



December 11, 2017

Mr. Steve Smallwood, PE
STANTEC
801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

TIP No.: U-5999
WBS No.: 47117.2.1
County: Johnston

Project Description: Kellie Rd from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)

Subject: Pavement Design Recommendations

As authorized, Falcon Engineering, Inc. (Falcon) has completed the geotechnical subsurface investigation for the proposed roadway construction of Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003) in Johnston County, North Carolina. This report presents our recommended pavement section design for the project performed in general accordance with the NCDOT Interim Pavement Design Procedure (Procedures) as modified in November 2007.

A design CBR value of 5.0 was assumed based on the soil conditions encountered in our field and laboratory testing program and all other design factors and assumptions were taken in accordance with NCDOT Procedures. Traffic data for the mainline was obtained from the roadway title sheet. ADT values for -Y1-, as well as truck traffic and direction factor values for all alignments were not available at the time of this letter. However, based on the types of facilities and typical values we anticipate the recommend pavement sections are adequate. Should detailed traffic data be provided for our use, we can assess the viability of thinner pavement sections for all relevant alignments.

We recommend proofrolling be performed on this project wherever practical, in accordance with Section 260 of the Standard Specifications. Smaller areas at intersection improvements and minor Y-line modifications may be impractical for proofrolling and should be inspected by alternative methods.

Recommended pavement section component thicknesses for the mainline and select other alignments are included in the table on the following page. Existing pavements to be resurfaced may be overlaid with 1.5" of S9.5B asphalt surface course.

Alignment	Current (2018) AADT	Projected (2040) AADT	% Trucks		Surface Course (inches)	Binder Course (inches)	Base Course (inches)
			Duals	TTST			
Kellie Rd (-L-)	3,600	4,100	N/A	N/A	3.0" S9.5B	4.0" I19.0B	4.0" B25.0B or 8.0" ABC
Buffalo Rd (-Y1-)	N/A	N/A	N/A	N/A	3.0" S9.5B	4.0" I19.0B	4.0" B25.0B or 8.0" ABC

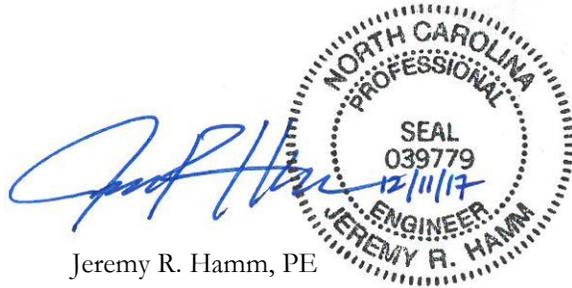
Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made. Falcon appreciates the opportunity to have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Respectfully submitted:

FALCON ENGINEERING, INC.



W. Scott Hunsberger, PE
Geotechnical Engineer



Jeremy R. Hamm, PE
Geotechnical Engineering Manager



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801 Jones Franklin Road, Suite 300
Raleigh, NC 27606

TIP No.: U-5999
WBS No.: 47117.2.1
County: Johnston

Project Description: Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)

Subject: Roadway Geotechnical Recommendations

As authorized, Falcon Engineering, Inc. (Falcon) has completed the geotechnical subsurface investigation for the proposed roadway construction of Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003) in Johnston County, North Carolina. This report includes roadway geotechnical recommendations for the preparation of final design, right of way plans, construction cost estimates, and construction procedures.

Recommendations and evaluations provided by Falcon are based on the information provided by STANTEC and established NCDOT standards. Modifications of our recommendations and evaluations may be required if there are changes to the design. Recommendations in this report are in part based on data obtained from soil borings. The nature and extent of variations between borings may not become evident until construction.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made. Falcon appreciates the opportunity to have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Respectfully submitted:

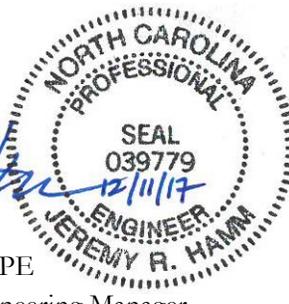
FALCON ENGINEERING, INC.

A blue ink signature of W. Scott Hunsberger, PE.

W. Scott Hunsberger, PE
Geotechnical Engineer

A blue ink signature of Jeremy R. Hamm, PE.

Jeremy R. Hamm, PE
Geotechnical Engineering Manager



TIP: U-5999
COUNTY: Johnston
DESCRIPTION: Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)
SUBJECT: Roadway Subsurface Investigation – Recommendations

Falcon has completed the subsurface investigation for this project and submits the following recommendations:

I. Slope/Embankment Stability

A. Slope Design

It is recommended that all roadway embankment fill and cut slopes be constructed at a 3:1 (H:V) ratio or flatter for this project. Slopes on the order of 7 or less feet in height are anticipated based on the proposed grades.

B. Undercut for Embankment Stability

Soft surficial soils are present in portions of the site where new embankments will be placed. These soils may not provide adequate stability for construction of embankments.

To assist in embankment stabilization in such locations, it is recommended that a quantity of **1,500 CY** of undercut be included in the contract as a contingency to be used at the discretion of the engineer.

C. Geotextile for Soil Stabilization

To aid in the placement of fill over unstable soil, it is recommended that a quantity of **2,750 SY** of Geotextile for Soil Stabilization be included in the contract as a contingency to be used in conjunction with the above referenced undercut at the discretion of the engineer.

II. Subgrade Stability

A. Subsurface Drainage – Subsurface Drain

High groundwater and poor surface drainage is present at many locations throughout the project. It is recommended that a quantity of **1,000 LF** of 6-inch perforated corrugated plastic pipe be included in the contract as a contingency item to be used at the discretion of the Engineer. Construction of underdrains shall follow Standard Specifications, Section 815 “Subsurface Drainage”, and Roadway Standard Drawing 815.02 “Subsurface Drain”.

Subsurface drains should maintain groundwater at least 4 feet beneath the proposed pavement subgrade, and should be installed with adequate outfall to prevent ponding. Where adequate outfall cannot be provided based on existing topography, proposed grades, and water surface elevations at natural drainage points, roadway grades should be adjusted to provide at least 6 feet of separation from groundwater. Falcon can provide detailed groundwater elevations for specific areas to assist with roadway grade adjustments as needed upon request.

B. Undercut for Subgrade Stability

Highly plastic soils or moderately plastic soils with more than 50% passing the number 200 sieve and moisture contents exceeding the plastic limit were encountered at or near proposed pavement

subgrades in cut and near-grade construction areas. We recommend undercut of these materials be performed to a depth of three feet beneath subgrade and one foot beyond edge of pavement or back of curb. A total of **1,400 CY** of undercut has been measured from cross sections. The area to be undercut is listed below:

Station (ft)	Quantity (CY)
46+25 to 49+50, -L-	1,400

This area is represented on the subsurface profile and cross sections by a double hatch pattern. If highly plastic or otherwise unsuitable subgrades are present in other areas, perform Undercut. To assist in subgrade stabilization in such locations, it is recommended an additional quantity of **300 CY** of undercut be included in the contract as a contingency to be used at the discretion of the Engineer. Undercut of unstable soils should be made to a depth of three feet, or to competent material, whichever is less, and to a width of one foot beyond edge of pavement or back of curb.

C. Geotextile for Soil Stabilization

The use of Geotextile for Soil Stabilization is anticipated in conjunction with Undercut for Subgrade Stabilization as discussed in Section II. B. It is recommended that a quantity of **1,900 SY** of Geotextile for Soil Stabilization be included in the contract. It is recommended that an additional quantity of **350 SY** of Geotextile for Soil Stabilization be included in the contract as a contingency to be used at the discretion of the Engineer.

D. Aggregate Subgrade

Soft, highly plastic, or otherwise unsuitable subgrades are likely to exist at portions of the widening along -Y1- (Buffalo Road). Shallow utilities and staging of traffic is likely to make full depth undercut impractical in these areas, and subgrade repair should instead be facilitated with Aggregate Subgrade. Therefore we recommend quantities of **250 CY** of Shallow Undercut, **500 tons** of Class IV Subgrade Stabilization, and **500 SY** of Geotextile for Soil Stabilization be included in the contract to be used at the discretion of the Engineer. Aggregate Subgrade shall be performed in accordance with Section 505 of the Standard Specifications, to a width of one foot beyond edge of pavement or back of curb, as necessary.

E. Aggregate Stabilization

Vibratory compaction of subgrades will not be allowed over the existing gas pipelines discussed in Section IV. C below. If achieving subgrade stability without vibratory equipment proves difficult, Aggregate Stabilization may aid in creating a stable subgrade to receive the pavement section. Therefore we recommend a quantity of **100 tons** of Stabilizer Aggregate be included in the contract to be used at the discretion of the Engineer. Aggregate Stabilization shall be performed in accordance with Section 510 of the Standard Specifications, to a width of one foot beyond edge of pavement or back of curb, as necessary.

III. Borrow Specifications**A. Disposal of Waste Materials**

Waste Materials may be disposed of in non-structural areas, such as outside of the embankment slopes at the discretion of the engineer.

B. Common Borrow

Common borrow for embankment fill shall meet the Exception to the Statewide Criteria outlined in the Standard Specification, Article 1018-2, Section II (B).

C. Select Granular Material

Select granular material for embankment/backfill, geotextile for soil stabilization, or for fill in standing water shall meet the criteria outlined in the Standard Specifications, Article 1016-3, Class II and/or III. The select granular material should be placed to a height of 3 feet above geotextile for soil stabilization and/or water level.

It is recommended an additional quantity of **1,900 CY** of Select Granular Material be included in the contract for use in the area identified in Section II. B, Undercut for Subgrade Stabilization. It is recommended a quantity of **3,100 CY** of Select Granular Material be included in the contract as a contingency item to be used on Geotextile for Soil Stabilization or at the discretion of the Engineer.

Various areas of standing water may be present on site in wetlands and near existing waterways. If standing water is present in these or other areas, Select Granular Material, Class III, must be used. Therefore it is recommended a quantity of **1,850 CY** of Select Granular Material, Class III be included in the contract as a contingency to be used at the discretion of the Engineer.

D. Shrinkage Factor

A shrinkage factor of 25 percent is recommended to be used in the earthwork computations for this project.

IV. Miscellaneous**A. Reduction of Unclassified Excavation – Loss Due to Clearing and Grubbing**

It is recommended that Unclassified Excavation on the project be reduced by **2,900 CY** due to clearing and grubbing

B. Reduction of Unclassified Excavation – Unsuitable Unclassified Excavation

Highly plastic soils are anticipated to be present in cut excavations from the following locations and we recommend unclassified excavation be reduced by the following amounts.

Station	Quantity (CY)
47+75 to 49+50 -L-	450

These areas are represented on the subsurface profiles and cross sections by a single hatch pattern. Including an additional contingency to be used at the discretion of the engineer, it is recommended that Unclassified Excavation on the project be reduced by **550 CY** due to the presence of unsuitable soils.

C. Special Construction Considerations – Natural Gas Pipeline

Two natural gas pipelines (20 inch and 10 inch steel) cross the alignment near stations 29+31 and 29+57, respectively. Based on conversations with Piedmont Natural Gas, vibratory compaction will not be allowed over the pipelines regardless of vertical separation. Achieving embankment and subgrade stability may be more easily facilitated by utilizing Geotextile for Soil Stabilization, Select Granular Materials, and/or Aggregate Stabilization as referenced in the Section II Subgrade Stability above.



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

Summary of Quantities

WBS Number: 47117.2.1

County: Johnston

Project Engineer: Hamm, J. R.

TIP Number: U-5999

Field Office: Consultant

Project Geologist: Hunsberger, W. S.

Description: Kellie Road Form Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
0036000000-E	Undercut Excavation	225 - Roadway Excavation	I. B	Contingency	N/A	N/A	1,500	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. B	-L-	46+25.00	49+50.00	1,400	CY
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. B	Contingency	N/A	N/A	300	CY
Total Quantity of Undercut Excavation =							3,200	CY
0194000000-E	Select Granular Material, Class III	SP - Select Granular Material	III. C	Contingency	N/A	N/A	1,850	CY
Total Quantity of Select Granular Material, Class III =							1,850	CY
0195000000-E	Select Granular Material	265 - Select Granular Material	III. C	-L-	46+25.00	49+50.00	1,900	CY
0195000000-E	Select Granular Material	265 - Select Granular Material	III. C	Contingency	N/A	N/A	3,100	CY
Total Quantity of Select Granular Material =							5,000	CY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. C	Contingency	N/A	N/A	2,750	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. C	-L-	46+25.00	49+50.00	1,900	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. C	Contingency	N/A	N/A	350	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. D	Contingency	N/A	N/A	500	SY
Total Quantity of Geotextile for Soil Stabilization =							5,500	SY
1099500000-E	Shallow Undercut	505 - Aggregate Subgrade	II. D	Contingency	N/A	N/A	250	CY
Total Quantity of Shallow Undercut =							250	CY
1099700000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	II. D	Contingency	N/A	N/A	500	TON
Total Quantity of Class IV Subgrade Stabilization =							500	TON
1110000000-E	Stabilizer Aggregate	510 - Aggregate Stabilization	II. E	Contingency	N/A	N/A	100	TON
Total Quantity of Stabilizer Aggregate =							100	TON
2044000000-E	6" Perforated Subdrain Pipe	815 - Subsurface Drainage	II. A	Contingency	N/A	N/A	1,000	LF
Total Quantity of 6" Perforated Subdrain Pipe =							1,000	LF

These Items Only Impact Earthwork Totals								
N/A	Loss Due to Clearing & Grubbing	200 - Clearing and Grubbing	IV. A	N/A	N/A	N/A	2,900	CY
N/A	Shrinkage Factor	235 - Embankments	III. D	N/A	N/A	N/A	25	%



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

Summary of Quantities

WBS Number: 47117.2.1

County: Johnston

Project Engineer: Hamm, J. R.

