BORE DOUBLE_208-010_NCDOT FAYETTEVILLE BRIDGES.GPJ_CATLIN.GDT_4/18/08

DESCRIPTION:	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 26
Bridge No. 381 and Bridge No. 382 on -L- over US 401		T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
		F.A. NO.DPR-0100 (002)	R/W SHEET NO.:
		COUNTY: Cumberland	
	CATLIN PROJECT: 208-010	CATLIN ENGINEERS and SCIENTISTS 208-010	
		GEOTECHNICAL LABORATORY Wilmington, North Carolina	

NCDOT LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

(As modified by NCDOT, Material and Tests Unit, 2000.)

TEST RESULTS

Field Sample Number	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	SS-09	SS-10	SS-11	SS-12	SS-13	SS-14	SS-15
Lab Sample Number	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	SS-09	SS-10	SS-11	SS-12	SS-13	SS-14	SS-15
Retained #4 Sieve %	0.46	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0
Passing #10 Sieve %	95.7	100	99.1	98.4	100	100	100	100	100	99.5	99.1	100	100	100	100
Passing #40 Sieve %	57	98	74	60	100	100	71	85	97	61	62	93	96	75	99
Passing #200 Sieve %	13	43	8	29	92	70	5	47	49	20	12	30	77	17	86
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	63.0	7.8	56.7	54.7	0.7	1.2	70.9	28.2	8.4	59.6	65.9	14.4	7.7	47.5	2.2
Fine Sand Ret.-#270 %	25.4	54.7	36.8	18.0	12.5	40.0	25.2	32.5	49.0	23.4	24.1	64.8	21.5	39.1	16.8
Silt 0.05 - 0.005mm %	3.0	11.3	1.5	9.5	38.1	34.6	1.9	27.1	28.4	11.0	6.0	16.8	50.4	9.4	51.7
Clay <0.005mm %	8.6	26.2	5.0	17.8	48.7	24.2	2.0	12.2	14.2	6.0	4.0	4.0	20.4	4.0	29.3
Liquid Limit (LL)	17	28	20	28	49	30	17	36	38	32	32	37	39	37	54
Plasticity Index (PI)	NP	12	NP	15	29	12	NP	15	16	NP	NP	NP	19	NP	24
AASHTO Classification /Group Index	**A-2-4(0)**	**A-6(2)**	**A-3(0)**	**A-2-6(1)**	**A-7-6(29)**	**A-6(6)**	**A-3(0)**	**A-6(4)**	**A-6(5)**	**A-2-4(0)**	**A-2-4(0)**	**A-2-4(0)**	**A-6(14)**	**A-2-4(0)**	**A-7-5(24)**
Station	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86	146+86
Offset	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT	12m LT
Alignment	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-
Boring Identification	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**	**LLEB2-C**
Depth (M)	0.30	1.07	1.83	2.59	4.11	5.64	7.16	8.69	10.21	11.73	13.26	14.78	16.31	22.40	25.45
to	0.76	1.52	2.28	3.05	4.57	6.09	7.61	9.14	10.66	12.18	13.70	15.23	16.69	22.84	25.88
Field Moisture Content															
Tested By	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason	MDMason
Submitted By	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson	SVHudson
Date Submitted	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08	03/27/08

NP = Non-Plastic

Michael D. Mason
Laboratory Manager

Report Date: 4/9/2008

DESCRIPTION:	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 27
Bridge No. 381 and Bridge No. 382 on -L- over US 401		T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
		F.A. NO.DPR-0100 (002)	R/W SHEET NO.:
		COUNTY: Cumberland	
	CATLIN PROJECT: 208-010	CATLIN ENGINEERS and SCIENTISTS 208-010	
		GEOTECHNICAL LABORATORY Wilmington, North Carolina	

NCDOT LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

(As modified by NCDOT, Material and Tests Unit, 2000.)

TEST RESULTS

Field Sample Number	SS-16	M-06	M-07	M-08	M-09	M-10	M-11	M-01	M-02	M-03	M-04	M-05	M-12	M-13	M-14
Lab Sample Number	SS-16	M-06	M-07	M-08	M-09	M-10	M-11	M-01	M-02	M-03	M-04	M-05	M-12	M-13	M-14
Retained #4 Sieve %	0														
Passing #10 Sieve %	100														
Passing #40 Sieve %	100														
Passing #200 Sieve %	89														

MINUS NUMBER 10 FRACTION

SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	0.5														
Fine Sand Ret.-#270 %	19.3														
Silt 0.05 - 0.005mm %	55.9														
Clay <0.005mm %	24.3														
Liquid Limit (LL)	54														
Plasticity Index (PI)	23														
AASHTO Classification /Group Index	**A-7-5(24)**														
Station	146+86	146+81	146+81	146+81	146+81	146+81	146+81	146+92	146+92	146+92	146+92	146+92	146+76	146+76	146+76
Offset	12m LT	0m CL	0m CL	0m CL	0m CL	0m CL	0m CL	1m RT	1m RT	1m RT	1m RT	1m RT	15m RT	15m RT	15m RT
Alignment	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-
Boring Identification	**LLEB2-C**	**MSE-01**	**MSE-01**	**MSE-01**	**MSE-01**	**MSE-01**	**MSE-01**	**MSE-02**	**MSE-02**	**MSE-02**	**MSE-02**	**MSE-02**	**MSE-03**	**MSE-03**	**MSE-03**
Depth (M)	30.02	1.07	2.59	3.35	4.11	4.88	5.64	2.59	3.35	4.11	4.88	5.64	1.83	3.35	4.11
to	30.45	1.52	3.05	3.81	4.57	5.33	6.09	3.05	3.81	4.57	3.33	6.09	2.28	3.81	4.57
Field Moisture Content		18	31	26	32	27	27	27	25	25	28	28	14	31	24
Tested By	MDMason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason	M.D. Mason
Submitted By	SVHudson	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler
Date Submitted	03/27/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08	03/24/08

NP = Non-Plastic

Michael D. Mason
Laboratory Manager

Report Date: 4/9/2008

DESCRIPTION:	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 28
Bridge No. 381 and Bridge No. 382 on -L- over US 401		T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
		F.A. NO.DPR-0100 (002)	R/W SHEET NO.:
		COUNTY: Cumberland	
	CATLIN PROJECT: 208-010	CATLIN ENGINEERS and SCIENTISTS 208-010	
		GEOTECHNICAL LABORATORY Wilmington, North Carolina	

NCDOT LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

(As modified by NCDOT, Material and Tests Unit, 2000.)

