HYDROLOGY REPORT

The watershed tributary to this culvert is believed to be 5.48 square miles in area with only 0.1% wetlands. Stormwater storage from lakes, ponds and wetlands is believed to be about 11% of the watershed area although there is no open water identified in the watershed and wetlands are few as well. Sand and gravel aquifers occupy a little over 1% of the total watershed area. Mean annual precipitation is about 48 inches. The average slope of the watershed is 4.25 percent. The following peak discharge rates for the various statistical storms were prepared by Charles Hebson, PE of the Department's Environmental Office.

SUMMARY

Drainage Area	5.48	mi^2
Q1.1	95	ft^3/s
Q10	350	ft^3/s
Q50	515	ft^3/s
Q100	590	ft^3/s
Q500	780	ft^3/s

Reported by: Gray, Mark
Date: April 15, 2022

Note: All elevations based on North American Vertical Datum (NAVD) of 1988.

Within the limits of the topographic survey, the stream channel is relatively flat. The outlet end of the culvert features a high spot in the stream about 20' beyond the culvert outlet invert. This high spot was modelled as a weir to provide a tailwater curve for the hydraulic analysis. HY8 was used to model the hydraulic performance of both the existing culvert and the proposed replacement culvert. HY8 was chosen for two reasons; survey information was insufficient to support a more rigorous HEC-RAS analysis; and the much larger culvert opening provided by the proposed box culvert made it clear that hydraulic capacity of the bridge would not be the controlling factor.

The existing culvert has been identified as a galvanized steel structural plate pipe arch with a span of 154 inches (12'-10") and a rise of 100 inches (8'-4"). The inlet and outlet ends of the culvert are tapered to conform to the roadway side slope. The length of the existing culvert at the invert is 65 feet and at the top, 42 feet. The culvert drops about 0.15 feet over its 65 foot length for a slope of 0.23 percent.

The proposed culvert is a 26' span by 9' rise precast concrete box culvert with 2' of special fill in the invert of the box. The inlet and outlet ends are proposed to be tapered to conform to the roadway embankment (2 horizontal to 1 vertical). The length of the proposed culvert along the invert is proposed to be about 80 feet. The length at the top is proposed to be 56 feet. The concrete invert elevations of the inlet and outlet ends of the culvert are intended to both be 101.25 feet.

As can be seen from the following chart, headwater elevations are reduced by about 15" for the Q50 storm and outlet velocities are reduced by about 3.8 feet per second for the same storm. Pressure flow is predicted to occur for the Q50 and larger storms but almost 3 feet of freeboard is present for the Q500 storm against roadway overtopping at the low point sag. Although the preferred 2' of superstructure clearance to the Q50 headwater elevation is not achieved, the proposed culvert configuration is believed to be adequate to serve at this location.

HY8 Hydraulic Analysis Results										
Marion TWP Clifford Bridge 5223										
	Q1.1 95 cfs		Q10 350 cfs		Q50 515 cfs		Q100 590 cfs		Q500 780 cfs	
	Headwater Elev ft	Outlet Velocity	Headwater Elev ft	Outlet Velocity	Headwater Elev ft	Outlet Velocity	Headwater Elev ft	Outlet Velocity	Headwater Elev ft	Outlet Velocity
Existing Pipe Arch 154x100	106.67	2.51	109.75	5.35	111.51	6.68	112.33	7.28	113.62	9.63
Proposed 26' x 9' box with 2' special fill	106.48	1.15	108.98	2.43	110.28	2.93	110.87	3.24	111.11	4.29
Difference	(0.19)	(1.36)	(0.77)	(2.92)	(1.23)	(3.75)	(1.46)	(4.04)	(2.51)	(5.34)