

REFERENCE: U-4751

PROJECT: 40191

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

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|-------|-----------------------------|-----------|--------------|
| N.C. | U-4751 | 1 | 12 |

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STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY NEW HANOVER
PROJECT DESCRIPTION SR 1409 (MILITARY CUTOFF ROAD) TO US 17 IN WILMINGTON
SITE DESCRIPTION BRIDGE NO. 203 ON SR 1409 (-L-) OVER US 17 (-Y8-) AT -L- STA. 225 + 92.26

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

W. S. HUNSBERGER

MID-ATLANTIC DRILLING

INVESTIGATED BY WSH

DRAWN BY WSH

CHECKED BY J.R. HAMM

SUBMITTED BY FALCON

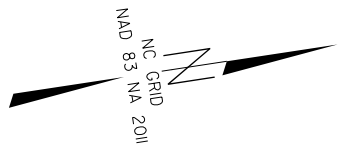
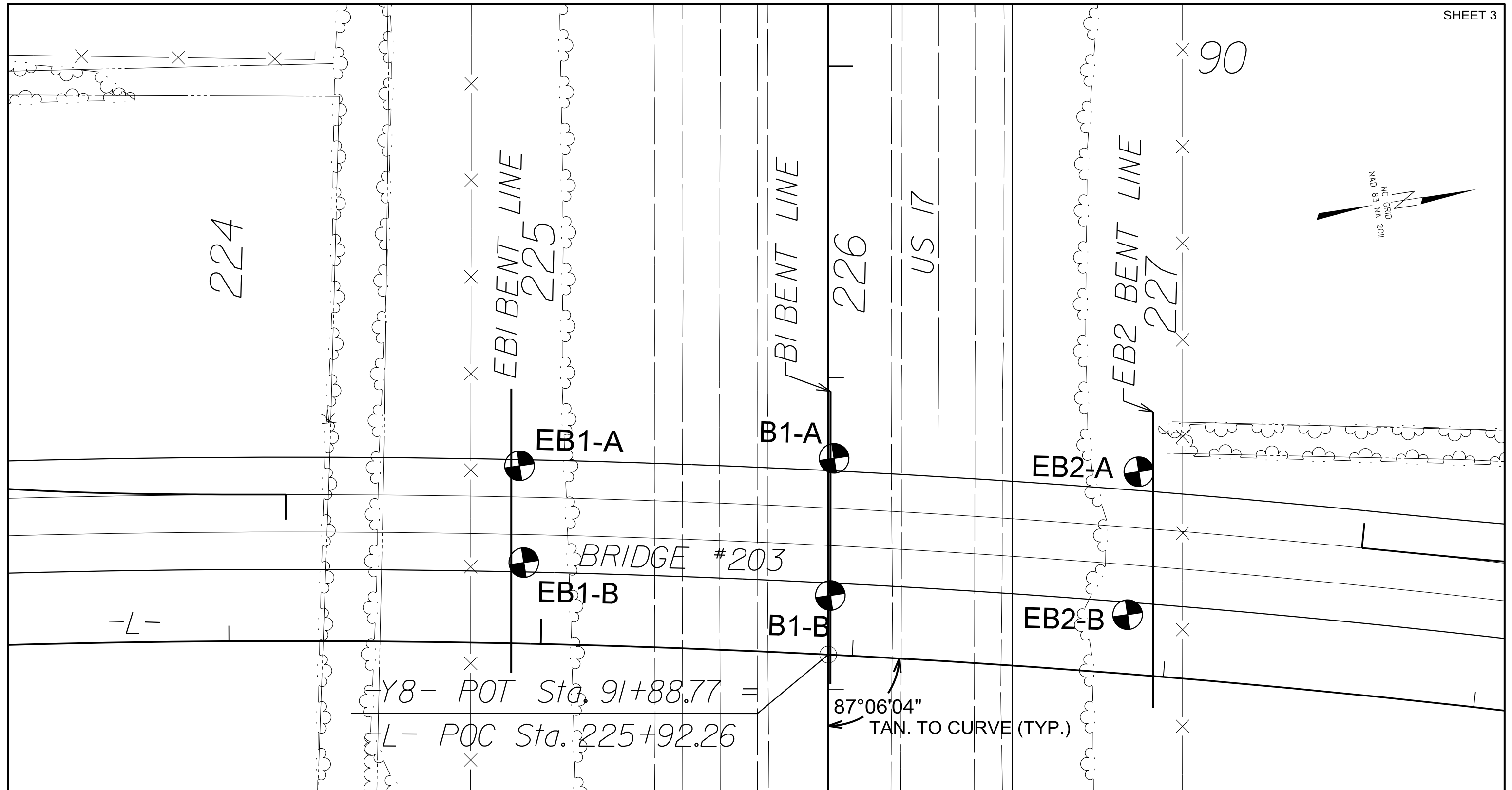
DATE FEBRUARY 2015



DocuSigned by:
W. Scott Hunsberger 3/25/2015
SIGNATURE DATE

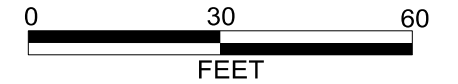
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

