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REFERENCE: B-4447

PROJECT: 38371

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

**STRUCTURE**  
**SUBSURFACE INVESTIGATION**

COUNTY BURKE  
PROJECT DESCRIPTION BRIDGES 160 & 162 ON I-40  
OVER SR 1758 (BEREA CHURCH ROAD)

**CONTENTS**

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4, 5	PROFILES
6, 7	CROSS SECTIONS
8-11	BORE LOGS
12	SITE PHOTOGRAPH

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4447	1	12

**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.
  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. MOHS, LG

E. MAYR, PE

TRIGON

E. ESTEP

T. PRESTON

INVESTIGATED BY N. MOHS, LG

DRAWN BY N. MOHS, LG

CHECKED BY D. BROWN, PE

SUBMITTED BY N. MOHS, LG

DATE JANUARY 2016



DocuSigned by  
*Nathan Daniel Mohs*

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1/28/2016

SIGNATURE

DATE

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

**SOIL DESCRIPTION**

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 208, 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			
	A-1	A-3	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5
GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 35 MX	40 MX 35 MX	41 MN 35 MX	41 MN 35 MX	40 MX 36 MN	41 MN 36 MN	40 MX 36 MN	41 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT	
MATERIAL PASSING #40 LL PI	-	-	40 MX 10 MN	41 MN 10 MN	41 MN 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 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	UNSATURABLE					

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 RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )
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 OPENING (MM)	4	10	40	60	200	270
	4.75	2.00	0.42	0.25	0.075	0.053
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CS, SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						
GRAIN SIZE	305	75	2.0	0.25	0.05	0.005
MM						
IN.	12	3				

**SOIL MOISTURE - CORRELATION OF TERMS**

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

	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
- 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
- DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

**RECOMMENDATION SYMBOLS**

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

**ABBREVIATIONS**

- AR - AUGER REFUSAL
- 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
- W - UNIT WEIGHT
- W<sub>d</sub> - DRY UNIT WEIGHT
- S - BULK
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RS - ROCK
- RT - RECOMPACTED TRIAXIAL
- CBR - CALIFORNIA BEARING RATIO

**EQUIPMENT USED ON SUBJECT PROJECT**

- DRILL UNITS:
  - CME-45C
  - CME-55
  - CME-550
  - VANE SHEAR TEST
  - PORTABLE HOIST
  - B-57
- ADVANCING TOOLS:
  - CLAY BITS
  - 6" CONTINUOUS FLIGHT AUGER
  - 8" HOLLOW AUGERS
  - HARD FACED FINGER BITS
  - TUNG-CARBIDE INSERTS
  - CASING  W/ ADVANCER
  - TRICONE 2 7/8" STEEL TEETH
  - TRICONE " TUNG-CARB.
  - CORE BIT
- HAMMER TYPE:
  - 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 IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

**WEATHERING**

- FRESH** - ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
- VERY SLIGHT (IV SLI.)** - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
- SLIGHT (SLI.)** - ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
- MODERATE (MOD.)** - SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
- MODERATELY SEVERE (MOD. SEV.)** - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *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 (IV SEV.)** - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *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 GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
- SOFT** - CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
- VERY SOFT** - CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.

**FRACTURE SPACING**

TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

**INDURATION**

- FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.**
- FRIABLE** - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
- MODERATELY INDURATED** - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
- INDURATED** - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
- EXTREMELY INDURATED** - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

**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 DISLOADED FROM PARENT MATERIAL.
- FLOOD PLAIN (FP)** - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.
- FORMATION (FM)** - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
- JOINT** - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
- LEDGE** - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
- LENS** - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.
- MOTTLED (MOT.)** - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
- PERCHED WATER** - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
- RESIDUAL (RES.) SOIL** - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
- ROCK QUALITY DESIGNATION (ROD)** - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.
- SAPROLITE (SAP.)** - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.
- SILL** - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
- SLICKENSIDE** - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.
- STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)** - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
- STRATA CORE RECOVERY (SREC.)** - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
- STRATA ROCK QUALITY DESIGNATION (SROD)** - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
- TOPSOIL (TS.)** - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

