

Climate Change Resilience and the Vermont Agency of Transportation



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Vermont Agency of Transportation

“Flooding, Vulnerability and Risk Oh My!”
AASHTO’s 21st Century Mobility for Freight and
Passenger Transportation Conference

July 8, 2015





Climate Change Resilience and the Vermont Agency of Transportation

Why is VTrans taking action

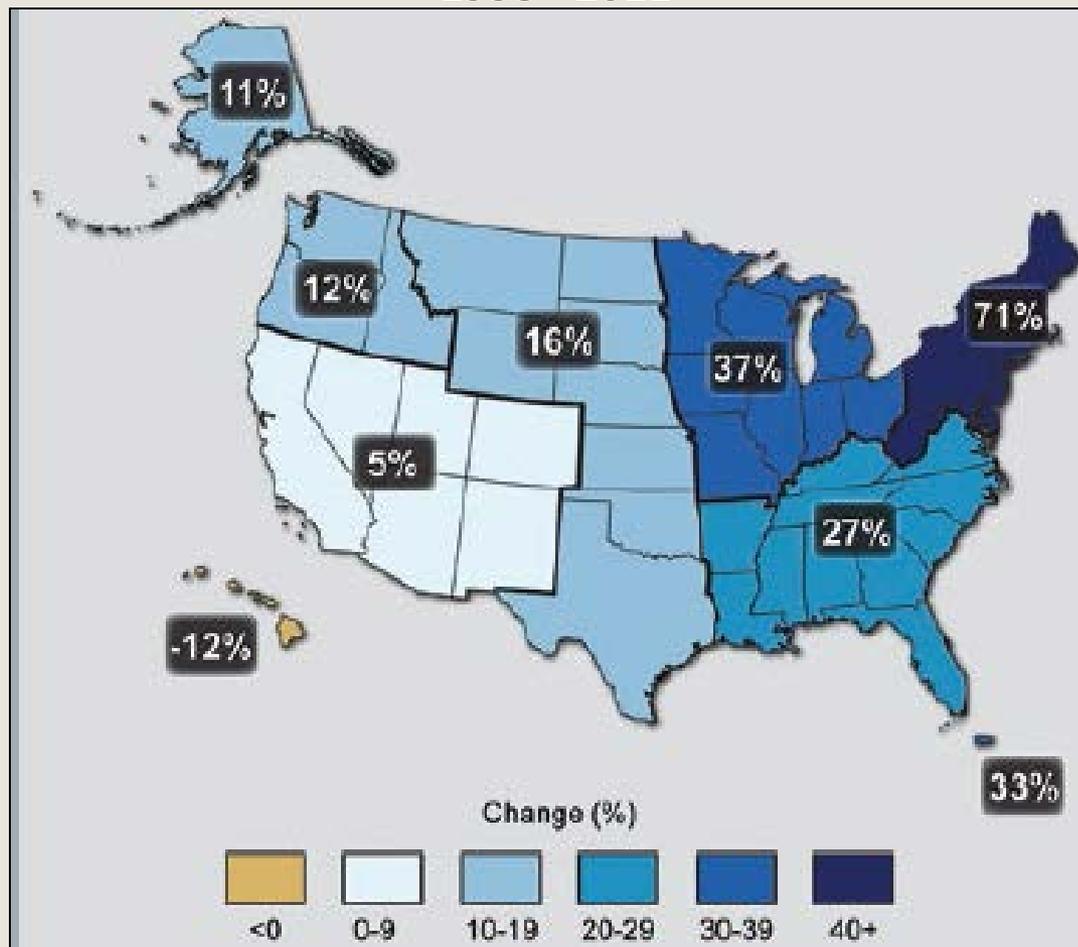
What data & information are we using

What action is resulting

The Problem for Vermont:

Climate change in the northeast means more intense and frequent storm events and the associated flooding of inland waterways.

Observed Change in Very Heavy Precipitation
1958 - 2011



Source:
The National Climate Assessment



Climate Change Preparedness Framing:

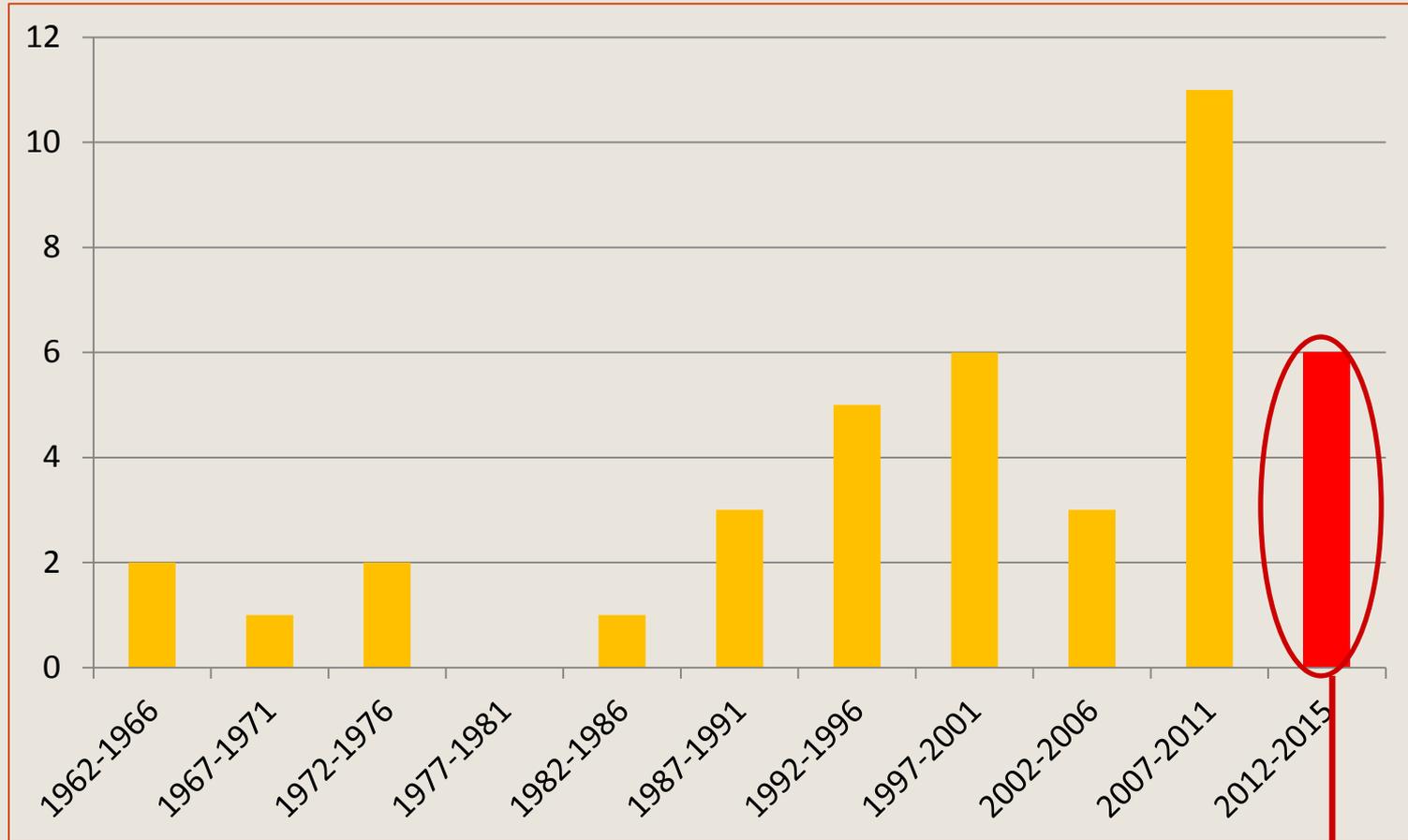
1. Response –emergency preparedness
2. Recovery – put back in order after the event
3. Resilience – build and act in such a way as to mitigate the problem in the future
– The outcome: No disruptions to transportation needs



Transportation infrastructure typically bears the greatest proportion of economic costs from flood disasters in Vermont



Major Disaster Declarations in Vermont



Source: Federal Emergency Management Agency

Only part way through the 5 year period





National Weather Service Record Reports for June 2015

RECORD REPORT NATIONAL WEATHER SERVICE BURLINGTON VT 217 AM EDT
WED JUN 10 2015 ...**RECORD DAILY MAXIMUM RAINFALL SET AT
BURLINGTON VERMONT... A RECORD DAILY RAINFALL OF 1.52 INCHES WAS
SET AT BURLINGTON VERMONT YESTERDAY JUNE 9TH. THIS BREAKS THE
OLD RECORD OF 1.22 SET IN 1889.**

RECORD REPORT NATIONAL WEATHER SERVICE BURLINGTON VT 527 PM EDT
MON JUN 29 2015 ...RECORD MONTHLY RAINFALL FOR JUNE SET AT MOUNT
MANSFIELD VERMONT... **AS OF 4 PM MONDAY JUNE 29TH...MOUNT
MANSFIELD`S (ELEVATION 3950 FEET) TOTAL RAINFALL FOR THE MONTH OF
JUNE 2015 HAS REACHED 15.54 INCHES. THIS BREAKS THE PREVIOUS
RECORD FOR JUNE OF 15.28 INCHES SET IN JUNE 1998.** WITH ADDITIONAL
RAINFALL POSSIBLE...AN UPDATED STATEMENT WILL BE ISSUED AT THE END
OF THE MONTH.



The problem and solution as articulated by UVM scientists speaking before the VT Legislature in 2012:

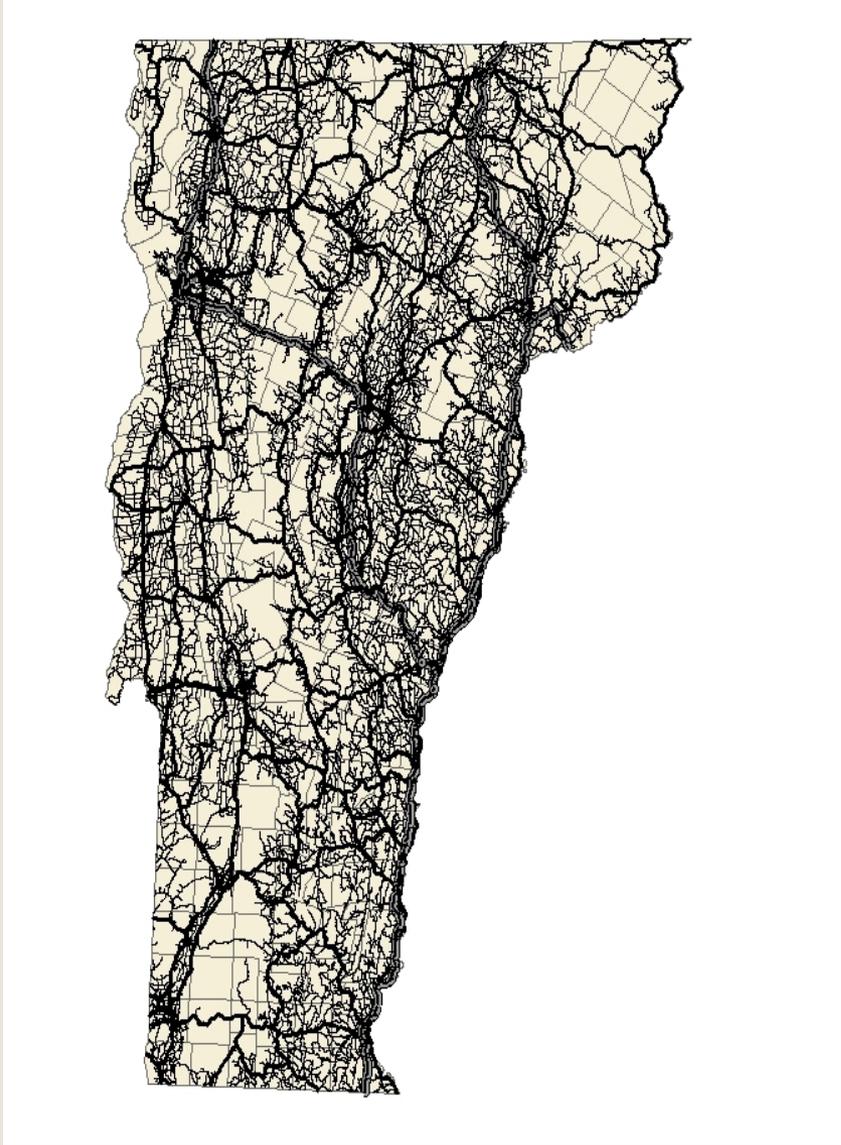
1. Climate change means more intense and frequent storm events and thus big changes in the timing and amount of stream flow
2. Confined and straightened rivers have greater power and erosive force while access to flood plains dissipates energy
3. Imperviousness of the landscape increases discharge

The Basic Approach:

- Give rivers more room to move
- Elevate bridges and take abutments and roadway fill out of the active river belt width
- Slow stormwater flow and allow for infiltration



Vermont Watersheds



Vermont Road Network



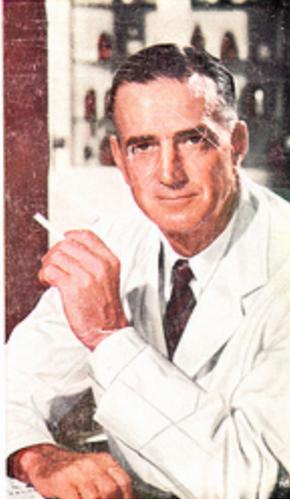


Inter-agency love

What we thought was true is no longer true

According to repeated nationwide surveys,

More Doctors Smoke **CAMELS** than any other cigarette!



Guard Against Throat-Scratch

enjoy the smooth smoking
of fine tobacco

See how **PALL MALL's** greater length
and fine tobacco
that makes you the way to



To keep a slender figure
No one can deny...



Reach
for a
LUCKY
instead of a
sweet

LUCKY STRIKE
CIGARETTES

Viceroy

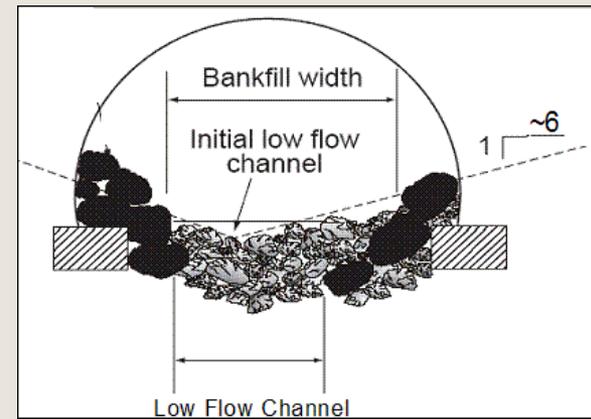
FILTER the Smoke!



