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DRAWN BY: W. Shuecraft

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Final Boring Logs

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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33600.I.I I.D. NO. B-4258
F.A. PROJECT BRSTP-0064(I)
COUNTY RUTHERFORD
PROJECT DESCRIPTION BRIDGE NO. 7 ON
US 64/74 OVER BROAD RIVER
SITE DESCRIPTION

STATE STATE PE	OJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C. B-42	58	1	29
STATE PROJ.NO.	P. A. PROJ. NO.	DESCRIP	TION
33600.1.1	BRSTP-0064(1)	P.E.	

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For Letting

NVESTIGATED BY D.M. Gragg PERSONNEL M. Johnson

CHECKED BY S.P. Washer F. Woodard

SUBMITTED BY S.P. Washer D. Kofron

DATE 7-13-07 M. Brown

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FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE
CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.



Skur P. Washer

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

	SOIL AND ROC	K LEGEND, TERMS	s, symbols, and abbre	EVIATIONS	
SOIL DESCRIPTION	GRADATION			CK DESCRIPTION	TERMS AND DEFINITIONS
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 180 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T286, ASTM 0-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:	WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SA POORLY GRADED) GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE T	AME SIZE. (ALSO E SIZES.	HARD ROCK IS NON-COASTAL PLAIN MATERIAL ROCK LINE INDICATES THE LEVEL AT WHICH SPT REFUSAL IS PENETRATION BY A SPLIT SIN NON-COASTAL PLAIN MATERIAL, THE TRAN OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS	. That when tested, would yield spt refusal. An inferred Non-Coastal plain material would yield spt refusal. Spoon sampler equal to or less than Ø.1 foot per 60 blows. Usition between soil and rock is often represented by a zone Follows:	ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.
VERY STIFF, GRAY SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6	SUBANGULAR, SUBROUNDED, OR ROUNDED. MINERALOGICAL COMPOSITION		ROCK (WR) NON-COAST	TAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL
SOIL LEGEND AND AASHTO CLASSIFICATION GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS OPERANC MATERIALS	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USE		CRYSTALLINE ROCK (CR) FINE TO C	COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT ELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE,	AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
CLASS. (45% PASSING *200) (785% PASSING *200) CROHNIC PHTERIALS	WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE. COMPRESSIBILITY		MON-COVETALLINE FINE TO C	IBBRO, SCHIST, ETC. OARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN	CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 CLASS. A-1-a A-1-b A-2-4 A-2-5 A-2-6 A-2-7 - A-3-7-6 A-3 A-6, A-7	SLIGHTLY COMPRESSIBLE LIQUID LIMIT LE	ESS THAN 30	ROCK (NCR) SEDIMENTA	RY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE PHYLLITE, SLATE, SANDSTONE, ETC.	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
SYMBOL 000000000000000000000000000000000000		1-5Ø REATER THAN 5Ø	COASTAL PLAIN SEDIMENTARY ROCK (CP) COASTAL P SPT REFUS SHELL BED	PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SAL. ROCK TYPE INCLUDES LIMESTONE, SANOSTONE, CEMENTED SECTO	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.
X PASSING ● 1Ø 5Ø MX SILT- CLAY MUCK,	PERCENTAGE OF MATERIAL ORGANIC MATERIAL GRANULAR SILT- CLAY ORGANIC MATERIAL	THE MATERIAL	J J J GIECLE DEU	WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
40 38 MX58 MX51 MN 200 15 MX 25 MX88 MX 35 MX35 MX35 MX36 MX36 MX36 MX36 MX36 MX96 MX SOILS PEAT	UNDERVIL MAILERIAL		FRESH ROCK FRESH, CRYSTALS BRIGHT, F	EW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.
LIQUID LIMIT 48 MX 41 MN 48 MX 41 MN 48 MX 41 MN 48 MX 41 MN 50ILS WITH PLASTIC INDEX 6 MX N.P. 18 MX 18 MX 11 MN 11 MN 11 MN LITTLE OR HIGHLY	Companie	20 - 35%		STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, IN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF	<u>DIP DIRECTION (DIP AZIMUTH) -</u> THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
GROUP INDEX Ø Ø Ø 4 MX 8 MX 12 MX 16 MX No MX MODERATE AROUNTS OF SOILS	GROUND WATER ✓ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DI	RILLING.	SLIGHT ROCK GENERALLY FRESH, JOINTS	STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO IN CLAY, IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR	<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.
OF MAJOR GRAVEL AND SAND GRAVEL AND GRAVEL AND GRAVEL AND SAND GRAVEL AND SAND GRAVEL AND SAND GRAVEL AND SAND SOILS SOILS MATTER	STATIC WATER LEVEL AFTER 24 HOURS.		CRYSTALS ARE DULL AND DISCOL	ORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. SHOW DISCOLORATION AND WEATHERING EFFECTS, IN	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
GEN.RATING AS A EXCELLENT TO GOOD FAIR TO POOR POOR POOR UNSUITABLE		IG STRATA	(MOD.) GRANITOID ROCKS, MOST FELDSPA	SHOW DISCOLUTE ON THE METHELING EFFECTS. IN RS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS WS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
SUBGRADE P.I. OF A-7-5 ≤ L.L 3Ø : P.I. OF A-7-6 > L.L 3Ø	O-MS→ SPRING OR SEEPAGE		WITH FRESH ROCK.	plored or stained. In granitoid rocks, all feldspars dull	FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
CONSISTENCY OR DENSENESS RANGE OF STANDARD RANGE OF UNCONFINED	MISCELLANEOUS SYMBOLS		SEVERE AND DISCOLORED AND A MAJORITY (MOD. SEV.) AND CAN BE EXCAVATED WITH A	Y SHOW KAOLINIZATION, ROCK SHOWS SEVERE LOSS OF STRENGTH GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK,	<u>FORMATION (FM.)</u> A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY PENETRATION RESISTENCE COMPRESSIVE STRENGTH (N-VALUE) (TONS/FT2)	ROADWAY EMBANKMENT WITH SOIL DESCRIPTION ROADWAY EMBANKMENT WITH TEST BORING	SAMPLE DESIGNATIONS	IF TESTED, WOULD YIELD SPT RESERVERE ALL ROCKS EXCEPT QUARTZ DISC	<u>FUSAL</u> COLORED OR STAINED.ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
GENERALLY VERY LOOSE 4 CRANIL OR LOOSE 4 TO 10	SOIL SYMBOL AUGER BORING		(SEV.) IN STRENGTH TO STRONG SOIL. I EXTENT. SOME FRAGMENTS OF ST	IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME FRONG ROCK USUALLY REMAIN.	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
MATERIAL MEDIUM DENSE 10 TO 30 N/A MATERIAL DENSE 30 TO 50	ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS	SS- SPLIT SPOON SAMPLE	IF TESTED, YIELDS SPT N VALUE		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
VERY DENSE >5Ø	— INFERRED SOIL BOUNDARIES	ST- SHELBY TUBE	(V. SEV.) THE MASS IS EFFECTIVELY REDU	CED TO SOIL STATUS WITH ONLY FRAGMENTS ARE DISCENDIBLE BUT CED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK AMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR	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	MONITORING WELL STATE INFERRED ROCK LINE A PIEZOMETER	RS- ROCK SAMPLE	VESTIGES OF THE ORIGINAL ROCK	C FABRIC REMAIN. IF TESTED, YIELDS SPT N VALUES C 100 BPF	INTERVENING IMPERVIOUS STRATUM.
MATERIAL STIFF 8 TO 15 1 TO 2 (COHESIVE) VERY STIFF 15 TO 30 2 TO 4	ALLUVIAL SOIL BOUNDARY ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR	RT- RECOMPACTED TRIAXIAL SAMPLE		ABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND ARTZ MAY BE PRESENT AS DIKES OR STRINGERS, SAPROLITE IS	RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF
HARD >30 >4 TEXTURE OR GRAIN SIZE	25/825 DIP/DIP DIRECTION OF INSTALLATION ROCK STRUCTURES	CBR - CBR SAMPLE		OCK HARDNESS	ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
U.S. STD. SIEVE SIZE 4 10 40 60 200 270	● - SOUNDING ROD REF SPT REFUSAL		VERY HARD CANNOT BE SCRATCHED BY KNIF SEVERAL HARD BLOWS OF THE (E OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES GEOLOGISTS PICK.	SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
OPENING (MM) 4.76 2.0 0.42 0.25 0.075 0.053	ABBREVIATIONS			PRICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS
BOULDER CDBBLE GRAVEL SAND SAND SILT CLAY (BLDR.) (COB.) (GR.) (CSE. SD.) (F. SD.) (SL.) (CL.)	AR - AUGER REFUSAL PMT - PRESSURE BT - BORING TERMINATED SD SAND, SAND CL CLAY St SIL, - SILT, SILT'	OY YC		OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE A GEOLOGISTS 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 SIZE IN. 12' 3'	CPT - CONE PENETRATION TEST SLI SLIGHTLY CSE COARSE TCR - TRICONE		MEDIUM CAN BE GROOVED OR GOUGED Ø.	.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE	STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF A 140 LB. HAMMER FALLING 30 INCHES REGUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH
SOIL MOISTURE - CORRELATION OF TERMS SOIL MOISTURE SCALE FIELD MOISTURE CUIDE FOR EYELD MOISTURE DESCRIPTION	DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST A - VOID RATIO - VOID RATIO		POINT OF A GEOLOGISTS PICK.		A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS LESS THAN Ø.1 FOOT PENETRATION WITH 60 BLOWS.
(ATTERBERG LIMITS) Continue of the continue	F FINE W - MOISTURE C FOSS FOSSILIFEROUS V VERY	CONTENT		ADILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS S IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN GER PRESSURE.	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
(SAT.) FROM BELOW THE GROUND WATER TABLE LL _ LIQUID LIMIT	FRAC FRACTURED VST - VANE SHE FRAGS FRAGMENTS MED MEDIUM	EAR TEST	SOFT OR MORE IN THICKNESS CAN BE	AN BE EXCAVATED READILY WITH POINT OF PICK, PIECES 1 INCH BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY	STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
PLASTIC SEMISOLID; REQUIRES DRYING TO	EQUIPMENT USED ON SUBJECT PR	ROJECT	FINGERNAIL. FRACTURE SPACING	BEDDING	IOPSOIL (I.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
(PI) PL PLASTIC LIMIT	DRILL UNITS: ADVANCING TOOLS:	HAMMER TYPE:	TERM SPACING	TERM THICKNESS VERY THICKLY BEDDED > 4 FEET	BENCH MARK: BMI- BL stg. 22+81 95' Lt.
OM OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE		AUTOMATIC MANUAL	VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET	T THICKLY BEDDED 1.5 - 4 FEET THINKLY BEDDED 0.16 - 1.5 FEET	RR spike in 24 needle pine. ELEVATION: 998.80
SL SHRINKAGE LIMIT	6* CONTINUOUS FLIGHT AUGER	CORE SIZE:	MODERATELY CLOSE 1 TO 3 FEET CLOSE Ø.16 TO 1 FEET	VERY THINLY BEDDED 0.03 - 0.16 FEET	BENCH MARK: BM2 - BL sta. II+90 89' Rt.
- DRY - (D) ATTAIN OPTIMUM MOISTURE	BK-51 S* HOLLOW AUGERS	□-в	VERY CLOSE LESS THAN Ø.16 FE	THINLY LAMINATED < 0.008 FEET	RR spike in 42" oak.
PLASTICITY PLASTICITY INDEX (PI) DRY STRENGTH	CME-45 HARD FACED FINGER BITS	N Q2WL	FOR SEDIMENTARY ROCKS, INDURATION IS THE H	INDURATION ARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	ELEVATION: 1003.52
NONPLASTIC Ø-5 VERY LOW	TUNGCARBIDE INSERTS CME-550 CME-550 TUNGCARBIDE INSERTS CASING W/ ADVANCER	H		IBBING WITH FINGER FREES NUMEROUS GRAINS; INTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	BENCH MARK: BM3 - BL sta. 5+00, N 46*44'50.4' W 277.09' RR spike in 36' oak.
LOW PLASTICITY 6-15 SLIGHT MED. PLASTICITY 16-25 MEDIUM HIGH PLASTICITY 26 OR MORE HIGH	CASING W ADVANCER PORTABLE HOIST TRICONE STEEL TEETH	HAND TOOLS: POST HOLE DIGGER		NILE BLOW BY HAMMER DISINTEGRATES SAMPLE. MAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE;	ELEVATION: 1065,39
HIGH PLASTICITY 26 OR MORE HIGH COLOR	TRICONE TUNGCARB.	HAND AUGER	BR	EAKS EASILY WHEN HIT WITH HAMMER.	NOTES:
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY)	CORE BIT	SOUNDING ROD VANE SHEAR TEST	DI	RAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; FFICULT TO BREAK WITH HAMMER.	
MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.	OTHER OTHER	OTHER		HARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; HMPLE BREAKS ACROSS GRAINS.	

STATE PROJECT NO. SHEET NO. TOTAL SHEETS
33600.I.I 2 29

ID B-4258



Florence & Hutcheson, Inc.

CONSULTING ENGINEERS

July 13, 2007

Mr. Don Moore Consultant Coordinator North Carolina Department of Transportation Geotechnical Unit P.O. Box 25201 Raleigh NC 27611

Re:

Structure Foundation Investigation Report Bridge No. 7 on US 64 / 74 Over Broad River Rutherford County, North Carolina Project No. 33600.1.1 ID B-4258

Project Description:

The subsurface investigation for the referenced project has been completed and compiled into this geotechnical package. The purpose of this exploration was to investigate the subsurface conditions with drilling, sampling, laboratory testing and engineering analysis. Field and laboratory procedures were performed in accordance with applicable ASTM and AASHTO specifications and NCDOT methods for geotechnical engineering and design.

The project site is located on US 64 approximately 0.6 mile northwest of Lake Lure NC, near the western most extent of the lake. US 64 will be re-aligned to accommodate approaches for a new three-span bridge over the French Broad River at this location. This new structure will have a width of 36', a length of 295' and a skew angle varying from 123° to 146° with -L-. Fill depths at the abutments range from 4 to 14 feet. Abutment slopes of 1.5H:1V shall be covered with Class II Rip-Rap erosion protection. Earthwork is not proposed at the interior bents.

The field investigation was conducted between May 12 and May 17, 2007. Eight (8) total test borings were advanced using a skid-mounted CME 45C drill rig for the four (4) "land borings" and a barge-mounted CME 45C drill rig with NW casing for the four (4) "water borings" respectively. Upon auger refusal or termination of casing advancement, the underlying material was cored in each boring utilizing Longyear NQ2 wireline coring equipment with diamond impregnated bits and water from the Broad River. Borings were surveyed and staked and additional field data provided by F&H surveyors, with survey control provided by NCDOT personnel.

