

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

STRUCTURE
SUBSURFACE INVESTIGATION

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PROJ. REFERENCE NO. 33464.1.1 F.A. PROJ. BRZ-1303(3)
COUNTY DURHAM
PROJECT DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER
MUD CREEK AT -L- STATION 16+21

INVENTORY

CAUTION NOTICE

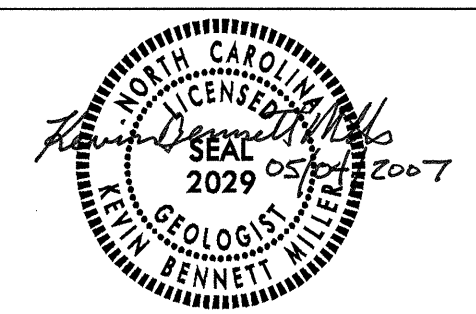
THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 250-4088. 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.

PERSONNEL
TIERRA

INVESTIGATED BY K.B. MILLER
CHECKED BY N.T. ROBERSON
SUBMITTED BY N.T. ROBERSON
DATE APRIL 2007



PROJECT: 33464.1.1
ID: B-4109

DRAWN BY: T.T. WALKER

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.

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

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

| SOIL DESCRIPTION | | GRADATION | | ROCK DESCRIPTION | | TERMS AND DEFINITIONS | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|
| SOIL IS CONSIDERED 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 D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, MOISTURE, AASHTO CLASSIFICATION AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: <i>VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LAYERS, HARD PLASTIC, A-7-6</i> | | 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. | | 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 60 BLOWS PER FOOT IN NON-COASTAL PLAIN MATERIAL. THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS: | | ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOADED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (ROQ) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 60 BLOWS PER FOOT. STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROQ) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. | | | | | |
| SOIL LEGEND AND AASHTO CLASSIFICATION | | MINERALOGICAL COMPOSITION | | WEATHERING | | | | | | | |
| GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS | | MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE. | | 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. IF TESTED, WOULD YIELD SPT REFUSAL. 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. 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. 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. | | COMPRESSIONIBILITY 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 SILT - CLAY 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 | | WEATHERED ROCK (WRI) CRYSTALLINE ROCK (CR) NON-CRYSTALLINE ROCK (NCR) COASTAL PLAIN SEDIMENTARY ROCK (CP) | | | |
| GROUP CLASS. A-1, A-2, A-3, A-4, A-5, A-6, A-7 | | GROUP CLASS. A-1, A-2, A-3, A-4, A-5, A-6, A-7 | | FRESH (F) | | | | | | | |
| SYMBOL | | SYMBOL | | MODERATELY SEVERE (MOD. SEV.) | | | | | | | |
| % PASSING #10 #40 #200 | | SYMBOL | | SEVERE (SEV.) | | | | | | | |
| LIQUID LIMIT PLASTIC INDEX | | SYMBOL | | VERY SEVERE (V SEV.) | | | | | | | |
| GROUP INDEX | | SYMBOL | | COMPLETE | | | | | | | |
| USUAL TYPES OF MAJOR MATERIALS | | SYMBOL | | | | | | | | | |
| GEN. RATINGS AS A SUBGRADE | | SYMBOL | | | | | | | | | |
| PI OF A-7-5 SUBGROUP IS <= LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30 | | SYMBOL | | | | | | | | | |
| CONSISTENCY OR DENSENESS | | MISCELLANEOUS SYMBOLS | | | | | | | | | |
| PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²) | | ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP & DIP DIRECTION OF ROCK STRUCTURES SOUNDING ROD | | SPT TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION SPT N-VALUE SPT REFUSAL | | | | | | | |
| GENERALY GRANULAR MATERIAL (NON-COHESSIVE) GENERALY SILT-CLAY MATERIAL (COHESSIVE) | | 25/825 | | | | | | | | | |
| TEXTURE OR GRAIN SIZE | | ABBREVIATIONS | | | | | | | | | |
| U.S. STD. SIEVE SIZE OPENING (MM) | | AR - AUGER REFUSAL BT - BORING TERMINATED CL - CLAY CPT - CONE PENETRATION TEST CSE - COARSE DMT - DILATOMETER TEST DPT - DYNAMIC PENETRATION TEST e - VOID RATIO F - FINE FOSS - FOSSILIFEROUS FRAC - FRACTURED, FRACTURES FRAGS. - FRAGMENTS | | HL - HIGHLY MED. - MEDIUM MICA - MICACEOUS MOD. - MODERATELY NP - NON PLASTIC ORG. - ORGANIC PMT - PRESSUREMETER TEST SAP. - SAPROLITIC SD. - SAND, SANDY SL. - SILT, SILTY SLI. - SLIGHTLY TCR - TRICONE REFUSAL | | | | | | | |
| BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GRV.) COARSE SAND (CSE, SD.) FINE SAND (F, SD.) SILT (SL.) CLAY (CL.) | | w - MOISTURE CONTENT v - VERY VST - VANE SHEAR TEST WEA. - WEATHERED W - UNIT WEIGHT W _g - DRY UNIT WEIGHT | | | | | | | | | |
| GRAIN SIZE MM 305 75 2.0 0.25 0.05 0.005 IN. 12 3 | | HI - 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 | | | | | | | | | |
| SOIL MOISTURE - CORRELATION OF TERMS | | EQUIPMENT USED ON SUBJECT PROJECT | | FRACTURE SPACING | | BEDDING | | | | | |
| SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION | | DRILL UNITS: MOBILE B- BK-51 CME-45C CME-550 PORTABLE HOIST CME-45 | | 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 | | | | | |
| LL - LIQUID LIMIT (SAT.) PLASTIC RANGE (PI) OM - OPTIMUM MOISTURE SL - SHRINKAGE LIMIT | | ADVANCING TOOLS: CLAY BITS 6" CONTINUOUS FLIGHT AUGER 6" HOLLOW AUGERS HARD FACED FINGER BITS TUNG-CARBIDE INSERTS CASING w/ ADVANCER TRICONE STEEL TEETH TRICONE TUNG-CARB. CORE BIT | | HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: B N W H HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST | | 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. | | | | | |
| PLASTICITY PLASTICITY INDEX (PI) DRY STRENGTH VERY LOW SLIGHT MEDIUM HIGH | | | | | | | | | | | |
| NONPLASTIC LOW PLASTICITY MED. PLASTICITY HIGH PLASTICITY | | | | | | | | | | | |
| 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. | | | | | | | | | | | |
| | | | | | | BENCH MARK: TBM 51-L- STATION 16+24, 152.0' RT, R.R. SPIKE IN 9" DIA. GUM ELEVATION: 260.2 FT. NOTES: | | | | | |



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

April 12, 2007

STATE PROJECT: 33464.1.1 (B-4109)
FEDERAL PROJECT: BRZ-1303 (3)
COUNTY: Durham

DESCRIPTION: Bridge No. 120 on -L- (SR 1303) over Mud Creek at Sta. 16+21

SUBJECT: Geotechnical Report – Structure Inventory

Site Description

The project is located in southwest Durham county approximately 5 miles southwest of Durham. The proposed replacement structure is 90 feet long comprised of two spans at a 60° skew.

