

REFERENCE: SF-800167

PROJECT: 17BP.13.R.173

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY RUTHERFORD
PROJECT DESCRIPTION REPLACE BRIDGE # 167 ON
SR-1007 (ANDREWS MILLS RD) OVER ROBERSON CREEK

CONTENTS

SHEET NO.	DESCRIPTION
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-800167	1	14

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.

PERSONNEL

DC CHEEK

CJ COFFEY

CD JOHNSON

DC ELLIOTT

INVESTIGATED BY DC ELLIOTT

DRAWN BY DC ELLIOTT ds

CHECKED BY JC KUHNE JK

SUBMITTED BY JC KUHNE

DATE _____



DocuSigned by:
D. Clayton Elliott 7/19/2018
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

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS									
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>										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.										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) CRYSTALLINE ROCK (CR) NON-CRYSTALLINE ROCK (NCR) COASTAL PLAIN SEDIMENTARY ROCK (CP)										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 DISLOGGED 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 (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERING																			
GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.										FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. 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 SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.																			
MINERALOGICAL COMPOSITION										COMPRESSION										PERCENTAGE OF MATERIAL										GROUND WATER									
MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE										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										MISCELLANEOUS SYMBOLS										ROCK HARDNESS																			
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 SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY										DIP & DIP DIRECTION OF ROCK STRUCTURES SPT DMT VST PMT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE										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 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.									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS										ABBREVIATIONS										SOIL MOISTURE - CORRELATION OF TERMS									
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										AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS HI. - HIGHLY MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL w - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST WEA. - WEATHERED % - UNIT WEIGHT %g - DRY UNIT WEIGHT										SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT										FRACTURE SPACING										BEDDING									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										DRILL UNITS: [X] CME-45C [X] CME-55 [] CME-550 [] VANE SHEAR TEST [] PORTABLE HOIST [] [] [] ADVANCING TOOLS: [] CLAY BITS [] 6" CONTINUOUS FLIGHT AUGER [X] 8" HOLLOW AUGERS [] HARD FACED FINGER BITS [] TUNG-CARBIDE INSERTS [X] CASING [X] w/ ADVANCER [] TRICONE * STEEL TEETH [] TRICONE * TUNG-CARB. [X] CORE BIT [] HAMMER TYPE: [X] AUTOMATIC [] MANUAL CORE SIZE: [] -B [] -H [X] -N XWL HAND TOOLS: [] POST HOLE DIGGER [] HAND AUGER [X] SOUNDING ROD [] VANE SHEAR TEST										TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FOOT VERY CLOSE LESS THAN 0.16 FEET										TERM THICKNESS VERY THICKLY BEDDED 4 FEET THICKLY BEDDED 1.5 - 4 FEET THINLY BEDDED 0.16 - 1.5 FEET VERY THINLY BEDDED 0.03 - 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET THINLY LAMINATED < 0.008 FEET									
COLOR										INDURATION										NOTES:																			
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.										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 # 2 ; RAILROAD SPIKE IN BASE OF 18' OAK @ -L- STA 12+82, 36' RT : N-616482.29, E-1154716.47 ELEVATION: 896.25 FEET																			

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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GEOTECHNICAL ENGINEERING UNIT

