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REFERENCE: W-5601EV

PROJECT: 50138

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

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APPENDICES

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

ROADWAY

SUBSURFACE INVESTIGATION

COUNTY COLUMBUS
PROJECT DESCRIPTION US 74 FROM SR 1824 (WATER
TANK RD.) TO JUST EAST OF THE BRUNSWICK
COUNTY LINE

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5601EV	1	30

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT 1919 T07-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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

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

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

PERSONNEL

GOODNIGHT, D. G.

LANE, R. W.

INVESTIGATED BY DJGRWL

DRAWN BY WSHMJH

CHECKED BY HAMM, J. R.

SUBMITTED BY FALCON

DATE FEBRUARY 2018



SIGNATURE

DATE

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

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

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																																																																																																																			
<p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.</p>										<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:</p>										<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN 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 (IN OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																			
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ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p style="text-align: center;">WEATHERING</p> <p>FRESH: ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>VERY SLIGHT (IV SLI.): ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p>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.</p> <p>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.</p> <p>MODERATELY SEVERE (MOD. SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p> <p>SEVERE (SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i></p> <p>VERY SEVERE (IV SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i></p> <p>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.</p>										<p style="text-align: center;">GROUND WATER</p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p>									
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 09/08/19
 cadmachine AT CAD01

TIP PROJECT: W-5601EV

CONTRACT: 50138

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

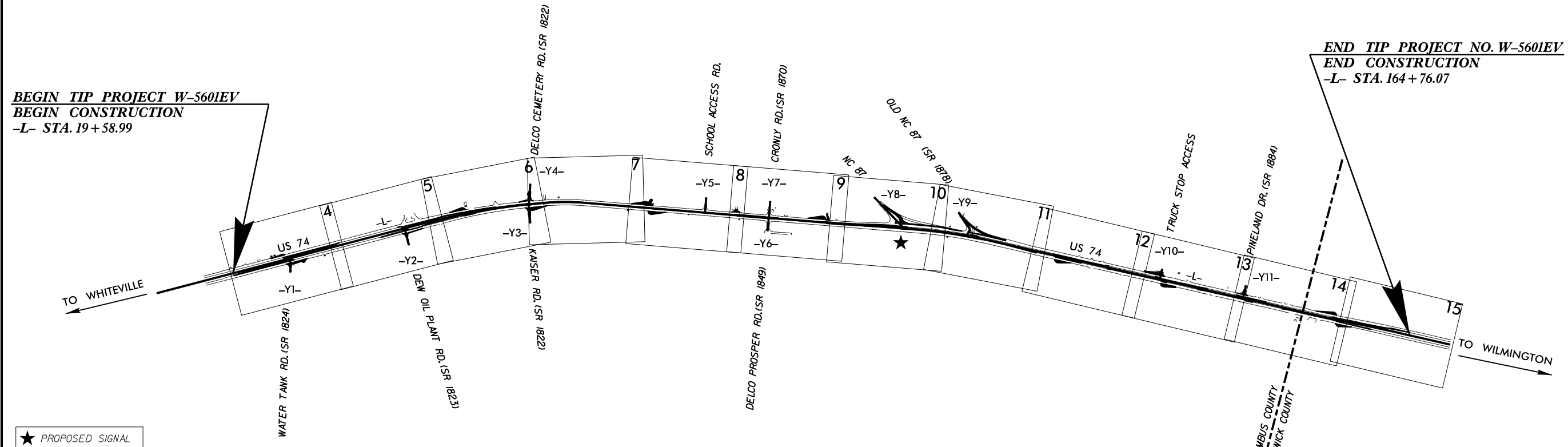
COLUMBUS COUNTY

LOCATION: US74 FROM SR 1824 (WATER TANK RD) TO JUST EAST OF THE BRUNSWICK COUNTY LINE

TYPE OF WORK: GRADING, PAVING, DRAINAGE, PAVEMENT MARKINGS/MARKERS, AND SIGNAL

Stantec
 Stantec Consulting Services Inc.
 801 Jones Franklin Road
 Suite 300
 Raleigh, NC 27606
 Tel. (919) 851-6866
 Fax. (919) 851-7024
 www.stantec.com
 License No. F-0672

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5601EV	3	30
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
50138.1.153	HSIP - 0074 (186)	P.E.	
50138.2.153	HSIP - 0074 (186)	R/W, UTIL.	
50138.3.153	HSIP - 0074 (186)	CONST.	



**BEGIN TIP PROJECT W-5601EV
BEGIN CONSTRUCTION
-L- STA. 19+58.99**

**END TIP PROJECT NO. W-5601EV
END CONSTRUCTION
-L- STA. 164+76.07**

★ PROPOSED SIGNAL

**CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.
THIS IS A NO CONTROL OF ACCESS PROJECT.**

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 20
PROFILE (VERTICAL)

DESIGN DATA

ADT 2014 = 14,000
 V = 50/60 MPH
 FUNC CLASS = ARTERIAL

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT W-5601EV = 2.749 MILES
 TOTAL LENGTH TIP PROJECT W-5601EV = 2.749 MILES

Prepared in the Office of STANTEC:
DIVISION OF HIGHWAYS
 1000 Birch Ridge Dr., Raleigh NC, 27610

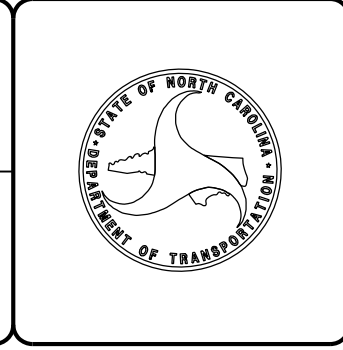
2012 STANDARD SPECIFICATIONS	STANTEC CONTACT:
RIGHT OF WAY DATE: June 27, 2017	STEVE SMALLWOOD, PE PROJECT ENGINEER
LETTING DATE: August 21, 2018	NCDOT DIVISION 6 CONTACT: STEVE KENDALL, PE PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: _____ P.E.





WBS: 50138.1.153
TIP: W-5601EV
COUNTY: Columbus
DESCRIPTION: US 74 from Water Tank Road (SR 1824) to East of Brunswick County Line
SUBJECT: Roadway Subsurface Investigation – Inventory

Roadway Subsurface Investigation Report - Inventory

US 74 from Water Tank Road (SR 1824) to East of Brunswick County Line
Columbus County, North Carolina
WBS: 50138.1.153 TIP: W-5601EV
Falcon Project No.: G16046.00

Prepared for:
STANTEC
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

Submitted by:
Falcon Engineering, Inc.
1210 Trinity Road, Suite 110
Cary, North Carolina 27513
(919) 871-0800
www.falconengineers.com

February 9, 2018

PROJECT DESCRIPTION

This project consists of various improvements along a corridor of approximately 2.75 miles of proposed new grading, realignment and widening on US 74 in Columbus County. A portion of US 74 from west of Water Tank Road to east of the Brunswick County Line will be converted to a superstreet including turn lane and intersection improvements and the addition of U-turn bulbs. Tie-ins and minor improvements to Y-lines and small drives are also included at various locations.

The investigation was conducted between October 16th and 18th, 2017 in general accordance with our Proposal to Provide Geotechnical Engineering Services, dated June 28th, 2016. The recommendations provided in this report are based solely on our site reconnaissance, soil test borings and laboratory test data, engineering evaluation of these data, and generally accepted soil and foundation engineering practices and principles.

A total of twenty-six (26) hand auger borings were performed throughout the project. Representative soil samples, collected with a hand auger, were selected for laboratory testing to verify visual field classifications. In addition, three (3) bulk samples were collected for standard Proctor compaction and California Bearing Ratio (CBR) testing.



The following alignment, totaling approximately 2.749 miles was investigated.

<u>Alignment</u>	<u>Station (ft)</u>
-L- (Kellie Drive)	19+58.99—164+76.07

AREAS OF SPECIAL GEOTECHNICAL INTEREST

- I. The following location contains highly plastic soils with plasticity indices (PI) greater than 25 within 3 feet of existing subgrade elevations:

<u>Alignment</u>	<u>Station (ft)</u>
-L-	154+97

- II. Shallow ground water was measured within the following areas and may cause groundwater related stability problems during construction:

<u>Alignment</u>	<u>Station (ft)</u>
-L-	30+01
-L-	43+96
-L-	70+63 – 73+00
-L-	89+96
-L-	121+12
-L-	130+00 – 144+00
-L-	151+00 – 159+00

- III. The following location contains highly organic soil near the ground surface:

<u>Alignment</u>	<u>Station (ft)</u>
-L-	134+32

PHYSIOGRAPHY AND GEOLOGY

The project site is in the Coastal Plain Physiographic Province of North Carolina. According to the *Geologic Map of North Carolina* (1985), the site is in the Peedee Formation of the Cretaceous period. These deposits are noted to consist of sand, clayey sand, and clay, greenish gray to olive black, massive, glauconitic, locally fossiliferous and calcareous with patches of sandy molluscan-mold limestone in the upper part.

Existing site topography is typical of North Carolina's coastal region. The site is a corridor of US 74 through the town of Delco. The current corridor is a four lane divided highway through a mixed residential and commercial area. Topography gradually grades upwards from west to east, but is relatively flat overall. The existing roadway approximately matches surrounding grades or sits atop a slight embankment, with the exception of roadside and median ditches.

SOIL PROPERTIES

A variety of soils were encountered along the project, including existing roadway embankments and undivided coastal plain soils.

Topsoil and rootmat was encountered in grassy, brushy, and wooded areas ranging in thickness from 0.1 to 0.9 feet, and typically on the order of 0.3 feet and consisting of clayey sand.

Roadway Embankment soils were encountered at the ground surface adjacent to existing roadways. These soils consist of up to 5 feet of moist to wet, clayey, silty and clean sand (A-2-4, A-2-5, A-2-6, A-3) and moist, sandy clay and silt (A-4, A-6) with trace to high amounts of organics.

