

REFERENCE: B-5322

PROJECT: 46036

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5	CROSS SECTIONS
6-8	BORE LOGS & CORE REPORT
9	LAB TEST RESULTS
10	CORE PHOTOGRAPH
11	SITE PHOTOGRAPH

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY PERSON
 PROJECT DESCRIPTION BRIDGE NO. 51 ON SR 1343
(JOHN BREWER RD.) OVER RICHLAND CREEK

 SITE DESCRIPTION 16+05 -L-

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-5322	1	11

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 1919 TOTTENHAM ST. 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:
1. 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.
 2. 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

C.T. TANG, EI

CAROLINA DRILLING

G. EISTER

W. HAMIL

INVESTIGATED BY C.T. TANG, EI

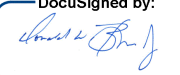
DRAWN BY C.T. TANG, EI

CHECKED BY D. BROWN, PE

SUBMITTED BY D. BROWN, PE

DATE OCTOBER 2017



DocuSigned by:

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 SIGNATURE

10/16/2017
 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																																																																																																																																																
<p>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></p>										<p>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.</p>										<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><u>ALLUVIUM (ALLUV.)</u> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <u>AQUIFER</u> - A WATER BEARING FORMATION OR STRATA. <u>ARENACEOUS</u> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. <u>ARGILLACEOUS</u> - 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. <u>ARTESIAN</u> - 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. <u>CALCAREOUS (CALC.)</u> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. <u>COLLUVIUM</u> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. <u>CORE RECOVERY (REC.)</u> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. <u>DIKE</u> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. <u>DIP</u> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. <u>DIP DIRECTION (DIP AZIMUTH)</u> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. <u>FAULT</u> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. <u>FISSILE</u> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. <u>FLOAT</u> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL. <u>FLOOD PLAIN (FP)</u> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. <u>FORMATION (FM)</u> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. <u>JOINT</u> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. <u>LEDGE</u> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. <u>LENS</u> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. <u>MOTTLED (MOT.)</u> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. <u>PERCHED WATER</u> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. <u>RESIDUAL (RES.) SOIL</u> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. <u>ROCK QUALITY DESIGNATION (ROD)</u> - 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. <u>SAPROLITE (SAP.)</u> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. <u>SILL</u> - 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. <u>SLICKENSIDE</u> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. <u>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</u> - 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. <u>STRATA CORE RECOVERY (SREC.)</u> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. <u>STRATA ROCK QUALITY DESIGNATION (SROD)</u> - 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. <u>TOPSOIL (TS.)</u> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																
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<p>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.</p>										<p>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</p> <p>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</p> <p>VST - VANE SHEAR TEST WEA. - WEATHERED W - UNIT WEIGHT W_d - DRY UNIT WEIGHT</p> <p>SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO</p>										<p>DRILL UNITS: <input checked="" type="checkbox"/> CME-45C <input type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST</p> <p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input 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 2 5/8" STEEL TEETH <input type="checkbox"/> TRICONE " TUNG-CARB. <input type="checkbox"/> CORE BIT</p> <p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input checked="" type="checkbox"/> -N Q</p> <p>HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p>																																																																																																																																																

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**

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)

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.

STRUCTURE

SURFACE CONDITIONS

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
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DECREASING SURFACE QUALITY →

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.

