

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-5786	1	17

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY Johnston
 PROJECT DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95

REFERENCE: I-5786

PROJECT: N/A

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
I	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-13	BORE LOG(S), CORE LOG(S), & CORE PHOTOGRAPH(S)
14	ROCK TEST RESULTS

PERSONNEL

- D. Racey
- J. Cranston
- S. Sequist
- D. Williams
- D. Aiello
- H. Riggs

INVESTIGATED BY F&R, Inc.
 DRAWN BY T.T. Walker
 CHECKED BY P. Alton
 SUBMITTED BY P. Alton
 DATE June 2017

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT 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 THE 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.

NOTES:

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

SINCE *Prepared in the Office of:*

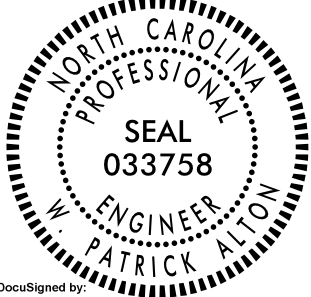


FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
 Raleigh, North Carolina 27603-2302 USA
 T 919.828.3441 F 919.828.5751
 www.fandr.com

6/12/2017



DocuSigned by:
W. Patrick Alton
A270EF78A6DF442...

SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 1 OF 2)

SOIL DESCRIPTION															
SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>															
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-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7
SYMBOL															
% PASSING	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX 35 MX	35 MX 35 MX	35 MX 35 MX	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT	
MATERIAL PASSING #40 LL PI	-		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	0	0	0	0	0	0				
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 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															

GRADATION			
WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.			
COMPRESSIBILITY			
SLIGHTLY COMPRESSIBLE	LL < 31		
MODERATELY COMPRESSIBLE	LL = 31 - 50		
HIGHLY COMPRESSIBLE	LL > 50		
PERCENTAGE OF MATERIAL			
ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY
			1 - 10%
			10 - 20%
			20 - 35%
			35% AND ABOVE
GROUND WATER			
	WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING		
	STATIC WATER LEVEL AFTER 24 HOURS		
	PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA		
	SPRING OR SEEP		

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

MISCELLANEOUS SYMBOLS			
	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		DIP & DIP DIRECTION OF ROCK STRUCTURES
	SOIL SYMBOL		TEST BORING
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		AUGER BORING
	INFERRED SOIL BOUNDARY		CORE BORING
	INFERRED ROCK LINE		MONITORING WELL
	ALLUVIAL SOIL BOUNDARY		PIEZOMETER INSTALLATION
	SLOPE INDICATOR INSTALLATION		CONE PENETROMETER TEST
	SOUNDING ROD		TEST BORING WITH CORE
	SPT N-VALUE		SPT N-VALUE

TEXTURE OR GRAIN SIZE							
U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270	
	4.75	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 IN.	305 12	75 3	2.0	0.25	0.05	0.005

RECOMMENDATION SYMBOLS		
	UNDERCUT	
	SHALLOW UNDERCUT	
	UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL	

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

ABBREVIATIONS		
AR - AUGER REFUSAL	MED. - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA. - WEATHERED
CL - CLAY	MOD. - MODERATELY	U - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	U _g - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
e - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	V - VERY	

PLASTICITY	
	PLASTICITY INDEX (PI) DRY STRENGTH
NON PLASTIC	0-5 VERY LOW
SLIGHTLY PLASTIC	6-15 SLIGHT
MODERATELY PLASTIC	16-25 MEDIUM
HIGHLY PLASTIC	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.	





EQUIPMENT USED ON SUBJECT PROJECT		
DRILL UNITS: <input type="checkbox"/> CME-45C <input checked="" type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST <input checked="" type="checkbox"/> CME-75	ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG.-CARBIDE INSERTS <input checked="" type="checkbox"/> CASING <input checked="" type="checkbox"/> W/ ADVANCER <input checked="" type="checkbox"/> TRICONE 3 1/8" - STEEL TEETH <input type="checkbox"/> TRICONE " TUNG.-CARB. <input checked="" type="checkbox"/> CORE BIT	HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input checked="" type="checkbox"/> -N 0 HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST

PROJECT REFERENCE NO.	SHEET NO.
I-5786	2A

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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 2 OF 2)

ROCK DESCRIPTION	
HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, 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 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.

