STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	21

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

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NOTES:
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2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

C. WANG

S. DAVIS

W. SHENBERGER

D. JENKS

INVESTIGATED BY *F&R Inc.*

DRAWN BY *T.T. WALKER*

CHECKED BY *P. ALTON*

SUBMITTED BY *P. ALTON*

DATE *SEPTEMBER 2015*

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON

DocuSigned by:
W. Patrick Alton, P.E 12/3/2015
A270EE78A6DE442
SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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 EXCAVATION
- 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:
- [ ] CME-45C
- [X] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: NCGS MONUMENT "UIGI": BRASS DISC IN BRIDGE WING WALL AT STATION 346+22, 61' LT. N:74,134 E: 2,291,688
ELEVATION: 11.27' FEET

NOTES:

FIAD: FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 50 100

FEET

NC GRID
NAD 83/NSRS 2007

368

370

372

WOODS

SOUTHPORT CITY LIMITS

DUTCHMAN CK

NCGS MONUMENT "UI6I" ELEVATION = 11.27'
N 74134 E 2291688
-BL- STATION (R-5021) 346+22 61' LT.
BRASS DISC IN BRIDGE WING WALL

EXISTING R/W

EB1-A

B1-A

B2-A

EB2-A

EOI

POWER CABINET

B2-C

EB1-C

NCGS "UI6I"

EB2-C

B1-C

BRIDGE #24

B2-B

TO HWY 133
LONG BEACH RD.

NC 211

SOUTHPORT SUPPLY RD.

TO HWY 133
(DOSHER CUTOFF)

24" DIP

EB1-B

B1-B

EB2-B

2 VAULTS

6" PVC

8" AC

CONDUIT

PUMP STATION

CO

TOWER
DOWN GUY
& ANCHOR

TIME WARNER
CABLE
TV TOWER

GRASS

WOODS

WOODS

DUTCHMAN CK

SKEW=105°

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4

PROFILE BORINGS PROJECTED ALONG –L

0 20 40
FEET
VE = 1:1

EB1–C
368+68
16' RT

B1–C
369+03
16' RT

B2–C
369+73
6' RT

EB2–C
370+09
5' RT

1" ASPHALT

12" ASPHALT AND 12" ABC STONE

DUTCHMAN CREEK

WATER SURFACE 7/29/14

07/15

VERY LOOSE TO LOOSE, MOIST, GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND SHELL FRAGMENTS.

MEDIUM DENSE, MOIST TO SATURATED, GRAY-BROWN AND BLACK, SILTY FINE TO COARSE SAND (A-2-4) WITH SHELL FRAGMENTS.

-COASTAL PLAIN-

LOOSE TO VERY DENSE, SATURATED, GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS AND CLAYEY FINE SAND (A-2-6)

-COASTAL PLAIN-

STIFF TO HARD, SATURATED, GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND

STIFF TO HARD, SATURATED, GRAY AND BLACK, CLAYEY FINE SANDY SILT (A-4)

LOOSE TO MEDIUM DENSE, SATURATED, GRAY AND BLACK, SILTY FINE SAND (A-2-4)

CEMENTED SAND

-COASTAL PLAIN SEDIMENTARY ROCK-

BT
0 HR: NM
FIAD
07/15

(A) MEDIUM DENSE TO LOOSE, MOIST, GRAY-BROWN, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE TO LITTLE GRAVEL **-ROADWAY EMBANKMENT-**

(B) LOOSE, MOIST TO WET, GRAY, BROWN, AND BLACK, SILTY FINE SAND (A-2-4) WITH SHELL FRAGMENTS AND TRACE ORGANICS (ROOTS) **-COASTAL PLAIN-**

(C) VERY SOFT TO SOFT, SATURATED, GRAY, SILTY CLAY (A-7-6) WITH LITTLE FINE SAND AND TRACE SHELL FRAGMENTS **-COASTAL PLAIN-**

(D) CEMENTED SAND **-COASTAL PLAIN SEDIMENTARY ROCK-**

369+00 370+00

PROJECT REFERENCE NO.	SHEET NO.
R-5021	5

CROSS SECTION THROUGH END BENT 1

0 20 40
FEET
VE = 1:1

℄

EB1–A
368+71
33' LT

EB1–C
368+68
16' RT

EB1–B
368+55
44' RT

20
0
-20
-40
-60
-80
-100
-120

1" ASPHALT

07/15

VERY LOOSE TO MEDIUM DENSE, ORGANICS AND SHELL FRAGMENTS

MOIST TO SATURATED, GRAY, BROWN, AND CLAYEY FINE SAND (A-2-6)

AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE WITH TRACE CEMENTED SAND AND SHELL FRAGMENTS

ST-1
ST-2

Ⓑ

-COASTAL PLAIN-

Ⓒ

60/0.1

100/0.6

60/0.0

MEDIUM DENSE TO VERY DENSE, SATURATED TO WET, GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS

-COASTAL PLAIN-

VERY STIFF TO HARD, SATURATED TO WET, GRAY AND BLACK, SILTY CLAY (A-7-5/6) WITH TRACE FINE SAND

-COASTAL PLAIN-

MEDIUM DENSE, SATURATED, GRAY AND BLACK, SILTY FINE SAND (A-2-4)

BT
07/15

BT
FIAD
07/15

Ⓐ MEDIUM DENSE, MOIST, GRAY-BROWN, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE TO LITTLE GRAVEL **-ROADWAY EMBANKMENT-**

Ⓑ VERY SOFT TO SOFT, WET, GRAY, SILTY FINE SANDY CLAY (A-6) WITH TRACE SHELL FRAGMENTS, INTERLAYERED WITH THIN SEAMS OF SILTY FINE SAND (A-2-4) **-COASTAL PLAIN-**

Ⓒ CEMENTED SAND **-COASTAL PLAIN SEDIMENTARY ROCK-**

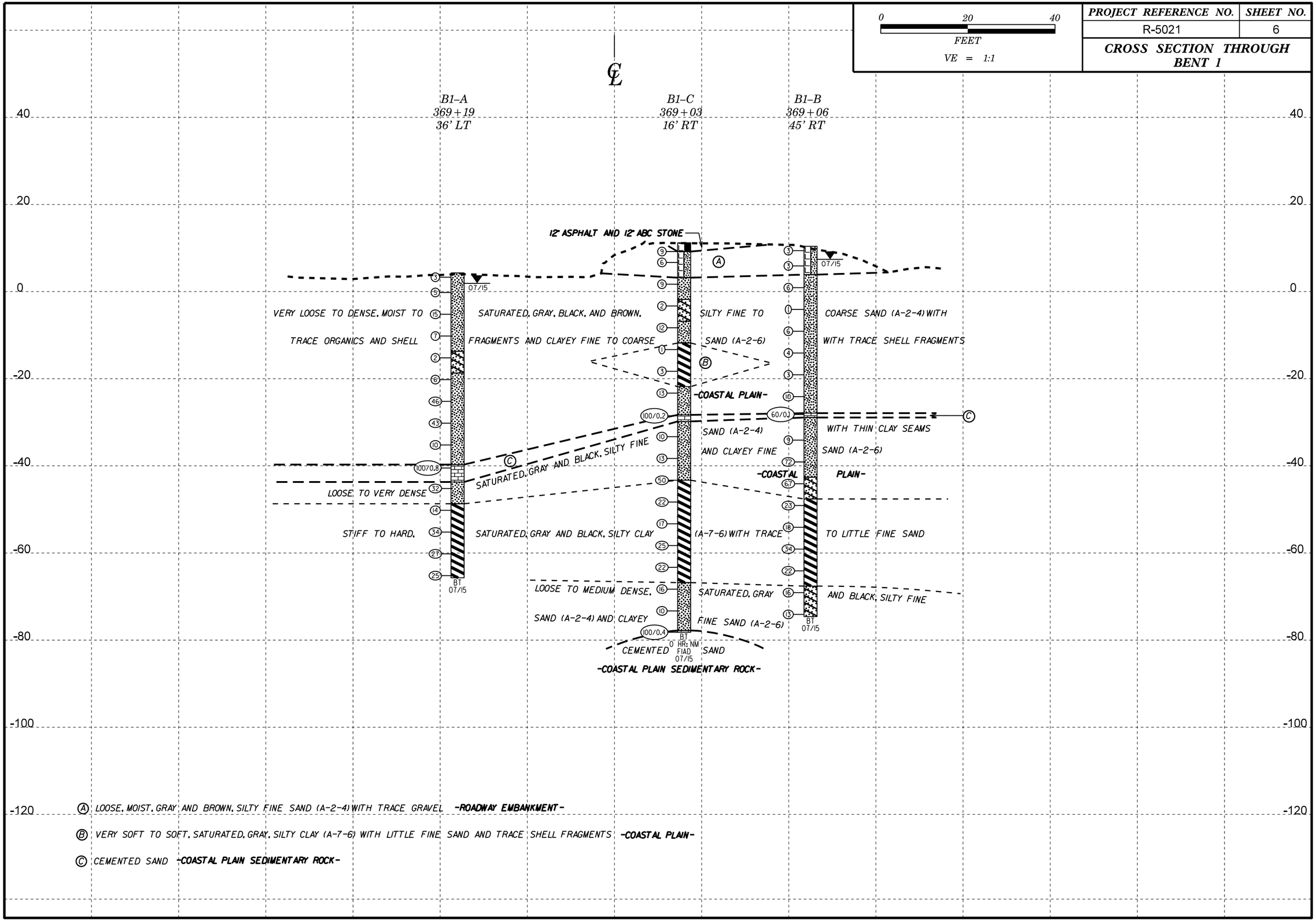
0	20	40

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET NO.
R-5021	6

CROSS SECTION THROUGH BENT 1



Ⓐ LOOSE, MOIST, GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE GRAVEL **-ROADWAY EMBANKMENT-**

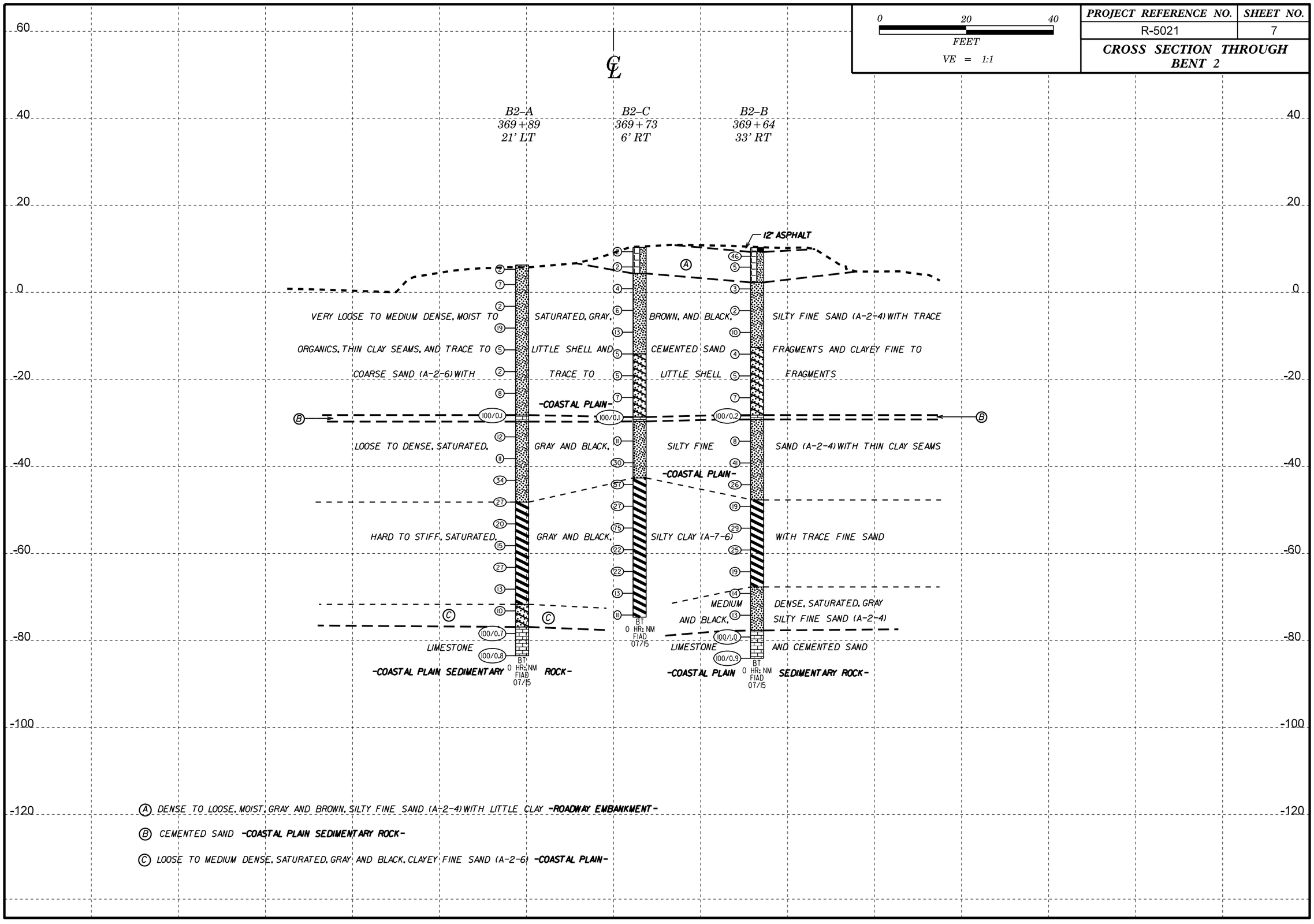
Ⓑ VERY SOFT TO SOFT, SATURATED, GRAY, SILTY CLAY (A-7-6) WITH LITTLE FINE SAND AND TRACE SHELL FRAGMENTS **-COASTAL PLAIN-**

Ⓒ CEMENTED SAND **-COASTAL PLAIN SEDIMENTARY ROCK-**

PROJECT REFERENCE NO.	SHEET NO.
R-5021	7

CROSS SECTION THROUGH BENT 2

0 20 40
FEET
VE = 1:1



(A) DENSE TO LOOSE, MOIST, GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH LITTLE CLAY **-ROADWAY EMBANKMENT-**

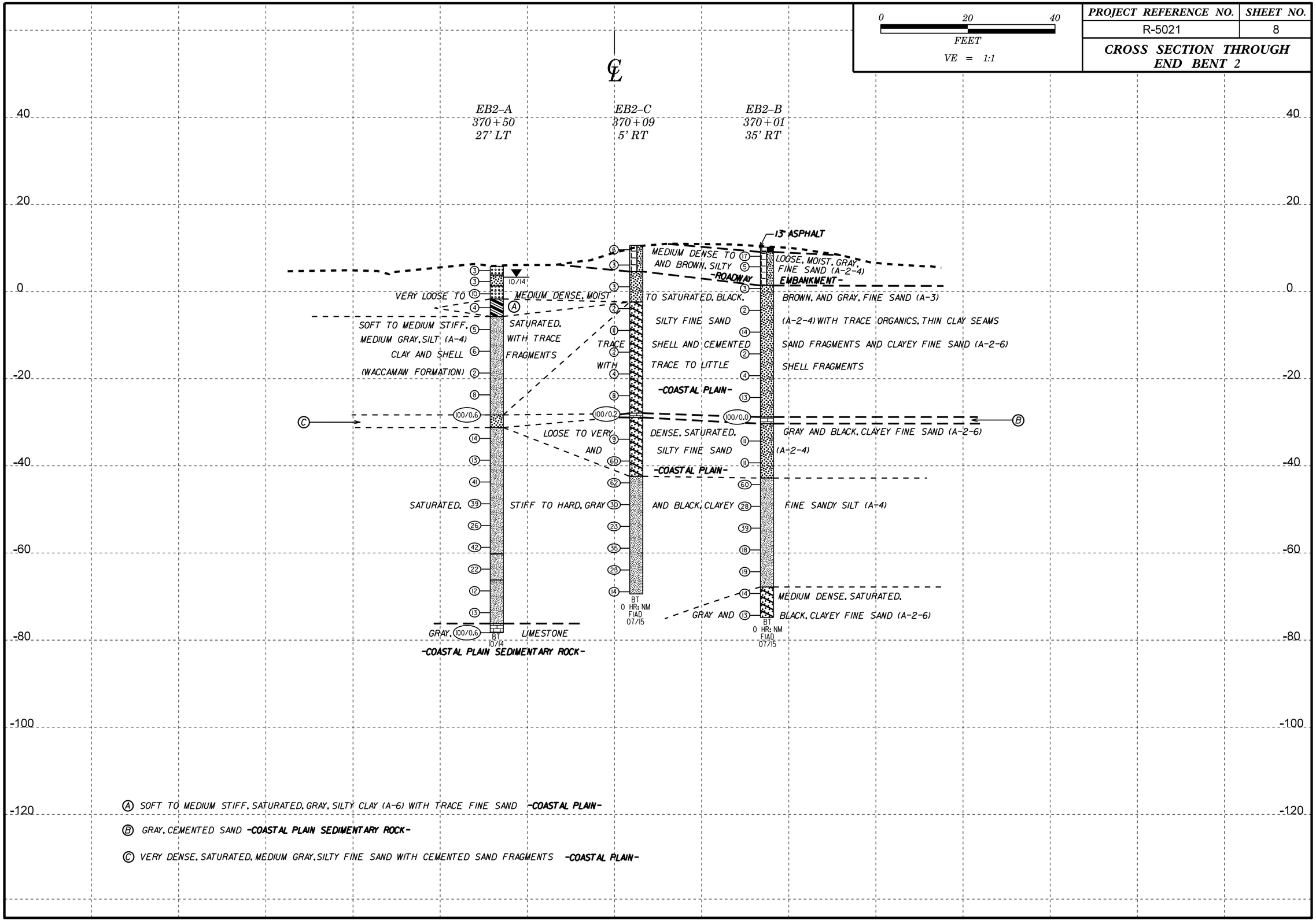
(B) CEMENTED SAND **-COASTAL PLAIN SEDIMENTARY ROCK-**

(C) LOOSE TO MEDIUM DENSE, SATURATED, GRAY AND BLACK, CLAYEY FINE SAND (A-2-6) **-COASTAL PLAIN-**

PROJECT REFERENCE NO.	SHEET NO.
R-5021	8

CROSS SECTION THROUGH END BENT 2

0 20 40
FEET
VE = 1:1



Ⓐ SOFT TO MEDIUM STIFF, SATURATED, GRAY, SILTY CLAY (A-6) WITH TRACE FINE SAND **-COASTAL PLAIN-**

Ⓑ GRAY, CEMENTED SAND **-COASTAL PLAIN SEDIMENTARY ROCK-**

Ⓒ VERY DENSE, SATURATED, MEDIUM GRAY, SILTY FINE SAND WITH CEMENTED SAND FRAGMENTS **-COASTAL PLAIN-**

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 368+71	**OFFSET** 33 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 4.3 ft	**TOTAL DEPTH** 70.0 ft	**NORTHING** 74,203	**EASTING** 2,291,626 / **24 HR.** 3.6
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/07/15	**COMP. DATE** 07/08/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	4.3	0.0								GROUND SURFACE 0.0
5										
			4	3	4	7		M		**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS), COARSE SAND AND SHELL FRAGMENTS
0	0.8	3.5	4	4	3	7		Sat.		
-5	-4.2	8.5	2	3	3	6		Sat.		
-10	-9.2	13.5	2	2	6	8		Sat.		
-15	-14.2	18.5	1	1	1	2		40% W 66%		-13.7 18.0 GRAY, SILTY FINE SANDY CLAY (A-6) WITH TRACE SHELL FRAGMENTS, INTERLAYERED WITH THIN SEAMS OF SILTY FINE SAND (A-2-4)
-20	-19.2	23.5	12	14	4	18		Sat.		-18.7 23.0 GRAY, SILTY FINE SAND (A-2-4) WITH TRACE CEMENTED SAND AND SHELL FRAGMENTS
-25	-24.2	28.5	3	5	8	13		Sat.		
-30	-29.2	33.5	60/0.1			60/0.1				-29.2 33.5 -29.5 33.8 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND **COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS
-35	-34.2	38.5	5	7	6	13		Sat.		
-40	-39.2	43.5	4	9	18	27		W		
-45	-44.2	48.5	21	26	30	56		W		-43.7 48.0 GRAY AND BLACK, FINE SANDY SILTY CLAY (A-7-5)
-50	-49.2	53.5	15	10	33	43	SS-18	34%		
-55	-54.2	58.5	18	18	22	40		W		
-60	-59.2	63.5	15	17	19	36		W		
-65	-64.2	68.5	6	8	9	17		W		-65.7 70.0 Boring Terminated at Elevation -65.7 ft in CLAY (COASTAL PLAIN)

Other Samples:
ST-1 (17.0 - 19.0)
ST-2 (19.0 - 21.0)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 368+68	**OFFSET** 16 ft RT	**ALIGNMENT** -L-	**0 HR.** 10.0
COLLAR ELEV. 11.4 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,159	**EASTING** 2,291,605	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/13/15	**COMP. DATE** 07/14/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
20										
15										
10	10.5	0.9								11.4 0.0 GROUND SURFACE
			8	7	5	12		M		10.5 0.9 ASPHALT **ROADWAY EMBANKMENT** GRAY-BROWN, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE TO LITTLE GRAVEL
5	7.9	3.5	8	6	8	14		M		
	2.9	8.5	WOH	WOH	1	1		Sat.		3.4 8.0 **COASTAL PLAIN** GRAY-BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS)
0	-2.1	13.5	3	3	2	5		Sat.		
-5	-7.1	18.5	3	2	7	9		Sat.		
-10	-12.1	23.5	3	2	2	4		Sat.		-11.6 23.0 GRAY, CLAYEY FINE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS
-15	-17.1	28.5	2	2	3	5		Sat.		
-20	-22.1	33.5	5	4	4	8		Sat.		-21.6 33.0 GRAY, SILTY FINE SAND (A-2-4)
-25	-27.1	38.5	7	100/0.1		100/0.6		Sat.		-27.6 39.0 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND
-30										-29.1 40.5 **COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4)
-35	-32.1	43.5	6	5	6	11		Sat.		
-40	-37.1	48.5	5	14	45	59		Sat.		-40.6 52.0 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND
-45	-42.1	53.5	60/0.0			60/0.0				-42.6 54.0 **COASTAL PLAIN** GRAY AND BLACK, SILTY CLAY (A-7-6)
-50	-47.1	58.5	9	20	19	39		Sat.		
-55	-52.1	63.5	6	10	11	21		Sat.		
-60	-57.1	68.5	16	25	22	47		Sat.		

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 368+68	**OFFSET** 16 ft RT	**ALIGNMENT** -L-	**0 HR.** 10.0
COLLAR ELEV. 11.4 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,159	**EASTING** 2,291,605	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/13/15	**COMP. DATE** 07/14/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-60						Match Line				
	-62.1	73.5	7	9	12	21		Sat.		**COASTAL PLAIN** GRAY AND BLACK, SILTY CLAY (A-7-6) *(continued)*
-65	-67.1	78.5	7	7	8	15		Sat.		-66.6 78.0 GRAY AND BLACK, SILTY FINE SAND (A-2-4)
-70	-72.1	83.5	4	5	6	11		Sat.		-73.6 85.0 Boring Terminated at Elevation -73.6 ft in SAND (COASTAL PLAIN)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 368+55	**OFFSET** 44 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.0 ft	**TOTAL DEPTH** 75.0 ft	**NORTHING** 74,138	**EASTING** 2,291,582	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/08/15	**COMP. DATE** 07/08/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
10											
	10.0	0.0	1	4	5	9		M		10.0 GROUND SURFACE	0.0
	6.5	3.5								**ROADWAY EMBANKMENT** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS	
5			3	2	2	4		M			
	1.5	8.5								3.0 **COASTAL PLAIN** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS	7.0
0			1	3	4	7		W			
	-3.5	13.5								-3.0 GRAY, CLAYEY FINE SAND (A-2-6) WITH TRACE COARSE SAND	13.0
-5			1	2	6	8		Sat.			
	-8.5	18.5								-8.0 GRAY, SILTY COARSE TO FINE SAND (A-2-4) WITH THIN CLAY SEAMS	18.0
-10			4	4	8	12		Sat.			
	-13.5	23.5	WOH	1	1	2	SS-23	41%			
-15											
	-18.5	28.5	1	3	4	7		Sat.		-18.0 GRAY, CLAYEY FINE SAND (A-2-6) WITH TRACE CEMENTED SAND AND SHELL FRAGMENTS	28.0
-20											
	-23.5	33.5	5	7	11	18		Sat.		-23.0 GRAY, SILTY FINE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND CEMENTED SAND	33.0
-25											
	-28.5	38.5	60/0.0			60/0.0		Sat.		-26.5 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND	36.5
-30										-29.0 **COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4)	39.0
	-33.5	43.5	2	4	9	13		Sat.			
-35											
	-38.5	48.5	22	29	29	58		Sat.			
-40											
	-43.5	53.5	60/0.1			60/0.1		Sat.		-43.5 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND -43.8	53.8
-45										**COASTAL PLAIN** GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND	
	-48.5	58.5	8	24	33	57		Sat.			
-50											
	-53.5	63.5	8	11	18	29		Sat.			
-55											
	-58.5	68.5	10	14	17	31		Sat.			
-60											
	-63.5	73.5	6	10	15	25		Sat.		-65.0 Boring Terminated at Elevation -65.0 ft in CLAY (COASTAL PLAIN)	75.0
-65											

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 369+19	**OFFSET** 36 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 4.3 ft	**TOTAL DEPTH** 70.0 ft	**NORTHING** 74,187	**EASTING** 2,291,672	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/06/15	**COMP. DATE** 07/07/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
5											
	4.3	0.0	2	1	2	3		M		4.3 GROUND SURFACE	0.0
	0.8	3.5								**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS	
0			3	2	3	5		W			
	-4.2	8.5									
-5			3	7	8	15		Sat.			
	-9.2	13.5									
-10			2	4	3	7		Sat.			
	-14.2	18.5	WOH	1	1	2				-13.7 GRAY, CLAYEY FINE TO COARSE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS	18.0
-15											
	-19.2	23.5	2	3	3	6		Sat.		-18.7 GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE SHELL FRAGMENTS AND TRACE TO LITTLE CEMENTED SAND FRAGMENTS	23.0
-20											
	-24.2	28.5	5	10	36	46		Sat.			
-25											
	-29.2	33.5	37	21	22	43		Sat.		THIN LAYERS OF HARD DRILLING NOTED FROM 30.0' TO 34.0'	
-30											
	-34.2	38.5	4	4	6	10		Sat.			
-35											
	-39.2	43.5	4	50	50/0.3	100/0.8		Sat.		-39.7	44.0
-40										**COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND	
	-44.2	48.5	14	14	18	32		Sat.		-43.7	48.0
-45										**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4)	
	-49.2	53.5	5	6	8	14		Sat.		-48.7 GRAY AND BLACK, FINE SANDY SILTY CLAY (A-7-6)	53.0
-50											
	-54.2	58.5	8	17	17	34		Sat.			
-55											
	-59.2	63.5	5	11	16	27		Sat.			
-60											
	-64.2	68.5	4	7	18	25		Sat.		-65.7 Boring Terminated at Elevation -65.7 ft in CLAY (COASTAL PLAIN)	70.0
-65											

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 369+03	**OFFSET** 16 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 11.2 ft	**TOTAL DEPTH** 89.4 ft	**NORTHING** 74,145	**EASTING** 2,291,637	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/14/15	**COMP. DATE** 07/15/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
20											
15											
10	10.2	1.0								11.2 GROUND SURFACE	0.0
			14	6	3	9 16		M		12" ASPHALT AND 12" ABC STONE	
	7.7	3.5								9.2	2.0
5			5	3	3			M		**ROADWAY EMBANKMENT** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE GRAVEL	
	2.7	8.5								3.2	8.0
0			4	3	6	9		W		**COASTAL PLAIN** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS)	
	-2.3	13.5								-1.8	13.0
-5			1	1	1	2		Sat.		GRAY, CLAYEY FINE SAND (A-2-6)	
	-7.3	18.5								-6.8	18.0
-10			1	6	6	12		Sat.		GRAY, SILTY FINE SAND (A-2-4)	
	-12.3	23.5								-11.8	23.0
			WOH	WOH	1	1		Sat.		GRAY, SILTY CLAY (A-7-6) WITH LITTLE FINE SAND AND TRACE SHELL FRAGMENTS	
-15											
	-17.3	28.5	1	1	2	3		Sat.			
-20											
	-22.3	33.5	7	8	5	13		Sat.		-21.8 GRAY, SILTY FINE TO COARSE SAND (A-2-4) WITH LITTLE CEMENTED SAND FRAGMENTS	33.0
-25											
	-27.3	38.5	5	10	100/0.2	100/0.2				-28.3	39.5
-30										-29.8 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND	41.0
	-32.3	43.5	5	5	5	10		Sat.		**COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS	
-35											
	-37.3	48.5	4	6	7	13		Sat.			
-40											
	-42.3	53.5	7	14	36	50		Sat.		-43.3	54.5
-45										GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE SAND	
	-47.3	58.5	7	10	12	22		Sat.			
-50											
	-52.3	63.5	7	8	9	17		Sat.			
-55											
	-57.3	68.5	10	11	14	25		Sat.			
-60											

