STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BP12.R015	1	

REFERENCE: 480014

PROJECT: BP12.R015

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY IREDELL

PROJECT DESCRIPTION BRIDGE NO. 14 OVER WEATHERS CREEK ON SR 2382 (BRAWLEY RD) BETWEEN SR 2383 AND SR 1001

SITE DESCRIPTION BRIDGE NO. 14 AT -L- STA. 13+95

CONTENTS

CAUTION NOTICE

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

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

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DocuSigned by:
James W. Mize
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3/5/2024
SIGNATURE DATE

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PROJECT REFERENCE NO.	SHEET NO.
BP12.R015	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PLASTIC RANGE (PI): LL — LIQUID LIMIT		
	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

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

COLOR

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

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM #2 AT -L- STA. 12+55.76, 92.6' LT
(N: 703765.85, E: 1467288.63)
ELEVATION: 756.65 FEET

NOTES:

BOREHOLE ELEVATIONS DETERMINED FROM PROVIDED .TIN FILE
TIN FILE: 480014_merge.tin DATE: 6/2/2017

FIAD = FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
BP12.R015	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

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

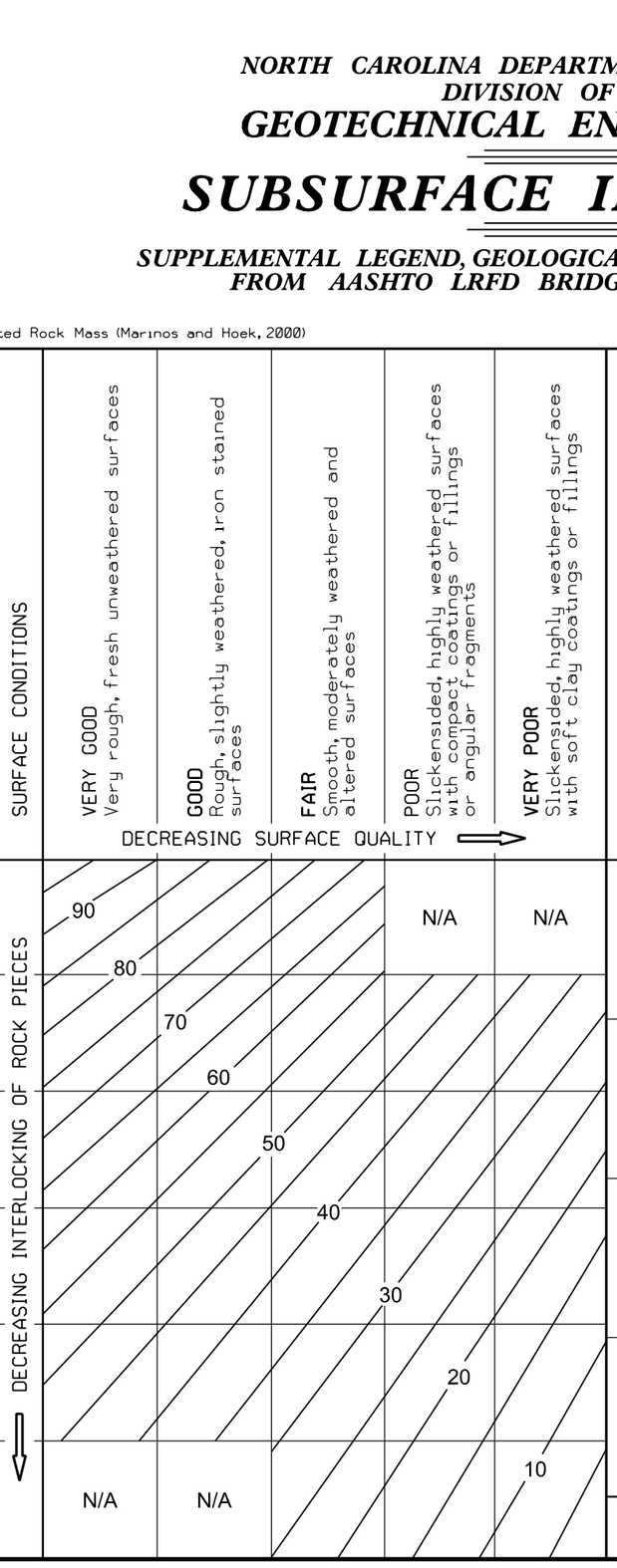
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

