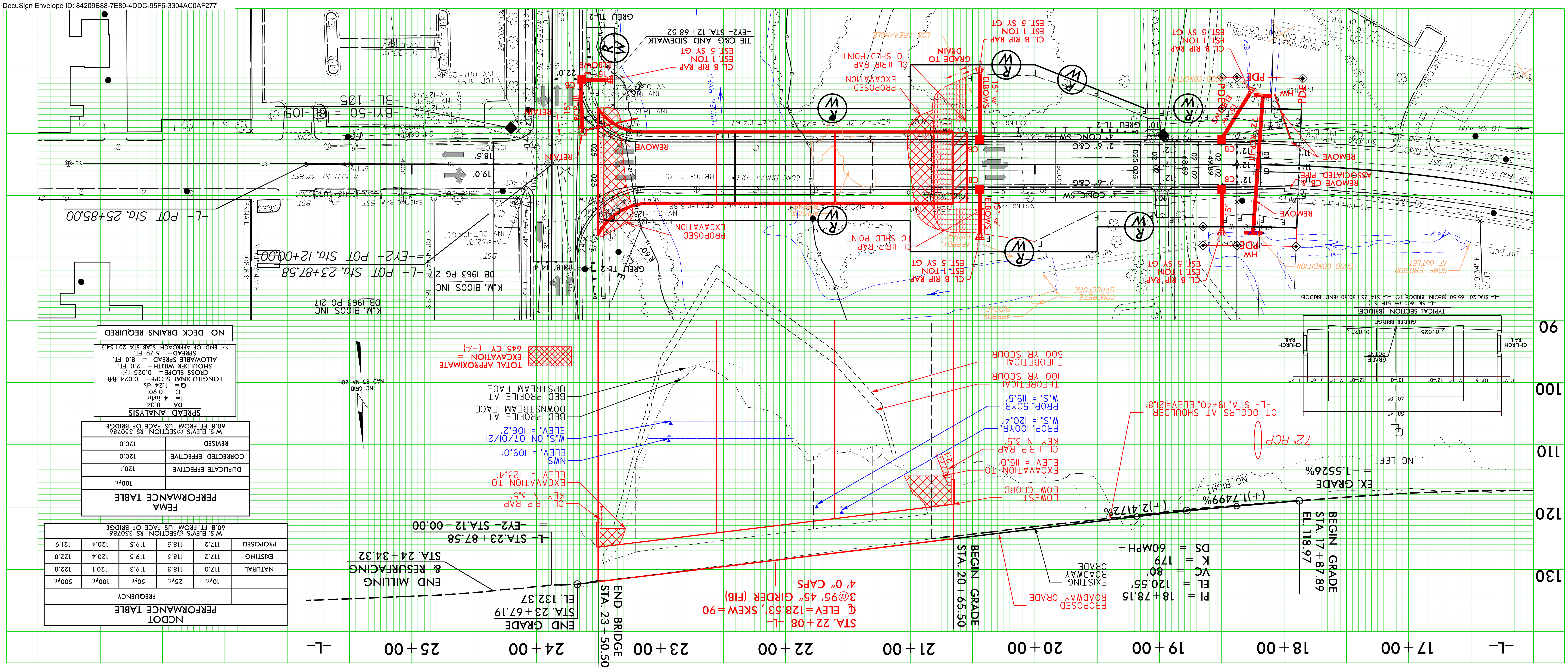
DocuSign Envelope ID: 84209B88-7E80-4DDC-95F6-3304AC0AF277



INFORMATION TO BE SHOWN ON PLANS

WS EL. Taken @ River Station 350786

Design:	Discharge	13,700 c.f.s.	Frequency	50 yr.	Elev.	119.5 ft.
Base Flood:	Discharge	15,900 c.f.s.	Frequency	100 yr.	Elev.	120.4 ft.
Overtopping:	Discharge	21,100+ c.f.s.	Frequency	500+ yr.	Elev.	121.8* ft.

