ID: B-4584

PROJECT: 33785.1.1

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4584	1	20

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
33785.1.1		P.E.
		CONST.

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33785.1.1 I.D. NO. B-4584

F.A. PROJECT

COUNTY MOORE

PROJECT DESCRIPTION

BRIDGE 11 OVER LITTLE RIVER

SITE DESCRIPTION

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CAUTION NOTICE

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

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INVESTIGATED BY J. HAMM PERSONNEL J. HAMM, T. EVANS

CHECKED BY G. LANG, P.E.

SUBMITTED BY FALCON ENGINEERING

DATE APRIL, 2009

DRAWN BY: J. HAMM, T. EVANS

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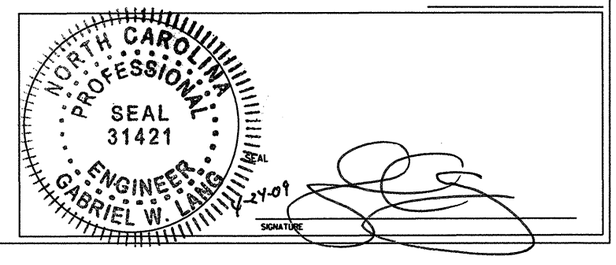


PROJECT REFERENCE NO.	SHEET NO.
33785.1.1	2

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

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	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	
CLASS.	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
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	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT PLASTIC INDEX	6 MX			NP	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

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 ($TONS/FT^2$)
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 1.0 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	2.00	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) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- 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
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-45
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 3 " STEEL TEETH
- [ ] TRICONE __ " TUNG.-CARB.
- [X] CORE BIT
- [X] DRAG BIT

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N Q____
- [ ] -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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT 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 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 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 0.25 INCHES 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 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A 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 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS 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 4 INCHES 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 OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

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 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

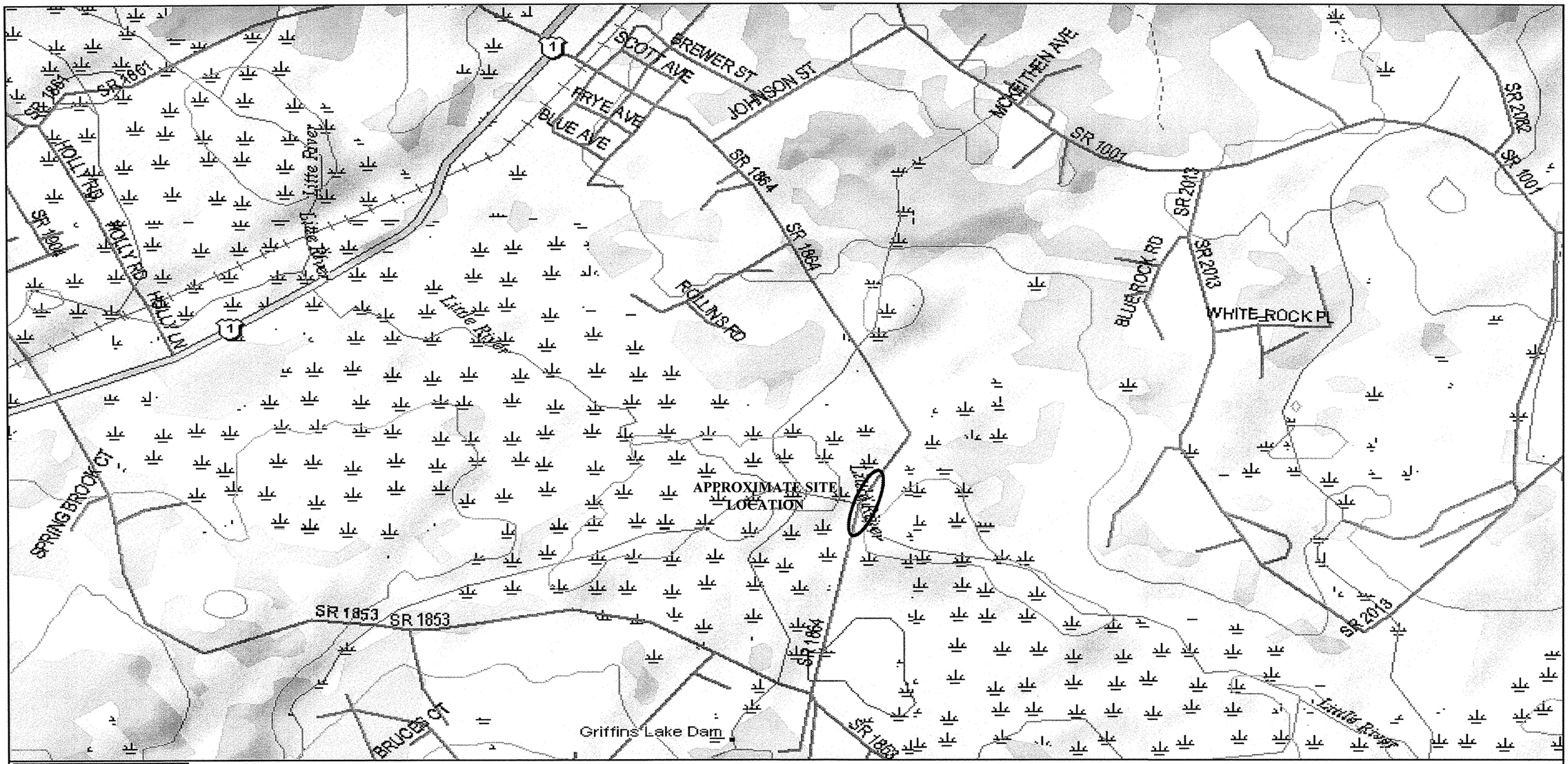
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM#1-L- STA. 15+64.10, 71.0' LT

ELEVATION: 238.24 FT.

NOTES:

REVISED 02/23/06



SITE VICINITY MAP

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
TIP NO: B-4584, STATE PROJECT NO: 33785.1.1

FALCON ENGINEERING

FALCON ENGINEERING, INC.
2736 ROWLAND RD.
RALEIGH, NC 27615
PHONE (919) 871-0800
FAX (919) 871-0803

BMI ELEVATION = 238.24'
N 540368 E 1916561
BL STATION 10+72 57' LEFT
RR SPIKE IN BASE OF 15" GUM
= -L- POT STA. 15+64.10
71.00' LT.

15+00

STATE GRID NORTH

BONITA BLUE
DB 2041 PG 514

HIGH WATER MARK
ELEV = 239.38'
DETERMINED BY FIELD CREW
7-11-07

BRIDGE SEAT
ELEV = 246.24

S 54°32'38" E
99.02'

ALTON TINNEY, JR.
DB 624 PG 353

GRAU-350

EB1-A

B1-A

B1-B

BRIDGE # 11
WOOD & STEEL
WITH PAVED DECK

B2-A

B2-B

EB2-B

-L-

SR 1864 LONG POINT ROAD

WOOD W.W.

GRAU-350

WOODS

BETTYRENE RICHARDSON
DB 845 PG 52

S 47°34'02" E
41.72'

S 03°09'00" E
113.98'

LITTLE RIVER

S 15°23'43" E
60.50'

MACK BLUE
DB 495 PG 382

0 40 80
FEET

NOTES:

PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM NCDOT, DATED FEBRUARY 2009.

PROPOSED BRIDGE SKEW: 90 DEGREES

BORING LOCATION PLAN

BRIDGE 11 ON SR 1864 LONG POINT ROAD OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
NCDOT PROJECT NO.: 33785.1.1
TIP NO.: B-4584

