

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.12.R.48	1	21

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

**STRUCTURE
SUBSURFACE INVESTIGATION**

COUNTY CLEVELAND
PROJECT DESCRIPTION DIVISION 12 LOW
IMPACT BRIDGE REPLACEMENT
SITE DESCRIPTION BRIDGE NO. 220162 ON SR 1612
OVER BUFFALO CREEK BETWEEN HWY 18
AND SR 1142

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4-21	BORE LOGS, CORE LOGS & CORE PHOTOGRAPHS

PERSONNEL
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AMERIDRILL

INVESTIGATED BY ESP Associates, Inc.
DRAWN BY C.R. PASTRANA
CHECKED BY P.M. WEAVER
SUBMITTED BY ESP Associates, Inc.
DATE September 2018

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- 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.

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SIGNATURE _____ DATE _____

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

REFERENCE: N/A

PROJECT: 17BP.12.R.48

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										GRADATION									
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, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										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									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ 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									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING SLOPE INDICATOR INSTALLATION ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE PENETROMETER TEST INFERRED SOIL BOUNDARY CORE BORING SOUNDING ROD INFERRED ROCK LINE MONITORING WELL TEST BORING WITH CORE ALLUVIAL SOIL BOUNDARY PIEZOMETER INSTALLATION SPT N-VALUE									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7/2 - 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 SD. - SAND, SANDY SS - SPLIT SPOON F - FINE SL. - SILT, SILTY SLI. - SLIGHTLY ST - SHELBY TUBE FOSS. - FOSSILIFEROUS TCR - TRICONE REFUSAL RS - ROCK FRAC. - FRACTURED, FRACTURES W - MOISTURE CONTENT RT - RECOMPACTED TRIAXIAL FRAGS. - FRAGMENTS HI. - HIGHLY V - VERY CBR - CALIFORNIA BEARING RATIO									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										<input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input checked="" type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER <input type="checkbox"/> CORE SIZE: <input type="checkbox"/> CME-550 <input type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> -B _____ <input type="checkbox"/> -H _____ <input checked="" type="checkbox"/> CME-550 <input type="checkbox"/> HARD FACED FINGER BITS <input checked="" type="checkbox"/> -N Q _____ <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> PORTABLE HOIST <input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> _____ <input type="checkbox"/> TRICONE _____ * STEEL TEETH <input type="checkbox"/> _____ <input type="checkbox"/> TRICONE _____ * TUNG-CARB. <input type="checkbox"/> HAND TOOLS: <input type="checkbox"/> _____ <input checked="" type="checkbox"/> CORE BIT <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> HAND AUGER <input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> VANE SHEAR TEST									
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.									

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

ROCK DESCRIPTION		TERMS AND DEFINITIONS
<p>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:</p>		<p>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 (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS 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 (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>
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.
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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT		CAN BE GROOVED 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		BEDDING
TERM	SPACING	TERM
VERY WIDE	MORE THAN 10 FEET	THICKNESS
WIDE	3 TO 10 FEET	4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THICKLY BEDDED
CLOSE	0.16 TO 1 FOOT	1.5 - 4 FEET
VERY CLOSE	LESS THAN 0.16 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 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: BM-1; -BL- STA. 13+05.22, 160.47' RT - RR SPIKE
		IN 18" BLACK WALNUT
		ELEVATION: 897.48 FEET
NOTES:		
F.I.A.D. = FILLED IMMEDIATELY AFTER DONE		
		DATE: 8-15-14

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**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)**

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.

SURFACE CONDITIONS

VERY GOOD
Very rough, fresh unweathered surfaces

GOOD
Rough, slightly weathered, iron stained surfaces

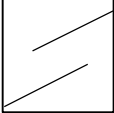
FAIR
Smooth, moderately weathered and altered surfaces

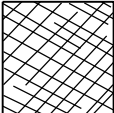
POOR
Slackensided, highly weathered surfaces with compact coatings or fillings or angular fragments

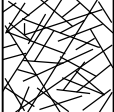
VERY POOR
Slackensided, highly weathered surfaces with soft clay coatings or fillings


DECREASING SURFACE QUALITY →


STRUCTURE

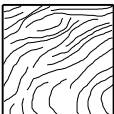
 **INTACT OR MASSIVE** - intact rock specimens or massive in situ rock with few widely spaced discontinuities

 **BLOCKY** - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets

 **VERY BLOCKY** - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets

 **BLOCKY/DISTURBED/SEAMY** - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity

 **DISINTEGRATED** - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces

 **LAMINATED/SHEARED** - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ↓

	90			N/A	N/A
	80				
		70			
		60			
			50		
			40		
				30	
				20	
					10
	N/A	N/A			

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.

