17BP.9.R.85
REFERENCE: 1
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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.9.R.85	1	26

### STATE OF NORTH CAROLINA

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

### **STRUCTURE** SUBSURFACE INVESTIGATION

COUNTY ROWAN

SITE DESCRIPTION BRIDGE NO. 198 AND 199 ON SR 2529 (ST. PAUL CHURCH ROAD) OVER CRANE

**CREEK** 

### **CONTENTS**

SHEET NO.	<b>DESCRIPTION</b>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
2B, 2C	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN - BRIDGE 199
4	SITE PLAN - BRIDGE 198
5-8	CROSS SECTIONS
9-24	BORELOGS, CORELOGS, AND ROCK CORE PHOTOS
25-26	SITE PHOTOS

PERSONNEL

CG2 EXPLORATION

C. ODOM

J. K. STICKNEY

M. BREWER

INVESTIGATED BY J. E. BEVERLY CAROLINAS
DRAWN BY GEOTECHNICAL GROUP

CHECKED BY <u>C. R. LAVENDER, III</u>

SUBMITTED BY K. B. MILLER

DATE \_\_FEBRUARY 2022

### **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 (99) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

CEMERAL 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 BORCHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (INP-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOL. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE OR 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 DEEM NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED TO 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.

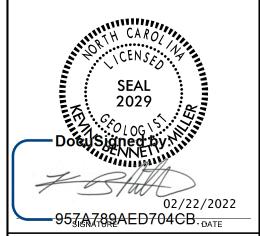
- NOTES:

  I. 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 MAIVES 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.



**CHARLOTTE. NC 28227** 



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
17BP.9.R.85	2

# 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)

											(11	IUL	101 2)							
					SOI	L DE	SCR:	<u>IPT</u> I	ON				GRADATION							
BE PENE ACCORD IS	TRATED WI ING TO TH BASED ON	TH A C E STAN THE AA	ONTINI IDARD ASHTO	IDATED UOUS I PENET SYSTE	, SEMI LIGHT RATIO M. BA	I-CONSOL T POWER N TEST SIC DES	IDATE AUGE (AASH CRIPT	D, OR R ANO TO T IONS	WEATHERE D YIELD L 206, ASTM GENERALL	SS THAN 10 D1586). SO INCLUDE T	00 BLOWS F IL CLASSIF HE FOLLOW	PER FOOT ICATION /ING:	WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.  ANGULARITY OF GRAINS							
	SOIL DESCRIPTION						UCTUR	RE, PLASTIC	ITY, ETC. FO	OR EXAMPLE	Ε.	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:								
	S. CONSIDERED LINCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERDE DEATH MATER BETRATED WITH A CONTINUOUS FLIGHT POWER QUEER AND YELD LESS THAN AND RESTRICTED LESS THAN AND OTHER PROTINCE. AGASHTO TEST (AGASHTO T. 286, ASTM DISSELS. SOIL THE FERNEY, COLOR, TEXTURE, MOISTURE, AGASHTO CLASSIFICATION, AND OTHER PERTINCE. SHE TENCY, COLOR, TEXTURE, MOISTURE, AGASHTO CLASSIFICATION, AND OTHER PERTINCE. YELD YELD YELD STAFF, CRAY, SITY CLAY, MOST WITH MITERBECOCO FINE. SAMO LAKERS, HIGHEN PLASTIC.  SOIL LEGEND AND AASHTO CLASSIFICATION, AND OTHER PERTINCE. YELD YELD YELD YELD YELD YELD YELD YELD											·	ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.  MINERALOGICAL COMPOSITION							
GENERAL CLASS.										0	RGANIC MATE	RIALS	MINERALUGICAL CUMPUSITION  MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC.							
GROUP		A-3		A	-2				A-6 A-		A-4, A-5		ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.							
CLASS.			A-2-4	A-2-5	A-2-6	A-2-7	3185331		A-7- A-7-	A-3	A-6, A-7		COMPRESSIBILITY  SLIGHTLY COMPRESSIBLE LL < 31							
SYMBOL	000000000000000000000000000000000000000	o i						1.7.1					MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50							
% PASSING *10											SILT- CLAY	MUCK,	PERCENTAGE OF MATERIAL							
*40 *200	30 MX 50 M 15 MX 25 M	X 51 MN X 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN 36 I		SOILS	PEAT	GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS SOILS OTHER MATERIAL							
MATERIAL PASSING *40													TRACE OF ORGANIC MATTER 2 - 3%. 3 - 5%. TRACE 1 - 10%. LITTLE ORGANIC MATTER 3 - 5%. 5 - 12%. LITTLE 10 - 20%.							
LL	_ 6 MY	- MD								N LIT	TLE OR	HIGHLY	MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE							
GROUP INDEX		+	+		+		-			MUL		ORGANIC	GROUND WATER							
USUAL TYPES	LL − − − − − − − − − − − − − − − − − −									OR OR	GANIC	SOILS	✓ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING							
	*************************************												▼ STATIC WATER LEVEL AFTER <u>24</u> HOURS							
GEN. RATING	NODEX   0   0   0   0   4   MX   8   MX   12   MX   16   MX   NO   MX   MAIDLE												√PW  PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA							
43 SOBORHUE		PI OF	A-7-5 S	SUBGROU	P IS ≤		9 ; PI 0	F A-7-	6 SUBGROUP				O-MG→ SPRING OR SEEP							
		_	С	ONS	ISTE	NCY							MISCELLANEOUS SYMBOLS							
PRIMARY	PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)  GENERALLY VERY LOOSE (4 TO 10 GRANDLAR MEDIUM DENSE 18 TO 28 N/A												ROADWAY EMBANKMENT (RE) 25/025 DIP & DIP DIRECTION WITH SOIL DESCRIPTION OF ROCK STRUCTURES							
	CUNSISTENLY (N-VALUE) (TONS/FT²)  GENERALLY (STANDLAR MEDIUM DENSE 18 TO 38 N/A												SOIL SYMBOL SYMBOL SIDE INDICATOR  SPI OMT TEST BORING SLOPE INDICATOR INSTALLATION							
MATERI	GRANULAR MATERIAL (NON-COHESIVE)					30 TO 50					N/A		ARTIFICIAL FILL (AF) OTHER							
CENEDA													→ INFERRED SOIL BOUNDARY - CORE BORING SOUNDING ROD							
SILT-C	LAY	Y MEDIUM STI			TIFF	4 TO 8					Ø.5 TO	1.0	= INFERRED ROCK LINE MY MONITORING WELL — TEST BORING WITH CORE							
			VEF	RY ST	IFF			15 T	0 30		2 TO		→→→→→→ ALLUVIAL SOIL BOUNDARY A PIEZOMETER OF SPT N-VALUE							
$\vdash$					(TUF	RE OF	₹ GF				> 4		RECOMMENDATION SYMBOLS							
				4		10	40		60 2				UNDERCUT UNCLASSIFIED EXCAVATION - UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE							
	R C			GRAV	ΈL		COARS	SE.	FI	NE	SILT	CLAY	SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET O EMBANKMENT OR BACKFILL							
		(CUB.)		(GR				D.)	(F	SD.)		(CL.)	ABBREVIATIONS							
	. 12	CO11	3	IICT:			חחר				0.00	05	AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED CL CLAY MOD MODERATELY Z. UNIT WEIGHT							
	MOISTURE	SCAL	E	1211								CCDIDTION	CPT - CONE PENETRATION TEST NP - NON PLASTIC $\dot{\gamma}_{ m d}$ - DRY UNIT WEIGHT CSE COARSE ORG ORGANIC							
(AT	TERBERG L	IMITS			- SA	TURATE			USUALLY	LIQUID; VER	Y WET, USI	UALLY	DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON							
	. <del> </del> LIQUI	D LIMI	т	_	(	SAT.)			FROM BEL	OW THE GR	OUND WAT	ER TABLE	F - FINE SL SILT, SILTY ST - SHELBY TUBE FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK							
PLASTIC RANGE < (PI) PL	_ PI AS	יו בונ	міт		- WE	T - (W)						0	FRAC FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAGS FRAGMENTS # - MOISTURE CONTENT CBR - CALIFORNIA BEARING HI HIGHLY V - VERY RATIO							
	T			 RE	- MC	DIST - (	M)		SOLID; AT	OR NEAR O	PTIMUM M	10ISTURE	EQUIPMENT USED ON SUBJECT PROJECT  DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:							
SL									DE01:125-	40017101			CME-45C CLAY BITS X AUTOMATIC MANUAL							
							TIC					10	G* CONTINUOUS FLIGHT AUGER   CORE SIZE:     B * HOLLOW AUGERS   -B   -H							
									PI)	r	DRY STREN	IGTH	CME-55ØX HARD FACED FINGER BITS X-N Q							
							Ø-5	N	· • ·	Ī	VERY LO	W	TUNGCARBIDE INSERTS							
MO	DERATELY	PLAST	IC			1	6-25	יחר			SLIGHT MEDIUM		X CASING X W/ ADVANCER POST HOLE DIGGER							
ніс	HLT PLAS	ııc									HIGH		PORTABLE HOIST TRICONE*STEEL TEETH HAND AUGER							
													X DIEDRICH D-50   TRICONE TUNGCARB.   SOUNDING ROD   YANE SHEAR TEST							
										D. YELLOW- DESCRIBE			X CORE BIT VANE SHEAR TEST							