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 369+03	**OFFSET** 16 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 11.2 ft	**TOTAL DEPTH** 89.4 ft	**NORTHING** 74,145	**EASTING** 2,291,637	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/14/15	**COMP. DATE** 07/15/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-60						Match Line				GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE SAND *(continued)*
	-62.3	73.5	9	10	12	22		Sat.		
-65										
	-67.3	78.5	5	8	8	16		Sat.		-66.8 78.0
-70										GRAY AND BLACK, SILTY FINE SAND (A-2-4)
	-72.3	83.5	5	5	5	10		Sat.		
-75										
	-77.3	88.5	38	100/0.4		100/0.4				-77.8 89.0
										-78.2 **COASTAL PLAIN SEDIMENTARY ROCK** 89.4 CEMENTED SAND
										Boring Terminated at Elevation -78.2 ft in SEDIMENTARY ROCK (COASTAL PLAIN)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 369+06	**OFFSET** 45 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.4 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,117	**EASTING** 2,291,628	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/09/15	**COMP. DATE** 07/10/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
15										
10	10.4	0.0	1	1	2	3		M		10.4 0.0 GROUND SURFACE
	6.9	3.5	2	2	1	3		M		**ROADWAY EMBANKMENT** GRAY, BROWN, AND BLACK, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS AND SHELL FRAGMENTS
5										3.9 6.5
	1.9	8.5	2	2	4	6		W		**COASTAL PLAIN** GRAY, BROWN, AND BLACK, SILTY FINE TO COARSE SAND (A-2-4) WITH TRACE ORGANICS AND SHELL FRAGMENTS
0	-3.1	13.5	WOH	WOH	1	1		Sat.		
-5	-8.1	18.5	2	2	4	6		Sat.		
-10	-13.1	23.5	1	2	2	4		Sat.		
-15	-18.1	28.5	2	2	1	3		Sat.		
-20	-23.1	33.5	3	4	6	10		Sat.		
-25	-28.1	38.5	60/0.1			60/0.1		Sat.		-27.9 38.3 **COASTAL PLAIN SEDIMENTARY ROCK** -28.9 39.3 CEMENTED SAND
-30	-33.1	43.5	4	4	5	9		Sat.		**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS
-35	-38.1	48.5	7	18	54	72		Sat.		HARD DRILLING NOTED FROM 51.8' TO 52.2'
-40	-43.1	53.5	20	10	57	67		Sat.		-42.6 53.0 GRAY AND BLACK, CLAYEY FINE SAND (A-2-6)
-45	-48.1	58.5	10	12	11	23		Sat.		-47.6 58.0 GRAY AND BLACK, SILTY CLAY (A-7-6) WITH LITTLE FINE SAND
-50	-53.1	63.5	6	8	10	18		Sat.		
-55	-58.1	68.5	7	14	20	34		Sat.		
-60	-63.1	73.5	8	10	12	22		Sat.		
-65										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 369+06	**OFFSET** 45 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.4 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,117	**EASTING** 2,291,628	**24 HR.** 3.0
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/09/15	**COMP. DATE** 07/10/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				
-70	-68.1	78.5	6	8	8	16		Sat.		-67.6 78.0 GRAY AND BLACK, SILTY CLAY (A-7-6) WITH LITTLE FINE SAND *(continued)* GRAY AND BLACK, CLAYEY FINE SAND (A-2-6)
	-73.1	83.5	5	6	7	13		Sat.		-74.6 85.0 Boring Terminated at Elevation -74.6 ft in SAND (COASTAL PLAIN)

NCDOT BORE DOUBLE R-5021_GEO_BH_BRDG0024.GPJ NC_DOT.GDT 10/8/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 369+89	**OFFSET** 21 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 6.3 ft	**TOTAL DEPTH** 89.8 ft	**NORTHING** 74,145	**EASTING** 2,291,730	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/21/15	**COMP. DATE** 07/21/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
15										
10										
5	6.3	0.0	WOH	1	1	2				6.3 GROUND SURFACE 0.0
										COASTAL PLAIN
	2.8	3.5	3	3	4	7		W		GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS), THIN CLAY SEAMS, AND TRACE TO LITTLE SHELL AND CEMENTED SAND FRAGMENTS
0	-2.2	8.5	2	1	1	2		W		
-5	-7.2	13.5	8	9	10	19		Sat.		
-10	-12.2	18.5	2	3	2	5		Sat.		
-15	-17.2	23.5	WOH	1	1	2		Sat.		
-20	-22.2	28.5	4	4	4	8		Sat.		
-25	-27.2	33.5	5	9	100/0.1	100/0.1				
-30	-28.2	34.5								**COASTAL PLAIN SEDIMENTARY ROCK**
	-29.7	36.0								CEMENTED SAND
	-32.2	38.5	7	6	6	12		Sat.		**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4)
-35	-37.2	43.5	4	5	6	11		Sat.		
-40	-42.2	48.5	12	15	19	34		Sat.		
-45	-47.2	53.5	8	10	17	27		Sat.		
-50	-48.2	54.5								GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND
	-52.2	58.5	6	8	12	20		Sat.		
-55	-57.2	63.5	6	7	8	15		Sat.		
-60	-62.2	68.5	6	11	16	27		Sat.		
-65										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 369+89	**OFFSET** 21 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 6.3 ft	**TOTAL DEPTH** 89.8 ft	**NORTHING** 74,145	**EASTING** 2,291,730	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/21/15	**COMP. DATE** 07/21/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				
	-67.2	73.5	6	6	7	13		Sat.		GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND *(continued)*
-70	-72.2	78.5	5	5	5	10		Sat.		
-75	-71.7	78.0								GRAY AND BLACK, CLAYEY FINE SAND (A-2-6)
	-77.2	83.5	32	59	41/0.2	100/0.7				
-80	-76.9	83.2								**COASTAL PLAIN SEDIMENTARY ROCK** LIMESTONE
	-82.2	88.5	28	32	68/0.3	100/0.8				
	-83.5	89.8								Boring Terminated at Elevation -83.5 ft in SEDIMENTARY ROCK (COASTAL PLAIN)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. B2-C	**STATION** 369+73	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.6 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,127	**EASTING** 2,291,705	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/20/15	**COMP. DATE** 07/21/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
15										
10	10.6	0.0	WOH	1	1	2		M		10.6 0.0 GROUND SURFACE
	7.1	3.5	1	1	1	2		M		**ROADWAY EMBANKMENT** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND SHELL FRAGMENTS
5	2.1	8.5	WOH	1	3	4		W		4.6 6.0
0	-2.9	13.5	1	4	2	6		W		**COASTAL PLAIN** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND SHELL FRAGMENTS
-5	-7.9	18.5	6	5	8	13		Sat.		
-10	-12.9	23.5	4	3	2	5		Sat.		-13.9 24.5 **COASTAL PLAIN** GRAY, CLAYEY FINE SAND (A-2-6) WITH TRACE TO LITTLE SHELL FRAGMENTS
-15	-17.9	28.5	1	2	3	5		Sat.		
-20	-22.9	33.5	2	3	4	7		Sat.		
-25	-27.9	38.5	17	100/0.1		100/0.1		Sat.		-28.4 39.0 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND -29.4 40.0 **COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4)
-30	-32.9	43.5	6	6	5	11		Sat.		
-35	-37.9	48.5	6	8	22	30		Sat.		
-40	-42.9	53.5	21	20	37	57		Sat.		-42.4 53.0 GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND
-45	-47.9	58.5	7	14	13	27		Sat.		
-50	-52.9	63.5	23	48	27	75		Sat.		
-55	-57.9	68.5	7	8	14	22		Sat.		
-60	-62.9	73.5	8	9	13	22		Sat.		
-65										

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND *(continued)*
-70	-67.9	78.5	5	6	7	13		Sat.		
	-72.9	83.5	5	5	6	11		Sat.		-74.4 85.0 Boring Terminated at Elevation -74.4 ft in CLAY (COASTAL PLAIN)

NCDOT BORE DOUBLE R-5021_GEO_BH_BRDG0024.GPJ NC_DOT.GDT 10/8/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 369+64	**OFFSET** 33 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.3 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 74,106	**EASTING** 2,291,686	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/15/15	**COMP. DATE** 07/16/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
15										
10	9.3	1.0	7	43	3	46		M		10.3 GROUND SURFACE 0.0 9.3 ASPHALT 1.0
	6.8	3.5	3	3	2	5		M		**ROADWAY EMBANKMENT** GRAY AND BROWN, SILTY FINE SAND (A-2-4) WITH LITTLE CLAY
5	1.8	8.5	2	2	1	3		W		2.3 8.0 **COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS
0	-3.2	13.5	1	1	1	2		Sat.		
-5	-8.2	18.5	5	3	7	10		Sat.		
-10	-13.2	23.5	WOH	2	2	4		Sat.		-12.7 23.0 GRAY, CLAYEY FINE TO COARSE SAND (A-2-6) WITH TRACE SHELL FRAGMENTS
-15	-18.2	28.5	WOH	2	3	5		Sat.		
-20	-23.2	33.5	5	3	4	7		Sat.		
-25	-28.2	38.5	100/0.2			100/0.2				-28.2 38.5 -29.2 **COASTAL PLAIN SEDIMENTARY ROCK** 39.5 CEMENTED SAND
-30	-33.2	43.5	5	4	4	8		Sat.		**COASTAL PLAIN** GRAY, SILTY FINE SAND (A-2-4) WITH THIN CLAY SEAMS
-35	-38.2	48.5	6	15	26	41		Sat.		HARDER DRILLING NOTED FROM 51.0' TO 51.7'
-40	-43.2	53.5	17	13	13	26		Sat.		
-45	-48.2	58.5	6	8	11	19		Sat.		-47.7 58.0 GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND
-50	-53.2	63.5	8	10	19	29		Sat.		
-55	-58.2	68.5	7	11	14	25		Sat.		
-60	-63.2	73.5	7	8	11	19		Sat.		
-65										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 369+64	**OFFSET** 33 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.3 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 74,106	**EASTING** 2,291,686	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/15/15	**COMP. DATE** 07/16/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				
-70	-68.2	78.5	6	7	7	14		Sat.		GRAY AND BLACK, SILTY CLAY (A-7-6) WITH TRACE FINE SAND *(continued)* -67.7 78.0 GRAY AND BLACK, SILTY FINE SAND (A-2-4)
-75	-73.2	83.5	5	6	7	13		Sat.		
-80	-78.2	88.5	49	54	46/0.5	100/1.0				-77.7 88.0 **COASTAL PLAIN SEDIMENTARY ROCK** GRAY, LIMESTONE WITH TRACE CEMENTED SAND
	-83.2	93.5	40	60/0.4		100/0.9				-84.1 94.4 Boring Terminated at Elevation -84.1 ft in SEDIMENTARY ROCK (COASTAL PLAIN)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** Corey Futral	
SITE DESCRIPTION NC 211 FROM WEST OF SR 1500 (MIDWAY ROAD) TO EAST OF NC 87				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 370+50	**OFFSET** 27 ft LT	**ALIGNMENT** -L-	**0 HR.** 3.7
COLLAR ELEV. 5.8 ft	**TOTAL DEPTH** 84.1 ft	**NORTHING** 74,126	**EASTING** 2,291,789	**24 HR.** 2.5
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER D.T. Chalmers, Jr.	**START DATE** 10/09/14	**COMP. DATE** 10/13/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
10										
5	5.8	0.0								5.8 GROUND SURFACE 0.0
	3.3	2.5	2	1	2	3 3		M		**UNDIVIDED COASTAL PLAIN**
0	0.5	5.3	2	1	2			W		3.8 Med. gray, f. SAND 2.0 Black, Silty, f. SAND w/some organics
	-2.7	8.5	1	4	6	10	SS-13	Sat.		1.3 4.5 Med. brown to gray, f. SAND
-5	-7.7	13.5	WOH	2	2	4	SS-14	Sat.		-1.7 7.5 Med. gray, Silty CLAY w/tr. f. sand
-10	-12.7	18.5	3	2	3	5		Sat.		-5.7 11.5 **COASTAL PLAIN** Med. gray, SILT w/tr. clay and shell frags. Waccamaw Formation
-15	-17.7	23.5	4	3	3	6		Sat.		
-20			WOH	1	1	2		Sat.		
-25	-22.7	28.5	2	3	5	8		Sat.		
-30	-27.7	33.5	30	70/0.1		100/0.6	SS-15	Sat.		-28.3 34.1 Med. gray, Silty, f. SAND w/cemented sand frags.
-35	-32.7	38.5	6	8	6	14		Sat.		-31.2 37.0 Med. gray, Sandy SILT
-40	-37.7	43.5	4	5	8	13		Sat.		
-45	-42.7	48.5	9	11	30	41		Sat.		
-50	-47.7	53.5	6	15	24	39		Sat.		
-55	-52.7	58.5	5	6	20	26		Sat.		
-60	-57.7	63.5	20	22	20	42		Sat.		-60.2 66.0 Dark gray, Clayey SILT
-65	-62.7	68.5	7	10	12	22		Sat.		-66.2 72.0 Dark gray, Sandy SILT
-70	-67.7	73.5	5	6	6	12		Sat.		

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** Corey Futral	
SITE DESCRIPTION NC 211 FROM WEST OF SR 1500 (MIDWAY ROAD) TO EAST OF NC 87				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 370+50	**OFFSET** 27 ft LT	**ALIGNMENT** -L-	**0 HR.** 3.7
COLLAR ELEV. 5.8 ft	**TOTAL DEPTH** 84.1 ft	**NORTHING** 74,126	**EASTING** 2,291,789	**24 HR.** 2.5
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER D.T. Chalmers, Jr.	**START DATE** 10/09/14	**COMP. DATE** 10/13/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-70						Match Line				Dark gray, Sandy SILT *(continued)*
-75	-72.7	78.5	5	6	7	13		Sat.		-76.2 82.0 **COASTAL PLAIN SEDIMENTARY ROCK**
	-77.7	83.5	31	69/0.1		100/0.6		Sat.		-78.3 Gray, Weathered Limestone 84.1 Boring Terminated at Elevation -78.3 ft in LIMESTONE (COASTAL PLAIN)

NCDOT BORE DOUBLE R-5021_GEO_BH_BRDG0024.GPJ NC_DOT.GDT 10/8/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 370+09	**OFFSET** 5 ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 10.6 ft	**TOTAL DEPTH** 80.0 ft	**NORTHING** 74,113	**EASTING** 2,291,738 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/22/15	**COMP. DATE** 07/22/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
15										
10	10.6	0.0	2	2	4	6		M		10.6 GROUND SURFACE 0.0 **ROADWAY EMBANKMENT** GRAY, BROWN, AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS)
	7.1	3.5	2	2	1	3		M		
5	2.1	8.5	3	1	2	3		Sat.		4.6 6.0 **COASTAL PLAIN** GRAY, BROWN, AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS (ROOTS)
0	-2.9	13.5	1	1	1	2		Sat.		-2.4 13.0 GRAY, CLAYEY FINE SAND (A-2-6) WITH TRACE TO LITTLE SHELL FRAGMENTS
-5	-7.9	18.5	5	5	6	11		Sat.		
-10	-12.9	23.5	1	1	1	2		Sat.		
-15	-17.9	28.5	WOH	1	3	4		Sat.		
-20	-22.9	33.5	2	4	4	8		Sat.		
-25	-27.9	38.5	100/0.2			100/0.2				-27.9 38.5 -28.9 39.5 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND **COASTAL PLAIN** GRAY AND BLACK, CLAYEY FINE SAND (A-2-6)
-30	-32.9	43.5	5	4	5	9		Sat.		
-35	-37.9	48.5	5	20	40	60		Sat.		HARDER DRILLING NOTED FROM 52.0' TO 53.0'
-40	-42.9	53.5	19	16	46	62		Sat.		-42.4 53.0 **COASTAL PLAIN** GRAY AND BLACK, CLAYEY FINE SANDY SILT (A-4)
-45	-47.9	58.5	6	16	14	30		Sat.		
-50	-52.9	63.5	12	11	12	23		Sat.		
-55	-57.9	68.5	13	15	20	35		Sat.		
-60	-62.9	73.5	9	11	12	23		Sat.		
-65										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 370+09	**OFFSET** 5 ft RT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 10.6 ft	**TOTAL DEPTH** 80.0 ft	**NORTHING** 74,113	**EASTING** 2,291,738 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER S. DAVIS	**START DATE** 07/22/15	**COMP. DATE** 07/22/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				
	-67.9	78.5	6	7	7	14		Sat.		**COASTAL PLAIN** GRAY AND BLACK, CLAYEY FINE SANDY SILT (A-4) *(continued)* -69.4 80.0 Boring Terminated at Elevation -69.4 ft in SILT (COASTAL PLAIN)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 370+01	**OFFSET** 35 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.2 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,089	**EASTING** 2,291,719	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/16/15	**COMP. DATE** 07/17/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
15										
10										10.2 GROUND SURFACE 0.0
	9.1	1.1								9.1 ASPHALT 1.1
	6.7	3.5	10	8	9	17		M		**ROADWAY EMBANKMENT** GRAY AND BROWN, SILTY FINE SAND (A-2-4)
5			2	2	3	5		M		
	1.7	8.5								1.4 8.8
0			2	2	1	3		W		**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4) WITH TRACE ORGANICS AND THIN CLAY SEAMS, TRACE SHELL, AND CEMENTED SAND FRAGMENTS
	-3.3	13.5								
-5			1	1	1	2		Sat.		
	-8.3	18.5								
-10			3	6	8	14		Sat.		
	-13.3	23.5								
-15			1	1	1	2		Sat.		
	-18.3	28.5								
-20			1	2	2	4		Sat.		
	-23.3	33.5								
-25			5	5	8	13		Sat.		
	-28.3	38.5								-28.8 39.0
-30			30	100/0.0		100/0.0				**COASTAL PLAIN SEDIMENTARY ROCK** -30.3 GRAY, CEMENTED SAND 40.5
	-33.3	43.5								**COASTAL PLAIN** GRAY AND BLACK, SILTY FINE SAND (A-2-4)
-35			5	5	6	11		Sat.		
	-38.3	48.5								
-40			4	6	5	11		Sat.		
	-43.3	53.5								-42.8 53.0
-45			10	40	20	60	SS-81	36%		GRAY AND BLACK, CLAYEY FINE SANDY SILT (A-4)
	-48.3	58.5								
-50			19	13	15	28		Sat.		
	-53.3	63.5								
-55			6	15	24	39		Sat.		
	-58.3	68.5								
-60			5	8	10	18		Sat.		
	-63.3	73.5								
-65			6	9	10	19		Sat.		

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** C. WANG	
SITE DESCRIPTION DUAL BRIDGES NO. 24 AND NO. 259 ON NC 211 OVER DUTCHMAN CREEK				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 370+01	**OFFSET** 35 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 10.2 ft	**TOTAL DEPTH** 85.0 ft	**NORTHING** 74,089	**EASTING** 2,291,719	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE F&R5785 CME-55 80% 04/23/2015		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER S. DAVIS	**START DATE** 07/16/15	**COMP. DATE** 07/17/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-65						Match Line				
	-68.3	78.5	6	7	7	14		Sat.		GRAY AND BLACK, CLAYEY FINE SANDY SILT (A-4) *(continued)* -67.8 78.0
-70										GRAY AND BLACK, CLAYEY FINE SAND (A-2-6)
	-73.3	83.5	5	6	7	13		Sat.		-74.8 85.0
										Boring Terminated at Elevation -74.8 ft in SAND (COASTAL PLAIN)

NCDOT BORE DOUBLE R-5021_GEO_BH_BRDG0024.GPJ NC_DOT.GDT 10/8/15

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: R-5021
DESCRIPTION: Dual Bridges Nos. 24 and 259 on NC 211 over Dutchman Creek

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 41582.1.1
DATE SAMPLED: 7/15
SAMPLED FROM: -L-
SUBMITTED BY: P. Alton, PE

COUNTY: Brunswick
RECEIVED: 8/15
REPORTED: 8/15
BY: D. Jenks
Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	SS-18	ST-2	ST-2	SS-23	SS-81											
BORING NO.	EB1-A	EB1-A	EB1-A	EB1-B	EB2-B											
Retained #4 Sieve %	0.9	0.0	0.0	0.1	0.0											
Passing #10 Sieve %	99.1	99.7	100.0	99.8	100.0											
Passing #40 Sieve %	95.6	98.7	98.2	88.1	97.9											
Passing #200 Sieve %	74.8	16.2	51.5	31.6	71.0											
SOIL MORTAR - 100%																
Coarse Sand Ret - #60 %	5.0	2.7	3.6	29.8	3.2											
Fine Sand Ret - #270 %	33.4	81.6	45.8	40.3	42.3											
Silt 0.053 - 0.010 mm %	26.7	4.5	21.2	9.0	29.9											
Clay < 0.010 mm %	34.9	11.3	29.4	20.9	24.6											
L.L.	57	22	38	24	38											
P.L.	33	NP	19	18	30											
P.I.	24	NP	19	6	8											
AASHTO Classification	A-7-5 (2)	A-2-4 (0)	A-6 (7)	A-2-4 (0)	A-4 (6)											
Station	368+84	368+84	368+84	368+63	370+03											
Offset	37' Lt	37' Lt	37' Lt	40' Rt	47' Rt											
Depth (ft)	53.5	19.5	18.5	23.5	53.5											
to	55.0	20.0	19.0	25.0	55.0											
Moisture Content (%)	34.4	65.8	40.3	40.7	35.5											
Organic Content (%)	NT	NT	NT	NT	NT											

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

W.P. Alton, PE
Soils Engineer

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: R-5021
DESCRIPTION: NC 211 from west of SR 1500 (Midway Road) to east of NC 87

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT: 41582.1.1 COUNTY: Brunswick
DATE SAMPLED: 10/13/14 RECEIVED: N/A
SAMPLED FROM: -L- REPORTED: 9/30/15
SUBMITTED BY: P. Alton, PE BY: Catlin

TEST RESULTS

PROJ. SAMPLE NO.	SS-13	SS-14	SS-15													
BORING NO.	L_37050	L_37050	L_37050													
	(EB2-A)	(EB2-A)	(EB2-A)													
Retained #4 Sieve %	0.0	0.5	0.0													
Passing #10 Sieve %	100.0	99.2	100.0													
Passing #40 Sieve %	67.0	99.0	99.0													
Passing #200 Sieve %	3.0	48.0	39.0													
SOIL MORTAR - 100%																
Coarse Sand Ret - #60 %	68.3	2.1	1.1													
Fine Sand Ret - #270 %	30.0	50.3	74.2													
Silt 0.053 - 0.010 mm %	1.4	19.8	15.4													
Clay < 0.010 mm %	0.3	27.8	9.4													
L.L.	21	35	28													
P.L.	NP	17	NP													
P.I.	NP	18	NP													
AASHTO Classification	A-3 (0)	A-6 (5)	A-4 (0)													
Station -L-	370+50	370+50	370+50													
Offset	27' Lt.	27' Lt.	27' Lt.													
Depth (ft)	5.3	8.5	33.5													
to	6.8	10.0	34.1													
Moisture Content (%)	28.0	58.0	31.0													
Organic Content (%)	NT	NT	1.1													

NP=Not plastic
NT=Not tested
ND = Not Determined
CL = Centerline

Soils Engineer

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	16

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY RD) TO NC 87*

SITE DESCRIPTION *BRIDGE OVER CP&L CANAL ON NC 211 BETWEEN NC 133 AND NC 87 LEFT LANE AND RIGHT LANE*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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PERSONNEL

HUNSBERGER, W. S.

MID-ATLANTIC DRILLING

INVESTIGATED BY *HUNSBERGER, W. S.*

DRAWN BY *HUNSBERGER, W. S.*

CHECKED BY *HAMM, J. R.*

SUBMITTED BY *FALCON*

DATE *AUGUST 2017*

NORTH CAROLINA PROFESSIONAL SEAL 036283 ENGINEER W. SCOTT HUNSBERGER

DocuSigned by:
W. Scott Hunsberger 8/16/2017
SIGNATURE DATE
EA39AB9EDF5845A...

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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 EXCAVATION
- 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-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: BM48 -BYI- STA. 369+26, 73' RT, RR SPIKE IN 17" PINE
N: 72776 E: 2293529
ELEVATION: 29.77 FEET

NOTES:
FIAD - FILLED IMMEDIATELY AFTER DRILLING
LT. - LIGHT
DK. - DARK
UCP - UNDIVIDED COASTAL PLAIN

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 30 60
FEET

℄ BRIDGE -L-
STA. 390+15.00

389

390

391

CP&L CANAL

EB1 END BENT LINE

B1 BENT LINE

B2 BENT LINE

EB2 END BENT LINE

NOTE: SUBSURFACE DATA FOR EB1-A ADAPTED FROM BORING LOGS BY OTHERS RECIEVED FROM NCDOT GEU, AUGUST 2015.

NOTE: SUBSURFACE DATA FOR EB2-A ADAPTED FROM BORING LOGS BY OTHERS RECIEVED FROM NCDOT GEU, AUGUST 2015.