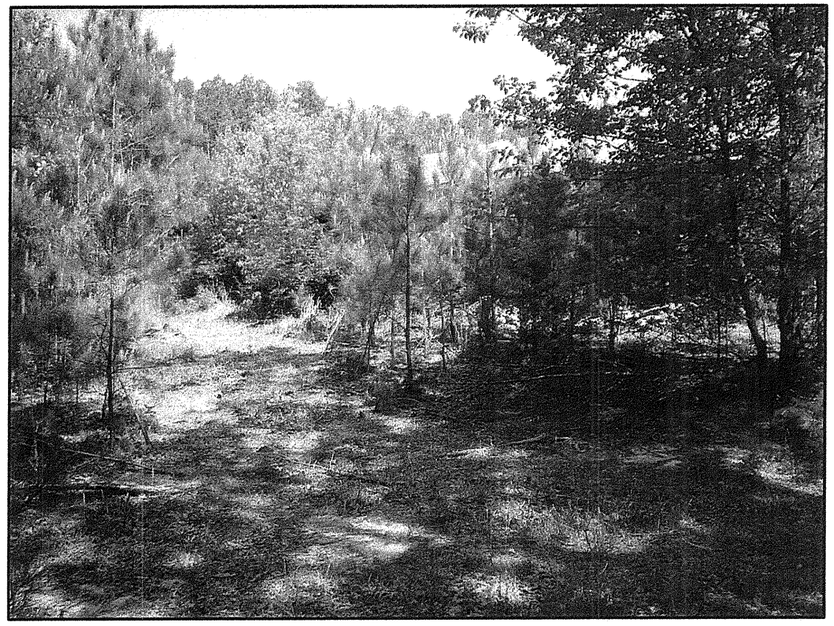
TEST RESULTS

Field Sample Number								M-15	M-16	ST-01	ST-02	ST-03	ST-04	ST-05	ST-06
Lab Sample Number								M-15	M-16	ST-01	ST-02	ST-03	ST-04	ST-05	ST-06
Retained #4 Sieve %										0	0	0	0	0	0
Passing #10 Sieve %										100	100	100	100	100	100
Passing #40 Sieve %										99	100	100	100	99	100
Passing #200 Sieve %										83.9	69.1	96.6	60.9	93.0	74.6
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %										1	1	1	1	1	1
Fine Sand Ret.-#270 %										26	46	5	54	9	35
Silt 0.05 - 0.005mm %										43	31	33	25	28	29
Clay <0.005mm %										30	22	61	20	62	35
Liquid Limit (LL)										38	26	61	26	54	35
Plasticity Index (PI)										19	5	36	4	28	19
AASHTO Classification /Group Index										**A-6(15)**	**A-4(2)**	**A-7-6(40)**	**A-4(1)**	**A-7-6(30)**	**A-6(12)**
Station								146+80	146+80	146+96	146+96	146+85	146+85	146+80	146+80
Offset								15m RT	15m RT	1m RT	1m RT	0m CL	0m CL	15m RT	15m RT
Alignment								-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-
Boring Identification								**MSE-03**	**MSE-03**	**MSE-02**	**MSE-02**	**MSE-01**	**MSE-01**	**MSE-03**	**MSE-03**
Depth (M)								4.88	5.64	3.65	5.48	3.65	5.48	3.35	3.35
to								5.33	5.79	4.26	6.09	4.26	6.09	3.96	3.96
Field Moisture Content								24	24	26.8	26.9	35.4	25.2	50.9	25.2
Tested By								M.D. Mason	M.D. Mason	S&ME	S&ME	S&ME	S&ME	S&ME	S&ME
Submitted By								Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler	Tom Stetler
Date Submitted								03/24/08	03/24/08	04/08/08	04/08/08	04/08/08	04/08/08	04/08/08	04/08/08

NP = Non-Plastic

Michael D. Mason
Laboratory Manager

Report Date: 4/9/2008



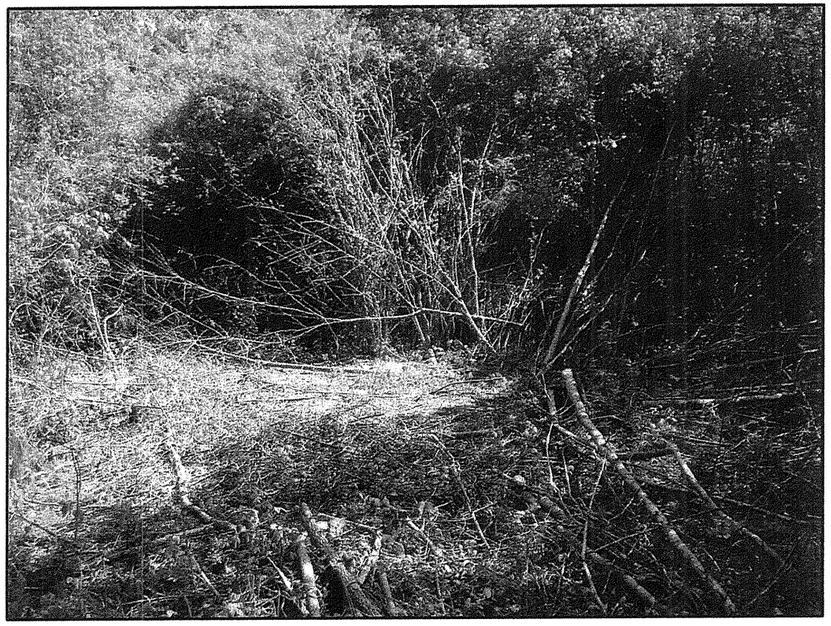
END BENT 1 (RLEB1-B IN FOREGROUND)
FACING NORTH NORTHWEST

BENT 1 (LLB1-B IN FOREGROUND)
FACING SOUTH SOUTHEAST

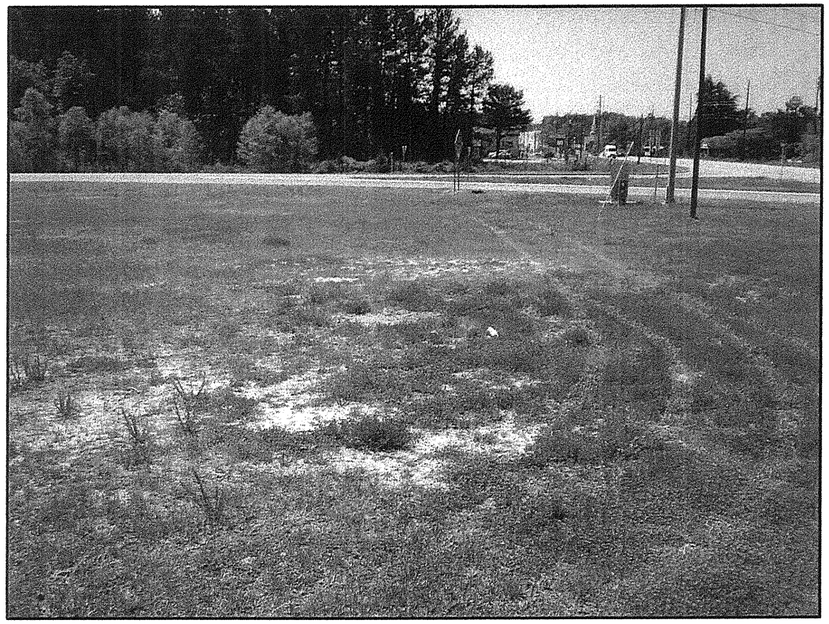
BENT 3 (LLB3-B IN FOREGROUND)
FACING SOUTH SOUTHEAST

BENT 4 (RLB4-B IN FOREGROUND)
FACING NORTH NORTHWEST

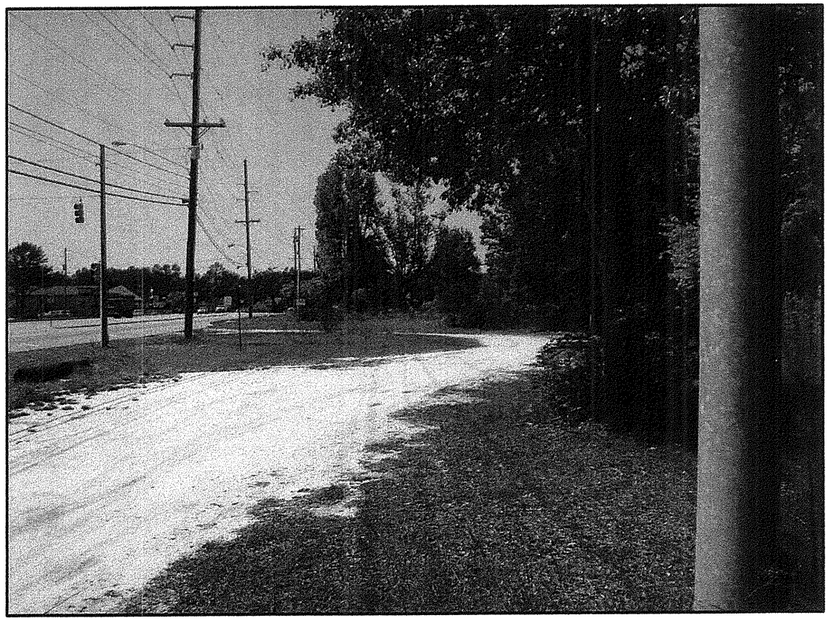
CATLIN ENGINEERS and SCIENTISTS WILMINGTON, NORTH CAROLINA	208-010	METRIC	PROJ. NO.: 35196.1.2	SHEET NO.: 30
			T.I.P. NO.: X-0002C	TOTAL SHEETS: 30
			F.A. NO.: DPR-0100 (002)	R/W SHEET NO.:
			COUNTY: Cumberland	



