STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33161.1.1(B-3608)	1	20

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *33161.1.1* F.A. PROJ. *BRZ-1131(6)*

COUNTY *Avery*

PROJECT DESCRIPTION *Bridge No. 44 on -L- (US 19E) over North Toe River*

ID: B-3608

PROJECT: 33161.1.1

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CAUTION NOTICE

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

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PERSONNEL

F&H:

J. Conci

F. Woodard

A. Bridges

INVESTIGATED BY *B.D. Worley*

CHECKED BY *K.B. Miller*

SUBMITTED BY *K.B. Miller*

DATE *June, 2009*

For Letting

DRAWN BY: *T.T. Walker and B.D. Worley*

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

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NORTH CAROLINA LICENSED 6-15-09 SEAL 1926 GEOLOGIST BRADLEY D. WORLEY

Signature

PROJECT REFERENCE NO.	SHEET NO.
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING • 10 • 40 • 200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/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 SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

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

- 45° — STRIKE AND DIP OF METAMORPHIC FOLIATION

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
FIAD - FILLED IN AFTER DRILLING
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
v - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

EQUIPMENT USED ON SUBJECT PROJECT

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

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 3 " TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N 02
- [ ] -H_____

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

ROCK DESCRIPTION

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

ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: BM #1
-BL- 10+28 135' RT
N 853684 E 1107926 ELEVATION: 2,935.97 FT.

NOTES:

REVISED 02/23/06

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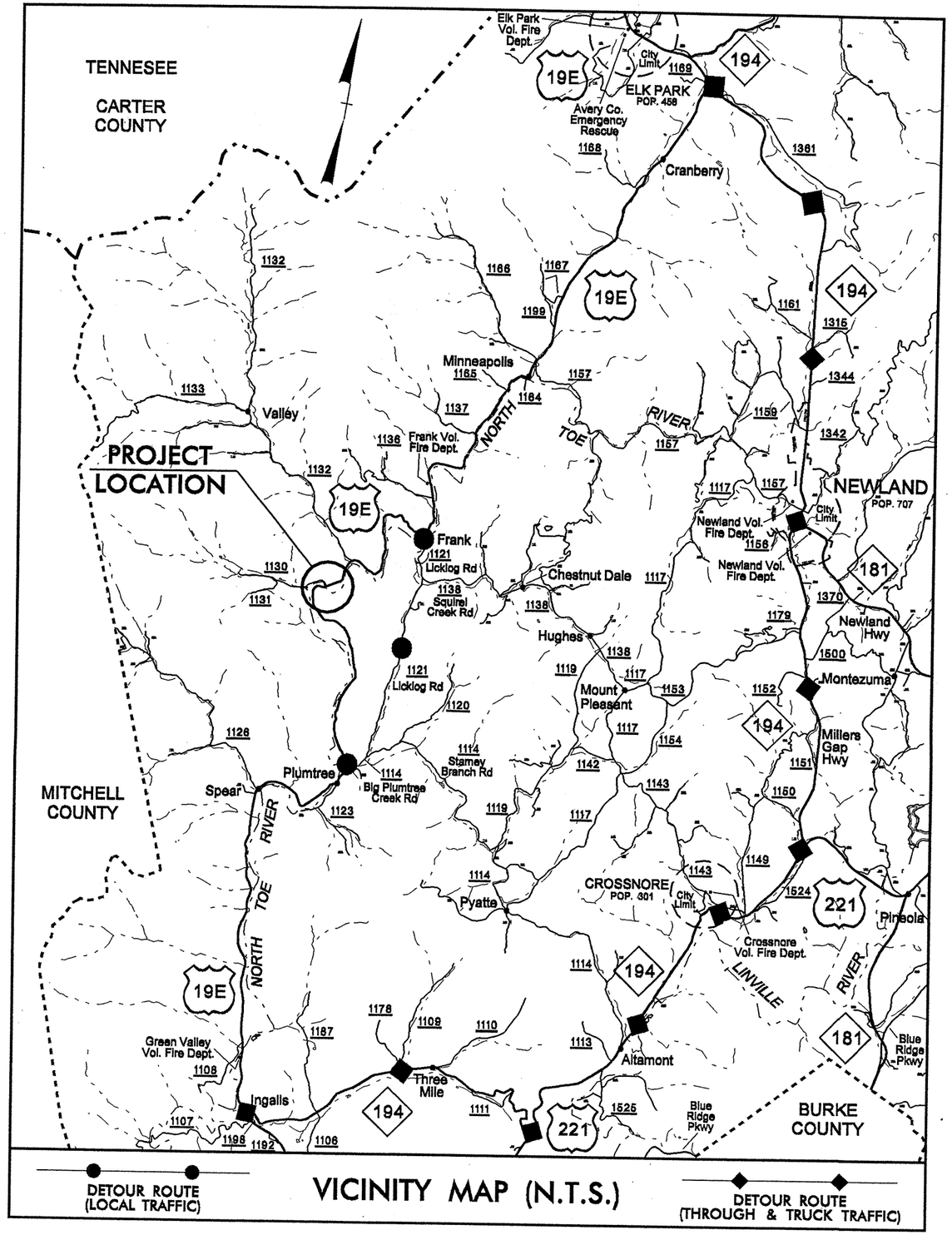
SITE VICINITY MAP

0 — 80
FEET



DETOUR ROUTE (LOCAL TRAFFIC)

VICINITY MAP (N.T.S.)

