

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

STRUCTURE
SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 33513.1.1(B-4165) F.A. PROJ. BRZ-1162(5)
 COUNTY JOHNSTON
 PROJECT DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER
SASSARIYA SWAMP AT STATION 16+30.5

INVENTORY

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N.C.D.O.T. PERSONNEL
O.B. OTI

CONSULTANT
 PERSONNEL

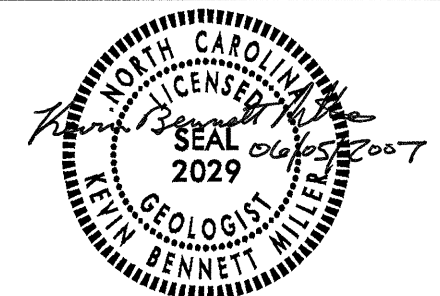
TIERRA

INVESTIGATED BY K.B. MILLER

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE MARCH 2007



DRAWN BY: T.T. WALKER

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

NOTE - 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.

PROJECT: 33513.1.1 ID: B-4165

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION			GRADATION			ROCK DESCRIPTION			TERMS AND DEFINITIONS		
SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HIGH PLASTIC, A-7-6</i>			WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) POORLY GRADED GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.			HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, 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 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:			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, 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 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 60 BLOWS PER FOOT. STRATA CORE RECOVERY (SRC) - 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.		
SOIL LEGEND AND AASHTO CLASSIFICATION			MINERALOGICAL COMPOSITION			WEATHERING			WEATHERING		
GENERAL CLASS. GRANULAR MATERIALS ($\leq 35\%$ PASSING #200) SILT-CLAY MATERIALS ($> 35\%$ PASSING #200) ORGANIC MATERIALS			MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.			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.		
GROUP CLASS. A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-1-A-2, A-3, A-4, A-5, A-6, A-7			COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50			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.		
SYMBOL			PERCENTAGE OF MATERIAL			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.		
% PASSING # 10, 40, 200			ORGANIC MATERIAL, OTHER MATERIAL			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.		
LIQUID LIMIT, PLASTIC INDEX, GROUP INDEX			GROUND WATER			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. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i>			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. <i>IF TESTED, YIELDS SPT N VALUES > 100 BPF</i>		
USUAL TYPES OF MAJOR MATERIALS			MISCELLANEOUS SYMBOLS			VERY SEVERE (V SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES < 100 BPF</i>			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.		
GEN. RATINGS AS A SUBGRADE			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, SOUNDING ROD			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.		
PI OF A-7-5 SUBGROUP IS $\leq LL - 30$; PI OF A-7-6 SUBGROUP IS $> LL - 30$			CONSISTENCY OR DENSENESS			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.		
PRIMARY SOIL TYPE, COMPACTNESS OR CONSISTENCY, RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE), RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)			TEXTURE OR GRAIN SIZE			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 PIECES 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.		
U.S. STD. SIEVE SIZE, OPENING (MM)			SOIL MOISTURE - CORRELATION OF TERMS			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.			FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.		
BOULDER, COBBLE, GRAVEL, COARSE SAND, FINE SAND, SILT, CLAY			FIELD MOISTURE DESCRIPTION			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.		
GRAIN SIZE			GUIDE FOR FIELD MOISTURE DESCRIPTION			EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.			INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.		
SOIL MOISTURE SCALE (ATTERBERG LIMITS), FIELD MOISTURE DESCRIPTION, GUIDE FOR FIELD MOISTURE DESCRIPTION			EQUIPMENT USED ON SUBJECT PROJECT			FRACTURE SPACING			BEDDING		
LL, PL, OM, SL			DRILL UNITS, ADVANCING TOOLS, HAMMER TYPE, CORE SIZE, HAND TOOLS			TERM, SPACING			TERM, THICKNESS		
PLASTICITY INDEX (PI), DRY STRENGTH			MOBILE B-51, CME-45C, CME-550, PORTABLE HOIST, CME-45			VERY WIDE, WIDE, MODERATELY CLOSE, CLOSE, VERY CLOSE			VERY THICKLY BEDDED, THICKLY BEDDED, MODERATELY THINLY BEDDED, VERY THINLY BEDDED, THICKLY LAMINATED, THINLY LAMINATED		
NONPLASTIC, LOW PLASTICITY, MED. PLASTICITY, HIGH PLASTICITY			CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING, TRICONE, CORE BIT			AUTOMATIC, MANUAL, B, N, WD, H			> 4 FEET, 1.5 - 4 FEET, 0.16 - 1.5 FEET, 0.03 - 0.16 FEET, 0.008 - 0.03 FEET, < 0.008 FEET		
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.			POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST			INDURATED		



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

March 23, 2007

STATE PROJECT: 33513.1.1 (B-4165)
FEDERAL PROJECT: BRZ-1162 (5)
COUNTY: Johnston
DESCRIPTION: Bridge No. 89 on -L- (SR 1162) over Sassarixa Swamp at Sta. 16+30.5
SUBJECT: Geotechnical Report – Structure Inventory

Site Description

The project is located in southeast Johnston County near Four Oaks between SR 1335 and SR 1347. The proposed replacement structure is 135 feet long with three spans at a skew of 90 degrees.

The subsurface investigation was conducted in January and February of 2007 using a CME-45 drill machine with a manual hammer. Two borings were cored using a NWD-4 core barrel. Two SPT borings were performed at each bent location. Borings were advanced through soil using a clay bit and Bentonite drilling fluid. Representative soil samples were collected and selected samples were submitted to the Materials and Tests Unit for analysis.

Physiography and Geology

Topography in the project area is gently rolling. The project site is located within the Eastern Slate Belt of the Piedmont Physiographic Province. Geologically, the project is underlain by non-crystalline phyllite.

Soil Properties

Soils encountered at the project site include roadway embankment, alluvial and residual soils. Weathered rock and non-crystalline rock were also encountered in each boring.

Roadway embankment soils range from 5.0 to 8.0 feet thick and consists of tan-brown, loose, silty sand and medium stiff sandy silt (A-2-4, A-4).

The alluvial soils consist of tan-gray-brown, very loose to very dense sand with gravel and silty sand (A-1-b, A-2-4) and brown-gray, very soft to stiff, sandy silt (A-4).

Residual soils consist of tan-brown medium stiff to hard, silty clay and sandy silt (A-7-5, A-4) and gray-brown, clayey silt (A-5) with relict rock fabric, interbedded with and underlain by severely weathered phyllite.

Rock Properties

Weathered rock is underlain by non-crystalline rock (phyllite) in borings B1-A and B2-B at elevation 92.8 feet and 93.2 feet respectively. Weathered rock recovery (REC) where cored ranges from 52% to 79%.

Core borings were performed at Bent 1 and Bent 2 locations to evaluate rock type and competency. Core Recovery (REC) ranges from 78% to 98%. Rock Quality Designation (RQD) ranges from 31% to 94%. Two rock samples were submitted to the Materials and Tests Unit for compressive strength and split tensile test. Detail descriptions may be found in the Core Boring Reports.


Groundwater

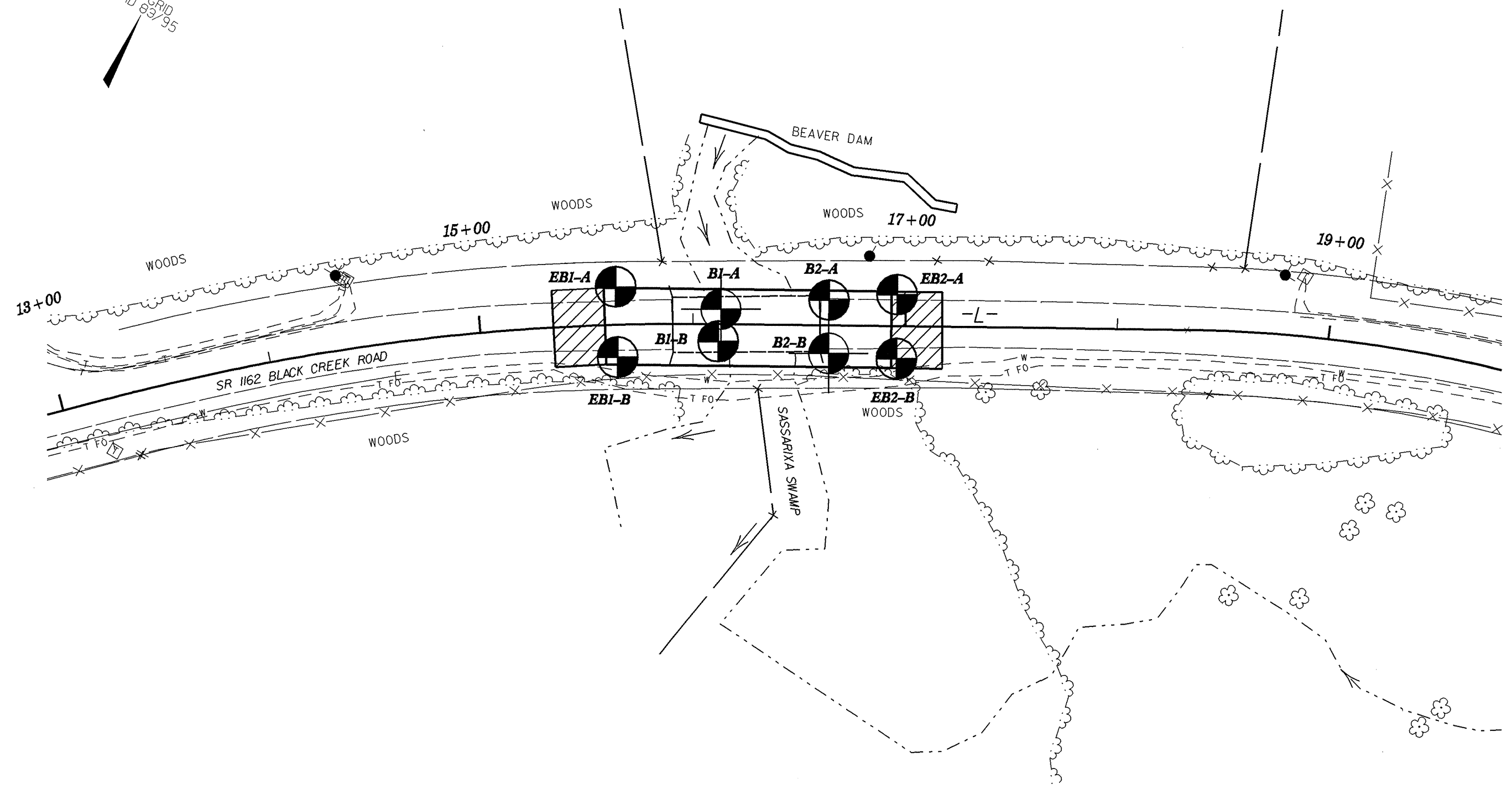
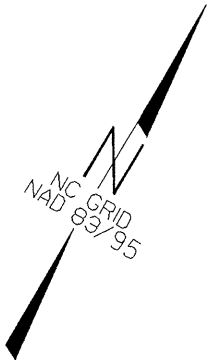
Groundwater elevations at the site ranged from 123.7 to 126.0 feet at the time of the investigation. The surface water elevation of Sassarixa Swamp was noted at 123.6 feet during our investigation. Seasonal fluctuation in the ground water table can be expected.