FALCON ENGINEERING
FALCON ENGINEERING, INC.
2376 ROWLAND RD.
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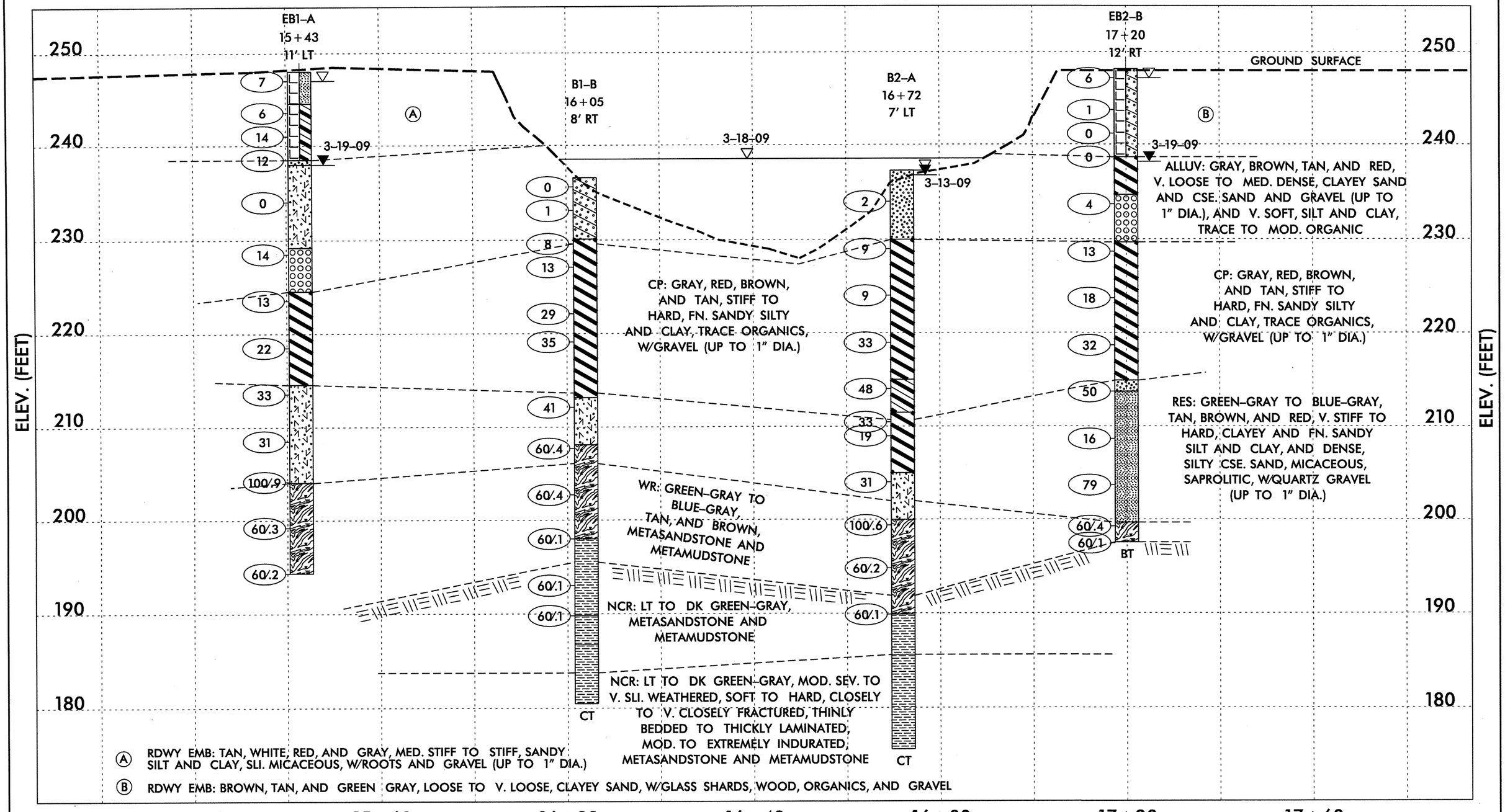

VERTICAL SCALE 0 10 20

HORIZONTAL SCALE 0 20 40

NOTES:

- GROUNDLINE ADOPTED FROM SURVEY DATA IN ELECTRONIC FILES RECIEVED FROM NCDOT, DATED FEBRUARY, 2009
- BRIDGE SKEW: APPROX. 90 DEGREES

SUBSURFACE PROFILE ALONG –L–

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
PROJECT NO: 33785.1.1
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FALCON ENGINEERING
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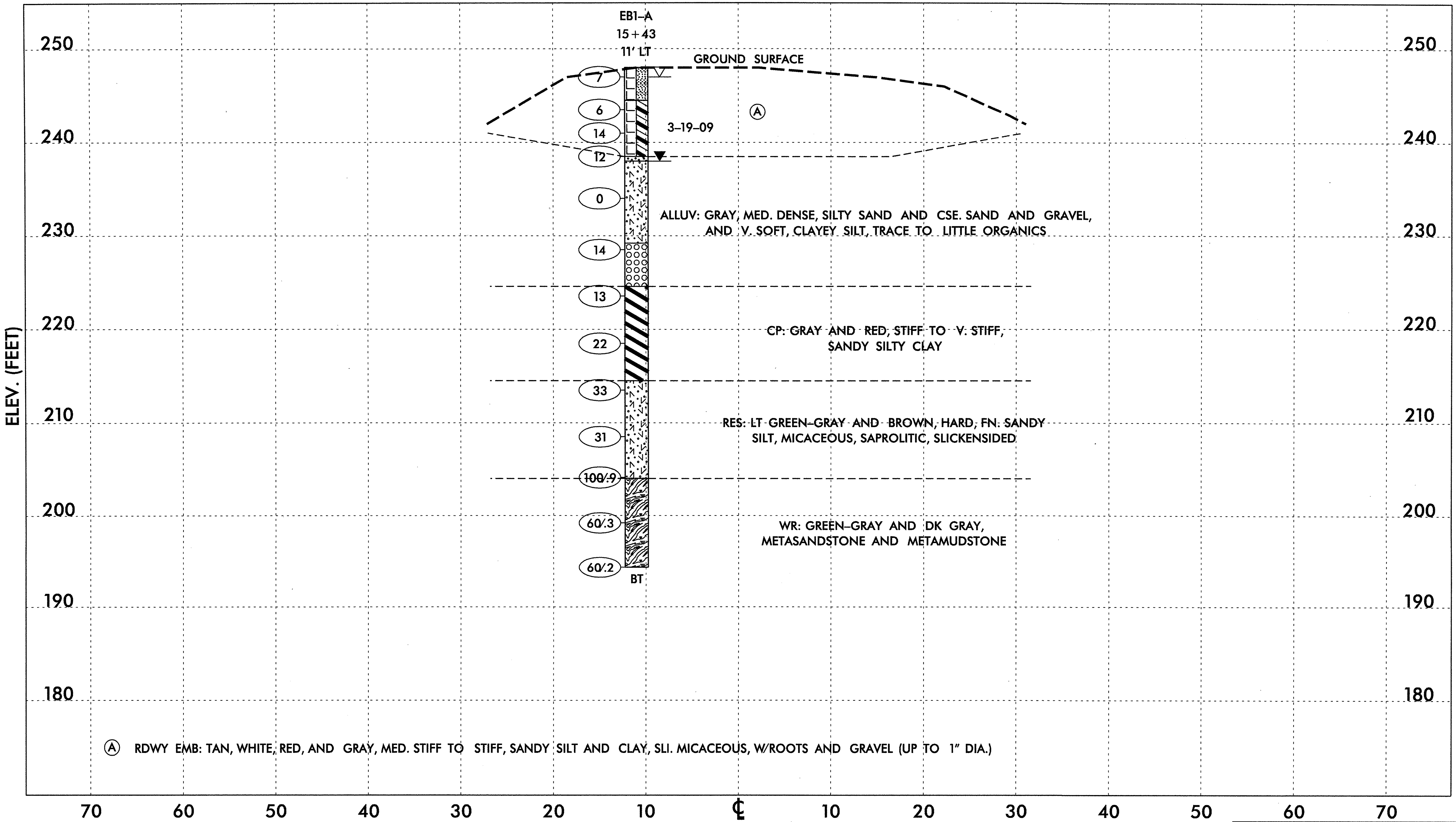


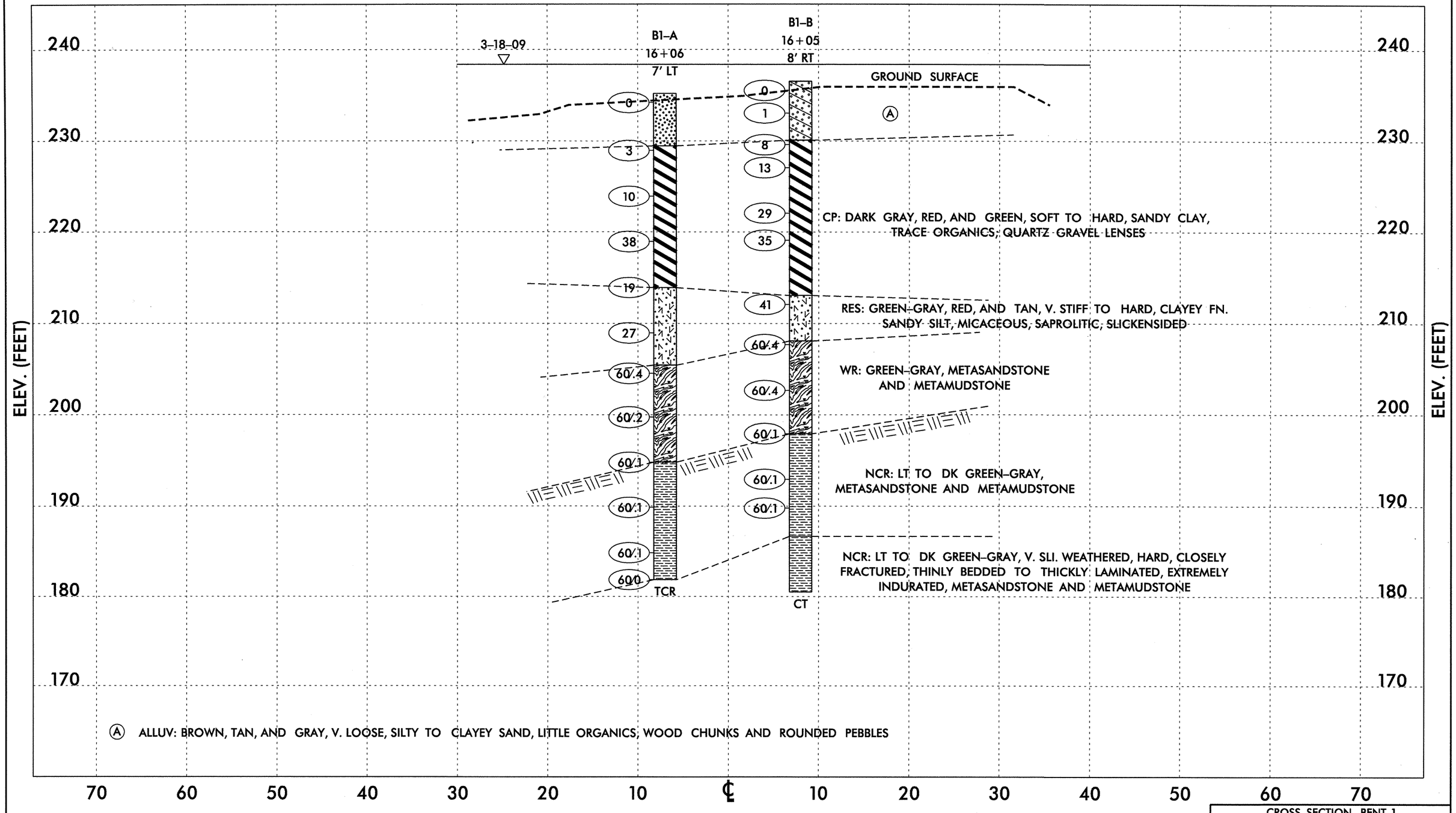
NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECIEVED FROM NCDOT, DATED FEBRUARY, 2009
- BRIDGE SKEW: APPROX. 90 DEGREES

