

Mid Winooski River Watershed Phase 2 Stream Geomorphic Assessment & River Corridor Planning

Waterbury, Vermont



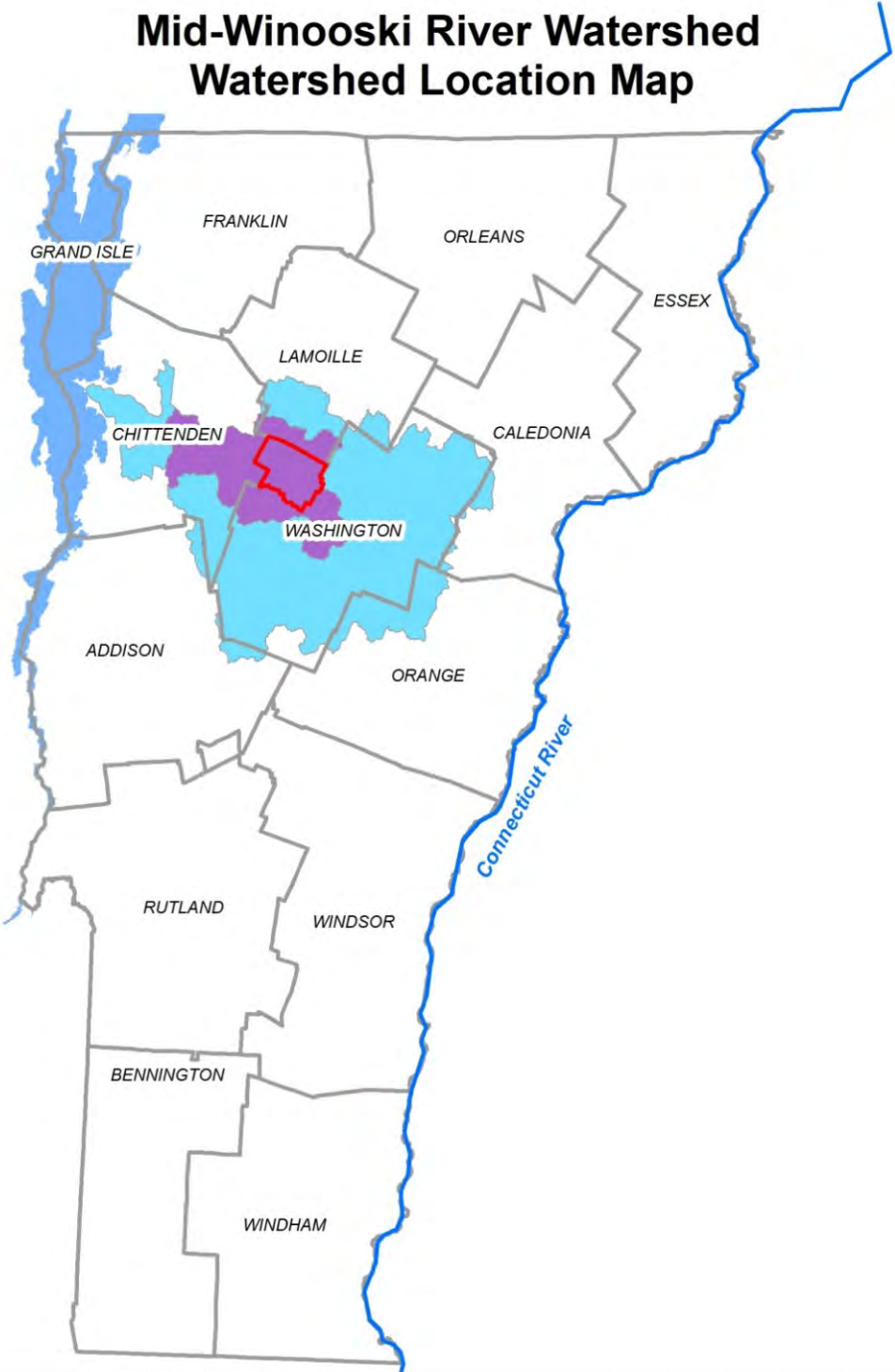
Bear Creek Environmental



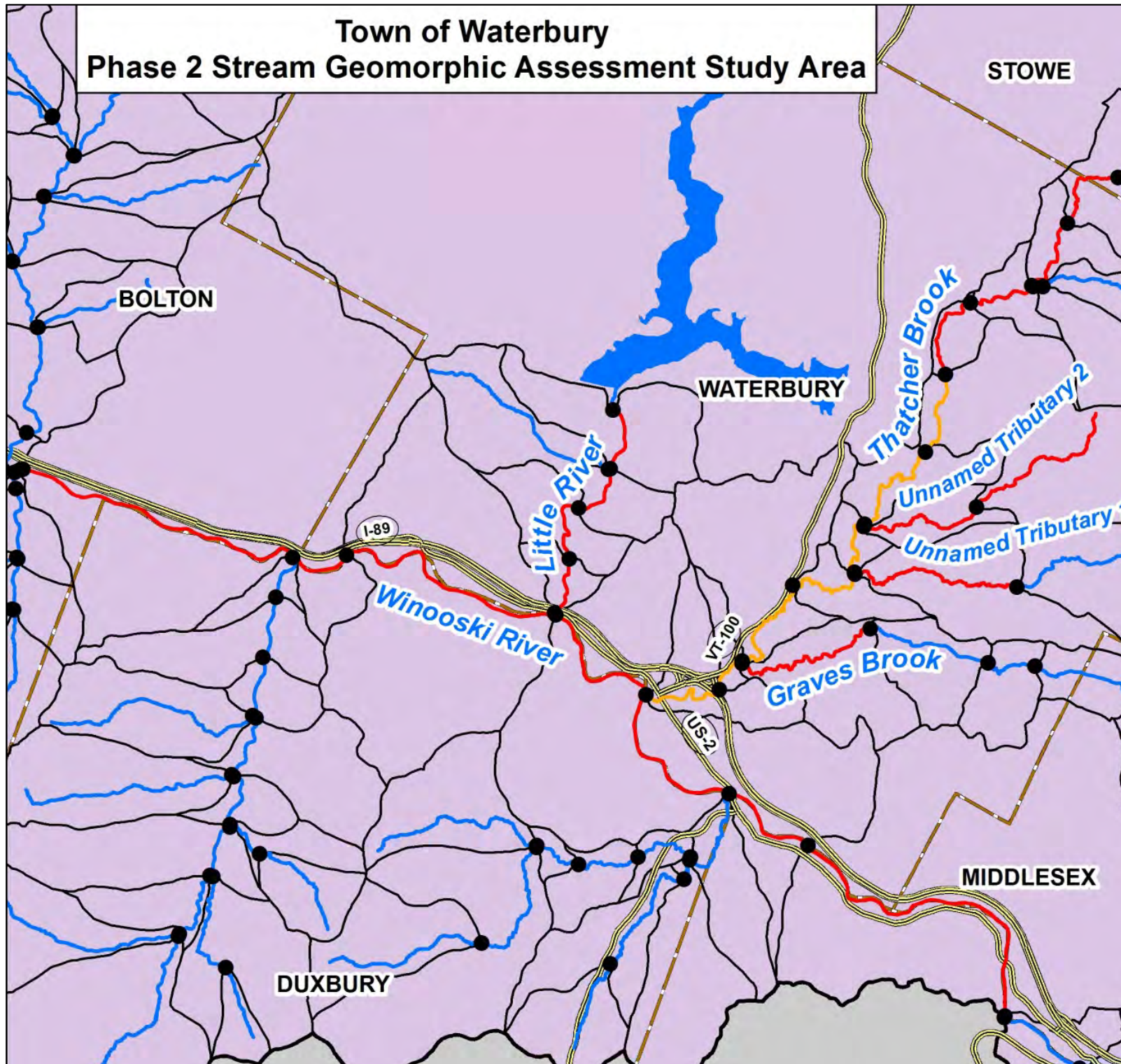
Funding provided by the Vermont Department of
Environmental Conservation – Watershed
Management Division