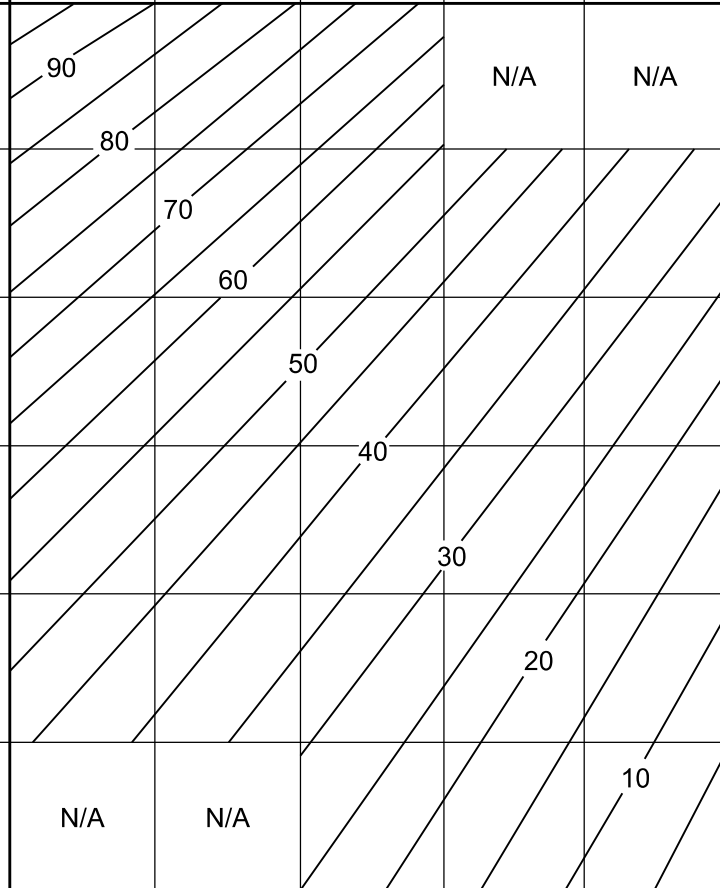
COMPOSITION AND STRUCTURE

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
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DECREASING INTERLOCKING OF ROCK PIECES

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			
DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				30		
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes					20	
						10
	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.

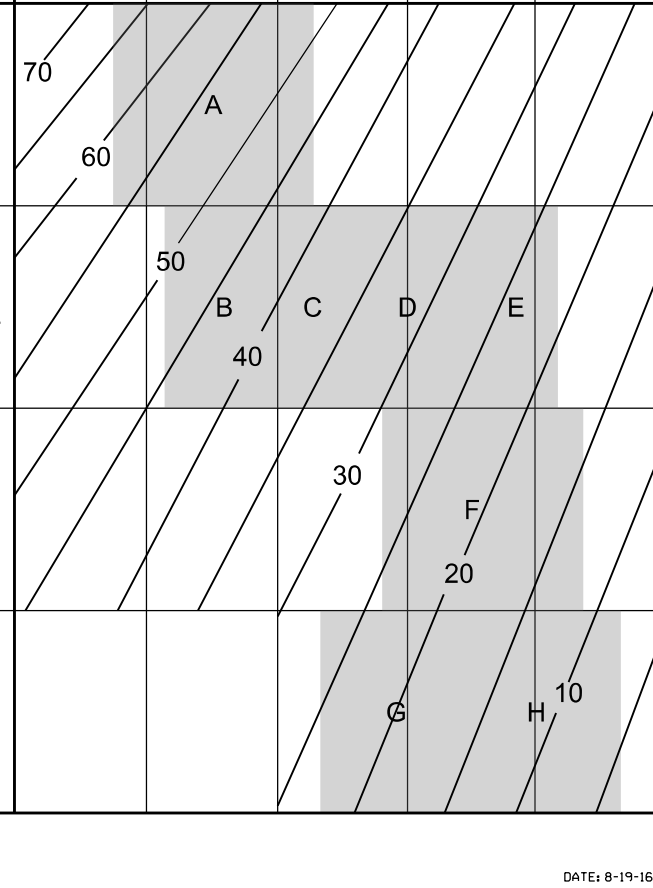
B. Sandstone with thin inter-layers of siltstone **C. Sandstone and siltstone in similar amounts** **D. Siltstone or silty shale with sandstone layers** **E. Weak siltstone or clayey shale with sandstone layers**

