STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33490.1.1 (B-4138)	1	29

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33490.1.1 (B-4138) F.A. PROJ. BRSTP-401(146)

COUNTY HARNETT

PROJECT DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER CAPE FEAR RIVER

ID: B-4138

PROJECT: 33490.1.1

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CAUTION NOTICE

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

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PERSONNEL

CONSULTANT: S&ME

INVESTIGATED BY J. L. PEDRO

CHECKED BY N. T. ROBERSON

SUBMITTED BY J. L. PEDRO

DATE MAY 2009

NORTH CAROLINA LICENSED SEAL 2157 GEOLOGIST JAIME LOVE PEDRO

Jaime Pedro 5-8-09

DRAWN BY: J.L. PEDRO, W.D. FIELDS

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.

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PROJECT REFERENCE NO.	SHEET NO.
33490.1.1 (B-4138)	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 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	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 ($TONS/FT^2$)
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	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	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 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
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

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

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR 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-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-750
- [X] BARGE

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16 " STEEL TEETH
- [ ] TRICONE _____ " TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N WD4
- [ ] -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: BL-2 at -SBL- Sta. 26+49.28, Offset=62.91' Rt
ELEVATION: 143.09' FT.

BENCH MARK: BL-3 at -SBL- Sta. 34+91.36, Offset=66.75' Rt
ELEVATION: 143.12' FT.

REVISED 02/23/06

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SITE PLAN

0 80 160

FEET

NAD 83

SKEW ANGLE = 90°

-BL- 2 PINC 11+78.59
-SBL- POC Sta. 26+49.28
Offset 62.91' (RT)

30+00

35+00

-SBL- PT Sta. 27+15.51

-SBL- PC Sta. 34+86.07

-BL- 3 PINC 20+17.08
-L- POC Sta. 34+91.36
Offset 66.75' (RT)

BST PARKING

CAPE FEAR RIVER

EBI-A
EBI-C
EBI-B
BI-A
BI-B
B2-A
B2-B
B3-A
B3-B
B4-A
B4-B
B5-A
B5-B
-SBL-
EB2-A
EB2-B

24" M.J.D.I.P. (BEVELED TIP IN CONCRETE)
24" D.I.
24" M.J.D.I.P.
6" BLOW OFF
6" DOMS (FO) HH
42" RCP
INV. OUT= 106.58'
INV. IN= 106.88'
dia.88'
WOODS
MTL

L GUARDRAIL
T FO
TO FAYETTEVILLE
BRIDGE NO 46
US 401 SBL 28' BST
MTL GUARDRAIL
HEDGE ROW
RIP RAP
-NBL-
US 401 NBL 28' BST
TO FUQUAY
BRIDGE SEAT ELEV. = 129.42'
BRIDGE SEAT ELEV. = 130.46'
20" D.I.
NOTE: TOWN OF LILLINGTON FSS LINE ATTACHED TO SIDE OF BRIDGE.
CAPE FEAR RIVER
HEDGE ROW
48"DIP

BM = 80
-BL- STA 10+97
148' RIGHT
ELEV = 133.71'

-NBL- PT Sta. 26+69.15

-NBL- POT Sta. 33+99.82

0	10	20
FEET		
VE = 5:1		

PROJECT REFERENCE NO.	SHEET
33490.1.1 (B-4138)	4
FENCE DIAGRAM OF BORINGS PROJECTED ALONG -SBL-	

EB1-A
27+48
11' LT

B1-A
28+53
10' LT

B2-A
29+58
10' LT

B3-A
30+63
10' LT

B4-A
31+68
10' LT

B5-A
32+73
10' LT

EB2-A
33+78
3' RT

CAPE FEAR RIVER

WATER SURFACE 4/15/09

NON-CRYSTALLINE ROCK (PHYLLITE)

NON-CRYSTALLINE ROCK (PHYLLITE)

NON-CRYSTALLINE ROCK, WIDELY FRACTURED, ZONES

GRAY, SEVERELY FRIABLE TO (0.1'-0.8' THICK)

WEATHERED TO INDURATED,

FRESH, SOFT TO PHYLLITE WITH REC=92%

MODERATELY SOME VERY RQD=75%

HARD, CLOSELY TO SEVERELY WEATHERED

Ⓐ ROADWAY EMBANKMENT, BROWN, SOFT TO MED. STIFF, MOIST TO WET, SANDY SILT AND SILTY CLAY

Ⓑ ALLUVIAL, BROWN, VERY SOFT TO SOFT, WET, SANDY SILT AND MEDIUM DENSE, SILTY AND COARSE SAND WITH GRAVEL

Ⓒ RESIDUAL, GRAY, HARD, WET, SAPROLITIC, SANDY SILT

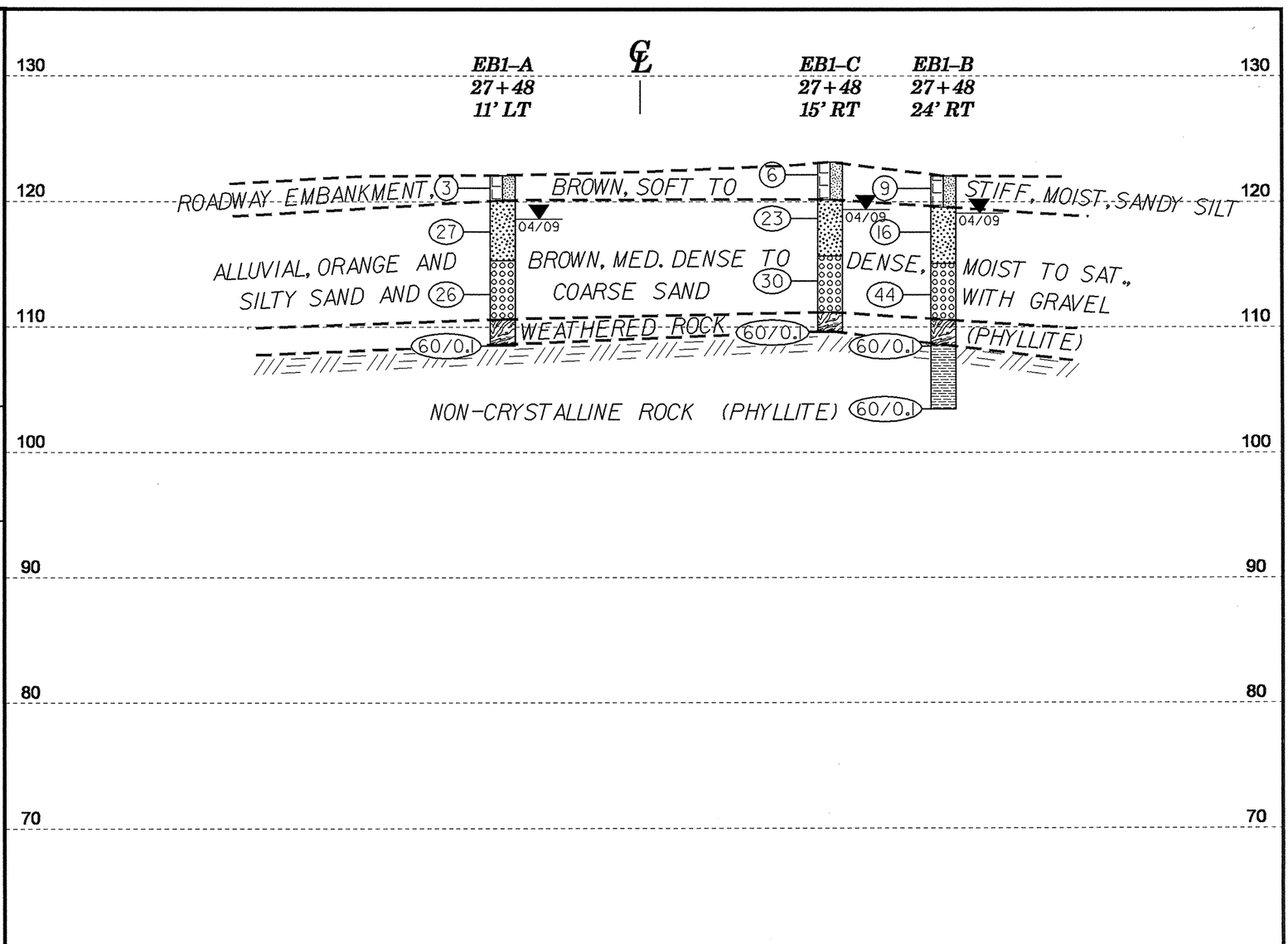
Ⓓ WEATHERED ROCK (PHYLLITE)

