

REFERENCE: SF-810213

PROJECT: 17BP.3.R.66

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

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|-------|-----------------------------|-----------|--------------|
| N.C.  | SF-810213                   | 1         | 7            |

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY SAMPSON  
PROJECT DESCRIPTION BRIDGE NO. 213 ON -L- (SR 1710)  
OVER KILL SWAMP

**CONTENTS**

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| 5-7       | BORE LOGS            |

**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

J.P. PEHRSON

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INVESTIGATED BY T.C. BOTTOMS

DRAWN BY T.C. BOTTOMS

CHECKED BY D.N. ARGENBRIGHT

SUBMITTED BY D.N. ARGENBRIGHT

DATE MARCH 2019



DocuSigned by:  
Tyler Bottoms 3/18/2019

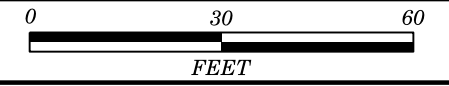
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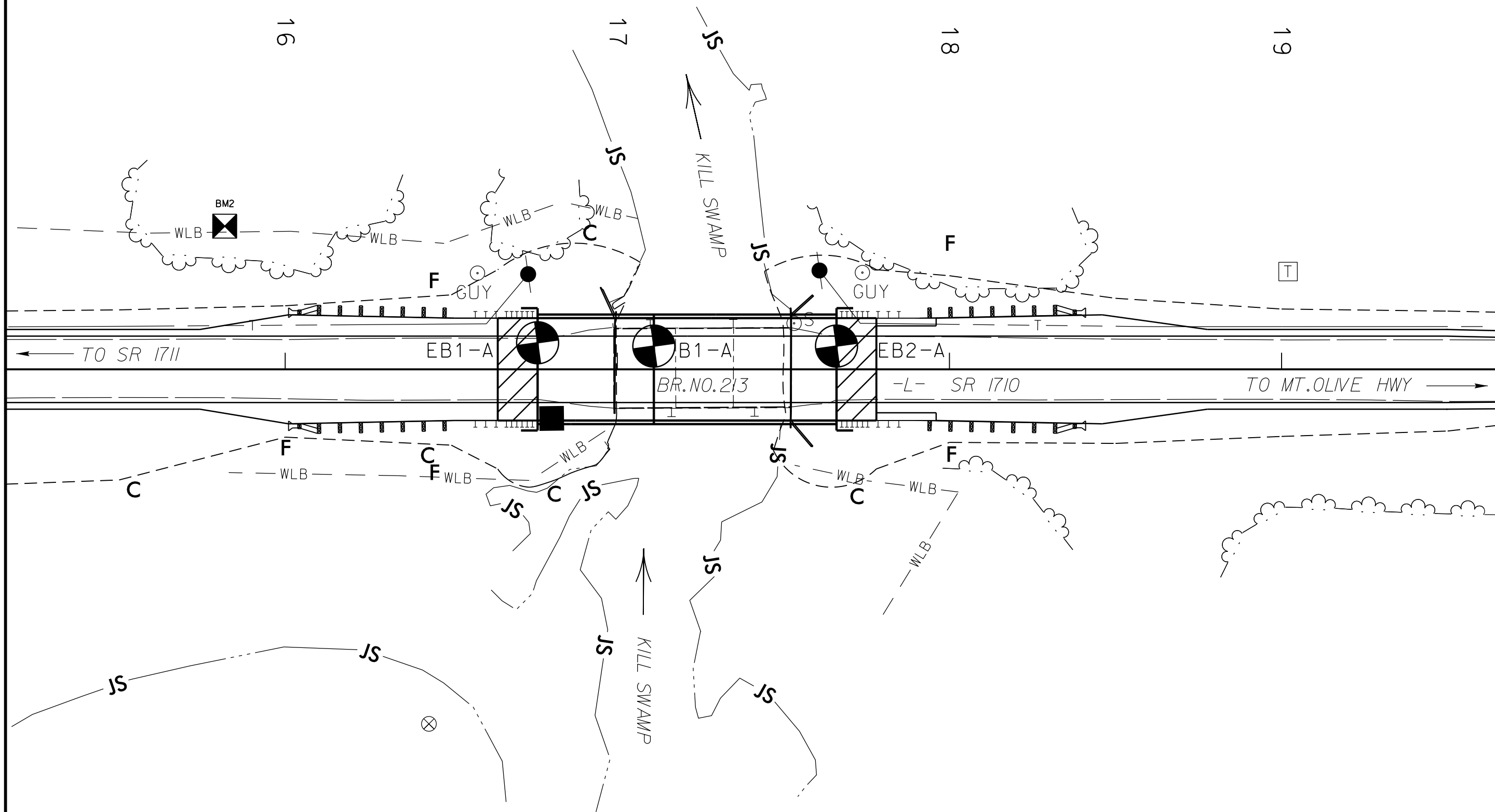
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS  
 GEOTECHNICAL ENGINEERING UNIT  
**SUBSURFACE INVESTIGATION**  
 SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

