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STATE OF NORTH CAROLINA

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY **ROCKINGHAM**

PROJECT DESCRIPTION REPLACE BRIDGE 780035 ON NC 770 OVER MAYO RIVER

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0093	1	

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 (1991) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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 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.

R. MAFFIA

C. SWAFFORD CATLIN ENGINEERS & SCIENTISTS

INVESTIGATED BY <u>C. SWAFFORD</u>

DRAWN BY _C. SWAFFORD

SUBMITTED BY SCHNABEL ENG.

DATE **_JUNE** 2023





DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO. SHEET NO. 2

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	<u>WELL GRADED</u> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.	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.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM DI586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING:	GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.	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	AQUIFER - A WATER BEARING FORMATION OR STRATA.
CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH	ANGULARITY OF GRAINS	REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:	ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF.GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6	THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS:	WEATHERED WIS-Non-coastal Plain Material that would yield SPT N VALUES >	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.
SOIL LEGEND AND AASHTO CLASSIFICATION	ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	ROCK (WR) 100 BLOWS PER FOOT IF TESTED.	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT
GENERAL GRANULAR MATERIALS SILT-CLAY MATERIALS ORGANIC MATERIALS	MINERALOGICAL COMPOSITION	CRYSTALLINE FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT	WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.
(> 35% PASSING "200) (> 35% PASSING "200)	MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAQLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	ROCK (CR) WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
CROUP A-1 A-3 A-2 A-4 A-5 A-6 A-7 A-1, A-2 A-4, A-5 CLASS. A-1-0 A-1-b A-2-4 A-2-5 A-2-6 A-2-7 A-3 A-6, A-7	COMPRESSIBILITY	NON-CRYSTALLINE FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YELLD SPT REFUSAL IF TESTED.	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM
SYMBOL 0000 G0000 G000 G0000 G0000 G0000 G000 G000 G000 G000 G000 G000 G0000 G000 G0	SLIGHTLY COMPRESSIBLE LL < 31	ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	OF SLOPE.
6660d000d::::::::::::::::::::::::::::::	MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	COASTAL PLAIN COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SEDIMENTARY ROCK SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED	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.
7. PASSING 10 50 MX GRANULAR SILT- CLAY MUCK,	PERCENTAGE OF MATERIAL	(CP) SHELL BEDS, ETC. WEATHERING	DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT
#40 30 MX 50 MX 51 MN PEAT 900 15 MX 25 MX 10 MX 35 MX 35 MX 35 MX 36 MN 36	GRANULAR SILT - CLAY ORGANIC MATERIAL SOILS SOILS OTHER MATERIAL		ROCKS OR CUTS MASSIVE ROCK.
MATERIAL MATERIAL	TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10%	FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE
PASSING #40 SOILS WITH	LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35%	VERY SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN,	HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE
LL — — 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 40 MX 41 MN 41 MX 41 MN LITTLE OR HIGHLY	HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE	(V SLI.) CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.	LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.
MODERATE ORGANIC GROUP INDEX 0 0 4 MX 8 MX 12 MX 16 MX NO MX AMOUNTS OF GROUP INDEX 0 0 0 0 0 0 0 0 0	GROUND WATER	SLIGHT ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO	FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE
USUAL TYPES STONE FRAGS. FINE SILTY OR CLAYEY SILTY CLAYEY MATTER	✓ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING	(SLI.) 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR	SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
OF MAJOR GRAVEL, AND MATERIALS SAND GRAVEL AND SAND SOILS SOILS	STATIC WATER LEVEL AFTER 24 HOURS	CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS. MODERATE SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM
CEN RATING FAIR TO	─────────────────────────────────────	(MOD.) GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS	PARENT MATERIAL.
AS SUBGRADE EXCELLENT TO GOOD FAIR TO POOR POOR UNSUITABLE	SPRING OR SEEP	DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.	FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30		MODERATELY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE
CONSISTENCY OR DENSENESS	MISCELLANEOUS SYMBOLS	SEVERE AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH (MOD.SEV.) AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK, ROCK GIVES "CLUNK" SOUND WHEN STRUCK.	FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
PRIMARY SOIL TYPE COMPACTNESS OR PENETRATION RESISTENCE COMPRESSIVE STRENGTH	ROADWAY EMBANKMENT (RE) 25/025 DIP & DIP DIRECTION	IF TESTED, WOULD YIELD SPT REFUSAL	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO
CONSISTENCY (N-VALUE) (TONS/FT ²)	₩ITH SOIL DESCRIPTION → OF ROCK STRUCTURES	SEVERE ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT	ITS LATERAL EXTENT.