Notice

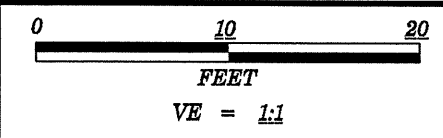
This Geotechnical Engineering Unit foundation report is based on the bent locations provided in the Preliminary General Drawing dated September 14, 2006 and the Bridge Survey and Hydraulic Design Report for Sassarixa Swamp dated September 18, 2006. If significant changes are made in the design and/or location of the proposed structure the subsurface information should be reviewed and modified as necessary.

Prepared by:

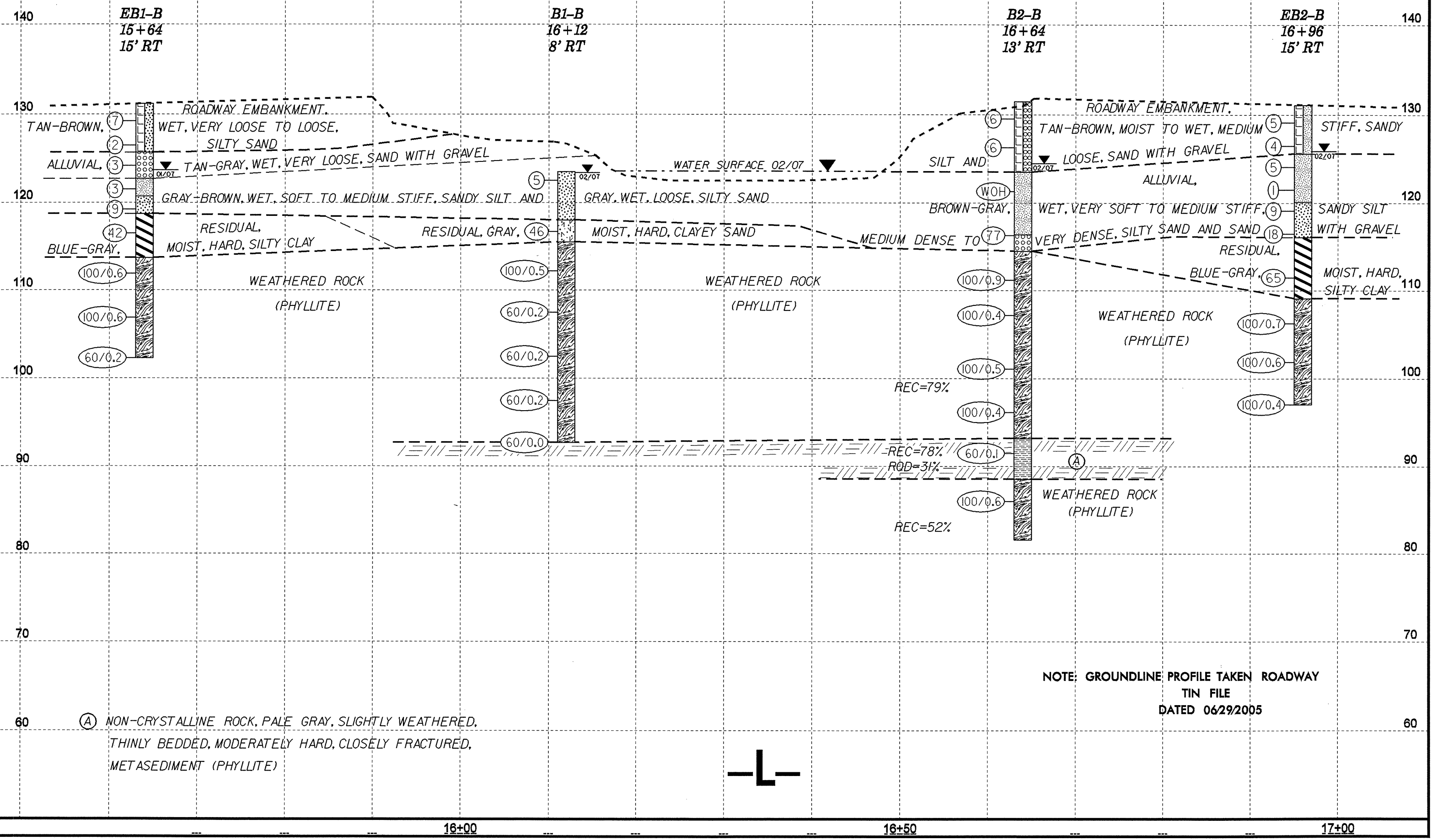

Onuoha B. Oti
Engineering Geologist II



SKEW = 90°



PROJECT REFERENCE NO.	SHEET
33513.1.1(B-4165)	5
FENCE DIAGRAM OF BORINGS PROJECTED ALONG -L- 15' RT	



NOTE: GROUNDLINE PROFILE TAKEN ROADWAY
TIN FILE
DATED 06/29/2005

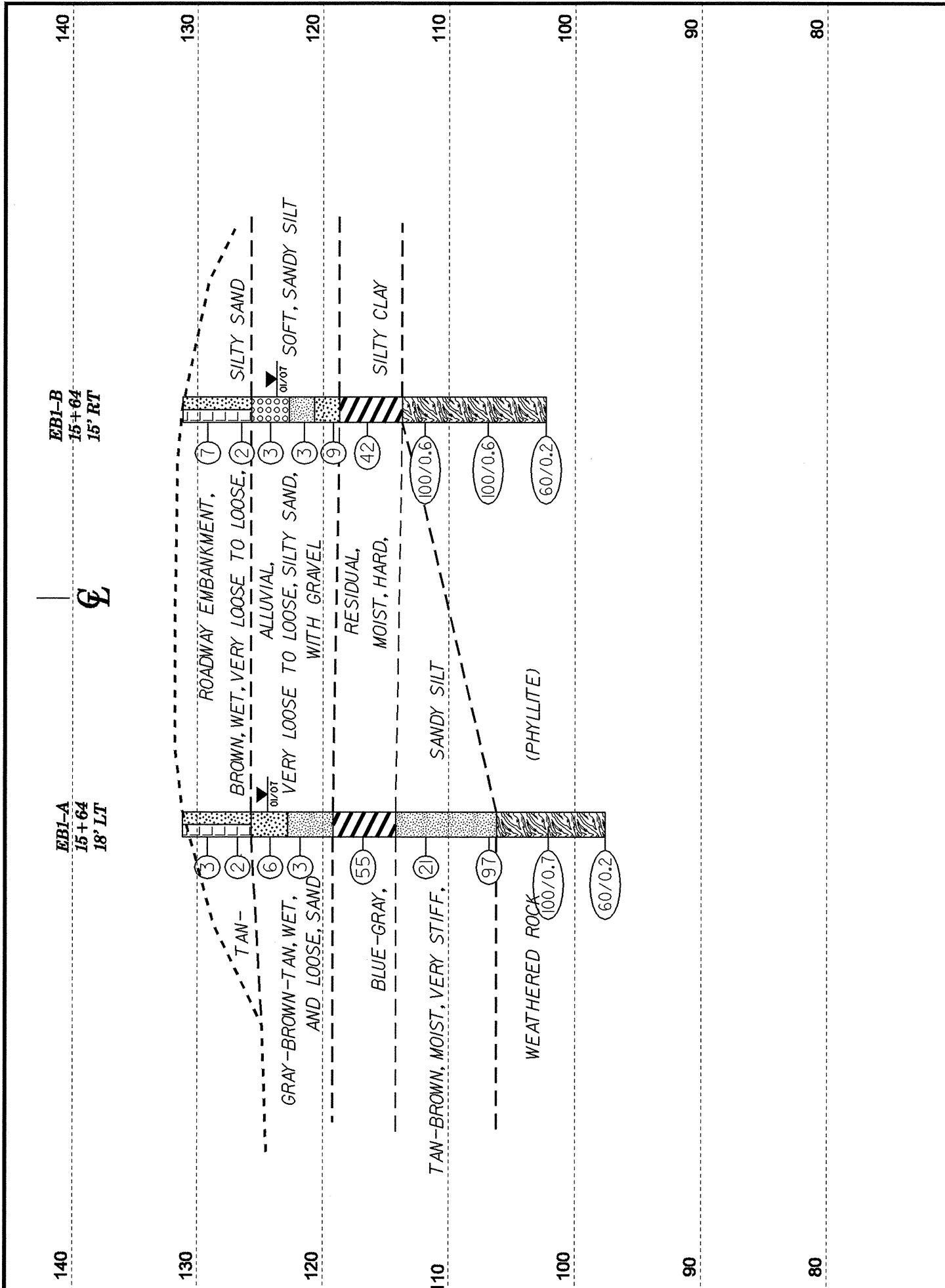
(A) NON-CRYSTALLINE ROCK, PALE GRAY, SLIGHTLY WEATHERED,
THINLY BEDDED, MODERATELY HARD, CLOSELY FRACTURED,
METASEDIMENT (PHYLLITE)