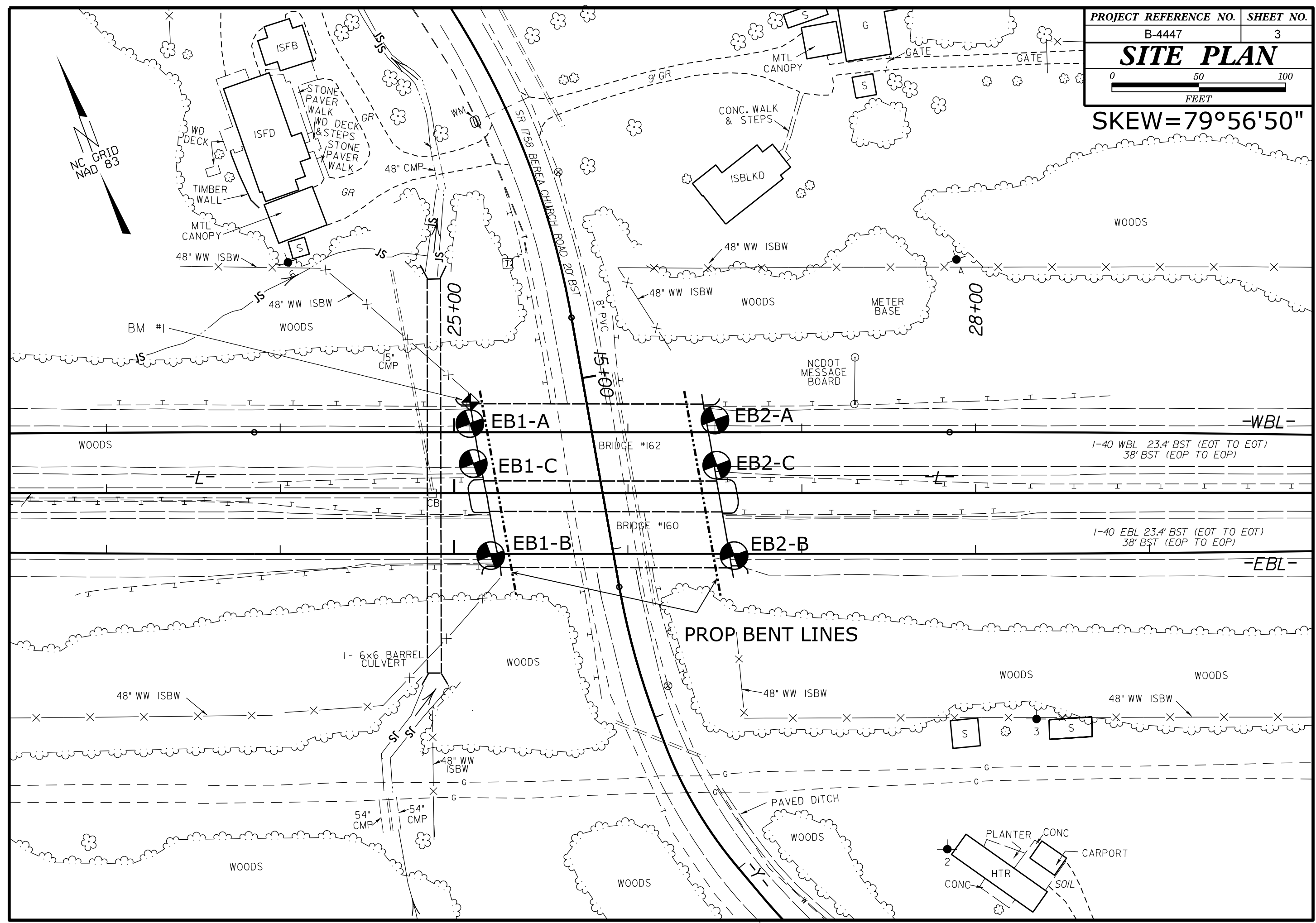
BENCH MARK: BM #1: -L- STATION 25+09, 52' LT

ELEVATION: 1209.55 FEET

**NOTES:**

ALL STATIONING AND OFFSETS ARE IN RELATION TO -L-

**SKEW=79°56'50"**



EB1-A

EB2-A

EB1-C

EB2-C

EB1-B

EB2-B

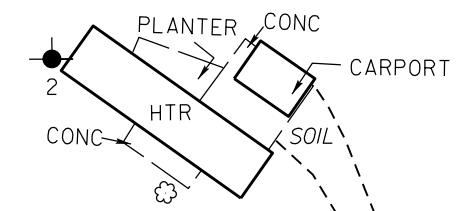
**PROP BENT LINES**

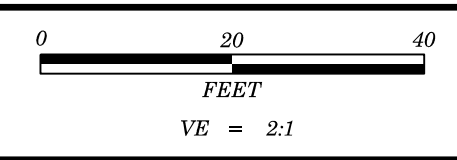
-WBL-

1-40 WBL 23.4' BST (EOT TO EOT)  
38' BST (EOP TO EOP)

1-40 EBL 23.4' BST (EOT TO EOT)  
38' BST (EOP TO EOP)

