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High Frequency Turbidity Monitoring to Quantify Sediment Loading in the Mad River

ABSTRACT

Excessive sediment loading of river systems is an indicator of a number of stressors to surface waters including channel erosion, encroachment, and land erosion. In river systems subject to stressors that cause disequilibrium, excessive sedimentation and deposition can negatively affect aquatic habitat. In addition, nutrients and organic matter associated with eroded sediments are a major source of impairment to surface waters including Lake Champlain. Accurately measuring sediment load is important for monitoring the effects of climate change and river management strategies. Typical sediment monitoring comprises periodic sampling during storm events and is often limited to gauged streams. Continuous turbidity monitoring enhances our understanding of river dynamics by offering high-resolution, temporal measurements to better quantify the total sediment loading occurring during and between storm events.

In this study the first distributed network of continuous turbidity sensors was deployed in Vermont in the Mad River Watershed. Periodic water quality sampling during storm events enabled turbidity versus total suspended solids relationships to be established. The Mad River and five tributaries were selected as a test bed because seven years of periodic turbidity sampling data are available and it represents a range of watershed characteristics. Total sediment loading was computed using the turbidity and discharge data for the Mad River and the five tributaries. During the 6-month period from April to October 2013, over 20,000 tonnes of suspended sediment was discharged pass the USGS gauging site. Utilizing the additional meteorological data, sediment loading on a per storm basis was also calculated. A probabilistic estimate of the sediment load associated with a given rainfall event is then calculated and used with future climate scenarios for stochastic simulation of sediment loading. With reliable estimates of suspended sediment discharged from the tributaries and the main stem a more robust foundation for building a sediment budget can be obtained.