STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33408.1.1 (B-4042)	1	10

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33408.1.1 9 (B-4042) F.A. PROJ. BRZ-1248(3)

COUNTY BURKE

PROJECT DESCRIPTION BRIDGE NO. 274 ON SR-1248 OVER CANOE CREEK

SITE DESCRIPTION

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CAUTION NOTICE

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PERSONNEL

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M M HAGER

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INVESTIGATED BY C A DUNNAGAN

CHECKED BY W D FRYE, Jr

SUBMITTED BY W D FRYE, Jr

DATE AUGUST 2006

NORTH CAROLINA LICENSED SEAL 10047 GEOLOGIST CHARLES ANDREWS DUNNAGAN

DRAWN BY: C A DUNNAGAN

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PROJECT: 33408.1.1

ID: B-4042

PROJECT REFERENCE NO.	SHEET NO.
33408.1.1 (B-4042)	2/10

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 PLASTIC INDEX	6 MX		NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

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

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

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

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

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

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

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

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

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BM#2 - ETCHED CROW'S FOOT IN CORNER OF HEADWALL
NORTHEAST TOP FACE. S 70,17' 40.2" E, 398.39
FROM STA 20+50.0. ELEVATION: 1097.45 FT.

NOTES:

REVISED 02/23/06

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

August 16, 2006

STATE PROJECT: 33408.1.1 (B-4042)
F. A. PROJECT: BRZ-1248(3)
COUNTY: Burke

DESCRIPTION: Bridge No. 274 on SR-1248 over Canoe Creek

SIBKECT: Geotechnical Report – Foundation Investigation

Introduction

This project is located in central Burke County, approximately 6.5 miles northwest of Morganton. The existing three-span bridge is to be replaced with a single-span structure. The length will be 88.0 feet; the skew is to be 75 degrees.

The subsurface investigation was conducted using a CME-550 drill machine with -N- casing and advancer. Standard Penetration Tests were performed at intervals of 5.0 feet using an automatic drop hammer. Soil samples were collected and submitted for testing of quality.

Geology and Rock Characteristics

Since rock core was not taken at this site, the underlying rock type was inferred from the Geologic Map of North Carolina (1985). This rock, denoted as CZbg on the map, is primarily a biotite gneiss and schist. It is presumed that the weathered rock encountered on this project is derived from the aforementioned biotite gneiss.

One trend is worthy of note: the depth to continuous weathered rock/rock is 14.0 to 22.0 feet deeper left of centerline than right.

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WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
CENTURY CENTER COMPLEX
BUILDING B
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

Foundation Materials

End Bent One

The existing embankment across this bent consists of about 2.0 feet of loose silty sand. The embankment was placed upon alluvium. This horizon is composed of 5.0 to 6.0 feet of medium stiff silty clay. A basal gravel layer is present at EB1-B.

The saprolite beneath the alluvium is a medium dense to dense silty sand. In EB1-A, the saprolite extends to 32.0 feet (elevation 1058.0) before grading into weathered rock. However, a seam of weathered rock is present between the depths of 9.9 to 12.5 feet (elevations 1080.1 to 1077.5). Weathered rock grades into biotite gneiss by 33.0 feet (elevation 1057.0). The boring was terminated in the biotite gneiss.

In the boring for EB1-B, the saprolite grades to weathered rock by 12.5 feet (elevation 1080.3). This weathered rock continues without interruption until grading into biotite gneiss by 21.1 feet (elevation 1071.7). Here too, the boring was terminated in the biotite gneiss.

Static groundwater levels were measured at 5.5 feet (elevation 1084.5) in EB1-A, and 8.7 feet (elevation 1084.1).

End Bent Two

The embankment encountered at this bent is approximately 3.5 feet of loose silty sand. The alluvium beneath the embankment consists of 6.0 to 7.5 feet of very soft sandy silt. A basal gravel layer was encountered in both borings.

In the boring for EB2-A, the saprolite is comprised of 24.0 feet of medium to very dense silty sand and sandy silt. The contact between saprolite and weathered rock is sharp, occurring at 32.0 feet (elevation 1058.7). The boring was terminated in weathered rock of biotite gneiss at 34.6 feet (elevation 1056.1).

