## **HYDROLOGY REPORT**

There are no historical stream gage records or other hydrologic data for College Swamp Brook. Flood discharges were estimated from USGS Scientific Investigations Report (SIR) 2020-5092 and SIR 2015-5049 regression equations for small, ungaged streams in Maine, based on watershed area and characteristics calculated using USGS StreamStats. Peak flow estimates from this hydrologic analysis were applied for hydraulic modeling. The following table presents a summary of peak flows at the crossing.

SUMMARY					
Drainage Area	3.82	mi <sup>2</sup>			
Q1.1	88	ft³/s			
Q10	307	ft³/s			
Q25	399	ft³/s			
Q50	472	ft³/s			
Q100	549	ft³/s			
Q500	748	ft³/s			

Reported by: Cloutier, David Date: June 28, 2023

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

## **HYDRAULIC REPORT**

Hydraulic modeling was conducted using the Federal Highway Administration (FHWA) HY-8 software, version 7.8, to evaluate hydraulic performance of existing conditions and of the proposed design. Hydraulic analysis included evaluation of the 1.1-year ( $Q_{1.1}$ ), design discharge 50-year ( $Q_{50}$ ), and check discharge 100-year ( $Q_{100}$ ) flood events.

College Brook is a tributary to Smith Brook, with Bridge #3475 located approximately 2 miles upstream of the confluence and approximately 0.5 miles upstream of the closest crossing at Oak Hill Road; bridge hydraulics assume free discharge tailwater conditions. The crossing is located within Special Flood Hazard Area (SFHA) Zone A as depicted on the effective Flood Insurance Rate Map (FIRM) 23017C1416FD for the Town of Otisfield, Maine (Effective Date July 7, 2009); there is no existing detailed flood study for College Swamp Brook, and no effective base flood elevation or regulatory floodway defined for College Swamp Brook.

Bolsters Mills Road is skewed approximately 25° to the stream channel through the crossing, and due to this skew the effective hydraulic width is 9.4% less than the structural span for both existing and proposed bridges.

In terms of model calibration, the 1936 plans note a "high water" elevation of 405.1 ft (NAVD88) which is roughly consistent with the calculated 500-year ( $Q_{500}$ ) event headwater elevation of 405.2 ft. The plans do not specify the date of the high-water event, however based on historic records it is likely from the March 1936 flood, which was greater than the  $Q_{100}$  magnitude for this geographic location. The 1936 plans mention "log stringers" superstructure with "large round field stones roughly laid dry" substructure and graphically depict a slightly shorter span than the current span. Based on this information, the proposed  $Q_{100}$  elevation is expected to be slightly lower than the 1936 "high water" elevation due to the larger opening, reduced roughness, and reduced flow. Additionally, a model sensitivity analysis was conducted by reducing the tailwater slope in half resulting in no impact to the headwater elevations or inlet depths. This analysis indicates that the results from the model are not affected by the tailwater conditions.

		Existing Structure	Recommended Structure	
		20' Span Bridge	22' Span x 3' Rise Frame	
Total Area of Waterway Opening	ft <sup>2</sup>	148	129	
Headwater Elevation @ Q <sub>1.1</sub>	ft	401.7	401.5	
Headwater Elevation @ Q <sub>10</sub>	ft	402.9	402.7	
Headwater Elevation @ Q <sub>25</sub>	ft	403.4	403.2	
Headwater Elevation @ Q <sub>50</sub>	ft	403.8	403.6	
Headwater Elevation @ Q <sub>100</sub>	ft	404.2	404.0	
Headwater Elevation @ Q <sub>500</sub>	ft	405.2	404.9	
Freeboard @ Q <sub>50</sub>	ft	3.4	2.2	
Freeboard @ Q <sub>100</sub>	ft	3.0	1.8	
Flood of Record unknown				
Outlet Velocity (Q <sub>1.1</sub> )	ft/s	5.4	5.2	
Outlet Velocity (Q <sub>10</sub> )	ft/s	8.6	8.3	
Outlet Velocity (Q <sub>25</sub> )	ft/s	9.5	9.2	
Outlet Velocity (Q <sub>50</sub> )	ft/s	10.2	9.8	
Outlet Velocity (Q <sub>100</sub> )	ft/s	10.7	10.4	
Outlet Velocity (Q <sub>500</sub> )	ft/s	12.0	11.6	

## SUMMARY

Reported by: Cloutier, David Date: June 28, 2023

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