STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

E. NORRIS TOLSON
SECRETARY

August 25, 1998

| | |
|---|---|
| STATE PROJECT: | 6.499002T (R-2413C) |
| FEDERAL PROJECT: | N/A |
| COUNTY: | Guilford and Rockingham |
| DESCRIPTION: | NC 68 Connector - US 220 from South of Haw River to the Intersection of US 220 and Existing NC 68 |
| SUBJECT: | Geotechnical Report - Structure #8 Culvert Investigation |

At your request, the Geotechnical Unit has performed detailed mapping and surveying for Structure #8. The attached Test Site Plan shows the location of profiles, borings and rod soundings. The specific boring locations requested could not be accessed by our drill machines. Hand auger borings and rod soundings were utilized to depict subsurface conditions. Subsurface profiles or sections are provided for the east and west side of the existing culvert.

No hard rock outcrops are present at Structure #8. In the existing channel, up to 2.5 meters of alluvial sand (A-2-4) overlie hard rock (granite). We were unable to obtain information at the inlet and outlet of the existing culvert. Scour has resulted in deep water conditions at these locations. The channel banks consist of up to 3 meters of alluvial sandy silt (A-4), sandy clay (A-6) and silty sand (A-2-4). The underlying rock (granite) dips toward the south.

Based on our findings, a floorless culvert is <u>not</u> recommended at this site. As proposed, the culvert floor will be constructed on alluvial sand. The loose to medium dense alluvial sand will provide adequate support for the proposed culvert. The use of sheet piles for construction will likely be required.

If we may be of further assistance, please advise.

Sincerely,

Robin R. Held

Robin R. Held
Project Geologist

# NORTH CAROLINA DIVISION OF HIGHWAYS

# GEOTECHNICAL UNIT

# SOIL AND ROCK CLASSIFICATION, LEGEND, AND ABBREVIATIONS

6.499002T R-2413C
STRUCTURE #8
SHEET 1 OF 5

## SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP CLASS. | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 | A-1,A-2 A-3 | A-4,A-5 A-6,A-7 | |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5 A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | | | |
| % PASSING #10 | 50 MX | | | | | | | | | | | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| #40 | 30 MX | 50 MX | 51 MN | | | | | | | | | | | |
| #200 | 15 MX | 25 MX | 10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | | | |
| (PASSING #40) LL | | | | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| PI | 6 MX | | N.P. | 10 MX | 10 MX | 11 MN | 11 MN | 10 MX | 10 MX | 11 MN | 11 MN | | | |
| GROUP INDEX | 0 | | 0 | 0 | | 4 MX | | 8 MX | 12 MX | 16 MX | NO MX | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. GRAVEL & SAND | | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | | SILTY SOILS | | CLAYEY SOILS | | | | |

* PI OF A-7-5 ≤ (LL-30); PI OF A-7-6 > (LL-30)

## TEXTURE OR GRAIN SIZE

| BOULDER | COBBLE | GRAVEL | COARSE SAND | MED. SAND | FINE SAND | SILT | CLAY |
|---|---|---|---|---|---|---|---|

GRAIN SIZE (mm): 305, 75, 2, 0.6, 0.425, 0.2, 0.075, 0.005
(IN): 12, 3

## SOIL MOISTURE - CORRELATION OF TERMS

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

## ROCK DESCRIPTION

IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED TO BE THAT INDURATED EARTH MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF "WEATHERED ROCK". FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:

| TERM | SYMBOLS | | DESCRIPTION |
|---|---|---|---|
| HARD ROCK (HR) | CORED ROCK | INFERRED ROCK LINE [2] | MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS. EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE |
| WEATHERED ROCK (WR) | | HARD WEATHERED ROCK (HWR) | MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL [1] |
| | | SOFT WEATHERED ROCK (SWR) | MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL |

[1] SPT REFUSAL ≤ 2.5 cm OF PENETRATION PER 50 BLOWS IN SPT.
[2] AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED. A DESCRIPTION OF ROCK IS GIVEN, INCLUDING:

CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

ROCK QUALITY DESIGNATION (RQD) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO 10 cm DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

NORTH CAROLINA LICENSED SEAL 604 GEOLOGIST RICHARD S. JOHNSON

SEAL

Signature

## CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N - VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (qu) (kN / m²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>> 400 |

## GROUND WATER

- WATER LEVEL IN BORE HOLE [IMMEDIATELY AFTER DRILLING (I.A.D.) / SOON AFTER DRILLING (∅ HRS.)]
- STATIC WATER LEVEL (AFTER 24 HRS.)
- PERCHED WATER (PW), SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEPAGE

## MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 25° STRIKE AND DIP
- APPARENT DIP (NORMAL TO_____)
- ROD SOUNDING
- SPT / DPT / VST TEST BORING
- AUGER BORING
- CORE BORING
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- MONITORING WELL

SAMPLE DESIGNATIONS
- S-BULK SAMPLE
- SS-SPLIT SPOON SAMPLE
- ST-SHELBY TUBE SAMPLE

## ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| AR | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| CALC. | CALCAREOUS | NS | NO SAMPLE TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | P.P. | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
| GR. | GRAVEL | SPT | STANDARD PENETRATION TEST |
| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
| GW | GROUND WATER | VST | VANE SHEAR TEST |
| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

BENCH MARK: #15-A PAINTED S.W. CORNER OF EXISTING RCBC. ELEV. = 251.602m

STATE PROJECT NO. 6.499002T

T.I.P. NO. R-2413C F.A. NO. N/A

COUNTY GUILFORD & ROCKINGHAM ROUTE US 220

SITE DESCRIPTION STRUCTURE #8 AT -L- REV 56+54

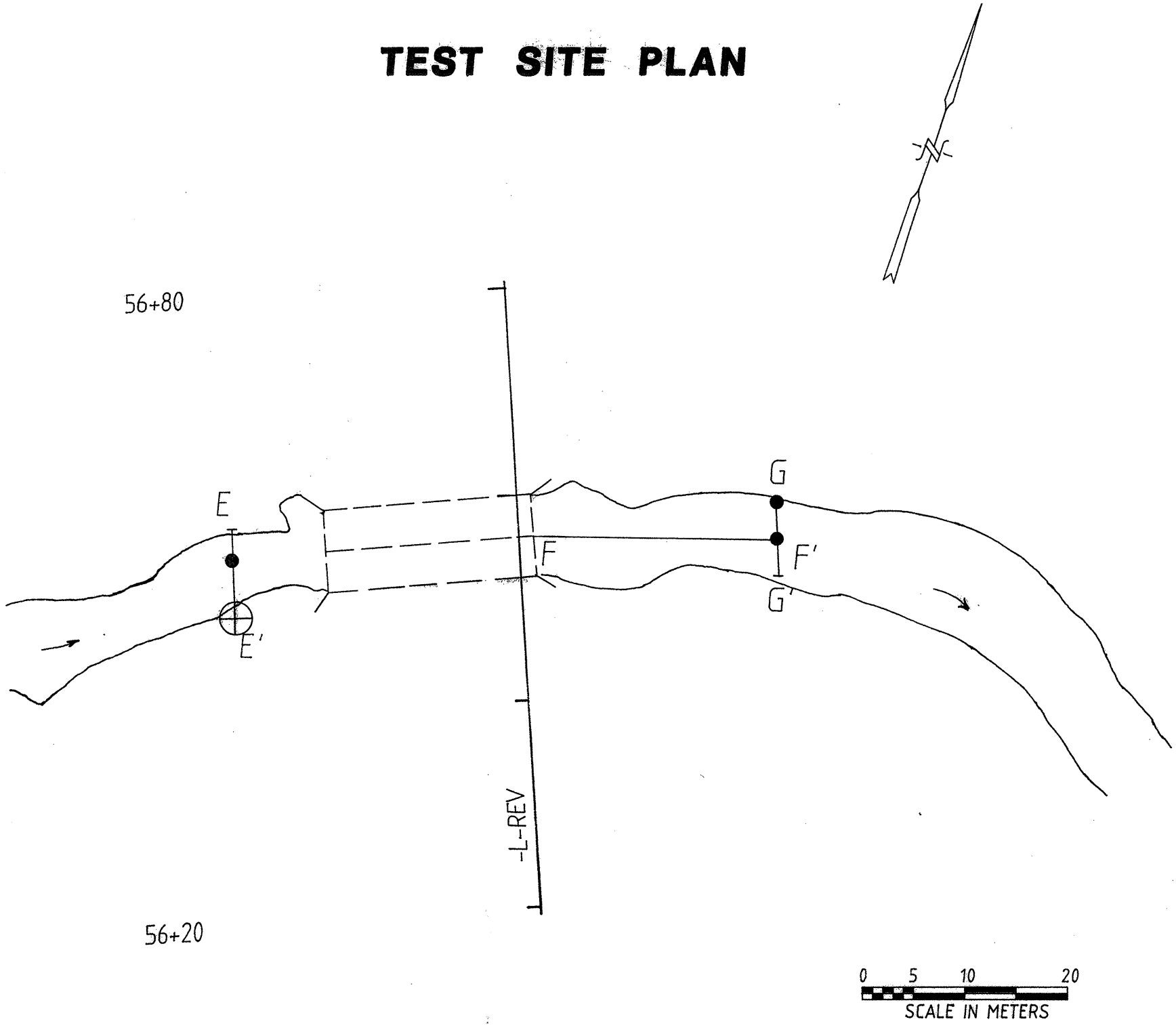
PROJECT GEOLOGIST R.R. HELD SUBMITTED BY R.S. JOHNSON

PERSONNEL A.L. SMITH
E.C. CAMPBELL
S.W. MILLER

DATE SUBMITTED 8/98

6.499002T R-2413C
STRUCTURE # 8
SHEET 2 OF 5

# TEST SITE PLAN



6.499002T R-2413C
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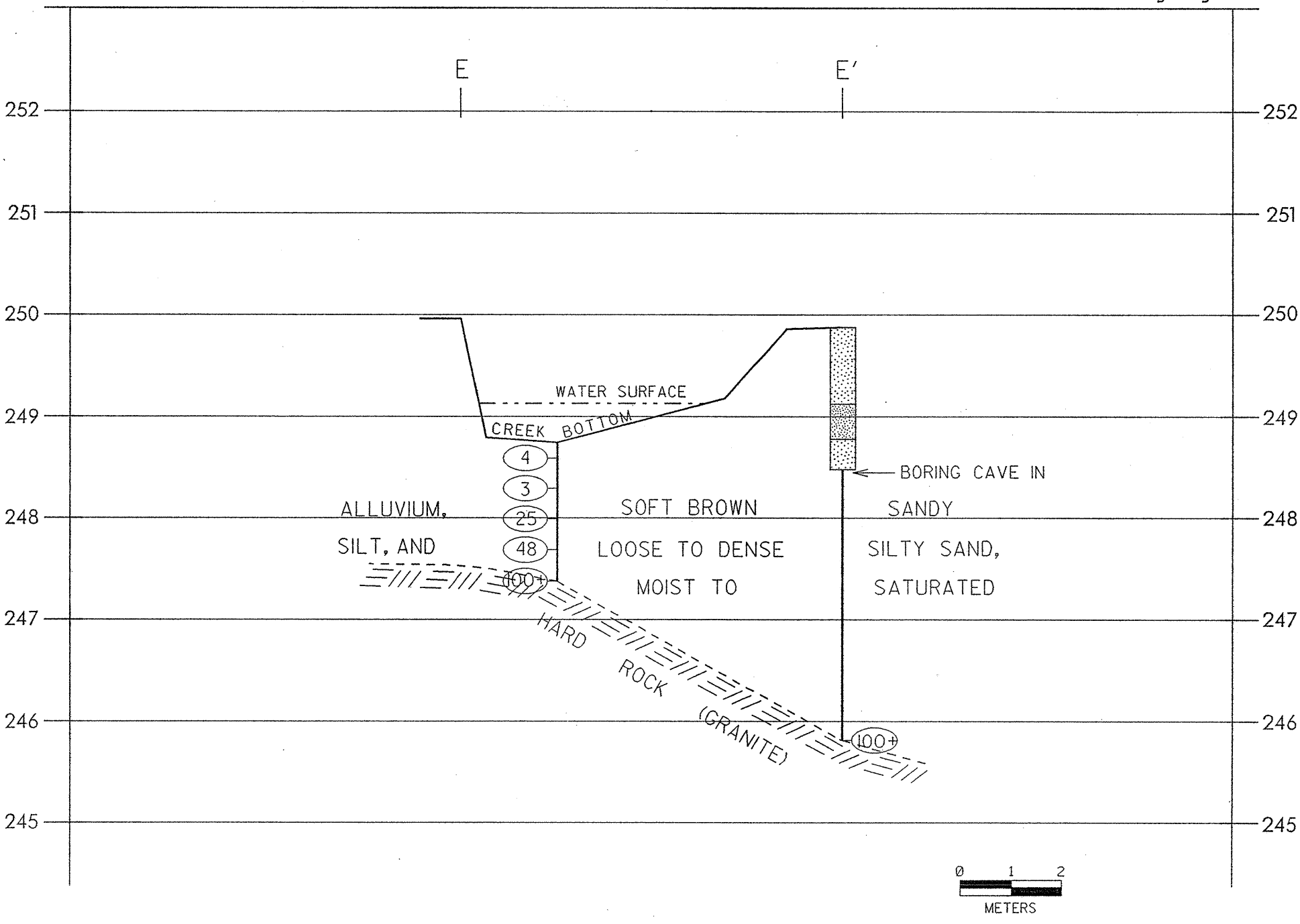
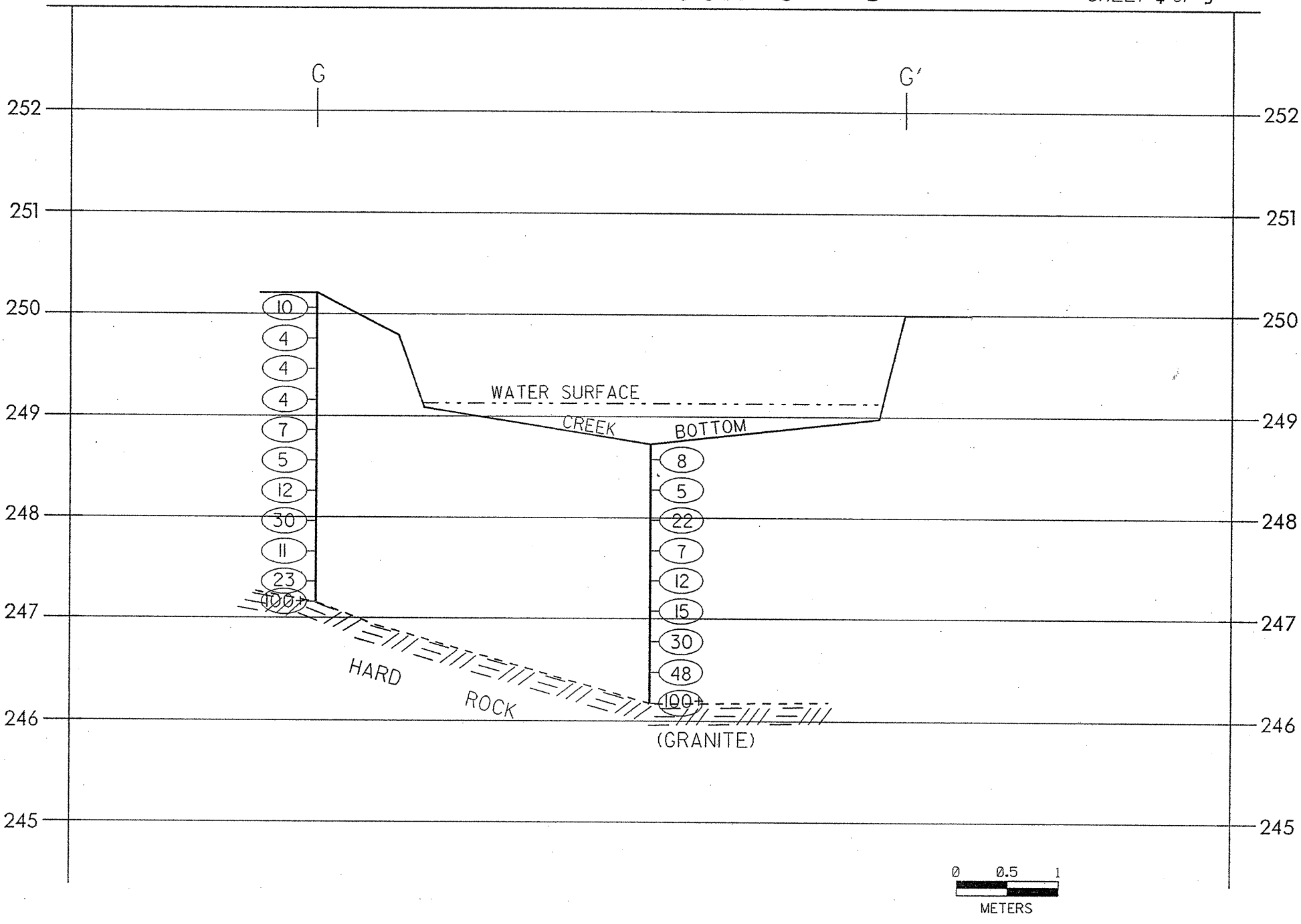
SHEET 3 OF 5

# SECTION THROUGH E – E'



6.499002T R-2413C
STRUCTURE #8
SHEET 4 OF 5

# SECTION THROUGH G – G′



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NORTH CAROLINA LICENSED SEAL 604 GEOLOGIST RICHARD S. JOHNSON

SEAL

Signature

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## GROUND WATER

- WATER LEVEL IN BORE HOLE — IMMEDIATELY AFTER DRILLING (I.A.D.) / SOON AFTER DRILLING (▽ 0 HRS.)
- STATIC WATER LEVEL (AFTER 24 HRS.)
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SAMPLE DESIGNATIONS
S-BULK SAMPLE
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## ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| AR | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| CALC. | CALCAREOUS | NS | NO SAMPLE TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | P.P. | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
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| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
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| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

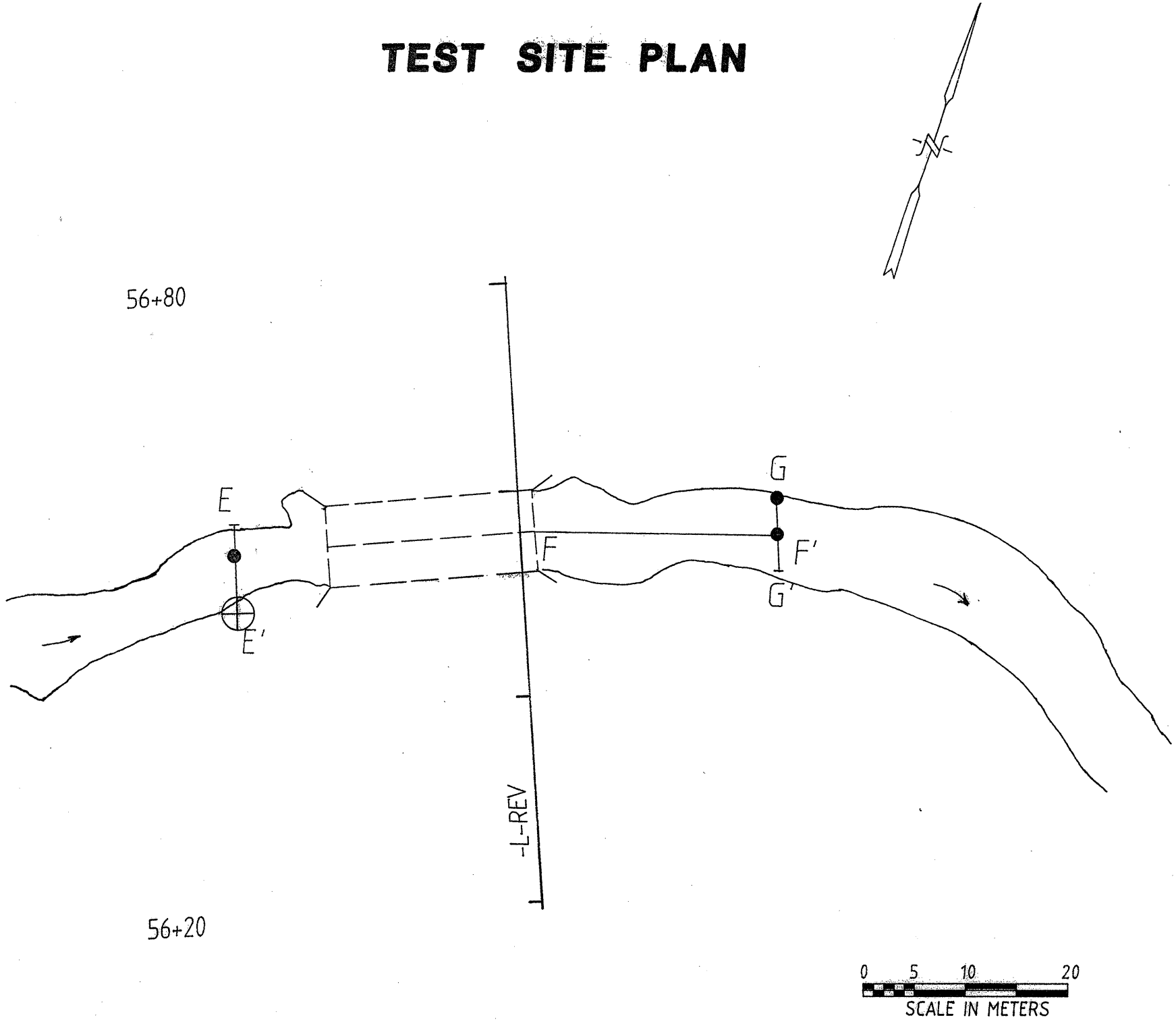
BENCH MARK: #15-A PAINTED S.W. CORNER OF EXISTING RCBC. ELEV. = 251.602m

STATE PROJECT NO. 6.499002T
T.I.P. NO. R-2413C F.A. NO. N/A
COUNTY GUILFORD & ROCKINGHAM ROUTE US 220
SITE DESCRIPTION STRUCTURE #8 AT -L- REV 56+54

PROJECT GEOLOGIST R.R. HELD SUBMITTED BY R.S. JOHNSON
PERSONNEL A.L. SMITH
E.C. CAMPBELL
S.W. MILLER
DATE SUBMITTED 8/98

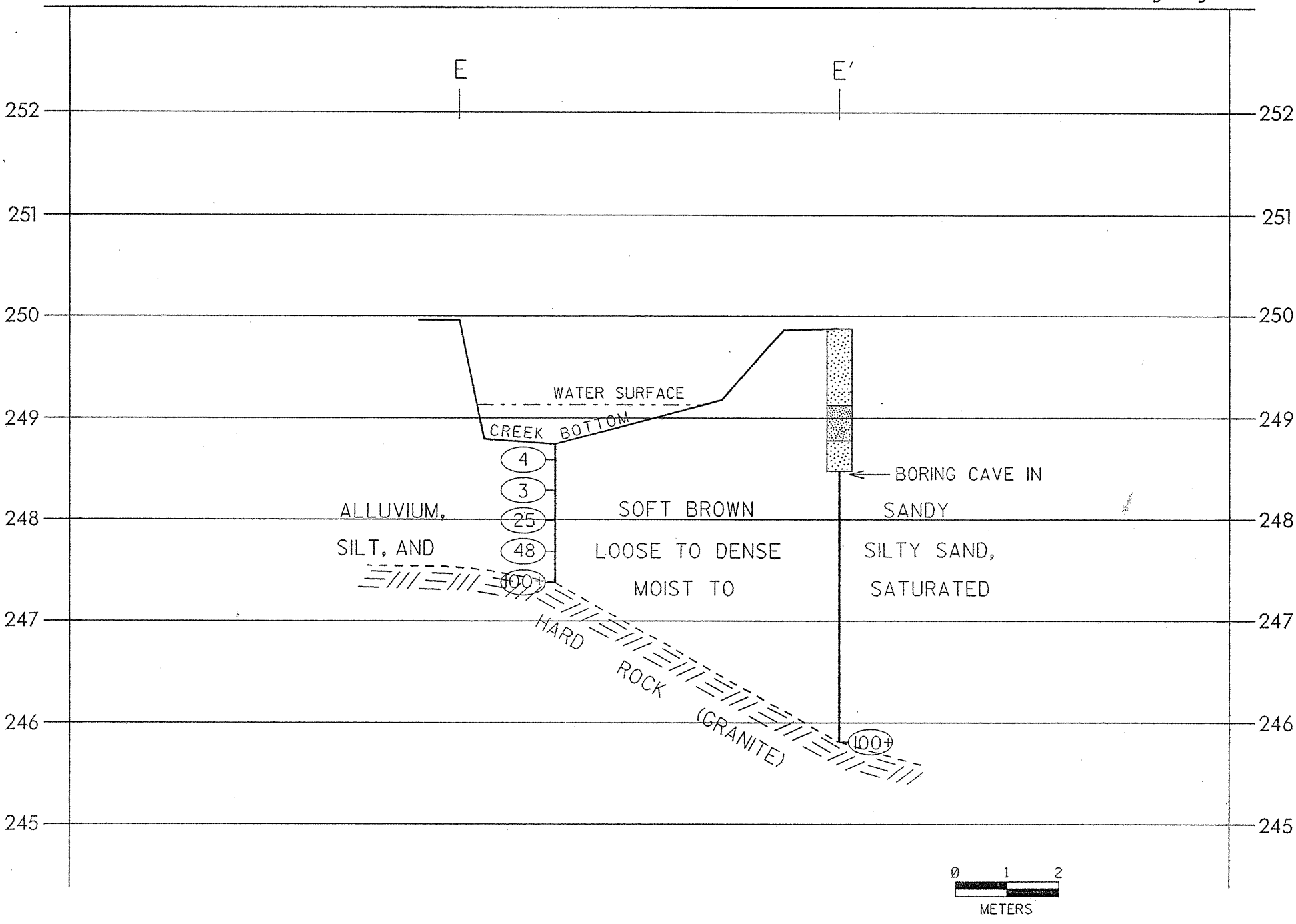
6.499002T R-2413C
STRUCTURE # 8
SHEET 2 OF 5

# TEST SITE PLAN



6.499002T R-2413C
STRUCTURE #8
SHEET 3 OF 5

# SECTION THROUGH E – E′



6.499002T R-2413C
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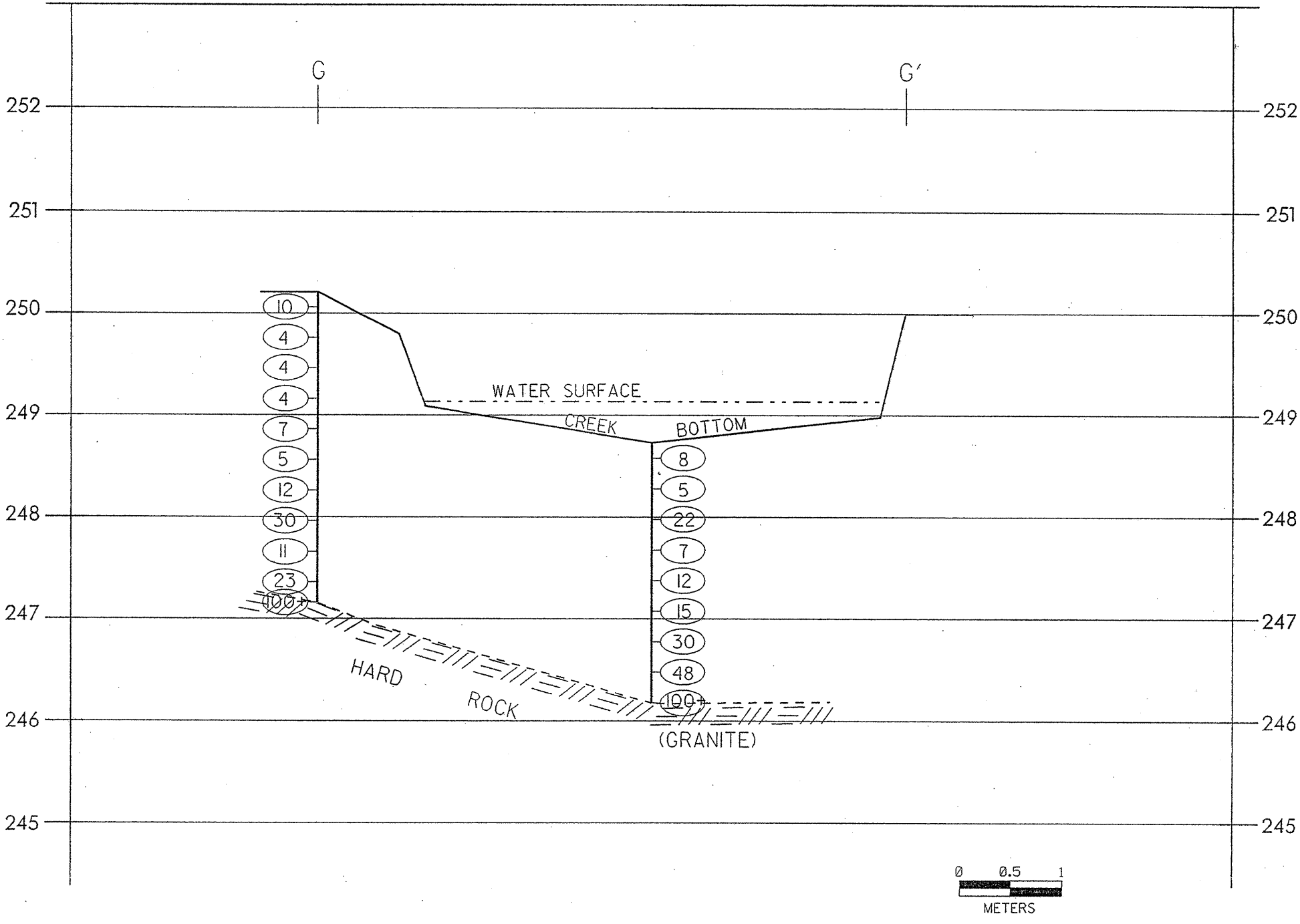
SHEET 4 OF 5

# SECTION THROUGH G – G′



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DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

# GEOTECHNICAL REPORT AND APPENDIX A

## NCDOT PROJECT NO. 6.499002T (R-2413C)

DESCRIPTION: BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-)

PREPARED BY ENGINEERING TECTONICS, P.A.

Let

| | |
|---|---|
| **SUBMITTED TO:** | State of North Carolina<br>Department of Transportation<br>Division of Highways<br>Geotechnical Unit<br>Post Office Box 25201<br>Raleigh, North Carolina 27611-5201 |
| **ATTENTION:** | Mr. William L. Moore, III, L.G.<br>State Engineering Geologist<br>Geotechnical Unit |
| **SUBMITTED BY:** | Engineering Tectonics, P.A.<br>Post Office Box I<br>Winston-Salem, North Carolina 27108 |
| **DATE:** | January 20, 1999 |
| **STATE PROJECT:** | 6.499002T (R-2413C) |
| **F.A. NUMBER:** | N/A |
| **COUNTY:** | Guilford/Rockingham |
| **DESCRIPTION:** | Bridge on NC 65 (-Y10 REV-) over US 220 (-L REV-) |
| **SUBJECT:** | Geotechnical Report of Subsurface Exploration and Recommendations for Bridge on -Y10 REV - (NC 65) over -L REV- (US 220) |

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3. NCDOT Legend Supplement
4. Vicinity Map
5. Boring Location Diagram
6. Subsurface Profiles and Cross Sections
7. Boring Logs, Core Boring Reports, and Core Photographs
8. AASHTO Tests Results

Appendix B (Issued Under Separated Cover)

1. Boring Quantity Summation Sheet
2. Check List
3. Field Notes
4. Survey Notes
5. Laboratory Test Sheets
6. Bearing Calculations

ENGINEERING TECTONICS, P.A.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS
P.O. Box I, Winston-Salem, NC 27108 (336) 724-6994

**STATE PROJECT:** 6.499002T (R-2413C)

**COUNTY:** Guilford/Rockingham

**DESCRIPTION:** Bridge on NC 65 (-Y10 REV-) over US 220 (-L REV-)

**SUBJECT:** Geotechnical Report of Subsurface Exploration and Recommendations for Bridge on -Y10 REV- (NC 65) over -L REV- (US 220)

Engineering Tectonics, P.A. (ETPA) has completed the authorized geotechnical investigation for the above referenced project in Rockingham County, North Carolina. The purpose of the exploration was to investigate the subsurface conditions at the proposed bent locations and provide general foundation design recommendations.

## PROJECT DESCRIPTION

The proposed project will consist of the construction of a two lane bridge on NC 65 (-Y10 REV-) over US 220 (-L REV-). Only an at-grade crossing currently exist at the site. The proposed bridge will be a two span structure with a length of 62.4 meters and a roadway width of 15.6 meters. Based on the preliminary structure plans, the skew angles tangent to curve for all bents is proposed to be 72°23'08". The preliminary plans provided to ETPA by the NCDOT indicate proposed fill amounts of approximately 5.6 meters at End Bent-1 and 4.3 meters at End Bent-2, and cut amounts of approximately 3.1 meters at Bent-1.

## SITE DESCRIPTION

The site of the proposed bridge is located at the intersection of US 220 and NC 65, approximately 200 meters north of the Guilford/Rockingham County line in Rockingham County, North Carolina. The proposed bridge will cross over US 220.

The project site lies within the Piedmont Physiographic Province, and topography of the general site vicinity is gently rolling hills. The site is located on the Ellisboro, N.C. 7.5 minute topographic quadrangle. The elevation of the subject site is approximately 280 meters above mean sea level. The site is located near the top of a knoll with apparent drainage to the south-southeast towards the Haw River which is located approximately 8 kilometers southeast. Site relief in the area of our borings ranges from a high of Elevation 282.57 meters (MSL) at 4.38 meters left (north) of Boring EB2-A, to a low of Elevation 280.48 meters (MSL) at 4.38 meters right (south) of Boring EB1-B. The land adjacent to the subject site is residential to the southwest, agricultural to the northwest, commercial to the northeast, and wooded to the southeast.

## DESCRIPTION OF SUBSURFACE EXPLORATION

The subsurface exploration was conducted between December 28, 1998 and January 5, 1999. A total of six (6) soil test borings, two borings at each bent location, were drilled at the site using an ATV mounted Mobile B-57 drilling rig. An 8.26 cm (I.D.) hollow stem auger was used to advance each borehole through soil. Standard Penetration Tests were performed in all borings in accordance with North Carolina Department of Transportation (NCDOT) guidelines, and representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with AASTO Specification T 206. The recovered soil samples were visually classified in the field, then returned to our laboratory for specific laboratory testing on selected samples. The laboratory tests results are included in Appendix A.

One (1) of the six borings performed for this project (B1-B) was extended below the auger refusal depth to obtain core samples of the underlying rock. The rock coring was performed with an NQ size (5.50 cm O.D.) Wireline Coring system manufactured by the Longyear Company. This system uses a diamond impregnated NQ series bit fastened to

the end of a NQ size hollow double-tube core barrel. The rock coring was performed through the augers or casing using creek water alone as the drilling fluid. The rock core samples were returned to our laboratory for review of field classifications and for further descriptive analysis.

Boring locations were established by an NCDOT survey crew. Site elevations were surveyed by personnel from Engineering Tectonics, P.A. using the elevations established for the boring locations by the NCDOT survey crew.

Boring B1-A was offset 2.0 meters left (north) along the bent from the staked location in order to place it on the shoulder of NC 65 out of traffic. Boring EB2-A was offset 2.1 meters along the bent toward the center line of NC 65 in order to avoid overhead powerlines. The actual locations of the borings are shown on the Boring Location Diagram, Drawing No. 2, included in Appendix A.

## LABORATORY TESTING

Laboratory testing was performed on representative split-spoon samples to aid in the assessment of AASHTO soil classification and to provide data for evaluation of engineering properties. The laboratory testing consisted of natural moisture content determination, Atterberg Limits tests, and grain size analysis with hydrometer. All laboratory testing was performed in accordance with applicable AASHTO and NCDOT specifications. The results of the laboratory tests are included in Appendix A.

## PHYSIOGRAPHY AND GEOLOGY

### Regional Geology

Guilford and Rockingham Counties lie within the Piedmont physiographic province of the Southern Appalachian Highlands. The Piedmont is comprised of several northeast-southwest trending belts of igneous and metamorphic rock, thought to have been accreted to the eastern edge of the North American continent during the closing of several Paleozoic ocean basins (Hatcher 1987). The subject site is located within the Milton Belt. Milton Belt rocks are "characterized by strongly foliated gneiss and schist,

commonly with compositional layering and having felsic composition; quartzite, calc-silicate gneiss, and marble are minor units." (Horton, J.W. and Zullo, V.A., *The Geology of the Carolinas*, 1991). It is suggested that Milton Belt rocks are mainly Precambrian and were metamorphosed and deformed during the early to middle Paleozoic.

Site Geology

According to the North Carolina State Geologic Map (Brown, et al., 1985), underlying bedrock at the subject site is inequigranular biotite gneiss and schist. The Geologic Map of Region G, North Carolina (State of North Carolina Department of Natural Resources and Community Development, Geological Survey Section , P. Albert Carpenter , III, 1982), indicates that this rock is a "heterogeneous unit of dark colored, medium to coarse-grained biotite gneiss and schist" with distinct layering and foliation being common.

The cored rock is very good in quality with high RQD and Recovery values. No iron staining was noted in the recovered core.

In the Piedmont, bedrock is typically overlain by unconsolidated materials or regolith including alluvium, saprolite, and soils. Saprolite is a common clay-rich weathering product of the underlying bedrock units. A thin layer of soil usually covers both saprolite and alluvial deposits. The soils above the bedrock at the subject site are the residual product from the physical and chemical weathering of the underlying bedrock.

## SUBSURFACE CONDITIONS

The generalized subsurface conditions, as indicated by our borings, are described below. For soil descriptions and weathered rock descriptions at a particular boring location, the respective test boring logs should be reviewed. A representative subsurface profile along the "A" line, as well as cross sections at each bent, are included in Appendix A as Drawing Nos. 3 through 6.

## Soils

Soils at the site are embankment fill and residual in origin. The embankment fill is present in the uppermost 1.0m to 1.4m of material in all borings. The existing embankment fill generally consists of medium stiff to stiff, orange and red with brown, slightly micaceous, silty coarse to fine sandy clay (A-7-5) and very clayey coarse to fine very sandy silt (A-4). These soils are typically moist to wet, and traces of organics (topsoil and root fragments) and occasional rock fragments are present within this fill. Standard Penetration Resistance values of 7 to 19 blows per 0.30m were measured within the existing embankment fill.

Residual soils are present below the fill at an elevation of ±280m. These residual soils generally consist of medium stiff to very stiff; tan, orange, gray yellow, brown, and red; micaceous; variably clayey coarse to fine very sandy silt (A-4 and A-5); and of medium dense to very dense; gray, tan, red, and brown; micaceous; silty coarse to fine sand (A-2-4 and A-2-5) with traces of clay and occasional rock fragments. It should be noted that the majority of the sand present at the site is fine grained. Standard Penetration Resistance values of 10 to 84 blows per 0.30m were measured within the residual soil, with the highest blow counts occurring in the lowest portions of the soil. The residual soil extends to depths ranging from 11.5m to 16.2m below the existing ground surface.

Weathered rock is present below the residual soils in all executed borings. The elevation of the top of the weathered rock ranges between ±270m to ±265m. All borings, with the exception of Boring B1-B, were terminated within weathered rock. The thickness of the weathered rock in B1-B is 3.94m.

## Rock

Hard Rock was encountered in Boring B1-B at a depth of 17.04m below the existing ground surface, and rock coring was performed in this boring to obtain samples of the bedrock. The top of rock in this boring is present at elevation 263.82m. The rock is very slightly weathered to fresh, moderately fractured to sound, medium to fine grained, moderately to very slightly foliated, biotite-mica gneiss. Core Recovery values for this rock were 95% to 100% and Rock Quality Designation (RQD) values were 88% to 100%.

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## QUALIFICATION OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report were based on the applicable standards of our profession at the time this report was prepared.

The analysis and recommendations submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations between borings may not become evident until construction. If variations are then evident, it will be necessary to reevaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structure are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by Engineering Tectonics, P.A., (ETPA) and the conclusions of this report modified or verified in writing.

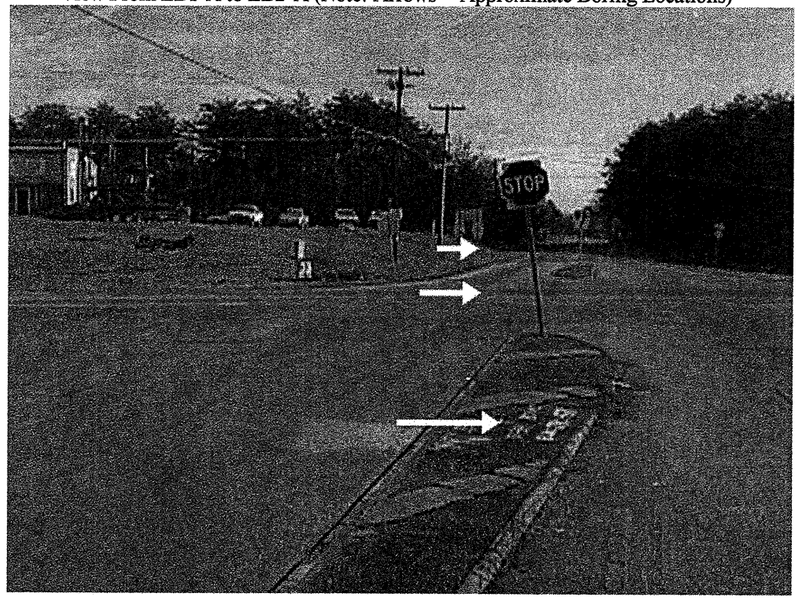
The stratification of the soils, as shown on the Soil Boring Logs, Cross Sections, and Profiles, represents the soil conditions in the actual boring locations, and variations may occur between borings. Lines of demarcation represent the approximate boundaries between soil types, but the transitions may be gradual. It should be noted that even though the test borings are drilled and sampled by experienced drillers and geologists, it is sometimes difficult to record changes in stratification within narrow limits, especially at great depths. In addition, it is sometimes difficult to distinguish between discolored soils and soil fill in the absence of foreign substances.

The information presented in the "Project Description" section of this report was utilized in our geotechnical analysis. Therefore, if any of this information is in error due to either our misunderstanding or to a design change, ETPA should be provided the opportunity to reevaluate the "Foundations Recommendations" section of this report for either possible changes to the report or verification of the information.

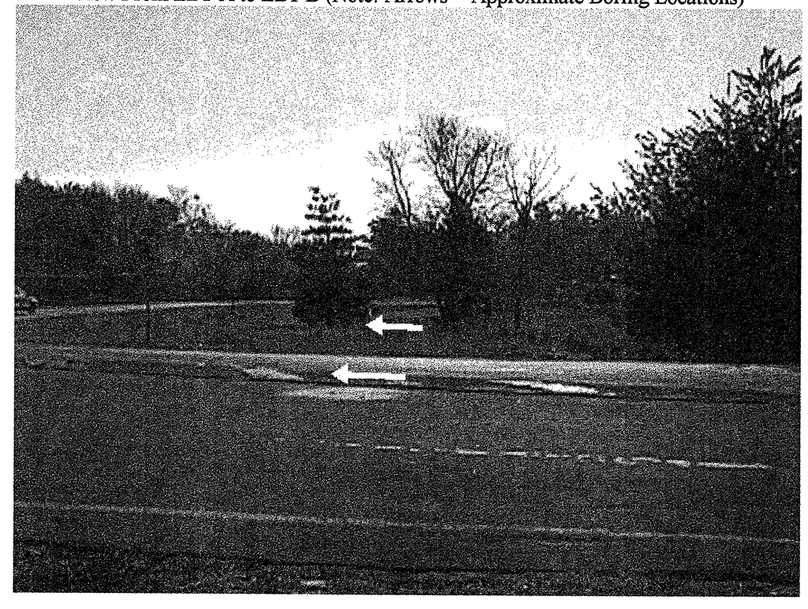
# APPENDIX A

# SITE PHOTOGRAPHS

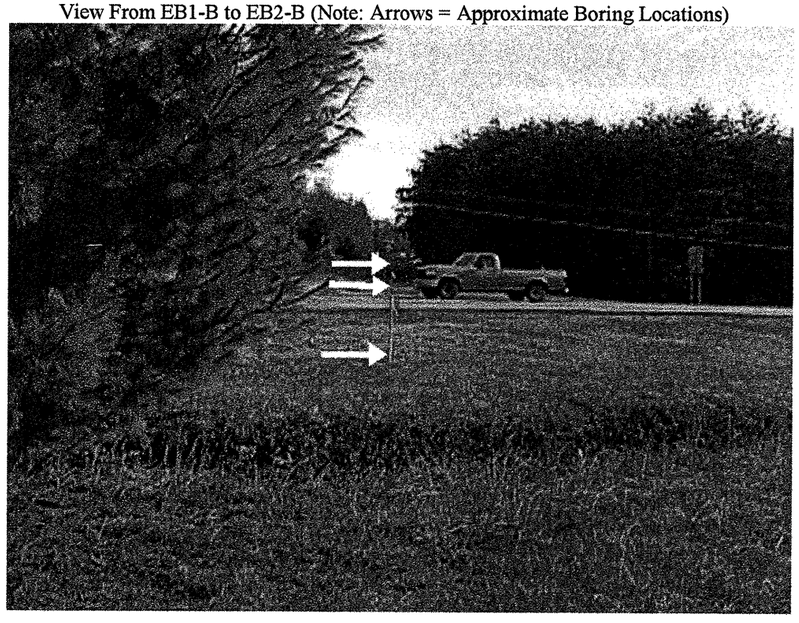
View From EB1-A to EB2-A (Note: Arrows = Approximate Boring Locations)



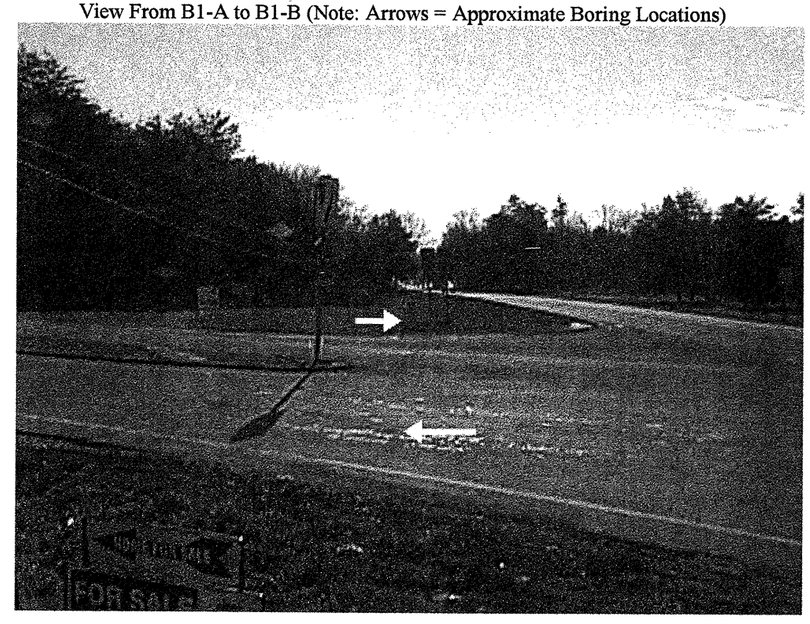

View From EB1-A to EB1-B (Note: Arrows = Approximate Boring Locations)



View From EB1-B to EB2-B (Note: Arrows = Approximate Boring Locations)

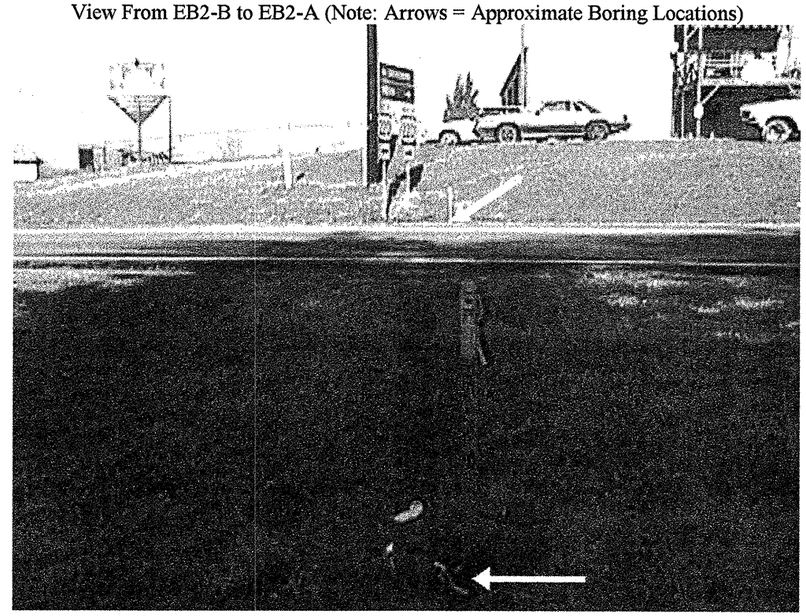


View From B1-A to B1-B (Note: Arrows = Approximate Boring Locations)



# SITE PHOTOGRAPH

View From EB2-B to EB2-A (Note: Arrows = Approximate Boring Locations)



# CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS PART OF THE CONTRACT.

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

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

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

# NORTH CAROLINA DIVISION OF HIGHWAYS
## GEOTECHNICAL UNIT
## SOIL AND ROCK CLASSIFICATION, LEGEND, AND ABBREVIATIONS

### SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP CLASS. | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 | A-1,A-2 A-3 | A-4,A-5 A-6,A-7 | |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5 A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| % PASSING #10 | 50 MX | | | | | | | | | | | | | |
| #40 | 30 MX | 50 MX | 51 MN | | | | | | | | | | | |
| #200 | 15 MX | 25 MX | 10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | | | |
| (PASSING #40) LL | | | | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| PI | 6 MX | | N.P. | 10 MX | 10 MX | 11 MX | 11 MX | 10 MX | 10 MX | 11 MN | 11 MN | | | |
| GROUP INDEX | 0 | | 0 | 0 | | 4 MX | | 8 MX | 12 MX | 16 MX | NO MX | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. GRAVEL & SAND | | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | | SILTY SOILS | | CLAYEY SOILS | | | | |

* PI OF A-7-5 ≤ (LL-30); PI OF A-7-6 > (LL-30)

### TEXTURE OR GRAIN SIZE

| BOULDER | COBBLE | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY |
|---|---|---|---|---|---|---|

GRAIN SIZE (mm): 305 | 75 | 2 | 0.25 | 0.05 | 0.005
GRAIN SIZE (IN): 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### ROCK DESCRIPTION

IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED TO BE THAT INDURATED EARTH MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF "WEATHERED ROCK". FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:

| TERM | SYMBOLS | | DESCRIPTION |
|---|---|---|---|
| HARD ROCK (HR) | CORED ROCK | INFERRED ROCK LINE [2] | MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE |
| WEATHERED ROCK (WR) | | HARD WEATHERED ROCK (HWR) | MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL [1] |
| | | SOFT WEATHERED ROCK (SWR) | MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL |

[1] SPT REFUSAL ≤ 2.5 cm OF PENETRATION PER 50 BLOWS IN SPT.
[2] AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED. A DESCRIPTION OF ROCK IS GIVEN, INCLUDING:

CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

ROCK QUALITY DESIGNATION (RQD) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO .01m DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

NORTH CAROLINA LICENSED SEAL 1630 GEOLOGIST PAUL M. WEAVER

SEAL

Signature

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N - VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($q_u$) (kN / m²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>> 400 |

### GROUND WATER

- WATER LEVEL IN BORE HOLE — IMMEDIATELY AFTER DRILLING (I.A.D.) / SOON AFTER DRILLING (▽ 0 HRS.)
- STATIC WATER LEVEL (AFTER 24 HRS.)
- PERCHED WATER (PW), SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEPAGE

### MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION — SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 25° STRIKE AND DIP
- APPARENT DIP (NORMAL TO _____)
- ROD SOUNDING
- SPT DPT VST TEST BORING
- AUGER BORING
- CORE BORING
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- ASPHALT & STONE

SAMPLE DESIGNATIONS: S-BULK SAMPLE; SS-SPLIT SPOON SAMPLE; ST-SHELBY TUBE SAMPLE; RS-ROCK SAMLE

### ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| A.R. | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| B.T. | BORING TERMINATED | NS | NO SAMPLE TAKEN |
| C.T. | CORING TERMINATED | N/A | NOT APPLICABLE |
| CALC. | CALCAREOUS | N/T | NOT TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | PP | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
| GR. | GRAVEL | SPT | STANDARD PENETRATION TEST |
| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
| GW | GROUND WATER | VST | VANE SHEAR TEST |
| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

BENCH MARK: STEEL PIN AT BASE OF STAKE FOR BORING
B1-A, 8.27m LEFT OF -L- 10+62.5 ELEV. 281.259m

STATE PROJECT NO. 6.499002T
T.I.P. NO. R-2413C F.A. NO. N/A
COUNTY ROCKINGHAM ROUTE NC 65
SITE DESCRIPTION BRIDGE ON NC 65 (-Y 10 REV-) OVER US 220 (-L REV-)

PROJECT GEOLOGIST P.M. WEAVER, M. TAYLOR SUBMITTED BY J.M. RILEY & P.M. WEAVER

PERSONNEL D. BARRON, R. MIDDLETON, R. MOORE

DATE SUBMITTED 1/20/99

# LEGEND SUPPLEMENT

In addition to the terms and abbreviations on the Legend Sheet, the following will be used to further descibe rock quality on this project. Because of limited space on the logs, abbreviations are in parenthesis.

## WEATHERING

| | |
|---|---|
| FRESH | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| VERY SLIGHT (V.SLI.) | Rock generally fresh, joints stained, some joints may show thin clay coatings if open, crystals on a broken specimen face shine brightly. Rock rings under hammer blows if of a crystalline nature. |
| SLIGHT (SLI.) | Rock generally fresh, joints stained and discoloration extends into rock up to 0.025m (1 in.). Open joints may contain clay. In granitoid rocks, some occasional feldspar crystals are dull and discolored. |
| 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 are dull and discolored and a majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock gives "clunk" sound when struck with a hammer. *Comparable to hard weathered rock.* |
| SEVERE (SEV.) | All rocks 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. *Comparable to soft weathered rock.* |
| VERY SEVERE (V.SEV.) | All rock except quartz discolored or stained. Rock frabric 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. *Comparable to soil.* |
| COMPLETE | Rock reduced to soil. Rock fabric discernible only in small and scattered concentrations. Quartz may be present as dikes or stringers. Saprolite is also an example. *Comparable to soil.* |

## ROCK CONTINUITY

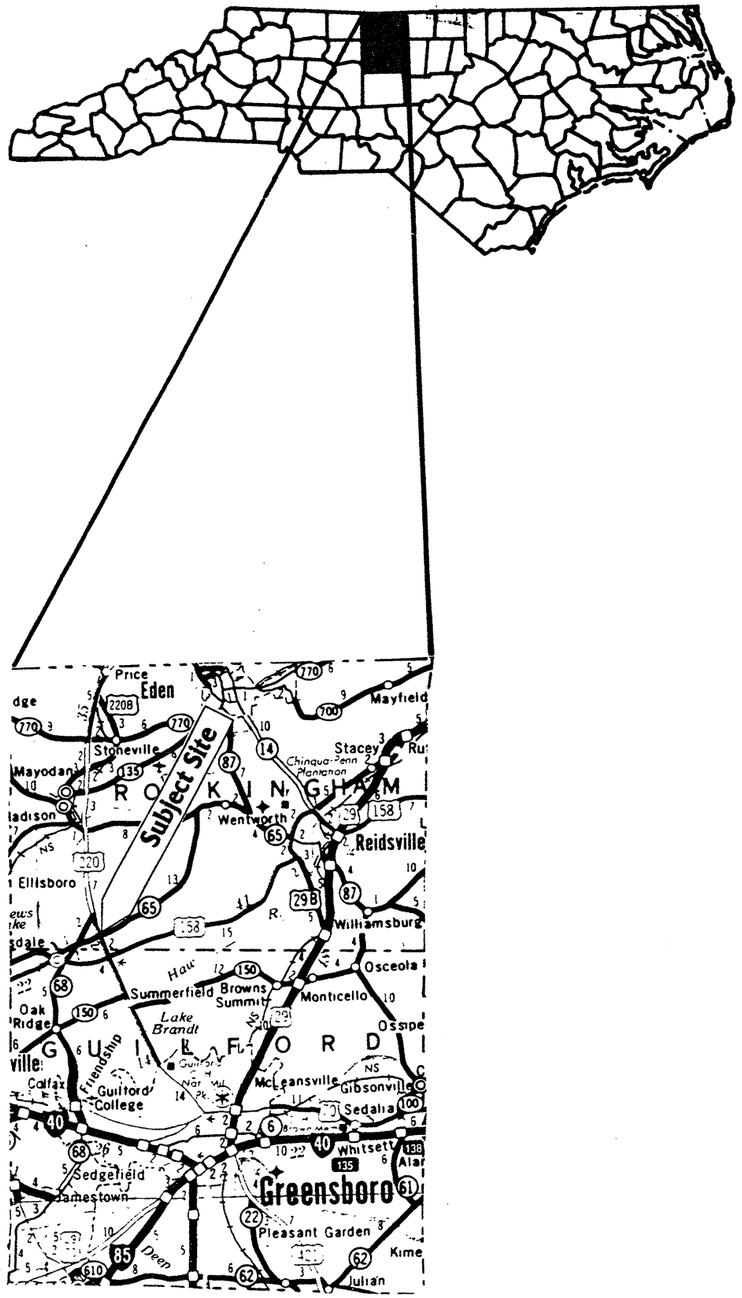
| | |
|---|---|
| Sound- | Core pieces larger than 0.20m |
| Slightly Fractured (SLI.FRAC.) | Core pieces between 0.10 and 0.20m |
| Moderately Fractured (MOD.FRAC.) | Core pieces between 0.025 and 0.10m |
| Extremely Fractured (EXT.FRAC.) | Core pieces less than 0.025m |

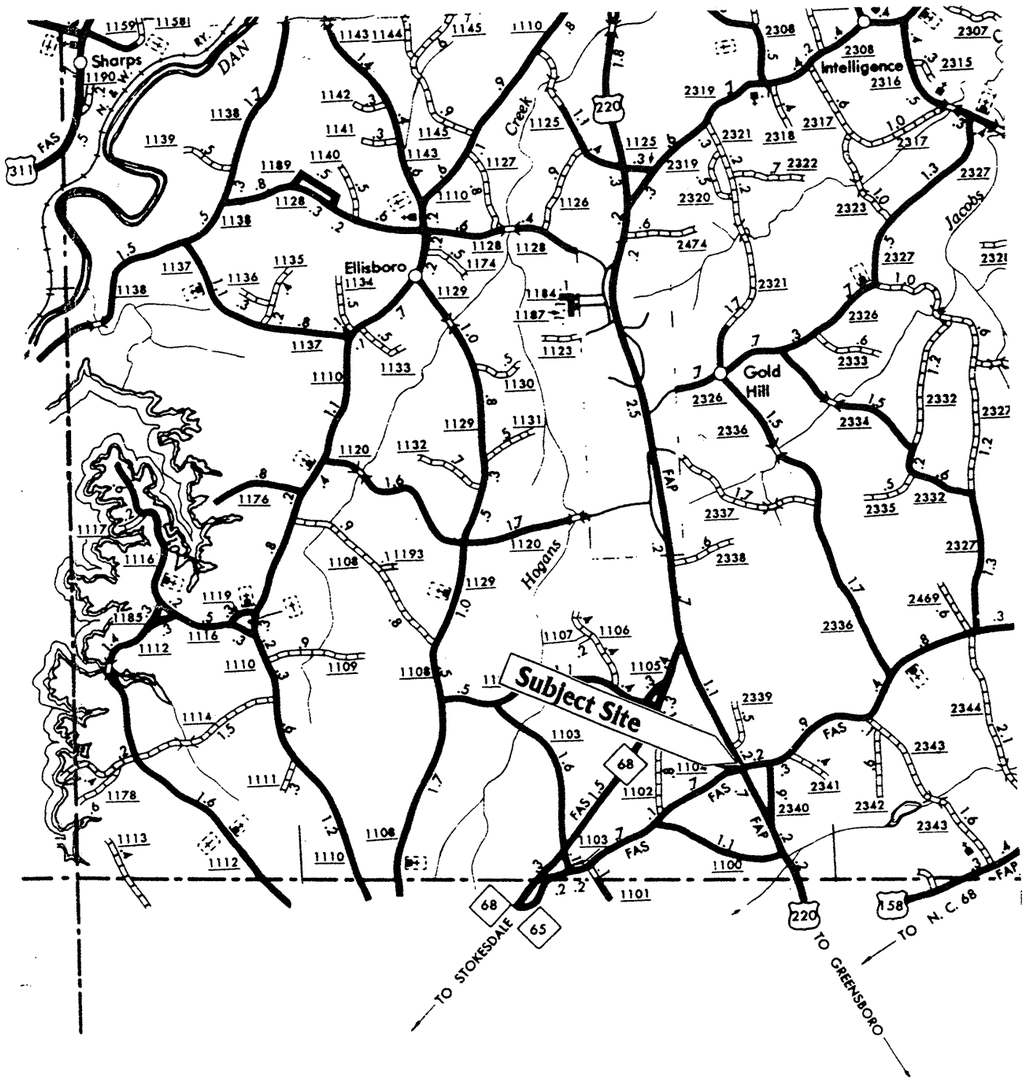
## JOINT SPACING

Average Discontinuity Spacing (ADS)
The average measured distance (in meters) between joints in the same set. Will not apply to individual joints.

## JOINT THICKNESS

Average Discontinuity Thickness (ADT)
The average thickness or width of gap in the joint (in meters).



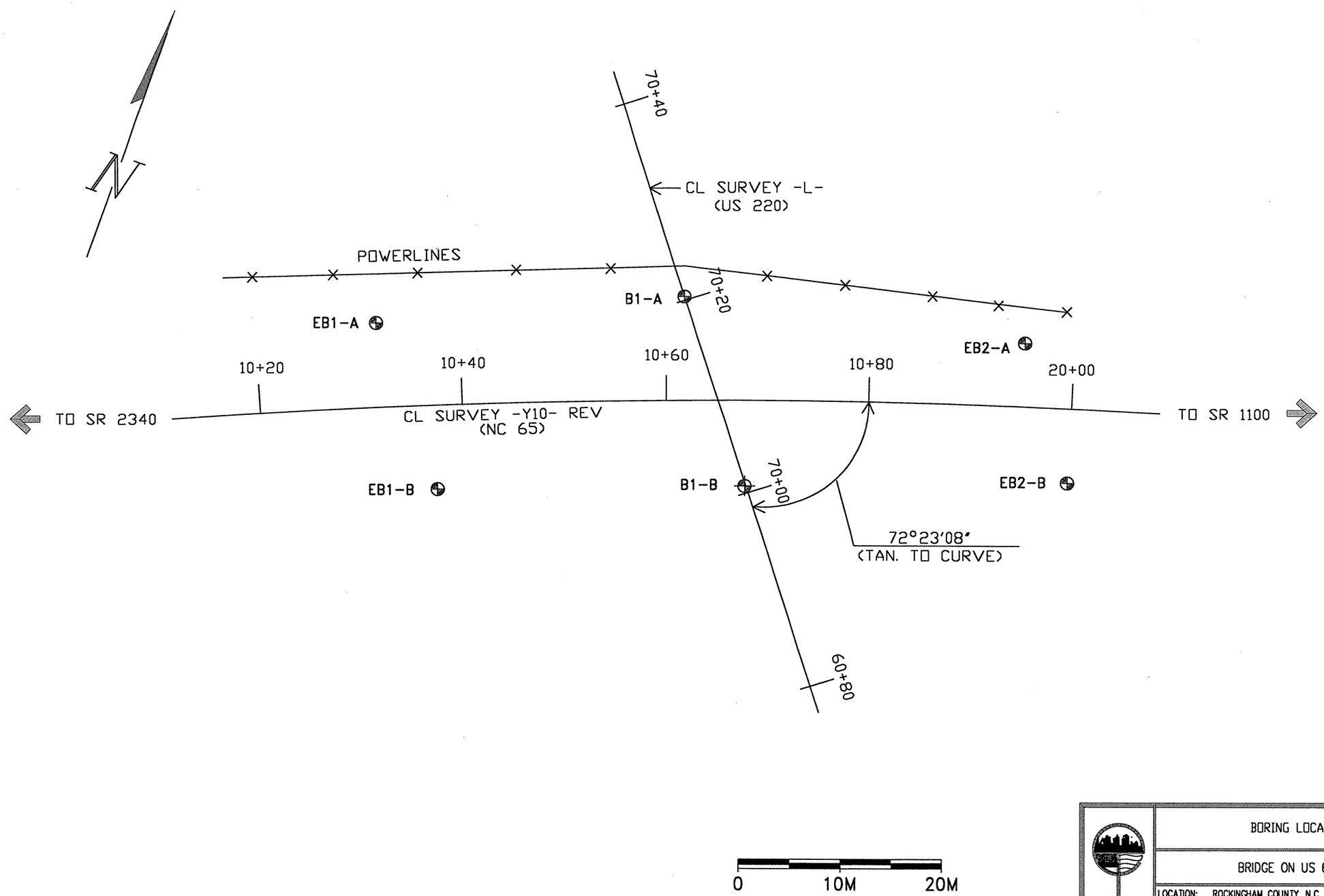




VICINITY MAP

BRIDGE ON NC 65 OVER US 220

| | | | |
|---|---|---|---|
| LOCATION: ROCKINGHAM COUNTY, N.C. | | PROJECT #: | 6.4990021 |
| TIP #: R-2413C | FA #: N/A | SCALE: | NOT TO SCALE |
| ENGINEERING TECTONICS, P.A. | APPROVED BY: JMR | DATE: | 1/99 |
| GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS | DRAWN BY: PMW | DWG. No. | 1 |

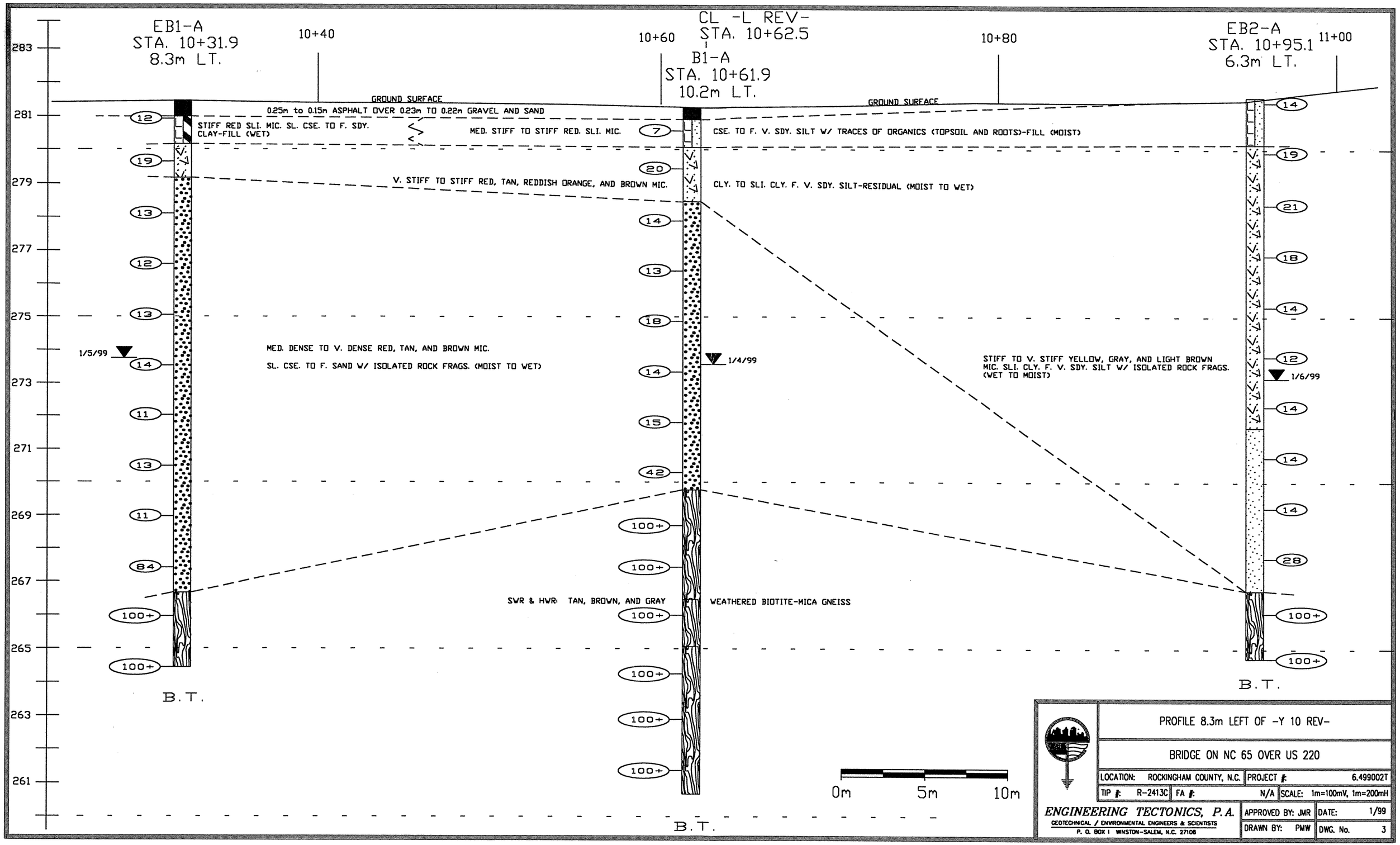
P. O. BOX 1 WINSTON-SALEM, N.C. 27108




BORING LOCATION DIAGRAM

BRIDGE ON US 65 OVER US 220

| | | | |
|---|---|---|---|
| LOCATION: ROCKINGHAM COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1:400 |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 1/99 |
| | DRAWN BY: PMW | DWG. No. | 2 |




PROFILE 8.3m LEFT OF -Y 10 REV-

BRIDGE ON NC 65 OVER US 220

| | | | |
|---|---|---|---|
| LOCATION: ROCKINGHAM COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100mV, 1m=200mH |

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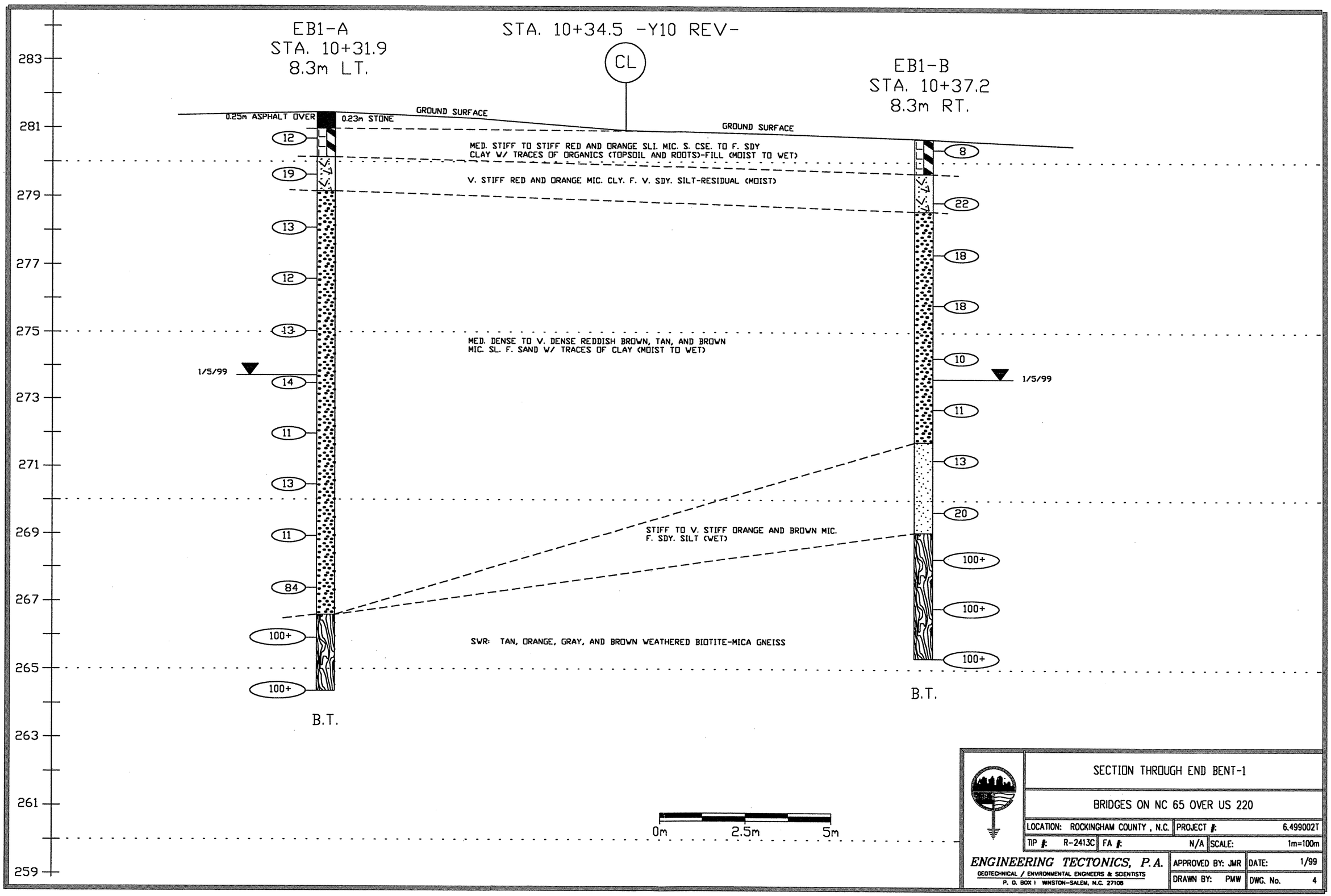
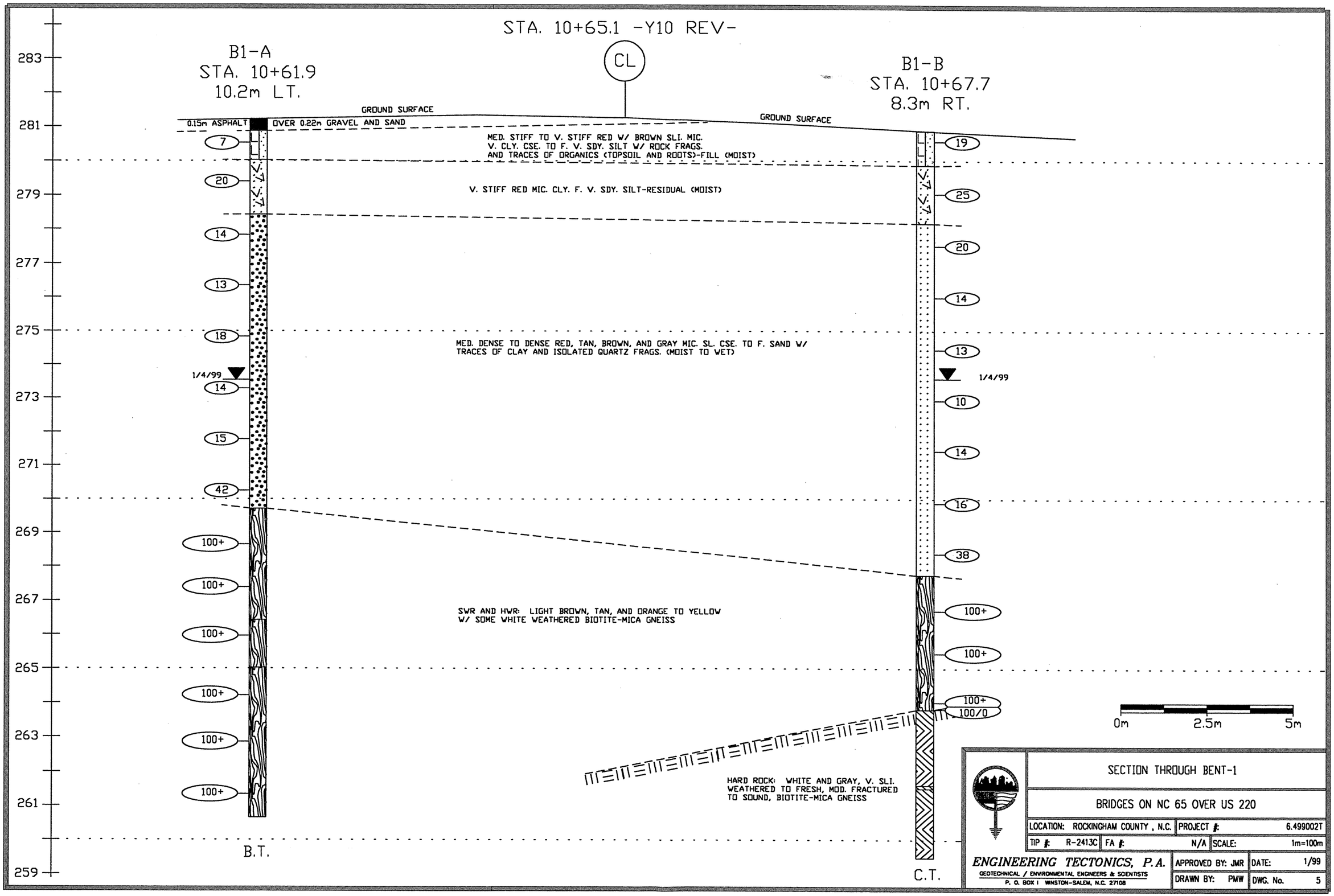
| | | |
|---|---|---|
| APPROVED BY: JMR | DATE: | 1/99 |
| DRAWN BY: PMW | DWG. No. | 3 |

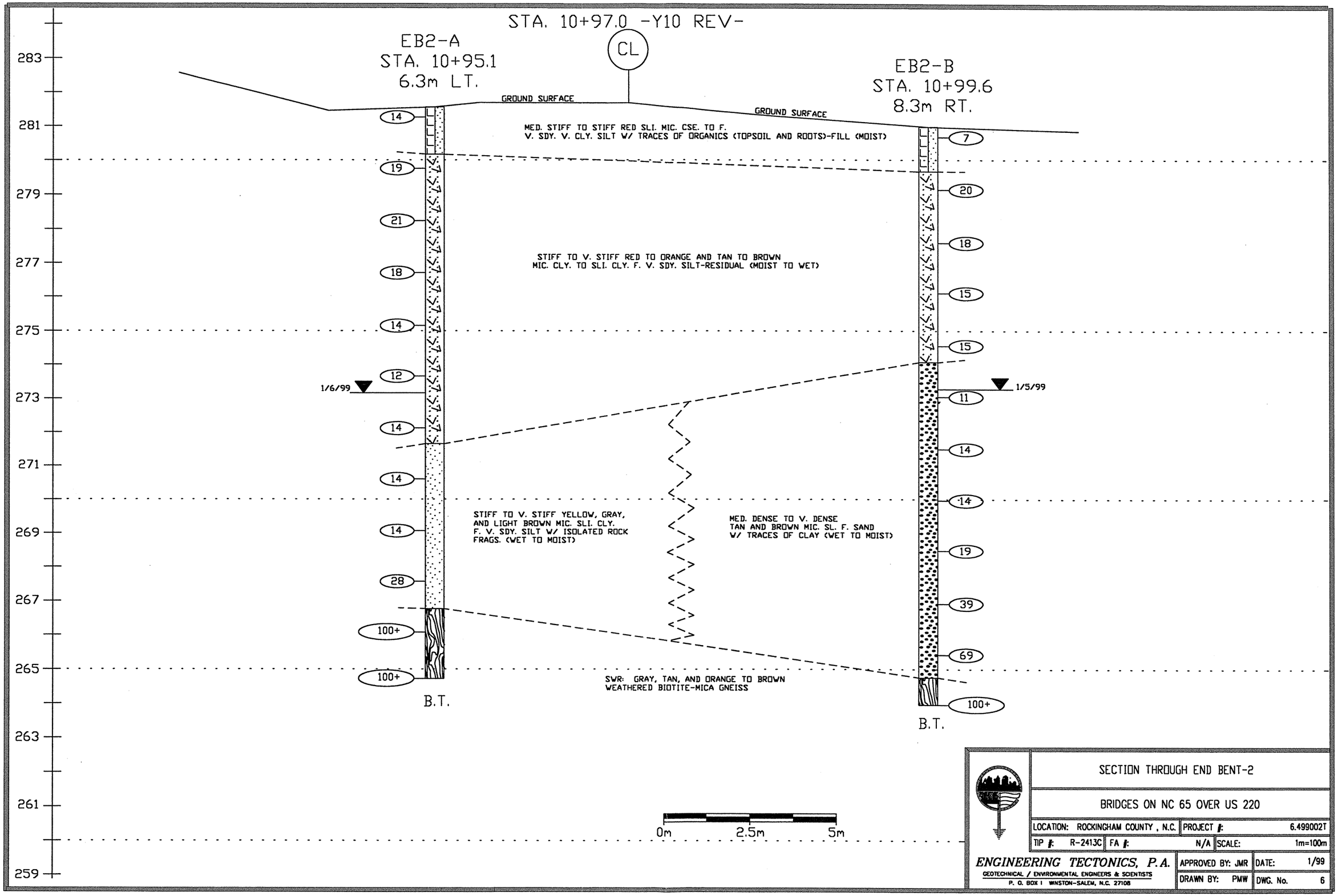



SECTION THROUGH END BENT-1

BRIDGES ON NC 65 OVER US 220

| | | | |
|---|---|---|---|
| LOCATION: ROCKINGHAM COUNTY , N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 1/99 |
| | DRAWN BY: PMW | DWG. No. | 4 |


STA. 10+65.1 -Y10 REV-
CL
B1-A
STA. 10+61.9
10.2m LT.
B1-B
STA. 10+67.7
8.3m RT.
GROUND SURFACE
GROUND SURFACE
0.15m ASPHALT
OVER 0.22m GRAVEL AND SAND
MED. STIFF TO V. STIFF RED W/ BROWN SLI. MIC.
V. CLY. CSE. TO F. V. SDY. SILT W/ ROCK FRAGS.
AND TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL (MOIST)
V. STIFF RED MIC. CLY. F. V. SDY. SILT-RESIDUAL (MOIST)
MED. DENSE TO DENSE RED, TAN, BROWN, AND GRAY MIC. SL. CSE. TO F. SAND W/
TRACES OF CLAY AND ISOLATED QUARTZ FRAGS. (MOIST TO WET)
SWR AND HWR: LIGHT BROWN, TAN, AND ORANGE TO YELLOW
W/ SOME WHITE WEATHERED BIOTITE-MICA GNEISS
HARD ROCK: WHITE AND GRAY, V. SLI.
WEATHERED TO FRESH, MOD. FRACTURED
TO SOUND, BIOTITE-MICA GNEISS
1/4/99
1/4/99
B.T.
C.T.
283
281
279
277
275
273
271
269
267
265
263
261
259
7
20
14
13
18
14
15
42
100+
100+
100+
100+
100+
100+
19
25
20
14
13
10
14
16
38
100+
100+
100+
100/0
0m
2.5m
5m
SECTION THROUGH BENT-1
BRIDGES ON NC 65 OVER US 220
LOCATION: ROCKINGHAM COUNTY , N.C.
PROJECT #: 6.499002T
TIP #: R-2413C
FA #: N/A
SCALE: 1m=100m
ENGINEERING TECTONICS, P.A.
GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS
P. O. BOX 1 WINSTON-SALEM, N.C. 27108
APPROVED BY: JMR
DATE: 1/99
DRAWN BY: PMW
DWG. No. 5


STA. 10+97.0 -Y10 REV-
CL
EB2-A
STA. 10+95.1
6.3m LT.
EB2-B
STA. 10+99.6
8.3m RT.
GROUND SURFACE
GROUND SURFACE
MED. STIFF TO STIFF RED SLI. MIC. CSE. TO F.
V. SDY. V. CLY. SILT W/ TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL (MOIST)
STIFF TO V. STIFF RED TO ORANGE AND TAN TO BROWN
MIC. CLY. TO SLI. CLY. F. V. SDY. SILT-RESIDUAL (MOIST TO WET)
STIFF TO V. STIFF YELLOW, GRAY,
AND LIGHT BROWN MIC. SLI. CLY.
F. V. SDY. SILT W/ ISOLATED ROCK
FRAGS. (WET TO MOIST)
MED. DENSE TO V. DENSE
TAN AND BROWN MIC. SL. F. SAND
W/ TRACES OF CLAY (WET TO MOIST)
SWR: GRAY, TAN, AND ORANGE TO BROWN
WEATHERED BIOTITE-MICA GNEISS
1/6/99
1/5/99
B.T.
B.T.
283
281
279
277
275
273
271
269
267
265
263
261
259
14
19
21
18
14
12
14
14
14
28
100+
100+
7
20
18
15
15
11
14
14
19
39
69
100+
0m
2.5m
5m
SECTION THROUGH END BENT-2
BRIDGES ON NC 65 OVER US 220
LOCATION: ROCKINGHAM COUNTY , N.C.
PROJECT #: 6.499002T
TIP #: R-2413C
FA #: N/A
SCALE: 1m=100m
ENGINEERING TECTONICS, P.A.
GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS
P. O. BOX 1 WINSTON-SALEM, N.C. 27108
APPROVED BY: JMR
DATE: 1/99
DRAWN BY: PMW
DWG. No. 6

ENGINEERING TECTONICS, P.A.
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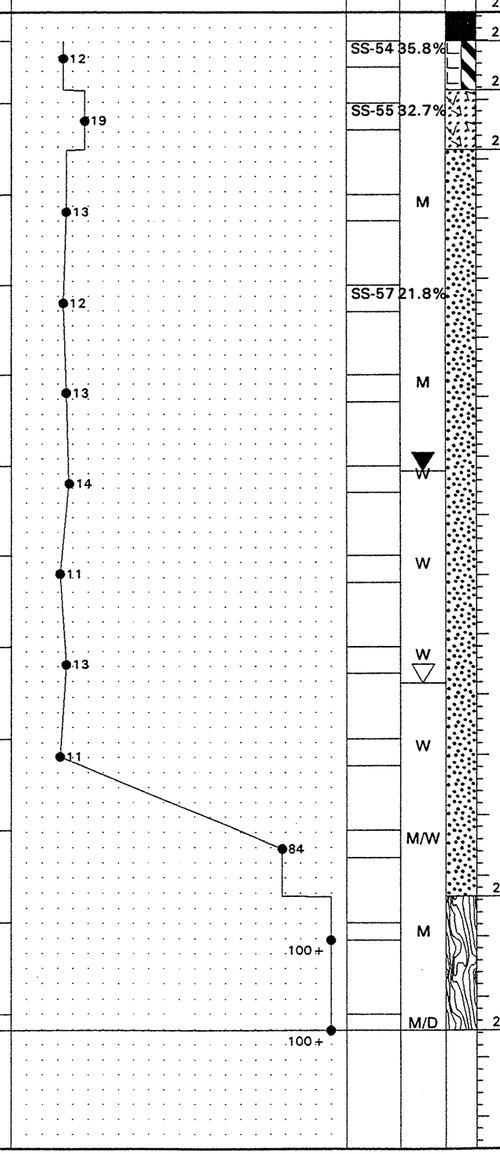
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** EB1-A | **BORING LOCATION** 10+31.9 | **OFFSET** 8.3m LT | **ALIGNMENT** -Y10 REV- | **0 HR.** 11.28 |
| **COLLAR ELEV.** 281.46 m | **NORTHING** | **EASTING** | **24 HR.** 7.71 |
| **TOTAL DEPTH** 17.02 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 1/4/99 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| 281.46 | | | | | | | | | 0.00 |
| | 0.48 | | | | | | | 0.25m ASPHALT OVER 0.23m GRAVEL | 0.48 |
| | | 4 | 5 | 7 | SS-54 | 35.8% | | STIFF RED. SLI. MIC. SL. CSE. TO F. SDY. CLAY-FILL | 1.30 |
| 280 | 1.52 | 5 | 8 | 11 | SS-55 | 32.7% | | V. STIFF RED MIC. CLY. F. V. SDY. SILT-RESIDUAL | 2.30 |
| | 3.05 | 4 | 6 | 7 | | M | | | |
| 278 | 4.57 | 4 | 5 | 7 | SS-57 | 21.8% | | | |
| 276 | 6.10 | 4 | 6 | 7 | | M | | MED. DENSE TO V. DENSE REDDISH BROWN TO TAN AND BROWN MIC. SL. F. SAND W/ TRACES OF CLAY | |
| 274 | 7.62 | 6 | 6 | 8 | | W | | | |
| | 9.14 | 4 | 4 | 7 | | W | | | |
| 272 | 10.67 | 3 | 5 | 8 | | W | | | |
| 270 | 12.19 | 4 | 4 | 7 | | W | | | |
| 268 | 13.72 | 14 | 29 | 55 | | M/W | | | 14.80 |
| 266 | 15.24 | 33 | 67/.14 | | | M | | SWR: TAN AND BROWN WEATHERED BIOTITE-MICA GNEISS | |
| | 16.76 | 38 | 62/.11 | | | M/D | | | 17.02 |
| 264 | | | | | | | | BORING TERMINATED AT ELEVATION 264.44m IN WEATHERED BIOTITE-MICA GNEISS | |

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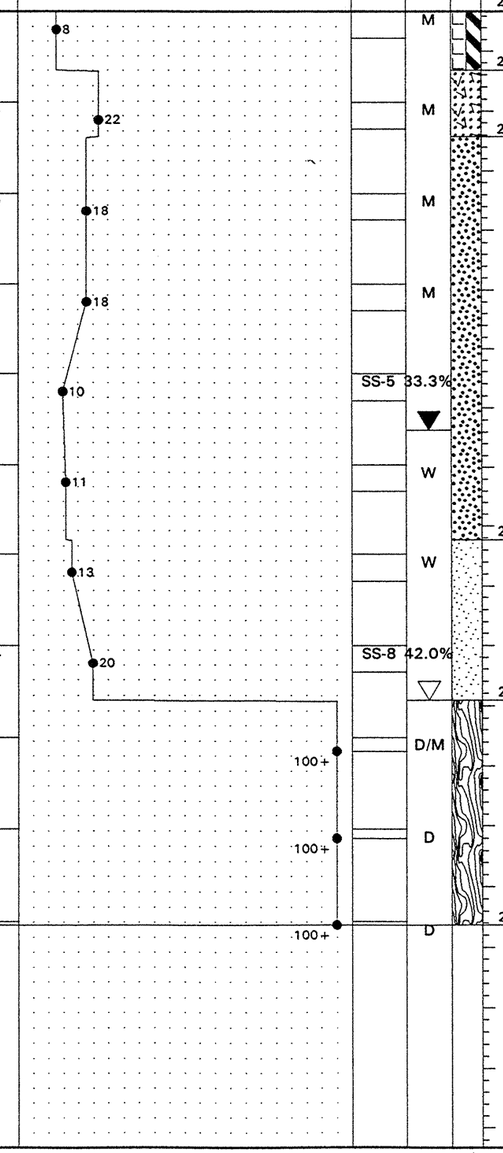
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** EB1-B | **BORING LOCATION** 10+37.2 | **OFFSET** 8.3m RT | **ALIGNMENT** -Y10 REV- | **0 HR.** 11.58 |
| **COLLAR ELEV.** 280.67 m | **NORTHING** | **EASTING** | **24 HR.** 7.04 |
| **TOTAL DEPTH** 15.30 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/28/98 | **COMPLETED** 1/4/99 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| 280.67 | | | | | | | | | 0.00 |
| | 0.00 | 3 | 4 | 4 | | M | | MED. STIFF RED AND ORANGE SLI. MIC. SL. CSE. TO F. SDY. CLAY W/ TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL | 1.00 |
| 280 | 1.52 | 6 | 8 | 14 | | M | | V. STIFF RED AND ORANGE MIC. CLY. F. V. SDY. SILT-RESIDUAL | 2.10 |
| 278 | 3.05 | 6 | 8 | 10 | | M | | | |
| 276 | 4.57 | 5 | 9 | 9 | | M | | MED. DENSE TAN AND REDDISH BROWN TO BROWN MIC. SL. F. SAND | 8.90 |
| | 6.10 | 3 | 5 | 5 | SS-5 | 33.3% | | | |
| 274 | 7.62 | 3 | 4 | 7 | | W | | | |
| 272 | 9.14 | 3 | 5 | 8 | | W | | STIFF TO V. STIFF ORANGE AND BROWN MIC. F. V. SDY. SILT | 11.58 |
| 270 | 10.67 | 4 | 6 | 14 | SS-8 | 42.0% | | | |
| | 12.19 | 39 | 61/.08 | | | D/M | | SWR: TAN, ORANGE, GRAY AND BROWN WEATHERED BIOTITE-MICA GNEISS | |
| 268 | 13.72 | 100/.15 | | | | D | | | |
| 266 | 15.24 | 100/.06 | | | | D | | BORING TERMINATED AT ELEVATION 265.37m IN WEATHERED BIOTITE-MICA GNEISS | 15.30 |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-A | **BORING LOCATION** 10+61.9 | **OFFSET** 10.2m LT | **ALIGNMENT** -Y10 REV- / **0 HR.** 13.56 |
| **COLLAR ELEV.** 281.25 m | **NORTHING** | **EASTING** | **24 HR.** 7.68 |
| **TOTAL DEPTH** 20.58 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 12/30/98 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 281.25 | | | | | | | | | | |
| | | | | | | | | | 281.25 | 0.00 |
| | 0.40 | | | | | | | | 0.15m ASPHALT OVER 0.22m GRAVEL AND SAND | |
| | | 8 | 3 | 4 | 7 | | M | | 280.89 | 0.36 |
| 280 | 1.52 | | | | | | | | MED. STIFF RED SLI. MIC. V. CLY. CSE. TO F. V. SDY. SILT W/ TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL | |
| | | 6 | 8 | 12 | 20 | SS-41 | 25.6% | | 280.05 | 1.20 |
| | | | | | | | | | V. STIFF RED MIC. CLY. F. V. SDY. SILT-RESIDUAL | |
| | 3.05 | | | | | | | | 278.45 | 2.80 |
| 278 | | 4 | 6 | 8 | 14 | | M | | | |
| | 4.57 | | | | | | | | | |
| | | 4 | 5 | 8 | 13 | | M | | | |
| 276 | 6.10 | | | | | | | | | |
| | | 5 | 9 | 9 | 18 | | M | | MED. DENSE TO DENSE RED, TAN AND BROWN MIC. SL. CSE. TO F. SAND W/ ISOLATED ROCK FRAGS. | |
| 274 | 7.62 | | | | | | | | | |
| | | 5 | 6 | 8 | 14 | | M | | | |
| 272 | 9.14 | | | | | | | | | |
| | | 4 | 7 | 8 | 15 | | M | | | |
| | 10.67 | | | | | | | | | |
| | | 8 | 15 | 27 | 42 | SS-47 | 22.4% | | | |
| 270 | | | | | | | | | 269.75 | 11.50 |
| | 12.19 | | | | | | | | | |
| | | 20 | 45 | 55/.08 | 100+ | | M | | SWR: LIGHT BROWN W/ SOME WHITE WEATHERED BIOTITE-MICA GNEISS | |
| 268 | 13.72 | | | | | | | | | |
| | | 100/.11 | | | 100+ | | D | | | |
| | | | | | | | | | 266.45 | 14.80 |
| 266 | 15.24 | | | | | | | | HWR: LIGHT BROWN W/ SOME WHITE WEATHERED BIOTITE-MICA GNEISS | |
| | | 100/.02 | | | 100+ | | D | | | |
| | | | | | | | | | 265.05 | 16.20 |
| | 16.76 | | | | | | | | | |
| 264 | | 41 | 59/.09 | | 100+ | | D | | | |
| | 18.29 | | | | | | | | | |
| | | 100/.07 | | | 100+ | | D | | SWR: LIGHT BROWN W/ SOME WHITE WEATHERED BIOTITE-MICA GNEISS | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-A | **BORING LOCATION** 10+61.9 | **OFFSET** 10.2m LT | **ALIGNMENT** -Y10 REV- / **0 HR.** 13.56 |
| **COLLAR ELEV.** 281.25 m | **NORTHING** | **EASTING** | **24 HR.** 7.68 |
| **TOTAL DEPTH** 20.58 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 12/30/98 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 262.25 | | | | | Continued from previous page | | | | | |
| 262 | 19.81 | | | | | | | | | |
| | | 100/.07 | | | 100+ | | D | | 260.67 | 20.58 |
| | | | | | | | | | BORING TERMINATED AT ELEVATION 260.67m IN WEATHERED BIOTITE-MICA GNEISS | |
| 260 | | | | | | | | | | |
| 258 | | | | | | | | | | |
| 256 | | | | | | | | | | |
| 254 | | | | | | | | | | |
| 252 | | | | | | | | | | |
| 250 | | | | | | | | | | |
| 248 | | | | | | | | | | |
| 246 | | | | | | | | | | |
| 244 | | | | | | | | | | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-B | **BORING LOCATION** 10+67.7 | **OFFSET** 8.3m RT | **ALIGNMENT** -Y10 REV- | **0 HR.** 14.17 |
| **COLLAR ELEV.** 280.86 m | **NORTHING** | **EASTING** | **24 HR.** 7.28 |
| **TOTAL DEPTH** 21.36 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A./NQ-2 | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 12/30/98 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 280.86 | | | | | | | | | 280.86 — 0.00 |
| | 0.00 | 4 | 9 | 10 | 19 | SS-19 | 14.4% | | V. STIFF RED W/ BROWN SLI. MIC. V. CLY. CSE. TO F. V. SDY. SILT W/ GRAVEL AND TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL — 279.86 — 1.00 |
| 280 | 1.52 | 6 | 10 | 15 | 25 | | M | | V. STIFF RED MIC. CLY. F. V. SDY. SILT-RESIDUAL — 278.16 — 2.70 |
| 278 | 3.05 | 7 | 8 | 12 | 20 | | M | | |
| 276 | 4.57 | 3 | 6 | 8 | 14 | | M | | |
| 274 | 6.10 | 5 | 5 | 8 | 13 | SS-23 | 32.9% | | MED. DENSE TO DENSE RED, TAN, BROWN, AND GRAY MIC. SL. F. SAND W/ TRACES OF CLAY AND ISOLATED QUARTZ FRAGS. |
| 272 | 7.62 | 3 | 4 | 6 | 10 | | M | | |
| 270 | 9.14 | 3 | 6 | 8 | 14 | | M | | |
| 268 | 10.67 | 3 | 7 | 9 | 16 | | M/W | | |
| 266 | 12.19 | 12 | 15 | 23 | 38 | | M/W | | 267.76 — 13.10 |
| 264 | 13.72 | 15 | 35 | 65/.14 | 100+ | | | | SWR: LIGHT BROWN, TAN, AND ORANGE TO YELLOW WEATHERED BIOTITE-MICA GNEISS |
| | 15.24 | 68 | 32/.03 | | 100+ | | D/M | | |
| | 16.76 | | | | | | | | |
| | 17.04 | 100/.08 | | | 100+ 10/0 | | D | | 263.82 — 17.04 |
| | | 10/0 | | | | | | | HARD ROCK: WHITE AND GRAY, V. SLI. WEATHERED TO FRESH, SOUND, BIOTITE-MICA GNEISS |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-B | **BORING LOCATION** 10+67.7 | **OFFSET** 8.3m RT | **ALIGNMENT** -Y10 REV- | **0 HR.** 14.17 |
| **COLLAR ELEV.** 280.86 m | **NORTHING** | **EASTING** | **24 HR.** 7.28 |
| **TOTAL DEPTH** 21.36 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A./NQ-2 | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 12/30/98 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 261.86 | | | | | Continued from previous page | | | | 261.62 — 19.24 |
| 260 | | | | | | | | | 261.52 — 19.34 WHITE AND GRAY, V. SLI. WEATHERED, MOD. FRAC., BIOTITE-MICA GNEISS; WHITE AND GRAY, V. SLI. WEATHERED TO FRESH, SOUND, BIOTITE-MICA GNEISS — 259.50 — 21.36 |
| 258 | | | | | | | | | CORING TERMINATED AT ELEVATION 259.50m IN HARD ROCK: BIOTITE-MICA GNEISS |
| 256 | | | | | | | | | |
| 254 | | | | | | | | | |
| 252 | | | | | | | | | |
| 250 | | | | | | | | | |
| 248 | | | | | | | | | |
| 246 | | | | | | | | | |
| 244 | | | | | | | | | |

NCBMM3 98858 1/18/99

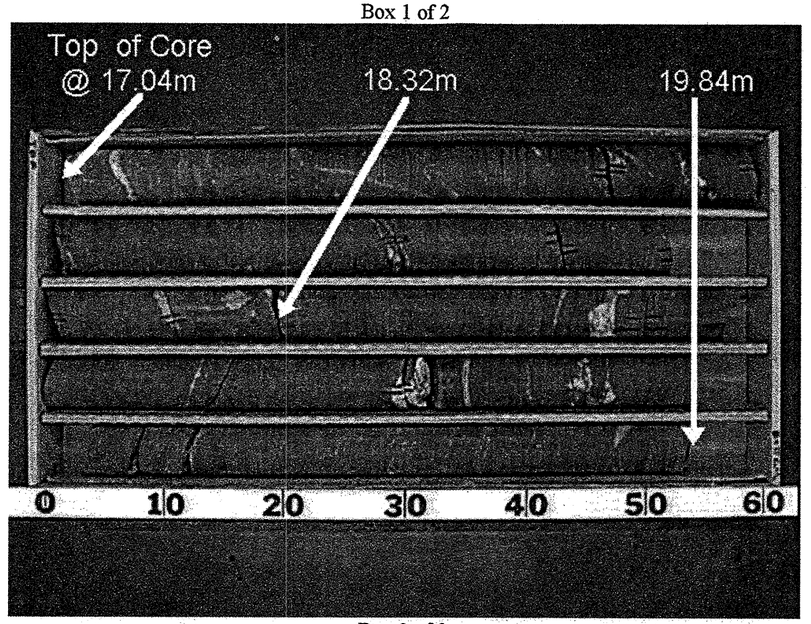
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT CORE BORING REPORT
PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC

PROJECT NO.: 6.499002T I.D. NO.: R-2413C COUNTY: ROCKINGHAM BORING NO: B1-B
SITE DESCRIPTION: BRIDGE ON -Y 10 REV- (NC 65) OVER -L REV- (US 220)
COLLAR ELEV.: 280.85M CORE SIZE: NQ-2 EQUIPMENT: B-57 PAGE 1 0F 2
DRILLER: D. BARRON GEOLOGIST: M. TAYLOR PERSONNEL: R. MIDDLETON
TOTAL DEPTH: 21.36M TOTAL RUN: 4.32 M DATE: 12/29/98

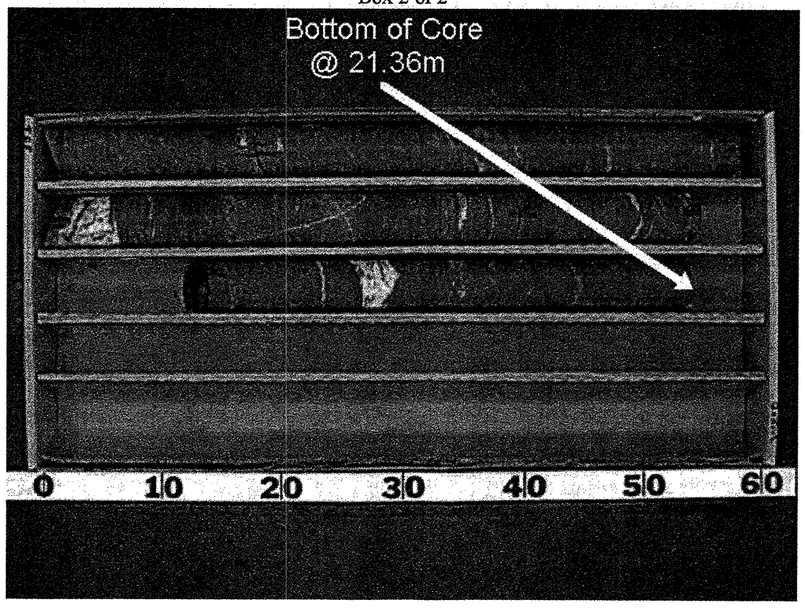
| ELEV. (M) | DEPTH (M) | DRILL RATE MN./30CM | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 263.82 | 17.04 | 3:47<br>4:21<br>3:51<br>4:15/.38 | 1.28 | 100%<br>1.28 | 100%<br>1.28 | RS-1<br>17.06-<br>17.21m | 17.04m to 19.24m: White and gray, v. sli. weathered to fresh, sound, moderately to v. sli. foliated, med. to f. grained, biotite-mica gneiss w/ isolated thin quartz veins.<br>No Natural Breaks<br>Strata REC=98% RQD=98% |
| 262.54 | 18.32 | | | | | | |
| 262.54 | 18.32 | 3:45<br>4:04<br>3:57<br>2:34<br>4:11/.32 | 1.52 | 95%<br>1.45 | 88%<br>1.33 | | 19.24 to 19.34: White and gray, v. sli. weathered, mod. frac., moderately foliated, med. to f. grained, biotite-mica gneiss<br>3 jts. @ 15° parallel to foliation<br>ADT=.001m ADS=.045m<br>Strata REC=90% RQD=0% |
| 261.02 | 19.84 | | | | | | |
| 261.02 | 19.84 | 2:47<br>2:58<br>3:13<br>3:07<br>2:59/.32 | 1.52 | 100%<br>1.52 | 100%<br>1.52 | | 19.34m to 21.36m: White and gray, v. sli. weathered to fresh, sound, moderately to v. sli. foliated, med. to f. grained, biotite-mica gneiss w/ isolated thin quartz veins.<br>No Natural Breaks<br>Strata REC=100% RQD=100% |
| 259.50 | 21.36 | | | | | | |

Boring B1-B
Scale = 1:5

Box 1 of 2




Box 2 of 2



ENGINEERING TECTONICS, P.A.
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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-A | **BORING LOCATION** 10+95.1 | **OFFSET** 6.3m LT | **ALIGNMENT** -Y10 REV- |
| **COLLAR ELEV.** 281.56 m | **NORTHING** | **EASTING** | |
| **TOTAL DEPTH** 16.84 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/29/98 | **COMPLETED** 1/5/99 | **SURFACE WATER DEPTH** | |

| GROUND WATER (m) | |
|---|---|
| 0 HR. | DRY |
| 24 HR. | 8.41 |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 281.56 | | | | | | | | | 281.56 0.00 |
| | 0.00 | 3 | 7 | 7 | 14 | | M | | STIFF RED SLI. MIC. CSE. TO F. V. SDY. V. CLY. SILT W/ TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL |
| | | | | | | | | | 280.16 1.40 |
| 280 | 1.52 | 5 | 8 | 11 | 19 | | M | | |
| | 3.05 | 5 | 10 | 11 | 21 | SS-33 | 28.7% | | |
| 278 | 4.57 | 4 | 7 | 11 | 18 | | M | | V. STIFF TO STIFF TAN, REDDISH ORANGE, AND BROWN MIC. CLY. TO SLI. CLY. F. V. SDY. SILT-RESIDUAL |
| 276 | 6.10 | 5 | 6 | 8 | 14 | | M | | |
| 274 | 7.62 | 3 | 5 | 7 | 12 | SS-36 | 44.4% | | |
| | 9.14 | 3 | 6 | 8 | 14 | | W | | 271.66 9.90 |
| 272 | 10.67 | 4 | 5 | 9 | 14 | SS-38 | 40.9% | | STIFF TO V. STIFF YELLOW, GRAY, AND LIGHT BROWN MIC. SLI. CLY. F. V. SDY. SILT W/ ISOLATED ROCK FRAGS. |
| 270 | 12.19 | 3 | 6 | 8 | 14 | | W | | |
| 268 | 13.72 | 8 | 13 | 15 | 28 | | M | | 266.76 14.80 |
| 266 | 15.24 | 26 | 74/.10 | | 100+ | | M | | SWR: GRAY AND LIGHT BROWN WEATHERED BIOTITE-MICA GNEISS |
| | 16.76 | 100/.08 | | | 100+ | | D | | 264.72 16.84 |
| 264 | | | | | | | | | BORING TERMINATED AT ELEVATION 264.72m IN WEATHERED BIOTITE-MICA GNEISS |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** ROCKINGHAM | **GEOLOGIST** MATT TAYLOR |
| **SITE DESCRIPTION** BRIDGE ON NC 65 (-Y10 REV-) OVER US 220 (-L REV-) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-B | **BORING LOCATION** 10+99.6 | **OFFSET** 8.3m RT | **ALIGNMENT** -Y10 REV- |
| **COLLAR ELEV.** 280.96 m | **NORTHING** | **EASTING** | |
| **TOTAL DEPTH** 17.00 m | **DRILL MACHINE** B-57 | **DRILL METHOD** 8.26cm H.S.A. | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 12/30/98 | **COMPLETED** 1/4/99 | **SURFACE WATER DEPTH** | |

| GROUND WATER (m) | |
|---|---|
| 0 HR. | 11.43 |
| 24 HR. | 7.82 |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 280.96 | | | | | | | | | 280.96 0.00 |
| | 0.00 | 3 | 3 | 4 | 7 | SS-10 | 23.4% | | MED. STIFF RED. SLI. MIC. CSE. TO F. V. SDY. V. CLY. SILT W/ TRACES OF ORGANICS (TOPSOIL AND ROOTS)-FILL |
| 280 | 1.52 | 7 | 9 | 11 | 20 | SS-11 | 23.7% | | 279.66 1.30 |
| 278 | 3.05 | 6 | 7 | 11 | 18 | | M | | V. STIFF RED AND TAN BROWN W/ GRAY MIC. CLY. TO SLI. CLY. CSE. TO F. V. SDY. SILT-RESIDUAL |
| 276 | 4.57 | 5 | 7 | 8 | 15 | | M | | |
| 274 | 6.10 | 5 | 6 | 9 | 15 | | M | | 274.06 6.90 |
| | 7.62 | 4 | 5 | 6 | 11 | SS-15 | | | MOISTURE = 39.6% |
| 272 | 9.14 | 4 | 6 | 8 | 14 | | W | | |
| 270 | 10.67 | 4 | 6 | 8 | 14 | | W | | MED. DENSE TO V. DENSE TAN AND BROWN MIC. SL. F. SAND W/ TRACES OF CLAY |
| 268 | 12.19 | 4 | 7 | 12 | 19 | | W | | |
| | 13.72 | 9 | 15 | 24 | 39 | | M | | |
| 266 | 15.24 | 12 | 22 | 47 | 69 | | M | | 264.76 16.20 |
| | 16.76 | 43 | 57/.09 | | 100+ | | M | | SWR: TAN AND ORANGE WEATHERED BIOTITE-MICA GNEISS |
| 264 | | | | | | | | | 263.96 17.00 |
| | | | | | | | | | BORING TERMINATED AT ELEVATION 263.96m IN WEATHERED BIOTITE-MICA GNEISS |

NCBMM3 98858 1/18/99

## TABLE 1

## SUMMARY OF LABORATORY TEST DATA

| BORING NO. | SAMPLE DEPTH (METERS) | SAMPLE TYPE & NO. | NATURAL MOISTURE CONTENT | AASHTO CLASS. | N (BLOWS/ 0.30m | ATTERBERG LIMITS | | | GRADATION RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L.L. | P.L. | P.I. | PASS #10 SIEVE(%) | PASS#40 SIEVE(%) | PASS#200 SIEVE(%) | COARSE SAND(%) | FINE SAND(%) | SILT (%) | CLAY (%) |
| EB1-A | 0.48-0.93 | SS-54 | 35.8% | A-7-5 (9) | 12 | 48 | 35 | 13 | 95.1 | 91.2 | 67.8 | 8.8 | 23.4 | 24.0 | 43.8 |
| EB1-A | 1.52-1.97 | SS-55 | 32.7% | A-5 (0) | 19 | 48 | NP | NP | 99.7 | 98.6 | 49.7 | 1.4 | 48.9 | 29.8 | 19.9 |
| EB1-A | 4.57-5.02 | SS-57 | 21.8% | A-2-4 (0) | 12 | 34 | NP | NP | 99.5 | 96.3 | 30.0 | 3.7 | 66.3 | 28.0 | 2.0 |
| EB1-B | 6.10-6.55 | SS-5 | 33.3% | A-2-4 (0) | 10 | 31 | NP | NP | 99.3 | 98.1 | 35.1 | 1.9 | 62.9 | 35.2 | 0.0 |
| EB1-B | 10.67-11.12 | SS-8 | 42.0% | A-4 (0) | 20 | 39 | NP | NP | 98.8 | 97.6 | 36.6 | 2.4 | 61.0 | 36.6 | 0.0 |
| B1-A | 1.52-1.97 | SS-41 | 25.6% | A-5 (0) | 20 | 47 | NP | NP | 97.3 | 96.4 | 43.2 | 3.6 | 53.1 | 35.5 | 7.8 |
| B1-A | 10.67-11.12 | SS-47 | 22.4% | A-2-4 (0) | 42 | 30 | NP | NP | 94.0 | 90.6 | 29.2 | 9.4 | 61.4 | 29.2 | 0.0 |
| B1-B | 0.00-0.45 | SS-19 | 14.4% | A-4 (0) | 19 | 26 | 23 | 3 | 79.8 | 71.0 | 38.1 | 29.0 | 32.9 | 16.5 | 21.6 |
| B1-B | 6.10-6.55 | SS-23 | 32.9% | A-2-5 (0) | 13 | 43 | NP | NP | 97.7 | 95.3 | 34.4 | 4.7 | 60.9 | 28.5 | 5.9 |
| EB2-A | 3.05-3.50 | SS-33 | 28.7% | A-5 (0) | 21 | 45 | NP | NP | 99.4 | 98.3 | 42.9 | 1.7 | 55.4 | 31.0 | 11.9 |
| EB2-A | 7.62-8.07 | SS-36 | 44.4% | A-5 (0) | 12 | 42 | NP | NP | 99.6 | 98.4 | 51.0 | 1.6 | 47.3 | 43.1 | 8.0 |
| EB2-A | 10.67-11.12 | SS-38 | 40.9% | A-4 (0) | 14 | 40 | NP | NP | 98.4 | 96.5 | 42.0 | 3.5 | 54.6 | 36.0 | 5.9 |
| EB2-B | 0.00-0.45 | SS-10 | 23.4% | A-4 (4) | 7 | 34 | 25 | 9 | 98.8 | 94.2 | 62.0 | 5.8 | 32.2 | 22.5 | 39.5 |
| EB2-B | 1.52-1.97 | SS-11 | 23.7% | A-5 (0) | 20 | 45 | NP | NP | 97.6 | 94.6 | 47.6 | 5.4 | 47.0 | 30.0 | 17.6 |
| EB2-B | 7.62-8.07 | SS-15 | 39.6% | A-2-4(0) | 11 | 36 | NP | NP | 99.5 | 97.6 | 21.9 | 2.4 | 75.6 | 20.0 | 2.0 |

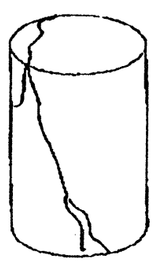
**UNCONFINED COMPRESSION WITH YOUNG'S MODULUS**
**(ASTM D2938 and D3148)**

**PROJECT:** Bridge on NC 65 over US 220

**Hole #:** B1-B
**Depth, m.:** 17.04
**Specimen diameter, cm.:** 5.04
**Sample #:** RS-1

**Moisture Content, %:** 0.09
**Total Unit Weight, kg/m³:** 2750
**Length, cm.:** 7.42
**L/D Ratio :** 1.47
**Loading Rate, KN/min.:** 13.34

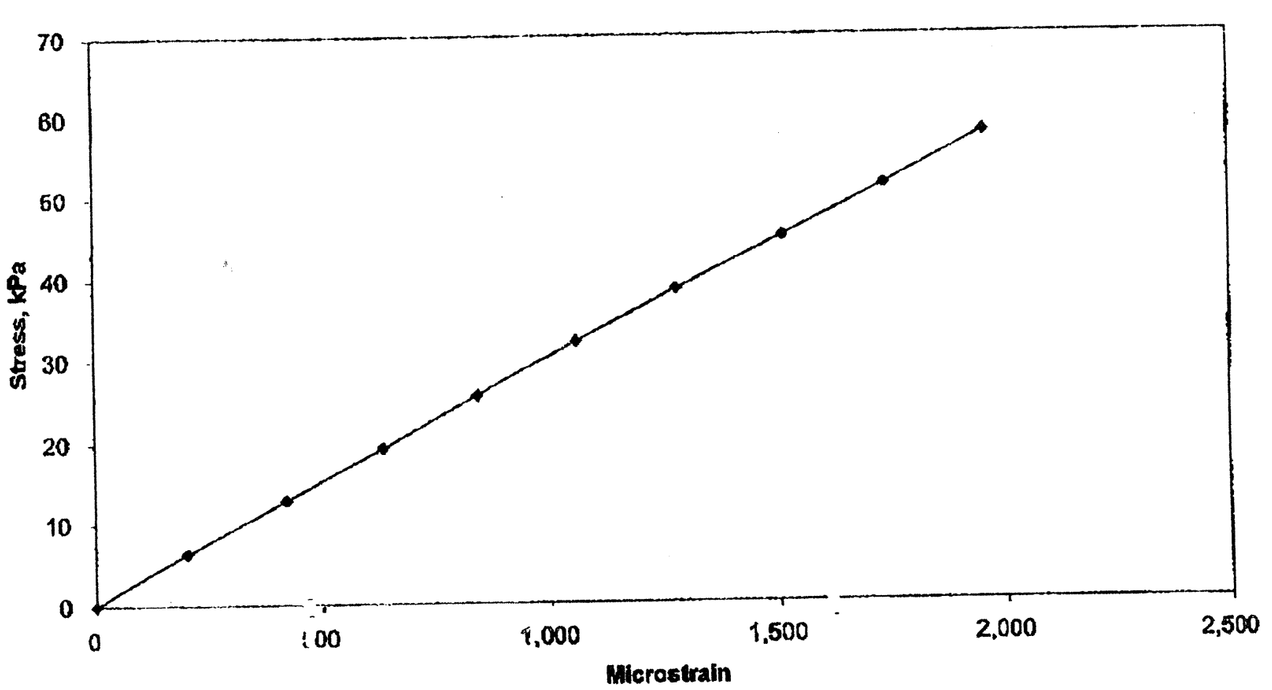
**Job No.:** 98-858
**Date:** 1/19/98
**Tested by:** WDT, JBB
**Reviewed by:** JBP

| Data Point | Microstrain (axial) | Load (KN) | Corrected Stress ($10^3$ kPa) | Secant Modulus x $10^6$ (kPa) | Remarks Failure |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 |  |
| 2 | 210 | 13.34 | 6.42 | 30.57 | |
| 3 | 425 | 26.69 | 12.84 | 30.22 | |
| 4 | 636 | 40.03 | 19.26 | 30.29 | |
| 5 | 849 | 53.38 | 25.69 | 30.25 | |
| 6 | 1,061 | 66.72 | 32.11 | 30.26 | |
| 7 | 1,284 | 80.07 | 38.53 | 30.01 | |
| 8 | 1,517 | 93.41 | 44.95 | 29.63 | |
| 9 | 1,740 | 106.76 | 51.37 | 29.52 | |
| 10 | 1,959 | 120.10 | 57.79 | 29.50 | |
| 11 | | 133.76 | 64.36 | | Failure |

NOTE: Compressive strength was corrected since an L/D ratio of 2 could not be obtained.

