CULVERT FOUNDATION RECOMMENDATIONS REPORT (REV. 1)
REPLACMENT OF BRIDGE 890201 WITH
PRECAST REINFORCED THREE-SIDED CULVERT ON SR 1149
(DOSTER ROAD) OVER TWELVE MILE CREEK

WBS No.: 17BP.10.R.5
Tip No.: NA
County: UNION

Prepared by:

AMEC Environment and Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703
(Project No. 6469-12-1040)

Prepared for:

NCDOT

June 27, 2012

June 27, 2012

Mr. Joel Gregory Jones, P.E.
Division Bridge Program Manager
NCDOT Division 10 Office
716 W. Main Street
Albemarle, North Carolina 28001

Attention: Mr. Joel Gregory Jones, P.E.:

Subject: **Culvert Foundation Recommendation Report (Rev. 1)**
Replacement of Bridge 890201 with
Precast Reinforced Three-Sided Culvert on SR 1149
(Doster Road) Over Twelve Mile Creek
WBS No.: 17BP.10.R.5
TIP No.: NA
Federal Aid No.: NA
County: Union
AMEC Project Number: 6469-12-1040

Dear Mr. Jones:

AMEC Environment and Infrastructure, Inc. (AMEC) is pleased to transmit the attached Culvert Foundation Recommendations Report associated with the Replacement of Bridge No. 890201 on SR 1149 (Doster Road) over Twelve Mile Creek. The Structure Subsurface Investigation Report provided by NCDOT and the additional Structure Subsurface Exploration Report performed by AMEC are provided in the Appendix.

This Foundation Recommendations Report has been prepared using boring data obtained by AMEC and others. The recommendations for the Three-Sided Culvert are based upon AASHTO LRFD bridge design procedures as required by the NCDOT.

If you have any questions regarding recommendations contained in this report, please contact us at 919-381-9900.

Sincerely,

AMEC Environment and Infrastructure, INC.

G. Shane Johnson, P.E., P.G.
Senior Geotechnical Engineer
Registered, North Carolina 037422

Gary R. Taylor, P.E.
Geotechnical Department Manager
Registered, North Carolina 18580

Correspondence:
AMEC Environment & Infrastructure, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703
Tel (919) 381-9900
Fax (919) 381-9901
Licensure: NC Engineering F-1253 NC Geology C-247

CULVERT FOUNDATION RECOMMENDATIONS

STATE NO. 17BP.10.R.5 DESCRIPTION Precast Reinforced Concrete Three-Sided Culvert on SR 1149

F.A. PROJ. NO. NA (Doster Road) Over Twelve Mile Creek

COUNTY Union

STATION 12+08.46 -L-

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENG. UNIT-WRO

___ ACCEPTED
X ACCEPTED AS NOTED
___ RETURNED FOR CORRECTIONS
___ SEE LETTER

BY: Dean Hardister, PE

DATE: 06/20/2012

SEAL
NORTH CAROLINA PROFESSIONAL
037422
6/6/12
ENGINEER
J. SHANE JOHNSON

SIGNATURE

	INITIALS	DATE
DESIGN	JSJ	6/5/2012
CHECK	CAT	6/6/12
APPROVAL		

BENT	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEAOUS DETAILS
END BENT 1	11+90.52 -L-	Spread Footings	4 TSF	Bottom of Footing Elevation = 576.5 feet
END BENT 2	12+26.58 -L-	Spread Footings	4 TSF	Bottom of Footing Elevation = 576.0 feet

FOUNDATION RECOMMENDATION NOTES ON PLANS

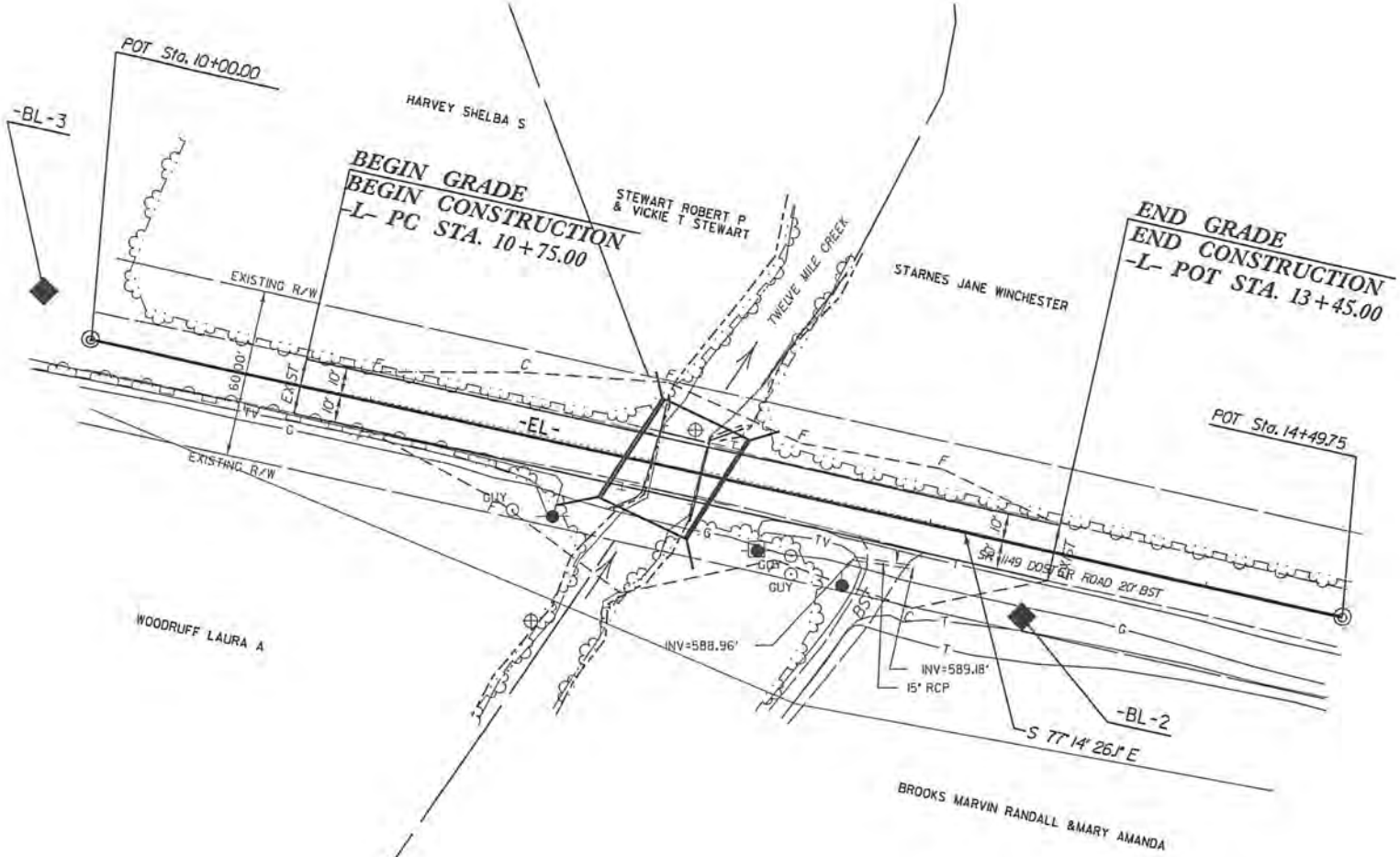
1. THE SCOUR CRITICAL ELEVATION ~~FOR END BENT NO. 1 AND END BENT NO. 2~~ IS THE BOTTOM OF FOOTING ELEVATION. SCOUR CRITICAL ELEVATIONS ARE USED TO MONITOR POSSIBLE SCOUR PROBLEMS DURING THE LIFE OF THE STRUCTURE.
2. THE SPREAD FOOTINGS ~~AT END BENT NO. 1 AND END BENT NO. 2~~ ARE DESIGNED FOR A FACTORED RESISTANCE OF 4 TSF. CHECK FIELD CONDITIONS FOR THE REQUIRED RESISTANCE OF 9 TSF JUST BEFORE PLACING CONCRETE.
3. KEY IN SPREAD FOOTINGS ~~AT END BENT NO. 1 AND END BENT NO. 2~~ AT LEAST 12 INCHES INTO WEATHERED ROCK OR ~~NON-CRYSTALLINE~~ ROCK WITH MINIMUM THICKNESS AS SHOWN ON THE PLANS.

FOUNDATION RECOMMENDATION COMMENTS

1. THE BOTTOM OF THE FOOTING ELEVATIONS MAY BE LOWERED IN ORDER TO SATISIFY THE REQUIRED BEARING RESISTANCE AND MINIMUM ROCK EMBEDMENT REQUIREMENTS.

