STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

CONTENTS

SHEET	DESCRIPTION
ı	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE
5-7	BORE LOGS
8	SOIL TEST RESULTS
9	SCOUR REPORT
10	SITE PHOTOGRAPHS

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33614.1.1 (B-4273) F.A. PROJ. BRNHS-0401(14)
COUNTY SCOTLAND /HOKE
PROJECT DESCRIPTION BRIDGE NO. 47 OVER LUMBER RIVER
ON US 401

| STATE | STATE PROJECT REPERENCE NO. | SHEST | TOTAL SHEETS |
| N.C. | 33614.1.1 (B-4273) | 1 | 10

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 VARROUS FIELD BORING LOGS, ROCK CORES, AND SOL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEGHE BY CONTACTING THE N. C. DEPARTMENT OF TRANSFORTATION, GEOTECHNICAL ENGINEERING UNIT AT (9)9) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

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

PERSONNEL

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NOVEMBER, 2010



Brodly Wody

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

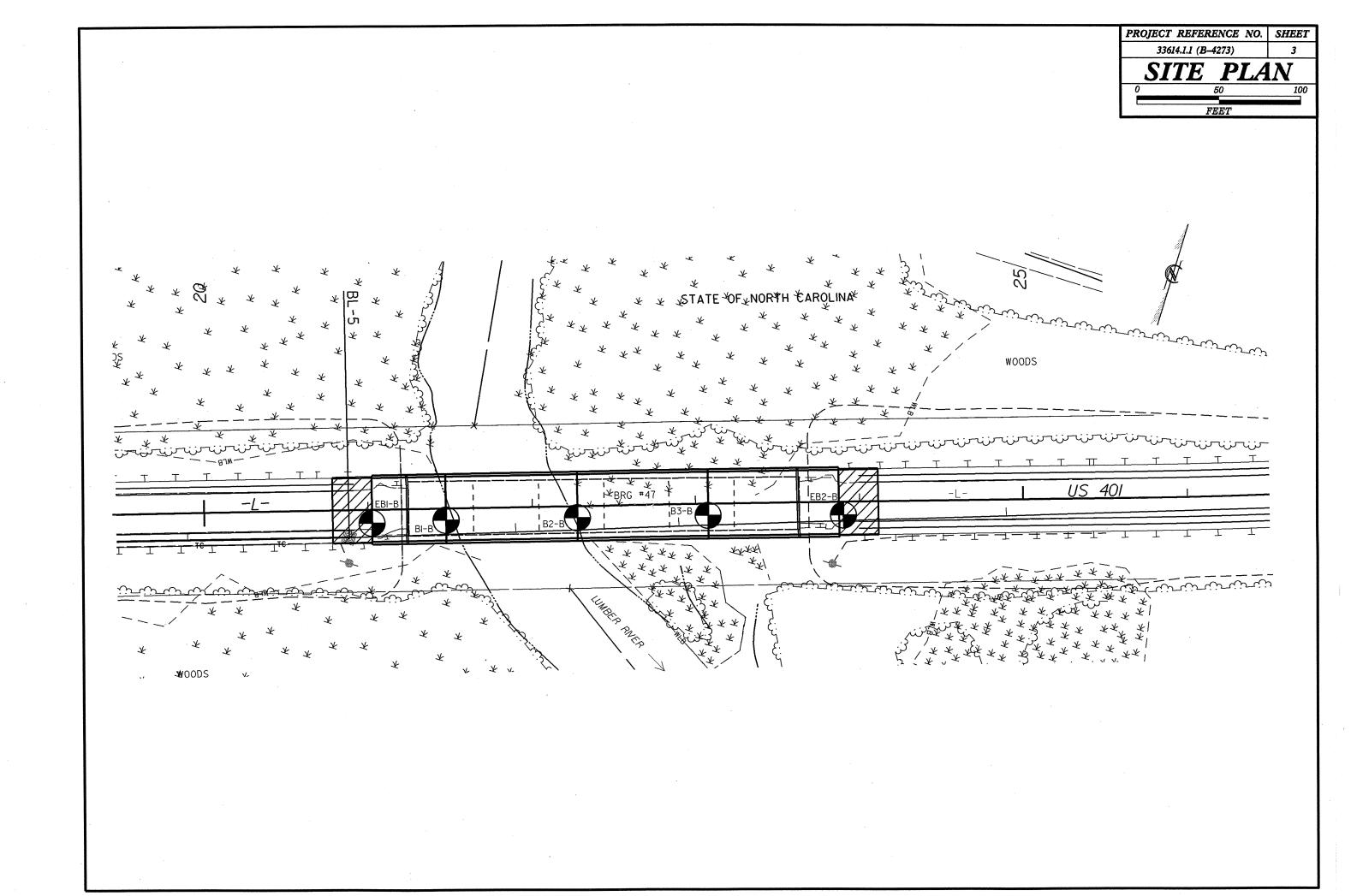
GEOTECHNICAL ENGINEERING UNIT

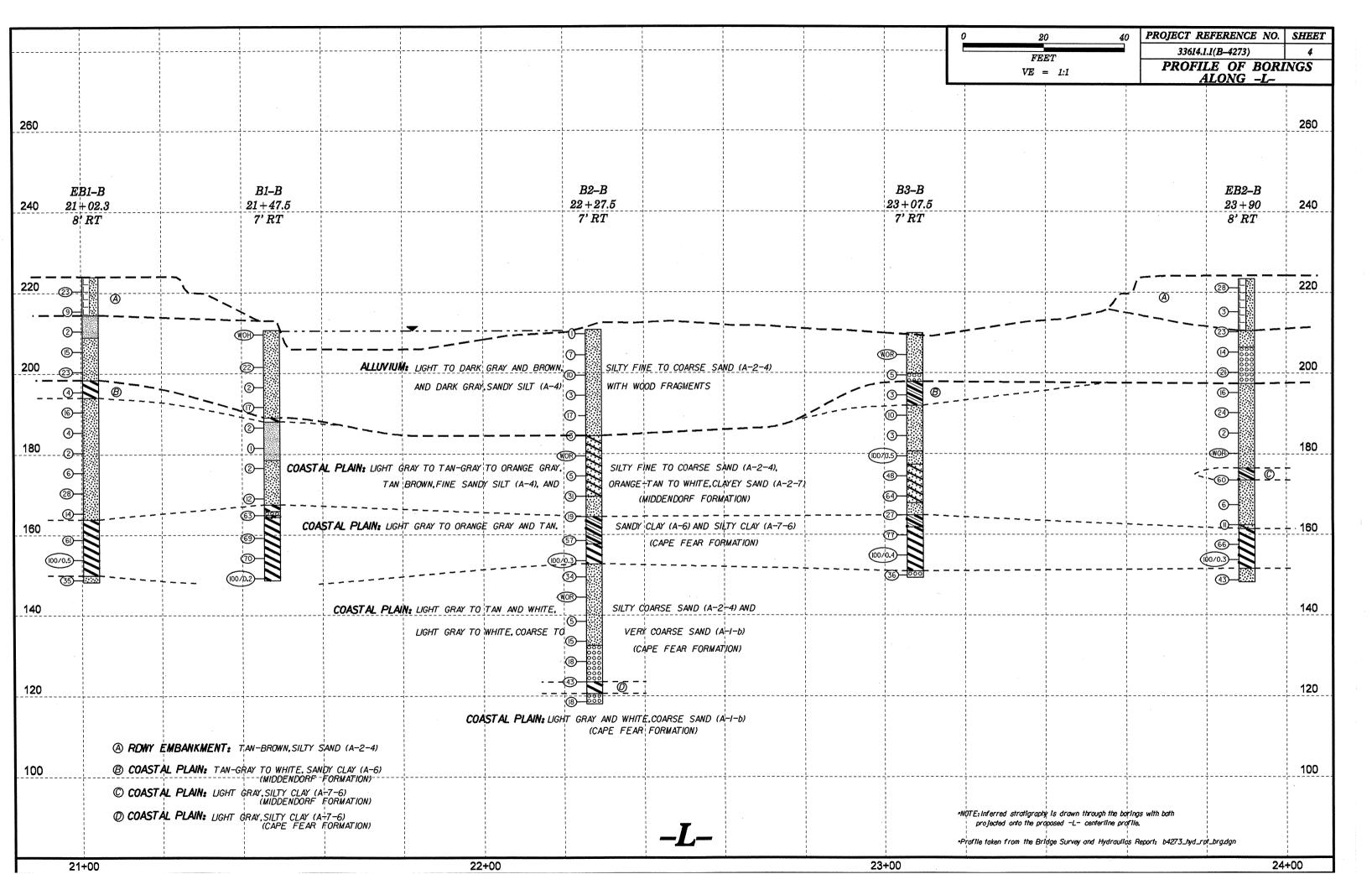
SUBSURFACE INVESTIGATION

	SOIL AND ROCK	LEGEND, TERMS	S, SYMBOLS, AND ABBREVIATIONS	
SOIL DESCRIPTION	GRADATION		ROCK DESCRIPTION	TERMS AND DEFINITIONS
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS	WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM LUNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME POORLY GRADED)	FINE TO COARSE.	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.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN	POORLY GRADED: GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE	S17FS.		ADUIFER - A WATER BEARING FORMATION OR STRATA.
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:	ANGULARITY OF GRAINS	JIZES.	DF WEATHERED ROCK.	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS	SI ANGULAR,	5///A///A	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.
VERY STIFF, GRAY, SUTY CLAY, MOIST WITH INTERBEDDED FINE SAND LINERS, HIGHLY PLASTIC, A-7-6	SUBANGULAR, SUBROUNDED, OR ROUNDED.		WEATHERED NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 ROCK (WR) BLOWS PER FOOT IF TESTED.	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL
SOIL LEGEND AND AASHTO CLASSIFICATION	MINERALOGICAL COMPOSITION		GW SW THE TO SOLD OF SOLD VOLENCE AND APPROXIMATION OF THE SOLD OF	AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.	IN DESCRIPTIONS	I BULK (LB) I TO THE ANDER THE DOLL HELD ON HE HELD ON	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