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, SUCH 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 IN 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.

WEATHERING	
FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SL.)	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 (SL.)	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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>
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. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i>
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i>
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 FINGER NAIL.

FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

INDURATION	
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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.

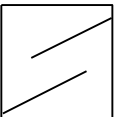
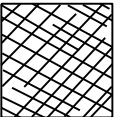
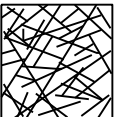

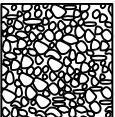
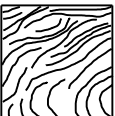
BENCH MARK: BL -10, -BL - STA. 8+98.16, N: 652283, E: 2224820
ELEVATION: 175.93 FEET
NOTES:
NM= NOT MEASURED
FIAD= FILLED IMMEDIATELY AFTER DRILLING

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

SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS				
<p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.</p>		VERY GOOD Very rough, fresh unweathered surfaces	GOOD Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slackensided, highly weathered surfaces with compact coatings or fillings or angular fragments	VERY POOR Slackensided, highly weathered surfaces with soft clay coatings or fillings
		STRUCTURE				
		DECREASING SURFACE QUALITY →				
	INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90			N/A	N/A
	BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80	70			
	VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets		60	50		
	BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			40	30	
	DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				20	
	LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	N/A	N/A			10

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

SUBSURFACE INVESTIGATION

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)**

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

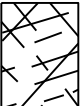
VERY GOOD - Very Rough, fresh unweathered surfaces


GOOD - Rough, slightly weathered surfaces


FAIR - Smooth, moderately weathered and altered surfaces


POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments


VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

 **A. Thick bedded, very blocky sandstone**
The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.


 **B. Sandstone with thin inter-layers of siltstone**


 **C. Sandstone and siltstone in similar amounts**


 **D. Siltstone or silty shale with sandstone layers**

 **E. Weak siltstone or clayey shale with sandstone layers**

C, D, E, and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to F and H.