GENERALLY VERY LOOSE < 4 CONTROL LOOSE	SOIL SYMBOL SOIL SYMBOL SET DON'T TEST BORING SLOPE INDICATOR INSTALLATION	(SEV.) REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN.	<u>LENS</u> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
MATERIAL MEDIUM DENSE 10 TO 30 N/A	시 전	IF TESTED. WOULD YIELD SPT N VALUES > 100 BPF	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
(NON-COHESIVE) DENSE 30 TO 50 VERY DENSE > 50	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CONE PENETROMETER TEST	VERY ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE SEVERE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE
VERY SOFT < 2 < 0.25	— _ INFERRED SOIL BOUNDARY — CORE BORING ● SOUNDING ROD	(V SEV.) REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR	OF AN INTERVENING IMPERVIOUS STRATUM.
GENERALLY SOFT 2 TO 4 0.25 TO 0.5	### INFERRED ROCK LINE MONITORING WELL TEST BORING	VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
SILT-CLAY MEDIUM STIFF 4 TO 8 0.5 TO 1.0 MATERIAL STIFF 8 TO 15 1 TO 2	with core	COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS	ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE
(COHESIVE) VERY STIFF 15 TO 30 2 TO 4 HARD > 30 > 4	TTTTT ALLUVIAL SOIL BOUNDARY A PIEZOMETER INSTALLATION - SPT N-VALUE	ALSO AN EXAMPLE.	RUN AND EXPRESSED AS A PERCENTAGE.
TEXTURE OR GRAIN SIZE	RECOMMENDATION SYMBOLS	ROCK HARDNESS	SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT
U.S. STD. SIEVE SIZE 4 10 40 60 200 270		VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.	ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
OPENING (MM) 4.76 2.00 0.42 0.25 0.075 0.053	UNDERCUT UNCLASSIFIED EXCAVATION - UNCLASSIF	HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED	RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO
BOULDER COBBLE GRAVEL COARSE FINE SILT CLAY	SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - UNDERCUT UNDER	TO DETACH HAND SPECIMEN.	THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
(BLDR.) (COB.) (GR.) (CSE. SD.) (F SD.) (SL.) (CL.)	ABBREVIATIONS	MODERATELY CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE HARD EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK, HAND SPECIMENS CAN BE DETACHED	<u>SLICKENSIDE</u> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
GRAIN MM 305 75 2.0 0.25 0.05 0.005	AR - AUGER REFUSAL MED MEDIUM VST - VANE SHEAR TEST	BY MODERATE BLOWS.	STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF
SIZE IN. 12 3	BT - BORING TERMINATED MICA MICACEOUS WEA WEATHERED CL CLAY MOD MODERATELY 7 - UNIT WEIGHT	MEDIUM CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT.	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
SOIL MOISTURE - CORRELATION OF TERMS	CL CLAY MOD MODERATELY 7 - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7 - DRY UNIT WEIGHT	HARD CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.	TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
SOIL MOISTURE SCALE FIELD MOISTURE GUIDE FOR FIELD MOISTURE DESCRIPTION	CSE COARSE ORG ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS	SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK, CAN BE EXCAVATED IN FRAGMENTS	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
	DPT - DYNAMIC PENETRATION TEST SAP SAPROLITIC S - BULK	FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.	
- SATURATED - USUALLY LIQUID; VERY WET, USUALLY (SAT.) FROM BELOW THE GROUND WATER TABLE	e - VOID RATIO SD SAND, SANDY SS - SPLIT SPOON F - FINE SL SILT, SILTY ST - SHELBY TUBE	VERY CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH	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.
LL LIQUID LIMIT	FOSS FOSSILIFEROUS SLI SLIGHTLY RS - ROCK	SOFT OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.	TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
PLASTIC SEMISOLID: REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE	FRAC FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAGS FRAGMENTS \(\omega \) - MOISTURE CONTENT CBR - CALIFORNIA BEARING	FRACTURE SPACING BEDDING	
(PI) PL PLASTIC LIMIT ATTAIN OPTIMUM MOISTURE	HI HIGHLY V - VERY RATIO	TERM SPACING TERM THICKNESS	BENCH MARK: BL-4 N:991691.81 E:1720281.74
- MOIST - (M) COLID. AT OR NEAR ORTIMIN MOISTURE	EQUIPMENT USED ON SUBJECT PROJECT	VERY WIDE MORE THAN 10 FEET VERY THICKLY BEDDED 4 FEET WIDE 3 TO 10 FEET THICKLY BEDDED 1.5 - 4 FEET	ELEVATION: 678.66 FEET
OM OPTIMUM MOISTURE SL SHRINKAGE LIMIT	DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:	MODERATELY CLOSE 1 TO 3 FEET THINLY BEDDED 0.16 - 1.5 FEET	NOTES:
REQUIRES ADDITIONAL WATER TO	CME-45C CLAY BITS X AUTOMATIC MANUAL	CLOSE 0.16 TO 1 FOOT VERY THINLY BEDDED 0.03 - 0.16 FEET VERY CLOSE LESS THAN 0.16 FEET THICKLY LAMINATED 0.008 - 0.03 FEET	FIAD - FILLED IMMEDIATELY AFTER DRILLING
- DRY - (D) ATTAIN OPTIMUM MOISTURE	X CME-55 CORE SIZE:	THINLY LAMINATED < 0.008 FEET	
PLASTICITY	☐ 8-HOLLOW AUGERS ☐ ☐-B ☐-H	INDURATION	- PAVEMENT / ABC STONE
PLASTICITY INDEX (PI) DRY STRENGTH	CME-550 HARD FACED FINGER BITS X-N	FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
NON PLASTIC Ø-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT	VANE SHEAR TEST UNGCARBIDE INSERTS	RUBBING WITH FINGER FREES NUMEROUS GRAINS; FRIABLE GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.	
MODERATELY PLASTIC 16-25 MEDIUM	X CASING W/ ADVANCER POST HOLE DIGGER	CRAINC CAN BE CERABATED FROM CAMBLE WITH CIFFL BRORE.	
HIGHLY PLASTIC 26 OR MORE HIGH	PORTABLE HOIST X TRICONE 3 1/4 STEEL TEETH HAND AUGER	MODERATELY INDURATED ORTHON SHIPLE WITH SIEEL FRODE; BREAKS EASILY WHEN HIT WITH HAMMER.	
COLOR	TRICONE TUNGCARB. SOUNDING ROD	INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.	
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY).	X CORE BIT VANE SHEAR TEST		
MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.		EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.	DATE: 8-15-1-
		1	

