SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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STATE OF NORTH CAROLINA

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY <u>NEW</u> HANOVER

PROJECT DESCRIPTION US 17 BUSINESS (MARKET ST.) FROM LENDIRE ROAD TO MARSH OAKS DRIVE

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-4902D	1	18

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PERSONNEL LINDSAY PUGH COREY FUTRAL T. TRIANTIS W.J. MILLER, CWC MICHAEL D. MASON

INVESTIGATED BY ______CATLIN DRAWN BY <u>DAVID MCPHERSON</u> CHECKED BY <u>STEVEN</u> V. HUDSON SUBMITTED BY STEVEN V. HUDSON



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT SUBSURFACE INVESTIGATION

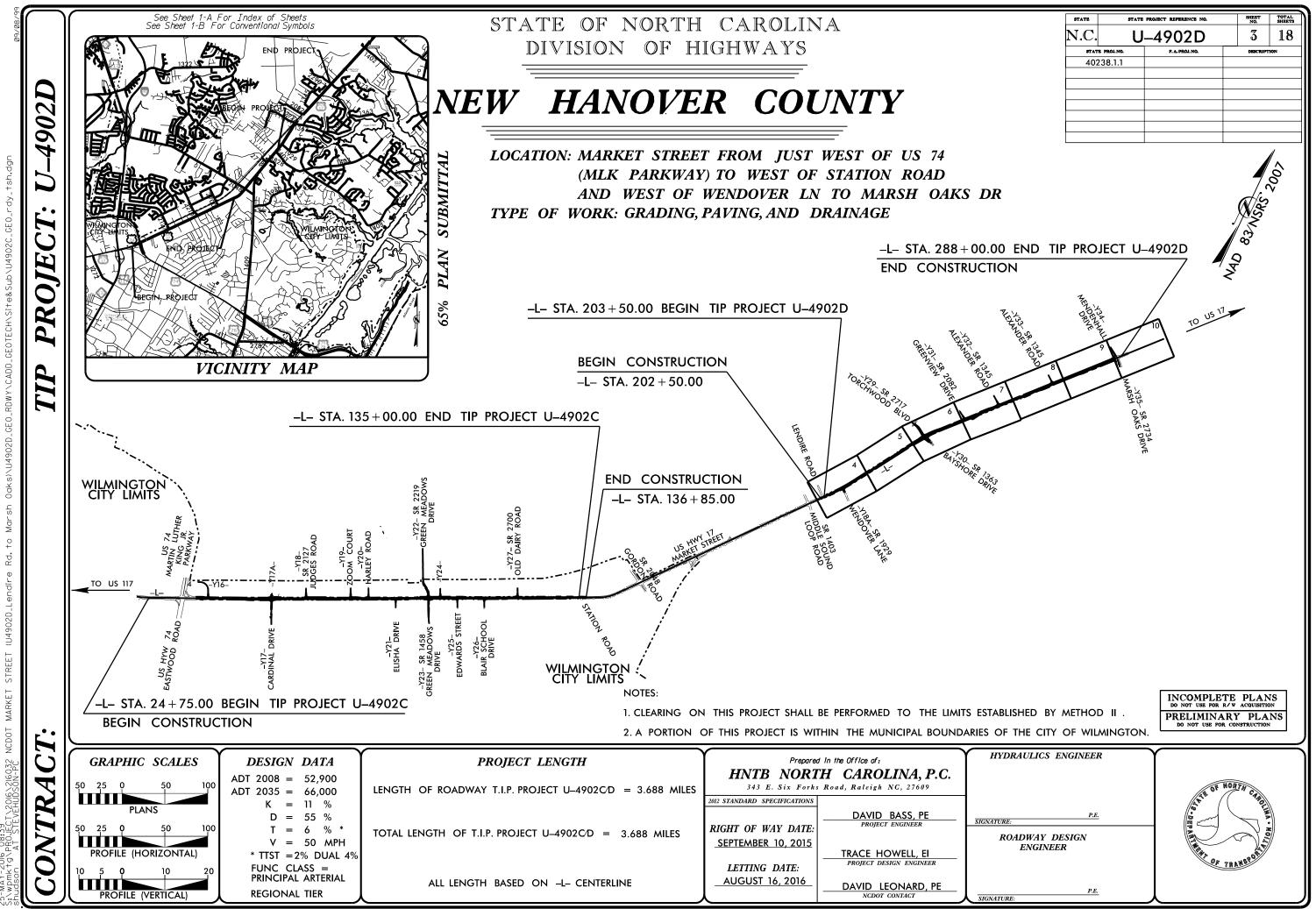
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

