

REFERENCE: I-25I3AC

PROJECT: 34165

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SHEET NO.	DESCRIPTION
1	TITLE SHEET
2, 2A	LEGEND
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY BUNCOMBE
PROJECT DESCRIPTION I-26I-40I-240 INTERCHANGE TO
SR 3548 (HAYWOOD RD)

SITE DESCRIPTION RETAINING WALL NO. 9, FROM
-Y8- STA. 19+25.53 TO -Y8- STA. 21+03.96

STATE	TOWN OF HOLLY SPRINGS PROJECT NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-2513AC	1	11

CAUTION NOTICE

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

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

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

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

PERSONNEL

CG2

GOODNIGHT, D.J.

INVESTIGATED BY FALCON ENG.

DRAWN BY CROCKETT, S.C.

CHECKED BY HUNSBERGER, W.S.

SUBMITTED BY FALCON ENG.

DATE JULY 2024



DocuSigned by:

Stephen Crockett

C6CA6FED48E0436

SIGNATURE

7/22/2024

DATE

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

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																													
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										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.										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:										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 (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROQ) - 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.																													
SOIL LEGEND AND AASHTO CLASSIFICATION										MINERALOGICAL COMPOSITION										WEATHERING																																							
GENERAL CLASS. SILT-CLAY MATERIALS (< 35% PASSING #200) ORGANIC MATERIALS										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.										FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.																																							
GROUP CLASS. A-1 A-3 A-2 A-5 A-6 A-7 A-1, A-2 A-3 A-4, A-5 A-6, A-7										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50										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.																																							
SYMBOL										PERCENTAGE OF MATERIAL										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.																																							
%										ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL										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.																																							
MATERIAL PASSING #10 #40 #200										GROUND WATER										MODERATELY SEVERE (MOD. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. IF TESTED, WOULD YIELD SPT REFUSAL																																							
GROUP INDEX										MISCELLANEOUS SYMBOLS										SEVERE (SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF																																							
USUAL TYPES OF MAJOR MATERIALS																				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. IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF																																							
GEN. RATING AS SUBGRADE																				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.																																							
PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30																																																											
CONSISTENCY OR DENSENESS										RECOMMENDATION SYMBOLS										ROCK HARDNESS																																							
PRIMARY SOIL TYPE										UNDERCUT EXCAVATION UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK										VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.																																							
COMPACTNESS OR CONSISTENCY										SHALLOW UNDERCUT										HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.																																							
RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)										ABBREVIATIONS										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.																																							
RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAG. - FRAGMENTS HL - HIGHLY										MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRI-CONE REFUSAL w - MOISTURE CONTENT V - VERY										VST - VANE SHEAR TEST WEA. - WEATHERED % - UNIT WEIGHT %g - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO																													
TEXTURE OR GRAIN SIZE										EQUIPMENT USED ON SUBJECT PROJECT										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.																																							
U.S. STD. SIEVE SIZE OPENING (MM)										DRILL UNITS: CME-45C CME-55 CME-550X VANE SHEAR TEST PORTABLE HOIST DIEDRICH D-50										ADVANCING TOOLS: CLAY BITS 6" CONTINUOUS FLIGHT AUGER 8" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE *STEEL TEETH TRICONE *TUNG-CARB. CORE BIT										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: -B -H -N 0 HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST										SOFT CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.																			
SOIL MOISTURE - CORRELATION OF TERMS																				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 FINGER NAIL.																																							
SOIL MOISTURE SCALE (ATTERBERG LIMITS)																				FRACTURE SPACING										BEDDING																													
FIELD MOISTURE DESCRIPTION																				TERM SPACING										TERM THICKNESS																													
GUIDE FOR FIELD MOISTURE DESCRIPTION																				VERY WIDE MORE THAN 10 FEET										VERY THICKLY BEDDED 4 FEET																													
																				WIDE 3 TO 10 FEET										THICKLY BEDDED 1.5 - 4 FEET																													
																				MODERATELY CLOSE 1 TO 3 FEET										THINLY BEDDED 0.16 - 1.5 FEET																													
																				CLOSE 0.16 TO 1 FOOT										VERY THINLY BEDDED 0.03 - 0.16 FEET																													
																				VERY CLOSE LESS THAN 0.16 FEET										THICKLY LAMINATED 0.008 - 0.03 FEET																													
																														< 0.008 FEET																													
PLASTICITY																				INDURATION																																							
NON PLASTIC SLIGHTLY PLASTIC MODERATELY PLASTIC HIGHLY PLASTIC																				FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.																																							
PLASTICITY INDEX (PI)																				FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.																																							
DRY STRENGTH																				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.																																							
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

