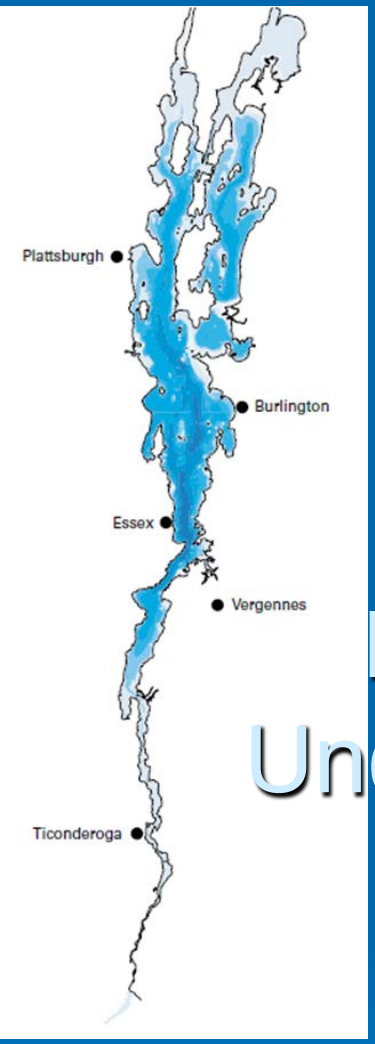


Lake Champlain

Monitoring and Assessment to Understand Lake Champlain and its Tributary Lakes and Streams

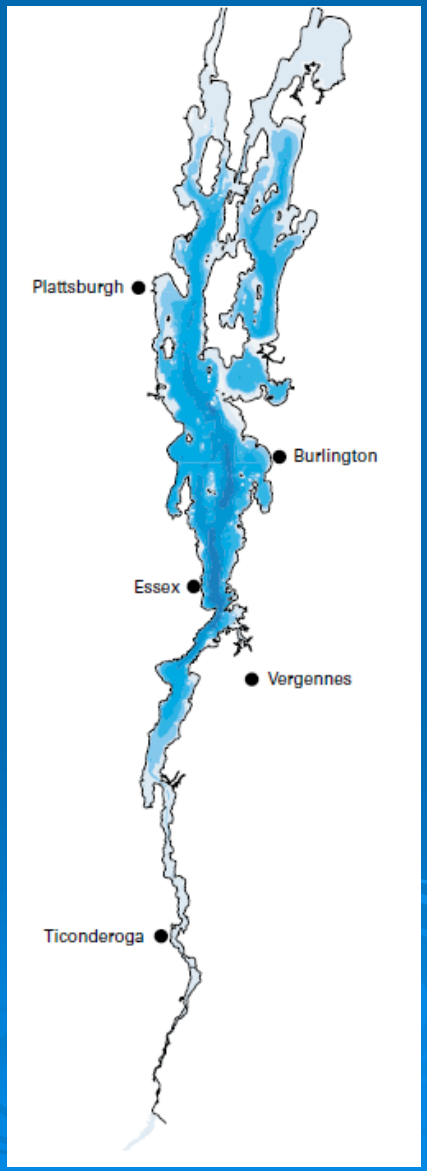
Karen Bates
Monitoring, Assessment and Planning Program
VT Dept. of Env. Conservation – Water Quality Division

Today's content

- Lake Champlain
  - Setting
  - Pollution issues
- Phosphorus Pollution
- Stream Equilibrium and Flood Resilience
- Tools: Vt. ANR Atlas