| SOIL DESCRIPTION | | | | | | | | | | GRADATION | | | | | | | | | | ROCK DESCRIPTION | | | | | | | | | | TERMS AND DEFINITIONS | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|--|--|--|--|--|--|--|--|--|
| <p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p> | | | | | | | | | | <p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p> | | | | | | | | | | <p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p> | | | | | | | | | | <p>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 (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND 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 (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p> | | | | | | | | | | | | | | | | | | | |
| SOIL LEGEND AND AASHTO CLASSIFICATION | | | | | | | | | | ANGULARITY OF GRAINS | | | | | | | | | | WEATHERED ROCK (WR) | | | | | | | | | | CRYSTALLINE ROCK (CR) | | | | | | | | | | | | | | | | | | | |
| <p>GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS</p> | | | | | | | | | | <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p> | | | | | | | | | | <p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p> | | | | | | | | | | <p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p> | | | | | | | | | | | | | | | | | | | |
| MINERALOGICAL COMPOSITION | | | | | | | | | | NON-CRYSTALLINE ROCK (NCR) | | | | | | | | | | COASTAL PLAIN SEDIMENTARY ROCK (CP) | | | | | | | | | | WEATHERING | | | | | | | | | | | | | | | | | | | |
| <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p> | | | | | | | | | | <p>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.</p> | | | | | | | | | | <p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p> | | | | | | | | | | <p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. VERY SLIGHT (IV 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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i> 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. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i> VERY SEVERE (IV 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. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i> COMPLETE ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. FABRIC MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p> | | | | | | | | | | | | | | | | | | | |
| COMPRESSION | | | | | | | | | | PERCENTAGE OF MATERIAL | | | | | | | | | | GROUND WATER | | | | | | | | | | MISCELLANEOUS SYMBOLS | | | | | | | | | | | | | | | | | | | |
| <p>SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</p> | | | | | | | | | | <p>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</p> | | | | | | | | | | <p>▽ 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</p> | | | | | | | | | | <p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY</p> | | | | | | | | | | | | | | | | | | | |
| TEXTURE OR GRAIN SIZE | | | | | | | | | | RECOMMENDATION SYMBOLS | | | | | | | | | | ABBREVIATIONS | | | | | | | | | | EQUIPMENT USED ON SUBJECT PROJECT | | | | | | | | | | | | | | | | | | | |
| <p>U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053</p> | | | | | | | | | | <p>UNDERCUT EXCAVATION UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK</p> | | | | | | | | | | <p>AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS HI. - HIGHLY</p> | | | | | | | | | | <p>DRILL UNITS: [X] CME-45B [] CME-55 [] CME-550 [] VANE SHEAR TEST [] PORTABLE HOIST</p> | | | | | | | | | | | | | | | | | | | |
| SOIL MOISTURE - CORRELATION OF TERMS | | | | | | | | | | ROCK HARDNESS | | | | | | | | | | FRACTURE SPACING | | | | | | | | | | BEDDING | | | | | | | | | | | | | | | | | | | |
| <p>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION</p> | | | | | | | | | | <p>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 GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROUDED 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 FINGER NAIL.</p> | | | | | | | | | | <p>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</p> | | | | | | | | | | <p>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</p> | | | | | | | | | | | | | | | | | | | |
| PLASTICITY | | | | | | | | | | INDURATION | | | | | | | | | | NOTES: | | | | | | | | | | FRACURE SPACING | | | | | | | | | | | | | | | | | | | |
| <p>NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH</p> | | | | | | | | | | <p>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.</p> | | | | | | | | | | <p>FIAD - FILLED IMMEDIATELY AFTER DRILLING</p> | | | | | | | | | | <p>FRACURE SPACING</p> | | | | | | | | | | | | | | | | | | | |
| COLOR | | | | | | | | | | FRACURE SPACING | | | | | | | | | | BEDDING | | | | | | | | | | NOTES: | | | | | | | | | | | | | | | | | | | |
| <p>DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.</p> | | | | | | | | | | <p>DRILL UNITS: [] CME-45B [] CME-55 [] CME-550 [] VANE SHEAR TEST [] PORTABLE HOIST</p> | | | | | | | | | | <p>ADVANCING TOOLS: [X] CLAY BITS [] 6" CONTINUOUS FLIGHT AUGER [] 8" HOLLOW AUGERS [] HARD FACED FINGER BITS [] TUNG-CARBIDE INSERTS [] CASING [] W/ ADVANCER [X] TRICONE 2-15/16" STEEL TEETH [] TRICONE " TUNG-CARB. [] CORE BIT</p> | | | | | | | | | | <p>HAND TOOLS: [] POST HOLE DIGGER [] HAND AUGER [] SOUNDING ROD [] VANE SHEAR TEST</p> | | | | | | | | | | <p>FRACURE SPACING</p> | | | | | | | | | |



NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU, DATED SEPTEMBER 2014.
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 BENT 1: 87°07'14"
 END BENT 2: 85°20'32"

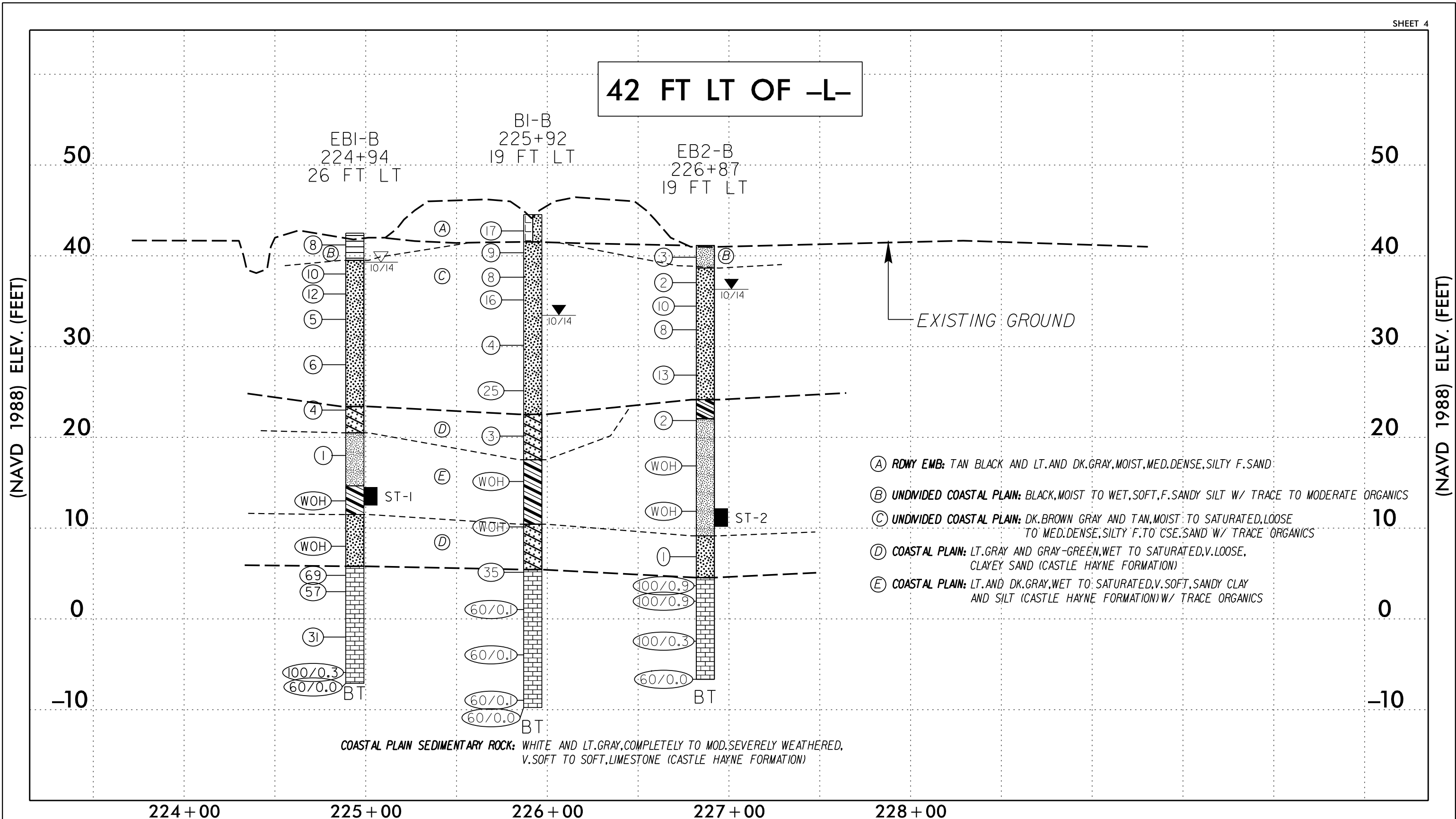


FALCON ENGINEERING
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 RALEIGH, NC 27607
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BORING LOCATION PLAN