The collected soil and rock samples were visually described in the field then documented on the field logs. The samples were then moved to the laboratory, tested and grouped into strata units. Laboratory testing consisted of liquid limit, plastic limit, sieve and hydrometer grain size analysis, unconfined compression, one-dimensional consolidation properties and rock unconfined compression. A representative sample of the material from the channel bed was also subjected to laboratory analysis. Rock core data including identified and described rock type, Core Recovery (REC) and Rock Quality Designation (RQD) determinations for each core run interval, and Strata Recovery and Strata Rock

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Mr. Don Moore July 13, 2007

Quality Designation (SREC and SRQD) for each discrete rock unit were recorded. Rock core specimens were selected for laboratory testing of unconfined compressive strength.

Geology:

The project site is located within the Inner Piedmont block, near the eastern boundary of the Chauga Belt, as depicted by the *Geologic Map of North Carolina (1985)*. Lithologic units exposed are not assigned to a formal formation rather are described as "massive to foliated, granodioritic, migmatic, porphyroblastic gneiss". Nearby units include biotite gneiss and schist and Henderson Gneiss. Units are assigned to the Cambrian Period to Late Proterozoic Era.

Split spoon sampling, Shelby tube sampling and rock coring operations conducted at the bridge site intercepted alluvial, colluvial and residual origin materials. Alluvium materials consist of boulders, cobbles, gravel, sand, silt and clay deposited in irregular thickness across the site. Boulders are noted within alluvium units and exposed at the surface upstream from the proposed bridge site but likely were deposited from up slope through gravity movement. Colluvium units are intermingled with some of the alluvium units and consist of boulders and cobbles with finer gradation materials infilling between the boulders and cobbles. Residual units consist of silty sand and silt overlying the weathered rock and unweathered bedrock at End Bent 2.

Underlying rock recovered from core borings was described as predominately moderately weathered to fresh, hard to very hard granitic gneiss. Thin (0.1' to 0.5') moderately severe to completely weathered intervals, developed along horizontal fractures, were noted throughout cores recovered from the rock mass. Material interpreted as Alluvium was intercepted within core runs but was composed of granitic gneiss, granodiorite, and quartzite broken and rounded into gravel, cobbles and boulders. This strata unit underlies unconsolidated material described above and overlies in-situ granitic gneiss. Iron (Fe) oxide staining is prevalent throughout much of the recovered rock core with accumulations also on fracture faces. Fracturing ranges from open to healed with orientations ranging from horizontal (0°) to 85°. Advanced borings were terminated in granitic gneiss at elevations ranging from 975.0 feet to 950.0 feet. The inferred rock line is interpreted to range from 970.1 feet to 992.9 feet beneath the proposed structure footprint.

Two (2) in-situ rock outcrops were noted southeast of the site along US 64 / US 74 (-L-) at Station $22+00\pm$ to $23+50\pm$ and Chimney Cliffs Drive (-Y2-) at Station $10+20\pm$ to $10+40\pm$ respectively. The rock outcrop exposed along -L- is described as massive granodiorite with pegmatite veins, fresh and very hard. The rock outcrop exposed along -Y2- is described as foliated granitic gneiss, moderately weathered and hard to medium hard. Rock data collected from discontinuities in these outcrops is summarized below.

Outcrop along –L-	
Discontinuity	Dip / Dip Azimuth
Fracture 1	74° / 017°
Foliation	21°/000°
Fracture 2	21°/090°
Fracture 3	69° / 020°
Fracture 4	34° / 022°

 $\begin{array}{cc} \text{Outcrop along -Y2-} \\ \underline{\text{Discontinuity}} & \underline{\text{Dip / Dip Azimuth}} \\ \text{Foliation} & 26^{\circ} / \, 062^{\circ} \\ \text{Foliation} & 14^{\circ} / \, 054^{\circ} \end{array}$

Mr. Don Moore July 13, 2007

The topography surrounding the site is mountainous with a relatively flat, narrow floodplain and lakeshore at the site location. The proposed site is located at the point where Broad River empties into Lake Lure with river current energy and sediment bed load dissipated into the lake. Lake Lure is a popular recreational and tourist location with moderate to heavy pleasure boat traffic.

Discussion of Subsurface Conditions:

Four (4) predominant material types, based upon response to standard penetration testing, observation, review of rock core samples, and laboratory testing were identified within the borings: alluvium / colluvium, fill, residual and bedrock. The alluvial materials were composed of silt, clay and silty sand as well as a wide variety of gravel, cobbles and boulders. Standard penetration testing in unconsolidated soils produced "N" values ranging from 2 to 100+ blows per foot throughout the proposed site. Unconfined compression testing performed on recovered Shelby tube samples produced values ranging from .39 Ksf to 1.34 Ksf. Samples of the colluvial material are interpreted to be intermixed with the alluvial material and primarily consisted of boulders, cobbles, and gravel. Fill material was recognized and described as silty, clayey sand and rock fragments at End Bent 2. Underlying residual material at End Bent 2 was composed of sandy clay, silt and rock fragments. Samples of recovered bedrock indicate a wide range of weathering, hardness and fracturing characteristics as described in the Geology section above and on the core logs included with this report. Rock unconfined compression testing on selected rock core specimens indicate strengths ranging from 1,299 psi to 15,005 psi for granitic gneiss specimens.

Rock recovered from coring operations was described as granitic gneiss in sizes ranging from boulders to gravel and also described as an in-situ rock mass. Weathering of the rock varied from fresh to moderate with intervals of moderately severe to severe (weathered rock) and very severe to completely weathered (soil). Rock hardness characteristics varied from very hard to soft generally mimicking the weathering deterioration. Fracture spacing was predominately recognized as very close to close with intervals in fresh rock reaching moderately close to wide spacing. Core examination revealed horizontal joints and high angle joints (65° to 85°). Iron oxide staining was noted on many fracture faces and throughout the upper intervals of the residual rock.

Groundwater:

Immediately following drilling operations, groundwater measurements were recorded in each end bent boring, however the presence of coring water/fluid makes these results questionable. A static groundwater level (24 hour) measurement in EB2-B suggested the boring did not intercept groundwater.

Scour:

A field scour report was conducted on the existing Bridge No. 7 over the Broad River as part of this project. The scour investigation was performed during the subsurface investigation and is included in this report.

Notes to Designer:

Potentially problematic materials in the form of gravel, cobbles and boulders (alluvium / colluvium) were encountered in the rock core samples. These materials must be considered when selecting and designing bridge foundations.

Mr. Don Moore July 13, 2007

Closure:

This geotechnical investigation is based upon the Preliminary General Drawing dated April 25, 2007. Changes to this design may require alteration and modification to the information discussed in this report. It should be noted that the presentations and discussions in this report are generalized interpretations of available information. Soil and rock descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations and may not necessarily reflect the actual variations in subsurface conditions between borings and samples.

Thank you for the opportunity to provide geotechnical engineering services. Please contact our office if you have questions or comments.

Respectfully,

FLORENCE & HUTCHESON, INC.

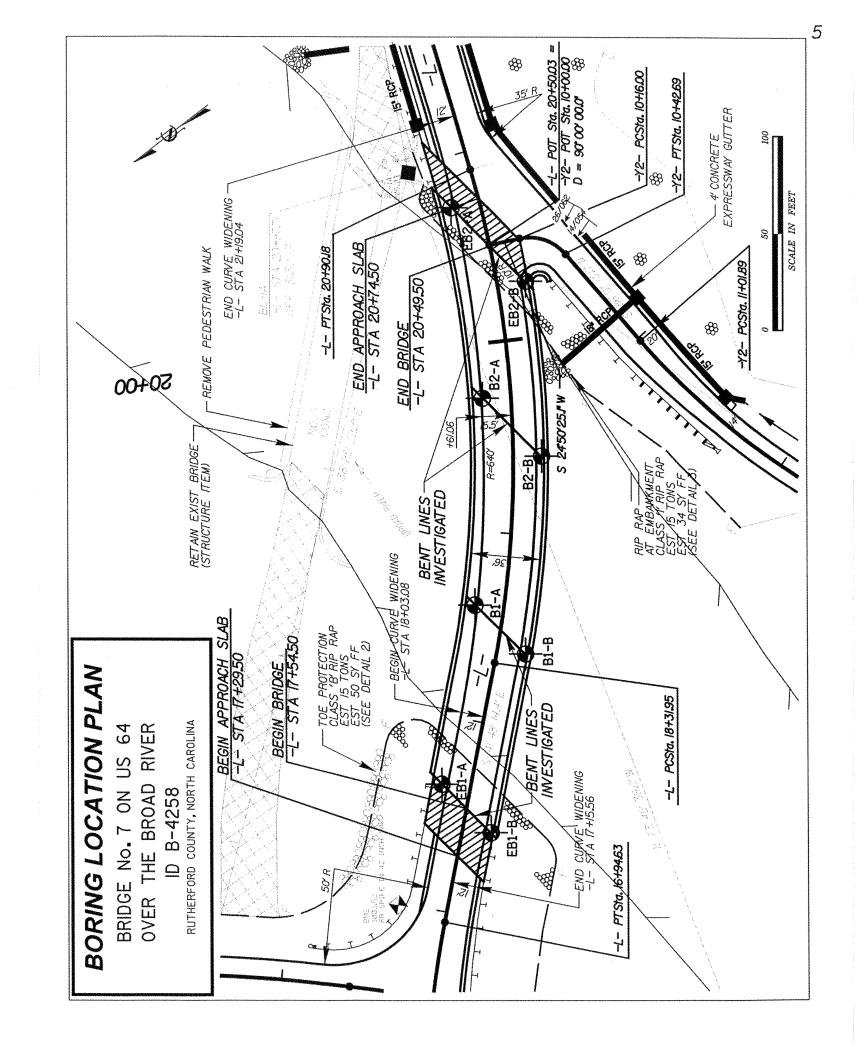
Shawn P. Washer, P.E.

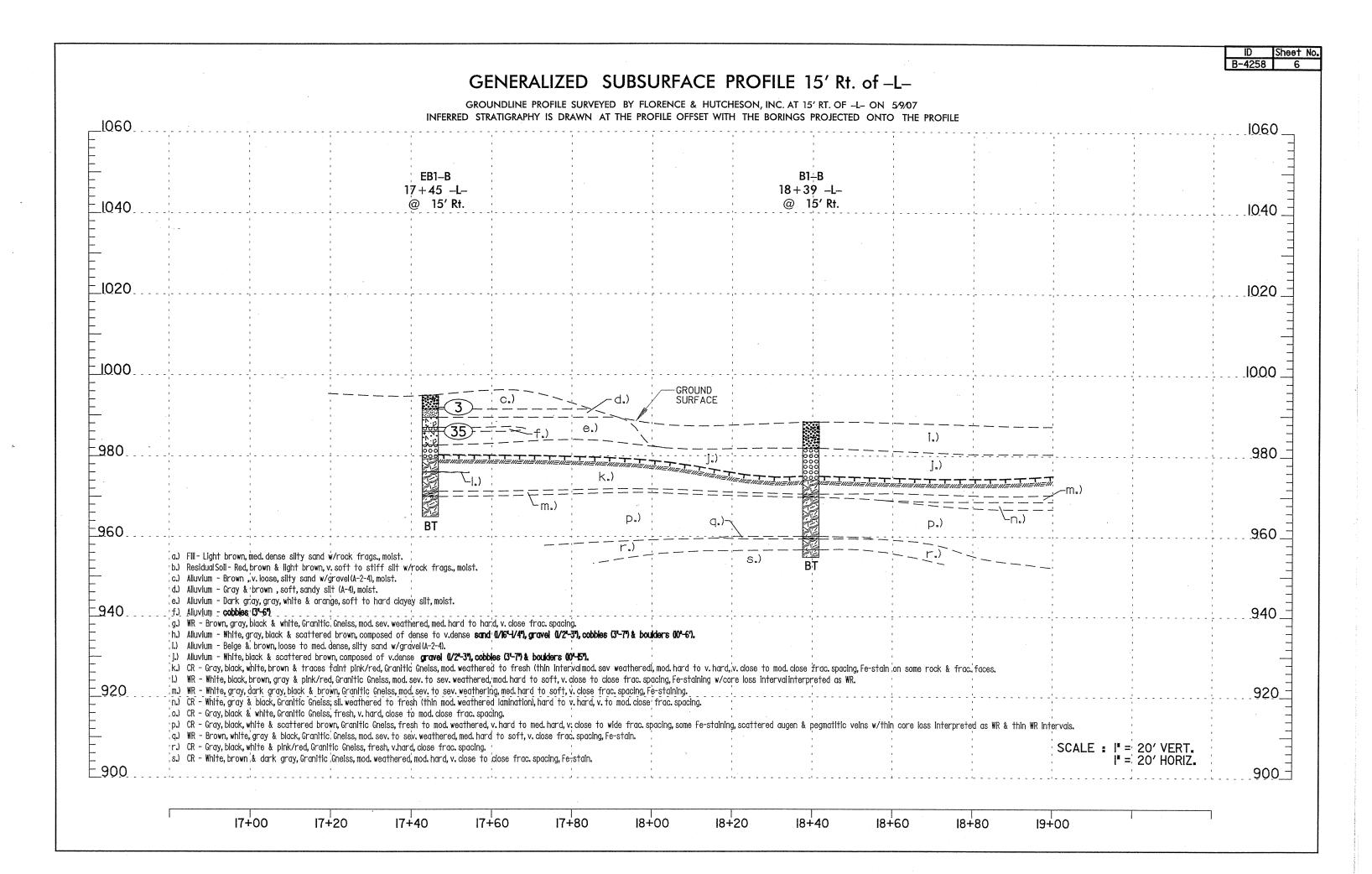
Vice President

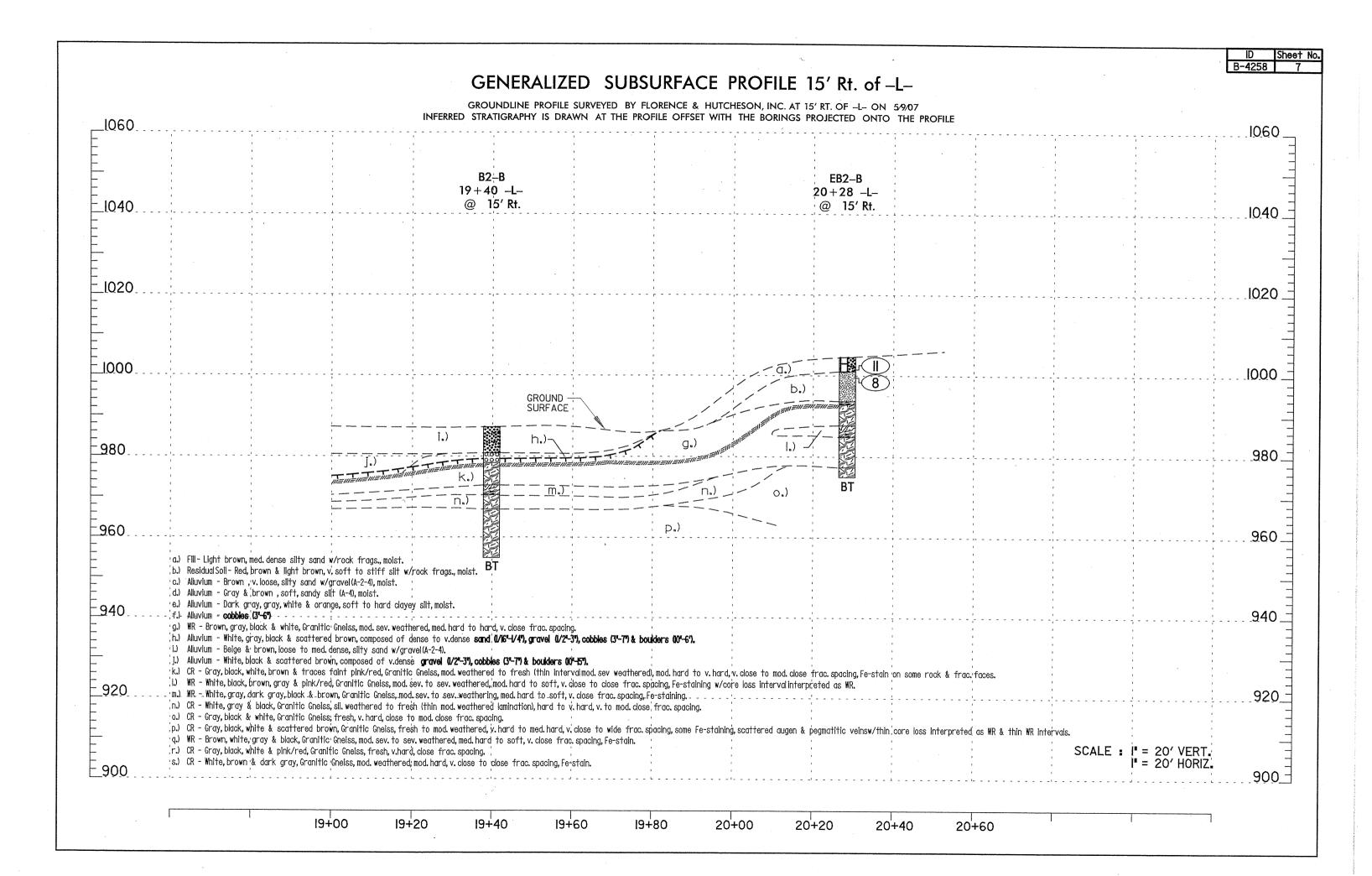
D. Michael Gragg, P.G.

