

PROJECT: 33172.1.1 ID: B-3624

# STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

## STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 33172.1.1 I.D. NO. B-3624  
 F.A. PROJECT BRZ-1328(4)  
 COUNTY CALDWELL  
 PROJECT DESCRIPTION BRIDGE No. 190  
ON SR 1328 (PLAYMORE BEACH ROAD)  
OVER JOHNS RIVER

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3624	1	27
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33172.1.1	BRZ-1328(4)	P.E.	
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### 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 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 @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS PART OF THE CONTRACT.

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

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

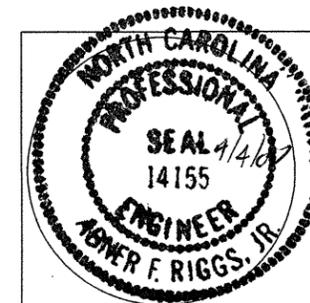
INVESTIGATED BY	<u>S&amp;ME, INC.</u>	PERSONNEL	<u>S. JOHNSON</u>
CHECKED BY	<u>A.F. RIGGS, JR.</u>		<u>A. BROWNING</u>
SUBMITTED BY	<u>S&amp;ME, INC.</u>		<u>N. BRADLEY</u>
DATE	<u>MARCH 16, 2007</u>		<u>R. NORWOOD</u>
			<u>S. LOWE</u>
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			<u>Jo. WHITE</u>
			<u>P. PHELPS</u>
			<u>T. PEREZ</u>

For Letting

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

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.

DRAWN BY: T. PEREZ



*A. F. Riggs, Jr.*  
SIGNATURE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
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SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																																																																																																	
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRN SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										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 ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.										HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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 YIELDS SPT N VALUES > 100 BLOWS PER FOOT. 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 YIELD 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.										ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. 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 WHICH 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 DISLOGGED FROM PARENT MATERIAL. FLOOD PLAIN (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF 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 WHICH 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, WHICH 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 (IN OR B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS. STRATA CORE RECOVERY (S.R.C.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. 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GRAVEL AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS</td> <td>CLAYEY SOILS</td> <td colspan="4">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td>HIGHLY ORGANIC SOILS</td> </tr> <tr> <th>GEN. RATING AS A SUBGRADE</th> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td colspan="2">UNSATISFACTORY</td> </tr> </table>										GENERAL CLASS.	GRANULAR MATERIALS (>5% PASSING #200)				SILT-CLAY MATERIALS (>85% PASSING #200)				ORGANIC MATERIALS		GROUP CLASS.	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STATE PROJECT NO.: 33172.1.1  
 I.D. NO.: B-3624  
 FEDERAL PROJECT NO.: BRZ-1328(4)  
 COUNTY: Caldwell

DESCRIPTION: Bridge No. 190 on SR 1328 (Playmore Beach Road) Over Johns River

SUBJECT: Structure Subsurface Investigation – Inventory Report

### Project Description

The project site is located on Playmore Beach Road (SR 1328) southwest of Lenoir in southwestern Caldwell County, North Carolina at the crossing of the Johns River (See Site Vicinity Map, Sheet 5). The proposed project consists of a replacement bridge structure. Based on the Preliminary General Drawings, the center of the proposed bridge structure will be at Station 15+71.50 along the -L- survey line. The new bridge structure will have a clear roadway width of 25 feet and 2 inches. The new bridge structure will be approximately 135 feet long with the bents constructed on a skew angle of 120° to the -L- survey line. The new bridge structure will consist of three spans with lengths of 1 at 40 feet, 1 at 50 feet, and 1 at 45 feet. The structure will have four bents (two end bents and two interior bents).

The existing Bridge No. 190 structure is approximately 87.5 feet long with a bridge deck width of approximately 12 feet (outside to outside). The existing bridge is situated within the flood plain of the Johns River along a gravel road SR 1328 (Playmore Beach Road). The existing structure is a four bent, three span bridge structure consisting of asphalt overlaid on a timber deck on I-beams, supported on timber caps and timber post and sills / timber piles. The structure also has timber abutments and wingwalls. S.R. 1328 (Playmore Beach Road) runs approximately east and west and has roadway embankment shoulders. The flood plain extends approximately 400 feet on the west side of the river and approximately 1,000 feet on the east side of the river. The flood plain consists of undeveloped woods within a rural mountainous area. A concrete slab was placed at the east and west approaches of the existing bridge. An abandoned asbestos mine is located southeast of the existing bridge

Based upon the Preliminary General Drawings provided by NCDOT, the finished grade elevations for the new bridge structure will be approximately elevation 1046 feet at the west approach and approximately elevation 1048 feet at the east approach. The center line of the replacement bridge structure will be located approximately 35 to 40 feet north of the center of the existing structure. Earthwork is anticipated at the east and west approaches. Excavation depths on the order of 3 to 5 feet are anticipated, within the flood plain, along the shoulders at the east and west approaches. In addition, the river banks will be cut back and reworked at the end bents to a slope of 1.5:1 (horizontal to vertical) and Class II Rip-Rap erosion protection will be placed.

A geotechnical investigation was conducted between February 12 and March 6, 2007. Borings EB1-A, EB1-B, EB2-A were drilled within the floodplain of the Johns River and boring EB2-B was drilled within the existing gravel roadway. Borings B1-A, B1-B, B2-A and B2-B were drilled in the river channel as shown on the boring location plan (Sheet No. 6). All borings were performed with a CME-550x drill rig or BK-51 drill rig mounted on an all-terrain carrier. Representative soil samples were collected for visual classification in the field and for laboratory classification analysis by the NCDOT accredited S&ME soil testing laboratory. No Shelby tube sample was obtained from the river channel to perform Erosion Function Apparatus testing due to non-cohesive materials located at the surface.

### Physiography and Geology

The proposed bridge structure site is located within the Piedmont Physiographic and Geologic Province of North Carolina. The Piedmont Province is characterized by gently to steeply sloping topography with well-rounded hills and along rolling ridges with a northeast-southwest trend dissected by a moderate to well developed (mature) dendritic-type drainage system consisting of drainage swales, hollows, tributaries, streams and rivers. More specifically, the site is located within the Inner Piedmont Belt. The Inner Piedmont is described as a fault bounded stack of thrust sheets containing metamorphic and intrusive rock types. The metamorphic rocks found in this region include schist, gneiss, metagraywacke and amphibolite. Based on previous mapping and our knowledge of the local geology, the parent rock is interpreted to be (NC Geologic Map) gneiss. This unit is competent and relatively resistant to weathering. In addition, southeast of the existing bridge, meta-ultramafic rocks are present. This unit consists of metamorphosed dunite, local peridotite, serpentinite, soapstone, anthophyllite and other ultramafic rocks (NC Geologic Map).

### Foundation Materials

The borings were advanced to depths ranging from 37.4 to 59.1 feet (elevations 999.5 to 986.2 feet) at collar elevations ranging from 1051.0 to 1034.1 feet.

Artificial fill material was encountered in boring EB2-B to a depth of about 1.5 feet (elevation 1042.1 feet) below the collar elevation. The fill material encountered was crushed aggregate base course stone used for the roadbed material. No standard penetration test (SPT) was performed in the fill material.

Alluvial deposits were encountered beneath the artificial fill material in boring EB2-B and at the ground surface in the flood plain in borings EB1-A, EB1-B and EB2-A to depths ranging from about 13.0 to 17.5 feet (elevations 1034.0 to 1030.6 feet) beneath collar elevations. Typically, alluvial deposits encountered in the flood plain consist of very loose to loose brown, tan and gray silty coarse to fine sand (A-2-4) and very soft to medium stiff gray and brown fine sandy and clayey silt (A-4) overlying a layer of loose to medium dense brown and gray fine to coarse sand (A-1-a) with gravel, silt, clay and cobbles (0.25 to 0.5 feet in diameter). The standard penetration test (SPT) N-values for the alluvial soils encountered in floodplain ranged from 1 to 17 blows per foot (bpf).

Alluvial deposits were encountered in the river channel in borings B1-A, B1-B, B2-A and B2-B to depths ranging from about 2.0 to 6.0 feet (elevations 1032.1 to 1028.3 feet) beneath collar elevations. Typically, alluvial deposits encountered in the river channel consist of loose to dense brown and tan fine to coarse sand (A-1-a) with little to trace amounts of silt, clay, gravel and cobbles (0.25 to 0.5 feet in diameter). The SPT N-values for the alluvial deposits encountered in the river channel ranged from 12 bpf to 100 blows per 0.9 feet of penetration. The higher N-values are likely inflated due to the gravel and cobbles.

Beneath the alluvium, residual soils were encountered in all of the borings to depths ranging from about 13.1 to 44.3 feet (elevations 1024.4 to 1006.7 feet) consisting of stiff to hard tan, brown and gray coarse to fine sandy silt (A-4) with trace of clay. The SPT N-values for the residual soils ranged from 9 to 72 bpf. A layer of weathered rock exists within the residual soils between the depths of 23.7 to 27.5 feet (elevations 1019.9 to 1016.1 feet) beneath the collar elevation in boring EB2-B. The residual soils transition to weathered rock (gneiss) at depths ranging from about 13.1 to 44.3 feet (elevations 1024.4 to 1006.7 feet) and extend to depths ranging from about 37.4 to 43.2 feet (elevations 996.7 to 991.3

feet) beneath collar elevations in borings B1-B, B2-A and B2-B and to the depth of boring termination in the remaining borings. Standard penetration test (SPT) N-values in the weathered rock ranged from 100 blows with 1.0 feet of penetration to 60 blows with 0.2 feet of penetration. The weathered rock contains layers of very severely weathered hard brown and gray clayey fine sandy silt (A-4) and very dense gray silty fine sand (A-2-4) in borings EB1-A, EB1-B, and B1-B. The layer of soil within the weathered rock in boring B1-B exists between the depths of 21.6 and 27.9 feet (elevations 1012.5 to 1006.2 feet) beneath the collar elevation. Standard penetration test (SPT) N-values in these soil layers ranged from 63 to 84 bpf.

The weathered rock transitions to crystalline rock (gneiss) at depths ranging from about 37.4 to 43.2 feet (elevations 996.7 to 991.3 feet) in borings B1-B, B2-A and B2-B beneath collar elevations and extends to termination of borings. The crystalline rock consists of brown and gray gneiss. The weathered rock and crystalline rock were evaluated utilizing rock coring techniques in borings B1-A and B2-B. The weathered rock and rock were evaluated utilizing coring techniques by advancing a NQ-3 core barrel. The recovered core samples were classified as very soft to soft severely weathered brown-tan gneiss with close fracture spacing with very severely weathered seams and hard to very hard slightly weathered to fresh gray gneiss with close fracture spacing. Coring activities recovered 65 to 93 percent of the weathered rock and crystalline rock cored per individual core run. A rock Quality Designation (RQD) value of 14 percent per individual core run was determined for the crystalline rock. Borings EB1-A, EB1-B, B1-A, EB2-A and EB2-B were terminated in weathered rock (brown and gray gneiss) at elevations ranging from 999.5 to 989.4 feet. Borings B1-B, B2-A and B2-B were terminated on or in hard to very hard crystalline rock (gneiss) at elevations ranging from 996.7 to 986.2 feet.

#### Notes to Designer

The CME-550x and BK-51 drill rigs are equipped with a hydraulic automatic hammer. Standard Penetration tests were performed with the attached Autohammer and not with a traditional rope, cathead and Safety Hammer.

#### Groundwater

Groundwater was not encountered in borings EB1-A, EB1-B, EB2-A and EB2-B at the time of drilling operations. However, borehole cave depths ranging from about 10 to 15 feet beneath the collar elevation were measured 24 hours after the time of boring termination. The remaining borings were performed with the river channel. The river level at the time of our field investigation ranged from 1036.3 to 1035.7 feet from February 28 to March 6, 2007.

#### **QUALIFICATIONS OF REPORT**

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report were based on the applicable standards of our profession at the time this report was prepared. No other warranty, expressed or implied, is made.

The conclusions submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the borings may not become evident until construction. If variations appear evident, then the conclusions contained in this report may need to be re-evaluated. In the event that any changes in the nature, design, or location of the structure are planned, the conclusions contained in this report will not be considered valid unless the changes are reviewed by S&ME, and the conclusions of the report are modified or verified in writing.

S&ME appreciates the opportunity to be your geotechnical consultant on this project. If you have any questions or need additional information in regard to this report, please contact us.

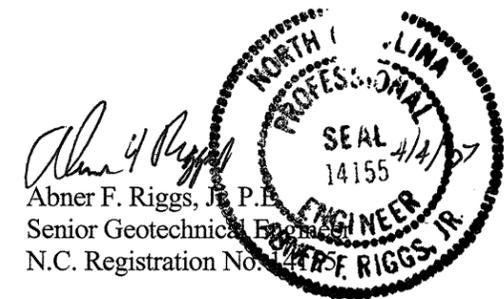
Very truly yours,  
S&ME, Inc.