16+00

16+50

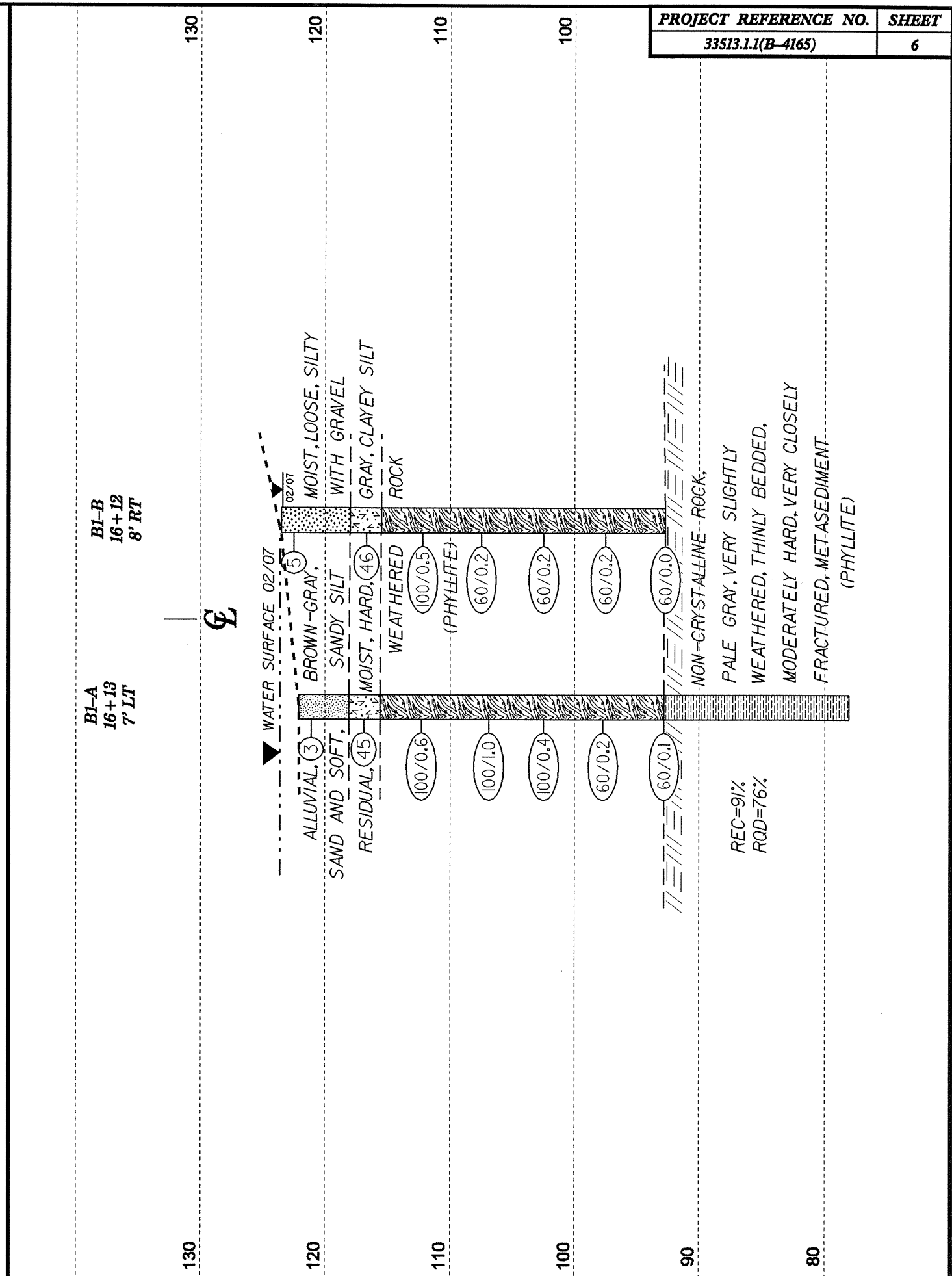
17+00



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

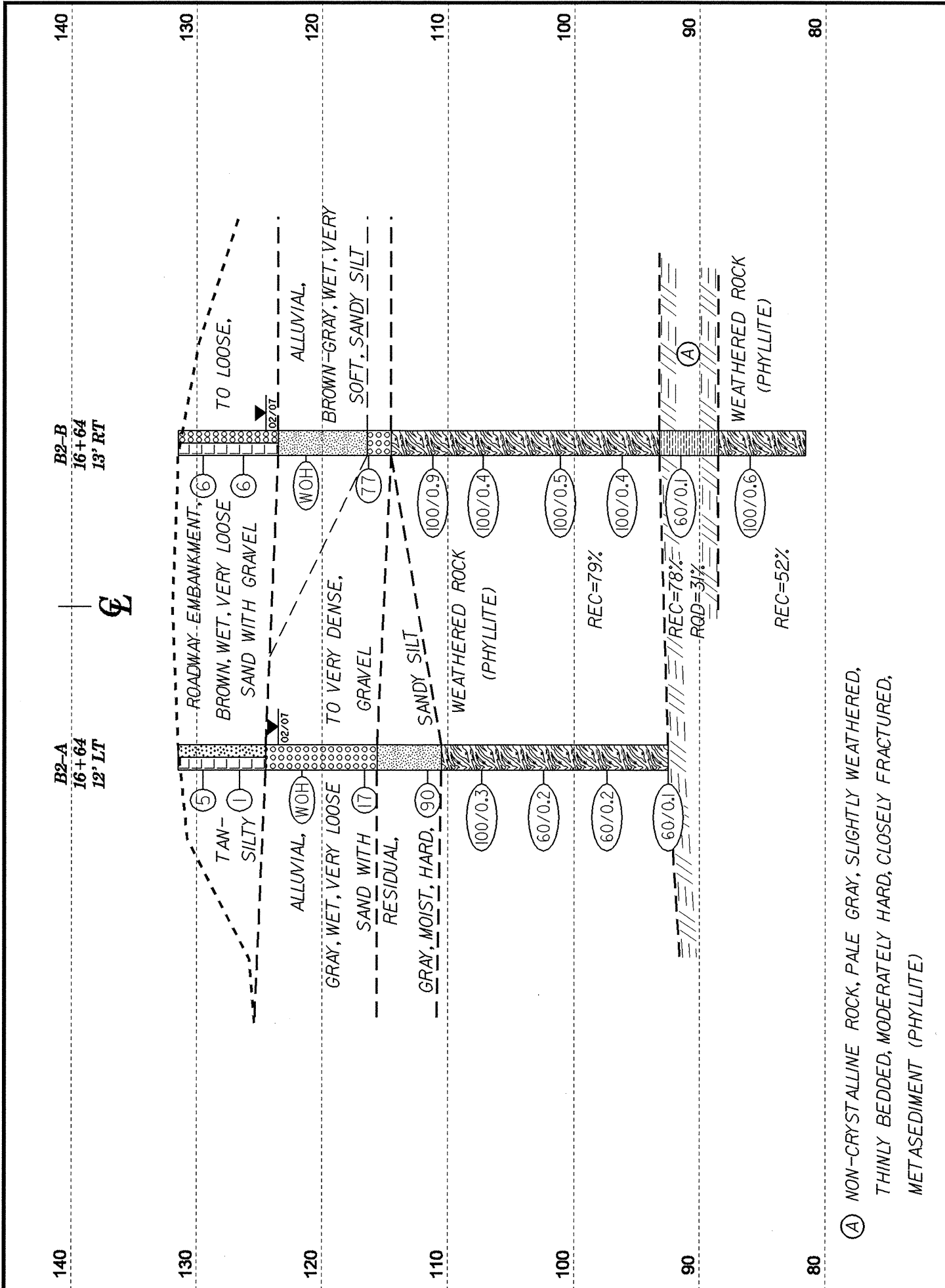
CROSS SECTION THROUGH END BENT 1



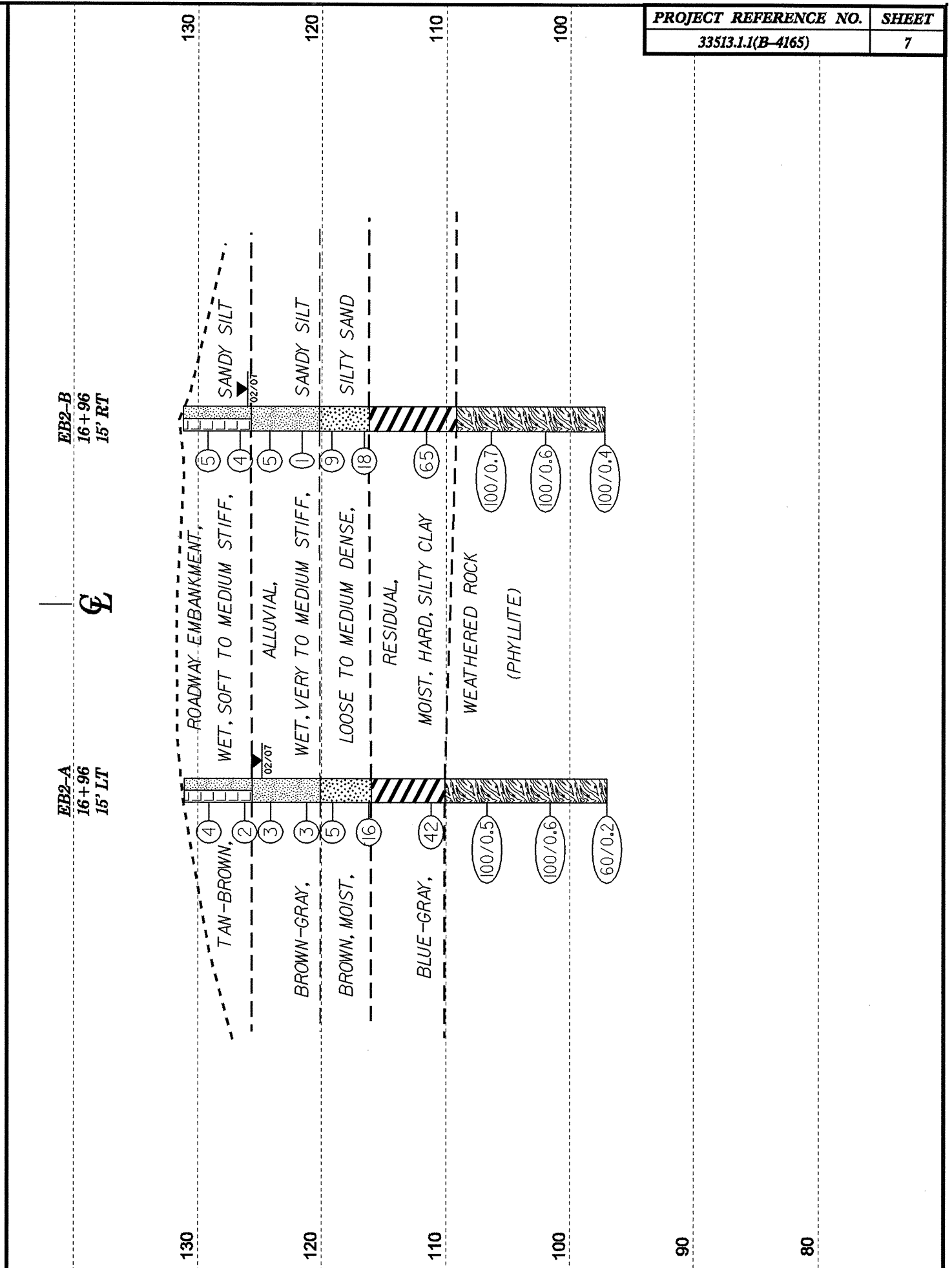