EB1-A

EB2-A

EB1-B

B1-B

B2-B

B3-B

B4-B

EB2-B

FSS

W

TC

T

16" PVC

EOI

SUSPENDED UNDER BRIDGE

BRIDGE #93
CONC
100° SKEW

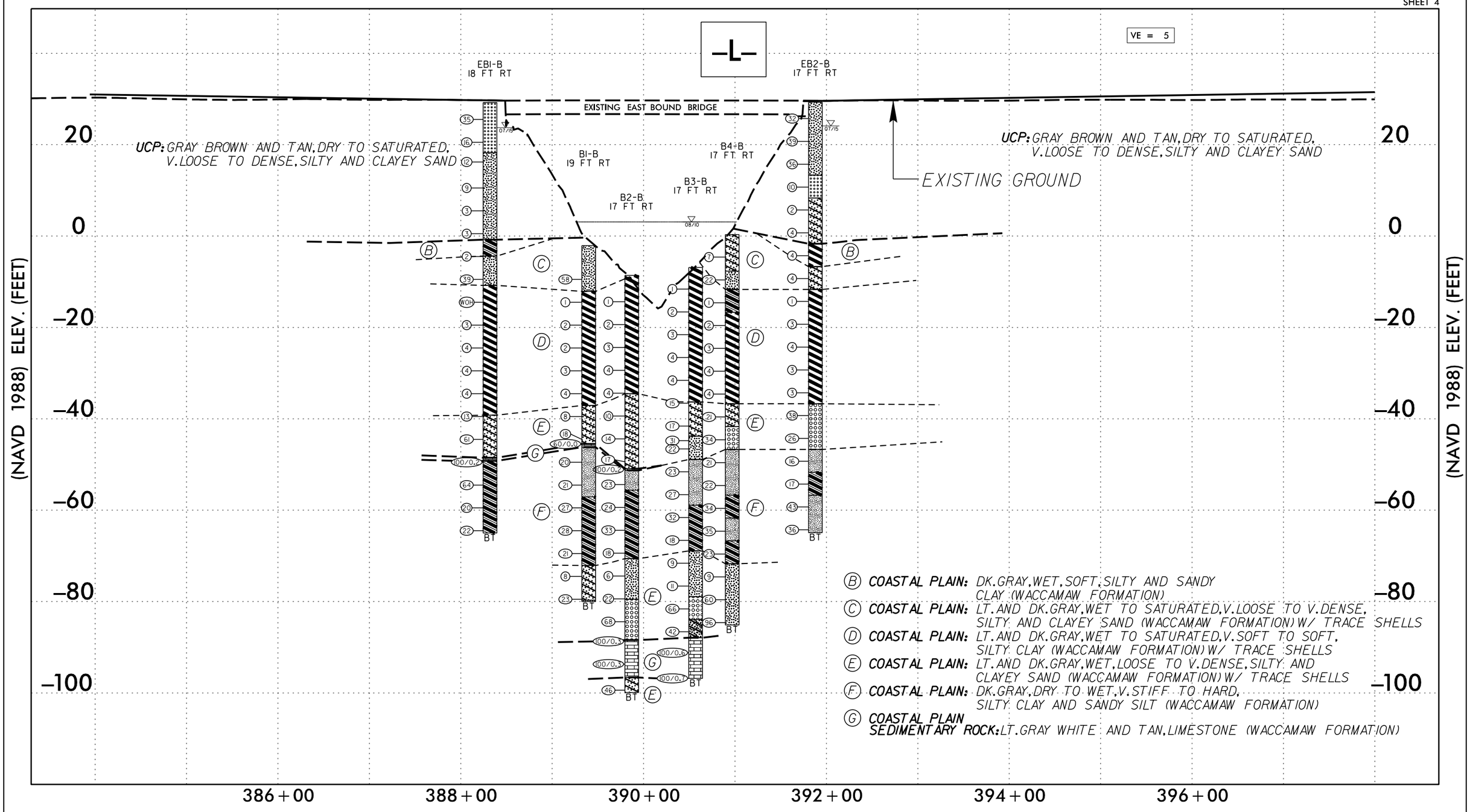
6" PVC

WATER ELEV = 3.10'
9:30 AM 8-25-2010

WOODS

247

CAROLINA POWER &
LIGHT COMPANY
DB 3002 PG 479



NOTES:

- SUBSURFACE PROFILE AT –L– TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU IN SEPTEMBER 2015.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.
- VERTICAL EXAGGERATION = 5

VERTICAL SCALE
0 20 40
FEET

HORIZONTAL SCALE
0 100 200
FEET

FALCON ENGINEERING
FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607
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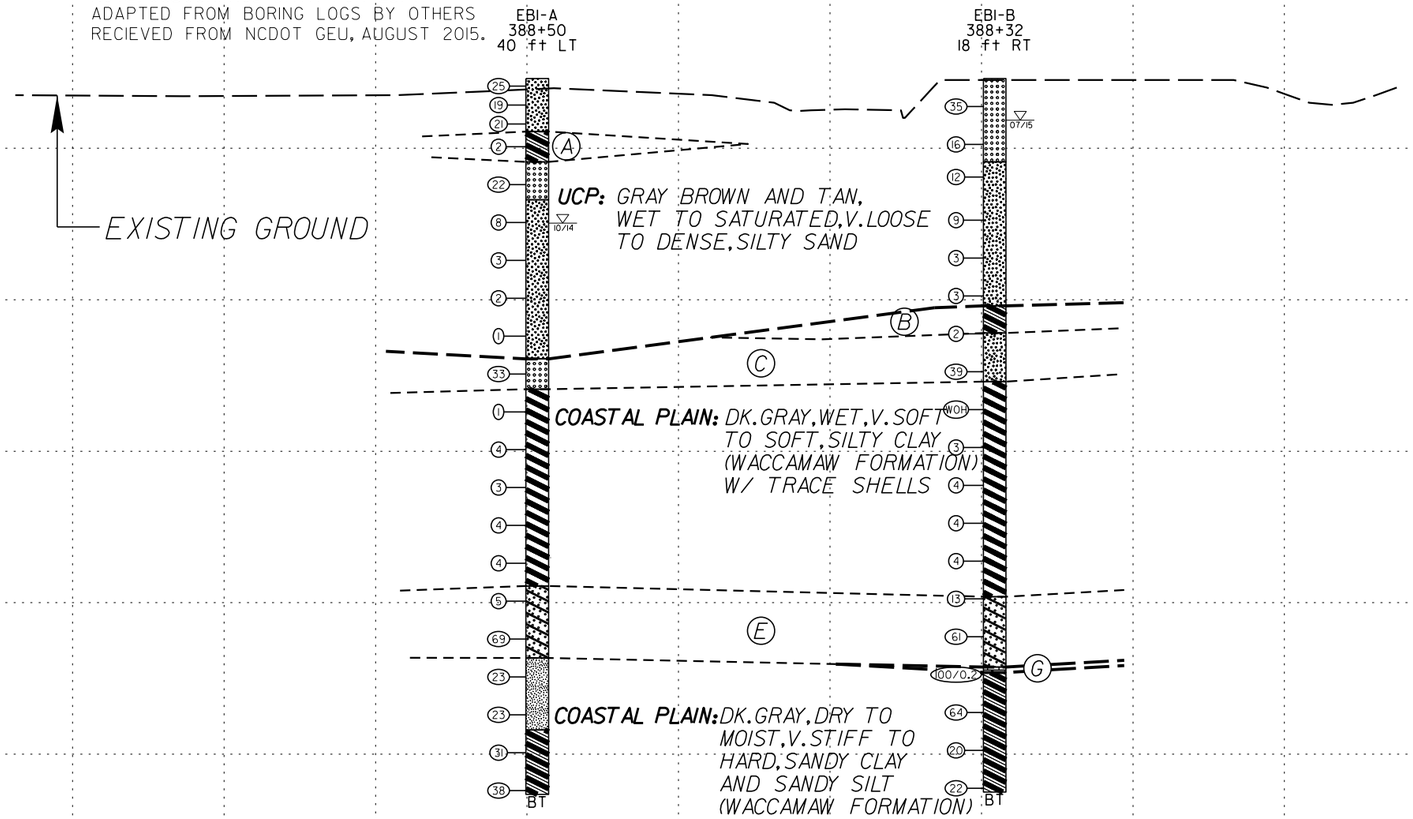
SUBSURFACE PROFILE AT CENTERLINE

BRIDGE ON NC 211 OVER CP&L OUTFALL CANAL
BRUNSWICK COUNTY, NORTH CAROLINA
WBS.: 41582.1.1, TIP.: R–5021

-L-
388+57.85

NOTE: SUBSURFACE DATA FOR EBI-A ADAPTED FROM BORING LOGS BY OTHERS RECIEVED FROM NCDOT GEU, AUGUST 2015.



(A) **UCP:** DK.GRAY, WET, V.SOFT, SANDY CLAY

(B) **COASTAL PLAIN:** DK.GRAY, WET, V.SOFT TO SOFT, SILTY AND AND SANDY CLAY (WACCAMAW FORMATION)

(C) **COASTAL PLAIN:** DK.GRAY, WET, DENSE, SILTY SAND (WACCAMAW FORMATION) W/ TRACE SHELLS

(E) **COASTAL PLAIN:** LT. AND DK.GRAY, WET, LOOSE TO V.DENSE, CLAYEY SAND (WACCAMAW FORMATION) W/ CEMENTED LAYERS

(G) **COASTAL PLAIN SEDIMENTARY ROCK:** LT.GRAY WHITE AND TAN, LIMESTONE (WACCAMAW FORMATION)

(NAVD 1988) ELEV. (FEET): 40, 20, 0, -20, -40, -60, -80

120 100 80 60 40 20 $\mathbb{C}_L$ 20 40 60 80 100 120

NOTES:
- GROUNDLINE CROSS SECTION ALONG BENT TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU, DATED AUGUST 2015.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
- BENT SKEW: 101° 12' 02" TAN. TO CURVE

VERTICAL SCALE 0 20 40 FEET

HORIZONTAL SCALE 0 20 40 FEET

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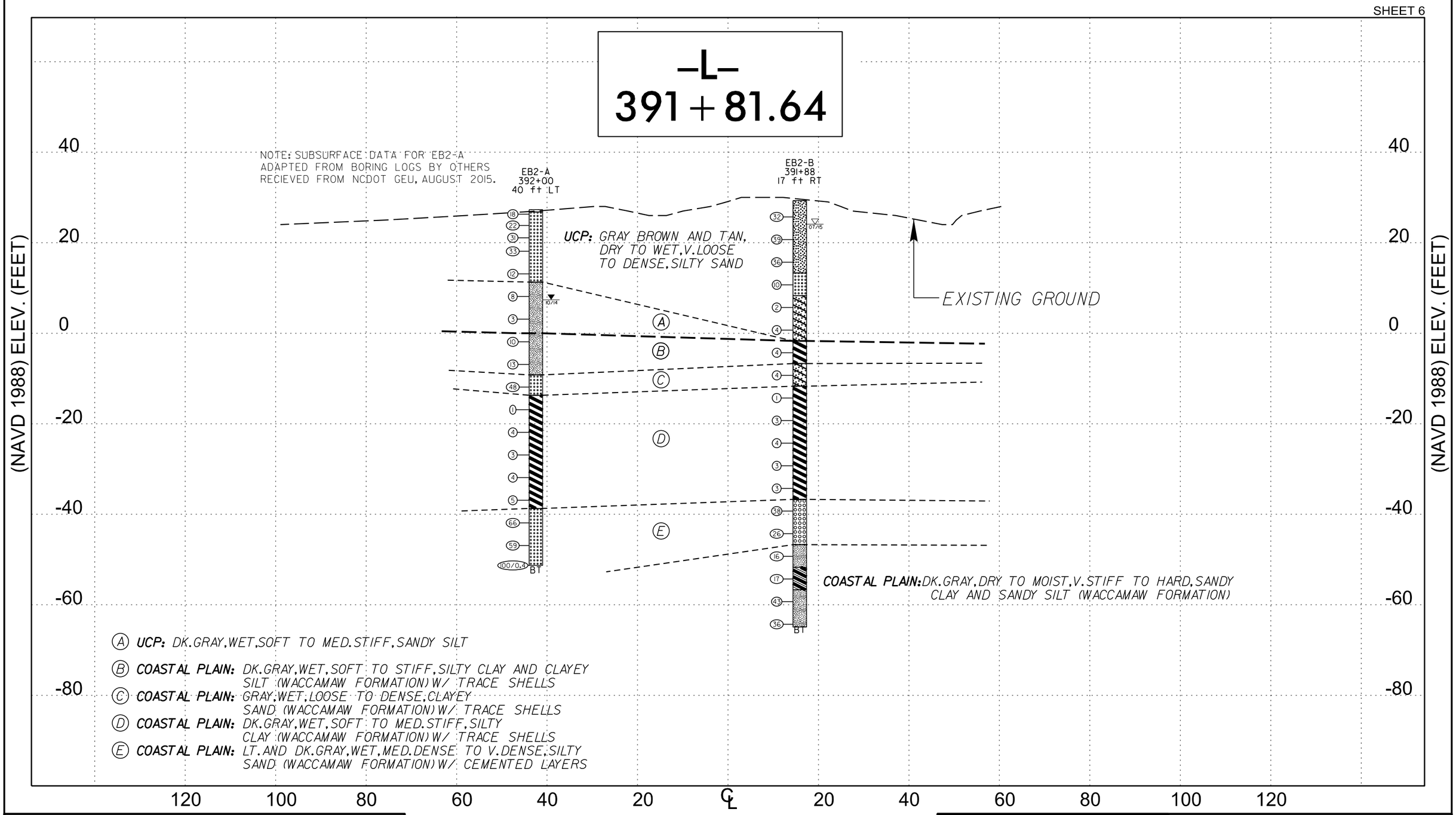
-L - SUBSURFACE CROSS SECTION (END BENT 1)

BRIDGE ON NC 211 OVER CP&L CANAL
BRUNSWICK COUNTY, NC
WBS: 41582.1.1, TIP: R-5021
FALCON PROJECT NO. G15019.00

-L-
391+81.64

NOTE: SUBSURFACE DATA FOR EB2-A ADAPTED FROM BORING LOGS BY OTHERS RECIEVED FROM NCDOT GEU, AUGUST 2015.



Ⓐ **UCP:** DK.GRAY, WET, SOFT TO MED.STIFF, SANDY SILT

Ⓑ **COASTAL PLAIN:** DK.GRAY, WET, SOFT TO STIFF, SILTY CLAY AND CLAYEY SILT (WACCAMAW FORMATION) W/ TRACE SHELLS

Ⓒ **COASTAL PLAIN:** GRAY, WET, LOOSE TO DENSE, CLAYEY SAND (WACCAMAW FORMATION) W/ TRACE SHELLS

Ⓓ **COASTAL PLAIN:** DK.GRAY, WET, SOFT TO MED.STIFF, SILTY CLAY (WACCAMAW FORMATION) W/ TRACE SHELLS

Ⓔ **COASTAL PLAIN:** LT. AND DK.GRAY, WET, MED.DENSE TO V.DENSE, SILTY SAND (WACCAMAW FORMATION) W/ CEMENTED LAYERS

NOTES:
- GROUNDLINE CROSS SECTION ALONG BENT TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU, DATED AUGUST 2015.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
- BENT SKEW: 98° 43' 37" TAN. TO CURVE

VERTICAL SCALE
0 20 40
FEET

HORIZONTAL SCALE
0 20 40
FEET

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-L - SUBSURFACE CROSS SECTION (END BENT 2)

BRIDGE ON NC 211 OVER CP&L CANAL
BRUNSWICK COUNTY, NC
WBS: 41582.1.1, TIP: R-5021
FALCON PROJECT NO. G15019.00

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** FUTRAL, C.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 388+50	**OFFSET** 40 ft LT	**ALIGNMENT** -L-	**0 HR.** 19.1
COLLAR ELEV. 29.3 ft	**TOTAL DEPTH** 94.5 ft	**NORTHING** 73,173	**EASTING** 2,293,320	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 10/13/14	**COMP. DATE** 10/14/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
30	29.3	0.0								29.3 / 0.0 GROUND SURFACE
			3	10	15	25		D		**UNDIVIDED COASTAL PLAIN** Light tan to brown, f. SAND
25	26.8	2.5	11	10	9	19	SS-16	10% D		
	24.3	5.0	7	10	11	21		M		
20	21.3	8.0	1	1	1	2	SS-17	35% Sat.		22.3 / 7.0 Dark gray, Sandy CLAY. Low plast.
	18.3	11.0								Brown, f. to cse. SAND
15	16.3	13.0	7	10	12	22		Sat.		
	13.3	16.0								**COASTAL PLAIN** Med. gray, f. SAND Waccamaw Formation
10	11.3	18.0	4	4	4	8		Sat.		
5	6.3	23.0	2	1	2	3	SS-18	35% Sat.		
0	1.3	28.0	1	1	1	2		Sat.		
-5	-3.7	33.0	1	0	1	1		Sat.		
-10	-8.7	38.0	20	19	14	33		Sat.		-7.7 / 37.0 Lt. gray, f. SAND w/tr. shell frags.
-15	-13.7	43.0	WOH	WOH	1	1	SS-19	63% Sat.		-11.7 / 41.0 Med. gray, Silty CLAY. High. plast.
-20	-18.7	48.0	WOH	2	2	4		Sat.		
-25	-23.7	53.0	1	2	1	3		Sat.		
-30	-28.7	58.0	1	2	2	4		Sat.		
-35	-33.7	63.0	1	2	2	4		Sat.		
-40	-38.7	68.0	2	3	2	5	SS-20	45% Sat.		-37.7 / 67.0 Dark gray, Clayey, f. SAND w/tr. shell frags.
-45	-43.7	73.0	9	10	59	69		Sat.		
-50	-48.7	78.0	4	8	15	23		Sat.		-47.2 / 76.5 Dark gray, SILT

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** FUTRAL, C.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 388+50	**OFFSET** 40 ft LT	**ALIGNMENT** -L-	**0 HR.** 19.1
COLLAR ELEV. 29.3 ft	**TOTAL DEPTH** 94.5 ft	**NORTHING** 73,173	**EASTING** 2,293,320	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 10/13/14	**COMP. DATE** 10/14/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				Dark gray, SILT *(continued)*
	-53.7	83.0	10	10	13	23		Sat.		
-55										-56.7 / 86.0 Dark gray, CLAY w/tr. silt. Med. plast.
	-58.7	88.0	8	13	18	31		Sat.		
-60										
	-63.7	93.0	11	18	20	38		Sat.		-65.2 / 94.5 Boring Terminated at Elevation -65.2 ft
-65										

NOTE: SUBSURFACE DATA FOR EB1-A ADAPTED FROM BORING LOGS BY OTHERS RECEIVED FROM NCDOT GEU, AUGUST 2015.

NCDOT BORE DOUBLE R5021_GEO_GINT.GPJ NC_DOT.GDT 12/15/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 388+32	**OFFSET** 18 ft RT	**ALIGNMENT** -L-	**0 HR.** 5.5 *
COLLAR ELEV. 29.2 ft	**TOTAL DEPTH** 94.2 ft	**NORTHING** 73,140	**EASTING** 2,293,269	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/21/15	**COMP. DATE** 07/22/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
30										29.2 / 0.0 GROUND SURFACE
	26.5	2.7								**UNDIVIDED COASTAL PLAIN** GRAY AND TAN, SLI. SILTY SAND (A-3)
25			7	14	21	35	SS-1	16%		
	21.5	7.7								
20			4	8	8	16		W		
	16.5	12.7								18.2 / 11.0
15			3	5	7	12		W		LT. BROWN AND GRAY, SILTY F. TO MED. SAND (A-2-4)
	11.5	17.7								
10			4	4	5	9		W		
	6.5	22.7								
5			2	2	1	3		Sat.		
	1.5	27.7								
0			2	2	1	3	SS-2	27%		
	-3.5	32.7								-0.8 / 30.0 DK. GRAY, SANDY CLAY (A-6)
-5			1	1	1	2		W		-4.4 / 33.6 **COASTAL PLAIN** DK. GRAY, SILTY F. TO MED. SAND (A-2-4) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
	-8.5	37.7								
-10			12	18	21	39		W		
	-13.5	42.7								-10.8 / 40.0 DK. GRAY, SILTY CLAY (A-7-6) W/ TRACE SHELL FRAGS.
-15			WOH	WOH	WOH	0	SS-3	56%		
	-18.5	47.7								
-20			1	1	2	3		W		
	-23.5	52.7								
-25			1	2	2	4		W		
	-28.5	57.7								
-30			1	2	2	4		W		
	-33.5	62.7								
-35			1	2	2	4		W		
	-38.5	67.7								
-40			2	4	9	13		W		-39.2 / 68.4 DK.TO LT. GRAY, CLAYEY MED. SAND (A-2-6) W/ CSE. SAND
	-43.5	72.7								
-45			5	28	33	61		W		
	-48.5	77.7								-48.5 / 77.7 -49.2 / 78.4 **COASTAL PLAIN SEDIMENTARY ROCK**
-50			100/0.2			100/0.2				

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 388+32	**OFFSET** 18 ft RT	**ALIGNMENT** -L-	**0 HR.** 5.5 *
COLLAR ELEV. 29.2 ft	**TOTAL DEPTH** 94.2 ft	**NORTHING** 73,140	**EASTING** 2,293,269	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/21/15	**COMP. DATE** 07/22/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
	-53.5	82.7	21	14	50	64		D		LIMESTONE OR CEMENTED SAND LAYER (NO RECOVERY) **COASTAL PLAIN** DK. GRAY, SANDY CLAY (A-6) *(continued)*
-55										
	-58.5	87.7	7	8	12	20		D		
-60										
	-63.5	92.7	10	9	13	22		M		-65.0 / 94.2 Boring Terminated at Elevation -65.0 ft IN CP: SANDY CLAY (WACCAMAW FORMATION)
-65										

*0-HOUR WATER LEVEL MAY APPEAR FALSELY HIGH DUE TO FLUID INTRODUCED DURING DRILLING.

NCDOT BORE DOUBLE R5021_GEO_GINT.GPJ NC_DOT.GDT 12/18/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 389+40	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -2.1 ft	**TOTAL DEPTH** 77.9 ft	**NORTHING** 73,070	**EASTING** 2,293,350	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/22/15	**COMP. DATE** 07/23/15	**SURFACE WATER DEPTH** 5.8ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
0										ELEV. (ft) DEPTH (ft)
										-2.1 0.0
-5										**COASTAL PLAIN** LT. GRAY, SILTY F. SAND (A-2-4) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
	-8.5	6.4	21	41	17	58		W		
-10										
	-13.5	11.4	WOH	1	WOH	1		W		-12.1 10.0
-15										DK. GRAY TO LT. GRAY, SILTY CLAY (A-7-6) W/ TRACE SHELL FRAGS.
	-18.5	16.4	1	1	1	2		W		
-20										
	-23.5	21.4	1	1	1	2	SS-4	75%		
-25										
	-28.5	26.4	1	1	2	3		W		
-30										
	-33.5	31.4	1	2	2	4		W		
-35										
	-38.5	36.4	8	4	4	8		W		-37.1 35.0
-40										DK. GRAY, CLAYEY F. TO MED. SAND (A-2-6)
	-43.5	41.4	7	8	10	18	SS-5	35%		
-45	-45.5	43.4	60/0.0			60/0.0		W		-45.5 43.4
	-48.5	46.4	12	10	10	20		W		-46.2 44.1 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND (NO RECOVERY)
-50										**COASTAL PLAIN** DK. BROWN, SLI. SANDY TO CLAYEY SILT (A-4)
	-53.5	51.4	6	7	14	21		W		
-55										
	-58.5	56.4	9	14	13	27		D		-57.1 55.0
-60										DK. GRAY, SANDY CLAY (A-6)
	-63.5	61.4	8	14	14	28		D		
-65										
	-68.5	66.4	7	10	11	21		D		
-70										
	-73.5	71.4	5	4	4	8		W		-72.1 70.0
-75										DK. GRAY, CLAYEY F. SAND (A-2-6)
	-78.5	76.4	5	4	19	23		W		
-80										-79.7 77.6

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 389+40	**OFFSET** 19 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -2.1 ft	**TOTAL DEPTH** 77.9 ft	**NORTHING** 73,070	**EASTING** 2,293,350	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/22/15	**COMP. DATE** 07/23/15	**SURFACE WATER DEPTH** 5.8ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-80						Match Line				-80.0 GRAY, SLI. SILTY CSE. SAND (A-1-b) 77.9 Boring Terminated at Elevation -80.0 ft IN CP: CLAYEY SAND (WACCAMAW FORMATION)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 389+87	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -8.6 ft	**TOTAL DEPTH** 91.3 ft	**NORTHING** 73,040	**EASTING** 2,293,387	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/26/15	**COMP. DATE** 07/27/15	**SURFACE WATER DEPTH** 12.9ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
-5										-8.6 / 0.0
-10										**COASTAL PLAIN** DK. GRAY TO LT. GRAY, SLI. SILTY CLAY (A-7) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
-15	-13.4	4.8	WOH	WOH	1	1		W		
-20	-18.4	9.8	WOH	1	1	2		W		
-25	-23.4	14.8	1	1	2	3		W		
-30	-28.4	19.8	1	2	2	4		W		
-35	-33.4	24.8	1	2	2	4		W		-34.5 / 25.9
-40	-38.4	29.8	2	4	6	10		W		DK. GRAY, CLAYEY MED. TO CSE. SAND (A-2-6)
-45	-43.4	34.8	9	6	8	14		W		
-50	-48.4	39.8	5	9	8	17		W		
	-50.9	42.3	100/0.2			100/0.2				-50.9 / 42.3 -51.3 / 42.7 **COASTAL PLAIN SEDIMENTARY ROCK** CEMENTED SAND (NO RECOVERY)
-55	-53.4	44.8	5	11	12	23		W		**COASTAL PLAIN** DK. GRAY AND BROWN, F. SANDY SILT (A-4) W/ CEMENTED LAYERS
-60	-58.4	49.8	5	6	18	24		W		-55.6 / 47.0 DK. GRAY, SANDY CLAY (A-6) W/ CEMENTED SAND LAYERS
-65	-63.4	54.8	6	11	22	33		W		
-70	-68.4	59.8	6	8	10	18		W		-70.6 / 62.0
-75	-73.4	64.8	3	2	4	6		W		DK. GRAY AND BROWN, SILTY F. SAND (A-2-4)
-80	-78.4	69.8	4	4	18	22		W		-79.5 / 70.9
-85	-83.4	74.8	24	36	32	68	SS-6	16%		GRAY, SLI. SILTY CSE. SAND (A-1-a) W/ CEMENTED LAYERS, LIMESTONE FRAGMENTS, TRACE SHELL FRAGMENTS AND FOSSILS

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 389+87	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -8.6 ft	**TOTAL DEPTH** 91.3 ft	**NORTHING** 73,040	**EASTING** 2,293,387	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/26/15	**COMP. DATE** 07/27/15	**SURFACE WATER DEPTH** 12.9ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-85						Match Line				
-90	-88.4	79.8	100/0.3			100/0.3				-88.4 / 79.8 **COASTAL PLAIN SEDIMENTARY ROCK** WHITE AND LT. GRAY, LIMESTONE
-95	-93.4	84.8	100/0.3			100/0.3				-96.6 / 88.0
	-98.4	89.8	40	16	30	46		W		**COASTAL PLAIN** LT. GRAY AND WHITE, CLAYEY MED. SAND (A-2-6) W/ CEMENTED LAYERS -99.9 / 91.3 Boring Terminated at Elevation -99.9 ft IN CP: CLAYEY SAND (WACCAMAW FORMATION)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 390+57	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -6.9 ft	**TOTAL DEPTH** 89.9 ft	**NORTHING** 73,995	**EASTING** 2,293,440	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/27/15	**COMP. DATE** 07/28/15	**SURFACE WATER DEPTH** 10.4ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
-5										
										-6.9 / 0.0 **COASTAL PLAIN** DK. GRAY, F. TO CSE. SANDY CLAY (A-7) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
-10	-10.6	3.7	WOH	WOH	1	1		W		
-15	-15.6	8.7	1	1	1	2		W		
-20	-20.6	13.7	1	1	2	3		W		
-25	-25.6	18.7	2	2	2	4		W		
-30	-30.6	23.7	1	2	2	4		W		
-35	-35.6	28.7	4	5	10	15		W		-36.3 / 29.4 DK. GRAY, CLAYEY MED. SAND (A-2-6) W/ GRAVEL
-40	-40.6	33.7	10	10	7	17	SS-7	19%		
-45	-43.8	36.9	18	10	21	31		W		-43.8 / 36.9 DK. GRAY, SILTY F. SAND (A-2-4)
	-45.6	38.7	6	10	12	22		W		
-50	-50.6	43.7	10	12	11	23		W		-48.9 / 42.0 DK. GRAY, SLI. SANDY SILT (A-4)
-55	-55.6	48.7	5	11	16	27		W		
-60	-60.6	53.7	13	14	18	32		D		-58.9 / 52.0 DK. GRAY, SANDY CLAY (A-6)
-65	-65.6	58.7	6	7	11	18		W		
-70	-70.6	63.7	3	4	5	9		W		-68.9 / 62.0 DK. GRAY, SILTY F. SAND (A-2-4)
-75	-75.6	68.7	6	5	6	11		W		
-80	-80.6	73.7	21	34	32	66		W		-78.9 / 72.0 LT. GRAY, SLI. CLAYEY CSE. SAND (A-1-b) W/ CEMENTED SAND LAYERS
-85										-83.9 / 77.0

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 390+57	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. -6.9 ft	**TOTAL DEPTH** 89.9 ft	**NORTHING** 73,995	**EASTING** 2,293,440	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/27/15	**COMP. DATE** 07/28/15	**SURFACE WATER DEPTH** 10.4ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-85						Match Line				
	-85.6	78.7	52	15	27	42		W		LT. GRAY, CLAYEY MED. SAND (A-2-6) W/ CEMENTED SAND LAYERS, LIMESTONE FRAGMENTS, TRACE SHELL FRAGMENTS *(continued)*
-90	-90.6	83.7	48	52/0.1		100/0.6				-87.9 / 81.0 **COASTAL PLAIN SEDIMENTARY ROCK** LT. GRAY WHITE AND TAN, LIMESTONE
-95	-95.6	88.7	37	45	55/0.2	100/0.7				-96.8 / 89.9 Boring Terminated at Elevation -96.8 ft IN COASTAL PLAIN SEDIMENTARY ROCK(WACCAMAW FORMATION)

NCDOT BORE DOUBLE R5021_GEO_GINT.GPJ NC_DOT.GDT 12/15/15

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 390+97	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 0.3 ft	**TOTAL DEPTH** 85.4 ft	**NORTHING** 72,969	**EASTING** 2,293,469	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/28/15	**COMP. DATE** 07/29/15	**SURFACE WATER DEPTH** 3.6ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
5										
0										0.3 / 0.0 **UNDIVIDED COASTAL PLAIN** DK. GRAY, CLAYEY F. SAND (A-2-6) W/ TRACE SHELL FRAGS.
-5	-3.6	3.9	2	3	4	7		Sat.		
-10	-8.6	8.9	3	9	13	22		M		-7.7 / 8.0 LT. AND DK. GRAY, SLI. SILTY F. SAND (A-2-4) W/ TRACE SHELL FRAGS.
-15	-13.6	13.9	WOH	WOH	1	1		W		-11.7 / 12.0 **COASTAL PLAIN** DK. GRAY, F. SANDY CLAY (A-6) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
-20	-18.6	18.9	1	1	1	2		W		-16.7 / 17.0 DK. GRAY, SILTY CLAY (A-7) W/ TRACE SHELL FRAGS.
-25	-23.6	23.9	1	1	2	3		W		
-30	-28.6	28.9	1	2	2	4		W		
-35	-33.6	33.9	1	2	2	4		W		
-40	-38.6	38.9	7	10	11	21		W		-36.7 / 37.0 GRAY, CLAYEY MED. TO CSE. SAND (A-2-6)
-45	-43.6	43.9	10	15	19	34		W		-41.7 / 42.0 LT. AND DK. GRAY, SLI. CLAYEY MED. TO CSE. SAND (A-1-b)
-50	-48.6	48.9	4	7	14	21	SS-8	42%		-46.7 / 47.0 DK. GRAY, CLAYEY SILT (A-4) CEMENTED SAND LAYER AT 53.9'
-55	-53.6	53.9	15	10	12	22		W		
-60	-58.6	58.9	11	15	19	34		W		-56.7 / 57.0 DK. GRAY, SANDY CLAY (A-6) W/ CEMENTED SAND LAYERS
-65	-63.6	63.9	16	14	21	35		W		-61.7 / 62.0 DK. GRAY, CLAYEY SILT (A-4) W/ CEMENTED SAND LAYERS
-70	-68.6	68.9	8	10	13	23		W		-66.7 / 67.0 DK. GRAY, SANDY CLAY (A-6)
-75	-73.6	73.9	4	4	5	9		W		-71.7 / 72.0 LT. AND DK. GRAY, SILTY F. SAND (A-2-4) W/ LIMESTONE FRAGMENTS

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 390+97	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 0.3 ft	**TOTAL DEPTH** 85.4 ft	**NORTHING** 72,969	**EASTING** 2,293,469	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/28/15	**COMP. DATE** 07/29/15	**SURFACE WATER DEPTH** 3.6ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-75						Match Line				
-80	-78.6	78.9	6	7	53	60		W		LT. AND DK. GRAY, SILTY F. SAND (A-2-4) W/ LIMESTONE FRAGMENTS *(continued)*
-85	-83.6	83.9	46	34	62	96		W		-85.1 / 85.4 Boring Terminated at Elevation -85.1 ft IN CP: SILTY SAND (WACCAMAW FORMATION)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** FUTRAL, C	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 392+00	**OFFSET** 40 ft LT	**ALIGNMENT** -L-	**0 HR.** 18.8
COLLAR ELEV. 27.4 ft	**TOTAL DEPTH** 78.6 ft	**NORTHING** 72,941	**EASTING** 2,293,584	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 10/14/14	**COMP. DATE** 10/16/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
30										
	27.4	0.0	2	9	9	18		D		27.4 / 0.0 GROUND SURFACE
	26.9	0.5								**UNDIVIDED COASTAL PLAIN**
25	24.9	2.5	10	11	11	22		M		Dark brown, Org. rich surficial material.
	22.2	5.2	10	12	19	31		M		Tan to med. brown, f. SAND
20	19.2	8.2	13	16	17	33		W		
15	14.2	13.2	4	5	7	12		Sat.		
	11.4	16.0								**COASTAL PLAIN**
10	9.2	18.2	3	4	4	8		Sat.		Med. gray, Silty SAND Waccamaw Formation
5	4.2	23.2	1	2	1	3		Sat.		
0	-0.8	28.2	5	6	4	10		Sat.		
-5	-5.8	33.2	4	5	8	13		Sat.		
-10	-9.1	36.5								Lt. gray, f. SAND
	-10.8	38.2	21	22	26	48		Sat.		
-15	-13.6	41.0								Med. gray, CLAY.
	-15.8	43.2	WOH	WOH	1	1		Sat.		
-20	-20.8	48.2	WOH	2	2	4		Sat.		
-25	-25.8	53.2	1	1	2	3		Sat.		
-30	-30.8	58.2	1	2	2	4		Sat.		
-35	-35.8	63.2	1	2	3	5		Sat.		
	-38.6	66.0								Lt. gray, f. SAND
-40	-40.8	68.2	20	21	45	66		Sat.		
-45	-45.8	73.2	21	35	24	59		Sat.		
-50										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** FUTRAL, C	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 392+00	**OFFSET** 40 ft LT	**ALIGNMENT** -L-	**0 HR.** 18.8
COLLAR ELEV. 27.4 ft	**TOTAL DEPTH** 78.6 ft	**NORTHING** 72,941	**EASTING** 2,293,584	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 77.2% 01/09/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 10/14/14	**COMP. DATE** 10/16/14	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
	-50.8	78.2	100/.4			100/0.4		Sat.		-51.2 / 78.6
										Boring Terminated at Elevation -51.2 ft

NOTE: SUBSURFACE DATA FOR EB2-A ADAPTED FROM BORING LOGS BY OTHERS RECEIVED FROM NCDOT GEU, AUGUST 2015.