J. Shane Johnson 

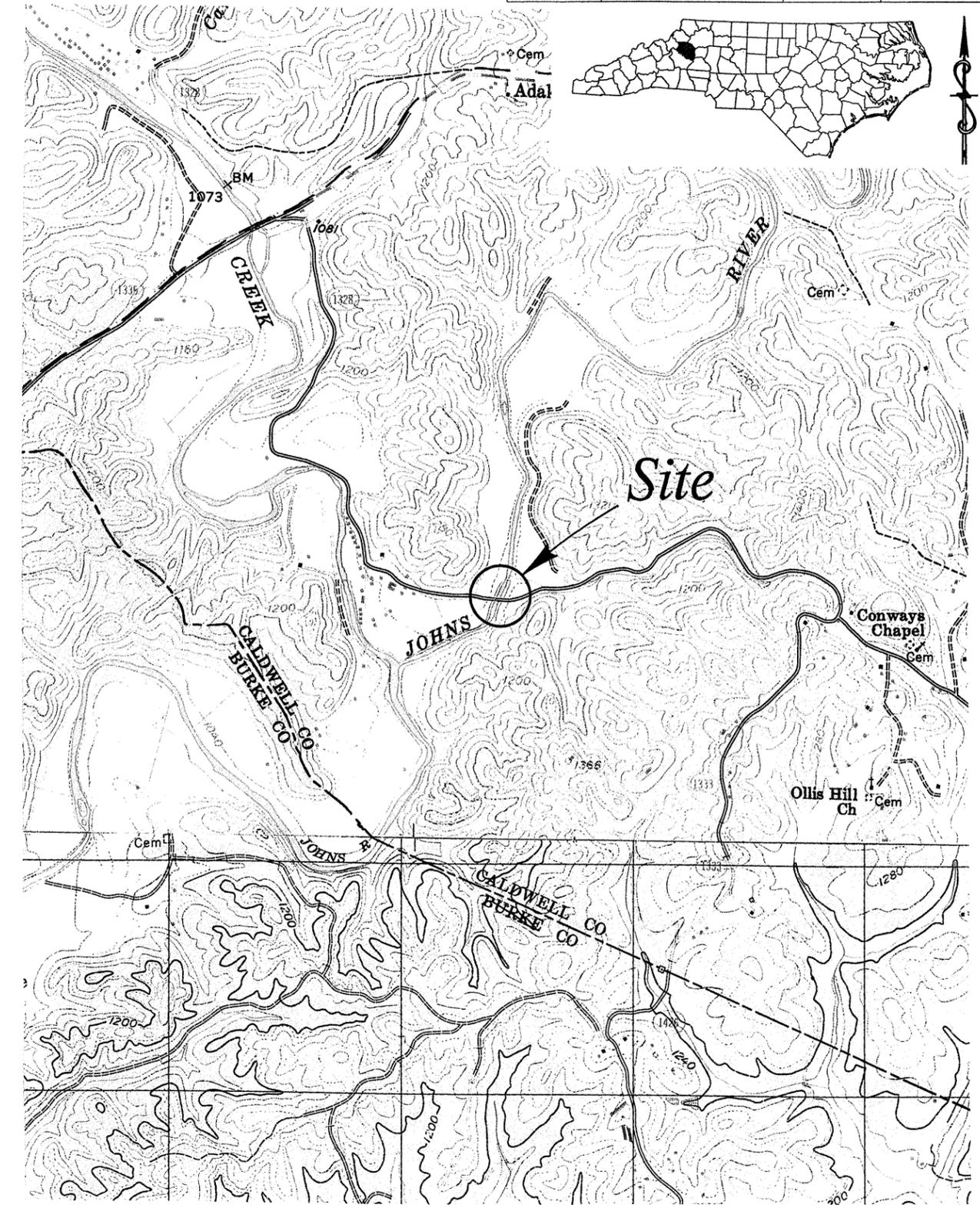
J. Shane Johnson, P.G.  
Project Geologist  
N.C. Registration No. 1753

Attachments

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ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
B-3624	33172.I.I	5	27

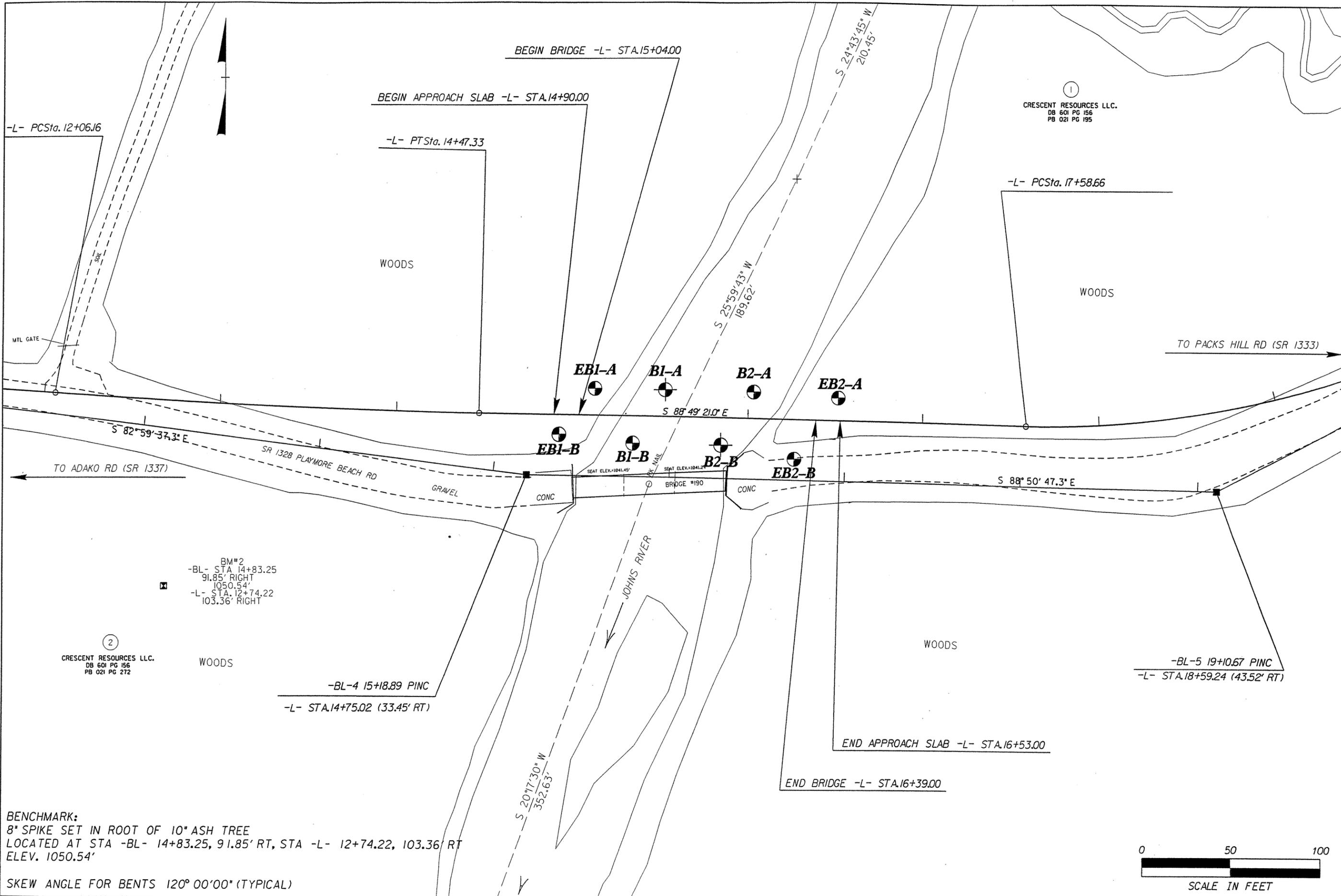


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DRAWN BY:	TRP
DATE:	MARCH 2007
JOB NO.	105 1-06-527



**SITE VICINITY MAP**  
 REPLACEMENT OF BRIDGE No. 190  
 ON SR 1328 OVER JOHNS RIVER  
 STATE PROJECT NO. 33172.I.I TIP NO. B-3624  
 FEDERAL I.D. NO. BRZ-1328 (4)  
 CALDWELL COUNTY, NORTH CAROLINA



-L- PCSta. 12+06.16

BEGIN APPROACH SLAB -L- STA.14+90.00

BEGIN BRIDGE -L- STA.15+04.00

-L- PTSta. 14+47.33

WOODS

CRESCENT RESOURCES LLC.  
DB 601 PG 156  
PB 021 PG 195

-L- PCSta. 17+58.66

WOODS

TO PACKS HILL RD (SR 1333)

EB1-A BI-A B2-A EB2-A

S 88° 49' 21.0" E

S 82° 59' 37.3" E

SR 1328 PLAYMORE BEACH RD

EB1-B

BI-B

B2-B

EB2-B

TO ADAKO RD (SR 1337)

GRAVEL

CONC

SEAT ELEV. 1041.45'

SEAT ELEV. 1041.12'

BRIDGE #190

CONC

S 88° 50' 47.3" E

BM#2  
-BL- STA. 14+83.25  
91.85' RIGHT  
1050.54'  
-L- STA. 12+74.22  
103.36' RIGHT

CRESCENT RESOURCES LLC.  
DB 601 PG 156  
PB 021 PG 272

WOODS

-BL-4 15+18.89 PINC

-L- STA.14+75.02 (33.45' RT)

-BL-5 19+10.67 PINC  
-L- STA.18+59.24 (43.52' RT)

END APPROACH SLAB -L- STA.16+53.00

END BRIDGE -L- STA.16+39.00

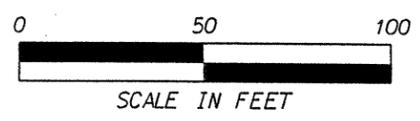
S 20°17'30" W  
352.63'

JOHNS RIVER

WOODS

BENCHMARK:  
8" SPIKE SET IN ROOT OF 10" ASH TREE  
LOCATED AT STA -BL- 14+83.25, 91.85' RT, STA -L- 12+74.22, 103.36' RT  
ELEV. 1050.54'

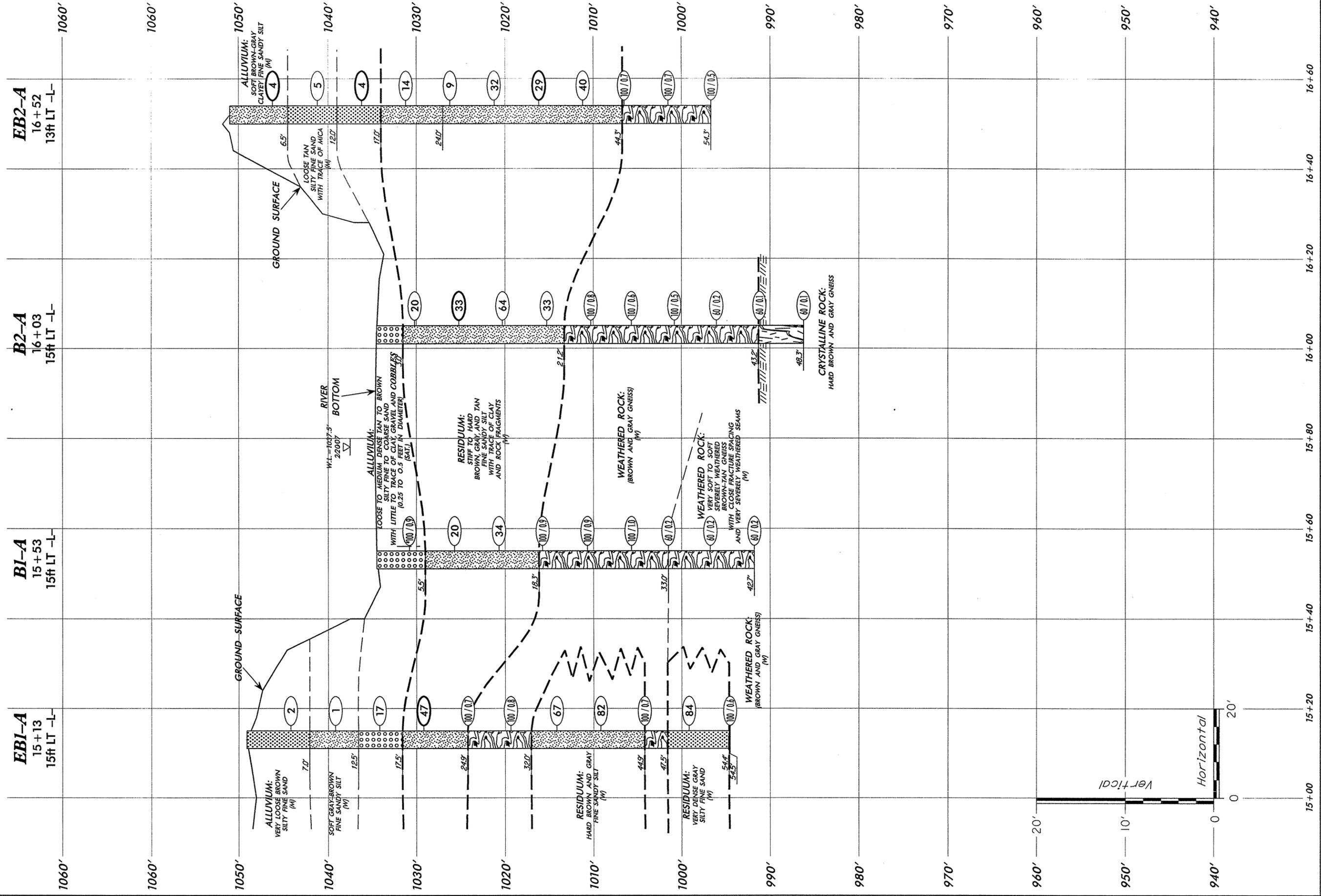
SKREW ANGLE FOR BENTS 120° 00' 00" (TYPICAL)



		APPROVED BY:	AFR
		DRAWN BY:	TRP
SCALE:	1" = 50'	DATE:	MARCH 2007
JOB NO.:	1051-06-527	SHEET	6 OF 27
<b>BORING LOCATION PLAN</b>			
REPLACEMENT OF BRIDGE No. 190 ON SR 1328 OVER JOHNS RIVER STATE PROJECT No. 33172.1.1 FEDERAL I.D. BRZ- 1328(4) CALDWELL COUNTY, NORTH CAROLINA			

S:\PROJECTS\2006\06-527\GEO\TECH\CADD\SITE PLAN.DGN

TO ADAKO RD. (SR 1337) GENERALIZED SUBSURFACE PROFILE 15.0' LEFT OF -L- TO PACKS HILL ROAD (SR 1333)



GENERALIZED SUBSURFACE PROFILE 15.0' LEFT OF -L-

REPLACEMENT OF BRIDGE No. 190  
ON SR. 1328 OVER JOHNS RIVER  
STATE PROJECT No. 33172.1.1 FEDERAL I.D. BRZ-1328(4)  
CALDWELL COUNTY, NORTH CAROLINA

