



ADDITIONAL INFORMATION AND COMPUTATIONS

DA=0.54 SQ. MI., QL2 LIDAR
 USGS REGRESSION, SIR 2014-5030, REGION 4
 IMPERVIOUS AREA % 34.8%
 (FROM CITY OF DUNN, FUTURE LAND USE MAPS)

24 HR., 50-YR. MAXIMUM PRECIPITATION = 7.78"

REGION 4: 0.10 SQ. MI. ≤ DA ≤ 53.4 SQ. MI.

SAY

$Q_{10} = 51.8 (DA)^{0.6004} = 267$ CFS

$Q_{25} = 67.1 (DA)^{0.6061} = 301$ CFS

$Q_{50} = 78.4 (DA)^{0.6111} = 323$ CFS

$Q_{100} = 90.5 (DA)^{0.6154} = 344$ CFS

$Q_{300} = 119 (DA)^{0.6221} = 386$ CFS

TAILWATER CALCULATED USING MANNING'S EQUATION FOR A SINGLE SECTION DOWNSTREAM.

CHANNEL SLOPE IS 0.1%. CHANNEL N-VALUE IS 0.04. OVERBANK N-VALUE IS 0.08.

COMPOSITE N-VALUE = $0.012(22/30) + 0.04(8/30) = 0.019$

N-VALUE OF 0.012 FOR 3' CONCRETE WALLS

N-VALUE OF 0.04 (NATURAL CHANNEL N-VALUE) FOR BOTTOM BED.

COMPOSITE N-VALUE = $0.04(P_{BED}/P_{TOTAL}) + 0.012(P_{SIDES}/P_{TOTAL})$

WHERE P_{TOTAL} IS THE WETTED PERIMETER.

$N_{100-YR} = 0.04(8/19.08) + 0.012(11.08/19.08) = 0.024$

$N_{50-YR} = 0.04(8/19.96) + 0.012(11.96/19.96) = 0.024$

$N_{25-YR} = 0.04(8/20.34) + 0.012(12.34/20.34) = 0.023$

$N_{10-YR} = 0.04(8/21.34) + 0.012(13.34/21.34) = 0.023$

$N_{OT} = 0.04(8/30) + 0.012(22/30) = 0.019$

SITE DATA

Drainage Area 0.545 SQ. MI. (349 AC.) Source QL2 LIDAR

River Basin CAPE FEAR Character RESIDENTIAL; AGRICULTURAL

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

Data on Existing Structure N/A (NEW LOCATION ROADWAY)

Total Waterway Opening N/A s.f. Waterway Opening Below 100yr. WS EL. N/A s.f.

Debris Potential: Low Moderate High

Data on Structures Up and Down Stream EXISTING US: 2 @ 54° ON I-95
 PROPOSED US: 2 @ 66° ON I-95

DS: 1 @ 12' x 6' RCBC ON US 421

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

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

Historical Flood Information: *ROADWAY HAS NEVER OVERTOPPED

Date - Elevation - ft. Est. Freq. - yr. Source KEITH ANDERSON, HARNETT County Maintenance Engineer Knowledge 20 yrs.

Date - Elevation - ft. Est. Freq. - yr. Source - Period of Knowledge - yrs.

Allowable HW Elev. 186.6 (HWD=1.20 IN 100-YR) ft. Normal Water Surface Elev. 180.6 ft.

Manning's n : Left O.B. 0.08 Channel 0.04 Right O.B. 0.08 Obtained From FIELD OBS

Flood Study / Status N/A Floodway Established? N/A

Flood Study 100 yr. Discharge N/A c.f.s. WS Elev.: Floodway N/A ft. Without Floodway N/A ft. @ River Station ?

DESIGN DATA

Hydrological Method USGS SIR 2014-5030; REGION 4; 34.8% IMPERVIOUS

Hydraulic Design Method HDS-5

Design Tailwater : $Q_{10} = 4.8$ ft.; $Q_{25} = 5.0$ ft.; $Q_{50} = 5.1$ ft.; $Q_{100} = 5.3$ ft.; $Q_{300} = 5.5$ ft.

