

PROJECT: 17BP.4.R.72 REFERENCE: 500239

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND
3	SITE PLAN
4	PROFILE(S)
5-6	CROSS SECTION(S)
7-II	BORE LOG(S) & CORE REPORT(S)
12	CORE PHOTOGRAPH(S)
13	SITE PHOTOGRAPH(S)

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY JOHNSTON
 PROJECT DESCRIPTION BRIDGE NO. 239 ON SR 2129
OVER BUFFALO CREEK

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	500239	1	13

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 1919 TOT-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.

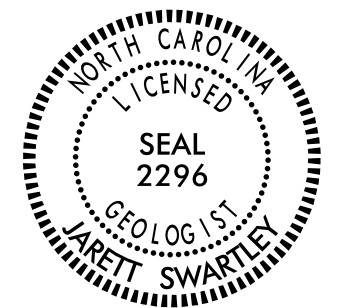
PERSONNEL

O. B. OTI

D. G. PINTER

J.R. SWARTLEY

INVESTIGATED BY J.R. SWARTLEY
 DRAWN BY J.R. SWARTLEY
 CHECKED BY N. T. ROBERSON
 SUBMITTED BY N. T. ROBERSON
 DATE MAY 2016



DocuSigned by:
Jarett Swartley 6/24/2016
 7F355C29E75A413
 SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

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		
	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	A-6, A-7
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 10 MX	51 MN 35 MX 35 MX	35 MX 35 MX 35 MX	35 MX 35 MX 35 MX	35 MX 35 MX 35 MX	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN	36 MN 36 MN 36 MN
MATERIAL PASSING #40 LL PI	-	6 MX	NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	40 MX 11 MN	
GROUP INDEX	0	0	0	4 MX	8 MX	12 MX	16 MX	NO MX							
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS	CLAYEY SOILS										
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 RESISTANCE (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 OPENING (MM)	4	10	40	60	200	270
	4.76	2.00	0.42	0.25	0.075	0.053
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CSE, SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						
GRAIN SIZE	305	75	2.0	0.25	0.05	0.005
SIZE 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-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
- 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
- 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
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- SHALLOW UNDERCUT
- 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
- 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
- ADVANCING TOOLS:
 - CLAY BITS
 - 6" CONTINUOUS FLIGHT AUGER
 - 8" HOLLOW AUGERS
 - HARD FACED FINGER BITS
 - TUNG-CARBIDE INSERTS
 - CASING w/ ADVANCER
 - TRICONE STEEL TEETH
 - TRICONE 2 1/4" TUNG-CARB.
 - CORE BIT
- HAMMER TYPE:
 - AUTOMATIC MANUAL
- CORE SIZE:
 - B
 - H
 - N -X
- 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 YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
- COASTAL PLAIN SEDIMENTARY ROCK (CP)
COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

- FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
- VERY SLIGHT (V SL.): ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
- SLIGHT (SL.): ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
- MODERATE (MOD.): SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
- MODERATELY SEVERE (MOD. SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. 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 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 FINGERNAIL.

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.
- FRIBLE: 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