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

VERY GOOD - Very Rough, fresh unweathered surfaces

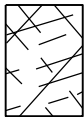
GOOD - Rough, slightly weathered surfaces

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

COMPOSITION AND STRUCTURE



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

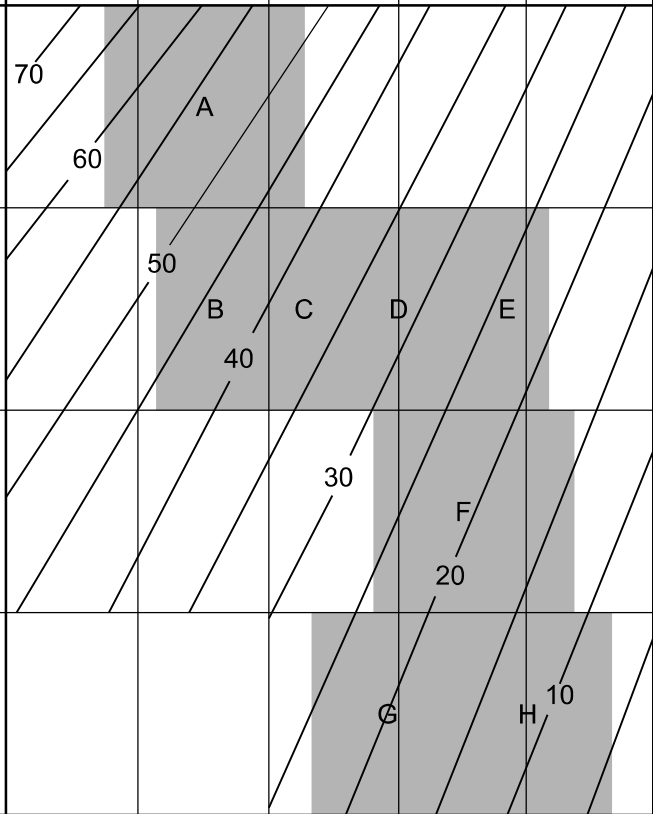


G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers



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

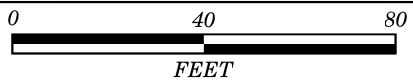


PROJECT REFERENCE NO. SHEET NO.