JOB NAME: Bridge on NC 65
TIP NUMBER: R-2413C
JOB NUMBER: 6.499002T
JOB LOCATION: Rockingham Co.
SAMPLE NUMBER: RS-1
SAMPLE LOCATION: B1-B
DEPTH: 17.04 m.

**Stress vs. Microstrain**



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

E. NORRIS TOLSON
SECRETARY

August 25, 1998

| | |
|---|---|
| STATE PROJECT: | 6.499002T (R-2413C) |
| FEDERAL PROJECT: | N/A |
| COUNTY: | Guilford and Rockingham |
| DESCRIPTION: | NC 68 Connector - US 220 from South of Haw River to the Intersection of US 220 and Existing NC 68 |
| SUBJECT: | Geotechnical Report - Structure #9 Culvert Investigation |

At your request, the Geotechnical Unit has performed detailed mapping and surveying for Structure #9. The attached Test Site Plan shows the location of profiles, cross sections, borings and rod soundings. The specific boring locations requested could not be accessed by our drill machines. Hand auger borings and rod soundings were advance to the depth of hard rock. Subsurface profiles are provided for the east and west side of the existing culvert.

On the west side of the existing culvert, a thin layer of alluvial sand overlies hard rock (granite) in the channel. The proposed culvert will intersect the existing channel bank. The channel bank is composed of loose alluvial sand (A-2-4). The sand on the bank is up to 1 meter in thickness and it overlies hard rock (granite).

On the east side of the existing culvert, hard rock (granite) is exposed in the channel. The granite is massive, dips toward the south, and has an irregular surface. The rock surface is depicted on the profile. Two sections, across the channel, are provided at locations where the rock surface is irregular.

Based on our findings, no problems are anticipated for a rock floor culvert. The rock will provide an adequate foundation for strip footings. If we may be of further assistance, please advise.

Sincerely,

Robin R Held

Robin R. Held
Project Geologist

# NORTH CAROLINA DIVISION OF HIGHWAYS

## GEOTECHNICAL UNIT

## SOIL AND ROCK CLASSIFICATION, LEGEND, AND ABBREVIATIONS

6.499002T R-2413C
STRUCTURE #9
SHEET 1 OF 5

### SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP CLASS. | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 | A-1,A-2 A-3 | A-4,A-5 A-6,A-7 | |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5 A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | | | |
| % PASSING #10 | 50 MX | | | | | | | | | | | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| #40 | 30 MX | 50 MX | 51 MN | | | | | | | | | | | |
| #200 | 15 MX | 25 MX | 10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | | | |
| (PASSING #40) LL | | | | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| PI | 6 MX | | N.P. | 10 MX | 10 MX | 11 MN | 11 MN | 10 MX | 10 MX | 11 MN | 11 MN | | | |
| GROUP INDEX | 0 | | 0 | 0 | | 4 MX | | 8 MX | 12 MX | 16 MX | NO MX | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. GRAVEL & SAND | | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | | SILTY SOILS | | CLAYEY SOILS | | | | |

* PI OF A-7-5 ≤ (LL-30); PI OF A-7-6 > (LL-30)

### TEXTURE OR GRAIN SIZE

| BOULDER | COBBLE | GRAVEL | COARSE SAND | MED. SAND | FINE SAND | SILT | CLAY |
|---|---|---|---|---|---|---|---|

GRAIN SIZE (mm): 305 | 75 | 2 | 0.6 | 0.425 | 0.2 | 0.075 | 0.005
GRAIN SIZE (IN): 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### ROCK DESCRIPTION

IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED TO BE THAT INDURATED EARTH MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF 'WEATHERED ROCK'. FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:

| TERM | SYMBOLS | | DESCRIPTION |
|---|---|---|---|
| HARD ROCK (HR) | CORED ROCK | INFERRED ROCK LINE [2] | MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE |
| WEATHERED ROCK (WR) | | HARD WEATHERED ROCK (HWR) | MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL [1] |
| | | SOFT WEATHERED ROCK (SWR) | MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL |

[1] SPT REFUSAL ≤ 2.5 cm OF PENETRATION PER 50 BLOWS IN SPT.
[2] AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED.
A DESCRIPTION OF ROCK IS GIVEN, INCLUDING:

CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

ROCK QUALITY DESIGNATION (RQD) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO 10 cm DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N - VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH (qu) (kN / m²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>> 400 |

### GROUND WATER

- WATER LEVEL IN BORE HOLE — IMMEDIATELY AFTER DRILLING (I.A.D.) / SOON AFTER DRILLING (▽ 0 HRS.)
- STATIC WATER LEVEL (AFTER 24 HRS.)
- PERCHED WATER (PW), SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEPAGE

### MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 25° STRIKE AND DIP
- APPARENT DIP (NORMAL TO _____ )
- ROD SOUNDING
- SPT DPT VST TEST BORING
- AUGER BORING
- CORE BORING
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- MONITORING WELL

SAMPLE DESIGNATIONS
S-BULK SAMPLE
SS-SPLIT SPOON SAMPLE
ST-SHELBY TUBE SAMPLE

### ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| AR | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| CALC. | CALCAREOUS | NS | NO SAMPLE TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | P.P. | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
| GR. | GRAVEL | SPT | STANDARD PENETRATION TEST |
| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
| GW | GROUND WATER | VST | VANE SHEAR TEST |
| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

BENCH MARK: #15-B PAINTED S.W. CORNER OF EXISTING RCBC. ELEV. = 254.004m

STATE PROJECT NO. 6.499002T
T.I.P. NO. R-2413C F.A. NO. N/A
COUNTY GUILFORD & ROCKINGHAM ROUTE US 220
SITE DESCRIPTION STRUCTURE #9 AT -L- REV 57+41.5

PROJECT GEOLOGIST R.R. HELD SUBMITTED BY R.S. JOHNSON
PERSONNEL A.L. SMITH
E.C. CAMPBELL
S.W. MILLER
DATE SUBMITTED 8/98

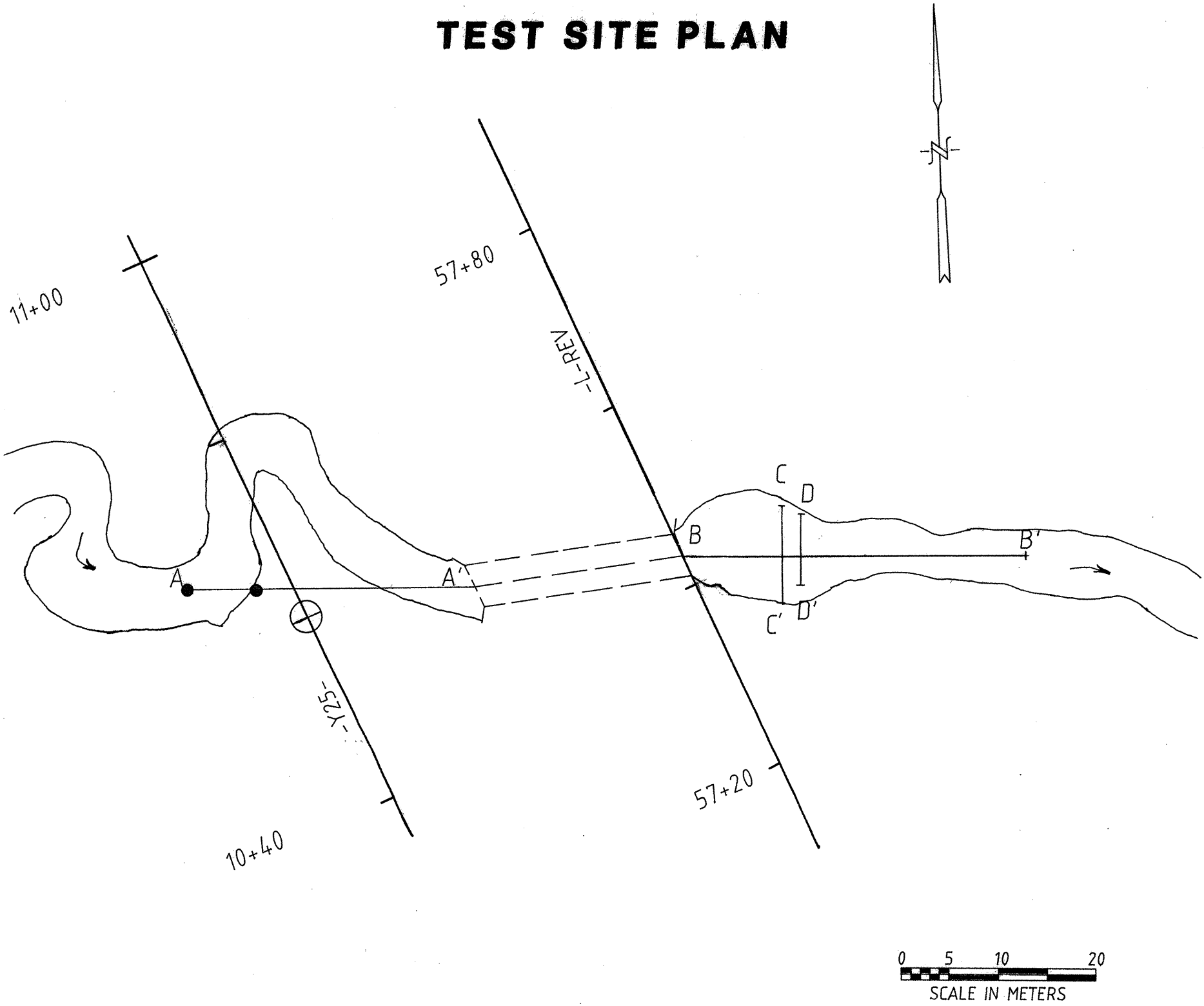
NORTH CAROLINA LICENSED SEAL 604 GEOLOGIST RICHARD S. JOHNSON

SEAL

Richard S. Johnson
Signature

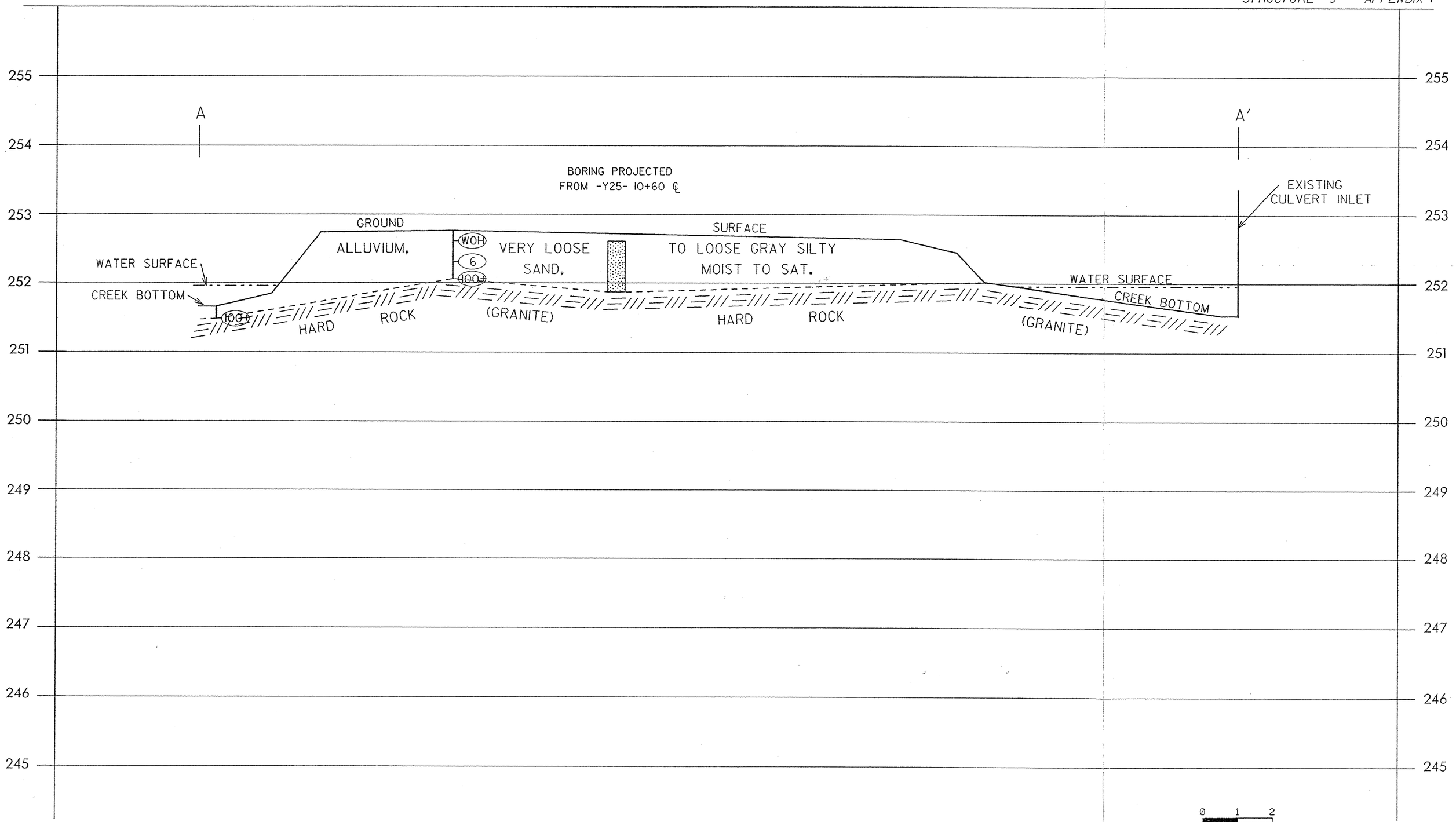
# TEST SITE PLAN

6.499002T R-2413C
STRUCTURE #9
SHEET 2 OF 5



# PROFILE THROUGH A – A′





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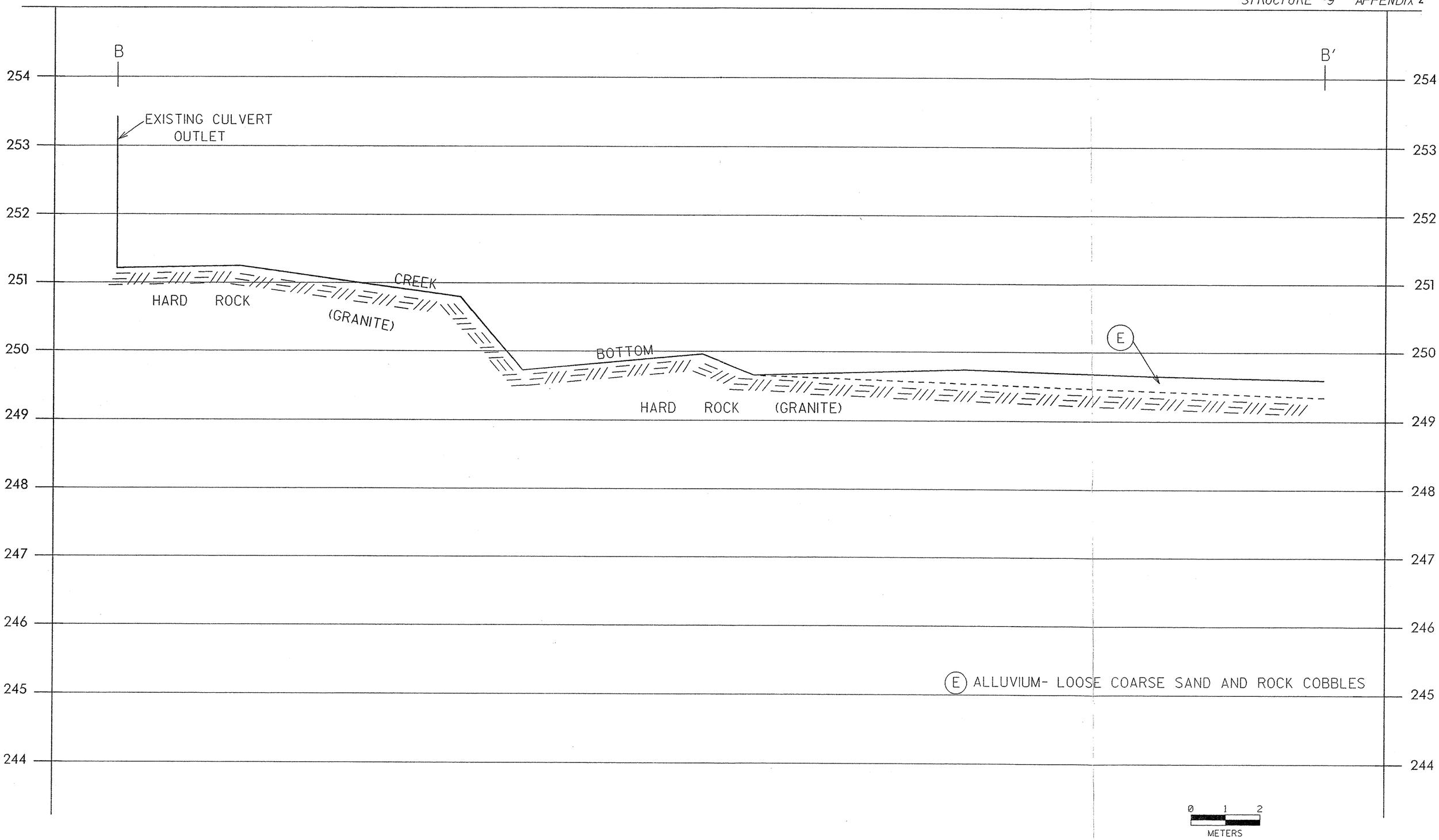

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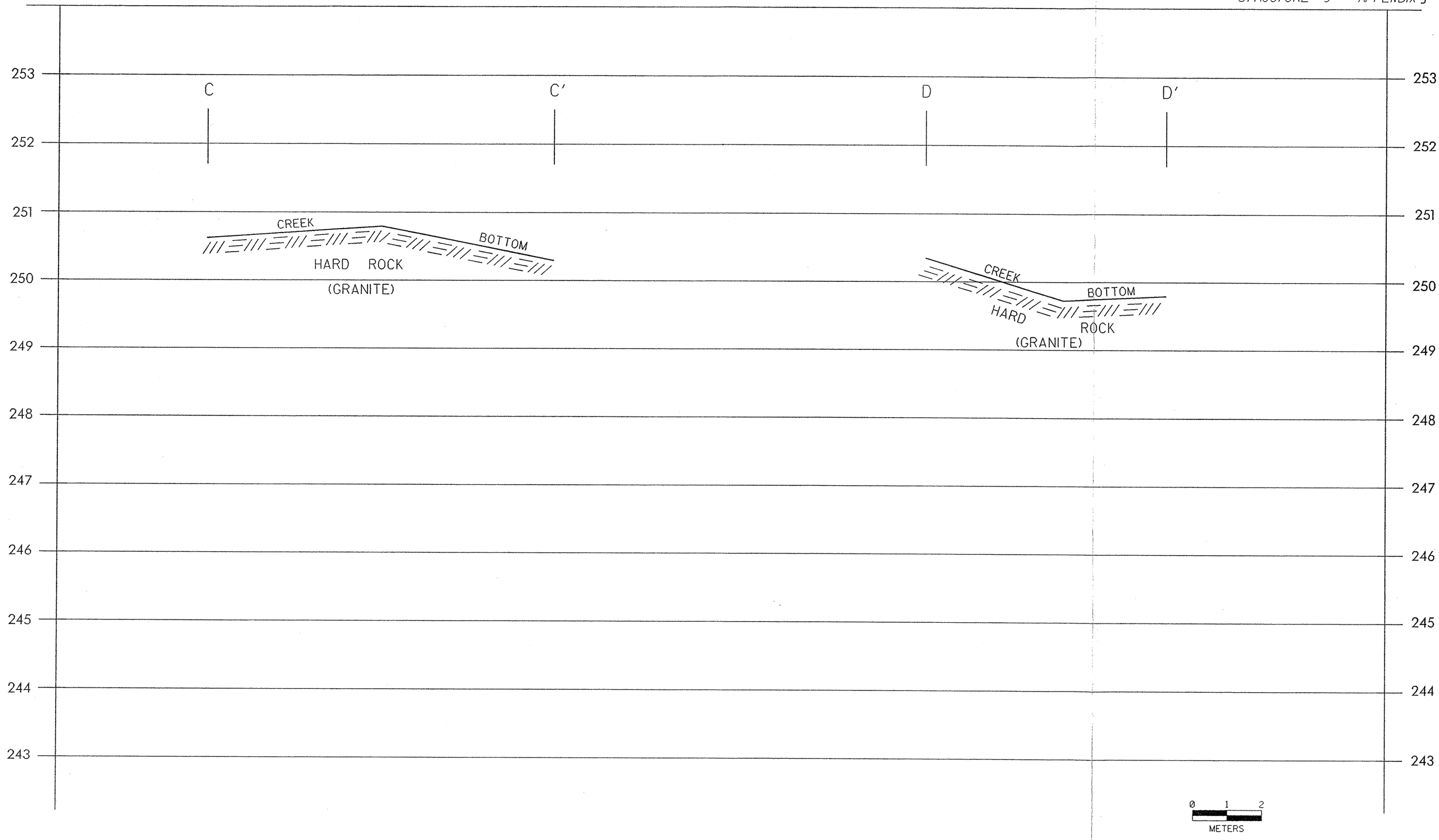

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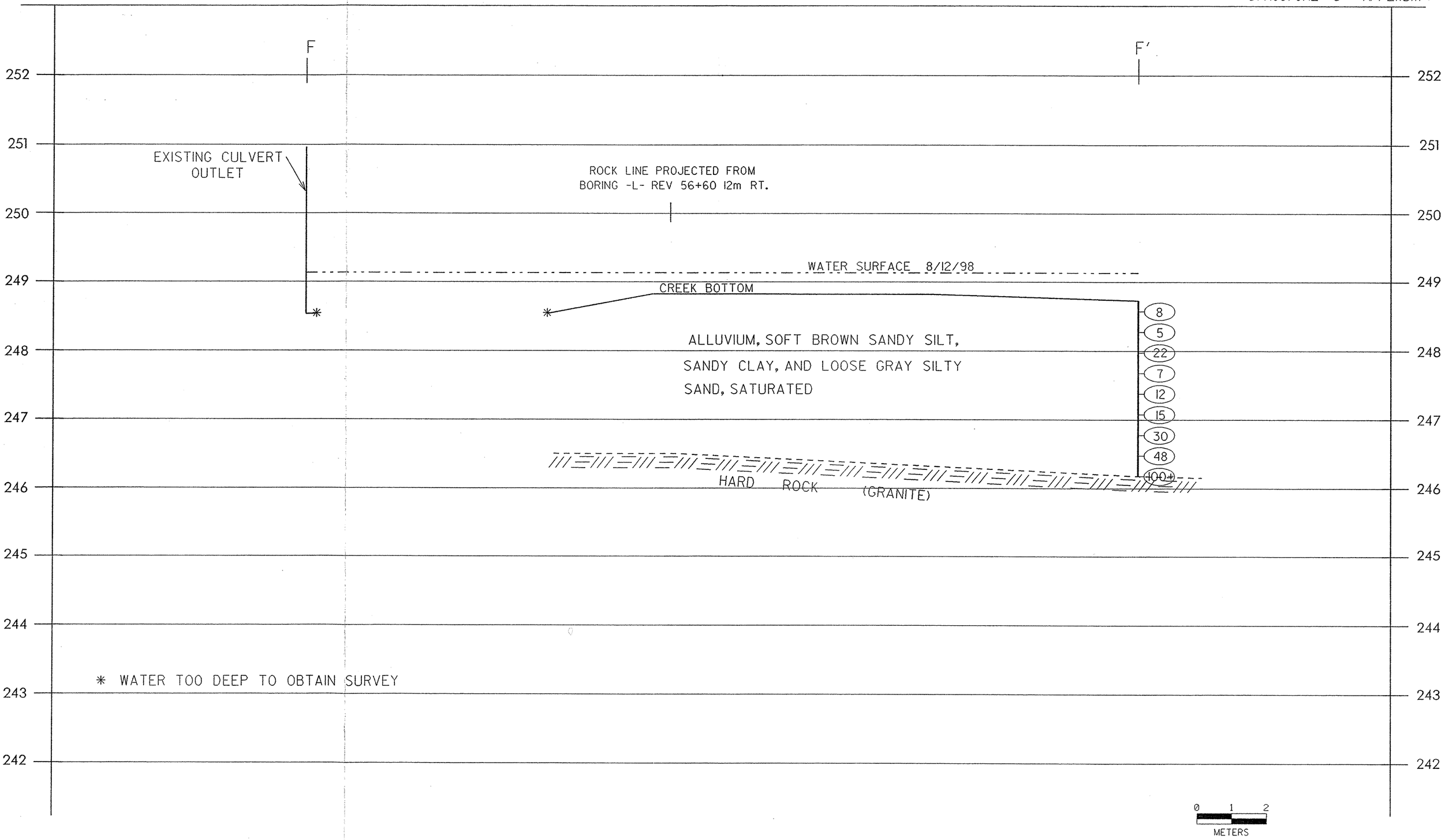

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201, RALEIGH, N.C. 27611-5201

JAMES B. HUNT JR.
GOVERNOR

E. NORRIS TOLSON
SECRETARY

August 25, 1998

STATE PROJECT: 6.499002T (R-2413C)
FEDERAL PROJECT: N/A
COUNTY: Guilford and Rockingham

DESCRIPTION: NC 68 Connector - US 220 from South of Haw River to the Intersection of US 220 and Existing NC 68

SUBJECT: Geotechnical Report - Structure #8 Culvert Investigation

At your request, the Geotechnical Unit has performed detailed mapping and surveying for Structure #8. The attached Test Site Plan shows the location of profiles, borings and rod soundings. The specific boring locations requested could not be accessed by our drill machines. Hand auger borings and rod soundings were utilized to depict subsurface conditions. Subsurface profiles or sections are provided for the east and west side of the existing culvert.

No hard rock outcrops are present at Structure #8. In the existing channel, up to 2.5 meters of alluvial sand (A-2-4) overlie hard rock (granite). We were unable to obtain information at the inlet and outlet of the existing culvert. Scour has resulted in deep water conditions at these locations. The channel banks consist of up to 3 meters of alluvial sandy silt (A-4), sandy clay (A-6) and silty sand (A-2-4). The underlying rock (granite) dips toward the south.

Based on our findings, a floorless culvert is <u>not</u> recommended at this site. As proposed, the culvert floor will be constructed on alluvial sand. The loose to medium dense alluvial sand will provide adequate support for the proposed culvert. The use of sheet piles for construction will likely be required.

If we may be of further assistance, please advise.

Sincerely,

Robin R. Held

Robin R. Held
Project Geologist

Environmental
Geotechnical
Construction
Consulting • Engineering • Testing

# GEOTECHNICAL EVALUATION – BRIDGE FOUNDATION

**NCDOT PROJECT NO.: 6.499002T**
**TIP NO.: R-2413C**
**F.A. NO.: N/A**
**COUNTY: GUILFORD-ROCKINGHAM**
**DESCRIPTION: SOUTH BOUND US 220 RAMP (STA. 16+77)**

Let

**PREPARED FOR:**

*Mr. Don Moore, L.G.*
*NCDOT – Geotechnical Unit*
*Post Office Box 25201*
*Raleigh, NC 27611-5201*

**PSI Project 460-75107-2**

*Information To Build On*

**psi** Environmental Geotechnical Construction
Consulting • Engineering • Testing

December 2, 1997

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DEC 3 199
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT

Mr. Don Moore, L.G.
Consultant Coordinator - Geotechnical Unit
State of North Carolina Department of Transportation
Post Office Box 25201
Raleigh, North Carolina 27611-5201

Reference: Geotechnical Evaluation
NCDOT Project No.: 6.499002T
TIP No.: R-2413C
F.A. No.: N/A
County: Guilford - Rockingham
Description: South Bound US 220 Ramp
(Sta. 16+77)
PSI File: 460-75107-2

Dear Mr. Moore:

As requested, Professional Service Industries, Inc. has conducted geotechnical evaluation at the referenced site. The accompanying report presents the results of our investigation and our recommendations concerning geotechnical-related design for the project.

Often, because of design and construction details which occur on a project, questions arise concerning soil conditions, and we would be pleased to continue our role as geotechnical engineers during the project implementation.

Very truly yours,
**PSI**

Andrew O. Steege
Staff Geologist

NORTH CAROLINA PROFESSIONAL SEAL 17577 ENGINEER ENRIQUE ALBERTO BLAT

Enrique A. Blat, P.E.
Department Manager

12/2/97

Harold D. Pruitt, P.E.
Chief Engineer

AOS:EAB:HDP/cms

*Information To Build On*

# GEOTECHNICAL EVALUATION

NCDOT PROJECT NO.: 6.499002T
TIP NO.: R-2413C
F.A. NO.: N/A
COUNTY: GUILFORD - ROCKINGHAM
DESCRIPTION: SOUTH BOUND US 220 RAMP
(STA. 16+77)
SUBJECT: GEOTECHNICAL EVALUATION - BRIDGE FOUNDATION

Prepared for:

NCDOT - GEOTECHNICAL UNIT
PO BOX 25201
RALEIGH, NORTH CAROLINA 27611-5201

Prepared by:

PROFESSIONAL SERVICE INDUSTRIES, INC.
5035-A WEST W.T. HARRIS BLVD.
CHARLOTTE, NORTH CAROLINA 28269

December 2, 1997

PSI FILE: 460-75107-2

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## APPENDIX

## TABLE OF CONTENTS


I. NCDOT Geotechnical Unit Soil & Rock Classification Sheet

II. USGS Topographic Map

III. Site Plan

IV. Profile and Cross Sections

V. Boring Logs and Coring Logs

VI. Photographs of Site

VII. Laboratory Test Results

# APPENDIX 1

## NCDOT Geotechnical Unit Soil & Rock Classification Sheet

NORTH CAROLINA DIVISION OF HIGHWAYS

# GEOTECHNICAL UNIT

# SOIL AND ROCK CLASSIFICATION, LEGEND, AND ABBREVIATIONS

## SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP CLASS. | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 | A-1,A-2 A-3 | A-4,A-5 A-6,A-7 | |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5 A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | | | |
| % PASSING #10 | 50 MX | | | | | | | | | | | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| #40 | 30 MX | 50 MX | 51 MN | | | | | | | | | | | |
| #200 | 15 MX | 25 MX | 10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | | | |
| (PASSING #40) LL | | | | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| PI | 6 MX | | N.P. | 10 MX | 10 MX | 11 MN | 11 MN | 10 MX | 10 MX | 11 MN | 11 MN | | | |
| GROUP INDEX | 0 | | 0 | 0 | | 4 MX | | 8 MX | 12 MX | 16 MX | NO MX | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. GRAVEL & SAND | | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | | SILTY SOILS | | CLAYEY SOILS | | | | |

• PI OF A-7-5 ≤ (LL-30); PI OF A-7-6 > (LL-30)

## TEXTURE OR GRAIN SIZE

| BOULDER | COBBLE | GRAVEL | COARSE SAND | MED. SAND | FINE SAND | SILT | CLAY |
|---|---|---|---|---|---|---|---|

| GRAIN SIZE | (mm) | 305 | 75 | 2 | 0.6 | 0.425 | 0.2 | 0.075 | 0.005 |
|---|---|---|---|---|---|---|---|---|---|
| | (IN) | 12 | 3 | | | | | | |

## SOIL MOISTURE - CORRELATION OF TERMS

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

## ROCK DESCRIPTION

IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED TO BE THAT INDURATED EARTH MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF 'WEATHERED ROCK'. FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:

| TERM | SYMBOLS | | DESCRIPTION |
|---|---|---|---|
| HARD ROCK (HR) | CORED ROCK | INFERRED ROCK LINE [2] | MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE |
| WEATHERED ROCK (WR) | | HARD WEATHERED ROCK (HWR) | MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL [1] |
| | | SOFT WEATHERED ROCK (SWR) | MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL |

[1] SPT REFUSAL ≤ 2.5 cm OF PENETRATION PER 50 BLOWS IN SPT.

[2] AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED.

A DESCRIPTION OF ROCK IS GIVEN, INCLUDING:

CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

ROCK QUALITY DESIGNATION (RQD) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO 10 cm DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

NORTH CAROLINA PROFESSIONAL SEAL 17577 ENGINEER ENRIQUE ALBERTO BLAT

12/2/97

SEAL

Enrique A. Blat

Signature

## CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N - VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($q_u$) (kN / m²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>> 400 |

## GROUND WATER

- WATER LEVEL IN BORE HOLE — IMMEDIATELY AFTER DRILLING (I.A.D.) / SOON AFTER DRILLING (▽ 0 HRS.)
- STATIC WATER LEVEL (AFTER 24 HRS.)
- PERCHED WATER (PW), SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEPAGE

## MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 25° STRIKE AND DIP
- APPARENT DIP (NORMAL TO _____ )
- ROD SOUNDING
- SPT DPT VST TEST BORING
- AUGER BORING
- CORE BORING
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- MONITORING WELL

SAMPLE DESIGNATIONS

- S-BULK SAMPLE
- SS-SPLIT SPOON SAMPLE
- ST-SHELBY TUBE SAMPLE

## ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| AR | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| CALC. | CALCAREOUS | NS | NO SAMPLE TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | P.P. | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
| GR. | GRAVEL | SPT | STANDARD PENETRATION TEST |
| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
| GW | GROUND WATER | VST | VANE SHEAR TEST |
| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

BENCH MARK: BM #4 R.R. spike 20.6m RT of -L- Sta. 19+13m, Elev. 253.561m.

STATE PROJECT NO. 6.499002T

T.I.P. NO. R-2413C F.A. NO. N/A

COUNTY Guilford-Rockingham ROUTE US 220

SITE DESCRIPTION South Bound US 220 Ramp (Sta. 16+77)

PROJECT GEOLOGIST A. Steege SUBMITTED BY A. Steege, E. Blat, PE, H. Pruitt, PE

PERSONNEL A. Steege, E. Blat, PE, K. Deaton, K. Islam, C. Scholz

DATE SUBMITTED 12/2/97

# LEGEND SUPPLEMENT

In addition to the terms and abbreviations listed on the Legend Sheet, the following will be used to further describe rock quality on this project. Because of limited space on the logs, abbreviations are in parenthesis.

## WEATHERING

| | |
|---|---|
| Fresh | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| Very Slight (V.SLI.) | Rock generally fresh, joints stained, some joints may show thin clay coatings if open, crystals on a broken specimen face shine brightly. Rock rings under hammer blows if of a crystalline nature. |
| Slight (SLI.) | Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in.). 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 show 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 & can be excavated with geologist's pick. Rock gives "clunk" sound when struck. **Comparable to hard weathered rock** |
| Severe (SEV.) | All rocks 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. **Comparable to soft weathered rock** |
| 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. **Comparable to soil** |
| Complete | Rock reduced to soil. Rock fabric not discernible only in small and scattered concentrations. Quartz may be present as dikes or stringers. Saprolite is also an example. **Comparable to soil** |

## ROCK CONTINUITY

| | |
|---|---|
| Sound - | Core pieces larger than 200 mm |
| Slightly Fractured (SLI.FRAC.) - | Core pieces between 100 mm and 200 mm |
| Moderately Fractured (MOD.FRAC.) - | Core pieces between 25 mm and 100 mm |
| Extremely Fractured (EXT.FRAC.) - | Core pieces less than 25 mm |

## JOINT SPACING

Average Discontinuity Spacing (ADS)
The average measured distance (in centimeters) between joints in the same set. Will not apply to individual joints.

## JOINT THICKNESS

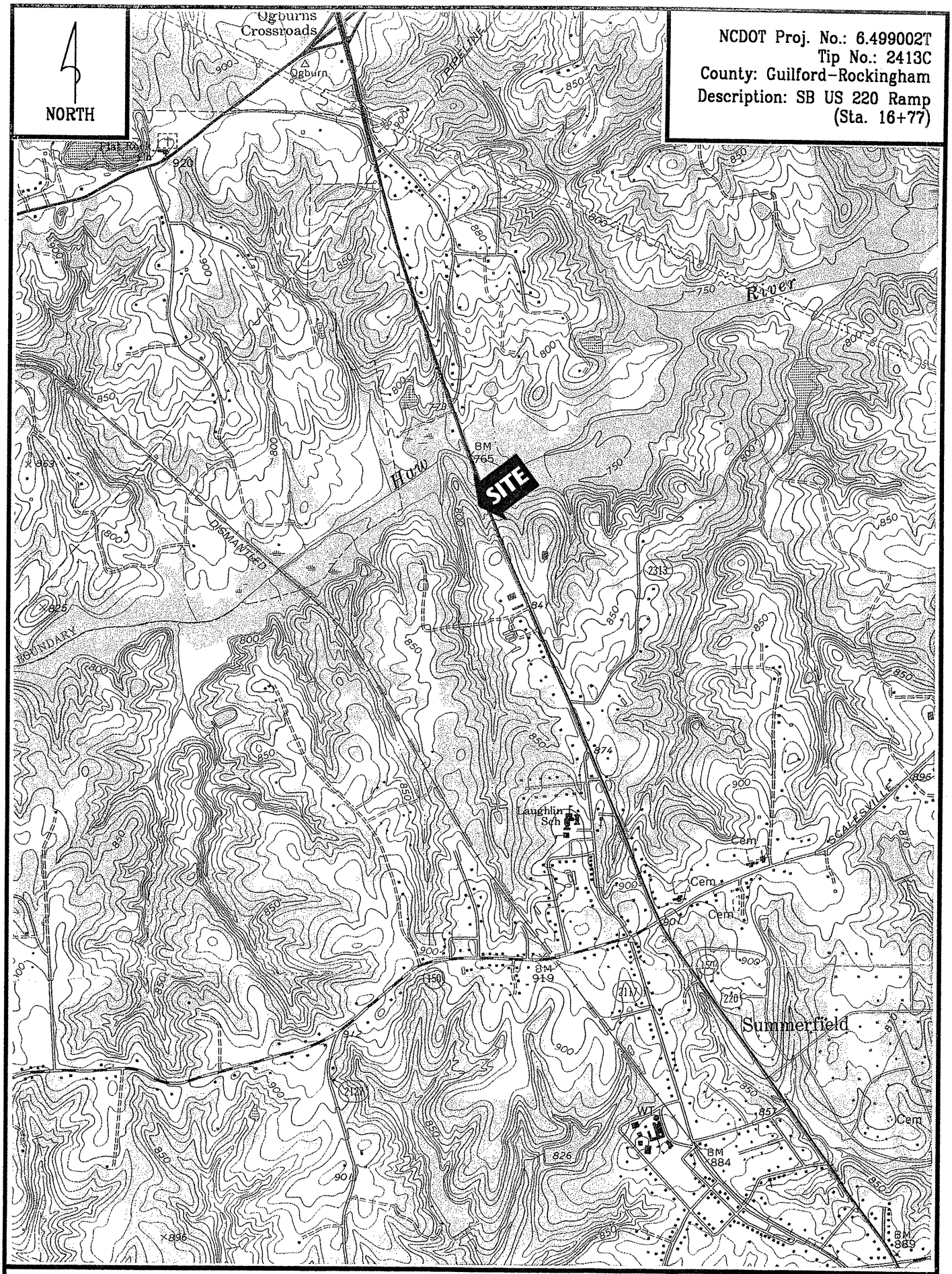
Average Discontinuity Thickness (ADT)
The average thickness or width of gap in the joint.

# APPENDIX II

USGS Topographic Map

NORTH

NCDOT Proj. No.: 6.499002T
Tip No.: 2413C
County: Guilford-Rockingham
Description: SB US 220 Ramp
(Sta. 16+77)



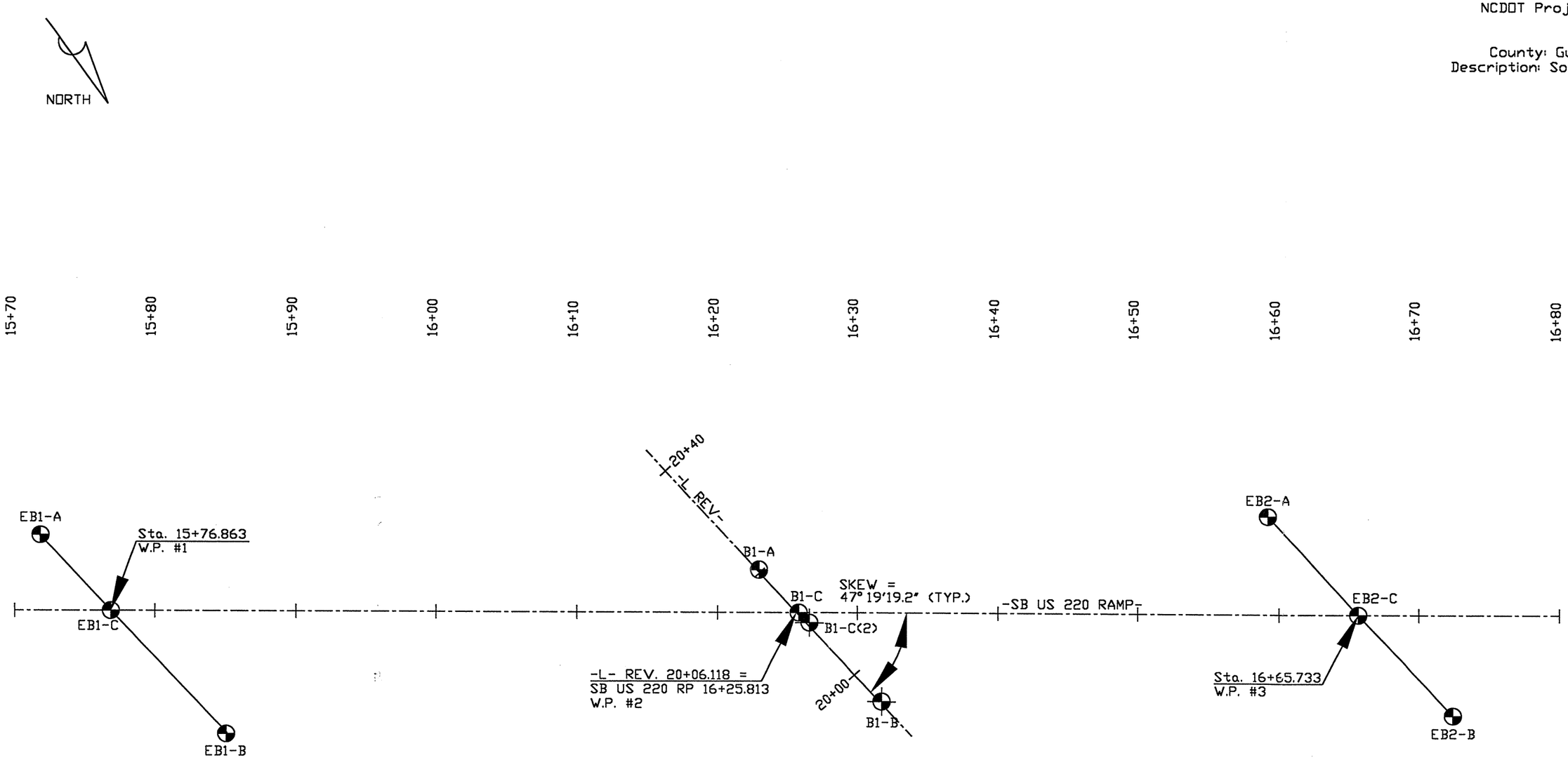

USGS TOPOGRAPHIC MAP QUADRANGLE
SUMMERFIELD, N.C., 1969, REV. 1994

SCALE: 1"=2000'
PSI FILE: 460-75107-2 DWG. #1

# APPENDIX III

## Site Plan

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220
Ramp (Sta. 16+77)

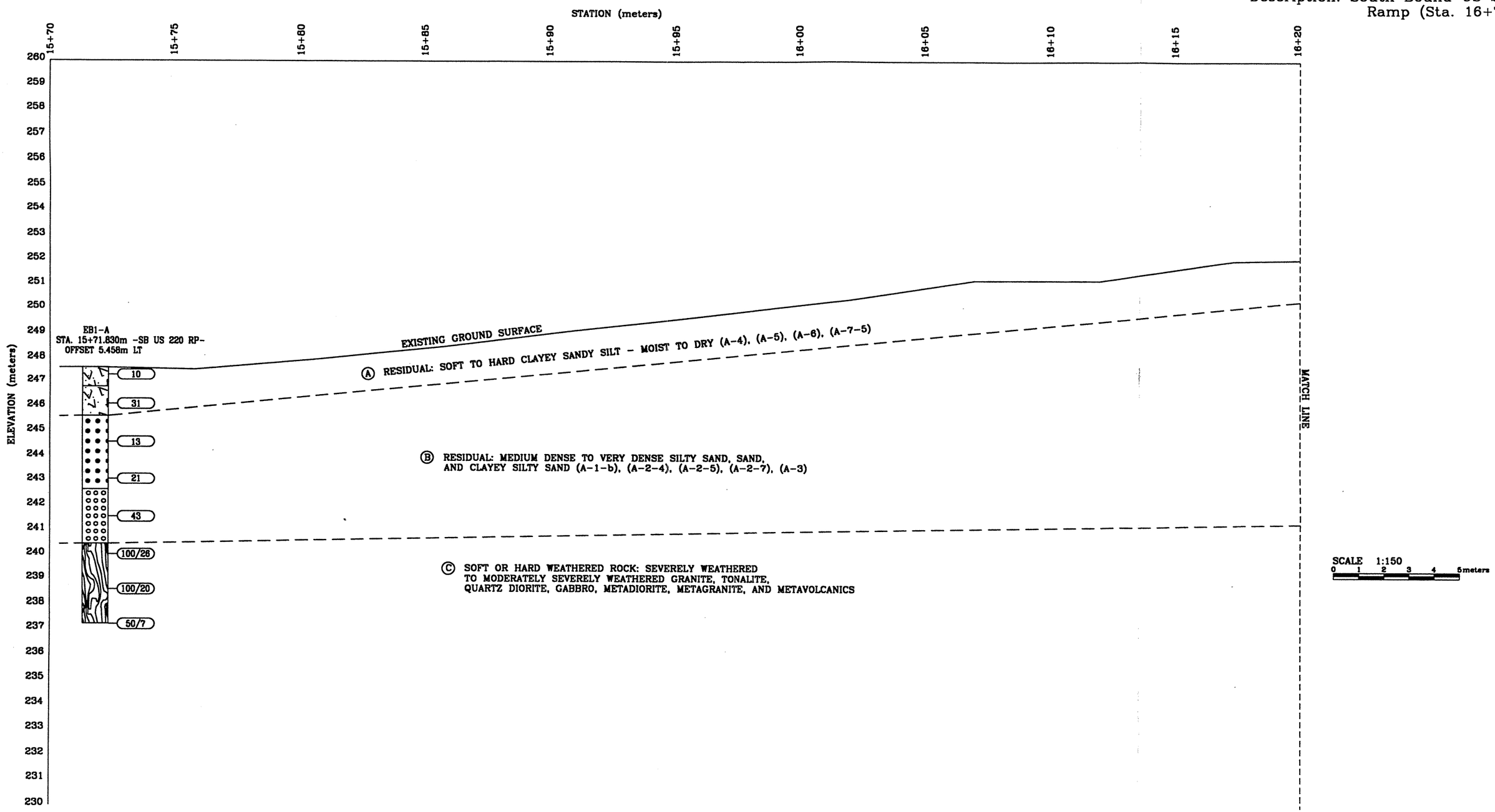


SITE PLAN
PSI FILE: 460-75107-2 DWG. #2

# APPENDIX IV

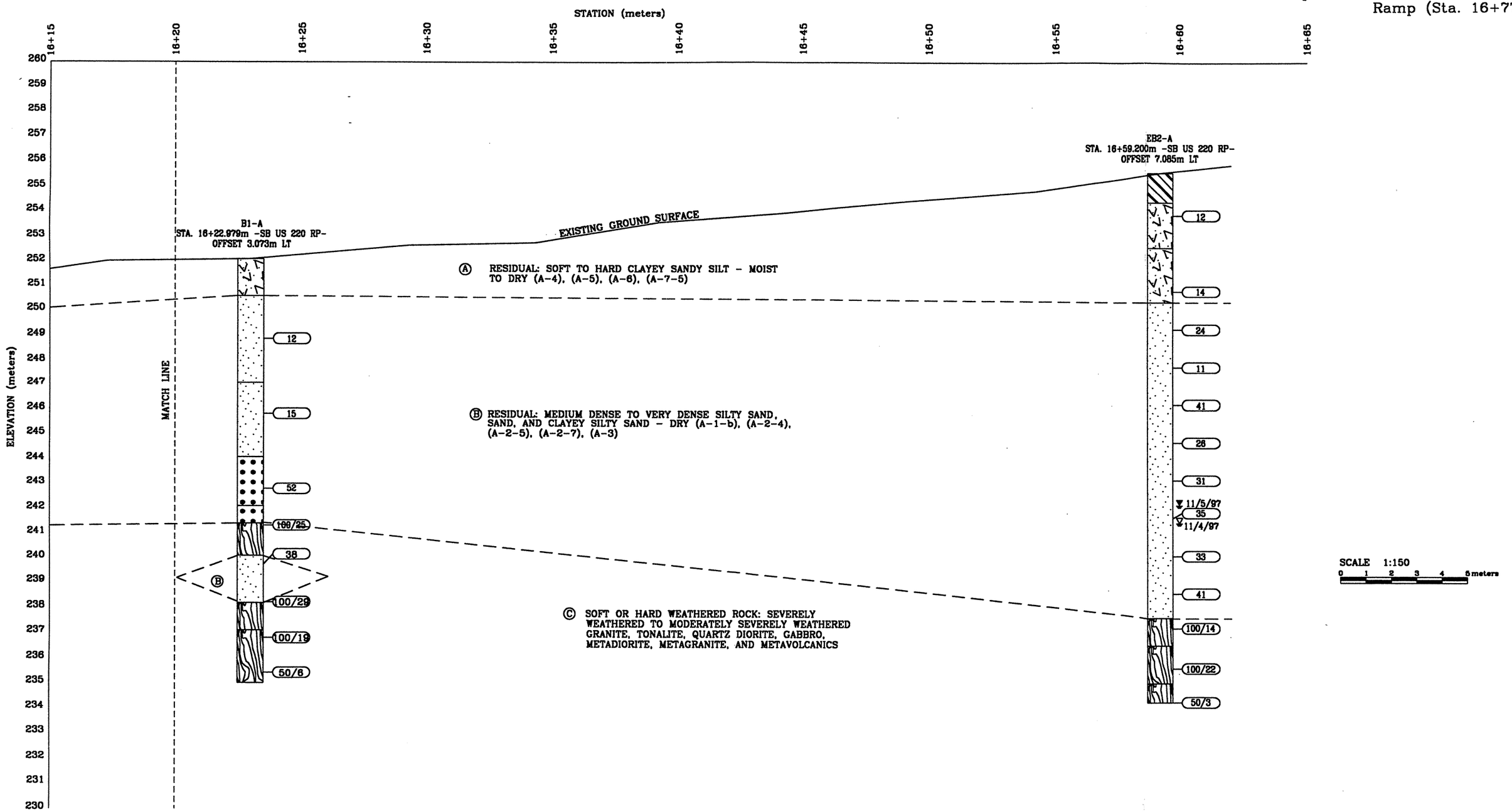
Profile and Cross Sections

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220
Ramp (Sta. 16+77)



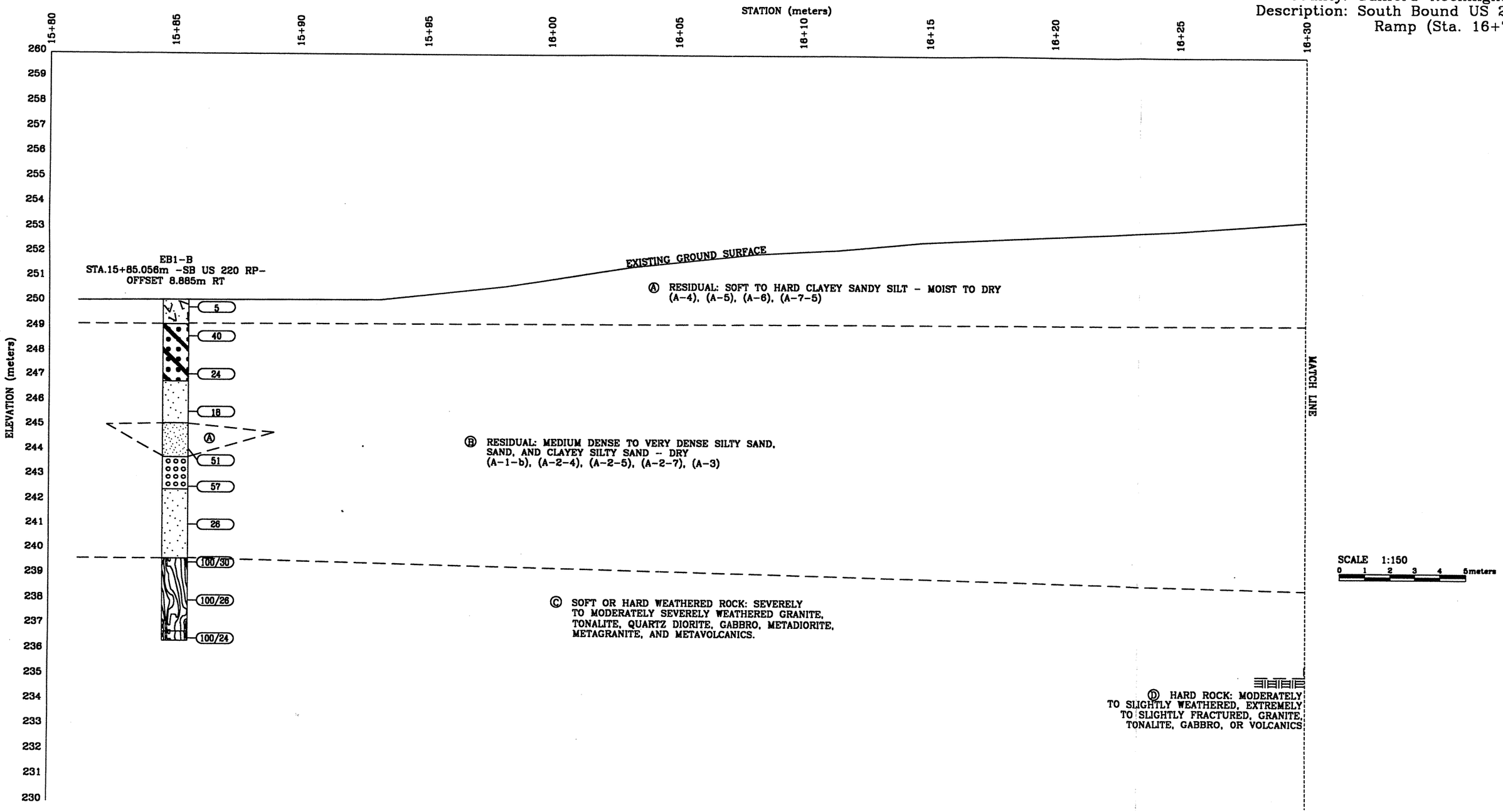

PROFILE 5 METERS LEFT OF
-SB US 220 RAMP-
PSI FILE: 460-75107-2 DWG. #3.1

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220
Ramp (Sta. 16+77)



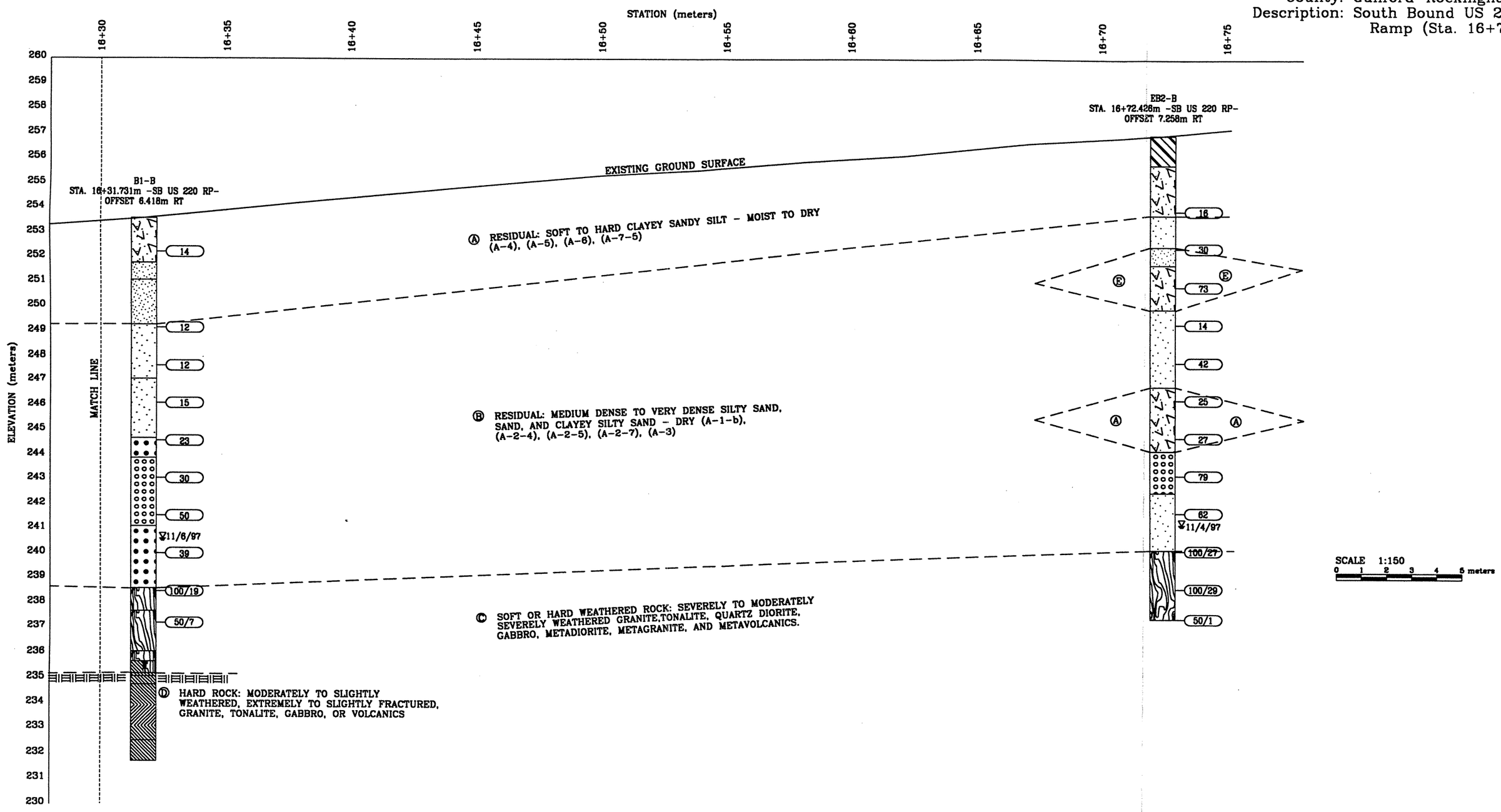

PROFILE 5 METERS LEFT OF
-SB US 220 RAMP-
PSI FILE: 460-75107-2 DWG. #3.2

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220 Ramp (Sta. 16+77)



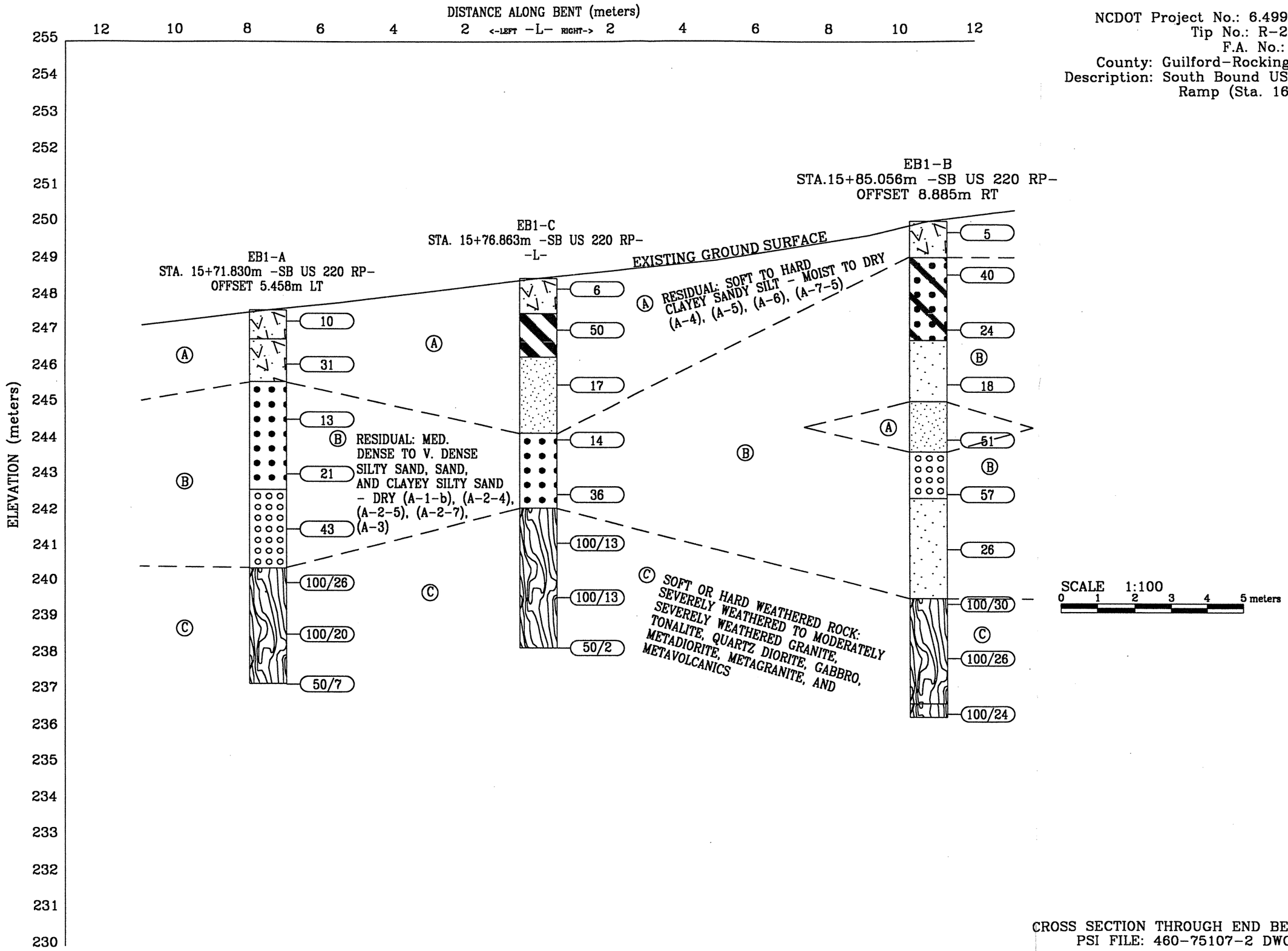

PROFILE 7 METERS RIGHT OF
-SB US 220 RAMP-
PSI FILE: 460-75107-2 DWG. #4.1

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220 Ramp (Sta. 16+77)



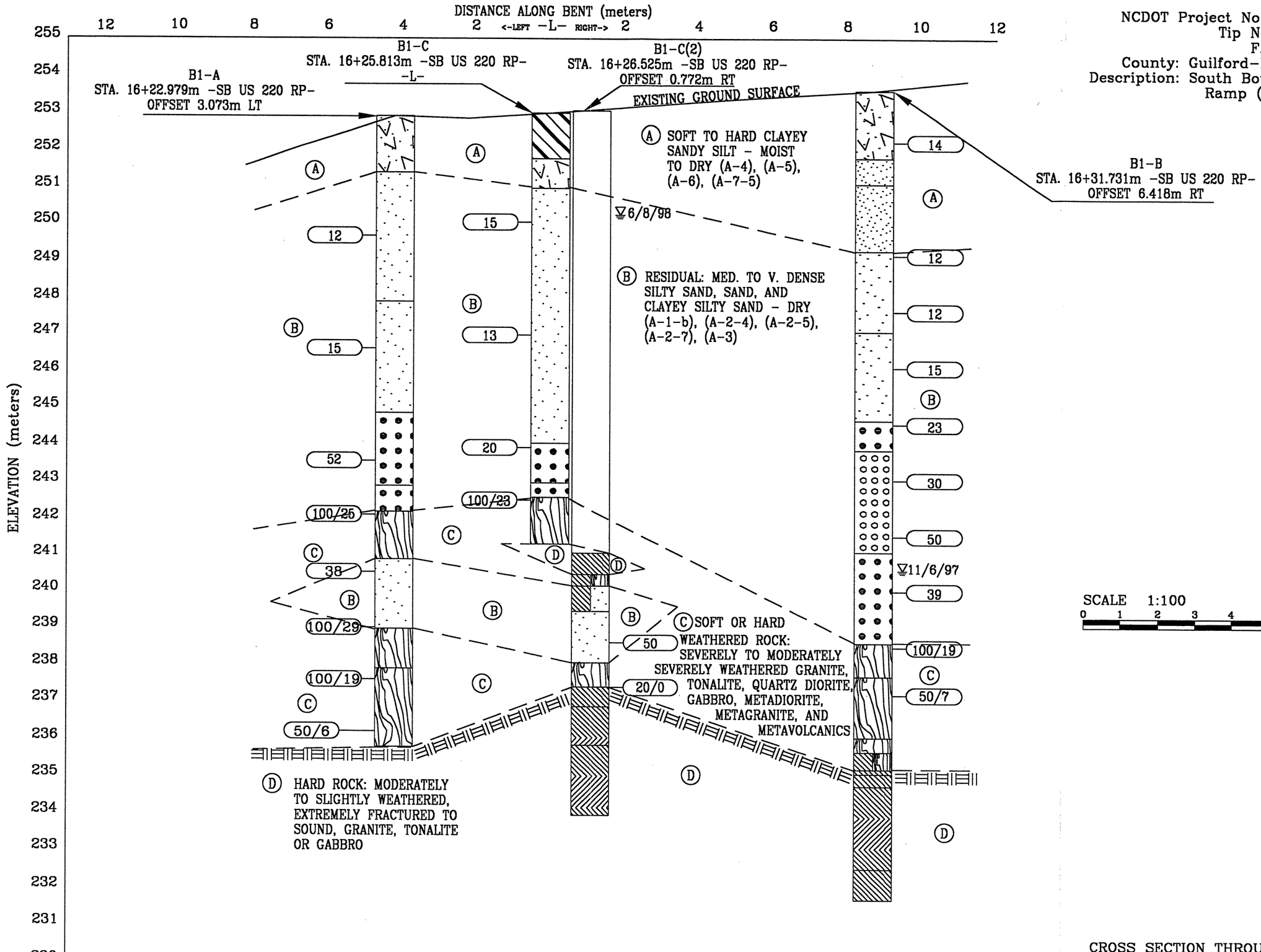

PROFILE 7 METERS RIGHT OF
-SB US 220 RAMP-
PSI FILE: 460-75107-2 DWG. #4.2

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220 Ramp (Sta. 16+77)



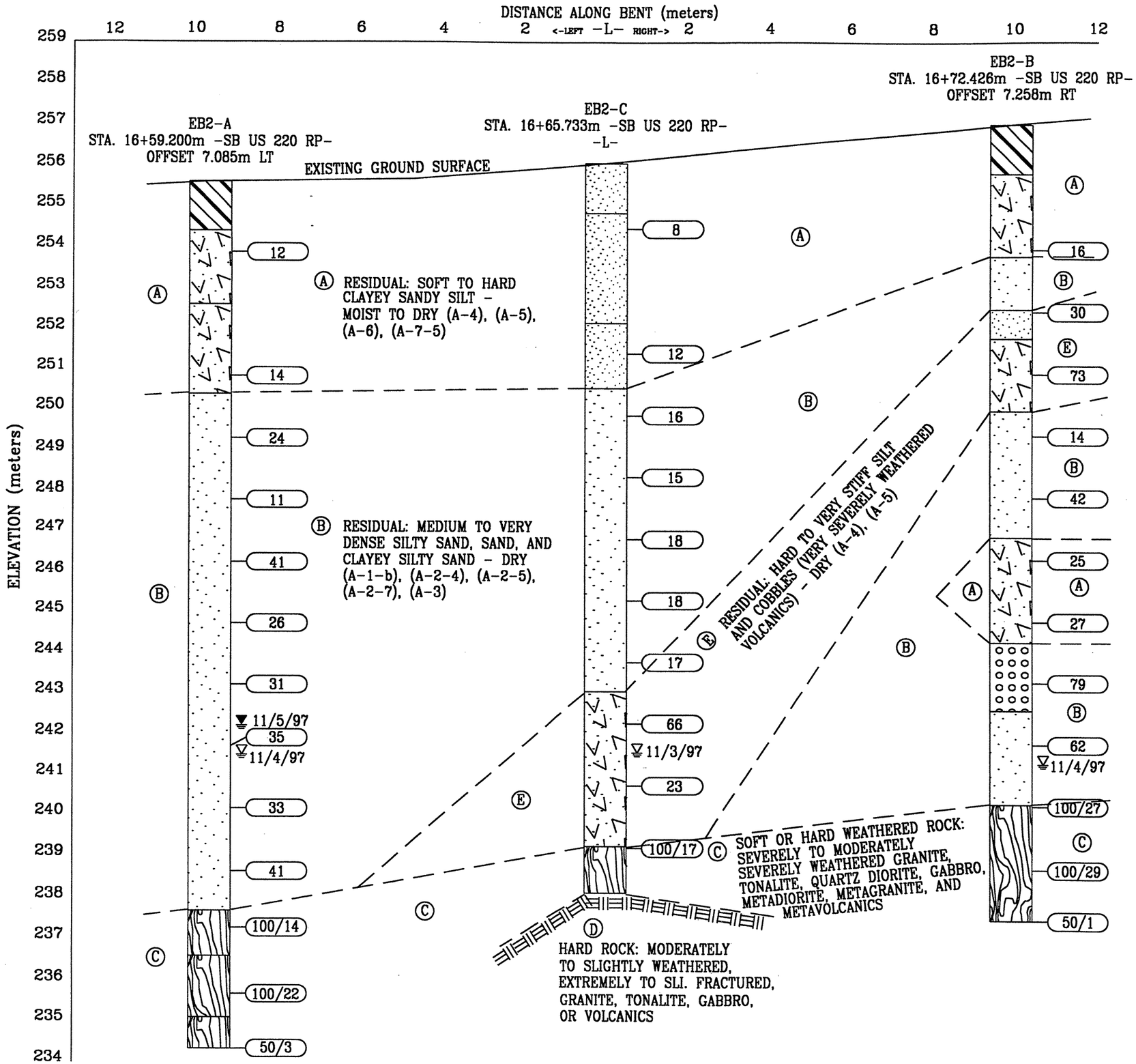

CROSS SECTION THROUGH END BENT 1
PSI FILE: 460-75107-2 DWG. #5

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220 Ramp (Sta. 16+77)




CROSS SECTION THROUGH BENT 1
PSI FILE: 460-75107-2 DWG. #6

NCDOT Project No.: 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: South Bound US 220 Ramp (Sta. 16+77)




SCALE 1:100
0 1 2 3 4 5 meters

CROSS SECTION THROUGH END BENT 2
PSI FILE: 460-75107-2 DWG. #7

# APPENDIX V

## Boring Logs and Coring Logs

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB1-A | **BORING LOCATION** 15+71.830m | **OFFSET** 5.458m LT | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 247.631 m | **NORTHING** 71.83 | **EASTING** -5.46 | **24 HR.** Dry |
| **TOTAL DEPTH** 10.42 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/7/97 | **COMPLETED** 11/7/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 247.63 | | | | | Existing Ground Surface | | | | 247.63 | 0.00 |
| | 0.00 | 2 | 4 | 6 | 10 | | M-D | | RESIDUAL: STIFF BROWN AND RED CLAYEY SANDY SILT (A-5) AND ROCK FRAGMENTS WITH SOME ROOTLETS | |
| | 1.20 | 7 | 16 | 15 | 31 | SS-77 | 9.9 | | 246.83 HARD RED AND BROWN CLAYEY SANDY SILT (A-5) | 0.80 |
| 246 | 2.73 | 5 | 6 | 7 | 13 | | D | | 245.63 MEDIUM DENSE TAN AND WHITE SAND (A-3) | 2.00 |
| 244 | 4.25 | 6 | 8 | 13 | 21 | | D | | 242.63 DENSE TAN AND WHITE SAND (A-1-b) | 5.00 |
| 242 | 5.78 | 10 | 19 | 24 | 43 | | D | | 240.43 SOFT WEATHERED ROCK: SEVERELY WEATHERED LIGHT TAN AND LIGHT GREY GRANITE | 7.20 |
| 240 | 7.30 | 21 | 56 | 44/11 | 100/26 | | D | | | |
| 238 | 8.83 | 51 | 49/5 | | 100/20 | | D | | | |
| | 10.35 | 50/7 | | | 50/7 | | D | | 237.21 BORING TERMINATED @ ELEV. 237.211 METERS IN SOFT WEATHERED ROCK (GRANITE) | 10.42 |
| 236 | | | | | | | | | GROUNDWATER: 0 HR. - DRY - 11/7/97 72 HR. - DRY - 11/10/97 | |
| 234 | | | | | | | | | | |
| 232 | | | | | | | | | | |
| 230 | | | | | | | | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB1-C | **BORING LOCATION** 15+76.863m | **OFFSET** -L- | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 248.531 m | **NORTHING** 76.86 | **EASTING** 0.00 | **24 HR.** Dry |
| **TOTAL DEPTH** 10.31 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/6/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 248.53 | | | | | Existing Ground Surface | | | | 248.53 | 0.00 |
| | 0.00 | 1 | 2 | 4 | 6 | | M-D | | RESIDUAL: MEDIUM STIFF RED AND BROWN CLAYEY SANDY SILT (A-5) WITH TRACE ROOTLETS | |
| 248 | 1.14 | 43 | 26 | 24 | 50 | SS-59 | 6.0 | | 247.53 HARD RED AND BROWN SILTY CLAY (A-7-5(7)) AND ROCK FRAGMENTS | 1.00 |
| 246 | 2.67 | 7 | 8 | 9 | 17 | SS-60 | 16.9 | | 246.33 VERY STIFF RED AND BROWN SANDY SILT (A-4) | 2.20 |
| | 4.19 | 6 | 5 | 9 | 14 | | D | | 244.23 MEDIUM DENSE TO DENSE LIGHT TAN, LIGHT GREY, AND WHITE SAND (A-3) | 4.30 |
| 244 | 5.72 | 16 | 17 | 19 | 36 | | D | | 242.13 SOFT WEATHERED ROCK: SEVERELY WEATHERED LIGHT GREY, TAN, AND WHITE, QUARTZ-RICH GRANITE | 6.40 |
| 242 | 7.24 | 100/13 | | | 100/13 | | D | | | |
| 240 | 8.77 | 100/13 | | | 100/13 | | D | | | |
| | 10.29 | 50/2 | | | 50/2 | | D | | 238.22 BORING TERMINATED @ ELEV. 238.221 METERS IN SOFT WEATHERED ROCK (GRANITE) | 10.31 |
| 238 | | | | | | | | | | |
| 236 | | | | | | | | | | |
| 234 | | | | | | | | | | |
| 232 | | | | | | | | | | |
| 230 | | | | | | | | | | |

GROUNDWATER:
0 HR. - DRY - 11/6/97
24 HR. - DRY - 11/7/97
HOLE CAVE @ 6.3 METERS - 11/7/97

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB1-B | **BORING LOCATION** 15+85.056m | **OFFSET** 8.885m RT | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 250.096 m | **NORTHING** 85.06 | **EASTING** 8.89 | **24 HR.** Dry |
| **TOTAL DEPTH** 13.77 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/6/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 250.10 | | | | | Existing Ground Surface | | | | 250.10 | 0.00 |
| | 0.00 | 1 | 2 | 3 | 5 | | M-D | | RESIDUAL: MEDIUM STIFF RED AND BROWN SANDY CLAYEY SILT (A-5) WITH SOME ROOTLETS AND SOME ROCK FRAGMENTS | |
| | 1.17 | 11 | 17 | 23 | 40 | SS-67 | D | | 249.10 — DENSE RED AND BROWN CLAYEY SILTY SAND (A-2-7(4)) WITH SOME ROCK FRAGMENTS | 1.00 |
| 248 | 2.70 | 11 | 13 | 11 | 24 | | D | | 246.80 — MEDIUM DENSE TAN SILTY SAND (A-2-4) | 3.30 |
| 246 | 4.22 | 4 | 8 | 10 | 18 | | D | | 245.10 — HARD TAN AND BROWN SANDY SILT (A-4) | 5.00 |
| 244 | 5.75 | 13 | 26 | 25 | 51 | SS-70 | 21.7 | | 243.70 — VERY DENSE TAN AND GREY SAND (A-1-b) | 6.40 |
| 242 | 7.27 | 13 | 37 | 20 | 57 | | D | | 242.40 — MEDIUM DENSE TAN SILTY SAND (A-2-4) | 7.70 |
| 240 | 8.80 | 9 | 12 | 14 | 26 | | D | | 239.60 — SOFT WEATHERED ROCK: SEVERELY WEATHERED TAN AND GREY GRANITE W/SOME QUARTZ-RICH ZONES | 10.50 |
| 238 | 10.33 | 33 | 67/15 | | 100/30 | | M-D | | | |
| | 11.85 | 18 | 50 | 50/11 | 100/26 | | D | | 236.70 | 13.40 |
| | 13.38 | 25 | 41 | 59/9 | 100/24 | | D | | 236.33 — SOFT WEATHERED ROCK: TAN GREY AND BLACK TONALITE (APPROX. 30% MAFICS) | 13.77 |
| 236 | | | | | | | | | BORING TERMINATED @ ELEV. 236.326 METERS IN SOFT WEATHERED ROCK (TONALITE) | |
| 234 | | | | | | | | | GROUNDWATER:<br>0 HR. - DRY - 11/7/97<br>72 HR. - DRY - 11/10/97 | |
| 232 | | | | | | | | | | |

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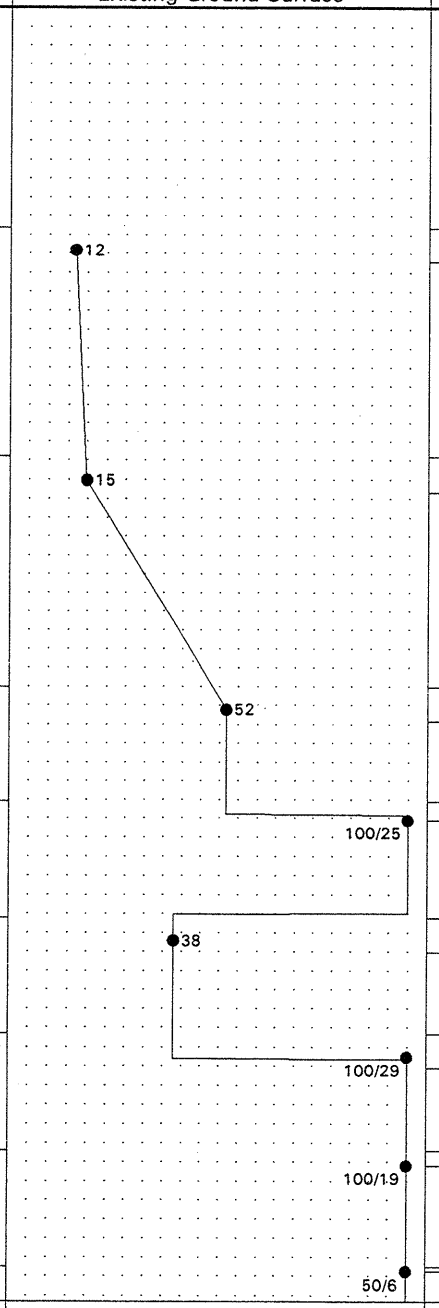
# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-A | **BORING LOCATION** 16+22.979m | **OFFSET** 3.073m LT | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 252.911 m | **NORTHING** 122.98 | **EASTING** -3.07 | **24 HR.** Dry |
| **TOTAL DEPTH** 17.08 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/6/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| 252.91 | | | | | | | | Existing Ground Surface | 252.91 / 0.00 |
| | | | | | | | | RESIDUAL: MEDIUM STIFF RED AND BROWN CLAYEY SANDY SILT (A-5) WITH SOME ROOTLETS | 251.41 / 1.50 |
| | 2.91 | 6 | 6 | 6 | | D | | MEDIUM DENSE TAN SILTY SAND (A-2-5) | 247.91 / 5.00 |
| | 5.96 | 6 | 6 | 9 | | D | | MEDIUM DENSE TAN GREY AND WHITE SILTY SAND (A-2-4) | 244.91 / 8.00 |
| | 9.01 | 16 | 23 | 29 | | D | | VERY DENSE TAN AND WHITE SAND (A-3) | 242.91 / 10.00 |
| | 10.53 | 20 | 80/10 | | | D-M | | VERY DENSE TAN WHITE AND BLACK SAND (A-3) (HIGH MAFIC CONTENT) | 242.21 / 10.70 |
| | 12.06 | 10 | 16 | 22 | | M | | SOFT WEATHERED ROCK: SEVERELY WEATHERED TAN AND BLACK TONALITE | 240.91 / 12.00 |
| | 13.58 | 6 | 24 | 76/14 | | M | | DENSE TAN BROWN AND GREY SILTY SAND (A-2-4) | 239.01 / 13.90 |
| | 15.11 | 59 | 41/4 | | | M-D | | SOFT WEATHERED ROCK: SEVERELY WEATHERED GREY AND BROWN QUARTZ DIORITE | 237.91 / 15.00 |
| | 16.63 | 50/6 | | | | D | | SOFT WEATHERED ROCK: SEVERELY TO MODERATELY SEVERELY WEATHERED TAN AND GREY QUARTZ DIORITE AND METADIORITE | 235.83 / 17.08 |
| | | | | | | | | AUGER REFUSAL @ ELEV. 235.831 METERS ON HARD ROCK (QUARTZ DIORITE) | |




GROUNDWATER:
0 HR. - DRY - 11/6/97
24 HR. - DRY - 11/7/97

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-A | **BORING LOCATION** 16+22.979m | **OFFSET** 3.073m LT | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 252.911 m | **NORTHING** 122.98 | **EASTING** -3.07 | **24 HR.** Dry |
| **TOTAL DEPTH** 17.08 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/6/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | ▼ MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 233.91 | | | | | Continued from previous page | | | | |
| | | | | | | | | | HOLE CAVE @ 9.9 METERS - 11/7/97 |
| | | | | | | | | | NOTES: BORING OFFSET 2.1 METERS SOUTH (ALONG AND INTO BENT) |
| 232 | | | | | | | | | |
| 230 | | | | | | | | | |
| 228 | | | | | | | | | |
| 226 | | | | | | | | | |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |
| 218 | | | | | | | | | |
| 216 | | | | | | | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-C | **BORING LOCATION** 16+25.813m | **OFFSET** -L- | **ALIGNMENT** SB US 220 — **0 HR.** Dry |
| **COLLAR ELEV.** 252.996 m | **NORTHING** 125.81 | **EASTING** 0.00 | **24 HR.** Dry |
| **TOTAL DEPTH** 11.66 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/6/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 253.00 | | | | | Existing Ground Surface | | | | 253.00 | 0.00 |
| | | | | | | | | | RESIDUAL: SOFT TO MEDIUM STIFF RED AND BROWN SILTY CLAY (A-6) WITH SOME ORGANICS | |
| | | | | | | | | | 251.80 | 1.20 |
| | | | | | | | | | MEDIUM STIFF RED AND BROWN SANDY CLAYEY SILT (A-5) | |
| | | | | | | | | | 251.00 | 2.00 |
| | 2.63 | | | | | | | | MEDIUM DENSE TAN GREY AND WHITE SILTY SAND (A-2-5(0)) | |
| 250 | | 11 | 7 | 8 | 15 | | D | | | |
| 248 | | | | | | | | | | |
| | 5.68 | | | | | | | | | |
| | | 4 | 6 | 7 | 13 | SS-47 | D | | | |
| 246 | | | | | | | | | | |
| | 8.73 | | | | | | | | | |
| 244 | | 8 | 10 | 10 | 20 | | M-D | | 244.10 | 8.90 |
| | | | | | | | | | MEDIUM DENSE GREY AND WHITE SAND (A-3) | |
| | | | | | | | | | 243.00 | 10.00 |
| | 10.25 | | | | | | | | VERY DENSE LIGHT TAN AND GREY SAND (A-3) | |
| | | 41 | 59/8 | | 100/23 | | M | | 242.60 | 10.40 |
| 242 | | | | | | | | | SOFT WEATHERED ROCK: SEVERELY WEATHERED FINE-GRAINED LIGHT TAN AND GREY GRANITE | |
| | | | | | | | | | 241.34 | 11.66 |
| | | | | | | | | | AUGER REFUSAL @ ELEV. 241.336 METERS ON HARD ROCK (GRANITE) | |
| 240 | | | | | | | | | GROUNDWATER: 0 HR. - DRY - 11/6/97 24 HR. - DRY - 11/7/97 | |
| 238 | | | | | | | | | | |
| 236 | | | | | | | | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-C(2) | **BORING LOCATION** 16+26.525m | **OFFSET** 0.772m RT | **ALIGNMENT** -SB US220- **0 HR.** 2.80 |
| **COLLAR ELEV.** 253.066 m | **NORTHING** 1626.53 | **EASTING** 0.77 | **24 HR.** dry |
| **TOTAL DEPTH** 19.08 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA/CASING/NWD4 CORE | **HAMMER TYPE** Manual |
| **DATE STARTED** 6/8/98 | **COMPLETED** 6/8/98 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 253.07 | | | | | Existing Ground Surface | | | | 253.07 | 0.00 |
| | | | | | | | | | AUGER PROBE | |
| 252 | | | | | | | | | | |
| 250 | | | | | | | | | | |
| 248 | | | | | | | | | | |
| 246 | | | | | | | | | | |
| 244 | | | | | | | | | | |
| 242 | | | | | | | | | | |
| | | | | | | | | | HARD LENSE AT 11.5 METERS | |
| | | | | | | | | | 241.08 | 11.99 |
| | | | | | | | | | AUGER REFUSAL @ ELEV. 241.076 METERS ON HARD ROCK (GRANITE) | |
| | | | | | | | | | 240.49 | 12.58 |
| | | | | | | | | | SET CASING @ ELEV. 238.936 METERS AND SPOON | |
| | | | | | | | | | 240.17 | 12.90 |
| 240 | | | | | | | | | | |
| | | | | | | | | | 239.48 | 13.59 |
| | 14.13 | | | | | | | | HARD ROCK: MODERATELY WEATHERED EXTREMELY FRACTURED TO SOUND MICACEOUS GREY AND BROWN GRANITE | |
| | | 18 | 27 | 23 | 50 | | | | | |
| | | | | | | | | | SOFT WEATHERED ROCK: SEVERELY WEATHERED GREY AND BROWN GRANITE | |
| 238 | | | | | | | | | 238.07 | 15.00 |
| | 15.65 | | | | | | | | DENSE GREY AND TAN MICACEOUS SILTY SAND (A-2-4) W/SOME LARGE QUARTZ FRAGMENTS - MOIST | |
| | | 20/0 | | | 20/0 | | | | 237.42 | 15.65 |
| | | | | | | | | | 236.90 | 16.17 |
| | | | | | | | | | DENSE GREY AND TAN MICACEOUS SILTY SAND (A-2-4) W/SOME LARGE QUARTZ FRAGMENTS - MOIST | |
| 236 | | | | | | | | | 235.87 | 17.20 |
| | | | | | | | | | SOFT WEATHERED ROCK AND HARD WEATHERED ROCK - GREY AND TAN GRANITE | |
| | | | | | | | | | CASING ADVANCING BUT SPLIT SPOON REFUSAL @ ELEV. 237.416 METERS ON HARD ROCK (GRANITE) | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-C(2) | **BORING LOCATION** 16+26.525m | **OFFSET** 0.772m RT | **ALIGNMENT** -SB US220- **0 HR.** 2.80 |
| **COLLAR ELEV.** 253.066 m | **NORTHING** 1626.53 | **EASTING** 0.77 | **24 HR.** dry |
| **TOTAL DEPTH** 19.08 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA/CASING/NWD4 CORE | **HAMMER TYPE** Manual |
| **DATE STARTED** 6/8/98 | **COMPLETED** 6/8/98 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 234.07 | | | | | Continued from previous page | | | | |
| | | | | | | | | | 233.99 HARD ROCK: MODERATELY WEATHERED EXTREMELY TO MODERATELY FRACTURED TAN AND GREY FRIABLE GRANITE — 19.08 |
| | | | | | | | | | HARD ROCK: MODERATELY WEATHERED EXTREMELY TO MODERATELY FRACTURED DARK GREY ORTHOCLASE RICH QUARTZ GABBRO |
| | | | | | | | | | HARD ROCK: MODERATELY TO SLIGHTLY WEATHERED MODERATELY TO EXTREMELY FRACTURED TAN AND GREY FRIABLE GRANITE |
| 232 | | | | | | | | | |
| 230 | | | | | | | | | |
| 228 | | | | | | | | | |
| 226 | | | | | | | | | |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |
| 218 | | | | | | | | | |
| 216 | | | | | | | | | |

CORING TERMINATED @ ELEV. 233.986 METERS IN HARD ROCK (GRANITE)

GROUNDWATER:
0 HR. - 2.8 METERS* - 6/8/98
48 HR. - DRY; CAVED @ 11.1 METERS - 6/10/98

NOTES:
*CORE WATER IN HOLE
SS-2 @ 15.65 METERS - NO RECOVERY

DATE _6/8/98_

# CORE BORING REPORT

| PROJECT: 6.499002T | I.D. NO.: R-2413C | BORING NO.: B1-C(2) | GEOLOGIST: Steege |
|---|---|---|---|

DESCRIPTION: South Bound US 220 Ramp (Sta. 16+77)

| COUNTY: Guilford-Rockingham | COLLAR ELEV.: 253.066 meters | TOTAL DEPTH: 19.08 meters |
|---|---|---|

| Elev. (m) | Depth (m) | Drill Rate MIN/0.3m | Run (m) | Rec (m) % | RQD (m) % | Samp # | Field Classification and Remarks |
|---|---|---|---|---|---|---|---|
| 241.076 | 11.99 | 2.5/0.3 | 1 | 0.59/1.6 37% | 0.43/1.6 27% | | 11.99-12.58 Moderately Weathered Moderately Fractured to Sound micaceous Grey and Brown Granite.<br>1 JT @ 54° ADT=.001m<br>1 JT @ 25° ADT=.001m.<br>12.58 Soft Weathered Rock: Severely Weathered Grey and Brown Granite - no recovery. Attempt spoon @ 13.59. Couldn't get spoon on bottom (plug @ approx. 12.7m). Could not auger. Will drill casing. Casing and SS sample 13.59-15.65. |
| | | 2.1/0.3 | | | | | |
| | | 1.2/0.3 | | | | | |
| | | 0.5/0.3 | | | | | |
| 239.476 | 13.59 | 0.4/0.4 | | | | | |
| 237.416 | 15.65 | 1.6/0.3 | 2 | 1.21/1.9 64% | 0.10/1.9 5% | | 15.65-16.17 Moderately Weathered Extremely to Moderately Fractured Tan and Grey Friable Granite - lost recovery @ bottom.<br>2 JTS @ 42° ADT=.001m<br>16.17-17.20 Moderately Weathered Extremely to Moderately Fractured Dark Grey Orthoclase Rich Quartz Gabbro w/low and high angle fractures. Lost recovery @ upper and lower contacts.<br>2 JTS @ 35° ADS=.03m ADT=.001m<br>1 JT @ 82° ADT=.001m<br>1 JT @ 75° ADT=.001m<br>1 JT @ 47° ADT=.001m<br>1 JT @ 25° ADT=.001m<br>17.20 Moderately Weathered Extremely Fractured Tan and Grey Friable Granite |
| | | 2.4/0.3 | | | | | |
| | | 2.6/0.3 | | | | | |
| | | 1.5/0.3 | | | | | |
| | | 1.3/0.3 | | | | | |
| 235.516 | 17.55 | 1.3/0.4 | | | | | |
| | | | | | | | Coring Terminated @ Elev.: 233.986 meters |

| DRILLER: Shull | CORE SIZE: NWD4 | EQUIPMENT: CME-55 |
|---|---|---|

DATE _6/8/98_

# CORE BORING REPORT

| PROJECT: 6.499002T | I.D. NO.: R-2413C | BORING NO.: B1-C(2) | GEOLOGIST: Steege |
|---|---|---|---|

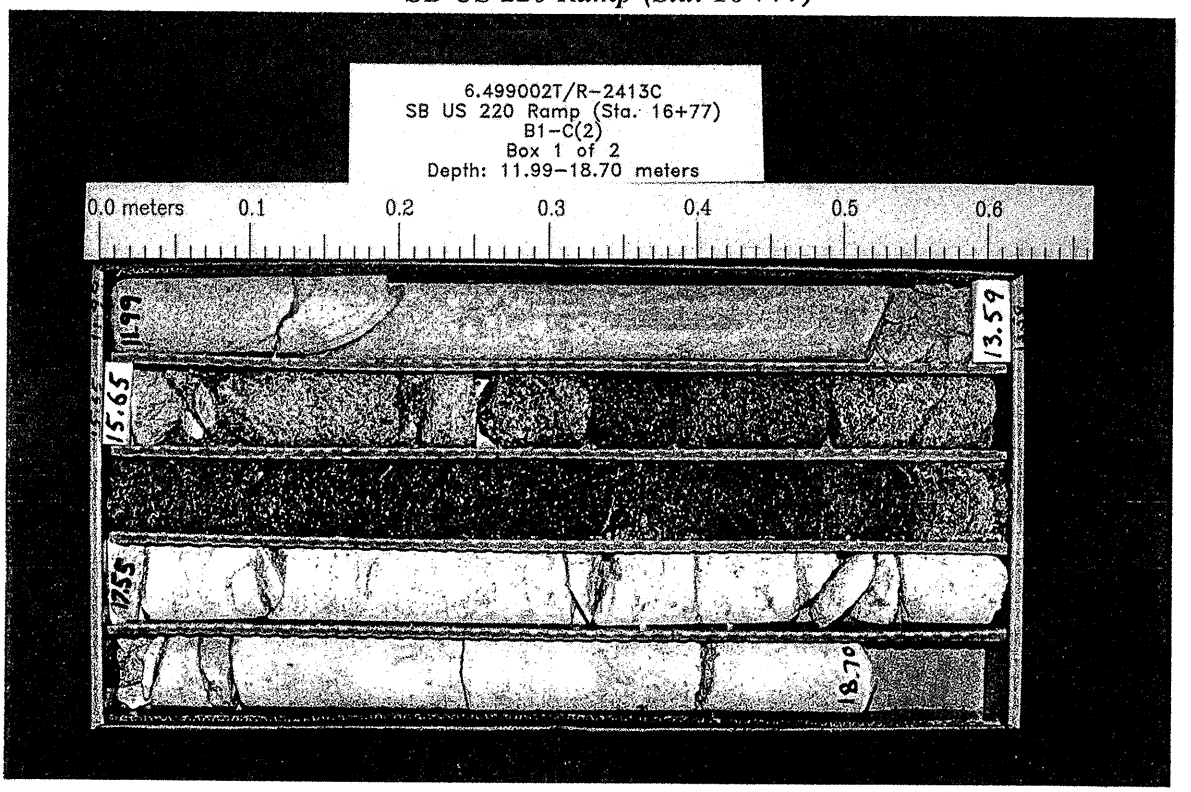
DESCRIPTION: South Bound US 220 Ramp (Sta. 16+77)

| COUNTY: Guilford-Rockingham | COLLAR ELEV.: 253.066 meters | TOTAL DEPTH: 19.08 meters |
|---|---|---|

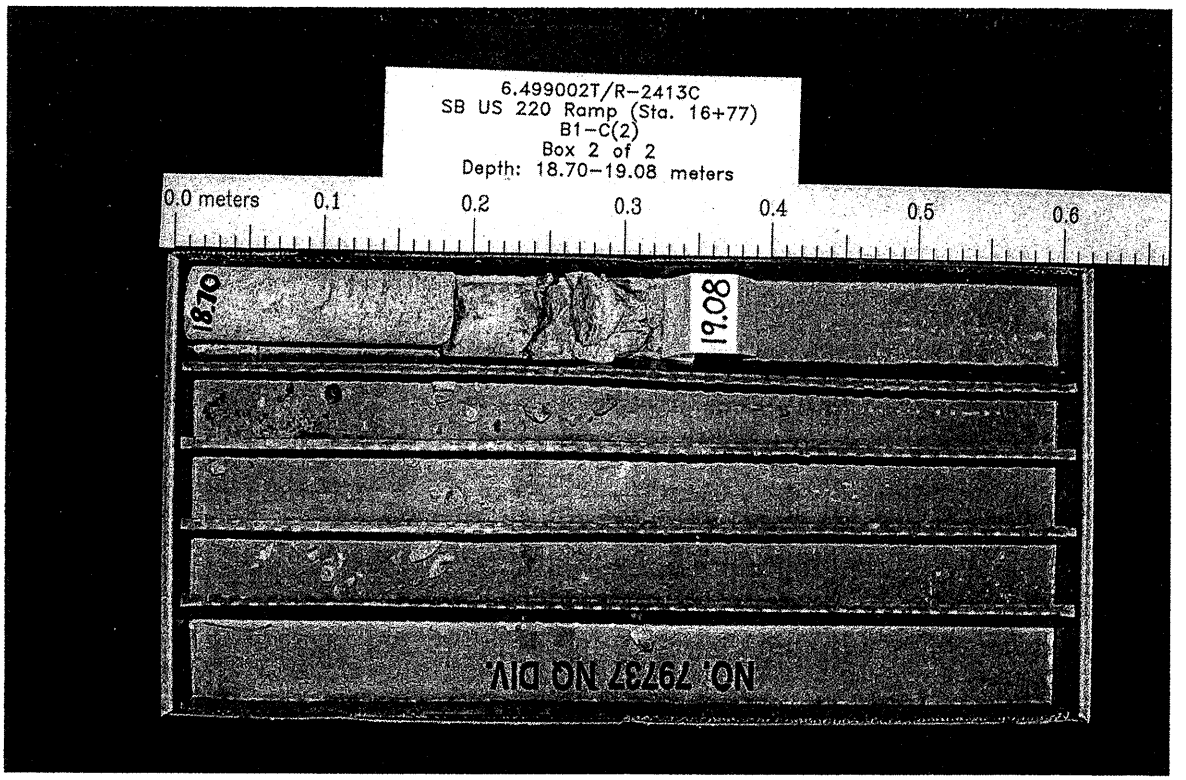
| Elev. (m) | Depth (m) | Drill Rate MIN/0.3m | Run (m) | Rec (m) % | RQD (m) % | Samp # | Field Classification and Remarks |
|---|---|---|---|---|---|---|---|
| 235.516 | 17.55 | 1.8/0.3 | 3 | 1.42/1.53 93% | 0.78/1.53 51% | | Moderately to Slightly Weathered, Moderately to Extremely Fractured, Tan and Grey, Granite |
| | | 2.2/0.3 | | | | | 1 JT @ 36° ADT=.001m |
| | | 4.9/0.3 | | | | | |
| | | 3.2/0.3 | | | | | |
| 233.986 | 19.08 | 3.0/0.3 | | | | | |
| | | | | | | | Coring Terminated @ Elev.: 233.986 meters |

| DRILLER: Shull | CORE SIZE: NWD4 | EQUIPMENT: CME-55 |
|---|---|---|

## *SB US 220 Ramp (Sta. 16+77)*




Core B1-C(2), 11.99-18.70 meters, Box 1 of 2.