STRUCTURE

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

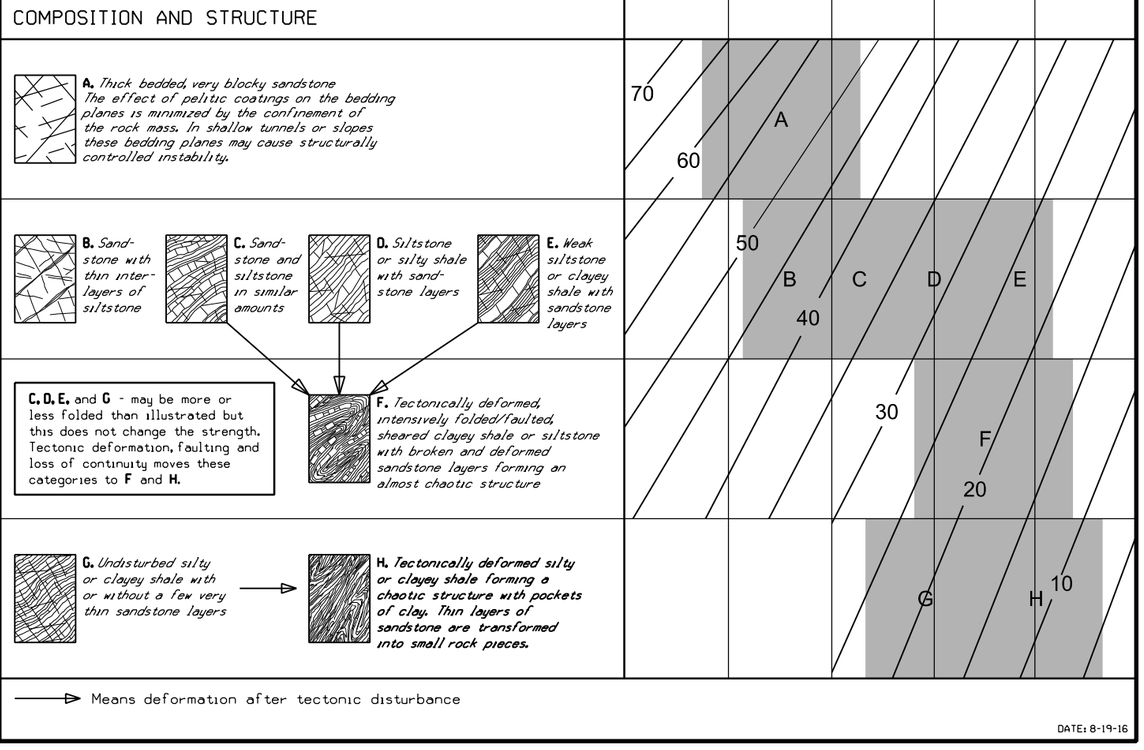


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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

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

COMPOSITION AND STRUCTURE



→ Means deformation after tectonic disturbance

DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
BP12.R015	3

SITE PLAN

0 40 80
FEET

NAD 83 NC GRID NA 2011

PC Sta. 10+23.89

PCC Sta.12+37.29

-DRI- PT Sta. 12+70.44

PT Sta. 16+01.86

N 31° 26' 47.6" W

N 54° 16' 28.0" W

END BENT 1
STA.13+45.00

END BENT 1
STA.14+45.00

EBI-A BI-A B2-A EB2-A

EBI-B BI-B B2-B EB2-B

12+00

15+00

-L- BRAWLEY RD.

AT-1 BRIDGE NO. 14

SOIL

WEATHERED ROCK

CREEK

E F PDE JS R/W

SKEW = APPROXIMATELY 90 DEGREES

PROJECT REFERENCE NO.	SHEET NO.
BP12.R015	4

PROFILE THROUGH A LINE ALONG -L-

0 50 100
FEET
VE = 5

-L-

EB1-A 13+35 16' LT
B1-A 13+67 12' LT
B2-A 14+23 14' LT
EB2-A 14+54 15' LT

PROPOSED GRADE
EXISTING GROUND

780 770 760 750 740 730 720 710 700

12+00 13+00 14+00 15+00 16+00 17+00

(A) **ROADWAY EMBANKMENT** Dark brown, medium stiff to stiff, sandy CLAY (A-6), moist

(B) **ROADWAY EMBANKMENT** Brown to gray, soft, micaceous, sandy SILT (A-4), moist

(C) **ROADWAY EMBANKMENT** Brown, loose to medium dense, silty fine SAND (A-2-4), moist

(D) **ALLUVIAL** Dark gray, very soft to medium stiff, sandy to silty CLAY (A-6, A-7-5), wet

(E) **ALLUVIAL** Brown to dark gray, soft, micaceous, sandy to clayey SILT (A-4, A-5), wet

(F) **ALLUVIAL** Gray, very loose to loose, silty SAND (A-2-4), moist to saturated

(G) **RESIDUAL** Light brown, yellow, medium stiff, micaceous, sandy SILT (A-4), moist

(H) **RESIDUAL** Brown to yellow to white, very loose to very dense, silty SAND (A-2-5), micaceous, saprolitic, moist to saturated

(I) **WEATHERED ROCK** BIOTITE GNEISS

(J) **CRYSTALLINE ROCK** BIOTITE GNEISS

NOTE: GROUND PROFILE DRAWN FROM PROVIDED .TIN FILE ALONG CENTERLINE OF -L-

PROJECT REFERENCE NO.	SHEET NO.
BP12.R015	5

PROFILE THROUGH B LINE ALONG -L-

0 50 100
FEET
VE = 5

EB1-B
13+36
6' RT

B1-B
13+67
4' RT

B2-B
14+22
3' RT

EB2-B
14+52
16' RT

PROPOSED GRADE

Pavement

EXISTING GROUND

760 750 740 730 720 710 700 690 680

12+00 13+00 14+00 15+00 16+00 17+00

A 10 5 3 3 WOH 7 11 19 33 64 100/0.9 100/0.7 100/0.8 100/0.5

B 5 7 1 4 14 35 86 90

C 3 3 1 9/2017

D 3 7 4 10 18 34 100/0.7 100/0.3 100/0.9 65 100/0.9 64 100/0.5 100/0.5 100/0.4

E 5 5 3 3 9/2017 1 12 13 32 43 100/0.8 61 100/0.4 100/0.3 100/0.7

BT FIAD

100/0.7 60/0.0

F 60/0.0

REC=99%
RQD=92%

BT FIAD

REC=58%
RQD=22%

BT FIAD

-L-

(A) **ROADWAY EMBANKMENT** *Brown to yellow to gray, very loose to loose, silty to fine SAND (A-3, A-2-4, A-2-5), micaceous, moist to wet*

