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<i>y</i>	

D. Hordister

## STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

#### 

For Letting

# STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT <u>33546.1.1</u> I.D. NO. <u>B-4199</u>
F.A. PROJECT <u>BRZ-1782(1)</u>
COUNTY McDOWELL
PROJECT DESCRIPTION Bridge No. 198 over the
Second Broad River on SR 1782
SITE DESCRIPTION

#### CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORNG LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, CEOTECHNICAL UNIT 8 1999) 250-4088, NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORNG LOGS, ROCK CORES, OR SOIL TEST DATA IS PART OF THE CONTRACT.

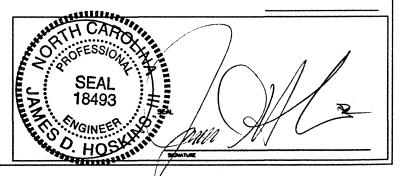
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# RETURNED FROM LETTING

INVESTIGATED BY D. Hordister	PERSONNEL D. Horris
CHECKED BY JD Hoskins III	R. Burleson
SUBMITTED BY JD Hoskins III	R. Kumar
DATE February 25, 2005	S. Tierney
	R. Benfield



#### NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS GEOTECHNICAL UNIT

# SUBSURFACE INVESTIGATION

				SOIL AND ROC	ck legend, term	s, symbols	S, AND ABBREV	/IATIONS		
	SOIL DESCRIPTION			GRADATION			ROCK	C DESCRIPTION	POELICAL AN INCEDED	TERMS AND DEFINITIONS
SOIL IS CONSIDERED TO BE THE UNC	CONSOLIDATED, SEMI-CONSOLIDATED OR WEA	THERED EARTH MATERIALS	WELL GRADED- INDICATES A GOOD UNIFORM- INDICATES THAT SOIL	REPRESENTATION OF PARTICLE SIZES FRE PARTICLES ARE ALL APPROXIMATELY THE S	om fine to coarse Same Size. (ALSO	ROCK LINE INDIC	ATES THE LEVEL AT WHICH NO	THAT WHEN TESTED, WOULD YIELD SPI IN-COASTAL PLAIN MATERIAL WOULD	YIELD SPT REFUSAL.	ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.
WHICH CAN BE PENETRATED WITH A C	CONTINUOUS FLIGHT POWER AUGER, AND WHI STANDARD PENETRATION TEST (AASHTO TZ	ICH YIELDS LESS THAN	POORLY GRADED	RE OF UNIFORM PARTICLES OF TWO OR MO				oon sampler edual to or less th Tion betveen soil and rock is of		ACUIFER - A WATER BEARING FORMATION OR STRATA,
CLASSIFICATION IS BASED ON THE A	MASHTO SYSTEM AND BASIC DESCRIPTIONS C TURE, AASHTO CLASSIFICATION, AND OTHER P	GENERALLY SHALL INCLUDE:		ANGULARITY OF GRAINS		OF WEATHERED R	OCK. ARE TYPICALLY DIVIDED AS F	OLOWS:		ARGILLACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND, ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS,
AS MINERALOGICAL COMPOSITION, AND	GULARITY, STRUCTURE, PLASTICITY, ETC. EXAM	PLE:	THE ANGULARITY OR ROUNDNESS SUBANGULAR, SUBROUNDED, OR RO	OF SOIL CRAINS ARE DESIGNATED BY THE	TERMS; ANGULAR,	WEATHERED		<del></del>	N VALUES > 100 BLOWS	OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.
	TY CLAT, MOIST WITH WITERBEDDED FINE SAND LAYERS, HIGHLY				N	ROCK (WR)		. PLAIN MATERIAL THAT YIELDS SPT		ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO DR ABOVE THE
	END AND AASHTO CLASSIFI  ERIALS SILT-CLAY MATERIALS			<u> 4INERALOGICAL COMPOSITIO</u> 1, feldspar, mica, talc, kaolin, etc. are u		CRYSTALLINE ROCK (CR)		rse Grain Igneous and Metamorphi I SPT REFUSAL IF TESTED. ROCK TYF		GROUND SURFACE.
CENERAL GRANULAR MATE		ORGANIC MATERIALS	WHENEVER THEY ARE CONSIDERED			NOCK (CIO		RO, SCHIST, ETC. RSE GRAIN METAMORPHIC AND NON-CO	ASTAL PLAIN	CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
GROUP A-1 A-3	A-2 A-4 A-5 A-6 A-7			COMPRESSIBILITY		NON-CRYSTALLINE ROCK (NCR)	SEDIMENTARY	ROCK THAT WOULD YEILD SPT REFU		COLLUYIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE,
CLASS. A-1-6 A-1-6 A-2-4	A-2-5 A-2-6 A-2-7	A-3 A-6, A-7	SLIGHTLY COMPRESSIBL MODERATELY COMPRESS			COASTAL PLAIN	COASTAL PLA	YLLITE, SLATE, SANDSTONE, ETC. IN SEDIMENTS CEMENTED INTO ROCK,		CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL
SYMBOL DOGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG			HIGHLY COMPRESSIBLE	LIQUID LIMIT (	CREATER THAN 50	SEDIMENTARY ROCK	SPT REFUSAL SHELL BEDS.	. ROCK TYPE INCLUDES LIMESTONE, S ETC.	ANOSTONE, CEMENTED	LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
Z PASSING		SILT-		PERCENTAGE OF MATERIAL	-			EATHERING		DIKE - A TABULAR BOOY OF ICHEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.
* 18 58 HX * 48 38 HX58 HX51 HN		GRANULAR CLAY SOILS PEAT		RANULAR SILT- CLAY SOILS SOILS	OTHER MATERIAL	FRESH ROCK	FRESH, CRYSTALS BRIGHT, FEW	JOINTS MAY SHOW SLIGHT STAINING	G. ROCK RINGS UNDER	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE
■ 2000 15 MX 25 MX 00 MX 35 MX	35 M35 M35 M36 M36 M36 M36 M	<b>M</b>   301C3		2 - 3% 3 - 5% TRAC 3 - 5% 5 - 12% LITT		HAMM	ER IF CRYSTALLINE.			HORIZONTAL.
	41 HN 48 HX41 HN 48 HX41 HN 48 HX41 H		MODERATELY ORGANIC	5 - 10% 12 - 20% SOM	E 20 - 35%	VERY SLIGHT ROCK (V. SLI.) CRYS	GENERALLY FRESH, JOINTS ST TALS ON A BROKEN SPECIMEN	AINED, SOME JOINTS MAY SHOW THIN FACE SHINE BRIGHTLY, ROCK RINGS L	CLAY COATINGS IF OPEN, MOER HAMMER BLOWS IF	<u>DIP DIRECTION (DIP AZIMUTH) -</u> THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH,
	the HX 11 MM 11 MM 18 HX 18 HX 11 HM 11 M	- HIGHLY	HIGHLY ORGANIC	>18% >28% HICH	LY 35% AND ABOVE		CRYSTALLINE NATURE.			FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE
CROUP INCEX 8 8 0	8 4 HX 8 HX 12 HX 16 HX No P	AMOUNTS OF SOILS	VATER LEV	GROUND WATER	COD + INC			'AINED AND DISCOLORATION EXTENOS CLAY, IN GRANITOID ROCKS SOME OC		SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
OF MAJOR GRAVEL AND SAME CRE	LTY OR CLAYEY SILTY CLAYEY AVEL AND SAND SOILS SOILS	ORGANIC MATTER	_	VEL IN BORE HOLE IMMEDIATELY AFTER	UNILLING	CRYS	TALS ARE DULL AND DISCOLOR	ED. CRYSTALLINE ROCKS RING UNDER	HAMMER BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
MATERIALS SAND	30.63		4	TER LEVEL AFTER 24 HOURS.				OV DISCOLORATION AND VEATHERING ARE DULL AND DISCOLORED, SOME SI		FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGED FROM PARENT MATERIAL.
CENTRATING AS A EXCELLENT TO	GOOD FAIR TO POOR	FAIR TO POOR UNSUITABLE	PERCHED W	ATER, SATURATED ZONE OR WATER BEAR!	ING STRATA	DULL	SOUND UNDER HAMMER BLOWS	AND SHOWS SIGNIFICANT LOSS OF S		FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY
SUBGRACE PLOS A-7	 7-5 ≤ L.L 30 : P.I. OF A-7-6 > L.		OM SPRING OR	SEEPAGE			FRESH ROCK. BOCY FYCEPT DUARTZ DISCOLD	RED OR STAINED. IN GRANITOID ROCK	S. ALL FELDSPARS DULL	THE STREAM.
	ONSISTENCY OR DENSENESS			MISCELLANEOUS SYMBOLS		SEVERE AND I	DISCOLORED AND A MAJORITY S	SHOW KAOLINIZATION, ROCK SHOWS S	EVERE LOSS OF STRENGTH	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
	CTNESS OR RANGE OF STANDARD PENETRATION RESISTENCE	RANGE OF UNCONFINED	RDADVAY EMBANKME	NT OPT OPT TEST BORING	G SAMPLE		CAN BE EXCAVATED WITH A GE STED. VOULD YIELD SPT REFU	OLOGIST'S PICK. ROCK GIVES "CLUNK" SAL	SUUND WHEN STRUCK.	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
PRIMARY SUIL TIPE. CONS	ISISTENCY (N-VALUE)	(TONS/F12 )	WITH SOIL DESCRIP	TION VST PHT	DESIGNATIONS			ORED OR STAINED, ROCK FABRIC CLE		LEGGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO
	/ LOOSE		SOIL SYMBOL	AUGER BORING	S- BULK SAMPLE		TRENGTH TO STRONG SOIL. IN I NT. SOME FRAGMENTS OF STRO	Granitoid Rocks all Felospars af ING ROCK USUALLY REMAIN.	RE KAOLINIZED TO SOME	ITS LATERAL EXTENT.
MATERIAL MEDIL	IUM DENSE 18 TO 38	N/A	ARTIFICIAL FILL OF	THER THAN	SS- SPLIT SPOON	<u>IF TI</u>	ESTED. YIELDS SPT N VALUES	> 190_BPF		LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  MOTTLED (NOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN
MON-PONCEIVE) UE	ENSE 30 TO 50 7 DENSE >50		ROADVAY EMBANKME	NTS - CORE BORING	SAMPLE ST- SHELBY TUBE	VERY SEVERE ALL (	ROCK EXCEPT QUARTZ DISCOLO MASS IS FEFFCTIVELY REDUCEI	RED OR STAINED, ROCK FABRIC ELEM D TO SOIL STATUS, WITH ONLY FRACE	ENTS ARE DISCERNIBLE BUT ÆNTS OF STRONG ROCK	SOILS USUALLY INDICATES POOR AFRATION AND LACK OF GOOD DRAINAGE.
	r SOFT (2	(0.25	INFERRED SOIL BOU	INDARIES MONITORING WEL	CAMPI C	REMA	INING. SAPROLITE IS AN EXAM	PLE OF ROCK WEATHERED TO A DEGR	EE SUCH THAT ONLY MINOR	PERCHED WATER - WATER MAINTAINED ABOVE THE MORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
	DFT 2 TO 4 IUM STIFF 4 TO 8	0.25 TO 0.5	STENE INFERRED ROCK LIN	_	RS- ROCK SAMPLE	i		FABRIC REMAIN. <i>IF TESTED. YIELDS</i> : RIC NOT DISCERNIBLE, OR DISCERNIBLE		RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
MATERIAL ST	TIFF 8 TO 15	8.5 TO 1 1 TO 2	TTTTT ALLUVIAL SOIL BOU	NDARY A INSTALLATION	RT- RECOMPACTED .	SCATI	TERED CONCENTRATIONS. QUART	Z MAY BE PRESENT AS DIKES OR ST		ROCK QUALITY DESIGNATION GLOLDJ - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF
	r STIFF 15 TO 30 ARO >30	2 TO 4	25/825 DIP/DIP DIRECTION	OF SLOPE INDICATOR INSTALLATION	R TRIAXIAL SAMPLE  CBR - CBR SAMPLE	ALSO	AN EXAMPLE.	CK HARDNESS		ROCK SECMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
	TEXTURE OR GRAIN SIZE		ROCK STRUCTURES	- SPT N-VALUE					POCETIMENT DECIMANCE	SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE
U.S. STO. SIEVE SIZE	4 19 49 69 29	80 279	• - SOUNDING ROD	(REF) SPT REFUSAL			ERAL HARD BLOWS OF THE GEO	OR SHARP PICK, BREAKING OF HAND : DLOGISTS PICK.	arethera reddinea	PARENT ROCK.
OPENING 04M0	4.76 2.8 8.42 8.25 8.8			ABBREVIATIONS				PICK ONLY WITH DIFFICULTY, HARD H	WHER BLOWS REQUIRED	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL
BOULDER COBBLE	GRAVEL COARSE FIN		AR - AUGER REFUSAL	HSA - HOLLOW STEM AUGER	W - MOISTURE CONTENT	1	DETACH HAND SPECIMEN.	DICY COURSE OF CONOUSS TO 8.825	INCHES DEED CAN DE	TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS
(8LDR.) (CO8.)	(GR.) (CSE. SO.) (F.	SON (SEN (CEN	BT - BORING TERMINATED	MED MEDIUM MIC MICACEDUS	V VERY VST - VANE SHEAR TEST	HARO EXC		PICK, COUCES OR GROOVES TO 8,825 GEOLOGISTS PICK, HAND SPECIMENS C		SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
GRAIN MM 3875 75 SIZE IN 12" 3"	2.0 0.25	<b>9.8</b> 5 <b>8.89</b> 5	CPT - CONE PENETRATION TES CSE COARSE	MAN - MAI - MELONAMED	ED WOH - WEIGHT OF HAMMER	MEDIUM CAN	BE GROOVED OR COUCED 8.85	INCHES DEEP BY FIRM PRESSURE OF		STANDARD PENETRATION TEST PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS ON OR B.P.F.) OF A 148 LB. HAMMER FALLING 36 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH
SOIL MOI	STURE - CORRELATION OF	TERMS	CT - CORING TERMINATED	PMT - PRESSUREMETER TEST SD SAND, SANDY			BE EXCAVATED IN SMALL CHIL AT OF A CEOLOGISTS PICK.	PS TO PEICES 1 INCH MAXIMUM SIZE	BY HAND BLUNS UP THE	A 2 INCH DUTSIDE DIAMETER SPLIT SPOON SAMPLER, SPT REFUSAL IS LESS THAN BLI FOOT PENETRATION
SOIL MOISTURE SCALE	FIELD MOISTURE GUIDE FO	R FIELD MOISTURE DESCRIPTION	DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION	St Sti T. Sti TY		SOFT CAN	BE GROVED OR GOUGED READ!	LY BY KNIFE OR PICK. CAN BE EXCA		WITH 68 BLOWS.  STRATA CORE RECOVERY ISRECJ - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH
(ATTERBERG LIMITS)	DESCRIPTION		e - VOID RATIO	TCR - TRICONE REFUSAL	•		m Chips to Several Inches Ces can be broken by Fingei	IN SIZE BY MODERATE BLOVS OF A ( R PRESSURE.	PICK PUINT. SMACE, THIN	DF STRATUM AND EXPRESSED AS A PERCENTAGE.
		LIQUID: VERY WET, USUALLY	FOSS FOSSILIFEROUS	7 - UNIT WEIGHT				BE EXCAVATED READILY WITH POINT		STRATA ROCK QUALITY DESIGNATION IS.R.O.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE
LL_ LIQUID LIMIT			FRAC FRACTURED FRAGS FRAGMENTS	7∕d - DRY UNIT WEIGHT			MORE IN THICKNESS CAN BE BI JERNAIL.	ROKEN BY FINGER PRESSURE. CAN BE	SCHATCHED REPORT BY	TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
PLASTIC   RANGE <		IDEREGUIRES DRYING TO OPTIMUM MOISTURE	EQUIF	PMENT USED ON SUBJECT P	ROJECT	FRACT	URE SPACING	BEDD1	NG	TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
(PI) PL PLASTIC LIMIT	ATTRIA (	OFTIMOR MUISTURE			HAMMER TYPE:	IERM	SPACING	TERM	THICKNESS	BENCH MARK: T-6 = Sto 14+00, 58' LT -L-
	e - MOIST - (M) SOLIDE	AT DR NEAR OPTIMUM MOISTURE	ORILL UNITS	ADVANCING TOOLS:	X AUTOMATIC MANUAL	VERY WIDE	MORE THAN 18 FEET 3 TO 18 FEET	VERY THICKLY BEDOED THICKLY BEDOED	> 4 FEET 1.5 - 4 FEET	FLEUATION 1001 DO F.
OM OPTIMUM MOISTURE SL SHRINKAGE LIMIT	<b>L</b>		MOBILE B	CLAY BITS		MODERATELY CL	OSE 1 TO 3 FEET	THINLY BEDOED VERY THINLY BEDOED	8.16 - 1.5 FEET 8.03 - 8.16 FEET	ELEVATION: 1081.09 ft
		S ADDITIONAL WATER TO	BK-51	6" CONTINUOUS FLIGHT AUGER	CORE SIZE:	CLOSE VERY CLOSE	B.16 TO 1 FEET LESS THAN B.16 FEET	THICKLY LAMINATED	8.006 - 8.83 FEET	NOTES:
	ATTAIN (	OPTIMUM MOISTURE	] LJ 8K-31	S'HOLLOW AUGERS	□-8 <u></u>			THINLY LAMINATED NDURATION	< 0.886 FEET	
	PLASTICITY		☐ CHE-45	HARD FACED FINGER BITS		FOR SEDIMENTARY R		DENING OF THE MATERIAL BY CEMENT	ING, HEAT, PRESSURE, ETC.	
	PLASTICITY INDEX (PI)	DRY STRENGTH		X TUNG,-CARBIDE INSERTS	X +0		0:00	ING WITH FINGER FREES NUMEROUS G		
NONPLASTIC LOW PLASTICITY	<b>8-</b> 5 6-15	VERY LOW SLIGHT	X CHE-550	X CASING W/ ACTION	HAND TOOLS:	FRIABLE		LE BLOW BY HAMPER DISINTEGRATES		
MED. PLASTICITY	16-25	MEDIUM HIGH	PORTABLE HOIST	TRICONE STEEL TEETH	POST HOLE DIGGER	MODERATE		S CAN BE SEPARATED FROM SAMPLE	WITH STEEL PROBE;	
HIGH PLASTICITY	26 OR MORE COLOR	11197	4 <u> </u>	TRICONE TUNGCARB.	HAND AUGER			KS EASILY WEN HIT WITH HANDER.	. etcs: 2000c	
		DER WEL-DON DLIE - MANN	OTHER CHE-55 TM	CORE BIT	SOUNDING ROD	INDURATE		NS ARE DIFFICULT TO SEPARATE VITO ICULT TO BREAK WITH HAMMER.	n artel PROBLE	
}	COLOR OR COLOR COMBINATIONS (TAN, DARK, STREAKED, ETC. ARE USED TO DES		OTHER	OTHER	VANE SHEAR TEST	EXTREMEL		P HANNER BLOWS REQUIRED TO BREA	K SAPLEI	
						<u> </u>	SMP	LE BREAKS ACROSS CRAINS.		REVISED DR/15/00
										16 VES D 09/15/00