2A

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

### SUBSURFACE INVESTIGATION

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

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

ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES 2 100 BLOWS PER FOOT IF TESTED. 100 BLOWS PER FOOT IF TESTED.

FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT
WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE,
CNEISS, GABBRO, SCHIST, ETC.

FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN
SEDIMENTARY ROCK THAT WOULD VEILD 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.

WEATHFRING CRYSTALLINE ROCK (CR) NON-CRYSTALLINE ROCK (NCR) COASTAL PLAIN SEDIMENTARY ROCK (CP) WEATHERING FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER VERY SLIGHT 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. (V SLI.) ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO SLIGHT 1 INCH, OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. (SLI.) MODERATE 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. 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 MODERATELY SEVERE (MOD, SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT SEVERE REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. (SEV.) IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF 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 VERY SEVERE (V SEV.) VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</u> ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND COMPLETE SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ROCK HARDNESS CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES VERY HARD SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED HARD TO DETACH HAND SPECIMEN. MODERATELY 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

CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.

CAN BE EXCAVATED IN SMALL CHIPS TO PEICES I 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

CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK, PIECES I INCH

OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY

FINGERNALL.

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

GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE;
BREAKS EASILY WHEN HIT WITH HAMMER.

GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE;
DIFFICULT TO BREAK WITH HAMMER.

EXTREMELY INDURATED

SAMPLE BREAKS ACROSS GRAINS.

### TERMS AND DEFINITIONS

<u>ALLUVIUM (ALLUV.)</u> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. <u>AQUIFER</u> - 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.

<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 SUBFACE.

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.

 $\overline{ ext{DIKE}}$  - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

 $\overline{ ext{DIP}}$  - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

 $\underline{\text{DIP DIRECTION (DIP AZIMUTH)}}$  - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

 $\underline{\text{FAULT}}$  - 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.

 $\underline{\mathsf{FLOAT}}$  - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

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

 $\underline{\mathsf{LEOGE}}$  - 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 EXPESSED AS A PERCENTAGE.

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

 $\underline{\text{SIL}}$  - 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.

 $\underline{\text{SLICKENSIDE}}$  - 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.

BENCH MARK: BM-2: BL STATION II+73.6I, 54.52' LT. RAIL SPIKE SET IN

28.5" DIA SWEET GUM

N = 677,085.9420 E = I,560,204.5830 ELEVATION: 728.05 FEET

### NOTES:

ROADWAY PLANS PROVIDED BY NCDOT ON 1/02/2022 FIAD = FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

17BP.9.R.85 **2B** 

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

## SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND GEOLOGICAL STRENGTH INDEX (GSL) TARLES

SUPPLEMENTAL LEGEND, GEOLOG FROM AASHTO LRFD BRIDGE L AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Joint	DES.	IGN SPE	CIFICATIO	ONS (PAC	I) TABLE GE 1 OF	S 2)
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	XX COOD Z Rough, slightly weathered, iron stained S surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	<b>VERY POOR</b> Slickensided, highly weathered surfaces with soft clay coatings or fillings
		DEC	REHSING SO	JAPACE GOF	<u> </u>	
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities	CES	90			N/A	N/A
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets	F ROCK PIECES		70 60			
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets	RLOCKING OF		5	0		
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity	INTE			40	30	
DISINTEGRATED - poorly inter- locked, heavily broken rock mass with mixture of angular and rounded rock pieces	DECREASING				20	
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes		N/A	N/A			10

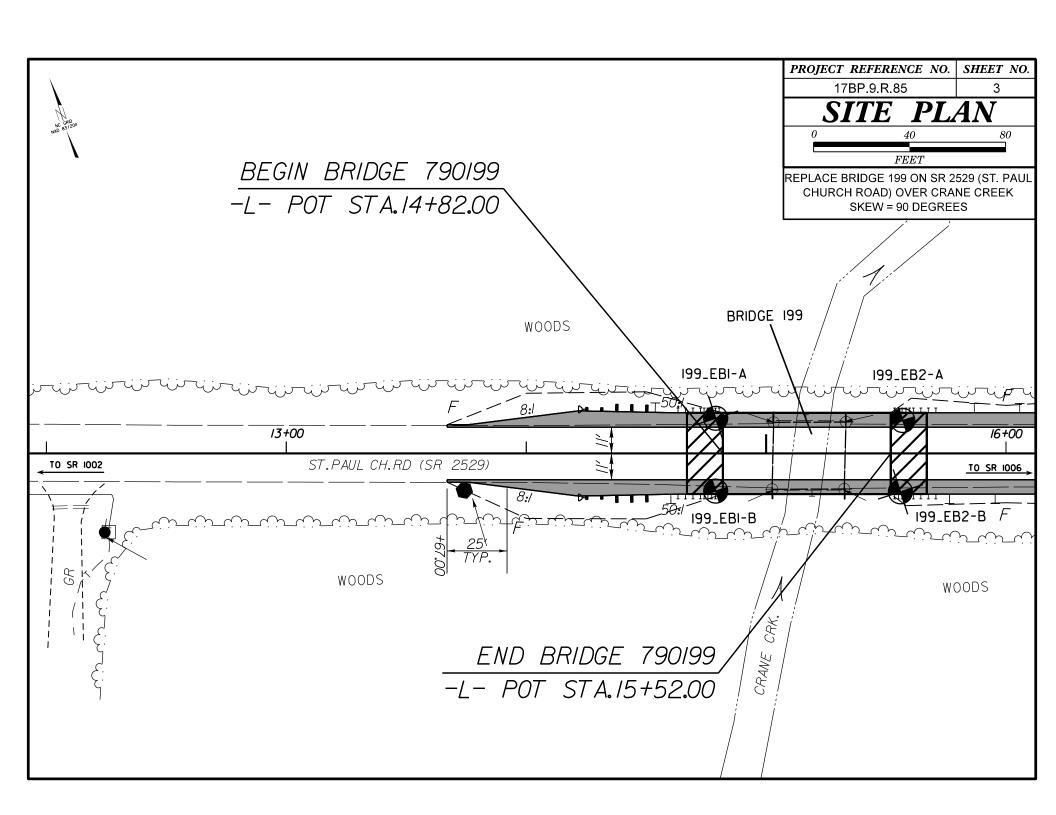
PROJECT REFERENCE NO.	SHEET NO.
17BP.9.R.85	2C