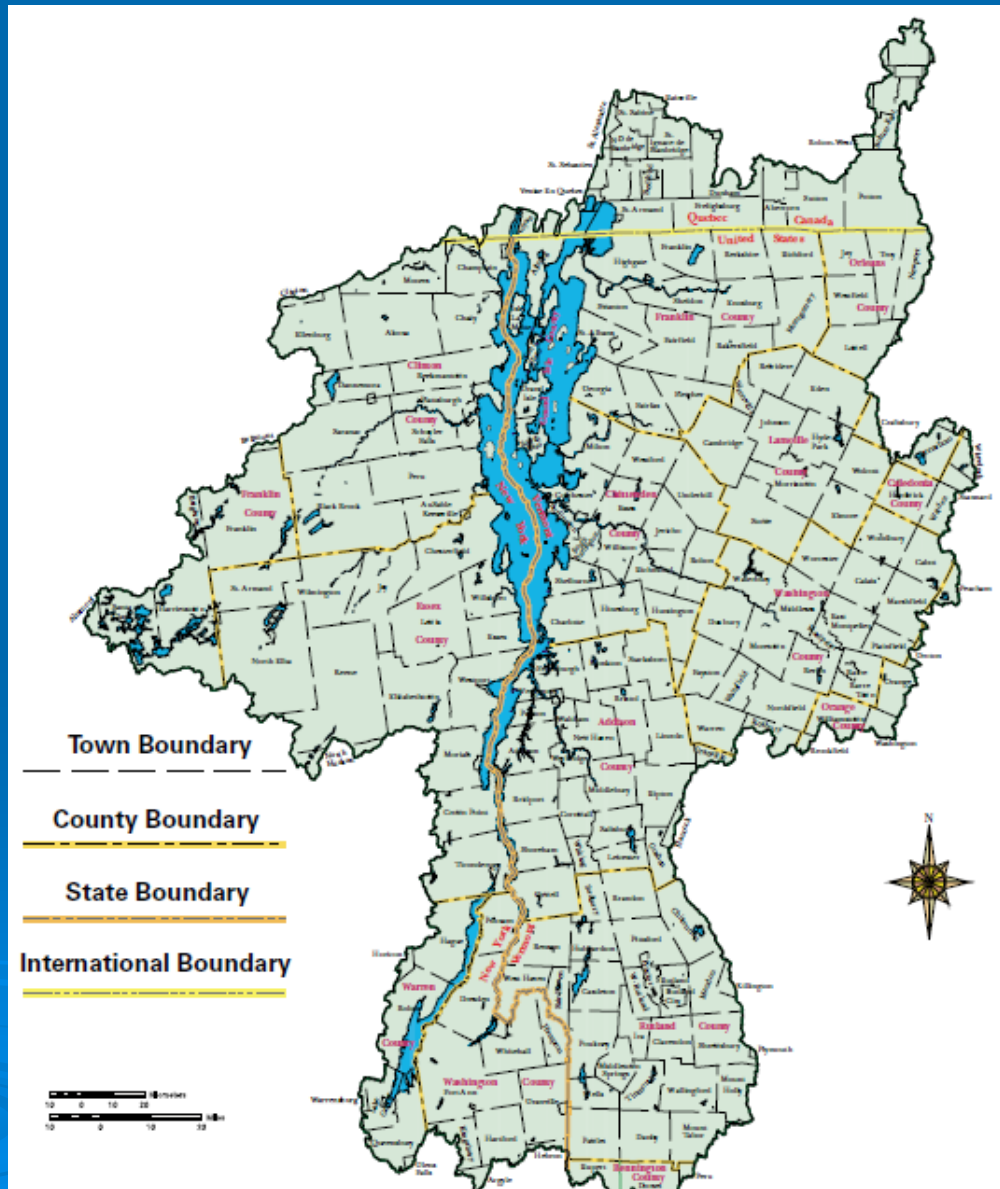
About Lake Champlain

- 120 miles long
- 587 miles of shoreline
- 435 sq miles of surface
- 70 islands
- 400 ft deep (max)
- 64 ft deep (avg)
- Retention time 3 years



The Lake Champlain Basin

- 239 Towns
  - 145 VT
  - 57 NY
  - 37 PQ
- Federal, State, and local rules and regulations apply in VT/NY, and PQ
- 8 Major VT Basins



A Spectacular Resource!

With some unfortunate problems…

Water Quality Monitoring and Assessment

to Understand the “health” of our Watersheds

- ✓**Biological**
- ✓**Physical**
- ✓**Chemical**

Water Quality Monitoring and Assessment

to Understand the “health” of our Watersheds

- **Biological**
  - benthic macroinvertebrates,
  - non-game fish
  - aquatic macrophytes

Water Quality Monitoring and Assessment

to Understand the “health” of our Watersheds

- **Chemical**
  - P, N, O, pH
  - sediments/turbidity,
  - metals
  - toxic contaminants

EPA's list of impaired waters

Part A. Waters appearing below have documentation and data indicating impairment and do not meet VT Water Quality Standards according to the methodology described in the Vermont Surface Water Assessment and Listing Methodology. Required or needed pollution controls have yet to be fully implemented and further pollutant loading determinations (i.e. TMDLs) are necessary - unless remediation will be completed prior to the scheduled TMDL.

Waterbody ID	ADB Code(s)	Segment Name/ Description	Pollutant(s)	Use(s) Impaired	Surface Water Quality Problem(s)	TMDL Priority
VT05-07	05	STEVENS BROOK, MOUTH UPSTREAM 6.8 MILES	NUTRIENTS, SEDIMENT, E. COLI	ALS, CR	AGRICULTURAL RUNOFF; MORPHOLOGICAL INSTABILITY	H
	06	STEVENS BROOK, APPROX. 1 MILE BELOW CTRL VT RAIL YARD UPSTREAM TO YARD	SEDIMENT, OIL, GREASE, HYDROCARBONS	AES, ALS, CR	SEDIMENT, SOIL & WATER CONTAMINATION FROM FUEL SPILLS & MANAGEMENT	L
VT05-07L01	01, 02	ST. ALBANS BAY - LAKE CHAMPLAIN (St. Albans)	PCBs	FC	ELEVATED LEVELS OF PCBs IN LAKE TROUT	L
VT05-09L01	01, 02, 03	MALLETTS BAY - LAKE CHAMPLAIN (Colchester)	PCBs	FC	ELEVATED LEVELS OF PCBs IN LAKE TROUT	L
VT05-10L01	01, 02, 03	BURLINGTON BAY - LAKE CHAMPLAIN (Burlington)	PCBs	FC	ELEVATED LEVELS OF PCBs IN LAKE TROUT	L
VT05-10L02	01, 02	MAIN SECTION - LAKE CHAMPLAIN (South Hero)	PCBs	FC	ELEVATED LEVELS OF PCBs IN LAKE TROUT	L
VT05-11L01	01, 02, 03	SHELBURNE BAY - LAKE CHAMPLAIN (Shelburne)	PCBs	FC	ELEVATED LEVELS OF PCBs IN LAKE TROUT	L
VT06-04	01	BERRY BK, MOUTH UP TO AND INCLUDING NO. TRIB (APPROX. 1 MI)	SEDIMENT, NUTRIENTS	ALS	AGRICULTURAL RUNOFF, AQUATIC HABITAT IMPACTS	H
	02	GODIN BROOK	NUTRIENTS, SEDIMENT	ALS	AGRICULTURAL RUNOFF, AQUATIC HABITAT IMPACTS	H
	03	SAMSONVILLE BROOK	NUTRIENTS, SEDIMENT	ALS	AGRICULTURAL RUNOFF, AQUATIC HABITAT IMPACTS	H
	04	TROUT BROOK, UPSTREAM FROM MOUTH FOR 2.3 MILES	NUTRIENTS	ALS	AGRICULTURAL RUNOFF	H
VT06-05	01	CHESTER BROOK	NUTRIENTS, SEDIMENT	ALS	AGRICULTURAL RUNOFF	H

What do the data tell us about the Lake Champlain Basin?