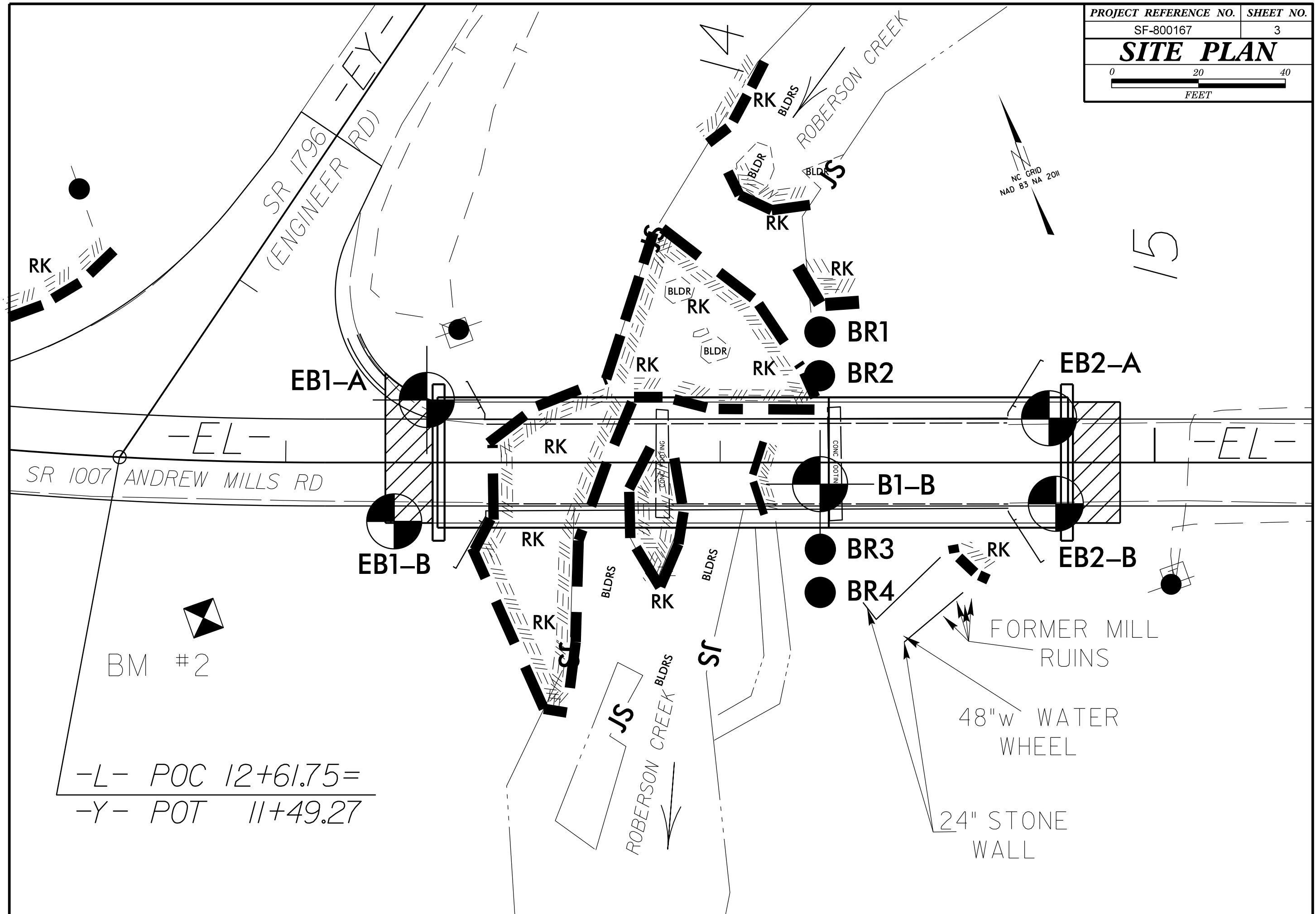
SUBSURFACE INVESTIGATION

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

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

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

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)				
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.		VERY GOOD Very rough, fresh unweathered surfaces	GOOD Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings	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.	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	
STRUCTURE		DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE						
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	90				N/A	N/A	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.	70					
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	80		70				B. Sandstone with thin inter-layers of siltstone	60					
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets			60				C. Sandstone and siltstone in similar amounts		50				
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity				50			D. Siltstone or silty shale with sandstone layers			40			
DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces					40		E. Weak siltstone or clayey shale with sandstone layers				30		
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes						30	F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure					20	
						20	G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers						10
						10	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.						
		N/A	N/A				→ Means deformation after tectonic disturbance						



