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CARY PROJECT: ST1220 TIP PROJECT: U-5315

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5315	1	15

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY WAKE
PROJECT DESCRIPTION MORRISVILLE PARKWAY
EXTENSION AND NC 540 INTERCHANGE FROM
SR 1625 (GREEN LEVEL CHURCH RD) TO NC 55
SITE DESCRIPTION HIGH MAST LIGHTING

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
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14	LABORATORY TESTING SUMMARY

PERSONNEL

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INVESTIGATED BY R. LANE
DRAWN BY A. PAUL
CHECKED BY J. HAMM
SUBMITTED BY J. HAMM
DATE SEPTEMBER 11, 2017

CAUTION NOTICE


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SEAL
039779
ENGINEER
JEREMY R. HAMM

Jeremy R. Hamm 9/11/17

SIGNATURE DATE

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE PIEZOMETER INSTALLATION SPT N-VALUE									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC ? - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SD. - SAND, SANDY F - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS SLL. - SLIGHTLY FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT HI. - HIGHLY v - VERY									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										SAMPLE ABBREVIATIONS									
LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE										S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO									
PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE																			
OM OPTIMUM MOISTURE SHRINKAGE LIMIT - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE																			
SL - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE																			
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
NON PLASTIC 0-5 VERY LOW										<input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL									
SLIGHTLY PLASTIC 6-15 SLIGHT										<input type="checkbox"/> CME-55 <input type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER									
MODERATELY PLASTIC 16-25 MEDIUM										<input type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS									
HIGHLY PLASTIC 26 OR MORE HIGH										<input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS									
										<input type="checkbox"/> PORTABLE HOIST <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 checked="" type="checkbox"/> MOBILE B57 <input type="checkbox"/> CORE BIT									
										<input type="checkbox"/> CORE BIT									
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.										HAND TOOLS:									
										<input type="checkbox"/> POST HOLE DIGGER									
										<input type="checkbox"/> HAND AUGER									
										<input type="checkbox"/> SOUNDING ROD									
										<input type="checkbox"/> VANE SHEAR TEST									





**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION

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:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

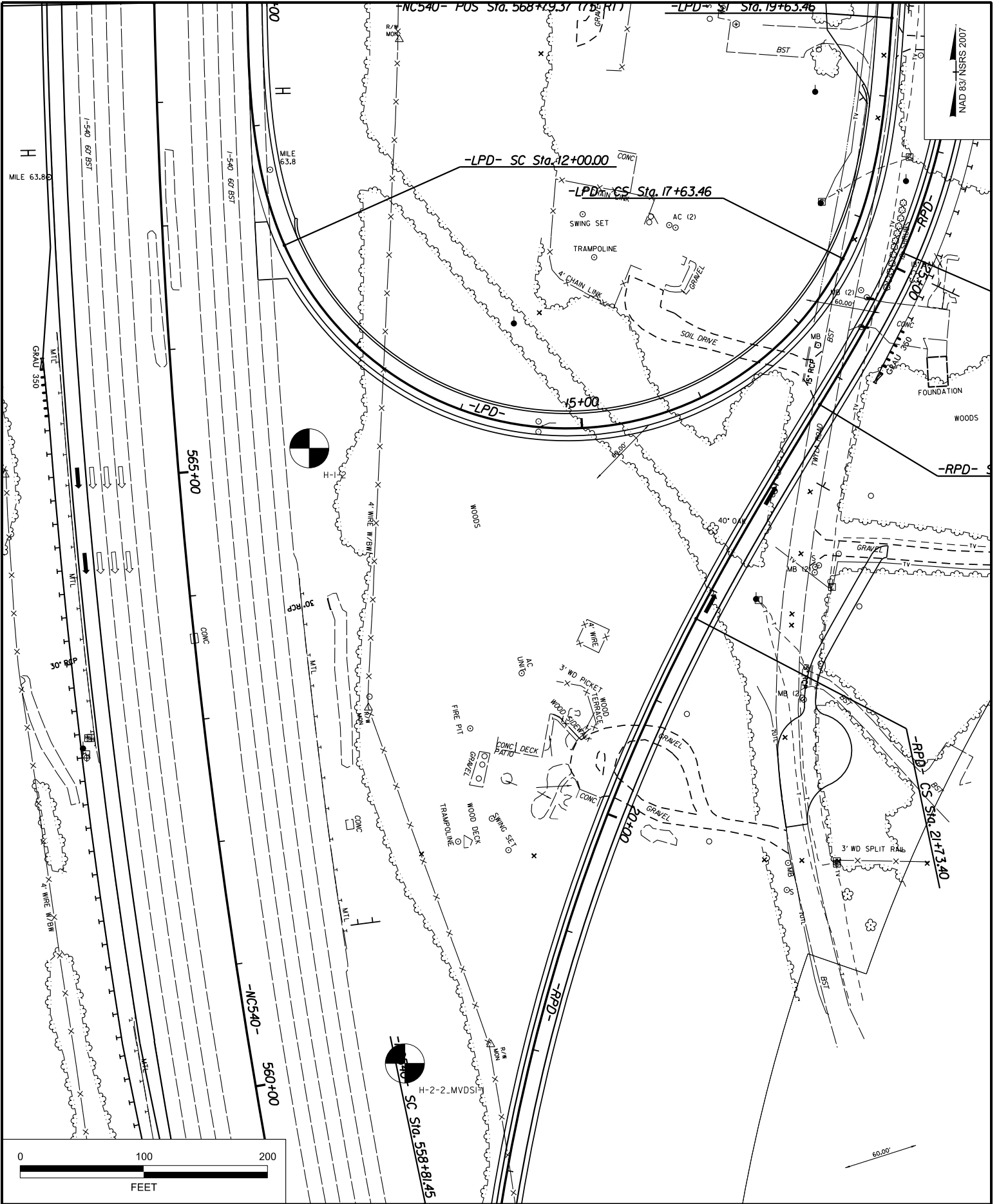
TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.	AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.	ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, 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 DISLODGED FROM PARENT MATERIAL.
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
ROCK QUALITY DESIGNATION (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.

BENCH MARK:

ELEVATION: FEET

NOTES:



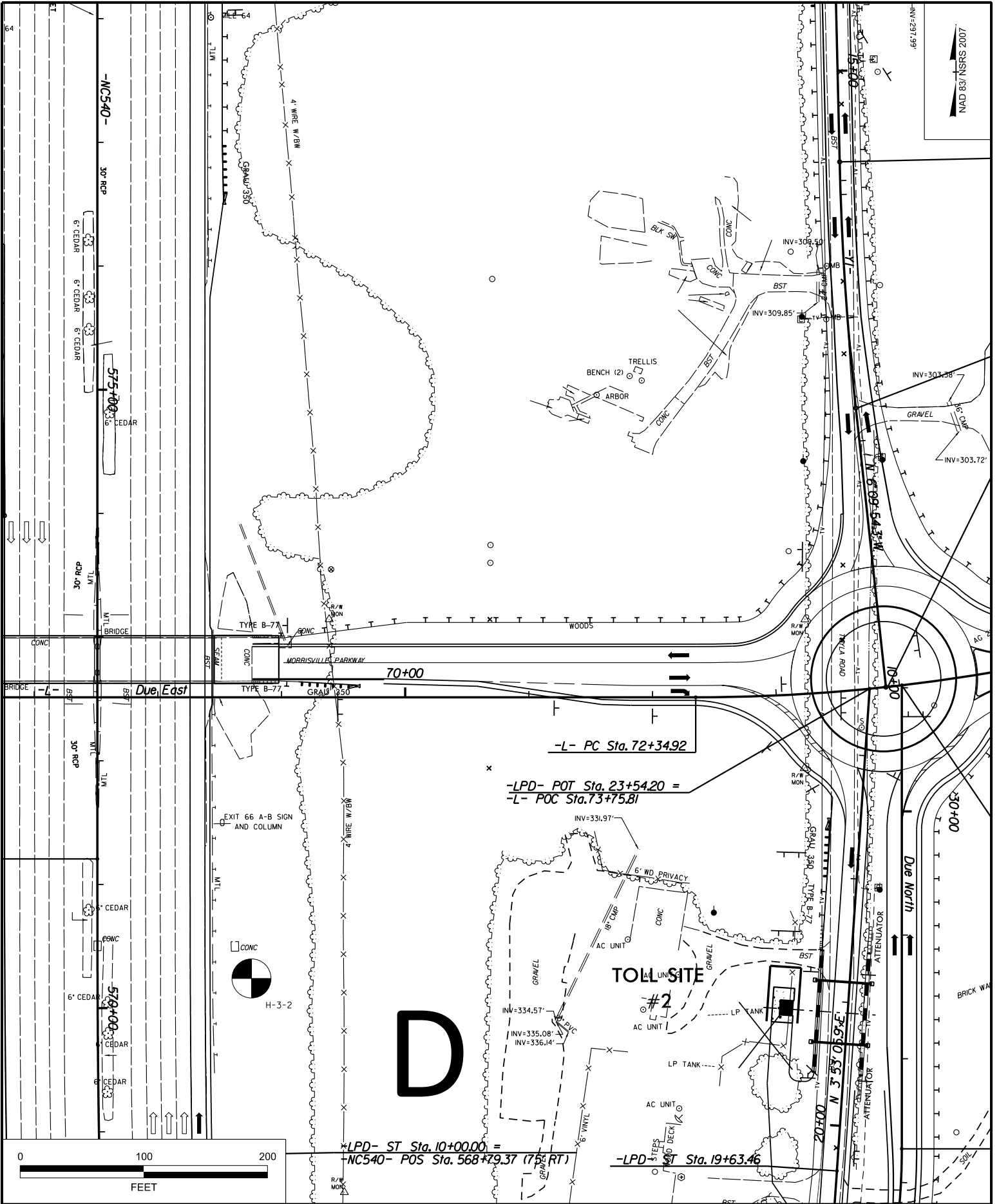
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BORING LOCATION PLAN
 MORRISVILLE PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00

NAD 83/ NSRS 2007

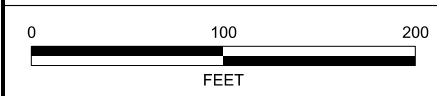
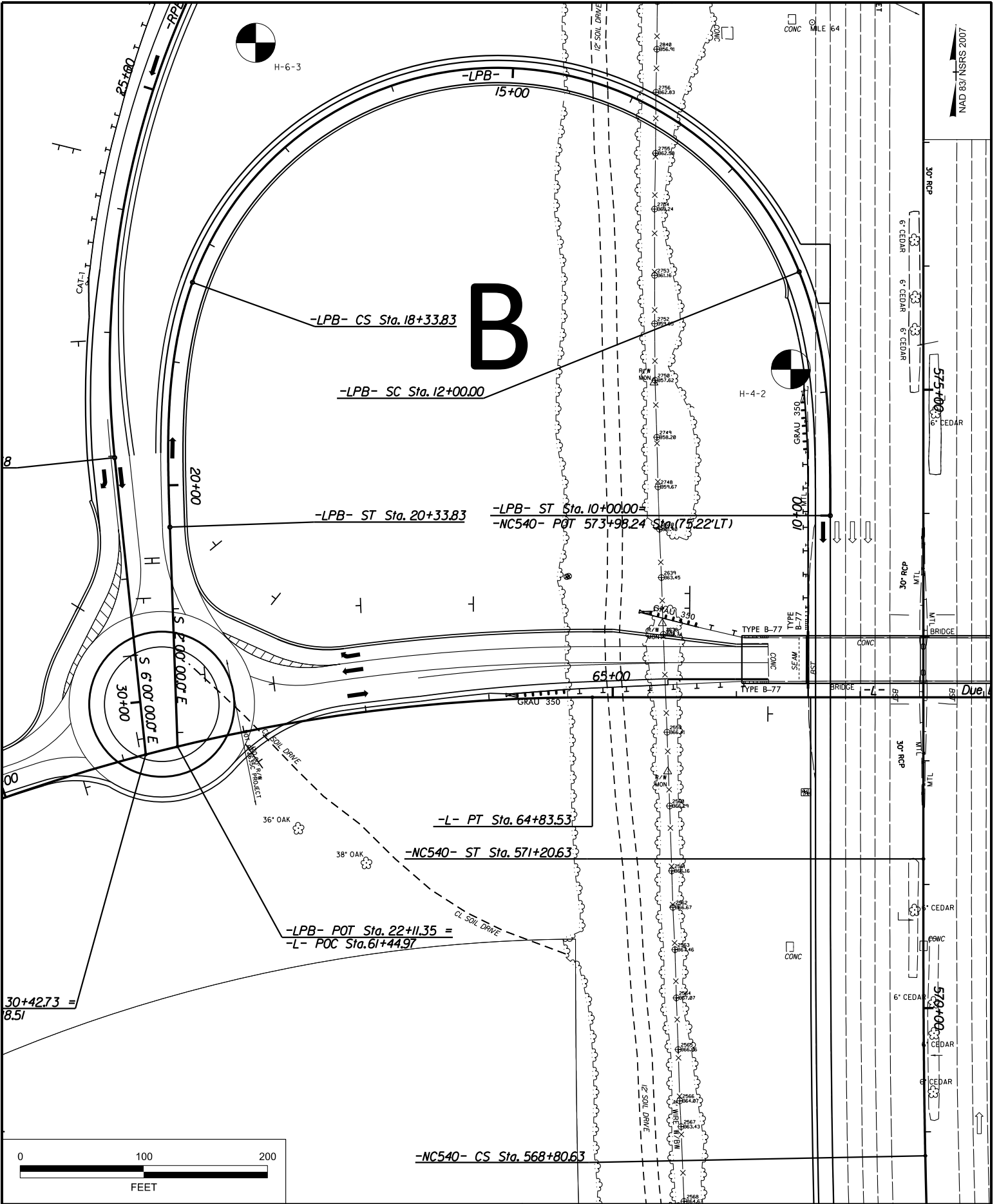


