

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.13.R.12	1	13

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

**STRUCTURE  
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.13.R.12 F.A. PROJ. NA  
 COUNTY McDowell  
 PROJECT DESCRIPTION Structure No. 580245 on SR 1128 over Jordan Branch

**MAP 1 MCDOWELL 245**

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DATE June 2013

**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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

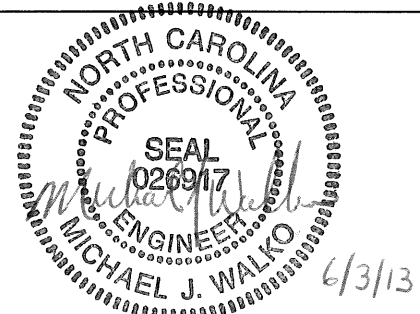
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: M. Brewer, E.I.



# NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

## DIVISION OF HIGHWAYS

### GEOTECHNICAL ENGINEERING UNIT

## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

### SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

*VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6*

### GRADATION

**WELL GRADED** - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.  
**UNIFORM** - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)  
**GAP-GRADED** - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

### ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS **ANGULAR**, **SUBANGULAR**, **SUBROUNDED**, OR **ROUNDED**.

### SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1	A-3	A-2		A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5				
SYMBOL														
% PASSING	# 10 # 40 # 200													
LIQUID LIMIT	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
PLASTIC INDEX	6 MX	NP	40 MX 10 MX	41 MN 10 MX	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN	40 MX 10 MX	41 MN 11 MN				
GROUP INDEX	0	0	0	4 MX	8 MX	12 MX	16 MX	No MX						
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND	FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER			HIGHLY ORGANIC SOILS		
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD				FAIR TO POOR				FAIR TO POOR	POOR	UNSATURABLE			

### MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

### COMPRESSIBILITY

**SLIGHTLY COMPRESSIBLE**      LIQUID LIMIT LESS THAN 31  
**MODERATELY COMPRESSIBLE**      LIQUID LIMIT EQUAL TO 31-50  
**HIGHLY COMPRESSIBLE**      LIQUID LIMIT GREATER THAN 50

### PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	>10%	>20%	HIGHLY
			1 - 10% 10 - 20% 20 - 35% 35% AND ABOVE

### GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

### CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

### MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- SPT REFUSAL

### TEXTURE OR GRAIN SIZE

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

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)
GRAIN SIZE	MM 305 IN. 12	75 3	2.0	0.25	0.05	0.005

### SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

### PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	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.

### ABBREVIATIONS

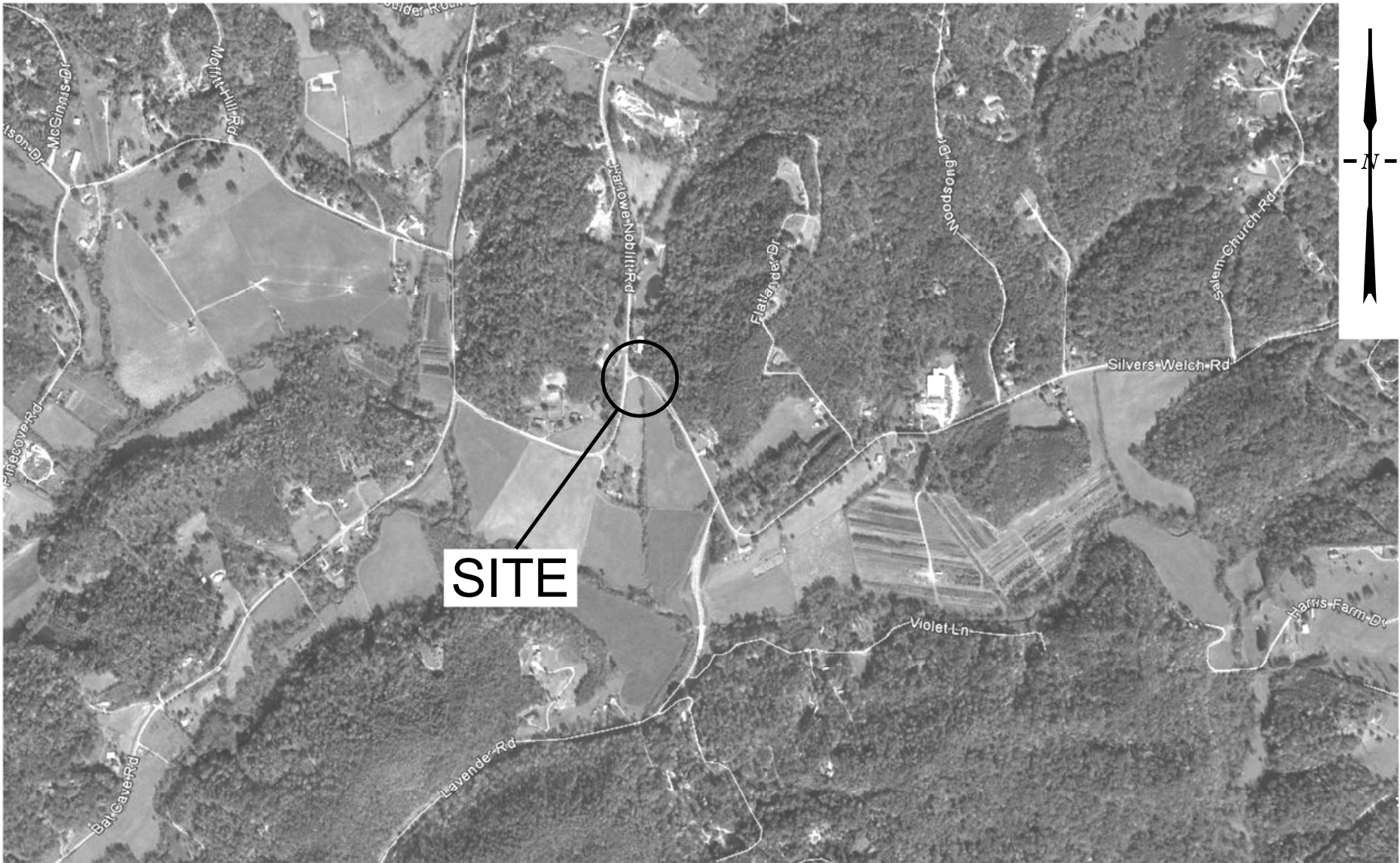
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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>AR - AUGER REFUSAL</li> <li>BT - BORING TERMINATED</li> <li>CL - CLAY</li> <li>CPT - CONE PENETRATION TEST</li> <li>CSE. - COARSE</li> <li>CT - CORING TERMINATED</li> <li>DMT - DILATOMETER TEST</li> <li>DPT - DYNAMIC PENETRATION TEST</li> <li>e - VOID RATIO</li> <li>EMBANK. - EMBANKMENT</li> <li>F - FINE</li> <li>FOSS. - FOSSILIFEROUS</li> <li>FRAC. - FRACTURED, FRACTURES</li> </ul> | <ul style="list-style-type: none"> <li>FRAGS. - FRAGMENTS</li> <li>HI. - HIGHLY</li> <li>MED. - MEDIUM</li> <li>MICA. - MICACEOUS</li> <li>MOD. - MODERATELY</li> <li>NP - NON PLASTIC</li> <li>ORG. - ORGANIC</li> <li>PMT - PRESSUREMETER TEST</li> <li>SAP. - SAPROLITIC</li> <li>SDY. - SANDY</li> <li>SL. - SILT, SILTY</li> <li>SLI. - SLIGHTLY</li> <li>TCR - TRICONE REFUSAL</li> </ul> | <ul style="list-style-type: none"> <li>w - MOISTURE CONTENT</li> <li>v - VERY</li> <li>WEA. - WEATHERED</li> <li>γ - UNIT WEIGHT</li> <li>γ<sub>d</sub> - DRY UNIT WEIGHT</li> <li><b>SAMPLE ABBREVIATIONS</b></li> <li>S - BULK</li> <li>SS - SPLIT SPOON</li> <li>ST - SHELBY TUBE</li> <li>RS - ROCK</li> <li>RT - RECOMPACTED TRIAXIAL</li> <li>CBR - CALIFORNIA BEARING RATIO</li> </ul> |
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### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
<input type="checkbox"/> MOBILE B- _____	<input type="checkbox"/> CLAY BITS	<input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL
<input type="checkbox"/> BK-51	<input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER	<b>CORE SIZE:</b>
<input checked="" type="checkbox"/> CME-550X	<input checked="" type="checkbox"/> 8" HOLLOW AUGERS	<input type="checkbox"/> -B _____
<input type="checkbox"/> CME-75	<input type="checkbox"/> HARD FACED FINGER BITS	<input type="checkbox"/> -N _____
<input type="checkbox"/> PORTABLE HOIST	<input type="checkbox"/> TUNG.-CARBIDE INSERTS	<input type="checkbox"/> -H _____
<input type="checkbox"/> _____	<input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER	<b>HAND TOOLS:</b>
<input type="checkbox"/> _____	<input type="checkbox"/> TRICONE _____ * STEEL TEETH	<input type="checkbox"/> POST HOLE DIGGER
<input type="checkbox"/> _____	<input type="checkbox"/> TRICONE _____ * TUNG.-CARB.	<input type="checkbox"/> HAND AUGER
<input type="checkbox"/> _____	<input type="checkbox"/> CORE BIT	<input type="checkbox"/> SOUNDING ROD
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> VANE SHEAR TEST
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____