Mid-Winooski River Watershed Watershed Location Map



**Town of Waterbury
Phase 2 Stream Geomorphic Assessment Study Area**



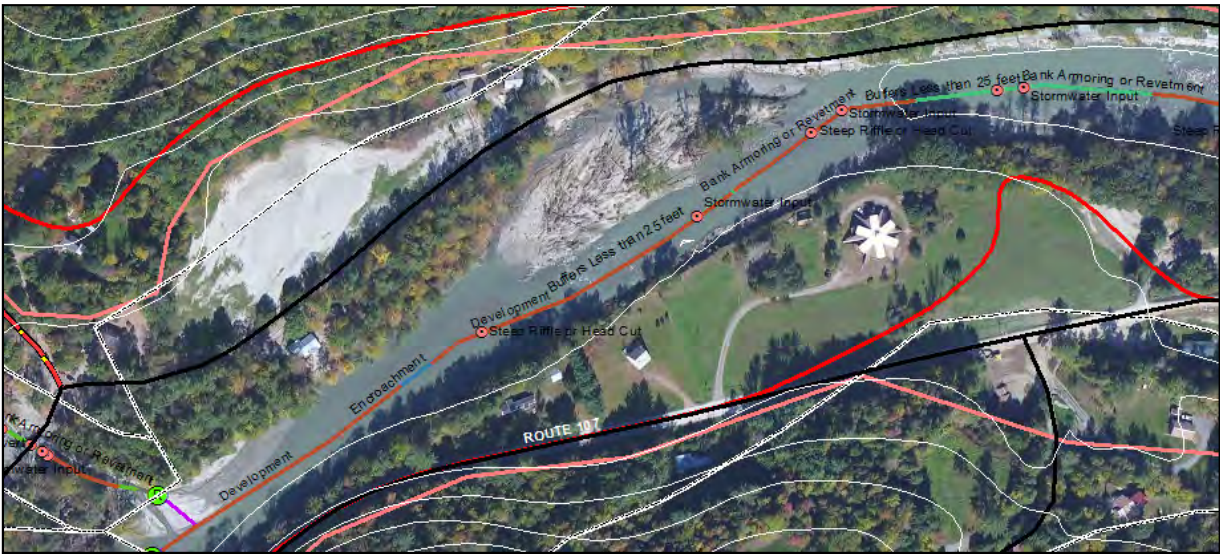
Study included
31 river miles

25 miles
assessed in 2014;
6 assessed in
2010

Fluvial Geomorphology

- Fluvial – of or produced by flowing water
- Geo – the earth
- Morph – form, shape, structure
- Ology – the science

The science of how flowing water shapes the earth.



Phase 1



Phase 2

| Project Category | Number of Proposed Projects |
|--|-----------------------------|
| Floodplain Improvement and Conservation | 40 |
| Public Safety Improvement | 1 |
| Stream Channel Improvement and Restoration | 8 |
| Structure Replacement/ Removal | 10 |
| Total Number of Projects | 59 |

River Corridor Planning



Output from Assessment

- Important Features & Impacts
- Bridge & Culvert Data
- Geomorphic and Habitat Condition
- River Corridor Plan
- Restoration & Protection Projects

