

# Vermont Transportation Resilience Planning Tool (TRPT)

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# Acknowledgements

## VERMONT AGENCY OF TRANSPORTATION

Joe Segale

## PROJECT PARTNERS

Vermont Agency of Natural Resources

Vermont Emergency Management

Vermont Agency of Commerce and Community  
Development

Two Rivers-Ottauquechee Regional Commission,

Windham Regional Commission

White River Partnership

## CONSULTANTS

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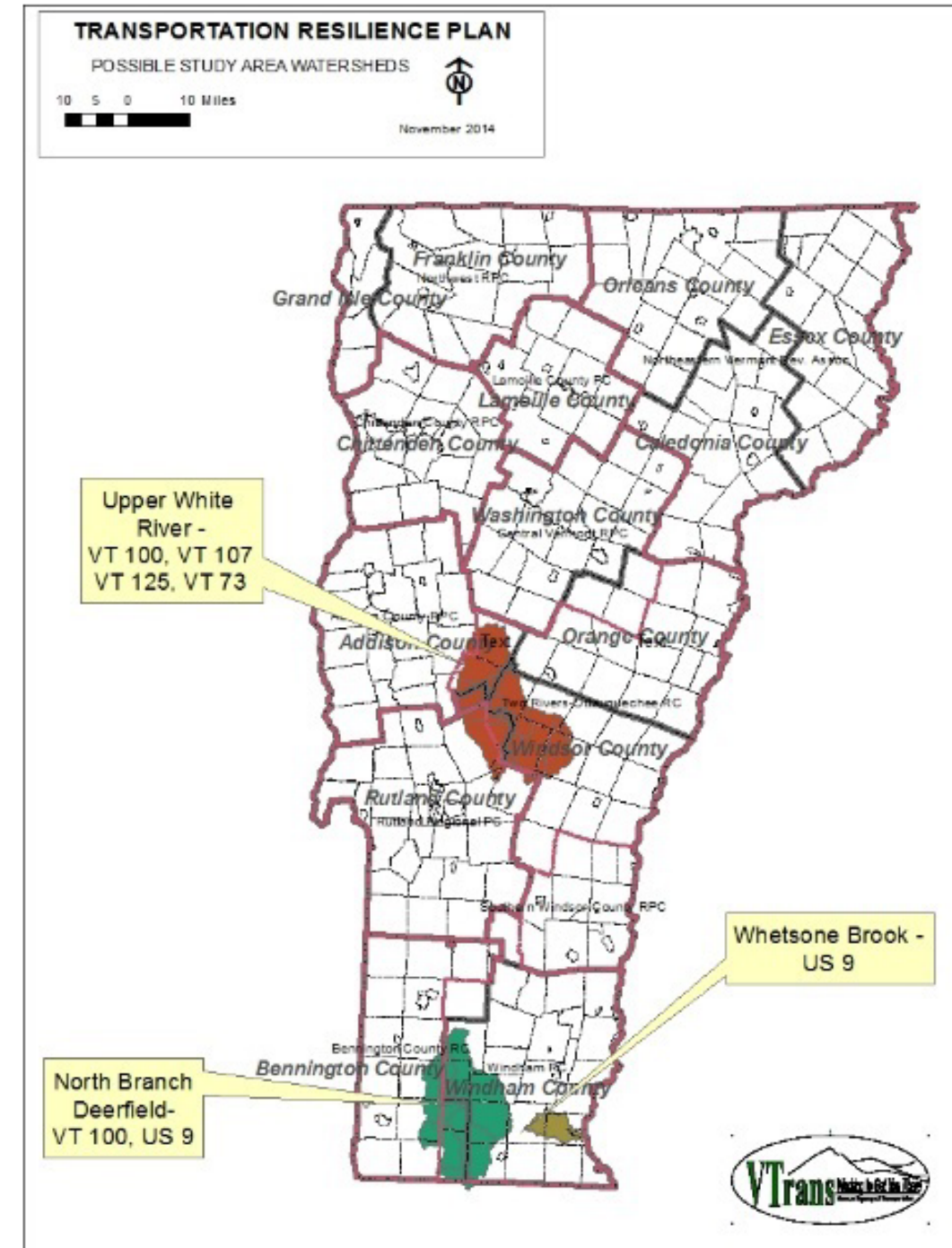
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*Stone Environmental*