-EBL-

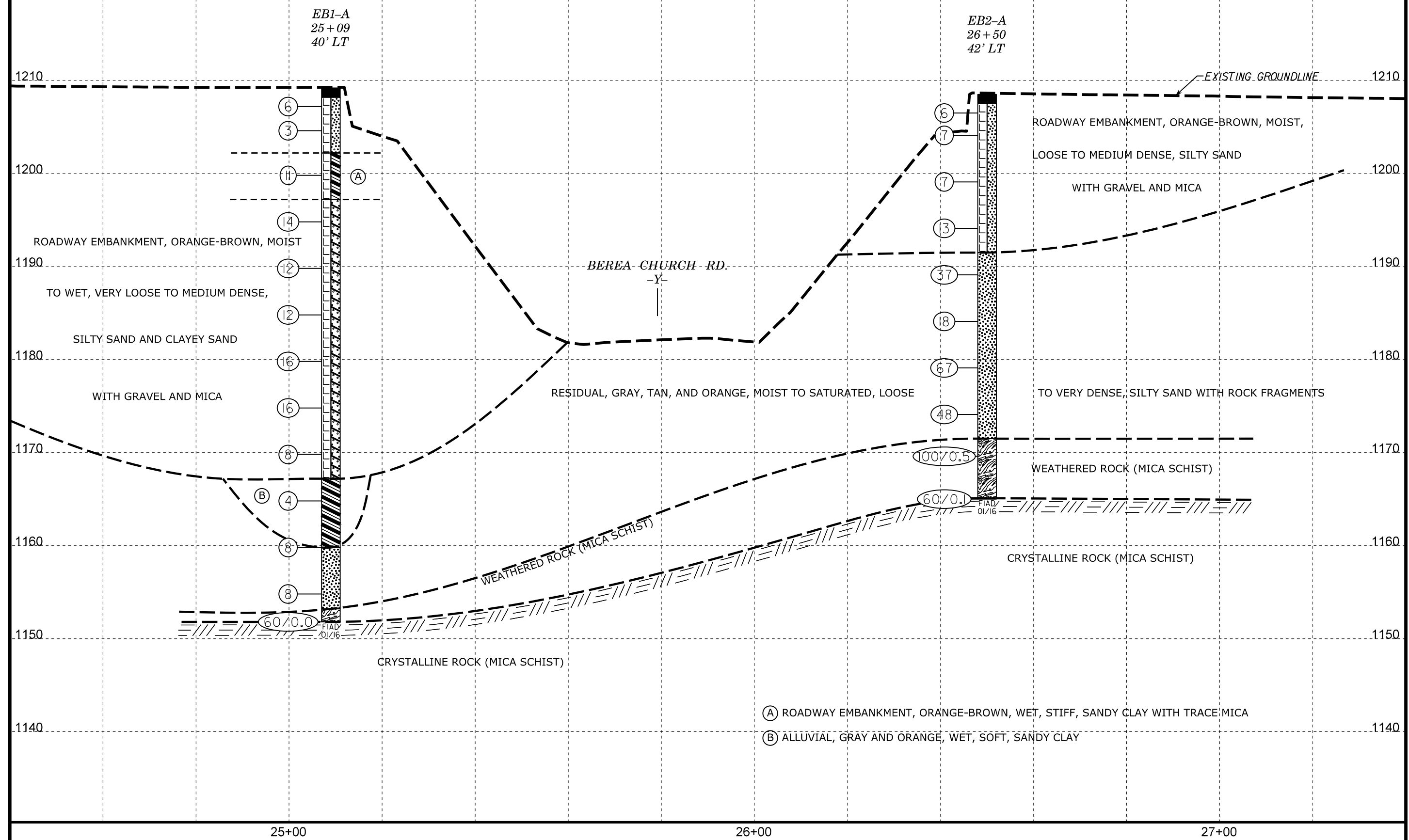


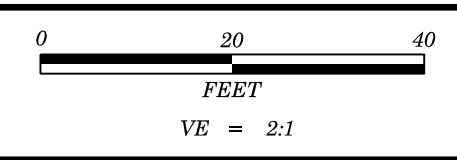


PROJECT REFERENCE NO.	SHEET NO.
B-4447	4
PROFILE OF BORINGS ALONG -WBL-	