CLASS. (≤ 35% PASSING *200) (> 35% PASSING *200) (> 35% PASSING *200) (> 35% PASSING *200)	COMPRESSIBILITY		NON-CRYSTALLINE FINE TO COARSE GRAIN METAMORPHIC AND NON-CDASTAL PLAIN	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-6 A-7 A-6 A-7 A-1, A-2 A-6 A-7	SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS		I NOLLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	DF SLOPE.
SYMBOL COCCODOCO	MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL HIGHLY COMPRESSIBLE LIQUID LIMIT GREA		COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SEDIMENTARY ROCK LL SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED	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.
Z PASSING SILT	PERCENTAGE OF MATERIAL		WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT
* 10 50 MX GRANULAR CLAY PEAT	ORGANIC MATERIAL GRANULAR SILT - CLAY SOILS SOILS OTHE	R MATERIAL	i i	ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE
* 200 35 MX 30 MX 30 MX 30 MX 35 MX 35 MX 35 MX 35 MX 36 MN 36 M	TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE	1 - 10%	1	DIP - THE ANGLE AT WHICH A STRATOM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
LIDUID LIMIT 48 MX 41 MN 48 MX 41 MN 48 MX 41 MN 48 MX 41 MN SOILS WITH	LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE MODERATELY ORGANIC 5 - 10% 12 - 20% SOME	10 - 20% 20 - 35%	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN,	DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF
PLASTIC INDEX 6 MX NP 18 MX 18 MX 11 MN 11 MN 18 MX 18 MX 11 MN 11 MN LITTLE OR HIGHLY	HIGHLY DRGANIC >10% >20% HIGHLY	35% AND ABOVE	J OF A CRYSTALLINE NATURE.	THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
GROUP INDEX 0 8 8 4 MX 8 MX 12 MX 16 MX No MX MODERATE AMOUNTS OF SOILS	GROUND WATER		SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO	<u>FAULT</u> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
USUAL TYPES STUNE FRANK FINE SILTY OR CLAYEY SILTY CLAYEY ORGANIC	WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILL	ING	(SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
MATERIALS SAND GRAVEL AND SHIND SULS SULS	STATIC WATER LEVEL AFTER 24 HOURS		MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
GEN. RATING AS A EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABL	PERCHED WATER, SATURATED ZONE, OR WATER BEARING ST	TRATA	(MOD.) 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	PARENT MATERIAL.
SUBGRADE	SPRING OR SEEP	`	WITH ERESH ROCK.	<u>FLOOD PLAIN (FP)</u> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30	MISCELLANEOUS SYMBOLS		MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL SEVERE AND DISCOLORED AND A MAJORITY SHOW KADLINIZATION, ROCK SHOWS SEVERE LOSS OF STRENGTH	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN
CONSISTENCY OR DENSENESS RANGE OF STANDARD RANGE OF UNCONFINED		TEST BORING	(MOD. SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK.	THE FIELD.