(B) **ALLUVIAL** *Gray to brown to white, very loose to medium dense, silty to clayey to fine SAND (A-2-4, A-2-6, A-3), moist to saturated*

(C) **ALLUVIAL** *Gray, very soft to medium stiff, sandy to silty CLAY (A-6, A-7-5), moist to saturated*

(D) **RESIDUAL** *Brown to yellow to white to orange to gray, medium dense to very dense, silty fine to coarse SAND (A-2-4), micaceous, saprolitic, moist to wet*

(E) **WEATHERED ROCK** *BIOTITE GNEISS*

(F) **CRYSTALLINE ROCK** *BIOTITE GNEISS*

NOTE: GROUND PROFILE DRAWN FROM PROVIDED .TIN FILE ALONG CENTERLINE OF -L-

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	BP12.R015	6

(A) **ROADWAY EMBANKMENT** Dark brown, medium stiff to stiff, sandy CLAY (A-6), moist

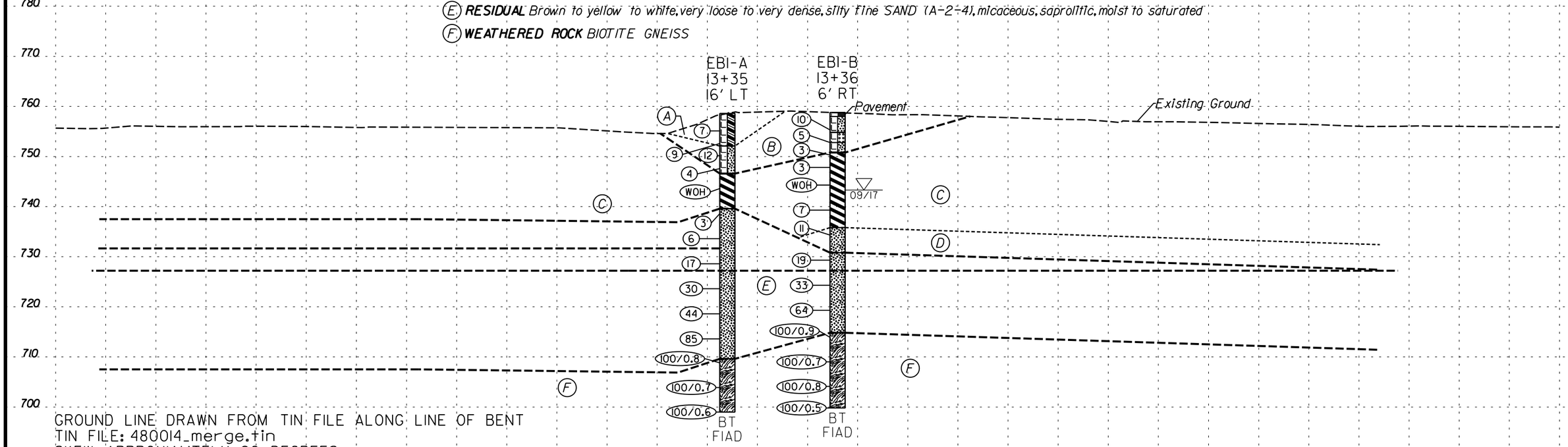
(B) **ROADWAY EMBANKMENT** Brown, very loose to medium dense, silty to fine SAND (A-2-4, A-3), moist to wet

(C) **ALLUVIAL** Gray, very soft to medium stiff, silty CLAY (A-7-5), moist to saturated

(D) **ALLUVIAL** Light gray to brown, medium dense, silty fine SAND (A-2-4), saturated

(E) **RESIDUAL** Brown to yellow to white, very loose to very dense, silty fine SAND (A-2-4), micaceous, saprolitic, moist to saturated

(F) **WEATHERED ROCK** BIOTITE GNEISS



GROUND LINE DRAWN FROM TIN FILE ALONG LINE OF BENT
TIN FILE: 480014_merge.tin
SKEW APPROXIAMTELY 90 DEGREES

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

CROSS SECTION ALONG END BENT 1 (13+45.00)

-L-

2/29/2024
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mlucas

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	BP12.R015	7

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

(A) **ROADWAY EMBANKMENT** Brown, loose, silty fine SAND (A-2-5), moist
(B) **ALLUVIAL** Dark gray, soft to medium stiff, sandy CLAY (A-6), moist to wet
(C) **ALLUVIAL** Gray to brown, very loose to medium dense, silty fine to coarse SAND (A-2-4), wet to saturated
(D) **RESIDUAL** Brown to gray to yellow to white, medium dense to very dense, silty fine to coarse SAND (A-2-4), saprolitic, moist to wet
(E) **WEATHERED ROCK** BIOTITE GNEISS
(F) **CRYSTALLINE ROCK** BIOTITE GNEISS