	SC	IL DESCRIPTION			GRADATION			ROCK DE	SCRIPTION
BE PENETRATE ACCORDING TO IS BASED	ED WITH A CONTINUOUS FLIC O THE STANDARD PENETRAT O ON THE AASHTO SYSTEM.	MI-CONSOLIDATED, OR WEATHERED GHT POWER AUGER AND YIELD LESS ION TEST (AASHTO T 206, ASTM D BASIC DESCRIPTIONS GENERALLY I	S THAN 100 BLOWS PER FOOT 01586). SOIL CLASSIFICATION NCLUDE THE FOLLOWING:	UNIFORMLY GRADED - IN	TES A GOOD REPRESENTATION OF PARTICL NDICATES THAT SOIL PARTICLES ARE ALL S A MIXTURE OF UNIFORM PARTICLE SIZE	APPROXIMATELY THE SAME SIZE. ES OF TWO OR MORE SIZES.	ROCK LINE INDICAT SPT REFUSAL IS P BLOWS IN NON-COA	TES THE LEVEL AT WHICH NON-CO PENETRATION BY A SPLIT SPOON S	WOULD YIELD SPT REFUSAL IF TESTI ASTAL PLAIN MATERIAL WOULD YIELD AMPLER EQUAL TO OR LESS THAN Ø. ANSITION BETWEEN SOIL AND ROCK
AS MIN	NERALOGICAL COMPOSITION, A	AASHTO CLASSIFICATION, AND OTHE ANGULARITY, STRUCTURE, PLASTICIT	Y,ETC. FOR EXAMPLE,	THE ANGULARIT'	Y OR ROUNDNESS OF SOIL GRAINS IS DES			ARE TYPICALLY DIVIDED AS FOLLO	WS:
VERY		AND AASHTO CLASSIFI			IGULAR, SUBROUNDED, OR ROUNDED. MINERALOGICAL COMPOSI		WEATHERED ROCK (WR)	100 BLOWS PER F	
GENERAL CLASS.	Granular Materials (≤ 35% Passing ≢200)	SILT-CLAY MATERIALS (> 35% PASSING =200)	ORGANIC MATERIALS		MES SUCH AS QUARTZ, FELDSPAR, MICA, TA	LC, KAOLIN, ETC.	CRYSTALLINE ROCK (CR)		GRAIN IGNEOUS AND METAMORPHIC RC REFUSAL IF TESTED. ROCK TYPE IN
	A-1-b A-2-4 A-2-5 A-2	A-4 A-5 A-6 A-7 2-6 A-2-7 A-75 A-7-6	A-1, A-2 A-4, A-5 A-3 A-6, A-7	HE USED IN	DESCRIPTIONS WHEN THEY ARE CONSIDE	NED OF SIGNIFICHINCE.	NON-CRYSTALLINE	FINE TO COARSE	GRAIN METAMORPHIC AND NON-COASTA CK THAT WOULD YEILD SPT REFUSAL
SYMBOL 00000				MODEF MODEF	HTLY COMPRESSIBLE	LL < 31 LL = 31 - 50	ROCK (NCR)	COASTAL PLAIN S	DES PHYLLITE, SLATE, SANDSTONE, ET EDIMENTS CEMENTED INTO ROCK, BUT
% PASSING *10 50 MX			GRANULAR SILT- MUCK,	HIGHL	PERCENTAGE OF MATERI	LL > 50	SEDIMENTARY ROCK (CP)	SHELL BEDS, ETC.	CK TYPE INCLUDES LIMESTONE, SANDS
	50 MX 51 MN 25 MX 10 MX 35 MX 35 MX 35	MX 35 MX 36 MN 36 MN 36 MN 36 MN	SOILS SOILS PEAT	ORGANIC MATERIAL	GRANULAR SILT - CLAY SOILS SOILS	OTHER MATERIAL			
MATERIAL PASSING *40 LL – PI 6 M	40 MX 41 MN 40	MX 41 MN 48 MX 41 MN 48 MX 11 MN MN 11 MN 18 MX 18 MX 11 MN 11 MN	SOILS WITH LITTLE OR HIGHLY MODERATE DOCUMENT	TRACE OF ORGANIC MAT LITTLE ORGANIC MAT MODERATELY ORGANIC HIGHLY ORGANIC	ATTER 2 - 3% 3 - 5% TER 3 - 5% 5 - 12%	TRACE 1 - 10% LITTLE 10 - 20% SOME 20 - 35% HIGHLY 35% AND ABOVE	HAMM VERY SLIGHT ROCK (V SLI.) CRYS	MER IF CRYSTALLINE. CGENERALLY FRESH, JOINTS STAINED	NTS MAY SHOW SLIGHT STAINING, ROCK),SOME JOINTS MAY SHOW THIN CLAY C SHINE BRIGHTLY, ROCK RINGS UNDER H
GROUP INDEX Ø USUAL TYPES STONE OF MAJOR GRAVEL	FRAGS. FINE STUTY OR CL		AMOUNTS OF ORGANIC ORGANIC MATTER		GROUND WATER		(SLI.) 1 INCH	H. OPEN JOINTS MAY CONTAIN CLAY) AND DISCOLORATION EXTENDS INTO RC . IN GRANITOID ROCKS SOME OCCASIONA RYSTALLINE ROCKS RING UNDER HAMMEI
MATERIALS SAT GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD	FAIR TO POOR	FAIR TO POOR UNSUITABLE	 ε 	STATIC WATER LEVEL AFTER <u>24</u> HC PERCHED WATER, SATURATED ZONE, OR SPRING OR SEEP		(MOD.) GRANI DULL	ITOID ROCKS, MOST FELDSPARS ARE	ISCOLORATION AND WEATHERING EFFECT DULL AND DISCOLORED, SOME SHOW CLA SHOWS SIGNIFICANT LOSS OF STRENGTH
		S ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS	> LL - 30		MISCELLANEOUS SYMBOL		MODERATELY ALL P	ROCK EXCEPT QUARTZ DISCOLORED	DR STAINED. IN GRANITOID ROCKS.ALL F KAOLINIZATION. ROCK SHOWS SEVERE L
PRIMARY SOIL	COMPACTNESS (RANGE OF UNCONFINED COMPRESSIVE STRENGTH		DE /00E		(MOD. SEV.) AND (IST'S PICK. ROCK GIVES "CLUNK" SOUND
GENERALLY	VERY LOOSE	(N-VALUE) < 4 4 TO 10	(TONS/FT ²)				(SEV.) REDUC TO SC	CED IN STRENGTH TO STRONG SOIL. OME EXTENT. SOME FRAGMENTS OF	
MATERIAL (NON-COHESIV	VE) MEDIUM DENSE DENSE VERY DENSE VERY SOFT	E 10 TO 30 30 TO 50 > 50 < 2	N/A < 0.25		ILL (AF) OTHER Y EMBANKMENT AUGER BORING	CONE PENETROMETER TEST	VERY ALL F SEVERE BUT P	MASS IS EFFECTIVELY REDUCED TO	<u>> 100 BPF</u> DR STAINED. ROCK FABRIC ELEMENTS AF SOIL STATUS, WITH ONLY FRAGMENTS OI DF ROCK WEATHERED TO A DEGREE THAT
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	SOFT MEDIUM STIFF STIFF VERY STIFF	2 TO 4	0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4	INFERRED ROCI		L + TEST BORING WITH CORE	COMPLETE ROCK	REDUCED TO SOIL. ROCK FABRIC N	MAIN. <u>IF TESTED, WOULD YIELD SPT N N</u> DT DISCERNIBLE, OR DISCERNIBLE ONLY NY BE PRESENT AS DIKES OR STRINGERS
	HARD	> 30	> 4	ALLUVIAL SOIL	INSTREETION	0	-		ARDNESS
U.S. STD. SIEVE S		JRE OR GRAIN SIZE	270		RECOMMENDATION SYMBO	JL 5 		IOT BE SCRATCHED BY KNIFE OR SHI RAL HARD BLOWS OF THE GEOLOGIS	ARP PICK. BREAKING OF HAND SPECIMEN T'S PICK.
OPENING (MM)	4.76	2.00 0.42 0.25 0.075 COARSE FINE	5 0.053	- SHALLOW	UNSUITABLE WASTE	ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL	HARD CAN E		NLY WITH DIFFICULTY. HARD HAMMER B
BOULDER (BLDR.)	COBBLE (COB.) GRAVEL (GR.) 305 75	SAND SAND (CSE, SD,) (F SD) SILT CLAY (SL.) (CL.)		ACCEPTABLE DEGRADABLE ROCK ABBREVIATIONS MED MEDIUM	VST - VANE SHEAR TEST	MODERATELY CAN E HARD EXCAN	BE SCRATCHED BY KNIFE OR PICK.	GOUGES OR GROOVES TO 0.25 INCHES DI IST'S PICK. HAND SPECIMENS CAN BE D
	12 3	2.0 0.25 E - CORRELATION OF	0.05 0.005 TERMS	BT - BORING TERMINATED CL CLAY CPT - CONE PENETRATION	D MICA MICACEOUS MOD MODERATELY	WEA WEATHERED γ - UNIT WEIGHT $\gamma_{\rm a}$ - DRY UNIT WEIGHT	MEDIUM CAN E HARD CAN E	BE GROOVED OR GOUGED 0.05 INCHE	S DEEP BY FIRM PRESSURE OF KNIFE C PEICES 1 INCH MAXIMUM SIZE BY HARD
	ERG LIMITS)	DESCRIPTION	FIELD MOISTURE DESCRIPTION	CSE COARSE DMT - DILATOMETER TES1 DPT - DYNAMIC PENETRAT	ORG ORGANIC T PMT - PRESSUREMETER TES		SOFT CAN E	BE GROVED OR GOUGED READILY BY	KNIFE OR PICK. CAN BE EXCAVATED IN E BY MODERATE BLOWS OF A PICK POIN SURE.
	LIOUID LIMIT		QUID; VERY WET, USUALLY W THE GROUND WATER TABLE	e - VOID RATIO F - FINE - FOSS FOSSILIFEROUS	SD SAND, SANDY SL SILT, SILTY SLI SLIGHTLY	SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK	SOFT OR M		CAVATED READILY WITH POINT OF PICK. BY FINGER PRESSURE. CAN BE SCRATCH
PLASTIC RANGE <			REQUIRES DRYING TO IMUM MOISTURE	FRAC FRACTURED, FRACT FRAGS FRAGMENTS	w - MOISTURE CONTENT	RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING	FRAC	CTURE SPACING	BEDDING
ом 🔔 о	UPTIMUM MUISTURE	MOIST - (M) SOLID; AT O	R NEAR OPTIMUM MOISTURE	HI HIGHLY EQU DRILL UNITS:		RATIO PROJECT HAMMER TYPE:	TERM VERY WIDE WIDE MODERATELY CL	<u>SPACING</u> MORE THAN 10 FEET 3 TO 10 FEET _OSE 1 TO 3 FEET	TERM VERY THICKLY BEDDED THICKLY BEDDED 1 THINLY BEDDED 0.
SL S	SHRINKAGE LIMIT		DDITIONAL WATER TO IMUM MOISTURE	X CME-45B	CLAY BITS	AUTOMATIC MANUAL	CLOSE VERY CLOSE	0.16 TO 1 FOOT LESS THAN 0.16 FEET	VERY THINLY BEDDED 0.0 THICKLY LAMINATED 0.00 THINLY LAMINATED <
		PLASTICITY			8" HOLLOW AUGERS	Вн			RATION
NON PLAS		PLASTICITY INDEX (PI) 0-5 6-15	DRY STRENGTH VERY LOW SLIGHT	CME-550	X HARD FACED FINGER BITS TUNGCARBIDE INSERTS	HAND TOOLS:	FOR SEDIMENTARY FRIABLE	RUBBING WITH	NING OF MATERIAL BY CEMENTING, HE I FINGER FREES NUMEROUS GRAINS; BY HAMMER DISINTEGRATES SAMPLE.
	ELY PLASTIC	16-25 26 OR MORE	MEDIUM HIGH		CASING W/ ADVANCER	POST HOLE DIGGER	MODERATELY	GRAINS CAN E	BE SEPARATED FROM SAMPLE WITH ST Y WHEN HIT WITH HAMMER.
		COLOR		4 🗂 🚽	TRICONE TUNGCARB.		INDURATED		DIFFICULT TO SEPARATE WITH STEEL
		COLOR COMBINATIONS (TAN, RED, STREAKED, ETC. ARE USED TO D				VANE SHEAR TEST	EXTREMELY	INDURATED SHARP HAMME	R BLOWS REQUIRED TO BREAK SAMPLI KS ACROSS GRAINS.

PROJECT REFERENCE NO.

U-4902D

	TERMS AND DEFINITIONS
). AN INFERRED SPT REFUSAL.	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.
FOOT PER 60	AQUIFER - A WATER BEARING FORMATION OR STRATA.
S OFTEN	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.
N VALUES >	ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT
K THAT	WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND
LUDES GRANITE,	SURFACE.
. PLAIN	CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.
TESTED.	COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.
MAY NOT YIELD	CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED
ONE, CEMENTED	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.
INGS UNDER	DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE
ATINGS IF OPEN.	HORIZONTAL.
MMER BLOWS IF	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
K UP TO FELDSPAR	SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.
BLOWS.	FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.
IN ROCK HAS	FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.
AS COMPARED	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
LDSPARS DULL SS OF STRENGTH	FIELD.
HEN STRUCK.	JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.
IDENT BUT	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
RE KAOLINIZED	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
DISCERNIBLE	USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
STRONG ROCK	PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.
ONLY MINOR IL <u>UES < 100 BPF</u>	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
N SMALL AND	ROCK QUALITY DESIGNATION (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF
SAPROLITE IS	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
REQUIRES	ROCK.
	SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND
DWS REQUIRED	RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.
P CAN BE	SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT
TACHED	OR SLIP PLANE.
PICK POINT.	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
BLOWS OF THE	WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.
RAGMENTS	STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY
. SMALL, THIN	TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.
	<u>STRATA ROCK QUALITY DESIGNATION (SROD)</u> - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY
PIECES 1 INCH D READILY BY	THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.
	TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.
	BENCH MARK:
HICKNESS 4 FEET	
5 - 4 FEET 5 - 1.5 FEET	ELEVATION: FEET
- 0.16 FEET	NOTES:
3 - 0.03 FEET 0.008 FEET	U.C.P. = UNDIFFERENTIATED COASTAL PLAIN
	W∕ = WITH
T, PRESSURE, ETC.	
EL PROBE;	
ROBE:	
	DATE: 8-15-14
	DATE: 8-15-14



STATE PROJECT: 40238.1.4 (U-4902D) F.A. PROJECT: NHS-0017(76) COUNTY: **NEW HANOVER**

DESCRIPTION: US 17 Business (Market Street) from Lendire Road to Marsh Oaks Drive

SUBJECT: Geotechnical Inventory Report

PROJECT DESCRIPTION

The proposed project is located in New Hanover County just north of the city of Wilmington. The proposed roadway will consist of widening existing US 17 Business (Market Street).