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ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.  <b>ARTESIAN</b> - 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.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.  <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - 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.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.  <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - 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.  <b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p><b>WEATHERED ROCK (WR)</b></p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>		
<p><b>CRYSTALLINE ROCK (CR)</b></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><b>NON-CRYSTALLINE ROCK (NCR)</b></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><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b></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			
FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.		
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.		
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH, OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.		
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, YIELDS SPT N VALUES &gt; 100 BPF</i>		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &lt; 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 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.		
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		BEDDING	
<b>TERM</b>	<b>SPACING</b>	<b>TERM</b>	<b>THICKNESS</b>
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 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.		
		BENCH MARK: Survey information provided by Mattern & Craig	
		ELEVATION: _____ FT.	
NOTES:			



**SITE**



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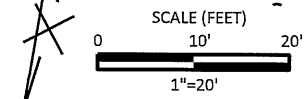
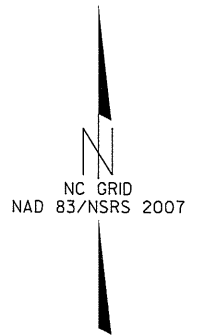
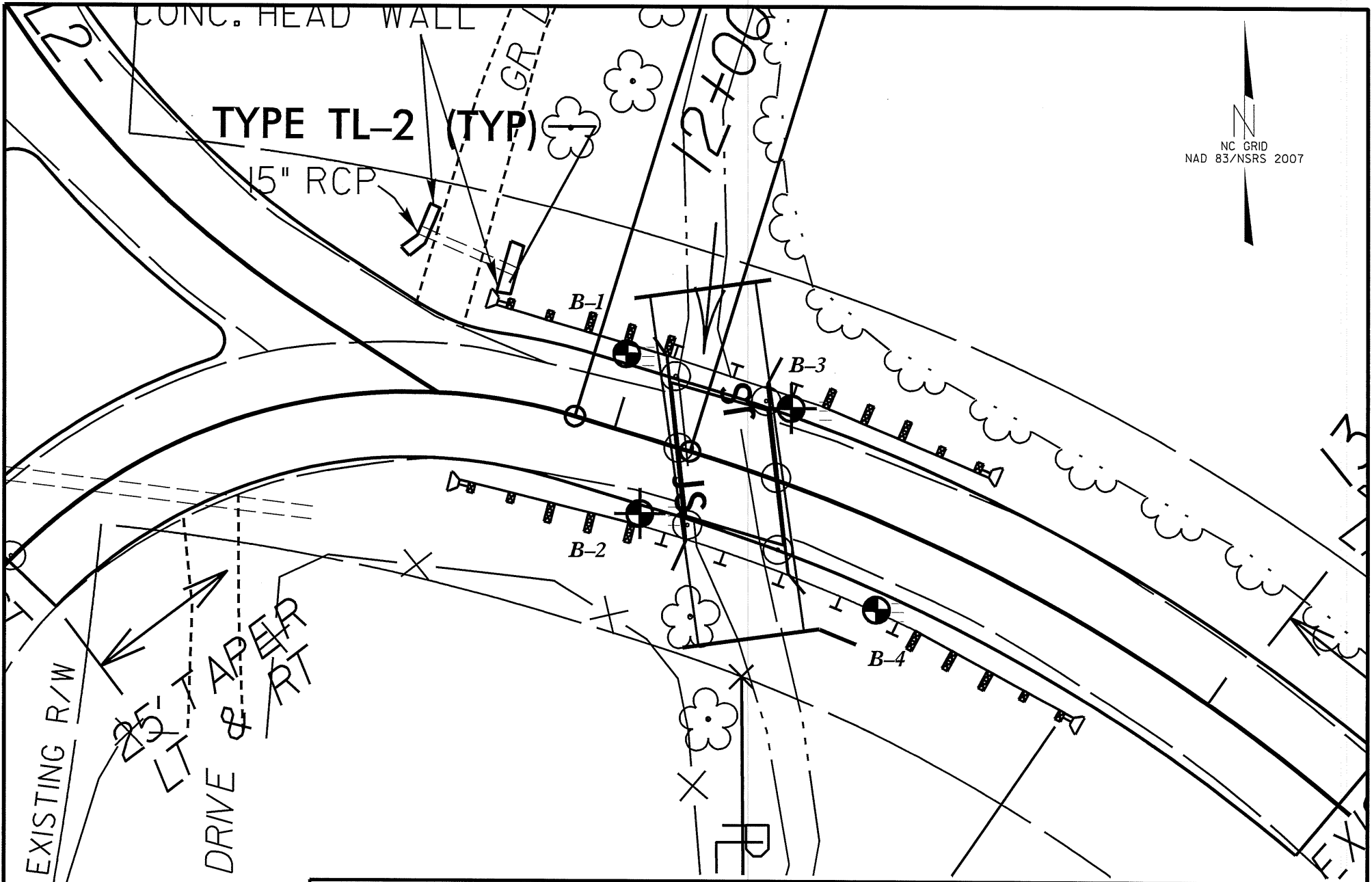
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**SITE LOCATION PLAN**