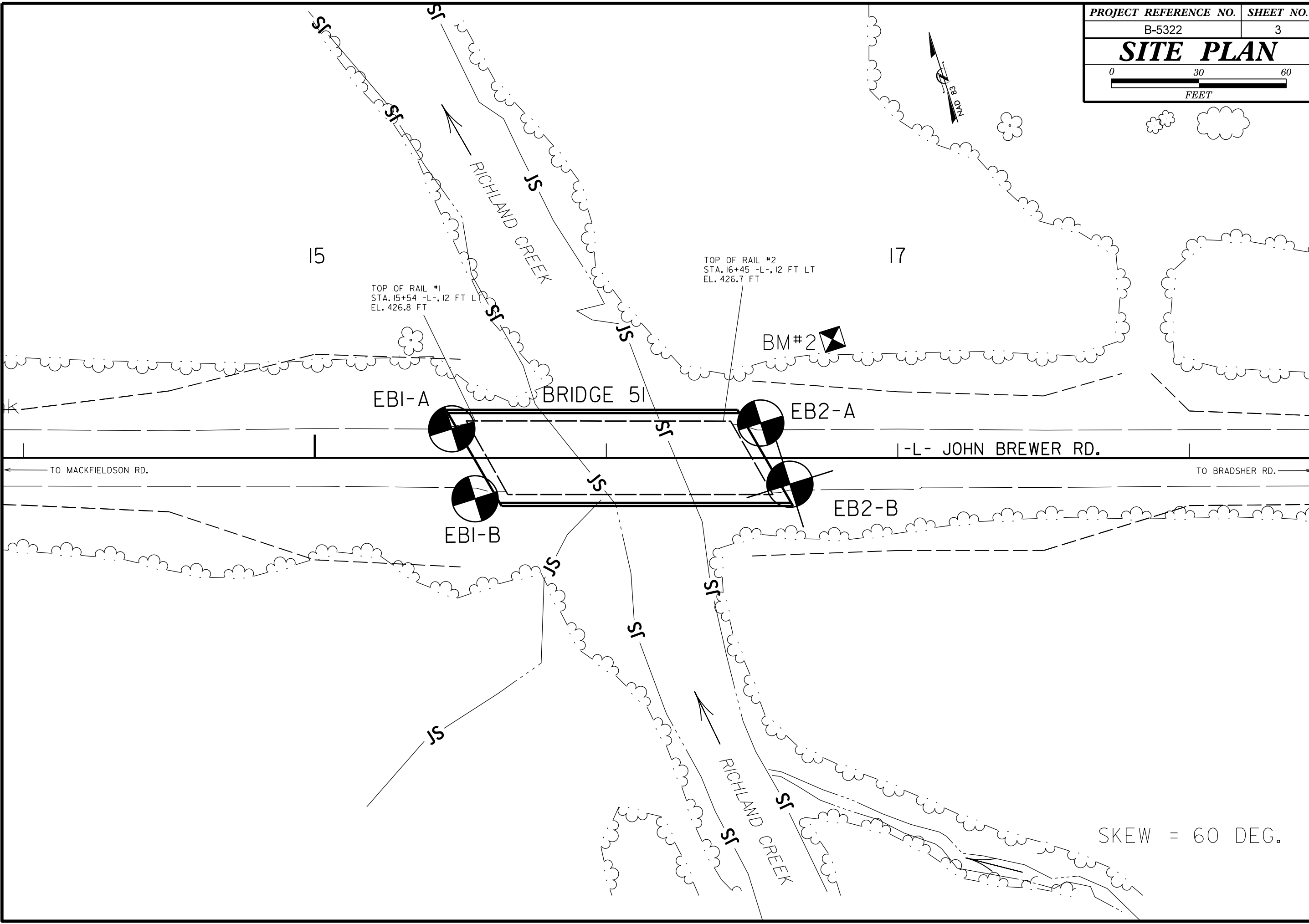
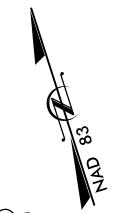
C, D, E, and G - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to **F** and **H**.

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





TOP OF RAIL #1
 STA. 15+54 -L-, 12 FT LT
 EL. 426.8 FT

TOP OF RAIL #2
 STA. 16+45 -L-, 12 FT LT
 EL. 426.7 FT

EBI-A

BRIDGE 51

EB2-A

|-L- JOHN BREWER RD.

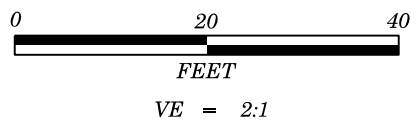
← TO MACKFIELDSON RD.