# Pilot Watersheds

1. Upper White River
2. North Branch Deerfield
3. Whetstone Brook



# Need for Transportation Resiliency

Deposition Money Brook,  
Route 100 in Plymouth, VT  
10/6/2013  
Photo taken by M. Tucker



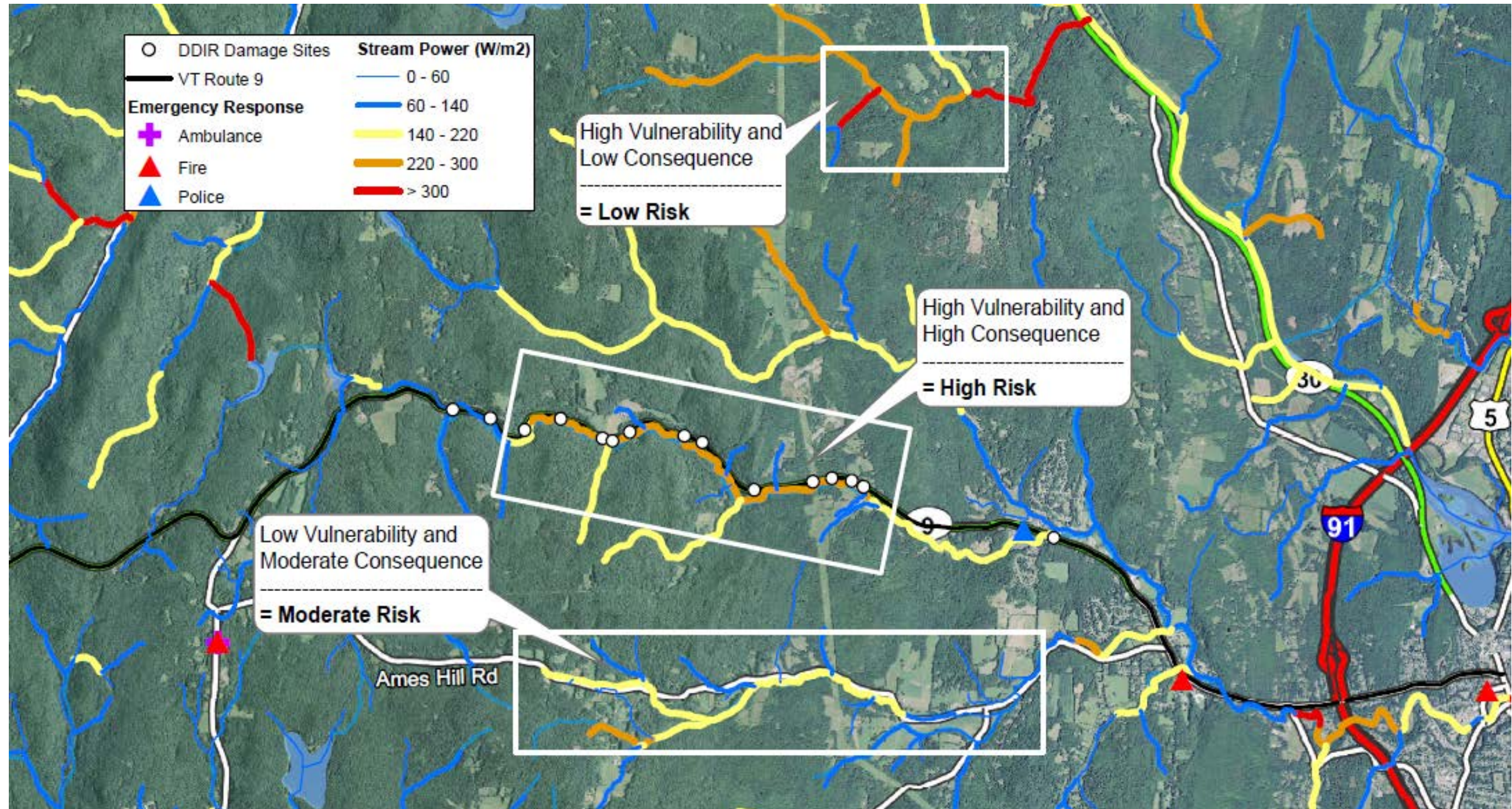
Photos taken by L. Grange and Mansfield  
Heliflight, 2011