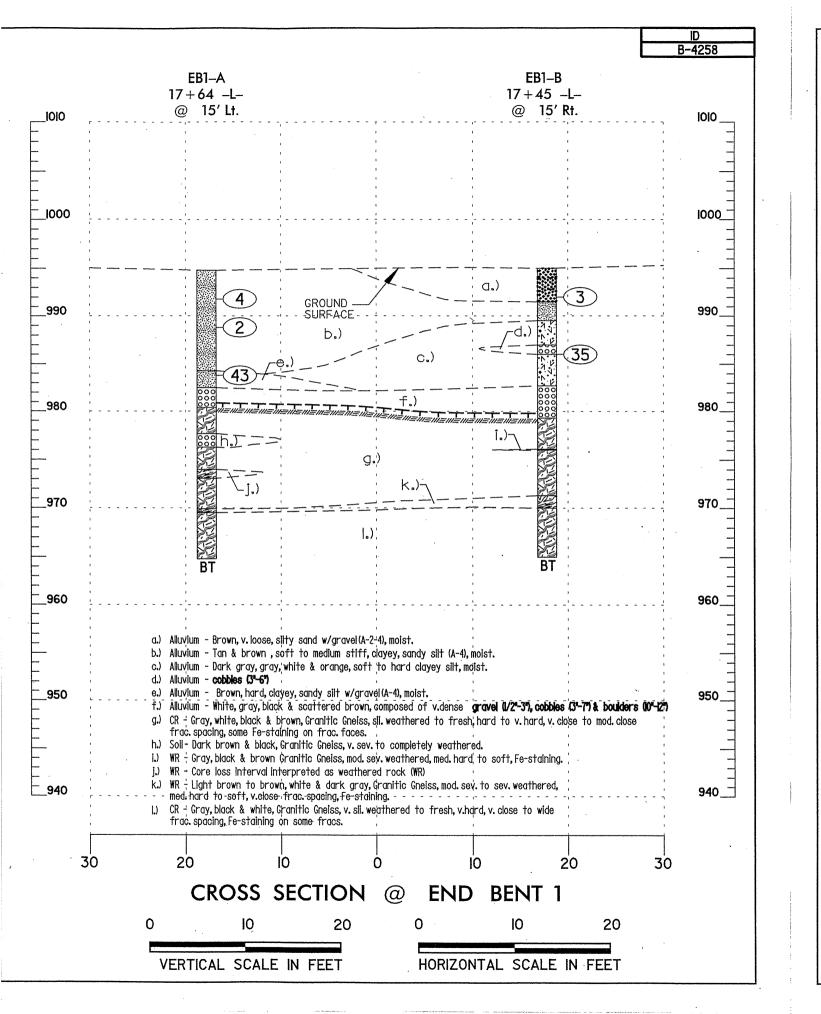
D. Wichaul Grays

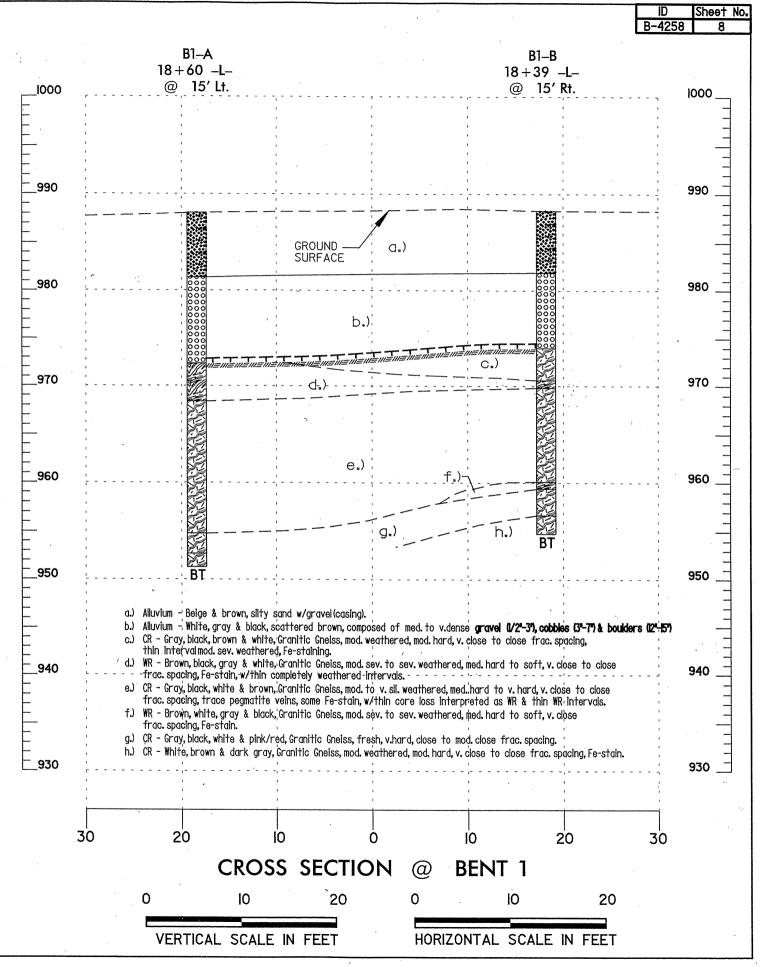
Project Geologist

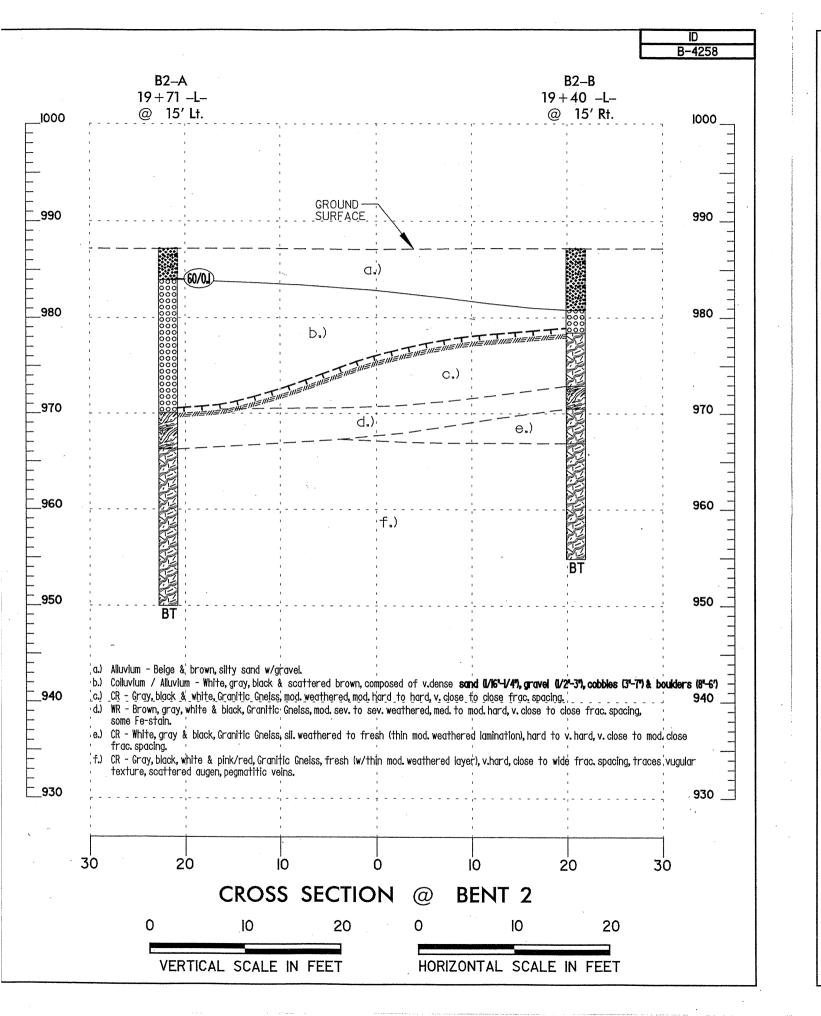


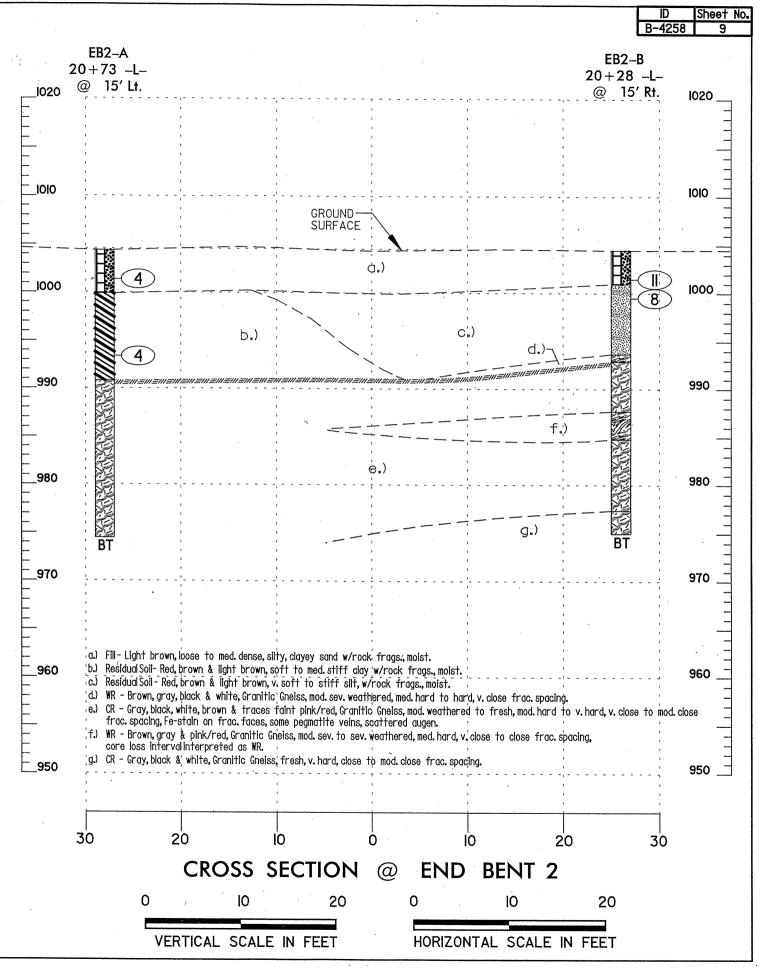








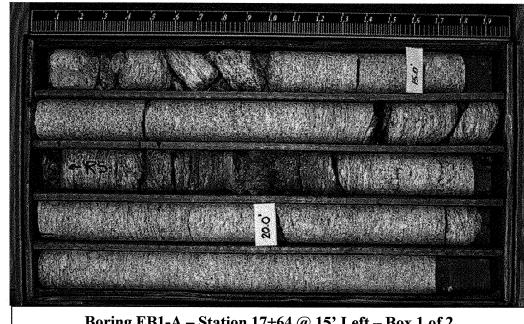




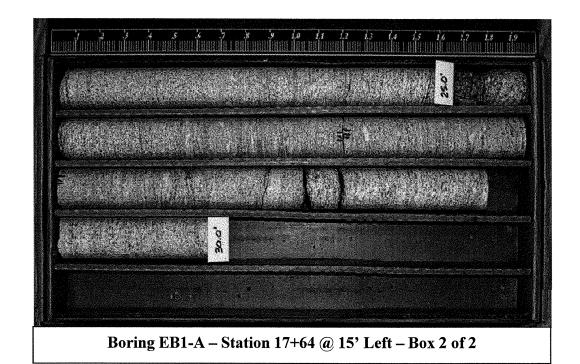
PROJE	CT NO.	3360	0.1.1	1	D.	B-4258	3				CC	TAUC	Y Ru	the	rford				GEOLOGIST N	1. Gragg / M. Jo	ohnso
SITE D	ESCRIP	TION	Bridge	No. 7	on	US 64/	74 over	Broa	ad Riv	/er								······································		GROUND V	VTR (
BORIN	G NO.	EB1-A		-	S	TATION	17+6				OF	FSET	15f	t LT	•		Α	LIGNMEN	T -L-	0 HR.	2
OLLA	R ELEV	7. 994	.8 ft		T	OTAL D	EPTH	30.0	ft		NC	RTHI	NG (529,	383		E	ASTING	1,036,439	24 HR.	Ν
RILL	MACHIN	NE CN	1E-45C		D	RILL MI	ETHOD	SP	T Cor	re Bo	ring	·····							HAMMER TYP	PE Manual	
TART	DATE	05/12/	07		+-	OMP. D						IRFAC	CE WA	ΛΤΕ	R DE	PTH	N/A		DEPTH TO RO	OCK 14.4 ft	
LEV	DEPTH	,	OW COL	 JNT	П				PER FO	TOC				ИР.		L					
(ft)	(ft)	0.5ft	0.5ft	0.5ft		0	25	5	60 I	7	5	100	NO	D.	моі	G	ELEV		OIL AND ROCK DES		DEPTI
995 _				<u> </u>	\mathbb{H}	<u> </u>			Γ				 - 	_		93335	994.8	Allenderm	GROUND SUR - Tan & brown, soft		
2.8	2.0	1			41	ļ								_	∇		-		andy silt.	to med. Still	
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9.8_	5.0	1	1	1	-	b 2	-								M		- 300.1	Alluvium	- Brown, soft, sandy	, clayey silt.	
-	-					: : :			• •	: :							- -				
4.8_	10.0					<u>'i · · · ·</u>	-	• •		• •							 984.3				
-		5	23	20		<u></u> ب		• 43	. :						M		- 982.5	Alluvium	- Brown, hard, claye	ey, sandy silt	
-							: : :	. . .					11			000	980.4	Alluvium	 Begin coring at Ele White, gray, black 	& brown	
_																	900.4	\(3"-7") &	ed of v. dense grave boulders (10"-12").		5
-							.						RS	_1		000	977.7		ay, black, white & bro	own, Granitic	,
-							.		: :								976.3	Soil - Da	rk brown & black, Goompletely weathered		
-	F										٠.		11				974.0 973.1	CR - Gra	ay, black & white, Gr		
-	ļ .						: : :					· · ·				P	-		s interval. ay, black & white, Gr	anitic Gneiss.	
_	_						-	• •		• •		· · ·					969.9				
	<u> </u>						: : :		: :	 							<u>969.5</u> -		hite, gray, light brow ay, black & white, Gr		
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			-	┼	+			-			L		┦—	_			964.8	Roring	Terminated at Eleva	tion 964.8 ft in CR	
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NCDOT GEOTECHNICAL ENGINEERING UNIT