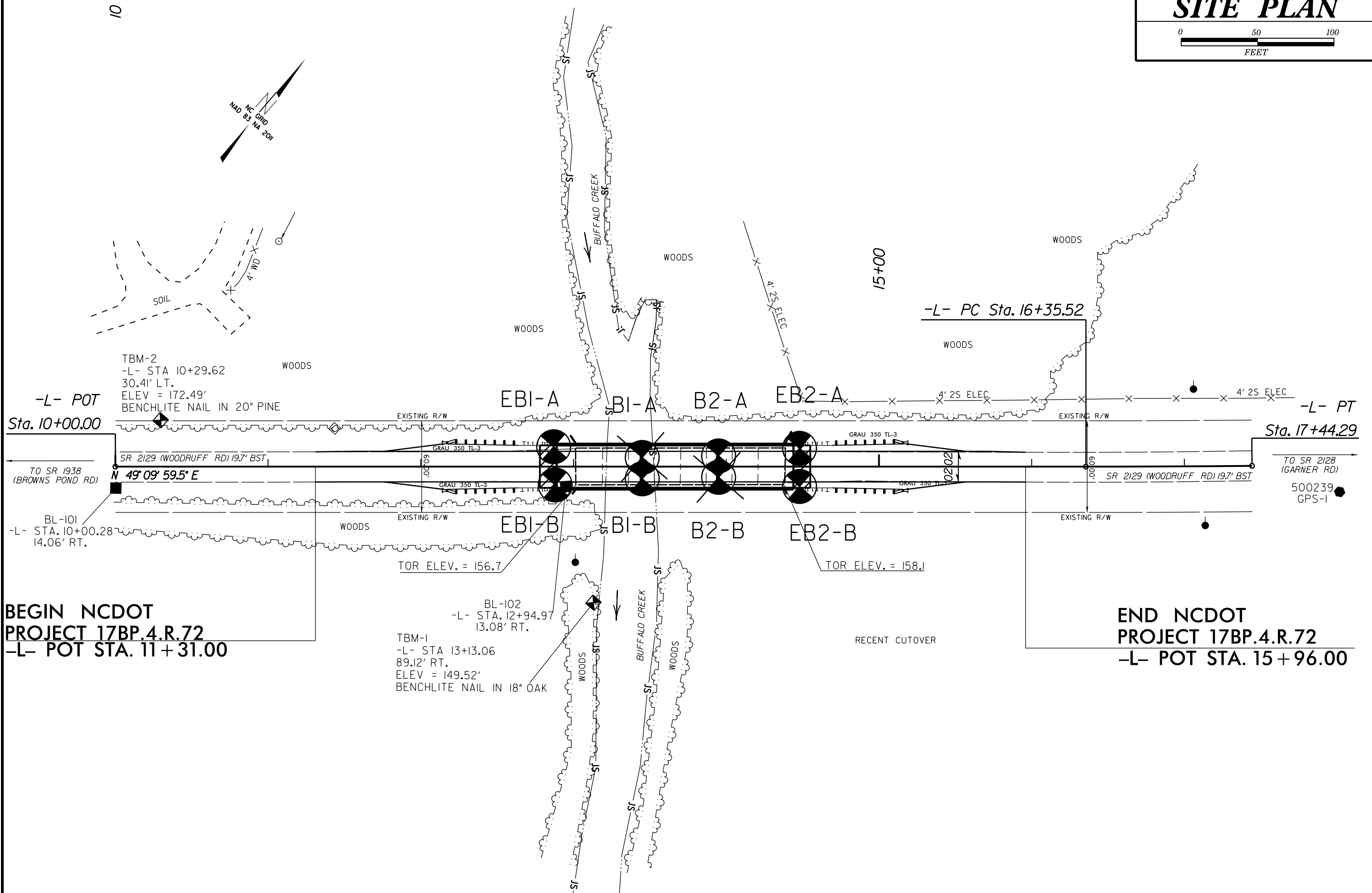
- ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
- AQUIFER - A WATER BEARING FORMATION OR STRATA.
- ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.
- ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION 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 DISLOGGED 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 EMBLACED 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: TBM # 2

N: 670654 E: 2229484 ELEVATION: 172.49 FEET

NOTES:

- TOP OF RAIL AT EB1 ELEV. = 156.7
- TOP OF RAIL AT EB2 ELEV. = 158.1



**BEGIN NCDOT
PROJECT 17BP.4.R.72
-L- POT STA. 11+31.00**

**END NCDOT
PROJECT 17BP.4.R.72
-L- POT STA. 15+96.00**

TBM-2
-L- STA 10+29.62
30.41' LT.
ELEV = 172.49'
BENHLITE NAIL IN 20" PINE

-L- POT
Sta. 10+00.00

SR 2129 (WOODRUFF RD) 19.7' BST
N 49° 09' 59.5" E

BL-101
-L- STA. 10+00.28
14.06' RT.

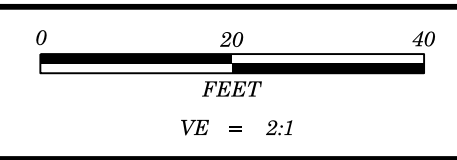
TBM-1
-L- STA 13+13.06
89.12' RT.
ELEV = 149.52'
BENHLITE NAIL IN 18" OAK

BL-102
-L- STA. 12+94.97
13.08' RT.