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES
FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000) From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.	SURFACE CONDITIONS VERY GOOD Very rough, fresh unweathered surfaces GOOD Rough, slightly weathered, iron stained surfaces FAIR Smooth, moderately weathered and altered surfaces POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings	STRUCTURE INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes	DECREASING SURFACE QUALITY ➡ DECREASING INTERLOCKING OF ROCK PIECES ⬇ 90 80 70 60 50 40 30 20 10 N/A N/A	GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000) From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.	SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes) VERY GOOD - Very Rough, fresh unweathered surfaces GOOD - Rough, slightly weathered surfaces FAIR - Smooth, moderately weathered and altered surfaces POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings	COMPOSITION AND STRUCTURE A. Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability. B. Sandstone with thin inter-layers of siltstone C. Sandstone and siltstone in similar amounts D. Siltstone or silty shale with sandstone layers E. Weak siltstone or clayey shale with sandstone layers F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces. — Means deformation after tectonic disturbance	70 60 50 40 30 20 10 A B C D E F G H
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050100

FEET

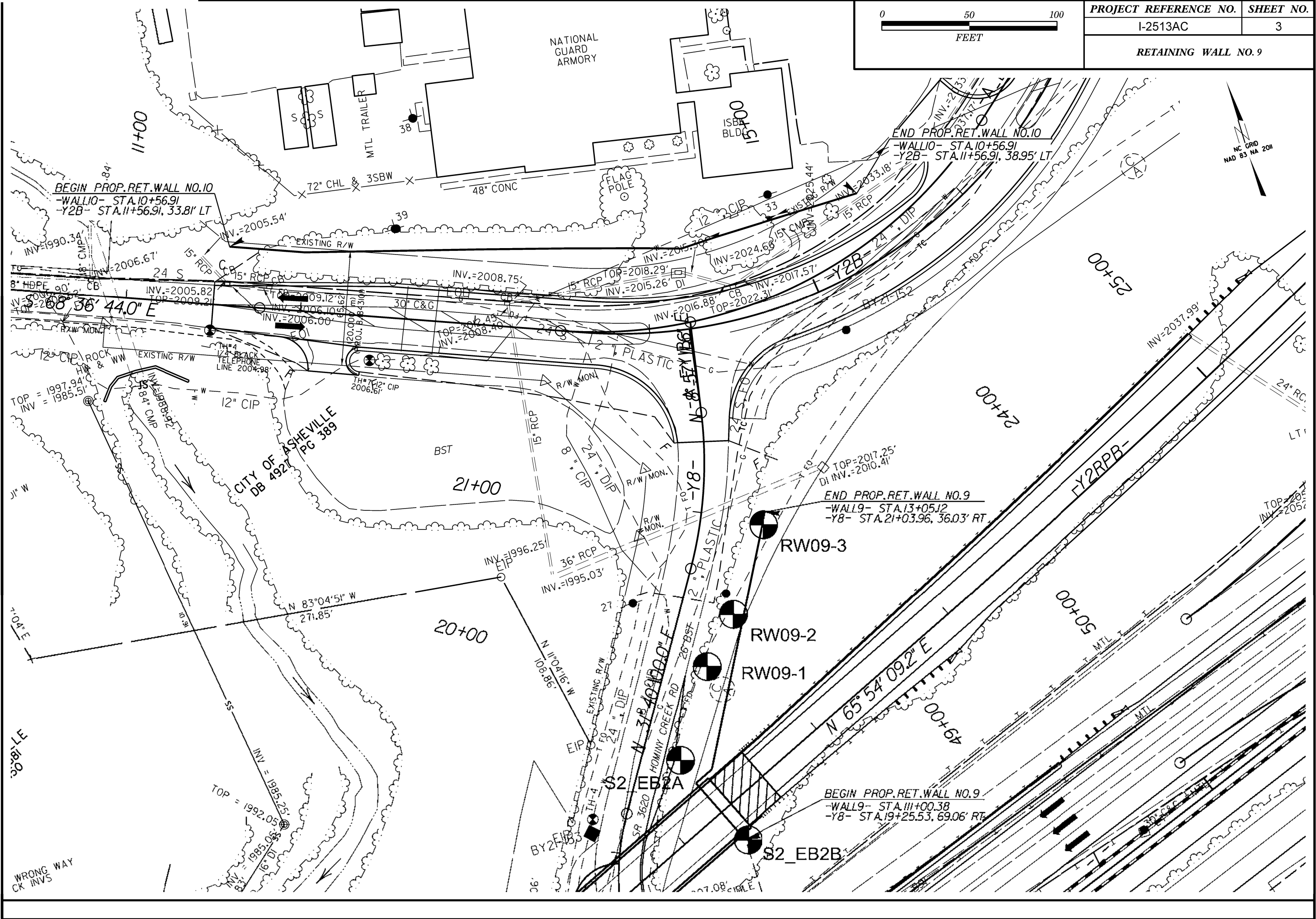
PROJECT REFERENCE NO.

