

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																																							
<p>SOIL IS CONSIDERED 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 (ASTM T208, 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:</p> <p style="text-align: center;"><i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HARD PLASTIC, A-7-6</i></p>	<p>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)</p> <p>GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.</p> <p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>	<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.</p> <p>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, 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 (RQD) - 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 (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 (SRQD) - 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>SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>GENERAL CLASS.</th> <th colspan="4">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="2">ORGANIC MATERIALS</th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1</th> <th>A-3</th> <th>A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th>A-6, A-7</th> </tr> </thead> <tbody> <tr> <td>SYMBOL</td> <td></td> </tr> <tr> <td>% PASSING</td> <td>10 40 200</td> </tr> <tr> <td>LIQUID LIMIT PLASTIC INDEX</td> <td>6 MX</td> <td>NP</td> <td>40 MX 10 MN 10 MN</td> <td>41 MN 11 MN 11 MN</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>0</td> <td>4 MX</td> <td>8 MX</td> <td>12 MX</td> <td>16 MX</td> <td>No MX</td> <td>No MX</td> <td>No MX</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS, GRAVEL, AND SAND</td> <td>FINE SAND</td> <td>SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS</td> <td>CLAYEY SOILS</td> <td>GRANULAR SOILS</td> <td>SILT-CLAY SOILS</td> <td>MUCK, PEAT</td> <td>HIGHLY ORGANIC SOILS</td> <td></td> </tr> <tr> <td>GENERAL RATING AS A SUBGRADE</td> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="2">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURATED</td> <td></td> <td></td> </tr> </tbody> </table> <p>PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30</p>	GENERAL CLASS.	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ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p>COMPRESSIBILITY</p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 31 MODERATELY COMPRESSIBLE LIQUID LIMIT EQUAL TO 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p>PERCENTAGE OF MATERIAL</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> </thead> <tbody> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td></td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td></td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td></td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>>10%</td> <td>>20%</td> <td></td> <td>HIGHLY 35% AND ABOVE</td> </tr> </tbody> </table> <p>GROUND WATER</p> <p> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING</p> <p> STATIC WATER LEVEL AFTER 24 HOURS</p> <p> PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA</p> <p> SPRING OR SEEP</p>		ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	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	<p>WEATHERED ROCK (WR) </p> <p>CRYSTALLINE ROCK (CR) </p> <p>NON-CRYSTALLINE ROCK (NCR) </p> <p>COASTAL PLAIN SEDIMENTARY ROCK (CP) </p> <p>WEATHERING</p> <p>FRESH ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.</p> <p>VERY SLIGHT (V SL.) ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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, YIELDS SPT N VALUES > 100 BPF.</p> <p>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, IF TESTED, YIELDS SPT N VALUES < 100 BPF.</p> <p>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.</p>	<p>CONSISTENCY OR DENSENESS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>PRIMARY SOIL TYPE</th> <th>COMPACTNESS OR CONSISTENCY</th> <th>RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)</th> <th>RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)</th> </tr> </thead> <tbody> <tr> <td>GENERALLY GRANULAR MATERIAL (NON-COHESIVE)</td> <td>VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE</td> <td><4 4 TO 10 10 TO 30 30 TO 50 >50</td> <td>N/A</td> </tr> <tr> <td>GENERALLY SILT-CLAY MATERIAL (COHESIVE)</td> <td>VERY SOFT MEDIUM STIFF STIFF VERY STIFF HARD</td> <td><2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 >30</td> <td><0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 >4</td> </tr> </tbody> </table> <p>TEXTURE OR GRAIN SIZE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>U.S. STD. 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<p>MISCELLANEOUS SYMBOLS</p> <p> ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION</p> <p> SOIL SYMBOL</p> <p> ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT</p> <p> INFERRED SOIL BOUNDARY</p> <p> INFERRED ROCK LINE</p> <p> ALLUVIAL SOIL BOUNDARY</p> <p> DIP & DIP DIRECTION OF ROCK STRUCTURES</p> <p> SOUNDING ROD</p> <p> SPT TEST BORING</p> <p> AUGER BORING</p> <p> CORE BORING</p> <p> MONITORING WELL</p> <p> PIEZOMETER INSTALLATION</p> <p> SLOPE INDICATOR INSTALLATION</p> <p> SPT N-VALUE</p> <p> SPT REFUSAL</p>	<p>ABBREVIATIONS</p> <p>AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST F - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED, FRACTURES FRAGS. - FRAGMENTS</p> <p>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 - TRICONE REFUSAL</p> <p>w - MOISTURE CONTENT v - VERY VST - VANE SHEAR TEST WEA. - WEATHERED W - UNIT WEIGHT W_d - DRY UNIT WEIGHT</p>	<p>ROCK HARDNESS</p> <p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK, BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.</p> <p>HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY, HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.</p> <p>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.</p> <p>MEDIUM HARD CAN BE GROVED 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 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>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.</p>	<p>EQUIPMENT USED ON SUBJECT PROJECT</p> <p>DRILL UNITS:</p> <p><input type="checkbox"/> MOBILE B- _____</p> <p><input type="checkbox"/> BK-51</p> <p><input type="checkbox"/> CME-45C</p> <p><input checked="" type="checkbox"/> CME-550</p> <p><input type="checkbox"/> PORTABLE HOIST</p> <p>ADVANCING TOOLS:</p> <p><input type="checkbox"/> CLAY BITS</p> <p><input type="checkbox"/> 6" CONTINUOUS FLIGHT AUGER</p> <p><input type="checkbox"/> 8" HOLLOW AUGERS</p> <p><input type="checkbox"/> HARD FACED FINGER BITS</p> <p><input type="checkbox"/> TUNG-CARBIDE INSERTS</p> <p><input checked="" type="checkbox"/> CASING [N] w/ ADVANCER</p> <p><input type="checkbox"/> TRICONE _____ STEEL TEETH</p> <p><input type="checkbox"/> TRICONE _____ TUNG-CARB.</p> <p><input type="checkbox"/> CORE BIT</p> <p>HAMMER TYPE:</p> <p><input checked="" type="checkbox"/> AUTOMATIC <input type="checkbox"/> MANUAL</p> <p>CORE SIZE:</p> <p><input type="checkbox"/> -B _____</p> <p><input checked="" type="checkbox"/> -N XLW</p> <p><input type="checkbox"/> -H _____</p> <p>HAND TOOLS:</p> <p><input type="checkbox"/> POST HOLE DIGGER</p> <p><input type="checkbox"/> HAND AUGER</p> <p><input type="checkbox"/> SOUNDING ROD</p> <p><input type="checkbox"/> VANE SHEAR TEST</p>	<p>FRACTURE SPACING</p> <table border="1" style="width: 100%; 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GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.</p> <p>MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.</p> <p>INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.</p> <p>EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>	TERM	SPACING	VERY WIDE	MORE THAN 10 FEET	WIDE	3 TO 10 FEET	MODERATELY CLOSE	1 TO 3 FEET	CLOSE	0.16 TO 1 FEET	VERY CLOSE	LESS THAN 0.16 FEET	TERM	THICKNESS	VERY THICKLY BEDDED	> 4 FEET	THICKLY BEDDED	1.5 - 4 FEET	THINLY BEDDED	0.16 - 1.5 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET	THINLY LAMINATED	< 0.008 FEET																																																																																																																																																												
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

April 1, 2006

STATE PROJECT: 33381.1.1 (B-4013)
F. A. PROJECT NO: BRZ-1320 (4)
COUNTY: Ashe

DESCRIPTION: Bridge No. 338 over Roaring Fork Creek on SR 1320
(Roaring Fork Road)

SUBJECT: Geotechnical Report – Foundation Investigation

Site Description

Bridge 338 is located in western Ashe County on SR 1320, approximately 17.5 miles west of the town of West Jefferson via NC 88 and SR 1315, and 0.3 miles from the intersection with SR 1315 (Big Laurel Creek Road). The existing bridge is a one-span structure 54 feet long and 22 feet wide, on steel girders and with timber abutments. Plans call for a single span, composite plate girder bridge to be constructed on alignment -L- approximately 100 feet downstream of the centerline of the existing bridge. The new bridge is to be approximately 85 feet long and 28 feet wide, with a skew of 23 degrees.

Roaring Fork Creek is a turbulent stream flowing in a channel about 15 feet wide on a bed of gravel, cobbles and abundant boulders. Channel banks are about 2 feet high, except where the existing roadway embankment encroaches on the east bank downstream of the existing bridge. The valley floor is about 250 feet wide and appears to be a debris-flow valley fill surface rather than a flood plain. A small, one-lane, steel girder bridge on a driveway lies across the creek about 100 feet downstream of the proposed new bridge. A single story pole barn encroaches on alignment -L- about 50 feet up station from End Bent Two.