A geotechnical field investigation was conducted by CATLIN Engineers and Scientists (CATLIN) personnel in March through May 2016. Standard penetration test borings were advanced using hollow-stem augers under the direct supervision of a North Carolina Licensed Well Contractor with a Central Mine Equipment (CME) CME 45B drilling rig and a Diedrich D-50 drilling rig equipped with an automatic hammer. Standard penetration testing was conducted in general accordance with American Society for Testing and Materials (ASTM) D-1586-84, "Penetration Test and Split Barrel Sampling of Soils" or American Association of State Highway and Transportation Officials (AASHTO) Standard Method T206-81. Hand auger borings were advanced across the entire project site to augment the SPT data. A total of 50 borings totaling roughly 355 vertical feet were advanced during this investigation.

Representative soil samples were collected for visual classification in the field and selected samples were submitted for laboratory analvsis bv CATLIN Geotechnical Laboratory in Wilmington, North Carolina. Samples were prepared and analyzed in accordance with one or more of the following AASHTO Standards as modified by NCDOT:

T 87-86	(Dry Preparation of Disturbed Soil)
T 88-93	(Particle Size Analysis)
T 89-94	(Liquid Limit)
T 90-94	(Plastic Limit)
T 265-93	(Soil Moisture Content)
T 267	(Organic Content)

CATLIN personnel used Global Positioning System (GPS) technology to locate all borings. All horizontal locations were recorded to the nearest foot and are presented in the North Carolina State Plane (NCSP), North American Datum 1983 (NAD 83). Vertical control was measured to the nearest 0.1 foot and referenced to the National Geodetic Vertical Datum

1988 (NGVD88). All measurements were recorded and reported in United States Survey Feet (US Ft).

The following alignments were investigated. Plan sheets, subsurface profiles, and selected cross sections of the alignment are included in this report.

Line	
-L-	
-Y28A-	
-Y29-	
-Y30-	
-Y31-	
-Y32-	
-Y33-	

The project reportedly will consist of 1.734 miles of roadway widening.

AREAS OF SPECIAL GEOTECHNICAL INTEREST

1) at the following sections:

Line

- -L--L--L--Y28A--Y29--Y30--Y31-
- -Y32-
- 2)

Line

-L-

Station (±)

202+50 to 288+00 10+00 to 11+25 13+00 to 17+10 10+00 to 11+75 11+25 to 12+50 11+50 to 13+02 11+65 to 12+50

GROUNDWATER: Groundwater within six (6) feet of natural ground was noted

Station (±)

202+50 to 224+00 226+00 to 254+00 272+00 to 288+00 10+00 to 11+25 13+00 to 17+10 10+00 to 11+75 11+25 to 12+50 11+50 to 13+02

COHESIVE SOILS: Clay or cohesive soils which may have the potential to cause embankment/subgrade and or slope stability problems during construction was encountered at the following sections of the project:

Station \pm

220+14 to 221+40

ORGANIC SOILS: Organic material that may cause construction related issues 3) was identified at the following sections on the project:

<u>Line</u>	Station ±
-L-	202+50 to 204+03
-L-	208+00 to 209+50
-L-	221+29 to 222+40
-L-	242+00 to 244+60
-L-	271+00 to 275+00
-L-	280+40 to 281+70
-Y28A-	10+00 to 11+25

WATER WELLS: No water wells were identified within the proposed 4) construction limits. Water supply wells may be present along the project corridors that were not detected.

PHYSIOGRAPHY AND GEOLOGY

The project is located within the eastern most portion of the North Carolina Coastal Plain physiographic province. Geology in the vicinity of Wilmington is dominated by Undifferentiated Coastal Plain (U.C.P.) materials which are noted as Quaternary Surficial Deposits on the Geologic Map of North Carolina. Coastal Plain materials are described as sand, clay, gravel, and peat deposits which were deposited in marine, fluvial, eolian, and lacustrine environments. Sediments of the Castle Hayne and Peedee Formations are reported to underlay the U.C.P. deposits in the vicinity of Wilmington.

Land use in the area is primarily commercial and residential. The land surface in the project vicinity is dominated by flat terrain typical of coastal environments with land surface elevations ranging from approximately 25 to 47 feet. Numerous underground and overhead utilities exist in the vicinity of the proposed project. The project is primarily drained by surficial runoff to stormwater systems and drainage ditches.

GROUNDWATER

Groundwater data was collected from open boreholes, where possible, during the field investigation conducted between March and May 2016

Measured groundwater elevations (24 hour measurements) ranged from elevation 22.5 feet to 42.5 feet with an average elevation of 34.8 feet. Twenty-four hour depth to groundwater measurements ranged from 1.5 feet to 6.4 feet below existing land surface (BLS), with an average depth to water of 3.7 feet. Formational material in which groundwater was typically observed was found to be predominantly silty sand material with an assumed moderate permeability.

SOIL PROPERTIES

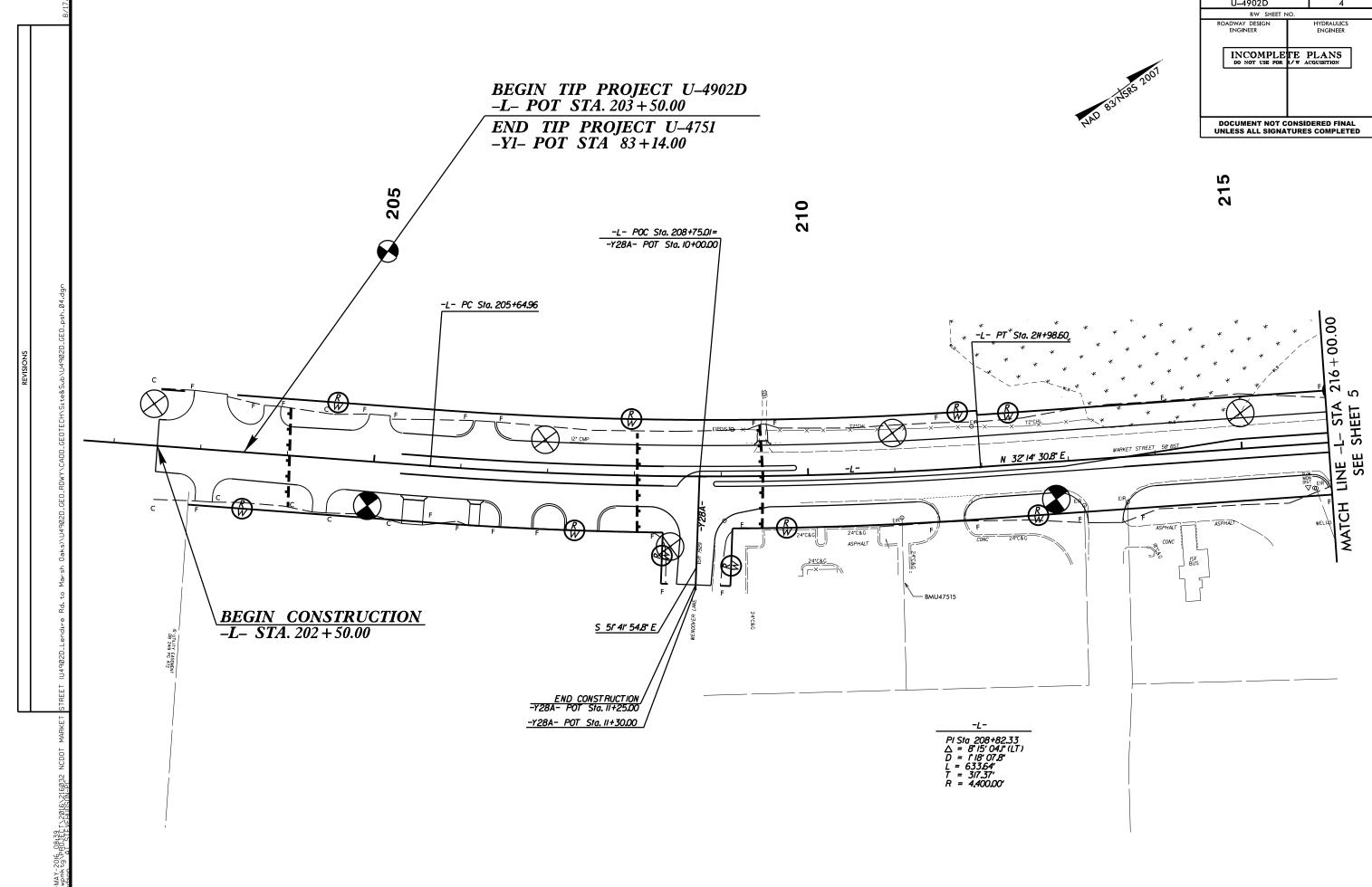
Soils encountered at the project site include roadway embankment and undifferentiated coastal plain sediments.

Roadway embankment soils were identified beneath and adjacent to existing roadways and consist of loose to medium dense, sand and silty sand (A-3 and A-2-4).

The dominant U.C.P. material encountered consisted of very loose to medium dense sand to silty sand (A-3 and A-2-4). The sand was encountered from land surface, or below the roadway embankment to a depth of at least 12 feet BLS (depth of deepest borings). A small amount of highly plastic clay, silt, and organic sands were encountered at the previously described locations.

