

A photograph of a narrow, winding road that curves through a dense forest. The road is paved and appears slightly damp. The trees are tall and green, with sunlight filtering through the canopy. The overall scene is serene and natural.

Understanding Water Quality Impacts of Vermont's Back Roads: a research summary for policy makers

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Presentation to the Vermont House
Transportation Committee

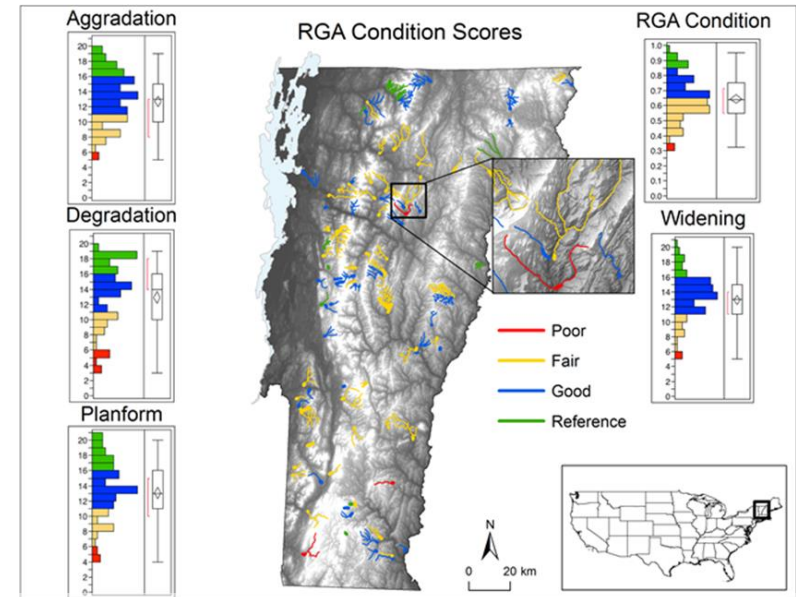
January 30, 2015

Context: Lake Champlain TMDL





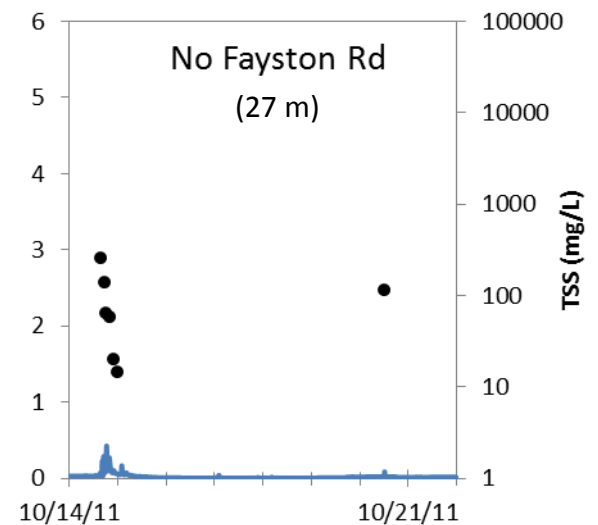
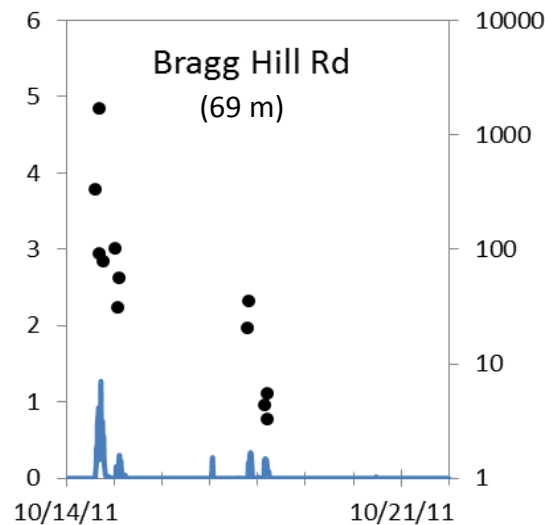
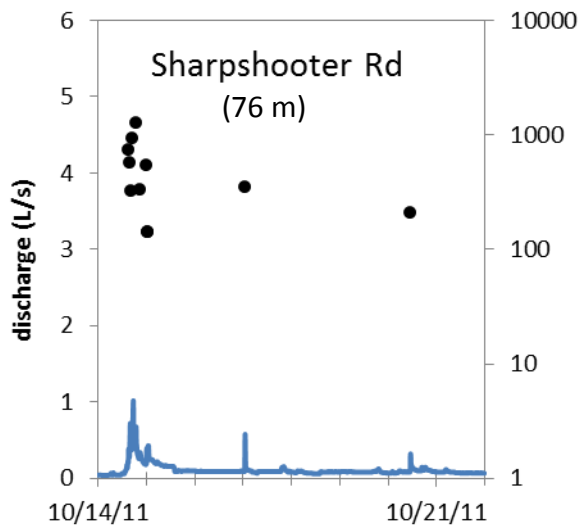
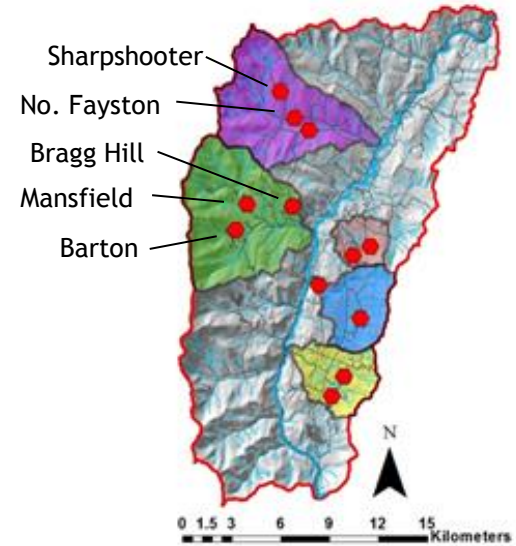
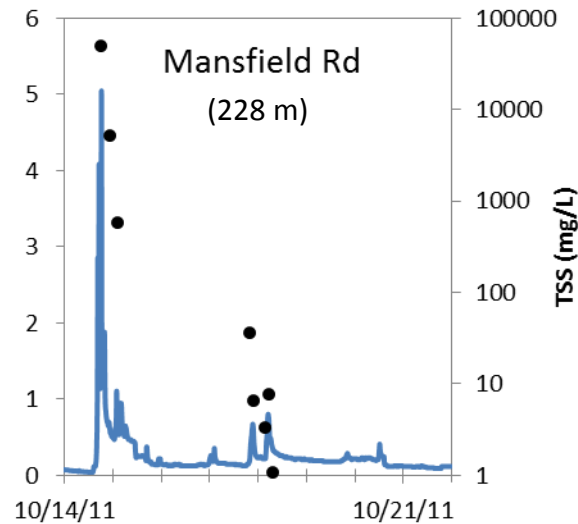
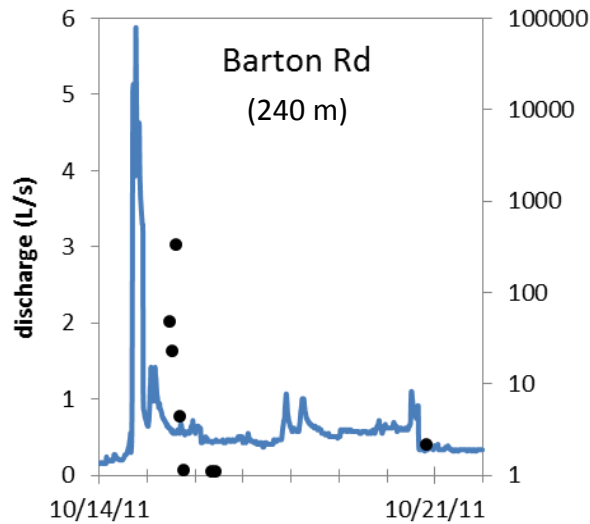
Research approach