780
770
760
750
740
730
720
710
700
690

EB2-A
14+54
15' LT

EB2-B
14+52
16' RT

Existing Ground

09/17

EB2-A: 4, 5, 6, 4, 1, 3, 9, 50, 16, 21, 64, 60/0.1, 100/0.2, 60/0.1
EB2-B: 5, 5, 3, 3, 1, 12, 13, 32, 43, 100/0.8, 61, 100/0.4, 100/0.3, 100/0.7

BT
FIAD
BT

GROUND LINE DRAWN FROM TIN FILE ALONG LINE OF BENT
TIN FILE: 480014_merge.tin
SKEW APPROXIAMTELY 90 DEGREES

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

CROSS SECTION ALONG END BENT 2 (14+45.00)

—L—

2/29/2024
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GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 13+35	**OFFSET** 16 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 758.6 ft	**TOTAL DEPTH** 59.6 ft	**NORTHING** 703,809	**EASTING** 1,467,283	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/26/17	**COMP. DATE** 09/26/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
760										758.6	0.0
										GROUND SURFACE	
										ROADWAY EMBANKMENT Dark brown, medium stiff to stiff, sandy CLAY (A-6)	
755	756.1	2.5	2	3	4	7		M			
	753.6	5.0	3	5	4	9		M		752.1	6.5
750	751.1	7.5	2	6	6	12		M		Dark brown, loose to medium dense, silty fine SAND (A-2-4)	
	748.6	10.0	1	2	2	4		M		746.6	12.0
745	744.6	14.0	WOH	WOH	WOH	0		W		**ALLUVIAL** Dark gray, very soft, silty CLAY (A-7-5)	
740	739.6	19.0	WOH	WOH	3	3		Sat.		739.6	19.0
735	734.6	24.0	2	2	4	6		M		**RESIDUAL** Brown to yellow to white, very loose to very dense, silty fine SAND (A-2-4), micaceous, saprolitic	
730	729.6	29.0	3	7	10	17		M			
725	724.6	34.0	5	10	20	30		M			
720	719.6	39.0	9	17	27	44		M			
715	714.6	44.0	10	25	60	85		M			
710	709.6	49.0	28	72/0.3		100/0.8				709.6	49.0
705	704.6	54.0	40	60/0.2		100/0.7				**WEATHERED ROCK** BIOTITE GNEISS	
700	699.6	59.0	50	50/0.1		100/0.6				699.0	59.6
										Boring Terminated at Elevation 699.0 ft in Weathered Rock: BIOTITE GNEISS	

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 13+36	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** 15.5
COLLAR ELEV. 758.8 ft	**TOTAL DEPTH** 59.0 ft	**NORTHING** 703,824	**EASTING** 1,467,299	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/22/17	**COMP. DATE** 09/22/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
760										758.8	0.0
										PAVEMENT	
										758.0	0.8
										Pavement	
										ROADWAY EMBANKMENT Light brown, loose, silty fine SAND (A-2-4)	
755	756.3	2.5	5	5	5	10		M		754.8	4.0
	753.8	5.0	3	3	2	5		M		Light brown, loose, fine SAND (A-3)	
750	751.3	7.5	2	1	2	3		M		752.8	6.0
	748.8	10.0	1	2	1	3		W		Dark brown to gray, very loose, fine silty SAND (A-2-4)	
745	745.3	13.5	WOH	WOH	WOH	0				750.8	8.0
740	740.3	18.5	3	4	3	7		Sat.		**ALLUVIAL** Light gray, very soft to medium stiff, silty CLAY (A-7-5)	
735	735.3	23.5	5	5	6	11		Sat.		735.8	23.0
730	730.3	28.5	4	7	12	19		W		Light gray to brown, medium dense, fine silty SAND (A-2-4)	
725	725.3	33.5	9	15	18	33		W		730.8	28.0
720	720.3	38.5	12	23	41	64		W		**RESIDUAL** Brown to yellow to white, medium dense to very dense, fine silty SAND (A-2-4), micaceous, saprolitic	
715	715.3	43.5	34	50	50/0.4	100/0.9					
710	710.3	48.5	36	68	32/0.2	100/0.7				714.8	44.0
705	705.3	53.5	33	54	46/0.3	100/0.8				**WEATHERED ROCK** BIOTITE GNEISS	
700	700.3	58.5	100/0.5			100/0.5				699.8	59.0
										Boring Terminated at Elevation 699.8 ft in Weathered Rock: BIOTITE GNEISS	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP12.R015 | **TIP** LIB-480014 | **COUNTY** IREDELL | **GEOLOGIST** A. Bozorgi

SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd) | **GROUND WTR (ft)**

BORING NO. B1-A | **STATION** 13+67 | **OFFSET** 12 ft LT | **ALIGNMENT** -L- | **0 HR.** N/A

COLLAR ELEV. 752.8 ft | **TOTAL DEPTH** 56.7 ft | **NORTHING** 703,835 | **EASTING** 1,467,265 | **24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016 | **DRILL METHOD** Mud Rotary | **HAMMER TYPE** Automatic