DETOUR ROUTE (THROUGH & TRUCK TRAFFIC)

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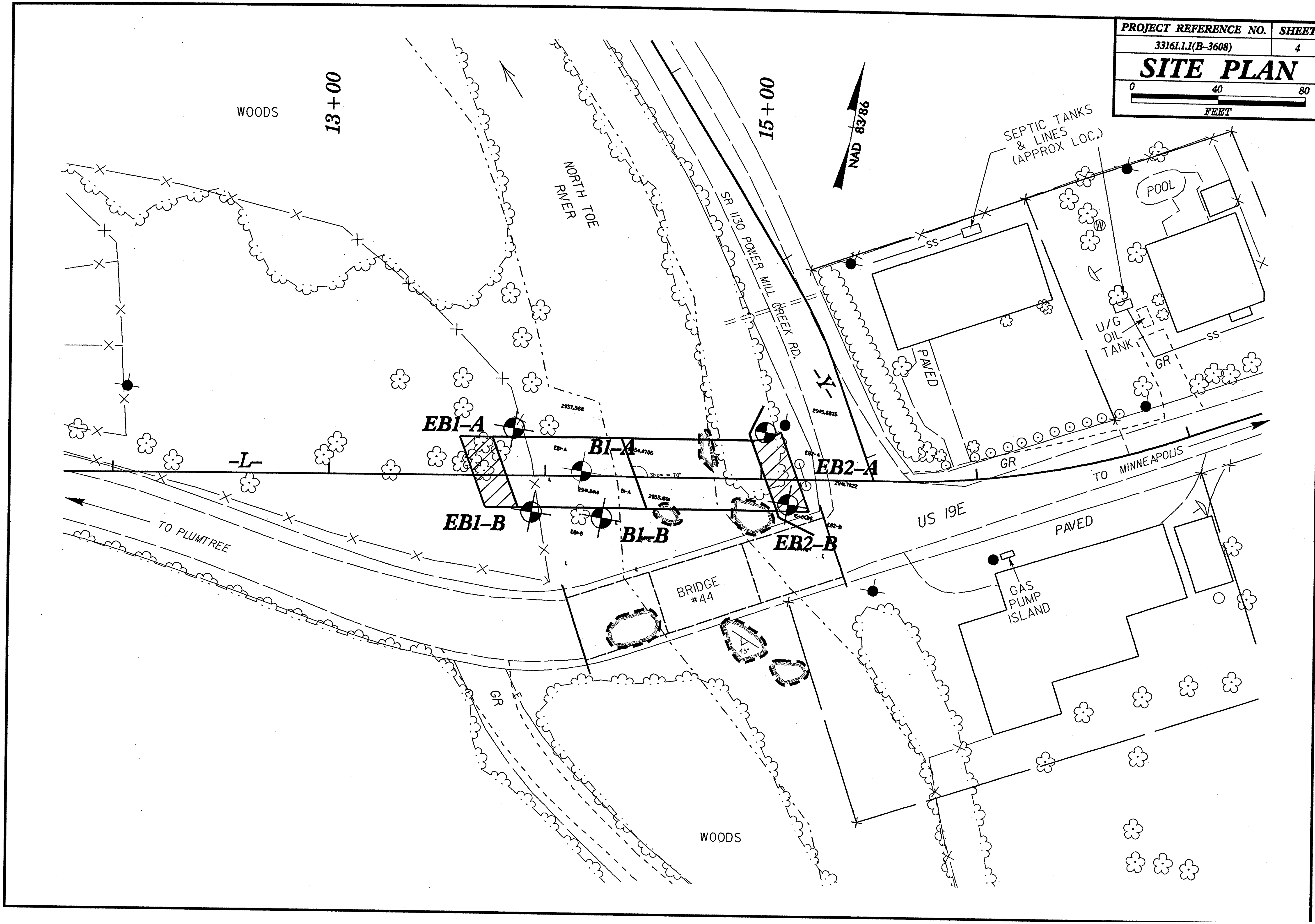
SITE PLAN



CROSS SECTION THROUGH END BENT 1

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

*NOTE: Ground lines surveyed along proposed bents during the field investigation.

EB1-A
13+85
22' LT

℄

EB1-B
13+94
17' RT

2950
2940
2930
2920
2910
2900

COLLUVIUM, Med. dense to dense, lt. brown to orange-red, coarse to fine, Silty Sand (A-2-4)

34

100/0.2

01/09

CRYSTALLINE ROCK (Gneiss)

REC 40%
RQD 0%

CRYSTALLINE ROCK (Gneiss)

WEATHERED ROCK (Gneiss)

REC 78%
RQD 18%

BT

COLLUVIUM, Med. stiff, lt. to dark brown, Sandy Clay (A-6)

6

100/0.0

01/09

CRYSTALLINE ROCK (Gneiss)

REC 100%
RQD 52%

23

9

RESIDUAL, Stiff to V. stiff, brown to orange-brown, Sandy Silt (A-4)

73

TCR

CRYSTALLINE ROCK (Gneiss)

*Note: Inferred lithologic boundaries are drawn through the borings with both projected onto the cross section.

CROSS SECTION THROUGH BENT 1

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

*NOTE: Ground lines surveyed along proposed bents during the field investigation.

℄

B1-A
14+17
2' LT

B1-B
14+26
20' RT

2930
2920
2910
2900
2890
2880

WATER SURFACE - 5/06

01/09

86

100/0.1

COLLUVIUM, Loose to v. dense, micaceous, Silty cse. Sand (A-2-4)

RESIDUAL, Dense, micaceous, Silty orange-brown Sand (A-2-4)

CRYSTALLINE ROCK (Gneiss)

REC 100%
RQD 70%

WEATHERED ROCK (Gneiss), RESIDUAL, loose to Silty cse. med. dense, Sand (A-2-4)

4

REC 100%
RQD 0%

100/0.1

CRYSTALLINE ROCK (GNEISS)

REC 100%
RQD 97%

BT

10

100/0.5

WEATHERED ROCK (Gneiss)

41

RESIDUAL, dense, black Med. dense to and white to orange-brown, Silty Sand (A-2-4)

47

REC 100%
RQD 100%

CRYSTALLINE ROCK (Gneiss)

BT

*Note: Inferred lithologic boundaries are drawn through the borings with both projected onto the cross section.

PROJECT REFERENCE NO.	SHEET
3316I.1.1(B-3608)	5

PROJECT REFERENCE NO.	SHEET
33161.1.1(B-3608)	6

*NOTE: Ground lines surveyed along proposed bents during the field investigation.

*Note: Inferred lithologic boundaries are drawn through the borings with both projected onto the cross section.