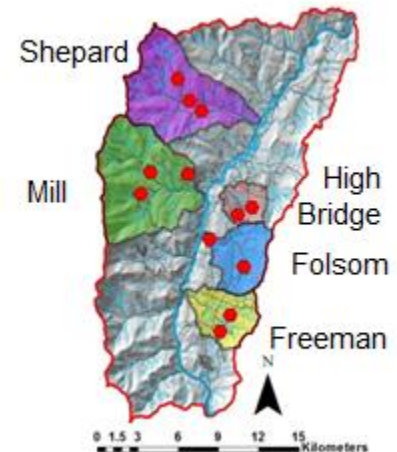
GIS mapping and analysis of stream geomorphic assessments



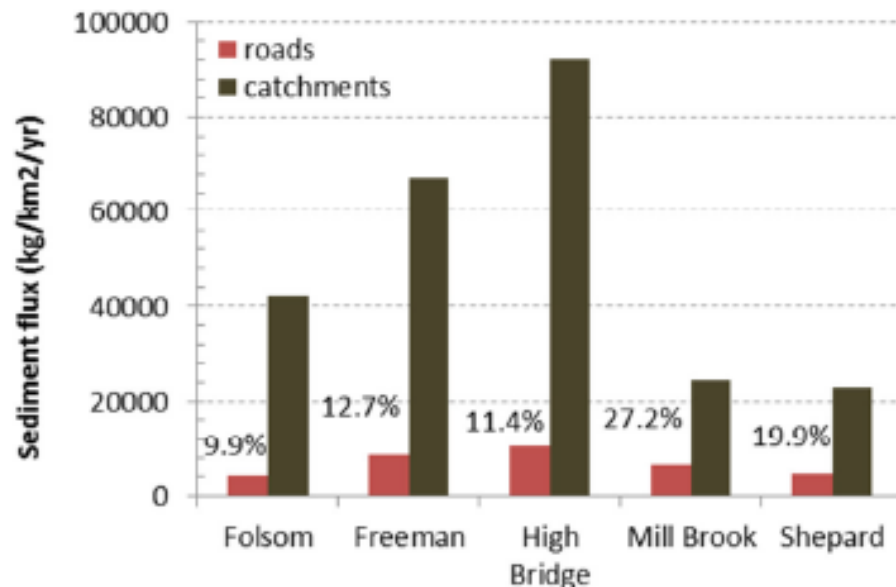
Runoff & sediment production



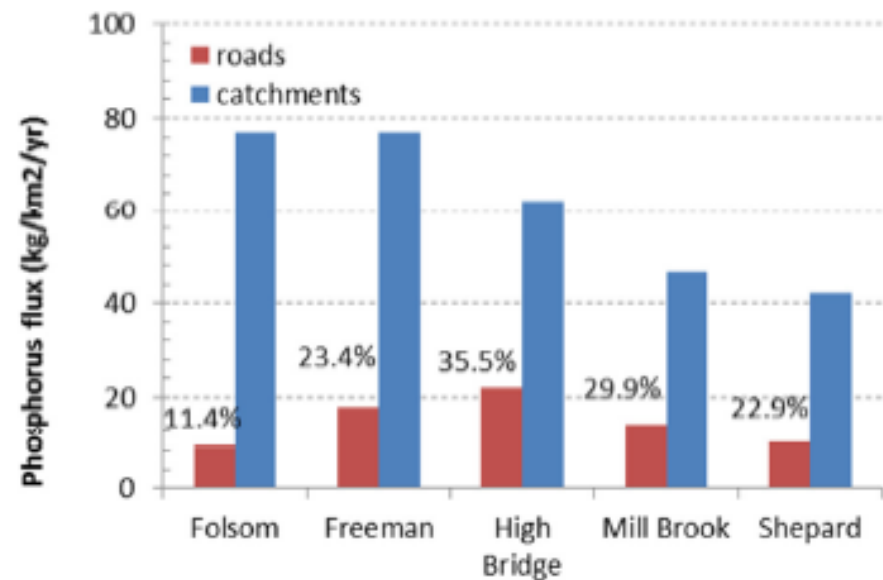
Back road contributions to sediment and phosphorus in streams



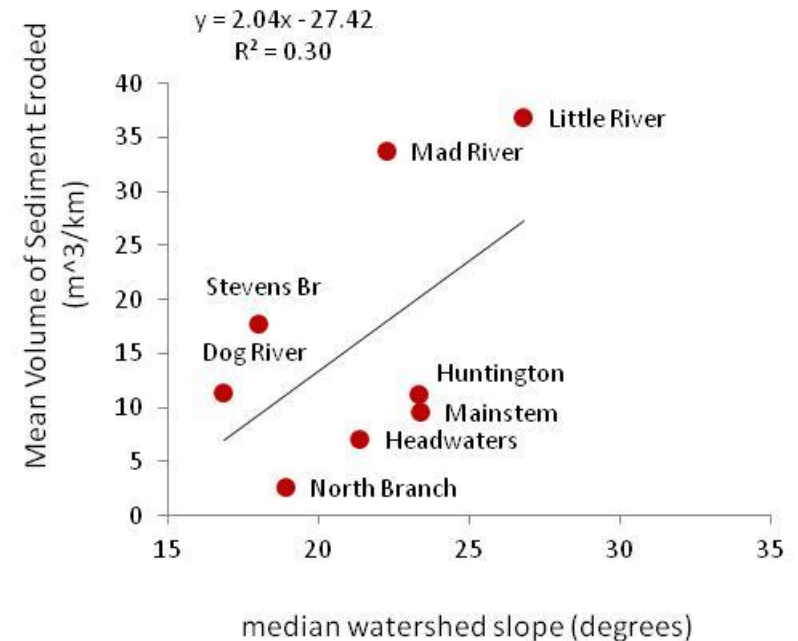
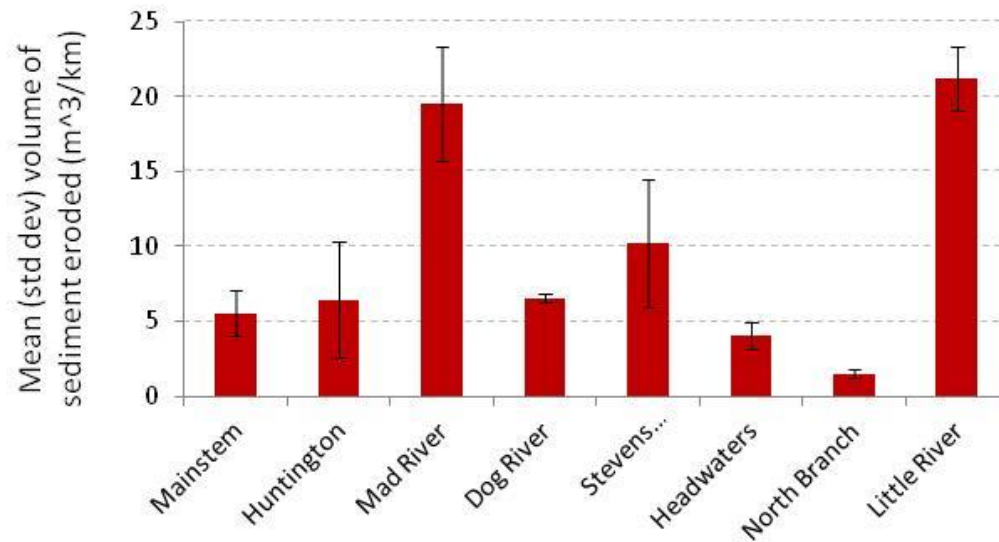
Suspended Sediment