Undivided Coastal Plain soils were encountered at the ground surface, or beneath roadway embankments. These soils consist of moist to saturated, clayey, silty and clean sand (A-2-4, A-2-6, A-3) and wet to saturated, sandy silt, and sandy and silty clays (A-4, A-6, A-7) with trace organics.

GROUNDWATER PROPERTIES

Groundwater levels were measured at the time of boring completion, and in many cases after a waiting period of at least 24 hours. Borings drilled within and in close proximity to existing roadways were backfilled immediately after completion due to safety considerations. In some areas, groundwater was visible above the ground surface in roadside ditches.

ADDITIONAL LABORATORY TESTING

The following bulk samples were obtained:

<u>Sample</u>	<u>Location</u>	<u>Depth (ft)</u>	<u>Test</u>
BS-1	155+94, 64' RT, -L-	1 – 10.0	California Bearing Ratio, Standard Proctor
BS-2	71+96, 38' RT, -L-	1 – 10.0	California Bearing Ratio, Standard Proctor
BS-3	27+02, 6' LT, -L-	1 – 10.0	California Bearing Ratio, Standard Proctor

Classification test results for the bulk samples are included in the subsurface profiles and cross section. The Standard Proctor and California Bearing Ratio (CBR) data is attached in Appendix A.



CLOSING

Falcon appreciates the opportunity to have provided our geotechnical engineering services for the above referenced project. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

FALCON ENGINEERING, INC.

Report Prepared By:

Report Reviewed By:

A handwritten signature in blue ink, appearing to read "W. Scott Hunsberger".

W. Scott Hunsberger, PE
Geotechnical Engineer

A handwritten signature in blue ink, appearing to read "Jeremy R. Hamm".

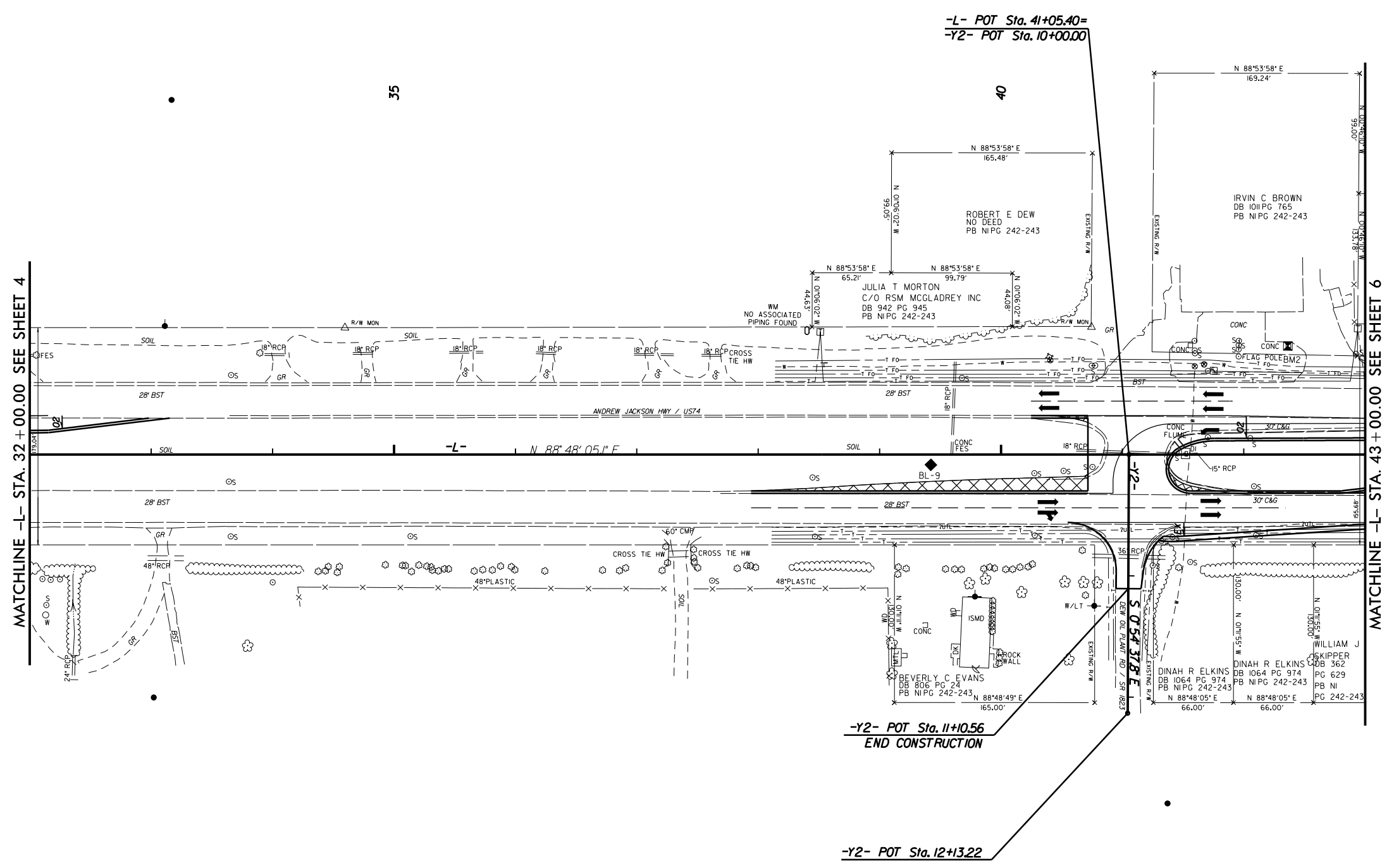
Jeremy R. Hamm, PE
Geotechnical Engineering Manager



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 8/17/99
 REVISIONS

Stantec
 Stantec Consulting Services Inc.
 801 Jones Franklin Road
 Suite 300
 Raleigh, NC 27606
 Tel. (919) 851-8866
 Fax. (919) 851-7024
 www.stantec.com
 License No. F-0672

PROJECT REFERENCE NO. W-5601EV	SHEET NO. 5
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

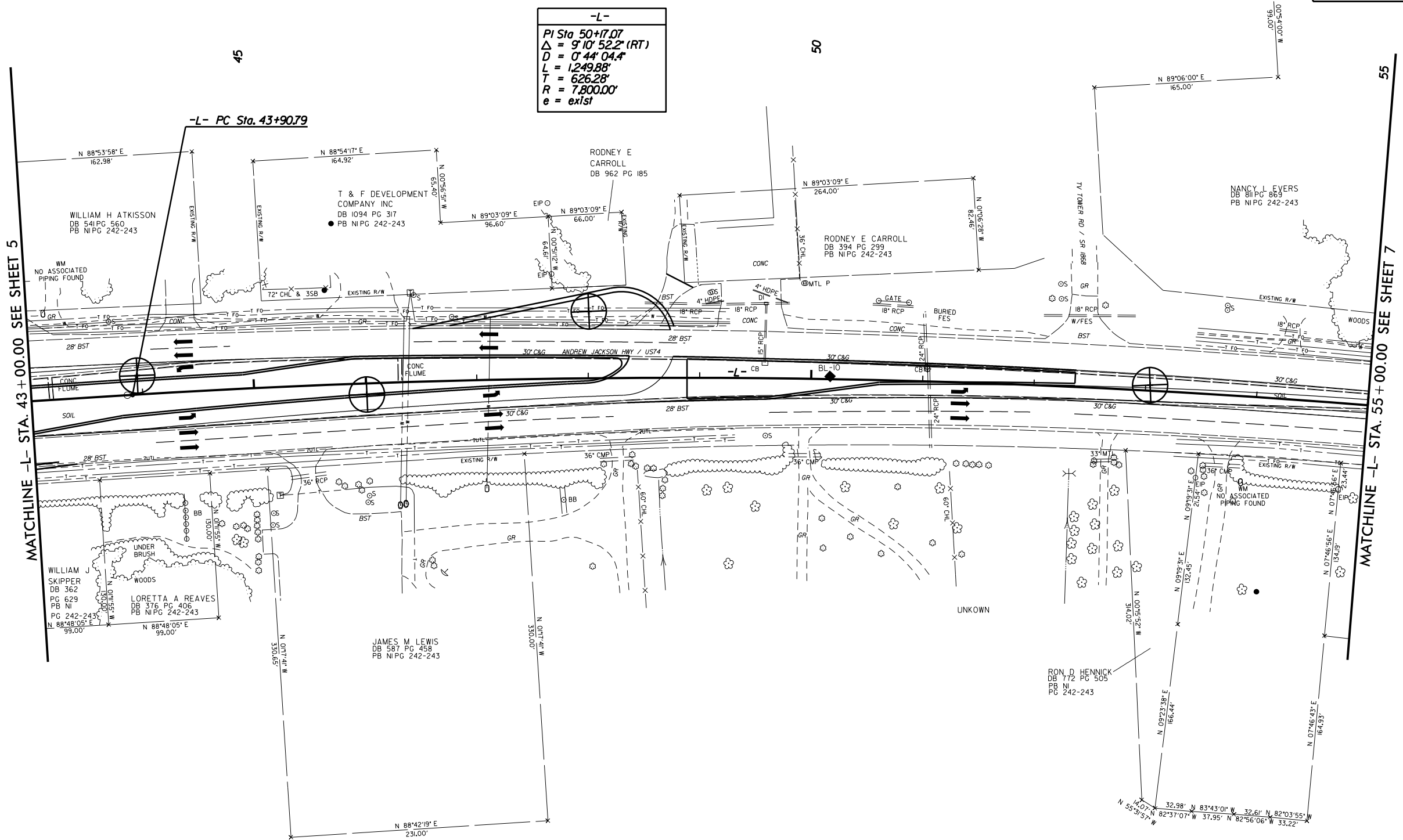


NOTE:
 SEE SHEET 16 & 17 FOR -L- PROFILE

PROJECT REFERENCE NO. W-5601EV	SHEET NO. 6
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

NAD 83/2001

-L-
 PI Sta 50+17.07
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 $D = 0^{\circ}44'04.4''$
 $L = 1,249.88'$
 $T = 626.28'$
 $R = 7,800.00'$
 $e = exist$