HORIZ. SCALE (FEET) 0 10 20 — VE = 1:1 — **CROSS SECTION THROUGH END BENT 2**

HORIZ. SCALE (FEET) 0 — VE = 1:1

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY		**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+85	**OFFSET** 22ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,937.0 ft	**TOTAL DEPTH** 20.9 ft	**NORTHING** 853,866	**EASTING** 1,107,774	**24 HR.** 8.0
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 01/10/09	**COMP. DATE** 01/10/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.8 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
2940										
2935										2,937.0 GROUND SURFACE 0.0 **COLLUVIUM** LIGHT BROWN TO ORANGE-RED, COARSE TO FINE, SILTY SAND
	2,932.4	4.6	9	14	20	34	SS-1	M		
2930										
	2,927.4	9.6	100/0.2			100/0.2		M		2,927.4 9.6 2,927.2 9.8 **WEATHERED ROCK** (GNEISS) 2,925.2 11.8 **CRYSTALLINE ROCK** (GNEISS)
2925										
2920										2,922.1 14.9 **WEATHERED ROCK** (GNEISS) **CRYSTALLINE ROCK** (GNEISS)
2915										2,916.1 20.9 Boring Terminated at Elevation 2,916.1 ft in CRYSTALLINE ROCK (GNEISS)
2910										
2905										
2900										
2895										
2890										
2885										
2880										
2875										
2870										
2865										
2860										

NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY		**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+85	**OFFSET** 22ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,937.0 ft	**TOTAL DEPTH** 20.9 ft	**NORTHING** 853,866	**EASTING** 1,107,774	**24 HR.** 8.0
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 01/10/09	**COMP. DATE** 01/10/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 9.8 ft	
CORE SIZE NQ2-WL	**TOTAL RUN** 11.1 ft	**DRILLER** Woodard, F.		

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
2927.2											ELEV. (ft) DEPTH (ft)
	2927.2	9.8	1.1	0:49/1.1	(0.8)	(0.0)		(0.8)	(0.0)		Begin Coring @ 9.8 ft
2925	2926.1	10.9	5.0	0:26/1.0	73%	0%		40%	0%		2,927.2 **CRYSTALLINE ROCK**
				0:08/1.0	(1.6)	(0.0)		(0.0)	N/A		2,925.2 BLACK AND WHITE, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED GNEISS 9.8 11.8
				0:06/1.0	32%	0%		0%			2,922.1 **WEATHERED ROCK** 14.9
2920	2,921.1	15.9		0:07/1.0							**CRYSTALLINE ROCK**
			5.0	0:23/1.0				(4.7)	(1.1)		BLACK AND WHITE, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED GNEISS
				1:05/1.0	(3.1)	(1.1)		78%	18%		
2915				1:00/1.0	62%	22%					
	2,916.1	20.9		0:42/1.0							2,916.1 20.9
				0:34/1.0							Boring Terminated at Elevation 2,916.1 ft in CRYSTALLINE ROCK (GNEISS)
				0:29/1.0							
2910											
2905											
2900											
2895											
2890											
2885											
2880											
2875											
2870											
2865											
2860											
2855											
2850											

NCDOT CORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

CORE PHOTOGRAPHS

EB1-A

BOX 1: 9.8 - 20.9 FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+94	**OFFSET** 17ft RT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 2,941.7 ft	**TOTAL DEPTH** 35.6 ft	**NORTHING** 853,828	**EASTING** 1,107,788 — **24 HR.** 10.5
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic
START DATE 01/09/09	**COMP. DATE** 01/10/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 35.6 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) — DEPTH (ft)
2945										2,941.7 — GROUND SURFACE — 0.0
2940										**COLLUVIUM** LIGHT TO DARK BROWN, SANDY CLAY
	2,936.9	4.8	2	2	4	6	SS-2	M		
2935										
	2,931.9	9.8	100/0.0			100/0.0	RS-1			2,931.9 — 9.8
2930										**CRYSTALLINE ROCK** (GNEISS)
2925										2,926.3 — 15.4
	2,920.5	21.2	15	13	10	23		M		**RESIDUAL** BROWN TO ORANGE-BROWN, SANDY SILT
2920										
	2,915.5	26.2	6	4	5	9	SS-3	M		
2915										2,911.7 — 30.0
	2,910.5	31.2	16	35	38	73		D		BLACK AND WHITE, SANDY SILT
2910										2,906.1 — 35.6
2905										Boring Terminated by TRI-CONE refusal at Elevation 2,906.1 ft on CRYSTALLINE ROCK (GNEISS)
2900										
2895										
2890										
2885										
2880										
2875										
2870										
2865										

NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY		**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+94	**OFFSET** 17ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,941.7 ft	**TOTAL DEPTH** 35.6 ft	**NORTHING** 853,828	**EASTING** 1,107,788	**24 HR.** 10.5
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core			**HAMMER TYPE** Automatic
START DATE 01/09/09	**COMP. DATE** 01/10/09	**SURFACE WATER DEPTH** N/A		**DEPTH TO ROCK** 35.6 ft
CORE SIZE NQ2-WL	**TOTAL RUN** 11.4 ft	**DRILLER** Woodard, F.		

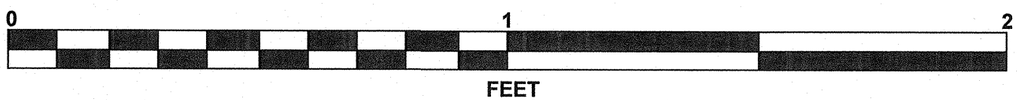
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
2931.9											ELEV. (ft) — DEPTH (ft)
	2,931.9	9.8	1.4	1:18/1.0	(1.4)	(1.2)	RS-1	(5.6)	(2.9)		Begin Coring @ 9.8 ft
2930	2,930.5	11.2	5.0	N=100/0.0 0:26/0.4	100%	86%		100%	52%		2,931.9 — **CRYSTALLINE ROCK** — 9.8
				0:49/1.0	(4.2)	(1.9)					MODERATELY TO SLIGHTLY WEATHERED, MEDIUM HARD TO HARD, CLOSELY FRACTURED, GNEISS
				1:02/1.0	84%	38%					
2925	2,925.5	16.2		1:10/1.0							2,926.3 — 15.4
				1:08/1.0							**RESIDUAL**
			5.0	0:34/1.0	(0.0)	N/A					
				0:14/1.0	0%						
2920	2,920.5	21.2		0:17/1.0							
				0:30/1.0							
				0:27/1.0							
				0:38/1.0							
2915				N=23							
							SS-3				
				N=9							
2910											2,911.7 — 30.0
				N=73							
2905											2,906.1 — 35.6
											Boring Terminated by TRI-CONE refusal at Elevation 2,906.1 ft on CRYSTALLINE ROCK (GNEISS)
2900											
2895											
2890											
2885											
2880											
2875											
2870											
2865											
2860											
2855											