Water Quality Assessment

- ANR produces a biennial WQ Assessment Report (required by CWA).

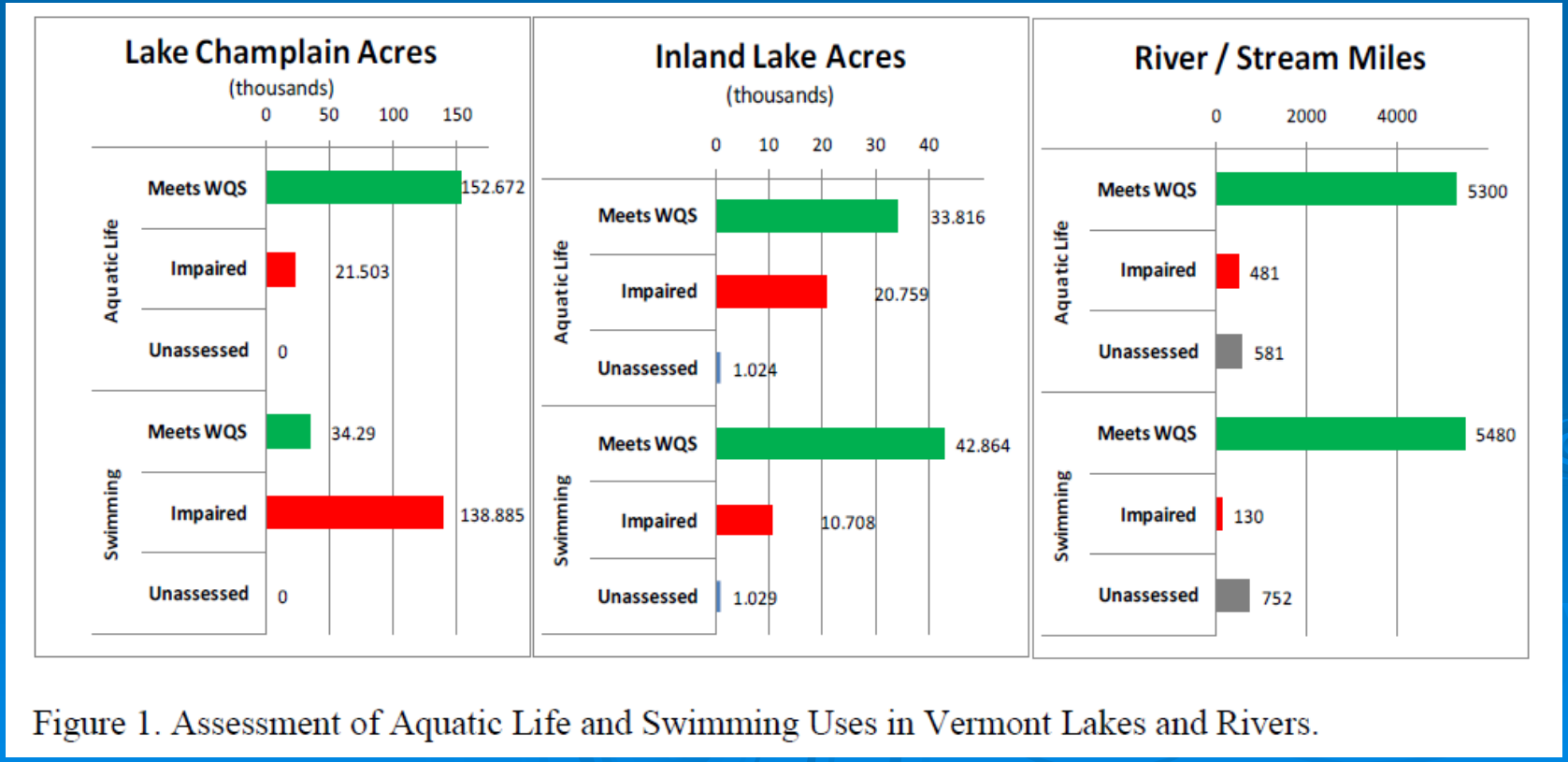


Figure 1. Assessment of Aquatic Life and Swimming Uses in Vermont Lakes and Rivers.