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY PENETRATION RESISTENCE (N-VALUE) (TONS/FT2)	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SPT DHT DHT TEST BORING VST PHT	W/ CORE	1	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
VERY LOOSE /4	SOIL SYMBOL AUGER BORING	- SPT N-VALUE	(SEV.) IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KADLINIZED TO SOME	<u>LEDGE</u> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
GENERALLY LOOSE 4 TO 10			EXTENT. SUME FRAUMENTS OF STRUNG ROCK USUALLY REMAIN.	LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
MATERIAL DENSE 20 TO 50	ARTIFICIAL FILL (AF) DTHER ————————————————————————————————————	REF SPT REFUSAL	VERY SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN
(NON-COHESIVE) VERY DENSE >50	INFERRED SOIL BOUNDARY MONITORING WELL		(V SEV.) THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK	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
VERY SOFT <2 <0.25 GENERALLY SOFT 2 TO 4 0.25 TO 0.50	PIEZOMETÉR			INTERVENING IMPERVIOUS STRATUM.
SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0	INFERRED ROCK LINE INSTALLATION		COMPLETE ROCK REDUCED TO SOIL, ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
MATERIAL STIFF 8 TO 15 1 TO 2 (COHESIVE) VERY STIFF 15 TO 30 2 TO 4	SLOPE INDICATOR INSTALLATION			ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF
HARD >30 >4	25/025 DIP & DIP DIRECTION OF	TECT		ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
TEXTURE OR GRAIN SIZE	ROCK STRUCTURES CONE PENETROMETER	1 1231		SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE
U.S. STD. SIEVE SIZE 4 10 40 60 200 270	SOUNDING ROD		SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.	PARENT ROCK.
OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053	ABBREVIATIONS			SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL
BOULDER COBBLE GRAVEL COARSE FINE SILT CLAY	AR - AUGER REFUSAL MED MEDIUM	VST - VANE SHEAR TEST	TO DETACH HAND SPECIMEN. MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE	TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
(BLDR.) (COB.) (GR.) (CSE. SD.) (F SD.) (SL.) (CL.)	BT - BORING TERMINATED MICA MICACEOUS CL CLAY MOD MODERATELY	WEA WEATHERED 7 - UNIT WEIGHT	HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
GRAIN MM 305 75 2.0 0.25 0.05 0.005	CPT - CONE PENETRATION TEST NP - NON PLASTIC	7d- DRY UNIT WEIGHT	BY MODERATE BLOWS. MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF
0122 114 12	CSE COARSE ORG ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS	HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE	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
