The primary source of information for this report is the Hydrology Report from the Erdman Anthony 1996 Preliminary Design Report. The hydrology of this reach has also been reevaluated and yielded discharges similar to the discharges presented in the 1996 PDR. A summary table can be found at the end of this report.

Littlefields Bridge is located in the city of Auburn, southwest of the city center. The structure spans the Little Androscoggin River which flows east through Auburn and has a drainage area of approximately 328 square miles. The river originates from Bryant Pond in Woodstock, Maine and flows southeast to its confluence with the Androscoggin River in Auburn, Maine.

The Little Androscoggin River has experienced three major flood events in the last 75 years in the proximity of the bridge. These floods occurred in 1936, 1953, and 1987 and the 1996 PDR reports that “these flood events (according to various sources) all appeared to have passed beneath the existing truss bridge, and caused little or no damage to the project area.” The flood of record occurred in March of 1936 with an estimated discharge of 16,800 ft^3 / s. A discharge of 16,500 ft^3 / s was recorded during the flood in March of 1953.

The 1996 PDR and the Department’s current hydrologic evaluation utilized discharges from the USGS based on a weighted average of stream gage information and hydrologic analysis. The USGS gage station used was located 100 feet upstream of the bridge and was maintained from 1936 to 1983. Independent hydrologic analyses were also conducted but the weighted USGS gage discharges are recommended in the 1996 PDR and by the Department’s hydrology team due to the extended period in which the gage station was in operation.

Summary

	1996 PDR	**2011 Data**
	USGS gage weighted avg	**USGS gage weighted avg**
Drainage Area	326 mi^2	328 mi^2
$Q_{1.1}$	4,130 ft^3 / s	
Q_{10}	7,390 ft^3 / s	6,885 ft^3 / s
Q_{50}	11,900 ft^3 / s	10,134 ft^3 / s
Q_{100}	14,300 ft^3 / s	11,652 ft^3 / s
Q_{500}	21,100 ft^3 / s	15,571 ft^3 / s

Reported By: Garrett Gustafson
Date: October 17, 2011

The primary source of information for this report is the Hydraulic Report from the Erdman Anthony 1996 Preliminary Design Report. The 1996 Hydraulic Report used the USGS/FHWA program WSPRO to model the existing and proposed bridges. A 1995 study by the Hydrologic Engineering Center (which compared observed water surface elevations during seventeen flood events to WSPRO and HEC-RAS computed water surface elevations) found that “no one model performed significantly better than another.” The report also noted that “the HEC-RAS and HEC-2 energy based bridge solution methodologies are very similar to the WSPRO bridge procedure.” Additionally, the 1996 PDR models were based on USGS and MaineDOT Survey cross-sections which are sufficiently similar to the cross-sections obtained in 2011. Lastly, the hydrology and alternatives considered in the 1996 PDR are sufficiently similar to the current hydrology and recommended structure to forego a repeat analysis.

Due to the proximity of the downstream concrete arch trolley bridge from Hotel Road (20 feet), the existing and proposed alternatives were modeled as a single structure with the trolley bridge. According to the HEC-RAS Manual Version 4, “if the parallel bridges are very close to each other, and the flow will not be able to expand between the bridges, the bridges can be modeled as a single bridge.” The existing bridge and trolley bridge abutments are adjoined and the proposed structure will keep the existing abutments intact up to the Q50 elevation. Therefore, the decision to model the parallel bridges as one bridge remains valid.

The low beam elevation of the trolley bridge is about 2.25 feet below the existing truss due to the wide flange I-beam on the upstream fascia of the trolley bridge which supports a 22 inch gravity sewer line. The trolley bridge has a flow area of approximately 72 percent of the existing truss due to this I-beam and therefore controls the hydraulics of the river.

The recommended structure is a 144 foot single span on integral abutments located behind the existing abutments. To regain some of the freeboard lost due to the switch from a through truss to a girder bridge, the profile of Hotel Road will be raised 2 feet at the north abutment and 3 feet at the south abutment. The existing abutments will be capped above the Q50 elevation to accommodate the new superstructure. The low beam elevation of the new structure will be 0.95 feet lower than the existing truss but 1.30 feet above the top of the arch opening.

The proposed structure provides 3.70 feet of freeboard over the Q50 elevation. This falls short of the requirement of major riverine bridges of 4 feet but does meet the 2 foot requirement of other riverine bridges. The Little Androscoggin River is generally not considered a major river so the proposed freeboard is adequate. This conclusion is further supported by the fact that this location has experienced flood events greater than Q_{100} without any serious issues. Additionally, the downstream trolley bridge controls the river hydraulics so the impact of the new structure on the hydraulics will be minimal. The proposed structure is hydraulically sufficient.

Summary

	Existing Structure	Recommended Structure
	108' Single Span Steel Through Truss	**144' Steel Welded Plate Girder**
$Q_{1.1}$ Headwater Elevation	215.16 ft	215.16 ft
Q_{50} Headwater Elevation	220.75 ft	220.75 ft
Q_{100} Headwater Elevation	222.10 ft	222.10 ft
$Q_{1.1}$ Discharge Velocity	4.7 ft / s	4.7 ft / s
Q_{50} Discharge Velocity	8.3 ft / s	8.3 ft / s
Q_{100} Discharge Velocity	11.3 ft / s	11.3 ft / s
Bottom Beam Elevation	225.40 ft	224.45 ft
Q_{50} Clearance	4.65 ft	3.70 ft
Q_{100} Clearance	3.30 ft	2.35 ft

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Note: All elevations based on North American Vertical Datum (NAVD) of 1988. Elevations based on National Geodetic Vertical Datum (NGVD) of 1929 were converted to NAVD88 by the appropriate shift (-0.607 ft) using the NGS Vertcon Program.