PROJECT REFERENCE NO.: 17BP.13.R.12		F&R PROJECT NO.: 63P-0198
I.D. NO.: N/A	F.A. PROJECT NO.: N/A	COUNTY: McDowell
PROJECT DESCRIPTION: Bridge #245 on SR 1128 over Jordans Branch Creek		
SITE DESCRIPTION: Bridge #245 on SR 1128 over Jordans Branch Creek		
DRAWN BY: R. Kral	CHECKED BY: M. Walko, P.E.	
DATE: March 2013		

**DRAWING**  
 No.: **1**



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<b>BORING LOCATION PLAN</b>		
PROJECT REFERENCE NO.: 17BP.13.R.12		F&R PROJECT NO.: 63P-0198
I.D. NO.: N/A	F.A. PROJECT NO.: N/A	COUNTY: McDowell
PROJECT DESCRIPTION: Bridge #245 on SR 1128 over Jordans Branch Creek		
SITE DESCRIPTION: Bridge #245 on SR 1128 over Jordans Branch Creek		
DRAWN BY: R. Kral	CHECKED BY: M. Walko, P.E.	
DATE: June 2013	SCALE: 1" = 20'	
		DRAWING No.: 2



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.13.R.12	TIP N/A	COUNTY McDowell	GEOLOGIST R. Kral
SITE DESCRIPTION Bridge 245 on SR 1128 over Jordan Branch			GROUND WTR (ft)
BORING NO. B-1	STATION 11+99	OFFSET 11 ft LT	ALIGNMENT -L-
COLLAR ELEV. 1,458.2 ft	TOTAL DEPTH 10.0 ft	NORTHING 1,058,912	EASTING 684,341
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012			DRILL METHOD H.S. Augers
DRILLER C. Boyce			HAMMER TYPE Automatic
START DATE 11/14/12		COMP. DATE 11/14/12	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)	
1460	1,458.2	0.0	0	0	1									1,458.2	0.0	GROUND SURFACE
1455	1,454.7	3.5	1	1	5								M	1,454.7		ROADWAY EMBANKMENT Brown fine to coarse sandy SILT (A-4(4)), trace rock fragments
1450	1,449.7	8.5	27	73/0.1									SS-1	1,449.7	8.5	
	1,448.2	10.0	60/0.0							100/0.6				1,448.2	10.0	WEATHERED ROCK Tan QUARTZ-MICA SCHIST Boring Terminated with Standard Penetration Test Refusal at Elevation 1,448.2 ft on Crystalline Rock (QUARTZ-MICA SCHIST)

NCDOT BORE SINGLE 63P-0198-0245 - GROUP 2 BRIDGE 245.GPJ NC\_DOT.GDT 11/14/13





# NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

WBS 17BP.13.R.12		TIP N/A		COUNTY McDowell		GEOLOGIST J. Harris					
SITE DESCRIPTION Bridge 245 on SR 1128 over Jordan Branch							GROUND WTR (ft)				
BORING NO. B-2		STATION 12+07		OFFSET 11 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 1,458.5 ft		TOTAL DEPTH 25.0 ft		NORTHING 1,058,914		EASTING 684,316					
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012				DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic					
DRILLER C. Boyce		START DATE 11/14/12		COMP. DATE 11/14/12		SURFACE WATER DEPTH N/A					
CORE SIZE NQ-2		TOTAL RUN 15.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
1448.5										Begin Coring @ 10.0 ft	
	1,448.5	10.0	5.0	N=60/0.0 2:10/1.0 1:50/1.0 2:34/1.0 2:29/1.0 2:06/1.0	(4.8) 96%	(2.4) 48%	(14.4) 96%	(10.4) 69%	1,448.5	<b>CRYSTALLINE ROCK</b> Gray and white fresh to slightly weathered, hard to very hard, very close to moderately close spaced fractured QUARTZ-MICA SCHIST with quartzite interbedding	10.0
1445											
	1,443.5	15.0	5.0	2:10/1.0 1:42/1.0 2:02/1.0 3:06/1.0 2:50/1.0	(4.8) 96%	(3.2) 64%					
1440											
	1,438.5	20.0	5.0	3:01/1.0 2:52/1.0 3:00/1.0 3:02/1.0 2:20/1.0	(4.8) 96%	(4.8) 96%					
1435											
	1,433.5	25.0							1,433.5	Boring Terminated at Elevation 1,433.5 ft in Crystalline Rock (QUARTZ-MICA SCHIST)	25.0

NCDOT CORE SINGLE 63P-0198-0245 - GROUP 2 BRIDGE 245.GPJ NC\_DOT.GDT 11/14/13







# NCDOT GEOTECHNICAL ENGINEERING UNIT CORE BORING REPORT

WBS 17BP.13.R.12		TIP N/A		COUNTY McDowell		GEOLOGIST J. Harris					
SITE DESCRIPTION Bridge 245 on SR 1128 over Jordan Branch							GROUND WTR (ft)				
BORING NO. B-3		STATION 12+24		OFFSET 11 ft LT		ALIGNMENT -L-					
COLLAR ELEV. 1,457.1 ft		TOTAL DEPTH 21.0 ft		NORTHING 1,058,950		EASTING 684,301					
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012				DRILL METHOD NW Casing w/ Core		HAMMER TYPE Automatic					
DRILLER C. Boyce		START DATE 11/15/12		COMP. DATE 11/15/12		SURFACE WATER DEPTH N/A					
CORE SIZE NQ-2		TOTAL RUN 15.0 ft									
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		L O G	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft)	RQD (%)	REC. (ft)	RQD (%)			
1451.1										Begin Coring @ 6.0 ft	
1450	1,451.1	6.0	5.0	N=60/0.0 2:24/1.0 2:47/1.0 2:56/1.0 2:40/1.0 2:40/1.0	(4.5) 90%	(3.4) 68%	(14.3) 95%	(10.3) 69%		1,451.1 <b>CRYSTALLINE ROCK</b> Gray and white slightly to moderately weathered, hard, very close to moderately close spaced fractured QUARTZ-MICA SCHIST with quartzite interbedding	6.0
1445	1,446.1	11.0	5.0	2:17/1.0 2:54/1.0 1:57/1.0 1:36/1.0 1:14/1.0	(4.8) 96%	(3.3) 66%					
1440	1,441.1	16.0	5.0	1:06/1.0 1:34/1.0 1:41/1.0 1:56/1.0 2:14/1.0	(5.0) 100%	(3.6) 72%					
	1,436.1	21.0									Boring Terminated at Elevation 1,436.1 ft in Crystalline Rock (QUARTZ-MICA SCHIST)