The subsurface investigation was conducted in February of 2007 using a CME-45 drill machine mounted on a tracked carrier and equipped with a manual hammer. Two SPT borings were performed at each bent location. Borings were advanced using a clay bit and Bentonite drilling fluid. Representative soil samples were collected and selected samples were submitted to the Materials and Tests Unit for laboratory analysis. A core boring was advanced at boring location B1-B using casing and an NWD4 core barrel. One rock sample was submitted for laboratory testing.

Physiography and Geology

The project is located in the Piedmont Physiographic Province within the Durham Triassic Basin. Topography of the project area is flat to gently sloping. The flood plain created by Mud Creek is approximately 600 feet wide at the bridge site and is somewhat asymmetrical being much wider on the east side. Geologically, the site is located on the western margin of the Durham Triassic Basin. The basin was formed by normal faulting as Africa began to pull away from present day North America resulting in a steep, high relief canyon feature that likely extend from Georgia to New Jersey. The interbedded siltstones and mudstones encountered at the site are consistent with the depositional environment found along the distal edge of alluvial fans.

Soil Properties

The soils encountered at the project site include roadway embankment, alluvial sediments and Triassic residual soils. Triassic weathered and non-crystalline rock was also encountered.

Roadway embankment soils consist of 5 to 6 feet of tan to red-brown, moist, medium stiff to stiff, sandy and silty clay (A-6, A-7-6).

Alluvial sediments at the site are comprised of up to 5 feet of brown, wet, very loose to loose, silty sand (A-2-4).

Residual soils include approximately 2 to 12 feet of tan, orange-brown to gray, moist to wet, very soft to stiff, silt and sandy/silty clay (A-4, A-6, A-7-6) along with 2 to 18 feet of tan, brown and gray, wet, very loose to medium dense, silty and coarse sand (A-2-4, A-3).

Rock Properties

Weathered Triassic siltstone and/or mudstone was encountered in all borings between elevation 235.4 to 236.6 feet. Non-crystalline Triassic siltstone and/or mudstone was noted in 4 borings from elevation 225.4 to 232.0 feet. A core boring was performed at boring location B1-B. Rock recovered from the boring had a REC=100% and a RQD of 63% to 70%. A rock core sample was submitted for laboratory testing and yielded an ultimate capacity of 4.75 ksi. A more detailed description of the rock core is contained in the Core Boring Report and Rock Test Results.

Groundwater

Groundwater elevations at the site ranged from 252.9 to 255.1 feet at the time of the investigation. The surface water elevation of Mud Creek was noted at 252.9 feet at the time of the investigation. Seasonal fluctuation in the ground water table can be expected.

Notice

This Geotechnical Engineering Unit foundation report is based on the bent locations provided in the Preliminary General Drawing dated November 7, 2006 and the Bridge Survey and Hydraulic Design Report for Mud Creek dated October 4, 2006. If significant changes are made in the design and/or location of the proposed structure the subsurface information should be reviewed and modified as necessary.

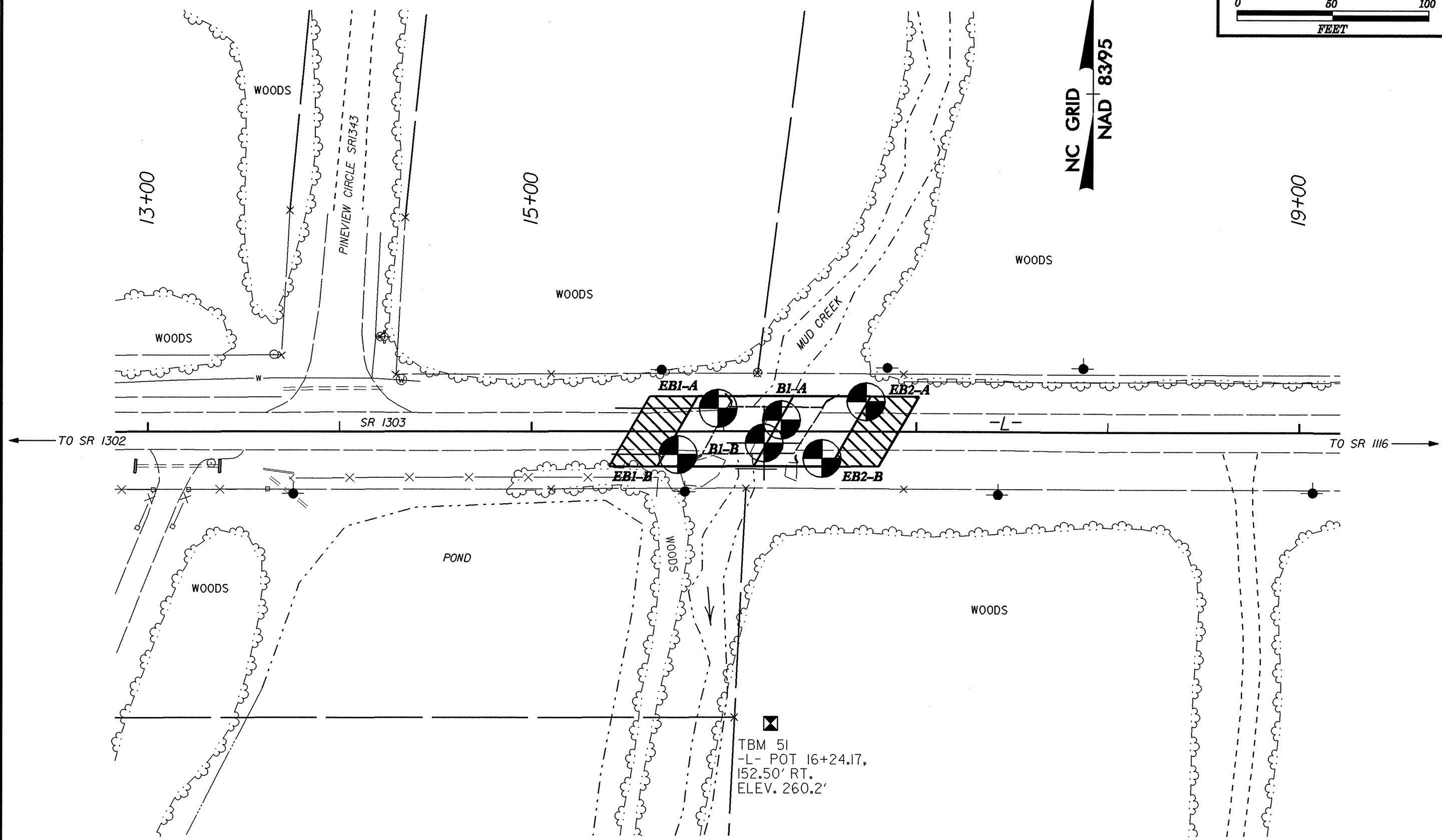
Prepared by:

Kevin B. Miller, LG
Project Geological Engineer

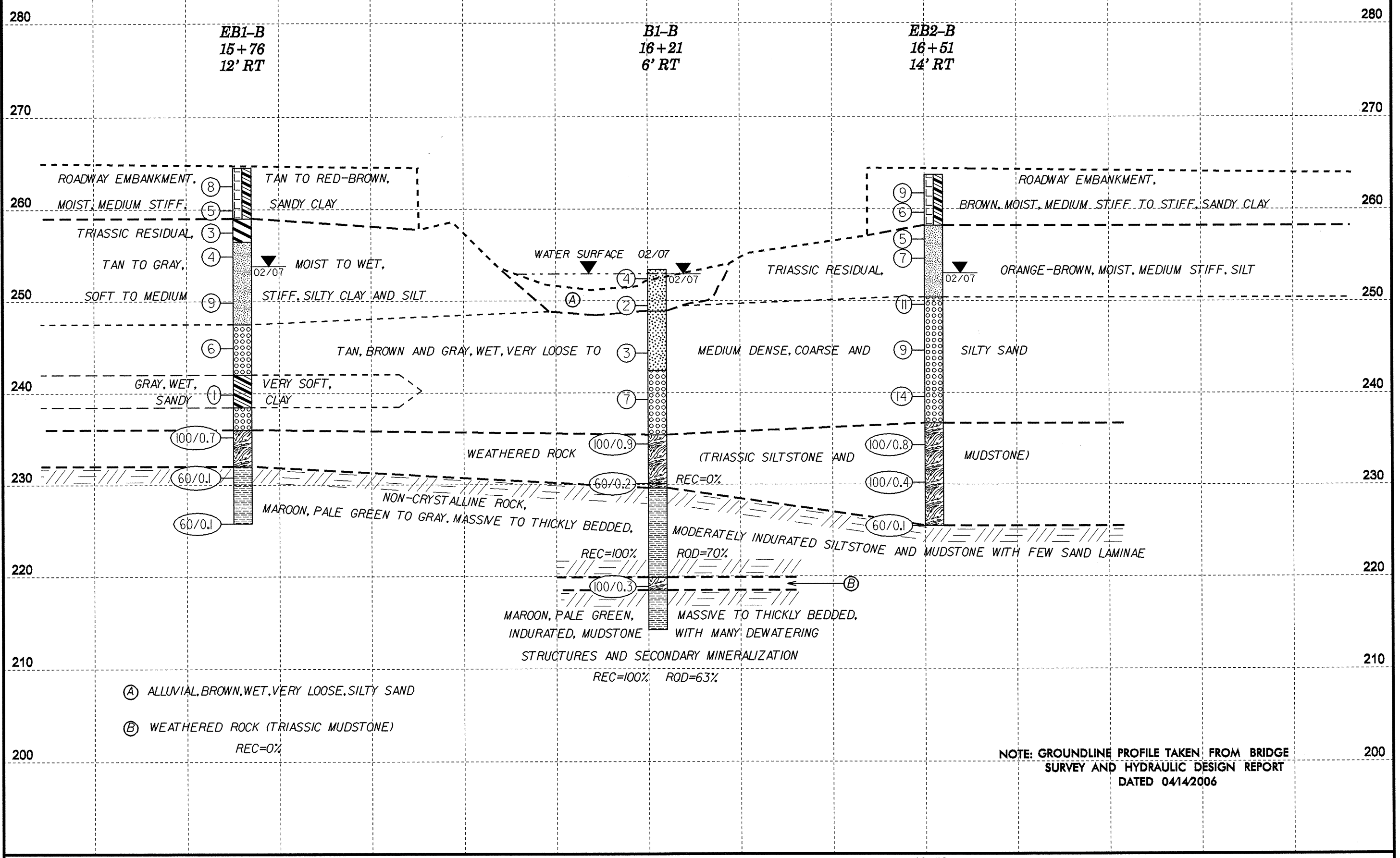
SITE PLAN



NC GRID
NAD 83/95



SKEW = 60°

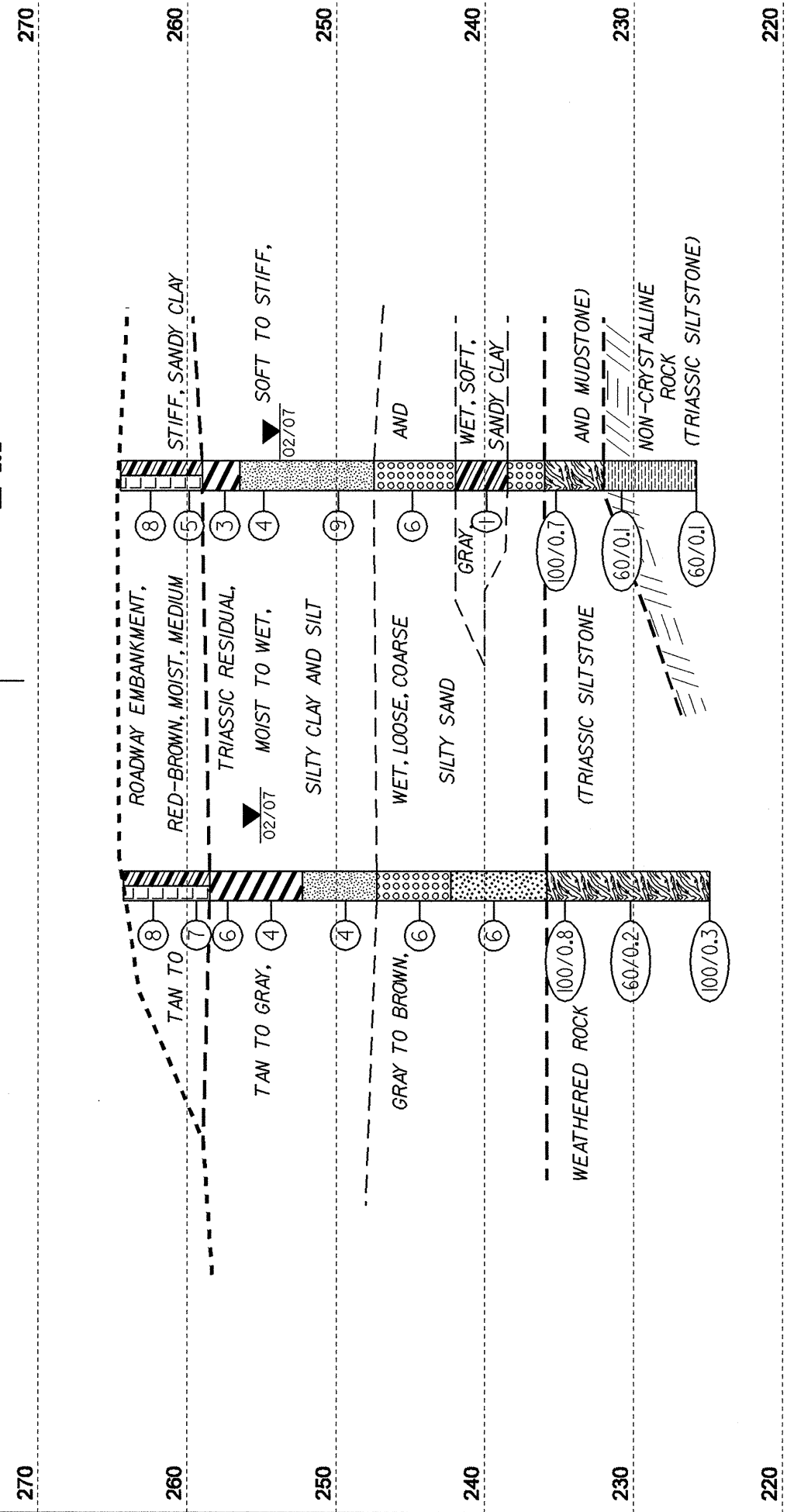


NOTE: GROUNDLINE PROFILE TAKEN FROM BRIDGE SURVEY AND HYDRAULIC DESIGN REPORT DATED 04/14/2006

EBI-A
15+97
12' LT

-L-

EBI-B
15+76
12' RT



HORIZ. SCALE 0 10 20 (FEET)