GROUNDLINE TAKEN FROM PROFILE IN HYDRO REPORT FILE DATED 1/1/2008

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

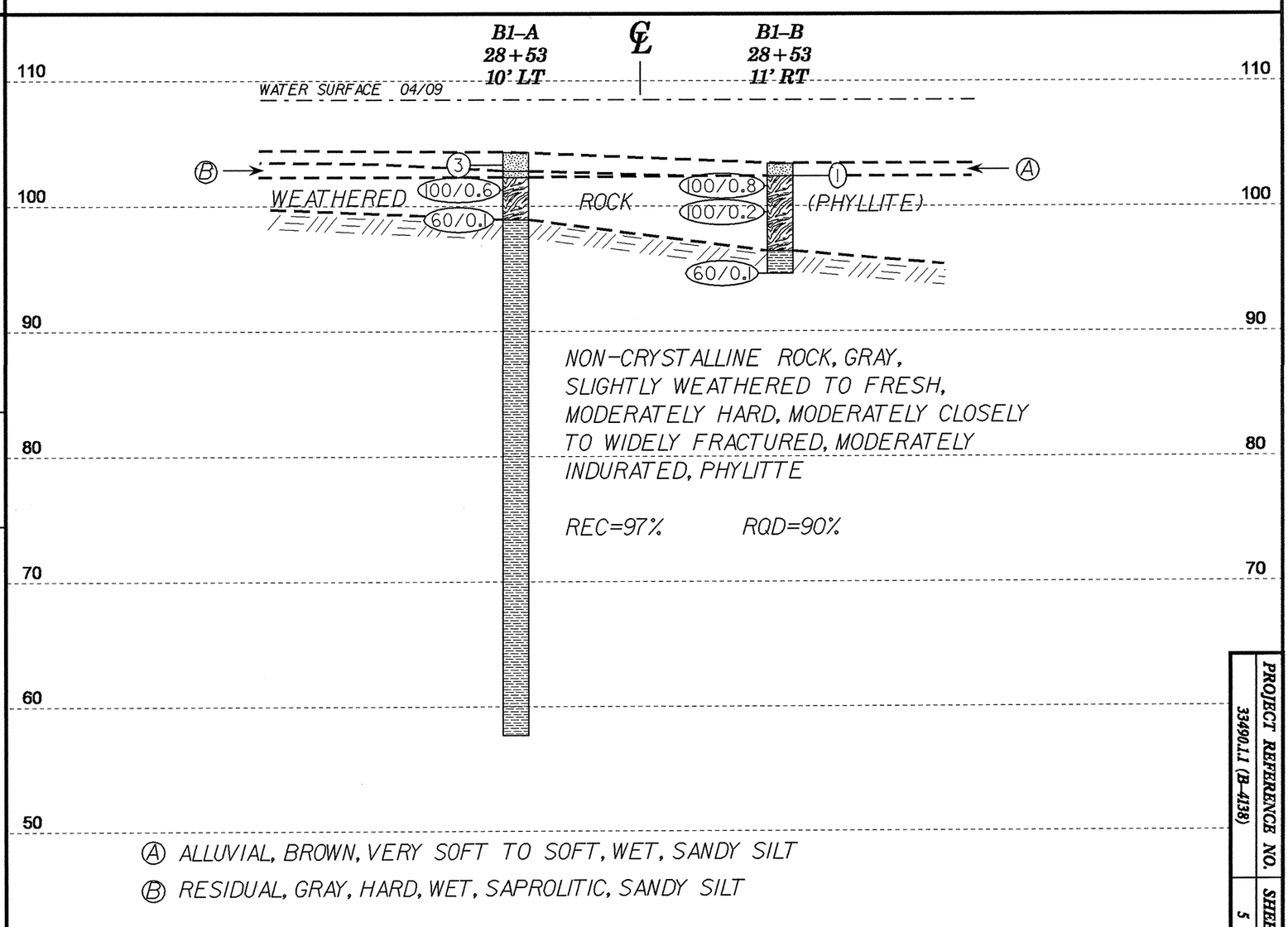
CROSS SECTION THROUGH END BENT 1



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 1

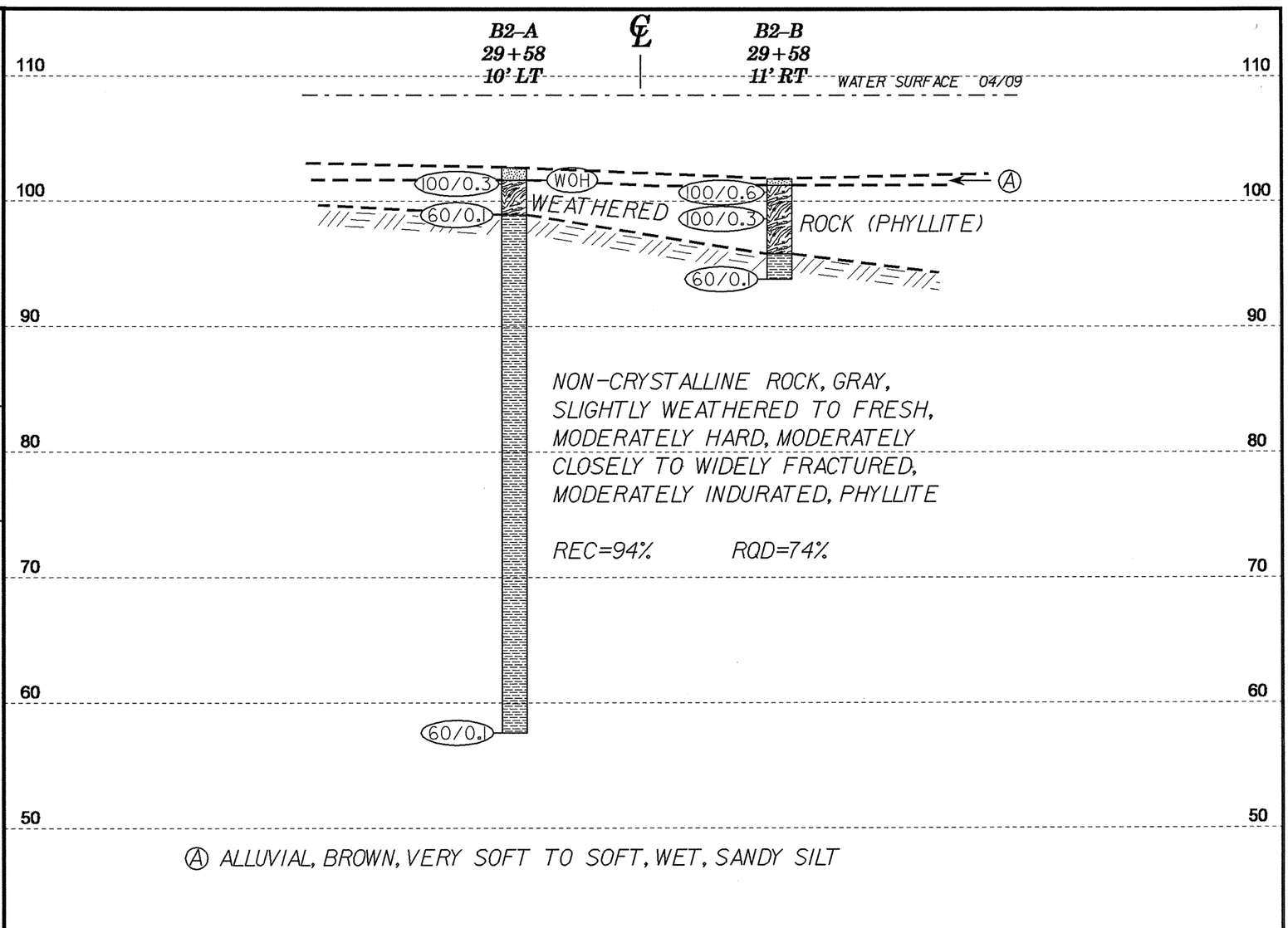


PROJECT REFERENCE NO.	SHEET
33490.1.1 (B-4138)	5

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

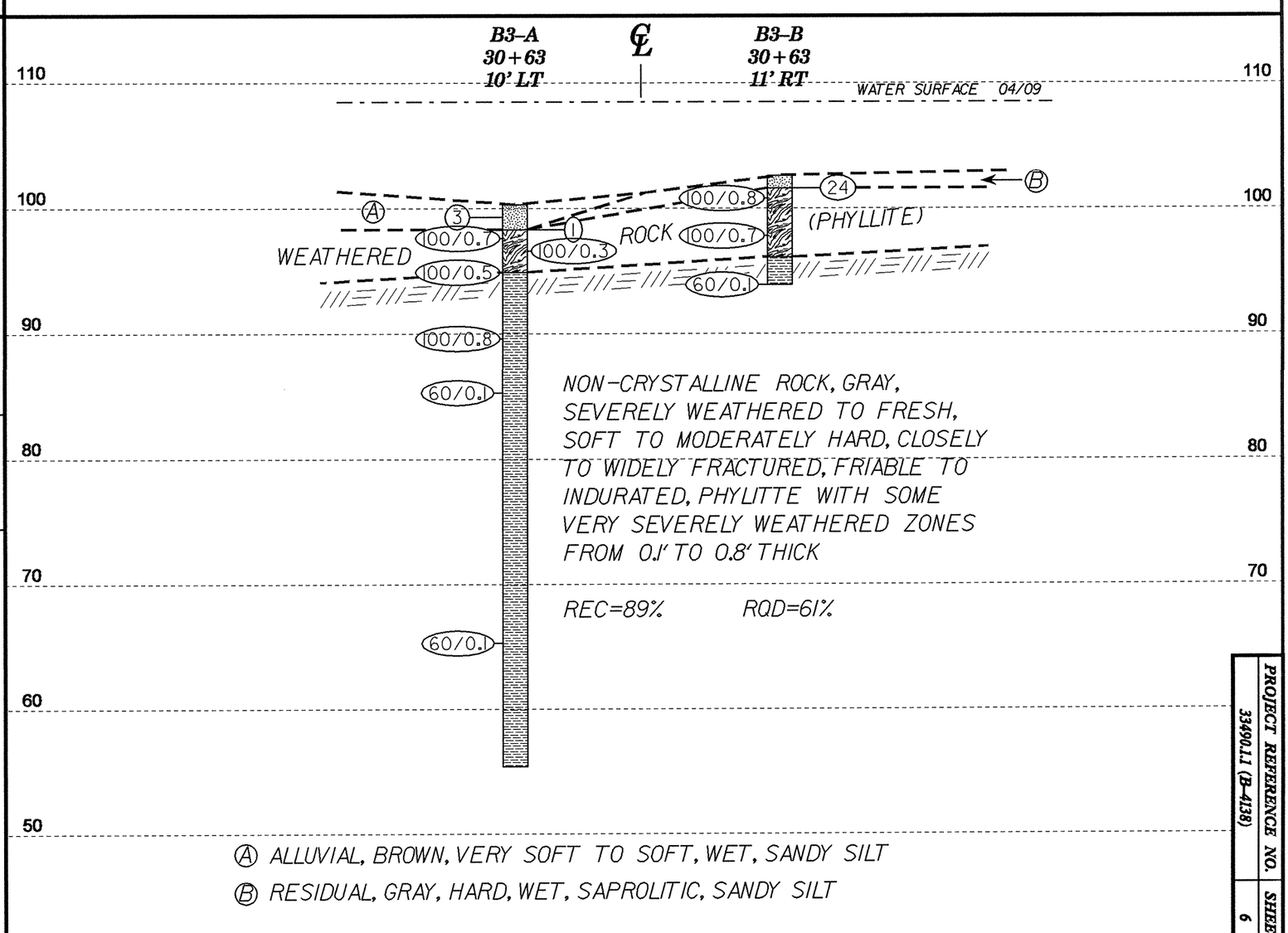
CROSS SECTION THROUGH BENT 2



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 3

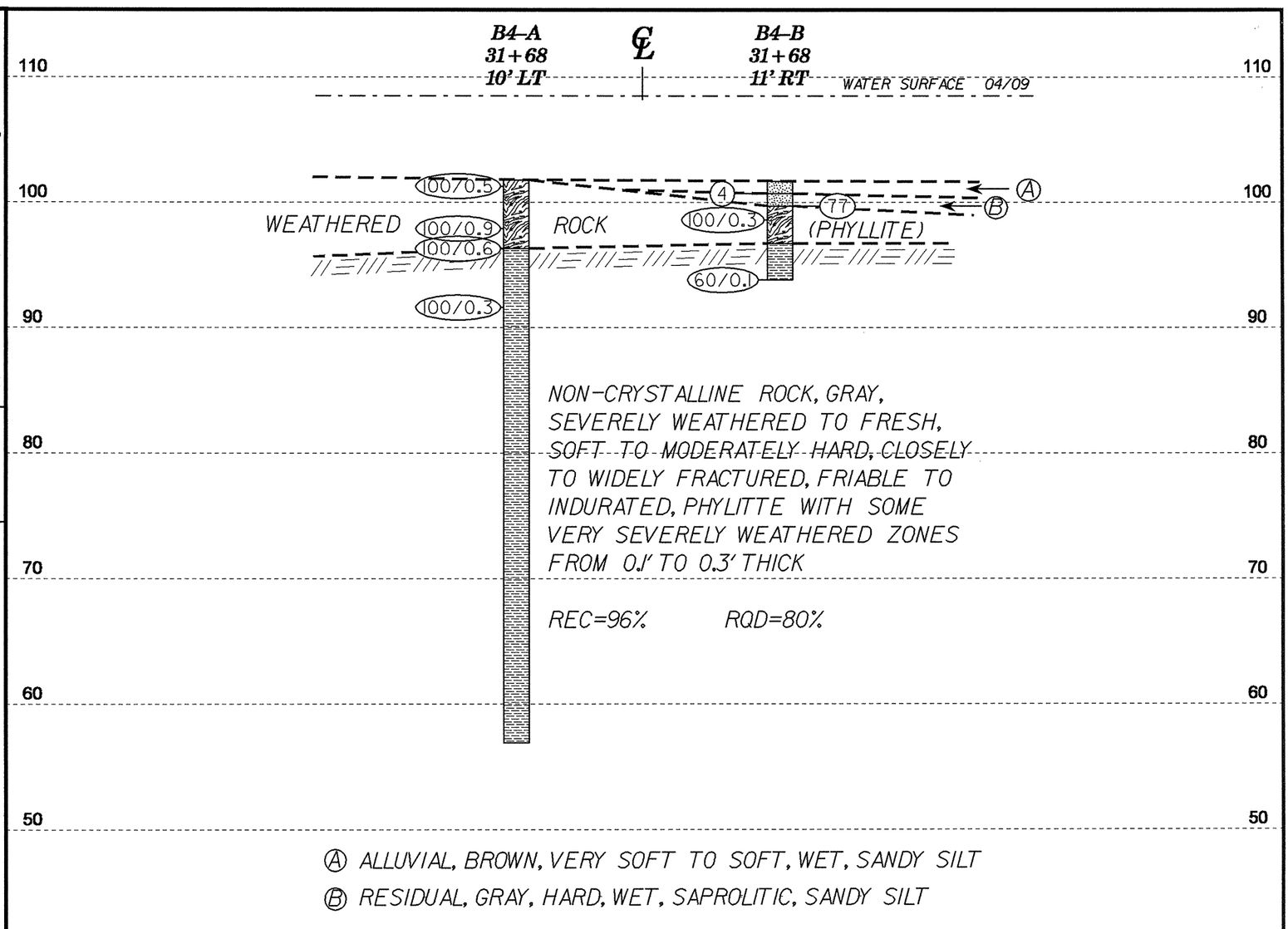


PROJECT REFERENCE NO.	SHEET
33490.1.1 (B-4138)	6

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 4



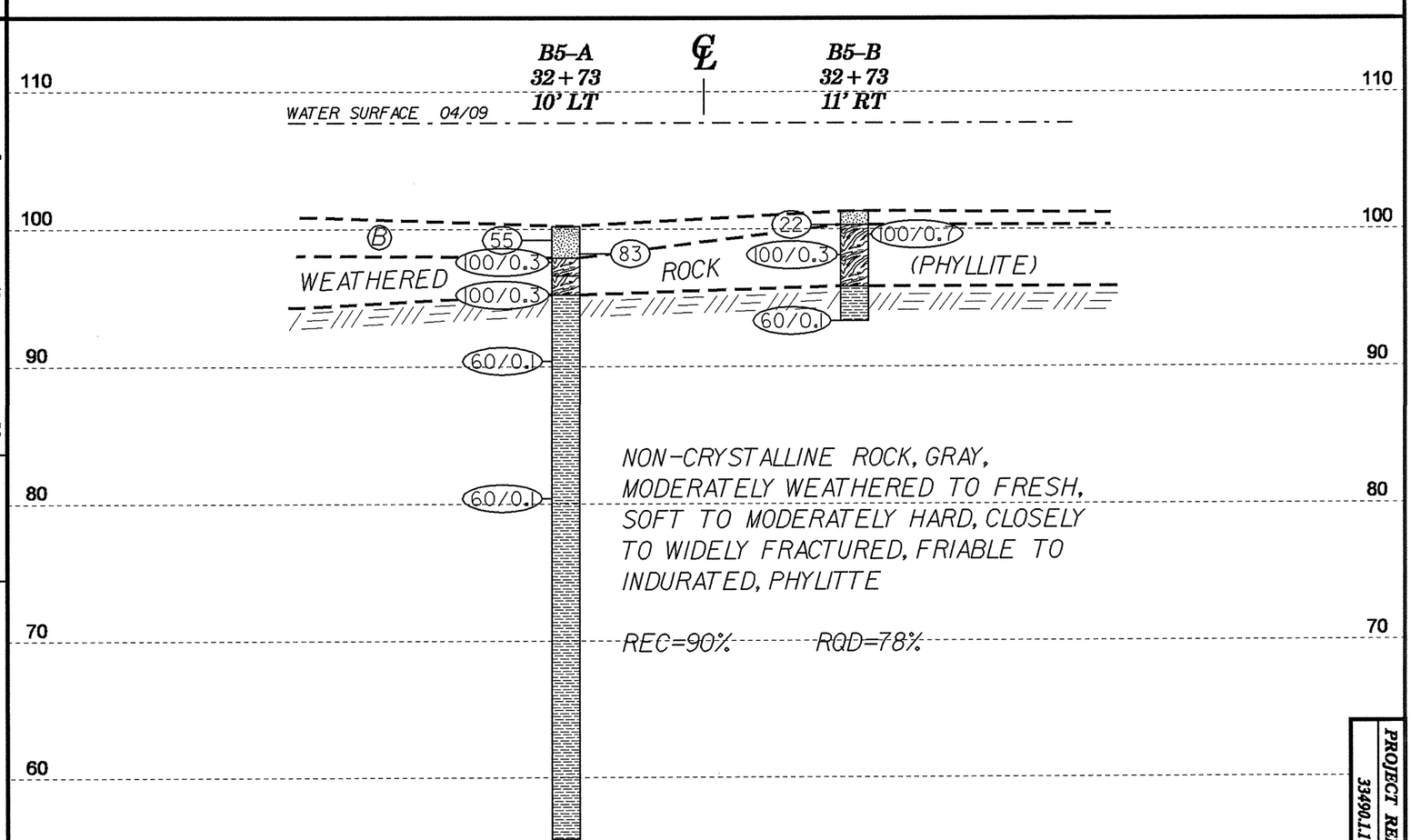
Ⓐ ALLUVIAL, BROWN, VERY SOFT TO SOFT, WET, SANDY SILT

Ⓑ RESIDUAL, GRAY, HARD, WET, SAPROLITIC, SANDY SILT

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH BENT 5



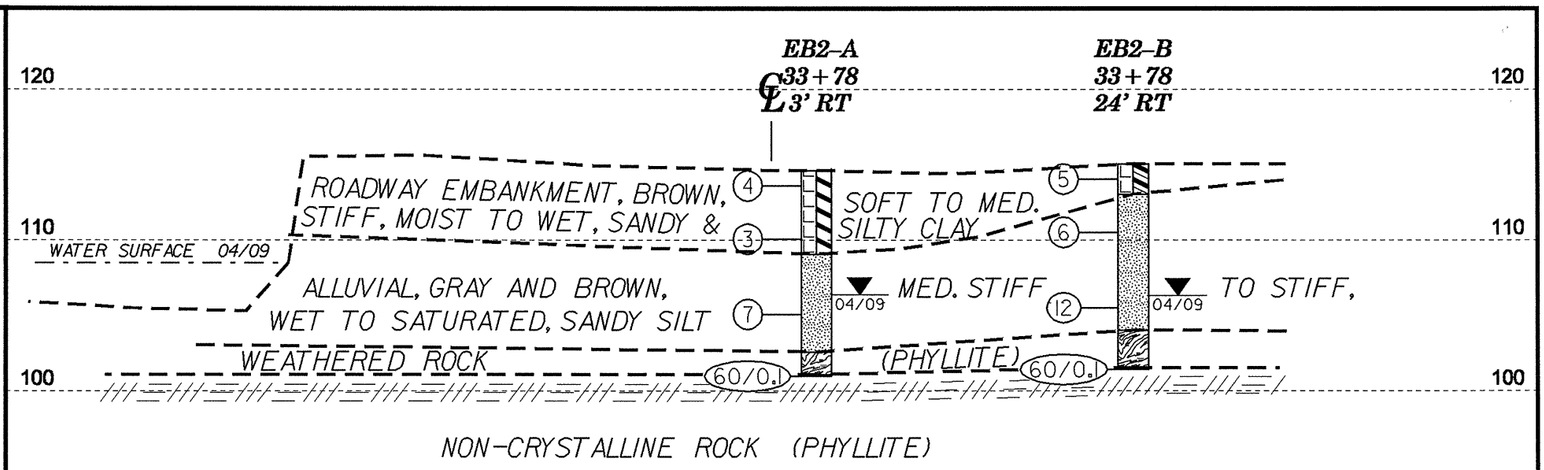
Ⓑ RESIDUAL, GRAY, HARD, WET, SAPROLITIC, SANDY SILT

PROJECT REFERENCE NO.	SHEET
33490.1.1 (B-4138)	7

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

CROSS SECTION THROUGH END BENT 2



PROJECT REFERENCE NO.
3349011 (B-4139)

SHEET
8

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 27+48	**OFFSET** 11ft LT	**ALIGNMENT** -SBL-	**0 HR.** 8.2
COLLAR ELEV. 122.1 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 602,832	**EASTING** 2,055,426	**24 HR.** 3.5
DRILL MACHINE CME-750	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 04/17/09	**COMP. DATE** 04/17/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 13.5 ft	

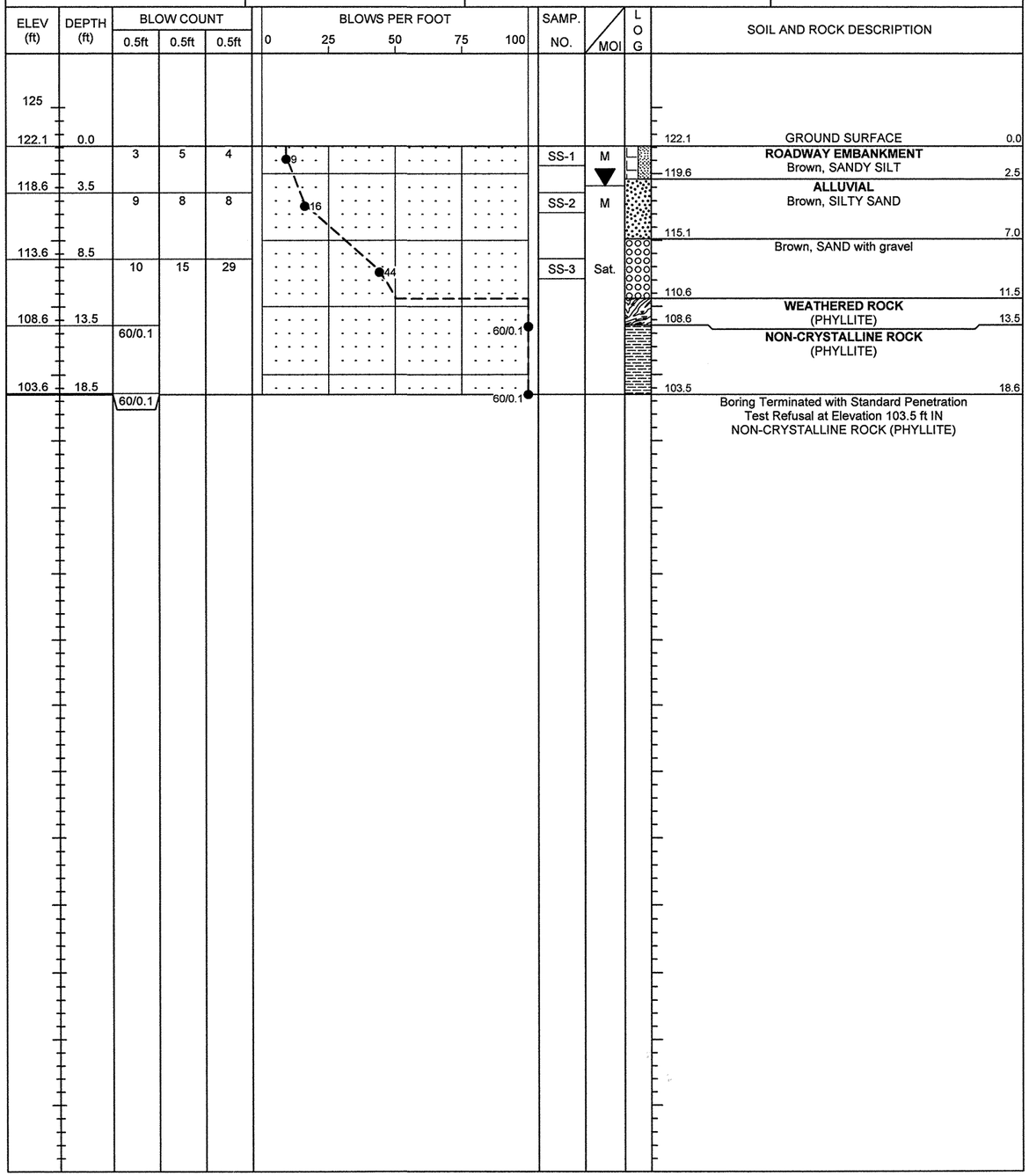
ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
125										
122.1	0.0								122.1 GROUND SURFACE	0.0
		1	1	2	3	SS-16	M		**ROADWAY EMBANKMENT**	
