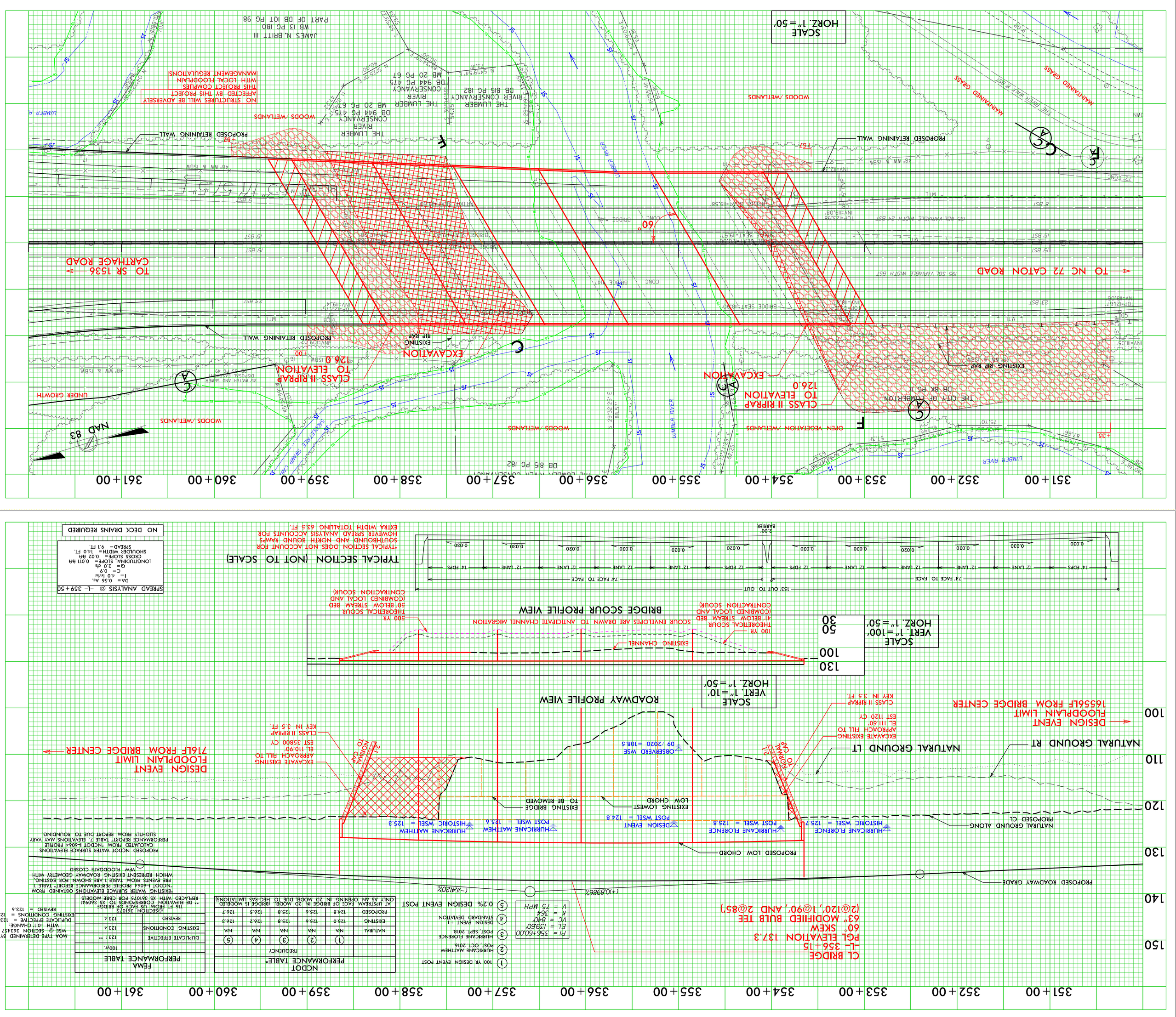

INFORMATION TO BE SHOWN ON PLANS

WS EL. Taken @ Upstream Face of Bridge in 2D Model

Design: Discharge 15200 c.f.s. Frequency DESIGN EVENT~100 yr. Elev. 124.8 ft.