APPENDIX

PROVIDED INFORMATION

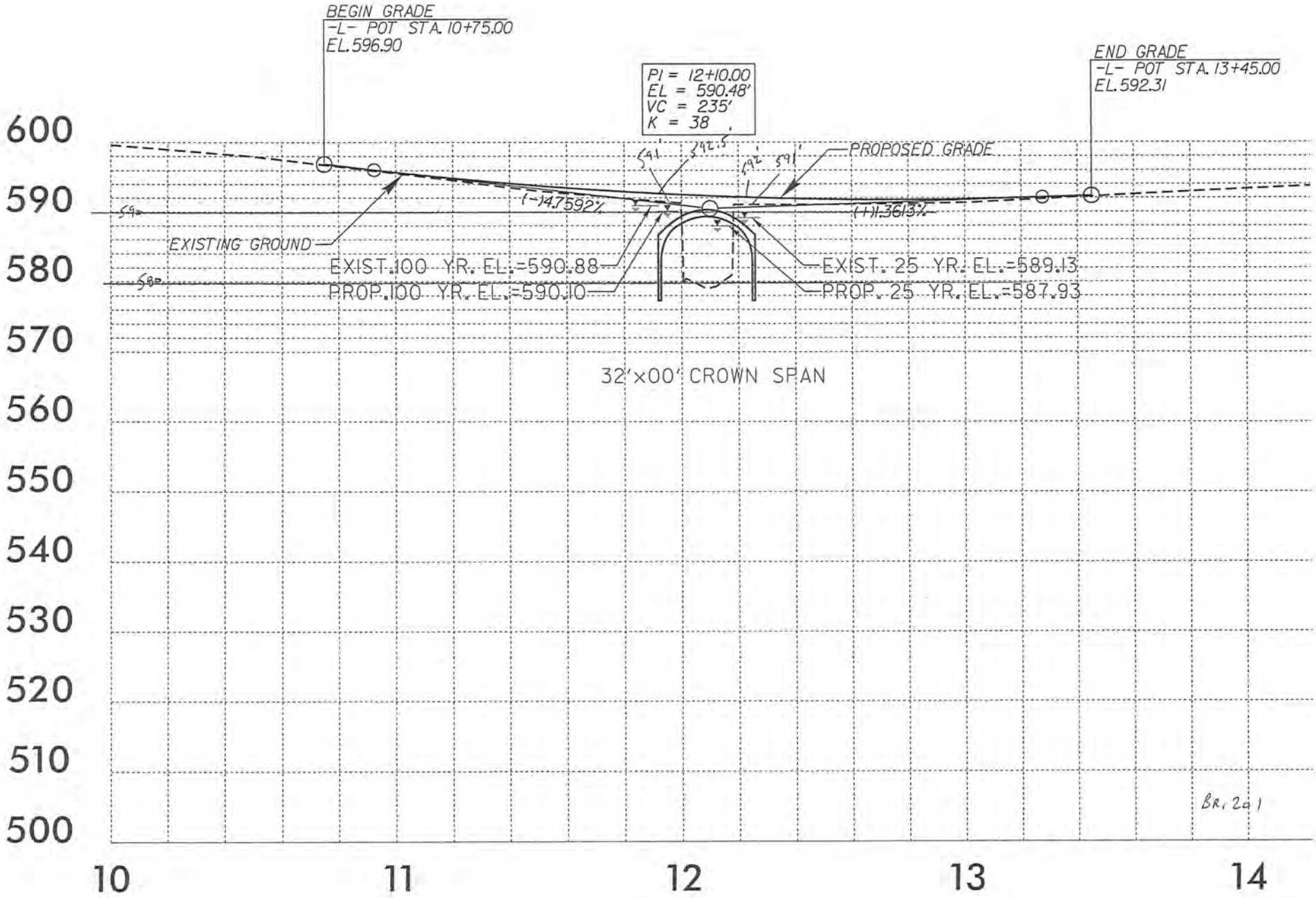


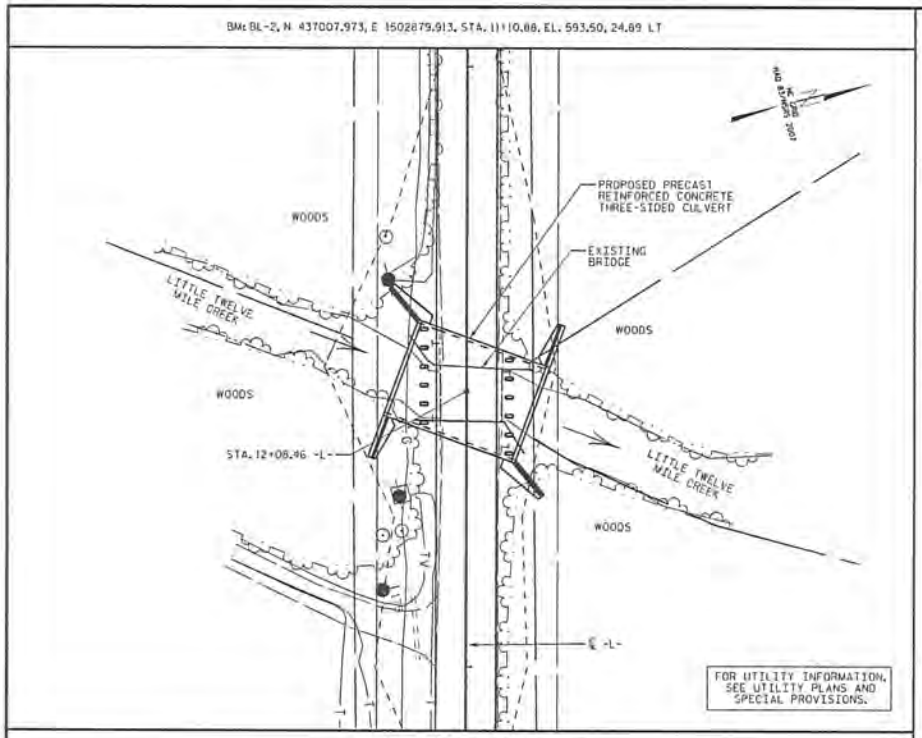
1" = 40'

Br. 201

BL

POINT	DESC.	NORTH	EAST	ELEVATION	EL STATION	OFFSET
1	BL-1	436957.8290	1503083.9110	597.34	9+00.84	28.77 LT
2	BL-2	437007.9730	1502879.9130	593.50	11+10.88	24.89 LT
3	BL-3	437124.1830	1502538.5230	600.03	14+69.49	13.10 RT


BEGIN GRADE
-L- POT STA. 10+75.00
EL. 596.90
PI = 12+10.00
EL = 590.48'
VC = 235'
K = 38
END GRADE
-L- POT STA. 13+45.00
EL. 592.31
PROPOSED GRADE
591'
592.5'
591'
591'
(-)4.7592%
(+)1.3613%
EXISTING GROUND
EXIST. 100 YR. EL. =590.88
PROP. 100 YR. EL. =590.10
EXIST. 25 YR. EL. =589.13
PROP. 25 YR. EL. =587.93
32'×00' CROWN SPAN
BR. 201
600
590
580
570
560
550
540
530
520
510
500
10
11
12
13
14



LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	= 890 CFS
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 587.9
DRAINAGE AREA	= 2.3 SQ. MI.
BASIC DISCHARGE (Q100)	= 1270 CFS
BASIC HIGH WATER ELEVATION	= 590.2

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 1460 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 200 YRS.
OVERTOPPING FLOOD ELEVATION	= 592.3

GRADE DATA

GRADE POINT ELEVATION @ STA. 12+08.46 -L-	= 592.30
BED ELEVATION @ STA. 12+08.46 -L-	= XXX.XX
ROADWAY SLOPES	= 2:1

NOTES:

ASSUMED LIVE LOAD ----------HL-93 OR ALTERNATE LOADING.

REPLACES BRIDGE NO. ----------890201

MAXIMUM DESIGN FILL ----------x.x'

MINIMUM DESIGN FILL ----------1.0'

FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.

A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.

THE REQUIRED BEARING CAPACITY OF THE STRIP FOOTINGS IS xx TSF. THE REQUIRED BEARING CAPACITY SHALL BE VERIFIED.

KEY FOOTINGS FOR THE THREE-SIDED CULVERT AT STATION 12+ -L-± AT LEAST 12 INCHES INTO THE ROCK WITH A MINIMUM THICKNESS AS SHOWN ON THE PRECAST REINFORCED CONCRETE THREE-SIDED CULVERT PLANS.

TO PROVIDE PROTECTION FROM POSSIBLE SCOUR, THE FOOTINGS SHALL NOT BE CONSTRUCTED AT AN ELEVATION HIGHER THAN SHOWN ON THE PLANS.

SCOUR PROTECTION SHALL BE REQUIRED, RIP RAP NOT TO BE PLACED ABOVE THE STREAMBED.

THE SCOUR CRITICAL ELEVATION IS THE AS BUILT BOTTOM OF FOOTING ELEVATION. THE SCOUR CRITICAL ELEVATIONS ARE FOR USE BY MAINTENANCE FORCES TO MONITOR POSSIBLE SCOUR PROBLEMS DURING THE LIFE OF THE STRUCTURE.

THE BOTTOM OF THE FOOTING ELEVATIONS MAY BE LOWERED IN ORDER TO SATIFFY BEARING CAPACITY AND MINIMUM ROCK EMBEDMENT REQUIREMENTS.

THIS STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH HEC 18 "EVALUATION SCOUR AT BRIDGES", MAY 2001

FOR PRECAST REINFORCED CONCRETE THREE SIDED CULVERT, SEE SPECIAL PROVISIONS.

THE EXISTING STRUCTURE CONSISTING OF A 19'-10" LONG SINGLE SPAN & 20'-5" CLEAR ROADWAY WIDTH ON A REINFORCED CONCRETE SLAB SUPPORTED ON MASS CONCRETE ABUTMENTS AT THE PROPOSED STRUCTURE SITE, SHALL BE REMOVED.

REMOVAL OF THE EXISTING BRIDGE SHALL BE PERFORMED SO AS NOT TO ALLOW DEBRIS TO FALL INTO THE WATER. THE CONTRACTOR SHALL REMOVE THE BRIDGE AND SUBMIT PLANS FOR DEMOLITION IN ACCORDANCE WITH ARTICLE 402-2 OF THE STANDARD SPECIFICATION.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

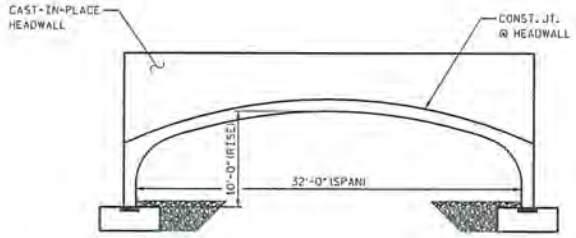
FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPLICED WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

THE CAST-IN-PLACE HEADWALL/BARRIER RAILS SHALL BE DESIGNED FOR THE AASHTO LRFD TEST LEVEL 2 (TL-2) CRASH TEST CRITERIA.

ALL REINFORCING STEEL FOR THE HEADWALL/BARRIER RAILS SHALL BE EPOXY COATED.

CONCRETE USED FOR THE HEADWALL/BARRIER RAILS SHALL MEET THE MINIMUM REQUIREMENTS OF CLASS AA CONCRETE.



ARCH SECTION

RIGHT ANGLE SECTION OF PRECAST CONCRETE THREE-SIDED CULVERT

TOTAL STRUCTURE QUANTITIES

REMOVAL OF EXISTING STRUCTURE		LUMP SUM
PRECAST REINFORCED CONCRETE THREE-SIDED CULVERT @ STA. 12+08.46 -L-		LUMP SUM
CLASS A CONCRETE	XX.X	CU. YDS.
PLAIN RIP RAP CLASS I	XX	TONS

PROJECT NO. _____

UNION COUNTY

STATION: 12+08.46 -L-

SHEET 1 OF 3

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

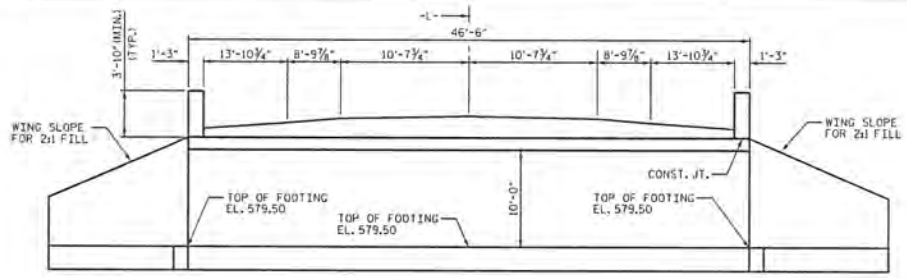
GENERAL DRAWING
PRECAST REINFORCED CONCRETE THREE-SIDED CULVERT
SR 1149 (DOSTER ROAD)
OVER TWELVE MILE CREEK
110° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
						TOTAL SHEETS

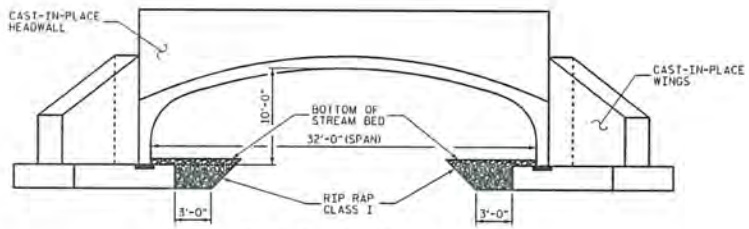
DRAWN BY : _____ DATE : _____

CHECKED BY : _____ DATE : _____

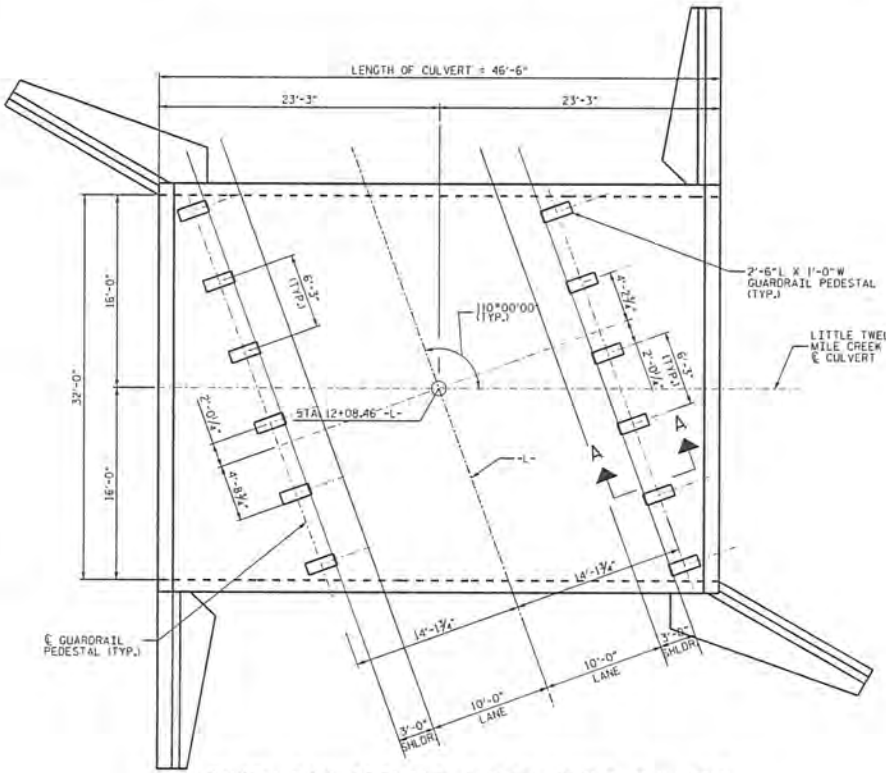
R2006BA_SD_CU_201_01.dgn 4/5/2017 2:07:25 PM