River Corridors

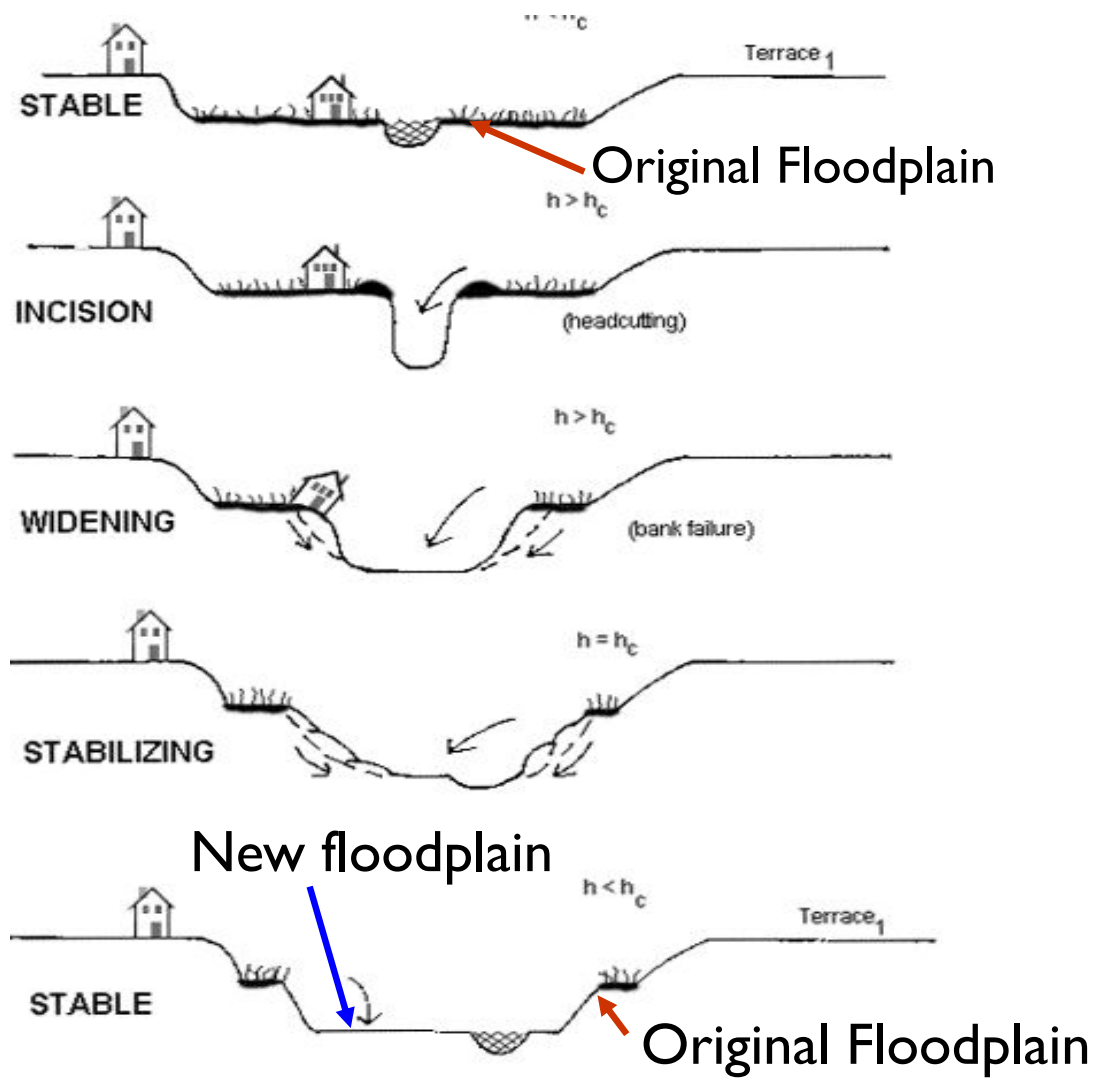


Tropical Storm Irene



Photos from Seven Days

The Channel Evolution Process



- Equilibrium
- Incision
- Widening
- Narrowing
- Equilibrium

Functioning Floodplains

Provide

- Floodwater storage
- Sediment storage
- Nutrient filtration
- Release of in-channel energy

Loss of floodplain causes

- Increased flow in channel
- Increased erosive forces along river banks



Photo of Winooski River following Irene from Mansfield Heliflight

Phase 2 Geomorphic Condition



Geomorphically stable – Upper Thatcher Brook
R13.SI.02-SI.09-A



Geomorphically unstable – Upper Unnamed Tributary #2 to
Reach 3 of Thatcher Brook – R13.SI.02-SI.03-SI.02-C

