REFERENCE: B-3186/B-5898

PROJECT: 38332/48030

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3186/B-5898	1	17

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *HAYWOOD*

PROJECT DESCRIPTION *US 23/US 74/US 19 (GREAT SMOKY MOUNTAIN HWY) FROM WEST OF NC 209 (CRABTREE RD.) TO EAST OF RUSS AVE.*

SITE DESCRIPTION *BRIDGE NO. 430110 & 430107 ON -L_LT- (US 19/23/74 WB) OVER THE BLUE RIDGE SOUTHERN RAILROAD (BLU) BETWEEN US 276 AND NC 209*

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4-5	PROFILES
6-7	CROSS SECTIONS
8-16	BORE LOGS, CORE REPORTS & CORE PHOTOGRAPHS
17	ROCK TEST RESULTS

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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1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
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PERSONNEL

C. SWAFFORD

J. CRENSHAW

GEOTECHNOLOGY, INC.

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SUBMITTED BY *HDR*

DATE *AUGUST 2021*

NORTH CAROLINA PROFESSIONAL SEAL 030788 ENGINEER PU ZHANG

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

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

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

ELEVATION: FEET

NOTES:

BORING ELEVATIONS OBTAINED FROM TRIMBLE R12 GNSS RECEIVER CERTIFIED WITH FCC PART 15 (CLASS B DEVICE), 24, 32; RCM; PTCRB; BT SIG

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	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

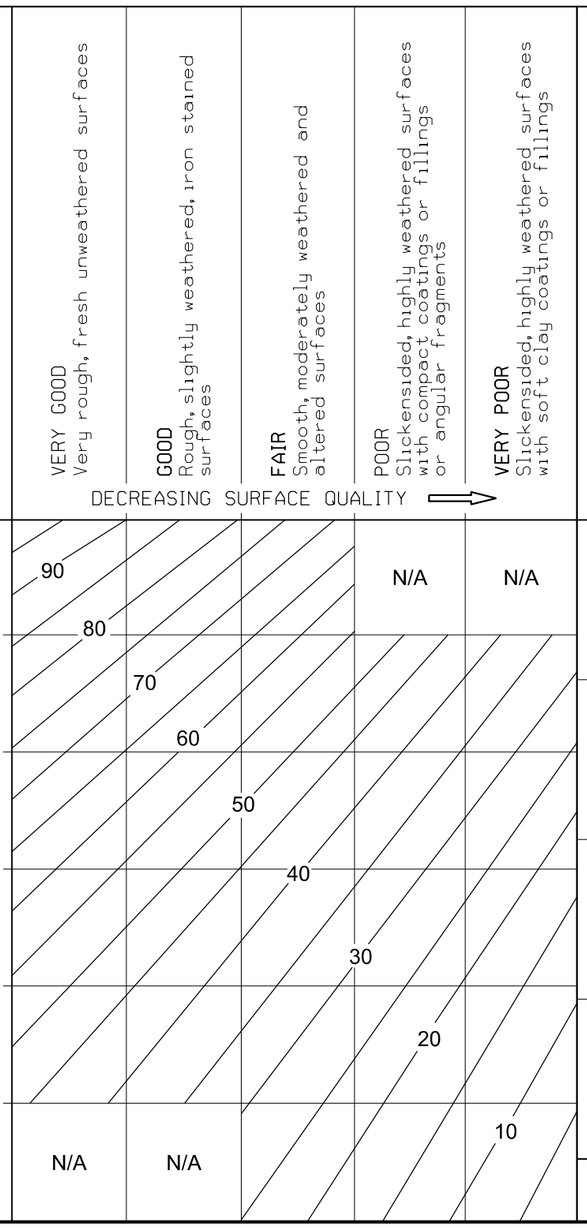
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

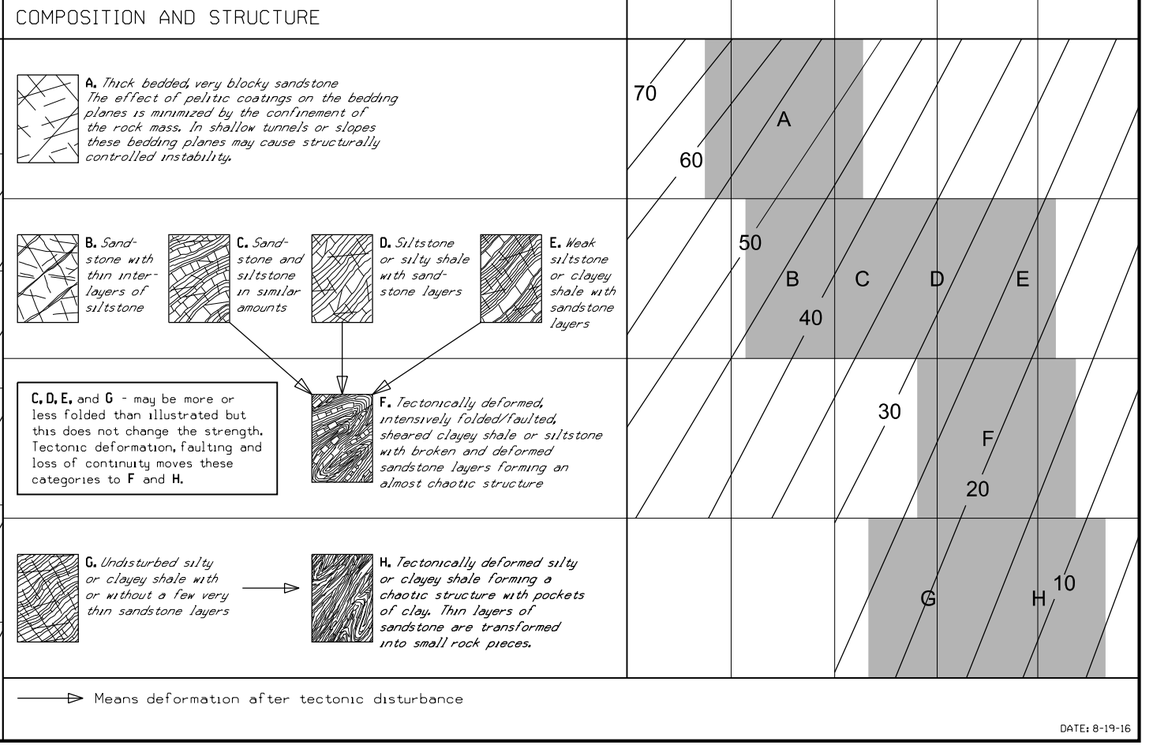


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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



DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	3

SITE PLAN

0 50 100

FEET

BRIDGE NO. 430110

TO WAYNESVILLE

TO ASHEVILLE

S3_EB1-A

S3_EB2-A

WBL-18

70+00

129°

129°

130+00

S3_EB1-B

S3_EB2-B

BM #3
-EBL- STA 59+63
N 74°5'46.5" E Dist 329'
ELEV.= 2649.74'

BRIDGE NO. 430107

NAD 83/2011

4' WW & ISBW

5' WW & ISBW

WOODS

INV=2606.96'

INV=2602.67'

INV=2607.00'

18" CMP

RIP RAP (C)

EXISTING R/W

ISMTL STO.

OPENING IN CURB
INV=2646.40'

MTL GAURD RAIL

INV=2645.05'

TOP=2650.14'

INV=2643.19'

2649.28

2643.13'

CB

15" RCP

TOP=2644.37'

-WEL-

-EEL-

APPROX. DIRECTION
END NOT FOUND

INV=2642.99'

CONC. BARRIER WALL

EXISTING R/W

GR

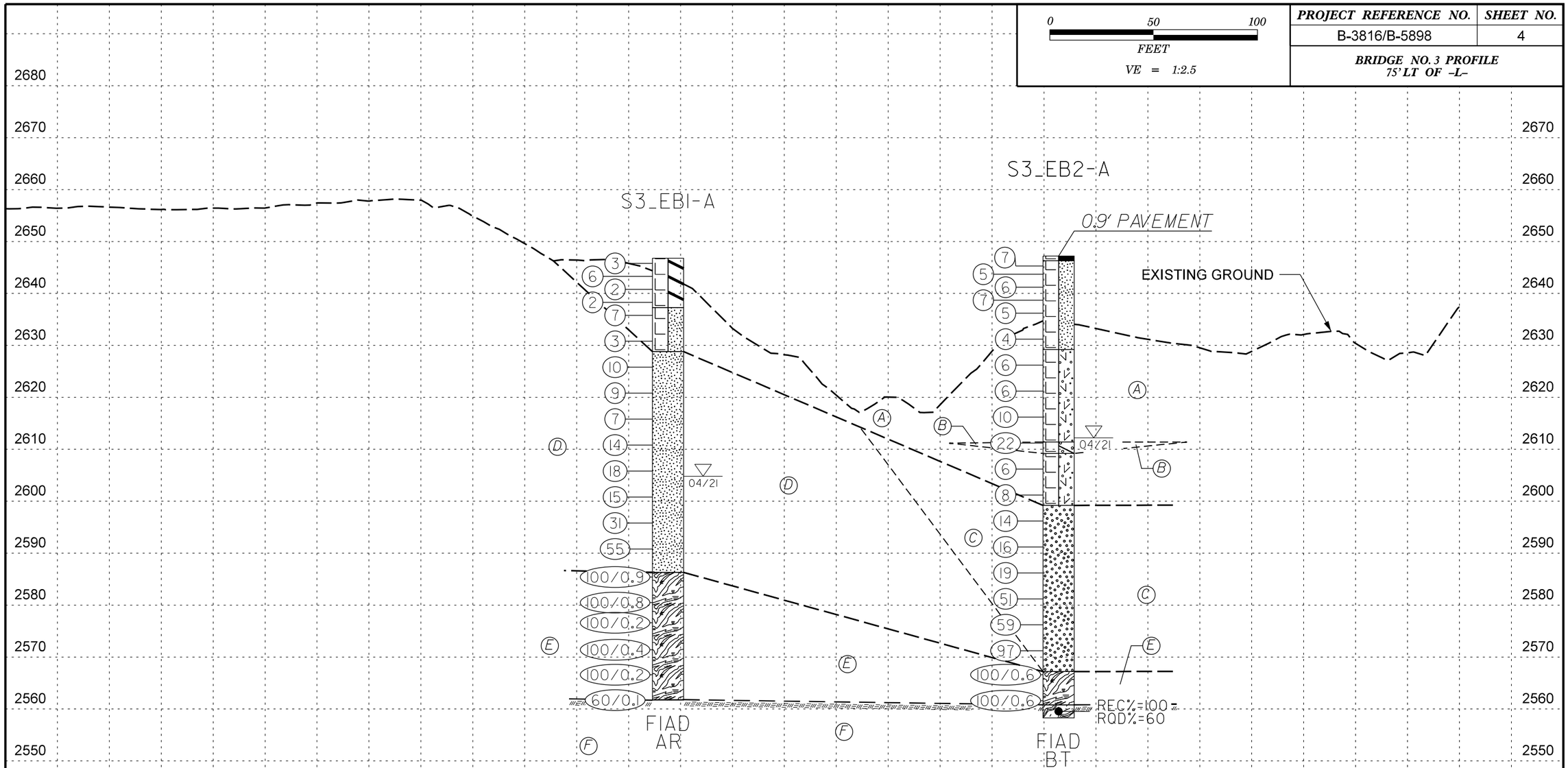
0	50	100

FEET

VE = 1:2.5

PROJECT REFERENCE NO.	SHEET NO.
B-3816/B-5898	4

BRIDGE NO. 3 PROFILE
75' LT OF -L-



(A) **ROADWAY EMBANKMENT:** *Soft to stiff, red, orange and gray, sandy SILT (A-4), clayey SILT (A-5), and silty CLAY (A-7-6), with trace to little gravel and trace wood fragments, micaceous, dry to wet*

(B) **ROADWAY EMBANKMENT:** *Medium dense, tan, clayey SAND (A-2-6), with trace gravel, moist*

(C) **RESIDUAL:** *Medium dense to very dense, black and orange, silty SAND (A-2-4), micaceous, saprolitic, wet to saturated*

(D) **RESIDUAL:** *Medium stiff to hard, brown, white and black, SILT (A-4), with trace sand, micaceous, saprolitic, moist to wet*

(E) **WEATHERED ROCK:** *Brown, orange, and white, GNEISS*

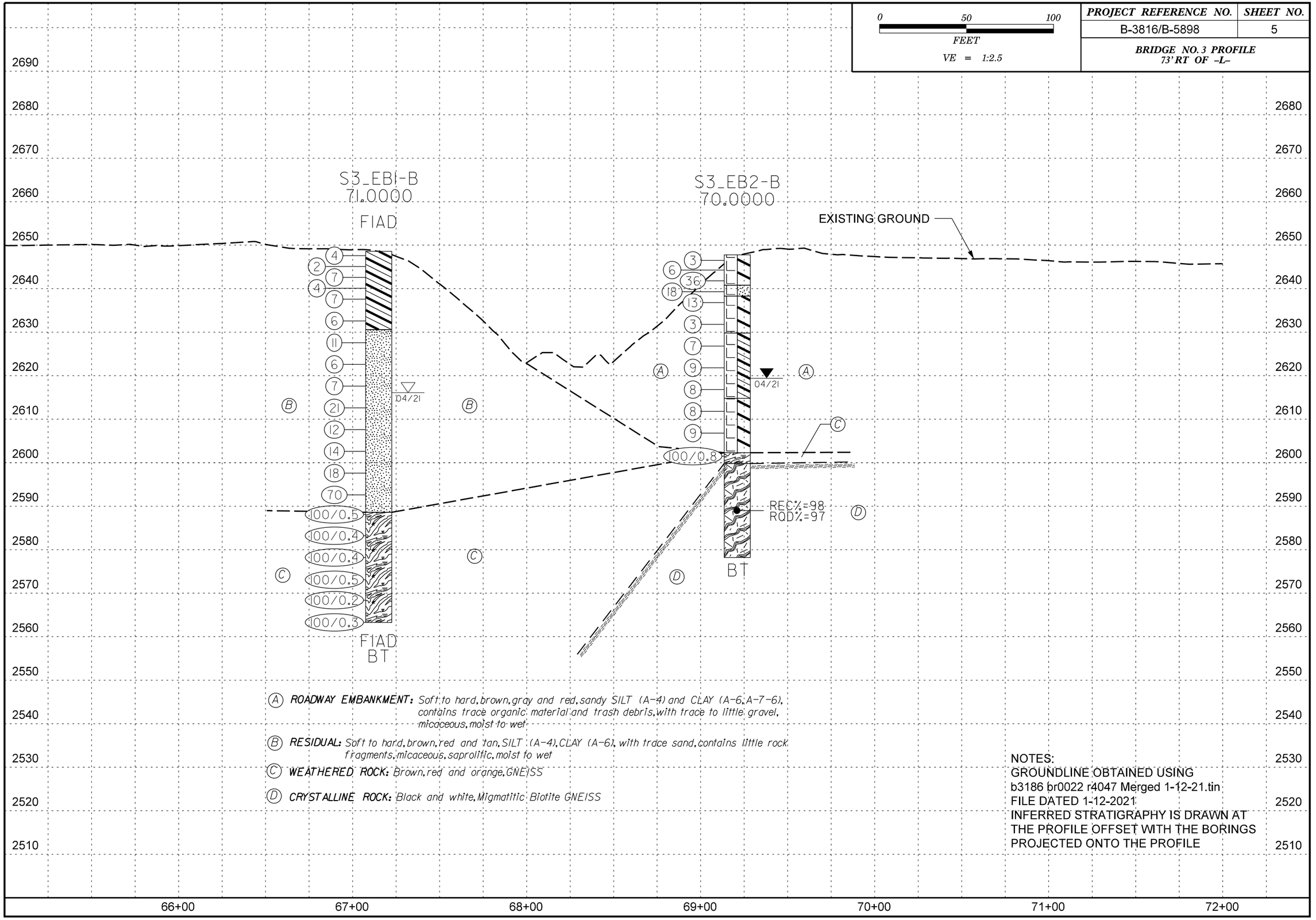
(F) **CRYSTALLINE ROCK:** *Brown, Migmatitic Biotite GNEISS*

NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

PROJECT REFERENCE NO.	SHEET NO.
B-3816/B-5898	5

BRIDGE NO. 3 PROFILE
73' RT OF -L-

0 50 100
FEET
VE = 1:2.5



(A) **ROADWAY EMBANKMENT:** *Soft to hard, brown, gray and red, sandy SILT (A-4) and CLAY (A-6, A-7-6), contains trace organic material and trash debris, with trace to little gravel, micaceous, moist to wet*

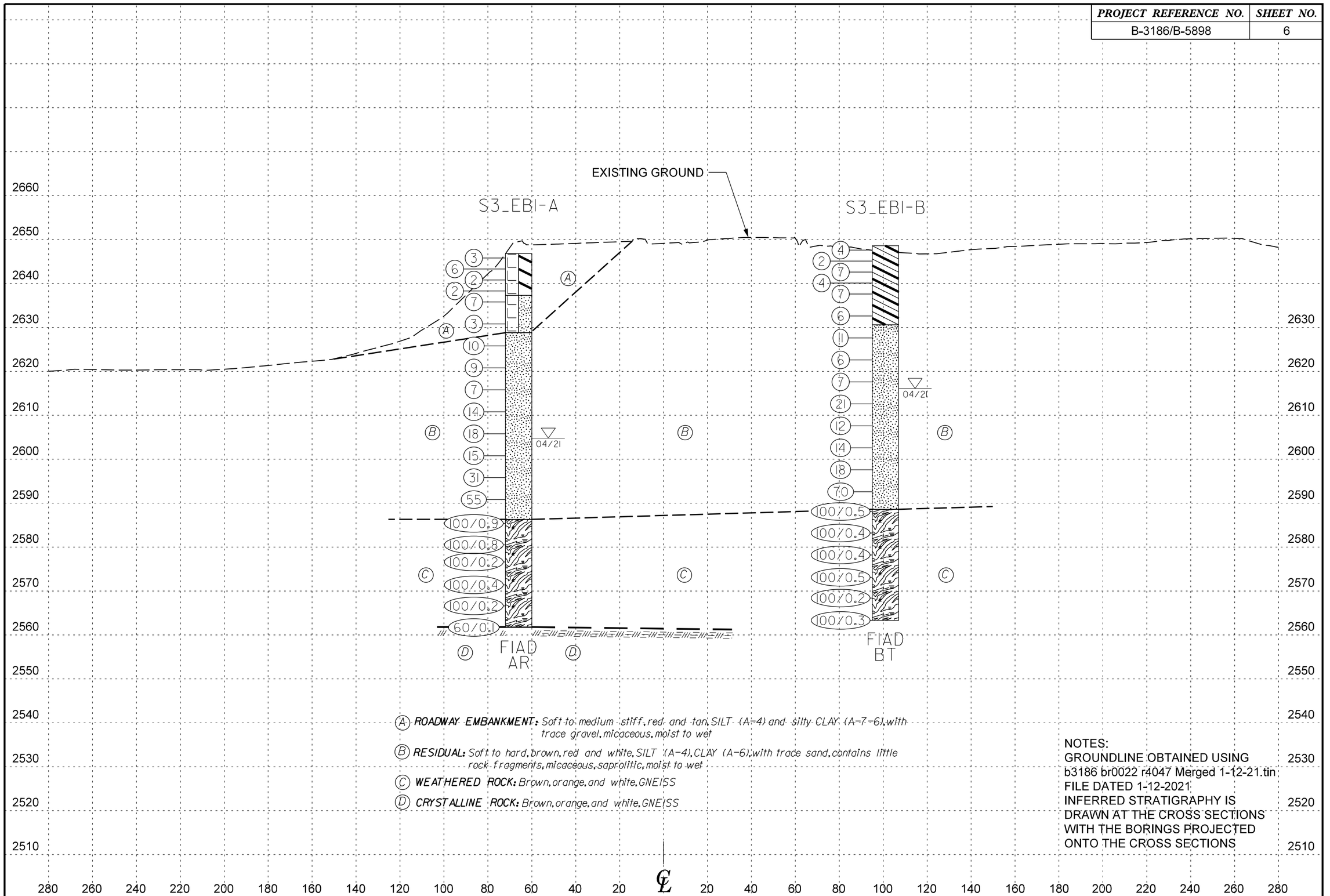
(B) **RESIDUAL:** *Soft to hard, brown, red and tan, SILT (A-4), CLAY (A-6), with trace sand, contains little rock fragments, micaceous, saprolitic, moist to wet*

(C) **WEATHERED ROCK:** *Brown, red and orange, GNEISS*

(D) **CRYSTALLINE ROCK:** *Black and white, Migmatitic Biotite GNEISS*

NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	6



(A) **ROADWAY EMBANKMENT:** *Soft to medium stiff, red and tan, SILT (A-4) and silty CLAY (A-7-6), with trace gravel, micaceous, moist to wet*

(B) **RESIDUAL:** *Soft to hard, brown, red and white, SILT (A-4), CLAY (A-6), with trace sand, contains little rock fragments, micaceous, saprolitic, moist to wet*

(C) **WEATHERED ROCK:** *Brown, orange, and white, GNEISS*

(D) **CRYSTALLINE ROCK:** *Brown, orange, and white, GNEISS*

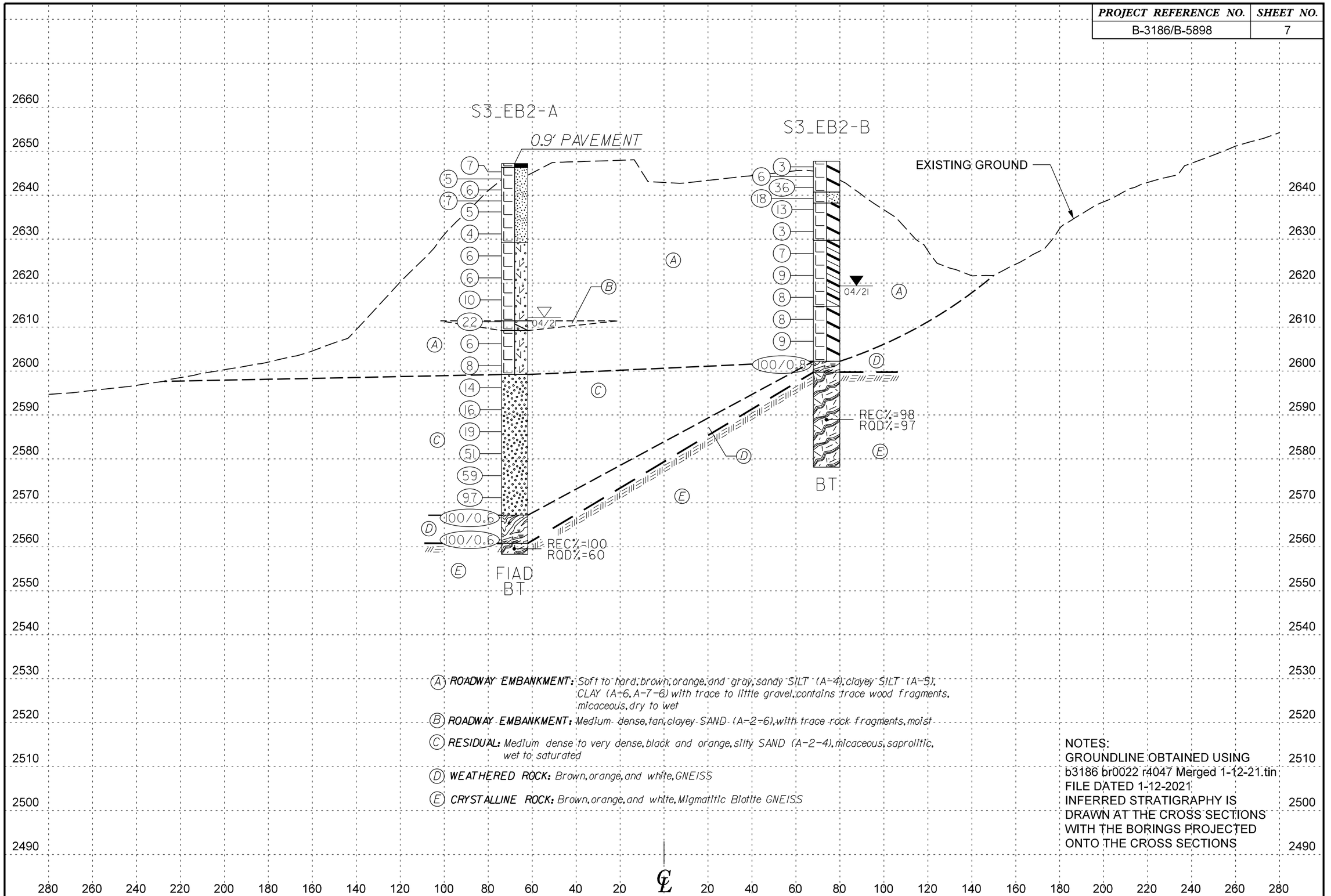
NOTES:
GROUNDLINE OBTAINED USING b3186 br0022 r4047 Merged 1-12-21.tin FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS

HORIZ. SCALE (FEET) 0 40 60

VE = 1:1

BRIDGE NO. 3 – END BENT 1 –L– STA. 67+86.38 129° SKEW

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	7



(A) **ROADWAY EMBANKMENT:** *Soft to hard, brown, orange, and gray, sandy SILT (A-4), clayey SILT (A-5), CLAY (A-6, A-7-6) with trace to little gravel, contains trace wood fragments, micaceous, dry to wet*

(B) **ROADWAY EMBANKMENT:** *Medium dense, tan, clayey SAND (A-2-6), with trace rock fragments, moist*

(C) **RESIDUAL:** *Medium dense to very dense, black and orange, silty SAND (A-2-4), micaceous, saprolitic, wet to saturated*

(D) **WEATHERED ROCK:** *Brown, orange, and white, GNEISS*

(E) **CRYSTALLINE ROCK:** *Brown, orange, and white, Migmatitic Biotite GNEISS*

NOTES:
GROUNDLINE OBTAINED USING b3186 br0022 r4047 Merged 1-12-21.tin FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS

HORIZ. SCALE (FEET) 0 40 60

VE = 2:1

BRIDGE NO. 3 – END BENT 2 –L– STA. 69+50.88 129° SKEW

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB1-A	**STATION** 68+19	**OFFSET** 59 ft LT	**ALIGNMENT** -L-	**0 HR.** 42.0
COLLAR ELEV. 2,646.8 ft	**TOTAL DEPTH** 85.1 ft	**NORTHING** 667,822	**EASTING** 820,989	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/11/21	**COMP. DATE** 04/11/21	**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)
2650											
	2,646.8	0.0								2,646.8 GROUND SURFACE	0.0
2645	2,644.3	2.5	2	1	2	3		M		**ROADWAY EMBANKMENT** Soft to medium stiff, pink, red and tan, silty CLAY (A-7-6), micaceous	
	2,641.8	5.0	1	2	4	6		M			
2640	2,639.3	7.5	2	1	1	2		M			
	2,636.8	10.0	WOH	1	1	2		W		2,637.3	9.5
2635	2,631.8	15.0	3	3	4	7		M		Medium stiff to soft, brown, SILT (A-4), with trace gravel, micaceous	
2630	2,626.8	20.0	3	2	1	3		M		2,628.8 **RESIDUAL** Medium stiff to hard, brown, white and black, SILT (A-4), with trace sand, micaceous, saprolitic	18.0
2625	2,621.8	25.0	3	5	5	10		M			
2620	2,616.8	30.0	3	4	5	9		M			
2615	2,611.8	35.0	3	3	4	7		M			
2610	2,606.8	40.0	6	6	8	14		M			
2605	2,601.8	45.0	3	8	10	18		▽			
2600	2,596.8	50.0	5	7	8	15		W			
2595	2,591.8	55.0	7	10	21	31		W			
2590	2,586.8	60.0	14	23	32	55		W			
2585	2,581.8	65.0	25	42	58/0.4	100/0.9				2,586.3 **WEATHERED ROCK** Brown, orange, and white, GNEISS	60.5
2580	2,576.8	70.0	25	45	55/0.3	100/0.8					
2575	2,571.8	75.0	100/0.2			100/0.2					
2570			100/0.4			100/0.4					

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
2570						Match Line				
	2,566.8	80.0	100/0.2			100/0.2				**WEATHERED ROCK** Brown, orange, and white, GNEISS *(continued)*
2565	2,561.8	85.0	60/0.1			60/0.1				2,561.8 85.0 2,561.7 **CRYSTALLINE ROCK** 85.1 Brown, orange, and white, GNEISS Boring Terminated with Standard Penetration Test Refusal at Elevation 2,561.7 ft in Crystalline Rock (GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB1-B	**STATION** 67+15	**OFFSET** 71 ft RT	**ALIGNMENT** -L-	**0 HR.** 32.5
COLLAR ELEV. 2,648.6 ft	**TOTAL DEPTH** 85.3 ft	**NORTHING** 667,659	**EASTING** 820,954	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/09/21	**COMP. DATE** 04/09/21	**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)
2650										
	2,648.6	0.0								2,648.6 0.0 GROUND SURFACE
			2	2	2	4		M		**RESIDUAL** Soft to medium stiff, brown and red, CLAY (A-6), with little rock fragments, micaceous, saprolitic
	2,646.1	2.5								
2645			2	1	1	2		M		
	2,643.6	5.0								
			4	1	6	7		M		
	2,641.1	7.5								
2640			2	2	2	4		M		
	2,638.6	10.0								
			2	3	4	7		M		
2635										
	2,633.6	15.0								
			3	2	4	6		M		
2630										
	2,628.6	20.0								2,630.6 18.0 Medium stiff to hard, tan, orange, and white, SILT (A-4), with trace sand, contains little rock fragments, micaceous, saprolitic
			4	6	5	11		M		
2625										
	2,623.6	25.0								
			3	2	4	6		M		
2620										
	2,618.6	30.0								
			3	4	3	7		▽		
2615										
	2,613.6	35.0								
			7	8	13	21		W		
2610										
	2,608.6	40.0								
			3	5	7	12		W		
2605										
	2,603.6	45.0								
			6	6	8	14		W		
2600										
	2,598.6	50.0								
			8	8	10	18		W		
2595										
	2,593.6	55.0								
			9	30	40	70		W		
2590										
	2,588.6	60.0								2,588.6 60.0 **WEATHERED ROCK** Brown, orange, and white, GNEISS
			85	15/0.0		100/0.5				
2585										
	2,583.6	65.0								
			100/0.4			100/0.4				
2580										
	2,578.6	70.0								
			100/0.4			100/0.4				
2575										
	2,573.6	75.0								
			100/0.5			100/0.5				
2570										

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB1-B	**STATION** 67+15	**OFFSET** 71 ft RT	**ALIGNMENT** -L-	**0 HR.** 32.5
COLLAR ELEV. 2,648.6 ft	**TOTAL DEPTH** 85.3 ft	**NORTHING** 667,659	**EASTING** 820,954	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/09/21	**COMP. DATE** 04/09/21	**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
2570						Match Line				**WEATHERED ROCK** Brown, orange, and white, GNEISS *(continued)*
	2,568.6	80.0			100/0.2	100/0.2				
2565										
	2,563.6	85.0			100/0.3	100/0.3				2,563.3 85.3 Boring Terminated at Elevation 2,563.3 ft in Weathered Rock (GNEISS)

NOTES
Rig chatter encountered at 7.5'
Split spoon at 45.0' had a 50°-60° orientation

NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 8/5/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** J. Crenshaw	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-A	**STATION** 70+07	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** 35.0
COLLAR ELEV. 2,647.2 ft	**TOTAL DEPTH** 88.9 ft	**NORTHING** 667,892	**EASTING** 821,164	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93%(11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/12/21	**COMP. DATE** 04/13/21	**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)
2650										
	2,647.2	0.0								2,647.2 GROUND SURFACE 0.0
	2,646.3	0.9								2,646.3 0.9' PAVEMENT 0.9
2645	2,644.7	2.5	3	4	3	7		D		**ROADWAY EMBANKMENT** Medium stiff, orange, sandy SILT (A-4), with trace gravel, micaceous
	2,642.2	5.0	3	2	3	5		D		
2640	2,639.7	7.5	3	3	3	6		D		
	2,637.2	10.0	2	3	4	7		D		
2635			2	3	2	5		D		
	2,632.2	15.0	2	2	2	4		D		
2630										2,629.2 18.0
	2,627.2	20.0	2	2	4	6		M		Medium stiff to stiff, brown, clayey SILT (A-5), contains trace wood fragments, micaceous
2625										
	2,622.2	25.0	2	2	4	6		M		
2620										
	2,617.2	30.0	4	4	6	10		M		
2615										
	2,612.2	35.0	10	14	8	22		M		2,611.4 35.8
2610										Medium dense, tan, clayey SAND (A-2-6), with trace gravel
	2,607.2	40.0	2	2	4	6		M		2,609.2 38.0
2605										Medium stiff, brown and gray, sandy and clayey SILT (A-4, A-5), with little gravel, micaceous
	2,602.2	45.0	3	3	5	8		M		
2600										
	2,597.2	50.0	3	6	8	14		W		2,599.2 48.0
2595										**RESIDUAL** Medium dense to very dense, black and orange, silty SAND (A-2-4), micaceous, saprolitic
	2,592.2	55.0	4	7	9	16		Sat.		
2590										
	2,587.2	60.0	6	7	12	19		Sat.		
2585										
	2,582.2	65.0	22	22	29	51		Sat.		
2580										
	2,577.2	70.0	25	29	30	59		Sat.		
2575										
	2,572.2	75.0	44	44	53	97		Sat.		
2570										

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** J. Crenshaw	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-A	**STATION** 70+07	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** 35.0
COLLAR ELEV. 2,647.2 ft	**TOTAL DEPTH** 88.9 ft	**NORTHING** 667,892	**EASTING** 821,164	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93%(11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/12/21	**COMP. DATE** 04/13/21	**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
2570						Match Line				
	2,567.2	80.0	90	10/0.1		100/0.6				2,567.2 80.0
2565										**WEATHERED ROCK** Brown, GNEISS
	2,562.2	85.0	85	15/0.1		100/0.6				2,560.8 86.4
2560										**CRYSTALLINE ROCK** Brown, Migmatitic Biotite GNEISS
										2,558.3 88.9
										Boring Terminated at Elevation 2,558.3 ft in Crystalline Rock (GNEISS)

NOTES

Core barrel blocked off and wireline cable malfunction - Rock fell into hole when core barrel removed to retrieve core barrel Abandoned boring to allow for time to get off road before traffic closure stop time

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** J. Crenshaw	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-A	**STATION** 70+07	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** 35.0
COLLAR ELEV. 2,647.2 ft	**TOTAL DEPTH** 88.9 ft	**NORTHING** 667,892	**EASTING** 821,164	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93% (11/24/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 04/12/21	**COMP. DATE** 04/13/21	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 2.5 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
											ELEV. (ft) / DEPTH (ft)
2560.8											Begin Coring @ 86.4 ft
2560	2,560.8	86.4	2.5	1:11	(2.5)	(1.5)		(2.5)	(1.5)		2,560.8 — **CRYSTALLINE ROCK** — 86.4
	2,558.3	88.9		1:56	100%	60%		100%	60%		2,558.3 — Brown, Migmatitic Biotite GNEISS, moderate to severe weathering, hard, close fracture spacing — 88.9
				2:35/0.5							Boring Terminated at Elevation 2,558.3 ft in Crystalline Rock (GNEISS)

NOTES

Core barrel blocked off and wireline cable malfunction - Rock fell into hole when core barrel removed to retrieve core barrel
Abandoned boring to allow for time to get off road before traffic closure stop time

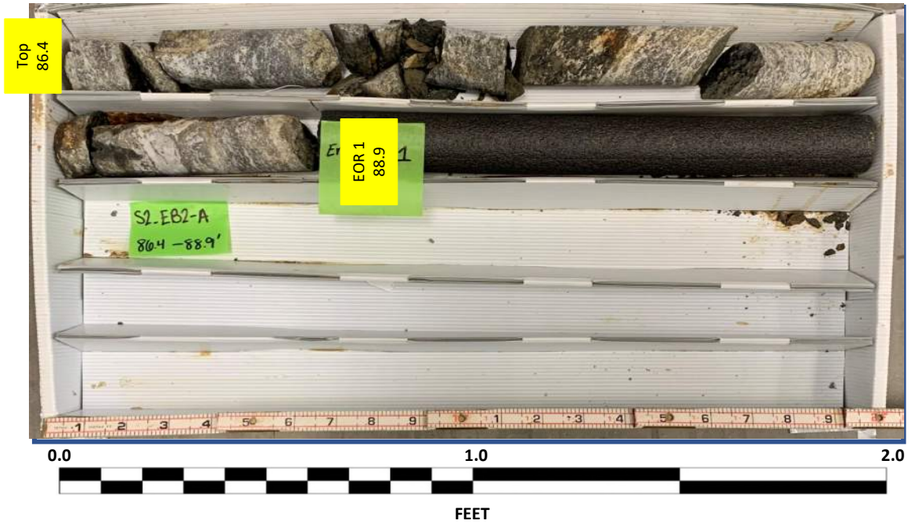
NCDOT CORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 8/5/21

CORE PHOTOGRAPHIC RECORD

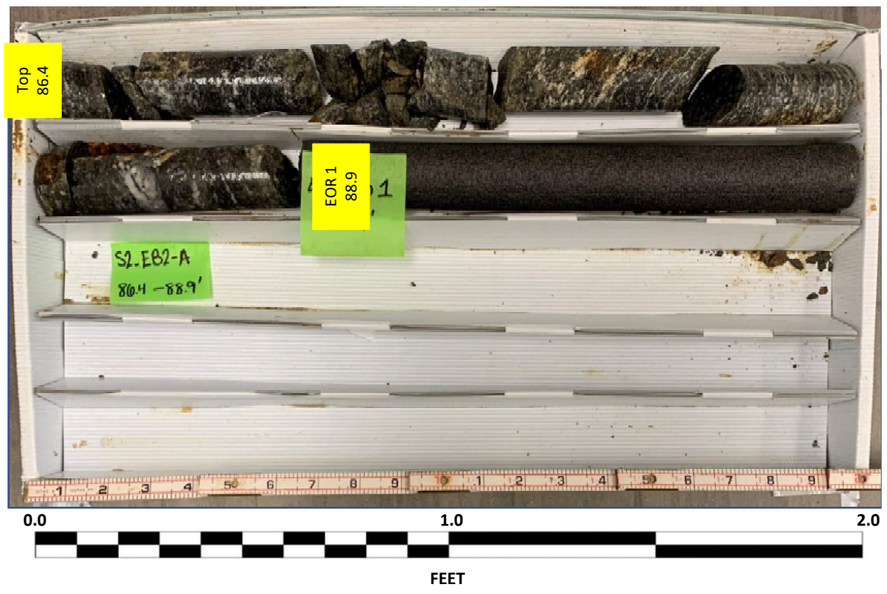
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S3_EB2-A
Box 1 of 1: 86.4 – 88.9 FEET
DRY



S3_EB2-A
Box 1 of 1: 86.4 – 88.9 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-B	**STATION** 69+21	**OFFSET** 70 ft RT	**ALIGNMENT** -L-	**0 HR.** 38.0
COLLAR ELEV. 2,647.8 ft	**TOTAL DEPTH** 69.6 ft	**NORTHING** 667,752	**EASTING** 821,138	**24 HR.** 28.4
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/09/21	**COMP. DATE** 04/09/21	**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)
2650											
	2,647.5	0.3								2,647.8 GROUND SURFACE	0.0
2645	2,645.3	2.5	2	1	2	3		M		**ROADWAY EMBANKMENT** Soft to hard, brown, CLAY (A-7-6), with trace gravel, contains trash debris and root fragments, micaceous	
	2,642.8	5.0	3	1	5	6		M			
2640	2,640.3	7.5	4	23	13	36		M		2,640.8 Very stiff, gray, fine sandy SILT (A-4), with little gravel and some clay	7.0
	2,637.8	10.0	3	9	9	18		M		2,638.3 Stiff to soft, brown and red, CLAY (A-7), with trace gravel, micaceous	9.5
2635			6	7	6	13		M			
	2,632.8	15.0									
2630			2	1	2	3		M		2,629.8 Medium stiff to stiff, tan and brown, CLAY (A-6)	18.0
	2,627.8	20.0	3	3	4	7		M			
2625											
	2,622.8	25.0	3	4	5	9		M			
2620											
	2,617.8	30.0	4	3	5	8		M			
2615										2,614.8 Stiff, green, gray, and brown, CLAY (A-7), contains trace organic material, micaceous	33.0
	2,612.8	35.0	3	3	5	8		M			
2610											
	2,607.8	40.0	3	5	4	9		W			
2605											
	2,602.8	45.0	3	41	59/0.3	100/0.8				2,602.3 **WEATHERED ROCK** Red and brown, GNEISS	45.5
2600										2,599.8 **CRYSTALLINE ROCK** Black and white, Migmatitic Biotite GNEISS	48.0
2595							RS-12				
2590											
2585											
2580										2,578.2 Boring Terminated at Elevation 2,578.2 ft in Crystalline Rock (GNEISS)	69.6

NOTES
0.3' Topsoil
Rig chatter and grinding encountered at 5.0'
Rig chatter encountered at 10.0'

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-B	**STATION** 69+21	**OFFSET** 70 ft RT	**ALIGNMENT** -L-	**0 HR.** 38.0
COLLAR ELEV. 2,647.8 ft	**TOTAL DEPTH** 69.6 ft	**NORTHING** 667,752	**EASTING** 821,138	**24 HR.** 28.4
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 04/09/21	**COMP. DATE** 04/09/21	**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
2570						Match Line				Rig chatter and hard drilling encountered at 48.0' Auger refusal at 48.0'

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S3_EB2-B	**STATION** 69+21	**OFFSET** 70 ft RT	**ALIGNMENT** -L-	**0 HR.** 38.0
COLLAR ELEV. 2,647.8 ft	**TOTAL DEPTH** 69.6 ft	**NORTHING** 667,752	**EASTING** 821,138	**24 HR.** 28.4
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 04/09/21	**COMP. DATE** 04/09/21	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 21.6 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
2599.8											Begin Coring @ 48.0 ft
	2,599.8	48.0	1.6	0:30/0.6	(1.2) 75%	(1.2) 75%		(21.2) 98%	(21.0) 97%		2,599.8 **CRYSTALLINE ROCK** 48.0
	2,598.2	49.6		1:59							Black and white, Migmatitic Biotite GNEISS, fresh to very slight weathering, hard to very hard, close to wide fracture spacing;
			5.0	1:49	(5.0) 100%	(5.0) 100%					0.4' core loss
2595				1:13							Epidote along healed fractures
				1:40			RS-12				RS-12 52.1' - 52.8'
	2,593.2	54.6		1:32							GSI= 80 - 90
				2:04							Qu= 11,009 psi
			5.0	1:37	(5.0) 100%	(5.0) 100%					
2590				1:41							
				1:50							
	2,588.2	59.6		1:52							
				2:08							
			5.0	1:58	(5.0) 100%	(5.0) 100%					
2585				1:36							
				2:08							
	2,583.2	64.6		1:59							
				2:29							
			5.0	1:46	(5.0) 100%	(4.8) 96%					
2580				1:39							
				1:52							
				1:57							
	2,578.2	69.6		1:54							2,578.2 69.6
											Boring Terminated at Elevation 2,578.2 ft in Crystalline Rock (GNEISS)

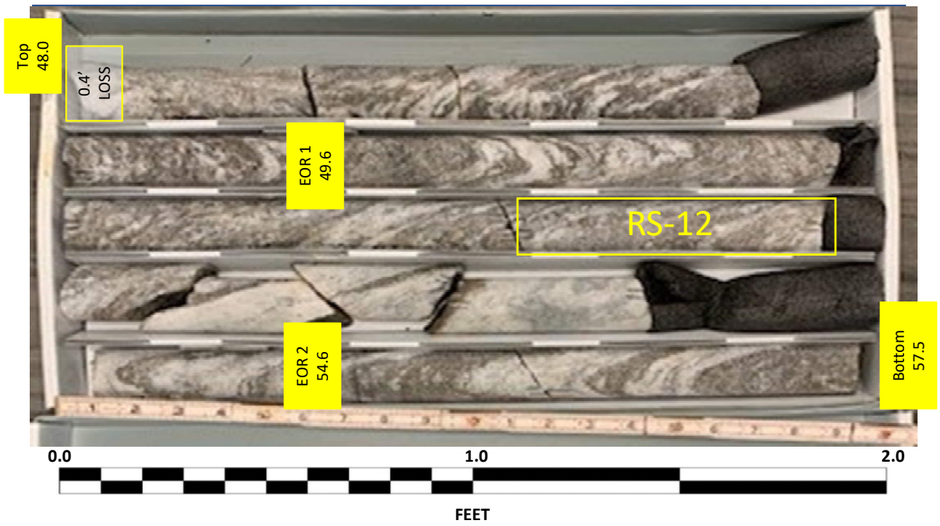
NOTES
0.3' Topsoil
Rig chatter and grinding encountered at 5.0'
Rig chatter encountered at 10.0'
Rig chatter and hard drilling encountered at 48.0'
Auger refusal at 48.0'

CORE PHOTOGRAPHIC RECORD

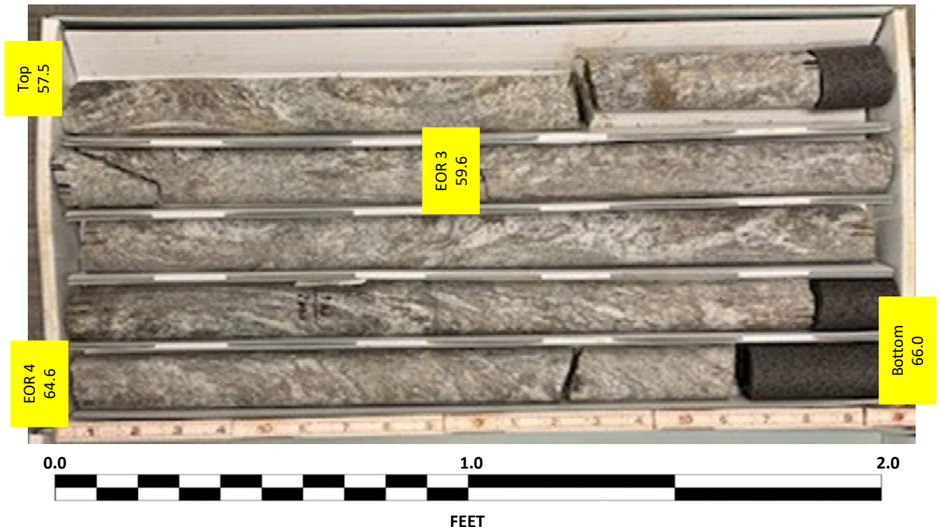
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

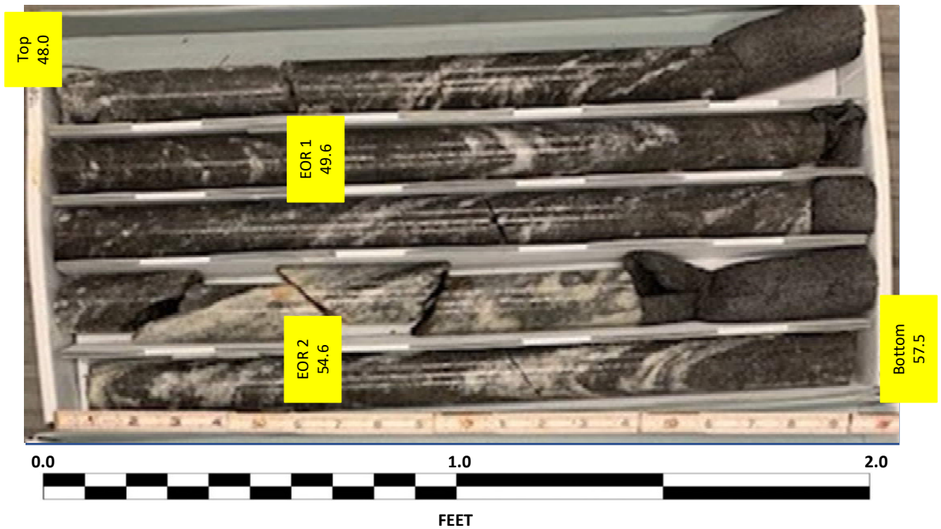
S3_EB2-B
Box 1 of 3: 48.0 – 57.5 FEET
DRY