CULVERT SECTION ALONG ℄ CULVERT



END ELEVATION



LENGTH FOR PRECAST THREE-SIDED CULVERT

PROJECT NO. _____

UNION COUNTY

STATION: 12+08.46 -L-

SHEET 2 OF 3

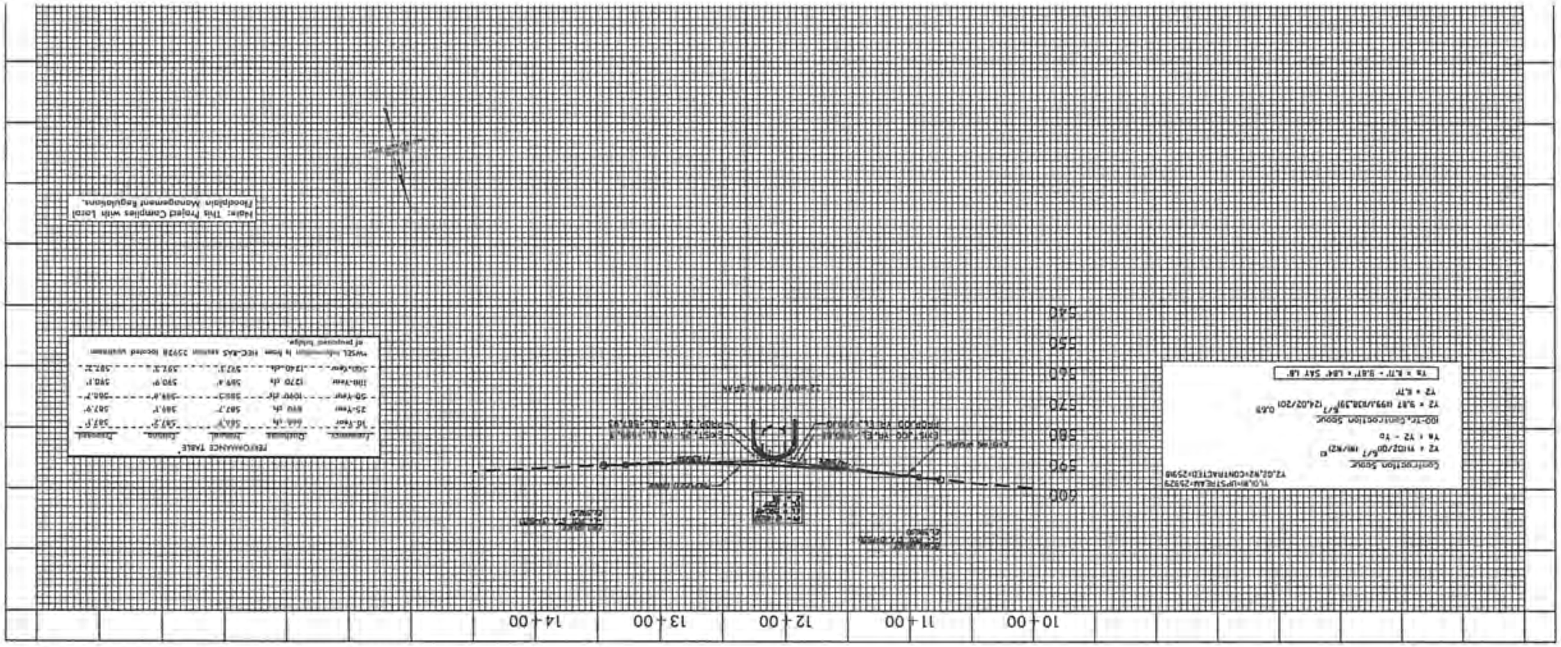
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

PLAN, SECTION & ELEVATION
PRECAST REINFORCED CONCRETE
THREE-SIDED CULVERT
SR 1149 (DOSTER ROAD)
OVER TWELVE MILE CREEK
110° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
						TOTAL SHEETS

DRAWN BY : _____ DATE : _____
CHECKED BY : _____ DATE : _____

R2006BA_SD_CU_201_02.dgn 4/5/2012 2:06:33 PM



INFORMATION TO BE SHOWN ON PLANS

Design: Discharge ...890 cfs... c.f.s. Frequency ...25 yr... Elev. ...587.9...

Base Flood: Discharge ...1270 cfs... c.f.s. Frequency ...100 yr... Elev. ...590.1...

Overtopping: Discharge ...XXXX... c.f.s. Frequency ...XXXX... Elev. ...XXXX...

ADDITIONAL INFORMATION AND COMPUTATIONS

10 YEAR

$QL = 298\,A^{0.617} = 298\,(2.3)^{0.617} = midcfs$ [illegible]

25 YEAR

$QL = 537\,A^{0.606} = 537\,(2.3)^{0.606} = 890cfs$

50 YEAR

$QL = 661\,A^{0.600} = 661\,(2.3)^{0.600} = 1090cfs$

100 YEAR

$QL = 776\,A^{0.594} = 776\,(2.3)^{0.594} = 1270cfs$

500 YEAR

$QL = 1072\,A^{0.583} = 1072\,(2.3)^{0.583} = 1740cfs$

SITE DATA

Drainage Area ...2.3 sq.mi... Source ...FEMA FIS...

River Basin ...Catawba... Character ...Rural...

Stream Classification (Such as Trout, High Quality Water, etc.) ...Class C...

Data on Existing Structure ...[illegible] Reinforced Concrete Slab with Mass Concrete Abutments...

Waterway Opening ...XXXX...

Debris Potential: Low ... Moderate ...X... High ...

Data on Structures Up and Down Stream ...Upstream structure [illegible] Timber Deck on I-beam with Mass Concrete Abutments. Downstream structure Non-comparable.

Design Control Elev. ...590.8 (Corrected Effective 100yr WS EL @ Section 25928)

Gage Station No. ...N/A... Period of Records ...N/A...

Max. Discharge ...N/A... c.f.s. Date ...N/A... Frequency ...N/A...

Historical Flood Information

Date ...XXXX... Elev. ...XXXX... Est. Freq. ...XXX... Source ...XXXX... Period of Knowledge ...XXXX...

Date ...XXXX... Elev. ...XXXX... Est. Freq. ...XXX... Source ...XXXX... Period of Knowledge ...XXXX...

Date ...XXXX... Elev. ...XXXX... Est. Freq. ...XXX... Source ...XXXX... Period of Knowledge ...XXXX...

Historical Scour Info.: General ...XXXXX... Contraction ...XXXXX... Local ...XXXXX...

Channel Slope ...XXXXX... Source ...Survey... Ordinary High Water Elev. ...XXXXX...

Manning's n: Left O.B. ...0.14... Channel ...0.05... Right O.B. ...0.14... Source ...FEMA FIS...

Flood Study / Status ...Limited Detail Study/Effective... Floodway Established? ...No...

Flood Study 100 yr. Discharge ...947... c.f.s.; W.S. Elev.: With Floodway ...XXX... Without Floodway ...XXX...

DESIGN DATA

Hydrological Method ...USGS Rural Regression (2009)...

Hydraulic Design Method ...HEC-RAS...

Floods Evaluated:

Freq.	Q	Elev.	Backwater	Bridge Opening Velocity
10	660 cfs	587.1	0.2'	2.84 ft/s
25	890 cfs	587.9	0.2'	3.64 ft/s
50	1090 cfs	588.7	0.4'	4.48 ft/s
100	1270 cfs	590.1	0.3'	5.01 ft/s
500	1740 cfs	591.2	0.1'	1.23 ft/s

Waterway Opening Provided Below: Design W.S. Elev. ...245.08 sq.ft... 100yr W.S. Elev. ...245.28 sq.ft...

Average Channel Velocity (Design) ...3.35 ft/s... Average Overbank Velocity (Design) Left-0.64 ft/s Right-0.65 ft/s

Computed Scour: General ...N/A... Contraction ...UP... Local ...N/A...

Is a Floodway Revision Required? ...NO...

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

N.C. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
HYDRAULICS UNIT
RALEIGH, N.C.

I.D. No. ...XXXXXXX... Project No. ...XXXXXXX... Proj. Station 51+20.00 to 51+80.00

County ...UNION... Bridge Over ...LITTLE TWELVE MILE CREEK... Bridge Inv. No. ...890101...

On Highway ...SR1002 Bonham-Monroe Rd/Deater Rd... Between ...SR1[illegible]... and ...SR1[illegible] Old Bonham-Monroe Rd

Recommended Structure ...3@10'x6' Culvert Span, NCDOT, Field Scaling Meeting...

Recommended Width of Roadway ...[illegible] NCDOT Field Scaling Meeting... Skew ...90...

Recommended Location is (Up, At, Down Stream from Existing Crossing) ...AT...

Nearest Shipping Point ...XXXXXXX... On ...XXXXXXX... R.R. ...XX... Miles From Bridge

Bench Mark is ...[illegible] N 473007.073 E 1607873.93...

Elev. ...593.20'... Datum ...NAVD 88...

Temporary Crossing ...N/A Detour Provided...

Stream Little 12 Mile Crk, Struc. Inv. No. 890101 I.D. No. ...XXXX... Project No. ...XXXX... PDF File ...XXXX...

Designed by: ...AMEC E&I Inc...