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 391+88	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** 5.2 *
COLLAR ELEV. 29.3 ft	**TOTAL DEPTH** 94.1 ft	**NORTHING** 72,906	**EASTING** 2,293,536	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/29/15	**COMP. DATE** 07/30/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
30										29.3 0.0 GROUND SURFACE
	26.7	2.6	9	13	19	32		D		**UNDIVIDED COASTAL PLAIN** BROWN AND TAN, SILTY F. SAND (A-2-4)
25	21.7	7.6	8	16	23	39		M		
20	16.7	12.6	10	15	21	36		M		
15	11.7	17.6	4	4	6	10	SS-9	20%		13.3 16.0 DK. BROWN, SLI. SILTY MED. SAND (A-3)
10	6.7	22.6	2	1	1	2		W		8.3 21.0 DK. GRAY, CLAYEY F. SAND (A-2-6)
5	1.7	27.6	1	2	2	4		W		
0	-3.3	32.6	1	1	3	4		W		-1.7 31.0 **COASTAL PLAIN** DK. GRAY, CSE. SANDY CLAY (A-7) W/ TRACE SHELL FRAGS. (WACCAMAW FORMATION)
-5	-8.3	37.6	2	2	2	4		W		-6.7 36.0 DK. GRAY, CLAYEY F. SAND (A-2-6) W/ TRACE SHELL FRAGS.
-10	-13.3	42.6	1	WOH	1	1		W		-11.7 41.0 DK. GRAY, SLI. F. SANDY TO SILTY CLAY (A-7-6) W/ TRACE SHELL FRAGS.
-15	-18.3	47.6	1	1	2	3	SS-10	63%		
-20	-23.3	52.6	1	2	2	4		W		
-25	-28.3	57.6	1	1	2	3		W		
-30	-33.3	62.6	1	1	2	3		W		
-35	-38.3	67.6	14	20	18	38		W		-36.7 66.0 LT. AND DK. GRAY, SLI. SILTY MED.TO CSE. SAND (A-1-b)
-40	-43.3	72.6	19	11	15	26		W		
-45	-48.3	77.6	4	6	10	16		W		-46.7 76.0 DK. GRAY, F. SANDY SILT (A-4)
-50										

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** HUNSBERGER, W. S.	
SITE DESCRIPTION BRIDGE ON NC 211 OVER CP&L CANAL				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 391+88	**OFFSET** 17 ft RT	**ALIGNMENT** -L-	**0 HR.** 5.2 *
COLLAR ELEV. 29.3 ft	**TOTAL DEPTH** 94.1 ft	**NORTHING** 72,906	**EASTING** 2,293,536	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MID3964 CME-45C 83% 08/07/2014		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 07/29/15	**COMP. DATE** 07/30/15	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				DK. GRAY, F. SANDY SILT (A-4) *(continued)*
	-53.3	82.6	7	7	10	17		W		-51.7 81.0 DK. GRAY, SANDY CLAY (A-6)
-55	-58.3	87.6	15	15	28	43		D		-56.7 86.0 DK. GRAY, CLAYEY SILT (A-4)
-60	-63.3	92.6	9	16	20	36		D		-64.8 94.1 Boring Terminated at Elevation -64.8 ft IN CP: CLAYEY SILT (WACCAMAW FORMATION)

*0-HOUR WATER LEVEL MAY APPEAR FALSELY HIGH DUE TO FLUID INTRODUCED DURING DRILLING.

Falcon Engineering, Inc. **1210 Trinity Road, Suite 110, Raleigh, NC 27607**

LABORATORY TEST RESULTS

BRIDGE ON NC 211 OVER CP&L CANAL
BRUNSWICK COUNTY, NORTH CAROLINA
Project: 41582.1.1 (R-5021)
Falcon Engineering Project No.: G15019.00

SAMPLE			DEPTH	AASHTO	ATTERBERG LIMITS		% BY WEIGHT				% PASSING (SIEVES)			%
NO.	STATION	OFFSET	INTERVAL	CLASS.	L.L.	P.I.	C.SAND	F.SAND	SILT	CLAY	10	40	200	MOISTURE
SS-1	388+32	18 ft RT	2.7-4.2	A-3	17	NP	25	68	4	3	100	96	8	16.0
SS-2	388+32	18 ft RT	27.7-29.2	A-2-4	26	NP	1	88	0	11	100	100	34	27.3
SS-3	388+32	18 ft RT	42.7-44.2	A-7-6	47	22	1	22	45	32	100	100	86	55.8
SS-4	389+40	19 ft RT	21.4-23.9	A-7-6	68	28	0	4	46	50	100	100	98	75.0
SS-5	389+40	19 ft RT	41.4-43.9	A-2-6	30	15	37	30	9	24	100	78	34	34.8
SS-6	389+87	17 ft RT	74.8-76.3	A-1-a	17	NP	64	15	15	6	41	19	9	15.6
SS-7	390+57	17 ft RT	33.7-35.2	A-2-6	38	16	70	6	9	15	92	35	22	18.6
SS-8	390+97	17 ft RT	48.9-50.4	A-4	39	30	2	43	30	25	100	99	74	41.8
SS-9	391+88	17 ft RT	17.6-19.1	A-3	18	NP	39	57	4	0	100	83	5	19.9
SS-10	391+88	17 ft RT	47.6-49.1	A-7-6	49	27	1	11	54	34	100	100	94	63.3

Signature: **NCDOT No.:** 123-01-0509

Notes: LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index = LL - PL
* Classification based only on field classification

CATLIN Engineers and Scientists 220 Old Dairy Road Wilmington, NC 28405 Corporate Licensure No. for Engineering Services C-0585 214114	PROJECT REFERENCE NO.	SHEET
	R-5021	16

Laboratory test data prepared by Catlin provided to Falcon by NCDOT GEU in December 2015.

LABORATORY SUMMARY SHEET

AASHTO Standard Specifications

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

TEST RESULTS															
Proj. Sample Number	SS-16	SS-17	SS-18	SS-19	SS-20										
Lab Sample Number	SS-16	SS-17	SS-18	SS-19	SS-20										
Retained #4 Sieve %	0	0	0	0	2.6										
Passing #10 Sieve %	99.9	100	100	99.2	96.8										
Passing #40 Sieve %	92	96	100	99	75										
Passing #200 Sieve %	20	36	26	84	31										
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	18.0	17.0	0.6	1.0	63.0										
Fine Sand Ret.-#270 %	64.8	49.5	87.5	23.3	6.9										
Silt 0.05 - 0.005mm %	9.8	11.0	5.6	42.6	12.2										
Clay <0.005mm %	7.3	22.5	6.3	33.1	17.9										
Liquid Limit (LL)	19	26	25	51	27										
Plasticity Index (PI)	NP	11	NP	28	13										
AASHTO Classification /Group Index	A-2-4(0)	A-6(0)	A-2-4(0)	A-7-6(25)	A-2-6(0)										
Organic Content %	N/A	N/A	N/A	N/A	N/A										
Station	388+50	388+50	388+50	388+50	388+50										
Offset	40ft LT	40ft LT	40ft LT	40ft LT	40ft LT										
Alignment	-L-	-L-	-L-	-L-	-L-										
Boring Identification	EB1-A	EB1-A	EB1-A	EB1-A	EB1-A										
Depth (FT)	2.5	8.0	23.0	43.0	68.0										
to	4.0	9.5	24.5	44.5	69.5										
Field Moisture Content	10	35	35	63	45										
Tested By	M. Mason	M. Mason	M. Mason	M. Mason	M. Mason										
Submitted By	S. Hudson	S. Hudson	S. Hudson	S. Hudson	S. Hudson										
Date Submitted	10/15/14	10/15/14	10/15/14	10/15/14	10/15/14										

NP = Non-Plastic

N/A = Not Applicable / Not Analyzed

Laboratory Manager

Report Date: 12/11/2015

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	8

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *BRIDGE ON -Y14A- (NC 133) OVER -L- (NC 211) AT -Y14A- STA. 39+52.37*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

LINDSAY PUGH

MICHAEL D. MASON

T. SPENCER

INVESTIGATED BY *J. L. STONE, LG*

DRAWN BY *S. V. HUDSON, LG*

CHECKED BY *J. L. STONE, LG*

SUBMITTED BY *S. V. HUDSON, LG*

DATE *DECEMBER 2017*

CATLIN Engineers and Scientists

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V. HUDSON

DocuSigned by:

62EFD88181E445F...

1/29/2018

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R–5021	2

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 RESISTANCE (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:
- [ ] CME-45C
- [ ] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] DIEDRICH D-50
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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 YIELD 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: BORING ELEVATIONS OBTAINED WITH RTK SURVEY GRADE GLOBAL POSITIONING SYSTEM.

ELEVATION: FEET

NOTES:

FIAD = FILLED IMMEDIATELY AFTER DRILLING
UCP = UNDIVIDED COASTAL PLAIN

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 30 60
FEET

SKEW = 87° 26' 33"

39+00

40+00

330+00

TO SR 1549

EB1 BENT LINE

EB2 BENT LINE

EB1-A

EB2-A

EB1-B

EB2-B

–Y14A–

–L–

NC 133

TO SR 1857

TO NC 87

TO SR 1852

NC 211

C

F

–Y14A– POT STA. 39+52.37 =
–L– POT STA. 331+20.00

0 20 40
FEET
VE = 2.0

PROFILE THROUGH BORINGS PROJECTED ALONG -Y14A-

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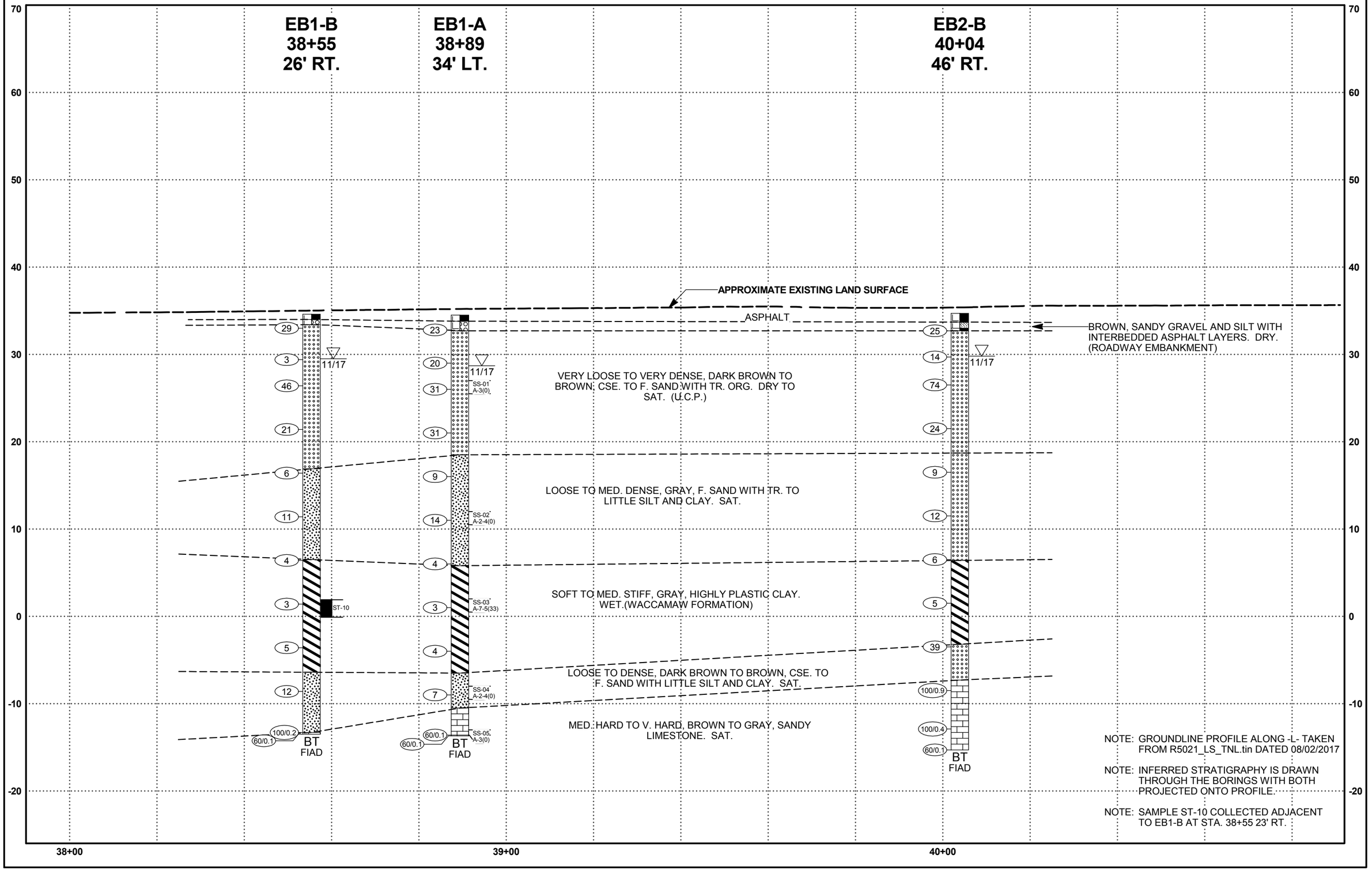
PROJECT REFERENCE NO.	SHEET
R-5021	4



NOTE: GROUNDLINE PROFILE ALONG -L- TAKEN FROM R5021_LS_TNL.tin DATED 08/02/2017

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

NOTE: SAMPLE ST-10 COLLECTED ADJACENT TO EB1-B AT STA. 38+55 23' RT.

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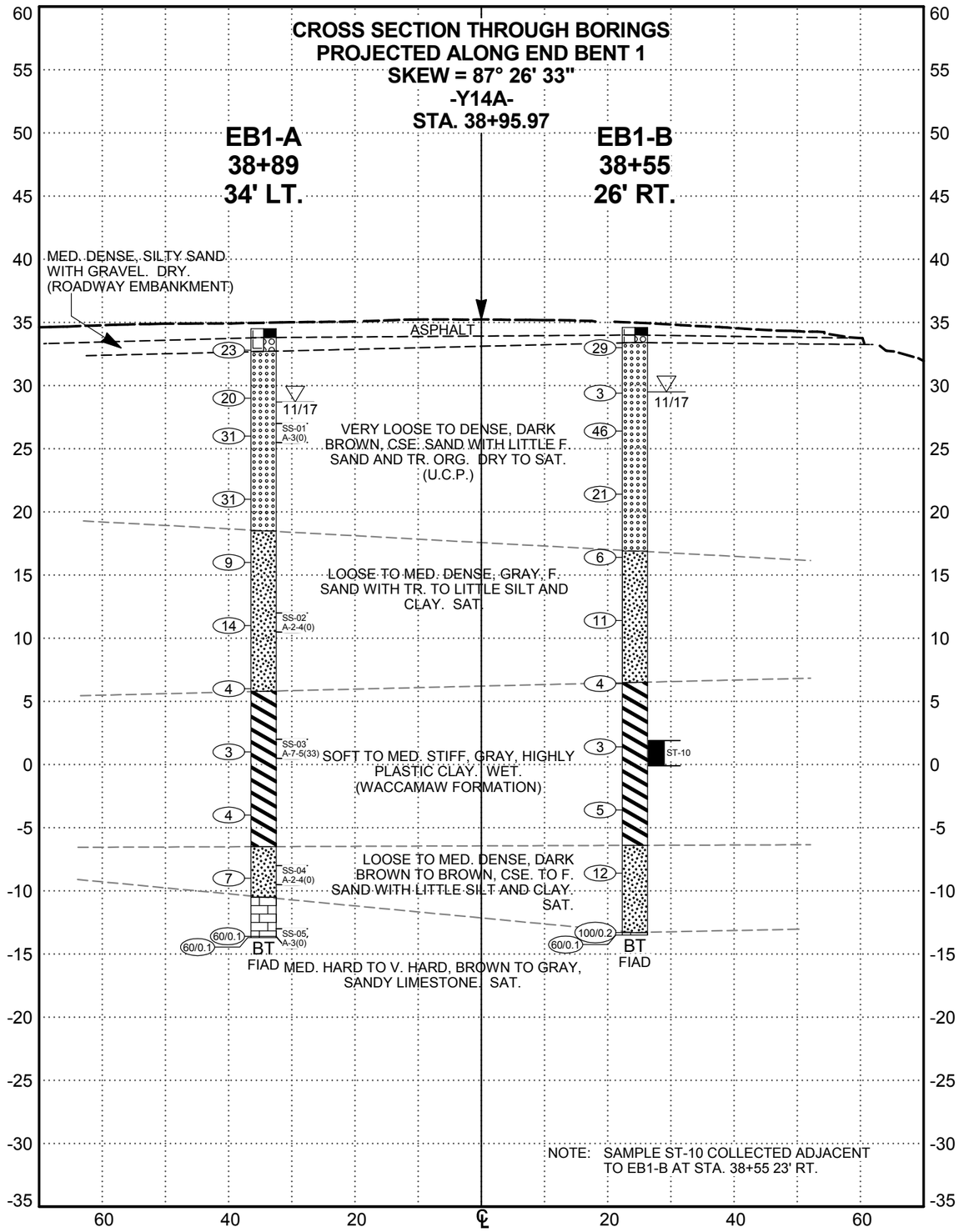
0 20 40
FEET
VE = 2.0

CROSS SECTION THROUGH BORINGS PROJECTED ALONG END BENT 1 SKEW = 87° 26' 33" -Y14A- STA. 38+95.97

EB1-A
38+89
34' LT.

EB1-B
38+55
26' RT.

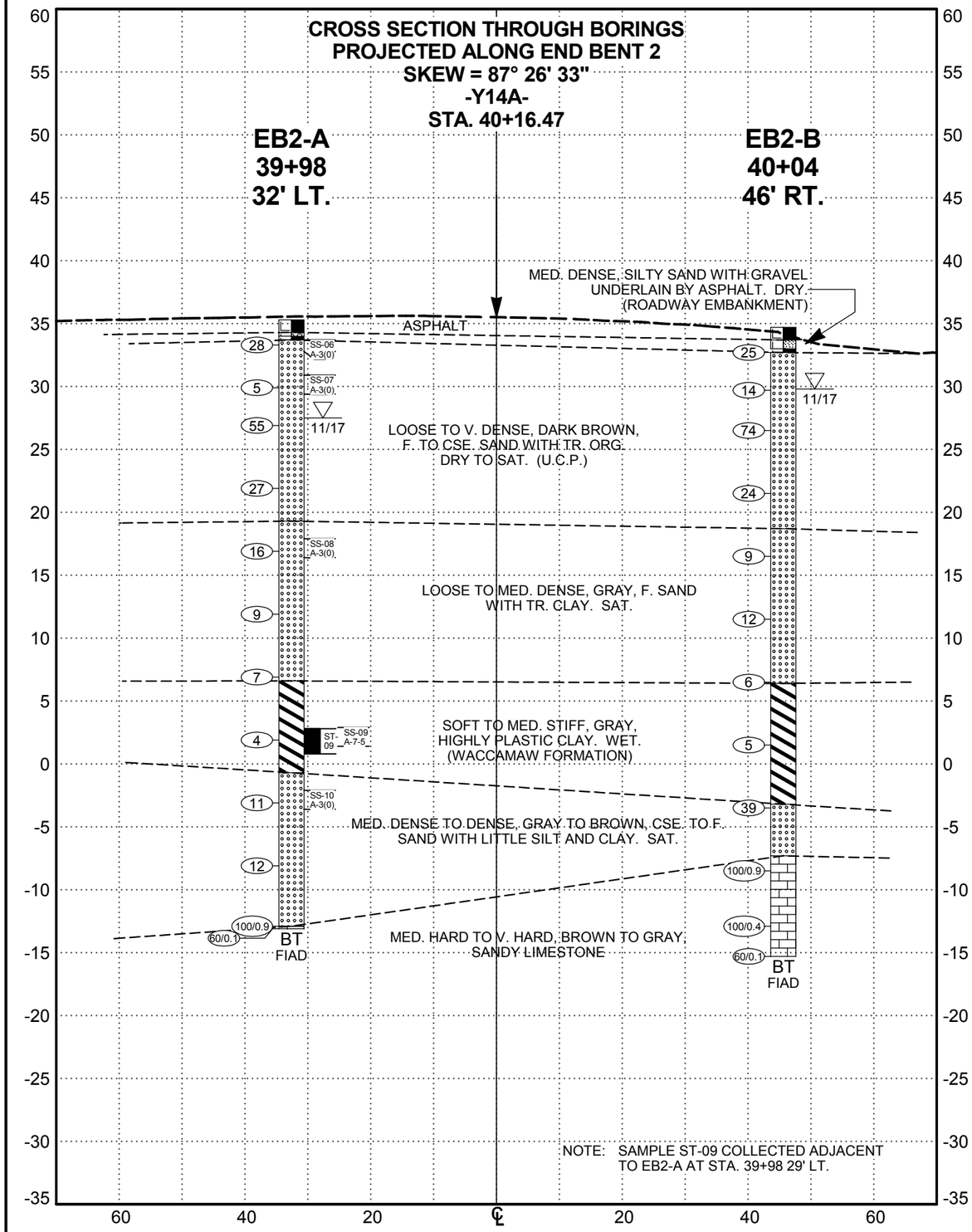


0 20 40
FEET
VE = 2.0

CROSS SECTION THROUGH BORINGS PROJECTED ALONG END BENT 2 SKEW = 87° 26' 33" -Y14A- STA. 40+16.47

EB2-A
39+98
32' LT.

EB2-B
40+04
46' RT.