-L- POC 12+61.75=
 -Y- POT 11+49.27

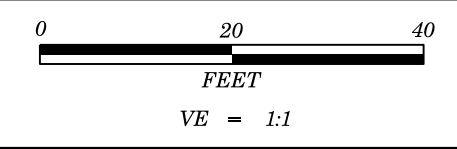
BM #2

FORMER MILL
 RUINS

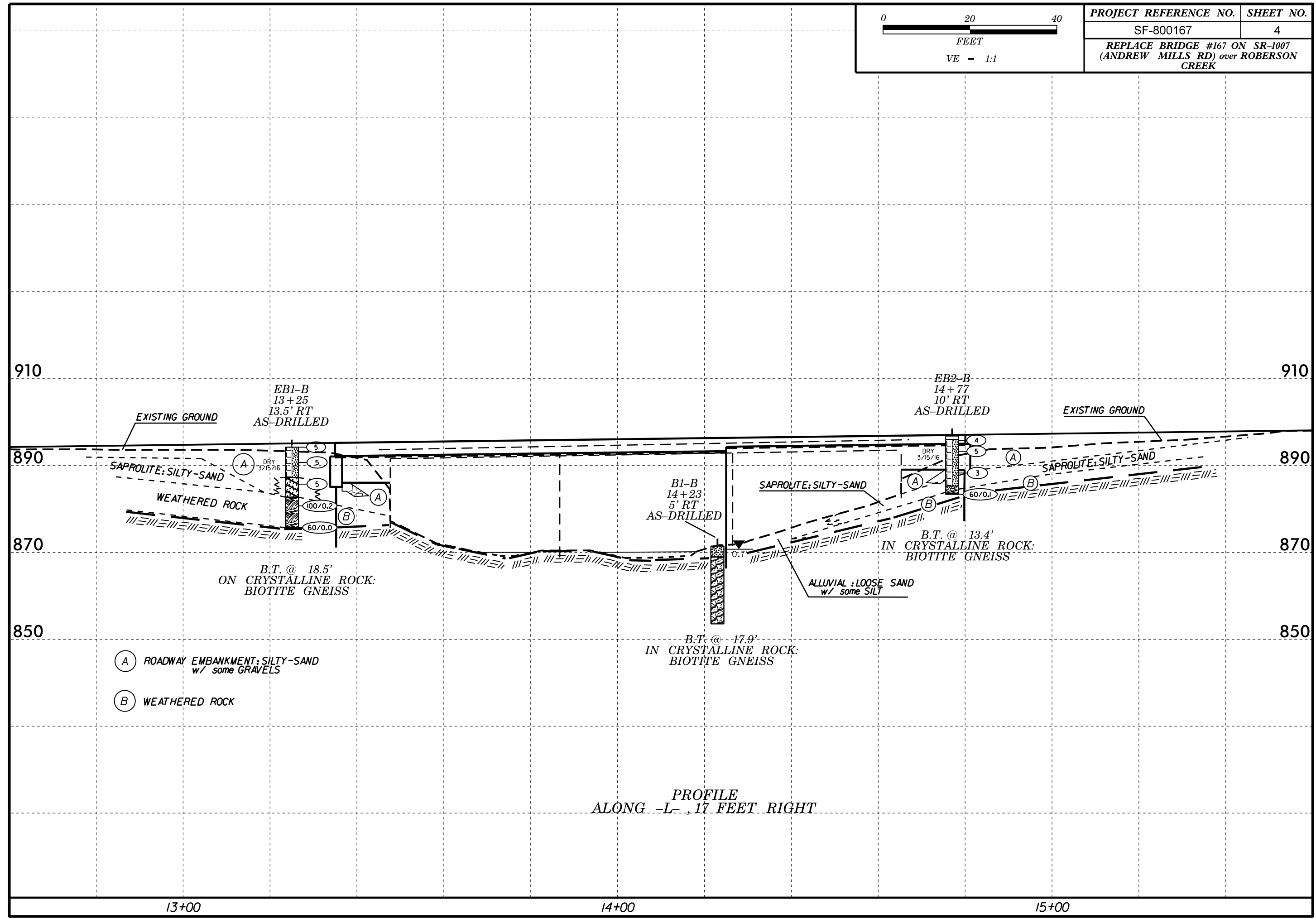
48" W WATER
 WHEEL

24" STONE
 WALL

15



PROJECT REFERENCE NO.	SHEET NO.
SF-800167	4
REPLACE BRIDGE #167 ON SR-1007 (ANDREW MILLS RD) over ROBERSON CREEK	



910

910

890

890

870

870

850

850

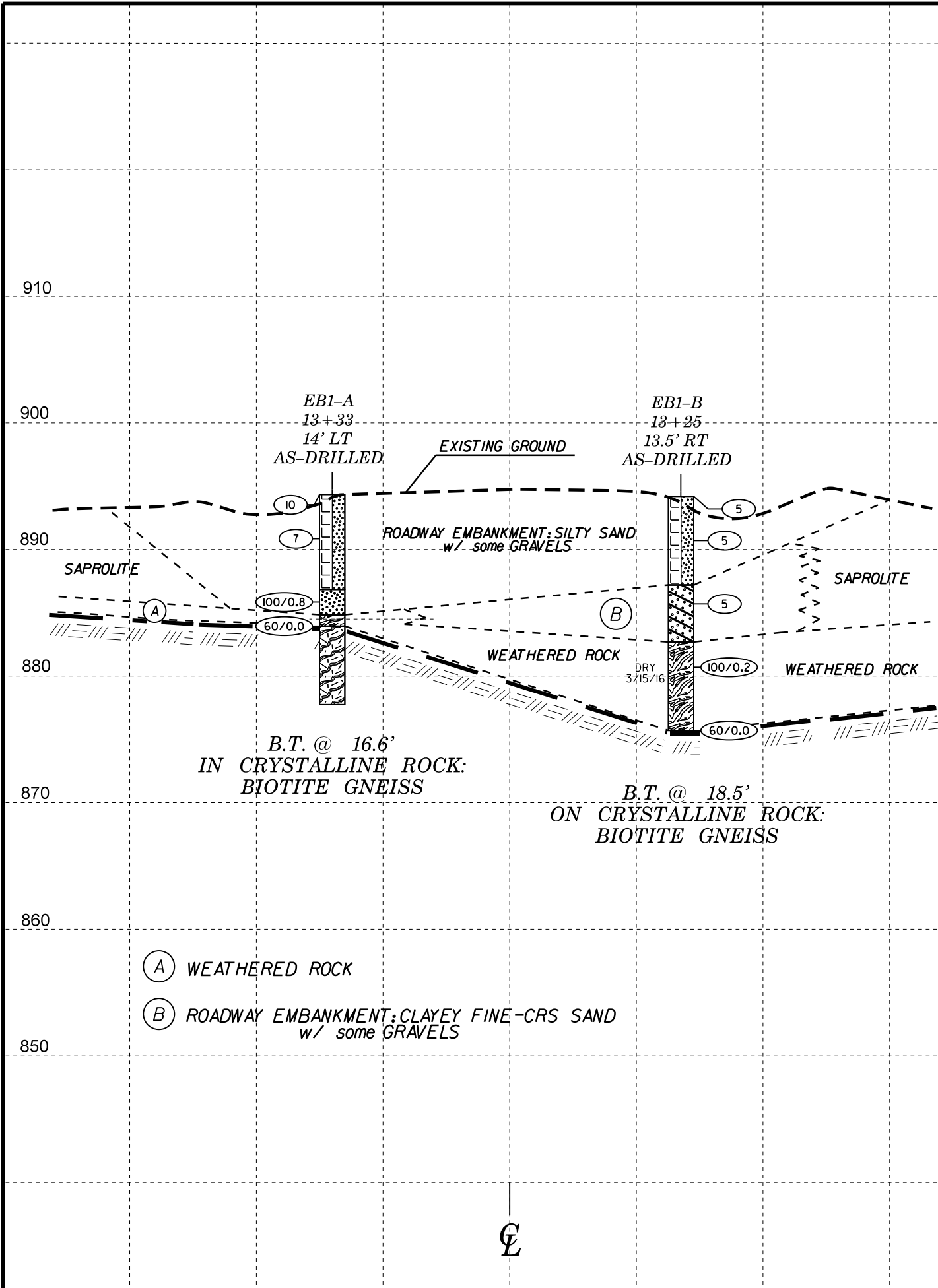
- (A) ROADWAY EMBANKMENT: SILTY-SAND w/ some GRAVELS
- (B) WEATHERED ROCK