NCDOT CORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/12/09

CORE PHOTOGRAPHS

EB1-B

BOX 1: 9.8 - 15.4 FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY		**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 14+17	**OFFSET** 2ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,930.9 ft	**TOTAL DEPTH** 55.1 ft	**NORTHING** 853,851	**EASTING** 1,107,808	**24 HR.** 0.5
DRILL MACHINE CME-45C-TRACK	**DRILL METHOD** NW Casing W/SPT & Core			**HAMMER TYPE** Automatic
START DATE 01/10/09	**COMP. DATE** 01/11/09	**SURFACE WATER DEPTH** N/A		**DEPTH TO ROCK** 8.7 ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
										GROUND SURFACE	2,930.9	0.0
										COLLUVIUM BLACK TO GRAY AND WHITE, SILTY COARSE SAND		
	2,925.8	5.1	30	42	44	86	SS-4	M				
	2,922.3	8.6	100/0.1			100/0.1	RS-2				2,922.2	8.7
										CRYSTALLINE ROCK (GNEISS)		
											2,917.8	13.1
										RESIDUAL ORANGE-BROWN, MICACEOUS, SILTY SAND		
											2,907.1	23.8
										WEATHERED ROCK (GNEISS)		
											2,904.4	26.5
										RESIDUAL BLACK AND WHITE, SILTY COARSE SAND		
	2,900.9	30.0	1	2	2	4	SS-5					
	2,895.9	35.0	100/0.1			100/0.1	RS-3				2,895.8	35.1
										CRYSTALLINE ROCK (GNEISS)		
											2,875.8	55.1
										Boring Terminated at Elevation 2,875.8 ft in CRYSTALLINE ROCK (GNEISS)		

NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET

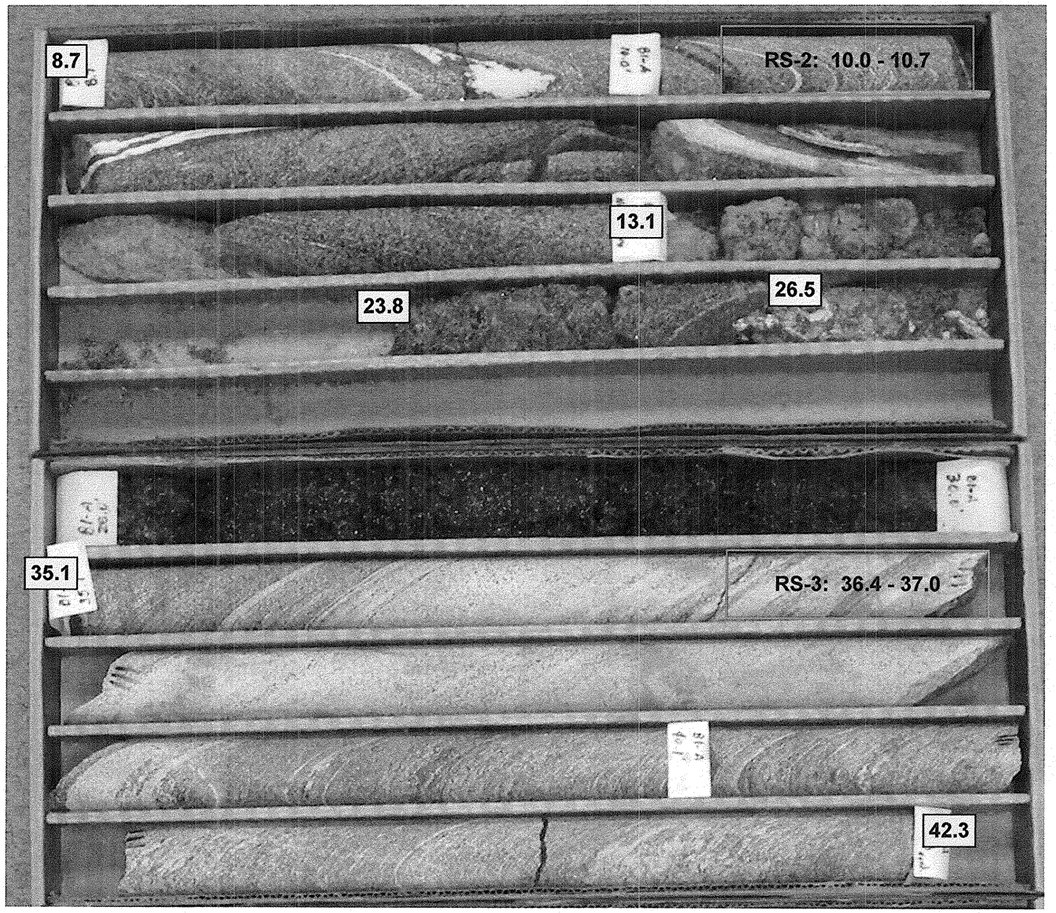
PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY		**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 14+17	**OFFSET** 2ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,930.9 ft	**TOTAL DEPTH** 55.1 ft	**NORTHING** 853,851	**EASTING** 1,107,808	**24 HR.** 0.5
DRILL MACHINE CME-45C-TRACK	**DRILL METHOD** NW Casing W/SPT & Core			**HAMMER TYPE** Automatic
START DATE 01/10/09	**COMP. DATE** 01/11/09	**SURFACE WATER DEPTH** N/A		**DEPTH TO ROCK** 8.7 ft
CORE SIZE NQ2-WL	**TOTAL RUN** 41.3 ft			**DRILLER** Woodard, F.