SOIL MOISTURE - CORRELATION OF TERMS SOIL MOISTURE SCALE FIELD MOISTURE CHIPS FOR EIGH A MOISTURE DESCRIPTION	DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC	S - BULK		THAN 0.1 FOOT PER 60 BLOWS.
(ATTERBERG LIMITS) GUIDE FOR FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTIO	• - VOID RATIO SD SAND, SANDY F - FINE SL SILT, SILTY	SS - SPLIT SPOON ST - SHELBY TUBE	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	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH
- SATURATED - USUALLY LIQUID; VERY WET, USUALLY	FOSS FOSSILIFEROUS SLI SLIGHTLY	RS - ROCK	PIECES CAN BE BROKEN BY FINGER PRESSURE.	OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY
(SAT.) FROM BELOW THE GROUND WATER TABLE	FRAC FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS FRAGMENTS W - MOISTURE CONTENT	RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING	VERY CAN BE CARVED WITH KNIFE, CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE, CAN BE SCRATCHED READILY BY	TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE
PLASTIC TO SEMICOLIDE PROVIDES DRIVING TO	HI HIGHLY V - VERY	RATIO	FINGERNAIL.	TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. IDPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
RANGE S - WET - (W) ATTAIN OPTIMUM MOISTURE	EQUIPMENT USED ON SUBJECT PRO-	JECT	FRACTURE SPACING BEDDING TERM THICKNESS	
PLL PLASTIC LIMIT		MAMMER TYPE:	TEND SERVING VERY THICKLY REPORTS	BENCH MARK: -BL- 5
OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE		AUTOMATIC MANUAL	VERT WILE MURE ITHIN 10 FEET THICKLY BEDDED 1.5 - 4 FEET	-L- Station 20+88,15 18,32' RT ELEVATION: 223,41 FT.
SL SHRINKAGE LIMIT	- MUBILE B -		MODERATELY CLOSE	
REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE		ORE SIZE:	VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET	NOTES:
HITHIN OF LINOIS FIDE	- I TO TOLLOW ADDLES		INDURATION (0.000 FEET	
PLASTICITY]		FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
PLASTICITY INDEX (PI) DRY STRENGTH NDNPLASTIC 0-5 VERY LOW	X CME-550 TUNG,-CARBIDE INSERTS		FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS:	
LOW PLASTICITY 6-15 SLIGHT	X CASING W/ ADVANCER	HAND TOOLS:	GENILE BLOW BY HAMMER DISTRIEGRATES SAMPLE.	
MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH	PORTABLE HOIST TRICONE STEEL TEETH	POST HOLE DIGGER	MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE: BREAKS EASILY WHEN HIT WITH HAMMER.	
COLOR	TRICONE TUNG,-CARB.	HAND AUGER		
	CORE BIT	SOUNDING ROD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.	
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.		VANE SHEAR TEST	EXTREMELY INDURATED SHARP HAMMER BLDWS REQUIRED TO BREAK SAMPLE;	
			SAMPLE BREAKS ACROSS GRAINS.	