PROFILE
ALONG -L-, 17 FEET RIGHT

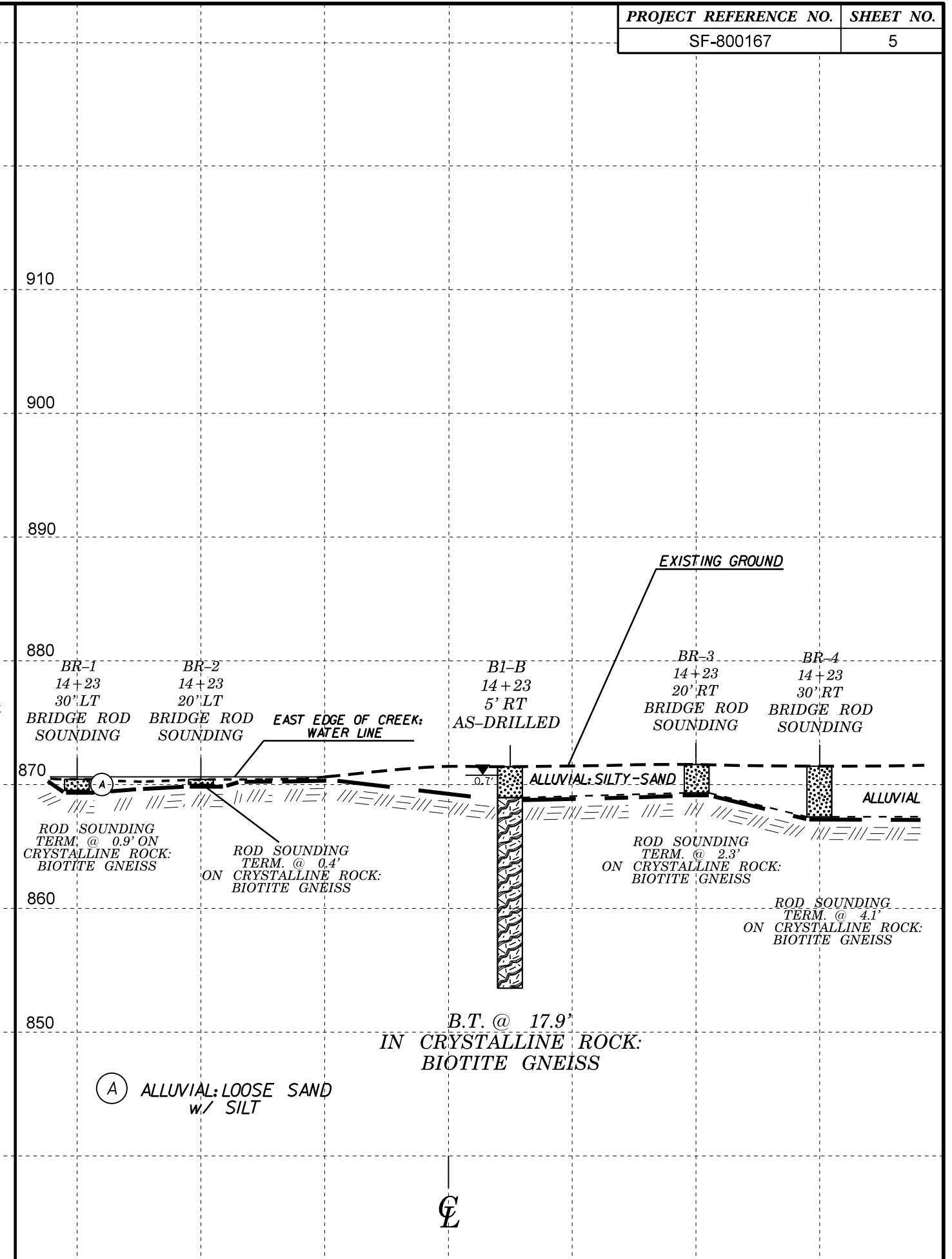
13+00

14+00

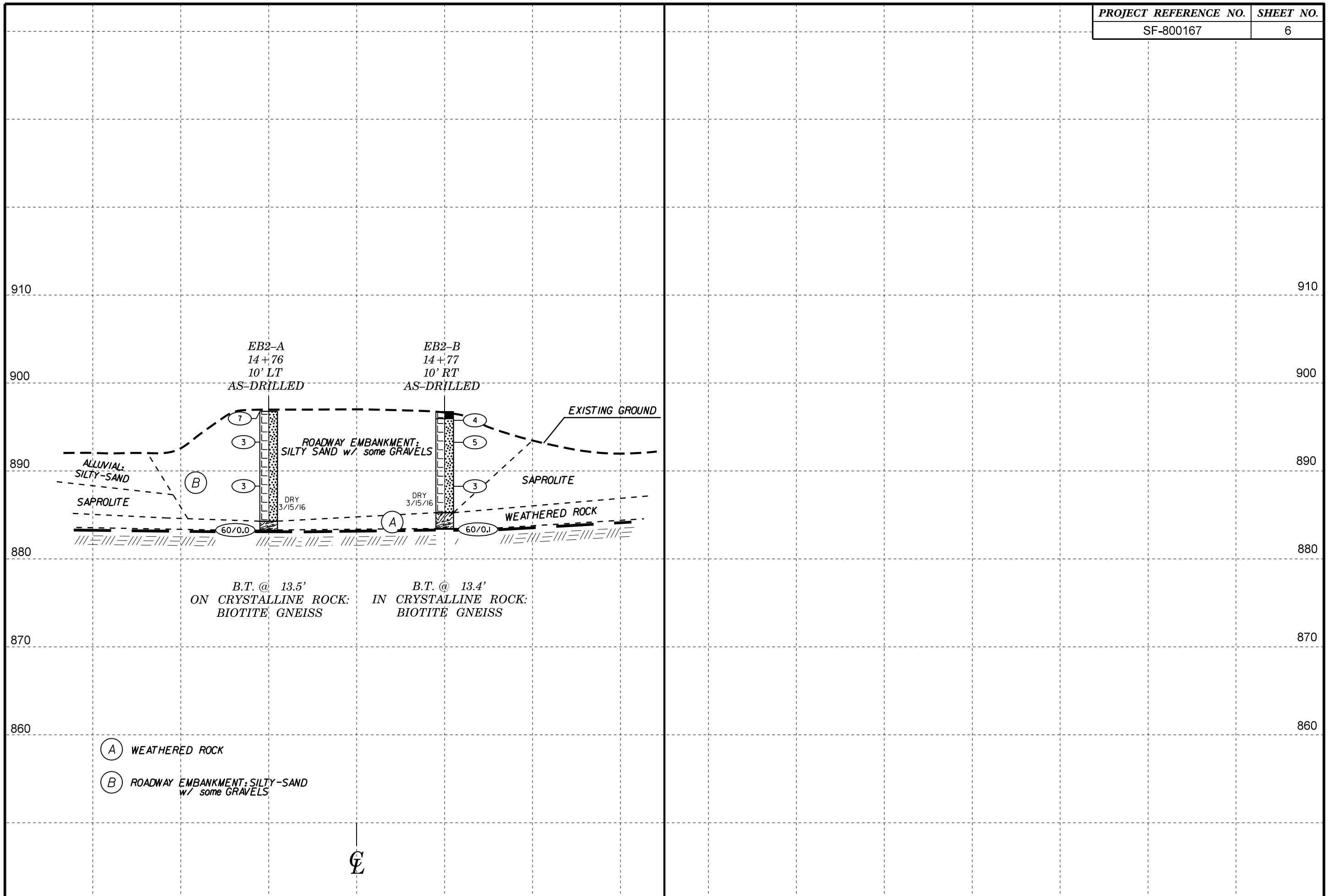
15+00



HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V SECTION THRU END BENT 1



HORIZ. SCALE 0 10 20 (FEET) VE = 1H:1V SECTION ALONG BENT 1 @ 14+23



HORIZ. SCALE 0 10 20 (FEET)

VE = 1H:1V

SECTION THRU END BENT 2

HORIZ. SCALE 0 10 20 (FEET)

VE = 1H:1V

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.13.R.173 ref 48073	TIP SF-800167 ref B-5879	COUNTY RUTHERFORD	GEOLOGIST Goodnight, D. J.
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY			GROUND WTR (ft)
BORING NO. EB1-A	STATION 13+33	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 894.4 ft	TOTAL DEPTH 16.6 ft	NORTHING 616,512	EASTING 1,154,782
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 03/15/16	COMP. DATE 03/15/16	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
895	894.4	0.0											894.4 GROUND SURFACE 0.0	
			2	4	6							M	ROADWAY EMBANKMENT NON PLASTIC, TAN-BROWN, SILTY CSE. TO F. SAND (A-2-4) WITH SOME GRAVEL/ROCK FRAGMENTS AND MICA	
890	890.9	3.5	11	4	3							M		
													RESIDUAL NON PLASTIC, BROWN, SILTY CSE. TO F. SAND (A-2-4) WITH SOME ROCK FRAGMENTS	7.5
885	885.9	8.5	25	15	85/0.3							M	WEATHERED ROCK BROWN, MICA SCHIST	9.5