STRUCTURE #3 - BRIDGE NO. 203 ON
 SR 1409 (-L-) OVER US 17 (-Y8-)
 NEW HANOVER COUNTY, NORTH CAROLINA
 WBS NO.: 40191.1.2, TIP NO.: U-4751

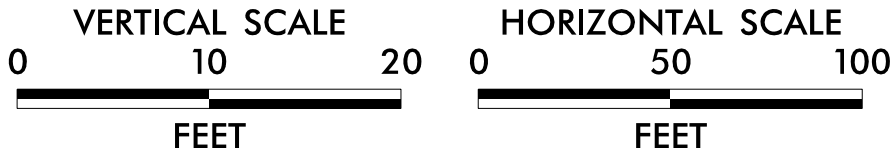
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- (A) **RDWY EMB:** TAN BLACK AND LT. AND DK. GRAY, MOIST, MED. DENSE, SILTY F. SAND
- (B) **UNDIVIDED COASTAL PLAIN:** BLACK, MOIST TO WET, SOFT, F. SANDY SILT W/ TRACE TO MODERATE ORGANICS
- (C) **UNDIVIDED COASTAL PLAIN:** DK. BROWN GRAY AND TAN, MOIST TO SATURATED, LOOSE TO MED. DENSE, SILTY F. TO CSE. SAND W/ TRACE ORGANICS
- (D) **COASTAL PLAIN:** LT. GRAY AND GRAY-GREEN, WET TO SATURATED, V. LOOSE, CLAYEY SAND (CASTLE HAYNE FORMATION)
- (E) **COASTAL PLAIN:** LT. AND DK. GRAY, WET TO SATURATED, V. SOFT, SANDY CLAY AND SILT (CASTLE HAYNE FORMATION) W/ TRACE ORGANICS

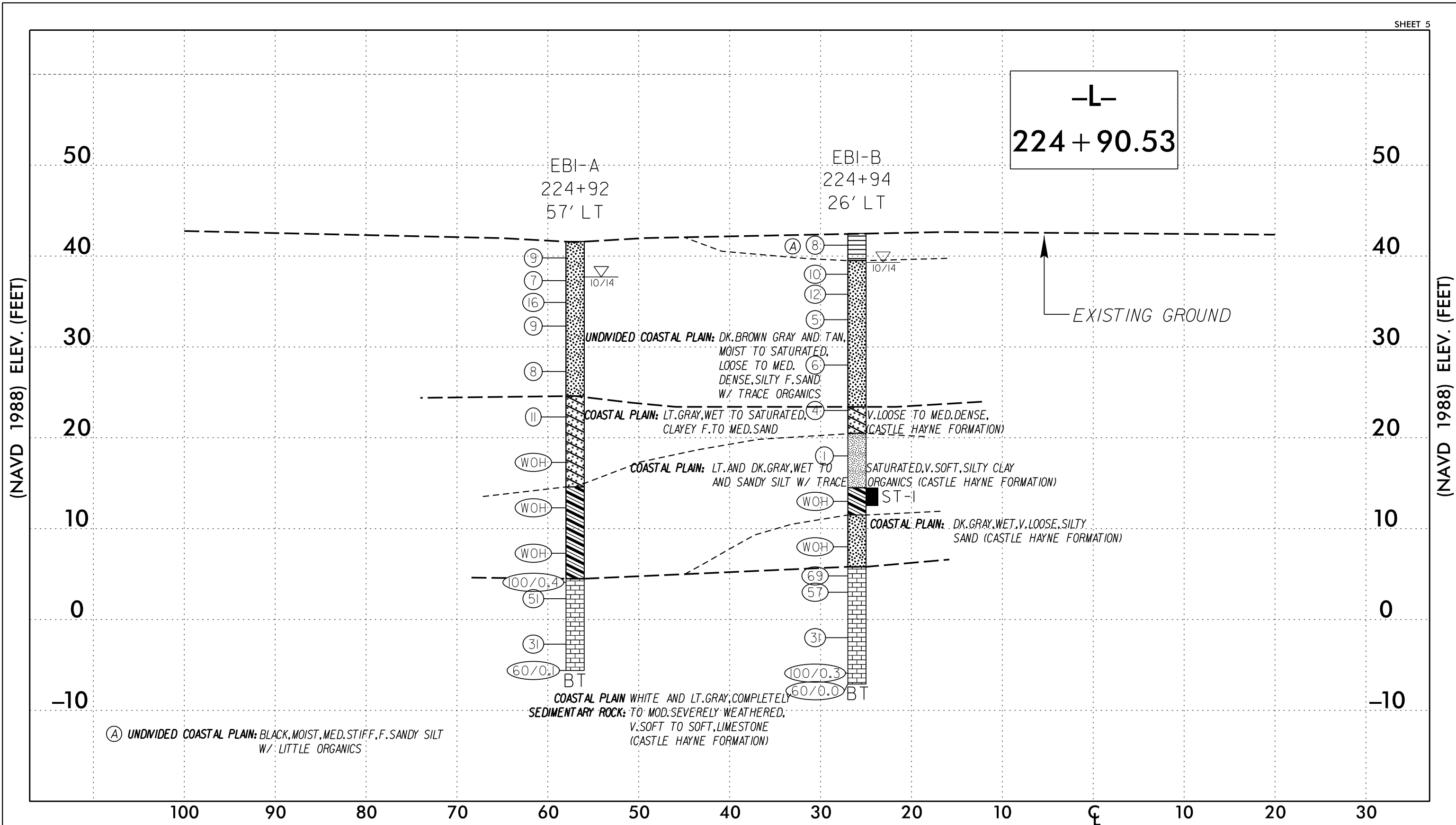
COASTAL PLAIN SEDIMENTARY ROCK: WHITE AND LT. GRAY, COMPLETELY TO MOD. SEVERELY WEATHERED, V. SOFT TO SOFT, LIMESTONE (CASTLE HAYNE FORMATION)

NOTES:
 • SUBSURFACE PROFILE AT 42 FT LT OF -L- TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU IN SEPTEMBER 2014. 42 FT LT OF -L- IS C OF BRIDGE 203.
 • INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.