| SOIL DESCRIPTION   | GRADATION   | ROCK DESCRIPTION   | TERMS AND DEFINITIONS   |
|--|---|--|---|
| SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT 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 | WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.<br>UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.<br>GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.   | 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:<br><br>WEATHERED ROCK (WR)<br><br>CRYSTALLINE ROCK (CR)<br><br>NON-CRYSTALLINE ROCK (NCR)<br><br>COASTAL PLAIN SEDIMENTARY ROCK (CP)   | ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.<br>AQUIFER - A WATER BEARING FORMATION OR STRATA.<br>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.<br>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.<br>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.<br>CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.<br>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.<br>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.<br>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.<br>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.<br>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.<br>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.<br>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.<br>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL.<br>FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.<br>FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.<br>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.<br>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.<br>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.<br>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.<br>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.<br>RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.<br>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.<br>SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.<br>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.<br>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.<br>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.<br>STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.<br>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.<br>TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. |
| <b>SOIL LEGEND AND AASHTO CLASSIFICATION</b>   | <b>ANGULARITY OF GRAINS</b><br>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.  | <b>WEATHERING</b><br>FRESH<br>VERY SLIGHT (V SL.)<br>SLIGHT (SL.)<br>MODERATE (MOD.)<br>MODERATELY SEVERE (MOD. SEV.)<br>SEVERE (SEV.)<br>VERY SEVERE (V SEV.)<br>COMPLETE   |   |
| GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS  | <b>MINERALOGICAL COMPOSITION</b><br>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.   | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.<br>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.<br>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.<br>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.   |   |
| <b>PERCENTAGE OF MATERIAL</b>  | <b>COMPRESSION</b><br>SLIGHTLY COMPRESSIBLE LL < 31<br>MODERATELY COMPRESSIBLE LL = 31 - 50<br>HIGHLY COMPRESSIBLE LL > 50  | <b>GROUND WATER</b><br>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING<br>▽ PW STATIC WATER LEVEL AFTER 24 HOURS<br>▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA<br>○ SPRING OR SEEP  |   |
| GROUP CLASS. A-1, A-1-b, A-1-c, A-2, A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-6, A-1, A-2, A-3, A-4, A-5, A-6, A-7   | <b>COMPRESSION</b><br>SLIGHTLY COMPRESSIBLE LL < 31<br>MODERATELY COMPRESSIBLE LL = 31 - 50<br>HIGHLY COMPRESSIBLE LL > 50  | <b>MISCELLANEOUS SYMBOLS</b><br>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION<br>SOIL SYMBOL<br>ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT<br>INFERRED SOIL BOUNDARY<br>INFERRED ROCK LINE<br>ALLUVIAL SOIL BOUNDARY<br>DIP & DIP DIRECTION OF ROCK STRUCTURES<br>SPT DMT VST PMT TEST BORING<br>AUGER BORING<br>CORE BORING<br>MONITORING WELL<br>PIEZOMETER INSTALLATION<br>SLOPE INDICATOR INSTALLATION<br>CONE PENETROMETER TEST<br>SOUNDING ROD<br>TEST BORING WITH CORE<br>SPT N-VALUE   |   |