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Project Geologist: Hunsberger, W. S.

Description: Kellie Road Form Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
N/A	Unclassified Excavation - Unsuitable Waste	225 - Roadway Excavation	IV. B	N/A	N/A	N/A	550	CY

REFERENCE: U-5999

PROJECT: 47117

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5999	1	8

CONTENTS

LINE	STATION	PLAN	PROFILE
-L-	16+99.29 - 50+21.51	4-6	4,5
-YI-	11+60.00 - 19+48.00	6	5

CROSS SECTIONS

LINE	STATION	SHEETS
-L-	47+00.00 - 49+50.00	6-8

ROADWAY SUBSURFACE INVESTIGATION

COUNTY JOHNSTON
PROJECT DESCRIPTION KELLIE ROAD FROM
BOOKER DAIRY ROAD (SR 1923) TO
BUFFALO ROAD (SR 1003)

RECOMMENDATIONS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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

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:
- 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.
 - 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

CAROLINA DRILLING

HILL, M.J.

INVESTIGATED BY FALCON ENG.

DRAWN BY HUNSBERGER, W.S.

CHECKED BY HAMM, J.R.

SUBMITTED BY FALCON ENG.

DATE DECEMBER 2017



Jeremy R. Hamm 12/11/2017

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

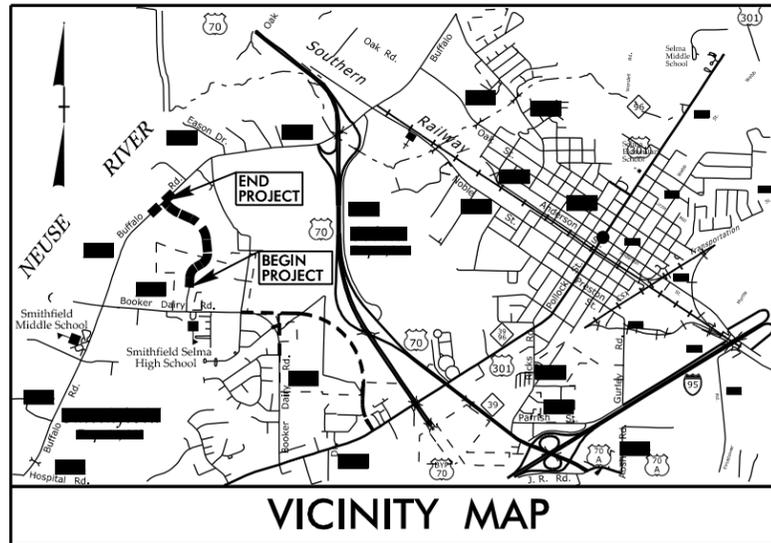
SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																																																																									
<p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</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 DISLOADED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (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>																																																																									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERED ROCK (WR)										NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.																																																																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>GENERAL CLASS.</th> <th colspan="5">GRANULAR MATERIALS (<= 35% PASSING #200)</th> <th colspan="5">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="5">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-2-4</th> <th>A-2-5</th> <th>A-2-6</th> <th>A-2-7</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> </tr> <tr> <th>SYMBOL</th> <td colspan="5">[Pattern]</td> <td colspan="5">[Pattern]</td> <td colspan="5">[Pattern]</td> </tr> <tr> <th>% PASSING #10 #40 #200</th> <td>50 MX 30 MX 15 MX</td> <td>50 MX 25 MX</td> <td>51 MN 10 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td>MUCK, PEAT</td> <td></td> </tr> </table>										GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)					ORGANIC MATERIALS					GROUP CLASS.	A-1	A-3	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	SYMBOL	[Pattern]					[Pattern]					[Pattern]					% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX 35 MX	36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT		<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										<p>CRISTALLINE 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.</p>										<p>NON-CRYSTALLINE ROCK (NCR) - FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>															
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<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</p>										<p>ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p>										<p>VERY SLIGHT (V SL.) - ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p>																																																																									
PERCENTAGE OF MATERIAL										GROUND WATER										MODERATE (MOD.)										SEVERE (SEV.)																																																																									
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<p>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.</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>										<p>u5999_ls.tin.tin DATED 06/2017 ELEVATION: _____ FEET</p>										<p>FIAD - FILLED IMMEDIATELY AFTER DRILLING</p>																																																																									

08-DEC-2017 11:27 I:\Projects\2017\G17032.00 Stantec U-5999 Kellie Drive Extension\U5999_NCDOT_Electronic_File_Tree\Geotech\InvestigationDesign\U5999_GEO_RDW\CADD_GEO\TECH\PlanProf\U5999_GEO_tsh.dgn
 09/28/19
 cadmachine AT CADD

TIP PROJECT: U-5999

CONTRACT: 47117

See Sheet 1-B for Conventional Symbols



VICINITY MAP

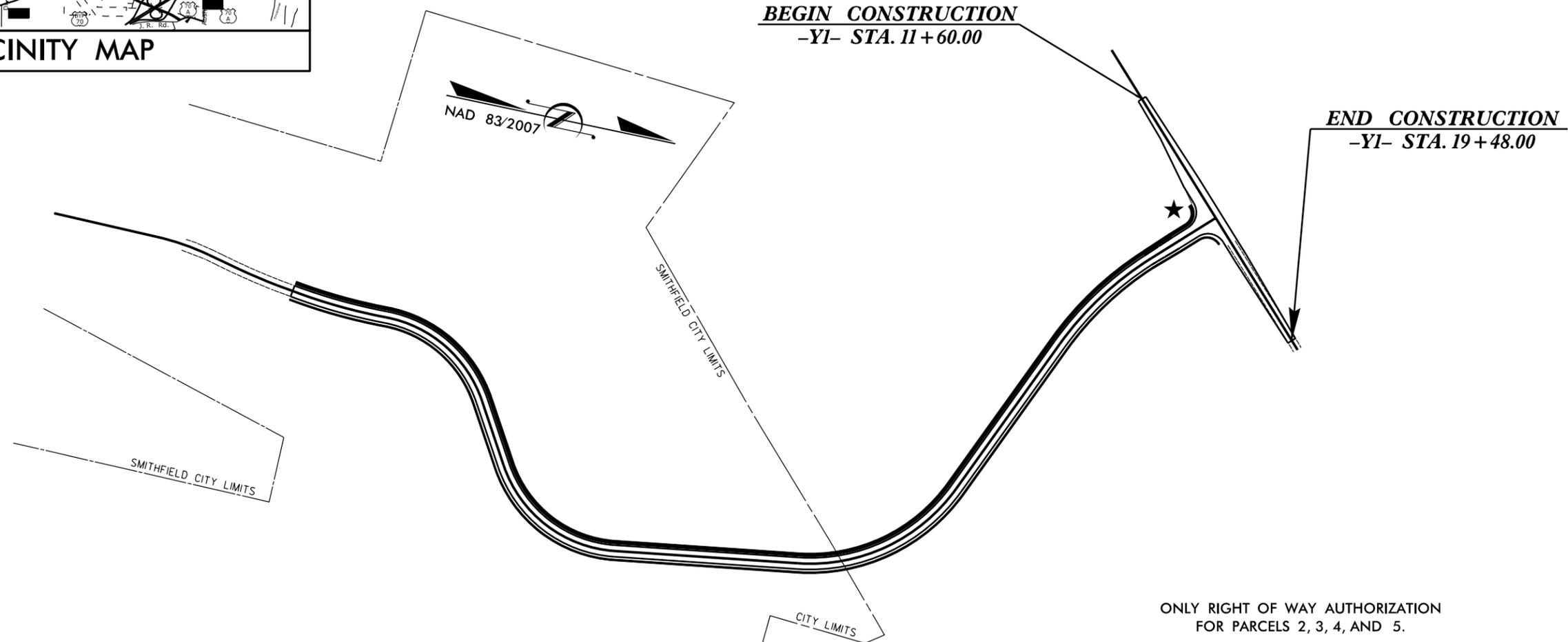
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

JOHNSTON COUNTY

**LOCATION: KELLIE ROAD FROM BOOKER DAIRY ROAD (SR 1923)
TO BUFFALO ROAD (SR 1003)**

TYPE OF WORK: GRADING, PAVING, DRAINAGE, AND SIGNAL

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5999	3	8
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
47117.1.1	N/A	P.E.	
47117.2.1	N/A	ROW	
47117.2.1	N/A	UTIL.	
47117.3.1	N/A	CONSTR.	



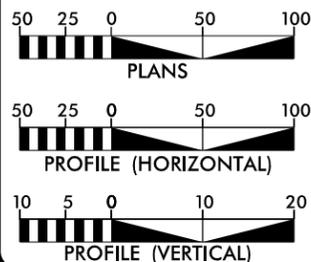
★ PROPOSED SIGNAL

A PORTION OF THIS PROJECT IS WITHIN THE MUNICIPAL BOUNDARIES OF SMITHFIELD.
CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD ____.

ONLY RIGHT OF WAY AUTHORIZATION
FOR PARCELS 2, 3, 4, AND 5.

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES



DESIGN DATA

ADT 2018 = 3,600
ADT 2040 = 4,100

V = 30 MPH

FUNC CLASS =
URBAN COLLECTOR
SUBREGIONAL TIER

PROJECT LENGTH

LENGTH OF ROADWAY TIP PROJECT U-3334B = 0.628 MILES

Prepared In the Office of:



for the North Carolina Department of Transportation

2016 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
August 18, 2017(Partial)

LETTING DATE:
January xx, 2018

STANTEC CONTACT

STEVE SMALLWOOD, PE
PROJECT ENGINEER

NCDOT CONTACT:

MATT CLARKE, PE

HYDRAULICS ENGINEER

SIGNATURE: _____ P.E.

ROADWAY DESIGN
ENGINEER

SIGNATURE: _____ P.E.



5/28/99
 I:\DEC-2017\914
 I:\Projects\2017\617032.00 Stantec U-5999 Kellie Drive Extension\U5999_NCDOT_Electronic_File_Tree\Geotech\InvestigationDesign\U5999_GEO_RDW\CAADD_GEO\TECH\Plan\Prof\U5999_GEO.plt_lay.dgn
 10/10/2017 10:10:10 AM
 cadman@stn.com

Stantec
 Stantec Consulting Services Inc.
 801 Jones Franklin Road
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 Raleigh, NC 27806
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 www.stantec.com
 License No. P-0672

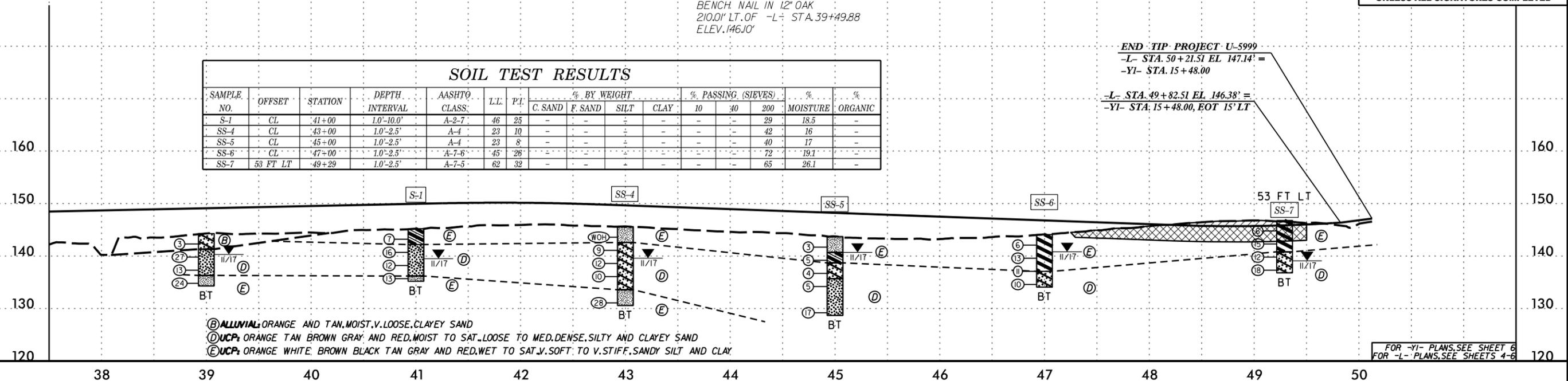
PROJECT REFERENCE NO. U-5999	SHEET NO. 5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

-L-

BM #2
 BENCH NAIL IN 12" OAK
 210.0' LT. OF -L- STA. 39+49.88
 ELEV. 146.10'

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	LL	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-1	CL	41+00	1.0'-10.0'	A-2-7	46	25	-	-	-	-	-	29	18.5	-	
SS-4	CL	43+00	1.0'-2.5'	A-4	23	10	-	-	-	-	-	42	16	-	
SS-5	CL	45+00	1.0'-2.5'	A-4	23	8	-	-	-	-	-	40	17	-	
SS-6	CL	47+00	1.0'-2.5'	A-7-6	45	26	-	-	-	-	-	72	19.1	-	
SS-7	53 FT LT	49+29	1.0'-2.5'	A-7-5	62	32	-	-	-	-	-	65	26.1	-	