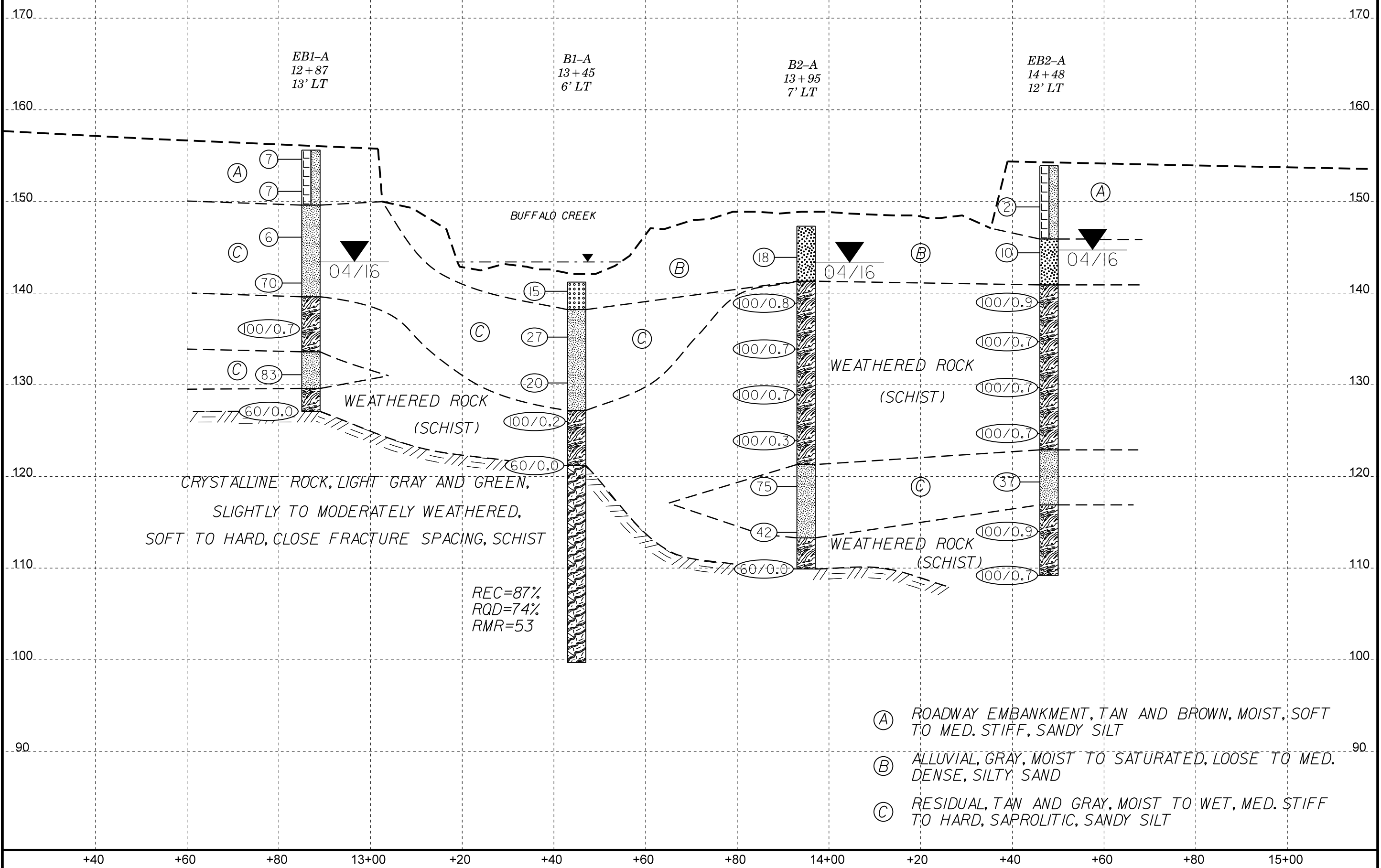
-L- PT
Sta. 17+44.29

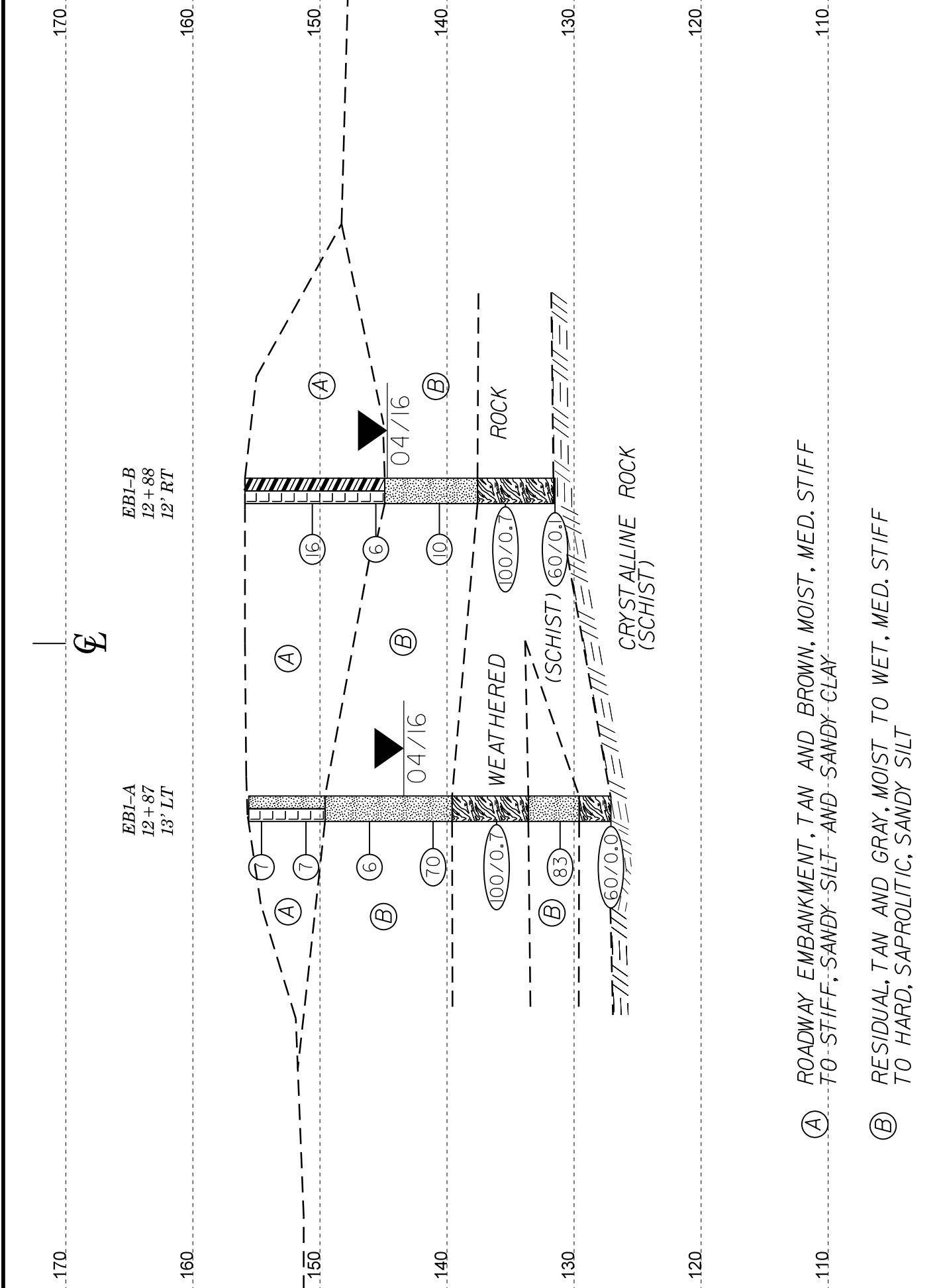
TO SR 2128
(GARNER RD)