| SYMBOL   | <b>PERCENTAGE OF MATERIAL</b><br>ORGANIC MATERIAL<br>TRACE OF ORGANIC MATTER 2 - 3%<br>LITTLE ORGANIC MATTER 3 - 5%<br>MODERATELY ORGANIC 5 - 10%<br>HIGHLY ORGANIC > 10%<br>GRANULAR SOILS<br>SILT - CLAY SOILS<br>OTHER MATERIAL<br>TRACE 1 - 10%<br>LITTLE 10 - 20%<br>SOME 20 - 35%<br>HIGHLY 35% AND ABOVE | <b>RECOMMENDATION SYMBOLS</b><br>UNDERCUT<br>SHALLOW UNDERCUT<br>UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE<br>UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK<br>UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL  |   |
| % PASSING #10 #40 #200   | <b>GROUND WATER</b><br>▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING<br>▽ PW STATIC WATER LEVEL AFTER 24 HOURS<br>▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA<br>○ SPRING OR SEEP   | <b>ABBREVIATIONS</b><br>AR - AUGER REFUSAL<br>BT - BORING TERMINATED<br>CL - CLAY<br>CPT - COARSE PENETRATION TEST<br>CSE - COARSE<br>DMT - DILATOMETER TEST<br>DPT - DYNAMIC PENETRATION TEST<br>e - VOID RATIO<br>F - FINE<br>FOSS. - FOSSILIFEROUS<br>FRAC. - FRACTURED, FRACTURES<br>FRAGS. - FRAGMENTS<br>HI. - HIGHLY<br>MED. - MEDIUM<br>MICA. - MICACEOUS<br>MOD. - MODERATELY<br>NP - NON PLASTIC<br>ORG. - ORGANIC<br>PMT - PRESSUREMETER TEST<br>SAP. - SAPROLITIC<br>SD. - SAND, SANDY<br>SL. - SILT, SILTY<br>SLI. - SLIGHTLY<br>TCR - TRICONE REFUSAL<br>w - MOISTURE CONTENT<br>V - VERY<br>VST - VANE SHEAR TEST<br>WEA. - WEATHERED<br>UNIT WEIGHT<br>DRY UNIT WEIGHT<br>SAMPLE ABBREVIATIONS<br>S - BULK<br>SS - SPLIT SPOON<br>ST - SHELBY TUBE<br>RS - ROCK<br>RT - RECOMPACTED TRIAXIAL<br>CBR - CALIFORNIA BEARING RATIO |   |
| GROUP INDEX  | <b>TEXTURE OR GRAIN SIZE</b><br>U.S. STD. SIEVE SIZE OPENING (MM)<br>BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CS. SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)<br>GRAIN SIZE MM IN. 305 12 75 3 2.0 0.25 0.075 0.05 0.005  | <b>ROCK HARDNESS</b><br>VERY HARD<br>HARD<br>MODERATELY HARD<br>MEDIUM HARD<br>SOFT<br>VERY SOFT   |   |
| USUAL TYPES OF MAJOR MATERIALS   | <b>CONSISTENCY OR DENSENESS</b><br>PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )<br>GENERALLY GRANULAR MATERIAL (NON-COHESSIVE)<br>GENERALLY SILT-CLAY MATERIAL (COHESIVE)                   | <b>SOIL MOISTURE - CORRELATION OF TERMS</b><br>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION<br>LL - LIQUID LIMIT<br>PL - PLASTIC LIMIT<br>OM - OPTIMUM MOISTURE<br>SL - SHRINKAGE LIMIT  |   |
| GEN. RATING AS SUBGRADE  | <b>PLASTICITY</b><br>NON PLASTIC SLIGHTLY PLASTIC MODERATELY PLASTIC HIGHLY PLASTIC   | <b>EQUIPMENT USED ON SUBJECT PROJECT</b><br>DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE HOIST<br>ADVANCING TOOLS: CLAY BITS 6" CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE 2 1/8" STEEL TEETH TRICONE TUNG-CARB. CORE BIT<br>HAMMER TYPE: AUTOMATIC MANUAL<br>CORE SIZE: B H N<br>HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST  |   |
| PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30  | <b>COLOR</b><br>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.  | <b>FRACTURE SPACING</b><br>TERM SPACING<br>VERY WIDE MORE THAN 10 FEET<br>WIDE 3 TO 10 FEET<br>MODERATELY CLOSE 1 TO 3 FEET<br>CLOSE 0.16 TO 1 FOOT<br>VERY CLOSE LESS THAN 0.16 FEET<br><b>BEDDING</b><br>TERM THICKNESS<br>VERY THICKLY BEDDED 4 FEET<br>THICKLY BEDDED 1.5 - 4 FEET<br>THINLY BEDDED 0.16 - 1.5 FEET<br>VERY THINLY BEDDED 0.03 - 0.16 FEET<br>THICKLY LAMINATED 0.008 - 0.03 FEET<br>THINLY LAMINATED < 0.008 FEET   | <b>INDURATION</b><br>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.<br>FRIABLE<br>MODERATELY INDURATED<br>INDURATED<br>EXTREMELY INDURATED   |
| PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30  |   |  | BENCH MARK: BM2<br>N 541872 E 2207287<br>ELEVATION: 158.29 FEET<br>NOTES:<br>-  |