HORIZ. SCALE 0 10 (FEET)

VE = 1:1

CROSS SECTION THROUGH BENT 1



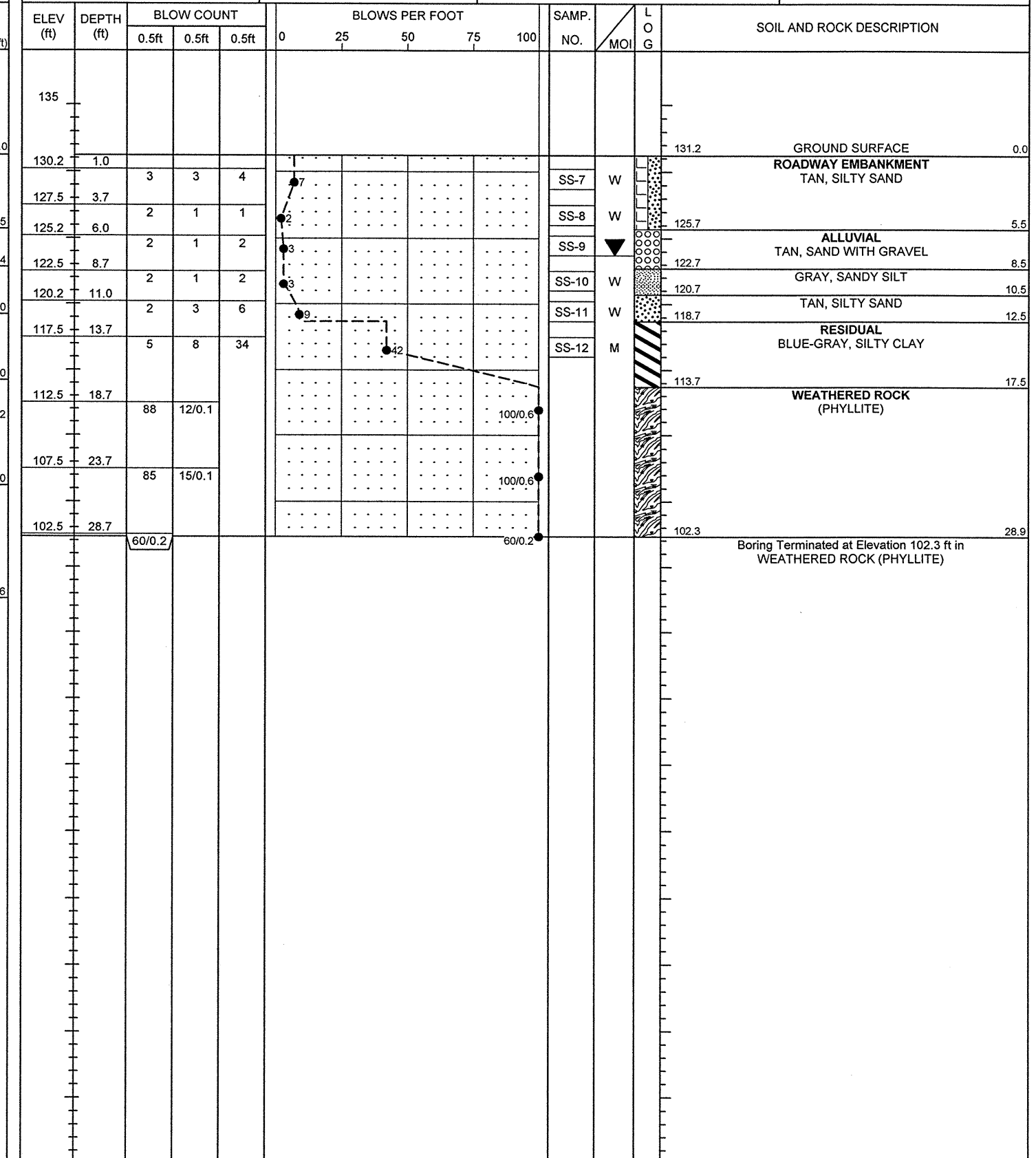
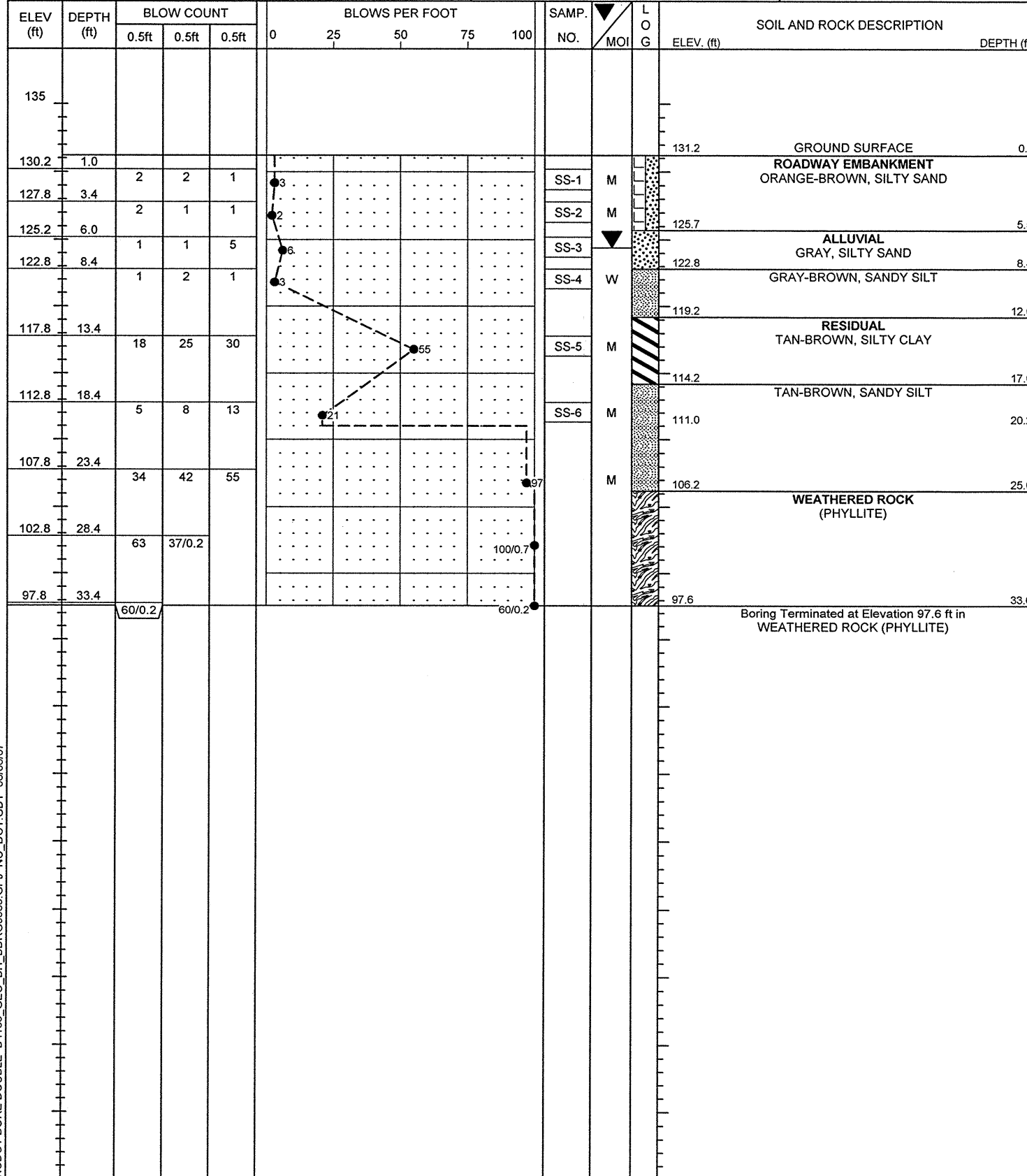
HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 CROSS SECTION THROUGH BENT 2