At the EB2-B site, saprolite begins at 8.0 feet and extends 18.2 feet. It consists of medium stiff sandy silt. The contact between saprolite is again sharp, occurring at 18.2 feet (elevation 1072.5). The weathered rock grades into biotite gneiss by 21.0 feet (elevation 1069.7). The boring was terminated at 21.8 feet (elevation 1068.9) in biotite gneiss.

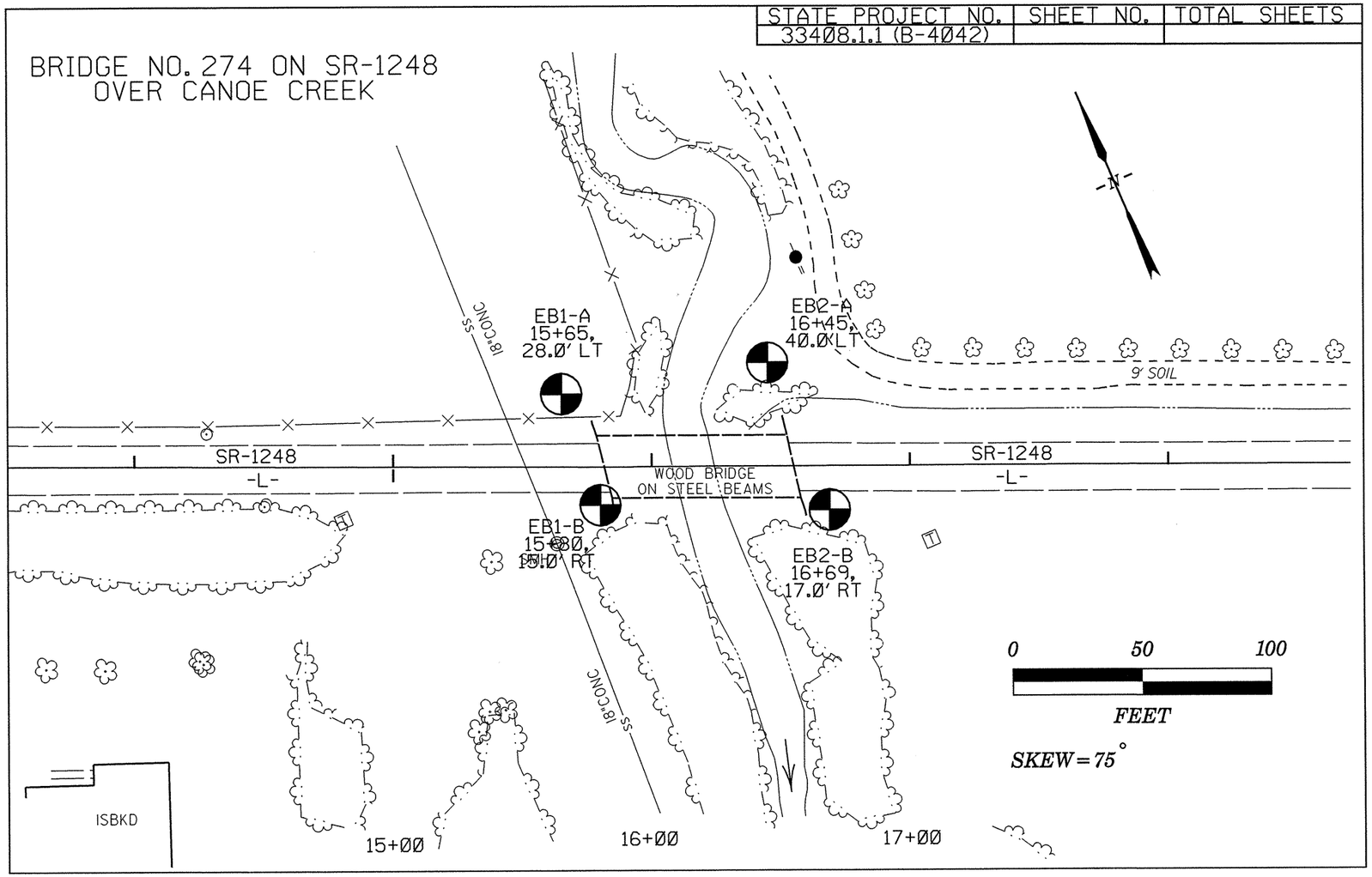
Static groundwater was measured in EB2-A at 4.5 feet (elevation 1086.2) and in EB2-B at 6.8 feet (elevation 1083.9).