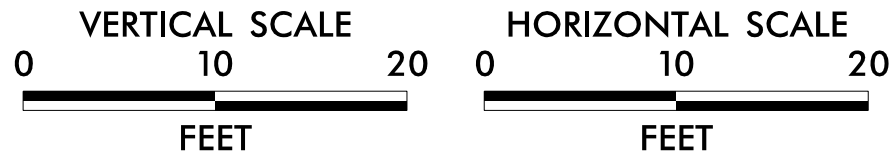
FALCON ENGINEERING
 FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 RALEIGH, NC 27607
 PHONE: 919.871.0800
 FAX: 919.871.0803

SUBSURFACE PROFILE AT 42 FT LT OF -L-
 BRIDGE NO. 203
 ON SR 1409 (-L-) OVER US 17 (-Y8-)
 NEW HANOVER COUNTY, NORTH CAROLINA
 WBS.: 40191.1.2, TIP.: U-4751



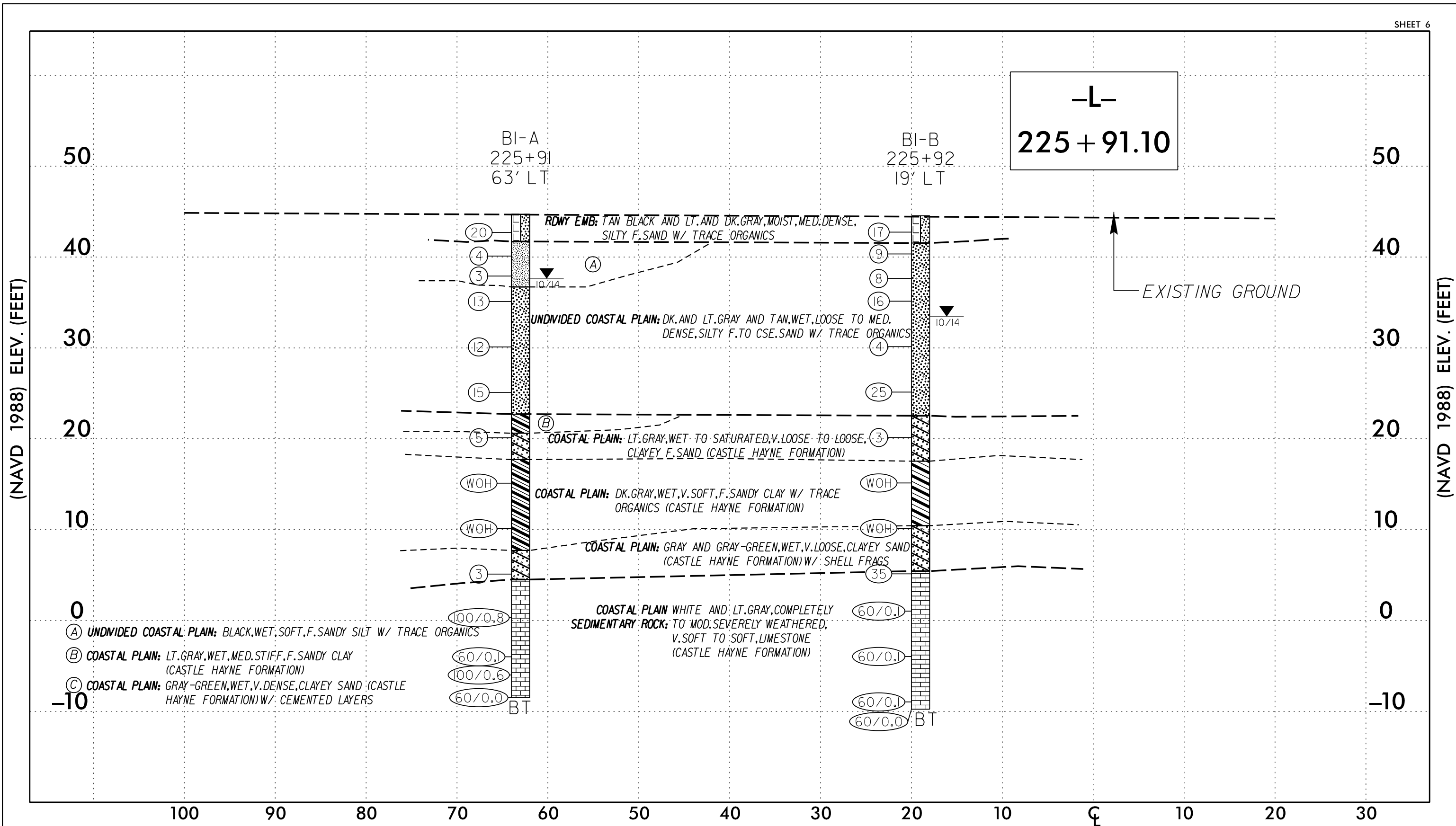
NOTES:

- GROUNDLINE CROSS SECTION ALONG BENT TAKEN FROM TOPOGRAPHIC DATA IN ELECTRONIC FILES RECEIVED FROM NCDOT GEU IN SEPTEMBER 2014.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
- BRIDGE SKEW: 88°48'56"



SUBSURFACE CROSS SECTION (END BENT 1)