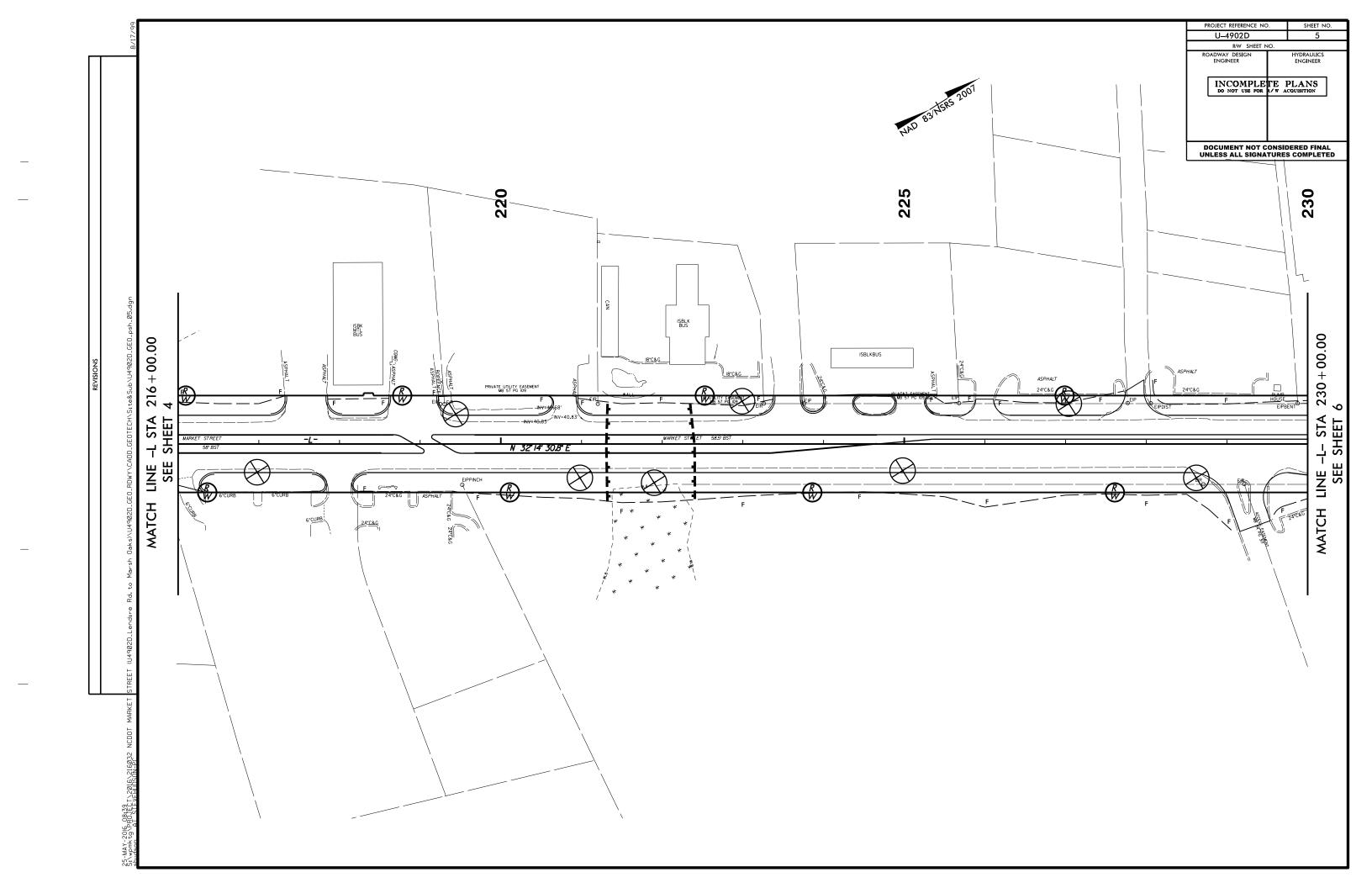
Material within the identified organic soil area was described as very loose, dark brown to black, highly organic (15.2% to 18.9%) sand to silty fine sand with little (3.1% to 6.8%) organics.

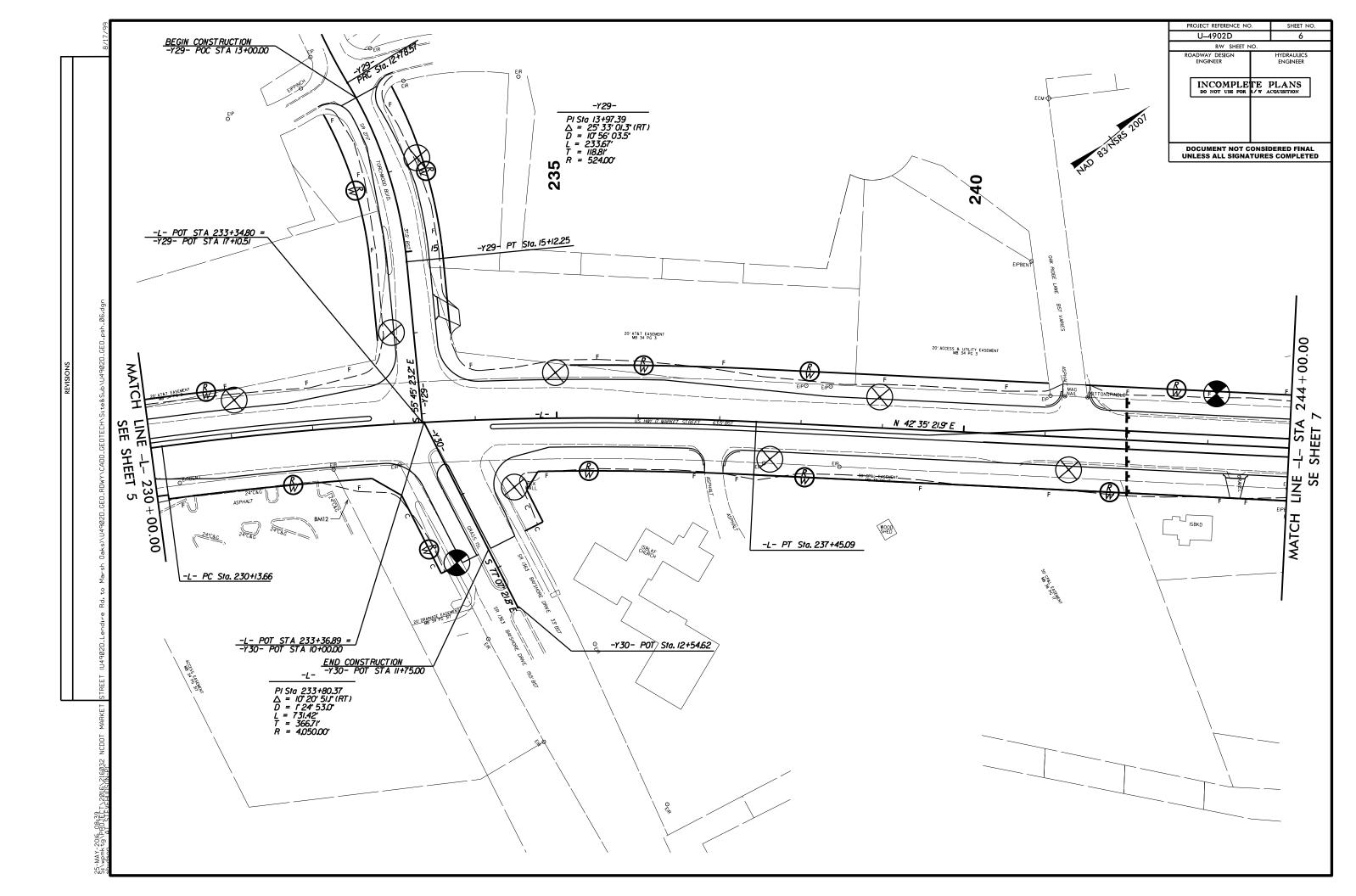
Prepared by, Steven V. Hudson, L.G. **Project Geologist** -DS SH 5/31/2016

