STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	32998.1.2 (B-3335)	1	22

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *32998.1.2 (B-3335)* F.A. PROJ. *BRZ-1134(1)*

COUNTY *GRAHAM*

PROJECT DESCRIPTION *BRIDGE NO. 70 ON SR-1147 OVER CHEOAH RIVER*

SITE DESCRIPTION

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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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For Letting

PERSONNEL

D C ELLIOT

C J COFFEY

L E RIDDLE

R D CHILDERS

D O CHEEK

G K ROSE

INVESTIGATED BY *C A DUNNAGAN*

CHECKED BY *W D FRYE, Jr*

SUBMITTED BY *W D FRYE, Jr*

DATE *JUNE 2009*

NORTH CAROLINA LICENSED GEOLOGIST SEAL 2 CHARLES ANDREWS DUNNAGAN

C A Dunnagan

DRAWN BY: *C A DUNNAGAN*

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NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PROJECT: 32998.1.2

ID: B-3335

PROJECT REFERENCE NO.	SHEET NO.
32998.1.2 (B-3335)	2/22

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

SAMPLE DESIGNATIONS

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

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B-__
- [X] -N XWL
- [ ] -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 (ROD) - 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 (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

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

BENCH MARK: BM#2-CHISELED SQUARE IN WINGWALL 35.5 FEET LEFT OF -BL- STATION 15+86.66

ELEVATION: 1733.88 FT.

NOTES:

REVISED 02/23/06

BRIDGE NO. 70 ON SR-1134 OVER CHEOAH RIVER

0	50	100
FEET		
SKEW = 120°		

PROJECT REFERENCE NO.	SHEET
32998.1.2 (B-3335)	3/22

PLAN VIEW

WOODS

BM #2
-BL- STA 15+86.66
35.48 LEFT
ELEV. 1733.88'

CHEOAH RIVER

CONC. WW

CONC. COLUMN

MTL

WOODS

ROCK HW

18" CMP

ROCK HW

-N-

-L- PC Sta. 10+00.00

EB1-A
13+35,
12.0' LT

B1-A
14+05,
11.0' LT

B2-A
14+73,
12.0' LT

EB2-A
15+45,
14.0' LT

GR

WOODS

18" CMP

SR 1134
JOYCE KILMER RD.

EB1-B
13+21,
14.0' RT

B1-B
13+91,
15.0' RT

-L-

B2-B
14+61,
16.0' RT

EB2-B
15+31,
16.0' RT

18" CMP

ROCK HW

-L- POT Sta. 15+98.88
-Y- POT Sta. 17+20.00

24"± CREEK

24"± CREEK

18"± CREEK

SR 1141 SANTEE LAH RD.

CHEOAH RIVER

7' GR

18" CMP

RESERVOIR

S

SPRING

ROCK HW

18" CMP

10"± CREEK
(DISAPPEARING)