17BP.12.R.48

3

SITE PLAN

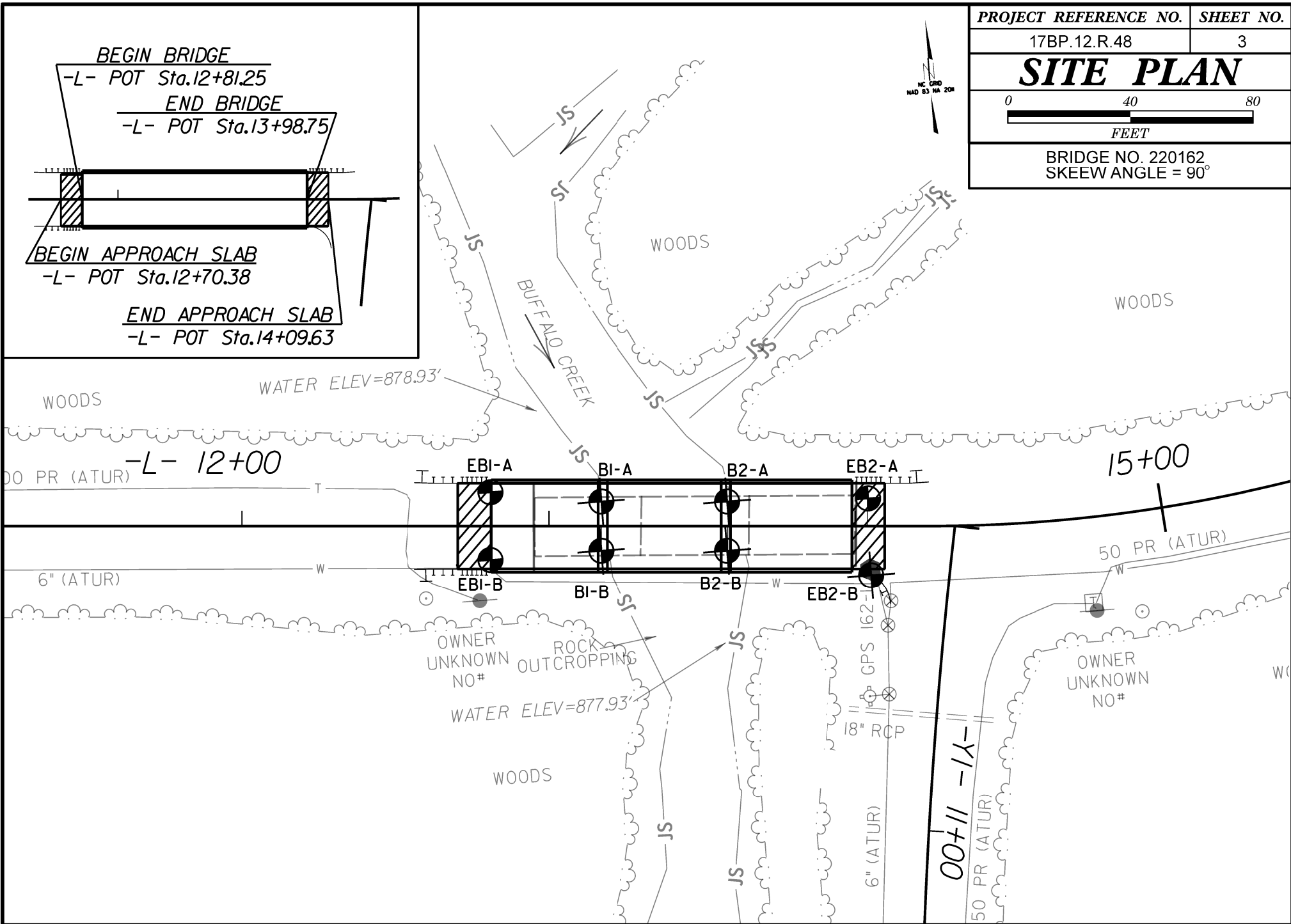


BRIDGE NO. 220162
SKEEW ANGLE = 90°

BEGIN BRIDGE
-L- POT Sta.12+81.25
END BRIDGE
-L- POT Sta.13+98.75

BEGIN APPROACH SLAB
-L- POT Sta.12+70.38

END APPROACH SLAB
-L- POT Sta.14+09.63



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.											
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)										
BORING NO. EB1-A		STATION 12+81		OFFSET 11 ft LT		ALIGNMENT -L-	0 HR. Dry										
COLLAR ELEV. 893.9 ft		TOTAL DEPTH 16.0 ft		NORTHING 634,377		EASTING 1,258,653	24 HR. Dry										
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Meatyard, C.		START DATE 08/14/18		COMP. DATE 08/14/18		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	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
895															893.9	GROUND SURFACE	0.0
890	890.4	3.5	3	2	2									ROADWAY EMBANKMENT Reddish Brown, Soft to Stiff, Fine Sandy SILT, Little Gravel and Trace Clay and Mica			
885	885.4	8.5	3	6	4						M						
880	880.4	13.5	7	10	20						M						
	877.9	16.0	60/0.0														
														878.3	Tan-Brown, Medium Dense to Dense, Silty Coarse to Fine SAND and Rock Fragments	15.6	
														877.9	WEATHERED ROCK METAMORPHOSED GRANITIC ROCK	16.0	
															Boring Terminated with Standard Penetration Test Refusal at Elevation 877.9 ft on Crystalline Rock: METAMORPHOSED GRANITIC ROCK Cave-In at 11.9'		

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/23/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.											
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)										
BORING NO. EB1-B		STATION 12+81		OFFSET 11 ft RT		ALIGNMENT -L-	0 HR. Dry										
COLLAR ELEV. 893.9 ft		TOTAL DEPTH 17.6 ft		NORTHING 634,355		EASTING 1,258,651	24 HR. Dry										
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Meatyard, C.		START DATE 08/14/18		COMP. DATE 08/14/18		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)		
895															893.9	GROUND SURFACE	0.0
890	890.4	3.5	2	3	2	5						M	ROADWAY EMBANKMENT Reddish Brown, Medium Stiff, Clayey Coarse to Fine Sandy SILT				
885	885.4	8.5	4	3	2	5						M					
880	880.4	13.5	3	4	3	7						D	RESIDUAL Brown, Medium Stiff, Fine to Coarse Sandy SILT, Trace Rock Fragments	12.6	16.1		
	876.3	17.6	60/0.0			60/0.0							WEATHERED ROCK METAMORPHOSED GRANITIC ROCK	17.6			
Boring Terminated with Standard Penetration Test Refusal at Elevation 876.3 ft on Crystalline Rock: METAMORPHOSED GRANITIC ROCK																	
Cave-In at 12.6'																	

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.											
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)										
BORING NO. B1-A		STATION 13+17		OFFSET 8 ft LT		ALIGNMENT -L-	0 HR. 0.5 N/A										
COLLAR ELEV. 878.5 ft		TOTAL DEPTH 20.8 ft		NORTHING 634,371		EASTING 1,258,689	24 HR. N/A										
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic											
DRILLER Meatyard, C.		START DATE 08/14/18		COMP. DATE 08/14/18		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	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
880															878.5	GROUND SURFACE	0.0
875														○○○○	875.7	ALLUVIAL BOULDERS, COBBLES, and SAND	2.8
															874.7	CRYSTALLINE ROCK	3.8
870															872.7	Gray, White, and Black with Brown, Slightly to Moderately Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 20-40	5.8
																WEATHERED ROCK	
865																Core Loss in METAMORPHOSED GRANITIC ROCK	
																CRYSTALLINE ROCK	
860																Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Very Wide Fracture Spacing GSI = 80-100	
															857.7	Boring Terminated at Elevation 857.7 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	20.8