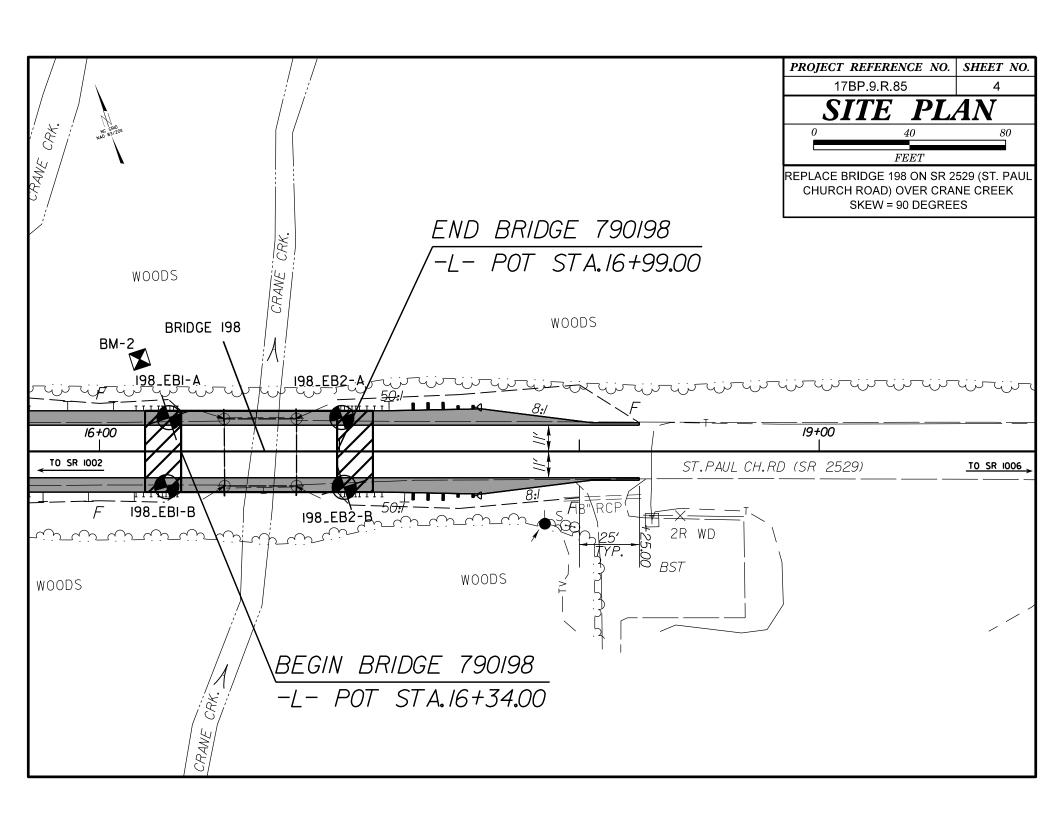
# NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