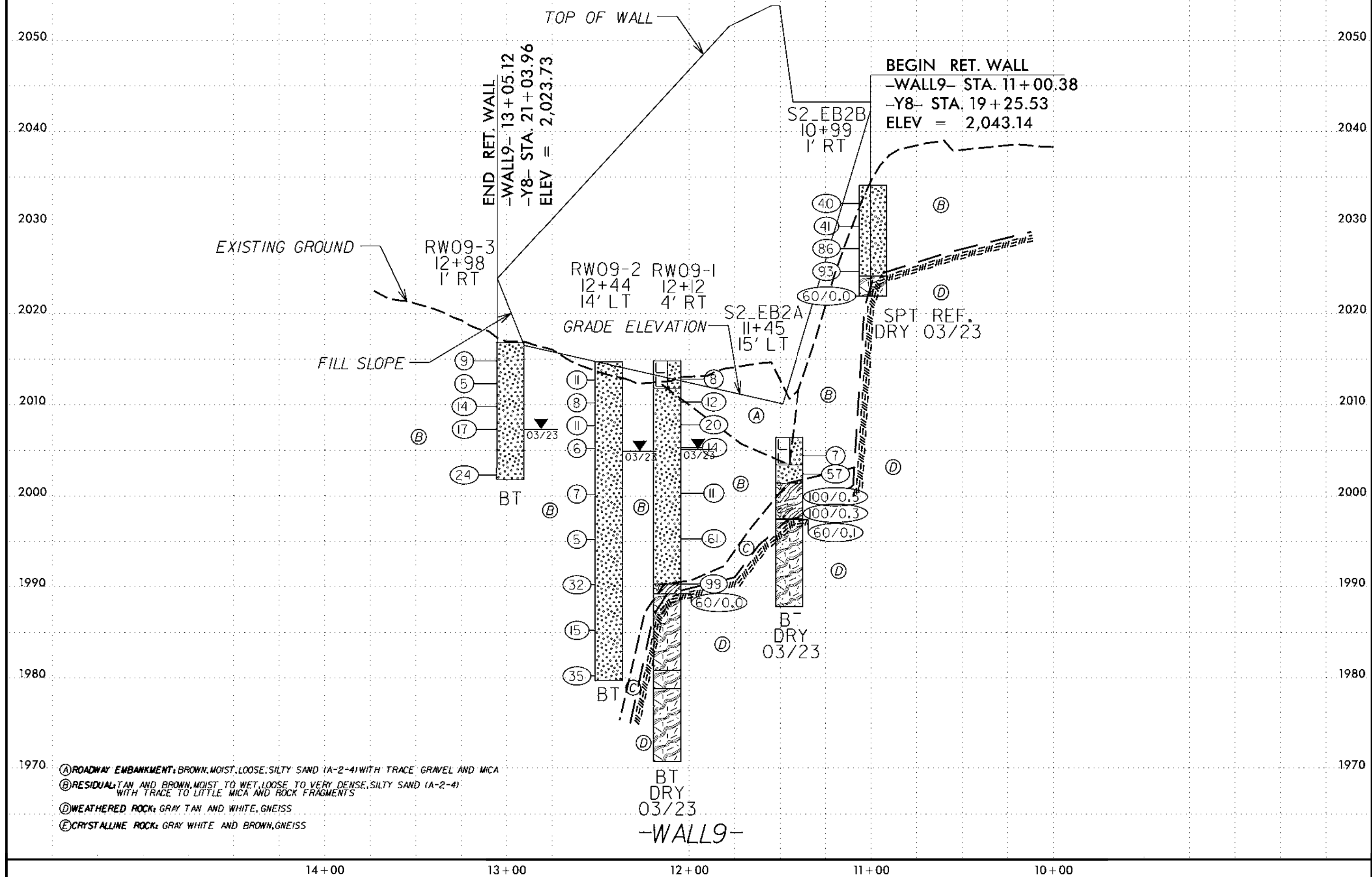
I-2513AC

SHEET NO.

3

RETAINING WALL NO.9





WBS		34165.1.2		TIP		1-2513AC		COUNTY		BUNCOMBE		GEOLOGIST		Goodnight, D.J.																																	
SITE DESCRIPTION													RETAINING WALL NO. 9			GROUND WTR (ft)																															
BORING NO.			S2_EB2B			STATION			10+99			OFFSET			1 ft RT			ALIGNMENT			-WALL9-			0 HR.		Dry																					
COLLAR ELEV.			2,034.0 ft			TOTAL DEPTH			12.2 ft			NORTHING			679,298			EASTING			930,532			24 HR.		N/A																					
DRILL RIG/HAMMER EFF./DATE						CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD						H.S. Augers						HAMMER TYPE						Automat																	
DRILLER						Odom, C.						START DATE						03/14/23						COMP. DATE						03/14/23						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)																											
2035																				2,034.0 GROUND SURFACE 0.0																											
		2,033.0		1.0		8 14 26			40							M				RESIDUAL																											