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 17BP.12.R.48				TIP N/A		COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.		
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)	
BORING NO. B1-A				STATION 13+17			OFFSET 8 ft LT		ALIGNMENT -L-		
COLLAR ELEV. 878.5 ft				TOTAL DEPTH 20.8 ft			NORTHING 634,371		EASTING 1,258,689		
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic		
DRILLER Meatyard, C.				START DATE 08/14/18			COMP. DATE 08/14/18		SURFACE WATER DEPTH N/A		
CORE SIZE NQ				TOTAL RUN 18.0 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
875.7											
875	875.7	2.8	3.0	2:07/1.0 N/A/1.0	(1.0) 33%	(0.0) 0%	(1.0) 100%	(0.0) 0%		Begin Coring @ 2.8 ft	2.8
	872.7	5.8		N/A/1.0						Gray, White, and Black with Brown, Slightly to Moderately Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 20-40	3.8
			5.0	1:49/1.0 3:03/1.0	(4.9) 98%	(4.9) 98%	(0.0) 0%	(0.0) 0%			5.8
870				3:38/1.0 4:15/1.0 3:23/1.0			(14.9) 99%	(14.9) 99%		WEATHERED ROCK Core Loss in METAMORPHOSED GRANITIC ROCK	
	867.7	10.8		3:00/1.0 4:24/1.0	(5.0) 100%	(5.0) 100%				CRYSTALLINE ROCK Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Very Wide Fracture Spacing No natural fractures Foliation at 20 degrees to 30 degrees GSI = 80-100	
865			5.0	3:59/1.0 6:32/1.0 6:31/1.0							
	862.7	15.8		8:40/1.0 3:31/1.0	(5.0) 100%	(5.0) 100%					
860			5.0	4:44/1.0 4:47/1.0 5:11/1.0							
	857.7	20.8								Boring Terminated at Elevation 857.7 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	20.8

NCDOT CORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

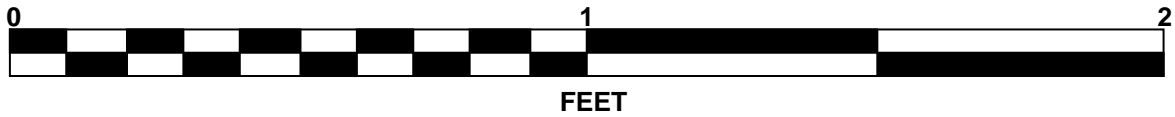
CORE PHOTOGRAPH

Project No. 17BP.12.R.48

Project Description: Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek
Cleveland County, North Carolina

B1-A

2.8 Feet to 14.5 Feet



14.5 Feet to 20.8 Feet




GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.											
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)										
BORING NO. B1-B		STATION 13+17		OFFSET 8 ft RT		ALIGNMENT -L-	0 HR. 1.9 N/A										
COLLAR ELEV. 879.9 ft		TOTAL DEPTH 17.0 ft		NORTHING 634,355		EASTING 1,258,688	24 HR. N/A										
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic											
DRILLER Meatyard, C.		START DATE 08/15/18		COMP. DATE 08/15/18		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
880															879.9	GROUND SURFACE	0.0
															878.9	ROADWAY EMBANKMENT	1.0
																Rip Rap	
																ALLUVIAL	
															875.1	BOULDERS, COBBLES, and SAND	4.8
																CRYSTALLINE ROCK	
																Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing GSI = 80-100	
875	875.5 875.1	4.4 4.8	100/0.4 60/0.0							100/0.4 60/0.0							
870																	
865																	
															862.9	Boring Terminated at Elevation 862.9 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	17.0

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.12.R.48				TIP N/A		COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.		
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)	
BORING NO. B1-B				STATION 13+17		OFFSET 8 ft RT		ALIGNMENT -L-			0 HR. 1.9 N/A
COLLAR ELEV. 879.9 ft				TOTAL DEPTH 17.0 ft		NORTHING 634,355		EASTING 1,258,688			24 HR. N/A
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic		
DRILLER Meatyard, C.				START DATE 08/15/18		COMP. DATE 08/15/18		SURFACE WATER DEPTH N/A			
CORE SIZE NQ				TOTAL RUN 12.2 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
875.1	875.1	4.8	2.2	4:51/1.0	(2.2)	(1.8)	(12.2)	(11.8)		Begin Coring @ 4.8 ft	
	872.9	7.0		4:50/1.0	100%	82%	100%	97%		CRYSTALLINE ROCK Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing Joints at 10 degrees to 30 degrees Foliation at 20 degrees to 30 degrees Includes garnets and quartz veins One natural break within the 4.8' to 7.0' run GSI = 80-100	4.8
			5.0	0:44/0.2	(5.0)	(5.0)					
870				2:59/1.0							
				3:50/1.0							
				3:05/1.0							
	867.9	12.0		3:08/1.0							
			5.0	3:30/1.0							
865				4:01/1.0	(5.0)	(5.0)					
				2:58/1.0	100%	100%					
				2:32/1.0							
	862.9	17.0		2:01/1.0						Boring Terminated at Elevation 862.9 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	17.0
				2:41/1.0							