As your Dentist,
I would recommend
VICEROYS



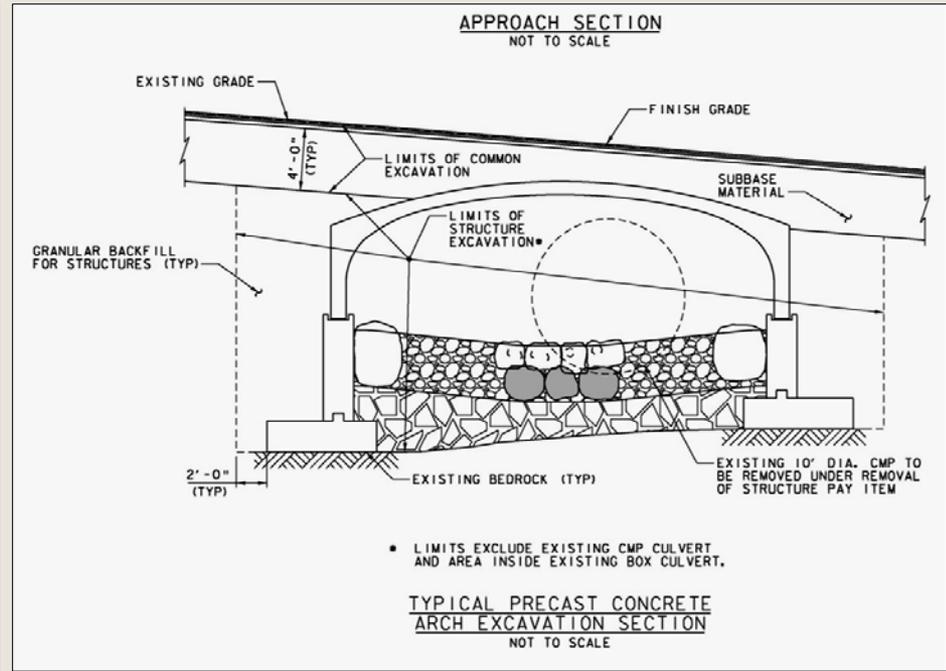
New VTrans Hydraulics Manual



Washington DOT



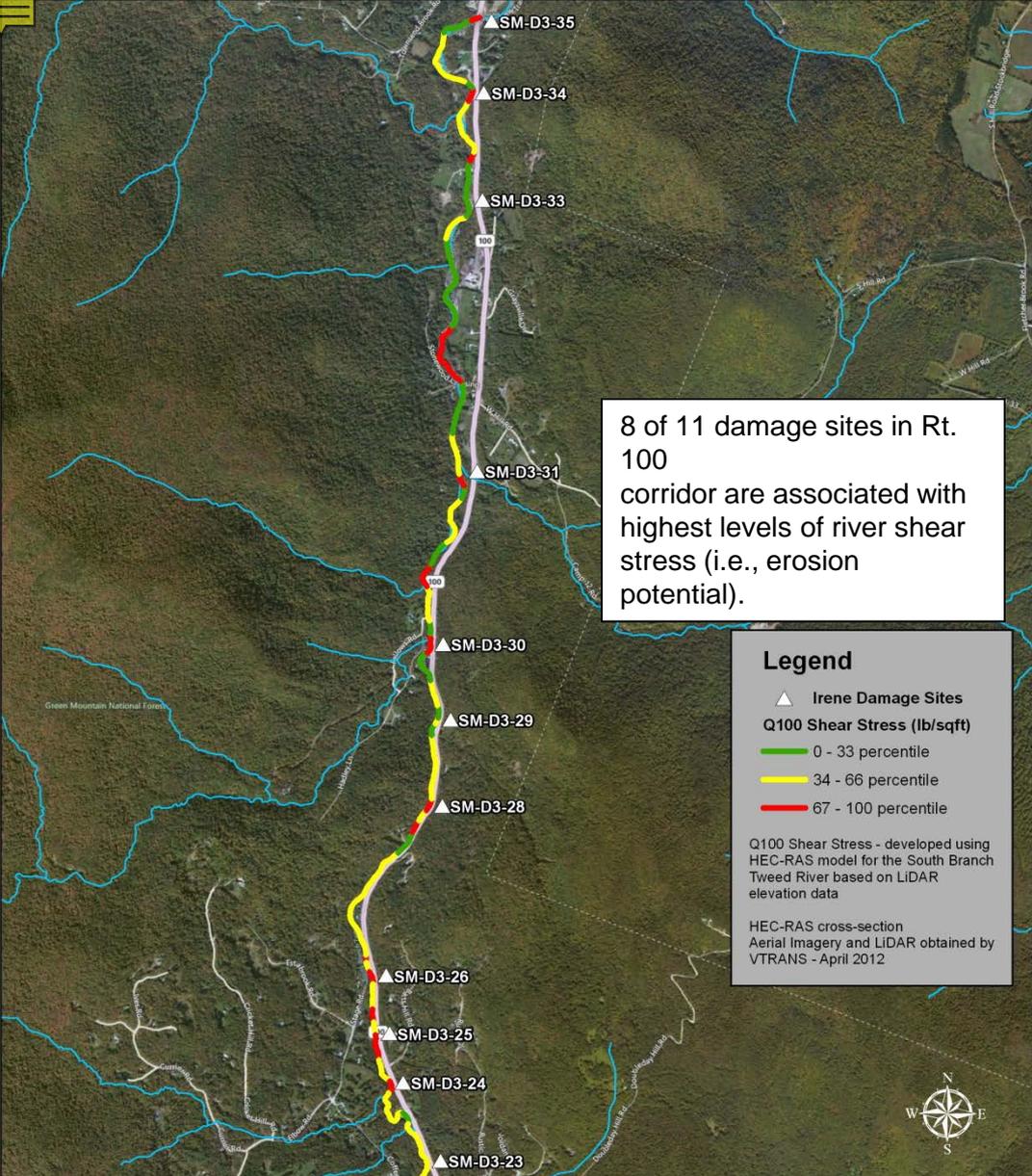
VT Agency of Transportation River Science Climate Resilience Strategy



Site of a culvert destroyed by Tropical Storm Irene in Rochester, VT on a tributary of the White River

Design for a flood a resilient box culvert that was built at the site in 2013. Note outline of temporary culvert put in place as part of the emergency response

FORCASTING: Flood Vulnerability Mapping Using LiDAR Data



8 of 11 damage sites in Rt. 100 corridor are associated with highest levels of river shear stress (i.e., erosion potential).