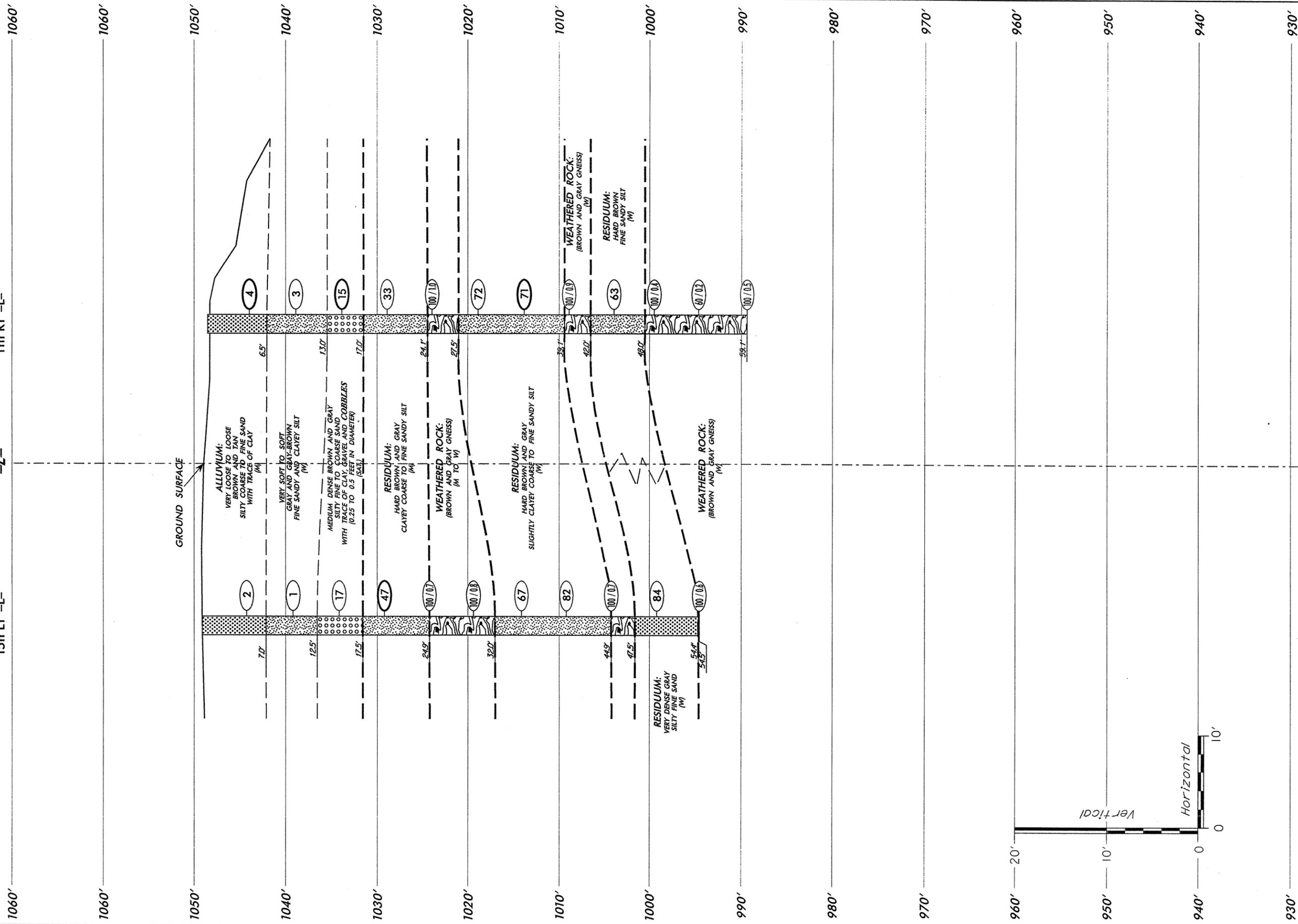


SCALE:	(V) 1" = 10' (H) 1" = 20'	APPROVED BY:	AFR
DATE:	MARCH 2007	DRAWN BY:	TRP
JOB NO.	105 1-06-527	SHEET	7 OF 27

**GENERALIZED SUBSURFACE CROSS SECTION THROUGH END BENT No.1**

**EBI-A**  
15+13  
15# LT -L-

**EBI-B**  
14+93  
11# RT -L-



**GENERALIZED SUBSURFACE CROSS SECTION**

THROUGH END BENT No. 1  
REPLACEMENT OF BRIDGE No. 190  
ON SR. 1328 OVER JOHNS RIVER  
TIP No. B-3624 STATE PROJECT No. 33172.1.1 FEDERAL I.D. BRZ-1328(4)  
CALDWELL COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 10'  
(H) 1" = 10'

DATE: MARCH 2007

JOB NO. 1051-06-527

APPROVED BY: AFR

DRAWN BY: TRP

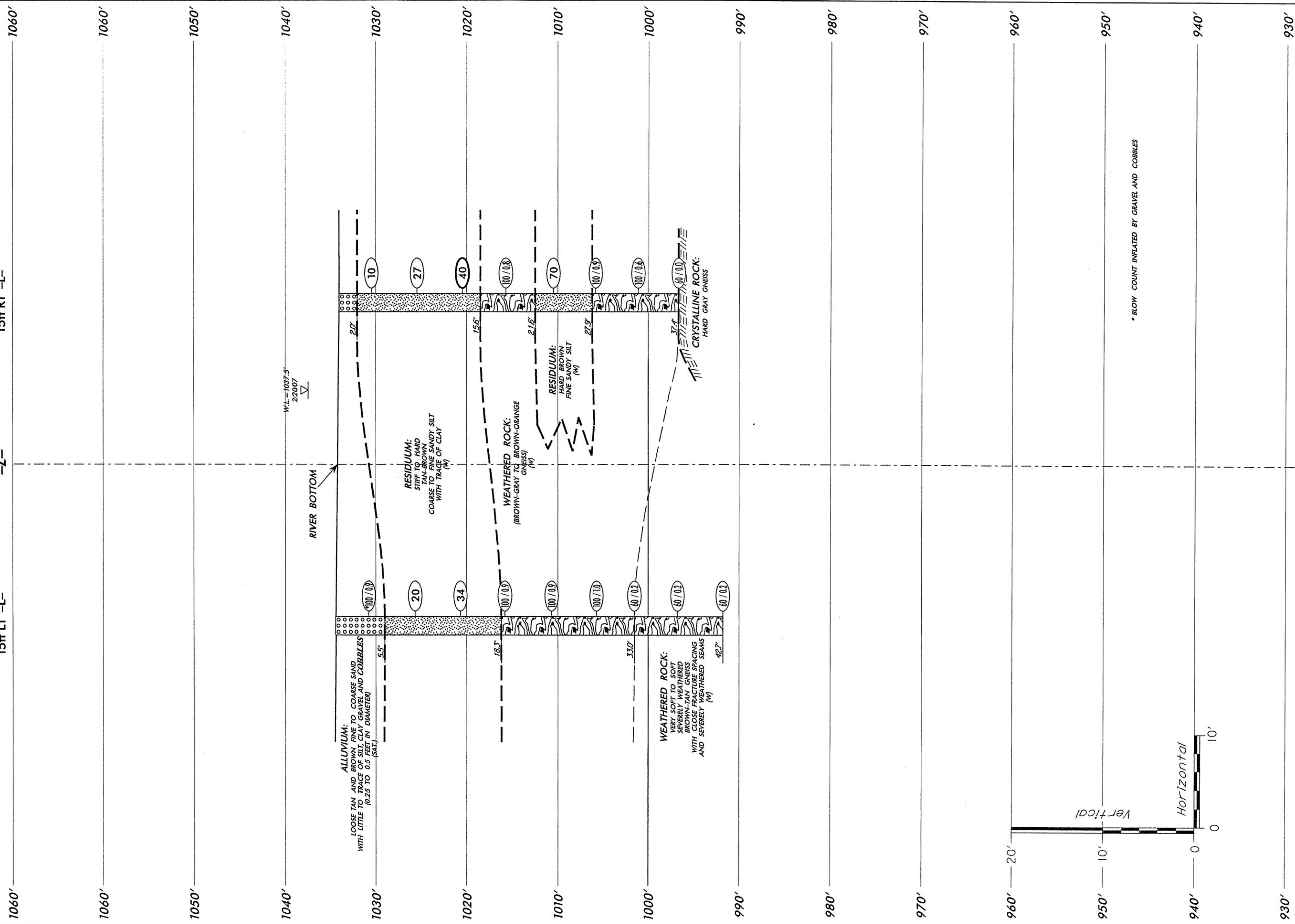
SHEET 8 OF 27

**GENERALIZED SUBSURFACE CROSS SECTION THROUGH INTERIOR BENT No. 1**

**BI-A**  
15 + 53  
15ft LT -L-

**BI-B**  
15 + 35  
15ft RT -L-

℄  
-L-



**GENERALIZED SUBSURFACE CROSS SECTION**

THROUGH INTERIOR BENT No. 1  
REPLACEMENT OF BRIDGE No. 190  
ON SR. 1328 OVER JOHNS RIVER  
STATE PROJECT No. 33172-1.1 FEDERAL I.D. BRZ-1328(4)  
CALDWELL COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 10'  
(H) 1" = 10'

DATE: MARCH 2007

APPROVED BY: AFR

JOB NO. 1051-06-527

DRAWN BY: TRP

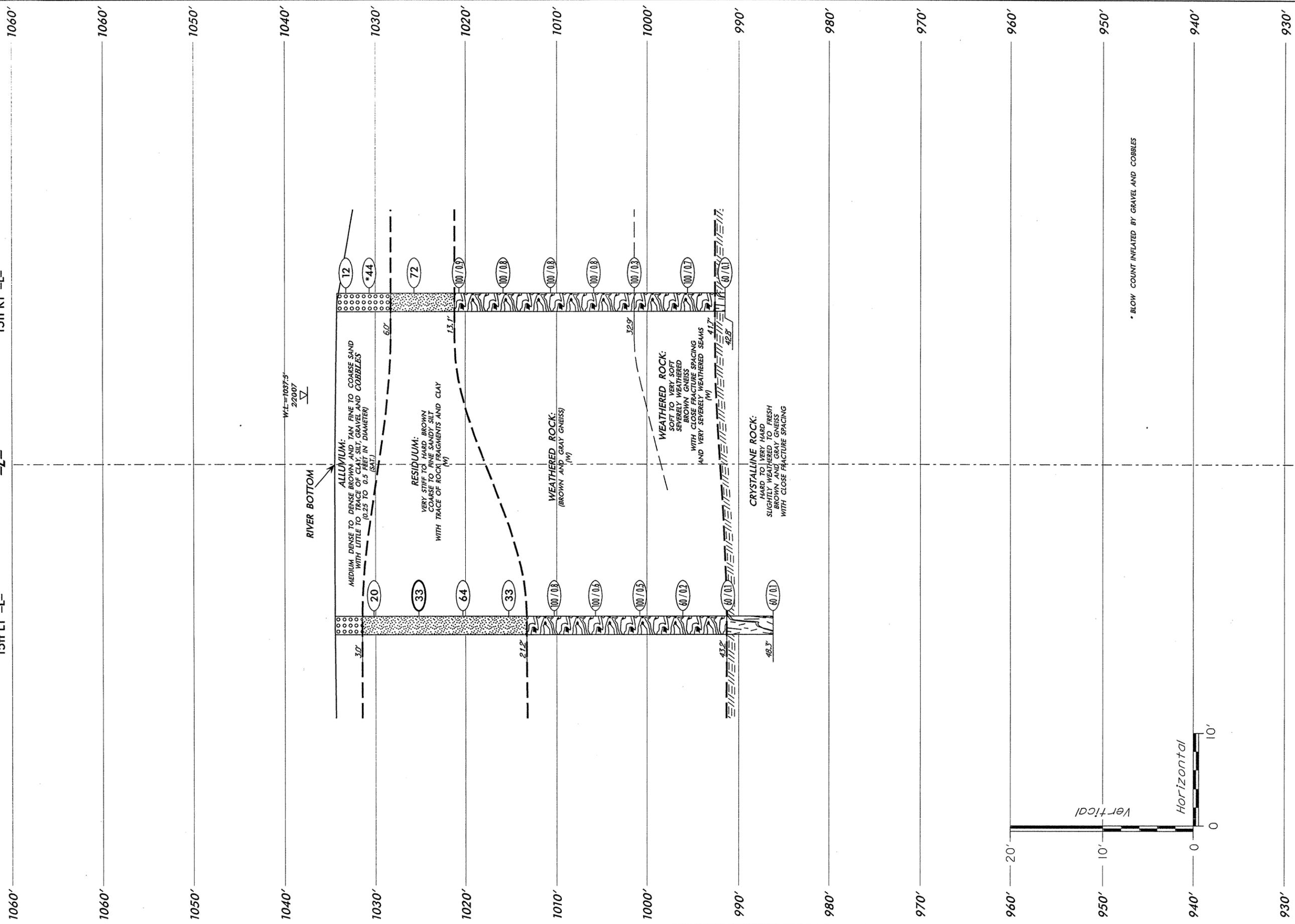
SHEET 9 OF 27

GENERALIZED SUBSURFACE CROSS SECTION THROUGH INTERIOR BENT No. 2

**B2-A**  
16+03  
15ft LT -L-

**B2-B**  
15+85  
15ft RT -L-

℄  
-L-



GENERALIZED SUBSURFACE CROSS SECTION

THROUGH INTERIOR BENT No. 2  
REPLACEMENT OF BRIDGE No. 190  
ON SR. 1328 OVER JOHNS RIVER  
STATE PROJECT No. 33172.1.1 FEDERAL I.D. BRZ-1328(4)  
CALDWELL COUNTY, NORTH CAROLINA



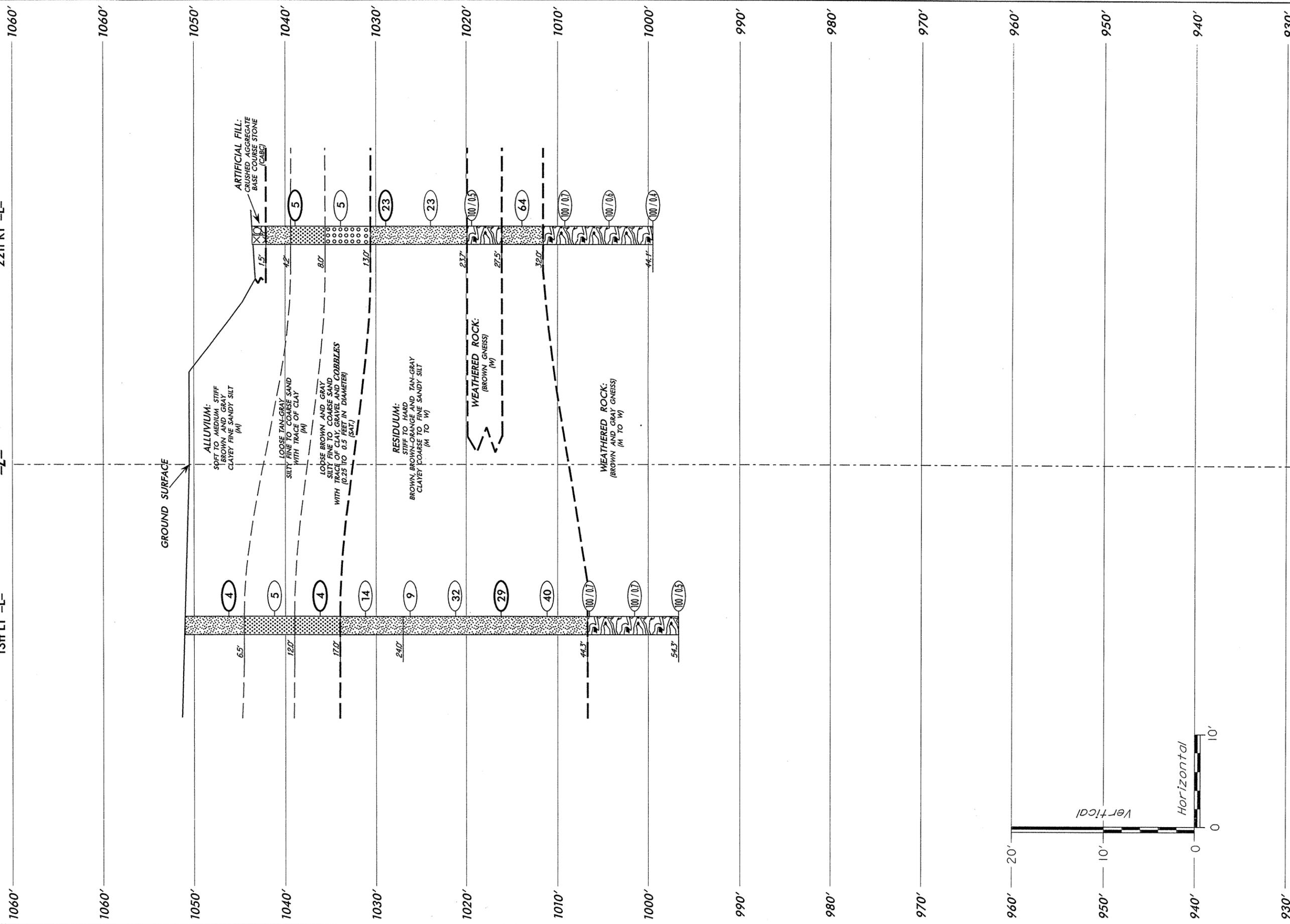
SCALE:	(V) 1" = 10'	APPROVED BY:	AFR
	(H) 1" = 10'	DRAWN BY:	TRP
DATE:	MARCH 2007	JOB NO.	105 1-06-527
		SHEET	10 OF 27