NCDOT CORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

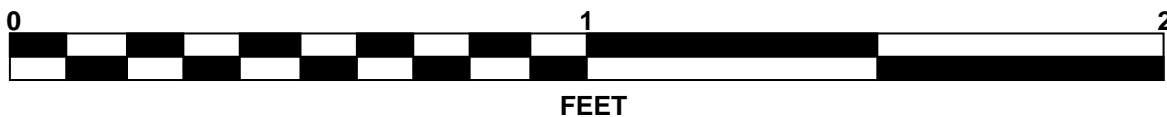
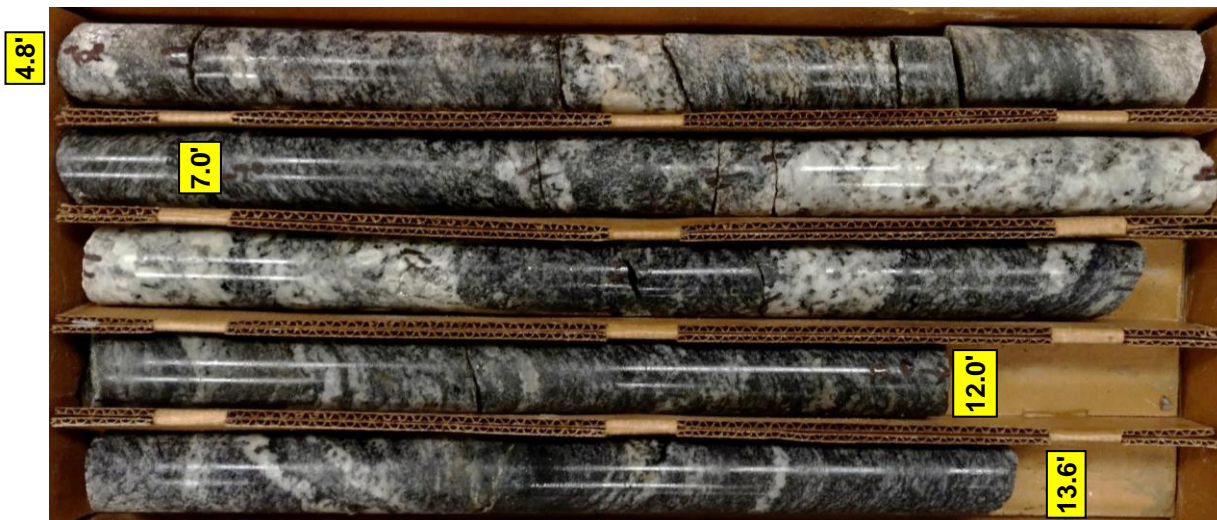
CORE PHOTOGRAPH

Project No. 17BP.12.R.48

Project Description: Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek
Cleveland County, North Carolina

B1-B

4.8 Feet to 13.6 Feet



13.6 Feet to 17.0 Feet



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48			TIP N/A			COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.							
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek									GROUND WTR (ft)							
BORING NO. B2-A			STATION 13+58			OFFSET 8 ft LT			ALIGNMENT -L-							
COLLAR ELEV. 877.8 ft			TOTAL DEPTH 24.8 ft			NORTHING 634,368			EASTING 1,258,730							
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic							
DRILLER Meatyard, C.			START DATE 08/16/18			COMP. DATE 08/16/18			SURFACE WATER DEPTH 0.2ft							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
880																
														877.8	GROUND SURFACE	0.0
														875.4	ALLUVIAL BOULDERS, COBBLES, and SAND	2.4
875														874.8	CRYSTALLINE ROCK	3.0
														869.6	White and Gray with Black, Slightly Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Very Close to Close Fracture Spacing GSI = 50-70	8.2
870															Mostly Core Loss in Gray, White, and Black with Brown, Moderately Severely to Moderately Weathered, Medium Hard to Moderately Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 10-30	
															White and Gray with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Very Wide Fracture Spacing GSI = 80-100	
865															Note: Last 1.7' of core could not be retrieved by the core barrel. The REC and RQD assume that the unrecovered core is the same as the recovered core and is calculated to include the unrecovered core.	
															Boring Terminated at Elevation 853.0 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	
860														853.0		24.8
855																

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 17BP.12.R.48				TIP N/A		COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.			
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)		
BORING NO. B2-A				STATION 13+58			OFFSET 8 ft LT		ALIGNMENT -L-			
COLLAR ELEV. 877.8 ft				TOTAL DEPTH 24.8 ft			NORTHING 634,368		EASTING 1,258,730			
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER Meatyard, C.				START DATE 08/16/18			COMP. DATE 08/16/18		SURFACE WATER DEPTH 0.2ft			
CORE SIZE NQ				TOTAL RUN 22.4 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
875.4											Begin Coring @ 2.4 ft	
	875.4	2.4	2.4	1:52/1.0	(0.6)	(0.0)		(0.6)	(0.0)		CRYSTALLINE ROCK	2.4
	873.0	4.8		N/A/1.0	25%	0%		100%	0%		White and Gray with Black, Slightly Weathered, Hard, METAMORPHOSED GRANITIC ROCK with Very Close to Close Fracture Spacing GSI = 50-70	3.0
			5.0	N/A/0.4	(2.6)	(1.9)		(1.0)	(0.3)			
				0:47/1.0	52%	38%		19%	6%			
870				0:32/1.0								
				4:08/1.0								
				4:19/1.0								
	868.0	9.8		5:45/1.0				(16.6)	(16.6)		Mostly Core Loss in Gray, White, and Black with Brown, Moderately Severely to Moderately Weathered, Medium Hard to Moderately Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 10-30	8.2
			5.0	4:07/1.0	(5.0)	(5.0)		100%	100%			
				4:22/1.0	100%	100%						
865				2:59/1.0								
				4:21/1.0								
	863.0	14.8		5:32/1.0							White and Gray with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Very Wide Fracture Spacing No natural breaks Foliation at 20 degrees to 30 degrees GSI = 80-100	
			5.0	3:15/1.0	(5.0)	(5.0)						
				3:38/1.0	100%	100%						
860				2:51/1.0								
				3:39/1.0								
	858.0	19.8		4:25/1.0							Note: Last 1.7' of core could not be retrieved by the core barrel. The REC and RQD assume that the unrecovered core is the same as the recovered core and is calculated to include the unrecovered core.	
			5.0	7:14/1.0	(5.0)	(5.0)						
				4:12/1.0	100%	100%						
855				3:24/1.0								
				4:17/1.0								
	853.0	24.8		3:10/1.0							Boring Terminated at Elevation 853.0 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	24.8