WBS ELEMENT (TIP):

33546.1.1 (B-4199)

**FEDERAL PROJECT:** 

BRZ-1782(1)

**COUNTY:** 

**McDowell** 

**DESCRIPTION:** 

Bridge No. 198 over the Second Broad River on SR 1782

**SUBJECT:** 

Geotechnical Report of Subsurface Exploration

#### **Project Description:**

Geoscience Group, Inc. (Geoscience) has completed the authorized geotechnical investigation for the above referenced project in McDowell County, North Carolina. The bridge will be located in southern McDowell County, south of Marion. More precisely, the bridge will be located northwest of the existing SR 1782 crossing of the Second Broad River. A Site Vicinity Map is included in the following pages. The project will consist of the construction of a three-span, cored slab bridge with an overall length of 110 feet, a width of 43 feet and skew angles ranging between 105° 39' 00" and 124° 21' 00" (tangent to curve). Fill depths of 4 to 7 feet are proposed at end bent-1 and end bent-2, respectively. Grading is not proposed at the interior bents. The 1.5H:1V end bent slopes are to be protected with rip rap.

The purpose of this exploration was to investigate the subsurface conditions at the proposed bridge bent locations. The subsurface exploration was conducted between February 2 and 8, 2005. This exploration consisted of the execution of eight (8) soil test borings. Using the baseline points provided by NCDOT, the actual boring locations were surveyed for elevation and location by Geoscience personnel. Drilled boring locations are shown on the Boring Identification Diagram included in the following pages.

The soil test borings were advanced using a CME 550x drilling machine utilizing hollow-stem auger and rotary drilling techniques. In each boring, Standard Penetration tests were performed in general accordance with NCDOT guidelines. In conjunction with this testing, split-barrel soil samples were recovered for visual classification in the field. The split-barrel soil samples were returned to our laboratory for testing. Water for drilling purposes was obtained from the Second Broad River. Drilling mud slurry was not utilized during the investigation. Core samples of the underlying weathered rock and bedrock were obtained from four (4) of the borings. The core samples were obtained using an HQ wireline barrel. The core samples were returned to our laboratory for review and classification as well as laboratory testing.

Laboratory testing was performed on representative split-barrel samples to aid in the assessment of AASHTO soil classification and to refine data for evaluation of engineering properties. The laboratory testing consisted of natural moisture content determinations, Atterberg Limits tests, and grain size analyses with hydrometer. The soil laboratory tests performed were in general accordance with AASHTO and NCDOT specifications. Rock core specimens were selected for laboratory testing of unconfined

compressive strength. These tests were performed in general accordance with ASTM Method D 2938. The results of the soil laboratory tests and a rock core test summary are included in the following pages. Complete rock core testing results are provided in Appendix C under separate cover.

#### Physiography and Geology:

The project site is located in the Inner Piedmont Belt of the Piedmont Physiographic Province of North Carolina. According to the 1985 Geologic Map of North Carolina, the site is located in an area consisting of metamorphosed granitic rock of Cambrian to Ordovician in age. Areas containing migmatitic granitic gneiss are present in the vicinity of the subject site. The core samples obtained on-site consist of metamorphosed granitic rock. The overlying soils are the residual product of the physical and chemical weathering of the underlying bedrock. The site is located in a valley between two ridges located north and south of the site.

#### **Foundation Materials:**

The foundation materials encountered at the site consist of alluvium, residual soils, weathered rock, and crystalline rock. Subsurface conditions will be described across the site.

With the exception of EB1-A, alluvial soil is present at the ground surface along each bent. The alluvial soil consists of moist to saturated, very loose and loose silty coarse to fine sand (A-3), with gravel present in some areas (A-1-a). Blow counts range between 2 and 7 bpf, with higher influenced blow counts.

Residual soil is present below the alluvium in EB1-B and along bent-1 and end bent-2. Additionally, residual soil is present at the ground surface along the left side of end bent-1. Residual soil is present interlayered with weathered and crystalline rock along bent-1. The residual soil consists of wet medium stiff sandy clayey silt (A-4) in EB1-A and moist to saturated, loose to very dense silty fine and coarse to fine sand elsewhere across the site (A-2-4, A-1-b). Some zones of the silty coarse to fine sand contained rock fragments. Blow counts in the residual soils range between 7 and 88 bpf.

Weathered rock is present below the alluvial soil along bent-2 and is present below the residuum in the remaining borings. The top of weathered rock elevation ranges between 1077 and 1060 feet. The weathered rock generally consists of severely weathered, soft and medium hard metamorphosed granite with very close fracture spacing. Recovery of cored weathered rock ranged between 0 and 64 percent. Boring EB1-A was terminated in weathered rock.

Crystalline rock is present in each boring, with the exception of EB1-A. The elevation of the first encounter with crystalline rock ranges between 1070 and 1050 feet. However, we would consider the crystalline rock line to range between 1053 and 1047 feet at the interior bents. The majority of the crystalline rock consists of moderately and slightly weathered, hard metamorphosed granite with close and very close fracture spacing. Recovery of the crystalline rock ranges between 60 and 100 percent and was variable boring to boring and with depth. The RQD values measured for the crystalline rock range between 0 and 92 percent. The lower values tended to occur higher in the borings with the greatest values corresponding to the depths below the crystalline rock line. Four specimens were tested for unconfined compressive strength. The specimen conditions range between moderately weathered, moderately hard to slightly weathered, hard metamorphosed granite. The unconfined compressive strength of the specimens range between 2,850 and 14,290 psi. With the exception of EB1-A, the borings were terminated in crystalline rock.

State No. 33546.1.1 (B-4199) Geotechnical Report of Subsurface Exploration

#### **Groundwater:**

After completion of each boring, temporary piezometers (slotted PVC pipe) were installed in the boreholes. Piezometers were used to measure stabilized groundwater levels at least 24 hours after the completion of drilling. Groundwater elevations range between 1079 and 1075 feet. Groundwater will typically conform to the level of the adjacent river.

#### **Closure:**

The geotechnical foundation investigation is based on the Preliminary General Drawing dated January 2005. If any significant changes are made in the design or location of the proposed structure, the subsurface information will have to be reviewed and modified as necessary. For soil descriptions and general stratification at a particular boring location, the respective Boring Log should be reviewed. Cross-sections and profiles are a generalized interpretation of soil conditions between borings and should not be considered accurate other than at the boring locations. Subsurface conditions between boring locations or elsewhere on the site may vary, and subsurface anomalies may exist which were not detected.

Geoscience Group, Inc. appreciates the opportunity to be of service to the NCDOT on this project. Should you have any questions concerning this report, please feel free to contact the undersigned.

Respectfully,

GEOSCIENCE GROUP, INC.

Dean Hardister, PE

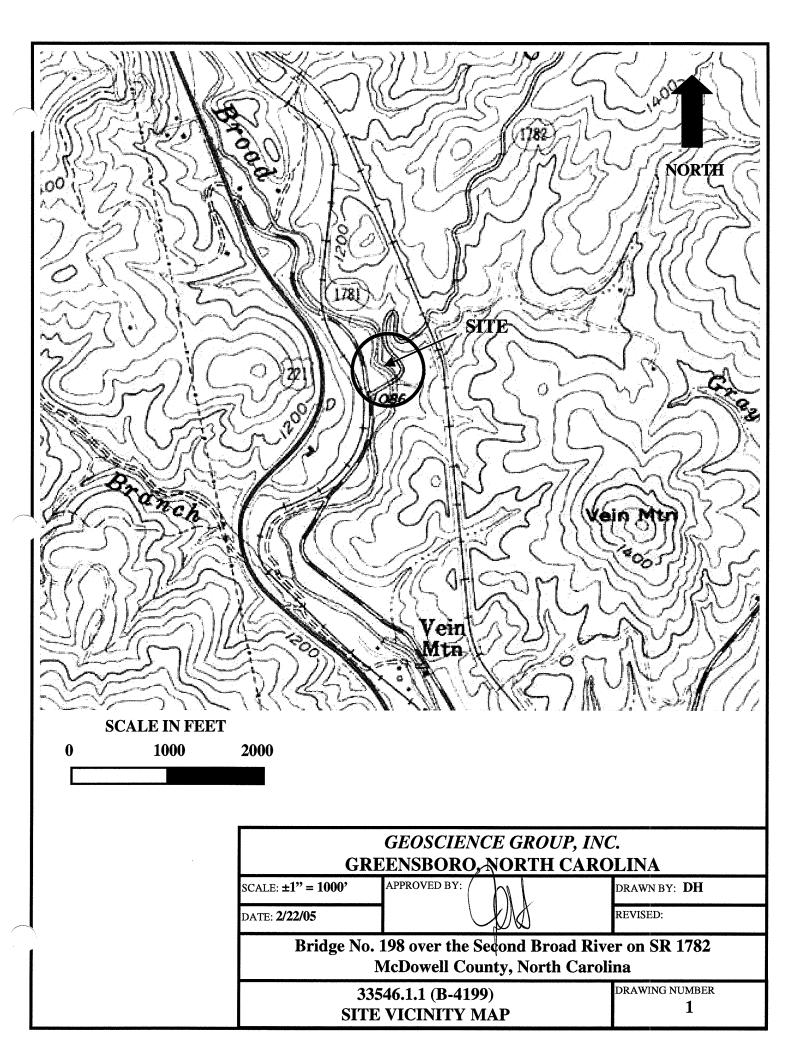
Project Manage

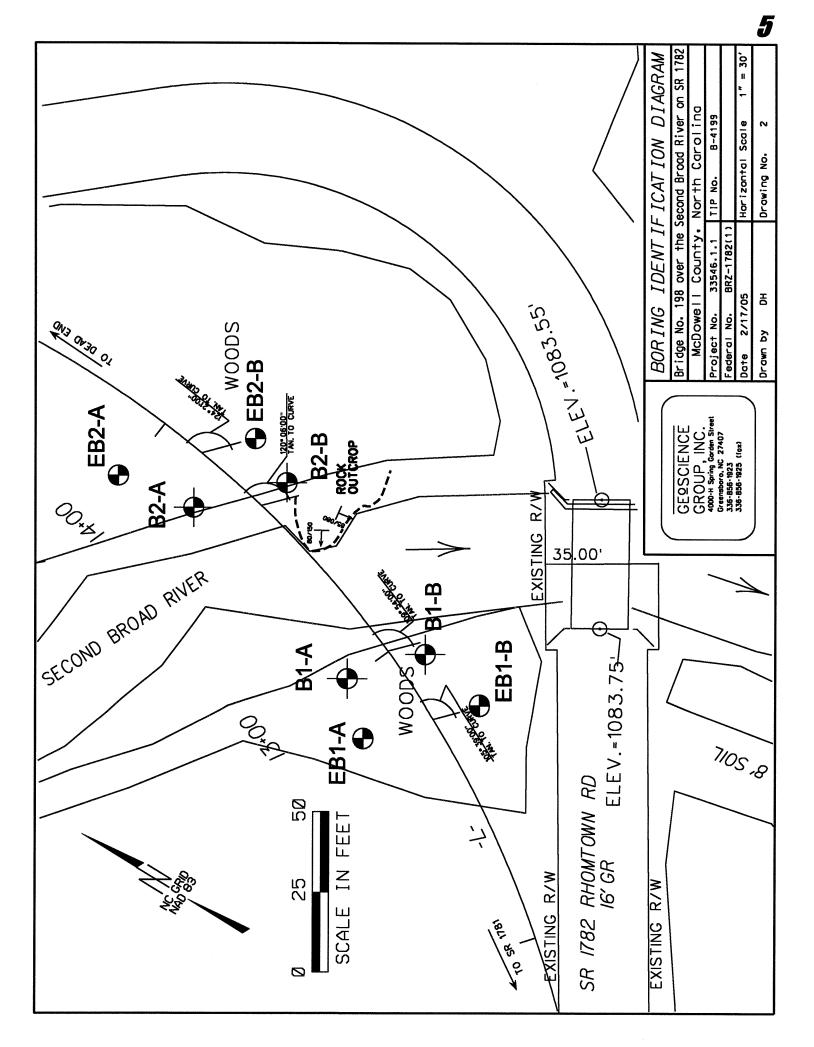
James D. Hoskins, III FE. Registered North Carolina