HORIZ. SCALE 0 10 20 (FEET) VE = 1:1 CROSS SECTION THROUGH END BENT 2

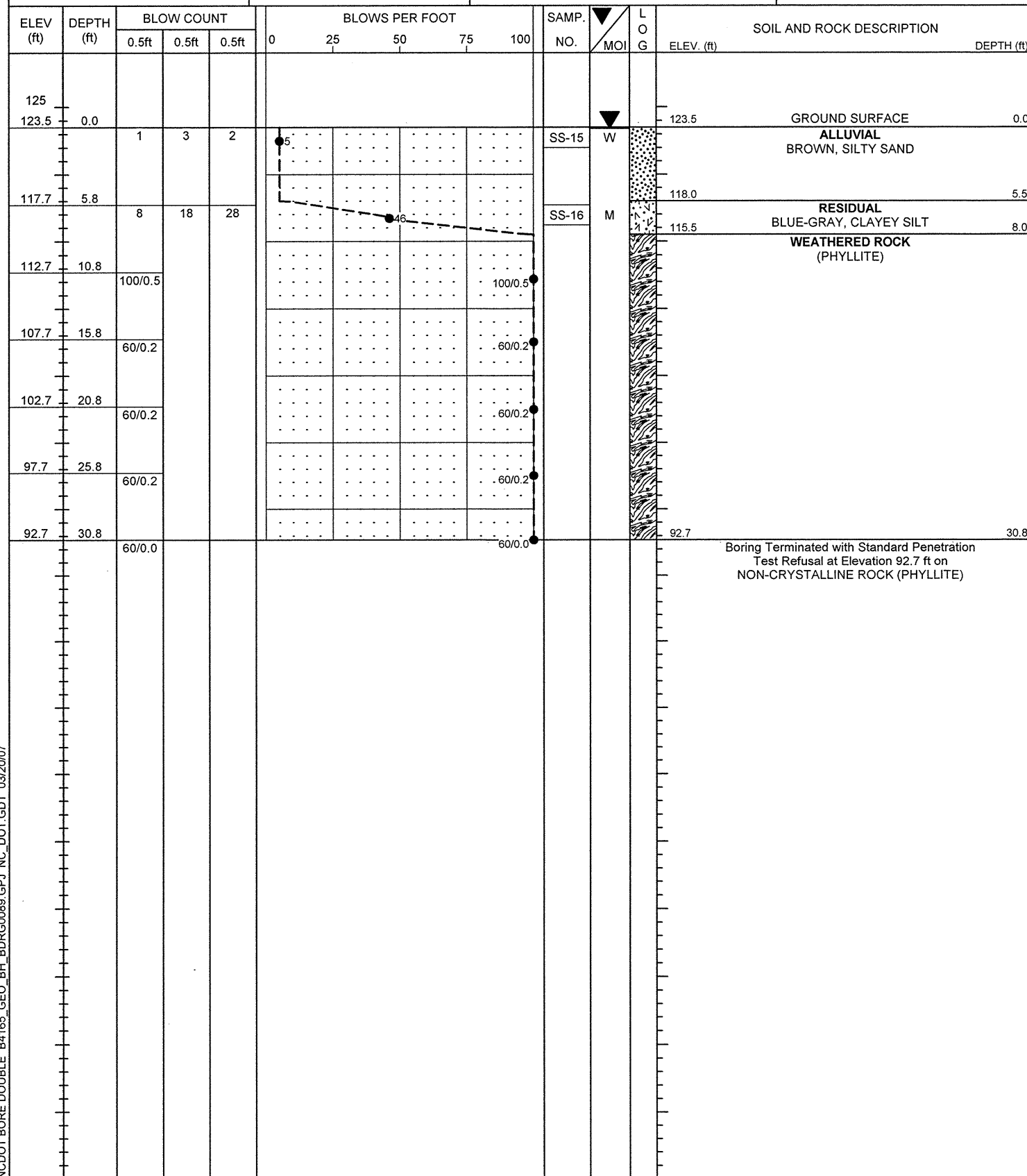
PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. EB1-A	STATION 15+64	OFFSET 18ft LT	ALIGNMENT -L-
COLLAR ELEV. 131.2 ft	TOTAL DEPTH 33.6 ft	NORTHING 2,164,672	EASTING 629,526
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 01/29/07	COMP. DATE 01/29/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. EB1-B	STATION 15+64	OFFSET 15ft RT	ALIGNMENT -L-
COLLAR ELEV. 131.2 ft	TOTAL DEPTH 28.9 ft	NORTHING 2,164,689	EASTING 629,498
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 01/29/07	COMP. DATE 01/29/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