NCDOT CORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

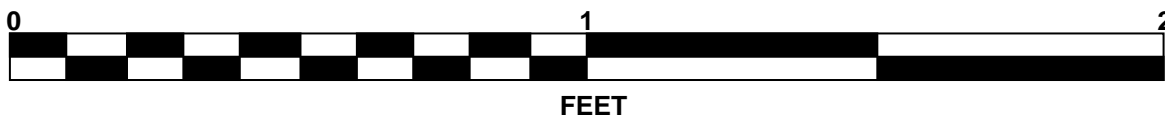
CORE PHOTOGRAPH

Project No. 17BP.12.R.48

Project Description: Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek
Cleveland County, North Carolina

B2-A

2.4 Feet to 13.7 Feet



13.7 Feet to 24.8 Feet



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.										
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)									
BORING NO. B2-B		STATION 13+58		OFFSET 8 ft RT		ALIGNMENT -L-	0 HR. N/A									
COLLAR ELEV. 877.6 ft		TOTAL DEPTH 20.9 ft		NORTHING 634,352		EASTING 1,258,728	24 HR. N/A									
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Meatyard, C.		START DATE 08/15/18		COMP. DATE 08/15/18		SURFACE WATER DEPTH 0.4ft										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
880																
														877.6	GROUND SURFACE	0.0
														875.2	ALLUVIAL BOULDERS, COBBLES, and SAND	2.4
875														873.2	CRYSTALLINE ROCK Mostly Core Loss in White and Brown with Gray, Moderately to Moderately Severely Weathered, Moderately Hard to Medium Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 10-30	4.4
870														866.4		11.2
														865.0	Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing GSI = 70-90	12.6
865														856.7	White and Gray with Black and Brown, Moderately to Slightly Weathered, Medium Hard to Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 20-40	20.9
860															White and Gray with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing GSI = 80-100	
															Boring Terminated at Elevation 856.7 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 17BP.12.R.48				TIP N/A		COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.			
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)		
BORING NO. B2-B				STATION 13+58			OFFSET 8 ft RT		ALIGNMENT -L-			
COLLAR ELEV. 877.6 ft				TOTAL DEPTH 20.9 ft			NORTHING 634,352		EASTING 1,258,728			
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER Meatyard, C.				START DATE 08/15/18			COMP. DATE 08/15/18		SURFACE WATER DEPTH 0.4ft			
CORE SIZE NQ				TOTAL RUN 18.5 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
875.2											Begin Coring @ 2.4 ft	
	875.2	2.4	3.5	1:06/1.0 1:13/1.0 3:38/1.0	(2.0) 57%	(1.7) 49%		(0.5) 25%	(0.0) 0%	875.2 873.2	CRYSTALLINE ROCK	2.4
	871.7	5.9	5.0	1:50/0.5 N/A/1.0 N/A/1.0	(5.0) 100%	(5.0) 100%		(6.8) 100%	(6.8) 100%	873.2	Mostly Core Loss in White and Brown with Gray, Moderately to Moderately Severely Weathered, Moderately Hard to Medium Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing GSI = 10-30	4.4
870				3:09/1.0 3:24/1.0						866.4	Gray and White with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing 1 joint at 20 degrees and 1 joint at 30 degrees Foliation at 0 degrees to 20 degrees GSI = 70-90	11.2
865	866.7	10.9	5.0	3:18/1.0 2:46/1.0 N/A/1.0	(4.2) 84%	(3.9) 78%		(0.5) 36%	(0.4) 29%	865.0	White and Gray with Black and Brown, Moderately to Slightly Weathered, Medium Hard to Hard, METAMORPHOSED GRANITIC ROCK with Close to Very Close Fracture Spacing Joints at 30 degrees with iron staining GSI = 20-40	12.6
860	861.7	15.9	5.0	4:56/1.0 N/A/1.0 5:18/1.0	(4.9) 98%	(4.9) 98%		(8.3) 100%	(8.3) 100%	856.7	White and Gray with Black, Fresh, Very Hard, METAMORPHOSED GRANITIC ROCK with Moderately Close to Wide Fracture Spacing 1 joint at 30 degrees Foliation at 10 degrees to 20 degrees GSI = 80-100	20.9
	856.7	20.9		4:24/1.0 6:48/1.0 8:36/1.0							Boring Terminated at Elevation 856.7 ft in Crystalline Rock: METAMORPHOSED GRANITIC ROCK	