118.6	3.5								120.1 Brown, SANDY SILT	2.0
		10	13	14	27	SS-17	M		**ALLUVIAL** Orange, SILTY SAND with gravel	
113.6	8.5								115.3	6.8
		10	10	16	26	SS-18	Sat.		Orange, COARSE SAND with gravel	
108.6	13.5	60/0.1			60/0.1				110.6	11.5
									WEATHERED ROCK (PHYLLITE) 108.6	13.5
									108.5 **NON-CRYSTALLINE ROCK** (PHYLLITE)	13.6
									Boring Terminated with Standard Penetration Test Refusal at Elevation 108.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 27+48	**OFFSET** 15ft RT	**ALIGNMENT** -SBL-	**0 HR.** 7.7
COLLAR ELEV. 123.2 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 602,821	**EASTING** 2,055,449	**24 HR.** 3.8
DRILL MACHINE CME-750	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 04/13/09	**COMP. DATE** 04/13/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 13.5 ft	

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)
125										
123.2	0.0								123.2 GROUND SURFACE	0.0
		2	3	3	6	SS-5	M		**ROADWAY EMBANKMENT** Brown, SANDY SILT	
119.7	3.5								120.2	3.0
		6	9	14	23	SS-6	M		**ALLUVIAL** Brown, SILTY SAND	
114.7	8.5								115.7	7.5
		10	17	13	30	SS-7	Sat.		Brown, SAND with gravel	
109.7	13.5	60/0.1			60/0.1				111.2	12.0
									WEATHERED ROCK (PHYLLITE) 109.7	13.5
									109.6 **NON-CRYSTALLINE ROCK** (PHYLLITE)	13.6
									Boring Terminated with Standard Penetration Test Refusal at Elevation 109.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/7/09

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 27+48	**OFFSET** 24ft RT	**ALIGNMENT** -SBL-
COLLAR ELEV. 122.1 ft	**TOTAL DEPTH** 18.6 ft	**NORTHING** 602,818	**EASTING** 2,055,457
DRILL MACHINE CME-750	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
START DATE 04/13/09	**COMP. DATE** 04/13/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 13.5 ft