Respectfully Submitted,

Charles A. Dunnagan, LG
Project Geological Engineer

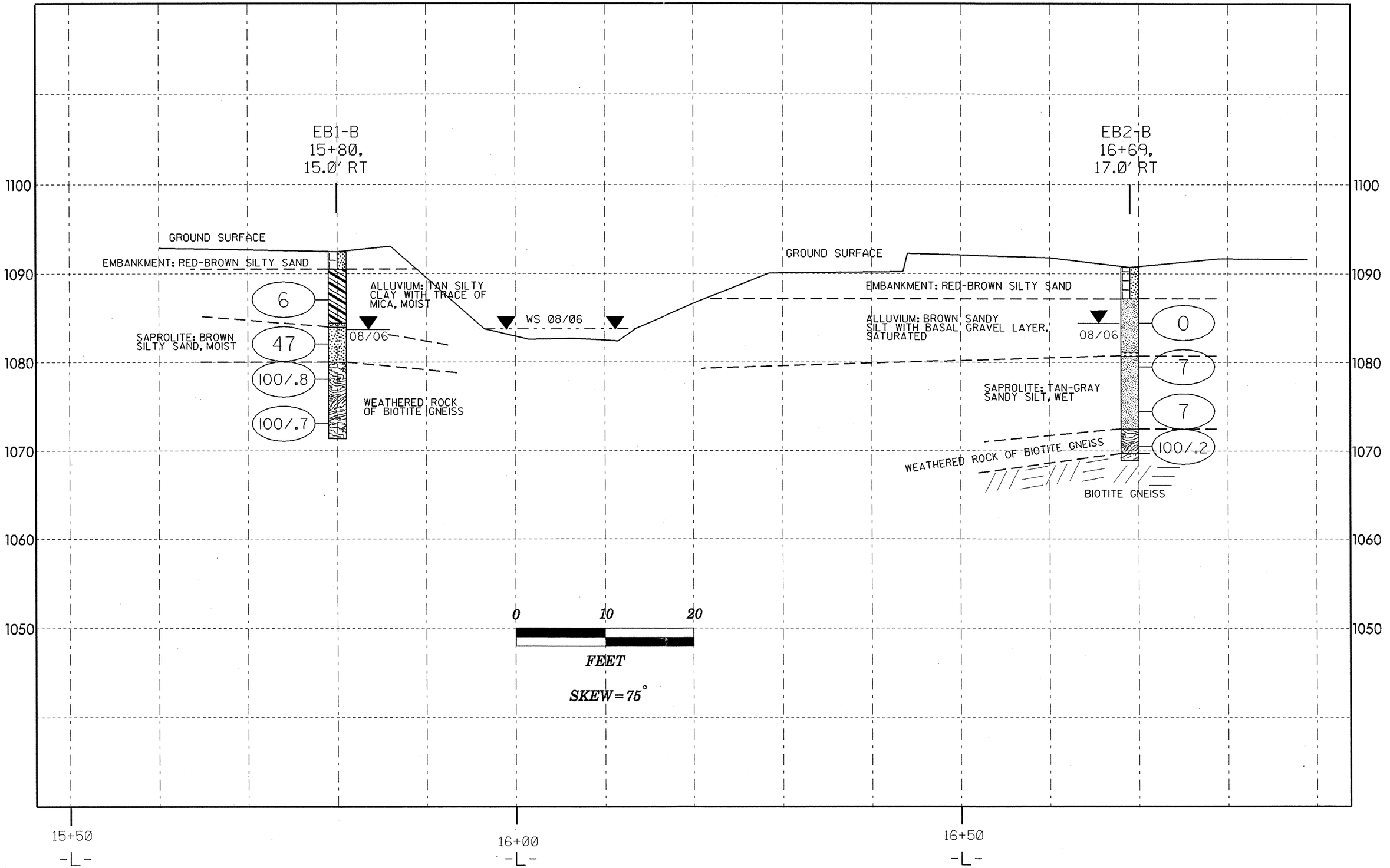
STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
3340Ø.1.1 (B-4042)		

