December 3, 2012

Mr. Brian D. Dehler, PE
WSP Sells
15401 Weston Pkwy, Suite 100
Cary, North Carolina 27513

Reference: **Foundation Design Recommendations**
Moore County Bridge Replacement
State Project No. 17BP.8.R.14
County: Moore County
Bridge (SR 1403) over Williams Creek
ECS Project No. 08-8089

Dear Mr. Dehler:

ECS Carolinas, LLC (ECS) is pleased to present this report of subsurface exploration and recommendations for design and construction of the subject bridge foundations. It includes analyses and recommendations for the end bents.

This work was completed in accordance with the agreement between ECS and WSP Sells dated March 5, 2012.

This report presents a review of the project information, discussions of the site and subsurface conditions, and our recommendations for design and construction of the new bridge foundations. The appendices present boring location plans, NCDOT boring logs, supporting calculations, and special provisions.

ECS has enjoyed working with you and the WSP Sells Design Team on this phase of the project. We look forward to serving as your geotechnical consultant on the remainder of this project and on future projects. If you have any questions regarding this report, please feel free to contact us.

Respectfully,

ECS Carolinas, LLP

NORTH CAROLINA PROFESSIONAL SEAL 7234 ENGINEER RICHARD L. NANCE

Richard L. Nance, P.E.
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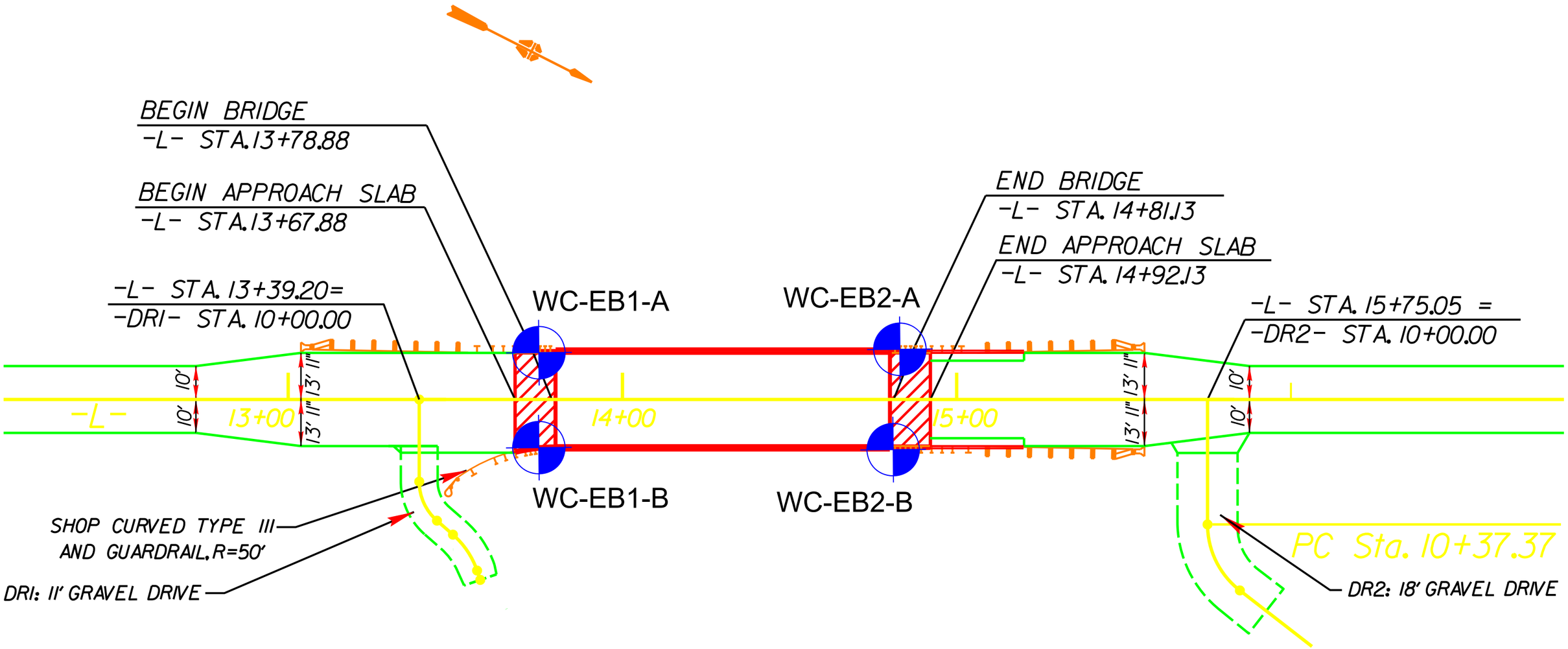

PROJECT NO. 17BP.8.R.14

MOORE COUNTY

15 30 30 0

HORIZONTAL
SCALE: 1" = 30'

DRAWN BY : JMR DATE : 12-4

CHECKED BY : EHF DATE : 12-4

$FILES

$TIMES

$DATES

REVISIONS			
NO.	BY:	DATE:	DESCRIPTION OF REVISION:
0			
1			
2			
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BORING LOCATION DIAGRAM
ECS PROJECT #08-8089
SR 1403 BRIDGE
OVER WILLIAMS CREEK