The Geotechnical Engineering Unit conducted a foundation investigation for this bridge in January and February, 2006. Six rock core borings were made using a CME 550 power drilling machine equipped with a NX casing advancer and NXWL diamond bit coring tools. The borings were located at the Left, Right, and Centerline positions of each end bent. Standard Penetration Tests (SPT's) were performed at regular intervals in soil and weathered rock. Six soil samples were submitted to a DOT laboratory for quality testing, and 9 rock core samples were submitted for strength testing.

Soil and Rock Materials

Borings at this site encountered colluvium, saprolite, weathered rock, crystalline rock, and roadway embankment soil. The embankment soil is similar in composition to the underlying colluvial soil. Both are composed primarily of angular boulders, cobbles and gravel with interstitial moist to wet, dark brown sandy silt (A-1-b). Many of the boulders are more than 2 feet in intermediate diameter. The colluvium overlies a thin layer of saprolite in three borings. The colluvium in other borings directly overlies weathered rock or crystalline rock.

The saprolite soils are orange to yellow-brown or greenish gray, very stiff to hard, sandy silt (A-4) in a bed three feet or less in thickness underlying colluvium and grading downward to weathered rock. Saprolite also occurs as numerous seams of brownish gray to greenish gray silt up to two feet in thickness below the weathered rock or crystalline rock line. Saprolite seams have been found more than 20 feet below the crystalline rock line.

The weathered rock zone varies in thickness from zero to more than 30 feet, grading downward to crystalline rock. It is composed of very severely weathered greenstone and biotite-chlorite gneiss. Joints in the weathered rock zone are heavily coated with manganese oxide.

The crystalline rock at this site is composed of two lithologies. The more abundant lithology is biotite-chlorite gneiss or metadiorite that grades to greenstone, which is composed chiefly of fine chlorite mica. This lithology may have lenses and thin sills of white felsite. Foliation is poorly to moderately well developed dipping 15 to 55 degrees.

The second lithology is white granite gneiss, composed chiefly of white feldspar with subordinate quartz and a few percent black silicate minerals. This lithology is dominant in the boring at EB2-B. It occurs near the base of the borings at EB2-A and EB2-C and as sills within biotite gneiss and greenstone in the other borings.

Both lithologies are highly fractured at this site, and the biotite gneiss/greenstone lithology is significantly weathered to depths around 30 feet below the base of the colluvium.

Bent Descriptions

End Bent One (EB1)

This bent is located on the east side of the creek, on the shoulder of the existing road and about 5 feet from the creek bank. All three borings on this bent penetrated 3.5 feet of roadway embankment and 5.5 to 6.0 feet of bouldery colluvium overlying residual material. The static groundwater level could not be determined on this bent due to rapid caving of the borings.

A boring on the Left Side (EB1-A) found weathered rock directly below the colluvium. The boring was advanced 32 feet through weathered rock before it encountered crystalline rock at a depth of 41.7 feet. The rock was very poor quality biotite gneiss with thin sills of granite gneiss.

A boring on the centerline (EB1-C) encountered weathered rock beneath the colluvium and continued in the same for 11 feet to encounter crystalline rock at a depth of approximately 20 feet. The boring was advanced from that point through very poor quality rock with saprolite and weathered rock seams to a total depth of 44.6 feet.

A boring on the Right Side (EB1-B) found saprolite below the colluvium. The boring penetrated a few feet of saprolite and weathered rock, then 4 feet of crystalline rock, and broke out again into saprolite at a depth of 17.4 feet. Crystalline rock was encountered once more at a depth of 22 feet. The boring continued through very poor quality rock with thin saprolite or weathered rock seams to 30 feet. From there to a total depth of 44.7 feet, rock quality was very good to poor, with fractured and weathered seams.

End Bent Two (EB2)

This bent is located on the west side of the creek approximately 5 feet from the creek bank, in a wooded area. Borings on this bent penetrated colluvium to depths of 11 feet on the Left Side and 8.5 to 9.0 feet on the Centerline and Right Side. The static ground water table was approximately 3.5 to 4 feet below ground surface.

A boring on the Left Side (EB2-A) found crystalline rock below the colluvium at a depth of 11 feet. The bit passed into weathered rock at a little over 14 feet and again encountered crystalline rock at a depth of 18 feet. The boring was carried through crystalline rock to a total depth of 39.1 feet. The rock consisted of very good quality ledges interlayered with very poor quality weathered layers.

A boring on the Centerline (EB2-C) found hard saprolite and weathered rock below the colluvium at a depth of 9 feet. Very good quality crystalline rock was encountered at a depth of 15 feet and continued to 20.4 feet, where the bit passed into weathered rock with a few hard seams. Crystalline rock was encountered again at 26.6 feet. The boring continued in good quality granite gneiss to a total depth of 29.5 feet.

A boring on the Right Side (EB2-B) found a little over 2 feet of dense saprolite and weathered rock below the colluvium at a depth of 8.5 feet. Crystalline rock was encountered at a depth of 10.7 feet. The rock was cored to a total depth of 28.9 feet, and it consisted of fair to very good quality granite gneiss, with the exception of a very poor, weathered seam a foot thick at about 19 feet depth.

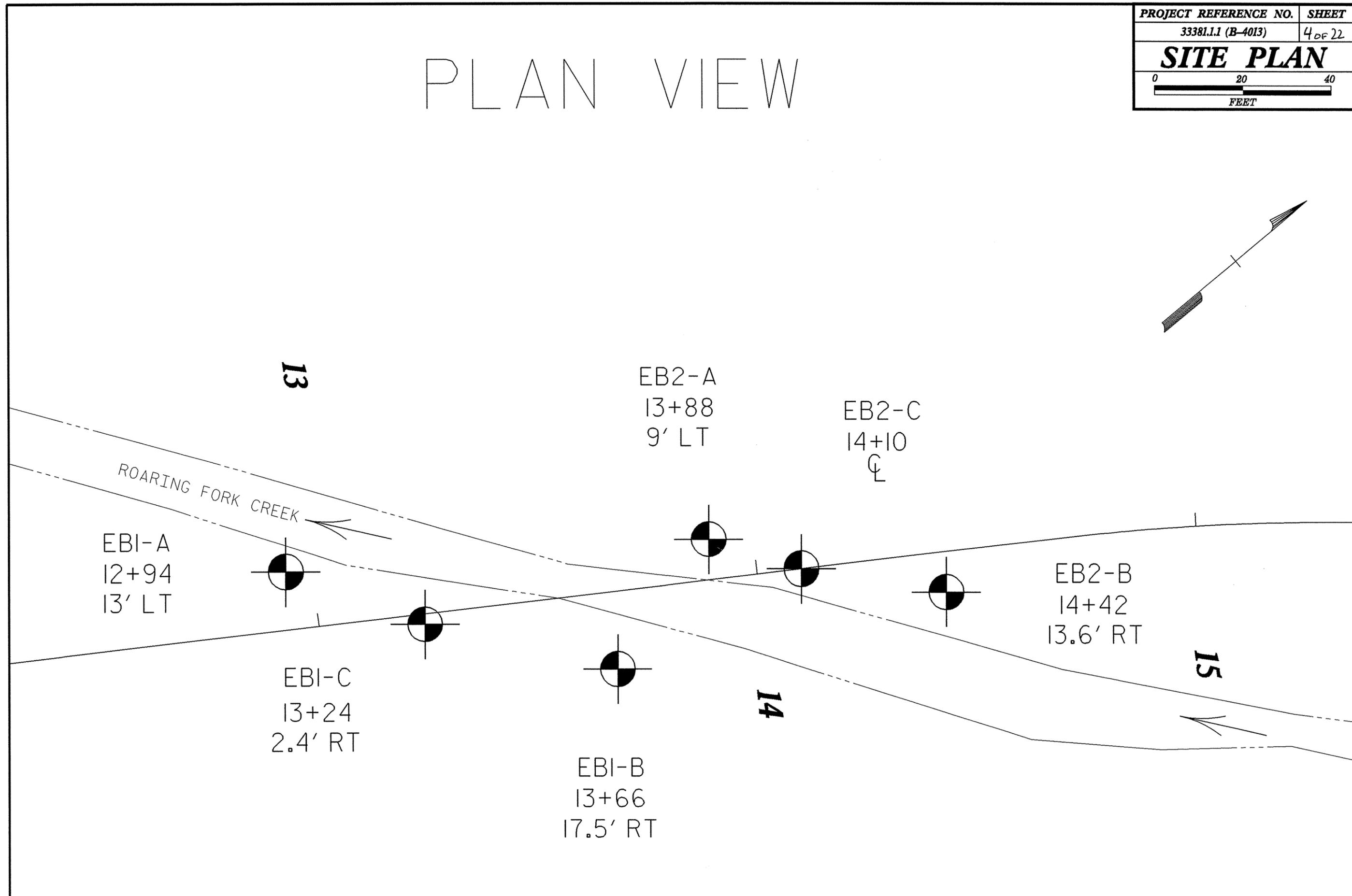
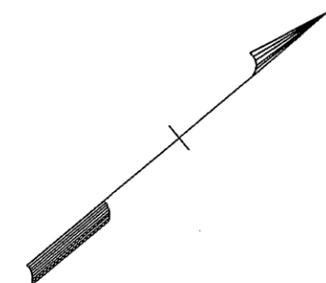
Respectfully submitted,



