STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	40107.1.1(B-4949)	1	15

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 40107.1.1(B-4949) F.A. PROJ. BRNHS-095-2(103)40

COUNTY CUMBERLAND

SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUSINESS) OVER CROSS CREEK

INVENTORY

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PROJECT: 40107.1.1

ID: B-4949

PERSONNEL

O.B. OTI

D.W. DIXON

J.R. TURNAGE

INVESTIGATED BY O.B. OTI

CHECKED BY C.M. BRUINSMA

SUBMITTED BY N.T. ROBERSON

DATE APRIL 2011

NORTH CAROLINA LICENSED SEAL 2031 GEOLOGIST CHRISTINA M. BRUINSMA

4/14/11

DRAWN BY: T.T. WALKER, C.M. BRUINSMA

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 REFERENCE NO.	SHEET NO.
40107.1.1(B-4949)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED 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:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	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 A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT^2)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45C
- ☐ CME-550
- ☐ PORTABLE HOIST
- ■ CME-550X
- ☐ _____

ADVANCING TOOLS:
- ■ CLAY BITS
- ☐ 6" CONTINUOUS FLIGHT AUGER
- ■ 8" HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ■ CASING ☐ W/ ADVANCER
- ■ TRICONE 3 3/8" STEEL TEETH
- ☐ TRICONE _____" TUNG.-CARB.
- ☐ CORE BIT
- ☐ _____

HAMMER TYPE:
- ■ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B_____
- ☐ -N_____
- ☐ -H_____

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

ROCK DESCRIPTION

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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: BL-3 (BL STATION 14+90.98)

ELEVATION: 90.55 FT.

NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
40107.1.1(B-4949)	3

SITE PLAN

0 60 120

FEET

NAD 83/95

GR

SS

GRAVEL

W

EB1-A

25

B1-A

B2-A

EB2-A

30

-L-

TRAFFIC SIGN

I-95 / US 301 SBL

I-95 / US 301 NBL

B1-B

B2-B

EB1-B

EB2-B

P

ALFALFA ST.

SOIL DR

CROSS CREEK

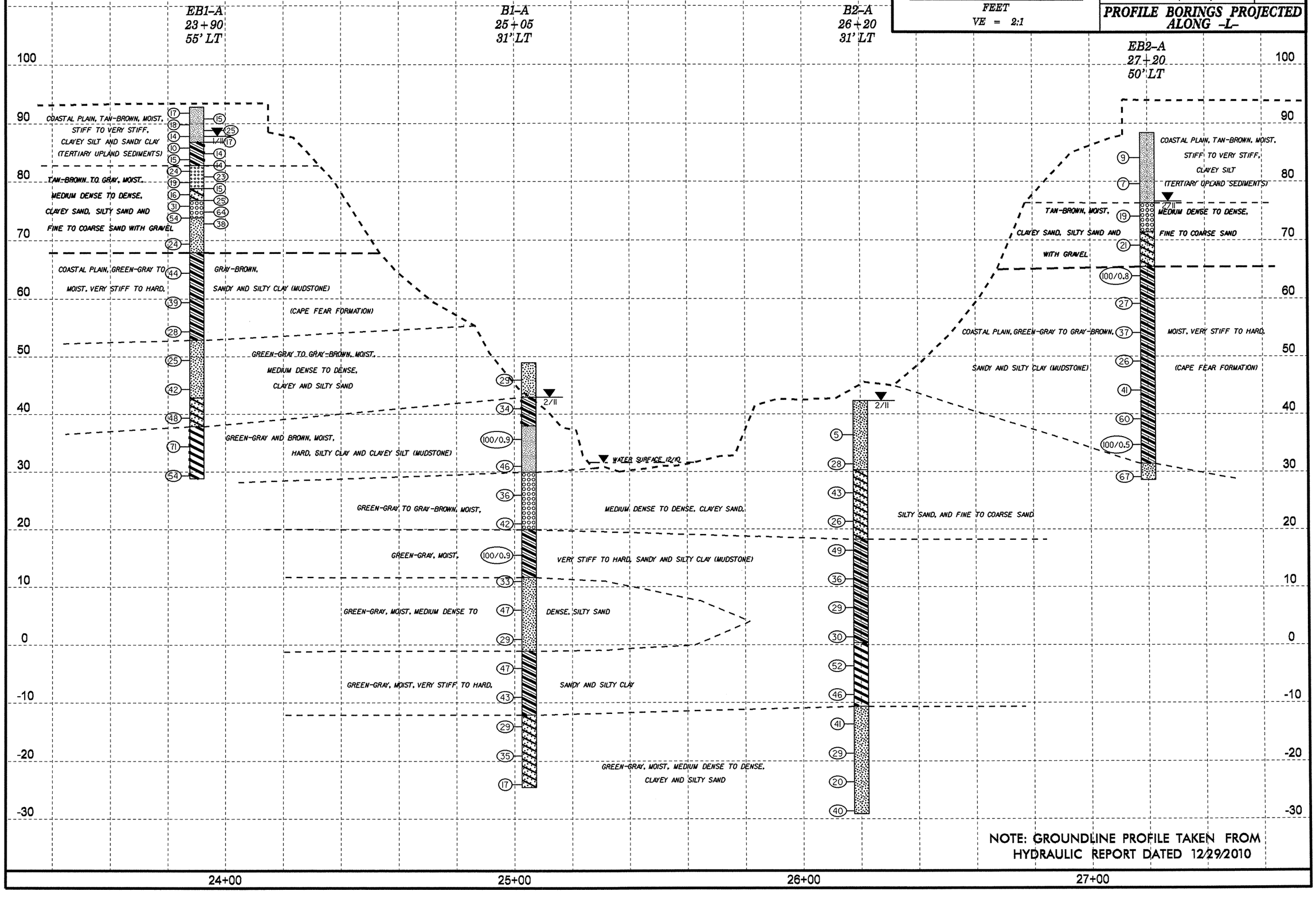
90° SKEW

0	30	60

FEET
VE = 2:1

PROJECT REFERENCE NO.	SHEET
40107.1.1(B-4949)	4

PROFILE BORINGS PROJECTED ALONG -L-



NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC REPORT DATED 12/29/2010

0	10	20
FEET		
VE = 1:1		

PROJECT REFERENCE NO.	SHEET
40107.1.1(B-4949)	5

CROSS SECTION THROUGH END BENT 1

110
100
90
80
70
60
50
40
30
20

EB1-A
23+90
55' LT

EB1-B
23+90
64' RT

℄

17 18 14 10 15 24 19 16 31 54 24 44 39 28 25 42 48 71 54

15 25 1/11 17 14 14 23 15 25 64 38

COASTAL PLAIN, TAN-BROWN, MOIST, MEIDUM STIFF TO VERY STIFF, CLAYEY SILT AND SANDY CLAY

(TERTIARY UPLAND SEDIMENTS)

TAN-BROWN AND GRAY, MOIST, MEDIUM DENSE TO DENSE, CLAYEY SAND, SILTY SAND AND FINE TO COARSE SAND WITH GRAVEL

COASTAL PLAIN, GREEN-GRAY TO GRAY-BROWN, MOIST, VERY STIFF TO HARD, SANDY AND SILTY CLAY

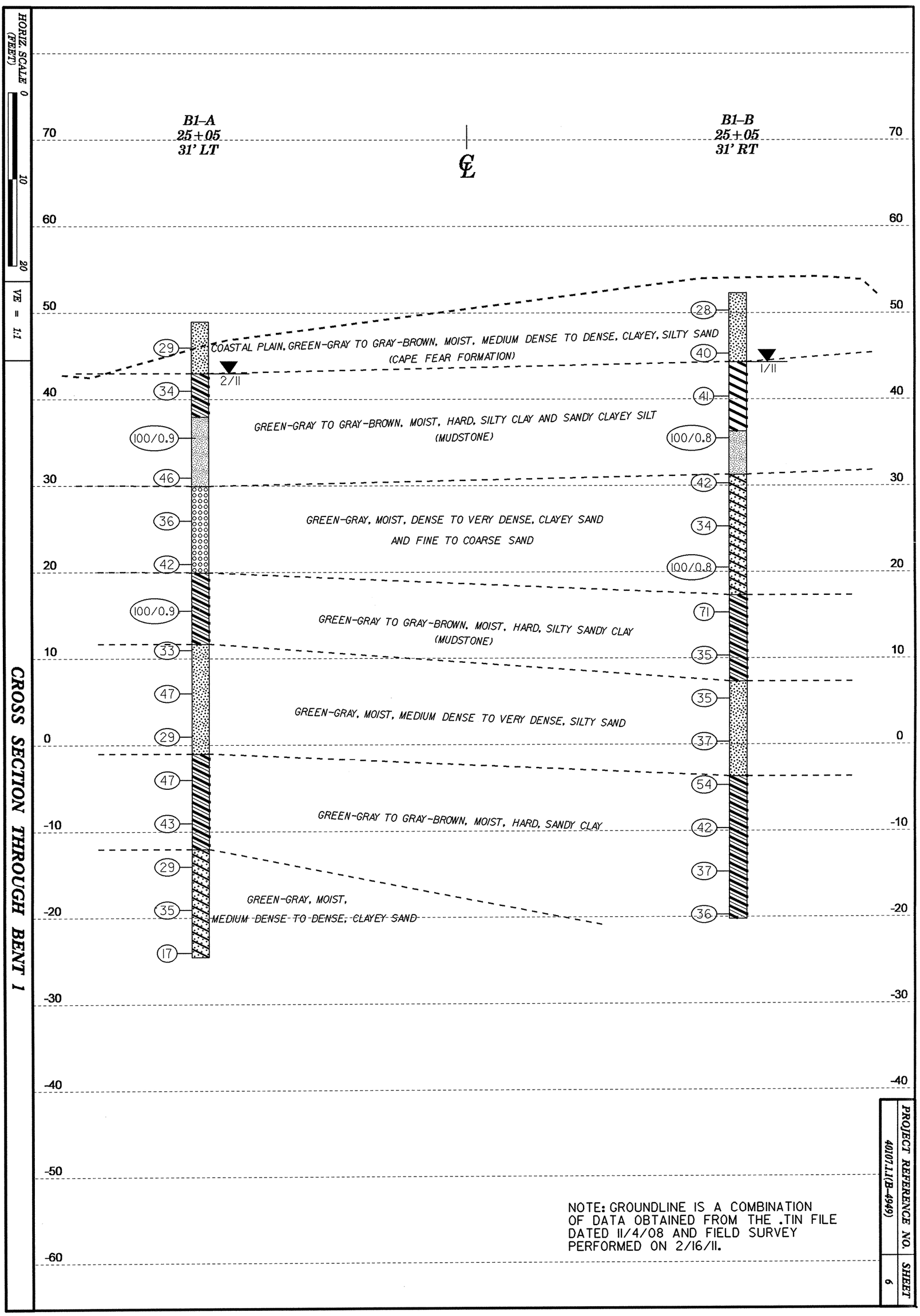
(CAPE FEAR FORMATION)

GREEN-GRAY, MOIST, MEDIUM DENSE TO DENSE, SILTY SAND

GREEN-GRAY TO GRAY-BROWN, MOIST, VERY STIFF TO HARD, SANDY AND SILTY CLAY

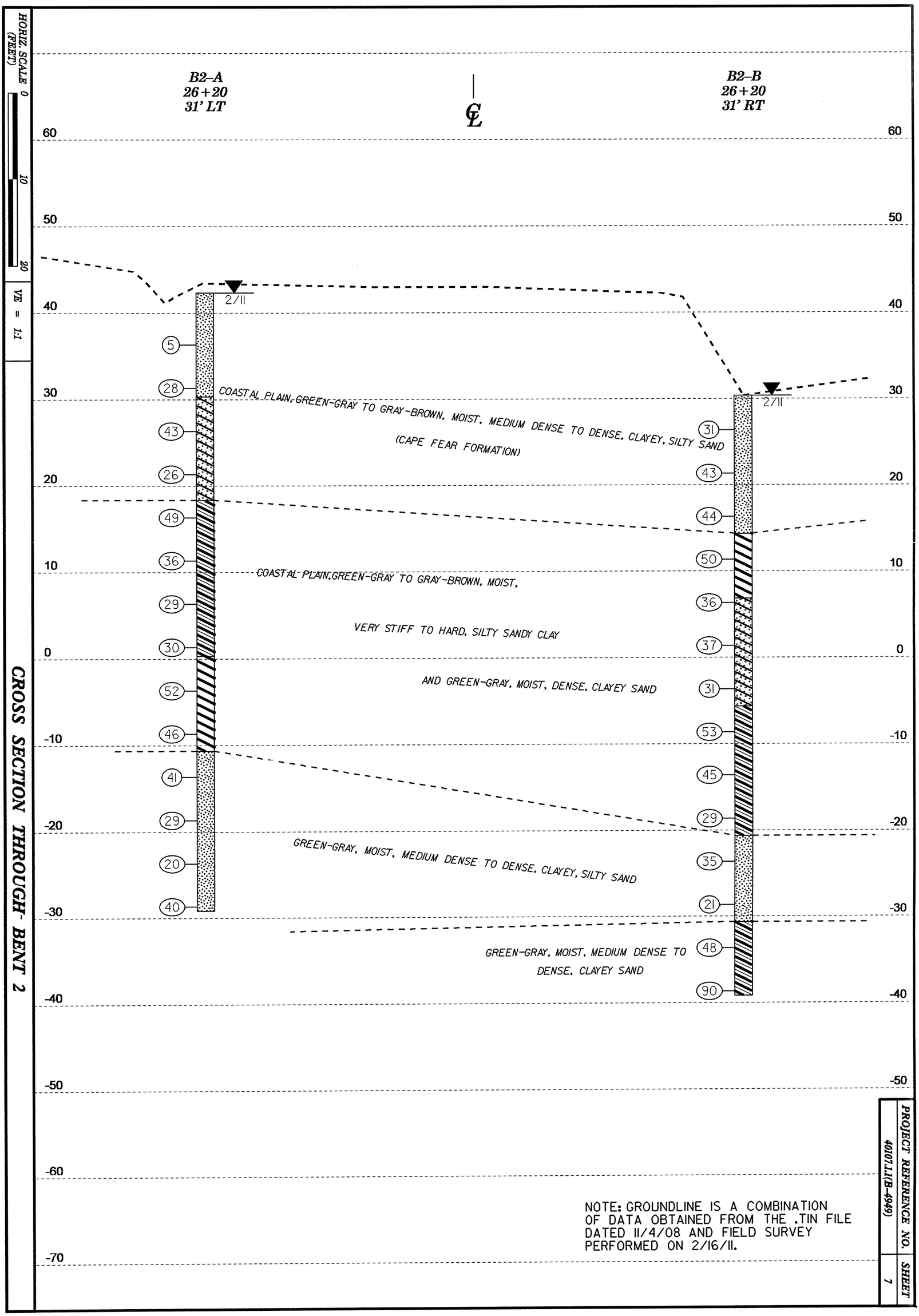
17 20 29 16 21 28 32 26 46 42 47

1/11



NOTE: GROUNDLINE IS A COMBINATION OF DATA OBTAINED FROM THE .TIN FILE DATED 11/4/08 AND FIELD SURVEY PERFORMED ON 2/16/11.

PROJECT REFERENCE NO.	SHEET
40107.1.1(B-4949)	6


HORIZ. SCALE (FEET)
0
10
20
VE = 1:1
B2-A
26+20
31' LT
℄
B2-B
26+20
31' RT
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
2/11
2/11
5
28
43
26
49
36
29
30
52
46
41
29
20
40
31
43
44
50
36
37
31
53
45
29
35
21
48
90
COASTAL PLAIN, GREEN-GRAY TO GRAY-BROWN, MOIST, MEDIUM DENSE TO DENSE, CLAYEY, SILTY SAND
(CAPE FEAR FORMATION)
COASTAL PLAIN, GREEN-GRAY TO GRAY-BROWN, MOIST,
VERY STIFF TO HARD, SILTY SANDY CLAY
AND GREEN-GRAY, MOIST, DENSE, CLAYEY SAND
GREEN-GRAY, MOIST, MEDIUM DENSE TO DENSE, CLAYEY, SILTY SAND
GREEN-GRAY, MOIST, MEDIUM DENSE TO
DENSE, CLAYEY SAND
CROSS SECTION THROUGH BENT 2
NOTE: GROUNDLINE IS A COMBINATION
OF DATA OBTAINED FROM THE .TIN FILE
DATED 11/4/08 AND FIELD SURVEY
PERFORMED ON 2/16/11.
PROJECT REFERENCE NO.
40107.1.1(B-4949)
SHEET
7

0	10	20

FEET

VE = 1:1

PROJECT REFERENCE NO.	SHEET
40107.1.1(B-4949)	8

CROSS SECTION THROUGH END BENT 2

℄

EB2-A
27+20
50' LT

EB2-B
27+20
59' RT

110
100
90
80
70
60
50
40
30
20

COASTAL PLAIN, TAN-BROWN, MOIST, MEDIUM STIFF TO VERY STIFF, CLAYEY SILT AND SANDY CLAY

(TERTIARY UPLAND SEDIMENTS)

TAN-BROWN, MOIST, MEDIUM DENSE, CLAYEY SAND, SILTY SAND AND FINE TO COARSE SAND WITH GRAVEL

COASTAL PLAIN, GREEN-GRAY, MOIST, VERY STIFF TO HARD, SANDY AND SILTY CLAY (MUDSTONE)

(CAPE FEAR FORMATION)

GREEN-GRAY, MOIST, DENSE TO VERY DENSE, SILTY SAND

EB2-A: 9, 7, 2/11, 19, 21, 100/0.8, 27, 37, 26, 41, 60, 100/0.5, 67

EB2-B: 6, 17, 2/11, 15, 16, 55, 28, 26, 37, 38, 34, 44, 49

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 23+90	**OFFSET** 55 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 92.9 ft	**TOTAL DEPTH** 64.0 ft	**NORTHING** 474,786	**EASTING** 2,041,011	**24 HR.** 5.0
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 01/19/11	**COMP. DATE** 01/19/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
95										
	92.9	0.0								92.9 GROUND SURFACE 0.0
	91.4	1.5	8	9	8	17	SS-1	9%		**COASTAL PLAIN** TAN-BROWN, SANDY SILT (TERTIARY UPLAND SEDIMENTS)
90	89.9	3.0	7	6	12	18		M		
	88.4	4.5	16	9	7	16	SS-2	M		
	86.9	6.0	7	8	9	17	SS-3			86.9 6.0
85	85.4	7.5	5	5	6	11	SS-4	12%		TAN-BROWN, SANDY CLAY
	83.9	9.0	8	7	8	15		M		
	82.4	10.5	7	7	12	19		M		82.9 10.0
	80.9	12.0	12	12	11	23	SS-5	M		TAN, FINE TO COARSE SAND
80	79.4	13.5	10	9	9	18		M		
	77.9	15.0	6	6	10	16	SS-6	20%		78.9 14.0
	76.4	16.5	10	15	19	34		M		TAN-BROWN, CLAYEY SAND
75	74.9	18.0	22	28	36	64	SS-7	M		76.9 16.0
			24	20	19	39		M		TAN-BROWN, COARSE SAND WITH GRAVEL
							SS-8			73.9 19.0
70	70.4	22.5	6	10	14	24		M		GREEN-GRAY, CLAYEY, SILTY SAND
										67.9 25.0
65	65.4	27.5	11	20	24	44	SS-9	20%		**COASTAL PLAIN** GREEN-GRAY, SANDY CLAY (CAPE FEAR FORMATION)
60	60.4	32.5	10	17	22	39		M		
55	55.4	37.5	8	14	14	28		M		52.9 40.0
										GREEN-GRAY, SILTY SAND
50	50.4	42.5	7	12	13	25	SS-10	M		
45	45.4	47.5	9	20	22	42		M		42.9 50.0
										GREEN-GRAY, CLAYEY SAND
40	40.4	52.5	15	22	26	48	SS-11	M		
										37.9 55.0
35	35.4	57.5	17	30	41	71	SS-12	22%		TAN AND GRAY, SANDY CLAY
30	30.4	62.5	21	27	27	54		M		28.9 64.0
										Boring Terminated at Elevation 28.9 ft IN CP: SANDY CLAY (CAPE FEAR FORMATION)

WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 23+90	**OFFSET** 64 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 88.4 ft	**TOTAL DEPTH** 54.0 ft	**NORTHING** 474,710	**EASTING** 2,041,102	**24 HR.** 10.1
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 01/24/11	**COMP. DATE** 01/24/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
90										
	85.9	2.5	4	7	10	17				88.4 GROUND SURFACE 0.0
85								M		**COASTAL PLAIN** TAN-BROWN, SANDY SILT (TERTIARY UPLAND SEDIMENTS)
	80.9	7.5	4	7	13	20				83.4 5.0
80								M		TAN-BROWN, SANDY CLAY
	75.9	12.5	9	13	16	29				78.4 10.0
75								M		**COASTAL PLAIN** GRAY-BROWN, TO GRAY-GREEN, CLAYEY SAND (CAPE FEAR FORMATION)
	70.9	17.5	6	8	8	16				
70								M		
	65.9	22.5	5	11	10	21				
65								M		
	60.9	27.5	9	12	16	28				63.4 25.0
60								M		GREEN-GRAY, SANDY CLAY
	55.9	32.5	7	13	19	32				53.4 35.0
55								M		GREEN-GRAY, CLAYEY, SILTY SAND
	50.9	37.5	9	12	14	26				
50								M		
	45.9	42.5	10	20	26	46				
45								M		
	40.9	47.5	11	17	25	42				
40								M		
	35.9	52.5	9	25	22	47				34.4 54.0
35								M		Boring Terminated at Elevation 34.4 ft IN CP: SILTY SAND (CAPE FEAR FORMATION)

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WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 25+05	**OFFSET** 31 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 49.0 ft	**TOTAL DEPTH** 73.5 ft	**NORTHING** 474,859	**EASTING** 2,041,104	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 02/17/11	**COMP. DATE** 02/23/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										49.0 GROUND SURFACE	0.0
	47.0	2.0	6	12	17	29		M		**COASTAL PLAIN** GREEN-GRAY, CLAYEY, SILTY SAND, MICACEOUS (CAPE FEAR FORMATION)	
	42.0	7.0	11	15	19	34		M		43.0 RED-BROWN AND GREEN, SANDY SILTY CLAY	6.0
	37.0	12.0	8	45	55/0.4	100/0.9		M		38.0 GREEN-GRAY TO RED-BROWN, CLAYEY SANDY SILT, MICACEOUS	11.0
	32.0	17.0	20	20	26	46		M		30.0 GREEN AND BROWN, SILTY CLAYEY COARSE SAND, MICACEOUS	19.0
	27.0	22.0	14	18	18	36	SS-32	M			
	22.0	27.0	13	22	20	42		M		20.0 GREEN-GRAY, SILTY SANDY CLAY (CLAYSTONE)	29.0
	17.0	32.0	29	50	50/0.4	100/0.9	SS-33	M			
	12.0	37.0	13	15	18	33	SS-34	M		11.7 GREEN-GRAY, CLAYEY SILTY SAND, MICACEOUS	37.3
	7.0	42.0	16	25	22	47		M			
	2.0	47.0	9	15	14	29		M		-1.1 GRAY-BROWN, SILTY CLAY	50.0
	-3.1	52.0	15	22	25	47		M			
	-8.1	57.0	14	20	23	43		M		-12.1 GREEN-GRAY, CLAYEY SAND	61.0
	-13.1	62.0	11	13	16	29	SS-31	M			
	-18.1	67.0	8	16	19	35		M			
	-23.1	72.0	7	7	10	17		M		-24.6 Boring Terminated at Elevation -24.6 ft IN CP: CLAYEY SAND (CAPE FEAR FORMATION)	73.5

WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 25+05	**OFFSET** 31 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 52.3 ft	**TOTAL DEPTH** 72.5 ft	**NORTHING** 474,819	**EASTING** 2,041,151	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 01/25/11	**COMP. DATE** 01/26/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	
										52.3 GROUND SURFACE	0.0
	51.3	1.0	9	14	14	28	SS-13	M		**COASTAL PLAIN** GREEN-GRAY, CLAYEY, SILTY SAND (CAPE FEAR FORMATION)	
	46.3	6.0	9	18	22	40		M		44.3 GRAY-BROWN, SILTY CLAY	8.0
	41.3	11.0	10	16	25	41	SS-14	M			
	36.3	16.0	21	64	36/0.3	100/0.8	SS-15	M		36.3 GREEN-GRAY, CLAYEY, SANDY SILT (MUDSTONE)	16.0
	31.3	21.0	12	20	22	42	SS-16	M		31.3 GREEN-GRAY, CLAYEY SAND	21.0
	26.3	26.0	12	17	17	34		M			
	21.3	31.0	18	51	49/0.3	100/0.8	SS-17	M		17.3 GREEN-GRAY, SANDY CLAY	35.0
	16.3	36.0	29	35	36	71		M			
	11.3	41.0	10	15	20	35	SS-18	M		7.3 GRAY-GREEN, CLAYEY, SILTY SAND	45.0
	6.3	46.0	12	15	20	35		M			
	1.3	51.0	12	16	21	37		M		-3.7 GRAY-BROWN TO GRAY-GREEN, SANDY SILTY CLAY	56.0
	-3.7	56.0	18	26	28	54	SS-19	M			
	-8.7	61.0	13	20	22	42		M			
	-13.7	66.0	12	17	20	37		M			
	-18.7	71.0	14	15	21	36		M		-20.2 Boring Terminated at Elevation -20.2 ft IN CP: CLAY (CAPE FEAR FORMATION)	72.5

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WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 26+20	**OFFSET** 31 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 42.3 ft	**TOTAL DEPTH** 71.5 ft	**NORTHING** 474,947	**EASTING** 2,041,177	**24 HR.** 0.0
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 02/09/11	**COMP. DATE** 02/14/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										42.3	0.0
										GROUND SURFACE	
										COASTAL PLAIN GRAY-BROWN TO GRAY-GREEN, CLAYEY, SILTY SAND (CAPE FEAR FORMATION)	
	37.3	5.0	2	2	3	5		M			
	32.3	10.0	2	10	18	28		M		30.3	12.0
										GREEN-GRAY, SILTY, CLAYEY SAND	
	27.3	15.0	17	22	21	43		M			
	22.3	20.0	8	11	15	26		M		18.3	24.0
										GRAY-BROWN, SANDY CLAY	
	17.3	25.0	13	25	24	49		M			
	12.3	30.0	7	13	23	36		M			
	7.3	35.0	12	14	15	29		M			
	2.3	40.0	9	15	15	30		M			
	-2.7	45.0	17	24	28	52	SS-29	M		0.3	42.0
										GRAY-BROWN, SILTY CLAY	
	-7.7	50.0	13	22	24	46		M			
	-12.7	55.0	11	19	22	41	SS-30	M		-10.7	53.0
										GREEN-GRAY, CLAYEY, SILTY SAND	
	-17.7	60.0	12	14	15	29		M			
	-22.7	65.0	5	9	11	20		M			
	-27.7	70.0	19	20	20	40		M		-29.2	71.5
										Boring Terminated at Elevation -29.2 ft IN CP: SILTY SAND (CAPE FEAR FORMATION)	

WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 26+20	**OFFSET** 31 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 30.4 ft	**TOTAL DEPTH** 69.5 ft	**NORTHING** 474,907	**EASTING** 2,041,225	**24 HR.** 0.0
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 01/31/11	**COMP. DATE** 02/02/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										30.4	0.0
										GROUND SURFACE	
										COASTAL PLAIN GRAY-BROWN TO GREEN-GRAY, CLAYEY, SILTY SAND (CAPE FEAR FORMATION)	
	27.4	3.0	10	16	15	31		M			
	22.4	8.0	10	18	25	43		M			
	17.4	13.0	13	20	24	44		M			
	12.4	18.0	16	22	28	50		M			
	7.4	23.0	11	16	20	36		M		14.4	16.0
										GRAY-BROWN, SILTY CLAY	
	2.4	28.0	11	16	21	37		M		6.9	23.5
										GRAY-BROWN TO GRAY-GREEN, SILTY, CLAYEY SAND	
	-2.7	33.0	10	12	19	31		M			
	-7.7	38.0	17	23	30	53		M		-5.7	36.0
										GREEN-GRAY TO GRAY-BROWN, SILTY CLAY	
	-12.7	43.0	13	20	25	45		M			
	-17.7	48.0	9	13	16	29		M		-20.7	51.0
										GRAY-BROWN, CLAYEY, SILTY SAND	
	-22.7	53.0	14	16	19	35		M			
	-27.7	58.0	7	9	12	21		M		-30.7	61.0
										GRAY-BROWN, SILTY CLAY	
	-32.7	63.0	16	23	25	48	SS-20	M			
	-37.7	68.0	22	40	50	90		M		-39.2	69.5
										Boring Terminated at Elevation -39.2 ft IN CP: CLAY (CAPE FEAR FORMATION)	

NCDOT GEOTECHNICAL ENGINEERING UNIT
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WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 27+20	**OFFSET** 50 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 88.4 ft	**TOTAL DEPTH** 59.8 ft	**NORTHING** 475,036	**EASTING** 2,041,227	**24 HR.** 11.7
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 02/07/11	**COMP. DATE** 02/08/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
										88.4	
										GROUND SURFACE	0.0
										COASTAL PLAIN TAN-BROWN, SANDY SILT	
85	85.1	3.3	2	4	5	9		M			
80	80.1	8.3	2	3	4	7		M			
										76.4	12.0
75	75.1	13.3	4	8	11	19		M		TAN-BROWN, SILTY FINE TO COARSE SAND	
70	70.1	18.3	5	9	12	21		M			
										65.4	23.0
65	65.1	23.3	19	56	44/0.3			M		**COASTAL PLAIN** GRAY-BROWN, SANDY CLAY (CAPE FEAR FORMATION)	
60	60.1	28.3	9	12	15	27		M			
55	55.1	33.3	8	17	20	37		M			
50	50.1	38.3	9	11	15	26		M			
45	45.1	43.3	15	20	21	41		M			
40	40.1	48.3	13	26	34	60		M			
35	35.1	53.3	100/0.5			100/0.5		M			
										31.4	57.0
30	30.1	58.3	18	30	37	67		M		GREEN-GRAY, CLAYEY, SILTY SAND	
										28.6	59.8
										Boring Terminated at Elevation 28.6 ft IN CP: CLAYEY SAND (CAPE FEAR FM)	

WBS 40107.1.1	**TIP** B-4949	**COUNTY** CUMBERLAND	**GEOLOGIST** Oti, O. B.	
SITE DESCRIPTION BRIDGE NO. 61 ON -L- (US 301/I-95 BUS.) OVER CROSS CREEK				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 27+20	**OFFSET** 59 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 87.5 ft	**TOTAL DEPTH** 60.0 ft	**NORTHING** 474,966	**EASTING** 2,041,311	**24 HR.** 12.5
DRILL RIG/HAMMER EFF./DATE RFO0057 CME-550X 73% 12/06/2005		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Dixon, D. W.	**START DATE** 02/04/11	**COMP. DATE** 02/05/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										87.5 GROUND SURFACE 0.0
										COASTAL PLAIN TAN-BROWN, SANDY CLAY (TERTIARY UPLAND SEDIMENTS)
85	84.0	3.5	2	2	4	6	SS-21	M		
80	79.0	8.5	2	8	9	17	SS-22	M		81.5 6.0
										TAN-BROWN, CLAYEY, SANDY SILT
75	74.0	13.5	3	5	10	15	SS-23	M		75.5 12.0
70	69.0	18.5	7	8	8	16	SS-24	M		TAN-BROWN, FINE TO COARSE SAND
										70.5 17.0
65	64.0	23.5	12	22	33	55	SS-25	M		TAN-BROWN, SILTY SAND
60	59.0	28.5	7	12	16	28		M		64.0 23.5
55	54.0	33.5	7	11	15	26	SS-26	M		**COASTAL PLAIN** GRAY-BROWN, SANDY CLAY (CAPE FEAR FORMATION)
50	49.0	38.5	12	18	19	37		M		
45	44.0	43.5	10	18	20	38	SS-27	M		
40	39.0	48.5	10	18	16	34		M		
35	34.0	53.5	9	17	27	44	SS-28	M		35.5 52.0
30	29.0	58.5	15	23	26	49		M		GREEN-GRAY TO GRAY-BROWN, CLAYEY, SILTY SAND
										27.5 60.0
										Boring Terminated at Elevation 27.5 ft IN CP: CLAYEY SAND (CAPE FEAR FM)

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	50 LT	23+90	0.0-1.0	A-4(1)	25	8	12.5	40.8	22.4	24.2	97	92	53	-	-
SS-2	50 LT	23+90	2.0-3.0	A-4(2)	24	8	10.5	39.4	25.9	24.2	99	93	60	9.2	-
SS-3	50 LT	23+90	4.0-5.0	A-4(5)	27	10	3.2	35.4	35.2	26.3	100	99	73	-	-
SS-4	50 LT	23+90	6.0-7.0	A-6(10)	36	15	2.8	34.3	30.5	32.3	100	99	73	11.6	-
SS-5	50 LT	23+90	10.0-11.0	A-3(0)	19	NP	63.1	28.1	3.7	5.1	93	58	10	-	-
SS-6	50 LT	23+90	14.0-15.0	A-2-7(4)	58	44	53.5	18.1	5.2	23.2	96	64	28	19.7	-
SS-7	50 LT	23+90	16.0-17.0	A-1-b(0)	23	NP	81.4	11.5	2.0	5.1	79	31	6	-	-
SS-8	50 LT	23+90	19.0-20.0	A-2-5(0)	44	NP	62.3	27.3	6.4	4.0	98	64	13	-	-
SS-9	50 LT	23+90	27.5-29.0	A-6(2)	28	14	27.3	40.6	24.0	8.1	100	86	41	20.1	-
SS-10	50 LT	23+90	42.5-44.0	A-2-4(0)	33	NP	63.1	23.4	9.4	4.0	97	56	17	-	-
SS-11	50 LT	23+90	52.5-54.0	A-2-6(1)	33	16	36.9	36.3	19.8	7.1	98	78	33	-	-
SS-12	50 LT	23+90	57.5-59.0	A-7-6(17)	41	22	9.9	14.3	45.5	30.3	100	94	80	21.7	-

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-31	31 LT	25+05	62.0-63.5	A-2-6(0)	32	14	53.3	29.6	15.1	2.0	100	73	22	-	-
SS-32	31 LT	25+05	22.0-23.6	A-1-b(0)	40	NP	72.1	21.0	4.9	2.0	97	47	9	-	-
SS-33	31 LT	25+05	32.0-33.5	A-6(3)	30	15	14.2	45.4	28.3	12.0	100	96	45	-	-
SS-34	31 LT	25+05	37.3-38.5	A-2-4(0)	25	9	46.6	31.2	18.1	4.0	100	77	26	-	-

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-13	31 RT	25+05	1.0-2.5	A-2-4(0)	37	NP	60.1	29.8	10.1	0.0	98	61	13	-	-
SS-14	31 RT	25+05	11.0-12.5	A-7-6(17)	51	25	12.2	25.2	48.5	14.0	100	93	70	-	-
SS-15	31 RT	25+05	16.0-17.5	A-4(0)	21	6	28.0	38.6	31.3	2.0	100	85	42	-	-
SS-16	31 RT	25+05	21.0-22.5	A-2-6(0)	36	11	29.8	45.8	22.3	2.0	100	87	32	-	-
SS-17	31 RT	25+05	36.0-37.5	A-6(3)	32	14	9.0	52.3	30.7	8.0	100	99	46	-	-
SS-18	31 RT	25+05	46.0-47.5	A-2-4(0)	36	NP	46.6	40.6	12.7	0.0	99	75	17	-	-
SS-19	31 RT	25+05	56.0-57.5	A-6(8)	35	17	19.0	27.6	45.3	8.0	100	89	61	-	-

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-29	31 LT	26+20	45.0-46.5	A-7-6(17)	43	20	2.0	26.4	49.5	22.0	100	99	82	-	-
SS-30	31 LT	26+20	55.0-56.5	A-2-4(0)	33	6	23.6	49.8	22.5	4.0	98	88	31	-	-

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-20	31 RT	26+20	63.0-64.5	A-6(23)	38	24	1.0	5.6	43.3	50.1	100	99	96	-	-

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-21	59 RT	27+20	3.5-5.0	A-6(5)	28	12	8.0	37.8	30.1	24.0	99	96	62	-	-
SS-22	59 RT	27+20	8.5-20.0	A-4(0)	26	8	6.4	56.1	19.5	18.0	98	97	43	-	-
SS-23	59 RT	27+20	13.5-15.0	A-1-b(0)	20	NP	76.5	17.2	4.3	2.0	91	41	6	-	-
SS-24	59 RT	27+20	18.5-20.0	A-2-7(1)	41	25	66.3	13.6	6.1	14.0	96	58	20	-	-
SS-25	59 RT	27+20	0.0-0.0	A-6(6)	39	16	26.6	29.0	34.3	10.0	99	82	52	-	-
SS-26	59 RT	27+20	33.5-35.0	A-6(1)	30	12	17.8	54.5	23.7	4.0	100	98	36	-	-
SS-27	59 RT	27+20	43.5-45.0	A-6(1)	32	12	22.4	46.2	27.3	4.0	100	90	39	-	-
SS-28	59 RT	27+20	53.5-55.0	A-2-4(0)	35	NP	11.6	70.3	16.1	2.0	100	99	23	-	-

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: Q TIP: B-4949 COUNTY: CUMBERLAND

DESCRIPTION(1): BR. NO. 61 ON US 301/I-95 BUSINESS OVER CROSS CREEK

EXISTING BRIDGE

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

Bridge No.: 61 Length: 297 Total Bents: 6 Bents in Channel: 2 Bents in Floodplain: 4
Foundation Type: CONCRETE FOOTING ON PILES

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: GULLIES HAVE FORMED ADJACENT AND UNDERNEATH END BENTS. THESE GULLIES EXTEND FROM THE END BENT FOOTING TO THE CREEK.

Interior Bents: SOME GULLYING EXTENDS NEAR INTERIOR BENTS BUT DO NOT EXPOSE FOOTING

Channel Bed: NO SCOUR EVIDENT. SMALL TRIBUTARY/STREAM ON SOUTHEAST BANK HAS SCOURED DOWN CHANNEL TO CROSS CREEK

Channel Bank: BLUFFS ADJACENT TO CREEK HAVE LARGE GULLYING DUE TO RUNOFF. SOME OF THIS MAY ALSO BE FACILITATED BY SCOUR DURING HIGH WATER EVENTS.

EXISTING SCOUR PROTECTION

Type(3): NO SIDE SLOPE PROTECTION OR RIP RAP USED ONSITE

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): NONE

DESIGN INFORMATION

Channel Bed Material(7): ALLUVIAL SAND AND GRAVEL OVERLYING HARD/DENSE COASTAL PLAIN SOILS

Channel Bank Material(8): COASTAL PLAIN CLAYEY, SILTY SANDS (CAPE FEAR FORMATION)

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

Floodplain Width(10): 125 FT

Floodplain Cover(11): GRASS, SHRUB, OCCASIONAL TREES. URBAN DEVELOPMENT NEARBY

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): SOUTH

Observations and Other Comments: EVIDENCE OF SPRING AT TOP OF BLUFF ON SOUTH EAST SIDE LARGE DRAINAGE FEATURE/GULLY ON NORTHWEST SIDE AS WELL.

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS										
B1-A	B1-B	B2-A	B2-B							
30.9	30.9	33.7	30.0							

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the Hydraulic Unit's theoretical scour elevations at Interior Bent 1 and B2-A. The DSE has been lowered at B2-B by 3.7 feet.

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-13 (BANK) NO ALLUVIAL CHANNEL MATERIAL TESTED

Template Revised 02/07/06

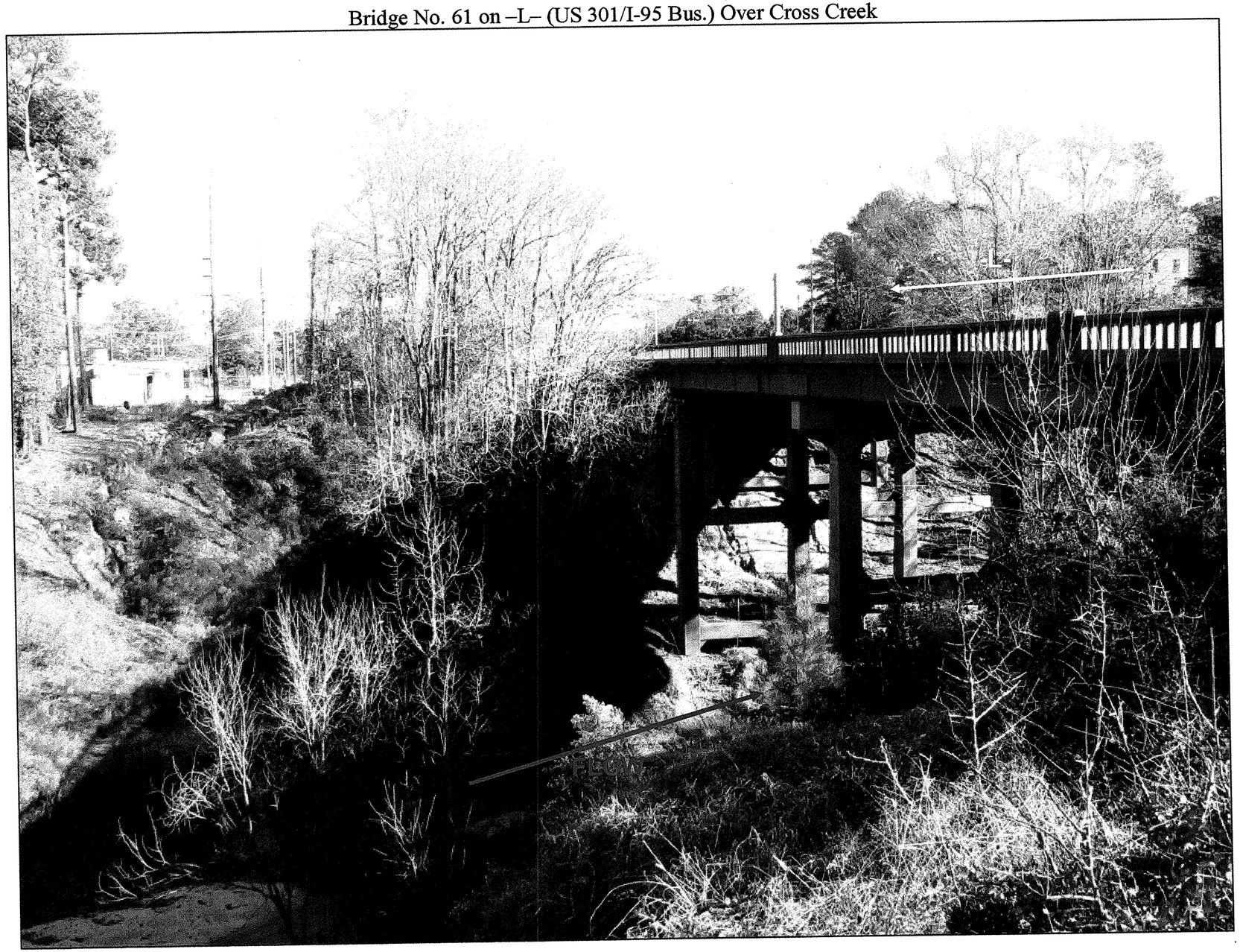
Reported by: Christina M. Bruinsma, L.G. **Date:** 2/22/2011

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 theoritical 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.

SITE PHOTOGRAPH

Bridge No. 61 on –L– (US 301/I-95 Bus.) Over Cross Creek



Looking Northeast towards End Bent 2

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4949 (40107.1.1)	1	3

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *40107.1.1 (B-4949)* F.A. PROJ. *BRNHS-095-2(103)40*

COUNTY *CUMBERLAND*

PROJECT DESCRIPTION *REPLACE BR. 61 OVER CROSS CREEK ON I-95 BUSINESS/US 301*

SITE DESCRIPTION *RETAINING WALL: -L- STA. 20+00*

WALL INVENTORY

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL

O. B. OTI

J. I. MILKOVITS

C. M. BRUINSMA

INVESTIGATED BY *C.M. BRUINSMA*

CHECKED BY *N.T. ROBERSON*

SUBMITTED BY *N. T. ROBERSON*

DATE *NOVEMBER 2011*

NORTH CAROLINA LICENSED SEAL 2031 GEOLOGIST CHRISTINA M. BRUINSMA 11/28/11

DRAWN BY: *W. D. FIELDS*

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: 40107.1.1

ID: B-4949

PROJECT REFERENCE NO.	SHEET NO.
B-4949 (40107.1.1)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED 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:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	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 A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- 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
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] 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 _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

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

ROCK DESCRIPTION

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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK:

ELEVATION: FT.