NOTE: EXISTING GROUND SURFACE PROFILE OF -WBL- CENTERLINE TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

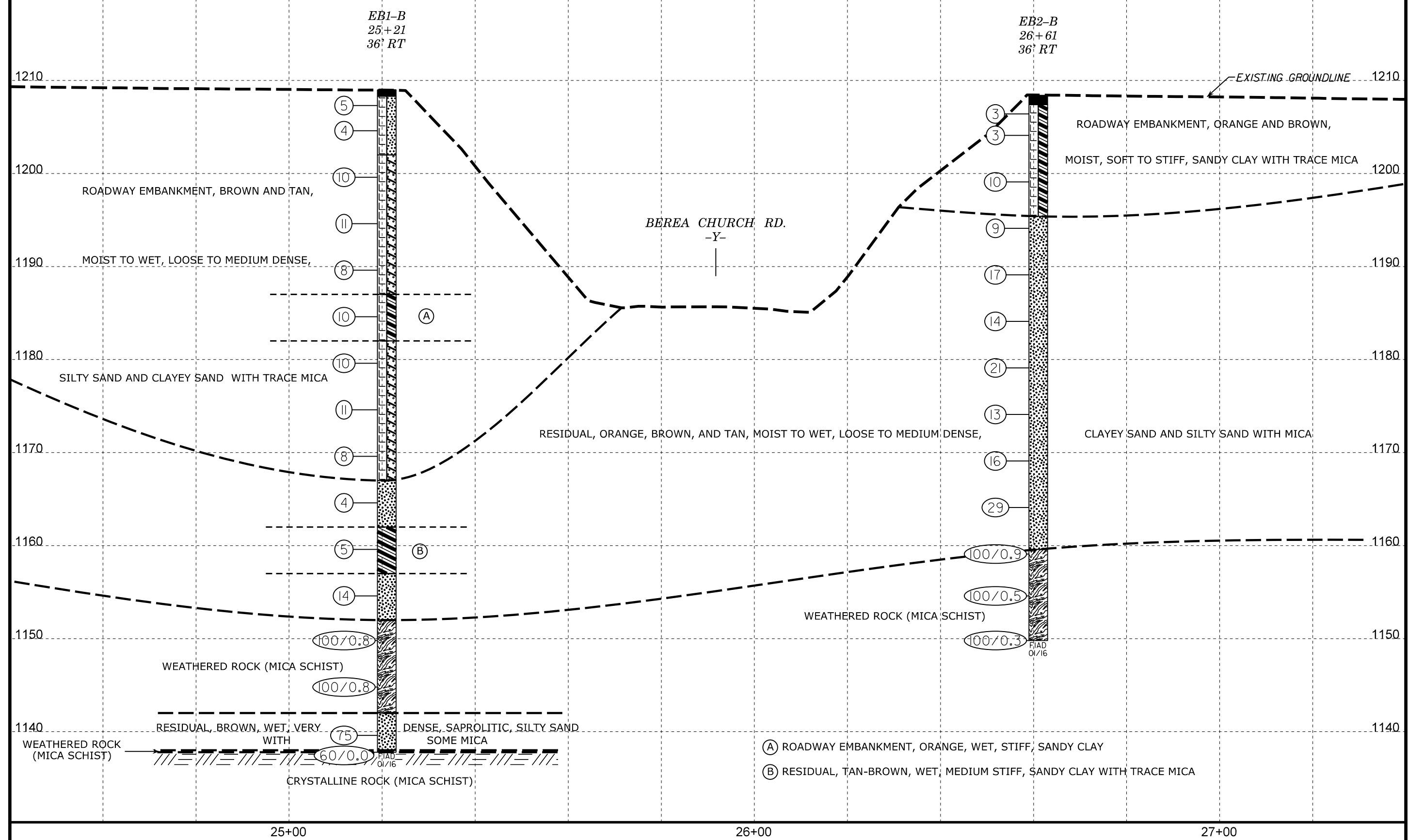
SKEW=79°56'50"