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. 1

TOTAL SHEETS 1

APPENDIX C

FIELD AND LABORATORY DATA

NCDOT Soil Legend
Soil Boring Logs
Rock Core Photographs

PROJECT REFERENCE NO.	SHEET NO.
17BP.8.R.14	1

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

SAMPLE DESIGNATIONS

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

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] MOBILE B-59
- [ ] BK-51
- [ ] CME-45C
- [X] CME-750
- [ ] PORTABLE HOIST
- [X] ACKER AD2
- [ ]

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] CONTINUOUS FLIGHT AUGER
- [X] 2¼" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE ____" STEEL TEETH
- [ ] TRICONE ____" TUNG.-CARB.
- [X] CORE BIT
- [ ]

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B
- [X] -N 0
- [ ] -H

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: SR 1403

ELEVATION: _ FT.

NOTES:

REVISED 02/23/06

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 17BP.8.R.14	**TIP** SF-620174	**COUNTY** MOORE	**GEOLOGIST** C. Dewalt	
SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge				**GROUND WTR (ft)**
BORING NO. WC-EB1-A	**STATION** 13+75	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 458.0 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
460										458.0 GROUND SURFACE 0.0
	457.0	1.0	9	18	25	43	SS-1	M		457.6 Asphalt 0.4 457.0 ABC Stone 1.0 **ROADWAY EMBANKMENT** Brownish Gray, Dense, Silty Fine to Coarse SAND with Gravel (A-2-4)
455	454.5	3.5	2	3	3	6	SS-2	M		455.0 3.0 **ALLUVIAL** Gray, Firm, Fine Sandy SILT with Roots (A-4) 453.3 4.8 Gray and Brown, Loose, Silty Fine SAND (A-2-4)
	452.0	6.0	2	1	1	2	SS-3	M		
450	449.5	8.5	2	4	4	8	SS-4	W		450.0 8.0 Decomposed Wood 449.0 9.0 448.5 Grayish Brown, Firm, Fine to Coarse Sandy SILT (A-4) 9.5 **RESIDUAL** 447.0 Yellowish Gray, Loose, Silty Fine to Coarse SAND (A-2-4) 11.0 **WEATHERED ROCK** Yellowish Gray GRAVEL interpreted as WEATHERED ROCK (Meta Granite with Schist)
445	444.5	13.5	100/0.4			100/0.4	SS-5			
440	439.5	18.5	60/0.1			60/0.1				438.0 20.0 **CRYSTALLINE ROCK** Gray META GRANITE WITH SCHIST
435										433.0 25.0 Boring Terminated by Auger Refusal at Elevation 433.0 ft in CRYSTALLINE ROCK

NCDOT BORE SINGLE 8089 WILLIAMS CREEK.GPJ NC_DOT.GDT 12/6/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

SHEET

WBS 17BP.8.R.14	**TIP** SF-620174	**COUNTY** MOORE	**GEOLOGIST** C. Dewalt
SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge			**GROUND WTR (ft)**
BORING NO. WC-EB1-A	**STATION** 13+75	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 458.0 ft	**TOTAL DEPTH** 25.0 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 5.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) / DEPTH (ft)
438											Begin Coring @ 20.0 ft
	438.0	20.0	5.0	4:30/1.0	(5.0) 100%	(0.6) 12%		(5.0) 100%	(0.6) 12%		438.0 / 20.0 **CRYSTALLINE ROCK** Light Gray, Moderately Weathered, Hard, High Jointing, Intensely Fractured META GRANITE WITH SCHIST, Joint Angles of 20 degrees
				6:45/1.0							
				6:00/1.0							
435				8:15/1.0							
				5:15/1.0							
	433.0	25.0									433.0 / 25.0 Boring Terminated by Auger Refusal at Elevation 433.0 ft in CRYSTALLINE ROCK

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SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge				**GROUND WTR (ft)**
BORING NO. WC-EB1-B	**STATION** 13+75	**OFFSET** 15 ft RT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 458.0 ft	**TOTAL DEPTH** 22.0 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
460										458.0 GROUND SURFACE	0.0
										457.8 Topsoil	0.2
	457.0	1.0	7	9	11	20	SS-1	M		**ROADWAY EMBANKMENT** Gray and Brown, Medium Dense, Silty Fine to Coarse SAND (A-2-4)	
455	454.5	3.5	3	6	9	15	SS-2	M			
	452.0	6.0	4	4	6	10	SS-3	M		452.5 **RESIDUAL** Gray and Reddish Brown, Stiff, Fine Sandy SILT (A-4)	5.5
450	449.5	8.5	8	12	32	44	SS-4	M		450.0 Same, Hard	8.0
445	444.5	13.5	60	40/0.2		100/0.7	SS-5			446.0 **WEATHERED ROCK** Light Brownish Gray, Silty SAND interpreted as WEATHERED ROCK (Meta Granite with Schist)	12.0
440	439.5	18.5	100/0.4			100/0.4	SS-6				
	436.1	21.9	60/0.1			60/0.1	SS-7			436.0 Boring Terminated by Auger Refusal at Elevation 436.0 ft on CRYSTALLINE ROCK	22.0

