

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|-------|-----------------------------|-----------|--------------|
| N.C.  | BP14.R010                   | 1         | 12           |

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

STRUCTURE  
SUBSURFACE INVESTIGATION

COUNTY CLAY

PROJECT DESCRIPTION BRIDGE NO. 79 ON SR 1171  
(DICK JONES ROAD) OVER EAGLE FORK CREEK

SITE DESCRIPTION \_\_\_\_\_

CONTENTS

| SHEET NO. | DESCRIPTION                                |
|-----------|--------------------------------------------|
| 1         | TITLE SHEET                                |
| 2, 2A     | LEGEND (SOIL & ROCK)                       |
| 2B, 2C    | SUPPLEMENTAL LEGEND (GSI)                  |
| 3         | SITE PLAN                                  |
| 4-9       | BORE LOGS, CORE LOGS, AND CORE PHOTOGRAPHS |

PERSONNEL  
TRIGON  
GOODNIGHT, D.J.

INVESTIGATED BY GOODNIGHT, D.J.  
DRAWN BY CROCKETT, S.C.  
CHECKED BY HAMM, J.R.  
SUBMITTED BY HAMM, J.R.  
DATE OCTOBER 2023

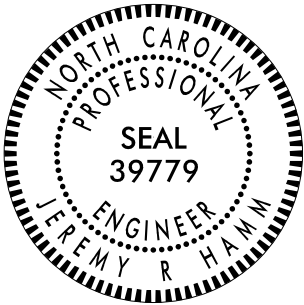
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  - BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.



DocuSigned by:  
Jeremy Hamm 10/16/2023  
462202304BBC46A...

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED

REFERENCE: BP14.R010

PROJECT: SF-210079

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS  
(PAGE 1 OF 2)

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<br>(≤ 35% PASSING #200) |                         |                |                |                                 |                | SILT-CLAY MATERIALS<br>(> 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-4, A-5             |  |
| SYMBOL                           | A-1-a                                      | A-1-b                   | A-2-4          | A-2-5          | A-2-6                           | A-2-7          |                                             |                |                |                |                |       | A-7-5, A-7-6      | A-3 | A-6, A-7                                                |  |                      |  |
| % PASSING<br>#10<br>#40<br>#200  | 50 MX<br>30 MX<br>15 MX                    | 50 MX<br>25 MX<br>10 MX | 51 MN<br>10 MX | 35 MX          | 35 MX                           | 35 MX          | 35 MX                                       | 35 MX          | 36 MN          | 36 MN          | 36 MN          | 36 MN |                   |     |                                                         |  |                      |  |
| MATERIAL PASSING #40<br>LL<br>PI | —<br>6 MX                                  |                         | —<br>NP        | 40 MX<br>10 MX | 41 MN<br>10 MX                  | 40 MX<br>11 MN | 41 MN<br>11 MN                              | 40 MX<br>10 MX | 41 MN<br>10 MX | 40 MX<br>11 MN | 41 MN<br>11 MN |       |                   |     |                                                         |  |                      |  |
| 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   |                |                |       |                   |     | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER |  | HIGHLY ORGANIC 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

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          |
| LITTLE ORGANIC MATTER   | 3 - 5%         | 5 - 12%           | LITTLE         |
| MODERATELY ORGANIC      | 5 - 10%        | 12 - 20%          | SOME           |
| HIGHLY ORGANIC          | > 10%          | > 20%             | HIGHLY         |

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE<br>OPENING (MM) | 4    | 10   | 40   | 60   | 200   | 270   |
|--------------------------------------|------|------|------|------|-------|-------|
|                                      | 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                                |
|----------------------------------------|----------------------------------|----------------------------|---------------------------------------------------------------------|
| LL<br>PLASTIC RANGE (PI)<br>PL         | LIQUID LIMIT                     | - SATURATED - (SAT.)       | USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE |
|                                        | PLASTIC LIMIT                    | - WET - (W)                | SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE               |
| OM<br>SL                               | OPTIMUM MOISTURE 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.

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

25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES  
SPT DMT VST PMT TEST BORING  
AUGER BORING  
CORE BORING  
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             | MED. - MEDIUM            | VST - VANE SHEAR TEST            |
| BT - BORING TERMINATED         | MICA - MICACEOUS         | WEA. - WEATHERED                 |
| CL - CLAY                      | MOD. - MODERATELY        | γ - UNIT WEIGHT                  |
| CPT - CONE PENETRATION TEST    | NP - NON PLASTIC         | γ <sub>d</sub> - DRY UNIT WEIGHT |
| CSE. - COARSE                  | ORG. - ORGANIC           |                                  |
| DMT - DILATOMETER TEST         | PMT - PRESSUREMETER TEST | SAMPLE ABBREVIATIONS             |
| DPT - DYNAMIC PENETRATION TEST | SAP. - SAPROLITIC        | S - BULK                         |
| e - VOID RATIO                 | SD. - SAND, SANDY        | SS - SPLIT SPOON                 |
| F - FINE                       | SL. - SILT, SILTY        | ST - SHELBY TUBE                 |
| FOSS. - FOSSILIFEROUS          | SLI. - SLIGHTLY          | RS - ROCK                        |
| FRAC. - FRACTURED, FRACTURES   | TCR - TRICONE REFUSAL    | RT - RECOMPACTED TRIAXIAL        |
| FRAGS. - FRAGMENTS             | w - MOISTURE CONTENT     | CBR - CALIFORNIA BEARING RATIO   |
| HI. - HIGHLY                   | V - VERY                 |                                  |