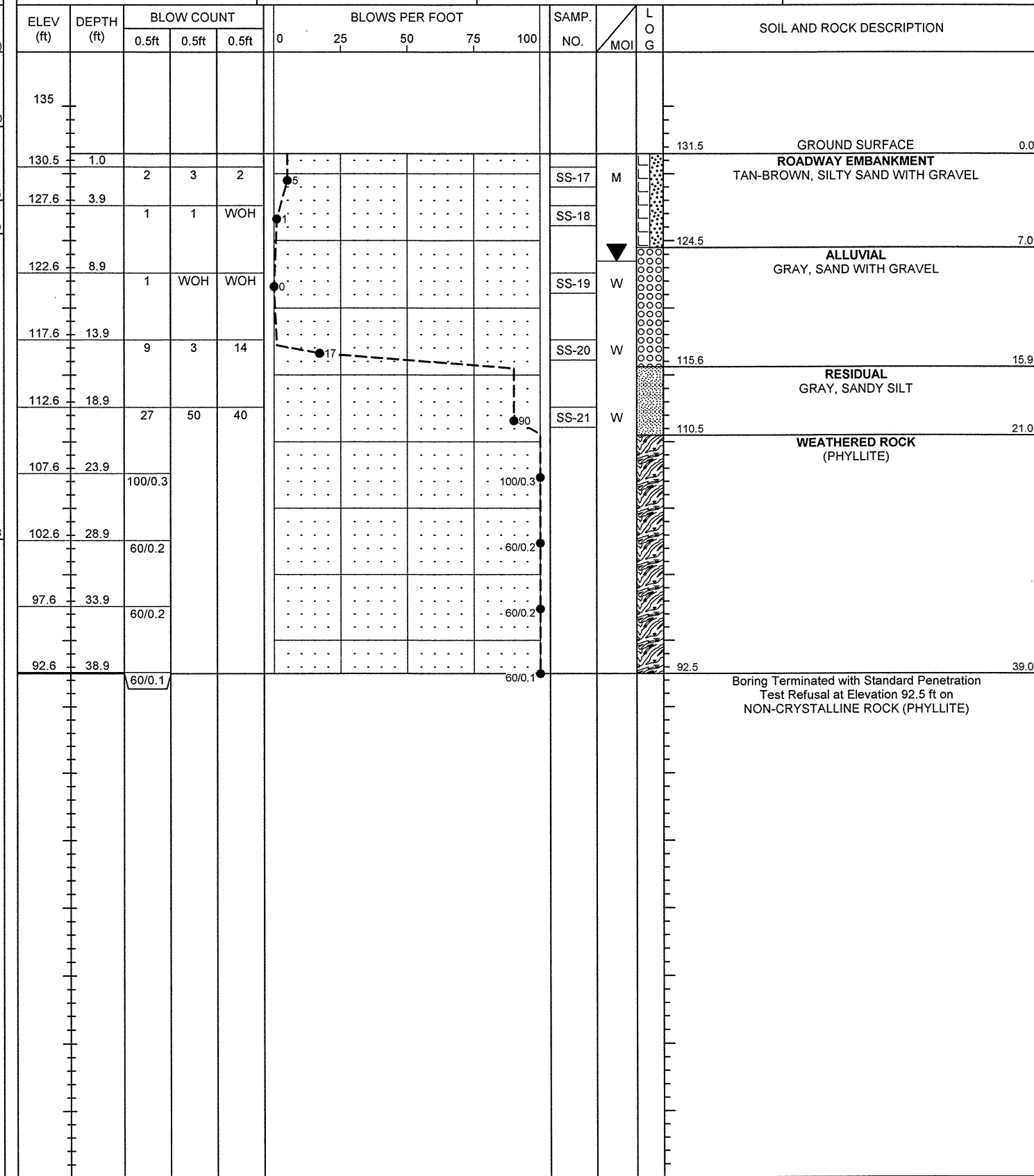


NCDOT BORE DOUBLE B4165_GEO_BH_BDRG0089.GPJ NC_DOT_GDT 08/08/07

PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. B1-B	STATION 16+12	OFFSET 8ft RT	ALIGNMENT -L-
COLLAR ELEV. 123.5 ft	TOTAL DEPTH 30.8 ft	NORTHING 2,164,727	EASTING 629,529
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 02/05/07	COMP. DATE 02/05/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 30.8 ft



PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. B2-A	STATION 16+64	OFFSET 12ft LT	ALIGNMENT -L-
COLLAR ELEV. 131.5 ft	TOTAL DEPTH 39.0 ft	NORTHING 2,164,761	EASTING 629,572
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 02/05/07	COMP. DATE 02/05/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 39.0 ft

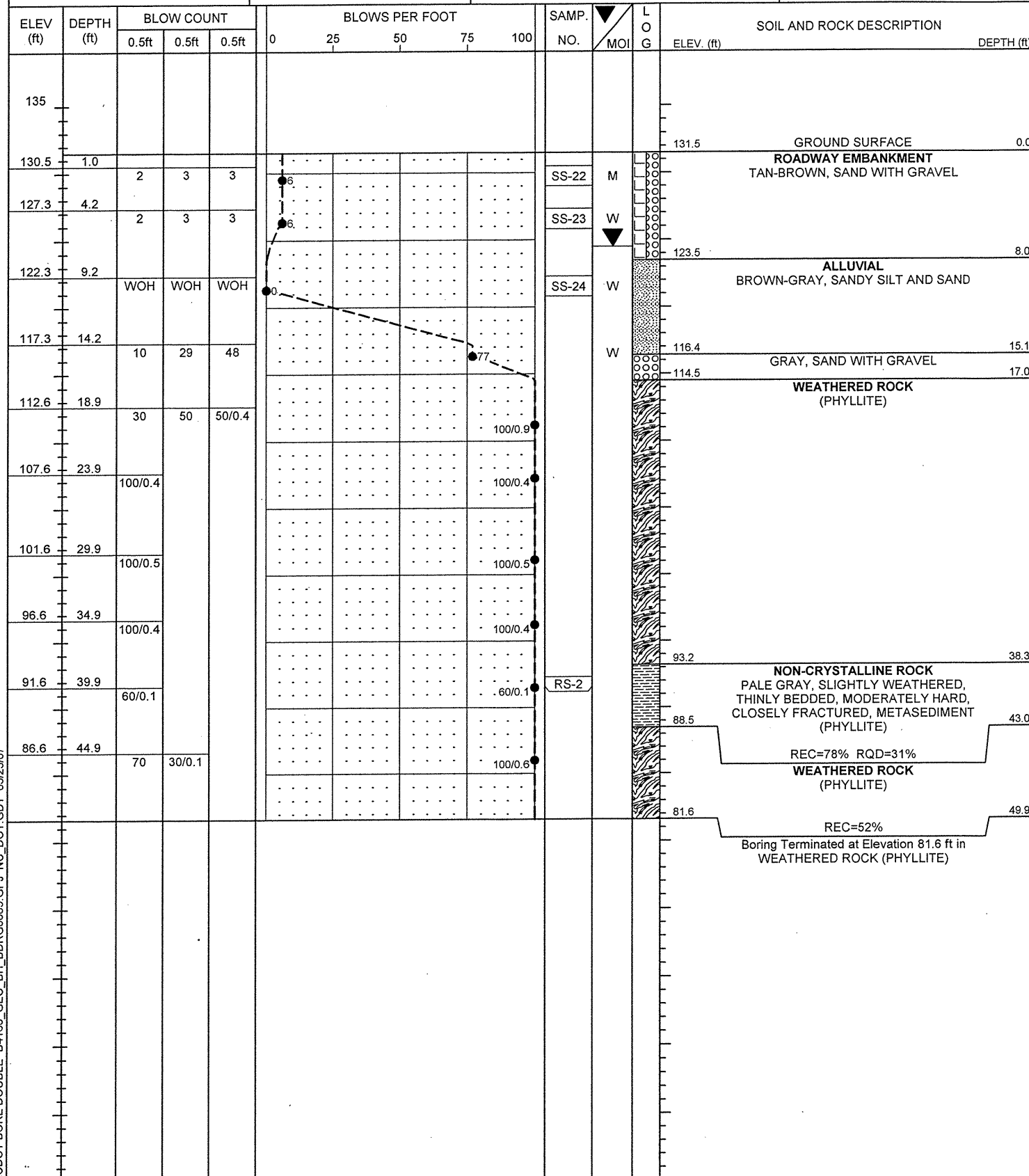


NCDOT BORE DOUBLE B4165 GEO_BH_BDR0089.GPJ NC_DOT.GDT 03/20/07



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. B2-B	STATION 16+64	OFFSET 13ft RT	ALIGNMENT -L-
COLLAR ELEV. 131.5 ft	TOTAL DEPTH 49.9 ft	NORTHING 2,164,774	EASTING 629,550
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 01/31/07	COMP. DATE 01/31/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK 49.9 ft



CORE BORING REPORT

PROJECT: 33513.1.1 ID: B-4165 COUNTY: JOHNSTON BORING NO: B2-B

DESCRIPTION: BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP

LOCATION OF BORING: -L- Sta. 16+64, 13' RT COMPLETION DATE: 1/31/2007

COLLAR or GROUND ELEVATION: 131.5 ft CORE SIZE: NWD4 GEOLOGIST: C. BRUINSMA

CORE EQUIPMENT: CME-45 DRILLER: J. SEWART

ELEV (ft)	DEPTH (ft)	DRILL RATE (min/ft)	RUN (ft)	REC (%)	RQD (%)	SAMPLE NUMBER	FIELD CLASSIFICATION and REMARKS
107.2	24.3	2:00/0.6					Weathered rock (Phyllite)
			0.6	0.5	83%		
106.6	24.9	2:45					Weathered rock (Phyllite)
		2:30					
106.6	24.9	2:30	5.0	4.0	80%		
		3:30					
101.6	29.9	4:00					SPT=100/0.5
101.1	30.4	2:37/0.5					Weathered rock (Phyllite)
		3:00					
		4:00	4.5	2.7	60%		
		3:10					
96.6	34.9	3:30					SPT=100/0.4
96.2	35.3	3:50					Weathered rock (Phyllite)
		3:45					
		3:54	4.6	4.5	98%		
		4:10					
91.6	39.9	4:30					SPT=60/0.1
91.5	40.0	2:30					Non-crystalline rock, pale gray, very slightly weathered, thinly bedded, moderately hard, very closely fractured, Metasediment (phyllite) (39.9-44.9')
		3:10					
		3:55	4.9	3.8	31%		
		5:50				RS-2	
86.6	44.9	5:15				39.2-39.9	SPT=100/0.6
	45.5	3:00/0.4					Weathered rock (Phyllite)
		3:55					
		4:00	4.4	2.3	N/A		
		5:30					
81.6	49.9	5:45					

BOREHOLE TERMINATED AT ELEVATION OF 81.6 FEET, IN ROCK.