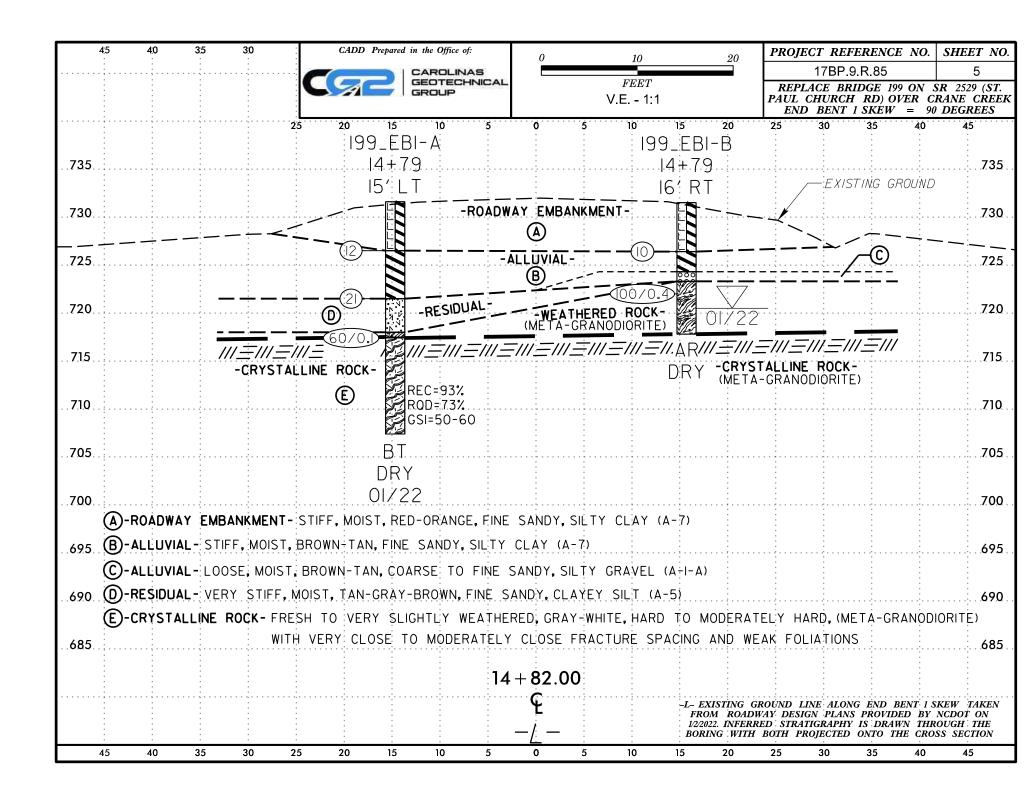
### SUBSURFACE INVESTIGATION

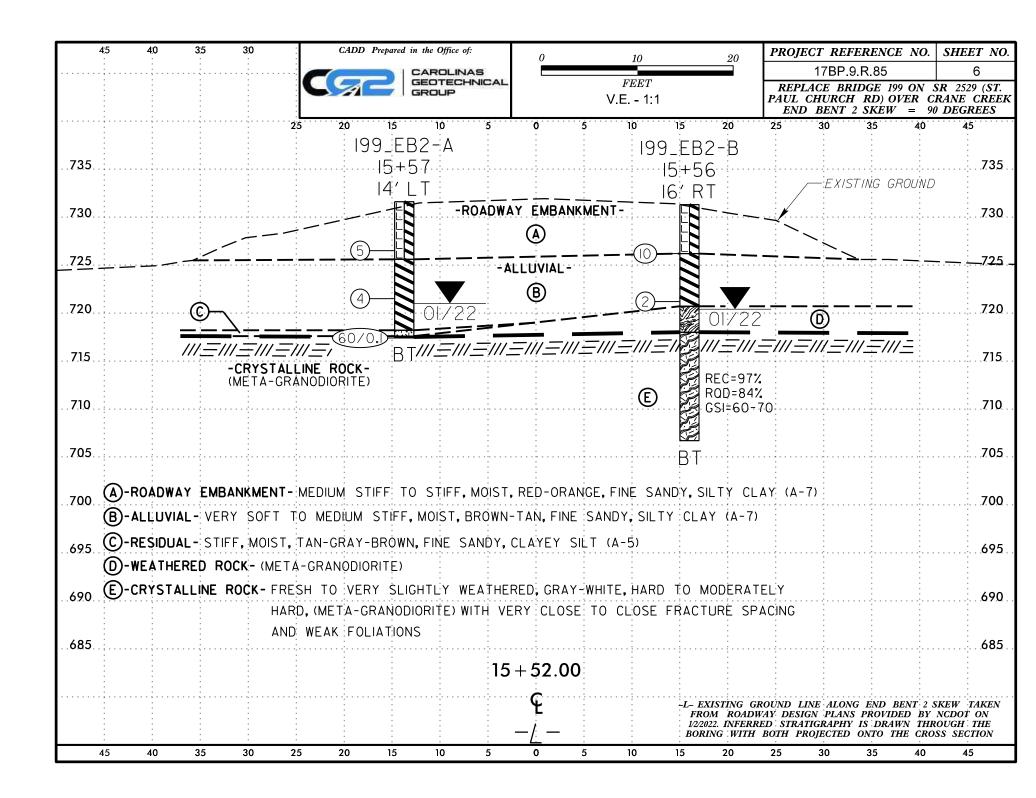
SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)

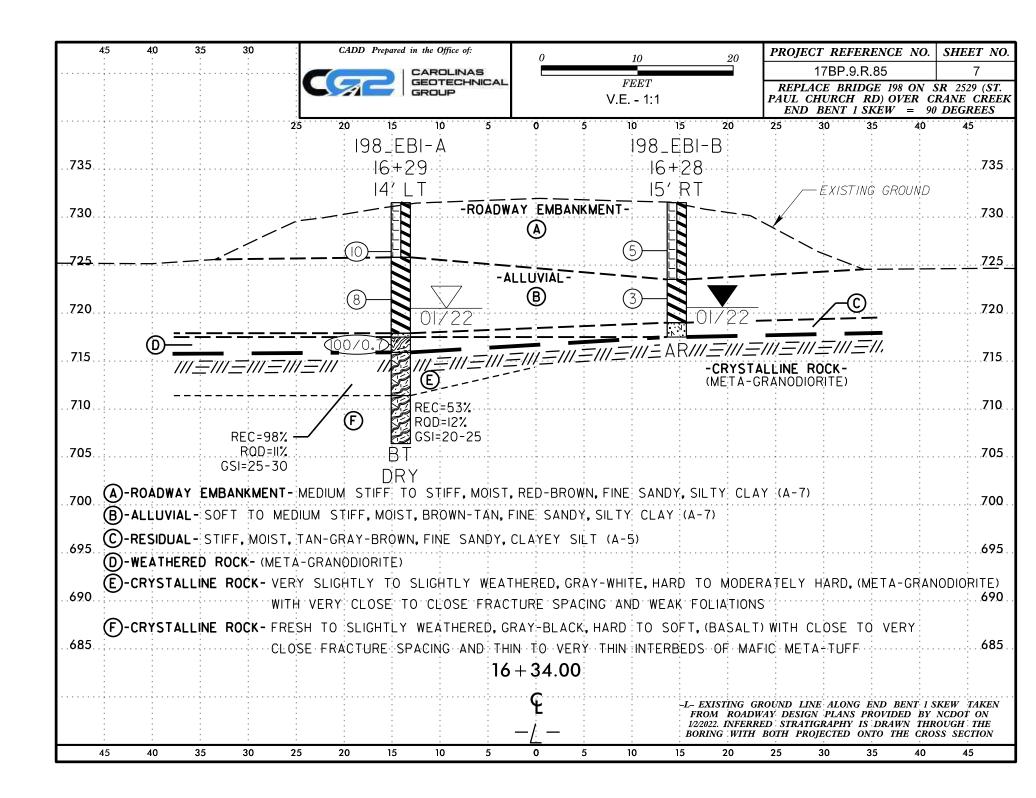
FROM AASHTO LRFD BRIDGE DESIGN AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Def			•		•
GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos.P and Hoek E., 2000)					
From a description of the lithology, structure and surface conditions (particularly of the bedding planes), 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	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, slicken- sided or highly weathered surfaces with soft clay coatings or fillings
A. Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass, in shallow tunnels or slopes these bedding planes may cause structurally controlled instability.	70 60	A			
B. Sand- stone with stone and siltstone layers of siltstone amounts  S. Sand- stone with stone or silty shale with sand- stone layers shale with sandstone layers		50 B 40	C [	E	
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.			30	F 20	
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.			<b>\$</b>	/ 	10
─────────────────────────────────────					DATE: 8-19-16