*OT OCCURS AT SHOULDER –L– STA. 19+40 ± ELEV=121.8′

ADDITIONAL INFORMATION AND COMPUTATIONS

HYDROLOGY:

USGS REPORT 2009–5158 ** DA=714 SQ. MI., REGION 3 (45.3%), REGION 4 (54.7%)	FEMA MODEL DISCHARGES:*
Q10= 8,850 cfs	D.A.=725.6 SQ. MI.
Q25= 11,500 cfs	Q10= 8,150 cfs
Q50= 13,700 cfs	Q25= 10,700 cfs
Q100= 15,900 cfs	Q50= 12,800 cfs
Q500= 21,100 cfs	Q100= 14,900 cfs
	Q500= 20,200 cfs

* NOTE: FEMA DISCHARGES USED FOR COMPLIANCE
** NOTE: USGS DISCHARGES USED FOR DESIGN

GAGE 02134170 COULD NOT BE USED WITH THE GAGED LOCATION WEIGHTED METHODOLOGY OR UNGAGED NEAR GAGED LOCATION METHODOLOGY SINCE THE GAGE IS NOT PART OF THE SIR 2009–5158 METHODOLOGY.

SCOUR

HEC–18, REV. 2012; computations by hand using HEC–RAS ver. 4.1.0 values

CONTRACTION SCOUR (100 YR)

(Live Bed Equations Used):

$Y_2 = Y_1 \left[\left(\frac{Q_2}{Q_1} \right)^{6/7} \left(\frac{w_1}{w_2} \right)^{K_1} \right]$ & $Y_S = Y_2 - Y_0$

$Y_1 = 18.2'$ $K_1 = 0.69$

$Q_1 = 12284$ cfs $Q_2 = 13335$ cfs

$w_1 = 119.2'$ $w_2 = 139.2'$

$Y_0 = 11.6'$ $Y_S = 6.0'$ CHANNEL

CONTRACTION SCOUR (500 YR)

(Live Bed Equations Used):

$Y_2 = Y_1 \left[\left(\frac{Q_2}{Q_1} \right)^{6/7} \left(\frac{w_1}{w_2} \right)^{K_1} \right]$ & $Y_S = Y_2 - Y_0$

$Y_1 = 19.8'$ $K_1 = 0.69$

$Q_1 = 16026$ cfs $Q_2 = 18273$ cfs

$w_1 = 119.2'$ $w_2 = 139.2'$

$Y_0 = 12.6'$ $Y_S = 7.4'$ CHANNEL

LOCAL SCOUR (100 YR)

$Ys_{Pier} = Y_1 \left[(2.0)(K_1)(K_2)(K_3)(a/Y_1)^{0.65} (Fr_1)^{0.43} \right]$

$Ys_{Pier} = 18.7 \left[(2.0)(1.0)(1.0)(1.1)(3.5/18.7)^{0.65} (0.23)^{0.43} \right] = 7.4'$

LOCAL SCOUR (500 YR)

$Ys_{Pier} = Y_1 \left[(2.0)(K_1)(K_2)(K_3)(a/Y_1)^{0.65} (Fr_1)^{0.43} \right]$

$Ys_{Pier} = 20.0 \left[(2.0)(1.0)(1.0)(1.1)(3.5/20.0)^{0.65} (0.27)^{0.43} \right] = 8.1'$

SITE DATA

Drainage Area 714 SQ. MI. Source USGS QUAD: SOUTHWEST LUMBERTON/STREAMSTATS

River Basin LUMBER Character RESIDENTIAL, WOODED

Stream Classification (Such as Trout, High Quality Water, etc.) CL C; SW; NC NATURAL & SCENIC RIVERS

Data on Existing Structure 1@47.25′, 3@47.5′, 1@47.75′, 1@30.25′ RC DECK ON I–BEAMS

E.BTS & INT.BTS: RC CAP/PPC PILES Total Waterway Opening 3951 s.f.

Waterway Opening Below 100yr. WS EL. 2952 s.f.

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

Data on Structures Up and Down Stream

UPSTREAM: BR #770146 (OAL=380′) ON I–95

DOWNSTREAM: BR #770125 (OAL=285′) ON NC–41/NC–72

Design Control Elev. MAINTAIN OR IMPROVE EXISTING L.O.S

Gage Station No. 02134170 Period of Records 2000–2021 yrs.