Louis L. Acker, LG
Project Geological Engineer

PROJECT REFERENCE NO.	SHEET
33381.1.1 (B-4013)	4 OF 22
SITE PLAN	
 0 20 40 FEET	

PLAN VIEW



13

EB2-A
13+88
9' LT

EB2-C
14+10
CL

EBI-A
12+94
13' LT

EB2-B
14+42
13.6' RT

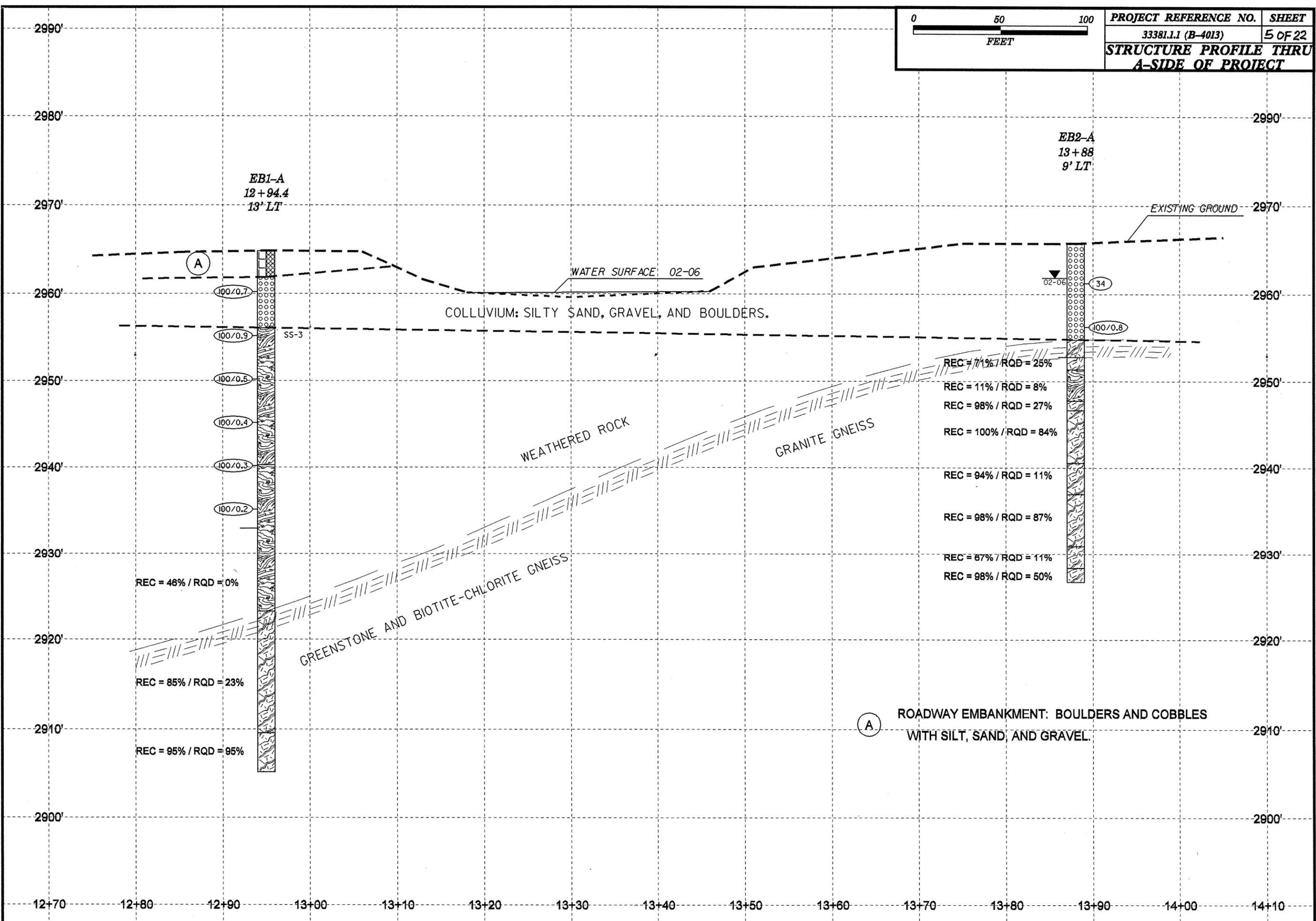
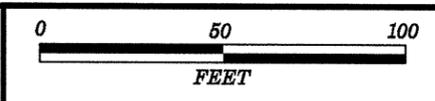
EBI-C
13+24
2.4' RT