GEOTECHNICAL BORING REPORT
BORE LOG

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PROJECT REFERENCE NO.	SHEET
R-5021	6

WBS: 41582.1.1	**TIP:** R-5021	**COUNTY:** BRUNSWICK	**GEOLOGIST:** L.PUGH	
SITE DESCRIPTION BRIDGE ON -Y14A- (NC 133) OVER -L- (NC 211) AT -Y14A- STA. 39+52				**GROUND WTR (ft)**
BORING NO.: EB1-A	**STATION:** 38+89	**OFFSET:** 34 ft LT	**ALIGNMENT:** -Y14A-	**0 HR.** 5.8
COLLAR ELEV.: 34.5 ft	**TOTAL DEPTH:** 48.2 ft	**NORTHING:** 75,172	**EASTING:** 2,287,962	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT0071 DIEDRICH D-50 89.0% 07/19/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 11/16/17	**COMP. DATE:** 11/16/17	**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	SOIL SAMPLE	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
40											
35										34.5	0.0
	33.8	0.7	11	12	11	23		D		GROUND SURFACE	
										33.8	0.7
										ASPHALT	
	32.7	1.8								32.7	1.8
										ROADWAY EMBANKMENT	
										BROWN, SANDY GRAVEL	
										UNDIVIDED COASTAL PLAIN	
30	30.0	4.5	3	9	11	20		Sat.		DARK BROWN, CSE. SAND WITH LITTLE	
	27.0	7.5								F. SAND AND TR. ORG.	
25			13	15	16	31	SS-01 A-3(0)	Sat.			
	22.0	12.5									
20			10	15	16	31		Sat.			
	17.0	17.5								18.5	16.0
15			4	4	5	9		Sat.		GRAY, F. SAND WITH LITTLE SILT AND CLAY	
	12.0	22.5									
10			4	5	9	14	SS-02 A-2-4(0)	Sat.			
	7.0	27.5								5.8	28.7
5			4	2	2	4		Sat.		**COASTAL PLAIN**	
										GRAY, HIGHLY PLASTIC CLAY	
	2.0	32.5								(WACCAMAW FORMATION)	
0			1	1	2	3	SS-03 A-7-5(33)	Sat.			
	-3.0	37.5									
-5			2	1	3	4		Sat.			
	-8.0	42.5								-6.5	41.0
										DARK BROWN, CSE. TO F. SAND WITH	
-10			3	3	4	7	SS-04 A-2-4(0)	Sat.		LITTLE SILT AND CLAY	
										-10.5	45.0
										GRAY, SANDY LIMESTONE	
	-13.0	47.5									
	-13.6	48.1	23	60/0.1		60/0.1	SS-05 A-3(0)	Sat.		-13.6	48.1
			60/0.1			60/0.1				-13.7	48.2
										BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEVATION -13.7 ft IN SANDY LIMESTONE (WACCAMAW FORMATION)	

WBS: 41582.1.1	**TIP:** R-5021	**COUNTY:** BRUNSWICK	**GEOLOGIST:** L.PUGH	
SITE DESCRIPTION BRIDGE ON -Y14A- (NC 133) OVER -L- (NC 211) AT -Y14A- STA. 39+52				**GROUND WTR (ft)**
BORING NO.: EB1-B	**STATION:** 38+55	**OFFSET:** 26 ft RT	**ALIGNMENT:** -Y14A-	**0 HR.** 5.1
COLLAR ELEV.: 34.6 ft	**TOTAL DEPTH:** 48.1 ft	**NORTHING:** 75,121	**EASTING:** 2,288,009	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT0071 DIEDRICH D-50 89.0% 07/19/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 11/14/17	**COMP. DATE:** 11/15/17	**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	MOI	LOG	SOIL AND ROCK DESCRIPTION
40									
35									34.6 0.0 GROUND SURFACE
	34.0	0.6	12	12	17	29	D		34.0 0.6 ASPHALT
									33.4 1.2 **ROADWAY EMBANKMENT**
									BROWN, SANDY GRAVEL
									UNDIVIDED COASTAL PLAIN
30	30.4	4.2	1	2	1	3	Sat.		DARK BROWN, CSE. SAND WITH LITTLE
	27.4	7.2							F. SAND AND TR. ORG.
25			9	20	26	46	Sat.		
	22.4	12.2							
20			9	10	11	21	Sat.		
	17.4	17.2							16.9 17.7
15			3	2	4	6	Sat.		GRAY, F. SAND WITH LITTLE SILT AND CLAY
	12.4	22.2							
10			4	5	6	11	Sat.		
	7.4	27.2							6.5 28.1
5			3	2	2	4	Sat.		**COASTAL PLAIN**
									GRAY, HIGHLY PLASTIC CLAY
	2.4	32.2							(WACCAMAW FORMATION)
0			1	1	2	3	Sat.		
	-2.6	37.2							
-5			1	2	3	5	Sat.		
	-7.6	42.2							-6.4 41.0
									DARK BROWN, CSE. TO F. SAND WITH
-10			5	5	7	12	Sat.		LITTLE SILT AND CLAY
	-12.6	47.2							
	-13.4	48.0	11	100/0.2		100/0.2	Sat.		-13.3 47.9
			60/0.1			60/0.1	Sat.		-13.5 LIMESTONE 48.1
									BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEVATION -13.5 ft IN SANDY LIMESTONE (WACCAMAW FORMATION) SAMPLE ST-10 COLLECTED ADJACENT TO EB1-B AT STA. 38+55 23' RT.
									Other Samples: ST-10 (32.7 - 34.7)

GEOTECHNICAL BORING REPORT
BORE LOG

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2141114.04

PROJECT REFERENCE NO.	SHEET
R-5021	7

WBS: 41582.1.1	**TIP:** R-5021	**COUNTY:** BRUNSWICK	**GEOLOGIST:** L.PUGH	
SITE DESCRIPTION BRIDGE ON -Y14A- (NC 133) OVER -L- (NC 211) AT -Y14A- STA. 39+52				**GROUND WTR (ft)**
BORING NO.: EB2-A	**STATION:** 39+98	**OFFSET:** 32 ft LT	**ALIGNMENT:** -Y14A-	**0 HR.** 7.8
COLLAR ELEV.: 35.3 ft	**TOTAL DEPTH:** 48.4 ft	**NORTHING:** 75,275	**EASTING:** 2,287,998	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT0071 DIEDRICH D-50 89.0% 07/19/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 11/15/17	**COMP. DATE:** 11/16/17	**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		MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
40											
35	34.3	1.0	11	13	15	28	SS-06 A-3(0)	D		35.3 GROUND SURFACE	0.0
										34.3 ASPHALT	1.0
										34.0 **ROADWAY EMBANKMENT** BROWN, SANDY GRAVEL	1.3
	30.9	4.4	3	3	2	5	SS-07 A-3(0)	Sat.		33.7 ASPHALT	1.6
30										**UNDIVIDED COASTAL PLAIN** DARK BROWN, F. TO CSE. SAND WITH TR. ORG.	
	27.9	7.4	10	25	30	55		Sat.			
25	22.9	12.4	10	12	15	27		Sat.			
20										19.3 GRAY, F. SAND WITH TR. CLAY	16.0
	17.9	17.4	6	8	8	16	SS-08 A-3(0)	Sat.			
15	12.9	22.4	3	4	5	9		Sat.			
10											
	7.9	27.4	4	3	4	7		Sat.		6.6 **COASTAL PLAIN** GRAY, HIGHLY PLASTIC CLAY (WACCAMAW FORMATION)	28.7
5											
	2.9	32.4	2	2	2	4	SS-09 A-7-5(36)	M			
0										-0.7 GRAY BROWN, F. TO CSE. SAND	36.0
	-2.1	37.4	3	4	7	11	SS-10 A-3(0)	Sat.			
-5											
	-7.1	42.4	2	4	8	12		Sat.			
-10											
	-12.1	47.4	41	100/0.4		100/0.9				-12.9 LIMESTONE	48.2
	-13.0	48.3	60/0.1			60/0.1				-13.1 BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEVATION -13.1 ft IN SANDY LIMESTONE (WACCAMAW FORMATION) SAMPLE ST-09 COLLECTED ADJACENT TO EB2-A AT STA. 39+98 29' LT.	48.4
										Other Samples: ST-09 (32.5 - 34.5)	

WBS: 41582.1.1	**TIP:** R-5021	**COUNTY:** BRUNSWICK	**GEOLOGIST:** L.PUGH	
SITE DESCRIPTION BRIDGE ON -Y14A- (NC 133) OVER -L- (NC 211) AT -Y14A- STA. 39+52				**GROUND WTR (ft)**
BORING NO.: EB2-B	**STATION:** 40+04	**OFFSET:** 46 ft RT	**ALIGNMENT:** -Y14A-	**0 HR.** 4.9
COLLAR ELEV.: 34.7 ft	**TOTAL DEPTH:** 50.0 ft	**NORTHING:** 75,256	**EASTING:** 2,288,074	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE: CAT0071 DIEDRICH D-50 89.0% 07/19/2017		**DRILL METHOD:** Mud Rotary	**HAMMER TYPE:** AUTOMATIC	
DRILLER: Thomas Spencer	**START DATE:** 11/13/17	**COMP. DATE:** 11/14/17	**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	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
40										
35	33.7	1.0	21	12	13	25	D		34.7 GROUND SURFACE	0.0
									33.7 ASPHALT	1.0
									33.0 **ROADWAY EMBANKMENT** BROWN, SILT WITH SOME GRAVEL	1.7
	30.7	4.0	4	6	8	14	W		32.7 **ROADWAY EMBANKMENT** ASPHALT	2.0
30									**UNDIVIDED COASTAL PLAIN** DARK BROWN, F. TO CSE. SAND WITH TR. ORGANICS	
	27.5	7.2	26	33	41	74	Sat.			
25	22.5	12.2	7	11	13	24	Sat.			
20										
	17.5	17.2	5	5	4	9	Sat.		18.7 GRAY, F. SAND WITH TR. CLAY	16.0
15	12.5	22.2	4	5	7	12	Sat.			
10										
	7.5	27.2	3	3	3	6	Sat.		6.4 **COASTAL PLAIN** GRAY, HIGHLY PLASTIC CLAY (WACCAMAW FORMATION)	28.3
5										
	2.5	32.2	1	2	3	5	Sat.			
0									-3.2 BROWN, F. TO CSE. SAND	37.9
	-2.5	37.2	7	23	16	39	Sat.			
-5									-7.3 GRAY, SANDY LIMESTONE	42.0
	-7.5	42.2	31	57	43/0.4	100/0.9	Sat.			
-10										
	-12.5	47.2	100/0.4			100/0.4	Sat.			
-15	-15.2	49.9	60/0.1			60/0.1	Sat.		-15.3 BORING TERMINATED WITH STANDARD PENETRATION TEST REFUSAL AT ELEVATION -15.3 ft IN SANDY LIMESTONE (WACCAMAW FORMATION)	50.0

NCDOT BORE DOUBLE R5021_GEO_BRDG_Y14AOVRL.GPJ NCDOT_CATLIN.GDT 12/06/17

CATLIN Engineers and Scientists 214114.04 220 Old Dairy Road Wilmington, NC 28405 Corporate Licensure No. for Engineering Services C-0586	PROJECT REFERENCE NO.	SHEET
	R-5021	8

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**	**SS-10**					
Lab Sample Number	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	SS-09	SS-10					
Retained #4 Sieve %	0	0	0	0	0	0.3	0	0.2	0	0					
Passing #10 Sieve %	99.5	100	100	99.3	99.4	99.6	99.9	99.8	100	100					
Passing #40 Sieve %	54	100	99	83	68	86	79	99	99	94					
Passing #200 Sieve %	9	23	97	15	5	5	10	8	95	9					
MINUS NUMBER 10 FRACTION															
SOIL MORTAR - 100%															
Coarse Sand Ret.-#60 %	74.6	0.7	1.5	37.3	68.2	55.6	60.1	1.6	2.6	29.3					
Fine Sand Ret.-#270 %	17.2	89.9	1.8	48.5	27.7	39.8	31.0	92.4	2.2	62.7					
Silt 0.05 - 0.005mm %	5.2	5.4	54.9	6.1	2.1	1.7	4.1	1.0	38.3	1.0					
Clay <0.005mm %	3.0	4.0	41.8	8.2	2.0	3.0	4.8	5.0	56.9	7.0					
Liquid Limit (LL)	10	16	60	20	7	11	16	13	63	10					
Plasticity Index (PI)	NP	NP	27	NP	NP	NP	NP	NP	31	NP					
AASHTO Classification /Group Index	**A-3(0)**	**A-2-4(0)**	**A-7-5(33)**	**A-2-4(0)**	**A-3(0)**	**A-3(0)**	**A-3(0)**	**A-3(0)**	**A-7-5(36)**	**A-3(0)**					
Organic Content %	**2.2**	N/A	N/A	N/A	N/A	**1.8**	N/A	N/A	N/A	N/A					
Station	38+89	38+89	38+89	38+89	38+89	39+98	39+98	39+98	39+98	39+98					
Offset	34ft LT	34ft LT	34ft LT	34ft LT	34ft LT	32ft LT	32ft LT	32ft LT	32ft LT	32ft LT					
Alignment	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-	-Y14A-					
Boring Identification	**EB1-A**	**EB1-A**	**EB1-A**	**EB1-A**	**EB1-A**	**EB2-A**	**EB2-A**	**EB2-A**	**EB2-A**	**EB2-A**					
Depth (FT)	7.5	22.5	32.5	42.5	47.5	1.6	4.4	17.4	32.4	37.4					
to	9.0	24.0	34.0	44.0	48.1	2.5	5.9	18.9	33.9	38.9					
Field Moist. Content %															
Tested By	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON	MDMASON					
Submitted By	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH	L. PUGH					
Date Submitted	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17	11/17/17					

NP = Non-Plastic

N/A = Not Applicable / Not Analyzed

Michael D. Mason
Laboratory Manager

Report Date: 12/4/2017

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	10

REFERENCE: R-5021

PROJECT: 41582

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE
5-6	CROSS SECTIONS
7-10	BORE LOGS

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30*

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

C.J. CORNETTE

S.N. ZIMARINO

R.E. SMITH

J.M. EDMONDSON

INVESTIGATED BY *T.C. BOTTOMS*

DRAWN BY *T.C. BOTTOMS*

CHECKED BY *D.N. ARGENBRIGHT*

SUBMITTED BY *D.N. ARGENBRIGHT*

DATE *SEPTEMBER 2017*

NORTH CAROLINA LICENSED SEAL 2240 GEOLOGIST TYLER C. BOTTOMS

DocuSigned by: Tyler Bottoms 48A2D3BD08CF4A6... 9/26/2017

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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:
- [ ] CME-45C
- [ ] 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
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: BM92
N=81586.9044 E=2264662.2379
ELEVATION: 52.85 FEET

NOTES:

FIAD: FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 30 60

FEET

PROPOSED STRUCTURE

08

30

33

EBI-A

EB2-A

EBI-B

EB2-B

TO NC 133

TO US 17

-L- STA. 79+32.24
-YREV- STA. 31+30.81

SKEW: 95° 24' 10"

SR 1500 MIDWAY RD SE -YREV-

TO OAK ISLAND DR

RIP RAP

EBI BENT LINE

EB2 BENT LINE

TO SR 1114

NC 211 SOUTHPORT SUPPLY RD -L-

CONC

78

CONC 30" C&G CONC

CB

BST

CONC

5/14/99

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG -YREV-

VE=2

EB1-B
30+37
5' RT

EB2-B
31+89
1' RT

PAVEMENT

LOOSE BROWN SAND, MOIST TO SATURATED (ALLUVIAL)

SOFT TO MEDIUM STIFF BROWN SILT, MOIST TO WET (ROADWAY EMBANKMENT)

SOFT GRAY SANDY AND SILTY CLAY, WET (ALLUVIAL)

VERY LOOSE TO LOOSE BROWN SAND, SATURATED (ALLUVIAL)

VERY SOFT TO SOFT GRAY SILT, SANDY AND SILTY CLAY WITH SHELL FRAGMENTS, WET (WACCAMAW FORMATION)

LOOSE TO DENSE GRAY SAND WITH SHELL FRAGMENTS, SATURATED

MEDIUM STIFF GRAY SANDY CLAY WITH SHELL FRAGMENTS, WET

SOFT GRAY LIMESTONE

LOOSE TO MEDIUM DENSE GRAY, BROWN AND GREEN SAND WITH SHELL FRAGMENTS, SATURATED

HARD GRAY LIMESTONE

MEDIUM DENSE TO VERY DENSE TAN SAND WITH LIMESTONE FRAGMENTS, SATURATED

SOFT GRAY LIMESTONE

MEDIUM DENSE TAN SAND, SATURATED

SOFT GRAY LIMESTONE

MEDIUM DENSE BROWN SAND, SATURATED

SOFT GRAY LIMESTONE

STIFF TO HARD GRAY SILT, WET

NOTE: GROUNDLINE PROFILE ALONG -YREV- TAKEN FROM r5021_ls_tin.tin DATED 7/17/2014

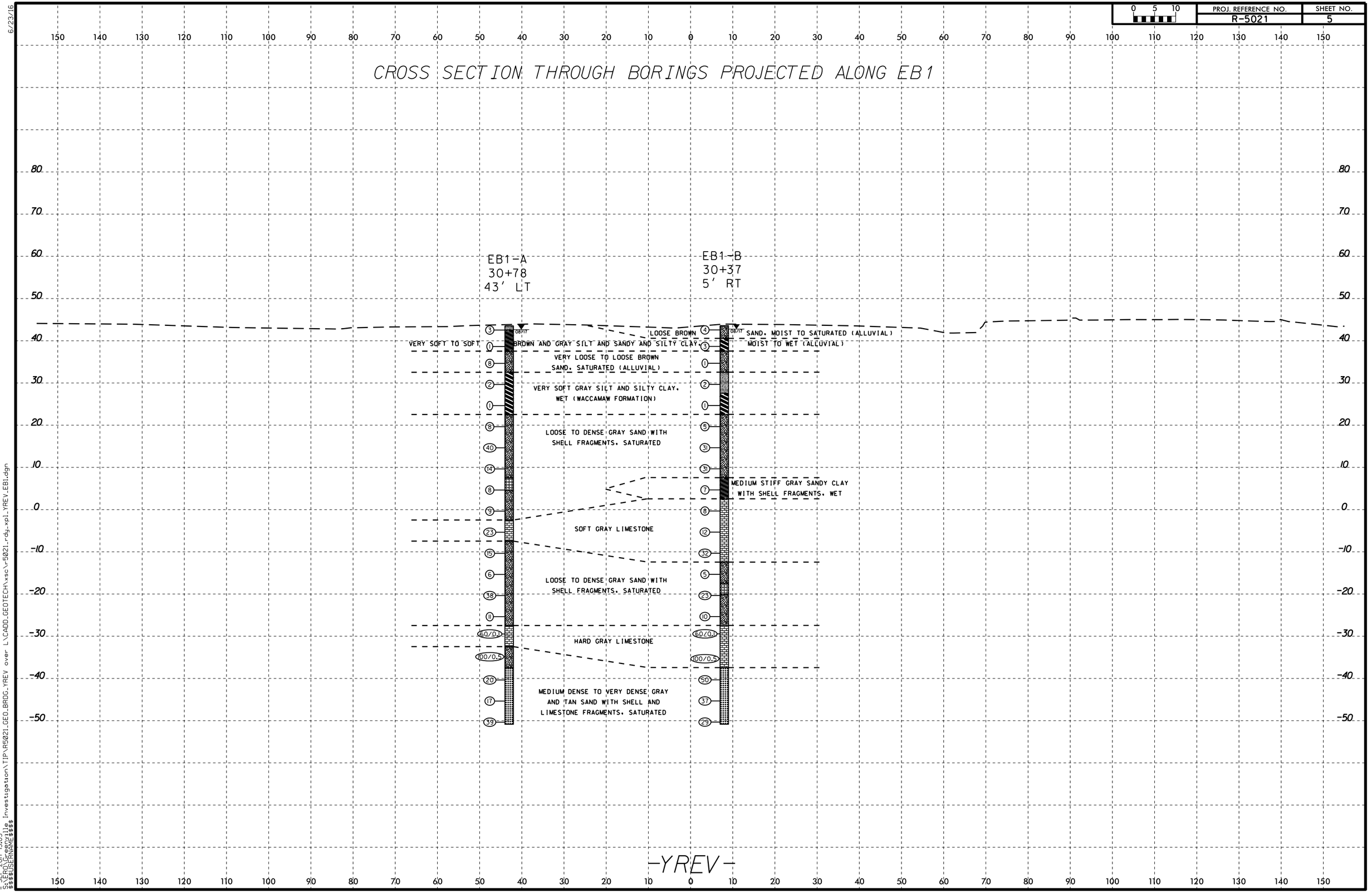
NOTE: INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

11-SEP-2017 15:06
S:\ENGINEERING\Greenville Investigation\TIP\R5021_GEO_BRDG_YREV over L\CADD_GEOTECH\PlanProf\R5021_GEO_BRDG_YREVovrL_prf1.dgn
$$$$USERNAME$$$$

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-5021	5

CROSS SECTION THROUGH BORINGS PROJECTED ALONG EB1



11-SEP-2017 15:05
S:\ERO\Greenville Investigation\TIP\R5021.GEO.BRDG_YREV over L\CADD.GEOTECH\xsc\r-5021_rdy_xpl_YREV_EB1.dgn
$$$$USERNAME$$$$

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-5021	6

CROSS SECTION THROUGH BORINGS PROJECTED ALONG EB2

EB2-A
31+87
44' LT

EB2-B
31+89
1' RT

PAVEMENT

LOOSE TO MEDIUM DENSE TO SATURATED BROWN SAND, MOIST (ROADWAY EMBANKMENT)

SOFT TO MEDIUM STIFF BROWN SILT, MOIST TO WET (ROADWAY EMBANKMENT)

SOFT GRAY SANDY CLAY, WET (ALLUVIAL)

VERY LOOSE TO LOOSE BROWN AND TAN SAND, SATURATED (ALLUVIAL)

SOFT GRAY SILTY CLAY WITH SHELL FRAGMENTS, WET (WACCAMAW FORMATION)

LOOSE TO VERY DENSE GRAY SAND WITH SHELL FRAGMENTS, SATURATED

SOFT GRAY LIMESTONE

SOFT GRAY LIMESTONE

MEDIUM DENSE TAN SAND, SATURATED

SOFT GRAY LIMESTONE

MEDIUM DENSE BROWN SAND, SATURATED

SOFT GRAY LIMESTONE

LOOSE TO MEDIUM DENSE BROWN, GRAY AND GREEN SAND, SATURATED

STIFF TO HARD GRAY SILT, WET

MEDIUM DENSE GRAY SAND WITH SHELL FRAGMENTS, SATURATED

HARD GRAY LIMESTONE

MEDIUM DENSE TAN SAND WITH LIMESTONE FRAGMENTS, SATURATED

-YREV-

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 30+78	**OFFSET** 43 ft LT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 43.5 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 82,021	**EASTING** 2,263,801	**24 HR.** 0.9
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/16/17	**COMP. DATE** 08/16/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
45											
	43.5	0.0	1	1	2	3				43.5 GROUND SURFACE	0.0
										42.5 **ALLUVIAL** BROWN SILT, MOIST TO WET	1.0
40	39.6	3.9	WOH	WOH	1	1				**ALLUVIAL** GRAY SANDY CLAY, WET	
										37.5	6.0
35	35.6	7.9	3	2	6	8				**ALLUVIAL** BROWN SAND, SATURATED	
										32.5	11.0
30	30.6	12.9	1	1	1	2				**COASTAL PLAIN** GRAY SILTY CLAY, WET (WACCAMAW FORMATION)	
25	25.6	17.9	1	1	0	1					
										22.5	21.0
20	20.6	22.9	5	3	5	8				**COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED	
15	15.6	27.9	12	18	22	40					
10	10.6	32.9	10	7	7	14					
										7.5	36.0
5	5.6	37.9	4	5	3	8				4.6	38.9
0	0.6	42.9	3	5	4	9					
-5	-4.4	47.9	7	13	10	23				-2.5 **COASTAL PLAIN** SOFT GRAY LIMESTONE	46.0
-10	-9.4	52.9	3	10	5	15				-7.5 **COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED	51.0
-15	-14.4	57.9	2	3	3	6					
-20	-19.4	62.9	6	7	31	38					
-25	-24.4	67.9	5	5	6	11					
										-27.5 **COASTAL PLAIN** HARD GRAY LIMESTONE	71.0
-30	-29.4	72.9	60/0.1			60/0.1					
										-32.5	76.0
-35	-34.4	77.9				100/0.5					

NCDOT BORE DOUBLE R5021_GEO_BRDG_YREVOVRL.GPJ NC_DOT.GDT 9/11/17

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 30+78	**OFFSET** 43 ft LT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 43.5 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 82,021	**EASTING** 2,263,801	**24 HR.** 0.9
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/16/17	**COMP. DATE** 08/16/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-35						Match Line				
			100/0.5							**COASTAL PLAIN** GRAY AND TAN SAND WITH SHELL FRAGMENTS, SATURATED *(continued)*
-40	-39.4	82.9	10	11	9	20				-37.5 81.0
-45	-44.4	87.9	7	9	8	17				
-50	-49.4	92.9	11	16	23	39				-50.9 94.4
										Boring Terminated at Elevation -50.9 ft in Dense Sand

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 30+37	**OFFSET** 5 ft RT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 43.6 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 82,068	**EASTING** 2,263,759	**24 HR.** 0.8
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/17/17	**COMP. DATE** 08/17/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
45											
	43.6	0.0	1	1	3	4				43.6 GROUND SURFACE	0.0
40	39.7	3.9	2	1	2	3				**ALLUVIAL** BROWN SAND, MOIST TO SATURATED 40.6	3.0
										ALLUVIAL GRAY SILTY CLAY, WET 37.6	6.0
35	35.7	7.9	WOH	WOH	1	1				**ALLUVIAL** BROWN SAND, SATURATED 32.6	11.0
30	30.7	12.9	1	1	1	2				**COASTAL PLAIN** GRAY SILT, WET (WACCAMAW FORMATION) 27.6	16.0
25	25.7	17.9	1	0	1	1				**COASTAL PLAIN** GRAY SILTY CLAY, WET 22.6	21.0
20	20.7	22.9	2	2	3	5				**COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED	
15	15.7	27.9	7	15	16	31					
10	10.7	32.9	3	6	25	31					
5	5.7	37.9	4	4	3	7				7.6	36.0
0	0.6	42.9	3	5	3	8				**COASTAL PLAIN** GRAY SANDY CLAY WITH SHELL FRAGMENTS, WET 2.6	41.0
-5	-4.4	47.9	5	7	5	12				**COASTAL PLAIN** SOFT GRAY LIMESTONE	
-10	-9.4	52.9	13	14	18	32					
-15	-14.4	57.9	4	1	4	5				-12.5	56.0
-20	-19.4	62.9	7	10	13	23				**COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED -17.5	61.0
-25	-24.4	67.9	4	5	5	10				-20.2	63.7
-30	-29.4	72.9	60/0.1			60/0.1				-27.5	71.0
-35	-34.4	77.9								**COASTAL PLAIN** HARD GRAY LIMESTONE	

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 30+37	**OFFSET** 5 ft RT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 43.6 ft	**TOTAL DEPTH** 94.4 ft	**NORTHING** 82,068	**EASTING** 2,263,759	**24 HR.** 0.8
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/17/17	**COMP. DATE** 08/17/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-35						Match Line				
			18	100/0.5		100/0.5				**COASTAL PLAIN** HARD GRAY LIMESTONE *(continued)*
-40	-39.4	82.9	25	21	29	50				-37.5 81.0 **COASTAL PLAIN** TAN SAND WITH LIMESTONE FRAGMENTS, SATURATED
-45	-44.4	87.9	8	16	21	37				
-50	-49.4	92.9	5	9	20	29				-50.9 94.4 Boring Terminated at Elevation -50.9 ft in Medium Dense Sand

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 31+87	**OFFSET** 44 ft LT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 46.4 ft	**TOTAL DEPTH** 89.5 ft	**NORTHING** 81,910	**EASTING** 2,263,782	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/22/17	**COMP. DATE** 08/31/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) DEPTH (ft)
50										
45	45.8	0.6	6	7	5	12				46.4 0.0 GROUND SURFACE 45.8 0.6 PAVEMENT **ROADWAY EMBANKMENT** BROWN SAND, MOIST TO SATURATED
	42.3	4.1	3	2	2	4				
40	38.4	8.0	WOH	1	1	2				40.4 6.0 **ALLUVIAL** BROWN AND TAN SAND, SATURATED
35	33.4	13.0	2	2	2	4				
30	28.4	18.0	WOH	WOH	2	2				30.4 16.0 **COASTAL PLAIN** GRAY SILTY CLAY, WET (WACCAMAW FORMATION)
25	23.4	23.0	3	2	7	9				25.4 21.0 **COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED
20	18.4	28.0	4	7	14	21				
15	13.4	33.0	7	19	40	59				
10	8.4	38.0	6	8	6	14				
5	3.4	43.0	4	4	3	7				
0	-1.6	48.0	6	6	6	12				-4.6 51.0 **COASTAL PLAIN** SOFT GRAY LIMESTONE
-5	-6.6	53.0	6	11	14	25				
-10	-11.6	58.0	4	4	4	8				-9.6 56.0 **COASTAL PLAIN** GRAY SAND, SATURATED
-15	-16.6	63.0	3	7	7	14				
-20	-21.6	68.0	6	26	17	43				-19.6 66.0 **COASTAL PLAIN** GRAY SILT, WET
-25	-26.6	73.0	5	7	5	12				
-30										-29.6 76.0

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 31+87	**OFFSET** 44 ft LT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 46.4 ft	**TOTAL DEPTH** 89.5 ft	**NORTHING** 81,910	**EASTING** 2,263,782	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/22/17	**COMP. DATE** 08/31/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-30						Match Line				
	-31.6	78.0	22	100/0.4		100/0.4				**COASTAL PLAIN** -32.1 78.5 GRAY SAND WITH LIMESTONE FRAGMENTS, SATURATED *(continued)*
-35	-36.6	83.0	42	18	60/0.1	60/0.1				**COASTAL PLAIN** HARD GRAY LIMESTONE
-40	-41.6	88.0	6	11	8	19				-39.6 86.0 **COASTAL PLAIN** TAN SAND WITH LIMESTONE FRAGMENTS, SATURATED -43.1 89.5 Boring Terminated at Elevation -43.1 ft in Medium Dense Sand

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 31+89	**OFFSET** 1 ft RT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 46.3 ft	**TOTAL DEPTH** 99.5 ft	**NORTHING** 81,917	**EASTING** 2,263,741	**24 HR.** 1.1
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/22/17	**COMP. DATE** 08/22/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
50											
45	45.6	0.7	3	4	3	7				46.3 45.6 GROUND SURFACE PAVEMENT	0.0 0.7
	42.2	4.1	2	1	2	3				**ROADWAY EMBANKMENT** BROWN SILT, MOIST TO WET	
40	38.3	8.0	WOH	1	1	2				40.3 **ALLUVIAL** GRAY SANDY CLAY, WET	6.0
35	33.3	13.0	2	4	2	6				37.5 **ALLUVIAL** BROWN AND TAN SAND, SATURATED	8.8
30	28.3	18.0	1	1	1	2				30.3 **COASTAL PLAIN** GRAY SILTY CLAY WITH SHELL FRAGMENTS, WET (WACCAMAW FORMATION)	16.0
25	23.3	23.0	WOH	WOH	4	4					
20	18.3	28.0	3	4	12	16				20.3 **COASTAL PLAIN** GRAY SAND WITH SHELL FRAGMENTS, SATURATED	26.0
15	13.3	33.0	4	7	20	27					
10	8.3	38.0	4	5	7	12					
5	3.3	43.0	3	4	3	7				5.3 41.0	
0	-1.7	48.0	6	6	6	12				0.3 **COASTAL PLAIN** SOFT GRAY LIMESTONE	46.0
-5	-6.7	53.0	13	2	1	3				-4.7 **COASTAL PLAIN** TAN SAND, SATURATED	51.0
-10	-11.7	58.0	5	11	2	13				-7.2 **COASTAL PLAIN** SOFT GRAY LIMESTONE	53.5
-15	-16.7	63.0	8	9	11	20				-9.7 **COASTAL PLAIN** BROWN SAND, SATURATED	56.0
-20	-21.7	68.0	22	20	14	34				-12.2 **COASTAL PLAIN** SOFT GRAY LIMESTONE	58.5
-25	-26.7	73.0	3	4	5	9				-14.7 **COASTAL PLAIN** BROWN AND GREEN SAND, SATURATED	61.0
-30										-19.7 **COASTAL PLAIN** GRAY SILT, WET	66.0

WBS 41582.1.1	**TIP** R-5021	**COUNTY** BRUNSWICK	**GEOLOGIST** ZIMARINO, S.N.	
SITE DESCRIPTION BRIDGE ON -YREV- (SR 1500) OVER -L- (NC 211) AT -YREV- STA. 31+30				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 31+89	**OFFSET** 1 ft RT	**ALIGNMENT** -YREV-	**0 HR.** N/A
COLLAR ELEV. 46.3 ft	**TOTAL DEPTH** 99.5 ft	**NORTHING** 81,917	**EASTING** 2,263,741	**24 HR.** 1.1
DRILL RIG/HAMMER EFF./DATE GFO0057 CME-550X 76% 06/13/2017		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Smith, R. E.	**START DATE** 08/22/17	**COMP. DATE** 08/22/17	**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. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-30						Match Line				
	-31.7	78.0	18	100/0.5		100/0.5				-32.2 78.5 **COASTAL PLAIN** HARD GRAY LIMESTONE
-35	-36.7	83.0	60/0.1			60/0.1				-39.7 86.0 **COASTAL PLAIN** TAN SAND WITH LIMESTONE FRAGMENTS, SATURATED
-40	-41.7	88.0	11	10	10	20				
-45	-46.7	93.0	13	7	7	14				
-50	-51.7	98.0	6	5	9	14				-53.2 99.5 Boring Terminated at Elevation -53.2 ft in Medium Dense Sand

NCDOT BORE DOUBLE R5021_GEO_BRDG_YREVOVRL.GPJ NC_DOT.GDT 9/11/17

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	4

REFERENCE: R-5021

PROJECT: 41582

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILES WITH SOIL TEST RESULTS

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *WALL 1 LEFT OF -L- STA. 233+00 AND WALL 2 LEFT OF -L- STA. 237+00*

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

CHRIS ALEXANDER

M. D. MASON

T. SPENCER

INVESTIGATED BY *CATLIN*

DRAWN BY *STEVEN HUDSON, LG*

CHECKED BY *J. LEE STONE, LG*

SUBMITTED BY *STEVEN HUDSON, LG*

DATE *JANUARY 2018*

CATLIN Engineers and Scientists

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V HUDSON

DocuSigned by:

62EFD88181E445F...