CONC.
SPRING BOX

ROCK HW

18"± CREEK

15+00

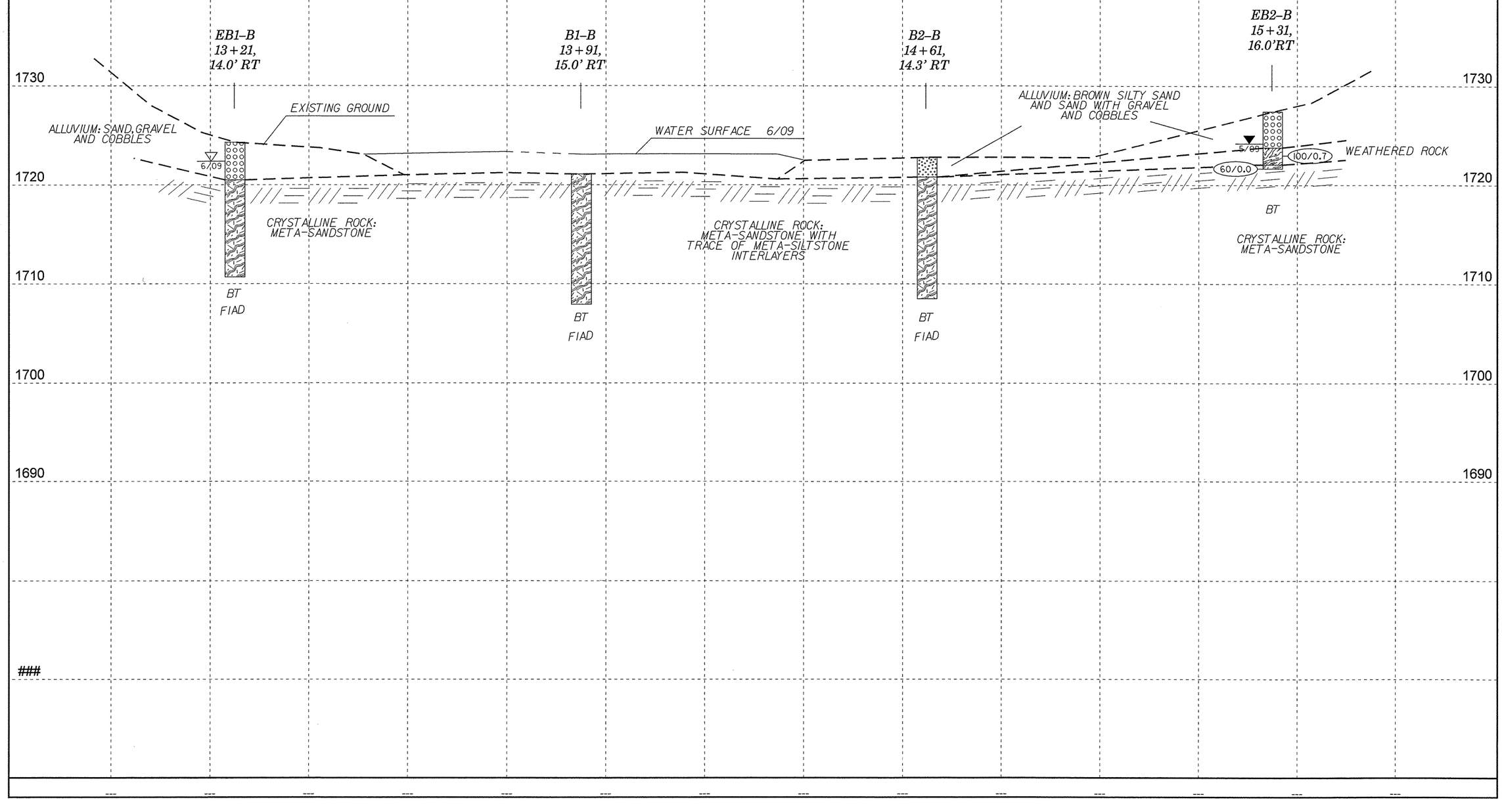
WOODS

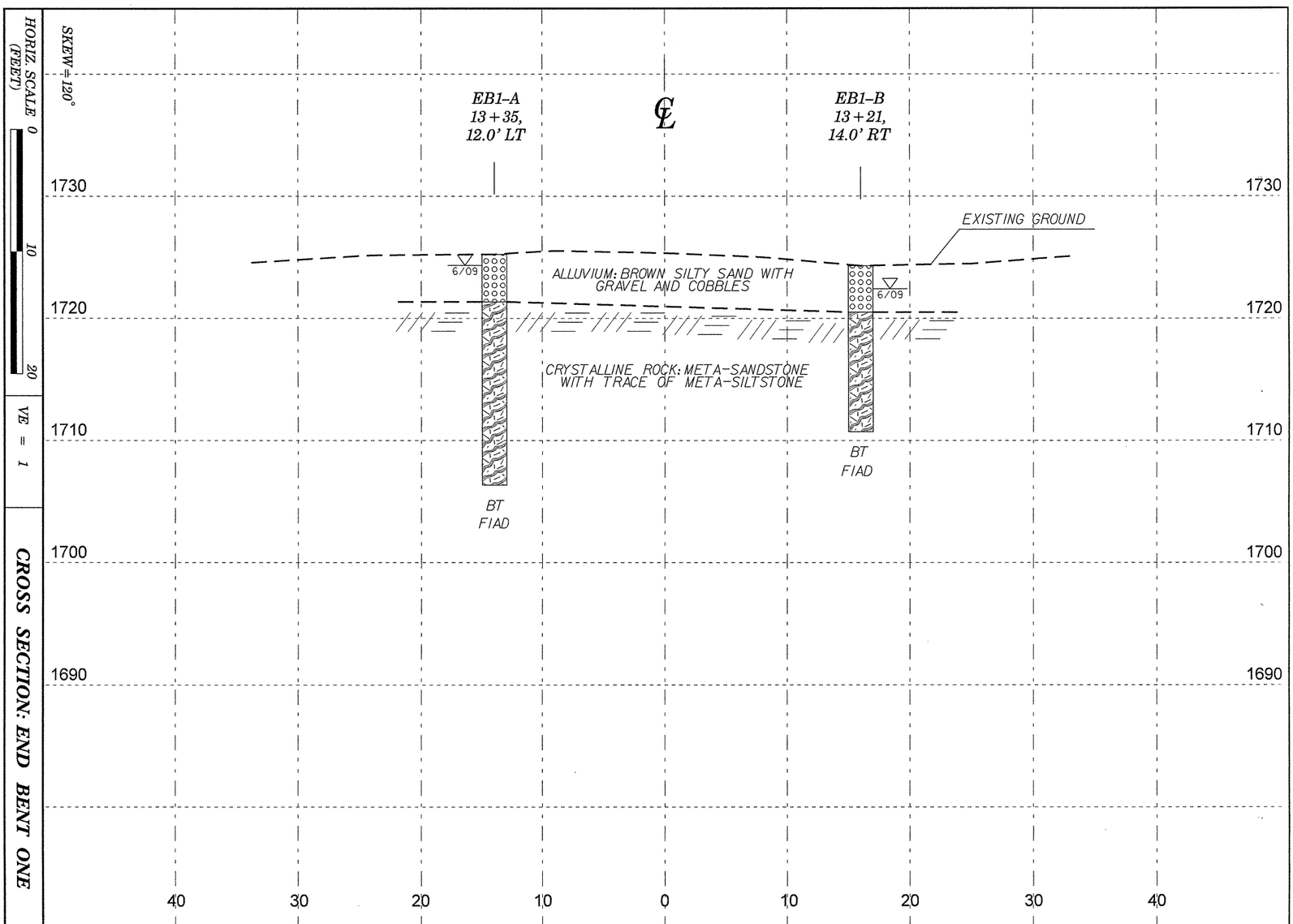
36"± CREEK

PROFILE RIGHT OF CENTERLINE –L–

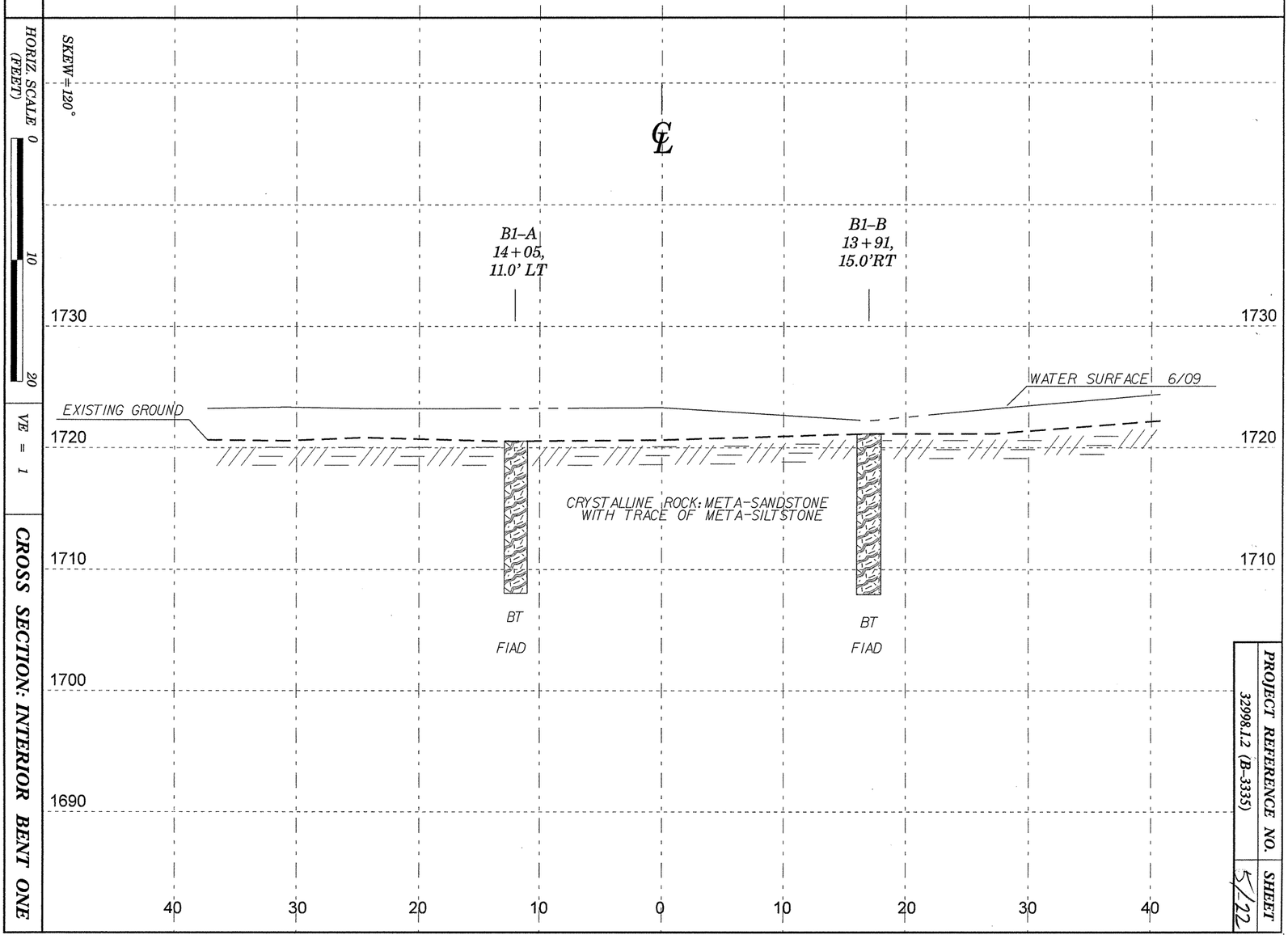
0 — 20 — 40
FEET