**GENERALIZED SUBSURFACE CROSS SECTION THROUGH END BENT No.2**

**EB2-A**  
16+52  
13ft LT -L-

ℓ  
-L-

**EB2-B**  
16+27  
22ft RT -L-



**GENERALIZED SUBSURFACE CROSS SECTION**

THROUGH END BENT No. 1  
REPLACEMENT OF BRIDGE No. 190  
ON SR. 1328 OVER JOHNS RIVER  
TIP No. B-3624 STATE PROJECT No. 33172.1.1 FEDERAL I.D. BRZ-1328(4)  
CALDWELL COUNTY, NORTH CAROLINA



SCALE: (V) 1" = 10'  
(H) 1" = 10'

DATE: MARCH 2007

JOB NO. 1051-06-527

APPROVED BY: AFR

DRAWN BY: TRP

SHEET 11 OF 27



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON									
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)									
BORING NO. EB1-A		BORING LOCATION 15+13		OFFSET 15.0 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 1,049.1 ft		NORTHING 787,788.4		EASTING 1,199,070.4		0 HR. N/A									
TOTAL DEPTH 54.5 ft		DRILL MACHINE BK-51		DRILL METHOD 3-1/4" HSA/Rotary Wash w/2-7/8" Tricone Roller		HAMMER TYPE AUTOMATIC									
DATE STARTED 2/21/07		COMPLETED 2/21/07		SURFACE WATER DEPTH N/A											
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100		
1,049.1													GROUND SURFACE	1,049.1	0.00
1,045.2	3.9	1	1	1							M		ALLUVIUM: VERY LOOSE BROWN SILTY FINE SAND (A-2-4)	1,042.1	7.0
1,040.2	8.9	1	WOH	1							W		VERY SOFT GRAY-BROWN FINE SANDY SILT (A-4)	1,036.6	12.5
1,035.2	13.9	2	7	10							Sat.		MEDIUM DENSE BROWN SILTY FINE TO COARSE SAND (A-1-a) WITH TRACE OF GRAVEL AND COBBLES (0.25 TO 0.5 FEET IN DIAMETER)	1,031.6	17.5
1,030.2	18.9	15	22	25							SS-12	14.6%	RESIDUUM: HARD BROWN AND GRAY CLAYEY COARSE TO FINE SANDY SILT (A-4)	1,024.2	24.9
1,025.2	23.9	18	57	43/0.2							M		WEATHERED ROCK: (BROWN AND GRAY GNEISS)	1,017.1	32.0
1,020.2	28.9	40	60/0.3								W		RESIDUUM: HARD BROWN AND GRAY FINE SANDY SILT (A-4)	1,004.2	44.9
1,015.2	33.9	12	29	38							W		WEATHERED ROCK: (BROWN AND GRAY GNEISS)	1,001.6	47.5
1,010.2	38.9	16	29	53							W		RESIDUUM: VERY DENSE GRAY SILTY FINE SAND (A-2-4)		
1,005.2	43.9	17	67	33/0.2							W		WEATHERED ROCK: (BROWN AND GRAY GNEISS)		
1,000.2	48.9	26	34	50							W		RESIDUUM: VERY DENSE GRAY SILTY FINE SAND (A-2-4)		
995.2	53.9	70	30/0.1								W		WEATHERED ROCK: (BROWN AND GRAY GNEISS)		
BORING TERMINATED AT ELEV. 994.6 FEET IN WEATHERED ROCK: (BROWN AND GRAY GNEISS)												100/0.6		54.4	
1) ADVANCED 3-1/4" HSA TO 18.9 FEET. 2) ADVANCED 2-7/8" TRICONE TO 63.9 FEET. 3) RIVER WATER USED AS DRILLING FLUID WITH QUICKGEL ADDED. 4) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 5) NO LOSS OF DRILLING FLUID OBSERVED.															

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/16/07



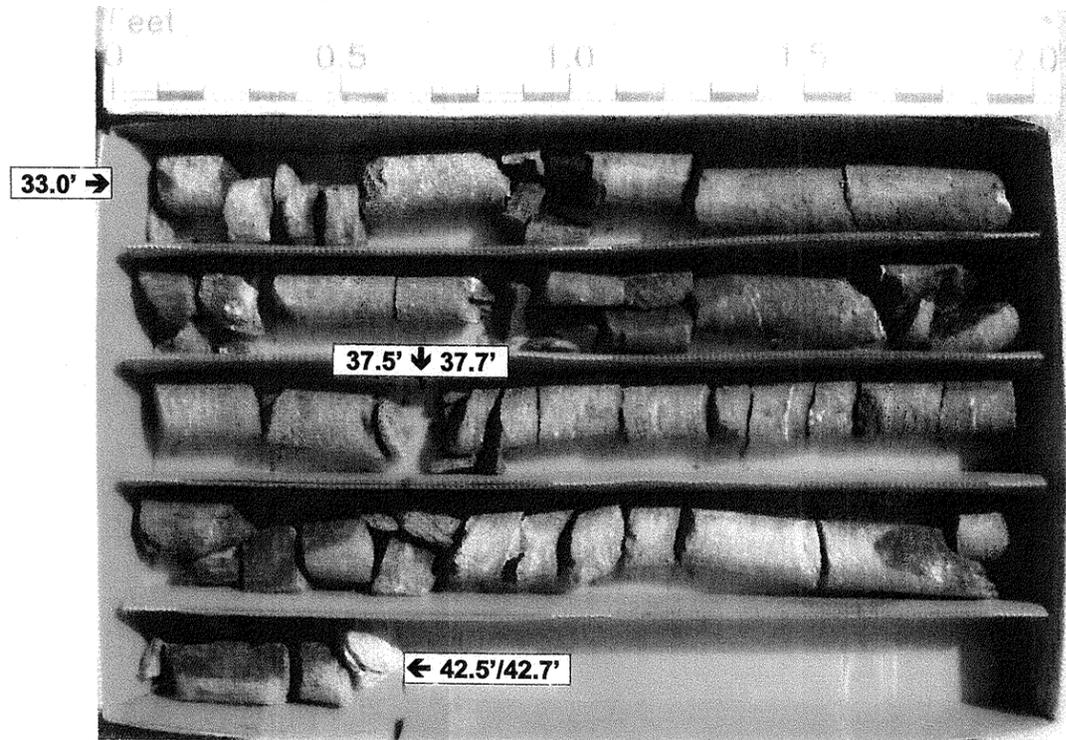
PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON									
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)									
BORING NO. EB1-B		BORING LOCATION 14+93		OFFSET 11.0 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 1,048.5 ft		NORTHING 787,762.4		EASTING 1,199,049.8		0 HR. Cave@10.0									
TOTAL DEPTH 59.1 ft		DRILL MACHINE CME-550x		DRILL METHOD 3-1/4" HSA		HAMMER TYPE AUTOMATIC									
DATE STARTED 2/14/07		COMPLETED 2/14/07		SURFACE WATER DEPTH N/A											
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100		
1,048.5													GROUND SURFACE	1,048.5	0.00
1,044.9	3.6	2	2	2							SS-13	M	ALLUVIUM: LOOSE TAN SILTY COARSE TO FINE SAND (A-2-4) WITH TRACE OF CLAY	1,042.0	6.5
1,039.9	8.6	2	1	2							W		SOFT GRAY CLAYEY SILT (A-4) WITH SAND LAYERS	1,035.5	13.0
1,034.9	13.6	9	9	6							SS-14	Sat.	MEDIUM DENSE GRAY SILTY FINE TO COARSE SAND (A-1-a) WITH TRACE OF GRAVEL AND CLAY	1,031.5	17.0
1,029.9	18.6	9	16	17							M		RESIDUUM: HARD BROWN FINE SANDY SILT (A-4)	1,024.4	24.1
1,024.9	23.6	27	73/0.5								M		WEATHERED ROCK: (BROWN GNEISS)	1,021.0	27.5
1,019.9	28.6	29	31	41							W		RESIDUUM: HARD BROWN AND GRAY SLIGHTLY CLAYEY COARSE TO FINE SANDY SILT (A-4)	1,009.4	39.1
1,014.9	33.6	16	20	51							SS-15	15.5%	WEATHERED ROCK: (BROWN GNEISS)	1,008.5	42.0
1,009.9	38.6	32	68/0.4								W		RESIDUUM: HARD BROWN FINE SANDY SILT (A-4)	1,000.5	48.0
1,004.9	43.6	27	33	30							W		WEATHERED ROCK: (BROWN GNEISS)		
999.9	48.6	100/0.4									W		RESIDUUM: VERY DENSE GRAY SILTY FINE SAND (A-2-4)		
994.9	53.6	60/0.2									W		WEATHERED ROCK: (BROWN GNEISS)		
989.9	58.6	100/0.5									W		WEATHERED ROCK: (BROWN GNEISS)		
BORING TERMINATED AT ELEV. 989.4 FEET IN WEATHERED ROCK: (BROWN GNEISS)												100/0.5		59.1	
1) ADVANCED 3-1/4" HSA TO 58.6 FEET.															

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/15/07



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON				
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)				
BORING NO. B1-A		BORING LOCATION 15+53		OFFSET 15.0 ft LT		ALIGNMENT -L-				
COLLAR ELEV. 1,034.5 ft		NORTHING 787,787.6		EASTING 1,199,110.4		0 HR. N/A				
TOTAL DEPTH 42.7 ft		DRILL MACHINE CME-550x		DRILL METHOD Rotary Wash w/NW Casing/2-7/8" Tricone Roller/NQ-3 Core Barrel		HAMMER TYPE AUTOMATIC				
DATE STARTED 3/5/07		COMPLETED 3/6/07		SURFACE WATER DEPTH 1.8 ft		24 HR. N/A				
CORE SIZE NQ-3		TOTAL RUN 9.3 ft		DRILLER R. NORWOOD						
ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	RQD (ft) %	LOG	DESCRIPTION AND REMARKS
										1,001.5 Begin Coring @ 33.0 ft 33.0
1,001.5	33.0	4.5	3:30 3:00 3:15 3:15	(4.2) 93%	(N/A)		(8.0) 86%	(N/A)		WEATHERED ROCK: VERY SOFT TO SOFT SEVERELY WEATHERED BROWN-TAN GNEISS WITH CLOSE FRACTURE SPACING AND WITH VERY SEVERELY WEATHERED SEAMS FROM 34.2 TO 35.1 AND 38.8 TO 39.1 FEET
997.0	37.5									
996.8	37.7	4.8	2:00/0.5 N=60/0.2	(3.8) 79%	(N/A)					
992.0	42.5		3:30 2:45							
991.8	42.7		3:30 3:45 3:30/0.8 N=60/0.2							BORING TERMINATED AT ELEV. 991.8 FEET IN WEATHERED ROCK: SOFT BROWN-TAN GNEISS 42.7

Project No.: 1051-06-527	ID No.: B-3624	Location: Caldwell County, NC	Boring No.: B1-A
Site Description: Replacement of Bridge No. 190 on SR 1328 over Johns River			Driller: R. Norwood
Collar Elev.: 1034.5 ft.	Core Size: NQ-3	Equipment: CME-550x	Geologist: S. Johnson
Elev. at T.D.: 991.8 ft.	Total Depth: 42.7 ft.	Total Run: 9.3 ft.	Date: 3/5-6/07



Box 1 of 1  
Top of Box @ 33.0 feet; Bottom of Box @ 42.7 feet



PROJECT NO.		ID.		COUNTY		GEOLOGIST										
33172.1.1		B-3624		Caldwell		N. Bradley										
SITE DESCRIPTION							GROUND WATER (ft)									
Bridge 190 over the Johns River on SR 1328							0 HR.	N/A								
BORING NO.		BORING LOCATION		OFFSET		ALIGNMENT										
B1-B		15+35		15.0 ft RT		-L-										
COLLAR ELEV.		NORTHING		EASTING		24 HR.										
1,034.1 ft		787,757.9		1,199,091.8		N/A										
TOTAL DEPTH		DRILL MACHINE		DRILL METHOD		HAMMER TYPE										
37.4 ft		CME-550x		Rotary Wash w/2-7/8" Tricone Roller		AUTOMATIC										
DATE STARTED		COMPLETED		SURFACE WATER DEPTH												
2/28/07		3/1/07		1.6 ft												
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION				
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100			
1,035.7					RIVER LEVEL											
					RIVER BOTTOM											
1,031.5	2.6	3	4	6	10						S-1	Sat.	1,034.1	0.00	ALLUVIUM: LOOSE BROWN FINE TO COARSE SAND (A-1-a) WITH TRACE OF GRAVEL, SILT AND CLAY	
1,026.5	7.6	6	10	17	27						W		1,032.1	2.0	RESIDUUM: STIFF TO HARD TAN-BROWN COARSE TO FINE SANDY SILT (A-4) WITH TRACE OF CLAY	
1,021.5	12.6	9	16	24	40						SS-21	25.6%	1,018.5	15.6	WEATHERED ROCK (BROWN-GRAY GNEISS)	
1,016.5	17.6	38	62/0.3						100/0.8		W		1,012.5	21.6	RESIDUUM: HARD BROWN FINE SANDY SILT (A-4)	
1,011.5	22.6	18	25	45	70						W		1,006.2	27.9	WEATHERED ROCK: (BROWN GNEISS)	
1,006.7	27.4	42	58/0.4						100/0.9		W					
1,001.7	32.4	47	53/0.1						100/0.6		W					
996.7	37.4								60/0.0		W		996.7	37.4		
																BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEV. 996.7 FEET ON CRYSTALLINE ROCK: HARD BROWN GNEISS
																1) ADVANCED NW CASING TO 7.6 FEET. 2) SET NW CASING TO 7.6 FEET. 3) ADVANCED 2-7/8" TRICONE TO 37.4 FEET. 4) 10 FEET OF ROD AND TRICONE LOST IN HOLE. 5) RIVER WATER USED AS DRILLING FLUID. 6) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 7) NO LOSS OF DRILLING FLUID OBSERVED.