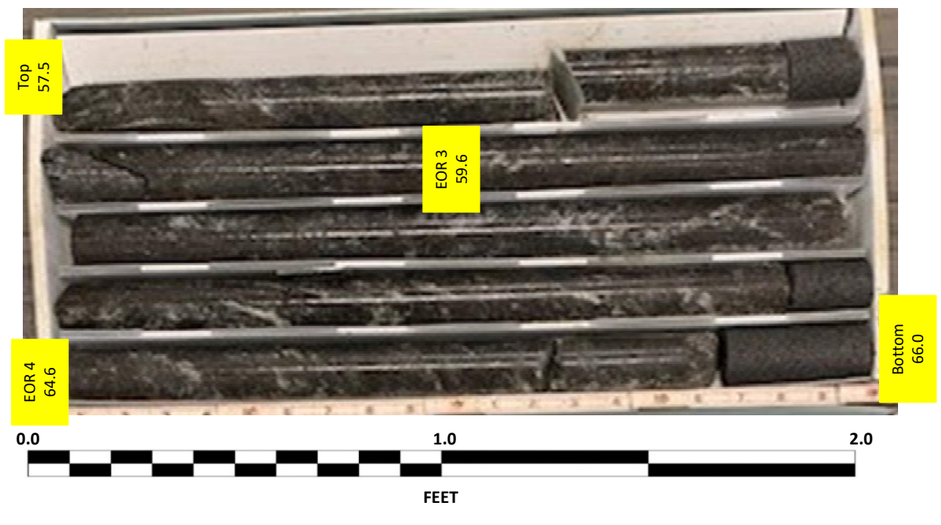
S3_EB2-B
Box 2 of 3: 57.5 – 66.0 FEET
DRY



S3_EB2-B
Box 1 of 3: 48.0 – 57.5 FEET
WET



S3_EB2-B
Box 2 of 3: 57.5 – 66.0 FEET
WET



CORE PHOTOGRAPHIC RECORD

38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S3_EB2-B
Box 3 of 3: 66.0 – 69.6 FEET
DRY

S3_EB2-B
Box 3 of 3: 66.0 – 69.6 FEET
WET

REPORT ON SAMPLES OF: Rock For Quality

PROJECT:	B-3186 / B-5898	COUNTY:	Haywood
DATE SAMPLED:	05/11/2021	RECEIVED:	5/11/2021
SAMPLED FROM:	Test Borings	REPORTED:	5/12/2021
SUBMITTED BY:	HDR	BY / CERT NO:	Kevin E. Walker

BORING NO	SAMPLE	DEPTH (FT)	ROCK TYPE	LENGTH (IN)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)
S3_EB2-B	RS-12	52.1-52.8	Biotite Gneiss	4.13	1.86	179.10	11,009

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3186/B-5898	1	35

REFERENCE: B-3186/B-5898

PROJECT: 38332/48030

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *HAYWOOD*

PROJECT DESCRIPTION *US 23/US 74/US 19 (GREAT SMOKY MOUNTAIN HWY) FROM WEST OF NC 209 (CRABTREE RD.) TO EAST OF RUSS AVE.*

SITE DESCRIPTION *BRIDGE NO. 430468 ON -L- (US 74/US 23) OVER RICHLAND CREEK BETWEEN US 276 AND NC 209*

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND
2A	SUPPLEMENTAL GSI LEGEND
3	SITE PLAN
4-5	PROFILES
6-9	CROSS SECTIONS
10-34	BORE LOGS, CORE REPORTS & CORE PHOTOGRAPHS
35	ROCK TEST RESULTS

CAUTION NOTICE

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

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

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

PERSONNEL

C. SWAFFORD

N. YACOBI

R. DUGGER

GEOTECHNOLOGY, INC.

INVESTIGATED BY *C. SWAFFORD*

DRAWN BY *T. LYNN*

CHECKED BY *K. BUSSEY*

SUBMITTED BY *HDR*

DATE *AUGUST 2021*

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

SIGNATURE DATE

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [X] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-75
- [ ] _____

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

ELEVATION: FEET

NOTES:

BORING ELEVATIONS OBTAINED FROM TRIMBLE RI2 GNSS RECEIVER CERTIFIED WITH FCC PART 15 (CLASS B DEVICE), 24, 32; RCM; PTCRB; BT SIG

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	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

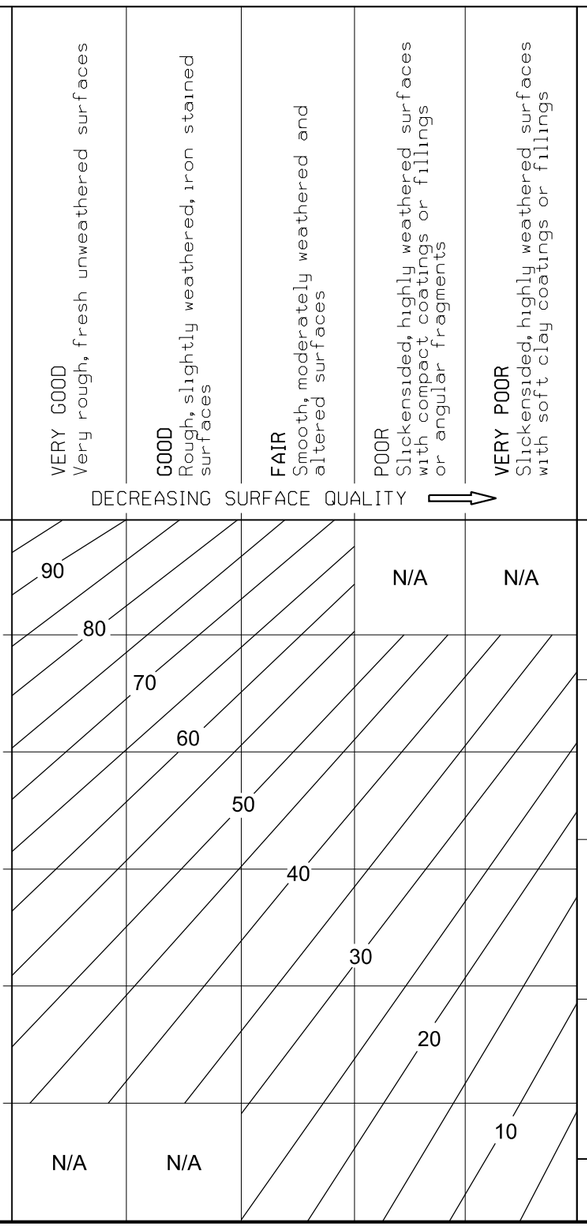
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

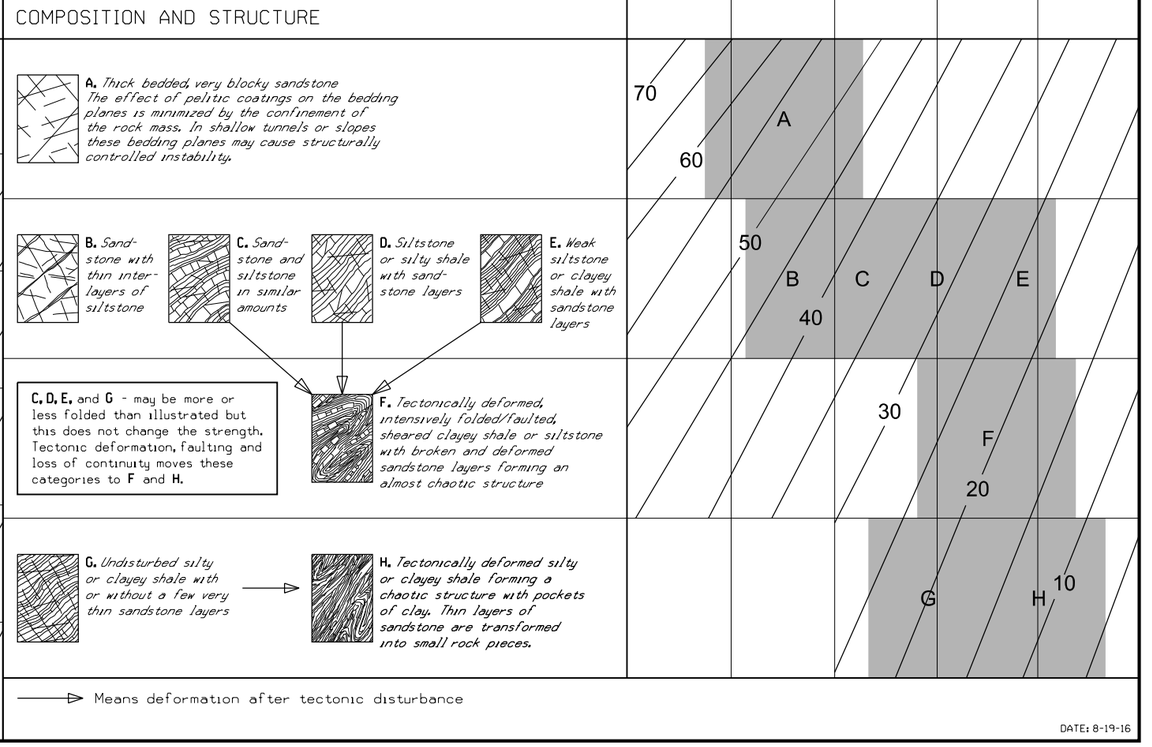


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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



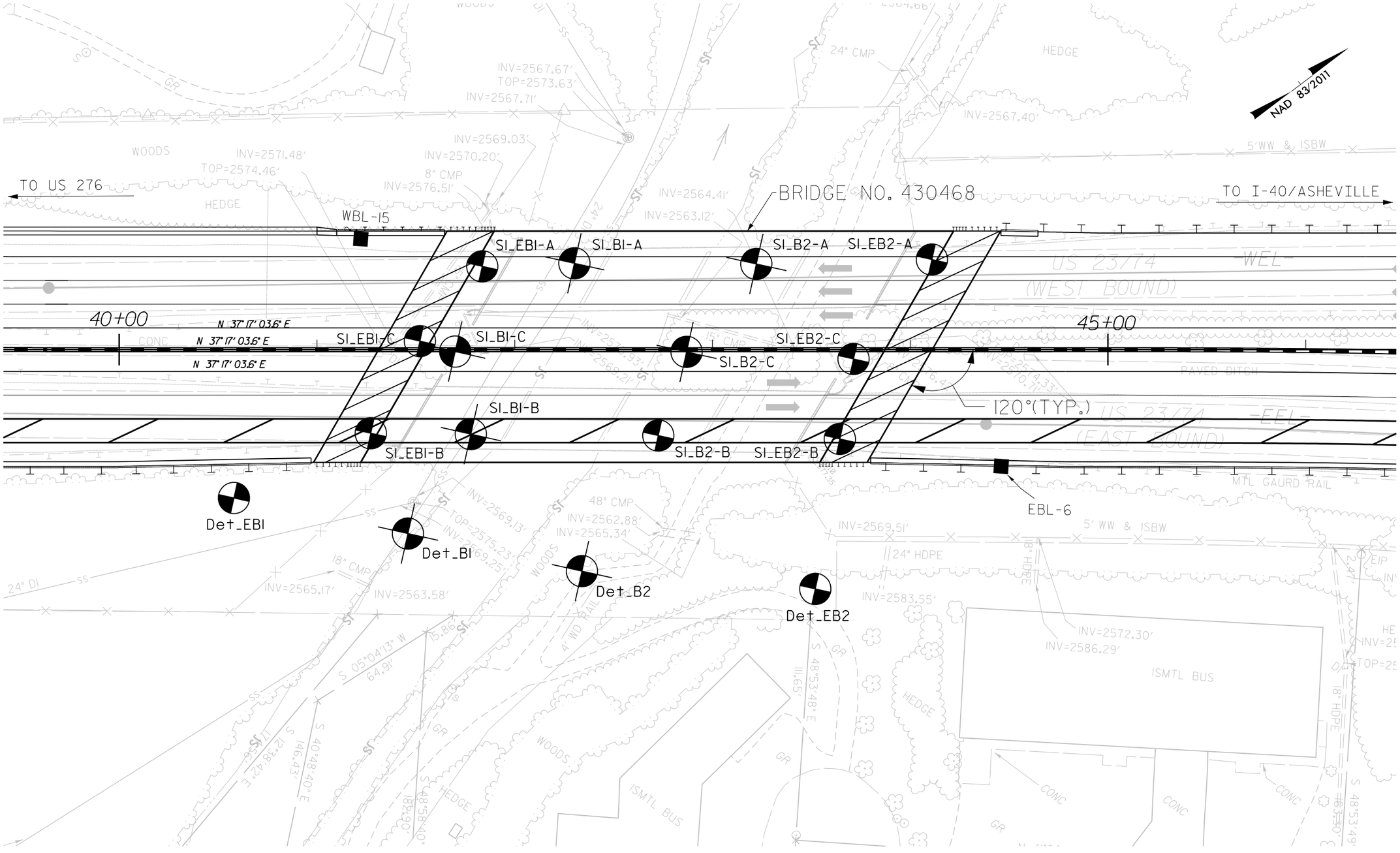
DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	3

SITE PLAN

0 50 100

FEET



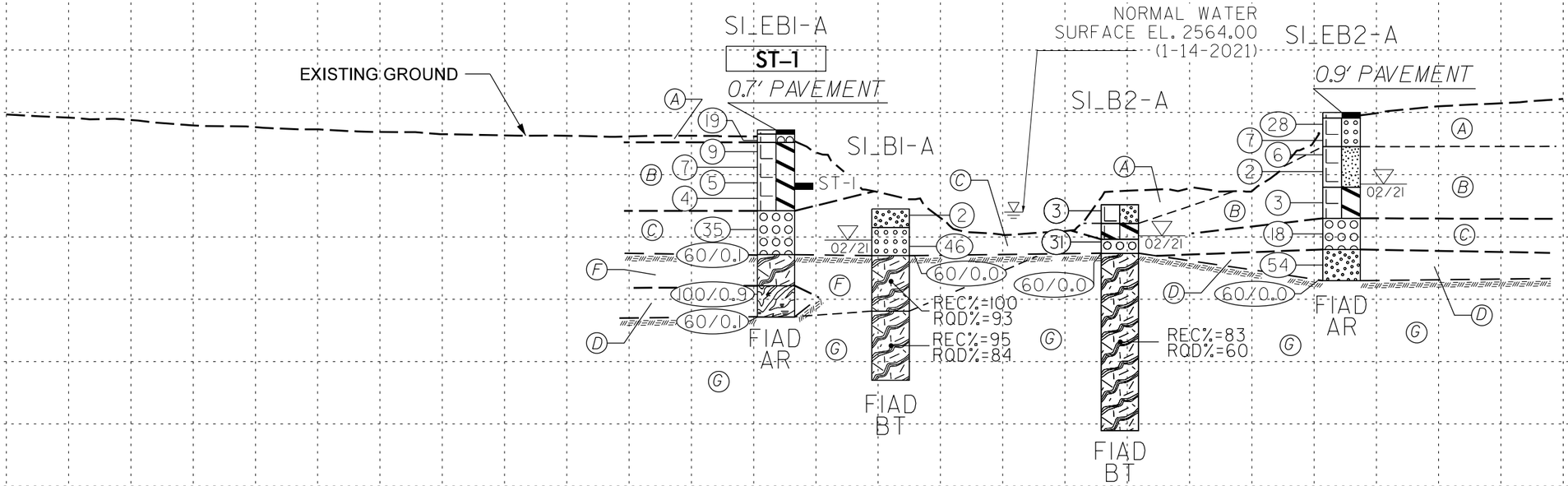
SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
ST-1	42' LT	41+84	8.5'-9.6'	A-7-6 (21)	51	27	7.8	19.6	26.4	46.2	98.9	96.8	75.4	26	-

0 50 100
FEET
VE = 1:2.5

PROJECT REFERENCE NO.	SHEET NO.
B-3816/B-5898	4

BRIDGE NO. 1 PROFILE
60' LT OF -L-



(A) **ROADWAY EMBANKMENT:** Very loose to dense, brown, silty SAND (A-2-4) and SAND and GRAVEL (A-1-b), micaceous

(B) **ROADWAY EMBANKMENT:** Soft to stiff, brown, gray, and orange, SILT (A-4) and silty CLAY (A-7-6), contains trace wood fragmetns, micaceous, organic odor

(C) **ALLUVIAL:** Very loose to dense, gray, brown, and orange, silty SAND (A-2-4), SAND (A-3), and SAND and GRAVEL (A-1-b), micaceous

(D) **RESIDUAL:** Very dense, brown, orange, and white, silty SAND (A-2-4), saprolitic

(E) **WEATHERED ROCK:** Brown, tan, and orange, GNEISS

(F) **CRYSTALLINE ROCK:** Light to dark gray with brown, m-c grained Biotite GNEISS, with trace garnets

(G) **CRYSTALLINE ROCK:** Light to dark gray with brown, Migmatitic Biotite GNEISS

NOTES:
GROUNDLINE OBTAINED USING b3186 br0022 r4047 Merged 1-12-21.tin FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

39+00 40+00 41+00 42+00 43+00 44+00 45+00

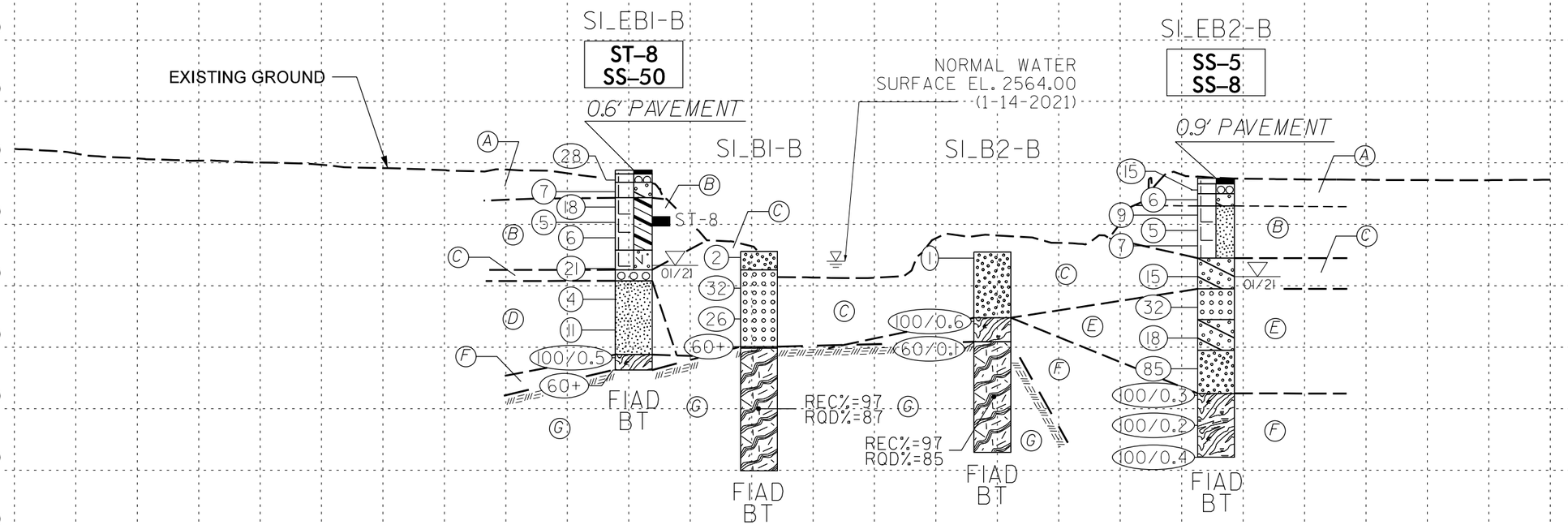
SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
ST-8	42' RT	41+27	7.5' - 9.1'	A-6 (8)	39	20	29.1	11.0	23.0	36.9	91.4	70.3	55.1	28	-
SS-50	42' RT	41+30	7.5' - 9.0'	A-6 (16)	40	20	14.0	10.3	44.4	31.3	99.7	90.9	80.9	63	-
SS-5	43' RT	43+63	10.0' - 11.5'	A-4 (1)	34	9	35.7	25.1	22.0	17.2	93.2	71.2	43.3	28	-
SS-8	43' RT	43+63	25.0' - 26.5'	A-2-7 (4)	52	30	47.3	29.7	18.3	4.7	91.9	58.9	28.6	18	-

0 50 100
FEET
VE = 1:2.5

PROJECT REFERENCE NO.	SHEET NO.
B-3816/B-5898	5

BRIDGE NO. 1 PROFILE
57' RT OF -L-



(A) **ROADWAY EMBANKMENT:** Loose to medium dense, brown, tan, and orange, clayey SAND (A-2-6) and SAND and GRAVEL (A-1-b), micaceous

(B) **ROADWAY EMBANKMENT:** Stiff to very stiff, brown and orange, clayey SILT (A-5) and sandy CLAY (A-6)(8)(16), micaceous

(C) **ALLUVIAL:** Very loose to medium dense, gray, brown, and orange, silty SAND (A-2-4), SAND (A-3), and SAND and GRAVEL (A-1-b), micaceous

(D) **RESIDUAL:** Medium stiff to hard, brown, orange and white, SILT (A-4), micaceous, saprolitic

(E) **RESIDUAL:** Medium dense to very dense, brown, orange, and white with black, clayey SAND (A-2-6, A-2-7) and SAND (A-3), contains trace rock fragments, saprolitic

(F) **WEATHERED ROCK:** Brown, tan, and white, GNEISS

(G) **CRYSTALLINE ROCK:** Light to dark gray with brown, Migmatitic Biotite GNEISS

NOTES:
GROUNDLINE OBTAINED USING b3186 br0022 r4047 Merged 1-12-21.tin FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE OFFSET WITH THE BORINGS PROJECTED ONTO THE PROFILE

2630 2620 2610 2600 2590 2580 2570 2560 2550 2540 2530 2520 2510 2500 2490 2480 2470 2460 2450

