STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BR-0086	1	19

REFERENCE: BR-0086

PROJECT: 67086

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY JOHNSTON

PROJECT DESCRIPTION REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STATION 17+26

CONTENTS

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DATE JULY 2023

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

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
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

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

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

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
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [X] CME-45B
- [ ] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [X] W/ ADVANCER
- [X] TRICONE 2 15/16" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

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:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 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 FINGERNAIL.

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

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

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (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 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 (SRQD) - 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:

ELEVATION: FEET

NOTES:

FIAD = FILLED IMMEDIATELY AFTER DRILLING
REF = REFUSAL

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
BR–0086	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)

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

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

DECREASING INTERLOCKING OF ROCK PIECES ⇩

SURFACE CONDITIONS

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very rough, fresh unweathered surfaces	Rough, slightly weathered, iron stained surfaces	Smooth, moderately weathered and altered surfaces	Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	Slickensided, highly weathered surfaces with soft clay coatings or fillings

DECREASING SURFACE QUALITY ⇨

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

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

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE

- **A.** *Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.*
- **B.** *Sandstone with thin interlayers 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

SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)

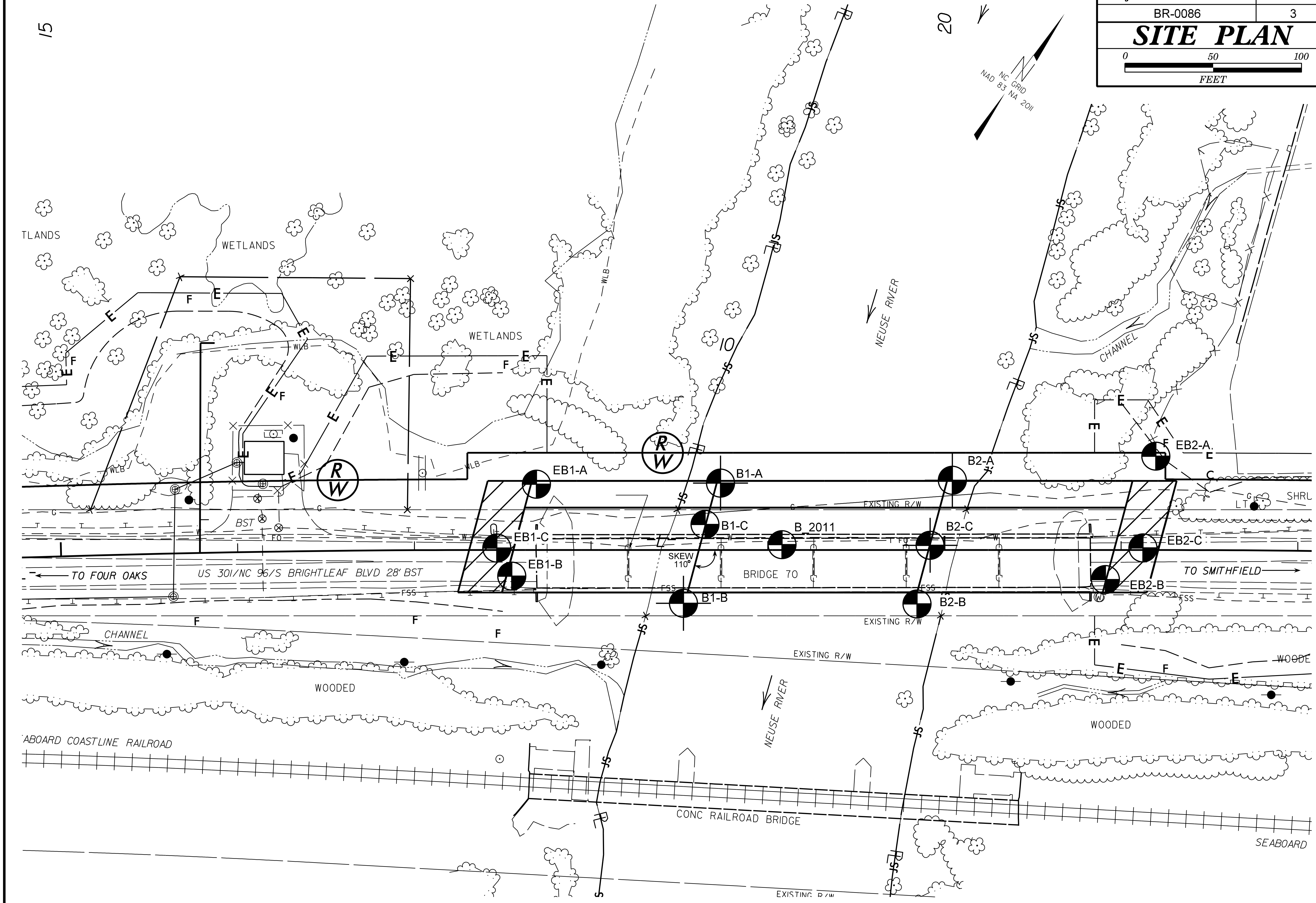
VERY GOOD	GOOD	FAIR	POOR	VERY POOR
Very Rough, fresh unweathered surfaces	Rough, slightly weathered surfaces	Smooth, moderately weathered and altered surfaces	Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings

70	A			
60				
50		B	C	D E
40				
30				F
20				
10			G	H

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
BR-0086	3

SITE PLAN



0 30 60
HORIZONTAL SCALE IN FEET
VE = 3.0

PROFILE THROUGH BORINGS PROJECTED ALONG -L-

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PROJECT REFERENCE	SHEET
BR-0086	4

SKEW = 105°

EB1-C 17+47 1' LT

B1-C 18+64 15' LT

B_2011 19+08 3' LT

B2-C 19+92 3' LT

EB2-B 20+91 17' RT

EB2-C 21+12 1' LT

ASPHALT AND CONCRETE

LOOSE TO MEDIUM DENSE, ORANGE BROWN TO GRAY BROWN, SILTY AND CLAYEY, F. AND CSE. SAND. DRY TO SAT. (ROADWAY EMBANKMENT)

APPROXIMATE LAND SURFACE

09/11

NEUSE RIVER SURFACE ELEVATION 05-03-23

VERY SOFT TO STIFF, BROWN AND LIGHT GRAY TO DARK GRAY, CLAY AND F. AND CSE. SANDY CLAY. TRACE ORG. AND GRAVEL, SLIGHTLY MICACEOUS. MOIST TO WET. (ALLUVIAL)

WEATHERED ROCK (PHYLLITE)

WEATHERED ROCK (PHYLLITE)

BT

BT FIAD

SS-08 SS-09

ASPHALT AND CONCRETE

MEDIUM STIFF, ORANGE BROWN TO TAN, CLAY AND F. AND CSE. SANDY CLAY. DRY TO MOIST (ROADWAY EMBANKMENT)

SS-08 A-6(6)

LOOSE TO MED. DENSE, BROWN TO DARK BROWN, F. AND CSE. SAND AND SILTY, F. AND CSE. SAND W/TR. ORGANICS. WET TO SAT. (ALLUVIAL)

SS-09 A-4(2)

RS-03 RS-04

MED. STIFF TO STIFF, GRAY AND BROWN, MOTTLED, F. SANDY AND CLAYEY SILT. MICACEOUS. MOIST TO WET. (ALLUVIAL)

RS-03 (4.4) 88%

RS-04 (4.3) 86%

(4.1) 82%

(2.8) 56%

(2.0) 40%

GREEN, SILTY SAND W/TR. MICA (RESIDUAL)

NON-CRYSTALLINE ROCK (PHYLLITE)
GREEN, VERY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, MODERATE CLOSE TO WIDE FRACTURE SPACING
(REC=93-100%, RQD=72-84%, GSI=40-80)

NON-CRYSTALLINE ROCK (PHYLLITE)
GREEN, VERY TO MODERATELY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, CLOSE TO WIDE FRACTURE SPACING
(REC=93, RQD=66, GSI=70-85)

(1.7) 94%

(5.0) 100%

(2.6) 93%

Ⓐ VERY LOOSE TO LOOSE, BROWN AND GRAY, SILTY, F. AND CSE. SAND AND F. AND CSE. SAND WITH TR. ORG. AND SHELL FRAGS. SAT. (ALLUVIAL)