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/15/07



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST N. Bradley							
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)							
BORING NO. B2-A		BORING LOCATION 16+03		OFFSET 15.0 ft LT		ALIGNMENT -L-							
COLLAR ELEV. 1,034.5 ft		NORTHING 787,786.5		EASTING 1,199,160.4		0 HR. N/A							
TOTAL DEPTH 48.3 ft		DRILL MACHINE CME-550x		DRILL METHOD Rotary Wash w/2-7/8" Tricone Roller		HAMMER TYPE AUTOMATIC							
DATE STARTED 2/26/07		COMPLETED 2/26/07		SURFACE WATER DEPTH 1.8 ft									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
1,036.3													RIVER LEVEL
													RIVER BOTTOM
1,031.2	3.3	10	10	10							S-2 Sat		ALLUVIUM: MEDIUM DENSE BROWN FINE TO COARSE SAND (A-1-a) WITH TRACE OF SILT, CLAY, GRAVEL AND COBBLES (0.25 TO 0.5 FEET IN DIAMETER)
1,026.2	8.3	14	15	18							W		RESIDUUM: VERY STIFF TO HARD BROWN COARSE TO FINE SANDY SILT (A-4) WITH TRACE OF ROCK FRAGMENTS AND CLAY
1,021.3	13.2	11	31	33							W		
1,016.3	18.2	8	14	19							W		
1,011.3	23.2	26	61	39/0.3							W		WEATHERED ROCK: (BROWN AND GRAY GNEISS)
1,006.3	28.2	66	34/0.1								W		
1,001.3	33.2	82	18/0.0								W		
996.3	38.2	60/0.2									W		
991.3	43.2	60/0.1									W		CRYSTALLINE ROCK: HARD BROWN AND GRAY GNEISS
986.3	48.2	60/0.1									W		
													<p>BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEV. 986.2 FEET IN CRYSTALLINE ROCK: HARD BROWN AND GRAY GNEISS</p> <p>1) ADVANCED NW CASING TO 8.3 FEET. 2) SET NW CASING TO 8.3 FEET. 3) ADVANCED 2-7/8" TRICONE TO 48.2 FEET. 4) RIVER WATER USED AS DRILLING FLUID. 5) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 6) NO LOSS OF DRILLING FLUID OBSERVED.</p>

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/16/07



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON							
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)							
BORING NO. B2-B		BORING LOCATION 15+85		OFFSET 15.0 ft RT		ALIGNMENT -L-							
COLLAR ELEV. 1,034.3 ft		NORTHING 787,756.9		EASTING 1,199,141.8		0 HR. N/A							
TOTAL DEPTH 42.8 ft		DRILL MACHINE CME-550x		DRILL METHOD Rotary Wash w/NW Casing/2-7/8" Tricone Roller/NQ-3 Core Barrel		HAMMER TYPE AUTOMATIC							
DATE STARTED 3/6/07		COMPLETED 3/6/07		SURFACE WATER DEPTH 2 ft									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
1,036.3													RIVER LEVEL
													RIVER BOTTOM
1,034.3	0.0	3	4	8							Sat		ALLUVIUM: MEDIUM DENSE TO DENSE TAN FINE TO COARSE SAND (A-1-a) WITH LITTLE GRAVEL AND COBBLES (0.25 TO 0.5 FEET IN DIAMETER) AND TRACE OF SILT
1,031.7	2.6	14	32	12							Sat		RESIDUUM: HARD BROWN FINE SANDY SILT (A-4) WITH TRACE OF CLAY
1,026.7	7.6	20	32	40							W		
1,021.7	12.6	15	85/0.4								W		WEATHERED ROCK: (BROWN GNEISS)
1,016.7	17.6	30	70/0.3								W		
1,011.7	22.6	20	45	55/0.3							W		
1,006.7	27.6	33	67/0.3								W		
1,001.7	32.6	100/0.3									W		
996.6	37.7	50	50/0.2								W		WEATHERED ROCK: SOFT TO VERY SOFT SEVERELY WEATHERED BROWN GNEISS WITH CLOSE FRACTURE SPACING AND VERY SEVERELY WEATHERED SEAMS FROM 33.5 TO 33.8 AND 39.4 TO 40.3 FEET 1 JOINT @ 40° 1 JOINT @ 70°
991.6	42.7	60/0.1									W		CRYSTALLINE ROCK: HARD TO VERY HARD SLIGHTLY WEATHERED TO FRESH GRAY GNEISS WITH CLOSE FRACTURE SPACING 1 JOINT @ 80° 1 JOINT @ 45°
													<p>BORING TERMINATED AT ELEV. 991.5 FEET IN CRYSTALLINE ROCK: VERY HARD GRAY GNEISS</p> <p>1) ADVANCED 2-7/8" TRICONE ROLLER TO 32.9 FEET. 2) ADVANCED NQ-3 CORE BARREL FROM 32.9 TO 42.7 FEET. 3) SET 32.6 FEET OF NW CASING. 4) RIVER WATER USED AS DRILLING FLUID. 5) APPROXIMATE DRILLING FLUID DENSITY 62.4 PCF. 6) NO LOSS OF DRILLING FLUID OBSERVED.</p> <p>* BLOW COUNT INFLATED BY GRAVEL AND COBBLES.</p>

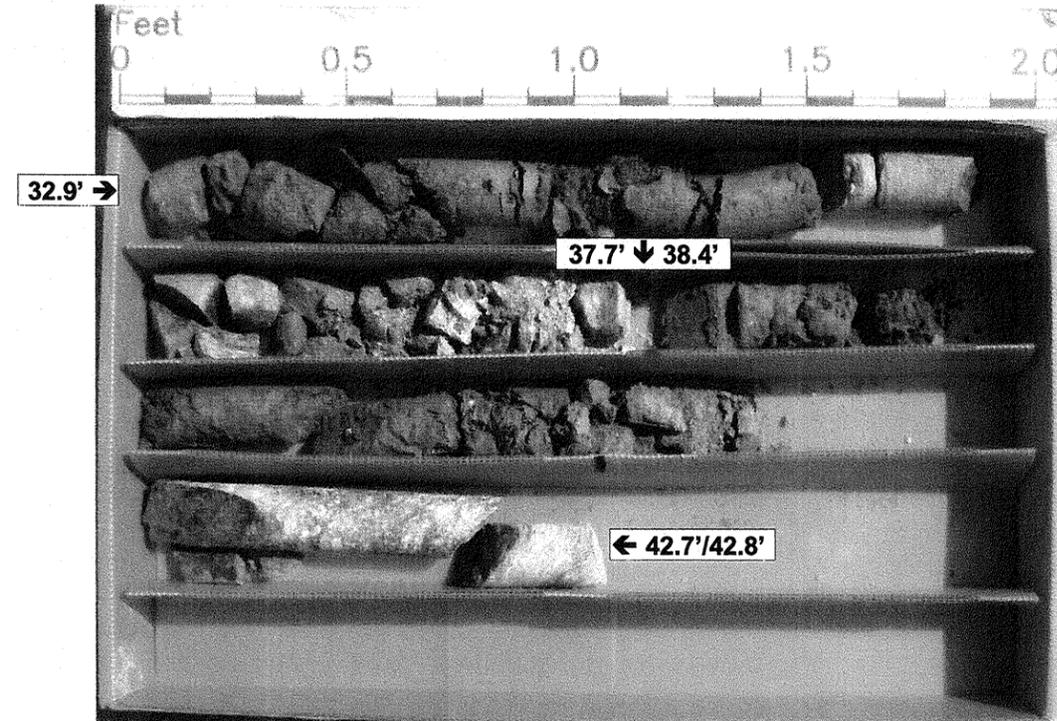
NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/16/07

**CORE PHOTOS**

PROJECT NO. 33172.1.1	ID. B-3624	COUNTY Caldwell	GEOLOGIST S. JOHNSON
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328			GROUND WATER (ft)
BORING NO. B2-B	BORING LOCATION 15+85	OFFSET 15.0 ft RT	ALIGNMENT -L-
COLLAR ELEV. 1,034.3 ft	NORTHING 787,756.9	EASTING 1,199,141.8	0 HR. N/A
TOTAL DEPTH 42.8 ft	DRILL MACHINE CME-550x	DRILL METHOD Rotary Wash w/NW Casing/2-7/8" Tricone Roller/NQ-3 Core Barrel	24 HR. N/A
DATE STARTED 3/6/07	COMPLETED 3/6/07	SURFACE WATER DEPTH 2 ft	
CORE SIZE NQ-3	TOTAL RUN 9.1 ft	DRILLER R. NORWOOD	

Project No.: 1051-06-527	ID No.: B-3624	Location: Caldwell County, NC	Boring No.: B2-B
Site Description: Replacement of Bridge No. 190 on SR 1328 over Johns River			Driller: R. Norwood
Collar Elev.: 1034.3 ft.	Core Size: NQ-3	Equipment: CME-550x	Geologist: S. Johnson
Elev. at T.D.: 991.5 ft.	Total Depth: 42.8 ft.	Total Run: 9.1 ft.	Date: 3/6/07

ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
				REC. (%)	RQD (%)		REC. (%)	RQD (%)		
										1,001.4 Begin Coring @ 32.9 ft 32.9
1,001.4	32.9	4.8	3:00 3:00 2:00 2:00	(3.1) 65%	(N/A)		(4.1) 45%	(N/A)		WEATHERED ROCK: SOFT TO VERY SOFT SEVERELY WEATHERED BROWN GNEISS WITH CLOSE FRACTURE SPACING AND VERY SEVERELY WEATHERED SEAMS FROM 33.5 TO 33.8 AND 39.4 TO 40.3 FEET 1 JOINT @ 40° 1 JOINT @ 70°
996.6	37.7		2:00/0.8							
995.9	38.4	4.3	N=100/0.7 1:00 1:00 2:00	(3.0) 70%	(0.6) 14%					992.6 991.5
991.6	42.7		4:15/0.3 N=60/0.1				(1.0) 100%	(0.6) 60%		41.7 42.8
991.5	42.8									CRYSTALLINE ROCK: HARD TO VERY HARD SLIGHTLY WEATHERED TO FRESH GRAY GNEISS WITH CLOSE FRACTURE SPACING 1 JOINT @ 80° 1 JOINT @ 45° BORING TERMINATED AT ELEV. 991.5 FEET IN CRYSTALLINE ROCK: VERY HARD GRAY GNEISS



Box 1 of 1  
Top of Box @ 32.9 feet; Bottom of Box @ 42.8 feet



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON							
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)							
BORING NO. EB2-A		BORING LOCATION 16+52		OFFSET 13.0 ft LT		ALIGNMENT -L-							
COLLAR ELEV. 1,051.0 ft		NORTHING 787,783.4		EASTING 1,199,209.0		0 HR. Cave@15.0							
TOTAL DEPTH 54.3 ft		DRILL MACHINE CME-550x		DRILL METHOD 3-1/4" HSA		HAMMER TYPE AUTOMATIC							
DATE STARTED 2/12/07		COMPLETED 2/13/07		SURFACE WATER DEPTH N/A									
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100
1,051.0													GROUND SURFACE
1,047.2	3.8	2	2	2							SS-16	M	ALLUVIUM: SOFT BROWN-GRAY CLAYEY FINE SANDY SILT (A-4)
1,042.2	8.8	2	2	3								M	LOOSE TAN SILTY FINE SAND (A-2-4) WITH TRACE OF MICA
1,037.2	13.8	1	2	2							SS-17	32.0%	LOOSE BROWN-GRAY SILTY COARSE TO FINE SAND (A-2-4) WITH TRACE OF CLAY
1,032.2	18.8	9	8	6								W	RESIDIUM: STIFF BROWN FINE SANDY SILT (A-4) WITH ROCK FRAGMENTS AT 17.0 FEET
1,027.2	23.8	4	4	5								W	STIFF TO HARD BROWN-ORANGE SLIGHTLY CLAYEY COARSE TO FINE SANDY SILT (A-4)
1,022.2	28.8	12	12	20								W	
1,017.2	33.8	11	10	19							SS-18	20.9%	
1,012.2	38.8	11	21	19								W	
1,007.2	43.8	63	37/0.2									W	WEATHERED ROCK: (BROWN-GRAY GNEISS)
1,002.2	48.8	45	55/0.2									W	
997.2	53.8											W	
													BORING TERMINATED AT ELEV. 996.7 FEET IN WEATHERED ROCK: (BROWN-GRAY GNEISS)

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/15/07



PROJECT NO. 33172.1.1		ID. B-3624		COUNTY Caldwell		GEOLOGIST S. JOHNSON								
SITE DESCRIPTION Bridge 190 over the Johns River on SR 1328						GROUND WATER (ft)								
BORING NO. EB2-B		BORING LOCATION 16+27		OFFSET 22.0 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 1,043.6 ft		NORTHING 787,749.4		EASTING 1,199,183.5		0 HR. Cave@8.5								
TOTAL DEPTH 44.1 ft		DRILL MACHINE CME-550x		DRILL METHOD 3-1/4" HSA		HAMMER TYPE AUTOMATIC								
DATE STARTED 2/13/07		COMPLETED 2/13/07		SURFACE WATER DEPTH N/A										
ELEV. (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION		
		0.5ft	0.5ft	0.5ft	0	20	40	60	80				100	
1,043.6													GROUND SURFACE	
1,039.9	3.7	2	2	3								SS-19	M	ARTIFICIAL FILL: CRUSHED AGGREGATE BASE COURSE STONE (CABC)
1,034.9	8.7	3	2	3								Sat.	M	ALLUVIUM: MEDIUM STIFF GRAY FINE SANDY SILT (A-4)
1,029.9	13.7	10	12	11								Sat.	M	LOOSE TAN-GRAY SILTY COARSE TO FINE SAND (A-2-4) WITH TRACE OF CLAY LOOSE GRAY SILTY FINE TO COARSE SAND (A-1-a) WITH TRACE OF GRAVEL AND COBBLES (0.25 TO 0.5 FEET IN DIAMETER)
1,024.9	18.7	8	11	12									M	RESIDIUM: VERY STIFF BROWN AND GRAY SLIGHTLY CLAYEY COARSE TO FINE SANDY SILT (A-4)
1,019.9	23.7												W	WEATHERED ROCK: (BROWN GNEISS)
1,014.9	28.7	12	29	35									M	HARD TAN-GRAY FINE SANDY SILT (A-4)
1,009.9	33.7	38	62/0.2										M	WEATHERED ROCK: (BROWN AND GRAY GNEISS)
1,004.9	38.7	74	26/0.1										M	
999.9	43.7												M	
														BORING TERMINATED AT ELEV. 999.5 FEET IN WEATHERED ROCK: (BROWN-GRAY GNEISS)

NCDOT BORE SINGLE 06-527.GPJ NCDOT.GDT 3/16/07

1) ADVANCED 3-1/4" HSA TO 43.7 FEET.