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FALCON ENGINEERING
 FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 CARY, NC 27513
 PHONE: 919.871.0800
 www.falconengineers.com

BORING LOCATION PLAN
 MORRISVILLE PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00



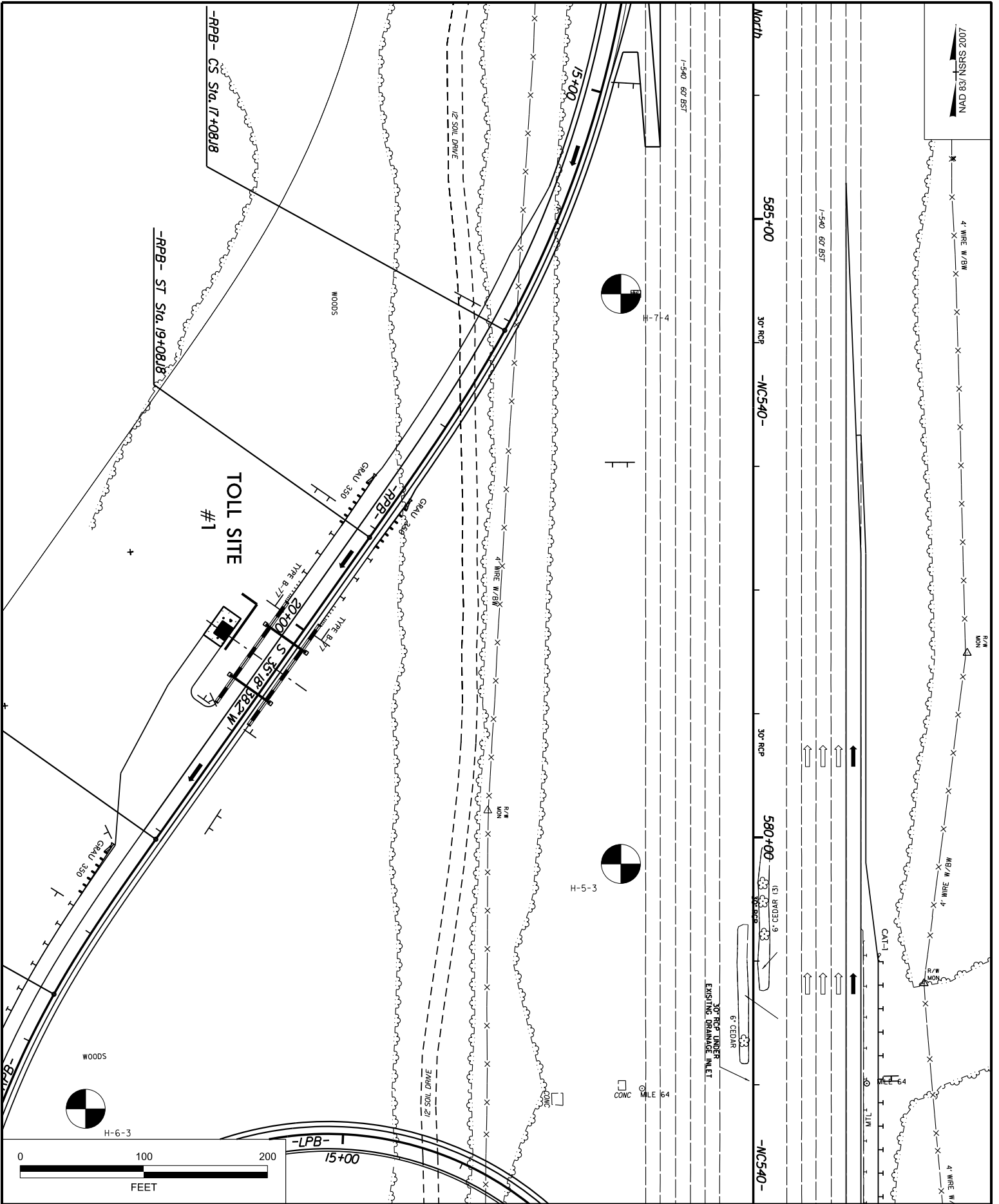
NOTES:

PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

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NAD 83/ 2007



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

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BORING LOCATION PLAN
 MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane								
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)								
BORING NO. MVDS1-1_H-2-2			STATION 559+98			OFFSET 122 ft RT			ALIGNMENT -NC540-								
COLLAR ELEV. 350.6 ft			TOTAL DEPTH 13.7 ft			NORTHING 748,177			EASTING 2,032,137								
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic								
DRILLER Estep, J. E.			START DATE 05/17/17			COMP. DATE 05/17/17			SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
355																	
350	349.6	1.0	12	32	42										350.6	3" TOPSOIL	0.0
	347.1	3.5	28	45	55/0.4										347.6	RESIDUAL TAN, SILTY SAND (A-2-4)	3.0
345	344.6	6.0	17	28	72/0.4										345.1	WEATHERED ROCK TAN, TRIASSIC SANDSTONE	5.5
	342.1	8.5	22	78/0.3												TAN-BROWN, TRIASSIC MUDSTONE	
340																	
	337.1	13.5													338.6	TAN, TRIASSIC SANDSTONE	12.0
															336.9	TAN, TRIASSIC SANDSTONE	13.7
																Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 336.9 ft IN WR: TRIASSIC SANDSTONE	

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT_GDT 9/11/17

GEOTECHNICAL BORING REPORT BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. H-1-2			STATION 565+11			OFFSET 107 ft RT			ALIGNMENT -NC540-							
COLLAR ELEV. 345.1 ft			TOTAL DEPTH 14.5 ft			NORTHING 748,674			EASTING 2,032,060							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/17/17			COMP. DATE 05/17/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
350																
345	344.1	1.0	9	17	36									345.1	3" TOPSOIL	0.0
340	341.6	3.5	6	11	14										RESIDUAL RED-ORANGE, CLAY (A-6) MICAEOUS	
	339.1	6.0	24	56	44/0.4									339.6		WEATHERED ROCK
335	336.6	8.5	77	23/0.1						100/0.9				337.1	RED-ORANGE, TRIASSIC MUDSTONE	8.0
	331.6	13.5	18	82/0.5						100/0.6				330.6	RED AND GRAY, TRIASSIC MUDSTONE	14.5
															Boring Terminated at Elevation 330.6 ft IN WR: TRIASSIC MUDSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. H-3-2	STATION 570+24	OFFSET 125 ft RT	ALIGNMENT -NC540-
COLLAR ELEV. 342.2 ft	TOTAL DEPTH 8.6 ft	NORTHING 749,178	EASTING 2,032,057
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/17/17	COMP. DATE 05/17/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100							
345																	
	341.2	1.0													342.2	3" TOPSOIL	0.0
340			2	5	14										340.7	ROADWAY EMBANKMENT RED-BROWN, CLAY (A-6)	1.5
	338.7	3.5													339.2	RESIDUAL GRAY, SILT (A-4)	3.0
	336.2	6.0	28	72/0.2						100/0.7						WEATHERED ROCK TAN, TRIASSIC SANDSTONE	
335																	
	333.7	8.5								100/0.3							
			60/0.1												333.7	NON-CRYSTALLINE ROCK TAN, SANDSTONE	8.5
										60/0.1					333.6		8.6

Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 333.6 ft IN NCR: TRIASSIC SANDSTONE

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. H-4-2			STATION 575+17			OFFSET 108 ft LT			ALIGNMENT -NC540-							
COLLAR ELEV. 339.2 ft			TOTAL DEPTH 8.6 ft			NORTHING 749,671			EASTING 2,031,826							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/19/17			COMP. DATE 05/19/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
340																
	338.2	1.0	9	14	33									339.2	5" TOPSOIL	0.0
	335.7	3.5												336.2	RESIDUAL BROWN-RED, CLAY (A-6) MICACEOUS	3.0
	333.2	6.0	100/0.3											333.7	WEATHERED ROCK TAN, TRIASSIC SANDSTONE	5.5
	330.7	8.5	60/0.1											330.6	NON-CRYSTALLINE ROCK GRAY, TRIASSIC SANDSTONE	8.6
			60/0.1												Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 330.6 ft IN NCR: TRIASSIC SANDSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1		TIP U-5315		COUNTY WAKE		GEOLOGIST R. Lane	
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55							GROUND WTR (ft)
BORING NO. H-6-3		STATION 24+32		OFFSET 64 ft LT		ALIGNMENT -RPB-	0 HR. Dry
COLLAR ELEV. 331.8 ft		TOTAL DEPTH 24.2 ft		NORTHING 749,935		EASTING 2,031,393	24 HR. Dry
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic	
DRILLER Estep, J. E.		START DATE 05/10/17		COMP. DATE 05/10/17		SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
335																
330	330.8	1.0	2	4	6								M	RESIDUAL TAN-ORANGE, CLAYEY SAND (A-2-6)	3.0	
	328.3	3.5	4	10	14								M	ORANGE AND GRAY, SANDY SILT (A-4)	5.5	
325	325.8	6.0	5	5	9								M	ORANGE AND GRAY, CLAYEY SAND (A-2-6)	8.0	
	323.3	8.5	7	10	14								D	GRAY AND TAN, SILTY F. TO CSE. SAND (A-2-4)	13.0	
320	318.3	13.5	6	20	33								D	GRAY AND BROWN, SILTY SAND (A-2-4) WITH ROCK FRAGS, SAPROLITIC	19.0	
315	313.3	18.5	32	55	45/0.2									WEATHERED ROCK GRAY, SILTSTONE	19.0	
310	308.3	23.5	22	68/0.2											24.2	
															Boring Terminated at Elevation 307.6 ft IN WR: TRIASSIC SILTSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. H-5-3			STATION 579+79			OFFSET 107 ft LT			ALIGNMENT -NC540-							
COLLAR ELEV. 335.1 ft			TOTAL DEPTH 13.9 ft			NORTHING 750,132			EASTING 2,031,826							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/18/17			COMP. DATE 05/18/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
340																
335	334.1	1.0	6	7	7									335.1	3" TOPSOIL	0.0
330	331.6	3.5	8	42	58/0.2									331.1	RESIDUAL RED AND GRAY, CLAY (A-6)	4.0
	329.1	6.0													WEATHERED ROCK TAN, TRIASSIC SANDSTONE	
325	326.6	8.5														
	321.6	13.5												321.2		13.9
															Boring Terminated at Elevation 321.2 ft IN WR: TRIASSIC SANDSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. H-7-4	STATION 584+40	OFFSET 107 ft LT	ALIGNMENT -NC540-
COLLAR ELEV. 327.4 ft	TOTAL DEPTH 14.1 ft	NORTHING 750,593	EASTING 2,031,826
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/18/17	COMP. DATE 05/18/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
330																
	326.4	1.0	24	55	45/0.4									327.4	0.0	3" TOPSOIL
325	323.9	3.5	10	77	23/0.1					100/0.9				324.4	3.0	WEATHERED ROCK TAN, TRIASSIC SANDSTONE
	321.4	6.0	28	72/0.3						100/0.6						GRAY AND RED, TRIASSIC MUDSTONE
320	318.9	8.5	100/0.3							100/0.8						
										100/0.3						
315	313.9	13.5	75	25/0.1						100/0.6				313.3	14.1	Boring Terminated at Elevation 313.3 ft IN WR: TRIASSIC MUDSTONE

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17



LABORATORY TEST RESULTS

Morrisville Pkwy. and 540 Interchange
Wake County, North Carolina

Falcon Engineering Project Number: G17027.00
May 30, 2017

SAMPLE IDENTIFICATION			PERCENTAGE PASSING			LIQUID & PLASTIC LIMITS			WATER CONTENT	AASHTO CLASSIFICATION
Location	Sample	Depth, ft	#10	#40	#200	LL	PL	PI	(%)	
D-median	SS-1	18.5-20	97	68	42	39	23	16	19	A-6 (3)
RWIS/MVD	SS-2	3.5-5	99	96	45	28	19	9	18	A-4 (1)
CCTV-1	SS-3	8.5-10	98	60	25	34	30	4	20	A-2-4 (0)
CCTV-2	SS-4	13.5-15	99	90	65	35	24	11	16	A-6 (6)
B-outside	SS-5	3.5-5	100	100	61	35	26	9	15	A-4 (4)
TB1	SS-6	8.5-10	99	80	51	32	20	12	10	A-6 (3)
F-median	SS-7	3.5-5	75	68	55	30	20	10	11	A-4 (3)
F-outside	SS-8	23.5-25	100	98	89	54	29	25	23	A-7-6 (26)
D-median	SS-9	23.5-25	99	62	37	44	29	15	26	A-7-6 (2)
F-outside	SS-10	3.5-5	98	87	63	35	20	15	16	A-6 (7)
D-outside	SS-11	3.5-5	100	98	78	47	25	22	22	A-7-6 (18)
MVDS2-1	SS-12	6-7.5	100	99	83	49	27	22	25	A-7-6 (20)

Reviewed by: *John Saily*

NCDOT No.: 105-03-0803

CARY PROJECT: ST1220 TIP PROJECT: U-5315

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5315	1	16

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY WAKE
PROJECT DESCRIPTION MORRISVILLE PARKWAY
EXTENSION AND NC 540 INTERCHANGE FROM
SR 1625 (GREEN LEVEL CHURCH RD) TO NC 55
SITE DESCRIPTION ITS EQUIPMENT

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3-7	SITE PLAN(S)
8-14	BORE LOG(S)
15	LABORATORY TESTING SUMMARY

PERSONNEL

J. HAMM
A. PAUL
R. LANE
S. HUNSBERGER

INVESTIGATED BY R. LANE
DRAWN BY A. PAUL
CHECKED BY J. HAMM
SUBMITTED BY J. HAMM
DATE SEPTEMBER 11, 2017

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.