MATCHLINE -L- STA. 43 + 00.00 SEE SHEET 5

MATCHLINE -L- STA. 55 + 00.00 SEE SHEET 7

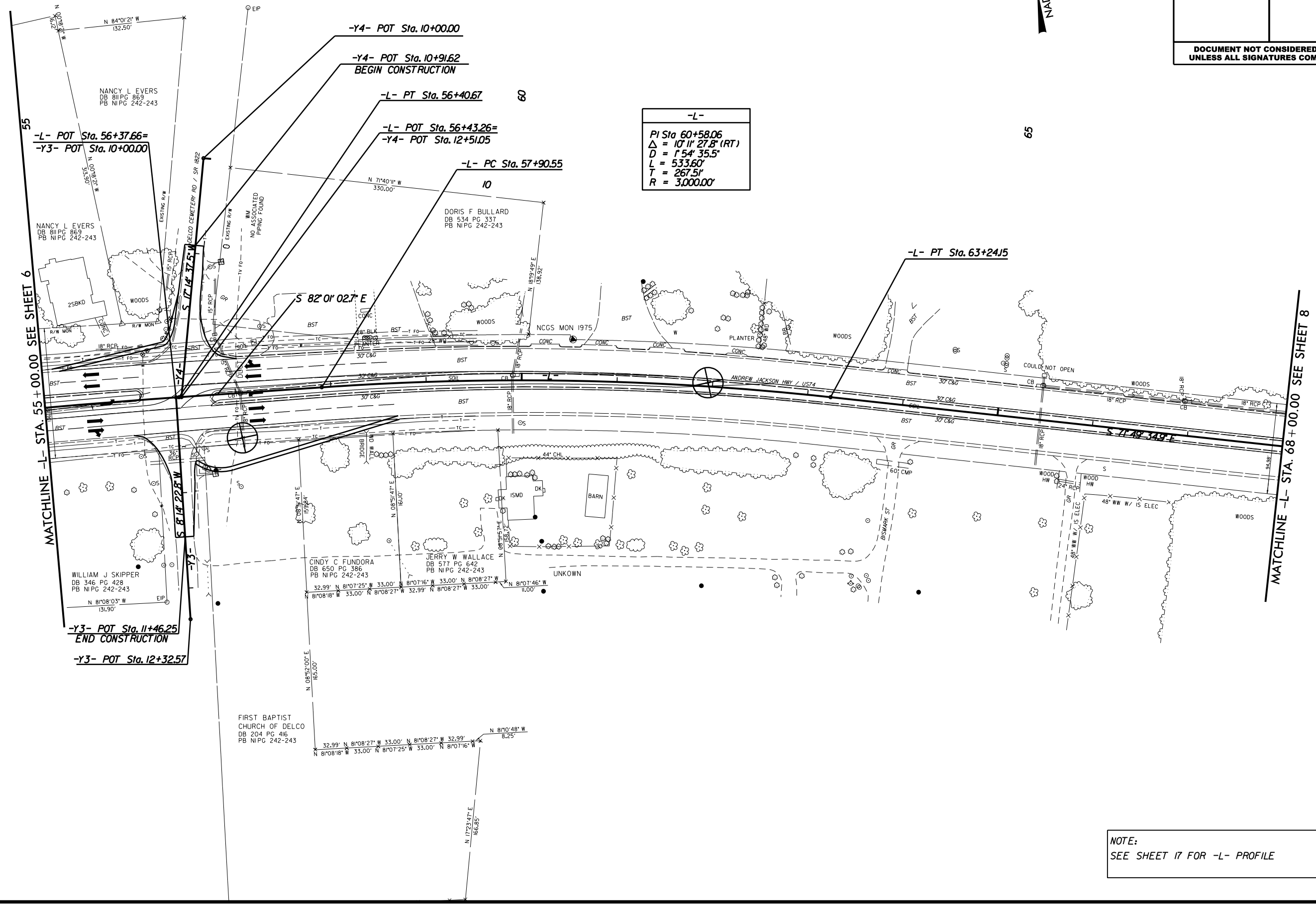
NOTE:
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 8/17/19

8/17/99
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PROJECT REFERENCE NO. W-5601EV	SHEET NO. 7
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



-L-
PI Sta 60+58.06
$\Delta = 10^{\circ} 11' 27.8''$ (RT)
$D = 1^{\circ} 54' 35.5''$
$L = 533.60'$
$T = 267.51'$
$R = 3,000.00'$

MATCHLINE -L- STA. 55 + 00.00 SEE SHEET 6

MATCHLINE -L- STA. 68 + 00.00 SEE SHEET 8

NOTE:
 SEE SHEET 17 FOR -L- PROFILE

PROJECT REFERENCE NO. W-5601EV	SHEET NO. 10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

-Y8SPA-	
PI Sta 13+30.80 Δ = 4° 39' 47.7" (RT) D = 8' 11" 06.4" L = 56.97' T = 28.50' R = 700.00'	PI Sta 11+17.61 Δ = 80° 45' 37.2" (LT) D = 70' 44' 07.9" L = 114.17' T = 68.89' R = 81.00'

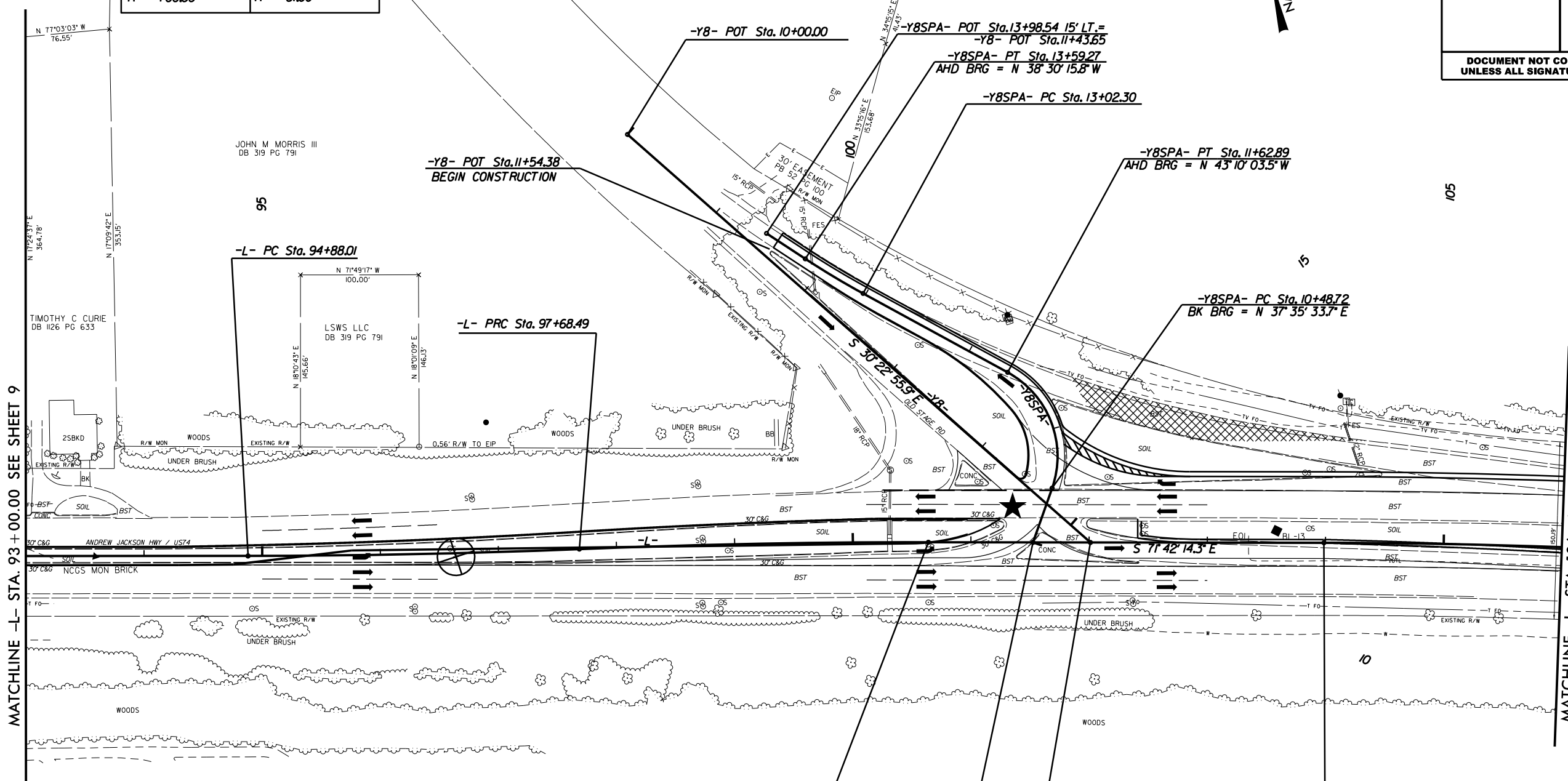
**-Y8- POT Sta. 11+54.38
BEGIN CONSTRUCTION**

JOHN M MORRIS III
DB 319 PG 791
PB 52 PG 100

JOHN M MORRIS III
DB 319 PG 791

MATCHLINE -L- STA. 93 + 00.00 SEE SHEET 9

MATCHLINE -L- STA. 106 + 00.00 SEE SHEET 11



-L-	
PI Sta 96+28.27 Δ = 2° 17' 44.6" (LT) D = 0' 49' 06.6" L = 280.47' T = 140.26' R = 7,000.00'	PI Sta 99+16.22 Δ = 2° 25' 05.1" (RT) D = 0' 49' 06.6" L = 295.43' T = 147.73' R = 7,000.00'