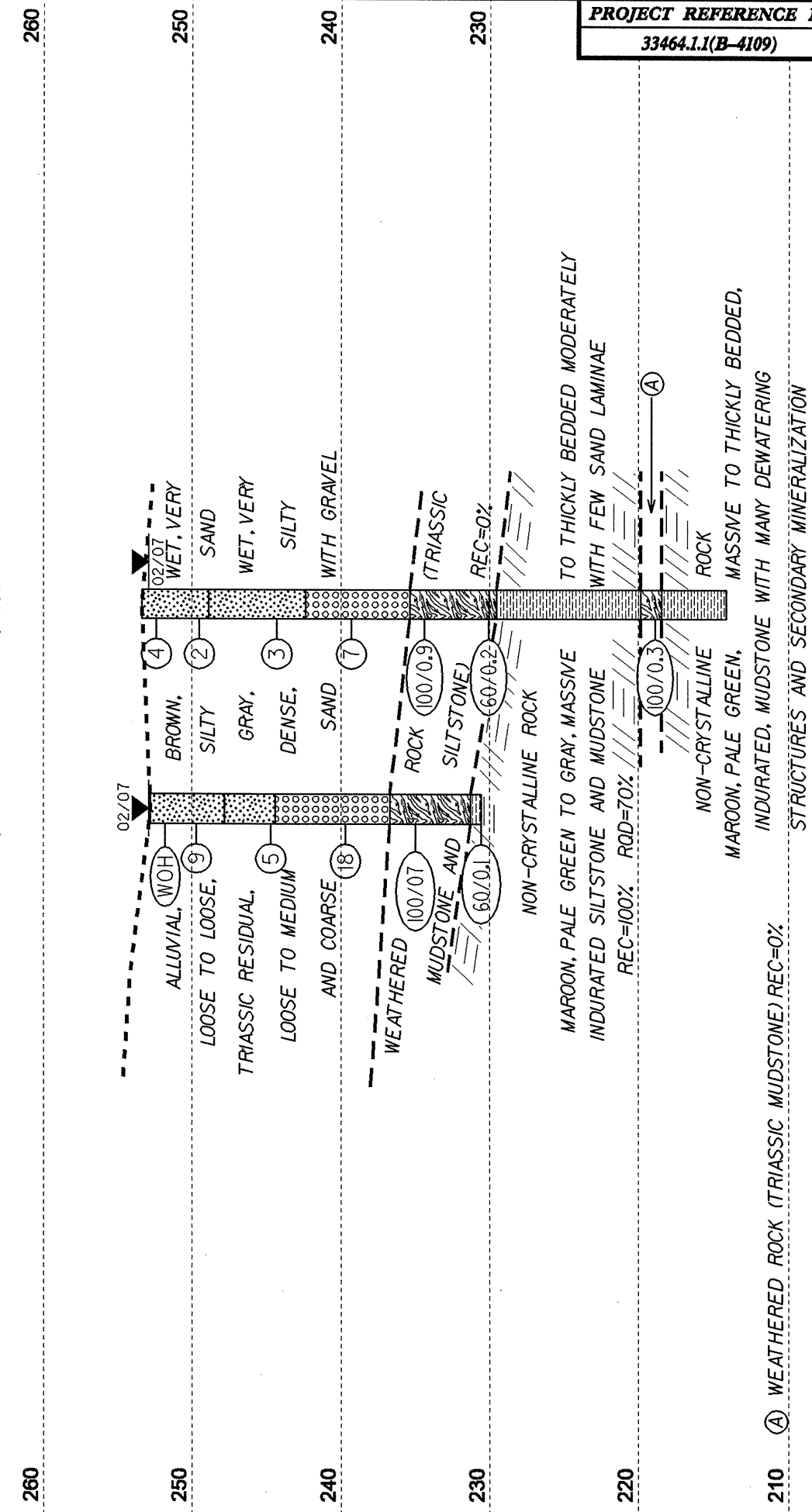
VE = 1:1

CROSS SECTION THROUGH END BENT 1

BI-A
16+30
6' LT

-L-

BI-B
16+21
6' RT



HORIZ. SCALE 0 10 20 (FEET)

VE = 1:1

CROSS SECTION THROUGH BENT 1

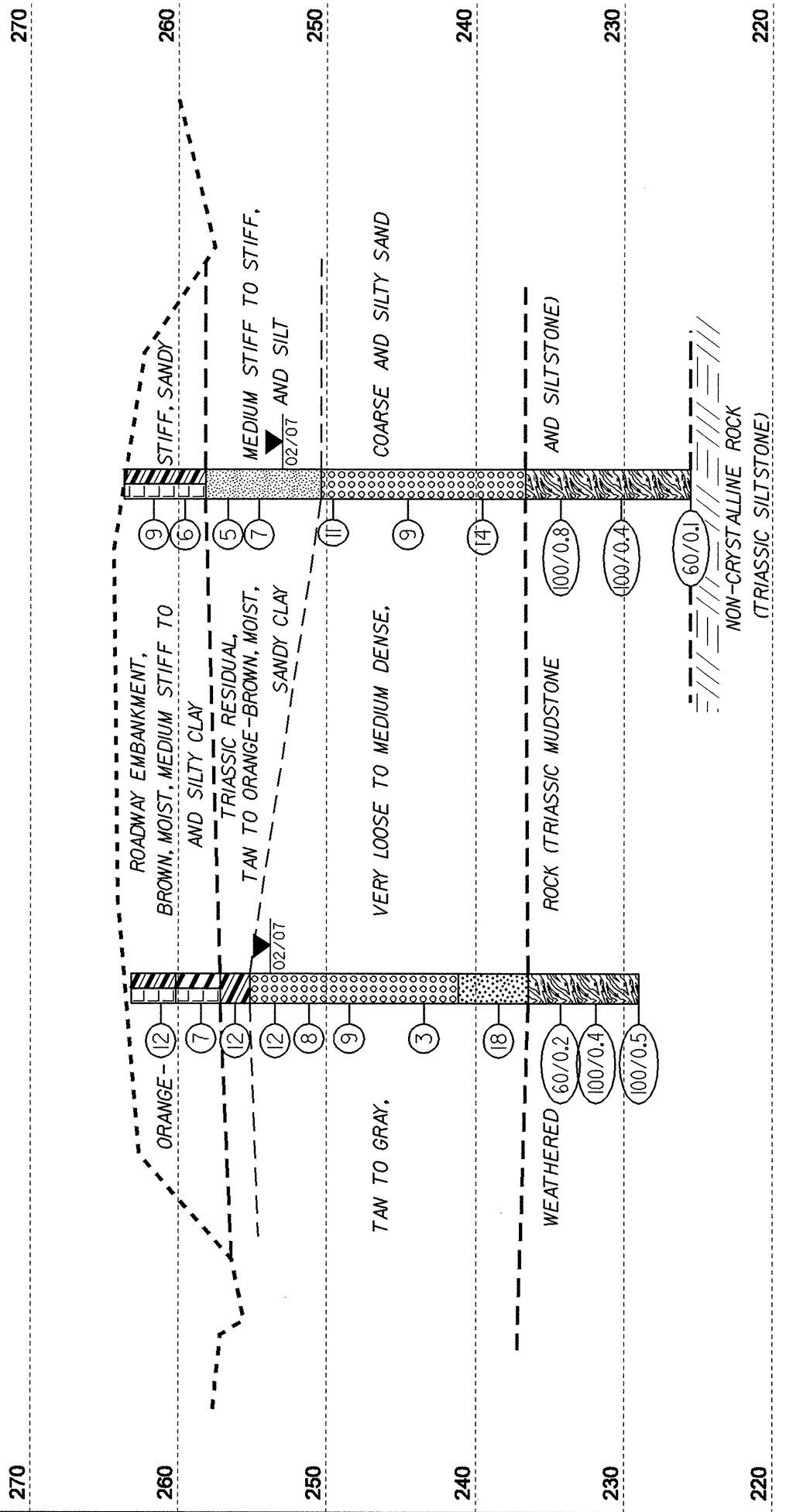
① WEATHERED ROCK (TRIASSIC MUDSTONE) REC=0%