500239
GPS-1

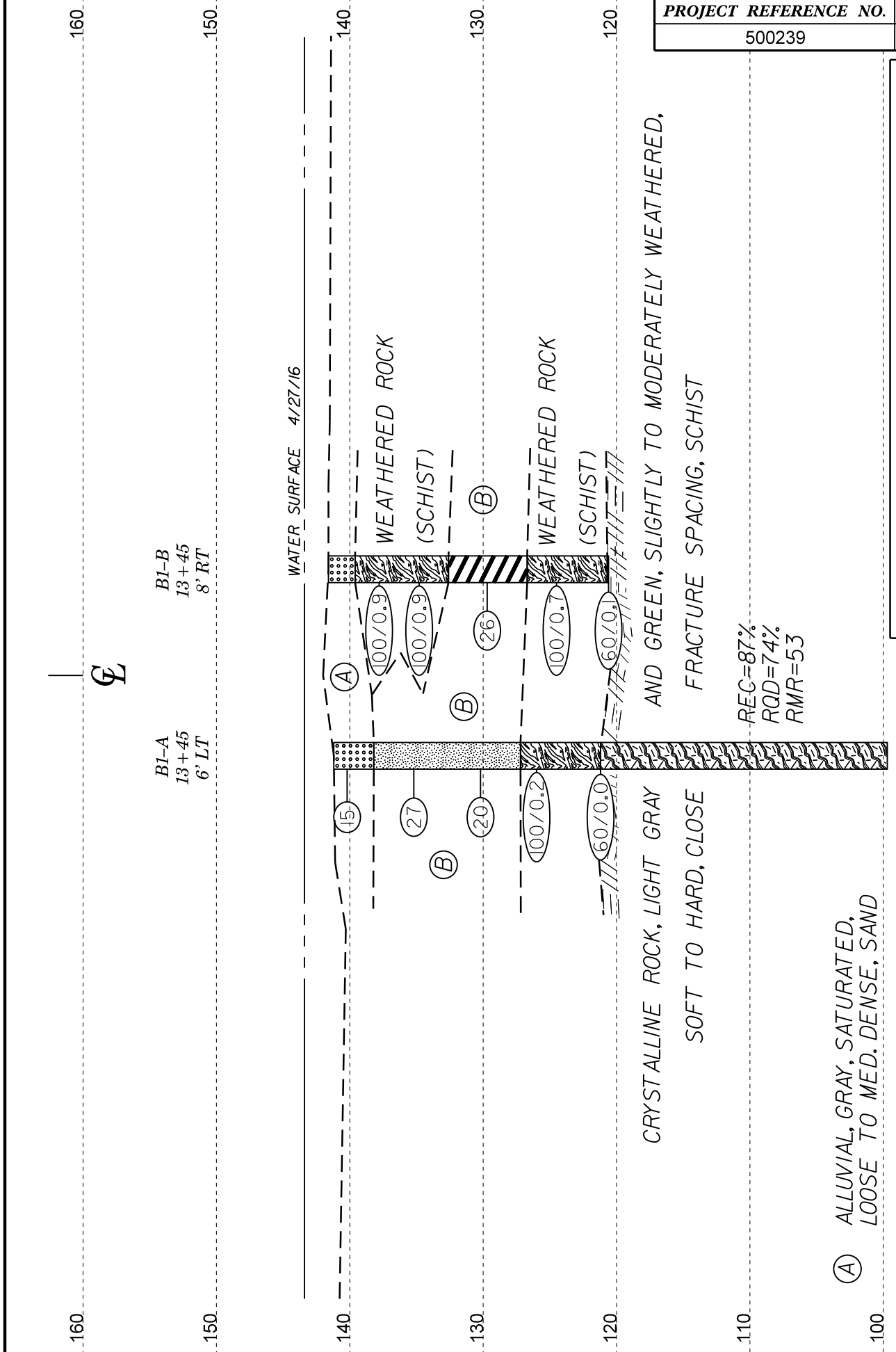


PROJECT REFERENCE NO.	SHEET NO.
500239	4
BORINGS PROJECTED ALONG -L- PROFILE	