VE = 2 SKEW=120°

PROJECT REFERENCE NO.	SHEET
32998.1.2 (B–3335)	4/-22
PROFILE	





CROSS SECTION: END BENT ONE



CROSS SECTION: INTERIOR BENT ONE

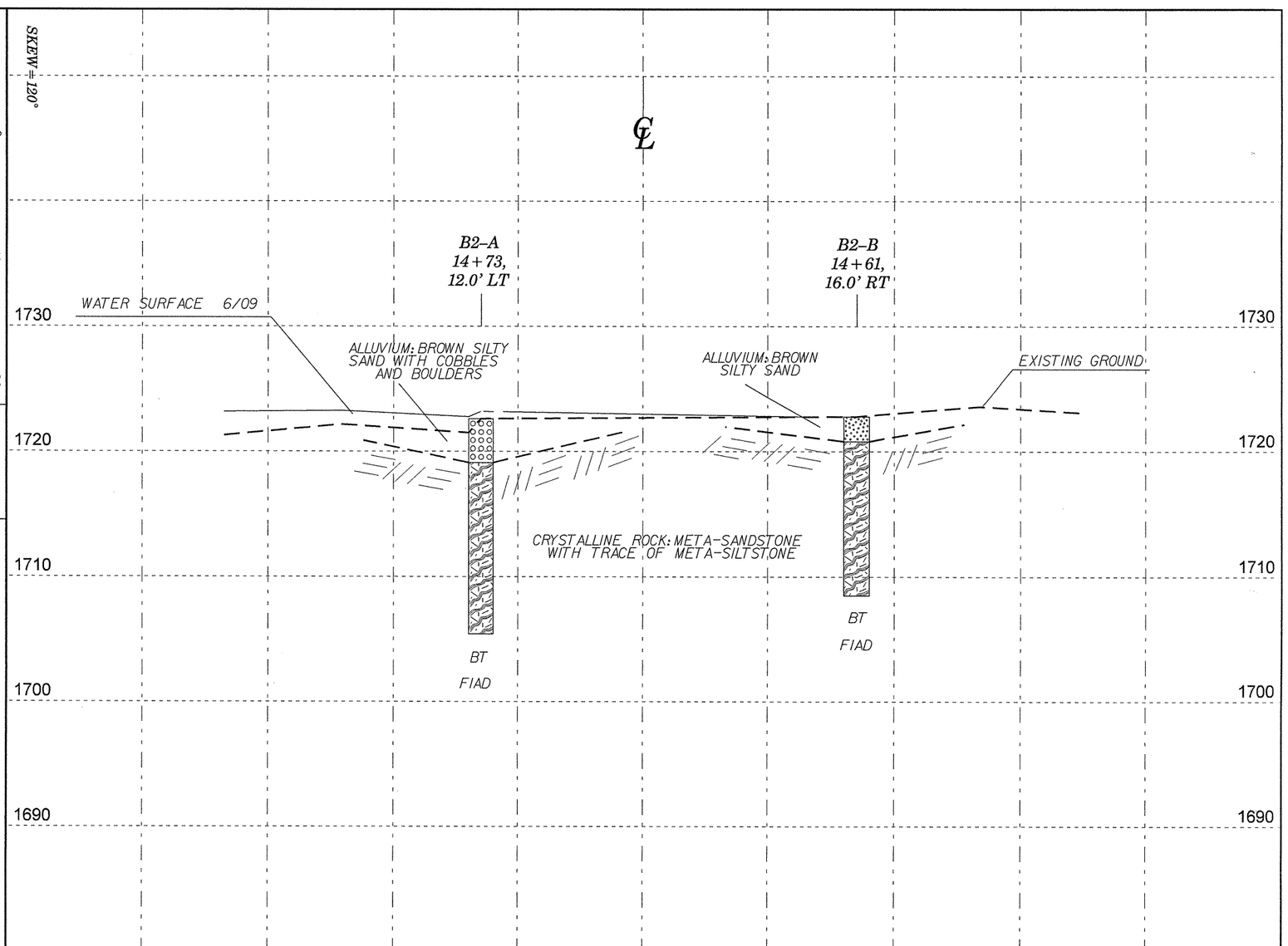
PROJECT REFERENCE NO.	SHEET
32998.12 (B-3335)	5/22