	The second secon		CORE	: B	OR	ING I	KEF	POF	7						,
PROJE	CT NO.	3360	00.1.1	II	D . B-4	1258				coul	NTY Rutherford		GEOLOGIST M.	Gragg / M. Joh	nson
SITE D	ESCRIP	TION	Bridge N	No. 7	oņ US	64/74 ov	er Bro	ad Riv	er	,				GROUND W	TR (ft)
BORIN	G NO.	EB1-A	4		STAT	ION 17-	⊦ 64			OFFS	ET 15ft LT	ALIGNMEN	T -L-	0 HR.	2.0
COLLA	R ELEV	'. 99 ²	1.8 ft		TOTA	L DEPTH	30.0) ft		NORT	THING 629,383	EASTING	1,036,439	24 HR.	N/A
DRILL	MACHIN	IE C	ME-45C		DRILL	METHO	D SP	T Cor	е Во	ring		<u> </u>	HAMMER TYPE	Manual	
START	DATE	05/12	2/07		COMF	. DATE	05/12	/07		SURF	FACE WATER DEPTH N/	'A	DEPTH TO ROC	K 14.4 ft	
CORE	SIZE N	IQ2			TOTA	L RUN	17.7 ft			DRIL	LER Contract Driller	PROPERTY OF THE PROPERTY OF TH			
ELEV	DEPTH		DRILL RATE	REC.	RQD	SAMP.	STR REC.	ATA RQD	LO		DES	CRIPTION AN	DEMARKS		
(ft)	(ft)	(ft)	(Min/ft)	(ft) %	(ft) %	NO.	REC. (ft) %	RQD (ft) %	Ğ	ELEV.				DI	EPTH (ft)
982.5 982.5 -	- 12.3	2.7	4:04	(4.0)	1 21/0		(4.0)	11/0	000		В	egin Coring (@ 12.3 ft		
979.8	15.0	2.1	1:21 1:18 0:59/0.7	(1.6) 59%	N/A		(1.0) 47%		000 000 000	- 982.5 - 980.4	Alluvium - White, gray, black cobbles (3"-7") & boulders (1	10"-12").	ŭ	,,,	12.3 14.4
-	_	5.0	1:38 2:10	(4.9) 97%	(3.1) 62%		(2.7) 100%	(1.8) 65%		 _ 977.7	CR - Gray, black, white & brov. hard, v. close to mod. close			fresh, hard to	47.4
	-		1:46 1:58	07,0	0270	RS-1	(1.2)	(0.0)	000	976.3	Soil - Dark brown & black, G	ranitic Gneiss,	v. sev. to completely w	eathered, soft to	17.1 18.5
974.8_	_ 20.0	5.0	1:21 1:36	(4.1)	(4.0)		(2.3)	(1.9) 83%		974.0	V. soft, close frac. spacing. CR - Gray, black & white, Gr	anitic Gneiss, v	. sli. weathered to fres	n, v. hard, close	20.8
-	_		1:27 1:09	82%	80%		(0.0)	(0.0)		973.1	to mod. close frac. spacing, Core loss interval interpreted	d as weathered	rock.	<i>-</i>	21.7
969.8	25.0		2:01 1:07				(3.2)	(3.2)		969.9	CR - Gray, black & white, Gr close to mod. close frac. spa	icing, some Fe-	staining on joints.		24.9
	-	5.0	1:48 2:36	(4.6) 92%	(4.0) 80%		(0.4)	(0.0)		969.5	WR - White, gray, light brow v. close frac. spacing.	n, Granitic Gne	iss, mod. sev. weather	ing, med. hard,	25.3
· _	-		1:03 1:49	52,0	1		\100% (4.4)	0% (4.0)			CR - Gray, black & white, Gr close to mod. close frac. spa			h, v. hard, v.	
964.8_	30.0		1:51		 		94%	85%		964.8	·	-	on 964.8 ft in CR (Gneis	:0)	30.0
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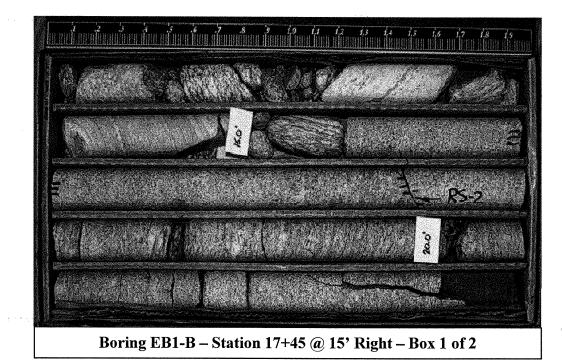
Boring EB1-A – Station 17+64 @ 15' Left – Box 1 of 2

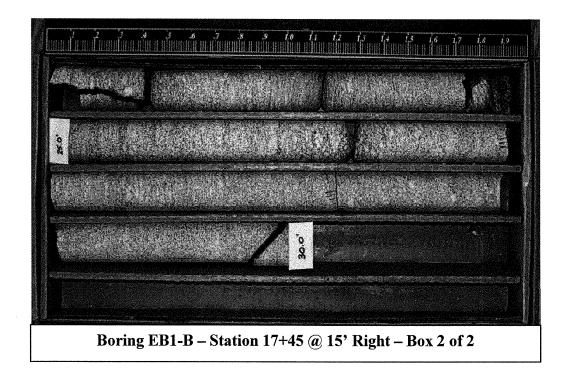


ROJE	CT NO.	3360	0.1.1		D. B-4258			COUNT	r Ruthe	erford			GEOLOGIST N	/I. Gragg / M. Jo	ohnso
TE D	ESCRIP	TION	Bridge	No. 7	on US 64/7	4 over Broad	River							GROUND \	VTR
ORIN	G NO.	EB1-B			STATION	17+45		OFFSET	15ft R	Т		ALIGNMEN	Γ -L-	0 HR.	2
OLLA	R ELEV	. 995.	0 ft		TOTAL DE	PTH 30.0 ft		NORTHI	NG 629	9,378		EASTING	1,036,404	24 HR.	N
RILL	MACHIN	IE CM	IE-45C		DRILL ME	THOD SPT	Core Bo	ring			·		HAMMER TYP	PE Manual	
TART	DATE	05/12/	07		COMP. DA	TE 05/12/07	7	SURFAC	E WATE	ER DE	PTH	N/A	DEPTH TO RO	OCK 15.7 ft	
LEV	DEPTH		OW COL	JNT	11.	BLOWS PE			SAMP.	V /		SC	IL AND ROCK DES	SCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	25 50	7	5 100	NO.	МО	G	ELEV. (ft)			DEPT
95 _				ļ	111	T		1		├		995.0	GROUND SUR - Brown, v. loose, si		
93.0	2.0	2	2	1	- <u> </u>					M		_	210111, 1. 10000, 01	my saria wigiavoi.	
1		_	_		3					IVI			- Gray/brown, soft,	sandy silt.	
7	-				1	1				M	, 77	989.5 - Alluvium	- Dark gray, soft, sa	ndy, clayey silt.	
1					i	 -					000	987.0 986.0 Cobbles	(3"_6")		
5.0	10.0	13	18	17						М	1,7	Alluvium	- Gray, white & orar n coring at Elev. 98	nge, hard, clayey	
1		"	10	''		• •35 -	· · · · ·		!	101	7,7	_ 982.7			
1										-	0000	 scattered 	- Composed of whit brown, v. dense, g	ravel (1/2"-3"),	
-	-				1						000	— _{979.3} cobbles (CR - Gra	3"-7") & boulders (1 y, white & black, Gr	0"-12"). anitic Gneiss.	
1									RS-2	-		976.1	,		
1	-									1		976.0_/\WR - Gra Gneiss.	y, white, black & br	own, Granitic	7
1													y, white, black & bro	own, Granitic	
1												9/1.3	wn, white, dark gra	v. Granitic Gneiss	
-	-				1								y, black & white Gra		·
1	-							::::				- -			
					11				4	 		965.0 Boring 3	erminated at Eleva	tion 965 0 ft in CF	
-												- 20.11.9	(Gneiss)		•
1	Ē											Other Sa	<u>mples:</u> 5.0 - 5.5)		
-								·				- ST-4 (5.5 - 6.9)		
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PROJEC	T NO.	3360	00.1.1	10). B-4	258				COUNTY Rutherford GEOLOGIST M. Gragg / M. Johnson
SITE DE	SCRIP	TION	Bridge I	No. 7	on US	64/74 ov	er Bro	ad Riv	er e	GROUND WTR
BORING	NO.	EB1-E	3		STAT	ION 17+	-45			OFFSET 15ft RT ALIGNMENT -L- 0 HR. 2
COLLAF					TOTA	L DEPTH	30.0) ft		NORTHING 629,378 EASTING 1,036,404 24 HR. N
DRILL N					DRILL	. METHO	D SP	T Cor	е Во	ring HAMMER TYPE Manual
STARTI	DATE	05/12	/07		COMP	DATE	05/12	/07		SURFACE WATER DEPTH N/A DEPTH TO ROCK 15.7 ft
CORE S	IZE N	Q2				L RUN ′			,	DRILLER Contract Driller
ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft)	UN RQD (ft) %	SAMP. NO.	STR REC. (ft) %	RQD (ft) %	L O G	DESCRIPTION AND REMARKS ELEV. (ft) DEPTH
982.7 982.7 980.0	12.3 15.0	2.7	0:38 1:21 0:45/0.7	(2.3) 85%	(0.7) 27%		(2.4) 70%	N/A	000 000 000	Begin Coring @ 12.3 ft - 982.7 Alluvium - Composed of white, black & scattered brown, v. dense, gravel (1/2"-3"), cobbles (3"-7") & boulders (10"-12").
1		5.0	1:36 1:42 1:38	(4.7) 94%	(3.8) 76%	RS-2	(3.2)	(3.1) 97%	000	CR - Gray, white & black, Granitic Gneiss, v. sli. weathered to fresh, v. hard, v. close to mod. close frac. spacing, some Fe-staining on fracs.
975.0	20.0	5.0	2:21 1:52 1:54 1:38 2:01	(3.7) 74%	(0.7)		(0.1) 100% (4.7) 100%	(0.0) 0% (1.1) 23%		\text{\text{\mathcal{W}R - Gray, white, black & brown, Granitic Gneiss, mod. sev. weathered, mod. hard to soft, Fe-staining, \text{CR - Gray, white, black & brown, Granitic Gneiss, sli. weathered to fresh, v. hard, \text{\text{\text{\text{\text{\text{\mathcal{W}}}}} v. close to mod. close frac. spacing, Fe-staining on joint faces, 80° frac. \text{\tex{
970.0	25.0	5.0	1:56 2:09 1:49 1:46	(4.7) 94%	(4.5) 90%		(0.1) 7% (4.7)	(0.0) 0% (4.5)		971.3 21.4'-22.3' heavily Fe-stained. 970.0 WR - Brown, white, dark gray, Granitic Gneiss, sev. weathering, med. hard to soft, V. close frac. spacing, heavy Fe-staining. CR - Gray, black & white Granitic Gneiss, fresh, v. hard, close to wide frac.
965.0	30.0		2:11 1:20 1:33				94%	90%		spacing, Fe-staining on one frac., 45° frac. @ 29.7' w/Fe-staining.
‡										Boring Terminated at Elevation 965.0 ft in CR (Gneiss)
+										Other Samples: ST-3 (5.0 - 5.5) ST-4 (5.5 - 6.9)
‡			,							- - -
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ITE D	ESCRIP	TION	Bridge	No. 7	on US	S 64/	74 ove	er Bro	ad Riv	er								GROUND V	VTR (
ORIN	G NO.	B1-A			STA	TION	18+	60			OFF	SET	15ft L7	Γ		ALIGNMEN	T -L-	0 HR.	N
OLLA	R ELEV	. 988.	1 ft		тот	AL D	EPTH	36.8	3 ft		NOF	RTHIN	IG 629	,313		EASTING	1,036,503	24 HR.	N
RILL	MACHIN	IE CM	IE-45C		DRIL	_L ME	THO	D NV	V Cas	ing w	/ Core						HAMMER TY	PE Manual	
TART	DATE	05/16/	07		CON	IP. D	ATE	05/16	5/07		SUF	RFAC	E WATE	R DEI	PTH	N/A	DEPTH TO R	OCK 19.7 ft	
LEV	DEPTH	BLO	OW COL	 JNT	П		BL	.OWS	PER FO	OOT	L		SAMP.	V/	L				
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0		25		50	7	5	100	NO.	мог	0 G	S(ELEV. (ft)	OIL AND ROCK DE		DEPTH
90 _																		•	
-	,															988.1	GROUND SUF		
-	-				-		. .									Alluvium (casing)	- Beige, brown, silt Begin coring at El	y sand w/gravel ev 981 4	
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_	ŀ				\parallel		+								000	gravel (1	- Composed of me /2"-3"), & cobbles (a. to v. aense 3"-7").	
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	F								: :	::		::	<u> </u>			WR - Br Gneiss.	own, black, gray & v	vhite, Granitic	
-	ļ .						: :		 							968,4			
	ţ						: :		: :	::		::	RS-3	1		CR - Gra	ay, black, white & br	own, Granitic	
-	ł				-		- -									Gneiss.			
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-	t				•		. .		• •			• •				954.8			
-	-				-		- -									. CR - Gra	ay, black, pink/red 8	white, Granitic	
-	ļ.				:	: :			: :		: :					- Gneiss. - 951.3		•	
_	<u> </u>															Boring	Terminated at Eleva (Gneiss	ation 951.3 ft in CR	
•	<u> </u>								4								(Gneiss)	
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	NCDOT	GEOT	ECHNICAL	ENGINEERING	UNIT
TI	CORF	CRINC	REPORT		