Size & Type	Q (c.f.s.)	Inlet Control		Outlet Control				Remarks			
		K_e	HWD (ft.)	dc	$\frac{dc+D}{2}$	h_o	H		LS_o	H.W. (ft.)	
10-YR 1@8'x8' RCBC	270	0.2	0.72	5.04	3.29	5.14	5.14	0.65	0.25	5.54	OUTLET CONTROL
50-YR 1@8'x8' RCBC	320	0.2	0.81	5.67	3.68	5.34	5.34	0.89	0.25	5.98	OUTLET CONTROL
100-YR 1@8'x8' RCBC	340	0.2	0.85	5.95	3.84	5.42	5.42	1.00	0.25	6.17	OUTLET CONTROL
500-YR 1@8'x8' RCBC	390	0.2	0.93	6.51	4.20	5.60	5.60	1.32	0.25	6.67	OUTLET CONTROL
OT 1@8'x8' RCBC	754	0.2	1.47	10.29	6.52	6.76	6.76	4.44	0.25	10.95	OUTLET CONTROL

CALCS BASED ON 1@8'x7' TO ACCOUNT FOR BURIAL INLET INV = 177.2'; BED @ INLET = 178.2'

Is a Floodway Revision Required? NO Total Proposed Waterway Opening 56 s.f.

Outlet Velocity (V_o) 6.0 f.p.s. Natural Channel Velocity (V_n) 4.9 f.p.s.

Required Outlet Protection CLASS RIP-RAP

INFORMATION TO BE SHOWN ON PLANS

WS EL. Taken @ UPSTREAM FACE OF CULVERT

Design: Discharge 340 c.f.s. Frequency 100 yr. Elev. 184.4 ft.

Base Flood: Discharge 340 c.f.s. Frequency 100 yr. Elev. 184.4 ft.

Overtopping: Discharge 754 c.f.s. Frequency 500+ yr. Elev. 189.2' ft. *OT SP @ 18+71 -NBCD- LT (SAG)

CULVERT SURVEY & HYDRAULIC DESIGN REPORT
 N. C. DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 HYDRAULICS UNIT
 RALEIGH, N. C.

I.D. No. I-5986B Project No. 47532.1.3 Proj. Station 15+47 -NBCD-

County HARNETT Stream UT TO MINGO SWAMP Stru. No. 0000

On Highway I-95 ON-RAMP SR 1793 US 421
 (NEW LOCATION) Between (SPRING BRANCH RD.) and (NC 55)

Recommended Structure 1 @ 8' x 8' RCBC W/6" BEVELED HW
 (BURY INVERT 1' BELOW STREAM BED)

Recommended Width of Roadway 42' S.P.-S.P. (NORMAL) Skew 87.6 DEG.

Recommended Location is (Up, At, Down) Stream from Existing Crossing DOWN
 Latitude 35.29196 DEG Longitude -78.60308 DEG.

Statewide Tier Regional Tier Sub-Regional Tier

Bench Mark is BM #62: BENCH TIE SET IN 24" BEECH, STA. 16+85 -BY72-, 10 FT LT
 N 561213 E 2118159 Elev. 198.28 ft. Datum: NAVD88

Temporary Crossing NOT REQUIRED (NEW LOCATION)



Designed by: DAVID J. STANOVICH Date 12/10/2019

Assisted by: J. STANOVICH, R. HOWARD, R. LOVING

Project Engineer: JOSHUA G. DALTON, P.E.

Reviewed by: Roy Lovingsgood

Stream: MINGO SWAMP, Struct. Inv. No. 0000, I.D. No. I-5986B, Project No. 47532.1.3, PDF File: 420000 2019 I-5986B UT TO MINGO SWAMP I-95 ON-RAMP.PDF

DAVID J. STANOVICH
 PE
 26971

JOSHUA G. DALTON
 PE
 26971

SUNGATE DESIGN GROUP, P.A.
 605 JONES FRANKLIN ROAD
 RALEIGH, NORTH CAROLINA 27603
 NC COA No. C-0890