Legend

- ▲ Irene Damage Sites
- Q100 Shear Stress (lb/sqft)
 - 0 - 33 percentile
 - 34 - 66 percentile
 - 67 - 100 percentile

Q100 Shear Stress - developed using HEC-RAS model for the South Branch Tweed River based on LiDAR elevation data

HEC-RAS cross-section
Aerial Imagery and LiDAR obtained by VTRANS - April 2012

<p>Fitzgerald Environmental Associates, LLC 18 Severance Green, Suite 203 Colchester, VT 05446 Telephone: 802.876.7778 www.fitzgeraldenvironmental.com</p>	<p>Flood Vulnerability Mapping VT 100, Pittsfield - Killington VT</p>		<p>0 2,000 4,000 Feet 1 inch = 2,000 Feet</p>	
	<p>VTrans Tropical Storm Irene PDD Corridor Project</p>		<p>VT 100 Overview</p>	<p>Drawn by: EPF Date: May 7, 2013</p>





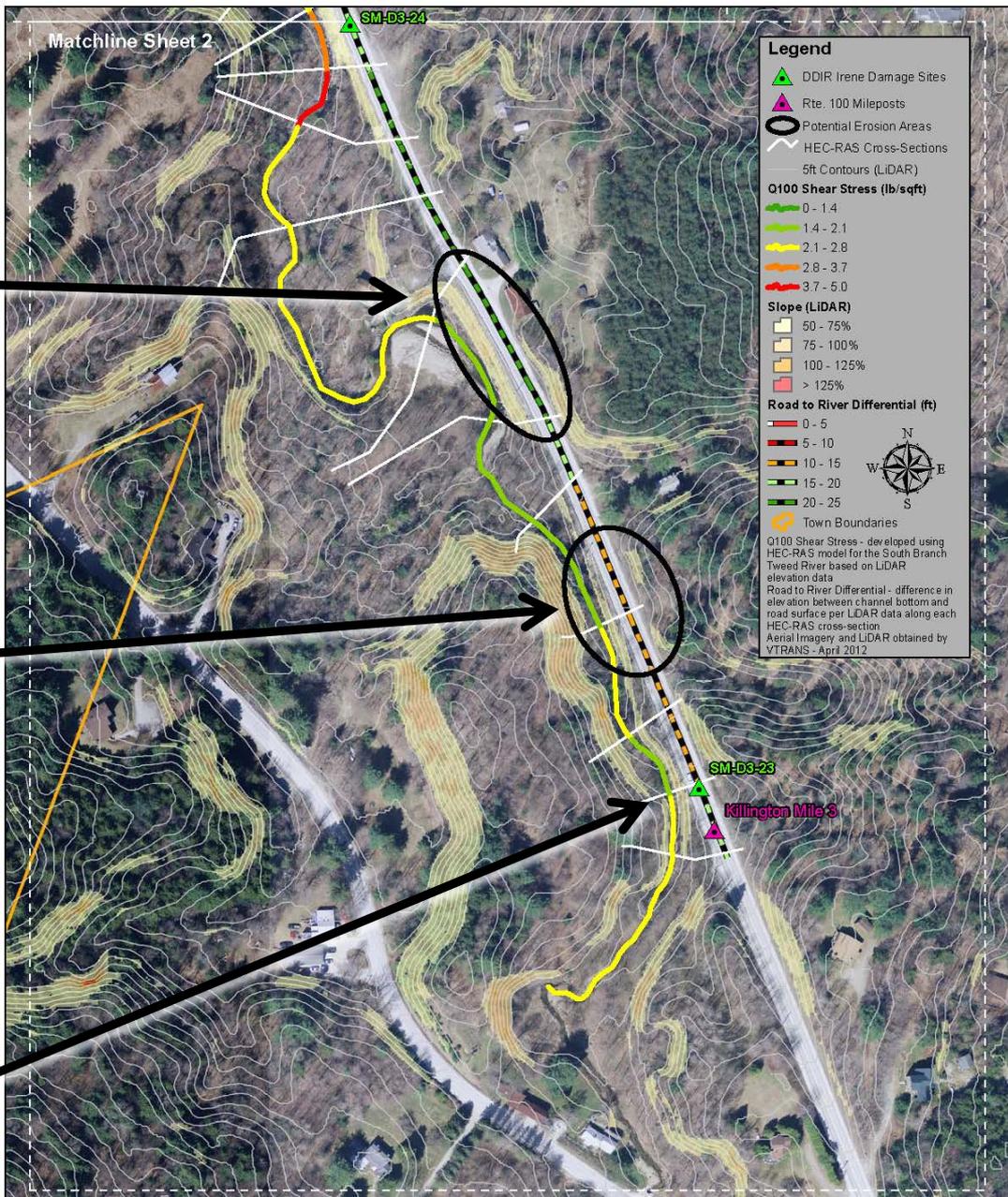
Previously armored site



Unknown erosion site

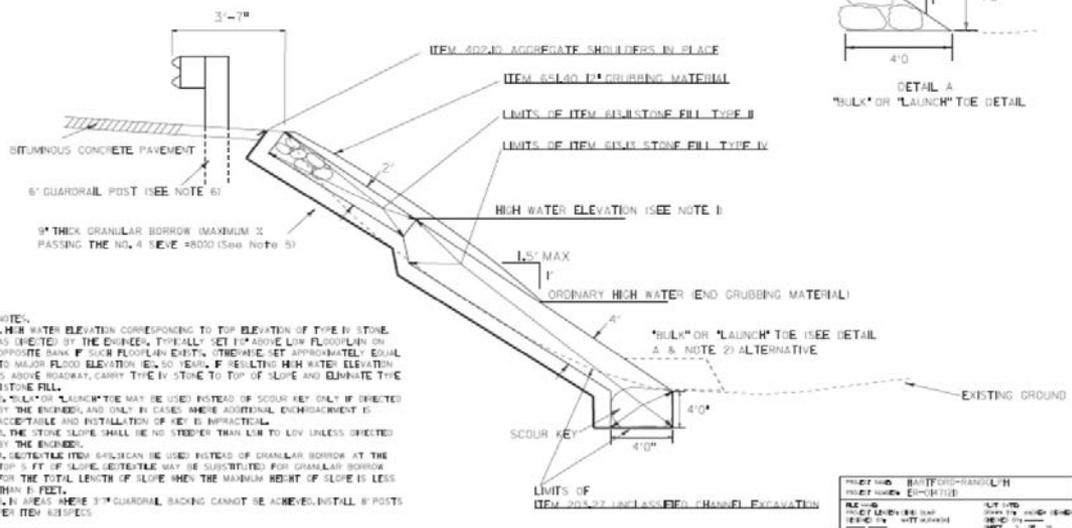


Known damage site





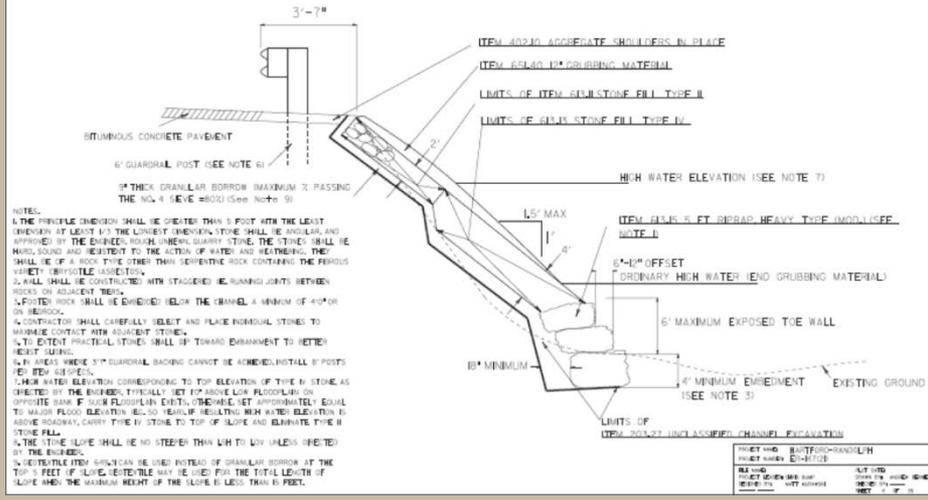
STONE FILL SLOPE PROTECTION



Before

Side Slope Design

STONE FILL SLOPE PROTECTION WITH STONE TOE WALL



After

ANR/VTrans Roads and Rivers Training:

<http://wsmd.vt.gov/rivers/roadstraining/>



Vulnerability Assessment

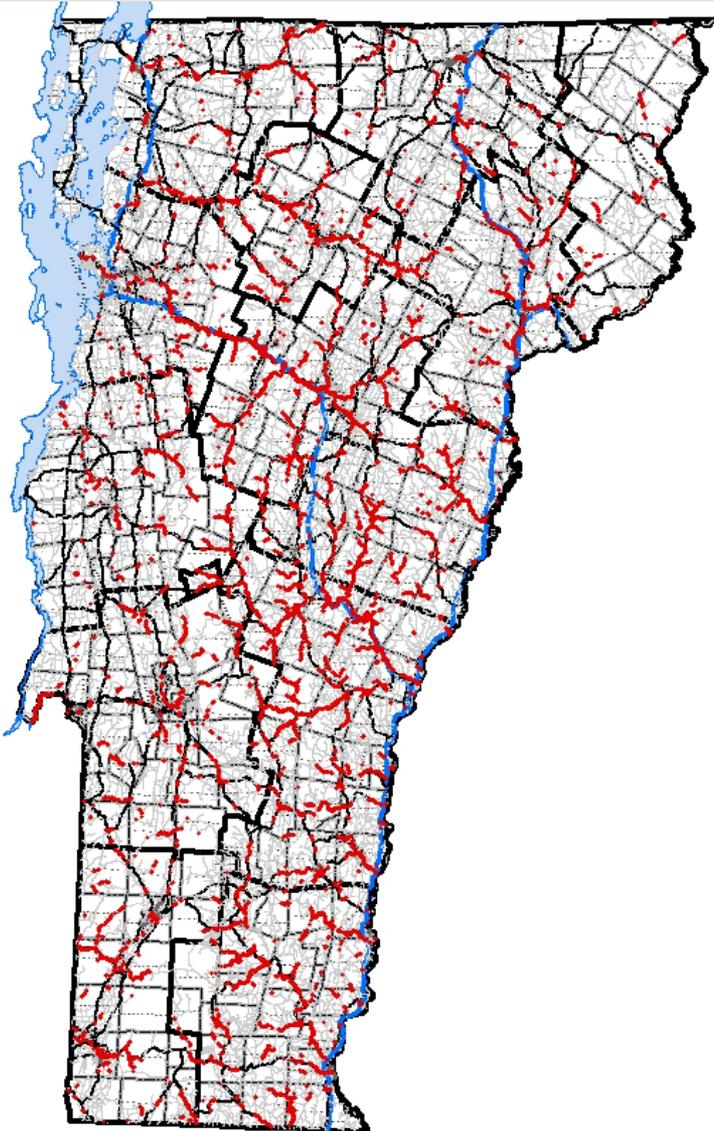
State and Local Roads

Road locations within High Sensitive River Corridor Reaches

– 3,200 locations on
State Highways

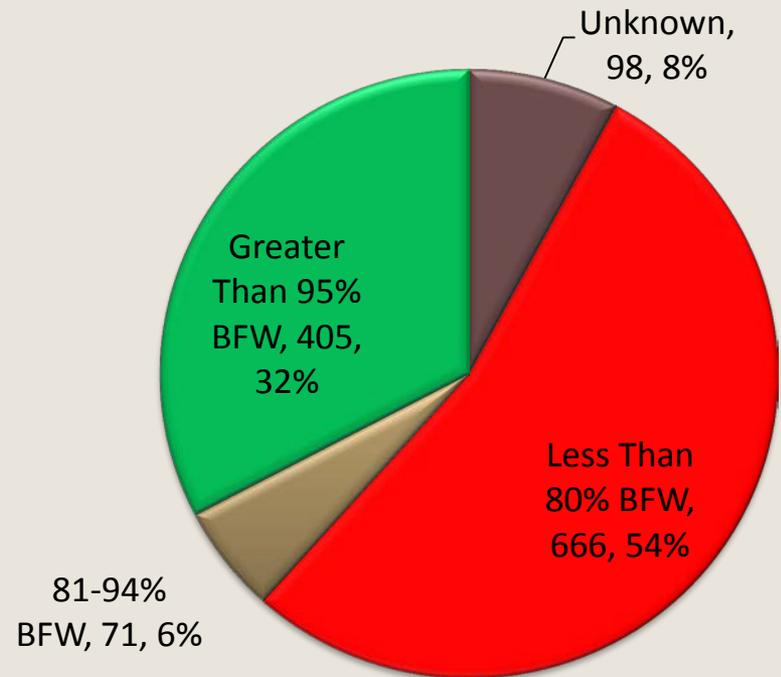
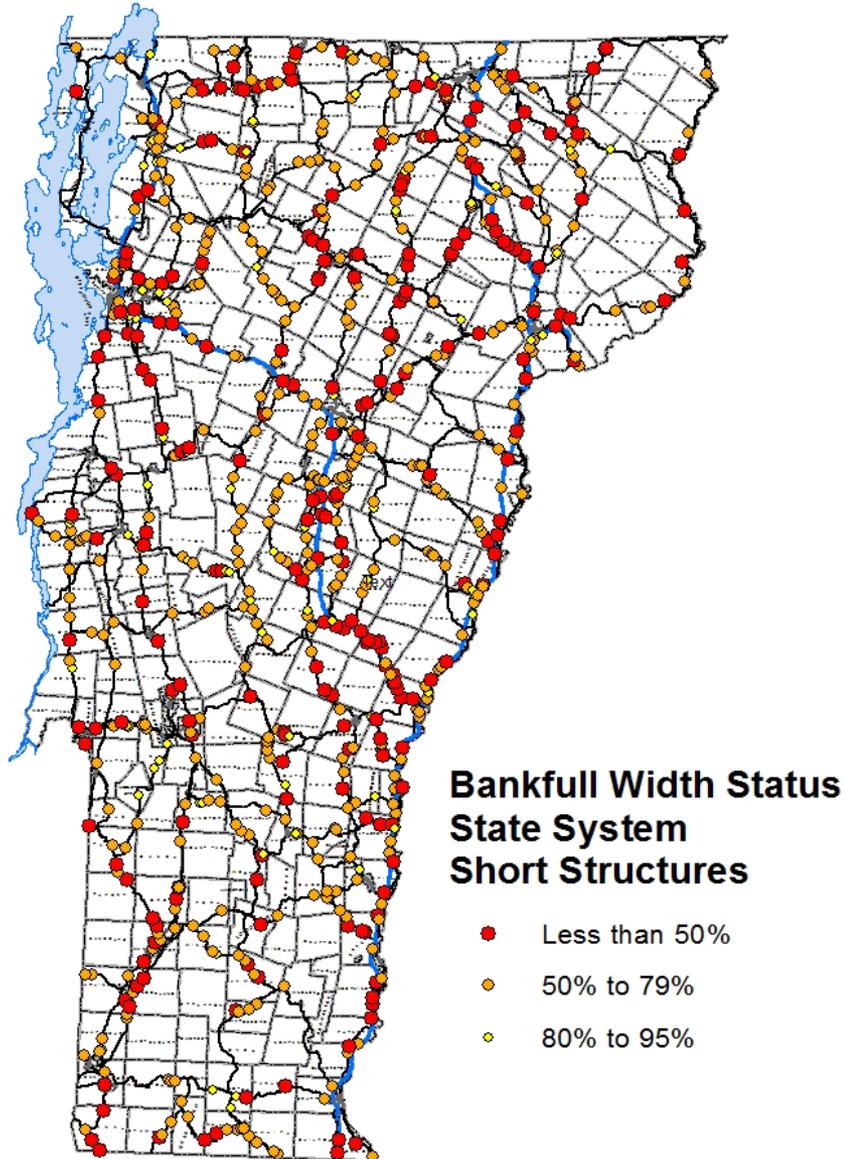
– 7,500 locations on
Local Roads