NCDOT CORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

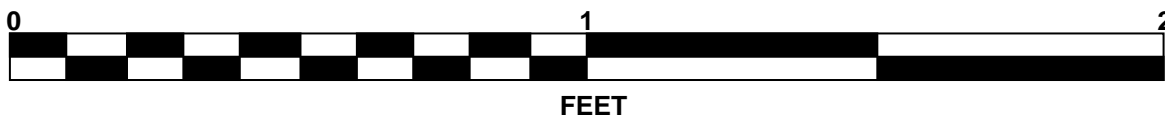
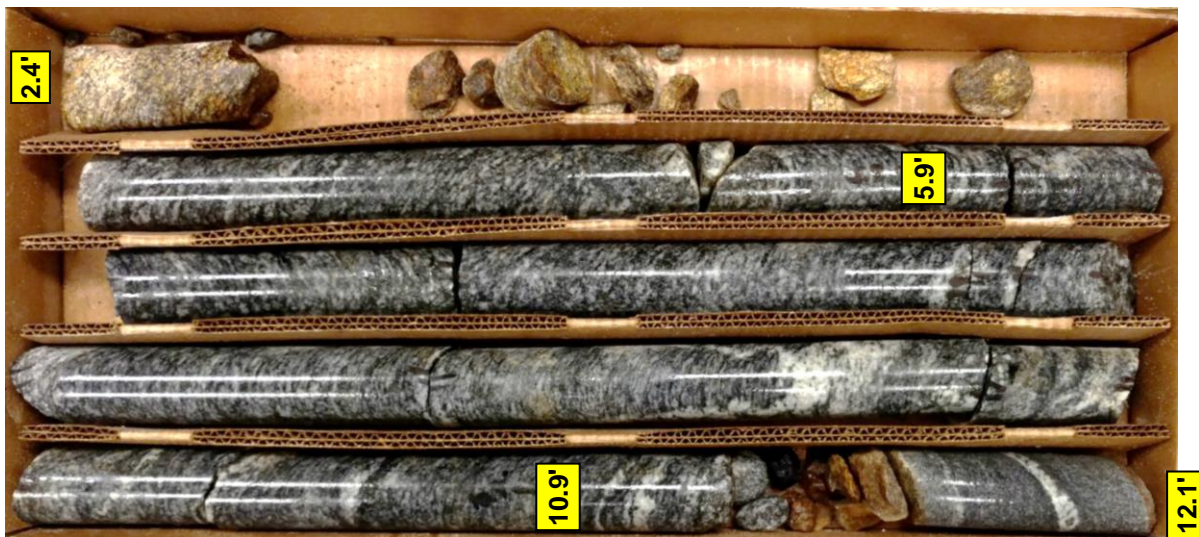
CORE PHOTOGRAPH

Project No. 17BP.12.R.48

Project Description: Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek
Cleveland County, North Carolina

B2-B

2.4 Feet to 12.1 Feet



12.1 Feet to 20.9 Feet



GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48			TIP N/A			COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.								
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)							
BORING NO. EB2-A			STATION 14+04			OFFSET 9 ft LT			ALIGNMENT -L-								
COLLAR ELEV. 894.0 ft			TOTAL DEPTH 11.7 ft			NORTHING 634,365			EASTING 1,258,776								
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic								
DRILLER Meatyard, C.			START DATE 08/14/18			COMP. DATE 08/14/18			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	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
895																	
															894.0	GROUND SURFACE	0.0
															893.0	0.6' Asphalt over 0.4' Gravel	1.0
	890.5	3.5														ROADWAY EMBANKMENT	
890			3	3	3											Reddish Brown, Medium Stiff to Stiff, Fine Sandy Silty CLAY with Gravel	
	885.5	8.5															
885			5	6	5												
	882.3	11.7														WEATHERED ROCK	
																METAMORPHOSED GRANITIC ROCK	11.7
																Boring Terminated with Standard Penetration Test Refusal at Elevation 882.3 ft on Crystalline Rock: METAMORPHOSED GRANITIC ROCK	
																Cave-In at 6.5'	

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.12.R.48		TIP N/A		COUNTY CLEVELAND		GEOLOGIST Pastrana, C.R.	
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek							GROUND WTR (ft)
BORING NO. EB2-B		STATION 14+05		OFFSET 16 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 893.5 ft		TOTAL DEPTH 21.6 ft		NORTHING 634,340		EASTING 1,258,775	
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic	
DRILLER Meatyard, C.		START DATE 08/14/18		COMP. DATE 08/14/18		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	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
895																
	892.5	1.0													893.5	0.0
	890.5	3.0	4	4	4											
	890.5		6	3	3											
	885.5	8.0													888.0	5.5
	884.7	8.8	60/0.1												884.7	8.8
	884.7		60/0.0													
	882.6														882.6	10.9
	880.7														880.7	12.8
	875														871.9	21.6