Water Resource Problems in the Lake Champlain Watershed

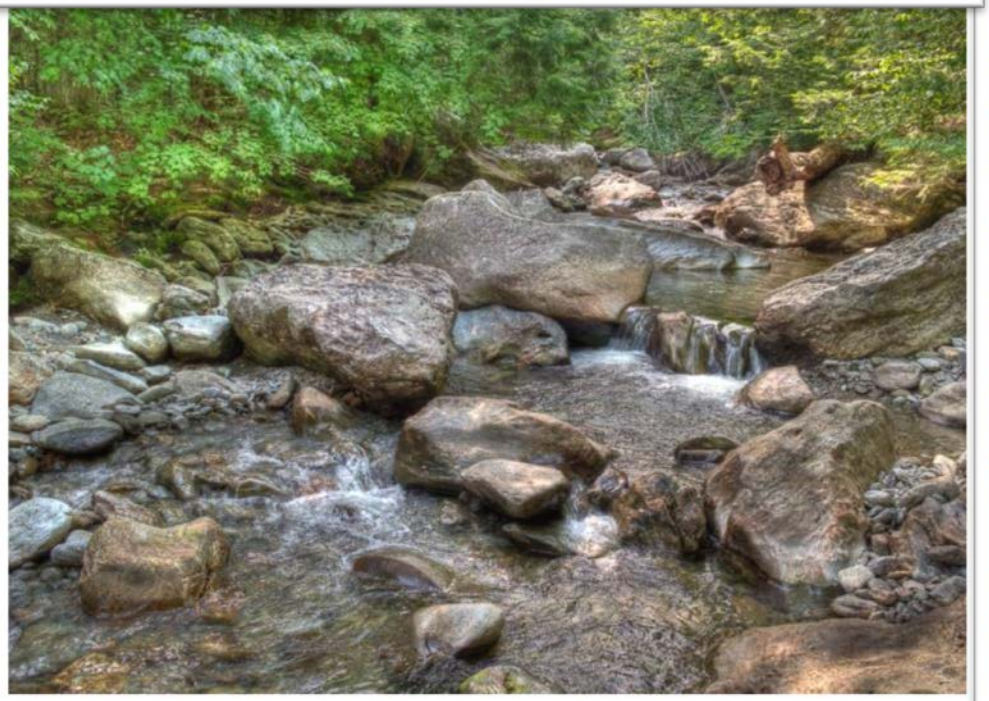
- *E. coli* (Pathogens)
- Sediment
- Nutrients
- Toxins and heavy metals
- Insufficient flows
- Aquatic Nuisance Species
- Unstable rivers
- Developed shoreline

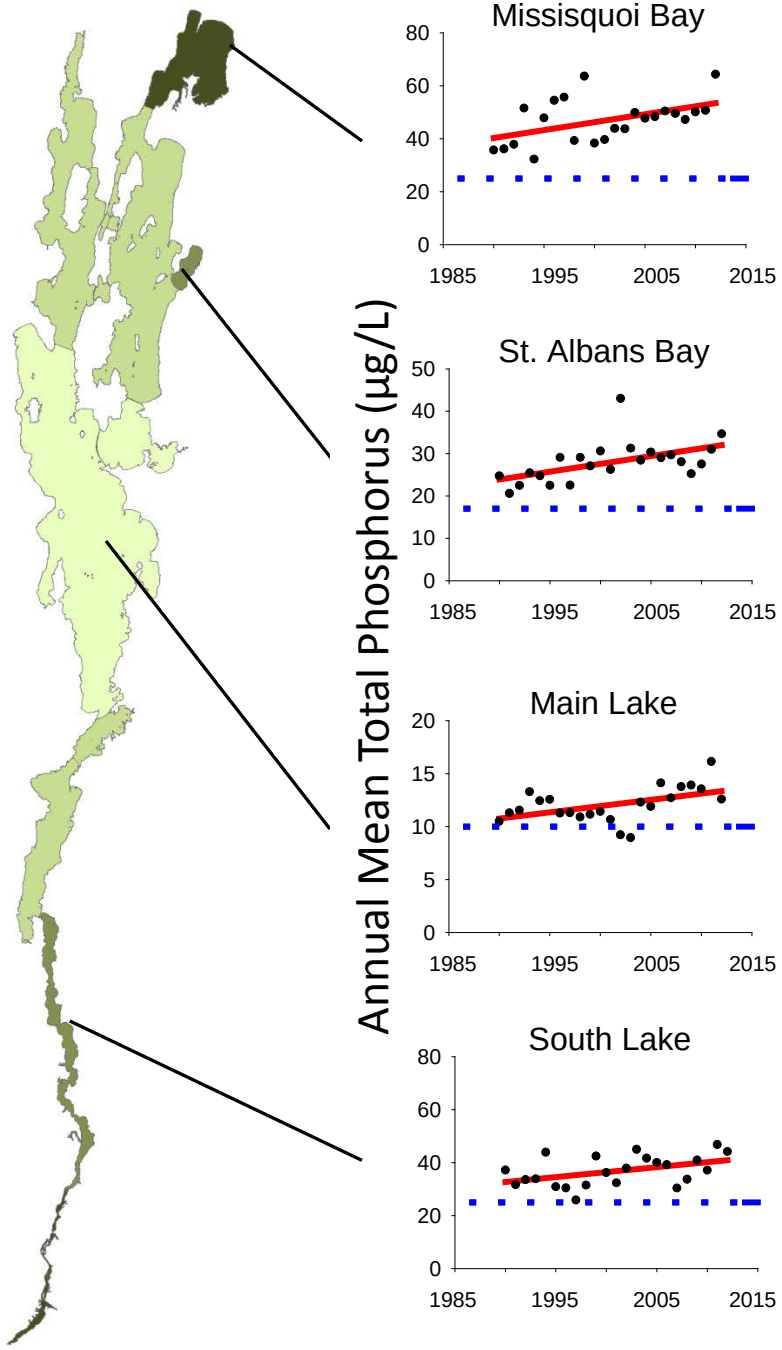
Nutrient Pollution: Phosphorus and Nitrogen

Impacts:

- Green Algae blooms
  - Loss of water clarity
- Toxic blue-green algae blooms
  - Impacts to natural ecosystem
  - Fish kills
- Increased costs in drinking water treatment
- Increased costs in wastewater treatment
- Loss in tourism and recreation
- Reductions in property values

Blue-green algae blooms, 2012, Lake Champlain





Lessons learned from the past 20 years

Phosphorus levels in the lake are above the allowable standards.