Erosion along  
Route 4 in Mendon

Inundation along  
Route 2 in Waterbury

# Goals



# Who are the intended users?

## Primary Users

- VTrans (Planner, Engineer, Asset Manager)
- Vermont Department of Environmental Conservation (Engineer, Floodplain Manager, Scientist )
- Regional Planning Commissions (Regional Planner, Transportation Planner, Other Staff)
- Vermont Emergency Management (Planner, Project Coordinator, Emergency Operation Center Watchstander)

# Initial Design

VERMONT Transportation Flood Resilience Help

Roads

- Risk
- Vulnerability
- Criticality

Bridges + Culverts

- Risk
- Vulnerability
- Criticality

Jump to:  of

Vulnerability

Criticality

Table chart

Top mitigation options for VT RT 14 near...

| Option                       | Cost/unit                    |
|------------------------------|------------------------------|
| 1. Repair Roadway Embankment | \$/ft road                   |
| 2. Relocate Roadway          | \$/ft road                   |
| 3. Reconnect Floodplain      | \$/ft <sup>3</sup> excavated |

Mitigation Asset Info Vulnerability

10% Storm (recommeneded) Share Workspace

# First Iteration

**VTrans Flood Resilience Map**

© (copyright info)  
Stone Env | Help  
For any questions, call toll-free, **1-802-229-4541**

**1% Storm (recommended)**

Layers

- Bridges
- Risk Watersheds
- Risk Roads
- E911
- VTrans Roads

INFO

Headwaters White River - 173212 ac.  
North Branch Deerfield River - 35842 ac.  
Whetstone Brook - 17653 ac.