NCDOT CORE SINGLE 63P-0198-0245 - GROUP 2 BRIDGE 245.GPJ NC\_DOT.GDT 11/14/13



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.13.R.12	TIP N/A	COUNTY McDowell	GEOLOGIST R. Kral
SITE DESCRIPTION Bridge 245 on SR 1128 over Jordan Branch			GROUND WTR (ft)
BORING NO. B-4	STATION 12+36	OFFSET 13 ft RT	ALIGNMENT -L-
COLLAR ELEV. 1,458.2 ft	TOTAL DEPTH 11.5 ft	NORTHING 1,058,937	EASTING 684,332
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER C. Boyce	START DATE 11/14/12	COMP. DATE 11/14/12	SURFACE WATER DEPTH N/A

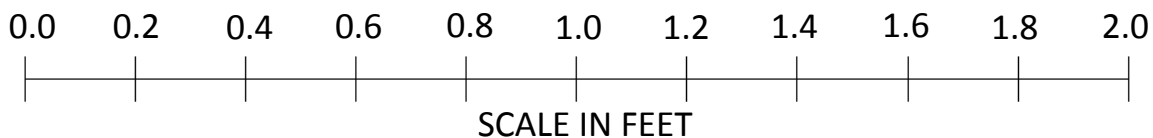
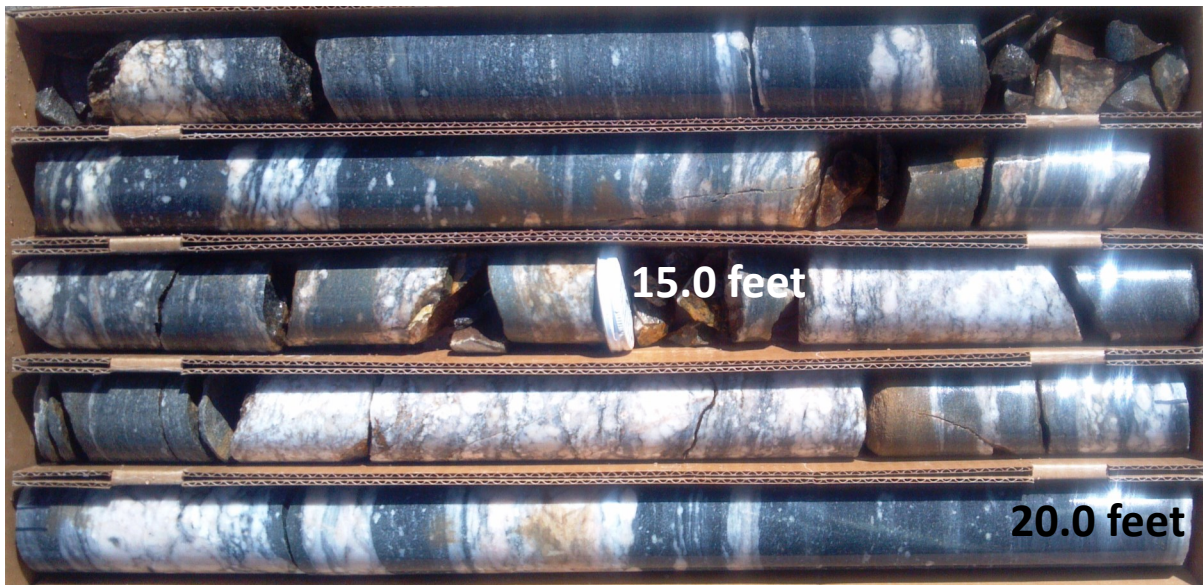
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
1460															1,458.2	0.0	GROUND SURFACE
	1,458.2	0.0	1	2	2	4									1,456.7	1.5	<b>ROADWAY EMBANKMENT</b> Orange-brown silty fine SAND (A-2-4) Brown fine to coarse sandy SILT (A-4(2)), trace rock fragments
1455	1,454.7	3.5	1	2	6	8						SS-2	29%				
1450	1,449.7	8.5	100/0.2												1,449.7	8.5	<b>WEATHERED ROCK</b> Tan and gray QUARTZ-MICA SCHIST
															1,446.7	11.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 1,446.7 ft on Crystalline Rock (QUARTZ-MICA SCHIST)

NCDOT BORE SINGLE 63P-0198-0245 - GROUP 2 BRIDGE 245.GPJ NC\_DOT.GDT 11/14/13

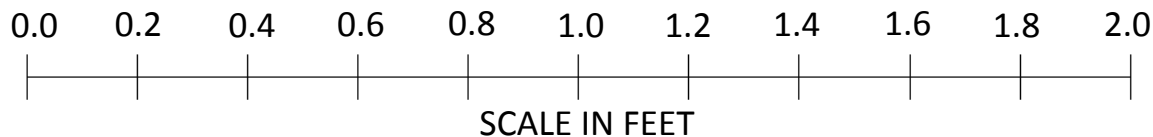
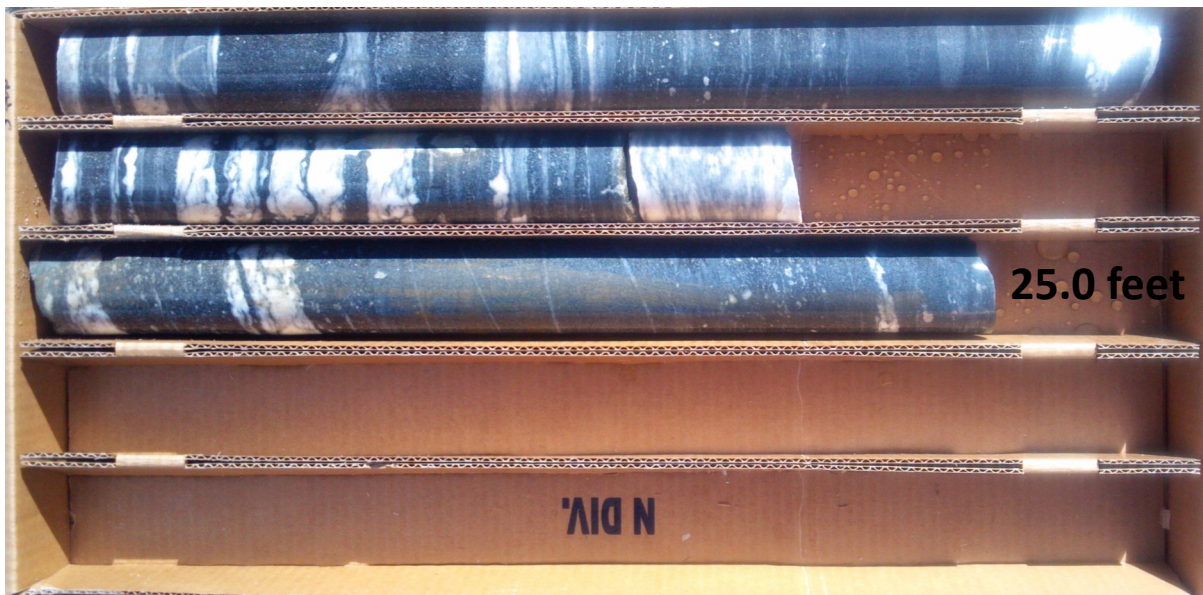