NCDOT BORE DOUBLE B4165 GEO_BH_BDRG0089.GPJ NC_DOT_GDT_03/23/07



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. EB2-A	STATION 16+96	OFFSET 15ft LT	ALIGNMENT -L-
COLLAR ELEV. 131.2 ft	TOTAL DEPTH 34.1 ft	NORTHING 2,164,787	EASTING 629,590
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 02/02/07	COMP. DATE 02/02/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
		0.5ft	0.5ft	0.5ft	0	25	50	75	100					
135														
130.2	1.0												GROUND SURFACE	0.0
127.3	3.9	4	2	2							SS-25	M	ROADWAY EMBANKMENT TAN-BROWN, SANDY SILT	
125.2	6.0	WOH	1	1							SS-26	W		5.5
122.3	8.9	1	2	1							SS-27	W	ALLUVIAL BROWN, SANDY SILT	
120.2	11.0	1	2	1							SS-28	W		11.0
117.3	13.9	4	2	3							SS-29	W	BROWN, SILTY SAND	
112.3	18.9	9	8	8							SS-30	W		15.1
112.3	18.9	16	21	21									RESIDUAL BLUE-GRAY, SILTY CLAY	
107.3	23.9	100/0.5									SS-31	M		21.0
102.3	28.9	75	25/0.1										WEATHERED ROCK (PHYLLITE)	
97.3	33.9	60/0.2												34.1

Boring Terminated at Elevation 97.1 ft in WEATHERED ROCK (PHYLLITE)

PROJECT NO. 33513.1.1	ID. B-4165	COUNTY JOHNSTON	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE NO. 89 ON -L- (SR 1162) OVER SASSARIXA SWAMP			GROUND WTR (ft)
BORING NO. EB2-B	STATION 16+96	OFFSET 15ft RT	ALIGNMENT -L-
COLLAR ELEV. 131.1 ft	TOTAL DEPTH 34.0 ft	NORTHING 2,164,802	EASTING 629,565
DRILL MACHINE CME-45	DRILL METHOD Mud Rotary	HAMMER TYPE Manual	
START DATE 02/02/07	COMP. DATE 02/02/07	SURFACE WATER DEPTH N/A	DEPTH TO ROCK N/A

ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
		0.5ft	0.5ft	0.5ft	0	25	50	75	100					
135														
130.1	1.0												GROUND SURFACE	0.0
127.5	3.6	3	3	2									ROADWAY EMBANKMENT TAN-BROWN, SANDY SILT	
125.1	6.0	2	2	2										5.5
122.5	8.6	4	3	2									ALLUVIAL BROWN-GRAY, SANDY SILT	
120.1	11.0	1	WOH	1										11.0
117.5	13.6	3	4	5									GRAY, SILTY SAND	
112.5	18.6	6	8	10										14.0
107.5	23.6	11	21	44									RESIDUAL BLUE-GRAY, SILTY CLAY	
102.5	28.6	18	55	45/0.2										14.8
97.5	33.6	92	8/0.1										WEATHERED ROCK (PHYLLITE)	
		100/0.4												22.0

Boring Terminated at Elevation 97.1 ft in WEATHERED ROCK (PHYLLITE)

NCDOT BORE DOUBLE B4165 GEO_BH_BDRG0089.GPJ NC_DOT_GDT_03/23/07

EB1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-1	18' LT	15+64	1.0-2.5	A-2-4(0)	22	7	60.6	20.9	4.4	14.1	100	65	20	-	-
SS-2	18' LT	15+64	3.4-4.9	A-2-4(0)	23	10	45.9	26.6	13.5	14.1	77	52	24	-	-
SS-3	18' LT	15+64	6.0-7.5	A-2-4(0)	17	NP	23.3	48.7	21.9	6.0	96	86	34	-	-
SS-4	18' LT	15+64	8.4-9.9	A-4(2)	28	6	11.9	35.6	40.4	12.1	100	95	60	-	-
SS-5	18' LT	15+64	13.4-14.9	A-7-5(19)	48	17	6.4	5.4	78.1	10.1	100	95	91	-	-
SS-6	18' LT	15+64	18.4-19.9	A-4(0)	33	10	41.9	18.9	33.2	6.0	86	58	37	-	-

EB1-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-7	15' RT	15+64	1.0-2.5	A-2-4(0)	16	NP	53.7	30.8	11.5	4.0	92	57	17	-	-
SS-8	15' RT	15+64	3.7-5.2	A-2-4(0)	19	NP	39.2	39.2	13.5	8.0	76	56	20	-	-
SS-9	15' RT	15+64	6.0-7.5	A-1-b(0)	19	NP	50.7	33.2	10.1	6.0	60	37	13	-	-
SS-10	15' RT	15+64	8.7-10.2	A-4(0)	20	2	21.7	37.0	33.2	8.0	98	86	47	-	-
SS-11	15' RT	15+64	11.0-12.5	A-2-4(0)	16	NP	45.5	28.0	18.5	8.0	72	51	22	-	-
SS-12	15' RT	15+64	13.7-15.2	A-7-5(17)	50	13	3.0	4.2	86.7	6.0	100	98	95	-	-

B1-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-13	7' LT	16+13	0.0-1.5	A-4(0)	30	5	24.3	37.4	32.2	6.0	98	85	43	-	-
SS-14	7' LT	16+13	4.2-5.7	A-5(11)	41	8	3.0	5.4	79.5	12.1	100	98	94	-	-

B1-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-15	8' RT	16+12	0.0-1.5	A-2-4(0)	23	NP	23.5	52.9	19.5	4.0	94	83	30	-	-
SS-16	8' RT	16+12	5.8-7.3	A-5(14)	49	9	3.2	5.8	78.9	12.1	100	98	94	-	-

B2-A

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-17	12' LT	16+64	1.0-2.5	A-2-4(0)	19	2	63.6	19.9	8.5	8.0	88	55	16	-	-
SS-18	12' LT	16+64	3.9-6.4	A-2-4(0)	18	NP	46.5	31.6	13.9	8.0	80	54	21	-	-
SS-19	12' LT	16+64	8.9-10.4	A-1-b(0)	23	6	56.1	19.9	15.9	8.0	67	36	18	-	-
SS-20	12' LT	16+64	13.9-15.4	A-1-b(0)	17	NP	59.3	30.3	6.4	4.0	69	42	9	-	-
SS-21	12' LT	16+64	19.0-20.4	A-4(2)	35	NP	7.8	6.0	74.0	12.1	100	94	89	-	-

B2-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-22	13' RT	16+64	1.0-2.5	A-1-b(0)	21	NP	66.8	17.9	9.3	6.0	78	46	12	-	-
SS-23	13' RT	16+64	4.2-5.7	A-1-b(0)	17	NP	66.2	24.9	4.8	4.0	87	45	10	-	-
SS-24	13' RT	16+64	9.2-10.7	A-4(5)	34	9	10.1	30.0	45.9	14.1	98	93	66	-	-

EB2-B

SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-25	15' LT	16+96	1.0-2.5	Not Enough Material			42.5	32.0	17.5	8.0	90	63	28	-	-
SS-26	15' LT	16+96	3.9-5.4	A-4(0)	24	6	20.7	38.2	24.9	16.1	93	80	46	-	-
SS-27	15' LT	16+96	6.0-7.5	A-4(5)	32	9	11.1	25.6	41.2	22.1	95	88	68	-	-
SS-28	15' LT	16+96	8.9-10.4	A-4(3)	36	7	24.5	18.5	44.9	12.1	98	80	61	-	-
SS-29	15' LT	16+96	11.0-12.5	A-2-4(0)	18	NP	60.4	26.1	8.5	5.1	98	61	15	-	-
SS-30	15' LT	16+96	13.9-15.1	Not Enough Material			72.1	11.6	13.3	3.0	54	23	9	-	-
SS-31	15' LT	16+96	18.9-20.4	A-7-5(12)	43	12	11.1	6.4	70.4	12.1	100	91	86	-	-



**FIELD
SCOUR REPORT**

WBS: 33513.1.1 TIP: B-4165 COUNTY: JOHNSTON

DESCRIPTION(1): BRIDGE NO.89 ON -L- (SR 1162) OVER SASSARIXA SWAMP AT STATION 16+30.5

EXISTING BRIDGE

Information from: Field Inspection Microfilm _____ (reel _____ pos: _____)
Other (explain) _____

Bridge No.: 89 Length: 70 Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2
Foundation Type: TIMBER PILES

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: MINOR LOCAL AND CONTRACTION SCOUR UP STREAM SIDE OF END BENTS ONE AND TWO

Interior Bents: NO EVIDENCE OF SCOUR OBSERVED

Channel Bed: NO EVIDENCE OF SCOUR OBSERVED

Channel Bank: MINOR CONTRACTION SCOUR

EXISTING SCOUR PROTECTION

Type(3): TIMBER WING WALLS AND RIP RAP IN PLACE AT END BENTS 1 AND 2

Extent(4): APPROXIMATELY 6' X 30' AT END BENTS 1 AND 2

Effectiveness(5): APPEARS SATISFACTORY

Obstructions(6): NONE OBSERVED

INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): SS-15 LOOSE, BROWN, SILTY SAND (A-2-4)

Channel Bank Material(8): SS-24 VERY SOFT, TAN-BROWN, SANDY SILT (A-3)

Channel Bank Cover(9): WOODS, SHRUBS, GRASS, LARGE AND SMALL TREES

Floodplain Width(10): APPROXIMATELY 200 FEET

Floodplain Cover(11): WOODS, SHRUBS, GRASS

Stream is(12): Aggrading _____ Degrading Static _____

Channel Migration Tendency(13): SLIGHT TENDENCY TO THE SOUTH TOWARDS BENT 2

Observations and Other Comments: N/A

DESIGN SCOUR ELEVATIONS(14)

Feet X Meters _____

500 YR	BENT 1	BENT 2																	
	116.1	113.3																	

Comparison of DSE to Hydraulics Unit theoretical scour:

No scour is anticipated beyond the end bents . The Geotechnical Engineering Unit agrees with the predicted scour for the 500 year event in the Bridge Survey and Hydraulic Design Report dated 9/14/06 all bents.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank																			
Sample No.																			
Retained #4																			
Passed #10																			
Passed #40																			
Passed #200																			
Coarse Sand																			
Fine Sand																			
Silt																			
Clay																			
LL																			
PI																			
AASHTO																			
Station																			
Offset																			
Depth																			