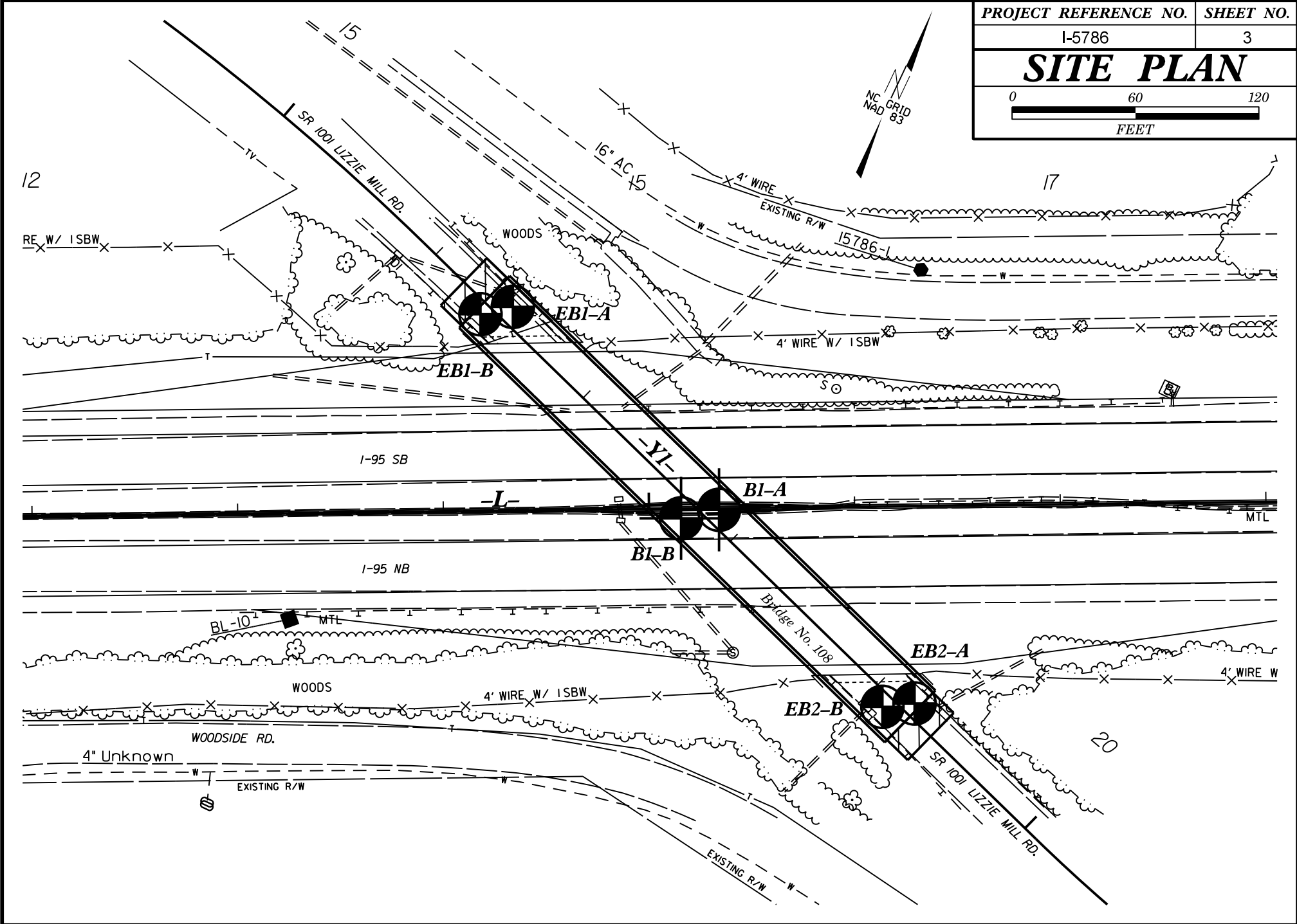
 **F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure**

 **G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers**

 **H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.**

→ Means deformation after tectonic disturbance

PROJECT REFERENCE NO.	SHEET NO.
I-5786	3
SITE PLAN	
0 60 120 FEET	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP I-5786		COUNTY JOHNSTON		GEOLOGIST J. Cranston											
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							GROUND WTR (ft)										
BORING NO. EB1-A		STATION 16+45		OFFSET 8 ft LT		ALIGNMENT -Y1-	0 HR. NM										
COLLAR ELEV. 195.9 ft		TOTAL DEPTH 60.7 ft		NORTHING 652,466		EASTING 2,224,854	24 HR. FIAD										
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER D. Aiello		START DATE 04/10/17		COMP. DATE 04/10/17		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
200																	
195															195.9	GROUND SURFACE	0.0
	194.6	1.3	8	11	10										194.6	ASPHALT	1.3
	192.4	3.5	4	4	6										191.9	ROADWAY EMBANKMENT Dark Gray, Silty Fine SAND (A-2-4)	4.0
190															188.9	Brown-Gray, Clayey Fine to Coarse SAND (A-2-6)	7.0
	187.4	8.5	1	4	5										183.9	Dark Gray, Silty Fine SAND (A-2-4) with Trace Wood Fragments	12.0
185															183.9	Dark to Light Gray, Fine Sandy CLAY (A-6) with Trace Wood Fragments	12.0
	182.4	13.5	2	2	5												
180																	
	177.4	18.5	2	3	4												
175																	
	172.4	23.5	1	2	2												
170																	
	167.4	28.5	3	4	5										168.9	COASTAL PLAIN Light Gray, Clayey Fine SAND (A-2-6)	27.0
165															163.9	Orange-Brown-Gray, Fine Sandy Silty CLAY (A-7)	32.0
	162.4	33.5	4	5	8										158.9	Brown-Light Gray, Clayey Fine to Coarse SAND (A-2-6) with Trace Mica	37.0
160															153.9	Light Brown and Gray, Fine to Coarse SAND (A-3) with Trace Gravel	42.0
	157.4	38.5	1	3	3												
155																	
	152.4	43.5	3	5	6												
150																	
	142.4	53.5	7	10	17										143.9	Orange-Brown, Fine Sandy SILT (A-4)	52.0
145																	
	137.4	58.5	100/0.5												138.9	WEATHERED ROCK Blue-Gray (META-ARGILLITE)	57.0
140															135.2	Boring Terminated with Standard Penetration Test Refusal at Elevation 135.2 ft on Crystalline Rock (META-ARGILLITE)	60.7
	135.2	60.7	60/0.0														