	884.0	10.4											CRYSTALLINE ROCK GRAY AND WHITE, BIOTITE GNEISS	10.4
880													877.8 Boring Terminated at Elevation 877.8 ft in CR: BIOTITE GNEISS	16.6

NCDOT BORE DOUBLE 80_GEO_BRD0167_GINT.GPJ NC_DOT.GDT 7/18/18

GEOTECHNICAL BORING REPORT

CORE LOG

WBS 17BP.13.R.173 ref 48073	TIP SF-800167 ref B-5879	COUNTY RUTHERFORD	GEOLOGIST Goodnight, D. J.
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY			GROUND WTR (ft)
BORING NO. EB1-A	STATION 13+33	OFFSET 14 ft LT	ALIGNMENT -L-
COLLAR ELEV. 894.4 ft	TOTAL DEPTH 16.6 ft	NORTHING 616,512	EASTING 1,154,782
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015		DRILL METHOD NW Casing W/SPT & Core	HAMMER TYPE Automatic
DRILLER Contract Driller	START DATE 03/15/16	COMP. DATE 03/15/16	SURFACE WATER DEPTH N/A

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
883.95	884.0	10.4	1.2	0:35/0.2	(1.2)	(1.2)					Begin Coring @ 10.4 ft	
	882.8	11.6	5.0	N=60/0.0 0:35/0.2 3:37/1.0	100%	100%					CRYSTALLINE ROCK GRAY AND WHITE, MODERATE TO SLIGHT WEATHERING, MODERATELY HARD TO HARD, BIOTITE GNEISS WITH CLOSE TO MODERATELY CLOSE FRACTURE SPACING	10.4
880				3:18/1.0 1:48/1.0 3:06/1.0 3:41/1.0 3:23/1.0	94%	64%						
		16.6									Boring Terminated at Elevation 877.8 ft in CR: BIOTITE GNEISS	16.6