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS	ELEV. (ft)	DEPTH (ft)
2922.2											Begin Coring @ 8.7 ft		
2920	2,922.2 2,920.5	8.7 10.0	1.3	0:21/0.3 2:00/1.0	(1.2) 92%	(1.2) 92%		(4.4) 100%	(3.1) 70%		**CRYSTALLINE ROCK** BLACK AND WHITE, SLIGHTLY WEATHERED, MODERATELY HARD, VERY CLOSE FRACTURED, GNEISS	2,922.2	8.7
			5.0	1:26/1.0 0:46/1.0 0:29/1.0 0:16/1.0 0:14/1.0	(3.2) 64%	(1.9) 38%	RS-2					2,917.8	13.1
2915	2,915.9	15.0	5.0	0:11/1.0 0:30/1.0 0:21/1.0 0:22/1.0 0:17/1.0	(0.0) 0%	(0.0) 0% N/A					**RESIDUAL** ORANGE-BROWN, DENSE, SILTY SAND		
2910	2,910.9	20.0	5.0	0:21/1.0 0:14/1.0 0:16/1.0 0:24/1.0 0:21/1.0	(1.2) 24%	(0.0) 0%		(2.7) 100%	(0.0) 0%			2,907.1	23.8
2905	2,905.9	25.0	5.0	0:31/1.0 0:10/1.0 0:30/1.0 0:13/1.0 0:12/1.0	(1.5) 30%	(0.0) 0%					**WEATHERED ROCK** BLACK AND WHITE, SEVERELY WEATHERED, SOFT TO MODERATELY HARD, VERY CLOSELY FRACTURED, GNEISS	2,904.4	26.5
2900	2,900.9	30.0		*N=4*			SS-5				**RESIDUAL** BLACK AND WHITE, LOOSE TO MEDIUM DENSE, SLIGHTLY COARSE SAND		
2895	2,895.8	35.1	5.0	*N=100/0.1* 3:50/1.0 2:24/1.0 2:18/1.0 2:17/1.0 2:04/1.0	(5.0) 100%	(5.0) 100%	RS-3	(20.0) 100%	(19.4) 97%			2,895.8	35.1
2890	2,890.8	40.1	5.0	2:52/1.0 2:35/1.0 2:23/1.0 1:53/1.0 1:50/1.0	(5.0) 100%	(4.4) 88%					**CRYSTALLINE ROCK** BLACK AND WHITE, VERY SLIGHTLY WEATHERED TO FRESH, HARD, CLOSELY FRACTURED, GNEISS		
2885	2,885.8	45.1	5.0	2:48/1.0 2:25/1.0 3:15/1.0 2:42/1.0 2:35/1.0	(5.0) 100%	(5.0) 100%							
2880	2,880.8	50.1	5.0	3:12/1.0 3:10/1.0 3:34/1.0 3:35/1.0 3:51/1.0	(5.0) 100%	(5.0) 100%							
2875	2,875.8	55.1										2,875.8	55.1
											Boring Terminated at Elevation 2,875.8 ft in CRYSTALLINE ROCK (GNEISS)		