NOTES:

REVISED 09/23/09

PLAN VIEW OF RETAINING WALL AND WALL ENVELOPE

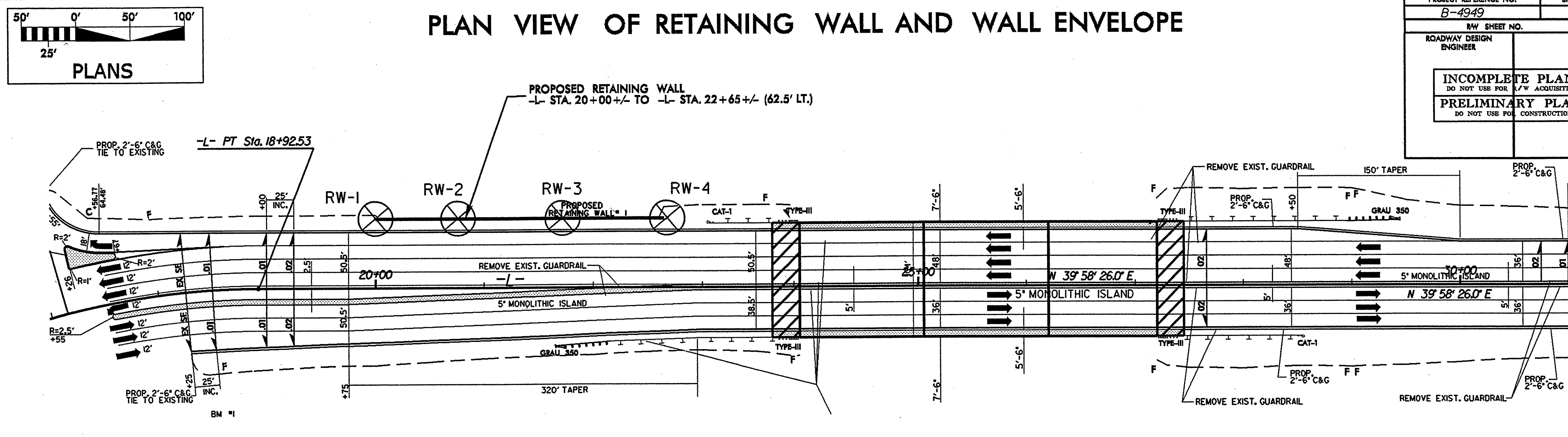
PROJECT REFERENCE NO.	SHEET NO.
B-4949	3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	

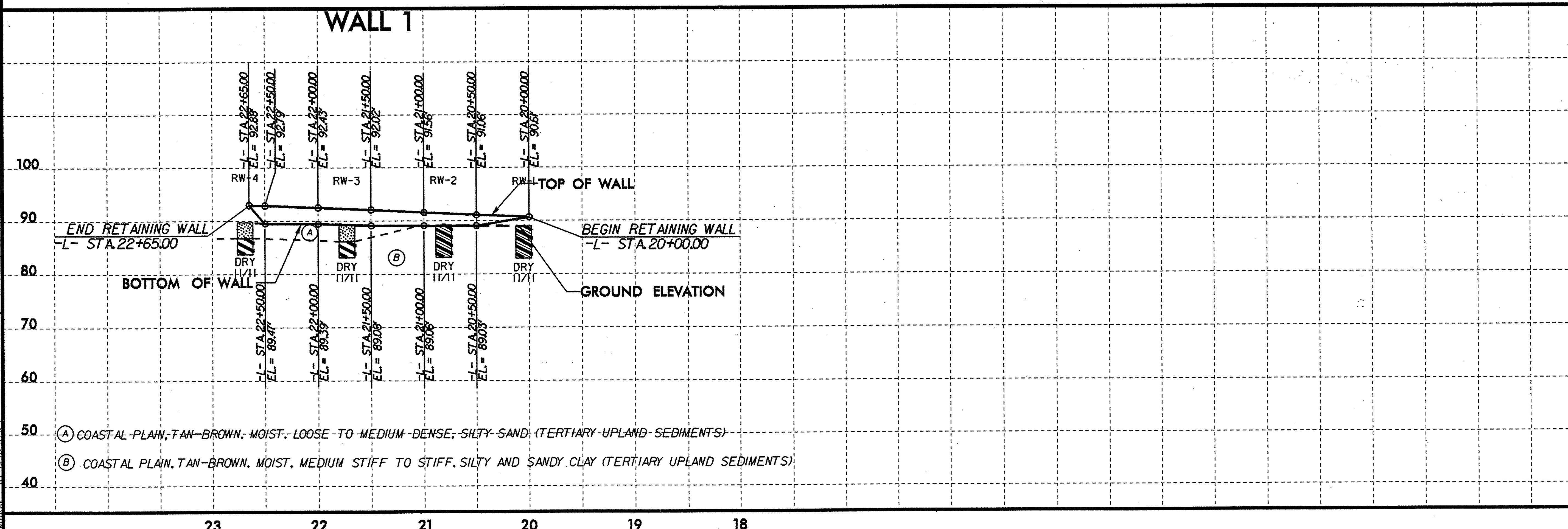
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

8/17/99

REVISIONS





(A) COASTAL PLAIN, TAN-BROWN, MOIST, LOOSE TO MEDIUM DENSE, SILTY SAND (TERTIARY UPLAND SEDIMENTS)

(B) COASTAL PLAIN, TAN-BROWN, MOIST, MEDIUM STIFF TO STIFF, SILTY AND SANDY CLAY (TERTIARY UPLAND SEDIMENTS)

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STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33449.1.1(B-4091)	1	34

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *33449.1.1(B-4091)* F.A. PROJ. *BRSTP-301(12)*

COUNTY *CUMBERLAND*

PROJECT DESCRIPTION *BRIDGE NO. 85 ON -L- (US 301/I-95 BUS. LOOP) OVER -Y1- (SR 1738), -Y2- (SR 1741) AND CAPE FEAR RIVER*

SITE DESCRIPTION

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL

C.M.BRUINSMA

MACTEC

INVESTIGATED BY *C.M. BRUINSMA*

CHECKED BY *N.T. ROBERSON*

SUBMITTED BY *N.T. ROBERSON*

DATE *AUGUST 2011*

NORTH CAROLINA LICENSED SEAL 2031 GEOLOGIST CHRISTINA M. BRUINSMA 8/12/11

DRAWN BY: *T.T. WALKER, D.W. FIELDS, C.M. BRUINSMA*

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: 33449.1.1

ID: B-4091

PROJECT REFERENCE NO.	SHEET NO.
33449.1.1(B-4091)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED 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:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45C
- ☐ CME-550
- ☐ PORTABLE HOIST
- ☐ CME-55
- ☐ _____

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 _____" TUNG.-CARB.
- ☐ CORE BIT
- ☐ _____

HAMMER TYPE:
- ☐ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B_____
- ☐ -N_____
- ☐ -H Q

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

ROCK DESCRIPTION

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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: BL-4; -BL- STA. 23+76.45
N: 476109.77 E: 2042852.84
ELEVATION: 93.59 FT.

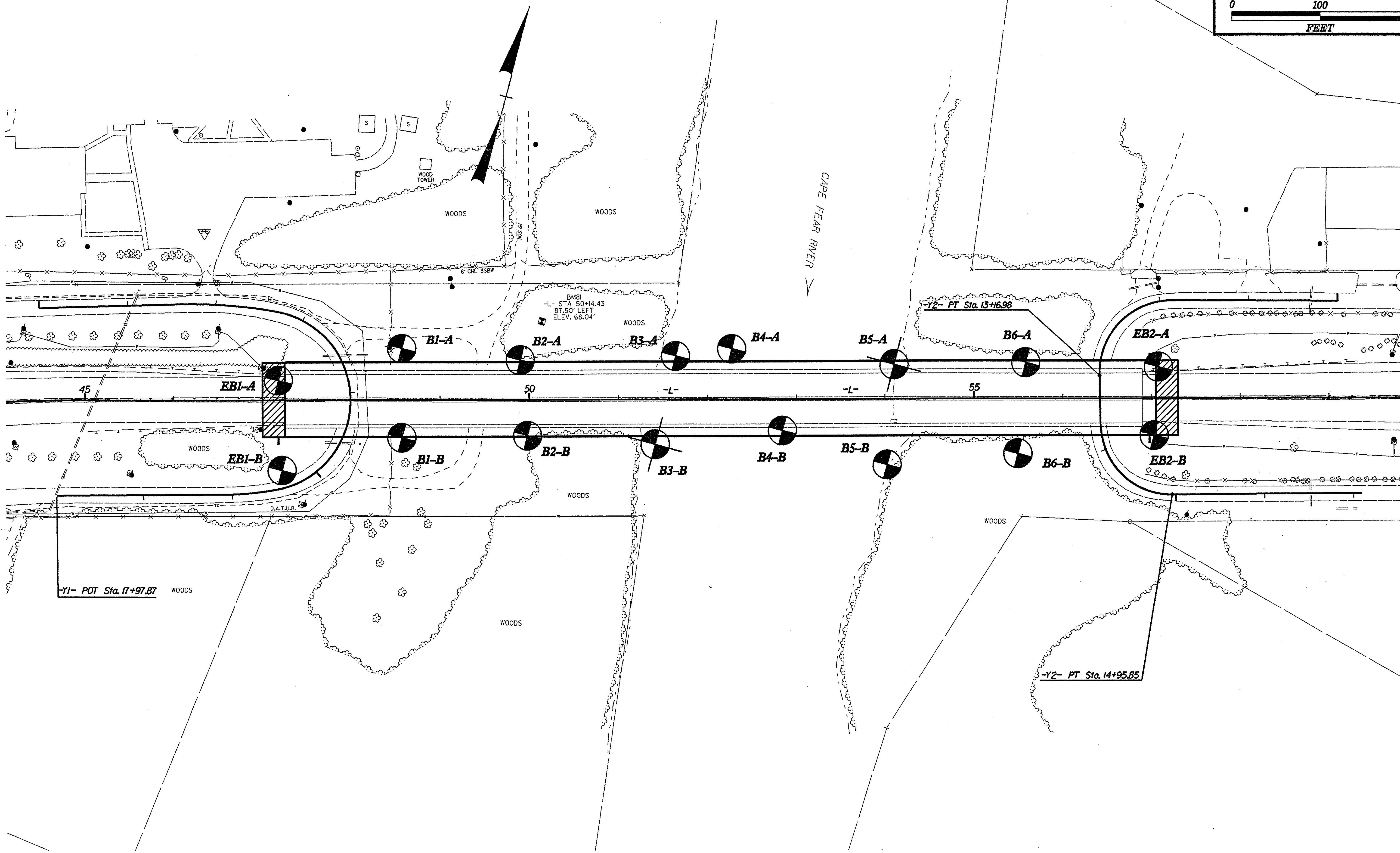
NOTES:

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET
33449.1.1 (B-4091)	3

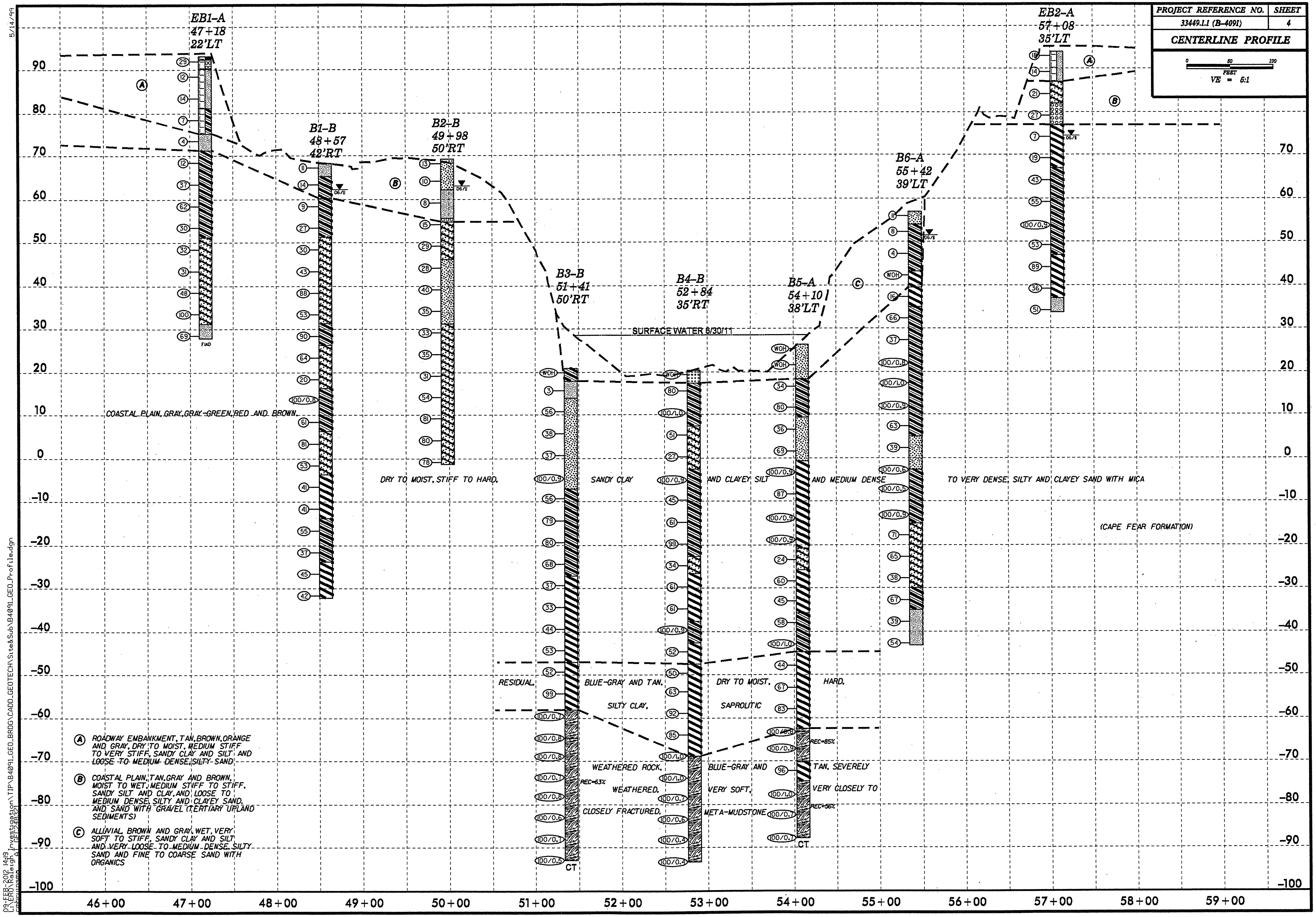
SITE PLAN

0 100 200
FEET



PROJECT REFERENCE NO.	SHEET
33449.1.1 (B-4091)	4

CENTERLINE PROFILE

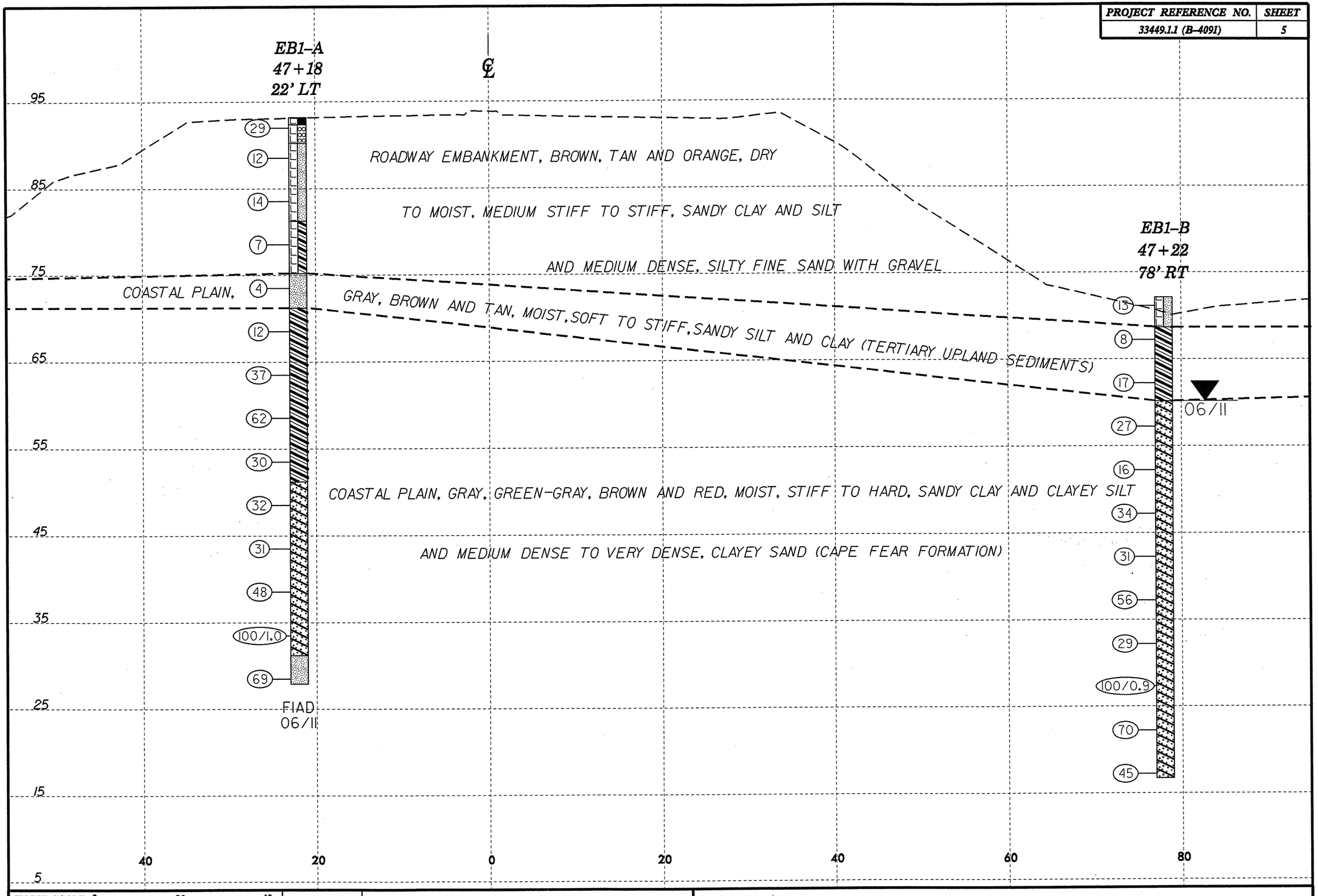


0 50 100 FEET
VE = 5:1
EB1-A 47+18 22'LT
B1-B 48+57 42'RT
B2-B 49+98 50'RT
B3-B 51+41 50'RT
B4-B 52+84 35'RT
B5-A 54+10 38'LT
B6-A 55+42 39'LT
EB2-A 57+08 35'LT
SURFACE WATER 6/30/11
COASTAL PLAIN, GRAY, GRAY-GREEN, RED AND BROWN,
DRY TO MOIST, STIFF TO HARD,
SANDY CLAY
AND CLAYEY SILT
AND MEDIUM DENSE
TO VERY DENSE, SILTY AND CLAYEY SAND WITH MICA
(CAPE FEAR FORMATION)
RESIDUAL,
BLUE-GRAY AND TAN,
SILTY CLAY,
DRY TO MOIST,
SAPROLITIC
HARD,
WEATHERED ROCK,
WEATHERED,
CLOSELY FRACTURED,
BLUE-GRAY AND
VERY SOFT,
META-MUDSTONE
TAN, SEVERELY
VERY CLOSELY TO
REC=63%
REC=85%
REC=56%
CT
(A) ROADWAY EMBANKMENT, TAN, BROWN, ORANGE AND GRAY, DRY TO MOIST, MEDIUM STIFF TO VERY STIFF, SANDY CLAY AND SILT AND LOOSE TO MEDIUM DENSE, SILTY SAND
(B) COASTAL PLAIN, TAN, GRAY AND BROWN, MOIST TO WET, MEDIUM STIFF TO STIFF, SANDY SILT AND CLAY, AND LOOSE TO MEDIUM DENSE, SILTY AND CLAYEY SAND, AND SAND WITH GRAVEL (TERTIARY UPLAND SEDIMENTS)
(C) ALLUVIAL, BROWN AND GRAY, WET, VERY SOFT TO STIFF, SANDY CLAY AND SILT AND VERY LOOSE TO MEDIUM DENSE, SILTY SAND AND FINE TO COARSE SAND WITH ORGANICS
46+00 47+00 48+00 49+00 50+00 51+00 52+00 53+00 54+00 55+00 56+00 57+00 58+00 59+00

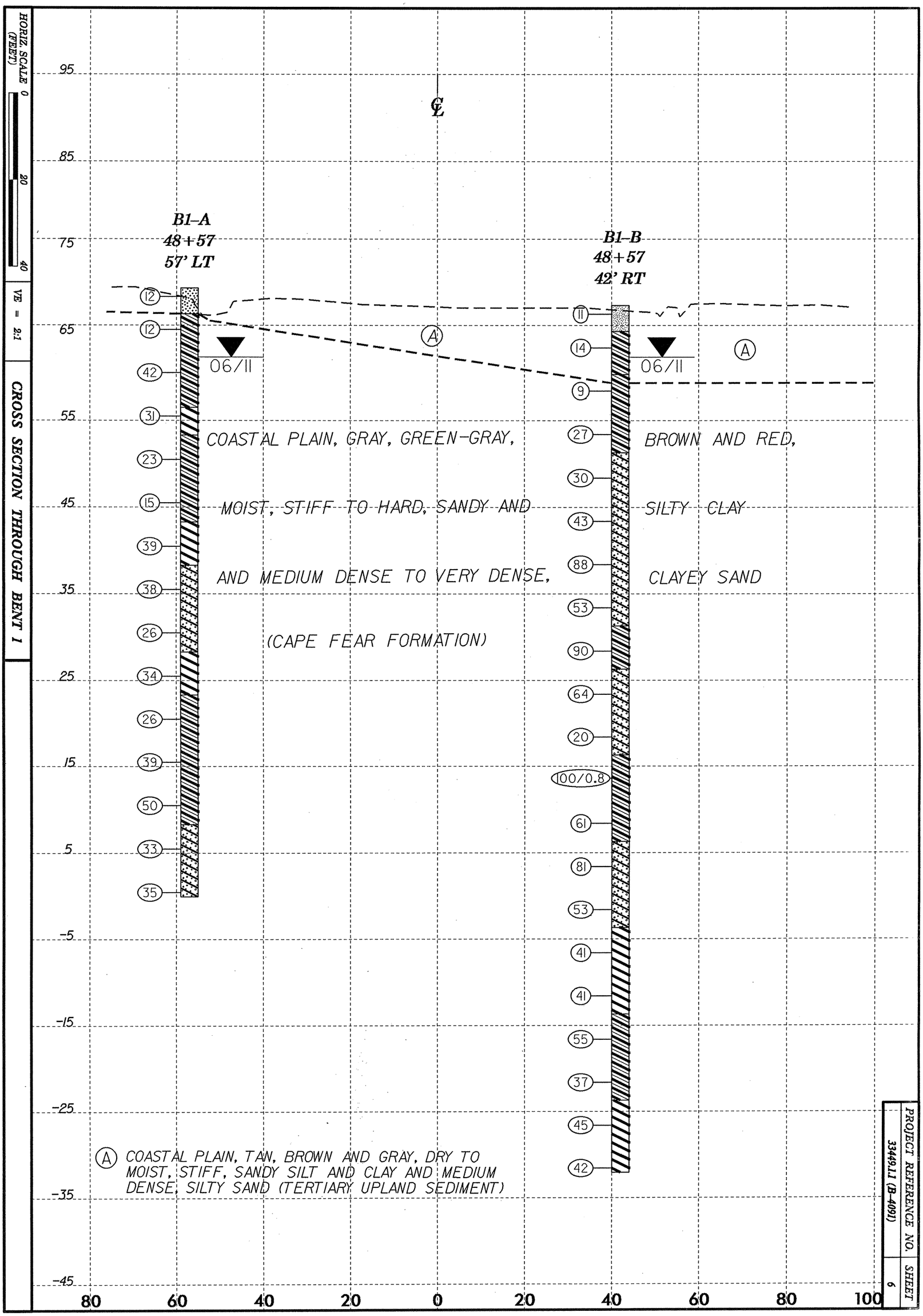
5/14/99

09-FEB-2012 14:19
L:\ERO\Raleigh Investigation\TIP\B4091_GEO_BRDG\CADD_GEOTECH\Site&Sub\B4091_GEO_Profile.dgn
cmbrunsma AT GEC248321