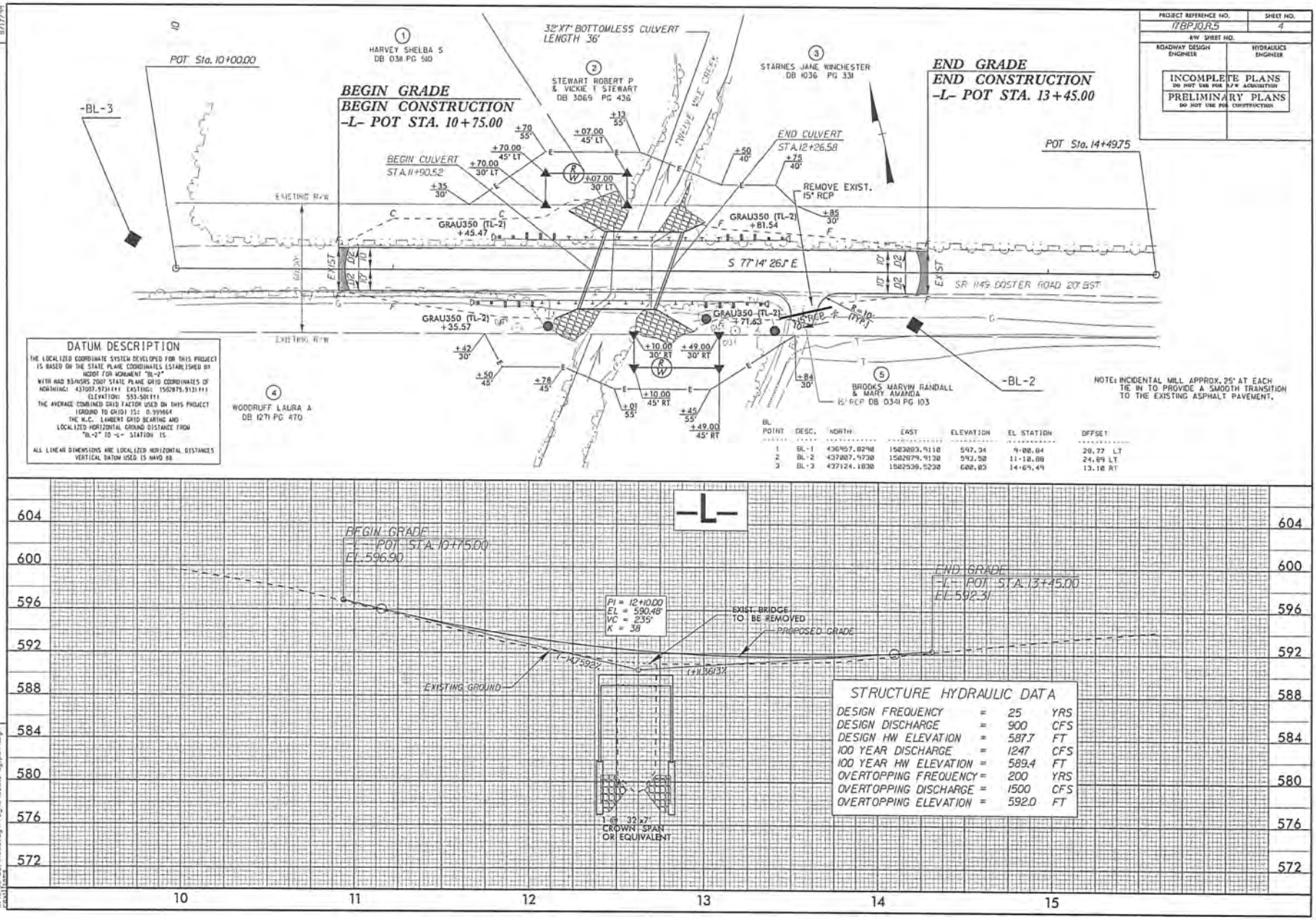
Assisted by: ...[illegible] McLaren, P.E....

Project Engineer: ...Richard L. Miner, P.E....

Reviewed By: ...XXX...

Date ...XX/XX/2012...

NORTH CAROLINA PROFESSIONAL SEAL 29185 ENGINEER RICHARD L. MINER


PROJECT REFERENCE NO. 17BP10R.5
SHEET NO. 4
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
POT Sta. 10+00.00
-BL-3
BEGIN GRADE
BEGIN CONSTRUCTION
-L- POT STA. 10+75.00
BEGIN CULVERT
STA. 11+90.52
32"X7" BOTTOMLESS CULVERT
LENGTH 36'
TWELVE LINE CREEK
END CULVERT
STA. 12+26.58
END GRADE
END CONSTRUCTION
-L- POT STA. 13+45.00
POT Sta. 14+49.75
REMOVE EXIST. 15" RCP
EXISTING R/W
GRAU350 (TL-2) +45.47
GRAU350 (TL-2) +81.54
GRAU350 (TL-2) +35.57
GRAU350 (TL-2) +71.63
S 77°14' 26.1" E
SR 1149 DOSTER ROAD 20' BST
EXIST.
15" RCP
-BL-2
1 HARVEY SHELBA S DB 0311 PG 510
2 STEWART ROBERT P & VICKIE T STEWART DB 3069 PG 436
3 STARNES JANE WINCHESTER DB 1036 PG 331
4 WOODRUFF LAURA A DB 1271 PG 470
5 BROOKS MARVIN RANDALL & MARY AMANDA 15" RCP DB 0341 PG 103
DATUM DESCRIPTION
THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCDOT FOR ALIGNMENT "BL-2"
WITH NAD 83/NSRS 2007 STATE PLANE GRID COORDINATES OF NORTHING: 437007.9731 FT EASTING: 1502879.9131 FT
ELEVATION: 593.50 FT
THE AVERAGE COMBINED GRID FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS: 0.999864
THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "BL-2" TO -L- STATION IS
ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES
VERTICAL DATUM USED IS NAVD 88
NOTE: INCIDENTAL MILL APPROX. 25' AT EACH TIE IN TO PROVIDE A SMOOTH TRANSITION TO THE EXISTING ASPHALT PAVEMENT.
BL POINT DESC. NORTH: EAST ELEVATION EL STATION OFFSET
1 BL-1 436957.8298 1503083.9118 597.34 9+00.84 28.77 LT
2 BL-2 437007.9730 1502879.9130 593.50 11+18.88 24.89 LT
3 BL-3 437124.1830 1502539.5230 600.83 14+69.49 13.16 RT
-L-
BEGIN GRADE
-L- POT STA. 10+75.00
EL. 596.90
PI = 12+10.00
EL = 590.48'
VC = 235'
K = 38
EXIST. BRIDGE TO BE REMOVED
PROPOSED GRADE
EXISTING GROUND
(-)1.75%
(+)1.36%
END GRADE
-L- POT STA. 13+45.00
EL. 592.31
1-@ 32 x7' CROWN SPAN OR EQUIVALENT
STRUCTURE HYDRAULIC DATA
DESIGN FREQUENCY = 25 YRS
DESIGN DISCHARGE = 900 CFS
DESIGN HW ELEVATION = 587.7 FT
100 YEAR DISCHARGE = 1247 CFS
100 YEAR HW ELEVATION = 589.4 FT
OVERTOPPING FREQUENCY = 200 YRS
OVERTOPPING DISCHARGE = 1500 CFS
OVERTOPPING ELEVATION = 592.0 FT
604
600
596
592
588
584
580
576
572
10
11
12
13
14
15
REVISIONS
8/17/11
EA1/2012 C:\Users\...\Roadway\Proj\BP10R5BL-dgn_sht4.dgn

FOUNDATION CALCULATIONS

FOR END BENT NO. 1

AND

END BENT NO. 2

amec

AMEC E&I, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703

JOB NO.	6469-12-1040	SHEET 1 OF	X
PHASE	Br. 201	TASK	X
JOB NAME	GROUP N : DIV. 10 Bridges		X
BY	JSJ	DATE 6/4/12	X
CHECKED BY	MBL	DATE 6/6/12	X

BR. 201

- RECOMMENDED STRUCTURE = 3-SIDE CULVERT (see provided plans)
- Replacement of BRIDGE 201
- Footings for Bottomless culverts shall be founded on "NON-Scourable Rock". Therefore Concrete footings must be Keyed 1-foot into NON-Scourable Rock. (50/3 on borders)
- NCDOT Provided a structure Inventory Report dated 2-18-04. This Report has 2-Borings per Bent w/ No Rock Core. Collar elevations are relative to an assumed datum (100.00'). AMEC Assigned elevations to borings by using the provided ground surface profile (-L). The Boring & profile are along the existing Road.
- AMEC Provided 1 Boring per Bent which included CORING Approx. 10 ft. of Rock to confirm rock refusal material is Rock and not a boulder. AMEC Collar elevations are referenced to NCDOT Benchmarks.
- Existing GRADE on -L- = ± 591'
- Proposed Grade on -L- = ± 592.5' @ EB1 ; 592' @ EB2
- Amount of fill (Estimate) = EB1 = ± 1.5'
  EB2 = ± 1'

amec

AMEC E&I, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703

JOB NO. 6469-12-1040 SHEET 2 OF X
PHASE Rev. 201 TASK X
JOB NAME GROUP N, DIV. 10 X
BY JSJ CRT DATE 6/4/12 X
CHECKED BY MBL DATE 6/6/12 X

END BENT NO. 1

- USE BORINGS B-1 and B-2 FROM NCDOT REPORT AND BORING B-5 FROM AMEC REPORT.

BORING	Collar Elev. El.	WR El.	NCR Elev.
B-1	591'	578.4'	577.3'
B-2	591'	578.9	576.5'
B-5	590'	577.5'	576.2'

→ Recommend Btm of Footing 577.5 − 1' = 576.5'

→ RECOMMEND R_R = 4 TSF

$R_n = \frac{4\ TSF}{0.45} = 8.89\ TSF \approx 9\ TSF$

- BASED ON INSPECTION, A FACTORED BEARING Resistance of 4 TSF IS Recommended for Footings Bearing IN WR/NCR.
- Footing must be "Keyed in" 12" into WR/NCR
- By Inspection, Settlement of structure should be neglible if footings Bear IN WR/NCR
- CREEK Btm Elev. = 580' (per provided profile)

10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 206 ON SR 1149
OVER LITTLE TWELVE MILE CREEK

ON 20 Scale → 1 tick = 0.5263'

591

B-1 WR = 591 - 12.6 = 578.4
B-1 NCR = 591 - 13.7' = 577.3
B-2 WR = 591 - 12.1 = 578.9'
B-2 NCR = 591 - 14.5 = 576.5'

Section Thru B-1 & B-2

SS-3
SS-4
B-1
9+95 -L-
5.00 LT.

SS-5
B-2
9+94.80 -L-
5.20 RT.

591'

591'

ROADWAY FILL
GROUND SURFACE

DITCH

ALLUVIUM

BRN-RED-GRAY TO BRN-GRAY
SOFT TO MED. STIFF WET
LOW TO MED. PLASTIC
SILTY CLAY

3

2

4

18

CREEK

WING WALL

WATER SURFACE
▽ 1/24/04

Creek Btm per profile = 580'

RESIDUAL GRAY V. STIFF WET CLAYEY SANDY SILT

WEATHERED ROCK

WEATHERED ROCK

CASING REFUSAL NM (1/24/04)

CASING REFUSAL NM (1/24/04)

HARD ROCK

WR = 578.4'

NCR = 577.3'

NCR = 576.5

WR = 578.9'

591 - 12.43 = 578.4'
591 - 13.68 = 577.3'

591 - 12.1 = 578.9'
591 - 14.5 = 576.5

ON 20 Scale
1 tick = 0.5263'

120 110 100 90 80 70 60 50

-50 -40 -30 -20 -10 0 10 20 30 40 50

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek				**GROUND WTR (ft)**
BORING NO. B-5	**STATION** 11+85	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 3.8
COLLAR ELEV. 590.0 ft	**TOTAL DEPTH** 24.6 ft	**NORTHING** 437,052	**EASTING** 1,502,732	**24 HR.** 5.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/21/12	**SURFACE WATER DEPTH** 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
590										ELEV. (ft) DEPTH (ft)
	590.0	0.0	1	2	2	4		M		590.0 GROUND SURFACE 0.0 **ROADWAY EMBANKMENT** Light brown to brown, soft, moist, sandy SILT (A-4)
	586.5	3.5								
585			2	2	2	4		M		
	584.0	6.0								**ALLUVIAL** Light yellowish brown, moist to wet, medium stiff, clayey SILT (A-4)
	581.5	8.5								
580			2	2	3	5		M-W		580' CREEK 47m,
	577.5	12.5								
	576.9	13.1								**WEATHERED ROCK** Tan to light gray, METAVOLCANIC
	576.2	13.8	60/0.0			60/0.0				**NON-CRYSTALLINE ROCK** Tan to light gray, METAVOLCANIC
575			60/0.0			60/0.0				
										NON-CRYSTALLINE ROCK Light greenish gray, METAVOLCANIC
570										
	565.4	24.6								Boring Terminated at Elevation 565.4 ft in Non-Crystalline Rock: METAVOLCANIC