**Bridge 580245 – SR 1128 across Jordan Branch**  
**CORE PHOTOGRAPHS: B-2: Station 12+07**

**10.0 feet**



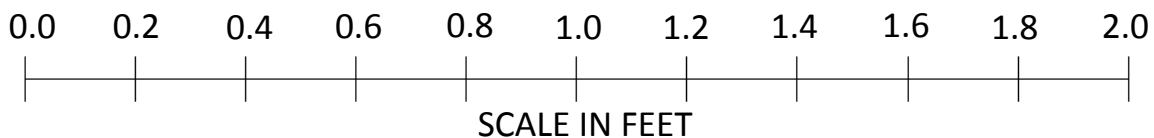
**20.0 feet**



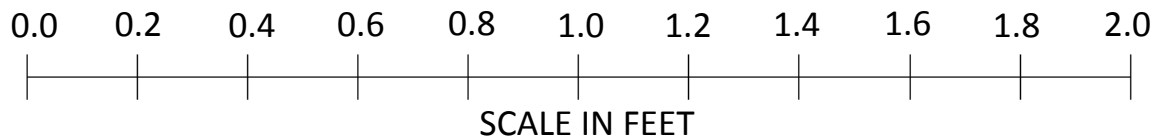


**Bridge 580245 – SR 1128 across Jordan Branch**  
**CORE PHOTOGRAPHS: B-3: Station 12+24**

**6.0 feet**



**16.0 feet**



STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.13.R.59	1	9

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

**STRUCTURE  
SUBSURFACE INVESTIGATION**

PROJ. REFERENCE NO. 17BP.13.R.59 F.A. PROJ. NA  
COUNTY McDowell  
PROJECT DESCRIPTION Structure No. 580284 on SR 1410 over Cave Creek

**MAP 2 MCDOWELL 284**

**CONTENTS**

<u>SHEET</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND
3	SITE PLAN
4	BORING LOCATION PLAN
5-8	BORE LOG REPORTS

PERSONNEL

C. Boyce

J. Pickett

M. Hosseini

R. Kral, E.I.

INVESTIGATED BY F&R, Inc.

CHECKED BY M. Walko, P.E.

SUBMITTED BY F&R, Inc.

DATE June 2013

**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. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

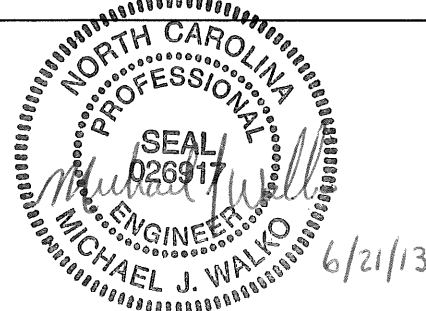
GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND 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 THIS 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.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.

DRAWN BY: M. Brewer, E.I.



## NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

### DIVISION OF HIGHWAYS

### GEOTECHNICAL ENGINEERING UNIT

## SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

**SOIL DESCRIPTION**

SOIL IS CONSIDERED TO BE THE 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 STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:  
*VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6*

**GRADATION**

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.  
 UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)  
 GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

**ANGULARITY OF GRAINS**

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS **ANGULAR**, **SUBANGULAR**, **SUBROUNDED**, OR **ROUNDED**.

**SOIL LEGEND AND AASHTO CLASSIFICATION**

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS			
GROUP CLASS.	A-1		A-3		A-2			A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5		
SYMBOL	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7					A-7-5	A-7-6	A-3	A-6, A-7	
% PASSING	# 10		# 40		# 200										
LIQUID LIMIT	50 MX		30 MX		50 MX		51 MN								
PLASTIC INDEX	6 MX		NP		40 MX		41 MN	40 MX	41 MN	41 MN	40 MX	41 MN	10 MX	11 MN	
GROUP INDEX	0		0		0		4 MX	8 MX	12 MX	16 MX	No MX				
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND			SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS	
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE		

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

**MINERALOGICAL COMPOSITION**

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

**COMPRESSIBILITY**

SLIGHTLY COMPRESSIBLE      LIQUID LIMIT LESS THAN 31  
 MODERATELY COMPRESSIBLE      LIQUID LIMIT EQUAL TO 31-50  
 HIGHLY COMPRESSIBLE      LIQUID LIMIT GREATER THAN 50

**PERCENTAGE OF MATERIAL**

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	>10%	>20%	HIGHLY

**GROUND WATER**

WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING

STATIC WATER LEVEL AFTER 24 HOURS

PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA

SPRING OR SEEP

**CONSISTENCY OR DENSENESS**

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> )
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	<4 4 TO 10 10 TO 30 30 TO 50 >50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	<2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30	<0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4

**MISCELLANEOUS SYMBOLS**

ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION	SPT DMT VST PMT TEST BORING	TEST BORING W/ CORE
SOIL SYMBOL	AUGER BORING	SPT N-VALUE
ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT	CORE BORING	SPT REFUSAL
INFERRED SOIL BOUNDARY	MONITORING WELL	
INFERRED ROCK LINE	PIEZOMETER INSTALLATION	
ALLUVIAL SOIL BOUNDARY	SLOPE INDICATOR INSTALLATION	
DIP & DIP DIRECTION OF ROCK STRUCTURES	CONE PENETROMETER TEST	
	SOUNDING ROD	

**TEXTURE OR GRAIN SIZE**

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

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)
GRAIN SIZE	MM 305 IN. 12	75 3	2.0	0.25	0.05	0.005

**ABBREVIATIONS**

AR - AUGER REFUSAL	FRAGS. - FRAGMENTS	w - MOISTURE CONTENT
BT - BORING TERMINATED	HI. - HIGHLY	v - VERY
CL. - CLAY	MED. - MEDIUM	WEA. - WEATHERED
CPT - CONE PENETRATION TEST	MICA. - MICACEOUS	γ - UNIT WEIGHT
CSE. - COARSE	MOD. - MODERATELY	γ <sub>d</sub> - DRY UNIT WEIGHT
CT - CORING TERMINATED	NP - NON PLASTIC	<b>SAMPLE ABBREVIATIONS</b>
DMT - DILATOMETER TEST	ORG. - ORGANIC	S - BULK
DPT - DYNAMIC PENETRATION TEST	PMT - PRESSUREMETER TEST	SS - SPLIT SPOON
e - VOID RATIO	SAP. - SAPROLITIC	ST - SHELBY TUBE
EMBANK. - EMBANKMENT	SDY. - SANDY	RS - ROCK
F - FINE	SL. - SILT, SILTY	RT - RECOMPACTED TRIAXIAL
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	CBR - CALIFORNIA BEARING RATIO
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	