PROJECT REFERENCE NO.	SHEET
33449.1.1 (B-4091)	5



HORIZ. SCALE (FEET) 0 20 40 | VE = 1:1 | **CROSS SECTION THROUGH END BENT 1**



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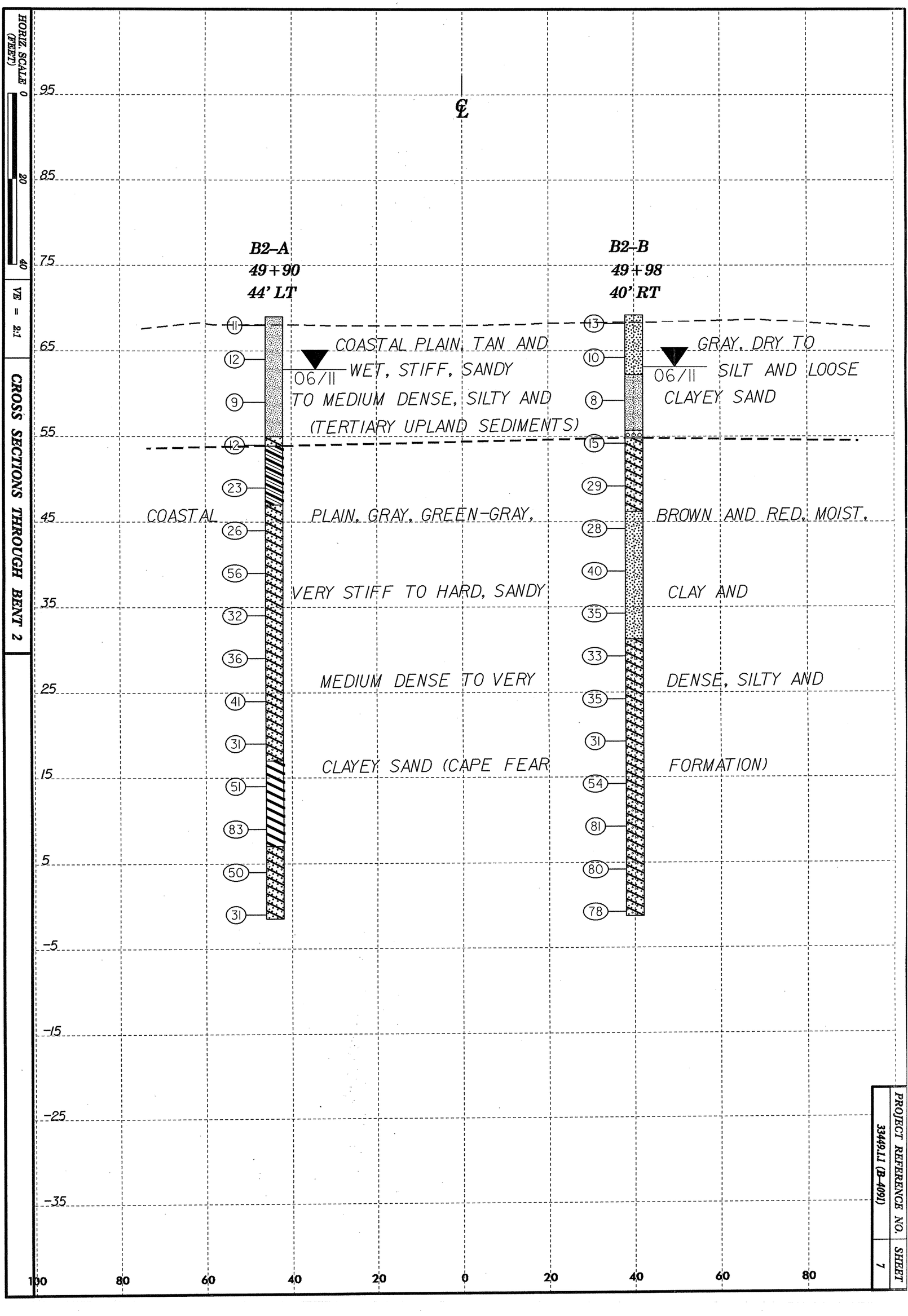
3349.1.1 (B-4091)	6



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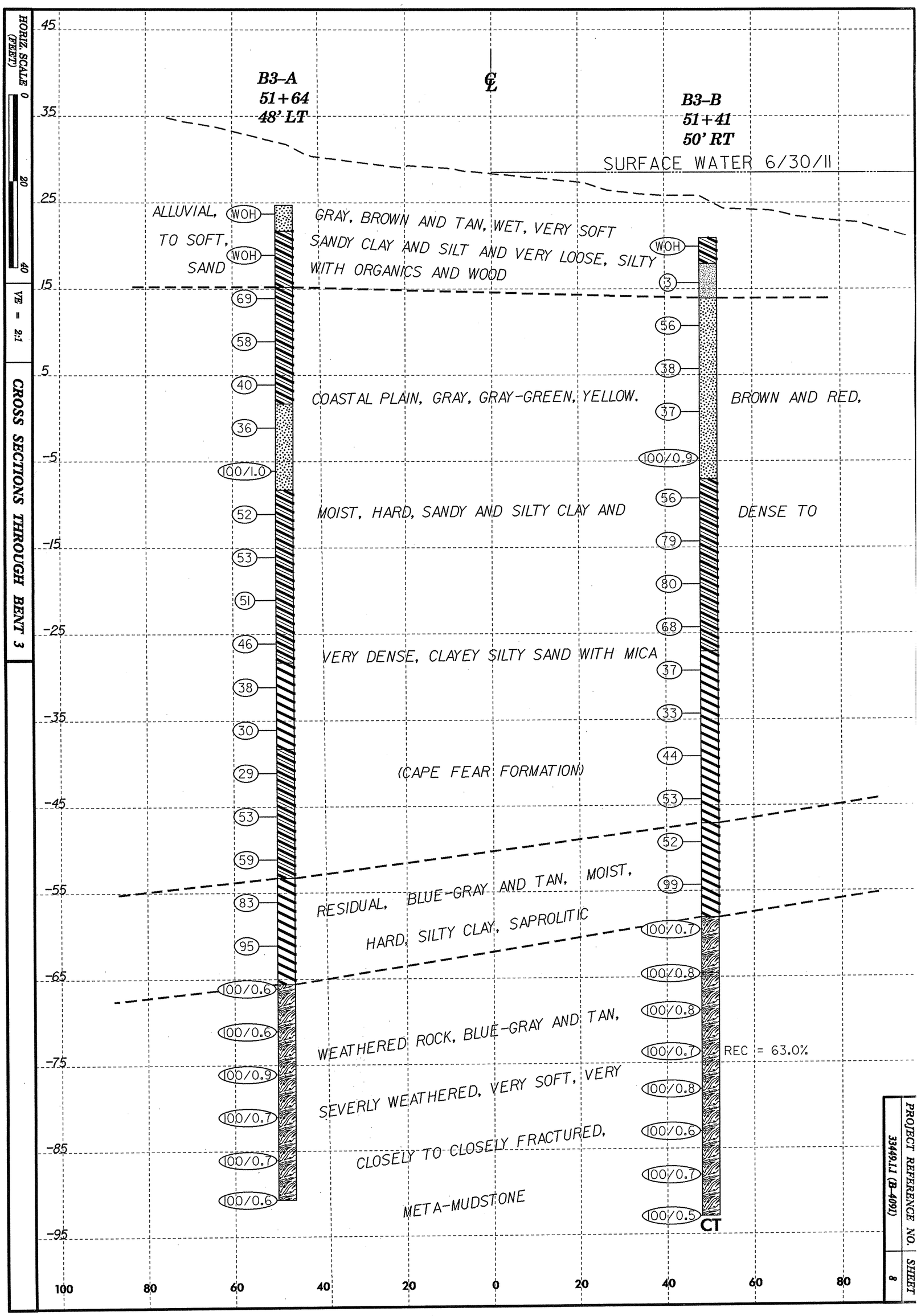

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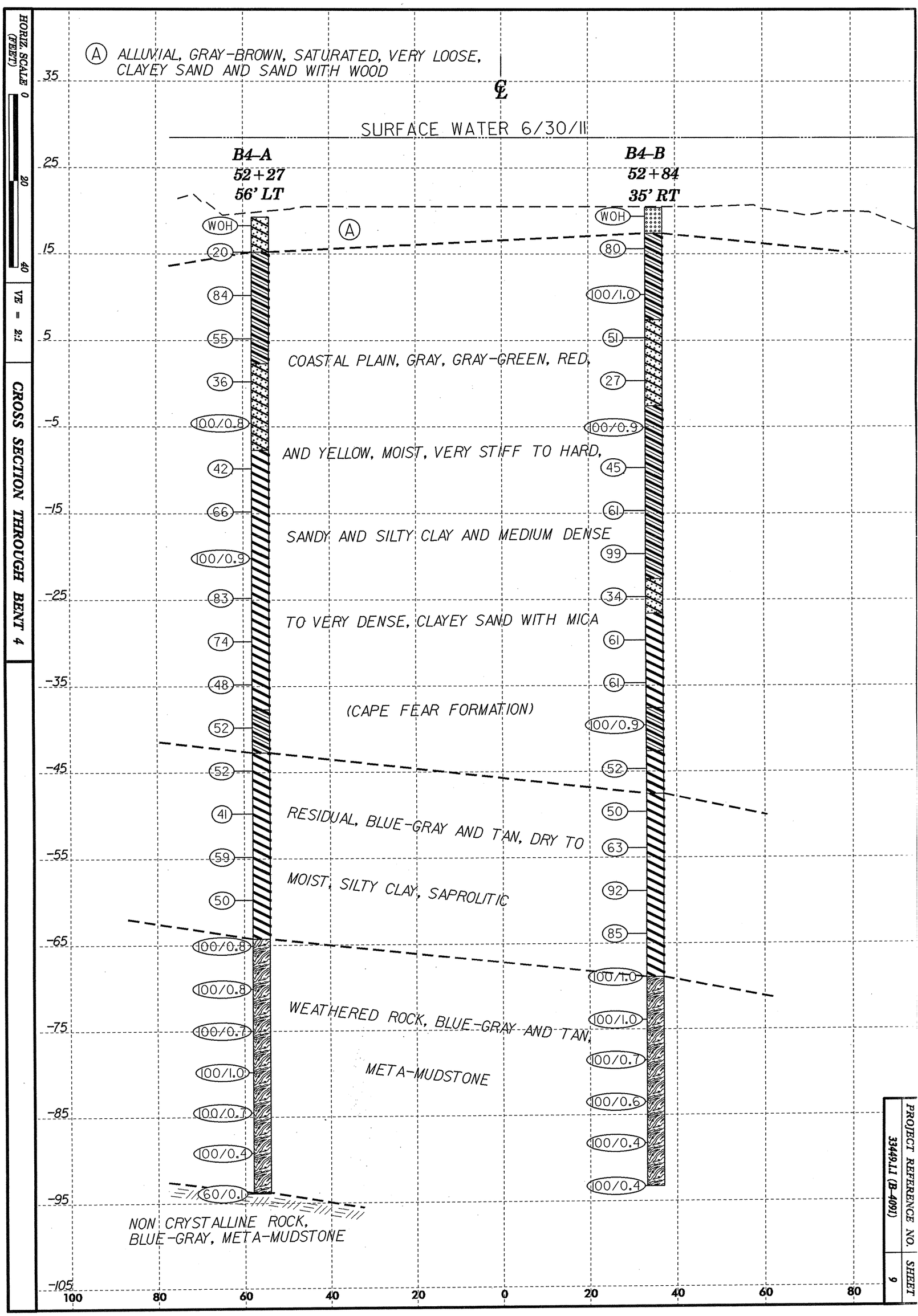
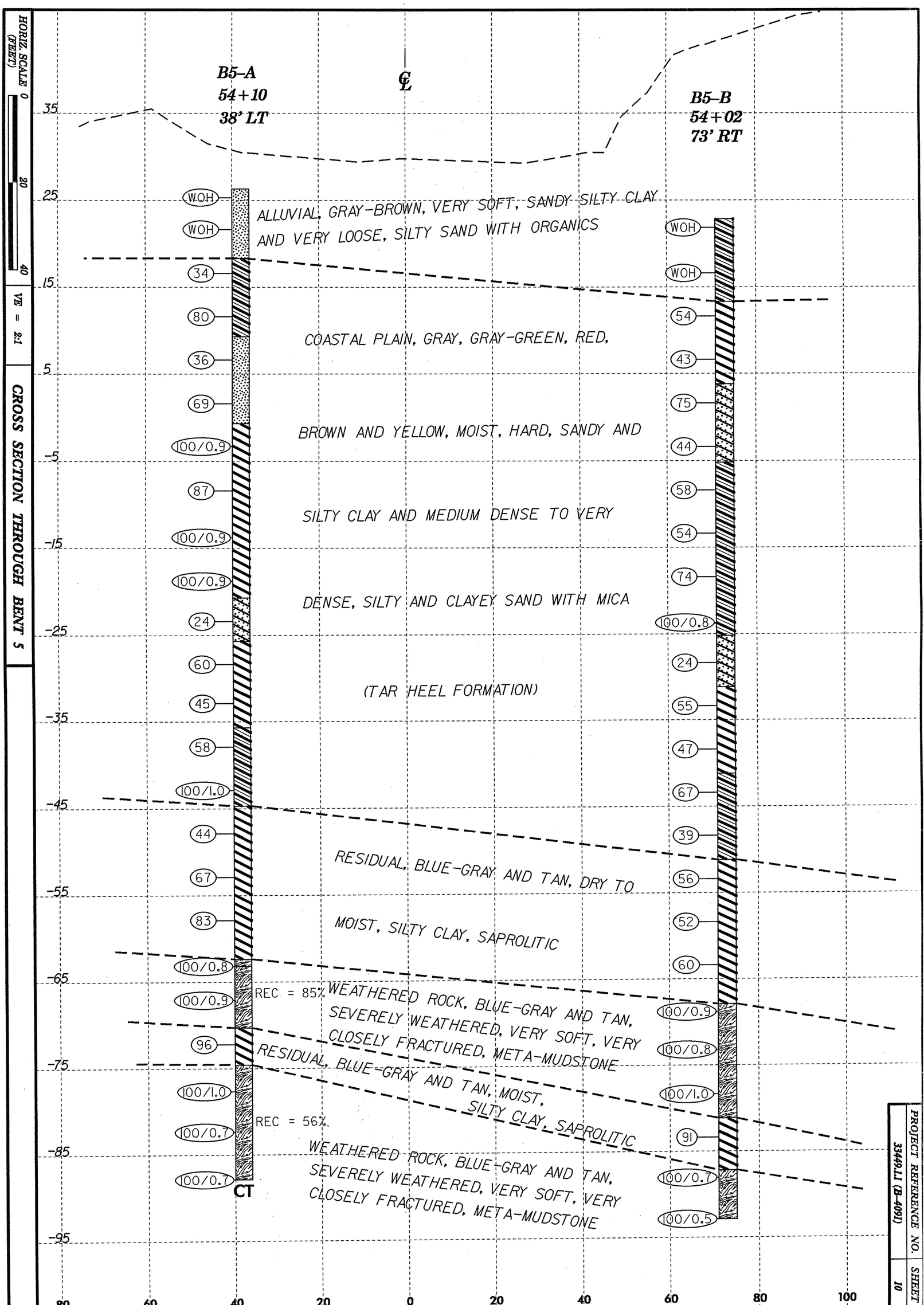


PROJECT REFERENCE NO. 3349.11 (B-4091)

SHEET 9



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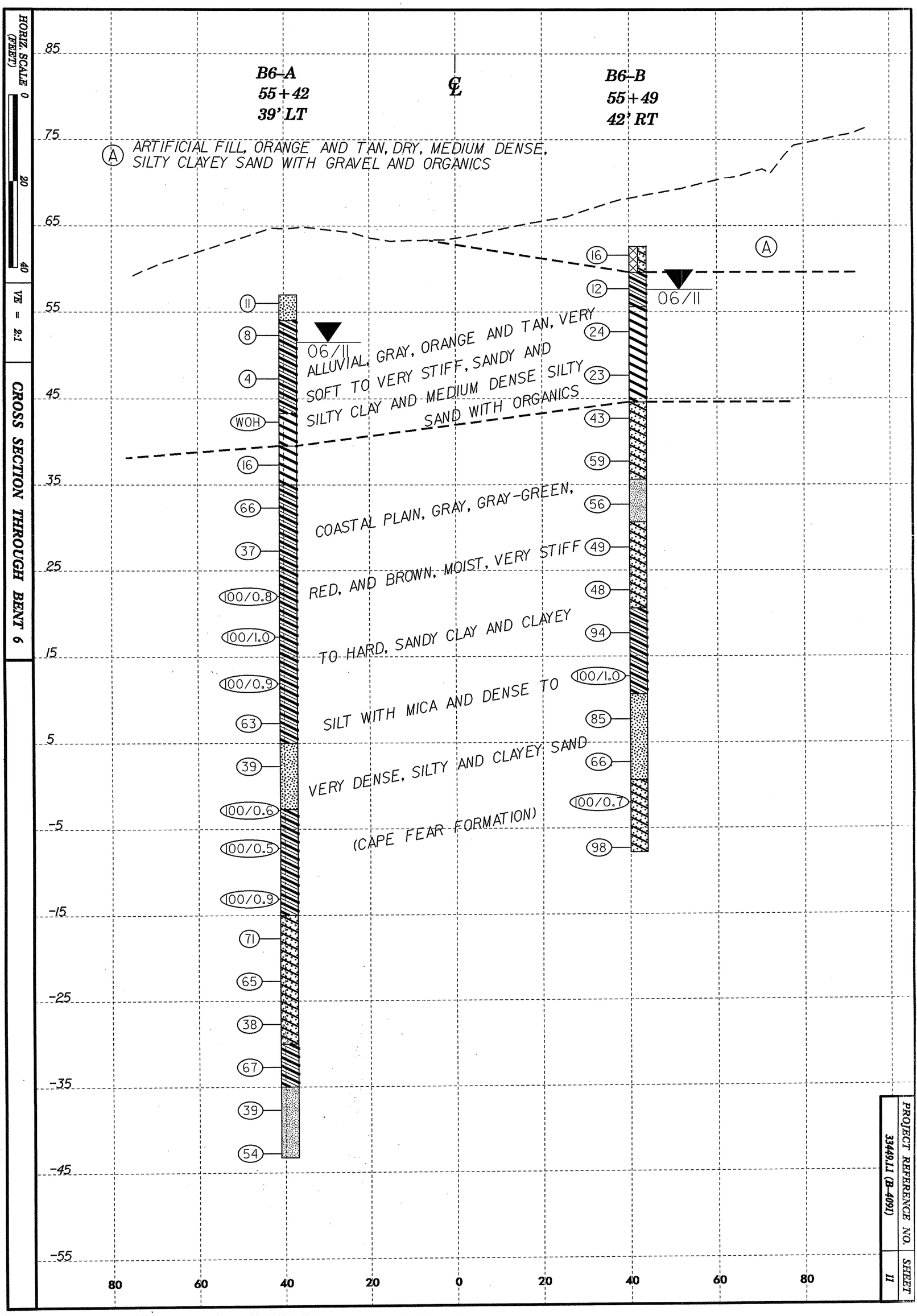
33449.1.1 (B-4091)	10



PROJECT REFERENCE NO. 33449.11 (B-4091)

SHEET 11

PROJECT REFERENCE NO.	SHEET
33449.1.1 (B-4091)	12

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EB2-A
57+08
35' LT

EB2-B
57+03
41' RT

105
95
85
75
65
55
45
35
25
15

ROADWAY EMBANKMENT, TAN, ORANGE AND BROWN, DRY TO MOIST, STIFF TO VERY STIFF, SANDY SILT

COASTAL PLAIN, TAN AND ORANGE, MOIST TO WET, MEDIUM DENSE, SILTY AND CLAYEY SAND AND FINE TO COARSE SAND WITH GRAVEL (TERTIARY UPLAND SEDIMENTS)

COASTAL PLAIN, GRAY, GREEN-GRAY AND RED, MOIST, MEDIUM STIFF TO HARD, SANDY CLAY AND CLAYEY SILT AND CLAYEY SAND WITH MICA (CAPE FEAR FORMATION)

EB2-A: 18, 14, 21, 27, 17, 19, 43, 55, 100/0.9, 53, 89, 36, 51
06/11

EB2-B: 8, 10, 15, 21, 12, 15, 35, 20, 62, 28, 30, 34, 38, 100/0.7
06/11

60 40 20 0 20 40 60

HORIZ. SCALE (FEET) 0 20 40 | VE = 1:1 | **CROSS SECTIONS THROUGH END BENT 2**

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 47+18	**OFFSET** 22 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 93.2 ft	**TOTAL DEPTH** 65.3 ft	**NORTHING** 476,160	**EASTING** 2,042,838 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/14/11	**COMP. DATE** 06/14/11	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft)	DEPTH (ft)
95											
	93.0	0.2	35	12	17	29	SS-51	D		93.2 GROUND SURFACE	0.0
										92.4 ASPHALT	0.8
90	89.5	3.7	5	6	6	12	SS-52	M		**ROADWAY EMBANKMENT** RED-ORANGE, SILTY, FINE SAND WITH GRAVEL / 90.2 BROWN-GRAY, SANDY SILT	3.0
85	84.5	8.7	4	6	8	14		M			
80	79.5	13.7	3	3	4	7	SS-53	M		81.2 GRAY, SANDY SANDY CLAY	12.0
75	74.5	18.7	2	2	2	4	SS-54	M		75.2 **COASTAL PLAIN** GRAY-BROWN, SANDY SILT (TERTIARY UPLAND SEDIMENTS)	18.0
70	69.5	23.7	3	5	7	12	SS-55	M		71.2 **COASTAL PLAIN** GREEN-GRAY, TAN, BROWN AND RED, SANDY CLAY, MICACEOUS (CAPE FEAR FORMATION)	22.0
65	64.5	28.7	6	17	20	37		M			
60	59.5	33.7	19	24	38	62		M			
55	54.5	38.7	8	13	17	30		M			
50	49.5	43.7	11	13	19	32	SS-57	M		51.2 GRAY, BROWN AND GREEN, CLAYEY SAND, MICACEOUS	42.0
45	44.5	48.7	11	15	16	31		M			
40	39.5	53.7	18	20	28	48		M			
35	34.5	58.7	13	22	78	100/1.0		M			
30	29.5	63.7	33	32	37	69	SS-59	M		31.2 GREEN-GRAY, SANDY SILT, MICACEOUS / 27.9 Boring Terminated at Elevation 27.9 ft in Coastal Plain, SANDY SILT (Cape Fear Formation)	62.0 / 65.3

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River			**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 47+22	**OFFSET** 78 ft RT	**ALIGNMENT** -L- / **0 HR.** 2.5
COLLAR ELEV. 72.1 ft	**TOTAL DEPTH** 55.4 ft	**NORTHING** 476,065	**EASTING** 2,042,868 / **24 HR.** 12.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/13/11	**COMP. DATE** 06/13/11	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
75										
	72.1	0.0	4	6	7	13	SS-40	D		72.1 GROUND SURFACE 0.0
70	68.2	3.9	3	4	4	8	SS-41	M		**ROADWAY EMBANKMENT** BROWN-TAN, SANDY SILT 68.6 3.5
65	63.2	8.9	3	6	11	17		M		**COASTAL PLAIN** GRAY AND RED, SANDY CLAY (TERTIARY UPLAND SEDIMENTS)
60	58.2	13.9	10	11	16	27	SS-42	M		60.1 12.0
55	53.2	18.9	6	7	9	16		M		**COASTAL PLAIN** GRAY, ORANGE, GREEN-GRAY, AND RED, CLAYEY SAND, MICACEOUS (CAPE FEAR FORMATION)
50	48.2	23.9	10	16	18	34	SS-43	M		
45	43.2	28.9	11	13	18	31		M		
40	38.2	33.9	16	28	28	56		M		
35	33.2	38.9	13	12	17	29		M		
30	28.2	43.9	39	61/0.4		100/0.9		M		
25	23.2	48.9	26	31	39	70		M		
20	18.2	53.9	11	15	30	45	SS-46	M		16.7 Boring Terminated at Elevation 16.7 ft in Coastal Plain, CLAYEY SAND (Cape Fear Formation) 55.4