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek				**GROUND WTR (ft)**
BORING NO. B-5	**STATION** 11+85	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 3.8
COLLAR ELEV. 590.0 ft	**TOTAL DEPTH** 24.6 ft	**NORTHING** 437,052	**EASTING** 1,502,732	**24 HR.** 5.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/21/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 10.8 ft			

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
576.2											Begin Coring @ 13.8 ft
575	576.2 – 575.4	13.8 – 14.6	0.8	4:05/0.8	(0.3) 38%	(0.0) 0%					**NON-CRYSTALLINE ROCK** Light greenish gray, slightly to very slightly weathered, closely to moderately closely fractured, medium hard to moderately hard, METAVOLCANIC *(continued)*
			5.0	3:47 3:58 4:12 4:05 4:09	(4.8) 96%	(3.7) 74%					
570	570.4	19.6	5.0	2:38 2:51 3:26 3:48 4:10	(5.0) 100%	(4.7) 94%					
	565.4	24.6									Boring Terminated at Elevation 565.4 ft in Non-Crystalline Rock: METAVOLCANIC

NCDOT CORE SINGLE BRIDGE 201 LOGS.GPJ NC_DOT.GDT 6/6/12

AMEC E&I, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703

JOB NO. 6469-12-1040 SHEET 6 OF X
PHASE Br. 201 TASK X
JOB NAME Group N, Div. 10 X
BY JSJ GRT DATE 6/4/12 X
CHECKED BY MBR DATE 6/6/12 X

END BENT No. 2

- USE Boring B-3 and B-4 From NCDOT REPORT
- USE Boring B-6 FROM AMEC REPORT

BORING	COLLAR ELEV.	WR ELEV.	NCR ELEV.
B-3	591'	578.9'	571.5'
B-4	591'	577.3'	574.4'
B-6	589.1'	577.1'	575.8'

→ RECOMMEND Btm of Footing @ Elev. 577.1 − 1 = 576.1
= 576.0'

→ R_R = 4 TSF
R_N = 4 TSF / 0.45 = 8.89 ≈ 9 TSF

- BASED ON INSPECTION, A FACTORED BEARING RESISTANCE OF 4 TSF IS RECOMMENDED FOR FOOTINGS BEARING IN WR/NCR.
- FOOTINGS MUST BE "KEY IN" 12" INTO WR/NCR
- By Inspection, Settlement of structure should be negligible if footing Bear IN WR/NCR.
- Btm. of Creek Elev. ≈ 581' (per provided profile)

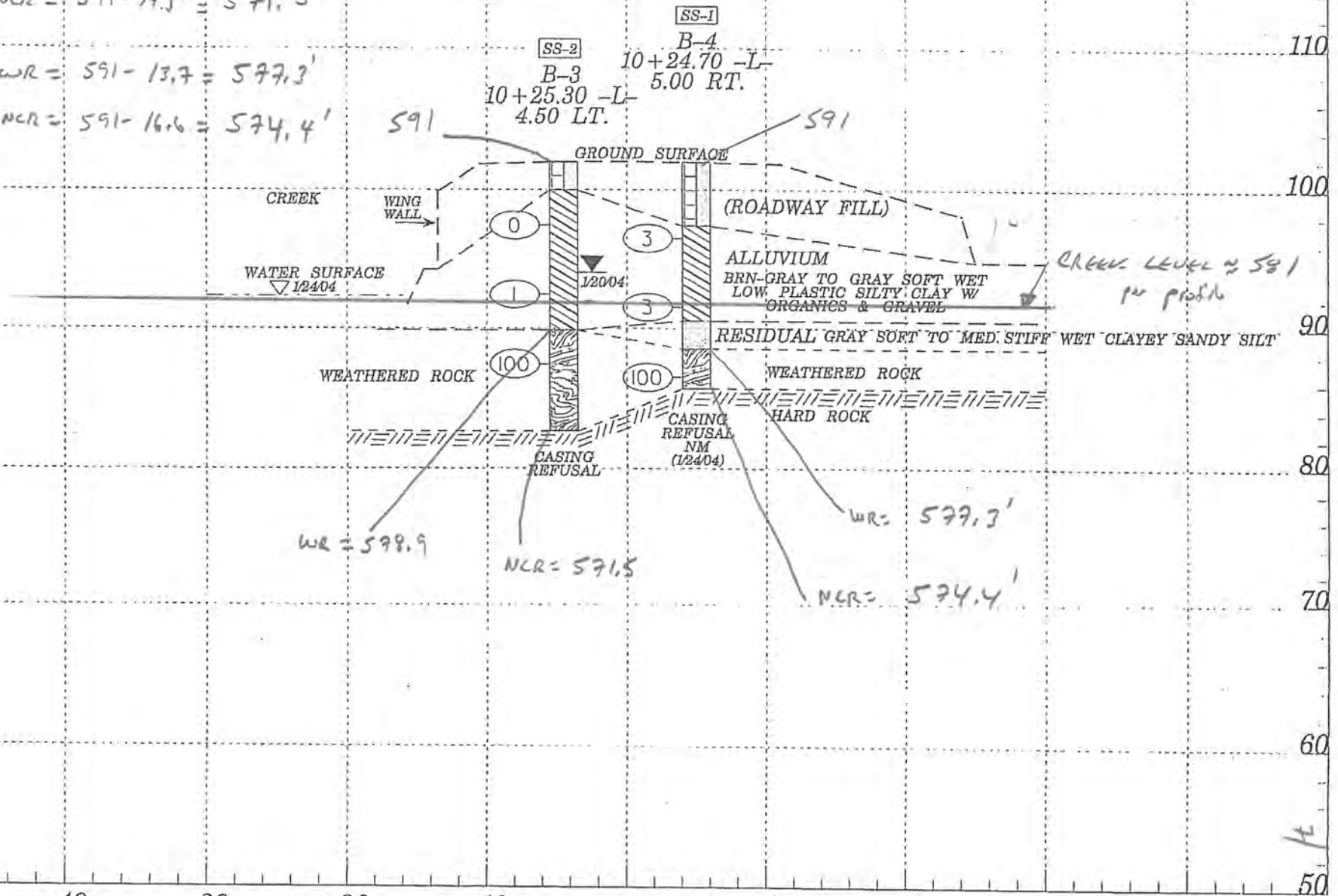
10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 206 ON SR 1149
OVER LITTLE TWELVE MILE CREEK

ON 20 scale = 1 inch = 0.5263

EB2

B3-WR = 591 - 12.1 = 578.9'
B3-NCR = 591 - 19.5 = 571.5'
B-4-WR = 591 - 13.7 = 577.3'
B-4 NCR = 591 - 16.6 = 574.4'

Section Thru B-3 & B-4



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek				**GROUND WTR (ft)**
BORING NO. B-6	**STATION** 12+33	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** 1.5
COLLAR ELEV. 589.1 ft	**TOTAL DEPTH** 28.8 ft	**NORTHING** 437,067	**EASTING** 1,502,786	**24 HR.** 5.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/22/12	**SURFACE WATER DEPTH** 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)
590											
	589.1	0.0	2	3	3	6		M		589.1 GROUND SURFACE	0.0
										ROADWAY EMBANKMENT Brown, moist, medium stiff to soft, sandy, clayey SILT (A-4) with trace organics and trace gravel	
585	585.6	3.5	1	1	2	3		M		583.1	6.0
						Creek Bottom: ~581'				**ALLUVIAL** Gray, wet, medium stiff, sandy, clayey SILT (A-4) with few organics	
580	580.6	8.5	3	4	3	7		W		577.1	12.0
	575.8	13.3	60/0.0			60/0.0				575.8 **WEATHERED ROCK** METAVOLCANIC	13.3
575										**NON-CRYSTALLINE ROCK** Light greenish gray, METAVOLCANIC	
570										567.8	21.3
										NON-CRYSTALLINE ROCK Light greenish gray, METAVOLCANIC	
565											
	560.3	28.8	60/0.0			60/0.0				560.3	28.8
										Boring Terminated at Elevation 560.3 ft in Non-Crystalline Rock: METAVOLCANIC	

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek			**GROUND WTR (ft)**
BORING NO. B-6	**STATION** 12+33	**OFFSET** 13 ft LT	**ALIGNMENT** -L- — **0 HR.** 1.5
COLLAR ELEV. 589.1 ft	**TOTAL DEPTH** 28.8 ft	**NORTHING** 437,067	**EASTING** 1,502,786 — **24 HR.** 5.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/22/12	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ	**TOTAL RUN** 15.5 ft		

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
575.8											Begin Coring @ 13.3 ft
575	575.8	13.3	0.5	2:10/0.5	(0.5)	(0.3)		(8.0)	(5.7)		575.8 NON-CRYSTALLINE ROCK 13.3
	575.3	13.8	5.0	3:28	100%	60%		100%	71%		Light greenish gray, slightly to very slghtly weathered, closely fractured, moderately hard, METAVOLCANIC
				3:39	(5.0)	(2.9)					
				4:05	100%	58%					
570	570.3	18.8		3:27							
			5.0	3:55							
				2:58	(3.3)	(2.5)					
				3:05	66%	50%					
				3:16							567.8 21.3
				2:10				(4.4)	(0.9)		NON-CRYSTALLINE ROCK
565	565.3	23.8		2:25				59%	12%		Light greenish gray, moderately severely weathered, closely to very closely fractured, medium hard, METAVOLCANIC
			5.0	4:05	(3.6)	(0.9)					
				4:51	72%	18%					
				5:10							
				5:17							
	560.3	28.8		5:22							560.3 28.8
				N=60/0.0							Boring Terminated at Elevation 560.3 ft in Non-Crystalline Rock: METAVOLCANIC

AMEC E&I, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, NC 27703

JOB NO. 6469-12-1040 SHEET 10 OF X
PHASE Br. 201 TASK X
JOB NAME Group N, Div. 10 X
BY JSJ DATE 6/4/12 X
CHECKED BY MBR DATE 6/6/12 X

- Embankment Settlement

- Minimal Grade change (1'-1.5') @ Approaches.

- Based on minimal grade changes at the approaches, significant Long Term settlements are not anticipated.

STRUCTURE SUBSURFACE INVESTIGATION PROVIDED BY NCDOT

17BP.10.R.5

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	(MAINT.)	1	8
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
10B.209011		P.E.	
		CONST.	

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

STATE PROJECT 10B.209011 I.D. NO. (MAINT.)

F.A. PROJECT

COUNTY UNION

PROJECT DESCRIPTION BRIDGE NO. 201 ON SR 1149 OVER LITTLE TWELVE MILE CREEK

SITE DESCRIPTION 1 @ 30.0' x 6.0' CROWN SPAN

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.