BRIDGE NO. 274 ON SR-1248
OVER CANOE CREEK

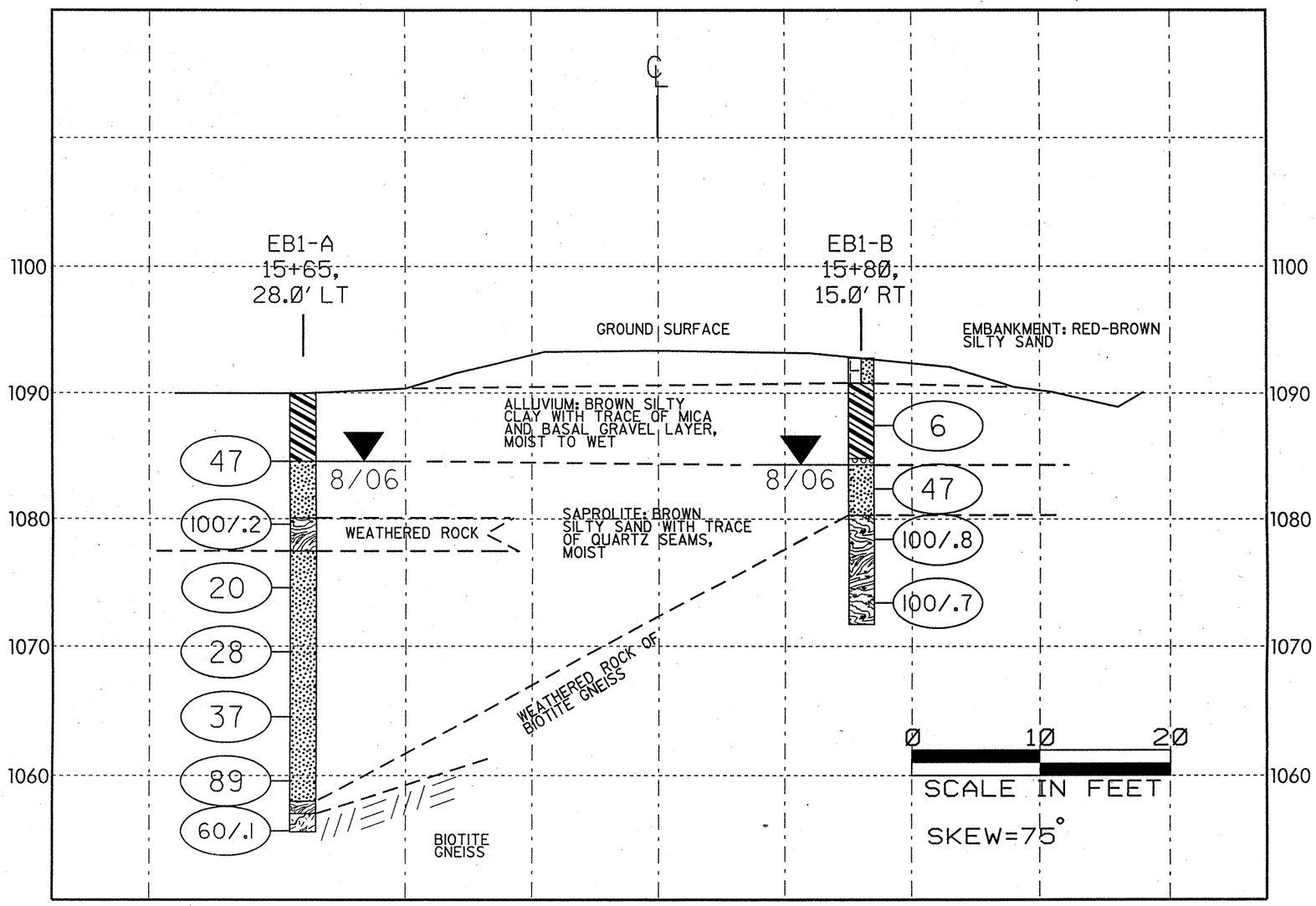


PROFILE 15.0 FEET RIGHT OF CENTERLINE

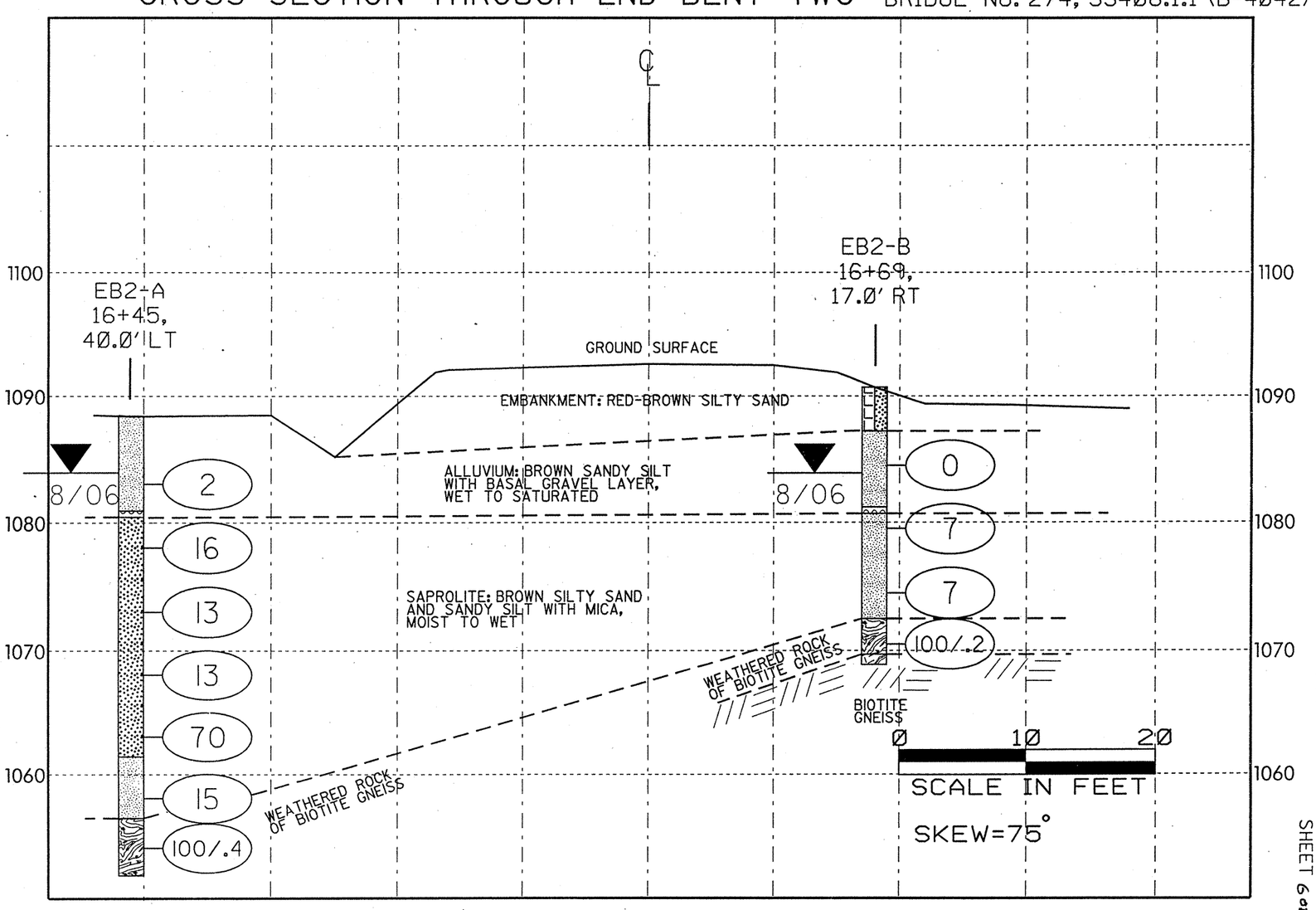
BRIDGE NO. 274, 33408.1.1 (B-4042)



CROSS SECTION THROUGH END BENT ONE BRIDGE NO. 274, 33408.1.1 (B-4042



CROSS SECTION THROUGH END BENT TWO BRIDGE NO. 274, 33408.1.1 (B-4042)