NCDOT BORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 17BP.12.R.48				TIP N/A		COUNTY CLEVELAND			GEOLOGIST Pastrana, C.R.			
SITE DESCRIPTION Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek										GROUND WTR (ft)		
BORING NO. EB2-B				STATION 14+05			OFFSET 16 ft RT		ALIGNMENT -L-			
COLLAR ELEV. 893.5 ft				TOTAL DEPTH 21.6 ft			NORTHING 634,340		EASTING 1,258,775			
DRILL RIG/HAMMER EFF./DATE AME9553 CME-550X 80% 12/15/2017						DRILL METHOD NW Casing W/SPT & Core			HAMMER TYPE Automatic			
DRILLER Meatyard, C.				START DATE 08/14/18			COMP. DATE 08/14/18		SURFACE WATER DEPTH N/A			
CORE SIZE NQ				TOTAL RUN 12.8 ft								
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
884.7											Begin Coring @ 8.8 ft	
	884.7	8.8	2.8	1:14/1.0	(2.8)	(2.3)		(2.1)	(2.1)		884.7	8.8
	881.9	11.6		1:13/1.0	100%	82%		100%	100%		882.6	10.9
880			5.0	2:19/0.5				(0.6)	(0.4)		880.7	12.8
				0:42/1.0	(3.7)	(3.6)		32%	21%			
				3:11/1.0	74%	72%		(8.8)	(8.2)			
	876.9	16.6		2:44/1.0				100%	93%			
				4:35/1.0								
875			5.0	2:20/1.0	(5.0)	(4.8)						
				3:49/1.0	100%	96%						
				3:16/1.0								
	871.9	21.6		3:29/1.0								
				4:01/1.0								

NCDOT CORE SINGLE BRIDGE NO. 162 GINT LOGS.GPJ NC_DOT.GDT 8/21/18

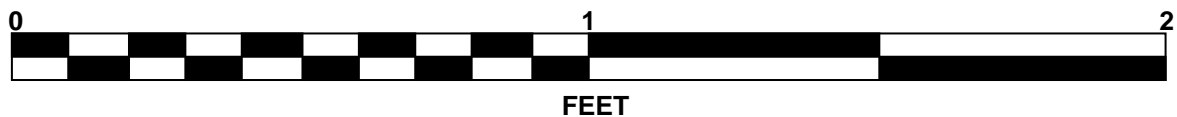
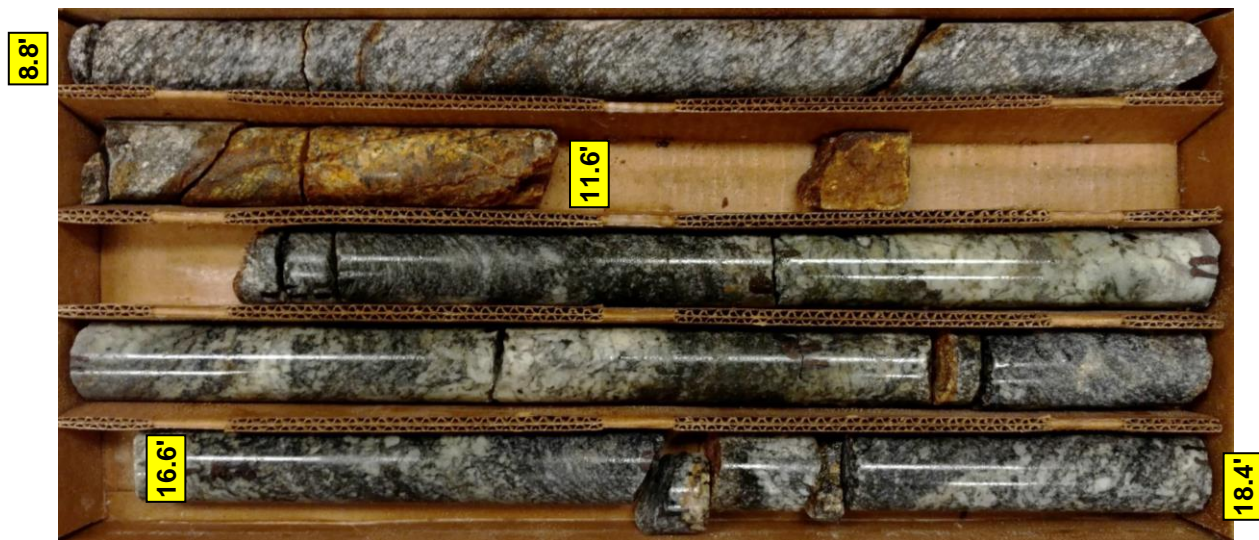
CORE PHOTOGRAPH

Project No. 17BP.12.R.48

Project Description: Bridge No. 162 on SR 1612 (Kadesh Church Road) over Buffalo Creek
Cleveland County, North Carolina

EB2-B

8.8 Feet to 18.4 Feet



18.4 Feet to 21.6 Feet