INVESTIGATED BY STICKNEY PERSONNEL BURRIS

CHECKED BY LITTLE C. SMITH

SUBMITTED BY LITTLE

DATE 2-18-04

NORTH CAROLINA LICENSED SEAL 1104 GEOLOGIST CLINTON B. LITTLE

2-18-04

SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
(MAINT.)	10B.209011	2A	8

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

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND 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												
#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		
											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN		
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	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER	HIGHLY ORGANIC SOILS
USUAL TYPES OF MAJOR MATERIALS	STONE FRAG. 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

P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	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, YEL-BRN, 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 ARE 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 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 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 SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- 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
- 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 - CBR 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
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

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

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 8" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [X] W/ ADVANCER
- [X] TRICONE 2¾" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] OTHER _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

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

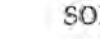
REVISED 09/15/00

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
(MAINT.)	10B.209011	28	8

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

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN 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 FOLOWS:

EATHERED OCK (WR)		NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
RYSTALLINE OCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
ON-CRYSTALLINE OCK (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.
OASTAL PLAIN EDIMENTARY ROCK S)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

RESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
RY SLIGHT S.L.)	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.
IGHT .)	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.
DERATE OD.)	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.
DERATELY VERE D. 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*
VERE EV.)	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. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
RY SEVERE 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*
MPLETE	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

ERY 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.
DERATELY ARD	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.
EDIUM ARD	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.
OFT	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.
ERY OFT	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

L 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 WHICH 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 IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 10 CENTIMETERS DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

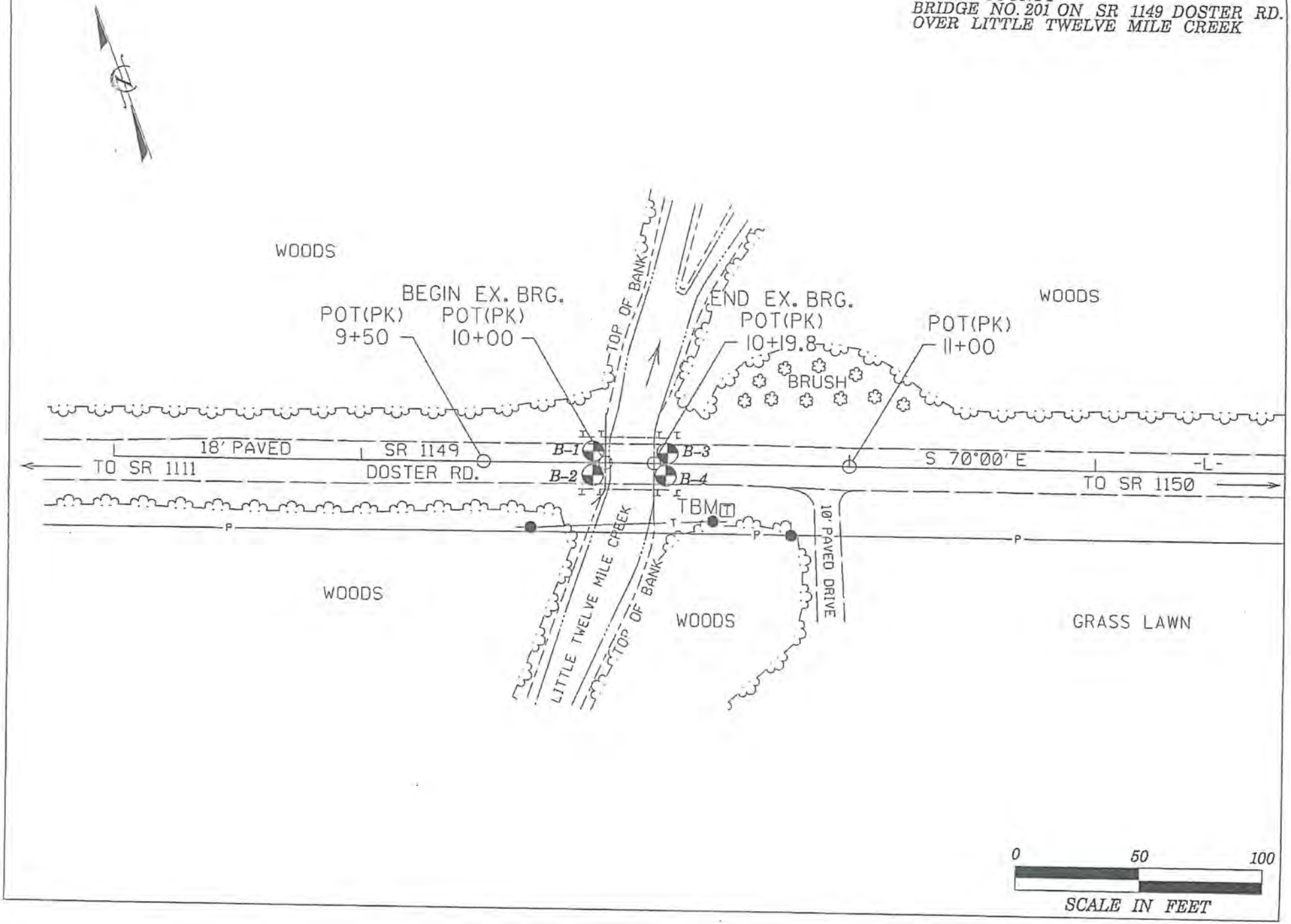
TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: TBM: NAIL IN BASE OF TELEPHONE POLE
24' RT. OF STA. 10+44 -L-
ELEVATION: 100.00 (ASSUMED)

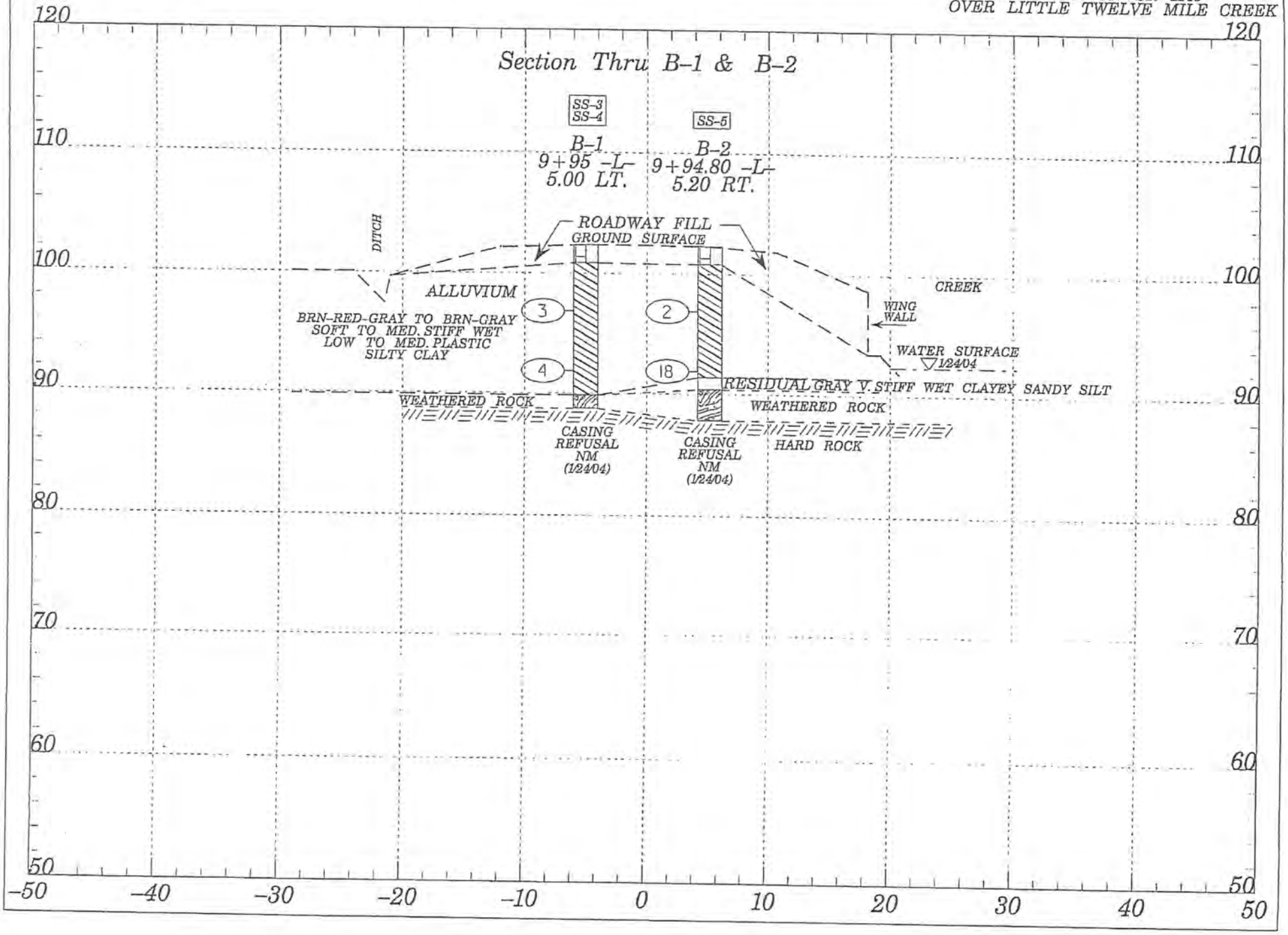
NOTES:

REVISED 09/15/00

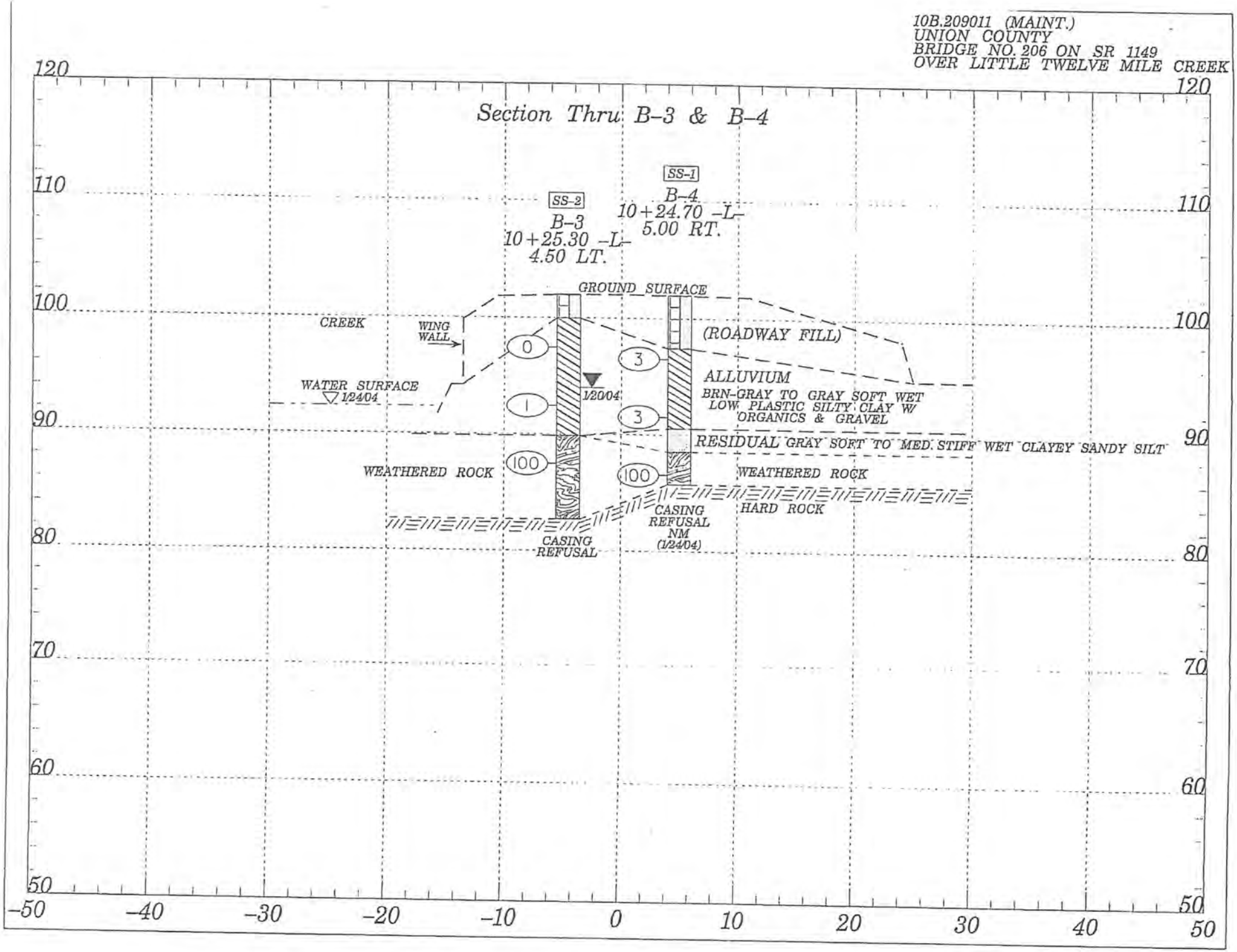
10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 201 ON SR 1149 DOSTER RD.
OVER LITTLE TWELVE MILE CREEK



10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 206 ON SR 1149
OVER LITTLE TWELVE MILE CREEK



10B.209011 (MAINT.)
UNION COUNTY
BRIDGE NO. 206 ON SR 1149
OVER LITTLE TWELVE MILE CREEK



M & T Form 503

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY
MATERIALS & TESTS UNIT
SOILS LABORATORY

BRIDGE # 201 UNION Co.