PROJECT REFERENCE NO. 33614.I.I (B-4273)

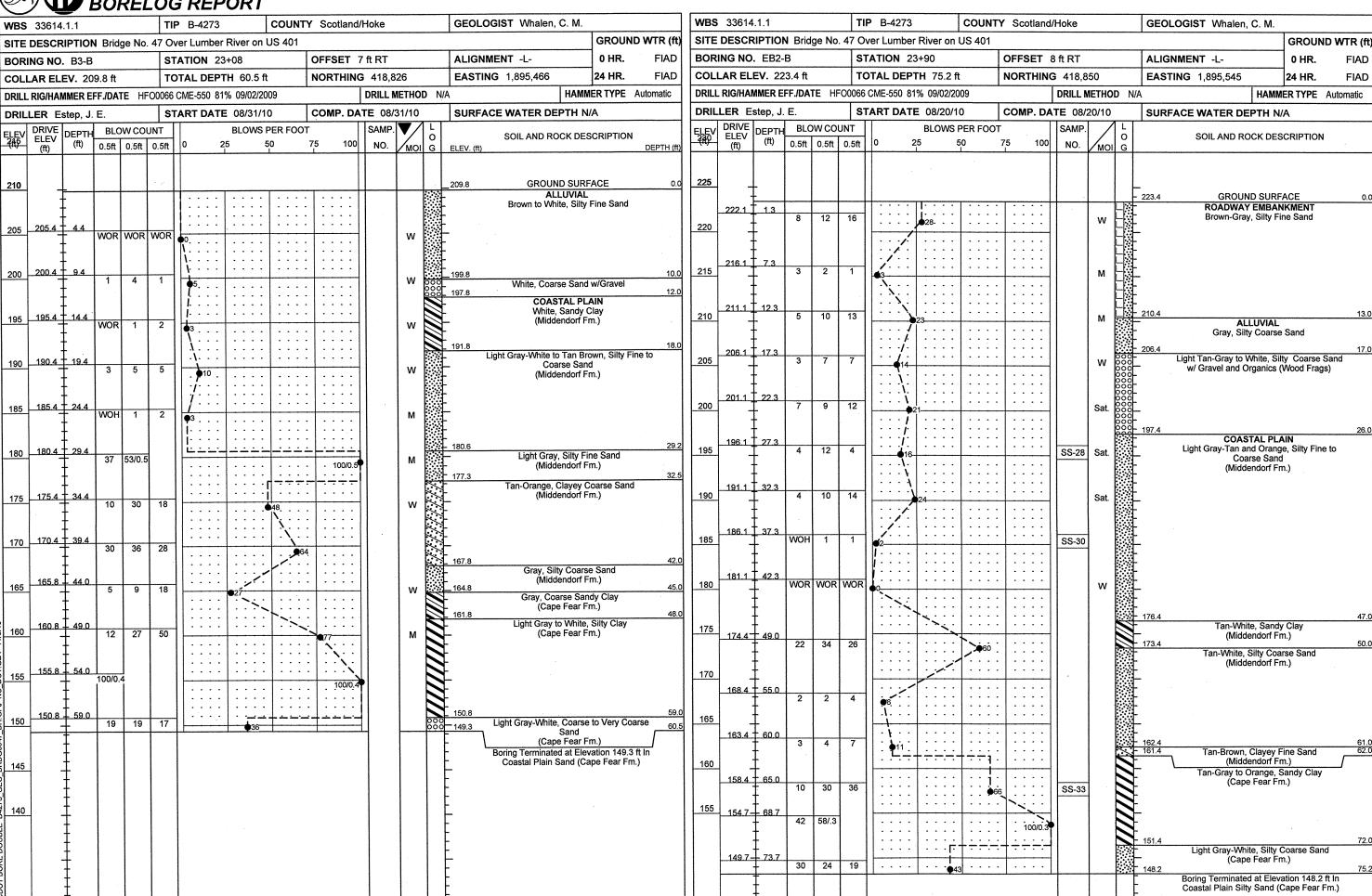
SHEET NO.