EQUIPMENT USED ON SUBJECT PROJECT

| DRILL UNITS:                               | ADVANCING TOOLS:                                                                | HAMMER TYPE:                                                                  |
|--------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <input type="checkbox"/> CME-45C           | <input type="checkbox"/> CLAY BITS                                              | <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL |
| <input checked="" type="checkbox"/> CME-55 | <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER                             | CORE SIZE:                                                                    |
| <input type="checkbox"/> CME-550           | <input checked="" type="checkbox"/> 8" HOLLOW AUGERS                            | <input type="checkbox"/> -B <input type="checkbox"/> -H                       |
| <input type="checkbox"/> VANE SHEAR TEST   | <input type="checkbox"/> HARD FACED FINGER BITS                                 | <input checked="" type="checkbox"/> -N Q                                      |
| <input type="checkbox"/> PORTABLE HOIST    | <input type="checkbox"/> TUNG-CARBIDE INSERTS                                   | HAND TOOLS:                                                                   |
| <input type="checkbox"/>                   | <input checked="" type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER | <input type="checkbox"/> POST HOLE DIGGER                                     |
| <input type="checkbox"/>                   | <input type="checkbox"/> TRICONE _____ * STEEL TEETH                            | <input type="checkbox"/> HAND AUGER                                           |
| <input type="checkbox"/>                   | <input type="checkbox"/> TRICONE _____ * TUNG.-CARB.                            | <input type="checkbox"/> SOUNDING ROD                                         |
| <input type="checkbox"/>                   | <input checked="" type="checkbox"/> CORE BIT                                    | <input type="checkbox"/> VANE SHEAR TEST                                      |
| <input type="checkbox"/>                   | <input type="checkbox"/>                                                        | <input type="checkbox"/>                                                      |

| PROJECT REFERENCE NO. | SHEET NO. |
|-----------------------|-----------|
| BP14.R010             | 2A        |

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
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**SUBSURFACE INVESTIGATION**  
**SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**  
**(PAGE 2 OF 2)**

| ROCK DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                         | TERMS AND DEFINITIONS                                                                                                                                               |                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 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 SL.)                                                                                                                                                                                                                                                                                                                                                                                                                                           | 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 (SL.)                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 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.<br><u>IF TESTED, WOULD YIELD SPT REFUSAL</u>                                              |                                                                                                                                                                     |                   |
| 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.<br><u>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</u>                                                            |                                                                                                                                                                     |                   |
| 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. <u>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</u> |                                                                                                                                                                     |                   |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                         | BEDDING                                                                                                                                                             |                   |
| TERM                                                                                                                                                                                                                                                                                                                                                                                                                                                          | SPACING                                                                                                                                                                                                                                                                                                                                                 | TERM                                                                                                                                                                | THICKNESS         |
| VERY WIDE                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MORE THAN 10 FEET                                                                                                                                                                                                                                                                                                                                       | VERY THICKLY BEDDED                                                                                                                                                 | 4 FEET            |
| WIDE                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3 TO 10 FEET                                                                                                                                                                                                                                                                                                                                            | THICKLY BEDDED                                                                                                                                                      | 1.5 - 4 FEET      |
| MODERATELY CLOSE                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 TO 3 FEET                                                                                                                                                                                                                                                                                                                                             | THINLY BEDDED                                                                                                                                                       | 0.16 - 1.5 FEET   |
| CLOSE                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.16 TO 1 FOOT                                                                                                                                                                                                                                                                                                                                          | VERY THINLY BEDDED                                                                                                                                                  | 0.03 - 0.16 FEET  |
| VERY CLOSE                                                                                                                                                                                                                                                                                                                                                                                                                                                    | LESS THAN 0.16 FEET                                                                                                                                                                                                                                                                                                                                     | THICKLY LAMINATED                                                                                                                                                   | 0.008 - 0.03 FEET |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                         | 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.                                                                                                                                                                                                                                                                               |                                                                                                                                                                     |                   |
| BENCH MARK: BL-2                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                         | ELEVATION: 2135.95 FEET                                                                                                                                             |                   |
| NOTES:<br>FIAD - FILLED IMMEDIATELY AFTER DRILLING                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                     |                   |
| DATE: 8-15-14                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                     |                   |

BP14.R010

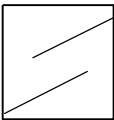
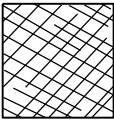
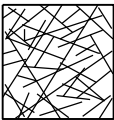
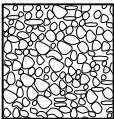
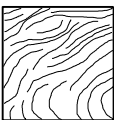
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT**

# **SUBSURFACE INVESTIGATION**

## **SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 1 OF 2)**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

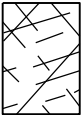
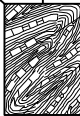
| GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                  | SURFACE CONDITIONS                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--|--|
| <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.</p> |                                                                                                                                                  | STRUCTURE                                                                            | <p align="center">SURFACE CONDITIONS</p> <p align="center">VERY GOOD<br/>Very rough, fresh unweathered surfaces</p> <p align="center">GOOD<br/>Rough, slightly weathered, iron stained surfaces</p> <p align="center">FAIR<br/>Smooth, moderately weathered and altered surfaces</p> <p align="center">POOR<br/>Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p align="center">VERY POOR<br/>Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> | <p align="center">DECREASING SURFACE QUALITY →</p> |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities                                         | <p align="center">DECREASING INTERLOCKING OF ROCK PIECES</p> <p align="center">↓</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets                     |                                                                                      | 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 80                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets                             |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 60                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces                                     |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 50                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes                                                  |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 40                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 30                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 20                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10                                                 |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                                                      | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | N/A                                                |  |  |