NCDOT BORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP I-5786		COUNTY JOHNSTON		GEOLOGIST J. Cranston										
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 16+36		OFFSET 6 ft RT		ALIGNMENT -Y1-	0 HR. NM									
COLLAR ELEV. 195.6 ft		TOTAL DEPTH 68.5 ft		NORTHING 652,456		EASTING 2,224,841	24 HR. FIAD									
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER D. Aiello		START DATE 04/14/17		COMP. DATE 04/14/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
195														195.6	GROUND SURFACE	0.0
	194.3	1.3	7	7	8									194.3	ASPHALT	1.3
	192.1	3.5	3	3	5									192.6	ROADWAY EMBANKMENT	3.0
190														191.1	Dark Gray, Silty Fine SAND (A-2-4)	3.0
														191.1	Brown-Black, Fine to Coarse SAND (A-3)	4.5
															Gray, Clayey Fine SAND (A-2-6)	
185														188.6	Gray to Dark Gray, Fine Sandy CLAY (A-6) with Trace Organics	7.0
	187.1	8.5	1	2	1											
180														182.1		
	182.1	13.5	2	1	2											
175														177.1		
	177.1	18.5	4	2	3											
170														172.1	Gray, Fine Sandy Silty CLAY (A-7)	22.0
	172.1	23.5	1	1	2											
165														173.6		
	167.1	28.5	3	4	6									168.6	COASTAL PLAIN	27.0
160															Brown-Gray, Fine Sandy Silty CLAY (A-7)	
	162.1	33.5	2	4	5											
155														156.1	Light Brown, Clayey Fine to Coarse SAND (A-2-6)	39.5
	157.1	38.5	1	2	3											
150														153.6	Light Brown, Fine to Coarse SAND (A-3) with Trace Gravel (48.5'-50.0')	42.0
	152.1	43.5	2	4	6											
145														143.6	Light Brown, GRAVEL (A-1-a) with Little Fine to Coarse Sand	52.0
	147.1	48.5	5	6	5											
140														142.1		
	142.1	53.5	7	4	5											
135														137.1	WEATHERED ROCK	57.0
	137.1	58.5	100/0.3												Blue-Gray (META-ARGILLITE)	
130														132.1	CRYSTALLINE ROCK	62.0
	132.1	63.5	60/0.0												(META-ARGILLITE)	
	127.1	68.5	60/0.0											127.1	Boring Terminated with Standard Penetration Test Refusal at Elevation 127.1 ft in Crystalline Rock (META-ARGILLITE)	68.5