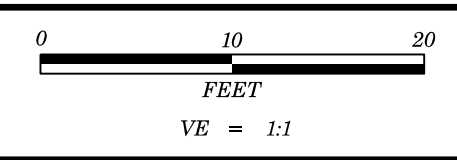




<b>PROJECT REFERENCE NO.</b>	<b>SHEET NO.</b>
B-4447	5
<b>PROFILE OF BORINGS ALONG -EBL-</b>	

NOTE: EXISTING GROUND SURFACE PROFILE OF -EBL- CENTERLINE TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

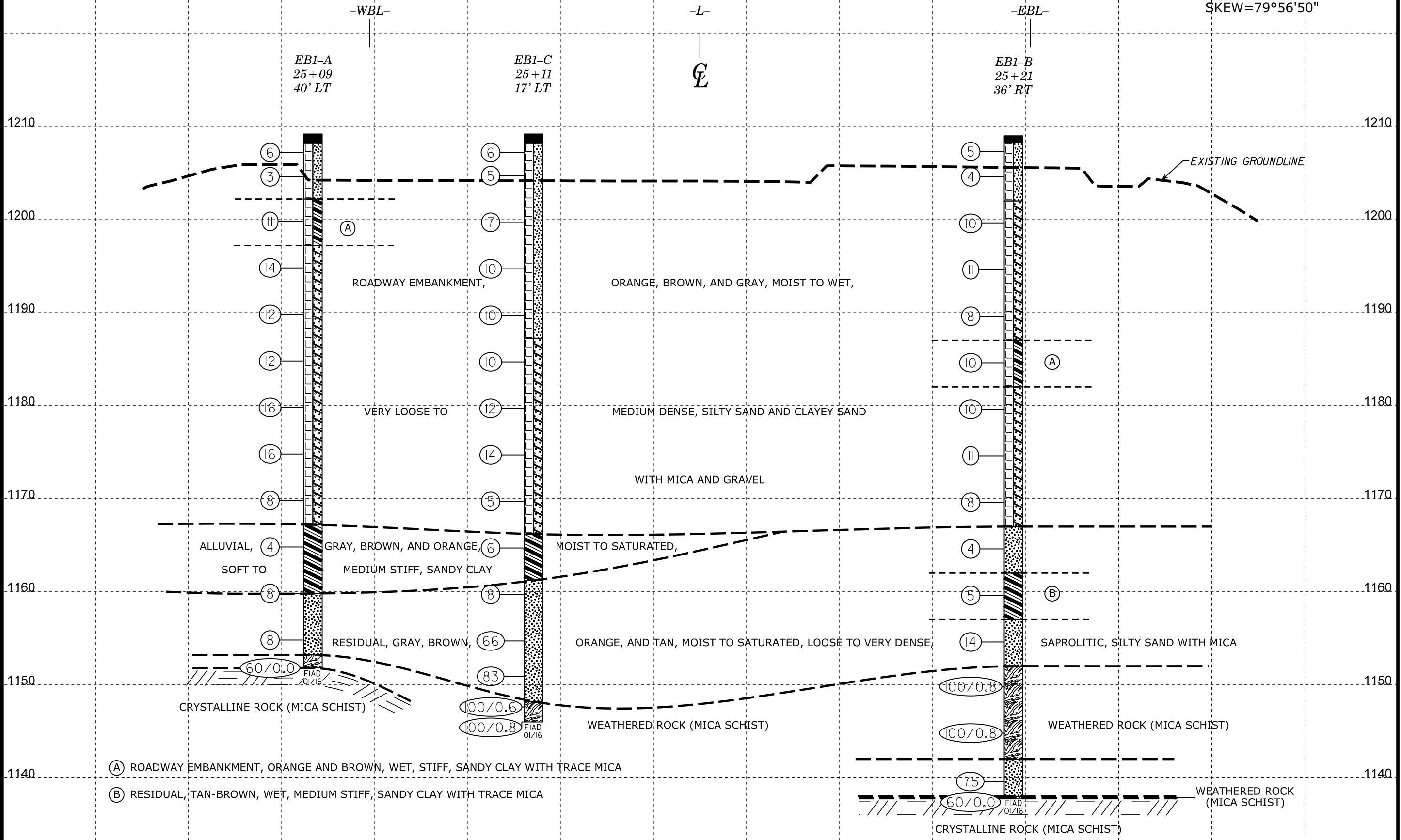


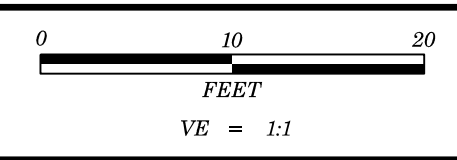


PROJECT REFERENCE NO.	SHEET NO.
B-4447	6
END BENT 1 CROSS SECTION	

NOTE: EXISTING GROUND SURFACE CROSS SECTION OF END BENT 1 TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

SKEW=79°56'50"