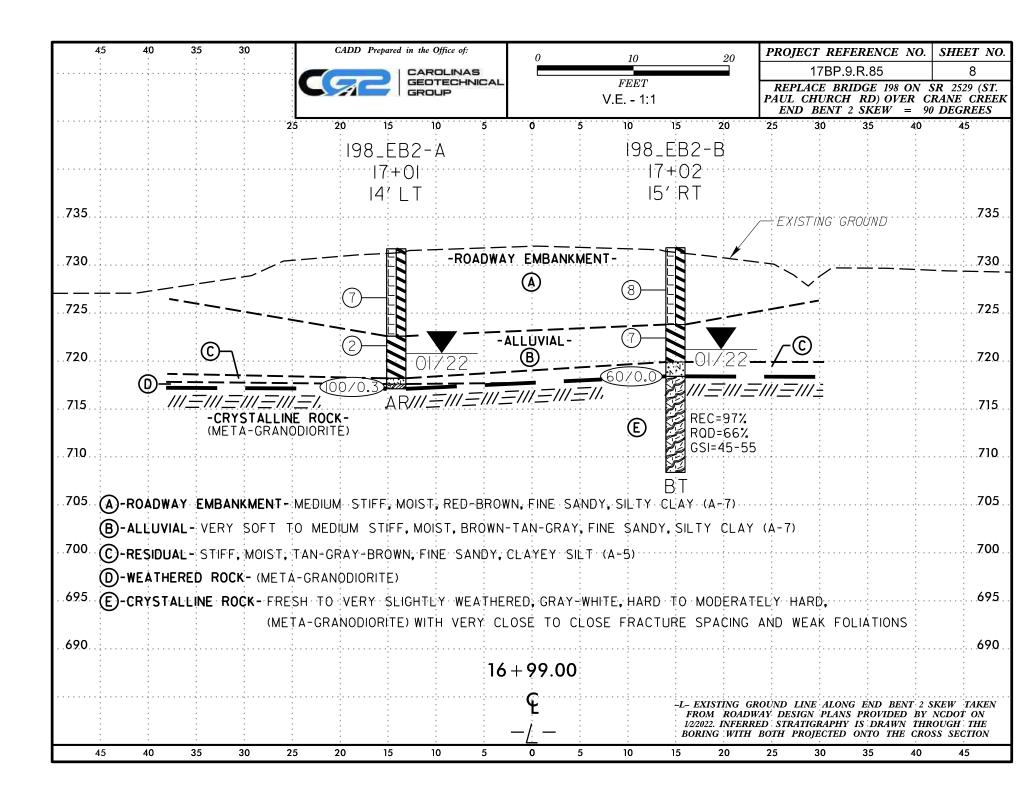


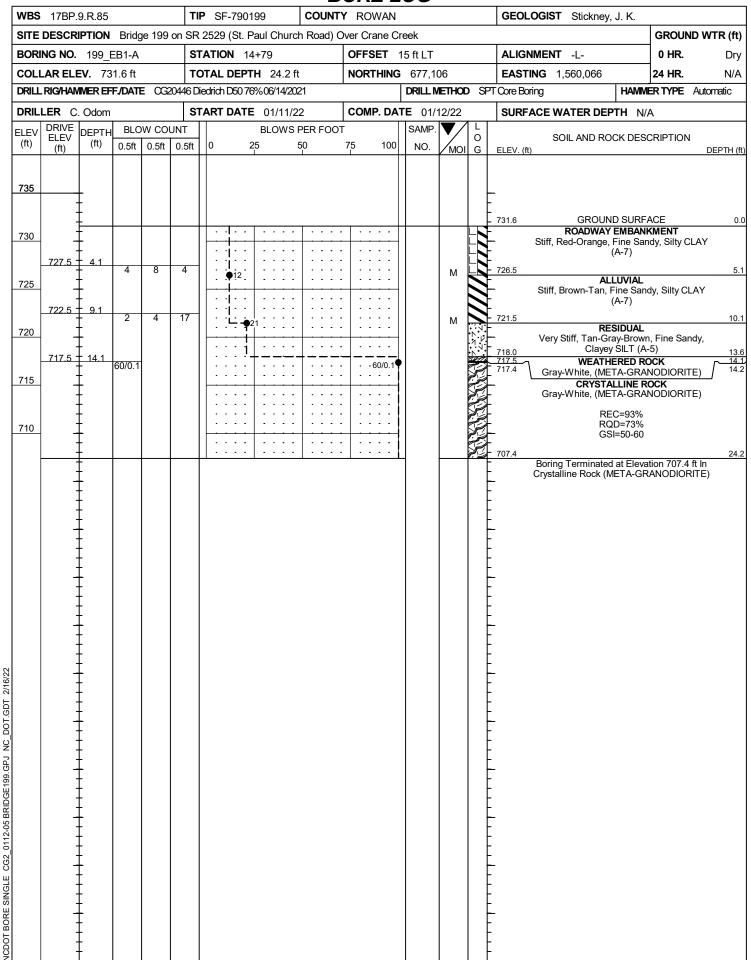












# GEOTECHNICAL BORING REPORT CORF I OG

									C	<u>UR</u>		<del>UG</del>				
WBS	17BP.	9.R.85			TIP	SF-79	0199	C	TNUC	Y RO	WAN		GEOLOGIST Stickney	/, J. K.		
SITE	DESCR	PTION	Bridg	je 199 on	SR 25	29 (St	. Paul Ch	urch R	oad) C	ver Cr	ane Cr	eek			GROUN	ID WTR (fi
BORII	NG NO.	TYPE 9 R RS			ALIGNMENT -L-											
										NOR'	THING				24 HR.	N//
DRILL	RIG/HAN	MER EF	F./DATE	CG2044	16 Diedr	ich D50	76%06/14	V2021				DRILL METHOD SPT	Core Boring	HAMM	ER TYPE	Automatic
DRILL	LER C	Odom			STAF	RT DA	<b>TE</b> 01/1	1/22		СОМ	P. DA1	E 01/12/22	SURFACE WATER DE	PTH N/	A	
CORE	SIZE	NQ					<b>1</b> 10.0 f									
LEV (ft)	LLLV	DEPTH (ft)	RUN (ft)	RATE	REC. (ft) %	JN RQD (ft) %		REC.	RQD	0	ELEV. (f		ESCRIPTION AND REMAR	KS		DEPTH
17.38	747.												Begin Coring @ 14.2 ft			
715	-	-			92%	64%		93%	(7.3) 73%		717.4	(Meta-Granodiorite)	y Weathered, Gray-White, I with very close fracture spa	cing to mo	oderately F oderately c	lard,
710	- - -	-	5.0		(4.7) 94%	(4.1) 82%										
											707.4	Boring Termin	nated at Elevation 707.4 ft Ir	n Crystallir	ne Rock	24