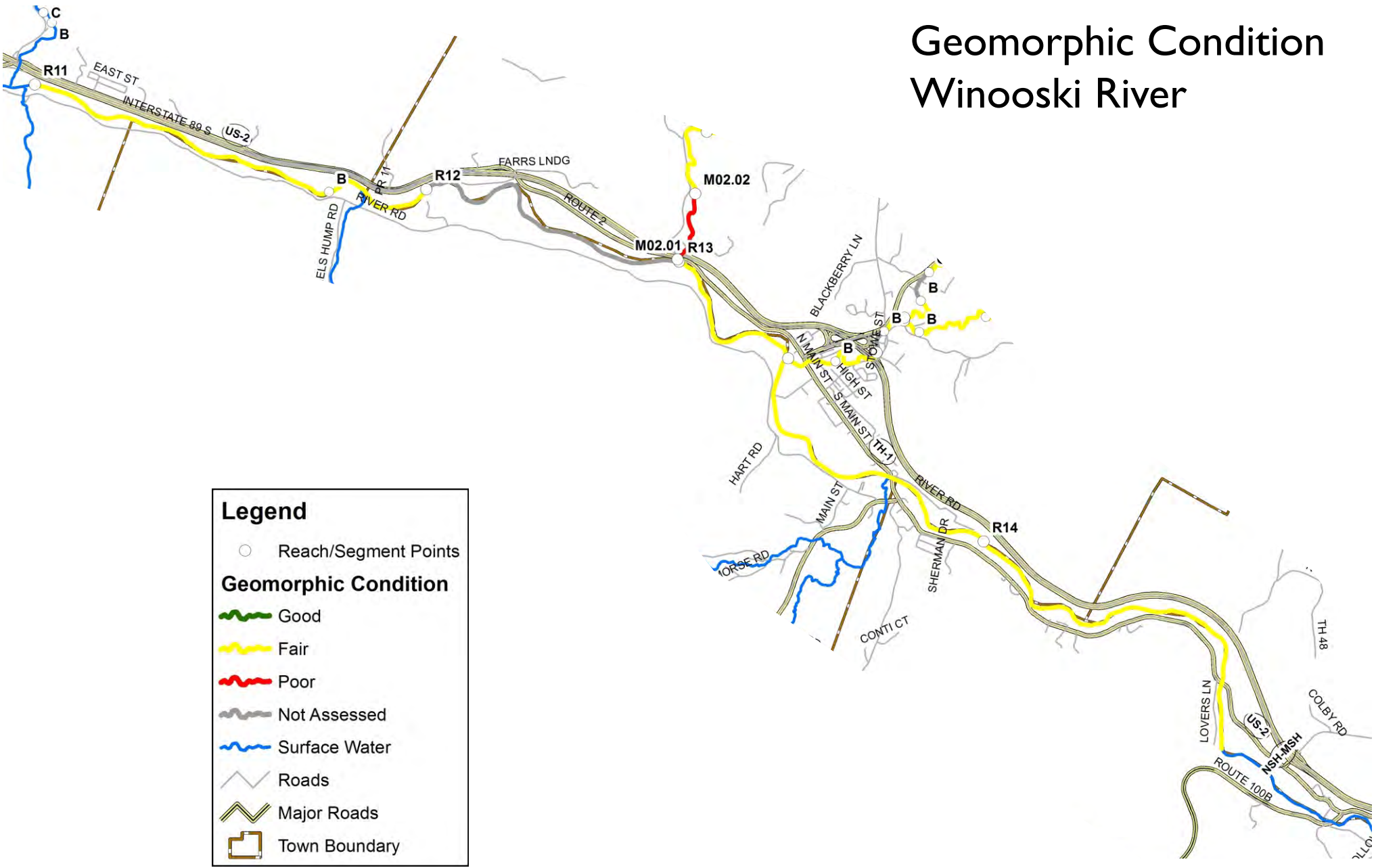
Reference – no departure

Good – minor departure

Fair – major departure

Poor – severe departure

Geomorphic Condition Winooski River



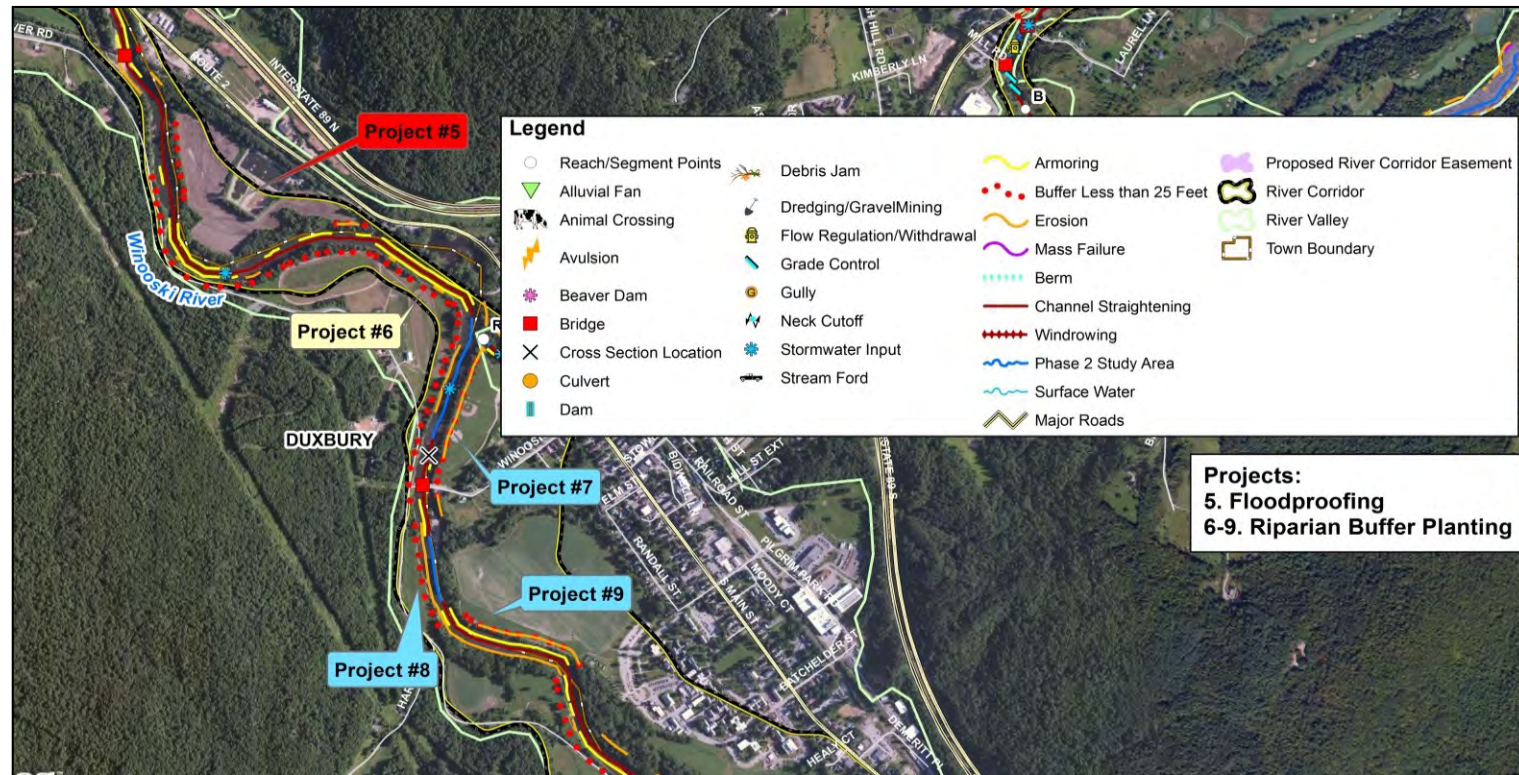
Legend

- Reach/Segment Points