**SOIL MOISTURE - CORRELATION OF TERMS**

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

**EQUIPMENT USED ON SUBJECT PROJECT**

<b>DRILL UNITS:</b> <input type="checkbox"/> MOBILE B- ____ <input type="checkbox"/> BK-51 <input checked="" type="checkbox"/> CME-550X <input type="checkbox"/> CME-75 <input type="checkbox"/> PORTABLE HOIST  <input type="checkbox"/> _____ <input type="checkbox"/> _____	<b>ADVANCING TOOLS:</b> <input type="checkbox"/> CLAY BITS <input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER <input checked="" type="checkbox"/> 8" HOLLOW AUGERS <input type="checkbox"/> HARD FACED FINGER BITS <input type="checkbox"/> TUNG.-CARBIDE INSERTS <input type="checkbox"/> CASING <input type="checkbox"/> W/ ADVANCER <input type="checkbox"/> TRICONE _____ * STEEL TEETH <input type="checkbox"/> TRICONE _____ * TUNG.-CARB. <input type="checkbox"/> CORE BIT <input type="checkbox"/> _____	<b>HAMMER TYPE:</b> <input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL  <b>CORE SIZE:</b> <input type="checkbox"/> -B _____ <input type="checkbox"/> -N _____ <input type="checkbox"/> -H _____  <b>HAND TOOLS:</b> <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"/> _____
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**PLASTICITY**

NONPLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
LOW PLASTICITY	0-5	VERY LOW
MED. PLASTICITY	6-15	SLIGHT
HIGH PLASTICITY	16-25	MEDIUM
	26 OR MORE	HIGH

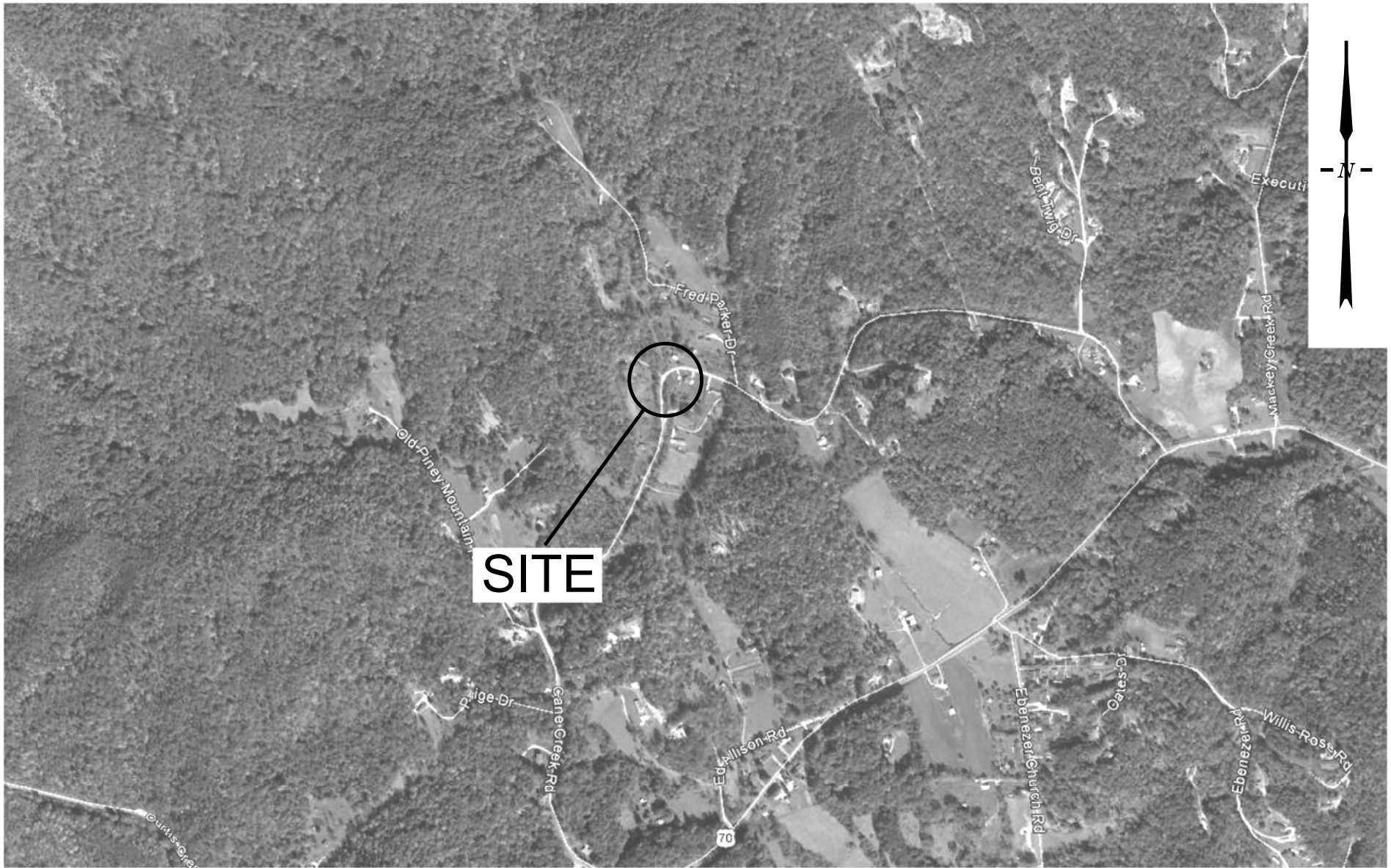
**COLOR**

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  
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS**