REC=100% ROD=63%

EB2-B
16+51
14' RT

-L-

EB2-A
16+74
16' LT



VE = 1:1

CROSS SECTION THROUGH END BENT 2

| | | | |
|---|-------------------------|-------------------------|----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. EB1-A | STATION 15+97 | OFFSET 12ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 264.3 ft | TOTAL DEPTH 39.4 ft | NORTHING 809,891 | EASTING 2,004,570 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/07/07 | COMP. DATE 02/07/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|------------|------------|--------|-------|----------------|----|----|----|-----|-----------|------|---|------------|
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 265 | | | | | | | | | | | | GROUND SURFACE | 0.0 |
| 263.3 | 1.0 | 4 | 4 | 4 | | | | | | | M | ROADWAY EMBANKMENT TAN, SANDY CLAY | |
| 260.4 | 3.9 | 2 | 3 | 4 | | | | | | | SS-1 | | |
| 258.3 | 6.0 | 2 | 3 | 3 | | | | | | | SS-2 | TRIASSIC RESIDUAL TAN TO GRAY, SILTY CLAY AND SILT | 5.8 |
| 255.4 | 8.9 | WOH | 2 | 2 | | | | | | | W | | |
| 250.4 | 13.9 | 3 | 2 | 2 | | | | | | | SS-3 | | 12.0 |
| 245.4 | 18.9 | 2 | 3 | 3 | | | | | | | SS-4 | GRAY TO BROWN, COARSE SAND AND SILTY SAND | 17.0 |
| 240.4 | 23.9 | 4 | 3 | 3 | | | | | | | SS-5 | | 22.0 |
| 235.4 | 28.9 | 52 | 48/0.3 | | | | | | | | | WEATHERED ROCK (TRIASSIC SILTSTONE AND MUDSTONE) | 28.5 |
| 230.4 | 33.9 | 60/0.2 | | | | | | | | | | | |
| 225.2 | 39.1 | 100/0.3 | | | | | | | | | | | |

Boring Terminated at Elevation 224.9 ft in WEATHERED ROCK (TRIASSIC MUDSTONE)

| | | | |
|---|-------------------------|-------------------------|-----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. EB1-B | STATION 15+76 | OFFSET 12ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 264.5 ft | TOTAL DEPTH 38.7 ft | NORTHING 809,867 | EASTING 2,004,549 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/08/07 | COMP. DATE 02/08/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK 32.5 ft |

| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) |
|-----------|------------|------------|--------|-------|----------------|----|----|----|-----|-----------|------|---|------------|
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 265 | | | | | | | | | | | | GROUND SURFACE | 0.0 |
| 263.5 | 1.0 | 3 | 4 | 4 | | | | | | | M | ROADWAY EMBANKMENT TAN TO RED-BROWN, SANDY CLAY | |
| 260.9 | 3.6 | 2 | 2 | 3 | | | | | | | M | | |
| 258.5 | 6.0 | 1 | 1 | 2 | | | | | | | SS-6 | TRIASSIC RESIDUAL TAN TO GRAY, SILTY CLAY AND SILT | 5.5 |
| 255.9 | 8.6 | 1 | 2 | 2 | | | | | | | SS-7 | | 8.0 |
| 250.9 | 13.6 | 4 | 4 | 5 | | | | | | | W | | |
| 245.9 | 18.6 | 3 | 2 | 4 | | | | | | | W | GRAY, COARSE SAND | 17.0 |
| 240.9 | 23.6 | WOH | WOH | 1 | | | | | | | SS-8 | GRAY, SANDY CLAY | 22.5 |
| 235.9 | 28.6 | 55 | 45/0.2 | | | | | | | | | GRAY, COARSE SAND WITH GRAVEL | 26.0 |
| 230.9 | 33.6 | 60/0.1 | | | | | | | | | | WEATHERED ROCK (TRIASSIC SILTSTONE) | 28.5 |
| 225.9 | 38.6 | 60/0.1 | | | | | | | | | | NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) | 32.5 |

Boring Terminated with Standard Penetration Test Refusal at Elevation 225.8 ft in NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE)

NCDOT BORE DOUBLE B4109_GEO_BH_BRDG0120.GPJ NC_DOT.GDT 05/15/07

| PROJECT NO. 33464.1.1 | | ID. B-4109 | | COUNTY DURHAM | | GEOLOGIST C.BRUINSMA | | | | | | | |
|---|------------|-------------------------|--------|---------------------------|----------------|-----------------------|-----------------|----|---------|-----------|------|---------------------------|--|
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | | | | | GROUND WTR (ft) | | | | | | |
| BORING NO. B1-A | | STATION 16+30 | | OFFSET 6ft LT | | ALIGNMENT -L- | | | | | | | |
| COLLAR ELEV. 252.8 ft | | TOTAL DEPTH 22.2 ft | | NORTHING 809,886 | | EASTING 2,004,603 | | | | | | | |
| DRILL MACHINE CME-45 | | DRILL METHOD Mud Rotary | | | | HAMMER TYPE Manual | | | | | | | |
| START DATE 02/07/07 | | COMP. DATE 02/07/07 | | SURFACE WATER DEPTH 0.1ft | | DEPTH TO ROCK 21.5 ft | | | | | | | |
| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | |
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | |
| 255 | | | | | | | | | | | | | |
| 252.8 | 0.0 | | | | | | | | | | | ▼ | 252.8 WATER SURFACE (02/07/07) 0.0 |
| 250.7 | 2.1 | WOH | WOH | WOH | 0 | 25 | 50 | 75 | 100 | | W | | ALLUVIAL BROWN, SILTY SAND |
| | | 3 | 4 | 5 | | | | | | | SS-9 | W | |
| 245.7 | 7.1 | | | | | | | | | | | W | 247.8 TRIASSIC RESIDUAL GRAY, SILTY AND COARSE SAND WITH GRAVEL 5.0 |
| | | 3 | 3 | 2 | | | | | | | | W | 244.4 8.4 |
| 240.7 | 12.1 | | | | | | | | | | | W | |
| | | 7 | 9 | 9 | | | | | | | | SS-10 | W |
| 235.7 | 17.1 | | | | | | | | | | | | 236.7 WEATHERED ROCK (TRIASSIC MUDSTONE) 16.1 |
| | | 22 | 78/0.5 | | | | | | 100/1.0 | | | | |
| 230.7 | 22.1 | | | | | | | | | | | | 231.3 21.5 |
| | | 60/0.1 | | | | | | | 60/0.1 | | | | 230.6 22.2 |
| | | | | | | | | | | | | | NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) Boring Terminated with Standard Penetration Test Refusal at Elevation 230.6 ft in NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) |