BRIDGE NO. 203
ON SR 1409 (-L-) OVER US 17 (-Y8-)
NEW HANOVER COUNTY, NORTH CAROLINA
WBS.: 40191.1.2, TIP.: U-4751

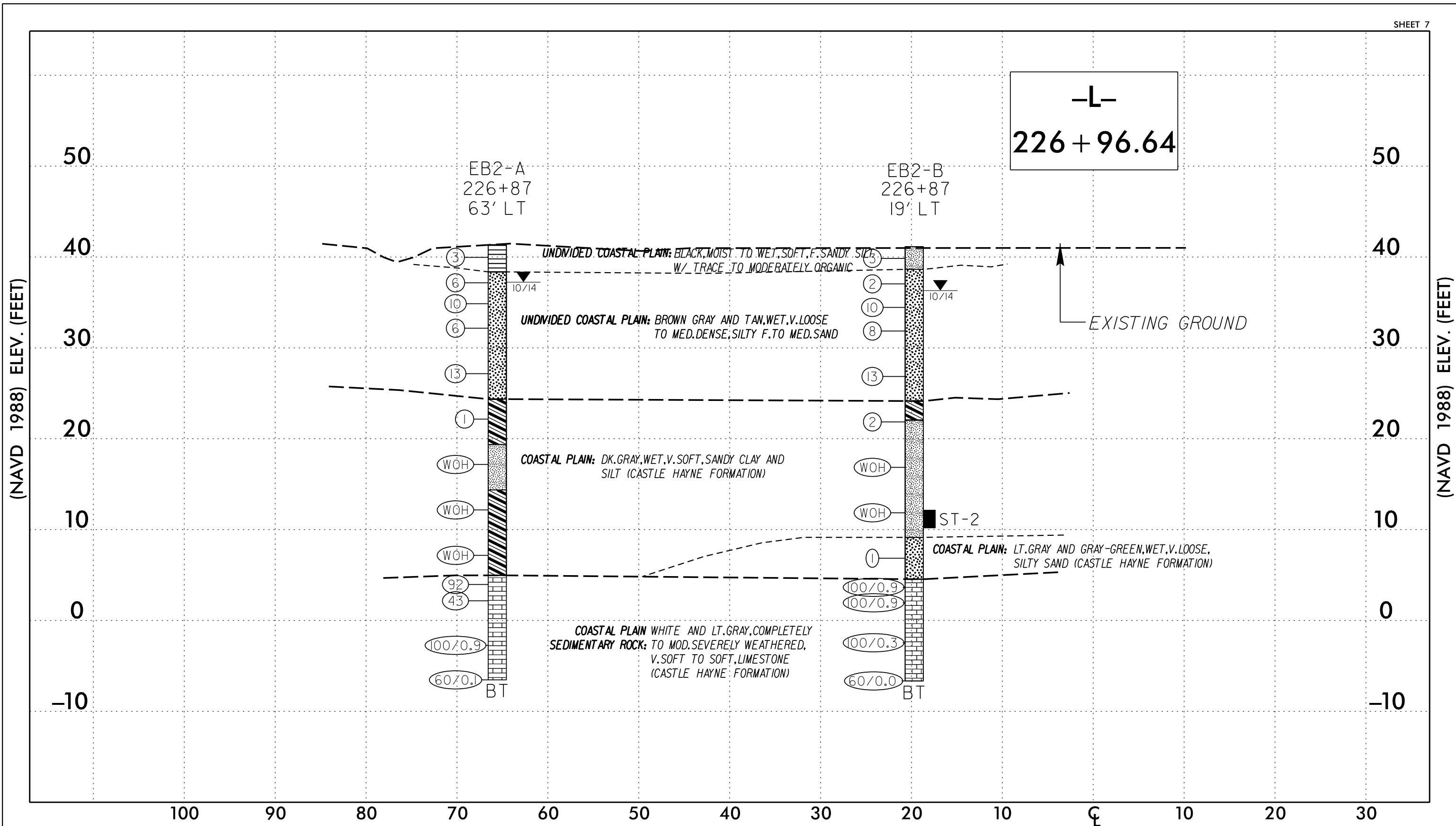


NOTES:

- GROUNDLINE CROSS SECTION ALONG BENT TAKEN FROM TOPOGRAPHIC DATA IN ELECTRONIC FILES RECEIVED FROM NCDOT GEU IN SEPTEMBER 2014.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
- BRIDGE SKEW: 87°07'14"

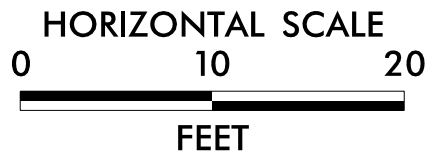
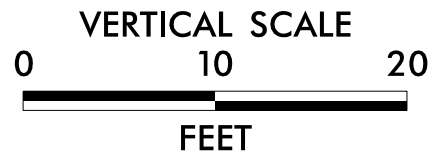
SUBSURFACE CROSS SECTION (INTERIOR BENT 1)

BRIDGE NO. 203
ON SR 1409 (-L-) OVER US 17 (-Y8-)
NEW HANOVER COUNTY, NORTH CAROLINA
WBS.: 40191.1.2, TIP.: U-4751



NOTES:

- GROUNDLINE CROSS SECTION ALONG BENT TAKEN FROM TOPOGRAPHIC DATA IN ELECTRONIC FILES RECEIVED FROM NCDOT GEU IN SEPTEMBER 2014.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.
- BRIDGE SKEW: 85°20'32"

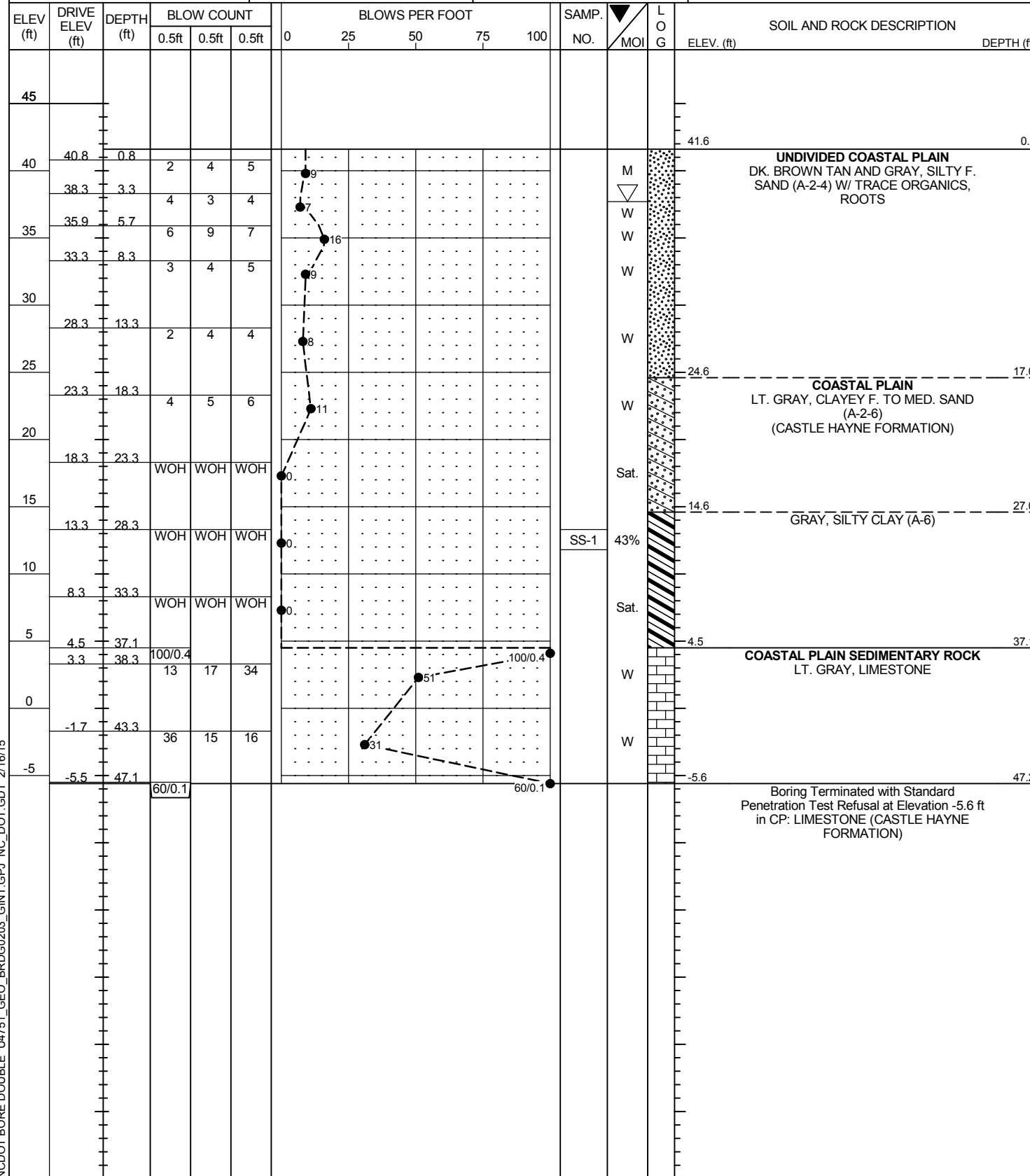


SUBSURFACE CROSS SECTION (END BENT 2)