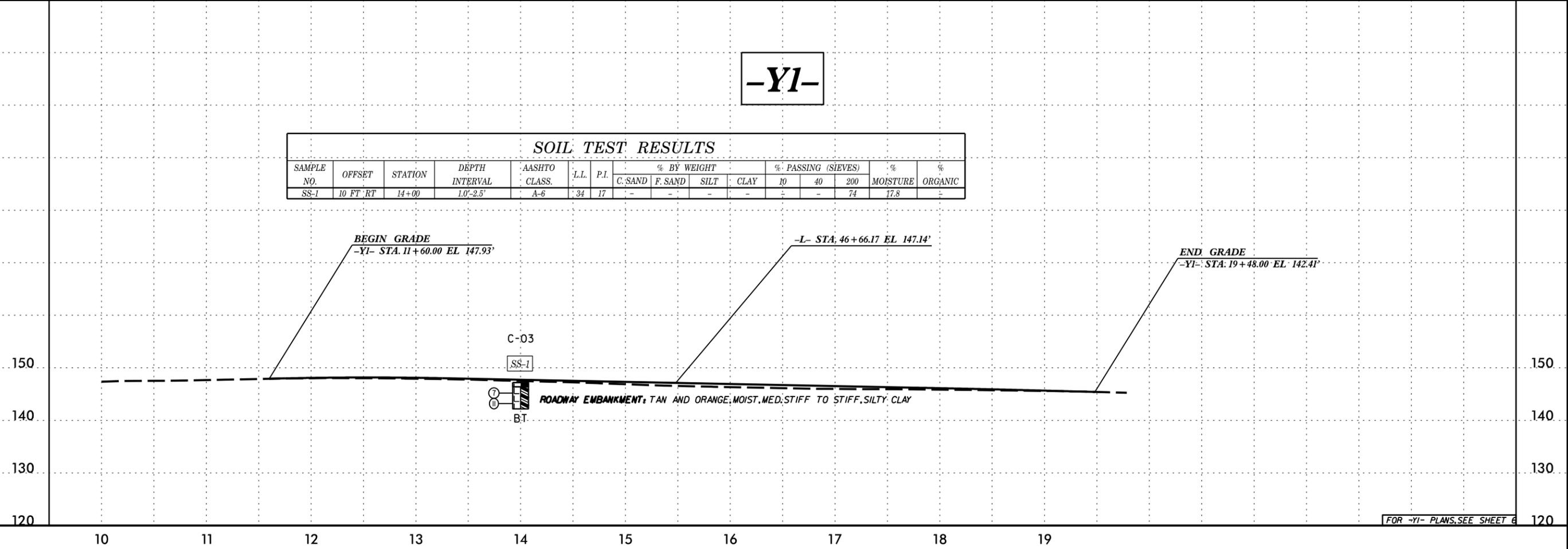


(B) ALLUVIAL: ORANGE AND TAN, MOIST, V. LOOSE, CLAYEY SAND
 (D) UCP: ORANGE TAN BROWN GRAY AND RED, MOIST TO SAT., LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND
 (E) UCP: ORANGE WHITE, BROWN BLACK TAN GRAY AND RED, WET TO SAT., V. SOFT TO V. STIFF, SANDY SILT AND CLAY

FOR -YI- PLANS, SEE SHEET 6
 FOR -L- PLANS, SEE SHEETS 4-6

-YI-

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	LL	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-1	10 FT RT	14+00	1.0'-2.5'	A-6	34	17	-	-	-	-	-	74	17.8	-	

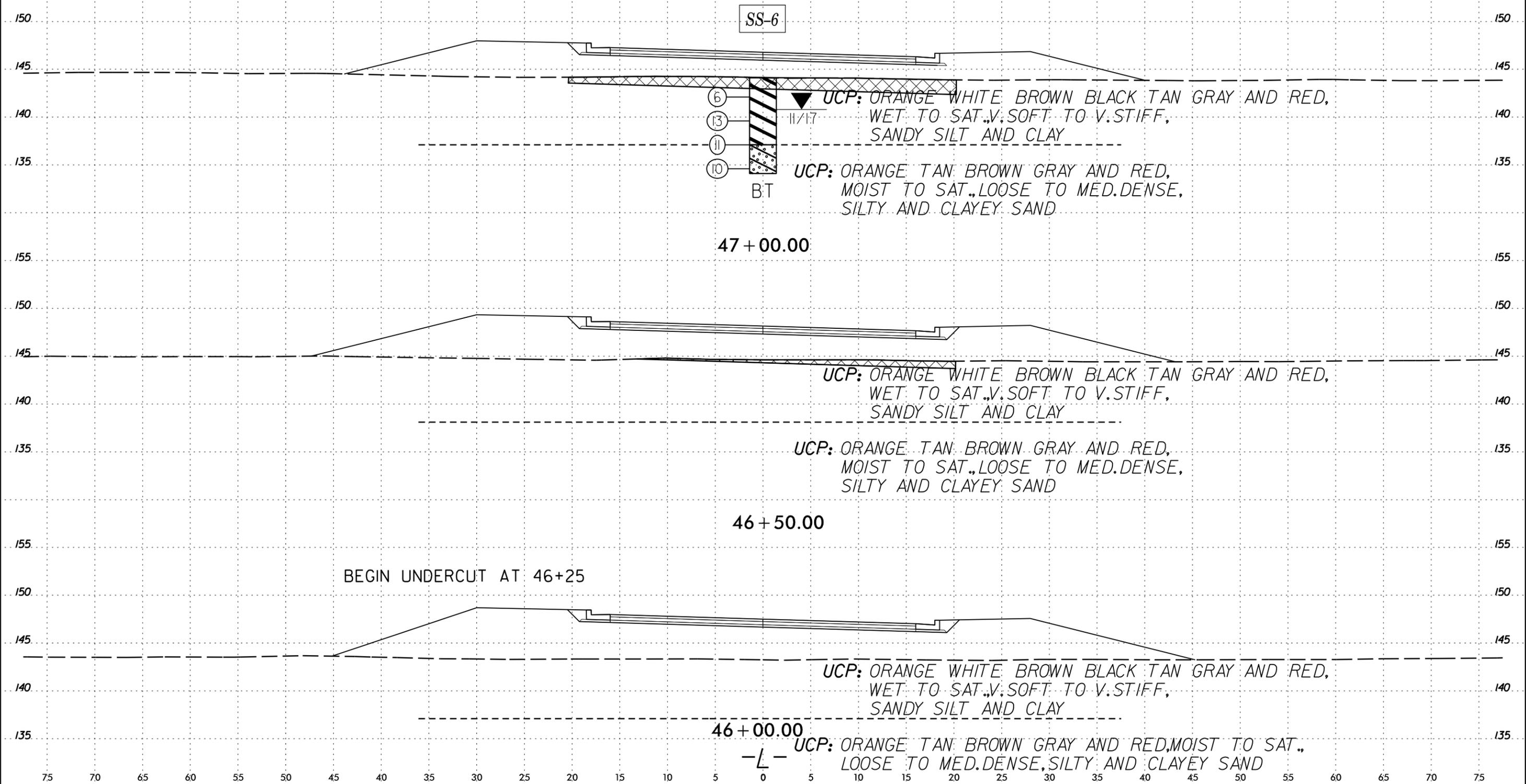


C-03
 (B) ROADWAY EMBANKMENT: TAN AND ORANGE, MOIST, MED. STIFF TO STIFF, SILTY CLAY
 (D) BT

FOR -YI- PLANS, SEE SHEET 6

I:\Projects\2017\10-DEC-2017 19:38\Stantec U-5999 Kellie Drive Extension\U5999\NCDDT\Electronic\File_Tree\Geotech\Investigation\Design\U5999_GEO\RDWY\CADD_GEO\TECH\XSC\U5999_GEO_xpr_L.dgn
 6/23/16
 cadman@stn.com

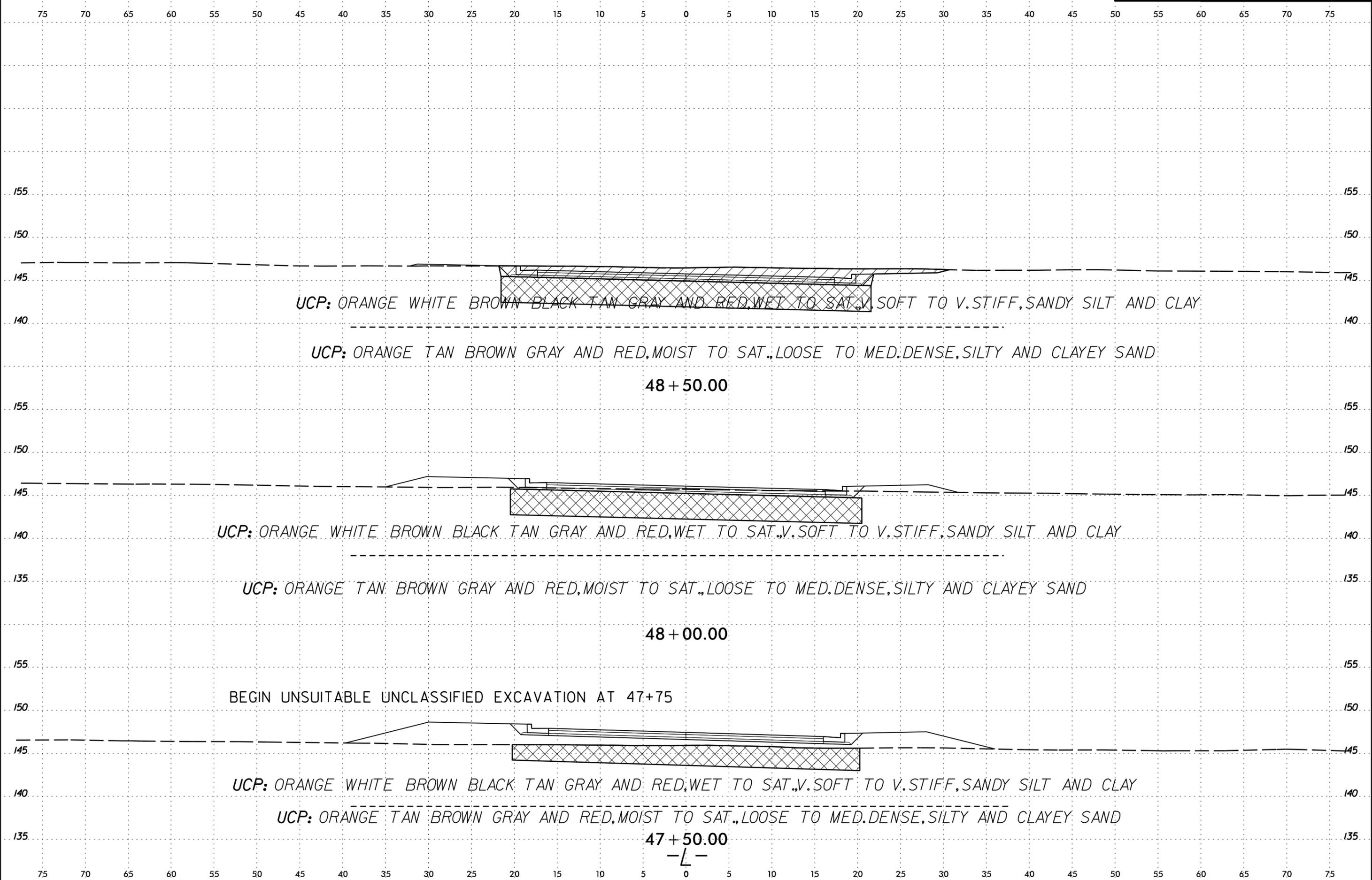
SOIL TEST RESULTS															
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-6	CL	47+00	1.0'-2.5'	A-7-6	45	26	-	-	-	-	-	-	72	19.1	-



6/23/16
I:\DEC-2017 09:30
I:\Projects\2017\167022-00 Stantec U-5999 Kellie Drive Extension\U5999_NCDOT\Electronic\File_Tree\Geotech\InvestigationDesign\U5999_GEO_RDWY\CADD_GEO\TECH\XSC\U5999_GEO_xpr_L.dgn
ceadmachine AI GEO-18



PROJ. REFERENCE NO.	SHEET NO.
U-5999	7



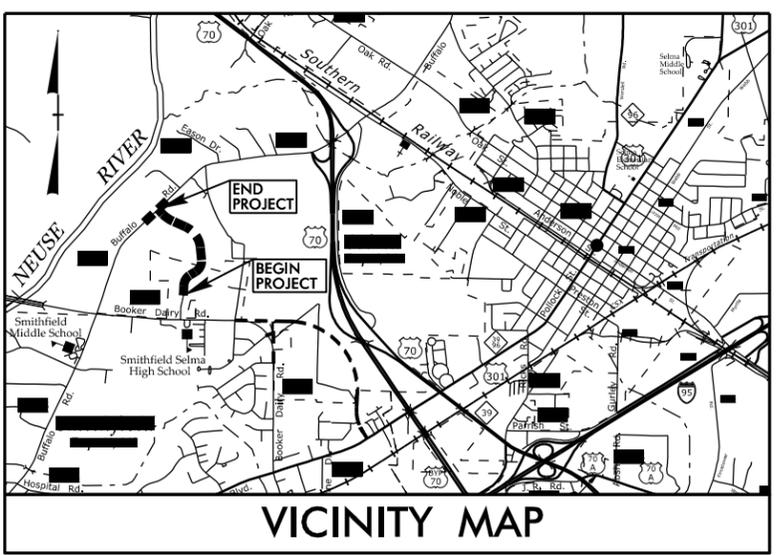
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