CROSS SECTION END BENT 1

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
PROJECT NO: 33785.1.1
TIP NO: B-4584

FALCON ENGINEERING



NOTES:
- PLANS ADOPTED FROM ELECTRONIC FILES RECIEVED FROM NCDOT, DATED FEBRUARY, 2009
- BRIDGE SKEW: APPROX. 90 DEGREES

CROSS SECTION BENT 1

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
PROJECT NO: 33785.1.1
TIP NO: B-4584

FALCON ENGINEERING

FALCON ENGINEERING, PC.
3736 ROYLAND RD.
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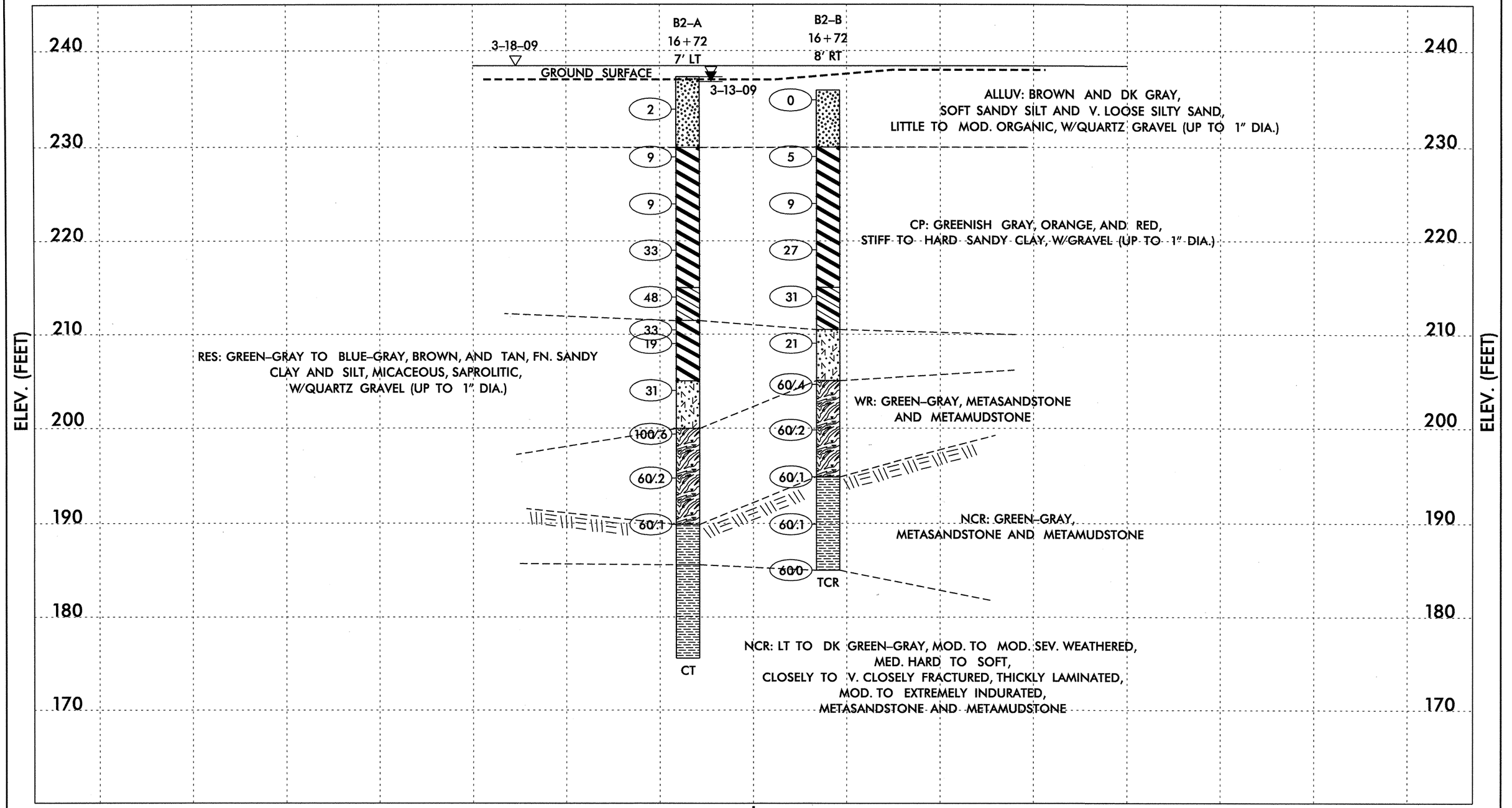

VERTICAL SCALE 0 10 20

HORIZONTAL SCALE 0 10 20

NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECIEVED FROM NCDOT, DATED FEBRUARY, 2009
- BRIDGE SKEW: APPROX. 90 DEGREES

CROSS SECTION BENT 2

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
PROJECT NO: 33785.1.1
TIP NO: B-4584

FALCON ENGINEERING
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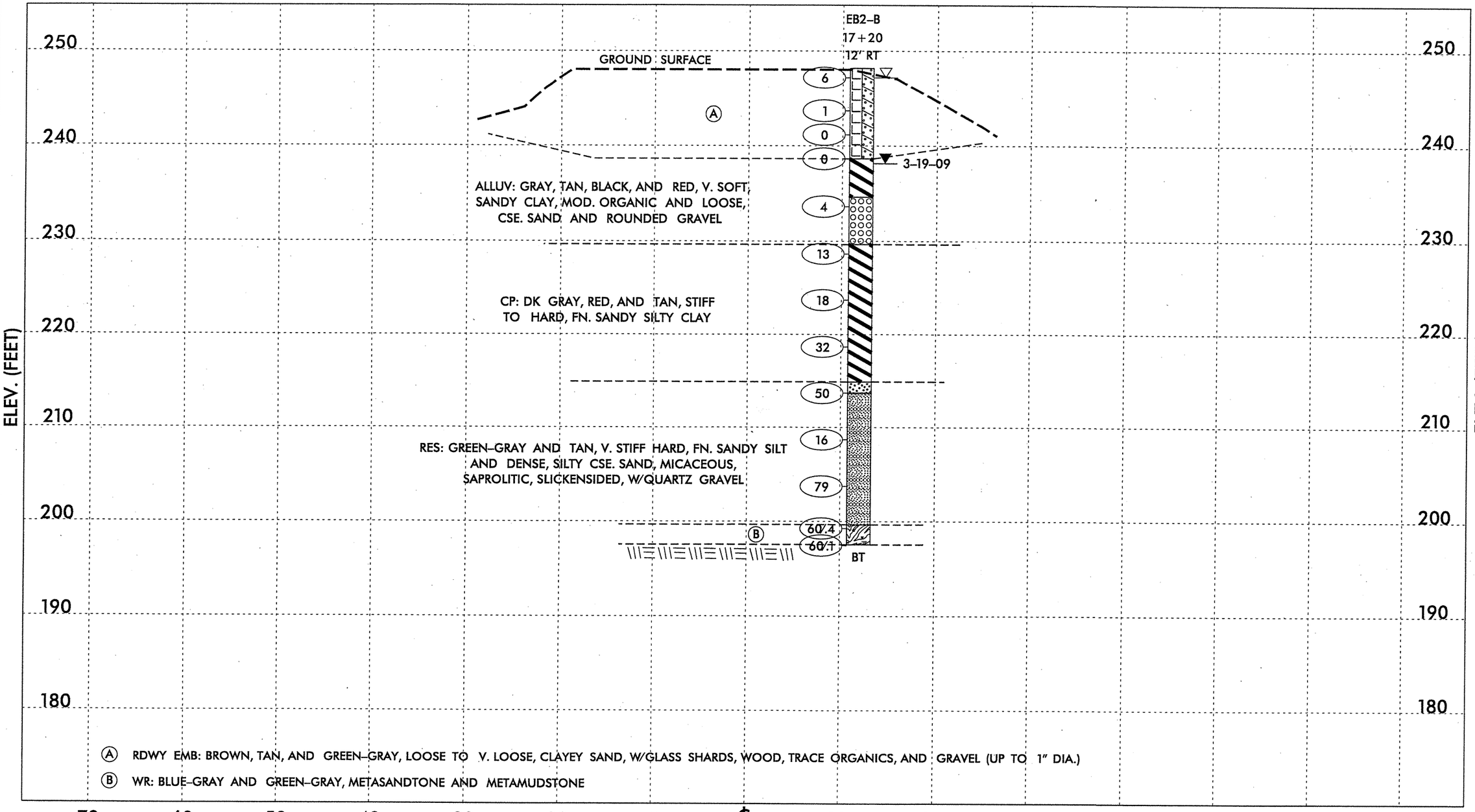