- Geomorphic Condition**
- ▬ Good
- ▬ Fair
- ▬ Poor
- ▬ Not Assessed
- ▬ Surface Water
- ▬ Roads
- ▬ Major Roads
- ▬ Town Boundary

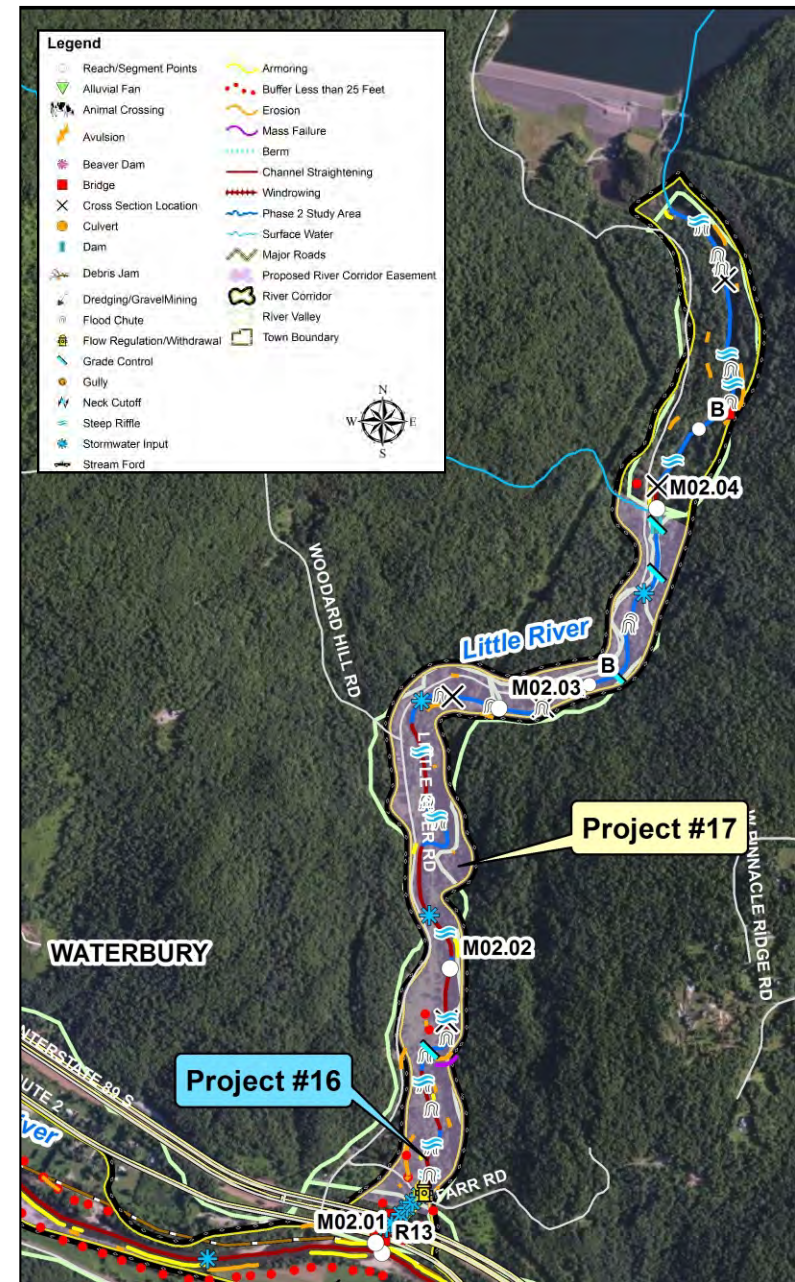
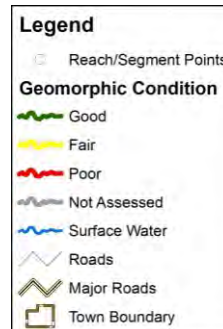
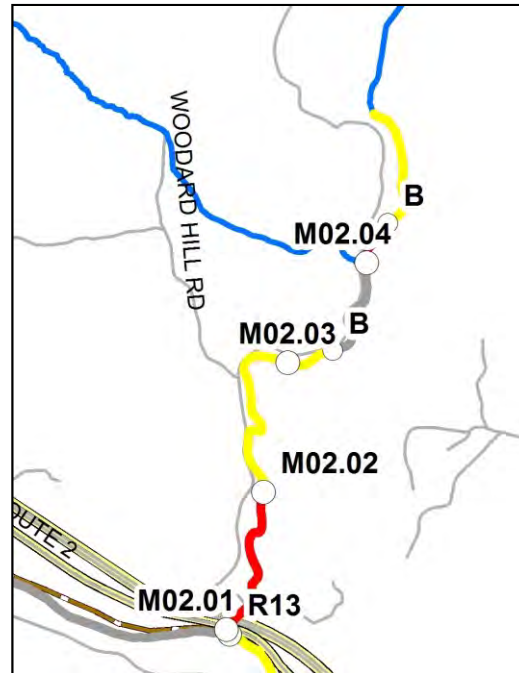