Base Flood: Discharge 15200 c.f.s. Frequency DESIGN EVENT~100 yr. Elev. 124.8 ft.

Overtopping: Discharge Overtopping not performed in 2-D model Elev. -L- Sta. 367+00 SHLDR ELEV = 125.8 PGL ELEV = 127.2 MED. BARRIER ELEV = 131.20

ADDITIONAL INFORMATION AND COMPUTATIONS

	NCDOT DISCHARGES @ LUMBER RIVER BRIDGE IN 2D SIMULATION				FEMA DISCHARGES @2400 FT UPSTREAM OF BRIDGE
	NCDOT DISCHARGE EVENTS DO NOT CORRELATE TO FEMA EVENTS				
1	100 YR DESIGN EVENT POST	Q AND WSE DERIVED FROM H&H SIMULATION	SIMILAR TO 100-YEAR STORM	Q = 15200 CFS	Q_{10} = 8150 CFS
2	HURRICANE MATTHEW POST, OCT. 2016.	Q AND WSE DERIVED FROM H&H SIMULATION	USGS EST. 175-YEAR STORM AT GAUGE 02134170*	Q = 16500 CFS	Q_{25} = 10700 CFS
3	HURRICANE FLORENCE POST, SEPT. 2018.	Q AND WSE DERIVED FROM H&H SIMULATION	USGS EST. 110-YEAR STORM AT GAUGE 02134170*	Q = 17000 CFS	Q_{50} = 12800 CFS
4	DESIGN EVENT +1 STANDARD DEVIATION POST	Q AND WSE DERIVED FROM H&H SIMULATION	UPPER BOUND OF DESIGN EVENT WITH 84% CONFIDENCE INTERVAL	Q = 18700 CFS	Q_{100} = 14900 CFS
5	0.2% DESIGN EVENT POST	Q AND WSE DERIVED FROM H&H SIMULATION	SIMILAR TO 500-YEAR STORM	Q = 20700 CFS	Q_{500} = 20200 CFS

"POST" TERMINOLOGY INDICATES FLOOD GATE IN PLACE AT VFW OPENING AND PROPOSED ROADWAY GEOMETRY ELIMINATING OVERTOPPING OF I-95 SEEN DURING PRE CONDITION

NOTE: FEMA DISCHARGES USED FOR COMPLIANCE; NCDOT DISCHARGES USED FOR DESIGN *USGS OFR 2018-1172

NOTE: NCDOT DISCHARGES FROM 2D MODEL H&H SIMULATION DATA USED TO DEVELOP THE *NCDOT I-6064 HYDROLOGIC AND HYDRAULIC ANALYSIS INTERSTATE 95, LUMBERTON, NC* REPORT

CONTRACTION SCOUR:

$Y_2 = Y_1 [Q_2/Q_1]^{.67} [W_1/W_2]^{K1}$

$Ys = Y_2 - Yo$

100-Year: $Y_2 = 21.2\ [12281/3915]^{.67}\ [112.4/136.8]^{0.69} = 49.2$ FT; $Ys = 49.2 - 20.1 = 29.1$ FT

500-Year: $Y_2 = 23.2\ [15158/4241]^{.67}\ [112.4/136.8]^{0.69} = 60.4$ FT; $Ys = 60.4 - 22.1 = 38.3$ FT

LOCAL SCOUR (CSU EQUATION) BASED ON POTENTIAL CHANNEL MIGRATION

$Ys = 2.0(K_1)(K_2)(K_3)(a)^{0.65}(Y_1)^{0.35}(Fr_1)^{0.43}$ $\quad Fr_1 = V_1/((g)(Y_1))^{0.5}$

100-Year: $Fr_1 = 4.4/((32.2)(19.3))^{0.5} = 0.18$; $Ys = 2.0(1)(1)(1.1)(8)^{0.65}19.3^{0.35}0.18^{0.43}$; $Ys = 11.4$ FT

500-Year: $Fr_1 = 5.0/((32.2)(20.9))^{0.5} = 0.19$; $Ys = 2.0(1)(1)(1.1)(8)^{0.65}20.9^{0.35}0.19^{0.43}$; $Ys = 12.1$ FT

NCDOT DESIGN FLOW RATES AND WATER SURFACE ELEVATIONS SHOWN ON THIS STRUCTURE REPORT ARE DERIVED FROM THE 2D HEC-RAS MODEL DEVELOPED FOR THE I-6064 PROJECT.