Ⓑ DENSE, GRAY TO BEIGE, WELL ROUNDED GRAVEL AND CSE. SAND. LAYERS OF WOOD THROUGHOUT. SAT. (ALLUVIAL)

Ⓒ HARD / VERY DENSE, DARK BROWN, ORANGE, AND BEIGE, F. SANDY SILT AND SILTY, F. SAND. DRY TO MOIST. (RESIDUAL)

NOTES: GROUNDLINE PROFILE ALONG -L- GENERATED FROM br0086_ls_tin.tin PROVIDED APRIL 2023

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO PROFILE

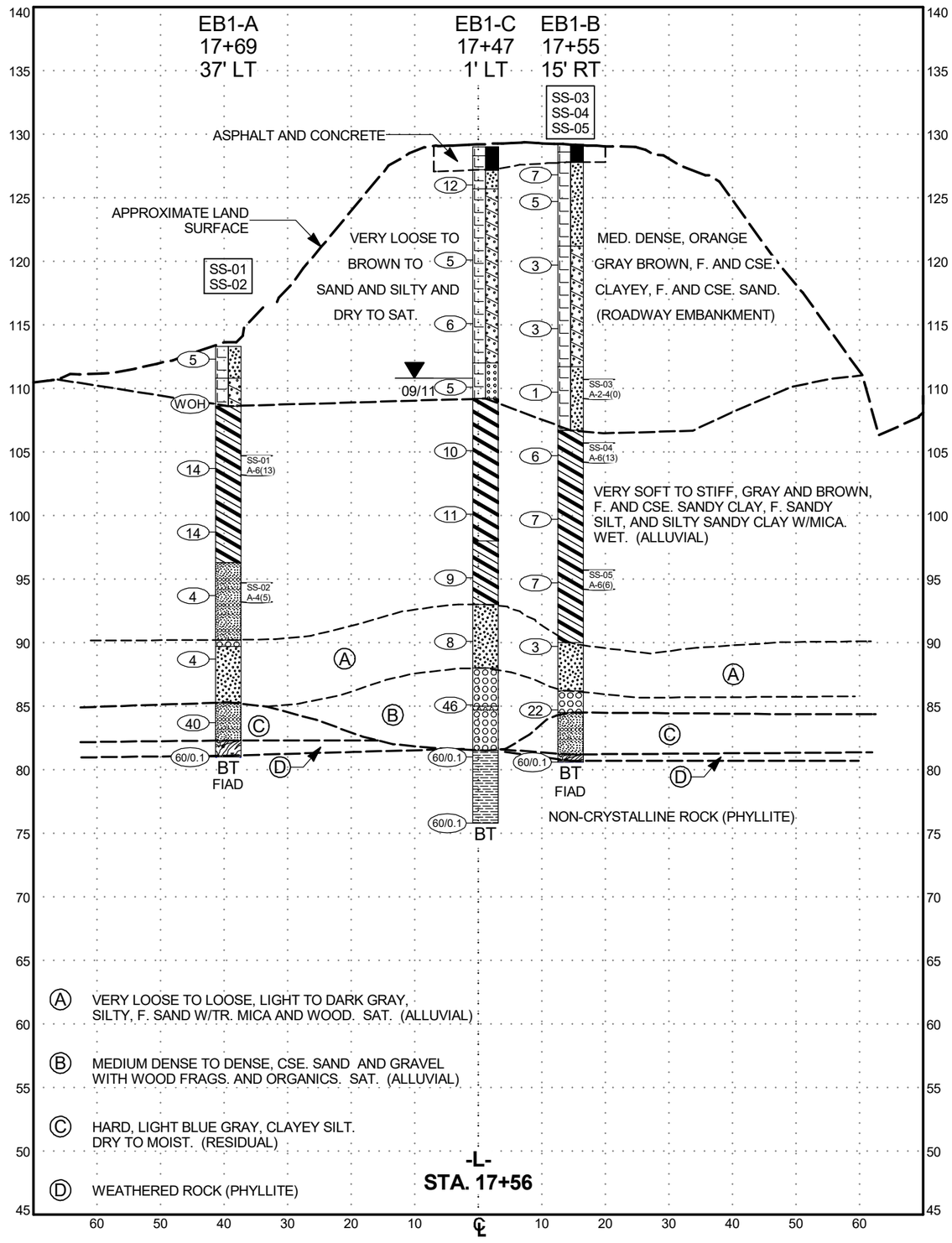
140 130 120 110 100 90 80 70 60 50

17+50 18+00 18+50 19+00 19+50 20+00 20+50 21+00 21+50

P:\2023\223101 BR-0086 - NCDOT BRIDGE 70 ON US 301 OVER NEUSE\BR0086_GEO_BRDG\CADD_GEOTECH\PLANPROF\BR0086_GEO_BRDG_GINT-PFL.GDW

CROSS SECTION
END BENT 1
SKEW = 105°

0 20 40
HORIZONTAL SCALE IN FEET
VE = 2.0



Ⓐ VERY LOOSE TO LOOSE, LIGHT TO DARK GRAY, SILTY, F. SAND W/TR. MICA AND WOOD. SAT. (ALLUVIAL)

Ⓑ MEDIUM DENSE TO DENSE, CSE. SAND AND GRAVEL WITH WOOD FRAGS. AND ORGANICS. SAT. (ALLUVIAL)

Ⓒ HARD, LIGHT BLUE GRAY, CLAYEY SILT. DRY TO MOIST. (RESIDUAL)

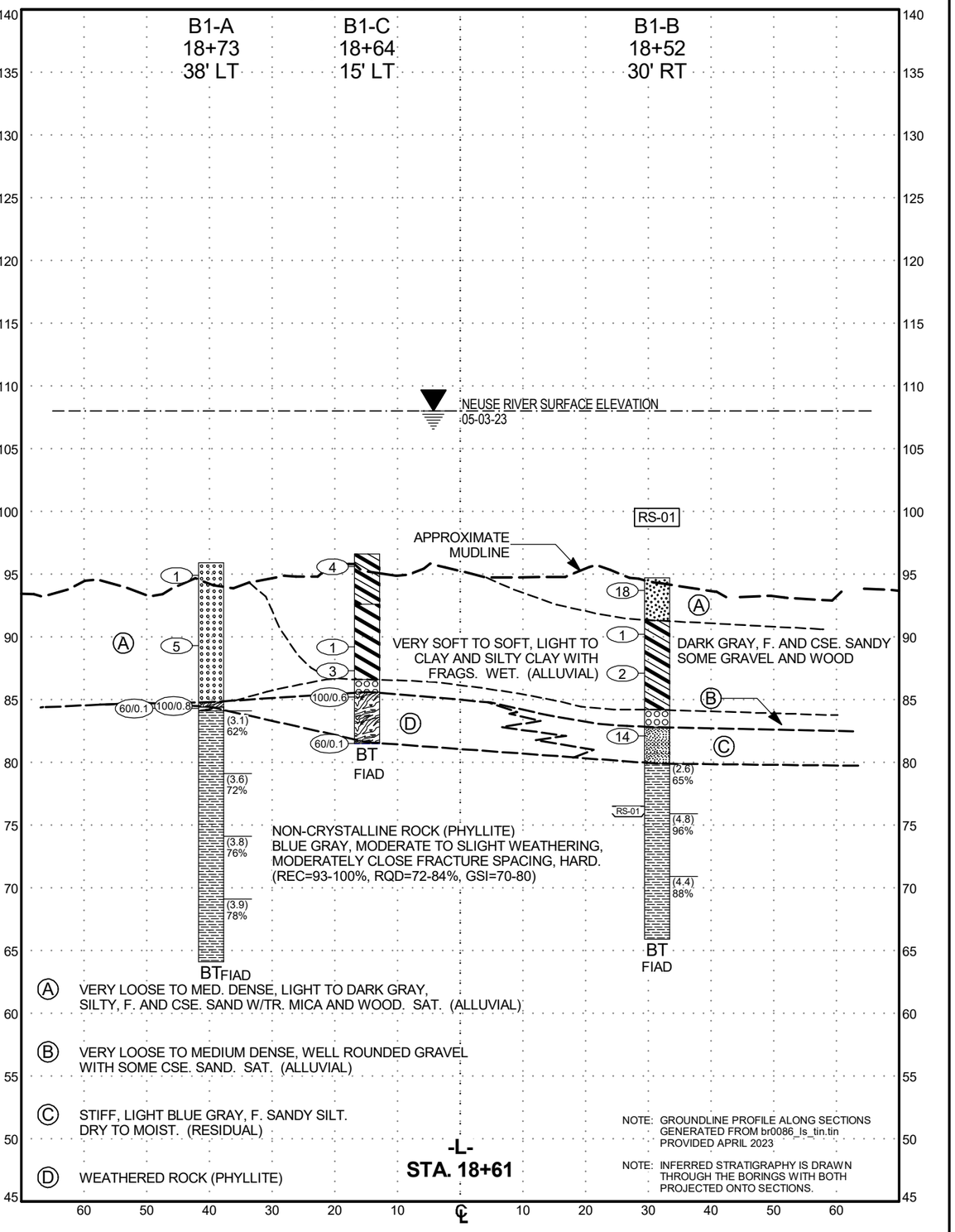
Ⓓ WEATHERED ROCK (PHYLLITE)