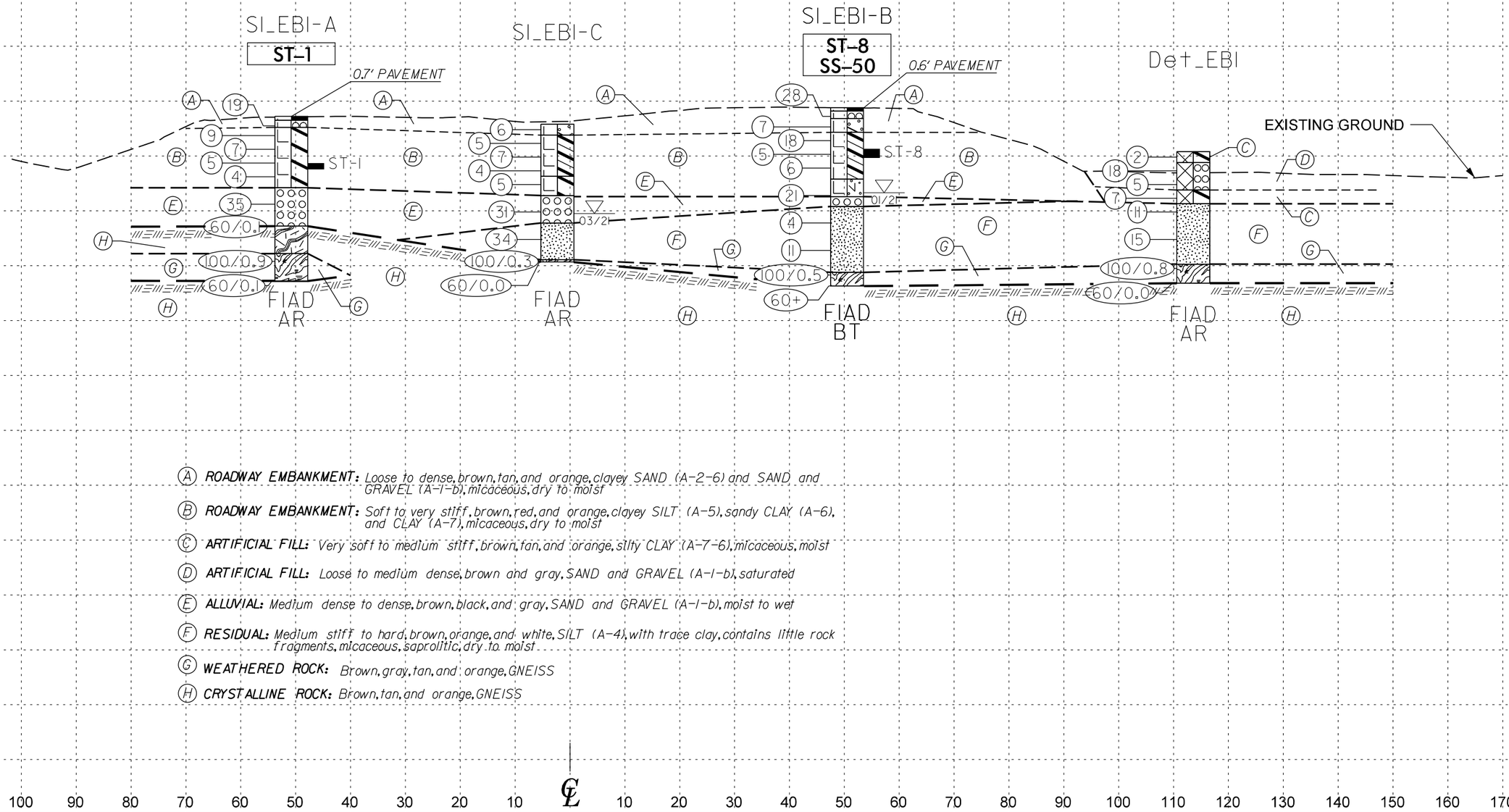
39+00 40+00 41+00 42+00 43+00 44+00 45+00

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	6

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
ST-1	42' LT	41+84	8.5' - 9.6'	A-7-6 (21)	51	27	7.8	19.6	26.4	46.2	98.9	96.8	75.4	26	-
ST-8	42' RT	41+27	7.5' - 9.1'	A-6 (8)	39	20	29.1	11.0	23.0	36.9	91.4	70.3	55.1	28	-
SS-50	42' RT	41+30	7.5' - 9.0'	A-6 (16)	40	20	14.0	10.3	44.4	31.3	99.7	90.9	80.9	63	-

NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS
DRAWN AT THE CROSS SECTIONS
WITH THE BORINGS PROJECTED
ONTO THE CROSS SECTIONS



(A) **ROADWAY EMBANKMENT:** Loose to dense, brown, tan, and orange, clayey SAND (A-2-6) and SAND and GRAVEL (A-1-b), micaceous, dry to moist

(B) **ROADWAY EMBANKMENT:** Soft to very stiff, brown, red, and orange, clayey SILT (A-5), sandy CLAY (A-6), and CLAY (A-7), micaceous, dry to moist

(C) **ARTIFICIAL FILL:** Very soft to medium stiff, brown, tan, and orange, silty CLAY (A-7-6), micaceous, moist

(D) **ARTIFICIAL FILL:** Loose to medium dense, brown and gray, SAND and GRAVEL (A-1-b), saturated

(E) **ALLUVIAL:** Medium dense to dense, brown, black, and gray, SAND and GRAVEL (A-1-b), moist to wet

(F) **RESIDUAL:** Medium stiff to hard, brown, orange, and white, SILT (A-4), with trace clay, contains little rock fragments, micaceous, saprolitic, dry to moist

(G) **WEATHERED ROCK:** Brown, gray, tan, and orange, GNEISS

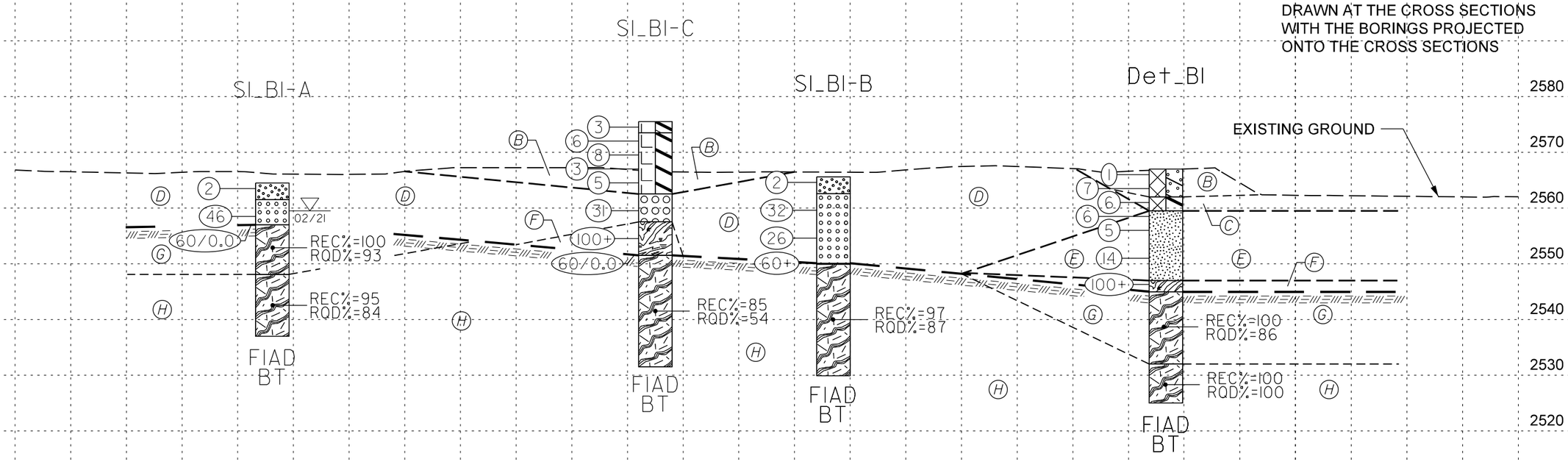
(H) **CRYSTALLINE ROCK:** Brown, tan, and orange, GNEISS

HORIZ. SCALE (FEET) 0 20 40 | VE = 1:1

BRIDGE NO. 1 – END BENT 1 – –L– STA. 41+54.99 120° SKEW

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	7

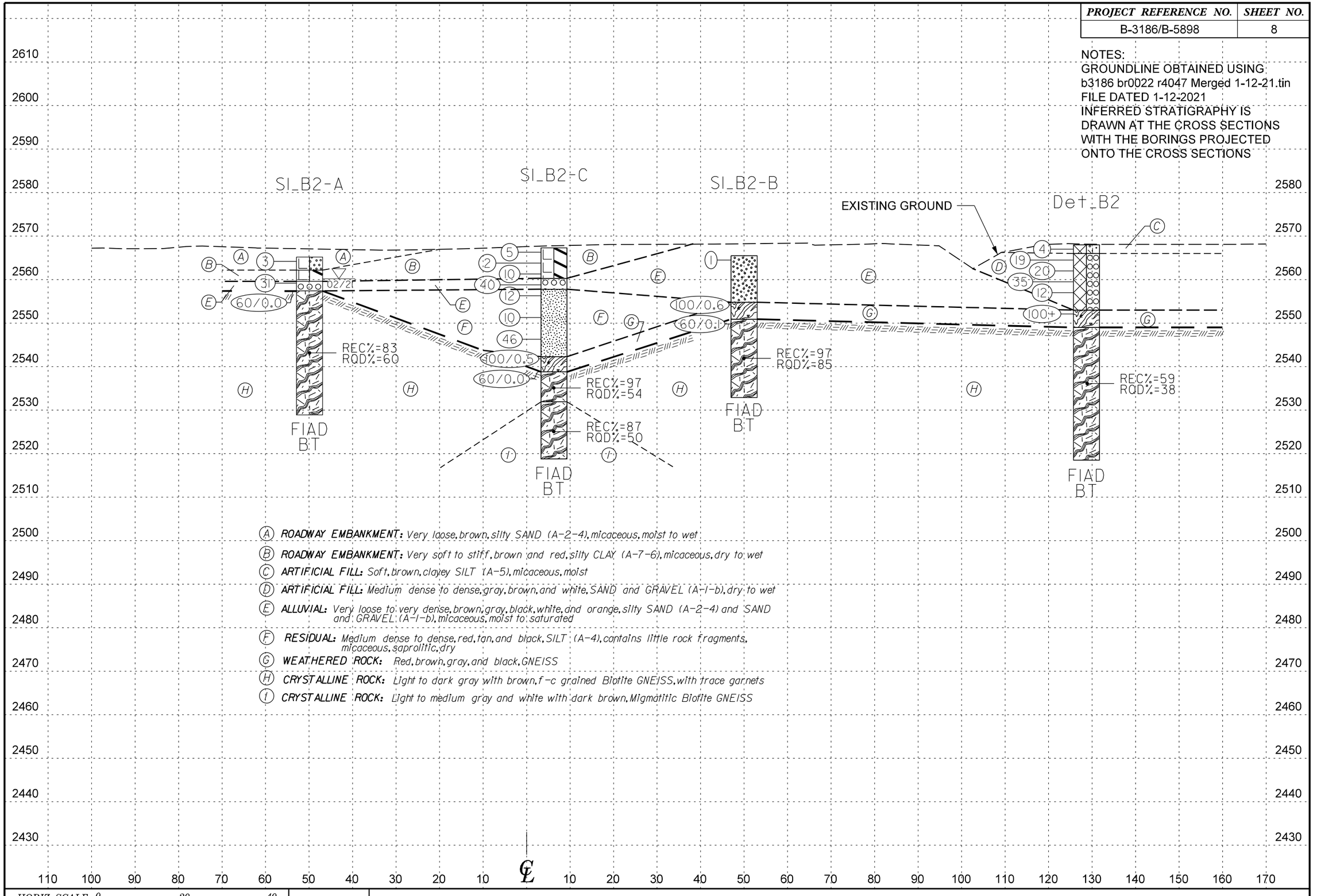
NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS
DRAWN AT THE CROSS SECTIONS
WITH THE BORINGS PROJECTED
ONTO THE CROSS SECTIONS



HORIZ. SCALE (FEET) 0 20 40 | VE = 1:1 | **BRIDGE NO. 1 – BENT 1 – –L– STA. 41+98.31 120° SKEW**

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	8

NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS
DRAWN AT THE CROSS SECTIONS
WITH THE BORINGS PROJECTED
ONTO THE CROSS SECTIONS



(A) **ROADWAY EMBANKMENT:** *Very loose, brown, silty SAND (A-2-4), micaceous, moist to wet*

(B) **ROADWAY EMBANKMENT:** *Very soft to stiff, brown and red, silty CLAY (A-7-6), micaceous, dry to wet*

(C) **ARTIFICIAL FILL:** *Soft, brown, clayey SILT (A-5), micaceous, moist*

(D) **ARTIFICIAL FILL:** *Medium dense to dense, gray, brown, and white, SAND and GRAVEL (A-1-b), dry to wet*

(E) **ALLUVIAL:** *Very loose to very dense, brown, gray, black, white, and orange, silty SAND (A-2-4) and SAND and GRAVEL (A-1-b), micaceous, moist to saturated*

(F) **RESIDUAL:** *Medium dense to dense, red, tan, and black, SILT (A-4), contains little rock fragments, micaceous, saprolitic, dry*

(G) **WEATHERED ROCK:** *Red, brown, gray, and black, GNEISS*

(H) **CRYSTALLINE ROCK:** *Light to dark gray with brown, f-c grained Biotite GNEISS, with trace garnets*

(I) **CRYSTALLINE ROCK:** *Light to medium gray and white with dark brown, Migmatitic Biotite GNEISS*

HORIZ. SCALE (FEET) 0 20 40

VE = 1:1

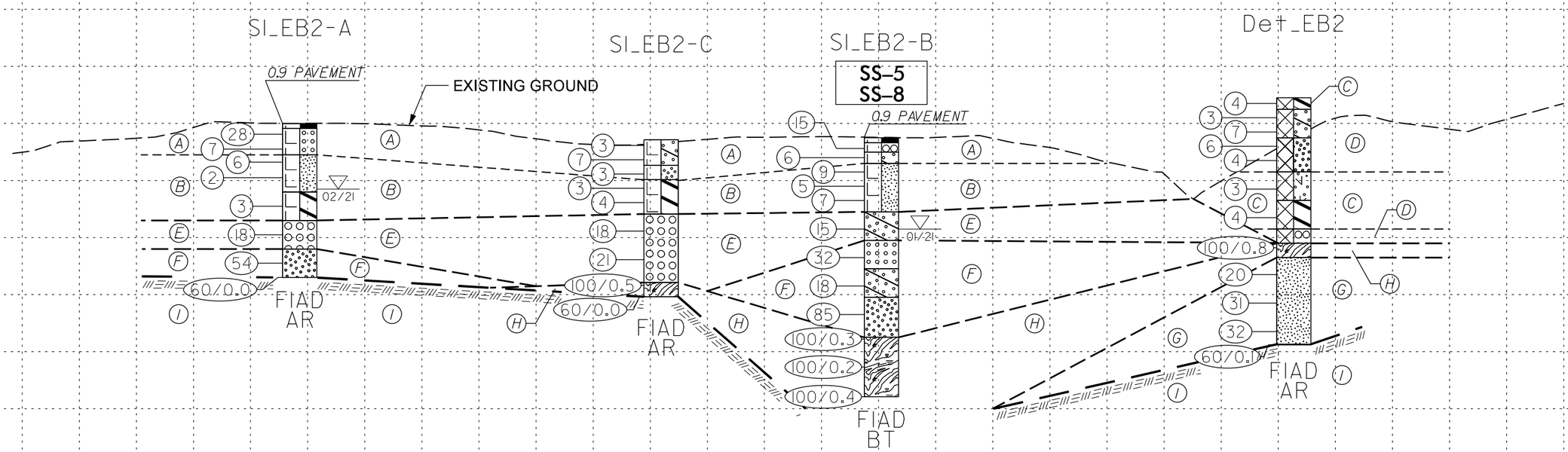
BRIDGE NO. 1 – BENT 2 – –L– STA. 42+97.46 119° SKEW

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	9

NOTES:
GROUNDLINE OBTAINED USING
b3186 br0022 r4047 Merged 1-12-21.tin
FILE DATED 1-12-2021
INFERRED STRATIGRAPHY IS
DRAWN AT THE CROSS SECTIONS
WITH THE BORINGS PROJECTED
ONTO THE CROSS SECTIONS

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
SS-5	43' RT	43+63	10.0' - 11.5'	A-4 (1)	34	9	35.7	25.1	22.0	17.2	93.2	71.2	43.3	28	-
SS-8	43' RT	43+63	25.0' - 26.5'	A-2-7 (4)	52	30	47.3	29.7	18.3	4.7	91.9	58.9	28.6	18	-



Ⓐ **ROADWAY EMBANKMENT:** Very loose to medium dense, brown, red, green, and gray, clayey SAND (A-2-6), silty SAND (A-2-4), SAND (A-3), and SAND and GRAVEL (A-1-b), dry to wet

Ⓑ **ROADWAY EMBANKMENT:** Soft to stiff, gray, brown, orange, and tan, sandy SILT (A-4) and CLAY (A-7-6), contains trace root and wood fragments, micaceous, organic odor, moist to wet

Ⓒ **ARTIFICIAL FILL:** Soft, red and brown, clayey SILT (A-5), sandy CLAY (A-6), and CLAY (A-7-6), micaceous, dry to moist

Ⓓ **ARTIFICIAL FILL:** Very loose to very dense, red, brown, and gray, silty SAND (A-2-4), and CLAYEY SAND (A-2-6), and SAND and GRAVEL (A-1-b), micaceous, moist

Ⓔ **ALLUVIAL:** Medium dense, gray, red, and brown, clayey SAND (A-2-6) and SAND and GRAVEL (A-1-b), wet to saturated

Ⓕ **RESIDUAL:** Medium dense to very dense, brown, orange, and white, silty SAND (A-2-4), clayey SAND (A-2-7), and SAND (A-3), contains trace to little rock fragments, micaceous, saprolitic, dry to wet

Ⓖ **RESIDUAL:** Very stiff to hard, white, gray, tan and brown, SILT (A-4), micaceous, saprolitic

Ⓗ **WEATHERED ROCK:** Gray, brown, orange, and black, GNEISS

Ⓘ **CRYSTALLINE ROCK:** Gray, white, and brown, GNEISS

HORIZ. SCALE (FEET) 0 20 40 | VE = 1:1

BRIDGE NO. 1 – CROSS SECTION – –L– STA. 43+87.22 119° SKEW

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB1-A	**STATION** 41+84	**OFFSET** 42 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,577.2 ft	**TOTAL DEPTH** 30.1 ft	**NORTHING** 666,335	**EASTING** 818,860	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 03/01/21	**COMP. DATE** 03/01/21	**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)
2580										
	2,576.5	0.7	13	13	6	19		M		2,577.2 — GROUND SURFACE — 0.0
2575	2,574.7	2.5	3	3	6	9		M		2,576.5 — 0.7' PAVEMENT — 0.7
	2,572.2	5.0	3	4	3	7		M		2,575.2 — **ROADWAY EMBANKMENT** — 2.0 Dense, brown, SAND and GRAVEL (A-1-b) Medium stiff to stiff, brown and orange, silty CLAY (A-7-6)(21)
2570	2,569.7	7.5	1	2	3	5		M		
	2,567.2	10.0	1	2	2	4		30%		
2565								M		2,564.2 — 13.0
	2,562.2	15.0	14	16	19	35		M		**ALLUVIAL** Dense, brown, SAND and GRAVEL (A-1-b)
2560	2,557.2	20.0	60/0.1			60/0.1				2,557.2 — 20.0 **CRYSTALLINE ROCK** Brown, tan, and orange, GNEISS
2555	2,552.2	25.0	17	20	80/0.4	100/0.9				2,552.2 — 25.0 **WEATHERED ROCK** Brown, tan, and orange, GNEISS
2550	2,547.2	30.0	60/0.1			60/0.1				2,547.2 — 30.0 2,547.1 — 30.1 **CRYSTALLINE ROCK** Brown, tan, and orange, GNEISS Boring Terminated with Standard Penetration Test Refusal at Elevation 2,547.1 ft in Crystalline Rock (GNEISS)

Other Samples:
ST-1 (8.5 - 9.6)

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB1-C	**STATION** 41+52	**OFFSET** 4 ft LT	**ALIGNMENT** -L-	**0 HR.** 16.3
COLLAR ELEV. 2,575.8 ft	**TOTAL DEPTH** 25.1 ft	**NORTHING** 666,287	**EASTING** 818,871	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 03/09/21	**COMP. DATE** 03/09/21	**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
2580										
	2,575.8	0.0	2	3	3	6		D		2,575.8 — GROUND SURFACE — 0.0
2575	2,573.3	2.5	4	2	3	5		D		**ROADWAY EMBANKMENT**
	2,570.8	5.0	2	3	4	7		D		2,573.8 — Loose, red and brown, clayey SAND (A-2-6) — 2.0 Soft to medium stiff, red and brown, sandy CLAY (A-6)
2570	2,568.3	7.5	2	2	2	4		D		
	2,565.8	10.0	1	1	4	5		M		2,566.3 — 9.5 Medium stiff, red, sandy CLAY (A-7-6)
2565										2,562.8 — 13.0
	2,560.8	15.0	6	11	20	31				**ALLUVIAL** Dense, gray and black, SAND and GRAVEL (A-1-b)
2560	2,557.8	18.0								2,557.8 — 18.0 **RESIDUAL** Dense, brown, tan and red, SILT (A-4), saprolitic
2555	2,555.8	20.0	14	13	21	34		D		
	2,551.1	24.7	100/0.3			100/0.3				2,551.1 — 24.7
	2,550.7	25.1	60/0.0			60/0.0				2,550.7 — 25.1 **WEATHERED ROCK** Gray, GNEISS Boring Terminated with Standard Penetration Test Refusal at Elevation 2,550.7 ft on Crystalline Rock (GNEISS)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB1-B	**STATION** 41+27	**OFFSET** 42 ft RT	**ALIGNMENT** -L-	**0 HR.** 15.5
COLLAR ELEV. 2,578.8 ft	**TOTAL DEPTH** 32.5 ft	**NORTHING** 666,239	**EASTING** 818,893	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 01/29/21	**COMP. DATE** 01/21/21	**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)
2580											
	2,578.2	0.6	15	18	10	28		D		2,578.8 GROUND SURFACE	0.0
	2,576.3	2.5	2	3	4	7		D		2,578.2 0.6' PAVEMENT	0.6
2575										2,576.8 **ROADWAY EMBANKMENT** Medium dense, brown, tan, and orange, SAND and GRAVEL (A-1-b)	2.0
	2,573.8	5.0	11	11	7	18		D		2,574.3 Loose, brown and orange, clayey SAND (A-2-6), micaceous	4.5
	2,571.3	7.5								Stiff to medium stiff, brown and orange, sandy CLAY (A-6)(8)(16), micaceous	
2570			1	2	3	5	SS-50	63%			
	2,568.8	10.0	2	2	4	6		28% D			
2565										2,565.8 Very stiff, brown, clayey SILT (A-5)	13.0
	2,563.8	15.0	2	7	14	21		▽		2,562.6 **ALLUVIAL**	16.2
2560										2,560.8 Medium dense, brown and gray, SAND and GRAVEL (A-1-b)	18.0
	2,558.8	20.0	2	2	2	4		D		**RESIDUAL** Medium stiff to hard, brown, orange and white, SILT (A-4), micaceous, saprolitic	
2555											
	2,553.8	25.0	2	5	6	11		D			
2550										2,548.8	30.0
	2,548.8	30.0	100/0.5			100/0.5				**WEATHERED ROCK**	
	2,546.3	32.5	100/0.0			60+				2,546.3 Brown, tan and white, GNEISS	32.5

Boring Terminated at Elevation 2,546.3 ft on Crystalline Rock (GNEISS)

Other Samples:
ST-8 (7.5 - 9.1)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B1-A	**STATION** 42+30	**OFFSET** 44 ft LT	**ALIGNMENT** -L-	**0 HR.** 5.0
COLLAR ELEV. 2,564.5 ft	**TOTAL DEPTH** 27.5 ft	**NORTHING** 666,373	**EASTING** 818,887	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 02/28/21	**COMP. DATE** 02/28/21	**SURFACE WATER DEPTH** N/A	