**Get sharable link**

**Get Started**

- Statewide Overview**
- Choose Watershed**

Headwaters White River  
North Branch Deerfield River  
Whetstone Brook

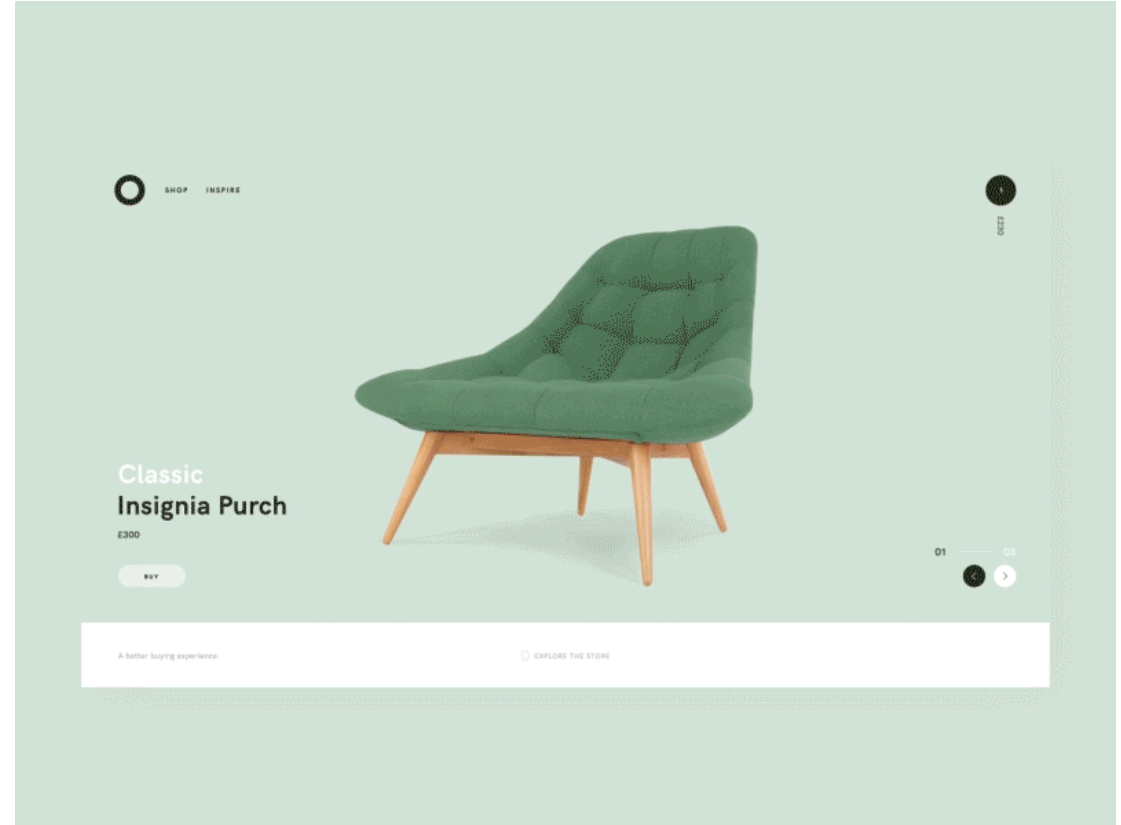
**Start** **About**

The screenshot shows a web-based map interface for Vermont. The main map displays a topographic view of the state with several watersheds highlighted in red. A central dialog box titled 'Get Started' is overlaid on the map, providing navigation options. The left sidebar contains a 'Layers' panel with 'Risk Watersheds' selected, and an 'INFO' section listing three watersheds with their respective acreages. A 'Get sharable link' button is also present in the sidebar. The top right corner includes copyright information and a toll-free phone number. The map itself shows major cities like Rutland, Brattleboro, and Keene, along with geographical features like the Green Mountain National Forest and the White Mountain National Forest. An inset map in the bottom right corner shows the location of Vermont within the Northeastern United States.





**One of the key rules of user interface design is that users need to be in control.**





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# First Iteration

**VTrans Flood Resilience Map**

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- Statewide Overview**
- Choose Watershed**

Headwaters White River  
North Branch Deerfield River  
Whetstone Brook

**Start** **About**

The screenshot shows a web-based map interface. A central dialog box titled 'Get Started' is overlaid on a topographic map of Vermont. The dialog box contains two main options: 'Statewide Overview' and 'Choose Watershed'. Under 'Choose Watershed', three specific watersheds are listed: 'Headwaters White River', 'North Branch Deerfield River', and 'Whetstone Brook'. At the bottom of the dialog box are 'Start' and 'About' buttons. The background map shows the state of Vermont with various geographical features, including the Green Mountain National Forest and several towns. A scale bar indicates 40 km. On the left side of the interface, there is a sidebar with a 'Layers' section where 'Risk Watersheds' is selected, and an 'INFO' section providing acreage data for the three watersheds listed in the dialog box. A 'Get sharable link' button is also present in the sidebar. The top of the page features the title 'VTrans Flood Resilience Map' and contact information for Stone Environmental.