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33408.1.1	ID B-4042	COUNTY BURKE	GEOLOGIST T B DANIEL
SITE DESCRIPTION BRIDGE NO. 274 ON SR-1248 OVER CANOE CREEK			GND WATER
BORING NO EB1-A	NORTHING 750983.00	EASTING 1176925.00	0 HR N/A
ALIGNMENT -L-	BORING LOCATION 15+65.000	OFFSET 28.00ft LT	24 HR 5.50ft
COLLAR ELEV 1090.00ft	TOTAL DEPTH 34.50ft	START DATE 8/04/06	COMPLETION DATE 08/04/06
DRILL MACHINE CME 550	DRILL METHOD WASH BORING		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK N/A		Log EB1-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
1090.00						Ground Surface				
	4.40	3	23	24	1.0	47	SS-8	▼		ALLUVIUM: BROWN SILTY CLAY WITH GRAVEL, WET
1080.00	9.40	33	66	34	0.2	100				SAPROLITE: WHITE SILTY SAND, MOIST
	14.40	6	10	10	1.0	20	SS-9			WEATHERED ROCK OF BIOTITE GNEISS
1070.00	19.40	9	10	18	1.0	28				SAPROLITE: BROWN SILTY SAND WITH QUARTZ SEAMS, MOIST
	24.40	9	15	22	1.0	37	SS-10			
1060.00	29.40	18	22	67	1.0	89				
1055.50	34.40	60			0.1	60				WEATHERED ROCK OF BIOTITE GNEISS
						BORING TERMINATED AT ELEV 1055.5 IN BIOTITE GNEISS.				BIOTITE GNEISS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33408.1.1	ID B-4042	COUNTY BURKE	GEOLOGIST T B DANIEL
SITE DESCRIPTION BRIDGE NO. 274 ON SR-1248 OVER CANOE CREEK			GND WATER
BORING NO EB1-B	NORTHING 750937.00	EASTING 1176925.00	0 HR N/A
ALIGNMENT -L-	BORING LOCATION 15+80.000	OFFSET 15.00ft RT	24 HR 8.70ft
COLLAR ELEV 1092.80ft	TOTAL DEPTH 21.10ft	START DATE 8/02/06	COMPLETION DATE 08/02/06
DRILL MACHINE CME 550	DRILL METHOD WASH BORING		HAMMER TYPE AUTOMATIC
SURFACE WATER DEPTH	DEPTH TO ROCK N/A		Log EB1-B, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
1092.80						Ground Surface				
1090.00	4.40	2	2	4	1.0	6	SS-1			EMBANKMENT: RED-BROWN SILTY SAND
	9.40	16	16	31	1.0	47	SS-2	▼		ALLUVIUM: TAN SILTY CLAY WITH TRACE MICA, MOIST
1080.00	14.40	48	52		0.8	100				ALLUVIUM: GRAVEL
	19.40	58	42		0.7	100				SAPROLITE: BROWN SILTY SAND, MOIST
1071.70						BORING TERMINATED AT ELEV 1071.7 IN BIOTITE GNEISS.				WEATHERED ROCK OF BIOTITE GNEISS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33408.1.1	**ID** B-4042	**COUNTY** BURKE	**GEOLOGIST** T B DANIEL
SITE DESCRIPTION BRIDGE NO. 274 ON SR-1248 OVER CANOE CREEK			**GND WATER**
BORING NO EB2-A	**NORTHING** 750963.00	**EASTING** 1177004.00	**0 HR** N/A
ALIGNMENT -L-	**BORING LOCATION** 16+45.000	**OFFSET** 40.00ft LT	**24 HR** 4.50ft
COLLAR ELEV 1090.70ft	**TOTAL DEPTH** 34.60ft	**START DATE** 8/03/06	**COMPLETION DATE** 08/03/06
DRILL MACHINE CME 550	**DRILL METHOD** WASH BORING		**HAMMER TYPE** AUTOMATIC
SURFACE WATER DEPTH	**DEPTH TO ROCK** N/A		Log EB2-A, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
1090.70						Ground Surface				
	4.40	1	1	0	1.0	1	SS-5	▼		ALLUVIUM: BROWN TO GRAY SANDY SILT, WET TO SATURATED
1080.00	9.40	8	7	9	1.0	16				ALLUVIUM: GRAVEL
	14.40	4	6	7	1.0	13	SS-6			SAPROLITE: BROWN SILTY SAND WITH TRACE MICA, MOIST
1070.00	19.40	4	5	8	1.0	13	29.9			
	24.40	4	22	48	1.0	70				
1060.00	29.40	4	6	9	1.0	15				SAPROLITE: BROWN-GRAY SANDY SILT WITH MICA, WET
1056.10	34.40	100			0.4	100				WEATHERED ROCK OF BIOTITE GNEISS
						BORING TERMINATED AT ELEV 1056.1 IN WEATHERED ROCK OF BIOTITE GNEISS				

