



SPREAD ANALYSIS
 SPREAD CALCULATED PER HEC-22
 C=0.9
 1=0.9 IN/HR
 SHOULDER WIDTH=8.0'
 ASSUMES NO FUTURE SIDEWALK AND NO RAISED ISLAND ON BRIDGE OR APPROACH
 MAX SPREAD ON BRIDGE AND APPROACH AT L-STA. 165+83 RT
 (IN 0.03 CONCRETE)
 DA=0.75 ACRES
 Q=2.7 CFS
 LONGITUDINAL SLOPE=0.3%
 AT TB 261 (L-STA. 165+83 RT)
 n=0.015 (ASPHALT)
 DA=0.78 ACRES
 LONGITUDINAL SLOPE=6.0%
 ROADWAY CROSS SLOPE=6.0%
 SPREAD=9.5'

NO DECK DRAINS REQUIRED

2700
 2720
 2740
 2760
 2780

INFORMATION TO BE SHOWN ON PLANS
 WS EL. Taken @ River Station 93683

Design:	Discharge	12244	c.f.s.	Frequency	50	yr.	Elev.	2743.2	ft.
Base Flood:	Discharge	15538	c.f.s.	Frequency	100	yr.	Elev.	2745.0	ft.
Overtopping:	Discharge	25567	c.f.s.	Frequency	500	yr.	Elev.	2765.1*	ft.

*OVERTOPPING ELEVATION REPRESENTS LOWEST ROADWAY ELEVATION LOCATED @ L STA. 165+97

ADDITIONAL INFORMATION AND COMPUTATIONS

HYDROLOGY:

RURAL BLUE RIDGE
 SIR 2009-5158

FEMA DISCHARGES 100% HYDROLOGIC REGION 2

FEMA Q	Discharge (c.f.s.)	Frequency (yr.)	Elevation (ft.)
Q10	6923	10	2739.8
Q50	12244	50	2743.2
Q100	15538	100	2745.0
Q500	25567	500	2765.1

FEMA DISCHARGES USED FOR NCDOT MODEL. FEMA DISCHARGES HAVE BEEN CALIBRATED WITH STREAM GAGE DATA FOR WATAUGA RIVER.

SCOUR

SCOUR CALCULATED PER HEC-18.
 OVERTOPPING DISCHARGE EXCEEDS THE 500 YR DISCHARGE, SO BOTH THE 100 & 500 YR WERE ANALYZED.

CONTRACTION SCOUR LOCAL SCOUR: (CSU EQ.)

(Live bed with mostly suspended material)

$$Y_2 = Y_1 \left[\left(\frac{Q_2}{Q_1} \right)^{0.65} \left(\frac{V_1}{V_2} \right)^{0.35} \right] \text{ and } Y_s = Y_2 - Y_o$$

$$Y_s = 2.0(K_1)(K_2)(K_3)(g) (Y_1) (Fr_1) \text{ and } Fr_1 = V_1 / (g(Y_1))^{0.5}$$

100 YR:		500 YR:		100 YR:		500 YR:	
Y ₁ = 13.6'	w ₁ = 77.2'	Y ₁ = 18.0'	w ₁ = 77.2'	K ₁ = 1.0	Y ₁ = 16.2'	K ₁ = 1.0	Y ₁ = 20.8'
Q ₁ = 14159 cfs	w ₂ = 97.9'	Q ₁ = 22086 cfs	w ₂ = 97.9'	K ₂ = 1.0	Fr ₁ = 0.57	K ₂ = 1.0	Fr ₁ = 0.61
Q ₂ = 14905 cfs	Y ₂ = 14.4'	Q ₂ = 23473 cfs	Y ₂ = 19.5'	K ₃ = 1.1	V ₁ = 12.9 ft/sec	K ₃ = 1.1	V ₁ = 15.9 ft/sec
K ₁ = 0.69	Y _s = 12.1'	K ₁ = 0.69	Y _s = 16.1'	a = 3.0'	g = 32.2 ft/sec ²	a = 3.0'	g = 32.2 ft/sec ²
Y _s = 0.0'	Y _s = 0.0'	Y _s = 7.2'	Y _s = 7.2'				

APPROACH XS RIVER STATION: 94166 (SECTION IS MORE REFLECTIVE OF SCOUR POTENTIAL THAN RS 93910)