DRILLER L. Gonzalez | **START DATE** 09/18/17 | **COMP. DATE** 09/18/17 | **SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
	752.8	0.0	2	1	3	4		M		752.8 / 0.0 GROUND SURFACE **ROADWAY EMBANKMENT** Brown to gray, soft, sandy SILT (A-4)
	749.8	3.0								749.8 / 3.0 **ALLUVIAL** Dark gray, soft, clayey SILT (A-5)
	748.8	4.0	3	2	2	4		W		
	745.8	7.0								745.8 / 7.0 Light gray, very loose to loose, silty SAND (A-2-4)
			2	3	1	4		W		
	740.8	12.0								
			1	0	1	1		W		
	737.8	15.0								737.8 / 15.0 **RESIDUAL** Brown to yellow to white to pink, medium dense to very dense, clayey fine to coarse SAND (A-2-6), micaceous, saprolitic
	735.8	17.0	4	5	8	13		M		
	730.8	22.0	8	11	15	26		M		
	725.8	27.0	13	21	28	49		M		
	720.8	32.0	24	29	35	64		M		
	715.8	37.0	16	47	38	85		M		
	710.8	42.0	16	20	40	60		M		
	705.8	47.0	41	59/0.3		100/0.8		M		705.8 / 47.0 **WEATHERED ROCK** BIOTITE GNEISS
	700.8	52.0	100/0.4			100/0.4				
	696.1	56.7	60/0.0			60/0.0				696.1 / 56.7 Boring Terminated with Standard Penetration Test Refusal at Elevation 696.1 ft on Crystalline Rock: BIOTITE GNEISS

WBS BP12.R015 | **TIP** LIB-480014 | **COUNTY** IREDELL | **GEOLOGIST** A. Bozorgi

SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd) | **GROUND WTR (ft)**

BORING NO. B1-B | **STATION** 13+67 | **OFFSET** 4 ft RT | **ALIGNMENT** -L- | **0 HR.** N/A

COLLAR ELEV. 754.7 ft | **TOTAL DEPTH** 67.0 ft | **NORTHING** 703,846 | **EASTING** 1,467,277 | **24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016 | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Automatic

DRILLER L. Gonzalez | **START DATE** 09/21/17 | **COMP. DATE** 09/21/17 | **SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
	754.7	0.0	1	2	3	5				754.7 / 0.0 GROUND SURFACE **ROADWAY EMBANKMENT** Dark brown to gray, loose, silty fine SAND (A-2-5)
	750.3	4.4	3	3	4	7		M		
	746.7	8.0								746.7 / 8.0 **ALLUVIAL** Light gray to white, very loose, fine to coarse SAND (A-3)
	745.7	9.0	2	1	0	1		W		
	742.7	12.0								742.7 / 12.0 Light brown to white, loose, silty fine to coarse SAND (A-2-4)
	740.7	14.0	WOH	2	2	4		Sat.		
	736.7	18.0								736.7 / 18.0 **RESIDUAL** Brown to orange to yellow, medium dense to very dense, silty fine to coarse SAND (A-2-4), micaceous, saprolitic
	735.7	19.0	2	6	8	14		W		
	730.7	24.0	8	12	23	35		W		
	725.7	29.0	9	35	51	86		W		
	720.7	34.0	9	30	60	90		W		
	715.7	39.0	30	48	52/0.4	100/0.9		W		715.2 / 39.5 **WEATHERED ROCK** BIOTITE GNEISS
	710.7	44.0	36	64/0.4		100/0.9				
	705.7	49.0	21	63	37/0.2	100/0.7				
	700.7	54.0	100/0.5			100/0.5				
	697.7	57.0	60/0.0			60/0.0				697.7 / 57.0 **CRYSTALLINE ROCK** BIOTITE GNEISS
	687.7	67.0								687.7 / 67.0 Boring Terminated at Elevation 687.7 ft in Crystalline Rock: BIOTITE GNEISS

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 13+67	**OFFSET** 4 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 754.7 ft	**TOTAL DEPTH** 67.0 ft	**NORTHING** 703,846	**EASTING** 1,467,277	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/21/17	**COMP. DATE** 09/21/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 10.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
697.7											Begin Coring @ 57.0 ft
695	697.7	57.0	5.0	1:40/1.0 2:10/1.0 3:00/1.0 3:08/1.0 2:47/1.0	(4.9) 98%	(4.2) 84%		(9.9) 99%	(9.2) 92%		ELEV. (ft) 697.7 **CRYSTALLINE ROCK** DEPTH (ft) 57.0 Very slight weathering to fresh, hard to very hard, wide to very wide fracture spacing, thickly bedded BIOTITE GNEISS GSI = 60 to 70
690	692.7	62.0	5.0	2:30/1.0 3:10/1.0 3:00/1.0 3:28/1.0 3:30/1.0	(5.0) 100%	(5.0) 100%					
	687.7	67.0									ELEV. (ft) 687.7 DEPTH (ft) 67.0 Boring Terminated at Elevation 687.7 ft in Crystalline Rock: BIOTITE GNEISS