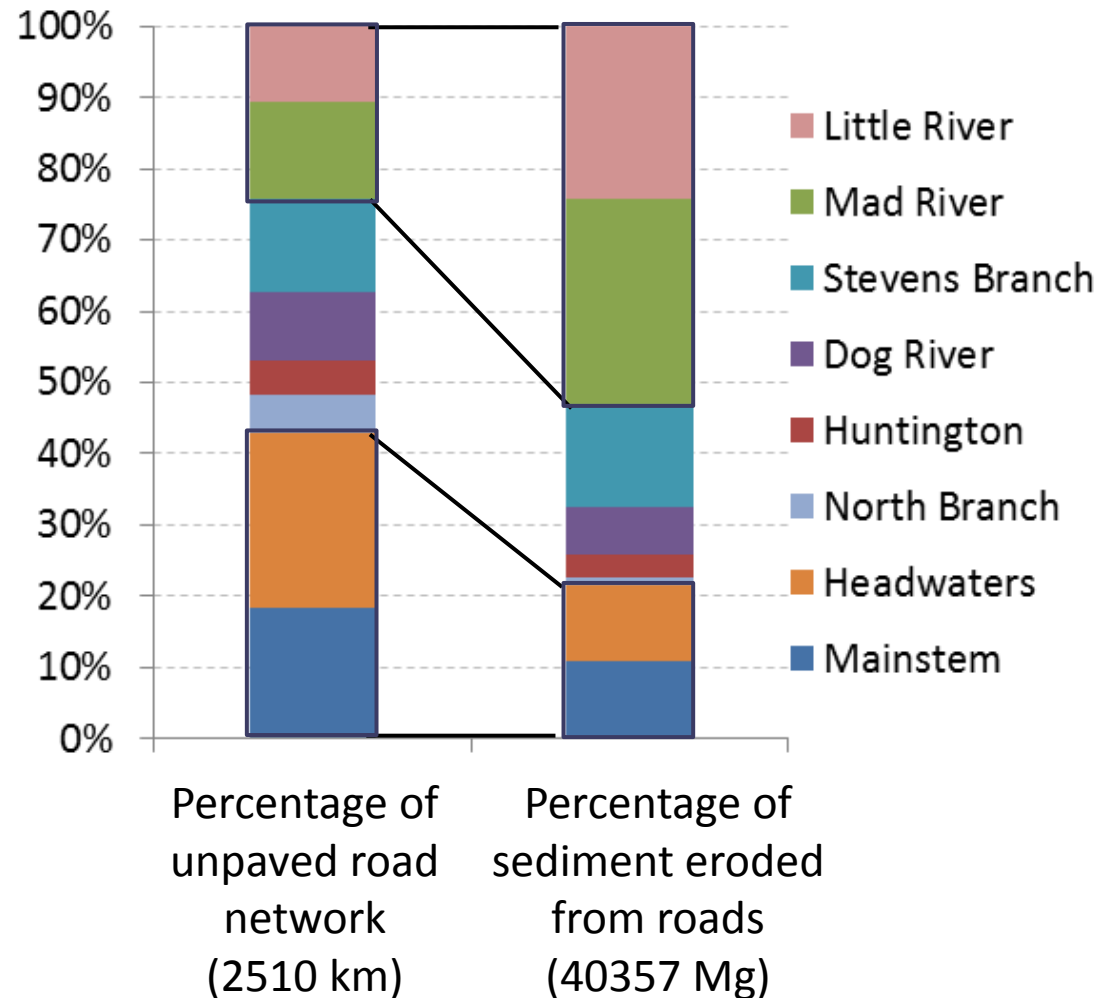
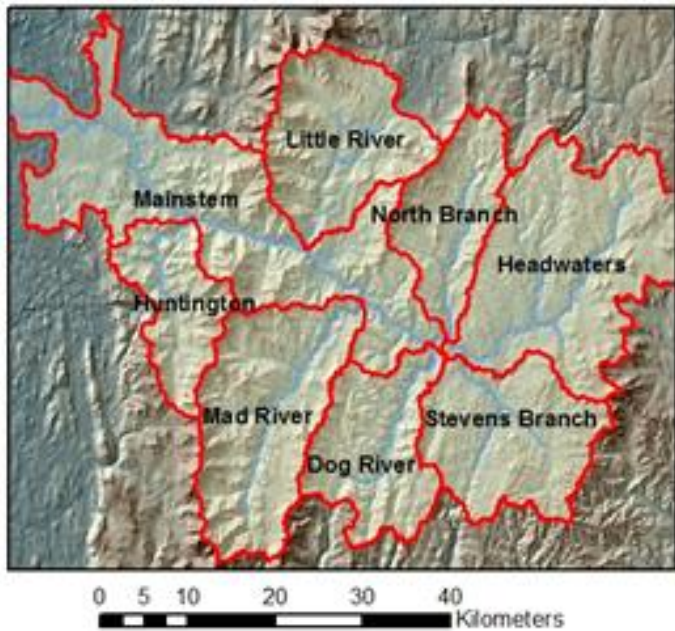
Total Phosphorus