| | | | |
|---|-------------------------|-------------------------|-----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. B1-B | STATION 16+21 | OFFSET 6ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 253.4 ft | TOTAL DEPTH 39.2 ft | NORTHING 809,874 | EASTING 2,004,594 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/06/07 | COMP. DATE 02/06/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK 23.8 ft |

| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
|-----------|------------|------------|--------|-------|----------------|----|----|----|-----|-----------|-----|---------------------------|------------|---|------|
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 255 | | | | | | | | | | | | | 253.4 | GROUND SURFACE | 0.0 |
| 253.4 | 0.0 | | | | | | | | | | | | | ALLUVIAL BROWN, SILTY SAND | |
| 250.5 | 2.9 | 1 | 2 | 2 | | | | | | | | | 248.9 | TRIASSIC RESIDUAL GRAY, SILTY AND COARSE SAND | 4.5 |
| 245.3 | 8.1 | 2 | 1 | 1 | | | | | | | | | 242.4 | TRIASSIC RESIDUAL GRAY, SILTY AND COARSE SAND | 11.0 |
| 240.3 | 13.1 | 1 | 1 | 2 | | | | | | | | | | | |
| 235.3 | 18.1 | 5 | 3 | 4 | | | | | | | | | | | |
| | | 33 | 67/0.4 | | | | | | | | | | 235.4 | WEATHERED ROCK (TRIASSIC SILTSTONE) | 18.0 |
| 230.3 | 23.1 | 60/0.2 | | | | | | | | | | | 230.1 | WEATHERED ROCK (TRIASSIC SILTSTONE) | 23.3 |
| | | | | | | | | | | | | | 229.6 | WEATHERED ROCK (TRIASSIC SILTSTONE) REC=0% | 23.8 |
| | | | | | | | | | | | | | | NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) REC=100% RQD=70% | |
| | | | | | | | | | | | | | 219.9 | WEATHERED ROCK (TRIASSIC MUDSTONE) | 33.5 |
| 219.2 | 34.2 | 100/0.3 | | | | | | | | | | | 218.5 | WEATHERED ROCK (TRIASSIC MUDSTONE) REC=0% | 34.9 |
| | | | | | | | | | | | | | | NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) REC=100% RQD=63% | |
| | | | | | | | | | | | | | 214.2 | Boring Terminated at Elevation 214.2 ft in NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) | |

| | | | |
|---|-------------------------|-------------------------|-----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. B1-B | STATION 16+21 | OFFSET 6ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 253.4 ft | TOTAL DEPTH 39.2 ft | NORTHING 809,874 | EASTING 2,004,594 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/06/07 | COMP. DATE 02/06/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK 23.8 ft |

| ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN | | SAMP. NO. | STRATA | | LOG | DESCRIPTION AND REMARKS | DEPTH (ft) |
|-----------|------------|----------|---------------------|----------|----------|-----------|---------|---------|-----|--|------------|
| | | | | REC (ft) | RQD (ft) | | REC (%) | RQD (%) | | | |
| 230.1 | | | | | | | | | | | |
| 230.1 | 23.3 | 1.4 | 03:00/0.4 | (0.9) | (0.9) | | (0.0) | N/A | | Begin Coring @ 23.3 ft | 23.3 |
| 228.7 | 24.7 | 5.0 | 04:30 | 64% | 64% | | 0% | (6.8) | | WEATHERED ROCK (TRIASSIC SILTSTONE) | 23.8 |
| | | | 04:45 | (5.0) | (4.7) | | (9.7) | 70% | | NON-CRYSTALLINE ROCK | |
| | | | 03:15 | 100% | 94% | RS-1 | | | | TRIASSIC, MAROON, PALE GREEN TO GRAY, MASSIVE TO THICKLY BEDDED, MODERATELY INDURATED, SILTSTONE WITH FEW THICK SAND LAMINAE | |
| | | | 04:15 | | | | | | | | |
| | | | 05:30 | | | | | | | | |
| | | | 06:00 | | | | | | | | |
| 223.7 | 29.7 | 4.5 | 04:00 | (3.8) | (1.2) | | | | | | |
| | | | 04:30 | 84% | 27% | | | | | | |
| | | | 03:00 | | | | | | | | |
| 219.2 | 34.2 | | 03:00 | | | | (0.0) | N/A | | WEATHERED ROCK (TRIASSIC MUDSTONE) | 33.5 |
| 218.9 | 34.5 | 4.7 | 01:30/0.5 | (4.3) | (2.7) | | 0% | (2.7) | | WEATHERED ROCK (TRIASSIC MUDSTONE) REC=0% | 34.9 |
| | | | N=100/0.3 | 91% | 57% | | (4.3) | 63% | | NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) REC=100% RQD=70% | |
| | | | 07:00/0.7 | | | | | | | | |
| | | | 08:45 | | | | | | | | |
| | | | 11:11 | | | | | | | | |
| | | | 11:05 | | | | | | | | |
| 214.2 | 39.2 | | 06:00 | | | | 100% | | | NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) REC=100% RQD=63% | 39.2 |
| | | | | | | | | | | Boring Terminated at Elevation 214.2 ft in NON-CRYSTALLINE ROCK (TRIASSIC MUDSTONE) | |

NCDOT BORE DOUBLE B4109_GEO_BH_BRD00120.GPJ NC_DOT.GDT 05/15/07

NCDOT CORE SINGLE B4109_GEO_BH_BRD00120.GPJ NC_DOT.GDT 05/15/07



| | | | |
|---|-------------------------|-------------------------|----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. EB2-A | STATION 16+74 | OFFSET 16ft LT | ALIGNMENT -L- |
| COLLAR ELEV. 263.2 ft | TOTAL DEPTH 34.2 ft | NORTHING 809,895 | EASTING 2,004,646 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/06/07 | COMP. DATE 02/06/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
|-----------|------------|------------|-------|-------|----------------|----|----|----|-----|-----------|-------|---------------------------|------------|---|------|
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 265 | | | | | | | | | | | | | 263.2 | GROUND SURFACE | 0.0 |
| 262.2 | 1.0 | 3 | 4 | 8 | | | | | | | SS-12 | M | 260.2 | ROADWAY EMBANKMENT ORANGE-BROWN, SANDY AND SILTY CLAY | 3.0 |
| 259.5 | 3.7 | 2 | 3 | 4 | | | | | | | SS-13 | M | 257.2 | | 6.0 |
| 257.2 | 6.0 | 3 | 5 | 7 | | | | | | | SS-14 | M | 255.2 | TRIASSIC RESIDUAL TAN-BROWN, SANDY CLAY | 8.0 |
| 254.5 | 8.7 | 3 | 4 | 8 | | | | | | | | W | 250.5 | TAN TO GRAY, COARSE AND SILTY SAND | |
| 252.2 | 11.0 | 3 | 4 | 4 | | | | | | | | W | | | |
| 249.5 | 13.7 | 2 | 5 | 4 | | | | | | | | W | | | |
| 244.5 | 18.7 | 2 | 2 | 1 | | | | | | | | W | | | |
| 239.5 | 23.7 | 10 | 11 | 7 | | | | | | | SS-15 | | 241.2 | | 22.0 |
| 234.5 | 28.7 | 60/0.2 | | | | | | | | | | | 236.5 | WEATHERED ROCK (TRIASSIC MUDSTONE) | 26.7 |
| 232.3 | 30.9 | 100/0.4 | | | | | | | | | | | | | |
| 229.5 | 33.7 | 100/0.5 | | | | | | | | | | | 229.0 | | 34.2 |
| | | | | | | | | | | | | | | Boring Terminated at Elevation 229.0 ft in WEATHERED ROCK (TRIASSIC MUDSTONE) | |