BENT 2 (RLB2-B IN FOREGROUND)
FACING NORTH NORTHWEST



END BENT 2 (LLEB2-C IN FOREGROUND)
FACING SOUTH



BENT 5 (LLB5-B FOREGROUND)
FACING SOUTH

WEST SOUTHWEST ALONG CENTERLINE OF -L-
END BENT 2 (DRILLING RIG) IN FOREGROUND

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	35196.3.19 (X-0002CA) 35196.3.20 (X-0002CB)	1	14

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 35196.3.19 (X-0002CA) / 35196.3.20 (X-0002CB)

COUNTY CUMBERLAND

PROJECT DESCRIPTION NC 24 EXT. (FAYETTEVILLE OUTER LOOP) FROM 1.3 MILES EAST OF NC 87-210 TO WEST OF US 401

SITE DESCRIPTION RETAINING WALLS LEFT OF -Y4- STA. 10+40, RIGHT OF -L- STA. 142+20, LEFT OF -L- STA. 143+00 AND RIGHT AND LEFT OF -L- STA. 147+00

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3-10	SITE PLAN AND PROFILES
11-14	SOIL TEST RESULTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

THIS SUBSURFACE INFORMATION WAS ORIGINALLY ASSEMBLED AS STATE PROJECT 35196.1.2 (X-0002C), BUT IS BEING LET AS 35196.3.19 (X-0002CA) AND 35196.3.20 (X-0002CB)

PERSONNEL
D. S. CANADY
D. W. DIXON
D. S. TIGNOR

INVESTIGATED BY F. M. WESCOTT III
CHECKED BY D. N. ARGENBRIGHT
SUBMITTED BY D. N. ARGENBRIGHT
DATE JUNE, 2007

NORTH CAROLINA LICENSED SEAL 1050 GEOLOGIST D. N. ARGENBRIGHT 6-1-07

PROJECT: 35196.3.19 / 35196.3.20 ID: X-0002CA / X-0002CB

DRAWN BY: C. P. TURNER, F. M. WESCOTT III

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

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

PROJECT REFERENCE NO.	SHEET NO.
35196.1.2 (X-0002C)	2 OF 14

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 THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER 30 CM ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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		NP	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

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<25
	SOFT	2 TO 4	25 TO 50
	MEDIUM STIFF	4 TO 8	50 TO 100
	STIFF	8 TO 15	100 TO 200
	VERY STIFF	15 TO 30	200 TO 400
	HARD	>30	>400

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	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, YELLOW-BROWN, 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 IS 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 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	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 SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 - DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT 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 - CALIFORNIA BEARING RATIO 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, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [X] CME-45B
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [ ] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 75 mm STEEL TEETH
- [ ] TRICONE _____ mm TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 3 CM 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:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER 30 CM IF TESTED.
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 ROCK 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 BLOWS PER 30 CM*
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 BLOWS PER 30 CM*
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 GEOLOGIST'S 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 6 MM DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S 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 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 3 M
WIDE	3 TO 10 M
MODERATELY CLOSE	30 TO 100 CM
CLOSE	5 TO 30 CM
VERY CLOSE	LESS THAN 5 CM

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 1 M
THICKLY BEDDED	0.5 - 1 M
THINLY BEDDED	0.05 - 0.5 M
VERY THINLY BEDDED	10 - 50 MM
THICKLY LAMINATED	2.5 - 10 MM
THINLY LAMINATED	< 2.5 MM

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 THAT 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 THAT 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 (FP) - 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 (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT 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, THAT 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM PER 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 (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK:

ELEVATION:

NOTES:

REVISED 02/23/06

PROJECT REFERENCE NO.	SHEET
X-0002C	3

SITE PLAN

0 10 20

METERS

NAD 83
NC GRID

5+60

5+00

-Y- RAMP D

F

BEG WALL -Y4-
STA 10+20 LT

END WALL -Y4-
STA 11+80 LT

10+00

-Y4-

N 31° 09' 06.3" W

-Y4-

11+00

N 20° 59' 20.3" E

REVISIONS
12/15/08 -PARCEL III- CHANGED TO 110
METRIC
PROJECT REFERENCE NO. X-0002C
SHEET NO. 4
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
PRELIMINARY PLANS
INCOMPLETE PLANS
CONST. REV.
R/W REV.
NAD 83 NC GRID
-Y12- RAMP A
PI Sta 3+21.554 PI Sta 4+24.352
Θs = 12° 43' 56.6" Δ = 63° 08' 26.8" (LT)
Ls = 60.000 L = 148.693
LT = 40.04 T = 82.952
ST = 20.095 R = 135.000
-Y12- RAMP AI
PI Sta 3+76.916
Δ = 34° 25' 15.8" (RT)
L = 27.034
T = 13.939
R = 45.000
-Y12- RAMP C
PI Sta 7+41.750 PI Sta 8+40.796
Θs = 12° 43' 56.6" Δ = 60° 44' 26.9" (LT)
Ls = 60.000 L = 143.117
LT = 40.04 T = 79.110
ST = 20.095 R = 135.000
SE = 0.08
RO = 60.000
DS = 60 kph
-Y12- RAMP CI
PI Sta 7+90.073
Δ = 33° 46' 25.0" (RT)
L = 26.526
T = 13.661
R = 45.000
SE = 0.07
RO = 24.000
DS = 30 kph
-Y12- RAMP D
PI Sta 4+14.729 PI Sta 4+82.198
Θs = 31° 15' 08.1" Δ = 82° 21' 15.3" (RT)
Ls = 60.000 L = 73.054
LT = 40.642 T = 48.110
ST = 20.585 R = 55.000
-Y12- RAMP DI
PI Sta 4+75.935
Δ = 66° 23' 38.4" (LT)
L = 52.145
T = 29.443
R = 45.000
-Y12- RAMP B
PI Sta 7+67.948 PI Sta 8+33.922
Θs = 31° 15' 08.1" Δ = 80° 35' 59.8" (RT)
Ls = 60.000 L = 77.338
LT = 40.642 T = 46.528
ST = 20.585 R = 55.000
SE = 0.06
RO = 60.000
DS = 40 kph
-Y12- RAMP BI
PI Sta 8+26.428
Δ = 68° 10' 53.7" (LT)
L = 53.550
T = 30.452
R = 45.000
SE = 0.05
RO = 24.000
DS = 30 kph
-Y9-
PI Sta 14+34.395
Δ = 35° 41' 03.6" (RT)
L = 143.646
T = 74.253
R = 230.000
SE = 0.05
RO = 30.000
DS = 60 kph
-Y10-
PI Sta 15+26.099
Δ = 36° 07' 15.6" (LT)
L = 104.021
T = 53.804
R = 165.000
PAVEMENT-BRIDGE RELATIONSHIP FOR -L- OVER -Y12-
(SEE SHEET 2L FOR A LARGER DETAIL VIEW)
TRAFFIC DIAGRAM
2008 ADT
2030 ADT
28,680 / 38,800
8,920 / 13,400
10,040 / 13,200
29,270 / 50,300
12,600 / 17,000
11,020 / 16,300
28,810 / 49,400
33,360 / 45,500
-Y12-
-L-
100
EDWIN C. OSTENDORF
DB 4186 PG 171
108
VIOLA FARMER
DB 319 PG 296
107
JOHN McCOARD
DB 2467 PG 104
CLAYTON L. FARMER
DB 706 PG 222
109
110
112
113
114
FAYETTEVILLE OUTER LOOP
-L-
N 80° 52' 27.8" E
-Y12- RAMP B
-Y12- RAMP C
-Y12- RAMP B TS 7+27.306 =
-Y12- RAMP BI POT 7+27.306
-Y12- RAMP B SC 7+87.306
-Y12- RAMP BI PT 8+49.521
-Y12- RAMP C PT 9+04.763
-Y12- RAMP BI PC 7+95.972
-L- POT 146+39.081 =
-Y12- POT 15+64.600
-Y12- RAMP C TS 7+01.646
-Y12- RAMP CI POT 7+01.646
-Y12- RAMP C SC 7+61.646
-Y12- RAMP CI PC 7+77.052
-Y12- RAMP CI PT 8+03.578
-Y12- RAMP CI POT 8+10.214
-Y12- RAMP AI POT 3+95.363 =
-Y12- POT 16+30.578 (11.400 LT)
-Y12- RAMP AI PT 3+90.013
-Y12- RAMP D PT 5+13.142 =
-Y12- POT 15+93.286 (0.600 RT)
-Y12- RAMP AI PC 3+62.379
-Y12- RAMP AI S 85° 29' 27.4" W
-Y12- RAMP A
-Y12- RAMP A SC 3+41.450
N 80° 05' 17.0" W
-Y12- RAMP B PT 8+64.645
-Y12- RAMP D SC 4+34.088
-Y12- RAMP D
-Y12- RAMP DI
S 76° 02' 40.7" W
-Y12- RAMP DI PC 4+46.492
-Y12- RAMP A PT 4+90.143 =
-Y12- POT 15+04.462 (7.300 LT)
-Y12- RAMP DI PT 4+98.637 =
-Y12- POT 14+82.063 (11.400 RT)
-Y12- RAMP D TS 3+74.087 =
-Y12- RAMP DI POT 3+74.087
MATCHLINE STA. 147+60
SEE SHEET 5
-Y9- PT 15+03.789 (LB) =
-Y10- PT 15+03.789 (LA)
-Y10- PC 14+72.205
-Y9- STA 15+03.789
END CONSTRUCTION
FOR DITCH DETAILS SEE SHEET 2-6
FOR -L- PROFILE SEE SHEET 42 AND 43
FOR -Y9- PROFILE SEE SHEET 60
FOR -Y12- RAMP B PROFILE SEE SHEET 51 & 52
FOR -Y12- RAMP BI PROFILE SEE SHEET 52
FOR -Y12- RAMP C PROFILE SEE SHEET 53
FOR -Y12- RAMP CI PROFILE SEE SHEET 53
LOCATION:
TIP NO.:
COUNTY:
DESIGNED BY:
DATE:
CHECKED BY:
DATE:

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

METRIC

5 0 10

CONST.REV.

R/W REV.

NORTH CAROLINA PROFESSIONAL SEAL 14863 ENGINEER J. R. KEITH — PRELIMINARY PLANS — NOT TO BE USED FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 29334 ENGINEER STACEY WELLS, III — INCOMPLETE PLANS — NOT TO BE USED FOR R/W OR CONSTRUCTION

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4865 FAX

SDG Sungate Design Group, P.A.
NORTH CAROLINA CORPORATION C-2683 LICENSED ENGINEERING & SURVEYING
810-A Jones Franklin Rd.
Raleigh, N.C. 27606

REVISIONS

8/17/2016

MATCHLINE STA. 147+60
SEE SHEET 4

-Y12- RAMP A

PIs Sta 3+21.554
θs = 12° 43' 56.6"
Ls = 60.000
LT = 40.104
ST = 20.095

PI Sta 1+45.135
θs = 1° 06' 23.7"
Ls = 90.000
LT = 60.001
ST = 30.001

PI Sta 0+57.579
Δ = 2° 49' 52.3" (LT)
L = 115.134
T = 57.579
R = 2,330.000

NAD 83
NC GRID

-Y12- RAMP A TS 2+81.450 =
-Y12- RAMP AI POT 2+81.450 (3.600 RT)

148+00

149+00

150+00

151+00

-Y12- RAMP A ST 2+05.134

END EXPRESSWAY GUTTER
-L- STA 148+80 LT

-Y12- RAMP A PC 0+00.000 =
-L- POC 150+60.000 (14.200 LT)

STA 149+10.035 END TIP PROJECT X-0002C
END CONSTRUCTION

-Y12- RAMP A CS 1+15.134

-Y12- RAMP A & AI

S 85° 29' 27.4" W

PROP. GUARDRAIL

20.3m

+49.0

+80

MSE WALL

GRAD 350

C

3.6m RPS
7.2m
7.0m
1.2m RPS
1.2m RPS
7.0m
7.2m
3.6m RPS

025 025 02 01 00 01 02 025 03 EXIST

-L-

N 80° 52' 27.6" E

PROP. CABLE GUIDERAIL

FAYETTEVILLE OUTER LOOP

025 025 025 03 EXIST

PROP. GUARDRAIL

-L- TS 148+49.035

MSE WALL

+80

CAT-1

-Y12- RAMP D

S 76° 02' 40.6" W

-Y12- RAMP D ST 1+34.213

-Y12- RAMP D SC 0+60.000

-Y12- RAMP D CS 0+74.213

-L- SC 149+10.035

END EXPRESSWAY GUTTER
-L- STA 149+00 RT

-Y12- RAMP D ST 0+00.000 =
-L- POC 151+09.002 (14.200 RT)

CLYDE A. CULBRETH
DB 3195 PG 198

-L-

PIs Sta 148+89.702
θs = 0° 45' 00.0"
Ls = 61.000
LT = 40.667
ST = 20.334

PI Sta 153+82.341
Δ = 22° 55' 04.4" (RT)
L = 931.983
T = 472.306
R = 2,330.000
SE = 0.025
RO = 61.000
DS = 110 kph

-Y12- RAMP D

PIs Sta 0+36.841
θs = 0° 44' 31.7"
θs = 3° 56' 00.4"
Ls = 60.000
LT = 36.841
ST = 23.189

PI Sta 0+67.107
Δ = 1° 51' 48.5" (LT)
L = 14.213
T = 7.107
R = 437.000

PIs Sta 0+94.222
θs = 3° 56' 00.1"
Ls = 60.000
LT = 40.010
ST = 20.009

FOR -L- PROFILE SEE SHEET 43

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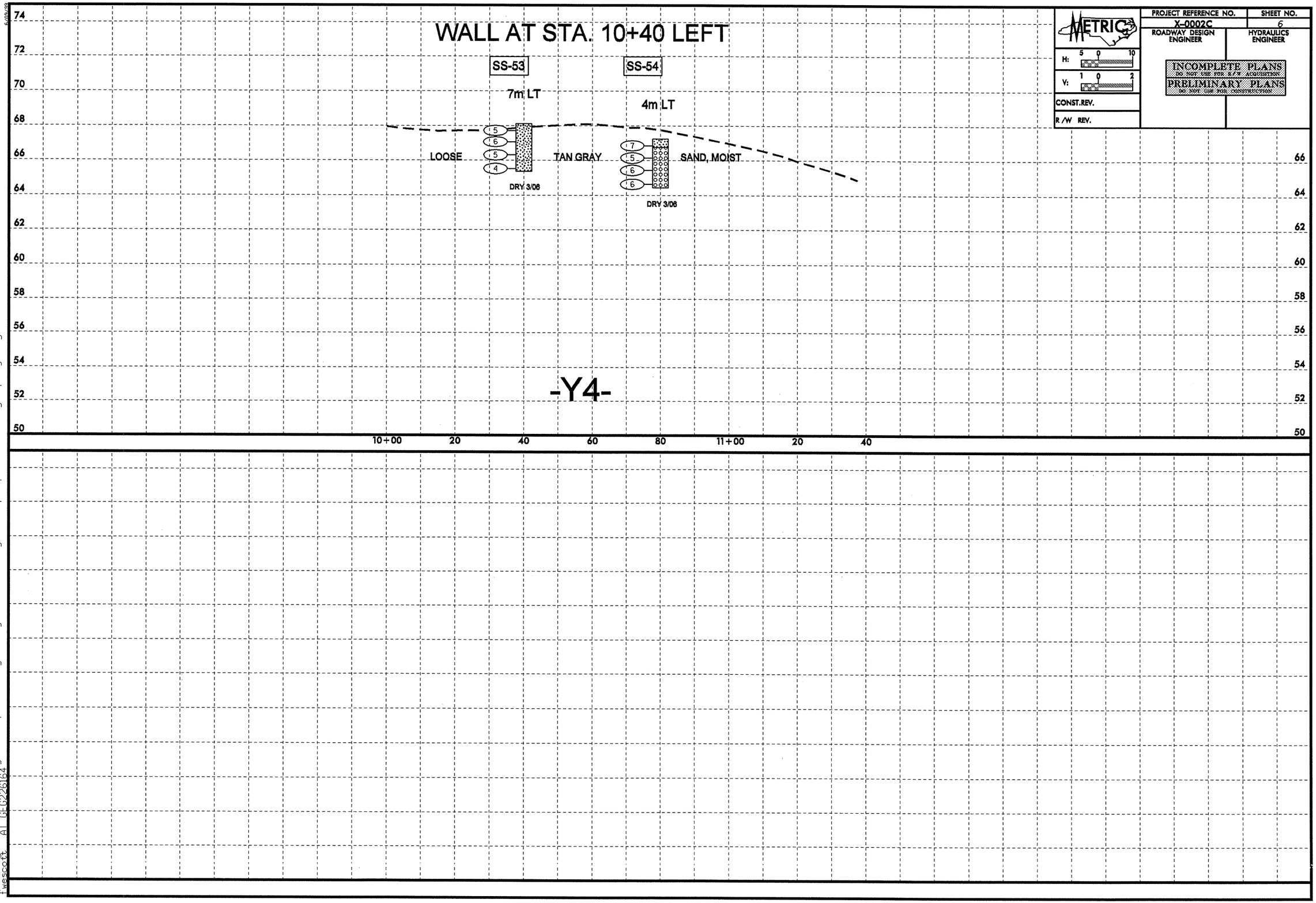

