Quarterly Progress Report:
Project Number and Title: #C5.2018: Leveraging High-Resolution LiDAR and Stream Geomorphic Assessment Datasets to Expand Regional Hydraulic Geometry Curves for Vermont: A Blueprint for New England States
Research Area: Thrust 1 Develop improved road and bridge monitoring and assessment tools
PI: *Kristen Underwood, Ph.D.; University of Vermont*
Co-PI(s): *Arne Bomblies, Ph.D.; Donna M. Rizzo, Ph.D.; University of Vermont*
Reporting Period: *10/1/2019 – 12/31/2019 (Transition from bimonthly to first occurrence of quarterly reporting)*
Submission Date: *12/31/2019*

Overview:

Provide overview and summary of activities performed during the reporting period….
We have compiled existing bankfull channel data for 20 original Vermont sites, 4 Massachusetts sites, and 4 New York sites. We have reviewed available stream geomorphic data for river reaches in proximity to a suitable USGS streamflow gauging station (i.e., with peak-flow discharge record >10 years in length, and not affected by regulation). One new reference-condition stream reach in VT has been identified co-located with a suitable streamflow gauge. Three additional Vermont stream reaches have been identified located in the same watershed as a suitable streamflow gauge. Upstream drainage areas have been delineated to all identified sites, for computation of catchment-scale predictor variables.

Provide context as to how these activities are helping achieve the overarching goal(s) of the project…
By relying on SGA datasets to expand the number of observations, and by exploring additional predictor variables that may better refine regression estimates, our objective is to improve the prediction ability and reduce estimation uncertainty using RHGCs.

Describe any accomplishments achieved under the project goals…
Task 1: Compile expanded set of observation sites.
1A: Compile locations and delineate catchments for 21 sites used in original VTANR RHGC publications (Jaquith & Kline, 2001, 2006) - completed
1B: Compile and filter VT SGA data for reaches classified in stable condition – completed.
1C: Compile USGS active or historic continuous and crest-stage streamflow gauging sites – completed
1D: Select subset of USGS gauges meeting criteria – completed
1F: Conduct flow frequency analysis – partially complete

Task 2: Compile regression variables.
2A: Literature Review – completed
2B: Define list of possible additional predictor variables – completed
2C: Develop GIS methods for calculating predictor variables – partially complete
2D: Compile and summarize predictor variables – partially complete
2E: Compile and summarize response variables – partially complete

Describe any opportunities for training/professional development that have been provided…
Masters student Roberge has successfully completed GIS training this semester (ArcGIS Pro including Model Builder scripts), and an Applied Geostatistics course.

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops, publications, etc. List all other outputs, outcomes, and impacts after the tables (i.e. patent applications, technologies, techniques, licenses inssued, and/or website addresses used to disseminate research findings).

On Dec 16, 2019, we attended a meeting with The Nature Conservancy of VT (Paul Marangelo) to discuss shared research objectives and methods. They are compiling bankfull channel dimensions as part of a study to assess terrestrial

and aquatic passage around stream / road crossings. We shared challenges
and information about data sources (e.g., varying resolution of LiDAR across the state, hydroflattened and hydroenforced LiDAR).

Table 1: Task Progress

Task Number	Start Date	End Date	Percent Complete
Task 1: Compile Expanded Set of Observation Sites	6/1/2019	12/31/2019	90%
Task 2: Compile Regression Variables	9/1/2019	3/31/2020	35%
Task 3: Develop and Test Statistical Models	1/1/2020	4/30/2020	0%
Task 4: Summary Report	3/1/2020	5/31/2020	0%

Table 2: Budget Progress

Entire Project Budget	Spend Amount	Spend Percentage to Date
$146,244		

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events

Title	Event	Type	Location	Date(s)
(Poster) Leveraging High-Resolution LiDAR and Stream Geomorphic Assessment Datasets to Expand Regional Hydraulic Geometry Curves for Vermont	STEM Complex Celebration	Symposium	University of Vermont	10/04/2019

Table 4: Publications and Submitted Papers and Reports

Type	Title	Citation	Date	Status
N/A				

Participants and Collaborators:

Use the table below to list all individuals who have worked on the project.

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members

Individual Name	Email Address	Department	Role in Research
Kristen Underwood	Kristen.Underwood@uvm.edu	UVM CEE	PI
Donna Rizzo	Donna.Rizzo@uvm.edu	UVM CEE	Co-PI
Arne Bomblies	Arne.Bomblies@uvm.edu	UVM CEE	Co-PI

Table 6: Student Participants during the reporting period

Student Name	Email Address	Class	Major	Role in research
Sienna Roberge		M.S.	Civil & Env Eng	Data analysis, GIS

Use the table below to list any students who worked on this project and graduated during this reporting period.

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**
N/A			

Use the table below to list organizations have been involved as partners on this project and their contribution to the project.

Table 8: Research Project Collaborators during the reporting period						
		Contribution to the Project				
Organization	**Location**	**Financial Support**	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
VTrans	Montpelier		Project Champion			

Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations.

Nick Wark, PE, is a project champion representing VTrans.

Changes:

None

Planned Activities:

Description of future activities over the coming months.

We will finish compilation of explanatory variables, and begin statistical analyses to develop predictive relationships for bankfull channel width, depth, cross-sectional area, and discharge.