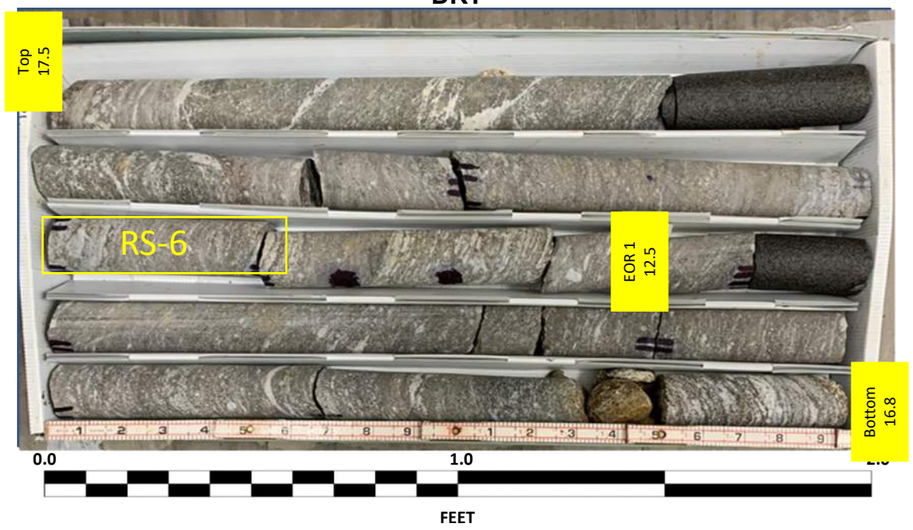
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
2565											
	2,564.5	0.0	WOR	1	1	2		W		2,564.5 GROUND SURFACE	0.0
										ALLUVIAL Very loose, brown, silty SAND (A-2-4), micaceous	
2560	2,559.5	5.0	67	25	21	46		Sat.		2,561.5	3.0
										Dense, brown, SAND (A-3), contains trace gravel	
	2,557.0	7.5	60/0.0			60/0.0				2,557.0	7.5
2555										**CRYSTALLINE ROCK** Light to dark gray with brown, m-c grained Biotite GNEISS, with trace garnets	
							RS-6				
2550											
										2,548.1	16.4
							RS-7			Light to dark gray with brown, Migmatitic Biotite GNEISS	
2545											
2540											
										2,537.0	27.5
										Boring Terminated at Elevation 2,537.0 ft in Crystalline Rock (GNEISS)	

CORE PHOTOGRAPHIC RECORD

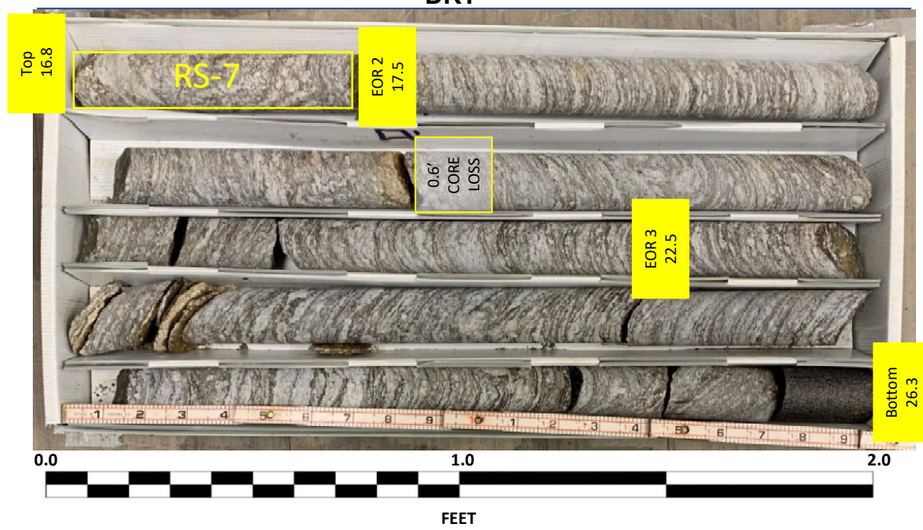
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

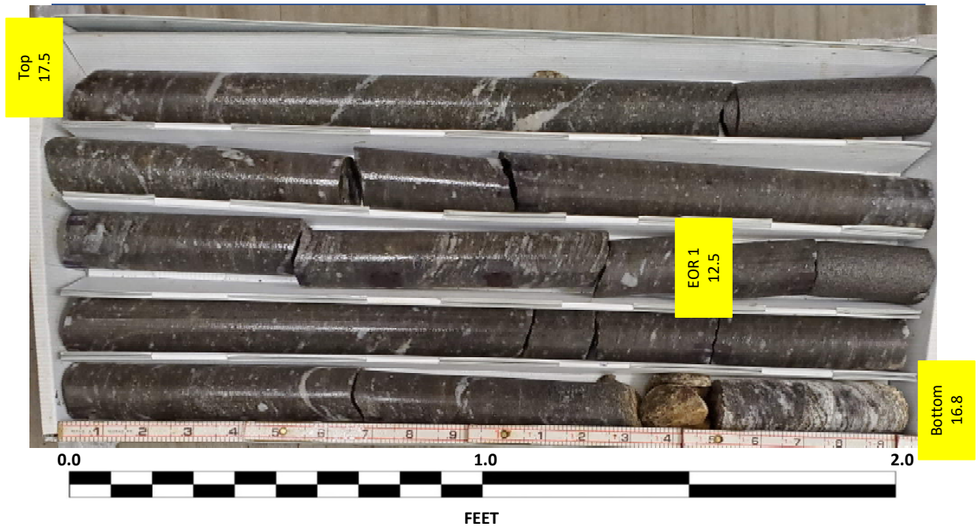
S1_B1-A
Box 1 of 3: 7.5 – 16.8 FEET
DRY



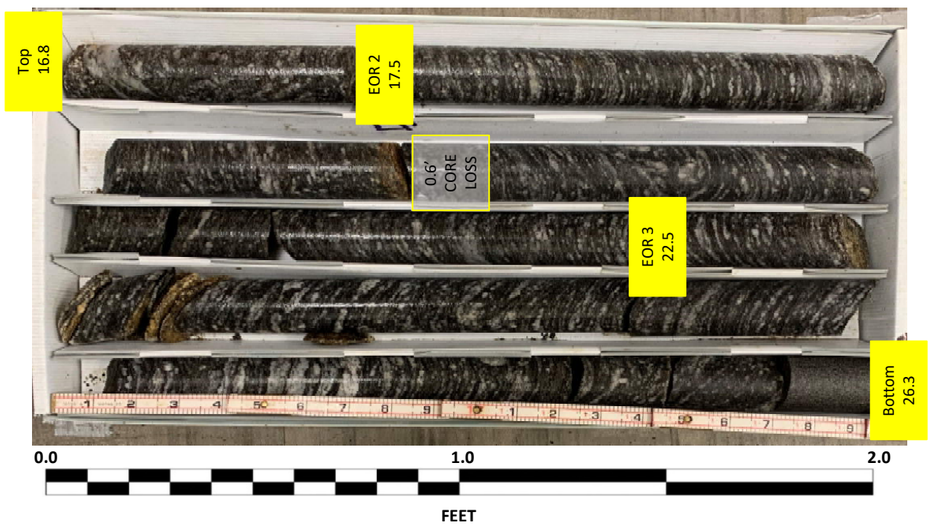
S1_B1-A
Box 2 of 3: 16.8 – 26.3 FEET
DRY



S1_B1-A
Box 1 of 3: 7.5 – 16.8 FEET
WET



S1_B1-A
Box 2 of 3: 16.8 – 26.3 FEET
WET

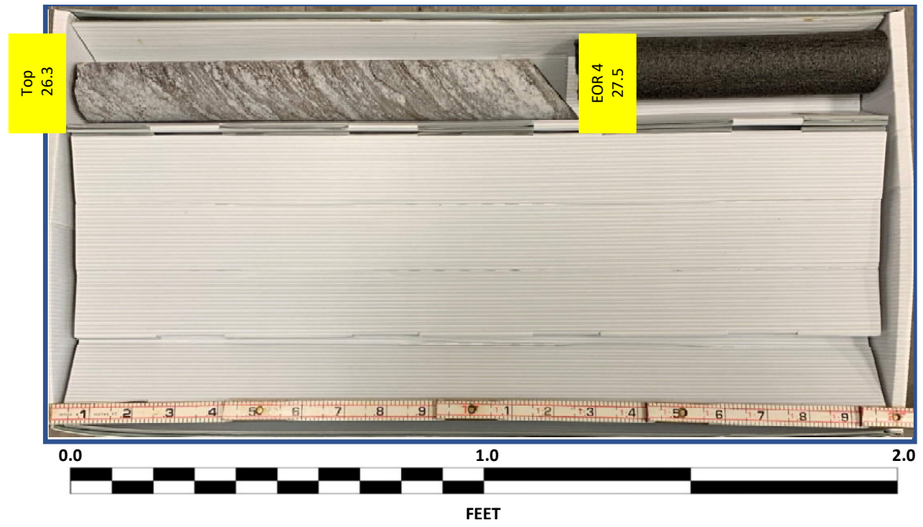


CORE PHOTOGRAPHIC RECORD

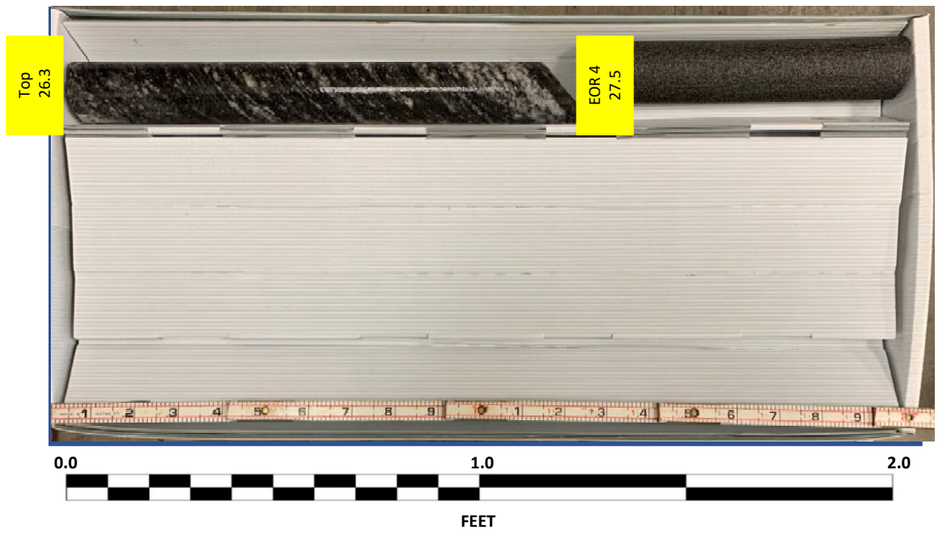
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S1_B1-A
Box 3 of 3: 26.3 – 27.5 FEET
DRY



S1_B1-A
Box 3 of 3: 26.3 – 27.5 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B1-C	**STATION** 41+70	**OFFSET** 1 ft RT	**ALIGNMENT** -L-	**0 HR.** 13.0
COLLAR ELEV. 2,575.5 ft	**TOTAL DEPTH** 44.0 ft	**NORTHING** 666,298	**EASTING** 818,886	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83% (09/15/2020)		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 03/10/21	**COMP. DATE** 03/10/21	**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)
2580											
2575	2,575.5	0.0	1	1	2	3		D		2,575.5 GROUND SURFACE	0.0
	2,573.0	2.5	3	3	3	6		D		**ROADWAY EMBANKMENT** 2,573.5 Very soft, red and brown, sandy CLAY (A-6)	2.0
2570	2,570.5	5.0	2	3	5	8		M		Soft to medium stiff, red, gray, and brown, CLAY (A-7-6)	
	2,568.0	7.5	2	2	1	3		M			
2565	2,565.5	10.0	1	2	3	5		M		2,562.5	13.0
2560	2,560.5	15.0	11	16	15	31		W		**ALLUVIAL** Dense, gray, SAND and GRAVEL (A-1-b)	
2555	2,555.5	20.0	87	50/0.5		100+				2,557.5 **WEATHERED ROCK** Gray and black, GNEISS	18.0
	2,551.5	24.0	60/0.0			60/0.0				2,551.5 **CRYSTALLINE ROCK** Gray, black, and white, Migmatitic Biotite GNEISS	24.0
2550											
2545											
2540											
2535							RS-9			2,531.5 Boring Terminated at Elevation 2,531.5 ft in Crystalline Rock (GNEISS)	44.0

NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 8/3/21

CORE PHOTOGRAPHIC RECORD

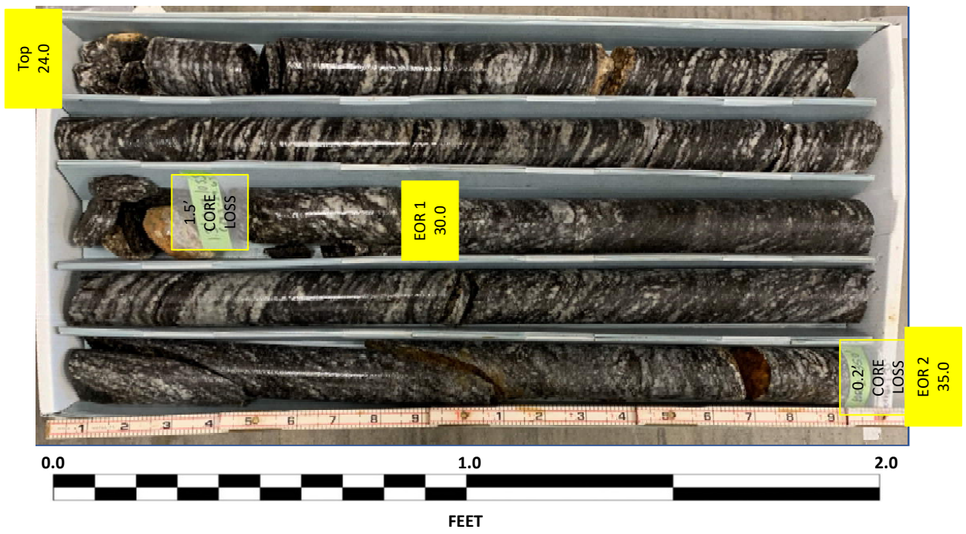
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S1_B1-C
Box 1 of 2: 24.0 – 35.0 FEET
DRY

S1_B1-C
Box 2 of 2: 35.0 – 44.0 FEET
DRY

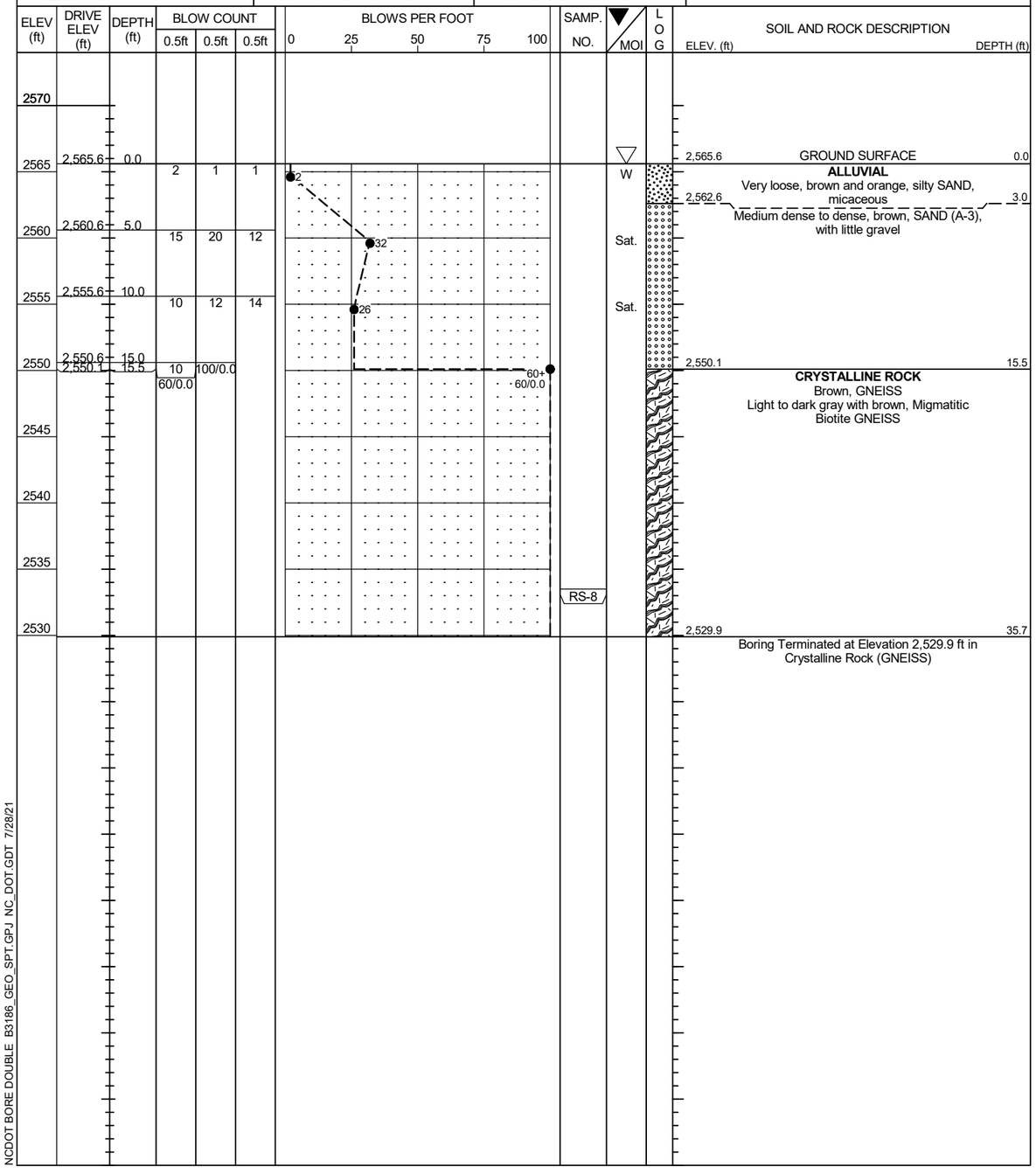
S1_B1-C
Box 1 of 2: 24.0 - 35.0 FEET
WET



S1_B1-C
Box 2 of 2: 35.0 – 44.0 FEET
WET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B1-B	**STATION** 41+78	**OFFSET** 43 ft RT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 2,565.6 ft	**TOTAL DEPTH** 35.7 ft	**NORTHING** 666,279	**EASTING** 818,924	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 02/16/21	**COMP. DATE** 02/16/21	**SURFACE WATER DEPTH** N/A	



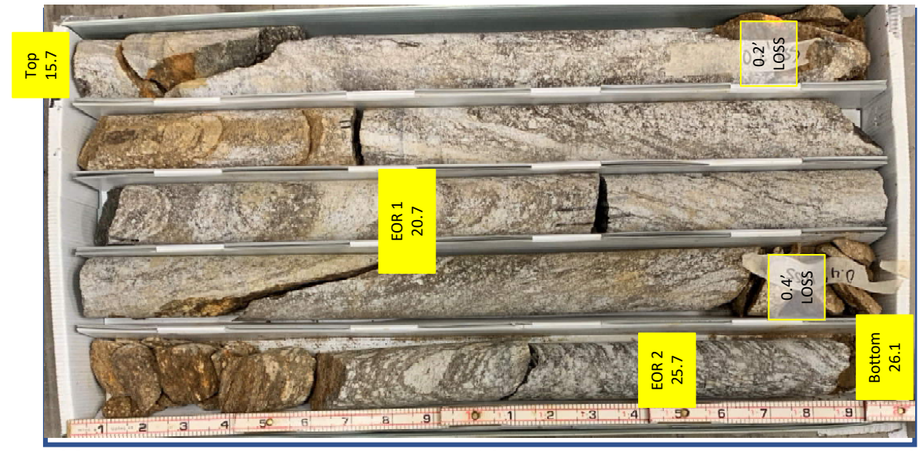
NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

CORE PHOTOGRAPHIC RECORD

38330.1.FS1 (B-3186/B-5898)

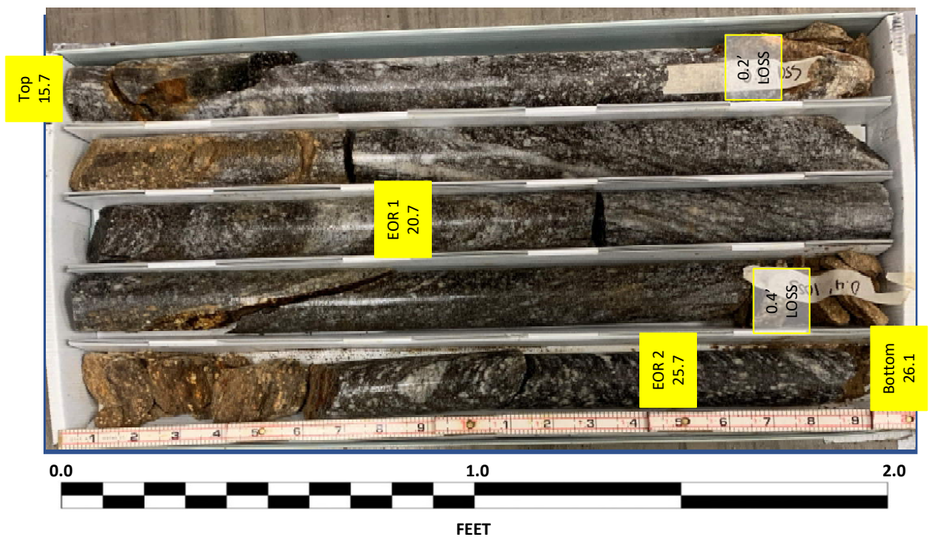
US 23/ US 74 Great Smokey Mountain Highway

S1_B1-B
Box 1 of 2: 15.7 – 26.1 FEET
DRY



S1_B1-B
Box 2 of 2: 26.1 – 35.7 FEET
DRY

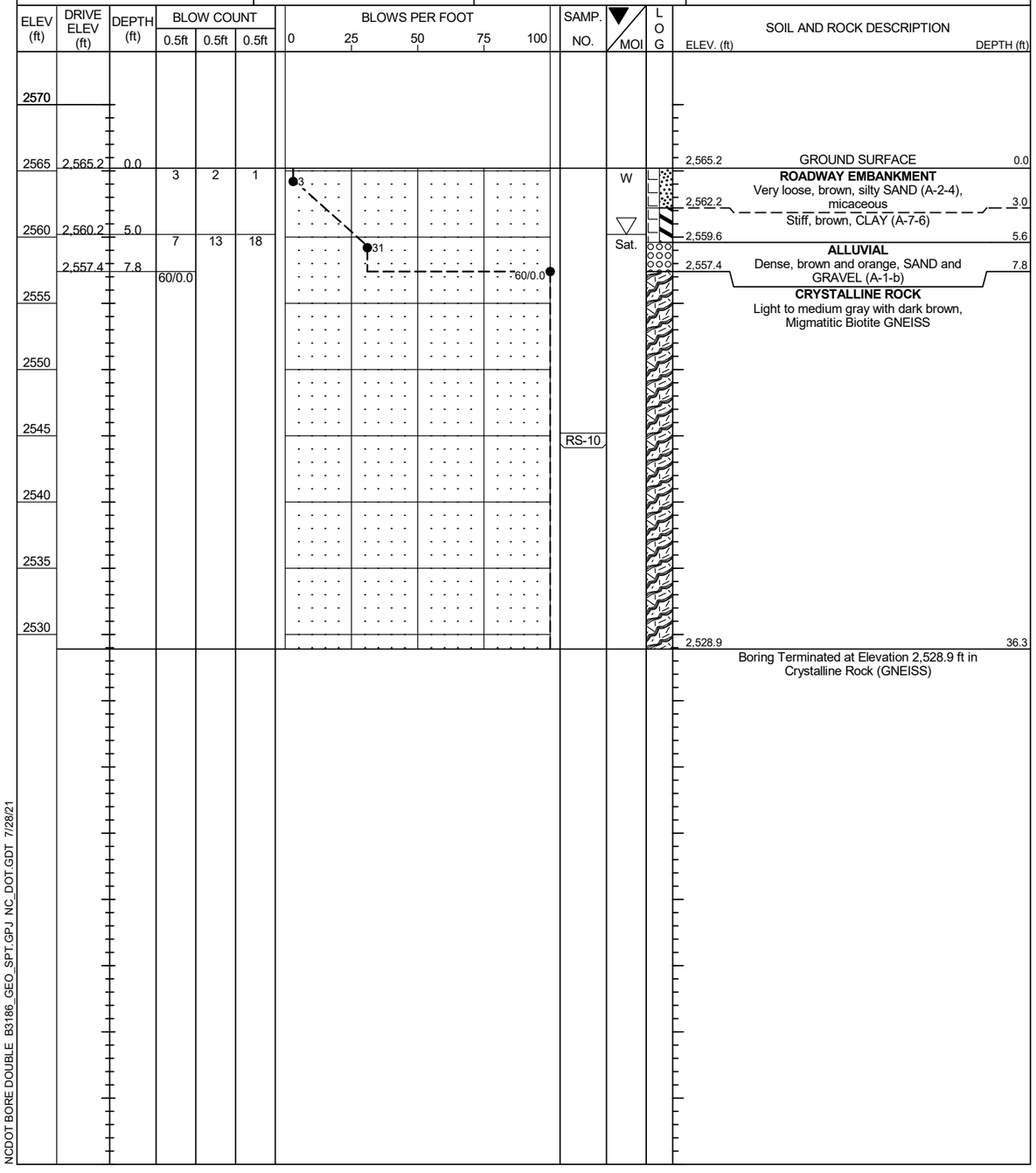
S1_B1-B
Box 1 of 2: 15.7 – 26.1 FEET
WET