The Winooski River

Project Priority:
 Low
 Moderate
 High

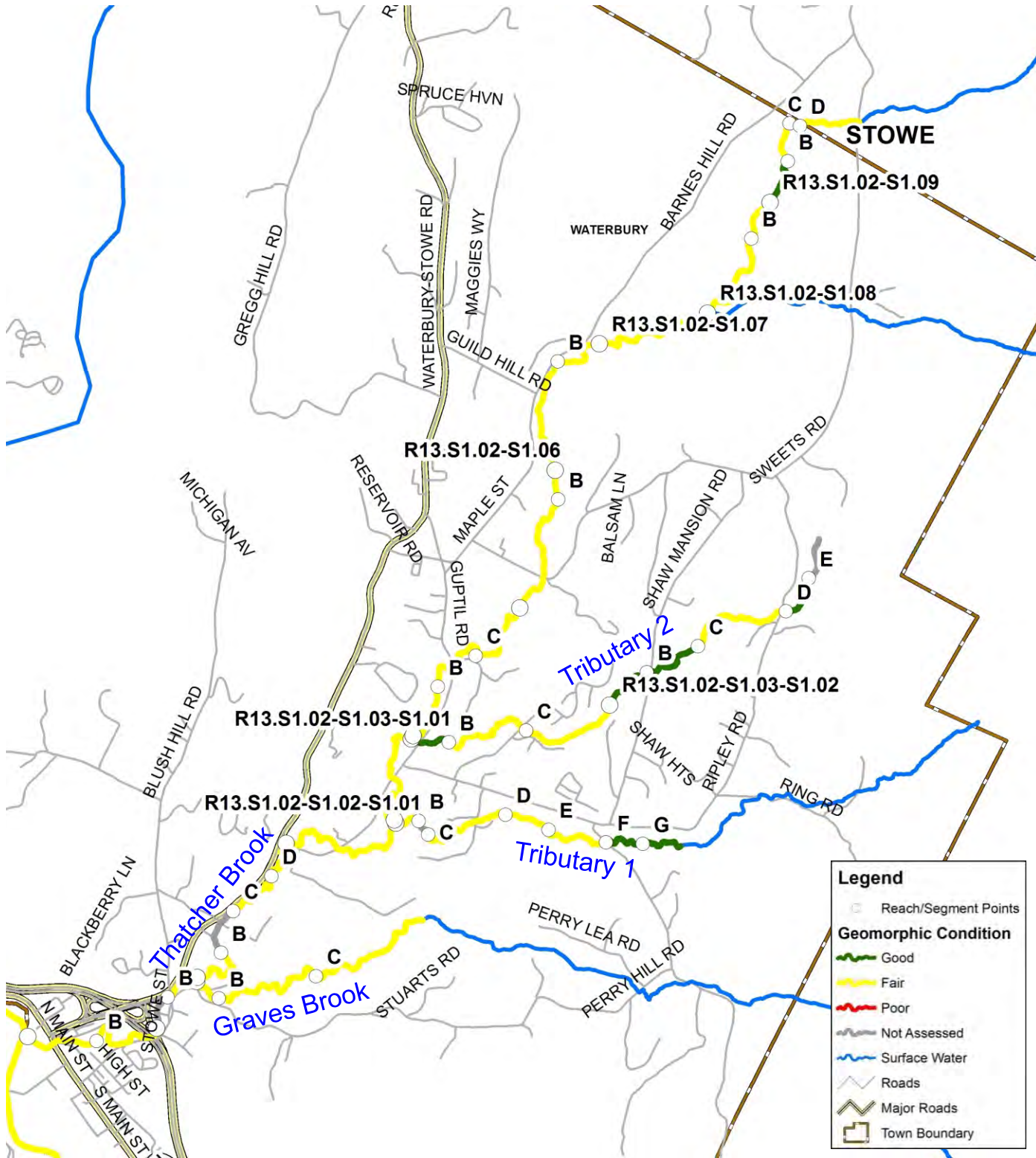


The Little River



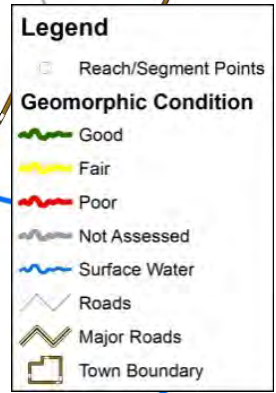
Project Priority:
 Low
 Moderate
 High

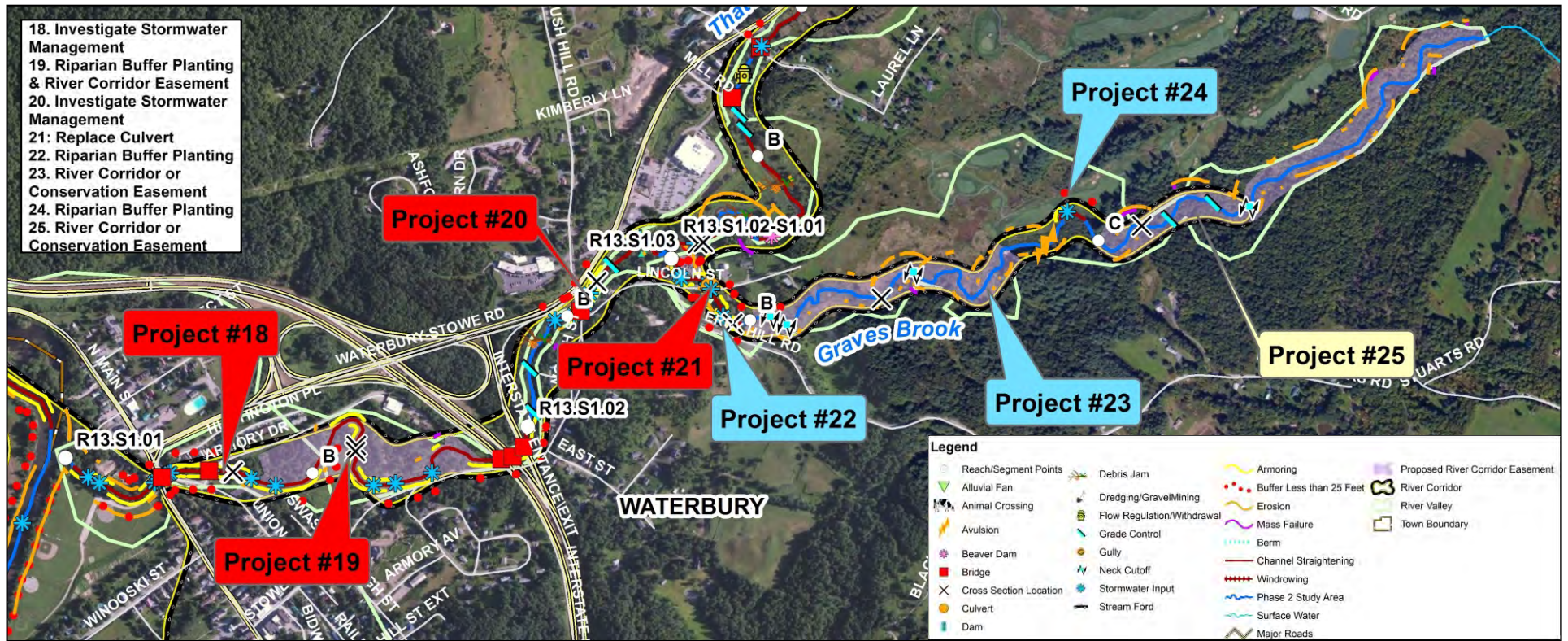
16. Create Floodplain
 17. River Corridor or Conservation Easement (Eastern Side)