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WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 48+57	**OFFSET** 57 ft LT	**ALIGNMENT** -L-	**0 HR.** 7.0
COLLAR ELEV. 70.3 ft	**TOTAL DEPTH** 70.3 ft	**NORTHING** 476,230	**EASTING** 2,042,964	**24 HR.** 8.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/09/11	**COMP. DATE** 06/09/11		**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
75										
70	70.3	0.0	10	6	6	12	SS-13	D		70.3 GROUND SURFACE 0.0
	66.5	3.8								**COASTAL PLAIN** TAN-YELLOW, SILTY, FINE SAND (TERIARY UPLAND SEDIMENT) 67.3 3.0
65			4	5	7	12	SS-14	M		**COASTAL PLAIN** RED-BROWN, GREEN-GRAY, AND GRAY, SANDY CLAY (CAPE FEAR FORMATION)
	61.5	8.8								
60			17	19	23	42		M		
	56.5	13.8								56.5 13.8
55			10	13	18	31	SS-15	M		TAN AND GRAY, SILTY CLAY
	51.5	18.8								53.3 17.0
50			8	11	12	23	SS-16	M		TAN AND GRAY, SANDY CLAY, MICACEOUS
	46.5	23.8								
45			7	7	8	15		M		43.3 27.0
	41.5	28.8								RED AND GRAY, SILTY CLAY, MICACEOUS
40			13	17	22	39	SS-17	M		38.3 32.0
	36.5	33.8								GREEN-GRAY AND BROWN, CLAYEY SAND, MICACEOUS
35			12	17	21	38	SS-18	M		
	31.5	38.8								
30			9	11	15	26		M		28.3 42.0
	26.5	43.8								GRAY AND RED, SILTY CLAY, MICACEOUS
25			12	15	19	34	SS-19	M		23.3 47.0
	21.5	48.8								GRAY AND RED, SANDY CLAY, MICACEOUS
20			11	12	14	26		M		
	16.5	53.8								
15			15	13	26	39	SS-20	M		
	11.5	58.8								
10			17	22	28	50		M		8.3 62.0
	6.5	63.8								LIGHT GRAY AND GREEN, CLAYEY SAND, MICACEOUS
5			13	15	18	33	SS-21	M		
	1.5	68.8								
0			12	16	19	35	SS-22	M		0.0 70.3
										Boring Terminated at Elevation 0.0 ft in Coastal Plain, CLAYEY SAND (Cape Fear Formation)

NCDOT BORE SINGLE B4091_GEO_BH_BRIDGE.GPJ NC_DOT.GDT 8/12/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
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WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 48+57	**OFFSET** 42 ft RT	**ALIGNMENT** -L-	**0 HR.** 8.2
COLLAR ELEV. 68.3 ft	**TOTAL DEPTH** 100.4 ft	**NORTHING** 476,134	**EASTING** 2,042,989	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/07/11	**COMP. DATE** 06/08/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
70										
	68.3	0.0	5	6	5	11	SS-1	D		68.3 / 0.0 GROUND SURFACE **COASTAL PLAIN** TAN AND BROWN, SANDY SILT WITH TRACE ORGANICS (TERTIARY UPLAND SEDIMENTS)
65	64.4	3.9	4	6	8	14	SS-2	M		65.3 / 3.0 TAN-GRAY, SANDY CLAY
60	59.4	8.9	3	4	5	9	SS-3	M		60.3 / 8.0 **COASTAL PLAIN** LIGHT GRAY, SANDY CLAY (CAPE FEAR FORMATION)
55	54.4	13.9	14	12	15	27		M		
50	49.4	18.9	13	15	15	30	SS-4	M		51.3 / 17.0 LIGHT GRAY AND RED, CLAYEY SAND
45	44.4	23.9	16	24	19	43		M		
40	39.4	28.9	18	34	54	88	SS-5	M		
35	34.4	33.9	35	25	28	53		M		
30	29.4	38.9	18	33	57	90	SS-6	M		31.3 / 37.0 GRAY AND RED, SANDY CLAY
25	24.4	43.9	15	24	40	64	SS-7	M		26.3 / 42.0 GRAY, CLAYEY SAND, MICACEOUS
20	19.4	48.9	9	9	11	20		M		
15	14.4	53.9	44	56/0.3		100/0.8	SS-8	M		16.3 / 52.0 RED AND GRAY, SANDY CLAY, MICACEOUS
10	9.4	58.9	20	26	35	61		M		
5	4.4	63.9	22	35	46	81	SS-9	M		6.3 / 62.0 GRAY AND RED, CLAYEY SAND, MICACEOUS
0	-0.6	68.9	17	26	27	53		M		
-5	-5.6	73.9	16	18	23	41	SS-10	M		-3.7 / 72.0 GRAY AND RED, SANDY CLAY, MICACEOUS
-10										

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 48+57	**OFFSET** 42 ft RT	**ALIGNMENT** -L-	**0 HR.** 8.2
COLLAR ELEV. 68.3 ft	**TOTAL DEPTH** 100.4 ft	**NORTHING** 476,134	**EASTING** 2,042,989	**24 HR.** 6.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/07/11	**COMP. DATE** 06/08/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-10	-10.6	78.9	16	16	25	Match Line 41		M		GRAY AND RED, SANDY CLAY, MICACEOUS *(continued)*
-15	-15.6	83.9	20	23	32	55	SS-11	M		-13.7 / 82.0 GRAY, BROWN, AND RED, SANDY CLAY, MICACEOUS
-20	-20.6	88.9	14	17	20	37		M		
-25	-25.6	93.9	15	20	25	45	SS-12	M		-23.7 / 92.0 GRAY AND BROWN, SILTY CLAY, MICACEOUS
-30	-30.6	98.9	13	18	24	42		M		-32.1 / 100.4 Boring Terminated at Elevation -32.1 ft in Coastal Plain, SILTY CLAY (Cape Fear Formation)

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WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River			**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 49+90	**OFFSET** 44 ft LT	**ALIGNMENT** -L- — **0 HR.** 9.0
COLLAR ELEV. 69.0 ft	**TOTAL DEPTH** 70.5 ft	**NORTHING** 476,251	**EASTING** 2,043,095 — **24 HR.** 6.2
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/09/11	**COMP. DATE** 06/10/11	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft) / DEPTH (ft)
70										
	69.0	0.0								69.0 / 0.0 GROUND SURFACE
65	65.0	4.0	3	4	7	11	SS-23	D		**COASTAL PLAIN** BROWN TO TAN, SANDY SILT (TERTIARY UPLAND SEDIMENTS)
60	60.0	9.0	4	6	6	12		M		
55	55.0	14.0	4	4	5	9	SS-24	M		55.0 / 14.0
50	50.0	19.0	6	7	5	12	SS-25	M		53.9 / 15.1 BROWN, CLAYEY, FINE TO MEDIUM COARSE SAND; **COASTAL PLAIN** BROWN AND GRAY, SANDY CLAY (CAPE FEAR FORMATION)
45	45.0	24.0	8	10	13	23		M		47.0 / 22.0
40	40.0	29.0	11	12	14	26	SS-26	M		GRAY, RED, AND GREEN-GRAY, CLAYEY SAND, MICACEOUS
35	35.0	34.0	16	19	37	56		M		
30	30.0	39.0	12	15	17	32	SS-27	M		
25	25.0	44.0	14	18	18	36		M		
20	20.0	49.0	16	17	24	41	SS-28	M		
15	15.0	54.0	11	11	20	31		M		17.0 / 52.0 GRAY AND RED, SANDY CLAY, MICACEOUS
10	10.0	59.0	19	24	27	51	SS-29	M		
5	5.0	64.0	23	32	51	83		M		7.0 / 62.0 GREEN-GRAY AND RED, CLAYEY SAND, MICACEOUS
0	0.0	69.0	22	22	28	50	SS-30	M		
			12	13	18	31		M		-1.5 / 70.5 Boring Terminated at Elevation -1.5 ft in Coastal Plain, CLAYEY SAND (Cape Fear Formation)

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River			**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 49+98	**OFFSET** 40 ft RT	**ALIGNMENT** -L- — **0 HR.** 9.2
COLLAR ELEV. 69.2 ft	**TOTAL DEPTH** 70.5 ft	**NORTHING** 476,172	**EASTING** 2,043,125 — **24 HR.** 6.1
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/10/11	**COMP. DATE** 06/10/11	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft) / DEPTH (ft)
70										
	69.2	0.0								69.2 / 0.0 GROUND SURFACE
65	65.2	4.0	9	7	6	13	SS-31	D		**COASTAL PLAIN** TAN, SILTY, FINE SAND (TERTIARY UPLAND SEDIMENTS)
60	60.2	9.0	4	5	5	10		M		62.2 / 7.0
55	55.2	14.0	4	4	4	8	SS-32	M		TAN, SANDY SILT
50	50.2	19.0	30	6	9	15	SS-33	W		55.7 / 13.5; 54.8 / 14.4 TAN, SANDY GRAVEL; **COASTAL PLAIN** GRAY, TAN, RED AND BROWN, CLAYEY SAND (CAPE FEAR FORMATION)
45	45.2	24.0	15	12	17	29		M		
40	40.2	29.0	11	12	16	28	SS-34	M		46.2 / 23.0 GRAY TO GREEN-GRAY, CLAYEY, SILTY SAND WITH MICA
35	35.2	34.0	15	20	20	40	SS-35	M		
30	30.2	39.0	12	15	20	35		M		
25	25.2	44.0	14	15	18	33		M		
20	20.2	49.0	12	15	20	35		M		
15	15.2	54.0	11	14	17	31	SS-37	M		
10	10.2	59.0	15	20	34	54		M		
5	5.2	64.0	23	34	47	81		M		
0	0.2	69.0	19	28	52	80		M		31.2 / 38.0 GREEN-GRAY, BROWN, AND RED, CLAYEY SAND WITH MICA
			17	24	54	78	SS-39	M		-1.3 / 70.5 Boring Terminated at Elevation -1.3 ft in Coastal Plain, CLAYEY SAND (Cape Fear Formation)

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WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B3-A	**STATION** 51+64	**OFFSET** 48 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 24.7 ft	**TOTAL DEPTH** 115.4 ft	**NORTHING** 476,300	**EASTING** 2,043,263	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/23/11	**COMP. DATE** 06/24/11	**SURFACE WATER DEPTH** 4.2ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
30										WATER SURFACE (06/23/11)	
25	24.7	0.0	WOH	1	WOH	1		Sat.		24.7 GROUND SURFACE	0.0
										ALLUVIAL GRAY, SILTY, FINE SAND WITH WOOD	
20	19.9	4.8	WOH	WOH	WOH	0	SS-152	W		21.7 GRAY, SILTY SANDY CLAY	3.0
15	14.9	9.8	14	33	36	69	SS-153	D		15.2 COASTAL PLAIN GREEN-GRAY, RED, BROWN AND GRAY, SANDY CLAY, MICACEOUS (CAPE FEAR FORMATION)	9.5
10	9.9	14.8	16	23	35	58	SS-154	M			
5	4.9	19.8	10	18	22	40		M			
0	-0.1	24.8	11	15	21	36	SS-155	M		1.7 GREEN-GRAY AND RED, CLAYEY SILTY SAND WITH MICA	23.0
-5	-5.1	29.8	24	45	55/0.5	100/1.0		M			
-10	-10.1	34.8	16	22	30	52	SS-156	M		-8.3 GREEN-GRAY AND RED, SANDY CLAY WITH MICA	33.0
-15	-15.1	39.8	20	28	25	53		M			
-20	-20.1	44.8	15	21	30	51	SS-157	M			
-25	-25.1	49.8	8	18	28	46		M		-28.3 DARK GRAY AND RED, SILTY CLAY	53.0
-30	-30.1	54.8	11	16	22	38	SS-158	M			
-35	-35.1	59.8	9	13	17	30		M		-38.3 GRAY, RED AND YELLOW, SANDY CLAY	63.0
-40	-40.1	64.8	14	12	17	29	SS-159	M			
-45	-45.1	69.8	12	24	29	53		D			
-50											

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B3-A	**STATION** 51+64	**OFFSET** 48 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 24.7 ft	**TOTAL DEPTH** 115.4 ft	**NORTHING** 476,300	**EASTING** 2,043,263	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/23/11	**COMP. DATE** 06/24/11	**SURFACE WATER DEPTH** 4.2ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50	-50.1	74.8	11	24	35	Match Line		D		GRAY, RED AND YELLOW, SANDY CLAY *(continued)*
-55	-55.1	79.8	16	30	53	83	SS-161	D		-53.3 RESIDUAL TAN AND BLUE-GRAY, SILTY CLAY, SAPROLITIC 78.0
-60	-60.1	84.8	18	33	62	95		D		
-65	-65.1	89.8	22	61	39/0.1	100/0.6				-65.6 WEATHERED ROCK BLUE-GRAY AND TAN, META-MUDSTONE 90.3
-70	-70.1	94.8	27	63	37/0.1	100/0.6				
-75	-75.1	99.8	34	66/0.4		100/0.9				
-80	-80.1	104.8	45	55/0.2		100/0.7				
-85	-85.1	109.8	50	50/0.2		100/0.7				
-90	-90.1	114.8	90	10/0.1		100/0.6				-90.7 Boring Terminated at Elevation -90.7 ft in WR: META-MUDSTONE 115.4

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WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 51+41	**OFFSET** 50 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.9 ft	**TOTAL DEPTH** 113.8 ft	**NORTHING** 476,199	**EASTING** 2,043,266	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/30/11	**COMP. DATE** 07/01/11	**SURFACE WATER DEPTH** 7.6ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
										WATER SURFACE (06/30/11)
	20.9	0.0	WOH	WOH	WOH	0	SS-195	M		20.9 GROUND SURFACE 0.0 **ALLUVIAL** GRAY-BROWN, SILTY SANDY CLAY
	16.7	4.2	WOH	1	2	3	SS-196	W		17.9 3.0 GRAY-TAN, SANDY SILT WITH WOOD
	11.7	9.2	14	26	30	56	SS-197	M		13.9 7.0 **COASTAL PLAIN** GREEN-GRAY AND RED CLAYEY, SILTY SAND WITH MICA (CAPE FEAR FORMATION)
	6.7	14.2	11	14	24	38		M		
	1.7	19.2	17	18	19	37	SS-198	M		
	-3.3	24.2	19	37	63/0.4	100/0.9		M		
	-8.3	29.2	18	24	32	56		M		-7.1 28.0 GREEN-GRAY AND RED, SANDY CLAY WITH MICA
	-13.3	34.2	21	42	37	79		M		
	-18.3	39.2	19	33	47	80	SS-200	M		
	-23.3	44.2	25	30	38	68		M		-27.1 48.0 DARK GRAY, RED AND YELLOW, SILTY CLAY
	-28.3	49.2	15	15	22	37	SS-201	M		
	-33.3	54.2	10	14	19	33		M		
	-38.3	59.2	13	18	26	44	SS-202	M		
	-43.3	64.2	15	21	32	53		D		
	-48.3	69.2	14	20	32	52	SS-203	D		-47.1 68.0

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 51+41	**OFFSET** 50 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.9 ft	**TOTAL DEPTH** 113.8 ft	**NORTHING** 476,199	**EASTING** 2,043,266	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/30/11	**COMP. DATE** 07/01/11	**SURFACE WATER DEPTH** 7.6ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
						Match Line				
	-53.3	74.2	17	32	67	99	D			**RESIDUAL** BLUE GRAY AND TAN, SILTY CLAY, SAPROLITIC *(continued)*
	-58.3	79.2	22	57	43/0.2	100/0.7				-58.1 79.0 **WEATHERED ROCK** BLUE GRAY AND TAN, META-MUDSTONE
	-63.3	84.2	20	55	45/0.3	100/0.8				-64.6 85.5 **WEATHERED ROCK** BLUE-GRAY AND TAN, SEVERELY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE REC=63%
	-67.6	88.5	27	46	54/0.3	100/0.8	RS-4			
	-72.5	93.4	23	46	54/0.2	100/0.7				
	-77.3	98.2	45	55/0.3		100/0.8				
	-82.4	103.3	50	50/0.1		100/0.6	RS-1			
	-87.4	108.3	50	50/0.2		100/0.7				
	-92.4	113.3	100/0.5			100/0.5				-92.9 113.8 Boring Terminated at Elevation -92.9 ft in WR: META-MUDSTONE

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B3-B	**STATION** 51+41	**OFFSET** 50 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.9 ft	**TOTAL DEPTH** 113.8 ft	**NORTHING** 476,199	**EASTING** 2,043,266	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/30/11	**COMP. DATE** 07/01/11	**SURFACE WATER DEPTH** 7.6ft	
CORE SIZE N/A	**TOTAL RUN** 23.2 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
-64.6											ELEV. (ft)
-65											Begin Coring @ 85.5 ft
	-64.6	85.5	3.0	1:30 1:15 1:45	(2.6) 87%	N/A		(17.8) 63%	N/A		-64.6 **WEATHERED ROCK** 85.5 BLUE-GRAY AND TAN, SEVERLEY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE
	-67.6	88.5									
	-68.9	89.8		N=100/0.8							
-70			3.6	2:15 2:00 2:15	(3.2) 89%	N/A	RS-4				
	-72.5	93.4		1:45/0.6							
	-73.7	94.6		N=100/0.7							
-75			3.6	3:00 3:00 2:45	(2.0) 56%	N/A					
	-77.3	98.2		0:45/0.6							
	-78.1	99.0		N=100/0.8							
-80			4.3	2:15 2:00 2:15 2:30	(3.4) 79%	N/A					
	-82.4	103.3		0:15/0.3							
	-83.0	103.9		N=100/0.6							
-85			4.4	3:00 3:15 3:00 3:00	(3.8) 86%	N/A	RS-1				
	-87.4	108.3		1:00/0.4							
	-88.1	109.0		N=100/0.7							
-90			4.3	2:00 2:30 2:30 3:30	(2.8) 65%	N/A					
	-92.4	113.3		0:15/0.3							-92.9 113.8
				N=100/0.5							Boring Terminated at Elevation -92.9 ft in WR: META-MUDSTONE

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 52+27	**OFFSET** 56 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 19.3 ft	**TOTAL DEPTH** 113.2 ft	**NORTHING** 476,323	**EASTING** 2,043,322	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/27/11	**COMP. DATE** 06/28/11	**SURFACE WATER DEPTH** 9.5ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
30										
25										WATER SURFACE (06/27/11)
20	19.3	0.0								19.3 / 0.0 GROUND SURFACE
			WOH	WOH	WOH	0		W		**ALLUVIAL** GRAY AND BROWN, SILTY CLAYEY SAND WITH GRAVEL
15	16.2	3.1	WOH	1	19	20	SS-166	M		15.2 / 4.1
										COASTAL PLAIN GRAY AND RED, SANDY CLAY WITH MICA (CAPE FEAR FORMATION)
10	11.2	8.1	7	24	60	84		D		
5	6.2	13.1	23	25	30	55		M		
0	1.2	18.1	13	17	19	36	SS-168	M		2.3 / 17.0 GREEN-GRAY, CLAYEY SAND WITH MICA
-5	-3.8	23.1	45	55/0.3		100/0.8		D		
-10	-8.8	28.1	12	17	25	42		M		
-15	-13.8	33.1	22	30	36	66	SS-169	M		
-20	-18.8	38.1	15	39	61/0.4	100/0.9		D		
-25	-23.8	43.1	30	35	48	83		M		
-30	-28.8	48.1	18	27	47	74	SS-171	M		
-35	-33.8	53.1	15	20	28	48		M		
-40	-38.8	58.1	18	22	30	52	SS-172	M		-37.7 / 57.0 TAN AND GRAY, SANDY CLAY
-45	-43.8	63.1	12	19	33	52		D		-42.7 / 62.0 **RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC
-50	-48.8	68.1	10	16	25	41		D		

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
-55	-53.8	73.1	15	22	37	59		D		**RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC *(continued)*
-60	-58.8	78.1	11	20	30	50		D		
-65	-63.8	83.1	20	42	58/0.3	100/0.8				
-70	-68.8	88.1	18	35	65/0.3	100/0.8				
-75	-73.8	93.1	23	52	48/0.2	100/0.7				
-80	-78.8	98.1	30	70/0.5		100/1.0				
-85	-83.8	103.1	53	47/0.2		100/0.7				
-90	-88.8	108.1	100/0.4			100/0.4				-64.3 / 83.6 **WEATHERED ROCK** BLUE-GRAY, META-MUDSTONE
	-93.8	113.1	60/0.1			60/0.1				-93.8 / 113.1 **NON-CRYSTALLINE ROCK** BLUE-GRAY, META-MUDSTONE Boring Terminated at Elevation -93.9 ft in NCR: META-MUDSTONE

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B4-A	**STATION** 52+27	**OFFSET** 56 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 19.3 ft	**TOTAL DEPTH** 113.2 ft	**NORTHING** 476,323	**EASTING** 2,043,322	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/27/11	**COMP. DATE** 06/28/11	**SURFACE WATER DEPTH** 9.5ft	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BOREHOLE REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 52+84	**OFFSET** 35 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.4 ft	**TOTAL DEPTH** 113.7 ft	**NORTHING** 476,250	**EASTING** 2,043,400	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/22/11	**COMP. DATE** 06/23/11	**SURFACE WATER DEPTH** 8.8ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
30										WATER SURFACE (06/22/11)	
25											
20	20.4	0.0	WOH	WOH	WOH	0	SS-136	W		20.4 GROUND SURFACE	0.0
										ALLUVIAL GRAY-BROWN, FINE TO MEDIUM SAND	
15	16.6	3.8	21	35	45	80	SS-137	M		17.4	3.0
	11.3	9.1	33	67/0.5		100/1.0	SS-138	D		**COASTAL PLAIN** GRAY, SANDY CLAY WITH MICA (CAPE FEAR FORMATION)	
10										7.4	13.0
5	6.3	14.1	13	25	26	51	SS-139	M		GREEN-GRAY AND RED, CLAYEY SAND WITH MICA	
0	1.3	19.1	13	13	14	27		M			
-5	-3.7	24.1	35	39	61/0.4	100/0.9	SS-140	M		-2.6	23.0
-10	-8.7	29.1	15	20	25	45		M		GREEN-GRAY AND GRAY, SANDY CLAY WITH MICA	
-15	-13.7	34.1	17	28	33	61		M			
-20	-18.7	39.1	16	40	59	99		M			
-25	-23.7	44.1	12	14	20	34	SS-142	M		-22.6	43.0
-30	-28.7	49.1	15	27	34	61		M		GREEN-GRAY AND RED, CLAYEY SAND WITH MICA	
-35	-33.7	54.1	16	25	36	61		M		-26.6	47.0
-40	-38.7	59.1	36	64/0.4		100/0.9	SS-144	M		DARK GRAY AND RED, SILTY CLAY	
-45	-43.7	64.1	14	22	30	52	SS-145	D		-37.6	58.0
-50	-48.7	69.1	15	21	29	50		D		RED AND GRAY, SANDY CLAY	
										-42.6	63.0
										RED, YELLOW AND GRAY, SILTY CLAY	
										-47.6	68.0

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B4-B	**STATION** 52+84	**OFFSET** 35 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 20.4 ft	**TOTAL DEPTH** 113.7 ft	**NORTHING** 476,250	**EASTING** 2,043,400	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/22/11	**COMP. DATE** 06/23/11	**SURFACE WATER DEPTH** 8.8ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
-55	-52.9	73.3	13	24	39	63	SS-146	D		**RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC *(continued)*
-60	-57.9	78.3	16	28	64	92		D		
-65	-62.9	83.3	15	29	56	85	SS-147	D		
-70	-67.9	88.3	19	38	62/0.5	100/1.0				
-75	-72.9	93.3	27	73/0.5		100/1.0				
-80	-77.9	98.3	36	64/0.2		100/0.7				
-85	-82.9	103.3	65	45/0.1		100/0.6				
-90	-87.9	108.3	100/0.4			100/0.4				
	-92.9	113.3	100/0.4			100/0.4				-68.9 89.3 **WEATHERED ROCK** BLUE-GRAY AND TAN, META-MUDSTONE
										-93.3 113.7 Boring Terminated at Elevation -93.3 ft in WR: META-MUDSTONE