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 28+53	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 104.3 ft	**TOTAL DEPTH** 46.6 ft	**NORTHING** 602,927	**EASTING** 2,055,470	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/24/09	**COMP. DATE** 04/24/09	**SURFACE WATER DEPTH** 2.1ft	**DEPTH TO ROCK** 5.4 ft	

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 (04/24/09)	
104.3	0.0								GROUND SURFACE	0.0
102.8	1.5	2	2	1	3	SS-35	W		**ALLUVIAL** Brown, SANDY SILT	
102.3	2.0									2.0
		57	83	17/0.1	100/0.6		W		**RESIDUAL** Gray, saprolitic, SANDY SILT	
98.9	5.4									5.4
		60/0.1			60/0.1				**WEATHERED ROCK** (PHYLLITE)	
						RS-1			**NON-CRYSTALLINE ROCK** Gray, slightly weathered to fresh, moderately hard, moderately closely to widely fractured, moderately indurated, PHYLLITE	
									REC=97% RQD=90%	
						RS-2				
57.7	46.6								Boring Terminated at Elevation 57.7 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 28+53	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 104.3 ft	**TOTAL DEPTH** 46.6 ft	**NORTHING** 602,927	**EASTING** 2,055,470	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/24/09	**COMP. DATE** 04/24/09	**SURFACE WATER DEPTH** 2.1ft	**DEPTH TO ROCK** 5.4 ft	
CORE SIZE NWD4	**TOTAL RUN** 41.2 ft	**DRILLER** Contract Driller		

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)
98.9										Begin Coring @ 5.4 ft	
98.9	5.4	1.2	1:00/1.0	(0.8)	(0.8)		(39.8)	(37.0)		98.9 **NON-CRYSTALLINE ROCK**	5.4
97.7	6.6	5.0	0:45/0.2	67%	67%		97%	90%		Gray, slightly weathered to fresh, moderately hard, moderately closely to widely fractured, moderately indurated, PHYLLITE, Joints range from 40 to 60 degrees	
			1:30/1.0 1:30/1.0 1:45/1.0 2:00/1.0 2:00/1.0	(5.0) 100%	(5.0) 100%	RS-1					
92.7	11.6	5.0	2:00/1.0 1:45/1.0 1:45/1.0 1:45/1.0 2:00/1.0	(5.0) 100%	(4.2) 84%						
87.7	16.6	5.0	2:00/1.0 1:30/1.0 1:15/1.0 1:15/1.0 1:30/1.0	(5.0) 100%	(5.0) 100%						
82.7	21.6	5.0	1:30/1.0 1:45/1.0 1:30/1.0 1:15/1.0 1:15/1.0	(4.7) 94%	(4.5) 90%						
77.7	26.6	5.0	1:45/1.0 1:30/1.0 1:30/1.0 1:30/1.0 1:45/1.0	(4.8) 96%	(4.8) 96%						
72.7	31.6	5.0	1:45/1.0 1:15/1.0 2:00/1.0 1:45/1.0 1:45/1.0	(5.0) 100%	(5.0) 100%	RS-2					
67.7	36.6	5.0	1:15/1.0 1:30/1.0 1:30/1.0 1:30/1.0 1:15/1.0	(5.0) 100%	(5.0) 100%						
62.7	41.6	5.0	1:45/1.0 1:45/1.0 1:15/1.0 1:15/1.0 1:15/1.0	(4.5) 90%	(2.7) 54%						
57.7	46.6									57.7 Boring Terminated at Elevation 57.7 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	46.6

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/13/09

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 28+53	**OFFSET** 11ft RT	**ALIGNMENT** -SBL- **0 HR.** N/A
COLLAR ELEV. 103.4 ft	**TOTAL DEPTH** 8.8 ft	**NORTHING** 602,919	**EASTING** 2,055,489 **24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Manual
START DATE 04/20/09	**COMP. DATE** 04/20/09	**SURFACE WATER DEPTH** 4.0ft	**DEPTH TO ROCK** 7.0 ft

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
							▼		WATER SURFACE (04/20/09)
105									
103.4	0.0								103.4 GROUND SURFACE 0.0
102.4	1.0	-	WOH	1	100/0.8	SS-20	D		102.4 **ALLUVIAL** 1.0
		60	40/0.3						Brown and gray, SANDY SILT
99.7	3.7								**WEATHERED ROCK**
		100/0.2			100/0.2				(PHYLLITE)
									96.4 7.0
94.7	8.7								**NON-CRYSTALLINE ROCK**
		60/0.1			60/0.1				94.6 (PHYLLITE) 8.8
									Boring Terminated at Elevation 94.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 29+58	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 102.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 603,023	**EASTING** 2,055,513	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/23/09	**COMP. DATE** 04/23/09	**SURFACE WATER DEPTH** 3.7ft	**DEPTH TO ROCK** 3.8 ft	

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)
105									WATER SURFACE (04/23/09)	
102.7	0.0								GROUND SURFACE	0.0
101.7	1.0	-	1	WOH		SS-34	W		ALLUVIAL	1.0
		100/0.3			100/0.3				Gray, SANDY SILT with weathered rock fragments	
99.0	3.7								WEATHERED ROCK (PHYLLITE)	3.8
		60/0.1			60/0.1				NON-CRYSTALLINE ROCK Gray, slightly weathered to fresh, moderately hard, moderately closely to widely fractured, moderately indurated, PHYLLITE	
									REC=94% RQD=74%	
						RS-3				
57.7	45.0	60/0.1			60/0.1				57.6	45.1
									Boring Terminated at Elevation 57.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 29+58	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 102.7 ft	**TOTAL DEPTH** 45.1 ft	**NORTHING** 603,023	**EASTING** 2,055,513	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/23/09	**COMP. DATE** 04/23/09	**SURFACE WATER DEPTH** 3.7ft	**DEPTH TO ROCK** 3.8 ft	
CORE SIZE NWD4	**TOTAL RUN** 41.2 ft	**DRILLER** Contract Driller		

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)
98.9										Begin Coring @ 3.8 ft	
98.9	3.8	1.2	1:30/1.0	(1.0)	(1.0)		(38.9)	(30.4)		98.9 NON-CRYSTALLINE ROCK	3.8
97.7	5.0	5.0	0:30/0.2	83%	83%		94%	74%		Gray, slightly weathered to fresh, moderately hard, moderately closely to widely fractured, moderately indurated, PHYLLITE, Joints range from 40 to 60 degrees	
			1:30/1.0	(5.0)	(5.0)						
			1:30/1.0	100%	100%						
			1:30/1.0								
			1:45/1.0								
92.7	10.0		2:00/1.0								
		5.0	1:30/1.0	(4.7)	(4.7)						
			1:30/1.0	94%	94%						
			1:15/1.0								
			1:45/1.0								
87.7	15.0		1:45/1.0								
		5.0	1:45/1.0	(5.0)	(4.3)						
			2:00/1.0	100%	86%						
			2:00/1.0								
			1:15/1.0								
82.7	20.0		1:15/1.0								
		5.0	1:45/1.0	(4.2)	(2.5)						
			2:00/1.0	84%	50%						
			2:00/1.0								
			1:30/1.0								
77.7	25.0		1:30/1.0			RS-3					
		5.0	1:30/1.0	(4.9)	(3.5)						
			1:30/1.0	98%	70%						
			1:15/1.0								
			1:30/1.0								
72.7	30.0		1:30/1.0								
		5.0	1:45/1.0	(4.5)	(4.1)						
			1:45/1.0	90%	82%						
			1:45/1.0								
			2:00/1.0								
67.7	35.0		1:45/1.0								
		5.0	1:45/1.0	(4.6)	(3.9)						
			2:00/1.0	92%	78%						
			1:30/1.0								
			1:00/1.0								
62.7	40.0		1:15/1.0								
		5.0	1:45/1.0	(5.0)	(1.4)						
			1:45/1.0	100%	28%						
			2:00/1.0								
			1:30/1.0								
57.7	45.0		1:30/1.0							57.6	45.1
			N=60/0.1							Boring Terminated at Elevation 57.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/13/09

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 29+58	**OFFSET** 11ft RT	**ALIGNMENT** -SBL- — **0 HR.** N/A
COLLAR ELEV. 101.8 ft	**TOTAL DEPTH** 8.0 ft	**NORTHING** 603,014	**EASTING** 2,055,532 — **24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Manual
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 4.6ft	**DEPTH TO ROCK** 6.0 ft

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
105									WATER SURFACE (04/21/09)
101.8	0.0								GROUND SURFACE 0.0
		1	86	14/0.1	100/0.6		D		**ALLUVIAL** Brown, SANDY SILT 0.5
98.9	2.9	100/0.3			100/0.3				**WEATHERED ROCK** (PHYLLITE) 6.0
93.9	7.9	60/0.1			60/0.1				**NON-CRYSTALLINE ROCK** (PHYLLITE) 8.0
									Boring Terminated at Elevation 93.8 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B3-A	**STATION** 30+63	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 100.3 ft	**TOTAL DEPTH** 44.9 ft	**NORTHING** 603,118	**EASTING** 2,055,557	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/22/09	**COMP. DATE** 04/22/09	**SURFACE WATER DEPTH** 4.0ft	**DEPTH TO ROCK** 5.4 ft	

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)
105									WATER SURFACE (04/22/09)	
100.3	0.0								100.3 GROUND SURFACE	0.0
98.8	1.5	2	2	1	3		Sat.		**ALLUVIAL**	
98.3	2.0	-	-	1					98.3 Gray, SANDY SILT	2.0
96.9	3.4	-	12	88/0.2	100/0.7				**WEATHERED ROCK** (PHYLLITE)	
95.4	4.9	100/0.3			100/0.3				94.9	5.4
		100/0.5			100/0.5				**NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE with some severely weathered zones less than 0.8'	
90.4	9.9									
		41	59/0.3		100/0.8				REC=89% RQD=61%	
85.4	14.9									
		60/0.1			60/0.1	RS-4				
65.4	34.9									
		60/0.1			60/0.1					
									55.4	44.9
									Boring Terminated at Elevation 55.4 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

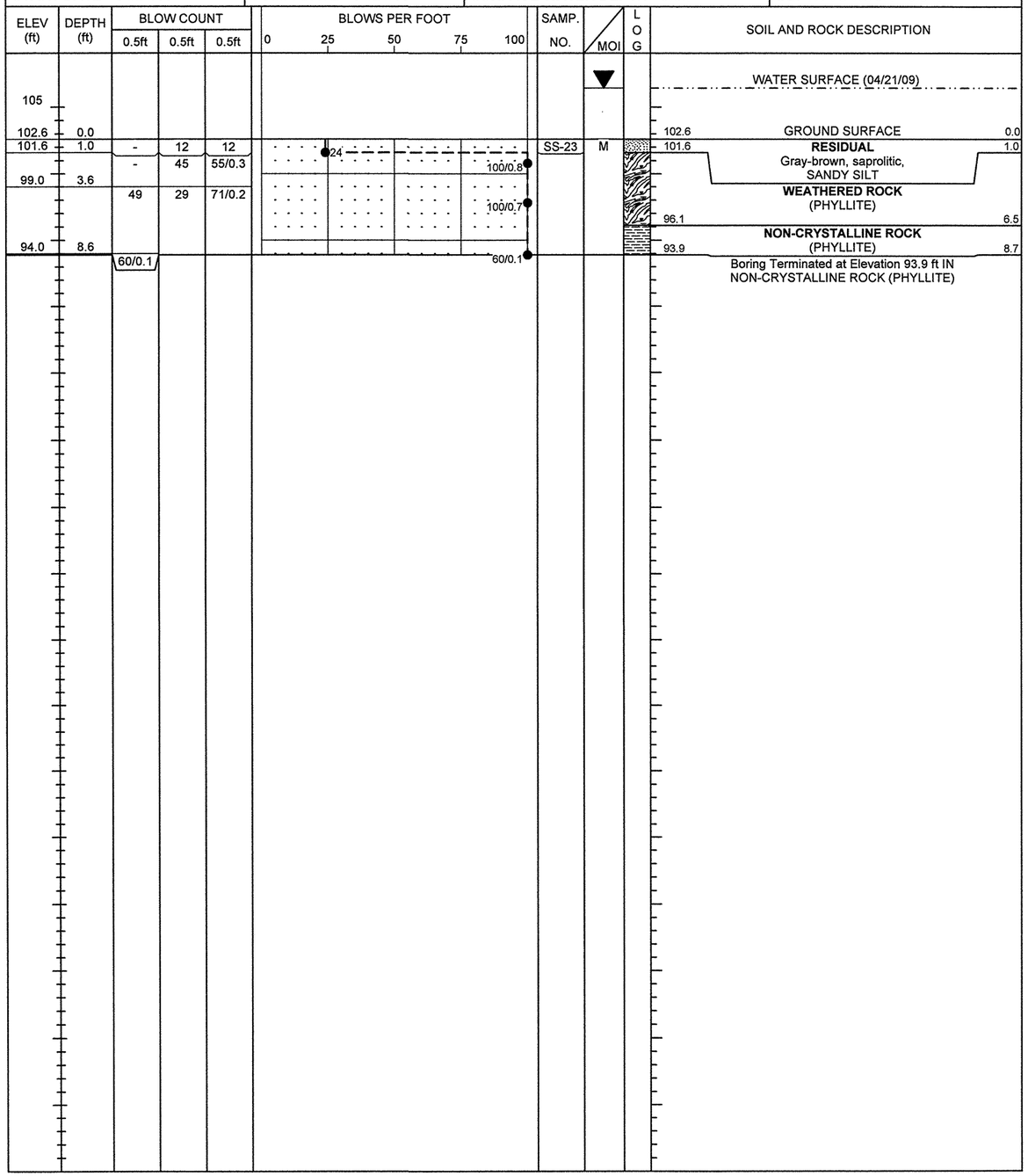
NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B3-A	**STATION** 30+63	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 100.3 ft	**TOTAL DEPTH** 44.9 ft	**NORTHING** 603,118	**EASTING** 2,055,557	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/22/09	**COMP. DATE** 04/22/09	**SURFACE WATER DEPTH** 4.0ft	**DEPTH TO ROCK** 5.4 ft	
CORE SIZE NWD4	**TOTAL RUN** 39.7 ft	**DRILLER** Contract Driller		