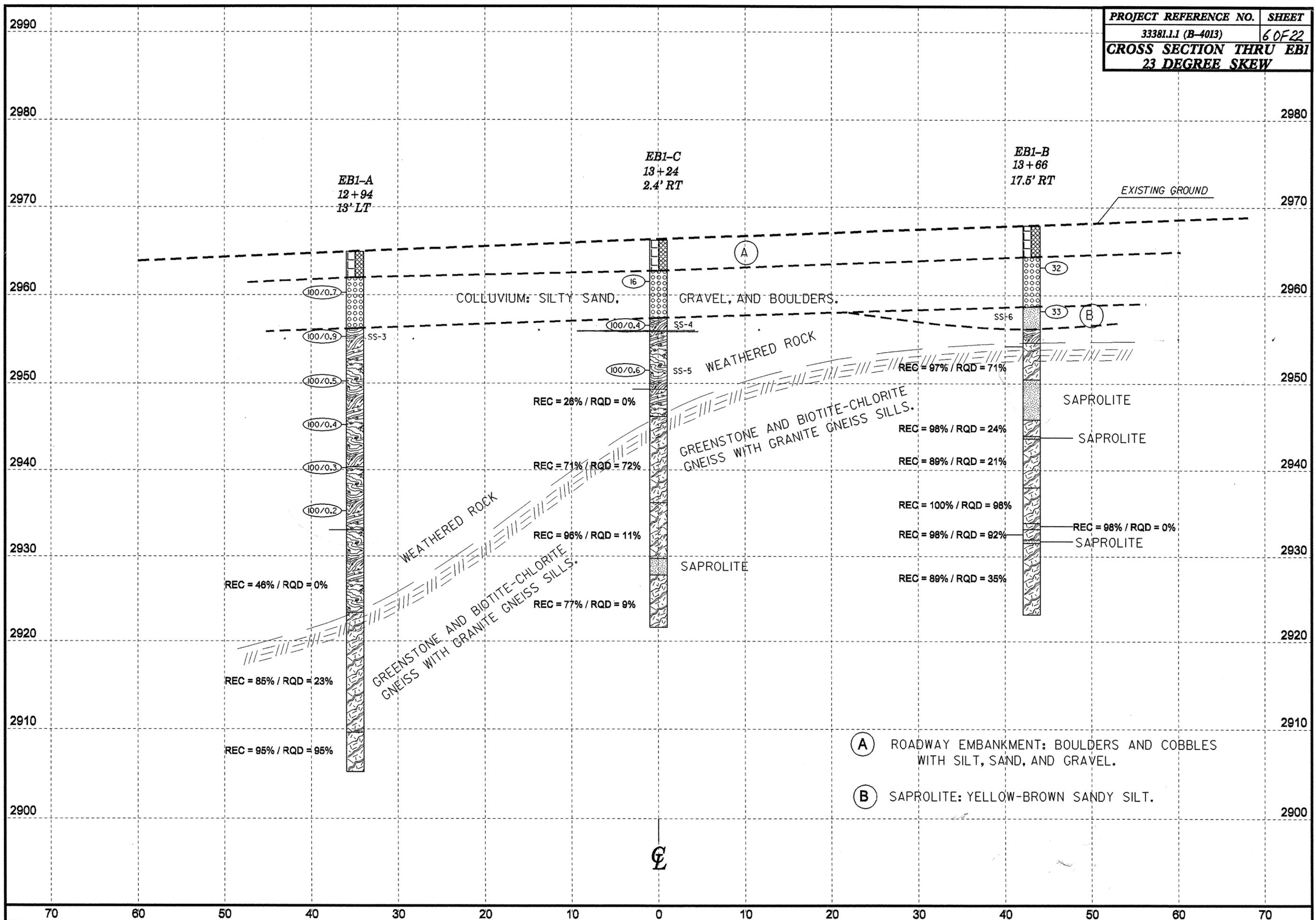
14

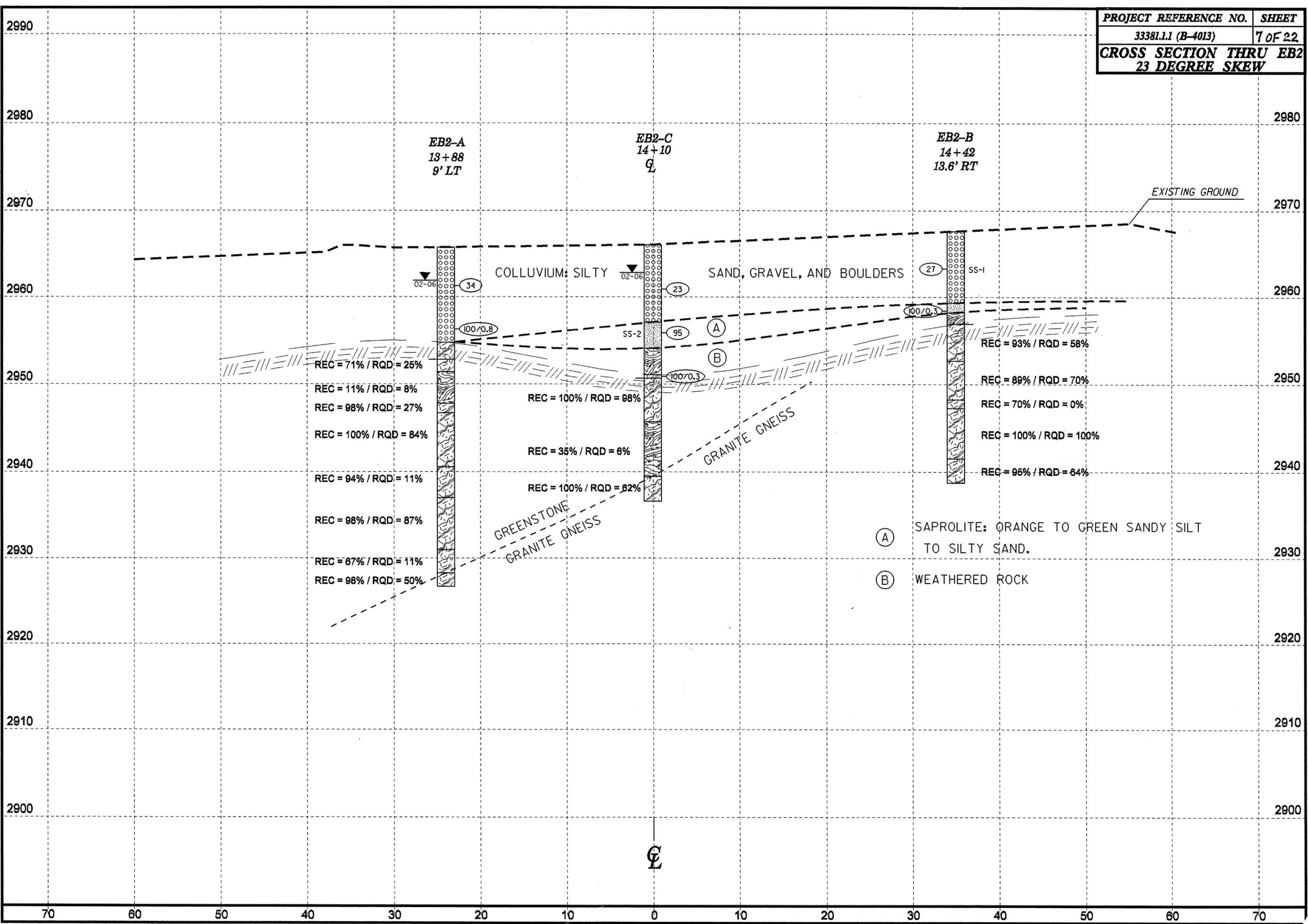
EBI-B
13+66
17.5' RT

15

ROARING FORK CREEK







NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 GEOTECHNICAL UNIT BORING LOG

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33381.1.1		ID B-4013		COUNTY ASHE		GEOLOGIST L.L. ACKER								
SITE DESCRIPTION BRIDGE 338 ON SR 1320 OVER ROARING FORK CREEK							GND WATER							
BORING NO EB1-A		NORTHING 0.00		EASTING 0.00		0 HR N/A	24 HR N/A							
ALIGNMENT -L-		BORING LOCATION 12+94.000		OFFSET 13.00ft LT										
COLLAR ELEV 2965.00ft		TOTAL DEPTH 59.70ft		START DATE 2/06/06		COMPLETION DATE 02/07/06								
DRILL MACHINE CME 550			DRILL METHOD SPT CORE BORING			HAMMER TYPE AUTOMATIC								
SURFACE WATER DEPTH			DEPTH TO ROCK 24.70ft			Log EB1-A, Page 1 of 2								
ELEV	DEPTH	BLOW CT			PEN (ft)	BLOWS PER FOOT					SAMPLE NO	LOG	SOIL AND ROCK DESCRIPTION	
		6in	6in	6in		0	25	50	75	100				
2965.00														Ground Surface
2960.00	4.70	35	65	0.7										EMBANKMENT: BOULDERS AND COBBLES WITH SILT, SAND, AND GRAVEL.
	9.70	22	18	0.9										COLLUVIUM: BOULDERS AND COBBLES IN SILTY SAND AND GRAVEL.
2950.00	14.70	48	60	0.9							SS-3	M		WEATHERED ROCK (BIOTITE GNEISS)
	19.70	56	44	0.4										
2940.00	24.70	100		0.3										
	29.70	100		0.2										WEATHERED ROCK WITH CRYSTALLINE ROCK SEAMS.(BIOTITE GNEISS)
2930.00											CORE 1			
											CORE 2			
											CORE 3			
2920.00											CORE 4			CRYSTALLINE ROCK: SLI. WEATHERED BIOTITE GNEISS REC= 85 RQD=23.
											CORE 5			
2910.00											CORE 6			
														Continued on the next page.

PROJECT NO 33381.1.1		ID B-4013		COUNTY ASHE		GEOLOGIST L.L. ACKER								
SITE DESCRIPTION BRIDGE 338 ON SR 1320 OVER ROARING FORK CREEK							GND WATER							
BORING NO EB1-A		NORTHING 0.00		EASTING 0.00		0 HR N/A	24 HR N/A							
ALIGNMENT -L-		BORING LOCATION 12+94.000		OFFSET 13.00ft LT										
COLLAR ELEV 2965.00ft		TOTAL DEPTH 59.70ft		START DATE 2/06/06		COMPLETION DATE 02/07/06								
DRILL MACHINE CME 550			DRILL METHOD SPT CORE BORING			HAMMER TYPE AUTOMATIC								
SURFACE WATER DEPTH			DEPTH TO ROCK 24.70ft			Log EB1-A, Page 2 of 2								
ELEV	DEPTH	BLOW CT			PEN (ft)	BLOWS PER FOOT					SAMPLE NO	LOG	SOIL AND ROCK DESCRIPTION	
		6in	6in	6in		0	25	50	75	100				
2910.00														
2905.30														CRYSTALLINE ROCK: HARD, FRESH BIOTITE GNEISS REC=95 RQD=95
														TERMINATED BORING IN CRYSTALLINE ROCK (BIOTITE GNEISS) AT ELEVATION 2905.3 FEET. BORING CAVED IN AND DRY TO -3.0'

PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

CORE BORING REPORT
EB1-A

CORE 1: 31.9 – 34.7	REC=82% RQD=0%
CORE 2: 34.7 – 39.7	REC=20% RQD=0%
CORE 3: 39.7 – 44.7	REC=84% RQD=8%
CORE 4: 44.7 – 49.7	REC=76% RQD=16%
CORE 5: 49.7 – 54.7	REC=92% RQD=36%
CORE 6: 54.7 – 59.7	REC=96% RQD=90%