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River			**GROUND WTR (ft)**
BORING NO. B5-A	**STATION** 54+10	**OFFSET** 38 ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 26.3 ft	**TOTAL DEPTH** 114.2 ft	**NORTHING** 476,353	**EASTING** 2,043,503 — **24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/28/11	**COMP. DATE** 06/30/11	**SURFACE WATER DEPTH** 4.4ft

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft) / DEPTH (ft)
30										WATER SURFACE (06/28/11)
	26.3	0.0								26.3 GROUND SURFACE 0.0
25			WOH	WOH	WOH	0	SS-179	W		**ALLUVIAL** TAN-GRAY, SILTY, FINE TO MEDIUM SAND WITH ORGANICS
	22.6	3.7	WOH	WOH	WOH	0		W		
20										18.3 8.0
	17.6	8.7	11	15	19	34	SS-180	M		**COASTAL PLAIN** GRAY AND RED, SANDY CLAY (CAPE FEAR FORMATION)
15										
	12.6	13.7	19	30	50	80		M		
10										9.3 17.0
	7.6	18.7	12	13	23	36	SS-181	M		GRAY AND RED, CLAYEY, SILTY SAND WITH MICA
5										
	2.6	23.7	18	29	40	69		M		
0										-0.7 27.0
	-2.4	28.7	55	45/0.4		100/0.9	SS-182	M		GRAY, RED AND GREEN-GRAY, SANDY SILTY CLAY WITH MICA
-5										
	-7.4	33.7	19	31	56	87		M		
-10										
	-12.4	38.7	23	38	62/0.4	100/0.9	SS-183	M		
-15										
	-17.4	43.7	34	48	52/0.4	100/0.9		M		
-20										-20.7 47.0
	-22.4	48.7	9	11	13	24		M		GREEN-GRAY, CLAYEY SAND WITH MICA
-25										-25.7 52.0
	-27.4	53.7	16	23	37	60		M		DARK GRAY AND RED, SANDY SILTY CLAY
-30										
	-31.9	58.2	11	19	26	45		M		
-35										-35.7 62.0
	-36.9	63.2	22	25	33	58	SS-186	M		DARK GRAY, RED AND YELLOW, SILTY SANDY CLAY
-40										
	-41.9	68.2	31	52	48/0.5	100/1.0		M		
-45										-44.7 71.0
	-46.9	73.2	12	18	26	44	SS-188	D		**RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC
-50										

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
	-51.9	78.2	15	25	42	67		D		**RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC *(continued)*
-55										
	-56.9	83.2	18	29	54	83		D		
-60										
	-61.9	88.2	25	48	52/0.3	100/0.8				-62.4 88.7
-65										-63.2 89.5 **WEATHERED ROCK** BLUE-GRAY AND TAN, META-MUDSTONE
	-66.2	92.5	32	68/0.4		100/0.9				**WEATHERED ROCK** BLUE-GRAY AND TAN, SEVERELY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE REC=85%
-70										-70.3 96.6
	-71.2	97.5	27	40	56	96	SS-191	M		**RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC
-75										-74.6 100.9
	-76.7	103.0	30	70/0.5		100/1.0				**WEATHERED ROCK** BLUE-GRAY AND TAN, SEVERELY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE REC=56%
-80										
	-81.7	108.0	50	50/0.2		100/0.7	RS-2			
-85										
	-86.7	113.0	17	58	42/0.2	100/0.7	RS-3			-87.9 114.2 Boring Terminated at Elevation -87.9 ft in WR: META-MUDSTONE

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B5-A	**STATION** 54+10	**OFFSET** 38 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 26.3 ft	**TOTAL DEPTH** 114.2 ft	**NORTHING** 476,353	**EASTING** 2,043,503	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/28/11	**COMP. DATE** 06/30/11	**SURFACE WATER DEPTH** 4.4ft	
CORE SIZE N/A	**TOTAL RUN** 19.4 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
-63.2											Begin Coring @ 89.5 ft
-65	-63.2	89.5	3.0	2:30 3:00 2:45	(3.0) 100%	N/A		(6.0) 85%	N/A		-63.2 **WEATHERED ROCK** 89.5 BLUE-GRAY AND TAN, SEVERELY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE
	-66.2	92.5		N=100/0.9							
	-67.1	93.4	4.1	2:00 2:15 2:30 2:25	(3.0) 73%	N/A					
-70	-71.2	97.5		0:05/0.1			SS-91	(0.0) 0%	N/A		-70.3 96.6 **RESIDUAL** BLUE-GRAY AND TAN, SILTY CLAY, SAPROLITIC
	-72.7	99.0		N=96							-74.6 100.9
-75	-76.7	103.0	4.0	3:15 3:30 3:30 3:15	(2.1) 53%	N/A		(7.4) 56%	N/A		**WEATHERED ROCK** BLUE-GRAY AND TAN, SEVERELY WEATHERED, VERY SOFT, VERY CLOSELY TO CLOSELY FRACTURED, META-MUDSTONE
	-77.7	104.0		N=100/1.0							
-80	-81.7	108.0	4.0	3:45 3:15 3:15 5:45	(1.8) 45%	N/A					
	-82.4	108.7		N=100/0.7							
-85	-86.7	113.0	4.3	4:45 3:45 2:30 2:45	(3.5) 81%	N/A	RS-2 RS-3				-87.9 114.2 Boring Terminated at Elevation -87.9 ft in WR: META-MUDSTONE
				3:00/0.3 N=100/0.7							

NCDOT CORE SINGLE B4091_GEO_BH_BRIDGE.GPJ NC_DOT.GDT 8/12/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B5-B	**STATION** 54+02	**OFFSET** 73 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 22.8 ft	**TOTAL DEPTH** 115.7 ft	**NORTHING** 476,243	**EASTING** 2,043,524	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/21/11	**COMP. DATE** 06/22/11	**SURFACE WATER DEPTH** 5.2ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										WATER SURFACE (06/21/11)
22.8		0.0								GROUND SURFACE 0.0
	22.8	0.0	WOH	WOH	WOH	0	SS-123	W		**ALLUVIAL** GRAY, SANDY CLAY WITH TRACE ORGANICS
17.6	17.6	5.2	WOH	WOH	WOH	0		W		
	12.6	10.2	13	24	30	54	SS-124	M		**COASTAL PLAIN** GRAY AND RED, SANDY, SILTY CLAY WITH MICA (CAPE FEAR FORMATION)
7.6	7.6	15.2	14	17	26	43		M		
	2.6	20.2	17	30	45	75	SS-125	M		
0	-2.4	25.2	17	17	27	44		M		
	-7.4	30.2	19	26	32	58	SS-126	M		
-10	-12.4	35.2	16	23	31	54		M		
	-17.4	40.2	19	22	52	74	SS-127	M		
-20	-22.4	45.2	17	32	68/0.3	100/0.8		M		
-25	-27.4	50.2	11	11	13	24	SS-128	M		
-30	-32.4	55.2	14	23	32	55	SS-129	M		
-35	-37.4	60.2	14	19	28	47		M		
-40	-42.4	65.2	19	33	34	67	SS-130	M		
-45	-47.4	70.2	10	18	21	39		D		
-50										
										22.8 GROUND SURFACE 0.0
										13.3 9.5
										COASTAL PLAIN GRAY AND RED, SANDY, SILTY CLAY WITH MICA (CAPE FEAR FORMATION)
										3.8 19.0
										GREEN-GRAY AND RED, CLAYEY SAND WITH MICA
										-5.2 28.0
										GREEN-GRAY AND RED, SANDY CLAY WITH MICA
										-25.2 48.0
										GREEN-GRAY, CLAYEY SAND WITH MICA
										-31.2 54.0
										DARK GRAY AND RED, SILTY CLAY
										-41.2 64.0
										GRAY, RED AND YELLOW, SANDY CLAY

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B5-B	**STATION** 54+02	**OFFSET** 73 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 22.8 ft	**TOTAL DEPTH** 115.7 ft	**NORTHING** 476,243	**EASTING** 2,043,524	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE MAC2425 CME-55 85% 09/02/2009		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/21/11	**COMP. DATE** 06/22/11	**SURFACE WATER DEPTH** 5.2ft	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-50						Match Line				
	-52.4	75.2	12	23	33	56	SS-131	D		
-55	-57.4	80.2	13	19	33	52		D		
-60	-62.4	85.2	13	24	36	60	SS-132	D		
-65	-67.4	90.2	12	37	63/0.4	100/0.9				
-70	-72.4	95.2	33	67/0.3		100/0.8				
-75	-77.4	100.2	18	34	66	100/1.0				
-80	-82.4	105.2	21	35	56	91	SS-134			
-85	-87.4	110.2	38	62/0.2		100/0.7				
-90	-92.4	115.2	100/0.5			100/0.5				
										-51.2 74.0
										RESIDUAL GRAY AND TAN, SILTY CLAY, SAPROLITIC
										-67.9 90.7
										WEATHERED ROCK GRAY AND TAN, META-MUDSTONE
										-81.2 104.0
										RESIDUAL GRAY AND TAN, SILTY CLAY, SAPROLITIC
										-87.2 110.0
										WEATHERED ROCK TAN AND GRAY, META-MUDSTONE
										-92.9 115.7
										Boring Terminated at Elevation -92.9 ft in WR: META-MUDSTONE

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B6-A	**STATION** 55+42	**OFFSET** 39 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 57.0 ft	**TOTAL DEPTH** 100.2 ft	**NORTHING** 476,388	**EASTING** 2,043,630	**24 HR.** 5.5
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/15/11	**COMP. DATE** 06/15/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION — ELEV. (ft) / DEPTH (ft)
60										
	57.0	0.0								57.0 / 0.0 GROUND SURFACE
55			7	6	5	11	SS-97	M		**ALLUVIAL** GRAY, SILTY, FINE SAND
	53.3	3.7								54.0 / 3.0 GRAY, SILTY CLAY WITH TRACE ORGANICS
50			3	4	4	8	SS-98	W		
	48.3	8.7								
45			WOH	1	3	4	SS-99	W		
	43.3	13.7								43.3 / 13.7 GRAY, SILTY CLAY
40			WOH	WOH	WOH	0	SS-100	W		
	38.3	18.7								39.5 / 17.5 **COASTAL PLAIN** GRAY AND RED, SILTY CLAY (CAPE FEAR FORMATION)
35			5	6	10	16	SS-101	W		35.0 / 22.0 GREEN-GRAY AND RED, SANDY CLAY
	33.3	23.7								
30			16	28	38	66	SS-102	M		
	28.3	28.7								
25			17	18	19	37		M		
	23.3	33.7								
20			20	54	46/0.3	100/0.8	SS-103	M		
	18.3	38.7								
15			15	28	72	100/1.0		M		
	13.3	43.7								
10			26	33	67/0.4	100/0.9	SS-104	M		
	8.3	48.7								
5			21	29	34	63		M		5.0 / 52.0 GREEN-GRAY AND RED, CLAYEY SILTY SAND
	3.3	53.7								
0			14	19	20	39	SS-106	W		
	-1.7	58.7								-2.7 / 59.7 GRAY AND RED, FINE TO COARSE, SANDY CLAY
-5			24	65	35/0.1	100/0.6	SS-107	M		
	-6.7	63.7	100/0.5			100/0.5		M		
-10										
	-11.7	68.7	33	50	50/0.4	100/0.9	SS-109	M		
-15										-15.0 / 72.0 GRAY TO GREEN-GRAY, CLAYEY SAND
	-16.7	73.7	26	33	38	71	SS-110	M		
-20										

NCDOT BORE DOUBLE B4091_GEO_BH_BRIDGE.GPJ NC_DOT.GDT 8/12/11

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B6-A	**STATION** 55+42	**OFFSET** 39 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 57.0 ft	**TOTAL DEPTH** 100.2 ft	**NORTHING** 476,388	**EASTING** 2,043,630	**24 HR.** 5.5
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/15/11	**COMP. DATE** 06/15/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-20						Match Line				
	-21.7	78.7	17	31	34	65		M		GRAY TO GREEN-GRAY, CLAYEY SAND *(continued)*
-25										
	-26.7	83.7	13	16	22	38		W		
-30										-30.0 / 87.0
	-31.7	88.7	20	30	37	67		M		GRAY AND RED, FINE TO COARSE, SANDY CLAY
-35										-35.0 / 92.0
	-36.7	93.7	24	22	17	39	SS-112	W		GRAY, CLAYEY SILT
-40										
	-41.7	98.7	16	23	31	54		W		-43.2 / 100.2 Boring Terminated at Elevation -43.2 ft in Coastal Plain, CLAYEY SILT (Cape Fear Formation)

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. B6-B	**STATION** 55+49	**OFFSET** 42 ft RT	**ALIGNMENT** -L-	**0 HR.** 0.0
COLLAR ELEV. 62.6 ft	**TOTAL DEPTH** 70.4 ft	**NORTHING** 476,311	**EASTING** 2,043,658	**24 HR.** 5.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER Contract Driller	**START DATE** 06/17/11	**COMP. DATE** 06/17/11		**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft) / DEPTH (ft)
	62.6	0.0	5	7	9	16	SS-114	D		62.6 GROUND SURFACE 0.0
										ARTIFICIAL FILL
	58.7	3.9								ORANGE AND TAN, SILTY CLAYEY SAND WITH GRAVEL AND ORGANICS 59.6 3.0
			6	7	5	12	SS-115	M		ALLUVIAL
										ORANGE-TAN, SANDY CLAY WITH ORGANICS 55.6 7.0
	53.7	8.9								GRAY-ORANGE, SANDY CLAY
			9	11	13	24	SS-116	M		
	48.7	13.9	9	11	12	23		M		
	43.7	18.9	12	19	24	43	SS-117	M		COASTAL PLAIN
										GRAY, RED, GREEN-GRAY AND BROWN, CLAYEY SAND (CAPE FEAR FORMATION)
	38.7	23.9	25	26	33	59		M		44.6 18.0
	33.7	28.9	35	27	29	56	SS-118	M		GRAY, SANDY SILT WITH MICA 35.6 27.0
	28.7	33.9	17	21	28	49	SS-119	M		GREEN-GRAY, CLAYEY SAND WITH MICA 30.6 32.0
	23.7	38.9	12	24	24	48		M		GREEN-GRAY AND RED, SANDY CLAY WITH MICA 20.6 42.0
	18.7	43.9	47	47	47	94	SS-120	M		
	13.7	48.9	39	57	43	100/1.0		M		GREEN-GRAY, CLAYEY SILTY SAND WITH MICA 10.6 52.0
	8.7	53.9	28	32	53	85		M		
	3.7	58.9	26	31	35	66		M		GRAY, CLAYEY SAND WITH MICA 0.6 62.0
	-1.3	63.9	45	55/0.2		100/0.7	SS-122	M		
	-6.3	68.9	25	41	57	98		M		-7.8 70.4 Boring Terminated at Elevation -7.8 ft in Coastal Plain, CLAYEY SAND (Cape Fear Formation)

NCDOT BORE SINGLE B4091_GEO_BH_BRIDGE.GPJ NC_DOT.GDT 8/12/11

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 57+08	**OFFSET** 35 ft LT	**ALIGNMENT** -L-	**0 HR.** 16.0
COLLAR ELEV. 94.0 ft	**TOTAL DEPTH** 60.3 ft	**NORTHING** 476,426	**EASTING** 2,043,792	**24 HR.** 19.5
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/15/11	**COMP. DATE** 06/16/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
95											
	94.0	0.0	12	9	9	18	SS-89	D		94.0 GROUND SURFACE	0.0
90	90.2	3.8	6	6	8	14		M		**ROADWAY EMBANKMENT** TAN, ORANGE AND BROWN, SANDY SILT	
85	85.2	8.8	5	8	13	21	SS-90	M		87.0 **COASTAL PLAIN** TAN-ORANGE,CLAYEY SAND (TERTIARY UPLAND SEDIMENTS)	7.0
80	80.2	13.8	9	13	14	27	SS-91	W		82.0 TAN-ORANGE, SLIGHTLY SILTY, FINE TO COARSE SAND WITH GRAVEL	12.0
75	75.2	18.8	2	2	5	7	SS-92	M		77.0 **COASTAL PLAIN** GRAY AND GRAY-GREEN, SANDY CLAY (CAPE FEAR FORMATION)	17.0
70	70.2	23.8	5	8	11	19		M			
65	65.2	28.8	11	17	26	43	SS-93	M		67.0 GRAY AND RED, GRAY-GREEN, AND BROWN, SANDY CLAY	27.0
60	60.2	33.8	18	23	32	55	SS-94	M			
55	55.2	38.8	25	49	51/0.4	100/0.9		M			
50	50.2	43.8	18	23	30	53		M		47.0 DARK GREEN-GRAY AND RED, SANDY SILTY CLAY WITH MICA	47.0
45	45.2	48.8	25	32	57	89	SS-95	M			
40	40.2	53.8	18	16	20	36		M		37.0 GREEN-GRAY, SANDY SILT	57.0
35	35.2	58.8	16	22	29	51	SS-96	M		33.7 Boring Terminated at Elevation 33.7 ft in Coastal Plain, SANDY SILT (Cape Fear Formation)	60.3

WBS 33449.1.1	**TIP** B-4091	**COUNTY** CUMBERLAND	**GEOLOGIST** Howard, J.	
SITE DESCRIPTION Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 57+03	**OFFSET** 41 ft RT	**ALIGNMENT** -L-	**0 HR.** 9.0
COLLAR ELEV. 93.7 ft	**TOTAL DEPTH** 64.5 ft	**NORTHING** 476,351	**EASTING** 2,043,807	**24 HR.** 19.0
DRILL RIG/HAMMER EFF./DATE MAC6893 CME-55 88% 02/10/2010		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER Contract Driller	**START DATE** 06/15/11	**COMP. DATE** 06/15/11	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
95										
	93.7	0.0	3	4	4	8	SS-78	D		93.7 GROUND SURFACE 0.0
90	89.9	3.8	WOH	6	4	10		M		**ROADWAY EMBANKMENT** TAN AND BROWN, SANDY SILT
85	84.9	8.8	7	7	8	15	SS-79	M		86.7 7.0 **COASTAL PLAIN** ORANGE-TAN, SLIGHTLY SILTY, FINE TO COARSE SAND (TERIARY UPLAND SEDIMENTS)
80	79.9	13.8	8	10	11	21		W		
75	74.9	18.8	10	8	4	12	SS-80	W		76.7 17.0 TAN, SILTY SAND
70	69.9	23.8	6	6	9	15	SS-81	M		71.7 22.0 **COASTAL PLAIN** GREEN-GRAY, GRAY, RED AND BROWN, CLAYEY SILTY SAND (CAPE FEAR FORMATION)
65	64.9	28.8	7	16	19	35		M		
60	59.9	33.8	9	9	11	20	SS-82	M		61.7 32.0 GREEN-GRAY, GRAY, RED AND BROWN, CLAYEY SAND
55	54.9	38.8	16	26	36	62		M		
50	49.9	43.8	11	14	14	28	SS-83	M		
45	44.9	48.8	9	10	20	30		M		41.7 52.0 GREEN-GRAY, GRAY, RED AND BROWN, SANDY CLAY
40	39.9	53.8	11	15	19	34	SS-84	M		
35	34.9	58.8	14	17	21	38		M		
30	29.9	63.8	55	45/0.2		100/0.7	SS-85	M		31.7 62.0 GREEN-GRAY, SANDY SILT WITH MICA 29.2 64.5 Boring Terminated at Elevation 29.2 ft in Coastal Plain, SANDY SILT (Cape Fear Formation)

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-51	22 LT	47+13	0.8-1.7	A-1-b(0)	17	NP	74.8	14.4	4.8	6.1	90	40	11	-	-
SS-52	22 LT	47+13	3.7-5.2	A-4(3)	28	9	8.7	42.1	29.0	20.2	100	99	58	-	-
SS-53	22 LT	47+13	13.7-15.2	A-6(7)	34	15	6.5	37.0	28.2	28.3	100	100	64	-	-
SS-54	22 LT	47+13	18.7-20.2	A-4(1)	27	8	7.3	50.6	21.9	20.2	100	100	51	-	-
SS-55	22 LT	47+13	23.7-25.2	A-6(11)	36	17	4.7	30.7	34.3	30.3	100	99	72	-	-
SS-57	22 LT	47+13	48.7-50.2	A-2-6(0)	35	17	57.3	23.1	14.6	5.1	95	61	22	-	-
SS-59	22 LT	47+13	63.7-65.2	A-4(2)	24	10	28.9	25.5	37.5	8.1	100	82	52	-	-

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-40	78 RT	47+22	0.0-1.5	A-4(0)	26	6	23.7	35.8	22.3	18.2	100	90	47	-	-
SS-41	78 RT	47+22	8.9-10.4	A-6(2)	27	11	16.4	39.2	24.2	20.2	100	98	50	-	-
SS-42	78 RT	47+22	13.9-15.4	A-2-6(0)	34	15	41.1	40.4	10.4	8.1	98	78	21	-	-
SS-43	78 RT	47+22	23.9-25.4	A-2-6(0)	39	16	63.4	19.5	12.0	5.1	96	54	19	-	-
SS-46	78 RT	47+22	53.9-55.4	A-2-6(0)	32	13	62.4	24.5	10.1	3.0	93	55	15	-	-

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	57 LT	48+57	0.0-1.5	A-2-4(0)	17	NP	52.7	33.7	8.5	5.1	98	64	16	-	-
SS-14	57 LT	48+57	3.8-5.3	A-6(14)	38	21	2.0	31.5	32.1	34.3	100	99	75	-	-
SS-15	57 LT	48+57	13.8-15.3	A-7-6(12)	51	28	20.8	32.1	32.9	14.1	100	90	55	-	-
SS-16	57 LT	48+57	18.8-20.3	A-6(2)	29	14	35.7	27.1	16.1	21.2	100	84	40	-	-
SS-17	57 LT	48+57	28.8-30.3	A-7-6(24)	47	28	4.6	16.2	42.8	36.4	100	99	83	-	-
SS-18	57 LT	48+57	33.8-35.3	A-2-6(0)	39	17	60.7	20.4	14.8	4.0	100	58	22	-	-
SS-19	57 LT	48+57	43.8-45.3	A-7-6(26)	54	29	3.6	20.0	48.1	28.3	100	98	84	-	-
SS-20	57 LT	48+57	53.8-55.3	A-6(16)	38	24	4.0	29.3	42.4	24.2	100	98	74	-	-
SS-21	57 LT	48+57	63.8-65.3	A-2-6(1)	31	15	52.6	23.3	17.0	7.1	95	62	26	-	-
SS-22	57 LT	48+57	68.8-70.3	A-2-7(1)	46	27	62.6	18.2	10.1	9.1	99	57	21	-	-