TO BRADSHER RD. →

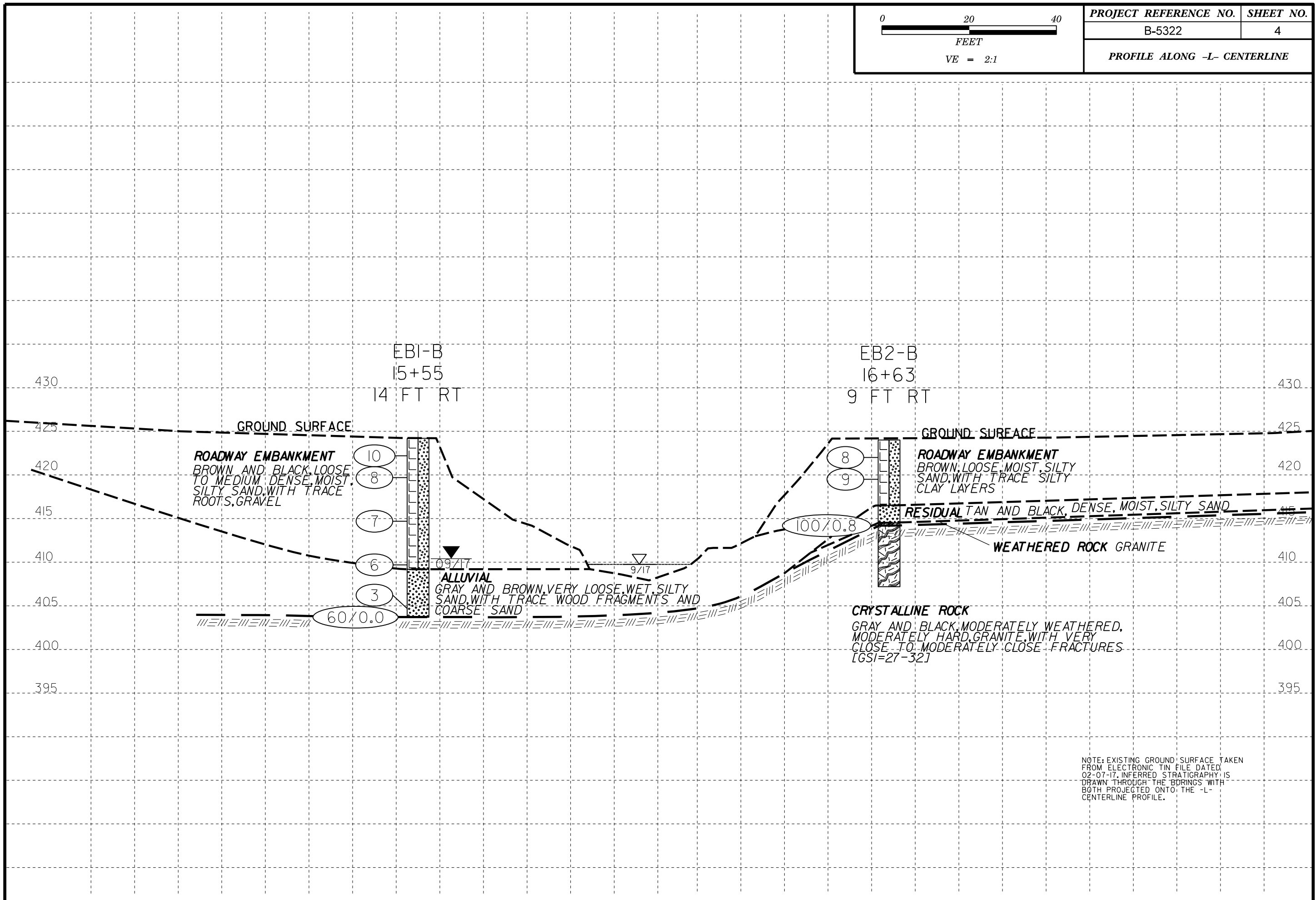
EBI-B

EB2-B

SKEW = 60 DEG.



PROJECT REFERENCE NO.	SHEET NO.
B-5322	4
PROFILE ALONG -L- CENTERLINE	