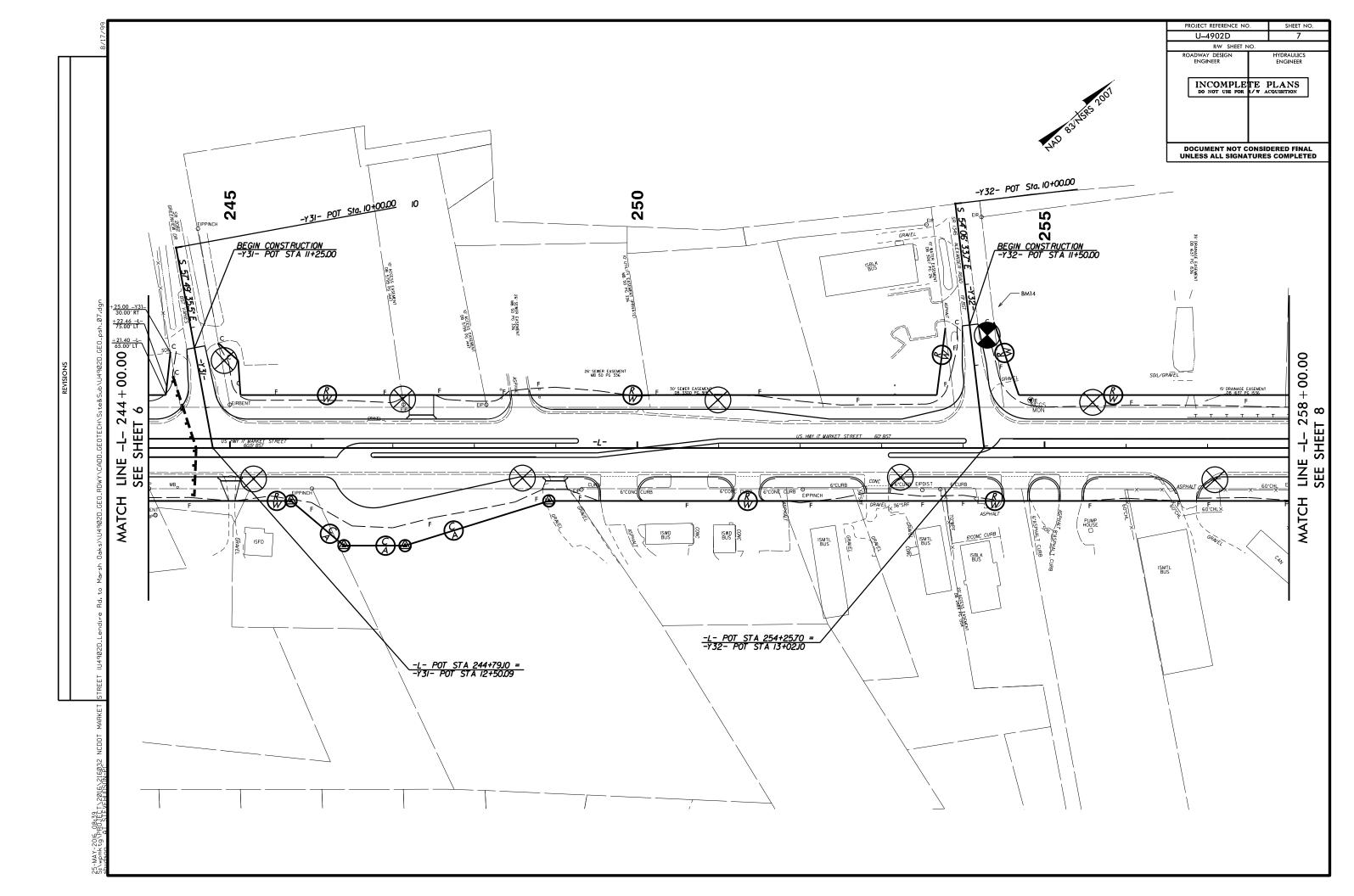


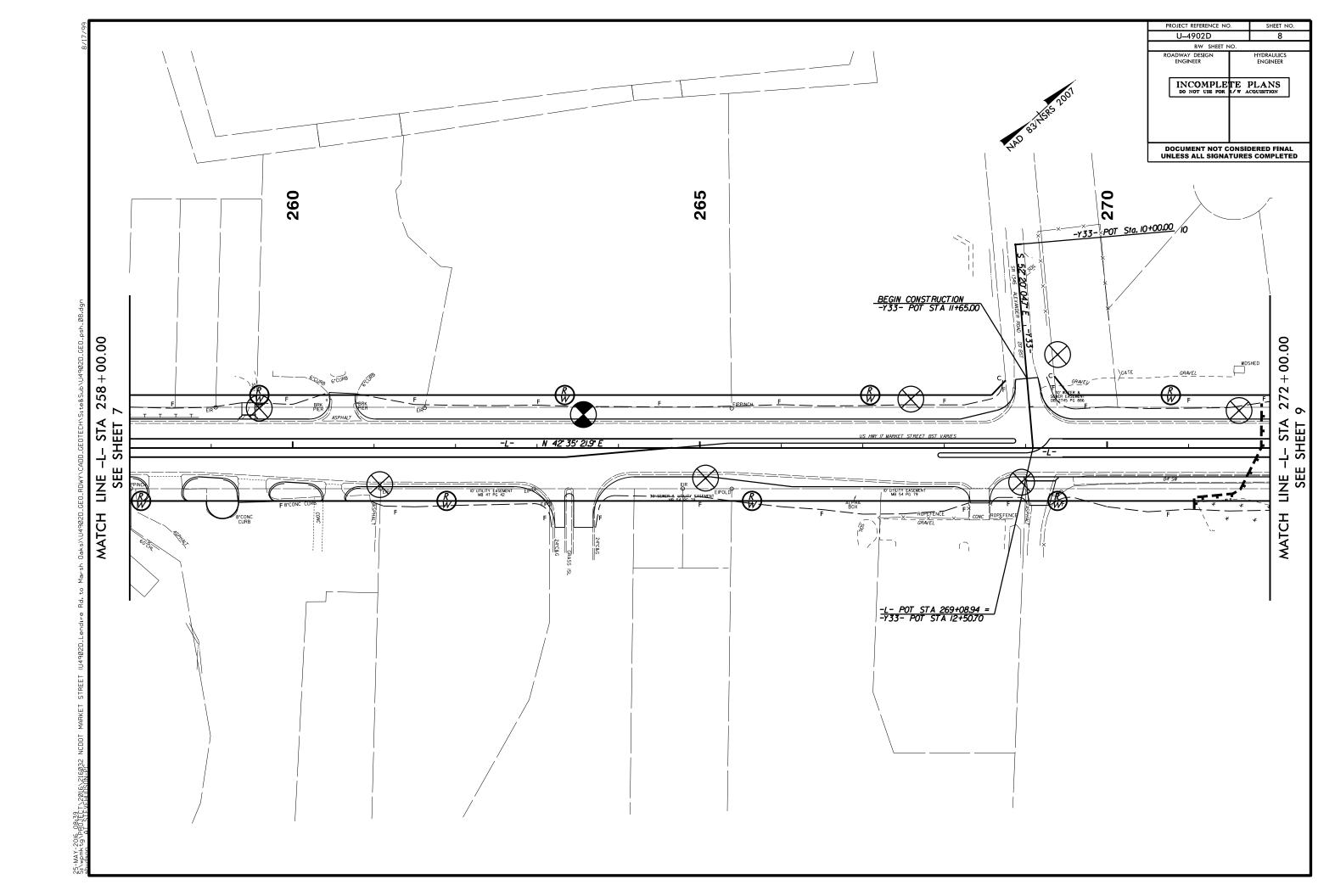


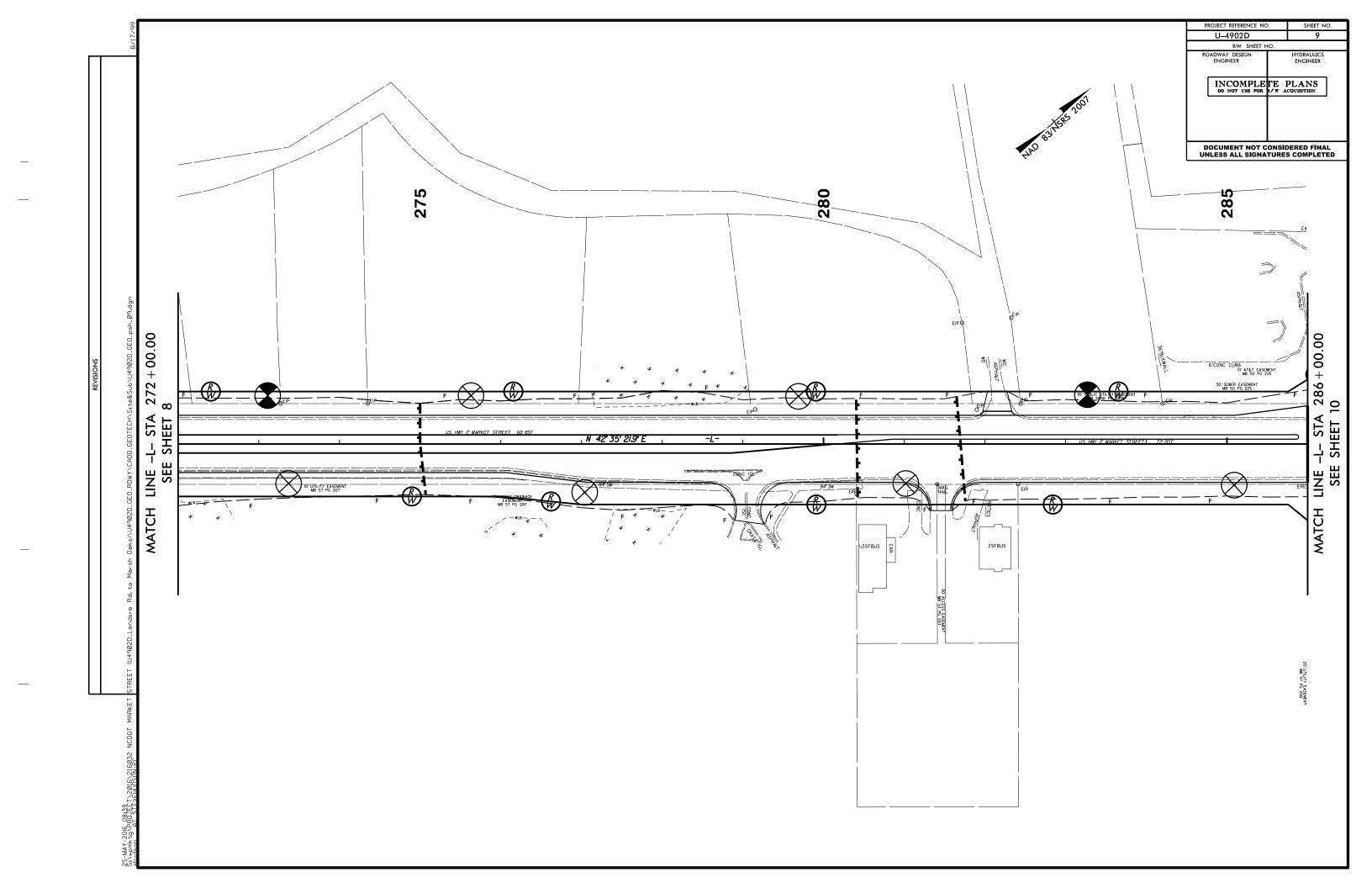