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WALL AT –L– STA. 143+00 LEFT

PROJECT REFERENCE NO.	SHEET NO.
X0002C	7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

CONST.REV.
R/W REV.

SS-75
SS-76
SS-77
SS-78
19m LT
02/98
WOH
2
2
2
2
1
5
A
1
6
38
36
33
VERY LOOSE TO MEDIUM
VERY SOFT TO MEDIUM
GRAY SANDY AND SILTY
WET
LOOSE TO MEDIUM DENSE
VERY STIFF TO HARD

SS-93
SS-94
SS-95
SS-96
19m LT
3
8
7
5
4
WOH
2
20
29
26
STIFF
CLAY,
GRAY SILTY AND

SS-105
SS-106
SS-107
SS-108
SS-109
SS-110
SS-111
19m LT
03/98
2
8
5
1
WOH
1
3
7
17
50
70
DENSE
GRAY SAND AND CLAYEY

SS-28
SS-29
SS-30
SS-31
SS-32
19m LT
02/98
2
1
4
10
1
WOH
WOH
WOH
2
33
46
100/0.2
B
TAN GRAY SAND AND
VERY SOFT TO SOFT
CLAY, WET
SAND, SATURATED
SANDY CLAY, WET
(CAPE FEAR FORMATION)

SS-85
SS-86
SS-87
SS-88
SS-89
SS-90
SS-91
23m LT
02/98
2
3
5
12
2
WOH
WOH
WOH
37
100/0.2
100/0.2
CLAYEY SAND,
MOIST TO SATURATED
BLACK MUCK
AND ORGANIC
VERY SOFT
SILT AND
WET
GRAY SANDY
SANDY CLAY,

A VERY LOOSE BLACK ORGANIC SAND, SATURATED

B DENSE GRAY SAND AND CLAYEY SAND, SATURATED (CAPE FEAR FORMATION)

143+00 20 40 60 80 144+00 20 40 60 80 145+00 20 40 60 80 146+00 20 40 60

WALL AT –L– STA. 147+00 LEFT

LOOSE TO DENSE TAN SAND, MOIST (ROADWAY EMBANKMENT)

SS-38
SS-39
ST-2
SS-40
SS-41
SS-42
SS-43
19m LT
1
6
7
14
J
7
4
21
34
76
51
VERY LOOSE TO
02/98
A
VERY LOOSE
B
ST-2 (X-0002DA)
VERY SOFT TO
MEDIUM DENSE
HARD GRAY
C

SS-49
SS-50
SS-51
SS-52
D
19m LT
5
13
17
2
7
WOH
1
20
100/0.2
37
LOOSE TAN SAND AND
02/98
TO MEDIUM DENSE TAN
MEDIUM STIFF TAN GRAY
GRAY SAND AND CLAYEY
SANDY SILT AND SILTY
(CAPE FEAR FORMATION)

SS-58
ST-3
SS-59
SS-60
SS-61
19m LT
2
9
11
6
5
8
4
21
49
52
48
48
02/98
ST-3 (X-0002DA)
C
CLAYEY SAND, MOIST
A
SAND,
SILTY AND SANDY
SAND, SATURATED
(CAPE FEAR FORMATION)
AND SANDY

SS-62
SS-63
SS-64
15m LT
1
5
12
2
8
2
1
20
15
34
48
TO SATURATED
02/98
SATURATED
CLAY, WET
CLAY, WET

A MEDIUM STIFF TO STIFF GRAY SANDY SILT AND SILTY AND SANDY CLAY, MOIST TO WET

B VERY SOFT TO SOFT SLIGHTY ORGANIC SANDY SILT AND SILTY CLAY, WET

C DENSE TO VERY DENSE GRAY SAND, SATURATED (CAPE FEAR FORMATION)

D OLD TRASH PILE (ARTIFICAL FILL)

60 80 147+00 20 40 60 80 148+00 20 40 60 80 149+00 20 40 60 80 150+00 20

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twesolek

PROJECT REFERENCE NO.	SHEET NO.
X-0002C	8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

METRIC

H 5 0 10

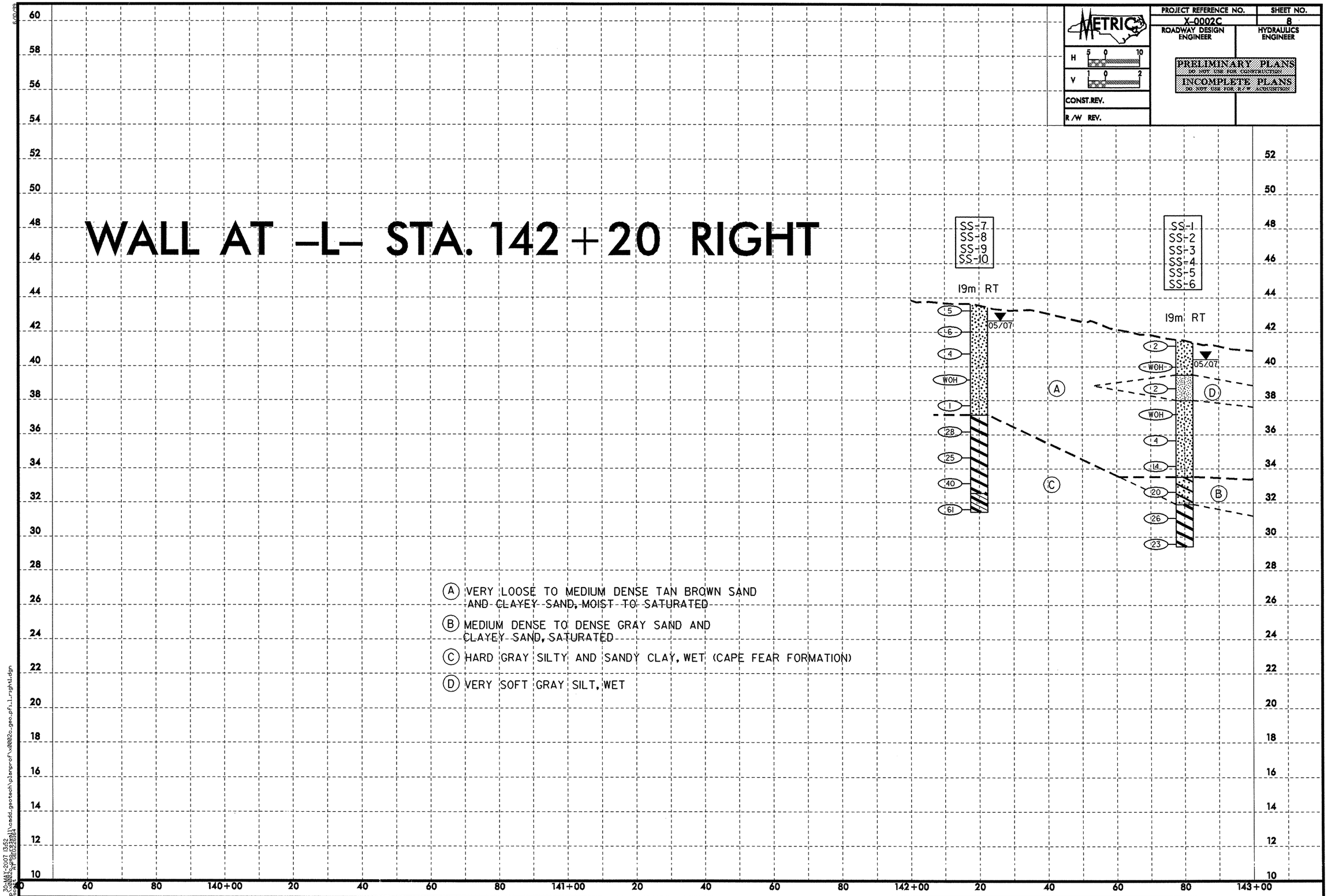
V 1 0 2

CONST.REV.