Erosion on Vermont's back roads



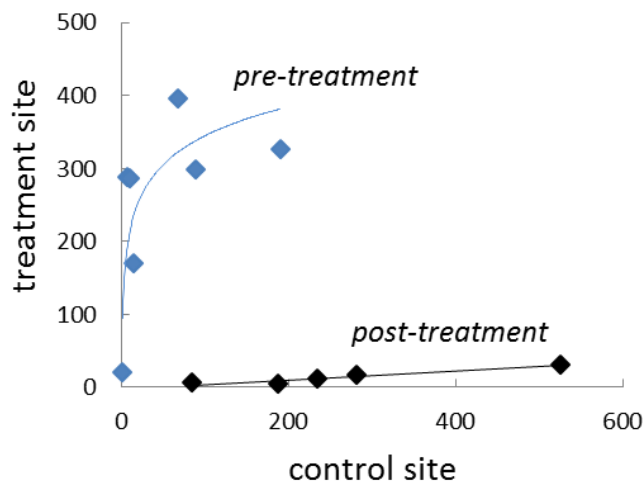
Identifying “hot spots” of erosion



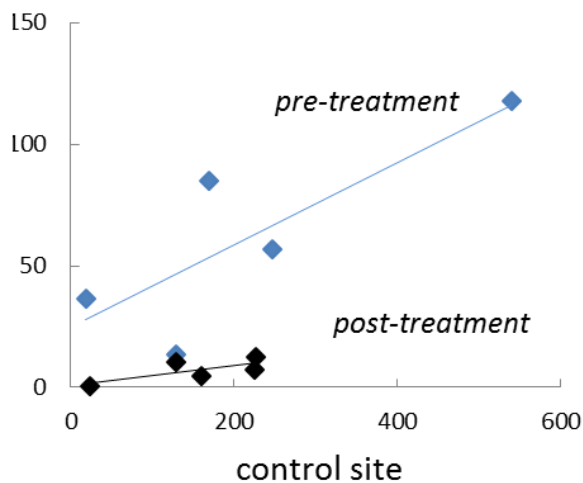
BMP effectiveness



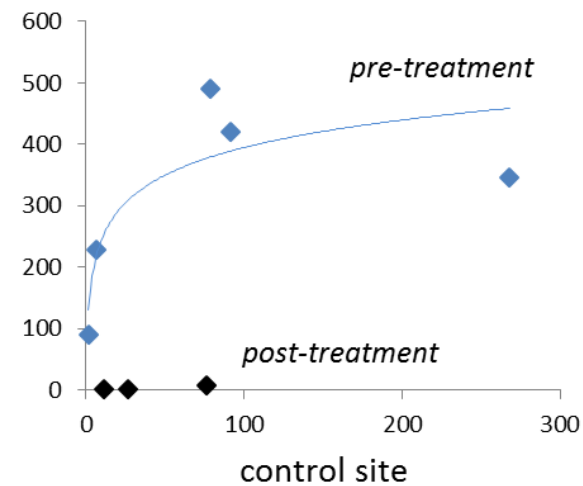
Randell



Kew Vasseur

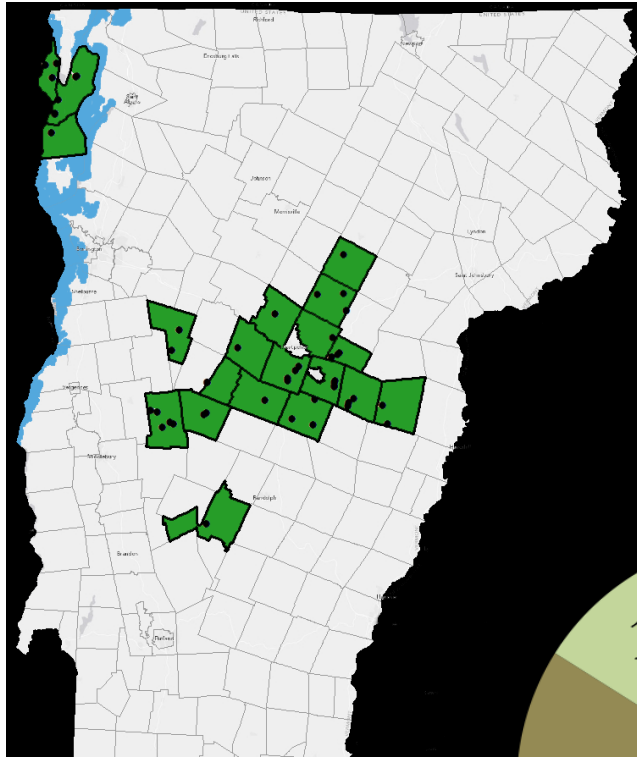


Ski Valley

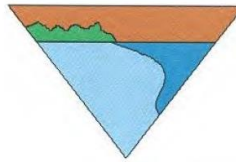


Sediment dry mass (kg)