NCDOT CORE DOUBLE 80_GEO_BRD0167_GINT.GPJ NC_DOT.GDT 7/18/18

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Goodnight, D. J.										
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)									
BORING NO. EB1-B		STATION 13+25		OFFSET 14 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 894.2 ft		TOTAL DEPTH 18.5 ft		NORTHING 616,489		EASTING 1,154,765										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Contract Driller		START DATE 03/15/16		COMP. DATE 03/15/16		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	894.2	0.0	2	2	3	0	25	50	75	100				894.2	0.0	GROUND SURFACE
890	890.7	3.5	4	3	2	5						M				ROADWAY EMBANKMENT NON PLASTIC, RED-BROWN, SILTY CSE. TO F. SAND (A-2-4) WITH TRACE GRAVEL AND MICA
885	885.7	8.5	7	3	2	5						M		887.2	7.0	ROADWAY EMBANKMENT MOD. PLASTIC, RED-BROWN, CLAYEY CRS-to-FINE SAND (A-2-6) w/ SOME GRAVEL & MICA
880	880.7	13.5	100/0.2											882.7	11.5	WEATHERED ROCK GRAY-BROWN, BIOTITE GNEISS
	875.7	18.5	60/0.0											875.7	18.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 875.7 ft on CR: BIOTITE GNEISS

NCDOT BORE DOUBLE 80_GEO_BRD0167_GINT.GPJ NC_DOT.GDT 7/18/18

GEOTECHNICAL BORING REPORT BORE LOG

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Johnson, C. D.								
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)							
BORING NO. B1-B		STATION 14+23		OFFSET 5 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 871.5 ft		TOTAL DEPTH 17.9 ft		NORTHING 616,464		EASTING 1,154,861								
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD Core Boring		HAMMER TYPE Automatic								
DRILLER Cheek, D. O.		START DATE 06/19/18		COMP. DATE 06/19/18		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
875														
870														GROUND SURFACE 0.0
865														ALLUVIAL CORE BARREL HOLE: SOFT SILTY-SANDY ALUV.: C.R. @ 2.5' 2.5
860														CRYSTALLINE ROCK GRAY/WHITE BIOTITE GNEISS
855														Boring Terminated at Elevation 853.6 ft in CR: BIOTITE GNEISS 17.9

GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Johnson, C. D.				
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)			
BORING NO. B1-B		STATION 14+23		OFFSET 5 ft RT		ALIGNMENT -L-				
COLLAR ELEV. 871.5 ft		TOTAL DEPTH 17.9 ft		NORTHING 616,464		EASTING 1,154,861				
DRILL RIG/HAMMER EFF./DATE AFO6744 CME - 45C 92% 07/31/2017				DRILL METHOD Core Boring		HAMMER TYPE Automatic				
DRILLER Cheek, D. O.		START DATE 06/19/18		COMP. DATE 06/19/18		SURFACE WATER DEPTH N/A				
CORE SIZE NWXL			TOTAL RUN 15.4 ft					LOG	DESCRIPTION AND REMARKS	
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (%)	RQD (%)	SAMP. NO.			STRATA REC. (%)
868.95	869.0	2.5	2.6	2:25/1.0	(2.5)	(2.5)			Begin Coring @ 2.5 ft CRYSTALLINE ROCK GRAY AND WHITE, MODERATE TO SLIGHT WEATHERING, MODERATELY HARD TO HARD, BIOTITE GNEISS	
	866.4	5.1	5.3	3:11/1.0 2:01/0.6	96%	96%				
865				2:03/1.0 1:43/1.0 1:51/1.0 2:11/1.0 2:05/1.0	(5.2)	(5.1)				
860	861.1	10.4	2.7	0:34/0.3	(2.6)	(2.4)				
	858.4	13.1	4.8	2:44/1.0 3:55/1.0 3:13/0.7	96%	89%				
855				4:22/1.0 4:40/1.0 4:22/1.0 4:04/1.0 3:41/0.8	100%	100%				
	853.6	17.9								Boring Terminated at Elevation 853.6 ft in CR: BIOTITE GNEISS 17.9

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)							
BORING NO. BR-1		STATION 14+23		OFFSET 30 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 870.4 ft		TOTAL DEPTH 0.9 ft		NORTHING 616,497		EASTING 1,154,872								
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 07/03/18		COMP. DATE 07/03/18		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
875														
870														

GROUND SURFACE 0.0

870.4

869.5

ALLUVIAL
BRWN/TAN SILTY-SAND ALLUV: TERM. on CR

Boring Terminated at Elevation 869.5 ft on CR: BIOTITE GNEISS

COLLAR ELEVATION DERIVED FROM SURVEYED CROSS-SECTION FOR INTERIOR BENT 1, ALONG -L- STA 14+23

NCDOT BORE DOUBLE 80_GEO_BRDGG0167_GINT.GPJ NC_DOT.GDT 7/18/18

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Elliott, D. C.								
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)							
BORING NO. BR-2		STATION 14+23		OFFSET 20 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 870.4 ft		TOTAL DEPTH 0.4 ft		NORTHING 616,488		EASTING 1,154,869								
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding		HAMMER TYPE N/A										
DRILLER N/A		START DATE 07/03/18		COMP. DATE 07/03/18		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
875														
870														