2030		2,030.5		3.5		15 23 18			41							M				TAN-BROWN, DENSE TO VERY DENSE, SILTY SAND (A-2-4) WITH SOME ROCK FRAGMENTS																											
		2,028.0		6.0		31 38 48			86							M																															
2025		2,025.5		8.5		36 51 42			93											2,024.0 10.0																											
		2,021.8		12.2		60/0.0			60/0.0											CRYSTALLINE ROCK																											
																				GRAY AND WHITE, GNEISS 12.2																											
																				Boring Terminated at Elevation 2,021.8 ft on CR: GNEISS																											

NC DOT BORE DOUBLE I-1213 AC GEO_RWALS.GPJ NC_DOT_GDT 3/25/24

NCDOT BORE SINGLE I-1213AC_GEO_RWALS.GPJ NC_DOT.GDT 4/19/24

NCDOT CORE SINGLE I-1213AC GEO RWALS.GPJ NC DOT.GDT 4/19/24



 FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 CARY, NC 27513 PHONE: 919.871.0800 www.falconengineering.com	ROCK CORE PHOTOGRAPHS
	RETAINING WALLS NO. 9 AND NO. 10 BUNCOMBE COUNTY, NC WBS: 34165 TIP: I-2513AC FALCON PROJECT NO. G22009.01