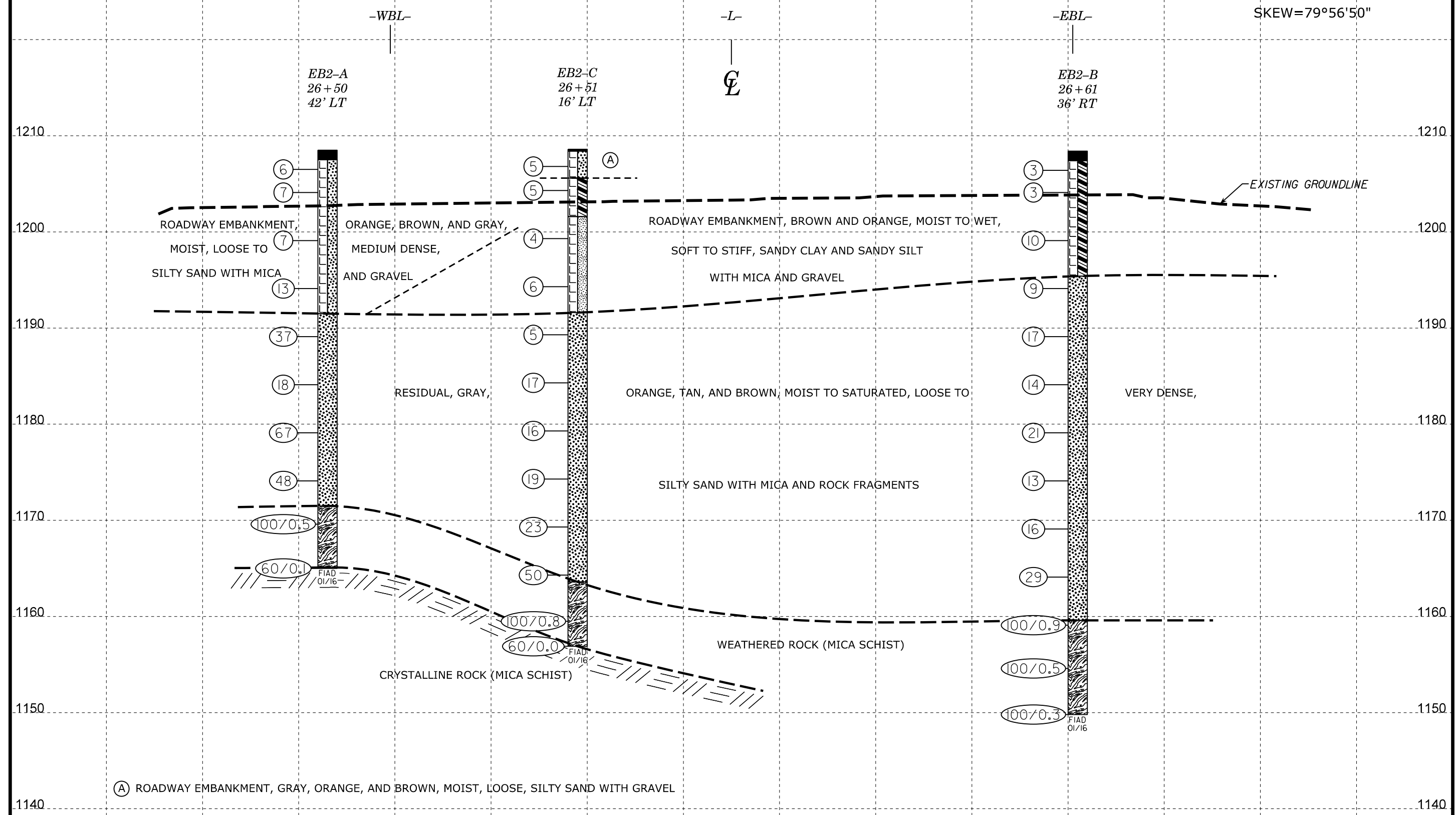




PROJECT REFERENCE NO.	SHEET NO.
B-4447	7
END BENT 2 CROSS SECTION	

NOTE: EXISTING GROUND SURFACE CROSS SECTION OF END BENT 2 TAKEN FROM ELECTRONIC FILES RECEIVED FROM NCDOT GEU. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

SKEW=79°56'50"





# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr										
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 25+09		OFFSET 40 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,209.2 ft		TOTAL DEPTH 57.4 ft		NORTHING 729,142		EASTING 1,259,996										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER E. Estep		START DATE 01/06/16		COMP. DATE 01/07/16		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
1210														1,209.2	0.0	GROUND SURFACE
	1,208.2	1.0	3	4	2								M	1,208.2	1.0	Asphalt & Gravel Base
1205	1,205.6	3.6	1	1	2								M			ROADWAY EMBANKMENT Orange-Brown, Silty Sand with some Gravel and Mica
	1,202.2	7.0											W	1,202.2	7.0	Orange-Brown, Sandy Clay with Trace Mica
1200	1,200.8	8.4	4	4	7								W	1,197.2	12.0	Orange, Brown, and Pink, Clayey Sand with Some Mica
1195	1,195.8	13.4	6	5	9								W			
1190	1,190.8	18.4	7	5	7								W			
1185	1,185.8	23.4	7	5	7								W			
1180	1,180.8	28.4	7	8	8								W			
1175	1,175.8	33.4	17	9	7								W			
1170	1,170.8	38.4	3	3	5								W			
1165	1,165.8	43.4	2	2	2								W	1,167.2	42.0	ALLUVIAL Gray and Orange, Sandy Clay
1160	1,160.8	48.4	2	2	6								Sat.	1,159.8	49.4	RESIDUAL Dark Brown to Black, Silty Sand with Trace Mica
1155	1,155.8	53.4	5	4	4								Sat.	1,153.2	56.0	WEATHERED ROCK (Mica Schist)
	1,151.8	57.4												1,151.8	57.4	Boring Terminated with Standard Penetration Test Refusal at Elevation 1,151.8 ft on Crystalline Rock (Mica Schist)
		60/0.0													60/0.0	