Ⓐ RDWY EMB: BROWN, TAN, AND GREEN–GRAY, LOOSE TO V. LOOSE, CLAYEY SAND, W/GLASS SHARDS, WOOD, TRACE ORGANICS, AND GRAVEL (UP TO 1" DIA.)

Ⓑ WR: BLUE–GRAY AND GREEN–GRAY, METASANDTONE AND METAMUDSTONE

VERTICAL SCALE 0 10 20

HORIZONTAL SCALE 0 10 20

NOTES:
- PLANS ADOPTED FROM ELECTRONIC FILES RECIEVED FROM NCDOT, DATED FEBRUARY, 2009
- BRIDGE SKEW: APPROX. 90 DEGREES

CROSS SECTION END BENT 2

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
PROJECT NO: 33785.1.1
TIP NO: B-4584

FALCON ENGINEERING
FALCON ENGINEERING, INC.
3736 HOWARD ST.
FALCON, NC 27313

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE		**GEOLOGIST** J. HAMM
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 15+43	**OFFSET** 11ft LT	**ALIGNMENT** -L-	**0 HR.** 1.0
COLLAR ELEV. 248.0 ft	**TOTAL DEPTH** 53.7 ft	**NORTHING** 540,324	**EASTING** 1,916,607	**24 HR.** 10.0
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/11/09	**COMP. DATE** 03/12/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
										248.0 EXISTING GROUND SURFACE 0.0
	247.0	1.0	2	3	4	7		M		**ROADWAY EMBANKMENT** TAN, WHITE, AND RED, MED. STIFF, SANDY SILT (A-4) W/ ROOTS
245	244.5	3.5	3	3	3	6 14	SS-1	19%		244.5 3.5 **ROADWAY EMBANKMENT** TAN AND GRAY, MOTTLED, MED. STIFF TO STIFF, SANDY CLAY (A-6) SLI. MICACEOUS, W/ GRAVEL (UP TO 1" DIA.)
	242.0	6.0	1	3	11			W		
240	239.5	8.5	7	6	6	12		W		238.5 9.5
										238.0 10.0 **ALLUVIAL** GRAY, MED. DENSE, SILTY SAND (A-2-4) TRACE ORGANICS
235	234.5	13.5	WOH	WOH	WOH	0		Sat.		**ALLUVIAL** DK GRAY, V. SOFT, CLAYEY SILT (A-5) LITTLE ORGANICS
230	229.5	18.5	4	8	6	14		Sat.		229.2 18.8 **ALLUVIAL** GRAY, MED. DENSE, CSE. SAND AND GRAVEL (A-1-a)
225	224.5	23.5	3	5	8	13		M		224.5 23.5 **COASTAL PLAIN** GRAY AND RED, STIFF TO V. STIFF, SANDY SILTY CLAY (A-7)
220	219.5	28.5	5	9	13	22		M		
215	214.5	33.5	4	11	22	33	SS-2	25%		214.5 33.5 **RESIDUAL** LT GREEN-GRAY AND BROWN, HARD, FN. SANDY SILT (A-5) MICACEOUS, SAPROLITIC, SLICKENSIDED
210	209.5	38.5	5	10	21	31		M		
205	204.5	43.5	30	50	50/.4	100/.9		M		204.0 44.0 **WEATHERED ROCK** GREEN-GRAY TO DARK GRAY, METASANDSTONE AND METAMUDSTONE
200	199.5	48.5	60/.3			60/.3		M		
195	194.5	53.5	60/.2			60/.2		M		194.3 53.7 Boring Terminated with SPT REFUSAL at Elevation 194.3 ft IN WR: METASANDSTONE AND METAMUDSTONE
190										
185										
180										
175										
170										

NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE		**GEOLOGIST** J. HAMM
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 16+06	**OFFSET** 7ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 235.2 ft	**TOTAL DEPTH** 53.4 ft	**NORTHING** 540,381	**EASTING** 1,916,636	**24 HR.** N/A
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/18/09	**COMP. DATE** 03/19/09	**SURFACE WATER DEPTH** 2.9ft	**DEPTH TO ROCK** 40.3 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
										WATER SURFACE (03/18/09)
	240									
235	234.9	0.3								235.2 0.0 EXISTING GROUND SURFACE
			WOH	WOH	WOH	0	SS-3	Sat.		**ALLUVIAL** BROWN AND GRAY, V. LOOSE, SILTY FN. TO CSE. SAND (A-2-4) LITTLE ORGANICS AND WOOD CHUNKS
230	229.9	5.3	4	2	1	3		W		229.4 5.8 **COASTAL PLAIN** DK GRAY, RED, AND GREEN, SOFT TO HARD, SLI. SANDY SILTY CLAY (A-7-5) TRACE ORGANICS, QUARTZ GRAVEL LENS FROM 17.8' TO 18.8'
225	224.9	10.3	3	5	5	10	SS-4	28%		
220	219.9	15.3	11	16	22	38		M		
215	213.9	21.3	12	10	9	19	SS-5	25%		213.9 21.3 **RESIDUAL** GREEN-GRAY, V. STIFF, FN. SANDY SILT (A-5) MICACEOUS, SAPROLITIC
210	209.9	25.3	10	11	16	27		M		
205	204.9	30.3	60/.4			60/.4		M		205.4 29.8 **WEATHERED ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
200	199.9	35.3	60/.2			60/.2		M		
195	194.9	40.3	60/.1			60/.1		M		194.9 40.3 **NON-CRYSTALLINE ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
190	189.9	45.3	60/.1			60/.1		M		
185	184.9	50.3	60/.1			60/.1		M		
180	181.8	53.4	60/0			60/0				181.8 53.4 Boring Terminated WITH SPT AND TRICONE REFUSAL at Elevation 181.8 ft IN NCR: GREEN-GRAY, METASANDSTONE AND METAMUDSTONE NOTE: CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK
175										
170										
165										
160										

NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM	
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 16+05	**OFFSET** 8ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 236.6 ft	**TOTAL DEPTH** 56.1 ft	**NORTHING** 540,374	**EASTING** 1,916,650	**24 HR.** N/A
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/10/09	**COMP. DATE** 03/12/09	**SURFACE WATER DEPTH** 0.3ft	**DEPTH TO ROCK** 38.5 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
	240									
	236.6	0.0								236.6 EXISTING GROUND SURFACE 0.0
235	234.1	2.5	WOH	WOH	WOH	0		Sat.		**ALLUVIAL** BROWN, TAN, AND GRAY, V. LOOSE, CLAYEY SAND (A-2-6) W/ ROUNDED PEBBLES
230	230.6	6.0	WOH	WOH	1	1		Sat.		230.1 6.5
	228.1	8.5	1	4	4	8		W		**COASTAL PLAIN** DK GRAY, STIFF TO HARD, SILTY AND FN. SANDY CLAY (A-7) TRACE ORGANICS, QUARTZ GRAVEL LENS AT 16.5'
225	223.1	13.5	2	5	8	13		M		
220	220.1	16.5	17	13	16	29		M		
215	213.1	23.5	24	22	13	35		M		213.1 23.5
210	208.1	28.5	20	19	22	41	SS-6	29%		**RESIDUAL** GREEN-GRAY, RED, AND TAN, HARD, CLAYEY FN. SANDY SILT (A-5) MICACEOUS, SLICKENSIDED
205	203.1	33.5	60/.4			60/.4		M		208.1 28.5 **WEATHERED ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
200	198.1	38.5	60/.4			60/.4		M		
195	193.1	43.5	60/.1			60/.1		M		198.1 38.5 **NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
190	189.9	46.7	60/.1			60/.1		M		
185			60/.1			60/.1		M		189.8 46.8 **NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, METASANDSTONE AND METAMUDSTONE 186.7 49.9
180										**NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, V. SLI. WEATHERED, HARD, CLOSELY FRACTURED, THINLY BEDDED TO THICKLY LAMINATED, EXTREMELY INDURATED, METASANDSTONE AND METAMUDSTONE 180.5 56.1
175										Boring Terminated at Elevation 180.5 ft IN NCR: METASANDSTONE AND METAMUDSTONE
170										NOTE: CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK
165										
160										