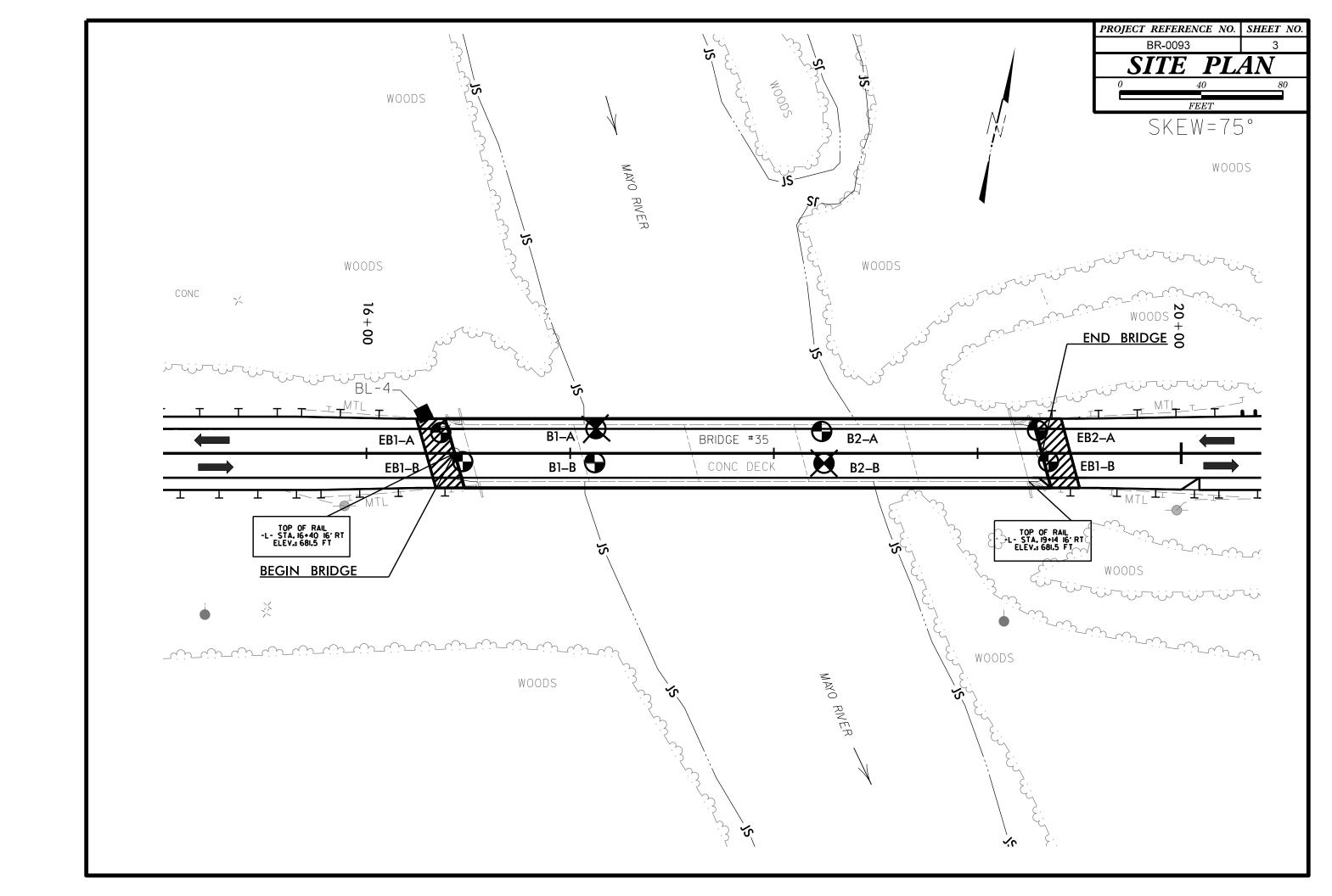
PROJECT REFERENCE NO.	SHEET NO.
BR-0093	2A