# Current Iteration

<http://vtrans.stone-env.net>

# Case Study

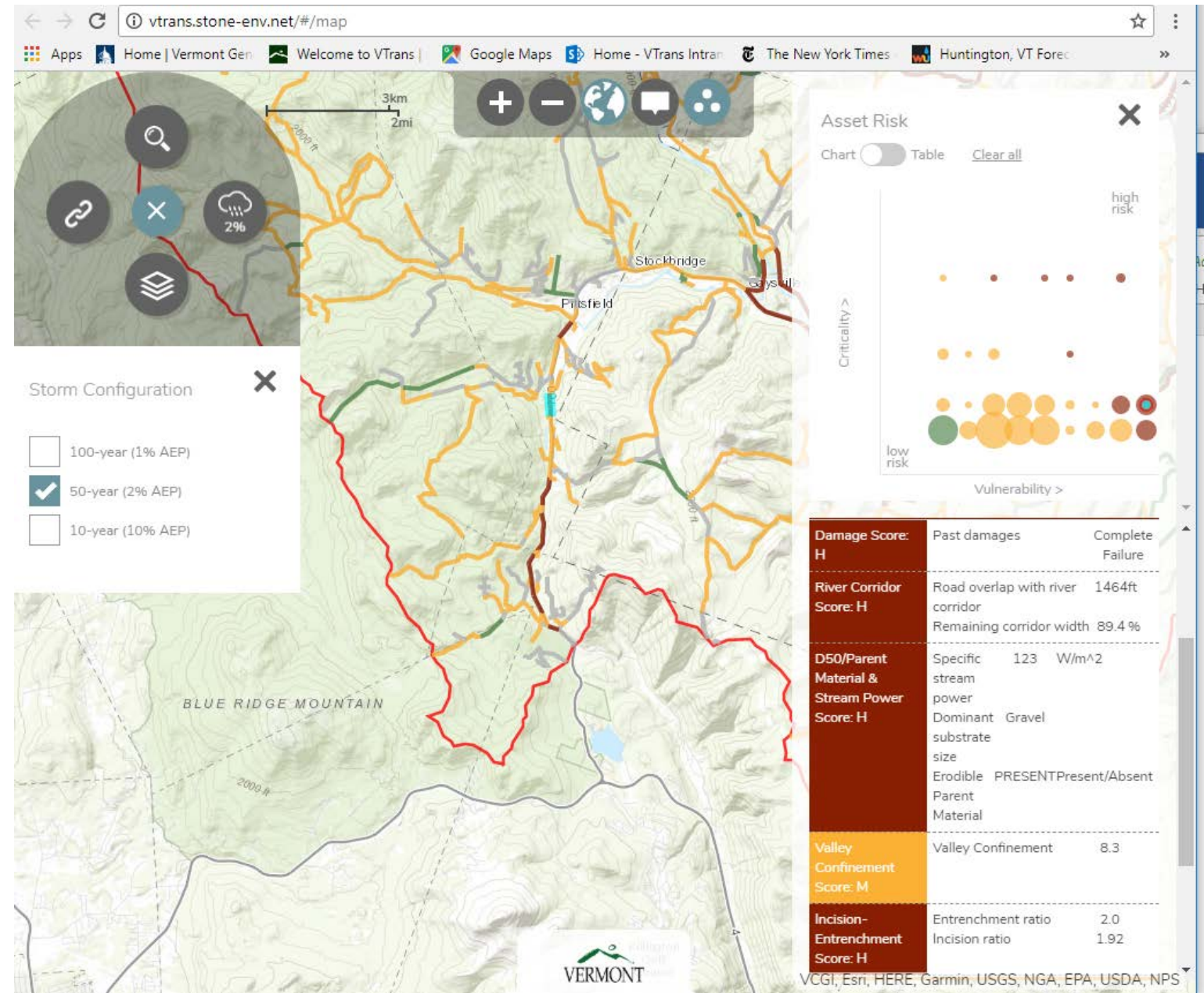
The Tweed River valley in Killington and Pittsfield is mostly narrow due to the mountainous setting and additional confinement by the road embankment. In many cases, the small natural floodplains in the narrow valley have been disconnected from the river channel as the river has cut down (i.e., incised) due to erosion. The Tweed River along Vermont Route 100 is very erosive as it has a lot of (stream) power to move sediment and is overly confined.

During Tropical Storm Irene, the erosive nature of the Tweed led to loss of several sections of the Vermont Route 100 road embankment. High velocity flows that could not spread into a floodplain gouged holes in the road embankment to make new. Small culverts and bridges were washed out.



# Case Study

The TRPT shows high and moderate risk sections of Vermont Route 100 along the Tweed River. The vulnerability due to erosion is high (10 out of 10). Stream power is moderate (123 Watts per square meter) and a long portion of the road segment is in the river corridor (1,464 feet). More than 10% of the floodplain is filled by the road embankment that is leading to high vulnerability. Road sections near Stage Road and Hadley Lane are the most constricted (V = 9 out of 10), lead to severe transportation consequences if damaged (C = 7 out of 10), and thus have the highest risk in the area (R = 8 out of 10).



# Case Study

With the understanding of the driving processes behind the vulnerability a mitigation project was designed to both protect the road and reduce erosion. Bed armoring was installed to elevate the channel to pre-flood levels and reconnect floodplain. The over-steepened bank armoring that spilled into the river channel was pulled back to restore the bankfull channel width. The bank armoring was re-installed at a shallower slope and the lower portion was seeded to restore riparian vegetation. Proper sediment and erosion controls were used during installation of this aggressive alternative to minimize construction impacts. The practice has been installed for nearly four years and is stable. The reconnected floodplain has been accessed several times. SUCCESS.





**Thank you.**

For more information / [www.stone-env.com](http://www.stone-env.com)

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