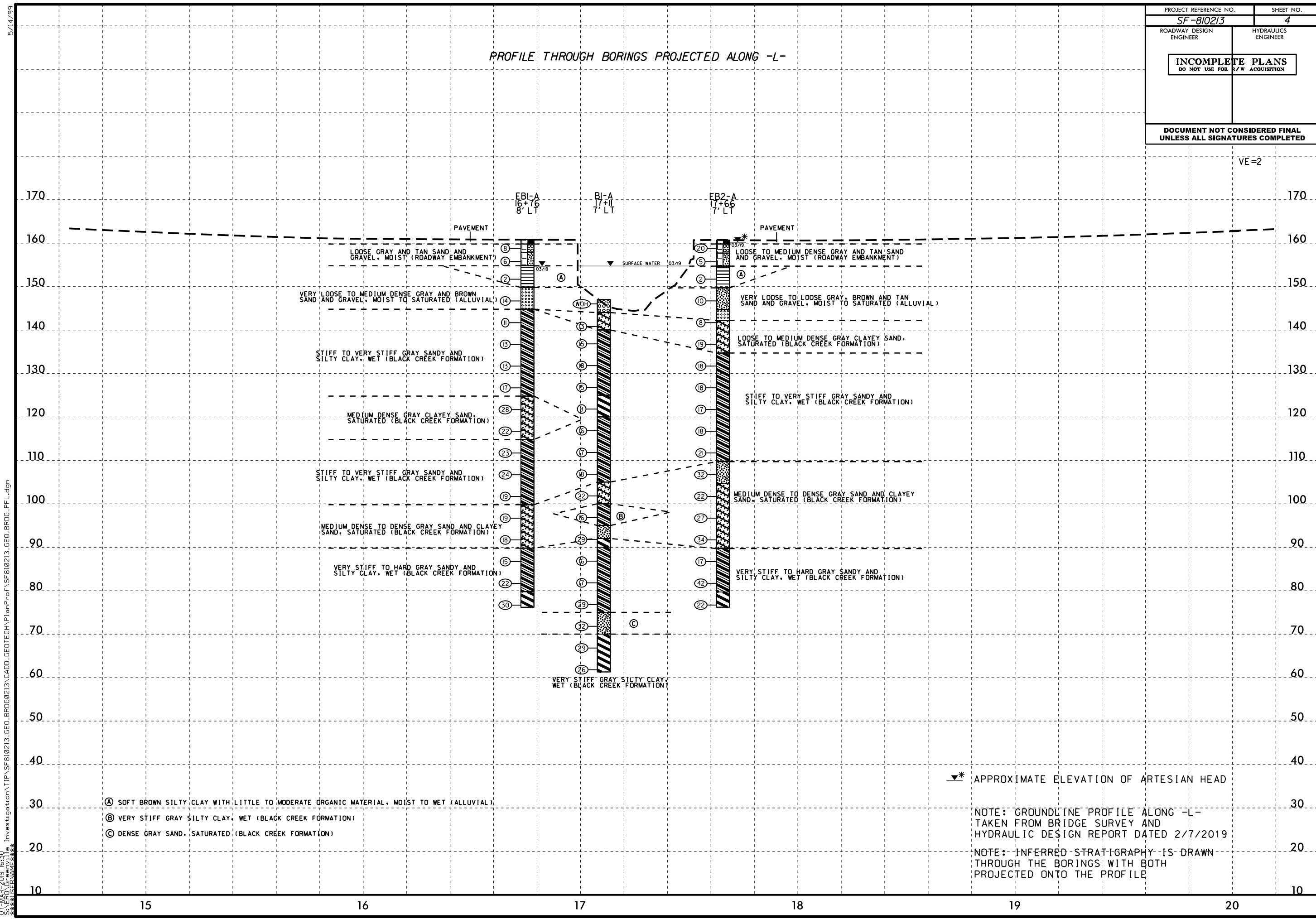
# SITE PLAN



SKEW = 90°



PROFILE THROUGH BORINGS PROJECTED ALONG -L-



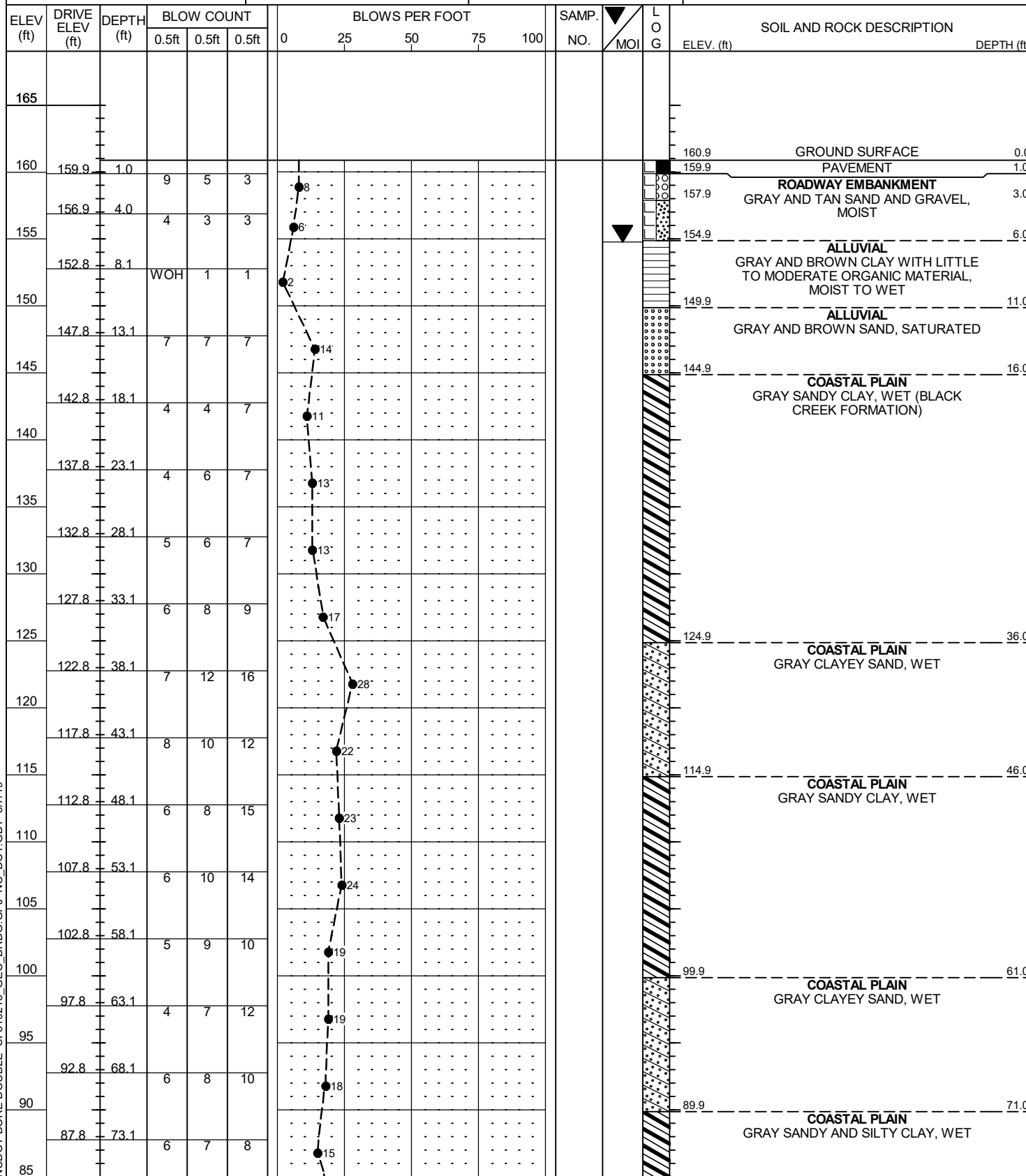
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- Ⓐ SOFT BROWN SILTY CLAY WITH LITTLE TO MODERATE ORGANIC MATERIAL, MOIST TO WET (ALLUVIAL)
- Ⓑ VERY STIFF GRAY SILTY CLAY, WET (BLACK CREEK FORMATION)
- Ⓒ DENSE GRAY SAND, SATURATED (BLACK CREEK FORMATION)