S1_B1-B
Box 2 of 2: 26.1 – 35.7 FEET
WET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B2-A	**STATION** 43+22	**OFFSET** 43 ft LT	**ALIGNMENT** -L-	**0 HR.** 5.0
COLLAR ELEV. 2,565.2 ft	**TOTAL DEPTH** 36.3 ft	**NORTHING** 666,446	**EASTING** 818,943	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 03/01/21	**COMP. DATE** 03/01/21	**SURFACE WATER DEPTH** N/A	



NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

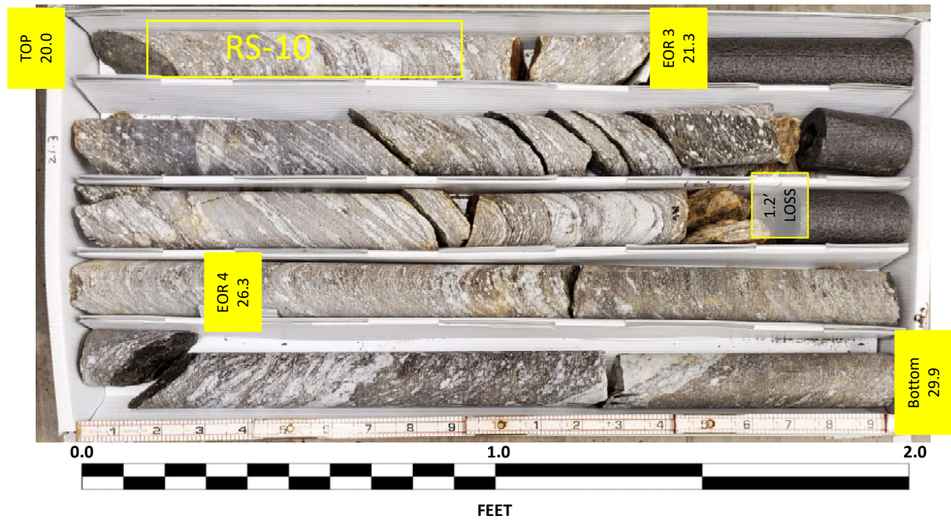
CORE PHOTOGRAPHIC RECORD

38330.1.FS1 (B-3186/B-5898)

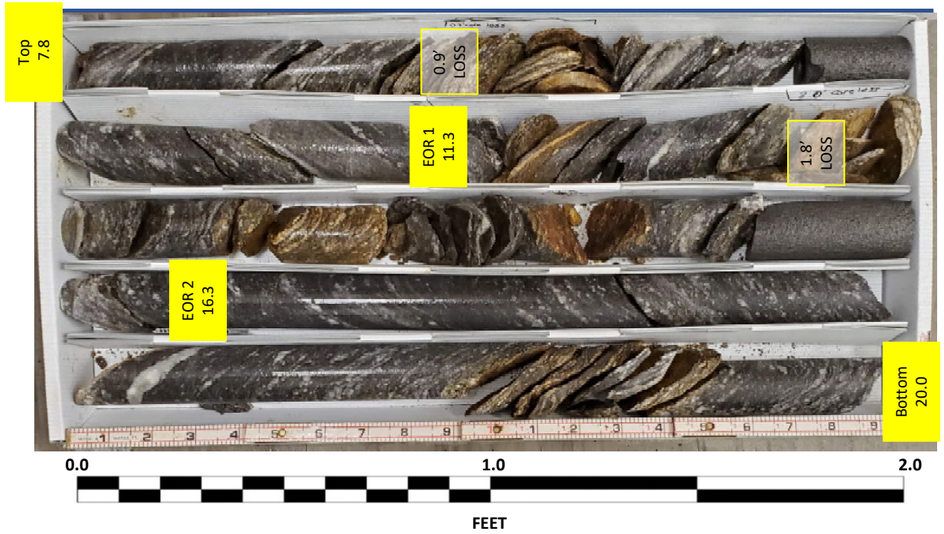
US 23/ US 74 Great Smokey Mountain Highway

S1_B2-A
Box 1 of 3: 7.8 – 20.0 FEET
DRY

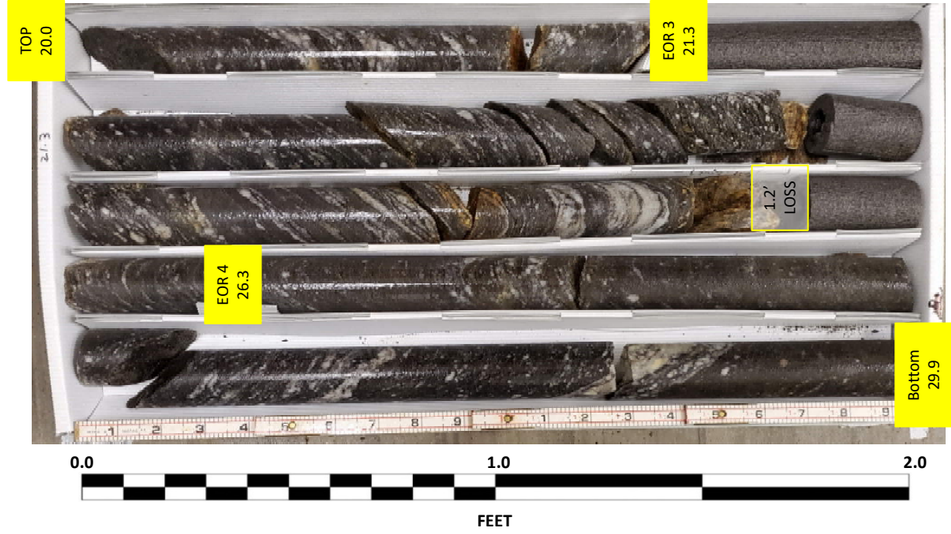
S1_B2-A
Box 2 of 3: 20.0-29.9 FEET
DRY



S1_B2-A
Box 1 of 3: 7.8 – 20.0 FEET
WET



S1_B2-A
Box 2 of 3: 20.0 – 29.9 FEET
WET

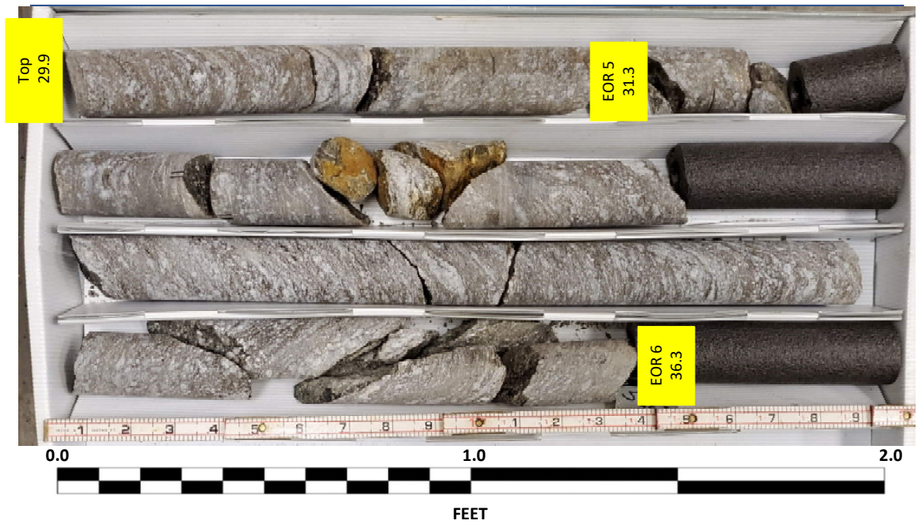


CORE PHOTOGRAPHIC RECORD

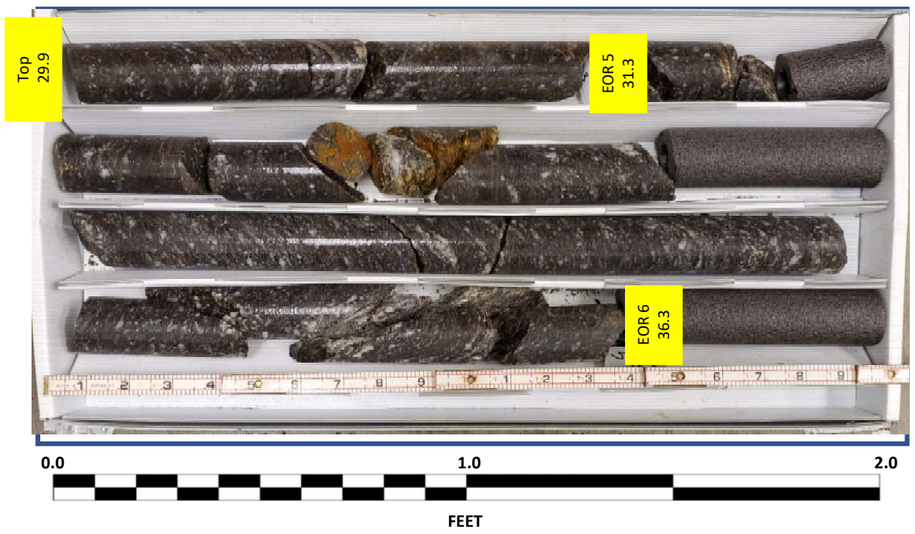
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

S1_B2-A
Box 3 of 3: 29.9 – 36.3 FEET
DRY



S1_B2-A
Box 3 of 3: 29.9 – 36.3 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B2-C	**STATION** 42+87	**OFFSET** 1 ft RT	**ALIGNMENT** -L-	**0 HR.** 4.0
COLLAR ELEV. 2,567.3 ft	**TOTAL DEPTH** 48.5 ft	**NORTHING** 666,391	**EASTING** 818,957	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 03/10/21	**COMP. DATE** 03/10/21	**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)
2570											
	2,567.3	0.0								2,567.3 GROUND SURFACE	0.0
2565			1	2	3	5		M		**ROADWAY EMBANKMENT** Very soft to medium stiff, red and brown, silty CLAY (A-7-6), micaceous	
	2,564.8	2.5									
	2,562.3	5.0	1	1	1	2		W			
2560			3	3	7	10				2,560.3	7.0
	2,559.8	7.5	18	14	26	40		W		**ALLUVIAL** Medium dense to very dense, gray, black, and white, SAND and GRAVEL (A-1-b)	
	2,557.3	10.0								2,557.8	9.5
2555			4	5	7	12		D		**RESIDUAL** Medium dense to dense, red, tan, and black, SILT (A-4), contains little rock fragments, micaceous, saprolitic	
	2,552.3	15.0									
2550			3	4	6	10		D			
	2,547.3	20.0									
2545			8	16	30	46		D			
	2,542.3	25.0	100/0.5			1 100/0.5				2,542.3	25.0
2540										**WEATHERED ROCK** Red, brown, and black, GNEISS	
	2,538.8	28.5	60/0.0			60/0.0				2,538.8	28.5
2535										**CRYSTALLINE ROCK** Light to dark gray with brown, f-c grained Biotite GNEISS, with trace garnets	
							RS-11			2,531.9	35.4
2530										Light to dark gray with brown, Migmatic Biotite GNEISS	
2525											
2520										2,518.8	48.5
										Boring Terminated at Elevation 2,518.8 ft in Crystalline Rock (GNEISS)	

NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 8/2/21

CORE PHOTOGRAPHIC RECORD

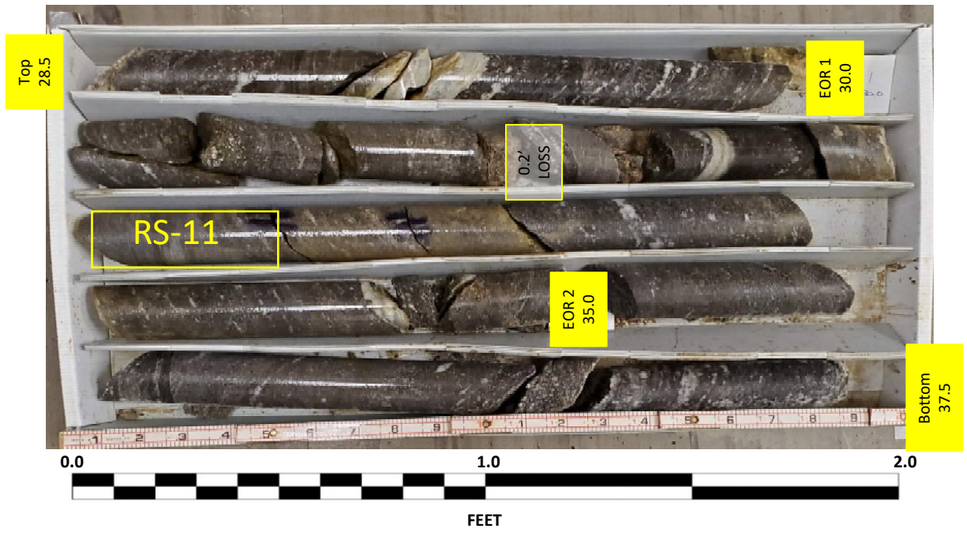
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

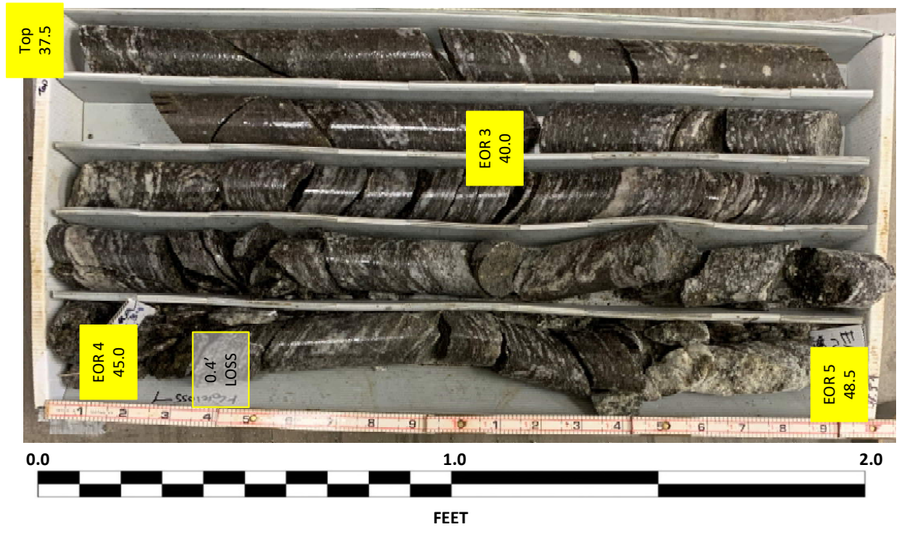
S1_B2-C
Box 1 of 2: 28.5 – 37.5 FEET
DRY

S1_B2-C
Box 2 of 2: 37.5 – 48.5 FEET
DRY

S1_B2-C
Box 1 of 2: 28.5 – 37.5 FEET
WET



S1_B2-C
Box 2 of 2: 37.5 – 48.5 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_B2-B	**STATION** 42+73	**OFFSET** 43 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,565.5 ft	**TOTAL DEPTH** 32.6 ft	**NORTHING** 666,354	**EASTING** 818,982	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83% (09/15/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER K. Boone	**START DATE** 02/15/21	**COMP. DATE** 02/15/21	**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
2570										
2565	2,565.5	0.0	1	1	0	1		M		2,565.5 GROUND SURFACE 0.0 **ALLUVIAL** Very loose, brown, silty SAND (A-2-4), micaceous
2560										
2555	2,554.8	10.7	100/0.5			100/0.5				2,554.8 10.7 **WEATHERED ROCK** Brown, GNEISS
2550	2,550.9	14.6	60/0.1			60/0.1				2,550.9 14.6 **CRYSTALLINE ROCK** Light to dark gray with brown, Migmatitic Biotite GNEISS
2545										
2540										
2535										2,532.9 32.6 Boring Terminated at Elevation 2,532.9 ft in Crystalline Rock (GNEISS)

NOTES
Rocking coring times not available

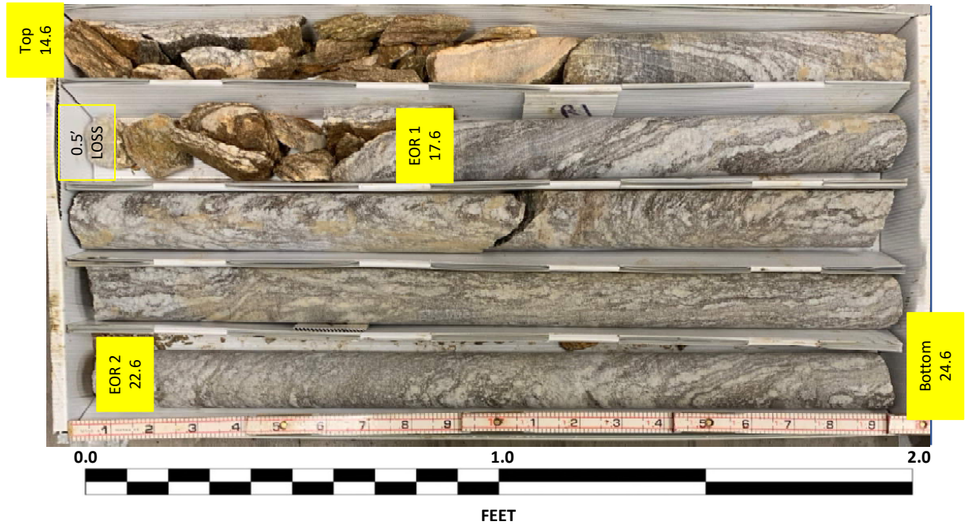
NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 8/2/21

CORE PHOTOGRAPHIC RECORD

38330.1.FS1 (B-3186/B-5898)

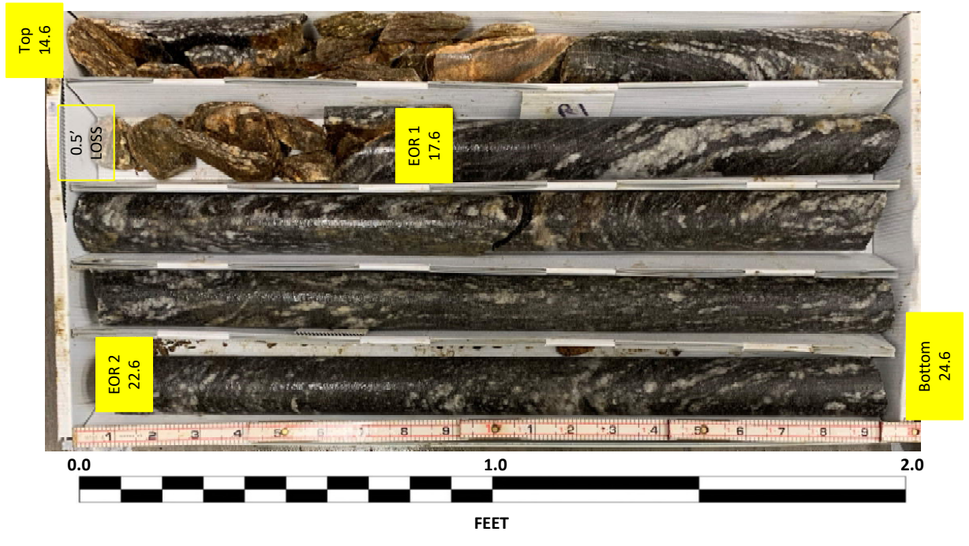
US 23/ US 74 Great Smokey Mountain Highway

S1_B2-B
Box 1 of 2: 14.6 – 24.6 FEET
DRY

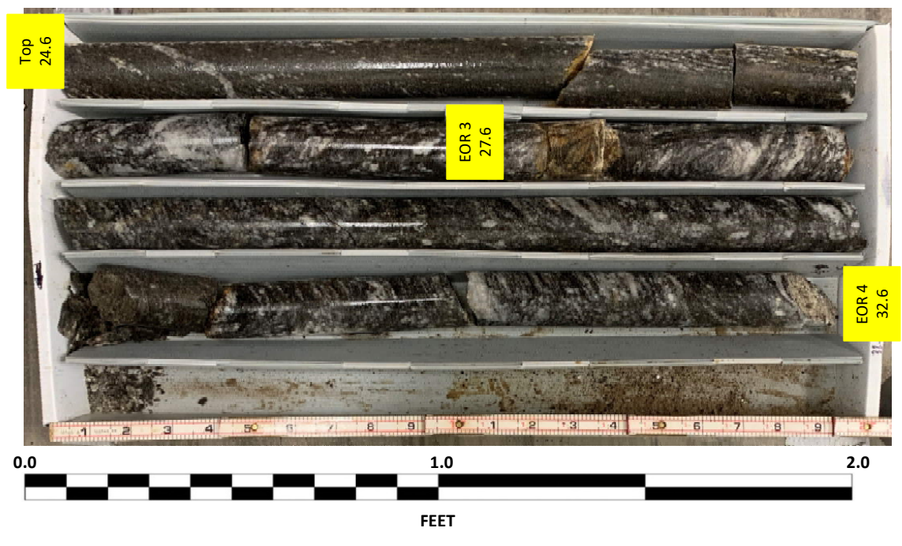


S1_B2-B
Box 2 of 2: 24.6 – 32.6 FEET
DRY

S1_B2-B
Box 1 of 2: 14.6 – 24.6 FEET
WET



S1_B2-B
Box 2 of 2: 24.6 – 32.6 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB2-A	**STATION** 44+11	**OFFSET** 46 ft LT	**ALIGNMENT** -L-	**0 HR.** 11.5
COLLAR ELEV. 2,580.0 ft	**TOTAL DEPTH** 27.0 ft	**NORTHING** 666,518	**EASTING** 818,995	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83% (09/15/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER K. Boone	**START DATE** 02/28/21	**COMP. DATE** 02/28/21	**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)
2580										2,580.0 GROUND SURFACE	0.0
	2,579.1	0.9	14	19	9	28		M		2,579.1 0.9' PAVEMENT	0.9
	2,576.5	3.5								**ROADWAY EMBANKMENT** Loose to medium dense, brown, SAND (A-3), with some gravel	
2575			6	3	4	7		M			
	2,574.2	5.8								2,574.5	5.5
			4	3	3	6		M		Soft to medium stiff, gray, SILT (A-4), contains trace root fragments, micaceous, organic odor	
	2,571.5	8.5									
2570			2	1	1	2		M			
										2,568.0	12.0
	2,566.5	13.5								Soft, gray, CLAY (A-7-6), contains trace wood fragments, micaceous	
			2	1	2	3		W			
2565										2,563.0	17.0
	2,561.5	18.5								**ALLUVIAL** Very loose, gray, SAND and GRAVEL (A-1-b)	
			4	6	12	18		W			
2560											
	2,556.5	23.5								2,558.0	22.0
			13	21	33	54		W		**RESIDUAL** Very dense, brown, orange, and white, silty SAND (A-2-4), saprolitic	
2555											
	2,553.0	27.0								2,553.0	27.0
			60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 2,553.0 ft on Crystalline Rock (GNEISS)	

