

# Ammonoosuc River Geomorphic Assessment and Floodplain Conversation

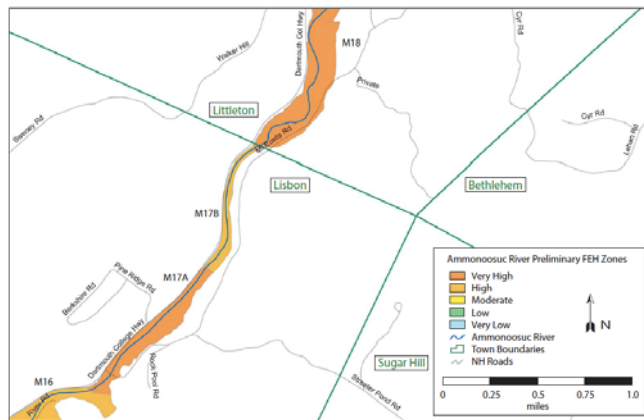
Tools for Reducing Flood and Erosion Hazards and Improving Aquatic Habitat

## PROJECT SUMMARY

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### Rivers are Dynamic

The Ammonoosuc River continually adjusts in response to a variety of natural conditions and human land uses in the watershed. Rivers are not static landscape features, but their channels change dimensions and position over time, especially where flowing across a level floodplain – often the most ideal location for agricultural fields, roads, and settlements in mountainous New Hampshire. Human encroachments on the floodplain and traditional river management practices, such as channel straightening and bank armoring, increases the river’s energy during floods, leading to unstable channels with the potential for rapid rates of channel migration and dramatic changes in channel width. These dynamic human-intensified adjustments increase sediment loading, generate dangerous, sometimes life-threatening, flooding and erosion hazards, and degrade aquatic habitat. To mitigate these impacts, watershed managers are increasingly identifying techniques that restore and maintain natural river stability while protecting human infrastructure.



Example of a fluvial erosion hazard map.

### Planning for Stable River Channels

The Ammonoosuc River Geomorphic Assessment compiled information to help watershed managers understand how the river responds to natural and human conditions in the watershed. The assessment was completed using *fluvial geomorphology*, a science devoted to understanding those factors in the watershed affecting the stability of the river channel. A fluvial geomorphologist seeks to predict what physical changes will occur to a river channel in response to alterations in watershed conditions and, in turn, how these changes will impact human infrastructure and aquatic habitat. River channel adjustments in response to changes in watershed conditions may take thousands of years, as is the case throughout much of New England due to deglaciation. In other instances, channel changes may occur in less than a decade, as is frequently the case with direct human activity in a river. Understanding how these stressors, operating

at different time scales, alter the width, depth, and planform of a channel is critical for identifying where rapid channel adjustments in a river system are most likely to occur. River managers are rapidly recognizing the role fluvial geomorphology can play in assessing channel conditions, identifying long-term solutions for channel instability, and evaluating the effectiveness of river restoration efforts. A geomorphological approach to river management provides a method for reducing flood and erosion damages while improving aquatic habitat.

The *Ammonoosuc River Geomorphic Assessment and Floodplain Conservation* project was completed to: 1) identify unstable channel reaches with degraded habitat and hazardous conditions; 2) create fluvial erosion hazard maps to assist towns in reducing risk to developments on the floodplain; and 3) develop a corridor planning guide that identifies river restoration and floodplain conservation projects designed to reduce sediment loading, eliminate flood and erosion hazards, and improve aquatic and riparian habitat.

### Project Team

The Ammonoosuc River watershed is experiencing development pressures on floodplains adjacent to the river. Concerns about the impact of these developments on the unique natural and cultural resources of the river are a major reason why the New

Hampshire Department of Environmental Services has included the river in the New Hampshire River Management and Protection Program. In addition, towns along the river are concerned about flooding, erosion, and associated loss of infrastructure during high flow events. In response to local concerns, the Connecticut River Joint Commissions, North Country Council, Ammonoosuc River Local Advisory Committee, the New Hampshire Department of Environmental Services, and other project partners initiated a comprehensive geomorphology-based assessment and planning effort to gather scientific information about channel stability, erosion hazards, and habitat conditions. The project partners hired Field Geology Services, LLC to conduct the assessment and develop a Corridor Planning Guide to prioritize river restoration and floodplain conservation projects.

### The Geomorphic Assessment Process

The project team assessed the sixty miles of the Ammonoosuc River to characterize the current physical condition of the river and identify stressors, or causes, for river instability on the river. For example, artificial channel straightening in the 19<sup>th</sup> century created hard bends in the river where high rates of energy expenditure destabilize high banks of glacial outwash deposits (see photo), lead to excess sediment loading downstream, high rates of channel migration, and bank erosion that threatens roads, businesses, and other infrastructure. The assessment analyzed maps, aerial photographs, and field data to determine the topographic, soil, and land use conditions having the greatest impact on channel stability. Assessment data collection included information on:

- Stream crossings: size/aquatic organism passage;
- Channel width, depth, slope and type;
- Substrate composition and instream habitat;
- Floodplain, river bank, and riparian features.



Mass failure downstream of a straightened reach.



### Using the Geomorphic Assessment Results

The assessment data were used to: 1) create fluvial erosion hazard maps for each town along the river, 2) develop a corridor planning guide with a list of prioritized sites for restoration and a discussion of techniques for addressing channel instability and aquatic habitat degradation, 3) complete designs for a restoration project near Salmon Hole in Lisbon, and 4) engage watershed managers, communities, and the general public in discussions that will lead to implementation of projects throughout the watershed. The fluvial erosion hazard maps delineate areas where channel migration is possible in the future and can help communities minimize development in hazardous locations. The types of restoration projects described in the Corridor Planning Guide include river corridor protection, riparian buffer restoration, removing floodplain constraints, and river bank stabilization using engineered log jams. Restoration sites were prioritized using a combination of factors including hazard mitigation potential, ecological benefits, costs, and local interest and priorities. More than 20 high priority projects were identified along the river that could reduce risk to infrastructure while improving aquatic habitat.

### Next Steps

The North Country Council, Ammonoosuc River Local Advisory Committee, and the New Hampshire Department of Environmental Services will use the Corridor Planning Guide to prioritize future efforts to restore and protect the river. The assessment results will also be used to educate watershed communities and residents about the importance and benefits of eliminating constraints to natural channel processes.

### For More Information

For copies of the completed project reports and maps, please contact the Connecticut River Joint Commissions at: 10 Water Street, Suite 225 • Lebanon, NH 03766 • (603) 727-9484

### For questions and more information, please contact:

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