Core B1-C(2), 18.70-19.08 meters, Box 2 of 2.

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-B | **BORING LOCATION** 16+31.731m | **OFFSET** 6.418m RT | **ALIGNMENT** SB US 220 — **0 HR.** 13.0 |
| **COLLAR ELEV.** 253.606 m | **NORTHING** 131.73 | **EASTING** 6.42 | **24 HR.** N.M. |
| **TOTAL DEPTH** 21.88 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/5/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 253.61 | | | | | Existing Ground Surface | | | | 253.61 | 0.00 |
| | 1.07 | 4 | 7 | 7 | 14 | SS-36 | 22.8 | | RESIDUAL: STIFF RED AND BROWN SANDY CLAYEY SILT (A-5) | |
| 252 | | | | | | | | | 251.81 | 1.80 |
| | | | | | | | | | STIFF RED AND BROWN SANDY SILT (A-4) | |
| | | | | | | | | | 251.11 | 2.50 |
| | | | | | | | | | STIFF TAN SANDY SILT (A-4) | |
| 250 | 4.12 | | | | | | | | 249.31 | 4.30 |
| | | 6 | 5 | 7 | 12 | SS-37a | 27.4 | | MEDIUM DENSE GREY AND TAN SILTY SAND (A-2-5) AND STIFF TAN AND BROWN SANDY SILT (A-4) | |
| 248 | 5.65 | | | | | | | | | |
| | | 5 | 6 | 6 | 12 | | D | | | |
| | | | | | | | | | 247.11 | 6.50 |
| | 7.17 | | | | | | | | MEDIUM DENSE BROWN GREY AND TAN SILTY SAND (A-2-5) | |
| 246 | | 5 | 6 | 9 | 15 | | D | | | |
| | 8.70 | | | | | | | | 244.71 | 8.90 |
| | | 8 | 11 | 12 | 23 | | D | | MEDIUM DENSE TAN AND WHITE SAND (A-3) | |
| 244 | | | | | | | | | 243.91 | 9.70 |
| | 10.22 | | | | | | | | DENSE TAN AND WHITE TO GREY SAND (A-1-b) WITH SOME SMALL QUARTZ VEINS | |
| | | 17 | 14 | 16 | 30 | | D | | | |
| 242 | 11.75 | | | | | | | | | |
| | | 16 | 20 | 30 | 50 | | M-D | | | |
| | | | | | | | | | 241.11 | 12.50 |
| | 13.27 | | | | | | | | DENSE GREY AND WHITE SAND (A-3) | |
| 240 | | 10 | 16 | 23 | 39 | | W | | | |
| | 14.80 | | | | | | | | 238.61 | 15.00 |
| | | 20 | 66 | 34/4 | 100/1.9 | | W | | SOFT WEATHERED ROCK: SEVERELY WEATHERED WHITE AND TAN QUARTZ-RICH GRANITE | |
| 238 | | | | | | | | | 237.71 | 15.90 |
| | 16.32 | | | | | | | | SOFT WEATHERED ROCK: SEVERELY WEATHERED BLACK AND WHITE GABBRO | |
| | | 50/7 | | | 50/7 | | W | | | |
| 236 | | | | | | | | | 236.08 | 17.53 |
| | 17.92 | | | | | | | | 235.69 AUGER REFUSAL @ ELEV. METERS ON HARD WEATHERED ROCK (GABBRO) | 17.92 |
| | | | | | | RUN1 | | | 235.21 MODERATELY SEVERELY WEATHERED, EXTREMELY FRACTURED, BROWN AND GREY, GRANITE | 18.40 |
| | 18.83 | | | | | | | | ~~235.07~~ | ~~18.54~~ |
| | | | | | | | | | ~~234.78~~ | ~~18.83~~ |

NCBMM3 71072 12/1/97

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** B1-B | **BORING LOCATION** 16+31.731m | **OFFSET** 6.418m RT | **ALIGNMENT** SB US 220 — **0 HR.** 13.0 |
| **COLLAR ELEV.** 253.606 m | **NORTHING** 131.73 | **EASTING** 6.42 | **24 HR.** N.M. |
| **TOTAL DEPTH** 21.88 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/5/97 | **COMPLETED** 11/6/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 234.61 | | | | | Continued from previous page | | | | |
| 234 | | | | | | RUN2 | | | MODERATELY WEATHERED, MODERATELY FRACTURED, FINE-GRAINED TONALITE |
| | 20.35 | | | | | | | | MODERATELY TO SLIGHTLY WEATHERED, MODERATELY TO SLIGHTLY FRACTURED, GREY AND WHITE GRANITE |
| | | | | | | RUN3 | | | |
| | | | | | | | | | 232.55 — 21.06 |
| 232 | | | | | | | | | MODERATELY TO SLIGHTLY WEATHERED, MODERATELY TO SLIGHTLY FRACTURED, GREY AND WHITE GRANITE WITH SOME INTERBEDDED MODERATELY TO SLIGHTLY WEATHERED, SLIGHTLY TO EXTREMELY FRACTURED, GREY GABBRO |
| | | | | | | | | | 231.73 — 21.88 |
| 230 | | | | | | | | | MODERATELY TO SLIGHTLY WEATHERED, EXTREMELY TO MODERATELY FRACTURED, GREY GABBRO WITH SOME GRANITE AS ABOVE |
| | | | | | | | | | CORING TERMINATED @ ELEV. 231.726 METERS ON HARD ROCK (GABBRO) |
| 228 | | | | | | | | | GROUNDWATER:<br>0 HR. - 13.0 METERS - 11/6/97<br>24 HR. - N.M. |
| 226 | | | | | | | | | NOTES:<br>AFTER AUGER REFUSAL, PULLED AUGERS AND SET CASING @ 17.92 METERS<br>*UNABLE TO OBTAIN 24-HR GROUNDWATER LEVEL; MUD AROUND BORING CAVED IN THE HOLE WHILE MOVING RIG ON B1-C. |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |
| 218 | | | | | | | | | |
| 216 | | | | | | | | | |

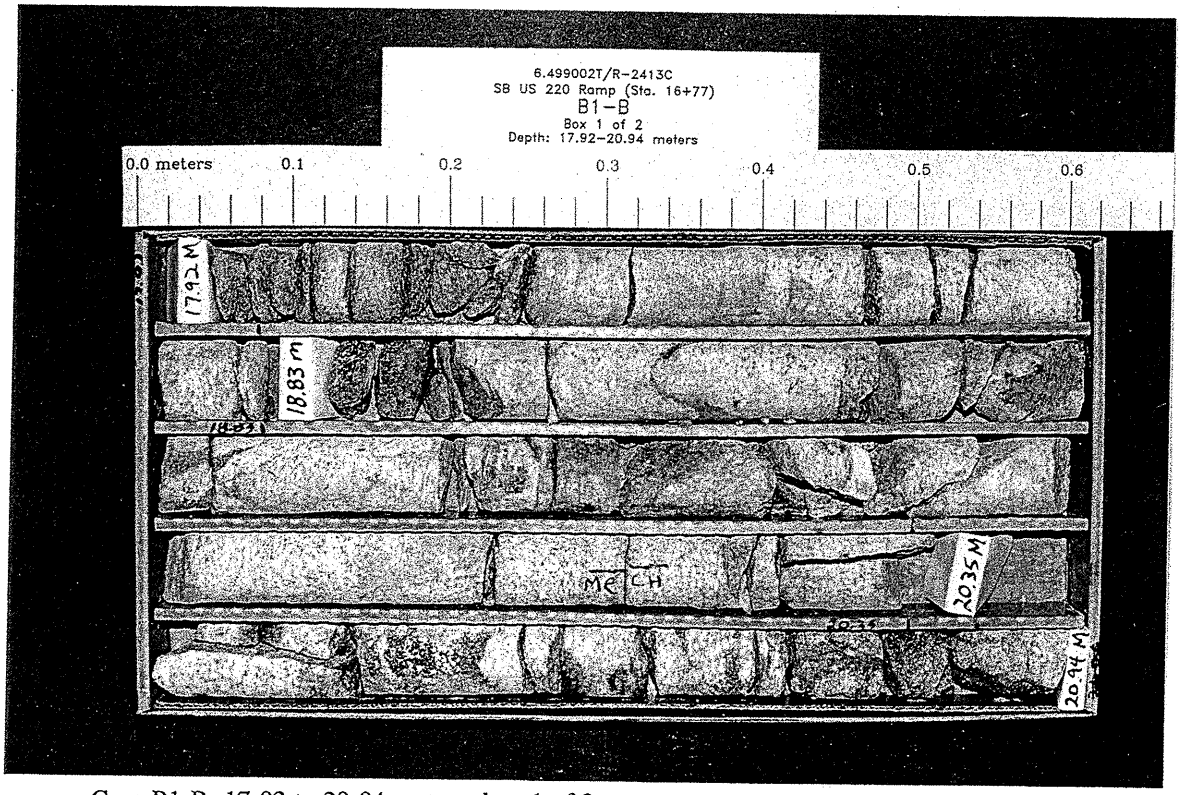
DATE 11/5/97 and 11/6/97

# CORE BORING REPORT

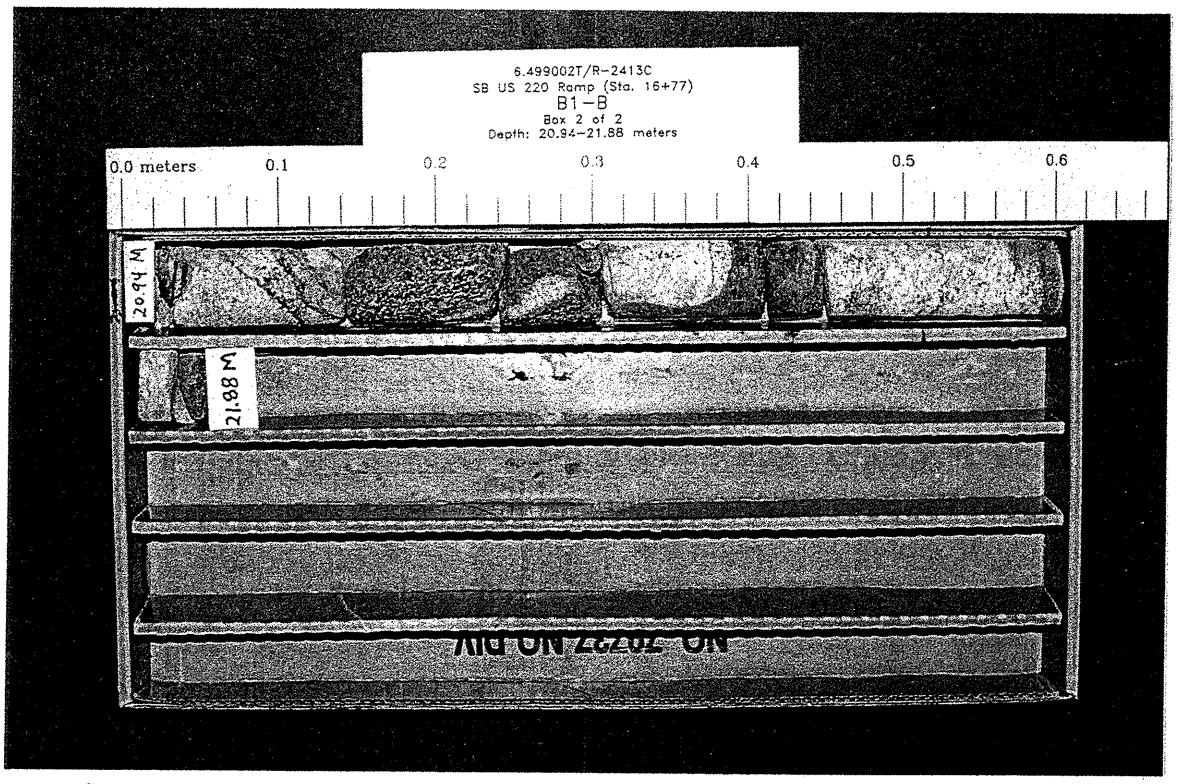
| PROJECT: 6.499002T | I.D. NO.: R-2413C | BORING NO.: B1-B | GEOLOGIST: Steege |
|---|---|---|---|
| DESCRIPTION: South Bound US 220 Ramp (Sta. 16+77) | | | |
| COUNTY: Guilford - Rockingham | COLLAR ELEV.: 253.606 meters | TOTAL DEPTH: 21.88 meters | |

| Elev. (m) | Depth (m) | Drill Rate MIN/0.3m | Run (m) | Rec (m) % | RQD (m) % | Samp # | Field Classification and Remarks |
|---|---|---|---|---|---|---|---|
| 235.686 | 17.92 | 3 min/0.3 m | 0.91 | 0.66<br>73% | 0.15<br>16% | RUN1 | 17.92 - 18.40 Moderately Severely Weathered, Extremely Fractured, Brown and Grey Granite. |
| | | 3 min/0.3 m | | | | | 18.40 - 18.54 Moderately Weathered, Moderately Fractured, Fine - Grained, Tonalite. |
| | | 4 min/0.31m | | | | | 18.54 Moderately to Slightly Weathered, Moderately to Slightly Fractured, Grey and White Granite. |
| 234.776 | 18.83 | | | | | | |
| 234.776 | 18.83 | 6 min/0.3 m | 1.52 | 1.56<br>103% | 0.68<br>45% | RUN2 | Granite as above, with some interbedded, Moderately to Slightly Weathered, Slightly to Extremely Fractured, Grey Gabbro. |
| | | 6 min/0.3 m | | | | | |
| | | 6 min/0.3 m | | | | | |
| | | 6 min/0.3 m | | | | | |
| 233.256 | 20.35 | 6 min/0.32 m | | | | | |
| 233.256 | 20.35 | 6 min/0.3 m | 1.53 | 1.22<br>80% | 0.56<br>37% | RUN3 | Granite as above to 21.06. |
| | | | | | | | 21.06 - 21.88 Moderately to Slightly Weathered, Extremely to Moderately Fractured, Grey Gabbro with some Granite as above. |
| | | 6 min/0.3 m | | | | | |
| | | 6 min/0.3 m | | | | | |
| | | 5 min/0.3 m | | | | | |
| 231.726 | 21.88 | 4 min/0.33 m | | | | | |

| | | |
|---|---|---|
| | | CORING TERMINATED AT EL.: 231.726 meters |
| DRILLER: Shull | CORE SIZE: NWD4 | EQUIPMENT: CME 55 |




Core B1-B, 17.92 to 20.94 meters, box 1 of 2.




Core B1-B, 20.94 to 21.88 meters, box 2 of 2.

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-A | **BORING LOCATION** 16+59.200m | **OFFSET** 7.085m LT | **ALIGNMENT** SB US 220 — **0 HR.** 14.1 |
| **COLLAR ELEV.** 255.606 m | **NORTHING** 159.20 | **EASTING** -7.09 | **24 HR.** 13.4 |
| **TOTAL DEPTH** 21.26 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/4/97 | **COMPLETED** 11/4/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 255.61 | | | | | Existing Ground Surface | | | | 255.61 | 0.00 |
| | | | | | | | | | RESIDUAL: MEDIUM STIFF RED AND BROWN SILTY CLAY (A-6) WITH SOME ORGANICS | |
| | 1.40 | | | | | | | | 254.41 | 1.20 |
| 254 | | 4 | 6 | 6 | 12 | SS-11 | 22.6 | | STIFF RED AND TAN SANDY SILT (A-5) | |
| | | | | | | | | | 252.61 | 3.00 |
| 252 | | | | | | | | | STIFF RED AND TAN SANDY CLAYEY SILT (A-5(1)) | |
| | 4.45 | | | | | | | | | |
| | | 6 | 7 | 7 | 14 | SS-12 | 22.5 | | | |
| | | | | | | | | | 250.41 | 5.20 |
| 250 | | | | | | | | | MEDIUM DENSE AND DENSE TAN AND GREY MICACEOUS SILTY SAND (A-2-4) WITH QUARTZ- AND ORTHOCLASE-RICH ZONES | |
| | 5.98 | | | | | | | | | |
| | | 4 | 8 | 16 | 24 | | D | | | |
| | 7.50 | | | | | | | | | |
| 248 | | 6 | 5 | 6 | 11 | | D | | | |
| | 9.03 | | | | | | | | | |
| | | 9 | 14 | 27 | 41 | | D-M | | | |
| 246 | | | | | | | | | | |
| | 10.55 | | | | | | | | | |
| | | 9 | 10 | 16 | 26 | | D-M | | | |
| 244 | | | | | | | | | | |
| | 12.08 | | | | | | | | | |
| | | 12 | 15 | 16 | 31 | | M-W | | | |
| 242 | 13.60 | | | | | | | | | |
| | | 10 | 18 | 17 | 35 | | M-W | | | |
| | 15.13 | | | | | | | | | |
| | | 14 | 18 | 15 | 33 | | W | | | |
| 240 | | | | | | | | | | |
| | 16.65 | | | | | | | | | |
| | | 12 | 19 | 22 | 41 | | W | | | |
| 238 | | | | | | | | | | |
| | 18.18 | | | | | | | | 237.71 | 17.90 |
| | | 100/14 | | | 100/14 | | W | | SOFT WEATHERED ROCK: SEVERELY WEATHERED TAN AND WHITE QUARTZ-RICH GRANITE | |
| | | | | | | | | | 236.61 | 19.00 |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-A | **BORING LOCATION** 16+59.200m | **OFFSET** 7.085m LT | **ALIGNMENT** SB US 220 — **0 HR.** 14.1 |
| **COLLAR ELEV.** 255.606 m | **NORTHING** 159.20 | **EASTING** -7.09 | **24 HR.** 13.4 |
| **TOTAL DEPTH** 21.26 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/4/97 | **COMPLETED** 11/4/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 236.61 | | | | | Continued from previous page | | | | |
| 236 | 19.70 | 26 | 74/7 | | 100/22 | | M | | SOFT WEATHERED ROCK: BROWN AND GREY MICACEOUS META GRANITE (GRANITE GNEISS) — 235.11 / 20.50 |
| | 21.23 | 50/3 | | | 50/3 | | M-W | | SOFT WEATHERED ROCK: SEVERELY WEATHERED TAN AND WHITE GRANITE — 234.35 / 21.26 |
| 234 | | | | | | | | | BORING TERMINATED @ ELEV. 234.346 METERS IN SOFT WEATHERED ROCK (GRANITE) |
| 232 | | | | | | | | | GROUNDWATER: 0 HR. - 14.1 METERS - 11/4/97; 24 HR.- 13.4 METERS - 11/5/97 |
| 230 | | | | | | | | | |
| 228 | | | | | | | | | |
| 226 | | | | | | | | | |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |
| 218 | | | | | | | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-C | **BORING LOCATION** 16+65.733m | **OFFSET** -L- | **ALIGNMENT** SB US 220 — **0 HR.** 14.5 |
| **COLLAR ELEV.** 256.061 m | **NORTHING** 165.73 | **EASTING** 0.00 | **24 HR.** Dry |
| **TOTAL DEPTH** 17.92 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/3/97 | **COMPLETED** 11/3/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 256.06 | | | | | Existing Ground Surface | | | | 256.06 | 0.00 |
| | | | | | | | | | RESIDUAL: SOFT BROWN AND RED CLAYEY SANDY SILT (A-4) WITH TRACE ROOTLETS | |
| | 1.29 | | | | | | | | 254.86 | 1.20 |
| | | 4 | 4 | 4 | 8 | SS-1 | 18.6 | | MEDIUM STIFF TO STIFF RED AND BROWN SANDY CLAYEY SILT (A-4) WITH TRACE ROCK FRAGMENTS | |
| 254 | | | | | | | | | | |
| 252 | 4.34 | | | | | | | | 252.16 | 3.90 |
| | | | | | | | | | STIFF TAN SANDY SILT (A-4) | |
| | | 4 | 6 | 6 | 12 | SS-2 | 19.0 | | | |
| | | | | | | | | | 250.56 | 5.50 |
| | 5.87 | | | | | | | | MEDIUM DENSE TAN AND GREY QUARTZ-RICH SILTY SAND (A-2-4) | |
| 250 | | 5 | 7 | 9 | 16 | | D | | | |
| | 7.39 | | | | | | | | | |
| | | 6 | 7 | 8 | 15 | | D | | | |
| 248 | | | | | | | | | | |
| | 8.92 | | | | | | | | | |
| | | 7 | 8 | 10 | 18 | | D | | | |
| 246 | | | | | | | | | | |
| | 10.44 | | | | | | | | | |
| | | 8 | 8 | 10 | 18 | | D | | | |
| | 11.97 | | | | | | | | | |
| 244 | | 8 | 8 | 9 | 17 | | M-W | | | |
| | | | | | | | | | 243.06 | 13.00 |
| | 13.49 | | | | | | | | HARD TO VERY STIFF BROWN SILT WITH COBBLES (VERY SEVERELY WEATHERED VOLCANICS) (A-5(0)) | |
| | | 16 | 25 | 41 | 66 | SS-8 | 41.8 | | | |
| 242 | | | | | | | | | | |
| | 15.02 | | | | | | | | | |
| | | 6 | 8 | 15 | 23 | SS-9 | 38.9 | | | |
| 240 | | | | | | | | | | |
| | 16.54 | | | | | | | | 239.26 | 16.80 |
| | | 16 | 52 | 48/2 | 100/1.7 | | S | | SOFT WEATHERED ROCK: SEVERELY WEATHERED BROWN META VOLCANICS | |
| | | | | | | | | | 238.14 | 17.92 |
| 238 | | | | | | | | | AUGER REFUSAL @ ELEV. 238.141 METERS ON HARD ROCK (VOLCANICS) | |
| | | | | | | | | | GROUNDWATER: | |

NCBMM3 71072 11/26/97

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-C | **BORING LOCATION** 16+65.733m | **OFFSET** -L- | **ALIGNMENT** SB US 220 — **0 HR.** 14.5 |
| **COLLAR ELEV.** 256.061 m | **NORTHING** 165.73 | **EASTING** 0.00 | **24 HR.** Dry |
| **TOTAL DEPTH** 17.92 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/3/97 | **COMPLETED** 11/3/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | ▼ MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 237.06 | | | | | Continued from previous page | | | | |
| 236 | | | | | | | | | 0 HR. - 14.5 METERS - 11/3/97<br>24 HR. - DRY - 11/4/97<br>HOLE CAVE @ 13.0 METERS - 11/4/97<br><br>NOTES:<br>WHILE AUGERING 13.00-17.92 METERS, RECOVERED LARGE (5-20 CM DIAMETER), ROUNDED, HARD, MORE RESISTANT NODULES ALONG WITH SOFTER, MORE WEATHERED MATERIAL. MATERIAL @ 17.92 METERS WAS DETERMINED UNCOREABLE. |
| 234 | | | | | | | | | |
| 232 | | | | | | | | | |
| 230 | | | | | | | | | |
| 228 | | | | | | | | | |
| 226 | | | | | | | | | |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-B | **BORING LOCATION** 16+72.426m | **OFFSET** 7.258m RT | **ALIGNMENT** SB US 220 — **0 HR.** 15.7 |
| **COLLAR ELEV.** 257.001 m | **NORTHING** 172.43 | **EASTING** 7.26 | **24 HR.** Dry |
| **TOTAL DEPTH** 19.51 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/4/97 | **COMPLETED** 11/4/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 257.00 | | | | | Existing Ground Surface | | | | 257.00 | 0.00 |
| | | | | | | | | | RESIDUAL: MEDIUM STIFF RED AND BROWN SILTY CLAY (A-6) WITH SOME ROOTLETS | |
| 256 | | | | | | | | | 255.80 | 1.20 |
| | | | | | | | | | VERY STIFF RED AND BROWN SANDY SILT (A-5) | |
| | 2.73 | | | | | | | | | |
| 254 | | 7 | 7 | 9 | 16 | SS-24 | 22.4 | | 253.80 | 3.20 |
| | | | | | | | | | MEDIUM DENSE TAN RED AND BROWN SILTY SAND (A-2-4) | |
| | 4.25 | | | | | | | | | |
| | | 12 | 14 | 16 | 30 | SS-25b | 15.2 | | 252.50 | 4.50 |
| 252 | | | | | | | | | VERY STIFF BROWN SILT AND ROCK FRAGMENTS (VERY SEVERELY WEATHERED VOLCANICS) (A-4) | |
| | | | | | | | | | 251.80 | 5.20 |
| | 5.78 | | | | | | | | HARD BROWN AND GREY SILT AND COBBLES (VERY SEVERELY WEATHERED VOLCANICS) (A-5) | |
| | | 29 | 36 | 37 | 73 | SS-26 | 16.9 | | | |
| 250 | | | | | | | | | 250.00 | 7.00 |
| | 7.30 | | | | | | | | MEDIUM DENSE TO DENSE TAN AND WHITE SILTY SAND (A-2-4) | |
| | | 7 | 7 | 7 | 14 | | D | | | |
| | 8.83 | | | | | | | | | |
| 248 | | 14 | 15 | 27 | 42 | | D | | | |
| | | | | | | | | | 246.90 | 10.10 |
| | 10.35 | | | | | | | | VERY STIFF TAN AND GREY SLIGHTLY MICACEOUS SANDY CLAYEY SILT (A-5(0)) | |
| | | 19 | 12 | 13 | 25 | SS-29 | 17.9 | | | |
| 246 | | | | | | | | | | |
| | 11.88 | | | | | | | | | |
| | | 5 | 11 | 16 | 27 | | M | | | |
| | | | | | | | | | 244.30 | 12.70 |
| 244 | | | | | | | | | VERY DENSE TAN AND GREY SAND (A-1-b) | |
| | 13.40 | | | | | | | | | |
| | | 22 | 25 | 54 | 79 | | M-D | | | |
| | | | | | | | | | 242.60 | 14.40 |
| | 14.93 | | | | | | | | VERY DENSE GREY AND TAN SILTY SAND (A-2-4) | |
| 242 | | 26 | 24 | 38 | 62 | | M | | | |
| | 16.45 | | | | | | | | | |
| | | 37 | 47 | 53/12 | 100/27 | | M | | 240.30 | 16.70 |
| 240 | | | | | | | | | SOFT WEATHERED ROCK: SEVERELY WEATHERED GREY AND TAN GRANITE | |
| | 17.98 | | | | | | | | | |
| | | 16 | 41 | 59/14 | 100/29 | | W-S | | | |

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# N.C.D.O.T. GEOTECHNICAL UNIT BORING LOG



| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** Guilford-Rockingham | **GEOLOGIST** Steege |
| **SITE DESCRIPTION** South Bound US 220 Ramp (Sta. 16+77) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-B | **BORING LOCATION** 16+72.426m | **OFFSET** 7.258m RT | **ALIGNMENT** SB US 220 — **0 HR.** 15.7 |
| **COLLAR ELEV.** 257.001 m | **NORTHING** 172.43 | **EASTING** 7.26 | **24 HR.** Dry |
| **TOTAL DEPTH** 19.51 m | **DRILL MACHINE** CME 55 | **DRILL METHOD** HSA | **HAMMER TYPE** Manual |
| **DATE STARTED** 11/4/97 | **COMPLETED** 11/4/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 238.00 | | | | | Continued from previous page | | | | |
| | 19.50 | | | | | | | | 237.49 — 19.51 |
| | | 50/1 | | | 50/1 | | W | | BORING TERMINATED @ ELEV. 237.491 METERS IN SOFT WEATHERED ROCK (GRANITE |
| 236 | | | | | | | | | GROUNDWATER:<br>0 HR. - 15.7 METERS - 11/4/97<br>24 HR. - DRY - 11/5/97<br>HOLE CAVE @ 14.1 METERS - 11/5/97 |
| 234 | | | | | | | | | NOTES:<br>WHILE AUGERING 5.0-7.0 METERS, ENCOUNTERED DIFFERENTIALLY WEATHERED VOLCANICS (BROWN SILT AND HARD, GREY, ROUNDED, MORE RESISTANT NODULES); EXTREMELY DIFFICULT TO AUGER YET UNCOREABLE. |
| 232 | | | | | | | | | |
| 230 | | | | | | | | | |
| 228 | | | | | | | | | |
| 226 | | | | | | | | | |
| 224 | | | | | | | | | |
| 222 | | | | | | | | | |
| 220 | | | | | | | | | |

# APPENDIX VI

## Photographs of Site

## INDEX TO PHOTO LOCATIONS

1. View from behind EB1-B looking NNE at End Bent 1.
2. View of rig on B1-B.
3. View looking NNE at Bent 1 from behind B1-B.
4. Trash which had to be moved from Bent 1.
5. View from behind EB2-B looking NNE at End Bent 2.
6. View from behind EB2-C, looking northwest along centerline.

1. View from behind EB1-B looking NNE at End Bent 1.

2. View of rig on B1-B.

3. View looking NNE at Bent 1 from behind B1-B.

4. Trash which had to be moved from Bent 1.

5. View from behind EB2-B looking NNE at End Bent 2.

6. View from behind EB2-C, looking northwest along centerline.

# APPENDIX VII

## Laboratory Test Results

NCDOT Proj. 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: SB US 220 Ramp (Sta. 16+77)

EB1-A

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-77 | 1.20-1.65 | A-5 | 31 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 9.9 |

EB1-C

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-59 | 1.14-1.59 | A-7-5(7) | 50 | 95.2 | 66.6 | 57.2 | 4.8 | 32.7 | 7.3 | 13.0 | 42.2 | 45 | 30 | 15 | 6.0 |
| SS-60 | 2.67-3.12 | A-4 | 17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 16.9 |

EB1-B

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-67 | 1.17-1.62 | A-2-7(4) | 40 | 99.2 | 43.7 | 30.5 | 0.8 | 62.2 | 8.3 | 8.5 | 20.2 | 60 | 45 | 15 | 31.8 |
| SS-70 | 5.75-6.20 | A-4 | 51 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 21.7 |

B1-C

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-47 | 5.68-6.13 | A-2-5(0) | 13 | 100 | 68.9 | 27.2 | - | 49.0 | 29.0 | 16.0 | 6.0 | 62 | -- | N.P. | 21.1 |

B1-B

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-36 | 1.07-1.52 | A-5 | 14 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.8 |
| SS-37a | 4.12-4.30 | A-4 | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 27.4 |

EB2-A

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-11 | 1.40-1.85 | A-5 | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.6 |
| SS-12 | 4.45-4.90 | A-5(1) | 14 | 98 | 87.9 | 50.9 | 2.0 | 18.6 | 40.4 | 30.9 | 8.1 | 55 | -- | N.P. | 22.5 |

NCDOT Proj. 6.499002T
Tip No.: R-2413C
F.A. No.: N/A
County: Guilford-Rockingham
Description: SB US 220 Ramp (Sta. 16+77)

EB2-C

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-1 | 1.29-1.74 | A-4 | 8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 18.6 |
| SS-2 | 4.34-4.79 | A-4 | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 19.0 |
| SS-8 | 13.49-13.94 | A-5 | 66 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 41.8 |
| SS-9 | 15.02-15.47 | A-5(0) | 23 | 83.6 | 79.1 | 63.5 | 16.4 | 7.4 | 18.7 | 39.1 | 18.4 | 43 | 41 | 2 | 38.9 |

EB2-B

| SAMPLE NUMBER | DEPTH INTERVAL | AASHTO | N | % PASS #10 | % PASS #40 | % PASS #200 | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY | LL | PL | PI | MOISTURE CONTENT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS-24 | 2.73-3.18 | A-5 | 16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.4 |
| SS-25b | 4.50-4.70 | A-4 | 30 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 15.2 |
| SS-26 | 5.78-6.23 | A-5 | 73 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 16.9 |
| SS-29 | 10.35-10.80 | A-5(0) | 25 | 99.6 | 67.4 | 40.0 | 0.4 | 39.4 | 28.5 | 23.4 | 8.3 | 48 | -- | N.P. | 17.9 |

| | |
|---|---|
| **SUBMITTED TO:** | State of North Carolina<br>Department of Transportation<br>Division of Highways<br>Geotechnical Unit<br>Post Office Box 25201<br>Raleigh, North Carolina 27611-5201 |
| **ATTENTION:** | Mr. William L. Moore, III, L.G.<br>State Engineering Geologist<br>Geotechnical Unit |
| **SUBMITTED BY:** | Engineering Tectonics, P.A.<br>Post Office Box I<br>Winston-Salem, North Carolina 27108 |
| **DATE:** | October 8, 1998 |
| **STATE PROJECT:** | 6.499002T (R-2413C) |
| **F.A. NUMBER:** | N/A |
| **COUNTY:** | Guilford/Rockingham |
| **DESCRIPTION:** | Dual Bridges on US 220 (-L REV-) over US 158 (-Y6-) |
| **SUBJECT:** | Geotechnical Report of Subsurface Exploration and Recommendations for Bridges on -L REV - (US 220) over -Y6- (US 158) |

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2. Appendices

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1. Site Photographs
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3. NCDOT Legend Supplement
4. Vicinity Map
5. Boring Location Diagram
6. Subsurface Profiles and Cross Sections
7. Boring Logs, Core Boring Reports, and Core Photographs
8. AASHTO Tests Results

Appendix B (Issued Under Separated Cover)

1. Boring Quantity Summation Sheet
2. Check List
3. Field Notes
4. Survey Notes
5. Laboratory Test Sheets
6. Bearing Calculations

ENGINEERING TECTONICS, P.A.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS
P.O. Box I, Winston-Salem, NC 27108 (336) 724-6994

**STATE PROJECT:** 6.499002T (R-2413C)

**COUNTY:** Guilford/Rockingham

**DESCRIPTION:** Dual Bridges on US 220 (-L REV-) over US 158 (-Y6-)

**SUBJECT:** Geotechnical Report of Subsurface Exploration and Recommendations for Bridges on -L REV- (US 220) over -Y6- (US 158)

Engineering Tectonics, P.A. (ETPA) has completed the authorized geotechnical investigation for the above referenced project in Guilford County, North Carolina. The purpose of the exploration was to investigate the subsurface conditions at the proposed bent locations and provide general foundation design recommendations.

## PROJECT DESCRIPTION

The proposed project will consist of the construction of dual bridges on -L REV (US 220) over -Y6- (US 158). A four lane bridge currently exist at the site. The proposed bridges will be two span structures with lengths of approximately 65 meters and widths of approximately 15.6 meters. Based on the preliminary structure plans, the skew angles to tangent for all bents is proposed to be 66°39'03".

## SITE DESCRIPTION

The site of the proposed bridge is located approximately 640 meters south of the Guilford/Rockingham County line at the intersections of US 220 and US 158 in Guilford County, North Carolina. The proposed bridge will cross over US 158.

The project site lies within the Piedmont Physiographic Province, and topography of the general site vicinity is gently rolling hills. The site is located on the Summerfield, N.C. 7.5 minute topographic quadrangle. The elevation of the subject site is approximately 277 meters above mean sea level. The site is located near the top of a knoll with apparent drainage to the south-southeast towards the Haw River which is located approximately 2 kilometers south. Site relief in the area of our borings ranges from a high of Elevation 282.28 meters (MSL) at Boring EB2-B RT, to a low of Elevation 275.97 meters (MSL) in the bottom of the drainage ditch 4.53 meters south of Boring B1-A LT. All land adjacent to the subject site, outside of the highway right-of-ways, is wooded.

## DESCRIPTION OF SUBSURFACE EXPLORATION

The subsurface exploration was conducted between August 26 and September 15, 1998. A total of eighteen (18) soil test borings, three borings at each bent location, were drilled at the site using either an ATV mounted Mobile B-50 or a truck mounted Mobile B-80 drilling rig. Either an 8.26 cm (I.D.) hollow stem auger or a 7.62 cm (I.D.) casing advancer was used to advance each borehole through soil. Standard Penetration Tests were performed in all borings in accordance with North Carolina Department of Transportation (NCDOT) guidelines, and representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with AASTO Specification T 206. The recovered soil samples were visually classified in the field, then returned to our laboratory for specific laboratory testing on selected samples. The laboratory tests results are included in Appendix A.

Nine (9) of the eighteen borings performed for this project were extended below the auger refusal depth to obtain core samples of the underlying rock. The rock coring was

performed with an NQ size (5.50 cm O.D.) Wireline Coring system manufactured by the Longyear Company. This system uses a diamond impregnated NQ series bit fastened to the end of a NQ size hollow double-tube core barrel. The rock coring was performed through the augers or casing using creek water alone as the drilling fluid. The rock core samples were returned to our laboratory for review of field classifications and for further descriptive analysis.

Work points indicating the locations of the proposed bents were located by an NCDOT survey crew. The actual boring locations were established by personnel from Engineering Tectonics, P.A. using the preliminary plans provided by the NCDOT and the work points established by the NCDOT survey crew. Site elevations were surveyed by personnel from Engineering Tectonics, P.A. using the elevations established for the work points by the NCDOT survey crew.

Boring EB1-B LT was offset along the bent from the staked location to avoid overhead power lines, while Borings EB1-A RT and B1-A RT were offset due to steep slopes at the staked boring locations. Borings EB1-B RT and EB1-D RT were offset to avoid existing abutment foundations at the staked locations, and Boring B1-D RT was offset to the shoulder of the existing US 220 to stay out of traffic. Boring B1-B RT was offset to avoid the existing bridge girder at the staked boring location. The actual locations of the borings are shown on the Boring Location Diagram, Drawing No. 2, included in Appendix A.

## LABORATORY TESTING

Laboratory testing was performed on representative split-spoon samples to aid in the assessment of AASHTO soil classification and to provide data for evaluation of engineering properties. The laboratory testing consisted of natural moisture content determination, Atterberg Limits tests, and grain size analysis with hydrometer. All laboratory testing was performed in accordance with applicable AASHTO and NCDOT specifications. The results of the laboratory tests are included in Appendix A.

# PHYSIOGRAPHY AND GEOLOGY

## Regional Geology

Guilford and Rockingham Counties lie within the Piedmont physiographic province of the Southern Appalachian Highlands. The Piedmont is comprised of several northeast-southwest trending belts of igneous and metamorphic rock, thought to have been accreted to the eastern edge of the North American continent during the closing of several Paleozoic ocean basins (Hatcher 1987). The subject site is located at the juncture between the Milton Belt and the Charlotte Belt. Milton Belt rocks are characterized by strongly foliated gneiss and schist, while the Charlotte Belt is defined by King (1955) as "dominantly plutonic". The granitic rock encountered in our subsurface exploration indicates that the rock at the subject site most likely belongs within the Charlotte Belt.

The oldest known Charlotte Belt rocks are Late Proterozoic to Cambrian mafic gneisses, amphibolites, metagabbros, and metavolcanic rocks. The Charlotte Belt is interpreted to have formed as the leading edge of a late Proterozoic to middle Cambrian volcanic arc. This volcanic arc was located just off shore of the proto North American continent during the initial opening of the Atlantic Ocean. Between the late Cambrian and the end of the Ordovician, the volcanic island arc collided and was sutured to the North American continent.

The Charlotte belt is bordered to the west by the Kings Mountain and Inner Piedmont Belts; and to the north by the Milton Belt. The metamorphosed sedimentary and volcanic rocks of the Carolina Slate Belt lie to the east of the Charlotte Belt. Metamorphic grade generally increases from east to west, from lower grade greenschist facies in the Carolina Slate Belt to amphibolite facies in the Charlotte and Kings Mountain Belts. In certain areas, the rocks have been correlated across the Charlotte Belt and Carolina Slate Belt boundary. The dominantly lower grade volcaniclastic rocks of the Carolina Slate Belt exhibit similar lithologies to the plutonic rocks of the Charlotte belt. The units are distinguished only by an increase to sillimanite grade metamorphism in the Charlotte Belt (Butler and Secor, 1991).

In addition to metamorphic grade, the Charlotte Belt is distinguished from adjacent belts by its numerous plutonic bodies. Three distinct pulses of regional plutonic activity are recognized in the Charlotte Belt (Butler and Secor, 1991). The oldest rocks in the Charlotte Belt provide evidence of a major plutonic episode, from 650 to 500 Ma. These calc-alkaline plutonic rocks record the main eruptive and intrusive centers of the magmatic arc (Butler and Secor, 1991). The peak of regional metamorphism occurred around 430 Ma, during the Taconic orogeny. The emplacement of the Concord and Salisbury Plutonic Suites occurred during this time.

Horton, J.W. and Zullo, V.A., *The Geology of the Carolinas*, 1991

Site Geology

According to the North Carolina State Geologic Map (Brown, et al., 1985), underlying bedrock at the subject site is "Granitic Rock: megacrystic to equigranular" of Pennsylvanian to Permian age. The Geologic Map of Region G, North Carolina (State of North Carolina Department of Natural Resources and Community Development, Geological Survey Section , P. Albert Carpenter , III, 1982), indicates that the bedrock at the site is part of the Churchland pluton, a porphyritic granite intrusion which is believed to be 282 ±6 million years old, and which is composed of gray microcline phenocrysts up to 13 cm in diameter in a matrix of quartz, oligoclase, and biotite in the vicinity of the subject site.

A local crushed stone quarry is located approximately 1 kilometer southwest of the subject site. Known as the Pearman Quarry, it has been in operation since 1937. The rock from the quarry has been described as "medium-grained, even-granular granite, showing strong parallelism of the abundant biotite and hornblende constituents and containing a large amount of quartz and a considerable amount of finely divided epidote" (R.J. Councill, *The Commercial Granites of North Carolina*, 1954). A thin section of the rock from this quarry shows it to be a biotite-hornblende gneissic granite with the following mineral composition: 27% quartz, 58% orthoclase, 12% biotite and hornblende, and 3% others (magnetite, myrmekite, sericite, calcite, chlorite, muscovite, and epidote).

One outcrop of rock was observed on the subject site between End Bent-One and Bent-One in the left lane. The rock in the outcrop has a strike of N65°E and a dip of 7°NW. The rock in the outcrop, as well as the cored rock, is a biotite-hornblende gneissic granite identical the Pearman Quarry rock described above. The cored rock is overall very good in quality with high RQD and Recovery values. Very little iron staining was noted in the recovered core.

In the Piedmont, bedrock is typically overlain by unconsolidated materials or regolith including alluvium, saprolite, and soils. Saprolite is a common clay-rich weathering product of the underlying bedrock units. A thin layer of soil usually covers both saprolite and alluvial deposits. The overlying soils at the site are the residual product from the physical and chemical weathering of the underlying bedrock.

Butler, J.R., and Secor, D.T., Jr., The Central Piedmont, The Geology of the Carolinas.
R.J. Councill, *The Commercial Granites of North Carolina*

## SUBSURFACE CONDITIONS

The generalized subsurface conditions, as indicated by our borings, are described below. For soil descriptions and weathered rock descriptions at a particular boring location, the respective test boring logs should be reviewed. Representative subsurface profiles along the "A" line of the left lane and the "B" line of the right lane, as well as cross sections at each bent, are included in Appendix A as Drawing Nos. 3 through 10.

### Soils

Soils at the site are embankment fill and residual in origin. The embankment fill is present in the area of the borings at End Bent-2 Left Lane, and End Bent-1 and End Bent-2 Right Lane. The fill ranges in thickness from 0.5 to 2.6 meters, being thickest on the right side of End Bent-2 Right Lane. The existing embankment fill generally consists of light brown, tan, and red to orange variably micaceous very clayey fine to coarse very sandy silt (A-4). These soils are typically dry to moist, and rock fragments are present within this fill at End Bent-2 Left Lane.

Residual soils are present below the fill at elevations ranging from 279.4m to 280.3m, and beginning at the existing ground in the remaining borings. These residual soils generally consist of medium stiff to hard; tan, white, black, and red; very sandy very clayey silt (A-5) and variably micaceous clayey to very clayey very sandy silt (A-4 and A-5). Also present as residual soil is loose to very dense; tan, red, white, and black; variably micaceous rock fragments and slightly clayey to clayey silty sand (A-1-b), and slightly clayey to clayey silty sand (A-2-4). The granular soils, where present, are generally present underlying the silt material at elevations ranging from ±275 meters to ±278 meters. The exception was encountered in Boring B1-D RT in which A-2-4 material is present between layers of A-5 material.

Weathered rock is present below the residual soils in all executed borings, with the exception of Boring EB1-A LT in which weathered rock is present beginning at the existing ground surface. The elevation of the top of the weathered rock ranges between ±272 meters to ±278 meters. The highest weathered rock is generally present in the area of End Bent-1, while the lowest top of weathered rock is generally present in the area of Bent-1. Soft weathered rock also occurs in Boring B1-B RT as a 0.7 meter thick zone within A-5 material, and in Boring EB2-D RT as a 0.9 meter thick zone between A-5 and A-2-4 material.

Rock

Hard Rock was encountered in seventeen of the eighteen borings drilled for this project, and rock coring was performed in nine of these borings. The elevations of the top of the hard rock range from ±272 meters to ±278 meters. The highest top of rock elevations are in the vicinity of End Bent-1, while the lowest are at Bent-1. The rock encountered in our borings is biotite-hornblende gneissic granite. The rock in the Left Lane borings is very slightly weathered to fresh and slightly fractured to sound, with Core Recovery values of 88% to 100% and Rock Quality Designation (RQD) values of 67% to 100%. These values indicate fair to very good rock. The rock in the Right Lane is moderately weathered to fresh and extremely fractured to sound with Core Recovery values of 80% to 100% and Rock Quality Designation values of 32% to 100% indicating poor to very good rock. All of the RQD values below 80% occurred in the top 1.52 meters of core in the borings at Bent-1 Right Lane. Dominant joint sets range from 0° to 20° with Average

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## CLOSURE

Engineering Tectonics, P.A. appreciates this opportunity to be of service to the North Carolina Department of Transportation. Should you have any questions regarding this report, or if we may be of further service to you in any way, please do not hesitate to contact us.

Very truly yours,
**Engineering Tectonics, P.A.**

NORTH CAROLINA LICENSED SEAL 1500 GEOLOGIST PAUL M. WEAVER

Paul M. Weaver, P.G.
Project Engineering Geologist

NORTH CAROLINA PROFESSIONAL SEAL No. 8233 ENGINEER JOHN M. RILEY

John M. Riley, P.E.
President

JMR,PMW;pmw
enclosures

## QUALIFICATION OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report were based on the applicable standards of our profession at the time this report was prepared.

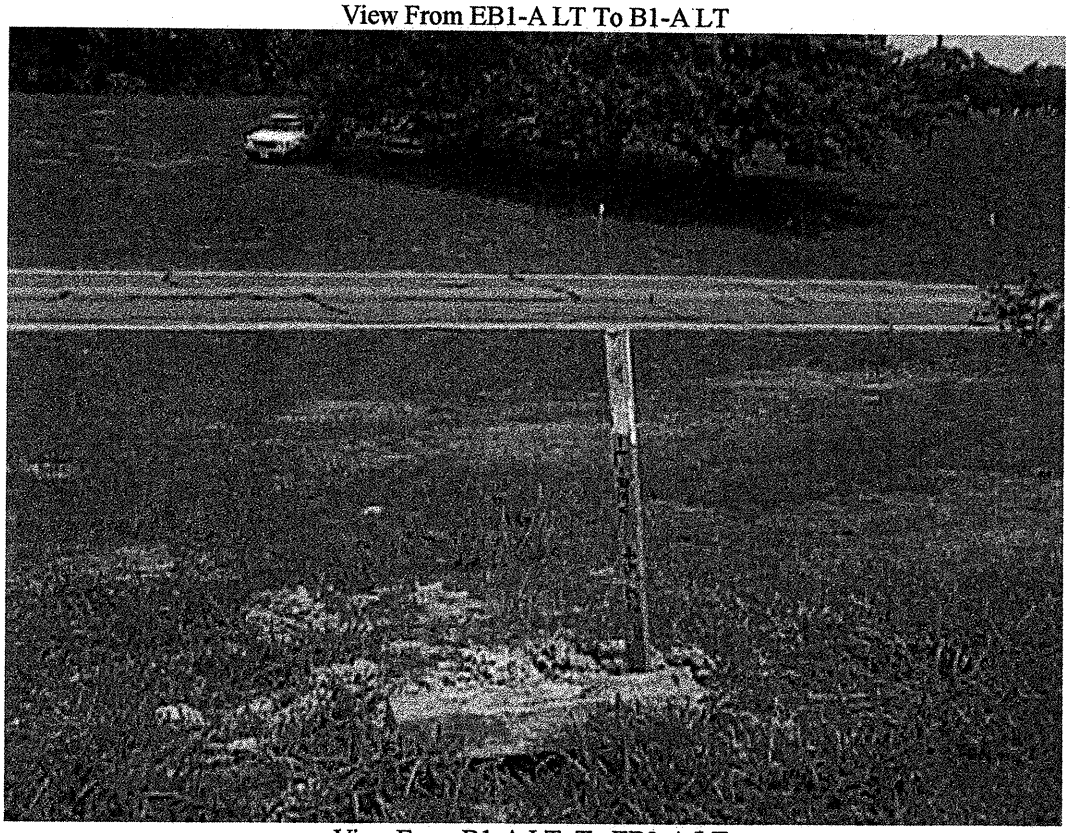
The analysis and recommendations submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations between borings may not become evident until construction. If variations are then evident, it will be necessary to reevaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structure are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by Engineering Tectonics, P.A., (ETPA) and the conclusions of this report modified or verified in writing.

The stratification of the soils, as shown on the Soil Boring Logs, Cross Sections, and Profiles, represents the soil conditions in the actual boring locations, and variations may occur between borings. Lines of demarcation represent the approximate boundaries between soil types, but the transitions may be gradual. It should be noted that even though the test borings are drilled and sampled by experienced drillers and geologists, it is sometimes difficult to record changes in stratification within narrow limits, especially at great depths. In addition, it is sometimes difficult to distinguish between discolored soils and soil fill in the absence of foreign substances.

The information presented in the "Project Description" section of this report was utilized in our geotechnical analysis. Therefore, if any of this information is in error due to either our misunderstanding or to a design change, ETPA should be provided the opportunity to review the "Foundations Recommendations" section of this report for either possible changes to the report or verification of the information.

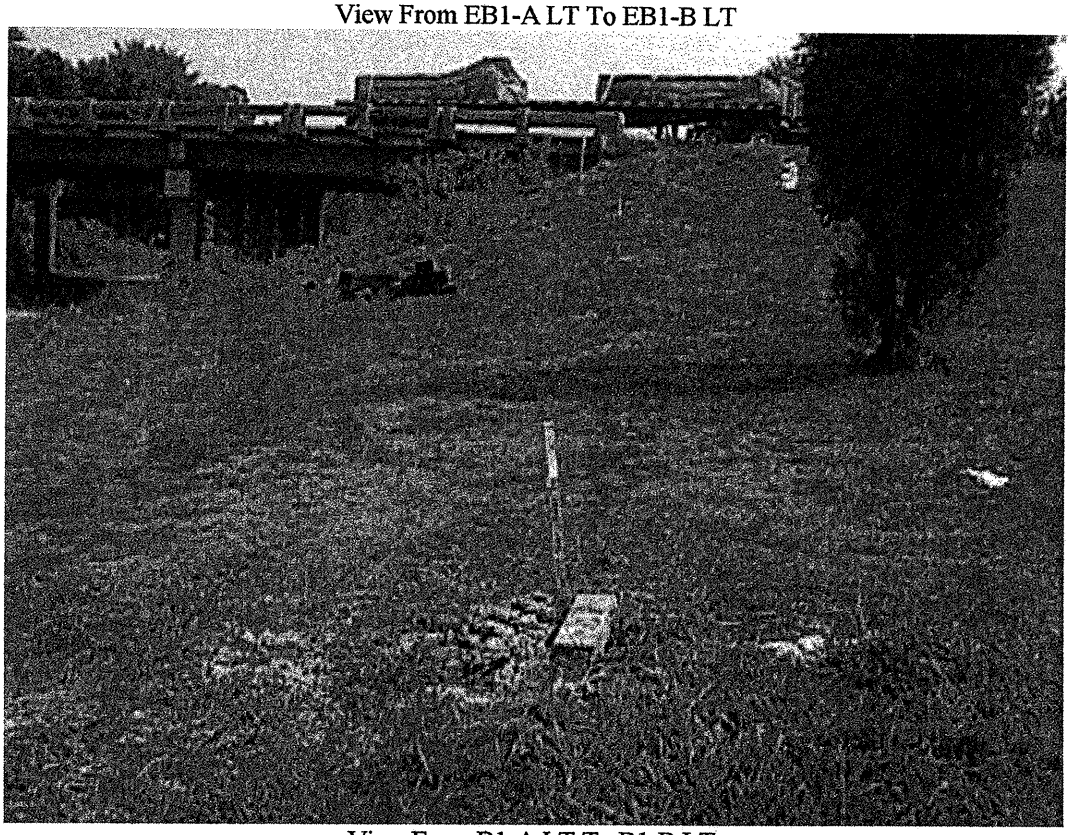
# Appendix A

View From EB1-A LT To B1-A LT

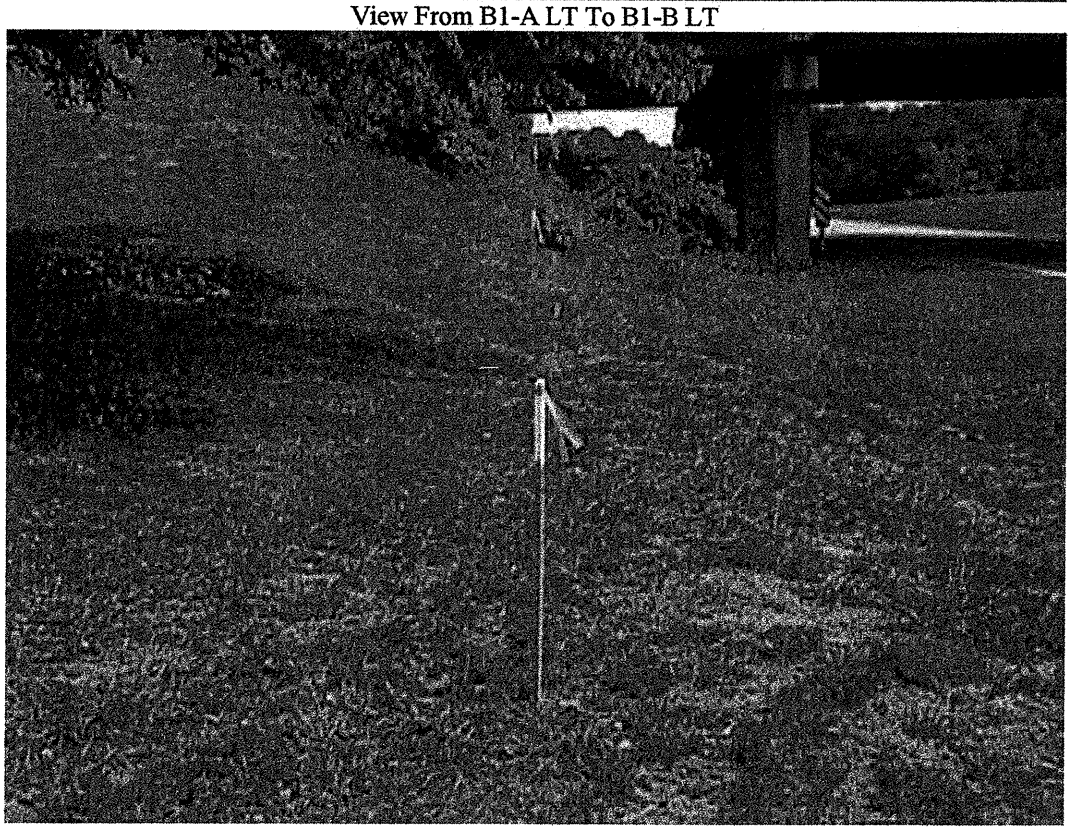


View From B1-A LT To EB2-A LT

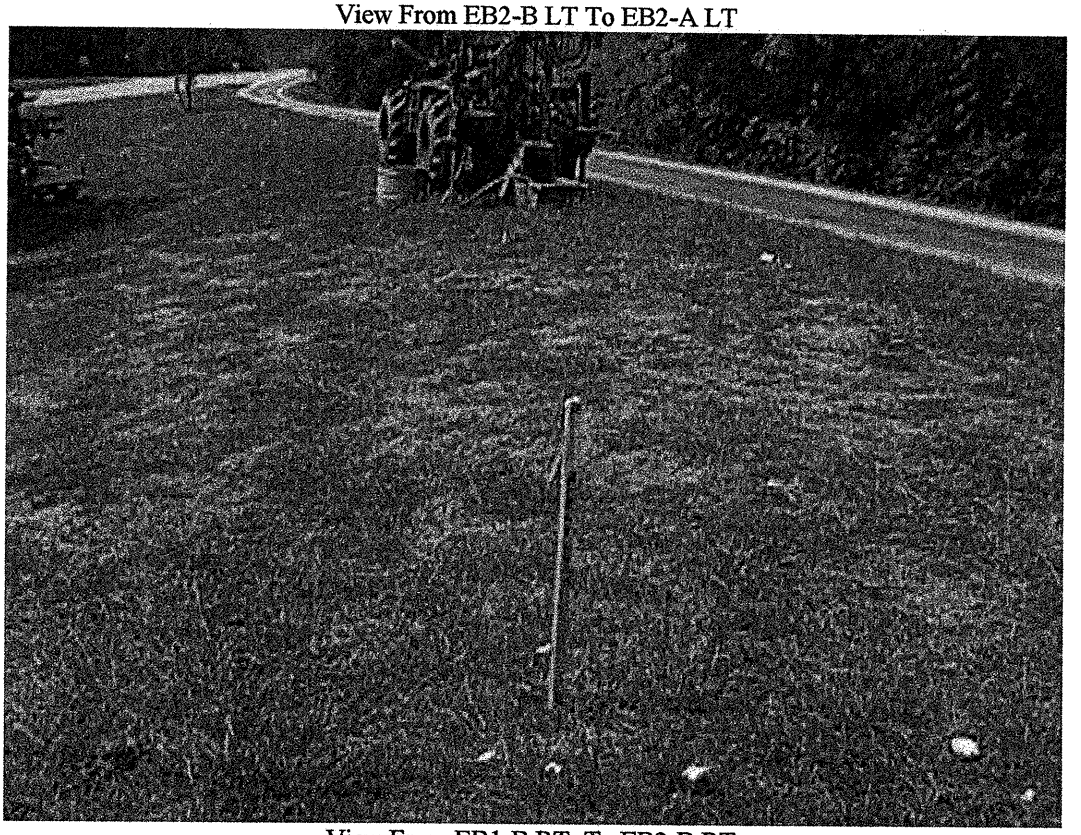
View From EB1-A LT To EB1-B LT



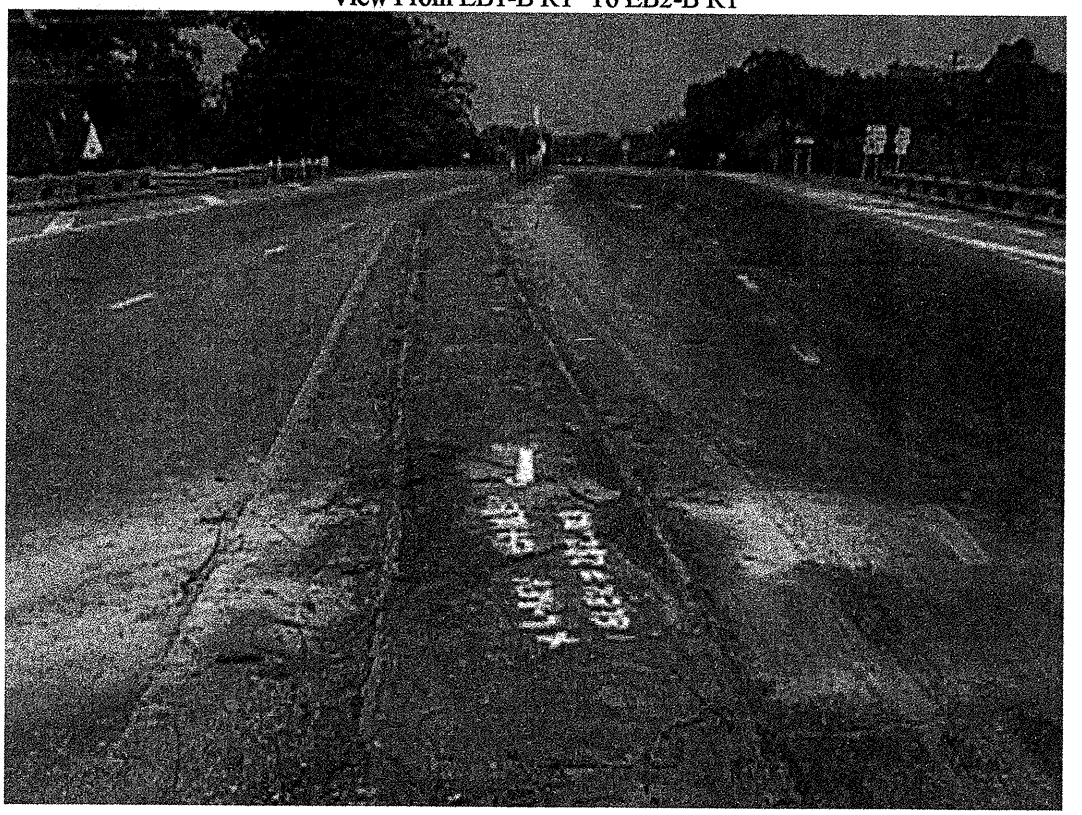
View From B1-A LT To B1-B LT



View From EB2-B LT To EB2-A LT

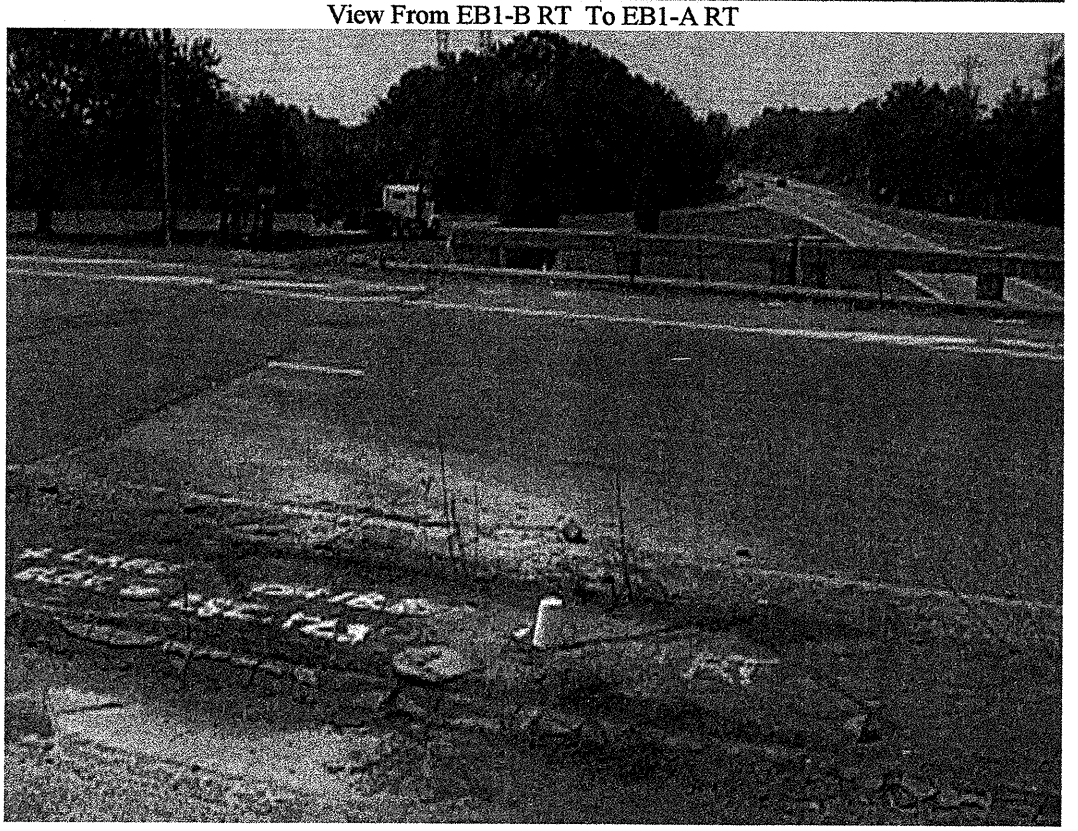


View From EB1-B RT To EB2-B RT

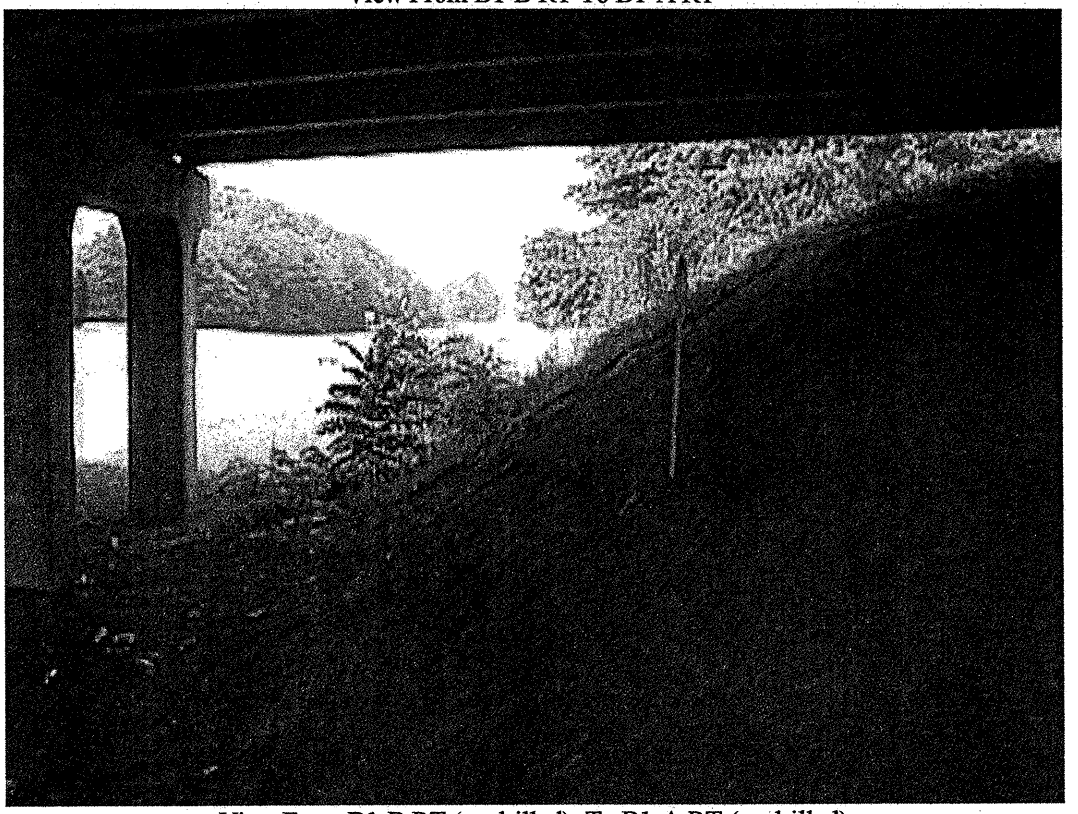


View From EB2-A RT To EB1-A RT

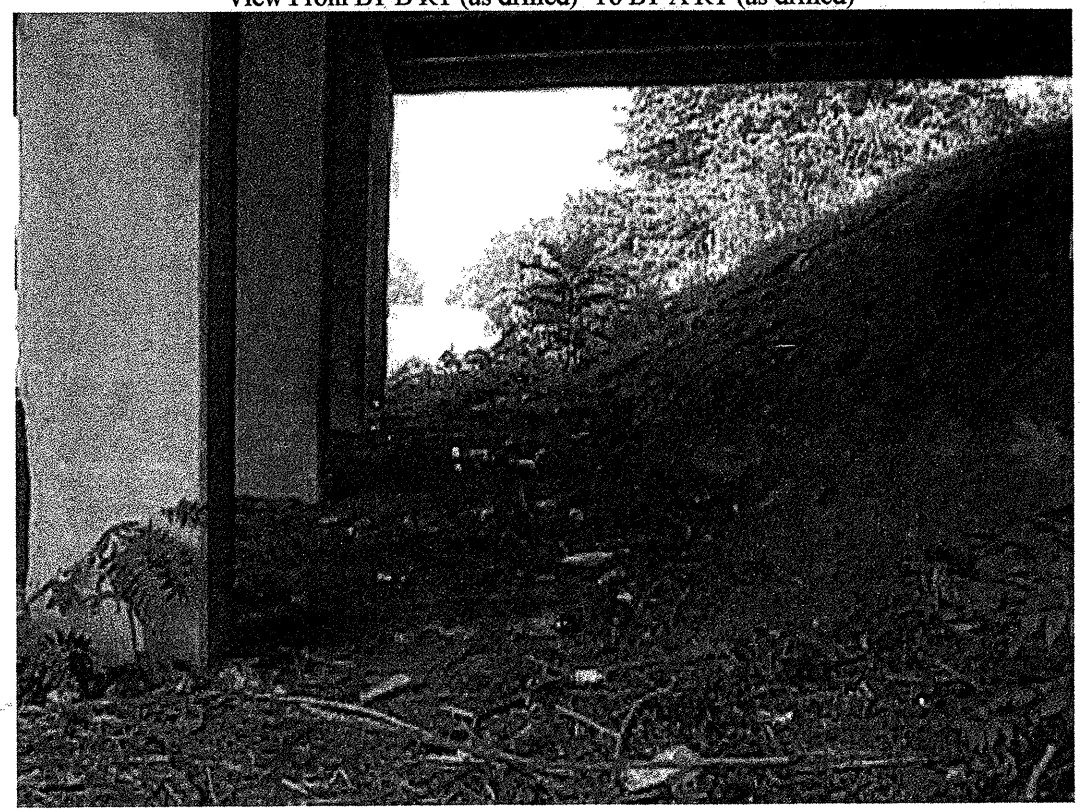
View From EB1-B RT To EB1-A RT



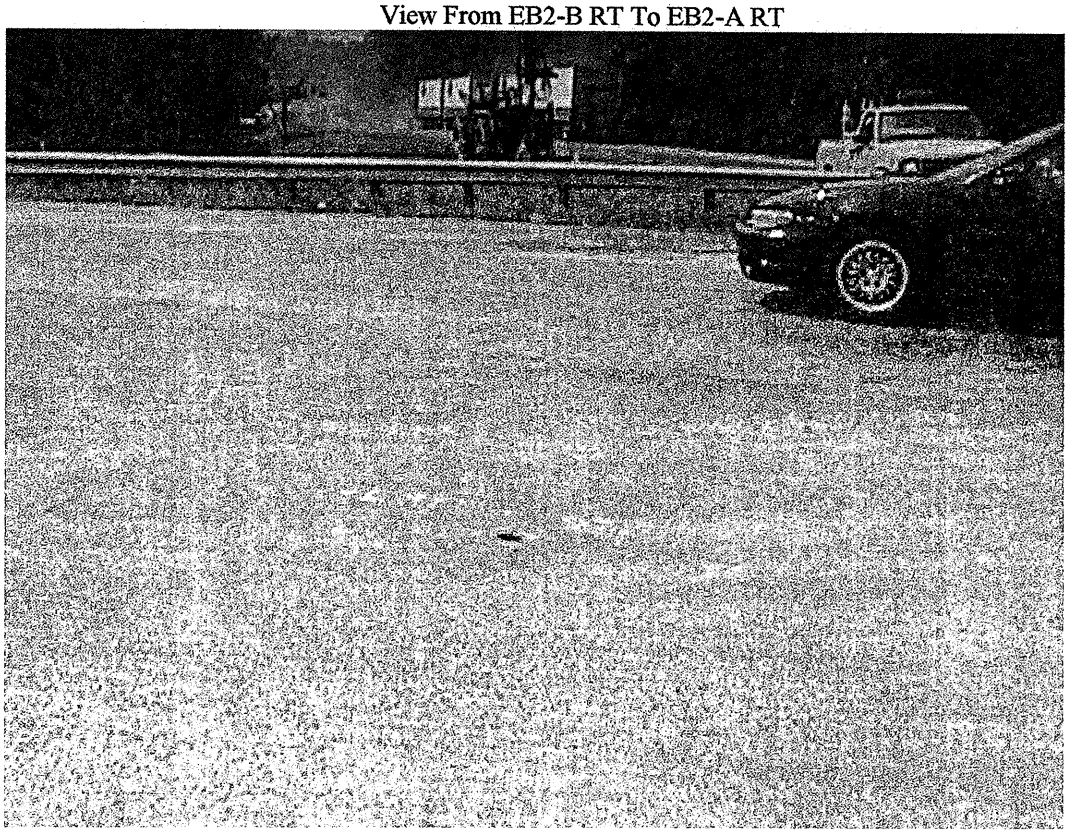
View From B1-B RT To B1-A RT



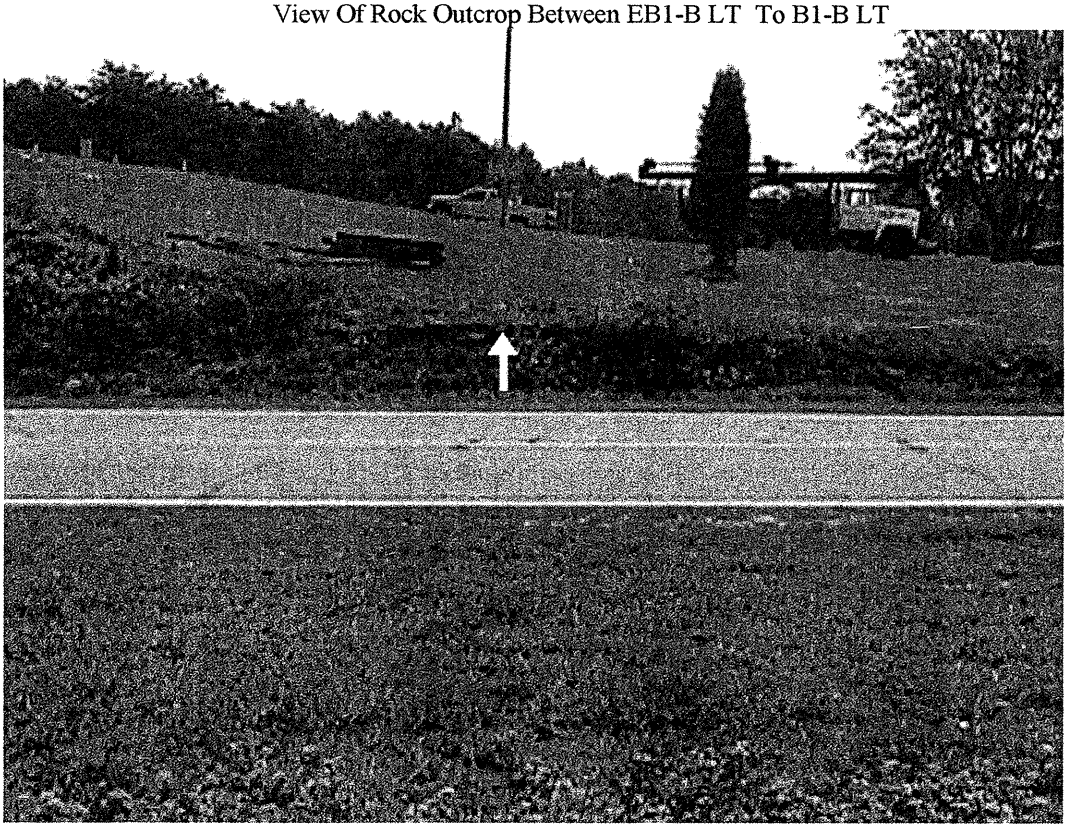
View From B1-B RT (as drilled) To B1-A RT (as drilled)



View From EB2-B RT To EB2-A RT



View Of Rock Outcrop Between EB1-B LT To B1-B LT



# CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WAS 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 UNIT @ (919) 250-4088. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA IS PART OF THE CONTRACT.

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

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

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

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

# NORTH CAROLINA DIVISION OF HIGHWAYS
## GEOTECHNICAL UNIT
## SOIL AND ROCK CLASSIFICATION, LEGEND, AND ABBREVIATIONS

### SOIL LEGEND AND AASHTO CLASSIFICATION

| GENERAL CLASS. | GRANULAR MATERIALS (≤ 35% PASSING #200) | | | | | | | SILT-CLAY MATERIALS (> 35% PASSING #200) | | | | ORGANIC MATERIALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GROUP CLASS. | A-1 | | A-3 | A-2 | | | | A-4 | A-5 | A-6 | A-7 | A-1,A-2 A-3 | A-4,A-5 A-6,A-7 | |
| | A-1-a | A-1-b | | A-2-4 | A-2-5 | A-2-6 | A-2-7 | | | | A-7-5 A-7-6 | | | |
| SYMBOL | | | | | | | | | | | | GRANULAR SOILS | SILT-CLAY SOILS | MUCK, PEAT |
| % PASSING #10 | 50 MX | | | | | | | | | | | | | |
| #40 | 30 MX | 50 MX | 51 MN | | | | | | | | | | | |
| #200 | 15 MX | 25 MX | 10 MX | 35 MX | 35 MX | 35 MX | 35 MX | 36 MN | 36 MN | 36 MN | 36 MN | | | |
| (PASSING #40) LL | | | | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | 40 MX | 41 MN | SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER | | HIGHLY ORGANIC SOILS |
| PI | 6 MX | | N.P. | 10 MX | 10 MX | 11 MN | 11 MN | 10 MX | 10 MX | 11 MN | 11 MN | | | |
| GROUP INDEX | 0 | | 0 | 0 | | 4 MX | | 8 MX | 12 MX | 16 MX | NO MX | | | |
| USUAL TYPES OF MAJOR MATERIALS | STONE FRAGS. GRAVEL & SAND | | FINE SAND | SILTY OR CLAYEY GRAVEL AND SAND | | | | SILTY SOILS | | CLAYEY SOILS | | | | |

* PI OF A-7-5 ≤(LL-30); PI OF A-7-6 > (LL-30)

### TEXTURE OR GRAIN SIZE

| | BOULDER | COBBLE | GRAVEL | COARSE SAND | FINE SAND | SILT | CLAY |
|---|---|---|---|---|---|---|---|
| GRAIN (mm) | 305 | 75 | 2 | 0.25 | 0.05 | 0.005 | |
| SIZE (IN) | 12 | 3 | | | | | |

### SOIL MOISTURE - CORRELATION OF TERMS

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

### ROCK DESCRIPTION

IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED TO BE THAT INDURATED EARTH MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF "WEATHERED ROCK". FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:

| TERM | SYMBOLS | | DESCRIPTION |
|---|---|---|---|
| HARD ROCK (HR) | CORED ROCK | INFERRED ROCK LINE [2] | MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE |
| WEATHERED ROCK (WR) | | HARD WEATHERED ROCK (HWR) | MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL [1] |
| | | SOFT WEATHERED ROCK (SWR) | MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL |

[1] SPT REFUSAL ≤ 2.5 cm OF PENETRATION PER 50 BLOWS IN SPT.
[2] AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED. A DESCRIPTION OF ROCK IS GIVEN, INCLUDING:

CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

ROCK QUALITY DESIGNATION (RQD) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO .01m DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.

NORTH CAROLINA LICENSED SEAL 1500 GEOLOGIST PAUL M. WEAVER

SEAL

Signature

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTANCE (N - VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($q_u$) (kN / m²) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | < 4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>> 50 | N/A |
| GENERALLY SILT-CLAY MATERIAL | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | < 2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>> 30 | < 25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>> 400 |

### GROUND WATER

- WATER LEVEL IN BORE HOLE — IMMEDIATELY AFTER DRILLING (I.A.D.); SOON AFTER DRILLING (0 HRS.)
- STATIC WATER LEVEL (AFTER 24 HRS.)
- PERCHED WATER (PW), SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEPAGE

### MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 25° STRIKE AND DIP
- APPARENT DIP (NORMAL TO _____)
- ROD SOUNDING
- SPT DPT VST TEST BORING
- AUGER BORING
- CORE BORING
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- MONITORING WELL

SAMPLE DESIGNATIONS
- S-BULK SAMPLE
- SS-SPLIT SPOON SAMPLE
- ST-SHELBY TUBE SAMPLE
- RS-ROCK SAMLE

### ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALLUV. | ALLUVIUM | MIC. | MICACEOUS |
| A.R. | AUGER REFUSAL | MOT. | MOTTLED |
| BLDR. | BOULDER | N | BLOWS / 30 CM |
| B.T. | BORING TERMINATED | NS | NO SAMPLE TAKEN |
| C.T. | CORING TERMINATED | N/A | NOT APPLICABLE |
| CALC. | CALCAREOUS | N/T | NOT TAKEN |
| CL. | CLAY | ORG. | ORGANIC |
| CLY. | CLAYEY | PP | POCKET PENETROMETER |
| COB. | COBBLE | REF. | REFER TO |
| CSE. | COARSE | RES. | RESIDUAL |
| DPT | DYNAMIC PENETRATION TEST | S. | SOFT |
| EST. | ESTIMATED | SAT. | SATURATED |
| F. | FINE | SD. | SAND |
| FIAD | FILLED IMMED. AFTER DRILLING | SDY. | SANDY |
| FOSS. | FOSSILIFEROUS | SED(S). | SEDIMENT(S) |
| FRAC. | FRACTURED | SL. | SILT, SILTY |
| FRAG(S). | FRAGMENT(S) | SLI. | SLIGHTLY |
| GR. | GRAVEL | SPT | STANDARD PENETRATION TEST |
| GS | SPECIFIC GRAVITY | TS. | TOPSOIL |
| GW | GROUND WATER | VST | VANE SHEAR TEST |
| MED. | MEDIUM | V. | VERY |
| | | W/ | WITH |

BENCH MARK: MARK ON SOUTHEAST CORNER OF BRIDGE ABUTMENT ELEVATION 282.12m

STATE PROJECT NO. 6.499002T

T.I.P. NO. R-2413C F.A. NO. N/A

COUNTY GUILFORD ROUTE US 220

SITE DESCRIPTION DUAL BRIDGES ON -L REV- (US 220) OVER -Y6 - (US 158)

PROJECT GEOLOGIST P.M. WEAVER M. TAYLOR SUBMITTED BY J.M. RILEY & P.M. WEAVER

PERSONNEL D. BARRON, J. CAIN, K. PUCKETT

DATE SUBMITTED 10/08/98

## LEGEND SUPPLEMENT

In addition to the terms and abbreviations on the Legend Sheet, the following will be used to further descibe rock quality on this project. Because of limited space on the logs, abbreviations are in parenthesis.

## WEATHERING

| | |
|---|---|
| FRESH | Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline. |
| VERY SLIGHT (V.SLI.) | Rock generally fresh, joints stained, some joints may show thin clay coatings if open, crystals on a broken specimen face shine brightly. Rock rings under hammer blows if of a crystalline nature. |
| SLIGHT (SLI.) | Rock generally fresh, joints stained and discoloration extends into rock up to 0.025m (1 in.). Open joints may contain clay. In granitoid rocks, some occasional feldspar crystals are dull and discolored. |
| 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 are dull and discolored and a majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock gives "clunk" sound when struck with a hammer. *Comparable to hard weathered rock.* |
| SEVERE (SEV.) | All rocks 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. *Comparable to soft weathered rock.* |
| VERY SEVERE (V.SEV.) | All rock except quartz discolored or stained. Rock frabric 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. *Comparable to soil.* |
| COMPLETE | Rock reduced to soil. Rock fabric discernible only in small and scattered concentrations. Quartz may be present as dikes or stringers. Saprolite is also an example. *Comparable to soil.* |

## ROCK CONTINUITY

| | |
|---|---|
| Sound- | Core pieces larger than 0.20m |
| Slightly Fractured (SLI.FRACT.) | Core pieces between 0.10 and 0.20m |
| Moderately Fractured (MOD.FRACT.) | Core pieces between 0.025 and 0.10m |
| Extremely Fractured (EXT.FRACT.) | Core pieces less than 0.025m |

## JOINT SPACING

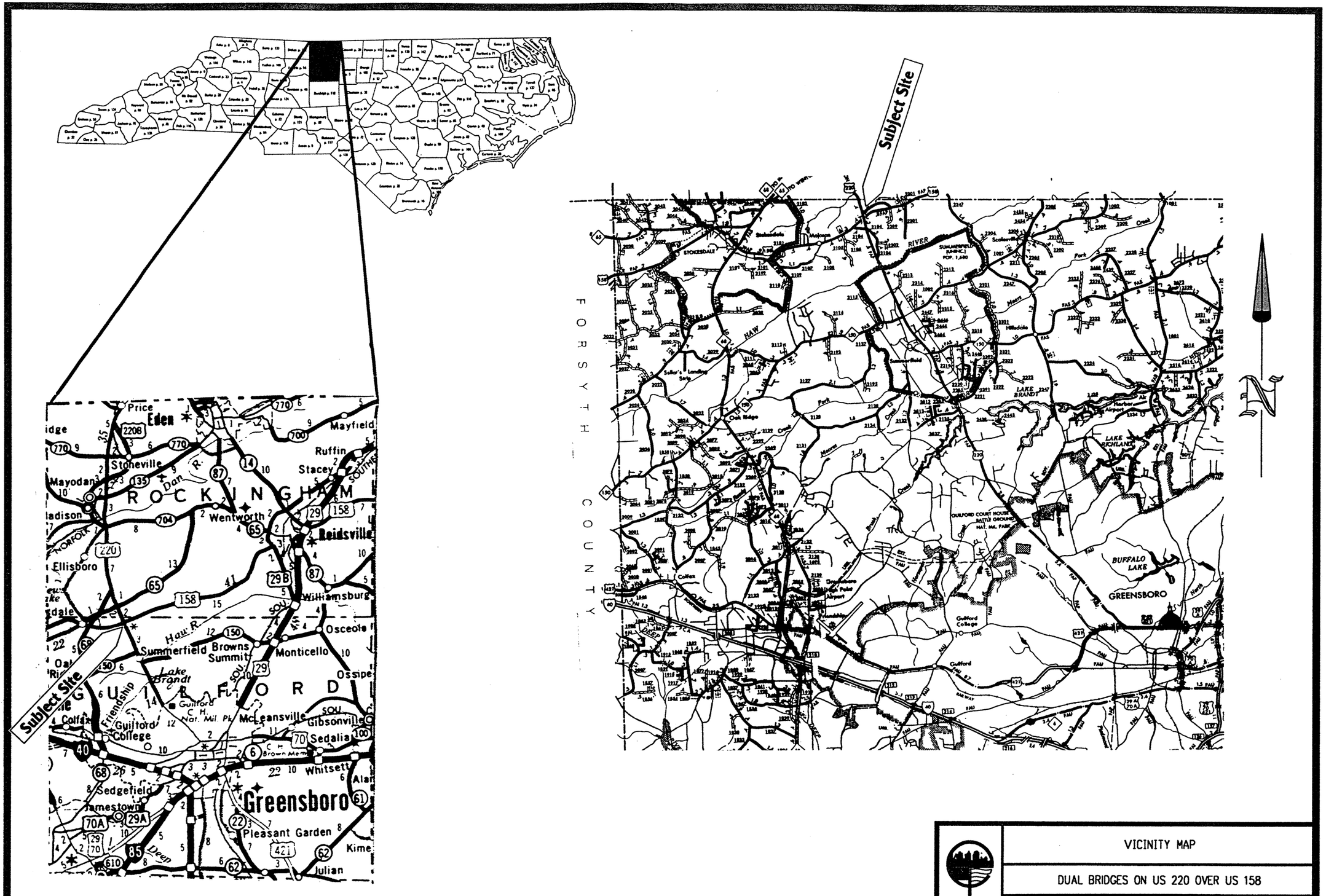
Average Discontinuity Spacing (ADS)

The average measured distance (in meters) between joints in the same set. Will not apply to individual joints.

## JOINT THICKNESS

Average Discontinuity Thickness (ADT)

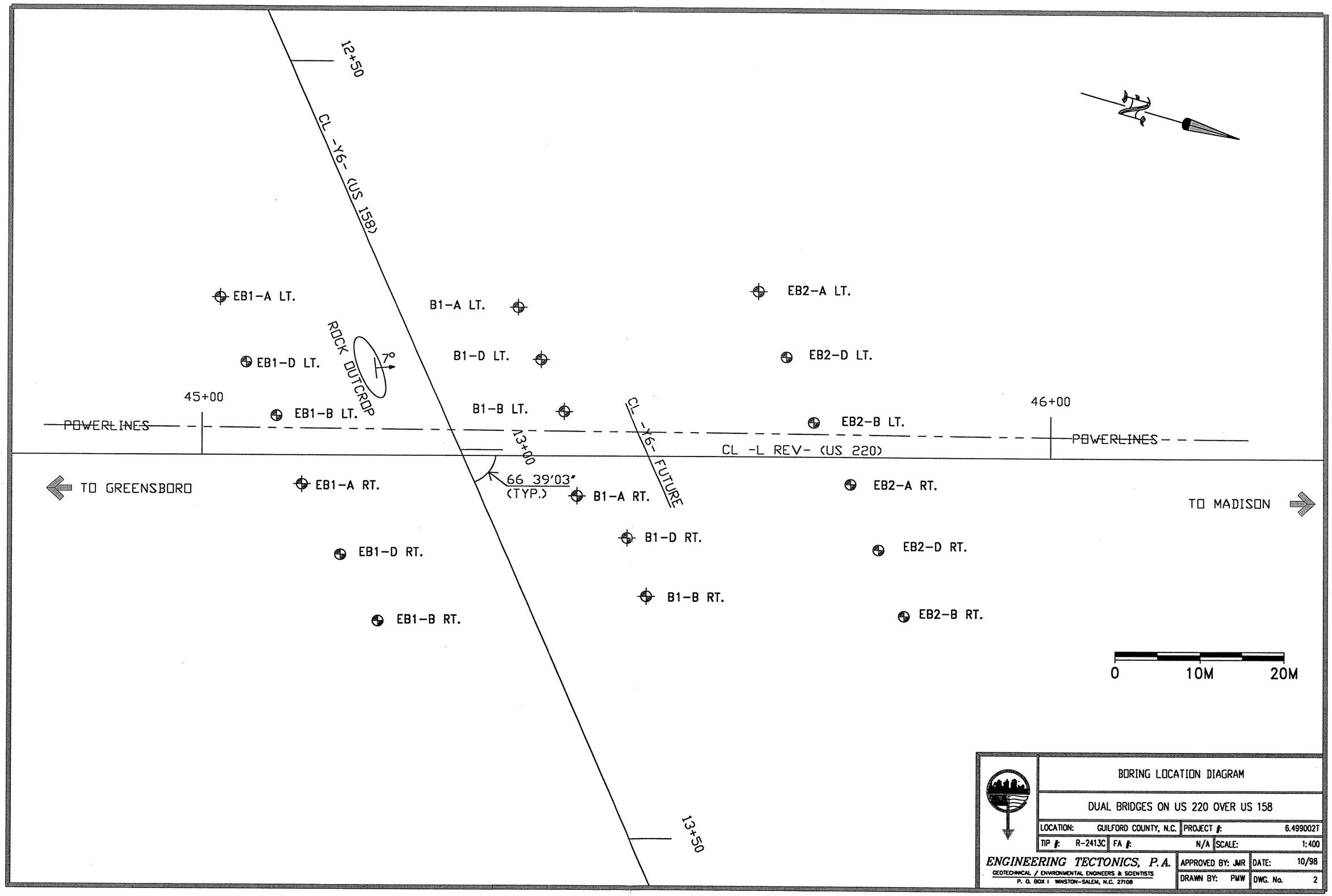
The average thickness or width of gap in the joint (in meters).