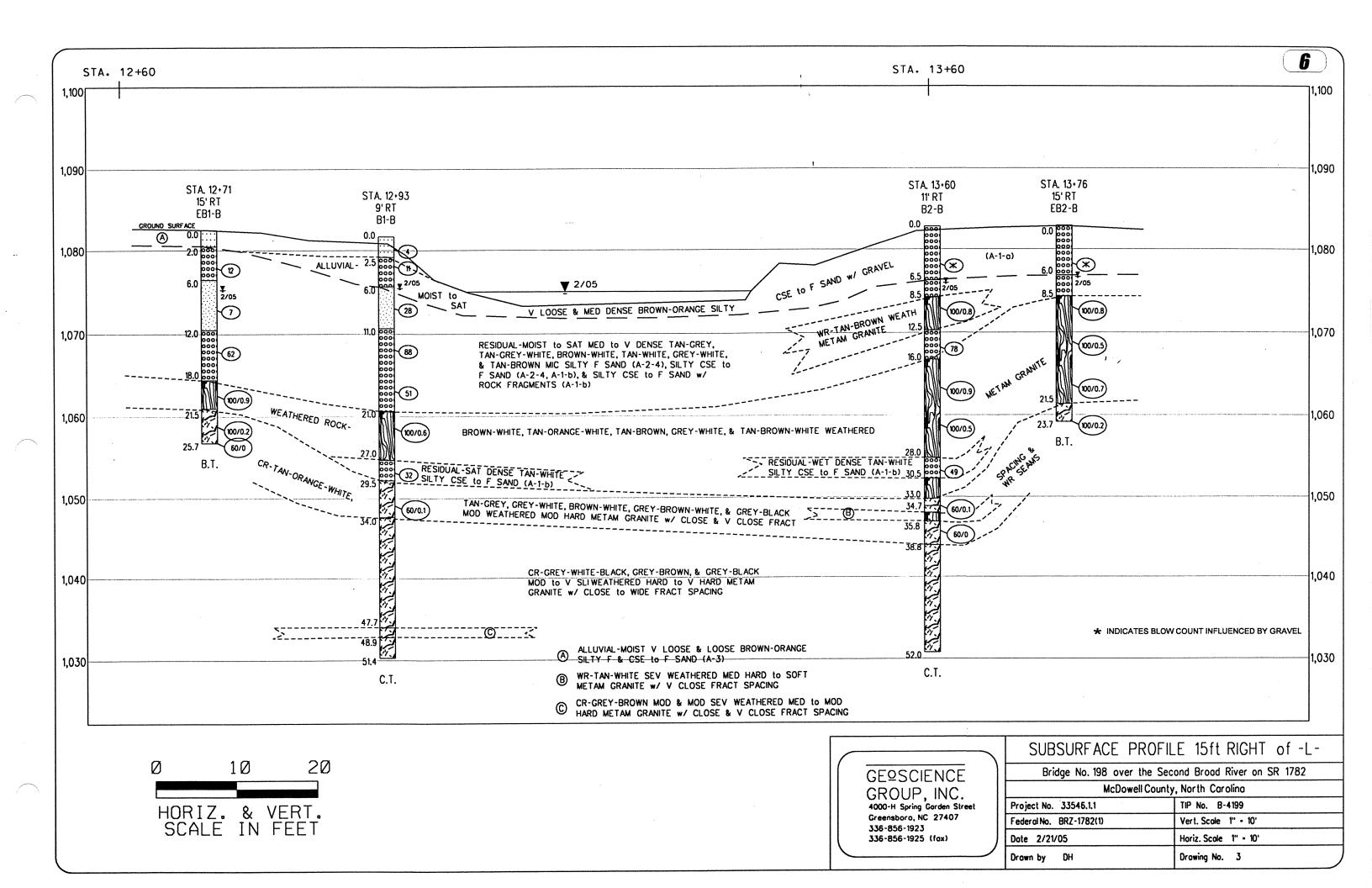
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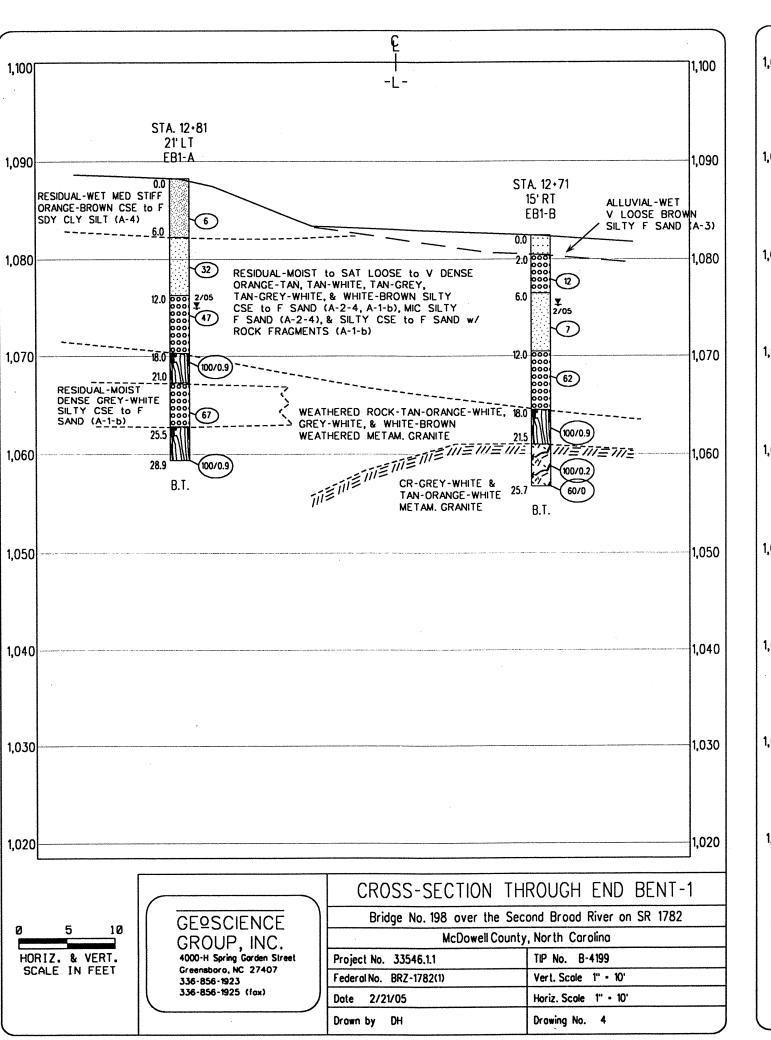
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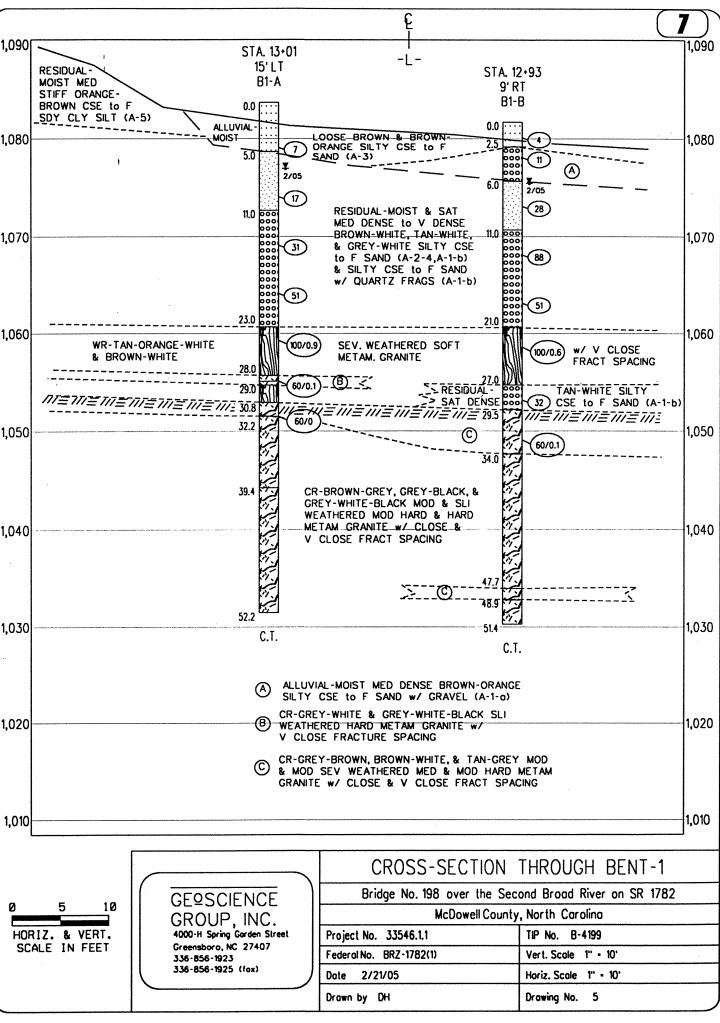
Enclosures