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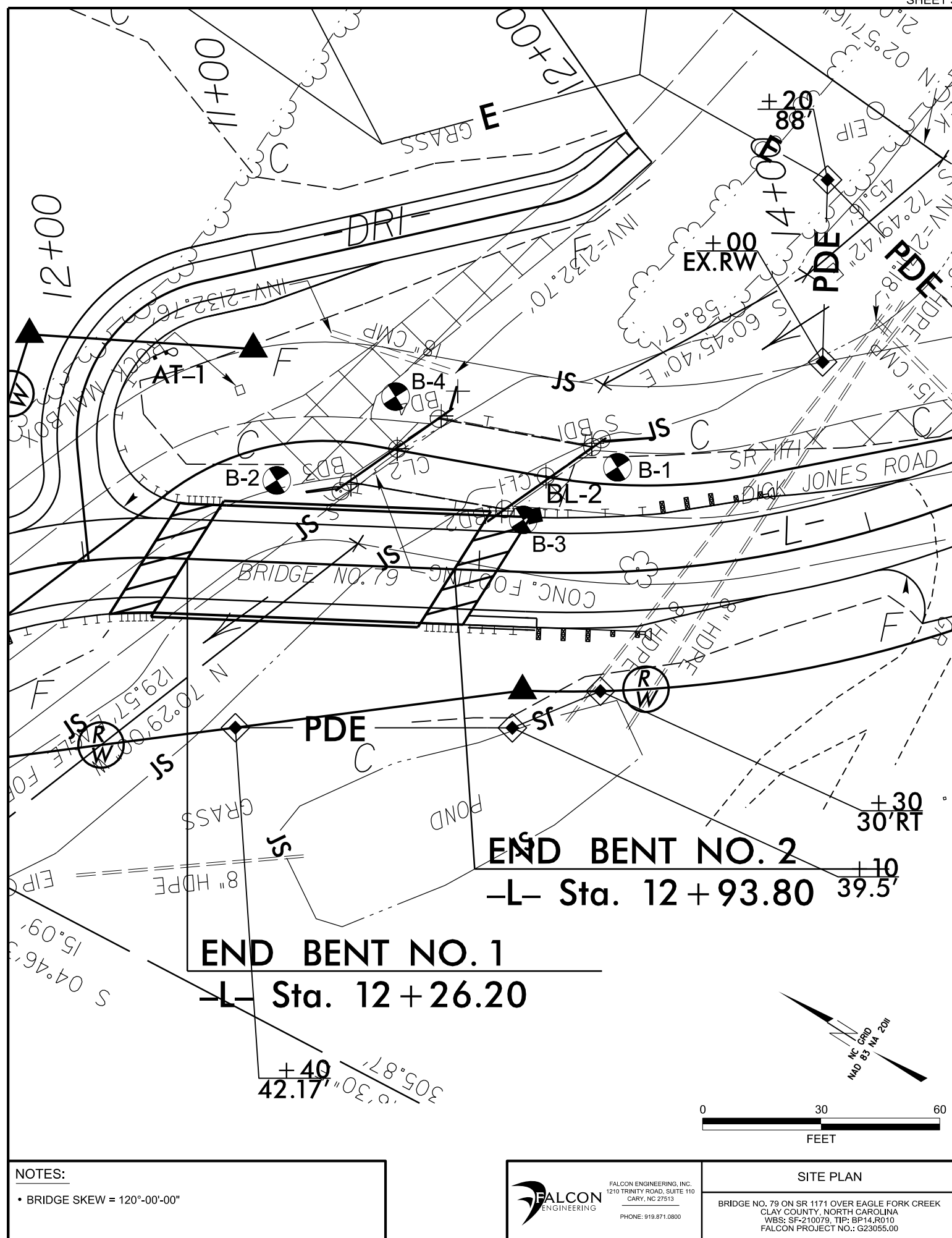
SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES  
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (PAGE 2 OF 2)

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

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------|--|----------------------------------------------------|-------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <p>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</p> <p>From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.</p> |  | SURFACE CONDITIONS OF DISCONTINUITIES<br>(Predominantly bedding planes) |  | VERY GOOD - Very Rough, fresh unweathered surfaces | GOOD - Rough, slightly weathered surfaces | FAIR - Smooth, moderately weathered and altered surfaces | POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments | VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings |
| COMPOSITION AND STRUCTURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
| <p> <b>A.</b> Thick bedded, very blocky sandstone. The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
| <p> <b>B.</b> Sandstone with thin inter-layers of siltstone</p> <p> <b>C.</b> Sandstone and siltstone in similar amounts</p> <p> <b>D.</b> Siltstone or silty shale with sandstone layers</p> <p> <b>E.</b> Weak siltstone or clayey shale with sandstone layers</p>                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
| <p><b>C, D, E, and G</b> - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to <b>F</b> and <b>H</b>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
| <p> <b>F.</b> Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |
| <p> <b>G.</b> Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p> <b>H.</b> Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                         |  |                                                    |                                           |                                                          |                                                                                                                 |                                                                                                        |