T. I. P. No. ~~BR-6201~~

REPORT ON SAMPLES OF SOILS FOR QUALITY

Project	10.B209011	County	UNION	Owner	
Date: Sampled		Received	1/29/04	Reported	2/2/2004
Sampled from	-L-			By	E. BEVERLY
Submitted by	N.W. WAINAINA				1995 Standard Specifications

711005 TO 711009
2/13/04

TEST RESULTS

Proj. Sample No.		SS-1	SS-2	SS-3	SS-4	SS-5	
Lab. Sample No.		711005	711006	711007	711008	711009	
Retained #4 Sieve	%	-	-	6	-	27	
Passing #10 Sieve	%	84	100	87	100	69	
Passing #40 Sieve	%	68	99	81	98	63	
Passing #200 Sieve	%	59	96	76	93	48	

MINUS NO. 10 FRACTION

SOIL MORTAR - 100%							
Coarse Sand Ret - #60	%	23.0	1.8	9.1	2.2	14.5	
Fine Sand Ret - #270	%	8.9	3.6	6.6	9.3	20.9	
Silt 0.05 - 0.005 mm	%	36.0	56.3	40.0	50.3	42.4	
Clay < 0.005 mm	%	32.2	38.3	44.3	38.3	22.2	
Passing #40 Sieve	%	-	-	-	-	-	
Passing #200 Sieve	%	-	-	-	-	-	

L. L.		NOT	39	40	35	26	
P. I.		ENOUGH	12	14	18	9	
AASHTO Classification		MAT.	A-6(14)	A-6(11)	A-6(16)	A-4(1)	
Station		10+24.7	10+25.3	9+95	9+95	9+94.8	
		5 RT	4.5 LT	5 LT	5 LT	5.2 RT	
Hole No.		B-4	B-3	B-1	B-1	B-2	
Depth (Ft)		5.90	10.00	6.00	11.00	10.90	
	to	6.90	11.00	7.00	12.00	11.90	

cc: E. BEVERLY
Soils File

Soils Engineer

GEOTECHNICAL UNIT FIELD SCOUR REPORT

'ROJECT: *10B.209011* TIP NO.: *(MAINT.)* COUNTY: *UNION*

)ESCRIPTION(1): *BRIDGE # 201 ON SR 1149 OVER LITTLE TWELVE MILE CREEK*

· *INFORMATION ON EXISTING BRIDGES* Information obtained from ☒ Field Inspection ☐ Microfilm (Reel: Position:) ☐ Other

'OUNTY BRIDGE NO. *201* BRIDGE LENGTH *19.8'* NO. BENTS *2* NO. BENTS IN: CHANNEL *0* FLOODPLAIN *2*

OUNDATION TYPE: *SINGLE SPAN ALL CONCRETE, DECK AND VERTICAL END BENTS*

'VIDENCE OF SCOUR(2):

.BUTMENTS OR END BENT SLOPES: *SOME SCOUR ON UPSTREAM WINGWALLS*

NTERIOR BENTS: *N/A*

HANNEL BED: *NONE*

HANNEL BANKS: *UNSTABLE - SHOW UNDERCUT*

EXISTING SCOUR PROTECTION:

YPE(3): *NONE*

XTENT(4): *N/A*

FFECTIVENESS(5): *N/A*

BSTRUCTIONS(6) (DAMS, DEBRIS, ETC.): *TREE LIMBS*

DESIGN INFORMATION

HANNEL BED MATERIAL(7) (Sample Results Attached): *SAND, GRAVEL, ROCK AND BOULDERS*

HANNEL BANK MATERIAL(8) (Sample Results Attached): *SILTY CLAY (REFERENCE SS-3)*

HANNEL BANK COVER(9): *MATURE TREES AND SHRUBS*

.OOD PLAIN WIDTH(10): *STATION 9+75 TO 10+25*

.OOD PLAIN COVER(11): *MATURE TREES AND SHRUBS*

TREAM IS: ☐ DEGRADING ☒ AGGRADING (12)

THER OBSERVATIONS AND COMMENTS:

DESIGN INFORMATION CONT.

CHANNEL MIGRATION TENDENCY(13): *SLIGHT TO NONE*

GEOTECHNICAL ADJUSTED SCOUR ELEVATIONS (14):

The geotechnical adjusted scour elevation is top of weathered rock. Weathered rock range, based on 4 boring locations for crown span design, is elevation 88 - 90 feet. This closely corresponds to the refusal / rock lineelevation of 89 feet depcited on the proposed crown span drawing.

REPORTED BY: *JEB /JKS* DATE: *2-13-04*

INSTRUCTIONS

) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED.
) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS DEGRADATIONS, ETC.)
) NOTE ANY EXISTING SCOUR PROTECTION (RIPRAP, ETC.)
) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.
) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
) DESCRIBE THE CHANNEL BED MATERIAL; A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
) DESCRIBE THE CHANNEL BANK MATERIAL; A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
) DESCRIBE THE BANK COVERING (GRASS, TREES, RIPRAP, NONE, ETC.)
0) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
1) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
2) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING.
3) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS).
4) GIVE THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION. IF THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION IS DEPENDENT ON SCOUR COUNTER MEASURES, EXPLAIN. (RIPRAP ARMORING ON SLOPES, ETC.) THE GEOTECHNICAL ADJUSTED SCOUR ELEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE; PERCENT RQD; DIFFERENTIAL WEATHERING; SHEAR STRENGTH; OBSERVATIONS AT EXISTING STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

SUPPLEMENTAL STRUCTURE SUBSURFACE INVESTIGATION PROVIDED BY AMEC

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.10.R.5	1	10

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

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. *17BP.10.R.5* F.A. PROJ. *N/A*

COUNTY *UNION*

PROJECT DESCRIPTION *DIVISION 10 GROUP N BRIDGE REPLACEMENT*

SITE DESCRIPTION *REPLACE STRUCTURE 890201 – PRECAST REINFORCED CONCRETE THREE-SIDED CULVERT ON SR 1149 (DOSTER ROAD) OVER TWELVE MILE CREEK*

CONTENTS

PERSONNEL

F. Cox

D. Rhodes

R. Clark

INVESTIGATED BY *AMEC E&I, Inc.*

CHECKED BY *S. Johnson, P.G. P.E.*

SUBMITTED BY *M. Lear, P.G.*

DATE *June 2012*

CAUTION NOTICE

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

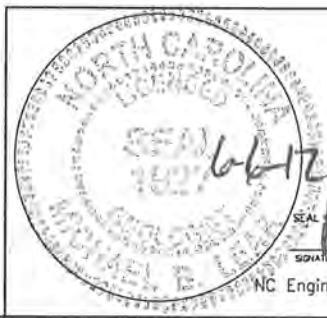
SOIL AND ROCK BOUNDARIES WITHIN A BOREHOLE ARE BASED ON GEOTECHNICAL INTERPRETATION UNLESS ENCOUNTERED IN A SAMPLE. INTERPRETED BOUNDARIES MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN SAMPLED STRATA, AND BOREHOLE INFORMATION MAY NOT NECESSARILY REFLECT ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS. 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 DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

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

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

DRAWN BY: *R. Rahie*



amec

AMEC E&I, Inc.
4021 STIRRUP CREEK DRIVE, SUITE 100
DURHAM, NORTH CAROLINA 27703
(919) 381-9900

NC Engineering F-1253 NC Geology C-247

PROJECT REFERENCE NO.	SHEET NO.
I7BP.10.R.5	2

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

SOIL DESCRIPTION

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

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

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 ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>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
	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
γ - UNIT WEIGHT
γ_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
- [X] CME-45C
- [ ] CME-550
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [X] CASING [ ] W/ ADVANCER
- [X] TRICONE 2 7/8" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B____
- [X] -N 0
- [ ] -H____

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

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET NO.
17BP.10.R.5	2A

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

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.

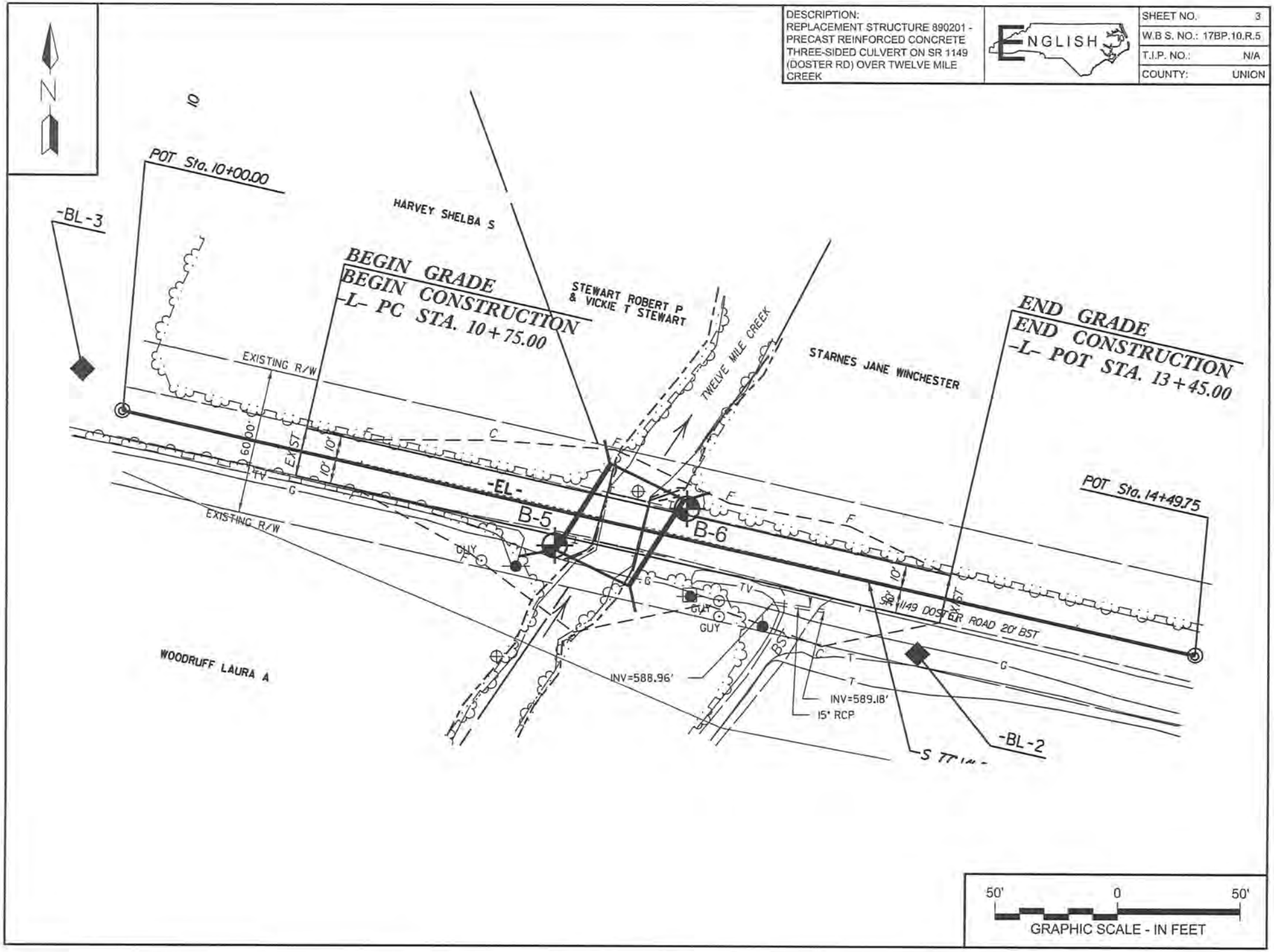
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: NCDOT REBAR & CAP STAMPED BL-2 LOCATED AT STATION 11+10.88 (-EL-), 24.89 LT