GEOTECHNICAL BORING REPORT
BORE LOG

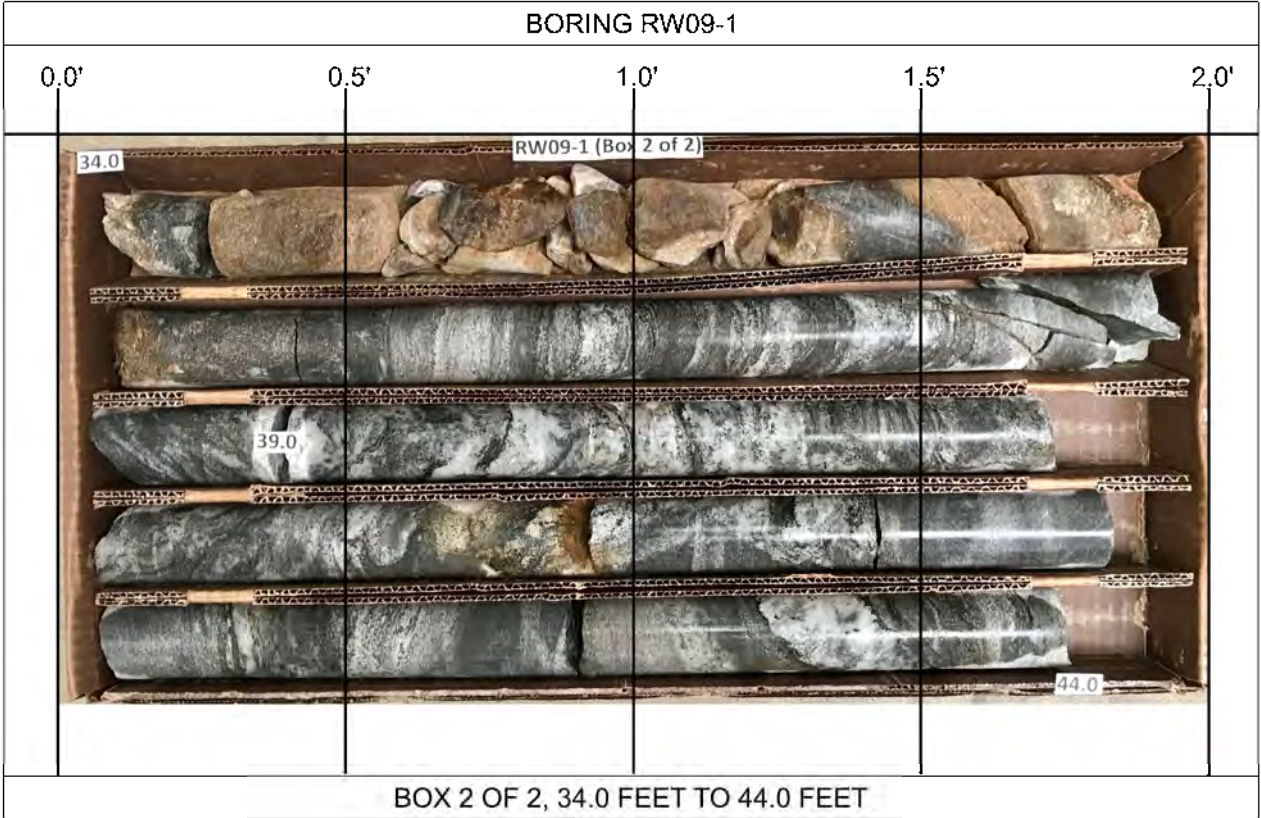
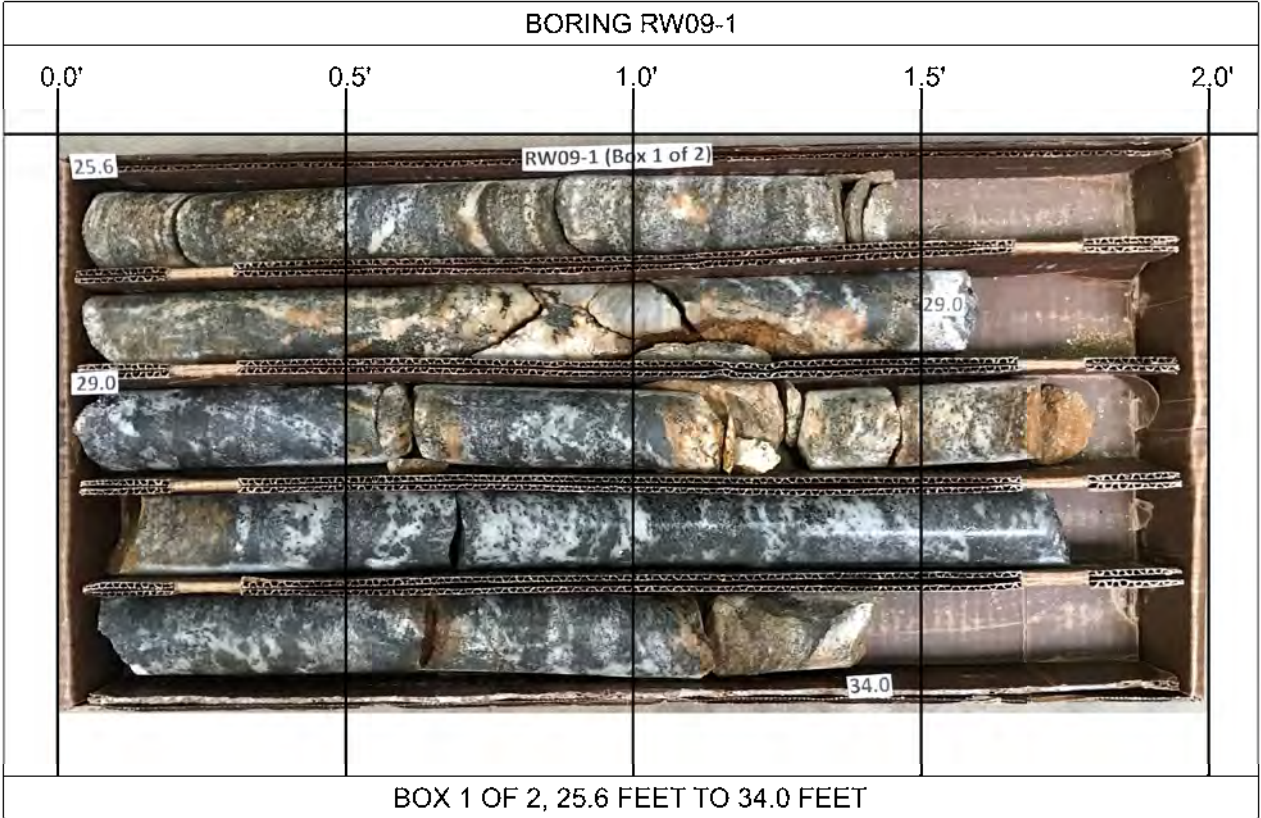
WBS 34165.1.2			TIP 1-2513AC			COUNTY BUNCOMBE			GEOLOGIST Goodnight, D.J.						
SITE DESCRIPTION RETAINING WALL NO. 9 FROM -Y8- STA. 19+25.53 TO -Y8- STA. 21+03.96										GROUND WTR (ft)					
BORING NO. RW09-1			STATION 12+12			OFFSET 14 ft LT			ALIGNMENT -WALL9-		0 HR. 12.8				
COLLAR ELEV. 2,014.7 ft			TOTAL DEPTH 44.0 ft			NORTHING 679,399			EASTING 930,539		24 HR. 9.7				
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Auto					
DRILLER Odom, C.			START DATE 03/13/23			COMP. DATE 03/13/23			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)
2015														2,014.7	0.0
2010	2,013.7	1.0												ROADWAY EMBANKMENT	
	2,011.2	3.5	2	3	5									BROWN, LOOSE, SILTY SAND (A-2-4)	
	2,008.7	6.0	5	6	6									WITH TRACE GRAVEL	
2005	2,006.2	8.5	6	8	12									RESIDUAL	
	2,001.2	13.5	6	8	6									TAN-BROWN, MEDIUM DENSE TO VERY DENSE, SILTY SAND (A-2-4) WITH LITTLE MICA	
2000															
1995	1,996.2	18.5	4	24	37										
	1,991.2	23.5													
1990	1,989.1	25.6	17	17	82									1,990.2	24.5
1985			60/0.0											1,989.1	25.6
														WEATHERED ROCK	
														TAN AND WHITE, GNEISS	
1980															
														1,980.7	34.0
1975														1,978.7	36.0
														GRAY AND WHITE, GNEISS	
														1,970.7	44.0
														Boring Terminated at Elevation 1,970.7 ft on CR: GNEISS	