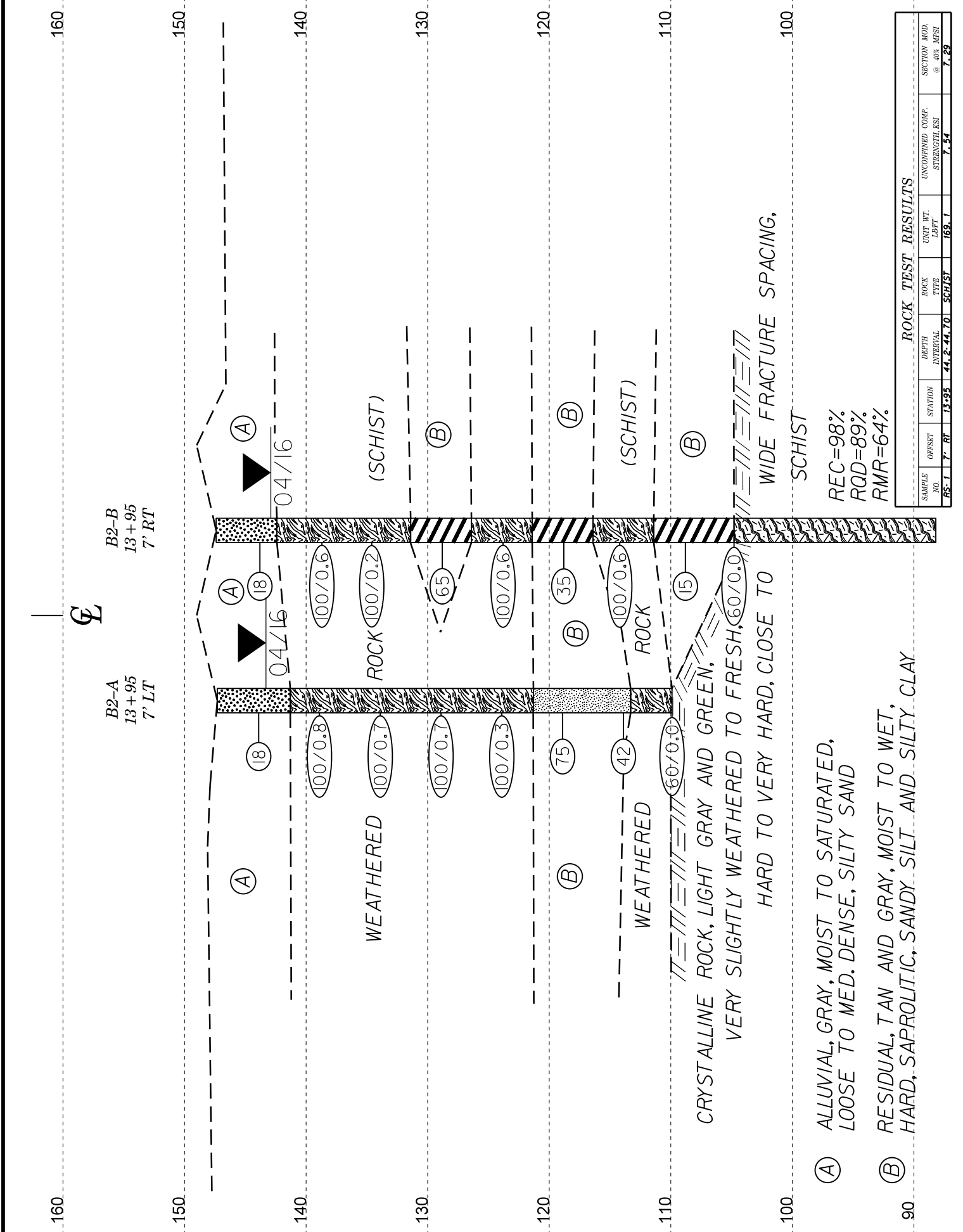
HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 CROSS SECTION THROUGH EBI