FEMA FLOW RATES AND WATER SURFACE ELEVATIONS AND SCOUR INPUTS ARE THE ONLY VALUES DERIVED FROM 1D HEC-RAS MODEL.

SITE DATA

Drainage Area 725 SQUARE MILES Source EFFECTIVE FIS /STREAMSTATS

River Basin LUMBER Character SAND HILLS /COASTAL PLAIN, RURAL

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

Data on Existing Structure (#0146) RC DECK /STEEL I BEAMS (2@47'-5", 2@47'-7", 1@47'-4", 1@47'-5", 1@47'-6", 1@47'-8" SIMPLE); LENGTH = 380' (#0147) RC DECK /RC I BEAMS (1@46'-9", 2@47'-6", 1@47'-4", 1@47'-4", 2@47'-6", 1@46'-9"); LENGTH = 378' (#0146) BTS: RC CAP ON PPC PILES @ 6'-6" CENTERS (#0147) END BTS: RC CAP ON STEEL PILES, INT BTS: RC CAPS ON DRILLED SHAFT PIERS Total Waterway Opening 3191 s.f. Waterway Opening Below 100yr. WS EL. 3191 s.f.

Debris Potential: Low ____ Moderate X High ____

Data on Structures Up and Down Stream

US: CATON RD., NC72, NCDOT STRUCTURE NO. 770043; 361' RC DECK ON PPC GIRDERS, MAX SPAN 83'

DS: SR1500, W. 5TH ST., NCDOT STRUCTURE 770175'; 268' RC DECK ON I-BEAMS, MAX SPAN 47'-9"

Design Control Elev. 125.0 ft. NCDOT I-6064 PROFILE PERFORMANCE REPORT, TABLE 1, DESIGN EVENT PRE-CONSTRUCTION (EXISTING ROADWAY GEOMETRY WITH VFW FLOODGATE CLOSED)

Gage Station No. 02134170 (10,000 ft downstream measured along GIS stream CL) Period of Records 07/2000 - CURRENT yrs.

Max. Discharge Hurricane Florence 17,100* c.f.s. Date 09/2018 Frequency 110

*15,600cfs GAUGE READING - WEIR FLOW OVER I-95 AND VFW BREACH FLOW BYPASSING THE GAUGE P.9, OF THE "FLOOD FREQUENCY ANALYSIS FOR USGS STATION 02134170 LUMBER RIVER AT LUMBERTON, NC"

Historical Flood Information:

Hurricane Matthew (NEAR RS 364713, US OF BRIDGE)			USGS SURVEYED HIGH WATER MARK FROM HURRICANE MATTHEW	Period of Knowledge N/A yrs.
Date 10/2016	Elev. 125.3 ft.	Est. Freq. 175 yr.	Source	
Hurricane Florence (NEAR RS 370117, US OF BRIDGE)			USGS SURVEYED HIGH WATER MARK FROM HURRICANE FLORENCE	Period of Knowledge N/A yrs.
Date 09/2018	Elev. 125.7 ft.	Est. Freq. 110 yr.	Source	
Hurricane Matthew (@ RS 363457, BRIDGE SECTION 4)			Paul Valenti, City of Lumberton water treatment operator	Period of Knowledge 45+ yrs.
Date 10/2016	Elev. 126 ft.	Est. Freq. yr.	Source	
Hurricane Florence			Historic Hurricane Florence flood elevation (122.2') was obtained from USGS guage 02134170, which is downstream at 5th Street.	Knowledge 20 yrs.
Date 09/2018	Elev. 122.2 ft.	Est. Freq. 110 yr.	Source	

Historical Scour Info. : General N/A ft. Contraction N/A ft. Local 6' (2017) ft.