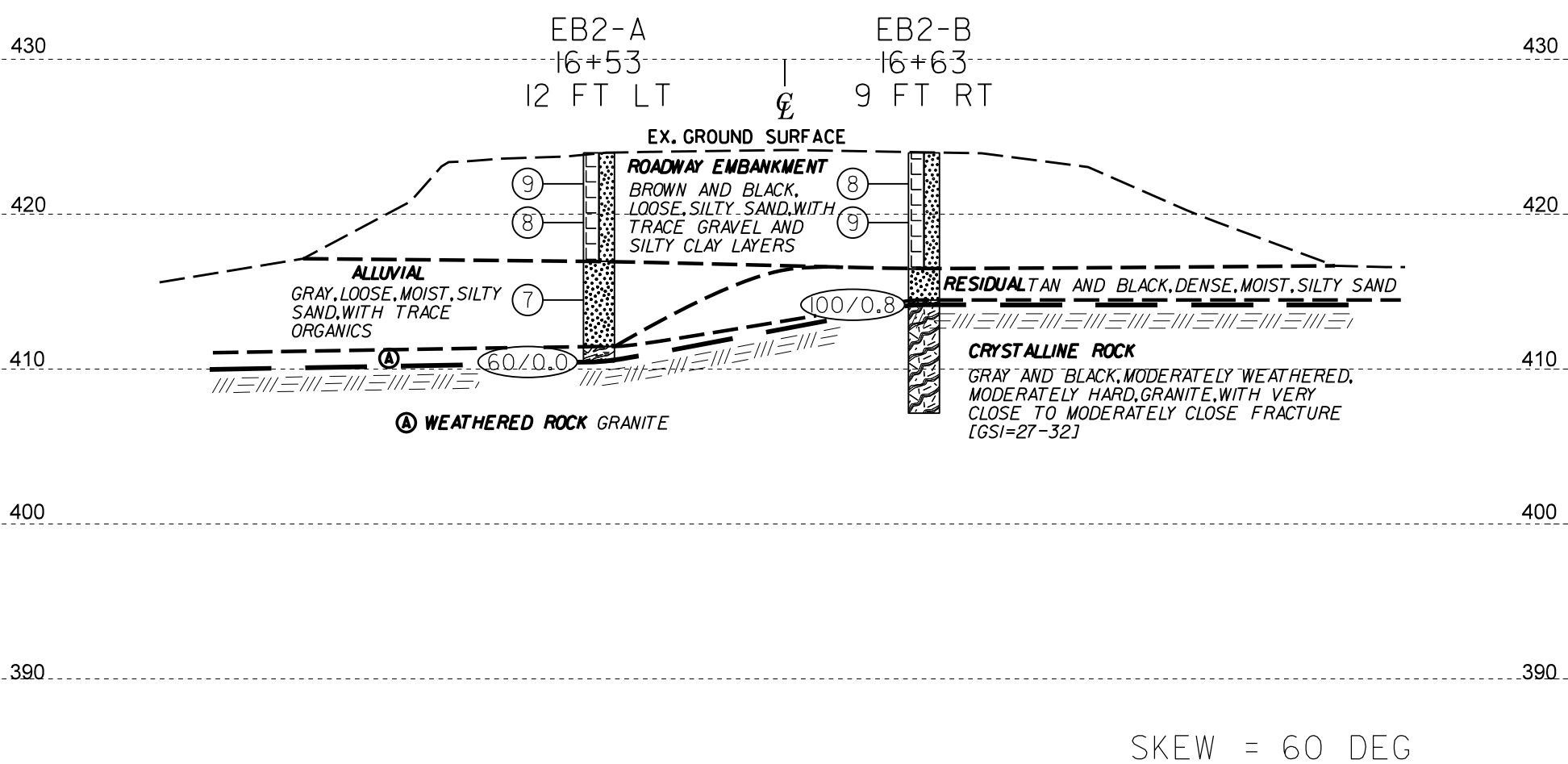
NOTE: EXISTING GROUND SURFACE TAKEN FROM ELECTRONIC TIN FILE DATED 02-07-17. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE -L- CENTERLINE PROFILE.