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)
96.6										Begin Coring @ 3.7 ft	
96.6	3.7	1.2	1:45/1.0 0:30/0.2	(0.0) 0%	(0.0) 0%					**WEATHERED ROCK** *(continued)*	
95.4	4.9									94.9	5.4
94.9	5.4	4.5	*N=100/0.5* 1:45/1.0 1:30/1.0 1:00/1.0 1:30/1.0 1:00/0.5	(4.1) 91%	(3.9) 87%		(35.2) 89%	(24.1) 61%		**NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE, with some severely weathered zones less than 0.8' Joints range from 40 to 60 degrees	
90.4	9.9										
89.6	10.7	4.2	*N=100/0.5* 1:30/1.0 1:45/1.0 1:30/1.0 1:30/1.0	(2.8) 67%	(0.0) 0%						
85.4	14.9										
85.3	15.0	4.9	1:30/0.2 *N=60/0.1* 1:30/1.0 1:45/1.0 1:45/1.0 1:30/1.0	(3.8) 78%	(3.8) 78%						
80.4	19.9	5.0	1:30/0.9 1:30/1.0 1:30/1.0 1:45/1.0 1:45/1.0	(5.0) 100%	(3.8) 76%	RS-4					
75.4	24.9	5.0	1:45/1.0 1:30/1.0 1:30/1.0 1:45/1.0 1:30/1.0	(4.9) 98%	(4.4) 88%						
70.4	29.9	5.0	1:00/1.0 1:45/1.0 2:00/1.0 1:30/1.0 2:00/1.0	(4.5) 90%	(0.4) 8%						
65.4	34.9										
65.3	35.0	4.9	*N=60/0.1* 1:45/0.9 1:45/1.0 2:00/1.0 2:00/1.0 1:45/1.0	(4.9) 100%	(3.9) 80%						
60.4	39.9	5.0	2:00/1.0 1:45/1.0 2:00/1.0 2:00/1.0 2:00/1.0	(5.0) 100%	(4.0) 80%						
55.4	44.9									55.4	44.9
										Boring Terminated at Elevation 55.4 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/13/09

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 30+63	**OFFSET** 11ft RT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 102.6 ft	**TOTAL DEPTH** 8.7 ft	**NORTHING** 603,110	**EASTING** 2,055,576	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Manual	
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 3.8ft	**DEPTH TO ROCK** 6.5 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 31+68	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 101.8 ft	**TOTAL DEPTH** 44.9 ft	**NORTHING** 603,214	**EASTING** 2,055,600	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/22/09	**COMP. DATE** 04/22/09	**SURFACE WATER DEPTH** 4.5ft	**DEPTH TO ROCK** 5.5 ft	

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)
105										
101.8	0.0								WATER SURFACE (04/22/09)	
									101.8 GROUND SURFACE	0.0
98.8	3.0	100/0.5			100/0.5				**WEATHERED ROCK** (PHYLLITE)	
96.9	4.9	43	57/0.4		100/0.9					
		71	29/0.1		100/0.6				96.3	5.5
91.9	9.9								**NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE with some very severely weatheres zones less than 0.3'	
		100/0.3			100/0.3					
						RS-5			REC=96% RQD=80%	
									56.9	44.9
									Boring Terminated at Elevation 56.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

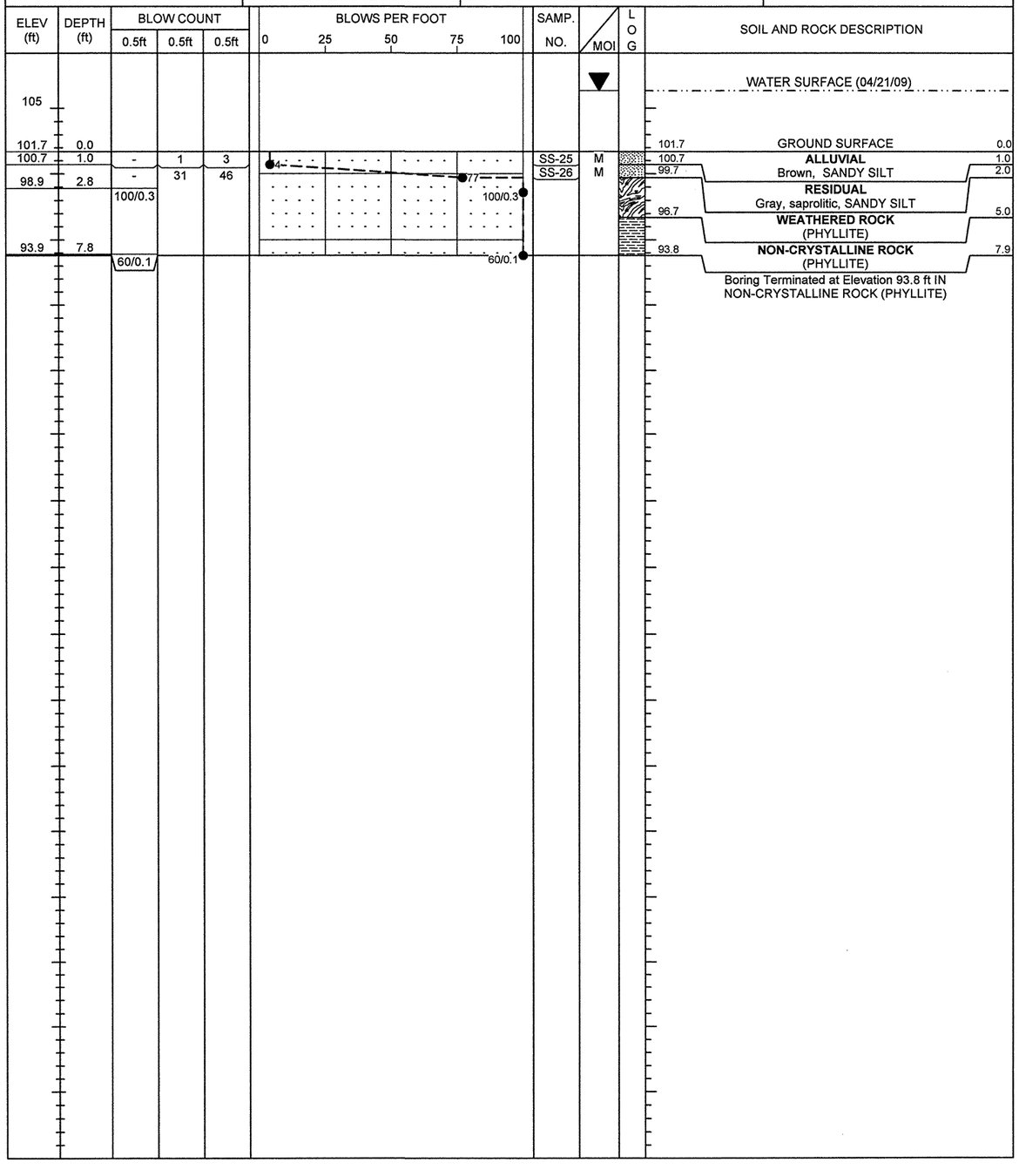
NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 31+68	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 101.8 ft	**TOTAL DEPTH** 44.9 ft	**NORTHING** 603,214	**EASTING** 2,055,600	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/22/09	**COMP. DATE** 04/22/09	**SURFACE WATER DEPTH** 4.5ft	**DEPTH TO ROCK** 5.5 ft	
CORE SIZE NWD4	**TOTAL RUN** 40.1 ft	**DRILLER** Contract Driller		

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)
97.9											
97.5	3.9	1.0	0:45/1.0	(0.0)	(0.0)					Begin Coring @ 3.9 ft	
96.9	4.5		*N=100/0.6*	0%	0%					**WEATHERED ROCK** *(continued)*	
96.3	5.5	4.4	0:45/1.0	(3.9)	(2.9)					96.3	5.5
			0:45/1.0	89%	66%		(37.8)	(31.6)		**NON-CRYSTALLINE ROCK**	
			0:30/1.0				96%	80%		Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE with some very severely weatheres zones less than 0.3' Joints range from 45 to 80 degrees	
91.9	9.9		1:15/1.0								
91.6	10.2		1:00/0.4								
		4.7	*N=100/0.3*	(4.6)	(4.6)						
			0:45/1.0	98%	98%						
			1:30/1.0								
			1:30/1.0								
86.9	14.9		1:45/1.0			RS-5					
			2:00/0.7								
		5.0	1:30/1.0	(4.8)	(4.8)						
			1:45/1.0	96%	96%						
			1:30/1.0								
			1:30/1.0								
81.9	19.9		1:30/1.0								
		5.0	1:45/1.0	(5.0)	(5.0)						
			1:30/1.0	100%	100%						
			1:45/1.0								
			1:45/1.0								
76.9	24.9		1:45/1.0								
		5.0	1:45/1.0	(4.9)	(4.9)						
			1:45/1.0	98%	98%						
			1:30/1.0								
			1:45/1.0								
71.9	29.9		1:45/1.0								
		5.0	1:45/1.0	(4.6)	(4.3)						
			1:45/1.0	92%	86%						
			1:30/1.0								
			1:30/1.0								
66.9	34.9		1:45/1.0								
		5.0	1:45/1.0	(5.0)	(2.9)						
			2:00/1.0	100%	58%						
			1:45/1.0								
			2:00/1.0								
61.9	39.9		2:15/1.0								
		5.0	1:45/1.0	(5.0)	(2.2)						
			1:45/1.0	100%	44%						
			1:00/1.0								
			2:00/1.0								
56.9	44.9		2:00/1.0							56.9	44.9
										Boring Terminated at Elevation 56.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/13/09

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 31+68	**OFFSET** 11ft RT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 101.7 ft	**TOTAL DEPTH** 7.9 ft	**NORTHING** 603,205	**EASTING** 2,055,619	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Manual	
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 4.6ft	**DEPTH TO ROCK** 5.0 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B5-A	**STATION** 32+73	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 100.2 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 603,310	**EASTING** 2,055,644	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 5.1ft	**DEPTH TO ROCK** 5.0 ft	