VICINITY MAP

DUAL BRIDGES ON US 220 OVER US 158

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.4990021 |
| TIP #: R-2413C | FA #: N/A | SCALE: | NOT TO SCALE |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No: | 1 |



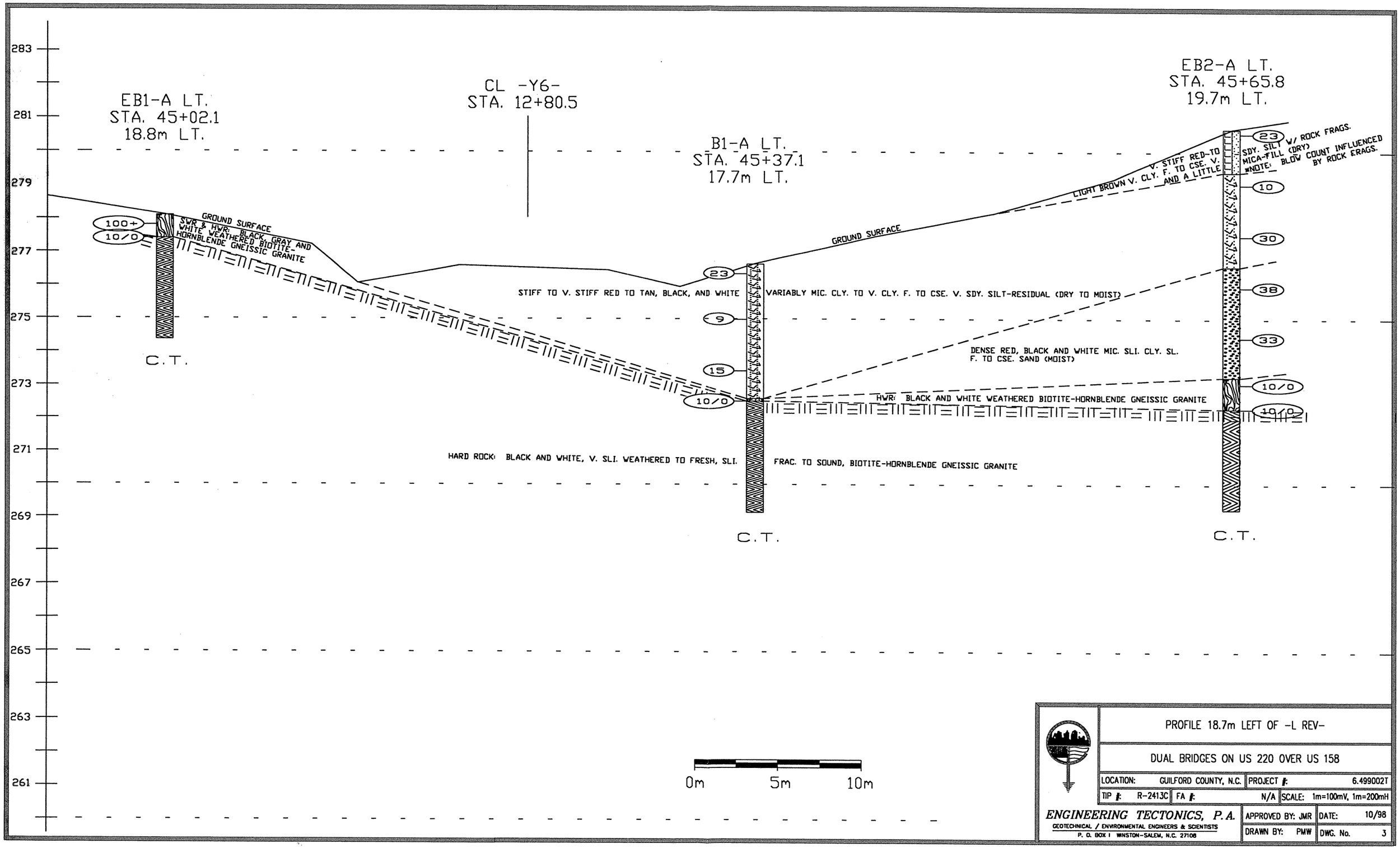

BORING LOCATION DIAGRAM

DUAL BRIDGES ON US 220 OVER US 158

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1:400 |

ENGINEERING TECTONICS, P.A.
GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS
P. O. BOX 1 WINSTON-SALEM, N.C. 27108

| | | | |
|---|---|---|---|
| APPROVED BY: JMR | | DATE: | 10/98 |
| DRAWN BY: PMW | | DWG. No. | 2 |



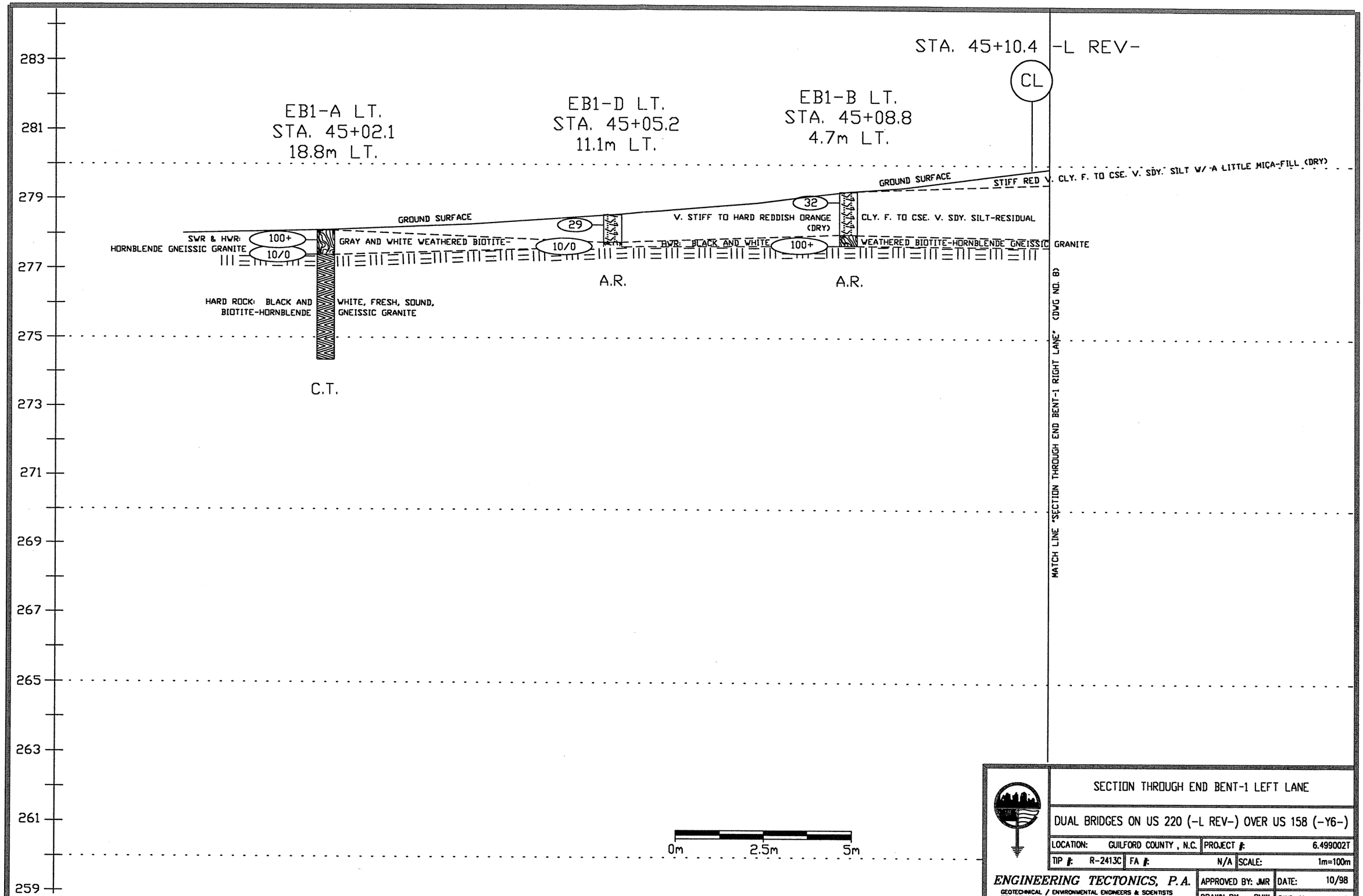

PROFILE 18.7m LEFT OF -L REV-

DUAL BRIDGES ON US 220 OVER US 158

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100mV, 1m=200mH |

ENGINEERING TECTONICS, P.A.
GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS
P. O. BOX 1 WINSTON-SALEM, N.C. 27108

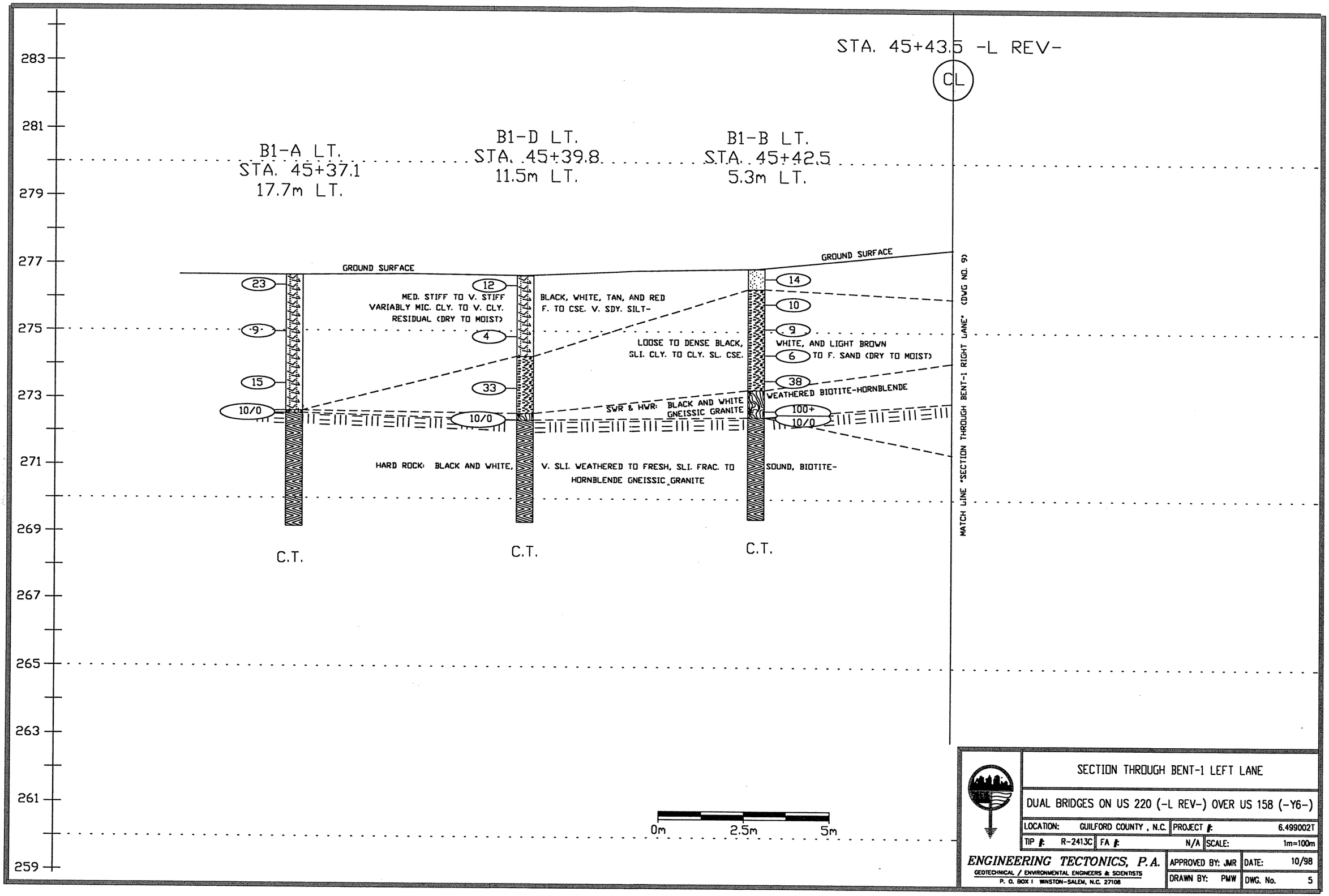
| | | | |
|---|---|---|---|
| APPROVED BY: JMR | | DATE: | 10/98 |
| DRAWN BY: PMW | | DWG. No. | 3 |




SECTION THROUGH END BENT-1 LEFT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

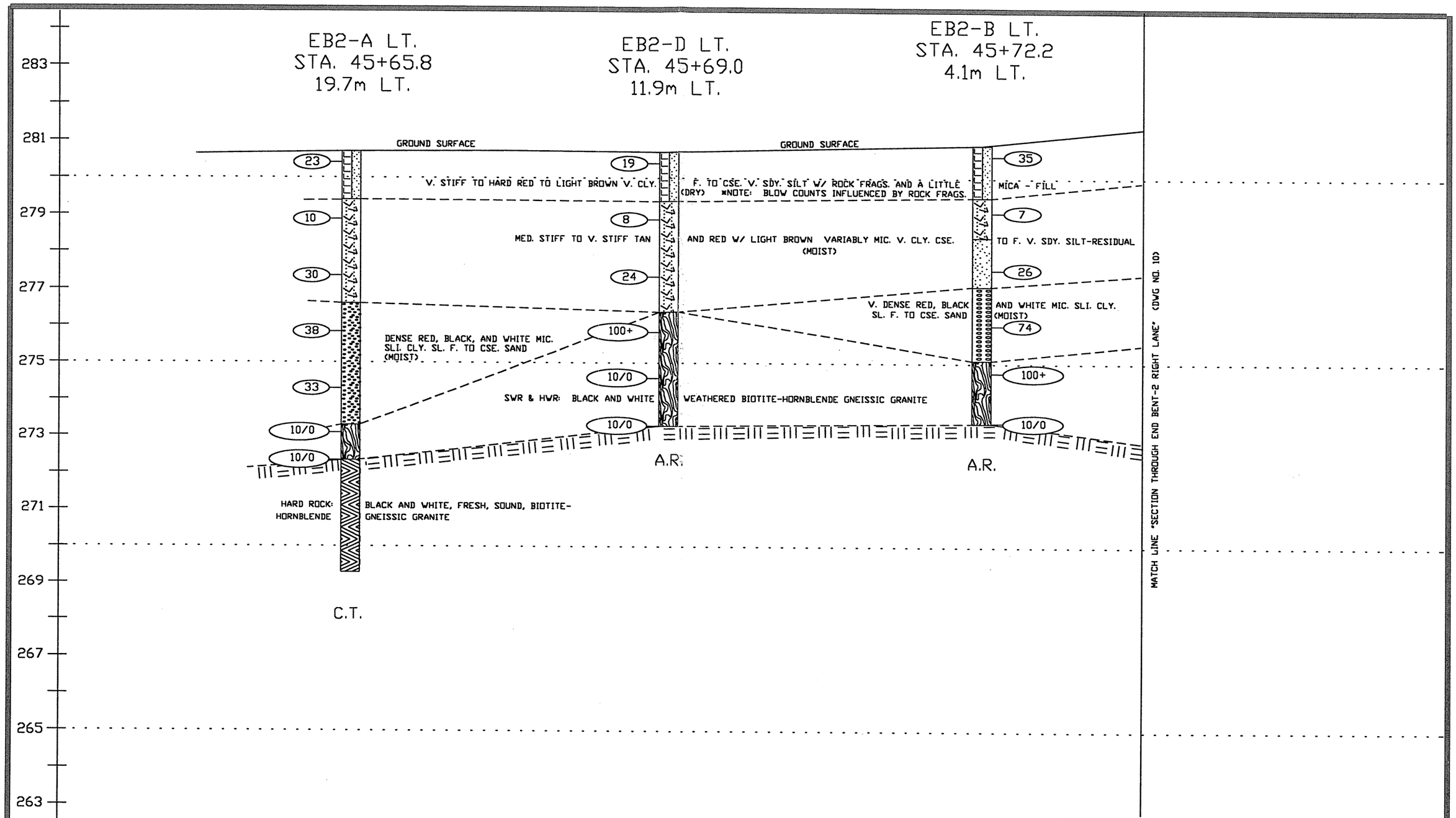
| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No. | 4 |




SECTION THROUGH BENT-1 LEFT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No. | 5 |

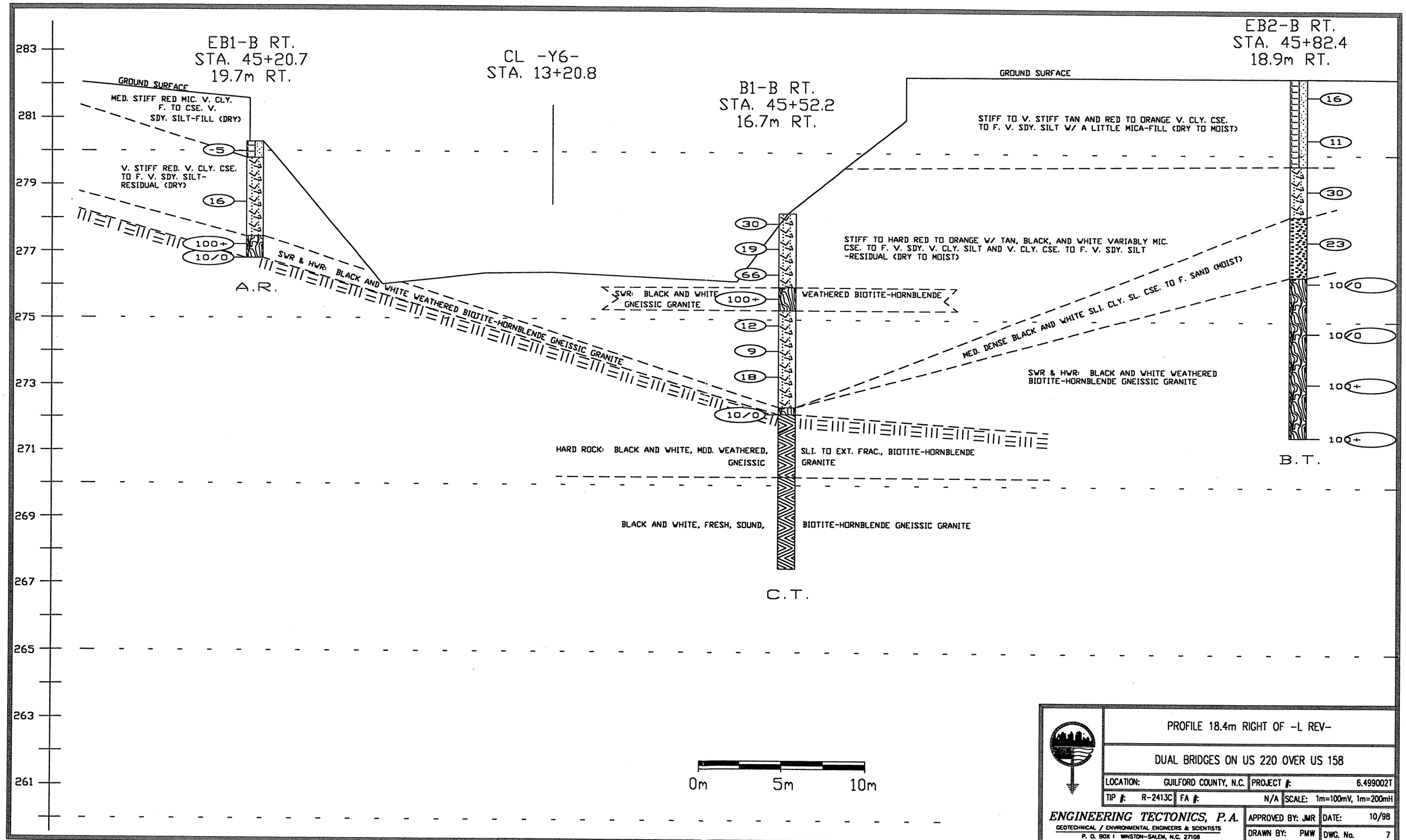



SECTION THROUGH END BENT-2 LEFT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |
| ENGINEERING TECTONICS, P.A. | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No. | 6 |

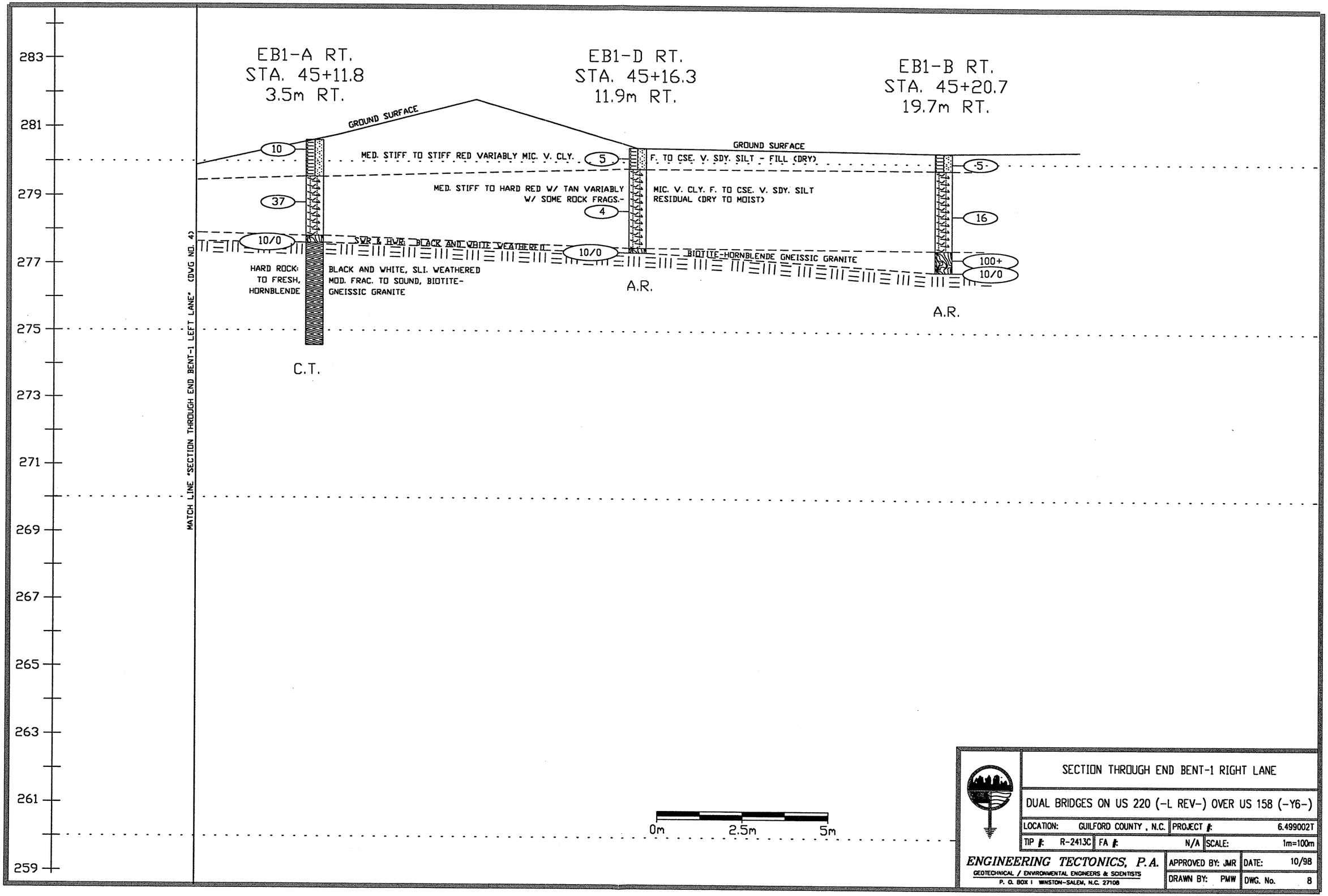
GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS
P. O. BOX 1 WINSTON-SALEM, N.C. 27108




PROFILE 18.4m RIGHT OF -L REV-

DUAL BRIDGES ON US 220 OVER US 158

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100mV, 1m=200mH |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No. | 7 |




SECTION THROUGH END BENT-1 RIGHT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |

ENGINEERING TECTONICS, P.A.
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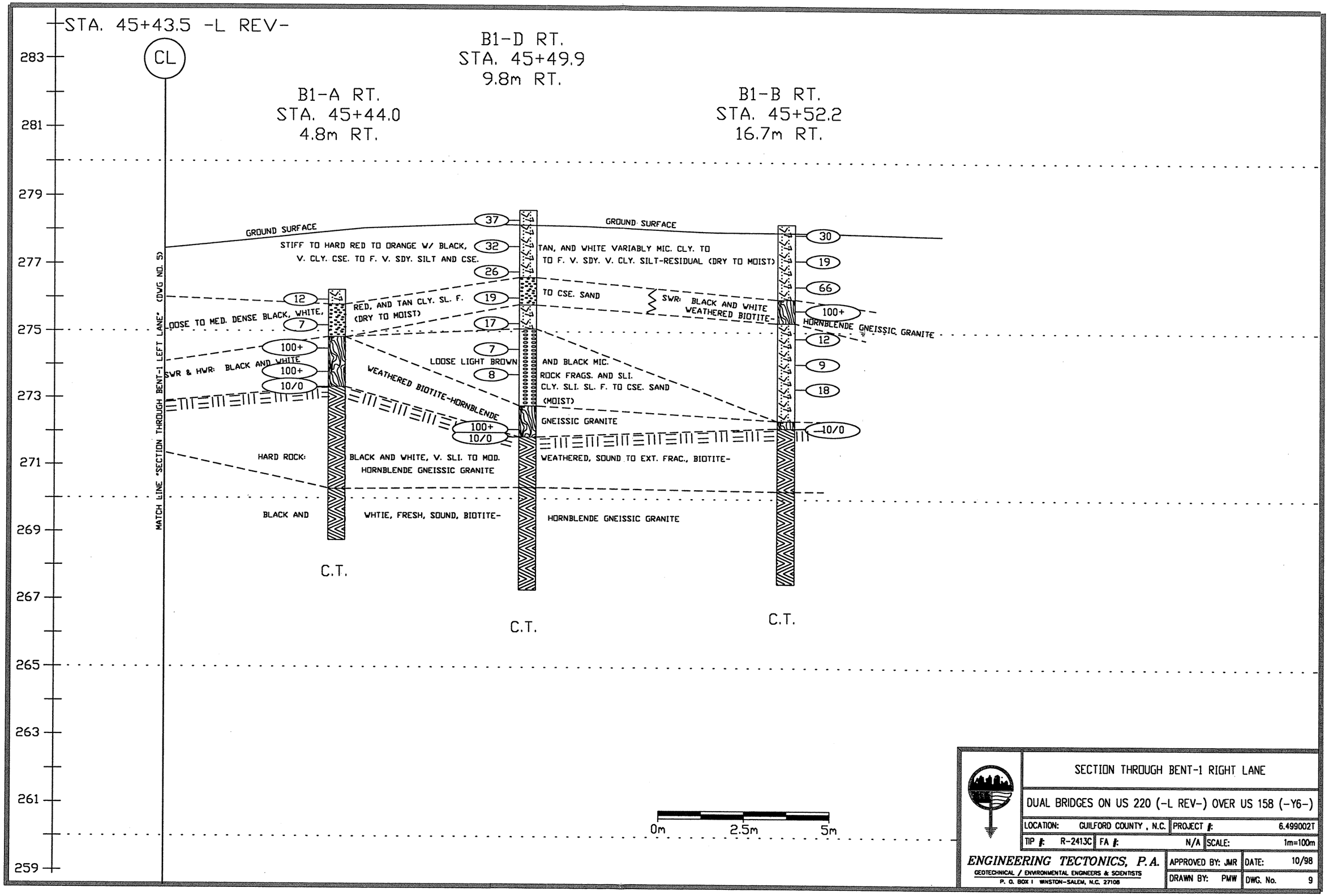
| | | | |
|---|---|---|---|
| APPROVED BY: JMR | DATE: | 10/98 | |
| DRAWN BY: PMW | DWG. No. | 8 | |




SECTION THROUGH BENT-1 RIGHT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |

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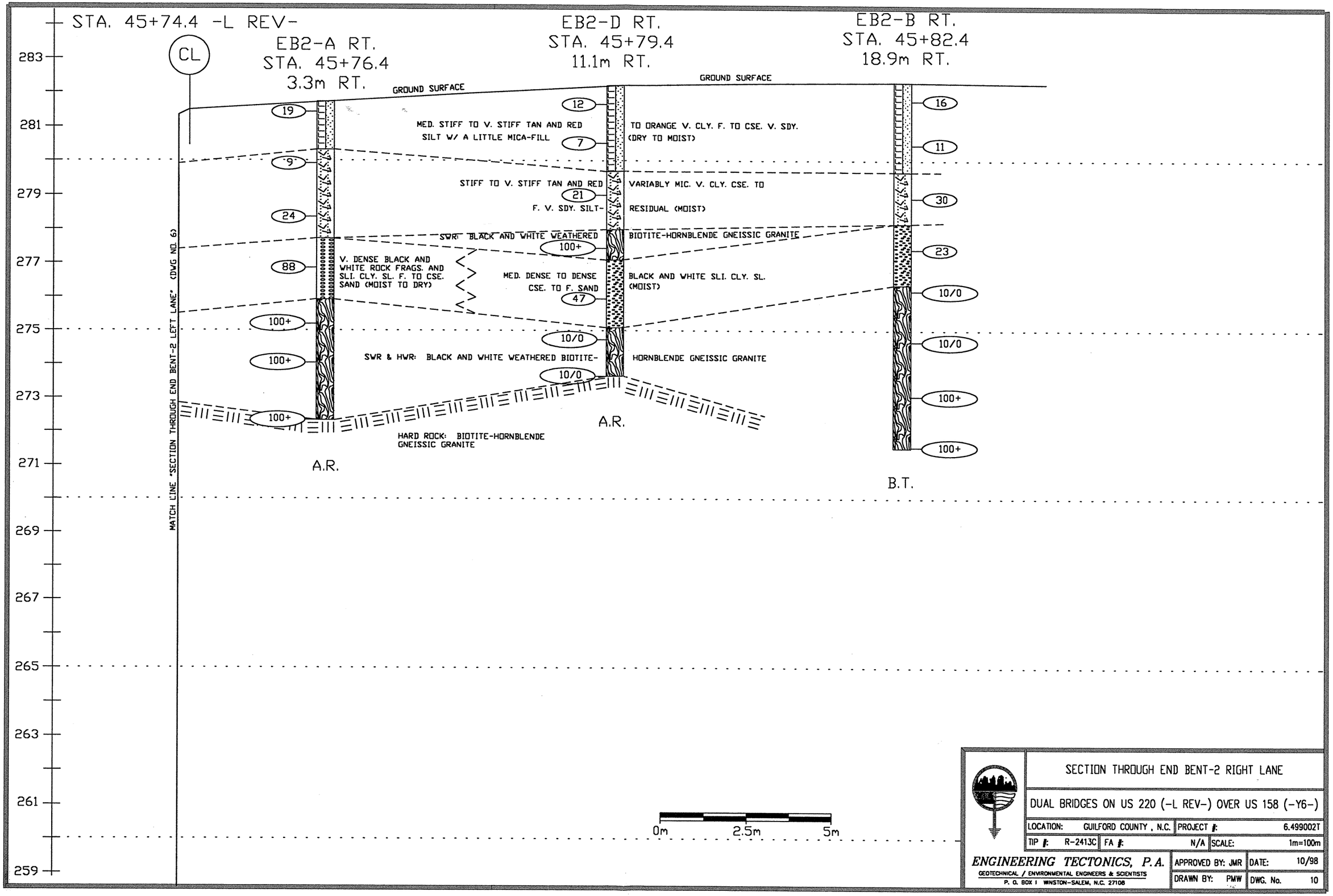
P. O. BOX 1 WINSTON-SALEM, N.C. 27108

| | | | |
|---|---|---|---|
| APPROVED BY: JMR | DATE: | 10/98 | |
| DRAWN BY: PMW | DWG. No. | 9 | |




SECTION THROUGH END BENT-2 RIGHT LANE

DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)

| | | | |
|---|---|---|---|
| LOCATION: GUILFORD COUNTY, N.C. | | PROJECT #: | 6.499002T |
| TIP #: R-2413C | FA #: N/A | SCALE: | 1m=100m |
| ENGINEERING TECTONICS, P.A. GEOTECHNICAL / ENVIRONMENTAL ENGINEERS & SCIENTISTS P. O. BOX 1 WINSTON-SALEM, N.C. 27108 | APPROVED BY: JMR | DATE: | 10/98 |
| | DRAWN BY: PMW | DWG. No. | 10 |

ENGINEERING TECTONICS, P.A.
1720 VARGRAVE STREET
WINSTON-SALEM, NORTH CAROLINA 27108
Phone (910) 724-6994 Fax (910) 724-7095

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-A LT | BORING LOCATION 45+02.1 | OFFSET 18.8m LT | ALIGNMENT -L REV- | 0 HR. NM |
| COLLAR ELEV. 278.11 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 3.74 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 8/26/98 | COMPLETED 8/26/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 278.11 | | | | | | | | | 278.11 0.00 |
| | 0.00 | 10 | 30 | 70/.06 | .100+ | | D | | SWR & HWR: GRAY AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | 0.70 | 10/0 | | | 10/0 | | | | 277.41 0.70 |
| 276 | | | | | | | | | HARD ROCK: BLACK AND WHITE, FRESH, SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 274.37 3.74 |
| 274 | | | | | | | | | CORING TERMINATED AT ELEVATION 274.37m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | | | | | | | | | |
| 270 | | | | | | | | | |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |

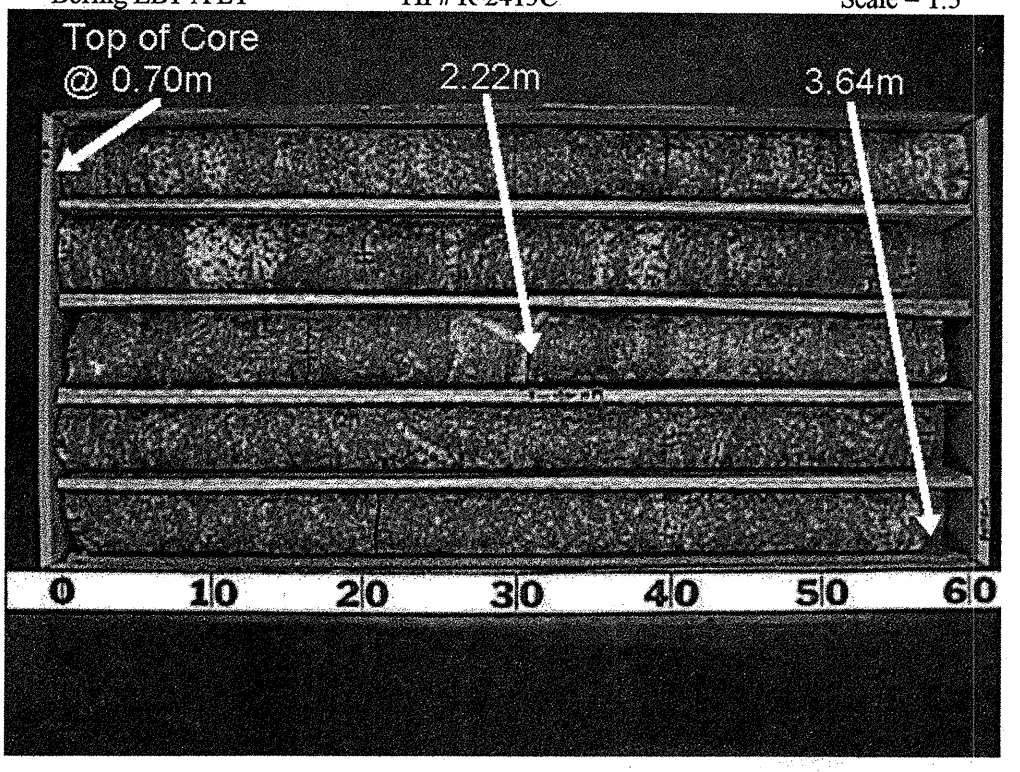
NCBMM3 98597 10/5/98

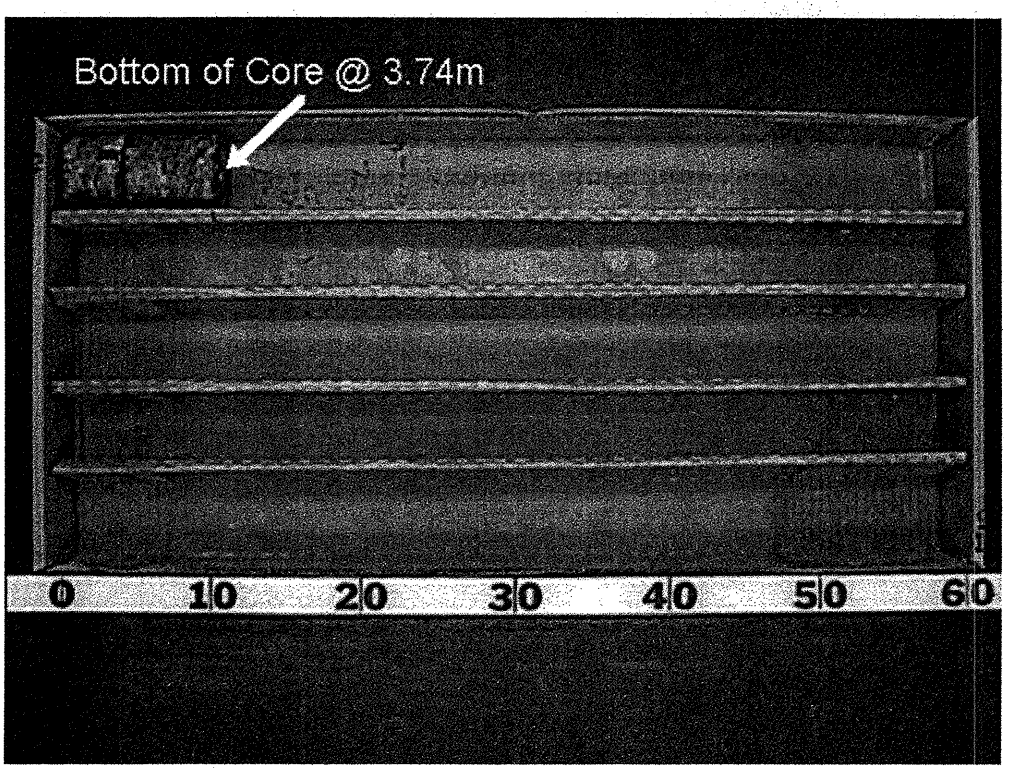
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** EB1-A LT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 278.11M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 3.74M **TOTAL RUN:** 3.04M **DATE:** 8/26/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 277.41 | .70 | 6:31<br>8:47<br>12:39<br>10:57<br>15:31 | 1.52 | 1.47<br>97% | 1.47<br>97% | | Drilling fluids milky gray<br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>1 joint @ near 0° (first run) ADT= .002m<br>1 joint @ near 0° (second run) ADT= .003m |
| 275.89 | 2.22 | | | | | | |
| 275.89 | 2.22 | 6:24<br>5:59<br>4:41<br>5:42<br>6:36 | 1.52 | 1.52<br>100% | 1.43<br>94% | | Strata REC=98.5% RQD=95.5% |
| 274.37 | 3.74 | | | | | | |

Boring EB1-A LT TIP# R-2413C Scale = 1:5



ENGINEERING TECTONICS, P.A.
1720 VARGRAVE STREET
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Phone (910) 724-6994 Fax (910) 724-7095

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-D LT | BORING LOCATION 45+05.2 | OFFSET 11.1m LT | ALIGNMENT -L REV- |
| COLLAR ELEV. 278.57 m | NORTHING | EASTING | 0 HR. NM / 24 HR. DRY |
| TOTAL DEPTH 0.93 m | DRILL MACHINE B-50 | DRILL METHOD 8.26cm HSA | HAMMER TYPE MANUAL |
| DATE STARTED 8/26/98 | COMPLETED 8/26/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 278.57 | | | | | | | | | |
| | 0.00 | 7 | 13 | 16 | 29 | SS-1 | 17.4% | | 278.57 0.00 V. STIFF REDDISH ORANGE CLY. F. TO CSE. V. SDY. SILT - RESIDUAL |
| 278 | 0.93 | 10/0 | | | 10/0 | | | | 277.77 0.80 277.65 0.92 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 276 | | | | | | | | | AUGER REFUSAL AT ELEVATION 277.64m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 274 | | | | | | | | | |
| 272 | | | | | | | | | |
| 270 | | | | | | | | | |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |

NCBMM3 98597 10/5/98

ENGINEERING TECTONICS, P.A.
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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-B LT | BORING LOCATION 45+08.8 | OFFSET 4.7m LT | ALIGNMENT -L REV- |
| COLLAR ELEV. 279.22 m | NORTHING | EASTING | 0 HR. NM / 24 HR. DRY |
| TOTAL DEPTH 1.54 m | DRILL MACHINE B-50 | DRILL METHOD 8.26cm HSA | HAMMER TYPE MANUAL |
| DATE STARTED 8/26/98 | COMPLETED 8/26/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 279.22 | | | | | | | | | |
| | 0.00 | 7 | 12 | 20 | 32 | | D | | 279.22 0.00 HARD REDDISH ORANGE CLY. F. TO CSE. V. SDY. SILT - RESIDUAL |
| 278 | 1.52 | 100/.02 | | | 100+ | | D | | 278.00 1.22 277.68 1.54 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 276 | | | | | | | | | AUGER REFUSAL AT ELEVATION 277.68 ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 274 | | | | | | | | | |
| 272 | | | | | | | | | |
| 270 | | | | | | | | | |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |

NCBMM3 98597 10/6/98

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1720 VARGRAVE STREET
WINSTON-SALEM, NORTH CAROLINA 27108
Phone (910) 724-6994 Fax (910) 724-7095

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-A LT | BORING LOCATION 45+37.1 | OFFSET 17.7m LT | ALIGNMENT -L REV- | 0 HR. NM |
| COLLAR ELEV. 276.66 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.42 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/3/98 | COMPLETED 9/4/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 276.66 | | | | | | | | | 276.66 0.00 |
| 276 | 0.00 | 6 | 10 | 13 | 23 | | D | | |
| | 1.37 | 3 | 4 | 5 | 9 | | M | | STIFF TO V. STIFF RED, BLACK AND WHITE CLY. F. TO CSE. V. SDY. SILT - RESIDUAL |
| 274 | 2.90 | 5 | 6 | 9 | 15 | | M | | |
| | 4.08 | | | | | | | | 272.66 4.00 |
| | 4.09 | 10/0 | | | 10/0 | RS-1 | | | 272.58 4.08 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | | | | | | | | | |
| 270 | | | | | | | | | HARD ROCK: BLACK AND WHITE, V. SLI. WEATHERED TO FRESH, SLI. FRAC. TO SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 269.24 7.42 |
| 268 | | | | | | | | | CORING TERMINATED AT ELEVATION 269.24m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |
| 258 | | | | | | | | | |

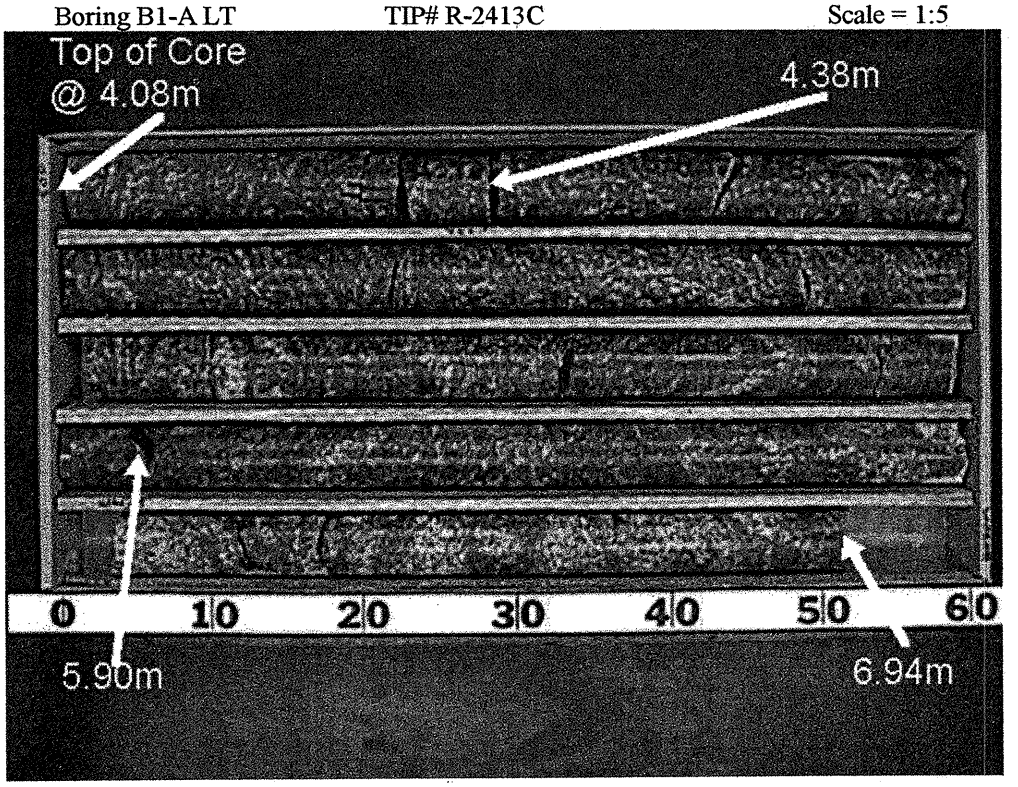
NCBMM3 98597 10/5/98

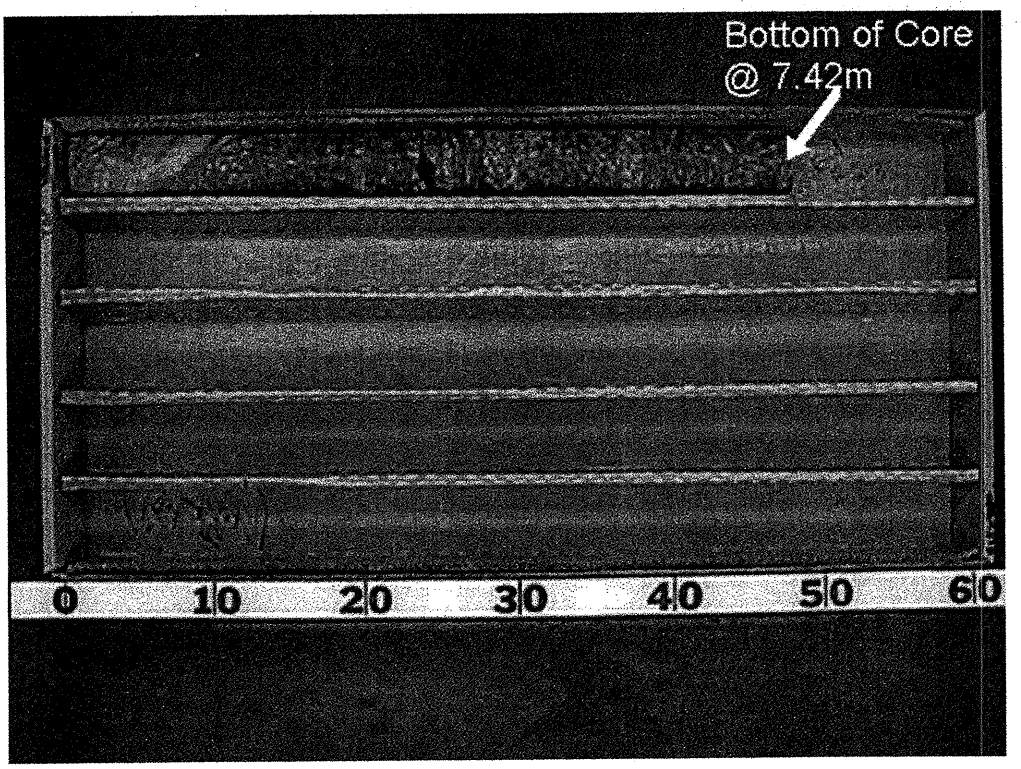
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-A LT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 276.66M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 7.42M **TOTAL RUN:** 3.34 M **DATE:** 9/4/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 272.58 | 4.08 | 9:37 | .30 * | .28 93% | .20 67% | RS-1 4.08 to 4.18 | Drilling fluids milky gray<br>Black and white; v. sli weathered to fresh; sli. frac.; Biotite-Hornblende Gneissic Granite<br>1 joint @ near 0°<br>ADT= .001m<br>* .30m run to get full stroke in next run |
| 272.28 | 4.38 | | | | | | |
| 272.28 | 4.38 | 7:01<br>5:23<br>7:16<br>7:33<br>9:19 | 1.52 | 1.52 100% | 1.52 100% | | Drilling fluids unchanged<br>Black and white; v. sli. weathered to fresh; sli. frac. to sound; Biotite-Hornblende Gneissic Granite<br>1 joint @ 20°<br>ADT= .002m<br>5 joints @ 0°-10°<br>ADT= .001-.002m<br>ADS= .74m |
| 270.76 | 5.90 | | | | | | |
| 270.76 | 5.90 | 7:24<br>8:47<br>10:03<br>11:21<br>13:40 | 1.52 | 1.50 99% | 1.50 99% | | Drilling fluids unchanged<br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>1 joint @ near 0°<br>ADT= .002m |
| 269.24 | 7.42 | | | | | | |

Boring B1-A LT TIP# R-2413C Scale = 1:5



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WINSTON-SALEM, NORTH CAROLINA 27108
Phone (910) 724-6994 Fax (910) 724-7095

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-D LT | BORING LOCATION 45+39.8 | OFFSET 11.5m LT | ALIGNMENT -L REV- 0 HR. NM |
| COLLAR ELEV. 276.66 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.35 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/4/98 | COMPLETED 9/9/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 276.66 | | | | | | | | | |
| | 0.00 | 4 | 6 | 6 | 12 | | D | | 276.66 — 0.00 |
| 276 | | | | | | | | | MED. STIFF TO STIFF RED AND TAN W/ BLACK MICACEOUS CLY. F. TO CSE. V. SDY. SILT - RESIDUAL |
| | 1.52 | 3 | 2 | 2 | 4 | | M | | 274.26 — 2.40 |
| 274 | 3.05 | 19 | 20 | 13 | 33 | SS-49 | 22.7% | | DENSE BLACK, WHITE AND LIGHT BROWN SLI. CLY. SL. CSE. TO F. SAND |
| | 4.31 | 10/0 | | | 10/0 | | | | 272.56 — 4.10; 272.36 — 4.30 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | | | | | | | | | |
| 270 | | | | | | | | | HARD ROCK: BLACK AND WHITE, FRESH, SLI. FRAC. TO SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 269.32 — 7.34 CORING TERMINATED AT ELEVATION 269.31m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |
| 258 | | | | | | | | | |

NCBMM3 98597 10/6/98

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-D LT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 276.66M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 7.35M **TOTAL RUN:** 3.04M **DATE:** 9/9/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 272.35 | 4.31 | 12:02<br>21:18<br>40:49<br>46:42<br>1:27:31 | 1.52 | 1.52<br>100% | 1.52<br>100% | | Drilling fluids milky gray<br><br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br><br>no breaks |
| 270.83 | 5.83 | | | | | | |
| 270.83 | 5.83 | 9:37<br>11:32<br>13:38<br>17:23<br>15:10 | 1.52 | 1.48<br>97% | 1.38<br>91% | | Drilling fluids unchanged<br><br>Black, white and pink; fresh, sli. frac. to sound; Biotite-Hornblende Gneissic Granite<br><br>4 joints @ near 0°<br>ADT= .002m<br>ADS= .10m |
| 269.31 | 7.35 | | | | | | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG



| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-B LT | BORING LOCATION 45+42.5 | OFFSET 5.3m LT | ALIGNMENT -L REV- — 0 HR. NM |
| COLLAR ELEV. 276.88 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.47 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/9/98 | COMPLETED 9/10/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 276.88 | | | | | | | | | 276.88 — 0.00 |
| | 0.00 | 3 | 6 | 8 | 14 | SS-50 | 17.6% | | STIFF RED W/ TAN MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT - RESIDUAL — 276.28 — 0.60 |
| | 0.76 | | | | | | | | |
| 276 | | 3 | 4 | 6 | 10 | | D/M | | LOOSE TO DENSE LIGHT BROWN TO BLACK AND WHITE CLY. SL. F. TO CSE. SAND |
| | 1.52 | | | | | | | | |
| | | 3 | 4 | 5 | 9 | | D/M | | |
| | 2.29 | | | | | | | | |
| | | 3 | 3 | 3 | 6 | SS-53 | 32.0% | | |
| 274 | 3.05 | | | | | | | | |
| | | 3 | 3 | 35 | 38 | | D/M | | |
| | 3.81 | | | | | | | | 273.28 — 3.60 |
| | | 32 | 47 | 53/.13 | 100+ | | D/M | | SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | 4.43 | | | | | | | | 272.46 — 4.42 |
| | 4.59 | 10/0 | | | 10/0 | RS-2 | | | |
| 272 | | | | | | | | | HARD ROCK: BLACK AND WHITE, FRESH, SLI. FRAC. TO SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 270 | | | | | | | | | 269.42 — 7.46 |
| | | | | | | | | | CORING TERMINATED AT ELEVATION 269.41m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |

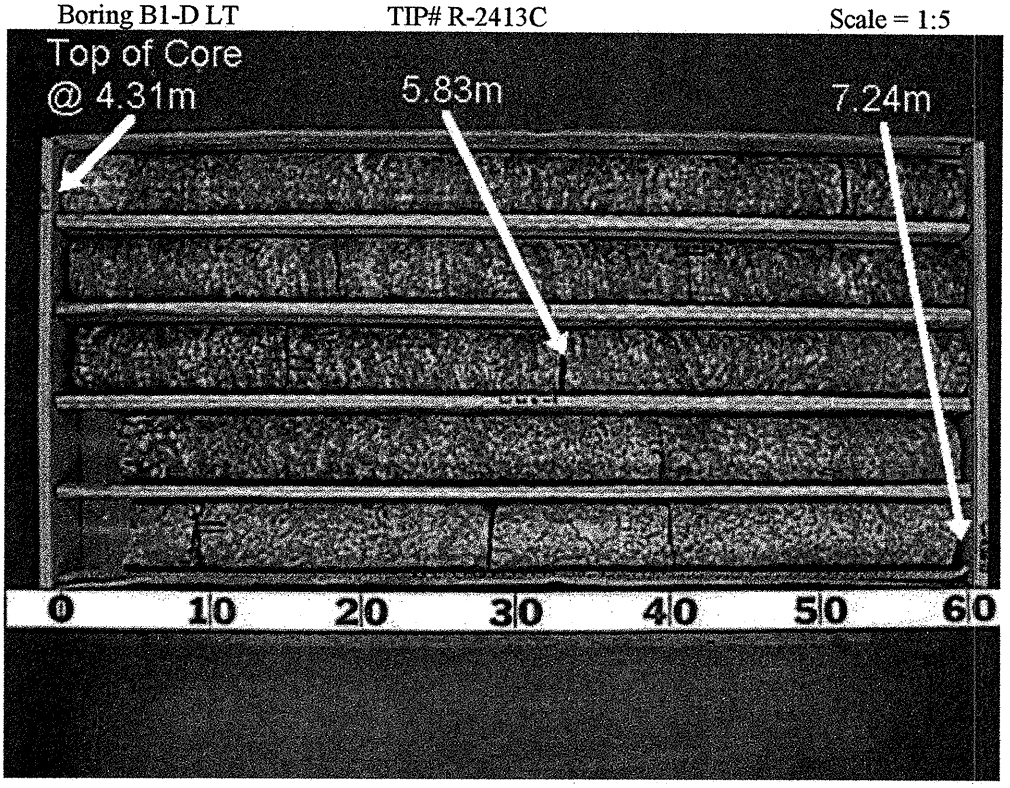
NCBMM3 98597 10/6/98

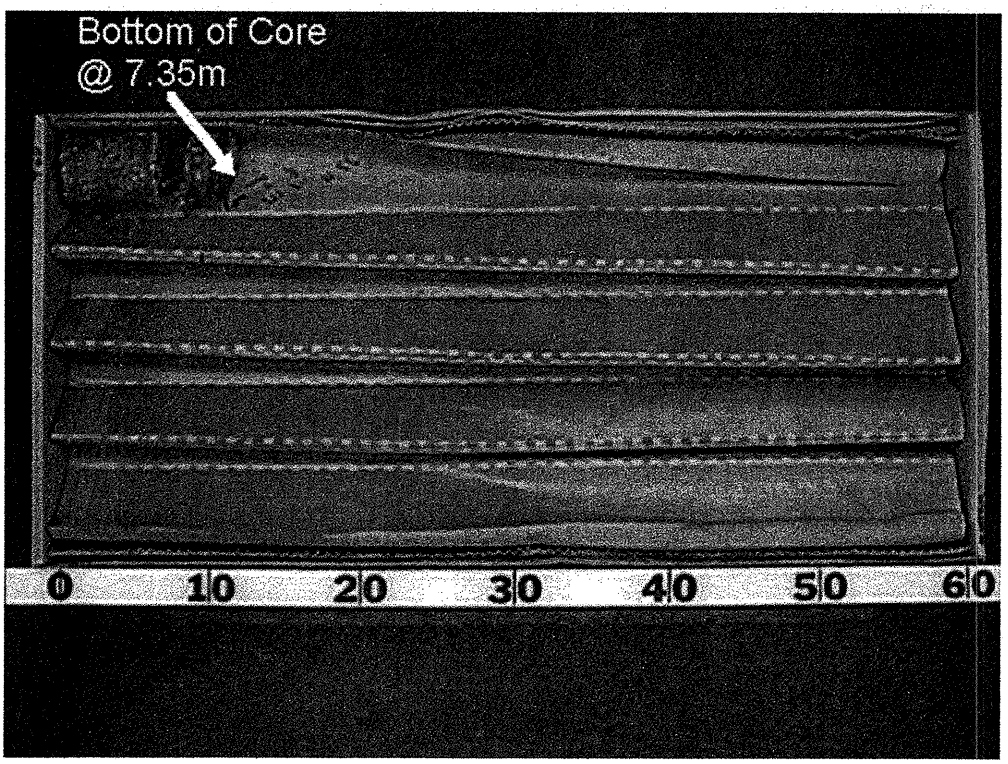
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-B LT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 276.88M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 7.47M **TOTAL RUN:** 3.04M **DATE:** 9/9/98 - 9/10/98

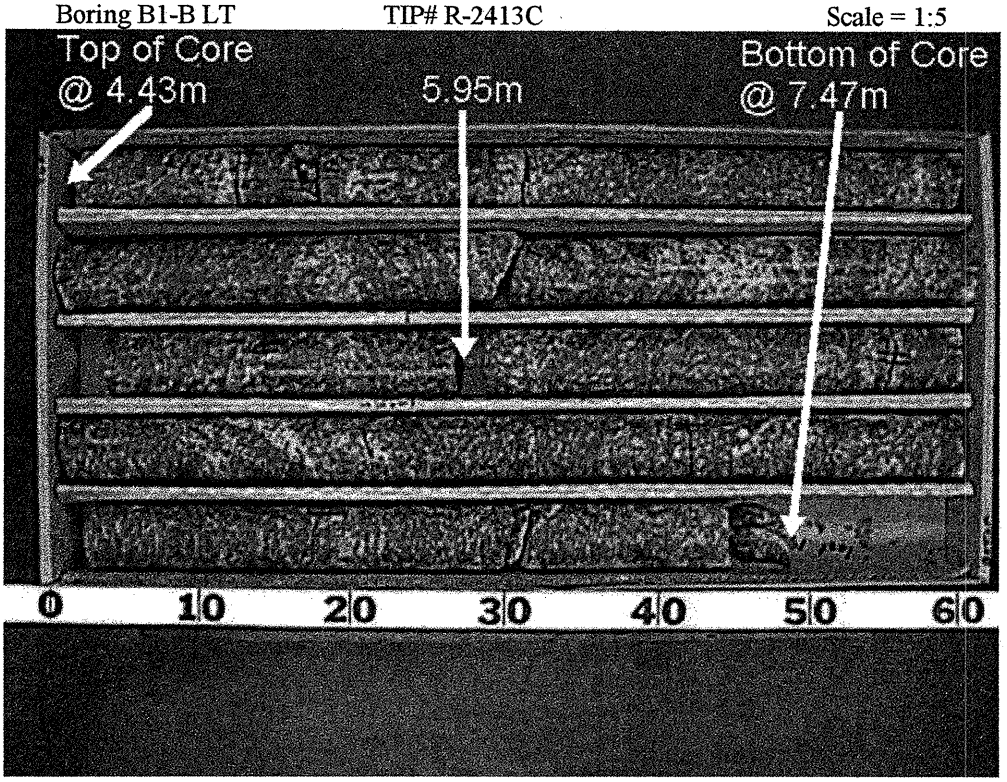
| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./ .30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 272.45 | 4.43 | 5:13<br>7:30<br>8:45<br>12:10<br>16:04 | 1.52 | 1.43<br>94% | 1.43<br>94% | RS-2<br>4.59 to<br>4.73 | Drilling fluids milky gray<br><br>Black and white; fresh; sli frac. to sound; Biotite-Hornblende Gneissic Granite<br><br>2 joints @ 0°-10°<br>ADT= .003m ADS= .76m<br><br>1 joint @ 10°<br>ADT= .01m |
| 270.93 | 5.95 | | | | | | |
| 270.93 | 5.95 | 9:08<br>12:19<br>15:48<br>24:33 | 1.20 | 1.20<br>100% | 1.20<br>100% | | Drilling fluids unchanged<br><br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br><br>no breaks |
| 269.73 | 7.15 | | | | | | |
| 269.73 | 7.15 | 5:08 /.32 | 0.32 | 0.14<br>44%<br>** | 0.14<br>44%<br>** | | * new reaming shoe at start of run<br><br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br><br>no breaks<br>** unable to break off last .18m of run - lost in hole |
| 269.41 | 7.47 | | | | | | |

Boring B1-D LT TIP# R-2413C Scale = 1:5



Boring B1-B LT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB2-A LT | BORING LOCATION 45+65.8 | OFFSET 19.7m LT | ALIGNMENT -L REV- 0 HR. NM |
| COLLAR ELEV. 280.70 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 11.40 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 8/28/98 | COMPLETED 9/1/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 280.70 | | | | | | | | | |
| | 0.00 | 8 | 11 | 12 | 23 | SS-7 | 13.4% | | V. STIFF RED TO LIGHT BROWN V. CLY. F. TO CSE. V. SDY. SILT W/ ROCK FRAGS. AND A LITTLE MICA - FILL *NOTE: BLOW COUNT INFLUENCED BY ROCK FRAGS. |
| 280 | 1.52 | 3 | 4 | 6 | 10 | | M | | STIFF TO V. STIFF RED TO TAN VARIABLY MICACEOUS V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL |
| 278 | 3.05 | 7 | 12 | 18 | 30 | SS-9 | 32.7% | | |
| 276 | 4.57 | 7 | 11 | 26 | 38 | | M | | DENSE RED, BLACK AND WHITE MICACEOUS SLI. CLY. SL. F. TO CSE. SAND |
| 274 | 6.10 | 20 | 21 | 12 | 33 | SS-11 | 22.6% | | |
| | 7.62 | 10/0 | | | 10/0 | | | | HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | 8.36 | 10/0 | | | 10/0 | | | | HARD ROCK: BLACK AND WHITE, FRESH, SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 270 | | | | | | | | | |
| 268 | | | | | | | | | |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |

| | |
|---|---|
| 280.70 | 0.00 |
| 279.40 | 1.30 |
| 276.60 | 4.10 |
| 273.30 | 7.40 |
| 272.34 | 8.36 |
| 269.30 | 11.40 |

CORING TERMINATED AT ELEVATION 269.30m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE

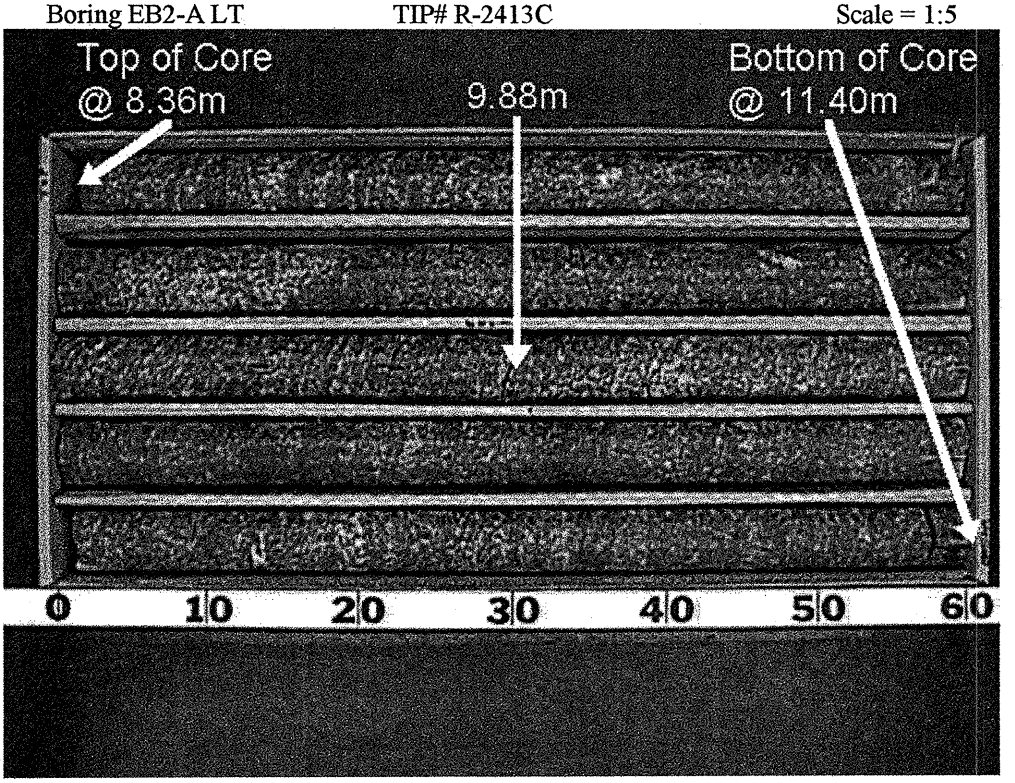
NCBMM3 98597 10/6/98

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** EB2-A LT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 280.70M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 11.40M **TOTAL RUN:** 3.04M **DATE:** 8/28/98 & 9/1/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 272.34 | 8.36 | 10:31<br>13:23<br>16:59<br>21:49<br>1:03:03 | 1.52 | 1.50 | 1.50 | | Drilling fluids milky gray<br><br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br><br>no breaks (both runs) |
| | | | | 99% | 99% | | Strata REC=98.5% RQD=98.5% |
| 270.82 | 9.88 | | | | | | |
| 270.82 | 9.88 | 6:07<br>6:02<br>4:59<br>6:36<br>6:56 | 1.52 | 1.49 | 1.49 | | |
| | | | | 98% | 98% | | |
| 269.30 | 11.40 | | | | | | |

Boring EB2-A LT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB2-D LT | BORING LOCATION 45+69.0 | OFFSET 11.9m LT | ALIGNMENT -L REV- | 0 HR. NM |
| COLLAR ELEV. 280.69 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.41 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 9/3/98 | COMPLETED 9/3/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| 280.69 | | | | | | | | | |
| | 0.00 | 6 | 10 | 9 | | D | | V. STIFF RED V. CLY. F. TO CSE. V. SDY. SILT W/ ROCK FRAGS. - FILL *NOTE: BLOW COUNT INFLUENCED BY ROCK FRAGS. | 280.69 / 0.00 |
| | 1.52 | 4 | 4 | 4 | | M | | STIFF TO V. STIFF TAN AND RED MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT - RESIDUAL | 279.37 / 1.32 |
| | 3.05 | 6 | 9 | 15 | SS-42 | 32.1% | | | |
| | 4.57 | 7 | 90 | 10/.01 | | D | | SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 276.39 / 4.30 |
| | 6.10 | 10/0 | | | | | | | |
| | 7.41 | 10/0 | | | | | | AUGER REFUSAL AT ELEVATION 273.28m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | 273.29 / 7.40 |

BLOWS PER 30 CM: 0 20 40 60 80 100

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB2-B LT | BORING LOCATION 45+72.2 | OFFSET 4.1m LT | ALIGNMENT -L REV- | 0 HR. NM |
| COLLAR ELEV. 280.89 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.52 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 9/3/98 | COMPLETED 9/3/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|
| 280.89 | | | | | | | | | |
| | 0.00 | 6 | 17 | 18 | SS-35 | 11.0% | | HARD RED V. CLY. F. TO CSE. V. SDY. SILT W/ ROCK FRAGS. - FILL *NOTE: BLOW COUNT INFLUENCED BY ROCK FRAGS. | 280.89 / 0.00 |
| | 1.52 | 3 | 3 | 4 | | M | | MED. STIFF TO V. STIFF RED W/ LIGHT BROWN V. CLY. F. TO CSE. V. SDY. SILT RESIDUAL | 279.49 / 1.40 |
| | 3.05 | 6 | 15 | 11 | | M | | | 277.09 / 3.80 |
| | 4.57 | 15 | 14 | 60 | SS-38 | 18.5% | | V. DENSE BLACK AND WHITE ROCK FRAGS. AND SLI. CLY. SL. F. TO CSE. SAND | 275.09 / 5.80 |
| | 6.10 | 100/.04 | | | | D | | SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 273.37 / 7.52 |
| | 7.52 | 10/0 | | | | | | AUGER REFUSAL AT ELEVATION 273.37m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | |

BLOWS PER 30 CM: 0 20 40 60 80 100

NCBMM3 98597 10/6/98

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-A RT | BORING LOCATION 45+11.8 | OFFSET 3.5m RT | ALIGNMENT -L REV- 0 HR. NM |
| COLLAR ELEV. 280.62 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 6.04 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 8/27/98 | COMPLETED 8/27/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 280.62 | | | | | | | | | |
| | 0.00 | 5 | 5 | 5 | 10 | SS-5 | 11.8% | | 280.62 — 0.00 STIFF RED V. CLY. F. TO CSE. V. SDY. SILT W/ A LITTLE MICA - FILL |
| | 1.52 | 11 | 16 | 21 | 37 | SS-6 | 30.3% | | 279.56 — 1.06 HARD RED WITH TAN MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT - RESIDUAL |
| | 3.00 | 10/0 | | | 10/0 | | | | 277.82 — 2.80; 277.62 — 3.00 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | HARD ROCK: BLACK AND WHITE, SLI. WEATHERED TO FRESH, MOD. FRAC. TO SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 274.58 — 6.04 CORING TERMINATED AT ELEVATION 274.58m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |

280 278 276 274 272 270 268 266 264 262

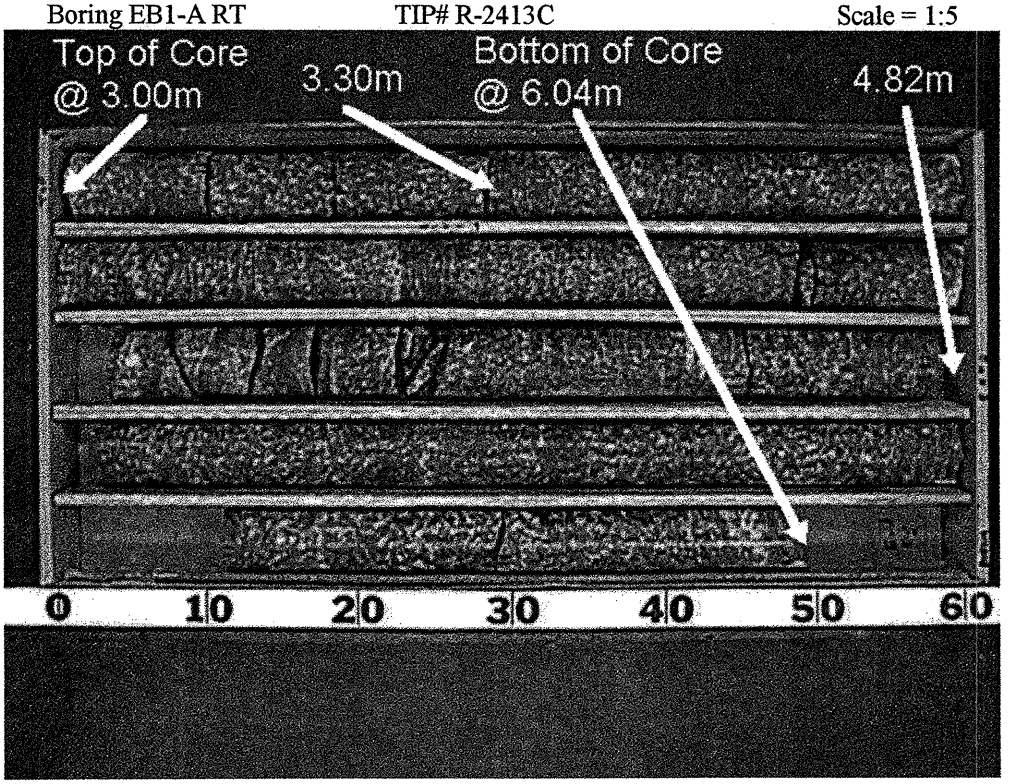
NCBMM3 98597 10/5/98

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL UNIT CORE BORING REPORT
PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC

PROJECT NO.: 6.499002T I.D. NO.: R-2413C COUNTY: GUILFORD/ROCKINGHAM BORING NO: EB1-A RT
SITE DESCRIPTION: DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
COLLAR ELEV.: 280.62M CORE SIZE: NQ-2 EQUIPMENT: B-50 PAGE 1 0F 1
DRILLER: R. BARRON GEOLOGIST: M. TAYLOR PERSONNEL: J. CAIN
TOTAL DEPTH: 6.04M TOTAL RUN: 3.04M DATE: 8/27/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./ .30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 277.62 | 3.00 | 11:17 | .30 * | .28 93% | .28 93% | | Drilling fluids milky gray<br>Black and white; sli weathered to fresh; sound; Biotite Hornblende Gneissic Granite<br>no breaks<br>* .30m run to get full stroke in next run |
| 277.32 | 3.30 | | | | | | |
| 277.32 | 3.30 | 8:21<br>10:03<br>11:25<br>23:13<br>48:50 | 1.52 | 1.47<br>97% | 1.29<br>85% | | Drilling fluids unchanged<br>Black and white; sli. weathered to fresh; mod frac. to sound; minor Fe staining in joints; Biotite Hornblende Gneissic Granite<br>1 joint @ 30°<br>ADT= .002m<br>4 joints @ 0° - 10°<br>ADT= .003m ADS= .12m<br>1 joint @ 10°<br>ADT= .002m |
| 275.58 | 4.82 | | | | | | |
| 275.80 | 4.82 | 6:35<br>7:40<br>9:47<br>13:52 | 1.22 | .97<br>80% ** | .97<br>80% ** | | Drilling fluids unchanged<br>Black and white; fresh; sound; Biotite Hornblende Gneissic Granite<br>no breaks<br>** could not break free last .25m of run - lost in hole |
| 274.58 | 6.04 | | | | | | |

Boring EB1-A RT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-D RT | BORING LOCATION 45+16.3 | OFFSET 11.9m RT | ALIGNMENT -L REV- |
| COLLAR ELEV. 280.40 m | NORTHING | EASTING | |
| TOTAL DEPTH 3.05 m | DRILL MACHINE B-80 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 9/1/98 | COMPLETED 9/1/98 | SURFACE WATER DEPTH | |

GROUND WATER (m): 0 HR. NM; 24 HR. DRY

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 280.40 | | | | | | | | | 280.40 | 0.00 |
| | 0.00 | 1 | 1 | 4 | 5 | | D | | MED. STIFF RED MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT - FILL | |
| | | | | | | | | | 279.80 | 0.60 |
| | 1.52 | 1 | 2 | 2 | 4 | | D/M | | MED. STIFF RED MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT W/ ROCK FRAGS. - RESIDUAL | |
| | 3.05 | | | | | | | | 277.50 | 2.90 |
| | | 10/0 | | | 10/0 | | | | 277.36 HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 3.04 |
| | | | | | | | | | AUGER REFUSAL AT ELEVATION 277.35m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | |

280 278 276 274 272 270 268 266 264 262

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB1-B RT | BORING LOCATION 45+20.7 | OFFSET 19.7m RT | ALIGNMENT -L REV- |
| COLLAR ELEV. 280.29 m | NORTHING | EASTING | |
| TOTAL DEPTH 3.48 m | DRILL MACHINE B-80 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 8/31/98 | COMPLETED 8/31/98 | SURFACE WATER DEPTH | |

GROUND WATER (m): 0 HR. NM; 24 HR. DRY

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 280.29 | | | | | | | | | 280.29 | 0.00 |
| | 0.00 | 1 | 2 | 3 | 5 | | D | | MED. STIFF RED MICACEOUS V. CLY. F. TO CSE. V. SDY. SILT - FILL | |
| | | | | | | | | | 279.79 | 0.50 |
| | 1.52 | 4 | 7 | 9 | 16 | SS-19 | 30.0% | | V. STIFF RED V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL | |
| | 3.05 | | | | | | | | 277.45 | 2.84 |
| | 3.48 | 100/.05 | | | 100+ | | D | | 276.81 SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 3.48 |
| | | 10/0 | | | 10/0 | | | | AUGER REFUSAL AT ELEVATION 276.81m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | |

280 278 276 274 272 270 268 266 264 262

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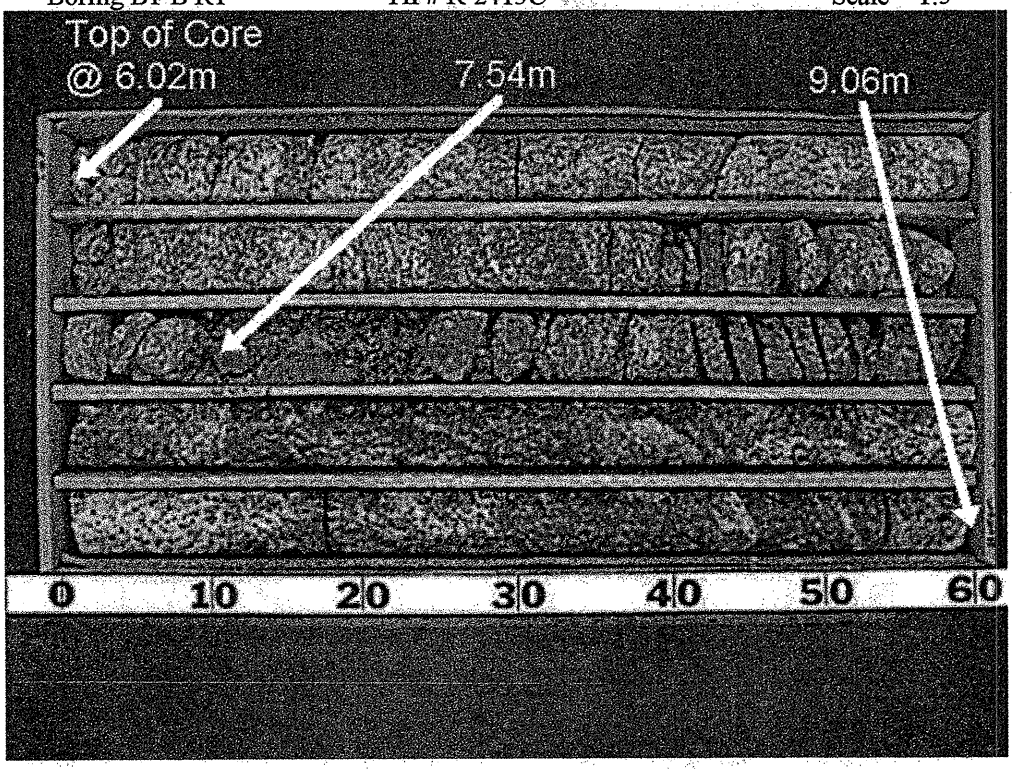
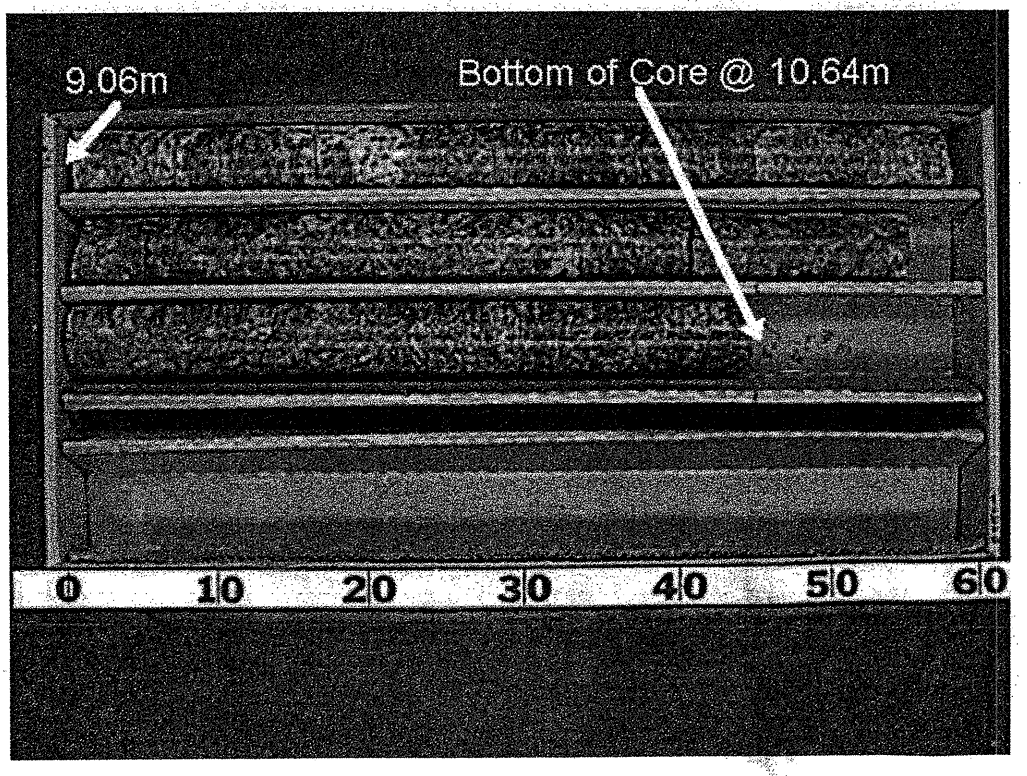
Boring B1-B RT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-A RT | BORING LOCATION 45+44.0 | OFFSET 4.8m RT | ALIGNMENT -L REV- — 0 HR. NM |
| COLLAR ELEV. 276.23 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 7.47 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/10/98 | COMPLETED 9/11/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 276.23 | | | | | | | | | |
| 276 | 0.00 | 2 | 5 | 7 | 12 | | D | | 276.23 — 0.00 |
| | 0.76 | | | | 7 | | | | STIFF RED MICACEOUS CLY. F. TO CSE. V. SDY. SILT - RESIDUAL — 275.79 — 0.44 |
| | | 3 | 3 | 4 | | | D/M | | LOOSE BLACK AND WHITE CLY. SL. F. TO CSE. SAND |
| | 1.52 | | | | | | | | 274.83 — 1.40 |
| | | 3 | 100/.07 | | 100+ | | D/M | | SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 274 | 2.29 | | | | | | | | |
| | | 78 | 22/.01 | | 100+ | | D/M | | |
| | 2.91 | | | | | | | | 273.33 — 2.90 |
| | 3.07 | 10/0 | | | 10/0 | RS-3 | | | |
| 272 | | | | | | | | | HARD ROCK: BLACK AND WHITE, SLI. WEATHERED TO FRESH, SOUND TO MOD. FRAC., BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 270.29 — 5.94 |
| 270 | | | | | | | | | BLACK AND WHITE, FRESH, SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | | | | | | | | | 268.77 — 7.46 |
| 268 | | | | | | | | | CORING TERMINATED AT ELEVATION 268.76m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |
| 258 | | | | | | | | | |

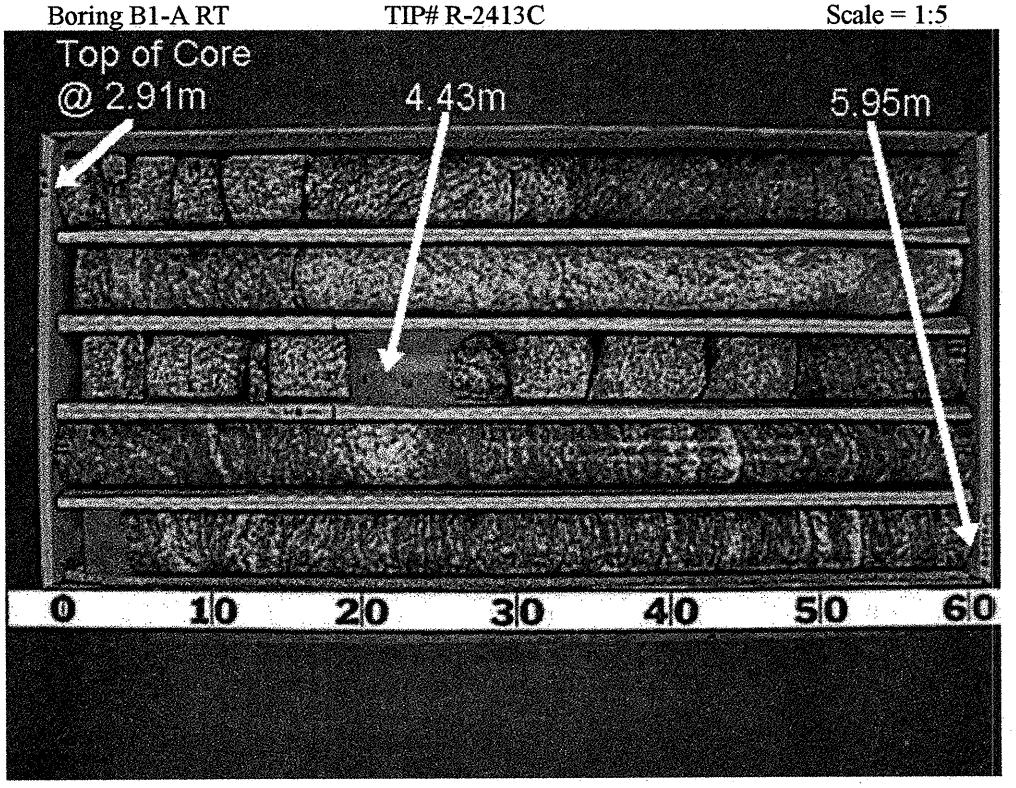
NCBMM3 98597 10/5/98

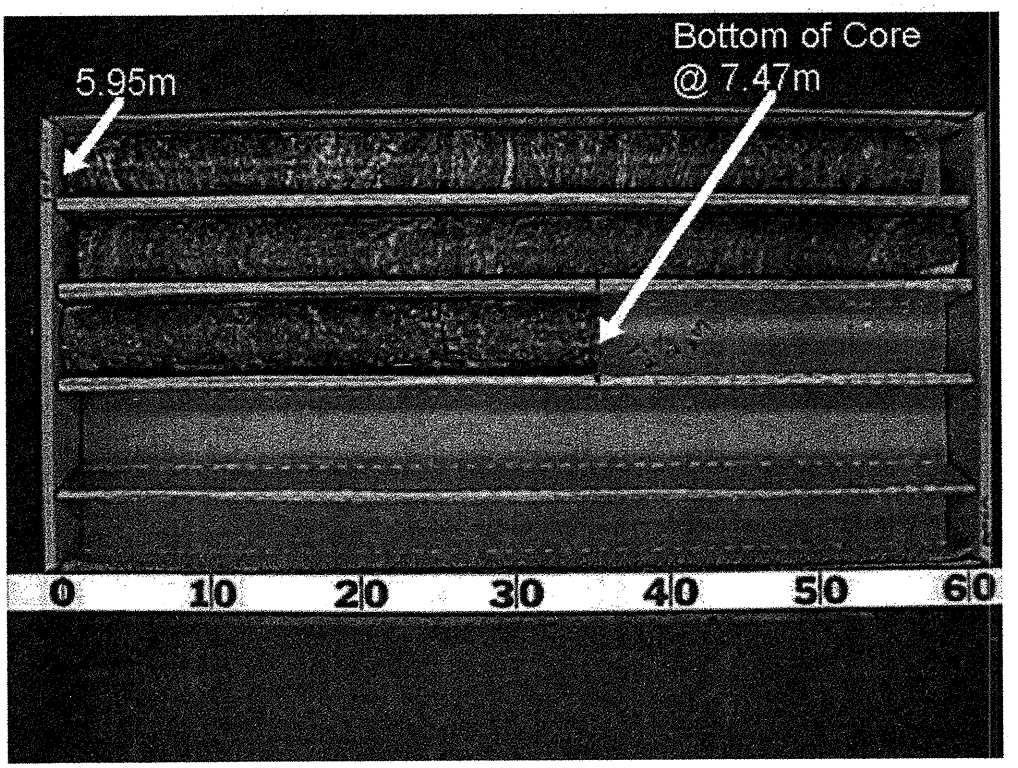
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-A RT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 276.23M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-50 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 7.47M **TOTAL RUN:** 4.56M **DATE:** 9/11/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./ .30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 273.32 | 2.91 | 7:30<br>8:20<br>8:41<br>8:32<br>5:36 | 1.52 | 1.39<br>91% | 1.05<br>69% | RS-3<br>3.07 to 3.17 | Drilling fluids milky gray to near clear<br><br>Black and white; sli. weathered to fresh; sound to mod frac.; Biotite-Hornblende Gneissic Granite sound and fresh 3.22 to 4.11<br><br>6 joints @ 10°<br>ADT= .002m ADS= .05m<br><br>4 joints @ 0°<br>ADT= .003m ADS= .04m |
| 271.80 | 4.43 | | | | | | |
| 271.80 | 4.43 | 6:16<br>8:30<br>11:36<br>15:04<br>43:12<br>* | 1.52 | 1.49<br>98% | 1.28<br>84% | | Drilling fluids milky gray<br><br>Black and white; sli weathered to fresh; sound to mod frac.; Biotite-Hornblende Gneissic Granite sound and fresh 4.66 to 5.95<br><br>3 joints @ 10°<br>ADT= .003m ADS= .07m<br><br>* took bit out of ground and sharpened it |
| 270.28 | 5.95 | | | | | | |
| 270.28 | 5.95 | 5:35<br>5:31<br>6:20<br>6:15<br>7:51 | 1.52 | 1.52<br>100% | 1.52<br>100% | | Drilling fluids unchanged<br><br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br><br>no breaks |
| 268.76 | 7.47 | | | | | | |

Boring B1-A RT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-D RT | BORING LOCATION 45+49.9 | OFFSET 9.8m RT | ALIGNMENT -L REV- — 0 HR. NM |
| COLLAR ELEV. 278.59 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 11.28 m | DRILL MACHINE B-80 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/15/98 | COMPLETED 9/15/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 278.59 | | | | | | | | | 278.59 — 0.00 |
| | 0.00 | 6 | 18 | 19 | 37 | | D | | V. STIFF TO HARD RED MICACEOUS V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL |
| 278 | 0.76 | 11 | 14 | 18 | 32 | SS-68 | 29.7% | | |
| | 1.52 | 9 | 12 | 14 | 26 | | D/M | | 276.61 — 1.98 |
| | 2.29 | 6 | 9 | 10 | 19 | | D | | MED. DENSE RED, BLACK AND TAN CLY. SL. F. TO CSE. SAND |
| 276 | 3.05 | 5 | 9 | 8 | 17 | | M | | 275.79 — 2.80; V. STIFF LIGHT BROWN, BLACK AND RED MICACEOUS CLY. F. TO CSE. V. SDY. SILT |
| | 3.81 | 6 | 3 | 4 | 7 | | M | | 275.09 — 3.50 |
| 274 | 4.57 | 3 | 4 | 4 | 8 | SS-73 | 50.4% | | LOOSE LIGHT BROWN AND BLACK MICACEOUS ROCK FRAGS. AND SLI. CLY. SLI. SL. F. TO CSE. SAND |
| | 6.10 | 9 | 11 | 89/.12 | 100+ | | D | | 272.79 — 5.80; SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | 6.72 | | | | | | | | 271.87 — 6.72 |
| | 6.92 | 10/0 | | | 10/0 | RS-4 | | | HARD ROCK: BLACK AND WHITE, V. SLI. TO MOD. WEATHERED, SOUND TO MOD. FRAC., BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 270 | | | | | | | | | 270.35 — 8.24; BLACK AND WHITE, FRESH, SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 268 | | | | | | | | | 267.31 — 11.28 |
| 266 | | | | | | | | | CORING TERMINATED AT ELEVATION 267.31m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |

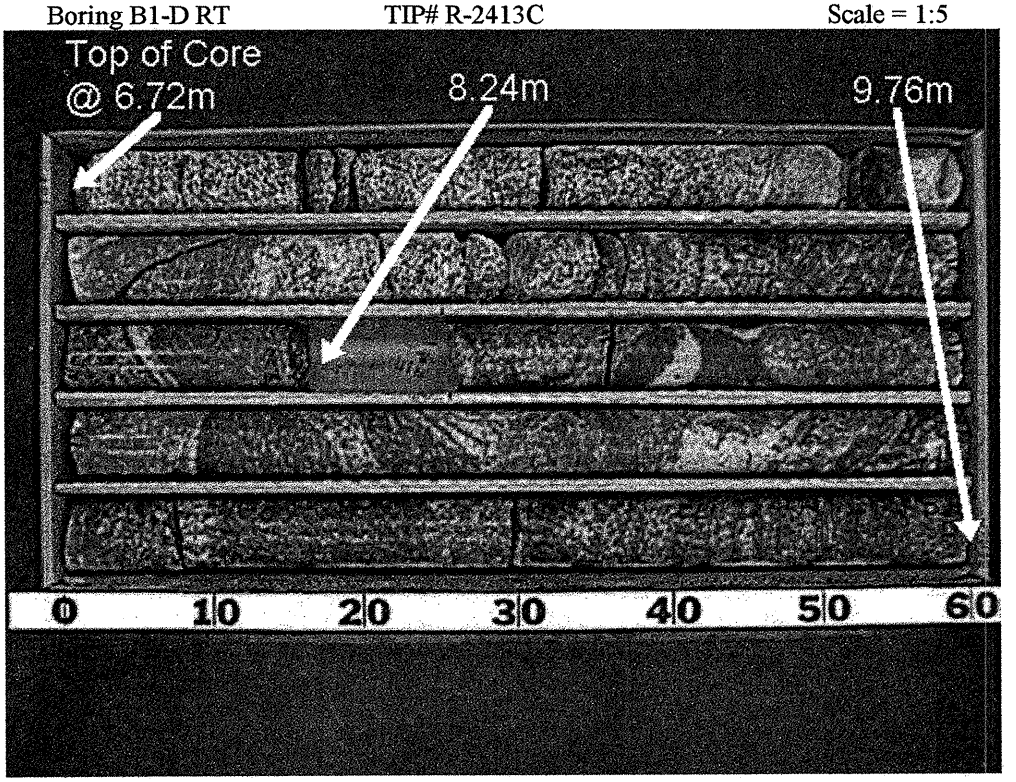
NCBMM3 98597 10/5/98

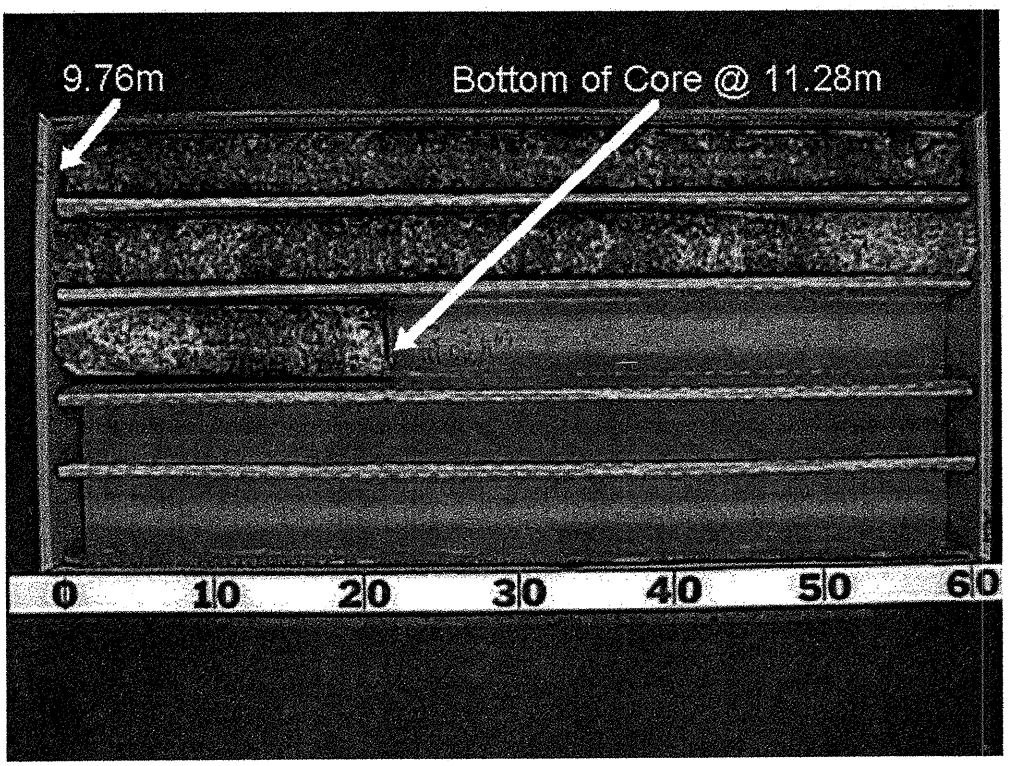
**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-D RT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 278.59M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-80 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 11.28M **TOTAL RUN:** 4.56M **DATE:** 9/15/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 271.87 | 6.72 | 8:59<br>8:46<br>4:42<br>8:28<br>9:13 | 1.52 | 1.30<br>86% | .82<br>54% | RS-4<br>6.92 to 7.02 | Drilling fluids milky gray<br>Black and white; v. sli. to mod weathered; sound to mod. frac.; Biotite-Hornblende Gneissic Granite<br>v. sli weathered to sound 7.92 to 8.24<br>light to mod Fe staining in most joins<br>13 joints @ 0°-20°<br>ADT= .002m ADS= .08m<br>1 joint w/ in above set @ 70°<br>ADT= .001m .30m long |
| 270.35 | 8.24 | | | | | | |
| 270.35 | 8.24 | 11:25<br>15:05<br>21:21<br>35:05 | 1.20 | 1.20<br>100% | 1.20<br>100% | | Drilling fluids unchanged<br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>no breaks |
| 267.63 | 9.44 | | | | | | |
| 267.63 | 9.44 | 10:28/.32 | .32 | .32<br>100% | .32<br>100% | | replaced bit with a newer one at start of run<br>Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>no breaks |
| 268.83 | 9.76 | | | | | | |
| 268.83 | 9.76 | 13:20<br>14:52<br>18:52<br>24:20<br>39:47 | 1.52 | 1.43<br>94%<br>** | 1.43<br>94%<br>** | | Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>no breaks<br>** could not break free last .09m of run - lost in hole |
| 267.31 | 11.28 | | | | | | |

Boring B1-D RT TIP# R-2413C Scale = 1:5



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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. B1-B RT | BORING LOCATION 45+52.2 | OFFSET 16.7m RT | ALIGNMENT -L REV- — 0 HR. NM |
| COLLAR ELEV. 278.18 m | NORTHING | EASTING | 24 HR. DRY |
| TOTAL DEPTH 10.64 m | DRILL MACHINE B-80 | DRILL METHOD CASING ADVANCER/NQ-2 | HAMMER TYPE MANUAL |
| DATE STARTED 9/14/98 | COMPLETED 9/14/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 20 40 60 80 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 278.18 | | | | | | | | | |
| | 0.00 | 8 | 15 | 15 | 30 | SS-60 | 12.7% | | 278.18 — 0.00 |
| | 0.76 | 9 | 9 | 10 | 19 | | D | | V. STIFF TO HARD RED TO ORANGE W/ BLACK MICACEOUS CSE. TO F. V. SDY. V. CLY. SILT - RESIDUAL |
| | 1.52 | 8 | 13 | 53 | 66 | | D\M | | |
| 276 | 2.29 | 27 | 73/.11 | | 100+ | | D | | 275.98 — 2.20; SWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| | 3.05 | 5 | 6 | 6 | 12 | | M | | 275.28 — 2.90 |
| | 3.81 | 4 | 4 | 5 | 9 | | M | | |
| 274 | 4.57 | 8 | 8 | 10 | 18 | | M | | STIFF TO V. STIFF RED W/ TAN AND BLACK AND WHITE V. CLY. CSE. TO F. V. SDY. SILT |
| | 6.02 | 10/0 | | | 10/0 | | | | 272.38 — 5.80; 272.16 — 6.02; HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 272 | | | | | | | | | HARD ROCK: BLACK AND WHITE, MOD. WEATHERED, SLI. TO EXT. FRAC., BIOTITE- HORNBLENDE GNEISSIC GRANITE |
| 270 | | | | | | | | | 270.28 — 7.90; BLACK AND WHITE, FRESH, SOUND, BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 268 | | | | | | | | | 267.54 — 10.64; CORING TERMINATED AT ELEVATION 267.54m IN BIOTITE-HORNBLENDE GNEISSIC GRANITE |
| 266 | | | | | | | | | |
| 264 | | | | | | | | | |
| 262 | | | | | | | | | |
| 260 | | | | | | | | | |

NCBMM3 98597 10/5/98

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAYS**
**GEOTECHNICAL UNIT CORE BORING REPORT**
**PREPARED BY: ENGINEERING TECTONICS, P.A. OF WINSTON-SALEM, NC**

**PROJECT NO.:** 6.499002T **I.D. NO.:** R-2413C **COUNTY:** GUILFORD/ROCKINGHAM **BORING NO:** B1-B RT
**SITE DESCRIPTION:** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-)
**COLLAR ELEV.:** 278.18M **CORE SIZE:** NQ-2 **EQUIPMENT:** B-80 **PAGE** 1 0F 1
**DRILLER:** R. BARRON **GEOLOGIST:** M. TAYLOR **PERSONNEL:** J. CAIN
**TOTAL DEPTH:** 10.64M **TOTAL RUN:** 4.62M **DATE:** 9/14/98

| ELEV. (M.) | DEPTH (M.) | DRILL RATE MN./.30 M. | RUN | REC % | RQD % | SAMPLE NO. | DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|
| 272.16 | 6.02 | 5:21<br>5:45<br>4:04<br>4:26<br>7:48 | 1.52 | 1.29<br>85% | .48<br>32% | | Drilling fluids milky gray to tan<br>Black, white and gray; mod weathered; sli. to mod. frac.; Biotite-Hornblende Gneissic Granite<br>20 joints @ 0°-20°<br>ADT= .003m ADS= .06m<br>some mod Fe staining |
| 270.64 | 7.54 | | | | | | |
| 270.64 | 7.54 | 7:41<br>9:40<br>10:45<br>12:31<br>14:50 | 1.52 | 1.51<br>99% | 1.23<br>81% | | Drilling fluids milky gray<br>7.54 to 7.90 Black to white; mod weathered; mod to ext. frac.; Biotite-Hornblende Gneissic Granite<br>9 joints @ 10°<br>ADT= .002-.004m ADS=. 03m<br>mod Fe staining<br>Strata: REC = 22% RQD = 0%<br>7.90 to 10.64 Black and white; fresh; sound; Biotite-Hornblende Gneissic Granite<br>no breaks<br>Strata: REC = 100% RQD = 100% |
| 269.12 | 9.06 | | | | | | |
| 269.12 | 9.06 | 13:09<br>19:18 | 0.60 | 0.60<br>100% | 0.60<br>100% | | stopped and sharpened bit at 9.66m |
| 268.52 | 9.66 | | | | | | |
| 268.52 | 9.66 | 13:37<br>17:52<br>32:59/.38 | .98 | 0.98<br>100% | 0.98<br>100% | | |
| 267.54 | 10.64 | | | | | | |

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB2-A RT | BORING LOCATION 45+76.4 | OFFSET 3.3m RT | ALIGNMENT -L REV- |
| COLLAR ELEV. 281.72 m | NORTHING | EASTING | 0 HR. NM / 24 HR. DRY |
| TOTAL DEPTH 9.40 m | DRILL MACHINE B-50 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 9/2/98 | COMPLETED 9/2/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | ELEV. | DEPTH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 281.72 | | | | | | | | | | 281.72 | 0.00 |
| | 0.00 | 4 | 8 | 11 | 19 | | D | | V. STIFF RED V. CLY. F. TO CSE. V. SDY. SILT - FILL | 280.32 | 1.40 |
| | 1.52 | 11 | 4 | 5 | 9 | | M | | STIFF TO V. STIFF RED AND TAN VARIABLY MICACEOUS V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL | 277.72 | 4.00 |
| | 3.05 | 6 | 10 | 14 | 24 | SS-30 30.5% | | | | | |
| | 4.57 | 14 | 38 | 50 | 88 | | M/D | | V. DENSE BLACK AND WHITE ROCK FRAGS. AND SLI. CLY SL. F. TO CSE. SAND | 275.92 | 5.80 |
| | 6.10 | 5 | 7 | 100/.13 | 100+ | | D | | SWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 272.32 | 9.40 |
| | 7.62 | 100/.07 | | | 100+ | | D | | | | |
| | 9.14 | 22 | 78/.11 | | 100+ | | D | | BORING TERMINATED AT ELEVATION 272.32m IN WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | | |

NCBMM3 98597 10/5/98

ENGINEERING TECTONICS, P.A.
1720 VARGRAVE STREET
WINSTON-SALEM, NORTH CAROLINA 27108
Phone (910) 724-6994 Fax (910) 724-7095

N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| PROJECT NO. 6.499002T | ID. R-2413C | COUNTY GUILFORD | GEOLOGIST M. TAYLOR |
| SITE DESCRIPTION DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | GROUND WATER (m) |
| BORING NO. EB2-D RT | BORING LOCATION 45+79.4 | OFFSET 11.1m RT | ALIGNMENT -L REV- |
| COLLAR ELEV. 282.19 m | NORTHING | EASTING | 0 HR. NM / 24 HR. DRY |
| TOTAL DEPTH 8.54 m | DRILL MACHINE B-80 | DRILL METHOD CASING ADVANCER | HAMMER TYPE MANUAL |
| DATE STARTED 9/1/98 | COMPLETED 9/1/98 | SURFACE WATER DEPTH | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | ELEV. | DEPTH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 282.19 | | | | | | | | | | 282.19 | 0.00 |
| | 0.24 | 7 | 6 | 6 | 12 | SS-21 18.8% | | | MED. STIFF TO STIFF TAN V. CLY. F. TO CSE. V. SDY. SILT - FILL | 279.69 | 2.50 |
| | 1.37 | 2 | 1 | 6 | 7 | | M | | V. STIFF RED V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL | 277.99 | 4.20 |
| | 2.90 | 6 | 8 | 13 | 21 | | M | | SWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 277.09 | 5.10 |
| | 4.42 | 5 | 56 | 44/.03 | 100+ | | D | | DENSE BLACK AND WHITE SLI. CLY. SL. CSE. TO F. SAND | 275.09 | 7.10 |
| | 5.94 | 19 | 19 | 28 | 47 | SS-25 20.0% | | | HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | 273.65 | 8.54 |
| | 7.47 | 10/0 | | | 10/0 | | | | | | |
| | 8.54 | 10/0 | | | 10/0 | | | | AUGER REFUSAL AT ELEVATION 273.65m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | | |

NCBMM3 98597 10/5/98

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

| | | | |
|---|---|---|---|
| **PROJECT NO.** 6.499002T | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** M. TAYLOR |
| **SITE DESCRIPTION** DUAL BRIDGES ON US 220 (-L REV-) OVER US 158 (-Y6-) | | | **GROUND WATER (m)** |
| **BORING NO.** EB2-B RT | **BORING LOCATION** 45+82.4 | **OFFSET** 18.9m RT | **ALIGNMENT** -L REV- / **0 HR.** NM |
| **COLLAR ELEV.** 282.28 m | **NORTHING** | **EASTING** | **24 HR.** DRY |
| **TOTAL DEPTH** 10.73 m | **DRILL MACHINE** B-80 | **DRILL METHOD** CASING ADVANCER | **HAMMER TYPE** MANUAL |
| **DATE STARTED** 8/31/98 | **COMPLETED** 8/31/98 | **SURFACE WATER DEPTH** | |

| ELEV. (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 20 40 60 80 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 282.28 | | | | | | | | | 282.28 | 0.00 |
| 282 | 0.23 | 18 | 8 | 8 | 16 | | D | | STIFF TO V. STIFF TAN AND RED TO ORANGE V. CLY. CSE. TO F. V. SDY. SILT W/ A LITTLE MICA - FILL | |
| 280 | 1.52 | 7 | 4 | 7 | 11 | SS-13 | 27.2% | | 279.68 | 2.60 |
| | 3.05 | 7 | 13 | 17 | 30 | | M | | V. STIFF RED MICACEOUS V. CLY. CSE. TO F. V. SDY. SILT - RESIDUAL | |
| 278 | 4.57 | 9 | 12 | 11 | 23 | | M | | 278.18 | 4.10 |
| | | | | | | | | | MED. DENSE BLACK AND WHITE SLI. CLY. SL. CSE. TO F. SAND | |
| | | | | | | | | | 276.38 | 5.90 |
| 276 | 6.10 | 10/0 | | | 10/0 | | | | | |
| 274 | 7.62 | 10/0 | | | 10/0 | | | | SWR & HWR: BLACK AND WHITE WEATHERED BIOTITE-HORNBLENDE GNEISSIC GRANITE | |
| | 9.14 | 100/.09 | | | 100+ | | M | | | |
| 272 | 10.67 | 100/.06 | | | 100+ | | M | | 271.56 | 10.72 |
| | | | | | | | | | AUGER REFUSAL AT ELEVATION 271.55m ON HARD ROCK: BIOTITE-HORNBLENDE GNEISSIC GRANITE | |
| 270 | | | | | | | | | | |
| 268 | | | | | | | | | | |
| 266 | | | | | | | | | | |
| 264 | | | | | | | | | | |

NCBMM3 98597 10/5/98

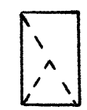
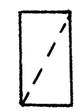
## TABLE 1

## SUMMARY OF LABORATORY TEST DATA (LEFT LANE)

| BORING NO. | SAMPLE DEPTH (METERS) | SAMPLE TYPE | NATURAL MOISTURE CONTENT | AASHTO CLASS. | N (BLOWS/ 0.30m | ATTERBERG LIMITS | | | GRADATION RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L.L. | P.L. | P.I. | PASS #10 SIEVE | PASS#40 SIEVE | PASS#200 SIEVE | COARSE SAND(%) | FINE SAND(%) | SILT (%) | CLAY (%) |
| EB1-D LT | 0.00-0.45 | SS-1 | 17.4% | A-5 (0) | 29 | 41 | 34 | 7 | 86.3 | 64.0 | 39.9 | 36.0 | 24.0 | 20.1 | 19.9 |
| B1-D LT | 3.05-3.50 | SS-49 | 22.7% | A-2-4 (0) | 33 | 26 | NP | NP | 98.1 | 59.0 | 17.6 | 41.0 | 41.4 | 12.2 | 5.4 |
| B1-B LT | 0.00-0.45 | SS-50 | 17.6% | A-4 (0) | 14 | 40 | 34 | 6 | 89.9 | 68.3 | 40.9 | 31.7 | 27.4 | 13.0 | 27.9 |
| B1-B LT | 2.29-2.74 | SS-53 | 32.0% | A-2-4 (0) | 6 | 34 | NP | NP | 99.4 | 60.4 | 20.9 | 39.6 | 39.5 | 11.5 | 9.4 |
| EB2-A LT | 0.00-0.45 | SS-7 | 13.4% | A-4 (1) | 23 | 34 | 27 | 7 | 87.4 | 68.4 | 46.0 | 31.6 | 22.4 | 11.9 | 34.1 |
| EB2-A LT | 3.05-3.50 | SS-9 | 32.7% | A-5 (3) | 30 | 44 | 38 | 6 | 99.2 | 83.2 | 58.2 | 16.8 | 24.9 | 19.6 | 38.7 |
| EB2-A LT | 6.10-6.55 | SS-11 | 22.6% | A-2-4 (0) | 33 | 28 | NP | NP | 84.6 | 53.5 | 16.5 | 46.5 | 37.0 | 11.0 | 5.5 |
| EB2-D LT | 3.05-3.50 | SS-42 | 32.1% | A-5 (5) | 24 | 55 | 46 | 9 | 99.2 | 76.9 | 56.1 | 23.1 | 20.8 | 19.4 | 36.7 |
| EB2-B LT | 0.00-0.45 | SS-35 | 11.0% | A-4 (0) | 35 | 35 | 30 | 5 | 83.9 | 65.8 | 43.1 | 34.2 | 22.6 | 13.8 | 29.4 |
| EB2-B LT | 4.57-5.02 | SS-38 | 18.5% | A-1 b (0) | 74 | 24 | NP | NP | 91.4 | 49.4 | 12.8 | 50.6 | 36.5 | 8.8 | 4.1 |

## SUMMARY OF LABORATORY TEST DATA (RIGHT LANE)

| BORING NO. | SAMPLE DEPTH (METERS) | SAMPLE TYPE | NATURAL MOISTURE CONTENT | AASHTO CLASS. | N (BLOWS/ 0.30m | ATTERBERG LIMITS | | | GRADATION RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | L.L. | P.L. | P.I. | PASS #10 SIEVE | PASS#40 SIEVE | PASS#200 SIEVE | COARSE SAND(%) | FINE SAND(%) | SILT (%) | CLAY (%) |
| EB1-A RT | 0.00-0.45 | SS-5 | 11.8% | A-4 (1) | 10 | 37 | 30 | 7 | 85.6 | 65.6 | 41.5 | 34.4 | 24.1 | 15.0 | 26.5 |
| EB1-A RT | 1.52-1.97 | SS-6 | 30.3% | A-5 (5) | 37 | 50 | 41 | 9 | 96.7 | 78.0 | 57.6 | 22.0 | 20.4 | 21.8 | 35.8 |
| EB1-B RT | 1.52-1.97 | SS-19 | 30.0% | A-5 (2) | 16 | 45 | 37 | 8 | 96.2 | 74.7 | 48.0 | 25.3 | 26.6 | 18.3 | 29.8 |
| B1-D RT | 0.76-1.21 | SS-68 | 29.7% | A-5 (4) | 32 | 53 | 49 | 4 | 99.4 | 85.1 | 58.8 | 14.9 | 26.3 | 20.0 | 38.8 |
| B1-D RT | 4.57-5.02 | SS-73 | 50.4% | A-1-b (0) | 8 | 29 | NP | NP | 99.4 | 46.9 | 13.3 | 53.1 | 33.6 | 7.8 | 5.5 |
| B1-B RT | 0.00-0.45 | SS-60 | 12.7% | A-5 (4) | 30 | 49 | 43 | 6 | 99.5 | 84.8 | 56.7 | 15.2 | 28.1 | 11.9 | 44.8 |
| EB2-A RT | 3.05-3.50 | SS-30 | 30.5% | A-5 (1) | 24 | 43 | 39 | 4 | 99.1 | 81.9 | 51.5 | 18.1 | 30.4 | 22.8 | 28.7 |
| EB2-D RT | 0.00-0.45 | SS-21 | 18.8% | A-4 (1) | 12 | 34 | 29 | 5 | 93.6 | 73.9 | 48.7 | 26.1 | 25.2 | 15.9 | 32.8 |
| EB2-D RT | 5.94-6.39 | SS-25 | 20.0% | A-2-4 (0) | 47 | 25 | NP | NP | 91.3 | 62.7 | 17.8 | 37.3 | 44.9 | 12.8 | 5.0 |
| EB2-B RT | 1.52-1.97 | SS-13 | 27.2% | A-4 (0) | 11 | 38 | 34 | 4 | 94.6 | 74.0 | 44.0 | 26.0 | 30.0 | 17.5 | 26.5 |

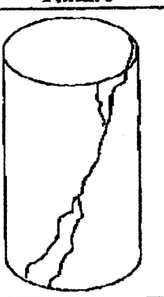
| Core No. | B1-A LT | B1-A RT | B1-D RT |
|---|---|---|---|
| Sample Number | RS 1 | RS 3 | RS 4 |
| Sample Location | 4.08m-4.18m | 3.07m-3.17m | 6.92m-7.02m |
| Date Tested | 9/24/98 | 9/24/98 | 9/24/98 |
| Sample Diameter (Meters) | 5.08 | 5.08 | 5.08 |
| Sample Length (Meters) | 10.16 | 10.16 | 10.16 |
| L/D Ratio | 2.00 | 2.00 | 2.00 |
| Compressive Load (kg.) | 31751.44 | 9525.43 | 10432.62 |
| Compressive Strength (kPa) | 153.63 | 46.09 | 50.48 |
| Load Rate | 1732.7 kg/min. | 1410.7 kg/min. | 1031.9 kg/min. |
| Type Failure | |  |  |

| L/D Ratio | 1.89 to 2.00 | Multiplier | 1.00 |
|---|---|---|---|
| " | 1.76 to 1.88 | " | 0.99 |
| " | 1.64 to 1.75 | " | 0.98 |
| " | 1.41 to 1.63 | " | 0.97 |
| " | 1.39 to 1.40 | " | 0.96 |
| " | 1.30 to 1.38 | " | 0.95 |
| " | 1.26 to 1.31 | " | 0.94 |
| " | 1.21 to 1.25 | " | 0.93 |
| " | 1.17 to 1.20 | " | 0.92 |
| " | 1.11 to 1.16 | " | 0.91 |
| " | 1.09 to 1.12 | " | 0.90 |
| " | 1.05 to 1.08 | " | 0.89 |
| " | 1.01 to 1.04 | " | 0.88 |
| " | 1.00 | " | 0.87 |

L/D Ratio less than 1.00 or over 2.00 is unacceptable.

