HYDROLOGY REPORT

The Drainage Basin Characteristics for Curtis Bridge in Gorham on Route 22 over South Branch, Stroudwater River was provided by the Maine Department of Transportation Office of the Environment-Hydrology Section. The flows were computed using the 1999 USGS full regression equation. The FEMA study does not provide data for this waterway and Flood Insurance Map only graphically show the Q_{100} areas but do not provide any elevations. No other flow data is available such as gauge data. Therefore the hydrology data was used as provided and as follows:

Summary

Drainage Area = 7.56 square miles
Fish passage flow (low) = 1.47 cfs
Fish passage flow (high) = 30.67 cfs
Ordinary High Water ($Q_{1.1}$) = 97.0 cfs
10 Year Flood (Q_{10}) = 384.6 cfs
Q_{25} = 492.9 cfs
Design Discharge (Q_{50}) = 577.7 cfs
Check Discharge (Q_{100}) = 669.3 cfs

Reported By: Brian Nichols
Date: January 13, 2012

HYDRAULIC REPORT

Existing Bridge

Curtis Bridge (#5768) is located in Gorham on Route 22 over South Branch, Stroudwater River. The culvert was built in 1959. The existing bridge is a single steel plate pipe 13' nominal diameter (5% vertical ellipse) x 84' long. The culvert has a 2.4% slope. The culvert is in poor condition and the inverts are heavily rusted. The Stroudwater River eventually flows into the Fore River. The drainage basin is 7.6 sq. miles. A hydraulic analysis of the existing structure was completed and it showed that the culvert is adequately sized to handle peak flows although outlet velocities are too high to accommodate fish passage in all but the lower median monthly flows.

Proposed Bridge

Curtis Bridge (#5768) in Gorham is scoped for bridge culvert rehabilitation in the 2012-2013 Workplan. All alternatives will have 10' wide plain riprap aprons at both ends of the culvert and riprap slope armoring. In addition, MaineDOT's Environment Office has requested fish passage measures at the site. A boulder weir and "rock ramp" will be installed at the outlet of the basin immediately downstream of the pipe. This will back water approximately. two-thirds of the way through the culvert. Four internal fish weirs will be required to ensure fish passage through the culverts entirety. These weirs will also serve to address the need of velocity reduction.

Alternative 1: Concrete invert lining: Hydraulic analysis showed that headwater elevations would be increased by approx. 0.66' @ Q_{50} and 0.69' @ $Q_{100.}$ Analysis shows the pipe will be 60% full at $Q_{100.}$ Outlet velocities at peak flows will be slightly higher than existing. Additional analysis shows that at the maximum median monthly flows, velocities are above that which will allow for fish passage, but the internal weirs should provide the necessary velocity control.

Alternative 2: Sliplining with a 12'-0" nom. dia. (5% vert. ellipse) aluminum plate pipe with annular grouting. Hydraulic analysis showed that headwater elevations would be increased by approx. 0.83' @ Q_{50} and 0.89' @ $Q_{100.}$ Analysis shows the pipe will be 75% full at $Q_{100.}$ Outlet velocities at peak flows will be virtually unchanged from existing. Additional analysis shows that at the maximum median monthly flows, velocities are above that which will allow for fish passage, but the internal weirs should provide the necessary velocity control.

Conclusion

Upon completion of the hydraulic analysis, both alternatives will be adequate to handle peak flows and will allow adequate fish passage. Therefore final selection of structure type will be made based on other factors such as life cycle, construction methods and maintenance of traffic. Please refer to the Summary of Preliminary Design for further information.

SUMMARY

	Existing	Invert Lining	Slip-Lining
Total Area of Waterway Opening	132.4 ft^2	124.2 ft^2	112.8 ft^2
Headwater El. @ low fish passage flow	80.2 ft	**81.25 ft**	**81.25 ft**
Headwater El. @ high fish passage flow	81.49 ft	**81.25 ft**	**81.25 ft**
Headwater El. @ $Q_{1.1}$	83.03 ft	83.57ft	83.61 ft
Headwater El. @ Q_{25}	87.25 ft	87.38 ft	87.51 ft
Headwater El. @ Q_{50}	87.92 ft	88.58 ft	88.75 ft
Headwater El. @ Q_{100}	88.65 ft	89.34 ft	89.54 ft
HW/D @ Q_{50}	0.58	0.65	0.67
Outlet Velocity @ low fish passage flow	3.36 ft/s	3.26 ft/s	3.16 ft/s
Outlet Velocity @ high fish passage flow	5.54 ft/s	8.33 ft/s	5.79 ft/s
Outlet Velocity @ $Q_{1.1}$	9.32 ft/s	12.91 ft/s	9.57 ft/s
Outlet Velocity @ Q_{25}	14.57 ft/s	17.05 ft/s	14.26 ft/s
Outlet Velocity @ Q_{50}	15.11 ft/s	17.89 ft/s	15.26 ft/s
Outlet Velocity @ Q_{100}	15.68 ft/s	18.42 ft/s	15.82 ft/s
Outlet Depth @ low fish passage flow	0.04 ft	**2.0 ft**	**2.0 ft**
Outlet Depth @ high fish passage flow	1.35 ft	**2.0 ft**	**2.0 ft**

Note: Hatching indicates values controlled by proposed external boulder fish weir to be located downstream of the culvert.

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