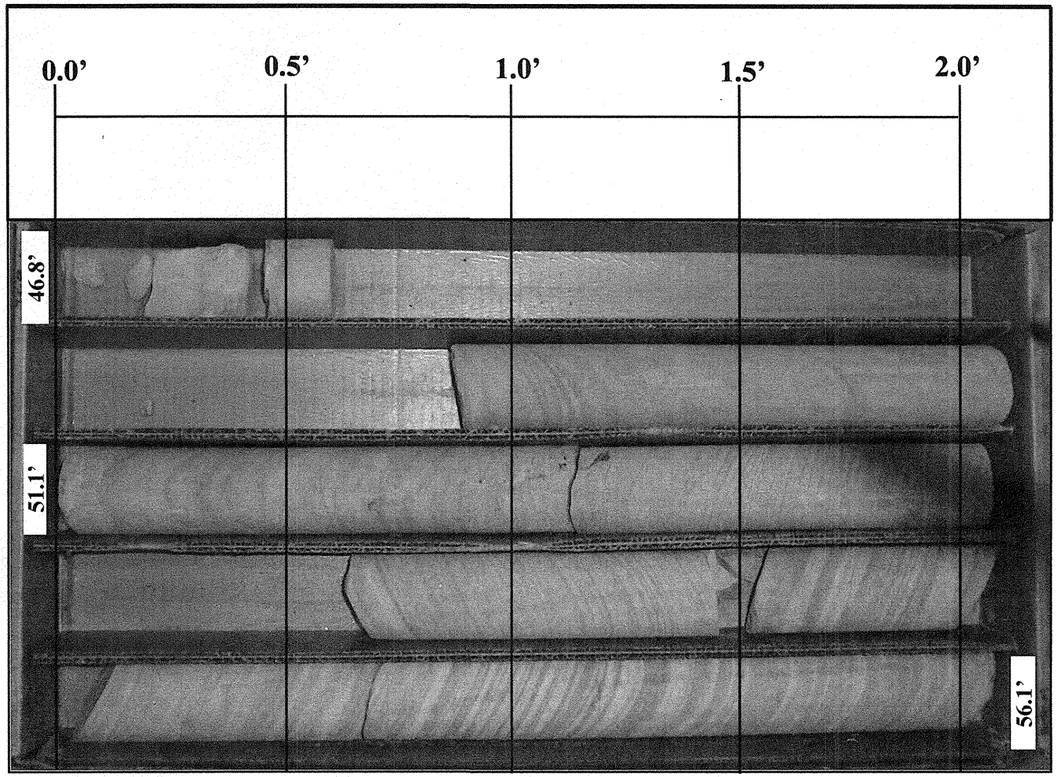
NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM	
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 16+05	**OFFSET** 8ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 236.6 ft	**TOTAL DEPTH** 56.1 ft	**NORTHING** 540,374	**EASTING** 1,916,650	**24 HR.** N/A
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/10/09	**COMP. DATE** 03/12/09	**SURFACE WATER DEPTH** 0.3ft	**DEPTH TO ROCK** 38.5 ft	
CORE SIZE NQ	**TOTAL RUN** 9.3 ft		**DRILLER** J. STEWART	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft) / DEPTH (ft)
	189.8										Begin Coring @ 46.8 ft
	189.8	46.8	4.3	:35/0.3 3:10/1.0 3:25/1.0 5:25/1.0 5:35/1.0	(1.6) 37%	(1.2) 28%		(0.4) 13%	(0.0) 0%		189.8 **NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, METASANDSTONE AND METAMUDSTONE 46.8
185	185.5	51.1									186.7 49.9
			5.0	3:15/1.0 3:45/1.0 3:30/1.0 3:05/1.0 3:05/1.0	(5.0) 100%	(5.0) 100%		(6.2) 100%	(6.2) 100%		**NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, V. SLI. WEATHERED, HARD, CLOSELY FRACTURED, THINLY BEDDED TO THICKLY LAMINATED, EXTREMELY INDURATED, METASANDSTONE AND METAMUDSTONE
180	180.5	56.1									180.5 56.1
175											Boring Terminated at Elevation 180.5 ft IN NCR: METASANDSTONE AND METAMUDSTONE
170											NOTE: CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK
165											
160											
155											
150											
145											
140											
135											
130											
125											
120											
115											
110											

NCDOT CORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09



Boring B1-B, Box 1 of 1, 46.8 feet to 56.1 feet.

SCALE 1"=4"

ROCK CORE PHOTOGRAPHS

BRIDGE #11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
TIP NO: B-4584, STATE PROJECT NO: 33785.1.1

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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM	
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 16+72	**OFFSET** 7ft LT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 237.2 ft	**TOTAL DEPTH** 61.7 ft	**NORTHING** 540,442	**EASTING** 1,916,662	**24 HR.** 0.5
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/09/09	**COMP. DATE** 03/13/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 47.4 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
	240									237.2 EXISTING GROUND SURFACE	0.0
235	234.9	2.3	1	WOH	2	2		Sat.		**ALLUVIAL** BROWN AND DK GRAY, SOFT, SANDY SILT (A-4) MOD. ORGANIC W/ QUARTZ GRAVEL (UP TO 1" DIA.)	
230	229.9	7.3	3	4	5	9	SS-7	25%		229.9	7.3
225	224.9	12.3	2	3	6	9		M		**COASTAL PLAIN** GRAY, STIFF TO HARD, SILTY CLAY (A-7-6)	
220	219.9	17.3	10	14	19	33		M		214.9	22.3
215	214.9	22.3	10	19	29	48		M		**COASTAL PLAIN** GREENISH GRAY, BROWN, AND RED, HARD, FN. SANDY CLAY (A-6) W/ GRAVEL (UP TO 1" DIA.)	
	211.4	25.8								211.4	25.8
210	209.9	27.3	30	23	10	33		M		**RESIDUAL** GREEN-GRAY, TAN, AND BROWN, HARD TO V. STIFF, SANDY SILTY CLAY (A-7-5) MICACEOUS, SAPROLITIC, SLICKENSIDED, W/ ANGULAR QUARTZ GRAVEL (UP TO 1" DIA.)	
205	204.9	32.3	4	8	11	19	SS-8	27%		204.9	32.3
200	199.9	37.3	6	12	19	31		M		**RESIDUAL** BLUE-GRAY AND BROWN, HARD, FN. SANDY CLAYEY SILT (A-5) MICACEOUS, SAPROLITIC	
195	194.9	42.3	84	16/.1		100/.6		M		199.9	37.3
190	189.9	47.3	60/.2			60/.2		M		**WEATHERED ROCK** GREEN-GRAY TO BLUE-GRAY AND BROWN, METASANDSTONE AND METAMUDSTONE	
185			60/.1			60/.1		M		189.8	47.4
180							RS-1			**NON-CRYSTALLINE ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE, QUARTZ COBBLE AT BEGINNING OF RUN	
175										186.2	51.0
170										**NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, MOD. TO MOD. SEV. WEATHERED, MED. HARD TO SOFT, CLOSELY TO V. CLOSELY FRACTURED, THICKLY LAMINATED, MOD. TO EXTREMELY INDURATED, METASANDSTONE AND METAMUDSTONE	
165										175.5	61.7
160										Boring Terminated at Elevation 175.5 ft IN NCR: METASANDSTONE AND METAMUDSTONE NOTE: CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK	

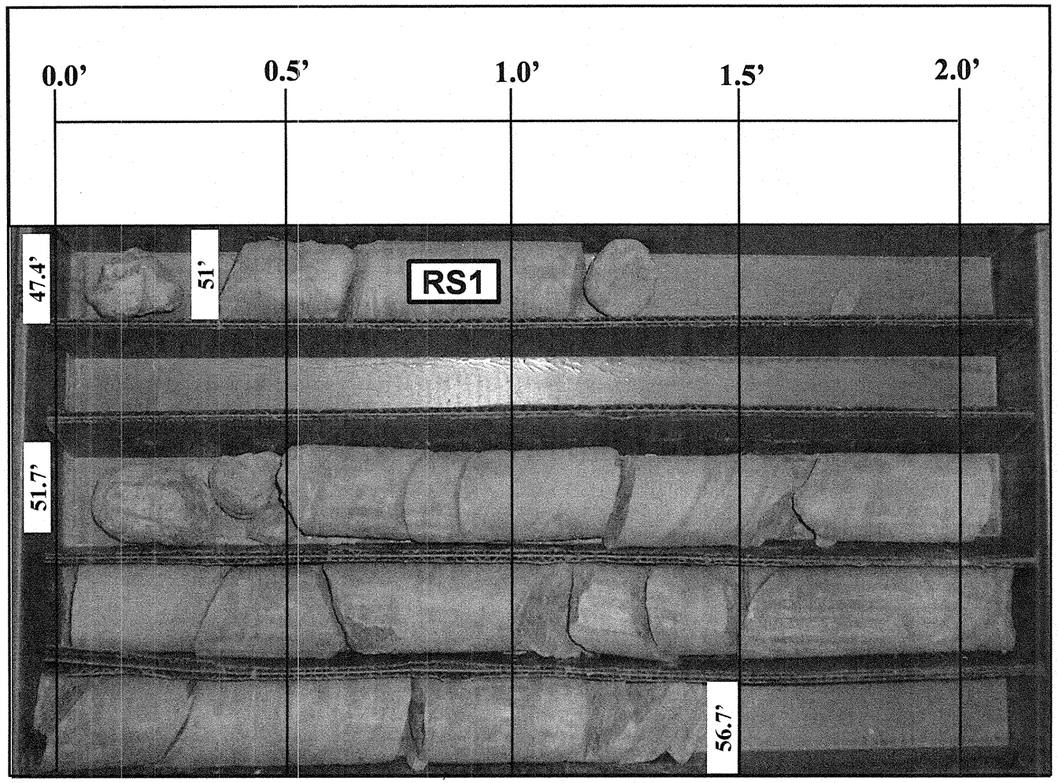
NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

