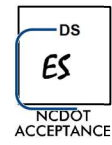


FEMA DETAILED STUDY



BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

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

State Proj. Reference No. BP7.R017.1 WBS Project No. BP7.R017.1 Proj. Station 14+53.00  
County ORANGE Bridge Over FORREST CREEK Bridge Inv. No. 670114  
On Highway SR 1548 Between NC-57 and SR 1538 (SCHLEY RD.) (NEW SHARON CHURCH RD.)  
Recommended Structure 1 @ 70'-0"; 24" CORED SLAB BRIDGE W/4'-0" CAPS

Recommended Width of Roadway 33'-6" CLEAR ROADWAY Skew 120°  
Recommended Location is (Up, A Down) Stream from Existing Crossing.

Longitude -79.02484 Latitude 36.14026

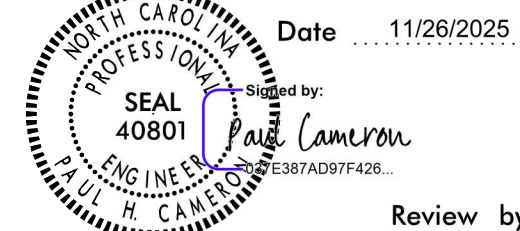
Statewide Tier ☐ Regional Tier ☐ Sub-Regional Tier ☒  
Bench Mark is BENCHMARK IS "BM1", RR SPIKE IN BASE OF 27" POPLAR, 35' LT. OF -L-, 15+29.23  
Northing 869998 Easting 1992734 Elev. 536.51 ft. Datum: NAD 83 /NA2011  
Temporary Crossing NOT REQUIRED; OFF SITE DETOUR PROVIDED



Designed by: AUSTIN SHIVELY, PE  
Assisted by: MATTHEW STRATTON, EI

**HNTB**

HNTB NORTH CAROLINA, P.C.  
343 E. 3rd Street, Suite 200  
Raleigh, North Carolina 27609  
NC License No. C-1054



Date 11/26/2025

Seal of  
Professional Engineer  
Austin Shively, PE  
No. 40801  
State of North Carolina

Review by:

Eric Sailer  
9140FG3C3C2450

Date 11/26/2025

SITE DATA

Drainage Area 7.3 SQ. MI. Source USGS /STREAM STATS  
River Basin NEUSE Character REGION 1 - Piedmont  
Stream Classification (Such as Trout, High Quality Water, etc.) WS-II, HQW, NSW  
Data on Existing Structure 2 @ 25'-0"; BRIDGE W/TIMBER DECK ON SALVAGE I-BEAMS  
Total Waterway Opening 259 s.f.  
Waterway Opening Below 100yr. WS EL 259 s.f.  
Debris Potential: Low Moderate X High  
Data on Structures Up and Down Stream UPSTREAM: 1 @ 23'-0" CONCRETE BRIDGE; HT. CROWN-TO-BED = 5.0'  
DOWNSTREAM: CONFLUENCE WITH LITTLE RIVER SOUTH FORK

Design Control Elev. \*540.4, \*\*541.9 ft. \* EX USGS 25 YR AT RS 8735  
ft. \*\* CE FEMA 100 YR AT RS 8735  
Gage Station No. NA Period of Records NA  
Max. Discharge NA c.f.s. Date NA Frequency NA

Historical Flood Information:  
Date NA Elev. <539.5 ft. Est. Freq. <50 yr. Source KYLAH CLAYTON (PROPERTY OWNER US LT QUAD.) Period of Knowledge 21 yrs.  
Date NA Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.  
Date NA Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.  
Historical Scour Info: General NA ft. Contraction NA ft. Local NA ft.  
Channel Slope 0.001 ft/ft Source FIELD SURVEY/LIDAR Normal Water Surface Elev. 531.6 ft.  
Manning's n: Left O.B. 0.060-0.150 Channel 0.035-0.065 Right O.B. 0.060-0.150 Source ORANGE COUNTY FIS  
Flood Study /Status FEMA DETAILED STUDY EFFECTIVE DATE: 22/2007  
REVISED DATE: 10/19/2018  
Flood Study 100yr. Discharge 2000 c.f.s. WS Elev.: Floodway 541.1 ft. Without Floodway 541.1 ft.  
@ River Station 8721