CROSS SECTION
BENT 1
SKEW = 105°

0 20 40
HORIZONTAL SCALE IN FEET
VE = 2.0

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	5



Ⓐ VERY LOOSE TO MED. DENSE, LIGHT TO DARK GRAY, SILTY, F. AND CSE. SAND W/TR. MICA AND WOOD. SAT. (ALLUVIAL)

Ⓑ VERY LOOSE TO MEDIUM DENSE, WELL ROUNDED GRAVEL WITH SOME CSE. SAND. SAT. (ALLUVIAL)

Ⓒ STIFF, LIGHT BLUE GRAY, F. SANDY SILT. DRY TO MOIST. (RESIDUAL)

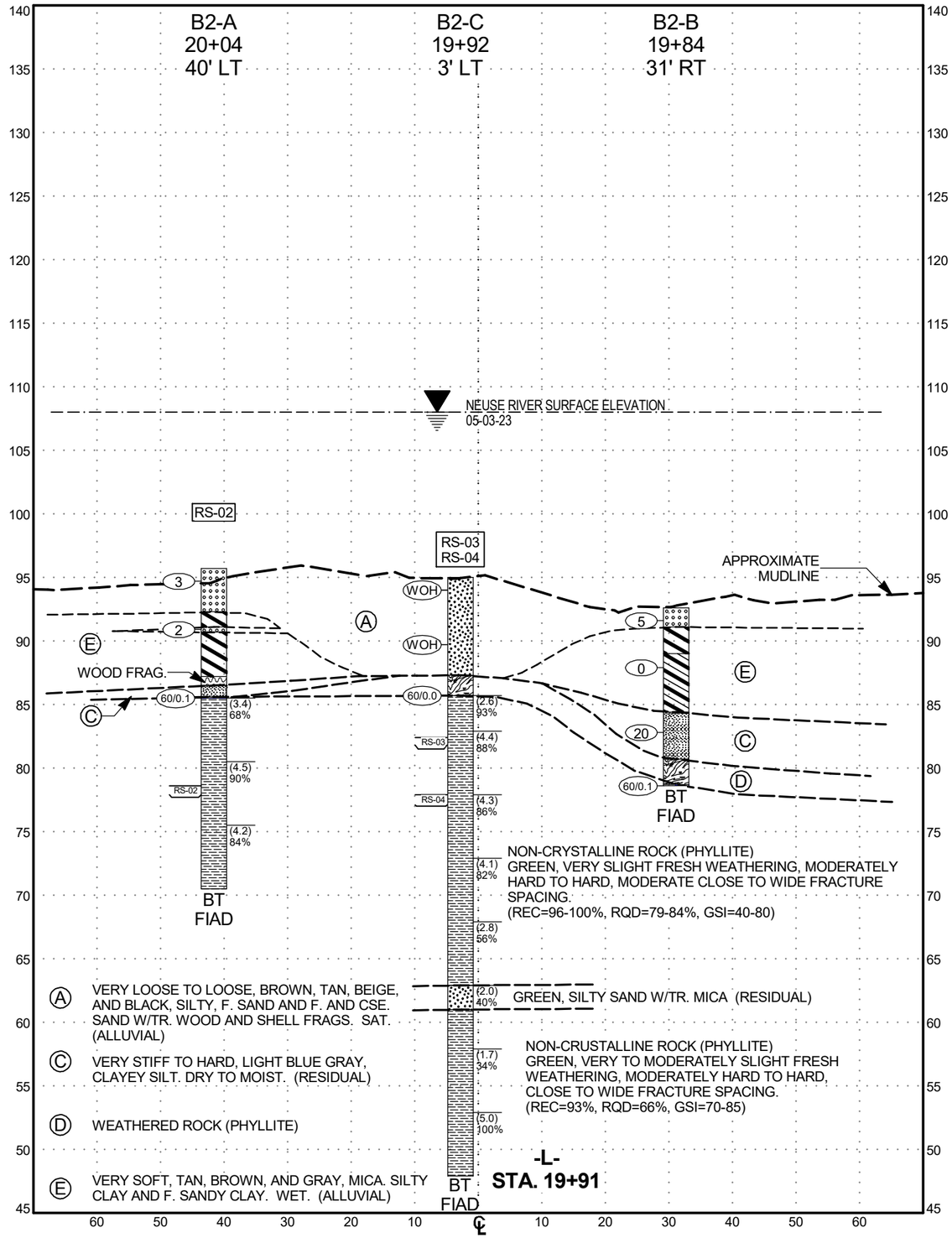
Ⓓ WEATHERED ROCK (PHYLLITE)

NOTE: GROUNDLINE PROFILE ALONG SECTIONS GENERATED FROM br0086_ls_tin.tin PROVIDED APRIL 2023

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO SECTIONS.

0 20 40
HORIZONTAL SCALE IN FEET
VE = 2.0

CROSS SECTION
BENT 2
SKEW = 105°



(A) VERY LOOSE TO LOOSE, BROWN, TAN, BEIGE, AND BLACK, SILTY, F. SAND AND F. AND CSE. SAND W/TR. WOOD AND SHELL FRAGS. SAT. (ALLUVIAL)

(C) VERY STIFF TO HARD, LIGHT BLUE GRAY, CLAYEY SILT. DRY TO MOIST. (RESIDUAL)

(D) WEATHERED ROCK (PHYLLITE)