Geomorphic Condition

Graves Brook
 Thatcher Brook
 and Thatcher Brook Tributaries

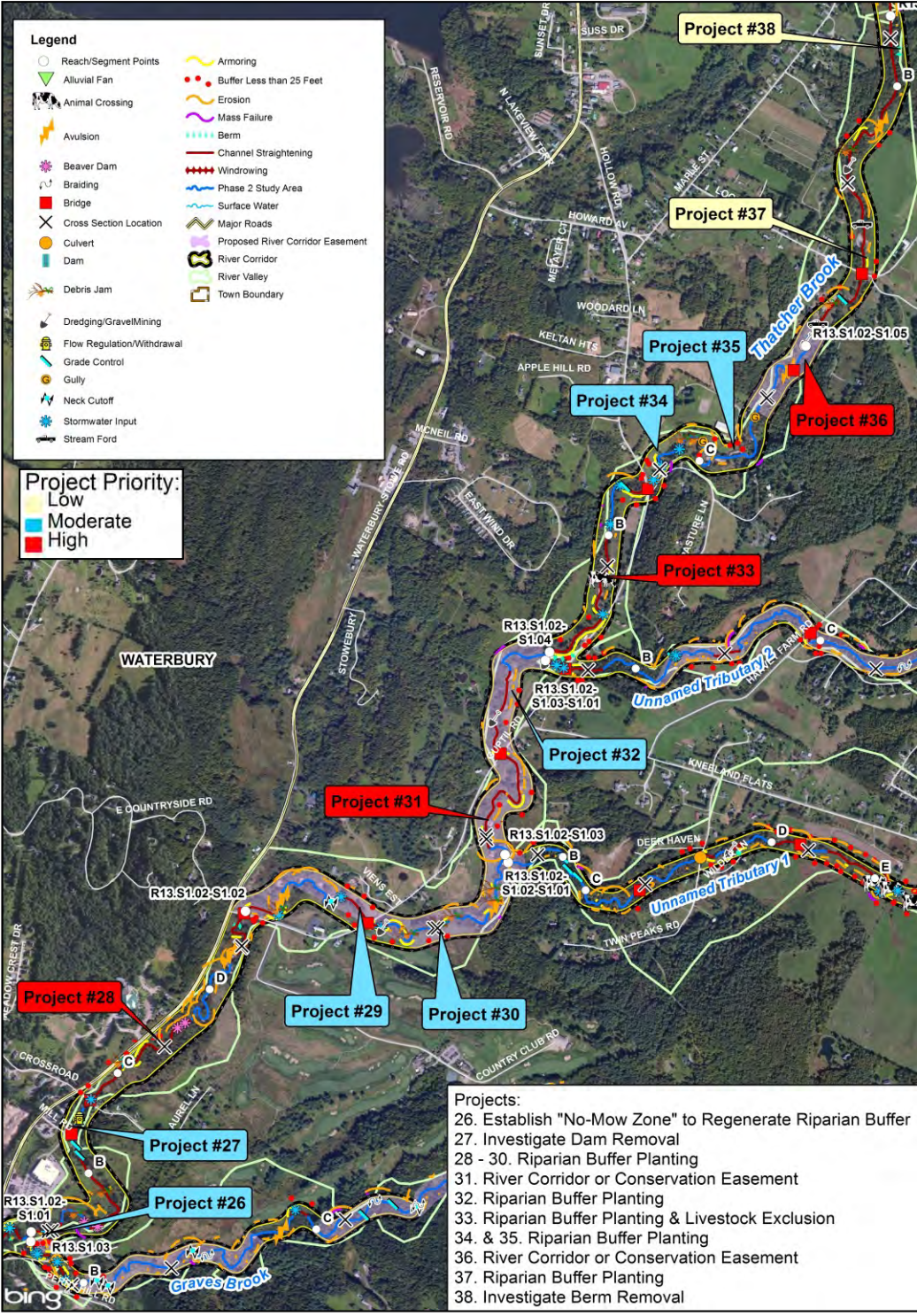




Graves Brook

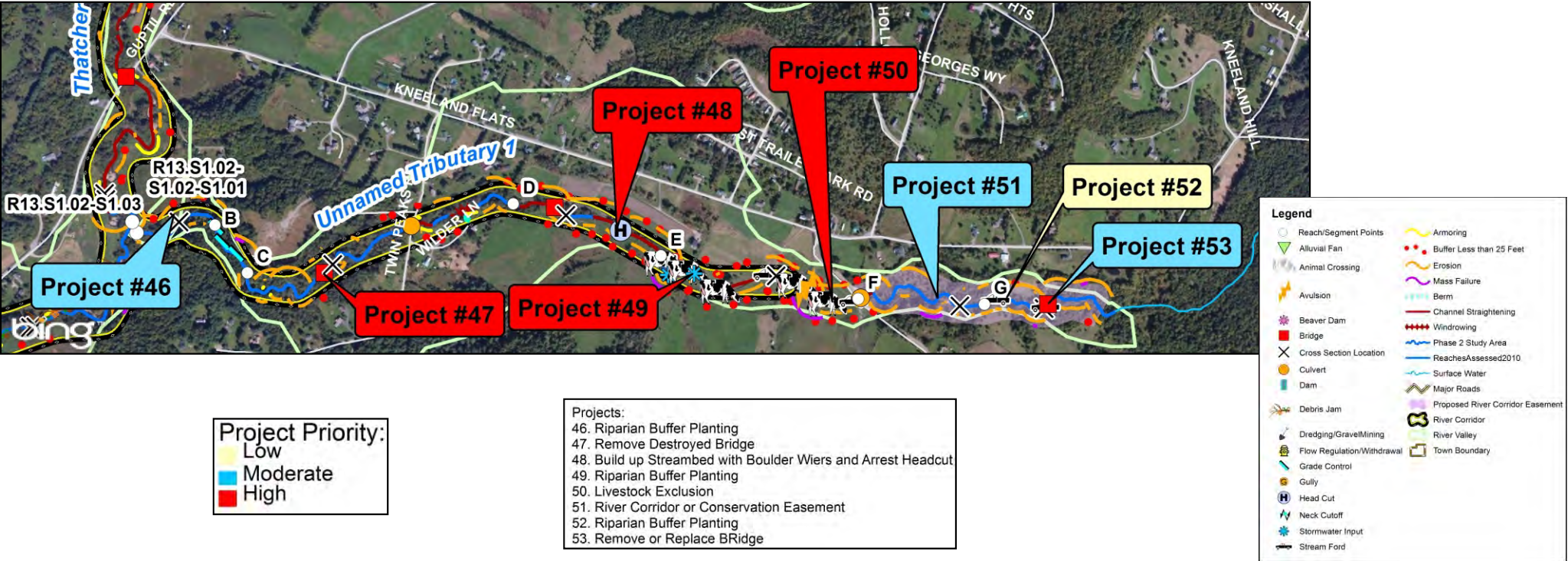


Thatcher Brook





Unnamed Tributary I to Thatcher Brook

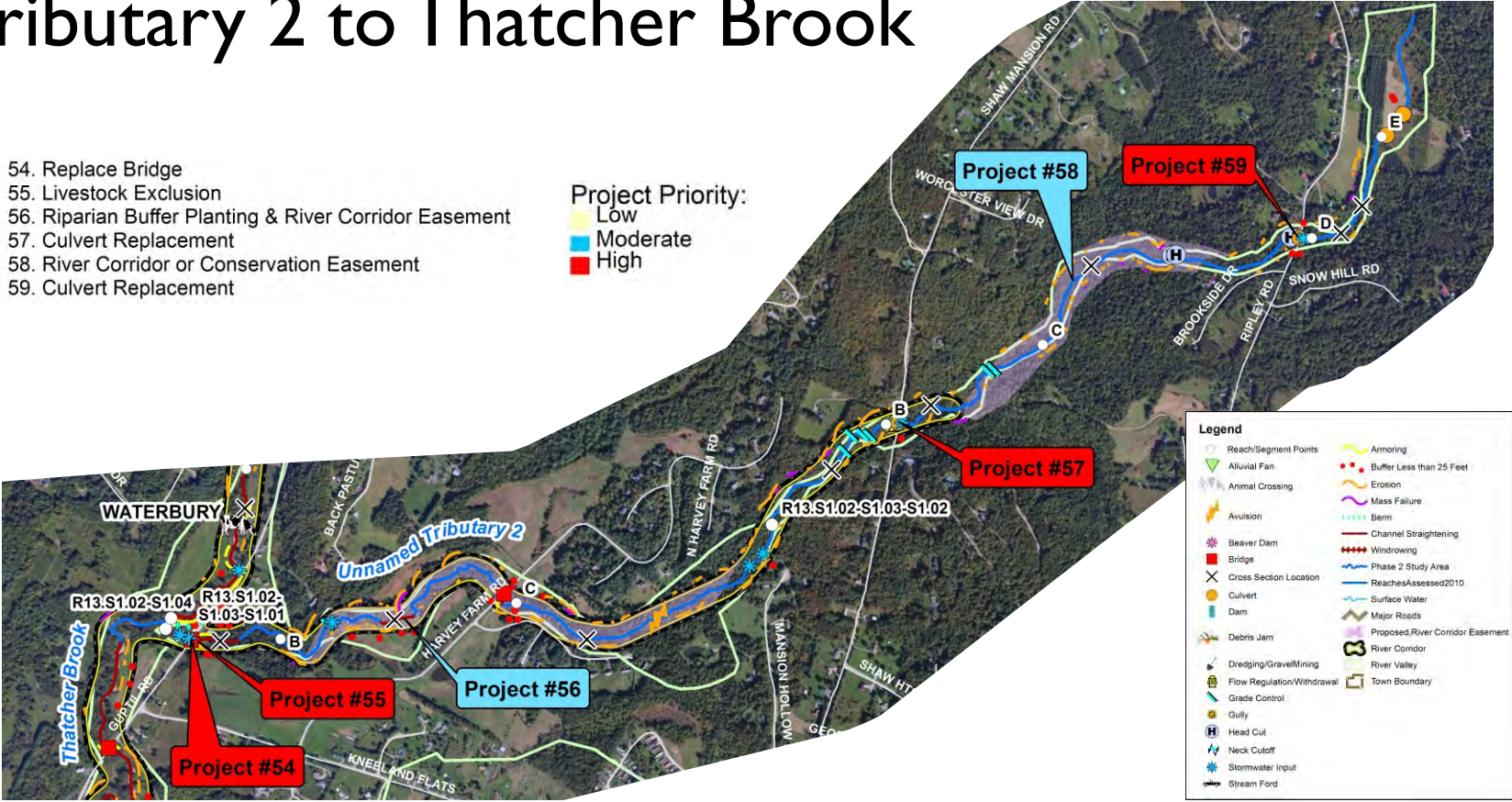




Unnamed Tributary 2 to Thatcher Brook

- 54. Replace Bridge
- 55. Livestock Exclusion
- 56. Riparian Buffer Planting & River Corridor Easement
- 57. Culvert Replacement
- 58. River Corridor or Conservation Easement
- 59. Culvert Replacement