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 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</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 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 DISLOADED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERED ROCK (WR)										NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.																																																																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>GENERAL CLASS.</th> <th colspan="5">GRANULAR MATERIALS (<= 35% PASSING #200)</th> <th colspan="5">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="5">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-2-4</th> <th>A-2-5</th> <th>A-2-6</th> <th>A-2-7</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-3</th> <th>A-4, A-5</th> <th>A-6, A-7</th> </tr> <tr> <th>SYMBOL</th> <td colspan="5">[Pattern]</td> <td colspan="5">[Pattern]</td> <td colspan="5">[Pattern]</td> </tr> <tr> <th>% PASSING #10 #40 #200</th> <td>50 MX 30 MX 15 MX</td> <td>50 MX 25 MX</td> <td>51 MN 10 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>35 MX 35 MX</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>36 MN 36 MN</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td>MUCK, PEAT</td> <td></td> </tr> </table>										GENERAL CLASS.	GRANULAR MATERIALS (<= 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)					ORGANIC MATERIALS					GROUP CLASS.	A-1	A-3	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	SYMBOL	[Pattern]					[Pattern]					[Pattern]					% 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	35 MX 35 MX	35 MX 35 MX	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	36 MN 36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT		<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										<p>CRISTALLINE 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.</p>										<p>NON-CRYSTALLINE ROCK (NCR) - FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.</p>									
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MINERALOGICAL COMPOSITION										COMPRESSION										WEATHERING										FRESH																																																																									
<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</p>										<p>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>																																																																									
PERCENTAGE OF MATERIAL										GROUND WATER										MODERATE (MOD.)										SEVERE (SEV.)																																																																									
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	4.75	2.00	0.42	0.25	0.075	0.053																																																																																																	
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NON PLASTIC</th> <th colspan="2">PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> <tr> <td>SLIGHTLY PLASTIC</td> <td>0-5</td> <td></td> <td>VERY LOW</td> </tr> <tr> <td>MODERATELY PLASTIC</td> <td>6-15</td> <td></td> <td>SLIGHT</td> </tr> <tr> <td>HIGHLY PLASTIC</td> <td>16-25</td> <td></td> <td>MEDIUM</td> </tr> <tr> <td></td> <td>26 OR MORE</td> <td></td> <td>HIGH</td> </tr> </table>										NON PLASTIC	PLASTICITY INDEX (PI)		DRY STRENGTH	SLIGHTLY PLASTIC	0-5		VERY LOW	MODERATELY PLASTIC	6-15		SLIGHT	HIGHLY PLASTIC	16-25		MEDIUM		26 OR MORE		HIGH	<p>DRILL UNITS: <input type="checkbox"/> CME-45C <input type="checkbox"/> CME-55 <input type="checkbox"/> CME-550 <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> PORTABLE HOIST <input checked="" type="checkbox"/> BK-51</p> <p>ADVANCING TOOLS: <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE * STEEL TEETH <input type="checkbox"/> TRICONE * TUNG-CARB. <input type="checkbox"/> CORE BIT</p> <p>HAMMER TYPE: <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE: <input type="checkbox"/> -B <input type="checkbox"/> -H <input type="checkbox"/> -N</p> <p>HAND TOOLS: <input type="checkbox"/> POST HOLE DIGGER <input checked="" type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST</p>										<p>VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FOOT VERY CLOSE LESS THAN 0.16 FEET</p>										<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>TERM</th> <th>THICKNESS</th> </tr> <tr> <td>VERY THICKLY BEDDED</td> <td>4 FEET</td> </tr> <tr> <td>THICKLY BEDDED</td> <td>1.5 - 4 FEET</td> </tr> <tr> <td>THINLY BEDDED</td> <td>0.16 - 1.5 FEET</td> </tr> <tr> <td>VERY THINLY BEDDED</td> <td>0.03 - 0.16 FEET</td> </tr> <tr> <td>THICKLY LAMINATED</td> <td>0.008 - 0.03 FEET</td> </tr> <tr> <td>THINLY LAMINATED</td> <td>< 0.008 FEET</td> </tr> </table>										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																														
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<p>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.</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p> <p>FRIABLE - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>										<p>u5999_ls.tin.tin DATED 06/2017 ELEVATION: _____ FEET</p>										<p>FIAD - FILLED IMMEDIATELY AFTER DRILLING</p>																																																																									

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 09/28/2017
 cadmachine AT GEOT-10

CONTRACT: 47117 **TIP PROJECT: U-5999**

See Sheet 1-B for Conventional Symbols



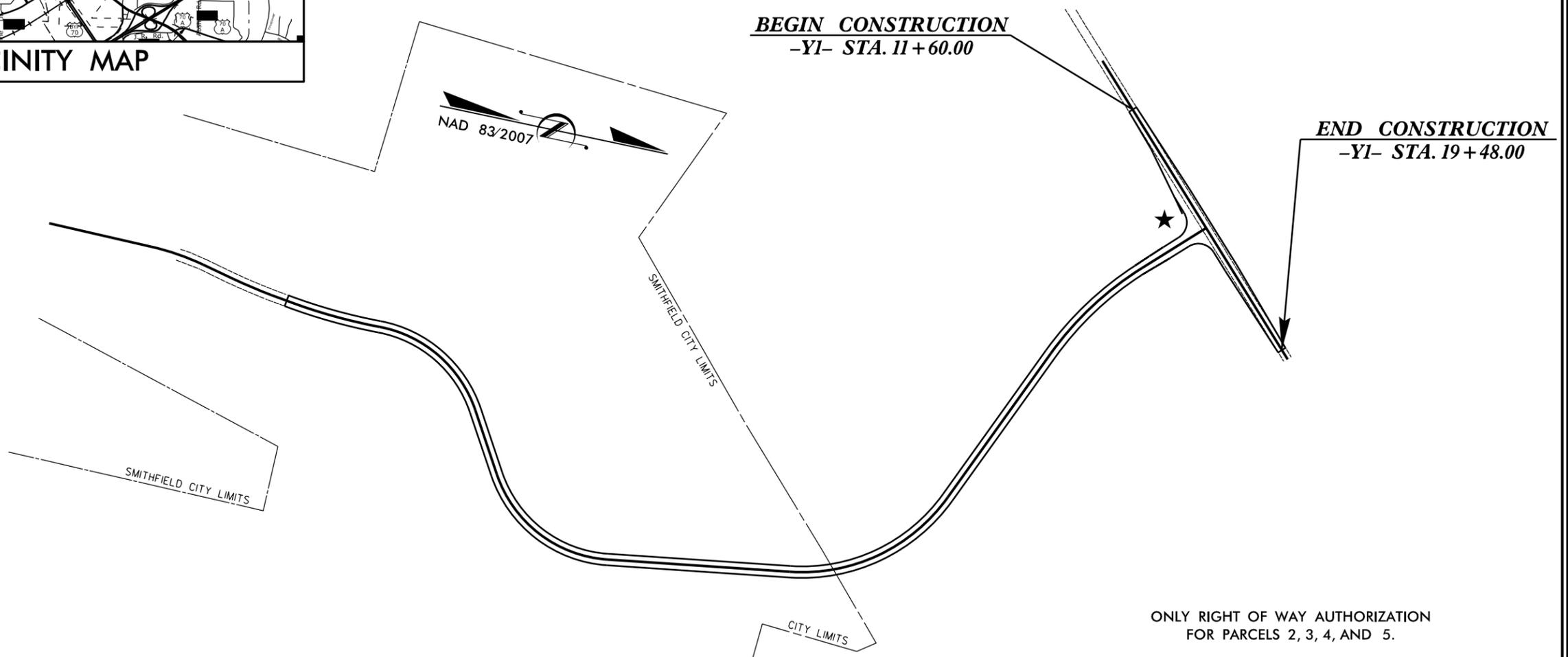
STATE OF NORTH CAROLINA
 DIVISION OF HIGHWAYS
JOHNSTON COUNTY

**LOCATION: KELLIE ROAD FROM BOOKER DAIRY ROAD (SR 1923)
 TO BUFFALO ROAD (SR 1003)**

TYPE OF WORK: GRADING, PAVING, DRAINAGE, AND SIGNAL

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5999	3	21
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
47117.1.1	N/A	P.E.	
47117.2.1	N/A	ROW	
47117.2.1	N/A	UTIL.	
47117.3.1	N/A	CONSTR.	

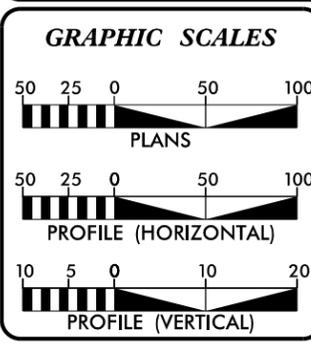
VICINITY MAP



★ PROPOSED SIGNAL
 A PORTION OF THIS PROJECT IS WITHIN THE MUNICIPAL BOUNDARIES OF SMITHFIELD.
 CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD ____

ONLY RIGHT OF WAY AUTHORIZATION FOR PARCELS 2, 3, 4, AND 5.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



DESIGN DATA
 ADT 2018 = 3,600
 ADT 2040 = 4,100

V = 30 MPH

FUNC CLASS =
 URBAN COLLECTOR
 SUBREGIONAL TIER

PROJECT LENGTH

LENGTH OF ROADWAY TIP PROJECT U-3334B = 0.628 MILES

Prepared In the Office of:

Stantec

Stantec Consulting Services Inc.
801 Jones Franklin Road, Suite 300
Raleigh, NC 27609
Tel: (919) 851-8999 Fax: (919) 851-7024 www.stantec.com License No. F-0672

for the North Carolina Department of Transportation

2016 STANDARD SPECIFICATIONS	STANTEC CONTACT
RIGHT OF WAY DATE: August 18, 2017(Partial)	STEVE SMALLWOOD, PE PROJECT ENGINEER
LETTING DATE: January xx, 2018	NCDOT CONTACT: MATT CLARKE, PE

HYDRAULICS ENGINEER

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: _____ P.E.





WBS: 47117.2.1
TIP: U-5999
COUNTY: Johnston
DESCRIPTION: Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)
SUBJECT: Roadway Subsurface Investigation – Inventory

Roadway Subsurface Investigation Report - Inventory

Kellie Road from Booker Dairy Road (SR 1923) to Buffalo Road (SR 1003)
Johnston County, North Carolina
WBS: 47117.2.1 TIP: U-5999
Falcon Project No.: G17032.00

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

December 8, 2017

PROJECT DESCRIPTION

This project consists of 0.76 miles of proposed new roadway in Johnston County. Existing Kellie Road will be extended from its terminus just north of Booker Dairy Road north and west to Buffalo Road. Buffalo Road will be widened with additional turn lanes to accommodate the new intersection with Kellie Road.

The investigation was conducted between October 31st, 2017 and November 1st, 2017 in general accordance with our Proposal to Provide Geotechnical Engineering Services, dated April 27th, 2017. 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 thirteen (13) Standard Penetration Test (SPT) borings, two (2) pavement cores with SPT testing and one (1) pavement core with a hand auger boring were performed for the proposed roadway alignments. All mechanical borings were drilled using a BK-51 Track drill rig equipped with 2 ¼-inch inside diameter hollow-stem augers, and SPT testing was performed with an automatic hammer. Representative soil samples, collected with a split-barrel sampler or hand auger, were selected for laboratory testing to verify visual field classifications. In addition, a bulk sample was collected for standard Proctor compaction and California Bearing Ratio (CBR) testing.



The following alignments, totaling approximately 0.76 miles were investigated.

<u>Alignment</u>	<u>Station (ft)</u>
-L- (Kellie Drive)	16+99.29—49+75.52
-Y1- (Buffalo Rd)	11+60—19+48

AREAS OF SPECIAL GEOTECHNICAL INTEREST

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

<u>Alignment</u>	<u>Station (ft)</u>
-L-	47+50 to 49+00

- II. The following locations contain very soft to soft/very loose soils with an N-value less than 4 near the ground surface:

<u>Alignment</u>	<u>Station (ft)</u>
-L-	31+00
-L-	39+00
-L-	42+00 to 46+00

- III. 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-	28+00 – 32+00
-L-	36+00 – 40+00
-L-	42+00 – 48+00

- IV. Alluvial soils were encountered near the following locations. The potential for wet, soft or organic soils should be anticipated at these locations:

<u>Alignment</u>	<u>Station (ft)</u>
-L-	31+00
-L-	39+00

Isolated alluvial soils are likely to exist elsewhere on the site between borings in proximity to natural waterways.

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 Terrace Deposits and Upland Sediments of the Tertiary period. These deposits are noted to consist of gravel, clayey sand, and sand, with minor iron-oxide cemented sandstone.

Existing site topography is typical of North Carolina's coastal region. The site lies northeast of the town of Smithfield, NC. The corridor begins from the small portion of Kellie Road already constructed at Booker Dairy Road and extends north to Buffalo Road. Topography gradually grades upward in either direction away from the small stream crossing near station 37+00 to 38+00 traversing the middle of the corridor.