R/W REV.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

WALL AT –L– STA. 142+20 RIGHT

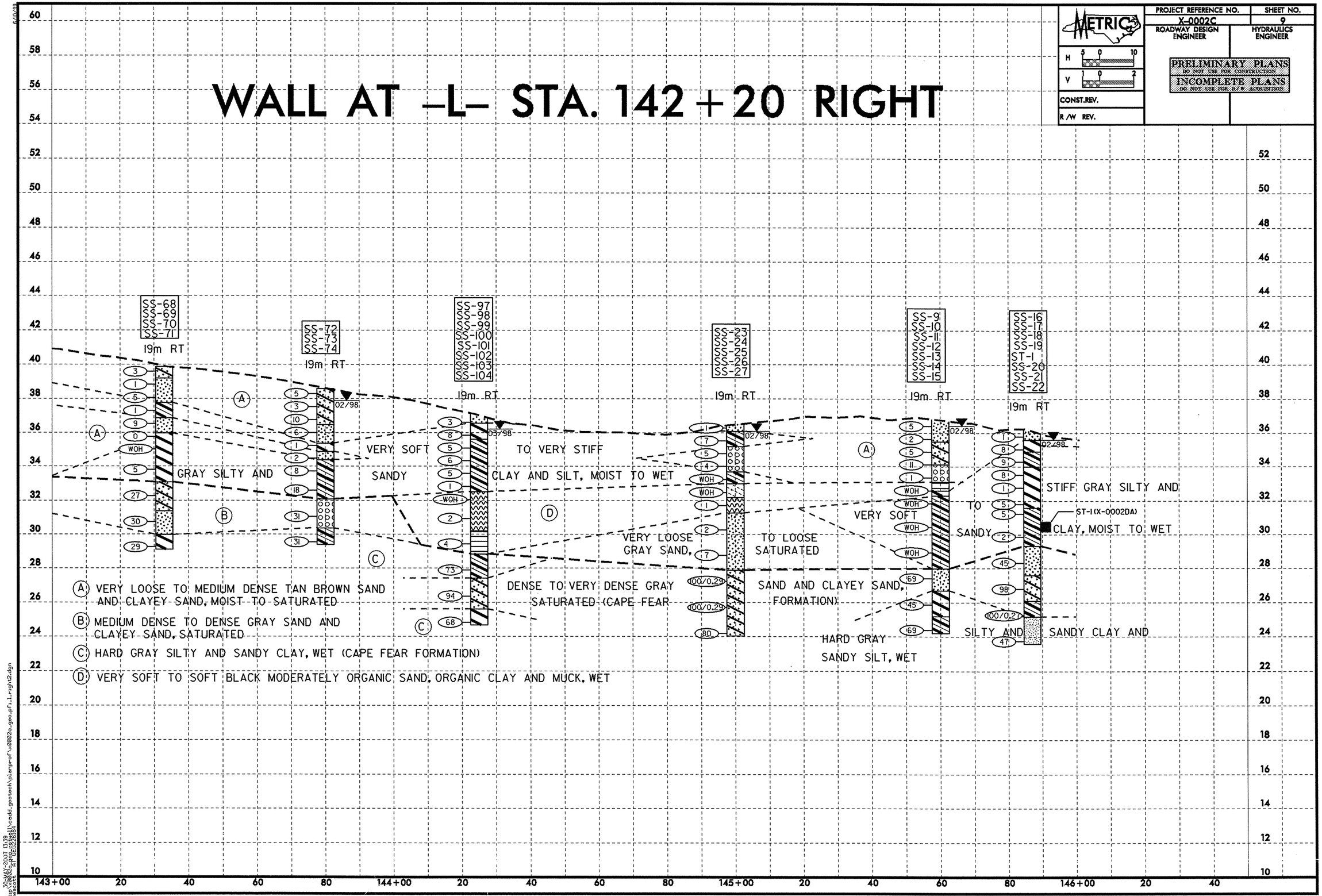


(A) VERY LOOSE TO MEDIUM DENSE TAN BROWN SAND AND CLAYEY SAND, MOIST TO SATURATED

(B) MEDIUM DENSE TO DENSE GRAY SAND AND CLAYEY SAND, SATURATED

(C) HARD GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)

(D) VERY SOFT GRAY SILT, WET



WALL AT -L- STA. 142+20 RIGHT
METRIC
PROJECT REFERENCE NO.
X-0002C
SHEET NO.
9
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
CONST.REV.
R/W REV.
SS-68
SS-69
SS-70
SS-71
19m RT
SS-72
SS-73
SS-74
19m RT
SS-97
SS-98
SS-99
SS-100
SS-101
SS-102
SS-103
SS-104
19m RT
SS-23
SS-24
SS-25
SS-26
SS-27
19m RT
SS-9
SS-10
SS-11
SS-12
SS-13
SS-14
SS-15
19m RT
SS-16
SS-17
SS-18
SS-19
ST-1
SS-20
SS-21
SS-22
19m RT
GRAY SILTY AND
VERY SOFT
SANDY
TO VERY STIFF
CLAY AND SILT, MOIST TO WET
VERY LOOSE
GRAY SAND,
TO LOOSE
SATURATED
DENSE TO VERY DENSE GRAY
SATURATED (CAPE FEAR
SAND AND CLAYEY SAND,
FORMATION)
VERY SOFT
TO
SANDY
STIFF GRAY SILTY AND
ST-1(X-0002DA)
CLAY, MOIST TO WET
HARD GRAY
SANDY SILT, WET
SILTY AND
SANDY CLAY AND
(A) VERY LOOSE TO MEDIUM DENSE TAN BROWN SAND AND CLAYEY SAND, MOIST TO SATURATED
(B) MEDIUM DENSE TO DENSE GRAY SAND AND CLAYEY SAND, SATURATED
(C) HARD GRAY SILTY AND SANDY CLAY, WET (CAPE FEAR FORMATION)
(D) VERY SOFT TO SOFT BLACK MODERATELY ORGANIC SAND, ORGANIC CLAY AND MUCK, WET
143+00
144+00
145+00
146+00

WALL AT -L- STA. 147+00 RIGHT

METRIC

PROJECT REFERENCE NO.: X-0002C
SHEET NO.: 10

ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER

H 5 0 10
V 1 0 2

CONST.REV.
R/W REV.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

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Soil Sample Test Results -Y4-