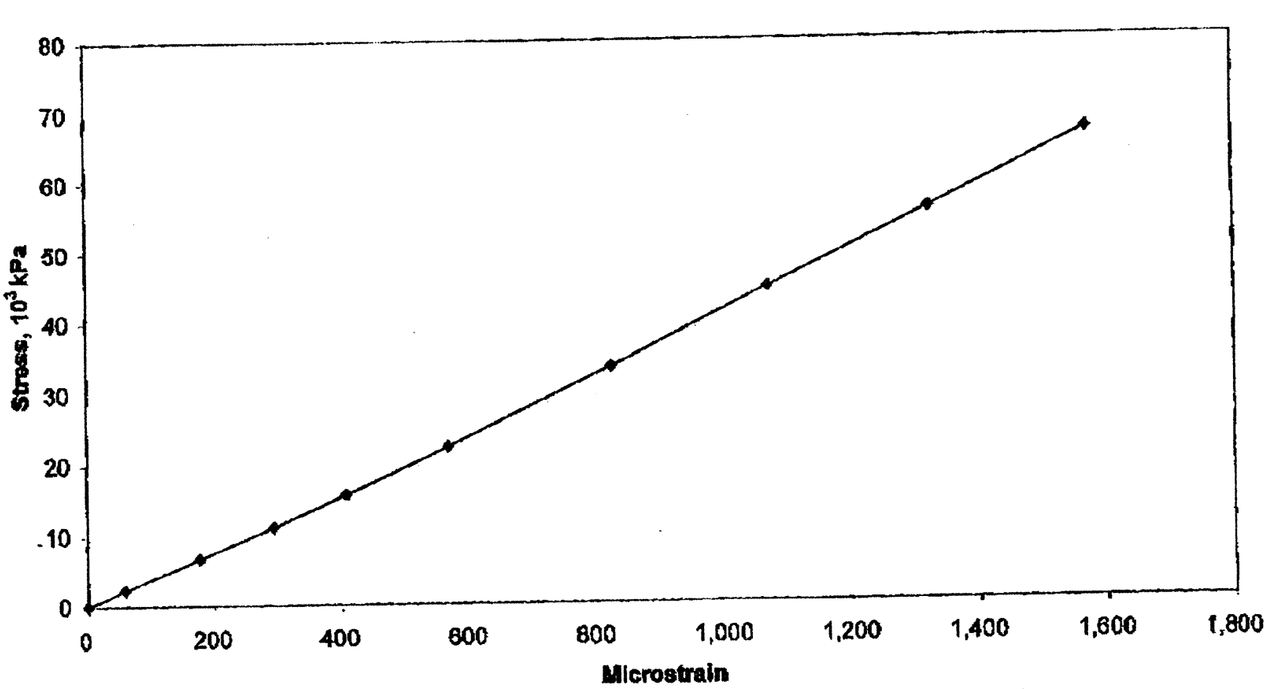
**UNCONFINED COMPRESSION WITH YOUNG'S MODULUS**
**(ASTM D2938 and D3148)**

| | | | | | |
|---|---|---|---|---|---|
| **PROJECT:** | Dual Bridges on U.S. 220 over U.S. 158; TIP No. R-2413C | | | | |
| | | **Moisture Content, %:** | | | |
| **Hole #:** | B1-BLT | **Total Unit Weight, kg/m³** | 2771.2 | **Job No.:** | 6.499002T |
| **Depth, m.:** | 4.59 - 4.73 | **Length, cm.:** | 10.46 | **Date:** | 10/9/98 |
| **Spec diameter, cm:** | 5.04 | **L/D Ratio:** | 2.1 | **Tested by:** | WDT |
| **Sample #:** | RS-2 | **Loading Rate, kPa/min.:** | 7770 | **Reviewed by:** | JBP |

| Data Point | Microstrain (axial) | Load (KN) | Stress ($10^3$ kPa) | Secant Modulus x $10^6$ (kPa) | Remarks Failure |
|---|---|---|---|---|---|
| 1 | 0 | 0.00 | 0 | 0 |  |
| 2 | 60 | 4.45 | 2.23 | 37.18 | |
| 3 | 176 | 13.34 | 6.69 | 37.99 | |
| 4 | 294 | 22.24 | 11.15 | 37.92 | |
| 5 | 408 | 31.14 | 15.61 | 38.26 | |
| 6 | 568 | 44.48 | 22.30 | 39.25 | |
| 7 | 824 | 66.72 | 33.44 | 40.59 | |
| 8 | 1,070 | 88.96 | 44.59 | 41.67 | |
| 9 | 1,324 | 111.21 | 55.74 | 42.10 | |
| 10 | 1,572 | 133.45 | 66.89 | 42.55 | |
| 11 | | 155.02 | 77.70 | | Failure |

JOB NAME; U.S. 220 over U.S. 158
TIP NUMBER: R-2413C
JOB NUMBER: 6.499002T
JOB LOCATION: Guilford County, NC
SAMPLE NUMBER: RS-2
SAMPLE LOCATION: B1-BLT
DEPTH: 4.59 - 4.73 m.

**Stress vs. Microstrain**



| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34429.1.1 (R-2413C) | 1 | 42 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34429.1.1 (R-2413C) F.A. PROJ. N/A

COUNTY GUILFORD

PROJECT DESCRIPTION NC 68 CONNECTOR - US 220 FROM HAW RIVER TO EXISTING NC 68-US 220 INTERSECTION

SITE DESCRIPTION DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER AT -L REV- STA. 24+37

## INVENTORY

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3 | SITE PLAN |
| 4,5 | PROFILE(S) |
| 6-10 | CROSS SECTION(S) |
| 11-32 | BORE LOG & CORE REPORT(S) |
| 33,34 | SOIL TEST RESULTS |
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PERSONNEL

CONSULTANT: S&ME

INVESTIGATED BY S&ME

CHECKED BY N. T. ROBERSON

SUBMITTED BY J. L. PEDRO

DATE JULY 2010

NORTH CAROLINA LICENSED SEAL 2157 GEOLOGIST JAIME LOVE PEDRO

Jaime Love Pedro 7-21-10

DRAWN BY: J. L. PEDRO, T. T. WALKER

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PROJECT: 34429.1.1

ID: R-2413C

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34429.1.1 (R-2413C) | 2 |

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

# SUBSURFACE INVESTIGATION

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

### SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER 30 CM ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

### SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($kN/m^2$) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | <4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>>50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | <2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>>30 | <25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>>400 |

### TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### PLASTICITY

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

### COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

### GRADATION

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

### ANGULARITY OF GRAINS

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

### MINERALOGICAL COMPOSITION

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

### COMPRESSIBILITY

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

### PERCENTAGE OF MATERIAL

| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | |
|---|---|---|---|---|
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | 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 |

### GROUND WATER

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

### MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT DMT / VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

### ABBREVIATIONS

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
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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-750
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [X] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 7.46 mm STEEL TEETH
- [ ] TRICONE ____ mm TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N WD4
- [X] -H Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

### ROCK DESCRIPTION

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 3 CM PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

| | |
|---|---|
| WEATHERED ROCK (WR) | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER 30 CM IF TESTED. |
| CRYSTALLINE ROCK (CR) | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. |

### WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V. 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 BLOWS PER 30 CM* |
| 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 BLOWS PER 30 CM* |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

### ROCK HARDNESS

| | |
|---|---|
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 6 MM DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. |
| SOFT | CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. |

### FRACTURE SPACING

| TERM | SPACING |
|---|---|
| VERY WIDE | MORE THAN 3 M |
| WIDE | 3 TO 10 M |
| MODERATELY CLOSE | 30 TO 100 CM |
| CLOSE | 5 TO 30 CM |
| VERY CLOSE | LESS THAN 5 CM |

### BEDDING

| TERM | THICKNESS |
|---|---|
| VERY THICKLY BEDDED | > 1 M |
| THICKLY BEDDED | 0.5 - 1 M |
| THINLY BEDDED | 0.05 - 0.5 M |
| VERY THINLY BEDDED | 10 - 50 MM |
| THICKLY LAMINATED | 2.5 - 10 MM |
| THINLY LAMINATED | < 2.5 MM |

### 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. |

### TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

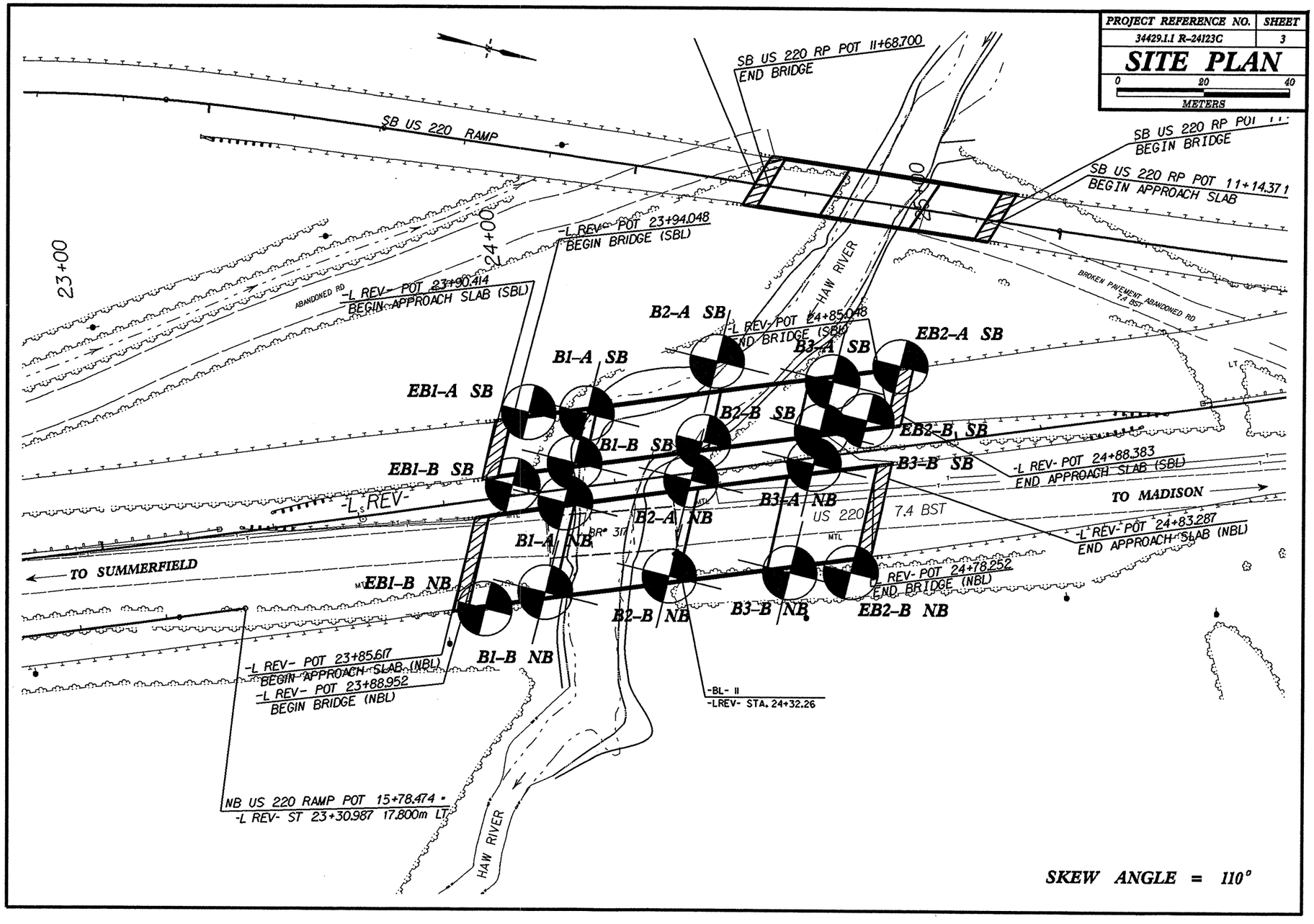
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL 11- DISC STAMPED E-170 1965 IN THE NE WING WALL OF BRIDGE AT -LREV- STA. 24+32.26, OFFSET - 18.2m RT
ELEVATION: 233.273 M

NOTES:

BRIDGE WAS INVESTIGATED IN OCT./NOV. 1997 AND APR./MAY 2001 BY S&ME.

REVISED 09/23/09


PROJECT REFERENCE NO.
34429.1.1 R-24123C
SHEET
3
SITE PLAN
0 20 40
METERS
SB US 220 RP POT 11+68.700
END BRIDGE
SB US 220 RAMP
SB US 220 RP POT
BEGIN BRIDGE
SB US 220 RP POT 11+14.371
BEGIN APPROACH SLAB
23+00
24+00
25+00
-L REV- POT 23+94.048
BEGIN BRIDGE (SBL)
-L REV- POT 23+90.414
BEGIN APPROACH SLAB (SBL)
ABANDONED RD
HAW RIVER
BROKEN PAVEMENT ABANDONED RD
7.4 BST
-L REV- POT 24+85.048
END BRIDGE (SBL)
B2-A SB
B3-A SB
EB2-A SB
B1-A SB
EB1-A SB
B2-B SB
EB2-B SB
B1-B SB
B3-B SB
EB1-B SB
-L REV- POT 24+88.383
END APPROACH SLAB (SBL)
TO MADISON
-L REV-
B3-A NB
US 220
7.4 BST
B2-A NB
B1-A NB
-L REV- POT 24+83.287
END APPROACH SLAB (NBL)
TO SUMMERFIELD
EB1-B NB
REV- POT 24+78.252
END BRIDGE (NBL)
B2-B NB
B3-B NB
EB2-B NB
B1-B NB
-L REV- POT 23+85.617
BEGIN APPROACH SLAB (NBL)
-L REV- POT 23+88.952
BEGIN BRIDGE (NBL)
-BL- II
-LREV- STA. 24+32.26
NB US 220 RAMP POT 15+78.474
-L REV- ST 23+30.987 17.800m LT
HAW RIVER
SKEW ANGLE = 110°

| PROJECT REFERENCE NO. | SHEET |
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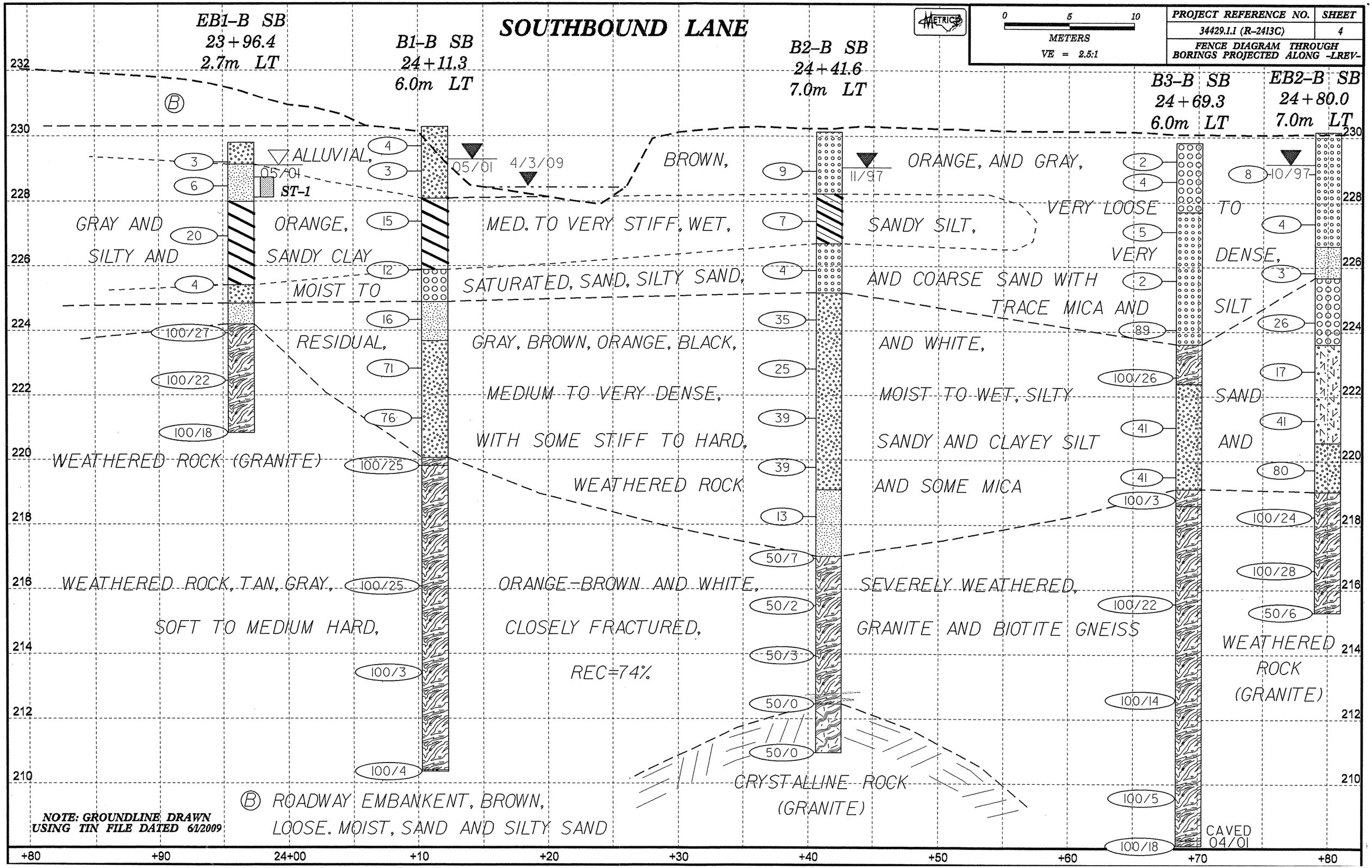
| FENCE DIAGRAM THROUGH BORINGS PROJECTED ALONG -LREV- | |



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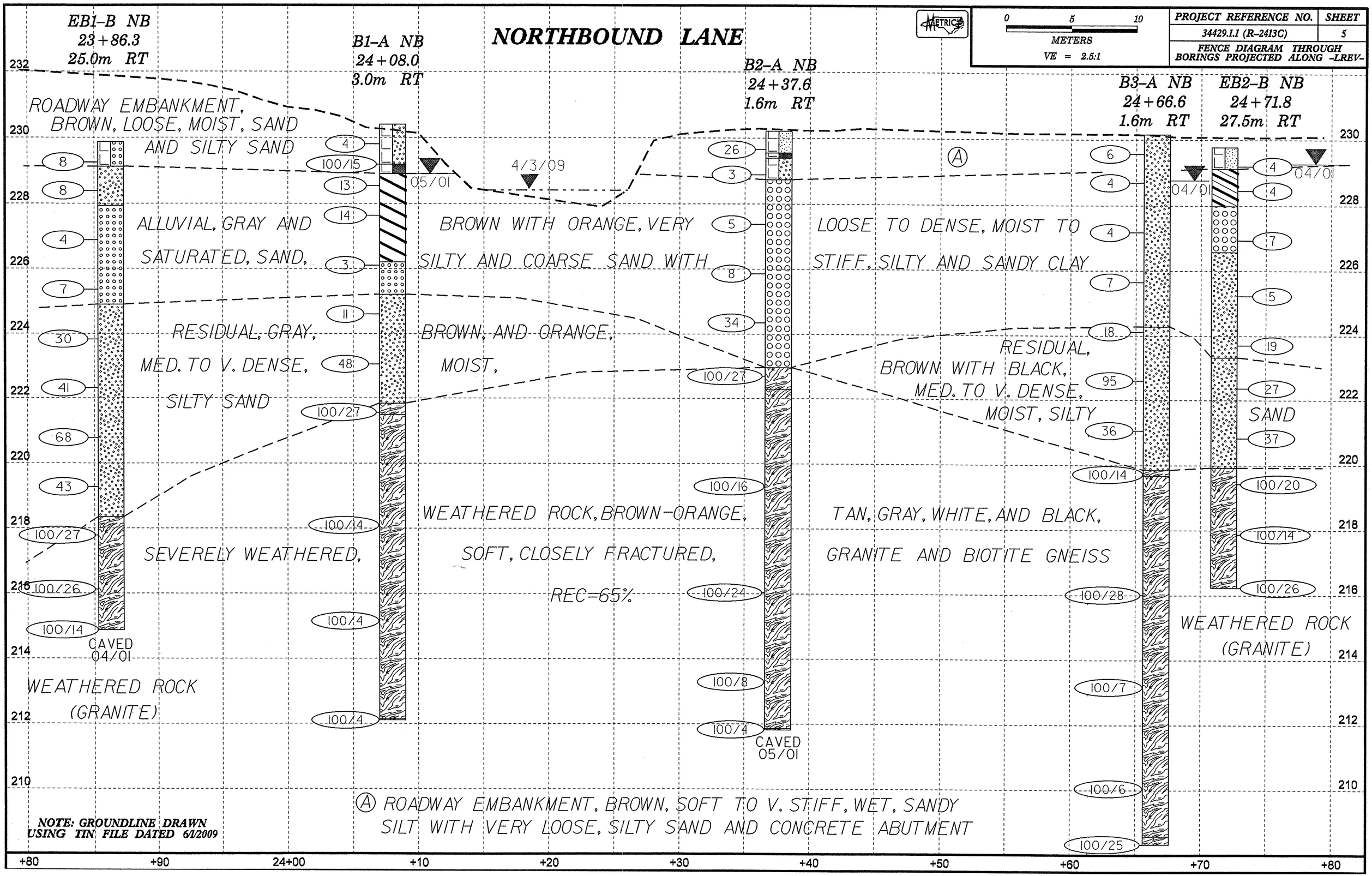

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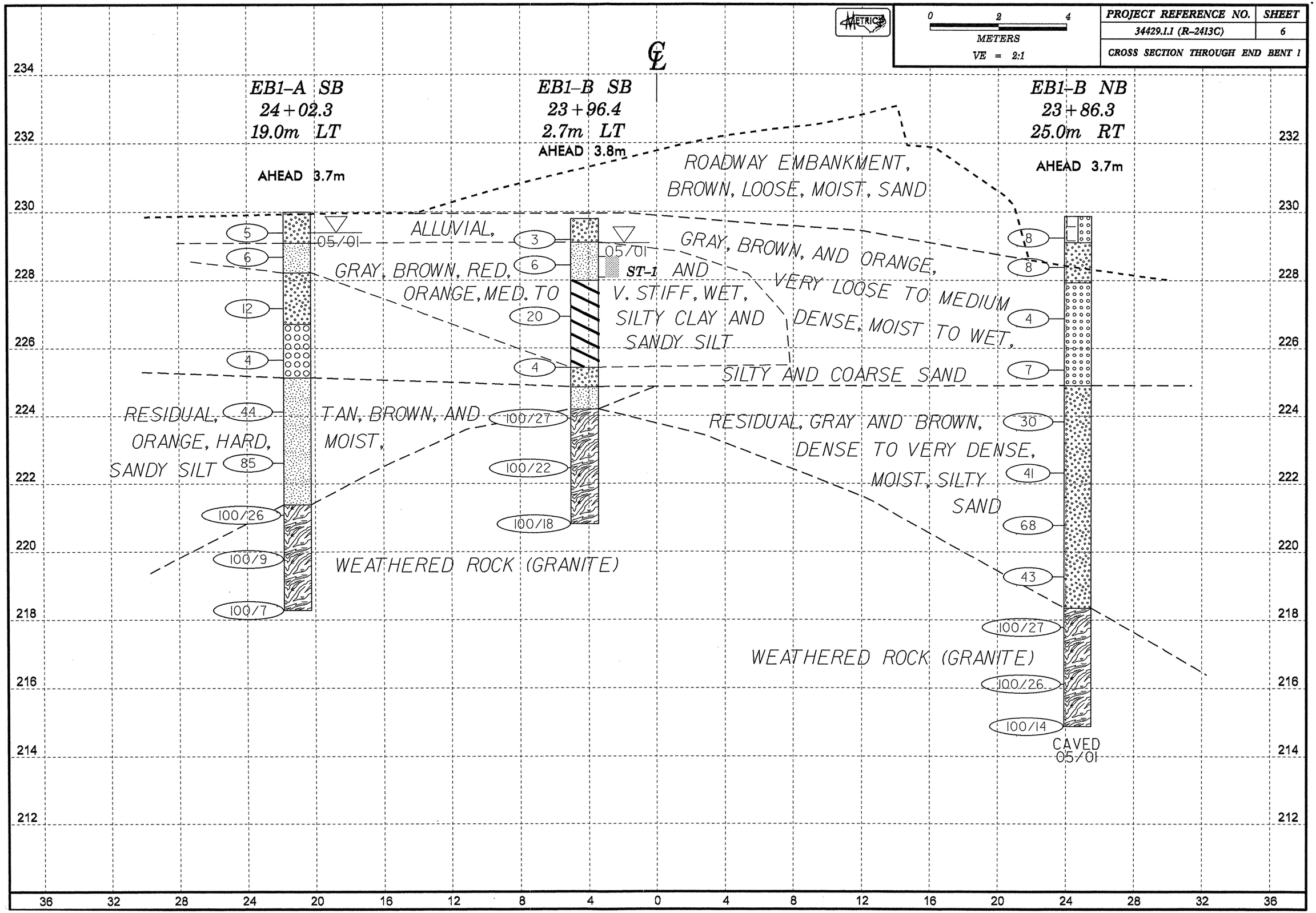
| CROSS SECTION THROUGH END BENT 1 | |



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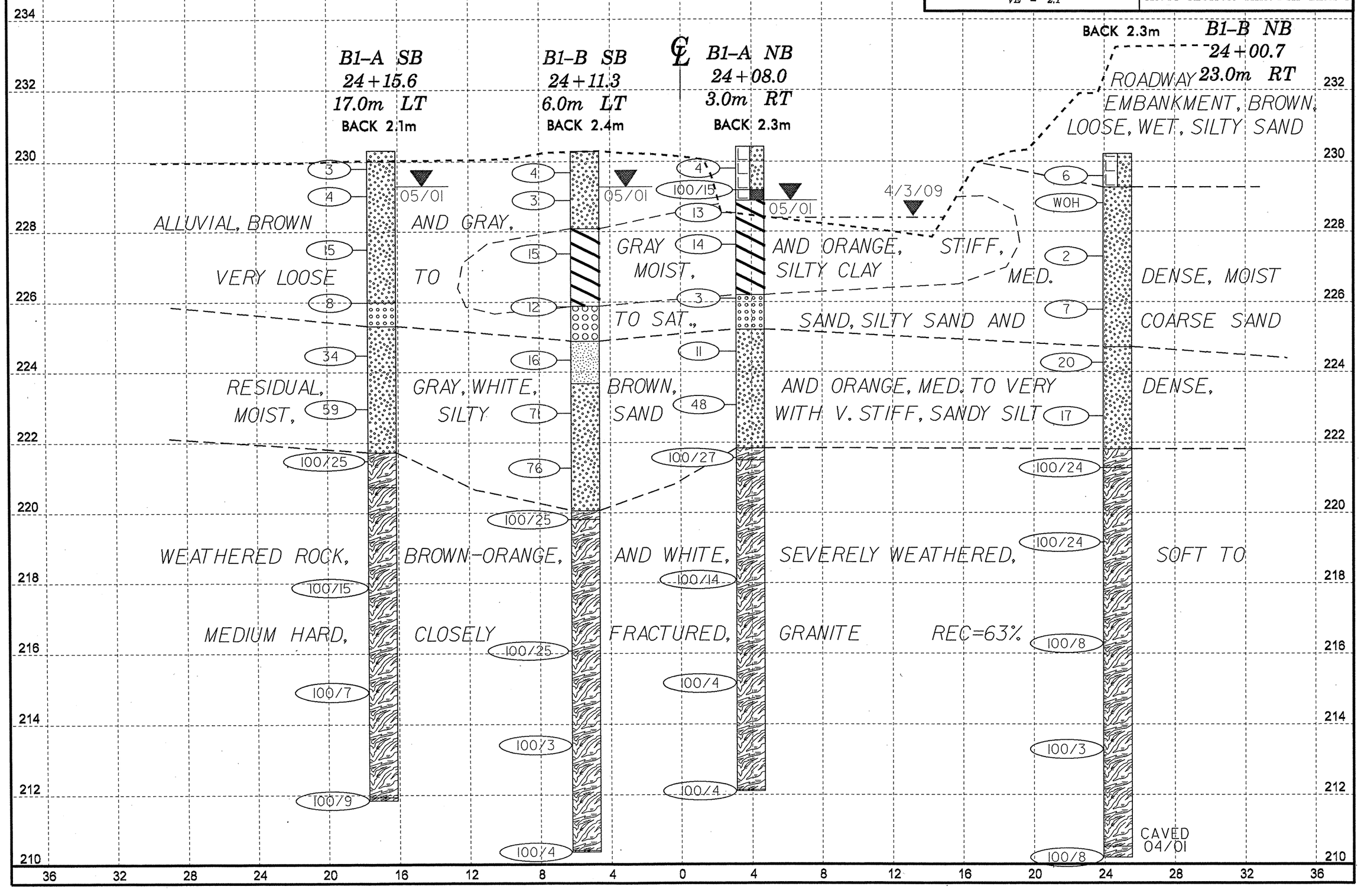
METRIC

0 2 4
METERS
VE = 2:1



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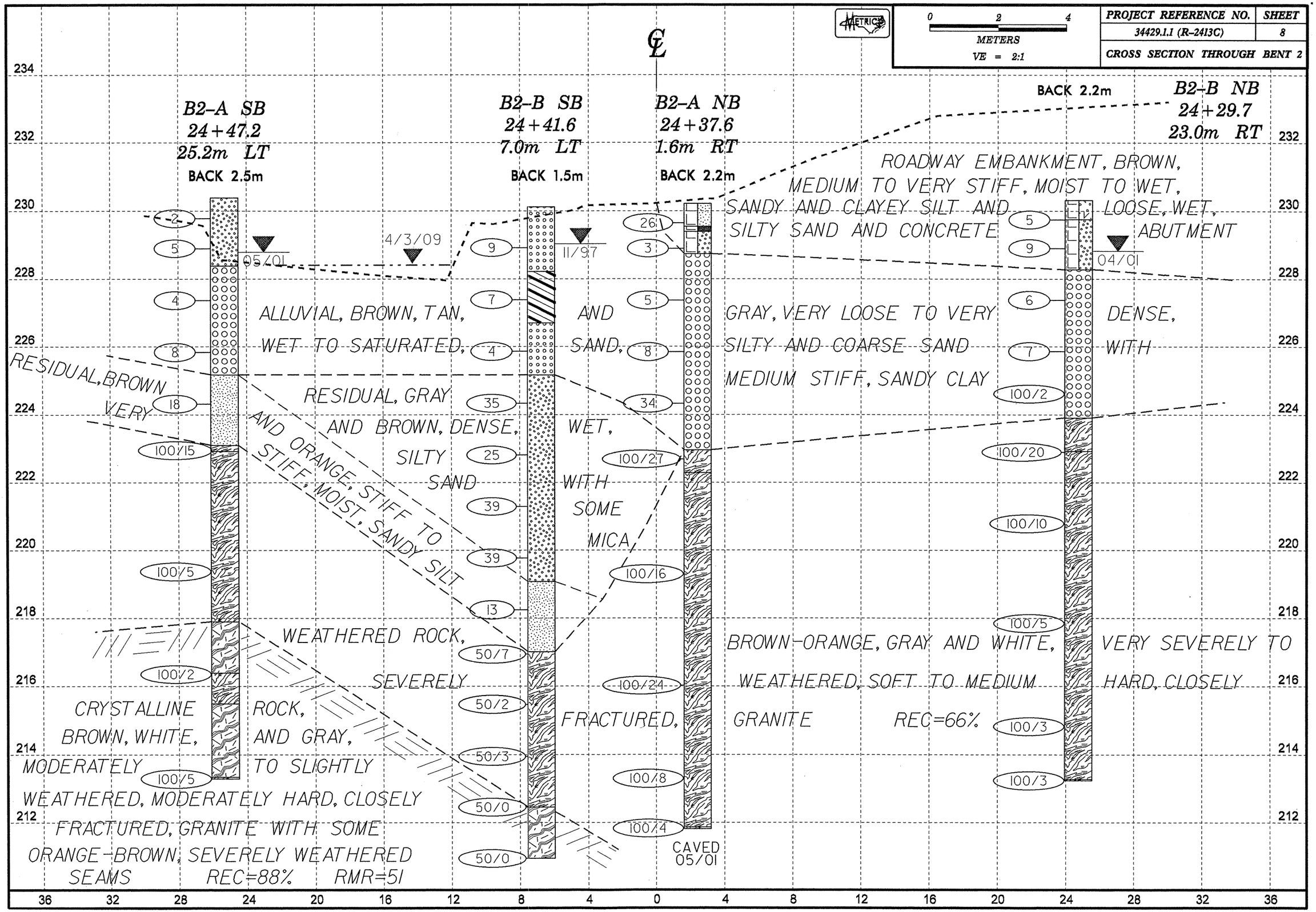

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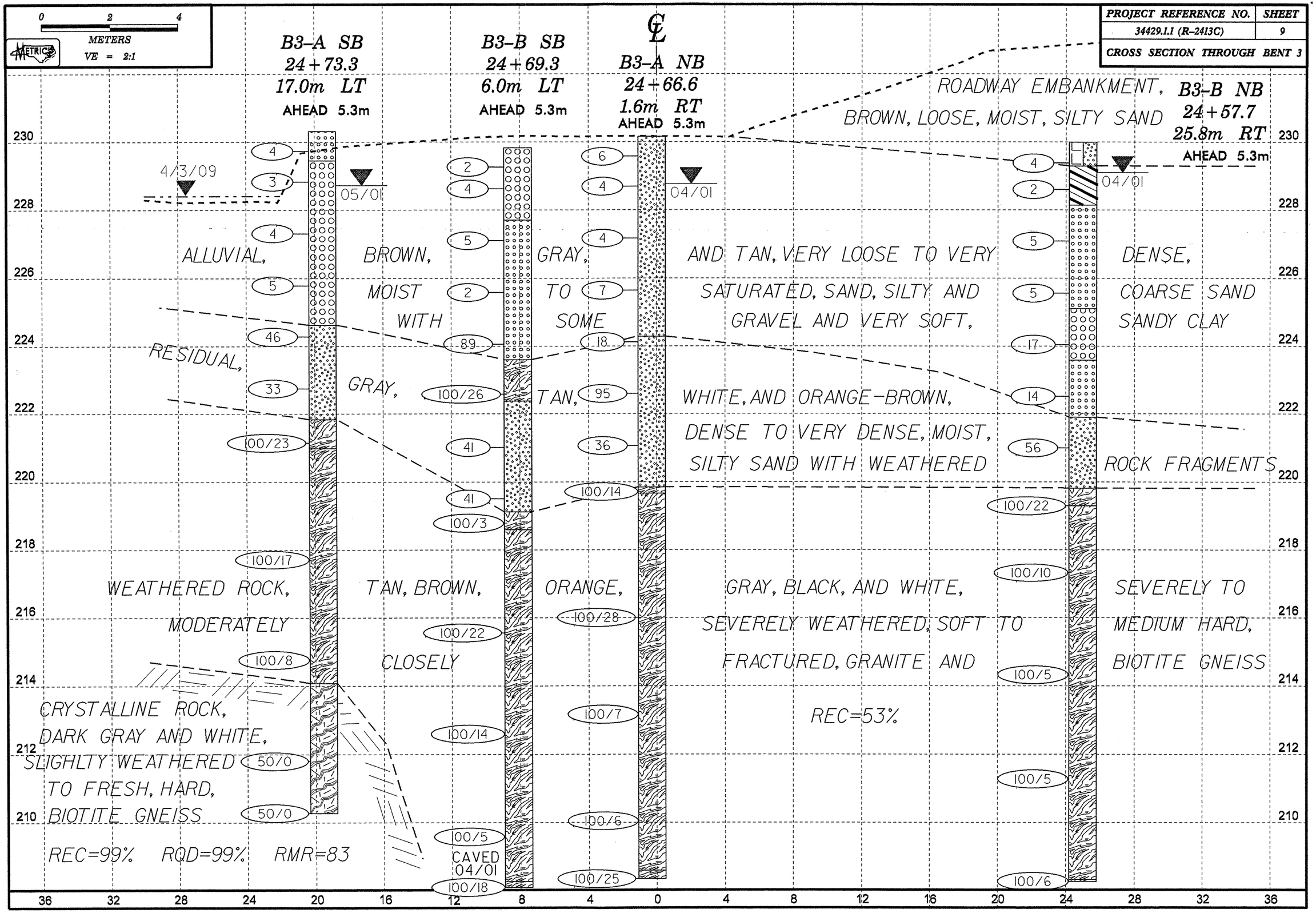

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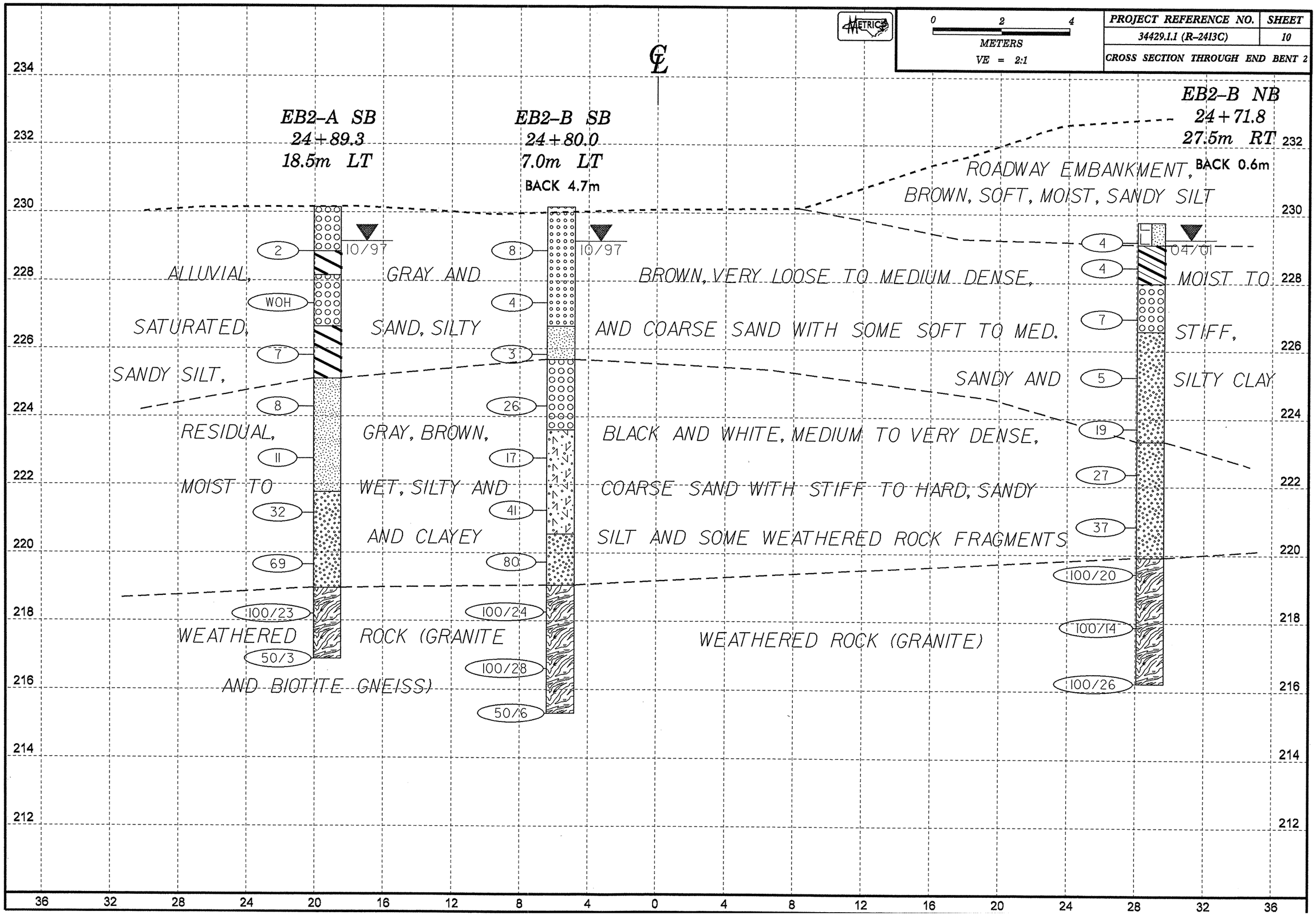
| CROSS SECTION THROUGH END BENT 2 | |

METRIC

0 2 4
METERS
VE = 2:1



# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** EB1-A SB | **STATION** 24+02.3 | **OFFSET** 19.0 m LT | **ALIGNMENT** -L REV- **0 HR.** 0.61 |
| **COLLAR ELEV.** 230.00 m | **TOTAL DEPTH** 11.72 m | **NORTHING** 275,303.5 | **EASTING** 527,409.0 **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/04/01 | **COMP. DATE** 05/04/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 230 | | | | | | | | | 230.00 GROUND SURFACE | 0.00 |
| | 229.70 | 0.30 | 2 | 3 | 2 | | M | | **ALLUVIAL** BROWN, SILTY SAND WITH TRACE MICA | |
| 229 | 228.99 | 1.01 | 1 | 2 | 4 | SS-2 | 21% | | 229.10 GRAY, SANDY SILT | 0.90 |
| 228 | | | | | | | | | 228.23 GRAY, SILTY SAND | 1.77 |
| | 227.47 | 2.53 | 4 | 7 | 5 | SS-3 | W | | | |
| 227 | | | | | | | | | 226.71 GRAY, COARSE SAND | 3.29 |
| 226 | 225.95 | 4.05 | 1 | 2 | 2 | | W | | | |
| 225 | | | | | | | | | 225.12 **RESIDUAL** TAN, SANDY SILT WITH SOME COARSE SAND | 4.88 |
| | 224.43 | 5.57 | 12 | 17 | 27 | | M | | | |
| 224 | | | | | | | | | | |
| 223 | 222.91 | 7.09 | 23 | 37 | 48 | | M | | | |
| 222 | | | | | | | | | | |
| | 221.39 | 8.61 | 45 | 55/11 | | | | | 221.39 **WEATHERED ROCK** (GRANITE) | 8.61 |
| 221 | | | | | | | | | | |
| 220 | 219.87 | 10.13 | 100/9 | | | | | | | |
| 219 | | | | | | | | | | |
| | 218.35 | 11.65 | 100/7 | | | | | | 218.28 Boring Terminated at Elevation 218.28 m IN WEATHERED ROCK (GRANITE) | 11.72 |
| 218 | | | | | | | | | | |
| 217 | | | | | | | | | | |
| 216 | | | | | | | | | | |
| 215 | | | | | | | | | | |
| 214 | | | | | | | | | | |
| 213 | | | | | | | | | | |
| 212 | | | | | | | | | | |
| 211 | | | | | | | | | | |
| 210 | | | | | | | | | | |

BLOWS PER 30 CM: 0 25 50 75 100

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** EB1-B SB | **STATION** 23+96.4 | **OFFSET** 2.7 m LT | **ALIGNMENT** -L REV- **0 HR.** 0.74 |
| **COLLAR ELEV.** 229.79 m | **TOTAL DEPTH** 8.97 m | **NORTHING** 275,304.0 | **EASTING** 527,426.3 **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/04/01 | **COMP. DATE** 05/04/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|
| 230 | | | | | | | | | 229.79 GROUND SURFACE | 0.00 |
| | 229.49 | 0.30 | 1 | 1 | 2 | | W | | **ALLUVIAL** BROWN-ORANGE, SILTY SAND WITH TRACE MICA | |
| 229 | 228.75 | 1.04 | 1 | 2 | 4 | | W 20% | | 229.12 GRAY AND ORANGE, SANDY SILT | 0.67 |
| 228 | | | | | | | | | 227.99 GRAY AND RED-ORANGE, SILTY CLAY WITH SOME FINE SAND | 1.80 |
| | 227.23 | 2.56 | 5 | 8 | 12 | SS-3A | 32% | | | |
| 227 | | | | | | | | | | |
| 226 | 225.71 | 4.08 | 4 | 2 | 2 | | W | | 225.41 BROWN-ORANGE, SILTY SAND | 4.38 |
| 225 | | | | | | | | | 224.84 **RESIDUAL** GRAY, SANDY SILT | 4.95 |
| 224 | 224.19 | 5.60 | 36 | 64/12 | | | | | 224.19 **WEATHERED ROCK** (GRANITE) | 5.60 |
| 223 | 222.67 | 7.12 | 56 | 44/7 | | | | | | |
| 222 | | | | | | | | | | |
| 221 | 221.15 | 8.64 | 25 | 58 | 42/3 | | | | 220.82 Boring Terminated at Elevation 220.82 m IN WEATHERED ROCK (GRANITE) | 8.97 |
| 220 | | | | | | | | | | |
| 219 | | | | | | | | | | |
| 218 | | | | | | | | | | |
| 217 | | | | | | | | | | |
| 216 | | | | | | | | | | |
| 215 | | | | | | | | | | |
| 214 | | | | | | | | | | |
| 213 | | | | | | | | | | |
| 212 | | | | | | | | | | |
| 211 | | | | | | | | | | |
| 210 | | | | | | | | | | |

BLOWS PER 30 CM: 0 25 50 75 100

Other Samples:
ST-1 (1.1 - 1.7)

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A SB | **STATION** 24+15.6 | **OFFSET** 17.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.30 m | **TOTAL DEPTH** 18.45 m | **NORTHING** 275,316.4 | **EASTING** 527,406.1 | **24 HR.** 1.00 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/07/01 | **COMP. DATE** 05/08/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230 | 230.10 | 0.20 | 2 | 2 | 1 | 3 | | M | | 230.30 GROUND SURFACE | 0.00 |
| 229 | 229.33 | 0.97 | 2 | 2 | 2 | 4 | SS-2A | M | | **ALLUVIAL** BROWN AND GRAY, SILTY SAND WITH TRACE MICA | |
| 227 | 227.81 | 2.49 | 6 | 8 | 7 | 15 | | Sat. | | | |
| 226 | 226.29 | 4.01 | 3 | 4 | 4 | 8 | | Sat. | | 226.00 BROWN, SAND | 4.30 |
| 225 | 224.77 | 5.53 | 13 | 15 | 19 | 34 | | M | | 225.30 **RESIDUAL** GRAY AND WHITE TO ORANGE-BROWN, SILTY SAND | 5.00 |
| 223 | 223.25 | 7.05 | 20 | 25 | 34 | 59 | | M | | | |
| 221 | 221.73 | 8.57 | 52 | 48/10 | | 100/25 | | | | 221.73 **WEATHERED ROCK** (GRANITE) | 8.57 |
| 220 | | | | | | | | | | 220.74 BROWN-ORANGE AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, THICKLY BEDDED, GRANITE REC=71% | 9.56 |
| 218 | 218.02 | 12.28 | 100/15 | | | 100/15 | | | | | |
| 215 | 214.98 | 15.32 | 100/7 | | | 100/7 | | | | | |
| 212 | 211.94 | 18.36 | 100/9 | | | 100/9 | | | | 211.94 (GRANITE) Boring Terminated at Elevation 211.85 m IN WEATHERED ROCK (GRANITE) | 18.36 / 18.45 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A SB | **STATION** 24+15.6 | **OFFSET** 17.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.30 m | **TOTAL DEPTH** 18.45 m | **NORTHING** 275,316.4 | **EASTING** 527,406.1 | **24 HR.** 1.00 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/07/01 | **COMP. DATE** 05/08/01 | **SURFACE WATER DEPTH** N/A | |
| **CORE SIZE** NWD4 | **TOTAL RUN** 8.58 m | | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 220.74 | | | | | | | | | | | Begin Coring @ 9.56 m | |
| 220 | 220.74 | 9.56 | 1.20 | 2:00/0.30 2:45/0.30 2:55/0.30 2:05/0.30 | (0.89) 74% | | | (6.27) 71% | | | 220.74 BROWN-ORANGE AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, THICKLY BEDDED, GRANITE | 9.56 |
| 219 | 219.54 | 10.76 | 1.52 | 3:05/0.30 3:10/0.30 3:00/0.30 5:00/0.30 5:45/0.32 | (0.75) 49% | | | | | | | |
| 218 | 218.02 | 12.28 | | | | | | | | | | |
| 217 | 217.87 | 12.43 | 1.37 | N=100/15 4:00/0.30 3:25/0.30 2:45/0.30 2:25/0.30 2:20/0.17 | (1.37) 100% | | | | | | | |
| 216 | 216.50 | 13.80 | 1.52 | 2:05/0.30 2:10/0.30 2:20/0.30 2:15/0.30 2:30/0.32 | (0.96) 63% | | | | | | | |
| 215 | 214.98 | 15.32 | | | | | | | | | | |
| 214 | 214.91 | 15.39 | 1.45 | N=100/7 4:25/0.30 2:30/0.30 1:45/0.30 1:45/0.30 2:00/0.25 | (0.86) 59% | | | | | | | |
| 213 | 213.46 | 16.84 | 1.52 | 2:25/0.30 2:30/0.30 2:45/0.30 3:15/0.30 3:10/0.32 | (1.44) 95% | | | | | | | |
| 212 | 211.94 | 18.36 | | N=100/9 | | | | | | | 211.94 (GRANITE) Boring Terminated at Elevation 211.85 m IN WEATHERED ROCK (GRANITE) | 18.36 / 18.45 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B SB | **STATION** 24+11.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.28 m | **TOTAL DEPTH** 19.92 m | **NORTHING** 275,316.7 | **EASTING** 527,417.8 | **24 HR.** 1.00 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/08/01 | **COMP. DATE** 05/08/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.28 GROUND SURFACE | 0.00 |
| | | | | | | | | | | **ALLUVIAL** BROWN AND GRAY, SILTY SAND WITH TRACE MICA | |
| 230 | 229.98 | 0.30 | 2 | 2 | 2 | 4 | | M | | | |
| 229 | 229.20 | 1.08 | 3 | 1 | 2 | 3 | | Sat. | | | |
| | | | | | | | | | | 228.08 | 2.20 |
| | | | | | | | | | | GRAY AND ORANGE, SILTY CLAY | |
| 228 | 227.68 | 2.60 | 4 | 6 | 9 | 15 | SS-3B | 26% | | | |
| 226 | 226.16 | 4.12 | 3 | 3 | 9 | 12 | | Sat. | | | |
| | | | | | | | | | | 225.88 | 4.40 |
| | | | | | | | | | | GRAY, COARSE SAND | |
| | | | | | | | | | | 224.88 | 5.40 |
| | | | | | | | | | | **RESIDUAL** BROWN-ORANGE, SANDY SILT | |
| 224 | 224.64 | 5.64 | 5 | 6 | 10 | 16 | | M | | | |
| | | | | | | | | | | 223.68 | 6.60 |
| | | | | | | | | | | BROWN-ORANGE AND WHITE, SILTY SAND | |
| 223 | 223.12 | 7.16 | 9 | 44 | 27 | 71 | | M | | | |
| 221 | 221.58 | 8.70 | 23 | 28 | 48 | 76 | | M | | | |
| 220 | 220.06 | 10.22 | 54 | 46/10 | | 100/25 | | | | 220.06 / 219.81 | 10.22 / 10.47 |
| | | | | | | | | | | **WEATHERED ROCK** (GRANITE) ORANGE-BROWN AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, GRANITE | |
| | | | | | | | | | | REC=55% | |
| 216 | 216.48 | 13.80 | 19 | 53 | 47/10 | 100/25 | | | | | |
| 213 | 213.44 | 16.84 | 100/3 | | | 100/3 | RS-1 | | | | |

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B SB | **STATION** 24+11.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.28 m | **TOTAL DEPTH** 19.92 m | **NORTHING** 275,316.7 | **EASTING** 527,417.8 | **24 HR.** 1.00 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/08/01 | **COMP. DATE** 05/08/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 211 | | | | | | Match Line | | | | |
| | 210.40 | 19.88 | | | | | | | | 210.40 / 210.36 — 19.88 / 19.92 |
| 210 | | | 100/4 | | | 100/4 | | | | (GRANITE) Boring Terminated at Elevation 210.36 m IN WEATHERED ROCK (GRANITE) |

NCDOT BORE DOUBLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B SB | **STATION** 24+11.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.28 m | **TOTAL DEPTH** 19.92 m | **NORTHING** 275,316.7 | **EASTING** 527,417.8 — **24 HR.** 1.00 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/08/01 | **COMP. DATE** 05/08/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 8.98 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 219.81 | | | | | | | | | | | Begin Coring @ 10.47 m |
| | 219.81 / 219.52 | 10.47 / 10.76 | 0.29 | 3:15/0.29 | (0.00) 0% | | | (5.20) 55% | | | 219.81 ORANGE-BROWN AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, GRANITE 10.47 |
| 219 | | | 1.52 | 2:40/0.30<br>2:50/0.30<br>2:35/0.30<br>4:50/0.30<br>3:50/0.32 | (0.70) 46% | | | | | | |
| 218 | 218.00 | 12.28 | | | | | | | | | |
| 217 | | | 1.52 | 2:20/0.30<br>2:35/0.30<br>2:50/0.30<br>3:20/0.30<br>4:00/0.32 | (0.76) 50% | | | | | | |
| | 216.48 | 13.80 | | | | | | | | | |
| 216 | 216.08 | 14.20 | | *N=100/25* | | | | | | | |
| 215 | 214.96 | 15.32 | 1.12 | 4:05/0.30<br>4:15/0.30<br>4:20/0.30<br>3:50/0.22 | (0.00) 0% | | | | | | |
| 214 | | | 1.52 | 3:20/0.30<br>3:35/0.30<br>3:05/0.30<br>3:45/0.30<br>4:10/0.32 | (1.15) 76% | | | | | | |
| | 213.44 / 213.41 | 16.84 / 16.87 | | | | | | | | | |
| 213 | | | 1.49 | *N=100/3*<br>3:10/0.30<br>3:45/0.30<br>3:20/0.30<br>3:30/0.30<br>3:40/0.29 | (1.49) 100% | | | | | | |
| 212 | 211.92 | 18.36 | | | | | RS-1 | | | | |
| 211 | | | 1.52 | 2:10/0.30<br>2:20/0.30<br>2:35/0.30<br>2:20/0.30<br>2:25/0.32 | (1.10) 72% | | | | | | |
| | 210.40 | 19.88 | | | | | | | | | 210.40 / 210.36 (GRANITE) 19.88 / 19.92 |
| 210 | | | | *N=100/4* | | | | | | | Boring Terminated at Elevation 210.36 m IN WEATHERED ROCK (GRANITE) |
| 209 | | | | | | | | | | | |
| 208 | | | | | | | | | | | |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |
| 201 | | | | | | | | | | | |
| 200 | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B2-A SB | **STATION** 24+47.2 | **OFFSET** 25.2 m LT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.38 m | **TOTAL DEPTH** 17.09 m | **NORTHING** 275,343.1 | **EASTING** 527,386.8 — **24 HR.** 1.57 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/09/01 | **COMP. DATE** 05/10/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.38 GROUND SURFACE | 0.00 |
| | 230.08 | 0.30 | | | | | | | | **ALLUVIAL** BROWN, SILTY SAND WITH TRACE MICA | |
| | | | 3 | 1 | 1 | 2 | | M | | | |
| | 229.19 | 1.19 | | | | | | | | | |
| | | | 2 | 3 | 2 | 5 | | M | | | |
| | | | | | | | | | | 228.38 GRAY, COARSE SAND | 2.00 |
| | 227.67 | 2.71 | | | | | | | | | |
| | | | 1 | 2 | 2 | 4 | | Sat. | | | |
| | 226.14 | 4.24 | | | | | | | | | |
| | | | 3 | 4 | 4 | 8 | | Sat. | | | |
| | | | | | | | | | | 225.18 **RESIDUAL** BROWN-ORANGE, SANDY SILT | 5.20 |
| | 224.62 | 5.76 | | | | | | | | | |
| | | | 4 | 5 | 13 | 18 | | M | | | |
| | 223.10 | 7.28 | | | | | | | | 223.10 / 222.92 **WEATHERED ROCK** (GRANITE) BROWN-ORANGE AND GRAY, VERY SEVERELY TO SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE REC=70% | 7.28 / 7.46 |
| | | | 100/15 | | | 100/15 | | | | | |
| | 219.42 | 10.96 | | | | | | | | | |
| | | | 100/5 | | | 100/5 | | | | | |
| | | | | | | | RS-2 | | | 217.90 **CRYSTALLINE ROCK** BROWN, WHITE, AND GRAY, MODERATELY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED, GRANITE REC=100% RQD=100% RMR=54 | 12.48 |
| | 216.38 | 14.00 | | | | | | | | | |
| | | | 100/2 | | | 100/2 | | | | | |
| | | | | | | | | | | 215.50 **WEATHERED ROCK** BROWN-ORANGE AND GRAY, VERY SEVERELY TO SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE REC=99% | 14.88 |
| | 213.34 | 17.04 | | | | | | | | 213.34 / 213.29 **CRYSTALLINE ROCK** BROWN, WHITE, AND GRAY, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED, GRANITE REC=75% RQD=75% RMR=47 | 17.04 / 17.09 |
| | | | 100/5 | | | 100/5 | | | | | |
| | | | | | | | | | | **WEATHERED ROCK** (GRANITE) Boring Terminated at Elevation 213.29 m IN WEATHERED ROCK (GRANITE) | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B2-A SB | **STATION** 24+47.2 | **OFFSET** 25.2 m LT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.38 m | **TOTAL DEPTH** 17.09 m | **NORTHING** 275,343.1 | **EASTING** 527,386.8 — **24 HR.** 1.57 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/09/01 | **COMP. DATE** 05/10/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 9.51 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 222.92 | | | | | | | | | | | Begin Coring @ 7.46 m | |
| | 222.92 | 7.46 | 0.46 | 0:30/0.30 0:10/0.16 | (0.00) 0% | | | (3.49) 70% | | | 222.92 BROWN-ORANGE AND GRAY, VERY SEVERELY TO SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE | 7.46 |
| | 222.46 | 7.92 | | | | | | | | | | |
| 222 | | | 1.52 | 2:00/0.30 2:20/0.30 2:40/0.30 3:50/0.30 3:35/0.32 | (0.84) 55% | | | | | | | |
| 221 | 220.94 | 9.44 | | | | | | | | | | |
| 220 | | | 1.52 | 2:40/0.30 2:50/0.30 3:25/0.30 3:30/0.30 2:40/0.32 | (1.27) 84% | | | | | | | |
| | 219.42 | 10.96 | | | | | | | | | | |
| | 219.37 | 11.01 | | | | | | | | | | |
| 219 | | | 1.47 | N=100/5 2:50/0.30 3:40/0.30 2:55/0.30 2:42/0.30 2:10/0.27 | (1.38) 94% | | | | | | | |
| 218 | 217.90 | 12.48 | | | | | RS-2 | | | | 217.90 **CRYSTALLINE ROCK** BROWN, WHITE, AND GRAY, MODERATELY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED, GRANITE | 12.48 |
| 217 | | | 1.52 | 3:00/0.30 2:50/0.30 3:10/0.30 3:10/0.30 3:20/0.32 | (1.51) 99% | (1.51) 99% | | (1.50) 100% | (1.50) 100% | | | |
| | 216.38 | 14.00 | | | | | | | | | | |
| | 216.36 | 14.02 | | | | | | | | | 216.40 **WEATHERED ROCK** BROWN-ORANGE AND GRAY, VERY SEVERELY TO SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE | 13.98 |
| 216 | | | 1.50 | N=100/2 3:30/0.30 3:20/0.30 2:20/0.30 | (1.50) 100% | (0.64) 43% | | (0.89) 99% | | | | |
| | | | | | | | | | | | 215.50 **CRYSTALLINE ROCK** BROWN, WHITE, AND GRAY, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD, CLOSELY FRACTURED, GRANITE | 14.88 |
| 215 | | | | 2:30/0.30 | | | | (1.61) 75% | (1.61) 75% | | | |
| | 214.86 | 15.52 | | 3:00/0.30 | | | | | | | | |
| 214 | | | 1.52 | 3:10/0.30 3:20/0.30 4:00/0.30 4:10/0.30 | (0.98) 64% | (0.98) 64% | | | | | | |
| | 213.34 | 17.04 | | 3:50/0.32 | | | | | | | | |
| 213 | | | | N=100/5 | | | | | | | 213.34 / 213.29 **WEATHERED ROCK** (GRANITE) Boring Terminated at Elevation 213.29 m IN WEATHERED ROCK (GRANITE) | 17.04 / 17.09 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B SB | **STATION** 24+41.6 | **OFFSET** 7.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.12 m | **TOTAL DEPTH** 19.18 m | **NORTHING** 275,344.5 | **EASTING** 527,405.8 | **24 HR.** 1.09 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** NW Casing w/ SPT | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 11/06/97 | **COMP. DATE** 11/07/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230.12 | | | | | | | | | | GROUND SURFACE | 0.00 |
| | 229.21 | 0.91 | 4 | 4 | 5 | | | Sat. | | **ALLUVIAL** BROWN, SAND | |
| 228.22 | | | | | | | | | | DARK GRAY, SANDY CLAY WITH SOME COARSE SAND | 1.90 |
| | 227.69 | 2.43 | 2 | 3 | 4 | | | W | | | |
| 226.70 | | | | | | | | | | GRAY, SAND WITH TRACE SILT | 3.42 |
| | 226.16 | 3.96 | 2 | 2 | 2 | | | Sat. | | | |
| 225.17 | | | | | | | | | | **RESIDUAL** GRAY AND BROWN, SILTY SAND WITH SOME MICA | 4.95 |
| | 224.64 | 5.48 | 13 | 14 | 21 | | | W | | | |
| | 223.11 | 7.01 | 8 | 12 | 13 | | SS-5 | W | | | |
| | 221.59 | 8.53 | 11 | 17 | 22 | | | W | | | |
| | 220.07 | 10.05 | 14 | 18 | 21 | | | W | | | |
| 219.08 | | | | | | | | | | BROWN, SANDY SILT WITH WEATHERED ROCK FRAGMENTS | 11.04 |
| | 218.54 | 11.58 | 3 | 4 | 9 | | SS-8 | M | | | |
| 217.02 | | | | | | | | | | **WEATHERED ROCK** (GRANITE) | 13.10 |
| | 217.02 | 13.10 | 50/7 | | | | | | | | |
| | 215.50 | 14.62 | 50/2 | | | | | | | | |
| | 213.98 | 16.14 | 50/3 | | | | | | | | |
| 212.46 | | | | | | | | | | **CRYSTALLINE ROCK** (GRANITE) | 17.66 |
| | 212.46 | 17.66 | 50/0 | | | | | | | | |


| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B SB | **STATION** 24+41.6 | **OFFSET** 7.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.12 m | **TOTAL DEPTH** 19.18 m | **NORTHING** 275,344.5 | **EASTING** 527,405.8 | **24 HR.** 1.09 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** NW Casing w/ SPT | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 11/06/97 | **COMP. DATE** 11/07/97 | **SURFACE WATER DEPTH** N/A | |


| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 212 | | | | | | Match Line | | | | |
| 211 | 210.94 | 19.18 | 50/0 | | | 50/0 | | | | **CRYSTALLINE ROCK** (GRANITE) *(continued)* 210.94 19.18 |
| | | | | | | | | | | Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 210.94 m IN CRYSTALLINE ROCK (GRANITE) |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A SB | **STATION** 24+73.3 | **OFFSET** 17.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.32 m | **TOTAL DEPTH** 20.04 m | **NORTHING** 275,370.4 | **EASTING** 527,384.9 | **24 HR.** 1.64 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/02/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.32 GROUND SURFACE | 0.00 |
| | | | | | | | | | | **ALLUVIAL** BROWN, SAND | |
| | 230.02 | 0.30 | 2 | 1 | 3 | 4 | | M | | 229.43 | 0.89 |
| | 229.13 | 1.19 | 3 | 1 | 2 | 3 | SS-2B | Sat. | | GRAY, COARSE SAND | |
| | 227.61 | 2.71 | 2 | 3 | 1 | 4 | | Sat. | | | |
| | 226.09 | 4.23 | 2 | 3 | 2 | 5 | | Sat. | | | |
| | 224.57 | 5.75 | 15 | 24 | 22 | 46 | | M | | 224.62 | 5.70 |
| | | | | | | | | | | **RESIDUAL** ORANGE-BROWN AND TAN, SILTY SAND WITH WEATHERED ROCK FRAGMENTS | |
| | 223.05 | 7.27 | 28 | 13 | 20 | 33 | | M | | | |
| | 221.53 | 8.79 | 41 | 58 | 42/8 | 100/23 | | | | 221.83 | 8.49 |
| | | | | | | | | | | **WEATHERED ROCK** (GRANITE) | |
| | | | | | | | | | | 220.99 | 9.33 |
| | | | | | | | | | | TAN, BROWN, AND GRAY, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE AND BIOTITE GNEISS<br>REC=60% | |
| | 217.88 | 12.44 | 72 | 28/2 | | 100/17 | | | | | |
| | 214.84 | 15.48 | 100/8 | | | 100/8 | | | | 214.08 | 16.24 |
| | | | | | | | | | | **CRYSTALLINE ROCK** DARK GRAY AND WHITE, SLIGHTLY WEATHERED TO FRESH, HARD, BIOTITE GNEISS<br>REC=99% RQD=99%<br>RMR=83 | |
| | | | | | | | RS-3 | | | | |
| | 211.80 | 18.52 | 50/0 | | | 50/0 | | | | | |


| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A SB | **STATION** 24+73.3 | **OFFSET** 17.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.32 m | **TOTAL DEPTH** 20.04 m | **NORTHING** 275,370.4 | **EASTING** 527,384.9 | **24 HR.** 1.64 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/02/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A | |


| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | 210.28 | 20.04 | 50/0 | | | 50/0 | | | | 210.28 20.04 |
| | | | | | | | | | | Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 210.28 m IN CRYSTALLINE ROCK (BIOTITE GNEISS) |

Match Line

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A SB | **STATION** 24+73.3 | **OFFSET** 17.0 m LT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.32 m | **TOTAL DEPTH** 20.04 m | **NORTHING** 275,370.4 | **EASTING** 527,384.9 — **24 HR.** 1.64 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 05/02/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 10.46 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 220.99 | | | | | | | | | | | Begin Coring @ 9.33 m |
| | 220.99 | 9.33 | 1.59 | 0:40/0.30<br>0:50/0.30<br>1:00/0.30<br>1:30/0.30<br>1:30/0.32 | (0.59)<br>37% | | | (4.15)<br>60% | | | 220.99 TAN, BROWN, AND GRAY, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE AND BIOTITE GNEISS 9.33 |
| 220 | | | | | | | | | | | |
| | 219.40 | 10.92 | | | | | | | | | |
| 219 | | | 1.52 | 0:20/0.07<br>1:20/0.30<br>1:40/0.30<br>1:30/0.30<br>2:00/0.30 | (0.93)<br>61% | | | | | | |
| 218 | 217.88 | 12.44 | | 2:00/0.32 | | | | | | | |
| | 217.71 | 12.61 | | *N=100/17* | | | | | | | |
| | | | 1.35 | 2:00/0.30<br>1:50/0.30<br>1:40/0.30<br>2:00/0.30 | (0.96)<br>71% | | | | | | |
| 217 | | | | | | | | | | | |
| | 216.36 | 13.96 | | 1:00/0.15 | | | | | | | |
| 216 | | | 1.52 | 2:30/0.30<br>2:20/0.30<br>3:30/0.30<br>3:30/0.30<br>3:10/0.32 | (1.04)<br>68% | | | | | | |
| 215 | 214.84 | 15.48 | | | | | | | | | |
| | 214.76 | 15.56 | | *N=100/8* | | | | | | | |
| | | | 1.44 | 3:40/0.30<br>3:20/0.30<br>3:00/0.30<br>3:20/0.30<br>3:30/0.24 | (1.39)<br>97% | (0.72)<br>50% | | | | | 214.08 16.24 |
| 214 | | | | | | | | (3.75)<br>99% | (3.75)<br>99% | | **CRYSTALLINE ROCK**<br>DARK GRAY AND WHITE, SLIGHTLY WEATHERED TO FRESH, HARD, BIOTITE GNEISS |
| | 213.32 | 17.00 | | | | | | | | | |
| 213 | | | 1.52 | 3:30/0.30<br>3:50/0.30<br>3:50/0.30<br>4:00/0.30<br>4:00/0.32 | (1.49)<br>98% | (1.49)<br>98% | RS-3 | | | | |
| 212 | 211.80 | 18.52 | | | | | | | | | |
| | | | 1.52 | *N=50/0* | (1.50)<br>99% | (1.50)<br>99% | | | | | |
| 211 | | | | 4:30/0.30<br>4:50/0.30<br>5:30/0.30<br>5:10/0.30<br>6:00/0.32 | | | | | | | |
| | 210.28 | 20.04 | | | | | | | | | 210.28 20.04 |
| 210 | | | | *N=50/0* | | | | | | | Boring Terminated WITH STANDARD PENETRATION TEST REFUSAL at Elevation 210.28 m IN CRYSTALLINE ROCK (BIOTITE GNEISS) |
| 209 | | | | | | | | | | | |
| 208 | | | | | | | | | | | |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |
| 201 | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B SB | **STATION** 24+69.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 229.82 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,370.7 | **EASTING** 527,396.6 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/27/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 229.82 | | | | | | | | | GROUND SURFACE | 0.00 |
| 229.55 | | 0.27 | | | | | | | **ALLUVIAL** BROWN, COARSE SAND | |
| | | | 2 | 1 | 1 | | W | | | |
| 228.92 | | 0.90 | | | | | | | | |
| | | | 3 | 3 | 1 | SS-2C | W | | | |
| 227.70 | | | | | | | | | | 2.12 |
| 227.40 | | 2.42 | | | | | | | GRAY, SAND WITH GRAVEL LAYER (5.61 - 6.22) | |
| | | | 2 | 1 | 4 | | Sat. | | | |
| 225.88 | | 3.94 | | | | | | | | |
| | | | WOH | 1 | 1 | | Sat. | | | |
| 224.36 | | 5.46 | | | | | | | | |
| | | | 4 | 36 | 53 | | Sat. | | | |
| 223.60 | | | | | | | | | **WEATHERED ROCK** (GRANITE) | 6.22 |
| 222.84 | | 6.98 | | | | | | | | |
| | | | 50 | 50/11 | | | | | | |
| 222.38 | | | | | | | | | **RESIDUAL** TAN, GRAY, AND WHITE, SILTY SAND WITH TRACE MICA | 7.44 |
| 221.32 | | 8.50 | | | | | | | | |
| | | | 12 | 22 | 19 | | D | | | |
| 219.80 | | 10.02 | | | | | | | | |
| | | | 20 | 20 | 21 | | D | | | |
| 219.12 | | | | | | | | | **WEATHERED ROCK** (GNEISS) | 10.70 |
| 218.82 | | 11.00 | | | | | | | | |
| | | | 100/3 | | | | | | | |
| 218.60 | | | | | | | | | TAN AND GRAY, SEVERELY TO MODERATELY SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, BIOTITE GNEISS | 11.22 |
| | | | | | | | | | REC=77% | |
| 215.78 | | 14.04 | | | | | | | | |
| | | | 56 | 44/7 | | | | | | |
| 212.74 | | 17.08 | | | | | | | | |
| | | | 100/14 | | | | | | | |

BLOWS PER 30 CM: 0 25 50 75 100


| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B SB | **STATION** 24+69.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 229.82 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,370.7 | **EASTING** 527,396.6 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/27/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A | |


| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| 210 | | | | | | | | | Match Line |
| 209.63 | | 20.19 | | | | | | | |
| | | | 100/5 | | | | | | |
| 208.27 | | 21.55 | | | | | | | |
| | | | 81 | 19/3 | | | | | |
| 208.27 | | | | | | | | | (BIOTITE GNEISS) 21.55 |
| 208.09 | | | | | | | | | Boring Terminated at Elevation 208.09 m IN WEATHERED ROCK (BIOTITE GNEISS) 21.73 |

BLOWS PER 30 CM: 0 25 50 75 100

NCDOT BORE DOUBLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B SB | **STATION** 24+69.3 | **OFFSET** 6.0 m LT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 229.82 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,370.7 | **EASTING** 527,396.6 — **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/27/01 | **COMP. DATE** 05/02/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 9.92 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 218.60 | | | | | | | | | | | Begin Coring @ 11.22 m |
| | 218.60 | 11.22 | 1.30 | 3:00/0.30<br>2:20/0.30<br>2:20/0.30<br>3:00/0.30 | (1.06)<br>82% | | | (7.92)<br>77% | | | 218.60 TAN AND GRAY, SEVERELY TO MODERATELY SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, BIOTITE GNEISS. 11.22 |
| 218 | | | | | | | | | | | |
| | 217.30 | 12.52 | | | | | | | | | |
| 217 | | | 1.52 | 0:30/0.10<br>2:30/0.30<br>2:50/0.30<br>2:50/0.30<br>2:40/0.30<br>2:50/0.32 | (0.98)<br>64% | | | | | | |
| 216 | | | | | | | | | | | |
| | 215.78 | 14.04 | | | | | | | | | |
| | 215.56 | 14.26 | | *N=100/22* | | | | | | | |
| 215 | | | 1.30 | 1:20/0.30<br>2:40/0.30<br>2:30/0.30<br>2:00/0.30 | (0.89)<br>68% | | | | | | |
| | 214.26 | 15.56 | | | | | | | | | |
| 214 | | | 1.52 | 0:30/0.10<br>2:00/0.30<br>2:20/0.30<br>3:00/0.30<br>2:30/0.30 | (0.75)<br>49% | | | | | | |
| 213 | | | | | | | | | | | |
| | 212.74 | 17.08 | | 2:00/0.32 | | | | | | | |
| | 212.60 | 17.22 | | *N=100/14* | | | | | | | |
| 212 | | | 1.38 | 1:50/0.30<br>2:10/0.30<br>2:00/0.30<br>2:10/0.30<br>1:00/0.18 | (1.34)<br>97% | | | | | | |
| | 211.22 | 18.60 | | | | | | | | | |
| 211 | | | 1.59 | 3:00/0.30<br>3:30/0.30<br>3:10/0.30<br>3:00/0.30<br>3:20/0.32 | (1.59)<br>100% | | | | | | |
| 210 | | | | | | | | | | | |
| | 209.63 | 20.19 | | | | | | | | | |
| | 209.58 | 20.24 | | 0:40/0.07 | | | | | | | |
| 209 | | | 1.31 | *N=100/5*<br>3:00/0.30<br>3:10/0.30<br>2:50/0.30<br>3:00/0.30 | (1.31)<br>100% | | | | | | |
| | 208.27 | 21.55 | | 2:40/0.11 | | | | | | | 208.27 21.55 |
| 208 | | | | *N=100/18* | | | | | | | 208.09 (BIOTITE GNEISS) 21.73 |
| | | | | | | | | | | | Boring Terminated at Elevation 208.09 m IN WEATHERED ROCK (BIOTITE GNEISS) |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |
| 201 | | | | | | | | | | | |
| 200 | | | | | | | | | | | |
| 199 | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-A SB | **STATION** 24+89.3 | **OFFSET** 18.5 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.15 m | **TOTAL DEPTH** 13.27 m | **NORTHING** 275,384.7 | **EASTING** 527,377.7 | **24 HR.** 1.02 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 10/30/97 | **COMP. DATE** 10/30/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 230.15 GROUND SURFACE | 0.00 |
| | 229.15 | 1.00 | 2 | 1 | 1 | | Sat. | | **ALLUVIAL** BROWN, COARSE SAND — 228.85 | 1.30 |
| | 227.63 | 2.52 | WOH | WOH | WOH | | Sat. | | DARK GRAY, SILTY CLAY WITH TRACE FINE SAND — 228.16 | 1.99 |
| | 226.10 | 4.05 | 1 | 3 | 4 | SS-3C | Sat. | | DARK GRAY, COARSE SAND WITH TRACE SILT — 226.64 | 3.51 |
| | 224.58 | 5.57 | 14 | 4 | 4 | SS-4 | W | | DARK GRAY, SILTY CLAY — 225.11 | 5.04 |
| | 223.06 | 7.09 | 5 | 5 | 6 | | W | | **RESIDUAL** BROWN AND BLACK, SANDY SILT WITH ROCK FRAGMENTS AND TRACE MICA — 221.77 | 8.38 |
| | 221.47 | 8.68 | 6 | 14 | 18 | | W | | DARK GRAY, BROWN, BLACK, AND WHITE, SILTY SAND WITH WEATHERED ROCK FRAGMENTS — 218.96 | 11.19 |
| | 219.95 | 10.20 | 26 | 26 | 43 | | W | | **WEATHERED ROCK** (BIOTITE GNEISS) — 216.88 | 13.27 |
| | 218.43 | 11.72 | 51 | 49/8 | | | | | Boring Terminated at Elevation 216.88 m IN WEATHERED ROCK (BIOTITE GNEISS) | |
| | 216.91 | 13.24 | 50/3 | | | | | | | |

BLOWS PER 30 CM (0, 25, 50, 75, 100): 2; 0; 7; 8; 11; 32; 69; 100/23; 50/3

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-B SB | **STATION** 24+80.0 | **OFFSET** 7.0 m LT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 14.85 m | **NORTHING** 275,380.2 | **EASTING** 527,391.8 | **24 HR.** 1.04 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** NW Casing w/ SPT | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 10/30/97 | **COMP. DATE** 10/30/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 230.16 GROUND SURFACE | 0.00 |
| | 229.18 | 0.98 | 3 | 4 | 4 | SS-1 | Sat. | | **ALLUVIAL** LIGHT GRAY, SAND — 226.66 | 3.50 |
| | 227.65 | 2.51 | 2 | 2 | 2 | | Sat. | | LIGHT GRAY, SANDY SILT — 225.68 | 4.48 |
| | 226.13 | 4.03 | 1 | 1 | 2 | | W | | **RESIDUAL** GRAY-WHITE TO BROWN, COARSE SAND WITH ROCK FRAGMENTS — 223.61 | 6.55 |
| | 224.60 | 5.56 | 28 | 11 | 15 | | W | | BROWN, BLACK, AND WHITE, MICACEOUS, CLAYEY SILT WITH SOME WEATHERED ROCK AND QUARTZ FRAGMENTS — 220.56 | 9.60 |
| | 223.08 | 7.08 | 6 | 6 | 11 | | W | | BROWN AND BLACK, MICACEOUS, SILTY SAND WITH WEATHERED ROCK FRAGMENTS — 219.04 | 11.12 |
| | 221.55 | 8.61 | 12 | 14 | 27 | | W | | **WEATHERED ROCK** (GRANITE) — 215.31 | 14.85 |
| | 220.03 | 10.13 | 18 | 24 | 56 | SS-7 | W | | Boring Terminated at Elevation 215.31 m IN WEATHERED ROCK (GRANITE) | |
| | 218.50 | 11.66 | 46 | 54/9 | | | | | | |
| | 216.89 | 13.27 | 33 | 67/13 | | | | | | |
| | 215.37 | 14.79 | 50/6 | | | | | | | |

BLOWS PER 30 CM (0, 25, 50, 75, 100): 8; 4; 3; 26; 17; 41; 80; 100/24; 100/26; 50/6

NCDOT BORE DOUBLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** EB1-B NB | **STATION** 23+86.3 | **OFFSET** 25.0 m RT | **ALIGNMENT** -L REV- **0 HR.** N/A |
| **COLLAR ELEV.** 229.87 m | **TOTAL DEPTH** 15.00 m | **NORTHING** 275,304.7 | **EASTING** 527,455.8 **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/25/01 | **COMP. DATE** 04/25/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 230 | | | | | | | | | | 229.87 GROUND SURFACE 0.00 |
| 229 | 229.55 | 0.32 | 2 | 4 | 4 | 8 | | M | | **ROADWAY EMBANKMENT** BROWN, SAND 229.12 0.75 |
| 228 | 228.69 | 1.18 | 1 | 3 | 5 | 8 | | Sat. | | **ALLUVIAL** GRAY, SILTY SAND 227.93 1.94 |
| 227 | 227.17 | 2.70 | 1 | 2 | 2 | 4 | | Sat. | | GRAY, SAND WITH SOME MICA 224.89 4.98 |
| 225 | 225.65 | 4.22 | 3 | 3 | 4 | 7 | | Sat. | | **RESIDUAL** GRAY AND BROWN, SILTY SAND |
| 223 | 224.13 | 5.74 | 10 | 13 | 17 | 30 | SS-5A | M | | |
| 222 | 222.61 | 7.26 | 16 | 16 | 25 | 41 | | M | | |
| 220 | 221.09 | 8.78 | 12 | 32 | 36 | 68 | | M | | |
| 219 | 219.57 | 10.30 | 17 | 21 | 22 | 43 | | M | | |
| 218 | 218.05 | 11.82 | 50 | 50/12 | | 100/27 | | | | 218.35 11.52 **WEATHERED ROCK** (GRANITE) |
| 216 | 216.53 | 13.34 | 32 | 32 | 68/11 | 100/26 | | | | |
| 215 | 215.01 | 14.86 | 100/14 | | | 100/14 | | | | 214.87 15.00 Boring Terminated at Elevation 214.87 m IN WEATHERED ROCK (GRANITE) |
| 214 | | | | | | | | | | |
| 213 | | | | | | | | | | |
| 212 | | | | | | | | | | |
| 211 | | | | | | | | | | |
| 210 | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A NB | **STATION** 24+08.0 | **OFFSET** 3.0 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.40 m | **TOTAL DEPTH** 18.29 m | **NORTHING** 275,316.9 | **EASTING** 527,427.4 | **24 HR.** 1.45 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/08/01 | **COMP. DATE** 05/09/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230.40 | | | | | | | | | | GROUND SURFACE | 0.00 |
| 230.10 | | 0.30 | 2 | 2 | 2 | 4 | | M | | **ROADWAY EMBANKMENT** BROWN, SILTY SAND WITH TRACE MICA | |
| 229.34 | | 1.06 | 3 | 50/0 | | 100/15 | | | | | |
| 229.19 | | 1.21 | | | | | | | | | |
| 228.90 | | 1.50 | | | | | | | | CONCRETE APRON AT BASE OF ABUTMENT (< 30cm THICK) | |
| 228.84 | | 1.56 | 4 | 6 | 7 | 13 | | M | | **ALLUVIAL** GRAY WITH ORANGE, SILTY CLAY | |
| 227.93 | | 2.47 | 3 | 6 | 8 | 14 | | M | | | |
| 226.40 | | 4.00 | 3 | 2 | 1 | 3 | | Sat. | | GRAY, SAND | |
| 226.20 | | 4.20 | | | | | | | | | |
| 225.20 | | 5.20 | | | | | | | | **RESIDUAL** GRAY TO BROWN-ORANGE, SILTY SAND | |
| 224.88 | | 5.52 | 4 | 5 | 6 | 11 | | M | | | |
| 223.36 | | 7.04 | 16 | 22 | 26 | 48 | | M | | | |
| 221.84 | | 8.56 | 44 | 56/12 | | 100/27 | | | | **WEATHERED ROCK** (GRANITE) BROWN-ORANGE, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE REC=60% | |
| 221.50 | | 8.90 | | | | | | | | | |
| 218.23 | | 12.17 | 100/14 | | | 100/14 | | | | | |
| 215.19 | | 15.21 | 100/4 | | | 100/4 | | | | | |
| 212.15 | | 18.25 | 100/4 | | | 100/4 | | | | (GRANITE) Boring Terminated at Elevation 212.11 m IN WEATHERED ROCK (GRANITE) | |
| 212.11 | | 18.29 | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A NB | **STATION** 24+08.0 | **OFFSET** 3.0 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.40 m | **TOTAL DEPTH** 18.29 m | **NORTHING** 275,316.9 | **EASTING** 527,427.4 | **24 HR.** 1.45 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/08/01 | **COMP. DATE** 05/09/01 | **SURFACE WATER DEPTH** N/A | |
| **CORE SIZE** NWD4 | **TOTAL RUN** 9.17 m | | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 221.50 | | | | | | | | | | | Begin Coring @ 8.90 m | |
| 221.50 | | 8.90 | 0.23 | 3:40/0.23 | (0.00) 0% | | | (5.62) 60% | | | BROWN-ORANGE, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE | |
| 221.27 | | 9.13 | 1.52 | 5:45/0.30 | | | | | | | | |
| | | | | 3:05/0.30 | (0.59) 39% | | | | | | | |
| | | | | 3:10/0.30 | | | | | | | | |
| | | | | 2:50/0.30 | | | | | | | | |
| | | | | 2:40/0.32 | | | | | | | | |
| | 219.75 | 10.65 | 1.52 | 4:30/0.30 | (0.00) 0% | | | | | | | |
| | | | | 3:40/0.30 | | | | | | | | |
| | | | | 2:35/0.30 | | | | | | | | |
| | | | | 3:00/0.30 | | | | | | | | |
| | | | | 3:00/0.32 | | | | | | | | |
| | 218.23 | 12.17 | | N=100/14 | | | | | | | | |
| | 218.09 | 12.31 | 1.38 | 4:30/0.30 | (0.87) 63% | | | | | | | |
| | | | | 4:05/0.30 | | | | | | | | |
| | | | | 3:50/0.30 | | | | | | | | |
| | | | | 3:30/0.30 | | | | | | | | |
| | 216.71 | 13.69 | | 2:50/0.18 | | | | | | | | |
| | | | 1.52 | 3:10/0.30 | (1.24) 82% | | | | | | | |
| | | | | 3:20/0.30 | | | | | | | | |
| | | | | 2:50/0.30 | | | | | | | | |
| | | | | 2:35/0.30 | | | | | | | | |
| | | | | 4:00/0.32 | | | | | | | | |
| | 215.19 | 15.21 | | N=100/4 | | | | | | | | |
| | 215.15 | 15.25 | 1.48 | 2:00/0.30 | (1.40) 95% | | | | | | | |
| | | | | 2:20/0.30 | | | | | | | | |
| | | | | 2:35/0.30 | | | | | | | | |
| | | | | 3:10/0.30 | | | | | | | | |
| | 213.67 | 16.73 | | 3:35/0.28 | | | | | | | | |
| | | | 1.52 | 3:10/0.30 | (1.52) 100% | | | | | | | |
| | | | | 3:15/0.30 | | | | | | | | |
| | | | | 3:45/0.30 | | | | | | | | |
| | | | | 3:50/0.30 | | | | | | | | |
| | 212.15 | 18.25 | | 4:20/0.32 | | | | | | | | |
| | | | | N=100/4 | | | | | | | | |
| 212.15 | | | | | | | | | | | (GRANITE) Boring Terminated at Elevation 212.11 m IN WEATHERED ROCK (GRANITE) | 18.25 |
| 212.11 | | | | | | | | | | | | 18.29 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B NB | **STATION** 24+00.7 | **OFFSET** 23.0 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.21 m | **TOTAL DEPTH** 20.01 m | **NORTHING** 275,317.4 | **EASTING** 527,448.7 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/19/01 | **COMP. DATE** 04/19/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.21 GROUND SURFACE | 0.00 |
| 230 | 229.89 | 0.32 | 3 | 4 | 2 | 6 | | W | | **ROADWAY EMBANKMENT** BROWN, SILTY SAND | 229.27 / 0.94 |
| 229 | 229.12 | 1.09 | 2 | 2 | WOH | 2 | | Sat. | | **ALLUVIAL** GRAY AND BROWN, SILTY SAND | |
| 228 | 227.60 | 2.61 | 1 | 1 | 1 | 2 | | Sat. | | | |
| 227 | 226.08 | 4.13 | 1 | 3 | 4 | 7 | SS-4A | Sat. | | | |
| 226 | 224.56 | 5.65 | 6 | 11 | 9 | 20 | | M | | **RESIDUAL** GRAY, WHITE, AND BROWN, SILTY SAND | 224.71 / 5.50 |
| 225 | 223.04 | 7.17 | 2 | 5 | 12 | 17 | | M | | | |
| 224 | 221.52 | 8.69 | 47 | 53/9 | | 100/24 | | | | **WEATHERED ROCK** (GRANITE) BROWN-ORANGE AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, GRANITE REC=65% | 221.81 / 8.40; 221.35 / 8.86 |
| 223 | 219.40 | 10.81 | 45 | 55/9 | | 100/24 | | | | | |
| 222 | 216.36 | 13.85 | 100/8 | | | 100/8 | | | | | |
| 221 | 213.32 | 16.89 | 100/3 | | | 100/3 | RS-4 | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B NB | **STATION** 24+00.7 | **OFFSET** 23.0 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.21 m | **TOTAL DEPTH** 20.01 m | **NORTHING** 275,317.4 | **EASTING** 527,448.7 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/19/01 | **COMP. DATE** 04/19/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 211 | | | | | | Match Line | | | | |
| 210 | 210.28 | 19.93 | 100/8 | | | 100/8 | | | | 210.51 / 19.70; 210.20 / 20.01 (GRANITE) Boring Terminated at Elevation 210.20 m IN WEATHERED ROCK (GRANITE) NOTE: BORING WAS DRILLED TWICE DUE TO CORING ISSUES. BOTH SETS OF DATA ARE COMPILED INTO ONE LOG. |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B NB | **STATION** 24+00.7 | **OFFSET** 23.0 m RT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.21 m | **TOTAL DEPTH** 20.01 m | **NORTHING** 275,317.4 | **EASTING** 527,448.7 — **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/19/01 | **COMP. DATE** 04/19/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 10.84 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 221.35 | | | | | | | | | | | Begin Coring @ 8.86 m |
| 221 | 221.35 / 221.15 | 8.86 / 9.06 | 0.20 | 0:30/0.20 | (0.20) 100% | | | (7.21) 67% | | | 221.35 BROWN-ORANGE AND WHITE, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, GRANITE 8.86 |
| | | | 1.52 | 1:10/0.30<br>1:30/0.30<br>1:30/0.30<br>1:20/0.30<br>1:30/0.32 | (1.00) 66% | | | | | | |
| 220 | 219.63 | 10.58 | | | | | | | | | |
| | | | 1.52 | 1:30/0.30<br>*N=100/24*<br>1:20/0.30<br>1:20/0.30<br>1:10/0.30<br>1:20/0.32 | (0.73) 48% | | | | | | |
| 219 | | | | | | | | | | | |
| 218 | 218.11 | 12.10 | | | | | | | | | |
| | | | 1.52 | 1:30/0.30<br>1:40/0.30<br>1:30/0.30<br>1:40/0.30<br>2:00/0.32 | (0.90) 59% | | | | | | |
| 217 | 216.59 | 13.62 | | | | | | | | | |
| | | | 1.52 | 1:50/0.30<br>*N=100/8*<br>1:50/0.30<br>2:00/0.30<br>1:50/0.30<br>2:00/0.32 | (0.53) 35% | | | | | | |
| 216 | | | | | | | | | | | |
| 215 | 215.07 | 15.14 | | | | | | | | | |
| | 214.57 | 15.64 | 0.50 | 3:30/0.30<br>3:00/0.20 | (0.37) 74% | | | | | | |
| | | | 1.02 | 3:02/0.30<br>2:50/0.30<br>3:00/0.30<br>3:00/0.12 | (0.92) 90% | | | | | | |
| 214 | 213.55 | 16.66 | | | | | | | | | |
| | | | 1.52 | 2:30/0.30<br>*N=100/3*<br>2:30/0.30<br>2:30/0.30<br>2:30/0.30<br>2:30/0.32 | (1.30) 86% | | RS-4 | | | | |
| 213 | | | | | | | | | | | |
| 212 | 212.03 | 18.18 | | | | | | | | | |
| | | | 1.52 | 2:30/0.30<br>2:20/0.30<br>2:40/0.30<br>2:30/0.30<br>2:40/0.32 | (1.26) 83% | | | | | | |
| 211 | 210.51 | 19.70 | | | | | | | | | 210.51 19.70 |
| 210 | | | | *N=100/8* | | | | | | | 210.20 (GRANITE) 20.01 |
| | | | | | | | | | | | Boring Terminated at Elevation 210.20 m IN WEATHERED ROCK (GRANITE)<br><br>NOTE: BORING WAS DRILLED TWICE DUE TO CORING ISSUES. BOTH SETS OF DATA ARE COMPILED INTO ONE LOG. |
| 209 | | | | | | | | | | | |
| 208 | | | | | | | | | | | |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B2-A NB | **STATION** 24+37.6 | **OFFSET** 1.6 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.21 m | **TOTAL DEPTH** 18.39 m | **NORTHING** 275,343.9 | **EASTING** 527,415.3 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/03/01 | **COMP. DATE** 05/03/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.21 GROUND SURFACE | 0.00 |
| | 229.94 | 0.27 | 3 | 2 | 24 | 26 | | W | | **ROADWAY EMBANKMENT** BROWN, SANDY SILT 229.54 | 0.67 |
| | 229.19 | 1.02 | 1 | 1 | 2 | 3 | | W | | CONCRETE APRON AT BASE OF ABUTMENT (15cm THICK) 229.39 | 0.82 |
| | | | | | | | | | | BROWN, SILTY SAND 228.73 | 1.48 |
| | 227.67 | 2.54 | 3 | 2 | 3 | 5 | | Sat. | | **ALLUVIAL** GRAY, COARSE SAND | |
| | 226.15 | 4.06 | 6 | 4 | 4 | 8 | SS-4B | Sat. | | | |
| | 224.63 | 5.58 | 7 | 11 | 23 | 34 | | Sat. | | | |
| | 223.11 | 7.10 | 25 | 48 | 52/12 | -100/27 | | | | 222.96 **WEATHERED ROCK** (GRANITE) | 7.25 |
| | | | | | | | | | | 222.29 GRAY AND WHITE TO TAN-ORANGE, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE REC=69% | 7.92 |
| | 219.46 | 10.75 | 90 | 10/1 | | -100/16 | | | | | |
| | 216.42 | 13.79 | 25 | 48 | 52/9 | 100/24 | | | | | |
| | 213.38 | 16.83 | 100/8 | | | 100/8 | | | | | |
| | 211.87 | 18.34 | 100/4 | | | 100/4 | | | | 211.87 (GRANITE) 211.82 | 18.34 18.39 |
| | | | | | | | | | | Boring Terminated at Elevation 211.82 m IN WEATHERED ROCK (GRANITE) | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B2-A NB | **STATION** 24+37.6 | **OFFSET** 1.6 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.21 m | **TOTAL DEPTH** 18.39 m | **NORTHING** 275,343.9 | **EASTING** 527,415.3 | **24 HR.** Caved |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 05/03/01 | **COMP. DATE** 05/03/01 | **SURFACE WATER DEPTH** N/A | |
| **CORE SIZE** NWD4 | **TOTAL RUN** 9.80 m | | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 222.29 | | | | | | | | | | | Begin Coring @ 7.92 m | |
| 222 | 222.29 | 7.92 | 1.31 | 1:30/0.30 1:40/0.30 1:30/0.30 1:30/0.30 0:30/0.11 | (1.31) 100% | | | (7.17) 69% | | | 222.29 GRAY AND WHITE TO TAN-ORANGE, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE | 7.92 |
| 221 | 220.98 | 9.23 | 1.52 | 1:40/0.30 2:00/0.30 2:10/0.30 2:40/0.30 2:10/0.32 | (0.70) 46% | | | | | | | |
| 220 | 219.46 | 10.75 | | *N=100/16* | | | | | | | | |
| | 219.30 | 10.91 | 1.36 | 2:00/0.30 1:50/0.30 1:40/0.30 2:00/0.30 2:10/0.16 | (1.30) 96% | | | | | | | |
| 219 | 217.94 | 12.27 | 1.52 | 2:00/0.30 1:40/0.30 1:40/0.30 1:50/0.30 2:00/0.32 | (1.05) 69% | | | | | | | |
| 218 | 216.42 | 13.79 | | *N=100/24* | | | | | | | | |
| 217 | 216.03 | 14.18 | 1.13 | 2:10/0.30 2:00/0.30 2:30/0.30 0:50/0.23 | (0.94) 83% | | | | | | | |
| 216 | 214.90 | 15.31 | 1.52 | 2:40/0.30 3:00/0.30 3:30/0.30 3:40/0.30 3:40/0.32 | (0.93) 61% | | | | | | | |
| 215 | 213.38 | 16.83 | | *N=100/8* | | | | | | | | |
| | 213.30 | 16.91 | 1.44 | 3:00/0.30 3:00/0.30 3:20/0.30 3:40/0.30 4:00/0.24 | (0.94) 65% | | | | | | | |
| 214 | 211.86 | 18.35 | | *N=100/4* | | | | | | | 211.87 (GRANITE) 211.82 | 18.34 18.39 |
| 213 | | | | | | | | | | | Boring Terminated at Elevation 211.82 m IN WEATHERED ROCK (GRANITE) | |
| 212 | | | | | | | | | | | | |
| 211 | | | | | | | | | | | | |
| 210 | | | | | | | | | | | | |
| 209 | | | | | | | | | | | | |
| 208 | | | | | | | | | | | | |
| 207 | | | | | | | | | | | | |
| 206 | | | | | | | | | | | | |
| 205 | | | | | | | | | | | | |
| 204 | | | | | | | | | | | | |
| 203 | | | | | | | | | | | | |
| 202 | | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B NB | **STATION** 24+29.7 | **OFFSET** 23.0 m RT | **ALIGNMENT** -L REV- / **0 HR.** N/A |
| **COLLAR ELEV.** 230.31 m | **TOTAL DEPTH** 17.07 m | **NORTHING** 275,344.4 | **EASTING** 527,438.1 / **24 HR.** 1.46 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/17/01 | **COMP. DATE** 04/18/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230.31 | | | | | | | | | | GROUND SURFACE | 0.00 |
| 229.75 | | | | | | | | W | | **ROADWAY EMBANKMENT** BROWN, MICACEOUS, CLAYEY SILT | 0.56 |
| | | | | | | | | W | | BROWN, SILTY SAND | |
| 228.28 | | | | | | | | | | **ALLUVIAL** GRAY TO TAN, COARSE SAND WITH GRAVEL LAYER (5.67-6.40) | 2.03 |
| 223.91 | | | | | | | | | | **WEATHERED ROCK** (GRANITE) | 6.40 |
| 222.92 | | | | | | | | | | ORANGE-BROWN TO GRAY, SEVERELY WEATHERED, SOFT T0 MEDIUM HARD, CLOSELY FRACTURED, GRANITE REC=59% | 7.39 |
| 213.27 | | | | | | | | | | (GRANITE) Boring Terminated at Elevation 213.24 m IN WEATHERED ROCK (GRANITE) | 17.04 / 17.07 |

| DRIVE ELEV (m) | DEPTH (m) | 15cm | 15cm | 15cm | SAMP. NO. |
|---|---|---|---|---|---|
| 230.04 | 0.27 | | | | |
| | | 3 | 2 | 3 | |
| 229.20 | 1.11 | | | | |
| | | 5 | 5 | 4 | |
| 227.68 | 2.63 | | | | |
| | | 2 | 3 | 3 | SS-3D |
| 226.16 | 4.15 | | | | |
| | | 4 | 4 | 3 | |
| 224.64 | 5.67 | | | | |
| | | 100/2 | | | |
| 223.12 | 7.19 | | | | |
| | | 72 | 28/5 | | |
| 220.88 | 9.43 | | | | |
| | | 100/10 | | | |
| 217.90 | 12.41 | | | | |
| | | 100/5 | | | RS-5 |
| 214.86 | 15.45 | | | | |
| | | 100/3 | | | |
| 213.27 | 17.04 | | | | |
| | | 100/3 | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B NB | **STATION** 24+29.7 | **OFFSET** 23.0 m RT | **ALIGNMENT** -L REV- / **0 HR.** N/A |
| **COLLAR ELEV.** 230.31 m | **TOTAL DEPTH** 17.07 m | **NORTHING** 275,344.4 | **EASTING** 527,438.1 / **24 HR.** 1.46 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/17/01 | **COMP. DATE** 04/18/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NQ & NWD4 | **TOTAL RUN** 9.47 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Begin Coring @ 7.39 m | |
| 222.92 | 222.92 | 7.39 | 0.42 | 0:30/0.30 | (0.00) 0% | | | (5.72) 59% | | | ORANGE-BROWN TO GRAY, SEVERELY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, GRANITE | 7.39 |
| | 222.50 | 7.81 | 1.62 | 0:10/0.12 | | | | | | | | |
| | | | | 0:50/0.30 | (0.00) 0% | | | | | | | |
| | | | | 1:10/0.30 | | | | | | | | |
| | | | | 1:00/0.30 | | | | | | | | |
| | | | | 1:00/0.30 | | | | | | | | |
| | | | | 1:00/0.30 | | | | | | | | |
| | 220.88 | 9.43 | | 0:20/0.12 | | | | | | | | |
| | 220.78 | 9.53 | 1.36 | N=100/10 | (0.00) 0% | | | | | | | |
| | | | | 1:10/0.30 | | | | | | | | |
| | | | | 1:00/0.30 | | | | | | | | |
| | | | | 1:00/0.30 | | | | | | | | |
| | | | | 1:10/0.30 | | | | | | | | |
| | 219.42 | 10.89 | | 0:20/0.16 | | | | | | | | |
| | | | 1.52 | 1:00/0.30 | (1.40) 92% | | | | | | | |
| | | | | 1:30/0.30 | | | | | | | | |
| | | | | 2:30/0.30 | | | | | | | | |
| | | | | 3:00/0.30 | | | | | | | | |
| | | | | 3:30/0.32 | | | | | | | | |
| | 217.90 | 12.41 | | | | | | | | | | |
| | 217.85 | 12.46 | 1.47 | N=100/5 | (1.47) 100% | | RS-5 | | | | | |
| | | | | 2:30/0.30 | | | | | | | | |
| | | | | 2:00/0.30 | | | | | | | | |
| | | | | 1:20/0.30 | | | | | | | | |
| | | | | 1:10/0.30 | | | | | | | | |
| | 216.38 | 13.93 | | 1:10/0.27 | | | | | | | | |
| | | | 1.52 | 1:20/0.30 | (1.29) 85% | | | | | | | |
| | | | | 1:30/0.30 | | | | | | | | |
| | | | | 2:00/0.30 | | | | | | | | |
| | | | | 2:30/0.30 | | | | | | | | |
| | | | | 3:00/0.32 | | | | | | | | |
| | 214.86 | 15.45 | | | | | | | | | | |
| | 214.83 | 15.48 | 1.56 | N=100/3 | (1.56) 100% | | | | | | | |
| | | | | 2:30/0.30 | | | | | | | | |
| | | | | 2:10/0.30 | | | | | | | | |
| | | | | 2:00/0.30 | | | | | | | | |
| | | | | 1:30/0.30 | | | | | | | | |
| | | | | 1:40/0.30 | | | | | | | | |
| | 213.27 | 17.04 | | 0:12/0.06 | | | | | | | | |
| | | | | N=100/3 | | | | | | | | |
| | | | | | | | | | | | 213.27 / 213.24 (GRANITE) Boring Terminated at Elevation 213.24 m IN WEATHERED ROCK (GRANITE) | 17.04 / 17.07 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A NB | **STATION** 24+66.6 | **OFFSET** 1.6 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 21.82 m | **NORTHING** 275,370.9 | **EASTING** 527,404.7 | **24 HR.** 1.43 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/26/01 | **COMP. DATE** 04/27/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 230.16 GROUND SURFACE | 0.00 |
| | 229.86 | 0.30 | 3 | 3 | 3 | 6 | | M | | **ALLUVIAL** BROWN AND GRAY, COARSE SAND WITH SOME GRAVEL | |
| | 228.99 | 1.17 | 1 | 2 | 2 | 4 | | Sat. | | | |
| | 227.47 | 2.69 | 2 | 2 | 2 | 4 | | Sat. | | | |
| | 225.94 | 4.22 | 2 | 3 | 4 | 7 | | Sat. | | | |
| | 224.42 | 5.74 | 34 | 8 | 10 | 18 | | M | | 224.27 **RESIDUAL** BROWN AND BLACK, SILTY SAND WITH TRACE MICA | 5.89 |
| | 222.90 | 7.26 | 21 | 55 | 40 | 95 | | M | | | |
| | 221.37 | 8.79 | 11 | 14 | 22 | 36 | SS-7A | M | | | |
| | 219.85 | 10.31 | 100/14 | | | 100/14 | | | | 219.85 **WEATHERED ROCK** (GRANITE) TAN-ORANGE TO BROWN AND BLACK, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE AND BIOTITE GNEISS REC=66% | 10.31 |
| | 219.66 | 10.50 | | | | | | | | | 10.50 |
| | 216.29 | 13.87 | 54 | 46/13 | | 100/25 | | | | | |
| | 213.25 | 16.91 | 100/7 | | | 100/7 | | | | | |