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)
105									WATER SURFACE (04/21/09)	
100.2	0.0								GROUND SURFACE	0.0
99.2	1.0	-	23	32	55 83	SS-29	M		**RESIDUAL**	
97.9	2.3	-	27	56			M		Gray, saprolitic, SANDY SILT	2.3
95.5	4.7	100/0.3			100/0.3				**WEATHERED ROCK** (PHYLLITE)	3.6
90.5	9.7	100/0.3			100/0.3				Gray, severely weathered to fresh, soft to moderately hard, closely to moderately fractured, friable to indurated, PHYLLITE with some very severely weathered zones	5.0
80.5	19.7	60/0.1			60/0.1				REC=29%	
		60/0.1			60/0.1	RS-6			**NON-CRYSTALLINE ROCK** Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE	
									REC=90% RQD=78%	
						RS-7				
55.5	44.7								Boring Terminated at Elevation 55.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant	
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. B5-A	**STATION** 32+73	**OFFSET** 10ft LT	**ALIGNMENT** -SBL-	**0 HR.** N/A
COLLAR ELEV. 100.2 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 603,310	**EASTING** 2,055,644	**24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Manual	
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 5.1ft	**DEPTH TO ROCK** 5.0 ft	
CORE SIZE NWD4	**TOTAL RUN** 40.6 ft	**DRILLER** Contract Driller		

ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. %	STRATA RQD %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
96.6										Begin Coring @ 3.6 ft	
96.6	3.6	1.1	0:30/1.0	(0.4)	(0.0)		(0.4)			96.6 **WEATHERED ROCK**	3.6
95.5	4.7		0:30/0.1	36%	0%		29%	(31.1)		Gray, severely weathered to fresh, soft to moderately hard, closely to moderately fractured, friable to indurated, PHYLLITE	
95.2	5.0	4.7	*N=100/0.3*	(4.6)	(3.2)		(35.8)	78%		95.2 with some very severely weathered zones	5.0
			0:45/0.7	98%	68%		90%			**NON-CRYSTALLINE ROCK**	
			1:30/1.0							Gray, moderately weathered to fresh, soft to moderately hard, closely to widely fractured, friable to indurated, PHYLLITE,	
			1:15/1.0							Joints range from 45 to 80 degrees	
90.5	9.7		1:30/1.0								
90.4	9.8	4.9	1:30/1.0	(2.8)	(2.2)						
			N=60/0.1	57%	45%						
			1:15/1.0								
			1:45/1.0								
			1:30/1.0								
85.5	14.7		2:00/1.0								
		5.0	1:00/0.9	(4.8)	(2.8)						
			1:30/1.0	96%	56%						
			1:15/1.0								
			1:30/1.0			RS-6					
			1:45/1.0								
80.5	19.7		1:30/1.0								
80.4	19.8	4.9	*N=60/0.1*	(4.6)	(4.6)						
			1:30/1.0	94%	94%						
			1:45/1.0								
			1:45/1.0								
75.5	24.7		1:15/1.0								
		5.0	1:00/0.9								
			1:30/1.0	(4.6)	(4.6)						
			1:45/1.0	92%	92%						
			1:45/1.0								
			1:45/1.0								
70.5	29.7		1:15/1.0								
		5.0	1:45/1.0	(5.0)	(5.0)						
			1:45/1.0	100%	100%						
			1:15/1.0								
			1:30/1.0								
65.5	34.7		1:30/1.0								
		5.0	1:45/1.0	(4.4)	(4.0)						
			2:00/1.0	88%	80%	RS-7					
			2:00/1.0								
			1:45/1.0								
60.5	39.7		1:45/1.0								
		5.0	1:30/1.0	(5.0)	(4.7)						
			1:45/1.0	100%	94%						
			2:00/1.0								
			2:00/1.0								
55.5	44.7		1:75/1.0							55.5	44.7
										Boring Terminated at Elevation 55.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT	**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER			**GROUND WTR (ft)**
BORING NO. B5-B	**STATION** 32+73	**OFFSET** 11ft RT	**ALIGNMENT** -SBL- **0 HR.** N/A
COLLAR ELEV. 101.3 ft	**TOTAL DEPTH** 8.0 ft	**NORTHING** 603,301	**EASTING** 2,055,663 **24 HR.** N/A
DRILL MACHINE CME-45C	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Manual
START DATE 04/21/09	**COMP. DATE** 04/21/09	**SURFACE WATER DEPTH** 5.0ft	**DEPTH TO ROCK** 5.5 ft

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
105							▼		WATER SURFACE (04/21/09)
101.3	0.0								101.3 GROUND SURFACE 0.0
100.3	1.0	-	2	20	22	SS-27	M		100.3 **RESIDUAL** 1.0
98.4	2.9	-	62	38/0.2	100/0.7				Gray-brown, saprolitic, SANDY SILT
		100/0.3			100/0.3				**WEATHERED ROCK**
									95.8 (PHYLLITE) 5.5
93.4	7.9								**NON-CRYSTALLINE ROCK**
		60/0.1			60/0.1				93.3 (PHYLLITE) 8.0
									Boring Terminated at Elevation 93.3 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT		**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 33+78	**OFFSET** 3ft RT	**ALIGNMENT** -SBL-	**0 HR.** Dry
COLLAR ELEV. 114.6 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 603,400	**EASTING** 2,055,699	**24 HR.** 8.2
DRILL MACHINE CME-750	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 04/14/09	**COMP. DATE** 04/14/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 13.5 ft	

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)
115										
114.6	0.0								114.6 GROUND SURFACE	0.0
		1	1	3	4	SS-9	M		**ROADWAY EMBANKMENT** Brown, SILTY CLAY	
111.1	3.5									
		2	1	2	3		W		109.1 **ALLUVIAL** Brown, SANDY SILT	5.5
106.1	8.5									
		4	3	4	7	SS-10	W		102.6	12.0
101.1	13.5								101.1 **WEATHERED ROCK** (PHYLLITE)	13.5
		60/0.1			60/0.1				101.0 **NON-CRYSTALLINE ROCK** (PHYLLITE)	13.6

Boring Terminated with Standard Penetration Test Refusal at Elevation 101.0 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

PROJECT NO. 33490.1.1	**ID.** B-4138	**COUNTY** HARNETT		**GEOLOGIST** Consultant
SITE DESCRIPTION BRIDGE NO. 46 ON -SBL- (US 401) OVER THE CAPE FEAR RIVER				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 33+78	**OFFSET** 24ft RT	**ALIGNMENT** -SBL-	**0 HR.** 11.5
COLLAR ELEV. 115.0 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 603,391	**EASTING** 2,055,718	**24 HR.** 8.7
DRILL MACHINE CME-750	**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic	
START DATE 04/14/09	**COMP. DATE** 04/14/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 13.5 ft	

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)
115										
115.0	0.0	1	2	3	5	SS-12	M		115.0 GROUND SURFACE	0.0
									113.0 **ROADWAY EMBANKMENT** Brown, SANDY CLAY	2.0
111.5	3.5	3	3	3	6	SS-13	Sat.		**ALLUVIAL** Gray and brown, SANDY SILT	
106.5	8.5									
		5	6	6	12	SS-14	W		104.0	11.0
101.5	13.5								101.5 **WEATHERED ROCK** (PHYLLITE)	13.5
		60/0.1			60/0.1				101.4 **NON-CRYSTALLINE ROCK** (PHYLLITE)	13.6

Boring Terminated with Standard Penetration Test Refusal at Elevation 101.4 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT BORE DOUBLE B4138_GEO_BH.GPJ NC_DOT.GDT 5/7/09

EB1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-16	11 LT	27+48	0.0-1.5	A-4(1)	23	6	21.0	23.8	39.0	16.3	90	79	54	-	-
SS-17	11 LT	27+48	3.5-5.0	A-2-4(0)	30	10	70.5	15.1	2.2	12.2	77	37	12	-	-
SS-18	11 LT	27+48	8.5-10.0	A-1-b	NEM	NEM	64.1	16.3	13.6	6.1	31	14	7	-	-

EB1-C

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-5	15 RT	27+48	0.0-1.5	A-4(4)	28	9	14.0	20.1	45.5	20.3	98	90	70	-	-
SS-6	15 RT	27+48	3.5-5.0	A-2-4(0)	23	6	53.9	25.5	6.3	14.2	96	63	22	-	-
SS-7	15 RT	27+48	8.5-10.0	A-1-a(0)	22	5	49.4	22.6	15.8	12.2	41	28	13	-	-

EB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	24 RT	27+48	0.0-1.5	A-4(5)	34	8	16.9	20.8	44.0	18.3	100	90	68	-	-
SS-2	24 RT	27+48	3.5-5.0	A-2-4(0)	25	7	59.0	23.2	7.6	10.2	80	48	16	-	-
SS-3	24 RT	27+48	8.5-10.0	A-1-b	NEM	NEM	51.7	21.8	18.4	8.1	34	20	10	-	-

B1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-35	10 LT	28+53	0.0-1.5	A-4(5)	34	5	8.7	9.3	74.0	8.0	100	95	87	-	-

B1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-20	11 RT	28+53	0.0-1.0	A-4(0)	27	5	41.0	14.9	34.0	10.1	92	65	44	-	-

B2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-34	10 LT	29+58	0.0-1.0	A-4(2)	30	5	18.1	12.7	51.1	18.1	92	83	67	-	-

B3-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-23	11 RT	30+63	0.0-1.0	A-4(3)	33	3	9.3	12.5	70.2	8.0	100	95	84	-	-

B4-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-25	11 RT	31+68	0.0-1.0	A-4(3)	31	6	20.7	14.7	56.6	8.0	97	82	67	-	-
SS-26	11 RT	31+68	1.0-2.0	A-4(6)	34	6	8.5	12.1	71.4	8.0	100	95	85	-	-

B5-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-29	10 LT	32+73	0.0-1.5	A-4(3)	32	3	13.1	11.1	67.8	8.0	100	91	80	-	-

B5-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-27	11 RT	32+73	0.0-1.0	A-4(5)	33	7	10.1	14.9	63.0	12.1	100	95	80	-	-

EB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-9	3 RT	33+78	0.0-1.5	A-7-6(26)	52	23	0.8	9.0	59.7	30.5	100	100	95	-	-
SS-10	3 RT	33+78	8.5-10.0	A-4(1)	25	6	3.3	48.2	30.2	18.3	100	99	58	-	-

EB2-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-12	24 RT	33+78	0.0-1.5	A-6(14)	39	15	0.6	17.1	49.7	32.6	100	100	88	-	-
SS-13	24 RT	33+78	3.5-5.0	A-4(0)	21	3	3.9	52.7	29.2	14.2	100	100	54	-	-
SS-14	24 RT	33+78	8.5-10.0	A-4(4)	25	9	1.6	41.7	36.3	20.3	100	99	68	-	-

B1-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT LB/FT^3	UNCONFINED COMP. STRENGTH, KSI	SECTION MOD. @ 40% MPSI
RS-1	**10 LT**	**28+53**	**9.2-9.8**	**PHYLLITE**	**160.3**	**0.99**	**1.17**
RS-2	**10 LT**	**28+53**	**29.4-29.9**	**PHYLLITE**	**167.3**	**5.09**	**6.93**

B2-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT LB/FT^3	UNCONFINED COMP. STRENGTH, KSI	SECTION MOD. @ 40% MPSI
RS-3	**10 LT**	**29+58**	**23.8-24.3**	**PHYLLITE**	**164.6**	**2.74**	**-0.60**

B3-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT LB/FT^3	UNCONFINED COMP. STRENGTH, KSI	SECTION MOD. @ 40% MPSI
RS-4	**10 LT**	**30+63**	**19.2-19.9**	**PHYLLITE**	**157.0**	**1.91**	**2.99**

B4-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT LB/FT^3	UNCONFINED COMP. STRENGTH, KSI	SECTION MOD. @ 40% MPSI
RS-5	**10 LT**	**31+68**	**13.1-13.7**	**PHYLLITE**	**179.6**	**1.99**	**3.42**

B5-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNIT WT LB/FT^3	UNCONFINED COMP. STRENGTH, KSI	SECTION MOD. @ 40% MPSI
RS-6	**10 LT**	**32+73**	**17.1-17.7**	**PHYLLITE**	**164.6**	**2.51**	**2.94**
RS-7	**10 LT**	**32+73**	**35.1-35.6**	**PHYLLITE**	**162.4**	**2.73**	**2.47**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33490.1.1 TIP: B-4138 COUNTY: Harnett

DESCRIPTION(1): Bridge No. 46 on -SBL- (US 401) over Cape Fear River

EXISTING BRIDGE

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

Bridge No.: 46 Length: 805' Total Bents: 17 Bents in Channel: 9 Bents in Floodplain: 8
Foundation Type: Concrete piers

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Minor contraction scour on bare slopes underneath bridge

Interior Bents: Minor to moderate local scour around piers at all bents in channel

Channel Bed: None

Channel Bank: Some high water scour

EXISTING SCOUR PROTECTION

Type(3): None

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): No debris around piles at the time of investigation