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL UNIT BORING LOG

8/10

PROJECT NO 33408.1.1	**ID** B-4042	**COUNTY** BURKE	**GEOLOGIST** T B DANIEL
SITE DESCRIPTION BRIDGE NO. 274 ON SR-1248 OVER CANOE CREEK			**GND WATER**
BORING NO EB2-B	**NORTHING** 750901.00	**EASTING** 1177004.00	**0 HR** N/A
ALIGNMENT -L-	**BORING LOCATION** 16+69.000	**OFFSET** 17.00ft RT	**24 HR** 6.80ft
COLLAR ELEV 1090.70ft	**TOTAL DEPTH** 21.80ft	**START DATE** 8/02/06	**COMPLETION DATE** 08/02/06
DRILL MACHINE CME 550	**DRILL METHOD** WASH BORING		**HAMMER TYPE** AUTOMATIC
SURFACE WATER DEPTH	**DEPTH TO ROCK** N/A		Log EB2-B, Page 1 of 1

ELEV	DEPTH	BLOW CT 6in	6in	6in	PEN (ft)	BLOWS PER FOOT 0 25 50 75 100	SAMPLE NO	MOI	LOG	SOIL AND ROCK DESCRIPTION
1090.70						Ground Surface				
	5.20	0	0	0	1.0	0		▼		EMBANKMENT: RED-BROWN SILTY SAND
1080.00	10.20	2	2	5	1.0	7	SS-3			ALLUVIUM: BROWN SANDY SILT, SATURATED
	15.20	1	3	4	1.0	7	SS-4			ALLUVIUM: GRAVEL
1070.00	20.20	100			0.2	100				SAPROLITE: TAN-GRAY SANDY SILT, WET
1068.90						BORING TERMINATED AT ELEV 1068.9 IN BIOTITE GNEISS				WEATHERED ROCK OF BIOTITE GNEISS
										BIOTITE GNEISS

JCS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-MATERIALS AND TESTS UNIT
SOILS TEST REPORT-SOILS LABORATORY

T.I.P. ID #:	B-4042

REPORT ON SAMPLES OF:	Soils for Quality

PROJECT:	33408.1.1	COUNTY:	Burke	Owner:	--
DATE SAMPLED:	8.2.06	DATE RECEIVED:	8.7.06	DATE REPORTED:	8.9.06
SAMPLED FROM:	Bridge	SAMPLED BY:	C. A. Dunnagan		
SUBMITTED BY:	W. D. Frye	2002	STANDARD SPECIFICATION		
LABORATORY:	Asheville				

TEST RESULTS

Project Sample No.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8
Lab Sample No. A	153368	153369	153370	153371	153372	153373	153374	153375
HiCAMS Sample #	--	--	--	--	--	--	--	--
Retained #4 Sieve %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Passing #10 Sieve %	89	90	99	98	100	96	98	96
Passing #40 Sieve %	88	82	97	94	99	88	89	90
Passing #200 Sieve %	68	29	57	44	43	31	41	25

MINUS #10 FRACTION

Soil Mortar - 100%								
Coarse Sand -Ret. #60	3	20	7	10	8	23	22	15
Fine Sand - Ret. #270	28	56	51	58	59	53	46	67
Silt 0.05-0.005 mm %	19	8	28	16	11	12	16	6
Clay < 0.005 mm %	50	16	14	16	22	12	16	12
Passing # 40 Sieve %	--	--	--	--	--	--	--	--
Passing # 200 Sieve %	--	--	--	--	--	--	--	--