GROUND SURFACE 0.0

870.4

ALLUVIAL
BRWN/TAN SILTY-SAND ALLUV: TERM. on CR

Boring Terminated at Elevation 870.0 ft on CR: BIOTITE GNEISS

COLLAR ELEVATION DERIVED FROM SURVEYED CROSS-SECTION FOR INTERIOR BENT 1, ALONG -L- STA 14+23

GEOTECHNICAL BORING REPORT

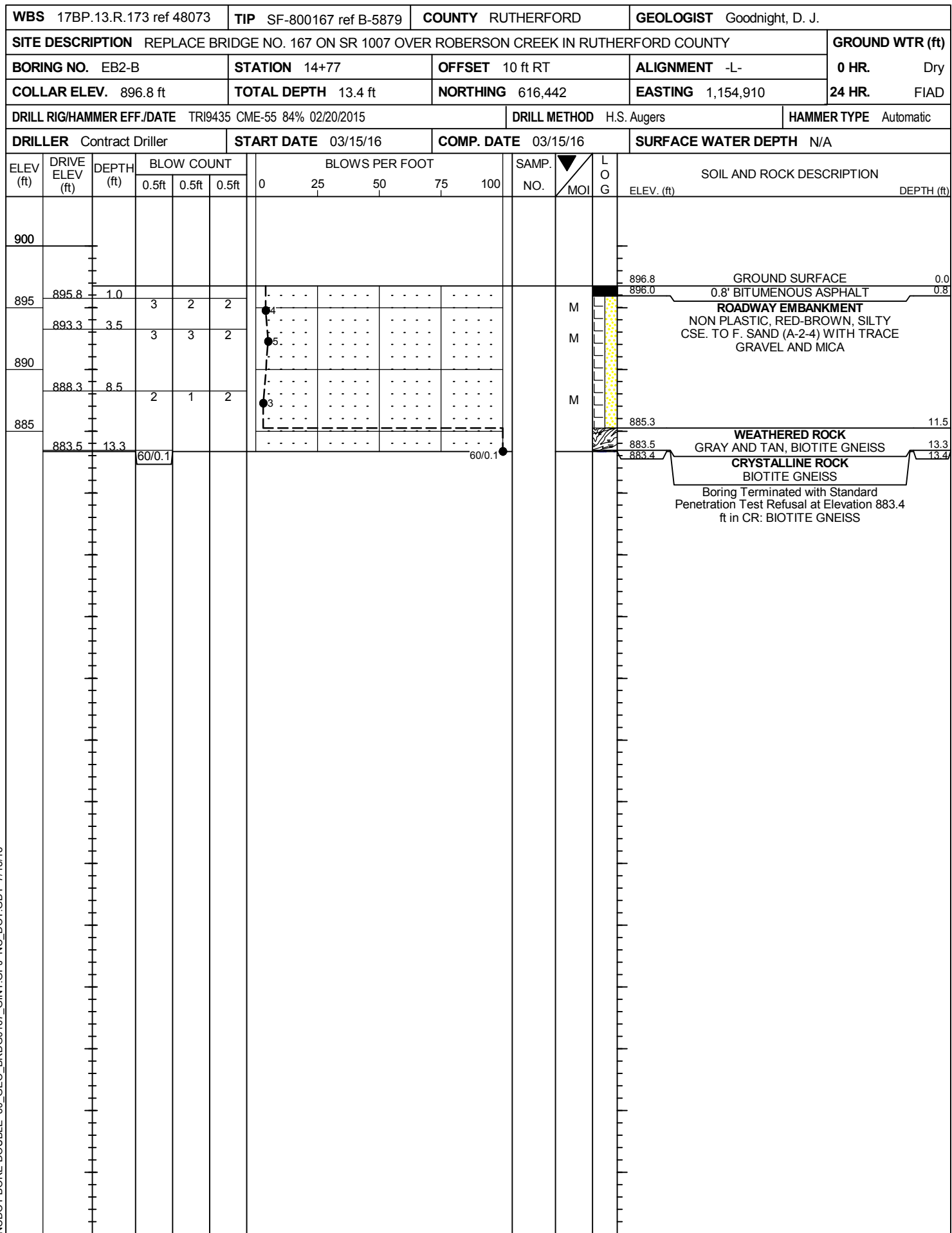
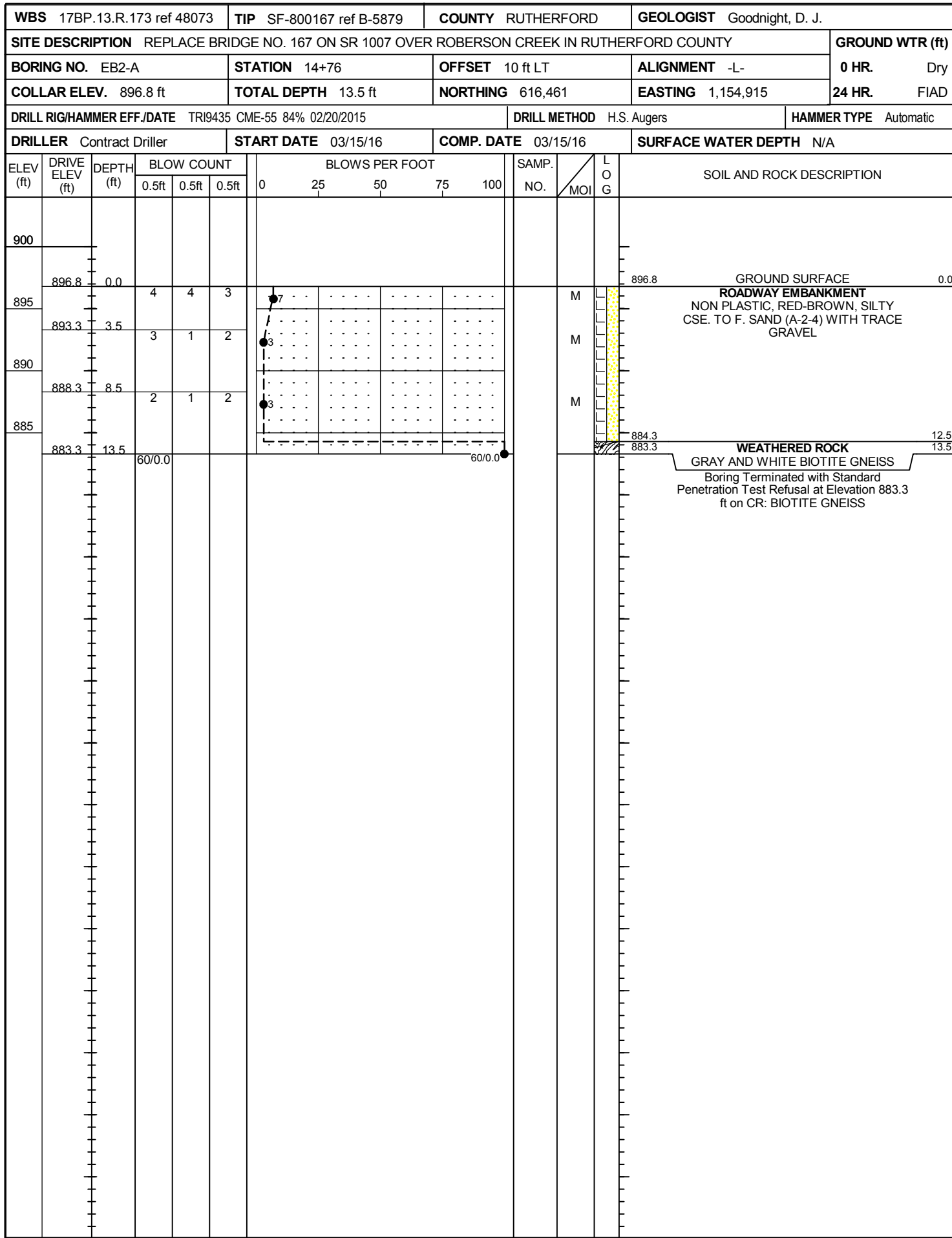
BORE LOG