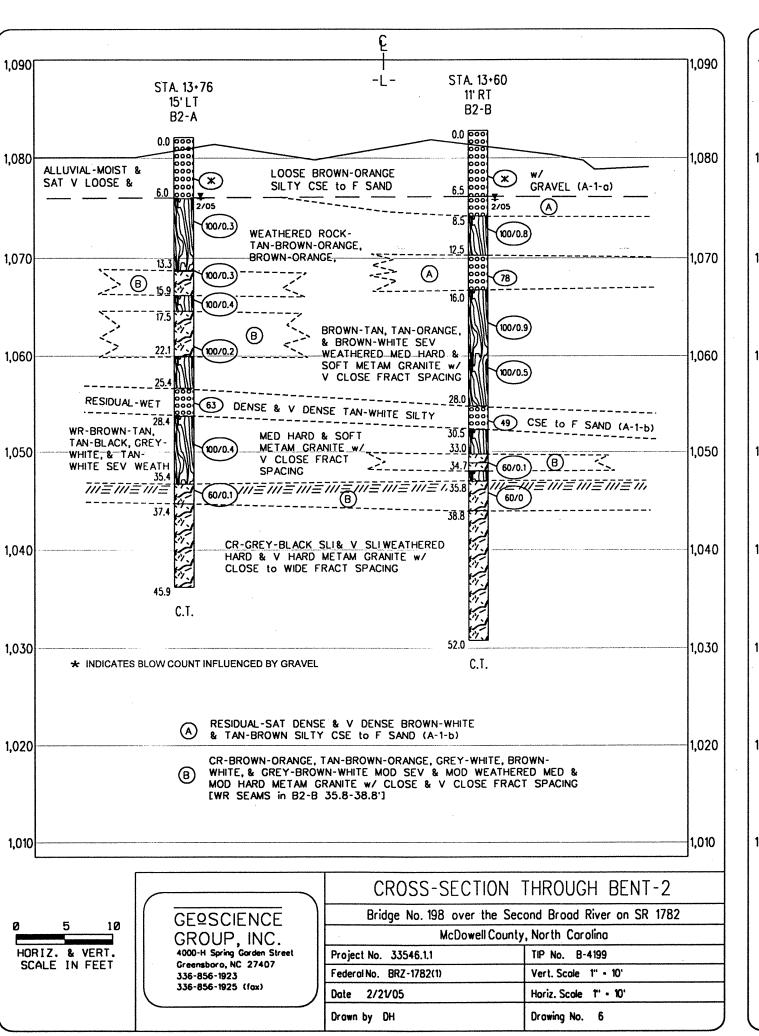


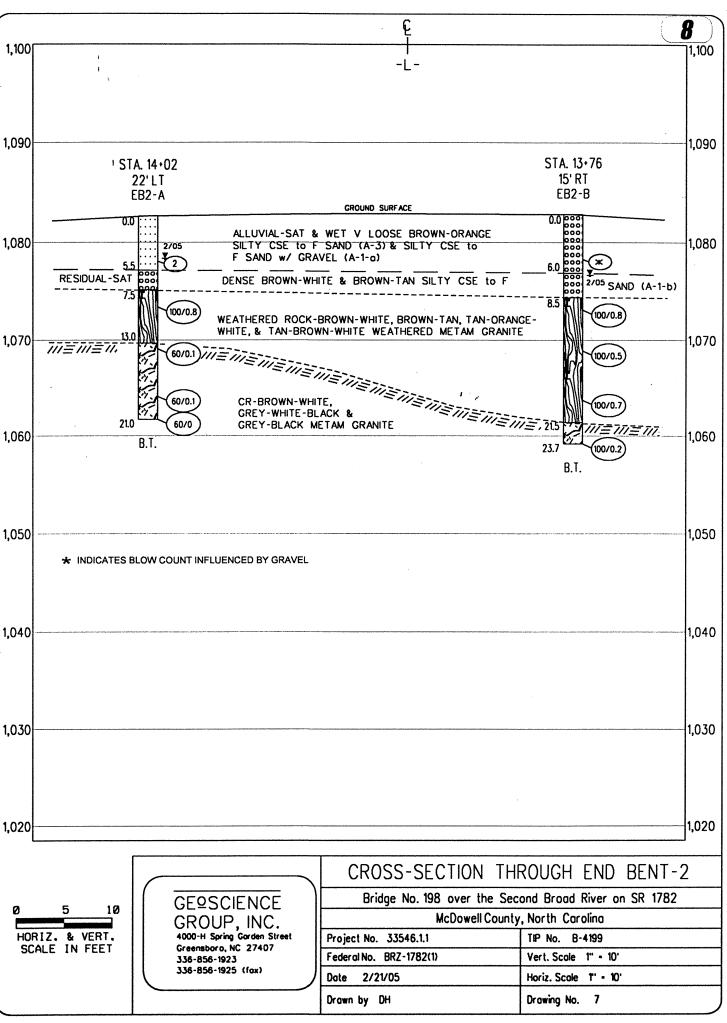












# GEOSCIENCE GROUP, INC. BORING LOG

# GEOSCIENCE GROUP

GEOSCIENCE GROUP, INC. BORING LOG

		M.						SHE	ET 1 OF 1			<b></b>		٧								SHEE	T 1 OF 1	I
PROJE	CT NO.	33546.1.1	ID.	B-4199 FED.	NO.BRZ-1782(1)	CO. N	cDowell		RV. D. Hardister		PROJI	ECT NO	. 33546.	1.1	ID. B-4	199 <b>FE</b>	D. NO.BR	Z-1782(1)		CO. Mo	Dowell	FIELD SUPER		
SITE DE	SCRIP	TION Bridg	e No. 1	98 over the Second	Broad River on SR 1782				GROUND W	ATER (ft)	SITE	DESCRI	PTION E	Bridge N	lo. 198 c	ver the Seco	nd Broad	River on SR 178	32	***************************************			GROUND	WATER (ft)
BORING	NO.	EB1-A	В	ORING LOCATION	12+81 OFFS	ET 21' LT	ALIG	NMENT -L-	0 HR.	13.8	BORIN	IG NO.	EB1-B		BORII	NG LOCATIO	ON 12+71	OFF	<b>SET</b> 15	RT	ALIG	NMENT -L-	0 HR.	8.8
COLLA	R ELEV	'. 1088.3 ft	TOTA	L DEPTH 28.9 ft	NORTHING 672	2031.41	EAS	TING 1118288.15	24 HR.	13.3	COLL	AR ELE	V. 1082	5 ft   T	OTAL D	EPTH 25.7	ft	NORTHING 6	72005.9	5	EAST	TING 1118315.70	24 HR.	7.2
DRILL N	IACHIN	E CME 55	)x	DRILL METHOD	HSA	HAMMER	TYPE A	utomatic FINAL C	CASING DEPTH	N/A	DRILL	MACHI	NE CME	550x	DR	ILL METHO	) HSA		HA	MMER	TYPE A	utomatic FINAL C	ASING DEPT	TH N/A
DATE S	TARTE	D 2/2/05	СОМ	PLETED 2/2/05	DRILLING FLUID DE	NSITY N/A	s	URFACE WATER DI	EPTH N/A		DATE	STARTE	ED 2/2/0	5 C	OMPLE	TED 2/2/05	DRIL	LING FLUID D	ENSITY	N/A	s	URFACE WATER DE	PTH N/A	~
ELEV.	٠ +	BLOW CO		4	VS PER FOOT		L	SOIL AND ROCI	K DESCRIPTION		i i	DEPTH		V COUNT			OWS PER F		SAMP.			SOIL AND ROCK	DESCRIPTIO	V
(ft)	(ft)	0.5ft 0.5ft	0.5ft	0 20 40	0 60 80 100	NO. MOI	G				(ft)	(ft)	0.5ft	0.5ft 0	0.5ft 0	20 	40 6 1 1	0 80 10	NO.	MOI	3			
	l	Ì		-																				
1088.3	0.00			Ground Sur	face Elev. 1088.3 ft		1088.3			0.00	1082,5	0.00				Ground S	urface Ele	v. 1082.5 ft			1082.5			0.00
l t								Residual-Medium Stift to Fine Sandy Clayey	f Orange-Brown Co SILT (A-4)	arse		†			.		<i>.</i>			:		Alluvial-Very Loose Br (A-3)	own Silty Fine S	SAND
<b>l</b> †				·								t								::	1080.5	D		2.0
	3.0		<u> </u>	<b>.</b>		SS-1 23.1					1080-	3.5			.					00	20	Residual-Medium Den Coarse to Fine SAND	with Rock Fragi	nty ments
1085		2 3	3	. •6		55-1 23.1						3.5	5	6	6 .					'''  oo	0	(A-1-b)		
lt				.   ·								†								00	00			•
l I				. <del> </del> .			1082.3	Residual-Dense Oran	nge Tan Silty Coars	6.0		†			.	لــــ				90	1076.5	Pesidual Losse Tan G	rev White Mica	6.0
l I					· · · · · · · · · · · · · · · · · · ·			Fine SAND (A-2-4)	ige-Tall Silly Coals	610		†			.							Residual-Loose Tan-G Silty Fine SAND (A-2-4	)	ceous
1080	8.0	14 17	15	<b>↓</b>		l l M	[			ĺ	1075-	85					· · · · · ·							
'**				•32		"							4	3	4 .				SS-2	<del></del>				
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1 1	l				· · · · · · · · · · · · · · · · · · ·					į					•									
1 1					<del></del>		1076.3	Residual-Dense Tan-\	White Silty Coarse	12.0 to	1070-				1.			1		00	1070.5	Residual-Very Dense \	White-Brown Sil	12.0 ty
1075	13.0	14 20	27	<b>.</b>		<b>Y</b>	000	Fine SAND (A-1-b)			1070	13.5								SAT		Coarse to Fine SAND	(A-1-b)	
]	l				47	M	000						15	24	38 .			62		SAT				
1 1	l						000								.					1 60	201			
							000					_			•					000				
1							000				1065-	_			•					00				
1070	18.0	41 59/0.	<del>                                     </del>			м	1070.3	Weathered Rock-Tan-	-Orange-White	18.0		18.5		44 5							1064.5	Weathered Rock-White		18.0 ered
					100/0.9		)/// <b> </b>	Weathered Metamorp	onosed Granite			1	9	41   59	9/0.4			• • • • • • • • • • • • • • • • • • • •		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\\\ <b>L</b>	Metamorphosed Grani	te	
							SSIF 1007.0			21.0		1						100/0.9	'		₩			
						1 1 1	1067.3	Residual-Dense Grey Fine SAND (A-1-b)	-White Silty Coarse	21.0 to		<u> </u>			'			• • • • • • •		, K	1061.0	Crystalline Rock-Tan-0	Yrango M/hito	21.5
<del> </del>	23.0						000	Fine SAND (A-1-b)			1060-	-			'					1		Metamorphosed Grani		
1065	23.0	16 27	40	1		м м	000					23.5	100/0.2					100/0.2		M	4			
1 +					• • • • • • • • • • • • • • • • • • • •	1 1 1	000					+									4			
<del> </del>							1062.8	Weathered Rock-Grey	v-White Weathered	25.5	1/05	25.7	60/0					60/0	<b>_</b>	M	1056.8	Boring Terminated with	Standard Dan	25.7
l t							M	Metamorphosed Gran	nite		1 2/2	+	60/0					, 33/3		"	ŀ	Test Refusal at Elev. 1 Rock (Metamorphosed	056.8ft in Cryst	alline
l t	28.0						KWF .				7.GD	+									-	Rock (Wetamorphosed	Granite)	
1060		25 75/0.		1		М	1059.4			28.9		+									+			
l t	l				100/0.9		F	Boring Terminated @ Weathered Rock (Met	Elev. 1059.4ft in tamorphosed Grani	te)	Ž .	-									ŀ			
†					•		ŀ				33.6	+									+			
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							[				BORE	†									t			
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GEOSCIENCE GROUP, INC. BORING LOG

GEOSCIENCE GROUP

GEOSCIENCE GROUP, INC. BORING LOG

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PROJ	ECT NO	. 3354	6.1.1	ID.	B-419	99	FED.	NO.BR	Z-1782(	1)			co.	McD	owell	FI	ELD SUPE	RV. D. Hardister	
SITE D	ESCRI	PTION	Bridge	e No. 1	98 ov	er the S	Second	Broad I	River or	SR	1782	2				,		GROUND V	/ATER (ft)
BORIN	IG NO.	B1-A		В	ORIN	G LOC	ATION	13+01		0	FFS	<b>SET</b> 15	'LT		AL	IGNMENT	-L-	0 HR.	N/M
COLL	AR ELE	<b>V</b> . 108	33.7 ft	TOTA	L DE	PTH	52.2 ft		NORTH	ling	67	2045.1	6		EA	STING 111	8301.02	24 HR.	6.7
DRILL	MACHI	NE C	ME 550	x	DRIL	LMET	HOD I	HSA/HC	2			HA	AMME	R TY	/PE	Automatic	FINAL	CASING DEPTH	28.6 ft
DATE	STARTE	ED 2/4	/05	СОМ	PLET	ED 2/7	7/05	DRIL	LING F	LUID	DE	NSITY	Cree	ek W	ater	SURFACE	WATER D	DEPTH N/A	
ı	DEPTH	ļ	ow col	·	1			S PER F		_		SAMP.	lacksquare			SC	II AND ROC	CK DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	<u> </u>	20	40 	60	8 (	0	100	NO.	MO	G					
	_				1						***************************************								
1045-	_									• •	• •			المنزية					
1										• • •				1	104		ne Book Gre	y-White-Black and	39.
										• •	• •			17.		Grev-Bla	ick Sliahtly V	Veathered Hard inite with Close and	\/ami
					· ·									1		Close Fr	rpnosed Gra acture Spac	ing	very
	,				• •		• • • •							W.	, .			•	
1					• •									1	-	,			
1040-	-												l	1	_				
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1035-	-														-				
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.					<u></u>		<b></b>	<u></u>	<u> </u>	<u> </u>	<u> </u>			17.	1031				52.
-	-														_	Coring T Crystallir	erminated at ne Rock (Me	t Elev. 1031.5ft in tamorphosed Grani	te)
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	-(;   Vit )	3354	311	ID.	199 <b>FED. NO</b> .BRZ-1782(1)	CO.	McDa	Well FIFI D QUIDE	RV. D. Hardister
	ESC PI				iver the Second Broad River on SR 1782	100.	IVICIDO	Weii FIELD 30PE	GROUND WATER (ff)
	IG NO.		Diluge	Y	NG LOCATION 13+01 OFFSET	15' I T		ALIGNMENT -L-	0 HR. N/M
	AR ELE		274		EPTH 52.2 ft NORTHING 67204			EASTING 1118301.02	24 HR. 6.7
	MACHI				ILL METHOD HSA/HQ		D TV		CASING DEPTH 28.6 ft
	STARTE		<sub>1</sub>		TED 2/7/05 DRILLING FLUID DENS				
	DEPTH		OW COL			MP. V	1	aler John AGE WATER	
(ft)	(ft)	0.5ft	0.5ft	0.5ft	00 40 00 00 400	0. MO	O G	SOIL AND ROO	CK DESCRIPTION
			·			V IVIO		······································	
1083.7	0.00				Ground Surface Elev. 1083.7 ft		<del>   </del>	1083.7 Alluvial-Loose Brown	0. Silty Coarse to Fine
•	-					ŀ		SAND (A-3)	Tolky obuide to this
•	-							•	
•	3.5							-	
1080-	- 3.5	2	2	5		М	:::	_	
	-					l		1078.7	
•	-							Residual-Medium De Coarse to Fine SANI	ense Brown-White Silty D (A-2-4)
	-						-	-	
	-				<u></u>			-	
1075-	8.5	6	11	6		SAT		_	
	F				<b>∮</b> 17			-	
	-							- 1072.7	11
	-						000	Residual-Dense to V Silty Coarse to Fine	ery Dense Brown-White SAND with Quartz
	L						000	Fragments (A-1-b)	
1070-	13.5	5	11	20		SAT	000	<del></del>	
		Ţ			<b>4</b> 31	0/11	000	-	
	L						000	-	
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	L						000	<u>-</u>	
1065-	18.5	6	17	34		S-3 SAT	000		
	L	ľ	.,	0,	51	0/11	000	<u>-</u>	
	L						000	_	
	L					l	000	_	
	Ĺ					ŀ	000	<del>-</del> 1060.7	23
4000	23.5		05/0.4			<b>1</b>	KIII	Weathered Rock-Bro	wn-White Weathered
1060-		35	65/0.4		100/0.9	W	NW.	<ul> <li>Metamorphosed Gra</li> </ul>	nite
•							W	<u>-</u>	
•								•	
•	T						KI	-	
•	28.5							1055.7 Crystalline Rock-Gre	y-White Metamorphosed 28
1055-		60/0.1				W		1054.7 \Granite	y-White-Black Slightly
•	t						NI	Weathered Hard Me	tamorphosed Granite
•	t							Weathered Rock-Bro	own-White Severely amorphosed Granite with
	32.2							1051 5 Very Close Fracture	Spacing / 33
•	<u> </u>	60/0			60/0	M	<b>**</b>	Crystalline Rock-Gre Brown-White Modera	itely Severely Weathered
1050-	H						1	Moderately Hard Me with Close and Very	Close Fracture Spacing
	i	I	1			1	ايزما	Crystalline Rock-Bro	wn-Grey and Grey-Black
•	r					ļ	1	Moderately Weather	ed Moderately Hard and d Granite with Close and

## GEOSCIENCE GROUP, INC. CORE BORING REPORT

SHEET 1 OF 2

PROJ	ECT N	<b>D.</b> 33	546.1.1	ID.	B-419	9	FED.	NO.BF	RZ-1782(1)	CO. McDo	weil	FIELD SUPE	RV. D. Hardister	
SITE	DESCR	IPTIC	ON Bridg	ge No.	198 ov	er the	Second	Broad	River on S	R 1782			GROUND W	/ATER (ft)
BORII	NG NO.	B1	-A	E	BORING	G LOC	ATION	13+0	1	OFFSET 15' LT	ALIGNME	NT -L-	0 HR.	N/M
COLL	AR ELI	EV.	1083.7 ft	тот	AL DE	PTH	52.2 ft		NORTHIN	IG 672045.16	<u> </u>	1118301.02	24 HR.	6.7
			CME 55	<del></del>			HOD	<del></del>		HAMMER TY	<del></del>		CASING DEPTH	28.6 ft
<b> </b>	START		·	CON	MPLET	<del></del>				JID DENSITY Creek Wa	ter SURFA	CE WATER D	EPTH N/A	
		HQ		l Ri	JN	,	AL RUN	1 23.6 ATA	ift T	DRILLER D. Harris				
(ft)	DEPTH (ft)	(ft)	DRILL RATE (Min./ft)	REC.	RQD (ft)	SAMP.	REC.	RQD		DESCR	IPTION AND F	REMARKS		
	(,,,	(,		<u>%</u>	<u>`%</u>	,,,,,	%	%						
1055.1 1055.1	28.6	3.6		(1.8)	(0.4)		0.4	0.0	1054.7	Begin Crystalline Rock-Grey-	Coring @ 1 White-Black		pered Hard	29.0
1000.1	20.0		2:26	50%	11%		100%	0% N/A	1034.7	Metamorphosed Grani	te with Very	Close Fracture	Spacing	\[ \frac{29.0}{}{}
			2:06				0.0	IN/A	F	4 Jts @ 0-10° Weathered Rock-Brow Metamorphosed Grani	n-White Sev	verely Weather	ed Soft	
			2.00						1052.9		te with Very	Close Fracture	Spacing	30.8
			1:52				1.4 100%	0.4 29%		No Discernible Jts Crystalline Rock-Grey- Weathered Moderately	Brown and I	Brown-White M	loderately Severe	
1051.5	32.2		1:53/0.6			N=60/0		2070	1051.5	Very Close Fracture Sp	pacing	norpriosed Gra	inite with Close a	na 32.2
1051.5	32.2	5.0	4:11	(4.7) 94%	(2.3) 46%	14-60/0	6.9	2.6		8 Jts @ 0-10° 3 Jts @ 20-30° 1 Jt @ 60-70°				<u> 32.2</u>
			4.11	3470	4070		96%	36%		1 Jt @ 60-70 Crystalline Rock-Brown	n-Grev and (	Grev-Black Mod	derately Weather	ed .
			2:11						_	Moderately Hard and F Very Close Fracture S	lard Metamo	orphosed Gran	ite with Close and	Ĭ
										·				
			2:06			<b>5</b> 0.4				27 Jts @ 0-10 2 Jts @ 10-20 3 Jts @ 20-30 5 Jts @ 50-60 3 Jts @ 80-90				
			2:57			RS-1			-	5 Jts @ 50-60 3 Jts @ 80-90				
							·							
1046.5	37.2		2:18					-	<u> </u>					
1046.5	37.2	5.0	4:17	(5.0) 100%	(2.8) 56%				_					
			3:38						-					
			5:11				12.4	8.6	1044.3	Crystalline Rock-Grey-	White-Black	and Grey-Blad	k Slightly Weathe	39.4 ered
			<b>5</b>				97%	67%		Hard Metamorphosed Spacing	Granite with	Close and Ver	y Close Fracture	
			3:57						F	23 Jts @ 0-10°				
			3:30							3 Jts @ 20-30 1 Jt @ 30-40				
1041.5 1041.5	42.2	5.0	3.00	(4.6)	(2.3)					25 Jis @ 10-20 3 Jis @ 20-30 1 Jis @ 20-30 1 Jit @ 30-40 2 Jis @ 50-60 4 Jis @ 60-70 7 Jis @ 70-80				
1041.5	42.2	3.0	5:13	(4.6) 92%	(2.3) 46%				-	7 Jts @ 70-80°				
			6:07											
			6:27						_					
			9:14						-					
			13:35						-					
			15:10											
1036.5 1036.5	47.2 47.2	5.0		(5.0)	(3.8)									
1000.0	71.2	5.0	3:27	(5.0) 100%	(3.8) 76%				-					
			4:04											
			4:01											
			8:19						-					
H	1	- 1	7:25						<del> </del>					