LAYER 1: 31.9 – 41.6 Mostly weathered rock, grading to saprolite and hard rock in seams and layers. Moderately to very severely weathered biotite-chlorite gneiss.
REC=46% RQD=0%

LAYER 2: 41.6 – 55.3 Hard, slightly weathered biotite gneiss with layers and lenses of white granite gneiss up to a foot thick. More than 86 pieces with gravel, longest piece 0.4 feet. Foliation poorly to moderately developed at 40 degrees.
47 joints on foliation, moderately rough,
4 joints at 60 degrees, moderately rough.
Other joint sets indeterminate. All joints coated with chlorite and/or Fe-oxide.
REC=85% RQD=23%

LAYER 3: 55.3 – 59.7 Hard, fresh, biotite-chlorite gneiss. 5 pieces, longest piece 1.7 feet. Foliation poorly developed at 35 degrees.
4 joints on foliation, moderately rough,
2 joints at 50 degrees, rough.
All joints coated with chlorite and/or Fe-oxide.
REC=95% RQD=95%

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33381.1.1		ID B-4013		COUNTY ASHE		GEOLOGIST L.L. ACKER						
SITE DESCRIPTION BRIDGE 338 ON SR 1320 OVER ROARING FORK CREEK							GND WATER					
BORING NO EB1-B		NORTHING 0.00		EASTING 0.00		0 HR N/A						
ALIGNMENT -L-		BORING LOCATION 13+66.000		OFFSET 17.50ft RT		24 HR N/A						
COLLAR ELEV 2968.00ft		TOTAL DEPTH 44.70ft		START DATE 2/08/06		COMPLETION DATE 02/08/06						
DRILL MACHINE CME 550			DRILL METHOD SPT CORE BORING			HAMMER TYPE AUTOMATIC						
SURFACE WATER DEPTH			DEPTH TO ROCK 13.20ft			Log EB1-B, Page 1 of 1						
ELEV	DEPTH	BLOW CT			PEN (ft)	BLOWS PER FOOT				SAMPLE NO	LOG	SOIL AND ROCK DESCRIPTION
		6in	6in	6in		0	25	50	75			
2968.00												
	4.70	23	16	16	1.0							EMBANKMENT: BOULDERS AND COBBLES IN SILTY SAND AND GRAVEL
	9.70	8	12	21	1.0							COLLUVIUM: BOULDERS AND COBBLES IN SILTY SAND AND GRAVEL
												SAPROLITE: YELLOW-BROWN SANDY SILT
												WEATHERED ROCK (BIOTITE GNEISS)
												CRYSTALLINE ROCK NOT CORED
												CRYSTALLINE ROCK: FRESH BIOTITE GNEISS WITH MOD WEATHERED SEAM REC=97 RQD=71
												SAPROLITE: BROWN SANDY SILT REC=22 RQD=0
												GRANITE GNEISS, SLI. WEATHERED REC=98 RQD=24
												SAPROLITE
												GREENSTONE, SLI. TO SEV. WEATHERED REC=89 RQD=21
												SAME, V. SLI. WEATHERED REC=100 RQD=98
												FRACTURED REC=98 RQD=0
												SLI. WEATHERED REC=98 RQD=92
												SAPROLITE: REC=98 RQD=0
												GREENSTONE WITH GRANITE GNEISS INTERLAYER, V. SLI. WEATHERED REC=89 (MACHINE GRINDING) RQD=35
												TERMINATED BORING IN CRYSTALLINE ROCK (GRANITE GNEISS) AT ELEVATION 2923.3 FEET. BORING CAVED IN AND DRY AT 6.3'

PROJECT NO. 33381.1.1 (B-4013)
 ASHE COUNTY

CORE BORING REPORT
 EB1-B

CORE 1: 13.6 – 14.7 REC=100% RQD=100%
 CORE 2: 14.7 – 19.7 REC=72% RQD=32%
 CORE 3: 19.7 – 24.7 REC=52% RQD=8%
 CORE 4: 24.7 – 29.7 REC=94% RQD=24%
 CORE 5: 29.7 – 34.7 REC=94% RQD=78%
 CORE 6: 34.7 – 39.7 REC=92% RQD=56%
 CORE 7: 39.7 – 44.7 REC=90% RQD=42%

LAYER 1: 13.6 – 17.4 Hard, fresh, biotite gneiss, except moderately weathered 15.8 to 16.2. 7 pieces, longest piece 2.1 feet. Foliated at 45-50 degrees. 3 joints on foliation and rough.
 LAYER 2: 17.4 – 22.0 Soft, very severely weathered, brown silty saprolite. Base estimated to be at 22 feet. REC=22% RQD=0%
 LAYER 3: 22.0 – 23.9 Hard, slightly weathered white granite gneiss. 14 pieces, longest piece 0.45 feet. Joints indeterminate. REC=98% RQD=24%
 LAYER 4: 23.9 – 24.2 Green silty saprolite.
 LAYER 5: 24.2 – 29.9 Hard to medium, slightly to severely weathered biotite gneiss grading to greenstone; includes 0.5 foot layer of white granite gneiss near base. 27 pieces plus gravel, longest piece 0.5 feet. Foliation well developed at 40 degrees. Joint count indeterminate; joints coated with Fe-oxide and Mn-oxide.
 LAYER 6: 29.9 – 34.0 Hard, very slightly weathered biotite gneiss grading to greenstone. 2 pieces, longer piece 2.4 feet. Foliated at 40 degrees. 1 joint on foliation, moderately rough, coated with Fe-oxide and Mn-oxide. REC=100% RQD=98%
 LAYER 7: 34.0 – 34.7 Moderately hard, slightly weathered lithology as above. More than 10 pieces including gravel, longest piece 0.1 feet. REC=98% RQD=0%
 LAYER 8: 34.7 – 35.9 Hard, slightly weathered lithology as above, 4 pieces, longest piece 0.7 feet. 2 close joints dipping 20 degrees near center of layer, moderately rough, coated with Mn-oxide. REC=98% RQD=92%
 LAYER 9: 35.9 – 36.3 Green silty saprolite.

PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

CORE BORING REPORT
EB1-B (continued)

LAYER 10: 36.3 – 44.7 Hard, very slightly weathered greenstone with granite gneiss layer 40.3 - 43.7. 29 pieces, longest piece 0.5 feet. Foliation at 45 degrees.
8 joints on foliation, smooth to moderately rough, clean or coated with chlorite.
7 joints at 20 degrees, moderately rough, coated with Fe-oxide and a little Mn-oxide. Few other joints at 60 to 80 degrees, smooth to rough, coated with Fe-oxide and Mn-oxide, otherwise indeterminate.
REC=89% RQD=35%

PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 GEOTECHNICAL UNIT BORING LOG

PROJECT NO 33381.1.1	ID B-4013	COUNTY ASHE	GEOLOGIST L.L. ACKER
SITE DESCRIPTION BRIDGE 338 ON SR 1320 OVER ROARING FORK CREEK			GND WATER
BORING NO EB1-C	NORTHING 0.00	EASTING 0.00	0 HR N/A
ALIGNMENT -L-	BORING LOCATION 13+24.000	OFFSET 2.40ft RT	24 HR N/A
COLLAR ELEV 2966.30ft	TOTAL DEPTH 44.60ft	START DATE 2/07/06	COMPLETION DATE 02/07/06
DRILL MACHINE CME-550	DRILL METHOD SPT CORE BORING	HAMMER TYPE AUTOMATIC	
SURFACE WATER DEPTH		DEPTH TO ROCK 20.00ft	Log EB1-C, Page 1 of 1

CORE BORING REPORT
 EB1-C

CORE 1: 16.9 – 19.6	REC=26% RQD=0%
CORE 2: 19.6 – 24.6	REC=58% RQD=14%
CORE 3: 24.6 – 29.6	REC=80% RQD=12%
CORE 4: 29.6 – 34.6	REC=86% RQD=14%
CORE 5: 34.6 – 39.6	REC=70% RQD=0%
CORE 6: 39.6 – 44.6	REC=78% RQD=10%