| | | | |
|---|-------------------------|-------------------------|----------------------|
| PROJECT NO. 33464.1.1 | ID. B-4109 | COUNTY DURHAM | GEOLOGIST C.BRUINSMA |
| SITE DESCRIPTION BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK | | | GROUND WTR (ft) |
| BORING NO. EB2-B | STATION 16+51 | OFFSET 14ft RT | ALIGNMENT -L- |
| COLLAR ELEV. 263.6 ft | TOTAL DEPTH 38.2 ft | NORTHING 809,865 | EASTING 2,004,623 |
| DRILL MACHINE CME-45 | DRILL METHOD Mud Rotary | HAMMER TYPE Manual | |
| START DATE 02/08/07 | COMP. DATE 02/08/07 | SURFACE WATER DEPTH N/A | DEPTH TO ROCK N/A |

| ELEV (ft) | DEPTH (ft) | BLOW COUNT | | | BLOWS PER FOOT | | | | | SAMP. NO. | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (ft) | | |
|-----------|------------|------------|-------|--------|----------------|----|----|----|-----|-----------|-------|---------------------------|------------|---|------|
| | | 0.5ft | 0.5ft | 0.5ft | 0 | 25 | 50 | 75 | 100 | | | | | | |
| 265 | | | | | | | | | | | | | 263.6 | GROUND SURFACE | 0.0 |
| 262.6 | 1.0 | 5 | 3 | 6 | | | | | | | SS-16 | M | 260.5 | ROADWAY EMBANKMENT BROWN, SANDY CLAY | 3.0 |
| 260.5 | 3.1 | 2 | 3 | 3 | | | | | | | | | 258.1 | | 5.5 |
| 257.6 | 6.0 | 2 | 2 | 3 | | | | | | | | | 255.2 | TRIASSIC RESIDUAL ORANGE-BROWN TO GRAY, SILT | 8.0 |
| 255.5 | 8.1 | 2 | 2 | 5 | | | | | | | SS-17 | W | 250.5 | | |
| 250.5 | 13.1 | 5 | 5 | 6 | | | | | | | | M | 250.3 | GRAY, COARSE SAND | 13.3 |
| 245.5 | 18.1 | 4 | 4 | 5 | | | | | | | | M | | | |
| 240.5 | 23.1 | 6 | 7 | 7 | | | | | | | | W | | | |
| 235.5 | 28.1 | 16 | 33 | 67/0.3 | | | | | | | | | 236.6 | WEATHERED ROCK (TRIASSIC SILTSTONE) | 27.0 |
| 230.5 | 33.1 | 100/0.4 | | | | | | | | | | | | | |
| 225.5 | 38.1 | 60/0.1 | | | | | | | | | | | 225.4 | | 38.2 |
| | | | | | | | | | | | | | | Boring Terminated with Standard Penetration Test Refusal at Elevation 225.4 ft on NON-CRYSTALLINE ROCK (TRIASSIC SILTSTONE) | |

NCDOT BORE DOUBLE B4109_GEO_BH_BRDGM120.GPJ NC_DOT.GDT 05/15/07

EB1-B

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-6 | 12' RT | 15+76 | 6.0-7.5 | A-7-6(20) | 41 | 21 | 1.8 | 9.3 | 44.6 | 44.4 | 100 | 99 | 93 | - | - |
| SS-7 | 12' RT | 15+76 | 8.6-10.1 | A-4(2) | 23 | 7 | 9.7 | 33.9 | 32.3 | 24.2 | 100 | 97 | 64 | - | - |
| SS-8 | 12' RT | 15+76 | 23.6-25.1 | A-6(5) | 29 | 11 | 3.6 | 34.7 | 35.5 | 26.2 | 100 | 99 | 69 | - | - |

| ROCK TEST RESULTS | | | | | | | |
|--------------------------|--------|---------|------------|----------------|-----------------|-------------------------------------|--------------------|
| SAMPLE NO. | OFFSET | STATION | BORING NO. | DEPTH INTERVAL | UNIT WT. LB/FT3 | UNCONFINED COMPRESSIVE STRENGTH KSI | SEC MOD @ 40% MPSI |
| RS-1 | 6' RT | 16+21 | B1-B | 26.7-27.3 | 173.4 | 4.75 | 2.22 |

EB1-A

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-1 | 12' LT | 15+97 | 3.9-5.4 | A-6(10) | 36 | 16 | 8.3 | 20.4 | 35.1 | 36.3 | 93 | 88 | 71 | - | - |
| SS-2 | 12' LT | 15+97 | 6.0-7.5 | A-7-6(18) | 43 | 21 | 4.2 | 13.5 | 39.9 | 42.3 | 100 | 98 | 85 | - | - |
| SS-3 | 12' LT | 15+97 | 13.9-15.4 | A-4(0) | 22 | 3 | 23.8 | 40.9 | 21.2 | 14.1 | 100 | 88 | 42 | - | - |
| SS-4 | 12' LT | 15+97 | 18.9-20.4 | A-1-b(0) | 19 | NP | 76.8 | 12.3 | 6.9 | 4.0 | 96 | 43 | 12 | - | - |
| SS-5 | 12' LT | 15+97 | 23.9-25.0 | A-2-4(0) | 22 | 5 | 57.3 | 15.9 | 18.8 | 8.1 | 97 | 61 | 28 | - | - |

B1-B

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-11 | 6' RT | 16+21 | 13.1-14.6 | A-1-b(0) | 19 | NP | 77.0 | 13.5 | 5.4 | 4.0 | 90 | 33 | 10 | - | - |

B1-A

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-9 | 6' LT | 16+30 | 2.1-3.6 | A-2-4(0) | 20 | NP | 51.2 | 28.2 | 8.5 | 12.1 | 100 | 72 | 23 | - | - |
| SS-10 | 6' LT | 16+30 | 12.1-13.6 | A-1-b(0) | 23 | 6 | 56.9 | 17.1 | 17.9 | 8.1 | 87 | 47 | 25 | - | - |

EB2-B

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-16 | 14' RT | 16+51 | 1.0-2.5 | A-6(2) | 32 | 13 | 28.3 | 22.7 | 20.6 | 28.3 | 78 | 63 | 42 | - | - |
| SS-17 | 14' RT | 16+51 | 8.1-9.6 | A-4(0) | 20 | NP | 8.1 | 43.9 | 23.7 | 24.3 | 100 | 98 | 58 | - | - |