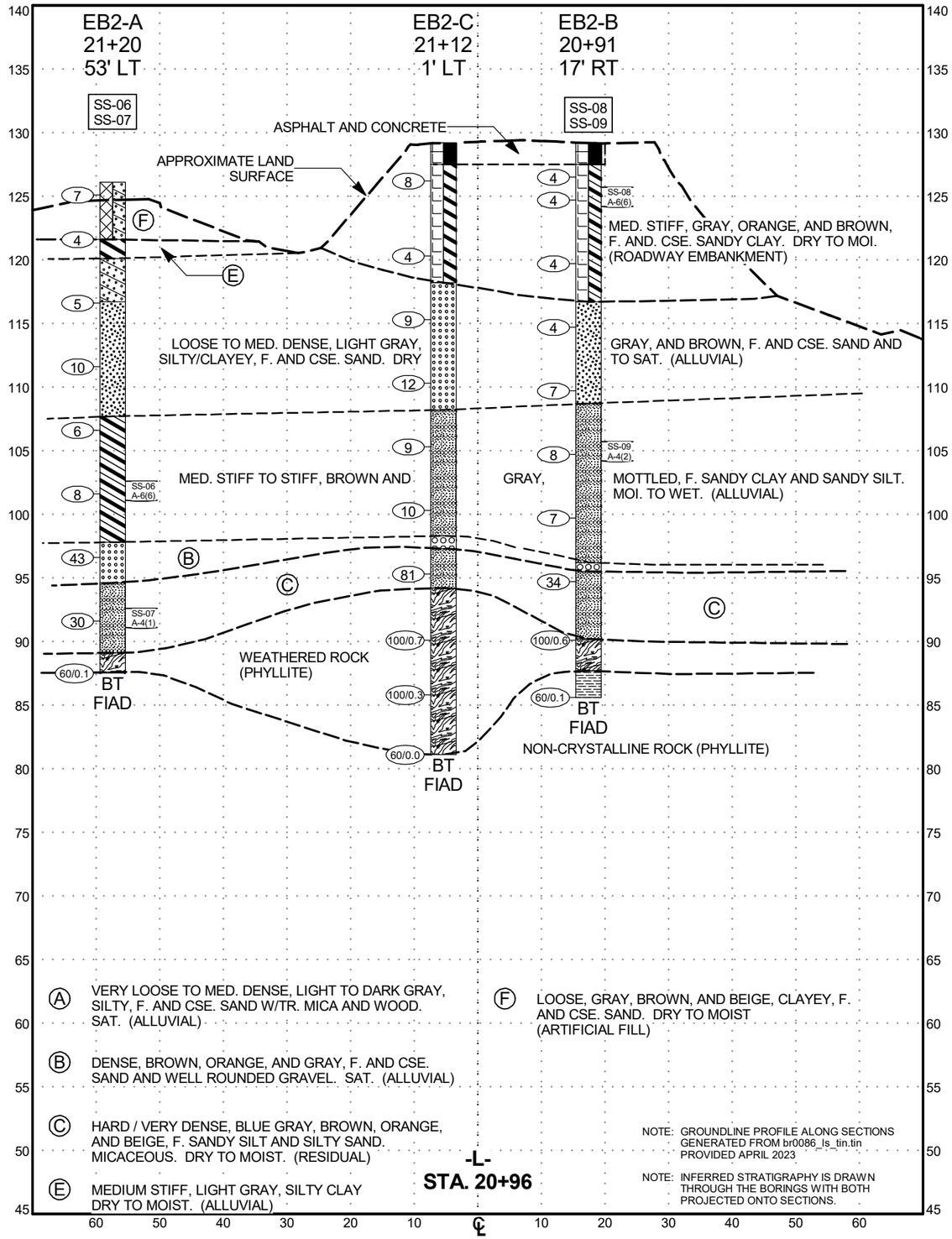
(E) VERY SOFT, TAN, BROWN, AND GRAY, MICA. SILTY CLAY AND F. SANDY CLAY. WET. (ALLUVIAL)

0 20 40
HORIZONTAL SCALE IN FEET
VE = 2.0

CROSS SECTION
END BENT 2
SKEW = 105°

223101 **CATLIN** Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	6



(A) VERY LOOSE TO MED. DENSE, LIGHT TO DARK GRAY, SILTY, F. AND CSE. SAND W/TR. MICA AND WOOD. SAT. (ALLUVIAL)

(B) DENSE, BROWN, ORANGE, AND GRAY, F. AND CSE. SAND AND WELL ROUNDED GRAVEL. SAT. (ALLUVIAL)

(C) HARD / VERY DENSE, BLUE GRAY, BROWN, ORANGE, AND BEIGE, F. SANDY SILT AND SILTY SAND. MICACEOUS. DRY TO MOIST. (RESIDUAL)

(E) MEDIUM STIFF, LIGHT GRAY, SILTY CLAY DRY TO MOIST. (ALLUVIAL)

(F) LOOSE, GRAY, BROWN, AND BEIGE, CLAYEY, F. AND CSE. SAND. DRY TO MOIST (ARTIFICIAL FILL)

NOTE: GROUNDLINE PROFILE ALONG SECTIONS GENERATED FROM br0086_ls_tin.tin PROVIDED APRIL 2023

NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO SECTIONS.

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 7

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: EB1-A	**STATION:** 17+69	**OFFSET:** 37 ft LT	**ALIGNMENT:** -L-	**0 HR.** 3.2
COLLAR ELEV.: 113.3 ft	**TOTAL DEPTH:** 32.3 ft	**NORTHING:** 630,755	**EASTING:** 2,187,565	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 94.5% 02/23/2023		**DRILL METHOD:** MUD ROTARY	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 04/21/23	**COMP. DATE:** 04/21/23	**SURFACE WATER DEPTH:** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION / ELEV. (ft)	DEPTH (ft)
130											
	113.3	0.0	1	2	3	5		M		113.3 LAND SURFACE	0.0
125										ROADWAY EMBANKMENT	
	109.8	3.5	WOH	WOH	WOH	0		M		DARK BROWN, SILTY, F. SAND	
120										110.8 GRAY, CLAYEY, F. AND CSE. SAND	2.5
	104.7	8.6	8	6	8	14	SS-01 A-6(13)	Sat.		108.6 ALLUVIAL	4.7
115										GRAY BROWN, SILTY CLAY W/F. SAND	
	99.7	13.6	8	9	5	14		Sat.			
110											
	94.7	18.6	2	2	2	4	SS-02 A-4(5)	M		96.3 LIGHT GRAY BLUE, F. SANDY SILT	17.0
105											
	89.7	23.6	1	2	2	4		W		89.7 LIGHT TO DARK GRAY, SILTY, F. SAND W/MICA AND TR. ORG.	23.6
100											
	84.7	28.6	16	19	21	40		D		85.3 RESIDUAL LIGHT BLUE GRAY, CLAYEY SILT	28.0
95										82.3 WEATHERED ROCK (PHYLLITE)	31.0
	81.1	32.2	60/0.1			60/0.1				81.1 NON-CRYSTALLINE ROCK (PHYLLITE)	32.2
90										81.0 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 81.0 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	32.3
85											

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: EB1-B	**STATION:** 17+55	**OFFSET:** 15 ft RT	**ALIGNMENT:** -L-	**0 HR.** 18.6
COLLAR ELEV.: 129.2 ft	**TOTAL DEPTH:** 48.6 ft	**NORTHING:** 630,705	**EASTING:** 2,187,585	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 94.5% 02/23/2023		**DRILL METHOD:** MUD ROTARY	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 04/20/23	**COMP. DATE:** 04/20/23	**SURFACE WATER DEPTH:** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION / ELEV. (ft)	DEPTH (ft)
130											
	127.8	1.4	5	4	3	7		M		129.2 ROAD SURFACE	0.0
125	125.7	3.5	3	2	3	5		M		128.6 ASPHALT PAVEMENT	0.6
	120.7	8.5	2	1	2	3		M		127.8 CONCRETE	1.4
120										ROADWAY EMBANKMENT	
	115.7	13.5	2	2	1	3		Sat.		TAN, BROWN, AND RED, SILTY, F. AND CSE. SAND	
115											
	110.7	18.5	2	0	1	1	SS-03 A-2-4(0)	Sat.		121.2 ORANGE, BEIGE, AND BROWN, CLAYEY, F. AND CSE. SAND	8.0
110											
	105.7	23.5	WOH	3	3	6	SS-04 A-6(13)	Sat.		111.7 GRAY, SILTY, F. AND CSE. SAND	17.5
105											
	100.7	28.5	2	3	4	7		M		106.7 ALLUVIAL	22.5
100										GRAY BROWN TO GRAY, SILTY CLAY W/F. SAND	
	95.7	33.5	3	4	3	7	SS-05 A-6(6)	M			
95											
	90.7	38.5	1	1	2	3		M		90.0 GRAY, SILTY, F. SAND. TR. CLAY, MICA, AND WOOD	39.2
90											
	85.7	43.5	5	10	12	22		Sat.		86.2 GRAY, BROWN, AND BEIGE, F. AND CSE. SANDY GRAVEL	43.0
85										84.5 RESIDUAL BLUE GRAY, CLAYEY SILT	44.7
	80.7	48.5	60/0.1			60/0.1				81.2 WEATHERED ROCK (PHYLLITE)	48.0
										80.7 NON-CRYSTALLINE ROCK (PHYLLITE)	48.5
										80.6 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 80.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	48.6