At the time of scoping, Kellie Road was paved up to station 16+53.82. Concurrently with our investigation, construction was underway on an extension up to around station 23+00. At the time of our field work, the roadway subgrade appeared to have been graded and prepared up to this point and therefore no borings were performed between existing pavement and station 24+00.

SOIL PROPERTIES

A variety of soils were encountered along the project, including existing roadway embankments, alluvial deposits, and undivided coastal plain soils. Areas where soils at the ground surface are of a unique origin (i.e. not coastal plain soils) are approximately delineated on the boring location plans based on subsurface conditions encountered in nearby borings, and various topographical, vegetative, or other visual surface features.

Topsoil and rootmat was encountered in grassy, brushy, and wooded areas ranging in thickness from 0.1 to 0.5 feet, and typically on the order of 0.3 feet and consisting of sandy clay.

Roadway Embankment soils were encountered at the ground surface beneath existing roadways. These soils consist of up to 3 feet of moist, stiff to very stiff, silty and sandy clay (A-6, A-7).

Alluvial soils were encountered at the ground surface near the existing water features. These soils extended to depths of up to approximately 3 feet and consist of wet, very soft sandy silt (A-4) and moist, very loose silty sand (A-2-4) with trace amounts of organic material.

Undivided Coastal Plain soils were encountered at the ground surface, or beneath roadway embankments or alluvial deposits. These soils consist of dry to saturated, loose to dense, clayey, silty and clean sand (A-2-4, A-2-6, A-3) and soft to hard, sandy clay and silt, and silty clays (A-4, A-6, A-7).

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.

The project crosses two small streams. Groundwater was observed at shallow depths near these streams and in low lying areas. Detailed groundwater measurements are included in the attached subsurface profiles and cross sections, and noted areas of shallow groundwater are included in the Areas of Special Geotechnical Interest earlier in this report.

ADDITIONAL LABORATORY TESTING

The following bulk samples were obtained:

<u>Sample</u>	<u>Location</u>	<u>Depth (ft)</u>	<u>Test</u>
BS-1	41+00, CL, -L-	1 – 10.0	California Bearing Ratio, Standard Proctor

Classification test results for the bulk sample are included in the subsurface profiles and the Standard Proctor and California Bearing Ratio (CBR) data is attached in Appendix B.



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".

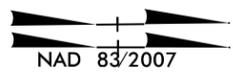
W. Scott Hunsberger, PE
Geotechnical Engineer

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

Jeremy R. Hamm, PE
Geotechnical Engineering Manager

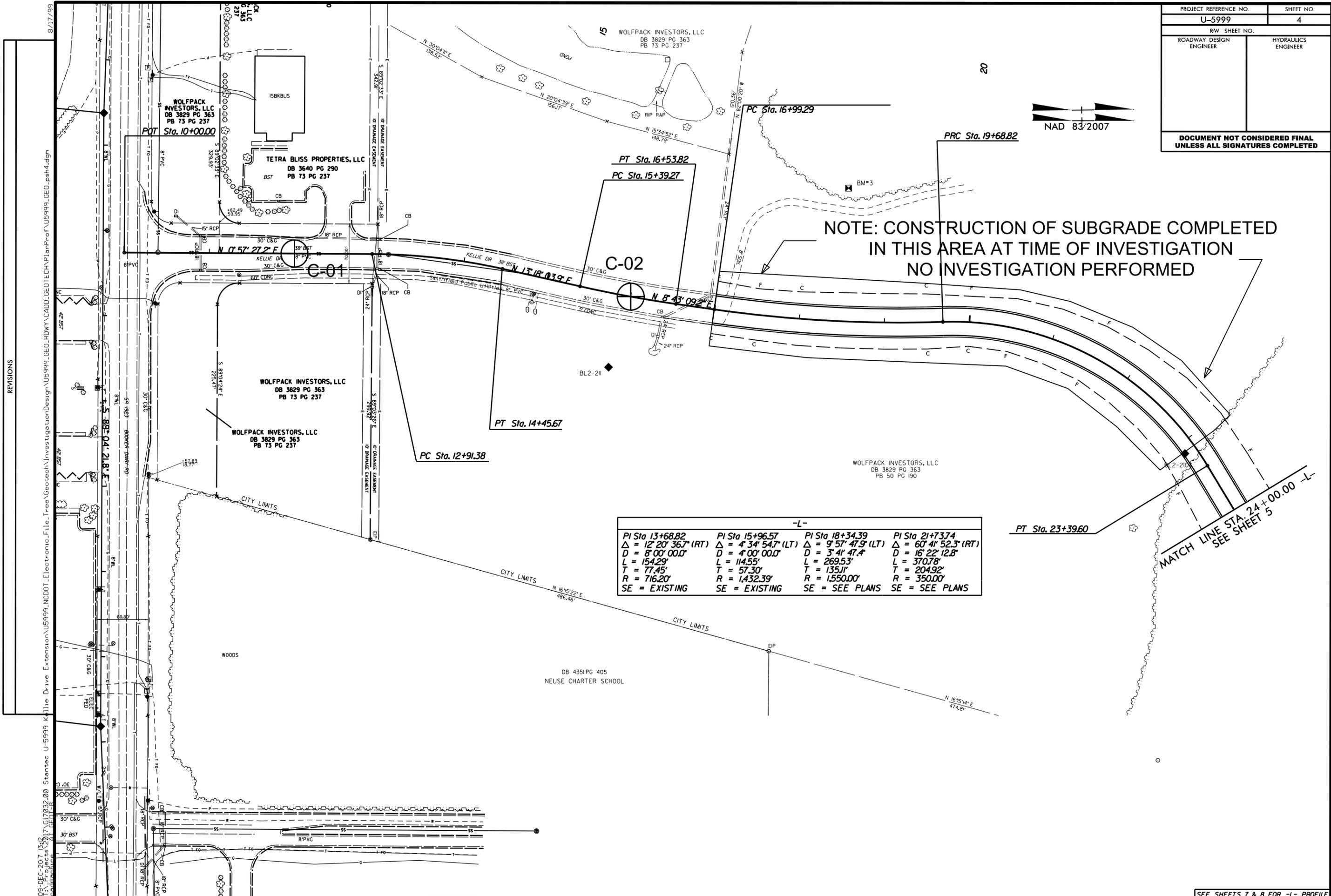


PROJECT REFERENCE NO.	SHEET NO.
U-5999	4
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



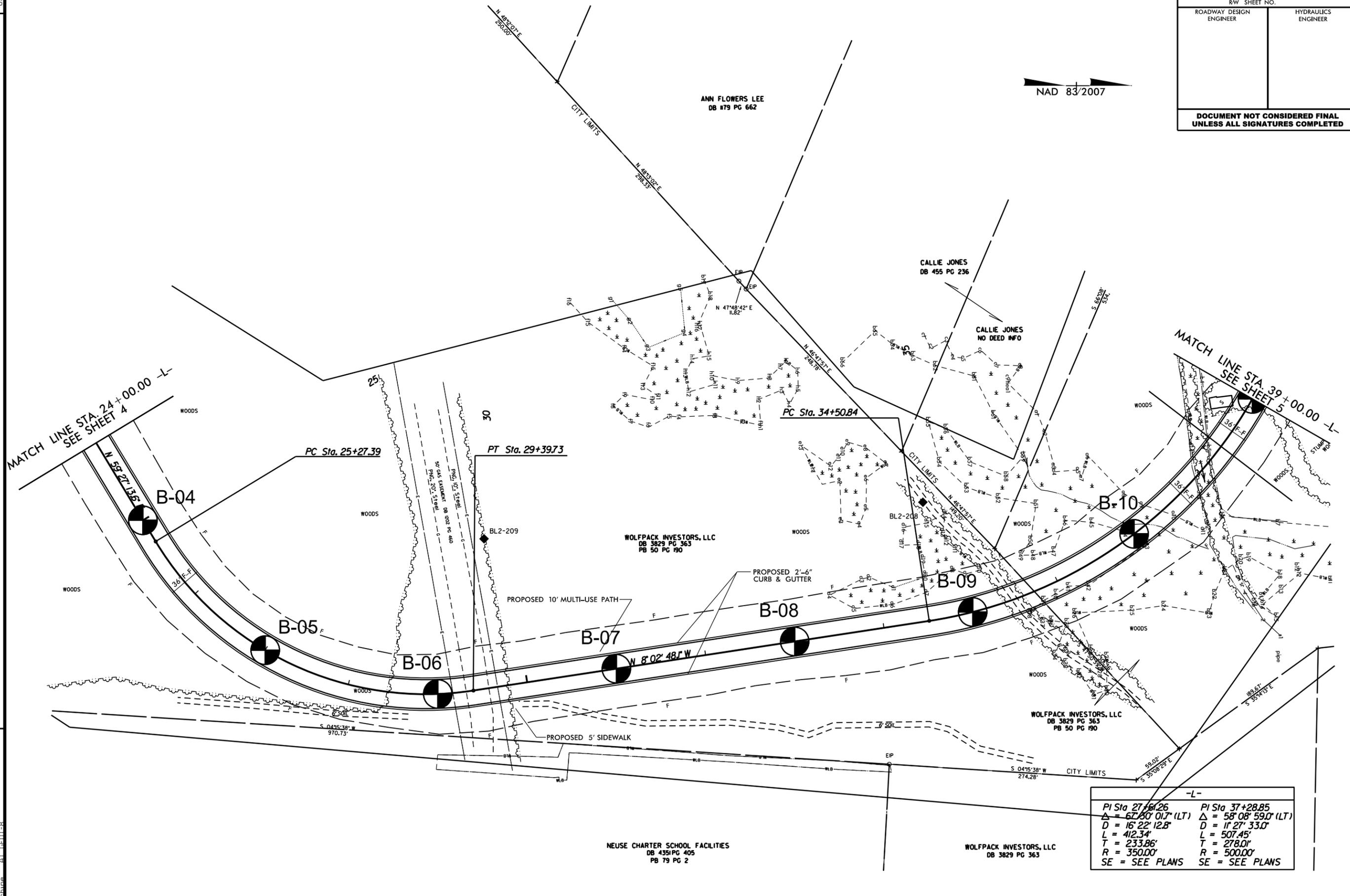
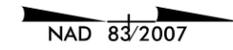
NOTE: CONSTRUCTION OF SUBGRADE COMPLETED
IN THIS AREA AT TIME OF INVESTIGATION
NO INVESTIGATION PERFORMED

-L-			
PI Sta 13+68.82	PI Sta 15+96.57	PI Sta 18+34.39	PI Sta 21+73.74
$\Delta = 12^{\circ} 20' 36.7''$ (RT)	$\Delta = 4^{\circ} 34' 54.7''$ (LT)	$\Delta = 9^{\circ} 57' 47.9''$ (LT)	$\Delta = 60^{\circ} 41' 52.3''$ (RT)
D = 8' 00' 00.0"	D = 4' 00' 00.0"	D = 3' 41' 47.4"	D = 16' 22' 12.8"
L = 154.29'	L = 114.55'	L = 269.53'	L = 370.78'
T = 77.45'	T = 57.30'	T = 135.11'	T = 204.92'
R = 716.20'	R = 1,432.39'	R = 1,550.00'	R = 350.00'
SE = EXISTING	SE = EXISTING	SE = SEE PLANS	SE = SEE PLANS



REVISIONS
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PROJECT REFERENCE NO.	SHEET NO.
U-5999	5
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



-L-	
PI Sta 27+61.26	PI Sta 37+28.85
$\Delta = 67^{\circ}30' 01.7\"$ (LT)	$\Delta = 58^{\circ}08' 59.0\"$ (LT)
D = 16' 22' 12.8"	D = 11' 27' 33.0"
L = 412.34'	L = 507.45'
T = 233.86'	T = 278.01'
R = 350.00'	R = 500.00'
SE = SEE PLANS	SE = SEE PLANS