PROJE	CT NO		00.1.1	·	D. B-4		- \/	- OI		COUNTY Rutherford			GEOLOGIST	M Cross /34 1 1	
ļ			Bridge 1				er Bro	ad Riv	er	COUNTY Rutherrord			GEOLOGIS I	M. Gragg / M. Joh	
BORIN			Diage i	10. 7		ION 18		au MIV		OFFSET 15ft LT		ALIGNMEN	т	GROUND W 0 HR.	` ′
COLLA			3 1 ft			L DEPTI		R ft		NORTHING 629,313		EASTING			N/A
			ME-45C			. METHO			ina	<u> </u>		LAGING	HAMMER TY	24 HR.	N/A
START						. DATE			ing w	SURFACE WATER DE	DTU NI/A				
CORE						L RUN				DRILLER Contract Di		·	DEPINION	OCK 19.7 ft	
ELEV	DEPTH	Т	DRILL	R	UN		STR	ATA	L	DRILLER CONTRACT DI	mei		**************************************		
(ft)	(ft)	(ft)	RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	REC. (ft) %	RQD (ft) %	O G	ELEV. (ft)	DESC	RIPTION ANI	O REMARKS	D	EDTIL (4)
981.4				"	/*		1 "	76		LLLV. (II)	B ₄	egin Coring	@ 6 7 ft	Di	EPTH (ft)
981.4 - 979.8_	- 6.7 - 8.3	1.6	1:38 0:57/0.6	(1.1) 68%	1		(1.5) 16%	N/A	000	981.4 Alluvium - Compos	sed of med.	to v. dense g	ravel (1/2"-3"), & co	obbles (3"-7").	6.7
_	-	5.0	2:10	(2.3) 46%	INA		10%		0000	•					
-	-		2:16 2:08	40 /6					0000	- -					
974.8_	_ 13.3 -	5.0	2:12 2:41	(3.3)	(0.0)		-		000						
-	-		2:12 2:31	66%	0%		(4.0)	(0.0)	000	972.4 WR - Brown, black	c aray & wh	ite Granitic G	ineies mod sov to		15.7
969.8_	18.3		2:14 2:28				100%	0%		med. hard to soft, thin complete wea	v. close to d	close frac. spa	cing, Fe-staining d	ecreasing w/depth,	
-	- -	5.0	2:32 2:18	(5.0) 100%		RS-3	(13.6)	(2.5)		- 968.4 CR - Gray, black,		,	•	weathered med	19.7
-			2:48 2:21				100%	18%		hard to v. hard, v. veins, 70° joints @	close to clo	se frac. spacir	ng, some Fe-stainir	ng, some pegmatitic	ļ
964.8_	23.3 -	5.0	2:16 2:50	(5.0)	(0.4)		1			joints @ 29.8'-31.0		, 20.4 -21.2 , 2	21.3-21.0 , 20.1-20	5.5 & 26.3, 275	
-	_	İ	2:16 2:21	100%	7%										
959.8	28.3	-	2:35 2:17	(7.5)			1			-					
-	_	5.0	2:24 3:06	(5.0) 100%	(1.1)										
0540	-		2:19 2:16							•					
954.8_	_ 33.3 -	3.5	2:51 2:46	(3.5) 100%	(2.7)		(3.5)	(2.7) 77%		_954.8 CR - Gray, black,	pink/red & v	vhite, Granitic	Gneiss, fresh, v. h	ard, close to mod.	33.3
951.3	36.8		2:51 2:38	100%	77%		100%	77%		close frac. spacing					36.8
_	-		1:47/0.5							Bori	ng Termina	ted at Elevatio	n 951.3 ft in CR (G	Gneiss)	30.0
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Boring B1-A – Station 18+60 @ 15' Left – Box 1 of 3



Boring B1-A – Station 18+60 @ 15' Left – Box 2 of 3

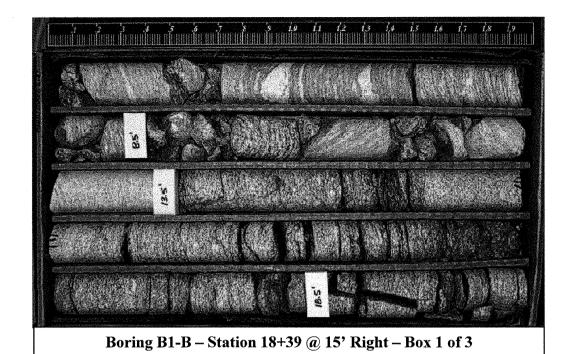


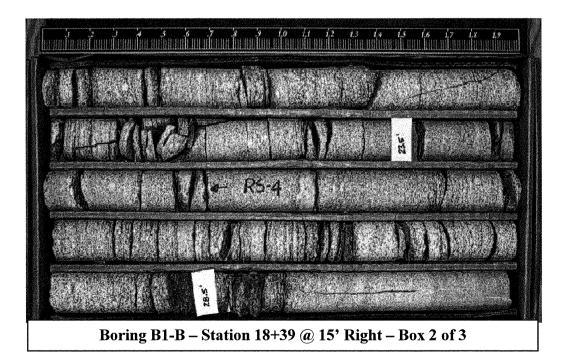
Boring B1-A – Station 18+60 @ 15' Left – Box 3 of 3

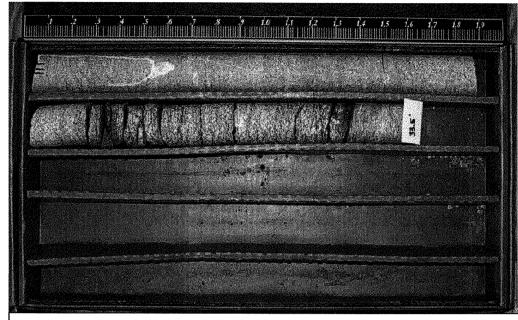
ROJE	CT NO.	3360	0.1.1		D . B-425	8		COUNTY	Ruthe	erford			GEOLOGIST M	. Gragg / M. Jo	ohnso
ITE D	ESCRIF	TION	Bridge	No. 7	on US 64	/74 over B	road River							GROUND V	VTR (
ORIN	G NO.	B1-B			STATION	1 18+39		OFFSET	15ft R	Т		ALIGNMEN	IT -L-	0 HR.	N
OLLA	R ELE	/ . 988	.3 ft		TOTAL	DEPTH 3	3.5 ft	NORTHIN	IG 629	,307		EASTING	1,036,467	24 HR.	N/
RILL	MACHII	NE CN	1E-45C		DRILL M	ETHOD 1	NW Casing w	<u> </u>					HAMMER TYP	E Manual	· · · · · · · · · · · · · · · · · · ·
	DATE			***************************************		ATE 05/		SURFAC	F WATE	R DE	OTH !	Δ	DEPTH TO RO		
	DEPTH	T	OW COL	INT	1		S PER FOOT	00111710	SAMP.		L	· · · · · · · · · · · · · · · · · · ·	<u> </u>	17.010	
.EV ft)	(ft)	0.5ft	0.5ft	0.5ft	 0	25		5 100	NO.	MOI	0	SELEV. (ft)	OIL AND ROCK DES		DEPTI
										,	-	The basic Co. (CC)			<u>DEI 11</u>
90						•									
~ -												988.3	GROUND SURF	ACF	
-												Alluvium	- Beige, brown, silty Begin coring at Elev	sand w/gravel	
_	_				1						此	(Casing)	. begin coming at ciev	7. 901.9.	
-	L														
-	L										000	981.9	- Composed of v. de	noo ground	
_	F .											(1/2"-3")	, cobbles (3"-7") & bo	ulders (12"-15").	
-	ţ .										ŏŏŏ-				
-	<u> </u>										0000				
_	<u> </u>						 				000	974.0			
_	-										% -	CR - Gra Gneiss.	ay, black, brown & wh	ite, Granitic	
-	F											970.6			
_	Ė				1							\Gneiss.	ack, gray, white & bro		Γ
-	ţ											CR - Gra Gneiss.	ay, black, brown & wh	ite, Granitic	_
-	L											, Oneiss.			
-	ŀ				1		-		RS-4						
-	F								130-4	1					
_	.											960.1 959.4 _ W.R - Br			
-	<u> </u>											Gneiss.	own, white, gray & bla		\int_{-}^{-}
-	<u>.</u>											\Gneiss.	ay, black, white & pink		_
_	_				 				-			954.8 CR - Wh Gneiss.	nite, brown & dark gra	y, Granitic	
-	F											Boring	Terminated at Elevati	on 954.8 ft in CR	
-	Ė												(Gneiss)		
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NCDOT GEOTECHNICAL	ENGINEERING UNIT
CORE RORING REPORT	

SITE DI BORINI COLLA	CT NO. ESCRIP				D. B-4	1258				I COHIN	ITY Rutherford	i	GEOLOGIST M.	Grann / M. In	
BORIN COLLA		HON		1- 7	110	04/74				1000.	TAUTOHOU	l	OLOLOGIOT W.		
COLLA			Diluge I	NO. 7				ad Riv	er	0==0		· T		GROUND W	
			2 2 4			ION 184		- 61		 	ET 15ft RT	ALIGNMEN		0 HR.	N/A
			····			L DEPTH					HING 629,307	EASTING	T	24 HR.	N/A
····			ME-45C			. METHO			ing w				HAMMER TYPE		
	DATE		707			P. DATE				 	ACE WATER DEPTH NA	/A 	DEPTH TO ROC	K 14.3 ft	
 1	SIZE N	Ι	DRILL	I R	UN	LRUN 2		ATA		DRILL	ER Contract Driller		***************************************		
(ft)	DEPTH (ft)	RUN (ft)	RATE (Min/ft)	REC. (ft) %		SAMP. NO.	REC. (ft) %	RQD (ft) %	LOG	ELEV. (SCRIPTION AND	O REMARKS		DEPTH (ft)
981.9 981.9	6.4	2.1	1:59	(2.1)	N/A		(4.7)	N/A	000	981.9	Alluvium - Composed of v. d	Begin Coring	@ 6.4 ft 2"-3"), cobbles (3"-7") 8	& houlders	6.4
979.8	_ 8.5 - - - - 13.5	5.0	2:27 \0:15/0.1 2:18 2:52 2:41 2:58 2:39	100 <u>%</u> (2.1) 42%	N/A		59%		000000000000000000000000000000000000000	-	(12"-15").	g. a. a. (, , ,	2 7, 303500 (5 7 7 6	a bouldore	0.4
314.0	- 10.0	5.0	2:12	(4.2)	(0.7)		(2.4)	(4.0)	000	974.0	65. 6		1		14.3
†	-		2:02 2:34	84%	14%		(3.4) 100%	(1.0) 28%			CR - Gray, black, brown & w close to close frac. spacing,	thin interval mo	d. sev. weathered, hea	, mod. nard, v. vily Fe-stained.	
969.8	18.5	5.0	2:48 2:56	(4.4)	(4.4)		(0.8)	(0.0)		970.6 969.8	WR - Black, gray, white & br	own, Granitic G	ineiss, mod. sev. to sev	v. weathered, v.	17.7 18.5
‡	-	0.0	2:48 2:56 3:51	(4.4) 88%	(1.4) 28%		\ <u>100%</u> / (4.7)	0% (1.4) 14%		•	close to close frac. spacing, CR - Gray, black, brown & w	Fe-stain. hite, Granitic G	neiss, mod. to v. slightl	ly weathered,	J
964.8	- - - 23.5		3:07 3:19				48%	14%		•	med. hard to v. hard, v. close decreasing w/depth, 80° frac	e to close frac. : c. @ 18.5', 20.0'	spacing, heavily Fe-sta ' & 22.1'-22.6', 80° part	ined, ially healed frac.	
007.0	- 20.0	5.0	2:58 2:51	(4.8) 96%	(1.3)	RS-4				•	@ 21.5'-21.9', core loss interweathered 26.7'-27.1'.	rval 19.1'-19.7' i	interpreted as WR, mo	d. sev.	
1	-		3:46 3:44	90%	26%					•					
959.8	28.5	5.0	3:51 1:21	(4.8)	(2.9)		(0.5)	(0.0)		960.1 959.4	¬ WR - Brown, white, gray & b	olack Granitic G	ineiss mod sev to sev	/ weathered	28.2 28.9
}	-	0.0	3:01 3:29	96%	58%		\ <u>71%</u> (2.7)	\ <u>`0%´</u> (2.7)		. 956.7	med. hard to soft, v. close from CR - Gray, black, white & pir	ac. spacing, Fe-	-stain.	· ·	
954.8	33.5		3:40 2:51				100%/ (1.6)	100% (0.0)		_ 954.8	\spacing, vert. frac. @ 28.9'-3 CR - White, brown & dark gr	30.8' - healed to	partially healed.		31.6
	-		2.01				84%	0%			close to close frac. spacing,	Fe-stain.		,	<u>33.5</u>
1	-										Bonng Termin	ated at Elevatio	n 954.8 ft in CR (Gneis	SS)	
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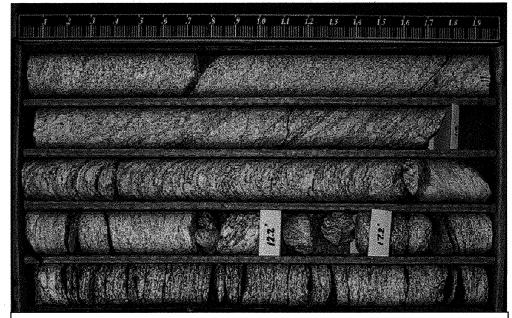
Boring B1-B – Station 18+39 @ 15' Right – Box 3 of 3



SITE DESCRIPTION Bridge No. 7 on US 64/74 over Broad River	-L-	ROUND WI 0 HR. 24 HR. anual	
BORING NO. B2-A STATION 19+71 OFFSET 15ft LT ALIGNMENT	-L- 036,586 2 HAMMER TYPE Ma DEPTH TO ROCK 2	0 HR. 24 HR. anual	N/A
COLLAR ELEV. 987.2 ft TOTAL DEPTH 37.2 ft NORTHING 629,245 EASTING 1, DRILL MACHINE CME-45C DRILL METHOD NW Casing w/ SPT Core START DATE 05/15/07 COMP. DATE 05/15/07 SURFACE WATER DEPTH N/A ELEV (ft) DEPTH (ft) BLOW COUNT (ft) BLOWS PER FOOT (ft) SAMP. V L O SOIL 990 O.5ft 0.5ft 0.5ft 0 25 50 75 100 NO. MOI G ELEV. (ft)	036,586 2 HAMMER TYPE Ma DEPTH TO ROCK 2	24 HR. anual	
DRILL MACHINE CME-45C DRILL METHOD NW Casing w/ SPT Core START DATE 05/15/07 COMP. DATE 05/15/07 SURFACE WATER DEPTH N/A ELEV (ft) DEPTH (ft) BLOW COUNT (ft) BLOW SPER FOOT (ft) SAMP. V COUNT (NO. MO) G ELEV. (ft) SOIL 990 MOI G ELEV. (ft) SOIL 987.2	HAMMER TYPE Ma	anual	N/A
START DATE 05/15/07 COMP. DATE 05/15/07 SURFACE WATER DEPTH N/A	DEPTH TO ROCK 2	···	
ELEV DEPTH BLOW COUNT 0.5ft 0.5ft 0.5ft 0 25 50 75 100 NO. MOI G ELEV. (ft) 990 990 990 990 997.2		20.9 ft	
(ft) (ft) 0.5ft 0.5ft 0.5ft 0 25 50 75 100 NO. MOI G ELEV. (ft)	AND ROCK DESCRIPTI		
990		ION	
Begin corin 984.0 Colluvium/a scattered by boulders (8 15 60/0.1	GROUND SURFACE Beige, brown, silty sand w g at Elev. 984.0. alluvium - White, gray, bla rown, composed of v. der by, gravel (1/2"-3"), cobbles "-6"). The province of the second of t	v/gravel. ack & nse sand s (3"-7"), &	17.1 20.9

NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT
CORE BORING REPORT

PROLECT NO. 33600.1.1 ID. B ±4258 COUNTY Rutherford GEOLOGIST M. Gragg / N. STET DESCRIPTION Bridge No. 7 on US 64/74 over Broad River OFFSET 15ft.LT ALIGNMENT -L-	
BORING NO. B2-A STATION 19+71 OFFSET 15ft LT ALIGNMENT -L- 0.4H	
COLLAR ELEV. 987.2 TOTAL DEPTH 37.2 NORTHING 629.245 EASTING 1,036,586 24 Hz	ID WTR (ft)
DRILL MACHINE CME-45C DRILL METHOD NW Casing w SPT Core HAMMER TYPE Manual START DATE 05/15/07 COMP. DATE 05/15/07 SURFACE WATER DEPTH N/A DEPTH TO ROCK 20.9	
START DATE 05/15/07 COMP. DATE 05/15/07 SURFACE WATER DEPTH N/A DEPTH TO ROCK 20.9	. N/A
CORE SIZE NG2 TOTAL RUN 34.0 ft TOTAL RUN 34.0 ft RUN RU	
ELEV (th) Chi	t
10	
984	
984.0 3.2 4.0 1.466 3.7 NA 5.5 98.0 5.0	DEPTH (ft)
980.0 7.2 2.81 (3.0) N/A 2.15 (5.0 2.16 (3.0) N/A 2.15 (5.0 2.07 2.07 2.07 2.07 2.07 2.07 2.07 2.	nse 3.2
975.0 12.2 2-16 (3.0) N/A 2-16 (3.0) N/A 2-16 (3.0) N/A 2-16 (3.0) N/A 2-16 (3.0) N/A 3-16 (3.0)	
975.0 12.2 2.34 2.07	
975.0 12.2 2.07	
17.2	
970.0 17.2 1:12 1:13	
5.0 2.11 (4.7) (1.3) 94% 26% 2.21 965.0 22.2 2.04 2.19 (4.7)	17.1
965.0 22.2 2.04 2.19 4.7	17.1
965.0 22.2 2.19 (4.7) (4.7) (4.7) (4.7) 95% 83% 55 (15.5)	20.9
960.0 27.2 3:20 3:20 3:20 3:20 3:20 3:20 3:20 3:2	°-80°
960.0 27.2 3:28 3:28 3:28 5.0 15:02 (5.0) (5.0) 100% 100% 12:16 9:50.0 32.2 18:21 9:50.0 37.2 8:16 9:50.0 37.2 8:16 9:50.0 37.2 8:16 9:50.0 9:40 9:52 10:21 9:50.0 Boring Terminated at Elevation 950.0 ft in CR (Gneiss)	,
955.0 32.2 17.08 12.16 18.21	
955.0 32.2 10:30 12:16 18:21 5.0 10:30 99% 90% 99% 52:10:21 8:16	
950.0 37.2 10:30 (4.5) 90% 90% 50% 90% 90% 90% 90% 90% 90% 90% 90% 90% 9	
950.0 37.2 9:52 10:21 8:16 Boring Terminated at Elevation 950.0 ft in CR (Gneiss)	
950.0 37.2 8:16 950.0 Boring Terminated at Elevation 950.0 ft in CR (Gneiss)	
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Boring B2-A – Station 19+71 @ 15' Left – Box 1 of 3



Boring B2-A – Station 19+71 @ 15' Left – Box 2 of 3



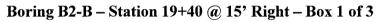
Boring B2-A – Station 19+71 @ 15' Left – Box 3 of 3

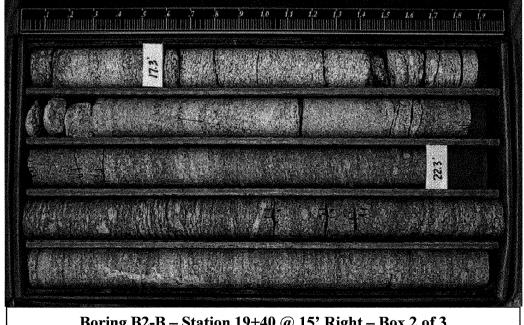
PROJE	CT NO.	3360	0.1.1		D . B-4258	;		COUNTY	Ruthe	erford			GEOLOGIST M.	Gragg / M. J	lohnson
SITE D	ESCRIP	TION	Bridge	No. 7	on US 64/7	4 over Broa	d River							GROUND	WTR (fi
BORIN	G NO.	B2-B			STATION	19+40		OFFSET	15ft R	Т		ALIGNMEN	T -L-	0 HR.	N/A
COLLA	R ELEV	. 987.	.2 ft		TOTAL D	EPTH 32.3	ft	NORTHIN	I G 629	,239		EASTING	1,036,544	24 HR.	N/A
DRILL	MACHIN	E CM	1E-45C		DRILL ME	THOD NW	/ Casing w	/ Core					HAMMER TYPE	Manual	
START	DATE	05/16/	07		COMP. DA	ATE 05/16/	07	SURFAC	E WATE	R DE	PTH 1	V/A	DEPTH TO RO	CK 8.8 ft	· LMWUI J VII LU LU
ELEV	DEPTH	BLO	ow cor	JNT		BLOWS F	ER FOOT		SAMP.	V /	L	sc	DIL AND ROCK DESC	RIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0	25 5	0 7	5 100	NO.	MOI		ELEV. (ft)			DEPTH
990 _					-										
-		,										987.2	GROUND SURF	ACE	C
-										-	-	Alluvium Begin co	- Beige, brown, silty s ring at Elev. 980.8.	sand w/gravel.	
-	-										F				
-				İ								980.8			6
_										ŀ	000	Alluvium	- White, gray, black &	scattered	
-										ŀ		\(1/16"-1/	omposed of dense to 4"), gravel (1/2"-3") &	cobbles (3"-5").	
1									RS-6	}		CR - Gra	y, black & white, Gra	nitic Gneiss.	
												972.9			14
_												WR - Bro	own, black & white, G	ranitic Gneiss.	
_	-								ľ			970.5 CR - Wh	ite, gray & black, Gra	nitic Gneiss.	16
-	-											966.9			20
-											ST	CR - Gra	y, black & white Gran	itic Gneiss.	
.]	F] .								ST.				
_				2											
_	-														
-									ľ						
_	-											954.9			32
	-				<u> </u>			<u> </u>			F		Ferminated at Elevati (Gneiss)	on 954.9 ft in Cl	R 3
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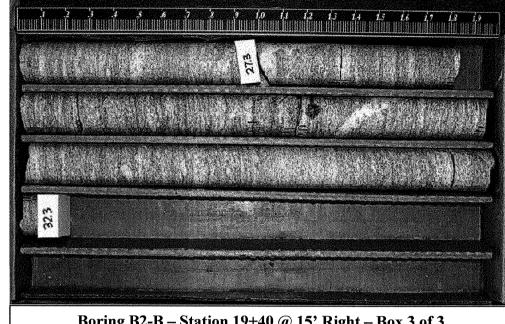
			JURE	= <u>D</u>	UKI	ING I	KE!	70 F	<u> </u>		
PROJE	CT NO.	3360	00.1.1	IE	D. B-4	258	·			COUNTY Rutherford GEOLOGIST M. Gragg / M. Johns	son
SITE D	ESCRIP	TION	Bridge I	No. 7	on US	64/74 ov	er Bro	ad Riv	er	GROUND WTR	R (ft)
BORIN	G NO.	B2-B			STAT	ION 194	-40			OFFSET 15ft RT ALIGNMENT -L- 0 HR.	N/A
COLLA	R ELEV	. 987	7.2 ft		TOTA	L DEPTH	32.3	3 ft		NORTHING 629,239 EASTING 1,036,544 24 HR.	N/A
DRILL	MACHIN	IE C	ME-45C		DRILL	METHO	D NV	V Cas	ing w	w/ Core HAMMER TYPE Manual	
START	DATE	05/16	6/07		COMP	DATE	05/16	/07		SURFACE WATER DEPTH N/A DEPTH TO ROCK 8.8 ft	
CORE	SIZE N	IQ2	· .			LRUN 2				DRILLER Contract Driller	
ELEV	DEPTH		DRILL RATE	REC.	UN RQD	SAMP.	REC.	ATA RQD	0 .	DESCRIPTION AND REMARKS	
(ft)	(ft)	(ft)	(Min/ft)	(ft) %	(ft) %	NO.	(ft) %	(ft) %	G	ELEV. (ft) DEPT	TH (ft)
980.8 980.8 979.9 7	- 6.4 - 7.3	0.9	1:38/0.9	(0.4)	N/A		(1.9)	N/A	000	Begin Coring @ 6.4 ft —980.8 Alluvium - White, gray, black & scattered brown, composed of dense to v. dense	- 0.4
979.9		5.0	1:38/0.9 2:38 2:57	(5.4) (5.0)	(1.8)		79%		000	}- _{978.4} sand (1/16"-1/4"), gravel (1/2"-3") & cobbles (3"-5").	6.4 8.8
-			2:40 2:09	100%			(5.5) 100%	(2.5) 45%		CR - Gray, black & white, Granitic Gneiss, mod. weathered, v. close to close frac. spacing, mod. hard to hard, healed vert. joint @ 10.3'.	
974.9	12.3	5.0	2:11 2:40	(4.4)	(1.2)	RS-6					
-			3:12 2:51	88%	24%		(1.9)	(0.0)		972.9 WR - Brown, black & white, Granitic Gneiss, mod. sev. to sev. weathered, med.	14.3
969.9	17.3		2:49 2:56				79%	0%		- 970.5 hard, v. close to close frac. spacing, Fe-stain.	16.7
-		5.0	2:41 3:26	(4.9) 98%	(3.2) 64%		(3.5) 97%	(1.7) 46%		CR - White, gray & black, Granitic Gneiss, sli. weathered to fresh (mod. weathered 18.1'-18.2'), hard to v. hard, v. close to mod. close frac. spacing, healed 80° joint	
-			2:38 2:51				(11.9)	(11.9)		966.9 @ 19.2'-19.7'. CR - Gray, black & white Granitic Gneiss, fresh, v. hard, mod. close to wide frac.	20.3
964.9	_ 22.3	5.0	2:59 2:46	(4.9)	(4.9)		99%	(11.9) 99%		spacing, scattered augen & pegmatitic veins.	
-			3:08 3:21	98%	98%						
959.9	27.3		3:46 3:19								
-		5.0	4:08 3:46	(5.0) 100%	(5.0) 100%						
	_		4:24 3:57		'						
954.9	32.3	-	4:21	-	 		ļ		74	954.9 Boring Terminated at Elevation 954.9 ft in CR (Gneiss)	32.3
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Boring B2-B – Station 19+40 @ 15' Right – Box 2 of 3



Boring B2-B – Station 19+40 @ 15' Right – Box 3 of 3

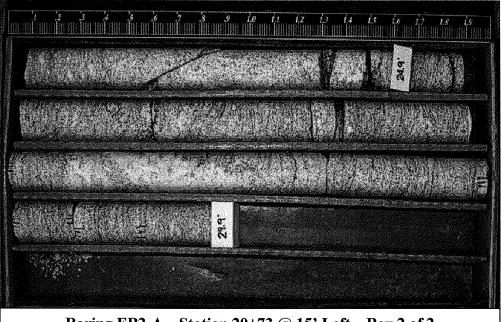
COUNTY Rutherford PROJECT NO. 33600.1.1 ID. B-4258 GEOLOGIST M. Gragg / M. Johnson SITE DESCRIPTION Bridge No. 7 on US 64/74 over Broad River GROUND WTR (ft) BORING NO. EB2-A STATION 20+73 OFFSET 15ft LT ALIGNMENT -L-0 HR. COLLAR ELEV. 1,004.4 ft TOTAL DEPTH 29.9 ft **NORTHING** 629,199 **EASTING** 1,036,675 24 HR. Dry DRILL MACHINE CME-45C DRILL METHOD SPT Core Boring HAMMER TYPE Manual **START DATE** 05/13/07 **COMP. DATE** 05/13/07 SURFACE WATER DEPTH N/A DEPTH TO ROCK 13.6 ft ELEV DEPTH BLOW COUNT **BLOWS PER FOOT** SAMP. SOIL AND ROCK DESCRIPTION (ft) (ft) 0.5ft 0.5ft 0.5ft 100 NO. MOI G ELEV. (ft) 1005 -- 1,004.4 GROUND SURFACE Fill - Light brown, loose, silty, clayey sand. 1,002.4 2.0 М Residual - Red, brown & light brown, soft to М med. stiff, clay w/rock frags. Begin coring at Elev. 990.8. 994.4 10.0 RS-7 CR - Gray, white & black, Granitic Gneiss. Boring Terminated at Elevation 974.5 ft in CR