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A NB | **STATION** 24+66.6 | **OFFSET** 1.6 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 21.82 m | **NORTHING** 275,370.9 | **EASTING** 527,404.7 | **24 HR.** 1.43 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/26/01 | **COMP. DATE** 04/27/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Match Line | | | | |
| | 210.11 | 20.05 | 100/6 | | | 100/6 | | | | TAN-ORANGE TO BROWN AND BLACK, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE AND BIOTITE GNEISS REC=66% *(continued)* |
| | 208.59 | 21.57 | 45 | 55/10 | | 100/25 | | | | 208.59 21.57 208.34 (GRANITE AND BIOTITE GNEISS) 21.82 Boring Terminated at Elevation 208.34 m IN WEATHERED ROCK (GRANITE AND BIOTITE GNEISS) |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B3-A NB | **STATION** 24+66.6 | **OFFSET** 1.6 m RT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 21.82 m | **NORTHING** 275,370.9 | **EASTING** 527,404.7 — **24 HR.** 1.43 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/26/01 | **COMP. DATE** 04/27/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 10.66 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 219.66 | | | | | | | | | | | Begin Coring @ 10.50 m |
| | 219.66 | 10.50 | 0.32 | 3:00/0.32 | (0.32) | | | (6.39) | | | 219.66 TAN-ORANGE TO BROWN AND BLACK, SEVERELY WEATHERED, SOFT, CLOSELY FRACTURED, GRANITE AND BIOTITE GNEISS 10.50 |
| 219 | 219.34 | 10.82 | 1.52 | 1:50/0.30 | 100% | | | 58% | | | |
| | | | | 1:55/0.30 | (0.51) | | | | | | |
| | | | | 1:40/0.30 | 34% | | | | | | |
| 218 | | | | 1:40/0.30 | | | | | | | |
| | 217.82 | 12.34 | | 1:50/0.32 | | | | | | | |
| | | | 1.53 | 1:50/0.30 | (0.76) | | | | | | |
| 217 | | | | 1:45/0.30 | 50% | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | 216.29 | 13.87 | | 1:55/0.33 | | | | | | | |
| 216 | 216.01 | 14.15 | | *N=100/28* | | | | | | | |
| | | | 1.24 | 2:00/0.30 | (0.91) | | | | | | |
| | | | | 2:05/0.30 | 73% | | | | | | |
| 215 | | | | 2:10/0.30 | | | | | | | |
| | 214.77 | 15.39 | | 2:05/0.34 | | | | | | | |
| | | | 1.52 | 1:40/0.30 | (0.97) | | | | | | |
| 214 | | | | 1:45/0.30 | 64% | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | 213.25 | 16.91 | | 2:00/0.32 | | | | | | | |
| 213 | 213.18 | 16.98 | 1.45 | *N=100/7* | (0.00) | | | | | | |
| | | | | 1:50/0.30 | 0% | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | | | | 1:45/0.30 | | | | | | | |
| 212 | | | | 1:40/0.30 | | | | | | | |
| | 211.73 | 18.43 | | 2:00/0.25 | | | | | | | |
| | | | 1.62 | 2:50/0.30 | (1.62) | | | | | | |
| 211 | | | | 2:30/0.30 | 100% | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | | | | 1:50/0.30 | | | | | | | |
| | | | | 1:30/0.42 | | | | | | | |
| 210 | 210.11 | 20.05 | | | | | | | | | |
| | 210.05 | 20.11 | 1.46 | *N=100/6* | (1.30) | | | | | | |
| | | | | 1:40/0.30 | 89% | | | | | | |
| | | | | 1:30/0.30 | | | | | | | |
| 209 | | | | 1:50/0.30 | | | | | | | |
| | | | | 2:00/0.30 | | | | | | | |
| | 208.59 | 21.57 | | 1:30/0.26 | | | | | | | 208.59 21.57 |
| | | | | *N=100/25* | | | | | | | 208.34 (GRANITE AND BIOTITE GNEISS) 21.82 |
| 208 | | | | | | | | | | | Boring Terminated at Elevation 208.34 m IN WEATHERED ROCK (GRANITE AND BIOTITE GNEISS) |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |
| 201 | | | | | | | | | | | |
| 200 | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B NB | **STATION** 24+57.7 | **OFFSET** 25.8 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 229.99 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,371.4 | **EASTING** 527,427.5 | **24 HR.** 0.90 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/16/01 | **COMP. DATE** 04/17/01 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230 | | | | | | | | | | 229.99 GROUND SURFACE | 0.00 |
| | 229.66 | 0.33 | | | | | | | | **ROADWAY EMBANKMENT** BROWN, SILTY SAND | |
| 229 | | | 3 | 3 | 1 | 4 | | M | | 229.28 | 0.71 |
| | 228.90 | 1.09 | | | | | | | | **ALLUVIAL** GRAY, SANDY CLAY | |
| 228 | | | 3 | 1 | 1 | 2 | SS-2D | 26% | | 228.14 | 1.85 |
| | 227.38 | 2.61 | | | | | | | | GRAY, SAND | |
| 227 | | | 1 | 2 | 3 | 5 | | Sat. | | | |
| 226 | 225.86 | 4.13 | | | | | | | | | |
| 225 | | | 1 | 2 | 3 | 5 | | Sat. | | 225.10 | 4.89 |
| | 224.34 | 5.65 | | | | | | | | TAN AND GRAY, COARSE SAND AND GRAVEL | |
| 224 | | | 21 | 8 | 9 | 17 | | Sat. | | 223.58 | 6.41 |
| 223 | | | | | | | | | | GRAY, SAND | |
| | 222.82 | 7.17 | | | | | | | | | |
| 222 | | | 3 | 6 | 8 | 14 | | Sat. | | 221.89 | 8.10 |
| | 221.30 | 8.69 | | | | | | | | **RESIDUAL** DARK GRAY AND WHITE, SILTY SAND | |
| 221 | | | 19 | 28 | 28 | 56 | | M | | | |
| 220 | | | | | | | | | | 219.81 | 10.18 |
| | 219.51 | 10.48 | | | | | | | | **WEATHERED ROCK** (GRANITE) | |
| 219 | | | 62 | 37/7 | | 100/22 | | | | 219.29 | 10.70 |
| 218 | | | | | | | | | | DARK GRAY AND WHITE, SEVERELY TO SLIGHTLY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, BIOTITE GNEISS WITH SOME THIN CRYSTALLINE ROCK SEAMS | |
| | 217.41 | 12.58 | | | | | | | | | |
| 217 | | | 100/10 | | | 100/10 | | | | REC=9% | |
| 216 | | | | | | | | | | | |
| 215 | | | | | | | | | | | |
| | 214.37 | 15.62 | | | | | | | | | |
| 214 | | | 100/5 | | | 100/5 | | | | | |
| 213 | | | | | | | | | | | |
| 212 | | | | | | | | | | | |
| | 211.33 | 18.66 | | | | | | | | | |
| 211 | | | 100/5 | | | 100/5 | | | | | |
| 210 | | | | | | | | | | | |


| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST | |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B NB | **STATION** 24+57.7 | **OFFSET** 25.8 m RT | **ALIGNMENT** -L REV- | **0 HR.** N/A |
| **COLLAR ELEV.** 229.99 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,371.4 | **EASTING** 527,427.5 | **24 HR.** 0.90 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **DRILLER** Contract Driller | **START DATE** 04/16/01 | **COMP. DATE** 04/17/01 | **SURFACE WATER DEPTH** N/A | |


| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 210 | | | | | | Match Line | | | | |
| 209 | | | | | | | | | | |
| | 208.32 | 21.67 | | | | | | | | 208.32 / 208.26 (BIOTITE GNEISS) 21.67 / 21.73 |
| 208 | | | 100/6 | | | 100/6 | | | | Boring Terminated at Elevation 208.26 m IN WEATHERED ROCK (BIOTITE GNEISS) |
| 207 | | | | | | | | | | |
| 206 | | | | | | | | | | |
| 205 | | | | | | | | | | |
| 204 | | | | | | | | | | |
| 203 | | | | | | | | | | |
| 202 | | | | | | | | | | |
| 201 | | | | | | | | | | |
| 200 | | | | | | | | | | |
| 199 | | | | | | | | | | |
| 198 | | | | | | | | | | |
| 197 | | | | | | | | | | |
| 196 | | | | | | | | | | |
| 195 | | | | | | | | | | |
| 194 | | | | | | | | | | |
| 193 | | | | | | | | | | |
| 192 | | | | | | | | | | |
| 191 | | | | | | | | | | |
| 190 | | | | | | | | | | |

NCDOT BORE DOUBLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** B3-B NB | **STATION** 24+57.7 | **OFFSET** 25.8 m RT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 229.99 m | **TOTAL DEPTH** 21.73 m | **NORTHING** 275,371.4 | **EASTING** 527,427.5 — **24 HR.** 0.90 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/16/01 | **COMP. DATE** 04/17/01 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NQ | **TOTAL RUN** 10.77 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS (ELEV. (m) / DEPTH (m)) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 219.29 | | | | | | | | | | | Begin Coring @ 10.70 m |
| 219 | 219.29 / 218.93 | 10.70 / 11.06 | 0.36 | 1:00/0.30<br>0:1/0.06 | (0.00)<br>0% | | | (1.02)<br>9% | | | 219.29 — 10.70<br>DARK GRAY AND WHITE, SEVERELY TO SLIGHTLY WEATHERED, SOFT TO MEDIUM HARD, CLOSELY FRACTURED, BIOTITE GNEISS WITH SOME THIN CRYSTALLINE ROCK SEAMS |
| 218 | 217.41 / 217.31 | 12.58 / 12.68 | 1.52 | 0:45/0.30<br>0:45/0.30<br>1:00/0.30<br>1:15/0.30<br>1:45/0.32<br>N=100/10 | (0.00)<br>0% | | | | | | |
| 217 | | | 1.42 | 1:00/0.30<br>1:15/0.30<br>1:00/0.30<br>0:45/0.30<br>1:00/0.22 | (0.00)<br>0% | | | | | | |
| 216 | 215.89 | 14.10 | 1.52 | 1:00/0.30<br>1:00/0.30<br>1:00/0.30<br>0:45/0.30<br>1:00/0.32 | (0.00)<br>0% | | | | | | |
| 215 | 214.37 / 214.32 | 15.62 / 15.67 | 1.47 | N=100/5<br>1:30/0.30<br>1:30/0.30<br>2:00/0.30<br>1:30/0.30<br>2:00/0.27 | (0.05)<br>3% | | | | | | |
| 214 | 212.85 | 17.14 | 1.52 | 1:30/0.30<br>1:30/0.30<br>1:30/0.30<br>1:20/0.30<br>1:20/0.32 | (0.16)<br>11% | | | | | | |
| 213 | 211.33 / 211.28 | 18.66 / 18.71 | 1.44 | N=100/5<br>1:20/0.30<br>1:10/0.30<br>1:20/0.30<br>1:20/0.30<br>0:30/0.24 | (0.40)<br>28% | | | | | | |
| 212 | 209.84 | 20.15 | 1.52 | 1:00/0.30<br>1:10/0.30<br>1:00/0.30<br>1:20/0.30<br>1:10/0.32 | (0.41)<br>27% | | | | | | |
| 211 | 208.32 | 21.67 | | N=100/6 | | | | | | | 208.32 — 21.67<br>208.26 — 21.73<br>(BIOTITE GNEISS)<br>Boring Terminated at Elevation 208.26 m IN WEATHERED ROCK (BIOTITE GNEISS) |
| 210 | | | | | | | | | | | |
| 209 | | | | | | | | | | | |
| 208 | | | | | | | | | | | |
| 207 | | | | | | | | | | | |
| 206 | | | | | | | | | | | |
| 205 | | | | | | | | | | | |
| 204 | | | | | | | | | | | |
| 203 | | | | | | | | | | | |
| 202 | | | | | | | | | | | |
| 201 | | | | | | | | | | | |
| 200 | | | | | | | | | | | |
| 199 | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_BH.GPJ NC_DOT.GDT 07/22/10

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** CONTRACT GEOLOGIST |
| **SITE DESCRIPTION** DUAL BRIDGES ON -L REV- (US 220) OVER HAW RIVER | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-B NB | **STATION** 24+71.8 | **OFFSET** 27.5 m RT | **ALIGNMENT** -L REV- — **0 HR.** N/A |
| **COLLAR ELEV.** 229.77 m | **TOTAL DEPTH** 13.54 m | **NORTHING** 275,384.3 | **EASTING** 527,427.3 — **24 HR.** 0.45 |
| **DRILL MACHINE** CME-750 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **DRILLER** Contract Driller | **START DATE** 04/16/01 | **COMP. DATE** 04/16/01 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 229.77 GROUND SURFACE | 0.00 |
| | 229.50 | 0.27 | | | | | | | | **ROADWAY EMBANKMENT** | |
| 229 | | | 1 | 2 | 2 | 4 | | M | | BROWN, SANDY SILT 229.12 | 0.65 |
| | 228.75 | 1.02 | | | | | | | | **ALLUVIAL** | |
| 228 | | | 5 | 2 | 2 | 4 | SS-2E | 37% | | GRAY AND BROWN, SANDY CLAY 227.99 | 1.78 |
| | 227.23 | 2.54 | | | | | | | | GRAY, COARSE SAND | |
| 227 | | | 2 | 5 | 2 | 7 | | Sat. | | 226.57 | 3.20 |
| 226 | | | | | | | | | | GRAY, SILTY SAND | |
| | 225.52 | 4.25 | | | | | | | | | |
| 225 | | | 3 | 2 | 3 | 5 | | Sat. | | | |
| 224 | 224.00 | 5.77 | | | | | | | | | |
| | | | 15 | 12 | 7 | 19 | | Sat. | | 223.33 | 6.44 |
| 223 | | | | | | | | | | **RESIDUAL** | |
| | 222.66 | 7.11 | | | | | | | | DARK GRAY AND BROWN, SILTY SAND | |
| 222 | | | 7 | 11 | 16 | 27 | | M | | | |
| 221 | 221.14 | 8.63 | | | | | | | | | |
| | | | 11 | 15 | 22 | 37 | | M | | | |
| 220 | | | | | | | | | | 219.92 | 9.85 |
| | 219.62 | 10.15 | | | | | | | | **WEATHERED ROCK** | |
| | | | 80 | 20/5 | | 100/20 | | | | (GRANITE) | |
| 219 | | | | | | | | | | | |
| 218 | 218.01 | 11.76 | | | | | | | | | |
| | | | 100/14 | | | 100/14 | | | | | |
| 217 | | | | | | | | | | | |
| | 216.49 | 13.28 | | | | | | | | | |
| | | | 62 | 38/11 | | 100/26 | | | | 216.23 | 13.54 |
| 216 | | | | | | | | | | Boring Terminated at Elevation 216.23 m IN WEATHERED ROCK (GRANITE) | |
| 215 | | | | | | | | | | | |
| 214 | | | | | | | | | | | |
| 213 | | | | | | | | | | | |
| 212 | | | | | | | | | | | |
| 211 | | | | | | | | | | | |
| 210 | | | | | | | | | | | |

## EB1-A SB

### 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-2 | 19.0m LT | 24+02.3 | 1.01-1.46 | A-4(0) | 19 | 4 | 17 | 43 | 20 | 20 | 98 | 88 | 44 | 20.5 | - |
| SS-3 | 19.0m LT | 24+02.3 | 2.53-2.98 | A-2-4(0) | 21 | NP | 37 | 43 | 5 | 15 | 100 | 90 | 23 | - | - |

## EB1-B SB

### 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 | | |
| ST-1 | 2.7m LT | 23+96.4 | 1.06-1.68 | A-4(1) | 24 | 7 | 8 | 46 | 21 | 24 | 100 | 97 | 54 | 19.8 | - |
| SS-3A | 2.7m LT | 23+96.4 | 2.56-3.01 | A-7-6(16) | 46 | 21 | 5 | 10 | 40 | 45 | 89 | 86 | 75 | 31.7 | - |

## B1-A SB

### 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-2A | 17.0m LT | 24+15.6 | 0.97-1.42 | A-2-4(0) | 18 | NP | 64 | 16 | 10 | 10 | 98 | 60 | 19 | - | - |

## B1-B SB

### 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-3B | 6.0m LT | 24+11.3 | 2.60-3.05 | A-7-6(14) | 42 | 20 | 5 | 27 | 23 | 45 | 100 | 99 | 96 | 25.5 | - |

## B1-B SB

### ROCK TEST RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | ROCK TYPE | UNIT WT Kg/m$^3$ | UNCONFINED COMP. STRENGTH, $10^3$ KPa |
|---|---|---|---|---|---|---|
| RS-1 | 6.0m LT | 24+11.3 | 18.00-18.20 | GRANITE | 2303 | 2.05 |

## B2-A SB

### ROCK TEST RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | ROCK TYPE | UNIT WT Kg/m$^3$ | UNCONFINED COMP. STRENGTH, $10^3$ KPa |
|---|---|---|---|---|---|---|
| RS-2 | 25.2m LT | 24+47.2 | 12.26-12.48 | GRANITE | 2447 | 3.15 |

## B2-B SB

### 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-5 | 7.0m LT | 24+41.6 | 7.01-7.46 | A-2-4(0) | 21 | NP | 17 | 55 | 21 | 7 | 100 | 93 | 33 | - | - |
| SS-8 | 7.0m LT | 24+41.6 | 11.58-12.03 | A-4(0) | 34 | 5 | 25 | 31 | 33 | 11 | 98 | 80 | 43 | - | - |

## B3-A SB

### 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-2B | 17.0m LT | 24+73.3 | 1.19-1.64 | A-1-b(0) | 14 | NP | 60 | 13 | 24 | 3 | 89 | 32 | 9 | - | - |

## B3-A SB

### ROCK TEST RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | ROCK TYPE | UNIT WT Kg/m$^3$ | UNCONFINED COMP. STRENGTH, $10^3$ KPa |
|---|---|---|---|---|---|---|
| RS-3 | 17.0m LT | 24+73.3 | 17.37-17.59 | GRANITE | 2971 | 154.50 |

## B3-B SB

### 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-2C | 6.0m LT | 24+69.3 | 0.90-1.35 | A-1-b(0) | 18 | NP | 51 | 16 | 27 | 6 | 90 | 50 | 16 | - | - |

## EB2-A SB

### 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-3C | 18.5m LT | 24+89.3 | 4.05-4.50 | A-7-6(11) | 51 | 26 | 24 | 22 | 22 | 31 | 100 | 81 | 54 | - | - |
| SS-4 | 18.5m LT | 24+89.3 | 5.57-6.02 | A-4(0) | 34 | 3 | 25 | 20 | 53 | 2 | 90 | 73 | 41 | - | - |

## EB2-B SB

### 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 | 7.0m LT | 24+80.0 | 0.98-1.43 | A-3(0) | 20 | NP | 41 | 49 | 5 | 4 | 100 | 91 | 10 | - | - |
| SS-7 | 7.0m LT | 24+80.0 | 10.13-10.58 | A-2-4(0) | 21 | NP | 35 | 33 | 25 | 7 | 97 | 74 | 29 | - | - |

## EB1-B NB

### 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-5A | 25.0m RT | 23+86.3 | 5.74-6.19 | A-2-4(0) | 35 | 8 | 41 | 24 | 29 | 6 | 91 | 58 | 25 | - | - |

## B1-B NB

### 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-4A | 23.0m RT | 24+00.7 | 4.13-4.58 | A-2-4(0) | 15 | NP | 28 | 46 | 18 | 8 | 93 | 79 | 16 | - | - |

## B1-B NB

### ROCK TEST RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | ROCK TYPE | UNIT WT $Kg/m^3$ | UNCONFINED COMP. STRENGTH, $10^3$ KPa |
|---|---|---|---|---|---|---|
| RS-4 | 23.0m RT | 24+00.7 | 17.31-17.45 | GRANITE | 2256 | 2.63 |

## B2-A NB

### 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-4B | 1.6m RT | 24+37.6 | 4.06-4.51 | A-1-b(0) | 15 | NP | 66 | 19 | 10 | 3 | 94 | 40 | 3 | - | - |

## B2-B NB

### 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-3D | 23.0m RT | 24+29.7 | 2.63-3.08 | A-1-b(0) | 15 | NP | 62 | 12 | 23 | 3 | 89 | 35 | 8 | - | - |

## B2-B NB

### ROCK TEST RESULTS

| SAMPLE NO. | OFFSET | STATION | DEPTH INTERVAL | ROCK TYPE | UNIT WT $Kg/m^3$ | UNCONFINED COMP. STRENGTH, $10^3$ KPa |
|---|---|---|---|---|---|---|
| RS-5 | 23.0m RT | 24+29.7 | 12.52-12.68 | GRANITE | 2386 | 5.01 |

## B3-A NB

### 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-7A | 1.6m RT | 24+66.6 | 8.79-9.24 | A-2-4(0) | 33 | 7 | 28 | 40 | 26 | 6 | 96 | 82 | 34 | - | - |

## B3-B NB

### 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-2D | 25.8m RT | 24+57.7 | 1.09-1.54 | A-6(3) | 30 | 14 | 24 | 30 | 21 | 25 | 96 | 79 | 44 | 26.0 | - |

## EB2-B NB

### 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-2E | 27.5m RT | 24+71.8 | 1.02-1.47 | A-6(5) | 36 | 16 | 10 | 30 | 27 | 33 | 92 | 89 | 52 | 36.5 | - |

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

# FIELD SCOUR REPORT

WBS: 34429.1.1 TIP: R-2413C COUNTY: GUILFORD

DESCRIPTION(1): DUAL BRIDGES ON -LREV- (US 220) OVER HAW RIVER

## EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____)
Other (explain) NCDOT Bridge Survey & Hydraulics Design Report

Bridge No.: 317 Length: 29.73 Total Bents: 4 Bents in Channel: 2 Bents in Floodplain: 2
Foundation Type: Reinforced concrete deck girders and concrete piles

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: No scour observed. Alluvial deposition was observed in the river between the abutments and interior bents on both sides of River downstream of bridge.

Interior Bents: None observed beneath the waters of Haw River.

Channel Bed: Typical channel bed erosion.

Channel Bank: Bank erosion observed on both sides of River. River banks are eroded approximately vertical, typical. Trees on channel banks have fallen across the River.

**EXISTING SCOUR PROTECTION**

Type(3): Concrete aprons protect the embankment fill slopes at the end bents.

Extent(4): Concrete aprons extend from the ends of abutment to toe of the embankment at the End Bents.

Effectiveness(5): No scour observed except at the toe of the southern approach apron on the east side of bridge.

Obstructions(6): Several trees have fallen across the River. Trees in channel just upstream from existing bridge.

## DESIGN INFORMATION

Channel Bed Material(7): Gray, sandy clay and brown, silty fine to coarse sand with trace mica

Channel Bank Material(8): Gray, sandy clay and brown, silty fine to coarse sand with trace mica

Channel Bank Cover(9): Trees, grass, briars, vines.

Floodplain Width(10): +/- 0.2km

Floodplain Cover(11): Dense undergrowth with poplar, sweet gum and water oak trees.

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tend.(13): To the south.

Observations and Other Comments: Telephone utility lines span over the River on the west side of the existing bridge. Telephone lines exist underground, beneath the embankment at the end bents and continue underground N&S along shoulders. Power line over east side.

**DESIGN SCOUR ELEVATIONS(14)** Feet ____ Meters X

| | BENTS B1 | B2 | B3 |
|---|---|---|---|
| SB Lane | 225.2 | 226.4 | 228.6 |
| | | | |
| NB Lane | 226.8 | 228.1 | 228.8 |

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit's DSE is the same as the Hydraulics Unit's 100 year 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 | | | | | | | |

See Sheet 33-34, "Soil Test Results", for samples: SS-3B SS-3D

Template Revised 02/07/06

**Reported by:** Abner F. Riggs, Jr. **Date:** 5/16/2001
PER Jaime Love Pedro 7/22/2010

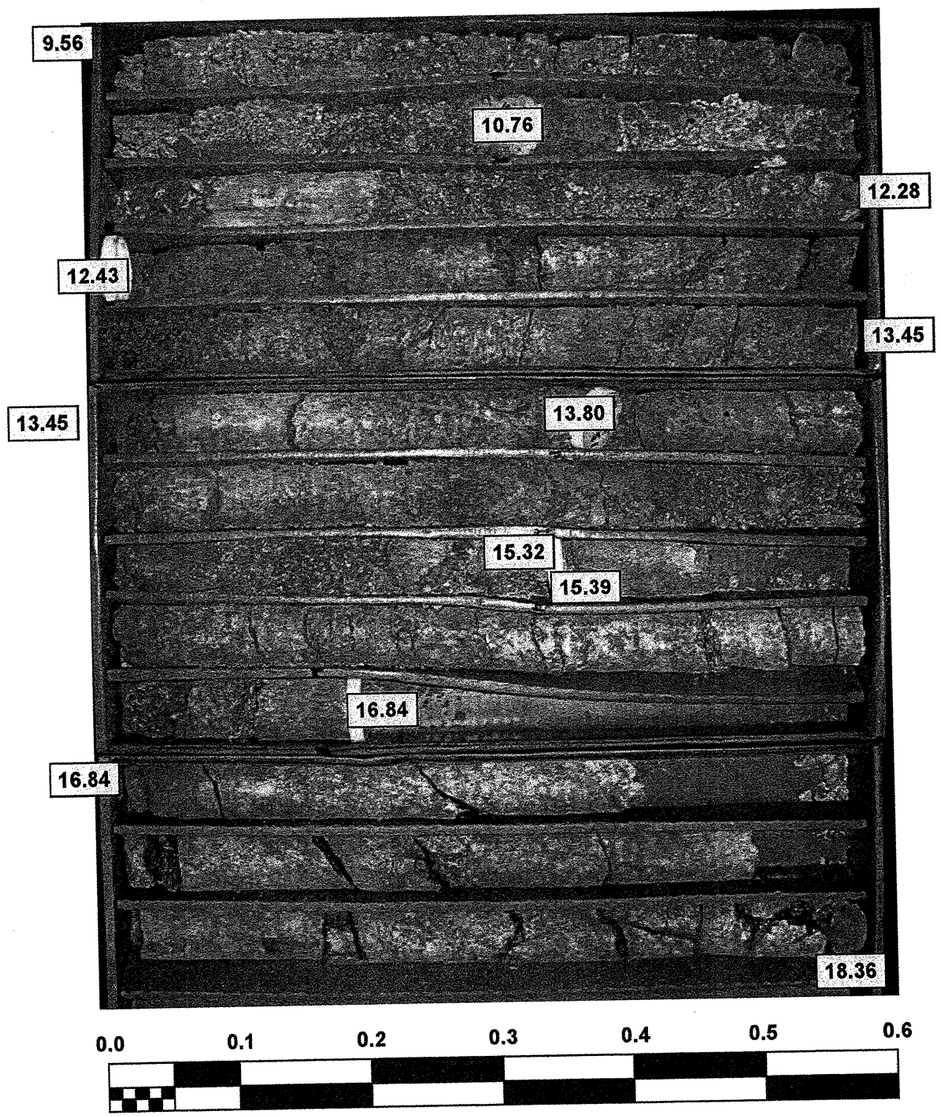
## INSTRUCTIONS

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 theoritical 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.

# CORE PHOTOGRAPHS

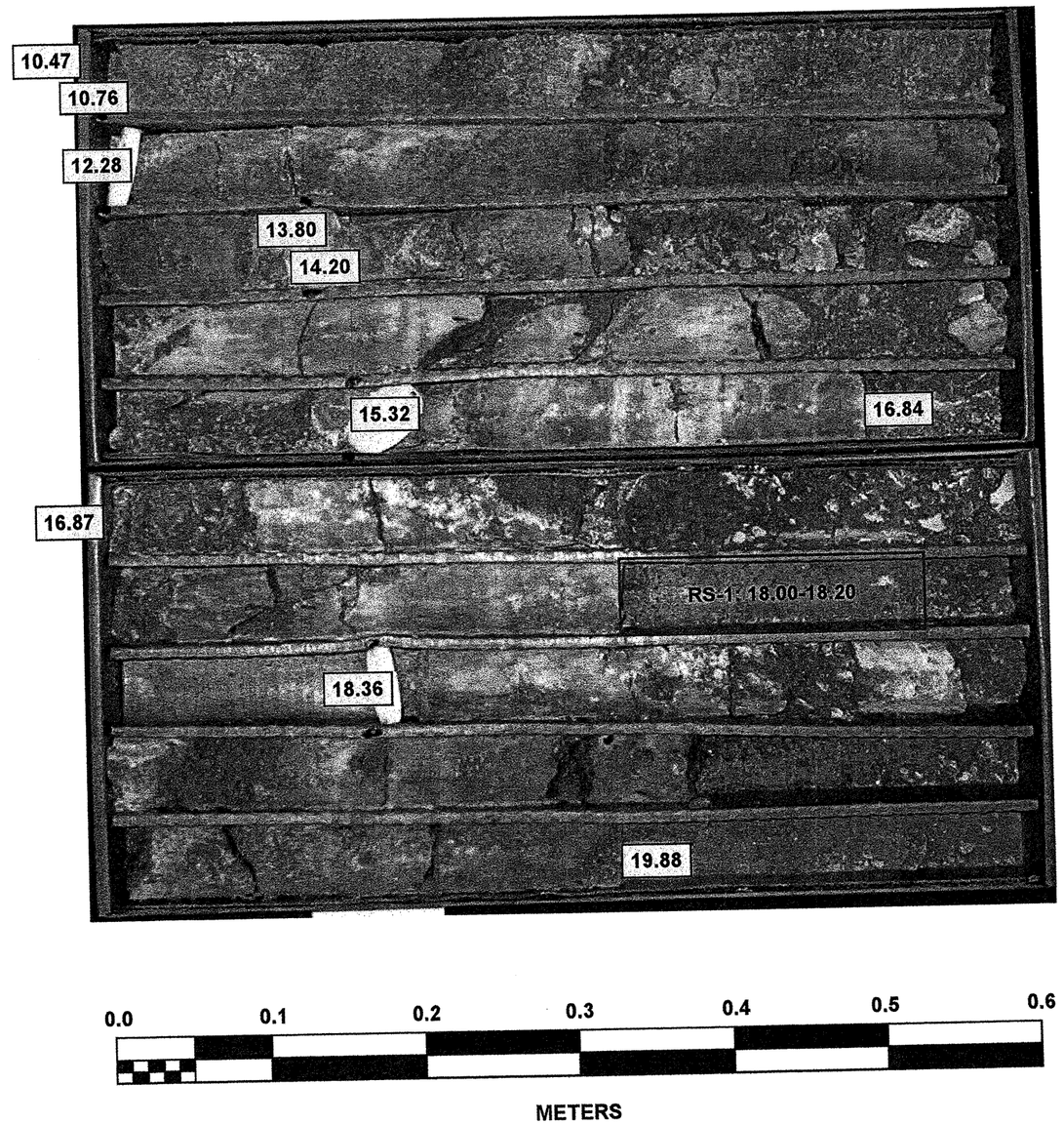
## B1-A SB

BOXES 1 - 3: 9.56 - 18.36 METERS




## B1-B SB

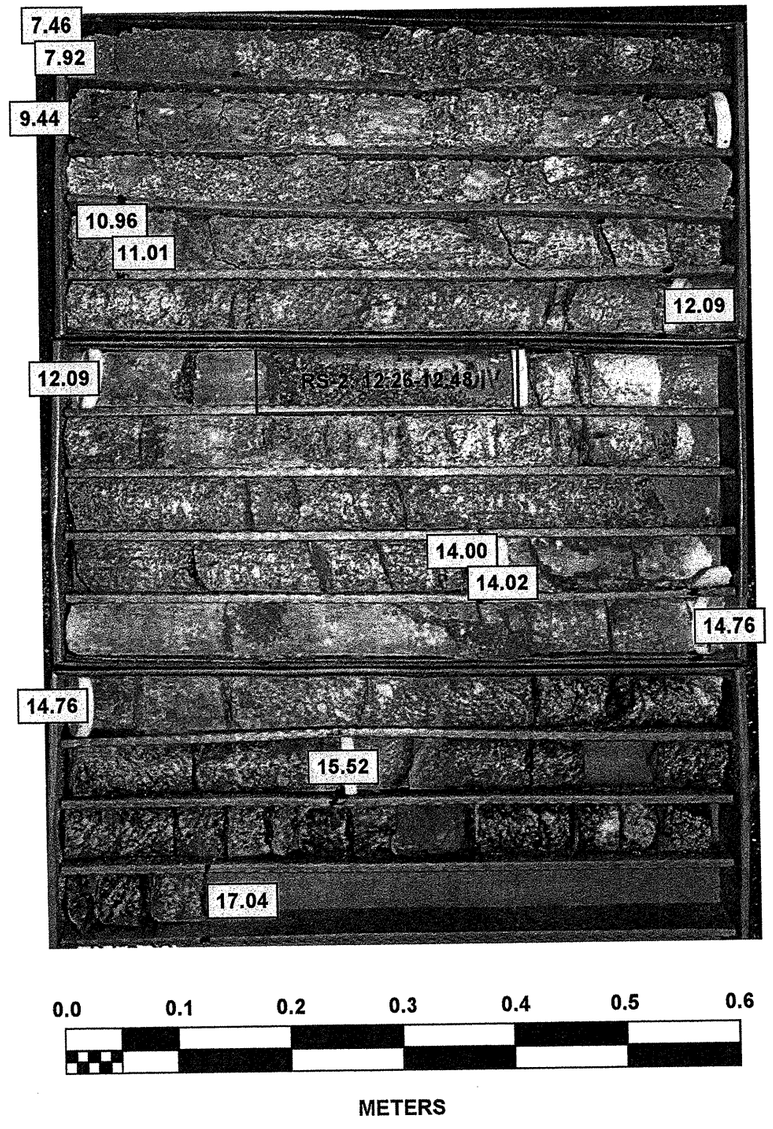
BOXES 1 & 2: 10.47 - 19.88 METERS



# CORE PHOTOGRAPHS

## B2-A SB

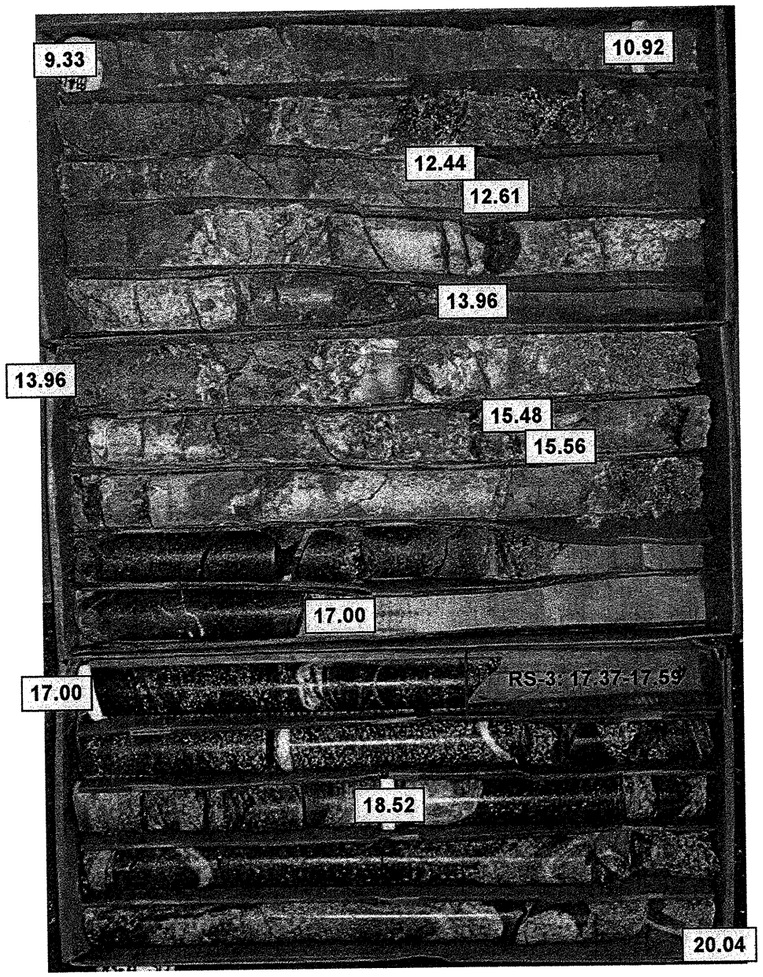
**BOXES 1 - 3: 7.46 - 17.04 METERS**

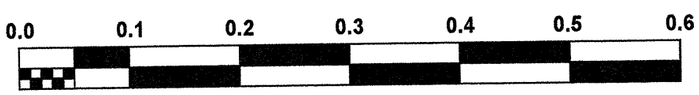


# CORE PHOTOGRAPHS

## B3-A SB

BOXES 1 - 3: 9.33 - 20.04 METERS

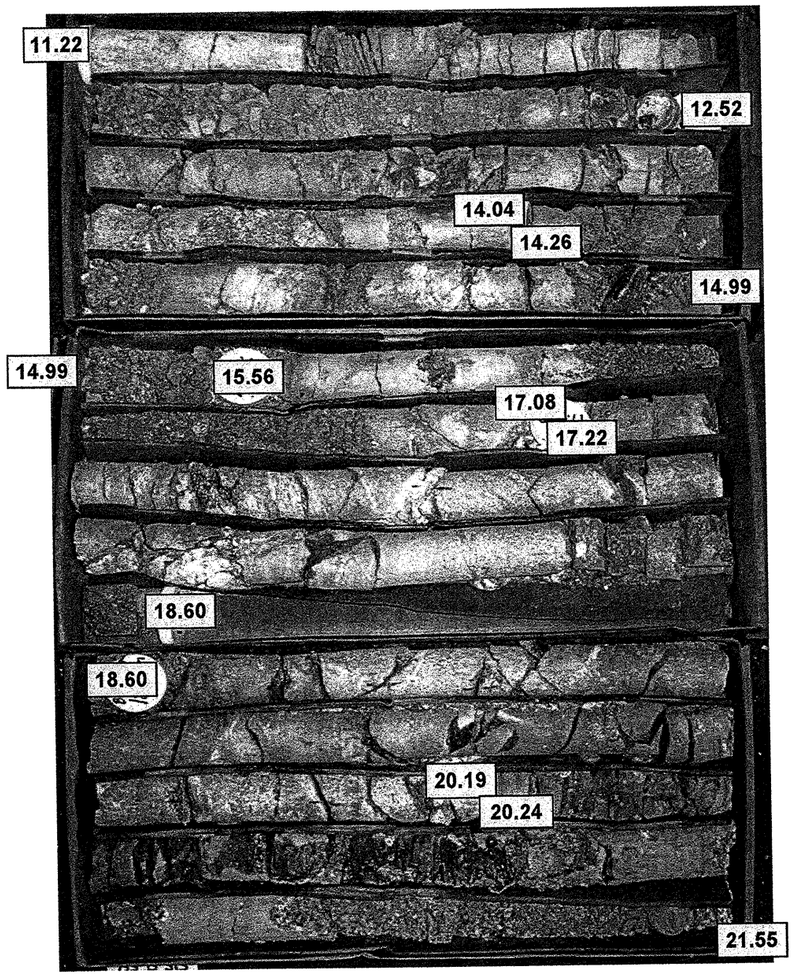


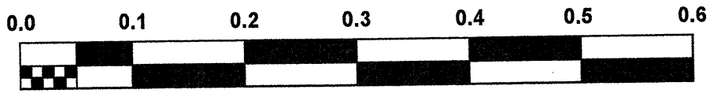




METERS

## B3-B SB

BOXES 1 - 3: 11.22 - 21.55 METERS



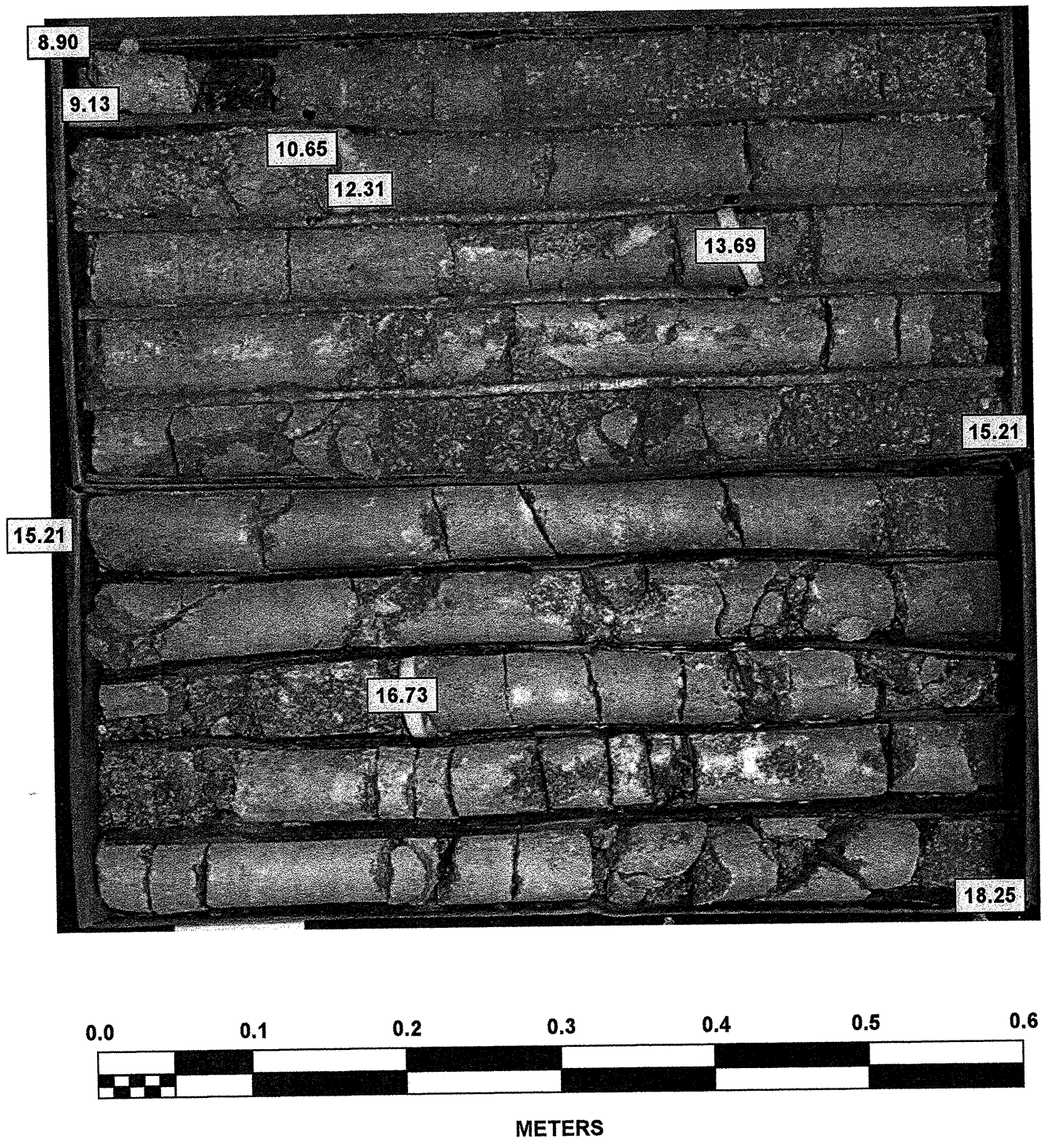




METERS

# CORE PHOTOGRAPHS

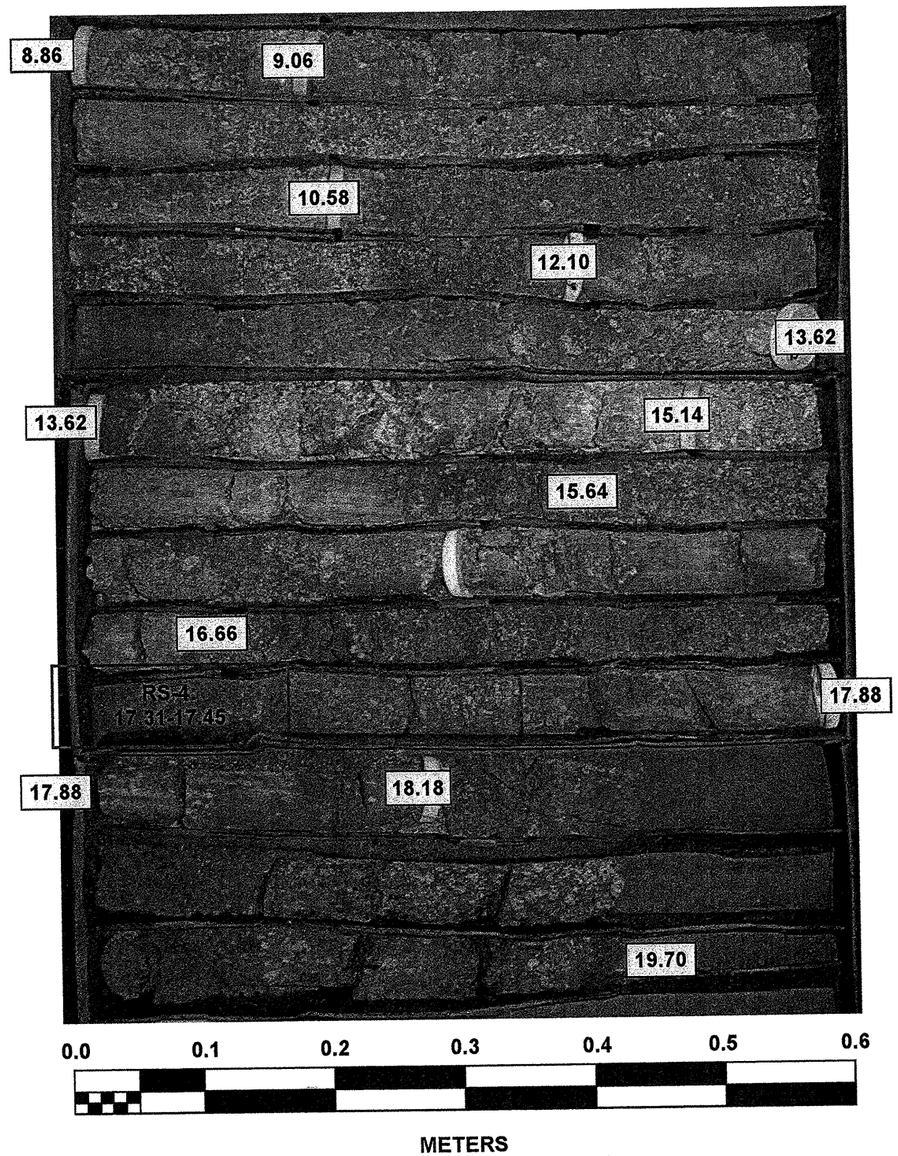
## B1-A NB

BOXES 1 & 2: 8.90 - 18.25 METERS




## B1-B NB

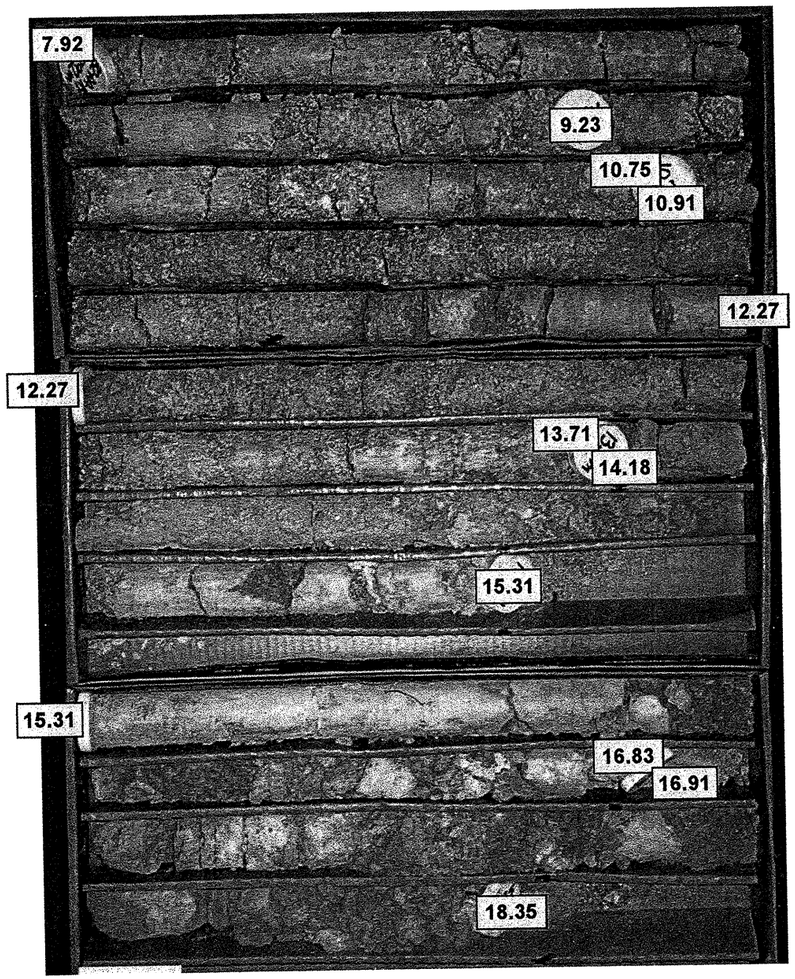
BOXES 1 & 2: 20.5 - 38.5 METERS

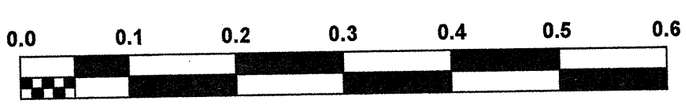


# CORE PHOTOGRAPHS

## B2-A NB

BOXES 1 - 3: 7.92 - 18.35 METERS

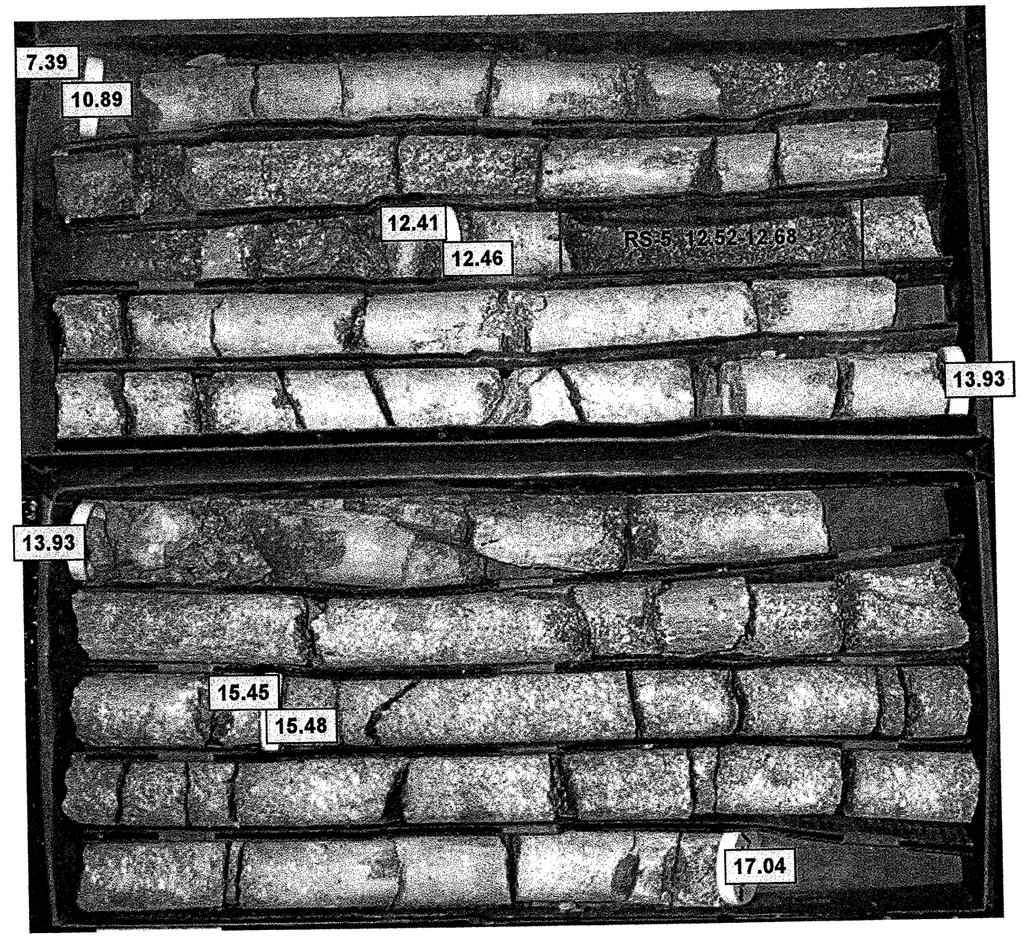


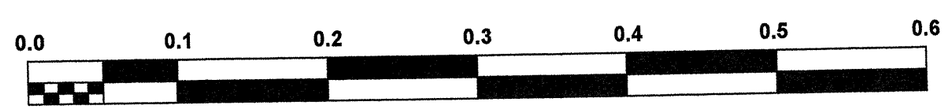




METERS

## B2-B NB

BOXES 1 & 2: 7.39 - 17.04 METERS



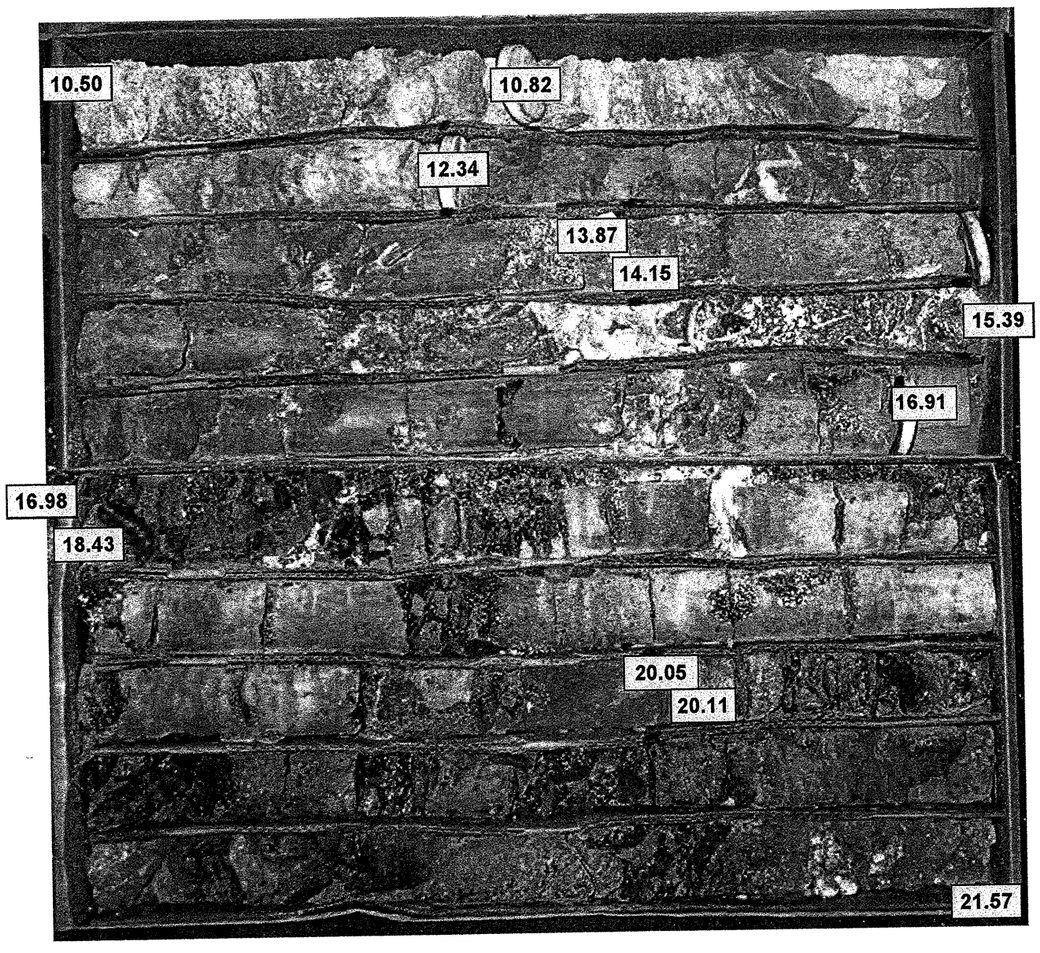



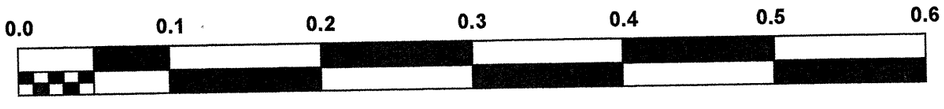

METERS

# CORE PHOTOGRAPHS

## B3-A NB

**BOXES 1 & 2: 10.50 - 21.57 METERS**

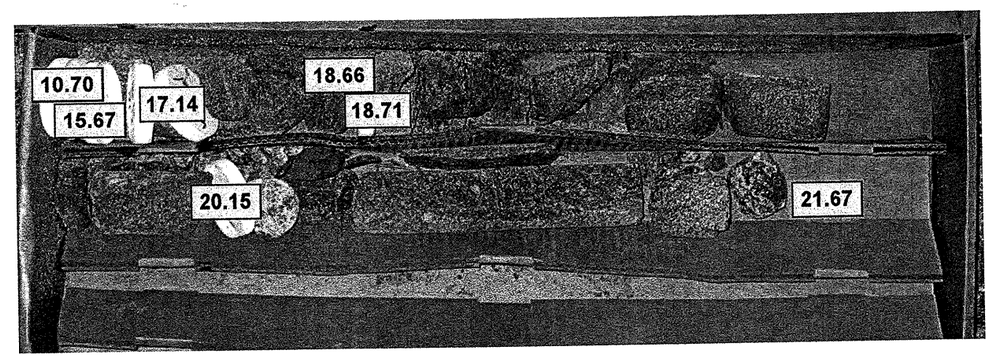


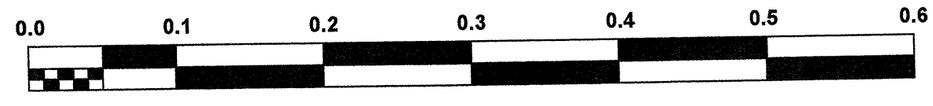




METERS

## B3-B NB

**BOX 1: 10.70 - 21.67 METERS**

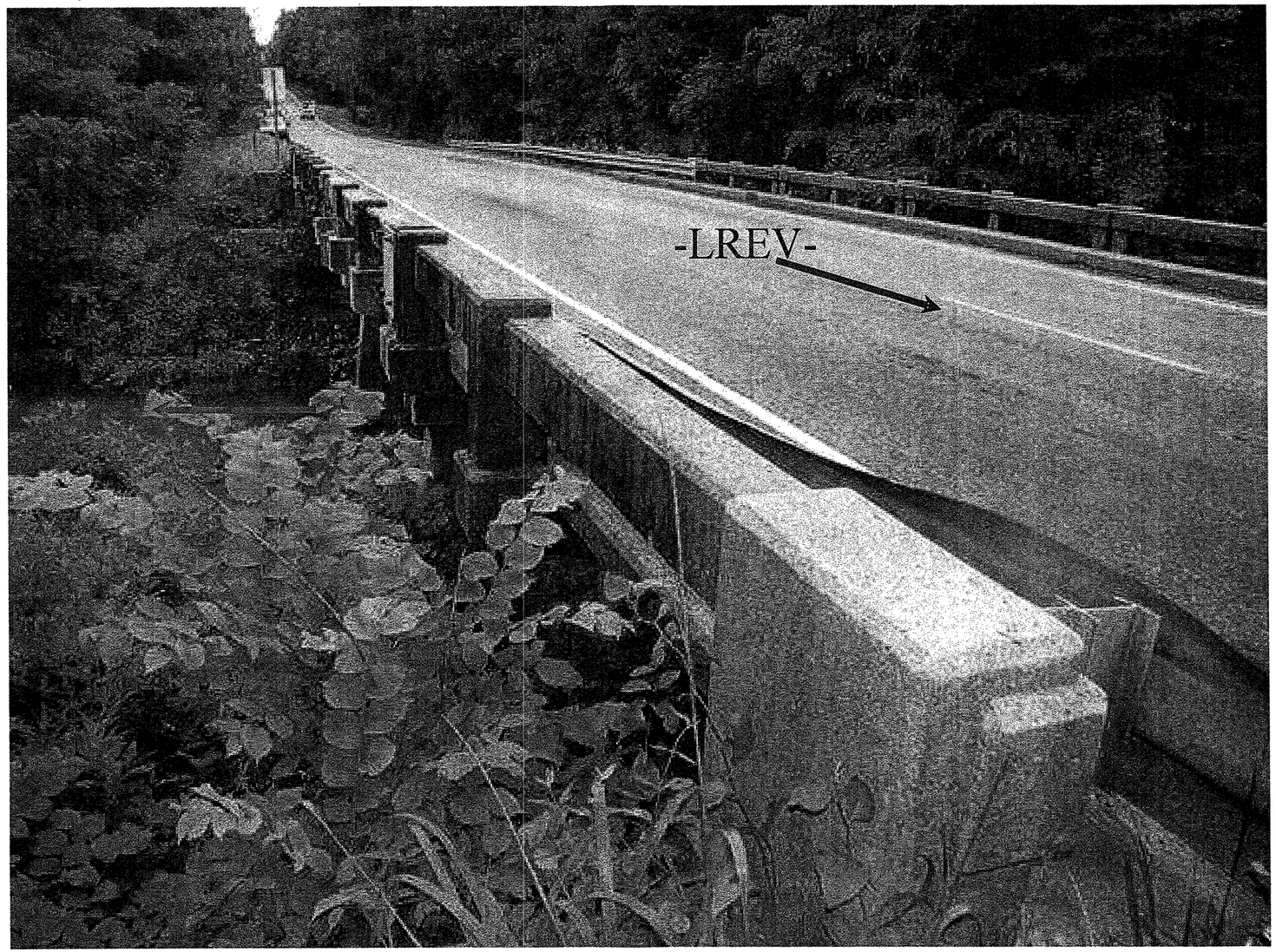



METERS

# SITE PHOTOGRAPH

Bridge No. 317 on –LREV– (US 220) over Haw River




Looking South towards End Bent 1

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34429.1.1(R-2413C) | 1 | 20 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34429.1.1(R-2413C) F.A. PROJ. N/A

COUNTY GUILFORD

PROJECT DESCRIPTION NC 68 CONNECTOR - US 220 FROM HAW RIVER TO EXISTING NC 68-US 220 INTERSECTION

SITE DESCRIPTION BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STATION 11+43.2 -US220RAMP-

INVENTORY

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3 | SITE PLAN |
| 4 | PROFILE(S) |
| 5-7 | CROSS SECTION(S) |
| 8-15 | BORE LOG & CORE REPORT(S) |
| 16 | SOIL TEST RESULTS |
| 17 | SCOUR REPORT |
| 18-19 | CORE PHOTOGRAPH(S) |
| 20 | SITE PHOTOGRAPH(S) |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PERSONNEL
C. M. BRUINSMA
PSI ENGINEERING

INVESTIGATED BY
CHECKED BY N.T. ROBERSON
SUBMITTED BY C.M. BRUINSMA
DATE OCTOBER 2010

NORTH CAROLINA LICENSED SEAL 2031 GEOLOGIST CHRISTINA M. BRUINSMA
10-5-10

DRAWN BY: T.T. WALKER, C.M. BRUINSMA

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PROJECT: 34429.1.1 ID: R-2413C

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34429.1.1(R-2413C) | 2 |

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

# SUBSURFACE INVESTIGATION

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

### SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER 30 CM ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

### SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($kN/m^2$) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | <4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>>50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | <2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>>30 | <25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>>400 |

### TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### PLASTICITY

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

### COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

### GRADATION

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

### ANGULARITY OF GRAINS

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

### MINERALOGICAL COMPOSITION

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

### COMPRESSIBILITY

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

### PERCENTAGE OF MATERIAL

| ORGANIC MATERIAL | GRANULAR SOILS | SILT - CLAY SOILS | OTHER MATERIAL | |
|---|---|---|---|---|
| TRACE OF ORGANIC MATTER | 2 - 3% | 3 - 5% | TRACE | 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 |

### GROUND WATER

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

### MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT / DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REP SPT REFUSAL

### ABBREVIATIONS

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
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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] CME-55
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [X] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 7.46 mm STEEL TEETH
- [ ] TRICONE _____ mm TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC
- [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N WD4
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

### ROCK DESCRIPTION

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 3 CM PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

| | |
|---|---|
| WEATHERED ROCK (WR) | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER 30 CM IF TESTED. |
| CRYSTALLINE ROCK (CR) | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. |

### WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V. 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 BLOWS PER 30 CM* |
| 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 BLOWS PER 30 CM* |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

### ROCK HARDNESS

| | |
|---|---|
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 6 MM DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. |
| SOFT | CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. |

### FRACTURE SPACING

| TERM | SPACING |
|---|---|
| VERY WIDE | MORE THAN 3 M |
| WIDE | 3 TO 10 M |
| MODERATELY CLOSE | 30 TO 100 CM |
| CLOSE | 5 TO 30 CM |
| VERY CLOSE | LESS THAN 5 CM |

### BEDDING

| TERM | THICKNESS |
|---|---|
| VERY THICKLY BEDDED | > 1 M |
| THICKLY BEDDED | 0.5 - 1 M |
| THINLY BEDDED | 0.05 - 0.5 M |
| VERY THINLY BEDDED | 10 - 50 MM |
| THICKLY LAMINATED | 2.5 - 10 MM |
| THINLY LAMINATED | < 2.5 MM |

### 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. |

### TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION. AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM #6; DISK STAMPED E-170 1965 IN NE WINGWALL OF BRIDGE, -L- STATION 25+94.14, 5.4 METERS RT
ELEVATION: 233.273 M

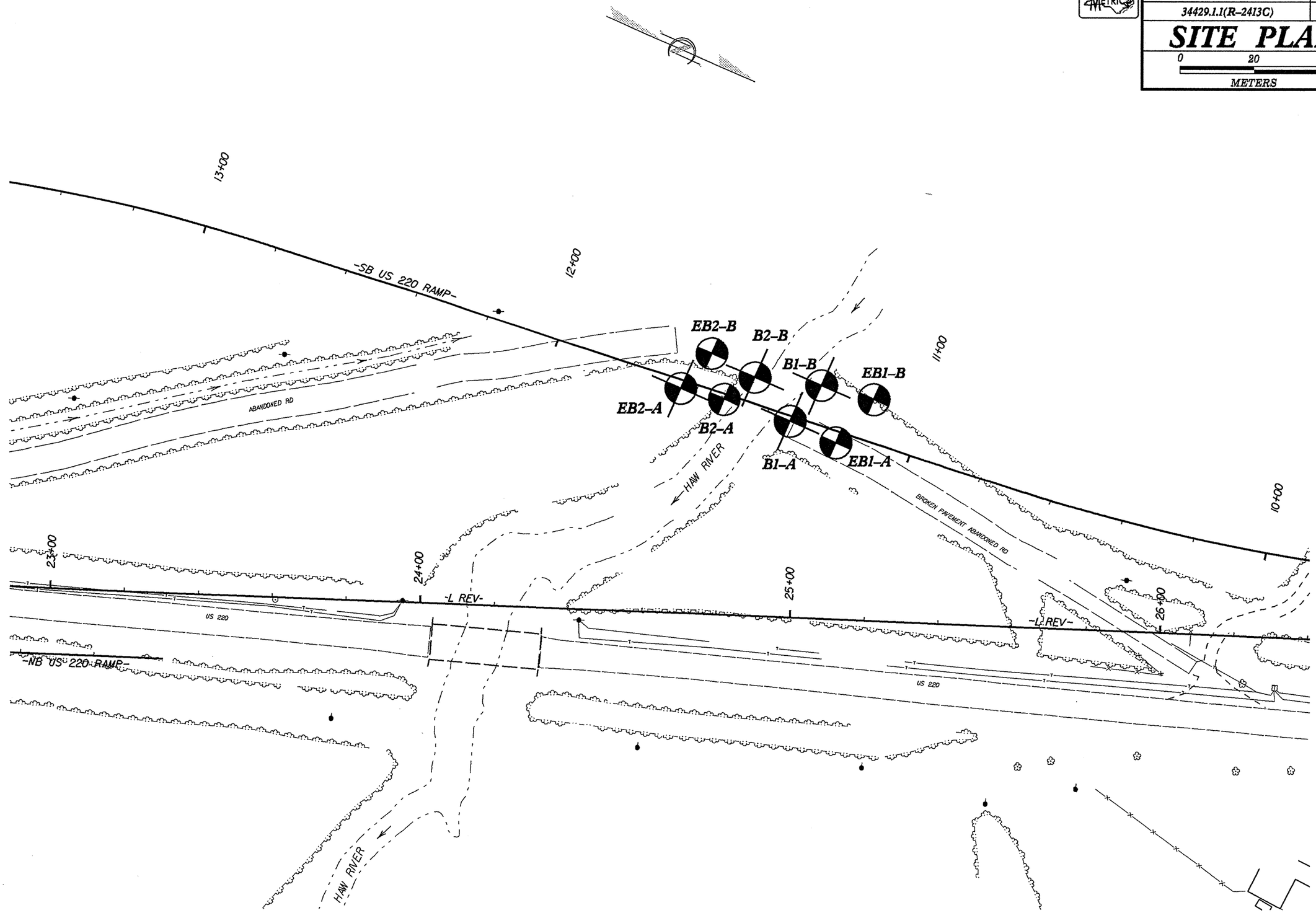
NOTES:
ORIGINAL INVESTIGATION BY PSI ENGINEERING 12/2/1997

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34429.1.1(R-2413C) | 3 |

# SITE PLAN

0 20 40

METERS




**BRIDGE IS PROPOSED AT A 115° SKEW**

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34429.1.1(R-2413C) | 4 |

**PROFILE AT CENTERLINE**

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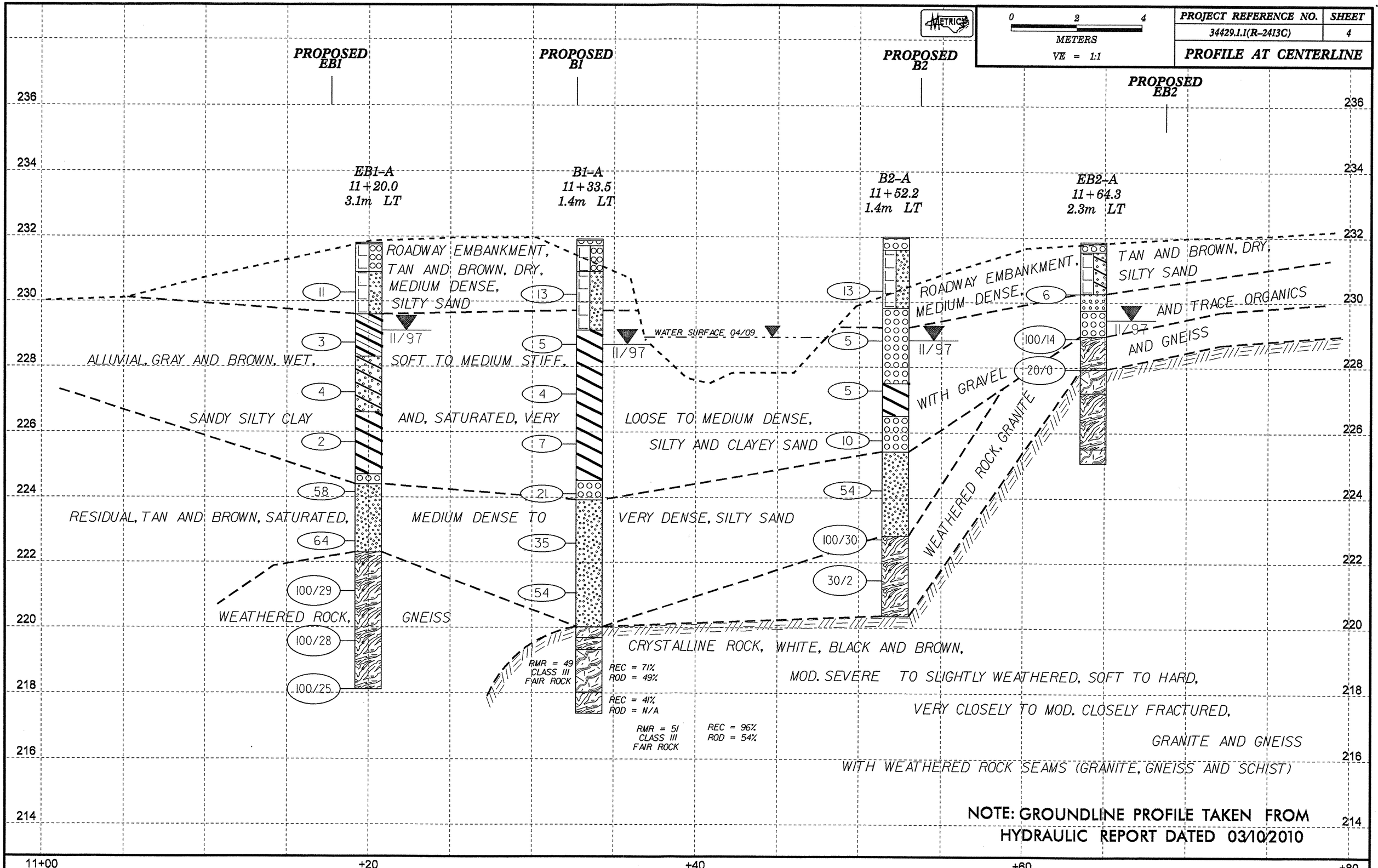


**NOTE: GROUNDLINE PROFILE TAKEN FROM HYDRAULIC REPORT DATED 03/10/2010**

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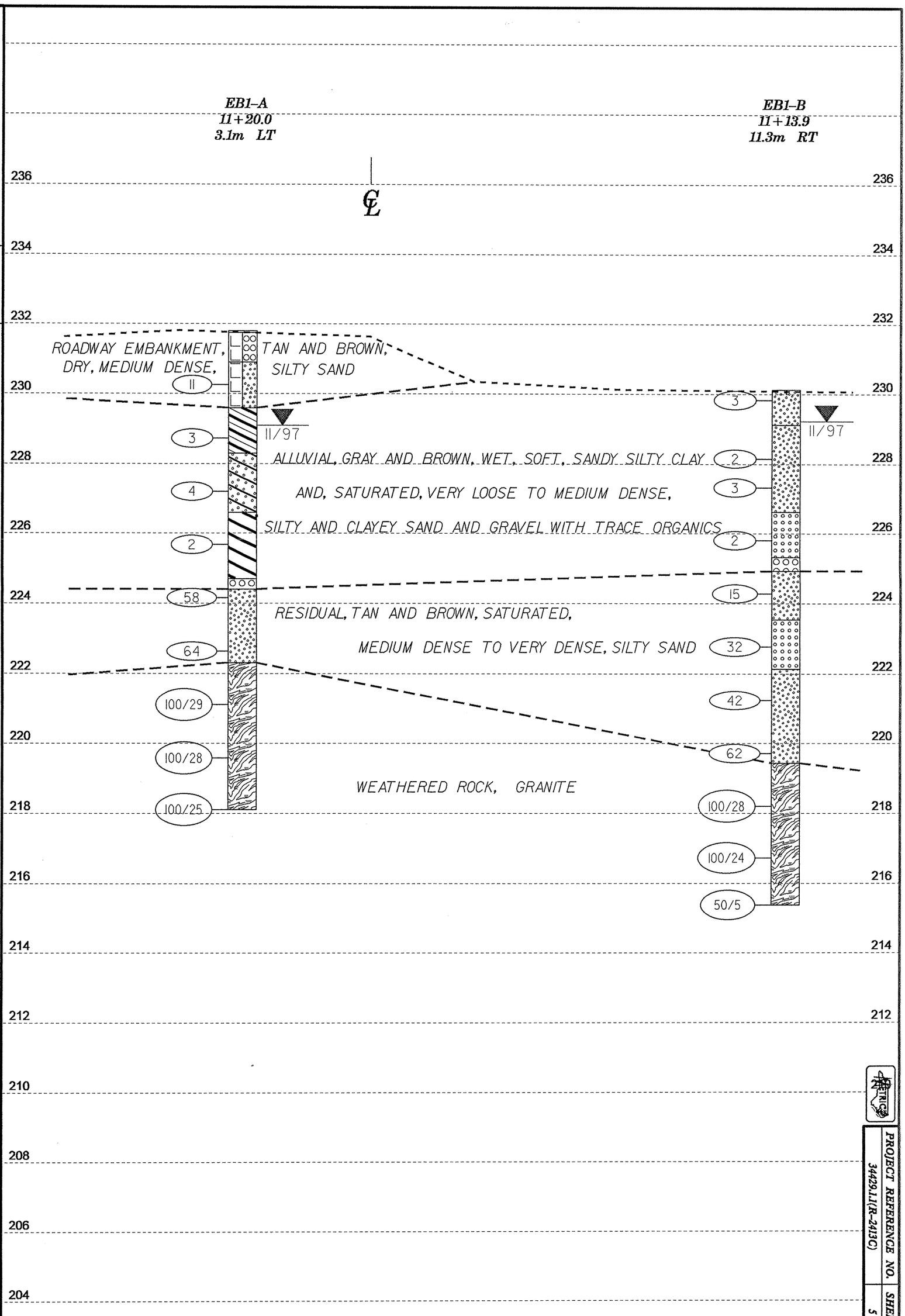


CROSS SECTION THROUGH END BENT 1

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34429.1.1(R-2413C) | 5 |

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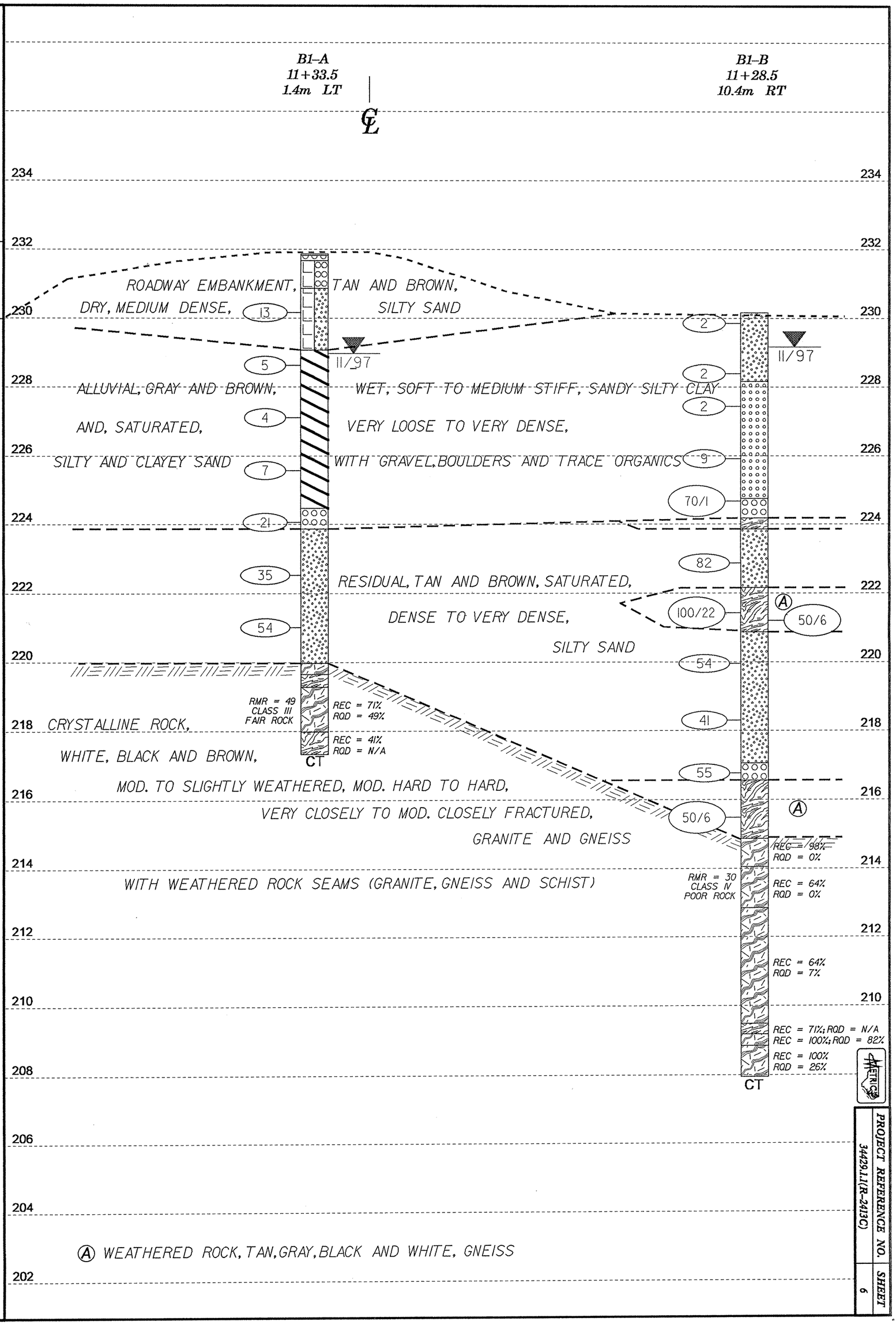
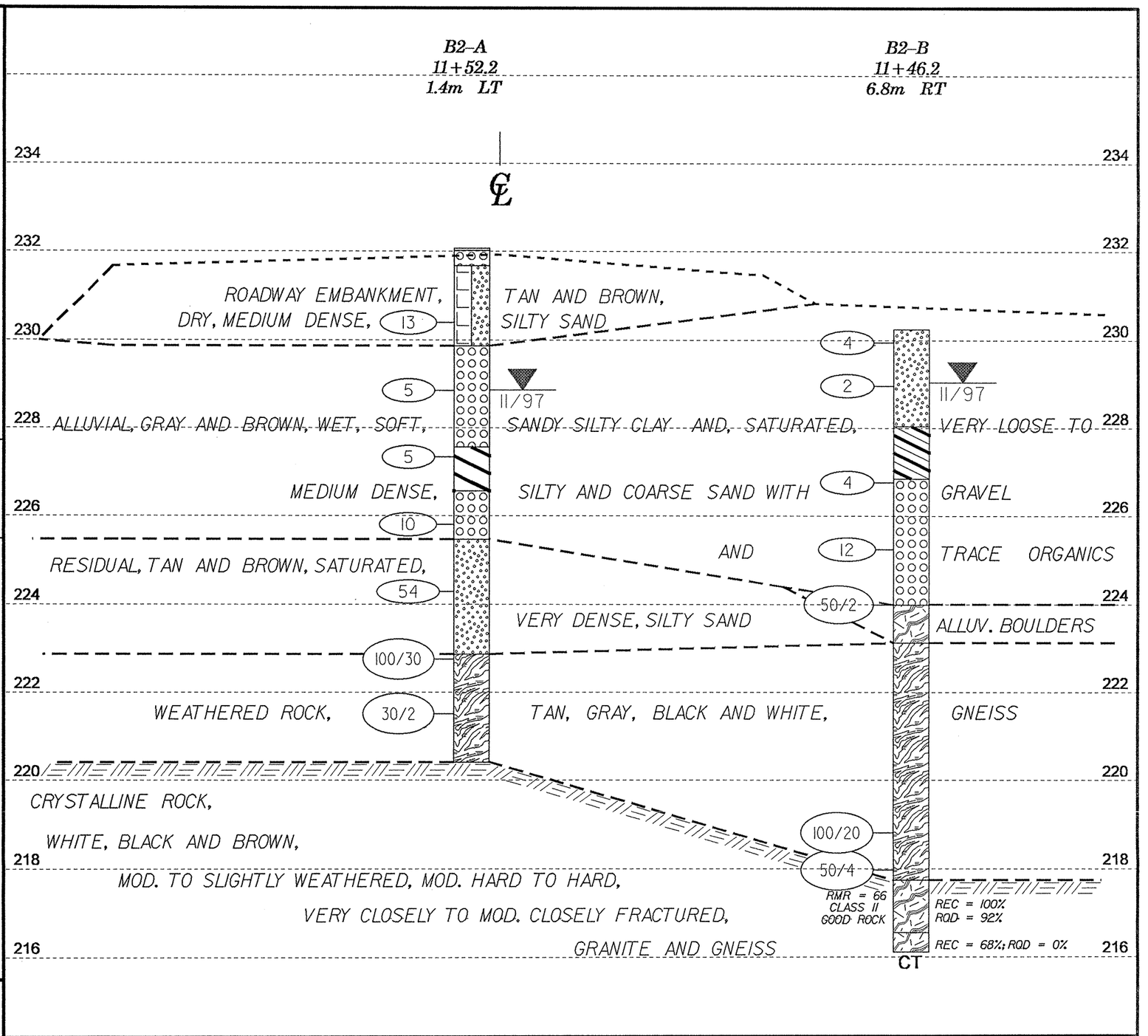
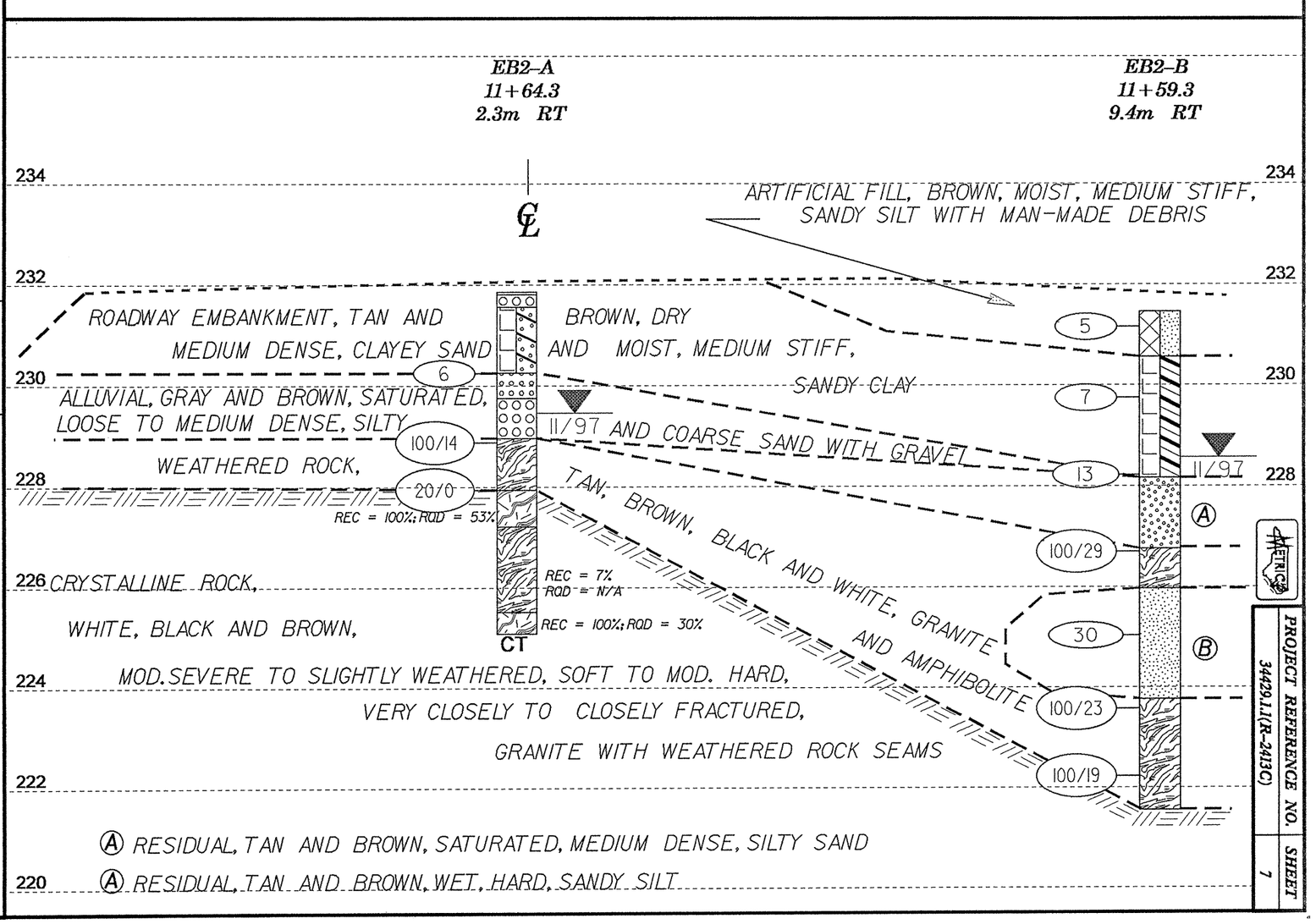



CROSS SECTION THROUGH BENT 1

PROJECT REFERENCE NO. 34429.1.1(R-2413C)

SHEET 6




PROJECT REFERENCE NO.
34429.1.1(R-2413C)
SHEET
7

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI | |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | | **GROUND WTR (m)** |
| **BORING NO.** EB1-A | **STATION** 11+20.0 | **OFFSET** 3.1 m LT | **ALIGNMENT** SB220RP | **0 HR.** 3.60 |
| **COLLAR ELEV.** 231.80 m | **TOTAL DEPTH** 13.69 m | **NORTHING** 275,393.7 | **EASTING** 527,342.6 | **24 HR.** 2.70 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual | |
| **DRILLER** Stull, PSI | **START DATE** 11/12/97 | **COMP. DATE** 11/12/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 231.88 GROUND SURFACE | 0.00 |
| | | | | | | | | | | ASPHALT | 0.08 |
| | | | | | | | | | | **ROADWAY EMBANKMENT** AGGREGATE BASE COARSE | |
| | | | | | | | | | | 230.90 TAN AND BROWN, SILTY SAND | 0.90 |
| | 230.56 | 1.24 | 7 | 5 | 6 | 11 | | D | | | |
| | | | | | | | | | | 229.60 **ALLUVIAL** GRAY AND BROWN, SILTY SANDY CLAY WITH ORGANICS (WOOD FRAGMENTS) | 2.20 |
| | 229.03 | 2.77 | 1 | 2 | 1 | 3 | | W | | | |
| | | | | | | | | | | 228.30 GRAY AND BROWN, CLAYEY SILTY SAND (SOME INDICATION OF HFC CONTAMINATION) | 3.50 |
| | 227.51 | 4.29 | 3 | 2 | 2 | 4 | | Sat. | | | |
| | | | | | | | | | | 226.60 GRAY, SILTY CLAY WITH SILTY SAND LAYERS AND LITTLE ORGANICS (WOOD FRAGMENTS) | 5.20 |
| | 225.98 | 5.82 | 2 | 1 | 1 | 2 | | W | | | |
| | | | | | | | | | | 224.70 GRAY, COARSE SAND AND GRAVEL | 7.10 |
| | 224.46 | 7.34 | 9 | 22 | 36 | 58 | | Sat. | | 224.40 **RESIDUAL** TAN AND BROWN, SILTY SAND | 7.40 |
| | 222.93 | 8.87 | 14 | 24 | 40 | 64 | | W | | | |
| | | | | | | | | | | 222.30 **WEATHERED ROCK** TAN, BLACK AND WHITE, GRANITE | 9.50 |
| | 221.41 | 10.39 | 28 | 41 | 59/14 | 100/29 | | | | | |
| | 219.88 | 11.92 | 42 | 52 | 48/13 | 100/28 | | | | | |
| | 218.36 | 13.44 | 44 | 56/10 | | 100/25 | | | | 218.11 Boring Terminated at Elevation 218.11 m IN WEATHERED ROCK (GRANITE) | 13.69 |

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI | |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | | **GROUND WTR (m)** |
| **BORING NO.** EB1-B | **STATION** 11+13.9 | **OFFSET** 11.3 m RT | **ALIGNMENT** SB220RP | **0 HR.** 1.30 |
| **COLLAR ELEV.** 230.10 m | **TOTAL DEPTH** 14.75 m | **NORTHING** 275,398.4 | **EASTING** 527,327.7 | **24 HR.** 0.90 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual | |
| **DRILLER** Stull, PSI | **START DATE** 11/12/97 | **COMP. DATE** 11/12/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | 230.10 | 0.00 | | | | | | | | 230.10 GROUND SURFACE 0.00 |
| | | | 2 | 2 | 1 | 3 | | M | | **ALLUVIAL** BROWN AND GRAY, SILTY SAND WITH TRACE ORGANICS AND GRAVEL |
| | 228.43 | 1.67 | 1 | 1 | 1 | 2 | SS-35 | Sat. | | |
| | 227.60 | 2.50 | 1 | 1 | 2 | 3 | | Sat. | | 226.60 GRAY AND BROWN, SAND WITH CLAY LENSES, WOOD FRAGMENTS 3.50 |
| | 226.08 | 4.02 | WOH | 1 | 1 | 2 | SS-37b | Sat. | | 225.30 GRAY AND BROWN, SANDY GRAVEL WITH COBBLES 4.80 |
| | 224.55 | 5.55 | 13 | 8 | 7 | 15 | | W | | 224.90 **RESIDUAL** TAN AND BROWN, SILTY SAND 5.20 |
| | 223.03 | 7.07 | 17 | 16 | 16 | 32 | | W | | 223.50 TAN, SAND 6.60 |
| | 221.50 | 8.60 | 7 | 17 | 25 | 42 | | W | | 222.10 TAN AND BROWN, SILTY SAND 8.00 |
| | 219.98 | 10.12 | 18 | 25 | 37 | 62 | SS-41 | W | | 219.40 **WEATHERED ROCK** LIGHT TAN AND GRAY, COARSE TO FINE GRAINED, GRANITE 10.70 |
| | 218.45 | 11.65 | 58 | 41/13 | | 100/28 | | | | |
| | 216.93 | 13.17 | 40 | 60/9 | | 100/24 | | | | |
| | 215.40 | 14.70 | 50/5 | | | 50/5 | | | | 215.35 Boring Terminated at Elevation 215.35 m IN WEATHERED ROCK (GRANITE) 14.75 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A | **STATION** 11+33.5 | **OFFSET** 1.4 m LT | **ALIGNMENT** SB220RP — **0 HR.** 2.90 |
| **COLLAR ELEV.** 231.87 m | **TOTAL DEPTH** 14.53 m | **NORTHING** 275,380.1 | **EASTING** 527,342.2 — **24 HR.** 2.90 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/19/97 | **COMP. DATE** 11/19/97 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 231.87 GROUND SURFACE | 0.00 |
| | | | | | | | | | | 231.67 ASPHALT | 0.20 |
| | | | | | | | | | | AGGREGATE BASE COURSE | |
| | | | | | | | | | | 230.87 ROADWAY EMBANKMENT | 1.00 |
| | | | | | | | | | | BROWN AND GRAY, SAND AND GRAVEL | |
| | | | | | | | | | | BROWN, SILTY CLAYEY SAND | |
| | 230.46 | 1.41 | 3 | 5 | 8 | 13 | | M | | | |
| | 228.93 | 2.94 | 2 | 3 | 2 | 5 | | Sat. | | 229.07 ALLUVIAL | 2.80 |
| | | | | | | | | | | BROWN AND GRAY, SILTY CLAY WITH SAND LAYERS AND TRACE WOOD FRAGMENTS | |
| | 227.41 | 4.46 | 3 | 3 | 1 | 4 | SS-59B | 37% | | | |
| | 225.88 | 5.99 | 3 | 3 | 4 | 7 | SS-60B | 33% | | | |
| | 224.36 | 7.51 | 15 | 10 | 11 | 21 | | Sat. | | 224.47 GRAY AND BROWN, SAND AND GRAVEL | 7.40 |
| | | | | | | | | | | 223.87 RESIDUAL | 8.00 |
| | | | | | | | | | | TAN, DARK GRAY AND WHITE, SILTY SAND | |
| | 222.83 | 9.04 | 11 | 12 | 23 | 35 | | W | | | |
| | 221.31 | 10.56 | 15 | 22 | 32 | 54 | | W | | | |
| | | | | | | | | | | 219.97 CRYSTALLINE ROCK | 11.90 |
| | | | | | | | | | | 219.65 WHITE AND BLACK GNEISS | 12.22 |
| | | | | | | | | | | 219.28 WEATHERED ROCK | 12.59 |
| | | | | | | | | | | TAN, BROWN AND WHITE, GRANITE | |
| | | | | | | | | | | CRYSTALLINE ROCK | |
| | | | | | | | | | | TAN AND WHITE, GRANITE | |
| | | | | | | | | | | 217.98 RMR = 49 (CLASS III - FAIR ROCK) | 13.89 |
| | | | | | | | | | | 217.34 WEATHERED ROCK | 14.53 |
| | | | | | | | | | | BROWN AND BLACK, SCHIST | |
| | | | | | | | | | | Boring Terminated at Elevation 217.34 m IN CRYSTALLINE ROCK (SCHIST) | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B1-A | **STATION** 11+33.5 | **OFFSET** 1.4 m LT | **ALIGNMENT** SB220RP — **0 HR.** 2.90 |
| **COLLAR ELEV.** 231.87 m | **TOTAL DEPTH** 14.53 m | **NORTHING** 275,380.1 | **EASTING** 527,342.2 — **24 HR.** 2.90 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/19/97 | **COMP. DATE** 11/19/97 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 2.63 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 219.97 | | | | | | | | | | | Begin Coring @ 11.90 m | |
| | 219.97 | 11.90 | 1.11 | 3:00 | (0.68) | (0.10) | | (0.32) | (0.00) | | 219.97 CRYSTALLINE ROCK | 11.90 |
| | | | | 1:00 | 61% | 9% | | 100% | 0% | | 219.65 WHITE AND BLACK, MODERATELY WEATHERED, MODERATELY | 12.22 |
| 219 | | | | 3:00 | | | | (0.00) | N/A | | 219.28 HARD, VERY CLOSELY TO CLOSELY FRACTURED, GNEISS | 12.59 |
| | 218.86 | 13.01 | | 4:00/0.21 | | | | 0% | (0.64) | | WEATHERED ROCK | |
| | | | 1.52 | 13:00 | (1.14) | (0.59) | | (0.92) | 49% | | TAN, BROWN AND WHITE, GRANITE | |
| 218 | | | | 8:00 | 75% | 39% | | 71% | | | CRYSTALLINE ROCK | |
| | | | | 6:00 | | | | | | | 217.98 TAN AND WHITE, MODERATELY TO SLIGHTLY WEATHERED, | 13.89 |
| | | | | 1:00 | | | | (0.26) | N/A | | MODERATELY HARD TO HARD, CLOSELY TO MODERATELY CLOSELY | |
| | 217.34 | 14.53 | | 1:00/0.32 | | | | 41% | | | FRACTURED, GRANITE | |
| 217 | | | | | | | | | | | 217.34 | 14.53 |
| | | | | | | | | | | | RMR = 49 (CLASS III - FAIR ROCK) | |
| | | | | | | | | | | | WEATHERED ROCK | |
| | | | | | | | | | | | BROWN AND BLACK, SEVERELY WEATHERED, SOFT, VERY CLOSELY FRACTURED, SCHIST | |
| | | | | | | | | | | | Boring Terminated at Elevation 217.34 m IN CRYSTALLINE ROCK (SCHIST) | |
| 216 | | | | | | | | | | | | |
| 215 | | | | | | | | | | | | |
| 214 | | | | | | | | | | | | |
| 213 | | | | | | | | | | | | |
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| 200 | | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI | |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B | **STATION** 11+28.5 | **OFFSET** 10.4 m RT | **ALIGNMENT** SB220RP | **0 HR.** 1.10 |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 22.21 m | **NORTHING** 275,383.9 | **EASTING** 527,330.0 | **24 HR.** 1.00 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Manual | |
| **DRILLER** Stull, PSI | **START DATE** 11/17/97 | **COMP. DATE** 11/18/97 | **SURFACE WATER DEPTH** N/A | |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230.16 | | 0.00 | | | | | | | | GROUND SURFACE | 0.00 |
| 228.69 | | 1.47 | 1 | 1 | 1 | 2 | | M | | **ALLUVIAL** BROWN TO GRAY, SILTY SAND WITH TRACE ROOTS AND WOOD FRAGMENTS | |
| 227.74 | | 2.42 | WOH | 1 | 1 | 2 | | Sat. | | | |
| 226.22 | | 3.94 | 1 | 1 | 1 | 2 | | Sat. | | GRAY AND BROWN, VERY FINE TO COARSE, SAND WITH TRACE WOOD FRAGMENTS | 2.00 |
| 224.69 | | 5.47 | 3 | 4 | 5 | 9 | | Sat. | | | |
| 223.17 | | 6.99 | 70/1 | | | 70/1 | | W | | | |
| 221.64 | | 8.52 | 30 | 33 | 49 | 82 | | W | | BOULDER (METAVOLCANIC ROCK) | 5.40 |
| 221.26 | | 8.90 | 51 | 49/7 | | 100/22 | | | | WEATHERED ROCK TAN, GRAY AND PINK, GRANITE | 5.98 |
| 220.25 | | 9.91 | 50/6 | | | 50/6 | | | | RESIDUAL BROWN, GRAY AND PINK, SILTY SAND | 6.30 |
| 218.59 | | 11.57 | 14 | 25 | 29 | 54 | | W | | | |
| 217.07 | | 13.09 | 16 | 19 | 22 | 41 | SS-54 | W | | WEATHERED ROCK TAN, GRAY AND PINK, GRANITE | 8.00 |
| 215.54 | | 14.62 | 12 | 28 | 27 | 55 | | W | | RESIDUAL TAN, GRAY AND BLACK, SILTY SAND | 9.30 |
| | | | 50/6 | | | 50/6 | | | | TAN AND BROWN, SAND | 13.10 |
| | | | | | | | | | | WEATHERED ROCK TAN AND BROWN, GRANITE | 13.60 |
| | | | | | | | | | | CRYSTALLINE ROCK BLACK, BROWN AND WHITE, GNEISS | 15.29 |
| | | | | | | | | | | RMR = 30 (CLASS IV - POOR ROCK) TAN, BROWN AND PINK, GRANITE WITH WR LAYERS | 16.11 |
| | | | | | | | | | | BLACK, TAN, WHITE AND BROWN, GNEISS WITH WR LAYERS | 17.32 |


| | | | | |
|---|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI | |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B | **STATION** 11+28.5 | **OFFSET** 10.4 m RT | **ALIGNMENT** SB220RP | **0 HR.** 1.10 |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 22.21 m | **NORTHING** 275,383.9 | **EASTING** 527,330.0 | **24 HR.** 1.00 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Manual | |
| **DRILLER** Stull, PSI | **START DATE** 11/17/97 | **COMP. DATE** 11/18/97 | **SURFACE WATER DEPTH** N/A | |


| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 211 | | | | | | Match Line | | | | |
| | | | | | | | | | | BLACK, TAN, WHITE AND BROWN, GNEISS WITH WR LAYERS *(continued)* |
| | | | | | | | | | | 209.48 — 20.68 |
| | | | | | | | | | | 209.18 — 20.98 WEATHERED ROCK BROWN, BLACK AND TAN, GRANITE |
| | | | | | | | | | | 208.85 — 21.31 CRYSTALLINE ROCK TAN, WHITE AND GRAY, GRANITE |
| | | | | | | | | | | 207.95 — 22.21 BLACK, BROWN AND TAN, GNEISS |
| | | | | | | | | | | Boring Terminated at Elevation 207.95 m IN CRYSTALLINE ROCK (GNEISS) |