**-L- PT Sta. 101+52.48 =
-Y8SPA- POT Sta. 10+00.00
AHD BRG = N 37° 35' 33.7" E**

**-L- POT Sta. 102+01.01 =
-Y8- POT Sta. 15+22.21**

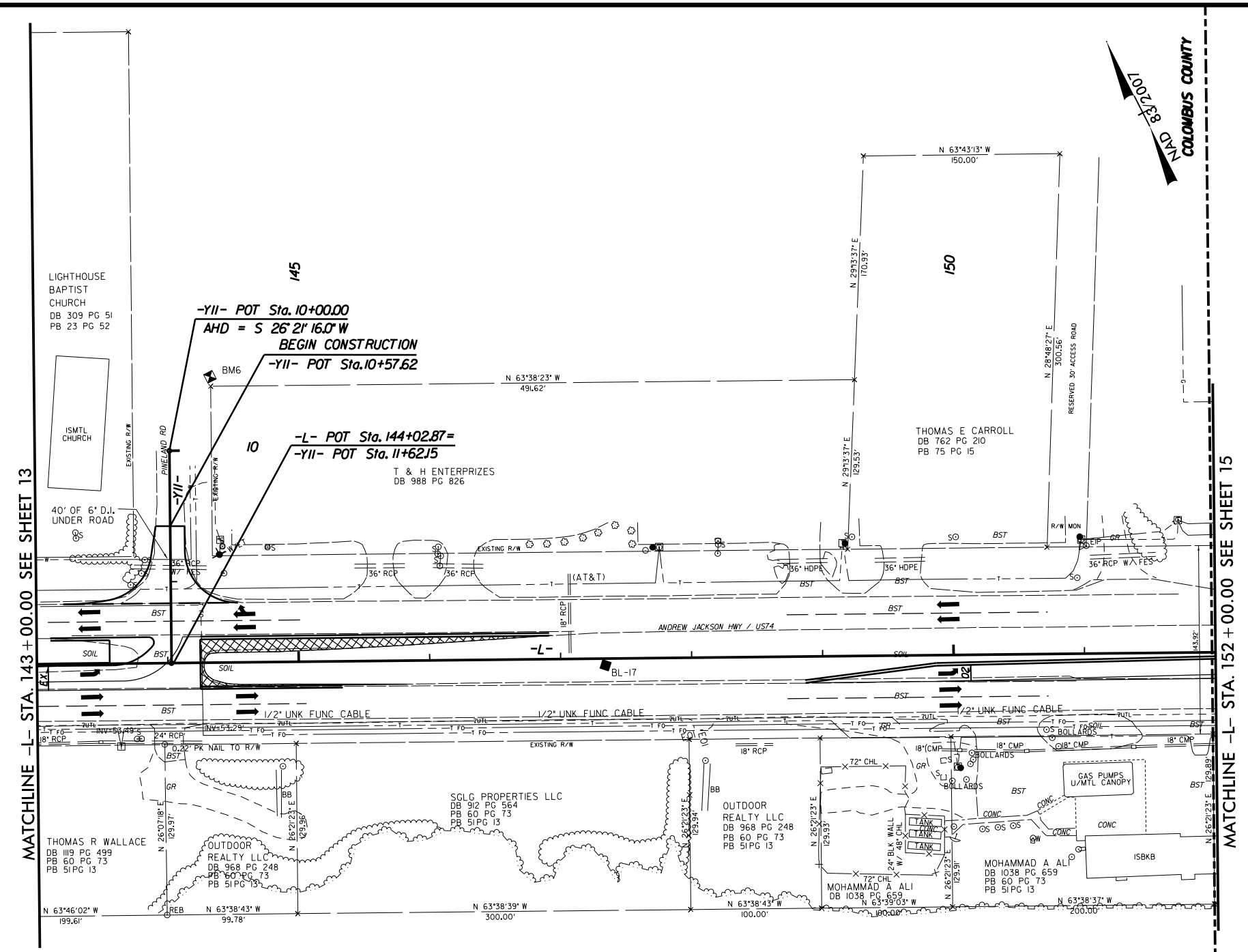
★ PROPOSED SIGNAL

NOTE:
SEE SHEET 18 & 19 FOR -L- PROFILE

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 8/17/19
 REVISIONS

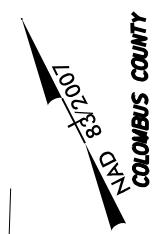
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RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

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MATCHLINE -L- STA. 143 + 00.00 SEE SHEET 13

MATCHLINE -L- STA. 152 + 00.00 SEE SHEET 15



NOTE:
 SEE SHEET 20 & 21 FOR -L- PROFILE

8/17/99

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MATCHLINE -L- STA. 152+00.00 SEE SHEET 14

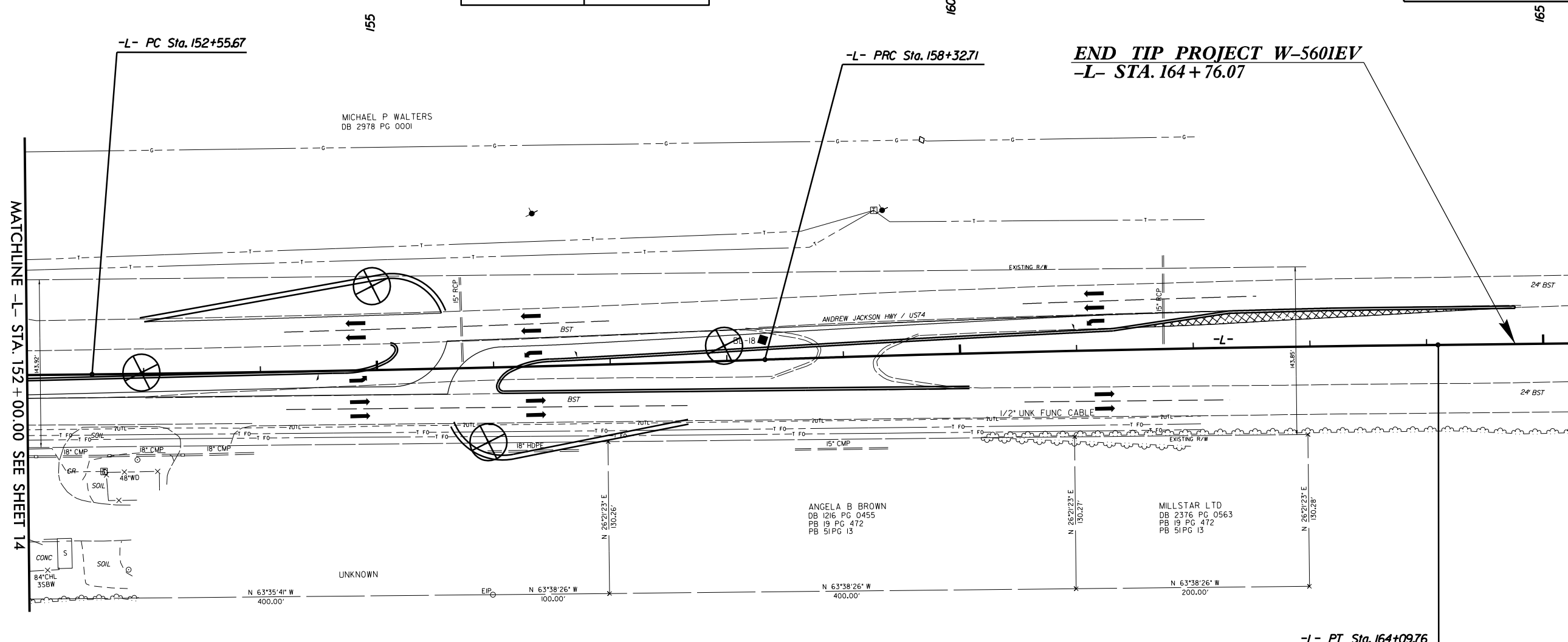
BRUNSWICK COUNTY

-L-	
PI Sta 155+44.20	PI Sta 161+21.25
$\Delta = 1' 19" 21.0" (LT)$	$\Delta = 1' 19" 21.0" (RT)$
$D = 0' 13' 45.1"$	$D = 0' 13' 45.1"$
$L = 577.04'$	$L = 577.04'$
$T = 288.54'$	$T = 288.54'$
$R = 25,000.00'$	$R = 25,000.00'$

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 Fax. (919) 851-7024
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 License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
W-5601EV	15
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