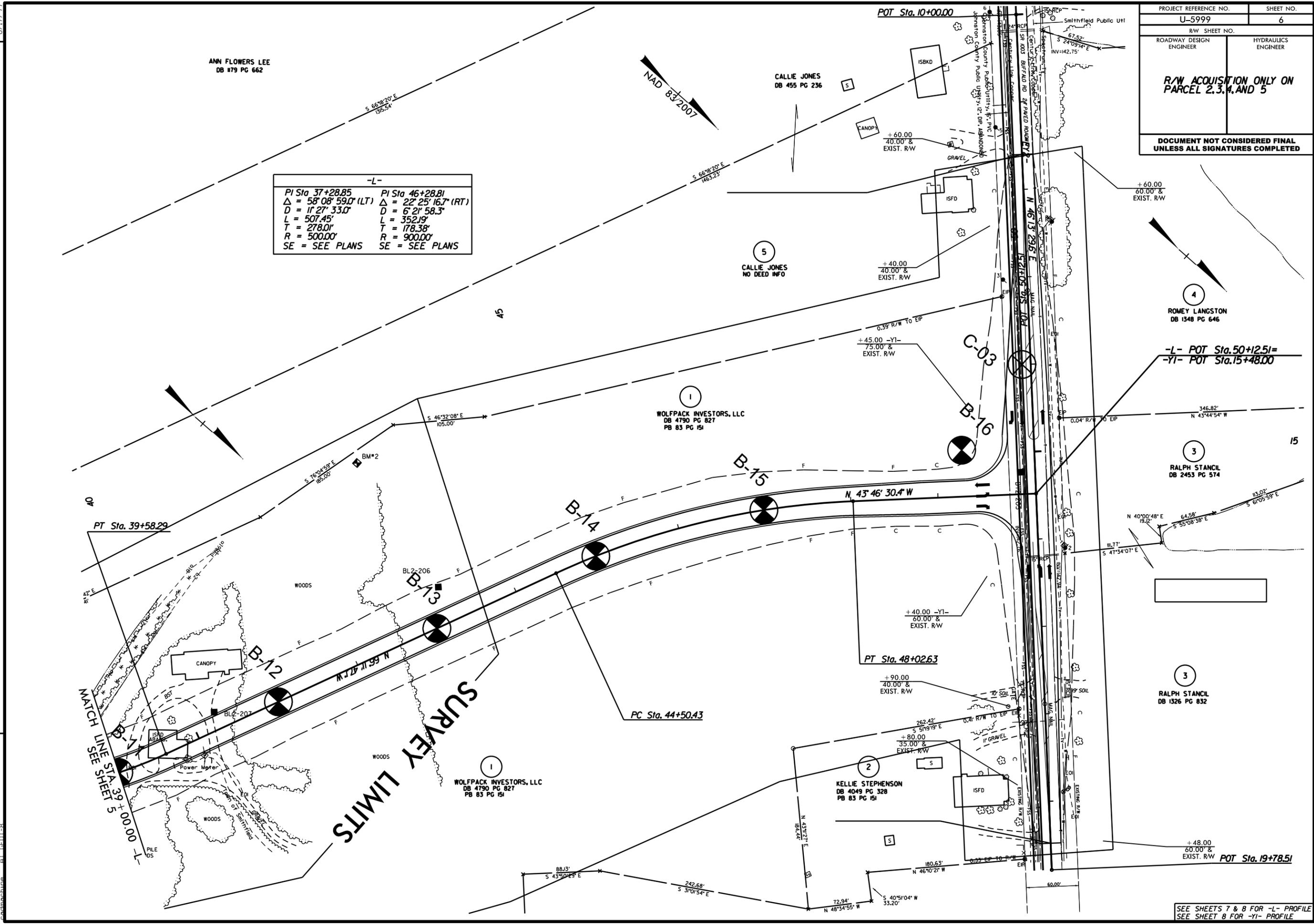
SEE SHEETS 7 & 8 FOR -L- PROFILE

REVISIONS

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PROJECT REFERENCE NO.	SHEET NO.
U-5999	6
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
RAW ACQUISITION ONLY ON PARCEL 2, 3, 4, AND 5	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

-L-	
PI Sta 37+28.85	PI Sta 46+28.81
$\Delta = 58^{\circ} 08' 59.0" (LT)$	$\Delta = 22^{\circ} 25' 16.7" (RT)$
D = 11' 27' 33.0"	D = 6' 21' 58.3"
L = 507.45'	L = 352.19'
T = 278.01'	T = 178.38'
R = 500.00'	R = 900.00'
SE = SEE PLANS	SE = SEE PLANS



SURVEY LIMITS

MATCH LINE SEE SHEET 5

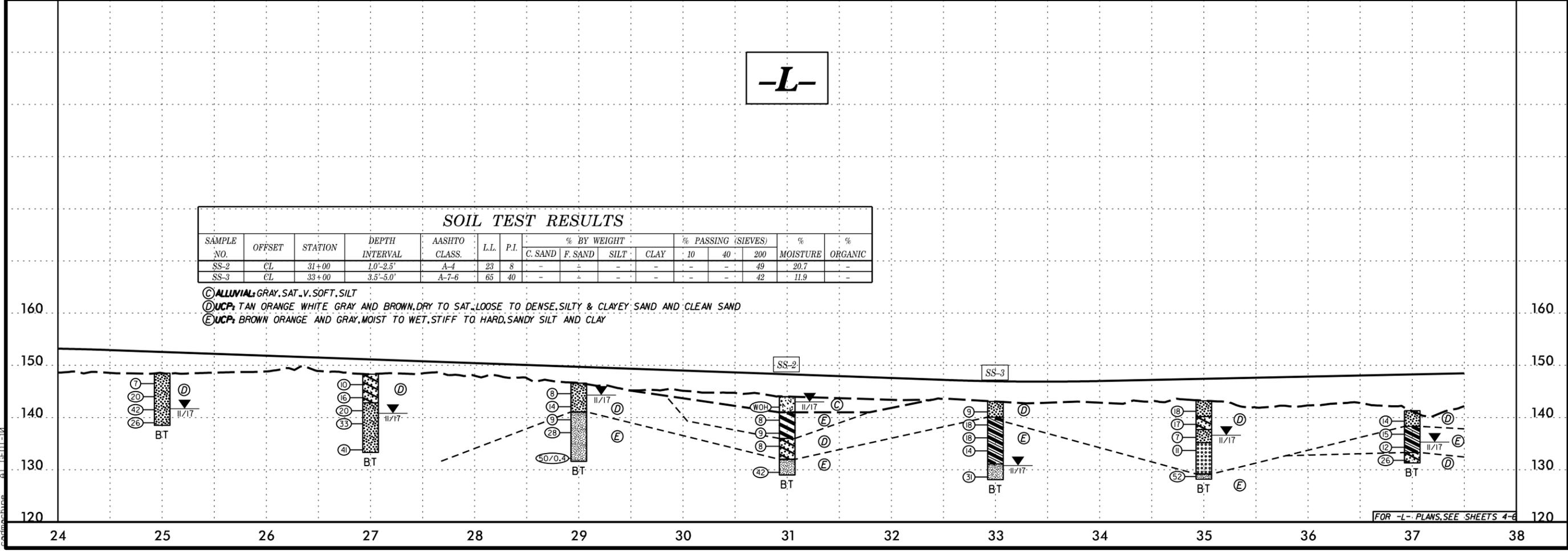
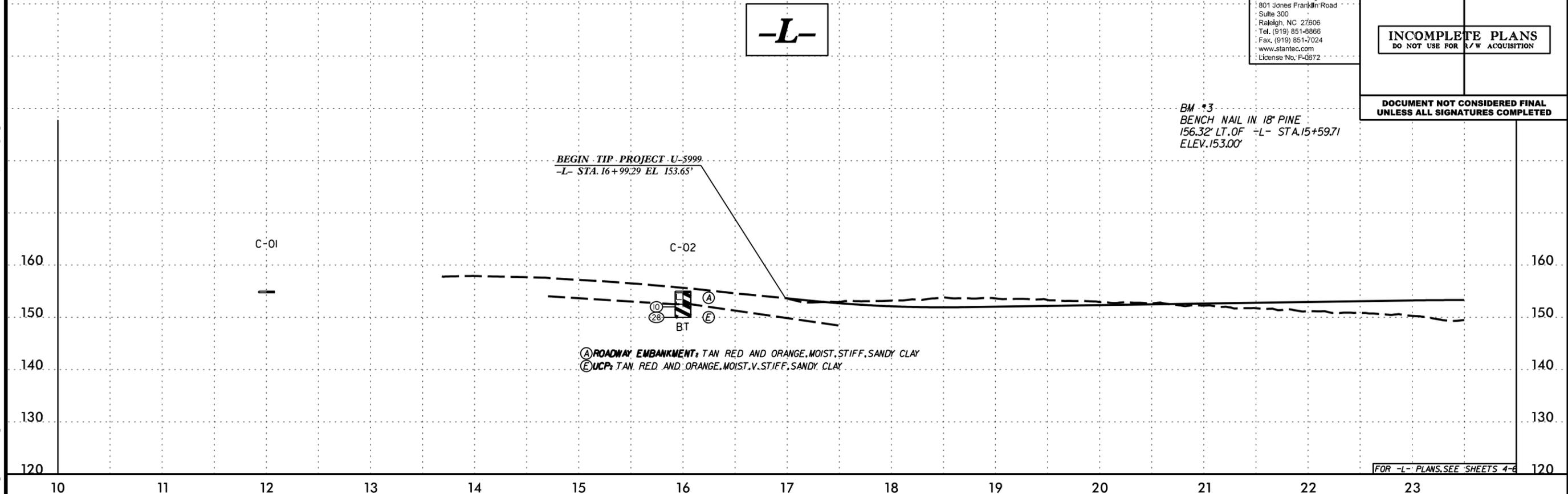
SEE SHEETS 7 & 8 FOR -L- PROFILE
SEE SHEET 8 FOR -YI- PROFILE

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 8/17/19

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 5/28/99

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

PROJECT REFERENCE NO. U-5999	SHEET NO. 7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



FOR -L- PLANS, SEE SHEETS 4-6

5/28/99
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 10/10/2017 10:10:10 AM
 cadman@stn.com



Stantec Consulting Services Inc.
 801 Jones Franklin Road
 Suite 300
 Raleigh, NC 27806
 Tel. (919) 851-8866
 Fax. (919) 851-7024
 www.stantec.com
 License No. P-0672

PROJECT REFERENCE NO.	U-5999	SHEET NO.	8
ROADWAY DESIGN ENGINEER	INCOMPLETE PLANS		HYDRAULICS ENGINEER
DO NOT USE FOR R/W ACQUISITION			

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

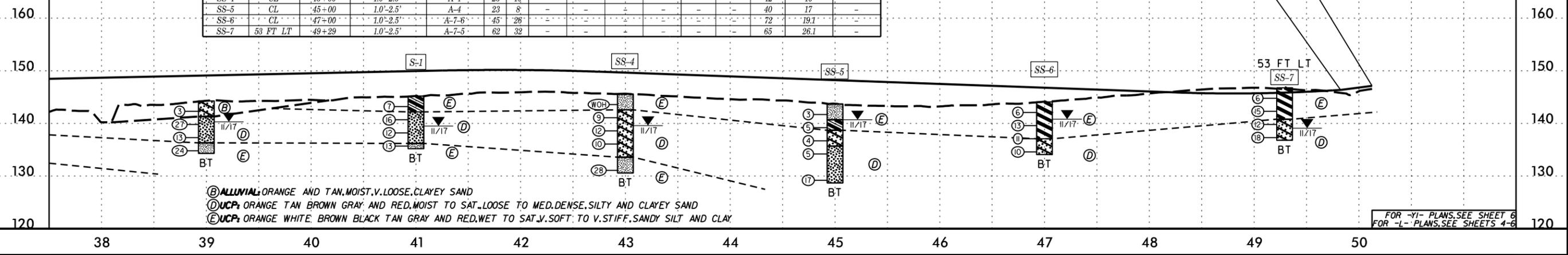
-L-

BM *2
 BENCH NAIL IN 12" OAK
 210.0' LT. OF -L- STA. 39+49.88
 ELEV. 146.10'

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	LL	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-1	CL	41+00	1.0'-10.0'	A-2-7	46	25	-	-	-	-	-	29	18.5	-	
SS-4	CL	43+00	1.0'-2.5'	A-4	23	10	-	-	-	-	-	42	16	-	
SS-5	CL	45+00	1.0'-2.5'	A-4	23	8	-	-	-	-	-	40	17	-	
SS-6	CL	47+00	1.0'-2.5'	A-7-6	45	26	-	-	-	-	-	72	19.1	-	
SS-7	53 FT LT	49+29	1.0'-2.5'	A-7-5	62	32	-	-	-	-	-	65	26.1	-	

END TIP PROJECT U-5999
 -L- STA. 50+21.51 EL 147.14' =
 -YI- STA. 15+48.00

-L- STA. 49+82.51 EL 146.38' =
 -YI- STA. 15+48.00, EOT 15' LT

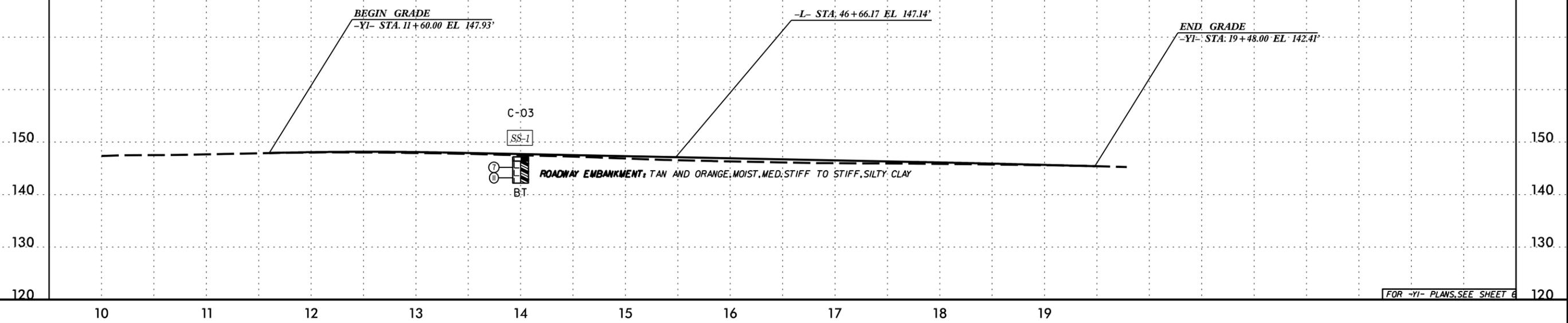


(B) ALLUVIAL, ORANGE AND TAN, MOIST, V. LOOSE, CLAYEY SAND
 (D) UCP, ORANGE TAN BROWN GRAY AND RED, MOIST TO SAT., LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND
 (E) UCP, ORANGE WHITE, BROWN BLACK TAN GRAY AND RED, WET TO SAT., V. SOFT TO V. STIFF, SANDY SILT AND CLAY