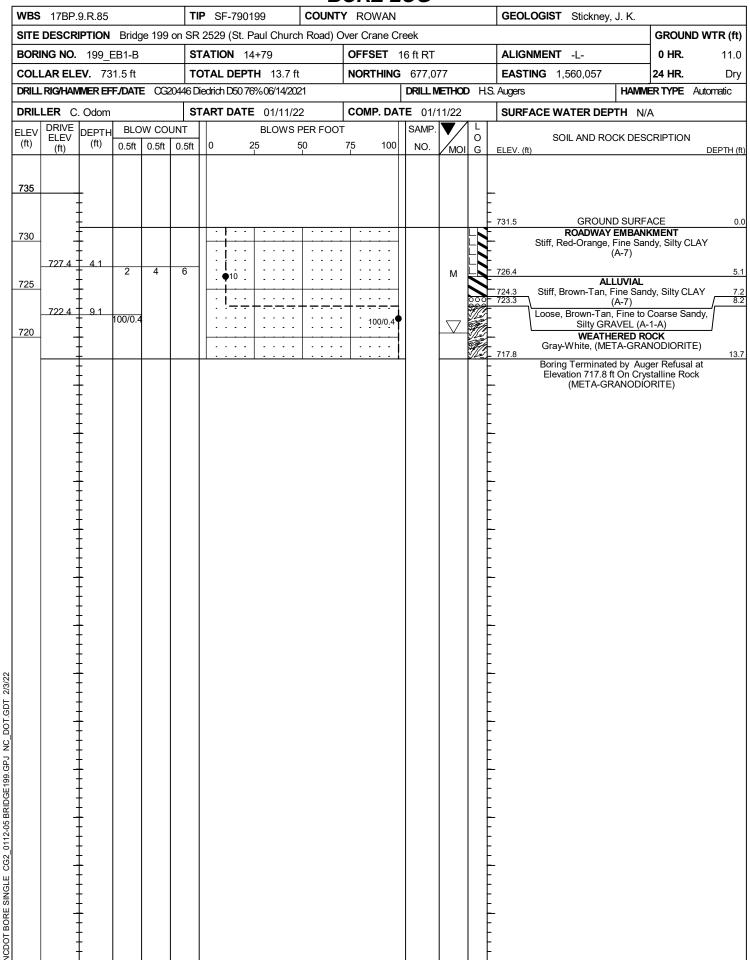


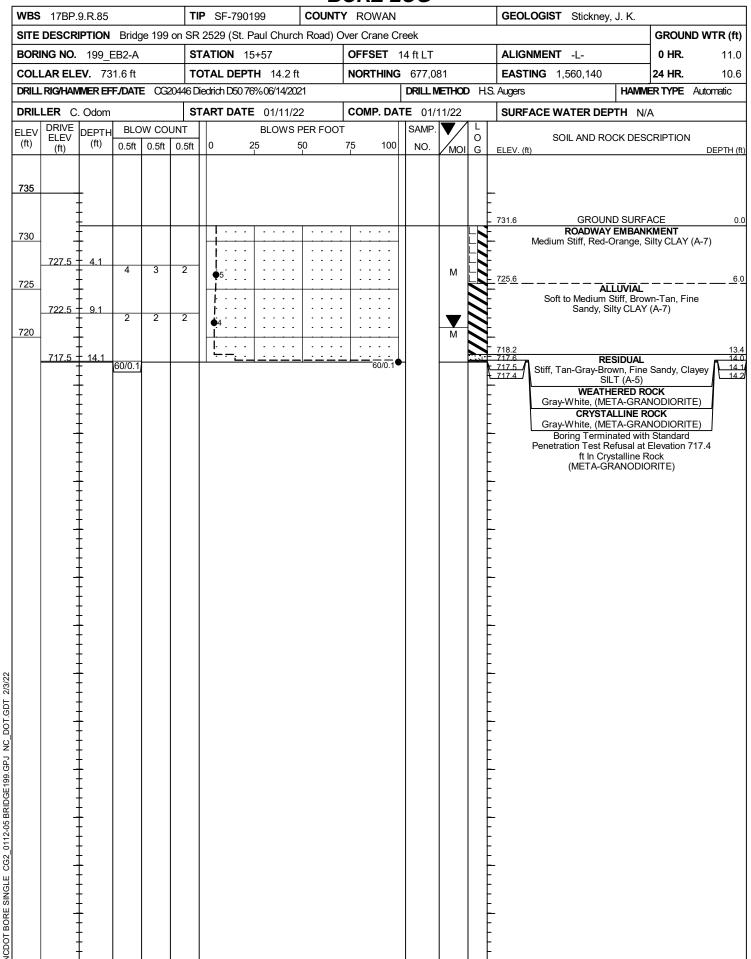
### Bridge 199 on SR 2529 Over Crane Creek Rock Core Photographs Boring: EB1-A

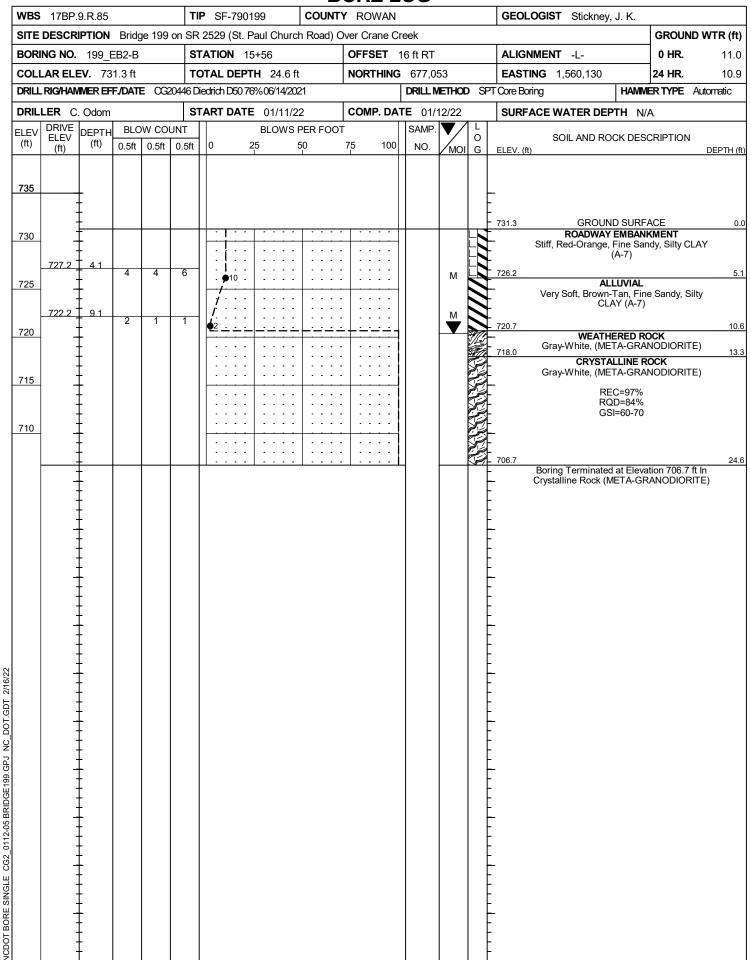
Box 1: 14.2 to 24.2 Feet



**FEET** 







# GEOTECHNICAL BORING REPORT CORF I OG

									<u>C</u>	<b>OF</b>	RE L	<u>OG</u>					
WBS	17BF	P.9.R.85			TIP	SF-79	0199	C	DUNT	<b>Y</b> R	OWAN		GEOLOGIST	Stickney,	, J. K.		
SITE	DESC	RIPTION	Bridg	je 199 on	SR 25	29 (St	. Paul Ch	urch R	oad) C	over (	Crane Cr	eek				GROU	ND WTR (ft
BOR	NG NC	. 199_l	EB2-B		STA	TION	15+56			OF	FSET 1	16 ft RT	ALIGNMENT	-L-		0 HR.	11.0
COL	LAR EI	. <b>EV</b> . 73	31.3 ft		тот	AL DE	<b>PTH</b> 24.	6 ft		NO	RTHING	677,053	EASTING 1,5	560,130		24 HR.	10.9
DRILL	.RIG/HA	MMER EF	F./DATE	CG2044	46 Diedr	ich D50	76%06/14	/2021				DRILL METHOD SE	T Core Boring		HAMM	ER TYPE	Automatic
DRIL	LER (	C. Odom			STAF	RT DA	<b>TE</b> 01/1	1/22		СО	MP. DA	<b>ΓΕ</b> 01/12/22	SURFACE WA	TER DEF	PTH N/	A	
COR	E SIZE	NQ					<b>N</b> 11.3 f	t									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	REC.   RQD   SAIVIP.   REC.					LOG	ELEV. (1	KS .		DEPTH (			
17.98	710 N	199	1.0		(4.0)	(0.7)		(44.0)	(0.5)				Begin Coring (	@ 13.3 ft			
715	718.0 716.7 711.7	<u> </u>	5.0		(1.0) (77%) (5.0) 100%			(11.0) 97%	(9.5) 84%		_ 718.0 - - - - -		CRYSTALLIN tly Weathered, Gra DIORITE) with very acture spacing and	y-White, H close fract	ture spac	oderately l ing to clos	13 Hard, se
710		Ŧ	5.0		(5.0) 100%	(4.5) 90%					- - - -						
	706.7	24.6									706.7	Boring Term	inated at Elevation	706 7 ft In	Crystallin	ne Rock	24
		**************************************															