NCDOT BORE DOUBLE R2413C_GEO_US220_SBRAMP_BH.GPJ NC_DOT.GDT 10/01/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B1-B | **STATION** 11+28.5 | **OFFSET** 10.4 m RT | **ALIGNMENT** SB220RP — **0 HR.** 1.10 |
| **COLLAR ELEV.** 230.16 m | **TOTAL DEPTH** 22.21 m | **NORTHING** 275,383.9 | **EASTING** 527,330.0 — **24 HR.** 1.00 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/17/97 | **COMP. DATE** 11/18/97 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 6.92 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | ELEV. (m) | DESCRIPTION AND REMARKS | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 214.87 | | | | | | | | | | | | Begin Coring @ 15.29 m | |
| | 214.87 | 15.29 | 0.82 | 4:00<br>4:00 | (0.80)<br>98% | (0.00)<br>0% | | (0.80)<br>98% | (0.00)<br>0% | | 214.87 | **CRYSTALLINE ROCK**<br>BLACK, BROWN AND WHITE, MODERATE TO MODERATELY SEVERELY WEATHERED, SOFT TO MODERATELY HARD, VERY CLOSE TO CLOSELY FRACTURED, GNEISS<br>RMR = 30 (CLASS IV - POOR ROCK) | 15.29 |
| 214 | 214.05 | 16.11 | | 4:00/0.22 | | | | | | | 214.05 | | 16.11 |
| 213 | | | 1.52 | 3:00<br>3:00<br>3:00<br>4:00 | (1.09)<br>72% | (0.24)<br>16% | | (0.77)<br>64% | (0.00)<br>0% | | 212.84 | TAN, BROWN AND PINK, MODERATELY SEVERELY WEATHERED, SOFT TO MODERATELY HARD, VERY CLOSE TO CLOSELY FRACTURED, GRANITE WITH WR LAYERS | 17.32 |
| | 212.53 | 17.63 | | 4:00/0.32 | | | | (2.15)<br>64% | (0.24)<br>7% | | | BLACK, TAN, WHITE AND BROWN, MODERATELY SEVERLY WATHERED, SOFT TO MODERATELY HARD, VERY CLOSE TO CLOSELY FRACTURED, GNEISS WITH WR LAYERS | |
| 212 | | | 1.53 | 3:00<br>3:00<br>3:00<br>4:00 | (1.20)<br>78% | (0.00)<br>0% | | | | | | | |
| 211 | 211.00 | 19.16 | | 3:00/0.33 | | | | | | | | | |
| 210 | | | 1.52 | 3:00<br>2:00<br>2:00<br>2:00 | (0.68)<br>45% | (0.00)<br>0% | | | | | | | |
| | 209.48 | 20.68 | | 2:00/0.32 | | | | | | | 209.48 | | 20.68 |
| 209 | | | 1.53 | 3:00<br>3:00<br>2:00<br>4:00 | (1.34)<br>88% | (0.39)<br>25% | | (0.11)<br>37%<br>(0.33)<br>100%<br>(0.90)<br>100% | N/A<br>(0.27)<br>82%<br>(0.23)<br>26% | | 209.18<br>208.85 | **WEATHERED ROCK**<br>BROWN, BLACK AND TAN, SEVERELY WEATHERED, SOFT, VERY CLOSELY FRACTURED, GRANITE | 20.98<br>21.31 |
| 208 | 207.95 | 22.21 | | 4:00/0.33 | | | | | | | 207.95 | **CRYSTALLINE ROCK**<br>TAN, WHITE AND GRAY, MODERATELY SEVERE TO MODERATELY WEATHERED, MODERATELY HARD, VERY CLOSE TO CLOSELY FRACTURED, GRANITE | 22.21 |
| 207 | | | | | | | | | | | | BLACK, BROWN AND TAN, MODERATELY SEVERE TO MODERATELY WEATHERED, MEDIUM HARD TO SOFT, VERY CLOSE TO CLOSELY FRACTURED, GNEISS | |
| 206 | | | | | | | | | | | | Boring Terminated at Elevation 207.95 m IN CRYSTALLINE ROCK (GNEISS) | |
| 205 | | | | | | | | | | | | | |
| 204 | | | | | | | | | | | | | |
| 203 | | | | | | | | | | | | | |
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| 195 | | | | | | | | | | | | | |

NCDOT CORE SINGLE R2413C_GEO_US220_SBRAMP_BH.GPJ NC_DOT.GDT 10/01/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B2-A | **STATION** 11+52.2 | **OFFSET** 1.4 m LT | **ALIGNMENT** SB220RP — **0 HR.** 3.20 |
| **COLLAR ELEV.** 232.01 m | **TOTAL DEPTH** 11.66 m | **NORTHING** 275,361.4 | **EASTING** 527,344.0 — **24 HR.** 3.20 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/12/97 | **COMP. DATE** 11/12/97 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 232.01 GROUND SURFACE | 0.00 |
| | | | | | | | | | | 231.61 ASPHALT | 0.40 |
| | | | | | | | | | | AGGREGATE BASE COURSE | |
| | | | | | | | | | | **ROADWAY EMBANKMENT** TAN AND BROWN, SILTY SAND | |
| | 230.63 | 1.38 | 4 | 6 | 7 | 13 | | D | | 229.81 | 2.20 |
| | 229.10 | 2.91 | 3 | 2 | 3 | 5 | | | | **ALLUVIAL** GRAY AND BROWN, SLIGHTLY SILTY SAND | |
| | 227.58 | 4.43 | 5 | 3 | 2 | 5 | SS-20 | 33% | | 227.51 | 4.50 |
| | | | | | | | | | | GRAY AND BROWN, SANDY SILTY CLAY | |
| | 226.05 | 5.96 | 2 | 4 | 6 | 10 | | Sat. | | 226.51 | 5.50 |
| | | | | | | | | | | GRAY AND BROWN, SAND WITH GRAVEL | |
| | 224.53 | 7.48 | 7 | 20 | 34 | 54 | | W | | 225.41 | 6.60 |
| | | | | | | | | | | **RESIDUAL** TAN, BROWN AND BLACK, SILTY SAND | |
| | 223.00 | 9.01 | 25 | 75/15 | | 100/30 | | | | 222.81 | 9.20 |
| | | | | | | | | | | **WEATHERED ROCK** TAN AND WHITE, GRANITE | |
| | 221.48 | 10.53 | 30/2 | | | 30/2 | | | | 220.35 | 11.66 |
| | | | | | | | | | | Boring Terminated at Elevation 220.35 m ON CRYSTALLINE ROCK (GRANITE) | |

NCDOT BORE SINGLE R2413C_GEO_US220_SBRAMP_BH.GPJ NC_DOT.GDT 10/01/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B | **STATION** 11+46.2 | **OFFSET** 6.8 m RT | **ALIGNMENT** SB220RP — **0 HR.** 1.00 |
| **COLLAR ELEV.** 230.19 m | **TOTAL DEPTH** 14.14 m | **NORTHING** 275,366.6 | **EASTING** 527,335.2 — **24 HR.** 1.20 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/10/97 | **COMP. DATE** 11/11/97 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 230.19 | | 0.00 | | | | | | | | GROUND SURFACE | 0.00 |
| 229.21 | | 0.98 | 1 | 2 | 2 | 4 | | M | | **ALLUVIAL** BROWN, SILTY AND WITH TRACE ORGANICS | |
| 227.99 | | 2.20 | 1 | 1 | 1 | 2 | | M | | | |
| 227.01 | | 3.18 | | | | | | | | TAN AND GRAY, SANDY SILTY CLAY | |
| 226.79 | | 3.40 | 3 | 2 | 2 | 4 | SS-3A | 27% | | GRAY, FINE TO COARSE GRAINED SAND WITH SOME WOOD FRAGMENTS | |
| 225.49 | | 4.70 | 2 | 3 | 9 | 12 | | Sat. | | | |
| 223.96 | | 6.23 | 50/2 | | | 50/2 | | | | **CRYSTALLINE ROCK** WHITE, BLACK AND BROWN, GNEISS | |
| 223.07 | | 7.12 | | | | | | | | **WEATHERED ROCK** BROWN, BLACK AND TAN, SCHIST | |
| 219.10 | | 11.09 | 27 | 63 | 37/5 | 100/20 | | | | | |
| 217.95 | | 12.24 | 50/4 | | | 50/4 | | | | | |
| 217.68 | | 12.51 | | | | | | | | **CRYSTALLINE ROCK** BLACK, GRAY AND WHITE, GNEISS WITH SCHIST LAYERS | |
| 216.49 | | 13.70 | | | | | | | | RMR = 66 (CLASS II - GOOD ROCK) | |
| 216.05 | | 14.14 | | | | | | | | BLACK AND BROWN, SCHIST | |

Boring Terminated at Elevation 216.05 m IN CRYSTALLINE ROCK (SCHIST)

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** B2-B | **STATION** 11+46.2 | **OFFSET** 6.8 m RT | **ALIGNMENT** SB220RP — **0 HR.** 1.00 |
| **COLLAR ELEV.** 230.19 m | **TOTAL DEPTH** 14.14 m | **NORTHING** 275,366.6 | **EASTING** 527,335.2 — **24 HR.** 1.20 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** NW Casing w/ Core | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/10/97 | **COMP. DATE** 11/11/97 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 6.70 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 223.94 | | | | | | | | | | | Begin Coring @ 6.25 m | |
| | 223.94 / 223.67 | 6.25 / 6.52 | 0.27 | 3:00/0.27 | (0.27) 100% | (0.00) 0% | | (0.87) 100% | (0.39) 45% | | 223.94 **CRYSTALLINE ROCK** WHITE, BLACK AND BROWN, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD TO HARD, VERY CLOSE TO MODERATELY CLOSELY FRACTURED, GNEISS | 6.25 |
| | | | 1.52 | 4:00 3:00 4:00 2:00 1:00/0.32 | (0.60) 39% | (0.12) 8% | | (0.15) 3% | (0.00) 0% N/A | | 223.07 **WEATHERED ROCK** BROWN, BLACK AND TAN, SEVERELY WEATHERED, SOFT, VERY CLOSELY FRACTURED, SCHIST | 7.12 |
| | 222.15 | 8.04 | 1.53 | 1:00 1:00 2:00 0:30 0:30/0.33 | (0.13) 8% | (0.00) 0% | | | | | | |
| | 220.62 | 9.57 | 1.52 | 0:30 0:30 0:30 0:30 0:30/0.32 | (0.02) 1% | (0.00) 0% | | | | | | |
| | 219.10 | 11.09 | | N=100/20 | | | | | | | | |
| | 217.91 | 12.28 | | | | | | | | | | |
| | 217.58 | 12.61 | 0.33 | N=50/4 4:00/0.33 | (0.12) 36% | (0.00) 0% | | (1.19) 100% | (1.09) 92% | | 217.68 **CRYSTALLINE ROCK** BLACK, GRAY AND WHITE, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY HARD TO HARD, VERY CLOSELY TO MODERATELY CLOSELY FRACTURED, GNEISS WITH SCHIST LAYERS | 12.51 |
| | | | 1.53 | 4:00 4:00 5:00 3:00 3:00/0.33 | (1.47) 96% | (1.09) 71% | | | | | | |
| | 216.05 | 14.14 | | | | | | (0.30) 68% | (0.00) 0% | | 216.49 RMR = 66 (CLASS II - GOOD ROCK) 216.05 BLACK AND BROWN, MODERATELY SEVERELY WEATHERED, SOFT TO MEDIUM HARD, VERY CLOSELY FRACTURED, SCHIST | 13.70 14.14 |

Boring Terminated at Elevation 216.05 m IN CRYSTALLINE ROCK (SCHIST)

NCDOT BORE DOUBLE R2413C_GEO_US220_SBRAMP_BH.GPJ NC_DOT.GDT 10/01/10

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-A | **STATION** 11+64.3 | **OFFSET** 2.3 m LT | **ALIGNMENT** SB220RP — **0 HR.** 1.00 |
| **COLLAR ELEV.** 231.86 m | **TOTAL DEPTH** 6.78 m | **NORTHING** 275,349.5 | **EASTING** 527,346.0 — **24 HR.** 2.40 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/11/97 | **COMP. DATE** 11/11/97 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 232 | | | | | | | | | | 231.86 GROUND SURFACE | 0.00 |
| | | | | | | | | | | 231.56 ASPHALT | 0.30 |
| 231 | | | | | | | | | | AGGREGATE BASE COURSE | |
| | 230.55 | 1.31 | | | | | | | | **ROADWAY EMBANKMENT** BROWN, CLAYEY SILTY SAND AND GRAVEL, WITH TRACE WOOD FRAGMENTS | |
| 230 | | | 5 | 4 | 2 | 6 | | M | | 230.26 | 1.60 |
| | | | | | | | | | | 229.76 **ALLUVIAL** BROWN, SAND | 2.10 |
| 229 | 229.02 | 2.84 | | | | | | | | BROWN, SILIGHTLY SILTY SAND WITH GRAVEL | |
| | | | 100/14 | | | | | | | 228.96 **WEATHERED ROCK** BROWN AND GRAY, GRANITE | 2.90 |
| 228 | 227.94 | 3.92 | | | | | | | | 227.94 | 3.92 |
| | | | 20/0 | | | | | | | **CRYSTALLINE ROCK** TAN AND GRAY, GRANITE | |
| 227 | | | | | | | | | | 227.22 | 4.64 |
| | | | | | | | | | | **WEATHERED ROCK** TAN AND BROWN, GRANITE | |
| 226 | | | | | | | | | | | |
| | | | | | | | | | | 225.51 | 6.35 |
| 225 | | | | | | | | | | 225.08 **CRYSTALLINE ROCK** TAN AND GRAY, GRANITE | 6.78 |
| | | | | | | | | | | Boring Terminated at Elevation 225.08 m IN CRYSTALLINE ROCK (GRANITE) | |
| 224 | | | | | | | | | | | |
| 223 | | | | | | | | | | | |
| 222 | | | | | | | | | | | |
| 221 | | | | | | | | | | | |
| 220 | | | | | | | | | | | |
| 219 | | | | | | | | | | | |
| 218 | | | | | | | | | | | |
| 217 | | | | | | | | | | | |
| 216 | | | | | | | | | | | |
| 215 | | | | | | | | | | | |
| 214 | | | | | | | | | | | |
| 213 | | | | | | | | | | | |
| 212 | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
## CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-A | **STATION** 11+64.3 | **OFFSET** 2.3 m LT | **ALIGNMENT** SB220RP — **0 HR.** 1.00 |
| **COLLAR ELEV.** 231.86 m | **TOTAL DEPTH** 6.78 m | **NORTHING** 275,349.5 | **EASTING** 527,346.0 — **24 HR.** 2.40 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/11/97 | **COMP. DATE** 11/11/97 | **SURFACE WATER DEPTH** N/A |
| **CORE SIZE** NWD4 | **TOTAL RUN** 2.86 m | | |

| ELEV (m) | RUN ELEV (m) | DEPTH (m) | RUN (m) | DRILL RATE (Min/0.3m) | RUN REC. (m) % | RUN RQD (m) % | SAMP. NO. | STRATA REC. (m) % | STRATA RQD (m) % | LOG | DESCRIPTION AND REMARKS ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 227.94 | | | | | | | | | | | Begin Coring @ 3.92 m | |
| | 227.94 | 3.92 | 1.33 | N=20/0 5:00 5:00 4:00 | (0.88) 66% | (0.38) 29% | | (0.72) 100% | (0.38) 53% | | 227.94 **CRYSTALLINE ROCK** BROWN, TAN, GRAY AND BLACK, MODERATELY SEVERE TO MODERATELY WEATHERED, SOFT TO MODERATELY HARD, VERY CLOSELY TO CLOSELY FRACTURED, GRANITE | 3.92 |
| 227 | | | | | | | | | | | 227.22 | 4.64 |
| | 226.61 | 5.25 | | 2:00 1:00/0.13 | | | | (0.12) 7% | N/A | | **WEATHERED ROCK** BROWN, TAN, GRAY AND BLACK, SEVERELY WEATHERED, SOFT, VERY CLOSELY FRACTURED, GRANITE | |
| 226 | | | 1.53 | 1:00 1:00 | (0.43) 28% | (0.13) 8% | | | | | | |
| | | | | 1:00 1:00 | | | | | | | 225.51 | 6.35 |
| 225 | 225.08 | 6.78 | | 2:30/0.33 | | | | (0.43) 100% | (0.13) 30% | | 225.08 **CRYSTALLINE ROCK** BROWN, TAN, GRAY AND BLACK, MODERATELY SEVERE TO MODERATELY WEATHERED, SOFT TO MODERATELY HARD, VERY CLOSELY TO CLOSELY FRACTURED, GRANITE | 6.78 |
| | | | | | | | | | | | Boring Terminated at Elevation 225.08 m IN CRYSTALLINE ROCK (GRANITE) | |
| 224 | | | | | | | | | | | | |
| 223 | | | | | | | | | | | | |
| 222 | | | | | | | | | | | | |
| 221 | | | | | | | | | | | | |
| 220 | | | | | | | | | | | | |
| 219 | | | | | | | | | | | | |
| 218 | | | | | | | | | | | | |
| 217 | | | | | | | | | | | | |
| 216 | | | | | | | | | | | | |
| 215 | | | | | | | | | | | | |
| 214 | | | | | | | | | | | | |
| 213 | | | | | | | | | | | | |
| 212 | | | | | | | | | | | | |
| 211 | | | | | | | | | | | | |
| 210 | | | | | | | | | | | | |
| 209 | | | | | | | | | | | | |
| 208 | | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34429.1.1 | **ID.** R-2413C | **COUNTY** GUILFORD | **GEOLOGIST** Steege, PSI |
| **SITE DESCRIPTION** BRIDGE ON SB US 220 RAMP OVER HAW RIVER AT STA. 11+43.2 -US 220 RAMP- | | | **GROUND WTR (m)** |
| **BORING NO.** EB2-B | **STATION** 11+59.3 | **OFFSET** 9.4 m RT | **ALIGNMENT** SB220RP — **0 HR.** 2.70 |
| **COLLAR ELEV.** 231.46 m | **TOTAL DEPTH** 9.91 m | **NORTHING** 275,353.4 | **EASTING** 527,333.9 — **24 HR.** 2.90 |
| **DRILL RIG/HAMMER EFF./DATE** CME-55 | | **DRILL METHOD** H.S. Augers | **HAMMER TYPE** Manual |
| **DRILLER** Stull, PSI | **START DATE** 11/11/97 | **COMP. DATE** 11/11/97 | **SURFACE WATER DEPTH** N/A |

| ELEV (m) | DRIVE ELEV (m) | DEPTH (m) | BLOW COUNT 15cm | 15cm | 15cm | BLOWS PER 30 CM (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (m) | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 231.46 | 0.00 | | | | | | | | 231.46 GROUND SURFACE | 0.00 |
| | | | 1 | 2 | 3 | 5 | | M | | **ARTIFICIAL FILL** BROWN, SANDY SILT WITH MAN-MADE DEBRIS | 230.56 / 0.90 |
| | 230.05 | 1.41 | 2 | 2 | 5 | 7 | SS-12 | 19% | | **ROADWAY EMBANKMENT** RED, SILTY CLAY, WITH SOME WOOD AND ROCK FRAGMENTS | |
| | 228.52 | 2.94 | 10 | 6 | 7 | 13 | SS-13A | 39% | | | 228.16 / 3.30 |
| | 227.00 | 4.46 | 22 | 68 | 32/14 | 100/29 | | | | **RESIDUAL** TAN TO GREEN AND GRAY, SILTY SAND | 226.76 / 4.70 |
| | 225.47 | 5.99 | 8 | 12 | 18 | 30 | | W | | **WEATHERED ROCK** GREEN AND GRAY, AMPHIBOLITE | 225.96 / 5.50 |
| | 223.95 | 7.51 | 15 | 52 | 48/8 | 100/23 | | | | **RESIDUAL** TAN, SANDY SILT | 223.76 / 7.70 |
| | 222.42 | 9.04 | 62 | 38/4 | | 100/19 | | | | **WEATHERED ROCK** TAN AND GRAY, GRANITE | 221.55 / 9.91 |
| | | | | | | | | | | Boring Terminated at Elevation 221.55 m ON CRYSTALLINE ROCK (GRANITE) | |

NCDOT BORE SINGLE R2413C_GEO_US220_SBRAMP_BH.GPJ NC_DOT.GDT 10/01/10

*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-35 | 11.3 RT | 11+13.9 | 1.67-2.12 | A-2-4(0) | 25 | NP | 28.5 | 49.7 | 13.0 | 8.2 | 99 | 86 | 25 | 29.3 | - |
| SS-37b | 11.3 RT | 11+13.9 | 4.02-4.47 | A-7 | - | - | - | - | - | - | - | - | - | 57.1 | - |
| SS-41 | 11.3 RT | 11+13.9 | 10.12-10.57 | A-2-4(0) | 35 | 3 | 50.3 | 27.4 | 15.4 | 5.9 | 99 | 64 | 27 | 20.2 | - |

*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-59b | 1.4 LT | 11+33.5 | 4.46-4.91 | A-7-5 | - | - | - | - | - | - | - | - | - | 37.3 | - |
| SS-60b | 1.4 LT | 11+33.5 | 5.99-6.44 | A-7-5(6) | 41 | 12 | 27.1 | 13.8 | 30.7 | 24.8 | 96 | 73 | 59 | 33.1 | - |

*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-54 | 10.4 RT | 11+28.5 | 11.57-12.02 | A-2-4(0) | 62 | 3 | 45.3 | 29.7 | 12.6 | 5.6 | 93 | 70 | 22 | - | - |

*B2-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-20 | 1.4 LT | 11+52.2 | 4.43-4.88 | A-7-5 | - | - | - | - | - | - | - | - | - | 33.3 | - |

*B2-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-3a | 6.8 RT | 11+46.2 | 3.18-3.40 | A-6(3) | 22 | 11 | 16.6 | 40.7 | 18.2 | 23.8 | 99 | 89 | 48 | 27.1 | - |

*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-12 | 9.4 RT | 11+59.3 | 1.41-1.86 | A-6(2) | 22 | 18 | 17.3 | 26.3 | 19.8 | 35.6 | 99 | 86 | 60 | 19.1 | - |
| SS-13a | 9.4 RT | 11+59.3 | 2.92-3.30 | A-6 | - | - | - | - | - | - | - | - | - | 38.5 | - |

*CHANNEL BED MATERIAL*

## 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 | | |
| S-1 | CL | 11+43 | SURFACE | A-1-b(0) | 30 | NP | 73.9 | 8.6 | 1.1 | 1.7 | 85 | 31 | 3 | - | - |

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

# FIELD SCOUR REPORT

WBS: 34429.1.1 TIP: R-2413C COUNTY: GUILFORD

DESCRIPTION(1): Bridge at 11+43.2 on South Bound US 220 Ramp over Haw River

## EXISTING BRIDGE

Information from: Field Inspection X Microfilm ____ (reel ____ pos: ____ )
Other (explain) NCDOT Bridge Survey & Hydraulics Design Report

Bridge No.: ____ Length: ____ Total Bents: ____ Bents in Channel: ____ Bents in Floodplain: ____
Foundation Type: ____

**EVIDENCE OF SCOUR(2)**

Abutments or End Bent Slopes: N/A

Interior Bents: N/A

Channel Bed: Minor channel erosion is evident in relation to downcutting of channel.

Channel Bank: Extensive bank erosion. Banks are near vertical and 5 to 15 feet in height.

**EXISTING SCOUR PROTECTION**

Type(3): N/A

Extent(4): N/A

Effectiveness(5): N/A

Obstructions(6): None

## DESIGN INFORMATION

Channel Bed Material(7): Brown and gray, silty sand and coarse sand, with gravel

Channel Bank Material(8): Brown, sandy clay and brown, silty fine to coarse sand with gravel and trace organics.

Channel Bank Cover(9): Dense undergrowth with young to mature trees, shrubs.

Floodplain Width(10): approximately 200 meters

Floodplain Cover(11): Dense undergrowth with young to mature trees, shrubs.

Stream is(12): Aggrading ____ Degrading X Static ____

Channel Migration Tend.(13): To the north.

There is an old abutment near the proposed bridge from a previous structure onsite.
US 220 bridges are approximately 100 meters downstream.
Old pavement system and roadway embankment are still intact from old road.

**DESIGN SCOUR ELEVATIONS(14)** Feet ____ Meters X

| BENTS | B1 | B2 |
|---|---|---|
| LT | 223.80 | 224.83 |
| RT | 223.48 | 223.57 |

Comparison of DSE to Hydraulics Unit theoretical scour:
The Geotechnical Engineering Unit's DSE was raised from the Hydraulics Unit estimate of scour in the Bridge Survey Report, dated Sept. 25, 2009.

**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 17, "Soil Test Results", for samples: SS-35, SS-3a (BANK) S-1 (CHANNEL)

Template Revised 02/07/06

**Reported by:** Christina M. Bruinsma, L.G. **Date:** 5/25/2010

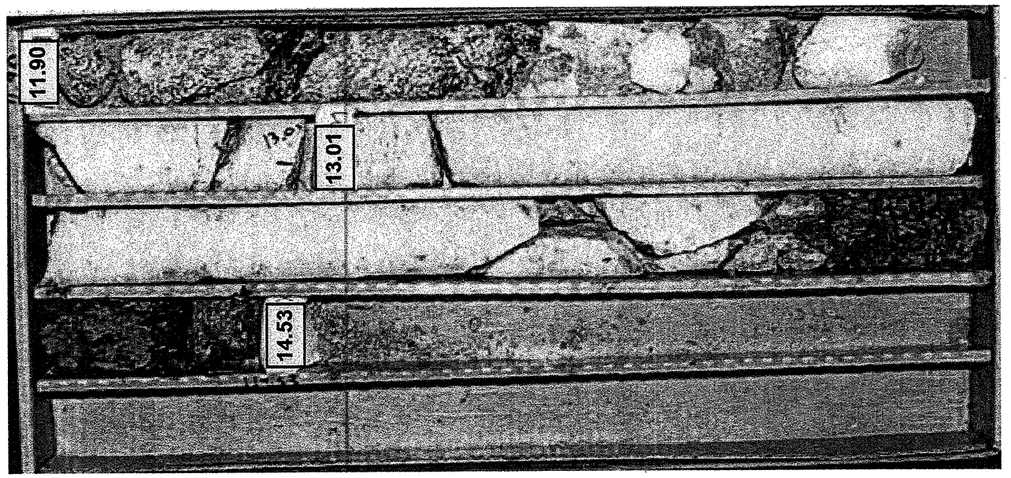
**INSTRUCTIONS**

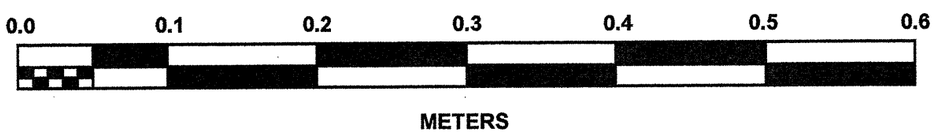
1 Describe the specific site's location, including route number and body of water crossed.
2 Note scour evidence at existing end bents or abutments (e.g. undermining, sloughing, degradations).
3 Note existing scour protection (e.g. rip rap).
4 Describe extent of existing scour protection.
5 Describe 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 theoritical 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.

# CORE PHOTOGRAPHS

## B1-A

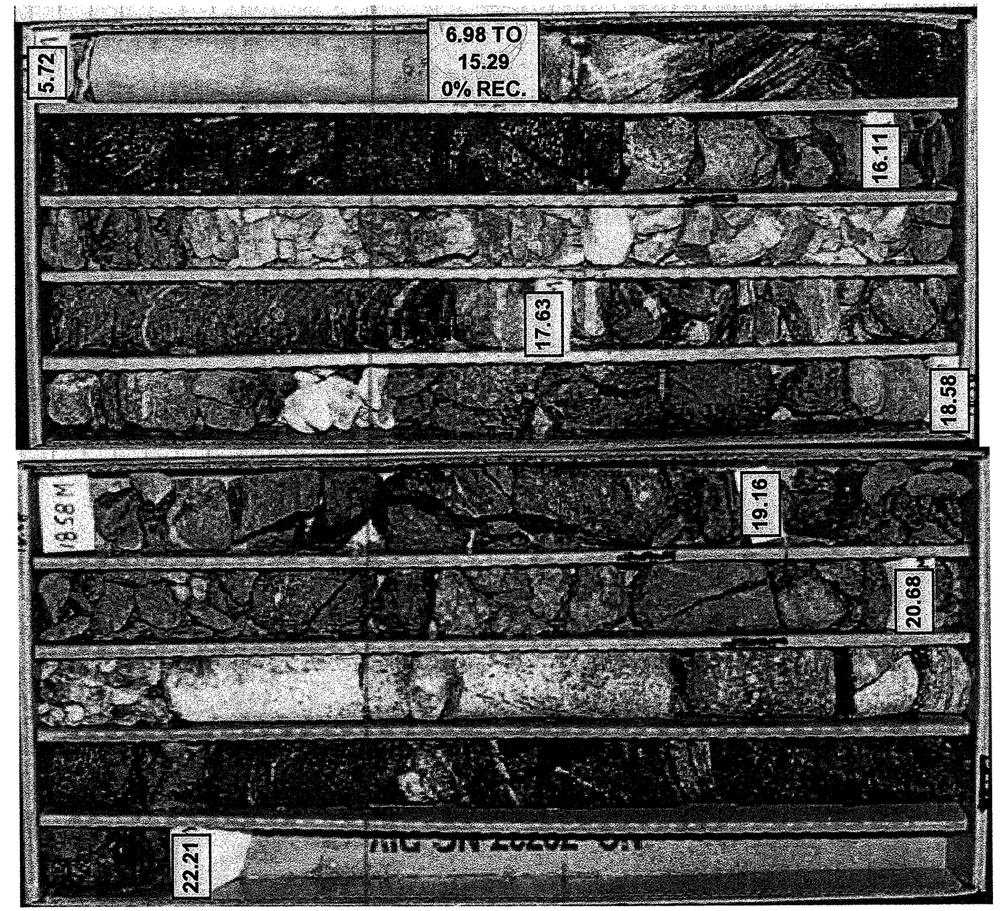
**BOX 1: 11.90 - 14.53 METERS**

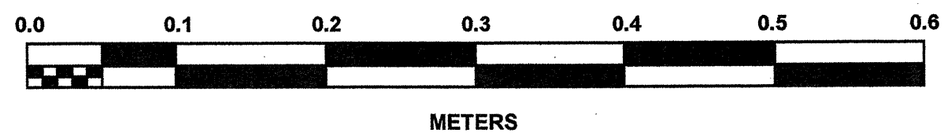



## B1-B

**BOXES 1 & 2: 5.72 - 22.21 METERS**

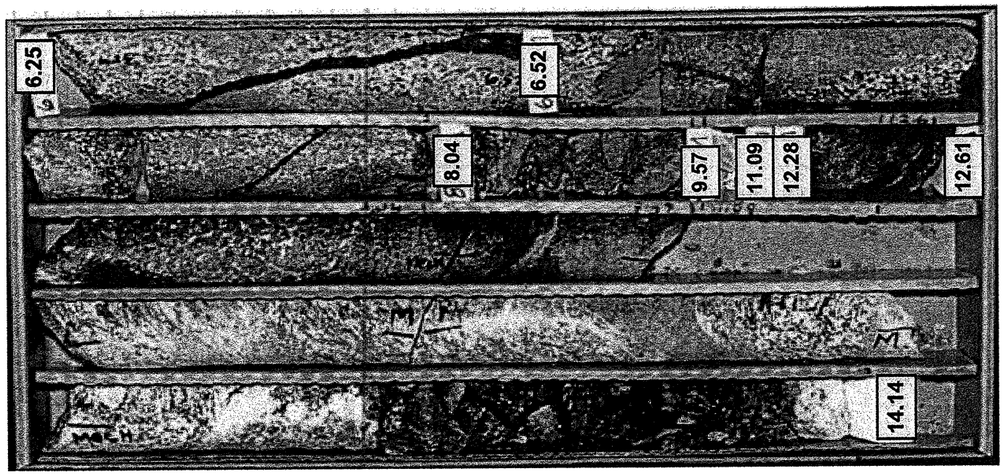


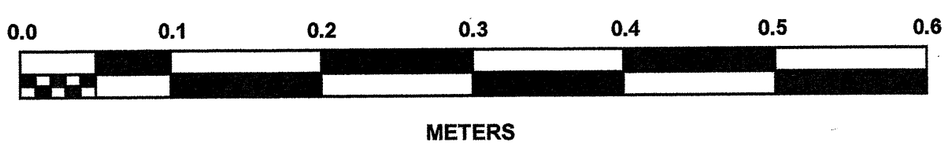



# CORE PHOTOGRAPHS

## B2-B

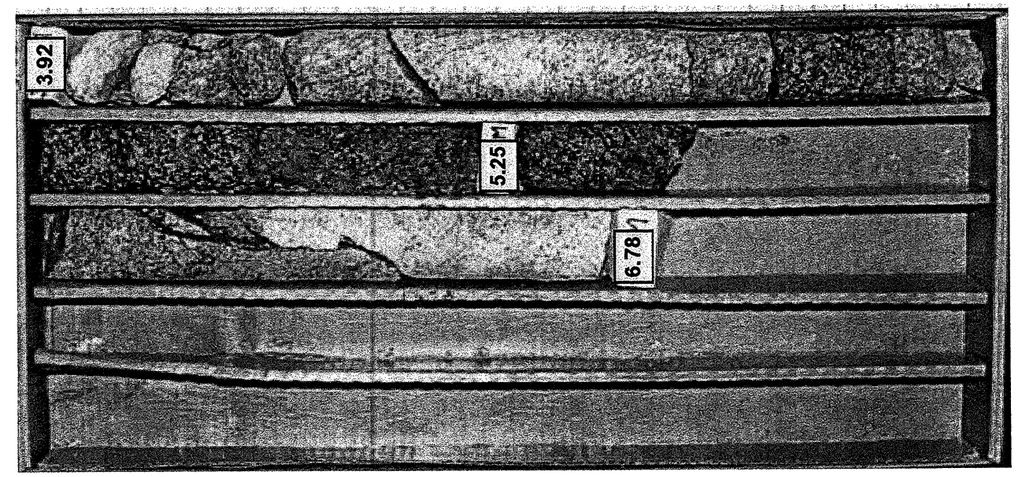
**BOX 1 : 6.25 - 14.14 METERS**

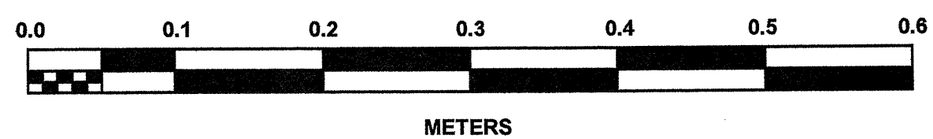



## EB2-A

**BOX 1: 3.92 - 6.78 METERS**



# SITE PHOTOGRAPH

Bridge on South Bound US 220 Ramp over Haw River at Station 11+43.2, -SB US 220 RAMP-

Looking East Towards US 220

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34429.1.1 (R-2413C) | 1 | 3 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34429.1.1 (R-2413C) F.A. PROJ. N/A

COUNTY ROCKINGHAM

PROJECT DESCRIPTION NC 68 CONNECTOR - US 220 FROM SOUTH OF HAW RIVER TO THE INTERSECTION OF US 220 AND EXISTING NC 68

SITE DESCRIPTION RETAINING WALL ALONG -Y10- FROM FROM STA. 12+08.00 TO 13+16.25

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3 | WALL ENVELOPE |


## 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.

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PERSONNEL

N. T. ROBERSON

J. L. PEDRO

INVESTIGATED BY J. L. PEDRO

CHECKED BY N. T. ROBERSON

SUBMITTED BY J. L. PEDRO

DATE JUNE 2011

NORTH CAROLINA LICENSED SEAL 2157 GEOLOGIST JAIME LOVE PEDRO

Jaime Love Pedro

PROJECT: 34429.1.1

ID: R-2413C

DRAWN BY: T. T. WALKER, J. L. PEDRO

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.

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34429.1.1 (R-2413C) | 2 |

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

# SUBSURFACE INVESTIGATION

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

### SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER 30 CM ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

### SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

### CONSISTENCY OR DENSENESS

| PRIMARY SOIL TYPE | COMPACTNESS OR CONSISTENCY | RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE) | RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($kN/m^2$) |
|---|---|---|---|
| GENERALLY GRANULAR MATERIAL (NON-COHESIVE) | VERY LOOSE<br>LOOSE<br>MEDIUM DENSE<br>DENSE<br>VERY DENSE | <4<br>4 TO 10<br>10 TO 30<br>30 TO 50<br>>50 | N/A |
| GENERALLY SILT-CLAY MATERIAL (COHESIVE) | VERY SOFT<br>SOFT<br>MEDIUM STIFF<br>STIFF<br>VERY STIFF<br>HARD | <2<br>2 TO 4<br>4 TO 8<br>8 TO 15<br>15 TO 30<br>>30 | <25<br>25 TO 50<br>50 TO 100<br>100 TO 200<br>200 TO 400<br>>400 |

### TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### PLASTICITY

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

### COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

### GRADATION

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

### ANGULARITY OF GRAINS

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

### MINERALOGICAL COMPOSITION

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

### COMPRESSIBILITY

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

### PERCENTAGE OF MATERIAL

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

| OTHER MATERIAL | |
|---|---|
| TRACE | 1 - 10% |
| LITTLE | 10 - 20% |
| SOME | 20 - 35% |
| HIGHLY | 35% AND ABOVE |

### GROUND WATER

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

### MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

### ABBREVIATIONS

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
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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 152mm CONTINUOUS FLIGHT AUGER
- [ ] 203mm HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE ____mm STEEL TEETH
- [ ] TRICONE ____mm TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [X] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

### ROCK DESCRIPTION

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 3 CM PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

| | |
|---|---|
| WEATHERED ROCK (WR) | NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER 30 CM IF TESTED. |
| CRYSTALLINE ROCK (CR) | FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC. |
| NON-CRYSTALLINE ROCK (NCR) | FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC. |
| COASTAL PLAIN SEDIMENTARY ROCK (CP) | COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC. |

### WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V. 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 BLOWS PER 30 CM* |
| 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 BLOWS PER 30 CM* |
| COMPLETE | ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE. |

### ROCK HARDNESS

| | |
|---|---|
| VERY HARD | CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. |
| HARD | CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. |
| MODERATELY HARD | CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 6 MM DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. |
| MEDIUM HARD | CAN BE GROOVED OR GOUGED 13 MM DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 25 MM MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. |
| SOFT | CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. |
| VERY SOFT | CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 25 MM OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL. |

### FRACTURE SPACING

| TERM | SPACING |
|---|---|
| VERY WIDE | MORE THAN 3 M |
| WIDE | 3 TO 10 M |
| MODERATELY CLOSE | 30 TO 100 CM |
| CLOSE | 5 TO 30 CM |
| VERY CLOSE | LESS THAN 5 CM |

### BEDDING

| TERM | THICKNESS |
|---|---|
| VERY THICKLY BEDDED | > 1 M |
| THICKLY BEDDED | 0.5 - 1 M |
| THINLY BEDDED | 0.05 - 0.5 M |
| VERY THINLY BEDDED | 10 - 50 MM |
| THICKLY LAMINATED | 2.5 - 10 MM |
| THINLY LAMINATED | < 2.5 MM |

### 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. |

### TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CM 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) OF A 63.5 KG HAMMER FALLING 0.76 M REQUIRED TO PRODUCE A PENETRATION OF 30 CM INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 3 CM PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK:

ELEVATION: M

NOTES:

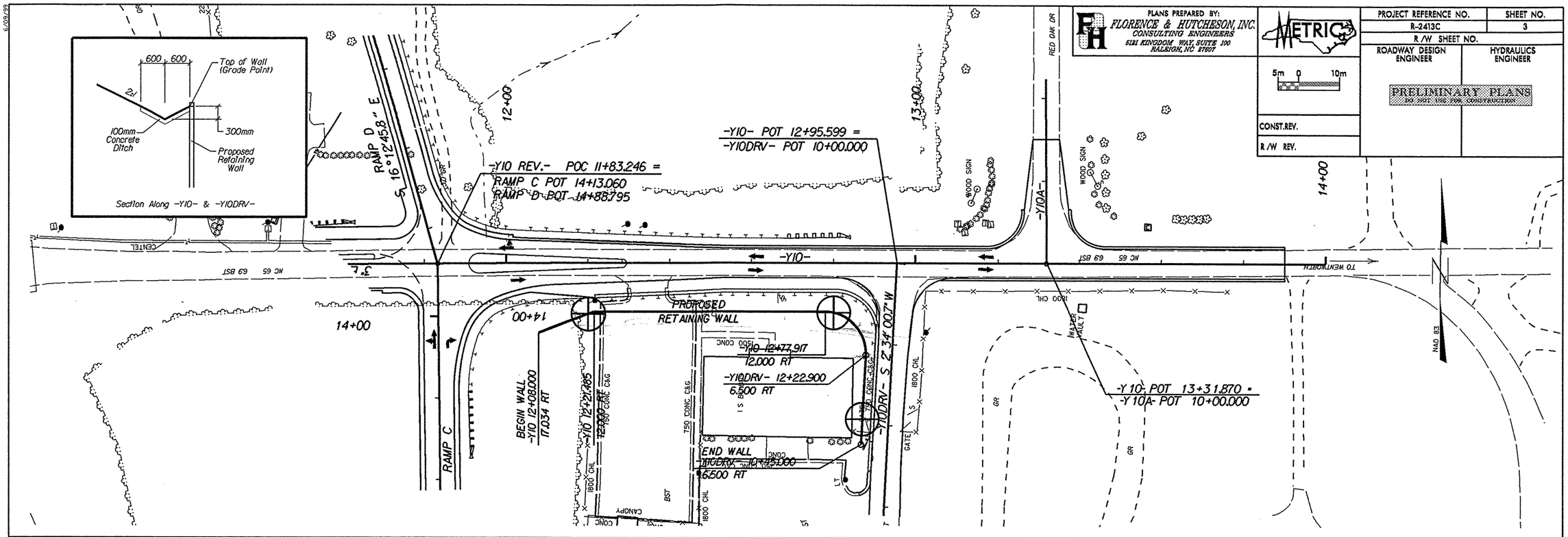
PLANS PREPARED BY:
FLORENCE & HUTCHESON, INC.
CONSULTING ENGINEERS
5121 KINGDOM WAY, SUITE 100
RALEIGH, NC 27607

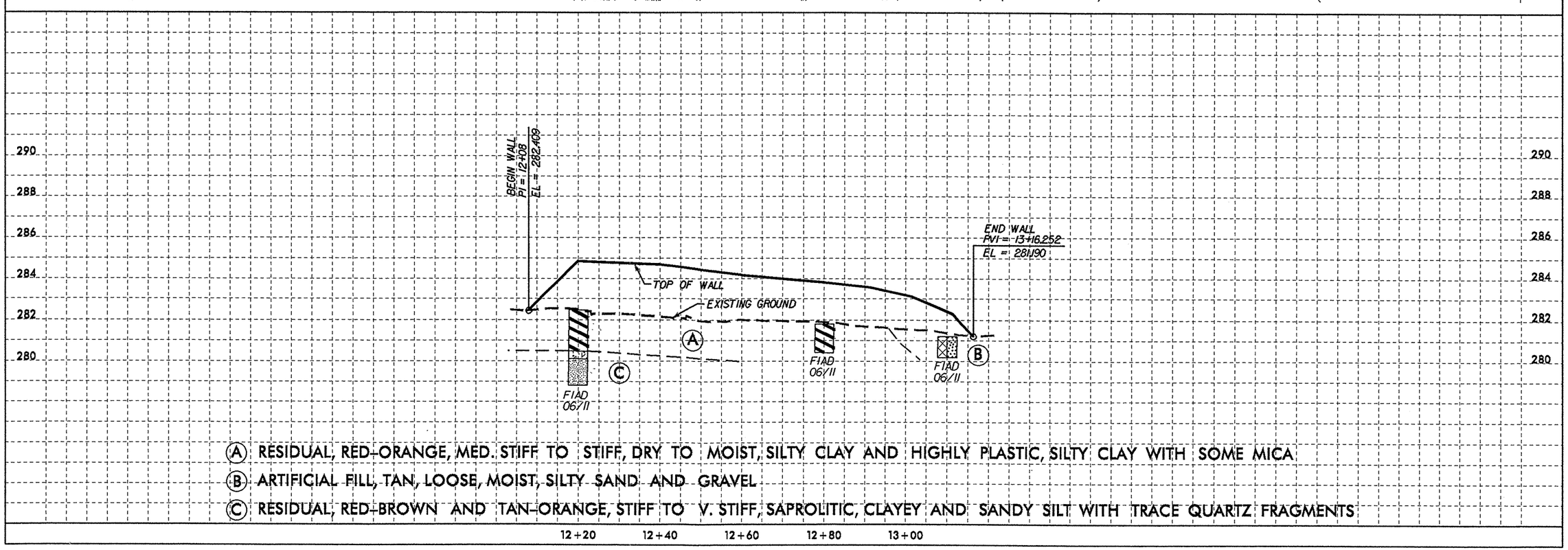
METRIC
5m 0 10m

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| R-2413C | 3 |
| R/W SHEET NO. | |
| ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER |

PRELIMINARY PLANS
NOT TO BE USED FOR CONSTRUCTION

CONST. REV.
R/W REV.




(A) RESIDUAL, RED-ORANGE, MED. STIFF TO STIFF, DRY TO MOIST, SILTY CLAY AND HIGHLY PLASTIC, SILTY CLAY WITH SOME MICA

(B) ARTIFICIAL FILL, TAN, LOOSE, MOIST, SILTY SAND AND GRAVEL

(C) RESIDUAL, RED-BROWN AND TAN-ORANGE, STIFF TO V. STIFF, SAPROLITIC, CLAYEY AND SANDY SILT WITH TRACE QUARTZ FRAGMENTS

FILE: SPOILS
DATE: 6/09/99
FOR SHEET: 3
FOR SHEETS: 3
FOR FIGURE: SPOILS

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34418.1.4 (R-2309AB) | 1 | 20 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34418.1.4 F.A. PROJ. STP-220(5)

COUNTY GUILFORD

PROJECT DESCRIPTION US 220 (BATTLEGROUND AVE.) FROM SR 2182 TO 0.2 MILES NORTH OF SR 2313 IN GREENSBORO

SITE DESCRIPTION BRIDGE NO 313 ON -L- (US 220, BATTLEGROUND AVE.) OVER LAKE BRANDT ON REEDY FORK

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3 | SITE PLAN |
| 4 | PROFILE |
| 5-8 | CROSS SECTIONS |
| 9-16 | BORE LOGS & CORE REPORTS |
| 17 | SOIL TEST RESULTS |
| 18-19 | CORE PHOTOGRAPHS |
| 20 | SITE PHOTOGRAPH |


## 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.

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KLEINFELDER PERSONNEL

J. FREGOSI

D. GOODNIGHT

C. HEUN

T.K. HICKS

R. TOOTHMAN

P. WEAVER

T. WELLS

INVESTIGATED BY C.D. CZAJKA

CHECKED BY N.T. ROBERSON

SUBMITTED BY N.T. ROBERSON

DATE JUNE 2009

NORTH CAROLINA LICENSED SEAL 2151 GEOLOGIST CHARLES DOUG CZAJKA 06/17/09

DRAWN BY: C.D. CZAJKA & T.T. WALKER

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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.

PROJECT: 34418.1.4

ID: R-2309AB

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34418.1.4 (R-2309AB) | 2 |

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

# SUBSURFACE INVESTIGATION

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

### SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

### SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

### CONSISTENCY OR DENSENESS

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

### TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

### SOIL MOISTURE - CORRELATION OF TERMS

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

### PLASTICITY

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

### COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

### GRADATION

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

### ANGULARITY OF GRAINS

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

### MINERALOGICAL COMPOSITION

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

### COMPRESSIBILITY

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

### PERCENTAGE OF MATERIAL

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

| OTHER MATERIAL | |
|---|---|
| TRACE | 1 - 10% |
| LITTLE | 10 - 20% |
| SOME | 20 - 35% |
| HIGHLY | 35% AND ABOVE |

### GROUND WATER

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

### MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL

SAMPLE DESIGNATIONS
S - BULK SAMPLE
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE
RS - ROCK SAMPLE
RT - RECOMPACTED TRIAXIAL SAMPLE
CBR - CALIFORNIA BEARING RATIO SAMPLE

### ABBREVIATIONS

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
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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

### EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [X] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [X] BARGE
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [ ] TRICONE ____" STEEL TEETH
- [X] TRICONE 2 7/8 " TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [ ] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [X] -N Q
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [X] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

### ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

### WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V 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. |

### ROCK HARDNESS

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

### FRACTURE SPACING

| 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 |

### BEDDING

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

### INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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. |

### TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (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.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (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.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

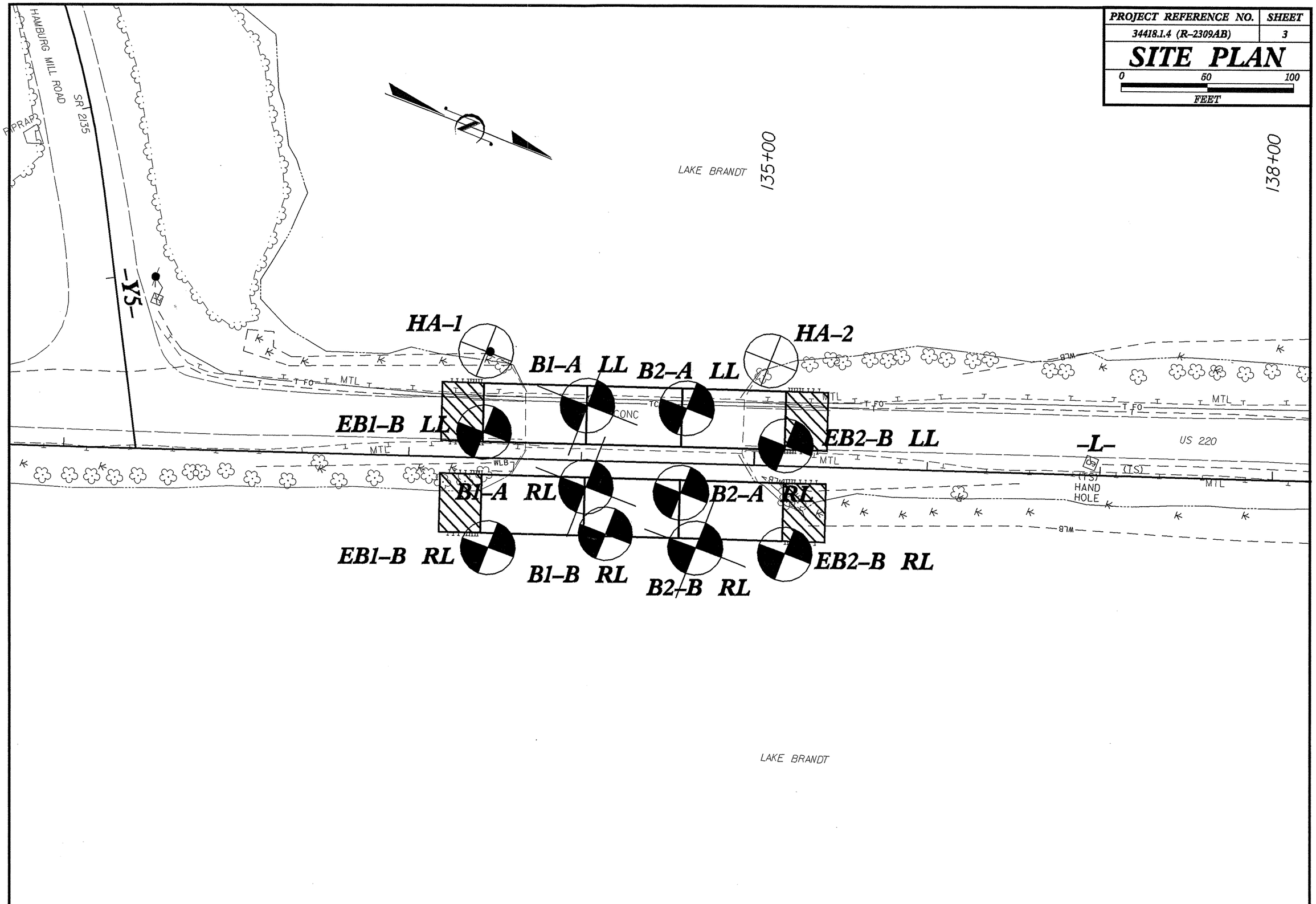
BENCH MARK: D-170, US COAST & GEODETIC SURVEY BENCHMARK ON EXISTING BRIDGE
ELEVATION: 751.3 FT.

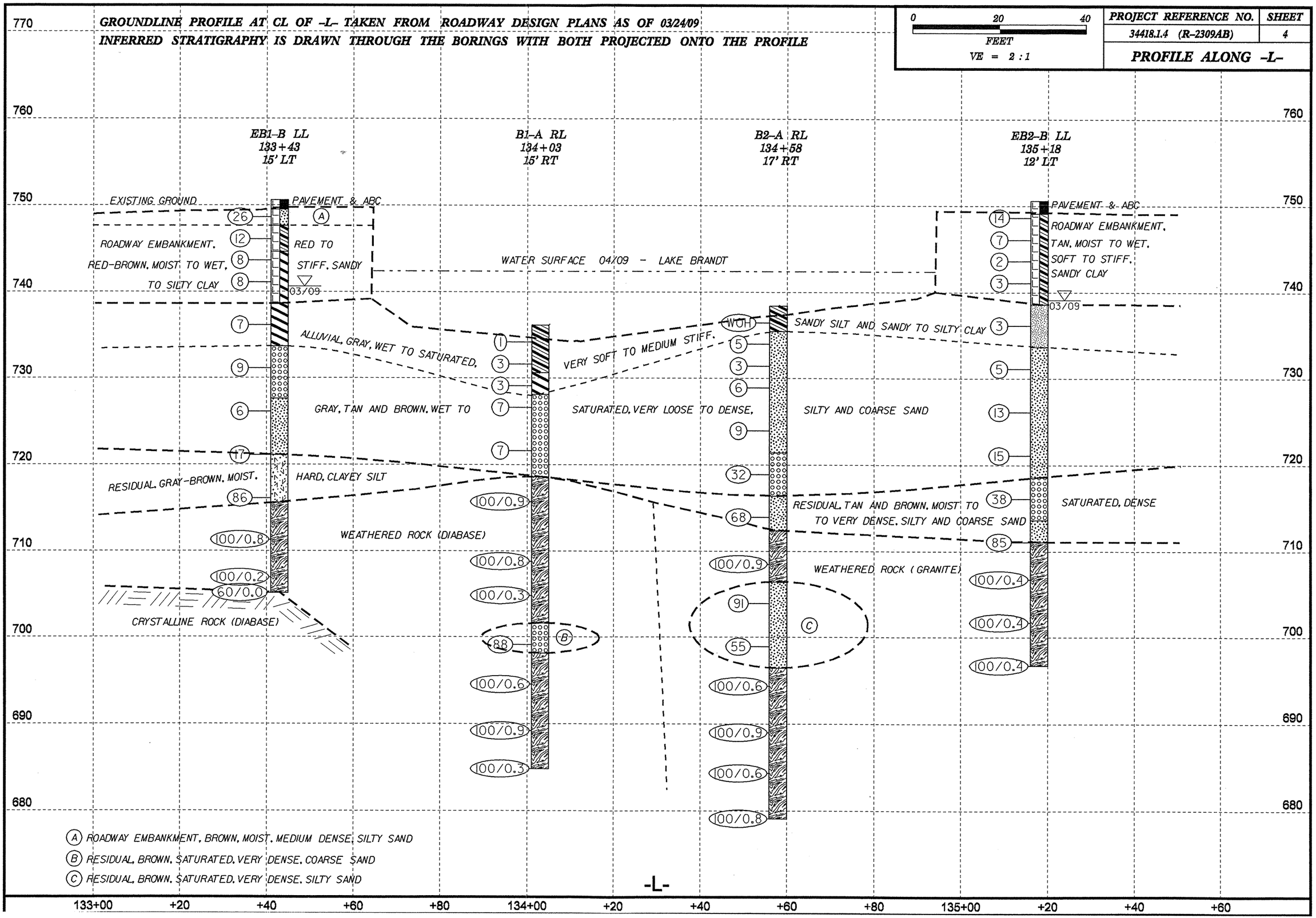
NOTES:

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 3 |

# SITE PLAN

0 50 100
FEET

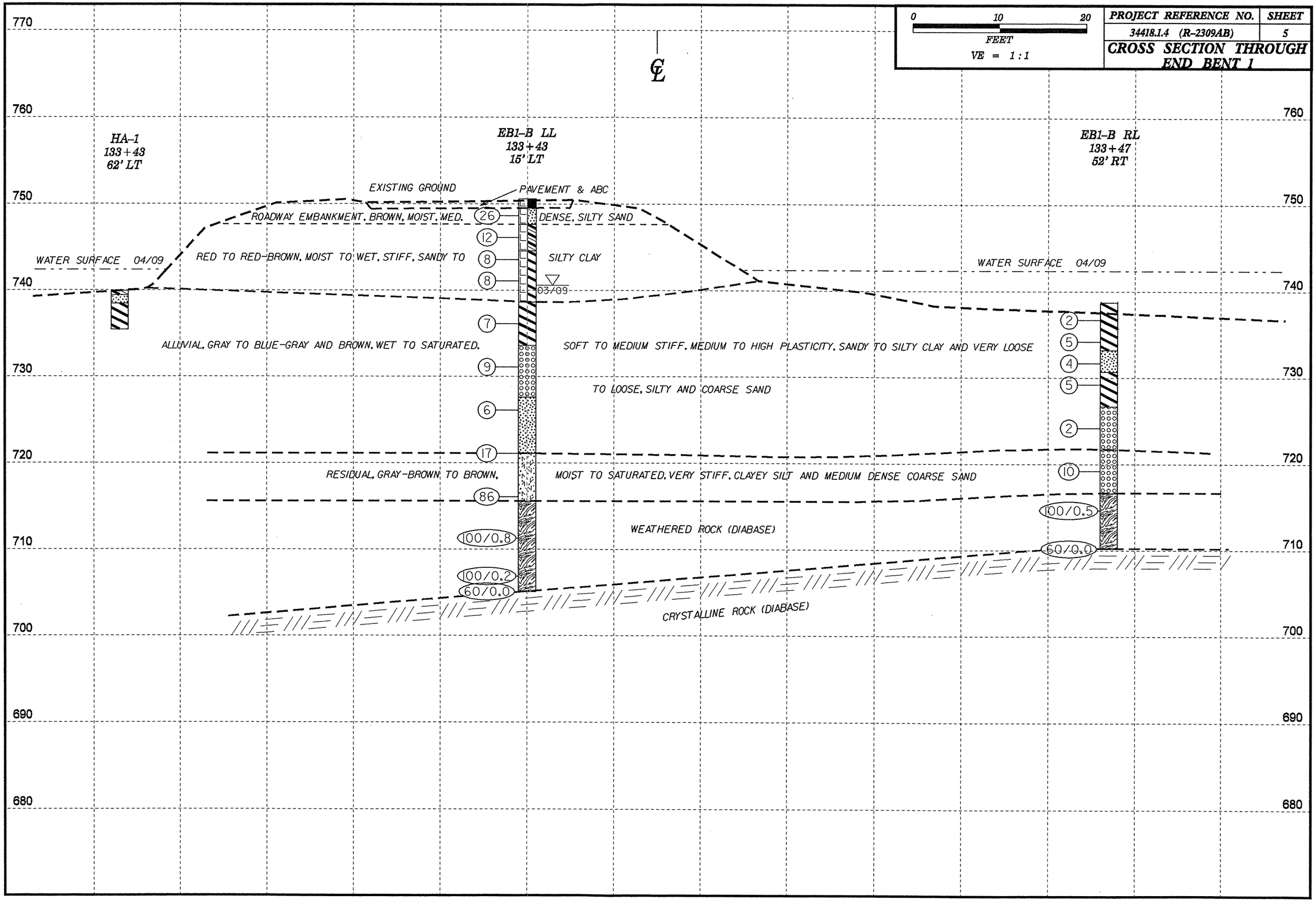



GROUNDLINE PROFILE AT CL OF -L- TAKEN FROM ROADWAY DESIGN PLANS AS OF 03/24/09
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE
0 20 40
FEET
VE = 2 : 1
PROJECT REFERENCE NO.
34418.1.4 (R-2309AB)
SHEET
4
PROFILE ALONG -L-
EB1-B LL
133+43
15' LT
B1-A RL
134+03
15' RT
B2-A RL
134+58
17' RT
EB2-B LL
135+18
12' LT
EXISTING GROUND
PAVEMENT & ABC
ROADWAY EMBANKMENT, RED-BROWN, MOIST TO WET, TO SILTY CLAY
RED TO STIFF, SANDY
03/09
WATER SURFACE 04/09 - LAKE BRANDT
ROADWAY EMBANKMENT, TAN, MOIST TO WET, SOFT TO STIFF, SANDY CLAY
ALLUVIAL, GRAY, WET TO SATURATED, VERY SOFT TO MEDIUM STIFF, SANDY SILT AND SANDY TO SILTY CLAY
GRAY, TAN AND BROWN, WET TO SATURATED, VERY LOOSE TO DENSE, SILTY AND COARSE SAND
RESIDUAL, GRAY-BROWN, MOIST, HARD, CLAYEY SILT
RESIDUAL, TAN AND BROWN, MOIST TO TO VERY DENSE, SILTY AND COARSE SAND
SATURATED, DENSE
WEATHERED ROCK (DIABASE)
WEATHERED ROCK (GRANITE)
CRYSTALLINE ROCK (DIABASE)
WOH
26
12
8
8
7
9
6
17
86
100/0.8
100/0.2
60/0.0
1
3
3
7
7
100/0.9
100/0.8
100/0.3
88
100/0.6
100/0.9
100/0.3
5
3
6
9
32
68
100/0.9
91
55
100/0.6
100/0.9
100/0.6
100/0.8
14
7
2
3
3
5
13
15
38
85
100/0.4
100/0.4
100/0.4
770
760
750
740
730
720
710
700
690
680
(A) ROADWAY EMBANKMENT, BROWN, MOIST, MEDIUM DENSE, SILTY SAND
(B) RESIDUAL, BROWN, SATURATED, VERY DENSE, COARSE SAND
(C) RESIDUAL, BROWN, SATURATED, VERY DENSE, SILTY SAND
-L-
133+00
+20
+40
+60
+80
134+00
+20
+40
+60
+80
135+00
+20
+40
+60

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 5 |

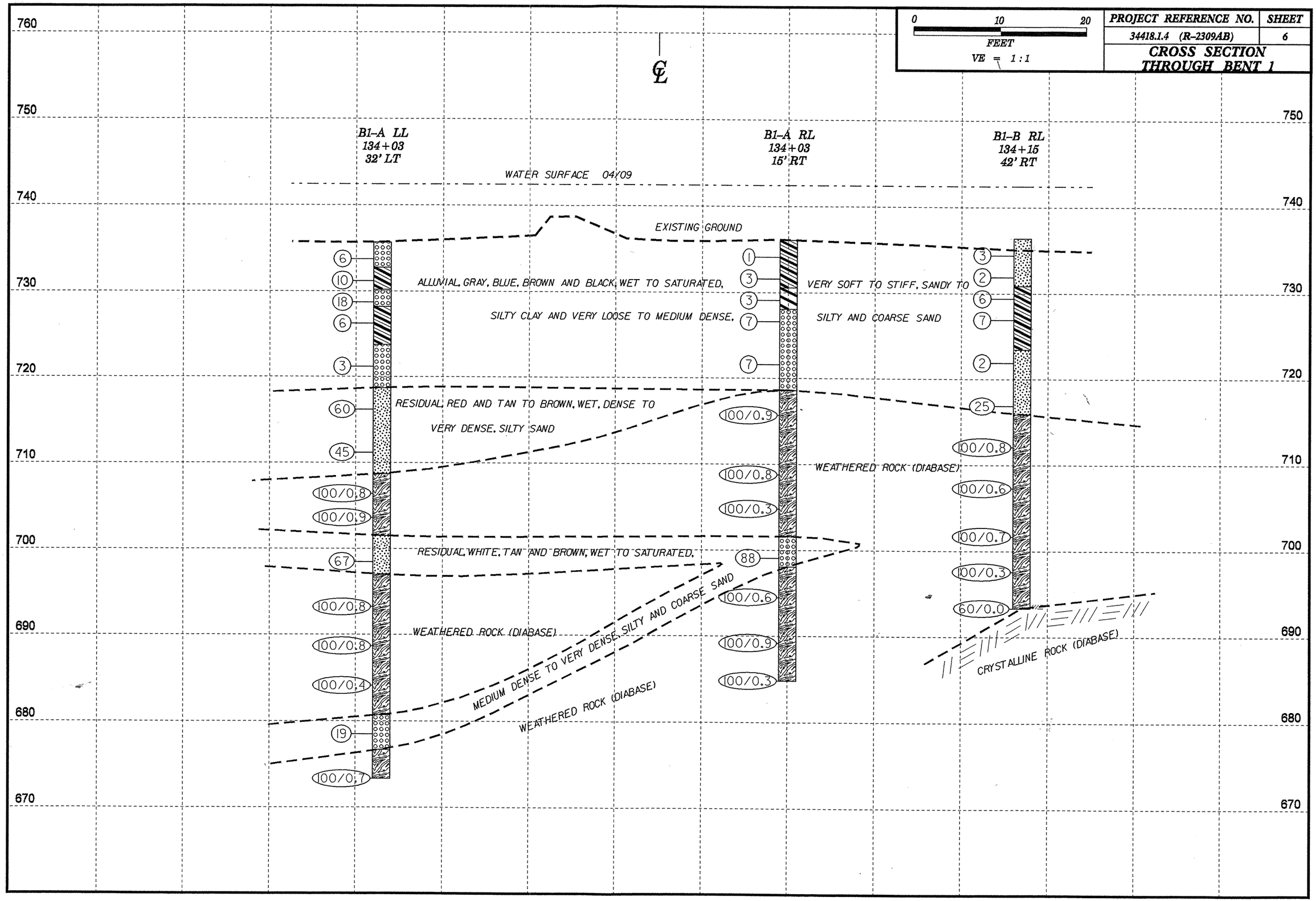
**CROSS SECTION THROUGH END BENT 1**

0 10 20
FEET
VE = 1:1



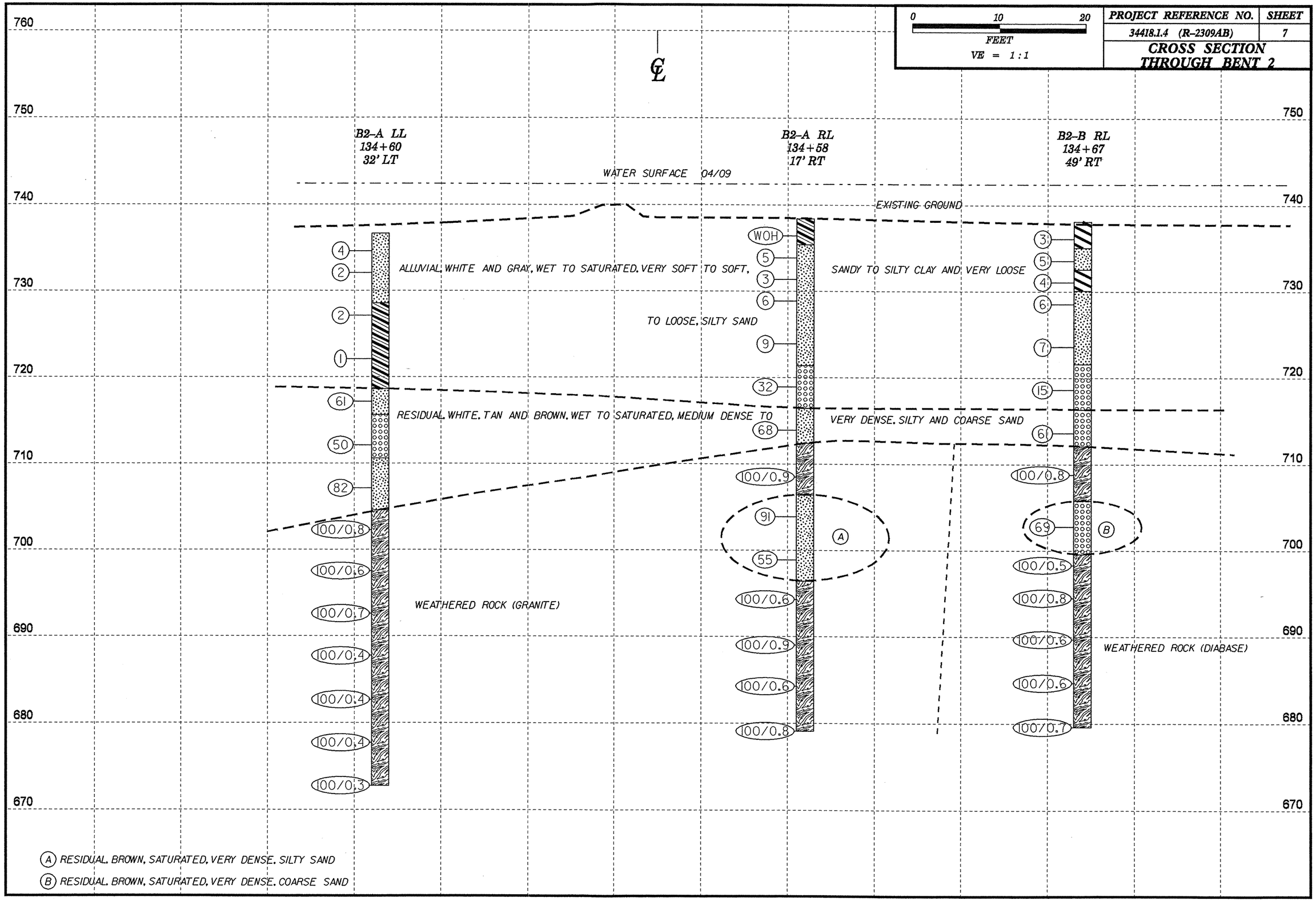
| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 6 |

**CROSS SECTION THROUGH BENT 1**



| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 7 |

**CROSS SECTION THROUGH BENT 2**

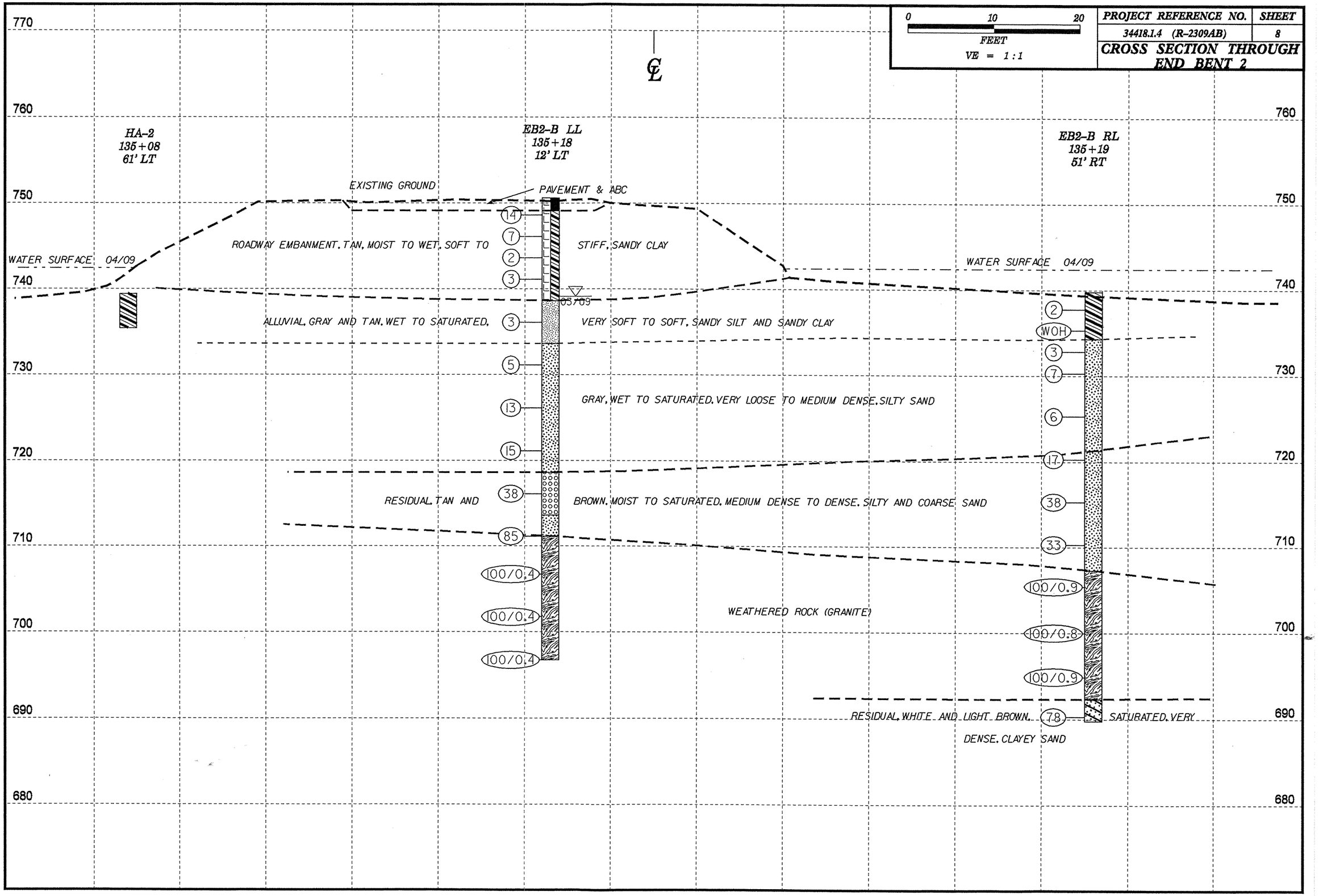



(A) RESIDUAL, BROWN, SATURATED, VERY DENSE, SILTY SAND

(B) RESIDUAL, BROWN, SATURATED, VERY DENSE, COARSE SAND

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 8 |

**CROSS SECTION THROUGH END BENT 2**



# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B LL | **STATION** 133+43 | **OFFSET** 15ft LT | **ALIGNMENT** -L- | **0 HR.** 10.0 |
| **COLLAR ELEV.** 750.6 ft | **TOTAL DEPTH** 45.5 ft | **NORTHING** 883,238 | **EASTING** 1,739,903 | **24 HR.** FIAD |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual | |
| **START DATE** 03/24/09 | **COMP. DATE** 03/24/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** 45.5 ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 755 | | | | | | | | | | | |
| 750 | | | | | | | | | | 750.6 GROUND SURFACE | 0.0 |
| | 749.5 | 1.1 | | | | | | | | 749.5 Pavement and ABC | 1.1 |
| | 747.1 | 3.5 | 10 | 13 | 13 | 26 | SS-1 | M | | 747.6 **ROADWAY EMBANKMENT** Brown, Silty Sand | 3.0 |
| 745 | 744.6 | 6.0 | 5 | 6 | 6 | 12 | SS-2 | M | | Red-Brown, Sandy Clay 744.6 | 6.0 |
| | 742.1 | 8.5 | 3 | 4 | 4 | 8 | SS-3 | W | | Red, Silty Clay | |
| 740 | | | 3 | 3 | 5 | 8 | | W | | | |
| | 737.1 | 13.5 | | | | | | | | 738.6 **ALLUVIAL** Gray, Silty Clay | 12.0 |
| 735 | | | 3 | 3 | 4 | 7 | SS-4 | W | | | |
| | 732.1 | 18.5 | | | | | | | | 733.6 Gray, Coarse Sand | 17.0 |
| 730 | | | 4 | 4 | 5 | 9 | SS-5 | W | | | |
| | 727.1 | 23.5 | | | | | | | | 727.6 Gray, Silty Sand | 23.0 |
| 725 | | | 3 | 3 | 3 | 6 | | W | | | |
| | 722.1 | 28.5 | | | | | | | | 721.1 **RESIDUAL** Gray-Brown, Clayey Silt | 29.5 |
| 720 | | | 5 | 8 | 9 | 17 | SS-7 | W | | | |
| | 717.1 | 33.5 | | | | | | | | 715.6 **WEATHERED ROCK** (Diabase) | 35.0 |
| 715 | | | 19 | 32 | 54 | 86 | | M | | | |
| | 712.1 | 38.5 | | | | | | | | | |
| 710 | | | 60 | 40/0.3 | | 100/0.8 | | | | | |
| | 707.1 | 43.5 | | | | | | | | | |
| | | | 100/0.2 | | | 100/0.2 | | | | | |
| 705 | 705.1 | 45.5 | 60/0.0 | | | 60/0.0 | | | | 705.1 Boring Terminated with Standard Penetration Test Refusal at Elevation 705.1 ft On Crystalline Rock (Diabase) | 45.5 |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B RL | **STATION** 133+47 | **OFFSET** 52ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 738.7 ft | **TOTAL DEPTH** 28.5 ft | **NORTHING** 883,264 | **EASTING** 1,739,963 | **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **START DATE** 03/31/09 | **COMP. DATE** 04/03/09 | **SURFACE WATER DEPTH** 3.7ft | **DEPTH TO ROCK** 28.5 ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (03/31/09) |
| 740 | | | | | | | | | | 738.7 GROUND SURFACE 0.0 |
| | 737.7 | 1.0 | | | | | | | | **ALLUVIAL** Gray, Highly Plastic, Silty Clay |
| | | | WOH | 1 | 1 | 2 | SS-8 | Sat. | | |
| 735 | 735.2 | 3.5 | | | | | | | | |
| | | | 1 | 2 | 3 | 5 | | Sat. | | 733.2 Gray, Silty Sand 5.5 |
| | 732.7 | 6.0 | | | | | | | | |
| | | | 1 | 2 | 2 | 4 | SS-9 | Sat. | | 730.7 Gray, Silty Clay 8.0 |
| 730 | 730.2 | 8.5 | | | | | | | | |
| | | | 7 | 2 | 3 | 5 | SS-10 | Sat. | | |
| 725 | 725.2 | 13.5 | | | | | | | | 726.7 Gray, Coarse Sand 12.0 |
| | | | 1 | 1 | 1 | 2 | SS-11 | Sat. | | |
| 720 | 720.2 | 18.5 | | | | | | | | 721.7 **RESIDUAL** Brown, Coarse Sand 17.0 |
| | | | 5 | 5 | 5 | 10 | SS-12 | Sat. | | |
| 715 | 715.2 | 23.5 | | | | | | | | 716.7 **WEATHERED ROCK** (Diabase) 22.0 |
| | | | 100/0.5 | | | 100/0.5 | | | | |
| 710 | 710.2 | 28.5 | | | | | | | | 710.2 Boring Terminated with Standard Penetration Test Refusal at Elevation 710.2 ft On Crystalline Rock (Diabase) 28.5 |
| | | | 60/0.0 | | | 60/0.0 | | | | |
| 705 | | | | | | | | | | |
| 700 | | | | | | | | | | |
| 695 | | | | | | | | | | |
| 690 | | | | | | | | | | |
| 685 | | | | | | | | | | |
| 680 | | | | | | | | | | |
| 675 | | | | | | | | | | |
| 670 | | | | | | | | | | |
| 665 | | | | | | | | | | |
| 660 | | | | | | | | | | |

NCDOT BORE DOUBLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Fregosi, J. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A LL | **STATION** 134+03 | **OFFSET** 32ft LT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 735.7 ft | **TOTAL DEPTH** 62.4 ft | **NORTHING** 883,288 | **EASTING** 1,739,864 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** SPT Core Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/07/09 | **COMP. DATE** 04/15/09 | **SURFACE WATER DEPTH** 6.7ft | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/07/09) | |
| 735.7 | | | | | | | | | | GROUND SURFACE | 0.0 |
| | 734.7 | 1.0 | 8 | 3 | 3 | 6, 10 | | W | | **ALLUVIAL** Gray and Black, Coarse Sand | |
| | 732.2 | 3.5 | 7 | 4 | 6 | 18 | SS-13 | W | | 732.7 | 3.0 |
| | 729.7 | 6.0 | 4 | 10 | 8 | 6 | | W | | Gray, Sandy Clay | |
| | 727.2 | 8.5 | 5 | 3 | 3 | 3 | | W | | 730.2 | 5.5 |
| | 722.2 | 13.5 | 3 | 1 | 2 | 60 | | W | | Gray, Coarse Sand | |
| | 717.2 | 18.5 | 30 | 33 | 27 | 45 | SS-14 | W | | 728.2 | 7.5 |
| | 712.2 | 23.5 | 14 | 19 | 26 | 100/0.8 | | W | | Gray, Sandy Clay | |
| | 707.2 | 28.5 | 36 | 64/0.3 | | 100/0.9 | | | | 723.7 | 12.0 |
| | 703.5 | 32.2 | 33 | 67/0.4 | | 67 | | W | | Tan and Brown, Coarse Sand | |
| | 698.5 | 37.2 | 9 | 29 | 38 | 100/0.8 | | | | 718.7 | 17.0 |
| | 693.5 | 42.2 | 30 | 60 | 40/0.3 | 100/0.8 | | | | **RESIDUAL** Red and Tan to Brown, Silty Sand | |
| | 688.5 | 47.2 | 37 | 63/0.3 | | 100/0.4 | | | | 708.7 | 27.0 |
| | 683.5 | 52.2 | 100/0.4 | | | 19 | SS-15 | W | | **WEATHERED ROCK** (Diabase) | |
| | 678.5 | 57.2 | 6 | 7 | 12 | 100/0.7 | | | | 701.5 | 34.2 |
| | 673.5 | 62.2 | 26 | 58 | 42/0.2 | | | | | **RESIDUAL** White to Tan and Brown, Silty Sand | |
| | | | | | | | | | | 697.0 | 38.7 |
| | | | | | | | | | | **WEATHERED ROCK** (Diabase) | |
| | | | | | | | | | | 680.7 | 55.0 |
| | | | | | | | | | | **RESIDUAL** Tan and Red to Brown, Coarse Sand | |
| | | | | | | | | | | 676.7 | 59.0 |
| | | | | | | | | | | **WEATHERED ROCK** (Diabase) | |
| | | | | | | | | | | 672.3 Boring Terminated at Elevation 673.3 ft In Weathered Rock (Diabase) | 63.4 |





# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Fregosi, J. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A LL | **STATION** 134+03 | **OFFSET** 32ft LT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 735.7 ft | **TOTAL DEPTH** 62.4 ft | **NORTHING** 883,288 | **EASTING** 1,739,864 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** SPT Core Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/07/09 | **COMP. DATE** 04/15/09 | **SURFACE WATER DEPTH** 6.7ft | **DEPTH TO ROCK** N/A |
| **CORE SIZE** NQ | **TOTAL RUN** 26.5 ft | **DRILLER** Heun, C. | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS — ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 706.4 | | | | | | | | | | | Begin Coring @ 29.3 ft | |
| 705 | 706.4 | 29.3 | 2.9 | 3:45/1.0 3:13/1.0 2:53/0.9 | (0.0) 0% | (0.0) 0% | | (0.0) 0% | (0.0) 0% | | **WEATHERED ROCK** (Diabase) *(continued)* | |
| | 703.5 | 32.2 | | N=100/0.9 | | | | | | | 701.5 | 34.2 |
| | 702.6 | 33.1 | 4.1 | 0:22/0.1 4:10/1.0 2:57/1.0 2:13/1.0 2:44/1.0 | (0.0) 0% | (0.0) 0% | | (0.0) 0% | (0.0) 0% | | **RESIDUAL** White to Tan and Brown, Silty Sand | |
| 700 | 698.5 | 37.2 | | N=67 | | | | | | | 697.0 | 38.7 |
| | 697.0 | 38.7 | 3.5 | 1:38/0.5 3:40/1.0 2:18/1.0 1:51/1.0 | (0.0) 0% | (0.0) 0% | | (0.7) 5% | (0.0) 0% | | **WEATHERED ROCK** (Diabase) | |
| 695 | 693.5 | 42.2 | | N=100/0.8 | | | | | | | | |
| | 692.2 | 43.5 | 3.7 | 1:42/0.7 2:10/1.0 3:04/1.0 2:50/1.0 | (0.7) 19% | (0.0) 0% | | | | | | |
| 690 | 688.5 | 47.2 | | N=100/0.8 | | | | | | | | |
| | 687.7 | 48.0 | 4.2 | 0:15/0.2 2:22/1.0 2:04/1.0 1:51/1.0 1:31/1.0 | (0.0) 0% | (0.0) 0% | | | | | | |
| 685 | 683.5 | 52.2 | | N=100/0.4 | | | | | | | | |
| | 683.1 | 52.6 | 4.6 | 2:50/0.6 2:45/1.0 2:55/1.0 2:55/1.0 2:40/1.0 | (0.0) 0% | (0.0) 0% | | | | | 680.7 | 55.0 |
| 680 | 678.5 | 57.2 | | N=19 | | | SS-15 | (0.0) 0% | (0.0) 0% | | **RESIDUAL** Tan and Red to Brown, Coarse Sand | |
| | 677.0 | 58.7 | 3.5 | 4:10/0.5 3:05/1.0 2:50/1.0 3:20/1.0 | (0.0) 0% | (0.0) 0% | | (0.0) 0% | (0.0) 0% | | 676.7 | 59.0 |
| 675 | 673.5 | 62.2 | | N=100/0.7 | | | | | | | **WEATHERED ROCK** (Diabase) | |
| | | | | | | | | | | | 672.3 | 63.4 |
| | | | | | | | | | | | Boring Terminated at Elevation 673.3 ft In Weathered Rock (Diabase) | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A RL | **STATION** 134+03 | **OFFSET** 15ft RT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 736.1 ft | **TOTAL DEPTH** 51.3 ft | **NORTHING** 883,304 | **EASTING** 1,739,909 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** SPT Core Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/08/09 | **COMP. DATE** 04/09/09 | **SURFACE WATER DEPTH** 6.3ft | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION — ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/08/09) |
| 740 | | | | | | | | | | |
| 735 | 735.1 | 1.0 | | | | | | | | 736.1 / 0.0 GROUND SURFACE |
| | 732.6 | 3.5 | WOH | WOH | 1 | 1 | SS-16 | Sat. | | **ALLUVIAL** Gray, Sandy Clay |
| 730 | 730.1 | 6.0 | 1 | 1 | 2 | 3 | | Sat. | | 730.6 / 5.5 |
| | 727.6 | 8.5 | 1 | 1 | 2 | 3 | SS-17 | Sat. | | Gray, Silty Clay — 728.1 / 8.0 |
| 725 | | | 2 | 3 | 4 | 7 | | Sat. | | Brown, Coarse Sand |
| | 722.6 | 13.5 | | | | | | | | |
| 720 | | | 4 | 4 | 3 | 7 | SS-18 | Sat. | | 718.6 / 17.5 |
| | 716.6 | 19.5 | | | | | | | | **WEATHERED ROCK** (Diabase) |
| 715 | | | 30 | 70/0.4 | | 100/0.9 | | | | |
| 710 | 710.1 | 26.0 | 7 | 30 | 70/0.3 | 100/0.8 | | | | |
| 705 | 705.1 | 31.0 | 100/0.3 | | | 100/0.3 | | | | |
| | | | | | | | | | | 701.6 / 34.5 |
| 700 | 700.1 | 36.0 | 21 | 23 | 65 | 88 | | Sat. | | **RESIDUAL** Brown, Coarse Sand — 698.1 / 38.0 |
| 695 | 695.1 | 41.0 | 60 | 40/0.1 | | 100/0.6 | | | | **WEATHERED ROCK** (Diabase) |
| 690 | 690.1 | 46.0 | 23 | 77/0.4 | | 100/0.9 | | | | |
| 685 | 685.1 | 51.0 | 100/0.3 | | | 100/0.3 | | | | 684.8 / 51.3 Boring Terminated at Elevation 684.8 ft In Weathered Rock (Diabase) |
| 680 | | | | | | | | | | |
| 675 | | | | | | | | | | |
| 670 | | | | | | | | | | |
| 665 | | | | | | | | | | |
| 660 | | | | | | | | | | |

NCDOT BORE DOUBLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09



# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-A RL | **STATION** 134+03 | **OFFSET** 15ft RT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 736.1 ft | **TOTAL DEPTH** 51.3 ft | **NORTHING** 883,304 | **EASTING** 1,739,909 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** SPT Core Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/08/09 | **COMP. DATE** 04/09/09 | **SURFACE WATER DEPTH** 6.3ft | **DEPTH TO ROCK** N/A |
| **CORE SIZE** NQ | **TOTAL RUN** 25.9 ft | **DRILLER** Toothman, R. E. | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS — ELEV. (ft) / DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 715.7 | | | | | | | | | | | Begin Coring @ 20.4 ft |
| 715 | 715.7 | 20.4 | 0.6 | 2:11/0.6 | (0.0) 0% | (0.0) 0% | | (6.9) 55% | (0.0) 0% | | **WEATHERED ROCK** (Diabase) *(continued)* |
| | 715.1 | 21.0 | 5.0 | 4:00/1.0 2:55/1.0 3:13/1.0 2:50/1.0 5:00/1.0 | (0.8) 16% | (0.0) 0% | | | | | |
| 710 | 710.1 | 26.0 | | *N=100/0.8* | | | | | | | |
| | 708.8 | 27.3 | 3.7 | 5:20/0.7 6:45/1.0 5:30/1.0 6:25/1.0 | (3.5) 95% | (0.0) 0% | | | | | |
| 705 | 705.1 | 31.0 | | *N=100/0.3* | | | | | | | |
| | 704.8 | 31.3 | 4.7 | 4:20/0.7 5:03/1.0 4:36/1.0 3:44/1.0 3:10/1.0 | (2.6) 55% | (0.0) 0% | | | | | 701.6 / 34.5 |
| 700 | 700.1 | 36.0 | | *N=88* | | | | (0.0) 0% | (0.0) 0% | | **RESIDUAL** Brown, Coarse Sand |
| | 698.6 | 37.5 | 3.5 | 0:51/0.5 6:14/1.0 7:00/1.0 5:09/1.0 | (2.5) 71% | (0.0) 0% | | (6.3) 55% | (0.0) 0% | | 698.1 / 38.0 **WEATHERED ROCK** (Diabase) |
| 695 | 695.1 | 41.0 | | *N=100/0.6* | | | | | | | |
| | 694.5 | 41.6 | 4.4 | 2:45/0.4 9:00/1.0 6:49/1.0 6:52/1.0 7:41/1.0 | (3.3) 75% | (0.0) 0% | | | | | |
| 690 | 690.1 | 46.0 | | *N=100/0.9* | | | | | | | |
| | 689.1 | 47.0 | 4.0 | 8:28/1.0 4:51/1.0 1:43/1.0 2:27/1.0 | (0.5) 13% | (0.0) 0% | | | | | |
| 685 | 685.1 | 51.0 | | *N=100/0.3* | | | | | | | 684.8 / 51.3 Boring Terminated at Elevation 684.8 ft In Weathered Rock (Diabase) |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |
| 655 | | | | | | | | | | | |
| 650 | | | | | | | | | | | |
| 645 | | | | | | | | | | | |
| 640 | | | | | | | | | | | |

NCDOT CORE SINGLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B1-B RL | **STATION** 134+15 | **OFFSET** 42ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 736.4 ft | **TOTAL DEPTH** 43.1 ft | **NORTHING** 883,325 | **EASTING** 1,739,930 | **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **START DATE** 04/10/09 | **COMP. DATE** 04/15/09 | **SURFACE WATER DEPTH** 6.0ft | **DEPTH TO ROCK** 43.1 ft | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT (0 25 50 75 100) | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/10/09) | |
| 740 | | | | | | | | | | | |
| | | | | | | | | | | 736.4 GROUND SURFACE | 0.0 |
| 735 | 735.4 | 1.0 | | | | | | | | **ALLUVIAL** Gray, Silty Sand | |
| | | | 1 | 2 | 1 | 3 | SS-19 | Sat. | | | |
| | 732.9 | 3.5 | | | | | | | | | |
| | | | 3 | 1 | 1 | 2 | | Sat. | | | |
| 730 | 730.4 | 6.0 | | | | | | | | 730.9 | 5.5 |
| | | | 2 | 3 | 3 | 6 | SS-20 | Sat. | | Blue and Gray, Sandy Clay | |
| | 727.9 | 8.5 | | | | | | | | | |
| | | | 2 | 3 | 4 | 7 | | Sat. | | | |
| 725 | | | | | | | | | | | |
| | | | | | | | | | | 723.4 | 13.0 |
| | 722.9 | 13.5 | | | | | | | | Gray and Brown, Silty Sand | |
| | | | 2 | 1 | 1 | 2 | SS-21 | Sat. | | | |
| 720 | | | | | | | | | | | |
| | 717.9 | 18.5 | | | | | | | | | |
| | | | 8 | 5 | 20 | 25 | | Sat. | | | |
| 715 | | | | | | | | | | 715.9 | 20.5 |
| | 712.9 | 23.5 | | | | | | | | **WEATHERED ROCK** (Diabase) | |
| | | | 46 | 54/0.3 | | 100/0.8 | | | | | |
| 710 | | | | | | | | | | | |
| | 707.9 | 28.5 | | | | | | | | | |
| | | | 85 | 15/0.1 | | 100/0.6 | | | | | |
| 705 | | | | | | | | | | | |
| | 702.9 | 33.5 | | | | | | | | | |
| | | | 18 | 56 | 44/0.2 | 100/0.7 | | | | | |
| 700 | | | | | | | | | | | |
| | 697.9 | 38.5 | | | | | | | | | |
| | | | 100/0.3 | | | 100/0.3 | | | | | |
| 695 | | | | | | | | | | | |
| | 693.3 | 43.1 | | | | | | | | 693.3 | 43.1 |
| | | | 60/0.0 | | | 60/0.0 | | | | Boring Terminated with Standard Penetration Test Refusal at Elevation 693.3 ft On Crystalline Rock (Diabase) | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

NCDOT BORE DOUBLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Fregosi, J. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B2-A LL | **STATION** 134+60 | **OFFSET** 32ft LT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 736.6 ft | **TOTAL DEPTH** 63.8 ft | **NORTHING** 883,342 | **EASTING** 1,739,845 | **24 HR.** N/A |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **START DATE** 03/31/09 | **COMP. DATE** 04/03/09 | **SURFACE WATER DEPTH** 5.8ft | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (03/31/09) | |
| 740 | | | | | | | | | | | |
| | | | | | | | | | | 736.6 GROUND SURFACE | 0.0 |
| 735 | 735.6 | 1.0 | | | | | | | | **ALLUVIAL** White to Gray, Silty Sand | |
| | 733.1 | 3.5 | 7 | 3 | 1 | 4 | | W | | | |
| 730 | | | 1 | 0 | 2 | 2 | | W | | | |
| | 728.1 | 8.5 | | | | | | | | 728.6 | 8.0 |
| 725 | | | WOH | WOH | 2 | 2 | SS-22 | W | | Gray, Sandy Clay | |
| | 723.1 | 13.5 | | | | | | | | | |
| 720 | | | WOH | WOH | 1 | 1 | | W | | | |
| | 718.1 | 18.5 | | | | | | | | 718.6 | 18.0 |
| 715 | | | 54 | 34 | 29 | 63 | | W | | **RESIDUAL** Tan to Brown, Silty Sand | |
| | | | | | | | | | | 715.6 | 21.0 |
| | 713.1 | 23.5 | | | | | | | | White and Black to Brown, Coarse Sand | |
| 710 | | | 17 | 22 | 28 | 50 | | W | | | |
| | | | | | | | | | | 710.6 | 26.0 |
| | 708.1 | 28.5 | | | | | | | | Tan and Black, Silty Sand | |
| 705 | | | 20 | 37 | 45 | 82 | | W | | | |
| | | | | | | | | | | 704.6 | 32.0 |
| | 703.1 | 33.5 | | | | | | | | **WEATHERED ROCK** (Granite) | |
| 700 | | | 39 | 61/0.3 | | 100/0.8 | | | | | |
| | 698.1 | 38.5 | | | | | | | | | |
| 695 | | | 61 | 39/0.1 | | 100/0.6 | | | | | |
| | 693.3 | 43.3 | | | | | | | | | |
| 690 | | | 74 | 26/0.2 | | 100/0.7 | | | | | |
| | 688.1 | 48.5 | | | | | | | | | |
| 685 | | | 100/0.4 | | | 100/0.4 | | | | | |
| | 683.1 | 53.5 | | | | | | | | | |
| 680 | | | 100/0.4 | | | 100/0.4 | | | | | |
| | 678.1 | 58.5 | | | | | | | | | |
| 675 | | | 100/0.4 | | | 100/0.4 | | | | | |
| | 673.1 | 63.5 | | | | | | | | 672.8 | 63.8 |
| 670 | | | 100/0.3 | | | 100/0.3 | | | | Boring Terminated at Elevation 672.8 ft In Weathered Rock (Granite) | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B2-A RL | **STATION** 134+58 | **OFFSET** 17ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 738.4 ft | **TOTAL DEPTH** 59.3 ft | **NORTHING** 883,357 | **EASTING** 1,739,892 | **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** SPT Core Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/07/09 | **COMP. DATE** 04/07/09 | **SURFACE WATER DEPTH** 4.0ft | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/07/09) | |
| 740 | | | | | | | | | | | |
| | | | | | | | | | | 738.4 GROUND SURFACE | 0.0 |
| | 737.4 | 1.0 | | | | | | | | **ALLUVIAL** Gray, Sandy Clay | |
| 735 | | | 1 | 0 | 0 | 0 | SS-23 | Sat. | | | |
| | 734.9 | 3.5 | | | | | | | | 735.4 | 3.0 |
| | | | 3 | 2 | 3 | 5 | SS-24 | Sat. | | Gray, Silty Sand | |
| | 732.4 | 6.0 | | | | | | | | | |
| 730 | | | 1 | 1 | 2 | 3 | | Sat. | | | |
| | 729.9 | 8.5 | | | | | | | | | |
| | | | 3 | 3 | 3 | 6 | | Sat. | | | |
| 725 | 724.9 | 13.5 | | | | | | | | | |
| | | | 1 | 4 | 5 | 9 | | Sat. | | | |
| 720 | 719.9 | 18.5 | | | | | | | | 721.4 | 17.0 |
| | | | 3 | 18 | 14 | 32 | | Sat. | | Light Brown, Coarse Sand | |
| 715 | 714.9 | 23.5 | | | | | | | | 716.4 | 22.0 |
| | | | 18 | 26 | 42 | 68 | SS-25 | Sat. | | **RESIDUAL** Brown, Silty Sand | |
| 710 | 709.9 | 28.5 | | | | | | | | 712.4 | 26.0 |
| | | | 21 | 50 | 50/0.4 | 100/0.9 | | | | **WEATHERED ROCK** (Granite) | |
| 705 | 704.9 | 33.5 | | | | | | | | 706.4 | 32.0 |
| | | | 28 | 45 | 46 | 91 | | Sat. | | **RESIDUAL** Brown, Silty Sand | |
| 700 | 699.9 | 38.5 | | | | | | | | | |
| | | | 15 | 19 | 36 | 55 | | Sat. | | | |
| 695 | 694.9 | 43.5 | | | | | | | | 696.4 | 42.0 |
| | | | 55 | 45/0.1 | | 100/0.6 | | | | **WEATHERED ROCK** (Granite) | |
| 690 | 689.9 | 48.5 | | | | | | | | | |
| | | | 54 | 46/0.4 | | 100/0.9 | | | | | |
| 685 | 684.9 | 53.5 | | | | | | | | | |
| | | | 73 | 27/0.1 | | 100/0.6 | | | | | |
| 680 | 679.9 | 58.5 | | | | | | | | | |
| | | | 65 | 35/0.3 | | 100/0.8 | | | | 679.1 | 59.3 |
| 675 | | | | | | | | | | Boring Terminated at Elevation 679.1 ft In Weathered Rock (Granite) | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B2-B RL | **STATION** 134+67 | **OFFSET** 49ft RT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 738.1 ft | **TOTAL DEPTH** 58.5 ft | **NORTHING** 883,376 | **EASTING** 1,739,918 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/15/09 | **COMP. DATE** 04/20/09 | **SURFACE WATER DEPTH** 4.3ft | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | BLOW COUNT 0.5ft | BLOW COUNT 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/15/09) | |
| 740 | | | | | | | | | | 738.1 GROUND SURFACE | 0.0 |
| | 737.1 | 1.0 | | | | | | | | **ALLUVIAL** Gray, Silty Clay | |
| 735 | | | 2 | 1 | 2 | 3 | SS-26 | Sat. | | 735.1 | 3.0 |
| | 734.6 | 3.5 | | | | | | | | Gray, Silty Sand | |
| | | | 1 | 3 | 2 | 5 | | Sat. | | 732.6 | 5.5 |
| | 732.1 | 6.0 | | | | | | | | Gray, Silty Clay | |
| | | | WOH | 1 | 3 | 4 | | Sat. | | 730.1 | 8.0 |
| 730 | 729.6 | 8.5 | | | | | | | | Gray, Silty Sand | |
| | | | 3 | 3 | 3 | 6 | | Sat. | | | |
| 725 | 724.6 | 13.5 | | | | | | | | | |
| | | | 3 | 2 | 5 | 7 | | Sat. | | 721.6 | 16.5 |
| 720 | 719.6 | 18.5 | | | | | | | | Brown, Coarse Sand | |
| | | | 2 | 6 | 9 | 15 | | Sat. | | 716.3 | 21.8 |
| 715 | 714.6 | 23.5 | | | | | | | | **RESIDUAL** Brown, Coarse Sand | |
| | | | 19 | 27 | 34 | 61 | | Sat. | | 712.1 | 26.0 |
| 710 | 709.6 | 28.5 | | | | | | | | **WEATHERED ROCK** (Diabase) | |
| | | | 56 | 44/0.3 | | 100/0.8 | | Sat. | | | |
| 705 | 703.8 | 34.3 | | | | | | | | 705.8 | 32.3 |
| | | | 12 | 29 | 40 | 69 | | Sat. | | **RESIDUAL** Brown, Coarse Sand | |
| 700 | 698.8 | 39.3 | | | | | | | | 699.6 | 38.5 |
| | | | 100/0.5 | | | 100/0.5 | | | | **WEATHERED ROCK** (Diabase) | |
| 695 | 695.3 | 42.8 | | | | | | | | | |
| | | | 22 | 78/0.3 | | 100/0.8 | | | | | |
| 690 | 690.3 | 47.8 | | | | | | | | | |
| | | | 33 | 67/0.1 | | 100/0.6 | | | | | |
| 685 | 685.3 | 52.8 | | | | | | | | | |
| | | | 46 | 54/0.1 | | 100/0.6 | | | | | |
| 680 | 680.3 | 57.8 | | | | | | | | 679.6 | 58.5 |
| | | | 45 | 55/0.2 | | 100/0.7 | | | | Boring Terminated at Elevation 679.6 ft In Weathered Rock (Diabase) | |
| 675 | | | | | | | | | | | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