WBS 33614.1.1		TY Scotland/Hoke	GEOLOGIST Whalen, C. M.	WBS 33614.1.1 TIP B-4	4273 COUNTY Scotland/Hoke	GEOLOGIST Whalen, C. M.
SITE DESCRIPTION Bridge No.	47 Over Lumber River on US 401		GROUND WTR (ft)	SITE DESCRIPTION Bridge No. 47 Over Lu	umber River on US 401	GROUND WTR (ff
BORING NO. EB1-B	STATION 21+02	OFFSET 8 ft RT	ALIGNMENT -L- 0 HR. N/A	BORING NO. B1-B STATIO	ON 21+48 OFFSET 7 ft RT	ALIGNMENT -L- 0 HR. FIAD
COLLAR ELEV. 223.9 ft	TOTAL DEPTH 75.6 ft	NORTHING 418,762	EASTING 1,895,272 24 HR. Dry		DEPTH 61.8 ft NORTHING 418,7	
DRILL RIG/HAMMER EFF./DATE HF	O0066 CME-550 81% 09/02/2009	DRILL METHOD N/	A HAMMER TYPE Automatic	DRILL RIG/HAMMER EFF./DATE HF00066 CME-5		ETHOD N/A HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 08/16/10	COMP. DATE 08/16/10	SURFACE WATER DEPTH N/A		DATE 08/17/10 COMP. DATE 08/	7/10 SURFACE WATER DEPTH N/A
DRIVE DEPTH BLOW COU		75 100 NO. MOI G	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)	ELEV CRIP (ft) BLOW COUNT CRIP (ft) 0.5ft 0.5f	BLOWS PER FOOT SAMP. 25 50 75 100 NO.	O SOIL AND ROCK DESCRIPTION
225			GROUND SURFACE 0.0	215		
221.4 7 2.5	12					
220 7 10	13	SS-1 Sat.	· - -	210 210.1 0.0 WOR WOR WOH 00		Sat. 210.1 GROUND SURFACE 0. Sat. ALLUVIAL Light to Dark Gray, Silty, Coarse, Sand w/
216.4 + 7.5 3 3	6		- 214.4 9.5	205		- Gravel
211.4 7 12.5		.	ALLUVIAL Dark Gray, Fine, Sandy Silt w/ Wood Fragments	202.1 8.0 4 11 11	22	Sat.
210 WOH WOH			208.9 15.0 Light-Gray, Silty Sand w/ Wood Fragments	197.1 13.0	Z.:	- - -
206.4 + 17.5 4 7	8 15	Sat.	- -	195 WOH WOH 2		w E
200 7 12	11	.	- -	190 18.0 3 7 10		w
				187.1 23.0	<u>/ </u>	- 188.6 21 187.6 COASTAL PLAIN 22. Clay Seam (little recovery)
195	2 4	SS-3 Sat.	(Middendorf Fm.) 193.9 Light Gray to Tan to White, Silty Coarse	185		Sat. Clay Seam (little recovery) (Middendorf Fm.) Tan-Brown, Fine, Sandy Silt (Middendorf Fm.)
191.4 + 32.5 0 7	9 16	SS-4 Sat.	Sand (Middendorf Fm.)	180 182.1 28.0 0 0 1		Sat.
186.4 7 37.5				177.1 33.0 1 1 1 1		178.1 32. Tan-Gray to Orange, Silty Coarse to Very Coarse Sand
185 3 2	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		175		(Middendorf Fm.)
181.4 + 42.5 0 1	1		-	170 169.6 40.5 5 5 7 \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	12	<u>-</u> м
1764 + 47.5	3	· : · · · · ·		165 165.5 44.6 4 12 51	<u> </u>	167.1 43 165.5 Clay Seam (No Recovery) 44 (Cape Fear Fm.) 45 154.0 Tan-Orange, Clayey, Coarse Sand 46
0 1714 + 525						(Cape Fear Fm.) Light to Dark Gray, Slightly Sandy Clay
170 15 15 2 15 15	28	· · · · · · ·		160 159.8 50.3 5 24 45	••••••••••••••••••••••••••••••••••••••	(Cape Fear Fm.) Light Tan to Orange and Gray, Silty Clay (Cape Fear Fm.)
3 3 3 3 3	11 14			155 154.8 55.3		
150 8 64 1			Light Gray and Orange-White, Silty Clay (Cape Fear Fm.)			
160 159.8 64.1 10 24	37	SS-8	-	149.8 60.3 41 59/0.2	100/0.2	D 148.3 61 Boring Terminated at Elevation 148.3 ft In Coastal Plain Silty Clay (Cape Fear Fm.)
22 28 28 29 20 20 20 20 20 20 20 20 20 20 20 20 20		100/0.5	<u>-</u> -	145		- Coastal Fiam Only Gray (Cape Feat Fill.)
149.8 74.1			149.9 74.0			
149.8 - 74.1 13 12 13 12	23		148.3 Light Tan to White, Silty Coarse Sand (Cape Fear Fm.)			
			Boring Terminated at Elevation 148.3 ft In Coastal Plain Silty Sand (Cape Fear Fm.)			