**SUMMARY OF LABORATORY TEST DATA**



Soil Classification and Gradation

<b>S&amp;ME Project #:</b>	<b>1051-06-527</b>
<b>State Project No.:</b>	<b>33172.1.1</b>
<b>Federal ID No.:</b>	<b>BRZ-1328(4)</b>
<b>TIP No.:</b>	<b>B-3624</b>
<b>Project Name:</b>	<b>Bridge 190 on SR 1328 over Johns River</b>
<b>County:</b>	<b>Caldwell</b>
<b>Client Name:</b>	<b>NCDOT</b>
<b>Client Address:</b>	

Boring No.	Sample No.	Sample Depth (Feet)	AASHTO Classification	Total % Passing				Total Motar Fraction				LL	PL	PI	Organic Content %	Moisture Content %
				Sieve #				Coarse Sand	Fine Sand	Silt	Clay					
				10	40	60	200									
EB1-A	SS-12	18.9-20.4	A-4 (1)	100	90	78	47	22	40	32	6	30	24	6	ND	14.6
EB1-B	SS-13	3.6-5.1	A-2-4 (0)	100	99	89	21	11	74	10	5	19	NP	NP	ND	ND
EB1-B	SS-14	13.6-15.1	A-1-a (0)	38	26	20	9	47	34	11	8	20	NP	NP	ND	ND
EB1-B	SS-15	33.6-35.1	A-4 (0)	99	80	70	46	29	32	30	9	31	28	3	ND	15.5
EB2-A	SS-16	3.8-5.3	A-4 (1)	100	100	98	58	2	52	27	19	33	30	3	ND	ND
EB2-A	SS-17	13.8-15.3	A-2-4 (0)	100	99	92	33	8	67	15	10	22	NP	NP	ND	32.0
EB2-A	SS-18	33.8-35.3	A-4 (3)	99	91	82	54	18	37	36	9	40	33	7	ND	20.9
EB2-B	SS-19	4.2-5.2	A-2-4 (0)	100	99	91	31	9	69	15	7	24	NP	NP	ND	ND
EB2-B	SS-20	13.7-15.2	A-4 (0)	89	79	70	41	21	42	29	8	32	28	4	ND	19.7
B1-B	S-1	0.0-2.0	A-1-a (0)	40	14	5	1	87	11	1	1	25	NP	NP	ND	ND
B1-B	SS-21	12.6-14.1	A-4 (1)	96	83	71	42	26	39	27	8	33	24	9	ND	25.6
B2-A	S-2	0.0-2.0	A-1-a (0)	16	5	2	1	86	11	2	1	24	NP	NP	ND	ND
B2-A	SS-22	8.3-9.8	A-4 (1)	98	84	73	44	26	36	29	9	36	29	7	ND	25.2

Notes: ND=Not Determined, NP=Nonplastic

Technical Responsibility:

B. Riggs

*Signature*

Geotechnical Engineer

*Position*



**FIELD**  
**SCOUR REPORT**

WBS: 33172.1.1 TIP: B-3624 COUNTY: Caldwell

DESCRIPTION(1): Bridge No. 190 on SR 1328 (Playmore Beach Road) over Johns River

**EXISTING BRIDGE**

Information from: Field Inspection  Microfilm \_\_\_\_\_ (reel \_\_\_\_\_ pos: \_\_\_\_\_)  
 Other (explain) Preliminary General Drawings \_\_\_\_\_

Bridge No.: 190 Length: 87.5' Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2  
 Foundation Type: Timber Caps and timber posts and sills / timber piles

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: Evidence of erosion was observed at both end bents. A concrete approach slab that extends to the wingwalls was placed at both approaches.

Interior Bents: Evidence of scour was observed at Interior Bent No. 1 and Interior Bent No. 2.

Channel Bed: Scour was noted in the channel bed on the north side and under the existing bridge.

Channel Bank: Banks appear steep upstream of the existing bridge.

**EXISTING SCOUR PROTECTION**

Type(3): Timber abutments and wingwalls at both end bents. Concrete slab at both approaches.

Extent(4): Timber wingwalls extend a few feet beyond the timber abutments.

Effectiveness(5): Relatively effective with some erosion at both abutments.

Obstructions(6): Some debris was observed at the Interior Bents on the upstream side of the existing bridge.

**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 theoretical 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): Brown and tan fine to coarse sand (A-1-a) with little to trace amounts of silt, clay, gravel and cobbles (0.25 to 0.5 feet in diameter)

Channel Bank Material(8): Brown and gray silty coarse to fine sand (A-2-4) with trace of clay  
 Brown-gray clayey and fine sandy silt (A-4)

Channel Bank Cover(9): Trees and underbrush

Floodplain Width(10): Approximately 400 feet to the west and Approximately 1000 feet to the east

Floodplain Cover(11): Undeveloped wooded area

Stream is(12): Aggrading \_\_\_\_\_ Degrading  Static \_\_\_\_\_

Channel Migration Tendency(13): Migration tendency to the west

Observations and Other Comments: Concrete approach slab appears to extend to the wingwalls at both end bents. Cobble, gravel and sand bar located approximately 50 to 60 feet downstream (south) of existing bridge.

Reported by: J. Shane Johnson <sup>DR</sup> Date: 2/20/2007  
 J. Shane Johnson (S&ME, Inc.)

**DESIGN SCOUR ELEVATIONS(14)**

Feet  Meters \_\_\_\_\_

		BENTS									
		B1	B2	B3	B4						
Left	1030.8	1029.7									
Right	1031.4	1027.7									

Comparison of DSE to Hydraulics Unit theoretical scour:

DSE based on OT scour event for site and derived from the Bridge Survey and Hydraulic Design Report sealed on 5/15/06.

DSE determined by: Bradley D. Worley Date: 3/21/2007  
 (Bradley D. Worley)

**SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL**

Bed or Bank	BED	BED	BANK	BANK	BANK	BANK	BANK
Sample No.	S-1	S-2	SS-13	SS-14	SS-16	SS-17	SS-19
Retained #4	45	78	0	51	0	0	0
Passed #10	40	16	100	38	100	100	100
Passed #40	14	5	99	26	100	99	99
Passed #200	1	1	21	9	58	33	31
Coarse Sand	87	86	11	47	2	8	9
Fine Sand	11	11	74	34	52	67	69
Silt	1	2	10	11	27	15	15
Clay	1	1	5	8	19	10	7
LL	25	24	19	20	33	22	24
PI	NP	NP	NP	NP	3	NP	NP
AASHTO	A-1-a (0)	A-1-a (0)	A-2-4 (0)	A-1-a (0)	A-4(1)	A-2-4 (0)	A-2-4 (0)
Station	15+35	16+03	14+93	14+93	16+52	16+52	16+27
Offset	15 RT	15 LT	11 RT	11 RT	13 LT	13 LT	22 RT
Depth	0.0-2.0	0.0-2.0	3.6-5.1	13.6-15.1	3.8-5.3	13.8-15.3	4.2-5.2

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

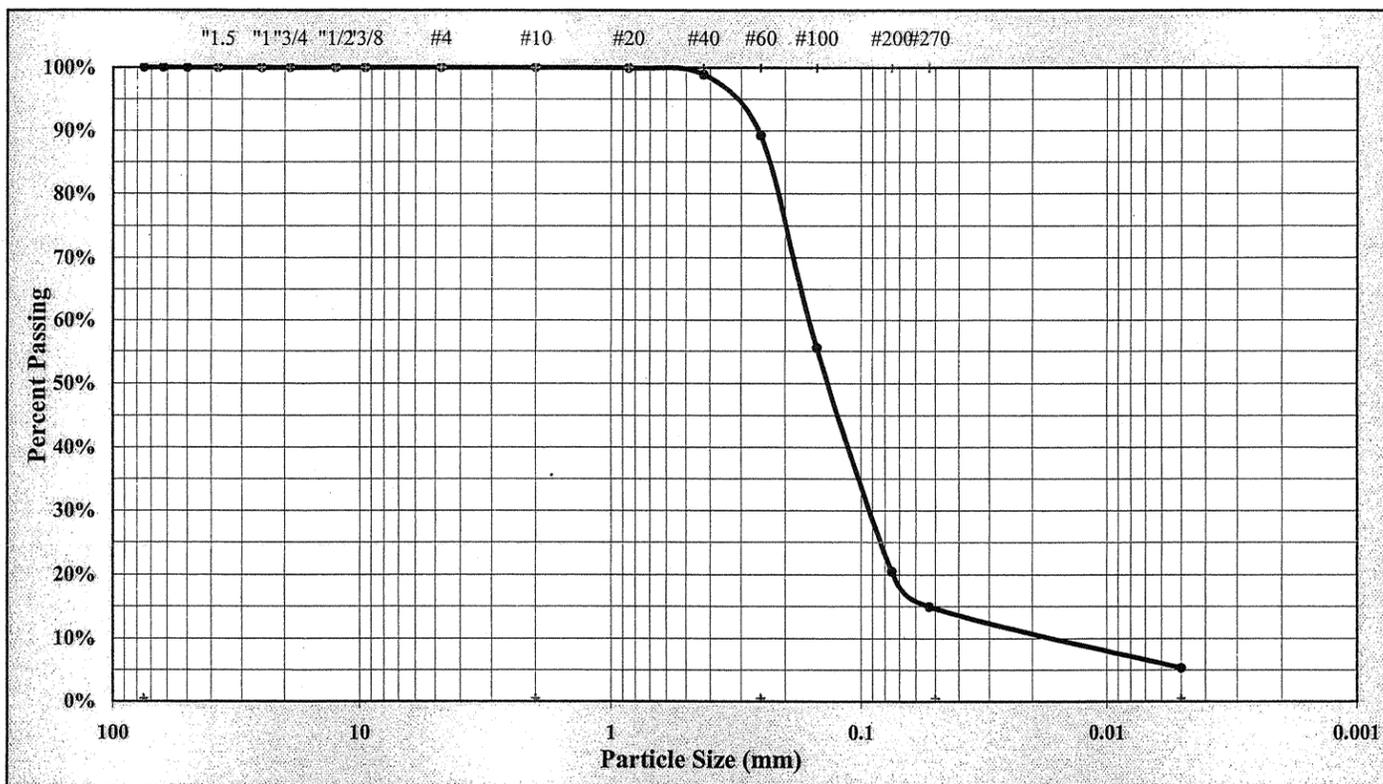


S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 on SR 1328 over Johns River**  
 Client Name: **NCDOT**

Report Date: 2/28/2007  
 Test Date(s): 2/23 - 2/28/07

Client Address:  
 State Project #: 33172.1.1 F.A. Project No: BRZ-1328(4) TIP NO: B-3624

Boring #:	EB1-B	Sample #:	SS-13	Sample Date:	2/16/07
Location:	14+93	Offset:	11 RT	Depth:	3.6'-5.1'
Sample Description:	Tan Silty Coarse to Fine Sand with trace of Clay A-2-4 (0)				



As Defined by NCDOT		Fine Sand		< 0.25 mm and > 0.05 mm	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm		
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm		
Maximum Particle Size	#10	Coarse Sand	10.8%	Silt	10.0%
Gravel	0.0%	Fine Sand	74.3%	Clay	5.0%
Apparent Relative Density		Moisture Content		% Passing #200	20.5%
Liquid Limit	19	Plastic Limit	N.P.	Plastic Index	N.P.

#### Soil Mortar (-#10 Sieve)

Coarse Sand	10.8%	Fine Sand	74.3%	Silt	9.6%	Clay	5.3%
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Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable   
 Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g/ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan Laboratory Supervisor  
Signature Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

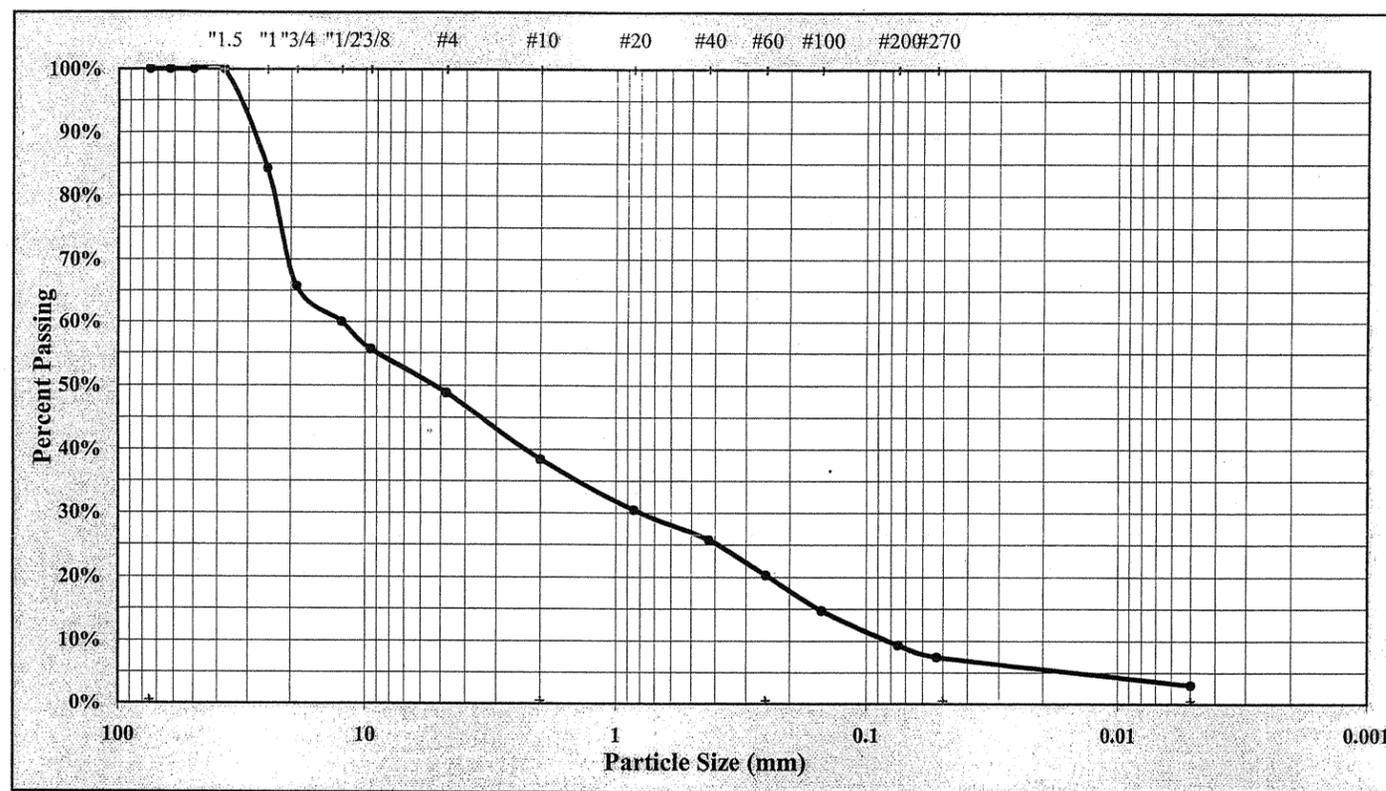


S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 on SR 1328 over Johns River**  
 Client Name: **NCDOT**