2/28/2019

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R–5021	2

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
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] DIEDRICH D-50
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 7/8" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [X] 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: LOCATIONS OBTAINED WITH REAL TIME KINEMATICS (RTK) SURVEY GRADE GLOBAL POSTIONING SYSTEM (GPS)
ELEVATION: FEET

NOTES:

U.C.P. = UNDIVIDED COASTAL PLAIN

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 50 100

FEET

235

239

ST JAMES CITY LIMIT

EXECUTIVE PARK BLVD. (60.00' PUBLIC R/W)

22' BST

ISMTLBUS

2SBKBUS

BEGIN RETAINING WALL
232+85.84 –L–
66.61' LT

END RETAINING WALL
236+48.52 –L–
63.07' LT

BEGIN RETAINING WALL
237+02.93 –L–
63.07' LT

END RETAINING WALL
237+90.00 –L–
56.00' LT

W1-01 W1-02 W1-03 W1-04 W1-05

W2-01 W2-01

BST

POND

CB

EOI

FSS

SS

T FO

TV

W

P

-L-

CONC

KEY PAD

01 02 00

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SOIL TEST RESULTS

SAMPLE NUMBER	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P. I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-01	CL	10+99	2.5 - 3.0	A-2-4(0)	12	NP	32.2	58.0	5.4	4.4	100	92	10	-	-
SS-01	4 ft LT	11+87	5.0 - 6.5	A-3(0)	19	NP	15.0	81.2	1.4	2.4	100	100	4	-	3.0
SS-02	4 ft LT	11+87	10.0 - 11.5	A-3(0)	21	NP	37.8	59.7	0.1	2.3	100	81	3	-	-
SS-03	4 ft LT	12+69	9.0 - 10.0	A-3(0)	17	NP	39.7	59.1	0.0	1.2	100	90	1	-	-
SS-04	CL	10+09	5.0 - 6.5	A-3(0)	13	NP	38.1	56.0	3.6	2.3	100	92	6	-	3.5
SS-05	2 ft RT	10+90	0.0 - 1.5	A-3(0)	21	NP	56.8	38.0	1.8	3.4	100	76	6	-	-

0 50 100
FEET
V.E. = 10

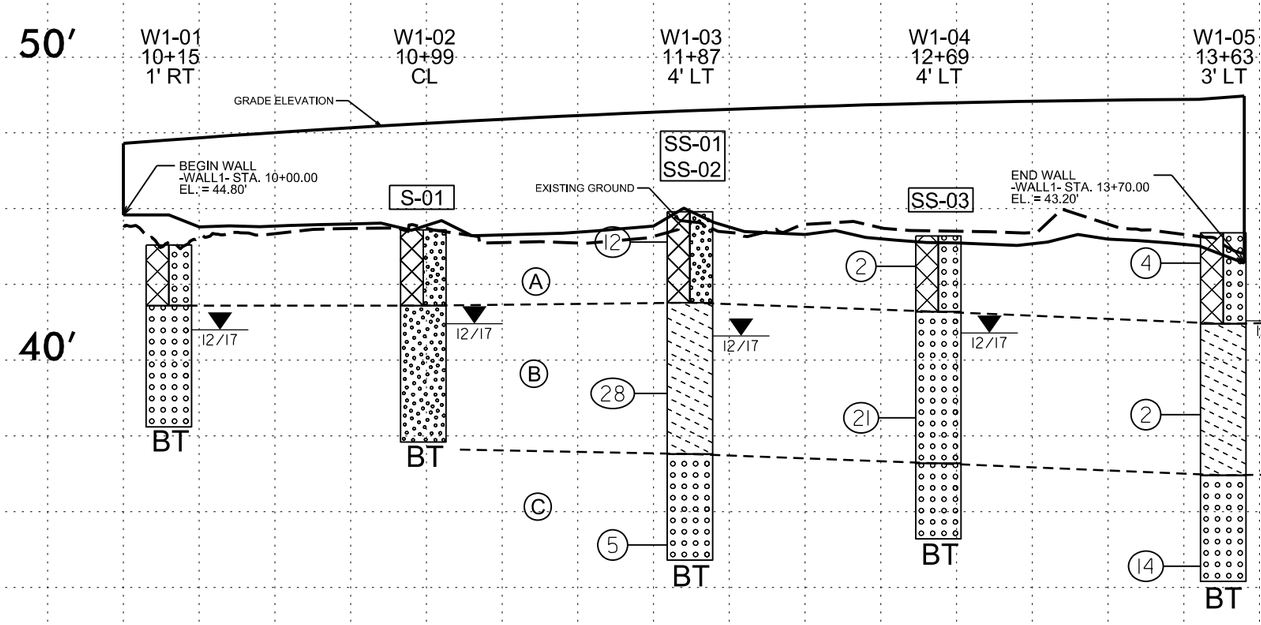
Ⓐ VERY LOOSE TO MED. DENSE, BROWN TO GRAY, SAND TO SILTY SAND. (ARTIFICIAL FILL)

Ⓑ VERY LOOSE TO DENSE, BROWN TO BLACK, SAND TO SILTY SAND WITH TRACE TO LITTLE ORGANICS. (U.C.P.)

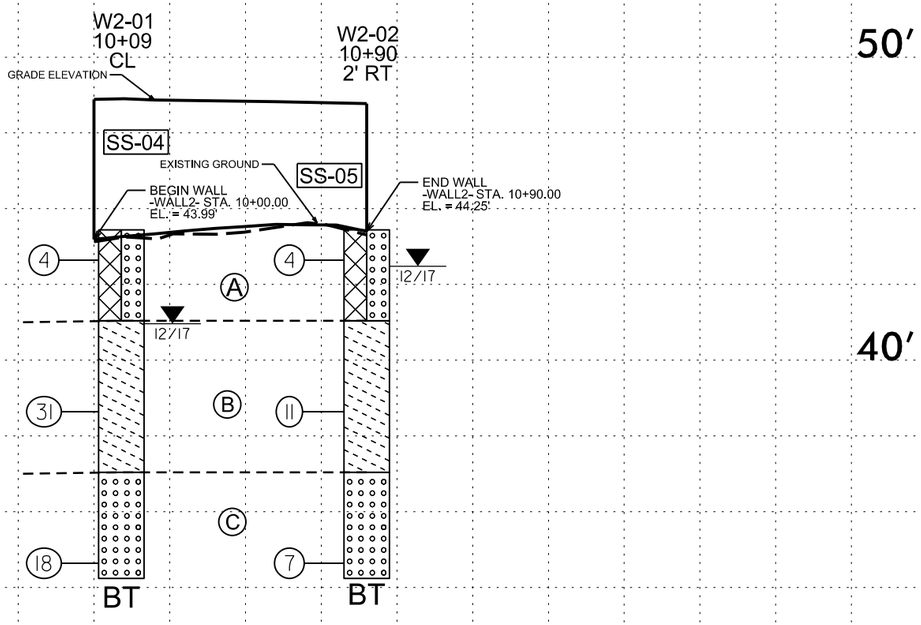
Ⓒ LOOSE TO MED. DENSE, BROWN TO TAN, SAND.

PROFILES THROUGH BORINGS PROJECTED ALONG -WALL 1- AND -WALL 2-

-WALL 1-



-WALL 2-



NOTES:

GROUND LINE PROFILE ALONG -WALL 1- AND -WALL 2- AND PROPOSED WALL LAYOUT TAKEN FROM WALL ENVELOPE DRAWINGS DATED 08/17/17 AND 08/15/17, RESPECTIVELY

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	7

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *RETAINING WALLS 3, 4, 5 AND 6*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

C.J. CORNETTE

S.N. ZIMARINO

R.E. SMITH

J.M. EDMONDSON

INVESTIGATED BY *T.C. BOTTOMS*

DRAWN BY *T.C. BOTTOMS*

CHECKED BY *D.N. ARGENBRIGHT*

SUBMITTED BY *D.N. ARGENBRIGHT*

DATE *OCTOBER 2017*

NORTH CAROLINA LICENSED SEAL 2240 GEOLOGIST TYLER C. BOTTOMS

DocuSigned by:
Tyler Bottoms 2/28/2019
48A2D3BD08CF4A6...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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		
	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PLASTIC RANGE (PI)		
PL — PLASTIC LIMIT		
	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT		
	- 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:
- [ ] CME-45C
- [ ] 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
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: BM92
N=81586.9044 E=2264662.2379
ELEVATION: 52.85 FEET

NOTES:

FIAD: FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 30 60

FEET

WALL 4

B2

EB1-A

TO NC 133

-L- STA. 79+32.24

-YREV- STA. 31+30.81

B4

WALL 6

EB2-A

TO US 17

EB1-B

EB2-B

SR 1500 MIDWAY RD SE -YREV-

B1

TO OAK ISLAND DR

B3

WALL 3

WALL 5

CONC

TO SR 1114

NC 211 SOUTHPORT SUPPLY RD -L-

18" RCP

30" C&G

CB

BST

CONC

5/14/99

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 3 RIGHT OF –YREV– STA. 30 + 00

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

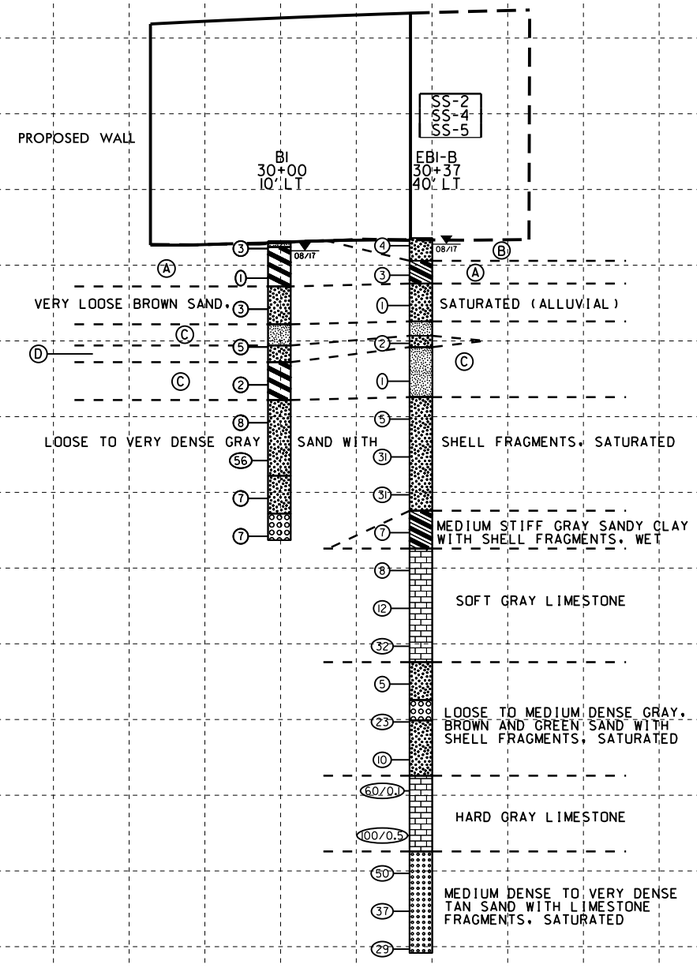
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

VE=2

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) #10	#40	#200	% MOISTURE	% ORGANIC
SS-2	40' LT	30+37	3.9'-5.4'	A-6(9)	32	18	6.9	32.7	30.2	30.3	100	98	84	-	-
SS-4	40' LT	30+37	12.9'-14.4'	A-2-4(0)	-	NP	15.9	63.6	10.4	10.1	100	92	33	-	-
SS-5	40' LT	30+37	17.9'-19.4'	A-4(5)	28	8	6.1	20.0	57.8	16.1	100	98	83	-	-



(A) VERY SOFT TO SOFT GRAY, BROWN AND ORANGE SILT AND SANDY AND SILTY CLAY. MOIST TO WET (ALLUVIAL)

(B) LOOSE BROWN SAND. MOIST TO SATURATED (ALLUVIAL)

(C) VERY SOFT GRAY SILT AND SILTY CLAY. WET (WACCAMAW FORMATION)

(D) LOOSE GRAY SAND. SATURATED (WACCAMAW FORMATION)

NOTE: GROUNDLINE PROFILE ALONG WALL 3 TAKEN FROM r5021 ls tin.tin DATED 7/14/14

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

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29 + 00 30 + 00 31 + 00

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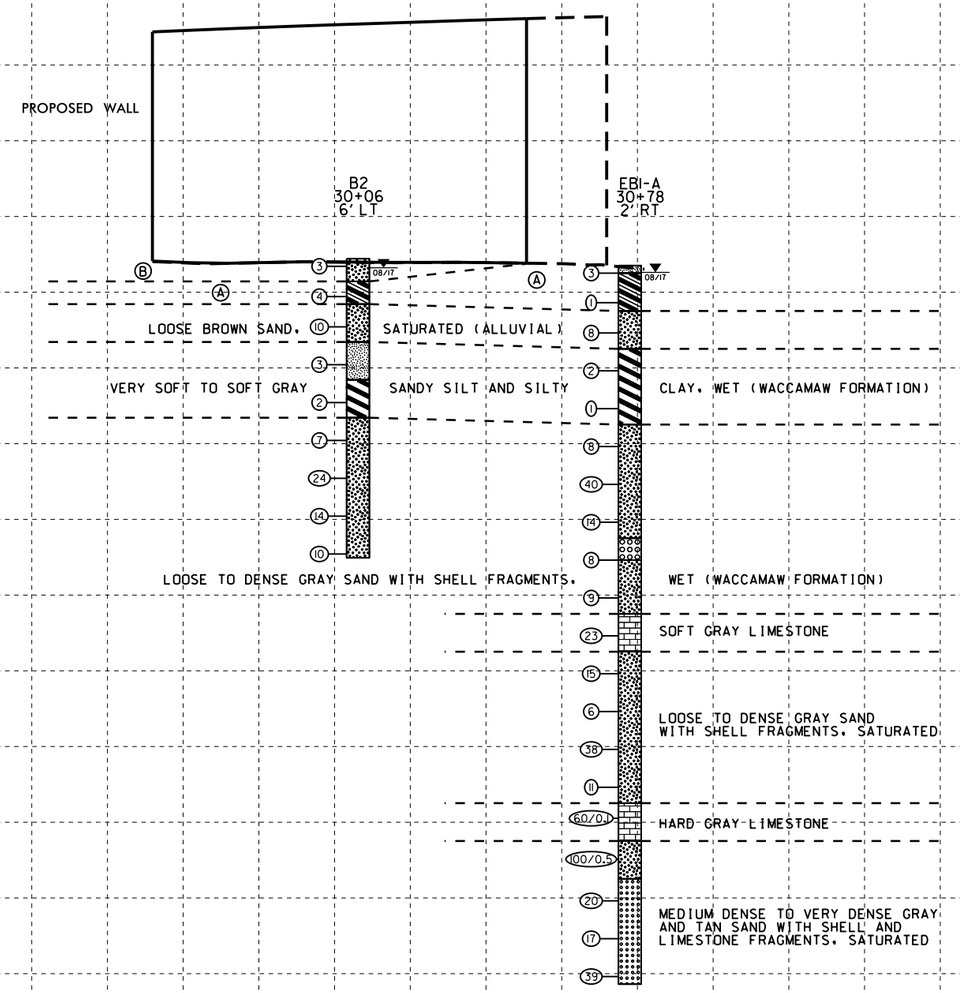
PROJECT REFERENCE NO.	SHEET NO.
R-5021	5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 4 LEFT ON –YREV– STA. 30+00

VE=2



Ⓐ VERY SOFT TO SOFT GRAY AND BROWN SILT AND SANDY AND SILTY CLAY WITH WOOD FRAGMENTS, MOIST TO WET (ALLUVIAL)

Ⓑ VERY LOOSE BROWN SAND, MOIST TO SATURATED (ALLUVIAL)

NOTE: GROUNDLINE PROFILE ALONG WALL 4 TAKEN FROM r5021 ls tin.tin DATED 7/14/14

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

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29+00 30+00 31+00

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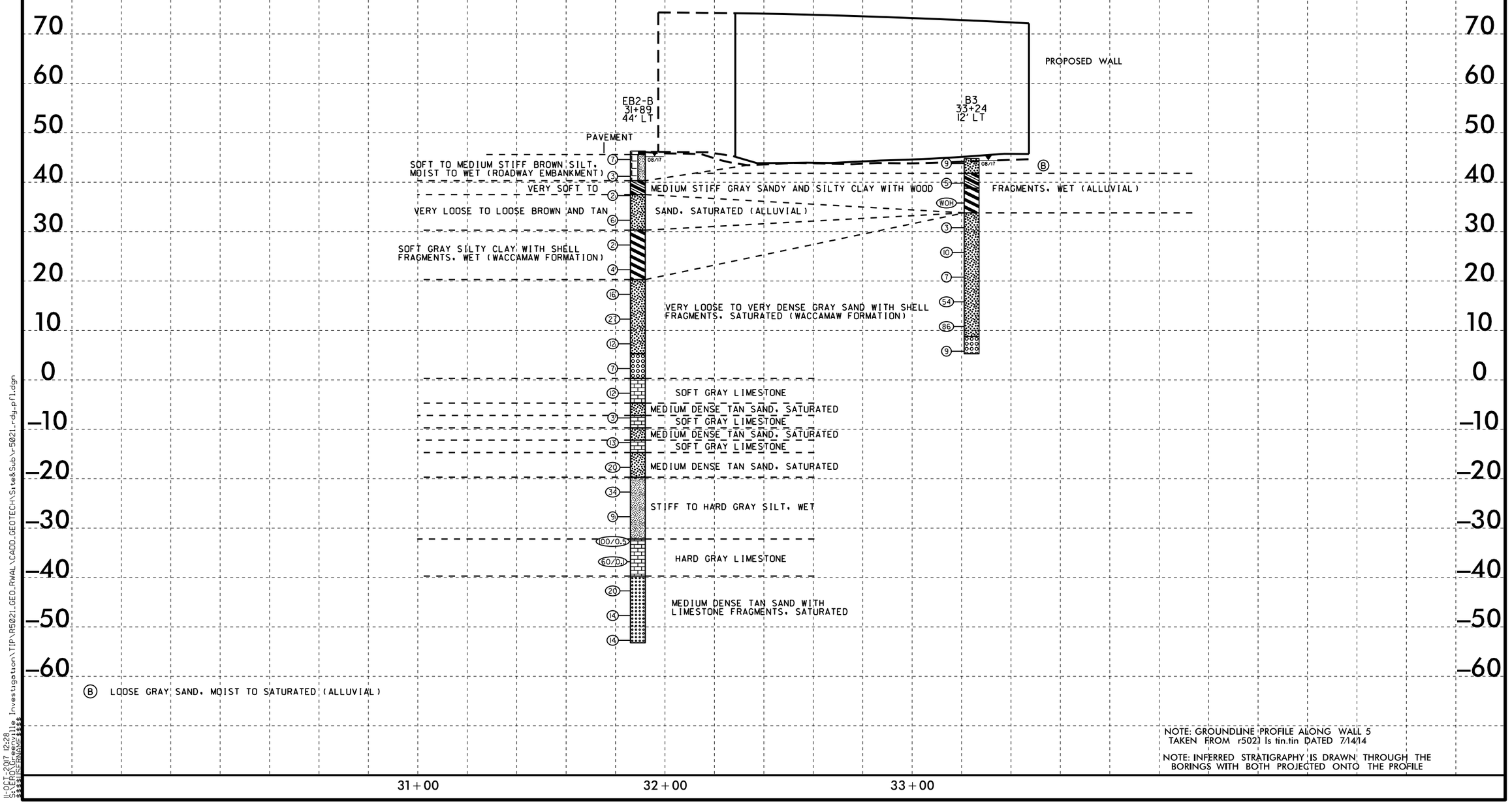
PROJECT REFERENCE NO.	SHEET NO.
R-5021	6
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 5 RIGHT OF –YREV– STA. 32 + 00



Ⓑ LOOSE GRAY SAND, MOIST TO SATURATED (ALLUVIAL)

NOTE: GROUNDLINE PROFILE ALONG WALL 5 TAKEN FROM r5021 ls tin.tin DATED 7/14/14

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

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PROJECT REFERENCE NO.	SHEET NO.
R-5021	7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

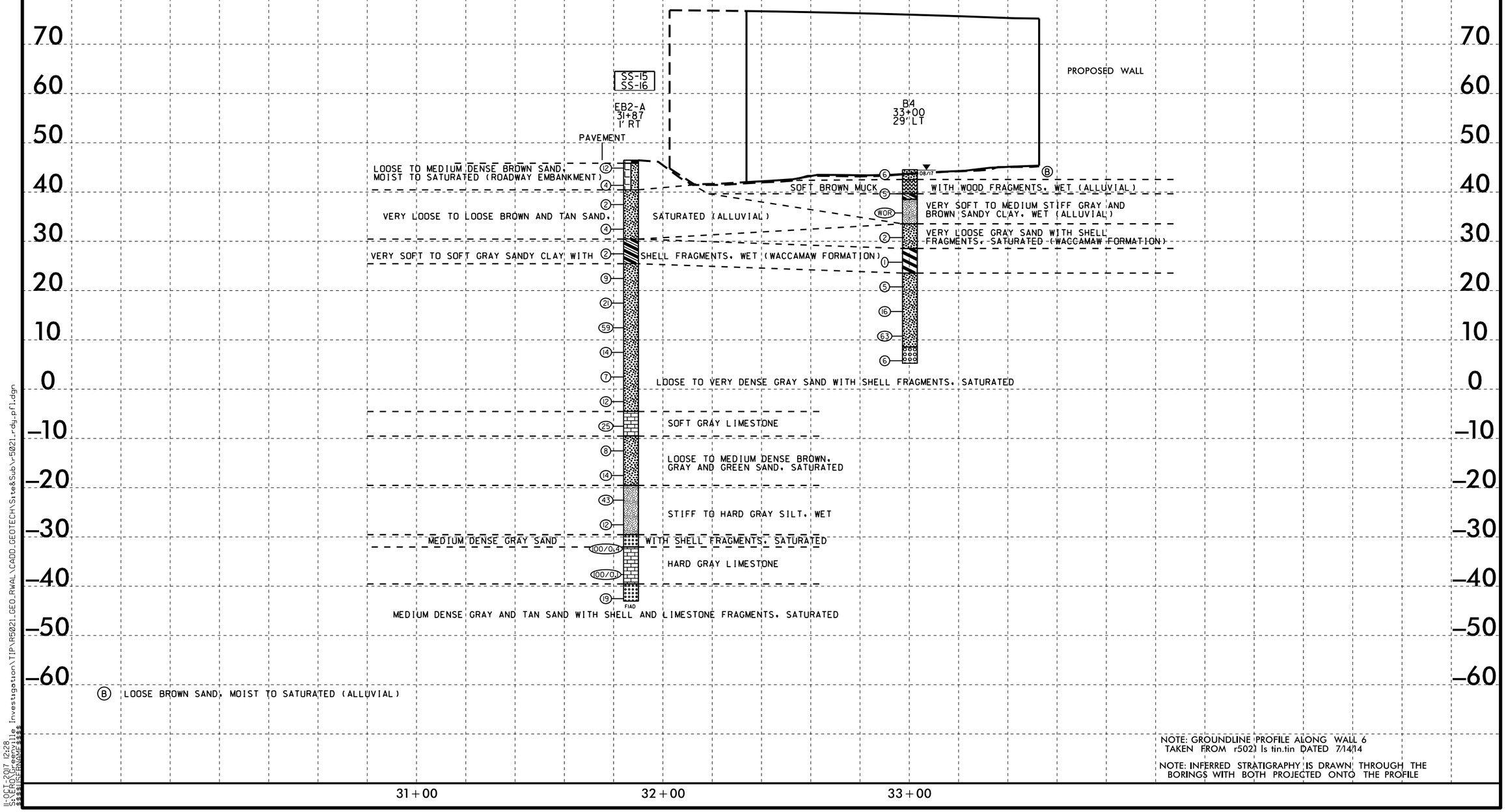
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 6 LEFT OF –YREV– STA. 32 + 00

VE=2

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C. SAND	F. SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-15	1' RT	31+87	18.0'-19.5'	A-6(9)	31	12	3.2	31.1	45.5	20.2	100	99	85	-	-
SS-16	1' RT	31+87	23.0'24.5'	A-2-4(0)	-	NP	17.8	55.9	20.3	6.1	99	90	29	-	-



NOTE: GROUNDLINE PROFILE ALONG WALL 6 TAKEN FROM r5021 ls tin.tin DATED 7/14/14

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

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	4

REFERENCE: R-5021

PROJECT: 41582

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE AND SOIL TEST RESULTS

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY ROAD) TO NC 87*

SITE DESCRIPTION *WALL 7: -YREV- STATION 38+00*

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

CHRIS ALEXANDER

COREY FUTRAL

D.T. CHALMERS

T. SPENCER

M. D. MASON

INVESTIGATED BY *S. V. HUDSON*

DRAWN BY *S. V. HUDSON*

CHECKED BY *J. L. STONE*

SUBMITTED BY *S. V. HUDSON*

DATE *DECEMBER 2017*

CATLIN
Engineers and Scientists

NORTH CAROLINA LICENSED SEAL 1583 GEOLOGIST STEVEN V HUDSON

DocuSigned by:
2/28/2019
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SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R–5021	2

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
- [X] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] 2 7/8" DRAG BIT

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: LOCATIONS AND ELEVATIONS OBTAINED WITH RTK SURVEY GRADE GLOBAL POSITIONING SYSTEM (GPS)

ELEVATION: FEET

NOTES:

U.C.P. = UNDIVIDED COASTAL PLAIN

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 100 200

FEET

40

45

50

20

BEGIN WALL
-WALL7- STA 37+95

-YA- POT Sta. 22+09.00
-YREV- PRC Sta. 40+05.11

-WALL7-

-YREV- PT Sta. 49+07.97

END WALL
-WALL7- STA 47+55

-YREV-

-YA- PT Sta. 19+40.63

S 56° 18' 34.7" E

S 9° 18' 44.7" W

+40.63 -YA-
85.00' RT

+34.20 -YREV-
133.45' RT

+71.68 -YREV-
111.77' RT
END WWF
TIE TO EXIST. WWF

-YA-

18" C&G

36" C&G

15" RCP

48" RCP

REBAR

E.P.