NCDOT BORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP I-5786		COUNTY JOHNSTON		GEOLOGIST J. Cranston										
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95							GROUND WTR (ft)									
BORING NO. B1-A		STATION 17+85		OFFSET 7 ft LT		ALIGNMENT -Y1-	0 HR. NM									
COLLAR ELEV. 176.4 ft		TOTAL DEPTH 72.2 ft		NORTHING 652,420		EASTING 2,224,986	24 HR. FIAD									
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 02/11/2017				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER D. Aiello		START DATE 04/12/17		COMP. DATE 04/13/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
180																
175	174.9	1.5	23	4	3									176.4	GROUND SURFACE	0.0
	172.9	3.5	1	1	2									174.9	ASPHALT	1.5
170																
	167.9	8.5	2	4	5									169.4	ROADWAY EMBANKMENT Dark Gray, Fine Sandy Silty CLAY (A-7) with Trace Organics and Trace Gravel	7.0
165																
	162.9	13.5	2	2	4											
160																
	157.9	18.5	2	2	4											
155																
	152.9	23.5	4	3	4									156.9	COASTAL PLAIN Light Brown-Gray, Fine Sandy Silty CLAY (A-7)	19.5
150																
	147.9	28.5	4	6	9											
145																
	142.9	33.5	40	16	14									149.4	Light Brown, GRAVEL (A-1-a) with Little Fine to Coarse Sand	27.0
140																
	137.9	38.5	60/0.1											144.4	RESIDUAL Orange-Brown, Fine Sandy SILT (A-4)	32.0
135																
	132.9	43.5	60/0.1											139.4	CRYSTALLINE ROCK Blue-Gray (META-ARGILLITE)	37.0
130																
	127.9	48.5	60/0.1													
125																
	122.9	53.5	60/0.0													
120																
	120.7	55.7	60/0.0											120.7		55.7
115																
	114.2	62.2	60/0.0											114.2		62.2
110																
105																
														104.2		72.2
															Boring Terminated at Elevation 104.2 ft in Crystalline Rock (META-ARGILLITE)	