NCDOT BORE DOUBLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09



# NCDOT GEOTECHNICAL ENGINEERING UNIT
# CORE BORING REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** B2-B RL | **STATION** 134+67 | **OFFSET** 49ft RT | **ALIGNMENT** -L- — **0 HR.** N/A |
| **COLLAR ELEV.** 738.1 ft | **TOTAL DEPTH** 58.5 ft | **NORTHING** 883,376 | **EASTING** 1,739,918 — **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual |
| **START DATE** 04/15/09 | **COMP. DATE** 04/20/09 | **SURFACE WATER DEPTH** 4.3ft | **DEPTH TO ROCK** N/A |
| **CORE SIZE** NQ | **TOTAL RUN** 24.5 ft | **DRILLER** Toothman, R. E. | |

| ELEV (ft) | RUN ELEV (ft) | DEPTH (ft) | RUN (ft) | DRILL RATE (Min/ft) | RUN REC. (ft) % | RUN RQD (ft) % | SAMP. NO. | STRATA REC. (ft) % | STRATA RQD (ft) % | LOG | DESCRIPTION AND REMARKS ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 708.8 | | | | | | | | | | | Begin Coring @ 29.3 ft | |
| | 708.8 | 29.3 | 5.0 | 1:33/1.0 6:33/1.0 3:13/1.0 1:27/1.0 2:27/1.0 | (0.5) 10% | (0.0) 0% | | (0.5) 17% | (0.0) 0% | | **WEATHERED ROCK** (Diabase) *(continued)* | |
| 705 | | | | | | | | | | | 705.8 | 32.3 |
| | 703.8 | 34.3 | | *N=69* | | | | (0.0) 0% | (0.0) 0% | | **RESIDUAL** Brown, Coarse Sand | |
| | 702.3 | 35.8 | 3.5 | 1:24/0.5 7:20/1.0 23:37/1.0 12:33/1.0 | (0.5) 14% | (0.0) 0% | | | | | | |
| 700 | | | | | | | | | | | 699.6 | 38.5 |
| | 698.8 | 39.3 | | *N=100/0.5* | | | | (4.4) 26% | (0.0) 0% | | **WEATHERED ROCK** (Diabase) | |
| | 698.3 | 39.8 | 3.0 | 2:06/1.0 3:05/1.0 3:26/1.0 | (0.9) 30% | (0.0) 0% | | | | | | |
| 695 | 695.3 | 42.8 | | *N=100/0.6* | | | | | | | | |
| | 694.5 | 43.6 | 4.2 | 1:43/0.2 3:06/1.0 2:35/1.0 2:20/1.0 3:45/1.0 | (0.3) 7% | (0.0) 0% | | | | | | |
| 690 | 690.3 | 47.8 | | *N=100/0.6* | | | | | | | | |
| | 689.7 | 48.4 | 4.4 | 1:54/0.4 7:47/1.0 3:04/1.0 1:42/1.0 10:53/1.0 | (1.3) 30% | (0.0) 0% | | | | | | |
| 685 | 685.3 | 52.8 | | *N=100/0.6* | | | | | | | | |
| | 684.7 | 53.4 | 4.4 | 1:03/0.4 3:22/1.0 3:47/1.0 7:12/1.0 7:18/1.0 | (1.9) 43% | (0.0) 0% | | | | | | |
| 680 | 680.3 | 57.8 | | *N=100/0.7* | | | | | | | 679.6 | 58.5 |
| | | | | | | | | | | | Boring Terminated at Elevation 679.6 ft In Weathered Rock (Diabase) | |
| 675 | | | | | | | | | | | | |
| 670 | | | | | | | | | | | | |
| 665 | | | | | | | | | | | | |
| 660 | | | | | | | | | | | | |
| 655 | | | | | | | | | | | | |
| 650 | | | | | | | | | | | | |
| 645 | | | | | | | | | | | | |
| 640 | | | | | | | | | | | | |
| 635 | | | | | | | | | | | | |
| 630 | | | | | | | | | | | | |

NCDOT CORE SINGLE R2309AB_GEO_BRDG313.GPJ NC_DOT.GDT 06/17/09

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B LL | **STATION** 135+18 | **OFFSET** 12ft LT | **ALIGNMENT** -L- | **0 HR.** 11.5 |
| **COLLAR ELEV.** 750.6 ft | **TOTAL DEPTH** 53.9 ft | **NORTHING** 883,402 | **EASTING** 1,739,845 | **24 HR.** FIAD |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual | |
| **START DATE** 03/24/09 | **COMP. DATE** 03/25/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 755 | | | | | | | | | | | |
| 750 | | | | | | | | | | 750.6 GROUND SURFACE | 0.0 |
| | 749.6 | 1.0 | | | | | | | | 749.1 Pavement & ABC | 1.5 |
| | 747.1 | 3.5 | 8 | 6 | 8 | 14 | | M | | **ROADWAY EMBANKMENT** Tan, Sandy Clay | |
| 745 | 744.6 | 6.0 | 2 | 3 | 4 | 7 | | M | | | |
| | 742.1 | 8.5 | 2 | 1 | 1 | 2 | SS-27 | W | | | |
| 740 | | | 2 | 1 | 2 | 3 | | W | | 738.6 | 12.0 |
| | 737.1 | 13.5 | | | | | | | | **ALLUVIAL** Gray, Sandy Silt | |
| 735 | | | 2 | 1 | 2 | 3 | SS-28 | W | | | |
| | 732.1 | 18.5 | | | | | | | | 733.6 | 17.0 |
| 730 | | | 3 | 3 | 2 | 5 | | W | | Gray to Tan, Silty Sand | |
| | 727.1 | 23.5 | | | | | | | | | |
| 725 | | | 4 | 6 | 7 | 13 | | W | | | |
| | 722.1 | 28.5 | | | | | | | | | |
| 720 | | | 6 | 6 | 9 | 15 | | W | | | |
| | 717.1 | 33.5 | | | | | | | | 718.6 | 32.0 |
| 715 | | | 10 | 15 | 23 | 38 | | M | | **RESIDUAL** Tan, Coarse Sand | |
| | 712.1 | 38.5 | | | | | | | | 713.6 | 37.0 |
| 710 | | | 26 | 33 | 52 | 85 | | M | | Tan, Silty Sand | |
| | 707.1 | 43.5 | 100/0.4 | | | 100/0.4 | | | | 711.1 | 39.5 |
| 705 | | | | | | | | | | **WEATHERED ROCK** (Granite) | |
| | 702.1 | 48.5 | 100/0.4 | | | 100/0.4 | | | | | |
| 700 | | | | | | | | | | | |
| | 697.1 | 53.5 | 100/0.4 | | | 100/0.4 | | | | 696.7 | 53.9 |
| 695 | | | | | | | | | | Boring Terminated at Elevation 696.7 ft In Weathered Rock (Granite) | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Wells, T. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B RL | **STATION** 135+19 | **OFFSET** 51ft RT | **ALIGNMENT** -L- | **0 HR.** N/A |
| **COLLAR ELEV.** 739.8 ft | **TOTAL DEPTH** 50.0 ft | **NORTHING** 883,426 | **EASTING** 1,739,903 | **24 HR.** N/A |
| **DRILL MACHINE** CME-45 SKID | **DRILL METHOD** Wash Boring | | **HAMMER TYPE** Manual | |
| **START DATE** 04/23/09 | **COMP. DATE** 04/23/09 | **SURFACE WATER DEPTH** 2.6ft | **DEPTH TO ROCK** N/A | |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | WATER SURFACE (04/23/09) | |
| 740 | | | | | | | | | | 739.8 GROUND SURFACE | 0.0 |
| | 738.8 | 1.0 | | | | | | | | **ALLUVIAL** Gray, Sandy Clay | |
| | 736.3 | 3.5 | 1 | 1 | 1 | 2 | SS-29 | Sat. | | | |
| 735 | | | WOR | WOR | WOH | 0 | | Sat. | | | |
| | 733.8 | 6.0 | 1 | 1 | 2 | 3 | | Sat. | | 734.3 | 5.5 |
| | 731.3 | 8.5 | | | | | | | | Gray, Silty Sand | |
| 730 | | | 1 | 3 | 4 | 7 | | Sat. | | | |
| | 726.3 | 13.5 | | | | | | | | | |
| 725 | | | 1 | 3 | 3 | 6 | | Sat. | | | |
| | 721.3 | 18.5 | | | | | | | | 721.3 | 18.5 |
| 720 | | | 6 | 9 | 8 | 17 | | Sat. | | **RESIDUAL** Brown, Silty Sand | |
| | 716.3 | 23.5 | | | | | | | | | |
| 715 | | | 25 | 19 | 19 | 38 | | Sat. | | | |
| | 711.3 | 28.5 | | | | | | | | | |
| 710 | | | 10 | 16 | 17 | 33 | | Sat. | | | |
| | 706.3 | 33.5 | | | | | | | | 707.3 | 32.5 |
| 705 | | | 42 | 58/0.4 | | 100/0.9 | | | | **WEATHERED ROCK** (Granite) | |
| | 701.3 | 38.5 | | | | | | | | | |
| 700 | | | 19 | 43 | 57/0.3 | 100/0.8 | | | | | |
| | 696.3 | 43.5 | | | | | | | | | |
| 695 | | | 35 | 46 | 54/0.4 | 100/0.9 | | | | | |
| | 691.3 | 48.5 | | | | | | | | 692.3 | 47.5 |
| 690 | | | 35 | 38 | 40 | 78 | SS-30 | Sat. | | **RESIDUAL** White and Light Brown, Clayey Sand | |
| | | | | | | | | | | 689.8 | 50.0 |
| 685 | | | | | | | | | | Boring Terminated at Elevation 689.8 ft In clayey Sand | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Weaver, P. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** HA-1 | **STATION** 133+43 | **OFFSET** 62ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 739.9 ft | **TOTAL DEPTH** 4.5 ft | **NORTHING** 883,221 | **EASTING** 1,739,857 |
| **DRILL MACHINE** N/A | **DRILL METHOD** Hand Auger | | **HAMMER TYPE** N/A |
| **START DATE** 04/21/09 | **COMP. DATE** 04/21/09 | **SURFACE WATER DEPTH** 2.5ft | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | N/A |
| 24 HR. | N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ▼ | | WATER SURFACE (04/21/09) | |
| 740 | | | | | | | | | | 739.9 GROUND SURFACE | 0.0 |
| | | | | | | | | | | 739.4 **ALLUVIAL** | 0.5 |
| | | | | | | | | | | 738.4 Blue-Gray, Sandy Clay | 1.5 |
| | | | | | | | S-31 | Sat. | | Blue-Gray, Silty Sand | |
| 735 | | | | | | | | | | 735.4 Brown, Highly Plastic, Silty Clay | 4.5 |
| | | | | | | | | | | Boring Terminated at Elevation 735.4 ft In Silty Clay | |
| 730 | | | | | | | | | | | |
| 725 | | | | | | | | | | | |
| 720 | | | | | | | | | | | |
| 715 | | | | | | | | | | | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |
| 670 | | | | | | | | | | | |
| 665 | | | | | | | | | | | |
| 660 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Weaver, P. |
| **SITE DESCRIPTION** Bridge No. 313 on -L- (US 220, Battleground Ave.) over Lake Brandt on Reedy Fork | | | **GROUND WTR (ft)** |
| **BORING NO.** HA-2 | **STATION** 135+08 | **OFFSET** 61ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 739.4 ft | **TOTAL DEPTH** 4.0 ft | **NORTHING** 883,377 | **EASTING** 1,739,801 |
| **DRILL MACHINE** N/A | **DRILL METHOD** Hand Auger | | **HAMMER TYPE** N/A |
| **START DATE** 04/21/09 | **COMP. DATE** 04/21/09 | **SURFACE WATER DEPTH** 3.0ft | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | N/A |
| 24 HR. | N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ▼ | | WATER SURFACE (04/21/09) |
| 740 | | | | | | | | | | 739.4 GROUND SURFACE 0.0 |
| | | | | | | | S-32 | Sat. | | **ALLUVIAL** Tan-Brown, Sandy Clay |
| 735 | | | | | | | | | | 735.4 4.0 |
| | | | | | | | | | | Boring Terminated at Elevation 735.4 ft in Sandy Clay |
| 730 | | | | | | | | | | |
| 725 | | | | | | | | | | |
| 720 | | | | | | | | | | |
| 715 | | | | | | | | | | |
| 710 | | | | | | | | | | |
| 705 | | | | | | | | | | |
| 700 | | | | | | | | | | |
| 695 | | | | | | | | | | |
| 690 | | | | | | | | | | |
| 685 | | | | | | | | | | |
| 680 | | | | | | | | | | |
| 675 | | | | | | | | | | |
| 670 | | | | | | | | | | |
| 665 | | | | | | | | | | |
| 660 | | | | | | | | | | |

### EB1-B LL

## 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 | 15' LT | 133+43 | 1.1-2.5 | A-2-4(0) | 31 | 10 | 43.2 | 27.4 | 17.3 | 12.1 | 54 | 39 | 18 | - | - |
| SS-2 | 15' LT | 133+43 | 3.5-5.0 | A-6(3) | 37 | 17 | 35.1 | 21.2 | 15.4 | 28.3 | 88 | 66 | 41 | - | - |
| SS-3 | 15' LT | 133+43 | 6.0-7.5 | A-7-6(16) | 46 | 24 | 17.4 | 14.1 | 24.1 | 44.4 | 98 | 86 | 70 | - | - |
| SS-4 | 15' LT | 133+43 | 13.5-15.0 | A-7-6(16) | 46 | 18 | 7.1 | 13.1 | 35.4 | 44.4 | 100 | 95 | 83 | - | - |
| SS-5 | 15' LT | 133+43 | 18.5-20.0 | A-1-b(0) | 31 | NP | 73.5 | 16.5 | 6.0 | 4.0 | 98 | 45 | 11 | - | - |
| SS-6 | 15' LT | 133+43 | 23.5-25.0 | A-2-4(0) | 26 | NP | 24.6 | 51.2 | 16.2 | 8.1 | 100 | 95 | 29 | - | - |
| SS-7 | 15' LT | 133+43 | 29.5-30.0 | A-5(0) | 42 | 2 | 27.0 | 39.8 | 25.1 | 8.1 | 93 | 81 | 37 | - | - |

### EB1-B RL

## 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-8 | 52' RT | 133+47 | 1.0-2.5 | A-7-6(21) | 51 | 26 | 12.7 | 11.3 | 23.5 | 52.5 | 100 | 93 | 78 | - | - |
| SS-9 | 52' RT | 133+47 | 6.0-7.5 | A-2-4(0) | 29 | NP | 43.8 | 39.8 | 8.4 | 8.1 | 100 | 87 | 19 | - | - |
| SS-10 | 52' RT | 133+47 | 8.5-10.0 | A-7-6(18) | 45 | 20 | 0.8 | 20.8 | 28.0 | 50.5 | 100 | 100 | 85 | - | - |
| SS-11 | 52' RT | 133+47 | 13.5-15.0 | A-1-b(0) | 31 | NP | 78.3 | 12.7 | 4.9 | 4.0 | 90 | 33 | 9 | - | - |
| SS-12 | 52' RT | 133+47 | 18.5-20.0 | A-1-b(0) | 36 | NP | 73.5 | 20.6 | 6.0 | 0.0 | 81 | 44 | 6 | - | - |

### B1-A LL

## 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-13 | 32' LT | 134+03 | 3.5-5.0 | A-6(4) | 32 | 15 | 24.8 | 28.3 | 18.7 | 28.3 | 100 | 85 | 50 | - | - |
| SS-14 | 32' LT | 134+03 | 18.5-20.0 | A-2-4(0) | 31 | 6 | 51.1 | 26.6 | 16.2 | 6.1 | 86 | 57 | 23 | - | - |
| SS-15 | 32' LT | 134+03 | 56.2-57.9 | A-1-b(0) | 31 | NP | 89.0 | 7.7 | 3.2 | 0.0 | 100 | 19 | 4 | - | - |

### B1-A RL

## 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 | 15' RT | 134+03 | 1.0-2.5 | A-6(0) | 39 | 11 | 38.9 | 23.7 | 23.1 | 14.2 | 85 | 61 | 36 | - | - |
| SS-17 | 15' RT | 134+03 | 6.0-7.5 | A-7-6(11) | 42 | 18 | 21.5 | 12.0 | 26.0 | 40.6 | 100 | 84 | 69 | - | - |
| SS-18 | 15' RT | 134+03 | 13.5-15.0 | A-1-b(0) | 33 | NP | 84.6 | 13.6 | 1.8 | 0.0 | 98 | 37 | 3 | - | - |

### B1-B RL

## 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-19 | 42' RT | 134+15 | 1.0-2.5 | A-2-4(0) | 28 | 7 | 75.1 | 11.0 | 7.9 | 6.1 | 91 | 36 | 14 | - | - |
| SS-20 | 42' RT | 134+15 | 6.0-7.5 | A-6(8) | 38 | 17 | 19.9 | 24.9 | 24.7 | 30.4 | 100 | 88 | 59 | - | - |
| SS-21 | 42' RT | 134+15 | 13.5-15.0 | A-2-4(0) | 29 | NP | 39.6 | 38.9 | 13.4 | 8.1 | 98 | 79 | 24 | - | - |

### B2-A LL

## 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-22 | 32' LT | 134+60 | 8.5-10.0 | A-6(7) | 40 | 11 | 2.2 | 43.2 | 32.3 | 22.3 | 100 | 100 | 65 | - | - |

### B2-A RL

## 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-23 | 17' RT | 134+58 | 1.0-2.5 | A-6(10) | 37 | 14 | 6.7 | 21.9 | 36.9 | 34.5 | 100 | 97 | 77 | - | - |
| SS-24 | 17' RT | 134+58 | 3.5-5.0 | A-2-4(0) | 25 | NP | 44.8 | 38.7 | 8.3 | 8.1 | 100 | 81 | 20 | - | - |
| SS-25 | 17' RT | 134+58 | 23.5-25.0 | A-2-4(0) | 33 | NP | 37.9 | 42.8 | 15.2 | 4.1 | 90 | 73 | 22 | - | - |

### B2-B RL

## 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-26 | 49' RT | 134+67 | 1.0-2.5 | A-7-6(16) | 46 | 21 | 13.6 | 13.2 | 30.6 | 42.6 | 100 | 90 | 76 | - | - |

### EB2-B LL

## 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-27 | 12' LT | 135+18 | 6.0-7.5 | A-6(3) | 34 | 17 | 38.3 | 23.7 | 15.6 | 22.3 | 97 | 71 | 40 | - | - |
| SS-28 | 12' LT | 135+18 | 13.5-15.0 | A-4(3) | 29 | 8 | 3.2 | 42.0 | 28.4 | 26.4 | 100 | 99 | 64 | - | - |

### EB2-B RL

## 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-29 | 51' RT | 135+19 | 1.0-2.5 | A-6(8) | 39 | 16 | 17.6 | 25.4 | 24.5 | 32.5 | 100 | 89 | 61 | - | - |
| SS-30 | 51' RT | 135+19 | 48.5-50.0 | A-2-6(1) | 40 | 15 | 38.9 | 21.3 | 25.6 | 14.2 | 58 | 40 | 26 | - | - |

### HA-1

## 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 | | |
| S-31 | 62' LT | 133+43 | 2.0-3.0 | A-7-5(35) | 66 | 31 | 4.5 | 5.3 | 37.5 | 52.7 | 100 | 97 | 92 | - | - |

### HA-2

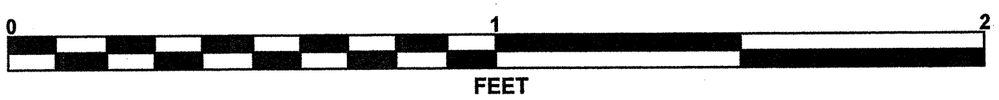
## SOIL TEST RESULTS

| 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 | | |
| S-32 | 61' LT | 135+08 | 0.5-1.5 | Not Enough Material | | | 30.4 | 22.7 | 16.4 | 30.4 | 97 | 77 | 49 | - | - |

# CORE PHOTOGRAPHS

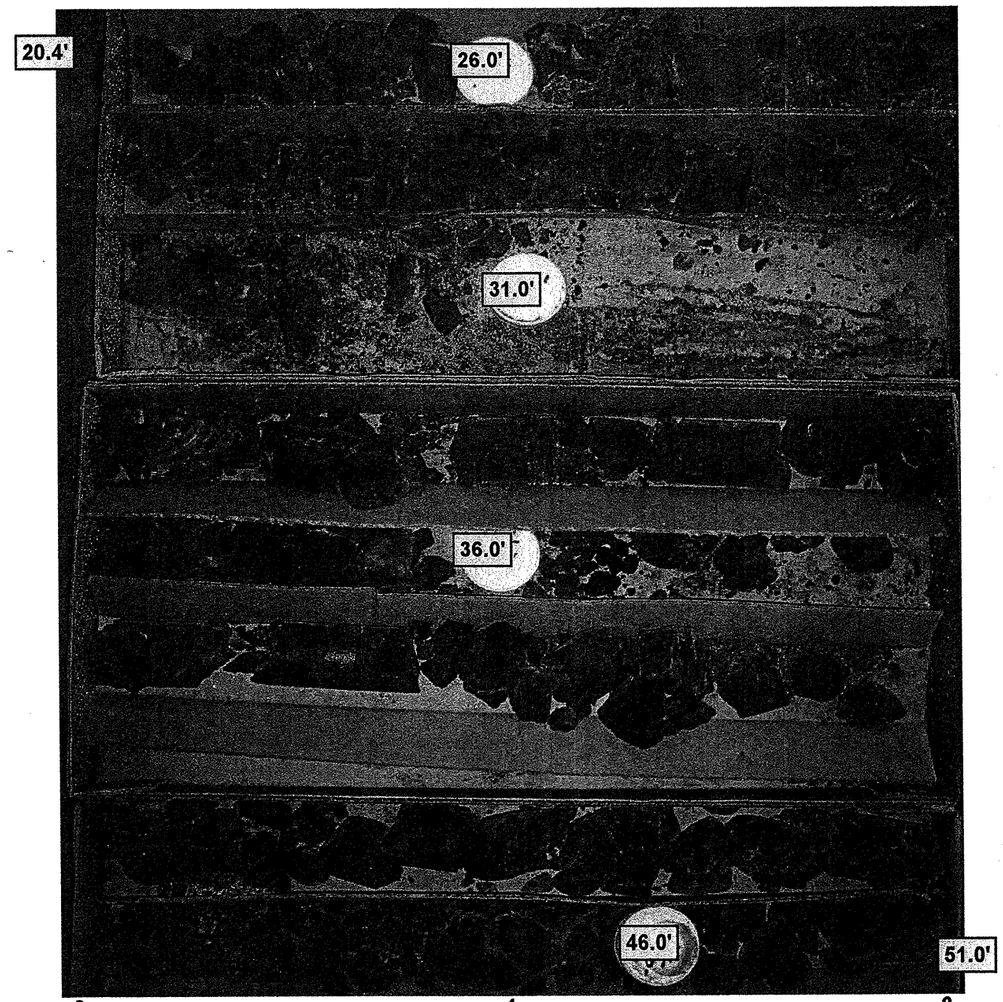
## B1-A LL

**BOX 1: 29.3 - 62.2 FEET**




## B1-A RL

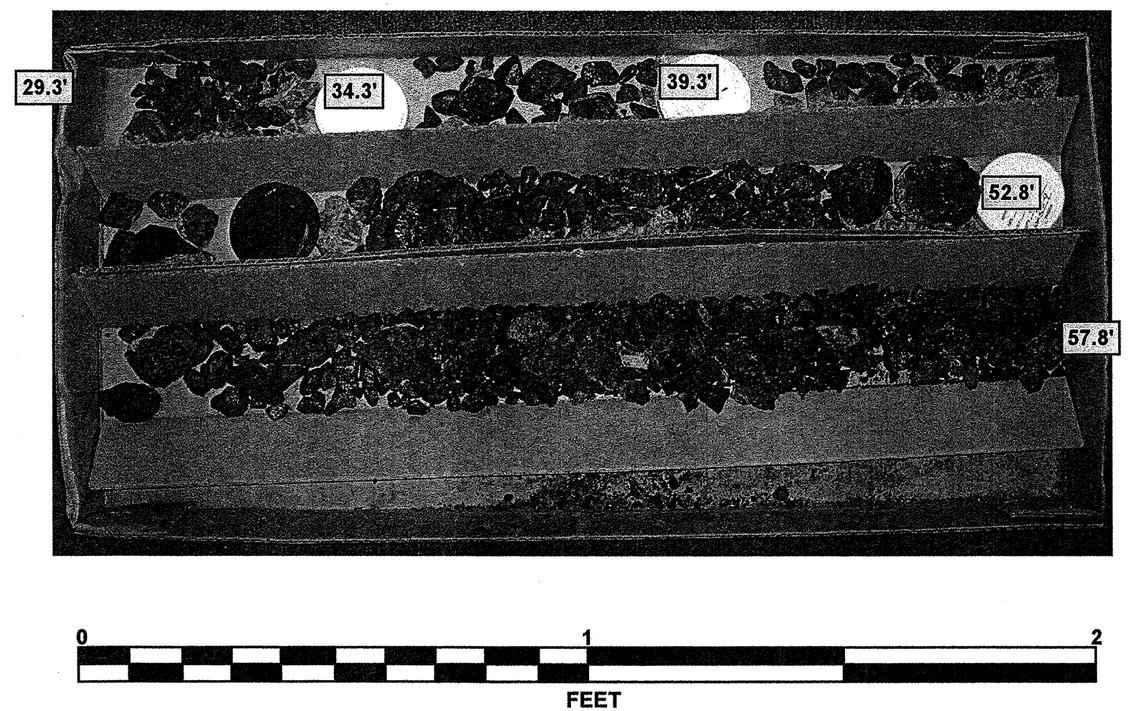
**BOXES 1-3: 20.4 - 51.0 FEET**



# CORE PHOTOGRAPHS

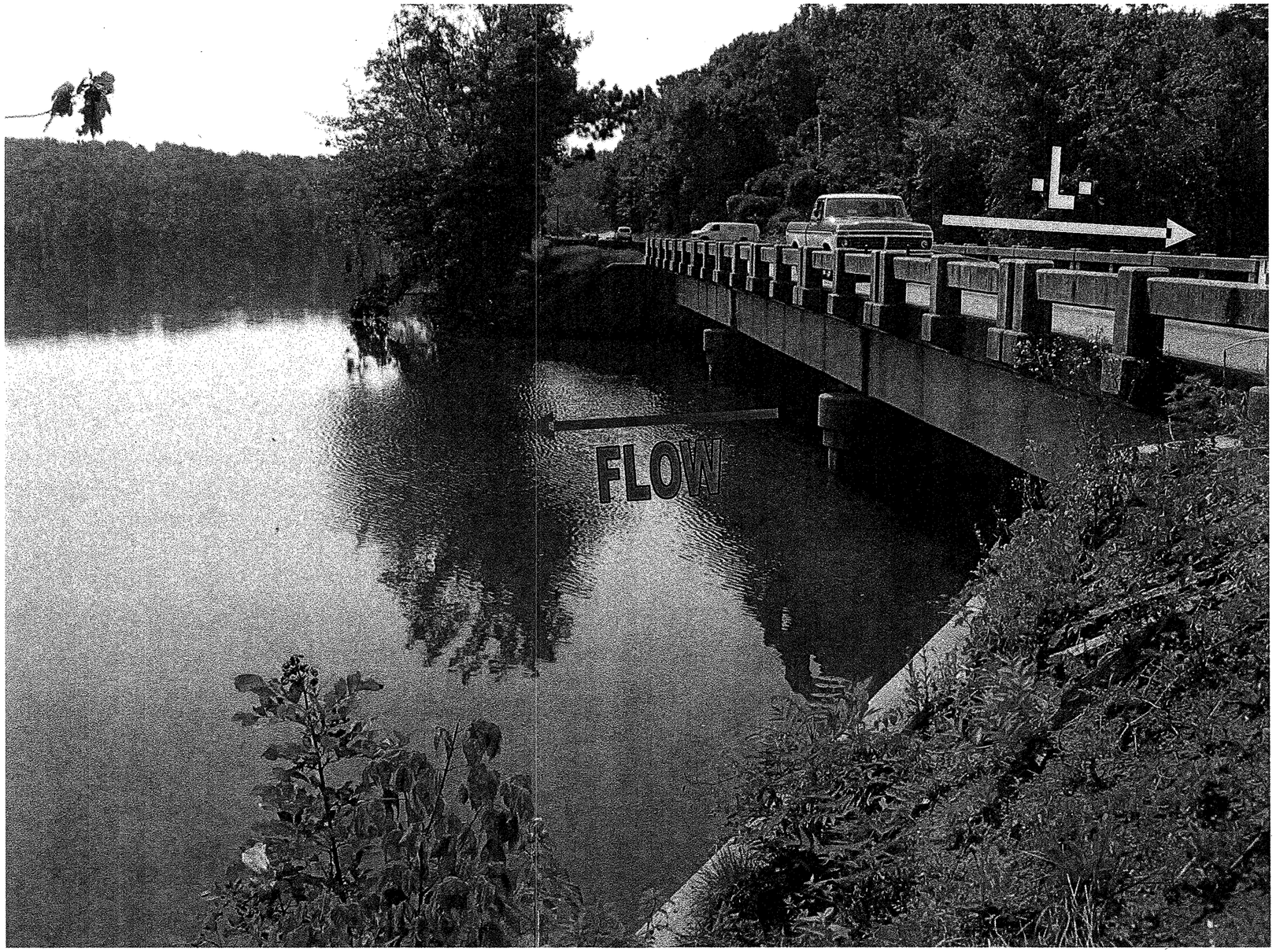
## B2-B RL

**BOX 1: 29.3 - 57.8 FEET**



# SITE PHOTOGRAPH

Bridge No. 313 on -L- (US 220, Battleground Ave.) Over Lake Brandt On Reedy Fork




Looking South

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34418.1.4 (R-2309AB) | 1 | 11 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34418.1.4 F.A. PROJ. STP-220(5)

COUNTY GUILFORD

PROJECT DESCRIPTION US 220 (BATTLEGROUND RD.) FROM SR 2182 TO 0.2 MILES NORTH OF SR 2313 IN GREENSBORO

SITE DESCRIPTION BRIDGE NO. 301 ON -L- (US 220, BATTLEGROUND RD.) OVER LAKE HIGGINS SPILLWAY ON BRUSH CREEK

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | LEGEND |
| 3 | SITE PLAN |
| 4 | PROFILE |
| 5 | CROSS SECTIONS |
| 6-9 | BORE LOGS |
| 10 | SOIL TEST RESULTS |
| 11 | SITE PHOTOGRAPH |


## CAUTION NOTICE

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CHECKED BY N.T. ROBERSON
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DATE JUNE 2009

NORTH CAROLINA LICENSED SEAL 2151 GEOLOGIST CHARLES DOUG CZAJKA 06/05/09

PROJECT: 34418.1.4

ID: R-2309AB

DRAWN BY: C.D. CZAJKA & T.T. WALKER

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| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34418.1.4 (R-2309AB) | 2 |

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

# SUBSURFACE INVESTIGATION

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

## SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

## SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

## CONSISTENCY OR DENSENESS

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

## TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

## SOIL MOISTURE - CORRELATION OF TERMS

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

## PLASTICITY

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

## COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

## GRADATION

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

## ANGULARITY OF GRAINS

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

## MINERALOGICAL COMPOSITION

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

## COMPRESSIBILITY

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

## PERCENTAGE OF MATERIAL

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

| OTHER MATERIAL | |
|---|---|
| TRACE | 1 - 10% |
| LITTLE | 10 - 20% |
| SOME | 20 - 35% |
| HIGHLY | 35% AND ABOVE |

## GROUND WATER

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

## MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF SPT REFUSAL

SAMPLE DESIGNATIONS
S - BULK SAMPLE
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE
RS - ROCK SAMPLE
RT - RECOMPACTED TRIAXIAL SAMPLE
CBR - CALIFORNIA BEARING RATIO SAMPLE

## ABBREVIATIONS

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
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
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

## EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-___
- [ ] BK-51
- [X] CME-45C
- [X] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [X] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [X] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

## WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V 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. |

## ROCK HARDNESS

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

## FRACTURE SPACING

| 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 |

## BEDDING

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

## INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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. |

## TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION. AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (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.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (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.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BL-16, -L- STA. 114+98.13, 38.75' LT

ELEVATION: 758.48 FT.

NOTES:

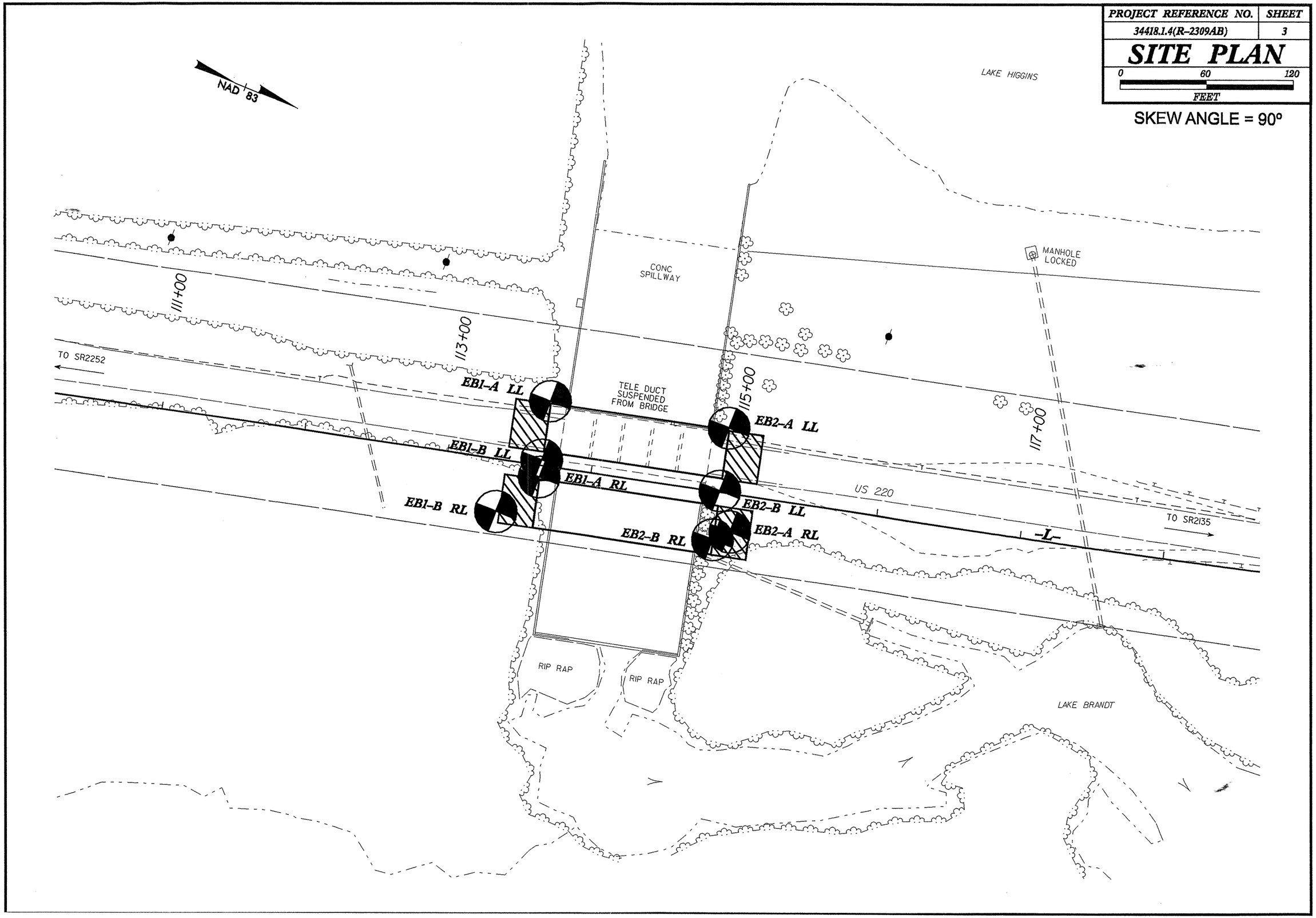
REVISED 02/23/06

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4(R-2309AB) | 3 |

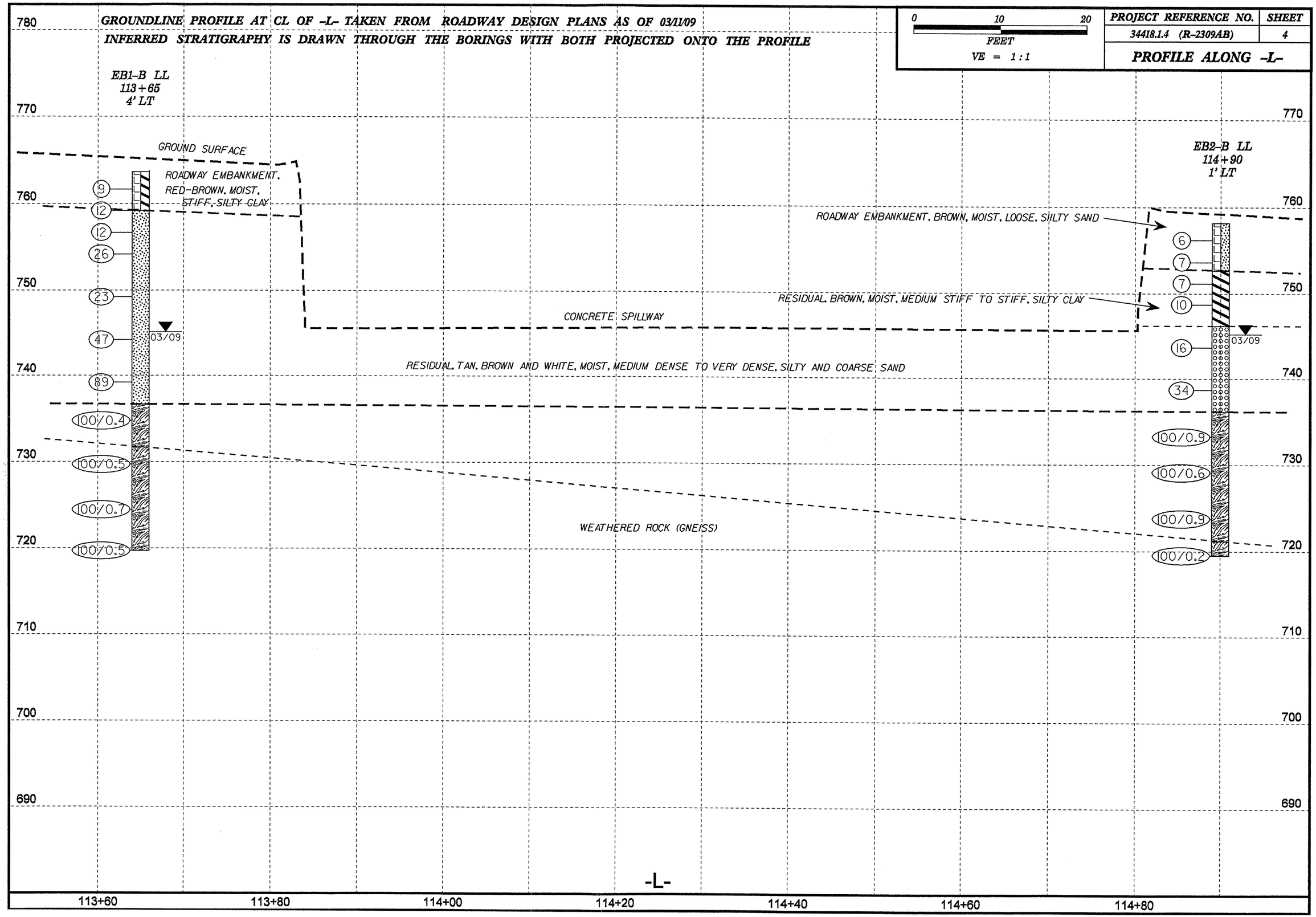
# SITE PLAN

0 60 120
FEET

SKEW ANGLE = 90°



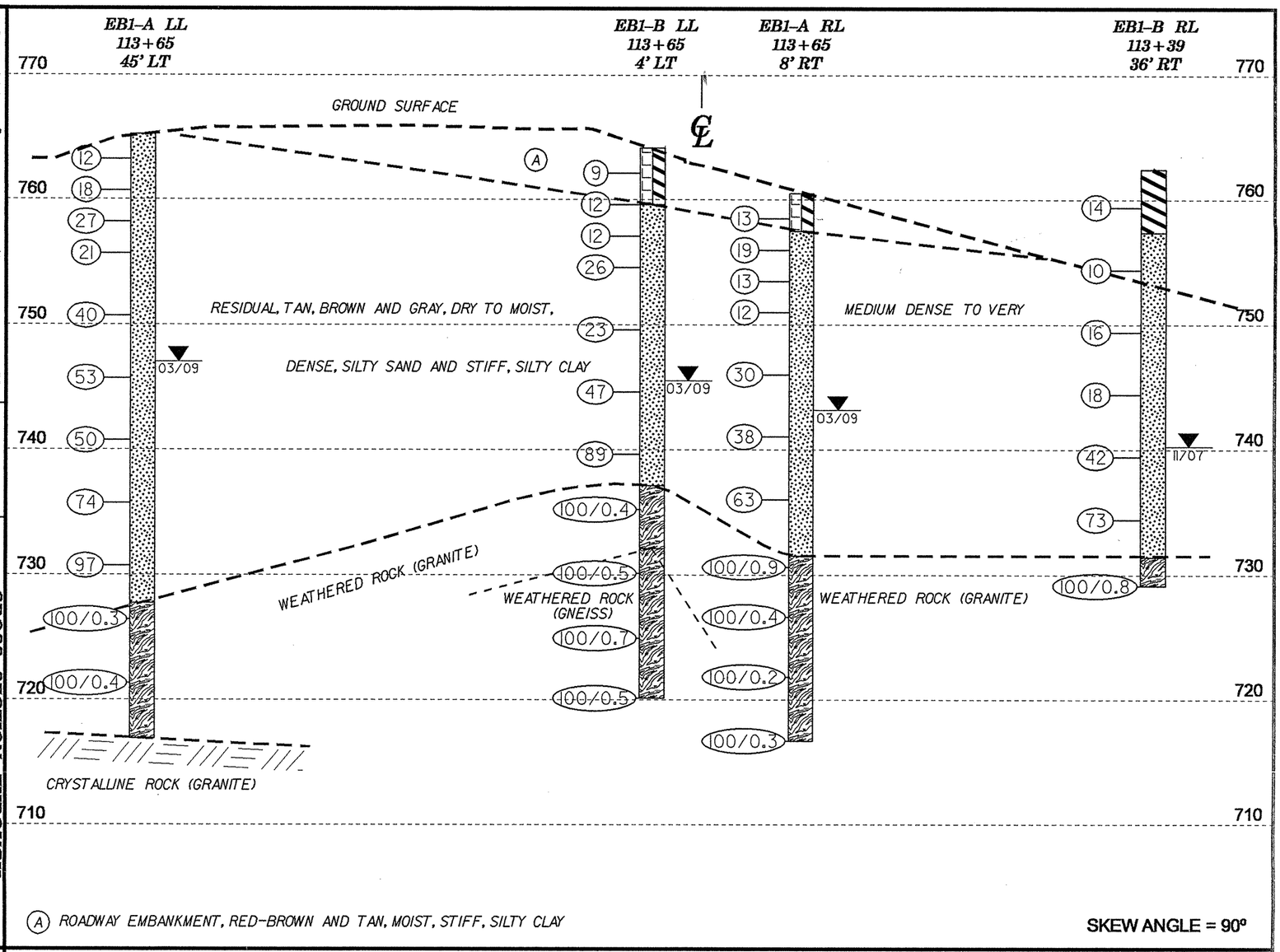
| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 4 |
| PROFILE ALONG -L- | |



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

## CROSS SECTION THROUGH END BENT 1



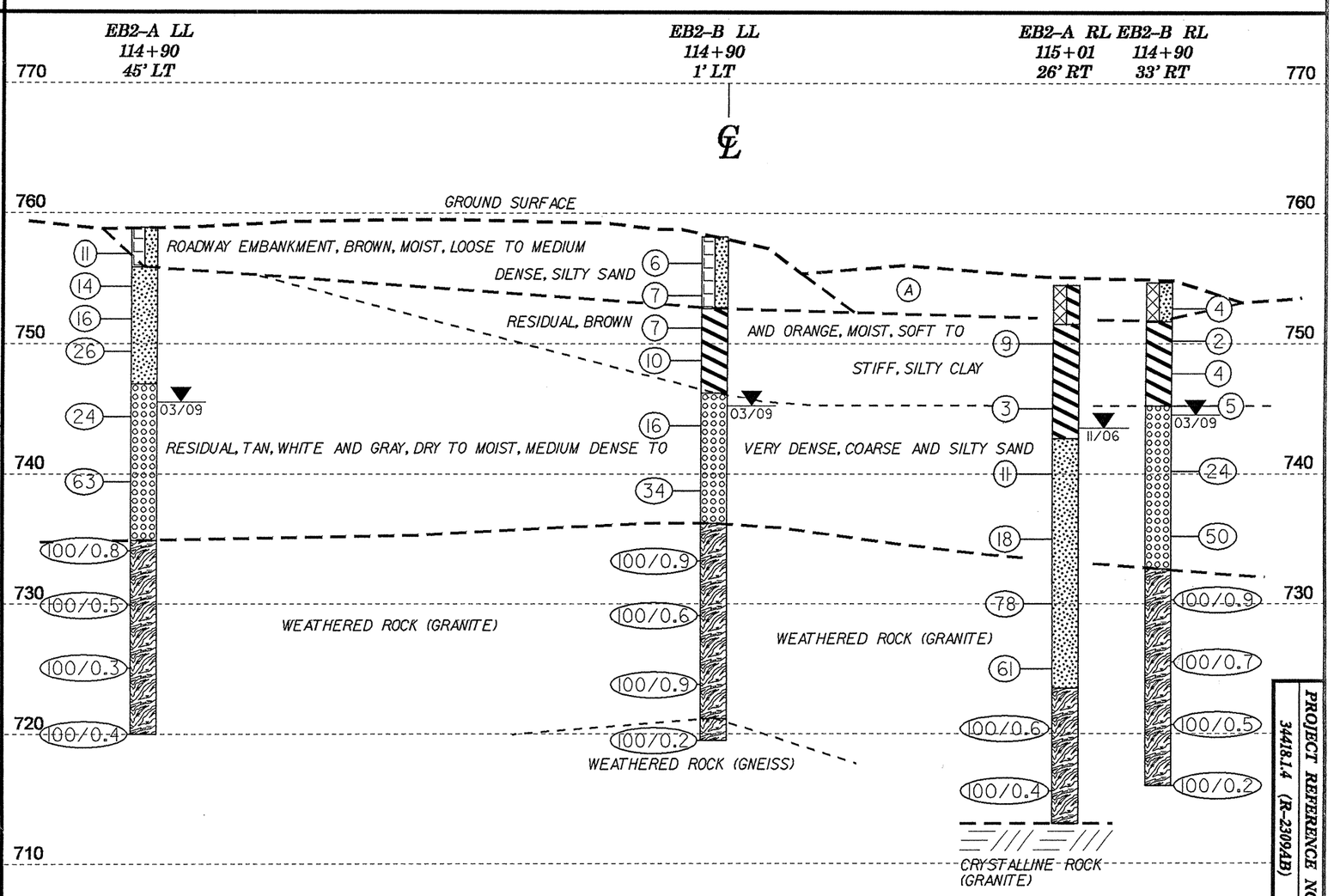

(A) ROADWAY EMBANKMENT, RED-BROWN AND TAN, MOIST, STIFF, SILTY CLAY

SKEW ANGLE = 90°

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

## CROSS SECTION THROUGH END BENT 2




(A) ARTIFICIAL FILL, BROWN, MOIST, MEDIUM STIFF, SILTY CLAY AND LOOSE SILTY SAND

SKEW ANGLE = 90°

| PROJECT REFERENCE NO. | SHEET |
|---|---|
| 34418.1.4 (R-2309AB) | 5 |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A LL | **STATION** 113+65 | **OFFSET** 45ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 764.8 ft | **TOTAL DEPTH** 48.3 ft | **NORTHING** 881,335 | **EASTING** 1,740,422 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/19/09 | **COMP. DATE** 03/19/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** 48.3 ft |

**GROUND WTR (ft)**: 0 HR. 18.4; 24 HR. 18.2

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 765 | | | | | | | | | | 764.8 GROUND SURFACE | 0.0 |
| | 763.8 | 1.0 | | | | | | | | **RESIDUAL** Tan and Brown, Silty Sand | |
| | | | 5 | 5 | 7 | 12 | SS-1 | M | | | |
| | 761.3 | 3.5 | | | | | | | | | |
| 760 | | | 6 | 7 | 11 | 18 | | D | | | |
| | 758.8 | 6.0 | | | | | | | | | |
| | | | 11 | 12 | 15 | 27 | SS-2 | D | | | |
| | 756.3 | 8.5 | | | | | | | | | |
| 755 | | | 9 | 10 | 11 | 21 | | D | | | |
| | 751.3 | 13.5 | | | | | | | | | |
| 750 | | | 14 | 19 | 21 | 40 | | D | | | |
| | 746.3 | 18.5 | | | | | | ▼ | | | |
| 745 | | | 34 | 30 | 23 | 53 | | M | | | |
| | 741.3 | 23.5 | | | | | | | | | |
| 740 | | | 12 | 21 | 29 | 50 | | M | | | |
| | 736.3 | 28.5 | | | | | | | | | |
| 735 | | | 28 | 27 | 47 | 74 | SS-3 | M | | | |
| | 731.3 | 33.5 | | | | | | | | | |
| 730 | | | 42 | 38 | 59 | 97 | | M | | | |
| | 726.3 | 38.5 | | | | | | | | 727.3 **WEATHERED ROCK** (Granite) | 37.5 |
| 725 | | | 100/0.3 | | | 100/0.3 | | | | | |
| | 721.3 | 43.5 | | | | | | | | | |
| 720 | | | 100/0.4 | | | 100/0.4 | | | | | |
| | | | | | | | | | | 716.5 Boring Terminated by Auger Refusal at Elevation 716.5 ft On Crystalline Rock (Granite) | 48.3 |
| 715 | | | | | | | | | | | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B LL | **STATION** 113+65 | **OFFSET** 4ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 763.7 ft | **TOTAL DEPTH** 44.0 ft | **NORTHING** 881,340 | **EASTING** 1,740,464 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/23/09 | **COMP. DATE** 03/23/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

**GROUND WTR (ft)**: 0 HR. Dry; 24 HR. 18.6

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 765 | | | | | | | | | | 763.7 GROUND SURFACE 0.0 |
| | 762.7 | 1.0 | | | | | | | | **ROADWAY EMBANKMENT** Red-Brown, Highly Micaceous, Silty Clay |
| | | | 2 | 4 | 5 | 9 | SS-4 | M | | |
| 760 | 760.2 | 3.5 | | | | | | | | 759.2 4.5 |
| | | | 3 | 5 | 7 | 12 | | M | | **RESIDUAL** Tan and Brown, Silty Sand |
| | 757.7 | 6.0 | | | | | | | | |
| | | | 7 | 6 | 6 | 12 | | M | | |
| 755 | 755.2 | 8.5 | | | | | | | | |
| | | | 6 | 11 | 15 | 26 | | M | | |
| 750 | 750.2 | 13.5 | | | | | | | | |
| | | | 9 | 10 | 13 | 23 | | M | | |
| 745 | 745.2 | 18.5 | | | | | | ▼ | | |
| | | | 11 | 25 | 22 | 47 | | M | | |
| 740 | 740.2 | 23.5 | | | | | | | | |
| | | | 23 | 34 | 55 | 89 | SS-5 | M | | |
| 735 | 735.2 | 28.5 | | | | | | | | 736.7 27.0 |
| | | | 100/0.4 | | | 100/0.4 | | | | **WEATHERED ROCK** (Granite) |
| 730 | 730.2 | 33.5 | | | | | | | | 731.7 32.0 |
| | | | 100/.05 | | | 100/0.5 | | | | (Gneiss) |
| 725 | 725.2 | 38.5 | | | | | | | | |
| | | | 57 | 43/0.2 | | 100/0.7 | | | | |
| 720 | 720.2 | 43.5 | | | | | | | | 719.7 44.0 |
| | | | 100/0.5 | | | 100/0.5 | | | | Boring Terminated at Elevation 719.7 ft In Weathered Rock (Gneiss) |
| 715 | | | | | | | | | | |
| 710 | | | | | | | | | | |
| 705 | | | | | | | | | | |
| 700 | | | | | | | | | | |
| 695 | | | | | | | | | | |
| 690 | | | | | | | | | | |
| 685 | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-A RL | **STATION** 113+65 | **OFFSET** 8ft RT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 760.1 ft | **TOTAL DEPTH** 43.8 ft | **NORTHING** 881,347 | **EASTING** 1,740,474 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/18/09 | **COMP. DATE** 03/18/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | 17.5 |
| 24 HR. | 17.4 |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 760 | | | | | | | | | | 760.1 GROUND SURFACE | 0.0 |
| | 759.1 | 1.0 | | | | | | | | **ROADWAY EMBANKMENT** Tan, Silty Clay | |
| | 756.6 | 3.5 | 4 | 5 | 8 | 13, 19 | | M | | 757.1 | 3.0 |
| 755 | 754.1 | 6.0 | 7 | 8 | 11 | | SS-6 | M | | **RESIDUAL** Tan and Brown, Silty Sand | |
| | 751.6 | 8.5 | 5 | 7 | 6 | 13, 12 | | M | | | |
| 750 | 746.6 | 13.5 | 4 | 5 | 7 | | | M | | | |
| 745 | 741.6 | 18.5 | 14 | 14 | 16 | 30 | | M | | | |
| 740 | 736.6 | 23.5 | 14 | 17 | 21 | 38 | | M | | | |
| 735 | 731.6 | 28.5 | 15 | 24 | 39 | 63 | | M | | 731.1 | 29.0 |
| 730 | 726.6 | 33.5 | 22 | 35 | 65/0.4 | 100/0.9 | | | | **WEATHERED ROCK** (Granite) | |
| 725 | 721.6 | 38.5 | 100/0.4 | | | 100/0.4 | | | | | |
| 720 | 716.6 | 43.5 | 100/0.2 | | | 100/0.2 | | | | 716.3 | 43.8 |
| 715 | | | 100/0.3 | | | 100/0.3 | | | | Boring Terminated at Elevation 716.3 ft In Weathered Rock (Granite) | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Kuntukova, K. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB1-B RL | **STATION** 113+39 | **OFFSET** 36ft RT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 762.0 ft | **TOTAL DEPTH** 33.3 ft | **NORTHING** 881,328 | **EASTING** 1,740,507 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 11/15/07 | **COMP. DATE** 11/15/07 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | 22.2 |
| 24 HR. | 22.2 |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 760 | 760.0 | 2.0 | 5 | 7 | 7 | 14 | SS-43 | M | | 762.0 GROUND SURFACE 0.0 |
| 755 | 755.0 | 7.0 | 4 | 5 | 5 | 10 | SS-44 | M | | **RESIDUAL** Red-Brown, Silty Clay |
| 750 | 750.0 | 12.0 | 6 | 7 | 9 | 16 | | M | | 757.0 5.0 |
| 745 | 745.0 | 17.0 | 6 | 8 | 10 | 18 | SS-45 | M | | Tan and Gray, Silty Sand |
| 740 | 740.0 | 22.0 | 14 | 19 | 23 | 42 | | M | | |
| 735 | 735.0 | 27.0 | 18 | 40 | 33 | 73 | | M | | 731.0 31.0 |
| 730 | 730.0 | 32.0 | 17 | 40 | 60/0.3 | 100/0.8 | | | | **WEATHERED ROCK** (Granite) 728.7 33.3 |
| 725 | | | | | | | | | | Boring Terminated at Elevation 728.7 ft In Weathered Rock (Granite) |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-A LL | **STATION** 114+90 | **OFFSET** 45ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 758.9 ft | **TOTAL DEPTH** 38.9 ft | **NORTHING** 881,457 | **EASTING** 1,740,394 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/19/09 | **COMP. DATE** 03/19/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | 13.7 |
| 24 HR. | 13.4 |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 760 | | | | | | | | | | 758.9 GROUND SURFACE | 0.0 |
| | 757.9 | 1.0 | | | | | | | | **ROADWAY EMBANKMENT** Brown, Silty Sand | |
| 755 | 755.4 | 3.5 | 4 | 4 | 7 | 11 | SS-7 | M | | 755.9 | 3.0 |
| | 752.9 | 6.0 | 5 | 7 | 7 | 14 | SS-8 | D | | **RESIDUAL** Tan and White, Silty Sand | |
| 750 | 750.4 | 8.5 | 5 | 7 | 9 | 16 | | D | | | |
| | | | 11 | 13 | 13 | 26 | | D | | 746.9 | 12.0 |
| 745 | 745.4 | 13.5 | 12 | 10 | 14 | 24 | SS-9 | M | | Tan and White, Coarse Sand | |
| 740 | 740.4 | 18.5 | 22 | 29 | 34 | 63 | | M | | | |
| 735 | 735.4 | 23.5 | 38 | 55 | 45/0.3 | 100/0.8 | | | | 734.9 **WEATHERED ROCK** (Granite) | 24.0 |
| 730 | 730.4 | 28.5 | 100/0.5 | | | 100/0.5 | | | | | |
| 725 | 725.4 | 33.5 | 100/0.3 | | | 100/0.3 | | | | | |
| 720 | 720.4 | 38.5 | 100/0.4 | | | 100/0.4 | | | | 720.0 Boring Terminated at Elevation 720.0 ft In Weathered Rock (Granite) | 38.9 |
| 715 | | | | | | | | | | | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B LL | **STATION** 114+90 | **OFFSET** 1ft LT | **ALIGNMENT** -L- |
| **COLLAR ELEV.** 758.2 ft | **TOTAL DEPTH** 38.7 ft | **NORTHING** 881,466 | **EASTING** 1,740,439 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/23/09 | **COMP. DATE** 03/23/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

| GROUND WTR (ft) | |
|---|---|
| 0 HR. | 13.3 |
| 24 HR. | 13.0 |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 760 | | | | | | | | | | 758.2 GROUND SURFACE | 0.0 |
| | 757.2 | 1.0 | | | | | | | | **ROADWAY EMBANKMENT** Brown, Silty Sand | |
| 755 | 754.7 | 3.5 | 2 | 3 | 3 | 6 | | M | | 752.7 | 5.5 |
| | 752.2 | 6.0 | 2 | 3 | 4 | 7 | | M | | **RESIDUAL** Brown, Highly Micaceous, Silty Clay | |
| 750 | 749.7 | 8.5 | 3 | 3 | 4 | 7 | SS-10 | M | | | |
| | | | 3 | 4 | 6 | 10 | | M | | 746.2 | 12.0 |
| 745 | 744.7 | 13.5 | 7 | 8 | 8 | 16 | | M | | Tan and White, Coarse Sand | |
| 740 | 739.7 | 18.5 | 17 | 15 | 19 | 34 | | W | | | |
| 735 | 734.7 | 23.5 | 35 | 49 | 51/0.4 | 100/0.9 | | | | 736.2 **WEATHERED ROCK** (Granite) | 22.0 |
| 730 | 729.7 | 28.5 | 66 | 34/0.1 | | 100/0.6 | | | | | |
| 725 | 724.7 | 33.5 | 55 | 45/0.4 | | 100/0.9 | | | | 721.2 (Gneiss) | 37.0 |
| 720 | 719.7 | 38.5 | 100/0.2 | | | 100/0.2 | | | | 719.5 Boring Terminated at Elevation 719.5 ft In Weathered Rock (Gneiss) | 38.7 |
| 715 | | | | | | | | | | | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |

# NCDOT GEOTECHNICAL ENGINEERING UNIT
# BORELOG REPORT

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Mohs, N. D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-A RL | **STATION** 115+01 | **OFFSET** 26ft RT | **ALIGNMENT** -L- | **0 HR.** 10.0 |
| **COLLAR ELEV.** 754.5 ft | **TOTAL DEPTH** 41.1 ft | **NORTHING** 881,483 | **EASTING** 1,740,461 | **24 HR.** 11.0 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Automatic |
| **START DATE** 10/31/06 | **COMP. DATE** 10/31/06 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** 41.1 ft |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION ELEV. (ft) | DEPTH (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 755 | | | | | | | | | | 754.5 GROUND SURFACE | 0.0 |
| | | | | | | | | | | **ARTIFICIAL FILL (ENGINEERED)** Brown, Silty Clay | |
| | 751.0 | 3.5 | | | | | | | | 751.5 | 3.0 |
| 750 | | | 4 | 4 | 5 | 9 | | M | | **RESIDUAL** Orange and Brown, Silty Clay | |
| | 746.0 | 8.5 | | | | | | | | | |
| 745 | | | 1 | 2 | 1 | 3 | | M | | | |
| | | | | | | | | | | 742.7 | 11.8 |
| | 741.0 | 13.5 | | | | | | | | White and Gray, Saprolitic, Silty Sand | |
| 740 | | | 1 | 5 | 6 | 11 | | M | | | |
| | 736.0 | 18.5 | | | | | | | | | |
| 735 | | | 7 | 10 | 8 | 18 | | W | | | |
| | 731.0 | 23.5 | | | | | | | | | |
| 730 | | | 23 | 34 | 44 | 78 | | M | | | |
| | 726.0 | 28.5 | | | | | | | | | |
| 725 | | | 20 | 29 | 32 | 61 | | M | | | |
| | | | | | | | | | | 723.5 | 31.0 |
| | 721.0 | 33.5 | | | | | | | | **WEATHERED ROCK** (Granite) | |
| 720 | | | 88 | 12/0.1 | | 100/0.6 | | | | | |
| | 716.0 | 38.5 | | | | | | | | | |
| 715 | | | 100/0.4 | | | 100/0.4 | | | | | |
| | | | | | | | | | | 713.4 | 41.1 |
| | | | | | | | | | | Boring Terminated by Auger Refusal at Elevation 713.4 ft On Crystalline Rock (Granite) | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **PROJECT NO.** 34418.1.4 | **ID.** R-2309AB | **COUNTY** Guilford | **GEOLOGIST** Goodnight, D. |
| **SITE DESCRIPTION** Bridge No. 301 on -L- (US 220, Battleground Rd.) over Lake Higgins Spillway on Brush Creek | | | **GROUND WTR (ft)** |
| **BORING NO.** EB2-B RL | **STATION** 114+90 | **OFFSET** 33ft RT | **ALIGNMENT** -L- | **0 HR.** 10.7 |
| **COLLAR ELEV.** 754.9 ft | **TOTAL DEPTH** 38.7 ft | **NORTHING** 881,458 | **EASTING** 1,740,484 | **24 HR.** 10.2 |
| **DRILL MACHINE** CME-45 | **DRILL METHOD** H.S. Augers | | **HAMMER TYPE** Manual |
| **START DATE** 03/18/09 | **COMP. DATE** 03/18/09 | **SURFACE WATER DEPTH** N/A | **DEPTH TO ROCK** N/A |

| ELEV (ft) | DRIVE ELEV (ft) | DEPTH (ft) | BLOW COUNT 0.5ft | 0.5ft | 0.5ft | BLOWS PER FOOT 0 25 50 75 100 | SAMP. NO. | MOI | LOG | SOIL AND ROCK DESCRIPTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 755 | | | | | | | | | | 754.9 GROUND SURFACE | 0.0 |
| | 753.9 | 1.0 | | | | | | | | **ARTIFICIAL FILL (ENGINEERED)** Brown, Highly Micaceous, Silty Sand | |
| | | | 2 | 2 | 2 | 4 | SS-11 | M | | 751.9 | 3.0 |
| | 751.4 | 3.5 | | | | | | | | **RESIDUAL** Brown, Highly Micaceous, Silty Clay | |
| 750 | | | 1 | 1 | 1 | 2 | | M | | | |
| | 748.9 | 6.0 | | | | | | | | | |
| | | | 2 | 2 | 2 | 4 | | M | | | |
| | 746.4 | 8.5 | | | | | | | | | |
| 745 | | | 2 | 2 | 3 | 5 | | M | | 745.4 | 9.5 |
| | | | | | | | | | | Tan and White, Coarse Sand | |
| | 741.4 | 13.5 | | | | | | | | | |
| 740 | | | 11 | 12 | 12 | 24 | | M | | | |
| | 736.4 | 18.5 | | | | | | | | | |
| 735 | | | 14 | 22 | 28 | 50 | | M | | | |
| | | | | | | | | | | 732.9 | 22.0 |
| | 731.4 | 23.5 | | | | | | | | **WEATHERED ROCK** (Granite) | |
| 730 | | | 58 | 42/0.4 | | 100/0.9 | | | | | |
| | 726.4 | 28.5 | | | | | | | | | |
| 725 | | | 50 | 50/0.2 | | 100/0.7 | | | | | |
| | 721.4 | 33.5 | | | | | | | | | |
| 720 | | | 100/0.5 | | | 100/0.5 | | | | | |
| | 716.4 | 38.5 | | | | | | | | | |
| 715 | | | 100/0.2 | | | 100/0.2 | | | | 716.2 | 38.7 |
| | | | | | | | | | | Boring Terminated at Elevation 716.2 ft In Weathered Rock (Granite) | |
| 710 | | | | | | | | | | | |
| 705 | | | | | | | | | | | |
| 700 | | | | | | | | | | | |
| 695 | | | | | | | | | | | |
| 690 | | | | | | | | | | | |
| 685 | | | | | | | | | | | |
| 680 | | | | | | | | | | | |
| 675 | | | | | | | | | | | |

NCDOT BORE DOUBLE R2309AB_GEO_BRDG301.GPJ NC_DOT.GDT 06/02/09

*EB1-A LL*

## 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 | 45' LT | 113+65 | 1.0-2.5 | A-2-4(0) | 35 | 4 | 48.7 | 23.5 | 17.6 | 10.2 | 79 | 52 | 25 | - | - |
| SS-2 | 45' LT | 113+65 | 6.0-7.5 | A-2-4(0) | 37 | NP | 49.1 | 37.4 | 11.5 | 2.0 | 93 | 66 | 17 | - | - |
| SS-3 | 45' LT | 113+65 | 28.5-30.0 | A-2-4(0) | 33 | NP | 35.6 | 41.3 | 21.1 | 2.0 | 100 | 85 | 28 | - | - |

*EB1-B LL*

## 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-4 | 4' LT | 113+65 | 1.0-2.5 | A-7-5(9) | 54 | 24 | 33.3 | 19.4 | 18.6 | 28.6 | 98 | 76 | 50 | - | - |
| SS-5 | 4' LT | 113+65 | 23.5-25.0 | A-2-4(0) | 33 | NP | 52.4 | 35.4 | 10.2 | 2.0 | 100 | 70 | 17 | - | - |

*EB1-A RL*

## 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 | 8' RT | 113+65 | 3.5-5.0 | A-2-5(0) | 41 | NP | 62.8 | 23.7 | 11.5 | 2.0 | 99 | 55 | 17 | - | - |

*EB1-B RL*

## 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-43 | 36' RT | 113+39 | 2.0-3.5 | A-7-5(6) | 62 | 20 | 35.3 | 21.0 | 23.6 | 20.2 | 96 | 73 | 45 | - | - |
| SS-44 | 36' RT | 113+39 | 7.0-8.5 | A-2-5(0) | 53 | 7 | 46.4 | 26.4 | 19.2 | 8.1 | 87 | 62 | 27 | - | - |
| SS-45 | 36' RT | 113+39 | 17.0-18.5 | A-2-5(0) | 49 | 6 | 34.5 | 36.3 | 23.2 | 6.0 | 99 | 81 | 34 | - | - |

*EB2-A LL*

## 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-7 | 45' LT | 114+90 | 1.0-2.5 | A-2-5(0) | 41 | 9 | 41.3 | 30.9 | 19.6 | 8.2 | 87 | 64 | 29 | - | - |
| SS-8 | 45' LT | 114+90 | 3.5-5.0 | A-2-5(0) | 44 | NP | 45.2 | 33.7 | 19.0 | 2.0 | 95 | 71 | 24 | - | - |
| SS-9 | 45' LT | 114+90 | 13.5-15.0 | A-1-b(0) | 37 | 2 | 57.3 | 25.4 | 15.3 | 2.0 | 83 | 48 | 18 | - | - |

*EB2-B LL*

## 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-10 | 1' LT | 114+90 | 6.0-7.5 | A-7-5(4) | 48 | 16 | 37.2 | 21.7 | 20.7 | 20.4 | 96 | 72 | 43 | - | - |

*EB2-B RL*

## 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 | 33' RT | 114+90 | 3.5-5.0 | A-2-5(0) | 46 | 9 | 47.4 | 25.4 | 17.0 | 10.2 | 89 | 61 | 27 | - | - |

# SITE PHOTOGRAPH

Bridge No. 301 on -L- (US 220, Battleground Rd.) Over Lake Higgins Spillway on Brush Creek

Looking West

# SITE PHOTOGRAPH

Bridge No. 301 on -L- (US 220, Battleground Rd.) Over Lake Higgins Spillway on Brush Creek

Looking West

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34418.1.4 (R-2309AB) | 1 | 4 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34418.1.4 F.A. PROJ. STP-220(5)

COUNTY GUILFORD

PROJECT DESCRIPTION US 220 FROM SR 2182 TO 0.2 MILES NORTH OF SR 2313

SITE DESCRIPTION NOISE WALL -NW1- FROM -L- STA 230+90.00, 49.5' RT TO -L- STA 248+89.60, 61.5' RT

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | NCDOT DIVISION OF HIGHWAYS GEOTECHNICAL UNIT SOIL AND ROCK LEGEND, TERMS, AND ABBREVIATIONS |
| 3-4 | STRUCTURE SUBSURFACE INVESTIGATION REPORT<br>SITE PLANS WITH BORING LOCATIONS<br>WALL ENVELOPES WITH BORING DATA |


## 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
C. NORVILLE
M. BAHIRADHAN
J. HAMM
T. EVANS
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INVESTIGATED BY T. EVANS
CHECKED BY M. BAHIRADHAN
SUBMITTED BY FALCON ENG.
DATE DECEMBER 12, 2011

NORTH CAROLINA PROFESSIONAL SEAL 036072 ENGINEER MAHALINGAM BAHIRADHAN
12/12/11

DRAWN BY: T. EVANS

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.

PROJECT: 34418.1.4 ID: R-2309AB

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34418.1.4 (R-2309AB) | 2 |

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

# SUBSURFACE INVESTIGATION

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

## SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

## SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

## CONSISTENCY OR DENSENESS

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

## TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

## SOIL MOISTURE - CORRELATION OF TERMS

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

## PLASTICITY

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

## COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

## GRADATION

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

## ANGULARITY OF GRAINS

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

## MINERALOGICAL COMPOSITION

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

## COMPRESSIBILITY

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

## PERCENTAGE OF MATERIAL

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

| OTHER MATERIAL | |
|---|---|
| TRACE | 1 - 10% |
| LITTLE | 10 - 20% |
| SOME | 20 - 35% |
| HIGHLY | 35% AND ABOVE |

## GROUND WATER

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

## MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

## ABBREVIATIONS

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
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
$w$ - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

## EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B-__
- [ ] BK-51
- [ ] CME-45C
- [X] CME-850
- [ ] PORTABLE HOIST
- [X] CME-55 (TRUCK)
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE __" STEEL TEETH
- [ ] TRICONE __" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B
- [ ] -N
- [ ] -H

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

## WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V 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. |

## ROCK HARDNESS

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

## FRACTURE SPACING

| 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 |

## BEDDING

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

## INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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. |

## TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (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.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (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.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK:

ELEVATION: FT.

NOTES:
FIAD - FILLED-IN AFTER DRILLING

Florence & Hutcheson
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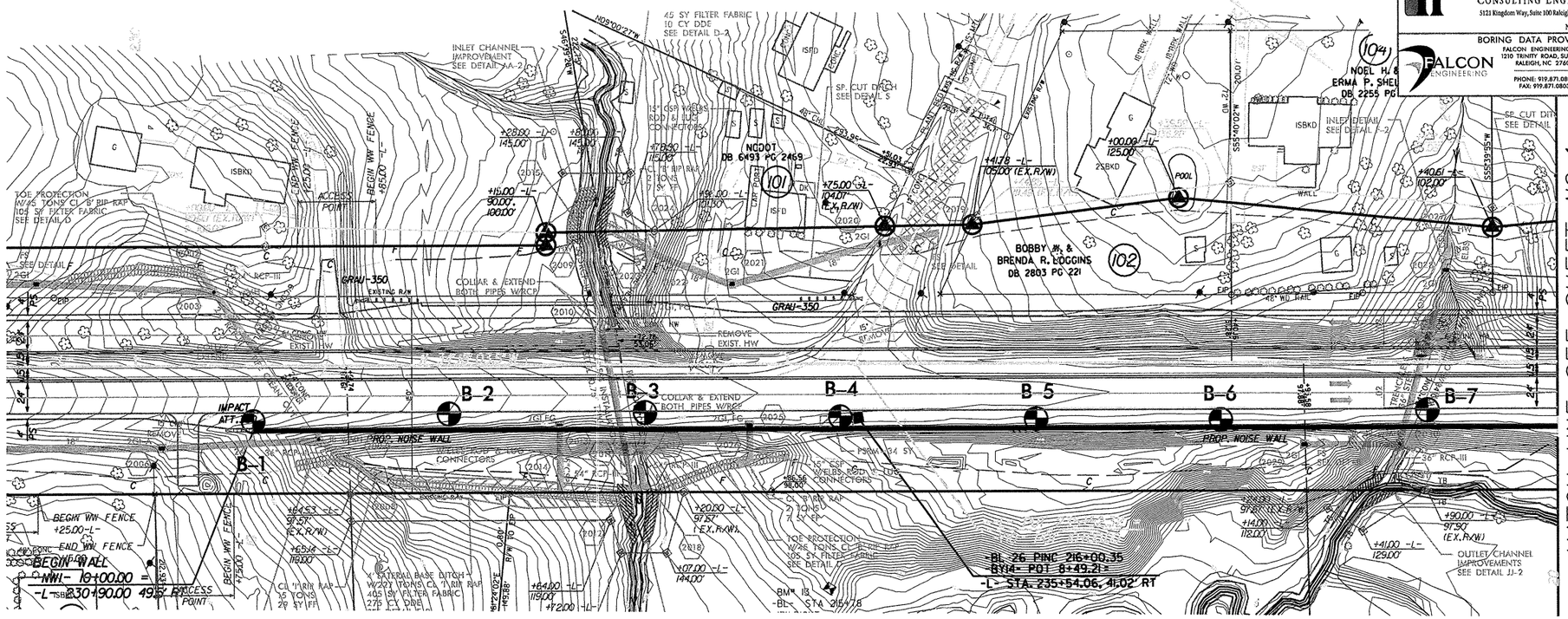
R-2309AB | 3

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

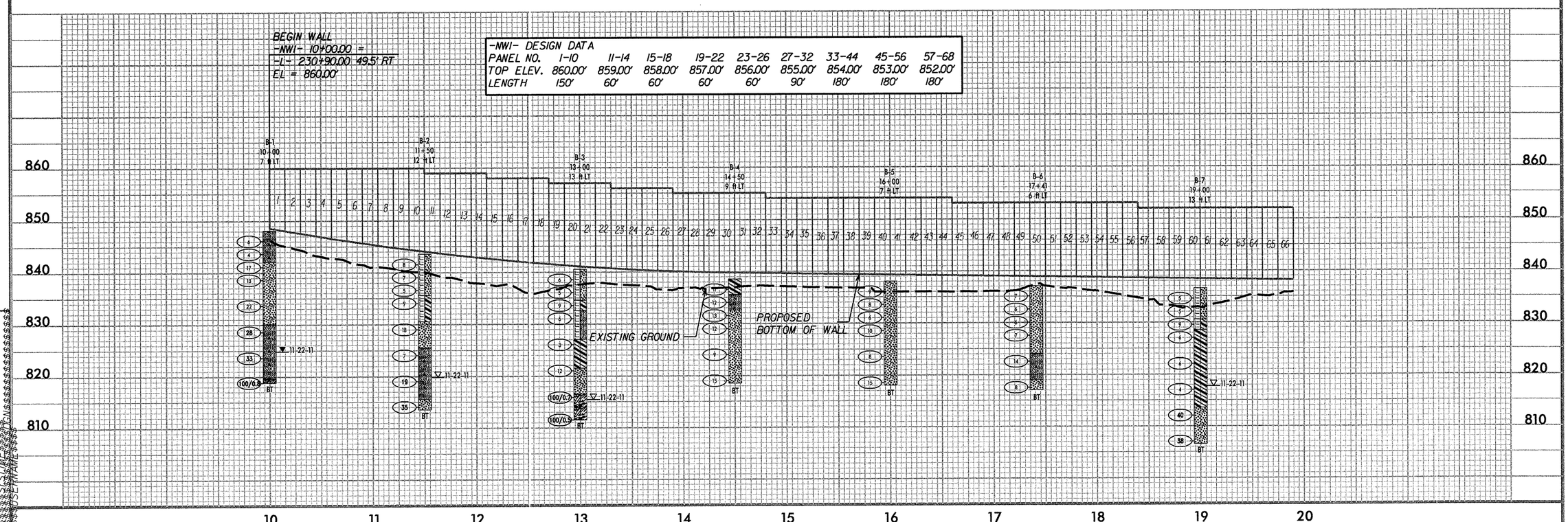
REVISIONS

REVISIONS




-NWI- DESIGN DATA

| PANEL NO. | 1-10 | 11-14 | 15-18 | 19-22 | 23-26 | 27-32 | 33-44 | 45-56 | 57-68 |
|---|---|---|---|---|---|---|---|---|---|
| TOP ELEV. | 860.00' | 859.00' | 858.00' | 857.00' | 856.00' | 855.00' | 854.00' | 853.00' | 852.00' |
| LENGTH | 150' | 60' | 60' | 60' | 60' | 90' | 180' | 180' | 180' |



| R-2309AB | 4 |
|---|---|

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

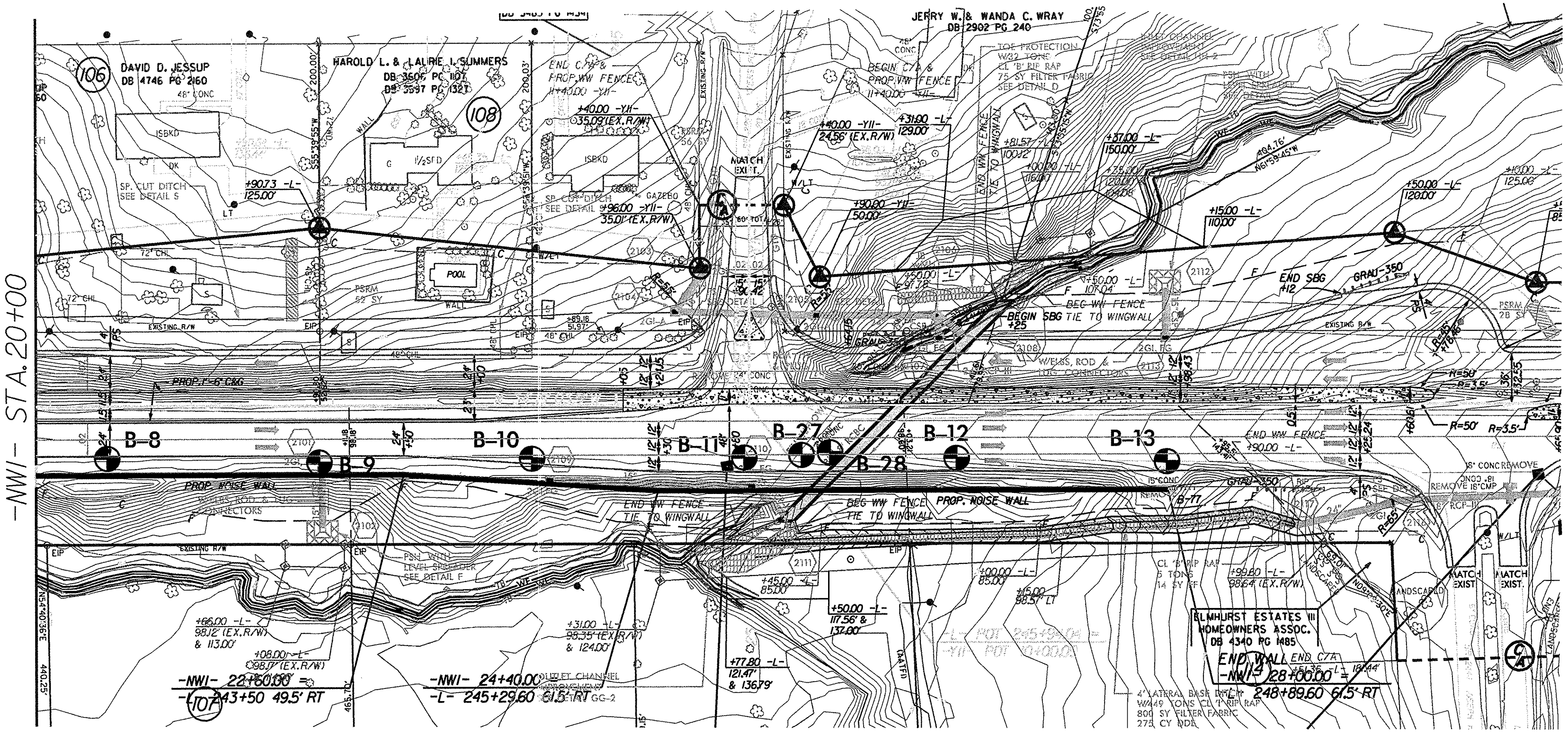
**Florence & Hutcheson**
CONSULTING ENGINEERS
5121 Kingdom Way, Suite 100 Raleigh, NC 27607
NC License No: F-0258

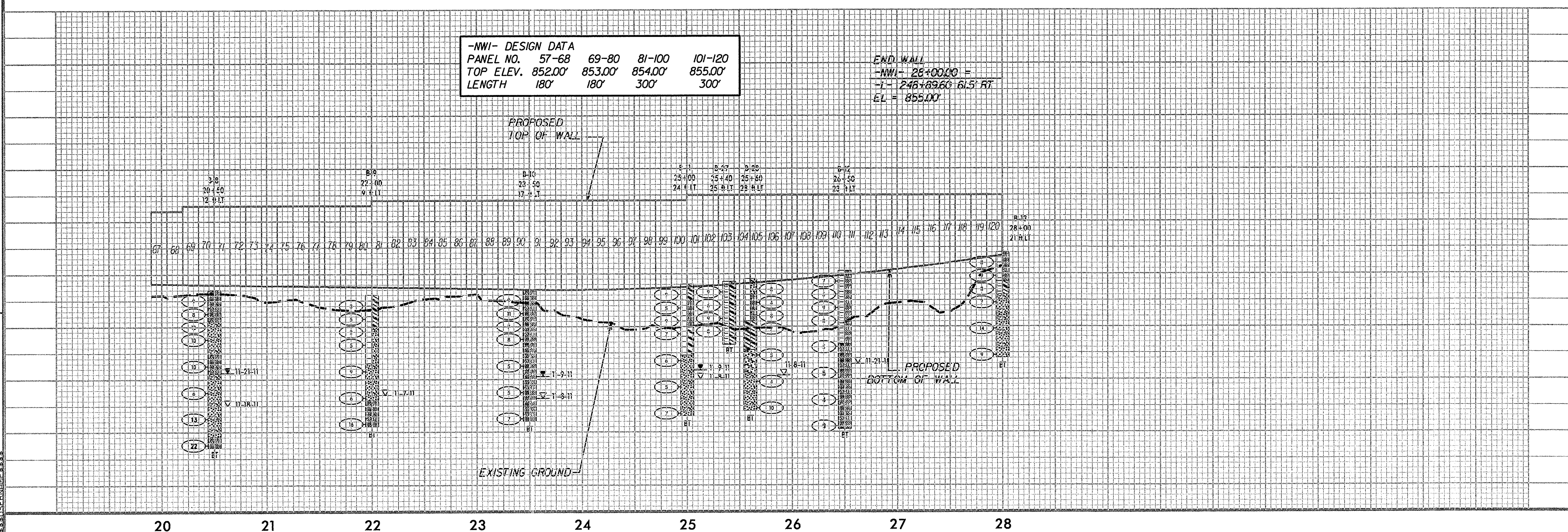
BORING DATA PROVIDED BY:
FALCON ENGINEERING
FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607
PHONE: 919.871.0800
FAX: 919.871.0803

8/17/99

REVISIONS

MATCH LINE SEE SHEET NO.3
-NWI- STA. 20+00




| -NWI- DESIGN DATA | | | | |
|---|---|---|---|---|
| PANEL NO. | 57-68 | 69-80 | 81-100 | 101-120 |
| TOP ELEV. | 852.00' | 853.00' | 854.00' | 855.00' |
| LENGTH | 180' | 180' | 300' | 300' |

$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$$

| STATE | STATE PROJECT REFERENCE NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 34418.1.4 (R-2309AB) | 1 | 4 |

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

# STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 34418.1.4 F.A. PROJ. STP-220(5)

COUNTY GUILFORD

PROJECT DESCRIPTION US 220 FROM SR 2182 TO 0.2 MILES NORTH OF SR 2313

SITE DESCRIPTION NOISE WALL -NW2- FROM -L- STA 251+69.39, 158.66' RT TO -L- STA 268+51.32, 84.55' RT

## CONTENTS


| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | NCDOT DIVISION OF HIGHWAYS GEOTECHNICAL UNIT SOIL AND ROCK LEGEND, TERMS, AND ABBREVIATIONS |
| 3-4 | STRUCTURE SUBSURFACE INVESTIGATION REPORT<br>SITE PLANS WITH BORING LOCATIONS<br>WALL ENVELOPES WITH BORING DATA |


## 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

C. NORVILLE

M. BAHIRADHAN

J. HAMM

T. EVANS

INVESTIGATED BY T. EVANS

CHECKED BY M. BAHIRADHAN

SUBMITTED BY FALCON ENG.

DATE DECEMBER 12, 2011

NORTH CAROLINA PROFESSIONAL SEAL 036072 ENGINEER MAHALINGAM BAHIRADHAN

12/12/11

PROJECT: 34418.1.4

ID: R-2309AB

DRAWN BY: T. EVANS

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.

| PROJECT REFERENCE NO. | SHEET NO. |
|---|---|
| 34418.1.4 (R-2309AB) | 2 |

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

# SUBSURFACE INVESTIGATION

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

## SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

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

## SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

## CONSISTENCY OR DENSENESS

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

## TEXTURE OR GRAIN SIZE

| U.S. STD. SIEVE SIZE | 4 | 10 | 40 | 60 | 200 | 270 |
|---|---|---|---|---|---|---|
| OPENING (MM) | 4.76 | 2.00 | 0.42 | 0.25 | 0.075 | 0.053 |

| BOULDER (BLDR.) | COBBLE (COB.) | GRAVEL (GR.) | COARSE SAND (CSE. SD.) | FINE SAND (F SD.) | SILT (SL.) | CLAY (CL.) |
|---|---|---|---|---|---|---|

GRAIN SIZE MM: 305 | 75 | 2.0 | 0.25 | 0.05 | 0.005
GRAIN SIZE IN.: 12 | 3

## SOIL MOISTURE - CORRELATION OF TERMS

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

## PLASTICITY

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

## COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

## GRADATION

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

## ANGULARITY OF GRAINS

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

## MINERALOGICAL COMPOSITION

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

## COMPRESSIBILITY

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

## PERCENTAGE OF MATERIAL

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

| OTHER MATERIAL | |
|---|---|
| TRACE | 1 - 10% |
| LITTLE | 10 - 20% |
| SOME | 20 - 35% |
| HIGHLY | 35% AND ABOVE |

## GROUND WATER

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

## MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

## ABBREVIATIONS

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
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
$w$ - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
$\gamma$ - UNIT WEIGHT
$\gamma_d$ - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS
S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

## EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] MOBILE B- __
- [ ] BK-51
- [ ] CME-45C
- [X] CME-850
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE ____" STEEL TEETH
- [ ] TRICONE ____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B _____
- [ ] -N _____
- [ ] -H _____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

## ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

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

## WEATHERING

| | |
|---|---|
| FRESH | ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. |
| VERY SLIGHT (V 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. |

## ROCK HARDNESS

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

## FRACTURE SPACING

| 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 |

## BEDDING

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

## INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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. |

## TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (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.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (REC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

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.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK:

ELEVATION: FT.

NOTES:
FIAD - FILLED-IN AFTER DRILLING

REVISED 09/23/09

8/17/99

REVISIONS

| R-2309AB | 3 |
|---|---|

**INCOMPLETE PLANS**
DO NOT USE FOR R/W ACQUISITION

**PRELIMINARY PLANS**
DO NOT USE FOR CONSTRUCTION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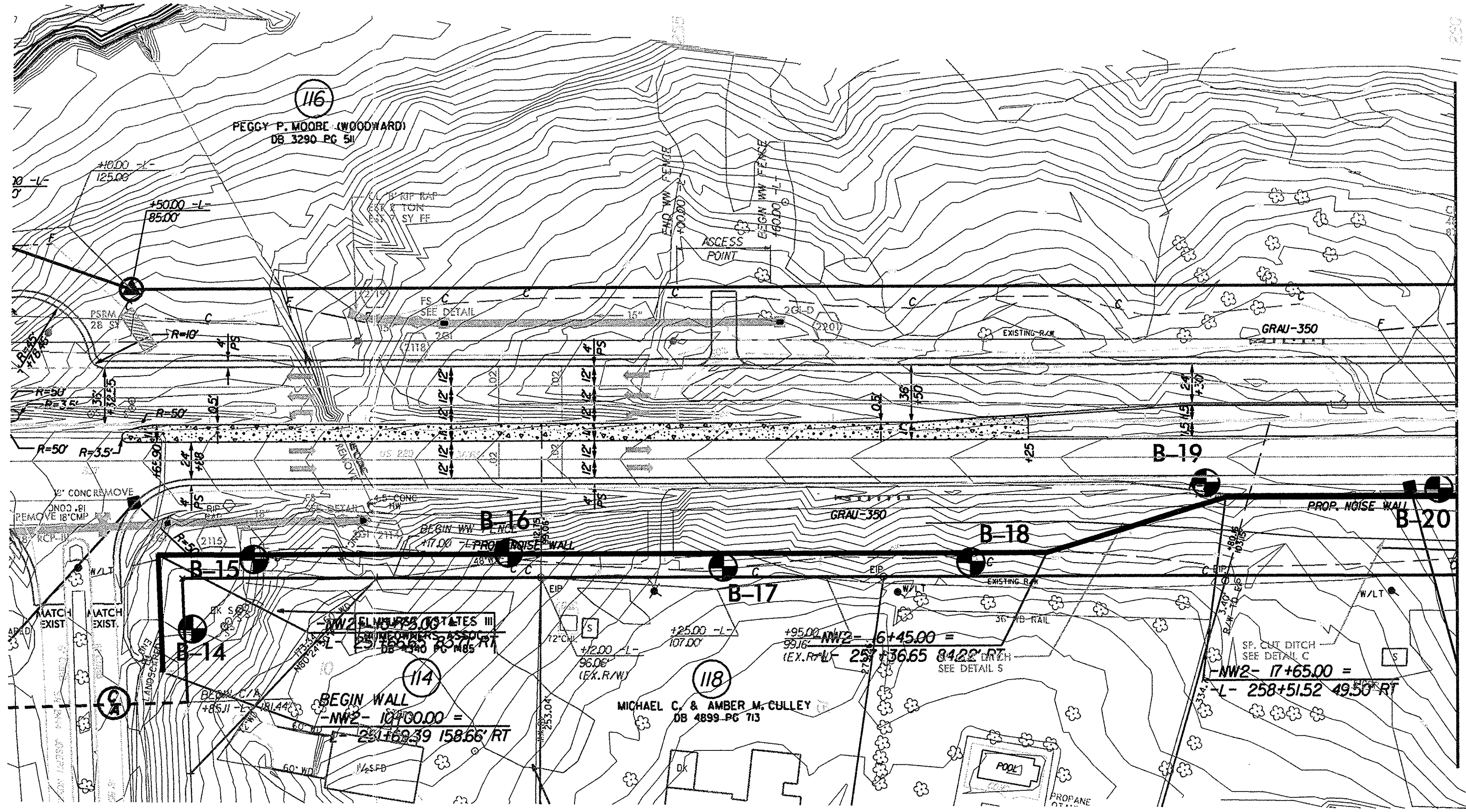
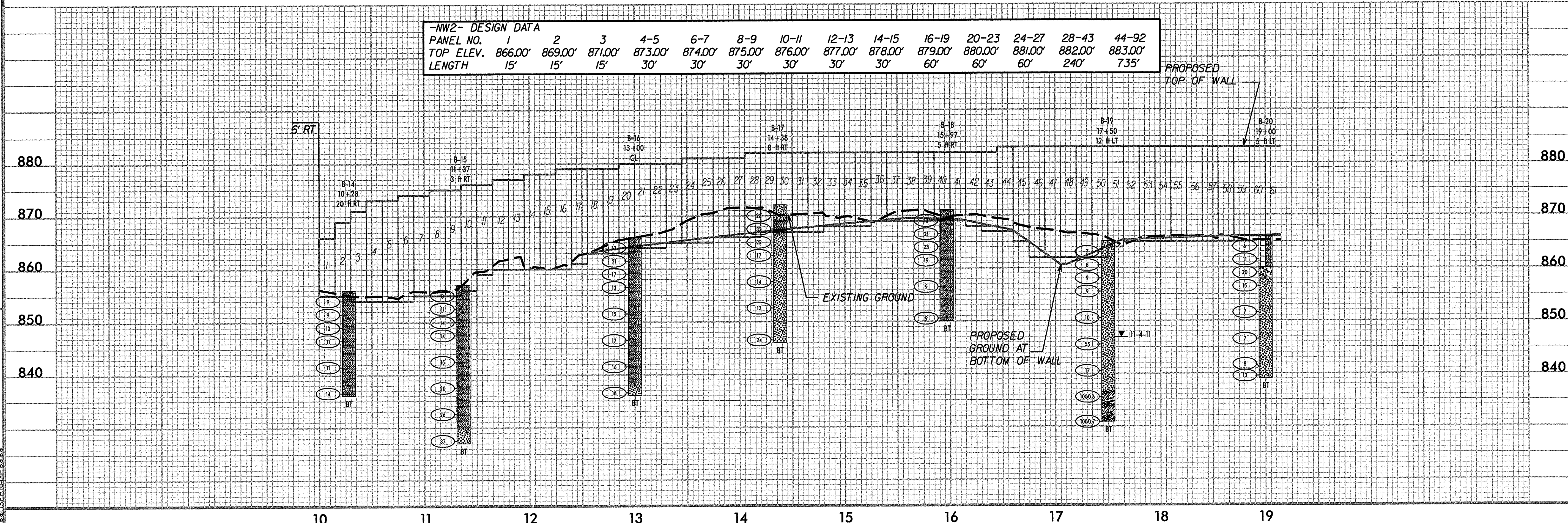



MATCH LINE SEE SHEET NO. 4
-NW2- STA.19+14

-NW2- DESIGN DATA

| PANEL NO. | 1 | 2 | 3 | 4-5 | 6-7 | 8-9 | 10-11 | 12-13 | 14-15 | 16-19 | 20-23 | 24-27 | 28-43 | 44-92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOP ELEV. | 866.00' | 869.00' | 871.00' | 873.00' | 874.00' | 875.00' | 876.00' | 877.00' | 878.00' | 879.00' | 880.00' | 881.00' | 882.00' | 883.00' |
| LENGTH | 15' | 15' | 15' | 30' | 30' | 30' | 30' | 30' | 30' | 60' | 60' | 60' | 240' | 735' |




$$$$SYSTIME$$$$ $$$$$$DGN$$$$$$ $$$$USERNAME$$$$

8/17/99

REVISIONS

| R-2309AB | 4 |
|---|---|

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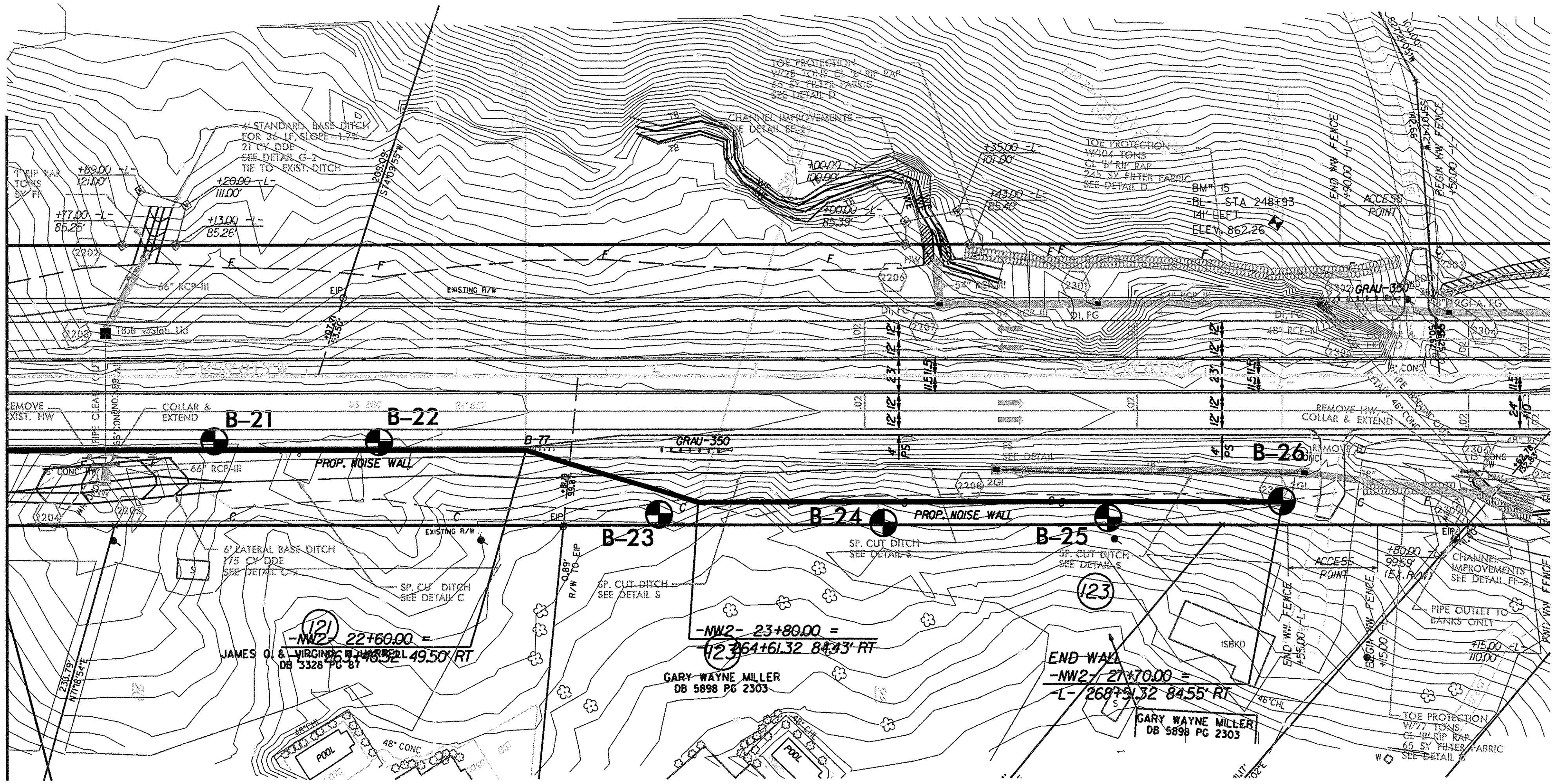
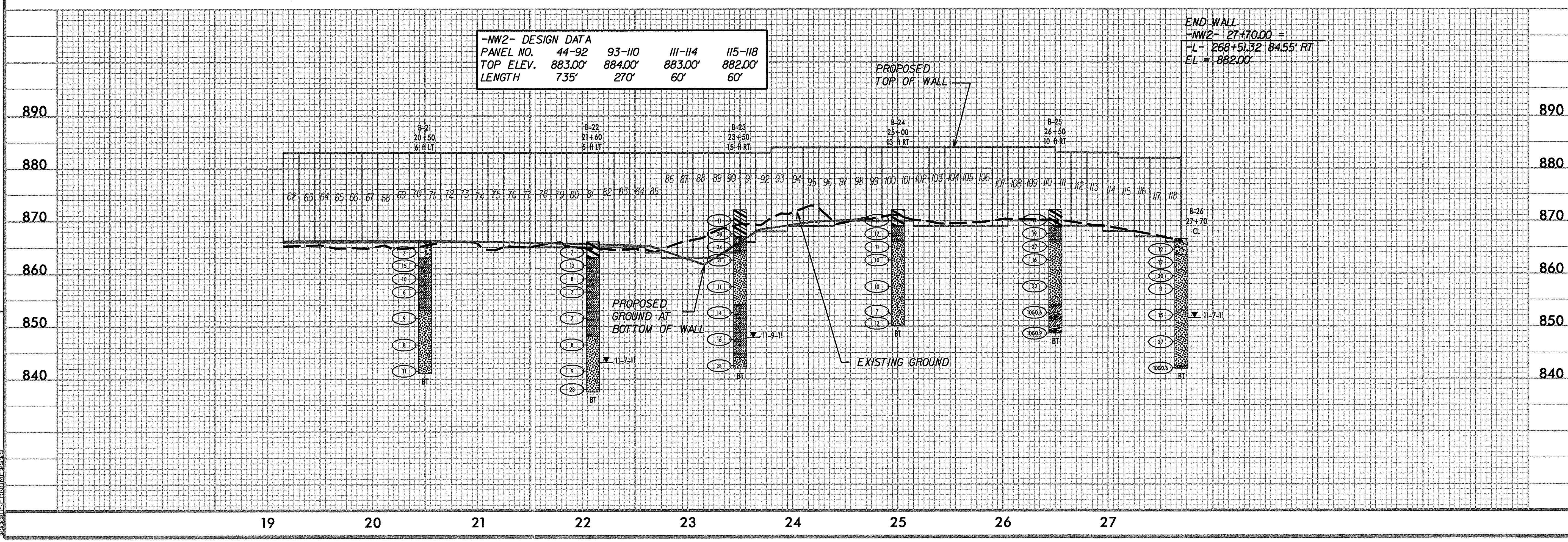
MATCH LINE SEE SHEET
NO.3 -NW2- STA.19+14




-NW2- DESIGN DATA

| PANEL NO. | 44-92 | 93-110 | 111-114 | 115-118 |
|---|---|---|---|---|
| TOP ELEV. | 883.00' | 884.00' | 883.00' | 882.00' |
| LENGTH | 735' | 270' | 60' | 60' |

$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$