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 14+23	**OFFSET** 14 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 754.1 ft	**TOTAL DEPTH** 48.0 ft	**NORTHING** 703,874	**EASTING** 1,467,226	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/19/17	**COMP. DATE** 09/19/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
755											
	754.1	0.0	2	1	2	3		M		754.1 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT	
										Brown, light gray, soft, micaceous, sandy SILT (A-4)	
750	750.1	4.0	1	2	2	4		W		752.1	2.0
										ALLUVIAL	
										Brown, dark gray, soft, micaceous, sandy SILT (A-4)	
	746.1	8.0								748.1	6.0
745			1	WOH	1	1		W		Dark gray, very loose to loose, silty SAND (A-2-4)	
	741.1	13.0									
740			4	2	4	6		M		740.1	14.0
										RESIDUAL	
	736.1	18.0								Brown, yellow, loose to medium dense, silty SAND (A-2-5), micaceous, saprolitic	
735			4	3	4	7		M			
	731.1	23.0									
730			5	7	8	15		M			
	726.1	28.0								728.1	26.0
725			4	3	3	6		M		Light brown, yellow, medium stiff, micaceous, sandy SILT (A-4)	
										724.1	30.0
	721.1	33.0								**WEATHERED ROCK**	
720			85	15/0.2		100/0.7				BIOTITE GNEISS	
	716.1	38.0	100/0.3			100/0.3					
715											
	711.1	43.0	80	20/0.1		100/0.6					
710											
	706.1	48.0	60/0.0			60/0.0				706.1	48.0
										Boring Terminated with Standard Penetration Test Refusal at Elevation 706.1 ft on Crystalline Rock: BIOTITE GNEISS	

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 14+22	**OFFSET** 3 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 754.0 ft	**TOTAL DEPTH** 76.2 ft	**NORTHING** 703,886	**EASTING** 1,467,239	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/19/17	**COMP. DATE** 09/20/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
755											
	754.0	0.0	1	1	2	3		W		754.0 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT	
										Light brown, yellow, very loose, micaceous, silty fine SAND (A-2-5)	
750	749.0	5.0	1	2	1	3		W		750.0	4.0
										ALLUVIAL	
										Dark brown, gray, very loose, clayey fine SAND (A-2-6)	
	746.0	8.0								747.0	7.0
745			1	3	4	7		Sat.		Dark gray, loose, silty fine SAND (A-2-4)	
	741.0	13.0								743.0	11.0
740			1	2	2	4		M		Light gray, loose, fine SAND (A-3)	
	736.0	18.0									
735			3	4	6	10		M		736.0	18.0
										RESIDUAL	
730	731.0	23.0	6	7	11	18		M		Brown, yellow, white, medium dense to dense, silty fine to coarse SAND (A-2-4), micaceous, saprolitic	
	726.0	28.0									
725			11	15	19	34		M			
	721.0	33.0								721.0	33.0
720			16	84/0.2		100/0.7				**WEATHERED ROCK**	
	716.0	38.0	100/0.3			100/0.3				BIOTITE GNEISS	
715										715.0	39.0
										RESIDUAL	
710	711.0	43.0	10	25	40	65		M		Brown, gray, very dense, silty fine to coarse SAND (A-2-4), saprolitic	
	708.0	46.0									
705	705.0	49.0	18	26	38	64		M		706.0	48.0
			100/0.5			100/0.5				**WEATHERED ROCK**	
700	700.0	54.0								BIOTITE GNEISS	
	697.8	56.2	100/0.4			100/0.4				697.8	56.2
			60/0.0			60/0.0				**CRYSTALLINE ROCK**	
695										BIOTITE GNEISS	
690											
685											
680											
										677.8	76.2
										Boring Terminated at Elevation 677.8 ft in Crystalline Rock: BIOTITE GNEISS	

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 14+22	**OFFSET** 3 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 754.0 ft	**TOTAL DEPTH** 76.2 ft	**NORTHING** 703,886	**EASTING** 1,467,239	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/19/17	**COMP. DATE** 09/20/17	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 20.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
697.8											Begin Coring @ 56.2 ft
695	697.8	56.2	5.0	1:10/1.0 0:22/1.0 1:00/1.0 2:00/1.0 2:25/1.0	(1.8) 36%	(0.0) 0%		(11.6) 58%	(4.3) 22%		ELEV. (ft) 697.8 — EPTH (ft) 56.2 **CRYSTALLINE ROCK** Moderately severe to slight weathering, moderately hard, very close to moderately close fracture spacing, BIOTITE GNEISS GSI = 30 to 40
690	692.8	61.2	5.0	1:57/1.0 1:26/1.0 1:33/1.0 1:25/1.0 1:45/1.0	(2.8) 56%	(1.3) 26%					
685	687.8	66.2	5.0	1:47/1.0 2:21/1.0 2:57/1.0 1:47/1.0 1:57/1.0	(4.0) 80%	(2.3) 46%					
680	682.8	71.2	5.0	1:56/1.0 2:27/1.0 2:02/1.0 2:00/1.0 1:48/1.0	(3.0) 60%	(0.7) 14%					
	677.8	76.2									ELEV. (ft) 677.8 — EPTH (ft) 76.2 Boring Terminated at Elevation 677.8 ft in Crystalline Rock: BIOTITE GNEISS