Report Date: 2/28/2007  
 Test Date(s): 2/23 - 2/28/07

Client Address:  
 State Project #: 33172.1.1 F.A. Project No: BRZ-1328(4) TIP NO: B-3624

Boring #:	EB1-B	Sample #:	SS-14	Sample Date:	2/16/07
Location:	14+93	Offset:	11 RT	Depth:	13.6'-15.1'
Sample Description:	Gray Silty Fine to Coarse Sand with Trace of Gravel and Clay A-1-a (0)				



As Defined by NCDOT		Fine Sand		< 0.25 mm and > 0.05 mm	
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm		
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm		
Maximum Particle Size	1.5	Coarse Sand	18.1%	Silt	4.0%
Gravel	61.6%	Fine Sand	12.9%	Clay	3.0%
Apparent Relative Density		Moisture Content		% Passing #200	9.3%
Liquid Limit	20	Plastic Limit	N.P.	Plastic Index	N.P.

#### Soil Mortar (-#10 Sieve)

Coarse Sand	47.1%	Fine Sand	33.6%	Silt	11.5%	Clay	7.8%
-------------	-------	-----------	-------	------	-------	------	------

Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable   
 Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g/ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T89: Determining the Liquid Limit of Soils AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan Laboratory Supervisor  
Signature Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 on SR 1328 over Johns River**  
 Client Name: **NCDOT**  
 Client Address:  
 State Project #: **33172.1.1**

Report Date: **3/9/2007**  
 Test Date(s): **3/3 - 3/9/07**

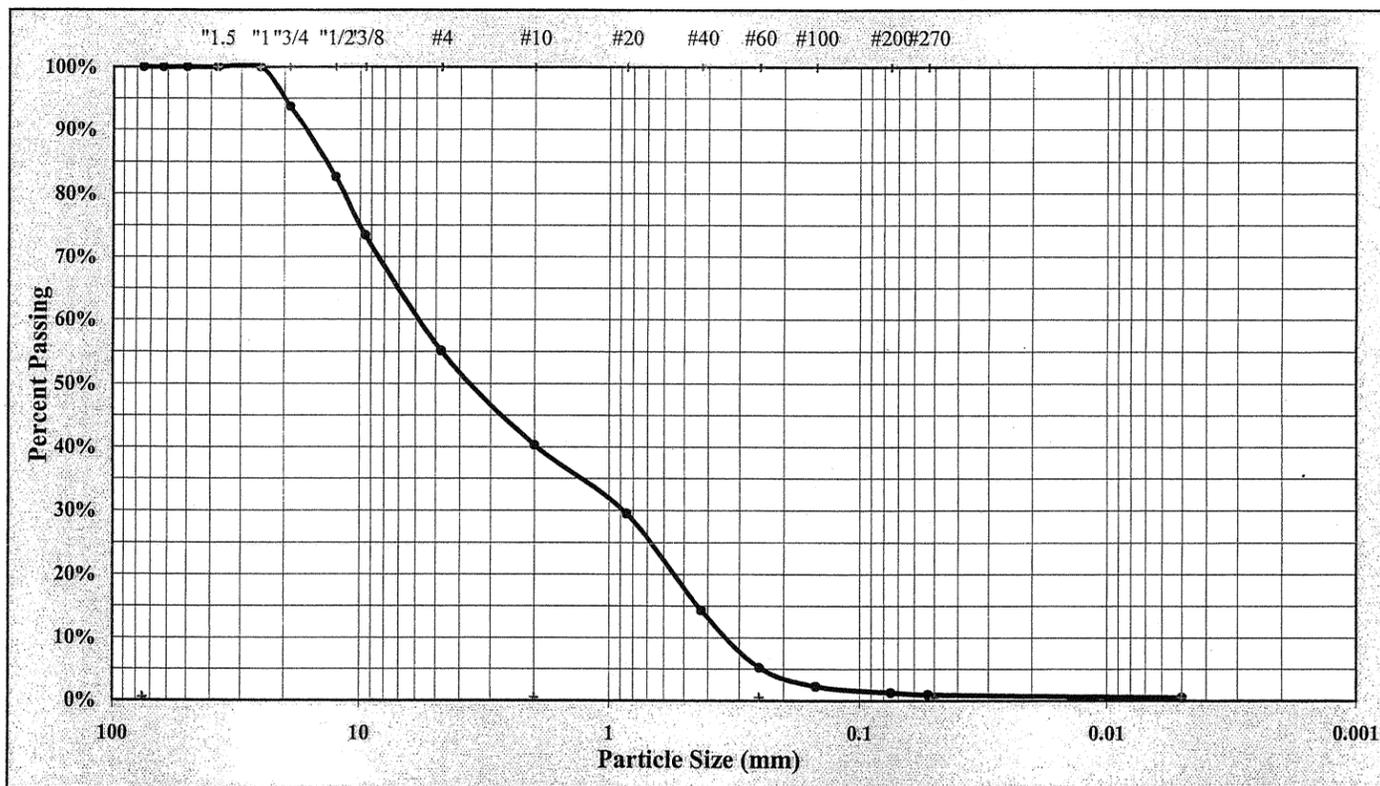


F.A. Project No: **BRZ-1328(4)**      TIP NO: **B-3624**

Boring #: **B1-B**      Sample #: **S-1**      Sample Date: **2/19/07**

Location: **15+35**      Offset: **15 RT**      Depth: **0' - 2'**

Sample Description: **Brown Fine to Coarse Sand with Trace of Gravel, Silt and Clay A-1-a (0)**



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm		
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm		
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm		
Maximum Particle Size	1"	Coarse Sand	35.1%	Silt	0.0%
Gravel	59.7%	Fine Sand	4.3%	Clay	1.0%
Apparent Relative Density		Moisture Content		% Passing #200	1.2%
Liquid Limit	25	Plastic Limit	N.P.	Plastic Index	N.P.

#### Soil Mortar (-#10 Sieve)

Coarse Sand 87.0%      Fine Sand 10.8%      Silt 0.9%      Clay 1.3%

Description of Sand & Gravel Particles:    Rounded     Angular     Hard & Durable     Soft     Weathered & Friable

Mechanical Stirring Apparatus (A)    Length of Dispersion Period: 1 min.    Dispersing Agent: Sodium Hexametaphosphate: 40 g / Liter

References:    AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test      AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T89: Determining the Liquid Limit of Soils      AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes      ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan      \_\_\_\_\_      Laboratory Supervisor  
 Signature      Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 on SR 1328 over Johns River**  
 Client Name: **NCDOT**  
 Client Address:  
 State Project #: **33172.1.1**

Report Date: **3/9/2007**  
 Test Date(s): **3/3 - 3/9/07**

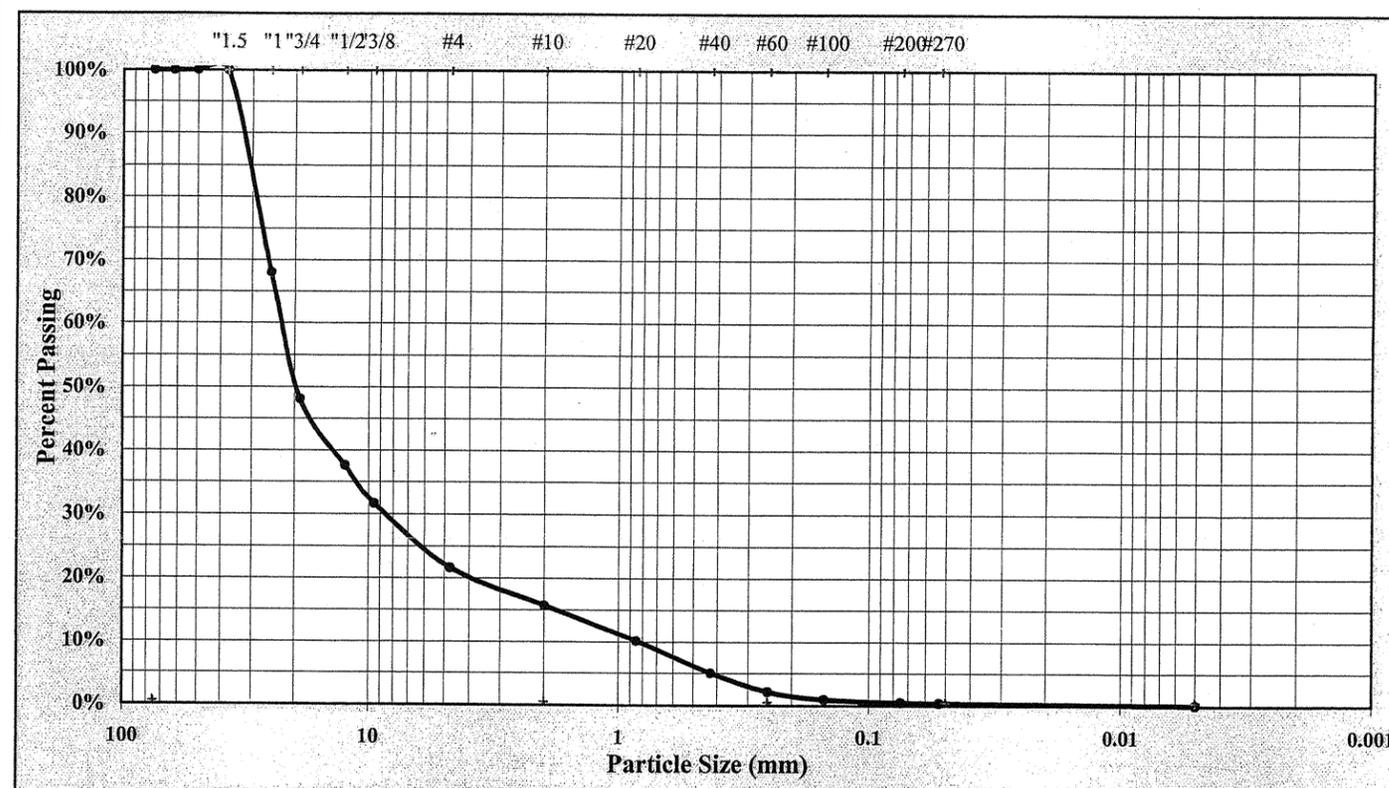


F.A. Project No: **BRZ-1328(4)**      TIP NO: **B-3624**

Boring #: **B2-A**      Sample #: **S-2**      Sample Date: **2/19/07**

Location: **16+03**      Offset: **15 LT**      Depth: **0' - 2'**

Sample Description: **Brown Fine to Coarse Sand with Trace of Gravel, Cobbles, Silt and Clay A-1-a (0)**



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm		
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm		
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm		
Maximum Particle Size	1.5	Coarse Sand	13.6%	Silt	0.0%
Gravel	84.3%	Fine Sand	1.7%	Clay	0.0%
Apparent Relative Density		Moisture Content		% Passing #200	0.5%
Liquid Limit	24	Plastic Limit	N.P.	Plastic Index	N.P.

#### Soil Mortar (-#10 Sieve)

Coarse Sand 86.4%      Fine Sand 11.3%      Silt 1.5%      Clay 0.8%

Description of Sand & Gravel Particles:    Rounded     Angular     Hard & Durable     Soft     Weathered & Friable

Mechanical Stirring Apparatus (A)    Length of Dispersion Period: 1 min.    Dispersing Agent: Sodium Hexametaphosphate: 40 g / Liter

References:    AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT

AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test      AASHTO T265: Laboratory Determination of Moisture Content of Soils

AASHTO T89: Determining the Liquid Limit of Soils      AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils

AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes      ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan      \_\_\_\_\_      Laboratory Supervisor  
 Signature      Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