HORIZ. SCALE (FEET) 0 10 20

VE = 1

SKEW = 120°

CROSS SECTION: INTERIOR BENT TWO

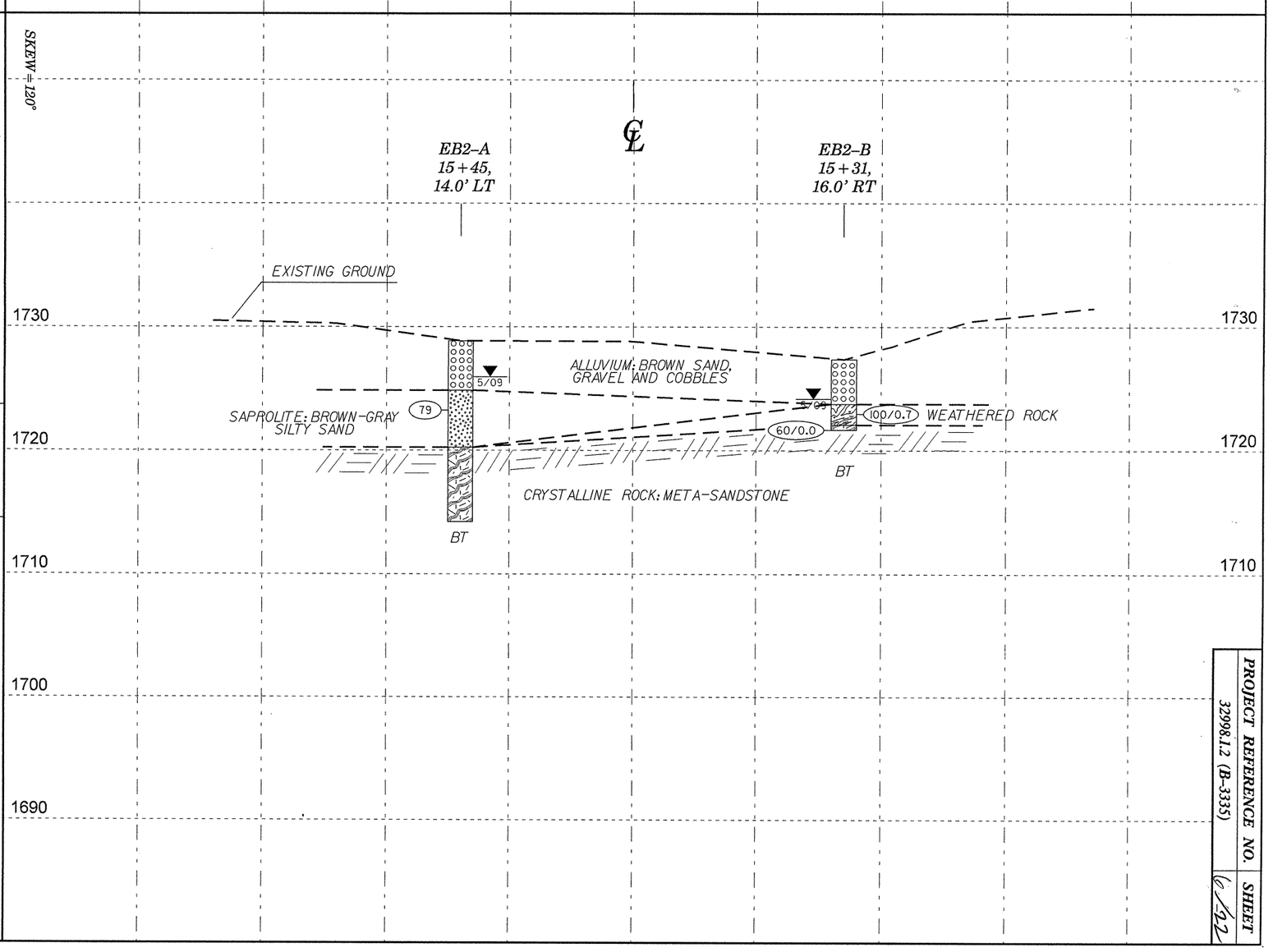


HORIZ. SCALE (FEET) 0 20

VE = 1

SKEW = 120°

CROSS SECTION: END BENT TWO



PROJECT REFERENCE NO. 32998.1.2 (B-3335)

SHEET 6 of 22

SHEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+35	**OFFSET** 12ft LT	**ALIGNMENT** -L-	**0 HR.** 0.9
COLLAR ELEV. 1,725.2 ft	**TOTAL DEPTH** 18.9 ft	**NORTHING** 629,173	**EASTING** 550,671	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/11/09	**COMP. DATE** 06/11/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.9 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)
1730											
1725										1,725.2 GROUND SURFACE	0.0
										ALLUVIAL Brown silty sand with gravel and cobbles.	
1720										1,721.3	3.9
										CRYSTALLINE ROCK Meta-sandstone with trace of meta-siltstone interlayers.	
1715											
1710										1,706.3	18.9
										Boring Terminated at Elevation 1,706.3 ft in crystalline rock.	
1705										Geologist: D C Elliot	
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

SHEET

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NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+35	**OFFSET** 12ft LT	**ALIGNMENT** -L-	**0 HR.** 0.9
COLLAR ELEV. 1,725.2 ft	**TOTAL DEPTH** 18.9 ft	**NORTHING** 629,173	**EASTING** 550,671	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/11/09	**COMP. DATE** 06/11/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.9 ft	
CORE SIZE NXWL	**TOTAL RUN** 15.0 ft		**DRILLER** Coffey, Jr., C.	