Based on preliminary statewide river corridor GIS
data by the ANR Rivers Program



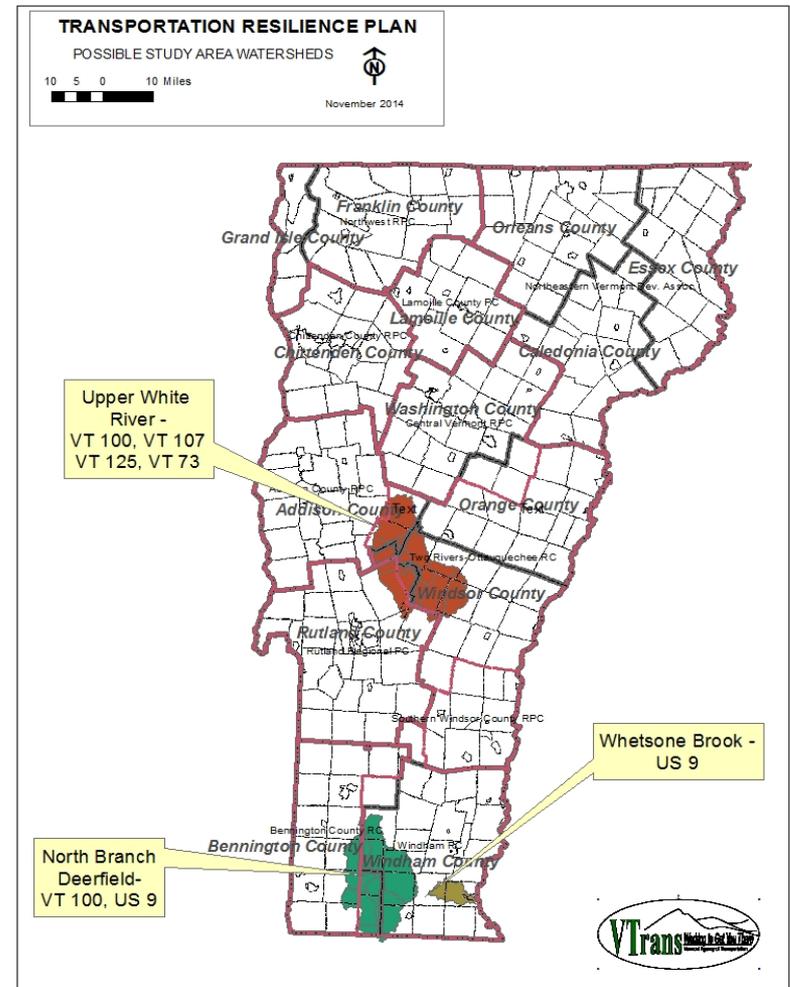
Vulnerability Assessment

State Short Structures (6-20 ft. span)



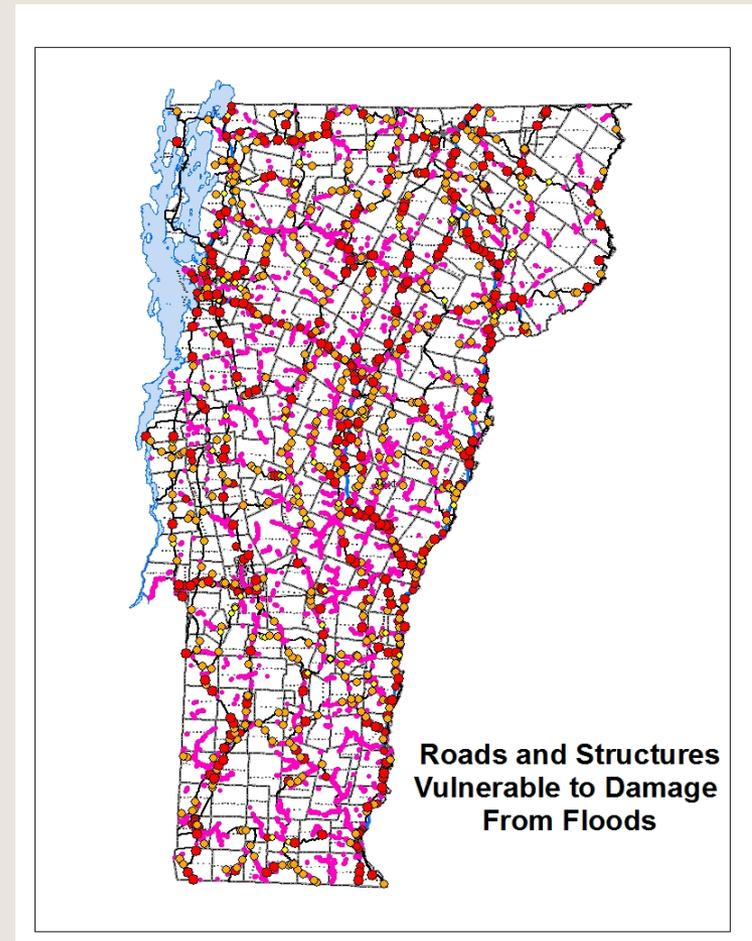
Tools & Methods for Transportation Resilience Planning

- Software tools to assess vulnerability, probability, consequence, and risk,.
- Technical documentation and training materials
- Training workshops
- Transportation System Resilience Plans for three study watersheds. Proposals now being reviewed
- A recommended update to the *VTrans Project Prioritization Process*



Final Observations

- Focus on Risk
- Incorporate into existing planning & project development
- Use available data
- Understand limitations
- Support innovation
- Collaborate



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