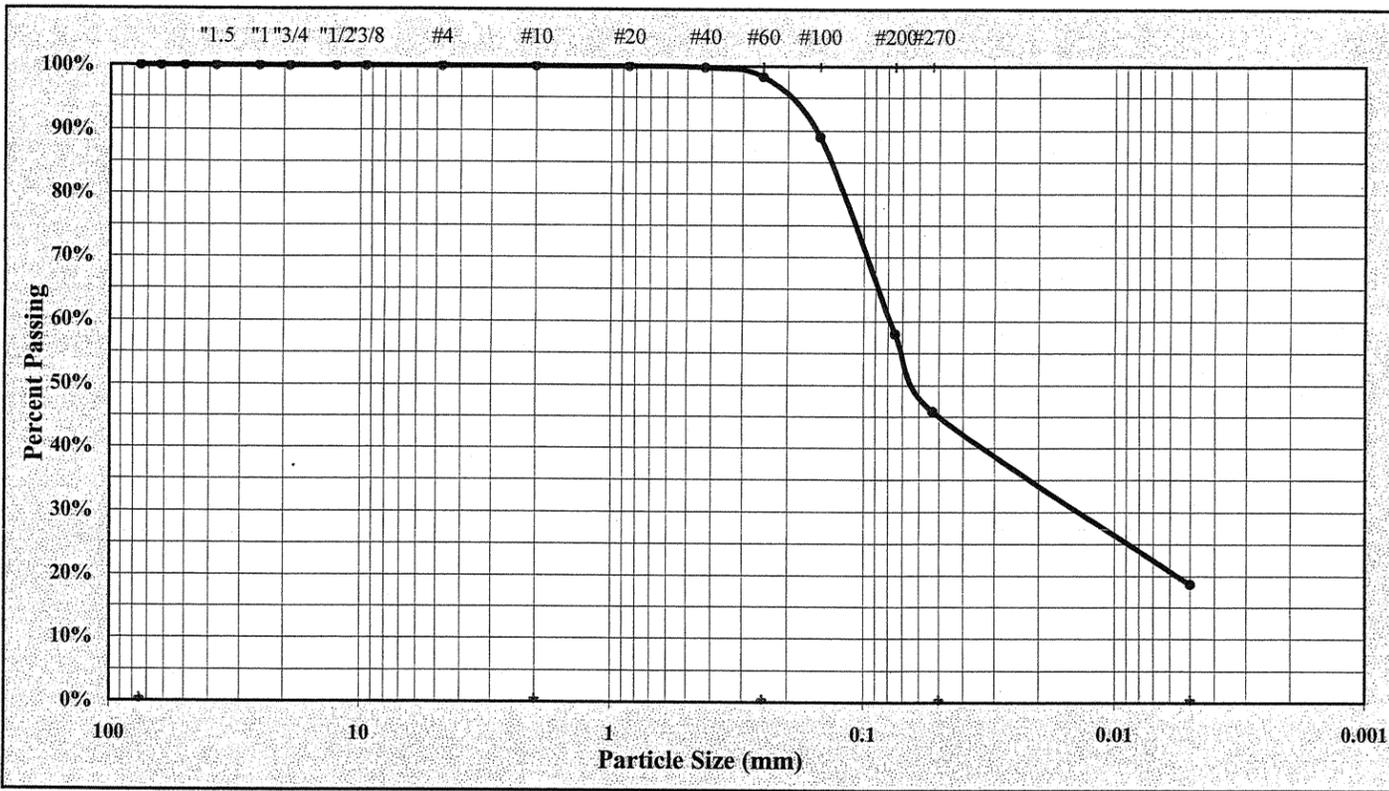


S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 on SR 1328 over Johns River**  
 Client Name: **NCDOT**  
 Client Address:  
 State Project #: **33172.1.1**

Report Date: **2/28/2007**  
 Test Date(s): **2/23 - 2/28/07**

F.A. Project No: **BRZ-1328(4)** TIP NO: **B-3624**

Boring #: **EB2-A** Sample #: **SS-16** Sample Date: **2/16/07**  
 Location: **16+52** Offset: **13 LT** Depth: **3.8'-5.3'**  
 Sample Description: **Brown-Gray Clayey Fine Sandy Silt A-4 (1)**



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#20	Coarse Sand	1.7%	Silt	27.0%
Gravel	0.0%	Fine Sand	52.5%	Clay	19.0%
Apparent Relative Density		Moisture Content		% Passing #200	58.0%
Liquid Limit	33	Plastic Limit	30	Plastic Index	3

#### Soil Mortar (-#10 Sieve)

Coarse Sand	1.7%	Fine Sand	52.5%	Silt	27.1%	Clay	18.7%
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Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test  
 AASHTO T89: Determining the Liquid Limit of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes  
 AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan Laboratory Supervisor  
 Signature

### Particle Size Analysis of Soils

AASHTO T 88 as Modified by NCDOT

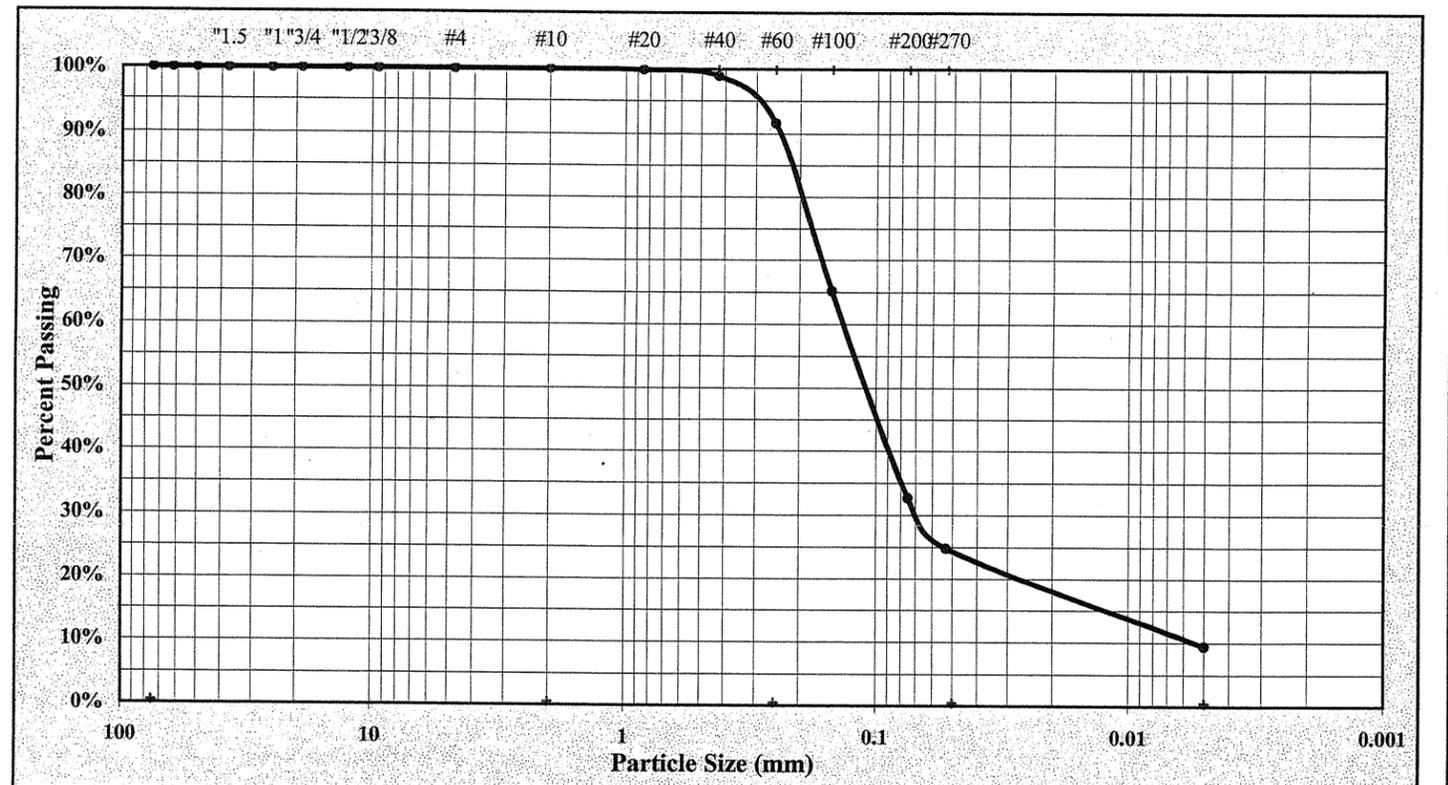


S&ME Project #: **1051-06-527**  
 Project Name: **Bridge 190 pm SR 1328 over Johns River**  
 Client Name: **NCDOT**  
 Client Address:  
 State Project #: **33172.1.1**

Report Date: **2/28/2007**  
 Test Date(s): **2/23 - 2/28/07**

F.A. Project No: **BRZ-1328(4)** TIP NO: **B-3624**

Boring #: **EB2-A** Sample #: **SS-17** Sample Date: **2/16/07**  
 Location: **16+52** Offset: **13 LT** Depth: **13.8'-15.3'**  
 Sample Description: **Brown-Gray Silty Coarse to Fine Sand with Trace of Clay A-2-4 (0)**



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and > 0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#10	Coarse Sand	8.4%	Silt	15.0%
Gravel	0.0%	Fine Sand	66.8%	Clay	9.0%
Apparent Relative Density		Moisture Content		% Passing #200	32.7%
Liquid Limit	22	Plastic Limit	N.P.	Plastic Index	N.P.

#### Soil Mortar (-#10 Sieve)

Coarse Sand	8.4%	Fine Sand	66.8%	Silt	15.4%	Clay	9.4%
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Description of Sand & Gravel Particles: Rounded  Angular  Hard & Durable  Soft  Weathered & Friable

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

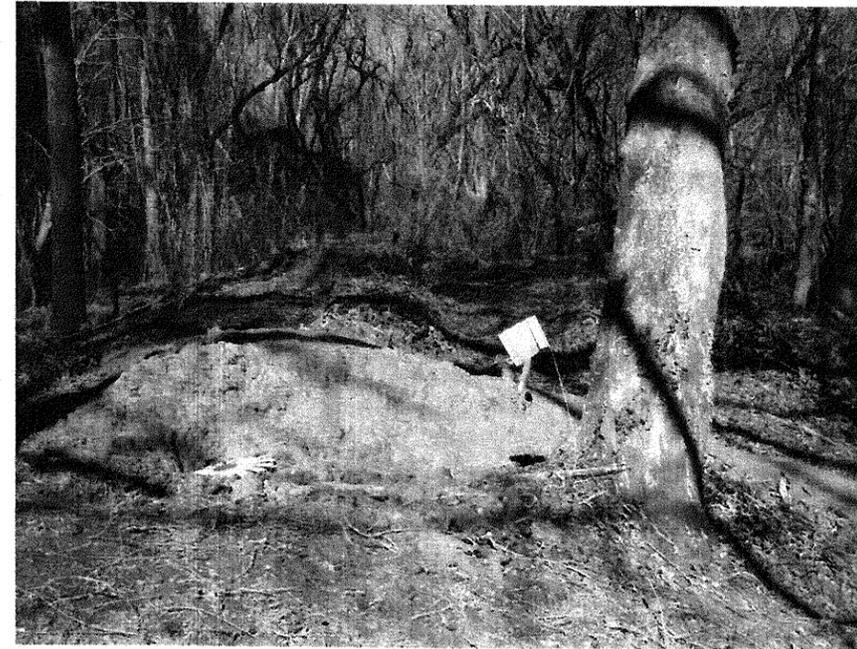
References: AASHTO T88: Particle Size Analysis of Soils as Modified by the NCDOT  
 AASHTO T87: Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test  
 AASHTO T89: Determining the Liquid Limit of Soils  
 AASHTO M 145: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes  
 AASHTO T265: Laboratory Determination of Moisture Content of Soils  
 AASHTO T90: Determining the Plastic Limit & Plasticity Index of Soils  
 ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Karajan Laboratory Supervisor  
 Signature





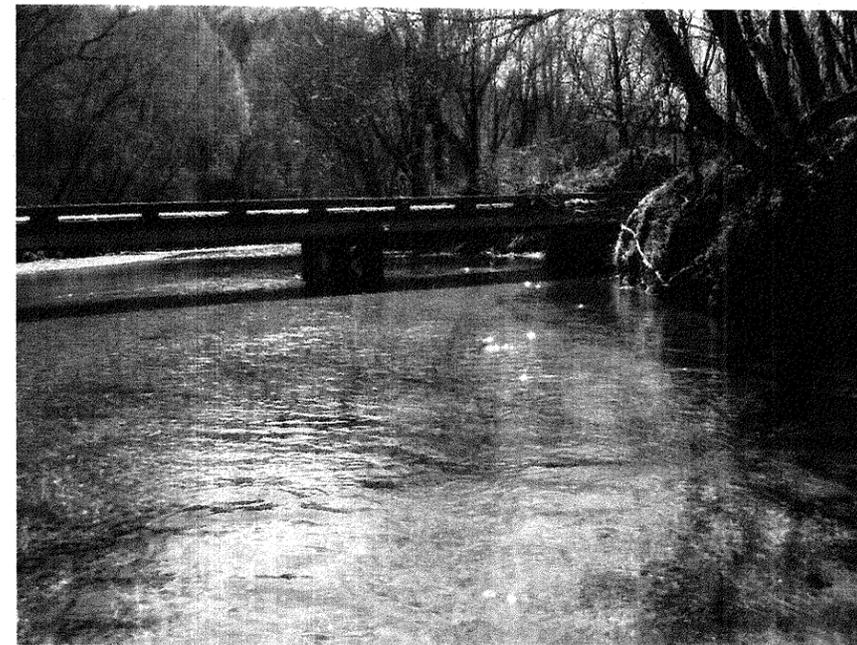
**Photograph No. 1:**  
This photograph was taken from the proposed west approach, along the -L- alignment, looking east.



**Photograph No. 3:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed End Bent No. 1.



**Photograph No. 2:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed End Bent No. 1.



**Photograph No. 4:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed Interior Bent No. 1.



**Photograph No. 5:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 1.



**Photograph No. 7:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed Interior Bent No. 2.



**Photograph No. 6:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed Interior Bent No. 2.

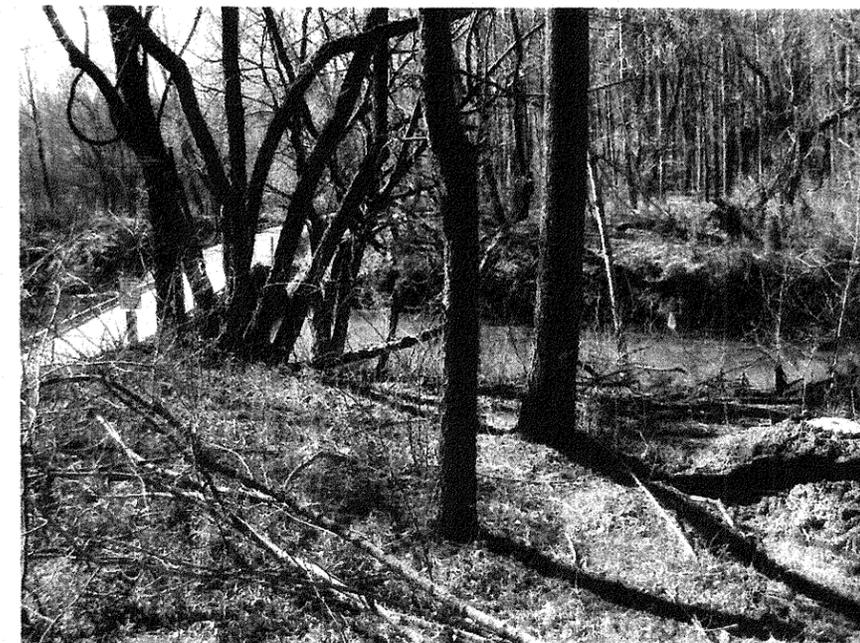


**Photograph No. 8:**  
This photograph was taken from the existing bridge, looking north (upstream).



**Photograph No. 9:**  
This photograph was taken from the existing bridge, looking south (downstream).

**Photograph No. 11:**  
This photograph was taken from the right side of the -L- alignment, looking north, across proposed End Bent No. 2.



**Photograph No. 10:**  
This photograph was taken from the left side of the -L- alignment, looking south, across proposed End Bent No. 2.

**Photograph No. 12:**  
This photograph was taken from the proposed east approach, along the -L- alignment, looking west.