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)
1721.34											Begin Coring @ 3.9 ft	
1720	1,721.3	3.9	5.0	1:58 2:07 2:21 2:10 2:23	(5.0) 100%	(4.2) 84%					1,721.3 **CRYSTALLINE ROCK** Gray meta-sandstone with trace of meta-siltstone interlayers. Fresh, hard. joints confined to interval between 3.9 ft and 5.8 ft. a) 4 joints @ 10°. b) 1 joint @ 35°.	3.9
	1,716.3	8.9										
1715			5.0	2:37 2:19 2:31 2:30 2:54	(5.0) 100%	(5.0) 100%						
	1,711.3	13.9										
1710			5.0	2:40 2:51 3:07 3:02 2:54	(5.0) 100%	(5.0) 100%						
	1,706.3	18.9									1,706.3	18.9
1705											Boring Terminated at Elevation 1,706.3 ft in crystalline rock.	
1700											Geologist: D C Elliot	
1695												
1690												
1685												
1680												
1675												
1670												
1665												
1660												
1655												
1650												
1645												

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+21	**OFFSET** 14ft RT	**ALIGNMENT** -L-	**0 HR.** 1.9
COLLAR ELEV. 1,724.3 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 629,149	**EASTING** 550,650	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/11/09	**COMP. DATE** 06/11/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.8 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)
1725										1,724.3 GROUND SURFACE	0.0
										ALLUVIAL Sand, gravel and cobbles.	
1720										1,720.5	3.8
										CRYSTALLINE ROCK Meta-sandstone.	
1715											
1710										1,710.7	13.6
										Boring Terminated at Elevation 1,710.7 ft in crystalline rock.	
1705										Geologist: D C Elliot	
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											
1645											

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+21	**OFFSET** 14ft RT	**ALIGNMENT** -L-	**0 HR.** 1.9
COLLAR ELEV. 1,724.3 ft	**TOTAL DEPTH** 13.6 ft	**NORTHING** 629,149	**EASTING** 550,650	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/11/09	**COMP. DATE** 06/11/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 3.8 ft	
CORE SIZE NXWL	**TOTAL RUN** 9.8 ft		**DRILLER** Coffey, Jr., C.	

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)
1720.5											Begin Coring @ 3.8 ft	
	1,720.5	3.8	4.8	1:41/0.8 2:24 2:30 2:29 2:41	(4.8) 100%	(4.7) 98%					1,720.5 **CRYSTALLINE ROCK** Gray meta-sandstone. Hard; fresh. Joints confined to interval between 4.7 ft and 4.8 ft. a) 2 joints @ 5°.	3.8
1715	1,715.7	8.6	5.0	2:38 2:51 2:40 2:43 2:31	(4.7) 94%	(4.7) 94%						
1710	1,710.7	13.6									1,710.7 Boring Terminated at Elevation 1,710.7 ft in crystalline rock.	13.6
1705											Geologist: D C Elliot	
1700												
1695												
1690												
1685												
1680												
1675												
1670												
1665												
1660												
1655												
1650												
1645												

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 14+05	**OFFSET** 11ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,720.5 ft	**TOTAL DEPTH** 12.5 ft	**NORTHING** 629,152	**EASTING** 550,738	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 2.6ft	**DEPTH TO ROCK** 0.0 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)
1725											
										WATER SURFACE (06/10/09)	
1720										1,720.5 GROUND SURFACE	0.0
										CRYSTALLINE ROCK Meta-sandatone.	
1715											
1710											
										1,708.0	12.5
1705										Boring Terminated at Elevation 1,708.0 ft in crystalline rock.	
										Geologist: D C Elliot	
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											
1645											

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 9/22

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 14+05	**OFFSET** 11ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,720.5 ft	**TOTAL DEPTH** 12.5 ft	**NORTHING** 629,152	**EASTING** 550,738	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 2.6ft	**DEPTH TO ROCK** 0.0 ft	
CORE SIZE NXWL	**TOTAL RUN** 12.5 ft	**DRILLER** Rose, G. K.		

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)
1720.53											Ground Surface	
	1,720.5	0.0	2.5	1:58	(2.5)	(2.5)					**CRYSTALLINE ROCK**	
				2:09	100%	100%					Gray meta-sandstone. Hard; fresh. Joints confined to interval between 8.5 ft and 10.3 ft.	
	1,718.0	2.5		1:01/0.5							a) 3 joints @ 10°.	
			5.0	1:46	(4.9)	(4.9)						
1715				1:53	98%	98%						
				1:54								
	1,713.0	7.5		1:58								
			5.0	1:50								
				2:18	(4.8)	(4.4)						
1710				2:38	96%	88%						
				2:21								
	1,708.0	12.5		2:47							1,708.0	12.5
				3:08							Boring Terminated at Elevation 1,708.0 ft in crystalline rock.	
1705											Geologist: D C Elliot	
1700												
1695												
1690												
1685												
1680												
1675												
1670												
1665												
1660												
1655												
1650												
1645												

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River			**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 13+91	**OFFSET** 15ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,721.1 ft	**TOTAL DEPTH** 13.2 ft	**NORTHING** 629,131	**EASTING** 550,718	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 2.0ft	**DEPTH TO ROCK** 0.0 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
1725										ELEV. (ft) DEPTH (ft)
										WATER SURFACE (06/10/09)
										1,721.1 GROUND SURFACE 0.0
1720										**CRYSTALLINE ROCK**
										Meta-sandstone with trace of meta-siltstone interlayers.
1715										
1710										1,707.9 13.2
										Boring Terminated at Elevation 1,707.9 ft in crystalline rock.
1705										Geologist: D C Elliot
1700										
1695										
1690										
1685										
1680										
1675										
1670										
1665										
1660										
1655										
1650										
1645										

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 10/22

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham		**GEOLOGIST** N/A
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 13+91	**OFFSET** 15ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,721.1 ft	**TOTAL DEPTH** 13.2 ft	**NORTHING** 629,131	**EASTING** 550,718	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 2.0ft	**DEPTH TO ROCK** 0.0 ft	
CORE SIZE NXWL	**TOTAL RUN** 13.2 ft	**DRILLER** Coffey, Jr., C.		