FOR -YI- PLANS, SEE SHEET 6
FOR -L- PLANS, SEE SHEETS 4-6

-YI-

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	LL	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C. SAND	F. SAND	SILT	CLAY	10	40	200		
SS-1	10 FT RT	14+00	1.0'-2.5'	A-6	34	17	-	-	-	-	-	74	17.8	-	



C-03
 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19)
 ROADWAY EMBANKMENT: TAN AND ORANGE, MOIST, MED. STIFF TO STIFF, SILTY CLAY

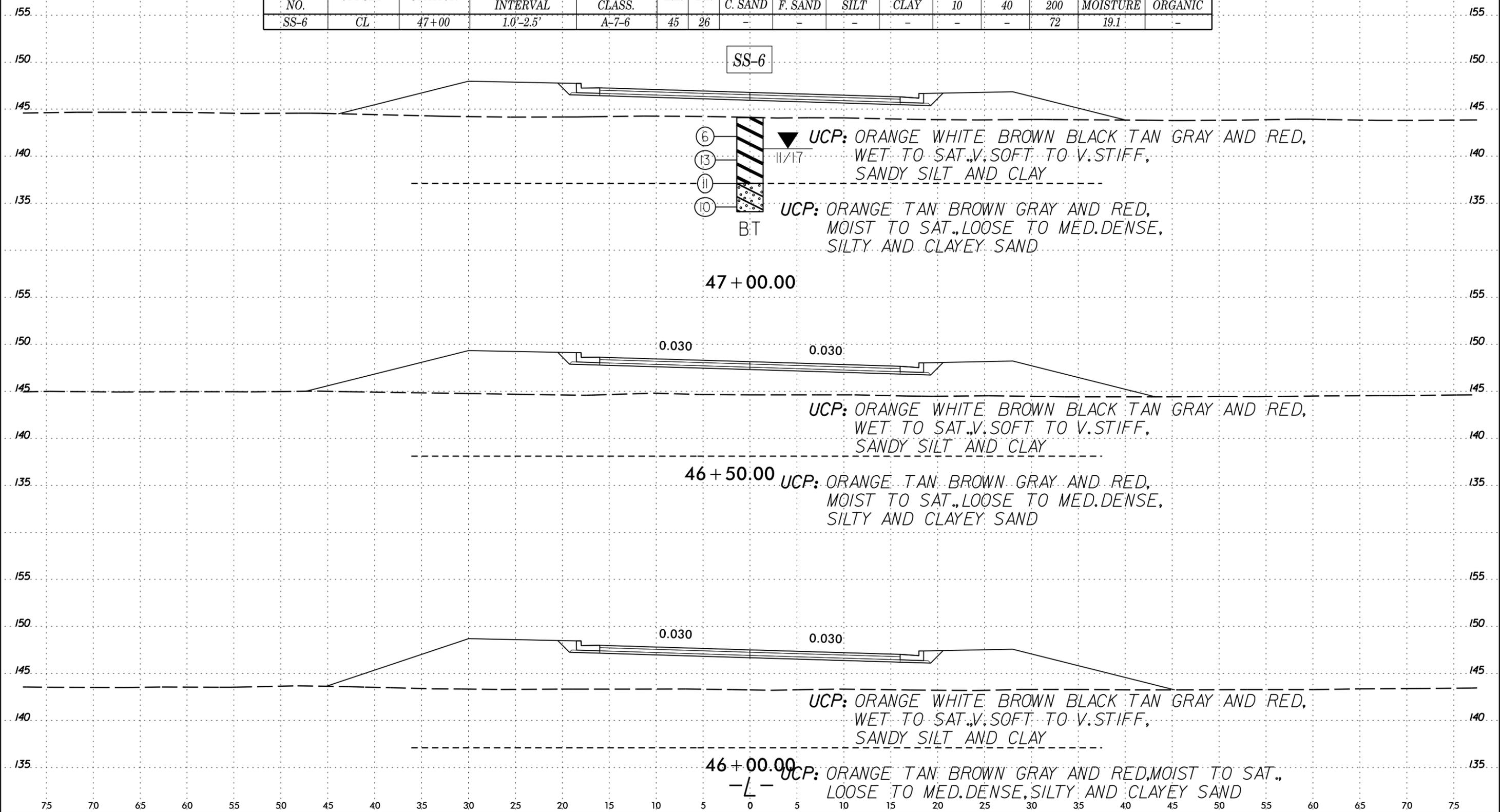
FOR -YI- PLANS, SEE SHEET 6

08-DEC-2017 17:02
 I:\Projects\2017\181702200 Stantec U-5999 Kellie Drive Extension\U5999_NCDOT\Electronic\File_Tree\Geotech\Investigation\Design\U5999_GEO_PDWY\CADD_GEO\TECH\XSC\U5999_GEO_XPL.L.dgn
 cadman@stn.com



75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

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-6	CL	47+00	1.0'-2.5'	A-7-6	45	26	-	-	-	-	-	-	72	19.1	-

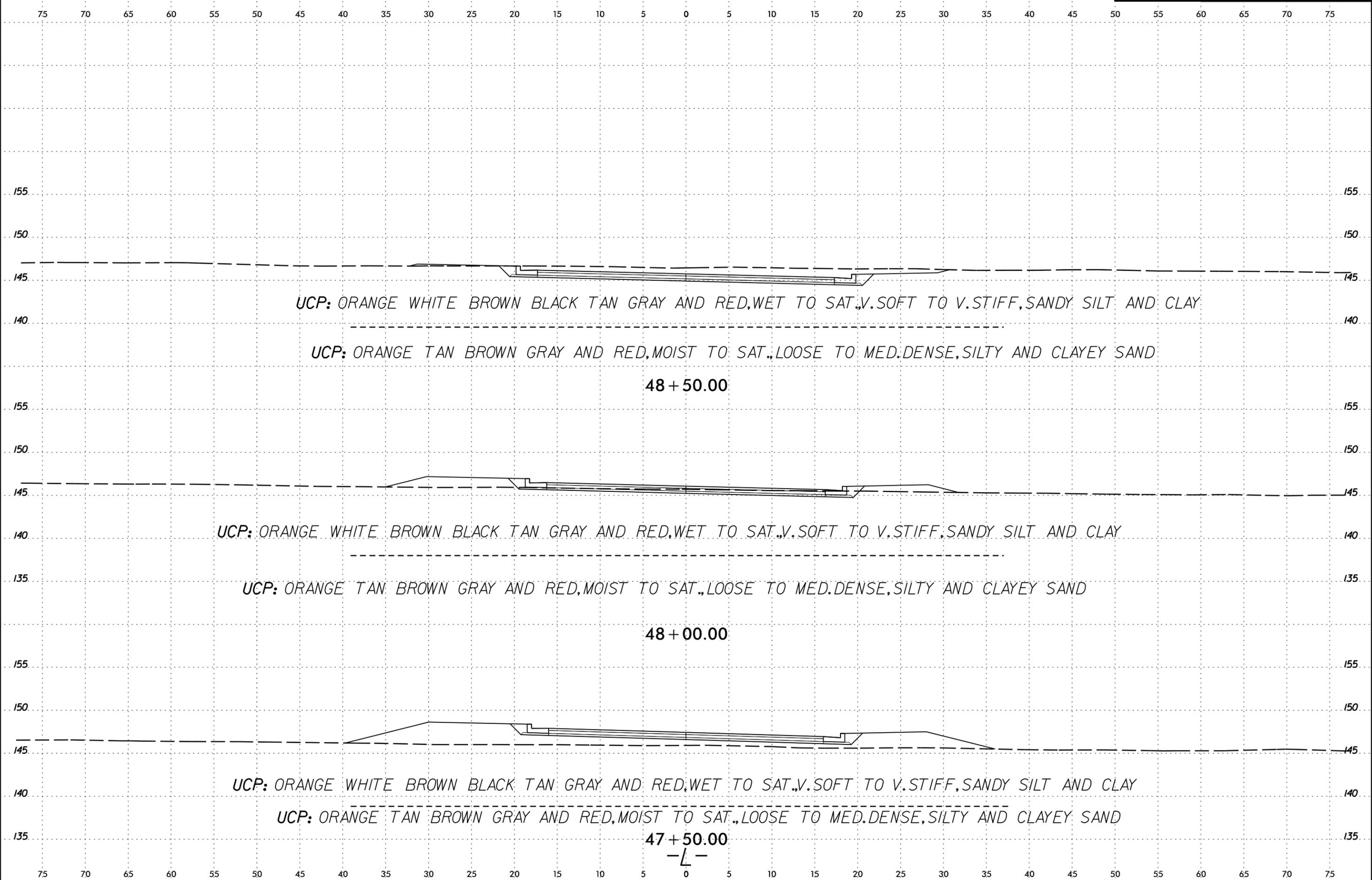


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6/23/16



PROJ. REFERENCE NO.	SHEET NO.
U-5999	10



UCP: ORANGE WHITE BROWN BLACK TAN GRAY AND RED, WET TO SAT., V. SOFT TO V. STIFF, SANDY SILT AND CLAY

UCP: ORANGE TAN BROWN GRAY AND RED, MOIST TO SAT., LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND

48 + 50.00

UCP: ORANGE WHITE BROWN BLACK TAN GRAY AND RED, WET TO SAT., V. SOFT TO V. STIFF, SANDY SILT AND CLAY

UCP: ORANGE TAN BROWN GRAY AND RED, MOIST TO SAT., LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND

48 + 00.00

UCP: ORANGE WHITE BROWN BLACK TAN GRAY AND RED, WET TO SAT., V. SOFT TO V. STIFF, SANDY SILT AND CLAY

UCP: ORANGE TAN BROWN GRAY AND RED, MOIST TO SAT., LOOSE TO MED. DENSE, SILTY AND CLAYEY SAND

47 + 50.00

-L-

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
APPENDIX A
PAVEMENT INVESTIGATION DATA

REFERENCE: U-5999

PROJECT: 47117

INITIALS

DATE



PAVEMENT CORE C-01



PAVEMENT CORE C-02



PAVEMENT CORE C-03



FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 CARY, NC 27513
 PHONE: 919.871.0800
 FAX: 919.871.0803

PAVEMENT CORE PHOTOGRAPHS

KELLIE ROAD FROM BOOKER DAIRY ROAD
 (SR 1923) TO BUFFALO ROAD (SR 1003)
 JOHNSTON / NORTH CAROLINA
 TIP NO.: U-5999
 FALCON PROJECT NO.: G17032.00

DCP TEST DATA

File Name: C-1

Project: G17032.00

Date: 1-Nov-17

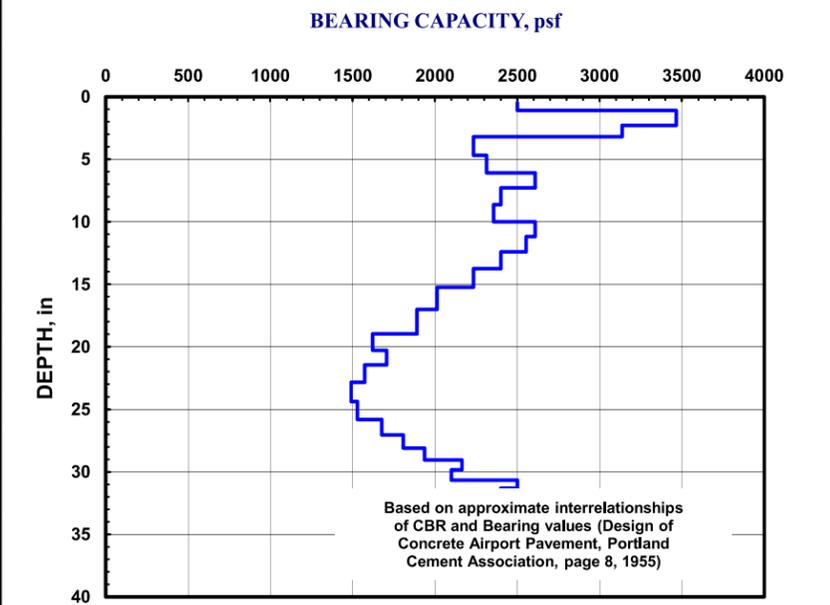
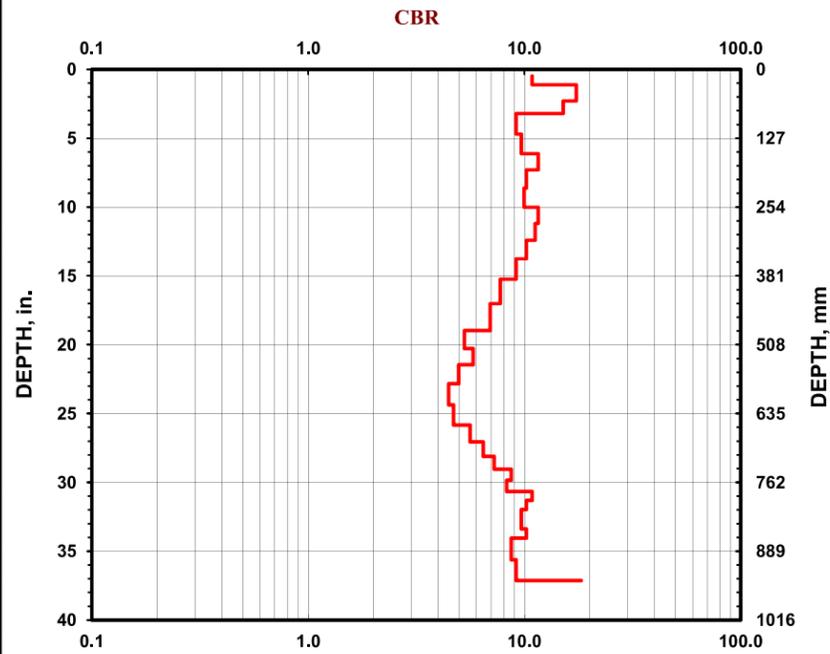
Location: Johnston, NC