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 14+54	**OFFSET** 15 ft LT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 758.7 ft	**TOTAL DEPTH** 59.1 ft	**NORTHING** 703,895	**EASTING** 1,467,203	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/25/17	**COMP. DATE** 09/26/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
760										758.7 GROUND SURFACE 0.0
	756.2	2.5	3	2	2	4		M		**ROADWAY EMBANKMENT** Brown, loose, silty fine SAND (A-2-4)
755	753.7	5.0	3	2	3	5		M		
	751.2	7.5	3	3	3	6		W		751.7 7.0 **ALLUVIAL** Dark gray, soft to medium stiff, sandy CLAY (A-6)
750	748.7	10.0	1	2	2	4		W		
	744.7	14.0	WOH	1	WOH	1		Sat.		745.7 13.0 Gray, very loose, silty fine to coarse SAND (A-2-4)
745										
	739.7	19.0	WOH	1	2	3		W		
740										
	734.7	24.0	3	4	5	9		W		734.7 24.0 **RESIDUAL** Brown to white to gray, medium dense to very dense, silty fine SAND (A-2-4), saprolitic
735										
	729.7	29.0	34	28	22	50		W		
730										
	724.7	34.0	5	7	9	16		W		
725										
	719.7	39.0	7	7	14	21		W		
720										
	714.7	44.0	30	30	34	64		W		
715										
	709.7	49.0	60/0.1			60/0.1				709.7 49.0 **CRYSTALLINE ROCK** BIOTITE GNEISS 709.6 49.1 **WEATHERED ROCK** BIOTITE GNEISS
710										
	704.7	54.0	100/0.2			100/0.2				
705										
	699.7	59.0	60/0.1			60/0.1				699.7 59.0 **CRYSTALLINE ROCK** BIOTITE GNEISS 699.6 59.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 699.6 ft in Crystalline Rock: BIOTITE GNEISS
700										

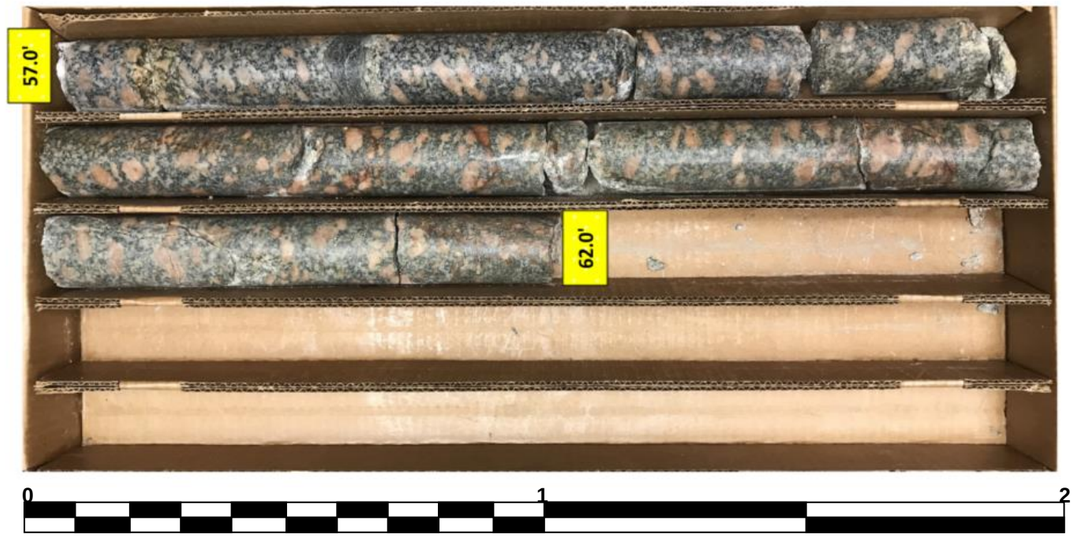
WBS BP12.R015	**TIP** LIB-480014	**COUNTY** IREDELL	**GEOLOGIST** A. Bozorgi	
SITE DESCRIPTION Bridge No. 14 over Weathers Creek on SR 2382 (Brawely Rd)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 14+52	**OFFSET** 16 ft RT	**ALIGNMENT** -L-	**0 HR.** 14.0
COLLAR ELEV. 758.4 ft	**TOTAL DEPTH** 60.2 ft	**NORTHING** 703,916	**EASTING** 1,467,226	**24 HR.** 13.2
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 88% 11/09/2016		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Gonzalez	**START DATE** 09/22/17	**COMP. DATE** 09/25/17	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
760										758.4 GROUND SURFACE 0.0
	755.9	2.5	3	2	3	5		M		**ROADWAY EMBANKMENT** Brown, loose, silty fine SAND (A-2-5)
755	753.4	5.0	2	2	3	5		M		
	750.9	7.5	1	1	2	3		M		750.4 8.0 **ALLUVIAL** Dark gray, soft, sandy CLAY (A-6)
750	748.4	10.0	1	1	2	3		M		
	743.9	14.5	WOH	WOH	1	1		Sat.		744.4 14.0 Light gray to brown, very loose to medium dense, silty fine SAND (A-2-4)
745										
	738.9	19.5	2	5	7	12		Sat.		
740										
	733.9	24.5	3	6	7	13		M		736.4 22.0 **RESIDUAL** Brown to gray to yellow, medium dense to dense, silty fine to coarse SAND (A-2-4), saprolitic
735										
	728.9	29.5	9	14	18	32		M		
730										
	723.9	34.5	4	15	28	43		M		
725										
	718.9	39.5	64	36/0.3		100/0.8				719.4 39.0 **WEATHERED ROCK** BIOTITE GNEISS 717.4 41.0 **RESIDUAL** Brown to gray to white, very dense, silty fine SAND (A-2-4)
720										
	713.9	44.5	42	32	29	61		M		
715										
	708.9	49.5	100/0.4			100/0.4				709.4 49.0 **WEATHERED ROCK** BIOTITE GNEISS
710										
	703.9	54.5	100/0.3			100/0.3				
705										
	698.9	59.5	25	75/0.2		100/0.7				698.2 60.2 Boring Terminated at Elevation 698.2 ft in Weathered Rock: BIOTITE GNEISS
700										