NCDOT BORE SINGLE I-213AC_GEO_RWALS.GPJ NC_DOT.GDT 4/19/24

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 34165.1.2				TIP 1-2513AC				COUNTY BUNCOMBE				GEOLOGIST Goodnight, D.J.					
SITE DESCRIPTION RETAINING WALL NO. 9 FROM -Y8- STA. 19+25.53 TO -Y8- STA. 21+03.96												GROUND WTR (ft)					
BORING NO. RW09-1				STATION 12+12				OFFSET 14 ft LT				ALIGNMENT -WALL9-				0 HR.	12.8
COLLAR ELEV. 2,014.7 ft				TOTAL DEPTH 44.0 ft				NORTHING 679,399				EASTING 930,539				24 HR.	9.7
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022								DRILL METHOD NW Casing W/SPT & Core				HAMMER TYPE Auto					
DRILLER Odom, C.				START DATE 03/13/23				COMP. DATE 03/13/23				SURFACE WATER DEPTH N/A					
CORE SIZE NQ				TOTAL RUN 18.4 ft													
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) % ROD (ft) %		SAMP. NO.	STRATA REC. (ft) % ROD (ft) %		LOG	DESCRIPTION AND REMARKS					DEPTH (ft)	
1989.1											Begin Coring @ 25.6 ft						
1985	1,989.1	25.6	3.4	6:01/1.0	(3.2)	(2.6)		(8.2)	(6.7)		1,989.1	CRYSTALLINE ROCK SLIGHT TO VERY SLIGHT WEATHERING, HARD TO VERY HARD, GRAY AND WHITE, GNEISS, WITH CLOSE TO MODERATELY CLOSE FRACTURE SPACING			25.6		
	1,985.7	29.0		5:07/1.0	94%	76%											
			5:33/1.0														
			2:24/0.4	(5.0)	(4.1)												
			4:50/1.0	100%	82%												
1980	1,980.7	34.0	5.0	4:55/1.0				(1.7)	(0.4)		1,980.7	MODERATE WEATHERING, MODERATELY HARD TO HARD, BROWN AND GRAY, GNEISS, WITH CLOSE TO VERY CLOSE FRACTURE SPACING			34.0		
				3:55/1.0				85%	20%		1,978.7				36.0		
1975				4:27/1.0				(8.0)	(7.2)			FRESH TO VERY SLIGHT WEATHERING, HARD TO VERY HARD, GRAY AND WHITE, GNEISS, WITH CLOSE TO MODERATELY CLOSE FRACTURE SPACING					
				4:46/1.0				100%	90%								
		1,975.7	39.0	5.0	4:42/1.0	(5.0)	(4.8)						Boring Terminated at Elevation 1,970.7 ft on CR: GNEISS				
				5:28/1.0	100%	96%											
	1,970.7	44.0		4:40/1.0							1,970.7				44.0		
				5:27/1.0													
				5:14/1.0													