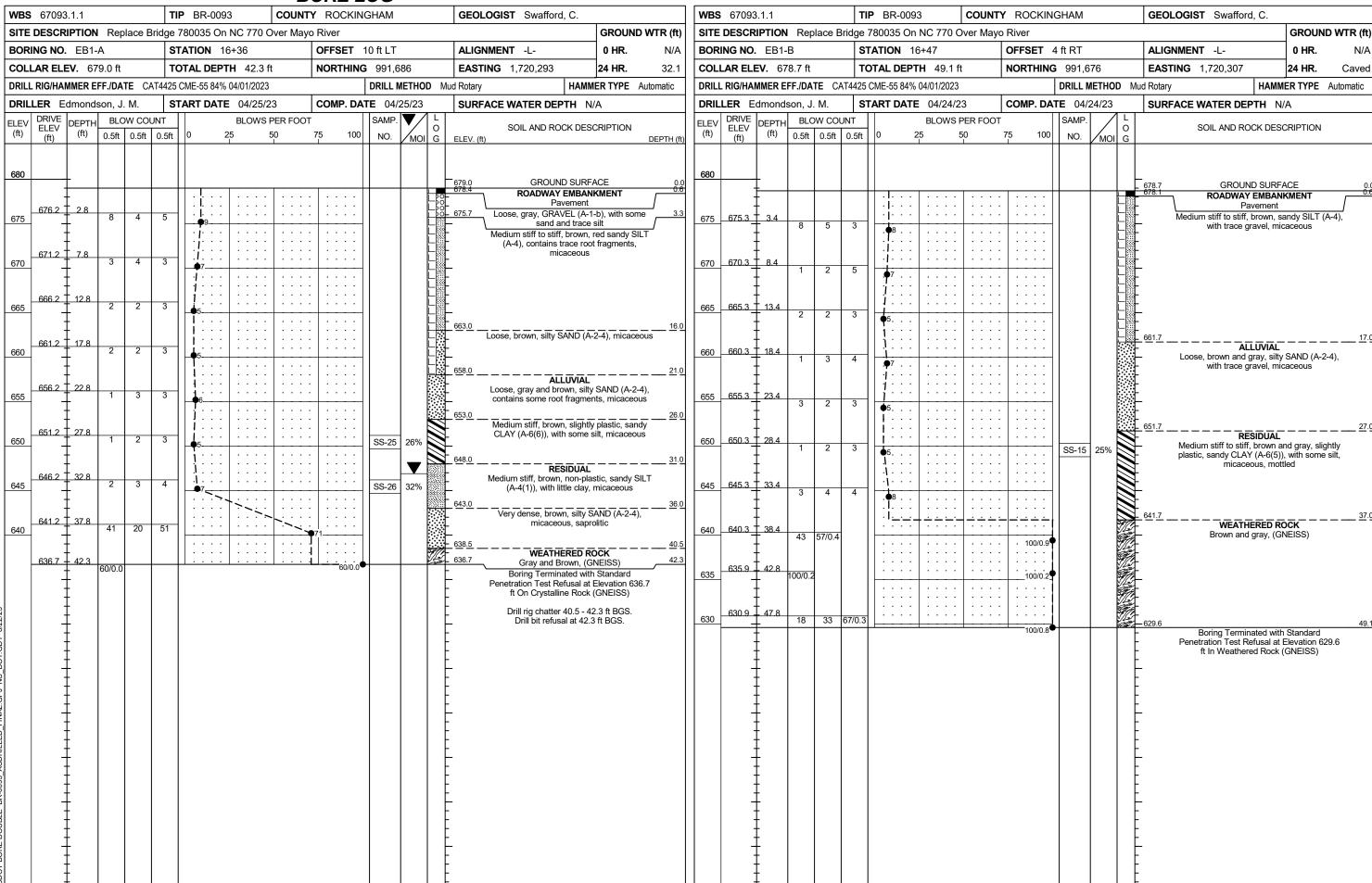
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION **DIVISION OF HIGHWAYS** GEOTECHNICAL ENGINEERING UNIT

