landmark
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Drainage Analysis
Roadway and Bridge - Ten Mile Flat Creek at West Main Street
Norman, Oklahoma

I. Drainage Analysis and History

This site is the location of a previous structure that was constructed in accordance with Case No. C-88-58 Recorded as Docket 102, Page 557 in the Office of the Court Clerk, Cleveland County, December 06, 1994. This document had several stipulations. The order was that 10- 72 inch corrugated metal pipes were to be constructed as a low water crossing and to allow the passing of 10,000 c.f.s., The low water crossing was to be 545 feet long across the top with a slope on each end 105 feet long, making the bottom at an elevation of 1112 feet a distance of 335 feet long. The pipe should have an elevation not greater than 1110 feet.

a. Pre Drainage

Based on the existing MacArthur HecRAS study, the Pipe Flowlines were 1108.75 (U.S.) and 1107.92 (D.S.), with a discharge of 10,794.51 c.f.s. , including the Roadway Weir. Based on Streamstats, the drainage area of Ten Mile Flat Creek at this location is 13.43 square miles or 8595.2 acres. Using HydroCAD the weir formed by the 10 - 72 inch CMP culverts and the existing road bed, based on a current survey, this low water crossing will pass 2,559.33 c.f.s. through the Pipe and an additional 8220.14 cfs across the roadbed, which is currently at elevation 1113 feet.

b. POST Drainage

The POST Drainage flows was calculated using HydroCAD with the identical configuration as the Pre Flow with the exception of the construction of the roadbed approach and the bridge. Using the POST Construction flow after the construction of the new roadbed approach and the Bridge, the Bridge would allow a flow of 3,576 c.f.s. while the existing low water crossing east of the Bridge will allow a flow of 7,203 c.f.s. The final elevation of the flow indicates that the POST Construction elevation is slightly lower than the Pre.

II. Conclusion

The Pre and POST Construction Flow crossing West Main Street remains the same, but due to the construction of the Bridge Structure, the elevation is slightly lower than the Pre Construction elevation. The inlet elevation for the Bridge Flow was assumed to be the same as the flow line of the CMP Culverts it is replacing.

There will not be a rise in the water surface elevation due to the construction of this project.

5/19/17

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HEC-RAS Plan: CLOMR

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	5086	100-YEAR	10794.51	1114.00	1123.31		1123.40	0.000434	3.59	5860.43	3930.23	0.25
1	5086	500-YEAR	12215.71	1114.00	1123.55		1123.65	0.000518	4.02	6721.25	4154.38	0.27
1	3593	100-YEAR	10794.51	1113.80	1122.17	1121.56	1122.41	0.001092	5.51	4110.88	2829.42	0.39
1	3593	500-YEAR	12215.71	1113.80	1122.32	1121.74	1122.55	0.001087	5.58	4526.29	2837.48	0.39
1	2100	100-YEAR	10794.51	1113.50	1119.25	1119.25	1119.64	0.003788	7.70	2928.19	3914.75	0.67
1	2100	500-YEAR	12215.71	1113.50	1119.33	1119.33	1119.74	0.003989	7.97	3136.02	3923.14	0.69
1	1600	100-YEAR	10794.51	1108.75	1119.03	1113.63	1119.03	0.000017	0.89	19777.57	4804.91	0.05
1	1600	500-YEAR	12215.71	1108.75	1119.02	1113.75	1119.03	0.000021	1.01	19748.84	4803.71	0.06
1	1550		Culvert									
1	1500	100-YEAR	10794.51	1107.92	1119.01		1119.01	0.000020	0.94	18818.33	4751.98	0.06
1	1500	500-YEAR	12215.71	1107.92	1119.01		1119.02	0.000025	1.06	18828.77	4752.53	0.06
1	1000	100-YEAR	10794.51	1104.40	1119.00	1113.42	1119.01	0.000015	0.75	20211.75	4987.50	0.05
1	1000	500-YEAR	12215.71	1104.40	1119.00	1113.52	1119.01	0.000019	0.85	20211.75	4987.50	0.05