— Means deformation after tectonic disturbance



|                                                                                  |                 |            |                     |        |       |                          |    |    |                            |     |           |             |       |                                                                                                     |            |
|----------------------------------------------------------------------------------|-----------------|------------|---------------------|--------|-------|--------------------------|----|----|----------------------------|-----|-----------|-------------|-------|-----------------------------------------------------------------------------------------------------|------------|
| WBS SF-210079                                                                    |                 |            | TIP BP14.R010       |        |       | COUNTY CLAY              |    |    | GEOLOGIST Goodnight, D. J. |     |           |             |       |                                                                                                     |            |
| SITE DESCRIPTION Bridge No. 79 on SR 1171 (Dick Jones Rd.) over Eagle Fork Creek |                 |            |                     |        |       |                          |    |    | GROUND WTR (ft)            |     |           |             |       |                                                                                                     |            |
| BORING NO. B-1                                                                   |                 |            | STATION 13+36       |        |       | OFFSET 26 ft LT          |    |    | ALIGNMENT -L-              |     |           | 0 HR. 7.3   |       |                                                                                                     |            |
| COLLAR ELEV. 2,135.9 ft                                                          |                 |            | TOTAL DEPTH 31.8 ft |        |       | NORTHING 494,203         |    |    | EASTING 610,022            |     |           | 24 HR. FIAD |       |                                                                                                     |            |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 85% 02/22/2016                         |                 |            |                     |        |       | DRILL METHOD H.S. Augers |    |    | HAMMER TYPE Automatic      |     |           |             |       |                                                                                                     |            |
| DRILLER Contract Driller                                                         |                 |            | START DATE 08/16/16 |        |       | COMP. DATE 08/16/16      |    |    | SURFACE WATER DEPTH N/A    |     |           |             |       |                                                                                                     |            |
| ELEV (ft)                                                                        | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT          |        |       | BLOWS PER FOOT           |    |    |                            |     | SAMP. NO. | MOI         | L O G | SOIL AND ROCK DESCRIPTION                                                                           |            |
|                                                                                  |                 |            | 0.5ft               | 0.5ft  | 0.5ft | 0                        | 25 | 50 | 75                         | 100 |           |             |       | ELEV. (ft)                                                                                          | DEPTH (ft) |
| 2140                                                                             |                 |            |                     |        |       |                          |    |    |                            |     |           |             |       |                                                                                                     |            |
| 2135                                                                             | 2,134.9         | 1.0        |                     |        |       |                          |    |    |                            |     |           |             |       | 2,135.9<br>2,135.2                                                                                  | 0.0<br>0.7 |
| 2130                                                                             | 2,132.4         | 3.5        | 3                   | 2      | 2     |                          |    |    |                            |     |           |             | M     | 0.2' BITUMINOUS CONCRETE<br>0.5' AGGREGATE BASE COURSE                                              |            |
|                                                                                  | 2,129.9         | 6.0        | 2                   | 2      | 2     |                          |    |    |                            |     |           |             | M     | ROADWAY EMBANKMENT<br>RED AND BROWN, SILTY CSE. TO F.<br>SAND (A-2-4) WITH TRACE GRAVEL<br>AND MICA | 5.5        |
|                                                                                  | 2,127.4         | 8.5        | 8                   | 10     | 14    |                          |    |    |                            |     |           |             | M     | ALLUVIAL<br>BROWN, F. TO CSE. SAND (A-1-b) WITH<br>TRACE GRAVEL                                     |            |
| 2125                                                                             |                 |            | 19                  | 20     | 20    |                          |    |    |                            |     |           |             | M     | 2,124.9                                                                                             | 11.0       |
| 2120                                                                             | 2,122.4         | 13.5       |                     |        |       |                          |    |    |                            |     |           |             |       | 2,122.3                                                                                             | 13.6       |
|                                                                                  |                 |            | 60/0.1              |        |       |                          |    |    |                            |     |           |             |       | 2,120.3                                                                                             | 15.6       |
| 2115                                                                             | 2,114.4         | 21.5       |                     |        |       |                          |    |    |                            |     |           |             |       |                                                                                                     |            |
|                                                                                  |                 |            | 50                  | 50/0.1 |       |                          |    |    |                            |     |           |             |       |                                                                                                     |            |
| 2110                                                                             | 2,110.3         | 25.6       |                     |        |       |                          |    |    |                            |     |           |             |       | 2,110.3                                                                                             | 25.6       |
| 2105                                                                             |                 |            | 60/0.0              |        |       |                          |    |    |                            |     |           |             |       |                                                                                                     |            |
|                                                                                  |                 |            |                     |        |       |                          |    |    |                            |     |           |             |       | 2,104.1                                                                                             | 31.8       |
|                                                                                  |                 |            |                     |        |       |                          |    |    |                            |     |           |             |       | Boring Terminated at Elevation 2,104.1 ft in<br>CR: BIOTITE GNEISS                                  |            |