DESIGN DATA

Hydrological Method USGS RURAL SIR 2009-5158  
Hydraulic Design Method HEC-RAS 5.0.7 (BP7.R017.1\_ForrestCreek\_SR-1548.PRIJ)  
Floods Evaluated: Freq. Q Elev. Backwater Bridge Opening Velocity  
(yr.) (c.f.s.) (ft.) (ft.) (f.p.s.)  
@ River Station 8735 10 1400 538.1 0.4 7.3  
25 1800 538.9 0.6 8.0  
50 2200 540.3 1.5 6.6  
100 2500 540.7 1.5 7.5  
500 3400 542.4 2.2 9.7  
Waterway Opening Provided Below Design W.S. Elev. 225 s.f., 100yr W.S. Elev. 255 s.f., Total 395 s.f.,  
Average Channel Velocity (Design) 5.8 f.p.s. Average Overbank Velocity (Design) 1.8 f.p.s.  
Computed Scour: General NA ft. Contraction 100yr: 0.4 ft. Local NA ft.  
State Floodway Compliance Type SFC TYPE B (MAX DECREASE OF -0.96' @ RS 8735)

INFORMATION TO BE SHOWN ON PLANS

| HYDRAULIC DATA              |              |
|-----------------------------|--------------|
| DESIGN DISCHARGE            | =1800 C.F.S. |
| FREQUENCY OF DESIGN FLOOD   | =25 YRS.     |
| DESIGN HIGH WATER ELEVATION | =538.9'      |
| DRAINAGE AREA               | =7.3 SQ. MI. |
| BASIC DISCHARGE (Q100)      | =2500 C.F.S. |
| BASIC HIGH WATER ELEVATION  | =540.7'      |

| OVERTOPPING FLOOD DATA                 |              |
|----------------------------------------|--------------|
| OVERTOPPING DISCHARGE                  | =3050 C.F.S. |
| FREQUENCY OF OVERTOPPING FLOOD         | =< 500 YRS.  |
| OVERTOPPING FLOOD ELEVATION            | =541.86' *   |
| *OVERTOPPING OCCURS AT THE SAG         |              |
| L+L= 13+75 0' L&RT                     |              |
| WS EL. Taken @ River Station 8678 BR U |              |

ADDITIONAL INFORMATION AND COMPUTATIONS

DISCHARGE CALCS. BY NCDOT GUIDELINES FOR DRAINAGE STUDIES & HYDRAULIC DESIGN & SIR 2009-5158

DRAINAGE AREA (DA) = 7.3 SQ. MI.; 100% IN HYDRAULIC REGION 1 - RIDGE AND VALLEY-PIEDMONT

SIR 2009-5158 RURAL PIEDMONT:

$Q_{10} = 398(DA)^{0.617} = 1356$  cfs SAY 1400 cfs  
 $Q_{25} = 537(DA)^{0.606} = 1790$  cfs SAY 1800 cfs  
 $Q_{50} = 661(DA)^{0.718} = 2177$  cfs SAY 2200 cfs  
 $Q_{100} = 776(DA)^{0.594} = 2525$  cfs SAY 2500 cfs  
 $Q_{200} = 1072(DA)^{0.393} = 3413$  cfs SAY 3400 cfs

FEMA DISCHARGES

$Q_{10} = 858$  cfs  
 $Q_{25} = 1260$  cfs  
 $Q_{50} = 1620$  cfs  
 $Q_{100} = 2000$  cfs  
 $Q_{200} = 3050$  cfs