NCDOT BORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17

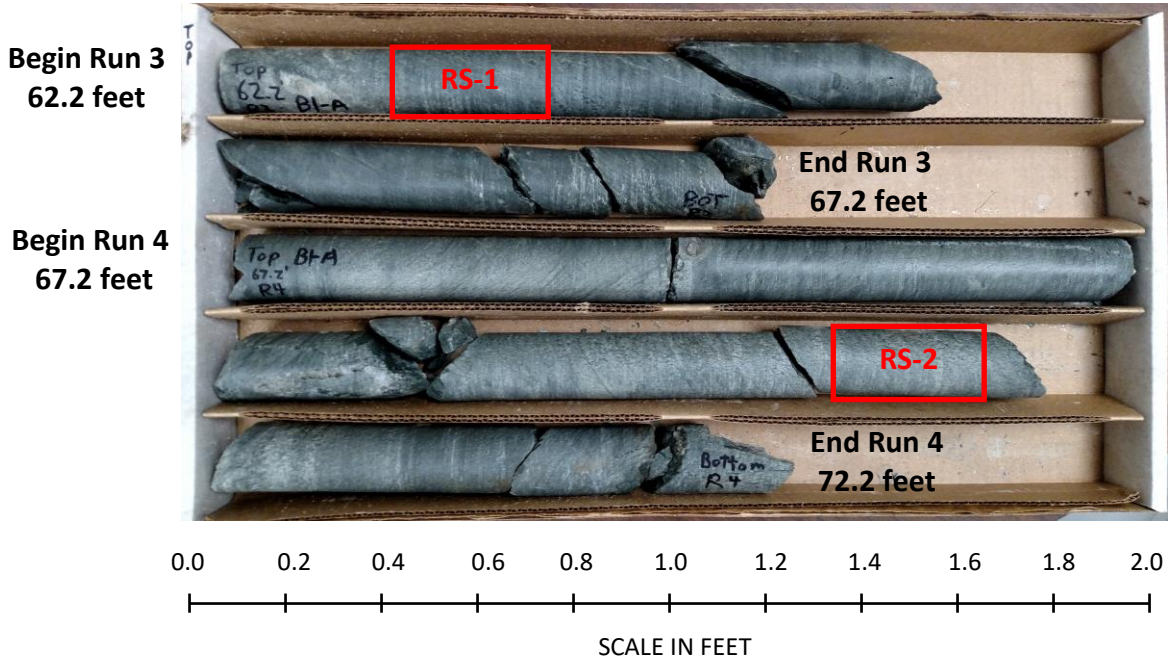
GEOTECHNICAL BORING REPORT CORE LOG

WBS N/A			TIP I-5786			COUNTY JOHNSTON			GEOLOGIST J. Cranston		
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95										GROUND WTR (ft)	
BORING NO. B1-A			STATION 17+85			OFFSET 7 ft LT			ALIGNMENT -Y1-		
COLLAR ELEV. 176.4 ft			TOTAL DEPTH 72.2 ft			NORTHING 652,420			EASTING 2,224,986		
DRILL RIG/HAMMER EFF/DATE F&R5785 CME-55 80% 02/11/2017						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic		
DRILLER D. Aiello			START DATE 04/12/17			COMP. DATE 04/13/17			SURFACE WATER DEPTH N/A		
CORE SIZE NQ			TOTAL RUN 13.7 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
					REC. (%)	RQD (%)		REC. (%)	RQD (%)		
120.7											
120	120.7	55.7	3.7	0:32/1.0 0:17/1.0 0:25/1.0 0:15/0.7	(0.0) 0%	(0.0) 0%		(0.0) 0%	(0.0) 0%		
	117.0	59.4									
115	114.2	62.2									
	109.2	67.2	5.0	N=60/0.0 0:31/1.0 0:30/1.0 1:14/1.0 1:25/1.0 0:58/1.0	(2.5) 50%	(1.9) 38%	RS-1	(7.4) 74%	(5.7) 57%		
110	109.2	67.2									
	104.2	72.2	5.0	0:43/1.0 0:53/1.0 0:47/1.0 0:36/1.0 0:54/1.0	(4.9) 98%	(3.8) 76%	RS-2				
105	104.2	72.2									

NCDOT CORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17



CORE PHOTOGRAPHS: I-5786, Bridge 108 on Lizzie Mill Road B1-A: -Y1- Station 17+85, 7 ft LT



GEOTECHNICAL BORING REPORT BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST M. Arnold
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95			GROUND WTR (ft)
BORING NO. B1-B	STATION 17+75	OFFSET 9 ft RT	ALIGNMENT -Y1-
COLLAR ELEV. 175.8 ft	TOTAL DEPTH 54.6 ft	NORTHING 652,408	EASTING 2,224,971
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 85%/01/30/2017		DRILL METHOD NW Casing w/ Advancer	HAMMER TYPE Automatic
DRILLER D. Tignor	START DATE 04/27/17	COMP. DATE 04/28/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)			
180																		
175	174.6	1.2	3	3	3										175.8	GROUND SURFACE	0.0	
															174.6	ASPHALT	1.2	
170	172.3	3.5	WOH	WOH	WOH											ROADWAY EMBANKMENT Black-Dark Gray, Silty Fine Sandy CLAY (A-7) with Trace Organics (Wood Fragments)		
165	167.3	8.5													168.8	Gray-Brown, Clayey GRAVEL (A-1-b) with Some Fine to Coarse Sand	7.0	
															166.8	COASTAL PLAIN Red-Gray-Brown, Fine Sandy Silty CLAY (A-7)	9.0	
160	162.3	13.5	3	6	6													
155	157.3	18.5	3	2	3													
150	152.3	23.5	3	5	6											Orange-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Gravel	22.0	
															148.8	Orange-Tan, Clayey Fine to Coarse SAND (A-2-6) with Trace Gravel	27.0	
145	147.3	28.5	4	7	9										145.3		30.5	
140	142.3	33.5														WEATHERED ROCK Black-Orange-Tan and Gray (META-ARGILLITE)		
135	137.3	38.5																
															133.8		42.0	
130	132.3	43.5													132.2	CRYSTALLINE ROCK Blue-Gray (META-ARGILLITE)	43.6	
125																		
															121.2	Boring Terminated at Elevation 121.2 ft in Crystalline Rock (META-ARGILLITE) Start Coring at 43.6'		54.6

