# Leveraging High-Resolution LiDAR and Stream Geomorphic Assessment Datasets to Expand Regional Hydraulic Geometry Curves for Vermont

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## Background & Project Need

In the decade since Regional Hydraulic Geometry Curves (RHGCs) were first developed for Vermont streams (Jaquith and Kline, 2006), new remote-sensing data have become available (including Light Detection and Ranging [lidar] data), and field-based stream geomorphic assessment (SGA) data have been collected for more than 1,500 miles of river. Our objective is to improve the RHGC's prediction of stream width, depth, and cross-sectional area using SGA data to expand the number of observations, and by exploring additional predictor variables to refine regression estimates and reduce uncertainty.

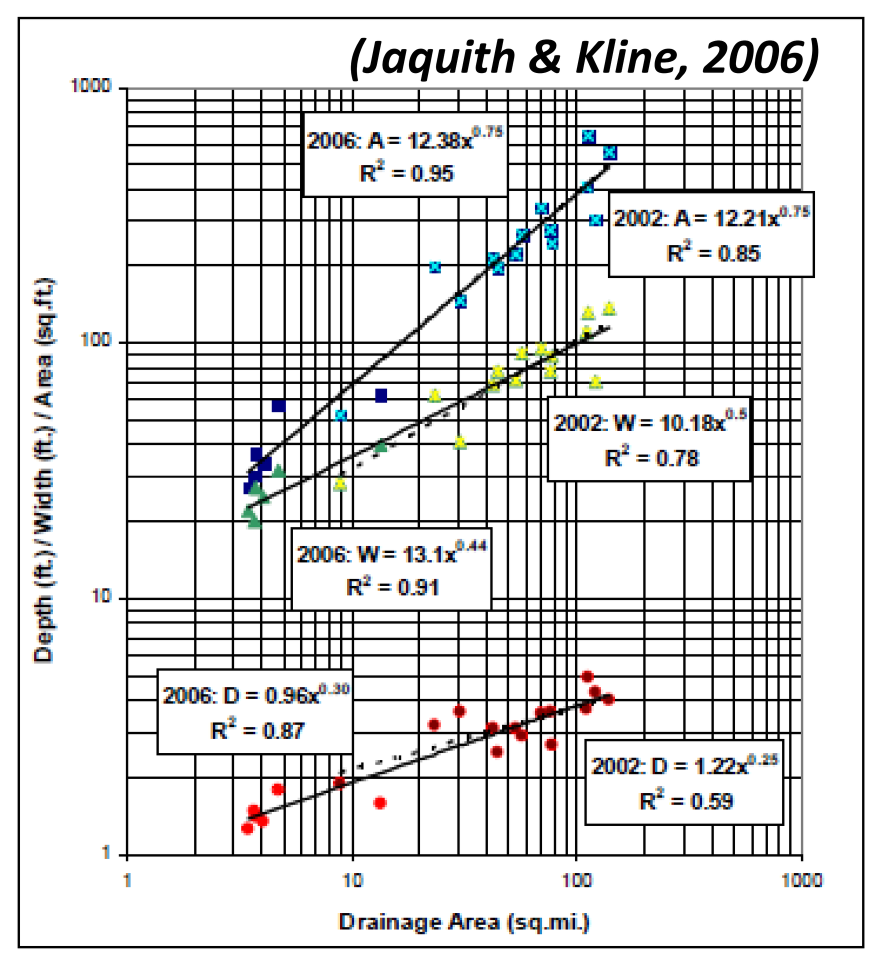
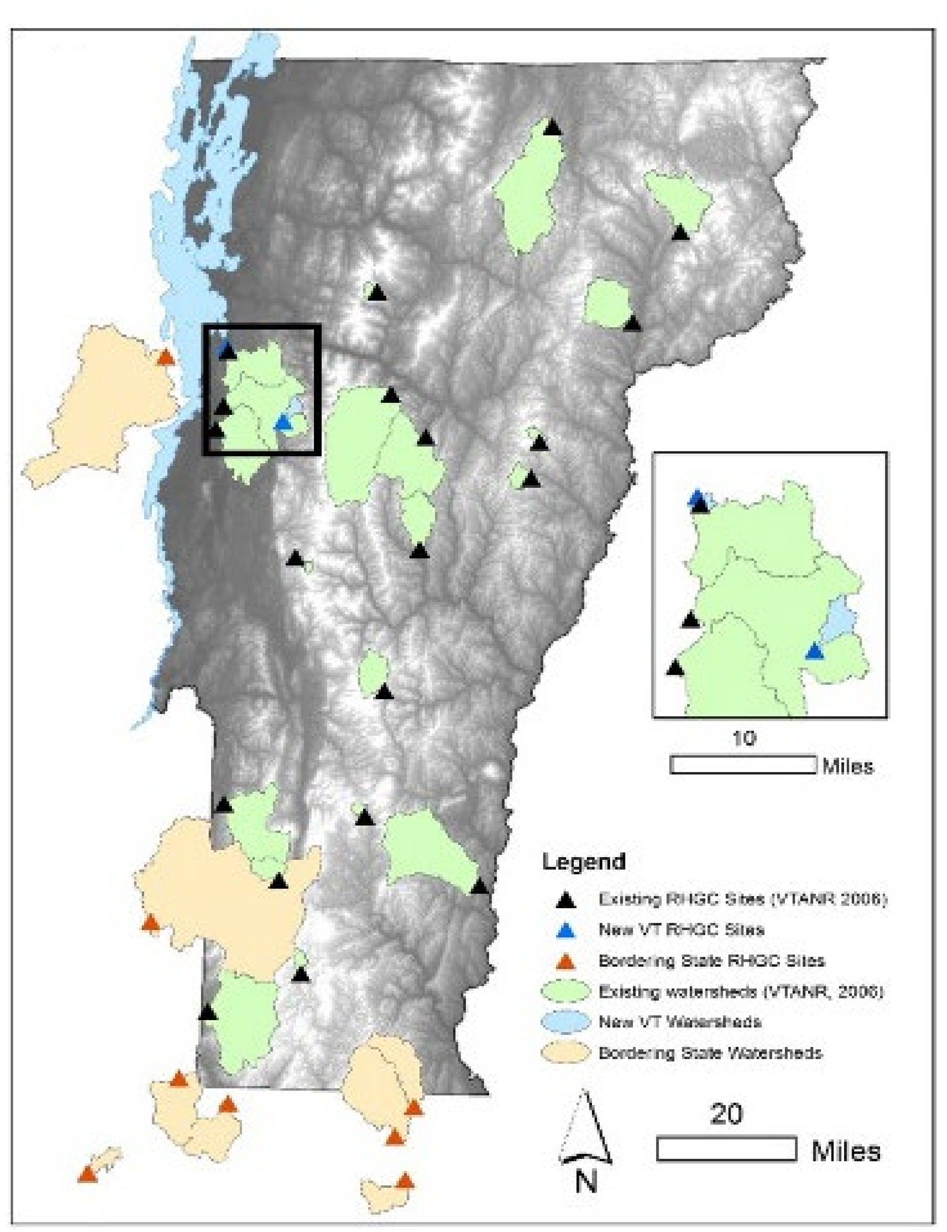