HORIZ. SCALE 0 (FEET) 10 20

VE = 1:1

CROSS SECTION AT END BENT #2

NOTE: EXISTING GROUND SURFACE AT END BENT NO. 2 TAKEN FROM ELECTRONIC TIN FILE DATED 02-07-17. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

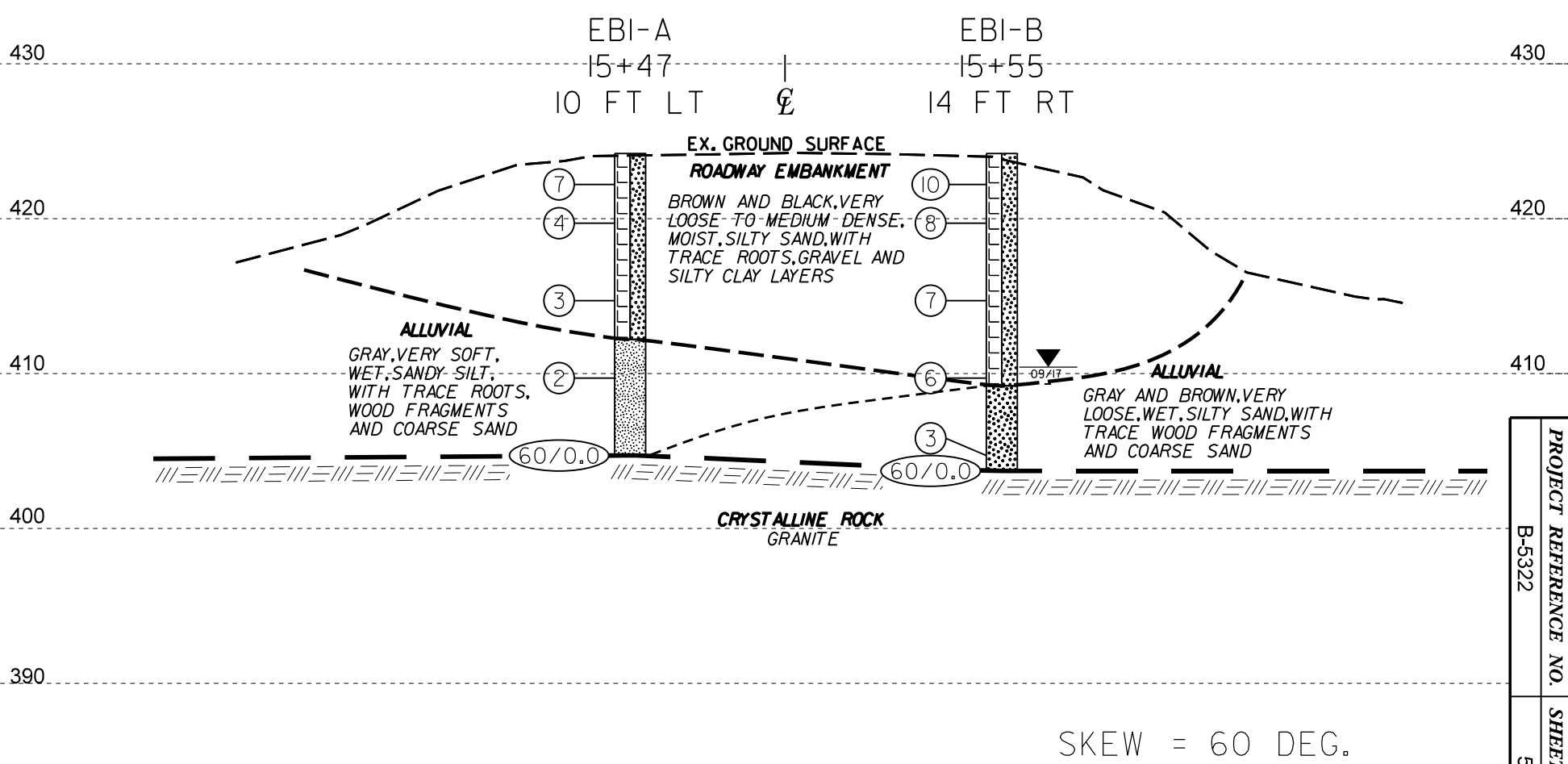


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VE = 1:1

CROSS SECTION AT END BENT #1

NOTE: EXISTING GROUND SURFACE AT END BENT NO. 1 TAKEN FROM ELECTRONIC TIN FILE DATED 02-07-17. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.



PROJECT REFERENCE NO. B-5322

SHEET NO. 5

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46036.1.1		TIP B-5322		COUNTY PERSON		GEOLOGIST C.T. Tang											
SITE DESCRIPTION Bridge No. 51 on SR 1343 (John Brewer Rd.) over Richland Creek							GROUND WTR (ft)										
BORING NO. EB1-A		STATION 15+47		OFFSET 10 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 424.2 ft		TOTAL DEPTH 19.5 ft		NORTHING 971,093		EASTING 1,970,727											
DRILL RIG/HAMMER EFF./DATE BRI0674 CME-45C 89% 05/04/2016			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic											
DRILLER G. Eister		START DATE 09/11/17		COMP. DATE 09/11/17		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							
425														424.2	0.0	GROUND SURFACE	
	423.2	1.0	3	3	4								M			ROADWAY EMBANKMENT Brown, Silty Sand, with Trace Silty Clay Layers	
420	420.7	3.5	2	2	2								M				
	415.7	8.5	2	1	2								W				
410	410.7	13.5	WOH	1	1								W			ALLUVIAL Gray, Sandy Silt, with Trace Roots, Wood Fragments and Coarse Sand	
405	405.7	18.5	1	2	60/0.0												
															60/0.0		
																	Boring Terminated with Standard Penetration Test Refusal at Elevation 404.7 ft on Crystalline Rock (Granite)

WBS 46036.1.1		TIP B-5322		COUNTY PERSON		GEOLOGIST C.T. Tang											
SITE DESCRIPTION Bridge No. 51 on SR 1343 (John Brewer Rd.) over Richland Creek							GROUND WTR (ft)										
BORING NO. EB1-B		STATION 15+55		OFFSET 14 ft RT		ALIGNMENT -L-											
COLLAR ELEV. 424.2 ft		TOTAL DEPTH 20.5 ft		NORTHING 971,067		EASTING 1,970,727											
DRILL RIG/HAMMER EFF./DATE BRI0674 CME-45C 89% 05/04/2016			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic											
DRILLER G. Eister		START DATE 09/11/17		COMP. DATE 09/11/17		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							
425														424.2	0.0	GROUND SURFACE	
	423.2	1.0	2	5	5								M			ROADWAY EMBANKMENT Brown and Black, Silty Sand, with Trace Roots and Gravel	
420	420.7	3.5	2	3	5								M				
	415.7	8.5	2	3	4								M				
410	410.7	13.5	1	2	4								W			ALLUVIAL Gray and Brown, Silty Sand, with Trace Wood Fragments and Coarse Sand	
405	405.7	18.5	WOH	1	2								W				
	403.7	20.5													60/0.0		
																	Boring Terminated with Standard Penetration Test Refusal at Elevation 403.7 ft on Crystalline Rock (Granite)