BMP longevity



Vermont Better Backroads Manual
Clean Water You Can Afford



intact



compromised



failed

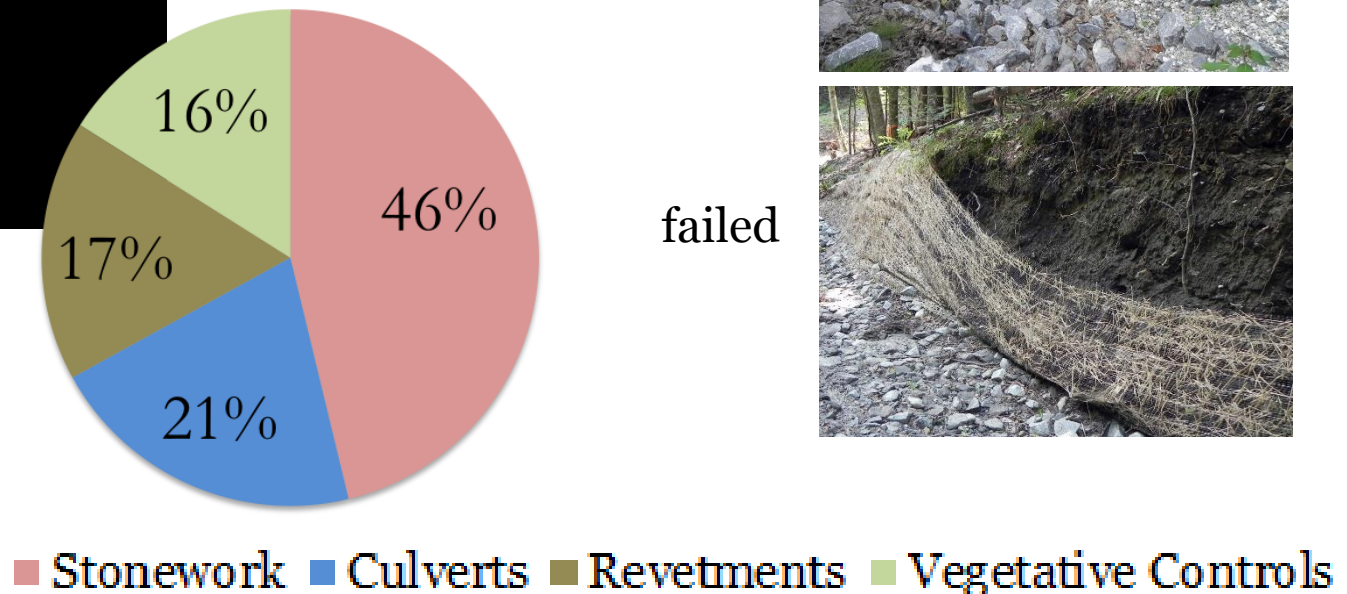


Field Visits

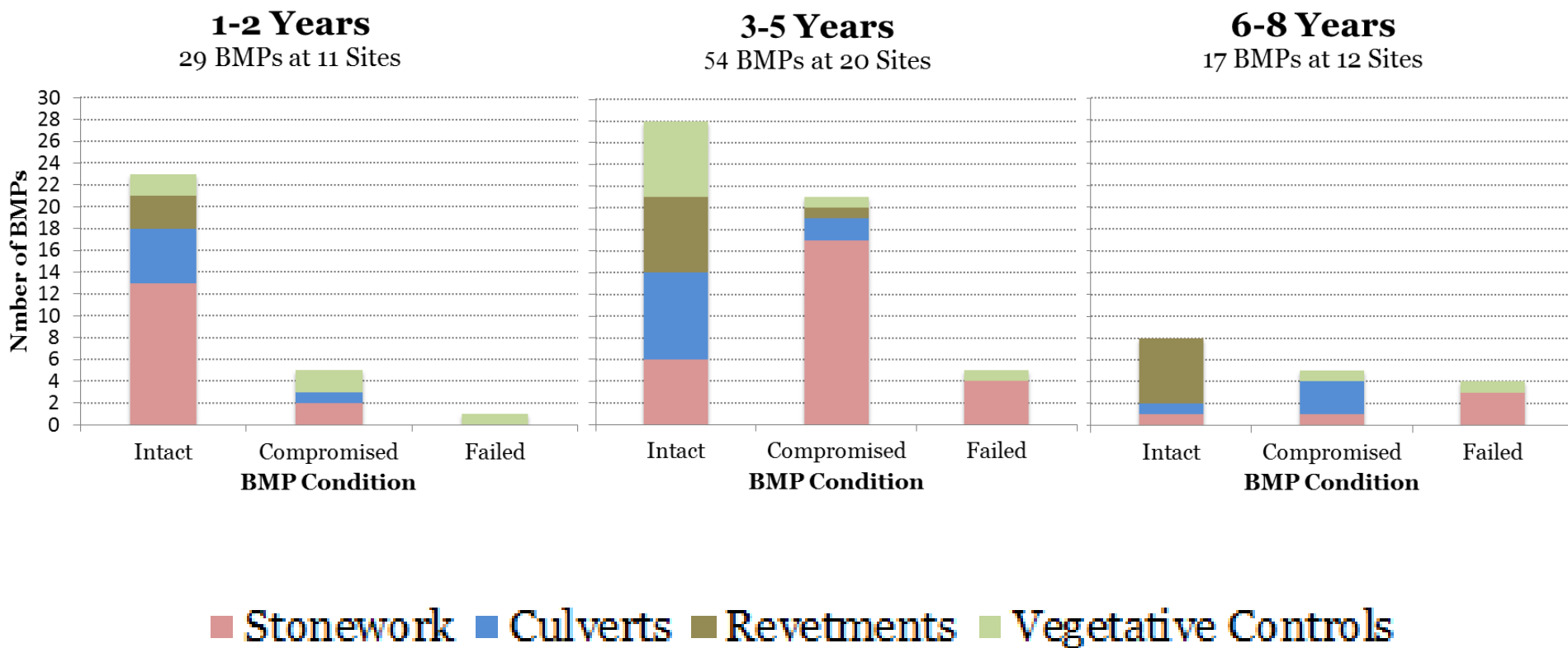
46 Sites

106 BMPs

Age 1-8 years



BMP persistence with time



BMP effectiveness with flood exposure



Flood Resilience in the Lake Champlain Basin and Upper Richelieu River

A comprehensive review of the 2011 flooding impacts on a watershed level to inform flood resilience policies and management strategies in the Lake Champlain Basin

2013

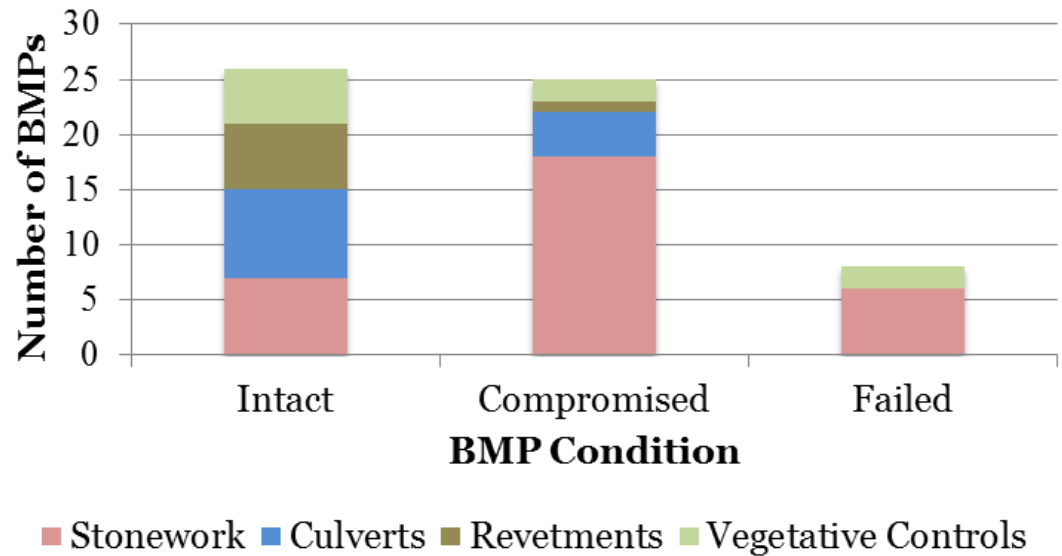
Learning from the Past, Preparing for the Future



Exposed to flood events

59 BMPs at 23 Sites

Average Age 4.8 years, SD 1.6

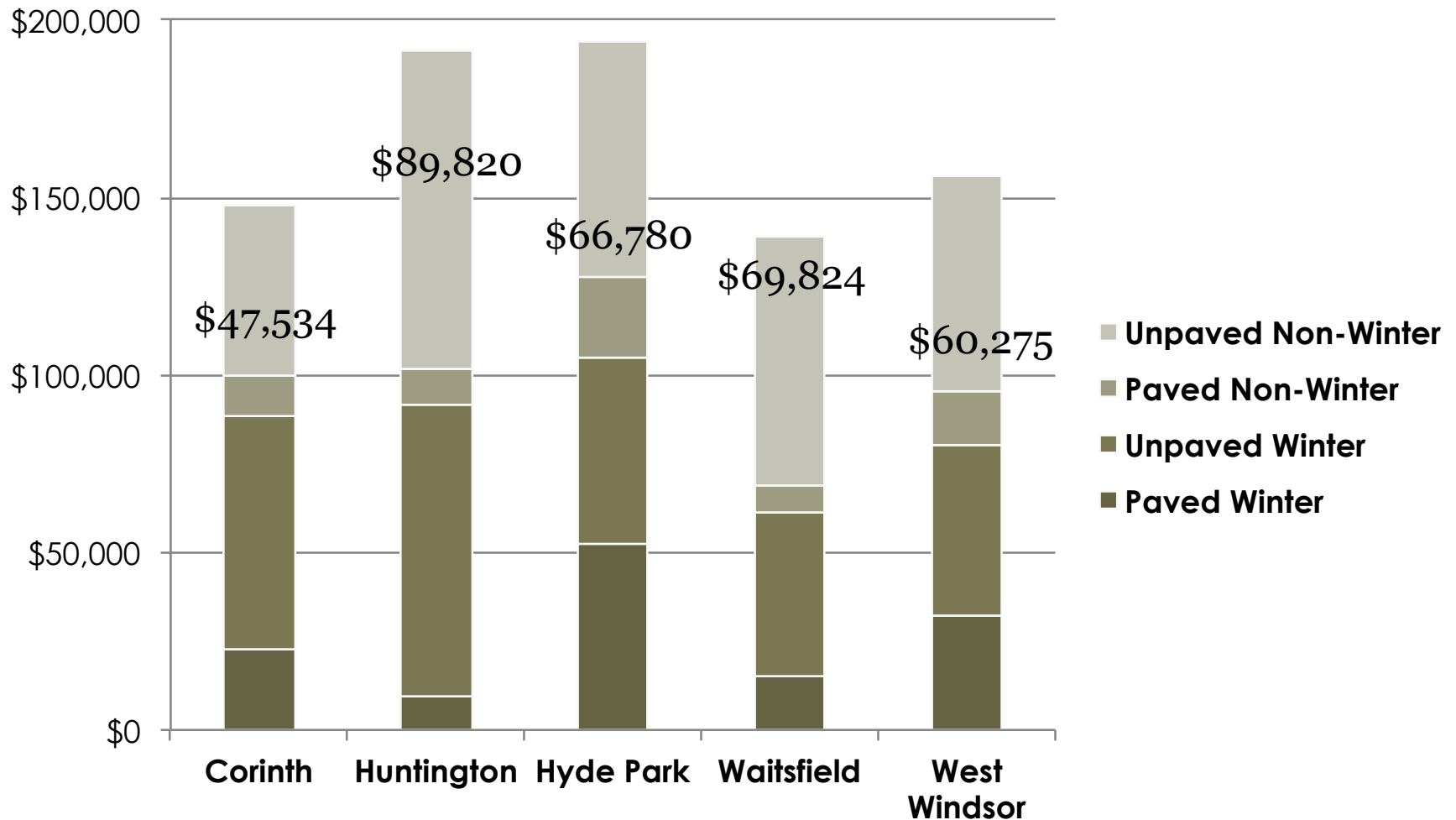


Road budget assessment

	Corinth	Huntington	Hyde Park	Waitsfield	West Windsor
Total Road Miles	93.74	43.96	63.45	29.67	51.28
% Unpaved	77	75	61	75	85
Population*	1,367	1,938	2,954	1,719	1,099
Road Budget (Year)	\$1,076,891 (FY 2014)	\$867,717 (FY 2013)	\$677,707 (FY 2014)	\$431,615 (CY 2013)	\$876,088 (CY 2013)
Budget \$/mile	\$11,488	\$19,739	\$10,680	\$14,547	\$17,084
Road crew Employees	3 FT 1 PT	4 FT	4 FT 1 PT	3 FT	3 FT 1 PT