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-53	10+40	7m LT	0.76-1.21	A-2-4(0)	17	NP	58.5	29.7	7.4	4.4	99	62	13		
SS-54	10+80	4m LT	0.80-1.30	A-1-b(0)	19	NP	74.5	16.4	6.6	2.4	96	43	9		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-7	142+20	19m RT	0.00-0.45	A-2-4(0)	15	NP	48.7	27.8	13.0	10.5	100	71	24		
SS-8	142+20	19m RT	4.02-4.47	A-2-4(0)	15	NP	50.7	27.0	12.2	10.1	100	70	23		
SS-9	142+20	19m RT	7.02-7.52	A-7-5(2)	42	11	34.3	22.1	14.8	28.8	100	81	45		
SS-10	142+20	19m RT	11.64-12.09	A-6(6)	39	13	28.2	15.4	35.7	20.7	100	82	57		
SS-1	142+80	19m RT	0.00-0.45	A-2-4(0)	20	NP	37.9	33.1	18.5	10.5	100	78	29		
SS-2	142+80	19m RT	2.50-2.95	A-4(0)	36	8	47.9	16.4	11.0	24.7	100	69	36		
SS-3	142+80	19m RT	4.02-4.47	A-2-4(0)	27	6	43.4	22.1	11.8	22.7	100	73	35		
SS-4	142+80	19m RT	5.54-5.99	A-2-4(0)	30	7	47.7	19.1	12.6	20.7	100	68	34		
SS-5	142+80	19m RT	8.59-9.04	A-2-6(0)	32	11	56.4	19.5	7.5	16.6	100	68	25		
SS-6	142+80	19m RT	10.11-10.56	A-7-6(16)	43	18	8.9	8.3	31.6	51.1	100	95	84	14.3	
SS-68	143+33	19m RT	2.28-2.73	A-6(1)	30	15	41.2	24.8	15.8	18.2	100	75	36	25.1	
SS-69	143+33	19m RT	4.56-5.01	A-7-5(30)	61	28	7.9	2.8	24.6	64.6	100	95	89	51.1	
SS-70	143+33	19m RT	7.30-7.75	A-2-6(1)	37	16	53.7	20.4	17.8	8.1	88	57	24	17	
SS-71	143+33	19m RT	10.34-10.79	A-7-6(3)	41	12	12.3	47.1	30.5	10.1	100	95	48	25	
SS-72	143+80	19m RT	0.76-1.21	A-2-6(1)	30	15	38.4	29.9	13.5	18.2	100	79	35	24.5	
SS-73	143+80	19m RT	4.56-5.01	A-6(3)	34	18	23.8	38.0	18.0	20.2	100	92	41	23.9	
SS-74	143+80	19m RT	8.75-9.20	A-6(1)	40	12	29.9	37.2	24.8	8.1	100	81	39	23.1	
SS-97	144+25	19m RT	0.76-1.21	A-7-6(9)	49	27	38.4	13.3	13.9	34.3	100	78	49	21.3	
SS-98	144+25	19m RT	2.28-2.73	A-6(6)	37	19	32.1	19.6	13.9	34.3	100	83	51	23.3	
SS-99	144+25	19m RT	3.80-4.25	A-6(3)	31	16	37.4	23.2	13.1	26.3	98	77	43		
SS-100	144+25	19m RT	4.56-5.01	A-7-5(8)	61	20	41.0	8.9	15.8	34.3	100	68	51	154.8	25.0
SS-101	144+25	19m RT	7.20-7.65	A-4(4)	30	7	6.9	28.7	44.2	20.2	100	94	76	49.2	3.8
SS-102	144+25	19m RT	8.73-9.18	A-6(3)	31	12	29.1	30.3	32.5	8.1	100	85	47	13.8	
SS-103	144+25	19m RT	10.25-10.70	A-2-6(1)	40	16	52.7	20.6	20.6	6.1	97	61	30		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-104	144+25	19m RT	11.78-12.23	A-7-6(8)	41	16	16.0	29.3	44.6	10.1	100	91	62	27.7	
SS-23	145+00	19m RT	0.76-1.21	A-6(8)	38	19	21.6	25.3	22.8	30.3	100	91	57	20.9	
SS-24	145+00	19m RT	3.04-3.49	A-6(2)	35	14	44.6	17.0	10.1	28.3	100	71	39	69.9	
SS-25	145+00	19m RT	3.80-4.25	A-2-5(0)	68	NP	53.7	14.9	19.2	12.1	100	60	33		
SS-26	145+00	19m RT	2.53-2.98	A-2-4(0)	24	NP	3.2	78.0	14.7	4.0	100	99	23	33.4	
SS-27	145+00	19m RT	12.10-12.55	A-2-7(1)	44	14	47.9	24.2	23.8	4.0	100	65	33		
SS-9	145+60	19m RT	1.52-1.97	A-2-6(1)	30	15	43.6	23.2	10.9	22.2	100	76	35	15.1	
SS-10	145+60	19m RT	3.80-4.25	A-7-5(11)	49	15	24.0	12.5	47.3	16.2	100	82	68	33.6	
SS-11	145+60	19m RT	4.56-5.01	A-6(19)	39	19	2.0	4.0	53.5	10.4	100	98	96		
SS-12	145+60	19m RT	5.96-6.41	A-6(9)	33	12	2.8	19.4	55.6	22.2	100	98	84	26.7	
SS-13	145+60	19m RT	9.00-9.45	A-2-4(0)	38	10	39.8	30.1	26.1	4.0	98	78	32	18.3	
SS-14	145+60	19m RT	10.52-10.97	A-7-5(3)	46	13	34.5	27.7	31.7	6.1	100	77	43		
SS-15	145+60	19m RT	12.04-12.49	A-6(1)	33	12	14.3	51.3	28.3	6.1	100	98	39	20.0	
SS-16	145+87	19m RT	0.76-1.21	A-7-6(3)	43	21	49.3	16.0	8.5	26.3	100	67	36		
SS-17	145+87	19m RT	1.56-2.01	A-6(2)	32	17	36.6	29.1	10.1	24.2	100	81	36	20.5	
SS-18	145+87	19m RT	2.28-2.73	A-7-6(18)	50	27	19.0	13.5	19.0	48.5	100	88	70	22.1	
SS-19	145+87	19m RT	3.98-4.43	A-7-6(30)	50	27	1.2	2.0	44.2	52.5	100	99	98	34.3	
ST-1	145+87	19m RT	5.32-5.93	A-6(14)	37	18	2.6	18.2	45.1	34.1	98	96	83	32.3	
SS-20	145+87	19m RT	5.93-6.48	A-6(13)	35	14	0.6	15.4	55.8	28.3	100	100	90	17.9	
SS-21	145+87	19m RT	9.01-9.46	A-2-7(1)	42	17	51.3	23.0	21.6	4.0	95	62	27	19.1	
SS-22	145+87	19m RT	12.06-13.51	A-4(0)	33	7	31.9	37.6	28.5	2.0	100	82	36	19.1	
SS-44	147+20	19m RT	0.76-1.21	A-6(6)	31	17	22.0	26.7	29.1	22.2	100	87	57	18.5	
SS-45	147+20	19m RT	3.04-3.49	A-7-6(39)	58	36	1.6	3.8	40.0	54.5	100	99	96	29.2	
SS-46	147+20	19m RT	4.56-5.01	A-4(1)	25	5	2.0	44.0	33.7	20.2	100	99	63		
SS-47	147+20	19m RT	7.14-7.59	A-3(0)	16	NP	75.2	19.6	3.2	2.0	100	65	6		
SS-48	147+20	19m RT	8.56-9.11	A-6(7)	38	20	0.8	20.4	48.5	30.3	100	99	86		
SS-53	147+80	19m RT	0.76-1.21	A-4(0)	24	8	12.5	53.5	15.8	18.2	100	97	39		
SS-54	147+80	19m RT	2.28-2.73	A-7-5(38)	65	32	3.2	1.8	26.3	68.7	100	98	96	53.6	
SS-55	147+80	19m RT	3.80-4.25	A-6(13)	40	14	7.1	10.5	60.2	22.2	99	94	85		
SS-56	147+80	19m RT	4.56-5.01	A-6(17)	38	20	0.8	20.4	48.5	30.3	100	99	86		