NCDOT CORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

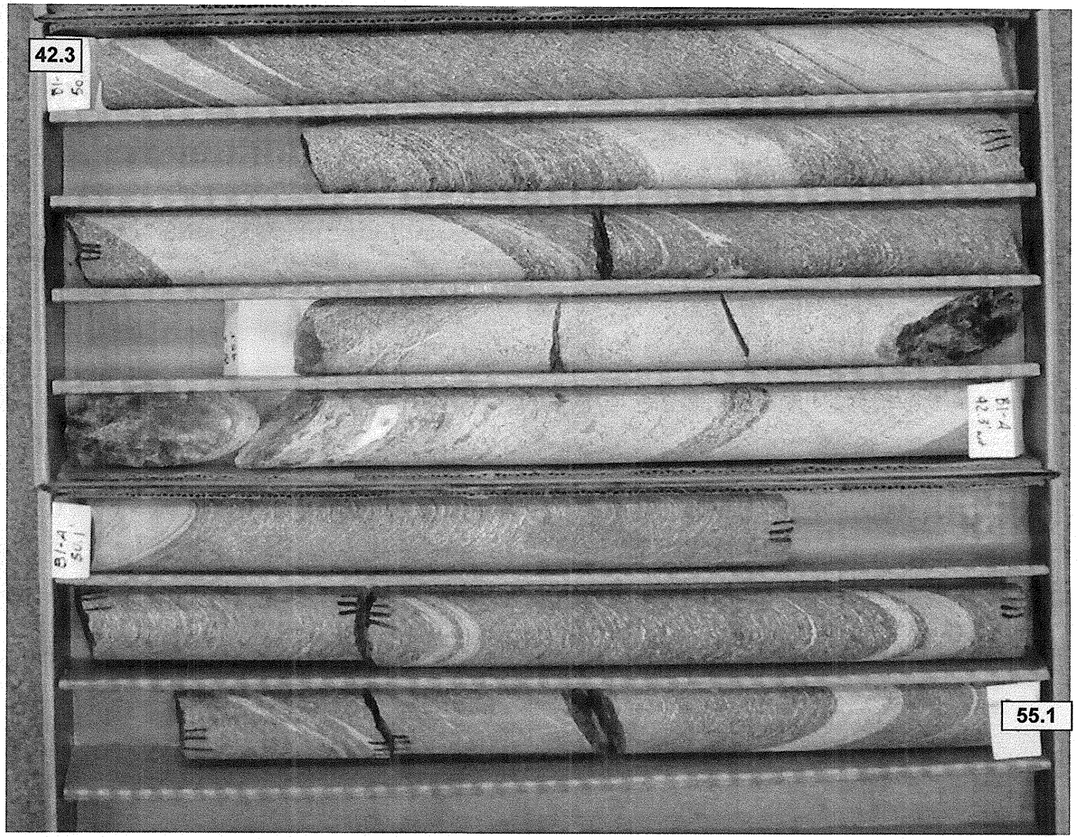
CORE PHOTOGRAPHS

B1-A
BOXES 1 & 2: 8.7 - 42.3 FEET



0 1 2
FEET

B1-A
BOXES 3 & 4: 42.3 - 55.1 FEET



0 1 2
FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 14+27	**OFFSET** 20ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,930.7 ft	**TOTAL DEPTH** 28.4 ft	**NORTHING** 853,831	**EASTING** 1,107,821	**24 HR.** N/A
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 01/12/09	**COMP. DATE** 01/12/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 23.4 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
2935											
2930										2,930.7 GROUND SURFACE	0.0
										COLLUVIUM BROWN, MICACEOUS, SILTY SAND	
	2,926.3	4.4									
2925			7	6	4	10		M			
	2,921.3	9.4								2,921.3	9.4
2920			100/0.5			100/0.5		D		**WEATHERED ROCK** (GNEISS)	
										2,918.7	12.0
	2,916.3	14.4								**RESIDUAL** BLACK AND WHITE TO RED-ORANGE, SILTY COARSE SAND	
2915			11	19	22	41	SS-6				
	2,911.3	19.4									
2910			8	16	31	47		D			
2905										2,907.3	23.4
										CRYSTALLINE ROCK (GNEISS)	
2900										2,902.3	28.4
2895										Boring Terminated at Elevation 2,902.3 ft in CRYSTALLINE ROCK (GNEISS)	
2890											
2885											
2880											
2875											
2870											
2865											
2860											
2855											

NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 13

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 14+27	**OFFSET** 20ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,930.7 ft	**TOTAL DEPTH** 28.4 ft	**NORTHING** 853,831	**EASTING** 1,107,821	**24 HR.** N/A
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 01/12/09	**COMP. DATE** 01/12/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 23.4 ft	
CORE SIZE NQ2-WL	**TOTAL RUN** 5.0 ft		**DRILLER** Woodard, F.	

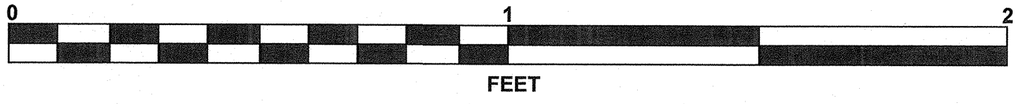
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
2907.3												
	2,907.3	23.4	5.0	3:03/1.0 2:57/1.0 2:51/1.0 2:47/1.0 3:10/1.0	(5.0) 100%	(5.0) 100%		(5.0) 100%	(5.0) 100%		Begin Coring @ 23.4 ft	
2905											2,907.3 **CRYSTALLINE ROCK** BLACK AND WHITE, FRESH, CLOSE FRACTURED, MODERATELY HARD TO HARD, GNEISS	23.4
	2,902.3	28.4									2,902.3	28.4
2900											Boring Terminated at Elevation 2,902.3 ft in CRYSTALLINE ROCK (GNEISS)	
2895												
2890												
2885												
2880												
2875												
2870												
2865												
2860												
2855												
2850												
2845												
2840												
2835												
2830												