Soil Type(s): High plasticity Clay

Hammer
 10.1 lbs.
 17.6 lbs.
 Both hammers used

Soil Type
 CH
 CL
 All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	12	2
1	28	2
1	38	2
2	58	2
2	81	2
2	119	2
2	155	2
2	185	2
2	219	2
2	254	2
2	284	2
2	315	2
2	349	2
2	387	2
2	432	2
2	482	2
1	515	2
1	545	2
1	580	2
1	619	2
1	656	2
1	687	2
1	714	2
1	738	2
1	758	2
1	779	2
1	795	2
1	812	2
1	830	2
1	848	2
1	865	2
1	885	2
1	905	2
1	924	2
1	943	2



DCP TEST DATA

File Name: C-2

Project: G17032.00

Date: 1-Nov-17

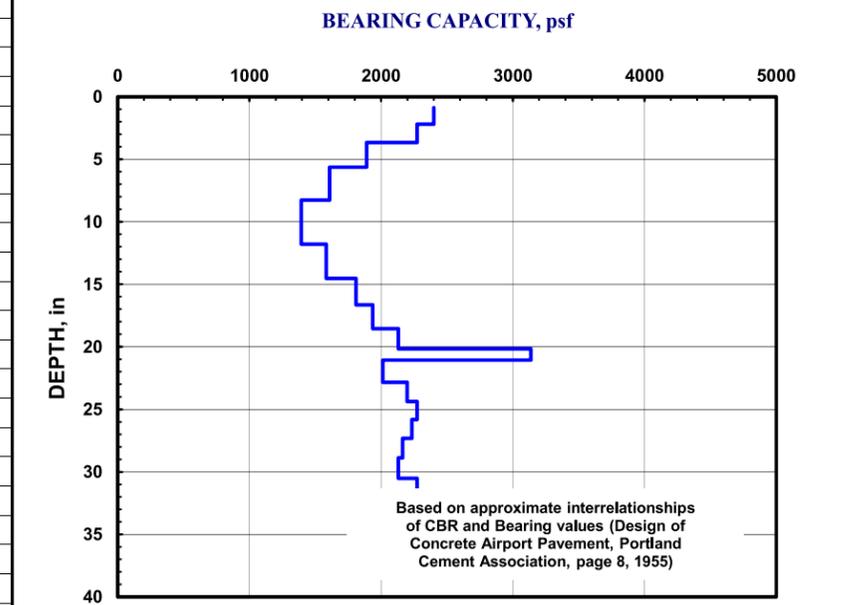
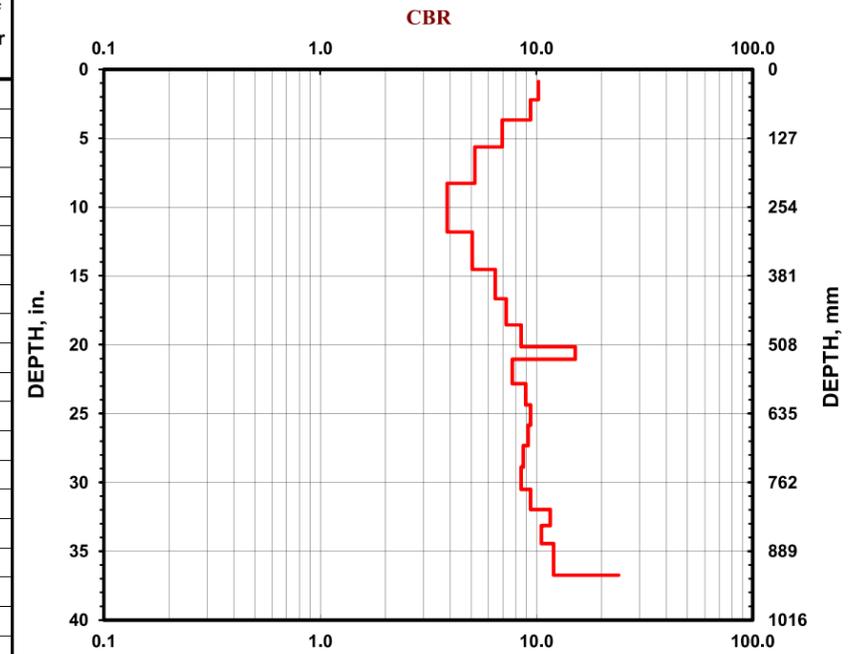
Location: Johnston, NC

Soil Type(s): High plasticity Clay

Hammer
 10.1 lbs.
 17.6 lbs.
 Both hammers used

Soil Type
 CH
 CL
 All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
2	22	2
2	56	2
2	93	2
2	143	2
2	210	2
2	300	2
2	369	2
2	423	2
2	471	2
2	512	2
2	535	2
2	580	2
2	619	2
2	656	2
2	694	2
2	734	2
2	775	2
2	812	2
2	842	2
2	875	2
2	904	2
2	933	2



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
APPENDIX B
LABORATORY RESULTS

REFERENCE: U-5999

PROJECT: 34462

INITIALS

DATE

**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 C
December 4, 2017

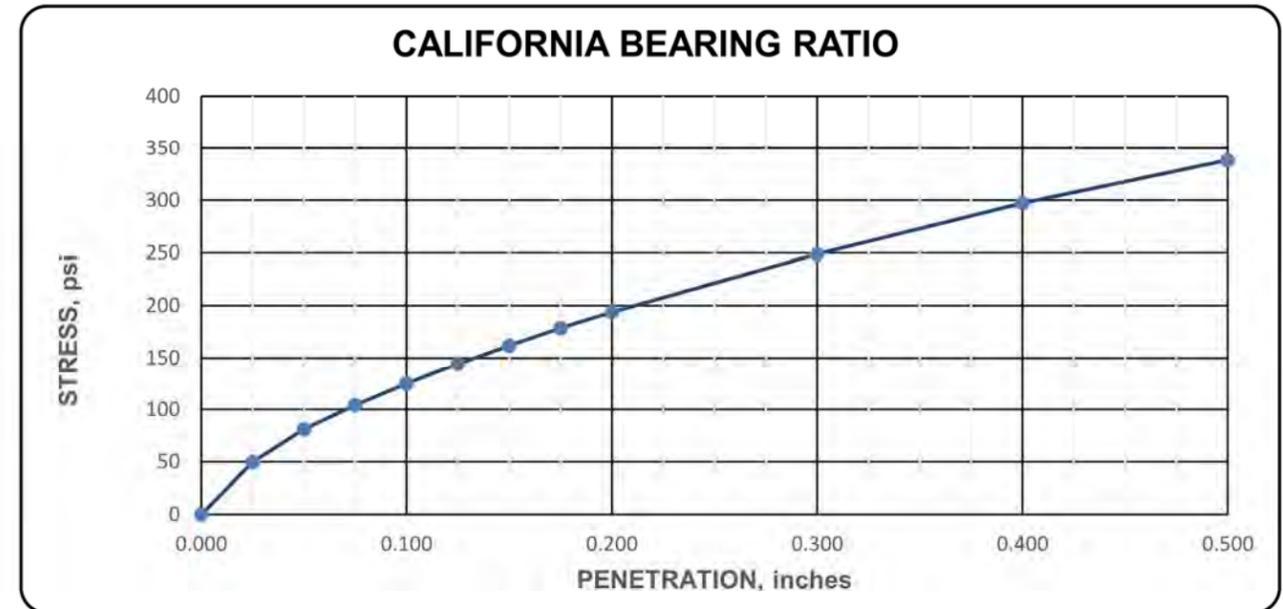
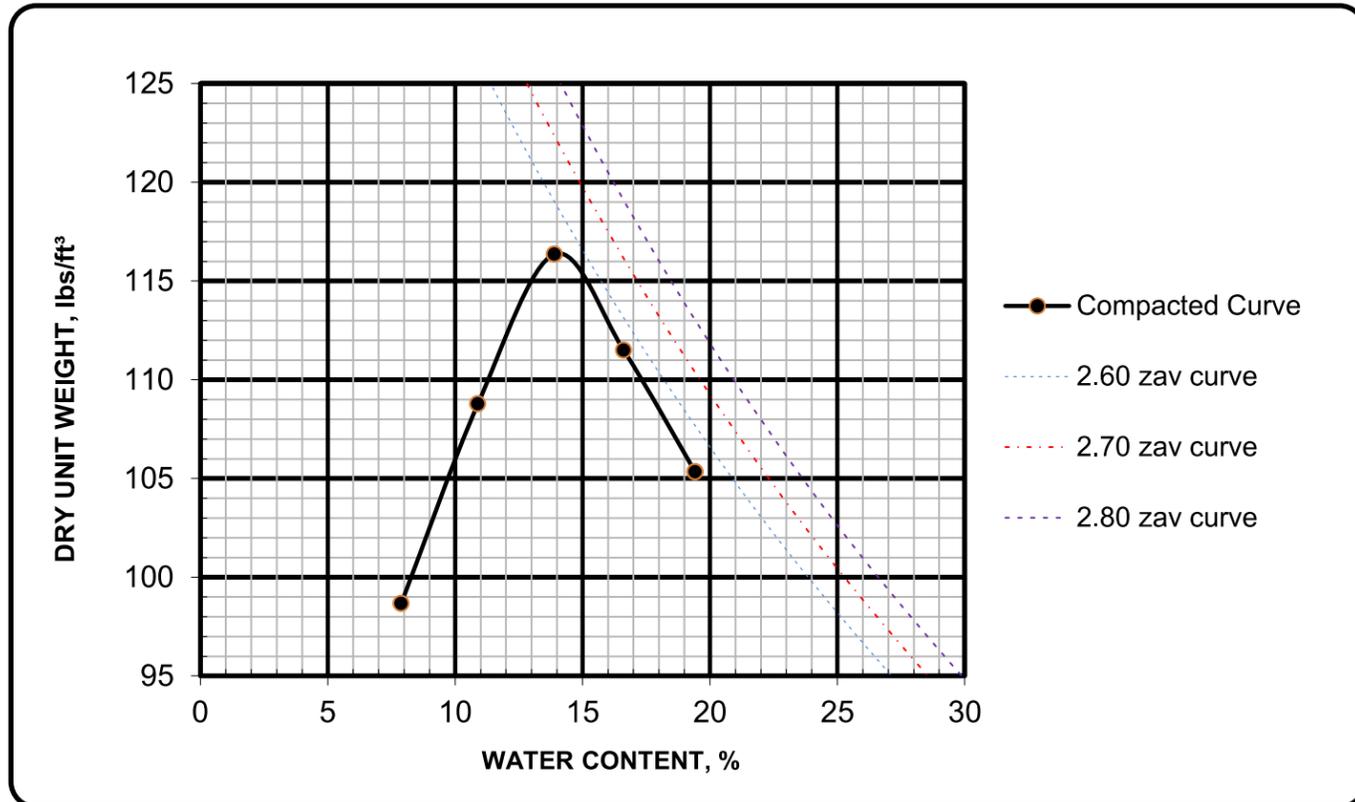


**REPORT OF CALIFORNIA BEARING RATIO (CBR)
OF LABORATORY-COMPACTED SOILS**
Performed in General Accordance with AASHTO T 193
December 5, 2017



PROJECT NAME: U-5999 Kellie Rd Extension
PROJECT NUMBER: G17032.00
SAMPLE IDENTIFICATION: B-12, BS-1, 1.0-10.0'
SAMPLE DESCRIPTION: Brown clayey sand

PROJECT NAME: U-5999 Kellie Rd Extension
PROJECT NUMBER: G17032.00
SAMPLE IDENTIFICATION: B-12, BS-1, 1.0-10.0'



MAXIMUM DENSITY, lbs/ft³: 116.4
OPTIMUM MOISTURE CONTENT, %: 14.1

AS-RECEIVED WATER CONTENT: 18.5
LIQUID LIMIT: 46
PLASTIC LIMIT: 21
PLASTICITY INDEX: 25
PERCENT FINER NO. 200: 29
AASHTO CLASSIFICATION: A-2-7 (2)

BEARING RATIO:	at 0.1 inches of penetration:	<u>uncorrected</u>	<u>corrected</u>
		12.5	12.5
	at 0.2 inches of penetration:	12.9	12.9

Compaction Method: AASHTO T 193
Maximum Dry Unit Weight, lbs/ft³: 116.4
Optimum Water Content, %: 14.1
Compacted Dry Unit Weight, lbs/ft³: 116.2
Compacted Water Content, %: 13.9
Compaction Percentage: 99.8
Water Content, Top one-inch after test, %: 16.0
Surcharge amount, lbs: 10
Immersion period, hours: 96
Swell, %: 0.0

REMARKS:

REVIEWED BY: John Dailly

Reviewed by: John Dailly