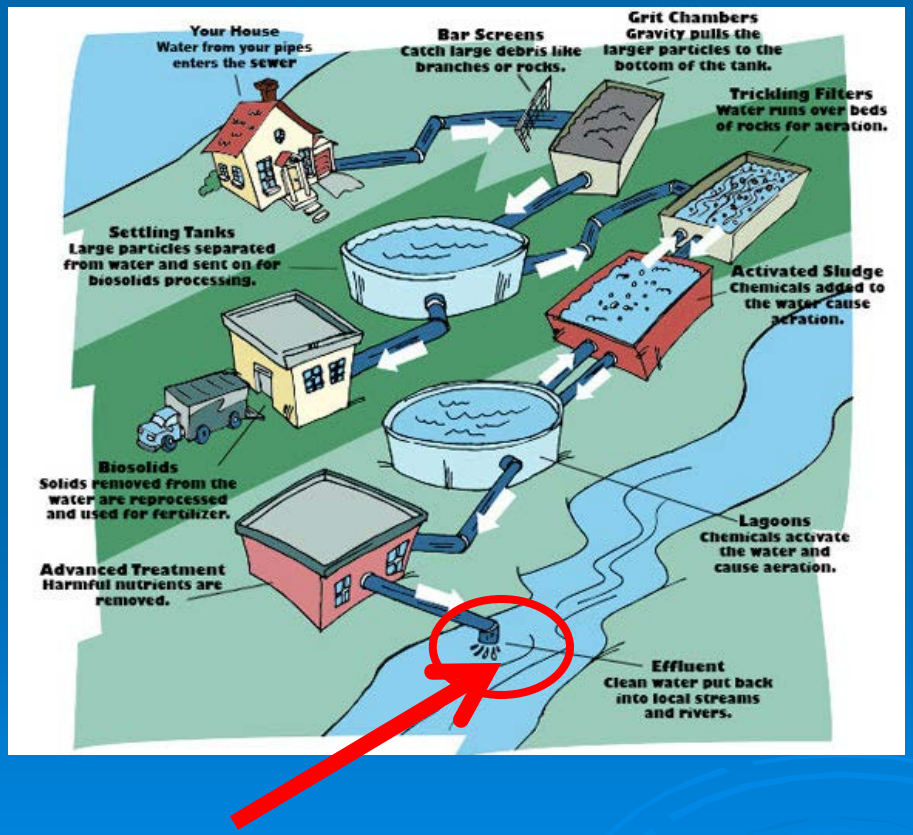
Vermont has taken many important actions, especially in the last 10 years.

Cleaning up the lake ecosystem is complex and recovery will take time.

We need to do a lot more.