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-1	40 RT	48+57	0.0-1.5	A-4(2)	27	7	19.2	25.7	37.0	18.2	99	90	60	-	-
SS-2	40 RT	48+57	3.9-4.4	A-6(10)	32	15	2.4	30.7	40.6	26.3	100	99	77	-	-
SS-3	40 RT	48+57	8.9-10.4	A-6(7)	30	14	10.3	33.1	32.3	24.2	100	96	65	-	-
SS-4	40 RT	48+57	18.9-20.4	A-2-6(0)	30	12	40.7	37.7	14.5	7.1	99	76	25	-	-
SS-5	40 RT	48+57	28.9-30.4	A-2-6(0)	34	17	67.0	16.2	11.8	5.1	100	57	19	-	-
SS-6	40 RT	48+57	38.9-40.4	A-6(10)	37	24	26.1	19.6	36.2	18.2	100	85	58	-	-
SS-7	40 RT	48+57	43.9-45.4	A-2-7(2)	43	27	57.3	14.8	12.7	15.2	98	65	29	-	-
SS-8	40 RT	48+57	53.9-55.4	A-6(13)	35	20	9.3	19.8	42.6	28.3	100	95	75	-	-
SS-9	40 RT	48+57	63.9-65.4	A-2-6(1)	37	17	55.7	19.8	15.5	9.1	97	60	27	-	-
SS-10	40 RT	48+57	73.9-75.4	A-7-6(10)	46	24	1.8	50.5	29.5	18.2	100	100	54	-	-
SS-11	40 RT	48+57	83.9-85.4	A-6(12)	37	19	3.0	35.6	43.2	18.2	100	98	73	-	-
SS-12	40 RT	48+57	93.9-94.4	A-7-6(32)	47	33	0.6	11.7	45.3	42.4	100	100	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-23	44 LT	49+90	0.0-1.5	A-4(1)	27	7	19.6	33.5	32.7	14.1	98	87	54	-	-
SS-24	44 LT	49+90	9.0-10.5	A-4(0)	22	4	7.5	47.9	28.5	16.2	100	100	52	-	-
SS-25	44 LT	49+90	14.0-15.1	A-2-6(1)	31	15	37.2	29.9	12.7	20.2	84	75	30	-	-
SS-27	44 LT	49+90	34.0-35.5	A-2-6(0)	33	12	41.6	32.5	21.8	4.0	95	72	29	-	-
SS-28	44 LT	49+90	49.0-50.5	A-2-7(5)	55	40	57.9	12.7	10.2	19.2	97	61	30	-	-
SS-29	44 LT	49+90	54.0-55.5	A-7-6(40)	60	38	1.4	8.7	43.4	46.5	100	99	94	-	-
SS-30	44 LT	49+90	64.0-65.5	A-2-6(1)	40	22	64.8	13.2	13.8	8.1	99	52	24	-	-

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-31	40 RT	49+98	0.0-1.5	A-2-4(0)	20	1	31.7	36.2	24.0	8.1	90	74	35	-	-
SS-32	40 RT	49+98	9.0-10.5	A-4(0)	19	NP	21.4	49.3	21.2	8.1	100	97	36	-	-
SS-33	40 RT	49+98	14.4-15.5	A-2-6(3)	40	25	21.0	27.5	17.2	34.3	61	54	34	-	-
SS-34	40 RT	49+98	24.0-25.0	A-2-4(0)	32	8	61.6	24.4	9.9	4.0	95	55	17	-	-
SS-35	40 RT	49+98	29.0-30.5	A-2-4(0)	29	8	57.5	23.8	13.6	5.1	100	64	22	-	-
SS-37	40 RT	49+98	49.0-50.5	A-2-6(0)	35	16	60.6	20.9	11.4	7.1	97	63	21	-	-
SS-39	40 RT	49+98	69.0-70.5	A-2-7(0)	46	23	71.3	12.9	10.7	5.1	98	50	18	-	-

B3-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-152	48 LT	51+64	4.8-6.3	A-6(6)	30	11	7.8	25.4	32.6	34.2	100	99	72	-	-
SS-153	48 LT	51+64	9.8-11.3	A-6(12)	38	21	10.1	31.2	38.6	20.1	100	96	67	-	-
SS-154	48 LT	51+64	14.8-16.3	A-6(4)	34	19	24.5	35.2	26.2	14.1	99	87	44	-	-
SS-155	48 LT	51+64	24.8-26.3	A-2-4(0)	39	NP	59.0	29.6	9.5	2.0	95	56	15	-	-
SS-156	48 LT	51+64	34.8-36.3	A-6(14)	40	22	8.9	31.6	43.5	16.1	100	96	72	-	-
SS-157	48 LT	51+64	49.8-61.3	A-6(3)	38	16	10.5	57.1	24.3	8.0	100	97	42	-	-
SS-158	48 LT	51+64	54.8-56.3	A-7-6(30)	48	30	1.6	5.8	42.3	50.3	100	99	95	-	-
SS-159	48 LT	51+64	64.8-66.3	A-6(22)	40	24	2.8	8.7	46.3	42.3	100	98	92	-	-
SS-161	48 LT	51+64	79.8-81.3	A-7-5(31)	63	23	1.4	1.8	50.5	46.3	100	99	98	-	-

B3-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-195	50 RT	51+41	0.0-1.5	A-6(13)	37	16	2.6	16.9	38.3	42.2	100	100	85	-	-
SS-196	50 RT	51+41	4.2-5.7	A-4(0)	26	3	18.3	50.1	17.6	14.1	95	92	36	-	-
SS-197	50 RT	51+41	9.2-10.7	A-2-4(0)	31	9	36.0	38.8	19.2	6.0	100	88	30	-	-
SS-198	50 RT	51+41	19.2-20.7	A-2-5(0)	42	NP	57.5	32.2	8.3	2.0	98	63	14	-	-
SS-200	50 RT	51+41	39.2-40.7	A-6(2)	36	13	10.3	53.5	20.2	16.1	100	99	42	-	-
SS-201	50 RT	51+41	49.2-50.7	A-7-6(34)	54	31	0.8	3.8	45.1	50.3	100	100	97	-	-
SS-202	50 RT	51+41	59.2-60.7	A-7-6(25)	44	26	3.2	6.4	38.1	52.3	100	98	93	-	-
SS-203	50 RT	51+41	69.2-70.7	A-7-5(34)	66	29	2.6	5.0	52.2	40.2	100	99	94	-	-

B4-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-166	56 LT	52+27	3.1-4.1	A-2-6(1)	29	15	43.7	25.4	16.9	14.1	85	59	30	-	-
SS-168	56 LT	52+27	18.1-19.6	A-2-6(0)	35	13	56.5	33.3	6.1	4.1	98	64	14	-	-
SS-169	56 LT	52+27	28.1-29.6	A-7-6(14)	42	20	10.5	23.5	43.9	22.1	100	95	74	-	-
SS-171	56 LT	52+27	48.1-49.6	A-7-6(34)	52	33	1.6	5.8	32.2	60.4	100	99	95	-	-
SS-172	56 LT	52+27	58.1-59.6	A-6(18)	35	19	1.8	6.0	41.9	50.3	100	99	95	-	-

B4-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-136	35 RT	52+84	0.0-1.5	A-3(0)	17	NP	82.3	15.3	2.4	0.0	100	65	3	-	-
SS-137	35 RT	52+84	3.8-5.3	A-6(1)	29	11	2.6	61.2	18.1	18.1	100	99	42	-	-
SS-138	35 RT	52+84	9.1-10.6	A-6(2)	32	14	6.0	56.3	21.5	16.1	100	98	42	-	-
SS-139	35 RT	52+84	14.1-15.6	A-2-6(0)	35	15	48.7	35.4	11.9	4.0	100	74	22	-	-
SS-140	35 RT	52+84	24.1-25.6	A-6(11)	32	15	2.4	31.6	47.9	18.1	100	99	81	-	-

B4-B (CONTINUED)

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-142	35 RT	52+84	44.1-45.6	A-2-7(2)	41	21	34.6	44.9	16.5	4.0	98	82	31	-	-
SS-144	35 RT	52+84	59.1-60.6	A-6(14)	36	19	10.9	9.9	41.0	38.2	97	90	80	-	-
SS-145	35 RT	52+84	64.1-65.6	A-7-5(35)	62	31	2.8	3.8	39.0	54.3	100	98	95	-	-
SS-146	35 RT	52+84	73.3-74.8	A-7-5(32)	63	25	1.4	2.6	57.7	38.2	100	99	97	-	-
SS-147	35 RT	52+84	83.3-84.8	A-7-5(28)	60	22	1.8	3.2	58.8	36.2	100	99	96	-	-

B5-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-179	38 LT	54+10	0.0-1.5	A-2-4(0)	27	NP	5.0	70.6	16.3	8.0	100	99	30	-	-
SS-180	38 LT	54+10	8.7-10.2	A-6(5)	40	19	7.8	52.7	25.4	14.1	93	89	45	-	-
SS-181	38 LT	54+10	18.7-20.2	A-2-4(0)	33	5	37.2	43.7	13.1	6.0	100	87	25	-	-
SS-182	38 LT	54+10	28.7-30.2	A-7-6(24)	42	27	3.2	12.5	42.1	42.3	100	99	89	-	-
SS-183	38 LT	54+10	38.7-40.2	A-7-6(15)	46	19	8.7	21.9	35.2	34.2	100	96	76	-	-
SS-186	38 LT	54+10	63.2-65.7	A-6(22)	38	23	1.8	6.2	37.6	54.3	100	99	95	-	-
SS-188	38 LT	54+10	73.2-75.7	A-7-5(23)	63	19	7.2	9.2	55.4	28.1	100	96	87	-	-
SS-191	38 LT	54+10	97.5-99.0	A-7-5(28)	62	23	3.2	5.8	60.8	30.2	100	98	93	-	-

B5-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-123	73 RT	54+02	0.0-1.5	A-6(9)	34	13	1.8	24.9	31.1	42.2	100	100	79	-	-
SS-124	73 RT	54+02	10.2-11.7	A-7-6(9)	42	22	3.6	49.6	28.7	18.1	100	98	55	-	-
SS-125	73 RT	54+02	20.2-21.7	A-2-7(2)	43	21	42.6	30.9	14.5	12.0	100	77	31	-	-
SS-126	73 RT	54+02	30.2-31.7	A-6(12)	38	18	9.4	28.1	44.4	18.1	100	94	72	-	-
SS-127	73 RT	54+02	40.2-41.7	A-6(9)	37	17	11.8	32.1	40.0	16.1	100	95	65	-	-
SS-128	73 RT	54+02	50.2-51.7	A-2-6(0)	35	15	48.2	32.9	10.8	8.0	98	76	22	-	-
SS-129	73 RT	54+02	55.2-56.7	A-7-6(36)	54	34	1.2	3.6	32.9	62.2	100	99	96	-	-
SS-130	73 RT	54+02	65.2-66.7	A-6(13)	35	18	13.1	8.4	38.4	40.2	97	88	78	-	-
SS-131	73 RT	54+02	75.2-76.7	A-7-5(31)	64	25	3.4	5.0	55.4	36.1	100	98	94	-	-
SS-132	73 RT	54+02	85.2-86.7	A-7-5(31)	59	25	1.2	2.0	50.6	46.2	100	99	98	-	-
SS-134	73 RT	54+02	105.1-106.7	A-7-5(27)	59	21	3.0	4.4	56.4	36.1	100	98	95	-	-

B6-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-97	39 LT	55+42	0.0-1.5	A-2-4(0)	24	6	54.9	17.4	16.7	11.1	95	67	28	-	-
SS-98	39 LT	55+42	3.7-5.2	A-6(12)	37	16	7.8	19.5	44.5	28.1	100	95	78	-	-
SS-99	39 LT	55+42	8.7-10.2	A-6(11)	39	15	13.7	10.9	59.4	16.1	99	91	77	-	-
SS-100	39 LT	55+42	13.7-15.2	A-7-6(19)	42	19	0.6	14.3	51.0	34.2	100	100	91	-	-
SS-101	39 LT	55+42	18.7-20.2	A-7-6(25)	54	36	4.8	30.2	34.9	30.2	100	98	73	-	-
SS-102	39 LT	55+42	23.7-25.2	A-6(5)	38	18	21.3	32.8	31.9	14.1	99	88	49	-	-
SS-103	39 LT	55+42	33.7-35.2	A-6(15)	36	19	4.2	17.5	56.2	22.1	100	98	84	-	-
SS-104	39 LT	55+42	43.7-45.2	A-6(8)	35	16	22.5	24.5	30.9	22.1	100	87	62	-	-
SS-106	39 LT	55+42	53.7-55.2	A-2-4(0)	34	10	63.2	22.7	10.1	4.0	99	64	17	-	-
SS-107	39 LT	55+42	58.7-60.2	A-6(17)	40	21	7.0	15.5	47.3	30.2	100	96	83	-	-
SS-109	39 LT	55+42	68.7-70.2	A-6(11)	37	18	10.1	25.5	50.4	14.1	100	96	72	-	-
SS-110	39 LT	55+42	73.7-75.2	A-2-6(1)	39	17	40.4	31.3	21.3	7.0	99	78	33	-	-
SS-112	39 LT	55+42	93.7-95.2	A-4(3)	22	6	2.2	6.0	67.6	24.1	100	99	94	-	-

B6-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-114	42 RT	55+49	0.0-1.5	A-2-6(0)	28	11	53.5	25.5	13.0	8.0	90	57	21	-	-
SS-115	42 RT	55+49	3.9-5.4	A-6(6)	40	23	33.0	23.3	19.6	24.1	95	77	45	-	-
SS-116	42 RT	55+49	8.9-10.4	A-7-6(6)	48	33	45.1	20.4	8.3	26.1	100	73	37	-	-
SS-117	42 RT	55+49	18.9-20.4	A-2-6(1)	32	14	37.4	35.6	22.0	5.0	100	83	33	-	-
SS-118	42 RT	55+49	28.9-30.4	A-4(0)	21	8	32.7	31.9	28.4	7.0	100	82	42	-	-
SS-119	42 RT	55+49	33.9-35.4	A-2-6(1)	35	18	57.4	18.4	17.2	7.0	96	61	26	-	-
SS-120	42 RT	55+49	43.9-45.4	A-6(14)	38	19	6.0	21.5	54.4	18.1	100	97	79	-	-
SS-122	42 RT	55+49	63.9-65.4	A-2-7(1)	45	22	56.7	19.5	15.8	8.0	97	61	25	-	-

EB2-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-89	35 LT	57+08	0.0-1.5	A-4(0)	20	5	31.7	28.7	21.3	18.2	96	79	42	-	-
SS-90	35 LT	57+08	8.8-10.3	A-2-6(1)	34	17	52.2	13.0	14.6	20.2	97	62	35	-	-
SS-91	35 LT	57+08	13.8-15.3	A-1-b(0)	20	NP	83.2	12.1	2.6	2.0	65	26	4	-	-
SS-92	35 LT	57+08	18.8-20.3	A-7-6(9)	41	21	4.7	47.9	29.2	18.2	100	99	55	-	-
SS-93	35 LT	57+08	28.8-30.3	A-6(5)	37	19	34.8	25.1	30.0	10.1	100	79	46	-	-
SS-94	35 LT	57+08	38.8-40.3	A-6(7)	39	21	30.9	23.7	31.2	14.2	100	83	51	-	-
SS-95	35 LT	57+08	48.8-50.3	A-7-6(16)	45	24	12.3	23.1	44.4	20.2	100	94	72	-	-
SS-96	35 LT	57+08	58.8-60.3	A-4(1)	25	10	30.1	31.1	30.6	8.1	100	83	45	-	-

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-78	41 RT	57+03	0.0-1.5	A-4(0)	22	8	32.2	27.1	22.5	18.2	96	78	44	-	-
SS-79	41 RT	57+03	8.8-10.3	A-2-4(0)	25	4	57.7	26.9	3.2	12.1	86	63	14	-	-
SS-80	41 RT	57+03	18.8-20.3	A-1-b(0)	18	NP	83.5	11.5	1.9	3.0	77	27	5	-	-
SS-81	41 RT	57+03	23.8-25.3	A-2-4(0)	30	3	59.6	30.1	7.3	3.0	100	72	13	-	-
SS-82	41 RT	57+03	33.8-35.3	A-2-6(1)	33	15	51.2	23.1	16.7	9.1	100	71	30	-	-
SS-83	41 RT	57+03	43.8-45.3	A-2-6(0)	36	12	60.4	21.5	13.0	5.1	92	51	19	-	-
SS-84	41 RT	57+03	53.8-55.3	A-6(2)	34	14	14.8	50.4	28.8	6.1	100	94	41	-	-
SS-85	41 RT	57+03	63.8-64.3	A-4(0)	20	5	33.6	30.5	27.8	8.1	100	81	41	-	-

B3-B

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	UNCONFINED STRENGTH (PSI)	UNDRAINED SHEAR STRENGTH (PSI)	SHEAR PLANE ANGLE (DEGREES)
RS-1	50 RT	51+41	104.-104.7	2.26	136.10	31.0	15.518	30
RS-4	50 RT	51+41	90.0-90.4	1.84	117.52	4.0	2.006	35

B5-A

ROCK TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	H/D RATIO	UNIT WT lbs/ft3	UNCONFINED STRENGTH (PSI)	UNDRAINED SHEAR STRENGTH (PSI)	SHEAR PLANE ANGLE (DEGREES)
RS-2	38 LT	54+02	108.3-108.7	1.81	143.37	312.3	156.150	30
RS-3	38 LT	54+02	112.3-113.0	2.32	139.10	128.5	64.246	40

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

FIELD SCOUR REPORT

WBS: 33449.1.1 TIP: B-4091 COUNTY: CUMBERLAND

DESCRIPTION(1): Br. No 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River

EXISTING BRIDGE

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

Bridge No.: 85 Length: 965 Total Bents: 19 Bents in Channel: 4 Bents in Floodplain: 15
Foundation Type: CONCRETE FOOTINGS, CONCRETE PILES

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: NONE EVIDENT

Interior Bents: SCOUR AT EXISTING BENT 7 AND BENT 8 (SOUTH BANK)
GULLY EXTENDING FROM EXISTING BENT 7 TO BENT 8 FROM DRAINAGE

Channel Bed: NO SCOUR EVIDENT

Channel Bank: SCOUR EVIDENT ON SOUTH BANK OF RIVER, DUE TO DRAINAGE CHANNELS
AND GULLYING CAUSED BY SECONDARY DRAINAGE/SEEPS

EXISTING SCOUR PROTECTION

Type(3): NO SIDE SLOPE PROTECTION OR RIP RAP USED ONSITE

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): LARGE AMOUNT OF DEBRIS AGAINST BENT 9, 10 AND 11

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 theoritical 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): ALLUVIAL SAND AND CLAY

Channel Bank Material(8): ALLUVIAL CLAYS
COASTAL PLAIN CLAYEY, SILTY SANDS (CAPE FEAR FORMATION)

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

Floodplain Width(10): 700 FT

Floodplain Cover(11): GRASS, SHRUB, YOUNG TO MODERATELY AGED TREES.

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tendency(13): SOUTH

Observations and Other Comments: ____

DESIGN SCOUR ELEVATIONS(14) Feet X Meters ____

BENTS B1	B2	B3	B4	B5	B6					
66.4	65.7	22.1	12.2	11.9	58.2					

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the Hydraulic Unit's theoretical scour elevations at Bent 1, Bent 2, Bent 3. The DSE has been raised at Bent 4 and Bent 5 by 8-10 feet. Bent 6 has been adjusted based on revised centerline elevation, which is lower than the elevation given by Hydraulics. The contraction scour is still 3.4 feet at Bent 6.

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

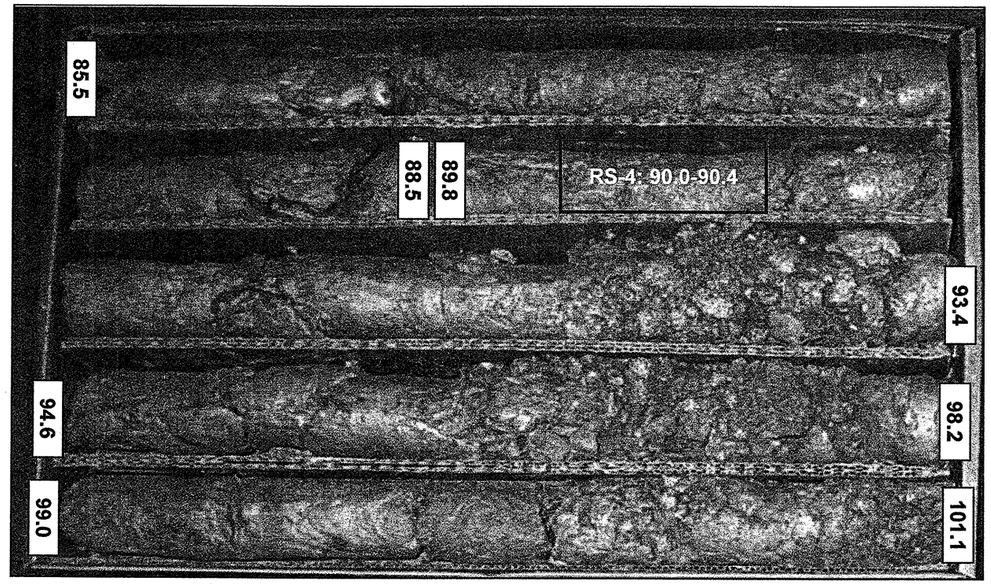
Bed or Bank						
Sample No.						
Retained #4						
Passed #10						
Passed #40						
Passed #200						
Coarse Sand						
Fine Sand						
Silt						
Clay						
LL						
PI						
AASHTO						
Station						
Offset						
Depth						

See Sheet 12, "Soil Test Results", for samples:
SS-195 (CHANNEL)
SS-196 (CHANNEL)
SS-166 (CHANNEL)
SS-136 (CHANNEL)
SS-179 (CHANNEL)
SS-97 (BANK)
SS-98 (BANK)
SS-100 (BANK)