ELEV	DEPTH	BLOW CT			PEN (ft)	BLOWS PER FOOT				SAMPLE NO	LOG	SOIL AND ROCK DESCRIPTION
		6in	6in	6in		0	25	50	75			
2966.30												Ground Surface
2960.00	4.70	7	8	8	1.0							EMBANKMENT: BOULDERS AND COBBLES IN SILTY SAND AND GRAVEL.
	9.70	12	100		0.4					SS-4	M	COLLUVIUM: BOULDERS AND COBBLES IN SILTY SAND AND GRAVEL.
2950.00	14.70	59	41		0.6					SS-5	M	WEATHERED ROCK WITH CRYSTALLINE ROCK SEAMS. (GRANITE GNEISS)
										CORE 1		
										CORE 2		
										CORE 3		CRYSTALLINE ROCK: MOD. SEV. WEATHERD GREENSTONE WITH WEATHERED ROCK/SAPROLITE SEAMS REC=71 RQD=7
										CORE 4		
										CORE 5		MODERATELY WEATHERED GREENSTONE REC= 96 RQD= 11
										CORE 6		
												SAPROLITE SEAM REC=19 RQD=0
												CRYSTALLINE ROCK: MOD. WEATHERED GREENSTONE WITH FEW GRANITE GNEISS SILLS REC= 77 RQD= 9
2921.70												TERMINATED BORING IN CRYSTALLINE ROCK (GRANITE GNEISS) AT ELEVATION 2921.7'. BORING CAVED IN AND DRY AT 2.4'

LAYER 1: 16.9 – 20.0 Weathered rock and/or saprolite. Very severely weathered greenstone. REC=26% RQD=0%

LAYER 2: 20.0 – 30.0 Moderately to medium hard, moderately severely weathered greenstone with saprolite or weathered rock seams at 23.6-24.2, 24.6-25.0, 25.9-26.0, and 28.5-28.7. About 60 pieces plus gravel, longest piece 0.4 feet. Joints indeterminate. REC=71% RQD=7%

LAYER 3: 30.0 – 36.5 Moderately hard, moderately weathered greenstone. At least 55 pieces, longest piece 0.3 feet. Foliation at 25-45 degrees. At least 15 joints on foliation, moderately rough. Other joint sets indeterminate. All joints coated with Mn-oxide and Fe-oxide. REC=96% RQD=11%

LAYER 4: 36.5 – 38.6 Green silty saprolite. REC=19% RQD=0%

LAYER 5: 38.6 – 44.6 Hard, moderately weathered greenstone with a few thin granite gneiss sills. More than 50 pieces plus gravel. Foliation at 15-20 degrees. At least 25 joints on foliation, moderately rough to smooth, coated with Fe-oxide and Mn-oxide. Other joint sets indeterminate. REC=77% RQD=9%

GEOTECHNICAL UNIT BORING LOG

13 of 22

PROJECT NO 33381.1.1		ID B-4013		COUNTY ASHE		GEOLOGIST L.L. ACKER						
SITE DESCRIPTION BRIDGE 338 ON SR 1320 OVER ROARING FORK CREEK							GND WATER					
BORING NO EB2-A		NORTHING 0.00		EASTING 0.00		0 HR N/A						
ALIGNMENT -L-		BORING LOCATION 13+88.000		OFFSET 9.00ft LT		24 HR 3.90ft						
COLLAR ELEV 2965.77ft		TOTAL DEPTH 39.10ft		START DATE 2/01/06		COMPLETION DATE 02/01/06						
DRILL MACHINE CME 550			DRILL METHOD SPT CORE BORING			HAMMER TYPE AUTOMATIC						
SURFACE WATER DEPTH			DEPTH TO ROCK 11.00ft			Log EB2-A, Page 1 of 1						
ELEV	DEPTH	BLOW CT			PEN (ft)	BLOWS PER FOOT				SAMPLE NO	LOG	SOIL AND ROCK DESCRIPTION
		6in	6in	6in		0	25	50	75			
2965.77												
	4.00	13	22	12	1.0							COLLUVIUM: SILTY SAND, GRAVEL AND BOULDERS
2960.00	9.00	58	40	60	0.8							CRYSTALLINE ROCK NOT CORED
2950.00												CRYSTALLINE ROCK: SLI. WEATH. GRANITE GNEISS REC=71 RQD=25
												V. SEVERELY WEATHERED GREENSTONE REC=11 RQD=8
												SLI. WEATH. GRANITE GNEISS REC=98 RQD=27
2940.00												SLI TO MOD. WEATHERED GREENSTONE REC=100 REC=84
												MOD. TO MOD. SEV. WEATHERED GREENSTONE REC=94 RQD=11
2930.00												HARD, FRESH GREENSTONE REC=98 RQD=87
2926.67												MOD. TO SEV. WEATH. GREENSTONE REC=67 RQD=11
												SLI. WEATH. GRANITE GNEISS REC=98 RQD=27
												TERMINATED BORING IN CRYSTALLINE ROCK (GRANITE GNEISS) AT ELEVATION 2926.7 FEET.

CORE BORING REPORT
EB2-A

CORE 1: 13.0 – 14.1	REC=73% RQD=32%
CORE 2: 14.1 – 19.1	REC=42% RQD=12%
CORE 3: 19.1 – 24.1	REC=98% RQD=83%
CORE 4: 24.1 – 29.1	REC=96% RQD=33%
CORE 5: 29.1 – 34.1	REC=96% RQD=76%
CORE 6: 34.1 – 39.1	REC=85% RQD=30%

- LAYER 1: 13.0 – 14.4 Slightly weathered, white granite gneiss. 4 pieces plus gravel, longest piece 0.4 feet. Joints indeterminate. REC=71% RQD=25%
- LAYER 2: 14.4 – 17.8 Mostly weathered rock or saprolite not recovered, except 0.8 feet of moderately weathered greenstone. REC=11% RQD=8%
- LAYER 3: 17.8 – 19.1 Hard, slightly weathered white granite gneiss. 11 pieces, longest piece 0.3 feet. Vertical joint throughout, moderately rough, coated with Fe-oxide and Mn-oxide. Other joint set indeterminate. REC=98% RQD=27%
- LAYER 4: 19.1 – 25.2 Hard, slightly to moderately weathered greenstone with a few thin severely weathered seams on foliation joints. 11 pieces, longest piece 1.3 feet. Poorly developed foliation dips 40-55 degrees. 5 joints on foliation, smooth, coated with silt and Fe-oxide. 1 horizontal joint, rough, coated with Mn-oxide and Fe-oxide. REC=100% RQD=84%
- LAYER 5: 25.2 – 28.8 Moderately hard to soft, moderately to moderately severely weathered greenstone. 34 pieces, longest piece 0.4 feet. Foliation dips 30 degrees. 22 joints on foliation, smooth. 2 joints at 70 degrees, smooth. All joints coated with Fe-oxide and Mn-oxide. REC=94% RQD=11%
- LAYER 6: 28.8 – 34.8 Hard, fresh greenstone. 11 pieces, longest piece 1.2 feet. Foliation dips 20 degrees. 5 joints on foliation, smooth, coated with chlorite. 2 joints at 20 degrees opposite direction from foliation, rough, coated with chlorite, both in upper half of layer. 2 joints at 70 degrees close together around 32.5 feet, rough, coated with Mn-oxide and Fe-oxide. REC=98% RQD=87%
- LAYER 7: 34.8 – 37.5 Hard to soft, moderately to severely weathered greenstone. 17 pieces, longest piece 0.3 feet. Foliation dips 30 degrees. Joints indeterminate. REC=67% RQD=11%

PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

CORE BORING REPORT
EB2-A (continued)

LAYER 8: 37.5 – 39.1 Hard, slightly weathered white granite gneiss to 38.2, overlying hard slightly weathered greenstone. 6 pieces, longest piece 0.5 feet. Foliation dips 20 degrees. 5 joints on foliation, smooth, coated with chlorite.
1 joint at 60 degrees, smooth, coated with Fe-oxide. REC=98% RQD=50%

JCS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-MATERIALS AND TESTS UNIT
SOILS TEST REPORT-SOILS LABORATORY

T.I.P. ID #: B-4013

REPORT ON SAMPLES OF: Soils for Classification

PROJECT:	33381.1.1	COUNTY:	Ashe	Owner:	--
DATE SAMPLED:	2.06	DATE RECEIVED:	2.13.06	DATE REPORTED:	2.17.06
SAMPLED FROM:	Bridge	SAMPLED BY:	L. L. Acker		
SUBMITTED BY:	W. D. Frye		2002	STANDARD SPECIFICATION	
LABORATORY:	Asheville				

TEST RESULTS

Project Sample No.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6		
Lab Sample No. A	151771	151772	151773	151774	151775	151776		
HiCAMS Sample #	--	--	--	--	--	--		
Retained #4 Sieve %	--	--	--	--	--	--		
Passing #10 Sieve %	36	80	83	100	81	90		
Passing #40 Sieve %	27	70	76	88	73	85		
Passing #200 Sieve %	17	39	47	46	46	59		