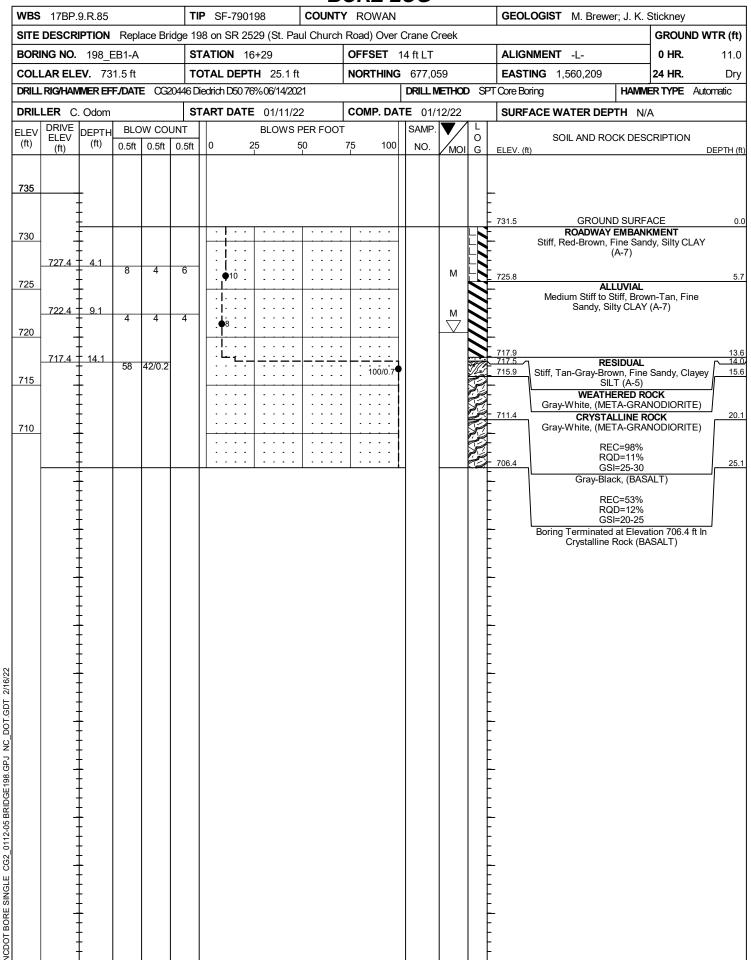


### Bridge 199 on SR 2529 Over Crane Creek Rock Core Photographs Boring: EB2-B

Box 1: 13.3 to 24.6 Feet



**FEET** 



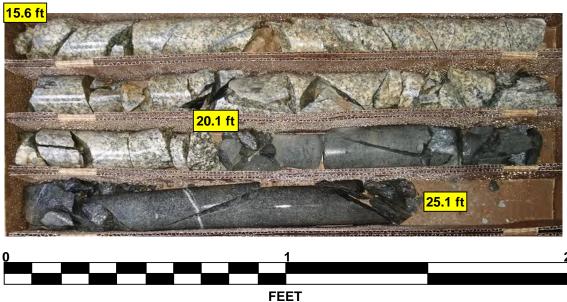
# GEOTECHNICAL BORING REPORT CORF I OG

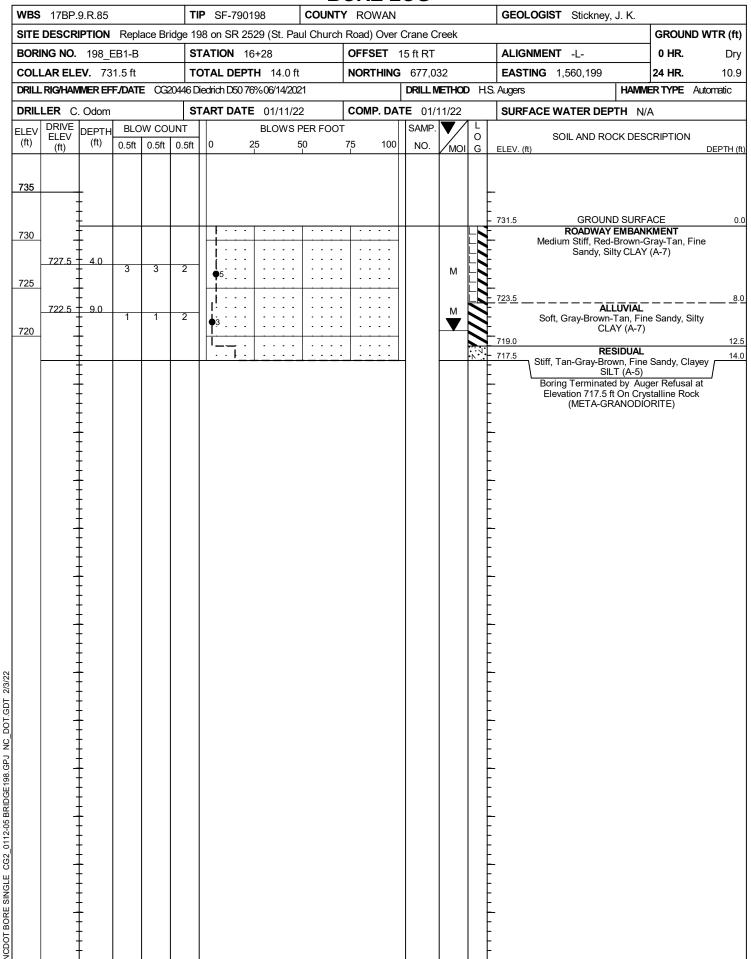
<b>WBS</b> 17BP.9.R.	.85		TIP	SF-79	0198	C	OUNT	YR	OWAN		GEOLOGIST M. Brew	er; J. K. S	Stickney	
SITE DESCRIPTI		ace Bridge								Crane Creek	<b>.</b>		· ·	ID WTR (
BORING NO. 19					16+29		<u> </u>	_	FSET 1		ALIGNMENT -L-		0 HR.	11
COLLAR ELEV.					PTH 25.	1 ft		+		677,059	<b>EASTING</b> 1,560,209		24 HR.	D
DRILL RIG/HAMMER		E 0G2044						1		DRILL METHOD SPT				Automatic
DRILLER C. Od					<b>TE</b> 01/1			СО	MP. DA	<b>FE</b> 01/12/22	SURFACE WATER DE			
CORE SIZE NQ					<b>v</b> 9.5 ft								•	
RUN SE	PTH RUN	DRILL	RU	JN I	SAMP.	STR	ATA	L						
(ft) (ft) (f	ft) (ft)	RATE (Min/ft)	REC. (ft) %	RQD (ft) %	NO.	REC. (ft) %	RQD (ft) %	O G	ELEV. (1		ESCRIPTION AND REMAR	KS ———		DEPTH
15.91 715 715.9 15	5.6 4.5	09:03/0.5 03:29/1.0 03:45/1.0 07:51/1.0	(4.4) 98%	(0.5) 11%		(4.4) 98%	(0.5) 11%		715.9 - -	Very Slightly to Slightl (META-GRANODIO	Begin Coring @ 15.6 ft CRYSTALLINE ROCK y Weathered, Gray-White, I RITE) with very close to close	Hard to Mo	oderately e	1 Hard, and
711.4 + 20	) 1 1 1	03:15/1.0 05:55/1.0 03:27/1.0 04:52/1.0 06:42/1.0		(0.6) 12%		(2.7) 53%	(0.6) 12%		- 711.4 - -		weak foliations eathered, Gray-Black, Hard cture spacing and thin to ve			
706.4 + 25	_	04:52/1.0 06:42/1.0 05:49/1.0							- - - 706.4		Meta-Tuff			2