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
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A-2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM BT - BORING TERMINATED MICA - MICACEOUS CL. - CLAY MOD. - MODERATELY CPT - CONE PENETRATION TEST NP - NON PLASTIC CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SD. - SAND, SANDY f - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS SLLI. - SLIGHTLY FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT HI. - HIGHLY v - VERY									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										SAMPLE ABBREVIATIONS									
LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE										S - BULK WE. - WEATHERED ? - UNIT WEIGHT 7/2 - DRY UNIT WEIGHT									
PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE										SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO									
OM OPTIMUM MOISTURE SHRINKAGE LIMIT - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE										EQUIPMENT USED ON SUBJECT PROJECT									
SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE HOIST MOBILE B57									
PLASTICITY										ADVANCING TOOLS: CLAY BITS 6' CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING W/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG-CARB. CORE BIT									
PLASTICITY INDEX (PI) DRY STRENGTH										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: B H N HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										COLOR									
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																			

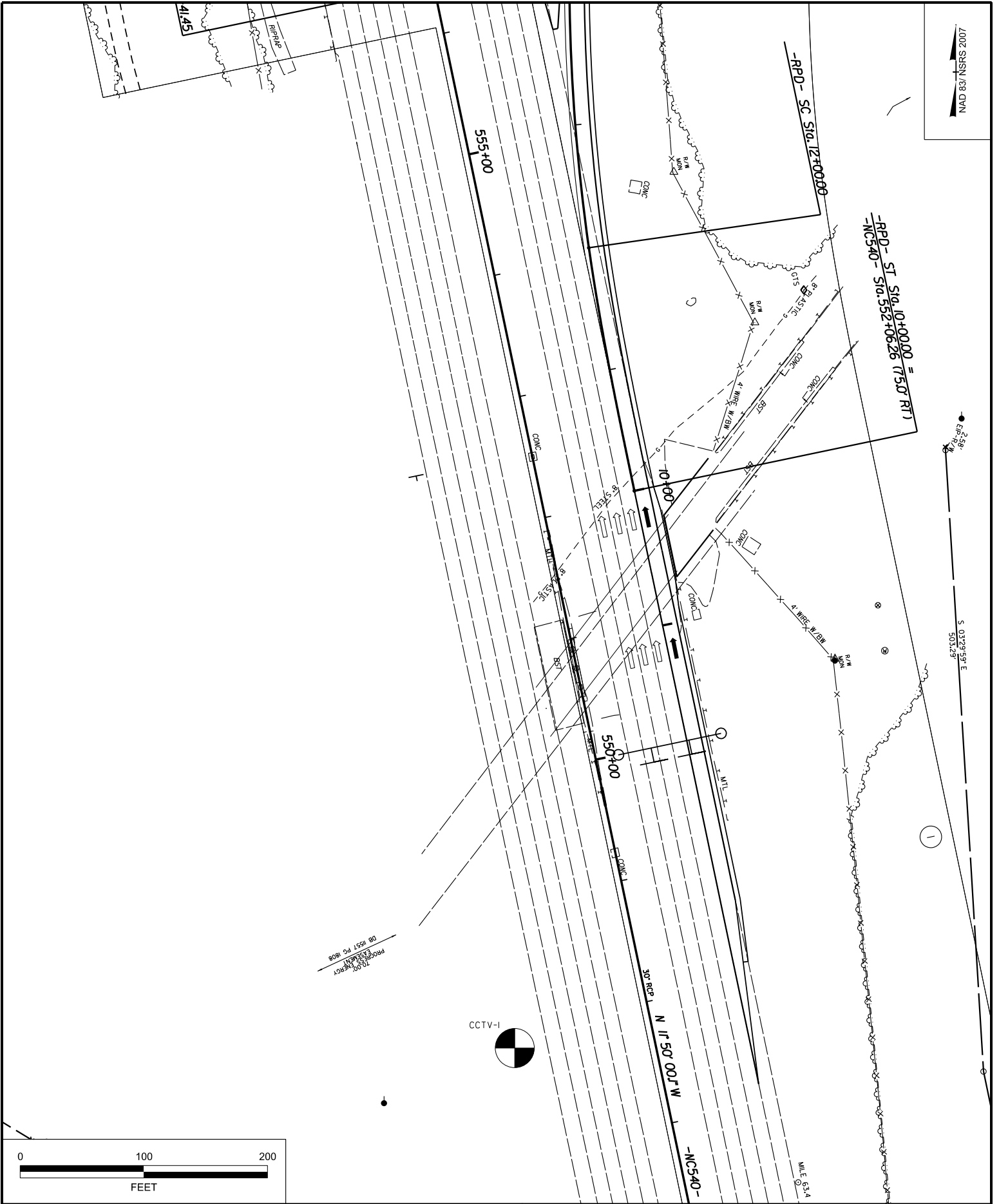
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT**

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS
<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.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>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.</p> <p>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.</p> <p>CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>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.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>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.</p> <p>SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>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.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>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.</p> <p>STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p>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.</p> <p>TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>
<p>WEATHERED ROCK (WR)</p>		<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>
<p>CRYSTALLINE ROCK (CR)</p>		<p>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)</p>		<p>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>
<p>COASTAL PLAIN SEDIMENTARY ROCK (CP)</p>		<p>COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>
WEATHERING		
<p>FRESH</p>	<p>ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p>	
<p>VERY SLIGHT (V SL.)</p>	<p>ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p>	
<p>SLIGHT (SL.)</p>	<p>ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p>	
<p>MODERATE (MOD.)</p>	<p>SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p>	
<p>MODERATELY SEVERE (MOD. SEV.)</p>	<p>ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p>	
<p>SEVERE (SEV.)</p>	<p>ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF</i></p>	
<p>VERY SEVERE (V SEV.)</p>	<p>ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF</i></p>	
<p>COMPLETE</p>	<p>ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p>	
ROCK HARDNESS		
<p>VERY HARD</p>	<p>CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p>	
<p>HARD</p>	<p>CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p>	
<p>MODERATELY HARD</p>	<p>CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.</p>	
<p>MEDIUM HARD</p>	<p>CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.</p>	
<p>SOFT</p>	<p>CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.</p>	
<p>VERY SOFT</p>	<p>CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.</p>	
FRACTURE SPACING		BEDDING
TERM	SPACING	TERM
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED
WIDE	3 TO 10 FEET	THICKLY BEDDED
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED
		THINLY LAMINATED
		4 FEET
		1.5 - 4 FEET
		0.16 - 1.5 FEET
		0.03 - 0.16 FEET
		0.008 - 0.03 FEET
		< 0.008 FEET
INDURATION		
<p>FRIABLE</p>	<p>RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p>	
<p>MODERATELY INDURATED</p>	<p>GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p>	
<p>INDURATED</p>	<p>GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p>	
<p>EXTREMELY INDURATED</p>	<p>SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>	
BENCH MARK:		
		ELEVATION: FEET
NOTES:		

NAD 83/ NRSRS 2007



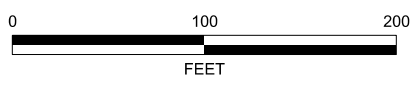
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CCTV-1



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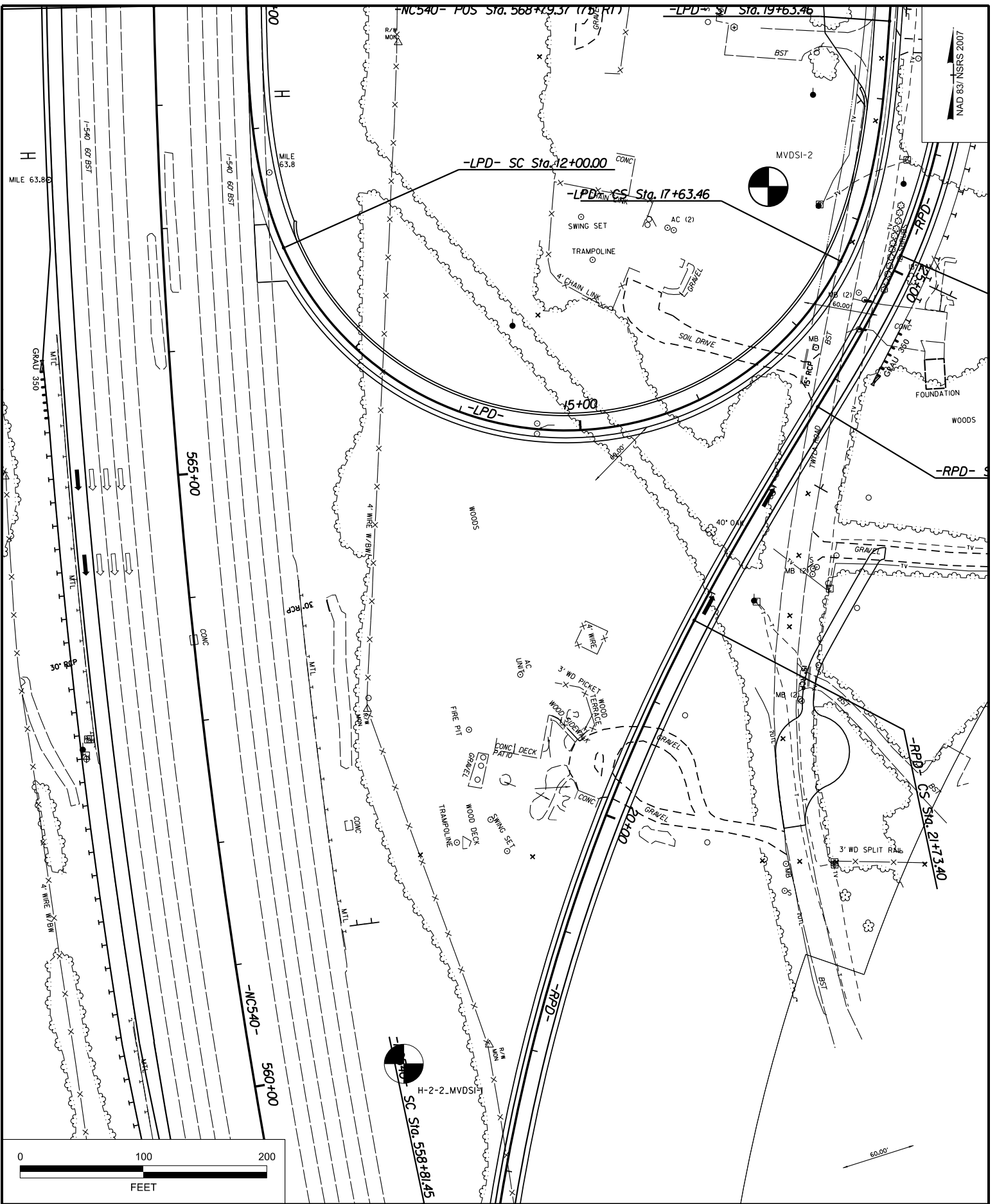


NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

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BORING LOCATION PLAN
 MORRISVILLE PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00



NOTES:

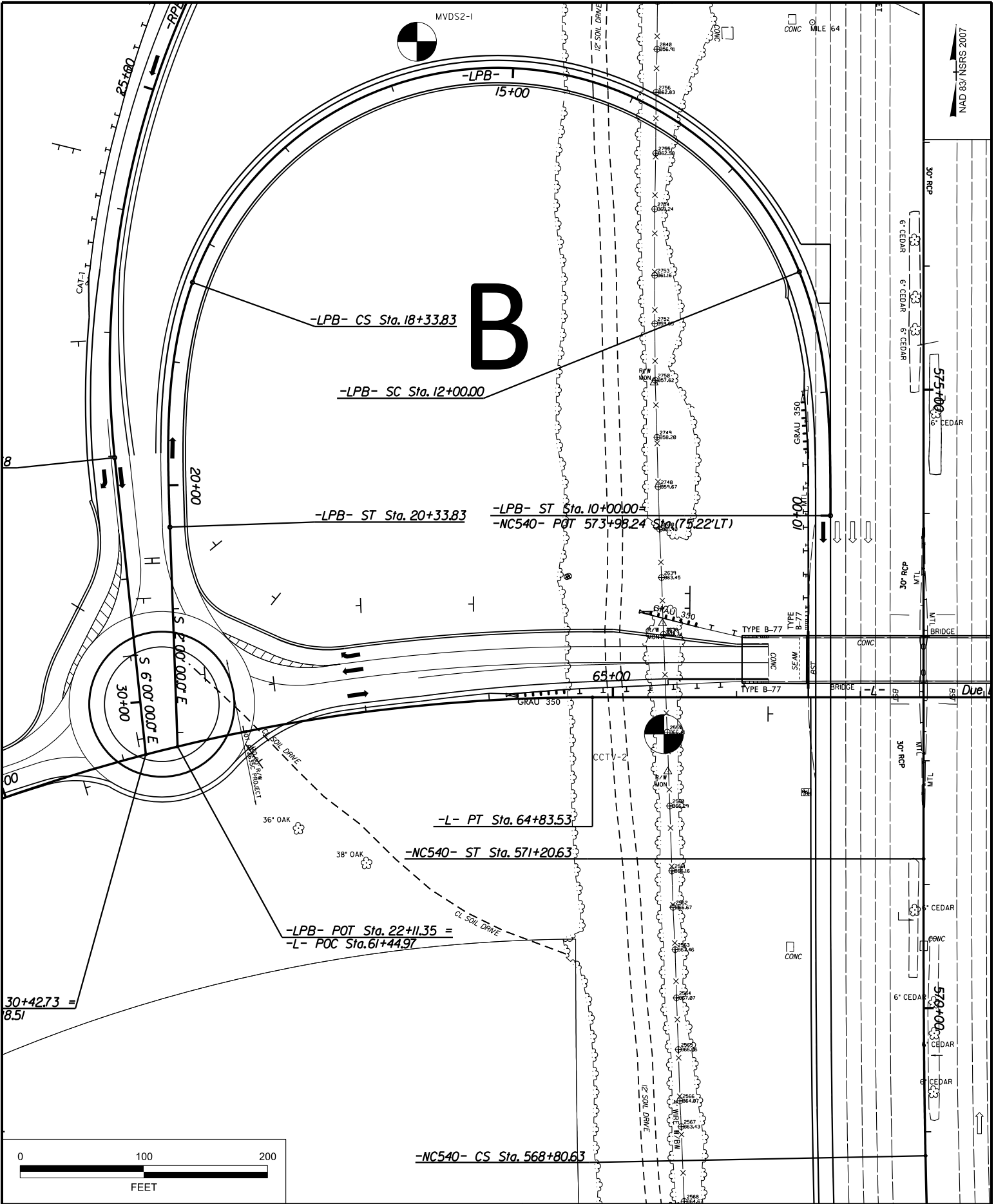
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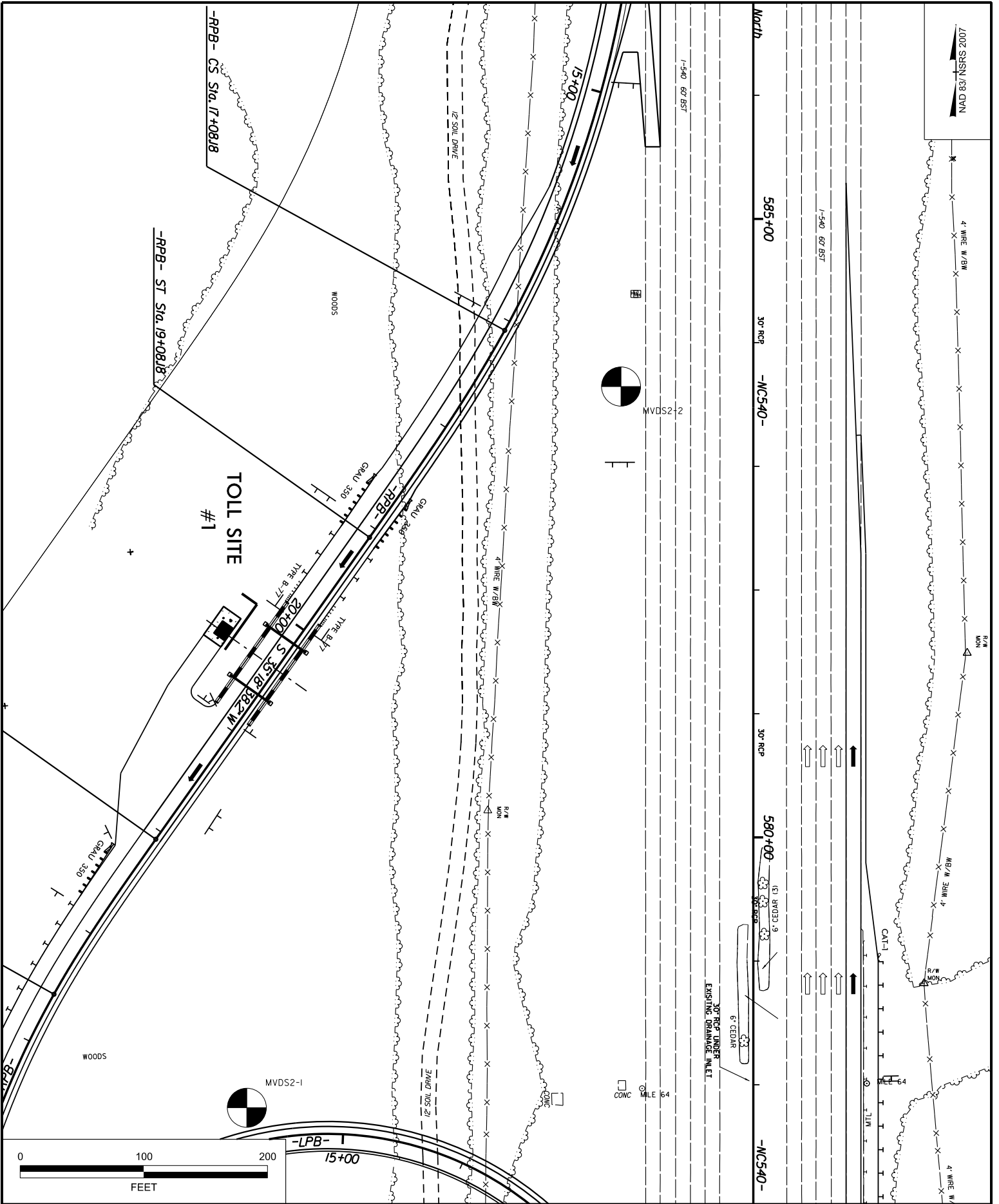
BORING LOCATION PLAN

MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55 CARY PROJECT: ST1220 | TIP PROJECT: U-5315 FALCON PROJECT NO.: G17027.00



<p>NOTES:</p> <p>PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.</p>	 <p>FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 CARY, NC 27513 PHONE: 919.871.0800 www.falconengineers.com</p>	<p>BORING LOCATION PLAN</p> <p>MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55 CARY PROJECT: ST1220 TIP PROJECT: U-5315 FALCON PROJECT NO.: G17027.00</p>
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NAD 83/ SRSN 2007

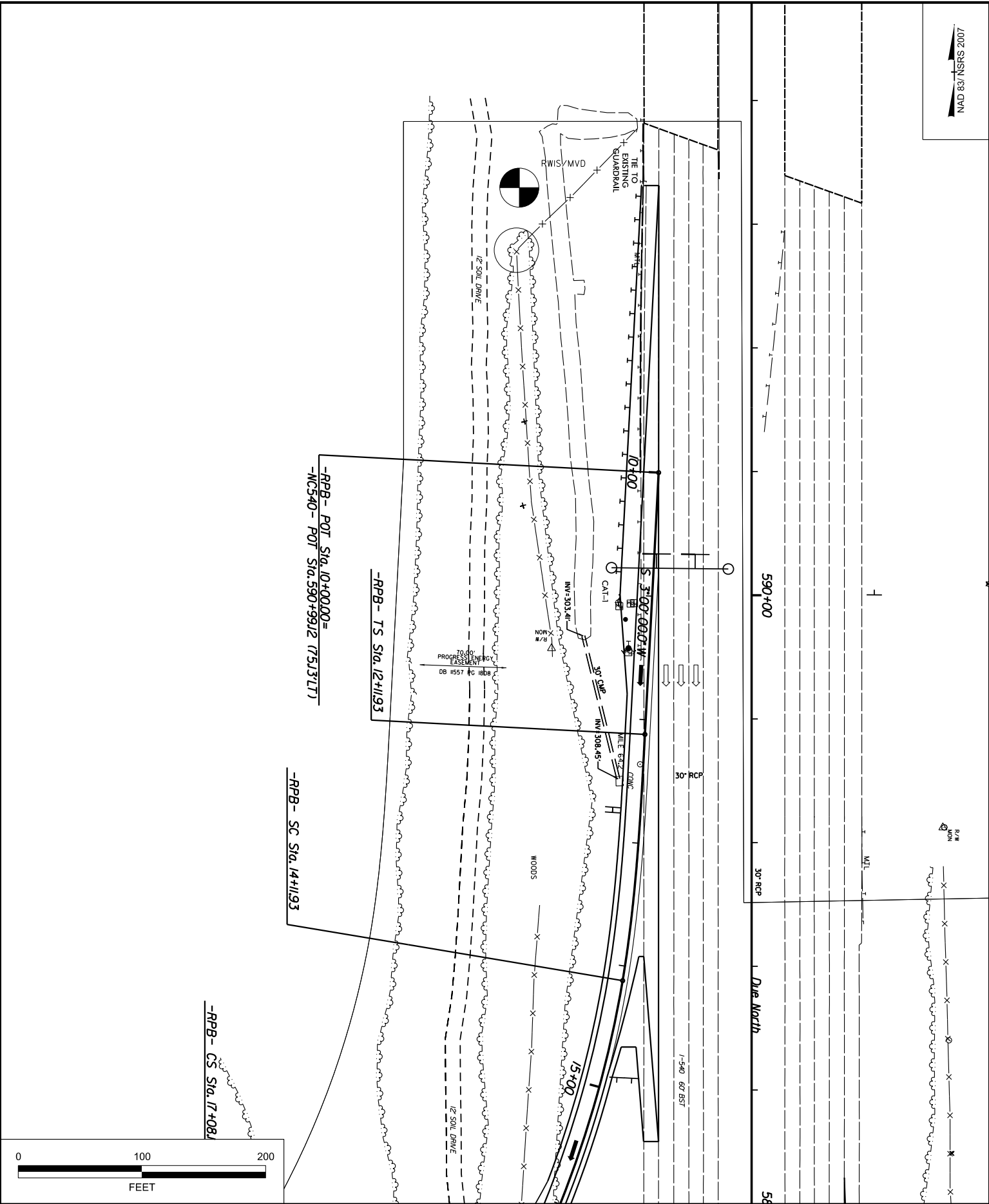


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<p>NOTES:</p> <ul style="list-style-type: none"> PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017. 	 <p>FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 CARY, NC 27513 PHONE: 919.871.0800 www.falconengineers.com</p>	<p style="text-align: center;">BORING LOCATION PLAN</p> <p>MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55 CARY PROJECT: ST1220 TIP PROJECT: U-5315 FALCON PROJECT NO.: G17027.00</p>
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GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. MVDS1-1_H-2-2			STATION 559+98			OFFSET 122 ft RT			ALIGNMENT -NC540-							
COLLAR ELEV. 350.6 ft			TOTAL DEPTH 13.7 ft			NORTHING 748,177			EASTING 2,032,137							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/17/17			COMP. DATE 05/17/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
355																
350	349.6	1.0	12	32	42									350.6	3" TOPSOIL	0.0
	347.1	3.5	28	45	55/0.4									347.6	RESIDUAL TAN, SILTY SAND (A-2-4)	3.0
345	344.6	6.0	17	28	72/0.4									345.1	WEATHERED ROCK TAN, TRIASSIC SANDSTONE	5.5
	342.1	8.5	22	78/0.3											TAN-BROWN, TRIASSIC MUDSTONE	
340																
	337.1	13.5												338.6	TAN, TRIASSIC SANDSTONE	12.0
														336.9	TAN, TRIASSIC SANDSTONE	13.7
															Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 336.9 ft IN WR: TRIASSIC SANDSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. MVDS1-2	STATION 18+02	OFFSET 77 ft LT	ALIGNMENT -LPD-
COLLAR ELEV. 353.3 ft	TOTAL DEPTH 19.1 ft	NORTHING 748,888	EASTING 2,032,433
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/11/17	COMP. DATE 05/11/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
355															
	352.3	1.0												2" TOPSOIL	0.0
	349.8	3.5	2	2	4	1							M	ARTIFICIAL FILL RED-ORANGE AND GRAY, SILTY CLAY (A-6) WITH TRACE ORGANICS	4.0
350	347.3	6.0	7	12	15								D	RESIDUAL RED, SILTY CLAY (A-6)	5.0
	344.8	8.5	7	10	28								D	TAN-ORANGE, SILTY SAND (A-2-4)	
345	344.8	8.5	18	34	40								D		
	339.8	13.5	16	25	38								D		
340	339.8	13.5	16	25	38								D		
	334.8	18.5	78	22/0.1										WEATHERED ROCK TAN, SANDSTONE	17.0
335	334.8	18.5	78	22/0.1										Boring Terminated at Elevation 334.2 ft IN WR: TRIASSIC SANDSTONE	19.1