CONC

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

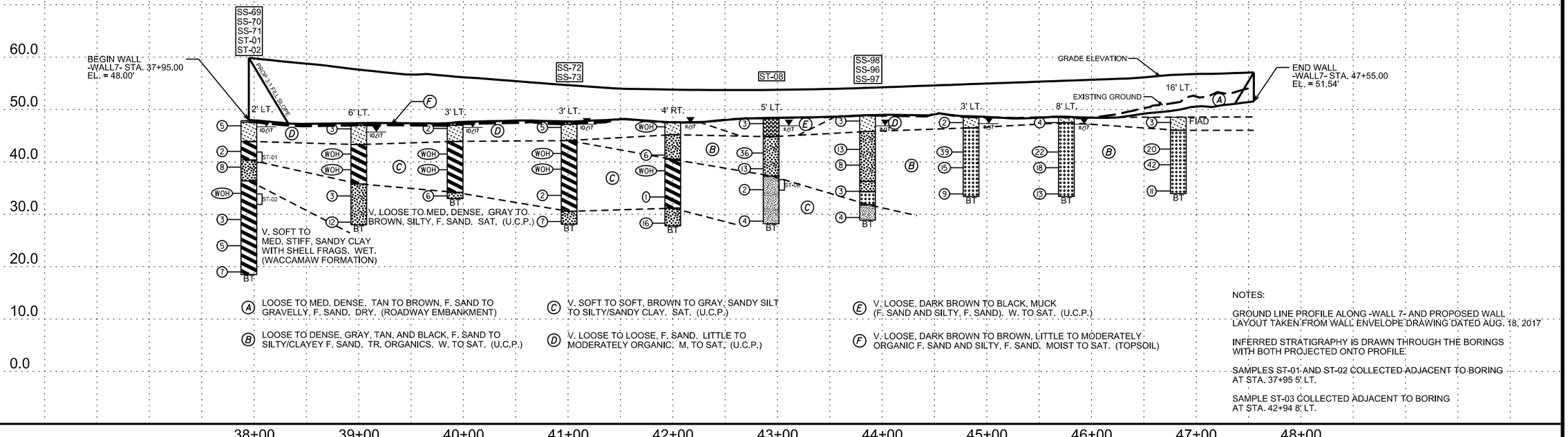
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SOIL TEST RESULTS

SAMPLE NUMBER	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P. I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-69	2 ft LT	37+95	0.3 - 1.5	A-3(0)	11	NP	38.7	59.4	1.1	0.8	100	93	2	-	-
SS-70	2 ft LT	37+95	4.9 - 6.4	A-7-6(13)	41	21	11.3	20.8	25.3	42.6	100	98	70	-	-
SS-71	2 ft LT	37+95	12.9 - 14.4	A-7-6(23)	49	31	2.3	23.4	31.6	42.7	100	100	77	-	-
SS-72	3 ft LT	41+01	5.0 - 6.5	A-7-6(30)	51	29	1.6	7.5	40.9	50.0	100	99	94	-	-
SS-73	3 ft LT	41+01	18.0 - 19.5	A-2-4(0)	19	NP	53.1	28.8	11.4	6.7	95.2	68	21	-	-
SS-98	CL	43+86	0.0 - 1.5	A-2-4(0)	26	NP	29.4	56.1	10.9	3.6	99.0	97	15	194	7.3
SS-96	CL	43+86	13.4 - 14.9	A-2-4(0)	17	NP	17.5	63.4	8.0	11.1	98.5	91	20	-	-
SS-97	CL	43+86	18.4 - 19.9	A-4(0)	22	6	6.3	57.6	19.5	16.6	100	98	43	-	-

0 100 200
FEET
V.E. = 5

PROFILE THROUGH BORINGS PROJECTED ALONG -WALL7-



(A) LOOSE TO MED. DENSE. TAN TO BROWN, F. SAND TO GRAVELLY, F. SAND. DRY. (ROADWAY EMBANKMENT)

(B) LOOSE TO DENSE, GRAY, TAN, AND BLACK, F. SAND TO SILTY/CLAYEY F. SAND. TR. ORGANICS. W. TO SAT. (U.C.P.)

(C) V. SOFT TO SOFT, BROWN TO GRAY, SANDY SILT TO SILTY/SANDY CLAY. SAT. (U.C.P.)

(D) V. LOOSE TO LOOSE, F. SAND. LITTLE TO MODERATELY ORGANIC. M. TO SAT. (U.C.P.)

(E) V. LOOSE, DARK BROWN TO BLACK, MUCK (F. SAND AND SILTY, F. SAND). W. TO SAT. (U.C.P.)

(F) V. LOOSE, DARK BROWN TO BROWN, LITTLE TO MODERATELY ORGANIC F. SAND AND SILTY, F. SAND. MOIST TO SAT. (TOPSOIL)

NOTES:

GROUND LINE PROFILE ALONG -WALL 7- AND PROPOSED WALL LAYOUT TAKEN FROM WALL ENVELOPE DRAWING DATED AUG. 18, 2017

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

SAMPLES ST-01 AND ST-02 COLLECTED ADJACENT TO BORING AT STA. 37+95 5' LT.

SAMPLE ST-03 COLLECTED ADJACENT TO BORING AT STA. 42+94 8' LT.

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	11

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY BRUNSWICK

PROJECT DESCRIPTION NC 211 FROM SR 1500 (MIDWAY RD.) TO NC 87

SITE DESCRIPTION WALL 8 RIGHT OF -Y14A- STA. 40+50
WALL 9 LEFT OF -Y14A- STA. 40+50
WALL 10 LEFT OF -Y14A- STA. 34+50
WALL 11 RIGHT OF -Y14A- STA. 32+50
EB1- ABUTMENT WALL
EB2- ABUTMENT WALL

CONTENTS

CAUTION NOTICE

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PERSONNEL

CATLIN PERSONNEL

INVESTIGATED BY JL STONE, PG

DRAWN BY JL, STONE PG

CHECKED BY STEVEN HUDSON, PG

SUBMITTED BY JL STONE, PG

DATE JUNE 2018

CATLIN
Engineers and Scientists
Wilmington, North Carolina

NORTH CAROLINA LICENSED SEAL 2007 GEOLOGIST JOSEPH L. STONE

DocuSigned by:
Joseph L. Stone
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SIGNATURE

2/28/2019
DATE

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PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 7/8" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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 DATA COLLECTED USING RTK
SURVEY GRADE GPS SYSTEM
ELEVATION: _____ FEET

NOTES:

U.C.P. = UNDIVIDED COASTAL PLAIN

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

CATLIN
Engineers and Scientists
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DO NOT USE FOR R/W ACQUISITION

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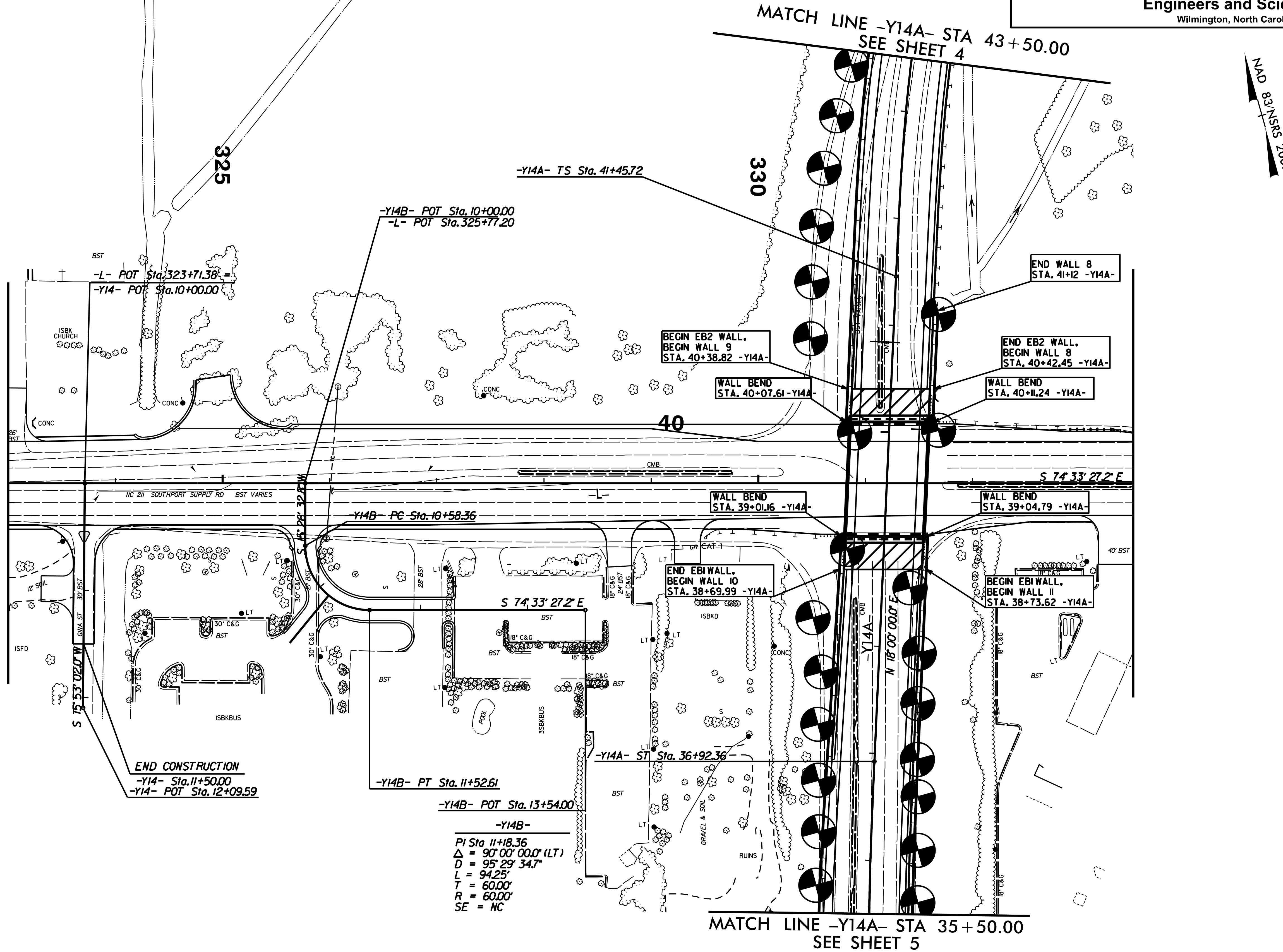

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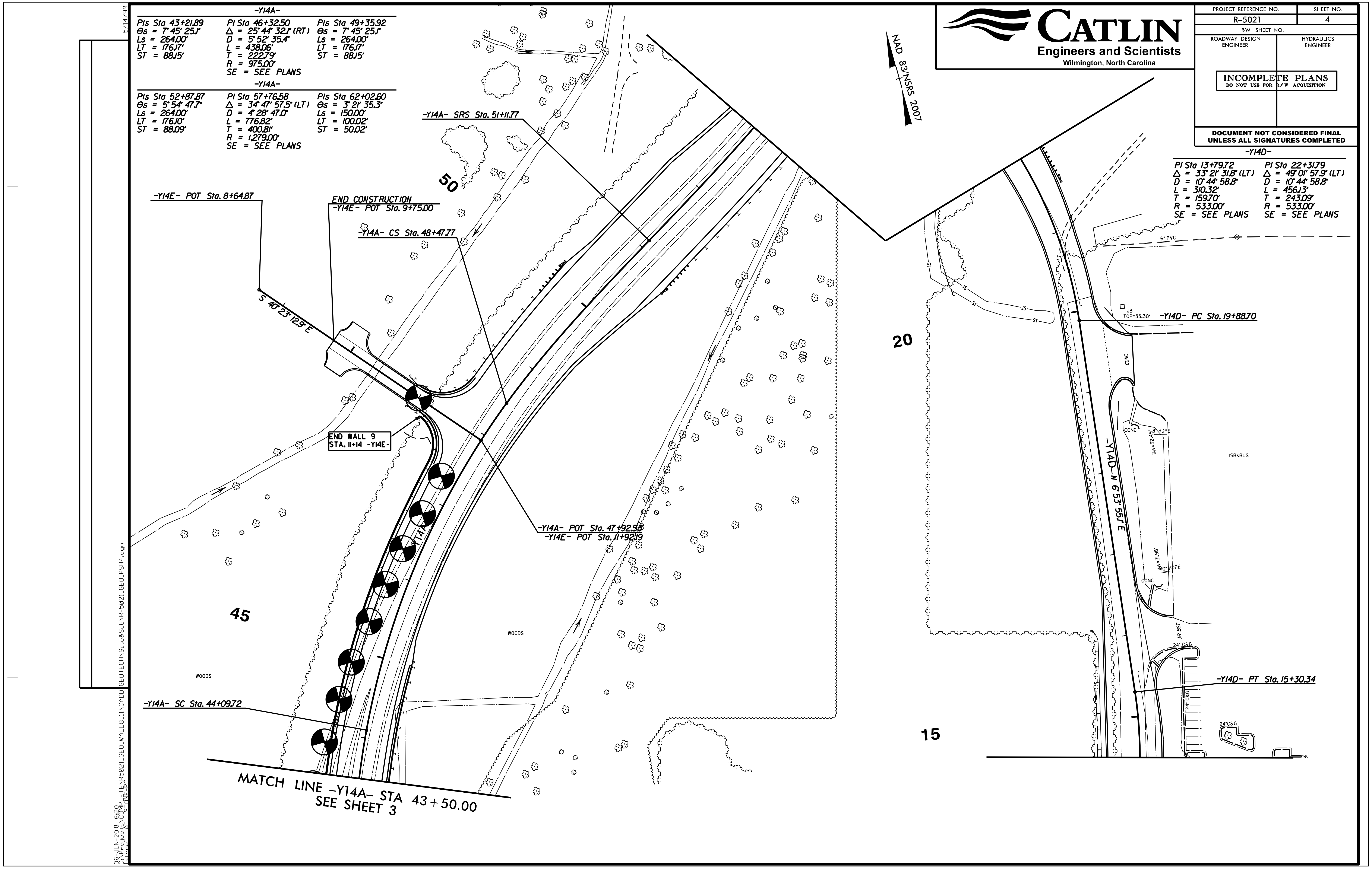

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-Y14A-
PIs Sta 43+21.89
Θs = 7° 45' 25.1"
Ls = 264.00'
LT = 176.17'
ST = 88.15'
PI Sta 46+32.50
Δ = 25° 44' 32.1" (RT)
D = 5° 52' 35.4"
L = 438.06'
T = 222.79'
R = 975.00'
SE = SEE PLANS
PIs Sta 49+35.92
Θs = 7° 45' 25.1"
Ls = 264.00'
LT = 176.17'
ST = 88.15'
-Y14A-
PIs Sta 52+87.87
Θs = 5° 54' 47.7"
Ls = 264.00'
LT = 176.10'
ST = 88.09'
PI Sta 57+76.58
Δ = 34° 47' 57.5" (LT)
D = 4° 28' 47.0"
L = 776.82'
T = 400.81'
R = 1,279.00'
SE = SEE PLANS
PIs Sta 62+02.60
Θs = 3° 21' 35.3"
Ls = 150.00'
LT = 100.02'
ST = 50.02'
-Y14D-
PI Sta 13+79.72
Δ = 33° 21' 31.8" (LT)
D = 10° 44' 58.8"
L = 310.32'
T = 159.70'
R = 533.00'
SE = SEE PLANS
PI Sta 22+31.79
Δ = 49° 01' 57.9" (LT)
D = 10° 44' 58.8"
L = 456.13'
T = 243.09'
R = 533.00'
SE = SEE PLANS
-Y14A- SRS Sta. 51+11.77
-Y14E- POT Sta. 8+64.87
END CONSTRUCTION
-Y14E- POT Sta. 9+75.00
-Y14A- CS Sta. 48+47.77
S 40° 23' 12.9" E
END WALL 9
STA. 11+14 -Y14E-
-Y14A- POT Sta. 47+92.53
-Y14E- POT Sta. 11+92.19
-Y14A- SC Sta. 44+09.72
MATCH LINE -Y14A- STA 43+50.00
SEE SHEET 3
50
45
20
15
WOODS
-Y14A-
6" PVC
JB
TOP=33.30'
-Y14D- PC Sta. 19+88.70
CONC
-Y14D- N 6° 53' 55.1" E
8" HDPE
INV=32.49'
ISBKBUS
INV=31.98'
10" HDPE
36" BST
24" C&G
-Y14D- PT Sta. 15+30.34
5/14/99
06-JUN-2018 16:20

5/14/99

CATLIN
Engineers and Scientists
Wilmington, North Carolina

PROJECT REFERENCE NO.	SHEET NO.
R-5021	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/NSRS 2007

MATCH LINE -Y14A-
STA 35+50.00 SEE SHEET 3

-Y14A- CS Sta. 34+72.36

END WALL 10
STA. 34+45 -Y14A-

-Y14A- SC Sta. 33+00.42

END WALL 11
STA. 32+45 -Y14A-

-Y14A- SRS Sta. 30+80.42

-Y14A- CS Sta. 28+16.42

-Y14A- POC Sta. 27+74.86
-Y14C- POT Sta. 10+81.18
BEGIN CONSTRUCTION
-Y14A- Sta. 27+20.00
-Y14A- PCC Sta. 27+00.00

-Y14A-
-Y14C-
N 86° 49' 10.7" E

-Y14C- PT Sta. 14+14.13

-Y14C- PC Sta. 12+51.59

N 40° 15' 27.0" E

-Y14A-

PIs Sta 20+73.01	PI Sta 24+15.37	PI Sta 27+68.26
Θs = 2° 57' 48.3"	Δ = 22° 47' 59.2" (LT)	Δ = 5° 45' 01.5" (LT)
Ls = 150.00'	D = 3° 57' 05.2"	D = 4° 56' 21.4"
LT = 100.01'	L = 577.00'	L = 116.42'
ST = 50.01'	T = 292.37'	T = 58.26'
	R = 1,450.00'	R = 1160.00'
	SE = SEE PLANS	SE = SEE PLANS

PIs Sta 29+04.57	PIs Sta 32+27.73	PI Sta 33+86.49
Θs = 6° 31' 11.5"	Θs = 4° 20' 47.1"	Δ = 6° 47' 38.1" (RT)
Ls = 264.00'	Ls = 220.00'	D = 3° 57' 05.2"
LT = 176.12'	LT = 146.71'	L = 171.94'
ST = 88'	ST = 73.37'	T = 86.07'
		R = 1,450.00'
		SE = SEE PLANS

PIs Sta 35+45.03
Θs = 4° 20' 47.1"
Ls = 220.00'
LT = 146.71'
ST = 73.37'

OAK ISLAND CITY LIMIT

NOTE:

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PROJECT REFERENCE NO.	SHEET NO.
R-5021	6

CATLIN Engineers and Scientists, Washington, North Carolina

ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER

INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 8

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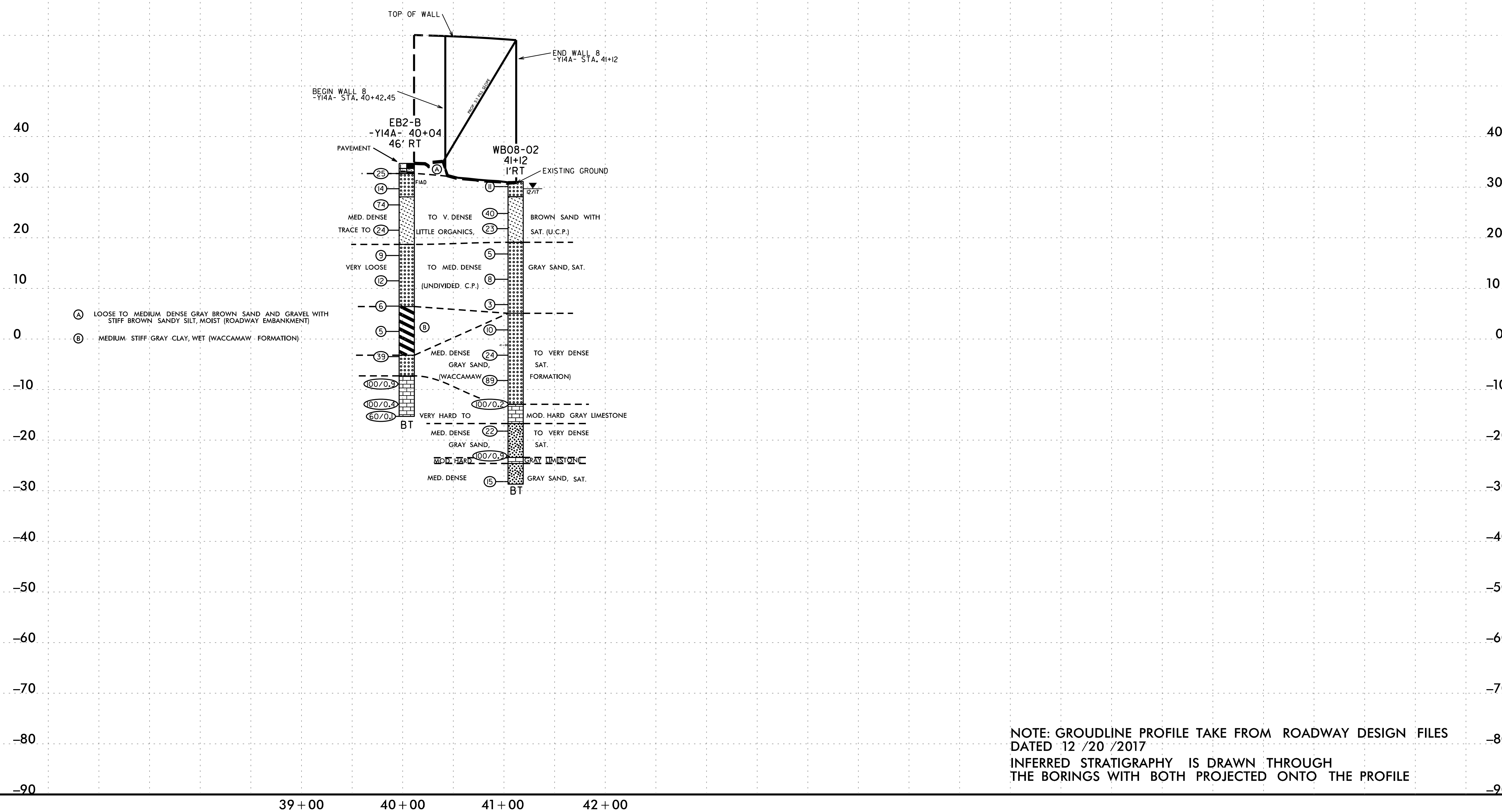

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CATLIN Engineers and Scientists, Washington, North Carolina

ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 9

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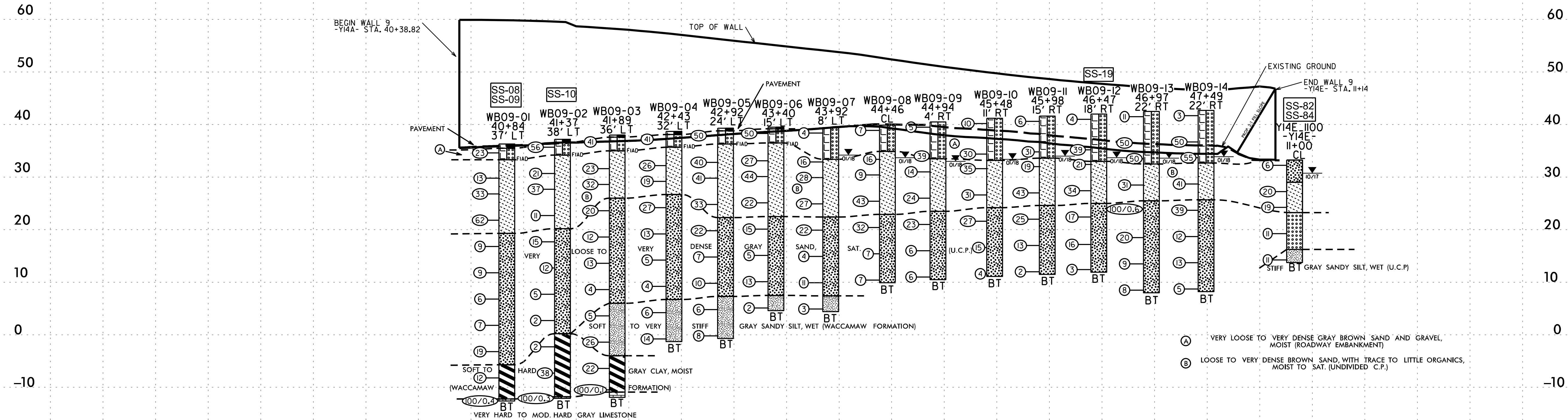

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-08	37LT	40+84	5.5 - 7.0	A-3(0)	22	NP	58	34.6	2.1	5.2	100	86	8	-	-
SS-09	37LT	40+84	33.5 - 35.0	A-2-4(0)	23	6	50.1	23.1	10	16.8	90.8	65	28	-	-
SS-10	38LT	41+37	38.5 - 40.0	A-7-5(20)	55	20	7	9.6	43.1	40.3	100	96	84	89	-
SS-19	18RT	46+47	13.6 - 15.1	A-3(0)	12	NP	46.4	48.9	0.8	3.9	97.4	88	5	27	4
SS-82	CL	11+00	0.0 - 1.5	A-2-4(0)	17	NP	43.4	40.3	10	6.3	100	94	17	-	2.2
SS-84	CL	11+00	13.0 - 14.5	A-3(0)	17	NP	53.1	44.6	1.2	1.1	98.3	73	3	-	-

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CATLIN Engineers and Scientists
Washington, North Carolina

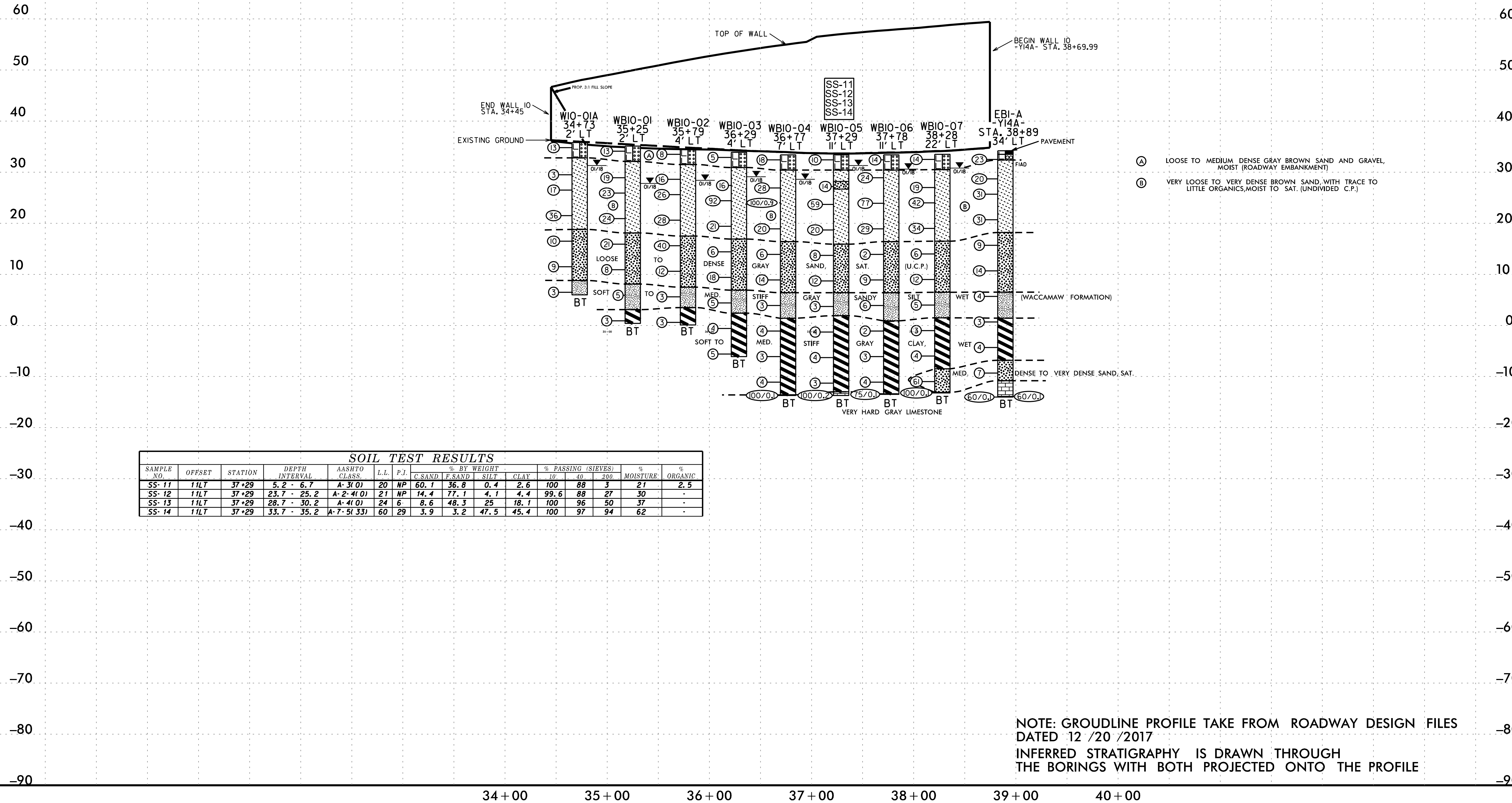
PROJECT REFERENCE NO.	SHEET NO.
R-5021	8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 10

VE = 5.0



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-11	11LT	37+29	5.2 - 6.7	A-3(0)	20	NP	60.1	36.8	0.4	2.6	100	88	3	21	2.5
SS-12	11LT	37+29	23.7 - 25.2	A-2-4(0)	21	NP	14.4	77.1	4.1	4.4	99.6	88	27	30	-
SS-13	11LT	37+29	28.7 - 30.2	A-4(0)	24	6	8.6	48.3	25	18.1	100	96	50	37	-
SS-14	11LT	37+29	33.7 - 35.2	A-7-5(33)	60	29	3.9	3.2	47.5	45.4	100	97	94	62	-