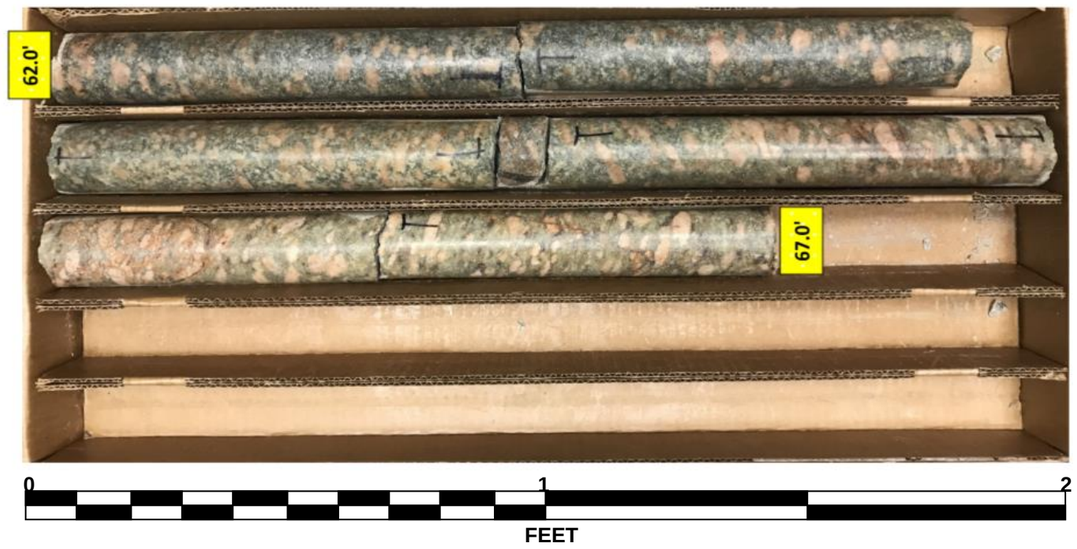
CORE PHOTOGRAPHS

B1-B

BOX 1 OF 2: 57.0 TO 62.0 FEET



BOX 2 OF 2: 62.0 TO 67.0 FEET

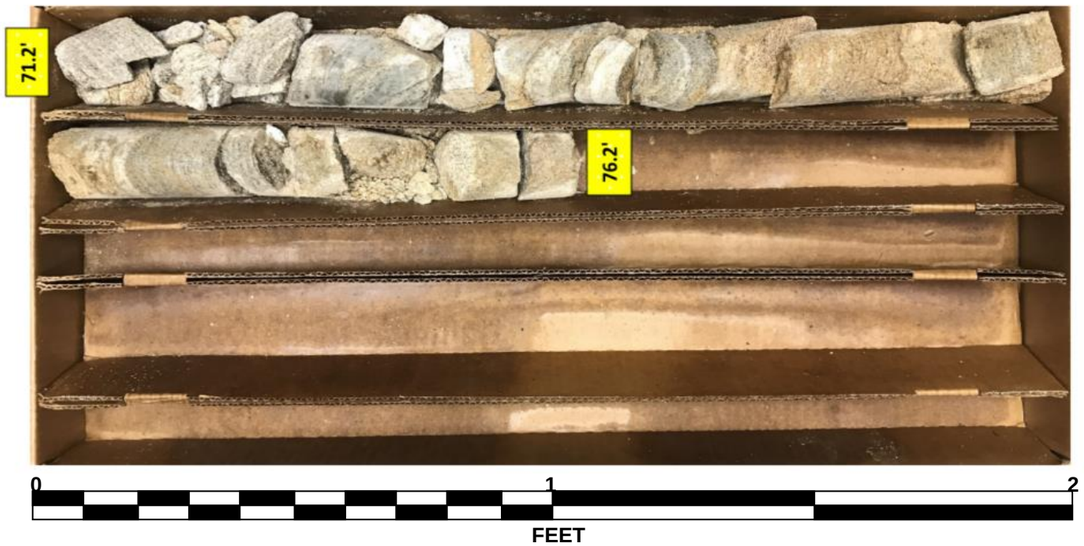


CORE PHOTOGRAPHS

B2-B

BOX 1 OF 2: 56.2 TO 71.2 FEET

BOX 2 OF 2: 71.2 TO 76.2 FEET



Facing Upstation from End Bent 1 (-L-)

Drilling Photo from Boring B2-A