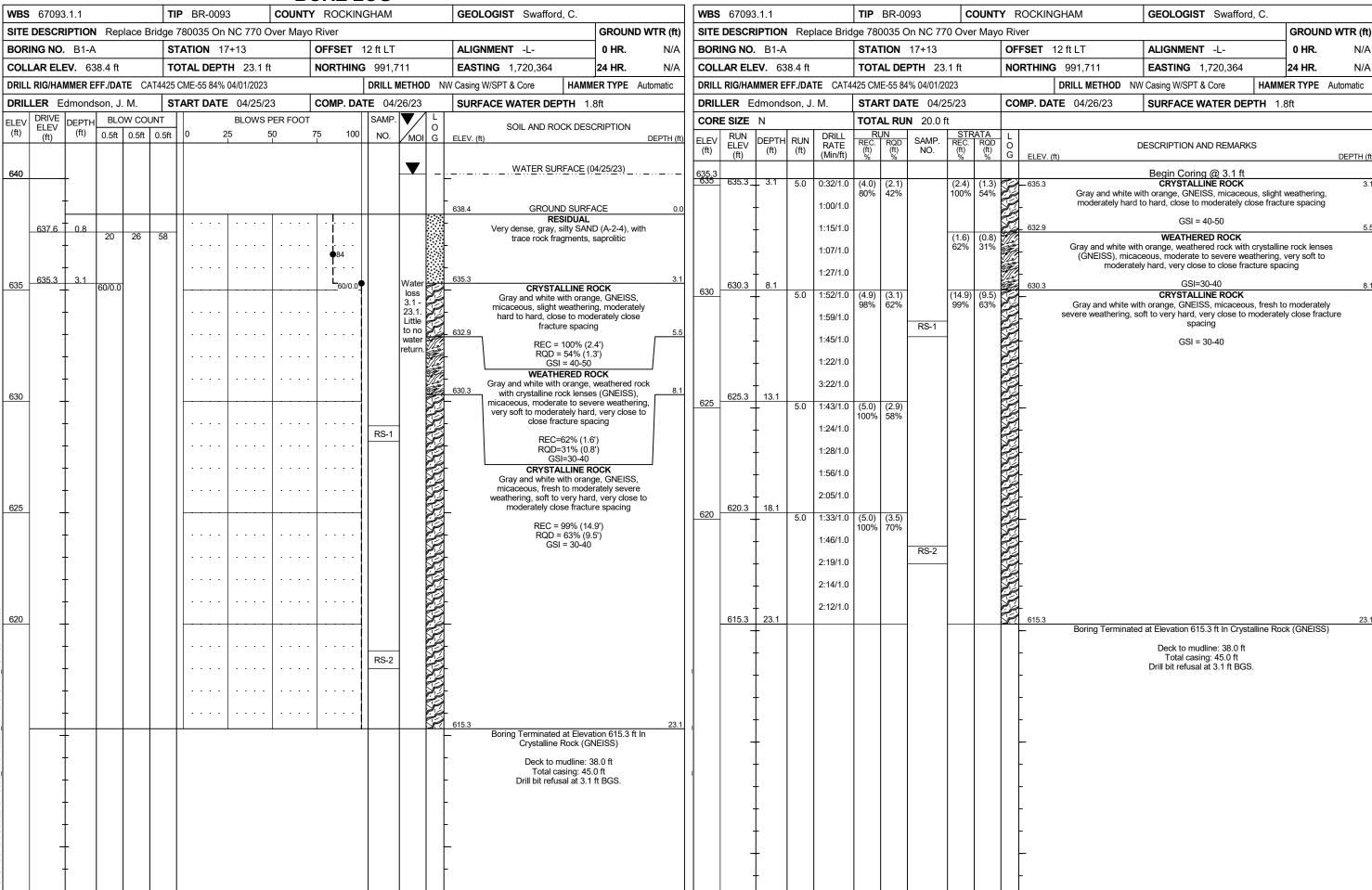
SUBSURFACE INVESTIGATION

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 GSI FOR HETEROGENEOUS ROCK MASSES SUCH JOINTED ROCKS (Hoek and Marinos, 2000) AS FLYSCH (Marinos. P and Hoek E., 2000) staın From a description of the lithology, structure and occasionally es with compact with angular From the lithology, structure and surface POOR - Very smooth, slicken-l or highly weathered surfaces soft clay coatings or fillings conditions of the discontinuities, estimate the average value of GSI. Do not try to athered sur or fillings surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the planes) be too precise. Quoting a range from 33 to 37 is more realistic than stating that position in the box that corresponds to the condition ered of the discontinuities and estimate the average value GSI = 35. Note that the table does not of GSI from the contours. Do not attempt to be too eq. apply to structurally controlled failures. Where weak planar structural planes are precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the slightlypresent in an unfavorable orientation RACE CONDITIONS CONTINUITIES Hoek-Brown criterion does not apply to structurally with respect to the excavation face. highly coatin agment these will dominate the rock mass controlled failures. Where unfavourably oriented behaviour. The shear strength of surfaces continuous weak planar discontinuities are present, in rocks that are prone to deterioration slightly es these will dominate the behaviour of the rock mass. nsided, k ompact yular fra as a result of changes in moisture The strength of some rock masses is reduced by the 7 content will be reduced if water is 600D rough, presence of groundwater and this can be allowed for present. When working with rocks in the by a slight shift to the right in the columns for fair, fair to very poor categories, a shift to th, ed GOOD -surface: GOOD Rough, s surface poor and very poor conditions. Water pressure does the right may be made for wet conditions. FAIR weath VERY VERY sided with VERY Very FAIR Smoo-alter VERY Slick With Water pressure is dealt with by effective not change the value of GSI and it is dealt with by stress analysis. using effective stress analysis. DECREASING SURFACE QUALITY COMPOSITION AND STRUCTURE STRUCTURE INTACT OR MASSIVE - intact A. Thick bedded, very blocky sandstone .90 rock specimens or massive in 7Ó N/A N/A The effect of pelitic coatings on the bedding planes is minimized by the confinement of situ rock with few widely spaced discontinuities the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally 80 controlled instability. PIE 60 BLOCKY - well interlocked un-70[′] disturbed rock mass consisting of cubical blocks formed by three D. Siltstone B. Sand-stone wi thin inte intersecting discontinuity sets MANA E. Weak 50 C. Sand-60 or silty shale stone with stone and siltstone /E thin inter siltstone with sandor clayey /B С lauers of stone lauers ın sımılar Shale with VERY BLOCKY - interlocked, sands tone siltstone amounts 40 partially disturbed mass with 50 multi-faceted angular blocks formed by 4 or more joint sets INTERL($\textbf{C}_{\bullet} \; \textbf{D}_{\bullet} \; \textbf{E}_{\bullet} \; \text{and} \; \textbf{G} \; \text{-} \; \text{may be more or}$ F. Tectonically deformed. BLOCKY/DISTURBED/SEAMY -30 less folded than illustrated but intensively folded/faulted, folded with angular blocks this does not change the strength. sheared clayey shale or siltstone formed by many intersecting Tectonic deformation, faulting and with broken and deformed DECREASING loss of continuity moves these discontinuity sets. Persistence sandstone layers forming an 30 categories to F and H. of bedding planes or schistosity almost chaotic structure 20 DISINTEGRATED - poorly interlocked, heavily broken rock mass 20 G. Undisturbed silty H. Tectonically deformed silty with mixture of angular and or clayey shale with or clayey shale forming a 10 rounded rock pieces chaotic structure with pockets or without a few very of clay. Thin layers of thin sandstone layers sandstone are transformed into small rock pieces. 10 LAMINATED/SHEARED - Lack of N/A N/A blockiness due to close spacing of weak schistosity or shear planes → Means deformation after tectonic disturbance