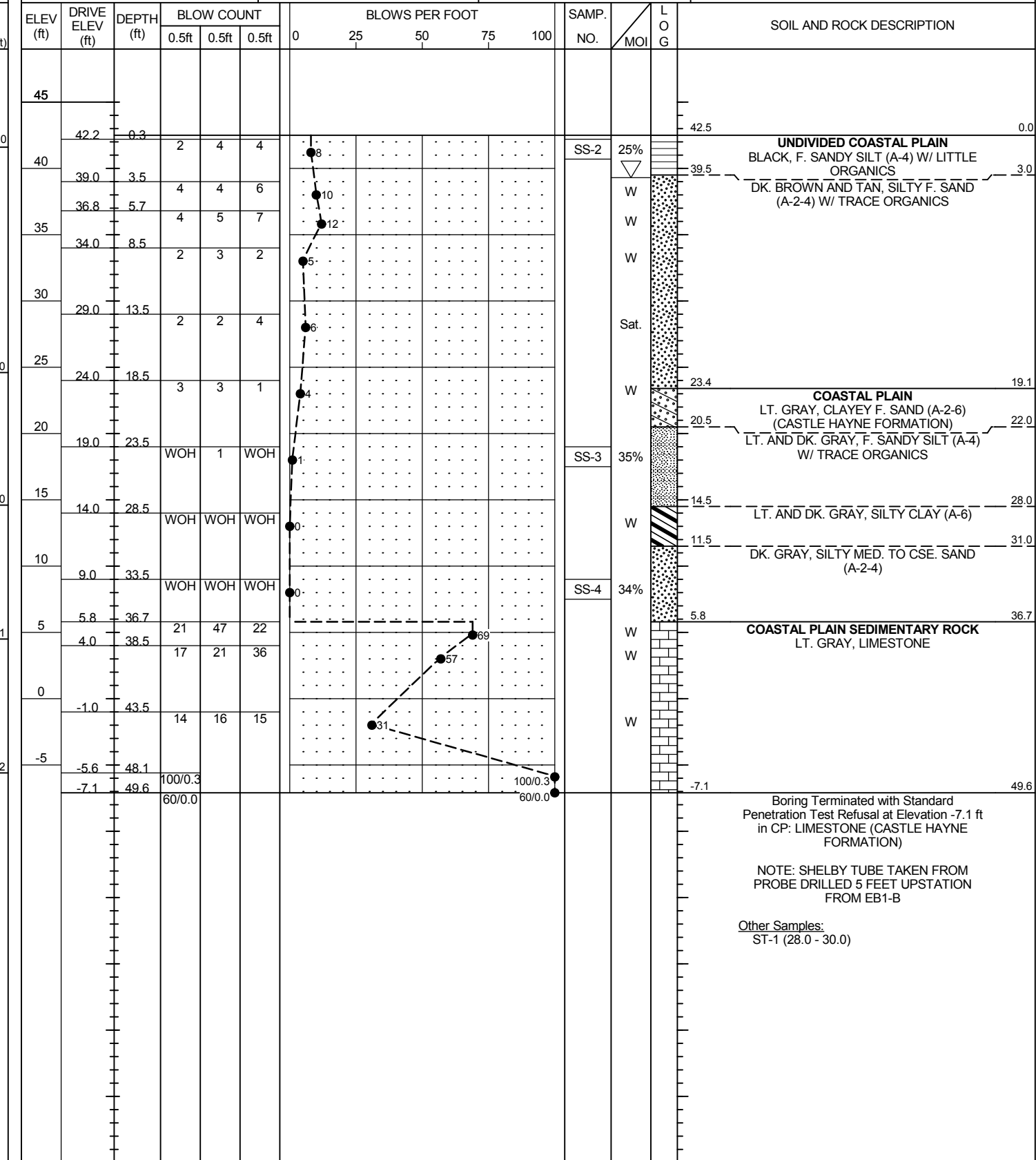
BRIDGE NO. 203
ON SR 1409 (-L-) OVER US 17 (-Y8-)
NEW HANOVER COUNTY, NORTH CAROLINA
WBS.: 40191.1.2, TIP.: U-4751

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

| | | | |
|--|---------------------|-------------------------|-----------------------------|
| WBS 40191.1.2 | TIP U-4751 | COUNTY NEW HANOVER | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 203 on SR 1409 (-L-) over US 17 (-Y8-) | | | GROUND WTR (ft) |
| BORING NO. EB1-A | STATION 224+92 | OFFSET 57 ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 41.6 ft | TOTAL DEPTH 47.2 ft | NORTHING 206,369 | EASTING 2,353,932 |
| DRILL RIG/HAMMER EFF./DATE MID1904 CME-45B 87% 07/30/2013 | | DRILL METHOD Mud Rotary | HAMMER TYPE Automatic |
| DRILLER Contract Driller | START DATE 10/23/14 | COMP. DATE 10/23/14 | SURFACE WATER DEPTH N/A |



| | | | |
|--|---------------------|-------------------------|-----------------------------|
| WBS 40191.1.2 | TIP U-4751 | COUNTY NEW HANOVER | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 203 on SR 1409 (-L-) over US 17 (-Y8-) | | | GROUND WTR (ft) |
| BORING NO. EB1-B | STATION 224+94 | OFFSET 26 ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 42.5 ft | TOTAL DEPTH 49.6 ft | NORTHING 206,365 | EASTING 2,353,963 |
| DRILL RIG/HAMMER EFF./DATE MID1904 CME-45B 87% 07/30/2013 | | DRILL METHOD Mud Rotary | HAMMER TYPE Automatic |
| DRILLER Contract Driller | START DATE 10/23/14 | COMP. DATE 10/23/14 | SURFACE WATER DEPTH N/A |