EB2-A

| SOIL TEST RESULTS | | | | | | | | | | | | | | | |
|--------------------------|--------|---------|----------------|---------------|------|------|-------------|--------|------|------|--------------------|----|-----|------------|-----------|
| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | AASHTO CLASS. | L.L. | P.I. | % BY WEIGHT | | | | % PASSING (SIEVES) | | | % MOISTURE | % ORGANIC |
| | | | | | | | C.SAND | F.SAND | SILT | CLAY | 10 | 40 | 200 | | |
| SS-12 | 16' LT | 16+74 | 1.0-2.5 | A-6(4) | 34 | 12 | 13.1 | 23.8 | 32.9 | 30.2 | 79 | 73 | 54 | - | - |
| SS-13 | 16' LT | 16+74 | 3.7-4.2 | A-7-6(21) | 55 | 33 | 12.5 | 24.8 | 18.3 | 44.4 | 100 | 94 | 68 | - | - |
| SS-14 | 16' LT | 16+74 | 6.0-7.5 | A-6(7) | 31 | 13 | 6.7 | 31.7 | 29.4 | 32.3 | 100 | 99 | 67 | - | - |
| SS-15 | 16' LT | 16+74 | 23.7-25.2 | A-2-4(0) | 19 | NP | 69.4 | 19.6 | 8.9 | 2.0 | 100 | 55 | 13 | - | - |



**FIELD
SCOUR REPORT**

WBS: 33464.1.1 TIP: B-4109 COUNTY: DURHAM

DESCRIPTION(1): BRIDGE NO. 120 ON -L- (SR 1303) OVER MUD CREEK

EXISTING BRIDGE

Information from: Field Inspection Microfilm _____ (reel _____ pos: _____)
Other (explain) Bridge Survey and Hydraulic Design Report 10/04/06

Bridge No.: 120 Length: 49.0' Total Bents: 3 Bents in Channel: 1 Bents in Floodplain: 2
Foundation Type: Timber Piles

EVIDENCE OF SCOUR(2)

Abutments or End Bent Slopes: None noted

Interior Bents: Local scour noted Bent 1 Pile 1

Channel Bed: Contraction scour noted between End Bent 1 and Bent 1

Channel Bank: Channel bank erosion noted from bridge to approximately 75' upstream; appears to have occurred during recent flooding event

EXISTING SCOUR PROTECTION

Type(3): Timber end walls and wing walls

Extent(4): 8' outside edge of bridge

Effectiveness(5): Appears satisfactory

Obstructions(6): Old drum in channel upstream of EB1/B1; Several trees in channel upstream of bridge

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): (SS-9) Brown to Gray, Wet, Very Loose to Loose, Silty Sand

Channel Bank Material(8): (SS-9) Brown to Gray, Wet, Very Loose to Loose, Silty Sand

Channel Bank Cover(9): Grass and shrubs

Floodplain Width(10): Approximately 600 feet

Floodplain Cover(11): Hardwoods

Stream is(12): Aggrading _____ Degrading Static _____

Channel Migration Tendency(13): Moderate tendency to the west

Observations and Other Comments: N/A

DESIGN SCOUR ELEVATIONS(14)

Feet Meters _____

BENTS

B1

| | | | | | | | | | | | | | | | | | | | |
|--------------------|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Over Topping Scour | 235.3 | | | | | | | | | | | | | | | | | | |
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Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit agrees with the theoretical scour predicted by the Hydraulics Unit in the Bridge Survey and Hydraulic Design Report dated October 4, 2006. No scour is anticipated at the End Bents.

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 | | | | | | | | | | | | | | | | | | | | |

See Sheet 12,
"Soil Test Results",
for samples:
SS-9

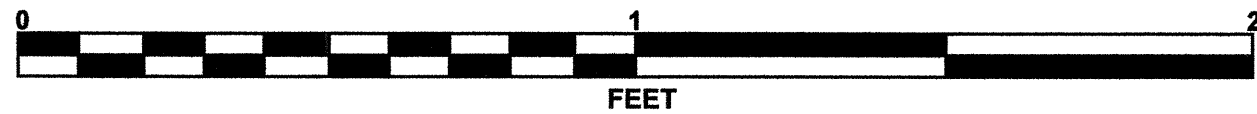
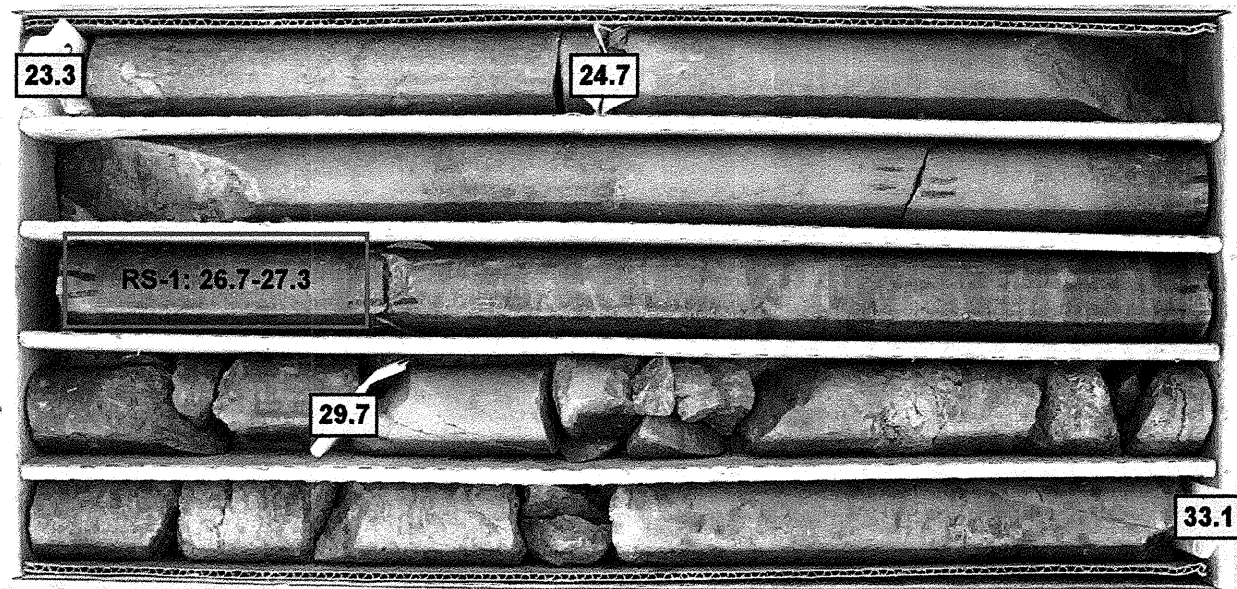
Reported by: Kevin B. Miller, LG

Date: 5/4/2007

CORE PHOTOGRAPHS

Bridge No. 120 on -L- (SR 1303) over Mud Creek

B1-B
BOX 1: 23.3-33.1 FEET



B1-B
BOX 2: 33.1-39.2 FEET



SITE PHOTOGRAPH

Bridge No. 120 on -L- (SR 1303) over Mud Creek



Looking East towards End Bent 1