Common No. 62:20 Common No.	33614.1				TIP B					Scotland	/Hoke			GEOLO	GIST Whale	en, C. M.				S 3361					P B-4273		TY Scotlan	d/Hoke		GEO	OLOGIST W	/halen, C. M		
Collaborary Table Month	DESCRI	PTION	Bridge	No. 47	Over L	umber	River or	US 401									-	, ,					ge No.			n US 401							GROU	ND WTR
DELLA PRINCIPAL PLANE PRINCIPAL PRINCIPAL PLANE PRINCIPAL PR	ING NO.	B2-B			STATIO	ON 22	+28		OF	FSET	7 ft RT			ALIGNN	MENT -L-		0 HR.	FIAD					·····	ST	ATION 22+28		OFFSET	7 ft RT		ALI	GNMENT -L	,=	0 HR.	FIA
Marked Process Company Compa	LAR ELE	V. 210.	.6 ft		TOTAL	DEPT	H 92.6	ft	NO	ORTHING	<u> </u>		i_	EASTIN	G 1,895,39		1		ļ								NORTHIN				STING 1,895	5,390	24 HR.	FIA
Part	. RIG/HAMI	MER EFF	F./DATE	HFO00	66 CME-	550 819	% 09/02/2	2009			<u> </u>		N/A	· · · · · · · · · · · · · · · · · · ·		HAMN	IER TYPE	Automatic	ļ				E HF					DRILL	METHOD	N/A	***************************************	HAN	MMER TYPE	Automati
10 10 10 10 10 10 10 10						DATE				OMP. DA				SURFA	CE WATER	DEPTH N	/A		DRI											SUF	RFACE WATE	ER DEPTH	N/A	
100 2014 A.D. WOR WOR ON THE CONTROL OF THE CONTROL	DRIVE ELEV (ft)	· · · · · · · · · · · · · · · · · · ·			→ 1	2				100	1	171	0	LEV. (ft)	SOIL AND	ROCK DES	SCRIPTION		ELE\	/ BRIVE ELEV (ft)	DEPTH (ft)				l .			11	1/1		SOIL A	AND ROCK DI	ESCRIPTIO	N
West Section Constitution Co	- - - - - -			٠									2	10.6	GRO	DUND SURI	FACE	0.0		134.5	76.1	2	7	8	Ma ∴ • 15			 	1 6		(Cap	pe Fear Fm.) (o to White, Coar	continued)	7
292 20.5 d	210.6 +	- 0.0 V	WOR W	OR 1	1			T				w				ALLUVIAL			130	129.5	81.1	2	- l					\exists	1 10	00			Fm.)	
200 200.4 1,02	205.4	5.2	3	3 4	-	7			: :			w	- - - -	. •	Sand Sand	d w/some G	ravel	Zaroc	125	124.5	86.1				18					000	L	Light Gray, Sil	ity Clay	8
100 190.4 1.5.2 1 2 1	200.4	10.2	4	4 6	- · '	•10						w	-						120	119.5	91.1	7	7	11				-	1 1	00_	Light Gray	-White, Coars	•	parse
180 1804 202 3 7 10 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 1 10 10 1804 202 1 2 2 3 10 10 10 10 10 10 10 10 10 10 10 10 10	195.4	15.2	1	2 1								10/							115	<u> </u>						_				-	Boring Terr	rminated at Ele	evation 118.0	
185	100.4		'		3	````` `````						V							110		‡ ‡													
189 1894 292	190.4	- 20.2	3	7 10					.		,	w							110	-	† ‡			-						- - -		·		
180. 180.4. 30.2 WOR WOR WOR WOR WOR TO THE TOTAL THE TO	185.4	- 25.2 -	1	2 1	- ·/	/ 						1 1	· · · · -	184.4	CC Top Orang	DASTAL PL	AIN Clavey San		105	-	† †									<u>-</u> -				
175	180.4	- - 30.2	WOR W	VOR WO)R •0.							w	////		ran-Orang (M	liddendorf F	m.)	u	100		† †									-				
170 170.4 - 40.2 6 18 13	175.4	35.2	2	2 3	_ \				.			\ \\							95		† † †									- - - -				
165 165.4 45.2 3 7 12 160 159.5 51.1 10 22 35 155.5 66.1 17 43 57/0.3 100.159 159.5 160.1 9 19 15 150.5 40.1 9 10.1 9	170.4							-	• • •										90		‡ ‡									-				
165 156.4 43.2 3 7 12 43.5 51.1 10 22 35 46.2 156.1 17 43 57/0.3 1000.3 150.5 60.1 9 19 15 43.5 65.1 WOR WOR WOR WOR 133.5 7.1 1 133.5 7.1 1 1 133.5 7.1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			6	18 13	3 .		31 .					M		169.4							‡ ‡								, ,	- - - -				
160 159.5 - 51.1 10 22 35	165.4	- 45.2 - -	3	7 12	2 .	•15						М		164.4					85	-	I I									F				
155	159.5	- 51.1 - 51.1	10	22 3	5 .		: ``\	1	1			D		157 G				E 2.6	80	-	 									<u>-</u>				
150 5 60.1 9 19 15 Light Gray to White, Silty Coarse Sand (Cape Fear Fm.) 145 145.5 65.1 WOR WOR WOR 139.5 71.1	154.5	56.1	47	42 57	╝			1						.01.0	Tan Ora (C	ange Gray, Cape Fear F	Silty Clay m.)	33.0	75		 									<u>[</u>				
45	150.5	60.1					·	l l	- 1		•			152.6	Light Gray to	White, Silt Cape Fear F	y Coarse Sa m.)		11		 						,			<u> </u>				
45 193 93 WOR	145.5	65.1																			† † †									- - -				
	145.5	00.1	WOR V	WOR WO	OR 0			1			1	w							65		 - -									- - - -				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	139.5	71.1	1	3 2	2 1	5						w									‡ ‡									<u> -</u>				



SHEET 8 OF 10 33614.1.1 (B-4273)

	SOIL TEST RESULTS														
SAMPLE			DEPTH	AASHTO				% BY WE	IGHT		% PASSING (SIEVES)			%	%
NO.	OFFSET	STATION	INTERVAL	CLASS.	L.L.	P.I.	C.SAND	F.SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
SS-1	8 RT	21+02.3	2.5-4.0	A-2-4(0)	14	NP	66.2	21.1	5.5	7.1	97	57	14	-	-
SS-2	8 RT	21+02.3	12.5-14.0	A-4(3)	32	8	16.3	31.0	34.3	18.4	100	96	58	•	-
SS-3	8 RT	21+02.3	27.5-29.0	A-7-6(22)	53	26	15.1	15.1	18.8	51.0	100	90	80	•	-
SS-4	8 RT	21+02.3	32.5-34.0	A-2-4(0)	22	3	60.4	24.1	7.3	8.2	100	54	30	-	-
SS-6	8 RT	21+02.3	42.5-44.0	A-2-4(0)	21	NP	18.7	69.7	1.4	10.2	99	85	12	•	•
SS-8	8 RT	21+02.3	0.0-0.0	A-7-6(26)	48	27	5.5	9.0	20.2	65.3	100	97	89		
SS-28	8 RT	23+90	27.3-28.8	A-2-4(0)	25	9	44.7	29.0	3.9	22.4	100	73	27	•	
SS-30	8 RT	23+90	37.3-38.8	A-2-4(0)	27	NP	1.2	81.6	2.9	14.3	100	. 99	19	•	•
SS-33	8 RT	23+90	65.0-66.5	A-7-6(23)	44	25	3.7	10.4	24.7	61.2	100	98	90	-	•