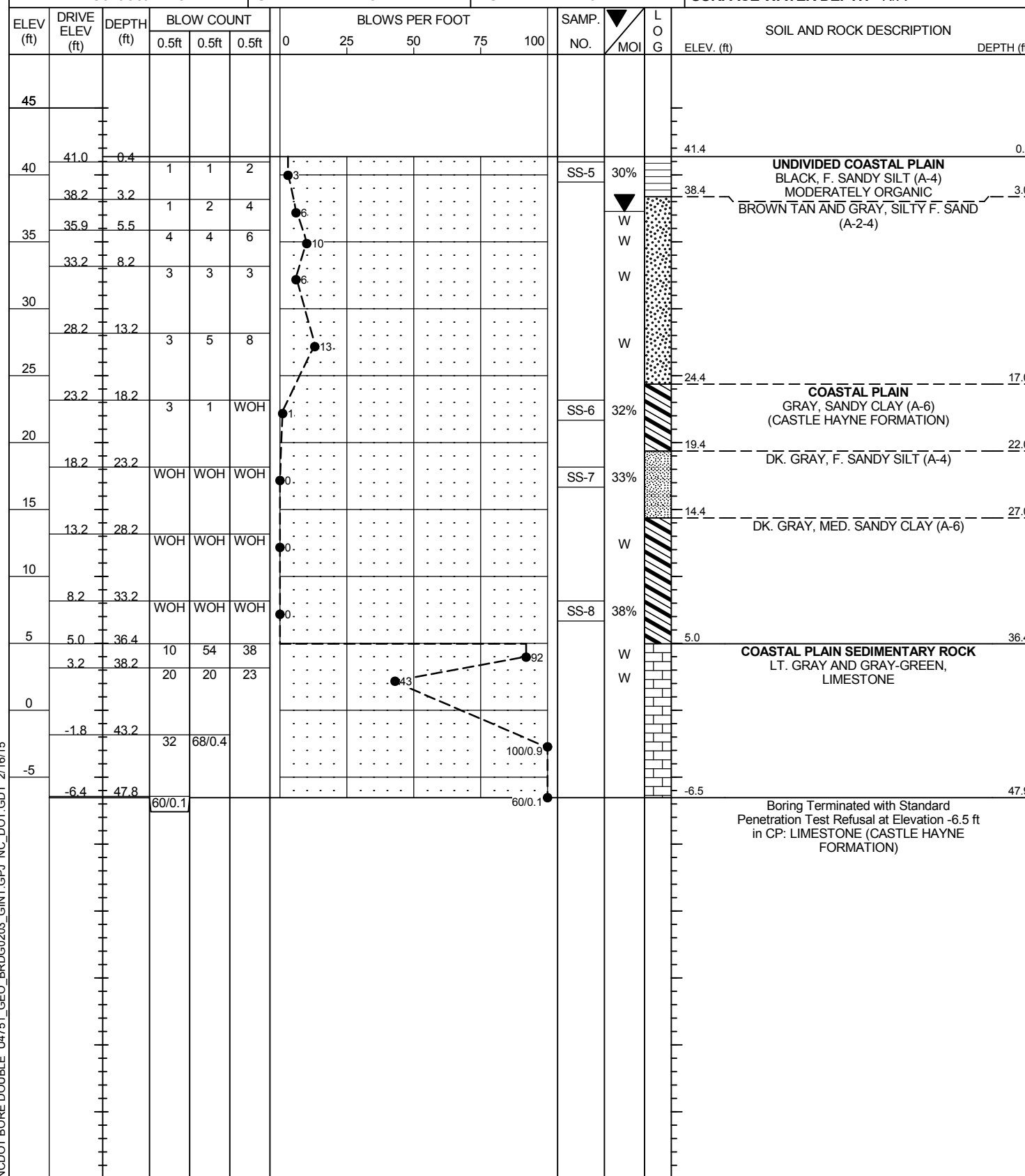
NOTE: SHELBY TUBE TAKEN FROM PROBE DRILLED 5 FEET UPSTATION FROM EB1-B

Other Samples:
ST-1 (28.0 - 30.0)

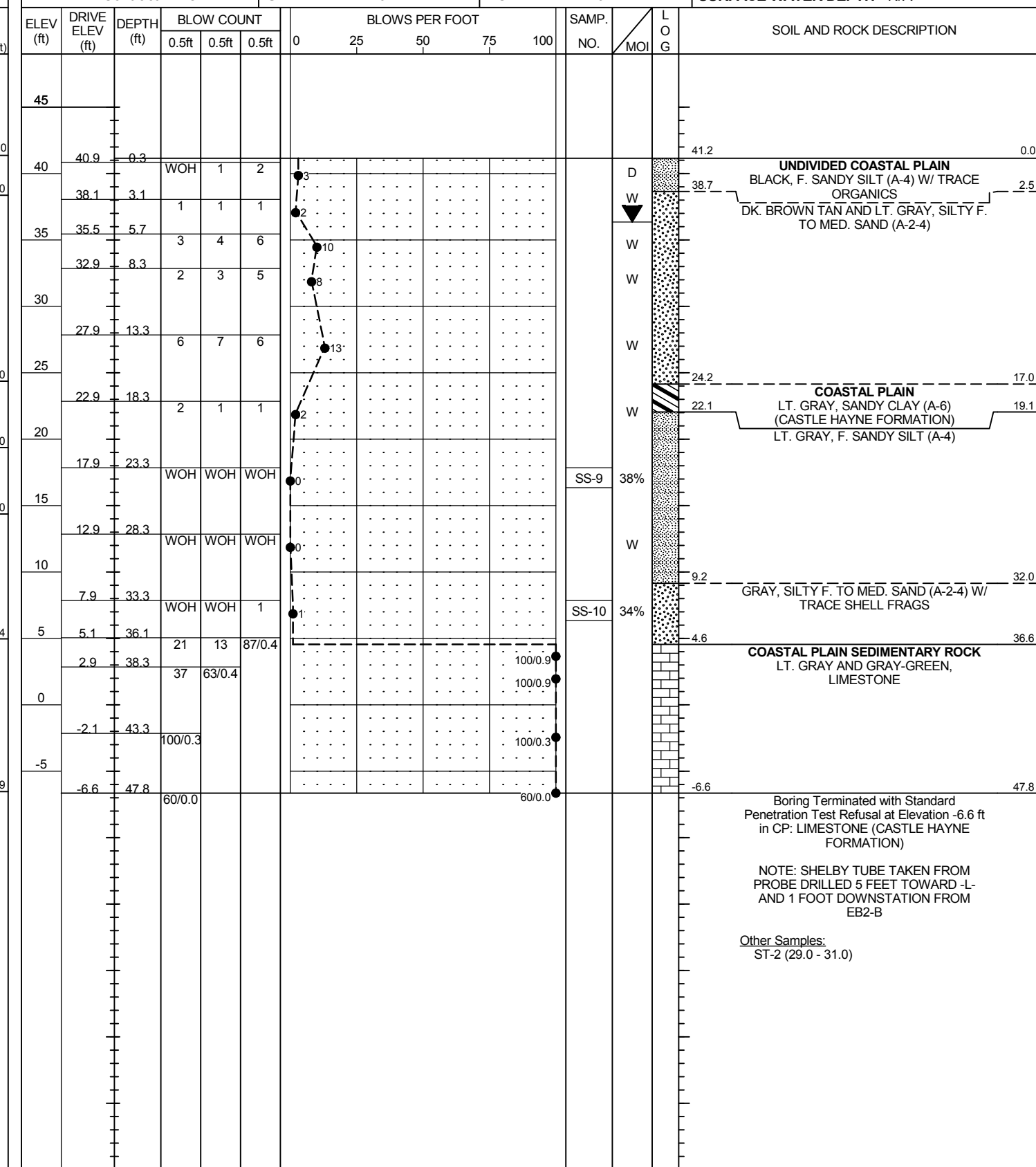
NCDOT BORE DOUBLE U4751_GEO_BRDG0203_GINT.GPJ NC_DOT_GDT_2/16/15