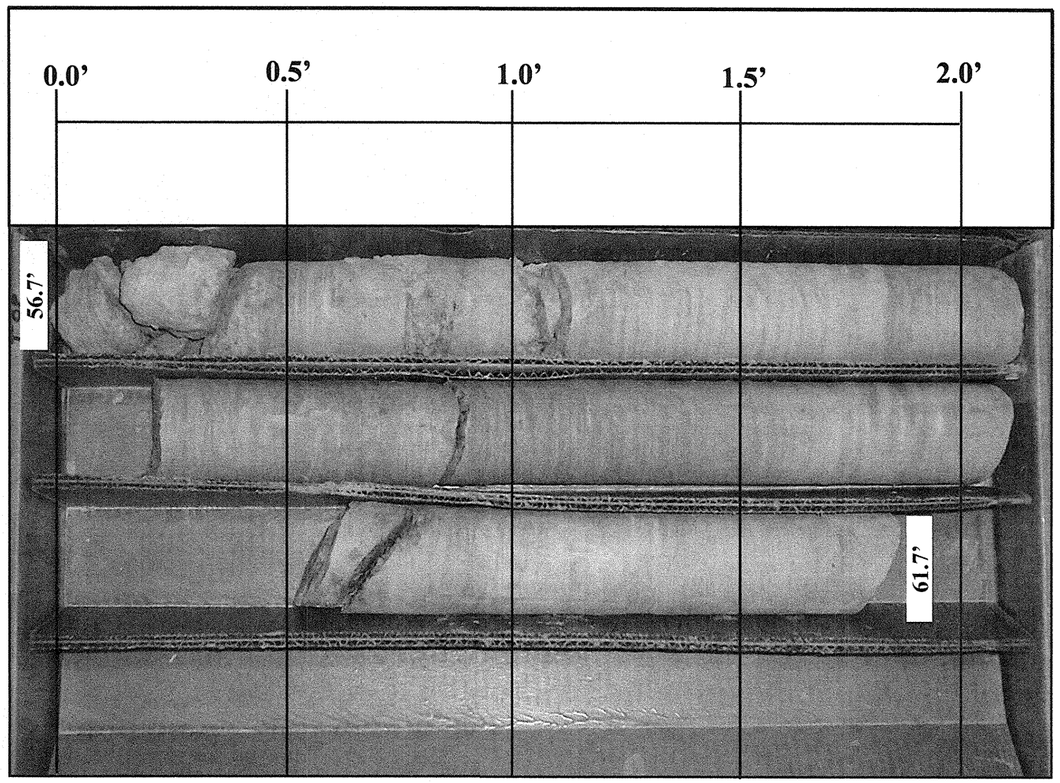
PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER			**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 16+72	**OFFSET** 7ft LT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 237.2 ft	**TOTAL DEPTH** 61.7 ft	**NORTHING** 540,442	**EASTING** 1,916,662	**24 HR.** 0.5
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/09/09	**COMP. DATE** 03/13/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 47.4 ft	
CORE SIZE NQ	**TOTAL RUN** 14.3 ft		**DRILLER** J. STEWART	

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
	189.82										Begin Coring @ 47.4 ft	
	189.8	47.4	4.3	:30/0.3 1:20/1.0 :55/1.0 1:40/1.0 3:00/1.0	(1.0) 23%	(0.5) 10%		(0.3) 8%	(0.0) 0%		189.8 **NON-CRYSTALLINE ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE, QUARTZ COBBLE AT BEGINNING OF RUN	47.4
185	185.5	51.7	5.0	4:10/1.0 4:40/1.0 3:50/1.0 4:45/1.0 4:15/1.0	(4.9) 97%	(2.4) 47%	RS-1	(10.4) 97%	(7.1) 66%		186.2	51.0
180	180.5	56.7	5.0	3:15/1.0 4:30/1.0 4:20/1.0 4:20/1.0 5:00/1.0	(4.8) 96%	(4.0) 80%					**NON-CRYSTALLINE ROCK** LT TO DK GREEN-GRAY, MOD. TO MOD. SEV. WEATHERED, MED. HARD TO SOFT, CLOSELY TO V. CLOSELY FRACTURED, THICKLY LAMINATED, MOD. TO EXTREMELY INDURATED, METASANDSTONE AND METAMUDSTONE	
175	175.5	61.7									175.5	61.7
170											Boring Terminated at Elevation 175.5 ft IN NCR: METASANDSTONE AND METAMUDSTONE NOTE: CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK	
165												
160												
155												
150												
145												
140												
135												
130												
125												
120												
115												
110												

NCDOT CORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09



Boring B2-A, Box 1 of 2, 47.4 feet to 56.7 feet.



Boring B2-A, Box 2 of 2, 56.7feet to 61.7 feet.

SCALE 1"=4"

ROCK CORE PHOTOGRAPHS

BRIDGE #11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
TIP NO: B-4584, STATE PROJECT NO: 33785.1.1

FALCON ENGINEERING

FALCON ENGINEERING, INC.
2736 ROWLAND RD.
RALEIGH, NC 27615
PHONE (919) 871-0800
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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER			**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 16+72	**OFFSET** 8ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 235.9 ft	**TOTAL DEPTH** 50.9 ft	**NORTHING** 540,435	**EASTING** 1,916,676	**24 HR.** N/A
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/18/09	**COMP. DATE** 03/18/09	**SURFACE WATER DEPTH** 2.5ft	**DEPTH TO ROCK** 40.9 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	240									WATER SURFACE (03/18/09)
235	235.9	0.0	WOH	WOH	WOH	0		Sat.		235.9 EXISTING GROUND SURFACE 0.0 **ALLUVIAL** GRAY AND BROWN, V. LOOSE, SILTY SAND (A-2-4) LITTLE ORGANICS
230	230.0	5.9	5	2	3	5		M		230.0 5.9 **COASTAL PLAIN** GRAY, ORANGE, AND RED, MED. STIFF TO V. STIFF, SILTY TO SLI. SANDY CLAY (A-7) W/ GRAVEL (UP TO 1" DIA.)
225	225.0	10.9								
220	220.0	15.9	4	4	5	9		M		
215	215.0	20.9	9	11	16	27		M		215.0 20.9
210	210.0	25.9	10	13	18	31	SS-9	15%		**COASTAL PLAIN** GRAY AND TAN, HARD, FN. SANDY CLAY (A-6) W/ FAT CLAY LENSES AND QUARTZ GRAVEL LENS
205	205.0	30.9	5	9	12	21	SS-10	25%		210.5 25.4 **RESIDUAL** GREEN-GRAY AND TAN, V. STIFF, FN. SANDY SILT (A-5) MICACEOUS, SAPROLITIC
200	200.0	35.9	60/.4			60/.4		M		205.0 30.9 **WEATHERED ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
195	195.0	40.9	60/.2			60/.2		M		
190	190.0	45.9	60/.1			60/.1		M		195.0 40.9 **NON-CRYSTALLINE ROCK** GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
185	185.0	50.9	60/.1			60/.1		M		
180			60/0			60/0				185.0 50.9 Boring Terminated WITH SPT AND TRICONE REFUSAL at Elevation 185.0 ft IN NCR: METASANDSTONE AND METAMUDSTONE NOTE: DUE TO LOSS OF CIRCULATION, CLEAN WATER WAS PUMPED FOR THE FINAL 10 FEET OF DRILLING. CORED THROUGH BRIDGE DECK WITH 1.5" ASPHALT AND 4" TIMBER DECK
175										
170										
165										
160										

NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33785.1.1	**ID.** B-4584	**COUNTY** MOORE	**GEOLOGIST** J. HAMM
SITE DESCRIPTION BRIDGE 11 OVER LITTLE RIVER			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 17+20	**OFFSET** 12ft RT	**ALIGNMENT** -L-	**0 HR.** 1.0
COLLAR ELEV. 248.1 ft	**TOTAL DEPTH** 50.6 ft	**NORTHING** 540,479	**EASTING** 1,916,699	**24 HR.** 10.0
DRILL MACHINE CME-45	**DRILL METHOD** MUD ROTARY		**HAMMER TYPE** Automatic	
START DATE 03/11/09	**COMP. DATE** 03/11/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	250									248.1 EXISTING GROUND SURFACE 0.0
	247.1	1.0						M		**ROADWAY EMBANKMENT** BROWN, TAN, AND GREEN-GRAY, LOOSE TO V. LOOSE, CLAYEY SAND (A-2-6) W/ GLASS SHARDS, WOOD, TRACE ORGANICS, AND GRAVEL (UP TO 1" DIA.)
245	244.6	3.5	4	3	3	6		W		
	242.1	6.0	1	WOH	1	1	SS-11	W		
240	239.6	8.5	WOH	WOH	WOH	0		W		238.6 9.5
			1	WOH	WOH	0		Sat.		**ALLUVIAL** DK GRAY, V. SOFT, HIGHLY ORGANIC SANDY CLAY (A-7), MOD. ORGANIC, W/ PINE STRAW
235	234.6	13.5								234.6 13.5
			2	2	2	4	SS-12	Sat.		**ALLUVIAL** GRAY, TAN, BLACK, AND RED, LOOSE, CSE. SAND AND ROUNDED GRAVEL (A-1-a)
230	229.6	18.5								229.6 18.5
			3	5	8	13		M		**COASTAL PLAIN** DK GRAY, RED, AND TAN, STIFF TO HARD, FN. SANDY SILTY CLAY (A-7)
225	224.6	23.5								
			3	6	12	18		M		
220	219.6	28.5								
			8	13	19	32		M		
215	214.6	33.5								214.8 33.3
			25	34	16	50		M		213.6 34.5 **RESIDUAL** LT GREEN-GRAY AND BROWN, DENSE, SILTY CSE. SAND (A-2-4) MICACEOUS, W/ QUARTZ GRAVEL
210	209.6	38.5								
			4	5	11	16		M		**RESIDUAL** GREEN-GRAY AND TAN, V. STIFF TO HARD, FN. SANDY SILT (A-4) MICACEOUS, SAPROLITIC, SLICKENSIDED
205	204.6	43.5								
			17	29	50	79		M		
200	199.6	48.5								199.6 48.5
	197.5	50.6	60/.4			60/.4		M		**WEATHERED ROCK** BLUE-GRAY TO GREEN-GRAY, METASANDSTONE AND METAMUDSTONE
195			60/.1			60/.1				197.5 50.6 Boring Terminated with SPT REFUSAL at Elevation 197.5 ft ON NCR: METASANDSTONE AND METAMUDSTONE
190										
185										
180										
175										
170										

NCDOT BORE SINGLE G9008.01 - NCDOT B-4584.GPJ NC_DOT.GDT 4/24/09

FALCON 2736 ROWLAND ROAD, RALEIGH, NORTH CAROLINA 27615

AASHTO SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE 11 OVER LITTLE RIVER

NCDOT Project No: 33785.1.1 - T.I.P. No: B-4584

MOORE COUNTY

FALCON ENGINEERING, INC. PROJECT NO: G9008.01

BORING #		SAMPLE #	TOTAL SAMPLE			MINUS 2.00 mm FRACTION				Atterberg Limits		MC
AASHTO Classification			PERCENT PASSING			PERCENT RETAINED						
STATION #	OFFSET (FEET)	DEPTH (FEET)	#10	#40	#200	Coarse Sand	Fine Sand	SILT	CLAY	LL	PI	%
EB1-A		SS-1	99	81	36	37	30	6	27	28	13	19.1
A-6												
15+43	11' LT	3.5-5.0										
EB1-A		SS-2	100	96	76	11	24	60	5	41	NP	24.7
A-5												
15+43	11' LT	33.5-35.0										
B1-A		SS-3	99	96	16	22	67	9	2	25	NP	-
A-2-4												
16+06	7' LT	0.3-1.8										
B1-A		SS-4	100	95	82	8	16	52	24	46	15	28.1
A-7-5												
16+06	7' LT	10.3-11.8										
B1-A		SS-5	100	97	75	5	36	54	5	44	NP	25.2
A-5												
16+06	7' LT	21.3-21.8										
B1-B		SS-6	99	98	76	1	36	47	16	42	9	28.6
A-5												
16+05	8' RT	23.5-25.0										
B2-A		SS-7	100	97	95	4	2	41	53	50	23	25.3
A-7-6												
16+72	7' LT	7.3-8.8										
B2-A		SS-8	100	100	78	0	33	42	25	52	21	27.1
A-7-5												
16+72	7' LT	38.5-40.0										
B2-B		SS-9	100	98	67	3	43	39	15	34	16	15.2
A-6												
16+72	8' RT	20.9-22.4										
B2-B		SS-10	100	99	74	4	37	55	4	43	NP	25.4
A-5												
16+72	8' RT	25.9-27.4										
EB2-B		SS-11	86	53	21	58	20	7	15	32	15	-
A-2-6												
17+20	12' RT	3.5-5.0										
EB2-B		SS-12	37	8	2	89	7	2	2	-	-	-
A-1-a												
17+20	12' RT	13.5-15.0										

SIGNATURE

NCDOT NO. 105-03-0803

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES

PROJECT NO.: 33785.1.1 (B-4584)
F.A. NO.:
COUNTY: MOORE
BRIDGE 11 OVER LITTLE RIVER

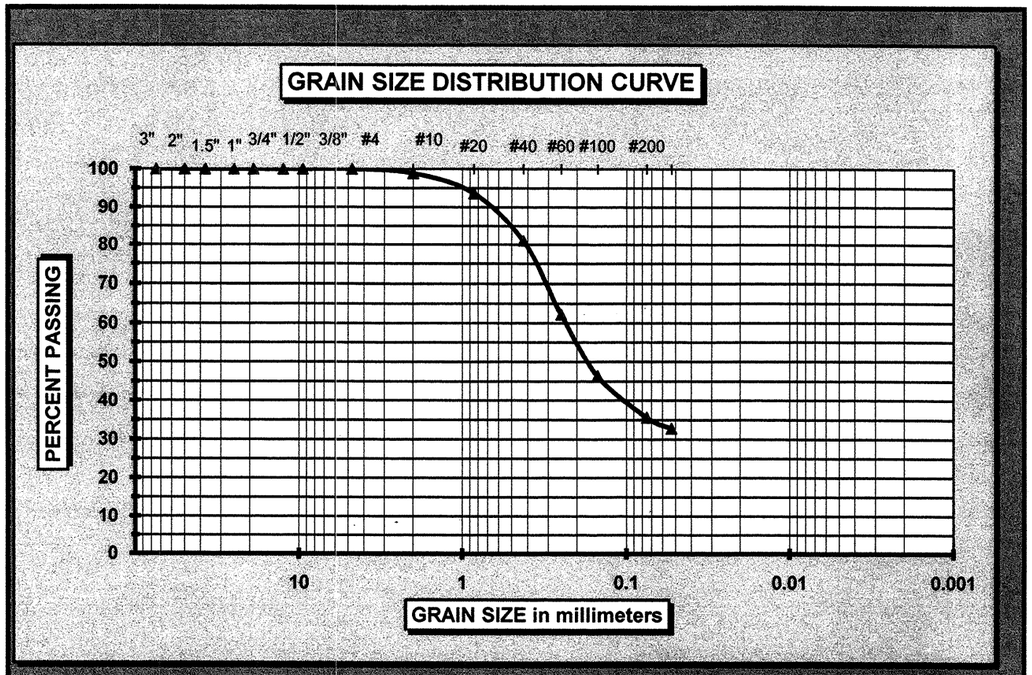
Sample #	Boring #	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (ft)	Diameter (ft)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus (PSI)	Splitting Tensile Strength (PSI)	Remarks
RS-1	B2-A	51.2-51.6	METASANDSTONE	CZph	10.0%	0.39	0.17	162.1	3,315	312,100	-	

SIGNATURE

NCDOT NO. 105-03-0803

BRIDGE 11 OVER LITTLE RIVER

MOORE COUNTY
NCDOT Project No: 33785.1.1 - T.I.P. No: B-4584



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

BORING #: EB1-A SAMPLE #: SS-1 DEPTH: 3.5-5.0

TAN AND GRAY, MOTTLED, MED. STIFF TO STIFF, SANDY CLAY (A-6)