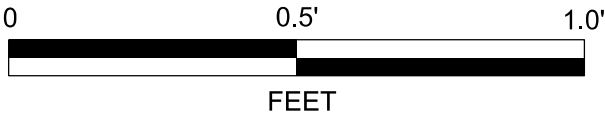
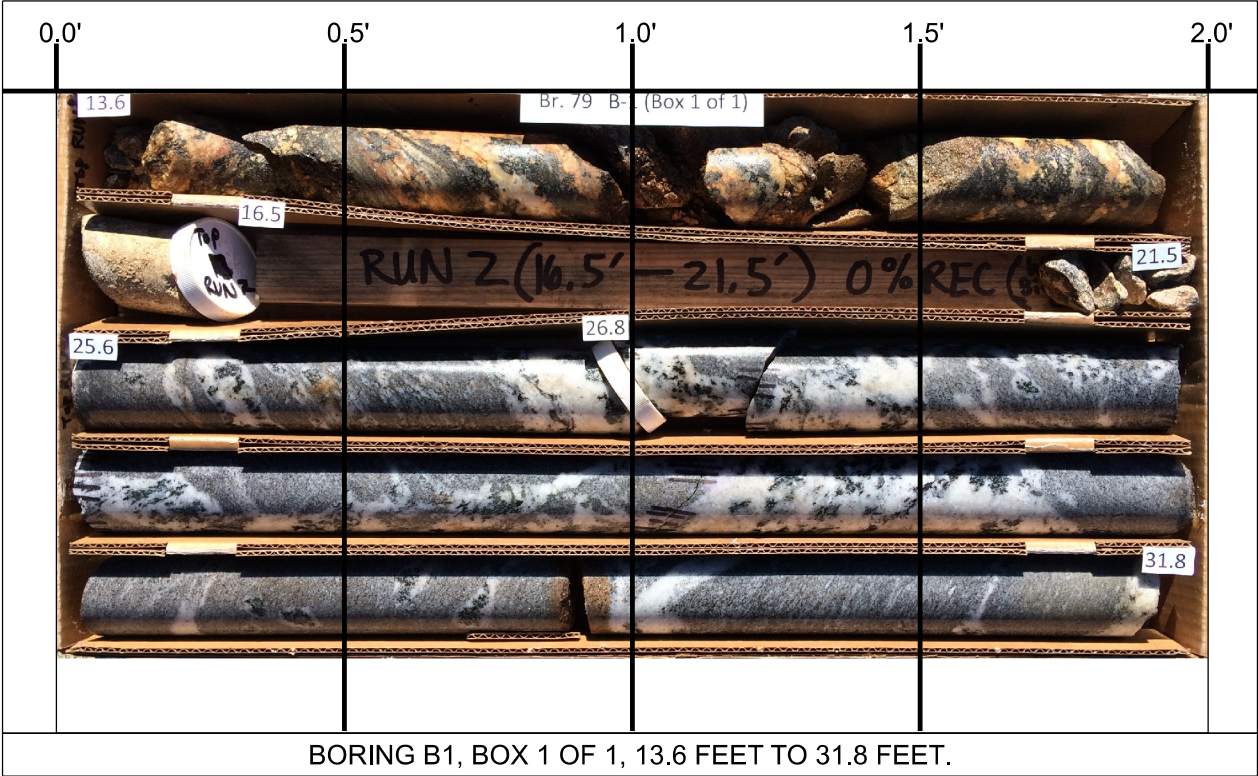
NCDOT BORE SINGLE G16038.02 BRIDGE 79.GPJ NC\_DOT.GDT 10/13/23