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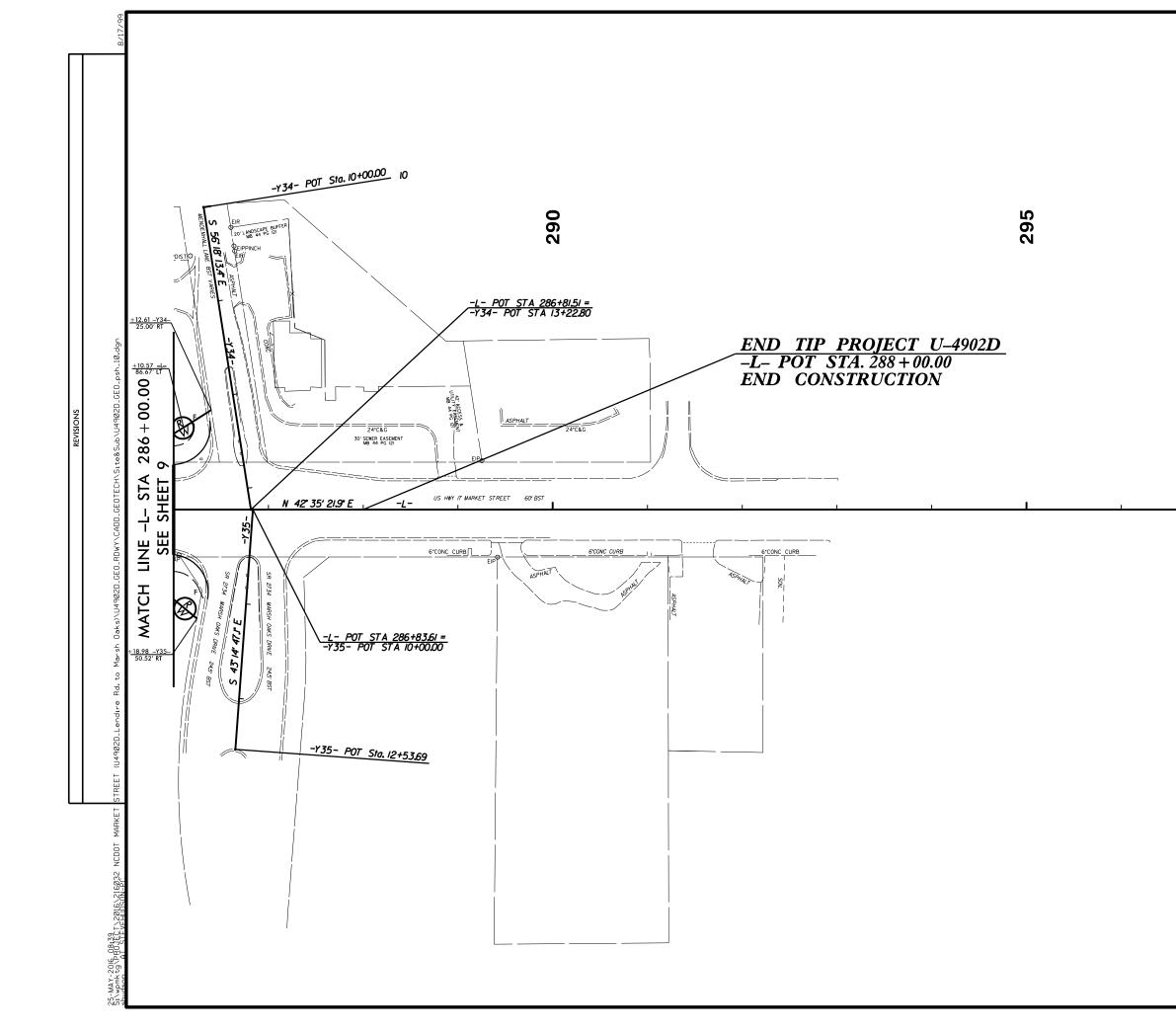