Figure 1. RHGCs (at right) are used to predict width, depth, and cross sectional area of the bankfull discharge (R.I. of Q1.5), to support flood-resilient sizing of infrastructure and permit passage of aquatic organisms (above).

## Expanded Observation Sites




By cross-referencing 70 USGS streamflow gauging stations that maintained records of sufficient length with available SGA data, we have identified ten new additional observation sites.

Figure 2. Expanded numbers of observation sites include 2 (blue triangles) located in Vermont; and 8 (red triangles) located in bordering regions of Massachusetts and New York state. These new stations will complement 21 existing stations used in the original Vermont RHGCs (black triangles).

## Next Steps – Statistical Analysis

Applying advanced statistical techniques (e.g., clustering, penalized logistic regression, multiple linear regression, Bayesian inference), we are developing and exploring additional predictor variables that may better refine regression estimates. Predictor variables (additional to drainage area) that may relate to the bankfull channel width, depth, cross-sectional area, and discharge, include main-channel slope, elevation, mean annual precipitation, mean annual runoff, percent carbonate bedrock, and percent basin storage (lakes, ponds, wetlands).

## Broader Impacts

Updated curves will support sizing of stream crossing structures as well as embankment design for roads and rails that share narrow valleys with rivers. Geomorphically-compatible structures will have greater resilience to extreme flood events and will support aquatic organism passage objectives.

Figure 3. (A) Channel straightened and windrowed after Tropical Storm Irene is restored with (B) near-vertical stacked wall to accommodate the bankfull-channel width.


*(Schiff et al., 2015)*

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## References

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