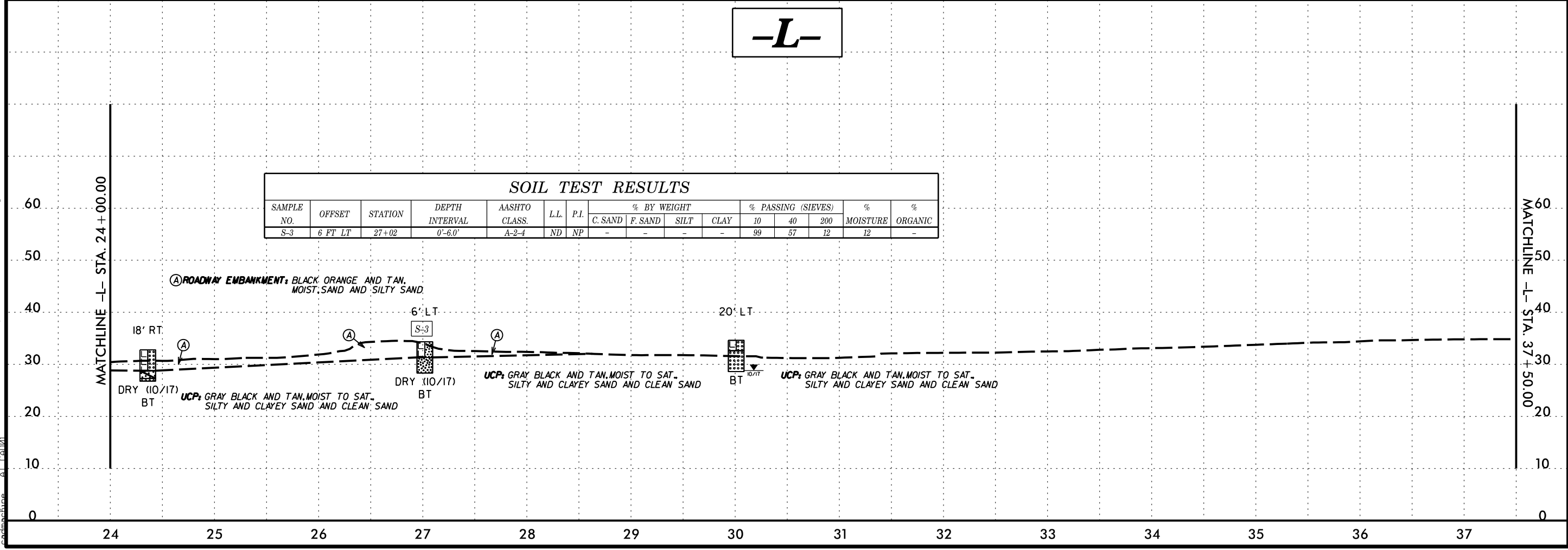
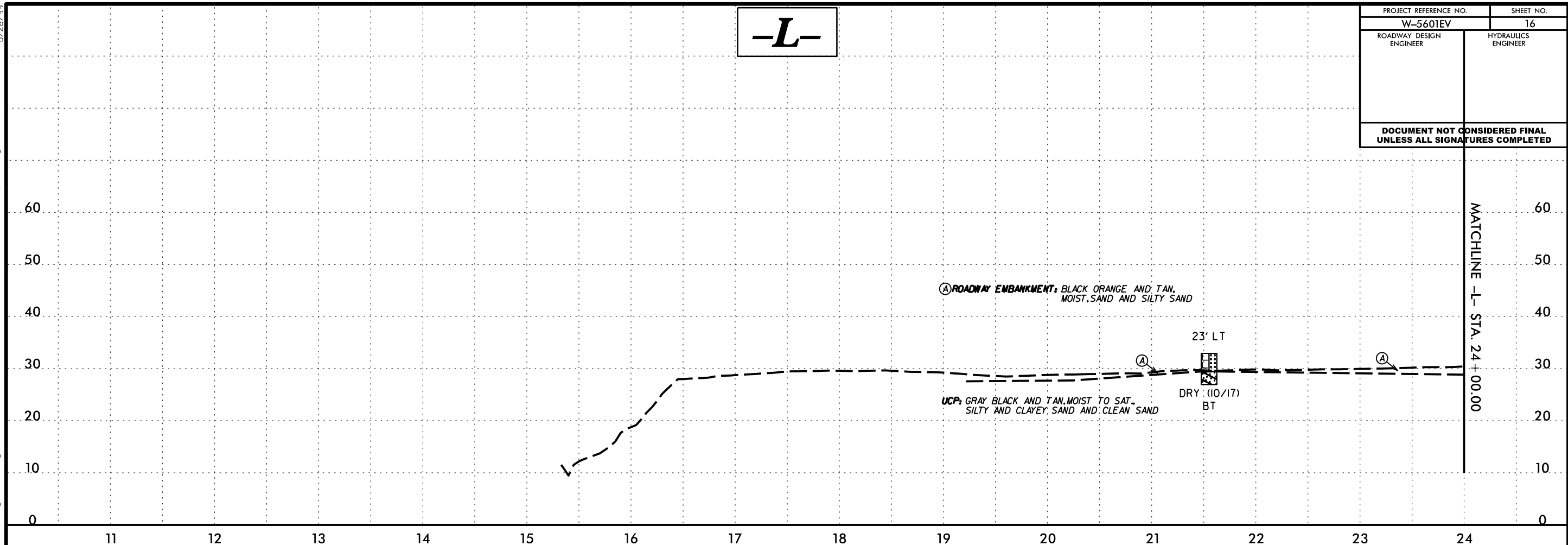
END TIP PROJECT W-5601EV
-L- STA. 164+76.07

-L- PT Sta. 164+09.76

NOTE:
SEE SHEET 21 FOR -L- PROFILE

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PROJECT REFERENCE NO.	SHEET NO.
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ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

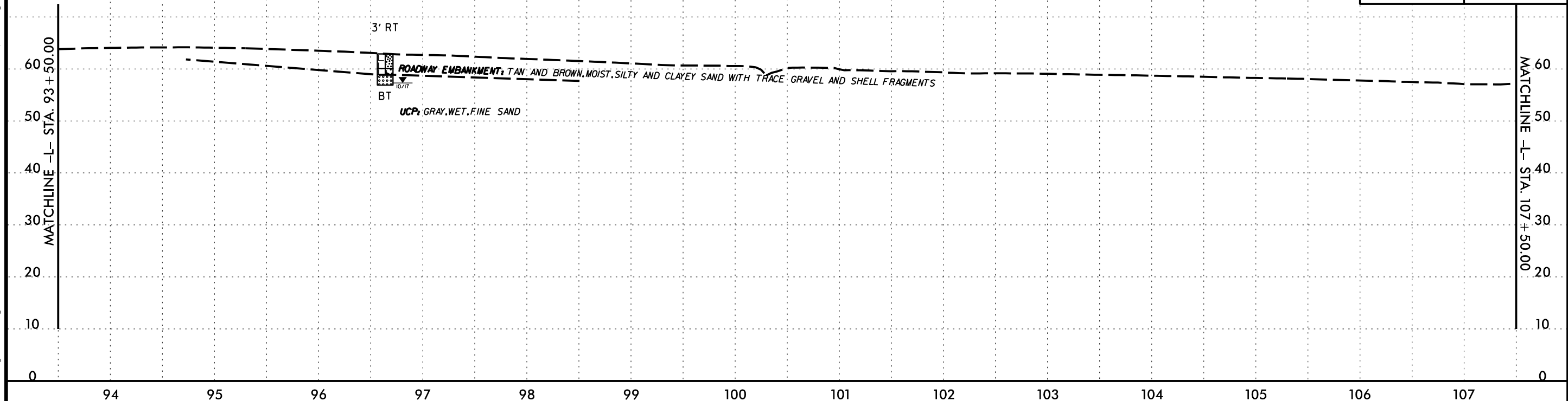


SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-3	6 FT LT	27+02	0'-6.0'	A-2-4	ND	NP	-	-	-	-	99	57	12	12	-

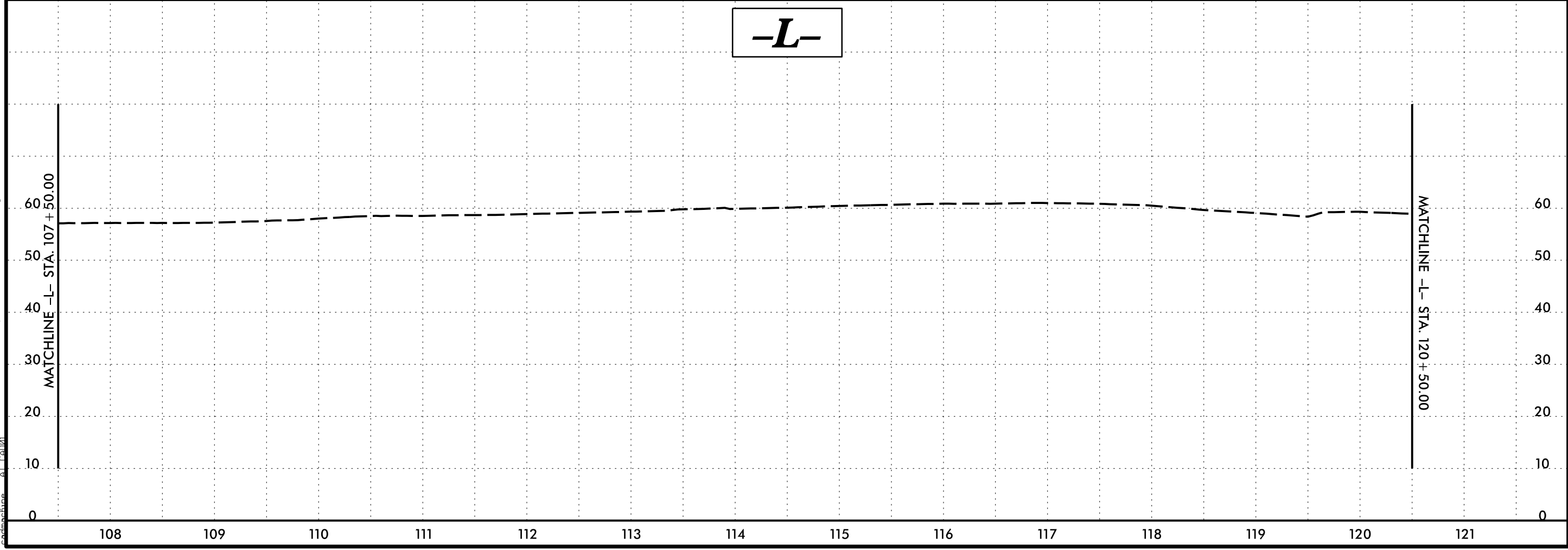
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PROJECT REFERENCE NO.	SHEET NO.
W-5601EV	19
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