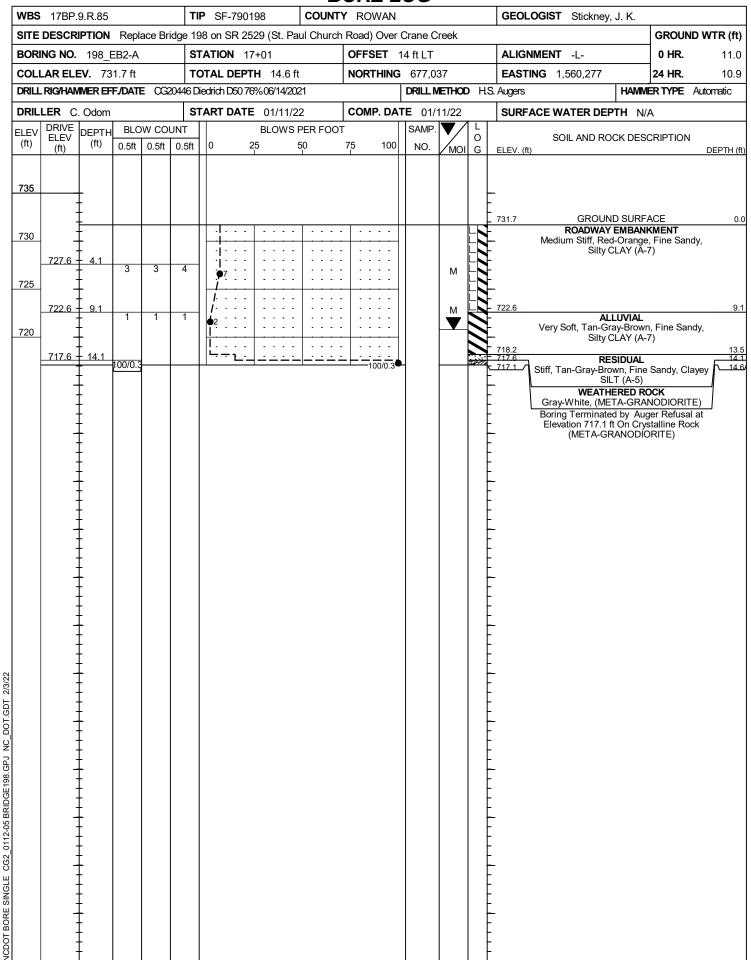


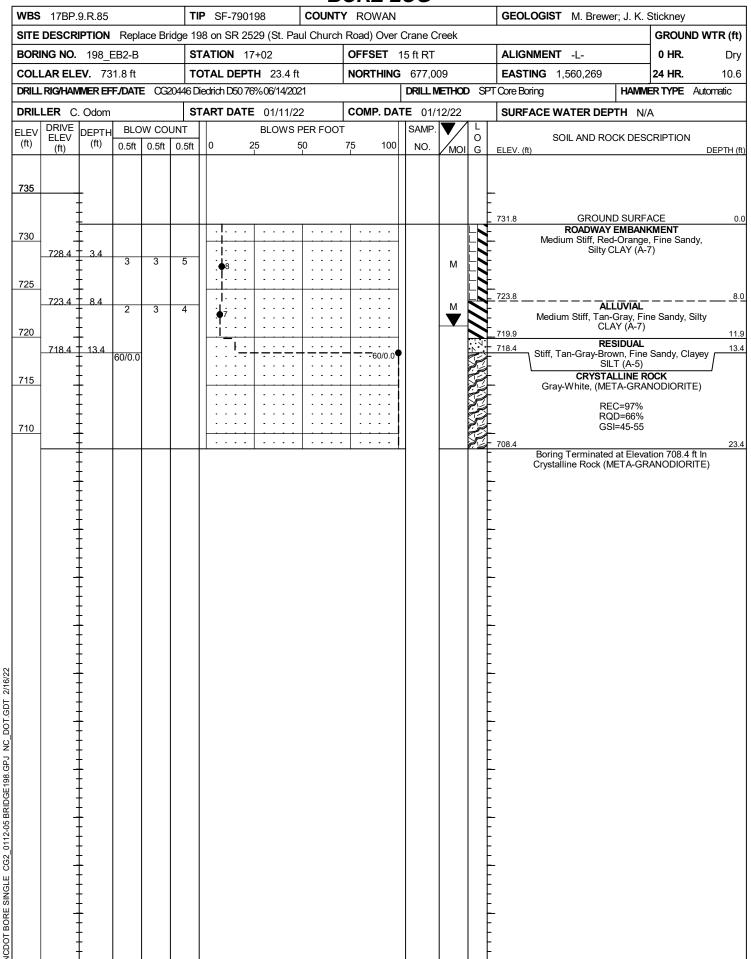
### Bridge 198 on SR 2529 Over Crane Creek **Rock Core Photographs Boring: EB1-A**

Box 1: 15.6 to 25.1 Feet









WBS	17BP.	9.R.85			TIP	SF-79	0198	С	C OUNT	<b>Y</b> R	OWAN		GEOLOGIST	M. Brewe	er; J. K. S	Stickney	
			Repla	ace Bridge								Crane Creek	1				ID WTR (f
	NG NO.			3			17+02			_	SET 1		ALIGNMENT	-L-		0 HR.	
	AR ELE						PTH 23.	4 ft		_		677,009	EASTING 1,5			24 HR.	10.
				E OG2044						1		DRILL METHOD SP	· ·				Automatic
	ER C.			12201			<b>TE</b> 01/1			CO	MD DAT	TE 01/12/22	SURFACE WA	TED DET			
	SIZE						N 10.0 ft			30	WIF. DA	U I/ 12/22	JUNFACE WA	יי בע אבר	TH N/A	1	
			5	DRILL	RU	JN		STR	ATA								
(ft)	RUN ELEV (ft)	DEPTH (ft)	(ft)	RATE (Min/ft)	REC. (ft) %	RQD (ft) %	SAMP. NO.	REC. (ft) %	RQD (ft) %	Ö G	ELEV. (f		DESCRIPTION AND	REMAR	KS		DEPTH
18.38	718.4 - 717.4 2	- 13.4	1.0	N=60/0 0	(0.9)	(0.8)		(9.7)	(6.6)		718.4		Begin Coring @ CRYSTALLIN	0 13.4 ft E ROCK			1;
715		14.4 / - -	$\overline{}$	N=60/0.0 \06:00/1.0/ 04:52/1.0 05:35/1.0 08:41/1.0 05:00/1.0 04:57/1.0	\90% / (4.8) 96%	\80% / (3.2) 64%		97%	66%		- ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	Fresh to Very Sli (META-GRANODIO	ghtly Weathered, G	Gray-White cose to clos	e, Hard to e fracture	Very Hard spacing	d,
710	712.4	- 19.4 - -	4.0	05:00/1.0 04:57/1.0 02:11/1.0 03:49/1.0	(4.0) 100%	(2.6) 65%					- - -						
7 10	708.4	- - 23.4		03:53/1.0 06:36/1.0							<del>-</del> - 708.4						2:
													nated at Elevation (META-GRANC	DIORITE			



### Bridge 198 on SR 2529 Over Crane Creek Rock Core Photographs Boring: EB2-B

Box 1: 13.4 to 23.4 Feet



PROJECT REFERENCE NO.	SHEET NO.
17BP.9.R.85	25
SITE PHO	TOS

# FLOW

Photo #1: Bridge 199 End Bent 2 looking west (downstation) towards End Bent 1



Photo #2: Bridge 199 south side looking west (downstation)

PROJECT REFERENCE NO.	SHEET NO.
17BP.9.R.85	26
SITE PHO	TOS

# FLOW

Photo #3: Bridge 198 End Bent 2 looking west (downstation) towards End Bent 1



Photo #4: Bridge 198 south side looking west (downstation)