

## HYDROLOGY & HYDRAULICS REPORT

Perkins Bridge (#6133) carries Lake Road over Black Stream in the town of Levant. The Black Stream watershed extends south and northwest from the bridge location. Black Stream originates near the Levant and Stetson town line and flows northeast towards Route 222 and Horseback Road. From there it flows southerly towards Hermon. Just below Route 2/100, there is a confluence with Black Stream and Souadabscook Stream as Black Stream heads northerly back towards Levant. Approximately 4.5 miles from the confluence, Black Stream flows through Perkins Bridge and continues northerly for another 5.25 miles before converging with the Kenduskeag Stream. Black Stream in the area of the bridge is very flat with wide floodplains. The floodplains to the east of Black Stream are wooded and marshy, whereas the floodplains on the west are maintained fields.

Due to the rural location of the project, there is minimal information about flooding and water levels. There is no FEMA Flood Insurance Study (FIS) for the town of Levant specifically. There is a FEMA Flood Insurance Study (FIS) that was done for Penobscot County which included all the towns and large waterbodies. Unfortunately, Black Stream was not included in that study. There are however Flood Insurance Rate Maps (FIRM) for Levant that show Black Stream at the bridge location. Looking at the FIRM compared to USGS topographic maps, the base flood elevation of Q100 could be in the range of elevation 120 feet to 130 feet. With no known flooding information, it is hard to determine how accurate the FIRM is. Based on information from a conversation with a local resident on site, there is no knowledge of the roadway overtopping at this location. There is also a bridge located just downstream from Perkins Bridge. Outreach was done to the Region to gather information about flooding at this downstream bridge. According to the Region, there is no known flooding issues and that the wide flood plain takes most of the water when levels rise.

The drainage basin characteristics for Black Stream at this location were provided by the Maine Department of Transportation Environmental Office, Hydrology Section. Peak flows were calculated according to USGS Regression Equations (Hodgkins, 1999 and Lombard/Hodgkins, 2015 & 2020). Below are calculated discharges:

SUMMARY			
Drainage Area	37	mi <sup>2</sup>	
Q1.1	500	ft <sup>3</sup> /s	
Q10	1,580	ft <sup>3</sup> /s	
Q25	1,945	ft <sup>3</sup> /s	
Q50	2,230	ft <sup>3</sup> /s	
Q100	2,515	ft <sup>3</sup> /s	
Q500	3,175	ft <sup>3</sup> /s	
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Due to the very flat terrain and shallow slope of the stream, it is very difficult to determine which way the stream flows at typical water levels. Looking at USGS topography maps, there are no contours that cross the stream for hundreds of feet both upstream and downstream. This would make standard 1-D hydraulic modeling and analysis very difficult and would not give accurate results. A 2-D hydraulic model would be appropriate and result in more accuracy, but these types of models usually require extensive survey and engineering time. With the accelerated nature of this project and the lack of recorded flooding, it was determined to take a more qualitative approach to determining if the proposed bridge would be hydraulically adequate.

To determine flooding on Black Stream and determine how a new structure may impact that, comparisons were made to a bridge just downstream from Perkins Bridge. Based on existing plans and topographic maps, the edge of water at the downstream bridge location was estimated to be at an elevation of 120 feet. An on-site inspection determined the high-water mark on the abutments was 2'-3' below the bridge seats. This would put the high-water for the bridge around elevation 122.5 feet to 123.5 feet. At the proposed Perkins Bridge, these elevations would result in a freeboard of at least 2 feet and would put high-water around the same elevation as the upper riprap shelves. Perkins Bridge would also have a longer span and increased flow area compared to the downstream bridge. Some past inspection reports indicate some minor debris collection, mostly due to some beaver dams on the upstream ends of the pipes. Otherwise, there has been some minor vegetation growth in between the pipes and little issue with debris. It does not appear that added freeboard for debris is needed at this location. Based on this information and the fact that the existing structure has conveyed the stream adequately with a significantly smaller hydraulic opening, it was decided that the proposed Perkins Bridge has adequate hydraulic capacity.