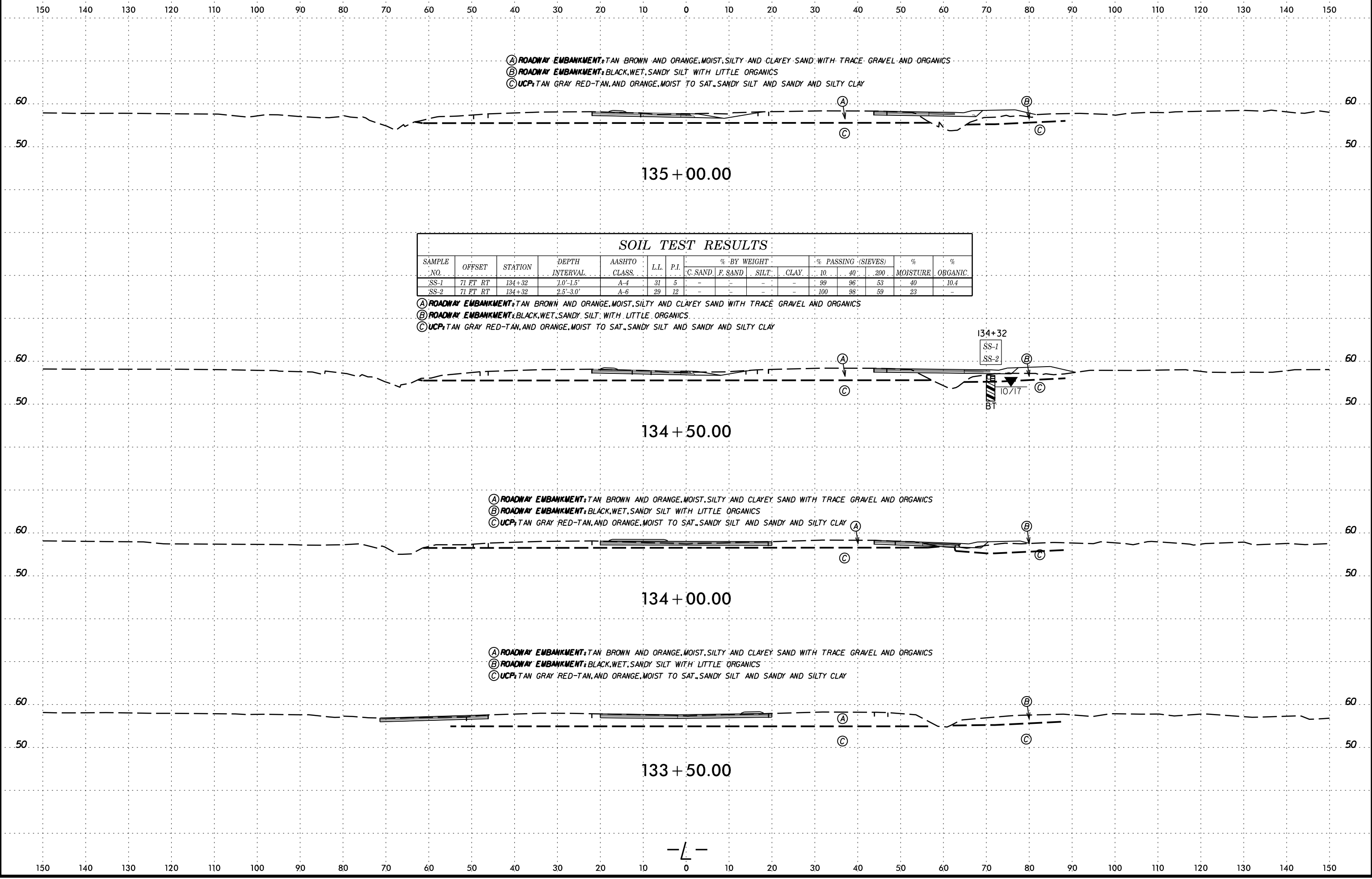
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 6/23/16
 cadmachine



(A) ROADWAY EMBANKMENT: TAN BROWN AND ORANGE, MOIST, SILTY AND CLAYEY SAND WITH TRACE GRAVEL AND ORGANICS
 (B) ROADWAY EMBANKMENT: BLACK, WET, SANDY SILT WITH LITTLE ORGANICS
 (C) UCP: TAN GRAY RED-TAN, AND ORANGE, MOIST TO SAT, SANDY SILT AND SANDY AND SILTY CLAY

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	71 FT RT	134+32	1.0'-1.5'	A-4	31	5	-	-	-	-	99	96	53	40	10.4
SS-2	71 FT RT	134+32	2.5'-3.0'	A-6	29	12	-	-	-	-	100	98	59	23	-

(A) ROADWAY EMBANKMENT: TAN BROWN AND ORANGE, MOIST, SILTY AND CLAYEY SAND WITH TRACE GRAVEL AND ORGANICS
 (B) ROADWAY EMBANKMENT: BLACK, WET, SANDY SILT WITH LITTLE ORGANICS
 (C) UCP: TAN GRAY RED-TAN, AND ORANGE, MOIST TO SAT, SANDY SILT AND SANDY AND SILTY CLAY

134+32
 SS-1
 SS-2
 10/17
 BT

(A) ROADWAY EMBANKMENT: TAN BROWN AND ORANGE, MOIST, SILTY AND CLAYEY SAND WITH TRACE GRAVEL AND ORGANICS
 (B) ROADWAY EMBANKMENT: BLACK, WET, SANDY SILT WITH LITTLE ORGANICS
 (C) UCP: TAN GRAY RED-TAN, AND ORANGE, MOIST TO SAT, SANDY SILT AND SANDY AND SILTY CLAY

(A) ROADWAY EMBANKMENT: TAN BROWN AND ORANGE, MOIST, SILTY AND CLAYEY SAND WITH TRACE GRAVEL AND ORGANICS
 (B) ROADWAY EMBANKMENT: BLACK, WET, SANDY SILT WITH LITTLE ORGANICS
 (C) UCP: TAN GRAY RED-TAN, AND ORANGE, MOIST TO SAT, SANDY SILT AND SANDY AND SILTY CLAY

-L-

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

SUBSURFACE INVESTIGATION

*APPENDIX A
LABORATORY RESULTS*

REFERENCE: W-5601EV

PROJECT: 50138

**REPORT OF MOISTURE-DENSITY RELATIONS OF SOILS
USING A 5.5-LB RAMMER AND A 12-IN. DROP**
Performed in general accordance with AASHTO T 99, Method D
November 20, 2017

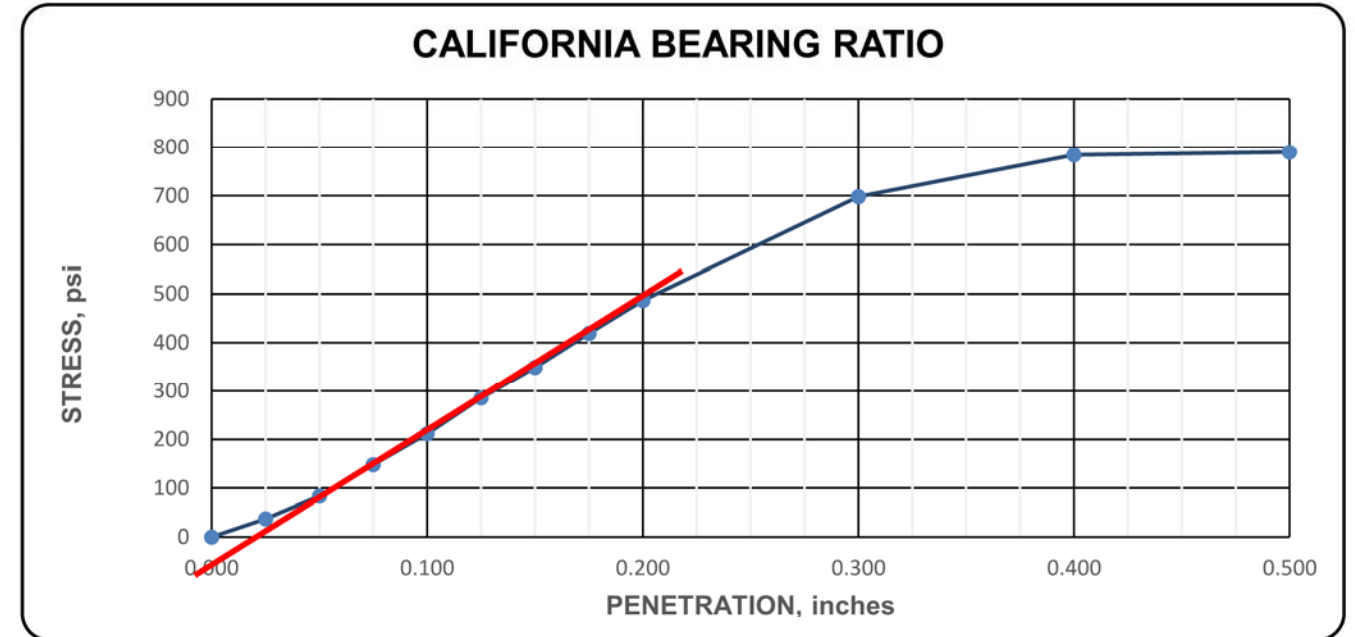
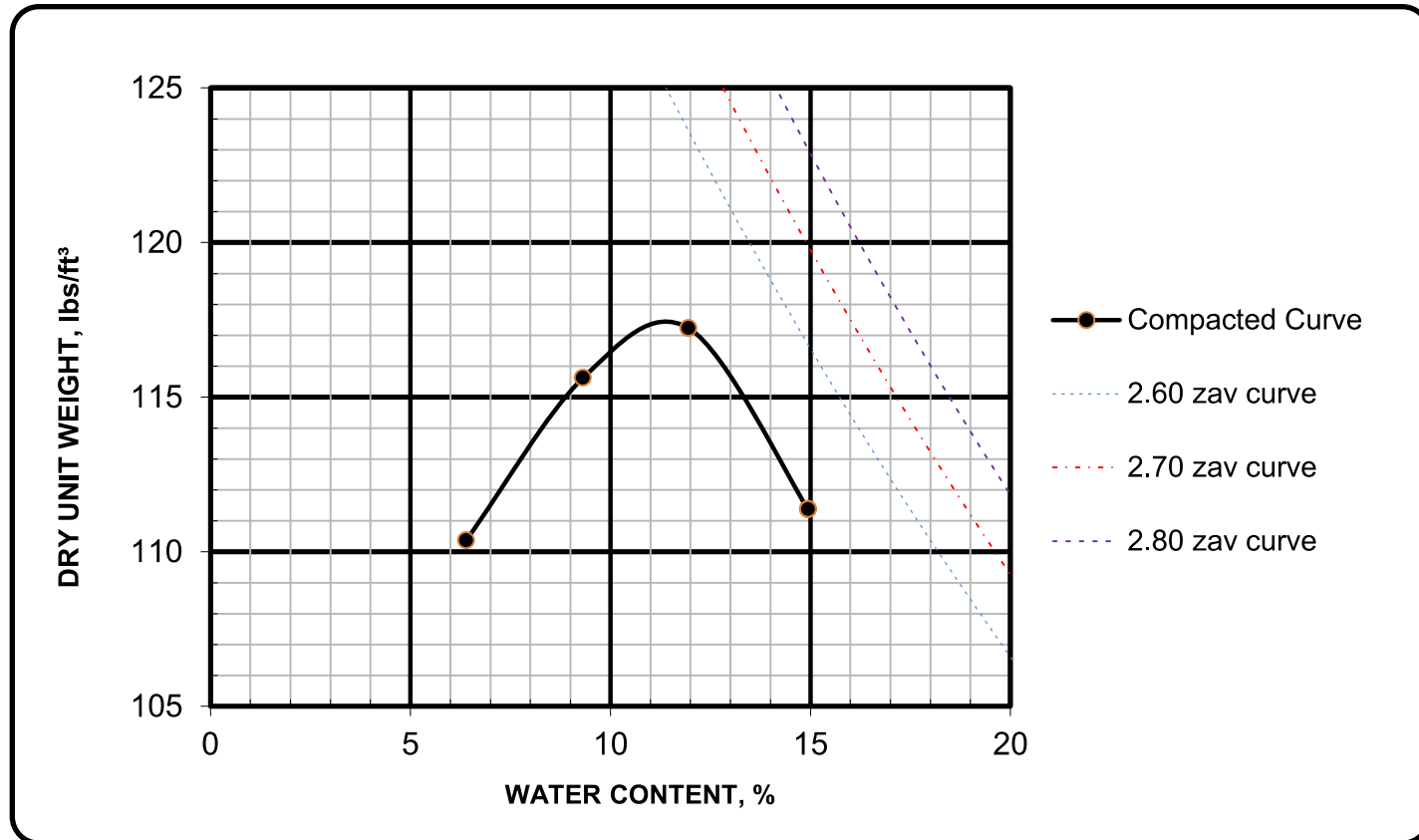