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. CCTV-2	STATION 65+41	OFFSET 30 ft RT	ALIGNMENT -L-
COLLAR ELEV. 336.0 ft	TOTAL DEPTH 23.8 ft	NORTHING 749,376	EASTING 2,031,723
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/22/17	COMP. DATE 05/22/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
340																
335	335.0	1.0	3	3	4										336.0	0.0
	332.5	3.5	3	4	7											
330	330.0	6.0	6	6	7										330.5	5.5
	327.5	8.5	5	8	10											
325	322.5	13.5	7	9	15										323.0	13.0
320	317.5	18.5									SS-4	16%			318.0	18.0
315	312.5	23.5													312.2	23.8

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1		TIP U-5315		COUNTY WAKE		GEOLOGIST R. Lane										
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55							GROUND WTR (ft)									
BORING NO. MVDS2-2		STATION 583+64		OFFSET 107 ft LT		ALIGNMENT -NC540-										
COLLAR ELEV. 328.5 ft		TOTAL DEPTH 13.9 ft		NORTHING 750,518		EASTING 2,031,826										
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic										
DRILLER Estep, J. E.		START DATE 05/18/17		COMP. DATE 05/18/17		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
330																
	327.5	1.0	56	44/0.3						100/0.8				328.5	3" TOPSOIL	0.0
325	325.0	3.5	34	66/0.3						100/0.8					WEATHERED ROCK TAN, TRIASSIC SANDSTONE	
	322.5	6.0	21	28	32									323.0	RESIDUAL	5.5
	321.5													321.5	TAN, SILTY SAND (A-2-4)	7.0
320	320.0	8.5	50	50/0.1						100/0.6				320.5	RED AND GRAY, CLAY (A-6)	8.0
															WEATHERED ROCK RED AND GRAY, TRIASSIC MUDSTONE	
315	315.0	13.5								100/0.4				314.6		13.9
															Boring Terminated at Elevation 314.6 ft IN WR: TRIASSIC MUDSTONE	

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT.GDT 9/11/17



LABORATORY TEST RESULTS

Morrisville Pkwy. and 540 Interchange
Wake County, North Carolina

Falcon Engineering Project Number: G17027.00
May 30, 2017

SAMPLE IDENTIFICATION			PERCENTAGE PASSING			LIQUID & PLASTIC LIMITS			WATER CONTENT	AASHTO CLASSIFICATION
Location	Sample	Depth, ft	TOTAL SAMPLE			LL	PL	PI	(%)	
			#10	#40	#200					
D-median	SS-1	18.5-20	97	68	42	39	23	16	19	A-6 (3)
RWIS/MVD	SS-2	3.5-5	99	96	45	28	19	9	18	A-4 (1)
CCTV-1	SS-3	8.5-10	98	60	25	34	30	4	20	A-2-4 (0)
CCTV-2	SS-4	13.5-15	99	90	65	35	24	11	16	A-6 (6)
B-outside	SS-5	3.5-5	100	100	61	35	26	9	15	A-4 (4)
TB1	SS-6	8.5-10	99	80	51	32	20	12	10	A-6 (3)
F-median	SS-7	3.5-5	75	68	55	30	20	10	11	A-4 (3)
F-outside	SS-8	23.5-25	100	98	89	54	29	25	23	A-7-6 (26)
D-median	SS-9	23.5-25	99	62	37	44	29	15	26	A-7-6 (2)
F-outside	SS-10	3.5-5	98	87	63	35	20	15	16	A-6 (7)
D-outside	SS-11	3.5-5	100	98	78	47	25	22	22	A-7-6 (18)
MVDS2-1	SS-12	6-7.5	100	99	83	49	27	22	25	A-7-6 (20)

Reviewed by: *John Saily*

NCDOT No.: 105-03-0803

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A-2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM BT - BORING TERMINATED MICA - MICACEOUS CL. - CLAY MOD. - MODERATELY CPT - CONE PENETRATION TEST NP - NON PLASTIC CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC e - VOID RATIO SD. - SAND, SANDY f - FINE SL. - SILT, SILTY FOSS. - FOSSILIFEROUS SLLI. - SLIGHTLY FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT HI. - HIGHLY v - VERY									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										SAMPLE ABBREVIATIONS									
LL LIQUID LIMIT - SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE										S - BULK WE. - WEATHERED ? - UNIT WEIGHT 7/2 - DRY UNIT WEIGHT									
PL PLASTIC LIMIT - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE										SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO									
OM OPTIMUM MOISTURE SHRINKAGE LIMIT - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE										EQUIPMENT USED ON SUBJECT PROJECT									
SL SHRINKAGE LIMIT - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE HOIST MOBILE B57									
PLASTICITY										ADVANCING TOOLS: CLAY BITS 6' CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG-CARB. CORE BIT									
PLASTICITY INDEX (PI) DRY STRENGTH										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: B H N HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										COLOR									
DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.																			





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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION

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:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

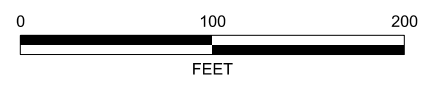
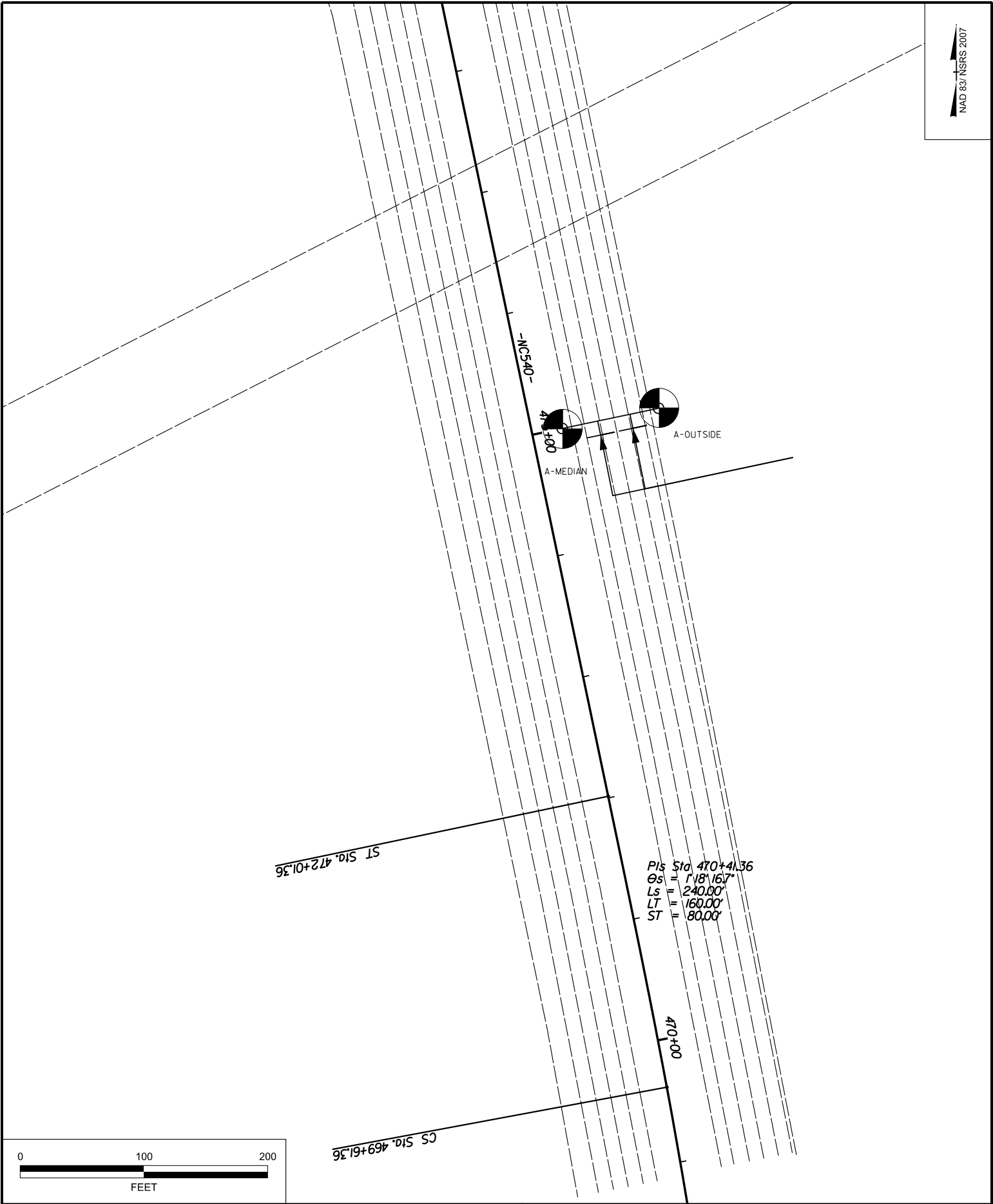
TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.	AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.	ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, 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 DISLODGED FROM PARENT MATERIAL.
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
ROCK QUALITY DESIGNATION (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.

BENCH MARK:

ELEVATION: FEET

NOTES:



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

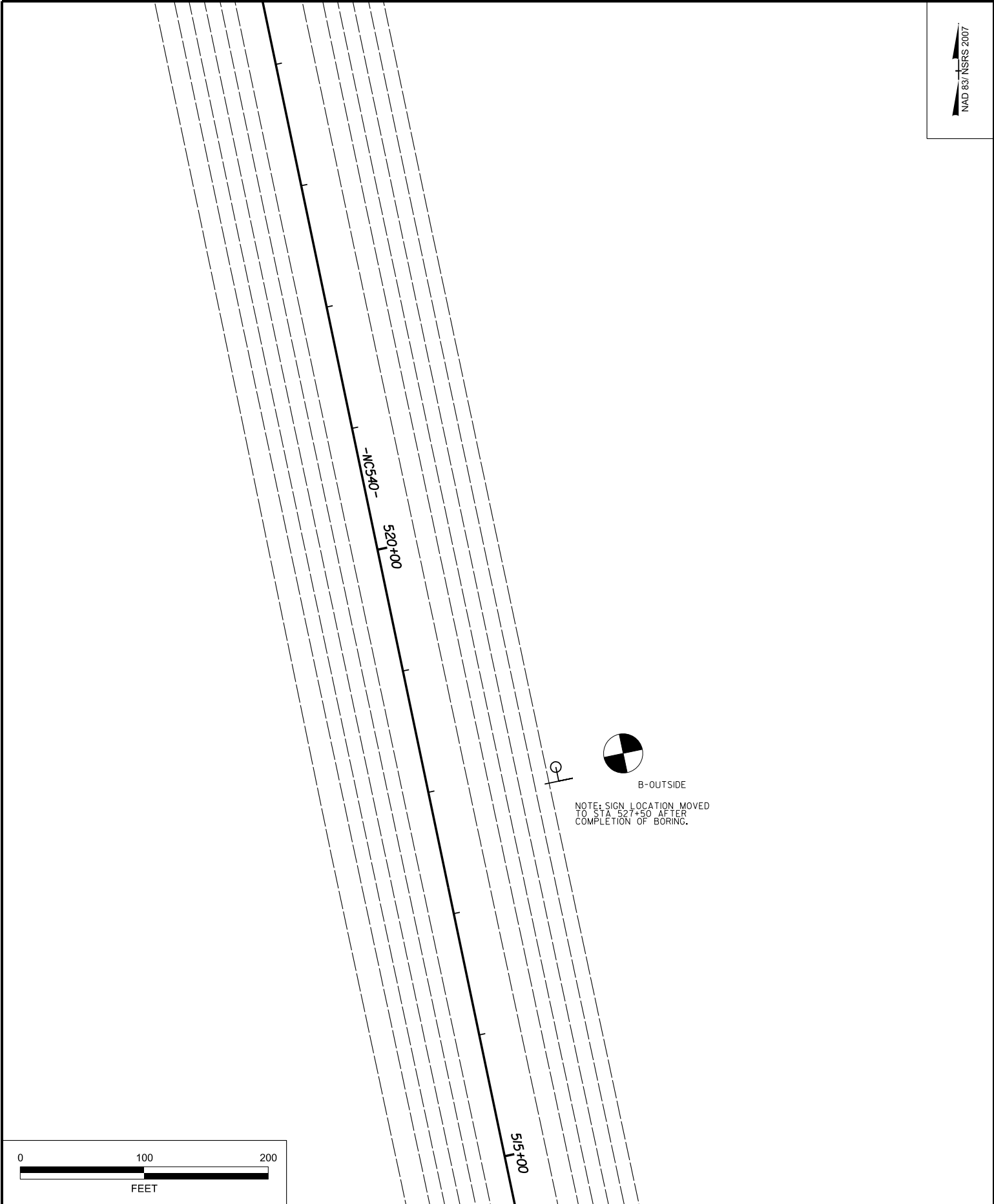


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BORING LOCATION PLAN

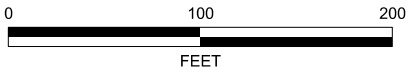
MORRISVILL PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00

NAD 83/ NSRS 2007



B-OUTSIDE

NOTE: SIGN LOCATION MOVED TO STA 527+50 AFTER COMPLETION OF BORING.