# GEOSCIENCE GROUP

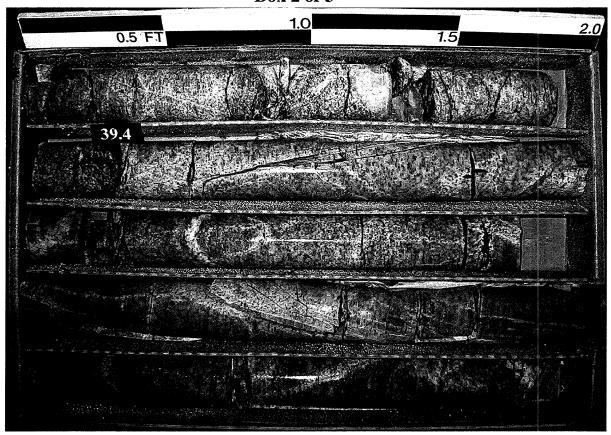
## GEOSCIENCE GROUP, INC. CORE BORING REPORT

			546.1.1		B-419		<del></del>		RZ-1782(1)		CO. McDov	well	FIELD SUPE	ERV. D. Hardister	
SITE	DESCR	IPTIC	N Bride	ge No.	198 ov	er the S	Second	Broad	River on S	SR 1782			·	GROUND W	ATER (ft)
	NG NO						ATION	13+0	1	OFFSET 15'	LT	ALIGNM	ENT -L-	0 HR.	N/M
			1083.7 ft		<del></del>	PTH			L	NG 672045.16			3 1118301.02	24 HR.	6.7
			CME 55	<del></del>			HOD				MMER TYP			CASING DEPTH	28.6 ft
	STAR		2/4/05	CO	MPLET	ED 2/7				UID DENSITY		ter SURI	ACE WATER	DEPTH N/A	
	SIZE	HQ		ГБІ	JN	,L	AL RUN		ft	DRILLER C	D. Harris				
ELEV.	DEPTH (ft)	RUN (ft)	DRILL RATE (Min./ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	REC.	RQD %			DESCR	IPTION AN	DREMARKS		
											Continu	ed from p	evious page		
1031.5	52.2		8:13						_ 1031.5						52.
						,			-	Coring Tern (Metamorph	ninated at E nosed Grani	lev. 1031 te)	5ft in Crystalline	e Rock	
									_			1 /			
	·								_						
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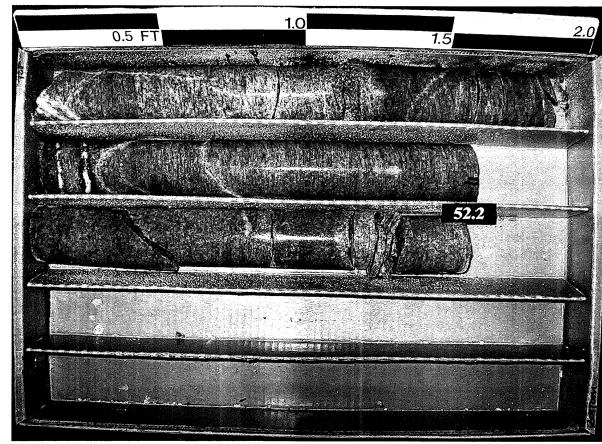
33546.1.1/B-4199 B1-A Box 1 of 3



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33546.1.1/B-4199 B1-A Box 3 of 3



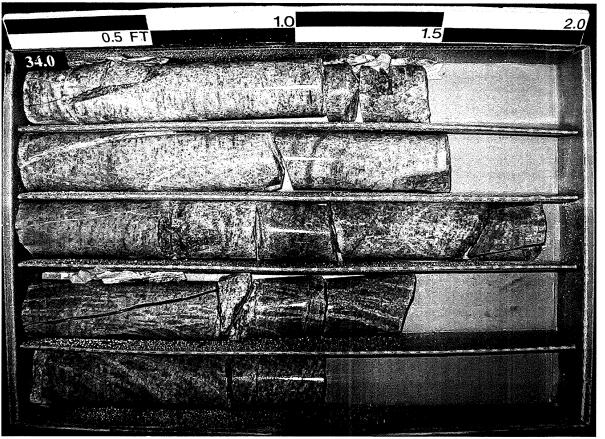
GEOSCIENCE GROUP, INC. **BORING LOG** 

GROUI	SHEET 1 OF		ar,		SHEET 2 OF 2
PROJECT NO. 33546.1.1 ID. B-4199 FED. NO.BRZ-1782(1)	CO. McDowell FIELD SUPERV. D. Hard	<del></del>	33546.1.1 <b>ID.</b> B-4199 <b>FED. NO.</b> BRZ-178	82(1) CO. McDow	
SITE DESCRIPTION Bridge No. 198 over the Second Broad River on SR 1	32 GROUI	UND WATER (ft) SITE DESCRIP	TION Bridge No. 198 over the Second Broad River		GROUND WATER (ft)
BORING NO. B1-B BORING LOCATION 12+93 OF	SET 9' RT ALIGNMENT -L- 0 HR.	R. N/M BORING NO. I	B1-B BORING LOCATION 12+93	OFFSET 9' RT	ALIGNMENT -L- 0 HR. N/M
COLLAR ELEV. 1081.7 ft TOTAL DEPTH 51.4 ft NORTHING	72028.59 <b>EASTING</b> 1118320.22 <b>24 HR.</b>	R. 6.2 COLLAR ELEV	. 1081.7 ft   TOTAL DEPTH 51.4 ft   NOR	RTHING 672028.59	EASTING 1118320.22 24 HR. 6.2
DRILL MACHINE CME 550x DRILL METHOD HSA/HQ	HAMMER TYPE Automatic FINAL CASING DE	DEPTH 34.0 ft DRILL MACHIN	E CME 550x DRILL METHOD HSA/HQ	HAMMER TYPE	
DATE STARTED 2/2/05   COMPLETED 2/4/05   DRILLING FLUID	ENSITY Creek Water SURFACE WATER DEPTH N/A	N/A DATE STARTE	D 2/2/05 COMPLETED 2/4/05 DRILLING		SURFACE WATER DEPTH N/A
ELEV. DEPTH BLOW COUNT BLOWS PER FOOT	SAMP. V	ELEV. DEPTH	BLOW COUNT BLOWS PER FOOT	SAMP. V	
(ft) (ft) 0.5ft 0.5ft 0.5ft 0 20 40 60 80	00 NO. MOI G SOIL AND ROCK DESCRIPT	(ft) (ft)	0.5ft 0.5ft 0.5ft 0 20 40 60	80 100 NO. MOI G	SOIL AND ROCK DESCRIPTION
000 7 0 00 Control Outlier 510 4004 7 ft					
1081.7 0.00 Ground Surface Elev. 1081.7 ft	1081.7 Alluvial-Loose Brown-Orange Silty	ty Coarse to			
1 2 2	M Fine SAND (A-3)				
25	. 1079.2	2.5			
1	M Ooo Alluvial-Medium Dense Brown-Oral Coarse to Fine SAND with Gravel (	range Silty T			
	. M Alluvial-Medium Dense Brown-Orai Coarse to Fine SAND with Gravel (	1040			
1075	Residual-Medium Dense Tan-White	nite Silty		RS-2	
7.5	Coarse to Fine SAND (A-2-4)				
7 11 17	.   M []				
T         · · · · ·   · · · · · · · ·		1035			
					034.0 47
1070	Residual-Very Dense Tan-White ar	and 11.0			Crystalline Rock-Grey-Brown Moderately and Moderately Severely Weathered Medium to 48
12.5	. Grey-vyrite Sitty Coarse to Fine SA	SAND			Moderately Hard Métamorphosed Granite with Close and Very Close Fracture Spacing
22 37 51	SS-4 M 000-				Crystalline Rock-Grey-Brown to Grey-Black-White Moderately to Slightly
†	000				030.3 Weathered Hard Metamorphosed Granite with Close and Very Close Fracture Spacing
†           /	.   000   00				Coring Terminated at Elev. 1030.3ft in Crystalline Rock (Metamorphosed Granite)
†             /	000				Crystalline Rock (Metamorphosed Granite)
1065	1 1 10001				
18 23 28	. M 000 000 000 000				
†   <sub> </sub>	.   000-				
†	.	†			
†	oool ooor 1060.7 III Weathered Rock-Tan-Orange-Whit	21.0 +			
1060+ 22.5	Weathered Metamorphosed Granit	nite +			
70 30/0.1		†			
†		†			
†		†			
†	,	1 10 10 10 10 10 10 10 10 10 10 10 10 10			
1055+ 27.5	1054.7 Residual-Dense Tan-White Silty Co	27.0 N			
6 7 25	SAT SAT Fine SAND (A-1-b)	6   +			
†	0000	29.5			
	Crystalline Rock-Tan-Grey Metamo	20.0			
†	Grainte	8			
1050+ 32.5		800			
60/0.1	·   w ₩	5  +			
†	- 1047.7 Crystalline Rock-Grey-White-Black	34.0			
†	Grey-Brown Moderately and Slightly Weathered Hard Metamorphosed O	h Granite			
	weathered Hard Metamorphosed G with Close and Very Close Fracture	ure Spacing			
1045	<u> </u>	JÖN +			

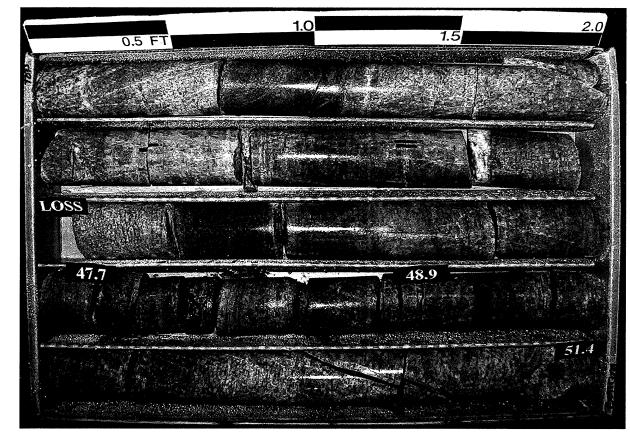
## GEOSCIENCE GROUP, INC. CORE BORING REPORT

PROJ	ECT N	<b>D</b> . 33	3546.1.1	ID.	B-419	99	FED.	NO.B		SHEET 1 OF 1 SUPERV. D. Hardister
SITE	DESCR	IPTIC	ON Bridg	ge No.	198 ov	er the	Second	Broad	River on SR 1782	GROUND WATER (ft
BORI	NG NO	B1	-B	E	BORIN	G LOC	ATION	12+9	OFFSET 9' RT ALIGNMENT -L-	0 HR. N/M
COLL	AR ELI	EV.	1081.7 ft	тот	AL DE	PTH	51.4 ft		NORTHING 672028.59 EASTING 1118320	.22 <b>24 HR</b> . 6.2
DRILL	MACH	INE	CME 55	0x	DRIL	L MET	HOD	HSA/F	HAMMER TYPE Automatic FI	NAL CASING DEPTH 34.0 ft
DATE	STAR	ED	2/2/05	CON	IPLET	ED 2/4				TER DEPTH N/A
	SIZE	HQ			(K)		AL RUI		t DRILLER D. Harris	
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min./ft)	REC. (ft) %	RQD (ft) %	SÁMP. NO.	REC.	RATA RQD %	DESCRIPTION AND REMARKS	\$
047.7									Begin Coring @ 1047.70 ft	
047.7	34.0	2.4	2:59	(2.4) 100%	(1.5) 63%		13.5 99%	10.4 76%	Crystalline Rock-Grey-White-Black and Gre Slightly Weathered Hard Metamorphosed G Close Fracture Spacing	y-Brown Moderately and ranite with Close and Very
			5:04						20 Jts @ 0-10° 7 Jts @ 10-20° 3 Jts @ 20-30° 2 Jts @ 60-70° 6 Jts @ 70-80°	
045.3	36.4		1:59/0.4						3 Jts @ 20-30° 2 Jts @ 60-70°	
045.3	36.4	5.0	3:53	(5.0) 100%	(3.6) 72%					
			0.00						17	
			2:56							
			3:53						•	
			4:03							
040.3	41.4		4:31							
040.3	41.4	5.0	4:50	(4.8) 96%	(4.2) 84%	RS-2				
			4:18			N3-2				,
			5:35							
			6:33							
									·	
035.3	46.4		5:14	/E 0\	(2.2)					
035.3	46.4	5.0	8:15	(5.0) 100%	(3.3) 66%					
			7:32				1.2	0.0	1034.0  Crystalline Rock-Grey-Brown Moderately an	d Moderately Severely
•			9:17				100%		Weathered Medium to Moderately Hard Met Close and Very Close Fracture Spacing	amorphosed Granite with
			16:04				2.5 100%	2.2 88%	7 Jts @ 0-10° 2 Jts @ 20-30° 1 Jt @ 60-70° Crystalline Rock-Grey-Brown to Grey-Black-	White Maderately to
									Slightly Weathered Hard Metamorphosed G Close Fracture Spacing	ranite with Close and Very
030.3	51.4		23:32						1030.3 3 Jts @ 0-10° 2 Jts @ 10-20° 1 Jt @ 30-40°	<u></u>
									2 Jts @ 70-80°  Coring Terminated at Elev. 1030.3ft in Cryst	
									(Metamorphosed Granite)	
		ì								