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 6

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** Bruinsma, C. M.	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: EB1-C	**STATION:** 17+47	**OFFSET:** 1 ft LT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 129.0 ft	**TOTAL DEPTH:** 53.2 ft	**NORTHING:** 630,713	**EASTING:** 2,187,569	**24 HR.** 18.2
DRILL RIG/HAMMER EFF./DATE: RFO0067 CME-550X 77% 03/15/2010		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: N/A	**START DATE:** 09/26/11	**COMP. DATE:** 09/26/11	**SURFACE WATER DEPTH:** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
130											129.0 GROUND SURFACE	0.0
	127.0	2.0									128.3 ASPHALT	0.7
			5	7	5	12			M		127.2 CONCRETE	1.8
125											125.7 ROADWAY EMBANKMENT ORANGE, SILTY, COARSE SAND	3.3
	121.1	7.9									ORANGE-BROWN, CLAYEY SAND	
			3	2	3	5			M			
120												
	116.1	12.9										
			2	3	3	6			M			
115												
	111.1	17.9									112.0	17.0
			3	3	2	5			M		ORANGE-BROWN TO GRAY-BROWN, SLIGHTLY SILTY, FINE TO MEDIUM COARSE SAND	
110											109.2	19.8
	106.1	22.9									ALLUVIAL GRAY AND BROWN, SANDY SILTY CLAY, MOTTLED	
			1	4	6	10			M			
105												
	101.1	27.9										
			3	5	6	11			M			
100												
	96.1	32.9									98.0	31.0
			2	4	5	9			W		GRAY AND BROWN, SILTY SANDY CLAY, SLIGHTLY MICACEOUS	
95											93.0	36.0
	91.1	37.9									GRAY, SILTY SAND WITH SILT LAYERS, SOME ORGANIC MATERIAL AND MICA	
			3	2	6	8			Sat.			
90											88.0	41.0
	86.1	42.9									GRAY, COARSE SAND WITH GRAVEL(ORGANIC LAYER FROM 44.0 FT TO 44.3 FT)	
			11	22	24	46			Sat.		85.0	44.0
85											84.7	44.3
	81.1	47.9	60/0.1			60/0.1					81.5	47.5
80											NON-CRYSTALLINE ROCK BLUE-GRAY, PHYLLITE	
	75.9	53.1	60/0.1			60/0.1					75.8	53.2
75											Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 75.8 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	
70											BORING DRILLED AS EB1-A IN 2011 BY NCDOT	
65												

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B1-A	**STATION:** 18+73	**OFFSET:** 38 ft LT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 95.9 ft	**TOTAL DEPTH:** 31.8 ft	**NORTHING:** 630,818	**EASTING:** 2,187,648	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 05/02/23	**COMP. DATE:** 05/02/23	**SURFACE WATER DEPTH:** 13.4ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
130											
125											
120											
115											
110											WATER SURFACE (05/02/23)
105											
100											
95	95.9	0.0	WOH	WOH	1	1		Sat.			95.9 MUDLINE 0.0
											ALLUVIAL BROWN, BEIGE, AND TAN, F. AND CSE. SAND WITH SOME MICA AND WOOD FRAGS.
90	90.3	5.6	6	4	1	5		Sat.			
85	85.3	10.6									
	84.4	11.5	6	100/0.3		100/0.8					84.8 11.1
			60/0.1			60/0.1					84.4 11.5 WEATHERED ROCK (PHYLLITE) 84.1 11.8
80											NON-CRYSTALLINE ROCK BLUE GRAY, MODERATE TO SLIGHT WEATHERING, MODERATELY CLOSE FRACTURE SPACING, HARD, PHYLLITE (REC=93%, RQD=72%, GSI=70-80)
75											
70											
65											64.1 31.8 Boring Terminated at Elevation 64.1 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: B1-A	**STATION:** 18+73	**OFFSET:** 38 ft LT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 95.9 ft	**TOTAL DEPTH:** 31.8 ft	**NORTHING:** 630,818	**EASTING:** 2,187,648	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 05/02/23	**COMP. DATE:** 05/02/23	**SURFACE WATER DEPTH:** 13.4ft	
CORE SIZE: NQ	**TOTAL RUN:** 20.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
84.1											Begin Coring @ 11.8 ft
	84.1	11.8	5.0	2:34/1.0 3:51/1.0 3:26/1.0 3:02/1.0 2:33/1.0	(4.0) 80%	(3.1) 62%		(18.5) 93%	(14.4) 72%		84.1 NON-CRYSTALLINE ROCK 11.8 BLUE GRAY, MODERATE TO SLIGHT WEATHERING, MODERATELY CLOSE FRACTURE SPACING, HARD, PHYLLITE (GSI=75-80)
80	79.1	16.8	5.0	2:15/1.0 2:45/1.0 3:04/1.0 2:36/1.0 1:59/1.0	(5.0) 100%	(3.6) 72%					
75	74.1	21.8	5.0	3:02/1.0 2:57/1.0 2:13/1.0 2:43/1.0 2:07/1.0	(4.5) 90%	(3.8) 76%					
70	69.1	26.8	5.0	2:12/1.0 2:14/1.0 1:52/1.0 1:47/1.0 1:58/1.0	(5.0) 100%	(3.9) 78%					
65	64.1	31.8									64.1 31.8 Boring Terminated at Elevation 64.1 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT CORE W-PHOTO_BR0086_GEO_BRDG_CATLIN.GPJ_CATLIN.GDT 05/16/23

B1-A
DEPTH: 11.8 to 31.8 ft

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	9

0.0 1.0 2.0
SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 10

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 18+52	**OFFSET:** 30 ft RT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 94.7 ft	**TOTAL DEPTH:** 28.8 ft	**NORTHING:** 630,751	**EASTING:** 2,187,672	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 05/04/23	**COMP. DATE:** 05/05/23	**SURFACE WATER DEPTH:** 11.0ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
130												
125												
120												
115												
110												
105											WATER SURFACE (05/04/23)	
100												
95	94.7	0.0	5	6	12	18			Sat.		94.7 MUDLINE	0.0
											ALLUVIAL	
											LIGHT TO DARK GRAY, SILTY, F. AND	
	91.2	3.5									CSE. SAND WITH ASPHALT FRAGS.	
90			1	1	0	1			Sat.		91.3	3.4
											GRAY TO DARK GRAY, SILTY CLAY W/TR.	
	88.1	6.6									F. SAND AND SOME WOOD FRAGS.	
			WOH	1	1	2			Sat.			
85												
	83.1	11.6									84.2	10.5
			6	4	10						GRAY, WELL ROUNDED GRAVEL	
											82.8	11.9
80						14			Sat.		RESIDUAL	
	79.9	14.8									LIGHT BLUE GRAY, F. SANDY SILT	
			60/0.1			60/0.1					79.9	14.8
75								RS-01			NON-CRYSTALLINE ROCK	
											GRAY BLUE AND BEIGE, VERY SLIGHT	
											WEATHERING, MODERATE CLOSE TO	
											WIDE FRACTURE SPACING, HARD,	
70											PHYLLITE WITH QUARTZ VEINS.	
											(REC=100%, RQD=84%, GSI=75-80)	
											65.9	28.8
											Boring Terminated at Elevation 65.9 ft IN	
											NON-CRYSTALLINE ROCK (PHYLLITE)	