NOTES:

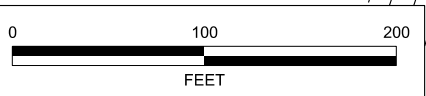
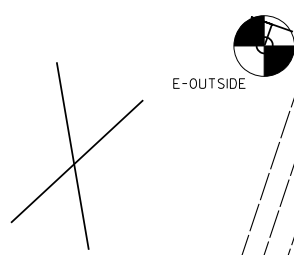
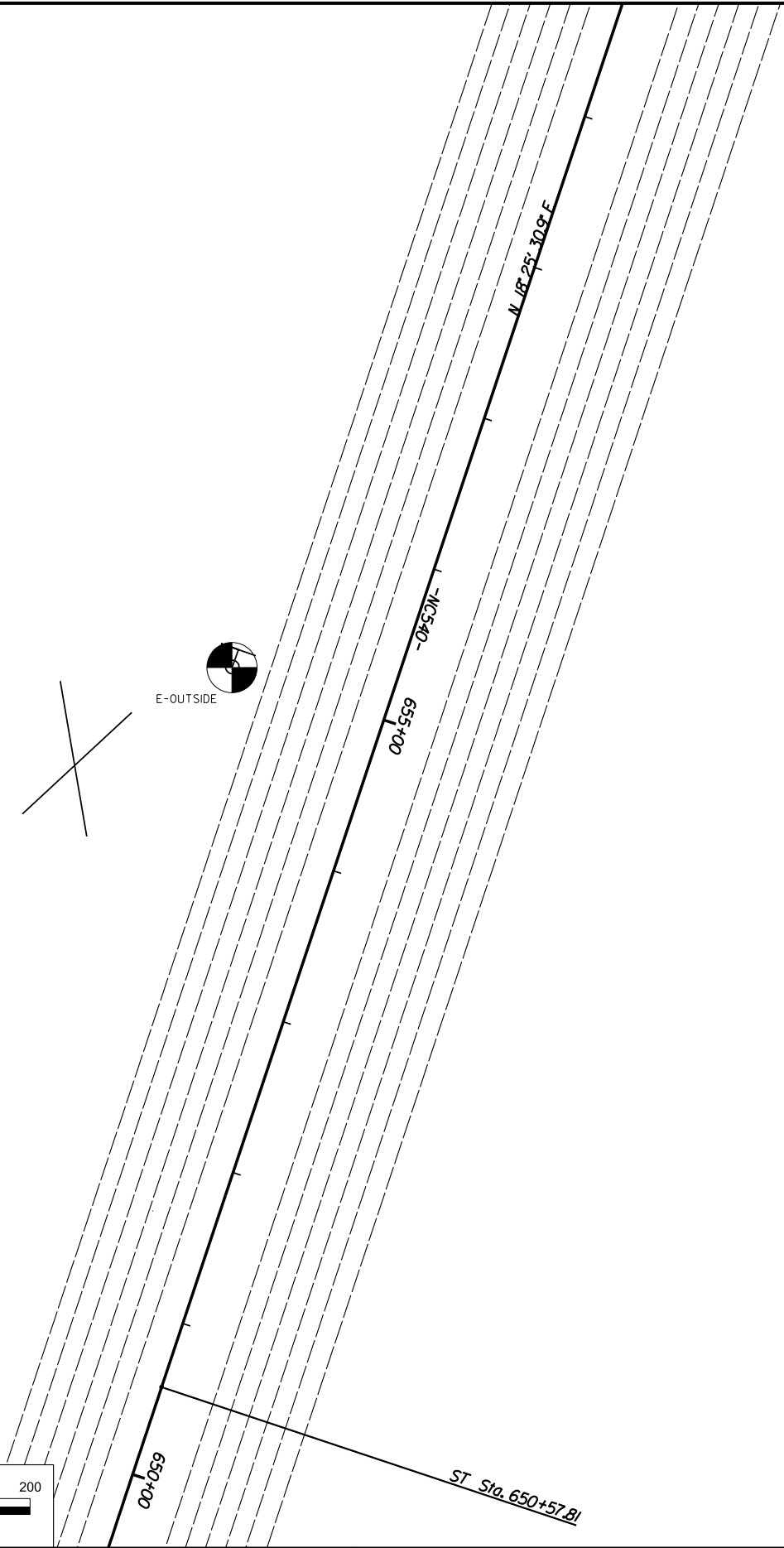
- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.



FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 CARY, NC 27513
 PHONE: 919.871.0800
 www.falconengineers.com

BORING LOCATION PLAN

MORRISVILL PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

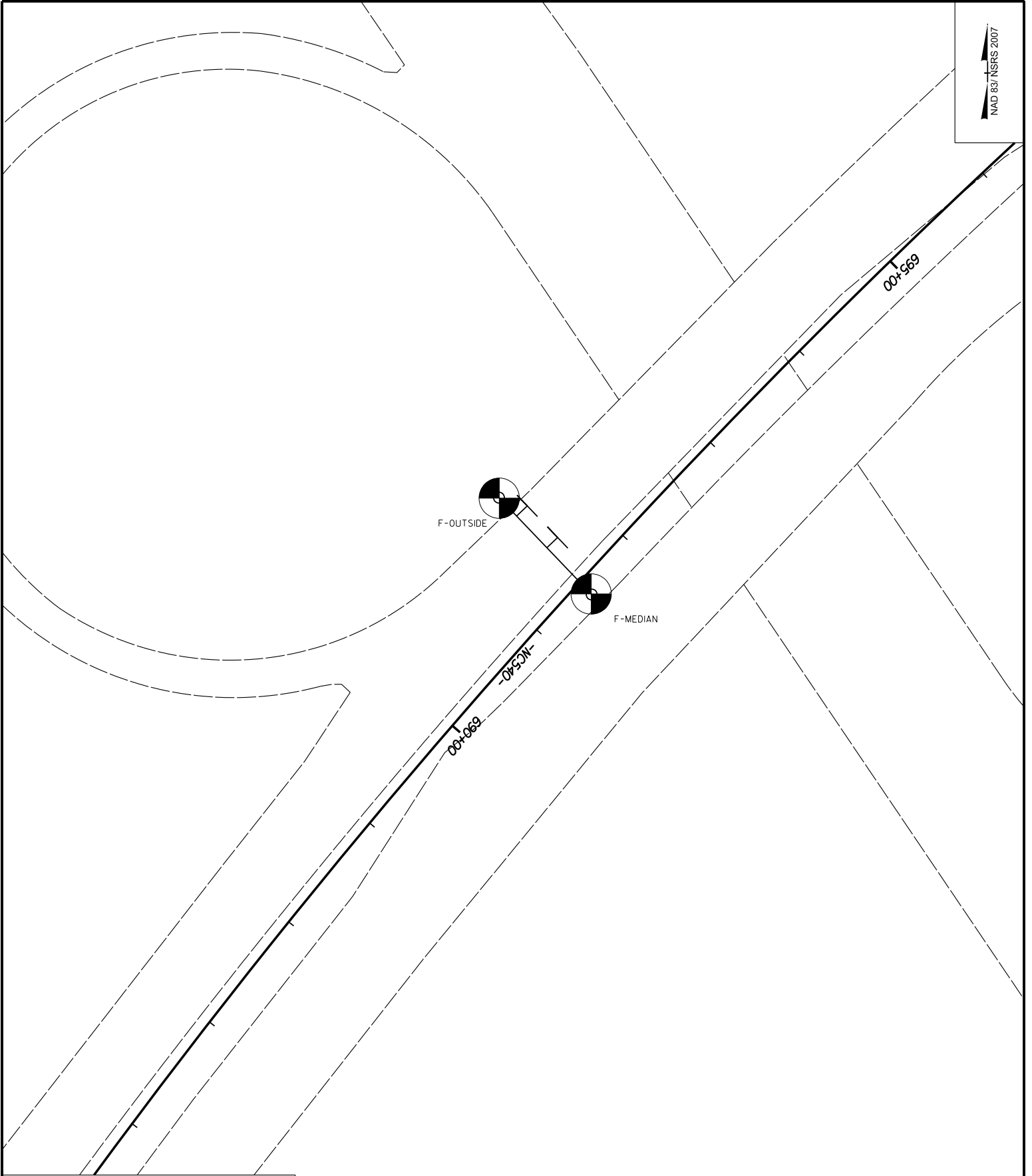


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NAD 83/ NSRS 2007



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.



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BORING LOCATION PLAN

MORRISVILL PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane						
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)						
BORING NO. A-OUTSIDE			STATION 475+00			OFFSET 104 ft RT			ALIGNMENT -NC540-						
COLLAR ELEV. 342.9 ft			TOTAL DEPTH 14.1 ft			NORTHING 739,860			EASTING 2,033,857						
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic						
DRILLER Estep, J. E.			START DATE 05/16/17			COMP. DATE 05/16/17			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
345															
	341.9	1.0	4	5	20									342.9	0.0
340	339.4	3.5	18	35	65/0.4									339.9	3.0
	336.9	6.0	11	33	67/0.3										
335	334.4	8.5	40		60/0.0					100/0.9					
										100/0.8					
330	329.4	13.5	59	51/0.1						100/0.5					
										100/0.6				328.8	14.1
Boring Terminated at Elevation 328.8 ft IN WR: TRIASSIC MUDSTONE															

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55										GROUND WTR (ft)						
BORING NO. C-MEDIAN			STATION 550+00			OFFSET 19 ft RT			ALIGNMENT -NC540-							
COLLAR ELEV. 351.0 ft			TOTAL DEPTH 13.9 ft			NORTHING 747,183			EASTING 2,032,235							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/16/17			COMP. DATE 05/16/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
355																
350	350.0	1.0	9	20	25									351.0	3" TOPSOIL	0.0
	347.5	3.5	11	27	31										RESIDUAL RED, CLAY (A-6)	
345	345.0	6.0	12	100/0.4										345.5	WEATHERED ROCK TAN, TRIASSIC SANDSTONE	5.5
	342.5	8.5	73	27/0.1						100/0.9						
340										100/0.6						
	337.5	13.5								100/0.4				337.1		13.9
															Boring Terminated at Elevation 337.1 ft IN WR: TRIASSIC SANDSTONE	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane						
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)						
BORING NO. C-OUTSIDE			STATION 550+00			OFFSET 104 ft RT			ALIGNMENT -NC540-						
COLLAR ELEV. 350.2 ft			TOTAL DEPTH 13.8 ft			NORTHING 747,200			EASTING 2,032,318						
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic						
DRILLER Estep, J. E.			START DATE 05/16/17			COMP. DATE 05/16/17			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
355															
350	349.2	1.0	41	59/0.3						100/0.8			350.2	3" TOPSOIL	0.0
	346.7	3.5	6	6	13								347.2	WEATHERED ROCK TAN, TRIASSIC SANDSTONE	3.0
345	344.2	6.0	11	47	53/0.3								345.2	RESIDUAL RED AND GRAY, CLAY (A-6) MICAEOUS WEATHERED ROCK GRAY, TRIASSIC SANDSTONE	5.0
	341.7	8.5	39	61/0.4						100/0.8					
340										100/0.9					
	336.7	13.5								100/0.3			336.4	Boring Terminated at Elevation 336.4 ft IN WR: TRIASSIC SANDSTONE	13.8
			100/0.3							100/0.3					

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. D-MEDIAN			STATION 590+21			OFFSET 19 ft LT			ALIGNMENT -NC540-							
COLLAR ELEV. 315.5 ft			TOTAL DEPTH 30.0 ft			NORTHING 751,175			EASTING 2,031,914							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/18/17			COMP. DATE 05/18/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
320																
315	314.5	1.0	2	3	5	8								315.5	3" TOPSOIL	0.0
310	312.0	3.5	4	3	4	7									ROADWAY EMBANKMENT BROWN-ORANGE AND GRAY, CLAY (A-6) MICACEOUS WITH TRACE ORGANICS	
	309.5	6.0	4	4	5	9										
	307.0	8.5	3	3	5	8										
300	302.0	13.5	3	3	5	8								303.5	ALLUVIAL BROWN ORANGE BLACK AND GRAY, SANDY CLAY (A-6) WITH SOME ORGANICS	12.0
	297.0	18.5	4	4	4	8										
290	292.0	23.5	9	12	9	21								293.5	RESIDUAL ORANGE AND GRAY, MODERATELY PLASTIC CLAY (A-7-6) MOTTLED	22.0
	287.0	28.5	4	5	5	10								285.5	Boring Terminated at Elevation 285.5 ft IN RESIDUAL (A-7-6)	30.0