NCDOT CORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

CORE PHOTOGRAPHS

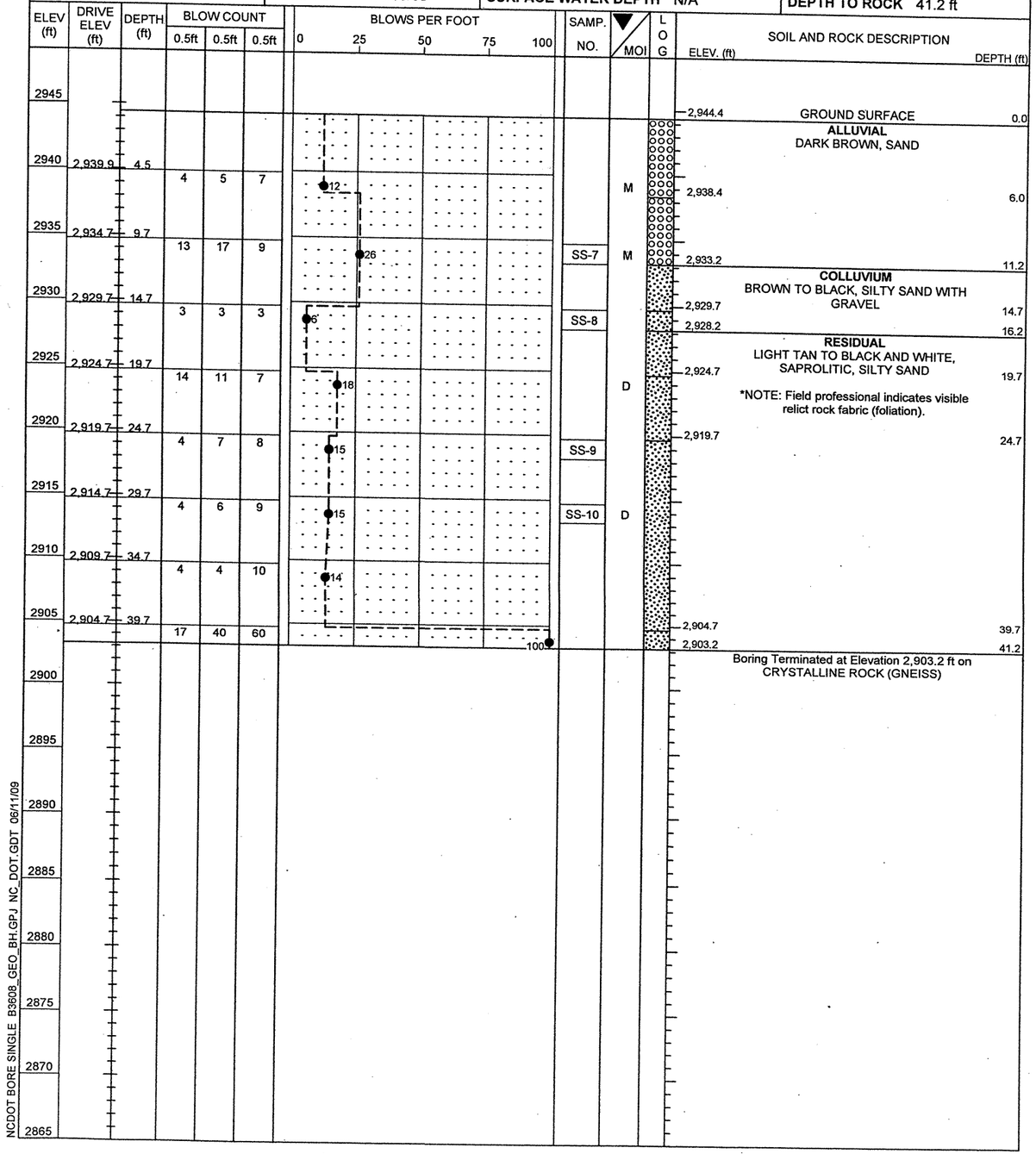
B1-B

BOX 1: 23.4 - 28.4 FEET



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 15+02	**OFFSET** 22ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 2,944.4 ft	**TOTAL DEPTH** 41.2 ft	**NORTHING** 853,884	**EASTING** 1,107,889 — **24 HR.** CAVED 8'
DRILL MACHINE CME-45C-TRAC	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Automatic
START DATE 01/08/09	**COMP. DATE** 01/08/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 41.2 ft



NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.	
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 15+13	**OFFSET** 12ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,943.1 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 853,853	**EASTING** 1,107,905	**24 HR.** N/A
DRILL MACHINE CME-45C-TRACK	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 02/04/09	**COMP. DATE** 02/04/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 33.0 ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
2945										2,943.1 GROUND SURFACE	0.0
2940										**ROADWAY EMBANKMENT** BROWN, COARSE SAND WITH GRAVEL	
	2,939.0	4.1	7	12	14	26		D		2,937.5	5.6
2935	2,934.0	9.1	2	3	4	7				**COLLUVIUM** LIGHT BROWN AND RED, SILTY SAND, WITH MICA	
2930	2,929.0	14.1	6	7	21	28	SS-11			2,929.0	14.1
2925	2,924.0	19.1	10	12	9	21		M		**RESIDUAL** BROW TO BLACK AND WHITE, COARSE GRAINED, MICACEOUS, SILTY SAND	
2920	2,919.0	24.1	6	6	9	15	SS-12			2,923.1	20.0
2915	2,914.0	29.1	6	6	9	15		M			
2910	2,910.1	33.0	50/0.05			50/0.05				2,910.1	33.0
2905							RS-4			2,909.1 **CRYSTALLINE ROCK** (GNEISS)	34.0
2900										**RESIDUAL** 2,905.5 TAN-BROWN, MICACEOUS, SILTY SAND	37.6
2895										**CRYSTALLINE ROCK** (GNEISS)	
2890										2,898.1	45.0
2885										Boring Terminated at Elevation 2,898.1 ft in CRYSTALLINE ROCK (GNEISS)	
2880											
2875											
2870											
2865											

NCDOT BORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

SHEET 16

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 33161.1.1	**ID.** B-3608	**COUNTY** AVERY	**GEOLOGIST** Conci, J.	
SITE DESCRIPTION BRIDGE NO. 44 ON -L- (US 19E) OVER NORTH TOE RIVER				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 15+13	**OFFSET** 12ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,943.1 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 853,853	**EASTING** 1,107,905	**24 HR.** N/A
DRILL MACHINE CME-45C-TRACK	**DRILL METHOD** NW Casing W/SPT & Core		**HAMMER TYPE** Automatic	
START DATE 02/04/09	**COMP. DATE** 02/04/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 33.0 ft	
CORE SIZE NQ2-WL	**TOTAL RUN** 12.0 ft		**DRILLER** Woodard, F.	

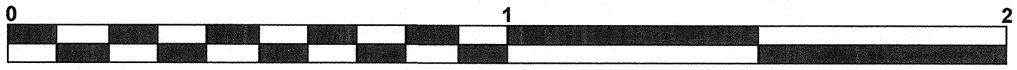
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
2910.1											Begin Coring @ 33.0 ft	
	2,910.1	33.0	2.0	1:06/1.0	(1.0)	(0.3)		(1.0)	(0.3)		2,910.1 **CRYSTALLINE ROCK**	
	2,908.1	35.0		W=50/0.05	50%	15%		100%	30%		2,909.1 BLACK AND WHITE, SLIGHTLY WEATHERED TO FRESH, MODERATELY HARD, CLOSE FRACTURED, GNEISS	33.0 34.0
2905			5.0	0:08/1.0 0:25/1.0 0:58/1.0 1:12/1.0 1:12/1.0 2:11/1.0	(4.0) 80%	(1.8) 36%					2,905.5 **RESIDUAL** TAN-BROWN, MICACEOUS, SILTY SAND	37.6
	2,903.1	40.0					RS-4	(5.6) 76%	(3.4) 46%		**CRYSTALLINE ROCK** BLACK AND WHITE, SLIGHTLY WEATHERED TO FRESH, MODERATELY TO HARD, CLOSE FRACTURED, GNEISS	
2900			5.0	0:58/1.0 0:35/1.0 0:29/1.0 1:04/1.0 0:35/1.0	(2.8) 56%	(0.6) 12%						
	2,898.1	45.0									2,898.1	45.0
2895											Boring Terminated at Elevation 2,898.1 ft in CRYSTALLINE ROCK (GNEISS)	
2890												
2885												
2880												
2875												
2870												
2865												
2860												
2855												
2850												
2845												
2840												
2835												

NCDOT CORE SINGLE B3608_GEO_BH.GPJ NC_DOT.GDT 06/11/09

CORE PHOTOGRAPHS

EB2-B

BOXES 1 & 2: 33.0 - 45.0 FEET



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33161.1.1 TIP: B-3608 COUNTY: Avery

DESCRIPTION(1): Bridge No. 44 over North Toe River on US 19E

EXISTING BRIDGE

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

Bridge No.: 44 Length: 125.5' Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2
Foundation Type: Concrete caps with H-piles

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: Moderate scour evident under existing end bent 2 on the south side of the bent. Scour under existing end bent 1 is moderately severe due to curve in river (cut bank).