See Sheet 12,
"Soil Test Results",
for samples:
SS-15
SS-24

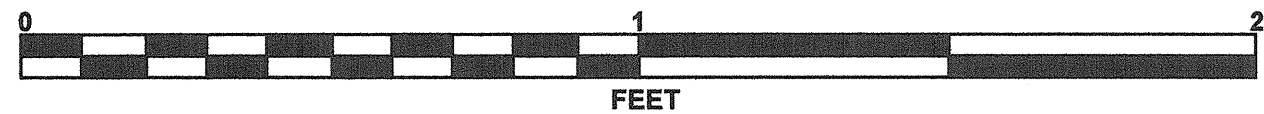
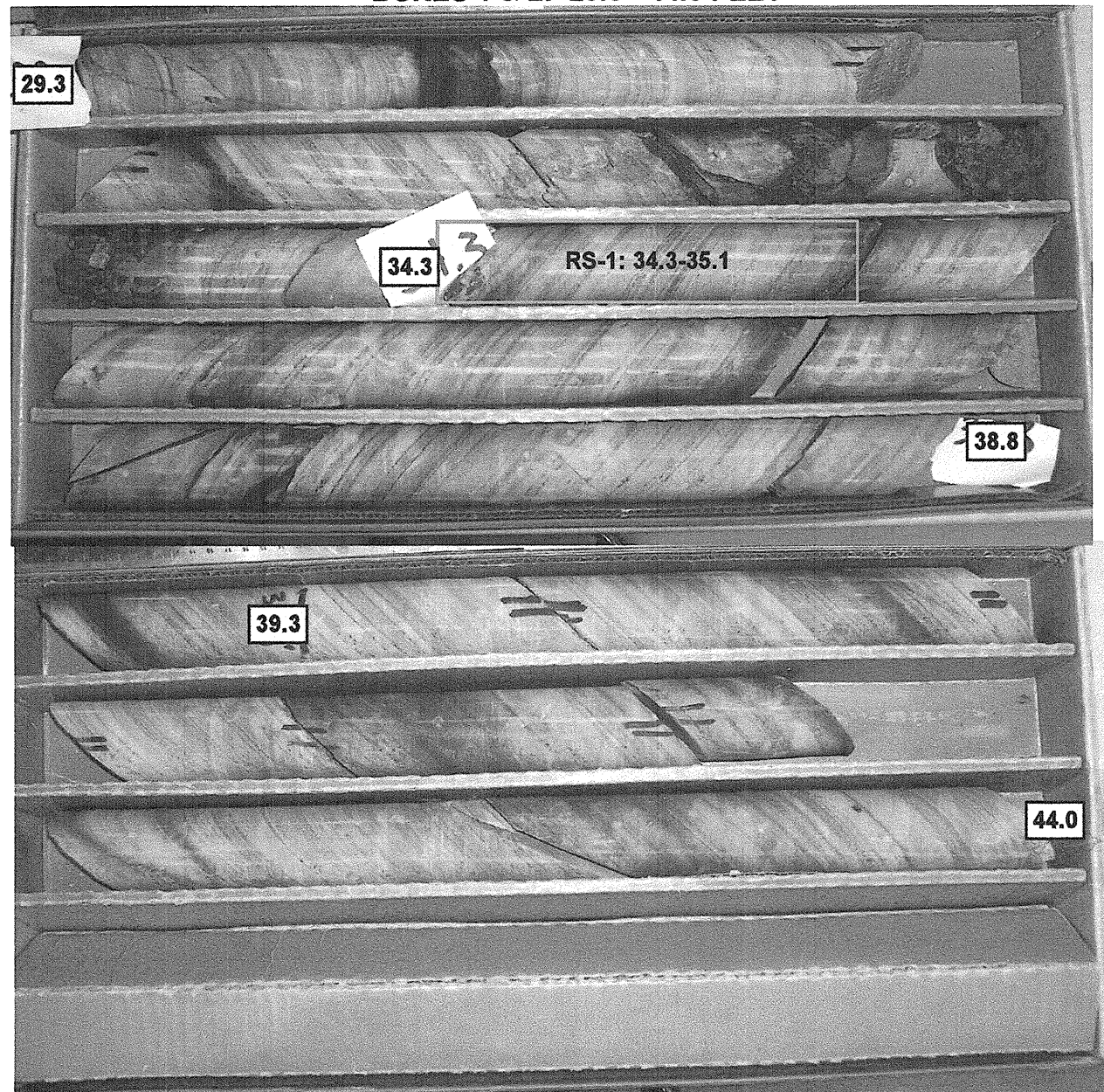
Reported by: Onuoha B. Oti
ONUOHA B. OTI

Date: 3/16/2007

CORE PHOTOGRAPHS

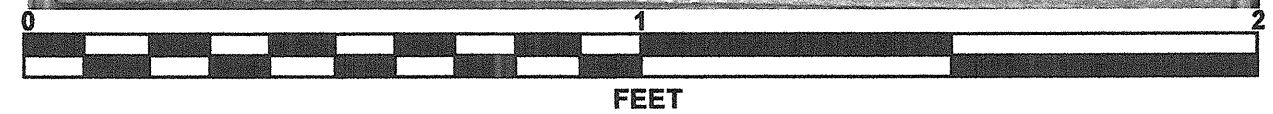
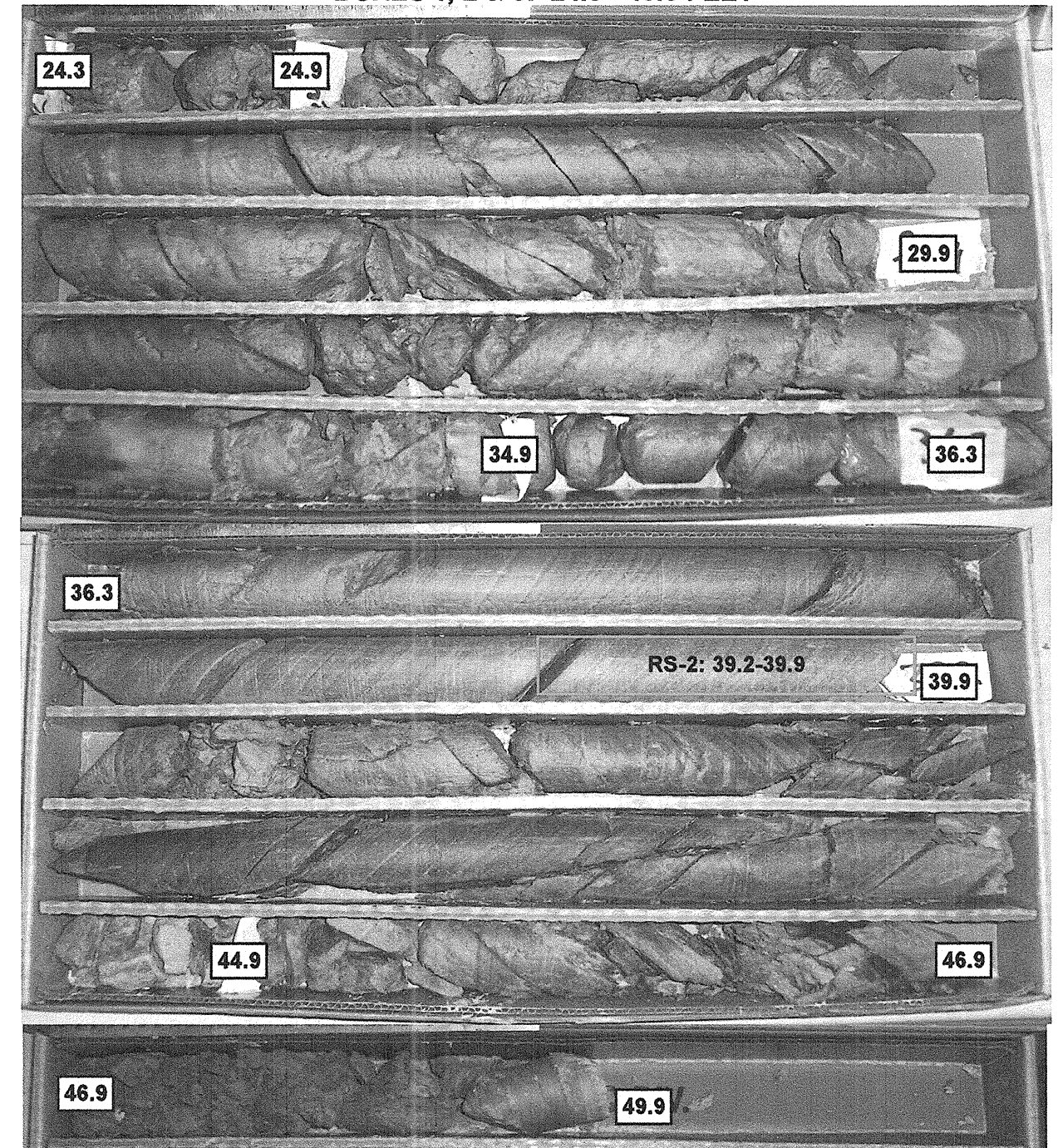
B1-A

BOXES 1 & 2: 29.3 - 44.0 FEET



B2-B

BOXES 1, 2 & 3: 24.3 - 49.9 FEET



SITE PHOTOGRAPH

Bridge No. 89 on -L- (SR 1162) Over Sassarixa Swamp



LOOKING NORTH TOWARDS END BENT 2