▼\* APPROXIMATE ELEVATION OF ARTESIAN HEAD

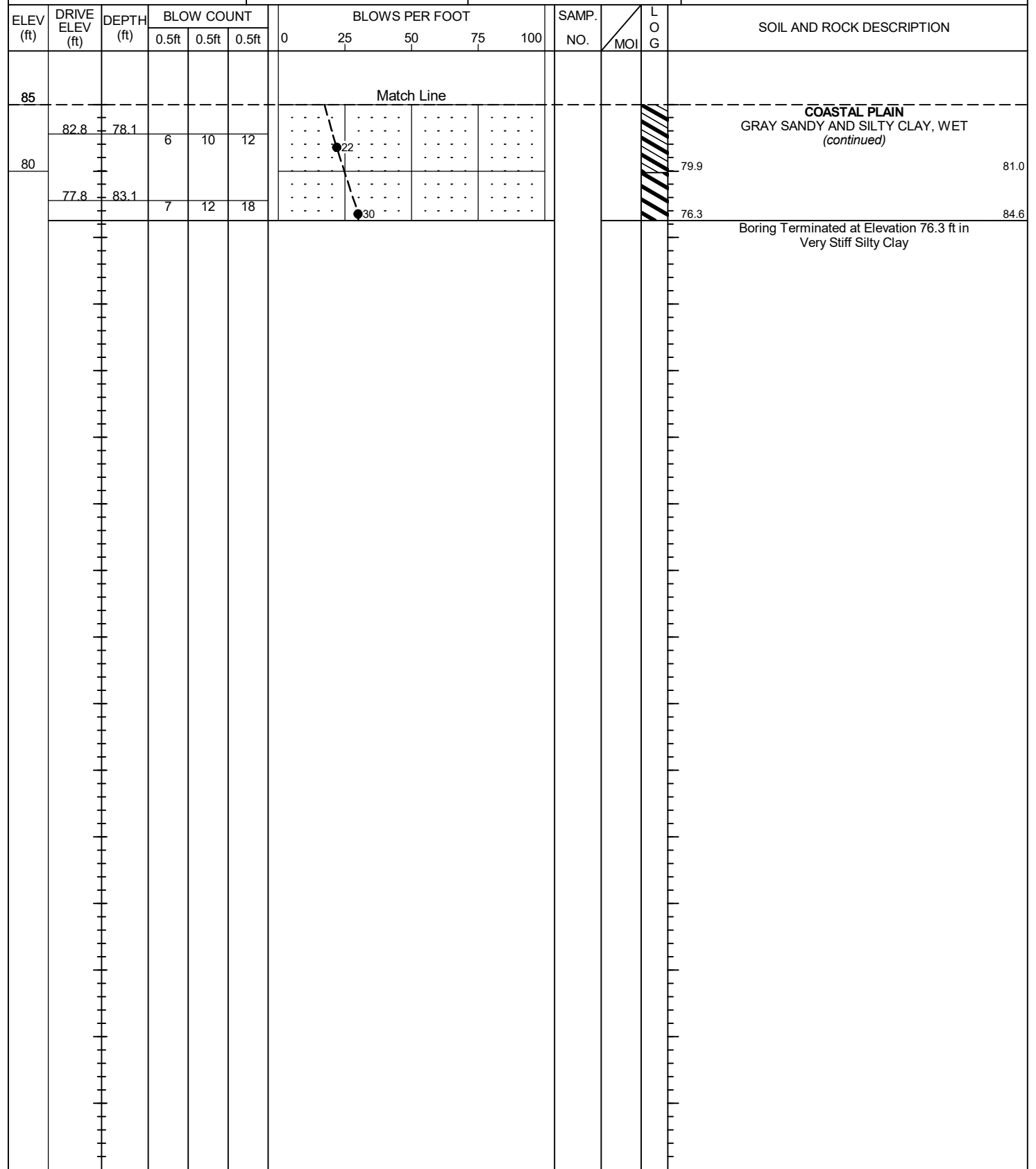
### GEOTECHNICAL BORING REPORT BORE LOG

|   |                        |                                |                   |                            |                              |                                  |                        |    |    |     |                  |            |                                  |
|---|------------------------|--------------------------------|-------------------|----------------------------|------------------------------|----------------------------------|------------------------|----|----|-----|------------------|------------|----------------------------------|
| <b>WBS</b> 17BP.3.R.66  |                        | <b>TIP</b> SF-810213           |                   | <b>COUNTY</b> SAMPSON      |                              | <b>GEOLOGIST</b> Zimarino, S. N. |                        |    |    |     |                  |            |                                  |
| <b>SITE DESCRIPTION</b> BRIDGE NO. 213 ON -L- (SR 1710) OVER KILL SWAMP |                        |                                |                   |                            |                              |                                  | <b>GROUND WTR (ft)</b> |    |    |     |                  |            |                                  |
| <b>BORING NO.</b> EB1-A   |                        | <b>STATION</b> 16+76           |                   | <b>OFFSET</b> 8 ft LT      |                              | <b>ALIGNMENT</b> -L-             |                        |    |    |     |                  |            |                                  |
| <b>COLLAR ELEV.</b> 160.9 ft  |                        | <b>TOTAL DEPTH</b> 84.6 ft     |                   | <b>NORTHING</b> 541,961    |                              | <b>EASTING</b> 2,207,335         |                        |    |    |     |                  |            |                                  |
| <b>DRILL RIGHAMMER EFF./DATE</b> GFC0075 CME-45C 89%/08/13/2018         |                        | <b>DRILL METHOD</b> Mud Rotary |                   |                            | <b>HAMMER TYPE</b> Automatic |                                  |                        |    |    |     |                  |            |                                  |
| <b>DRILLER</b> Smith, R. E.   |                        | <b>START DATE</b> 03/06/19     |                   | <b>COMP. DATE</b> 03/06/19 |                              | <b>SURFACE WATER DEPTH</b> N/A   |                        |    |    |     |                  |            |                                  |
| <b>ELEV (ft)</b>  | <b>DRIVE ELEV (ft)</b> | <b>DEPTH (ft)</b>              | <b>BLOW COUNT</b> |                            |                              | <b>BLOWS PER FOOT</b>            |                        |    |    |     | <b>SAMP. NO.</b> | <b>LOG</b> | <b>SOIL AND ROCK DESCRIPTION</b> |
|   |                        |                                | 0.5ft             | 0.5ft                      | 0.5ft                        | 0                                | 25                     | 50 | 75 | 100 |                  |            |                                  |