Max. Discharge 17,100 c.f.s. Date SEP. 2018 HURRICANE FLORENCE Frequency 100 YR +

Historical Flood Information:

Date SEP. 2018 Elev. NO OT 119.7′ ft. Est. Freq. 100+ yr. Source 02134170 GAGE PEAK STREAMFLOW Period of Knowledge 21 yrs.

Date NO OVERTOPPING Elev. ...... ft. Est. Freq. 100+ yr. Source BRANDON LOVE FLOODPLAIN ADMINISTRATOR Period of Knowledge 20 yrs.

Date ...... Elev. ...... ft. Est. Freq. ...... yr. Source ...... Period of Knowledge ...... yrs.

Historical Scour Info. : General — ft. Contraction — ft. Local — ft.

Channel Slope 0.003 ft/ft Source USGS QUAD Normal Water Surface Elev. 109.0 ft.

Manning's n: Left O.B. 0.032–0.15 Channel 0.035–0.065 Right O.B. 0.032–0.15 Source FIELD OBSERVATION/FIS

Flood Study /Status DETAILED STUDY DATE 12/6/2019 FIRM PANEL #9391 DATE 12/6/2019 Floodway Established? YES

Flood Study 100yr. Discharge 14900 c.f.s. WS Elev.: With Floodway 120.4 ft. Without Floodway 120.1 ft.
@ River Station 350786

DESIGN DATA

Hydrological Method USGS REPORT SIR 2009–5158

Hydraulic Design Method HEC–RAS VER. 4.1.0 PROJ. TITLE: B–5985_LUMBER_RIVER_SR1600_NC41_NC72.PRJ

Floods Evaluated: @ River Station 350786

Freq. (yr.)	Q (c.f.s)	Elev. (ft.)	Backwater (ft.)	Bridge Opening Velocity (f.p.s.)
10	8,850	117.2	0.2	3.9
25	11,500	118.5	0.2	4.4
(DESIGN) 50	13,700	119.5	0.2	4.8
100	15,900	120.4	0.3	5.2
500	21,100	121.9	0.1	6.3

Waterway Opening Provided Below:Design W.S. Elev. 2857 s.f., 100yr W.S. Elev. 3073 s.f., Total 3785 s.f.,

Average Channel Velocity (Design) 5.2 f.p.s. Average Overbank Velocity (Design) 1.0 f.p.s.

Computed Scour : General — ft. Contraction 100 YR – 6.0 500 YR – 7.4 ft. Local 100 YR – 7.4 500 YR – 8.1 ft.

Is a Floodway Revision Required? MOA TYPE 1 (0.1′ MAX DECREASE AT HEC–RAS SECTION 354165)

Stream LUMBER RIVER Struc. Inv. No. 0175 I.D. No. B–5985 Project No. 47749.1.1 PDF File 770175 2021 B–5985 LUMBER RIVER SR 1600 NC 41 NC 72.PDF

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

N. C. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

RALEIGH, N. C.

DS TP

I.D. No. B–5985 Project No. 47749.1.1 Proj. Station 22+08 –L–

County ROBESON Bridge Over LUMBER RIVER Bridge Inv. No. 0175

On Highway SR 1600 (W 5TH ST) Between APPLE ST (SR 1599) and N WATER ST (SR 1536)

Recommended Structure 3@95′ 45″ GIRDER (FIB)
4′–0″ DEEP CAP

Recommended Width of Roadway 40′–0″ CLEAR BRIDGE WIDTH, 58′–4″ OUT–TO–OUT Skew 90°

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

Latitude 34.62020 Longitude –79.01065

Statewide Tier ☐ Regional Tier ☒ Sub–Regional Tier ☐

Bench Mark is BM–1 (RR SPIKE IN BASE OF 20″ OAK) 32.81′ RT OF –L– STA 15+44.48

Northing 316724 Easting 1996085 Elev. 118.49 ft. Datum: NAVD 88

Temporary Crossing OFF–SITE DETOUR

Designed by: HARMINDER SINGH, PE

WETHERILL ENGINEERING

Assisted by: FORREST BROOKS, EI

Project Engineer : KEVIN ALFORD, PE

Reviewed by: DocuSigned by: Frank Fleming ABD4787727EC464...

Date 9/14/2021

NORTH CAROLINA PROFESSIONAL SEAL 044561 ENGINEER HARMINDER SINGH

DocuSigned by: Harminder Singh