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
1721.14											ELEV. (ft) DEPTH (ft)
1720	1,721.1	0.0	3.2	2:09	(3.2)	(3.2)					Ground Surface
				0:2	100%	100%					**CRYSTALLINE ROCK**
				1:58							Gray meta-sandstone with trace of meta-siltstone interlayers. Hard; fresh.
	1,717.9	3.2		1:57							Joints confined to interval between 10.1 ft and 10.8 ft.
			5.0	1:52	(5.0)	(5.0)					a) 2 joints @ 5°.
1715				1:46	100%	100%					b) 1 joint @ 40°.
				1:54							
	1,712.9	8.2		2:11							
			5.0	1:50	(4.5)	(4.5)					
1710				1:54	90%	90%					
				2:07							
	1,707.9	13.2		2:01							1,707.9 13.2
				1:50							Boring Terminated at Elevation 1,707.9 ft in crystalline rock.
1705				1:45							Geologist: D C Elliot
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											
1645											

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River			**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 14+73	**OFFSET** 12ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,722.6 ft	**TOTAL DEPTH** 17.2 ft	**NORTHING** 629,134	**EASTING** 550,804	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 0.5ft	**DEPTH TO ROCK** 3.7 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)
1725										WATER SURFACE (06/10/09)
										1,722.6 0.0
										ALLUVIAL Dark brown silty sand with cobbles and boulders.
1720										1,718.9 3.7
										CRYSTALLINE ROCK Meta-sandstone with interlayers of meta-siltstone.
1715										
1710										
1705										1,705.4 17.2
										Boring Terminated at Elevation 1,705.4 ft in crystalline rock.
										Geologist: D C Elliot
1700										
1695										
1690										
1685										
1680										
1675										
1670										
1665										
1660										
1655										
1650										
1645										

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 11 22

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham		**GEOLOGIST** N/A
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 14+73	**OFFSET** 12ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,722.6 ft	**TOTAL DEPTH** 17.2 ft	**NORTHING** 629,134	**EASTING** 550,804	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/10/09	**COMP. DATE** 06/10/09	**SURFACE WATER DEPTH** 0.5ft	**DEPTH TO ROCK** 3.5 ft	
CORE SIZE NXWL	**TOTAL RUN** 13.5 ft	**DRILLER** Coffey, Jr., C.		

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)
1718.92											Begin Coring @ 3.7 ft
	1,718.9	3.7	3.5	1:39 1:48 1:51 1:11/0.5	(3.5) 100%	(3.5) 100%					**CRYSTALLINE ROCK** Gray meta-sandstone with interlayers of meta-siltstone and a trace of pyrite. Hard; fresh. joint spacing is approximately 10 feet. a) 2 joints @ 10°. *(continued)*
1715	1,715.4	7.2	5.0	1:47 1:58 1:53 1:46 1:49	(4.8) 96%	(4.8) 96%					
1710	1,710.4	12.2		2:01 1:50							
	1,708.9	13.7	5.0	1:55 1:41 1:52	(4.6) 92%	(4.6) 92%					
1705											1,705.4 17.2
	1,703.9	18.7									Boring Terminated at Elevation 1,705.4 ft in crystalline rock.
											Geologist: D C Elliot
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											
1645											
1640											

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 14+61	**OFFSET** 16ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,722.8 ft	**TOTAL DEPTH** 14.3 ft	**NORTHING** 629,111	**EASTING** 550,784	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/08/09	**COMP. DATE** 06/08/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 2.0 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)
1725										
										1,722.8 GROUND SURFACE 0.0
										ALLUVIAL
1720										1,720.8 Dark brown silty sand. 2.0
										CRYSTALLINE ROCK
1715										Crystalline rock: meta-sandstone and meta-siltstone.
1710										1,708.5 14.3
										Boring Terminated at Elevation 1,708.5 ft in crystalline rock.
1705										Geologist: D C Elliot
1700										
1695										
1690										
1685										
1680										
1675										
1670										
1665										
1660										
1655										
1650										
1645										

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET 12/22

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 14+61	**OFFSET** 16ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,722.8 ft	**TOTAL DEPTH** 14.3 ft	**NORTHING** 629,111	**EASTING** 550,784	**24 HR.** FIAD
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ Core		**HAMMER TYPE** Automatic	
START DATE 06/08/09	**COMP. DATE** 06/08/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 2.0 ft	
CORE SIZE NXWL	**TOTAL RUN** 12.3 ft		**DRILLER** Coffey, Jr., C.	

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
1720.8											ELEV. (ft) DEPTH (ft)
1720	1,720.8	2.0	2.3	1:51	(2.0)	(1.1)					Begin Coring @ 2.0 ft
	1,718.5	4.3		1:45	87%	48%					1,720.8 **CRYSTALLINE ROCK** 2.0
			5.0	0:54/0.3	(5.0)	(5.0)					Gray meta-sandstone with interlayers of meta-siltstone from 9.0 ft. Hard, fresh with saprolite layer (missing) from 13.4 ft to 13.8 ft. Joint spacing approx. 10.0 ft. a) 1 joint @ 10°. b) 3 joints @ 0°.
1715				1:41	100%	100%					
				1:58							
				1:48							
	1,713.5	9.3		1:52							
			5.0	1:46	(4.6)	(4.6)					
1710				1:41	92%	92%					
				1:44							
				1:58							
				1:48							
	1,708.5	14.3		1:20							1,708.5 14.3
1705											Boring Terminated at Elevation 1,708.5 ft in crystalline rock.
											Geologist: D C Elliot
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											
1645											