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: B1-C	**STATION:** 18+64	**OFFSET:** 15 ft LT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 96.6 ft	**TOTAL DEPTH:** 15.1 ft	**NORTHING:** 630,794	**EASTING:** 2,187,655	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 05/03/23	**COMP. DATE:** 05/03/23	**SURFACE WATER DEPTH:** 11.4ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
130											
125											
120											
115											
110											
105											WATER SURFACE (05/03/23)
100											
95	96.6	0.0	7	3	1	4			Sat.		96.6 MUDLINE 0.0
											ALLUVIAL
											LIGHT TO DARK GRAY, F. AND CSE.
											SANDY CLAY W/TR. GRAVEL
											92.6 4.0
90	90.2	6.4	WOH	1	0	1			Sat.		LIGHT TO DARK GRAY, SILTY CLAY W/TR.
	88.3	8.3	2	1	2	3			Sat.		CSE. SAND AT BASE OF STRATUM
	85.8	10.8	56	44/0.1		100/0.6					86.6 10.0
85											85.6 GRAY BEIGE, WELL ROUNDED GRAVEL 11.0
											WEATHERED ROCK
											(PHYLLITE)
	81.6	15.0	60/0.1			60/0.1					81.6 15.0
											81.5 NON-CRYSTALLINE ROCK 15.1
											(PHYLLITE)
											Boring Terminated WITH STANDARD
											PENETRATION TEST REFUSAL at Elevation
											81.5 ft IN NON-CRYSTALLINE ROCK
											(PHYLLITE)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: B1-B	**STATION:** 18+52	**OFFSET:** 30 ft RT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 94.7 ft	**TOTAL DEPTH:** 28.8 ft	**NORTHING:** 630,751	**EASTING:** 2,187,672	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 05/04/23	**COMP. DATE:** 05/05/23	**SURFACE WATER DEPTH:** 11.0ft	
CORE SIZE: NQ	**TOTAL RUN:** 14.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
79.9											Begin Coring @ 14.8 ft
	79.9	14.8	4.0	3:24 2:56 2:31 3:05	(4.0) 100%	(2.6) 65%		(14.0) 100%	(11.8) 84%		ELEV. (ft) 79.9 — DEPTH (ft) 14.8 NON-CRYSTALLINE ROCK GRAY BLUE AND BEIGE, VERY SLIGHT WEATHERING, MODERATE CLOSE TO WIDE FRACTURE SPACING, HARD, PHYLLITE WITH QUARTZ VEINS. (GSI=75-85)
	75.9	18.8					RS-01				
75			5.0	2:56 3:07 3:29 2:47 2:05	(5.0) 100%	(4.8) 96%					
	70.9	23.8									
70			5.0	2:52 2:49 2:33 3:06 2:22	(5.0) 100%	(4.4) 88%					
	65.9	28.8									ELEV. (ft) 65.9 — DEPTH (ft) 28.8 Boring Terminated at Elevation 65.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

ROCK TEST RESULTS

SAMPLE NUMBER	DEPTH INTERVAL	ROCK TYPE	UNIT WT. (lb/ft3)	UNIAXIAL COMPRESSIVE STRENGTH (psi)
RS-01	18.2' - 18.8'	PHYLLITE	161.5	3,280

B1-B
DEPTH: 14.8 to 28.8 ft

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	11

0.0 1.0 2.0
SCALE IN FEET

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 12

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** Bruinsma, C. M.	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B_2011	**STATION:** 19+08	**OFFSET:** 3 ft LT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 94.7 ft	**TOTAL DEPTH:** 23.2 ft	**NORTHING:** 630,811	**EASTING:** 2,187,698	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE: RFO0067 CME-550X 77% 03/15/2010		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: N/A	**START DATE:** 09/28/11	**COMP. DATE:** 09/28/11	**SURFACE WATER DEPTH:** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
	94.7	0.0	WOH	WOH	WOH	0			Sat.		MUDLINE	94.7	0.0
											ALLUVIAL BROWN, FINE TO COARSE SAND WOOD FROM 6.0 FT - 6.5 FT GRAVEL LAYER FROM 7.0 FT - 8.0 FT		
												88.7	6.0
											WOOD LAYER	88.2	6.5
											GRAVEL	86.7	8.0
	86.5	8.2	60	40/0.1		100/0.6					WEATHERED ROCK (PHYLLITE)	83.7	11.0
											RESIDUAL BLUE-GRAY, SANDY SILT	81.7	13.0
	81.5	13.2	60/0.1			60/0.1					NON-CRYSTALLINE ROCK (PHYLLITE)	78.7	16.0
	76.5	18.2	100/0.2			100/0.2					WEATHERED ROCK (PHYLLITE)		
	71.5	23.2	60/0.0			60/0.0					Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 71.5 ft ON NON-CRYSTALLINE ROCK (PHYLLITE) BORING DRILLED AS B1-A IN 2011 BY NCDOT	71.5	23.2

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B2-A	**STATION:** 20+04	**OFFSET:** 40 ft LT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 95.7 ft	**TOTAL DEPTH:** 25.2 ft	**NORTHING:** 630,898	**EASTING:** 2,187,752	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 05/03/23	**COMP. DATE:** 05/04/23	**SURFACE WATER DEPTH:** 12.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
											WATER SURFACE (05/03/23)
	95.7	0.0	1	2	1	3			Sat.		MUDLINE 0.0
											ALLUVIAL BROWN, TAN, BEIGE, AND BLACK, F. AND CSE. SAND W/SOME WOOD FRAGS. 3.4
	91.9	3.8	WOH	2	0	2			Sat.		GRAY TO DARK GRAY, SILTY CLAY 4.6 GRAY, F. SAND 5.0 GRAY TO DARK GRAY, SILTY CLAY
											WOOD 9.2 RESIDUAL 10.1
	85.6	10.1	60/0.1			60/0.1		RS-02			DARK GRAY, SILT W/MICA 10.2 NON-CRYSTALLINE ROCK BLUE GRAY, VERY SLIGHT WEATHERING, MODERATELY CLOSE FRACTURE SPACING, HARD TO VERY HARD, PHYLLITE (REC=100%, RQD=81%, GSI=75-80)
											Boring Terminated at Elevation 70.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT BORE DOUBLE BR0086_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 05/23/23

GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B2-A	**STATION:** 20+04	**OFFSET:** 40 ft LT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 95.7 ft	**TOTAL DEPTH:** 25.2 ft	**NORTHING:** 630,898	**EASTING:** 2,187,752	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core		**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 05/03/23	**COMP. DATE:** 05/04/23	**SURFACE WATER DEPTH:** 12.0ft	
CORE SIZE: NQ	**TOTAL RUN:** 15.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
85.5											Begin Coring @ 10.2 ft	
	85.5	10.2	5.0	3:08 3:26 2:52 2:52 2:36	(5.0) 100%	(3.4) 68%		(15.0) 100%	(12.1) 81%		85.5 NON-CRYSTALLINE ROCK BLUE GRAY, VERY SLIGHT WEATHERING, MODERATELY CLOSE FRACTURE SPACING, HARD TO VERY HARD, PHYLLITE (GSI=75-80)	10.2
80	80.5	15.2	5.0	3:15 3:26 2:53 2:31 2:57	(5.0) 100%	(4.5) 90%	RS-02					
75	75.5	20.2	5.0	2:36 3:04 3:17 2:51 2:23	(5.0) 100%	(4.2) 84%						
	70.5	25.2									70.5 Boring Terminated at Elevation 70.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	25.2

ROCK TEST RESULTS

SAMPLE NUMBER	DEPTH INTERVAL	ROCK TYPE	UNIT WT. (lb/ft3)	UNIAXIAL COMPRESSIVE STRENGTH (psi)
RS-02	17.1' - 17.8'	PHYLLITE	163.8	7,420

B2-A
DEPTH: 10.2 to 25.2 ft

0.0 1.0 2.0
SCALE IN FEET

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	13

GEOTECHNICAL BORING REPORT
BORE LOG

223101 | CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 14

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B2-B	**STATION:** 19+84	**OFFSET:** 31 ft RT	**ALIGNMENT:** -L-	**0 HR.** FIAD
COLLAR ELEV.: 92.6 ft	**TOTAL DEPTH:** 14.0 ft	**NORTHING:** 630,830	**EASTING:** 2,187,778	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1314 CME-45B 86.7% 04/05/2023		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Austin Fowler	**START DATE:** 05/04/23	**COMP. DATE:** 05/04/23	**SURFACE WATER DEPTH:** 12.0ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
92.6	0.0		9	4	1	5			Sat.		MUDLINE	0.0
											ALLUVIAL	
91.1		1.5									TAN, BROWN, AND GRAY, F. AND CSE. SAND	
89.6		3.0									DARK GRAY, MICACEOUS SILTY CLAY W/TR. F. SAND	
88.9	3.7		1	0	0	0			Sat.		DARK GRAY, MICACEOUS F. AND CSE. SANDY CLAY	
84.4		8.2									SAPROLITE	
83.8	8.8		8	9	11	20			D		BLUE GRAY, SILT W/RELIC STRUCTURE	
80.7		11.9									WEATHERED ROCK (PHYLLITE)	
78.7	13.9		60/0.1			60/0.1					NON-CRYSTALLINE ROCK (PHYLLITE)	
78.6		14.0									Boring Terminated at Elevation 78.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)	

WATER SURFACE (05/04/23)