NCDOT BORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17

GEOTECHNICAL BORING REPORT CORE LOG

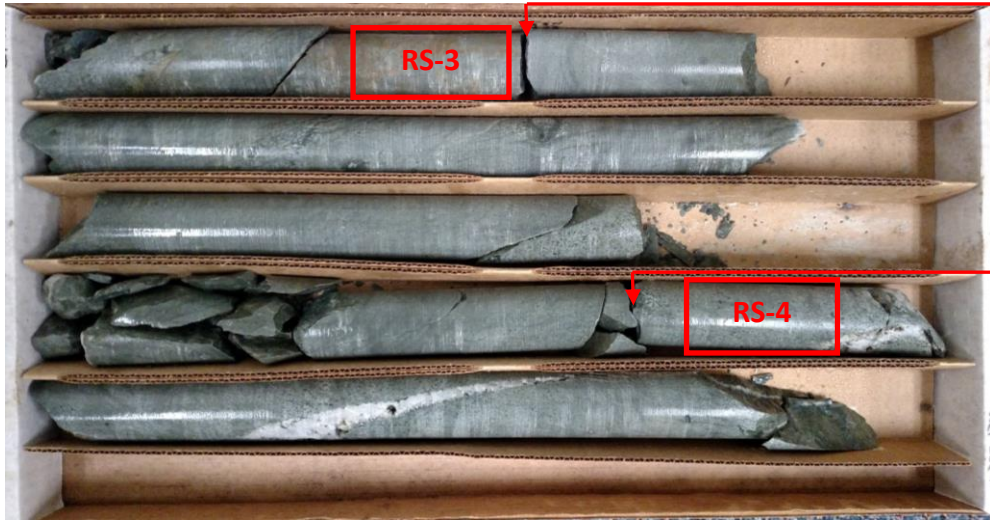
WBS N/A		TIP I-5786		COUNTY JOHNSTON		GEOLOGIST M. Arnold							
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95									GROUND WTR (ft)				
BORING NO. B1-B		STATION 17+75		OFFSET 9 ft RT		ALIGNMENT -Y1-		0 HR. NM					
COLLAR ELEV. 175.8 ft		TOTAL DEPTH 54.6 ft		NORTHING 652,408		EASTING 2,224,971		24 HR. FIAD					
DRILL RIG/HAMMER EFF./DATE F&R3495 CME-55 85% 01/30/2017						DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic					
DRILLER D. Tignor		START DATE 04/27/17		COMP. DATE 04/28/17		SURFACE WATER DEPTH N/A							
CORE SIZE NQ		TOTAL RUN 11.0 ft											
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)	
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %				
132.2	132.2	43.6	1.0	2:30/1.0	(1.0)	(0.8)		(10.4)	(9.3)		Begin Coring @ 43.6 ft		
130	131.2	44.6	5.0	2:13/1.0 1:50/1.0 2:00/1.0 2:11/1.0 2:28/1.0	100% (4.4) 88%	80% (3.5) 70%	RS-3	95%	85%		132.2	Gray, Very Slightly Weathered to Fresh, Medium Hard to Moderately Hard, META-ARGILLITE with Close to Moderately Close Fracture Spacing RS-3: 44.3-44.6, qu=3,347 psi, GSI=35-45 RS-4: 49.7-50.0, qu=4,608 psi, GSI=35-45	43.6
125	126.2	49.6	5.0	2:16/1.0 1:56/1.0 2:02/1.0 2:36/1.0 2:19/1.0	100% (5.0) 100%	(5.0) (5.0) 100%	RS-4						
	121.2	54.6									121.2	Boring Terminated at Elevation 121.2 ft in Crystalline Rock (META-ARGILLITE) Start Coring at 43.6'	54.6

NCDOT CORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17



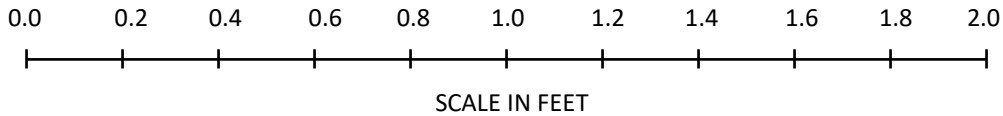
CORE PHOTOGRAPHS: I-5786, Bridge 108 on Lizzie Mill Road B1-B: -Y1- Station 17+75, 9 ft RT