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. 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.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.  <b>ARTESIAN</b> - 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.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM.)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.  <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - 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.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.  <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SRQD)</b> - 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.  <b>TOPSOIL (TS.)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p><b>WEATHERED ROCK (WR)</b></p> 	<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES &gt; 100 BLOWS PER FOOT IF TESTED.</p>		
<p><b>CRYSTALLINE ROCK (CR)</b></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><b>NON-CRYSTALLINE ROCK (NCR)</b></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><b>COASTAL PLAIN SEDIMENTARY ROCK (CP)</b></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><b>FRESH</b></p>	<p>ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p>		
<p><b>VERY SLIGHT (V SL.)</b></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><b>SLIGHT (SL.)</b></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><b>MODERATE (MOD.)</b></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><b>MODERATELY SEVERE (MOD. SEV.)</b></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><b>SEVERE (SEV.)</b></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, YIELDS SPT N VALUES &gt; 100 BPF</i></p>		
<p><b>VERY SEVERE (V SEV.)</b></p>	<p>ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, YIELDS SPT N VALUES &lt; 100 BPF</i></p>		
<p><b>COMPLETE</b></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><b>VERY HARD</b></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><b>HARD</b></p>	<p>CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p>		
<p><b>MODERATELY HARD</b></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><b>MEDIUM HARD</b></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><b>SOFT</b></p>	<p>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.</p>		
<p><b>VERY SOFT</b></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	
<p><b>TERM</b></p>	<p><b>SPACING</b></p>	<p><b>TERM</b></p>	<p><b>THICKNESS</b></p>
<p>VERY WIDE</p>	<p>MORE THAN 10 FEET</p>	<p>VERY THICKLY BEDDED</p>	<p>&gt; 4 FEET</p>
<p>WIDE</p>	<p>3 TO 10 FEET</p>	<p>THICKLY BEDDED</p>	<p>1.5 - 4 FEET</p>
<p>MODERATELY CLOSE</p>	<p>1 TO 3 FEET</p>	<p>THINLY BEDDED</p>	<p>0.16 - 1.5 FEET</p>
<p>CLOSE</p>	<p>0.16 TO 1 FEET</p>	<p>VERY THINLY BEDDED</p>	<p>0.03 - 0.16 FEET</p>
<p>VERY CLOSE</p>	<p>LESS THAN 0.16 FEET</p>	<p>THICKLY LAMINATED</p>	<p>0.008 - 0.03 FEET</p>
		<p>THINLY LAMINATED</p>	<p>&lt; 0.008 FEET</p>
INDURATION			
<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.</p>			
<p><b>FRIABLE</b></p>	<p>RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p>		
<p><b>MODERATELY INDURATED</b></p>	<p>GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p>		
<p><b>INDURATED</b></p>	<p>GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p>		
<p><b>EXTREMELY INDURATED</b></p>	<p>SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>		
		<p><b>BENCH MARK:</b> Survey information provided by Mattern &amp; Craig</p>	
		<p align="right"><b>ELEVATION:</b> _____ <b>FT.</b></p>	
<p><b>NOTES:</b></p>			





**SITE**



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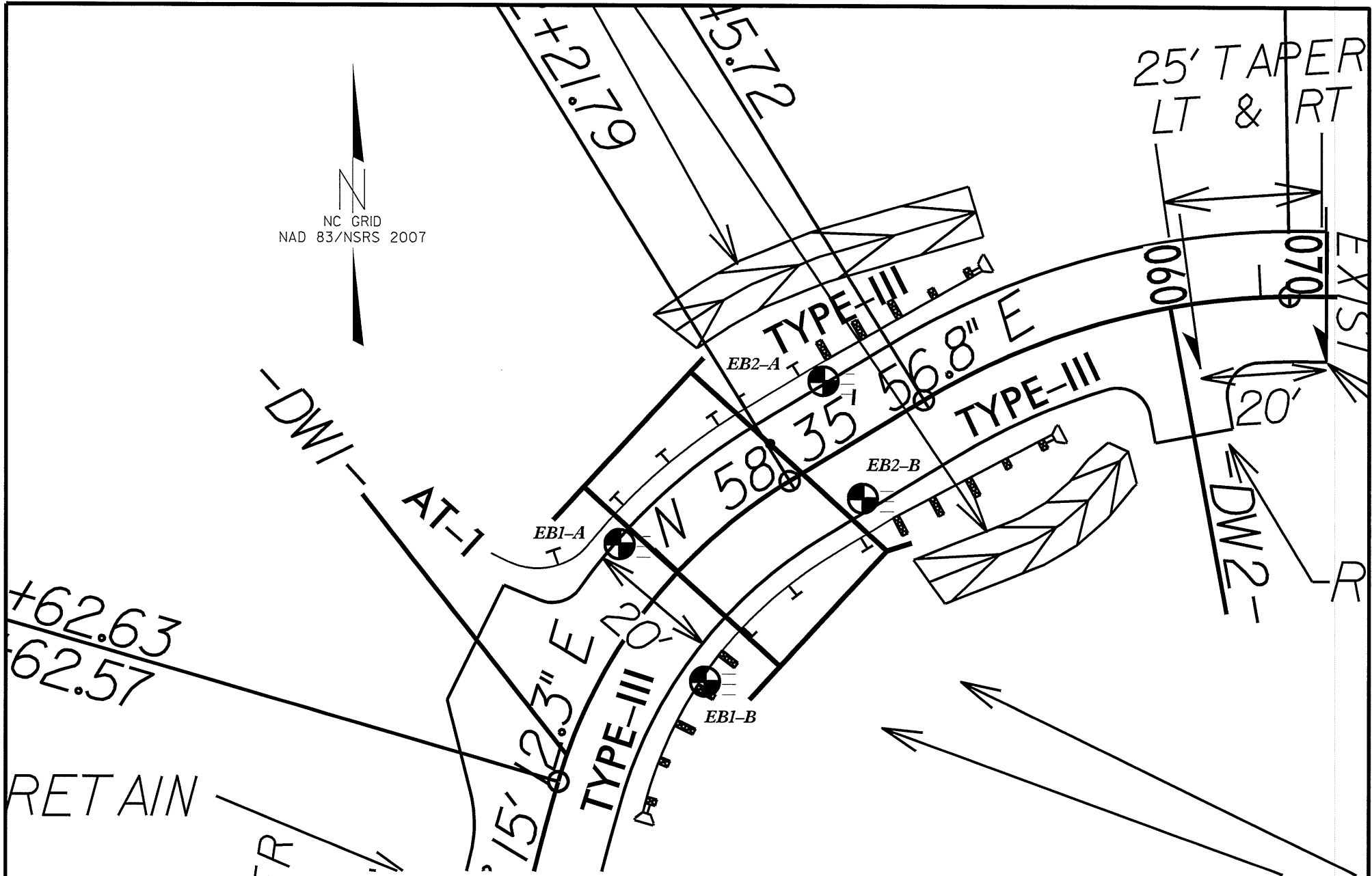
2505 Hutchison-McDonald Road  
 Charlotte, North Carolina 28269 | USA  
 T 704.596.2889 | F 704.596.3784  
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**SITE LOCATION PLAN**

PROJECT REFERENCE NO.: 17BP.13.R.59		F&R PROJECT NO.: 63P-0198
I.D. NO.: SF-580284	F.A. PROJECT NO.: N/A	COUNTY: McDowell
PROJECT DESCRIPTION: Bridge #284 on SR 1410 over Cave Creek		
SITE DESCRIPTION: Bridge #284 on SR 1410 over Cave Creek		
DRAWN BY: R. Kral	CHECKED BY: M. Walko, P.E.	
DATE: June 2013		