Summary for Pond Pipes: Pipe Pond

Inflow Area = 8,595.200 ac, 0.00% Impervious, Inflow Depth = 7.78" for 100-Year event
Inflow = 10,781.57 cfs @ 15.25 hrs, Volume= 5,572.024 af
Outflow = 10,779.46 cfs @ 15.29 hrs, Volume= 5,572.023 af, Atten= 0%, Lag= 2.4 min
Primary = 2,559.33 cfs @ 15.29 hrs, Volume= 2,600.331 af
Secondary = 8,220.14 cfs @ 15.29 hrs, Volume= 2,971.692 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-45.00 hrs, dt= 0.02 hrs
Peak Elev= 1,116.17' @ 15.29 hrs Surf.Area= 419,335 sf Storage= 1,676,656 cf

Plug-Flow detention time= 3.6 min calculated for 5,569.548 af (100% of inflow)
Center-of-Mass det. time= 3.6 min (1,009.3 - 1,005.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,108.75'	1,815,890 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,108.75	4,150	260.0	0	0	4,150
1,110.00	20,000	1,000.0	13,859	13,859	78,352
1,112.00	200,000	2,000.0	188,830	202,689	317,103
1,113.00	265,500	2,062.0	231,978	434,667	337,247
1,114.00	415,000	2,600.0	337,479	772,146	536,854
1,116.50	420,000	2,650.0	1,043,744	1,815,890	558,749

Device	Routing	Invert	Outlet Devices
#1	Primary	1,108.75'	**72.0" Round Culvert X 10.00** L= 55.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,108.75' / 1,107.92' S= 0.0151 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 28.27 sf
#2	Secondary	1,113.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.80 3.00 3.60 Width (feet) 335.00 545.00 1,162.00 1,170.00

Primary OutFlow Max=2,559.32 cfs @ 15.29 hrs HW=1,116.17' (Free Discharge)
└**1=Culvert** (Barrel Controls 2,559.32 cfs @ 9.36 fps)

Secondary OutFlow Max=8,219.97 cfs @ 15.29 hrs HW=1,116.17' (Free Discharge)
└**2=Custom Weir/Orifice** (Weir Controls 8,219.97 cfs @ 5.14 fps)

Summary for Pond Bridge: Bridge Pond

Inflow Area = 8,595.200 ac, 0.00% Impervious, Inflow Depth = 7.78" for 100-Year event
Inflow = 10,781.57 cfs @ 15.25 hrs, Volume= 5,572.024 af
Outflow = 10,779.20 cfs @ 15.29 hrs, Volume= 5,572.022 af, Atten= 0%, Lag= 2.5 min
Primary = 3,576.13 cfs @ 15.29 hrs, Volume= 3,052.602 af
Secondary = 7,203.07 cfs @ 15.29 hrs, Volume= 2,519.419 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-45.00 hrs, dt= 0.02 hrs
Peak Elev= 1,115.98' @ 15.29 hrs Surf.Area= 418,957 sf Storage= 1,597,656 cf

Plug-Flow detention time= 3.4 min calculated for 5,572.022 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (1,009.1 - 1,005.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,108.75'	1,815,890 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
1,108.75	4,150	260.0	0	0	4,150
1,110.00	20,000	1,000.0	13,859	13,859	78,352
1,112.00	200,000	2,000.0	188,830	202,689	317,103
1,113.00	265,500	2,062.0	231,978	434,667	337,247
1,114.00	415,000	2,600.0	337,479	772,146	536,854
1,116.50	420,000	2,650.0	1,043,744	1,815,890	558,749

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,113.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.80 3.00 3.60 Width (feet) 335.00 545.00 1,162.00 1,170.00
#2	Primary	1,108.75'	**Bridge Structure, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.00 8.56 Width (feet) 0.00 70.00 70.00

Primary OutFlow Max=3,576.12 cfs @ 15.29 hrs HW=1,115.98' (Free Discharge)
└**2=Bridge Structure** (Weir Controls 3,576.12 cfs @ 8.20 fps)

Secondary OutFlow Max=7,203.02 cfs @ 15.29 hrs HW=1,115.98' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 7,203.02 cfs @ 5.22 fps)