#### 33546.1.1/B-4199 B1-B Box 1 of 2



33546.1.1/B-4199 B1-B Box 2 of 2



#### GEOSCIENCE GROUP, INC. BORING LOG

SHEET 1 OF 2

CO. McDowell FIELD SUPERV. D. Hardister PROJECT NO. 33546.1.1 ID. B-4199 FED. NO.BRZ-1782(1) SITE DESCRIPTION Bridge No. 198 over the Second Broad River on SR 1782 **GROUND WATER (ft)** BORING NO. B2-A **BORING LOCATION 13+76** OFFSET 15' LT ALIGNMENT -L-0 HR. N/M COLLAR ELEV. 1082.1 ft TOTAL DEPTH 45.9 ft NORTHING 672113.85 **EASTING 1118321.21** 24 HR. 6.0 HAMMER TYPE Automatic FINAL CASING DEPTH 13.4 ft DRILL METHOD HSA/HQ DRILL MACHINE CME 550x DATE STARTED 2/8/05 COMPLETED 2/8/05 DRILLING FLUID DENSITY Creek Water SURFACE WATER DEPTH N/A **BLOW COUNT** ELEV. DEPTH **BLOWS PER FOOT** SAMP SOIL AND ROCK DESCRIPTION 0.5ft 0.5ft 0.5ft NO. (ft) (ft) Ground Surface Elev. 1082.1 ft 1082.1 Alluvial-Loose Brown-Orange Silty Coarse to Fine SAND with Gravel (A-1-a) 1080-▼ 000 Weathered Rock-Tan-Brown-Orange Weathered Metamorphosed Granite 1075-M 100/0. 100/0.3 1070-100/0. W Crystalline Rock-Brown-Orange Metamorphosed Granite
Crystalline Rock-Brown-Orange Moderately
Severely Weathered Medium Hard Metamorphosed Granite with Very Close to 15.9 Close Fracture Spacing
Weathered Rock-Brown-Orange Severely
Weathered Soft to Medium Hard
Metamorphosed Granite with Very Close 00/0 M 100/0.4 1065-Fracture Spacing
Crystalline Rock-Brown-Orange and Tan-Black-Orange Moderately Severely to Moderately Weathered Medium to Moderately Hard Metamorphosed Granite with Close and 20.9 Very Close Fracture Spacing 100/0.2 М 1060.0 1060-Weathered Rock-Brown-Tan Severely Weathered Soft Metamorphosed Granite with Very Close Fracture Spacing Residual-Very Dense White-Tan Silty Coarse to Fine SAND (A-1-b) W 30 1055 Weathered Rock-Brown-Tan and Tan-Black Severely Weathered Soft Metamorphosed
Granite with Very Close Fracture Spacing 100/0.4 M 1050 Crystalline Rock-Tan-White-Black Moderately and Moderately Severely Weathered
Moderately and Medium Hard 60/0.1

## GEOSCIENCE GROUP

GEOSCIENCE GROUP, INC. BORING LOG

SHEET 2 OF 2

				·		·							SF	HEET 2 OF 2	
PROJE	CT NO.	33546	5.1.1	ID. (	3-4199	FED. NO.	BRZ-1782( <i>1</i>	1)		CO. M	lcDov	well	FIELD SUI	PERV. D. Hardister	
SITE D	ESCRIP	TION	Bridge	No. 19	98 over the S	Second Broa	ad River on	SR 178	2					GROUND WA	ATER (ft)
BORIN	G NO.	32-A		ВС	ORING LOC	ATION 134	<b>⊦</b> 76	OFF	SET 15	LT		ALIGNMEN <sup>-</sup>	Γ -L-	0 HR.	N/M
COLLA	R ELEV	. 108	2.1 ft	TOTA	L DEPTH	45.9 ft	NORTH	ING 6	72113.8	5		EASTING 1	118321.21	24 HR.	6.0
DRILL	MACHIN	E CN	1E 550	λ T	DRILL MET	HOD HSA	/HQ		НА	MMER	TYF	PE Automatic	c FINA	L CASING DEPTH	
DATE	STARTE	D 2/8/	05	COME	PLETED 2/8	3/05 D	RILLING F	LUID DI	ENSITY	Creek	k Wat	ter SURFAC	E WATER	R DEPTH N/A	
ELEV.	DEPTH	BLC	ow cor	JNT		BLOWS PE			SAMP.	<b>V</b> /	L				<del></del>
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0 20	40	60 80	) 10	NO.	MOI		S	OIL AND R	OCK DESCRIPTION	
1	<b> </b> -								1	MOI		1014.7 Close Crysta Weath With C Spacir	and Very Ci Illine Rock-C ed Hard Mo lose and Mo ng	lose Fracture Spacing Grey-Black Slightly Metamorphosed Granite oderately Close Fracture d at Elev. 1036.2ft in Metamorphosed Granite blow count influenced b	45.9
-	-														

## GEOSCIENCE GROUP, INC. CORE BORING REPORT

SHEET 1 OF 2

PRO	JECT I	<b>10</b> . 3	3546.1.1	ID.	B-419	9	FED.	NO.BF	RZ-1782(1) CO. McDowell FIELD SUPERV. D. Hardister	
SITE	DESC	RIPTI	ON Bridg	ge No.	198 ov	er the S	Second	Broad	River on SR 1782 GROUND WATE	R (ft)
<b> </b>	ING N			<del></del>			ATION	13+76	1000-1000-1000-1000-1000-1000-1000-100	
			1082.1 ft		<del></del>	PTH				.0
<b> </b>			CME 55	<del></del>	J		HOD I	<del></del>		4 ft
ļ	E SIAF		2/8/05	CON	MPLE	ED 2/8	AL RUN		ILLING FLUID DENSITY Creek Water SURFACE WATER DEPTH N/A  Oft DRILLER D. Harris	
	DEPT		·	RU	JN	SAMP.	STR		DRILLER D. Hams	
(ft)	(ft)	(ft)	DRILL RATE (Min./ft)	REC. (ft) %	RQD (ft) %	NO.	REC. %	RQD %	DESCRIPTION AND REMARKS	
1068.	7								Begin Coring @ 1068.70 ft	
1068.	7 13.	4 2.5	2:03	(2.5) 100%	(0.0) 0%		2.5 100%	0.0 0%	Crystalline Rock-Brown-Orange Moderately Severely Weathered Medium Hard Metamorphosed Granite with Very Close to Close Fracture Spacing	
			1:51						12 Jts @ 0-10° 5 Jts @ 10-20° 1 Jt @ 80-90° (continuous from 13.4 to 15.3')	
1066.	2 15	9	1:08/0.5	-		N=100/ 0.4	0.6	N/A	1066.2	15.9
1065.	8 16	3 4.6	1.00	(4.0)	(1.5)	0.4	38%	IN/A	Weathered Rock-Brown-Orange Severely Weathered Soft to Medium Hard Metamorphosed Granite with Very Close Fracture Spacing	
			4:02	87%	33%				8 Jts @ 0-10° 1064.6 Other Jts Not Discernible	17.5
			2:51				4.4 96%	2.3 50%	Crystalline Rock-Brown-Orange and Tan-Black-Orange Moderately	
٠			3:25						13 Jts @ 0-10° - 3 Jts @ 10-20° 6 Jts @ 80-90° (from 18.5 to 20.5')	
			3:13						0 3/3 @ 00-90 (110111 10.3 to 20.3 )	
1061.	2 20	9	1:59/0.6			N=100/				
1061.	0 21	1 4.8	2:46	(1.0) 21%	(0.8) 17%	0.2				
							0.0	N/A	1060.0 Weathered Rock-Brown-Tan Severely Weathered Soft Metamorphosed	22.1
			1:38				0%	14//	Granite with Very Close Fracture Spacing	
			1:48						No Discernible Jts	
			1:42							
									1056.7	25.4
1056.	2 25	9	1:15/0.8			N=63	N/A	N/A	Residual-Very Dense White-Tan Silty Coarse to Fine SAND (A-1-b)	
1054.	7 27	4 3.5		(0.0)	N/A					
1004.	'	1	3:18	0%′	'"'				, F 1053.7	28.4
			2:11				0.5 7%	N/A	Weathered Rock-Brown-Tan and Tan-Black Severely Weathered Soft Metamorphosed Granite with Very Close Fracture Spacing	
			1:15						7 Jts @ 0-10° Other Jts Not Discernible	
1051	2 30	۵	0:51/0.5			N=100/				
1051	2 34			(1.0)	N/A	0.4			-	
1050.	8 31	3 4.0	2:05	22%	IN/A				_	
			2:16				9			
			1:36		Management of the Control of the Con				_	
1051. 1050.			3:12						T 1046.7	35.4
	2 35	9	1:34/0.6				1.5	0.0	Crystalline Rock-Tan-White-Black Moderately and Moderately Severely	55.4

## GEOSCIENCE GROUP

GEOSCIENCE GROUP, INC. CORE BORING REPORT

ROJ	ECT NO	D. 33	546.1.1	ID.	B-419	9	FED.	NO.BF	RZ-1782(1)	CO. Mo	Dowell	FIELD SU	JPERV. D. Hardister	
SITE	DESCR	IPTIC	ON Bridg	e No.	198 ov	er the S	Second	Broad	River on S	R 1782			GROUND W	ATER (ft)
30RII	NG NO.	B2-	-A	E	BORING	G LOC	ATION	13+7	6	OFFSET 15' LT	ALIG	NMENT -L-	0 HR.	N/M
OLL	AR ELE	EV.	1082.1 ft	тот	AL DE	PTH	45.9 ft		NORTHIN	G 672113.85	EAST	T <b>ING</b> 1118321.2	1 24 HR.	6.0
RILL	MACH	INE	CME 55	0x	DRIL	L MET	HOD	HSA/H	Q	HAMMER	TYPE A	utomatic FIN.	AL CASING DEPTH	13.4 ft
ATE	START	ED	2/8/05	COV	<b>IPLET</b>	ED 2/8	3/05	DRI	LLING FLU	JID DENSITY Creek	Water SI	URFACE WATE	R DEPTH N/A	
ORE	SIZE	HQ				TOTA	AL RUN		ft	DRILLER D. Harris	3			
LEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min./ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STR REC. %	ATA RQD %		DES	SCRIPTION	ANDREMARKS		
												n previous page		
46.1	36.0	4.9	0:40	(4.6) 94%	(2.9) 59%	N=60/ 0.1	75%	0%	-	Weathered Modera Close and Very Clo	tely and M	ledium Hard Met	tamorphosed Granite	with
			3:10	<b>34</b> 70	3976				1044.7	13 Jts @ 0-10 3 Jts @ 10-20 1 Jt @ 50-60				
			2:00				8.5 100%	7.6 89%		1 1 d 50-60 Crystalline Rock-Gr	ey-Black	Slightly Weather	ed Hard Metamorpho cture Spacing	sed 37
			2:25								and Mode	rately Close Frac	cture Spacing	
			2:40						-	9 Jts @ 0-10° 6 Jts @ 10-20° 1 Jt @ 50-60° 1 Jt @ 80-90°				
41.2	40.9		2:46/0.9			RS-3								
41.2	40.9	5.0	2:31	(4.9) 98%	(4.7) 94%				-					
			2:30											
			3:10						_					
			3:38						-					
			2:24						-					
036.2	45.9								1036.2 -					45
									_	Coring Terminated (Metamorphosed G	at Elev. 10 ranite)	036.2ft in Crystal	lline Rock	•
,									-		•			
									••• ·					
									-					
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33546.1.1/B-4199 B2-A Box 1 of 4



33546.1.1/B-4199 B2-A Box 2 of 4



33546.1.1/B-4199 B2-A Box 3 of 4



33546.1.1/B-4199 B2-A Box 4 of 4



#### **GEOSCIENCE** CPOI IP

**GEOSCIENCE GROUP, INC. BORING LOG** 

**GEOSCIENCE** GROUP

GEOSCIENCE GROUP, INC. **BORING LOG** 

SHEET 2 OF 2

PROJECT NO. 33546.1.1 ID. B-4199 FED. NO.BRZ-1782(1) CO. McDowell FIELD SUPERV. D. Hardister SITE DESCRIPTION Bridge No. 198 over the Second Broad River on SR 1782 **GROUND WATER (ft)** BORING NO. B2-B BORING LOCATION 13+60 OFFSET 11' RT ALIGNMENT -L-0 HR. N/M COLLAR ELEV. 1082.8 ft TOTAL DEPTH 52.0 ft NORTHING 672093.32 **EASTING** 1118343.18 24 HR. 6.8 DRILL MACHINE CME 550x DRILL METHOD Rotary/HQ HAMMER TYPE Automatic FINAL CASING DEPTH 33.9 ft DATE STARTED 2/7/05 COMPLETED 2/8/05 DRILLING FLUID DENSITY Creek Water SURFACE WATER DEPTH N/A ELEV. DEPTH **BLOW COUNT BLOWS PER FOOT** SAMP. SOIL AND ROCK DESCRIPTION (ft) (ft) 0.5ft 0.5ft 0.5ft NO. 60/0 Weathered Medium Hard to Soft 1045 Metamorphosed Granite with Very Close Fracture Spacing
Crystalline Rock-Brown-White to
Grey-Brown-White Moderately Weathered Moderately Hard Metamorphosed Granite with Close and Very Close Fracture Spacing & Weathered Rock Seams Crystalline Rock-Grey-Black Very Slightly Weathered Very Hard Metamorphosed Granite with Wide and Moderately Close Fracture Spacing 1040 1035-Coring Terminated at Elev. 1030.8ft in Crystalline Rock (Metamorphosed Granite) NOTE: \* indicates blow count influenced by

DDC ''	EOT NO	2254	2 1 1	lin .	7 440		FFF	NO 55	77 47-	0(4)		Т.		4-0	11	FIELD CLIDES	T 1 OF 2	
	ECT NO				B-419		L		RZ-178		4700	1	CO. 1	VICDO		FIELD SUPER	V. D. Hardister	
	ESCRI		Bridge	<del></del>						<del></del>					T		GROUND WAT	
	IG NO.						ATION	13+6	т			ET 11'				NMENT -L-		I/M
	AR ELE			Ь			52.0 ft		<u> </u>	THING	672	<del></del> -				ING 1118343.18	L	6.8
	MACHI			<del>,</del> -			HOD								PE Au		ASING DEPTH 33	3.9 ft
	STARTE	·		L	PLETI	ED 2/8				FLUID	DE	·	Cree	k Wa	ater   SL	JRFACE WATER DE	PTH N/A	
	DEPTH	ļ	OW COL	JNT 0.5ft	0	20	BLOW 40	SPER	FOOT 50	80	100	SAMP.	<b>V</b> /	0		SOIL AND ROCK	DESCRIPTION	
(ft)	(ft)	0.5ft	0.5ft	0.510	Ĭ.		<u></u>		<u> </u>	<u> </u>	-1	NO.	/MOI	G				
1082.8	0.00			ļ		Grou	nd Surf	ace El	ev. 10	82.8 ft					1082.8			0.00
_	-													000	-	Alluvial-Very Loose Bro Coarse to Fine SAND	own-Orange Silty with Gravel (A-1-a)	
	-				<b> </b>									000	-		•	
1080-	_				١									000				
-	3,5	13	7	16	l								SAT	000	•			
						•	*				•			000	-			
					l · ·				• • •		• •			000	-			
	L								• • •		• •		V	666	1076.3	Residual-Dense Brown	White Silty Coarse to	6.5
1075-											• •			000		Fine SAND (A-1-b)	-vvince only coarse to	,
1075-	8.5	26	51	49/0.3		[			• • •		· ·		SAT	000	1074.3	Weathered Rock-Tan-	Brown Weathered	8.5
		20	"	4310.3							$\cdot $		SAI	M	•	Metamorphosed Grani		
										- 100/	0.8			MIL	•			
•											•			M	•			
										:					1070.3			12.5
1070-	13.5				• •					.				000	-	Residual-Very Dense 1 to Fine SAND (A-1-b)	an-Brown Silty Coars	е
•		29	33	45						78			SAT	000	-			
•	r								· · ·	·				000	•			
-	<b> </b>				• •				• • •	. L	7			271	- 1066.8	Weathered Rock-Tan-	Orange to Brown-White	16.0 e
•					• •									N\\\\	•	Weathered Metamorph	osed Granite	
1065-	18.5													MI				
•	<b>t</b>	24	76/0.4							100/	n a		SAT		-			
•	r				• •										-			
					• •									N/W	•			
•														M	-	No.		
1060 -	23.5														-			
•		100/0.5								100/	0.5		W	KIII	•			
•	<b>F</b>													M/M	•			
-	}								<b>.</b>		.			M	•	·		
•	-				<b> </b>										•			
1055-	L				١						$\Box$				_1054.8			28.0
-	28.5	11	16	33	l				<b>.</b>				w	000	•	Residual-Dense Tan-W Fine SAND (A-1-b)	/hite Silty Coarse to	
_	L				l			49						000	-			
-	_		1		١			<u> </u>			$\Box$				1052.3	Weathered Rock-Grey-		30.5
	L													NVIL	-	Metamorphosed Granit		
1050-	L				l · ·		<b></b>		• • •		.			MIL	1049.8			33.0
	33.8				` `				• • •		. [				1048.9	Crystalline Rock-Grey- Granite	White Metamorphosed	
		60/0.1	ł							60/0	0:1		М	②	1048.1	Crystalline Rock-Brown Moderately Weathered		34.7
	L								• • •		.				1047.0	Metamorphosed Granit		35.8
	37.0				l · ·	• • •		• • •	· · •		.	RS-4		X		Spacing Weathered Rock-Tan-\	White Severely	1