Interior Bents: Bottom of all concrete piers scoured on upstream side.

Channel Bed: There is one predominant channel (on the west side) that is deeper than the rest of the river bottom.

Channel Bank: Some scour evident but channel banks are protected in places by insitu rock outcrop.

EXISTING SCOUR PROTECTION

Type(3): Slabs of old concrete, boulders

Extent(4): Placed in front of existing end bents under the bridge.

Effectiveness(5): Existing end bent 2 side is okay, existing end bent 1 needs improvement.

Obstructions(6): None visible.

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): Some old concrete slabs, some colluvial boulders, insitu bedrock.

Channel Bank Material(8): Colluvial and alluvial sand, gravel and cobbles. Insitu bedrock.

Channel Bank Cover(9): Rock, grass, weeds, brush.

Floodplain Width(10): 200' to 600'

Floodplain Cover(11): Grass, brush, weeds, trees, and rock

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

Channel Migration Tendency(13): To the west

Observations and Other Comments: ____

DESIGN SCOUR ELEVATIONS(14) Feet x Meters ____

	BENTS B1
B1-A	2921.3
B1-B	2918.9

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the Hydraulic Unit's theoretical scour elevations.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

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

See Sheet 19 "Lab Results" for samples:
S-13
S-14

Template Revised 02/07/06

Reported by: Bradley D. Woody Date: 6-12-09

EB1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	22' LT	13+85	4.6-6.1	A-2-4(0)	23	NP	36.5	43.5	15.9	4.1	100	86	26	-	-

EB1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-2	17' RT	13+94	4.8-6.3	A-6(3)	35	11	18.2	32.2	21.0	28.6	93	85	51	-	-
SS-3	17' RT	13+94	26.2-27.7	A-4(0)	34	3	28.0	43.1	22.9	6.1	100	88	38	-	-

B1-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-4	2' LT	14+17	3.6-5.1	A-2-4(0)	22	NP	36.4	40.1	17.3	6.1	100	82	31	-	-
SS-5	2' LT	14+17	30.0-31.5	A-2-4(0)	31	NP	43.9	35.3	16.7	4.1	93	68	26	-	-

B1-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6	20' RT	14+27	14.4-15.9	A-2-4(0)	21	NP	36.3	42.2	16.3	5.1	100	83	28	-	-

EB2-A

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-7	19' LT	15+18	9.7-11.2	A-1-b(0)	33	NP	30.8	40.8	24.3	4.1	56	47	20	-	-
SS-8	19' LT	15+18	14.7-16.2	A-2-4(0)	39	NP	37.6	40.6	17.8	4.1	100	82	29	-	-
SS-9	19' LT	15+18	24.7-26.2	A-2-4(0)	25	NP	45.5	36.9	13.5	4.1	100	77	24	-	-
SS-10	19' LT	15+18	29.7-31.2	A-2-4(0)	38	3	29.0	48.4	20.6	2.0	100	86	30	-	-

EB2-B

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-11	12' RT	15+13	14.1-15.6	A-2-4(0)	23	NP	51.8	33.1	11.0	4.1	100	69	20	-	-
SS-12	12' RT	15+13	24.1-25.6	A-2-5(0)	45	3	29.6	49.6	18.8	2.0	100	91	28	-	-

River Bank

SOIL TEST RESULTS

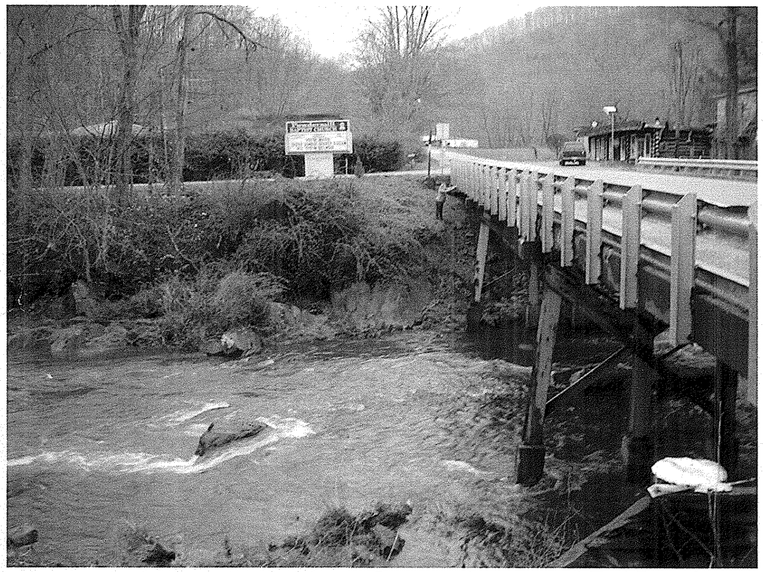
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
S-13	N/A	N/A	0.0-0.0	A-7-6(5)	41	12	20.6	20.4	24.3	34.7	90	80	56	-	-
S-14	N/A	N/A	0.0-0.0	A-1-a(0)	24	NP	78.0	17.1	2.9	2.0	27	12	2	-	-

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	BORING NO.	DEPTH INTERVAL	UNIT WT. (lbf/ft3)	UNCONFINED COMPRESSIVE STRENGTH KSI
RS-1	17' RT	13+93	EB1-B	10.1-11.0	179.6	3.81
RS-2	2' LT	14+17	B1-A	10.0-10.7	184.3	10.93
RS-3	2' LT	14+17	B1-A	36.4-37.0	176.3	9.87
RS-4	12' RT	15-13	EB2-B	37.9-38.5	174.5	7.17

SITE PHOTOS

View looking down station along –L- towards proposed End Bent 1



View looking up station along –L- towards proposed End Bent 2

View looking N-NW (upstream) from existing bridge deck. CL of the proposed –L- runs left to right through the center of the photo.