NOTES
Shelby tube obtained from 6.0'-8.0'
Shelby tube obtained from 13.5'-15.5'
Rig chatter and grinding at 27.0'

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB2-C	**STATION** 43+71	**OFFSET** 5 ft RT	**ALIGNMENT** -L-	**0 HR.** 9.0
COLLAR ELEV. 2,577.1 ft	**TOTAL DEPTH** 27.5 ft	**NORTHING** 666,456	**EASTING** 819,011	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 03/10/21	**COMP. DATE** 03/10/21	**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)
2580										2,577.1 GROUND SURFACE	0.0
	2,577.1	0.0	1	2	1	3		D		**ROADWAY EMBANKMENT** Very loose to loose, red and brown, clayey SAND (A-2-6)	
2575											
	2,574.6	2.5	3	4	3	7		D			
	2,572.1	5.0								2,572.6	4.5
			2	1	2	3		D		Very loose, gray and green, silty SAND (A-2-4)	
2570	2,569.6	7.5								2,570.1	7.0
			1	1	2	3				Soft, red, gray and tan, CLAY (A-7-6), with trace sand	
	2,567.1	10.0						W			
			1	1	3	4					
2565										2,564.1	13.0
	2,562.1	15.0								**ALLUVIAL** Medium dense, gray, red, and brown, SAND and GRAVEL (A-1-b)	
			5	10	8	18		W			
2560											
	2,557.1	20.0									
			25	15	6	21		W			
2555											
	2,552.1	25.0								2,552.1	25.0
			100/0.5			100/0.5				**WEATHERED ROCK** Gray and black, granitic GNEISS	
2550	2,549.6	27.5								2,549.6	27.5
			60/0.0			60/0.0				Boring Terminated with Standard Penetration Test Refusal at Elevation 2,549.6 ft on Crystalline Rock (GNEISS)	

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S1_EB2-B	**STATION** 43+64	**OFFSET** 45 ft RT	**ALIGNMENT** -L-	**0 HR.** 16.0
COLLAR ELEV. 2,577.5 ft	**TOTAL DEPTH** 45.4 ft	**NORTHING** 666,426	**EASTING** 819,039	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 01/28/21	**COMP. DATE** 01/28/21	**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)
2580										
	2,577.5	0.0								2,577.5 — GROUND SURFACE — 0.0
	2,576.6	0.9	11	10	5	15		D		2,576.6 — **ROADWAY EMBANKMENT** 0.9' PAVEMENT — 0.9
2575	2,575.0	2.5	4	2	4	6		M		2,575.0 — **ROADWAY EMBANKMENT** Medium dense, brown and orange, SAND and GRAVEL (A-1-b) — 2.5
	2,572.5	5.0	2	4	5	9		M		2,573.0 — Loose, brown and orange, clayey SAND (A-2-6) — 4.5
2570	2,570.0	7.5	4	2	3	5	SS-5	28%		Medium stiff to stiff, brown and orange, sandy SILT (A-4)(1), micaceous
	2,567.5	10.0	5	3	4	7		M		
2565										2,564.5 — **ALLUVIAL** — 13.0
	2,562.5	15.0	9	9	6	15		▽		Medium dense, brown and gray, clayey SAND (A-2-6), with little gravel
2560										2,559.5 — **RESIDUAL** — 18.0
	2,557.5	20.0	6	12	20	32		Sat.		Dense, brown and white, SAND (A-3), contains trace rock fragments, saprolitic
2555										2,554.5 — 23.0
	2,552.5	25.0	4	7	11	18	SS-8	18%		Medium dense, brown, orange and white, clayey SAND (A-2-7)(4), contains little rock fragments, micaceous
2550										2,549.5 — 28.0
	2,547.5	30.0	52	40	45	85		D		Very dense, brown and orange with black, silty SAND (A-2-4)
2545										
	2,542.5	35.0	100/0.3			100/0.3				2,542.5 — **WEATHERED ROCK** Brown and orange, GNEISS — 35.0
2540										
	2,537.5	40.0	100/0.2			100/0.2				
2535										
	2,532.5	45.0	100/0.4			100/0.4				2,532.1 — Boring Terminated at Elevation 2,532.1 ft in Weathered Rock (GNEISS) — 45.4

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. Det_EB1	**STATION** 40+58	**OFFSET** 75 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,570.8 ft	**TOTAL DEPTH** 24.0 ft	**NORTHING** 666,164	**EASTING** 818,877	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93% (11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wansrath	**START DATE** 03/22/21	**COMP. DATE** 03/22/21	**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
2575										
	2,570.8	0.0								2,570.8 — GROUND SURFACE — 0.0
2570			1	1	1	2		M		**ARTIFICIAL FILL**
	2,568.3	2.5	10	11	7	18		Sat.		2,568.8 — Very soft, brown and orange, silty CLAY (A-7-6), micaceous — 2.0
2565	2,565.8	5.0	10	3	2	5		Sat.		Loose to medium dense, brown and gray, SAND and GRAVEL (A-1-b)
	2,563.3	7.5	3	3	4	7		M		2,563.8 — Medium stiff, brown, and tan, silty CLAY (A-7-6) — 7.0
2560	2,560.8	10.0	2	3	8	11		M		2,561.3 — **RESIDUAL** — 9.5
	2,555.8	15.0	6	8	7	15		M		Stiff, brown and orange, SILT (A-4), with trace clay, contains little rock fragments
2555										
	2,550.8	20.0	22	15	85/0.3	100/0.8				2,550.3 — **WEATHERED ROCK** Brown, GNEISS — 20.5
2550	2,546.8	24.0	60/0.0			60/0.0				2,546.8 — Boring Terminated with Standard Penetration Test Refusal at Elevation 2,546.8 ft on Crystalline Rock (GNEISS) — 24.0

NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. Det_B1	**STATION** 41+46	**OFFSET** 93 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,567.0 ft	**TOTAL DEPTH** 42.0 ft	**NORTHING** 666,223	**EASTING** 818,945	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93% (11/24/2020)		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER L. Wansrath	**START DATE** 03/17/21	**COMP. DATE** 03/17/21	**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)
2570											
	2,567.0	0.0								2,567.0 GROUND SURFACE	0.0
2565			1	0	1	1		M		**ARTIFICIAL FILL** Very loose to loose, brown, clayey SAND (A-2-6)	
	2,564.5	2.5									
			2	4	3	7		M			
	2,562.0	5.0								2,562.0	5.0
2560			2	1	5	6		W		Medium stiff, brown and gray, CLAY (A-7-6), with little gravel	
	2,559.5	7.5								2,559.5 **RESIDUAL**	7.5
			2	3	3	6		M		Medium stiff to stiff, gray and white, sandy SILT (A-4)	
	2,557.0	10.0									
2555			2	2	3	5		M			
	2,552.0	15.0									
2550			5	6	8	14		M			
	2,547.0	20.0								2,547.0	20.0
2545			57	100/0.3		100+				**WEATHERED ROCK** 2,545.0 Brown and black, GNEISS	22.0
										CRYSTALLINE ROCK Light to medium gray and white with tan, m-c grained GRANITE with trace Bitoite Gneiss zenoliths	
2540							RS-1				
2535							RS-2				
										2,532.0	35.0
2530										Light to dark gray with brown, Migmatitic Biotite GNEISS	
2525							RS-3			2,525.0	42.0
										Boring Terminated at Elevation 2,525.0 ft in Crystalline Rock (GNEISS)	

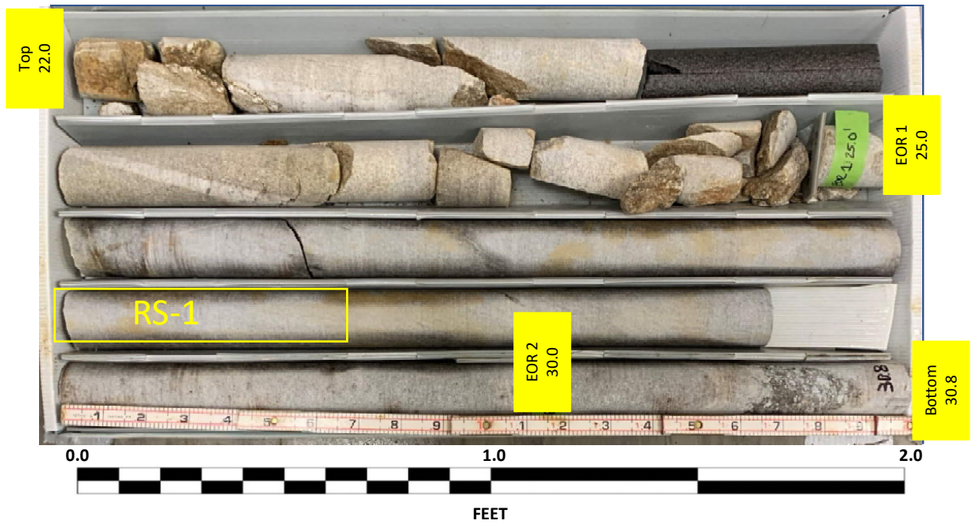
NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

CORE PHOTOGRAPHIC RECORD

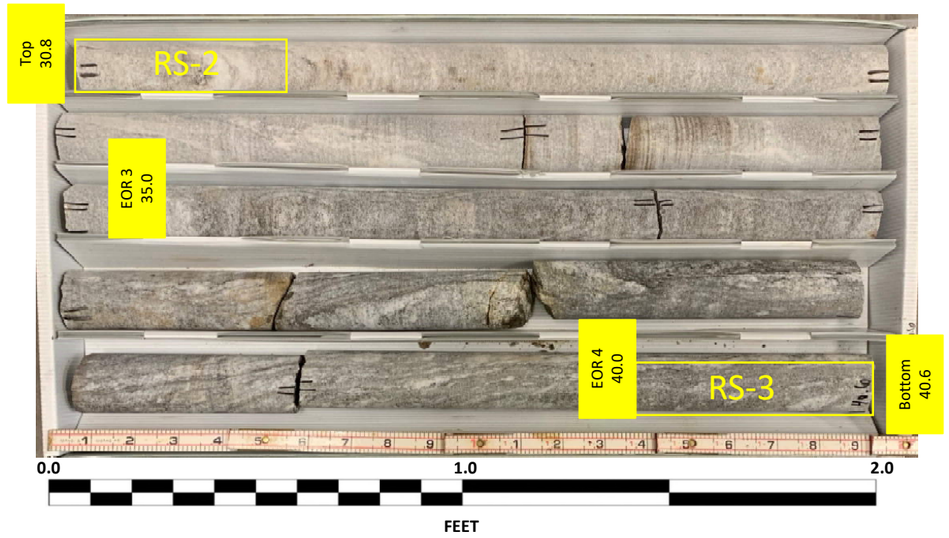
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

DET-B1
Box 1 of 3: 22.0 – 30.8 FEET
DRY



DET-B1
Box 2 of 3: 30.8 – 40.6 FEET
DRY



DET-B1
Box 1 of 3: 22.0 – 30.8 FEET
WET

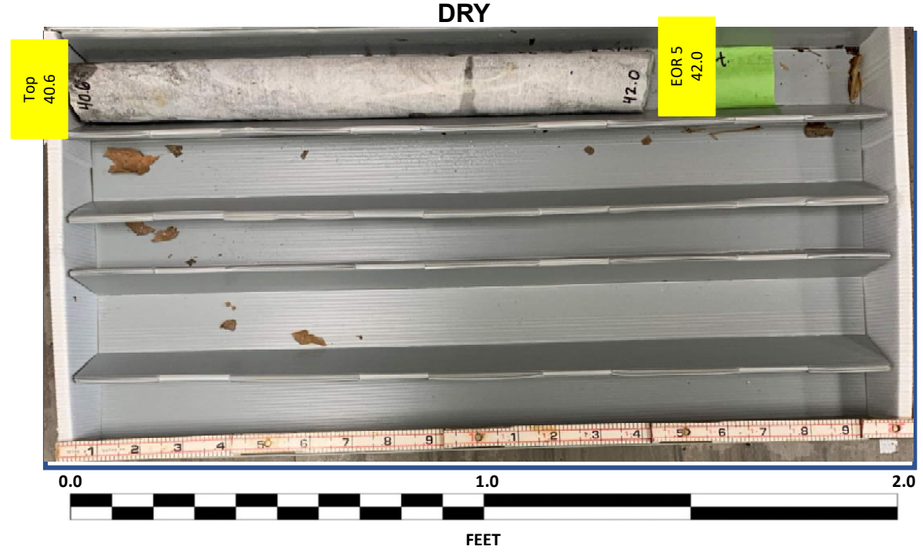
DET-B1
Box 2 of 3: 30.8 – 40.6 FEET
WET

CORE PHOTOGRAPHIC RECORD

38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

DET-B1
Box 3 of 3: 40.6 – FEET
DRY



DET-B1
Box 3 of 3: 40.6 – 42.0 FEET
WET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. Det_B2	**STATION** 42+34	**OFFSET** 113 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,568.0 ft	**TOTAL DEPTH** 49.5 ft	**NORTHING** 666,281	**EASTING** 819,014	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93% (11/24/2020)		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER L. Wansrath	**START DATE** 03/11/21	**COMP. DATE** 03/11/21	**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
2570										
	2,568.0	0.0	2	2	2	4		M		2,568.0 GROUND SURFACE 0.0
2565	2,565.5	2.5	5	10	9	19		D		**ARTIFICIAL FILL** 2,566.0 Soft, brown, clayey SILT (A-5), micaceous 2.0
	2,563.0	5.0	6	8	12	20		W		Medium dense to dense, gray, brown, and white, SAND and GRAVEL (A-1-b)
2560	2,560.5	7.5	33	15	20	35		W		
	2,558.0	10.0	4	6	6	12		W		
2555										
	2,553.0	15.0	53	58	100/0.5	100+				2,553.0 **WEATHERED ROCK** 15.0 Gray, GNEISS
2550										2,549.0 19.0
2545										**CRYSTALLINE ROCK** Light to dark gray, white, and brown, Migmatitic Biotite GNEISS interlayered with weathered rock seams and high concentrations of felsic dikes, with trace fault breccia
2540										
2535										
2530										
							RS-4			
2525										
2520										
							RS-5			2,518.5 49.5
										Boring Terminated at Elevation 2,518.5 ft in Crystalline Rock (GNEISS)

NOTES
Split spoon at 10.0' resulted in low recovery

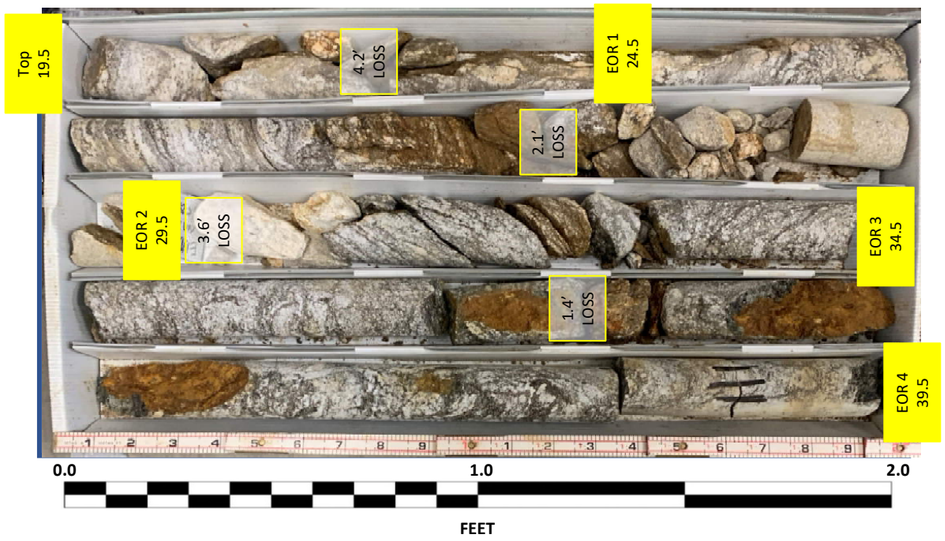
NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

CORE PHOTOGRAPHIC RECORD

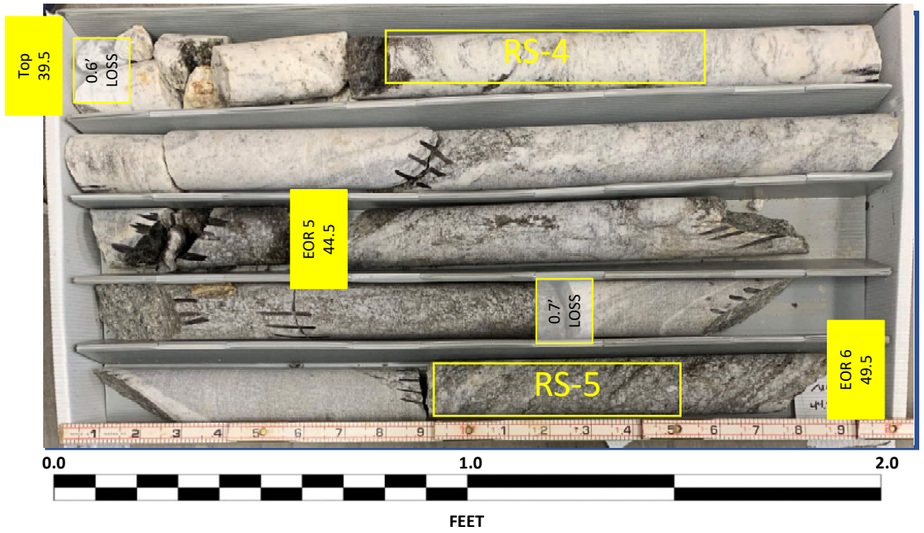
38330.1.FS1 (B-3186/B-5898)

US 23/ US 74 Great Smokey Mountain Highway

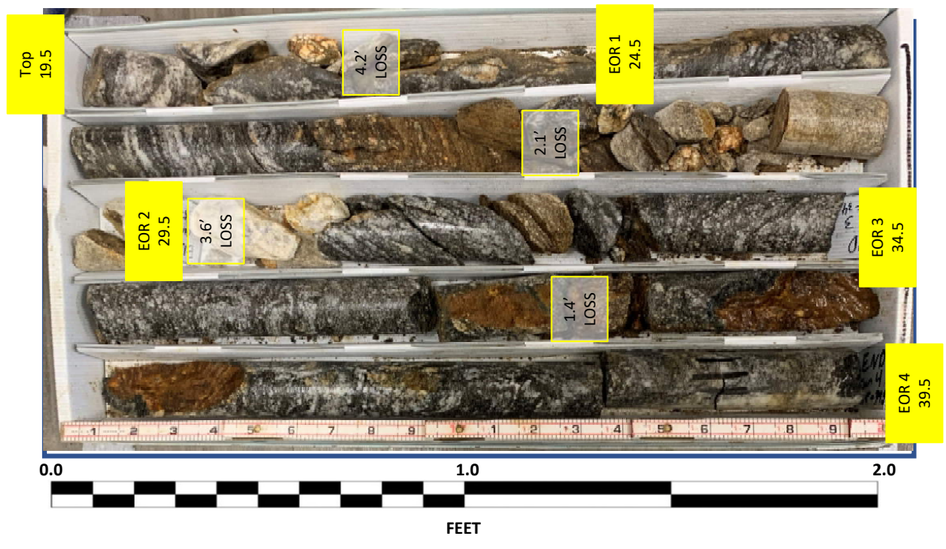
DET-B2
Box 1 of 2: 19.5 – 39.5 FEET
DRY



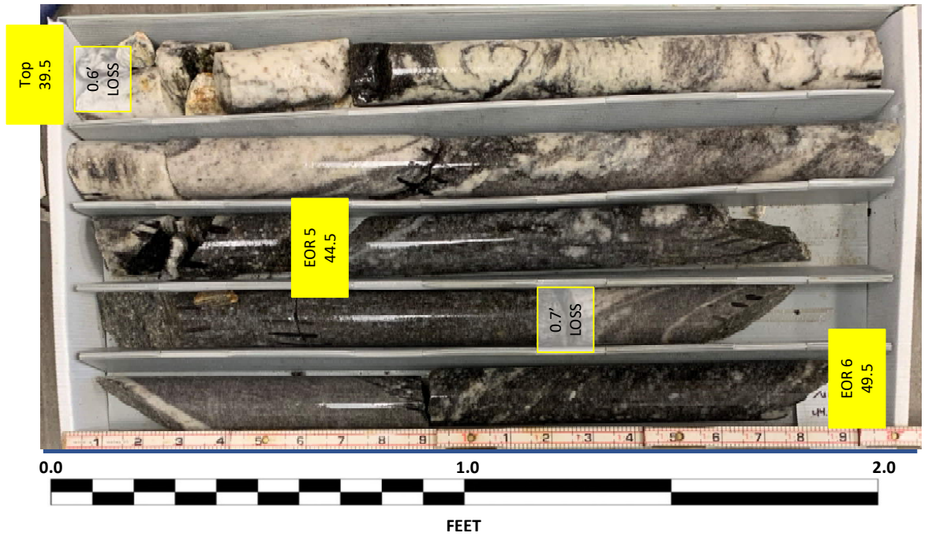
DET-B2
Box 2 of 2: 39.5 – 49.5 FEET
DRY



DET-B2
Box 1 of 2: 19.5 – 39.5 FEET
WET



DET-B2
Box 2 of 2: 39.5 – 49.5 FEET
WET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. Det_EB2	**STATION** 43+52	**OFFSET** 121 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,584.5 ft	**TOTAL DEPTH** 43.3 ft	**NORTHING** 666,370	**EASTING** 819,092	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC8255 CME-55 93% (11/24/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER L. Wansrath	**START DATE** 03/11/21	**COMP. DATE** 03/11/21	**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)
2585	2,584.5	0.0								2,584.5 GROUND SURFACE	0.0
			3	2	2	4		D		**ARTIFICIAL FILL**	
	2,582.0	2.5								2,582.5 Soft, red and brown, sandy CLAY (A-6), micaceous	2.0
2580			1	1	2	3		D		Very loose to loose, red, brown, and gray, clayey SAND (A-2-6), micaceous	
	2,579.5	5.0									
			2	3	4	7		D		2,577.5	7.0
	2,577.0	7.5								Loose, red, brown, and gray, silty SAND (A-2-4), micaceous	
2575			4	3	3	6		D			
	2,574.5	10.0									
			2	2	2	4		M		2,571.5	13.0
2570	2,569.5	15.0								Soft, gray, clayey SILT (A-5), micaceous	
			1	1	2	3		M			
2565										2,566.5	18.0
	2,564.5	20.0								Soft, gray, lean CLAY (A-7-6)	
			1	1	3	4		M			
2560										2,561.5	23.0
	2,559.5	25.0								Very dense, gray, white and tan, SAND and GRAVEL (A-1-b)	
			14	86	24/0.5	100+				2,559.0	25.5
2555	2,554.5	30.0								**WEATHERED ROCK** Gray, white, and tan, GNEISS	
			15	9	11	20				2,556.5	28.0
										RESIDUAL Very stiff to hard, white, gray, tan and brown, SILT (A-4), micaceous, saprolitic	
2550	2,549.5	35.0	8	15	16	31					
2545	2,544.5	40.0	6	7	25	32					
	2,541.3	43.2	60/0.1			60/0.1				2,541.3	43.2
										2,541.2 **CRYSTALLINE ROCK** Gray, white, and brown, GNEISS	43.3
										Boring Terminated with Standard Penetration Test Refusal at Elevation 2,541.2 ft in Crystalline Rock (GNEISS)	

NOTES

Offset and augered down to 18.0' for shelby tube sample

NCDOT BORE DOUBLE B3186_GEO_SPT.GPJ NC_DOT.GDT 7/28/21

REPORT ON SAMPLES OF: Rock For Quality

PROJECT:	B-3186 / B-5898	COUNTY:	Haywood
DATE SAMPLED:	05/11/2021	RECEIVED:	5/11/2021
SAMPLED FROM:	Test Borings	REPORTED:	5/12/2021
SUBMITTED BY:	HDR	BY / CERT NO:	Kevin E. Walker

BORING NO	SAMPLE	DEPTH (FT)	ROCK TYPE	LENGTH (IN)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)
S1_B1-A	RS-6	11.0-11.5	Biotite Gneiss	4.16	1.86	175.8	18,520
S1_B1-A	RS-7	16.8-17.5	Migmatitic Biotite Gneiss	3.49	1.86	173.40	10,027
S1_B1-B	RS-8	32.1-32.5	Migmatitic Biotite Gneiss	4.17	1.87	172.90	10,268
S1_B1-C	RS-9	39.4-40.0	Migmatitic Biotite Gneiss	4.14	1.87	171.40	13,205
S1_B2-A	RS-10	20.0-20.8	Migmatitic Biotite Gneiss	4.15	1.87	171.50	9,796
S1_B2-C	RS-11	33.5-34.1	Biotite Gneiss	4.16	1.86	173.10	3,264
DET_B1	RS-1	27.0-27.7	Granite	4.17	1.86	165.5	22,108
DET_B1	RS-2	30.8-31.3	Granite	4.19	1.86	165.1	20,364
DET_B1	RS-3	40.1-40.6	Migmatitic Biotite Gneiss	4.11	1.86	170.4	16,519
DET_B2	RS-4	40.2-41.0	Migmatitic Biotite Gneiss	4.25	1.87	170.3	8,866
DET_B2	RS-5	48.5-49.0	Migmatitic Biotite Gneiss	4.24	1.87	169.5	8,389

REFERENCE: B-3186/B-5898

PROJECT: 38332/48030

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3186/B-5898	1	5

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *HAYWOOD*

PROJECT DESCRIPTION *US 23/US 74/US 19 (GREAT SMOKY MOUNTAIN HWY) FROM WEST OF NC 209(CRABTREE RD.) TO EAST OF RUSS AVE.*

SITE DESCRIPTION *RETAINING WALL #1 FROM -L_LT- STA. 48+60.08 TO 49+09.03*

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4	PROFILE
5	BORE LOGS

CAUTION NOTICE

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

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

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

PERSONNEL

C. SWAFFORD

GEOTECHNOLOGY, INC.