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Elliott, D. C.									
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)								
BORING NO. BR-3		STATION 14+23		OFFSET 20 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 871.6 ft		TOTAL DEPTH 2.3 ft		NORTHING 616,450		EASTING 1,154,856									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 07/03/18		COMP. DATE 07/03/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
875															
															871.6 GROUND SURFACE 0.0
870															869.3 BRWN/TAN SILTY-SAND ALLUV: TERM. on CR 2.3
															Boring Terminated at Elevation 869.3 ft on CR: BIOTITE GNEISS
															COLLAR ELEVATION DERIVED FROM SURVEYED CROSS-SECTION FOR INTERIOR BENT 1, ALONG -L- STA 14+23

WBS 17BP.13.R.173 ref 48073		TIP SF-800167 ref B-5879		COUNTY RUTHERFORD		GEOLOGIST Elliott, D. C.									
SITE DESCRIPTION REPLACE BRIDGE NO. 167 ON SR 1007 OVER ROBERSON CREEK IN RUTHERFORD COUNTY							GROUND WTR (ft)								
BORING NO. BR-4		STATION 14+23		OFFSET 30 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 871.5 ft		TOTAL DEPTH 4.1 ft		NORTHING 616,441		EASTING 1,154,852									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Rod Sounding		HAMMER TYPE N/A											
DRILLER N/A		START DATE 07/03/18		COMP. DATE 07/03/18		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
875															
															871.5 GROUND SURFACE 0.0
870															867.4 BRWN/TAN SILTY-SAND ALLUV: TERM. on CR 4.1
															Boring Terminated at Elevation 867.4 ft on CR: BIOTITE GNEISS
															COLLAR ELEVATION DERIVED FROM SURVEYED CROSS-SECTION FOR INTERIOR BENT 1, ALONG -L- STA 14+23

NCDOT BORE DOUBLE 80_GEO_BRD0167_GINT.GPJ NC_DOT.GDT 7/18/18

GEOTECHNICAL BORING REPORT BORE LOG



NCDOT BORE DOUBLE 80_GEO_BRDG0167_GINT.GPJ NC_DOT.GDT 7/18/18

SF-800167 17BP.13.R.173

BORING EB1-A

-L- 13+32.5, 14.0' LT

BOX 1 OF 1

DEPTH: 10.4'-16.6'



GSI = 65 to 75

SF-800167 17BP.13.R.173

SHEET 13

BORING B1-B

-L- 14+23, 5.0' RT

BOX 1 OF 2

DEPTH: 2.5'-9.8'



GSI = 65 to 75

SF-800167 17BP.13.R.173

SHEET 14

BORING B1-B

-L- 14+23, 5.0' RT

BOX 2 OF 2

DEPTH: 9.8'-17.9'



GSI = 65 to 75