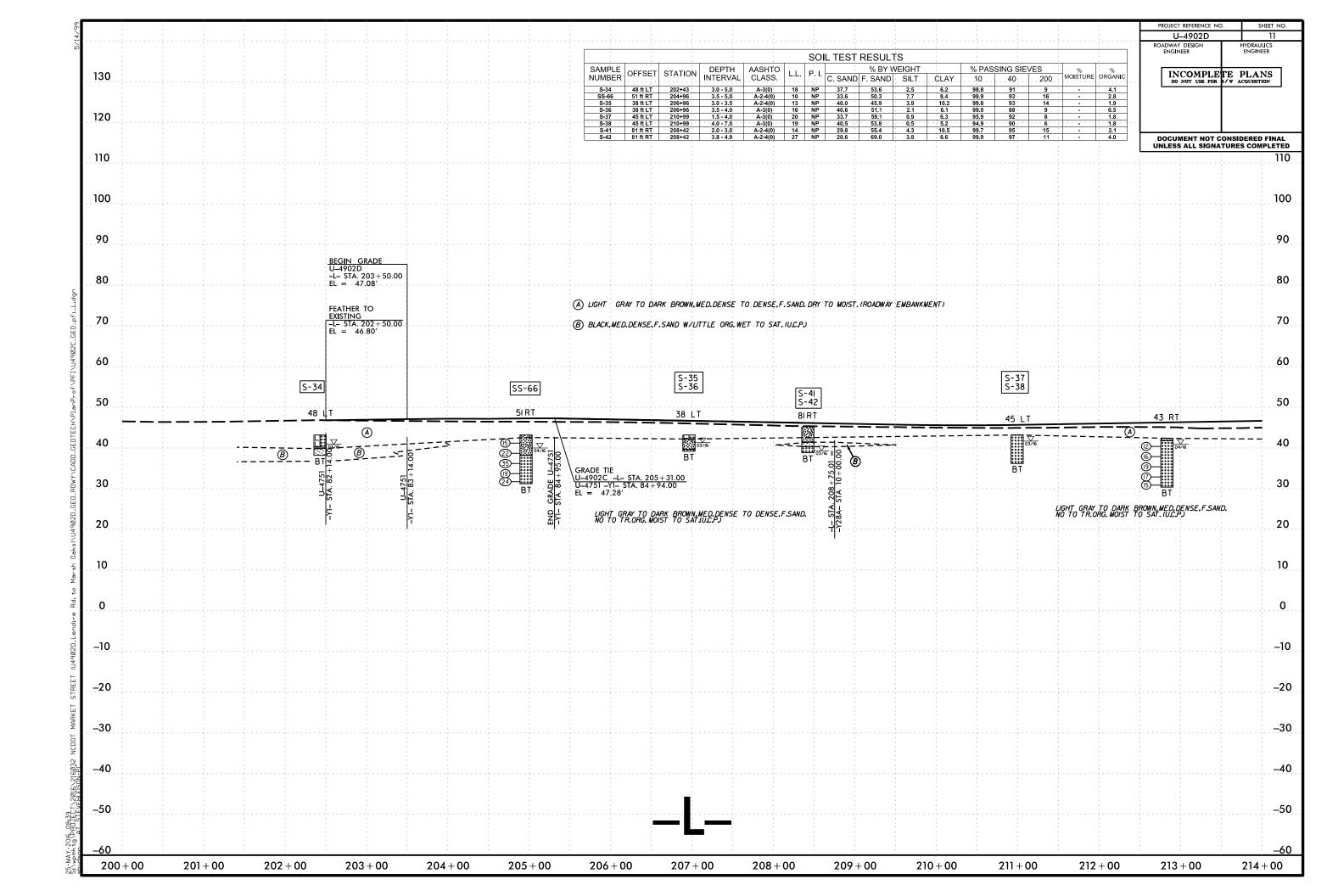


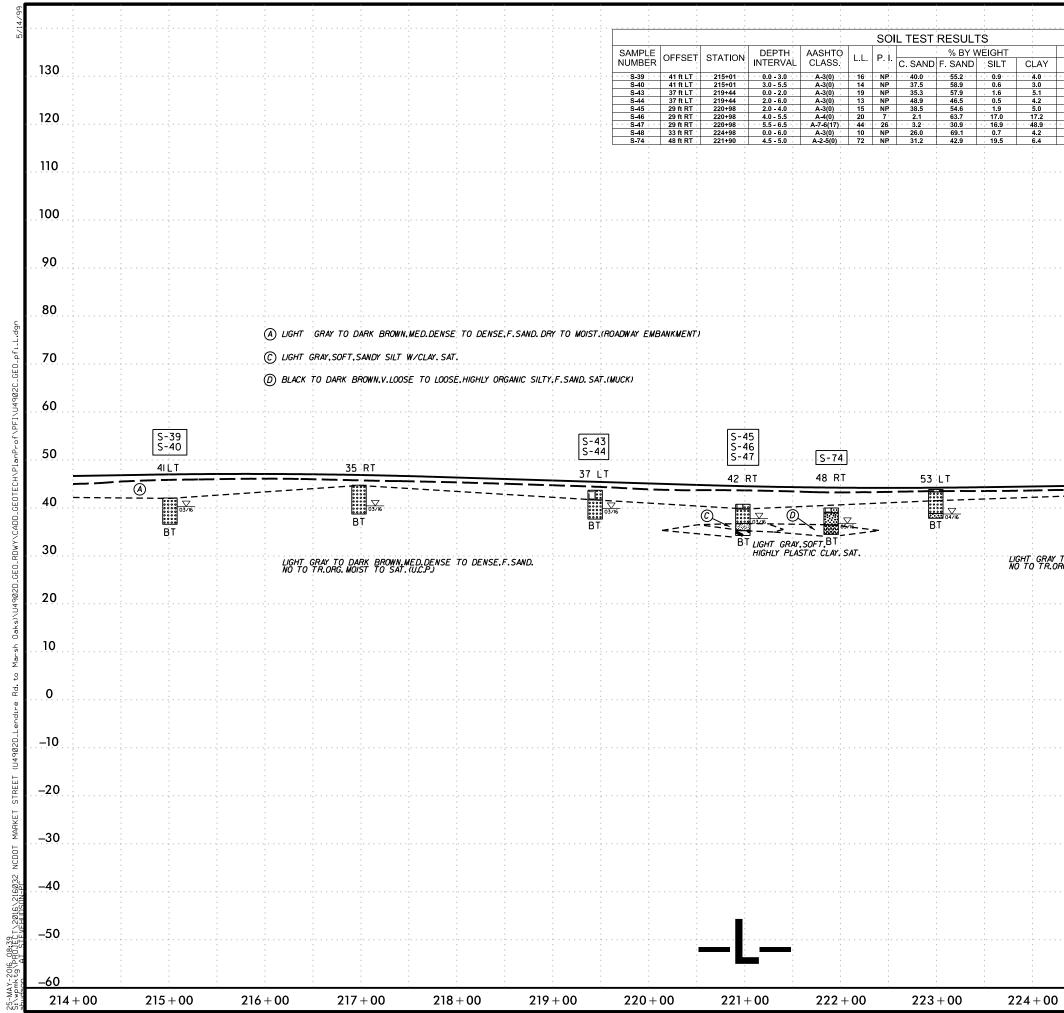




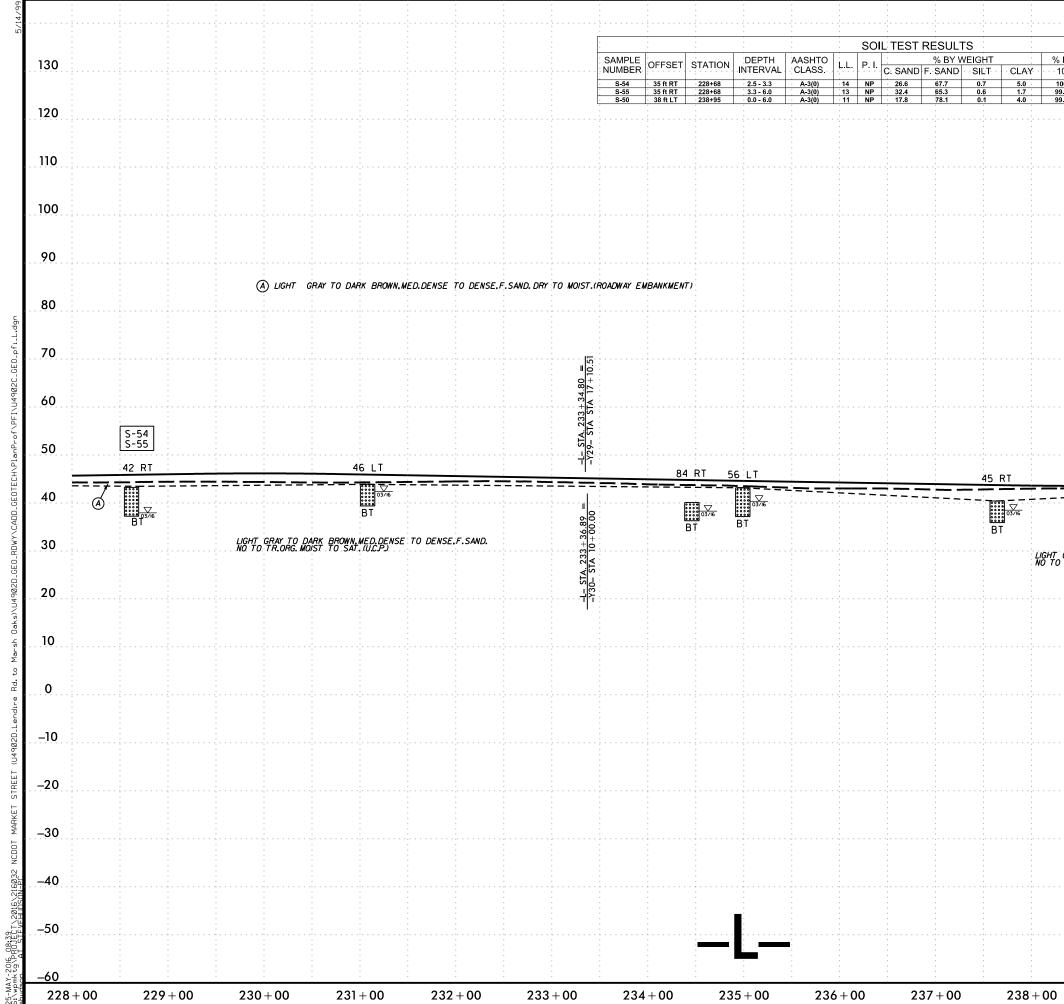
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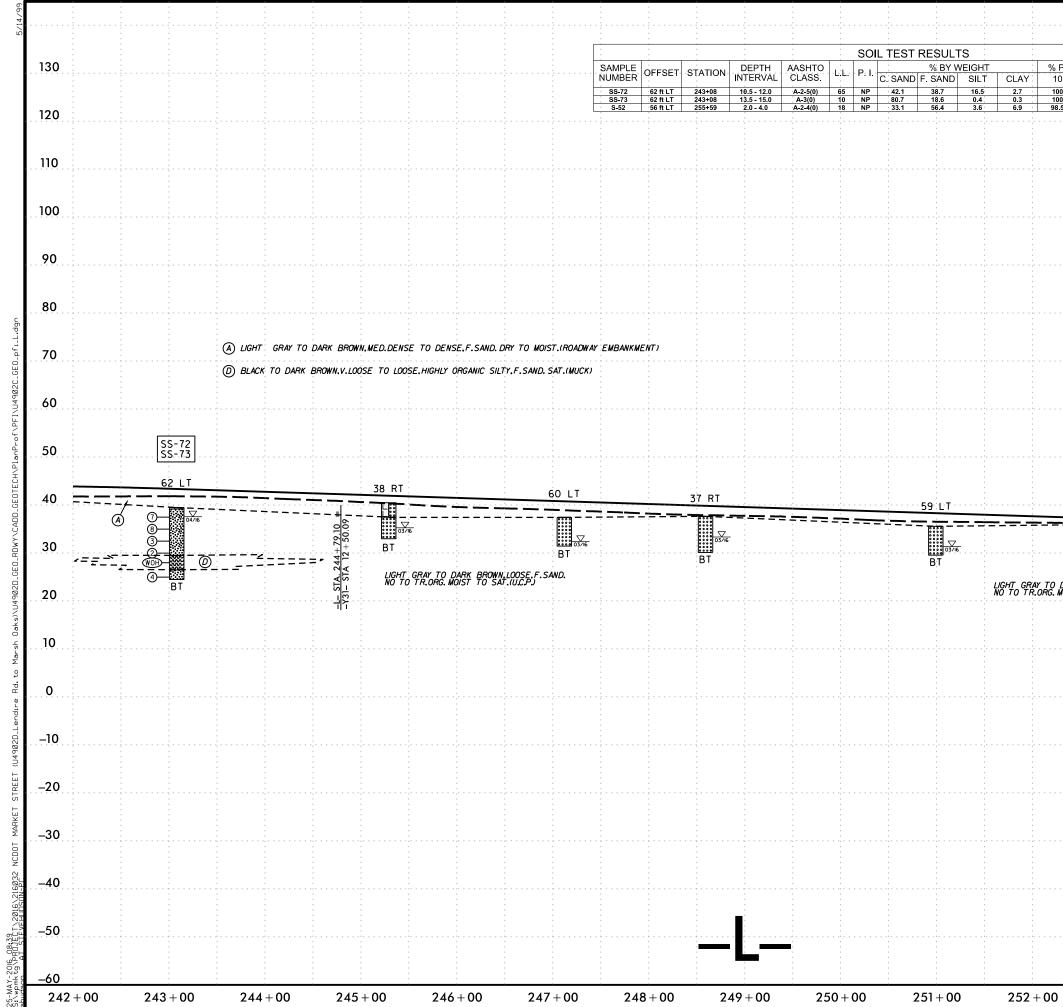