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 15+45	**OFFSET** 14ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,728.8 ft	**TOTAL DEPTH** 14.6 ft	**NORTHING** 629,116	**EASTING** 550,873	**24 HR.** 2.9
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Automatic	
START DATE 05/21/09	**COMP. DATE** 05/21/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.6 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)
1730										1,728.8 GROUND SURFACE	0.0
1725	1,724.2	4.6						▼		**ALLUVIAL** Brown sand, gravel and cobbles. 1,724.8	4.0
			10	25	54	79				**SAPROLITE** Brown-gray silty sand. 1,720.2	8.6
1720										**CRYSTALLINE ROCK** Meta-sandstone.	
1715										1,714.2	14.6
1710										Boring Terminated at Elevation 1,714.2 ft in crystalline rock. Geologist: D C Elliot	
1705											
1700											
1695											
1690											
1685											
1680											
1675											
1670											
1665											
1660											
1655											
1650											

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 15+45	**OFFSET** 14ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,728.8 ft	**TOTAL DEPTH** 14.6 ft	**NORTHING** 629,116	**EASTING** 550,873	**24 HR.** 2.9
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ SPT Core		**HAMMER TYPE** Automatic	
START DATE 05/21/09	**COMP. DATE** 05/21/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 8.6 ft	
CORE SIZE NXWL	**TOTAL RUN** 5.5 ft		**DRILLER** Coffey, Jr., C.	

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)
1719.74											Begin Coring @ 9.1 ft	
	1,719.7	9.1	0.5	0:59/0.5	(0.5) 100%	(0.5) 100%					**CRYSTALLINE ROCK** Gray meta-sandstone. Hard, fresh. Weakly bedded to massive. Increasing grainsize with depth. a) One joint @ 10°. *(continued)*	
	1,719.2	9.6	5.0	1:49 1:42 1:45 1:41 1:52	(4.8) 96%	(4.8) 96%						
1715	1,714.2	14.6									1,714.2	14.6
1710											Boring Terminated at Elevation 1,714.2 ft in crystalline rock. Geologist: D C Elliot	
1705												
1700												
1695												
1690												
1685												
1680												
1675												
1670												
1665												
1660												
1655												
1650												
1645												
1640												

NCDOT CORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 32998.1.2	**ID.** B-3335	**COUNTY** Graham	**GEOLOGIST** N/A	
SITE DESCRIPTION Bridge N0. 70 on SR-1134 over Cheoah River				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 15+31	**OFFSET** 16ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 1,727.4 ft	**TOTAL DEPTH** 5.7 ft	**NORTHING** 629,091	**EASTING** 550,852	**24 HR.** 3.2
DRILL MACHINE CME-550	**DRILL METHOD** NW Casing w/ SPT		**HAMMER TYPE** Automatic	
START DATE 05/21/09	**COMP. DATE** 05/21/09	**SURFACE WATER DEPTH** N/A	**DEPTH TO ROCK** 5.3 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)
1730										
1725										1,727.4 GROUND SURFACE 0.0
										ALLUVIAL Brown sand, gravel and cobbles.
	1,723.0	4.4								1,723.8 3.6
	1,721.7	5.7	9	40	60	100/0.7				1,722.1 **WEATHERED ROCK** Weathered rock of meta-sandstone. 5.3
1720			60/0.0			60/0.0				1,721.7 **CRYSTALLINE ROCK** Meta-sandstone. 5.7
1715										Boring Terminated with Standard Penetration Test Refusal at Elevation 1,721.7 ft in crystalline rock.
1710										Geologist: D C Elliot
1705										
1700										
1695										
1690										
1685										
1680										
1675										
1670										
1665										
1660										
1655										
1650										

NCDOT BORE SINGLE BORE_CORELOGS.GPJ NC_DOT.GDT 6/22/09

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 32998.1.2 TIP: B-3335 COUNTY: Graham

DESCRIPTION(1): Bridge No. 70 on SR-1134 over Cheoah River

EXISTING BRIDGE

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

Bridge No.: 70 Length: 160 Total Bents: 10 Bents in Channel: 7 Bents in Floodplain: 3
Foundation Type: Footings.

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None noted.

Interior Bents: None noted.

Channel Bed: None noted.

Channel Bank: None noted.

EXISTING SCOUR PROTECTION

Type(3): End-bent walls and wingwalls. EB1-B wingwall pile-and-panel; all other walls concrete.

Extent(4): Wingwalls extend 10 feet beyond end-bent walls.

Effectiveness(5): Good.

Obstructions(6): Occasional groves of small trees in channel. Ridges of rock cross channel an at oblique angle.

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): Crystalline rock with occasional alluvial overburden.

Channel Bank Material(8): Sand, gravel and boulders.

Channel Bank Cover(9): Grass and trees.

Floodplain Width(10): EB1 = 30 feet; EB2 = 80 feet.

Floodplain Cover(11): Trees.

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

Channel Migration Tendency(13): West.

Observations and Other Comments: Four additional structures added to interior bent locations; one additonal structure added near EB2.

Reported by: C A Dunnagan **Date:** 5/19/2009

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS

B1-A	B1-B	B2-A	B2-B							
1720	1720.5	1719	1720.5							

Comparison of DSE to Hydraulics Unit theoretical scour:
The DSE is 9.0 to 11.0 feet above the Hydraulics Unit's theoretical elevation as shown in the report dated 1/5/09.

DSE determined by: C A Dunnagan **Date:** 6/17/2009

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							

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
EB1-A
Box 1 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
EB1-A
Box 2 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
EB1-B
Box 1 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
EB1-B
Box 2 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B1-A
Box 1 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B1-A
Box 2 of 2