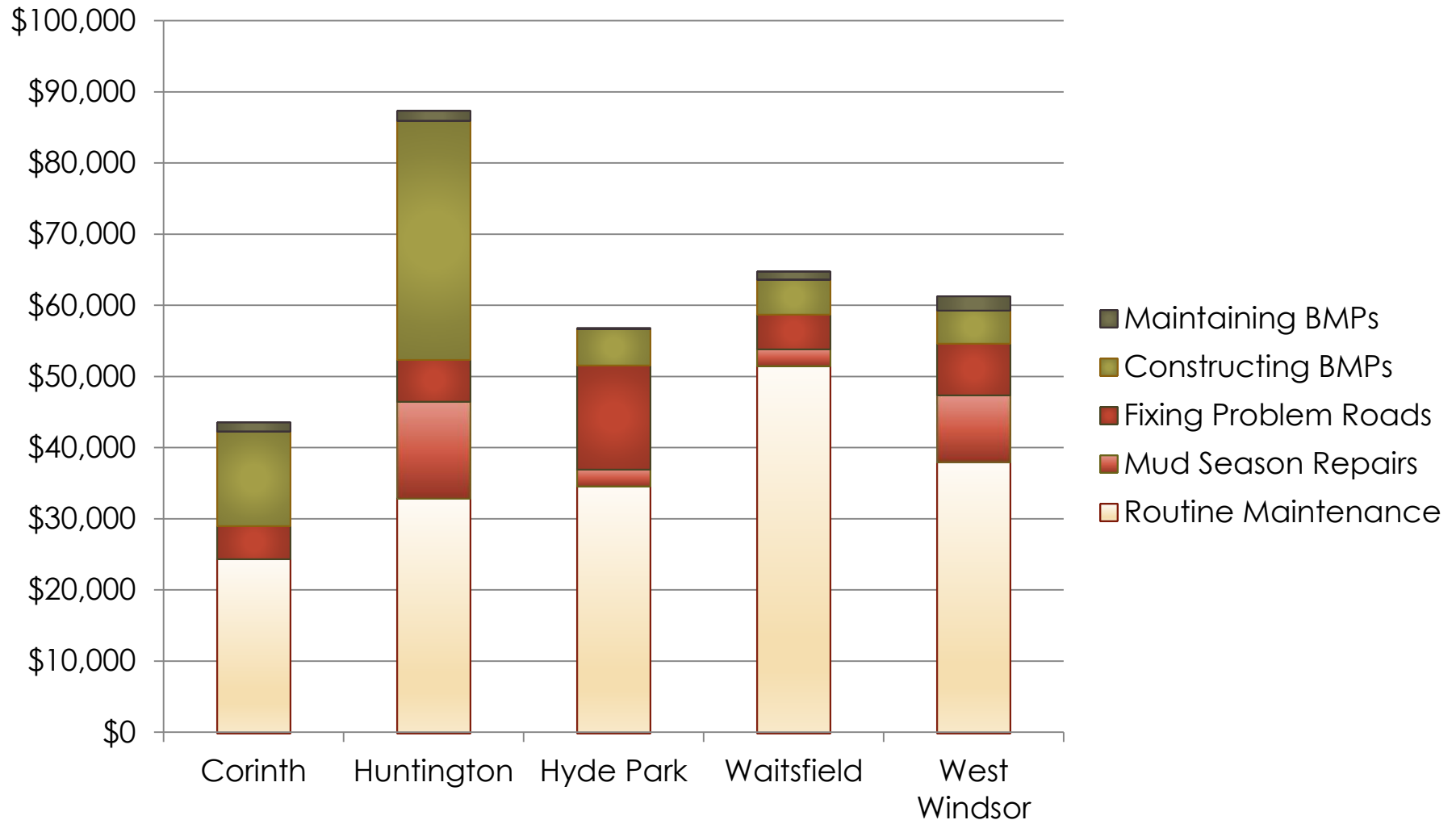
* Data from Vermont 2010 Census of Population and Housing