NCDOT BORE DOUBLE B5322_GEO_BRDG0051_BH.GPJ NC_DOT.GDT 10/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46036.1.1		TIP B-5322		COUNTY PERSON		GEOLOGIST C.T. Tang											
SITE DESCRIPTION Bridge No. 51 on SR 1343 (John Brewer Rd.) over Richland Creek							GROUND WTR (ft)										
BORING NO. EB2-A		STATION 16+53		OFFSET 12 ft LT		ALIGNMENT -L-											
COLLAR ELEV. 424.0 ft		TOTAL DEPTH 13.5 ft		NORTHING 971,063		EASTING 1,970,828											
DRILL RIG/HAMMER EFF./DATE BRI0674 CME-45C 89% 05/04/2016				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER G. Eister		START DATE 09/11/17		COMP. DATE 09/11/17		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)		
425															424.0	0.0	GROUND SURFACE
	423.0	1.0	4	4	5	•	•	•	•	•			M				ROADWAY EMBANKMENT Brown and Black, Silty Sand, with Trace Gravel
420	420.5	3.5	3	3	5	•	•	•	•	•			M				
						•	•	•	•	•					417.0	7.0	ALLUVIAL Gray, Silty Sand, with Trace Organics
415	415.5	8.5	2	4	3	•	•	•	•	•			M				
						•	•	•	•	•					411.5	12.5	WEATHERED ROCK Granite
	410.5	13.5	60/0.0			60/0.0									410.5	13.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 410.5 ft on Crystalline Rock (Granite)

NCDOT BORE DOUBLE B5322_GEO_BRDG0051_BH.GPJ NC_DOT.GDT 10/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 46036.1.1		TIP B-5322		COUNTY PERSON		GEOLOGIST C.T. Tang									
SITE DESCRIPTION Bridge No. 51 on SR 1343 (John Brewer Rd.) over Richland Creek							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 16+63		OFFSET 9 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 424.0 ft		TOTAL DEPTH 16.8 ft		NORTHING 971,040		EASTING 1,970,831									
DRILL RIG/HAMMER EFF./DATE BRI0674 CME-45C 89% 05/04/2016				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER G. Eister		START DATE 09/11/17		COMP. DATE 09/11/17		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					
425														424.0	0.0
	423.0	1.0													
	420.5	3.5	2	4	4										
420															
	415.5	8.5													
	414.2	9.8	16	29	71/0.3										
			60/0.0												
410															

WBS 46036.1.1		TIP B-5322		COUNTY PERSON		GEOLOGIST C.T. Tang					
SITE DESCRIPTION Bridge No. 51 on SR 1343 (John Brewer Rd.) over Richland Creek							GROUND WTR (ft)				
BORING NO. EB2-B		STATION 16+63		OFFSET 9 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 424.0 ft		TOTAL DEPTH 16.8 ft		NORTHING 971,040		EASTING 1,970,831					
DRILL RIG/HAMMER EFF./DATE BRI0674 CME-45C 89% 05/04/2016				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic					
DRILLER G. Eister		START DATE 09/11/17		COMP. DATE 09/11/17		SURFACE WATER DEPTH N/A					
CORE SIZE NQ				TOTAL RUN 7.0 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %		
414.2											
	414.2	9.8	1.0	7:28/1.0	(1.0)	(0.6)		(5.5)	(2.5)		Begin Coring @ 9.8 ft
	413.2	10.8	2.0	5:45/1.0	100%	60%					414.2 CRYSTALLINE ROCK Gray and Black, Moderately Weathered, Moderately Hard, Granite, with Very Close to Moderately Close Fractures [GSI= 27-32]
	411.2	12.8		3:10/1.0	(1.4)	(1.2)					
410	410.2	13.8	1.0	4:10/1.0	70%	60%					
			3.0	8:10/1.0	(0.8)	(0.0)					
				5:45/1.0	80%	0%					
	407.2	16.8		6:38/1.0	(2.3)	(0.8)					407.2
					77%	27%					Boring Terminated at Elevation 407.2 ft in Crystalline Rock (Granite)

LAB TEST RESULTS



**UNCONFINED COMPRESSIVE STRENGTH
OF INTACT ROCK CORE SPECIMEN**
ASTM D7012

WBS No.: 46036.1.1

Test Date: 9/25/2017

TIP No.: B-5322

Tested By: J. Evans

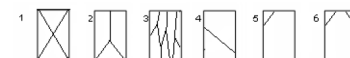
County: Person

Description: Bridge No. 51 on SR 1343 (John Brewer Rd) over Richland Creek

Test No.	1			
Boring ID	EB2-B			
Station	16+63			
Sample ID	RS-1			
Sample Depth, ft	16.3			
Core Length #1, in.	3.982			
Core Length #2, in.	3.991			
Core Length #3, in.	3.993			
Avg. Core Length, in.	3.989			
Core Dia. #1, in.	1.961			
Core Dia. #2, in.	1.961			
Avg. Core Dia., in.	1.961			
Length/Dia. Ratio	2.03			
X-Sectional Area, in ²	3.02			
Weight, lb	1.27			
Unit Weight, pcf	182.17			
Break Type	3			
Load at Failure, lb	44,110			
Correction Factor	1.00			
Comp. Strength, psi	14,610			
Comp. Strength, ksf	2,104			