Liquid Limit	36	28	36	34	28	30	39	21
Plastic Index	13	NP	NP	NP	NP	NP	NP	NP
AASHTO Classification	A-6 (8)	A-2-4 (0)	A-4 (4)	A-4 (2)	A-4 (2)	A-2-4 (0)	A-4 (1)	A-2-4 (0)
Quantity								
Texture								
Station	15+80	15+80	16+69	16+69	19+45	19+45	19+45	EB1-A
Hole No.								
Depth (ft) From:	4.9	9.9	10.7	15.7	4.9	14.9	29.9	4.9
To:	5.9	10.9	11.7	16.7	5.9	15.9	30.9	5.9

Remarks:

A-153368 - 153375

CC:

C. A. Dunnagan	
File	

SOILS ENGINEER:	

M&T 503E

9/10

JCS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-MATERIALS AND TESTS UNIT
SOILS TEST REPORT-SOILS LABORATORY

T.I.P. ID #:	B-4042

REPORT ON SAMPLES OF:	Soils for Quality

PROJECT:	33408.1.1	COUNTY:	Burke	Owner:	--
DATE SAMPLED:	8.4.06	DATE RECEIVED:	8.7.06	DATE REPORTED:	8.9.06
SAMPLED FROM:	Bridge	SAMPLED BY:	C. A. Dunnagan		
SUBMITTED BY:	W. D. Frye	2002	STANDARD SPECIFICATION		
LABORATORY:	Asheville				

TEST RESULTS

Project Sample No.	SS-9	SS-10						
Lab Sample No. A	153376	153377						
HiCAMS Sample #	--	--						
Retained #4 Sieve %	0.0	0.0						
Passing #10 Sieve %	93	94						
Passing #40 Sieve %	84	89						
Passing #200 Sieve %	30	38						

MINUS #10 FRACTION

Soil Mortar - 100%								
Coarse Sand -Ret. #60	21	16						
Fine Sand - Ret. #270	54	52						
Silt 0.05-0.005 mm %	11	14						
Clay < 0.005 mm %	14	18						
Passing # 40 Sieve %	--	--						
Passing # 200 Sieve %	--	--						

Liquid Limit	31	31						
Plastic Index	NP	NP						
AASHTO Classification	A-2-4 (0)	A-4 (1)						
Quantity								
Texture								
Station	EB1-A	EB1-A						
Hole No.								
Depth (ft) From:	14.9	24.9						
To:	15.9	25.9						

Remarks:

A-153376 - 153377

CC:

C. A. Dunnagan	
File	

SOILS ENGINEER:	

G:/Everyone. . . /M&T Forms/Regional Lab Statesville/Soils Test Report M&T 503E 8-19-2000

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33408.1.1 TIP: B-4042 COUNTY: Burke

DESCRIPTION(1): Bridge No. 274 on SR-1248 over Canoe Creek

EXISTING BRIDGE

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

Bridge No.: 274 Length: 74ft Total Bents: 4 Bents in Channel: 1 Bents in Floodplain: 3
Foundation Type: Piles

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None noted.

Interior Bents: Very minor amount at B1-A.

Channel Bed: None noted.

Channel Bank: Slight undercutting immediately upstream of B1-A.

EXISTING SCOUR PROTECTION

Type(3): Pile-and-panel endbent walls and wingwalls.

Extent(4): Wingwalls extend 5ft beyond endbent walls.

Effectiveness(5): Good.

Obstructions(6): None noted.

INSTRUCTIONS

1 Describe the specific site's location, including route number and body of water crossed.
2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
3 Note existing scour protection (e.g. rip rap).
4 Describe extent of existing scour protection.
5 Describe whether or not the scour protection appears to be working.
6 Note obstructions such as dams, fallen trees, debris at bents, etc.
7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
10 Determine the approximate floodplain width from field observation or a topographic map.
11 Describe the material covering the floodplain (e.g. grass, trees, crops).
12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoritical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): Silty sand with gravel.

Channel Bank Material(8): Silty sand.

Channel Bank Cover(9): Trees and shrubs.

Floodplain Width(10): > 100ft.

Floodplain Cover(11): Grass.

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

Channel Migration Tendency(13): West.

Observations and Other Comments: ____

DESIGN SCOUR ELEVATIONS(14) Feet ____ Meters ____

BENTS										
B1	B2	B3	B4							

Comparison of DSE to Hydraulics Unit theoretical scour:

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							

Template Revised 02/07/06

Reported by: C.W. Jernigan Date: 3/10/06