DESIGN INFORMATION

Channel Bed Material(7): Alluvial, brown, sandy silt (SS-25) and Residual, gray and brown, saprolitic, sandy silt and weathered phyllite

Channel Bank Material(8): Residual, gray and brown, sandy silt (SS-23)

Channel Bank Cover(9): Some grass, trees, and brush

Floodplain Width(10): Approximately 2200 feet

Floodplain Cover(11): Heavily wooded with some grass and brush

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

Channel Migration Tend.(13): No tendency

Observations and Other Comments: Debris potential is very high

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS				
B1	B2	B3	B4	B5
98.9	98.9	94.9	96.3	95.2

Comparison of DSE to Hydraulics Unit theoretical scour:
The DSE for all bents has been raised 3.0 feet to 7.7 feet from the 100 year scour on the Hydraulics report dated 4/14/09.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank							
Sample No.							
Retained #4							
Passed #10							
Passed #40							
Passed #200							
Coarse Sand							
Fine Sand							
Silt							
Clay							
LL							
PI							
AASHTO							
Station							
Offset							
Depth							

See Sheet 22, "Soil Test Results", for samples:
SS-23
SS-25

Template Revised 02/07/06

Reported by: Jaime Love Pedro Jaime Love Pedro **Date:** 4/15/2009

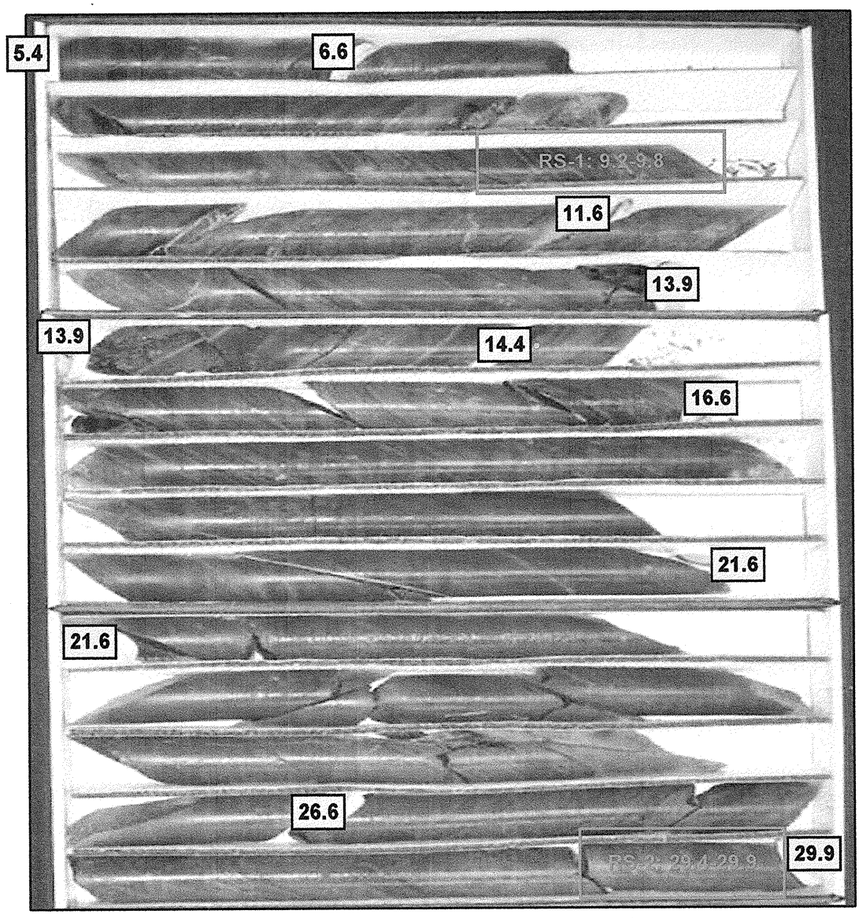
INSTRUCTIONS

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.