CORE PHOTOGRAPH REPLACE BRIDGE 780035 ON NC 770 OVER MAYO RIVER

B1-A BOX 1 OF 2: 3.1 - 13.1 FEET

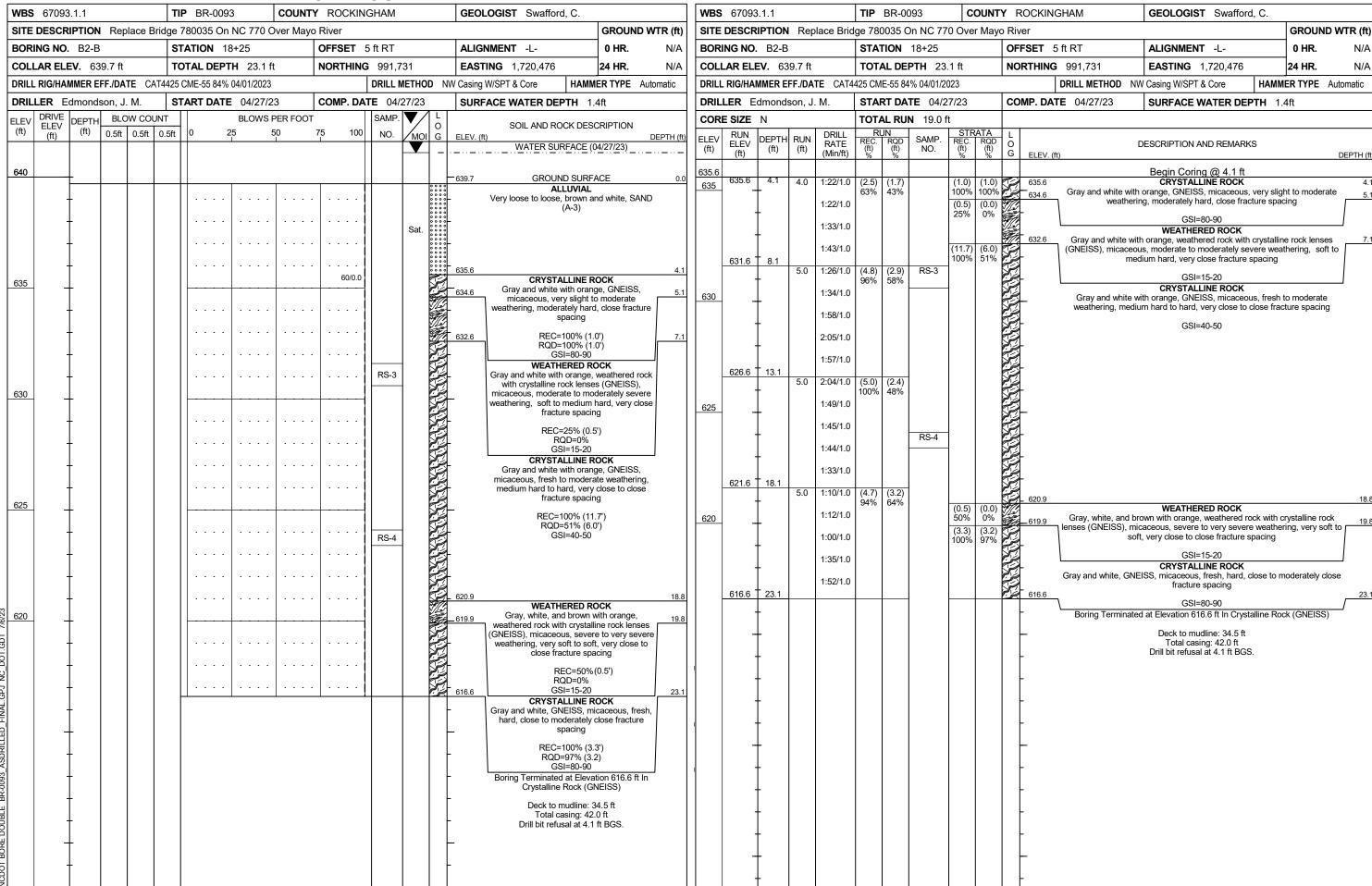
APPROXIMATE SCALE IN FEET

B1-A BOX 2 OF 2: 13.1 - 23.1 FEET



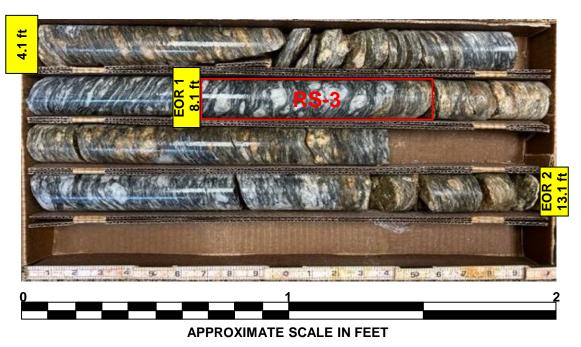
APPROXIMATE SCALE IN FEET

		BORE LOG									
WBS 67093.1.1	TIP BR-0093 COUN	TY ROCKINGHAM	GEOLOGIST Swafford, C.	_	WBS 67093	3.1.1	TIP BR-0093	COUNTY ROCK	INGHAM	GEOLOGIST Swafford, C	
SITE DESCRIPTION Replace Br	idge 780035 On NC 770 Over May	yo River	_	GROUND WTR (ft)	SITE DESCR	RIPTION Replace	Bridge 780035 On NC 770	Over Mayo River			GROUND WTR (ft)
BORING NO. B1-B	STATION 17+12	OFFSET 5 ft RT	ALIGNMENT -L-	0 HR . N/A	BORING NO	. B2-A	STATION 18+23	OFFSET	11 ft LT	ALIGNMENT -L-	0 HR. N/A
COLLAR ELEV. 638.4 ft	TOTAL DEPTH 6.0 ft	NORTHING 991,696	EASTING 1,720,369	24 HR . N/A	COLLAR EL	EV. 638.3 ft	TOTAL DEPTH 5.0	ft NORTHI	NG 991,746	EASTING 1,720,470	24 HR. N/A
DRILL RIG/HAMMER EFF./DATE CA	T4425 CME-55 84% 04/01/2023	DRILL METHOD M	ud Rotary HAMI	MER TYPE Automatic	DRILL RIG/HA	MMER EFF./DATE	CAT4425 CME-55 84% 04/01/20	23	DRILL METHOD	Mud Rotary H	AMMER TYPE Automatic
