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## Introduction

Transportation networks have been recognized as contributors to water quality impairments by discharging stormwater, sediment, and nutrients to receiving waters. Prior research in Vermont has documented the role of unpaved roads on water quality impairment (Wemple, 2013; Wemple, 2016). This project aims to expand this work by focusing on gully erosion on Vermont's roads and quantifying effectiveness of erosion control measures to mitigate gully erosion at concentrated road discharge points.

## Methodology

A selection of gully erosion sites at concentrated road discharge points are being periodically surveyed with a high resolution terrestrial lidar scanner to monitor erosion change. To evaluate longer-term rates of gully erosion, a coarser approach will be used from airborne lidar that is more widely available and covering a longer time interval than field surveys will allow. To assess erosion control effectiveness, high resolution surveys will take place at paired treatment and control gully sites before and after erosion mitigation is installed. To evaluate longer-term effectiveness, a retrospective field assessment of best management practices previously installed.

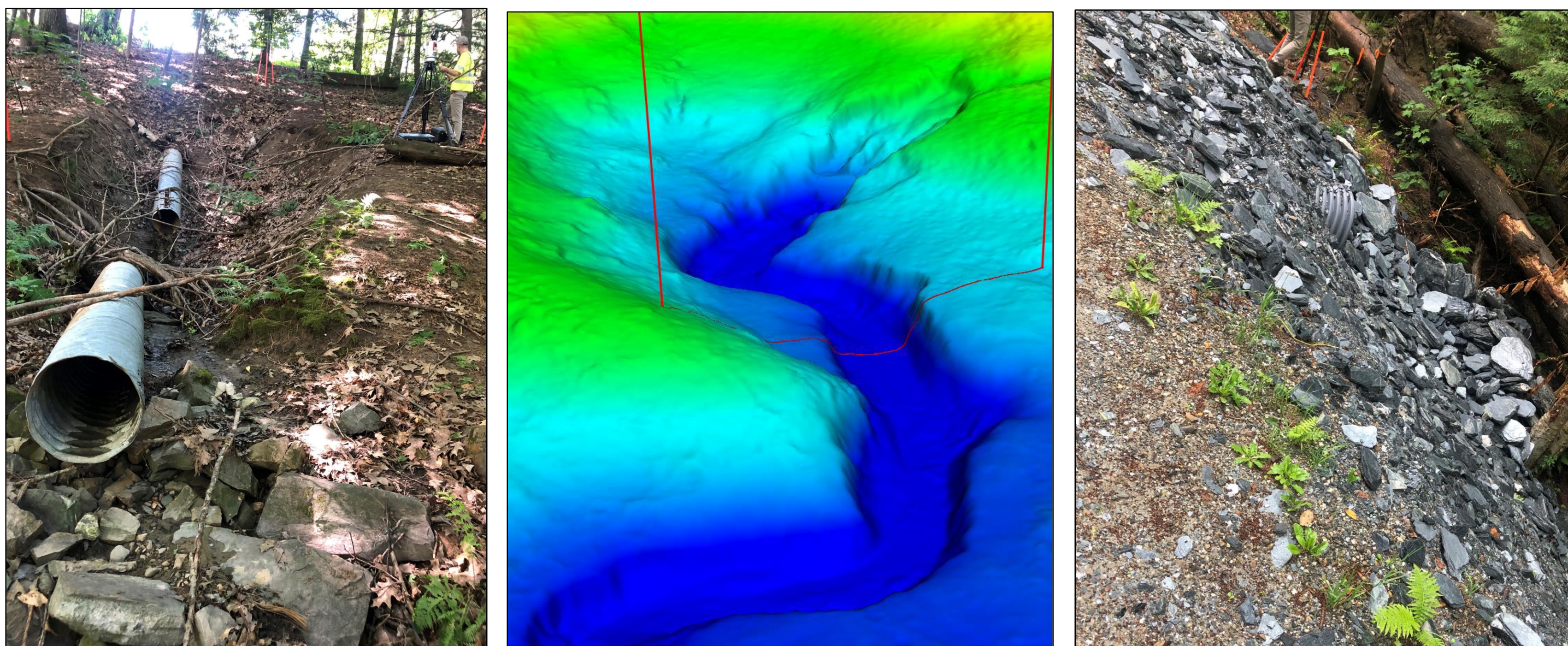


Figure 1. Left: field survey site for high resolution surveys, middle: digital elevation model derived from field surveys, and right: erosion mitigation installed at a field survey site.

## Results

Preliminary results from the field surveys show that gullies from concentrated road discharge points are increasing in volume. Eight of the 13 sites have been surveyed at least twice which allows for preliminary gully erosion rate estimates.

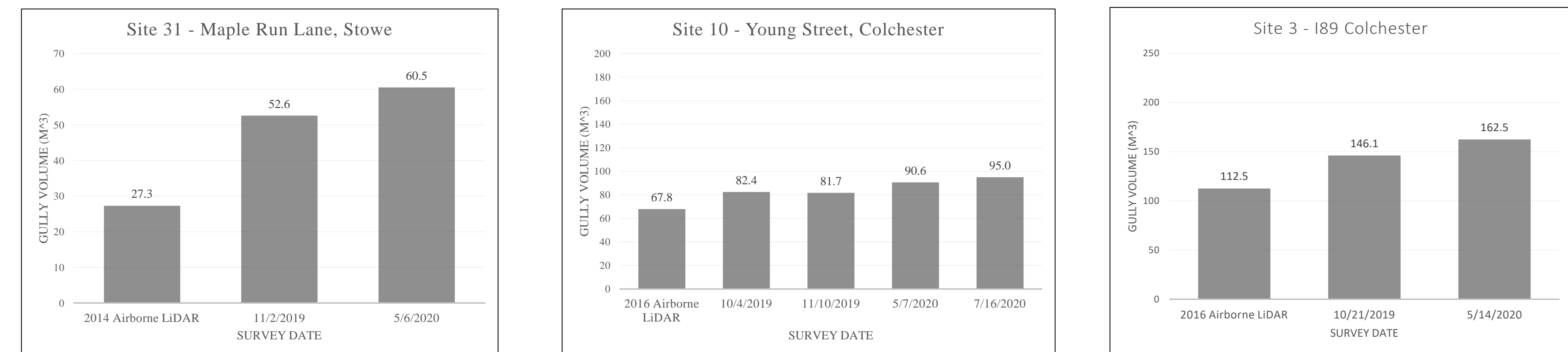


Figure 2. Gully Volume change from the 2016 airborne lidar and field surveys

## Next Steps

Surveying will take place through June 2021. By October 2020, we aim to have initial estimates of magnitude of sediment and phosphorus generated at sites that have erosion mitigation installed. Over the winter, data collected from the retrospective field and airborne lidar assessment will be analyzed. This information will provide context for determining opportunities to reduce loads to receiving waters and credit erosion-control efforts under the Lake Champlain TMDL.

## Acknowledgments

Administrative Lead: Emily Parkany, Vermont Agency of Transportation  
Champions: Joel Perrigo and Jennifer Callahan, Vermont Agency of Transportation  
Technical Advisory Committee:  
Alan May, VTRANS  
Ashley Bishop, VTRANS  
Jim Ryan, ANR DEC  
Emily Schelley, ANR DEC  
Amy Macrellis, Stone Environmental  
Chris Jolly, FHWA Division Office  
Chris Dubin, CCRPC  
Rob Moore, LVPC

## References

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Wemple BC. 2016. Controlling polluted stormwater runoff from roads. Vermont Journal of Environmental Law, 17: 785-810.