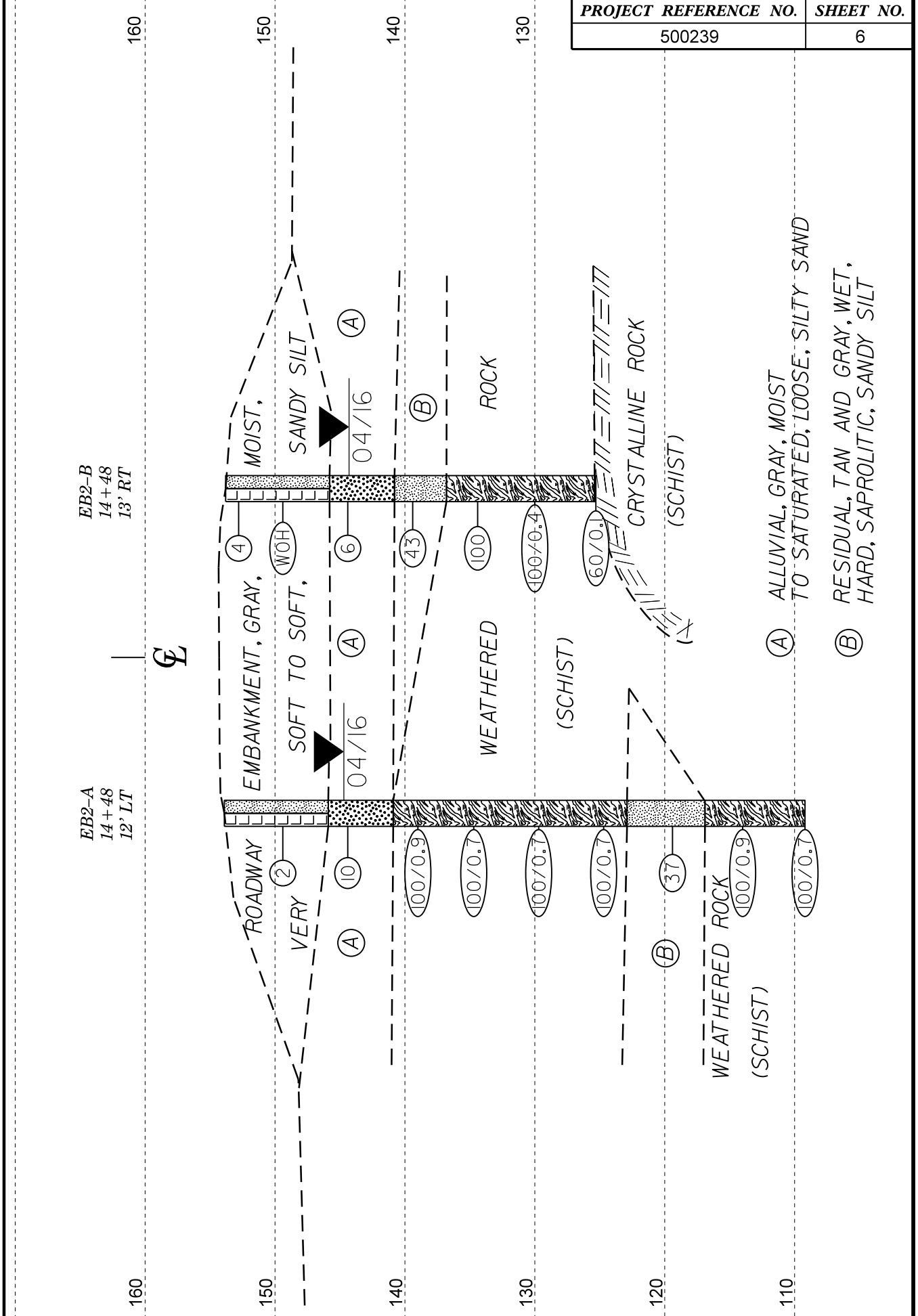
HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 CROSS SECTION THROUGH BI

ROCK TEST RESULTS						
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	ROCK TYPE	UNCONFINED COMP. STRENGTH (PSI)	SECTION MOD. @ 40% MPSI
RS-2	6' LT	13+45	26.5-27.0	SCHIST	160.4	3.52
						2.06

(A) ALLUVIAL, GRAY, SATURATED, LOOSE TO MED. DENSE, SAND
 (B) RESIDUAL, TAN AND GRAY, WET, VERY STIFF TO HARD, SAPROLITIC, SANDY SILT AND SILTY CLAY



HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 **CROSS SECTION THROUGH B2**



HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 **CROSS SECTION THROUGH EB2**

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.									
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK							GROUND WTR (ft)								
BORING NO. EB1-A		STATION 12+87		OFFSET 13 ft LT		ALIGNMENT -L-									
COLLAR ELEV. 155.6 ft		TOTAL DEPTH 28.5 ft		NORTHING 670,809		EASTING 2,229,690									
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015			DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Pinter, D. G.		START DATE 04/25/16		COMP. DATE 04/25/16		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					
160															
155	155.6	0.0	2	4	3								M	155.6	GROUND SURFACE
													M		ROADWAY EMBANKMENT TAN AND BROWN, SANDY SILT
150	152.1	3.5	5	3	4								M		
													M		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
145	147.1	8.5	2	3	3								M		
													W		WEATHERED ROCK (SCHIST)
140	142.1	13.5	32	31	39								W		
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
135	137.1	18.5	33	67/0.2									W		WEATHERED ROCK (SCHIST)
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
130	132.1	23.5	32	53	30								W		WEATHERED ROCK (SCHIST)
															Boring Terminated at Elevation 127.1 ft ON CRYSTALLINE ROCK (SCHIST)
	127.1	28.5	60/0.0												

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.									
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 12+88		OFFSET 12 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 155.9 ft		TOTAL DEPTH 24.4 ft		NORTHING 670,791		EASTING 2,229,707									
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015			DRILL METHOD NW Casing w/ Advancer		HAMMER TYPE Automatic										
DRILLER Pinter, D. G.		START DATE 04/21/16		COMP. DATE 04/21/16		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					
160															
155													M	155.9	GROUND SURFACE
													M		ROADWAY EMBANKMENT ORANGE, SANDY CLAY
150	151.6	4.3	2	4	12								M		
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
145	146.6	9.3	1	3	3								W		WEATHERED ROCK (SCHIST)
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
140	141.6	14.3	1	4	6								W		WEATHERED ROCK (SCHIST)
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
135	136.6	19.3	26	61	39/0.2								W		WEATHERED ROCK (SCHIST)
													W		RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT
	131.6	24.3	60/0.1										W		CRYSTALLINE ROCK (SCHIST)
															Boring Terminated at Elevation 131.5 ft IN CRYSTALLINE ROCK (SCHIST)

NCDOT BORE DOUBLE 500239_GEO_SPT_BORINGS.GPJ NC_DOT.GDT 5/12/16

GEOTECHNICAL BORING REPORT BORE LOG

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.								
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK						GROUND WTR (ft)								
BORING NO. B1-A		STATION 13+45		OFFSET 6 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 141.2 ft		TOTAL DEPTH 41.5 ft		NORTHING 670,842		EASTING 2,229,738								
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015		DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic										
DRILLER Pinter, D. G.		START DATE 04/28/16		COMP. DATE 04/28/16		SURFACE WATER DEPTH 2.0ft								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT				SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75					
145														
	141.2	0.0	6	2	13								WATER SURFACE (04/28/16)	
140													GROUND SURFACE	0.0
	136.2	5.0											ALLUVIAL TAN AND GRAY, SAND	3.0
135													RESIDUAL TAN AND GRAY, SAPROLITIC, SANDY SILT	
130														
	131.2	10.0												
125													WEATHERED ROCK (SCHIST)	14.0
	126.2	15.0	100/0.2											
120													CRYSTALLINE ROCK LIGHT GRAY AND GREEN, SLIGHTLY TO MODERATELY WEATHERED, SOFT TO HARD, CLOSE FRACTURE SPACING, SCHIST	20.0
	121.2	20.0	60/0.0											
115														
110														
105														
100														
														99.7
Boring Terminated at Elevation 99.7 ft IN CRYSTALLINE ROCK (SCHIST)														41.5