SCOUR ANALYSIS

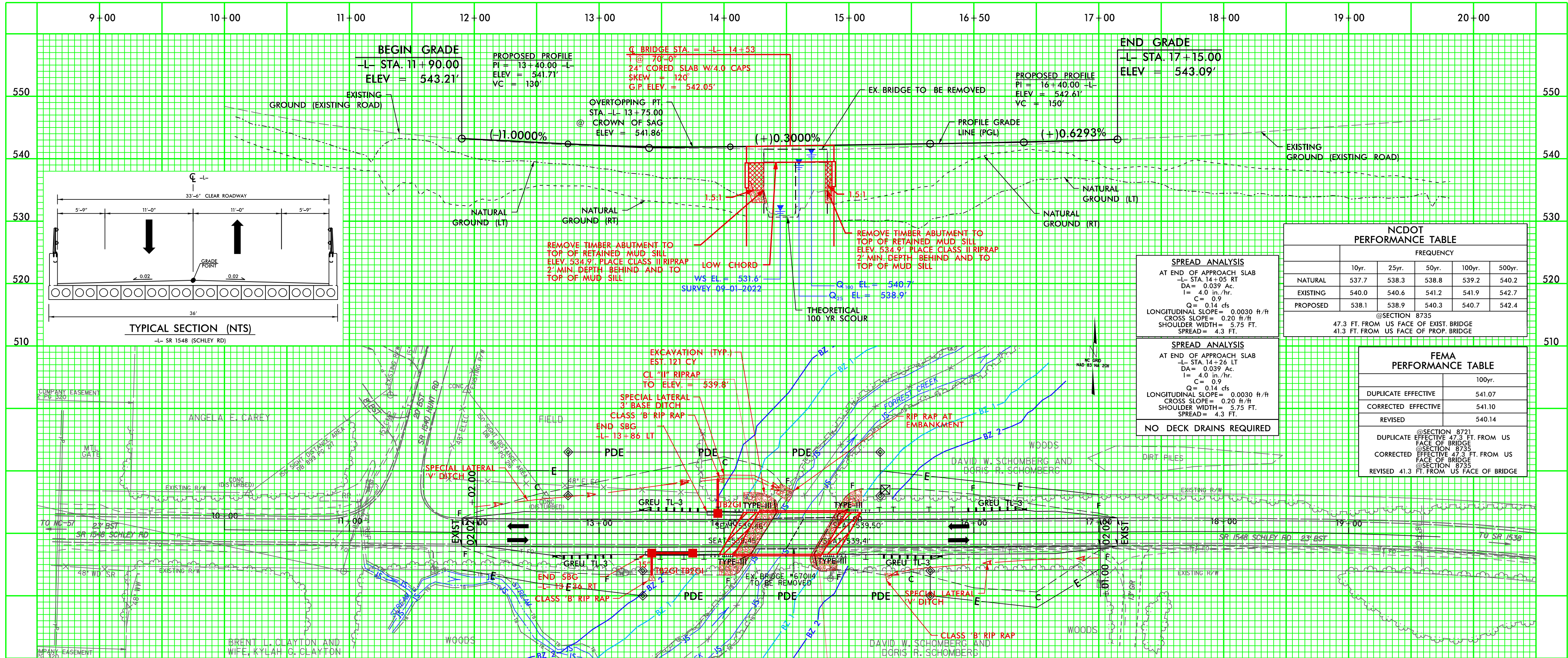
SCOUR COMPUTATIONS (HEC-RAS PLAN: PROPOSED)

$Q_1$  &  $W_1$  = RS 8897  $Q_2$  &  $W_2$  = RS 8678 BR U

CONTRACTION SCOUR:  $Y_2/Y_1 = (Q_2/Q_1)^{0.5} \times (W_1/W_2)^{1.5}$   $Y_2 = Y_1 - Y_0$   $K=0.69$

100YR:  $Q_1 = 1696.03$  cfs,  $Q_2 = 1595.42$  cfs,  $W_1 = 30.70$  ft,  $W_2 = 27.95$  ft,  $Y_1 = 8.58$  ft,  $Y_2 = 8.49$  ft

100YR:  $Y_2 = 8.7$  ft - 8.5 ft,  $Y_2 = 0.2$  ft



| SPREAD ANALYSIS                                                                                                           |  |
|---------------------------------------------------------------------------------------------------------------------------|--|
| AT END OF APPROACH SLAB<br>-L- STA. 14+49 RT<br>DA= 0.039 Ac<br>I= 4.0 in./hr.<br>C= 0.9                                  |  |
| Q= 0.14 cfs<br>LONGITUDINAL SLOPE= 0.0030 ft/ft<br>CROSS SLOPE= 0.20 ft/ft<br>SHOULDER WIDTH= 5.75 FT.<br>SPREAD= 4.3 FT. |  |
| NO DECK DRAINS REQUIRED                                                                                                   |  |

| NCDOT PERFORMANCE TABLE |                                 |
|-------------------------|---------------------------------|
| FREQUENCY               |                                 |
|                         | 10yr. 25yr. 50yr. 100yr. 500yr. |
| NATURAL                 | 537.7 538.3 538.8 539.2 540.2   |
| EXISTING                | 540.0 540.6 541.2 541.9 542.7   |
| PROPOSED                | 538.1 538.9 540.3 540.7 542.4   |

| FEMA PERFORMANCE TABLE |        |
|------------------------|--------|
| 100yr.                 |        |
| Duplicate Effective    | 541.07 |
| Corrected Effective    | 541.10 |
| Revised                | 540.14 |