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WBS 17BP.8.R.14	**TIP** SF-620174	**COUNTY** MOORE	**GEOLOGIST** C. Dewalt	
SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge				**GROUND WTR (ft)**
BORING NO. WC-EB2-A	**STATION** 14+83	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 459.0 ft	**TOTAL DEPTH** 24.0 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
460										
										459.0 GROUND SURFACE 0.0
										458.7 Asphalt 0.3
	458.0	1.0								458.2 ABC Stone 0.8
			8	5	5	10	SS-1	M		**ROADWAY EMBANKMENT** Gray and Brown, Medium Dense, Silty Fine to Coarse SAND (A-2-4)
	455.5	3.5								
455			10	7	6	13	SS-2	M		
										453.5 5.5
	453.0	6.0								Gray and Reddish Brown, Stiff, Fine Sandy SILT (A-4)
			2	2	6	8	SS-3	M		
	450.5	8.5								451.0 8.0 Same, Hard
450			2	2	2	4	SS-4	M		
										449.0 10.0 **ALLUVIAL** Dark Brown, Loose, Silty Fine to Coarse SAND (A-2-4)
										446.5 12.5
	445.5	13.5								**WEATHERED ROCK** Brown and Gray, Silty SAND interpreted as WEATHERED ROCK
445			66	34/0.3			SS-5			
						100/0.8				
	440.5	18.5								
440			100/0.3			100/0.3	SS-6			440.0 19.0
										CRYSTALLINE ROCK Light Brown and Gray, META GRANITE
435										435.0 24.0
										Boring Terminated by Auger Refusal at Elevation 435.0 ft in CRYSTALLINE ROCK

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CORE BORING REPORT

WBS 17BP.8.R.14	**TIP** SF-620174	**COUNTY** MOORE	**GEOLOGIST** C. Dewalt
SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge			**GROUND WTR (ft)**
BORING NO. WC-EB2-A	**STATION** 14+83	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 459.0 ft	**TOTAL DEPTH** 24.0 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic	
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 5.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) / DEPTH (ft)
440											Begin Coring @ 19.0 ft
	440.0	19.0	5.0	6:45/1.0 6:00/1.0 7:00/1.0 6:30/1.0 6:15/1.0	(5.0) 100%	(1.6) 32%		(5.0) 100%	(1.6) 32%		440.0 **CRYSTALLINE ROCK** 19.0 Light Brown and Gray, Slightly Weathered, Hard, High Jointing, Fractured META GRANITE
435	435.0	24.0									435.0 24.0 Boring Terminated by Auger Refusal at Elevation 435.0 ft in CRYSTALLINE ROCK

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BORELOG REPORT

SHEET

WBS 17BP.8.R.14	**TIP** SF-620174	**COUNTY** MOORE	**GEOLOGIST** C. Dewalt	
SITE DESCRIPTION 08-8089 - Moore County Bridges - Williams Creek Bridge				**GROUND WTR (ft)**
BORING NO. WC-EB2-B	**STATION** 14+81	**OFFSET** 15 ft RT	**ALIGNMENT** -L-	**0 HR.** GNE
COLLAR ELEV. 459.0 ft	**TOTAL DEPTH** 18.1 ft	**NORTHING** N/A	**EASTING** N/A	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE CME 75		DRILL METHOD H.S. Augers		HAMMER TYPE Automatic
DRILLER J&L Drilling	**START DATE** 11/15/12	**COMP. DATE** 11/15/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
460										
										459.0 GROUND SURFACE 0.0
										458.7 Asphalt 0.3
	458.0	1.0								458.3 ABC Stone 0.7
			5	6	5	11	SS-1	M		**RESIDUAL** Red and Yellow, Stiff, Fine to Coarse SAND with Gravel (A-2-4)
	455.5	3.5								456.0 3.0
455			5	2	3	5	SS-2	M		Grayish Brown, Firm to Stiff, Fine Sandy Clayey SILT with Gravel (A-4)
	453.0	6.0								
			2	3	7	10	SS-3	M		
	450.5	8.5								
450			2	3	19	22	SS-4	M		
										447.0 12.0
	445.5	13.5								**WEATHERED ROCK** Light Brownish Gray, Silty SAND interpreted as WEATHERED ROCK (Meta Granite with Schist)
445			39	61/0.1		100/0.6	SS-5			
	441.0	18.0	60/0.1			60/0.1	SS-6			440.9 18.1
										Boring Terminated by Auger Refusal at Elevation 440.9 ft on CRYSTALLINE ROCK

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WILLIAMS CREEK BRIDGE – BORING WC-EB1-A

20 feet

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET

WILLIAMS CREEK BRIDGE – BORING WC-EB2-A

19 feet

24 feet

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

SCALE IN FEET