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORF BORING REPORT

	y Yu		JUKE	B	UKI	NG I	KEF	POF	7		
PROJE	CT NO.	3360	00.1.1	11	D . B-4	258				COUNTY Rutherford GEOLOGIST M. Gragg / M. John	nson
SITE D	ESCRIP	TION	Bridge I	No. 7	on US	64/74 ov	er Bro	ad Riv	er	GROUND WT	
BORIN	G NO.	EB2-A	١		STATI	ON 20+	-73			OFFSET 15ft LT ALIGNMENT -L- 0 HR.	Dry
COLLA	R ELEV	'. 1,0	04.4 ft		TOTA	L DEPTH	29.9	ft ft		NORTHING 629,199 EASTING 1,036,675 24 HR.	Dry
DRILL	MACHIN	IE CI	ME-45C		DRILL	METHO	D SP	T Cor	е Во	oring HAMMER TYPE Manual	
START	DATE	05/13	3/07		COMP	. DATE	05/13	/07		SURFACE WATER DEPTH N/A DEPTH TO ROCK 13.6 ft	
CORE	SIZE N	IQ2				RUN 1				DRILLER Contract Driller	
ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	QN RQD (ft) %	SAMP. NO.	STR REC. (ft) %	ATA RQD (ft) %	10G	DESCRIPTION AND REMARKS	PTH (ft)
990.8										Begin Coring @ 13.6 ft	
990.8	-	1.3 5.0	1:22 0:31/0.3 2:08 2:16 2:26 2:11 1:58 2:29	(1.1) \85% (5.0) 100%	46% / (2.9) 58%	RS-7	(16.1) 99%	(11.7) 72%		990.8 CR - Gray, white & black, Granitic Gneiss, fresh to sli. weathered, v. hard, mod. close to very close frac. spacing, some pegmatitic veining, scattered augen, core loss & mud seam 14.6'-14.9' interpreted as WR, 65° fracs. @ 18.5'-18.8', 19.1'-19.5', 21.7'-22.1' & 23.8'-24.1' w/Fe-staining.	13.6
979.5	- 24.9	5.0	2:12 2:23 2:16 2:41 1:38	(5.0)	(4.6)						
ļ-			2:19 2:07 2:21	100%	92%						
974.5 -	- 29.9 -		2:34		-	~~~~			المنظر المنظم	974.5 Boring Terminated at Elevation 974.5 ft in CR (Gneiss)	29.9
										Other Samples: ST-1 (5.0 - 6.1)	
-	-								- - -		



Boring EB2-A – Station 20+73 @ 15' Left – Box 1 of 2



Boring EB2-A – Station 20+73 @ 15' Left – Box 2 of 2

ROJE	CT NO.	33600	0.1.1		D.	B-4258			COUN	TY	Ruthe	rford			1	GEOLOGIST M.	Gragg / M. Joh	nsor
ITE DI	ESCRIP	TION	Bridge	No. 7	on	US 64/74	over B	road Rive	r								GROUND W	TR (f
ORING	S NO.	EB2-B			S	TATION 2	20+28		OFFS	ET	15ft R	Γ			ALIGNMENT	· -L-	0 HR.	Dr
OLLA	R ELEV	1,00	4.5 ft		TO	OTAL DEP	TH 2	9.5 ft	NORT	HIN	G 629	,190			EASTING 1	,036,621	24 HR.	N/
RILL I	MACHIN	IE CM	IE-45C		DI	RILL MET	HOD :	SPT Core	Boring							HAMMER TYPE	Manual	
TART	DATE	05/14/	07		C	OMP. DAT	E 05/	14/07	SURF	ACE	WATE	R DE	PTH	N/	Ά.	DEPTH TO ROC	K 11.6 ft	
LEV	DEPTH	BLO	OW COL	INT	П		BLOW	S PER FOO)T		SAMP.	V /	L			I AND DOCK DECO	DIDTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft		0 2	5	50	75 1	00	NO.	МО	O G	EI	.EV. (ft)	IL AND ROCK DESC		EPTH
							•											
005														L	004.5	GROUND SURFA	CE	
02.5	2.0				$\dagger \dagger$	- 1							H	= ''	Fill - Light	brown, med. dense s		
+		7	6	5	11	111						М		F 1,1	frags. 001.0			
00.5	4.0	4	4	4	1	• 8				4		М		F	Residual -	Red, brown & light b	rown, v. soft to	
1						<u> </u>								ļ	993.7.	nook nags. Degin co	ning at Liev.	
‡										:				ţ				
7						İ						М		99	3.7 2.9 WR - Brow	4		1
‡														99		vn, gray, black & whit	e, Granitic	
	•						• • •							土	CR - Gray Gneiss.	, brown, black & white	e, Granitic	
‡	•													98	37.7			
1										:	•			1	WR - Brow	wn, gray & pink/red, G	Franitic Gneiss.	
1	-				\parallel					\exists	RS-8			98	34.8 CR - Grav	, brown, black, white	& faint nink/red	
1														-	Granitic G	ineiss,	a iant pintroa,	
Ŧ						,								7				
7	•									-				7				
‡	•													- 97 -	7.4 CR - Grav	, white & black, Gran	itic Gnoice	
	•				Ш			• • • •	.					97	5.0			
1														E	Boring T	erminated at Elevatio (Gneiss)	n 975.0 ft in CR	
1														E	Other Sar	nples:		
1														-	ST-2 (9	.0 - 10.3)		
1	•													F	*			
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NCDOT GEOTECHNICAL ENGINEERING UNIT

	CT NO.				D. B-4					COUNTY Rutherford GEOLOGIST M. Gragg / M. Jo	ohnsor
TE DI	ESCRIP	TION	Bridge I	No. 7	on US	64/74·ov	er Broa	ad Riv	er	GROUND W	VTR (f
PRINC	G NO.	EB2-E	3		STAT	ION 20+	+28			OFFSET 15ft RT ALIGNMENT -L- 0 HR.	Dr
LLA	R ELEV	'. 1,0	04.5 ft		TOTA	L DEPTH	1 29.5	ft .		NORTHING 629,190 EASTING 1,036,621 24 HR.	N/A
RILL I	MACHIN	IE C	ME-45C		DRILL	. METHO	D SP	T Cor	е Во	ring HAMMER TYPE Manual	
ART	DATE	05/14	/07		COMP	. DATE	05/14	/07		SURFACE WATER DEPTH N/A DEPTH TO ROCK 11.6 ft	
RE S	SIZE N	IQ2			TOTA	L RUN				DRILLER Contract Driller	
.EV ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STR REC. (ft) %	ATA RQD (ft) %	100	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH
3.7	40.0									Begin Coring @ 10.8 ft	
3.7	10.8	3.7	1:59 2:10	(3.5) 94%	(0.3) 9%		(0.8) \100%	N/A (1.5)		993.7 WR - Brown, gray, black & white, Granitic Gneiss, mod. sev. weathered, med.	/_1
0.0	14.5	5.0	2:14 1:31/0.7 2:08 1:57	(3.6) 72%	(1.2) 24%		96%	29%		CR - Gray, brown, black & white, Granitic Gneiss, mod. to sli. weathered, hard, v. close to close frac. spacing, heavily Fe-stained, 85° frac. @ 12.5'-14.3' w/clay in-fill, broken w/clay 12.3'-12.5' & 15.8'-16.3'.	11
1	•	h	2:24 2:31				(1.5) 52%	(0.0)		- WR - Brown, gray & pink/red, Granitic Gneiss, mod. sev. to sev. weathered, med.	
5.0	19.5	5.0	2:26 2:07	(5.0)	(2.0)	RS-8	(7.4)	(3.3)		hard, v. close to close frac. spacing, core loss 17.0'-18.6' interpreted as WR.	19
60.0	24.5	5.0	1:36 2:21 2:01 2:18 2:19	(5.0)	40%		100%	45%		CR - Gray, brown, black, white & faint pink/red, Granitic Gneiss, mod. to v. sli. weathered, mod. hard to hard, v. close to close frac. spacing, heavily Fe-stained w/85°-90° fracs some healed, some w/clay in-fill & heavy Fe-stain.	
7			2:24 2:36	100%	70%					977.4	2
5.0	- 29.5		2:41 2:06				(2.4)	(2.2) 92%		CR - Gray, white & black, Granitic Gneiss, fresh, v. hard, close to mod. close frac. 975.0 spacing, healed 75° frac. 27.7'-28.0' w/Fe-stain.	2
	-		2.55							Boring Terminated at Elevation 975.0 ft in CR (Gneiss)	
+	-									- Other Samples: - ST-2 (9.0 - 10.3)	
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Boring EB2-B – Station 20+28 @ 15' Right – Box 1 of 2



Boring EB2-B – Station 20+28 @ 15' Right – Box 2 of 2

STATE PROJECT NO.:

33600.1.1

TIP NO.:

B-4258

COUNTY:

Rutherford

PROJECT DESC.:

Bridge No. 7 on US 64 / 74 over Broad River

	SUMMARY OF SOIL CLASSIFICATIONS AND GRADATIONS																
	Sample	Depth Interval	AASHTO		Soil	Percent	Percent	Percent	Percent		SOIL M	ORTAR					D
Boring No.	No.	(ft.)	Class.	N	No.	Passing No.10	Passing No.40	Passing No.200	Retained No. 60	Coarse Sand	Fine Sand	Silt	Clay	LL	PI	PL	Percent Moisture
EB2-B	SS-1	2.0'-3.5'	A-2-4 (0)	11	1	94	81	27	38	34	40	16	10	27	NP	NP	18.6
EB1-A	SS-2	5.0'-6.5'	A-4 (0)	2	2	100	89	36	20	20	51	19	10	29	NP	NP	36.4
EB1-B	ST-3	5.0'-5.5'	A-4 (0)	N/A	3	99	93	47	19	18	40	30	12	33	NP	NP	50.0
EB1-B	ST-4	5.5'-6.9'	A-5 (11)	N/A	4	100	98	85	2	2	18	51	29	47	9	38	65.8
EB2-A	ST-1	5.8'-6.9'	A-6 (3)	N/A	5	95	81	50	27	23	28	16	33	30	13	17	21.7
EB2-B	ST-2	9.0'-10.3'	A-4 (0)	N/A	- 6	- 96	80	44	29	26	32	20	22	27	7	20	19.2
Bed	S-1	N/A	A-2-4 (0)	N/A	7	99	58	4	72	72	26	0	2	29	NP	NP	N/A

STATE PROJECT NO.:

33600.1.1

TIP NO.:

B-4258

COUNTY:

Rutherford

PROJECT DESC.:

Bridge No. 7 on US 64 / 74 over Broad River

	LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES										
Sample No.	Boring No.	Depth Interval (ft)	Rock Type	Run RQD (%)	Height (inches)	Diameter (inches)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)	Young's Modulus	Splitting Tensile Strength	Remarks
RS-1	EB1-A	17.1'-17.5'	Granitic Gneiss	62	2.56	1.98	148.2	1818	N/A	N/A	
RS-2	EB1-B	17.9'-18.4'	Granitic Gneiss	76	4.08	1.99	163.6	12474	N/A	N/A	
RS-3	B1-A	19.7'-20.1'	Granitic Gneiss	26	4.25	1.98	153.1	2088	· N/A	N/A	
RS-4	B1-B	24.5'-25.0'	Granitic Gneiss	26	4.05	1.99	163.3	7283	N/A	N/A	
RS-5	B2-A	21.7'-22.2'	Granitic Gneiss	, 26	4.02	1.99	163.8	15006	N/A	N/A	
RS-6	B2-B	11.3'-11.9'	Granitic Gneiss	35	4.00	1.99	158.4	6140	N/A	N/A	
RS-7	EB2-A	13.6'-14.2'	Granitic Gneiss	46	4.00	1.99	159.7	6449	N/A	N/A	
RS-8	EB2-B	19.1'-19.4'	Granitic Gneiss	24	3.21	1.99	141.4	1299	N/A	N/A	



FIELD SCOUR REPORT

WBS:	33600.1.1	_ TIP:	B-4258	COUNTY: Rutherford				
DESCRIPTION(1):	Bridge No. 7 or	uS 64 / 74 o	ver Broad Rive	r				
			EXISTING B	RIDGE				
Information from:	Field In Other	rspection X (explain)	Micro	film (reel pos:)				
Bridge No.: Foundation Type: \	7 Length Vertical Concre	:295' To te Abutments	otal Bents: 4 on Concrete F	Bents in Channel: 2 Bents in Floodplain: 4 ootings				
EVIDENCE OF S	COUR(2)							
Abutments or E	nd Bent Slopes	: Minor Bank	Sloughing @ E	B2 Upstream				
Interior Bents: \		ermining						
Channel Bed: \(\)	Very Little Unde							
Channel Bank:	Channel Bank: Some Sloughing Upstream, Downstream is Protected							
EXISTING SCOU	ID DDOTECTIC	nai -						
Type(3): <u>I</u>		/N						
Extent(4): _	None @ EB1, Ir	mmediate Ups	stream of EB2,	Downstream very Extensive				
Effectiveness(5):	√ery Effective							
Obstructions(6):	Small Trees @	Interior Bent 2	2	· .				

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).
- Note existing scour protection (e.g. rip rap).
- Describe extent of existing scour protection.
- Describe whether or not the scour protection appears to be working.
- Note obstructions such as dams, fallen trees, debris at bents, etc.
- Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- Describe the channel bank material based on observation and/or samples. Include any lab results with report,
- Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 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): Sample results attached, material also includes Alluvium: boulders (12") to gravel (0.75").

Channel Bank Material(8): Sample results attached, material also includes Alluvium: boulders (12") to gravel (0.75").

Channel Bank Cover(9): Grass with small trees and brush

Floodplain Width(10): 250'

Floodplain Cover(11): Grass, trees and brush

Stream is(12): Degrading Aggrading Static X

Channel Migration Tendency(13): To the East

Observations and Other Comments: River is upstream end of Lake Lure, appears Town of Lake Lure trying to control migration and flow.

Reported by:

Shawn P. Washer, P.E.

Date: 6/8/2007

Meters

DESIGN SCOUR ELEVATIONS(14)

Feet X

BENTS

100 Year 500 Year

	B2		* .			
981.6	980.3					
980.9	979.7					
L,						

Comparison of DSE to Hydraulics Unit theoretical scour:

We agree with the scour computations presented in the Bridge Survey and Hydraulic Design Report for B-4258, dated 5/9/2006.

DSE determined by: Chi M While C. M. Whalen

SOIL ANALYSIS RESULTS FROM CHANNEL RED AND DANK MATERIAL

SOIL ANALY	SIS KESULIS	FROM CHAI	NNEL BED AN	ID BANK MAI	ERIAL	
Bed or Bank	Bed	Bank	Bank	Bank		
Sample No.	S-1	SS-2	ST-3	ST-4		
Retained #4	1	0	0	0		
Passed #10	99	100	99	100		
Passed #40	58	89	93	. 98		
Passed #200	4	36	47	85		
Coarse Sand	72	20	19	2		
Fine Sand	25	50	40	18		
Silt	1	20	29	51		
Clay	2	10	12	29		
LL	29	29	33	47		
PI	NP	NP	NP	9		
AASHTO	A-2-4 (0)	A-4 (0)	A-4 (0)	A-5 (11)		
Station	N/A	17+64	17+45	17+45		
Offset	N/A	15' Lt.	15' Rt.	15' Rt.		
Depth	N/A	5.0'-6.5'	5.0'-5.5'	5.5'-6.9'		

PHOTOGRAPHIC RECORD

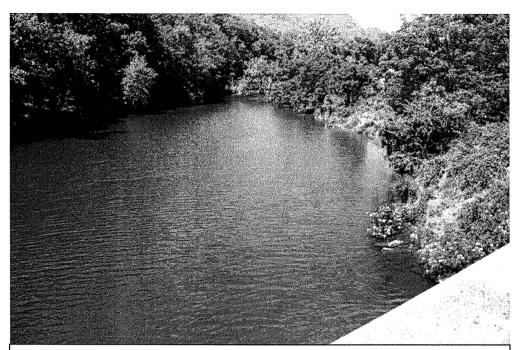
Replacement of Bridge No. 7 on US 64 / 74 over Broad River



Photograph No. 1 - This photograph was taken from Boring EB1-B looking at Borings EB2-A and EB2-B and the existing bridge.