% PASSING #200 SIEVE: 36%

NATURAL MOISTURE CONTENT = 19.1%

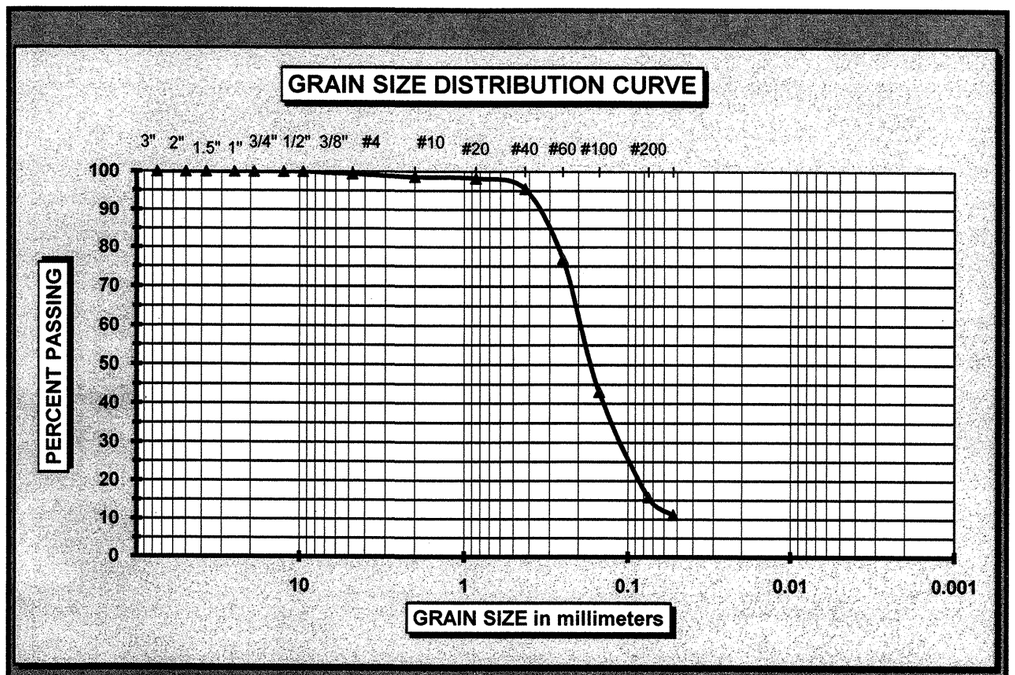
ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	28
PLASTIC LIMIT	15
PLASTIC INDEX	13

FALCON PROJECT #: G9008.01

FALCON 2736 ROWLAND ROAD, RALEIGH, NORTH CAROLINA 27615

BRIDGE 11 OVER LITTLE RIVER

MOORE COUNTY
NCDOT Project No: 33785.1.1 - T.I.P. No: B-4584



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

BORING #: B1-A SAMPLE #: SS-3 DEPTH: 13.5-15.0

BROWN AND GRAY, VERY LOOSE, FINE TO COARSE, SILTY SAND (A-2-4)

% PASSING #200 SIEVE: 16%

NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	25
PLASTIC LIMIT	NP
PLASTIC INDEX	NP

FALCON PROJECT #: G9008.01

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33785.1.1 TIP: B-4584 COUNTY: Moore

DESCRIPTION(1): Bridge 11 on SR 1864 Long Point Rd. over Little River

EXISTING BRIDGE

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

Bridge No.: 11 Length: 120' Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 4
Foundation Type: Timber piles, concrete caps, timber wing walls, steel girders and timber deck (paved)

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: EB2 displayed some signs of undermining around wing wall and timber piles
ruts and flow channels evident underneath bridge, mostly from bridge runoff

Interior Bents: not visable

Channel Bed: not visable

Channel Bank: some rutting and flow channels visable in unvegetated areas

EXISTING SCOUR PROTECTION

Type(3): Broken pieces of concrete slab

Extent(4): only present at EB1

Effectiveness(5): reasonable; appears to have limited scour

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 cse. to fn. sand (A-2-4) moderately organic
sandy clay (A-6), slightly micaceous, w/ gravel (up to 1" DIA.)

Channel Bank Material(8): gray, tan, black, and red, loose, cse. sand and rounded gravel (A-1-a)
also muck and highly organic clay (not enough soil to test)

Channel Bank Cover(9): grass, mature trees, brush, some wetland/swamp areas

Floodplain Width(10): 1/2 mile

Floodplain Cover(11): low lying swamps and wetlands, mature forest, and cultivated fields

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

Channel Migration Tendency(13): south, approximately 10 feet since construction of existing bridge

Observations and Other Comments: current eddies on both sides of river underneath bridge
static pools and wetlands surrounding site

Reported by: J. Hamm of Falcon Engineering, Inc. **Date:** 3/12/2009

DESIGN SCOUR ELEVATIONS(14) Feet x Meters ____

BENTS

B1	B2
NA	228.5

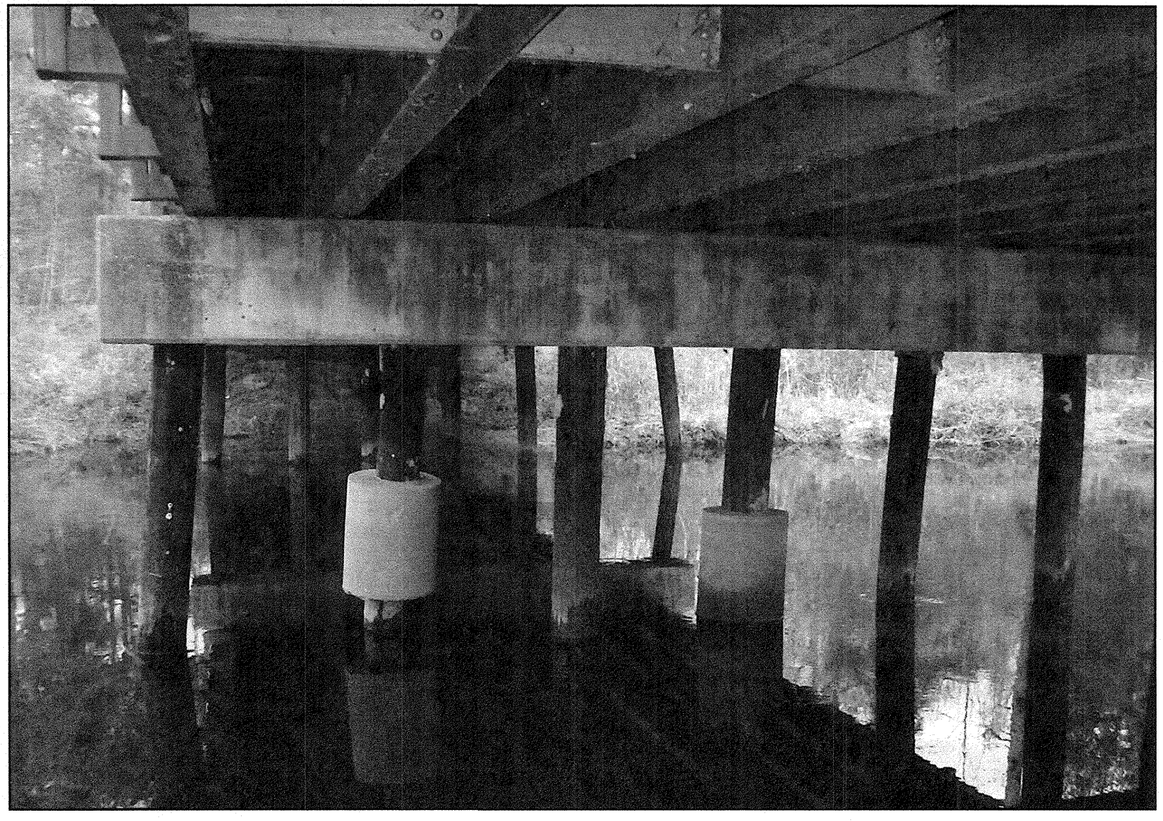
Comparison of DSE to Hydraulics Unit theoretical scour:
Geotechnical Engineering Unit agrees with Hydraulics Unit's theoretical scour elevation of 228.5 feet for Bent 2.

DSE determined by: William F. Goforth, PG **Date:** 5/11/2009

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank	BED	BANK
Sample No.	SS-3	SS-1
Retained #4	1	0
Passed #10	99	99
Passed #40	96	81
Passed #200	16	36
Coarse Sand	22	37
Fine Sand	67	30
Silt	9	6
Clay	2	27
LL	25	28
PI	NP	13
AASHTO	A-2-4	A-6
Station	16+06	15+43
Offset	7' LT	11' LT
Depth	0.0 - 1.5	3.5-5

OVERVIEW OF EXISTING BRIDGE, LOOKING NORTH (UPSTATION) FROM NEAR END BENT 1.



EXISTING BRIDGE LOOKING NORTH (UPSTATION) AT BENT 1 AND BENT 2.

SITE PHOTOGRAPHS

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
TIP NO: B-4584, STATE PROJECT NO: 33785.1.1

FALCON ENGINEERING

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LOOKING WEST AT LITTLE RIVER (UPSTREAM) FROM EXISTING BRIDGE.

LOOKING EAST AT LITTLE RIVER (DOWNSTREAM) FROM EXISTING BRIDGE.

SITE PHOTOGRAPHS

BRIDGE 11 OVER LITTLE RIVER
MOORE COUNTY, NORTH CAROLINA
TIP NO: B-4584, STATE PROJECT NO: 33785.1.1

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