**DRAWING**  
 No.: **1**

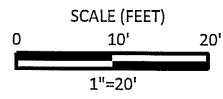
NC GRID  
NAD 83/NSRS 2007



+62.63  
62.57

RETAIN

25' TAPER  
DT



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**BORING LOCATION PLAN**

PROJECT REFERENCE NO.: 17BP.13.R.59		F&R PROJECT NO.: 63P-0198
I.D. NO.: SF-580284	F.A. PROJECT NO.: N/A	COUNTY: McDowell
PROJECT DESCRIPTION: Bridge #284 on SR 1410 over Cave Creek		
SITE DESCRIPTION: Bridge #284 on SR 1410 over Cave Creek		
DRAWN BY: R. Kral	CHECKED BY: M. Walko, P.E.	DRAWING No.: 2
DATE: June 2013	SCALE: 1" = 20'	



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.13.R.59	TIP N/A	COUNTY McDowell	GEOLOGIST R. Kral
SITE DESCRIPTION Bridge 284 on SR 1410 over Cave Creek			GROUND WTR (ft)
BORING NO. EB1-A	STATION 11+97	OFFSET 9 ft LT	ALIGNMENT -L-
COLLAR ELEV. 1,535.3 ft	TOTAL DEPTH 38.0 ft	NORTHING 710,011	EASTING 1,063,166
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012			DRILL METHOD H.S. Augers
DRILLER C. Boyce			HAMMER TYPE Automatic
START DATE 12/10/12		COMP. DATE 12/10/12	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)	
1540																
1535	1,535.3	0.0	4	5	6									1,535.3	0.0	GROUND SURFACE
1530	1,531.8	3.5	8	9	10	11										<b>ROADWAY EMBANKMENT</b> Brown silty fine to coarse SAND (A-2-4), little rock fragments
1525	1,526.8	8.5	3	3	3	19								1,527.3	8.0	<b>ALLUVIAL</b> Tan, orange and white silty GRAVEL (A-1-b)
1520	1,521.8	13.5	5	8	7	6								1,523.3	12.0	<b>RESIDUAL</b> Tan, orange and white silty fine to coarse SAND (A-2-4), little rock fragments
1515	1,516.8	18.5	3	7	8	15										
1510	1,511.8	23.5	5	11	14	15										
1505	1,506.8	28.5	10	12	24	25										
1500	1,501.8	33.5	100/0.4			36								1,501.8	33.5	<b>WEATHERED ROCK</b> Tan, orange and white (BIOTITE GNEISS)
	1,497.3	38.0	60/0.0											1,497.3	38.0	Boring Terminated with Standard Penetration Test Refusal at Elevation 1,497.3 ft On Crystalline Rock (BIOTITE GNEISS)

NCDOT BORE SINGLE 63P-0196-0284 - GROUP 2 BRIDGE 284.GPJ NC\_DOT.GDT 11/14/13



# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.13.R.59	TIP N/A	COUNTY McDowell	GEOLOGIST R. Kral
SITE DESCRIPTION Bridge 284 on SR 1410 over Cave Creek			GROUND WTR (ft)
BORING NO. EB1-B	STATION 11+89	OFFSET 14 ft RT	ALIGNMENT -L-
COLLAR ELEV. 1,534.4 ft	TOTAL DEPTH 35.0 ft	NORTHING 709,990	EASTING 1,063,179
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012			DRILL METHOD H.S. Augers
DRILLER C. Boyce			HAMMER TYPE Automatic
START DATE 12/12/12		COMP. DATE 12/12/12	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	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)
1535	1,534.4	0.0											GROUND SURFACE	0.0
	1,534.4	0.0	4	4	3							M	<b>ROADWAY EMBANKMENT</b> Brown silty fine to coarse SAND (A-2-4), some rock fragments	
1530	1,530.9	3.5	3	3	5									3.5
	1,529.4	5.0											<b>ALLUVIAL</b> Brown and orange slightly micaceous silty fine to coarse SAND (A-2-4), some gravel	5.0
1525	1,525.9	8.5	3	4	4						SS-1	33%	<b>RESIDUAL</b> Orange and white fine sandy SILT (A-4(1)), trace clay	
1520	1,520.9	13.5	7	15	19							M	Tan, orange and white silty fine to coarse SAND (A-2-4)	13.5
1515	1,515.9	18.5	12	14	20							M		
1510	1,510.9	23.5	5	6	12							M		
1505	1,505.9	28.5	100/0.5										<b>WEATHERED ROCK</b> Tan and white (BIOTITE GNEISS)	28.5
1500	1,500.9	33.5	9	30	70/0.4									
													Boring Terminated at Elevation 1,499.4 ft In Weathered Rock (BIOTITE GNEISS)	35.0

NCDOT BORE SINGLE 63P-0196-0284 - GROUP 2 BRIDGE 284.GPJ NC\_DOT.GDT 11/14/13





# NCDOT GEOTECHNICAL ENGINEERING UNIT

## BORELOG REPORT

WBS 17BP.13.R.59	TIP N/A	COUNTY McDowell	GEOLOGIST R. Kral
SITE DESCRIPTION Bridge 284 on SR 1410 over Cave Creek			GROUND WTR (ft)
BORING NO. EB2-B	STATION 12+30	OFFSET 8 ft RT	ALIGNMENT -L-
COLLAR ELEV. 1,534.6 ft	TOTAL DEPTH 30.5 ft	NORTHING 710,018	EASTING 1,063,203
DRILL RIG/HAMMER EFF./DATE F&R3763 CME-550X 82% 10/5/2012		DRILL METHOD H.S. Augers	HAMMER TYPE Automatic
DRILLER C. Boyce	START DATE 12/13/12	COMP. DATE 12/13/12	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)	
1535	1,534.6	0.0	5	9	12									1,534.6	0.0	GROUND SURFACE
														1,534.3	0.3	Asphalt (2"), Stone Base (2")
	1,531.1	3.5	3	4	3									1,531.1	3.5	<b>ROADWAY EMBANKMENT</b> Brown and tan silty fine to coarse SAND (A-2-4), little rock fragments
1530														1,529.6	5.0	<b>ALLUVIAL</b> Dark brown fine sandy CLAY (A-6) with organic odor
																<b>RESIDUAL</b> Tan, orange and white fine to coarse sandy SILT (A-4(1))
1525	1,526.1	8.5	3	4	6						SS-2	28%				
1520	1,521.1	13.5	4	6	9											
1515	1,516.1	18.5	6	12	30											
1510	1,511.1	23.5	9	12	17									1,511.1	23.5	Tan, orange and white fine sandy SILT (A-4)
1505	1,506.1	28.5	100/0.3											1,506.1	28.5	<b>WEATHERED ROCK</b> Brown and white (BIOTITE GNEISS)
	1,504.1	30.5	60/0.0											1,504.1	30.5	Boring Terminated with Standard Penetration Test Refusal at Elevation 1,504.1 ft On Crystalline Rock (BIOTITE GNEISS)

NCDOT BORE SINGLE 63P-0196-0284 - GROUP 2 BRIDGE 284.GPJ NC\_DOT.GDT 11/14/13