DRILLER Edmondson, J. M.	START DATE 04/26/23	COMP. DATE 04/26/23	SURFACE WATER DEPTH 1	1.8ft		dmondson, J. M.	START DATE 04/26	i/23 COMP. I	DATE 04/26/23	SURFACE WATER DEPTH	1 2.0ft
ELEV (ft) DRIVE ELEV (ft) DEPTH (ft) 0.5ft		75 100 NO. MOI G	WATER SURFACE 638.4 GROUND SURI ALLUVIAL 636.4 Very loose to loose, gray, Strace silt	DEPTH (ft) (04/26/23) FACE SAND (A-3), with 2.0	ELEV (ft) DRIVE ELEV (ft) 640 635 635.4	DEPTH (ft) 0.5ft 0			NO. MOI	WATER SURFA - 638.3 GROUND S ALLU	CE (04/26/23)
633.0			WEATHERED F 633.0 Gray, GNEISS, mi 632.4 CRYSTALLINE Gray, GNEISS, mi Boring Terminated will Penetration Test Refusal at ft In Crystalline Rock Deck to mudline: Total casing: 4: Drill bit refusal at 6.	ROCK icaceous 5.4 ROCK icaceous th Standard it Elevation 632.4 it (GNEISS) 37.8 ft 2.0 ft	633 3	 100/0.2		60/C		Gas.a Very loose to loose, bro trace to little s WEATHERE Gray and brov	DROCK In, GNEISS Id with Standard al at Elevation 633.3 Rock (GNEISS) ine: 36.0 ft g: 42.0 ft

