FACT SHEET

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http://vtrans.vermont.gov/planning/research

Bridge-Stream Network Assessments to Identify Sensitive Structural and Hydraulic Parameters for Flood Risk Assessment

Problem Statement

The 2011 Tropical Storm Irene resulted in monetary damages to infrastructure and property in Vermont and neighboring states, including damages to and failure of hundreds of bridges. The northeastern United States is experiencing a trend of more frequent and persistent extreme precipitation events. As a result, infrastructure must now be able to withstand more extreme flood events of greater magnitude. The interactions among rivers, hydraulic

Source: VTrans

structures and the surrounding hydrogeological features are not well-established or understood at the river network scale. Studies are often limited to steady-state analyses in the immediate vicinity of a specific structure or feature, and the far-reaching impacts up- and downstream are often not considered. In this work, we attempt to quantify the interactions between a river and its surrounding infrastructure under high-risk, transient conditions across three study sites in an attempt to identify structural and hydraulic parameters for a risk assessment at the bridge-stream network level.
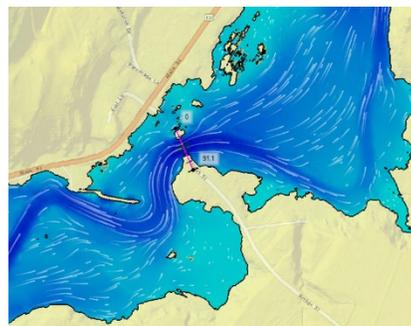
Methodology

Three two-dimensional HEC-RAS hydrologic models were developed of the Otter Creek, Black Creek and Mad River to capture low, medium and high gradient river corridors with multiple bridges and culverts. The models are calibrated to Tropical Storm Irene flows and surveyed high-water marks.

Next Steps

Infrastructure will be evaluated under varying storm events to assess risk. Features such as bridge width and road elevation will be perturbed in HEC-RAS to determine potential attenuating and or intensifying effects on the network scale. These effects will be compared and contrasted across the three study sites to develop a risk assessment of the surrounding infrastructure. Assessments will then be simplified in an attempt to be applicable to various rivers in similar geographic settings.

Potential Impacts and VTrans Benefits

By identifying critical structural and hydrogeological features in a bridge-stream network, a network-level infrastructure resiliency analysis is possible. This may help prioritize limited resources available for bridge and river rehabilitations, holistic design of bridges, and address stakeholder concerns raised in response to planned bridge and infrastructure alterations.