MINUS #10 FRACTION

Soil Mortar - 100%								
Coarse Sand -Ret. #60	36	27	19	23	20	13		
Fine Sand - Ret. #270	23	31	30	42	31	30		
Silt 0.05-0.005 mm %	25	32	37	27	35	45		
Clay < 0.005 mm %	16	10	14	8	14	12		
Passing # 40 Sieve %	--	--	--	--	--	--		
Passing # 200 Sieve %	--	--	--	--	--	--		

Liquid Limit	34	28	32	26	28	32		
Plastic Index	NP	NP	NP	NP	NP	NP		
AASHTO Classification	A-1-b (0)	A-4 (1)	A-4 (3)	A-4 (2)	A-4 (2)	A-4 (5)		
Quantity								
Texture								
Station	13+55	14+10	19+96.7	13+24	13+24	13+60		
Hole No.								
Depth (ft) From:	0.5	10.2	10.2	10.2	15.2	10.2		
To:	1.0	11.2	10.7	10.6	15.3	11.2		

Remarks:
A-151771 - 151776

CC:
L. L. Acker
File

SOILS ENGINEER:



**FIELD
 SCOUR REPORT**

WBS: 33381.1.1 TIP: B-4013 COUNTY: ASHE

DESCRIPTION(1): Bridge No. 338 on SR 1315 over Roaring Fork Creek

EXISTING BRIDGE

Information from: Field Inspection Microfilm (reel pos: _____)
 Other (explain) _____

Bridge No.: 338 Length: 54 Total Bents: 2 Bents in Channel: 0 Bents in Floodplain: 0
 Foundation Type: _____

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None

Interior Bents: N/A

Channel Bed: None

Channel Bank: None

EXISTING SCOUR PROTECTION

Type(3): old concrete abutment wall ruins

Extent(4): all of EB1 between end bent and channel

Effectiveness(5): good

Obstructions(6): _____

INSTRUCTIONS

- 1 Describe the specific site's location, including route number and body of water crossed.
- 2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
- 3 Note existing scour protection (e.g. rip rap).
- 4 Describe extent of existing scour protection.
- 5 Describe whether or not the scour protection appears to be working.
- 6 Note obstructions such as dams, fallen trees, debris at bents, etc.
- 7 Describe the channel bed material based on observation and/or samples. Include any lab results with report.
- 8 Describe the channel bank material based on observation and/or samples. Include any lab results with report.
- 9 Describe the material covering the banks (e.g. grass, trees, rip rap, none).
- 10 Determine the approximate floodplain width from field observation or a topographic map.
- 11 Describe the material covering the floodplain (e.g. grass, trees, crops).
- 12 Use professional judgement to specify if the stream is degrading, aggrading, or static.
- 13 Describe potential and direction of the stream to migrate laterally during the bridge's life (approx. 100 years).
- 14 Give the design scour elevation (DSE) expected over the life of the bridge (approx. 100 years). This elevation can be given as a range across the site, or for each bent. Discuss the relationship between the Hydraulics Unit theoretical scour and the DSE. If the DSE is dependent on scour counter measures, explain (e.g. rip rap armoring on slopes). The DSE is based on the erodability of materials, giving consideration to the influence of joints, foliation, bedding characteristics, % core recovery, % RQD, differential weathering, shear strength, observations at existing structures, other tests deemed appropriate, and overall geologic conditions at the site.

DESIGN INFORMATION

Channel Bed Material(7): boulders and gravel

Channel Bank Material(8): boulders, sand and gravel

Channel Bank Cover(9): trees, brush

Floodplain Width(10): 200 ft

Floodplain Cover(11): trees, grass, houses, barn

Stream is(12): Aggrading _____ Degrading Static _____

Channel Migration Tendency(13): None

Observations and Other Comments: Small steel girder bridge on driveway 100 ft downstream

DESIGN SCOUR ELEVATIONS(14)

Feet x Meters

	BENTS									
	EB1 ⁵³	EB2								
A, Lt	2955	2954								
C, CL	2956	2955								
B, Rt	2955	2957								

Comparison of DSE to Hydraulics Unit theoretical scour:
Within 5 feet of theoretical scour

SOIL ANALYSIS RESULTS FROM CHANNEL BED AND BANK MATERIAL

Bed or Bank									
Sample No.									
Retained #4									
Passed #10									
Passed #40									
Passed #200									
Coarse Sand									
Fine Sand									
Silt									
Clay									
LL									
PI									
AASHTO									
Station									
Offset									
Depth									

Reported by: _____

L. L. Acker

Date: 3/27/2006

PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

EB1-A



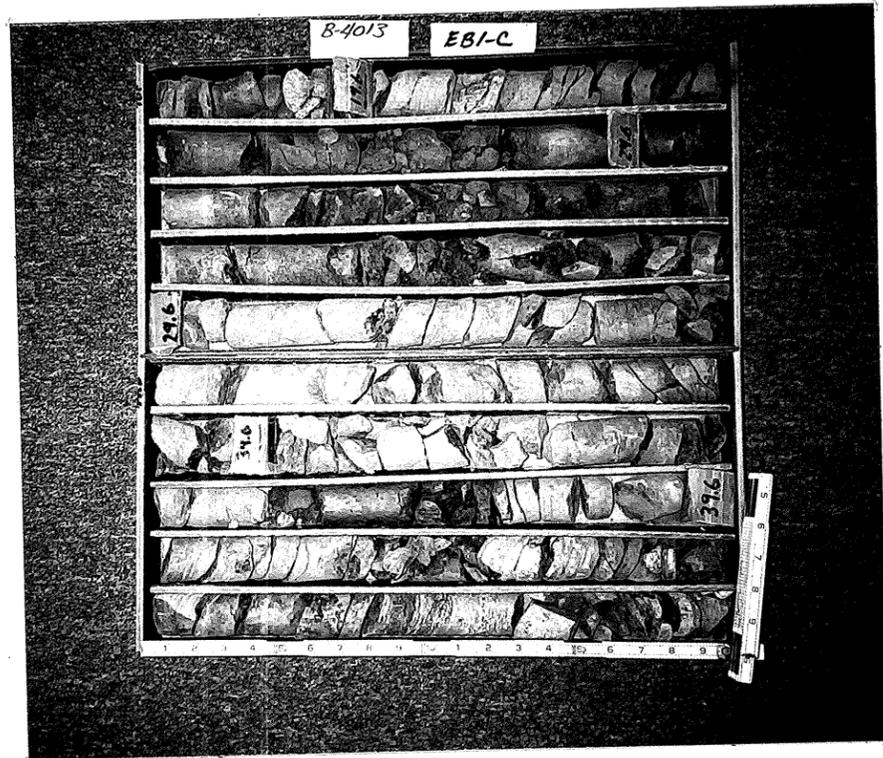
PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

EB1-B



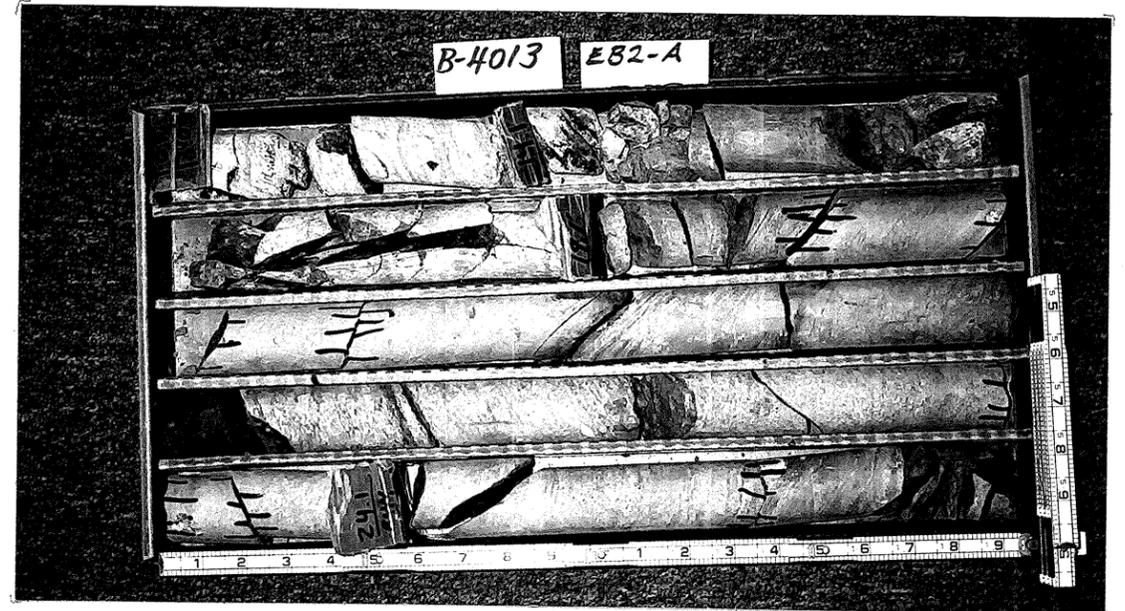
PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