**REPORT OF CALIFORNIA BEARING RATIO (CBR)
OF LABORATORY-COMPACTED SOILS**
Performed in General Accordance with AASHTO T 193
November 20, 2017



PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-1, 64 ft RT, 155+94, 0-4'
SAMPLE DESCRIPTION: Dark gray silty sand

PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-1, 64 ft RT, 155+94, 0-4'



MAXIMUM DENSITY, lbs/ft³: 117.4
OPTIMUM MOISTURE CONTENT, %: 11.4

AS-RECEIVED WATER CONTENT: 22
LIQUID LIMIT: 21
PLASTIC LIMIT: 17
PLASTICITY INDEX: 4
PERCENT FINER NO. 200: 45
AASHTO CLASSIFICATION: A-4 (0)

BEARING RATIO:	at 0.1 inches of penetration:	<u>uncorrected</u>	<u>corrected</u>
		at 0.2 inches of penetration:	21.1
		32.4	35.1

Compaction Method: AASHTO T 193
Maximum Dry Unit Weight, lbs/ft³: 117.4
Optimum Water Content, %: 11.4
Compacted Dry Unit Weight, lbs/ft³: 117.5
Compacted Water Content, %: 11.0
Compaction Percentage: 100.1
Water Content, Top one-inch after test, %: 12.8
Surcharge amount, lbs: 10
Immersion period, hours: 95
Swell, %: 0.0

REMARKS:

REVIEWED BY: John Dailly

Reviewed by: John Dailly

**REPORT OF MOISTURE-DENSITY RELATIONS OF SOILS
USING A 5.5-LB RAMMER AND A 12-IN. DROP**
Performed in general accordance with AASHTO T 99, Method D
November 20, 2017

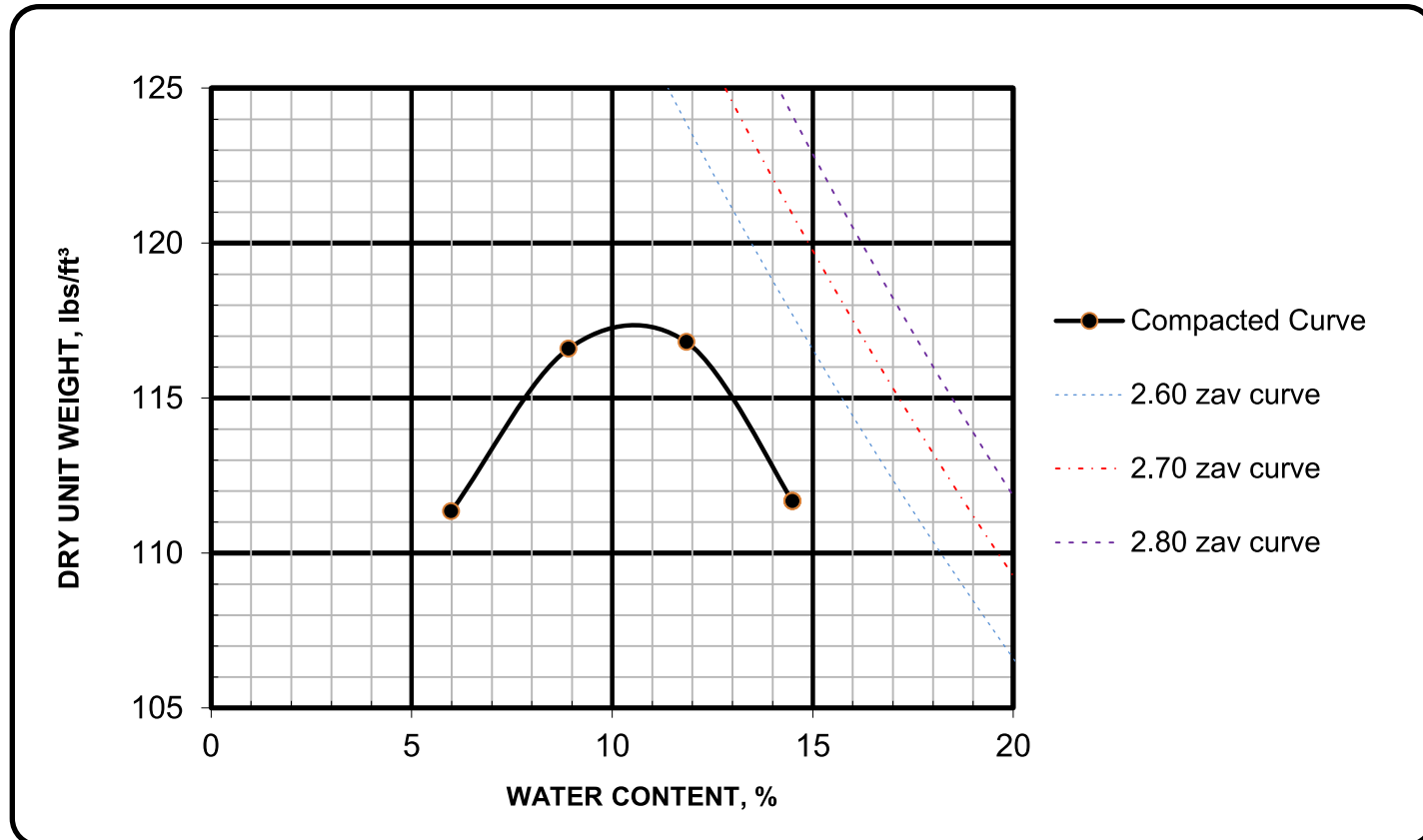


**REPORT OF CALIFORNIA BEARING RATIO (CBR)
OF LABORATORY-COMPACTED SOILS**
Performed in General Accordance with AASHTO T 193
November 20, 2017

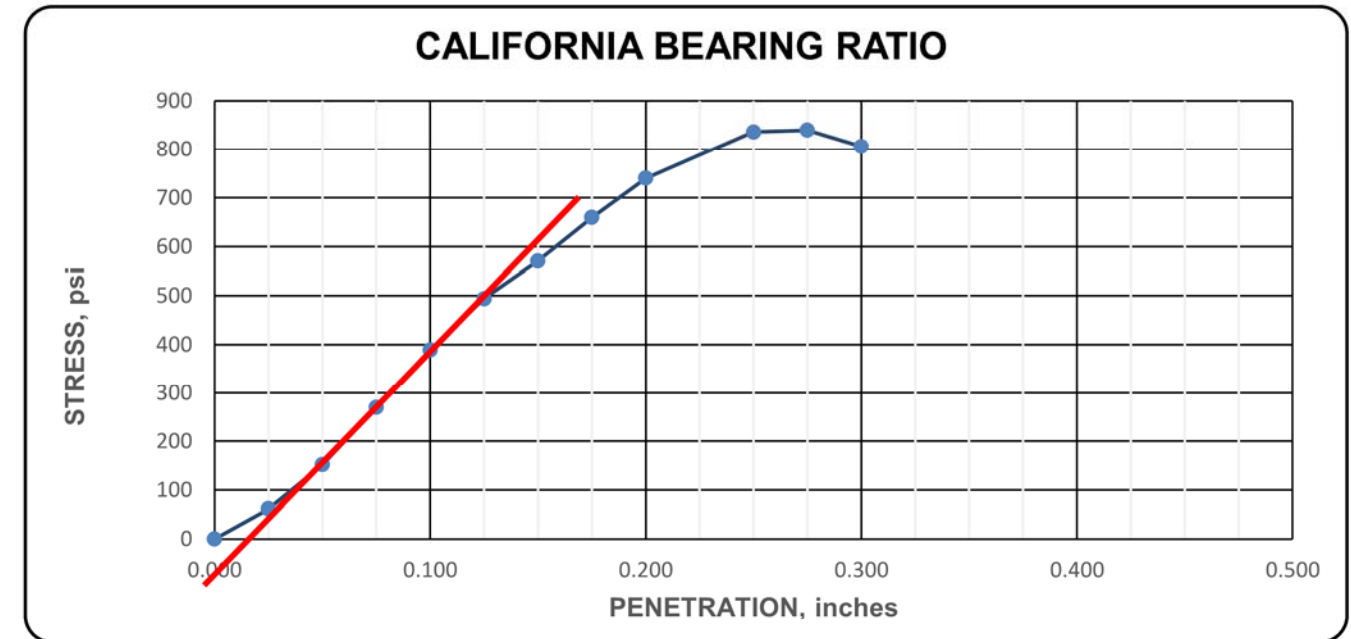


PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-2, 38 ft RT, 71+96, 0-6'
SAMPLE DESCRIPTION: Dark gray silty sand

PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-2, 38 ft RT, 71+96, 0-6'



MAXIMUM DENSITY, lbs/ft³: 117.3
OPTIMUM MOISTURE CONTENT, %: 10.6
AS-RECEIVED WATER CONTENT: 19
LIQUID LIMIT: 17
PLASTIC LIMIT: 16
PLASTICITY INDEX: 1
PERCENT FINER NO. 200: 33
AASHTO CLASSIFICATION: A-2-4 (0)



BEARING RATIO:	at 0.1 inches of penetration:	<u>uncorrected</u>	<u>corrected</u>
		39.0	46.1
	at 0.2 inches of penetration:	49.3	50.1

Compaction Method: AASHTO T 193
Maximum Dry Unit Weight, lbs/ft³: 117.3
Optimum Water Content, %: 10.6
Compacted Dry Unit Weight, lbs/ft³: 117.9
Compacted Water Content, %: 10.2
Compaction Percentage: 100.5
Water Content, Top one-inch after test, %: 12.5
Surcharge amount, lbs: 10
Immersion period, hours: 95
Swell, %: 0.0

REMARKS:

REVIEWED BY: John Dailly

Reviewed by: John Dailly

**REPORT OF MOISTURE-DENSITY RELATIONS OF SOILS
USING A 5.5-LB RAMMER AND A 12-IN. DROP**
Performed in general accordance with AASHTO T 99, Method D
November 20, 2017

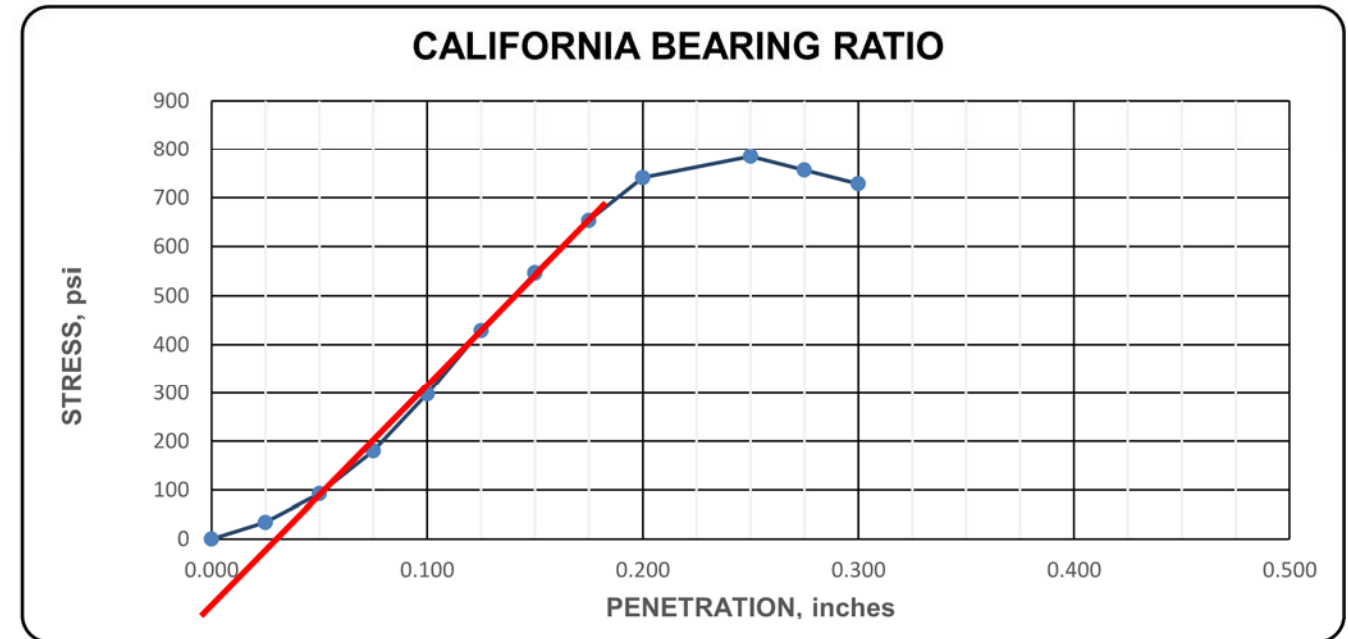
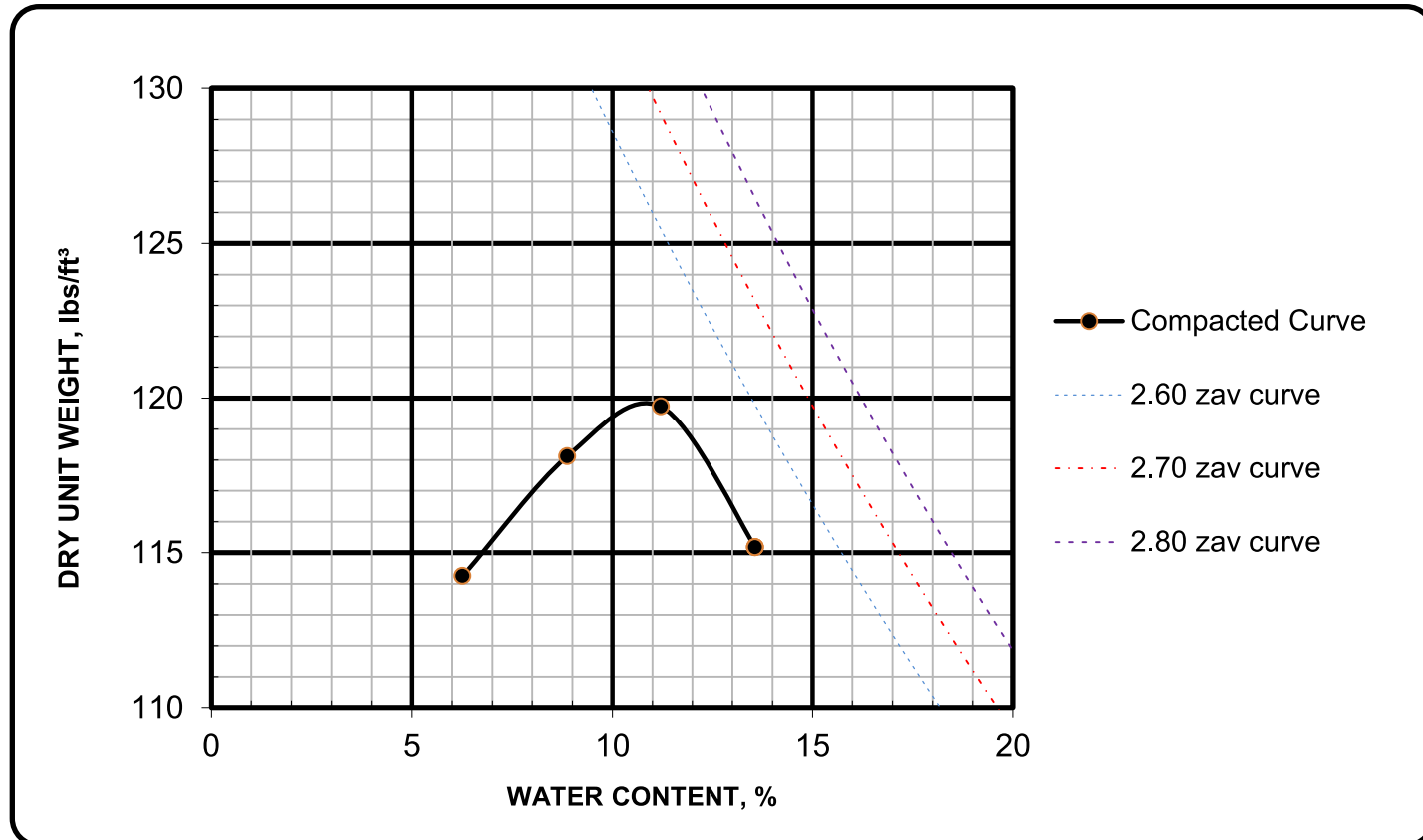


**REPORT OF CALIFORNIA BEARING RATIO (CBR)
OF LABORATORY-COMPACTED SOILS**
Performed in General Accordance with AASHTO T 193
November 20, 2017



PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-3, 6 ft LT, 27+02, 0-6'
SAMPLE DESCRIPTION: Dark gray brown silty sand

PROJECT NAME: US-74 Superstreet Columbus County, North Carolina
PROJECT NUMBER: G16046.00
SAMPLE IDENTIFICATION: BS-3, 6 ft LT, 27+02, 0-6'



MAXIMUM DENSITY, lbs/ft³: 119.8
OPTIMUM MOISTURE CONTENT, %: 10.9

AS-RECEIVED WATER CONTENT: 12
LIQUID LIMIT: ND
PLASTIC LIMIT: ND
PLASTICITY INDEX: NP
PERCENT FINER NO. 200: 12
AASHTO CLASSIFICATION: A-2-4 (0)

BEARING RATIO:	at 0.1 inches of penetration:	<u>uncorrected</u>	<u>corrected</u>
	at 0.2 inches of penetration:	29.8	44.8
		49.4	49.2

Compaction Method: AASHTO T 193
Maximum Dry Unit Weight, lbs/ft³: 119.8
Optimum Water Content, %: 10.9
Compacted Dry Unit Weight, lbs/ft³: 118.7
Compacted Water Content, %: 10.5
Compaction Percentage: 99.1
Water Content, Top one-inch after test, %: 11.9
Surcharge amount, lbs: 10
Immersion period, hours: 95
Swell, %: 0.0

REMARKS: ND=Not Determined. NP=Non-Plastic.

REVIEWED BY: John Dailly

Reviewed by: John Dailly