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** N. Moore	
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26				**GROUND WTR (ft)**
BORING NO.: B2-C	**STATION:** 19+92	**OFFSET:** 3 ft LT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 95.0 ft	**TOTAL DEPTH:** 47.1 ft	**NORTHING:** 630,861	**EASTING:** 2,187,764	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: N/A		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** N/A	
DRILLER: N/A	**START DATE:** 10/14/20	**COMP. DATE:** 10/14/20	**SURFACE WATER DEPTH:** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. #	RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
95.0	0.0		WOH	WOH	WOH	0					95.0 MUDLINE 0.0
											ALLUVIAL
90.7	4.3		WOH	WOH	WOH	0					BROWN AND GRAY, SILTY SAND W/TR. ROOT AND CLAM SHELL FRAGS.
87.3		7.7									WEATHERED ROCK (PHYLLITE)
85.7	9.3		60/0.0			60/0.0					85.7 9.3
							RS-03				NON-CRYSTALLINE ROCK GREEN, VERY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, MODERATE CLOSE TO WIDE FRACTURE SPACING, PHYLLITE (REC=96, RQD=79, GSI=40-80)
							RS-04				
62.9		32.1									RESIDUAL
61.0		34.0									GREEN, SILTY SAND W/TRACE MICA
47.9		47.1									NON-CRYSTALLINE ROCK GREEN, VERY TO MODERATELY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, CLOSE TO WIDE FRACTURE SPACING, PHYLLITE (REC=93, RQD=66, GSI=70-85)
											Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 47.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)
											BORING DRILLED AS B2-A IN 2020 BY NCDOT

NCDOT BORE DOUBLE BR0086 GEO BRDG CATLIN.GPJ NCDOT CATLIN.GDT 06/13/23

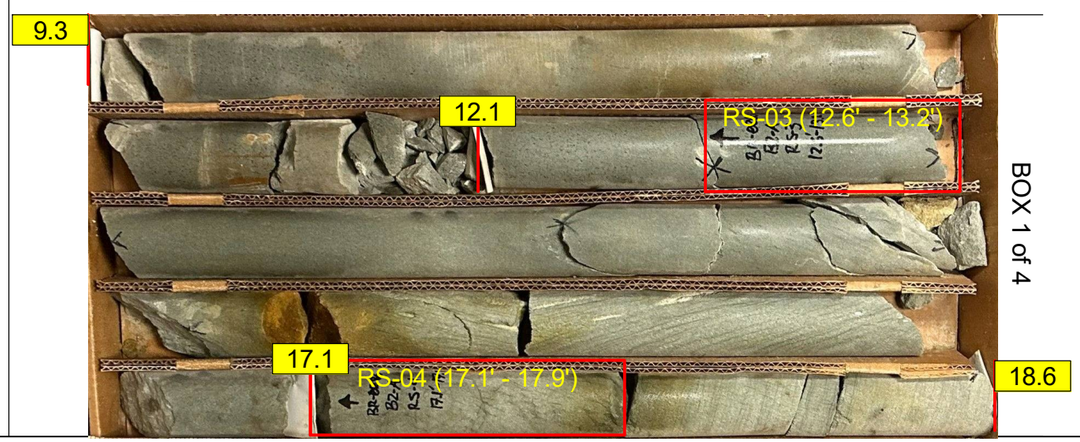
GEOTECHNICAL BORING REPORT
CORE LOG

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** N. Moore
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: B2-C	**STATION:** 19+92	**OFFSET:** 3 ft LT	**ALIGNMENT:** -L-	**0 HR.** N/A
COLLAR ELEV.: 95.0 ft	**TOTAL DEPTH:** 47.1 ft	**NORTHING:** 630,861	**EASTING:** 2,187,764	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: N/A		**DRILL METHOD:** NW Casing W/SPT & Core	**HAMMER TYPE:** AUTOMATIC	
DRILLER: N/A	**START DATE:** 10/14/20	**COMP. DATE:** 10/14/20	**SURFACE WATER DEPTH:** N/A	
CORE SIZE: NW	**TOTAL RUN:** 37.8 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
85.7											Begin Coring @ 9.3 ft
85	85.7	9.3	2.8	*N=60/0.0*	(2.6) 93%	(2.6) 93%		(21.8) 96%	(18.0) 79%		85.7 NON-CRYSTALLINE ROCK 9.3 GREEN, VERY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, MODERATE CLOSE TO WIDE FRACTURE SPACING, PHYLLITE (GSI=40-80)
	82.9	12.1	5.0		(4.9) 98%	(4.4) 88%	RS-03				
80	77.9	17.1	5.0		(4.7) 94%	(4.3) 86%	RS-04				
75	72.9	22.1	5.0		(4.8) 96%	(4.1) 82%					
70	67.9	27.1	5.0		(5.0) 100%	(2.8) 56%					
65	62.9	32.1	5.0		(4.1) 82%	(2.0) 40%		(1.9) 100%	(0.0) 0%		62.9 RESIDUAL 32.1 61.0 GREEN, SILTY SAND W/TRACE MICA 34.0
60	57.9	37.1	5.0		(5.0) 100%	(1.7) 34%		(12.2) 93%	(8.7) 66%		NON-CRYSTALLINE ROCK GREEN, VERY TO MODERATELY SLIGHT FRESH WEATHERING, MODERATELY HARD TO HARD, CLOSE TO WIDE FRACTURE SPACING, PHYLLITE (GSI=70-85)
55	52.9	42.1	5.0		(5.0) 100%	(5.0) 100%					
50	47.9	47.1									47.9 Boring Terminated at Elevation 47.9 ft IN NON-CRYSTALLINE ROCK (PHYLLITE) 47.1

ROCK TEST RESULTS

SAMPLE NUMBER	DEPTH INTERVAL	ROCK TYPE	UNIT WT. (lb/ft3)	UNIAXIAL COMPRESSIVE STRENGTH (psi)
RS-03	12.6' - 13.2'	PHYLLITE	162.8	5,460
RS-04	17.1' - 17.9'	PHYLLITE	154.8	2,370



B2-C
DEPTH: 9.3 to 47.1 ft

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	15

NCDOT CORE W-PHOTO BR0086_GEO_BRDG_CATLIN.GPJ CATLIN.GDT 06/02/23

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists | PROJECT REFERENCE: BR-0086 | SHEET: 16