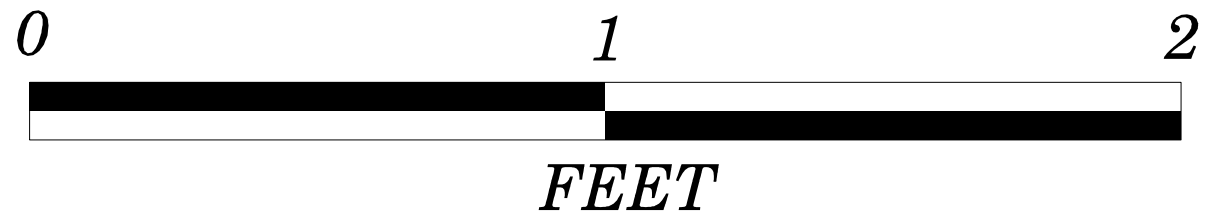
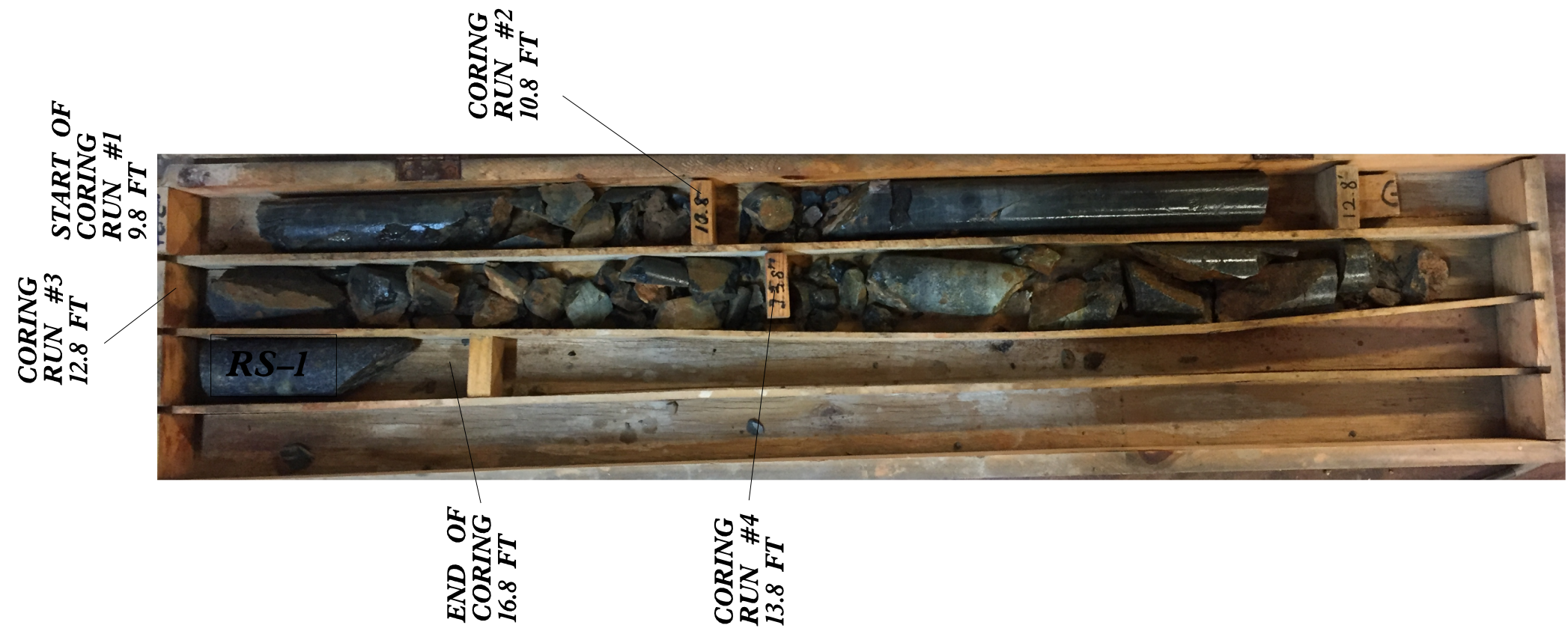
Rock Descriptions:

Test 1: Gray and Black, Moderately Weathered, Moderately Hard, Granite with Very Close to Moderately Close Fractures

Break Types:

CORE PHOTOGRAPHS

BORING EB2-B
STA. 16+63 -L-, 9 FT RT
DEPTH: 9.8 FT TO 16.8 FT



SITE PHOTOGRAPH

BRIDGE 51



PHOTOGRAPH NO.1. VIEW LOOKING UPSTREAM.