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane						
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)						
BORING NO. E-OUTSIDE			STATION 655+00			OFFSET 101 ft LT			ALIGNMENT -NC540-						
COLLAR ELEV. 351.9 ft			TOTAL DEPTH 13.8 ft			NORTHING 757,594			EASTING 2,031,824						
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic						
DRILLER Estep, J. E.			START DATE 05/18/17			COMP. DATE 05/18/17			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
355															
	350.9	1.0	15	21	27									351.9	3" TOPSOIL 0.0
350	348.4	3.5	55	45/0.3										348.9	RESIDUAL RED, CLAY (A-6) MICACEOUS 3.0
	345.9	6.0	44	66/0.3						100/0.8					WEATHERED ROCK RED, TRIASSIC MUDSTONE
345	343.4	8.5	37	63/0.3						100/0.8					
	340									100/0.8					
340	338.4	13.5	100	0.3						100/0.3				339.4	TAN-BROWN, TRIASSIC SANDSTONE 12.5
														338.1	Boring Terminated at Elevation 338.1 ft IN WR: TRIASSIC SANDSTONE 13.8

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. F-MEDIAN	STATION 691+49	OFFSET 14 ft RT	ALIGNMENT -NC540-
COLLAR ELEV. 370.7 ft	TOTAL DEPTH 29.9 ft	NORTHING 760,794	EASTING 2,033,528
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/18/17	COMP. DATE 05/18/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
375																
370	369.7	1.0	3	4	7									370.7	3" TOPSOIL	0.0
365	367.2	3.5	6	7	4										ROADWAY EMBANKMENT RED AND GRAY, SILT (A-4) WITH TRACE GRAVEL AND ORGANICS	
	364.7	6.0	4	9	11											
360	362.2	8.5	11	10	5										ARTIFICIAL FILL GRAVEL LAYER	
	357.2	13.5	12	16	8									359.7		
355	352.2	18.5	19	10	19									357.7	RESIDUAL RED BROWN AND GRAY, CLAY (A-6) WITH TRACE GRAVEL AND ORGANICS	13.0
	347.2	23.5	4	5	5											
345	342.2	28.5	19	30	70/0.4									344.2	WEATHERED ROCK GRAY AND RED, TRIASSIC MUDSTONE	26.5
														340.8		29.9
															Boring Terminated at Elevation 340.8 ft IN WR: TRIASSIC MUDSTONE	

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. F-OUTSIDE			STATION 691+57			OFFSET 91 ft LT			ALIGNMENT -NC540-							
COLLAR ELEV. 371.9 ft			TOTAL DEPTH 30.0 ft			NORTHING 760,869			EASTING 2,033,456							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/17/17			COMP. DATE 05/17/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						ELEV. (ft)
375																
370	370.9	1.0	2	2	4	6								371.9	3" TOPSOIL	0.0
	368.4	3.5	2	3	5	8									ROADWAY EMBANKMENT RED-BROWN, CLAY (A-6)	
365	365.9	6.0	7	3	3	6										
	363.4	8.5	4	6	6	12										
360	358.4	13.5	11	11	14	25										
355	353.4	18.5	15	9	10	19								357.9	RESIDUAL GRAY-RED, SANDY SILTY CLAY (A-6)	14.0
	348.4	23.5	3	5	9	14								355.9	RED AND GRAY, MODERATELY PLASTIC CLAY (A-7-6) W/ TRACE ORGANICS AND GRAVEL	16.0
345	343.4	28.5	40	46	43	89								345.4	RED AND GRAY, CLAY (A-6)	26.5
														341.9	Boring Terminated at Elevation 341.9 ft IN RESIDUAL (A-6)	30.0

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT.GDT 9/11/17



LABORATORY TEST RESULTS

Morrisville Pkwy. and 540 Interchange
Wake County, North Carolina

Falcon Engineering Project Number: G17027.00
May 30, 2017

SAMPLE IDENTIFICATION			PERCENTAGE PASSING			LIQUID & PLASTIC LIMITS			WATER CONTENT	AASHTO CLASSIFICATION
Location	Sample	Depth, ft	TOTAL SAMPLE			LL	PL	PI	(%)	
			#10	#40	#200					
D-median	SS-1	18.5-20	97	68	42	39	23	16	19	A-6 (3)
RWIS/MVD	SS-2	3.5-5	99	96	45	28	19	9	18	A-4 (1)
CCTV-1	SS-3	8.5-10	98	60	25	34	30	4	20	A-2-4 (0)
CCTV-2	SS-4	13.5-15	99	90	65	35	24	11	16	A-6 (6)
B-outside	SS-5	3.5-5	100	100	61	35	26	9	15	A-4 (4)
TB1	SS-6	8.5-10	99	80	51	32	20	12	10	A-6 (3)
F-median	SS-7	3.5-5	75	68	55	30	20	10	11	A-4 (3)
F-outside	SS-8	23.5-25	100	98	89	54	29	25	23	A-7-6 (26)
D-median	SS-9	23.5-25	99	62	37	44	29	15	26	A-7-6 (2)
F-outside	SS-10	3.5-5	98	87	63	35	20	15	16	A-6 (7)
D-outside	SS-11	3.5-5	100	98	78	47	25	22	22	A-7-6 (18)
MVDS2-1	SS-12	6-7.5	100	99	83	49	27	22	25	A-7-6 (20)

Reviewed by: *John Saily*

NCDOT No.: 105-03-0803

CARY PROJECT: ST1220 TIP PROJECT: U-5315

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-5315	1	11

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

STRUCTURE

SUBSURFACE INVESTIGATION

COUNTY WAKE

PROJECT DESCRIPTION MORRISVILLE PARKWAY
EXTENSION AND NC 540 INTERCHANGE FROM
SR 1625 (GREEN LEVEL CHURCH RD) TO NC 55

SITE DESCRIPTION TOLLING INFRASTRUCTURE

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND (SOIL & ROCK)
3-4	SITE PLAN(S)
5-8	BORE LOG(S)
9	LABORATORY TESTING SUMMARY

PERSONNEL

J. HAMM

A. PAUL

R. LANE

S. HUNSBERGER

INVESTIGATED BY R. LANE

DRAWN BY A. PAUL

CHECKED BY J. HAMM

SUBMITTED BY J. HAMM

DATE SEPTEMBER 11, 2017

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.



SEAL
039779

ENGINEER
JEREMY R. HAMM

Jeremy R. Hamm 9/11/17

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
(PAGE 1 OF 2)

SOIL DESCRIPTION										GRADATION									
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										MINERALOGICAL COMPOSITION									
GROUP CLASS. A-1, A-3, A-2, A-4, A-5, A-6, A-7, A-1-A-2, A-3, A-4, A-5, A-6, A-7										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
SYMBOL										COMPRESSIBILITY									
% PASSING #10, #40, #200										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
MATERIAL PASSING #40 LL, PI										PERCENTAGE OF MATERIAL									
GROUP INDEX										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										TRACE OF ORGANIC MATTER 2 - 3% 3 - 5% TRACE 1 - 10% LITTLE ORGANIC MATTER 3 - 5% 5 - 12% LITTLE 10 - 20% MODERATELY ORGANIC 5 - 10% 12 - 20% SOME 20 - 35% HIGHLY ORGANIC > 10% > 20% HIGHLY 35% AND ABOVE									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ STATIC WATER LEVEL AFTER 24 HOURS ▽PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION 25/825 DIP & DIP DIRECTION OF ROCK STRUCTURES SOIL SYMBOL SPT DMT VST PMT TEST BORING ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT AUGER BORING CORE BORING MONITORING WELL INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY SLOPE INDICATOR INSTALLATION CONE PENETROMETER TEST SOUNDING ROD TEST BORING WITH CORE SPT N-VALUE									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053										UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK									
GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										AR - AUGER REFUSAL MED. - MEDIUM VST - VANE SHEAR TEST BT - BORING TERMINATED MICA - MICACEOUS WEA. - WEATHERED CL. - CLAY MOD. - MODERATELY ? - UNIT WEIGHT CPT - CONE PENETRATION TEST NP - NON PLASTIC 7/2 - DRY UNIT WEIGHT CSE. - COARSE ORG. - ORGANIC DMT - DILATOMETER TEST PMT - PRESSUREMETER TEST SAMPLE ABBREVIATIONS DPT - DYNAMIC PENETRATION TEST SAP. - SAPROLITIC S - BULK e - VOID RATIO SD. - SAND, SANDY SS - SAND SPOON F - FINE SL. - SILT, SILTY ST - SHELBY TUBE FOSS. - FOSSILIFEROUS SLL. - SLIGHTLY RS - ROCK FRAC. - FRACTURED, FRACTURES TCR - TRICONE REFUSAL RT - RECOMPACTED TRIAXIAL FRAGS. - FRAGMENTS w - MOISTURE CONTENT CBR - CALIFORNIA BEARING RATIO HI. - HIGHLY v - VERY									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: ADVANCING TOOLS: HAMMER TYPE:									
NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH										<input type="checkbox"/> CME-45C <input type="checkbox"/> CLAY BITS <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL <input type="checkbox"/> CME-55 <input type="checkbox"/> 6' CONTINUOUS FLIGHT AUGER <input type="checkbox"/> CME-550 <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> PORTABLE HOIST <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 checked="" type="checkbox"/> MOBILE B57 <input type="checkbox"/> CORE BIT <input type="checkbox"/> _____									
COLOR										CORE SIZE: HAND TOOLS:									
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.										<input type="checkbox"/> -B _____ <input type="checkbox"/> -H _____ <input type="checkbox"/> -N _____ <input type="checkbox"/> POST HOLE DIGGER <input type="checkbox"/> HAND AUGER <input type="checkbox"/> SOUNDING ROD <input type="checkbox"/> VANE SHEAR TEST <input type="checkbox"/> _____									





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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION

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:

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.	
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

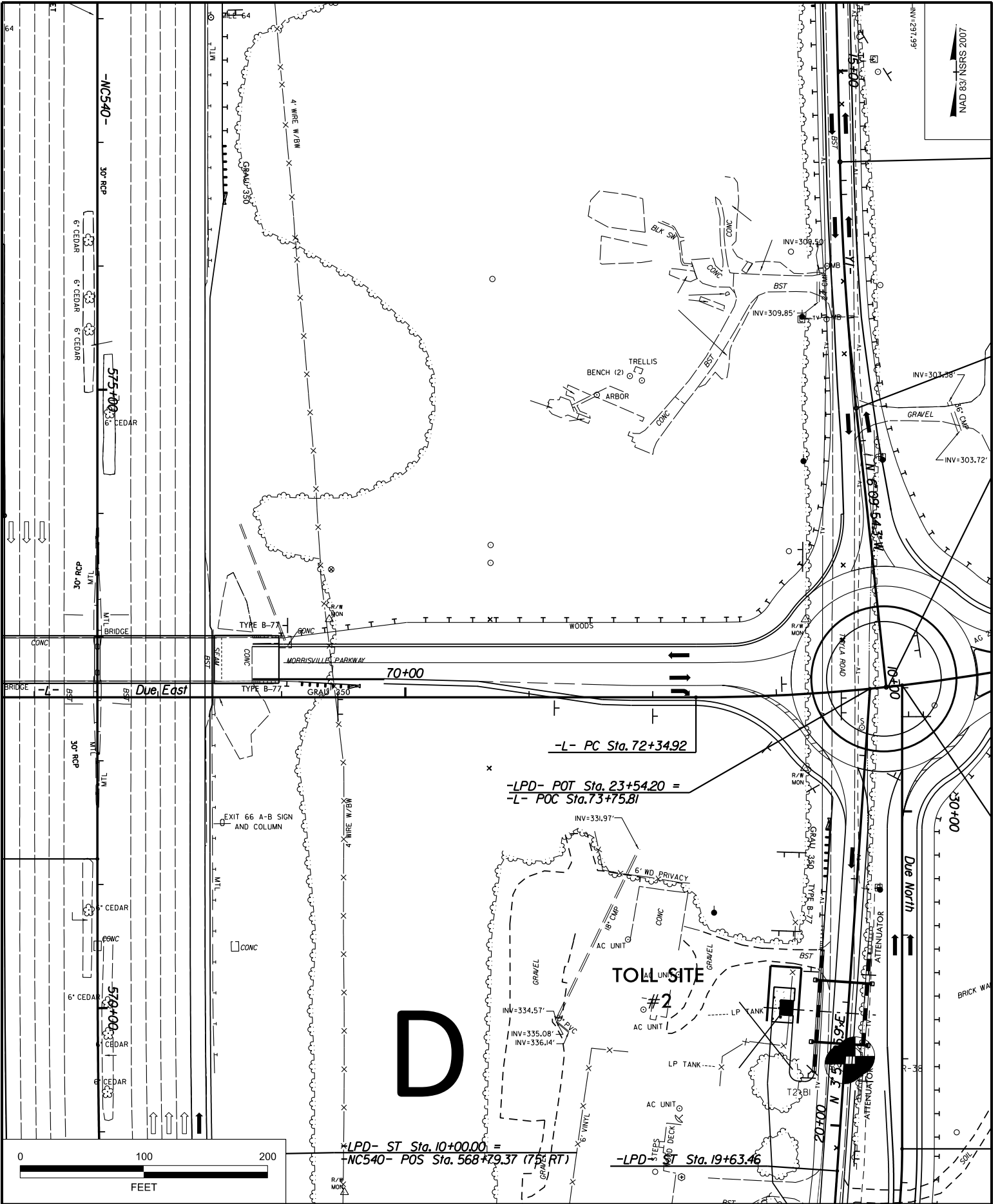
TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.	AQUIFER - A WATER BEARING FORMATION OR STRATA.
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.	ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, 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 DISLODGED FROM PARENT MATERIAL.
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.
ROCK QUALITY DESIGNATION (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.