Pollutants Entering Waterbodies

- Point Source



- Non-point Source

Pollution Source
Municipal Stormwater Runoff

Stormwater runoff, hitting hard surfaces and mobilizing sediments

Investments that Work
Stormwater Treatment

Green stormwater infrastructure, Montpelier

VTrans/VDEC constructed gravel wetland, St. Albans

Pollution Source
Road Runoff

Eroding roadside ditch

Storm-damaged gravel road

Investments that Work
Best Practices to Save Roads and Water Quality

Vermont Better Back Roads-funded drainage and culvert projects

Pollution Source
Runoff from Logging Operations

Poor stream crossing at logging job

Poor management of drainage along logging road

Investments that Work
Sound Logging Road Practices

Temporary stream crossing along logging road

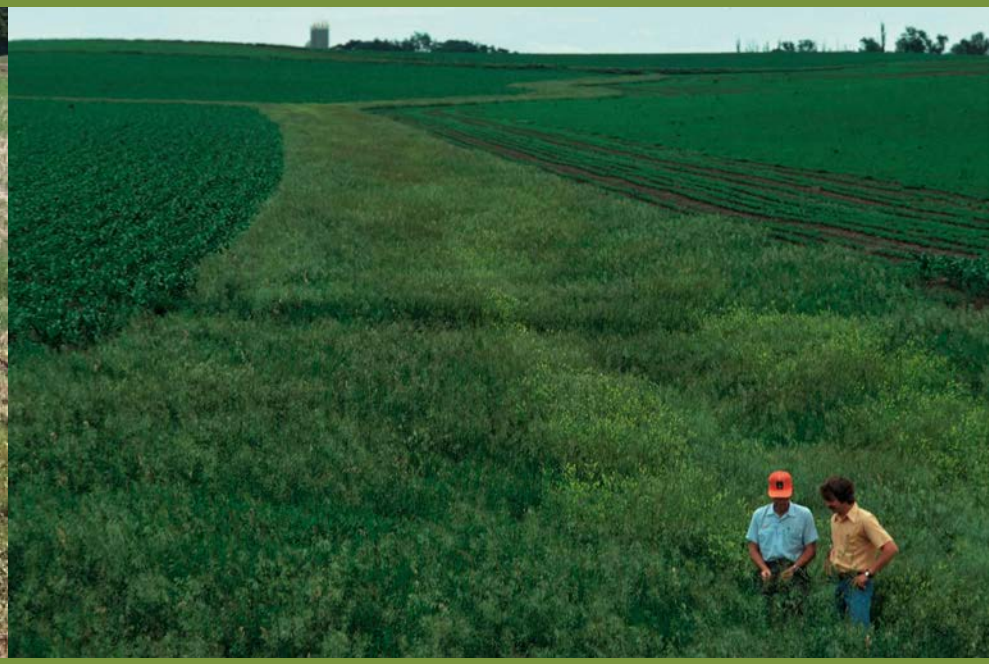
Pollution Source
Agricultural Runoff

Impacts from
livestock access

Eroding gully

Investments that Work
Reducing Agricultural Runoff

Manure injection



Grassed waterway
to prevent gullying


Stream Geomorphology

A river is the sum of its water, buffer, corridor, and floodplain

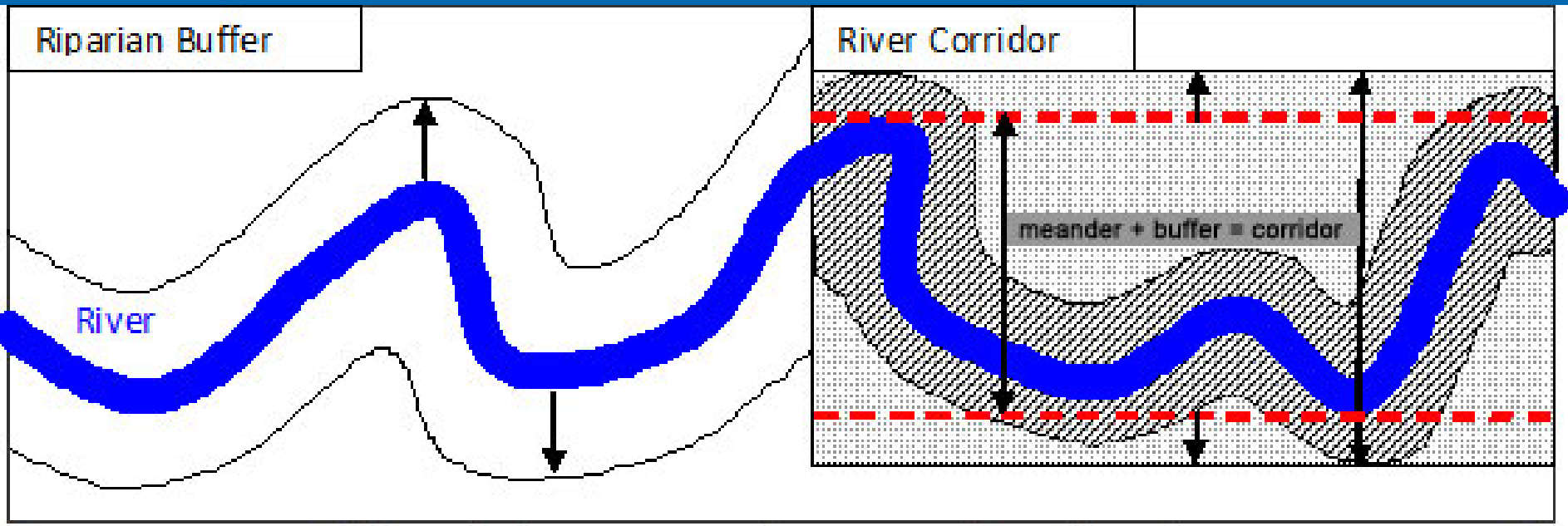
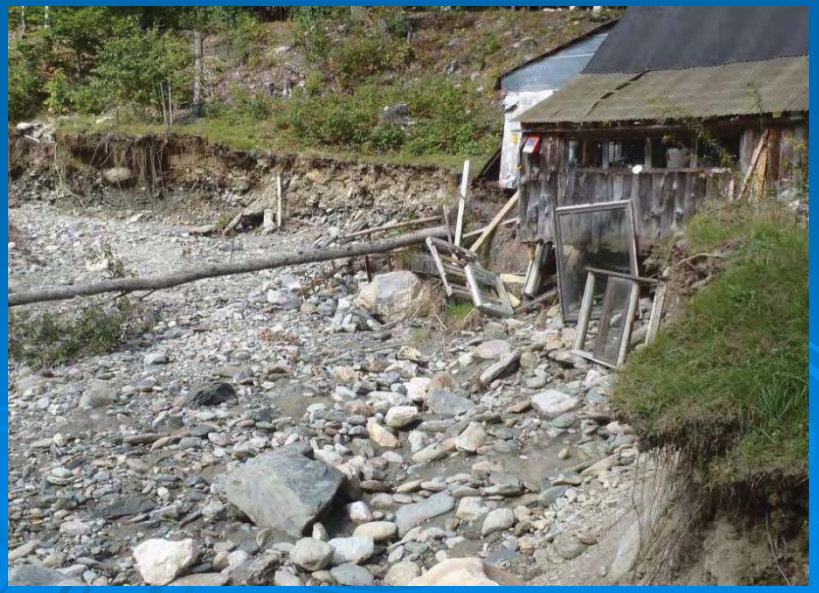


Figure 4. Comparing a buffer setback to a river corridor. Source: Adapted from Ohio DNR, Rainwater and Land Development Manual. 2006 Ed., Ch 2. Post Construction Stormwater Management Practices. p. 21

Streams are NOT stationary

- All streams move within their corridors and floodplains
- They move (evolve) in response to:
  - Equilibrium status (Climate Change!)
  - Stage of channel adjustment

Streams adjust during “channel forming events” What is in common among these 4 photos?