SITE DATA

Drainage Area: 26.3 SQ. MI. Source: USGS STREAM STATS
 River Basin: WATAUGA Character: RURAL BLUE RIDGE (FOREST, SOME RESIDENTIAL AND COMMERCIAL DEVELOPMENT)
 Stream Classification: CLASS B; Tr, HQW
 Data on Existing Structure: 5 @ 52'-6" REINFORCED CONCRETE FLOOR ON I-BEAMS
 E.B.TI:RC CAPH-PILES;INT.BTS:RC P&B;E.BT2:RC SPILL THRU Total Waterway Opening: 4204 s.f.
 Debris Potential: Low X Moderate High Waterway Opening Below 100yr. WS EL: 1381 s.f.
 Data on Structures Up and Down Stream US STRUCTURE #940003: 2 MI. US ON WATAUGA RIVER AT SR-1557 (SHULLS MILL RD); 3@50' REINFORCED CONCRETE FLOOR ON I-BEAMS; BED TO CROWN ~15'
 D5 STRUCTURE #940161: 2.8 MI. DS ON WATAUGA RIVER AT SR-1114 (DEWITT BARNETT RD); 3@25'-3" TIMBER FLOOR ON I-BEAMS; BED TO CROWN ~6'
 Design Control Elev. 2745.5' ft. *FEMA CORRECTED EFF. 100 YR. WSEL AT HEC-RAS RS 93683 (US TOE) WATAUGA RIVER NEAR FOSCOE
 Gage Station No. (2 MI. US @ SHULLS MILL RD) Period of Records UNK. yrs.
 Max. Discharge UNK. (2929.8' WSEL) c.f.s. Date SEP. 2011 Frequency 500+ yrs.
 Historical Flood Information: *NEVER OBSERVED OVERTOPPING OF EXISTING BRIDGE
 WATAUGA RIVER NEAR FOSCOE Period of Knowledge NA yrs.
 Date 9/2011 Elev. UNK. ft. Est. Freq. 500+ yr. Source GAGE DATA Period of Knowledge NA yrs.
 Date * Elev. NA ft. Est. Freq. NA yr. Source LOCAL RESIDENT Period of Knowledge 23 yrs.
 Date Elev. ft. Est. Freq. yr. Source Period of Knowledge yrs.
 Historical Scour Info.: General ft. Contraction ft. Local ft.
 Channel Slope 0.01 f/ft Source SITE SURVEY Normal Water Surface Elev. 2727 ft.
 Manning's n: Left O.B. 0.08-0.14 Channel 0.055 Right O.B. 0.14 Source EFFECTIVE MODEL/
 FLOOD STUDY / STATUS DETAILED (12/3/2009) / ZONE AE FIRM PANELS FIELD OBSERVATION
 1980 & 1990
 Flood Study 100yr. Discharge 15538 c.f.s. WS Elev.: Floodway 2747.2 ft. Without Floodway 2747.2 ft. @ River Station 93910

DESIGN DATA

Hydrological Method FEMA DISCHARGES USED.
 Hydraulic Design Method HEC-RAS V. 3.1.3, HEC-RAS PROJ. TITLE: R-25666BA WataugaRiver_NC105

Floods Evaluated:	Freq. (yr.)	Q (c.f.s.)	Elev. (ft.)	Backwater (ft.)	Bridge Opening Velocity (f.p.s.)
Q10	10	6923	2739.8	3.8	8.7
Q50	50	12244	2743.2	4.1	10.2
Q100	100	15538	2745.0	4.3	10.9
Q500	500	25567	2749.7	5.0	12.1

@ River Station 93683

Waterway Opening Provided Below Design W.S. Elev. 1197 s.f., 100yr W.S. Elev. 1420 s.f., Total 3850 s.f.,
 Average Channel Velocity (Design) 11.6 f.p.s. Average Overbank Velocity (Design) 2.5 f.p.s.
 0.0 (100 YR) 7.2 (100 YR)
 Computed Scour: General ft. Contraction 0.0 (500 YR) ft. Local 7.2 (500 YR) ft.
 Is a Floodway Revision Required? MOA TYPE 2b (MAX. DECREASE OF 0.5 FT. AT RS 93683)

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

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

I.D. No. R-25666BA Project No. 37512.1.4 Proj. Station L-164+30 +/-
 County WATAUGA Bridge Over WATAUGA RIVER Bridge Inv. No. 0005
 SR-1112 SR-1111
 On Highway NC 105 Between (BROADSTONE RD) and (OLD DANNER RD)
 Recommended Structure 1@100', 1@110', 1@60'; 63" MBT GIRDER WITH 4'-0" DEEP CAPS
 Recommended Width of Roadway 87'-0" CLEAR ROADWAY Skew 120 DEGREE
 Recommended Location is (Up, At, Down) Stream from Existing Crossing.
 Latitude 36.19429 Longitude -81.74526
 Statewide Tier Regional Tier Sub-Regional Tier
 Bench Mark is BM#8: L-163+44 160' RT (RR SPIKE IN BASE 16" TULIP-POPLAR)
 Northing 900648.35 Easting 1190131.67 Elev. 2749.41 ft. Datum: NAVD 88
 Temporary Crossing STAGED CONSTRUCTION

Designed by: DAVID B. PETTY, PE
 Assisted by: KATHLEEN P. GRAY, PE
 Project Engineer: RANDY C. HENEGAR, PE
 Reviewed by: [Signature] 7/28/2018

Stream WATAUGA RIVER - Struct. Inv. No. 0005 I.D. No. R-25666BA, Project No. 37512.1.4, PDF File 94 0005 2018, R-25666BA, WATAUGA, RIVER_NC105.pdf

Seal: NORTH CAROLINA PROFESSIONAL SEAL 088697 08/23/18 DAVID B. PETTY ENGINEER