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr										
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)									
BORING NO. EB1-C		STATION 25+11		OFFSET 17 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,209.2 ft		TOTAL DEPTH 63.2 ft		NORTHING 729,120		EASTING 1,259,990										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER E. Estep		START DATE 01/07/16		COMP. DATE 01/07/16		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)		
1210														1,209.2	0.0	GROUND SURFACE
	1,208.2	1.0	3	4	2								M	1,208.2	1.0	Asphalt, Concrete, & Gravel Base
1205	1,205.7	3.5	2	2	3								M			ROADWAY EMBANKMENT Orange, Brown, and Gray, Silty Sand with Trace Gravel and Mica
	1,200.7	8.5	2	4	3								M			
1200	1,195.7	13.5	5	5	5								M			
1195	1,190.7	18.5	5	5	5								M			
1190	1,185.7	23.5	3	5	5								M			
1185	1,180.7	28.5	4	6	6								M			
1180	1,175.7	33.5	4	7	7								M			
1175	1,170.7	38.5	3	3	2								M			
1170	1,165.7	43.5	2	2	4								M	1,187.2	22.0	Orange-Brown, Clayey Sand with Some Gravel and Mica
1165	1,160.7	48.5	2	3	5								M	1,166.2	43.0	ALLUVIAL Gray and Brown, Sandy Clay
1160	1,155.7	53.5	3	25	41								M	1,161.2	48.0	RESIDUAL Brown and Orange, Silty Sand with Some Mica
1155	1,151.9	57.3	32	55	28								Sat.			
1150	1,148.7	60.5	5	60	40/0.1								Sat.	1,148.2	61.0	WEATHERED ROCK (Mica Schist)
	1,147.3	61.9	11	11	89/0.3								Sat.	1,146.0	63.2	Boring Terminated at Elevation 1,146.0 ft in Weathered Rock (Mica Schist)
		100/0.6														
		100/0.8														

NCDOT BORE DOUBLE B4447\_GEO\_DUALS\_BH.GPJ NC\_DOT\_GDT 1/20/16

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr									
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 25+21		OFFSET 36 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 1,209.0 ft		TOTAL DEPTH 71.2 ft		NORTHING 729,067		EASTING 1,259,981									
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/20/2015				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER E. Estep		START DATE 01/10/16		COMP. DATE 01/11/16		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
1210															1,209.0 GROUND SURFACE 0.0
	1,208.3	0.7	3	2	3	5								M	1,208.3 Asphalt & Concrete 0.7
1205	1,205.6	3.4	3	2	2	4								M	ROADWAY EMBANKMENT Brown, Silty Sand with Some Gravel
															1,202.0 7.0
1200	1,200.6	8.4	5	6	4	10								W	Tan-Brown, Clayey Sand with Trace Mica
1195	1,195.6	13.4	5	5	6	11								W	
1190	1,190.6	18.4	5	4	4	8								W	
1185	1,185.6	23.4	5	5	5	10								W	1,187.0 Orange, Sandy Clay 22.0
1180	1,180.6	28.4	4	5	5	10								W	1,182.0 Brown, Clayey Sand with Trace Mica 27.0
1175	1,175.6	33.4	5	5	6	11								W	
1170	1,170.6	38.4	4	3	5	8								W	
1165	1,165.6	43.4	4	2	2	4								W	1,167.0 RESIDUAL 42.0 Gray and Tan, Saprolitic, Silty Sand with Trace Mica
1160	1,160.6	48.4	2	1	4	5								W	1,162.0 Tan-Brown, Sandy Clay with Trace Mica 47.0
1155	1,155.6	53.4	4	6	8	14								W	1,157.0 Brown, Silty Sand with Trace Mica 52.0
1150	1,150.6	58.4	40	60/0.3						100/0.8				W	1,152.0 WEATHERED ROCK 57.0 (Mica Schist)
1145	1,145.6	63.4	62	38/0.3						100/0.8				W	
1140	1,140.6	68.4	23	27	48					75				W	1,142.0 RESIDUAL 67.0 Brown, Saprolitic, Silty Sand with Some Mica
	1,137.8	71.2	60/0.0							60/0.0				W	1,138.0 WEATHERED ROCK 71.0 1,137.8 (Mica Schist) Boring Terminated with Standard Penetration Test Refusal at Elevation 1,137.8 ft on Crystalline Rock (Mica Schist)