GEOTECHNICAL BORING REPORT

CORE LOG

|                                                                                  |                     |               |             |                           |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|----------------------------------------------------------------------------------|---------------------|---------------|-------------|---------------------------|-------------------|------------------|--------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------|------------------|------------|-------------|--|--|--|
| WBS SF-210079                                                                    |                     |               |             | TIP BP14.R010             |                   |                  |              | COUNTY CLAY              |                                                                                                                          |                                                                                   |                         | GEOLOGIST Goodnight, D. J.                                                                                                    |         |                  |            |             |  |  |  |
| SITE DESCRIPTION Bridge No. 79 on SR 1171 (Dick Jones Rd.) over Eagle Fork Creek |                     |               |             |                           |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         | GROUND WTR (ft)                                                                                                               |         |                  |            |             |  |  |  |
| BORING NO. B-1                                                                   |                     |               |             | STATION 13+36             |                   |                  |              | OFFSET 26 ft LT          |                                                                                                                          |                                                                                   |                         | ALIGNMENT -L-                                                                                                                 |         |                  |            | 0 HR. 7.3   |  |  |  |
| COLLAR ELEV. 2,135.9 ft                                                          |                     |               |             | TOTAL DEPTH 31.8 ft       |                   |                  |              | NORTHING 494,203         |                                                                                                                          |                                                                                   |                         | EASTING 610,022                                                                                                               |         |                  |            | 24 HR. FIAD |  |  |  |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 85% 02/22/2016                         |                     |               |             |                           |                   |                  |              | DRILL METHOD H.S. Augers |                                                                                                                          |                                                                                   |                         | HAMMER TYPE Automatic                                                                                                         |         |                  |            |             |  |  |  |
| DRILLER Contract Driller                                                         |                     |               |             | START DATE 08/16/16       |                   |                  |              | COMP. DATE 08/16/16      |                                                                                                                          |                                                                                   |                         | SURFACE WATER DEPTH N/A                                                                                                       |         |                  |            |             |  |  |  |
| CORE SIZE NQ2                                                                    |                     |               |             | TOTAL RUN 14.1 ft         |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| ELEV<br>(ft)                                                                     | RUN<br>ELEV<br>(ft) | DEPTH<br>(ft) | RUN<br>(ft) | DRILL<br>RATE<br>(Min/ft) | RUN               |                  | SAMP.<br>NO. | STRATA                   |                                                                                                                          | L<br>O<br>G                                                                       | DESCRIPTION AND REMARKS |                                                                                                                               |         |                  | DEPTH (ft) |             |  |  |  |
|                                                                                  |                     |               |             |                           | REC.<br>(ft)<br>% | RQD<br>(ft)<br>% |              | REC.<br>(ft)<br>%        | RQD<br>(ft)<br>%                                                                                                         |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| 2122.3                                                                           |                     |               |             |                           |                   |                  |              |                          |                                                                                                                          |                                                                                   | Begin Coring @ 13.6 ft  |                                                                                                                               |         |                  |            |             |  |  |  |
| 2120                                                                             | 2,122.3             | 13.6          | 2.9         | 5:24/0.9                  | (2.0)             | (1.0)            |              |                          |                                                                                                                          |  | 2,122.3                 | CRYSTALLINE ROCK                                                                                                              |         | 13.6             |            |             |  |  |  |
|                                                                                  | 2,119.4             | 16.5          |             |                           |                   |                  |              | 2,120.3                  | MODERATELY SEVERE TO MODERATE WEATHERING, MEDIUM TO MODERATELY HARD, CLOSE FRACTURE SPACING, TAN AND GRAY BIOTITE GNEISS |                                                                                   | 15.6                    |                                                                                                                               |         |                  |            |             |  |  |  |
| 2115                                                                             |                     |               | 5.0         | 0:19/1.0                  | (0.0)             | (0.0)            |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 0:54/1.0                  | 0%                | 0%               |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 2:09/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| 2115                                                                             | 2,114.4             | 21.5          |             | 1:24/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 1:25/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| 2110                                                                             |                     |               |             | N=100/0.6                 |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  | 2,110.3             | 25.6          |             |                           |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               | 2,110.3 | CRYSTALLINE ROCK |            | 25.6        |  |  |  |
| 2110                                                                             | 2,109.1             | 26.8          | 1.2         | N=60/0.0                  | (1.1)             | (1.0)            |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               | 5.0         | 3:41/1.0                  | 92%               | 83%              |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| 2105                                                                             |                     |               |             | 0:28/0.2                  | (4.9)             | (4.9)            |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 5:29/1.0                  | 98%               | 98%              |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 3:16/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |
| 2105                                                                             | 2,104.1             | 31.8          |             | 4:58/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   | 2,104.1                 | VERY SLIGHT WEATHERING TO FRESH, VERY HARD TO HARD, CLOSE TO MODERATELY CLOSE FRACTURE SPACING, WHITE AND GRAY BIOTITE GNEISS |         | 31.8             |            |             |  |  |  |
|                                                                                  |                     |               |             | 4:25/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         | Boring Terminated at Elevation 2,104.1 ft in CR: BIOTITE GNEISS                                                               |         |                  |            |             |  |  |  |
|                                                                                  |                     |               |             | 4:44/1.0                  |                   |                  |              |                          |                                                                                                                          |                                                                                   |                         |                                                                                                                               |         |                  |            |             |  |  |  |

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GEOTECHNICAL BORING REPORT

BORE LOG

|                                                                                  |                 |            |                     |       |       |                          |    |    |                            |     |           |             |     |                                                                                                              |                      |
|----------------------------------------------------------------------------------|-----------------|------------|---------------------|-------|-------|--------------------------|----|----|----------------------------|-----|-----------|-------------|-----|--------------------------------------------------------------------------------------------------------------|----------------------|
| WBS SF-210079                                                                    |                 |            | TIP BP14.R010       |       |       | COUNTY CLAY              |    |    | GEOLOGIST Goodnight, D. J. |     |           |             |     |                                                                                                              |                      |
| SITE DESCRIPTION Bridge No. 79 on SR 1171 (Dick Jones Rd.) over Eagle Fork Creek |                 |            |                     |       |       |                          |    |    | GROUND WTR (ft)            |     |           |             |     |                                                                                                              |                      |
| BORING NO. B-2                                                                   |                 |            | STATION 12+48       |       |       | OFFSET 21 ft LT          |    |    | ALIGNMENT -L-              |     |           | 0 HR. Dry   |     |                                                                                                              |                      |
| COLLAR ELEV. 2,136.0 ft                                                          |                 |            | TOTAL DEPTH 18.3 ft |       |       | NORTHING 494,274         |    |    | EASTING 609,973            |     |           | 24 HR. FIAD |     |                                                                                                              |                      |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 85% 02/22/2016                         |                 |            |                     |       |       | DRILL METHOD H.S. Augers |    |    | HAMMER TYPE Automatic      |     |           |             |     |                                                                                                              |                      |
| DRILLER Contract Driller                                                         |                 |            | START DATE 08/17/16 |       |       | COMP. DATE 08/17/16      |    |    | SURFACE WATER DEPTH N/A    |     |           |             |     |                                                                                                              |                      |
| ELEV (ft)                                                                        | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT          |       |       | BLOWS PER FOOT           |    |    |                            |     | SAMP. NO. | MOI         | LOG | SOIL AND ROCK DESCRIPTION                                                                                    |                      |
|                                                                                  |                 |            | 0.5ft               | 0.5ft | 0.5ft | 0                        | 25 | 50 | 75                         | 100 |           |             |     | ELEV. (ft)                                                                                                   | DEPTH (ft)           |
| 2140                                                                             |                 |            |                     |       |       |                          |    |    |                            |     |           |             |     |                                                                                                              |                      |
| 2135                                                                             | 2,135.0         | 1.0        | 3                   | 2     | 16    |                          |    |    |                            |     |           |             |     | 2,136.0<br>2,135.4                                                                                           | 0.0<br>0.6           |
| 2130                                                                             | 2,132.5         | 3.5        | 13                  | 6     | 2     |                          |    |    |                            |     |           |             | M   | 0.1' BITUMINOUS CONCRETE<br>0.5' AGGREGATE BASE COURSE                                                       |                      |
|                                                                                  | 2,130.0         | 6.0        | 7                   | 9     | 12    |                          |    |    |                            |     |           |             | M   | ROADWAY EMBANKMENT<br>BROWN, SILTY CSE. TO F. SAND (A-2-4)<br>WITH TRACE GRAVEL                              |                      |
| 2125                                                                             | 2,127.5         | 8.5        | 27                  | 27    | 35    |                          |    |    |                            |     |           |             | M   | COLLUVIAL<br>BROWN, F. TO CSE. SAND (A-1-b) WITH<br>TRACE GRAVEL/COBBLES                                     |                      |
|                                                                                  | 2,122.5         | 13.5       | 11                  | 14    | 35    |                          |    |    |                            |     |           |             | M   | RESIDUAL<br>BROWN, SILTY CSE. TO F. SAND (A-2-4)<br>SAPROLITIC                                               |                      |
| 2120                                                                             | 2,117.7         | 18.3       | 60/0.0              |       |       |                          |    |    |                            |     |           |             |     | 2,120.5<br>2,117.7                                                                                           | 12.5<br>15.5<br>18.3 |
|                                                                                  |                 |            |                     |       |       |                          |    |    |                            |     |           |             |     | WEATHERED ROCK<br>GRAY AND WHITE, BIOTITE GNEISS                                                             |                      |
|                                                                                  |                 |            |                     |       |       |                          |    |    |                            |     |           |             |     | Boring Terminated with Standard<br>Penetration Test Refusal at Elevation<br>2,117.7 ft on CR: BIOTITE GNEISS |                      |