NCDOT BORE DOUBLE 500239_GEO_SPT_BORINGS.GPJ NC_DOT.GDT 5/11/16

GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.						
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK						GROUND WTR (ft)						
BORING NO. B1-A		STATION 13+45		OFFSET 6 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 141.2 ft		TOTAL DEPTH 41.5 ft		NORTHING 670,842		EASTING 2,229,738						
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015		DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic								
DRILLER Pinter, D. G.		START DATE 04/28/16		COMP. DATE 04/28/16		SURFACE WATER DEPTH 2.0ft						
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)		REC. (%)	RQD (%)			
121.2												
	121.2	20.0	1.5	N=60/0.0 :30/0.5 :52/1.0	(1.4) 93%	(0.7) 47%		(18.8) 87%	(15.9) 74%		Begin Coring @ 20.0 ft	20.0
	119.7	21.5	5.0	:55/1.0 :55/1.0 :52/1.0 :52/1.0 :40/1.0	(4.2) 84%	(3.5) 70%					CRYSTALLINE ROCK LIGHT GRAY AND GREEN, SLIGHTLY TO MODERATELY WEATHERED, SOFT TO HARD, CLOSE FRACTURE SPACING, SCHIST	
115												
	114.7	26.5	5.0	1:00/1.0 :53/1.0 :46/1.0 :50/1.0 :48/1.0	(4.3) 86%	(3.5) 70%	RS-2					
110												
	109.7	31.5	5.0	1:00/1.0 :50/1.0 :1:30/1.0 :1:31/1.0 :1:32/1.0	(4.3) 86%	(3.6) 72%						
105												
	104.7	36.5	5.0	1:06/1.0 :1:10/1.0 :1:23/1.0 :1:25/1.0 :1:30/1.0	(4.6) 92%	(4.6) 92%						
100												
	99.7	41.5										99.7
Boring Terminated at Elevation 99.7 ft IN CRYSTALLINE ROCK (SCHIST)												41.5

NCDOT CORE SINGLE 500239_GEO_SPT_BORINGS.GPJ NC_DOT.GDT 5/11/16

GEOTECHNICAL BORING REPORT BORE LOG

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.							
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK						GROUND WTR (ft)							
BORING NO. B2-B		STATION 13+95		OFFSET 7 ft RT		ALIGNMENT -L-							
COLLAR ELEV. 147.4 ft		TOTAL DEPTH 59.2 ft		NORTHING 670,864		EASTING 2,229,785							
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015		DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic									
DRILLER Pinter, D. G.		START DATE 04/26/16		COMP. DATE 04/26/16		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				
150													
145	144.8	2.6	8	8	10							147.4	0.0
140	139.8	7.6	17	70	30/0.1							142.4	5.0
135	134.8	12.6	100/0.2									131.4	16.0
130	129.8	17.6	19	31	34							126.4	21.0
125	124.8	22.6	85	15/0.1								121.4	26.0
120	119.8	27.6	15	20	15							116.4	31.0
115	114.8	32.6	20	80/0.1								111.4	36.0
110	109.8	37.6	5	5	10							104.8	42.6
105	104.8	42.6	60/0.0									88.2	59.2
100													
95													
90													

NCDOT BORE DOUBLE 500239_GEO_SPT_BORINGS.GPJ NC_DOT.GDT 5/11/16

GEOTECHNICAL BORING REPORT CORE LOG

WBS 17BP.4.R.72		TIP SF-500239		COUNTY JOHNSTON		GEOLOGIST Oti, O. B.					
SITE DESCRIPTION BRIDGE NO. 239 ON SR 2129 OVER BUFFALO CREEK						GROUND WTR (ft)					
BORING NO. B2-B		STATION 13+95		OFFSET 7 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 147.4 ft		TOTAL DEPTH 59.2 ft		NORTHING 670,864		EASTING 2,229,785					
DRILL RIG/HAMMER EFF./DATE RFO0067 CME-550X 86% 02/09/2015		DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic							
DRILLER Pinter, D. G.		START DATE 04/26/16		COMP. DATE 04/26/16		SURFACE WATER DEPTH N/A					
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (%)	RQD (%)	REC. (%)	RQD (%)			
104.8	104.8	42.6	1.6	N=60/0.0 55/0.6 57/1.0	(1.4) 88%	(1.2) 75%	(16.2) 98%	(14.8) 89%		Begin Coring @ 42.6 ft	42.6
100	103.2	44.2	5.0	1:18/1.0 1:18/1.0 1:18/1.0 1:18/1.0 1:18/1.0	(4.9) 98%	(4.9) 98%				LIGHT GRAY AND GREEN, VERY SLIGHTLY WEATHERED TO FRESH, HARD TO VERY HARD, CLOSE TO WIDE FRACTURE SPACING, SCHIST	
95	98.2	49.2	5.0	1:30/1.0 1:30/1.0 1:30/1.0 1:30/1.0	(4.9) 98%	(3.7) 74%					
90	93.2	54.2	5.0	1:30/1.0 1:35/1.0 1:40/1.0 1:45/1.0	(5.0) 100%	(5.0) 100%					
	88.2	59.2								Boring Terminated at Elevation 88.2 ft IN CRYSTALLINE ROCK (SCHIST)	59.2

NCDOT CORE SINGLE 500239_GEO_SPT_BORINGS.GPJ NC_DOT.GDT 5/11/16

CORE PHOTOGRAPHS

B1-A

BOXES 1-3: 20.0 - 41.5 FEET



B2-B

BOXES 1 - 2: 42.6 - 59.2 FEET



SITE PHOTOGRAPH

Bridge No. 239 on -L- (SR 2129) over Buffalo Creek



Looking Northeast towards End Bent 2