Reported by: Christina M. Bruinsma, L.G. Date: 6/28/2011

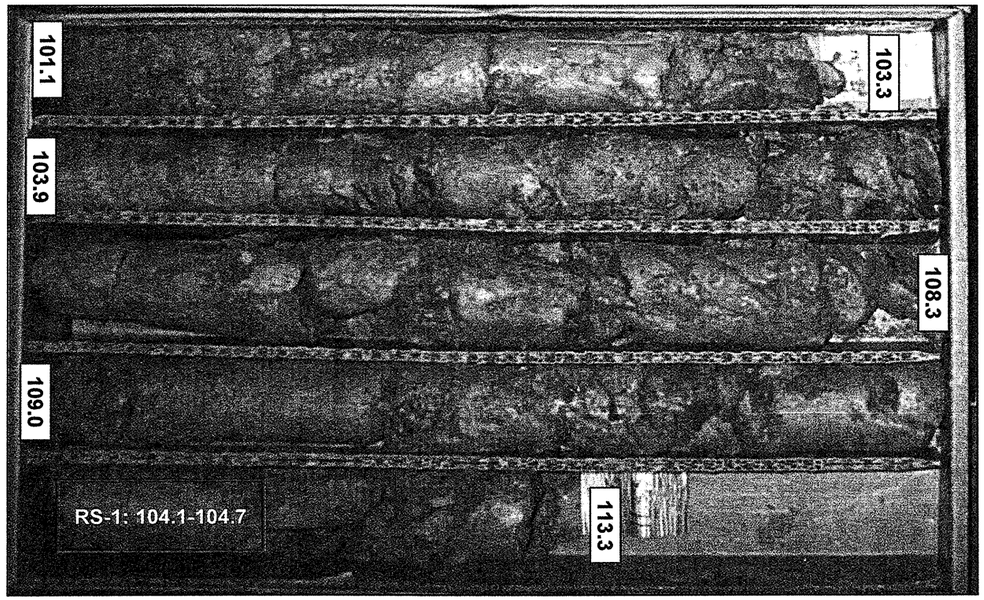
CORE PHOTOGRAPHS

B3-B
BOX 1: 85.5 - 101.1 FEET



0 1 2
FEET

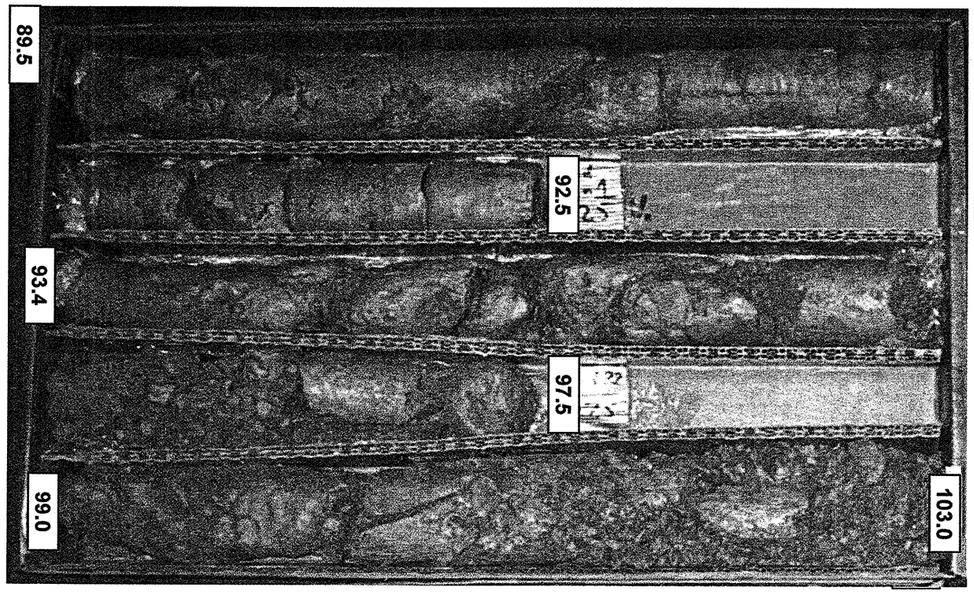
B3-B
BOX 2: 101.1 - 113.3 FEET

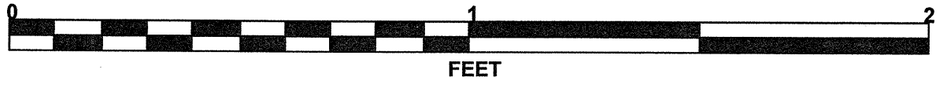


0 1 2
FEET

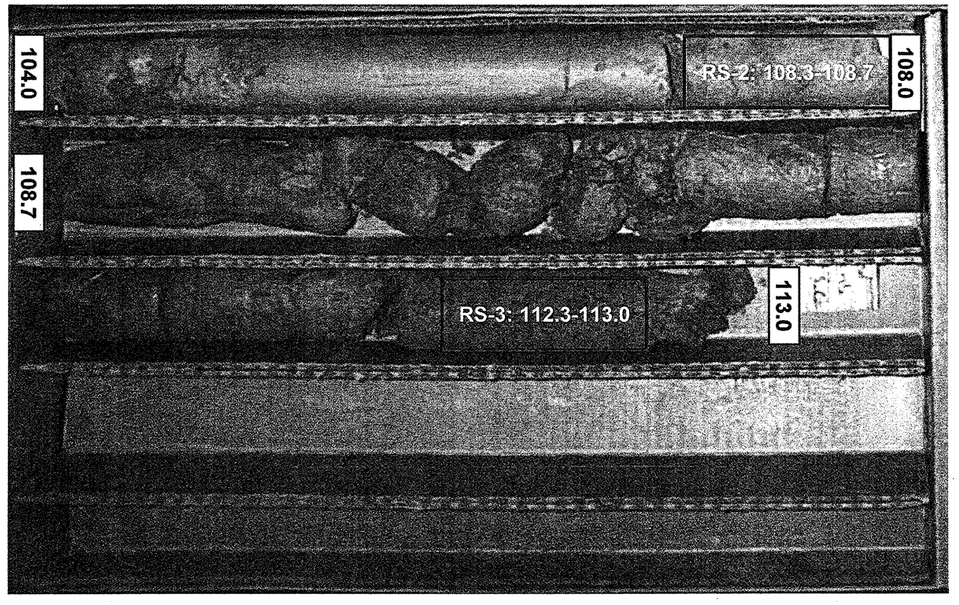
CORE PHOTOGRAPHS

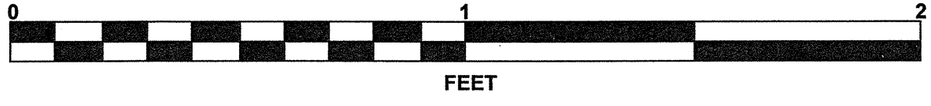
B5-A
BOX 1: 89.5 - 103.0 FEET





B5-A
BOX 2: 104.0 - 113.0 FEET





SITE PHOTOGRAPH

Bridge No. 85 on -L- (US 301/I-95 Bus. Loop) over -Y1- (SR 1738), -Y2- (SR 1741) and Cape Fear River

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	33449.1.1 (B-4091)	1	5

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *33449.1.1 (B-4091)* F.A. PROJ. *BRSTP-0301(12)*

COUNTY *CUMBERLAND*

PROJECT DESCRIPTION *BRIDGE NO. 85 ON -L- (US 301/I-95 BUS. LOOP) OVER -Y1- (SR 1738), -Y2- (SR 1741) AND CAPE FEAR RIVER*

SITE DESCRIPTION *WALL 1 LEFT OF -L- STATION 47+00*
WALL 2 RIGHT OF -L- STATION 46+00
WALL 3 LEFT OF -L- STATION 57+50
WALL 4 RIGHT OF -L- STATION 57+50

RETAINING WALLS

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE 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 THIS 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.

PERSONNEL
C.M. BRUINSMA
MACTEC

INVESTIGATED BY *C.M. BRUINSMA*
CHECKED BY *C.M. BRUINSMA*
SUBMITTED BY *N.T. ROBERSON*
DATE *MAY 2012*

NORTH CAROLINA LICENSED SEAL 2031 GEOLOGIST CHRISTINA M. BRUINSMA 5-23-12

PROJECT: 33449.1.1

ID: B-4091

DRAWN BY: *W.D. FIELDS*

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 REFERENCE NO.	SHEET NO.
33449.1.1 (B-4091)	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED 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:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
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 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES 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 WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

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

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

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

SAMPLE ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-55
- [ ] _____

ADVANCING TOOLS:
- [X] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] 3" ROLLER CONE

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

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

ROCK DESCRIPTION

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 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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, AS SHALE, SLATE, ETC.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BENCH MARK: BL-6 -BL- STA 41+21.17
N:476538.44 E:2044544.01
ELEVATION: 90.38 FT.

NOTES:

REVISED 09/23/09

PLAN VIEW OF RETAINING WALL AND WALL ENVELOPE

PROJECT REFERENCE NO.	SHEET NO.
B-4091	3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

GRAPHIC SCALE
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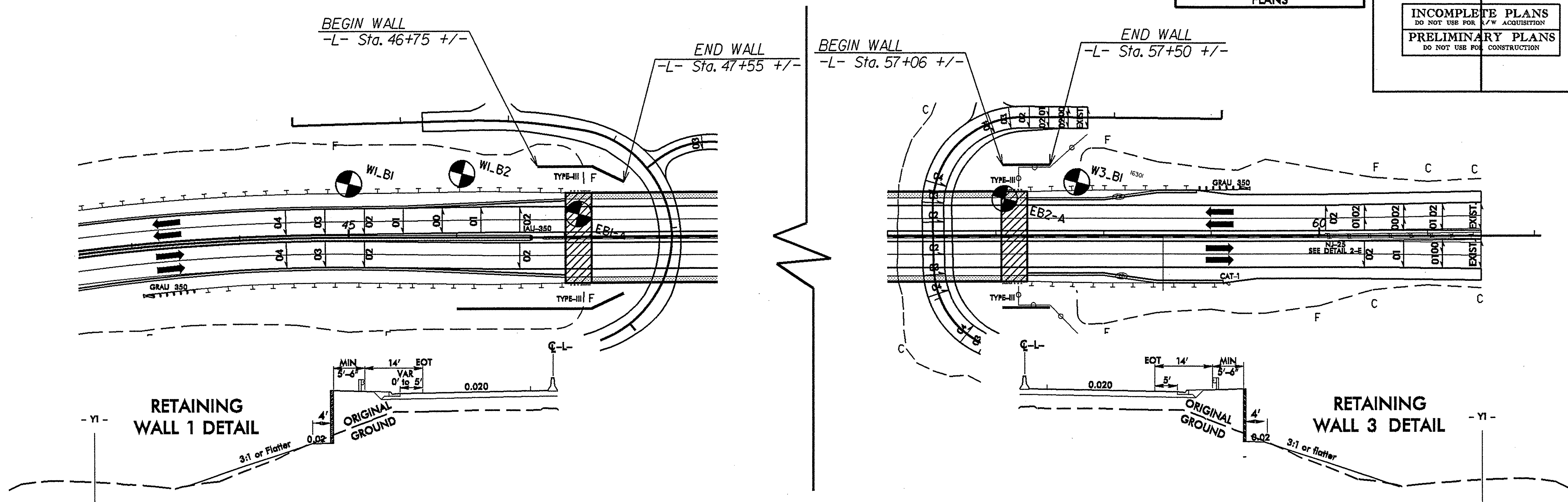
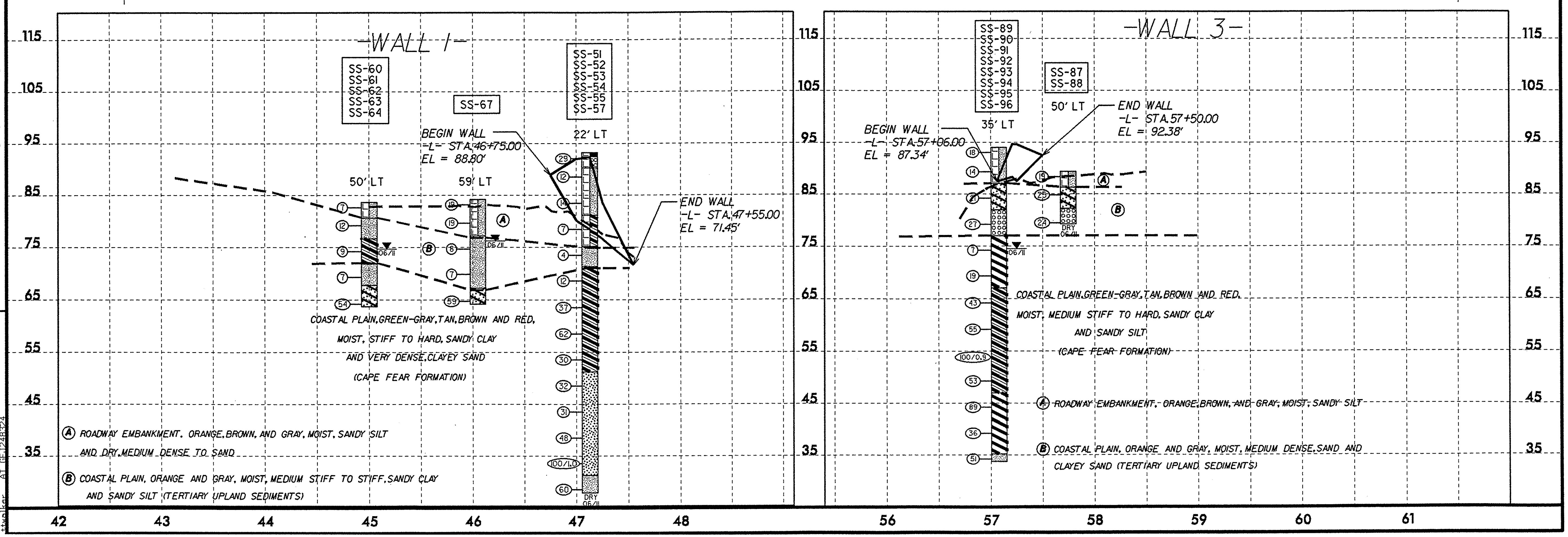
PLANS





REVISIONS

8/17/99

22-MAY-2012 10:50

PLAN VIEW OF RETAINING WALL AND WALL ENVELOPE

PROJECT REFERENCE NO.	SHEET NO.
B-4091	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

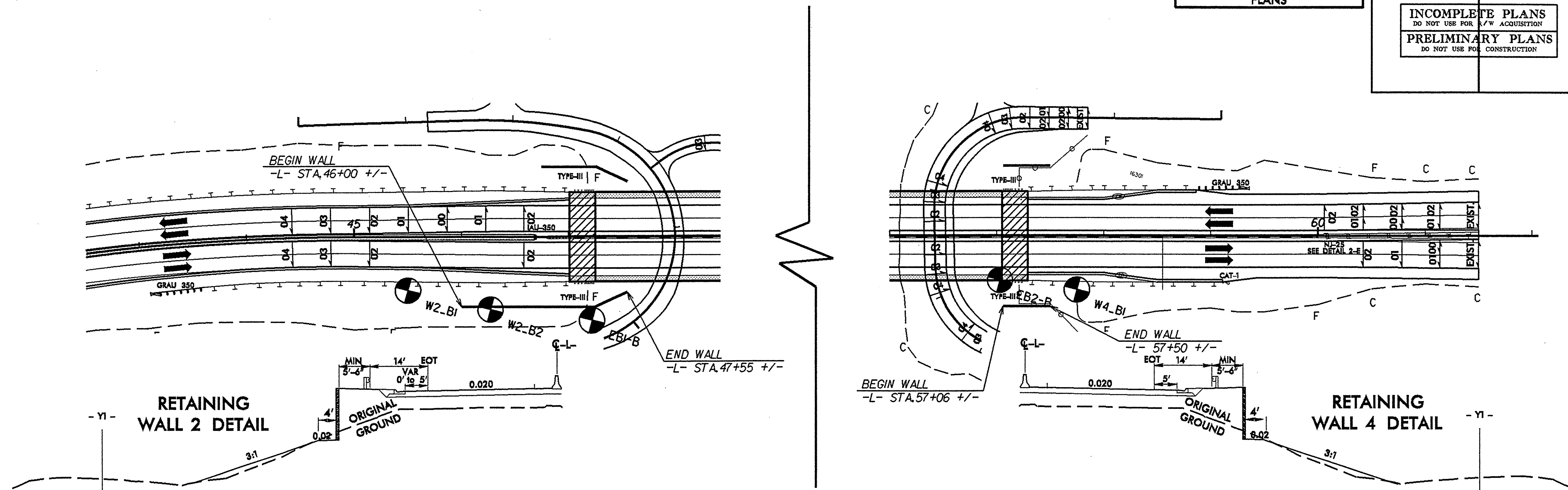
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

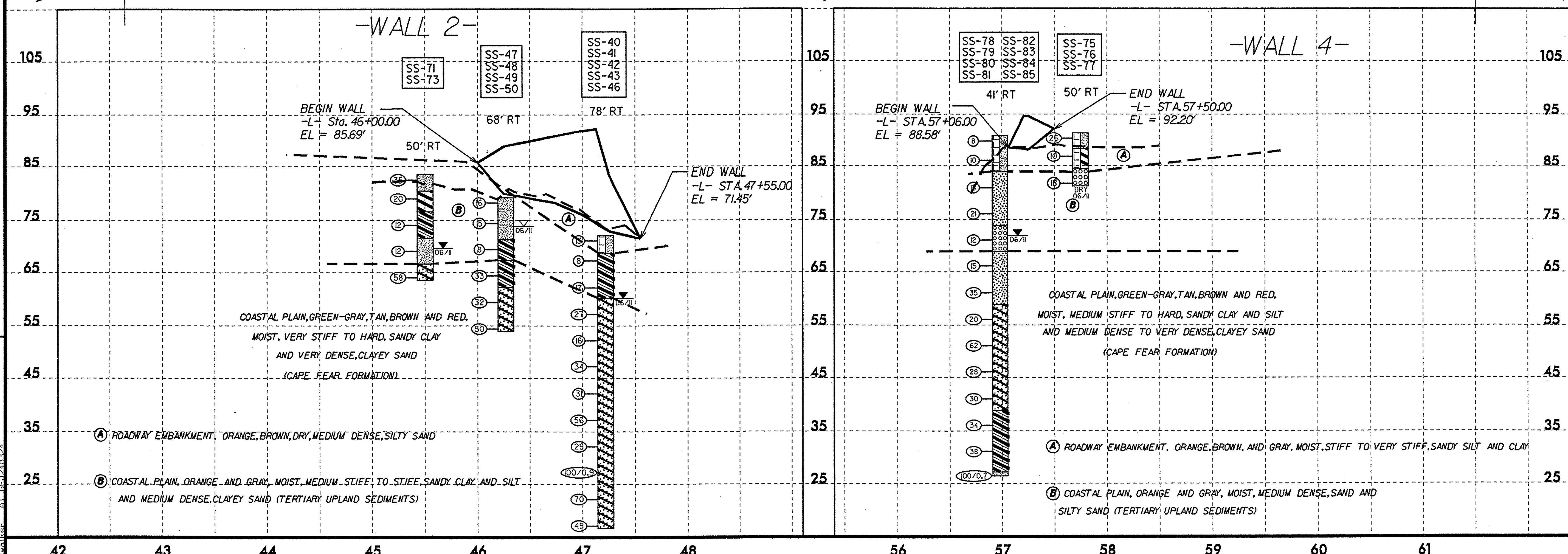
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

GRAPHIC SCALE
50 25 0 50 100
PLANS

8/17/99

REVISIONS





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PROJECT REFERENCE NO.	SHEET
B-4091	5

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-60	50 LT	45+00	0.0- 1.5	A-4(0)	22	4	30.5	36.7	18.7	14.1	100	88	39	-	-
SS-61	50 LT	45+00	3.5- 5.0	A-6(13)	38	18	2.8	28.9	36.1	32.1	100	98	78	-	-
SS-62	50 LT	45+00	8.5- 10.0	A-6(8)	29	13	2.0	31.5	34.3	32.1	100	100	78	-	-
SS-63	50 LT	45+00	13.5- 15.0	A-4(0)	21	4	26.5	42.2	15.3	16.1	100	80	40	-	-
SS-64	50 LT	45+00	18.5- 20.0	A-2-6(1)	36	16	39.6	31.5	20.9	8.0	90	69	33	-	-
SS-67	59 LT	46+05	13.5- 15.0	A-4(0)	22	3	3.0	54.0	22.9	20.1	100	100	54	-	-
SS-51	22 LT	47+13	0.8- 1.7	A-1-b(0)	17	NP	74.8	14.4	4.8	6.1	90	40	11	-	-
SS-52	22 LT	47+13	3.7- 5.2	A-4(3)	28	9	8.7	42.1	29.0	20.2	100	99	58	-	-
SS-53	22 LT	47+13	13.7- 15.2	A-6(7)	34	15	6.5	37.0	28.2	28.3	100	100	64	-	-
SS-54	22 LT	47+13	18.7- 20.2	A-4(1)	27	8	7.3	50.6	21.9	20.2	100	100	51	-	-
SS-55	22 LT	47+13	23.7- 25.2	A-6(11)	36	17	4.7	30.7	34.3	30.3	100	99	72	-	-
SS-57	22 LT	47+13	48.7- 50.2	A-2-6(0)	35	17	57.3	23.1	14.6	5.1	95	61	22	-	-
SS-89	35 LT	57+08	0.0- 1.5	A-4(0)	20	5	31.7	28.7	21.3	18.2	96	79	42	-	-
SS-90	35 LT	57+08	8.8- 10.3	A-2-6(1)	34	17	52.2	13.0	14.6	20.2	97	62	35	-	-
SS-91	35 LT	57+08	13.8- 15.3	A-1-b(0)	20	NP	83.2	12.1	2.6	2.0	65	26	4	-	-
SS-92	35 LT	57+08	18.8- 20.3	A-7-6(9)	41	21	4.7	47.9	29.2	18.2	100	99	55	-	-
SS-93	35 LT	57+08	28.8- 30.3	A-6(5)	37	19	34.8	25.1	30.0	10.1	100	79	46	-	-
SS-94	35 LT	57+08	38.8- 40.3	A-6(7)	39	21	30.9	23.7	31.2	14.2	100	83	51	-	-
SS-95	35 LT	57+08	48.8- 50.3	A-7-6(16)	45	24	12.3	23.1	44.4	20.2	100	94	72	-	-
SS-96	35 LT	57+08	58.8- 60.3	A-4(1)	25	10	30.1	31.1	30.6	8.1	100	83	45	-	-
SS-87	50 LT	57+75	3.5- 5.0	A-2-6(2)	35	18	54.4	12.7	10.8	22.1	97	58	34	-	-
SS-88	50 LT	57+75	8.5- 10.0	A-1-b(0)	16	NP	83.1	13.3	1.6	2.0	76	32	4	-	-
SS-71	50 RT	45+50	3.5- 5.0	A-7-6(16)	42	20	0.4	35.1	30.3	34.1	100	100	79	-	-
SS-73	50 RT	45+50	13.5- 15.0	A-4(0)	22	NP	10.8	61.8	13.3	14.1	99	94	39	-	-
SS-47	68 RT	46+27	0.0- 1.5	A-4(0)	20	3	28.3	39.0	14.7	18.1	100	89	39	-	-
SS-48	68 RT	46+27	3.9- 5.4	A-4(1)	26	8	8.2	56.2	15.5	20.1	100	99	46	-	-
SS-49	68 RT	46+27	8.9- 10.4	A-6(7)	30	14	2.0	39.0	30.9	28.1	100	100	70	-	-
SS-50	68 RT	46+27	18.9- 20.9	A-2-6(0)	30	12	40.0	33.1	16.9	10.0	99	78	31	-	-
SS-40	78 RT	47+22	0.0- 1.5	A-4(0)	26	6	23.7	35.8	22.3	18.2	100	90	47	-	-
SS-41	78 RT	47+22	8.9- 10.4	A-6(2)	27	11	16.4	39.2	24.2	20.2	100	98	50	-	-
SS-42	78 RT	47+22	13.9- 15.4	A-2-6(0)	34	15	41.1	40.4	10.4	8.1	98	78	21	-	-
SS-43	78 RT	47+22	23.9- 25.4	A-2-6(0)	39	16	63.4	19.5	12.0	5.1	96	54	19	-	-
SS-46	78 RT	47+22	53.9- 55.4	A-2-6(0)	32	13	62.4	24.5	10.1	3.0	93	55	15	-	-
SS-78	41 LT	57+03	0.0- 1.5	A-4(0)	22	8	32.2	27.1	22.5	18.2	96	78	44	-	-
SS-79	41 LT	57+03	8.8- 10.3	A-2-4(0)	25	4	57.7	26.9	3.2	12.1	86	63	14	-	-
SS-80	41 LT	57+03	18.8- 20.3	A-1-b(0)	18	NP	83.5	11.5	1.9	3.0	77	27	5	-	-
SS-81	41 LT	57+03	23.8- 25.3	A-2-4(0)	30	3	59.6	30.1	7.3	3.0	100	72	13	-	-
SS-82	41 LT	57+03	33.8- 35.3	A-2-6(1)	33	15	51.2	23.1	16.7	9.1	100	71	30	-	-
SS-83	41 LT	57+03	43.8- 45.3	A-2-6(0)	36	12	60.4	21.5	13.0	5.1	92	51	19	-	-
SS-84	41 LT	57+03	53.8- 55.3	A-6(2)	34	14	14.8	50.4	28.8	6.1	100	94	41	-	-
SS-85	41 LT	57+03	63.8- 65.3	A-4(0)	20	5	33.6	30.5	27.8	8.1	100	81	41	-	-
SS-75	50 RT	57+75	0.0- 1.5	A-4(0)	20	4	14.7	43.4	23.9	18.1	100	94	53	-	-
SS-76	50 RT	57+75	3.5- 5.0	A-7-6(21)	45	26	3.0	20.3	26.5	50.2	100	99	81	-	-
SS-77	50 RT	57+75	8.5- 10.0	A-1-b(0)	14	NP	77.3	17.7	1.0	4.0	89	40	6	-	-