NCDOT CORE SINGLE I-213AC_GEO_RWALS.GPJ NC_DOT.GDT 4/19/24



 FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 CARY, NC 27513 PHONE: 919.871.0800 www.falconengineering.com	ROCK CORE PHOTOGRAPHS
	RETAINING WALLS NO. 9 AND NO. 10 BUNCOMBE COUNTY, NC WBS: 34165 TIP: I-2513AC FALCON PROJECT NO. G22009.01

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34165.1.2			TIP 1-2513AC			COUNTY BUNCOMBE			GEOLOGIST Goodnight, D.J.						
SITE DESCRIPTION RETAINING WALL NO. 9 FROM -Y8- STA. 19+25.53 TO -Y8- STA. 21+03.96												GROUND WTR (ft)			
BORING NO. RW09-2			STATION 12+44			OFFSET 6 ft LT			ALIGNMENT -WALL9-			0 HR.	10.6		
COLLAR ELEV. 2,014.6 ft			TOTAL DEPTH 35.0 ft			NORTHING 679,424			EASTING 930,562			24 HR.	9.8		
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD H.S. Augers			HAMMER TYPE Auto						
DRILLER Odom, C.			START DATE 03/10/23			COMP. DATE 03/10/23			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)
2015															
	2,013.6	1.0												2,014.6	GROUND SURFACE 0.0
	2,011.1	3.5	2	4	7	1	.	.	.	.		M		RESIDUAL TAN AND BROWN, LOOSE TO DENSE, SILTY SAND (A-2-4) WITH TRACE TO LITTLE MICA	
2010	2,008.6	6.0	4	4	4	3	.	.	.	.		M			
	2,006.1	8.5	2	3	8	11	.	.	.	.		M			
2005	2,001.1	13.5	2	2	4	6	.	.	.	.		▼			
	1,996.1	18.5				7	.	.	.	.		W			
2000	1,991.1	23.5	3	3	4	5	.	.	.	.		W			
1995	1,986.1	28.5	1	2	3	32	.	.	.	.		W			
1990	1,981.1	33.5	10	10	22	15	.	.	.	.		W			
1985			3	7	8	35	.	.	.	.		W			
1980			41	21	14							W			1,979.6
														Boring Terminated at Elevation 1,979.6 ft in RESIDUAL: SILTY SAND	

NCDOT BORE SINGLE I-213AC_GEO_RWALS.GPJ NC_DOT.GDT 4/19/24

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 34165.1.2			TIP 1-2513AC			COUNTY BUNCOMBE			GEOLOGIST Goodnight, D.J.						
SITE DESCRIPTION RETAINING WALL NO. 9 FROM -Y8- STA. 19+25.53 TO -Y8- STA. 21+03.96												GROUND WTR (ft)			
BORING NO. RW09-3			STATION 12+98			OFFSET 1 ft RT			ALIGNMENT -WALL9-			0 HR.	10.0		
COLLAR ELEV. 2,016.7 ft			TOTAL DEPTH 15.0 ft			NORTHING 679,467			EASTING 930,593			24 HR.	9.5		
DRILL RIG/HAMMER EFF./DATE CG20446 Diedrich D50 87% 05/10/2022						DRILL METHOD H.S. Augers			HAMMER TYPE Auto						
DRILLER Odom, C.			START DATE 03/10/23			COMP. DATE 03/10/23			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)
2020															
2015	2,015.7	1.0													
	2,013.2	3.5	2	5	4										
	2,010.7	6.0	2	2	3										
2010															
	2,010.7	6.0	3	6	8										
	2,008.2	8.5	5	7	10										
2005															
	2,003.2	13.5	8	11	13										
												</			

NCDOT BORE SINGLE I-213AC_GEO_RWALS.GPJ NC_DOT.GDT 4/19/24