#### 20

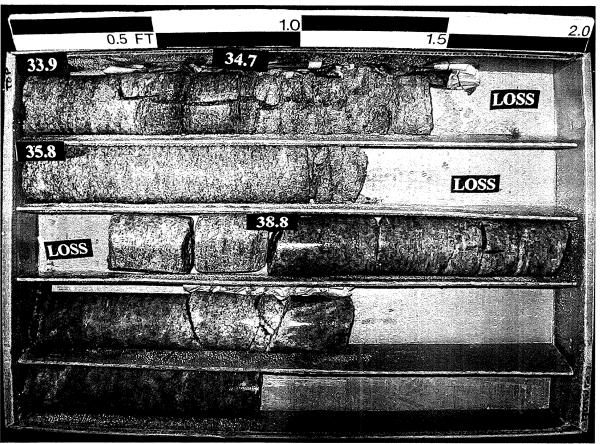
# GEOSCIENCE GROUP

#### GEOSCIENCE GROUP, INC. CORE BORING REPORT

SHEET 1 OF 1

						<del></del>	<del>,                                     </del>		·				SHE	ET 1 OF 1	
			3546.1.1		B-419		-L		RZ-1782(1)		CO. McD	owell	FIELD SUPE	RV. D. Hardister	
SITE	DESCF	RIPTI	ON Brid	ge No.	198 ov	er the	Second	Broad	River on SR	1782				GROUND WA	TER (ft
BORI	NG NO	. B2	-B	E	BORIN	G LOC	ATION	13+6	0 0	FFSET 1	I' RT	ALIGNMEN	NT -L-	0 HR.	N/M
COLL	AR EL	EV.	1082.8 h	TOT	AL DE	PTH	52.0 ft		NORTHING	672093.3	32	EASTING	1118343.18	24 HR.	6.8
DRILL	MACH	IINE	CME 55	0x	DRIL	L MET	THOD	Rotary	/HQ	Н	AMMER T	YPE Automa	tic FINAL C	CASING DEPTH 3	3.9 ft
DATE	STAR	TED	2/7/05	CO	MPLET	ED 2/8	3/05	DR	LLING FLUID	DENSITY	Creek W	/ater SURFA	CE WATER D	EPTH N/A	
	SIZE	,	·	1 5		TOT	AL RUN		ft D	RILLER	D. Harris	······································			
	DEPTH	l	RATE	REC	RQD	SAMP.	REC.	RATA			DESC	RIPTION AND F	REMARKS		
(ft)	(ft)	(ft)	(Min./ft)	(ft) %	(ft) %	NO.	% %	% %		****					
048.9												in Coring @ 1			
1048.9	33.9	3.1	3:06	(2.8) 90%	(1.5) 48%		0.8	0.4 50%	1048.1	Crystalline Moderatel	Rock-Brov y Hard Met	vn-White to G amorphosed (	rey-White Mod Granite with Clo	erately Weathered ose Fracture Spacir	ng a
							0.7	N/A		3 Jts @ 10 3 Jts @ 80	)-2g			·	19 <u>34</u>
			2:44				64%		1047.0	Weathered	Rock-Tan	-White Severe	ely Weathered	Medium Hard to So Spacing	 oft 35
			1:36			RS-4	1.8 60%	1.0 33%	1 1				Close Fracture	Spacing	
1045.8	37.0		0:15/0.1		(2.5	N=60/0			-	5 Jts @ 80	)-100 )-900 Not Discern	ihle -		•	
1045.8	37.0	5.0	4:53	(3.7) 74%	(2.8) 56%					Crystalline	Rock-Brov	vn-White to G	rey-Brown-Whi	te Moderately nite with Close and	
										Very Close	Fracture S	Spacing & We	athered Rock S	Seams	
			5:24				40.0	40.0	1044.0	1 Jt @ 0-1 3 Jts @ 10 2 Jts @ 20 1 Jt @ 40-	ර )-2රි				38
			4:44				13.0 98%	12.2 92%		2 Jts @ 20 1 Jt @ 40-	)-30° 50°				-
			7.77						-	Crystalline Metamorp	Rock-Grey	/-Black Very S nite with Wide	Slightly Weathe	red Very Hard y Close Fracture	
			4:34							Spacing				,	
									-	6 Jts @ 0- 2 Jts @ 10	10° )-20°				
1040.8	42.0		4:58						_						
040.8	42.0	5.0	5:38	(5.0) 100%	(4.7) 94%										
									-						
			5:23						-						
			6:10												
			0.10						_						
			8:11												
									_						
035.8	47.0		10:00						_						
035.8	47.0	5.0	10:17	(4.8) 96%	(4.6) 92%										
			10:56						_						
			13:47												
			10.41						-						
			17:43						_						
									_						
030.8	52.0		25:51						1030.8						52
										Coring Ter	minated at	Elev. 1030.8ft	in Crystalline I	Rock	
									- (	(Metamorp	hosed Grai	nite)	,		
									_						
									-						
							İ								
							ı		•						

33546.1.1/B-4199 B2-B Box 1 of 2



33546.1.1/B-4199 B2-B Box 2 of 2



## GEOSCIENCE GROUP, INC. BORING LOG

SHEET 1 OF 1

PROJECT NO. 33546.1.1 ID. B-4199 FED. NO.BRZ-1782(1) CO. McDowell FIELD SUPERV. D. Hardister **GROUND WATER (ft)** SITE DESCRIPTION Bridge No. 198 over the Second Broad River on SR 1782 BORING NO. EB2-A BORING LOCATION 14+02 OFFSET 22' LT ALIGNMENT -L-0 HR. 4.7 COLLAR ELEV. 1082.7 ft TOTAL DEPTH 21.0 ft NORTHING 672139.16 **EASTING** 1118317.56 24 HR. 4.3 DRILL METHOD HSA DRILL MACHINE CME 550x HAMMER TYPE Automatic FINAL CASING DEPTH N/A DATE STARTED 2/7/05 COMPLETED 2/7/05 DRILLING FLUID DENSITY N/A SURFACE WATER DEPTH N/A ELEV. DEPTH **BLOW COUNT** BLOWS PER FOOT -- SOIL AND ROCK DESCRIPTION (ft) 0.5ft 0.5ft 0.5ft (ft) NO. 1082.7 0.00 Ground Surface Elev. 1082.7 ft Alluvial-Very Loose Brown-Orange Silty Coarse to Fine SAND (A-3) 1080-Residual-Dense Brown-White Silty Coarse to Fine SAND (A-1-b) 1075 Weathered Rock-Brown-White Weathered Metamorphosed Granite 23 77/0.3 100/0.8 Crystalline Rock-Brown-White to 60/0.1 Grey-White-Black Metamorphosed Granite 1065 18.5 60/0.1 W Boring Terminated with Standard Penetration Test Refusal at Elev. 1061.7ft in Crystalline 60/0 Rock (Metamorphosed Granite)

## GEOSCIENCE GROUP

GEOSCIENCE GROUP, INC. BORING LOG

SHEET 1 OF 1

						·									SHE	ET 1 OF 1	
PROJE	CT NO.	3354	6.1.1	ID. I	B-4199	FED. N	IO.BRZ-1	782(1)			CO. I	ИcDo	well	l F	IELD SUPER	RV. D. Hardister	
SITE D	ESCRIF	PTION	Bridge	No. 19	98 over the S	Second E	Broad Rive	er on SR	1782	}						GROUND W	ATER (ft)
BORIN	G NO.	EB2-B	}	ВС	ORING LOCA	ATION	13+76	0	FFS	<b>ET</b> 15'	RT		AL	JGNMENT	-L-	0 HR.	6.8
COLLA	R ELE	<b>/</b> . 108	32.9 ft	TOTA	L DEPTH	23.7 ft	NO	RTHING	672	2108.90	0		EA	ASTING 11	18349.85	24 HR.	6.2
DRILL	MACHI	VE CI	ИЕ 550:	×	DRILL MET	HOD H	SA			НА	MME	R TYI	PE	Automatic	FINAL	ASING DEPTH	N/A
DATE S	TARTE	D 2/7	/05	COM	PLETED 2/7	7/05	DRILLIN	IG FLUID	DEI	NSITY	N/A			SURFACI	E WATER DI	EPTH N/A	
ELEV.	DEPTH	BLO	ow cor	JNT		BLOWS	PER FOO	T ·		SAMP.	<b>V</b> /	L					
(ft)	(ft)	0.5ft	0.5ft	0.5ft	0 20	40	60	80	100	NO.	MOI	0 G		S	OIL AND ROCI	K DESCRIPTION	
1082.9	0.00				Groun	nd Surfa	ce Elev.	1082.9 ft			<del> </del>	000	108	2.9 Alluvial	-Verv Loose Bi	own-Orange Silty	0.00
1 1	-								٠ . ا		1	000		Coarse	to Fine SAND	own-Orange Silty with Gravel (A-1-a)	)
1 1	-										l	000					
1080	- 3.5											000	-				
1 1	-	4	13	9	,	*						000					ĺ
1 +	- '											000	,	. ,		,	
1 +	.										Y	000	107	6.9	10	T 0:11 0	6.0
	.											000		Fine SA	al-Dense Brow ND (A-1-b)	n-Tan Silty Coarse	to
1075												000					
1	8.5	21	48	52/0.3					$\neg$ $ $		М	200	107	Weathe	red Rock-Brov	/n-Tan,	8.5
] ]	.							100/0	.8			ML		Tan-Ora Weathe	ange-White, ar red Metamorpi	d Tan-Brown-White nosed Granite	9
	.								. 11			ML					
] ]	.																
1070	.											KIL	_				
1 1070	13.5	100/0.5									м		-				
I								100/0	1.5			M					
l T	•							• • • •	.								
1 1	.								.		1	KIIT					
1 1	•								.			$\mathbb{W}$					
1065	18.5	- 00	14/0.0					• • • •	•			M	-				
1 †	.	86	14/0.2		<i></i>			100/0	.7		W						
<b> </b>	.								•			KIIT					
l †	.								.			$\parallel\parallel$	1061	1.4			21.5
l †	.								.			1			ne Rock-Grey-	Black Metamorpho	sed
1060	23.5								.				-				
<b>l</b>		100/0.2						100/0	. <del>2</del>		M	+	1059	Boring 1	erminated with	Standard Penetra	23.7 tion
	.											-		Test Re Rock (N	fusal at Elev. 1 letamorphosec	059.2ft in Crystallir I Granite)	ie
	.											-					
]	.											-					
]	.								1			L					
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] ]												L		NOTE: 1	' indicates blov	v count influenced t	ру
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# SUMMARY OF LABORATORY TEST DATA FOR INCHOL

# 33546.1.1/B-4199 Bridge No. 198 over The Second Broad River on SR 1782 McDowell, North Carolina

_												 		 	 	 		
			Clay (%)	29	4	. 5	9	5	2	-	0							
			Silt (%)	14	6	6	6	9	2	3	0							
		Fine	(Ret. #270)	40	43	30	29	30	27	23	1							
			(Ret. #60)	17	4	56	56	59	69	73	66							
	Gradation Results	D. G.	#270 Sieve	43	13	П	13	4	3	4	0							
		Dogs	#200 Sieve	50	20	16	17	9	4	7	0			-				
			Pass #40 Sieve	93	08	4	49	22	65	43	2.4							
			Pass #10 Sieve	66	66	75	₹ 2	07	46	76	39							
	nits		P.I.	9	ŝ	â	ŝ	ŝ	άN	ŝ	ďZ							
	Atterberg Limits		P.L.	26	åZ	ŝ	ŝ	ŝ	ŝ	ŝ	άZ							
	Att		L.L.	32	31	21	23	61	25	21	NP							
	z	Value		9	62	51	51	7]	2	N/A	N/A							
	AASHTO	Class		A-4(1)	A-2-4(0)	A-1-b(0)	A-1-b(0)	A-1-a(0)	A-3(0)	A-1-b(0)	A-1-a(0)							
	Natural Moisture Content	(%)		23.1	V/V	V/V	V/N	V/N	N/A	N/N	V/N							
	Samole	Type		SS-1	SS-2	SS-3	SS-4	SS-5	9-88	S-1	S-2							
	Sample	(ft.)		3.0-4.5	8.5-10.0	18.5-20.0	12.5-14.0	3.0-4.5	3.5-5.0	0.2-0.5	0.0-0.5							
	Roring	No.		EB1-A	EB1-B	BI-A	B1-B	B2-A	EB2-A	BANK	BED		ŀ				·	
ŧ				_					-	_		 	_		 			

GEOSCIENCE GROUP, INC. GREENSBORO, NORTH CAROLINA PROJECT NO: GR05.0033.GE PAGE 1 of 1

# GEOSCIENCE GROUP, INC. GREENSBORO, NORTH CAROLINA

# 33546.1.1 (B-4199) Bridge No. 198 over The Second Broad River on SR 1782 McDowell County, North Carolina

#### **ROCK TESTING SUMMARY**

BORING NO.	SAMPLE NO.	DEPTH (ft)	UNCONFINED COMP. STRENGTH (psi)	YOUNG'S MODULUS (psi)	POISSON'S RATIO								
B1-A	RS-1	35.4-35.8	4,970	N/A	N/A								
B1-B	RS-2	42.5-42.9	14,290	N/A	N/A								
B2-A	RS-3	40.3-40.7	10,290	N/A	N/A								
B2-B	RS-4	36.1-36.5	2,850	N/A	N/A								
			• , .										
				-									
	·												
·													

#### GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: 33546.1.1   ID: B-4199   COUNTY:   McDowell
DESCRIPTION(1): Bridge No. 198 over the Second Broad River on SR 1782
INFORMATION ON EXISTING BRIDGES Information obtained from: X field inspection microfilm(Reel:Pos:) other
COUNTY BRIDGE NO. 198 BRIDGE LENGTH 40 NO. BENTS IN: CHANNEL 0 FLOOD PLAIN 2
FOUNDATION TYPE: Footings
EVIDENCE OF SCOUR(2):
ABUTMENTS OR END BENT SLOPES: None
INTERIOR BENTS: N/A
CHANNEL BED: None
CHANNEL BANKS: Major sloughing of upstream west bank
EXISTING SCOUR PROTECTION:
TYPE(3): Concrete wingwalls
EXTENT(4): 5' outside of bridge
EFFECTIVENESS(5): OK
OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): Fallen trees in channel
DESIGN INFORMATION
CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED):  Alluvial-Brown-Tan Silty Cse to F SAND w/
Gravel (A-1-a), Residual-V Dense Grey-White & Brown-White Silty Cse to F SAND (A-1-b) & w/ Quartz Frags (A-1-b)
CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED):Alluvial-Silty Coarse to Fine SAND (A-3, A-1-b),
Silty Coarse to Fine SAND w/ Gravel (A-1-a)
CHANNEL BANK COVER(9): Underbrush, trees
FLOOD PLAIN WIDTH(10): 200'
FLOOD PLAIN COVER(11):Trees, underbrush, grass

Λ

DES	SIGN INFORMATION CONT. PAGE 2
STF	REAM IS DEGRADINGX AGGRADING (12)
	HER OBSERVATIONS AND COMMENTS:
UII	
	· 1
CHA	ANNEL MIGRATION TENDENCY (13):
	REPORTED BY: DATE: 2/24/05
05/	
GE	OTECHNICALLY ADJUSTED SCOUR ELEVATION (14):
	The Geotechnical Unit agrees with the Computed Scour depths in the
	The Geolechinical Offic agrees with the Compated Scoul depths in the
	Bridge Survey & Hydraulic Design Report dated 10/21/04.
	REPORTED BY: Clob on Wally DATE: 3/10/05
	NCDOT GEOTE HNICAL UNIT
	<u>INSTRUCTIONS</u>
(1)	GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED.
(2)	NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING,
(0)	SLOUGHING, SCOUR LOCATIONS, DEGRADATIONS, ETC.)
(3)	NOTE ANY EXISTING SCOUR PROTECTION (RIP RAP, ETC.)
(4)	DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
(5) (6)	DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.  NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
(6) (7)	DESCRIBE THE CHANNEL BED MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION,
(1)	ATTACH LAB RESULTS.
(8)	DESCRIBE THE CHANNEL BANK MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE
(-)	DISTRIBUTION, ATTACH LAB RESULTS.
(9)	DESCRIBE THE BANK COVERING (GRASS, TREES, RIP RAP, NONE, ETC.
(10)	GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
(11)	DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
(12)	CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING
(13)	DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE
	BRIDGE (APPROXIMATELY 100 YEARS).
(14)	GIVE THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE
	(APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON
	A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS
	THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. THE GEOTECHNICALLY
	ADJUSTED SCOUR ELEVEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION
	FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE;
	PERCENTAGE RQD; DIFFERENTIAL WEATHERING, SHEAR STRENGTH; OBSERVATIONS AT EXISTING

STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

PROJECT #:

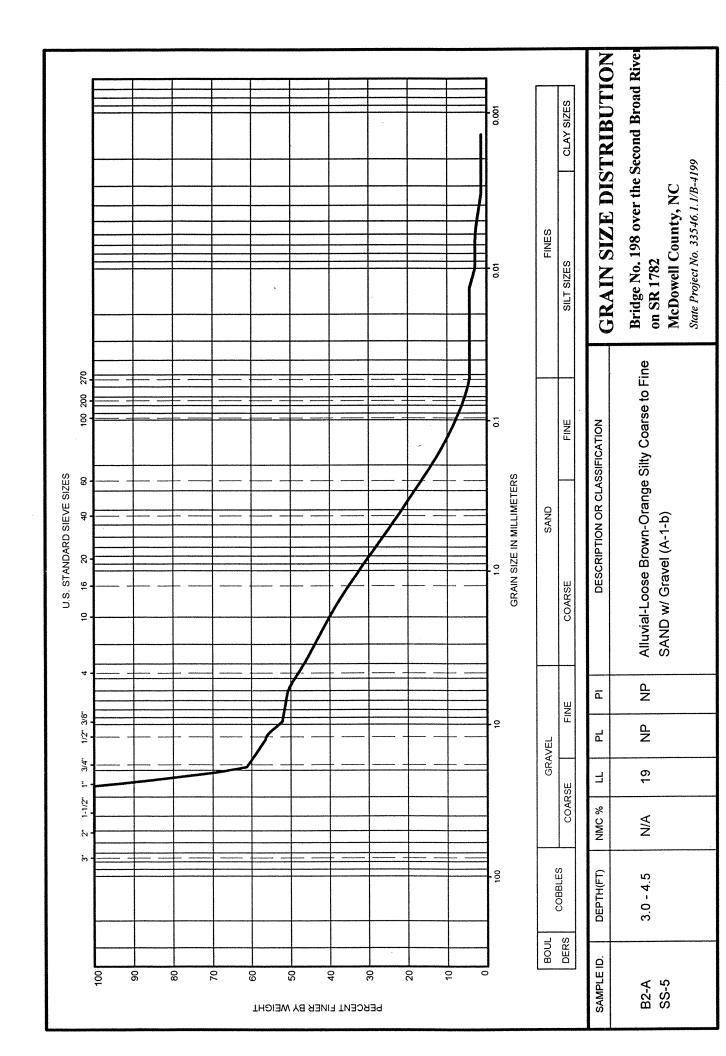
33546.1.1/B-4199

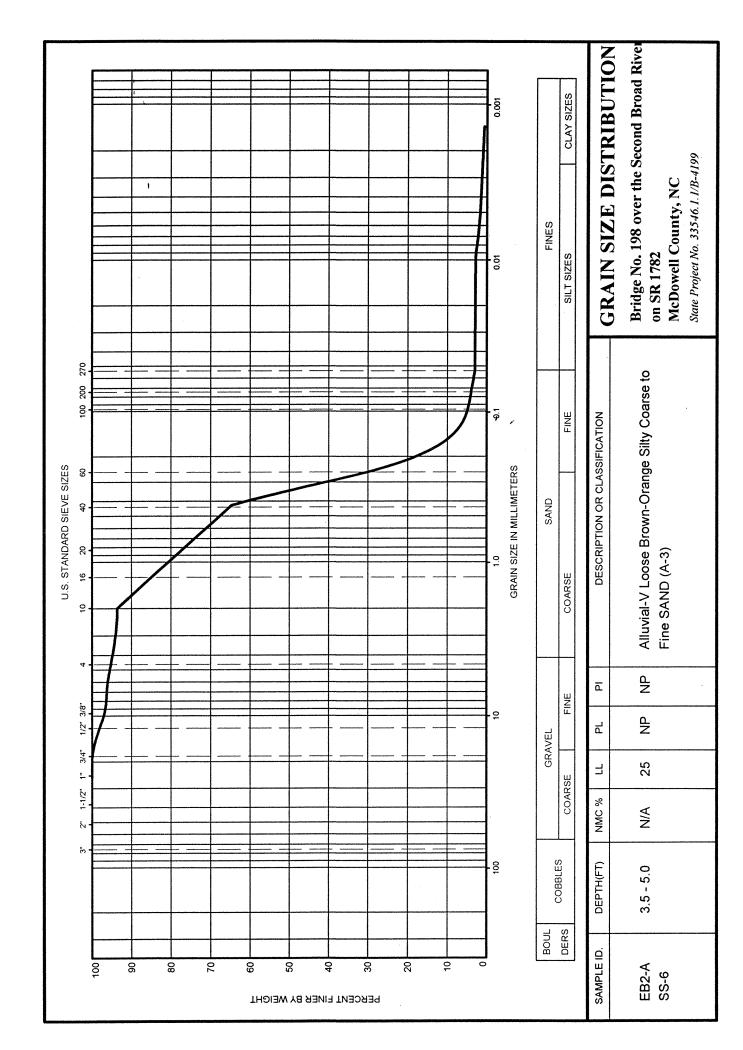
COUNTY:

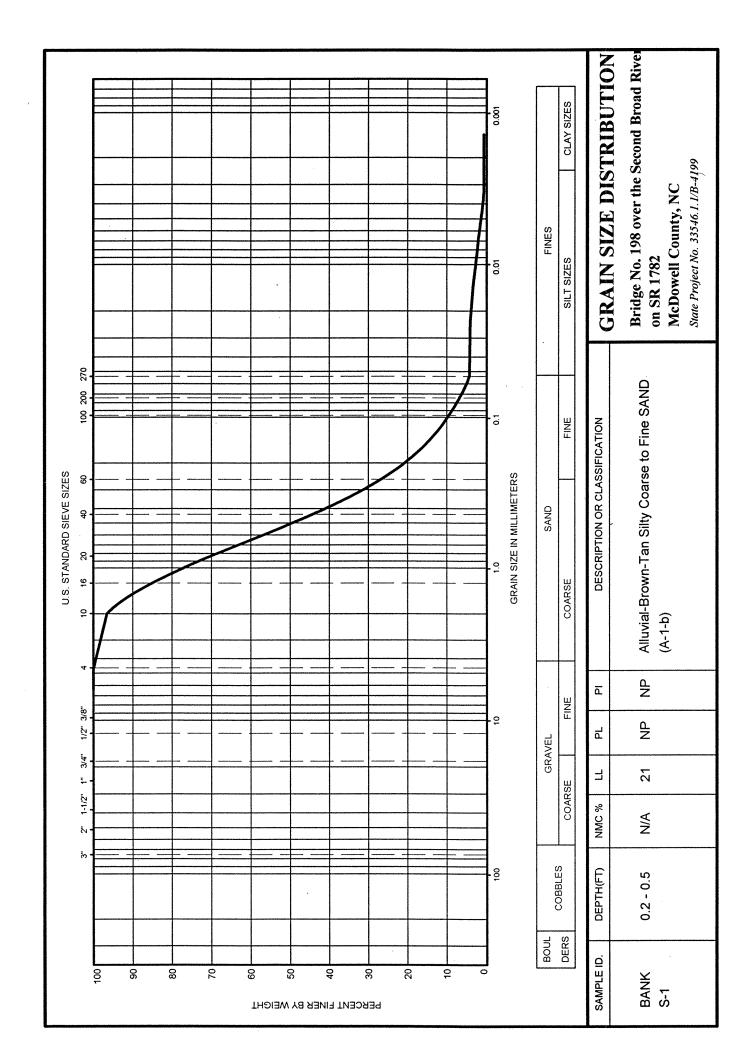
McDowell

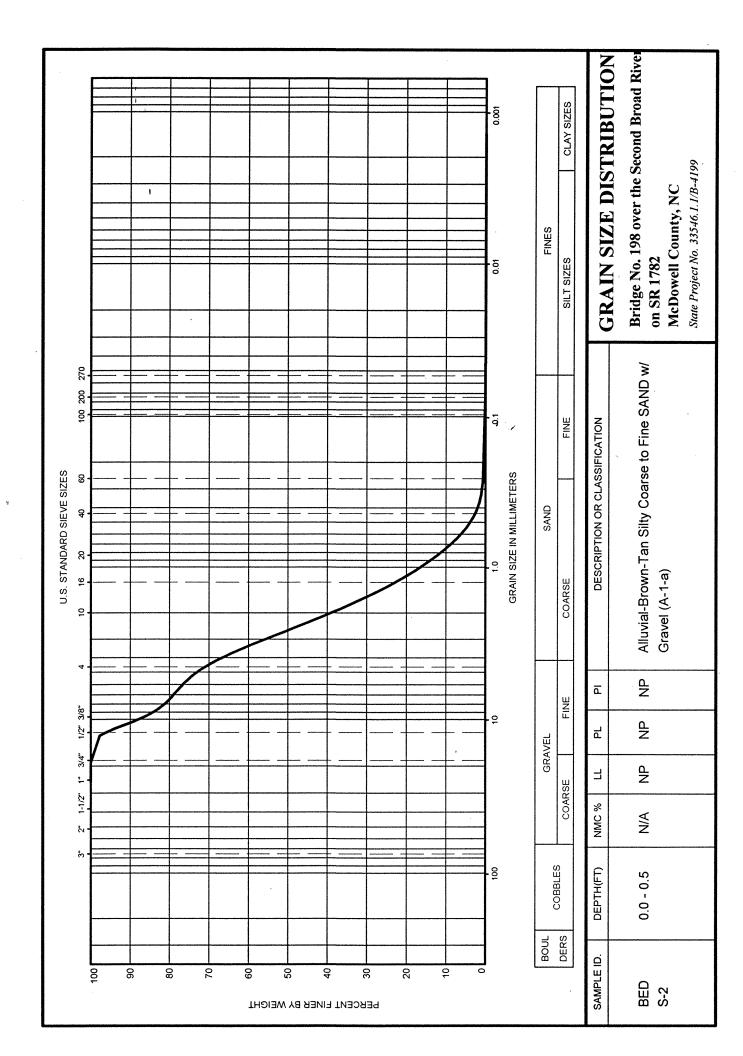
DESCRIPTION: Bridge No. 198 over The Second Broad River on SR 1782

	CH	IANNEL B	ED	CHANNEL BANK MATERIAL					
	l	MATERIAL	_						
SAMPLE #	SS-4	SS-3	S-2	SS-5	SS-6	S-1			
RETAINED #4	5	14	28	54	5	0			
PASSING #10	84	75	39	40	94	97			
PASSING #40	49	44	2	22	65	43			
PASSING #200	17	16	0	6 ′ ′	4	7			
COARSE SAND	56.0	56.0	99.0	59.0	69.0	73.0			
FINE SAND	29.0	30.0	1.0	30.0	27.0	23.0			
SILT	9.0	9.0	0.0	6.0	2.0	3.0			
CLAY	6.0	5.0	0.0	5.0	2.0	1.0			
LL	23	21	0	19	25	21			
PL	0	0	0	0	0	0			
AASHTO									
CLASSIFICATION	A-1-b(0)	A-1-b(0)	<b>A-1-</b> a(0)	A-1-a(0)	A-3(0)	A-1-b(0)			
STATION	12+93	13+1	13+35	13+76	14+2	13+50			
OFFSET	9' RT	15' LT	5' RT	15' LT	22' LT	CL			
DEPTH	12.5-14.0	18.5-20.0	0.0-0.5	3.0-4.5	3.5-5.0	0.2-0.5			









#### SITE PHOTOGRAPHS



**Looking Left to Right along End Bent-1** 



**Looking Left to Right along Bent-1** 

#### **SITE PHOTOGRAPHS**



**Looking Left to Right along Bent-2** 



**Looking Left to Right along End Bent-2** 

#### SITE PHOTOGRAPHS



Looking Increasing Station along -L-



Looking along Profile – 15' RT of -L-

#### **SITE PHOTOGRAPHS**



**Looking Upstream** 



**Looking Downstream**