Channel evolution

Stream Power

Low

High

Moderate

Moderating

Low

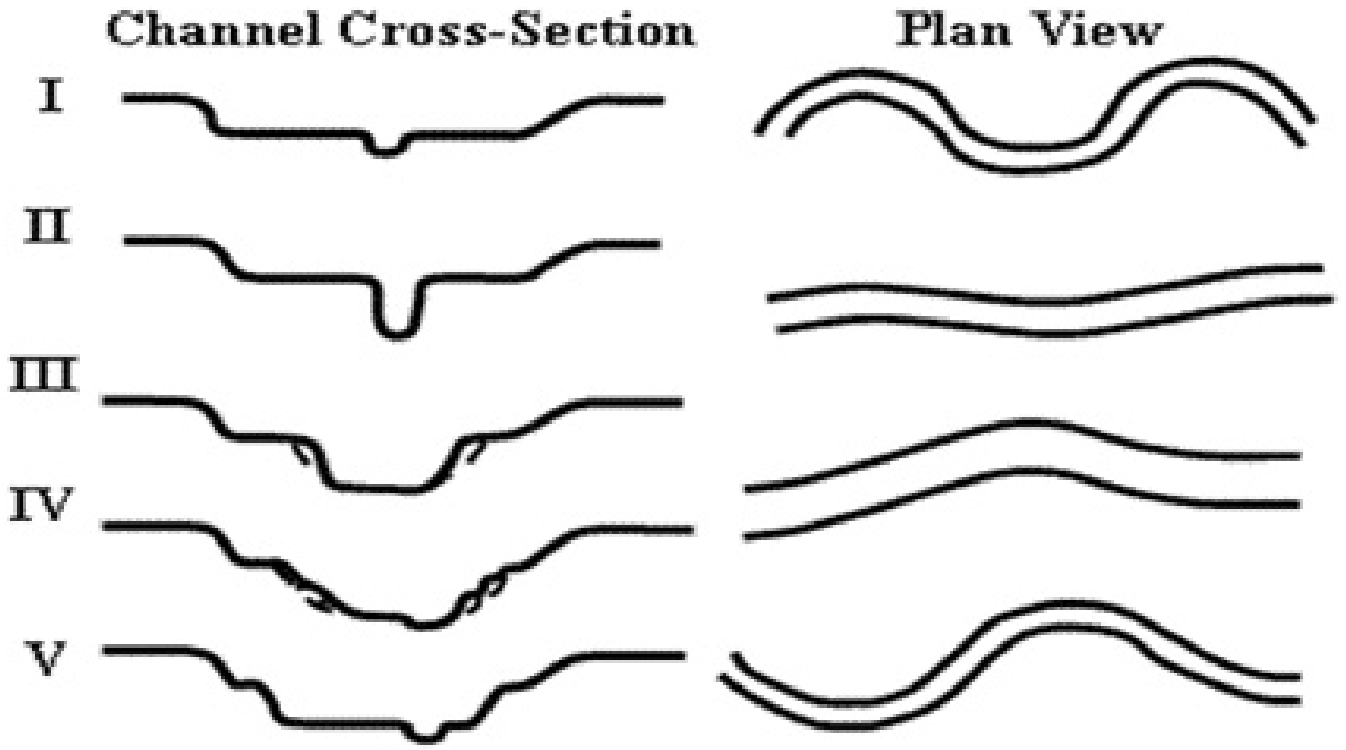


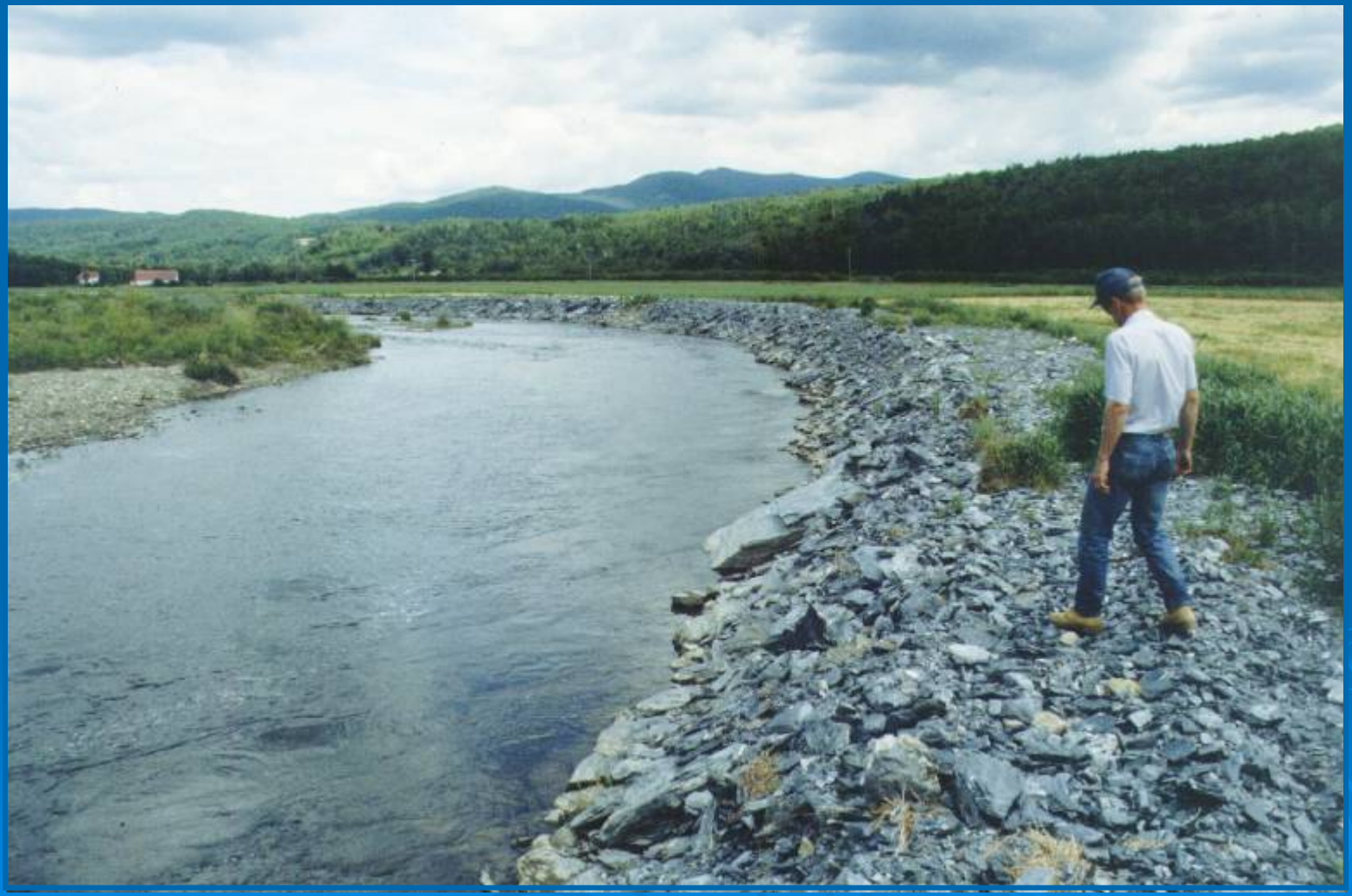
Figure 4. Channel Evolution Model showing a stable channel in Stage I, channel down-cutting or incision in Stage II, widening through Stages III and IV, and floodplain re-establishment at lower elevation in Stage V. Stages I and V represent equilibrrium conditions. The Plan View shows the meandor pattern of streams in the various stages of evolution.