Annual road crew salary



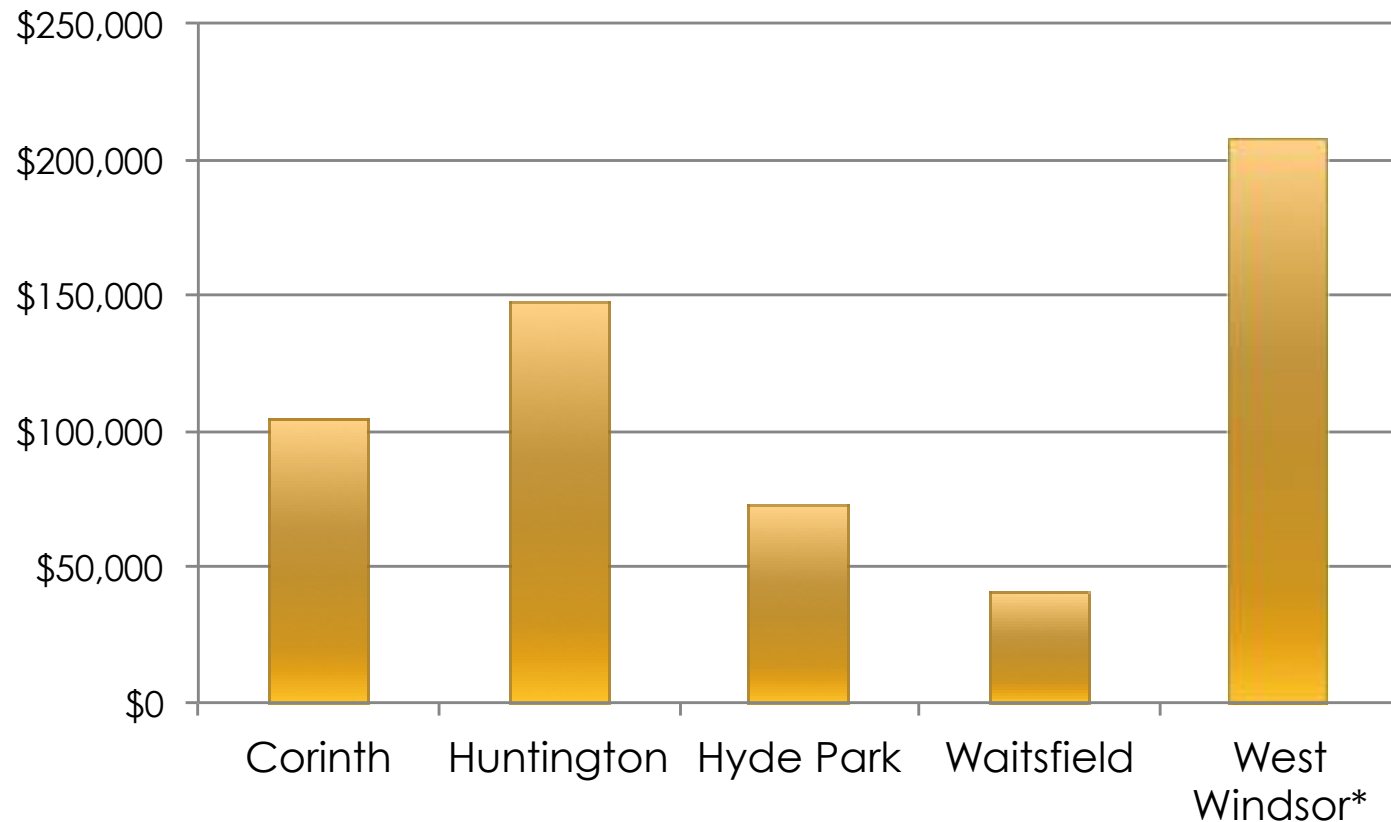
Distribution of road crew salary

by non-winter unpaved road maintenance tasks



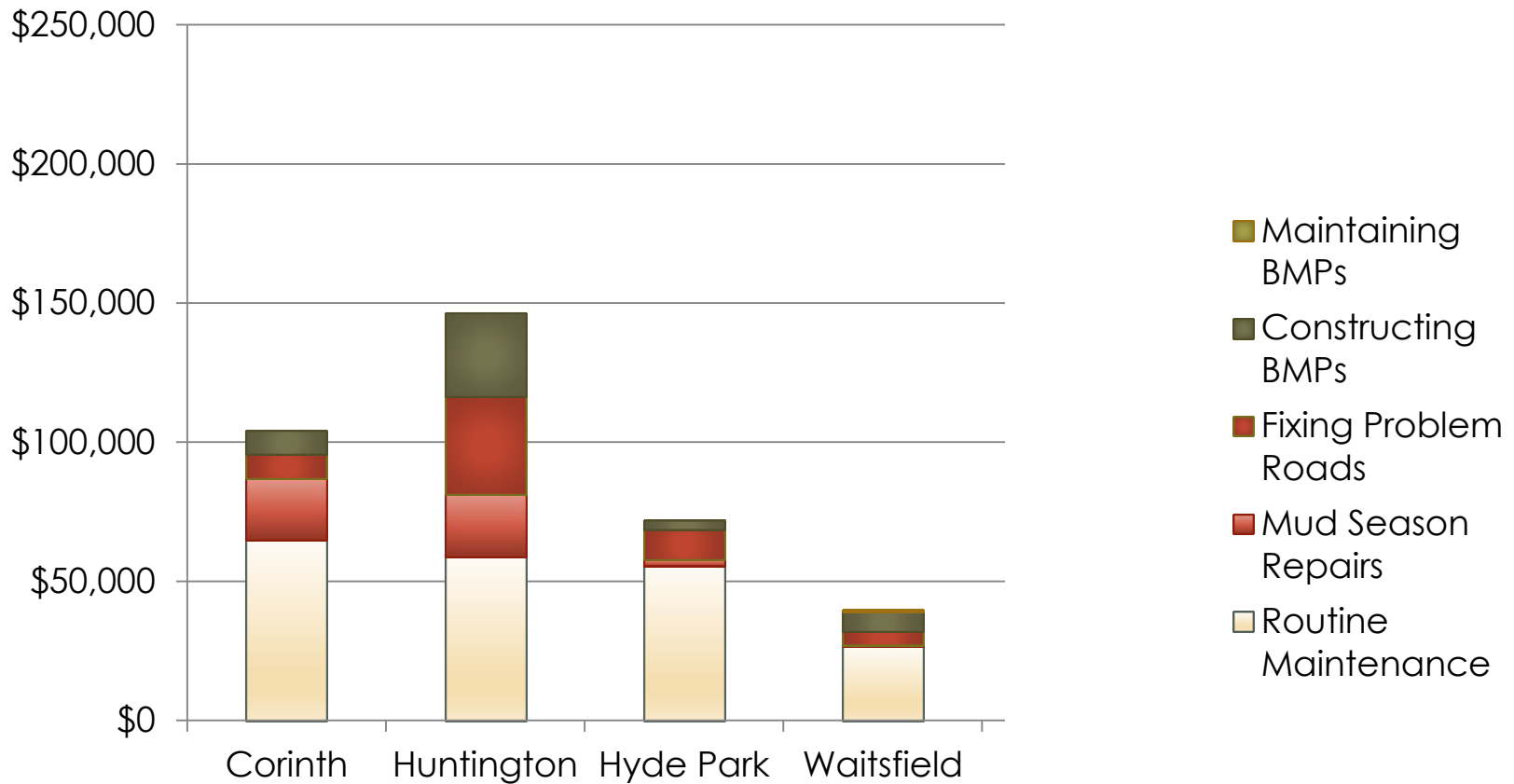
Annual materials costs

Non-Winter Unpaved Road Maintenance

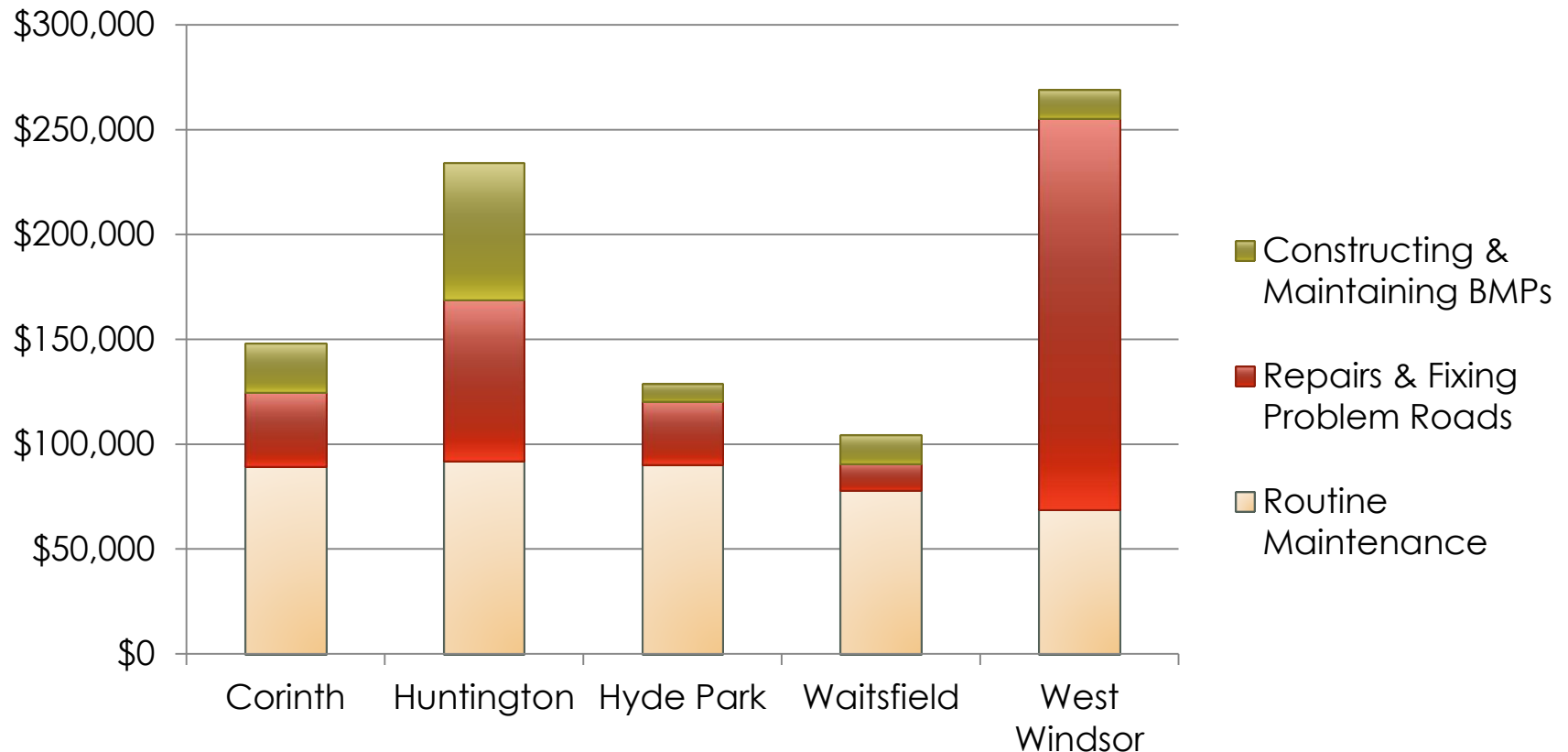


* West Windsor materials total includes \$55,686.81 of itemized equipment rental, materials and trucking as a needed after a 2013 flood event