NCDOT BORE DOUBLE SF810213\_GEO\_BRDG.GPJ\_NC\_DOT.GDT 3/7/19

|   |                        |                                |                   |                            |                              |                                  |                        |    |    |     |                  |            |                                  |
|---|------------------------|--------------------------------|-------------------|----------------------------|------------------------------|----------------------------------|------------------------|----|----|-----|------------------|------------|----------------------------------|
| <b>WBS</b> 17BP.3.R.66  |                        | <b>TIP</b> SF-810213           |                   | <b>COUNTY</b> SAMPSON      |                              | <b>GEOLOGIST</b> Zimarino, S. N. |                        |    |    |     |                  |            |                                  |
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| <b>BORING NO.</b> EB1-A   |                        | <b>STATION</b> 16+76           |                   | <b>OFFSET</b> 8 ft LT      |                              | <b>ALIGNMENT</b> -L-             |                        |    |    |     |                  |            |                                  |
| <b>COLLAR ELEV.</b> 160.9 ft  |                        | <b>TOTAL DEPTH</b> 84.6 ft     |                   | <b>NORTHING</b> 541,961    |                              | <b>EASTING</b> 2,207,335         |                        |    |    |     |                  |            |                                  |
| <b>DRILL RIGHAMMER EFF./DATE</b> GFC0075 CME-45C 89%/08/13/2018         |                        | <b>DRILL METHOD</b> Mud Rotary |                   |                            | <b>HAMMER TYPE</b> Automatic |                                  |                        |    |    |     |                  |            |                                  |
| <b>DRILLER</b> Smith, R. E.   |                        | <b>START DATE</b> 03/06/19     |                   | <b>COMP. DATE</b> 03/06/19 |                              | <b>SURFACE WATER DEPTH</b> N/A   |                        |    |    |     |                  |            |                                  |
| <b>ELEV (ft)</b>  | <b>DRIVE ELEV (ft)</b> | <b>DEPTH (ft)</b>              | <b>BLOW COUNT</b> |                            |                              | <b>BLOWS PER FOOT</b>            |                        |    |    |     | <b>SAMP. NO.</b> | <b>LOG</b> | <b>SOIL AND ROCK DESCRIPTION</b> |
|   |                        |                                | 0.5ft             | 0.5ft                      | 0.5ft                        | 0                                | 25                     | 50 | 75 | 100 |                  |            |                                  |





# GEOTECHNICAL BORING REPORT

## BORE LOG

| WBS 17BP.3.R.66  |                 | TIP SF-810213       |                         | COUNTY SAMPSON      |       | GEOLOGIST Zimarino, S. N. |                 |    |    |     |           |     |                           |            |   |
|--|-----------------|---------------------|-------------------------|---------------------|-------|---------------------------|-----------------|----|----|-----|-----------|-----|---------------------------|------------|---|
| SITE DESCRIPTION BRIDGE NO. 213 ON -L- (SR 1710) OVER KILL SWAMP |                 |                     |                         |                     |       |                           | GROUND WTR (ft) |    |    |     |           |     |                           |            |   |
| BORING NO. EB2-A   |                 | STATION 17+66       |                         | OFFSET 7 ft LT      |       | ALIGNMENT -L-             |                 |    |    |     |           |     |                           |            |   |
| COLLAR ELEV. 160.8 ft  |                 | TOTAL DEPTH 84.5 ft |                         | NORTHING 542,050    |       | EASTING 2,207,348         |                 |    |    |     |           |     |                           |            |   |
| DRILL RIGHAMMER EFF./DATE GFC0075 CME-45C 89% 08/13/2018         |                 |                     | DRILL METHOD Mud Rotary |                     |       | HAMMER TYPE Automatic     |                 |    |    |     |           |     |                           |            |   |
| DRILLER Smith, R. E.   |                 | START DATE 03/05/19 |                         | COMP. DATE 03/05/19 |       | SURFACE WATER DEPTH N/A   |                 |    |    |     |           |     |                           |            |   |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)          | BLOW COUNT              |                     |       | BLOWS PER FOOT            |                 |    |    |     | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |   |
|  |                 |                     | 0.5ft                   | 0.5ft               | 0.5ft | 0                         | 25              | 50 | 75 | 100 |           |     |                           |            |   |
| 165  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |   |
| 160  | 159.9           | 0.9                 | 12                      | 10                  | 10    |                           |                 |    |    |     |           |     |                           | 160.8      | GROUND SURFACE 0.0  |
|  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 159.9      | PAVEMENT 0.9  |
|  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 157.8      | ROADWAY EMBANKMENT 3.0  |
|  | 156.8           | 4.0                 | 4                       | 3                   | 2     |                           |                 |    |    |     |           |     |                           | 154.8      | GRAY AND TAN SAND AND GRAVEL, MOIST 6.0   |
| 155  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 149.8      | ALLUVIAL BROWN SILTY CLAY WITH LITTLE TO MODERATE ORGANIC MATERIAL, MOIST TO WET 11.0 |
|  | 152.8           | 8.0                 | 2                       | 1                   | 1     |                           |                 |    |    |     |           |     |                           | 147.8      | ALLUVIAL BROWN AND TAN SAND, SATURATED 13.0   |
| 150  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 144.8      |   |
|  | 147.8           | 13.0                | 4                       | 5                   | 5     |                           |                 |    |    |     |           |     |                           | 142.8      |   |
| 145  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 142.3      | COASTAL PLAIN GRAY CLAYEY SAND, SATURATED (BLACK CREEK FORMATION) 18.5                |
|  | 142.8           | 18.0                | 3                       | 3                   | 5     |                           |                 |    |    |     |           |     |                           | 137.8      |   |
| 140  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 134.8      | COASTAL PLAIN GRAY SANDY CLAY, WET 26.0   |
|  | 137.8           | 23.0                | 6                       | 8                   | 11    |                           |                 |    |    |     |           |     |                           | 132.8      |   |
| 135  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 127.8      |   |
|  | 132.8           | 28.0                | 7                       | 9                   | 9     |                           |                 |    |    |     |           |     |                           | 122.8      |   |
| 130  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 117.8      |   |
|  | 127.8           | 33.0                | 6                       | 8                   | 10    |                           |                 |    |    |     |           |     |                           | 112.8      |   |
| 125  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 109.8      | COASTAL PLAIN GRAY SAND AND CLAYEY SAND, SATURATED 51.0                               |
|  | 122.8           | 38.0                | 5                       | 8                   | 9     |                           |                 |    |    |     |           |     |                           | 107.8      |   |
| 120  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 104.8      |   |
|  | 117.8           | 43.0                | 5                       | 8                   | 10    |                           |                 |    |    |     |           |     |                           | 102.8      |   |
| 115  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 100.8      |   |
|  | 112.8           | 48.0                | 10                      | 9                   | 12    |                           |                 |    |    |     |           |     |                           | 97.8       |   |
| 110  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 92.8       |   |
|  | 107.8           | 53.0                | 11                      | 14                  | 18    |                           |                 |    |    |     |           |     |                           | 89.8       | COASTAL PLAIN GRAY SANDY AND SILTY CLAY, WET 71.0                                     |
| 105  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 87.8       |   |
|  | 102.8           | 58.0                | 7                       | 9                   | 13    |                           |                 |    |    |     |           |     |                           |            |   |
| 100  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |   |
|  | 97.8            | 63.0                | 10                      | 11                  | 16    |                           |                 |    |    |     |           |     |                           |            |   |
| 95   |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |   |
|  | 92.8            | 68.0                | 9                       | 16                  | 18    |                           |                 |    |    |     |           |     |                           |            |   |
| 90   |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |   |
|  | 87.8            | 73.0                | 6                       | 8                   | 9     |                           |                 |    |    |     |           |     |                           |            |   |
| 85   |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |   |