# GEOTECHNICAL BORING REPORT

## BORE LOG

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr										
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)									
BORING NO. EB2-A		STATION 26+50		OFFSET 42 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,208.5 ft		TOTAL DEPTH 43.5 ft		NORTHING 729,095		EASTING 1,260,129										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER E. Estep		START DATE 01/07/16		COMP. DATE 01/07/16		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
1210																
	1,207.5	1.0														
1205	1,205.1	3.4	3	2	4											
			2	4	3											
1200	1,200.1	8.4														
			1	2	5											
1195	1,195.1	13.4	3	7	6											
1190	1,190.1	18.4	14	20	17											
1185	1,185.1	23.4	6	10	8											
1180	1,180.1	28.4	4	49	18											
1175	1,175.1	33.4	12	25	23											
1170	1,170.1	38.4	100/0.5													
1165	1,165.1	43.4	60/0.1													

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr										
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)									
BORING NO. EB2-C		STATION 26+51		OFFSET 16 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 1,208.6 ft		TOTAL DEPTH 51.7 ft		NORTHING 729,070		EASTING 1,260,121										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 84% 02/20/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER E. Estep		START DATE 01/08/16		COMP. DATE 01/08/16		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
1210																
	1,207.8	0.8														
1205	1,205.3	3.3	5	3	2											
			1	2	3											
1200	1,200.3	8.3														
			4	2	2											
1195	1,195.3	13.3	2	2	4											
1190	1,190.3	18.3	3	2	3											
1185	1,185.3	23.3	7	9	8											
1180	1,180.3	28.3	4	6	10											
1175	1,175.3	33.3	5	8	11											
1170	1,170.3	38.3	8	11	12											
1165	1,165.3	43.3	22	21	29											
1160	1,160.3	48.3	52	48/0.3												
	1,156.9	51.7	60/0.0													

NCDOT BORE DOUBLE B4447\_GEO\_DUALS\_BH1.GPJ NC\_DOT\_GDT 1/20/16

WBS 38371.1.1		TIP B-4447		COUNTY BURKE		GEOLOGIST E. Mayr								
SITE DESCRIPTION Bridges 160 & 162 on I-40 over SR 1758 (Berea Church Road)							GROUND WTR (ft)							
BORING NO. EB2-B		STATION 26+61		OFFSET 36 ft RT		ALIGNMENT -L-								
COLLAR ELEV. 1,208.4 ft		TOTAL DEPTH 58.6 ft		NORTHING 729,018		EASTING 1,260,112								
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/20/2015				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic								
DRILLER E. Estep		START DATE 01/11/16		COMP. DATE 01/11/16		SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
1210														GROUND SURFACE 0.0
	1,207.4	1.0	1	2	1	3							W	Asphalt & Concrete 1.0
1205	1,205.1	3.3	1	2	1	3							W	ROADWAY EMBANKMENT
														Orange and Brown, Silty Clay with Trace Mica
1200	1,200.1	8.3	3	5	5	10							W	
1195	1,195.1	13.3	3	3	6	9							M	RESIDUAL
														Orange and Brown, Silty Sand with Some Mica
1190	1,190.1	18.3	7	9	8	17							M	
1185	1,185.1	23.3	5	6	8	14							M	
1180	1,180.1	28.3	10	10	11	21							M	
1175	1,175.1	33.3	4	4	9	13							M	
1170	1,170.1	38.3	4	7	9	16							M	
1165	1,165.1	43.3	7	12	17	29							M	
1160	1,160.1	48.3	15	36	64/0.4	100/0.9							M	WEATHERED ROCK
														(Mica Schist) 48.8
1155	1,155.1	53.3	100/0.5			100/0.5								
1150	1,150.1	58.3	100/0.3			100/0.3								Boring Terminated at Elevation 1,149.8 ft in Weathered Rock (Mica Schist) 58.6

SITE PHOTOGRAPH



LOOKING NORTH FROM BEREA CHURCH ROAD