Project Priority:
■ Low
■ Moderate
■ High



| Legend | |
|------------------------------|------------------------------------|
| ○ Reach/Segment Points | ○ Armoring |
| ○ Alluvial Fan | ○ Buffer Less than 25 Feet |
| ○ Animal Crossing | ○ Erosion |
| ○ Avulsion | ○ Mass Failure |
| ○ Beaver Dam | ○ Berm |
| ○ Bridge | ○ Channel Straightening |
| ○ Cross Section Location | ○ Windrowing |
| ○ Dam | ○ Phase 2 Study Area |
| ○ Debris Jam | ○ ReachesAssesses2010 |
| ○ Dredging/GravelMining | ○ Surface Water |
| ○ Flow Regulation/Withdrawal | ○ Major Roads |
| ○ Grade Control | ○ Proposed River Corridor Easement |
| ○ Gully | ○ River Corridor |
| ○ Head Cul | ○ River Valley |
| ○ Neck Cutoff | ○ Town Boundary |
| ○ Stormwater Input | |
| ○ Stream Ford | |

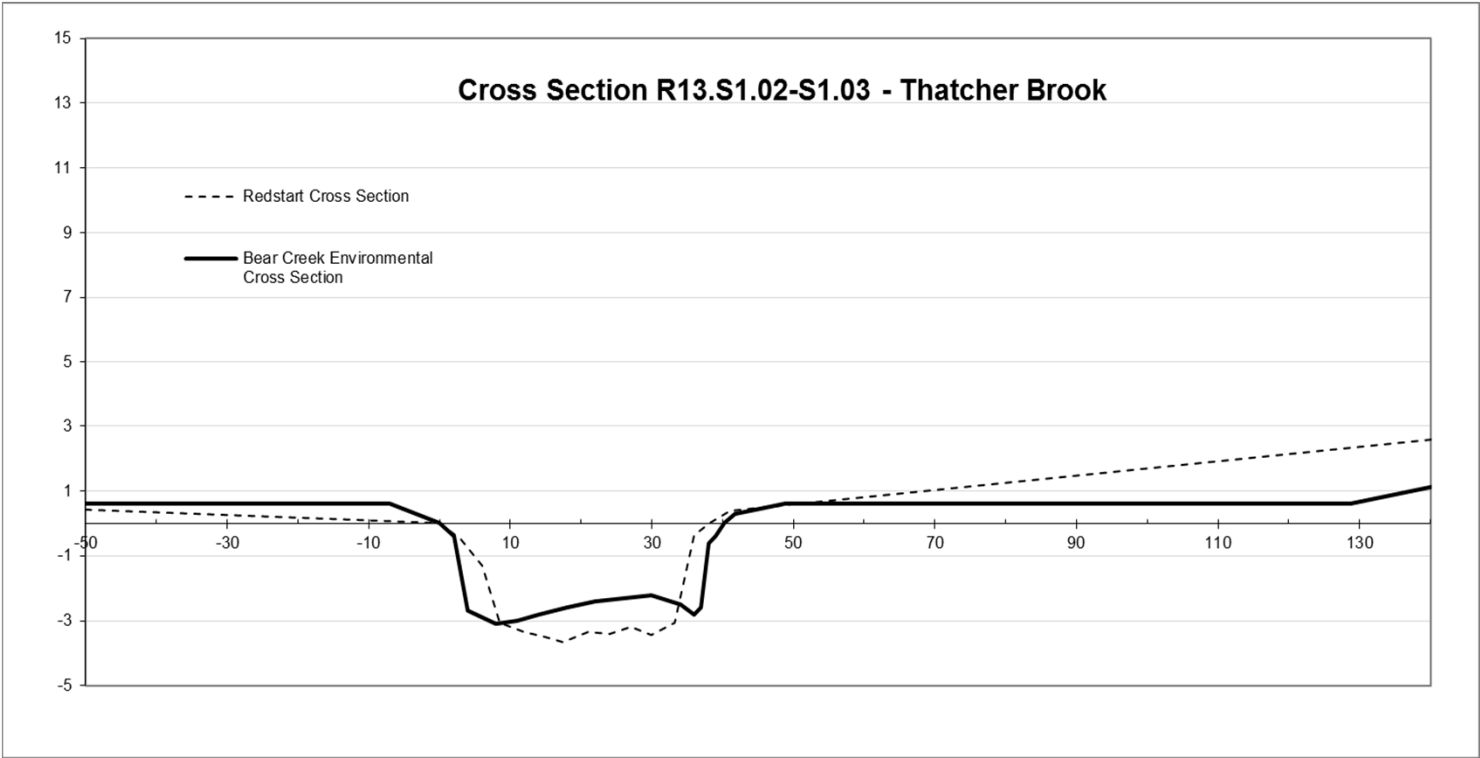
Post Flood Update on Thatcher Brook



Figure 1. Side by side comparison of a location along Thatcher Brook where meander migration (purple dots) occurred likely as a result of TSI (2009 imagery on left, 2013 on right).



Figure 2. Side by side comparison of a location along Thatcher Brook where channel avulsion occurred as a result of TSI (2009 imagery on left, 2013 on right).



Floodplain Connectivity





Town and Village Flood Resiliency Recommendation

- Adopt river corridor protection (increase ERAF match to 17.5%)

Next Steps

A photograph of a person standing in a shallow river, surrounded by lush green trees and vegetation. The person is wearing a blue backpack and dark clothing. The river is surrounded by a dense forest of tall trees with green leaves. The water is clear and reflects the surrounding greenery.

- Finalize River Corridor Plan
- Project partners will choose select projects to pursue



Bear Creek
Environmental



Mary Nealon, Principal / River Scientist
Mary@bearcreekenvironmental.com

Alex Marcucci, Environmental Scientist /
GIS Specialist
alex@bearcreekenvironmental.com

Bear Creek Environmental, LLC
149 State Street, Suite 3
Montpelier, VT 05602
www.bearcreekenvironmental.com
(802)223-5140