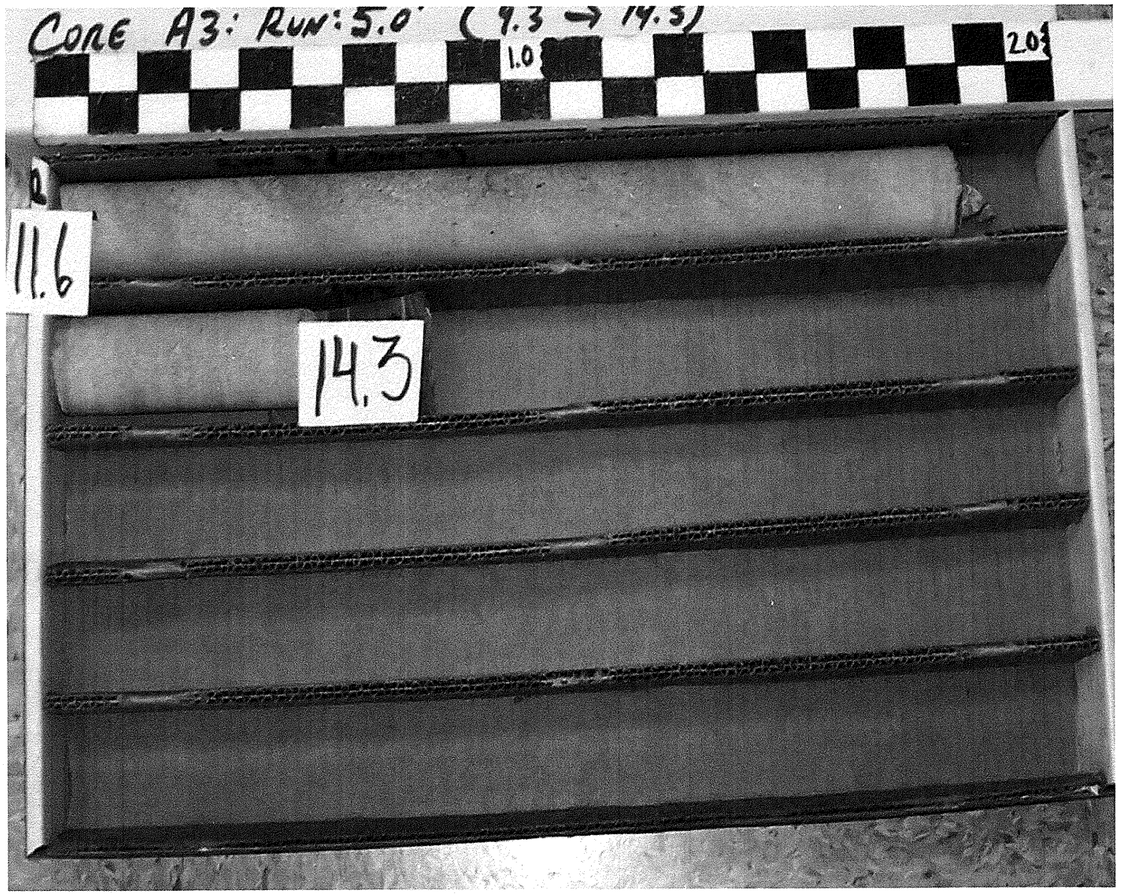
32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B1-B
Box 1 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B1-B
Box 2 of 2

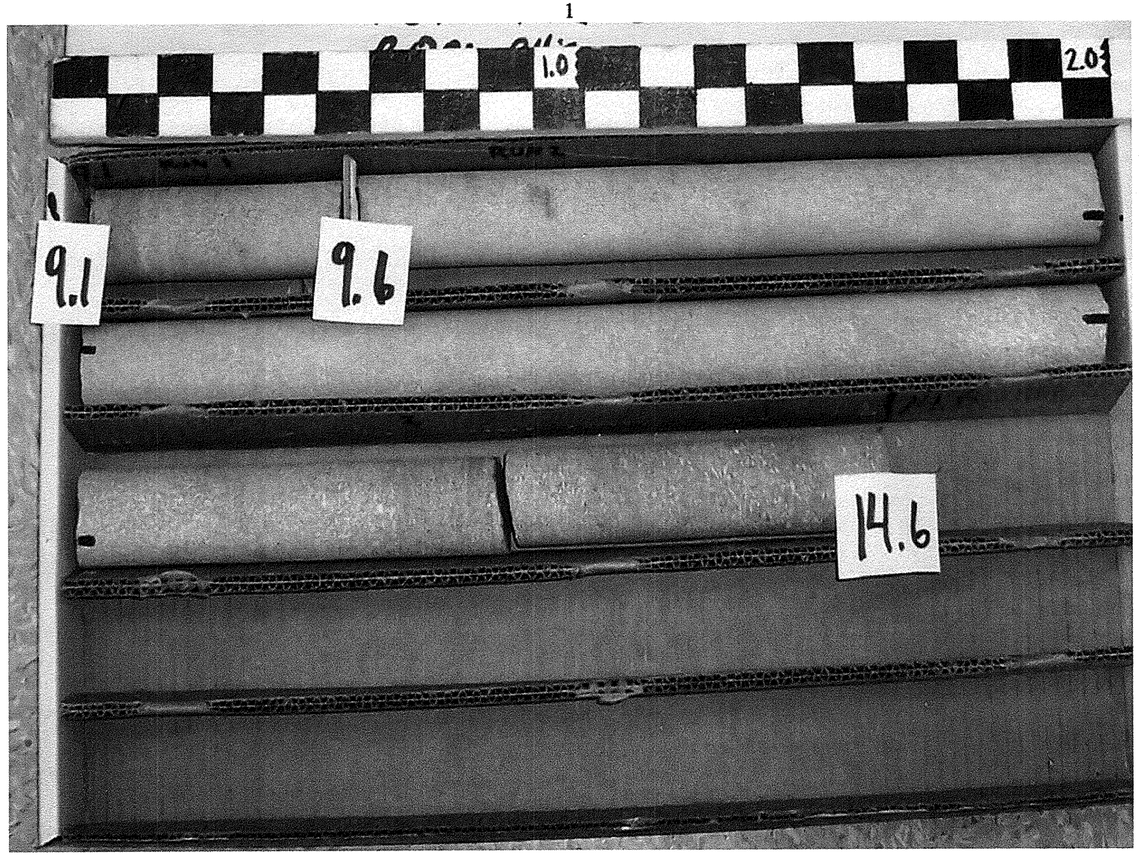
32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B2-A
Box 1 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B2-A
Box 2 of 2

32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B2-B
Box 1 of 2



32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
B2-B
Box 2 of 2



32998.1.2 (B-3335)
Graham County
Bridge No. 70 over Cheoah River
EB2-B
Box 1 of 2