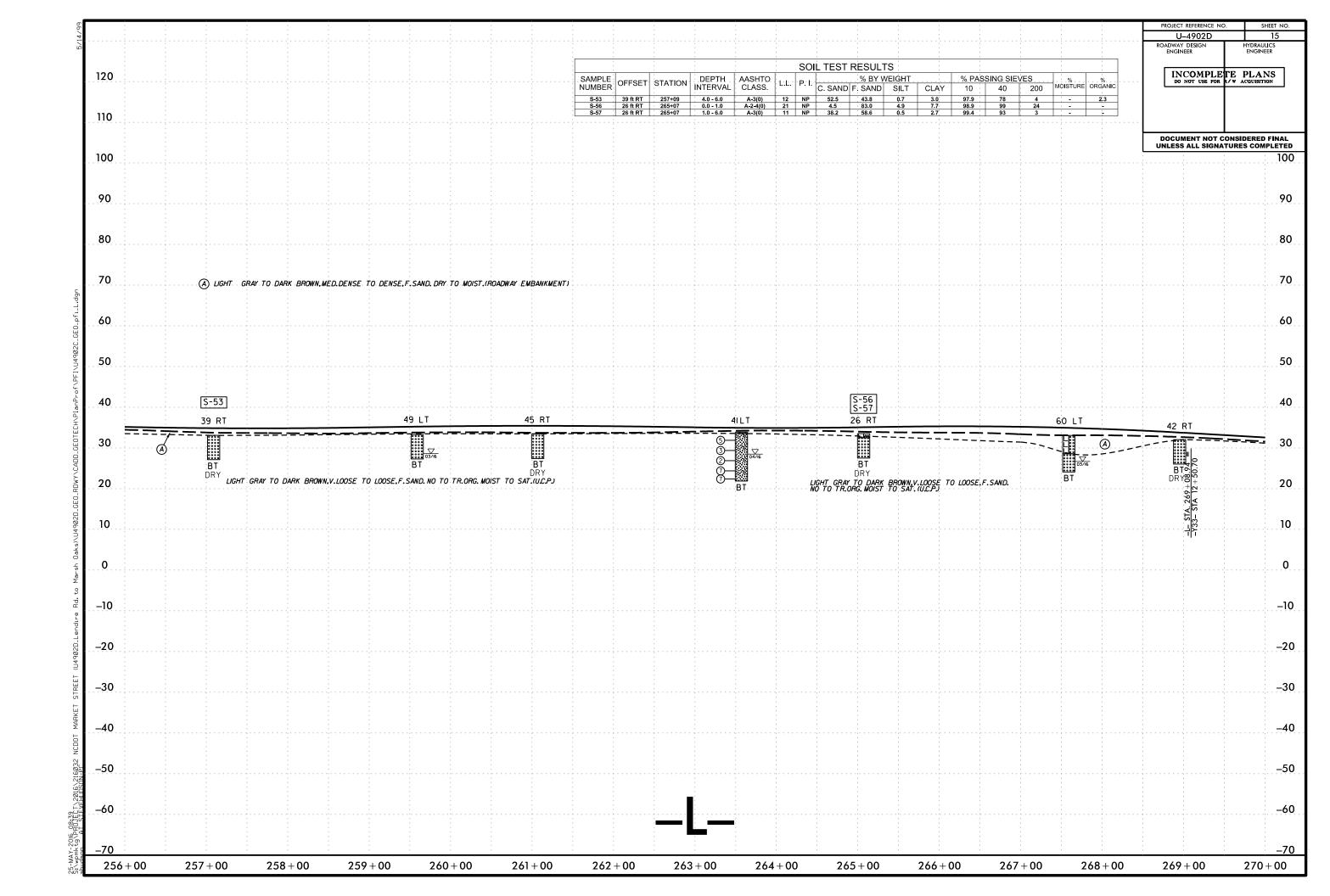
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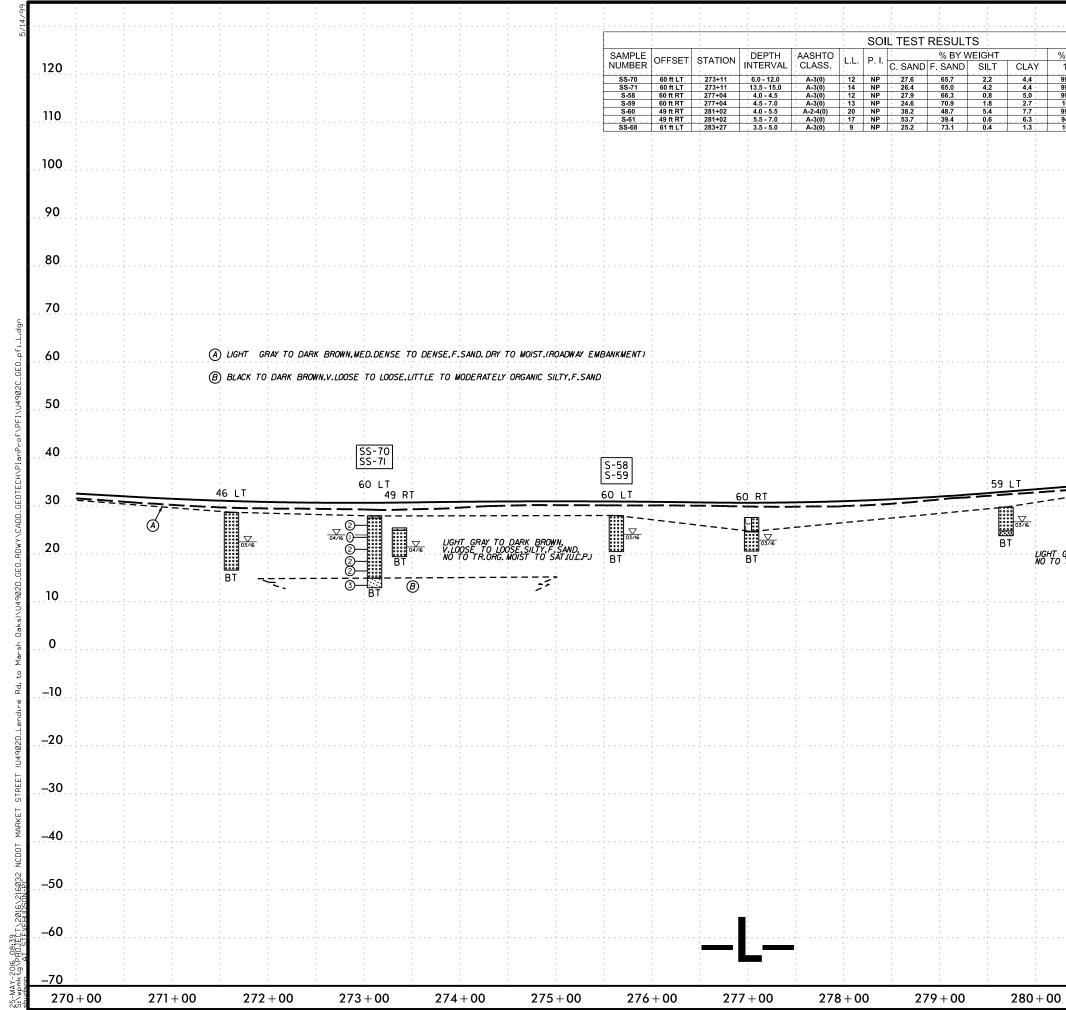


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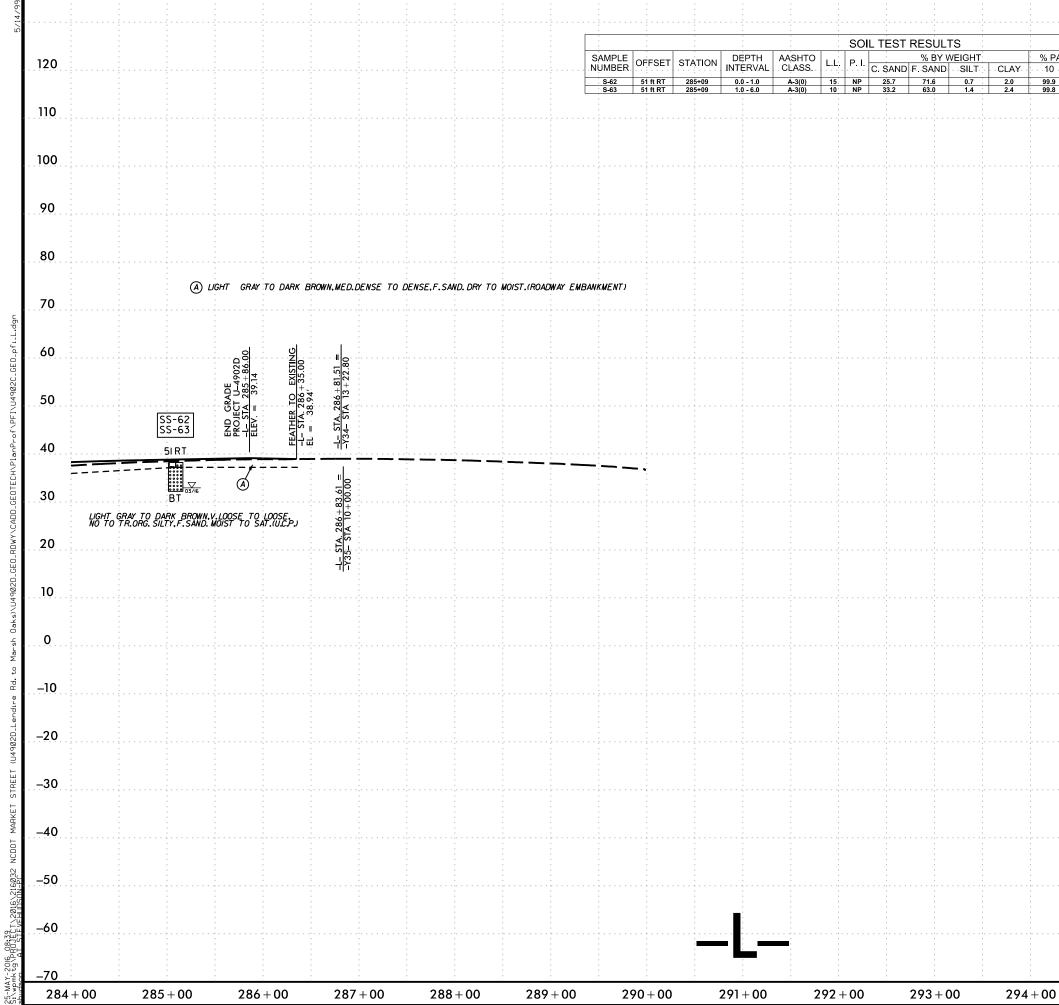


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