BENCH MARK:

ELEVATION: FEET

NOTES:



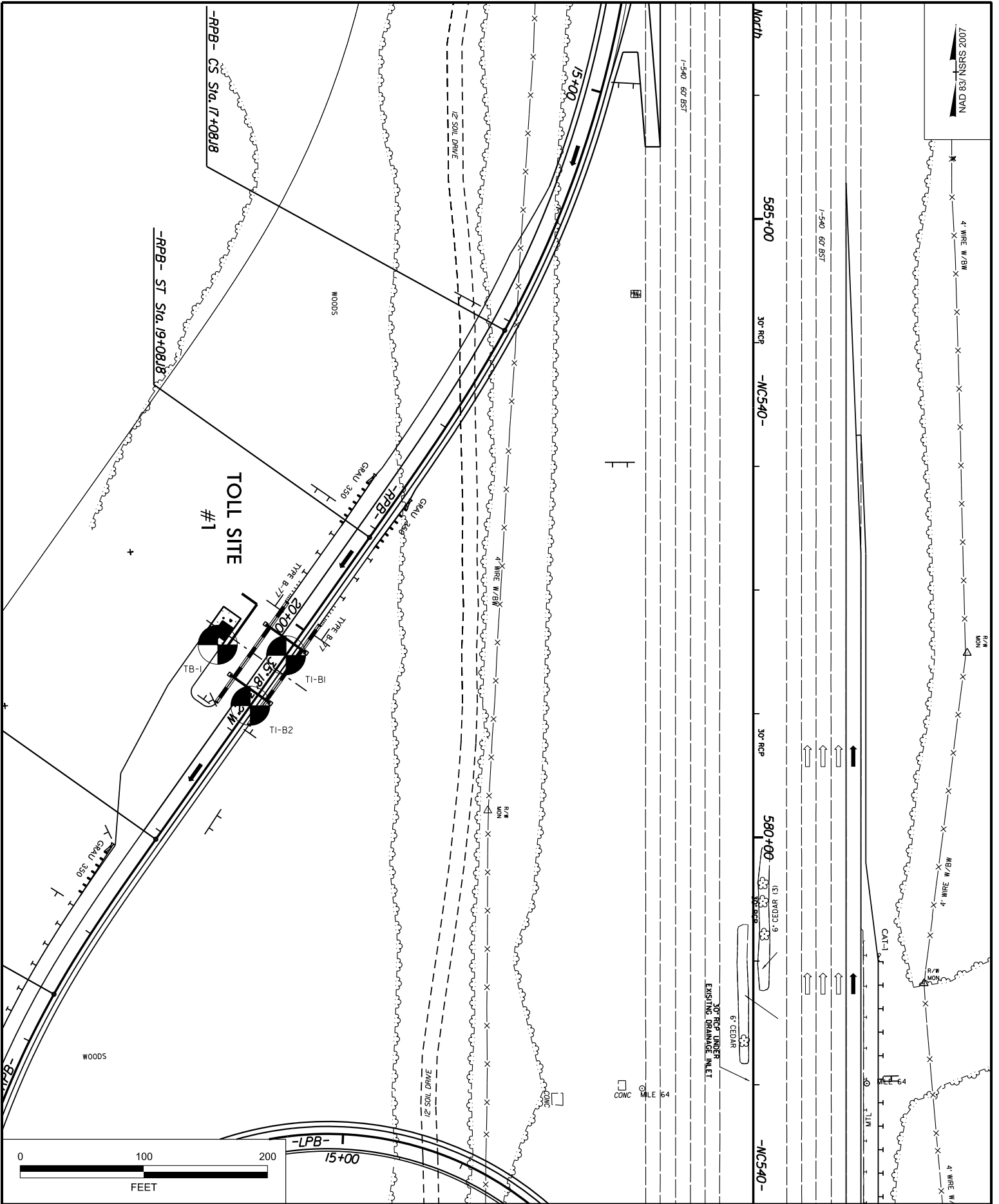
NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.

FALCON ENGINEERING
 FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 CARY, NC 27513
 PHONE: 919.871.0800
 www.falconengineers.com

BORING LOCATION PLAN
 MORRISVILLE PARKWAY EXTENSION AND NC 540
 INTERCHANGE FROM SR 1625 TO NC 55
 CARY PROJECT: ST1220 | TIP PROJECT: U-5315
 FALCON PROJECT NO.: G17027.00

NAD 83/ 2007



NOTES:

- PLANS ADOPTED FROM ELECTRONIC SURVEY FILES RECEIVED FROM RK&K DATED MAY, 2017.



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BORING LOCATION PLAN

MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55 CARY PROJECT: ST1220 | TIP PROJECT: U-5315 FALCON PROJECT NO.: G17027.00

GEOTECHNICAL BORING REPORT BORE LOG

WBS 45429.1.1	TIP U-5315	COUNTY WAKE	GEOLOGIST R. Lane
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55			GROUND WTR (ft)
BORING NO. T2-B1	STATION 20+50	OFFSET CL	ALIGNMENT -LPD-
COLLAR ELEV. 344.7 ft	TOTAL DEPTH 14.3 ft	NORTHING 749,109	EASTING 2,032,537
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER Estep, J. E.	START DATE 05/11/17	COMP. DATE 05/11/17	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					ELEV. (ft)
345														344.7	0.0
	343.7	1.0	2	2	4						M	RESIDUAL ORANGE AND GRAY, SANDY, MODERATELY PLASTIC CLAY (A-7-6) TAN AND ORANGE, SILTY SAND (A-2-4)	3.0		
340	341.2	3.5	11	16	22						D		3.0		
	338.7	6.0	13	18	23						D				
335	336.2	8.5	10	15	15						D	9.1			
	331.2	13.5	9	91/0.3											
													330.4	14.3	

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. T1-B1			STATION 20+25			OFFSET CL			ALIGNMENT -RPB-							
COLLAR ELEV. 338.7 ft			TOTAL DEPTH 9.4 ft			NORTHING 750,301			EASTING 2,031,555							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/10/17			COMP. DATE 05/12/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
340																
	337.7	1.0													338.7	0.0
335	335.2	3.5	3	4	7								W	RESIDUAL ORANGE AND GRAY, SILTY, MODERATELY PLASTIC CLAY (A-7)	3.0	
	332.7	6.0	12	27	41								D	RED-BROWN AND GRAY, SILTY F. SAND (A-2-4)	5.5	
330	330.2	8.5	9	44	56/0.4									WEATHERED ROCK TAN, MUDSTONE		
			36	64/0.4						100/0.9					329.3	9.4
Boring Terminated at Elevation 329.3 ft IN WR: TRIASSIC MUDSTONE																

NCDOT BORE SINGLE U5315 BORINGS.GPJ NC_DOT.GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 45429.1.1			TIP U-5315			COUNTY WAKE			GEOLOGIST R. Lane							
SITE DESCRIPTION MORRISVILLE PARKWAY EXTENSION AND NC 540 INTERCHANGE FROM SR 1625 TO NC 55									GROUND WTR (ft)							
BORING NO. TB1			STATION 20+50			OFFSET 50 ft RT			ALIGNMENT -RPB-							
COLLAR ELEV. 336.2 ft			TOTAL DEPTH 19.8 ft			NORTHING 750,310			EASTING 2,031,500							
DRILL RIG/HAMMER EFF./DATE TRI8016 MOBILE B-57 90% 02/22/2016						DRILL METHOD H.S. Augers			HAMMER TYPE Automatic							
DRILLER Estep, J. E.			START DATE 05/12/17			COMP. DATE 05/12/17			SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
340																
335	335.2	1.0	3	3	4										5" TOPSOIL	0.0
	332.7	3.5	4	17	28										ALLUVIAL GRAY AND RED, CLAY (A-6) MOTTLED, MICACEOUS WITH TRACE ORGANICS	4.0
330	330.2	6.0	28	40	48										RESIDUAL GRAY, SILTY SAND (A-2-4)	
	327.7	8.5	11	15	27										DARK RED, CLAY (A-6) MICACEOUS	8.0
325											SS-6	10%				
	322.7	13.5	17	24	33										GRAY, SILTY, F. TO CSE. SAND (A-2-4)	12.0
320																
	317.7	18.5	17	40	60/0.3										WEATHERED ROCK RED AND GRAY, MUDSTONE	18.5
															Boring Terminated at Elevation 316.4 ft IN WR: TRIASSIC MUDSTONE	19.8

NCDOT BORE SINGLE U5315_BORINGS.GPJ NC_DOT_GDT 9/11/17

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 111GJ55		TIP U-5315		COUNTY WAKE		GEOLOGIST Evans, T. E.											
SITE DESCRIPTION MORRISVILLE PARKWAY AND NC540 INTERCHANGE							GROUND WTR (ft)										
BORING NO. R-38		STATION 28+02		OFFSET 38 ft LT		ALIGNMENT -RPD-	0 HR. Dry										
COLLAR ELEV. 344.0 ft		TOTAL DEPTH 15.0 ft		NORTHING 749,115		EASTING 2,032,545	24 HR. Dry										
DRILL RIG/HAMMER EFF./DATE SDS1873 CME-550X 79% 08/21/2013				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Contract Driller		START DATE 07/14/14		COMP. DATE 07/14/14		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
345															344.0	GROUND SURFACE	0.0
	343.0	1.0	3	3	5						SS-23	25% M		341.0	RED-BROWN AND TAN, MOTTLED, SILTY CLAY (A-7-6)	3.0	
340	340.5	3.5	16	25	23							M		338.5	GRAY AND TAN, SILTY MED. TO CSE. SAND (A-2-4)	5.5	
	338.0	6.0	16	21	27							M		336.0	TAN AND BLACK, SILTY F. SAND (A-2-4)	8.0	
335	335.5	8.5	10	18	23							D		332.0	RED-BROWN, F. SANDY CLAY (A-6)	8.0	
330	330.5	13.5	43	57/0.2					100/0.7					329.8	WEATHERED ROCK TAN AND GRAY, TRIASSIC SANDSTONE	14.2	
Boring Terminated at Elevation 329.0 ft in WR: Triassic Sandstone																	

NCDOT BORE SINGLE U5315_GEO_RDWYBORINGS.GPJ_NC_DOT.GDT 9/11/17



LABORATORY TEST RESULTS

Morrisville Pkwy. and 540 Interchange
Wake County, North Carolina

Falcon Engineering Project Number: G17027.00
May 30, 2017

SAMPLE IDENTIFICATION			PERCENTAGE PASSING			LIQUID & PLASTIC LIMITS			WATER CONTENT	AASHTO CLASSIFICATION
Location	Sample	Depth, ft	#10	#40	#200	LL	PL	PI	(%)	
D-median	SS-1	18.5-20	97	68	42	39	23	16	19	A-6 (3)
RWIS/MVD	SS-2	3.5-5	99	96	45	28	19	9	18	A-4 (1)
CCTV-1	SS-3	8.5-10	98	60	25	34	30	4	20	A-2-4 (0)
CCTV-2	SS-4	13.5-15	99	90	65	35	24	11	16	A-6 (6)
B-outside	SS-5	3.5-5	100	100	61	35	26	9	15	A-4 (4)
TB1	SS-6	8.5-10	99	80	51	32	20	12	10	A-6 (3)
F-median	SS-7	3.5-5	75	68	55	30	20	10	11	A-4 (3)
F-outside	SS-8	23.5-25	100	98	89	54	29	25	23	A-7-6 (26)
D-median	SS-9	23.5-25	99	62	37	44	29	15	26	A-7-6 (2)
F-outside	SS-10	3.5-5	98	87	63	35	20	15	16	A-6 (7)
D-outside	SS-11	3.5-5	100	98	78	47	25	22	22	A-7-6 (18)
MVDS2-1	SS-12	6-7.5	100	99	83	49	27	22	25	A-7-6 (20)

Reviewed by: *John Saily*

NCDOT No.: 105-03-0803