| WBS 17BP.3.R.66  |                 | TIP SF-810213       |                         | COUNTY SAMPSON      |       | GEOLOGIST Zimarino, S. N. |                 |    |    |     |           |     |                           |            |      |
|--|-----------------|---------------------|-------------------------|---------------------|-------|---------------------------|-----------------|----|----|-----|-----------|-----|---------------------------|------------|------|
| SITE DESCRIPTION BRIDGE NO. 213 ON -L- (SR 1710) OVER KILL SWAMP |                 |                     |                         |                     |       |                           | GROUND WTR (ft) |    |    |     |           |     |                           |            |      |
| BORING NO. EB2-A   |                 | STATION 17+66       |                         | OFFSET 7 ft LT      |       | ALIGNMENT -L-             |                 |    |    |     |           |     |                           |            |      |
| COLLAR ELEV. 160.8 ft  |                 | TOTAL DEPTH 84.5 ft |                         | NORTHING 542,050    |       | EASTING 2,207,348         |                 |    |    |     |           |     |                           |            |      |
| DRILL RIGHAMMER EFF./DATE GFC0075 CME-45C 89% 08/13/2018         |                 |                     | DRILL METHOD Mud Rotary |                     |       | HAMMER TYPE Automatic     |                 |    |    |     |           |     |                           |            |      |
| DRILLER Smith, R. E.   |                 | START DATE 03/05/19 |                         | COMP. DATE 03/05/19 |       | SURFACE WATER DEPTH N/A   |                 |    |    |     |           |     |                           |            |      |
| ELEV (ft)  | DRIVE ELEV (ft) | DEPTH (ft)          | BLOW COUNT              |                     |       | BLOWS PER FOOT            |                 |    |    |     | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |      |
|  |                 |                     | 0.5ft                   | 0.5ft               | 0.5ft | 0                         | 25              | 50 | 75 | 100 |           |     |                           |            |      |
| 85   |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |      |
|  | 82.8            | 78.0                | 11                      | 17                  | 25    |                           |                 |    |    |     |           |     |                           | 79.8       | 81.0 |
| 80   |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           | 76.3       | 84.5 |
|  | 77.8            | 83.0                | 7                       | 10                  | 12    |                           |                 |    |    |     |           |     |                           |            |      |
|  |                 |                     |                         |                     |       |                           |                 |    |    |     |           |     |                           |            |      |

Match Line

COASTAL PLAIN  
GRAY SANDY AND SILTY CLAY, WET  
(continued)

Boring Terminated at Elevation 76.3 ft in  
Very Stiff Silty Clay

APPROXIMATE ELEVATION OF  
ARTESIAN HEAD: 161.3'

NCDOT BORE DOUBLE SF810213\_GEO\_BRDG.GPJ\_NC\_DOT.GDT 3/7/19