INVESTIGATED BY *C. SWAFFORD*

DRAWN BY *T. LYNN*

CHECKED BY *K. BUSSEY*

SUBMITTED BY *HDR*

DATE *NOVEMBER 2021*

HDR Engineering, Inc. of the Carolinas
555 Fayetteville St, Suite 900 Raleigh, N.C. 27601
N.C.B.E.L.S. License Number: F-0116

NORTH CAROLINA PROFESSIONAL SEAL 038206 ENGINEER KENNETH R. BUSSEY, JR.

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-75
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: N/A

ELEVATION: FEET

NOTES:

BORING ELEVATIONS OBTAINED FROM TRIMBLE RI2 GNSS RECEIVER CERTIFIED WITH FCC PART 15 (CLASS B DEVICE), 24, 32; RCM; PTCRB; BT SIG

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	3

SITE PLAN

0 50 100
FEET

NAD 83/2011

–RW1– STA. 48+53.66 =
–RW5– STA. 26+21.86 =
–L_LT– STA. 48+60.08 47.5' LT
–Y1RT– STA. 26+21.97 24.5' RT
EL. 2609.74' BEGIN WALL

–RW1– STA. 49+10.40 =
–L_LT– STA. 49+09.03 47.5' LT
EL. 2609.74'
END WALL

S2_EBI-A
S2_EBI-B
–RW1–
–RW4–
–Y1LT–
–Y1RT–
–RW5–
–L LT–
–L–
–L RT–
–RW2–
–RW3–
25+00
50+00
55+00
30+00
WBL
WEL
EEL
EBYI-25
EBYI-22
HILL ROAD
PRIVATE ROAD
EXISTING R/W
MTL GUARD RAIL
PAVED DITCH
HEDGE
WOODS
MASONRY WALL
ELECTRIC PANELS
ISMTL BUS
ISMTLBUS
ISF
CONC
SHRUBS
INV=2574.93'
INV=2575.69'
TOP=2580.84'
INV=2576.57'
INV=2575.42'
INV=2570.50'
INV=2579.53'
INV=2582.88'
INV=2605.98'
INV=2611.06'

SOIL TEST RESULTS

	SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
-Y1RT-	SS-3009	44' RT	25+96	38.9' - 40.4	A-4	37	8	26.8	36.0	25.4	11.8	86.6	72.3	36.7	43	-
-Y1RT-	SS-513	5' LT	26+29	10.0' - 11.5'	A-5 (9)	48	10	4.1	32.5	49.9	13.5	100.0	98.0	74.1	51	-
-Y1RT-	ST-4	5' LT	26+29	15.0' - 17.0'	A-2-4	27	6	41.2	30.8	7.0	21.0	94.4	66.3	31.2	28	-

0 50 100
FEET
VE = 1:5

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	4

-RW1- PROFILE

-RW1- STA. 48+53.66 =
-RW5- STA. 26+21.86 =
-L_LT- STA. 48+60.08 47.5' LT
-Y1RT- STA. 26+21.97 24.5' RT
EL. 2609.74' BEGIN WALL

-RW1- STA. 49+10.40 =
-L_LT- STA. 49+09.03 47.5' LT
EL. 2609.74'
END WALL

-RW1- STA. 48+53.66 =
-RW5- STA. 26+21.86 =
-L_LT- STA. 48+60.08 47.5' LT
-Y1RT- STA. 26+21.97 24.5' RT
EL. 2592.97' BEGIN WALL

-RW1- STA. 49+10.40 =
-L_LT- STA. 49+09.03 47.5' LT
EL. 2595.09'
END WALL

S2_EBI-B
4' RT
SS-3009

S2_EBI-A
14' LT
SS-513
ST-4

10' PAVEMENT

EXISTING GROUND

ST-4

02/21

FIAD
BT

FIAD
AR

-RW1-

2,620
2,610
2,600
2,590
2,580
2,570
2,560
2,550
2,540

48+00
49+00

(A) ROADWAY EMBANKMENT: Loose to dense, brown and gray, GRAVEL and SAND (A-1-b, A-2-4)

(B) ROADWAY EMBANKMENT: Soft to medium stiff, brown, orange and black, CLAY and clayey SILT (A-5, A-7) with trace fine Sand

(C) ALLUVIAL: Very loose to loose, gray, fine to coarse silty SAND and SAND (A-2-4, A-3), micaceous

(D) ALLUVIAL: Very soft to soft, gray, sandy CLAY and sandy SILTS (A-4, A-7), micaceous, trace wood fragments

(E) RESIDUAL: Very stiff to hard, tan, brown and orange, sandy CLAY and sandy SILT (A-4, A-7), micaceous, saprolitic, trace rock fragments

(F) WEATHERED ROCK: Brown, orange and white, GNEISS

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S2_EB1-B	**STATION** 25+96	**OFFSET** 44 ft RT	**ALIGNMENT** -Y1RT-	**0 HR.** 22.0
COLLAR ELEV. 2,600.4 ft	**TOTAL DEPTH** 60.4 ft	**NORTHING** 666,863	**EASTING** 819,251	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83%(09/15/2020)		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER K. Boone	**START DATE** 02/27/21	**COMP. DATE** 02/27/21	**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)
2605											
2600	2,599.4	1.0	11	20	16	36		M		2,600.4 GROUND SURFACE	0.0
										2,599.4 **ROADWAY EMBANKMENT** 1.0' PAVEMENT	1.0
	2,596.5	3.9	6	4	4	8		M		2,596.9 **ROADWAY EMBANKMENT** Dense, brown, GRAVEL (A-1-b)	3.5
2595	2,594.6	5.8	6	3	3	6		M		Medium stiff, orange and brown with black, clayey SILT (A-5), with trace sand	
	2,591.5	8.9	4	3	4	7		M			
2590											
	2,586.5	13.9	3	2	3	5		M			
2585											
	2,581.5	18.9	3	3	4	7		M			
2580								▽		2,578.4 **ALLUVIAL**	22.0
	2,576.5	23.9	4	4	5	9		W		Very loose to loose, gray, SAND (A-3), micaceous	
2575											
	2,571.5	28.9	3	3	1	4		W			
2570											
	2,566.5	33.9	1	3	3	6		W			
2565											
	2,561.5	38.9	WOH	1	2	3	SS-3009	43%		2,568.4 Soft to medium stiff, gray, sandy SILT (A-4), contains trace wood fragments, micaceous, organic odor	32.0
2560										2,558.4 **RESIDUAL**	42.0
	2,556.5	43.9	18	27	33	60		W		Hard, tan and brown, sandy CLAY (A-7), contains trace rock fragments, micaceous, saprolitic	
2555											
	2,551.5	48.9	32	68/0.3		100/0.8				2,551.5 **WEATHERED ROCK** Brown, GNEISS, micaceous	48.9
2550											
	2,546.5	53.9	86	14/0.0		100/0.5					
2545											
	2,541.5	58.9	79	21/0.0		100/0.5				2,540.0 Boring Terminated at Elevation 2,540.0 ft in Weathered Rock (GNEISS)	60.4
2540											

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** C. Swafford	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S2_EB1-A	**STATION** 26+29	**OFFSET** 5 ft LT	**ALIGNMENT** -Y1RT-	**0 HR.** 13.0
COLLAR ELEV. 2,584.6 ft	**TOTAL DEPTH** 34.5 ft	**NORTHING** 666,917	**EASTING** 819,274	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80%(11/24/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER L. Wanstrath	**START DATE** 02/25/21	**COMP. DATE** 02/25/21	**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	
2585											
	2,584.6	0.0	5	7	4	11		M		2,584.6 GROUND SURFACE	0.0
	2,582.1	2.5	3	4	4	8		M		2,583.6 **ROADWAY EMBANKMENT** Medium dense, brown, f SAND (A-2-4), with trace gravel	1.0
2580	2,579.6	5.0	6	5	6	11		M		2,580.1 Soft, brown and orange, CLAY (A-7)	4.5
	2,577.1	7.5	3	3	3	6		Sat.		Loose to medium dense, gray, f-c SAND (A-2-4)	
2575	2,574.6	10.0	3	2	2	4	SS-513	51%		2,574.6 **ALLUVIAL**	10.0
								▽		Soft, gray, SILT (A-5)(9), micaceous	
2570	2,569.6	15.0	1	WOH	1	1		W		2,571.6 Very loose, gray, f silty SAND (A-2-4), micaceous	13.0
								28%			
2565	2,564.6	20.0	1	1	2	3		W		2,566.6 Soft, gray, f sandy SILT (A-4), micaceous	18.0
										2,561.6 **RESIDUAL**	23.0
2560	2,559.6	25.0	4	7	11	18		W		Very stiff, brown and orange, f sandy SILT (A-4), micaceous, saprolitic	
2555	2,554.6	30.0	90	10/0.1		100/0.6				2,554.6 **WEATHERED ROCK** Brown, orange, and white, GNEISS	30.0
	2,550.1	34.5	60/0.0			60/0.0				2,550.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 2,550.1 ft on Crystalline Rock (GNEISS)	34.5

Other Samples:
ST-4 (15.0 - 17.0)

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-3186/B-5898	1	6

REFERENCE: B-3186/B-5898

PROJECT: 38332/48030

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *HAYWOOD*

PROJECT DESCRIPTION *US 23/US 74/US 19 (GREAT SMOKY MOUNTAIN HWY) FROM WEST OF NC 209 (CRABTREE RD) TO EAST OF RUSS AVE.*

SITE DESCRIPTION *RETAINING WALL #2 FROM -L_RT- STA. 51+62.74 TO 53+56.35*

CONTENTS

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

CAUTION NOTICE

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

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

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

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

PERSONNEL

N. YACOBI

R. DUGGER

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INVESTIGATED BY *C. SWAFFORD*

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DATE *NOVEMBER 2021*

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SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

RECOMMENDATION SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [X] CME-75
- [ ] _____

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

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

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

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: N/A

ELEVATION: FEET

NOTES:

BORING ELEVATIONS OBTAINED USING b3186_br0022_r4047_Merged_1-12-21.tin

SITE 2 BORING ELEVATIONS OBTAINED FROM TRIMBLE R12 CNSS RECEIVER CERTIFIED WITH FCC PART 15 (CLASS B DEVICE), 24, 32; RCM; PTCRB; BT SIG

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

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SITE PLAN

0 50 100
FEET

NAD 83/2011

–RW2– POC STA. 53+33.39 =
–RW3– POT STA. 29+39.51
–Y1RT– POC STA. 29+39.51 15.61' RT =
–L_RT– STA. 51+68.50 66.0' RT

–RW2– STA. 53+50.20 =
–L_RT– STA. 53+56.35 52.0' RT

BM #2
-EBL- STA 49+11
[illegible]' LEFT
ELEV.= 2615.00'

S2_EB2-A
RW2_3
RW2_4

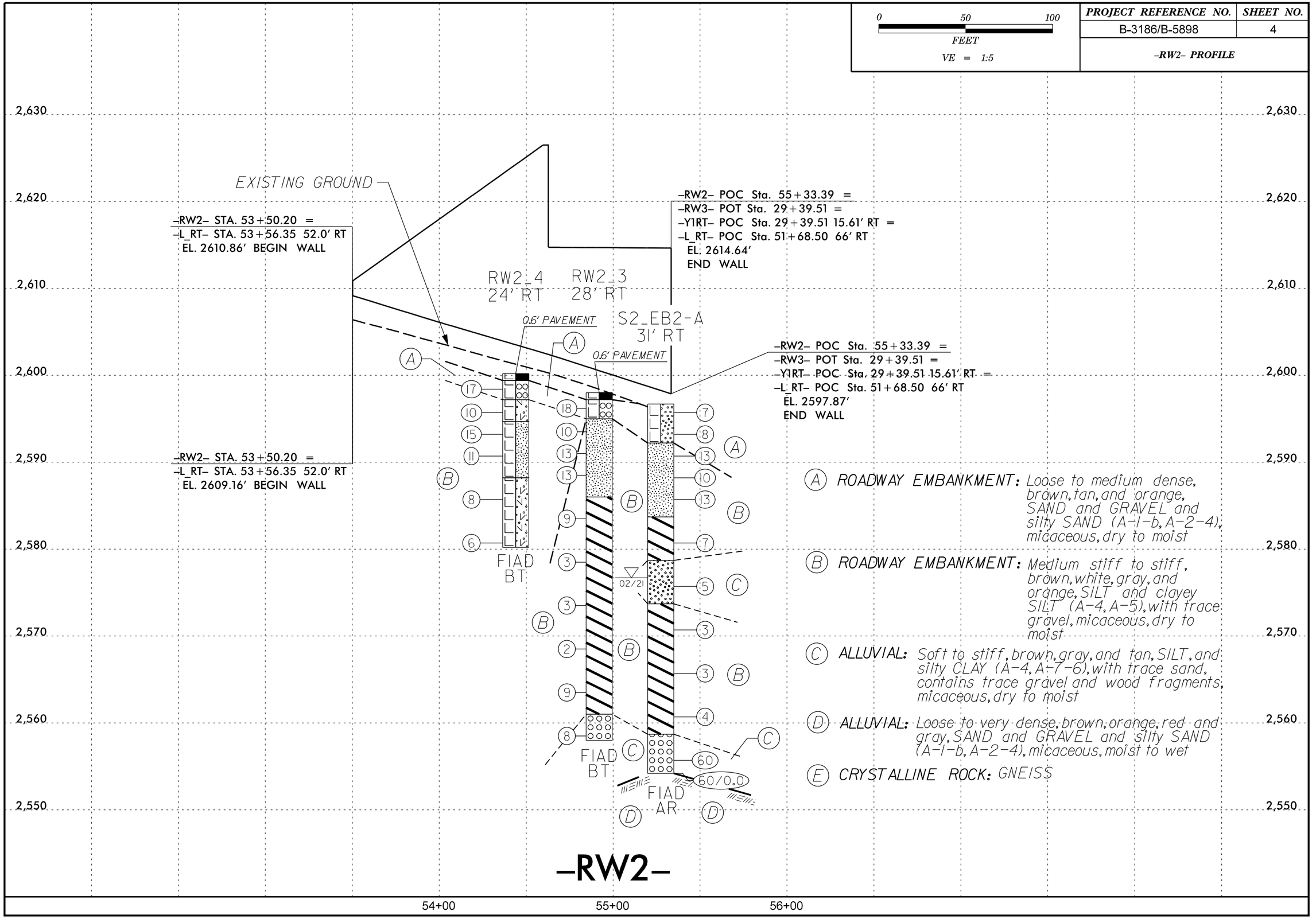
–RW1–
–L LT–
–L–
–L RT–
–RW2–
–RW3–
–RW4–
–Y1–

30+00
50+00
55+00

EBY1-22
GPS 101
WOODS
HEDGE
PAVED DITCH
EXISTING R/W
DISH
CONC DUMPSTER PAD
18" C & G
GR
4' CHL GATE
6" CHL & SBW
CONC PAD
CONC SW
BST
BUS
EIP
CB
ICB
LT
24" CMP
MTL GAURD RAIL
JS
OVH WIRE HGT

PROJECT REFERENCE NO.	SHEET NO.
B-3186/B-5898	4
–RW2– PROFILE	

0 50 100
FEET
VE = 1:5



(A) ROADWAY EMBANKMENT: Loose to medium dense, brown, tan, and orange, SAND and GRAVEL and silty SAND (A-1-b, A-2-4), micaceous, dry to moist

(B) ROADWAY EMBANKMENT: Medium stiff to stiff, brown, white, gray, and orange, SILT and clayey SILT (A-4, A-5), with trace gravel, micaceous, dry to moist

(C) ALLUVIAL: Soft to stiff, brown, gray, and tan, SILT, and silty CLAY (A-4, A-7-6), with trace sand, contains trace gravel and wood fragments, micaceous, dry to moist

(D) ALLUVIAL: Loose to very dense, brown, orange, red and gray, SAND and GRAVEL and silty SAND (A-1-b, A-2-4), micaceous, moist to wet

(E) CRYSTALLINE ROCK: GNEISS

–RW2–

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION Retaining Wall No. 2 from -L_RT- STA 51+63 to 53+56				**GROUND WTR (ft)**
BORING NO. RW2_4	**STATION** 54+44	**OFFSET** 24 ft RT	**ALIGNMENT** -RW2-	**0 HR.** Dry
COLLAR ELEV. 2,600.2 ft	**TOTAL DEPTH** 20.0 ft	**NORTHING** 667,055	**EASTING** 819,630	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83%(09/15/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER K. Boone	**START DATE** 02/10/21	**COMP. DATE** 02/11/21	**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))
2605										
2600	2,599.4	0.8	15	11	6	17		D		2,600.2 GROUND SURFACE 0.0 2,599.4 0.8' PAVEMENT 0.8 **ROADWAY EMBANKMENT** 2,597.2 Medium dense, brown and tan, SAND and GRAVEL (A-1-b) 3.0
	2,596.7	3.5	6	5	5	10		M		2,594.7 Stiff, brown and white, clayey SILT (A-5) 5.5
2595	2,594.2	6.0	8	7	8	15		D		Stiff to very stiff, brown and gray, SILT (A-4), with trace gravel, micaceous
	2,591.7	8.5	4	5	6	11		D		
2590										
	2,586.7	13.5	2	4	4	8		M		2,588.2 12.0 Medium stiff to stiff, gray, brown, and orange, clayey SILT (A-5), with trace gravel, micaceous
2585	2,581.7	18.5	3	3	3	6		M		2,580.2 20.0 Boring Terminated at Elevation 2,580.2 ft in SILT

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** N. Yacobi	
SITE DESCRIPTION Retaining Wall No. 2 from -L_RT- STA 51+63 to 53+56				**GROUND WTR (ft)**
BORING NO. RW2_3	**STATION** 54+92	**OFFSET** 28 ft RT	**ALIGNMENT** -RW2-	**0 HR.** Dry
COLLAR ELEV. 2,598.0 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 667,028	**EASTING** 819,591	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC3277 CME-75 83%(09/15/2020)		**DRILL METHOD** H.S. Augers	**HAMMER TYPE** Automatic	
DRILLER K. Boone	**START DATE** 02/10/21	**COMP. DATE** 02/10/21	**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
2600										2,598.0 GROUND SURFACE 0.0
	2,597.2	0.8	9	12	6	18		D		2,597.2 0.8' PAVEMENT 0.8 **ROADWAY EMBANKMENT**
2595	2,594.5	3.5	5	5	5	10		D		2,595.0 Medium dense, brown, SAND and GRAVEL (A-1-b), micaceous 3.0
	2,592.0	6.0	5	6	7	13		D		**ALLUVIAL** Stiff, brown and tan, SILT (A-4), with trace sand and gravel, micaceous
2590	2,589.5	8.5	7	6	7	13		D		
2585	2,584.5	13.5	4	4	5	9		M		2,586.0 12.0 Soft to stiff, gray, silty CLAY (A-7-6), with trace sand, micaceous
2580	2,579.5	18.5	2	1	2	3		M		
2575	2,574.5	23.5	1	1	2	3		M		
2570	2,569.5	28.5	1	1	1	2		M		
2565	2,564.5	33.5	0	4	5	9		M		2,561.0 37.0 Loose, brown, orange, and red, SAND and GRAVEL (A-1-b)
2560	2,559.5	38.5	0	3	5	8		W		2,558.0 40.0 Boring Terminated at Elevation 2,558.0 ft in SAND and GRAVEL

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 38332.1.FS1	**TIP** B-3186 / B-5898	**COUNTY** HAYWOOD	**GEOLOGIST** R. Dugger	
SITE DESCRIPTION US 23/ US 74 (Great Smoky Mountain Highway)				**GROUND WTR (ft)**
BORING NO. S2_EB2-A	**STATION** 29+30	**OFFSET** 14 ft LT	**ALIGNMENT** -Y1RT-	**0 HR.** 20.0
COLLAR ELEV. 2,596.7 ft	**TOTAL DEPTH** 42.5 ft	**NORTHING** 667,001	**EASTING** 819,562	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE GTC9083 CME-550X 80% (11/24/2020)		**DRILL METHOD** H.S. Augers		**HAMMER TYPE** Automatic
DRILLER L. Wanstrath	**START DATE** 02/10/21	**COMP. DATE** 02/10/21	**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
2600										ELEV. (ft) DEPTH (ft)
	2,596.7	0.0								2,596.7 GROUND SURFACE 0.0
2595	2,594.2	2.5	2	3	4	7		M		**ROADWAY EMBANKMENT** Loose, brown and orange, f-c silty SAND (A-2-4), with little gravel
	2,591.7	5.0	3	4	4	8		D		2,592.2 4.5
2590	2,589.2	7.5	3	6	7	13		D		**ALLUVIAL** Stiff, brown and orange, SILT (A-4), micaceous
	2,586.7	10.0	4	4	6	10		D		
2585	2,581.7	15.0	7	6	7	13		D		2,583.7 13.0 Medium stiff, brown and gray, f silty CLAY (A-7-6), micaceous
2580	2,576.7	20.0	3	3	4	7		M		2,578.7 18.0 Loose, brown and gray, f-c silty SAND (A-2-4), micaceous
2575	2,571.7	25.0	3	3	2	5		M		2,573.7 23.0 Soft to medium stiff, gray, CLAY (A-7-6), contains trace wood fragments, micaceous
2570	2,566.7	30.0	1	1	2	3		M		
2565	2,561.7	35.0	1	1	2	3		M		
2560	2,556.7	40.0	1	2	2	4		M		2,558.7 38.0 Very dense, gray, SAND and GRAVEL (A-1-b)
2555	2,554.2	42.5	9	25	35	60		W		2,554.2 42.5 Boring Terminated with Standard Penetration Test Refusal at Elevation 2,554.2 ft on Crystalline Rock (GNEISS). A.R. at a depth of 42.5'.
			60/0.0			60/0.0				