Photograph No. 2 - This photograph was taken from Boring EB1-A looking at Boring EB1-B.



Photograph No. 3 - This photograph was taken from the deck of the existing bridge looking upstream.



Photograph No. 4 - This photograph was taken from Boring EB2-B looking at Boring EB2-A and the existing bridge.

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS**

GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFER	RENCE I	NO	33600	alal (B	-4258	<u> </u>	_ F.A. I	PRO.	J. <u>BRST</u>	P-000	<u> 64(6</u>
COUNTY			RUTHE	<u>RFOR</u>	D	5.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1					
PROJECT DE	SCRIPT	ION _	APP	ROACI	HES TO) BRID	GE NO.	7			
							AD RIVE				
SITE DESCR	IPTION	PRO	POSED	RET	AINING	WALL	RIGHT	OF	CENTER	RLINE	-L-
DITE BEOOK					ENTER						

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL
N.C.	33600.1.1 (B-4258)	1	

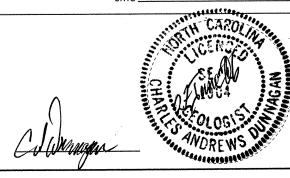
CAUTION NOTICE

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 LOCS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

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

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT, FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOLOMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT, THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR POINON 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 SATISTY HUMBLE AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PRODUCT, THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

PERSONNEL T B DANIEL



CONTENTS

DESCRIPTION

TITLE SHEET

LEGEND

SITE PLAN CROSS SECTION(S)

PROJECT REFERENCE NO. SHEET NO. 33600.I.I (B-4258) 2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

Fig. Fig.		SOIL AND ROCK	K LEGEND, TERMS	s, symbols,	AND ABBREVI	ATIONS	
Company Comp	SOIL DESCRIPTION						TERMS AND DEFINITIONS
State Column Co	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, ASSHTO CLASSIFICATION, AND OTHER PERTIMENT FACTORS SUCH	UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SI POORLY GRADED GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORI ANGULARITY OF GRAINS	AME SIZE. (ALSO E SIZES.	ROCK LINE INDICAT SPT REFUSAL IS PI IN NON-COASTAL PI OF WEATHERED ROC	ES THE LEVEL AT WHICH NON-(ENETRATION BY A SPLIT SPOON AIN MATERIAL, THE TRANSITI K.	COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. I SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. ON BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE	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.
Column C	VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDOED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6	SUBANGULAR, SUBROUNDED, OR ROUNDED.			NON-COASTAL P BLOWS PER FOO	PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 DT IF TESTED.	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL
A	GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USE		CRYSTALLINE ROCK (CR)	WOULD YIELD SI GNEISS, GABBRO,	PT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, ,SCHIST,ETC.	GROUND SURFACE.
March 1	GROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5		SS THAN 31		SEDIMENTARY RO	OCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE	
March Marc	SYMBOL 000000000000000000000000000000000000	MODERATELY COMPRESSIBLE LIQUID LIMIT EQ HIGHLY COMPRESSIBLE LIQUID LIMIT GR		SEDIMENTARY ROCK	SPT REFUSAL. R	ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED	LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
1	# 10 GRANULAR CLAY MUCK,	OPCONIC MATERIAL GRANULAR SILT - CLAY	THER MATERIAL		WE	ATHERING	
1	* 40 30 MX 50 MX 51 MN	TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE	1 - 10%	HAMMER	R IF CRYSTALLINE.		HORIZONTAL.
Company Comp	LASTIC INDEX 6 MX NP 10 MX 10 MX 11 MN 11 MN 10 MX 10 MX 11 MN 11 MN LITTLE OR HIGHLY	HIGHLY ORGANIC >10% >20% HIGHLY		(V SLI.) CRYSTA	LS ON A BROKEN SPECIMEN FA		THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
Common and Com	USUAL TYPES STONE FRAGS. FINE SILTY OR CLAYEY SILTY CLAYEY ORGANIC		LLING	(SLI.) 1 INCH.	OPEN JOINTS MAY CONTAIN CL	AY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR	SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
Column C	OF MAJOR DRAYEL, AND SAND GRAVEL AND SAND SOILS SOILS MATTER MATERIALS SAND GRAVEL AND SAND SOILS SOILS FOR TO	——————————————————————————————————————	STRATA	MODERATE SIGNIFI (MOD.) GRANIT	CANT PORTIONS OF ROCK SHOW DID ROCKS, MOST FELDSPARS AF	DISCOLORATION AND WEATHERING EFFECTS, IN RE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
Second Column Col	AS A EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE SUBGRADE		- Charles	DULL S WITH F	RESH ROCK.		FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY
## PRINGE OF THE CONVECTION OF SECURITY REPORTS AND ADDRESS OF THE SECOND OF THE PRINCE SECON	CONSISTENCY OR DENSENESS PANCE OF STANDARD RANGE OF LINCONFINED	MISCELLANEOUS SYMBOLS	OALS: 5	SEVERE AND DI (MOD. SEV.) AND CA	SCOLORED AND A MAJORITY SHO N BE EXCAVATED WITH A GEOL	OW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH OGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK.	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN
Second Part Control Part Part Control Part Part Control Part Part Control Part Part Part Control Part Part Control Part	PRIMARY SOIL TYPE COMPACTNESS OR PENETRATION RESISTENCE COMPRESSIVE STRENGTH		DESIGNATIONS				
## 1995 See	GENERALLY LOOSE 4 TO 10		SS - SPLIT SPOON	(SEV.) IN STR	. SOME FRAGMENTS OF STRONG	ROCK USUALLY REMAIN.	ITS LATERAL EXTENT.
Control Cont	MATERIAL DENSE 10 TO 50 VERY DENSE 30 TO 50 VERY DENSE 550	THAN ROADWAY EMBANKMENT - CORE BORING INFERRED SOIL BOUNDARY	ST - SHELBY TUBE SAMPLE	VERY SEVERE ALL RO	CK EXCEPT QUARTZ DISCOLORE	D OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK	MOTILED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
**************************************	GENERALLY SOFT 2 TO 4 0.25 TO 0.50 SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0	INFERRED ROCK LINE	RS - ROCK SAMPLE	VESTIG	ES OF THE ORIGINAL ROCK FAB	RIC REMAIN. IF TESTED, YIELDS SPT N VALUES < 100 BPF	
TEXTURE OR GRAIN SIZE	(COHESIVE) VERY STIFF 15 TO 30 2 TO 4	SLOPE INDICATOR			N EXAMPLE.		ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RU
\$ 5.00 LINES SET 4		ROCK STRUCTURES SPT N-VALUE	RATIO SAMPLE	VERY HARD CANNO			SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE
MODIFIED 100		(REP ST THE OSAL		HARD CAN E	E SCRATCHED BY KNIFE OR PIC		SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
PARTICIPY NOR POT 10 SOUD AT THE REPORT NOT THE POST NOR POST NOR POST NOR POS	BOULDER COBBLE GRAVEL SAND SAND SILI CLAY	AR - AUGER REFUSAL HI HIGHLY BT - BORING TERMINATED MED MEDIUM	V - VERY	MODERATELY CAN E	BE SCRATCHED BY KNIFE OR PI		SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR
SOL MOSTURE - CORRELATION OF TEMMS SOL ADDITION COLOR FEEL ON STUDY FEEL MOSTURE FEEL	5.1.1.1.1	CPT - CONE PENETRATION TEST MOD MODERATELY CSE COARSE NP - NON PLASTIC	WEA WEATHERED	BY MI MEDIUM CAN I	ODERATE BLOWS. BE GROOVED OR GOUGED 0.05 IN	NCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	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 I FOOT INTO SOIL
ACTIVE SECTION DESCRIPTION USUALLY LIQUID VETY WET, USUALLY SECRET SECTION SECTION OF A PICK POINT, SWALL THIN PICK CAR BE BROKED ON THE GROUND WATER TABLE PROSE. SPECIAL SECTION SEC	SOIL MOISTURE SCALE FIELD MOISTURE CHIDE FOR FIELD MOISTURE DESCRIPTION	DPT - DYNAMIC PENETRATION TEST PMT - PRESSUREMETER TEST	\ ^q - nki nvii meichi	POINT SOFT CAN	OF A GEOLOGIST'S PICK. BE GROVED OR GOUGED READILY	BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS	THAN 0.1 FOOT PER 60 BLOWS.
THAT HAVE TO BE SENSITION OF THAM MOISTURE THAT HAVE TO BE SENSITION OF THAM HAVE TO BE AND THAT HAVE TO BE AND THAT HAVE TO BE AND THAT HAVE TO BE SENSITION OF THAM HAVE TO BE SENSITION OF THAT HAVE TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE SENS TO BE	(ATTERBERG LIMITS) DESCRIPTION - SATURATED - USUALLY LIQUID; VERY WET, USUALLY	F - FINE SD SAND, SANDY FOSS FOSSILIFEROUS SL SILT, SILTY	•	PIECE	S CAN BE BROKEN BY FINGER	PRESSURE.	OF STRATUM AND EXPRESSED AS A PERCENTAGE.
SENSILIFY PLASTICITY PLASTIC	LL LIOUID LIMIT			SOFT OR MO	DRE IN THICKNESS CAN BE BRO		TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
ORILL UNITS: OR OPTIMUM MOISTURE ON OPTIMUM MO	RANGE - WET - (W) ATTAIN OPTIMUM MOISTURE	EQUIPMENT USED ON SUBJECT PR					
SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE ACTION POPULAM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY - (D) REQUIREM MOISTURE - DRY -	MOIST - (M) SOLID-AT OR NEAR OPTIMUM MOISTURE			VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED > 4 FEET THICKLY BEDDED 1.5 - 4 FEET	
PLASTICITY PLASTICITY INDEX (P)) DRY STRENGTH ON PLASTICITY 16-55 ON PLASTICITY 16-25 MEDIUM IDDIPLASTICITY 16-25 MEDIUM DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SICH AS LIGHT JARK STREAKED, FIG. APE JUST D. DESCRIPT APPEABANCE. SHOULD AUGERS WEN HOLLOW AUGERS HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C HARD FACED FINGER BITS CME-45C TINUGCARBIDE INSERTS TUNGCARBIDE INSERTS W CME-550 CME-45C TUNGCARBIDE INSERTS TUNGCARBIDE INSERTS W A AVANACER HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD DIFFICULT TO BREAK SAMPLE; MODERATELY INDURATED GRAINS ARE DIFFICULT TO BREAK SAMPLE; WERY CLUSE LESS THAN 0.15 FEET THINLY LAMINATED < 0.008 FEET THINLY LAMINATED CME-45C TUNGCARBIDE INSERTS TUNGCARBIDE INSERTS W A AVANACER HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD DIFFICULT TO BREAK WITH STEEL PROBE; DOMAIN ARE DIFFICULT TO BREAK SAMPLE; WANE SHEAR TEST EXTREMELY INDURATED SHAPP HAMMER BLOWS REQUIRED TO BREAK SAMPLE;	SL SHRINKAGE LIMIT	6° CONTINUOUS FLIGHT AUGER	CORE SIZE:	MODERATELY CLO CLOSE	SE 1 TO 3 FEET Ø.16 TO 1 FEET	VERY THINLY BEDDED 0.03 - 0.16 FEET	
PLASTICITY INDEX (PI) DRY STRENGTH ONPLASTIC 0-5 VERY LOW ONPLASTICITY 6-15 SLIGHT IED. PLASTICITY 16-25 MEDIUM PLASTICITY 16-25 MEDIUM PODIFIERS SUCH AS INDIRED TO DESCRIPE APPEARANCE. PLASTICITY INDEX (PI) DRY STRENGTH TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS TUNG,-CARBIDE INSERTS FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAWMER DISINTEGRATES SAMPLE. HAND TOOLS: HAND TOOLS: MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS CAN BE DIFFICULT TO SEPARATE WITH STEEL PROBE; BREAKS CAN BE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. WORDERED SOUNDING ROD DIFFICULT TO BREAK WITH HAMMER. WORDERED SOUNDING ROD DIFFICULT TO BREAK SAMPLE; WAND STREMED, TIC. ARE LIGHT, INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE;	- DRY - (D) ATTAIN OPTIMUM MOISTURE	- A O HOLLOW ACCENS		VERT CLUSE		THINLY LAMINATED < 0.008 FEET	
INDIPASTIC 0-5 VERY LOW LOND ASTIC 0-5 VERY LOW LOW LOW LOW LOW LOW LOW LOW LOW LOW		- Che-43c		FOR SEDIMENTARY RO			
HED. PASTICITY 16-25 MEDIUM 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 TRICONE TRICONE SOUNDING ROD INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAIN CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAIN CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. COLOR GRAIN CAN	NONPLASTIC 0-5 VERY LOW LOW PLASTICITY 6-15 SLIGHT			FRIABLE			
COLOR CORE BIT SOUNDING ROD INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. DIFFICULT TO BREAK WITH HAMMER. VANE SHEAR TEST VANE SHEAR TEST EXTREMELY INDURATED SOUNDING ROD SOUNDING ROD SOUNDING ROD DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. SOUNDING ROD SOUNDING ROD SOUNDING ROD DIFFICULT TO BREAK WITH HAMMER. SARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE;	MED. PLASTICITY 16-25 MEDIUM		POST HOLE DIGGER	MODERATE			
MODIFIES SUCH AS 1904. STREAKE, FIC. ARE USED TO DESCRIBE APPEARANCE.			SOUNDING ROD	INDURATED			
			VANE SHEAR TEST	EXTREMELY			

PROJECT REFERENCE NO. B-4258 INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION 10¢00 140 83 <u>-YI- POTSta. 10+00.00</u> WD BOAT POOL -L- POT /Sta. 24+45.00 END STATE: PROJECT B-4258 END CONSTRUCTION -YI- POT Sta.10+90.00 BEGIN CONSTRUCTION PROPANS TOWN OF LAKE LURE ISLOGD I SFBUS IS BLOCK ROCK OUTCRE PROPOSED RETAINING WALL PROPOSED RETAINING WALL ISFBUS 7, 60 Eb සුස -L- POC Sta/16+55.00 = -YI- POT Sta. 13+80.00 WD SIGN _ €3 NO. 7 CONC \mathfrak{P} \<u>-L- PTSta. 24+15.37</u> ISFD B B -L- PFCSta. 22+63.54 -L- 1 Sta. 20+90J8 5' RETAINING WALL PROPOSED RETAINING WALL WD DECK _L_ POT_Sta/20450.03 = _Y2_ POT_\$ta/10+00.00 ISFD -Y2- POC Sta./2+25.00 END CONST/RUCTION <u>-L- PCSta. 13+39.99</u> -L- PCSta. 18+31.95 <u>-L- PTSta. 16+94.63</u> -L- POT Sta.12+40.00 BEGIN STATE PROJECT B-4258 BEGIN CONSTRUCTION GENEVA C. CHAPMAN DB 264 PG 729 ANDREW HSUEH DB 613 PG 297 KERMIT LYNN SMITH -L- POTSta. 10+00,00