Begin Run 1
43.6 feet

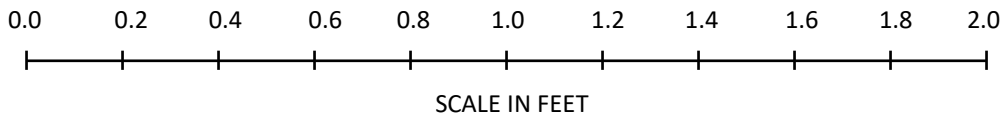


End Run 1
Begin Run 2
@44.6 feet

End Run 2
Begin Run 3
@49.6 feet



End Run 3
54.6 feet



GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A	TIP I-5786	COUNTY JOHNSTON	GEOLOGIST D. Racey
SITE DESCRIPTION Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95			GROUND WTR (ft)
BORING NO. EB2-B	STATION 19+09	OFFSET 6 ft RT	ALIGNMENT -Y1-
COLLAR ELEV. 195.9 ft	TOTAL DEPTH 63.5 ft	NORTHING 652,367	EASTING 2,225,099
DRILL RIG/HAMMER EFF./DATE F&R4637 CME-75 81% 07/18/2015		DRILL METHOD Mud Rotary	HAMMER TYPE Automatic
DRILLER S. Sequist	START DATE 04/14/17	COMP. DATE 04/14/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
200															
195.6	195.6	0.3												GROUND SURFACE	0.0
195.3														ASPHALT	0.6
192.4		3.5	27	7	9									ROADWAY EMBANKMENT	
191.5			30	11	5									Gray-Tan, Clayey Silty Fine SAND (A-2-4)	4.4
188.9														Red-Tan, Silty CLAY (A-7)	7.0
187.4		8.5	3	2	1									Gray, Clayey Fine SAND (A-2-6)	7.0
183.9															12.0
182.4		13.5	4	3	2									Gray and Black, Fine Sandy CLAY (A-6) with Trace Organics (Roots)	12.0
177.4		18.5	1	2	3										
172.4		23.5	WOR	WOH	1										
168.9															27.0
167.4		28.5	2	3	6									COASTAL PLAIN	
166.9														Gray-Tan-Red, Silty CLAY (A-7)	27.0
162.4		33.5	3	5	7										
157.4		38.5	4	4	5										
153.9															42.0
152.4		43.5	2	4	4									Gray-Tan, Fine to Coarse SAND (A-3), with Trace Gravel	42.0
148.9															47.0
147.4		48.5	2	3	6									Tan, Clayey Fine to Coarse SAND (A-2-6)	47.0
143.9															52.0
142.4		53.5	26	36	36									RESIDUAL	
138.9														Gray, Silty Fine SAND (A-2-4)	57.0
137.4		58.5													60/0.0
132.4		63.5												CRYSTALLINE ROCK	
														Gray (META-ARGILLITE)	57.0
															63.5
														Boring Terminated with Standard Penetration Test Refusal at Elevation 132.4 ft in Crystalline Rock (META-ARGILLITE)	

NCDOT BORE SINGLE I5786_GEO_BH_BRDG108.GPJ NC_DOT.GDT 5/5/17

PROJECT NO.: N/A
TIP NO.: I-5786
COUNTY: Johnston
DESCRIPTION: Bridge No. 108 on SR 1001 (Lizzie Mill Road) over I-95

Sample #	Boring No.	Alignment	Station	Offset	Depth (ft)	Rock Type	Geologic Map Unit	Run RQD	Length (in)	Diameter (in)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	Young's Modulus, E (ksi)	GSI
RS-1	B1-A	-Y1-	17+85	7' Lt.	62.6 - 62.9	Meta-Argillite	CZfv	38%	4.10	1.78	163.0	2,422	830	35 - 45
RS-2	B1-A	-Y1-	17+85	7' Lt.	70.5 - 70.9	Meta-Argillite	CZfv	76%	4.14	1.77	158.7	5,227	1,537	35 - 45
RS-3	B1-B	-Y1-	17+75	9' Rt.	44.3 - 44.6	Meta-Argillite	CZfv	70%	4.06	1.77	162.2	3,347	500	35 - 45
RS-4	B1-B	-Y1-	17+75	9' RT.	49.7 - 50.0	Meta-Argillite	CZfv	100%	4.02	1.77	163.9	4,608	724	35 - 45