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INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

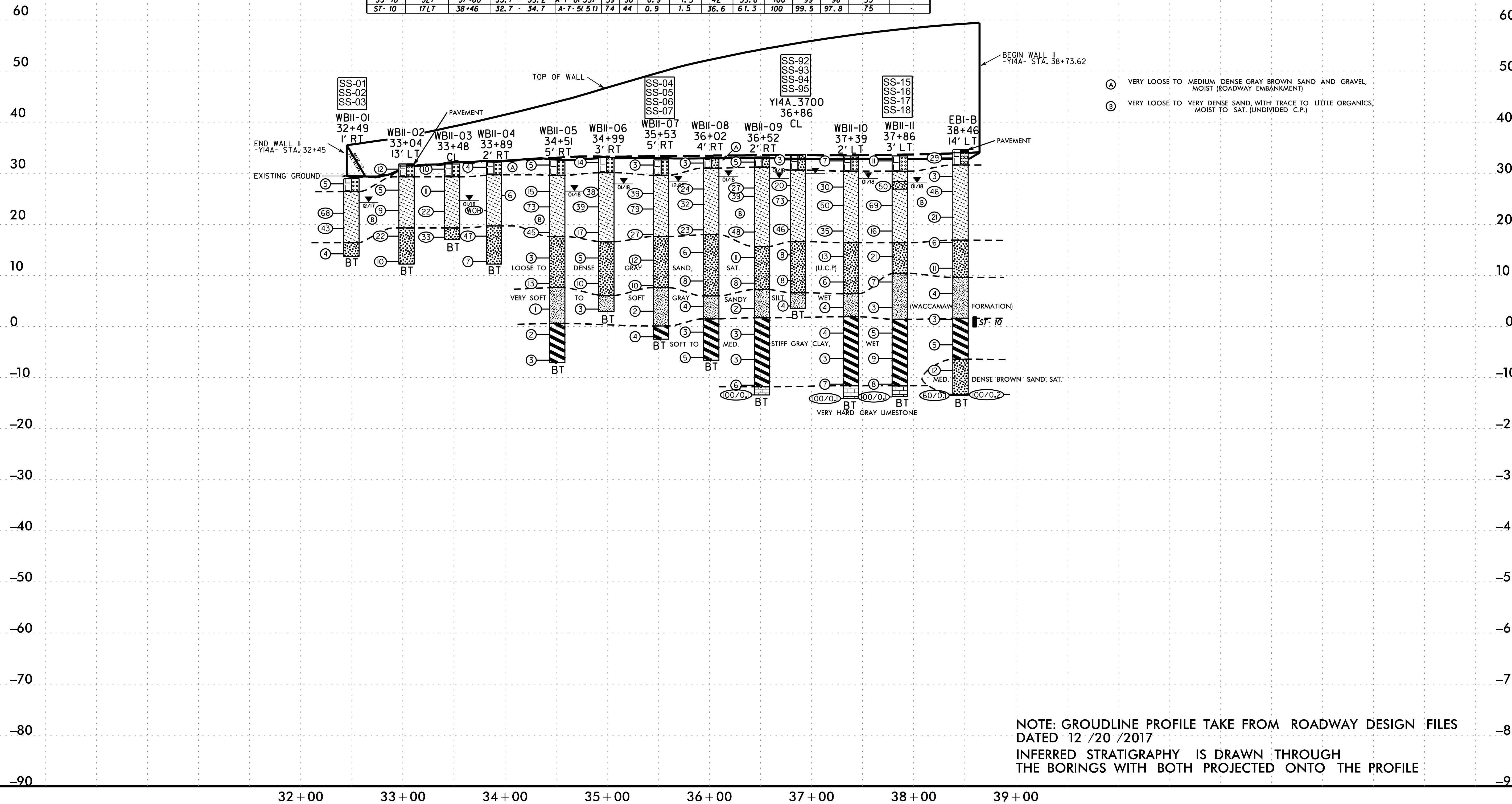
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 11

VE = 5.0

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-01	1RT	32+49	0.0 - 1.5	A-3(0)	18	NP	50.6	43.9	3.5	1.9	80.1	84	6	-	1.8
SS-02	1RT	32+49	5.7 - 7.2	A-3(0)	30	NP	28.3	66.2	4.1	1.4	99.6	86	7	-	-
SS-03	1RT	32+49	13.7 - 15.2	A-2-4(0)	26	8	4.1	78.4	11.3	6.2	99.5	97	27	-	-
SS-04	5RT	35+53	5.6 - 7.1	A-3(0)	21	NP	66.9	29.6	2	1.5	100	88	4	-	3.2
SS-05	5RT	35+53	18.6 - 20.1	A-2-4(0)	25	NP	0.6	89.8	3.4	6.2	99.8	100	19	-	-
SS-06	5RT	35+53	28.6 - 30.1	A-4(0)	18	5	19.3	45.6	23.2	11.9	96.8	90	43	-	-
SS-07	5RT	35+53	33.6 - 35.1	A-7-6(36)	62	33	3.6	3.8	40.7	52	100	98	93	60	-
SS-92	CL	36+86	0.5 - 1.5	A-2-4(0)	23	NP	37.8	53.5	5.5	3.2	99	90	11	-	-
SS-93	CL	36+86	5.0 - 6.5	A-3(0)	19	NP	68.9	24.9	3.9	2.2	100	75	7	-	4.9
SS-94	CL	36+86	13.6 - 15.1	A-3(0)	19	NP	51.8	44.2	1.1	2.8	88.4	63	5	-	-
SS-95	CL	36+86	18.6 - 20.1	A-2-4(0)	25	NP	1	89.6	4.4	5	99.9	99	18	-	-
SS-15	3LT	37+86	5.0 - 6.5	A-3(0)	14	NP	60.4	34.8	2.4	2.4	99.8	80	6	19	2.9
SS-16	3LT	37+86	23.7 - 25.2	A-4(0)	21	NP	1.4	86	5.1	7.5	100	99	35	34	-
SS-17	3LT	37+86	28.7 - 30.2	A-4(0)	19	NP	26	42.2	14.7	17	96.6	84	36	34	-
SS-18	3LT	37+86	33.7 - 35.2	A-7-6(35)	59	30	0.9	1.5	42	55.6	100	99	98	53	-
ST-10	17LT	38+46	32.7 - 34.7	A-7-5(51)	74	44	0.9	1.5	36.6	61.3	100	99.5	97.8	75	-



NOTE: GROUDLINE PROFILE TAKE FROM ROADWAY DESIGN FILES DATED 12 /20 /2017
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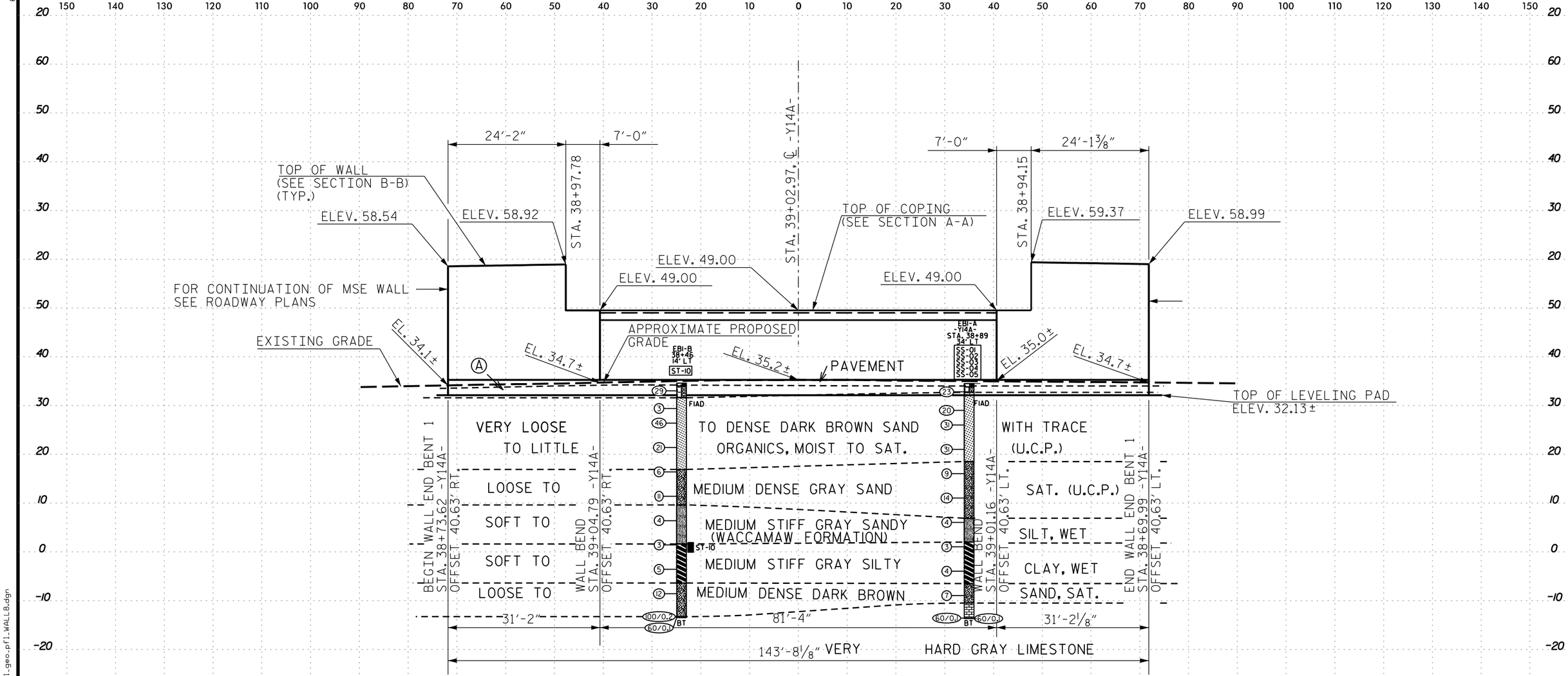


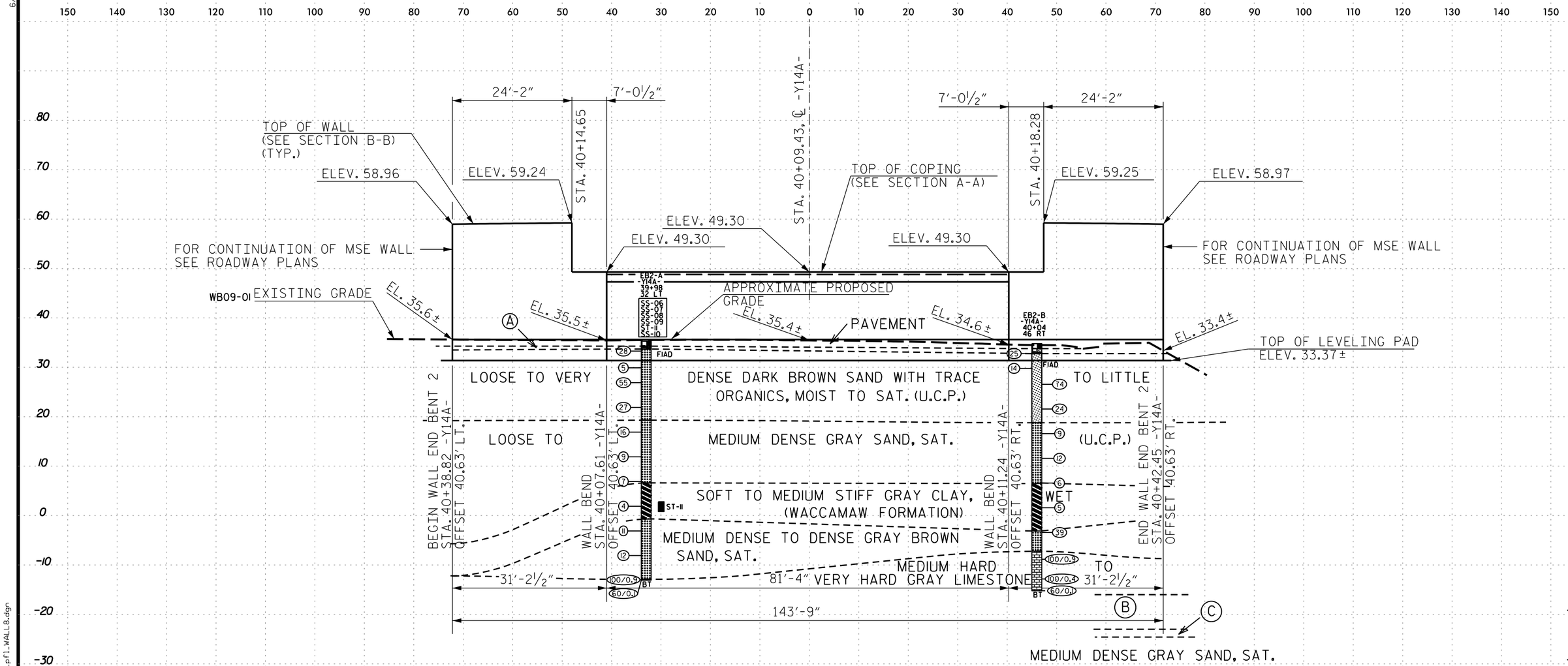
Ⓐ MEDIUM DENSE SAND WITH GRAVEL, MOIST (ROADWAY EMBANKMENT)

SOIL TEST RESULTS

SAMPLE NUMBER	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P. I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-01	34 ft LT	38+89	7.5 - 9.0	A-3(0)	10	NP	74.6	17.2	5.2	3.0	99.5	54	9	-	2.2
SS-02	34 ft LT	38+89	22.5 - 24.0	A-2-4(0)	16	NP	0.7	89.3	5.4	4.0	100	100	23	-	-
SS-03	34 ft LT	38+89	32.5 - 34.0	A-7-5(33)	60	27	1.5	1.8	54.9	41.8	100	99	97	-	-
SS-04	34 ft LT	38+89	42.5 - 44.0	A-2-4(0)	20	NP	37.3	48.5	6.1	8.2	99.3	83	15	-	-
SS-05	34 ft LT	38+89	47.5 - 48.1	A-3(0)	7	NP	68.2	27.7	2.1	2.0	99.4	68	5	-	-
ST-10	17 ft LT	38+46	32.7 - 34.7	A-7-5(51)	74	44	0.9	1.5	36.3	61.3	100	99.5	97.8	75	-

END BENT 1 WALL ELEVATION

LOOKING AT EXPOSED FACE



(A) MEDIUM DENSE SAND WITH GRAVEL UNDERLAIN BY PAVEMENT, MOIST (ROADWAY EMBANKMENT)

(B) MEDIUM DENSE TO VERY DENSE GRAY SAND, SAT.

(C) MODERATELY HARD GRAY LIMESTONE

SOIL TEST RESULTS

SAMPLE NUMBER	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P. I.	% BY WEIGHT				% PASSING SIEVES			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-06	32 ft LT	39+98	1.6 - 2.5	A-3(0)	11	NP	55.6	39.8	1.7	3.0	99.6	86	5	-	1.8
SS-07	32 ft LT	39+98	4.4 - 5.9	A-3(0)	16	NP	60.1	31.0	4.1	4.8	99.9	79	10	-	-
SS-08	32 ft LT	39+98	17.4 - 18.9	A-3(0)	13	NP	1.6	92.4	1.0	5.0	99.8	99	8	-	-
SS-09	32 ft LT	39+98	32.4 - 33.9	A-7-5(36)	63	31	2.6	2.2	38.3	56.9	100	99	95	-	-
ST-11	29 ft LT	39+98	32.5 - 34.5	A-7-5(51)	74	44	0.9	1.5	36.3	61.3	100	99	98	51	-
SS-11	29 ft LT	39+98	37.4 - 38.9	A-3(0)	10	NP	29.3	62.7	1.0	7.0	100	94	9	-	-

END BENT 2 WALL ELEVATION

LOOKING AT EXPOSED FACE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	4

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY RD.) TO NC 87*

SITE DESCRIPTION *WALL 12 LEFT OF -Y14A- STA. 48+50*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

S.N. ZIMARINO

R.E. SMITH

C.E. RAWLINS

INVESTIGATED BY *T.C. BOTTOMS*

DRAWN BY *T.C. BOTTOMS*

CHECKED BY *D.N. ARGENBRIGHT*

SUBMITTED BY *D.N. ARGENBRIGHT*

DATE *JUNE 2018*

NORTH CAROLINA LICENSED SEAL 2240 GEOLOGIST TYLER C. BOTTOMS

DocuSigned by: Tyler Bottoms 2/28/2019
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SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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		—	—	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:
- [ ] CME-45C
- [X] CME-55
- [ ] 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
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: ELEVATIONS OBTAINED FROM R5021_LS_TNL.TIN

ELEVATION: FEET

NOTES:

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 50 100

FEET

49

50

51

52

55

-WALL 12- PC Sta. 47+94.52
-Y14E- POC Sta. 11+04.54
OFF 18'-10 1/2'

-WALL 12- PRC Sta. 48+50.16
-Y14A- POC Sta. 48+50.16
OFF 55'-11 3/16'

-WALL 12- PT Sta. 50+45.01
-Y14A- POC Sta. 50+37.96
OFF 58'-8 7/8'

-WALL 12- PI Sta. 52+06.99
-Y14A- POC Sta. 52+00.00
OFF 58'-7 1/2'

-WALL 12- PC Sta. 53+05.60
-Y14A- POC Sta. 53+00.00
OFF 46'-7 1/2'

-WALL 12- PT Sta. 54+64.37
-Y14F- POC Sta. 11+74.08
OFF 34'-7 1/2'

-WALL 12- PCC Sta. 54+15.26
-Y14A- POC Sta. 54+13.40
OFF 46'-7 1/2'

-Y14A- SC Sta. 53+75.77

-WALL 12- 49+00

-WALL 12- 50+00

-Y14E-

-Y14F-

-Y14A-

-Y14D-

48" WW

60" WW

W12-01

W12-02

W12-03

W12-04

W12-05

W12-06

W12-07

52+00

53+00

54+00

BYY4
BP-2.3

BYY4
BP-2.3

BYY4
BP-2.6

BYY4
BP-2.6

BL-400Z

5/14/99

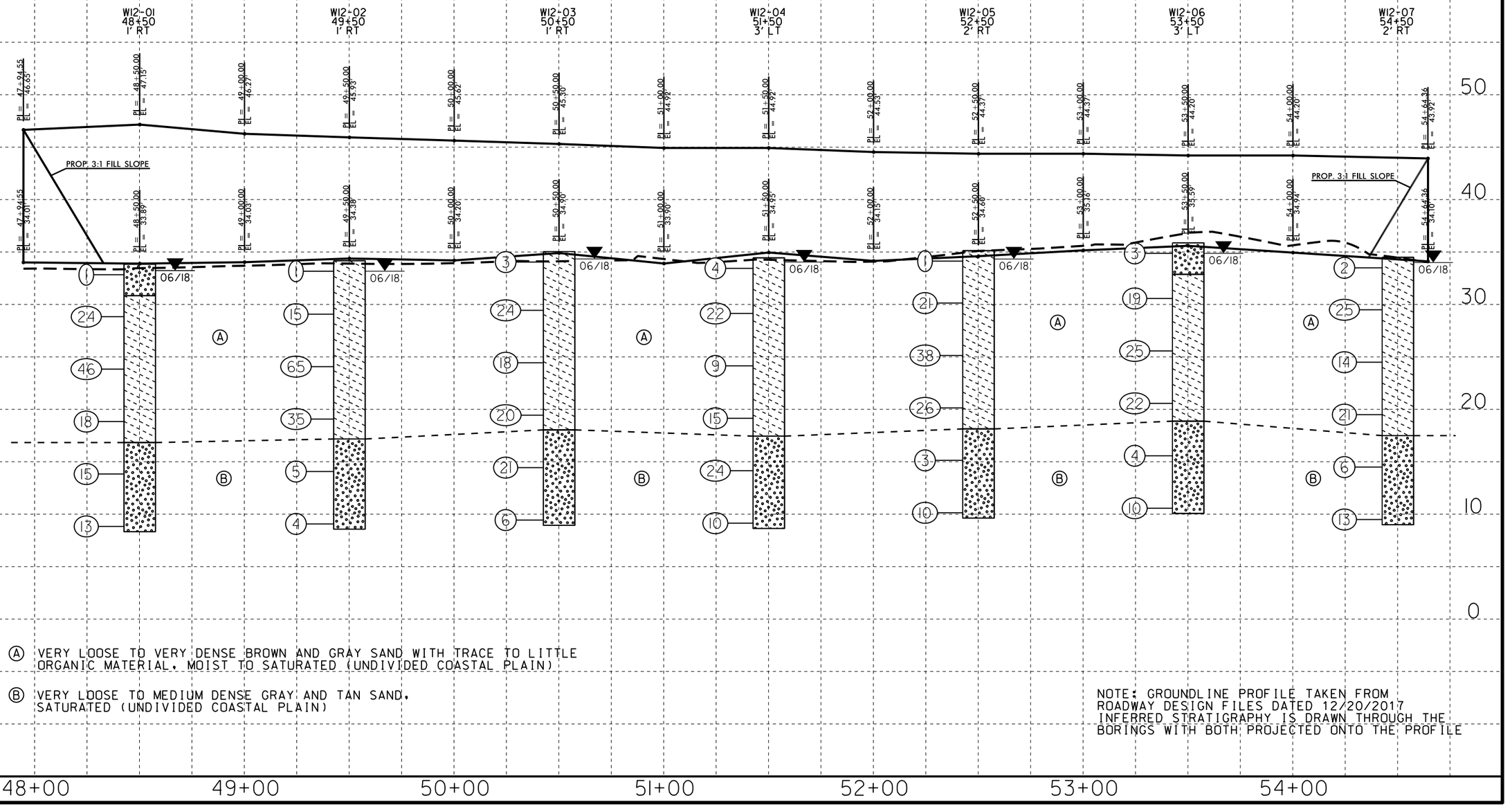
PROFILE THROUGH BORINGS PROJECTED ALONG WALL 12

PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

VE=5



Ⓐ VERY LOOSE TO VERY DENSE BROWN AND GRAY SAND WITH TRACE TO LITTLE ORGANIC MATERIAL, MOIST TO SATURATED (UNDIVIDED COASTAL PLAIN)

Ⓑ VERY LOOSE TO MEDIUM DENSE GRAY AND TAN SAND, SATURATED (UNDIVIDED COASTAL PLAIN)

NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY DESIGN FILES DATED 12/20/2017
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

20-JUN-2018 13:10
$$$$USERNAME$$$$
...\Greenville Investigation\TIP\R5021_GEO_RWAL12-13\CADD_GEOTECH\PlanProf\R5021_rdy_pf1_WALL12.dgn

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5021	1	4

REFERENCE: R-5021

PROJECT: 41582

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *BRUNSWICK*

PROJECT DESCRIPTION *NC 211 FROM SR 1500 (MIDWAY RD.) TO NC 87*

SITE DESCRIPTION *WALL 13 RIGHT OF -YREV- STA. 47+00*

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

S.N. ZIMARINO

R.E. SMITH

C.E. RAWLINS

INVESTIGATED BY *T.C. BOTTOMS*

DRAWN BY *T.C. BOTTOMS*

CHECKED BY *D.N. ARGENBRIGHT*

SUBMITTED BY *D.N. ARGENBRIGHT*

DATE *JUNE 2018*

NORTH CAROLINA LICENSED SEAL 2240 GEOLOGIST TYLER C. BOTTOMS

DocuSigned by:
Tyler Bottoms
48A2D3BD08CF4A6...

2/28/2019

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
R-5021	2

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-45C
- [ ] CME-55
- [ ] 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
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 15/16" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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: ELEVATIONS OBTAINED FROM R5021_LS_TNL.TIN

ELEVATION: FEET

NOTES:

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-5021	3

SITE PLAN

0 40 80

FEET

47

48

50

51

18" C&G

36" C&G

15" RCP

-YREV-

S 9°18' 44.7" W

48" RCP

W13-01

W13-02

W13-03

W13-04

W13-05

C

F

-WALL 13- PC Sta. 46+75.00
-YREV- PC Sta. 46+75.00
OFF 57'-4 1/2"

-WALL 13- 48+00

CONC

-WALL 13- PI Sta. 49+31.59
-YREV- PC Sta. 49+25.25
OFF 57'-4 1/2"

-WALL 13- PT Sta. 49+14.31
-YREV- PC Sta. 49+07.97
OFF 57'-4 1/2"

-WALL 13- 50+00

CONC

-WALL 13- POT Sta. 51+21.49
-YREV- PC Sta. 51+15.00
OFF 49'-9 7/16"

CAT-1

5/14/99

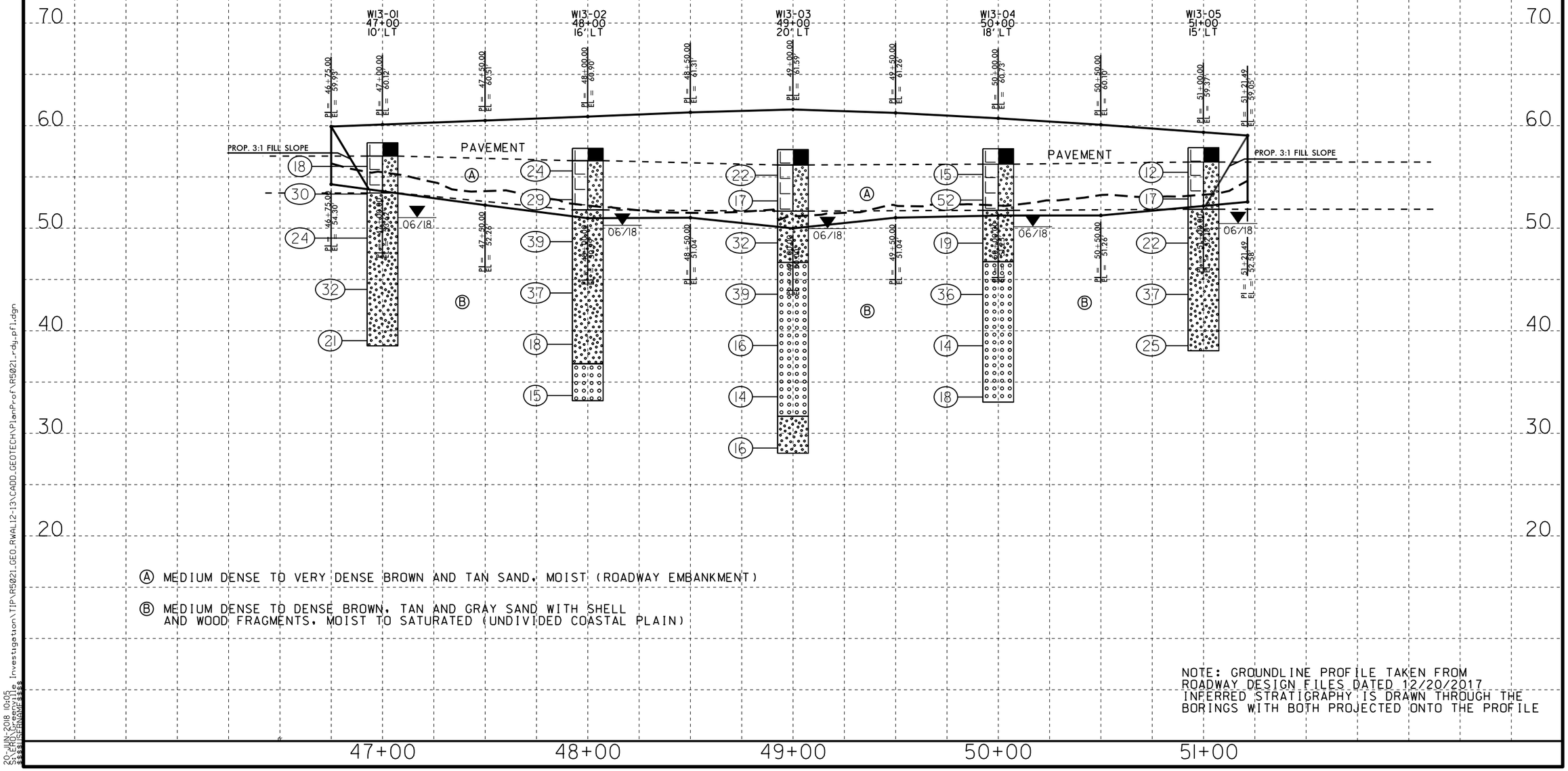
PROJECT REFERENCE NO.	SHEET NO.
R-5021	4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROFILE THROUGH BORINGS PROJECTED ALONG WALL 13

VE=5



Ⓐ MEDIUM DENSE TO VERY DENSE BROWN AND TAN SAND, MOIST (ROADWAY EMBANKMENT)

Ⓑ MEDIUM DENSE TO DENSE BROWN, TAN AND GRAY SAND WITH SHELL AND WOOD FRAGMENTS, MOIST TO SATURATED (UNDIVIDED COASTAL PLAIN)

NOTE: GROUNDLINE PROFILE TAKEN FROM ROADWAY DESIGN FILES DATED 12/20/2017
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE

20-JUN-2018 10:05
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