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|                                                                                  |                 |                     |            |                         |       |                            |    |           |     |                           |                                                                                                                     |
|----------------------------------------------------------------------------------|-----------------|---------------------|------------|-------------------------|-------|----------------------------|----|-----------|-----|---------------------------|---------------------------------------------------------------------------------------------------------------------|
| WBS SF-210079                                                                    |                 | TIP BP14.R010       |            | COUNTY CLAY             |       | GEOLOGIST Goodnight, D. J. |    |           |     |                           |                                                                                                                     |
| SITE DESCRIPTION Bridge No. 79 on SR 1171 (Dick Jones Rd.) over Eagle Fork Creek |                 |                     |            |                         |       | GROUND WTR (ft)            |    |           |     |                           |                                                                                                                     |
| BORING NO. B-3                                                                   |                 | STATION 13+11       |            | OFFSET 13 ft LT         |       | ALIGNMENT -L-              |    |           |     |                           |                                                                                                                     |
| COLLAR ELEV. 2,136.2 ft                                                          |                 | TOTAL DEPTH 18.5 ft |            | NORTHING 494,216        |       | EASTING 609,998            |    |           |     |                           |                                                                                                                     |
| DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 85% 02/22/2016                         |                 |                     |            |                         |       | DRILL METHOD H.S. Augers   |    |           |     |                           |                                                                                                                     |
| DRILLER Contract Driller                                                         |                 |                     |            |                         |       | HAMMER TYPE Automatic      |    |           |     |                           |                                                                                                                     |
| START DATE 08/16/16                                                              |                 | COMP. DATE 08/16/16 |            | SURFACE WATER DEPTH N/A |       |                            |    |           |     |                           |                                                                                                                     |
| ELEV (ft)                                                                        | DRIVE ELEV (ft) | DEPTH (ft)          | BLOW COUNT |                         |       | BLOWS PER FOOT             |    | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION |                                                                                                                     |
|                                                                                  |                 |                     | 0.5ft      | 0.5ft                   | 0.5ft | 0                          | 25 | 50        | 75  | 100                       | DEPTH (ft)                                                                                                          |
| 2140                                                                             |                 |                     |            |                         |       |                            |    |           |     |                           |                                                                                                                     |
| 2135                                                                             | 2,135.2         | 1.0                 |            |                         |       |                            |    |           |     |                           | 2,136.2 0.0                                                                                                         |
| 2130                                                                             | 2,132.7         | 3.5                 | 4          | 5                       | 7     |                            |    |           |     |                           | ROADWAY EMBANKMENT<br>TAN AND BROWN, SILTY CSE. TO F. SAND (A-2-4) WITH TRACE GRAVEL                                |
|                                                                                  | 2,130.2         | 6.0                 | 9          | 8                       | 20    |                            |    |           |     |                           |                                                                                                                     |
| 2125                                                                             | 2,127.7         | 8.5                 | 17         | 16                      | 22    |                            |    |           |     |                           | ALLUVIAL<br>TAN AND BROWN, F. TO CSE. SAND (A-1-b) WITH TRACE GRAVEL/COBBLES                                        |
|                                                                                  | 2,122.7         | 13.5                | 20         | 31                      | 30    |                            |    |           |     |                           |                                                                                                                     |
| 2120                                                                             | 2,122.7         | 13.5                | 16         | 61                      | 29    |                            |    |           |     |                           | RESIDUAL<br>TAN, SLI. SILTY F. TO CSE. SAND (A-1-b) SAPROLITIC                                                      |
|                                                                                  | 2,117.7         | 18.5                |            |                         |       |                            |    |           |     |                           |                                                                                                                     |
|                                                                                  |                 |                     |            |                         |       |                            |    |           |     |                           | WEATHERED ROCK<br>TAN AND WHITE, METAMORPHOSED GRANITIC ROCK                                                        |
|                                                                                  |                 |                     |            |                         |       |                            |    |           |     |                           | Boring Terminated with Standard Penetration Test Refusal at Elevation 2,117.7 ft on CR: METAMORPHOSED GRANITIC ROCK |