CORE PHOTOGRAPHS

B1-A

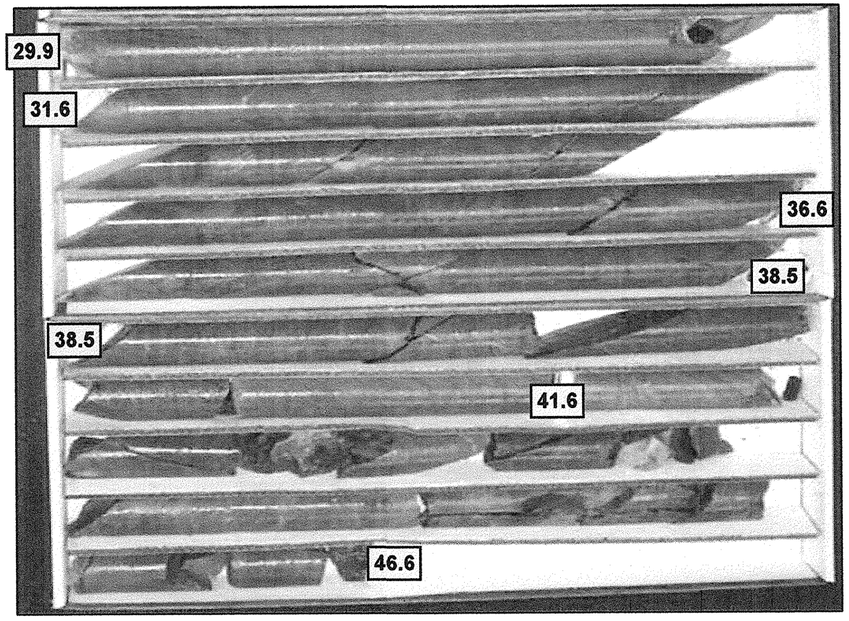
BOXES 1-3: 5.4 - 29.9 FEET



0 1 2
FEET

B1-A

BOXES 4 & 5: 29.9 - 46.6 FEET

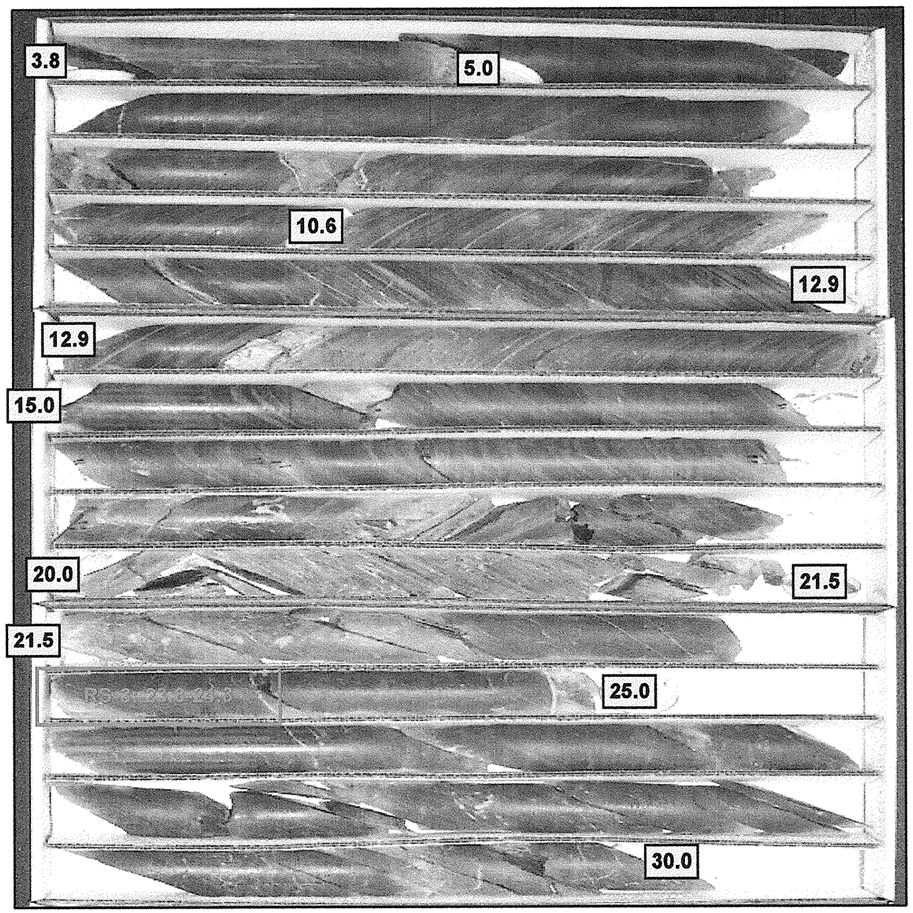


0 1 2
FEET

CORE PHOTOGRAPHS

B2-A

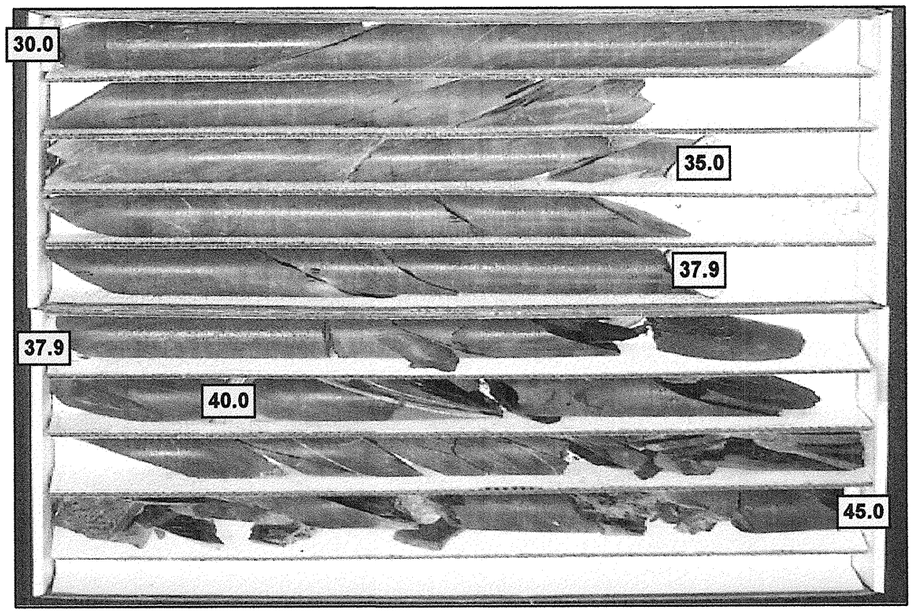
BOXES 1 - 3: 3.8 - 30.0 FEET



0 1 2
FEET

B2-A

BOXES 4 & 5: 30.0 - 45.0 FEET

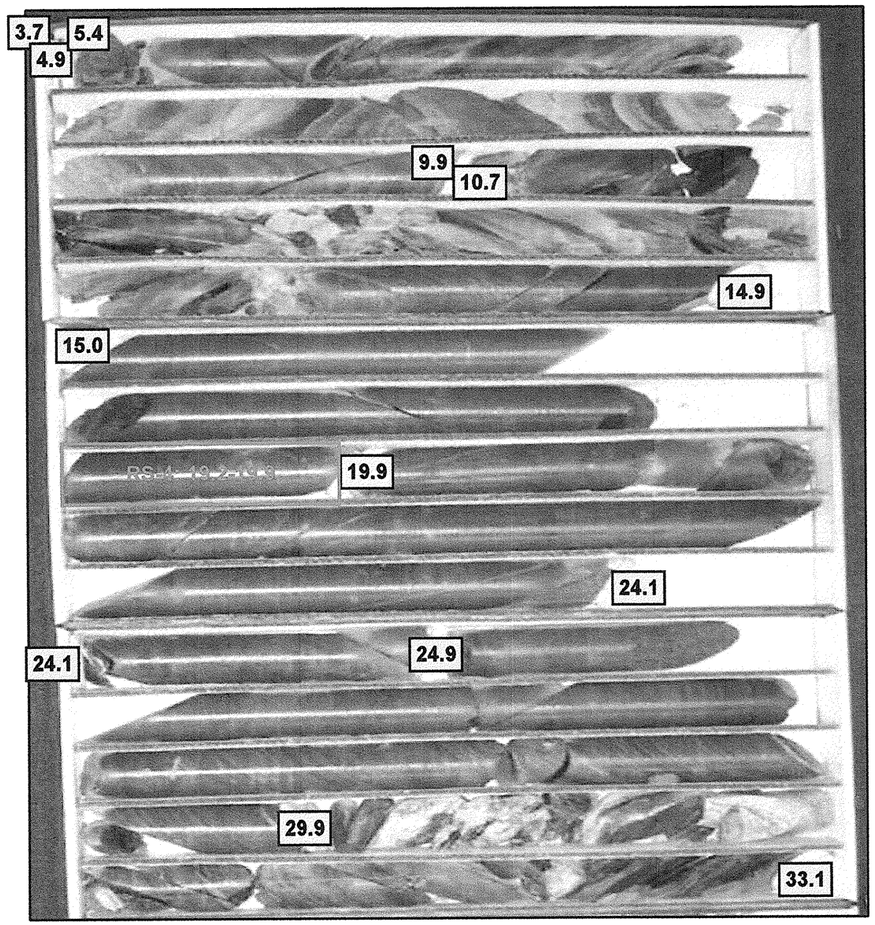


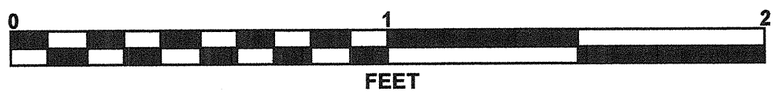
0 1 2
FEET

CORE PHOTOGRAPHS

B3-A

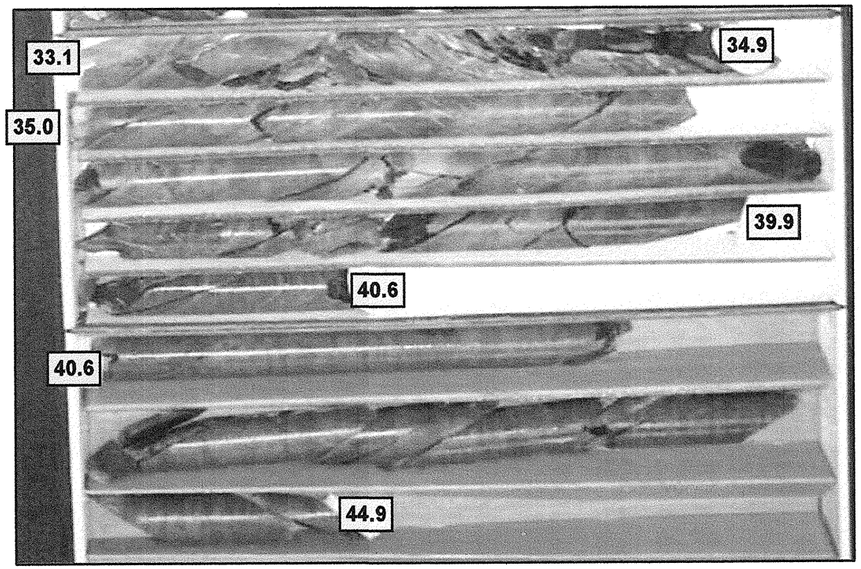
BOXES 1 - 3: 3.7 - 33.1 FEET

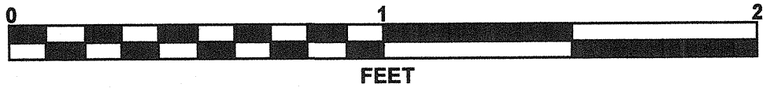




B3-A

BOXES 4 & 5: 33.1 - 44.9 FEET

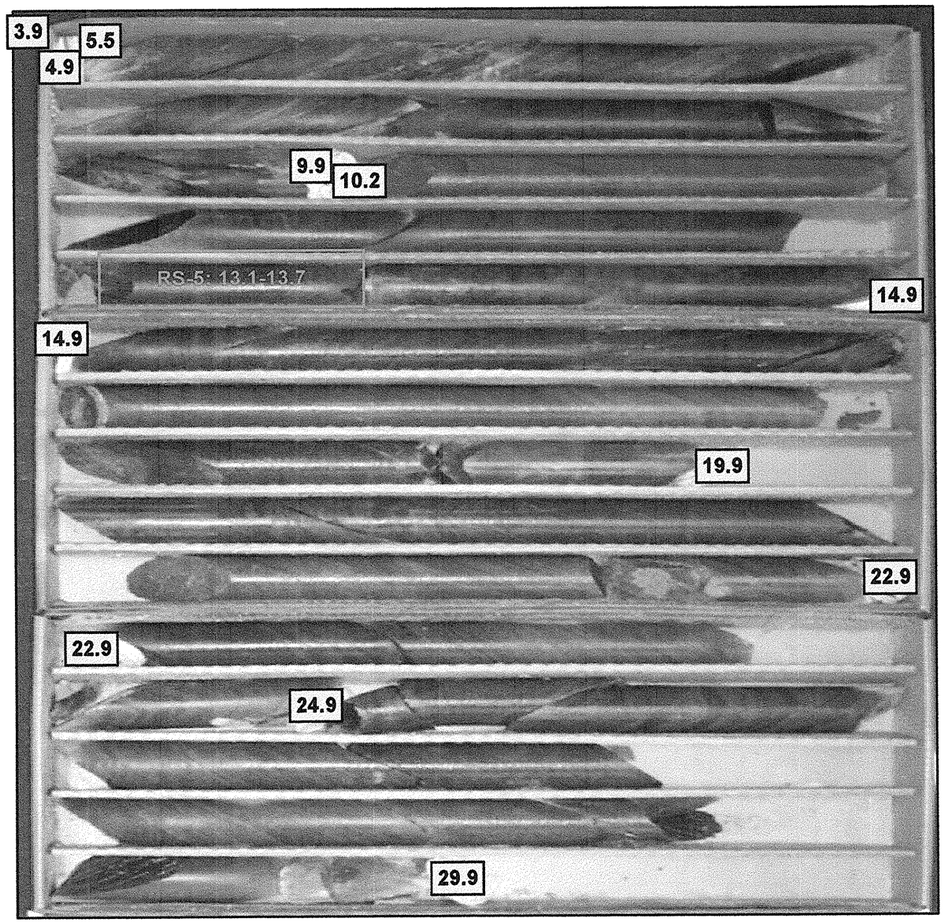




CORE PHOTOGRAPHS

B4-A

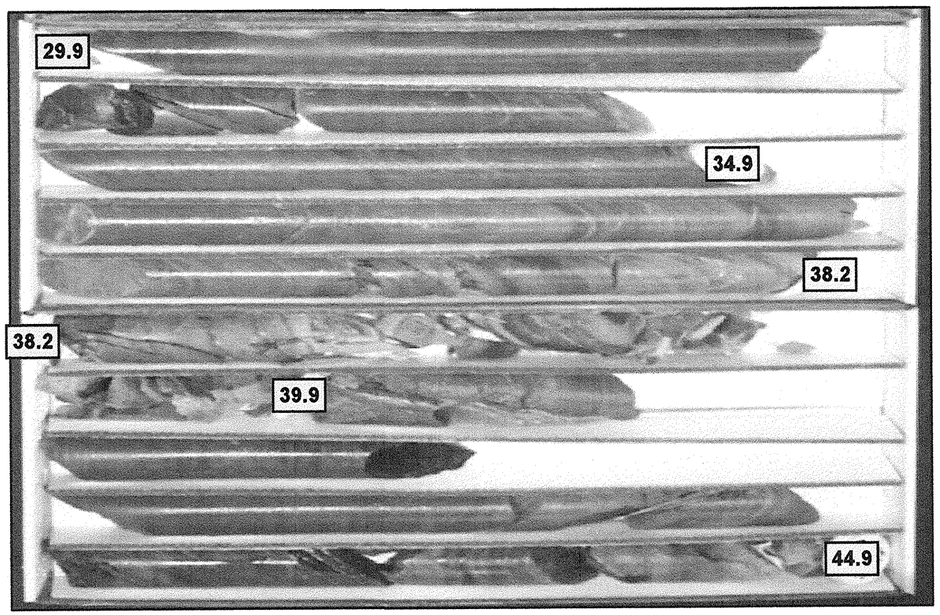
BOXES 1 - 3: 3.9 - 29.9 FEET



0 1 2
FEET

B4-A

BOXES 4 & 5: 29.9 - 44.9 FEET

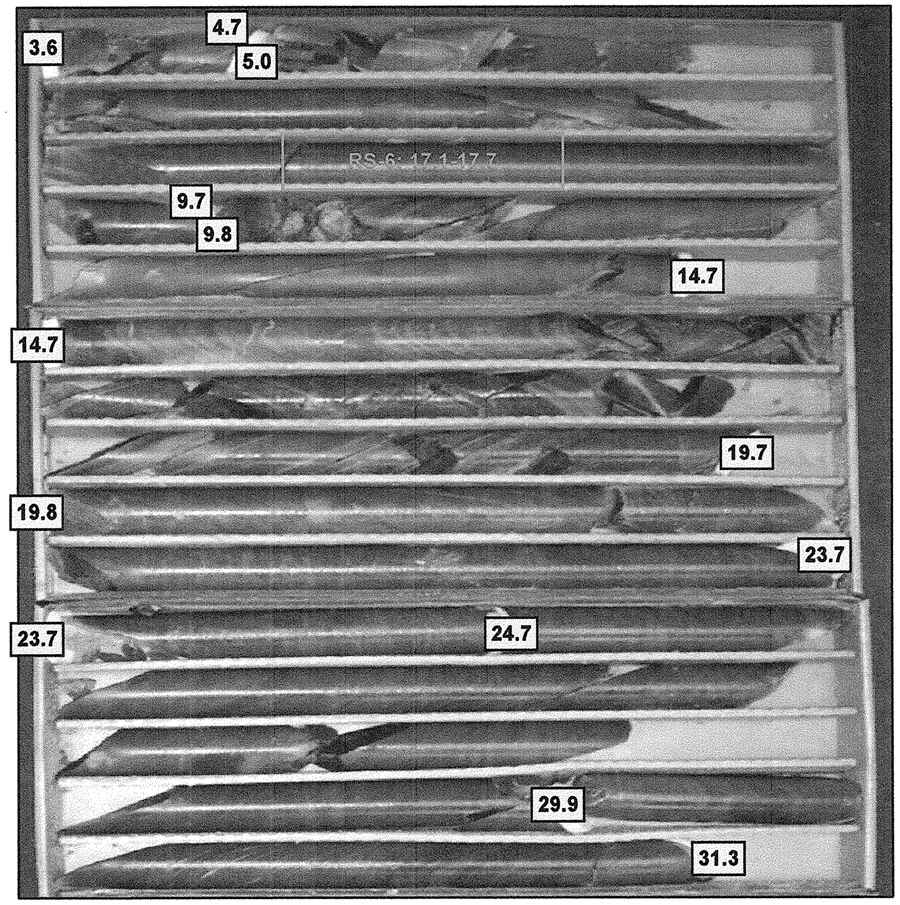


0 1 2
FEET

CORE PHOTOGRAPHS

B5-A

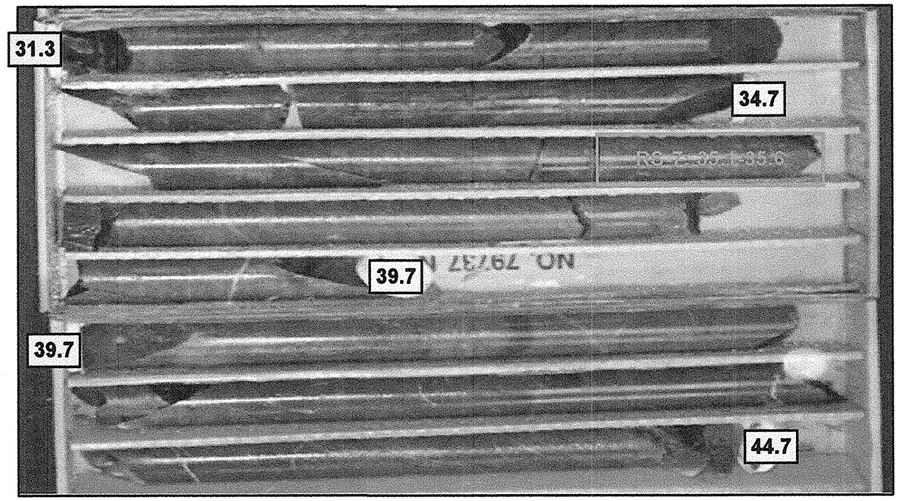
BOXES 1 - 3: 1.1 - 31.3 FEET



0 1 2
FEET

B5-A

BOXES 4 & 5: 31.3 - 44.7 FEET



0 1 2
FEET

SITE PHOTOGRAPH

Bridge No. 46 on –SBL– (US 401 South) over Cape Fear River

Looking Downstream at US 401*
*Note: The front bridge carries the southbound lanes.