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

| | | | |
|--|---------------------|-------------------------|-----------------------------|
| WBS 40191.1.2 | TIP U-4751 | COUNTY NEW HANOVER | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 203 on SR 1409 (-L-) over US 17 (-Y8-) | | | GROUND WTR (ft) |
| BORING NO. EB2-A | STATION 226+87 | OFFSET 65 ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 41.4 ft | TOTAL DEPTH 47.9 ft | NORTHING 206,565 | EASTING 2,353,964 |
| DRILL RIG/HAMMER EFF./DATE MID1904 CME-45B 87% 07/30/2013 | | DRILL METHOD Mud Rotary | HAMMER TYPE Automatic |
| DRILLER Contract Driller | START DATE 10/22/14 | COMP. DATE 10/22/14 | SURFACE WATER DEPTH N/A |



| | | | |
|--|---------------------|-------------------------|-----------------------------|
| WBS 40191.1.2 | TIP U-4751 | COUNTY NEW HANOVER | GEOLOGIST Hunsberger, W. S. |
| SITE DESCRIPTION Bridge No. 203 on SR 1409 (-L-) over US 17 (-Y8-) | | | GROUND WTR (ft) |
| BORING NO. EB2-B | STATION 226+87 | OFFSET 19 ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 41.2 ft | TOTAL DEPTH 47.8 ft | NORTHING 206,554 | EASTING 2,354,009 |
| DRILL RIG/HAMMER EFF./DATE MID1904 CME-45B 87% 07/30/2013 | | DRILL METHOD Mud Rotary | HAMMER TYPE Automatic |
| DRILLER Contract Driller | START DATE 10/22/14 | COMP. DATE 10/22/14 | SURFACE WATER DEPTH N/A |



NCDOT BORE DOUBLE U4751_GEO_BRDG0203_GINT.GPJ NC_DOT_GDT_2/16/15

AASHTO SOIL CLASSIFICATION AND GRADATION SHEET

STRUCTURE #3 - BRIDGE NO. 203 ON SR 1409 (-L-) OVER US 17 (-Y8-)

WBS NO.: 40191.1.2, TIP NO.: U-4751

NEW HANOVER COUNTY, NORTH CAROLINA
FALCON ENGINEERING, INC. PROJECT NO: G14045.00

| BORING | | SAMPLE | TOTAL SAMPLE | | | COARSE SAND (%) | FINE SAND (%) | SILT (%) | CLAY (%) | Atterberg Limit Test Results | | | Natural Moisture Content (%) | Organic Content (%) |
|-----------------------|---------------|--------------|-----------------|-----|------|-----------------|---------------|----------|----------|------------------------------|----|----|------------------------------|---------------------|
| AASHTO Classification | | | PERCENT PASSING | | | | | | | LL | PL | PI | | |
| STATION | OFFSET (FEET) | DEPTH (FEET) | #10 | #40 | #200 | | | | | | | | | |
| EB1-A | | SS-1 | | | | | | | | | | | | |
| | A-6 | | 100 | 98 | 90 | 3 | 24 | 45 | 28 | 36 | 19 | 17 | 43.4 | - |
| 224+92 | 57' LT | 28.3-29.8 | | | | | | | | | | | | |
| EB1-B | | SS-2 | | | | | | | | | | | | |
| | - | | - | - | - | - | - | - | - | - | - | - | 25.3 | 6.9 |
| 224+94 | 26' LT | 0.3-1.8 | | | | | | | | | | | | |
| EB1-B | | SS-3 | | | | | | | | | | | | |
| | A-4 | | 100 | 99 | 76 | 1 | 68 | 19 | 12 | 23 | 0 | NP | 35.4 | - |
| 224+94 | 26' LT | 23.5-25.0 | | | | | | | | | | | | |
| EB1-B | | SS-4 | | | | | | | | | | | | |
| | A-2-4 | | 100 | 83 | 27 | 45 | 31 | 14 | 10 | 19 | 0 | NP | 33.7 | - |
| 224+94 | 26' LT | 33.5-35.0 | | | | | | | | | | | | |
| EB2-A | | SS-5 | | | | | | | | | | | | |
| | - | | - | - | - | - | - | - | - | - | - | - | 29.6 | 13.2 |
| 226+87 | 65' LT | 0.4-1.9 | | | | | | | | | | | | |
| EB2-A | | SS-6 | | | | | | | | | | | | |
| | A-6 | | 100 | 99 | 52 | 5 | 44 | 11 | 40 | 39 | 14 | 25 | 31.9 | - |
| 226+87 | 65' LT | 18.2-19.7 | | | | | | | | | | | | |
| EB2-A | | SS-7 | | | | | | | | | | | | |
| | A-4 | | 100 | 100 | 66 | 1 | 69 | 21 | 9 | 23 | NP | NP | 32.6 | - |
| 226+87 | 65' LT | 23.2-24.7 | | | | | | | | | | | | |
| EB2-A | | SS-8 | | | | | | | | | | | | |
| | A-6 | | 100 | 82 | 37 | 41 | 27 | 16 | 16 | 26 | 15 | 11 | 38.3 | - |
| 226+87 | 65' LT | 33.2-34.7 | | | | | | | | | | | | |
| EB2-B | | SS-9 | | | | | | | | | | | | |
| | A-4 | | 100 | 99 | 69 | 1 | 60 | 29 | 10 | 25 | NP | NP | 37.5 | - |
| 226+87 | 19' LT | 23.3-24.8 | | | | | | | | | | | | |
| EB2-B | | SS-10 | | | | | | | | | | | | |
| | A-2-4 | | 98 | 79 | 23 | 49 | 30 | 4 | 12 | 20 | NP | NP | 34.1 | - |
| 226+87 | 19' LT | 33.3-34.8 | | | | | | | | | | | | |
| EB1-B | | | | | | | | | | | | | | |
| | A-6 | | 100 | 98 | 91 | 3 | 14 | 52 | 30 | 36 | 19 | 17 | 40.0 | - |
| 224+92 | 57' LT | 28.0-30.0 | | | | | | | | | | | | |
| EB2-B | | | | | | | | | | | | | | |
| | A-4 | | 99 | 80 | 44 | 44 | 14 | 25 | 17 | 24 | 14 | 10 | 30.0 | - |
| 226+87 | 19' LT | 29.0-31.0 | | | | | | | | | | | | |

SIGNATURE *BT Stt*

105-03-0803

Notes: LL = Liquid Limit
 PL = Plastic Limit
 PI = Plasticity Index = LL - PL



LOOKING DOWNSTATION ALONG -L- TOWARD INTERIOR BENT FROM END BENT 2



LOOKING LEFT TOWARDS -L-: DRILL RIG SETUP ON EB2-B



FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607
PHONE: 919.871.0800
FAX: 919.871.0803

SITE PHOTOGRAPHS

BRIDGE NO. 203 ON
SR 1409 (-L-) OVER US 17 (-Y8-)
NEW HANOVER COUNTY, NORTH CAROLINA
WBS NO.: 40191.1.2, TIP NO.: U-4751