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: EB2-A	**STATION:** 21+20	**OFFSET:** 53 ft LT	**ALIGNMENT:** -L- / **0 HR.** 9.7
COLLAR ELEV.: 126.1 ft	**TOTAL DEPTH:** 38.6 ft	**NORTHING:** 630,978	**EASTING:** 2,187,836 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 94.5% 02/23/2023		**DRILL METHOD:** MUD ROTARY	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 04/21/23	**COMP. DATE:** 04/21/23	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
130										
	126.1	0.0								126.1 LAND SURFACE 0.0
125			5	4	3	7		D		ARTIFICIAL FILL GRAY, BROWN, AND BEIGE, CLAYEY, F. AND CSE. SAND
	122.6	3.5								121.6 4.5
			2	2	2	4		M		ALLUVIAL LIGHT GRAY, SILTY CLAY
120										120.1 6.0
	117.6	8.5								LIGHT GRAY, CLAYEY, F. AND CSE. SAND
			2	2	3	5		M		116.7 9.4
115										LIGHT TO DARK GRAY, SILTY, F. AND CSE. SAND
	112.6	13.5								
			4	4	6	10		M		
110										
	107.6	18.5								107.7 18.4
			2	3	3	6		M		MOTTLED BROWN GRAY, F. SANDY AND SILTY CLAY, MICACEOUS
105										
	102.6	23.5								
			3	3	5	8	SS-06 A-6(6)	M		
100										
	97.6	28.5								97.8 28.3
			12	14	29	43		Sat.		BROWN, ORANGE, AND GRAY, F. AND CSE. SAND W/SOME CLAY AND GRAVEL
95										94.6 31.5
	92.6	33.5								RESIDUAL BLUE GRAY, F. SANDY SILT, MICACEOUS
			11	13	17	30	SS-07 A-4(1)	M		
90										89.1 37.0
	87.6	38.5	60/0.1			60/0.1				WEATHERED ROCK (PHYLLITE) 87.6 38.5
										87.5 38.6
										NON-CRYSTALLINE ROCK (PHYLLITE)
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 87.5 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** C. Stratton
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: EB2-B	**STATION:** 20+91	**OFFSET:** 17 ft RT	**ALIGNMENT:** -L- / **0 HR.** 10.4
COLLAR ELEV.: 129.2 ft	**TOTAL DEPTH:** 43.6 ft	**NORTHING:** 630,905	**EASTING:** 2,187,855 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT1303 CME-550 94.5% 02/23/2023		**DRILL METHOD:** MUD ROTARY	**HAMMER TYPE:** AUTOMATIC
DRILLER: Austin Fowler	**START DATE:** 04/20/23	**COMP. DATE:** 04/20/23	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. # / RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION
130										
	127.5	1.7								129.2 ROAD SURFACE 0.0
			1	2	2	4		Sat.		128.5 ASPHALT 0.7
125	125.7	3.5	WOH	2	2	4	SS-08 A-6(6)	Sat.		127.5 CONCRETE 1.7
										ROADWAY EMBANKMENT ORANGE, RED, TAN, AND GRAY, F. AND CSE. SANDY CLAY
	120.7	8.5	1	2	2	4		Sat.		
120										
			2	2	2	4		M		116.7 12.5
115	115.7	13.5								ALLUVIAL DARK BROWN TO BROWN, SILTY, F. AND CSE. SAND W/SOME MICA
			4	3	4	7		M		
110	110.7	18.5								
			2	3	5	8	SS-09 A-4(2)	M		108.7 20.5
105	105.7	23.5								GRAY BROWN MOTTLED, F. SANDY AND CLAYEY SILT
			3	3	4	7		M		
100	100.7	28.5								
			8	11	23	34		M		96.2 33.0
95	95.7	33.5								95.5 WELL ROUNDED GRAVEL 33.7
										RESIDUAL DARK BROWN, ORANGE, AND BEIGE, F. SANDY SILT
	90.7	38.5	18	82/0.1		100/0.6				90.2 39.0
90										WEATHERED ROCK (PHYLLITE)
	85.7	43.5	60/0.1			60/0.1				87.7 41.5
										NON-CRYSTALLINE ROCK (PHYLLITE)
										85.6 43.6
										Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 85.6 ft IN NON-CRYSTALLINE ROCK (PHYLLITE)

NCDOT BORE DOUBLE BR0086_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 07/10/23

GEOTECHNICAL BORING REPORT
BORE LOG

223101 CATLIN Engineers and Scientists

PROJECT REFERENCE	SHEET
BR-0086	17

WBS: 67086.1.1	**TIP:** BR-0086	**COUNTY:** JOHNSTON	**GEOLOGIST:** Bruinsma, C. M.
SITE DESCRIPTION: REPLACE BRIDGE 500070 ON US 301 OVER NEUSE RIVER AT -L- STA. 17+26			**GROUND WTR (ft)**
BORING NO.: EB2-C	**STATION:** 21+12	**OFFSET:** 1 ft LT	**ALIGNMENT:** -L- **0 HR.** 12.6
COLLAR ELEV.: 129.2 ft	**TOTAL DEPTH:** 48.1 ft	**NORTHING:** 630,932	**EASTING:** 2,187,861 **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: RFO0067 CME-550X 77% 03/15/2010		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC
DRILLER: N/A	**START DATE:** 09/27/11	**COMP. DATE:** 09/27/11	**SURFACE WATER DEPTH:** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. # RESULT	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
130											
	127.2	2.0	3	3	5	8		M		129.2 GROUND SURFACE	0.0
										128.5 ASPHALT	0.7
125										127.5 CONCRETE	1.7
	121.3	7.9	2	2	2	4		M		ROADWAY EMBANKMENT GRAY AND ORANGE-BROWN, SANDY CLAY	
120											
	116.3	12.9	5	5	4	9		M		118.2 ALLUVIAL BROWN, FINE TO MEDIUM COARSE, SAND WITH TRACE ORGANIC MATERIAL	11.0
115											
	111.3	17.9	5	5	7	12		M			
110											
	106.3	22.9	2	4	5	9		M		108.2 GRAY AND BROWN, SANDY CLAYEY SILT, MOTTLED TO MICACEOUS	21.0
105											
	101.3	27.9	4	4	6	10		M			
100											
	96.3	32.9	11	30	51	81		M		98.3	30.9
95										97.3 GRAY, GRAVEL	31.9
										RESIDUAL BROWN, SILTY SAND (PHYLLITE)	
	91.1	38.1	14	55	45/0.2	100/0.7				94.2 WEATHERED ROCK (PHYLLITE)	35.0
90											
	86.1	43.1	100/0.3			100/0.3					
85											
	81.1	48.1	60/0.0			60/0.0				81.1 Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 81.1 ft ON NON-CRYSTALLINE ROCK	48.1
										BORING DRILLED AS EB2-A IN 2011 BY NCDOT	

NCDOT BORE DOUBLE BR0086_GEO_BRDG_CATLIN.GPJ NCDOT_CATLIN.GDT 06/13/23

223101 CATLIN Engineers and Scientists	PROJECT REFERENCE	SHEET
	BR-0086	18

LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

(As modified by NCDOT, Material and Tests Unit, 2000.)

TEST RESULTS															
Proj. Sample Number	**SS-01**	**SS-02**	**SS-03**	**SS-04**	**SS-05**	**SS-06**	**SS-07**	**SS-08**	**SS-09**						
Lab Sample Number	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	SS-09						
Retained #4 Sieve %	0	0	0.6	0	0	1.3	0	4.4	0						
Passing #10 Sieve %	100	99.9	98.3	100	100	98.0	100	89.2	100						
Passing #40 Sieve %	98	100	83	99	100	97	99	69	98						
Passing #200 Sieve %	88	74	29	87	66	57	61	44	64						
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	2.7	1.3	32.6	1.7	1.2	8.0	7.4	34.3	7.4						
Fine Sand Ret.-#270 %	15.5	38.4	42.7	17.1	44.0	40.6	38.3	20.5	37.4						
Silt 0.05 - 0.005mm %	42.1	32.8	13.9	39.2	29.4	24.5	49.2	20.8	29.8						
Clay <0.005mm %	39.7	27.5	10.9	42.0	25.4	26.8	5.1	24.4	25.4						
Liquid Limit (LL)	37	28	NP	37	31	35	31	37	22						
Plasticity Index (PI)	14	9	NP	14	12	15	3	20	7						
AASHTO Classification /Group Index	**A-6(13)**	**A-4(5)**	**A-2-4(0)**	**A-6(13)**	**A-6(6)**	**A-6(6)**	**A-4(1)**	**A-6(6)**	**A-4(2)**						
Organic Content %	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Station	17+69	17+69	17+55	17+55	17+55	21+20	21+20	20+91	20+91						
Offset	37ft LT	37ft LT	15ft RT	15ft RT	15ft RT	53ft LT	53ft LT	17ft RT	17ft RT						
Alignment	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-	-L-						
Boring Identification	**EB1-A**	**EB1-A**	**EB1-B**	**EB1-B**	**EB1-B**	**EB2-A**	**EB2-A**	**EB2-B**	**EB2-B**						
Depth (FT)	8.6	18.6	18.5	23.5	33.5	23.5	33.5	3.5	23.5						
to	10.1	20.1	20.0	25.0	35.0	25.0	35.0	5.0	25.0						
Field Moist. Content %															
Tested By	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON						
Submitted By	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON	SVHUDSON						
Date Submitted	05/02/23	05/02/23	05/02/23	05/02/23	05/02/23	05/02/23	05/02/23	05/02/23	05/02/23						

NP = Non-Plastic

NEM = Not Enough Material for Analysis

N/A = Not Applicable / Not Analyzed

Michael D. Mason
Laboratory Manager

Report Date: 5/25/2023

SITE PHOTOGRAPHS

223101 CATLIN Engineers and Scientists	PROJECT REFERENCE	SHEET
	BR-0086	19

FACING UPSTATION ALONG -L- EB1-B IN FOREGROUND

FACING DOWNSTATION ALONG -L- EB2-B IN FOREGROUND

DOWNSTREAM OF BRIDGE 70 NEAR EB2 RIGHT OF -L- FACING SOUTHWEST