ELEVATION: 593.50 FT.

NOTES:

REVISED 09/23/09


DESCRIPTION:
REPLACEMENT STRUCTURE 890201 - PRECAST REINFORCED CONCRETE THREE-SIDED CULVERT ON SR 1149 (DOSTER RD) OVER TWELVE MILE CREEK
ENGLISH
SHEET NO. 3
W.B S. NO.: 17BP.10.R.5
T.I.P. NO.: N/A
COUNTY: UNION
N
POT Sta. 10+00.00
-BL-3
HARVEY SHELBA S
BEGIN GRADE
BEGIN CONSTRUCTION
-L- PC STA. 10+75.00
STEWART ROBERT P & VICKIE T STEWART
TWELVE MILE CREEK
STARNES JANE WINCHESTER
END GRADE
END CONSTRUCTION
-L- POT STA. 13+45.00
POT Sta. 14+49.75
EXISTING R/W
60.00'
EXIST
10'
-EL-
B-5
B-6
GUY
SR 1149 DOSTER ROAD 20' BST
WOODRUFF LAURA A
INV=588.96'
INV=589.18'
15" RCP
-BL-2
50'
0
50'
GRAPHIC SCALE - IN FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek				**GROUND WTR (ft)**
BORING NO. B-5	**STATION** 11+85	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 3.8
COLLAR ELEV. 590.0 ft	**TOTAL DEPTH** 24.6 ft	**NORTHING** 437,052	**EASTING** 1,502,732	**24 HR.** 5.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/21/12	**SURFACE WATER DEPTH** 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)
590										590.0 GROUND SURFACE 0.0
	590.0	0.0	1	2	2	4		M		**ROADWAY EMBANKMENT** Light brown to brown, soft, moist, sandy SILT (A-4)
	586.5	3.5								
585			2	2	2	4		W		
										584.0 6.0
	581.5	8.5								**ALLUVIAL** Light yellowish brown, moist to wet, medium stiff, clayey SILT (A-4)
580			2	2	3	5		M-W		
	576.9	13.1								577.5 12.5
	576.2	13.8	60/0.0			60/0.0				576.9 13.1 **WEATHERED ROCK** Tan to light gray, METAVOLCANIC
575			60/0.0			60/0.0				576.2 13.8 **NON-CRYSTALLINE ROCK** Tan to light gray, METAVOLCANIC
										NON-CRYSTALLINE ROCK Light greenish gray, METAVOLCANIC
570										
										565.4 24.6
										Boring Terminated at Elevation 565.4 ft in Non-Crystalline Rock: METAVOLCANIC

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

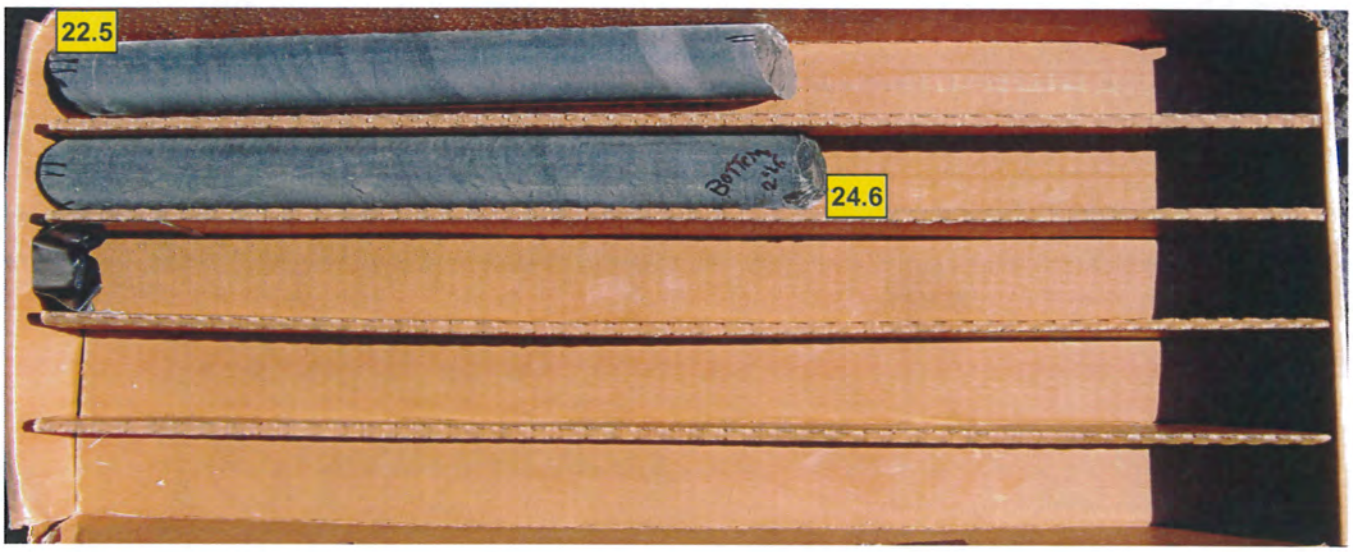
WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek			**GROUND WTR (ft)**
BORING NO. B-5	**STATION** 11+85	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** 3.8
COLLAR ELEV. 590.0 ft	**TOTAL DEPTH** 24.6 ft	**NORTHING** 437,052	**EASTING** 1,502,732	**24 HR.** 5.2
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/21/12	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ	**TOTAL RUN** 10.8 ft			

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
576.2											ELEV. (ft) / DEPTH (ft)
	576.2	13.8									Begin Coring @ 13.8 ft
575	575.4	14.6	0.8	4:05/0.8	(0.3) 38%	(0.0) 0%					**NON-CRYSTALLINE ROCK**
			5.0	3:47 3:58 4:12 4:05 4:09	(4.8) 96%	(3.7) 74%					Light greenish gray, slightly to very slightly weathered, closely to moderately closely fractured, medium hard to moderately hard, METAVOLCANIC *(continued)*
570	570.4	19.6	5.0	2:38 2:51 3:26 3:48 4:10	(5.0) 100%	(4.7) 94%					
	565.4	24.6									565.4 / 24.6 Boring Terminated at Elevation 565.4 ft in Non-Crystalline Rock: METAVOLCANIC

CORE PHOTOGRAPHS

B-5

BOXES 1 & 2: 13.8 - 24.6 FEET



0 1 2

FEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark	
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek				**GROUND WTR (ft)**
BORING NO. B-6	**STATION** 12+33	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** 1.5
COLLAR ELEV. 589.1 ft	**TOTAL DEPTH** 28.8 ft	**NORTHING** 437,067	**EASTING** 1,502,786	**24 HR.** 5.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring		**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/22/12	**SURFACE WATER DEPTH** 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)
590										
	589.1	0.0	2	3	3	6		M		589.1 GROUND SURFACE 0.0 **ROADWAY EMBANKMENT** Brown, moist, medium stiff to soft, sandy, clayey SILT (A-4) with trace organics and trace gravel
585	585.6	3.5	1	1	2	3		M		
								W		583.1 6.0 **ALLUVIAL** Gray, wet, medium stiff, sandy, clayey SILT (A-4) with few organics
580	580.6	8.5	3	4	3	7				
										577.1 12.0
575	575.8	13.3	60/0.0			60/0.0				575.8 **WEATHERED ROCK** 13.3 METAVOLCANIC **NON-CRYSTALLINE ROCK** Light greenish gray, METAVOLCANIC
570										
										567.8 21.3 **NON-CRYSTALLINE ROCK** Light greenish gray, METAVOLCANIC
565										
	560.3	28.8	60/0.0			60/0.0				560.3 28.8 Boring Terminated at Elevation 560.3 ft in Non-Crystalline Rock: METAVOLCANIC

NCDOT GEOTECHNICAL ENGINEERING UNIT
CORE BORING REPORT

WBS 17BP.10.R.5	**TIP** 17BP.10.R.5	**COUNTY** UNION	**GEOLOGIST** R. Clark
SITE DESCRIPTION Bridge 890201 on SR 1149 Over Little Twelve Mile Creek			**GROUND WTR (ft)**
BORING NO. B-6	**STATION** 12+33	**OFFSET** 13 ft LT	**ALIGNMENT** -L- / **0 HR.** 1.5
COLLAR ELEV. 589.1 ft	**TOTAL DEPTH** 28.8 ft	**NORTHING** 437,067	**EASTING** 1,502,786 / **24 HR.** 5.3
DRILL RIG/HAMMER EFF./DATE MAC9354 CME-45C 86% 10/3/2010		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic
DRILLER F. Cox	**START DATE** 05/21/12	**COMP. DATE** 05/22/12	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ	**TOTAL RUN** 15.5 ft		

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
575.8											Begin Coring @ 13.3 ft
575	575.8	13.3	0.5	2:10/0.5	(0.5) 100%	(0.3) 60%		(8.0) 100%	(5.7) 71%		575.8 / 13.3 **NON-CRYSTALLINE ROCK** Light greenish gray, slightly to very slghtly weathered, closely fractured, moderately hard, METAVOLCANIC
	575.3	13.8	5.0	3:28 3:39 4:05 3:27 3:55	(5.0) 100%	(2.9) 58%					
570	570.3	18.8	5.0	2:58 3:05 3:16 2:10 2:25	(3.3) 66%	(2.5) 50%					567.8 / 21.3 **NON-CRYSTALLINE ROCK** Light greenish gray, moderately severely weathered, closely to very closely fractured, medium hard, METAVOLCANIC
565	565.3	23.8	5.0	4:05 4:51 5:10 5:17 5:22	(3.6) 72%	(0.9) 18%		(4.4) 59%	(0.9) 12%		
	560.3	28.8		N=60/0.0							560.3 / 28.8 Boring Terminated at Elevation 560.3 ft in Non-Crystalline Rock: METAVOLCANIC

CORE PHOTOGRAPHS

B-6

BOXES 1 & 2: 13.3 - 28.8 FEET