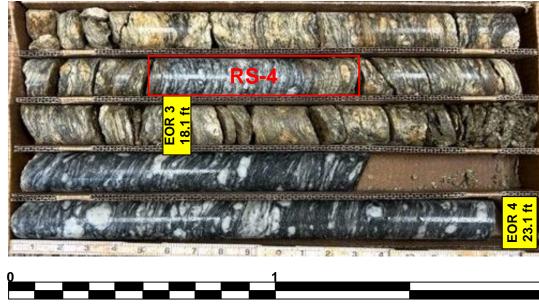


CORE PHOTOGRAPH REPLACE BRIDGE 780035 ON NC 770 OVER MAYO RIVER

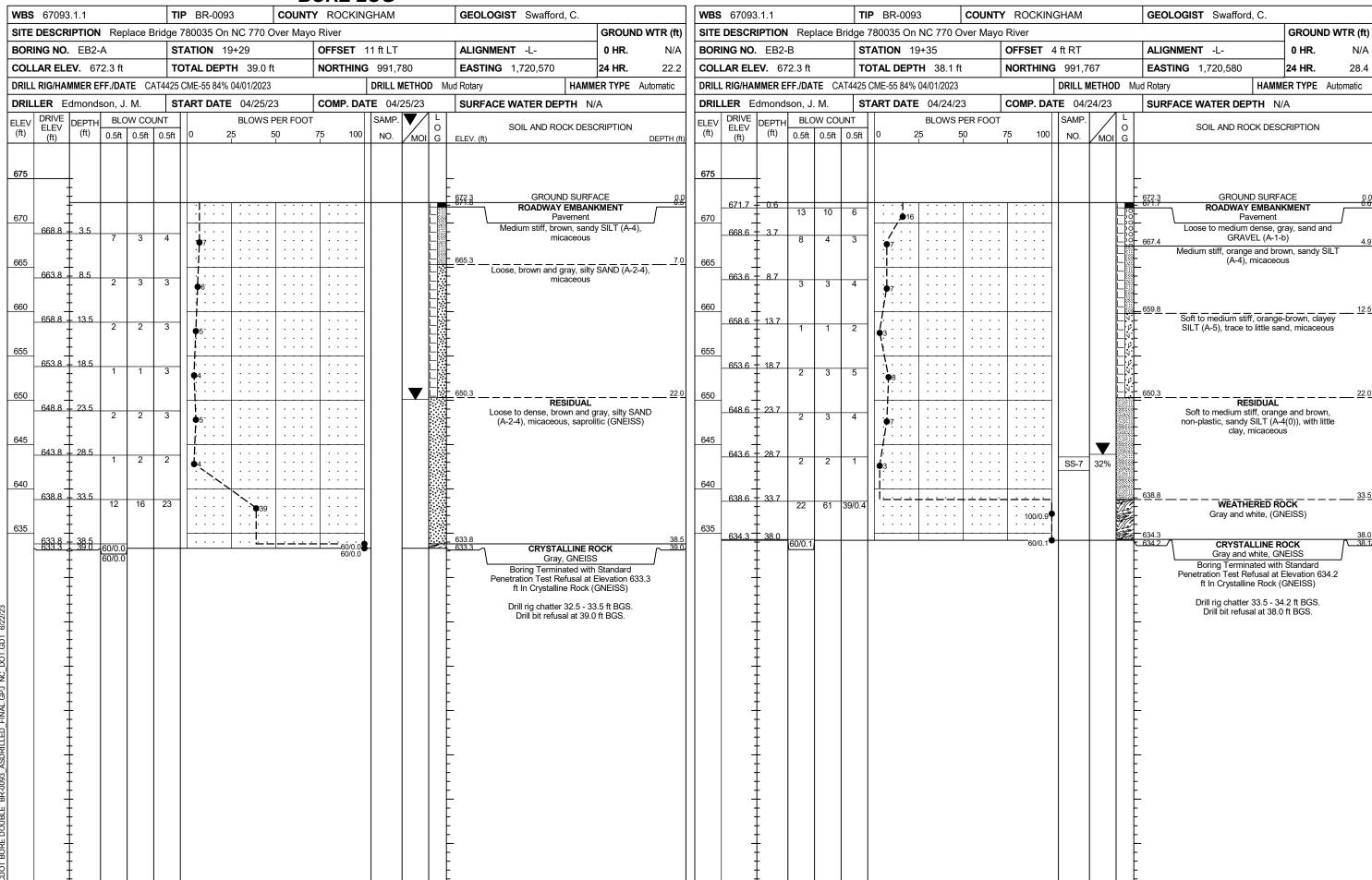
B2-B BOX 1 OF 2: 4.1 - 13.1 FEET



B2-B BOX 2 OF 2: 13.1 - 23.1 FEET



APPROXIMATE SCALE IN FEET



PROJECT REFERENCE NO.	SHEET NO.
BR-0093	11

	SOIL TEST RESULTS															
BORING	SAMPLE	OFFSET	STATION	DEPTH	AASHTO	$ _{L.L.}$	PI			WEIGHT	1	% PAS	SING (S		%	%
ID	NO.	OTTOBI	BIMITON	INTERVAL	CLASS.	B.B.	1 .1.	C.SAND	F.SAND	SILT	CLAY	10	40	200	MOISTURE	ORGANIC
EB 1- A	SS- 25	7' LT	16 +23	27.8-29.3	A-6(6)	35	14	8.7	38.8	24. 1	28.5	100	97	61	26	-
EB 1- A	SS- 26	7' LT	16 +23	32. 8- 34. 3	A-4(1)	33	4	11.2	45. 3	29. 3	14. 1	99	94	53	32	-
EB 1- B	SS- 15	8' RT	16 +26	28. 4- 29. 9	A-6(5)	33	12	7.8	40.8	24.4	27.0	95	93	57	25	-
EB2-B	SS-7	7' RT	19 +25	28.7-30.3	A-4(0)	28	3	4.4	58.9	22. 5	14. 2	100	100	47	32	-

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REPORT ON SAMPLES OF: Rock for Quality (ASTM D 7012-14e1 Method C)

T.I.P. ID NO.: BR-0093

DESCRIPTION: Replace Bridge 780035 On NC 770 Over Mayo River
PROJECT: BR-0093
COUNTY: Rockingham

DATE SAMPLED: 4/25/2023

BORING NO	SAMPLE NO	DEPTH (FT)	ROCK TYPE	LENGTH (IN)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	YOUNG'S MODULUS (PSI)	SPLITTING TENSILE STRENGTH (PSI)	REMARKS
B1-A-b	RS-1	9.5-10.2	Gneiss	4.59	1.99	165.9	5,940			
B1-A-b	RS-2	19.6-20.4	Gneiss	4.58	1.99	167.9	12,150	1		
B2-B	RS-3	8.1-9.1	Gneiss	4.55	1.99	165.5	3,690	1		
B2-B	RS-4	15.6-16.3	Gneiss	4.33	1.99	164.9	7,280	1		

SITE PHOTOGRAPH REPLACE BRIDGE 780035 ON NC 770 OVER MAYO RIVER





