

HYDRAULIC REPORT

Revision # 1

Existing Bridge

Starvation Brook Bridge (#1086) is located in T28 MD on Rte 9 over Starvation Brook. The culvert was built in 1976. The existing bridge is twin 12'-10" x 8'-4" Steel Pipe Arch x 102' long. The culverts have virtually no slope. The culverts are in poor condition and the inverts are heavily rusted. The use of two culverts at the site do not appear to be for the purpose of hydraulic capacity, but rather the presence of two separate channels at the crossing require two culverts to maintain stream geometry. The "overflow" pipe east of the crossing drains a low laying area that otherwise would hold standing water resulting from the occasional stream bank overflow originating at a location several hundred feet upstream and does not appear to be for enhanced hydraulic capacity.

Hydraulic Analysis

A detailed analysis of the crossing using HY8 was not conducted. Due to the complexities of both the drainage basin and the crossing itself, (as described in the Hydrology Report) an HY8 analysis would rely heavily on assumption, therefore not providing enough solid data from which to draw any specific conclusions.

However, on August 25, 2011, field observations were conducted at a period of low flow. Velocities were approximated to be 0.5 fps, well under the maximum velocity allowed to permit fish passage. Essentially, any alternative would have to quadruple currently velocities to adversely affect fish passage. Water depth was measured to be 1' which would still permit fish passage into the culverts after a 5" rise in invert elevation. However, due to the slope of the existing culverts, MaineDOT Biologist John Perry believes that internal weirs will be required. By all observations, the culverts were sufficiently sized to handle peak flows. Additionally, there appears to be sufficient freeboard with 7+ feet from the top of culverts to finished grade. Please refer to Appendix E for field visit notes.

Proposed Bridge

Starvation Brook Bridge (#1086) in T28 MD is scoped for bridge culvert rehabilitation in the 2012-2013 Work Plan. All alternatives will have 10' wide plain riprap aprons at both ends of the culverts.

Alternative 1: Concrete invert lining: As the culverts in their existing state appear to be sufficiently sized, the minor reduction in hydraulic opening should

not be problematic. Even with a 5" rise in invert elevation, there will be sufficient depth of water at the outlets to allow for the fish passage. However, internal weirs will be required to ensure fish passage is maintained entirely through each pipe. Velocities would be marginally increased but should remain less than 2.0 fps at low flows.

Alternative 2: Sliplining: The reduction in hydraulic opening could be problematic however the invert would only be raised 6", leaving sufficient water depths to ensure fish passage into the pipes. However, internal weirs will be required to ensure fish passage is maintained entirely through each pipe. Velocities would be slightly increased but remain less than 2.0 fps as well. The pipe arch selected for this option is the largest that would fit within the existing structure and still allow for ample annular space for grouting. If deformation and deflection of the existing culvert require the use of a slipline smaller than what is proposed, adverse hydraulics and fish passage is likely.

Summary

In summary, both alternatives will be adequate to handle peak flows and will allow adequate fish passage. However, should the continued deterioration of the culvert result in further deformation and deflection, a smaller pipe may be required to ensure constructability. If this happens, Alternative 2 should be eliminated as a viable alternative. Therefore it is the recommendation of this report to propose invert lining as the preferred alternative. Please refer to the Summary of Preliminary Design for further information.

Reported by: Brian J. Nichols

Date: October 27, 2011

Revised: December 28, 2011