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| <b>WBS</b> SF-210079                                                                    |                       |               |            |       |       | <b>TIP</b> BP14.R010       |    |    |    |     |              | <b>COUNTY</b> CLAY              |     |                           |                                                                                                                                                                        |      |  | <b>GEOLOGIST</b> Goodnight, D. J. |  |  |  |  |  |                    |  |  |  |  |  |
|-----------------------------------------------------------------------------------------|-----------------------|---------------|------------|-------|-------|----------------------------|----|----|----|-----|--------------|---------------------------------|-----|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--|-----------------------------------|--|--|--|--|--|--------------------|--|--|--|--|--|
| <b>SITE DESCRIPTION</b> Bridge No. 79 on SR 1171 (Dick Jones Rd.) over Eagle Fork Creek |                       |               |            |       |       |                            |    |    |    |     |              |                                 |     |                           |                                                                                                                                                                        |      |  | <b>GROUND WTR (ft)</b>            |  |  |  |  |  |                    |  |  |  |  |  |
| <b>BORING NO.</b> B-4                                                                   |                       |               |            |       |       | <b>STATION</b> 12+77       |    |    |    |     |              | <b>OFFSET</b> 43 ft LT          |     |                           |                                                                                                                                                                        |      |  | <b>ALIGNMENT</b> -L-              |  |  |  |  |  | <b>0 HR.</b> Dry   |  |  |  |  |  |
| <b>COLLAR ELEV.</b> 2,135.6 ft                                                          |                       |               |            |       |       | <b>TOTAL DEPTH</b> 13.5 ft |    |    |    |     |              | <b>NORTHING</b> 494,260         |     |                           |                                                                                                                                                                        |      |  | <b>EASTING</b> 610,007            |  |  |  |  |  | <b>24 HR.</b> FIAD |  |  |  |  |  |
| <b>DRILL RIG/HAMMER EFF./DATE</b> TRI9435 CME-55 85% 02/22/2016                         |                       |               |            |       |       |                            |    |    |    |     |              | <b>DRILL METHOD</b> H.S. Augers |     |                           |                                                                                                                                                                        |      |  | <b>HAMMER TYPE</b> Automatic      |  |  |  |  |  |                    |  |  |  |  |  |
| <b>DRILLER</b> Contract Driller                                                         |                       |               |            |       |       | <b>START DATE</b> 08/17/16 |    |    |    |     |              | <b>COMP. DATE</b> 08/17/16      |     |                           |                                                                                                                                                                        |      |  | <b>SURFACE WATER DEPTH</b> N/A    |  |  |  |  |  |                    |  |  |  |  |  |
| ELEV<br>(ft)                                                                            | DRIVE<br>ELEV<br>(ft) | DEPTH<br>(ft) | BLOW COUNT |       |       | BLOWS PER FOOT             |    |    |    |     | SAMP.<br>NO. | MOI                             | LOG | SOIL AND ROCK DESCRIPTION |                                                                                                                                                                        |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         |                       |               | 0.5ft      | 0.5ft | 0.5ft | 0                          | 25 | 50 | 75 | 100 |              |                                 |     | ELEV. (ft)                | DEPTH (ft)                                                                                                                                                             |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
| 2140                                                                                    |                       |               |            |       |       |                            |    |    |    |     |              |                                 |     |                           |                                                                                                                                                                        |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
| 2135                                                                                    | 2,134.6               | 1.0           | 1          | 1     | 1     |                            |    |    |    |     |              |                                 |     |                           | 2,135.6                                                                                                                                                                | 0.0  |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
| 2130                                                                                    | 2,132.1               | 3.5           | 1          | 2     | WOH   |                            |    |    |    |     |              |                                 | M   |                           | <b>ROADWAY EMBANKMENT</b><br>BROWN, SILTY CSE. TO F. SAND (A-2-4)<br>WITH TRACE GRAVEL                                                                                 |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         | 2,129.6               | 6.0           | 7          | 16    | 11    |                            |    |    |    |     |              |                                 | M   |                           |                                                                                                                                                                        |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
| 2125                                                                                    | 2,127.1               | 8.5           | 34         | 44    | 38    |                            |    |    |    |     |              |                                 | W   |                           | <b>ALLUVIAL</b><br>BROWN, SLI. SILTY F. TO CSE. SAND<br>(A-1-b) WITH TRACE GRAVEL                                                                                      |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         | 2,124.1               | 13.5          | 60/0.0     |       |       |                            |    |    |    |     |              |                                 | W   |                           |                                                                                                                                                                        |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         | 2,122.1               |               |            |       |       |                            |    |    |    |     |              |                                 |     |                           | 2,124.1                                                                                                                                                                | 11.5 |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         |                       |               |            |       |       |                            |    |    |    |     |              |                                 |     |                           | 2,122.1                                                                                                                                                                | 13.5 |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |
|                                                                                         |                       |               |            |       |       |                            |    |    |    |     |              |                                 |     |                           | <b>WEATHERED ROCK</b><br>TAN AND WHITE, BIOTITE GNEISS<br>Boring Terminated with Standard<br>Penetration Test Refusal at Elevation<br>2,122.1 ft on CR: BIOTITE GNEISS |      |  |                                   |  |  |  |  |  |                    |  |  |  |  |  |

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