Soil Sample Test Results -L- RIGHT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-57	147+80	19m RT	8.73-9.18	A-2-4(0)	18	3	55.8	18.6	19.6	6.1	100	78	28		
SS-65	148+40	19m RT	1.52-1.97	A-7-6(33)	57	29	1.0	4.8	33.5	60.6	22.2	99	94	85.0	
SS-66	148+40	19m RT	8.84-9.29	A-6(1)	35	12	40.2	24.4	25.3	10.1	100	84	37	17.5	
SS-67	148+40	19m RT	10.36-10.81	A-2-4(0)	34	10	48.5	34.5	14.9	2.0	100	70	21	21.8	
SS-165	148+80	19m RT	1.24-1.69	A-4(2)	25	7	3.2	46.1	30.5	20.2	100	99	59		
SS-166	148+80	19m RT	2.00-2.45	A-3(0)	48	NP	79.8	16.0	4.2	0.0	100	64	6		
SS-167	148+80	19m RT	3.52-3.97	A-3(0)	16	NP	77.0	19.6	3.4	0.0	100	61	7		
SS-168	148+80	19m RT	5.04-5.49	A-7-6(4)	44	16	28.1	31.9	29.9	10.1	100	88	45	27.6	
SS-169	148+80	19m RT	5.82-6.27	A-2-6(1)	34	13	37.8	31.5	20.6	10.1	98	83	34		
SS-170	148+80	19m RT	8.86-9.31	A-2-6(0)	40	20	76.0	12.7	7.3	4.0	100	54	13		
SS-171	148+80	19m RT	11.90-12.35	A-4(4)	32	10	20.0	31.7	38.2	10.1	100	88	63	18.0	

Soil Sample Test Results -L- LEFT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-75	143+50	19m LT	2.28-2.73	A-2-4(0)	20	5	43.0	32.5	14.3	10.1	100	77	28	21.8	
SS-76	143+50	19m LT	3.80-4.25	A-7-6(18)	55	32	23.0	14.9	17.6	44.4	100	88	63	31.7	
SS-77	143+50	19m LT	5.75-6.20	A-2-5(0)	47	NP	60.6	23.0	14.3	2.0	100	58	19	84.6	20.9
SS-78	143+50	19m LT	11.83-12.28	A-2-4(0)	25	NP	43.0	39.6	15.4	2.0	100	79	19		
SS-93	144+10	19m LT	1.52-1.97	A-6(2)	33	17	43.0	22.0	16.8	18.2	100	75	37	17.1	
SS-94	144+10	19m LT	3.80-4.25	A-6(1)	30	13	41.2	25.1	15.6	18.2	100	77	36	24.9	
SS-95	144+10	19m LT	5.81-6.26	A-2-6(1)	40	20	62.8	13.3	13.7	10.1	97	58	25	21.6	
SS-96	144+10	19m LT	7.33-7.78	A-7-5(8)	57	17	37.0	9.3	31.5	22.2	97	68	54		
SS-105	144+60	19m LT	0.76-1.21	A-2-4(0)	24	4	69.9	16.0	4.0	10.1	97	56	14		
SS-106	144+60	19m LT	2.28-2.73	A-7-5(24)	60	21	7.9	4.4	27.1	60.6	100	95	88	74.5	
SS-107	144+60	19m LT	3.04-3.49	A-7-5(28)	67	28	14.7	4.8	17.8	62.6	100	89	82	54.6	16.0
SS-108	144+60	19m LT	3.80-4.25	A-1-b(0)	122	NP	60.6	14.1	17.2	8.1	90	47	24		64.8
SS-109	144+60	19m LT	4.56-5.01	A-7-5(31)	58	28	2.6	2.4	34.3	60.6	100	95	88	74.5	10.3
SS-110	144+60	19m LT	8.78-9.23	A-2-6(1)	38	16	56	23.4	12.5	8.1	100	62	25		
SS-111	144+60	19m LT	10.30-10.75	A-6(9)	38	13	5.9	30.5	53.5	10.1	100	97	71	19.9	
SS-28	145+20	19m LT	1.52-1.97	A-1-b(0)	18	NP	84.8	14.9	0.2	0.0	97	49	0		

Soil Sample Test Results -L- LEFT

SAMPLE NO.	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	2.0 mm	425 um	75 um		
SS-29	145+20	19m LT	3.05-3.50	A-1-b(0)	18	NP	88.3	6.9	4.8	0.0	92	17	5		
SS-30	145+20	19m LT	3.81-4.26	A-7-5(20)	52	21	11.5	6.5	29.5	52.5	100	91	84	57.8	
SS-31	145+20	19m LT	5.91-6.36	A-4(3)	26	7	4.4	33.3	42.0	20.2	100	96	70	26.0	
SS-32	145+20	19m LT	8.96-9.41	A-2-6(1)	37	13	40.0	30.3	23.6	6.1	99	75	34		
SS-85	145+60	23m LT	1.52-1.97	A-2-6(1)	32	18	54.9	18.0	17.0	10.1	100	63	29		
SS-86	145+60	23m LT	2.28-2.73	A-2-4(0)	15	NP	67.9	18.8	11.3	2.0	99	60	14		
SS-87	145+60	23m LT	3.04-3.49	A-2-4(0)	27	9	37.4	30.9	21.6	10.1	100	78	35	34.0	
SS-88	145+60	23m LT	3.80-4.25	A-7-5(12)	46	17	29.1	8.9	25.7	36.4	100	79	63	69.0	25.6
SS-89	145+60	23m LT	4.56-5.01	A-7-6(25)	46	23	1.0	2.6	47.9	48.5	100	99	98	37.2	
SS-90	145+60	23m LT	7.32-7.77	A-6(18)	39	16	0.6	6.9	64.2	28.3	100	100	96	30.2	
SS-91	145+60	23m LT	10.36-10.81	A-6(5)	38	16	30.1	26.7	41.2	2.0	100	83	46	119.8	
SS-38	146+91	19m LT	1.52-1.97	A-4(1)	24	9	15.8	46.5	19.6	18.2	100	95	42		
SS-39	146+91	19m LT	3.04-3.49	A-7-6928)	68	39	18.2	12.1	9.1	60.6	100	87	71	47.5	
ST-2	146-91	19m LT	4.56-5.17	A-6(17)	39	19	1.4	18.4	43.8	36.4	100	99	88		
SS-40	146+91	19m LT	5.80-6..25	A-4(4)	27	9	2.2	36.8	36.8	24.2	100	99	69	28.8	
SS-41	146+91	19m LT	7.32-7.77	A-2-4(0)	15	NP	62.4	21.6	11.9	4.0	100	83	18		
SS-42	146+91	19m LT	8.84-9.29	A-4(2)	35	6	12.7	37.8	45.5	4.0	100	93	58	21.0	
SS-43	146+91	19m LT	11.88-12.33	A-2-4(0)	32	NP	48.3	30.1	17.6	4.0	99	75	24	18.3	
SS-49	147+40	19m LT	1.52-1.97	A-6(6)	37	18	20.0	32.9	18.8	28.3	100	88	52	18.6	
SS-50	147+40	19m LT	3.80-4.25	A-7-6(29)	53	25	1.2	2.0	42.2	54.5	100	99	98	30.5	
SS-51	147+40	19m LT	7.25-7.70	A-3(0)	17	NP	71.7	20.6	7.7	0.0	100	71	9		
SS-52	147+40	19m LT	10.30-10.75	A-4(0)	33	6	7.9	58.2	27.9	6.1	100	98	40	19.5	
SS-58	148+00	19m LT	1.51-1.96	A-6(1)	29	12	29.7	33.5	12.5	24.2	100	85	41	20.3	
ST-3	148+00	19m LT	3.52-4.12	A-7-6(43)	63	39	0.6	3.6	41.2	54.5	100	100	97		
SS-59	148+00	19m LT	4.12-4.57	A-7-6(24)	50	22	1.2	8.5	43.8	46.5	100	99	93	33.6	
SS-60	148+00	19m LT	7.26-7.71	A-2-7(0)	42	14	58.2	21.0	16.8	4.0	96	56	23	16.8	
SS-61	148+00	19m LT	8.78-9.23	A-6(6)	40	12	12.7	30.8	46.4	10.1	99	92	62		
SS-62	148+50	19m LT	3.15-3.60	A-7-5(36)	66	32	5.3	3.0	29.1	62.6	100	96	92		
SS-63	148+50	19m LT	4.67-5.11	A-6(6)	31	12	1.4	39.6	34.7	24.2	100	100	65	30.2	
SS-64	148+50	19m LT	11.77-12.22	A-6(3)	35	12	21.6	33.1	29.1	16.2	100	93	49	19	