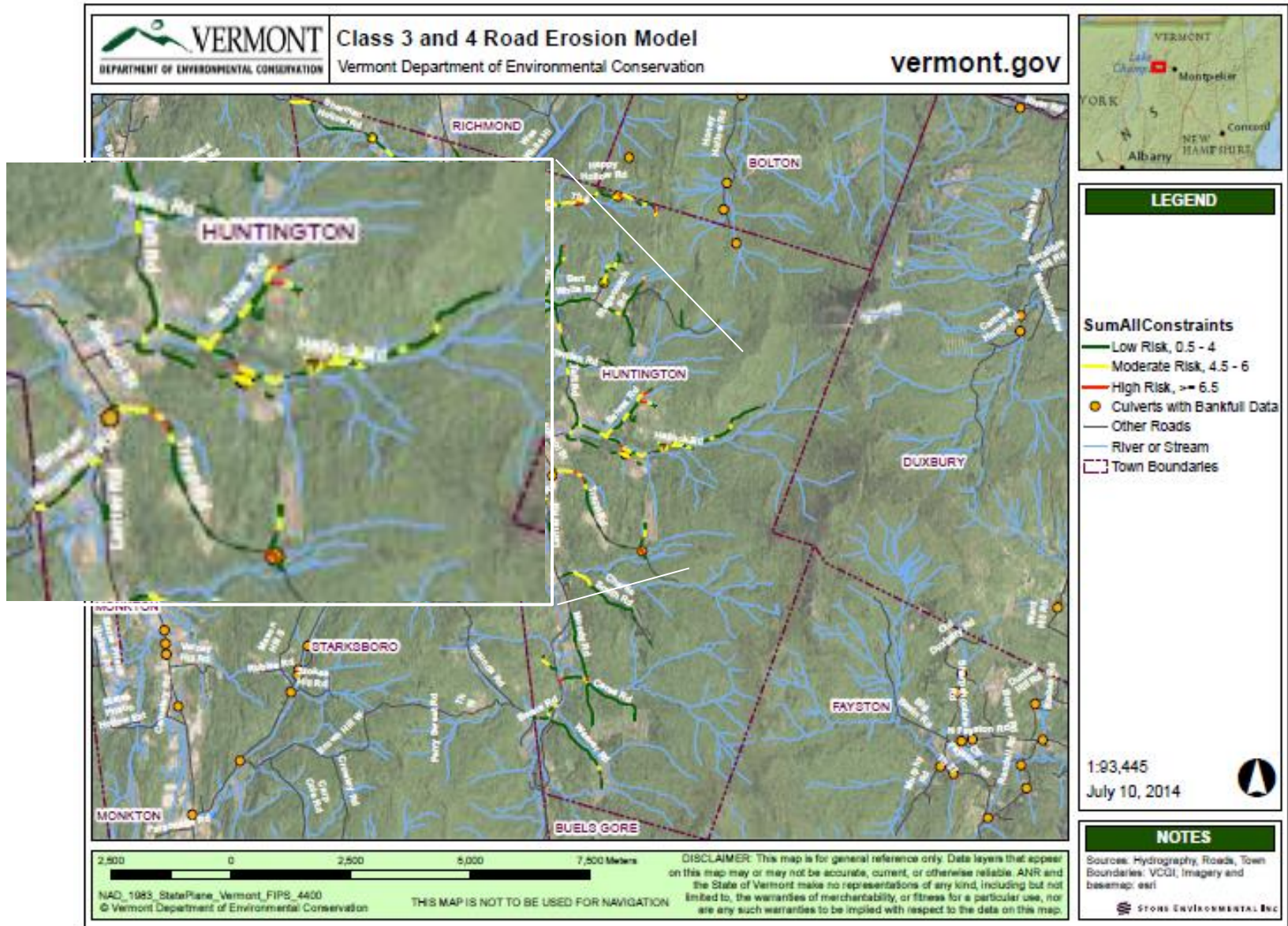
Distribution of materials costs by non-winter unpaved road maintenance tasks



Total salary and materials costs unpaved non-winter road work



Prioritization of back road treatments



“Ground truthing” prioritization

	Stone Environmental Ranking			
		High	Medium	Low
Field Ranking	High	8	8	8
	Medium	5	5	2
	Low	3	10	7
	No Priority*	10	5	10

A “No Priority” ranking was assigned if the road is:

- Paved
- No longer has an erosion-related problem
- A class 4 road or private driveway not maintained by the town

- 20 of the 56 assessed roads that towns must maintain earned matching ranks
- Class 4 roads and driveways pose risks to water quality

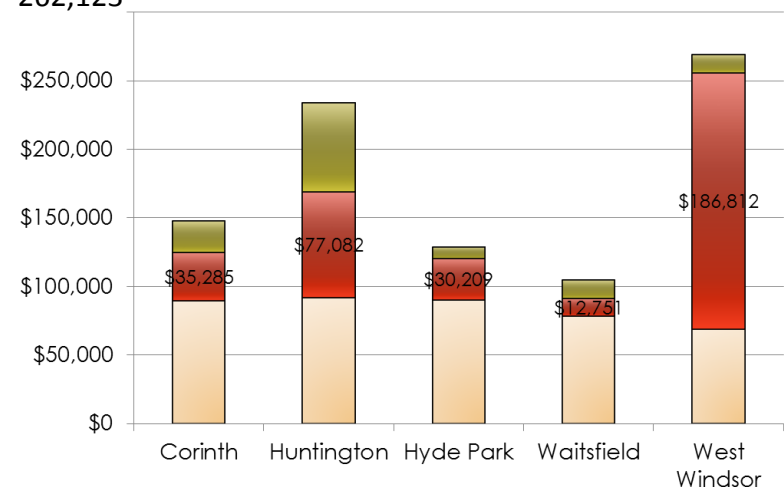
Estimated need & treatment costs

	Corinth	Huntington	Hyde Park	Waitsfield	West Windsor
Estimated mileage					
High priority	2.02	1.34	1.47	1.23	2.59
Medium priority	13.71	6.40	5.13	7.13	9.93
Low priority	57.61	22.76	32.48	18.83	38.21

Cost of treatment (@ \$4000/100 feet)					
High priority	\$425,675	282,816	311,452	260,529	546,174
Medium priority	\$2,895,892	1,351,951	1,083,773	1,505,657	2,096,981

Treatment cost over 8 years					
High	\$53,209	35,352	38,932	32,566	68,272
Medium	\$361,987	168,994	135,472	188,207	262,123

- Constructing & Maintaining BMPs
- Repairs & Fixing Problem Roads
- Routine Maintenance



Summary

- Vermont's back roads have meaningful effects on water quality
- Storm damage and on-going repairs strain local budgets
- “Problem” or “high priority” sites represent small fraction of the network
- BMPs reduce water quality impacts and last over time
- Benefits to be achieved by moving from reactive (fixing problems) to pro-active (BMP-based) approach
- Broader investment (capital and training) needed to address downstream WQ benefits and build resilience

Acknowledgements

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- Leslie Morrissey, Rubenstein School, UVM

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