FIELD SCOUR REPORT

WBS:	33614.1.1	TIP:	B-4273	co	UNTY: Scotland / I	Hoke
DESCRIPTION(1):	Bridge No. 47 o	n US 401	over Lumber R	liver		
			EXISTING	BRIDGI		
Information from:	Field Ir Other	nspection (explain)	M	icrofilm	(reelpc	os:)
Bridge No.: Foundation Type:	47 Length	: 240'	Total Bents:	7 Bents	s in Channel: 2	Bents in Floodplain:7_
EVIDENCE OF S	SCOUR(2)					V
Interior Bents:	Minor scour poo	ckets evic	lent near all exis	sting interio	r bents.	
Channel Bed:	None					
Channel Bank:	None					
EXISTING SCO	UR PROTECTION	ON				
Type(3):	End bents have	concrete	abutment slop	es. No othe	er scour protection	observed.
Extent(4):	N/A					
Effectiveness(5):	N/A					:
Obstructions(6):	Some trees/bru	ish downs	stream.			

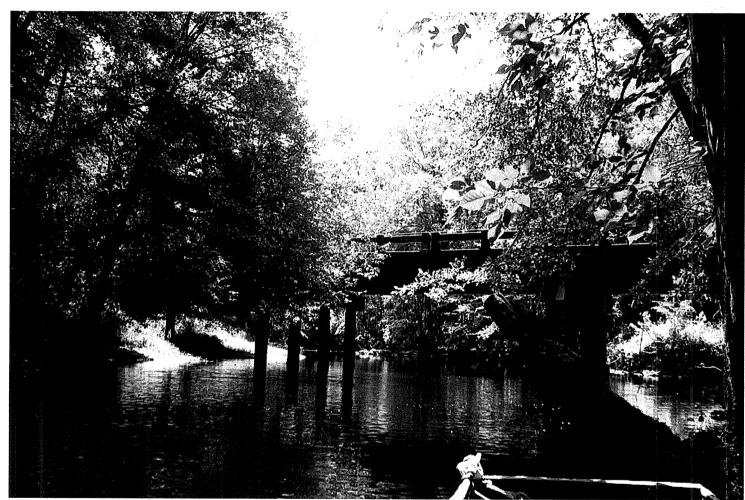
INSTRUCTIONS

- 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).
- 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.

			DE:	SIGN IN	IFORM	ATION								
Channel Be	ed Material(7):	Loose, s	silty sand	d (A-2-4)										
Channel Bar	nk Material(8):	Loose, s	silty sand											
Channel B	Channel Bank Cover(9): Brush, grass, trees													
Floodpla	Floodplain Width(10): Approximately 2,100 ft.													
Floodpla	Floodplain Cover(11): Brush, grass, trees													
;	Stream is(12):	Αç	ggrading	l	Degr	ading		Sta	tic <u>x</u>					
Channel Migration Tendency(13): South at existing bridge location														
Observations and	d Other Comn	nents:												
	Re	eported b	ov:						Date:	8/19/2	2010			
		eported b		B.D. Wo	rley and	C.M. W	nalen, Jr.							
DESIGN SCOUL									ro					
DESIGN SCOU	K ELEVATIO	VO(14)				reeu	X	Mete	ers					
	BENTS	<u> </u>												
	B1	B2	B3											
	206.1'	207.8'	207.5'											
											-			
			l											
Comparison of E	SE to Hydrau	lics Unit	theoretic	cal scour:		1								
The Geotechnic							etical sco	our as sh	ow on the	•				
Bridge Survey	and Hydraulic	Design F	Report (d	dated Ma	rch 2010).								
.'	DSE data	rminad l	21/1	Quelo A	/1.A.				Date:	11/2/2	0010			
	DSE dete	rminea i	oy:	DIBOURY	WOW				Date.	1 1/2/2	.010			
				V										
SOIL ANALYSI	S RESULTS F	ROM CH	HANNEL	BED A	ND BAN	K MATE	RIAL							
Bed or Bank														
Sample No.														
Retained #4		ee Sheet												
Passed #10 Passed #40	1	Soil Test I	Results"											
Passed #40	1	S-2				-:14 (A A)								
Coarse Sand		hannel b	ed mate	riai: Gray	, sandy s	SIIT (A-4)								
Fine Sand		1												
Silt														
Clay									,					
LL														
PI														
AASHTO	·													
Station Offset							-			 ,				
Depth														
	1					I		1						

SITE PHOTOGRAPHS

Bridge No. 47 on –L– (US 401) Over Lumber River



View of existing bridge facing North (upstream) from Lumber River



View facing East along South side of existing bridge