EB1-C



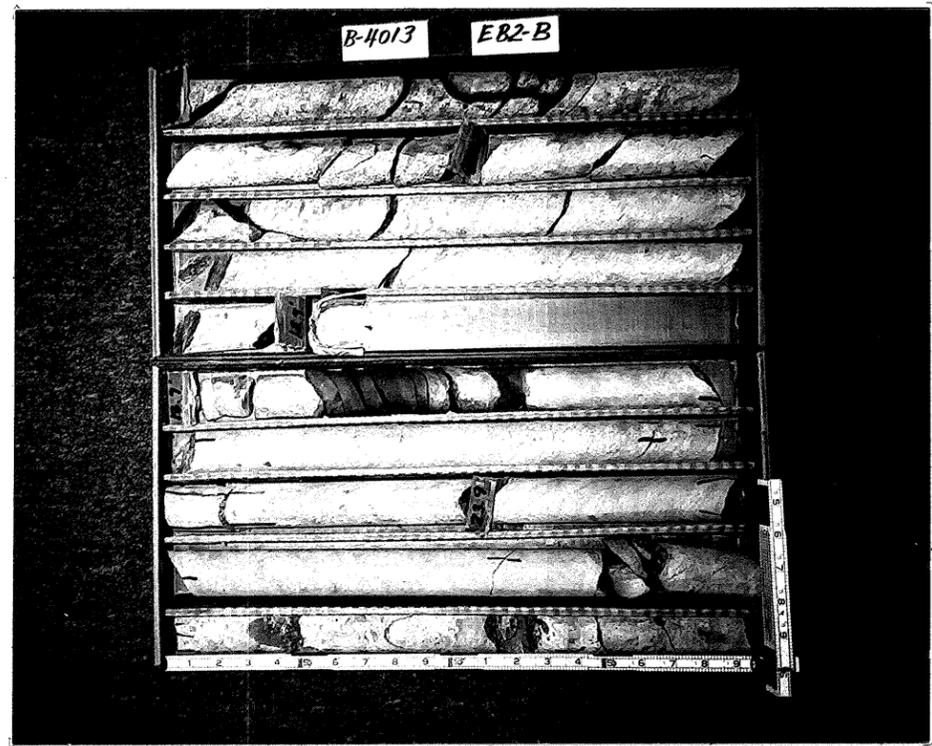
PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

EB2-A



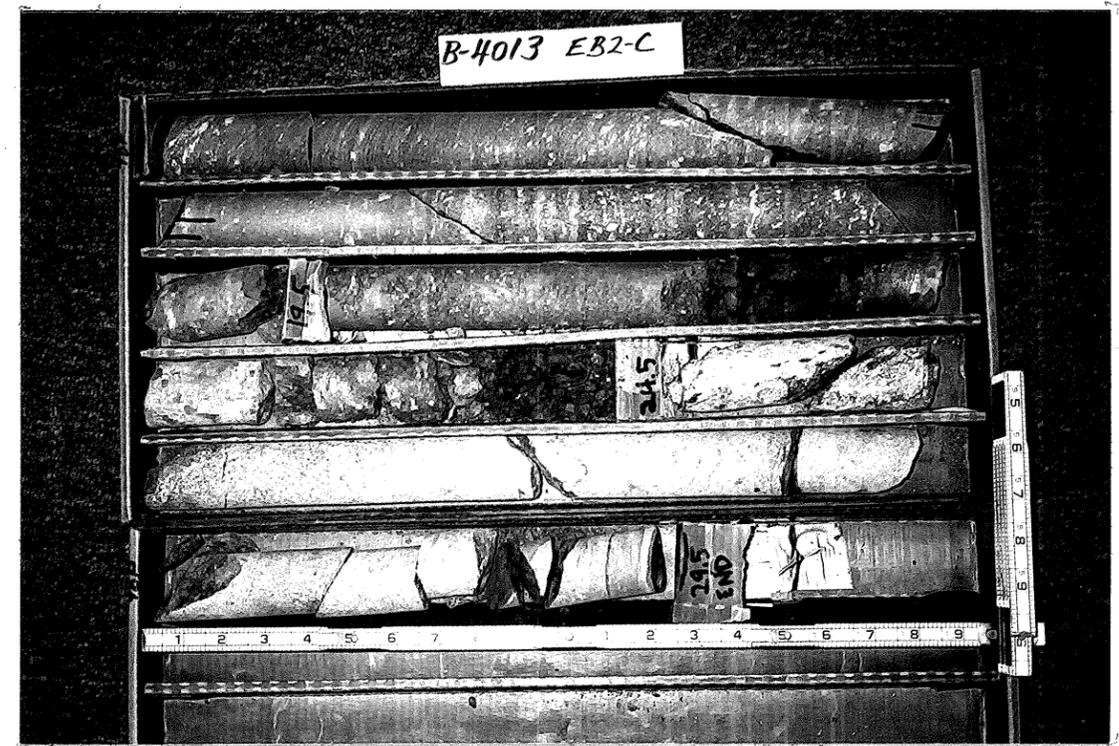
PROJECT NO. 33381.1.1 (B-4013)
ASHE COUNTY

EB2-B

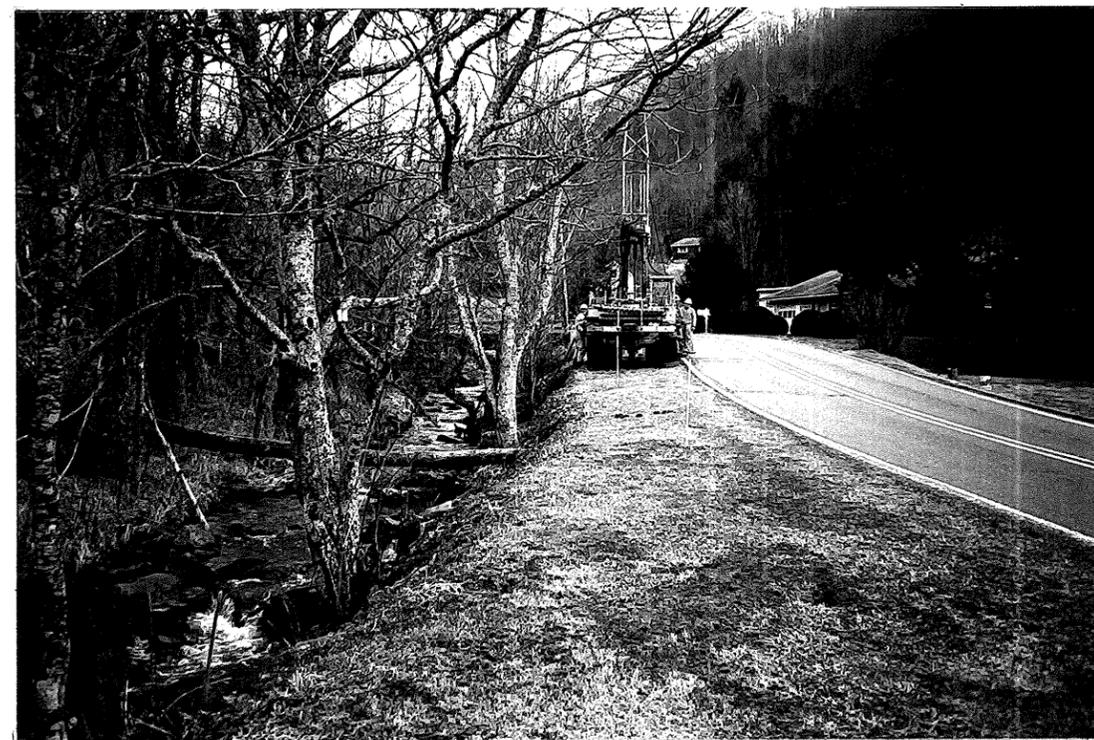


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ASHE COUNTY

EB2-C



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ASHE COUNTY



Drilling on EB1-B. Note stakes at EB1-A and EB1-C.