Channel Slope 0.0003 ft/ft Source EFFECTIVE MODEL Normal Water Surface Elev. 109 +/- ft.

Manning's n: Left O.B. 0.032 - 0.15 Channel 0.035 - 0.065 Right O.B. 0.032 - 0.15 Source EFFECTIVE FIS

Flood Study /Status DETAILED (EFF: DEC. 6, 2019) Floodway Established? Yes

Flood Study 100yr. Discharge 14,900 c.f.s. WS Elev.: With Floodway 123.1 ft. Without Floodway 122.8 ft.

DESIGN DATA @ River Station 360721

Hydrological Method AS DESCRIBED IN NCDOT I-6064 HYDROLOGIC AND HYDRAULIC ANALYSIS INTERSTATE 95, LUMBERTON, NC

Hydraulic Design Method ELEVATIONS CALCULATED FROM TABLE 7 OF PROFILE PERFORMANCE REPORT (MAY VARY SLIGHTLY FROM REPORT DUE TO ROUNDING)

Floods Evaluated:

	Freq. (yr.)	Q (c.f.s)	Elev. (ft.)	Backwater (ft.)	Bridge Opening Velocity (f.p.s.)
@ Bridge Face in 2D Model	100 YR DESIGN EVENT POST	15200	124.8	*	2.1
	HURRICANE MATTHEW POST	16500	125.6	*	2.2
	HURRICANE FLORENCE POST	17000	125.8	*	2.2
	DESIGN EVENT +1 STD. DEV. POST	18700	126.5	*	2.4
	0.2% DESIGN EVENT POST	20700	126.7	*	2.6

*NATURAL MODEL NOT DEVELOPED FOR THIS PROJECT

Waterway Opening Provided Below Design W.S. Elev. 5954 s.f., 100yr W.S. Elev. 5954 s.f., Total 7463 s.f.,

Average Channel Velocity (Design) 2.1 f.p.s. Average Overbank Velocity (Design) 1.1 f.p.s.

Computed Scour : General N/A ft. Contraction 29.1 (100YR) 38.3 (500YR) ft. Local 11.4 (100YR) 12.1 (500YR) ft.

Is a Floodway Revision Required? YES- 0.1' decrease at RS 363457 MOA Type 1.

LUMBER RIVER BASIN
FEMA DETAILED STUDY

BRIDGE SURVEY & HYDRAULIC DESIGN REPORT

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

I.D. No. I-6064 Project No. 49067.1.1 Proj. Station -L- 356+15

County Robeson Bridge Over Lumber River Bridge Inv. No. NB 0146 / SB 0147

On Highway I-95 Between NC 72 Caton Rd and SR-1536 Carthage Rd

Recommended Structure 63" Modified Bulb Tee (2@120, 1 @ 90' AND 2 @ 85') WITH 4' CAPS

Recommended Width of Roadway 74'-0" CLEAR ROADWAY, (153'-0" OUT-OUT) Skew 60°

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

Latitude 34.63229° Longitude -79.02957°

Statewide Tier ☒ Regional Tier ☐ Sub-Regional Tier ☐

Bench Mark is BM #15 NORTHING 320120 FT EASTING 1989990 FT BL REV1 STATION 274+51.00 201, RIGHT, RR SPIKE IN BASE OF 15" PINE Elev. 117.97 ft. Datum: NAVD88

Temporary Crossing NONE

Designed by: M.KEMP, PE AECOM

Assisted by: K.SLOAN, EI

Project Engineer : C.SMITH, PE

Reviewed by: DocuSigned by: Ray D. Lovingood 045BBB7F58224FE... Kemp, Matthew

Date 2/5/2021

NORTH CAROLINA PROFESSIONAL SEAL 047680 ENGINEER MATTHEW KEMP

Stream Lumber River Struc. Inv. No. 0147 I.D. No. I-6064 Project No. 49067.1.1 PDF File 0770147_2020_I6064_LUMBER_RIVER_I-95.PDF