Mendon Brook recreated some meanders

Why are we in this mess?

Dredge

Armor



Berm

Pollution Source

Unstable Stream Channels

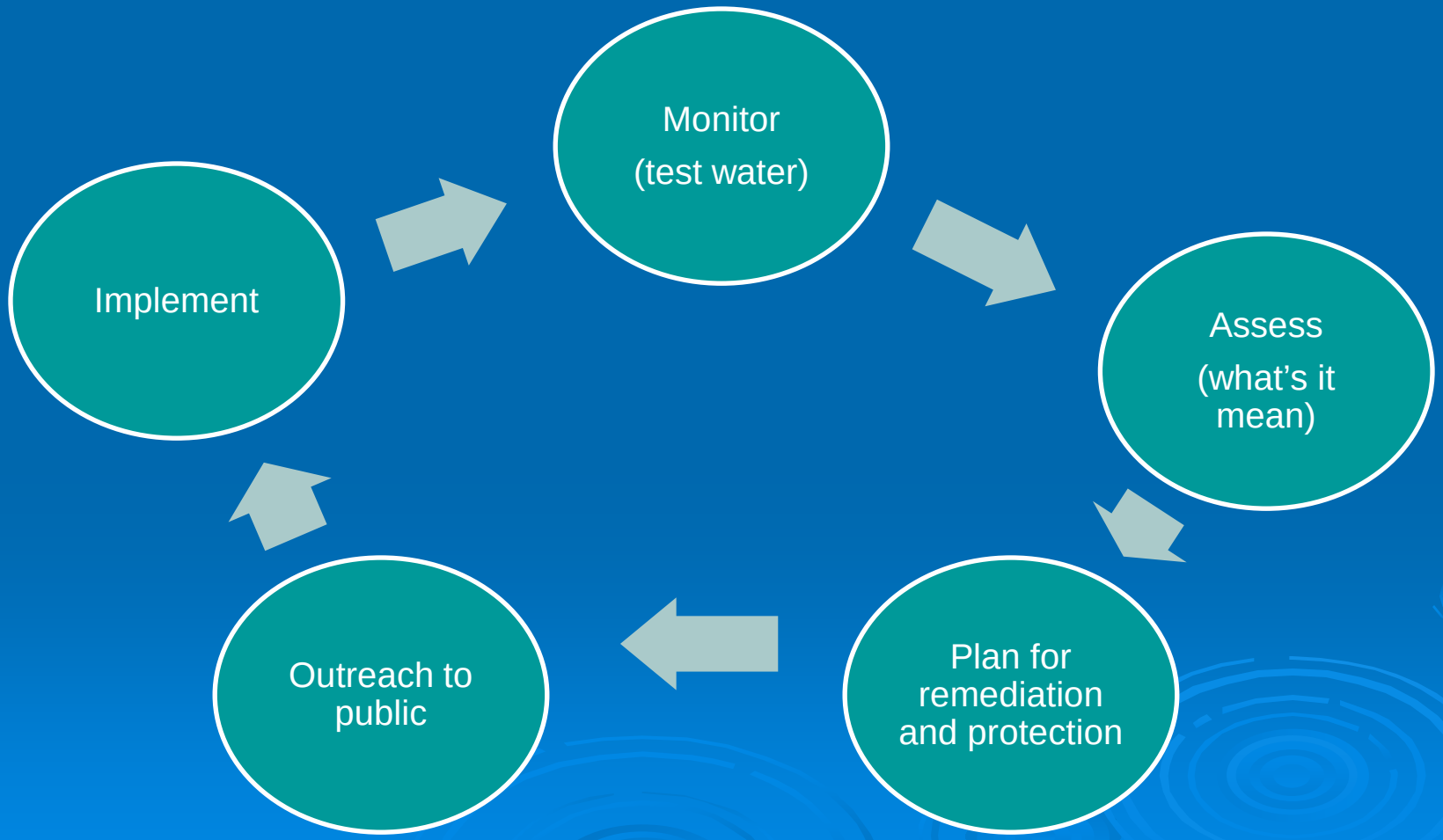
Floodplain development

Channelization

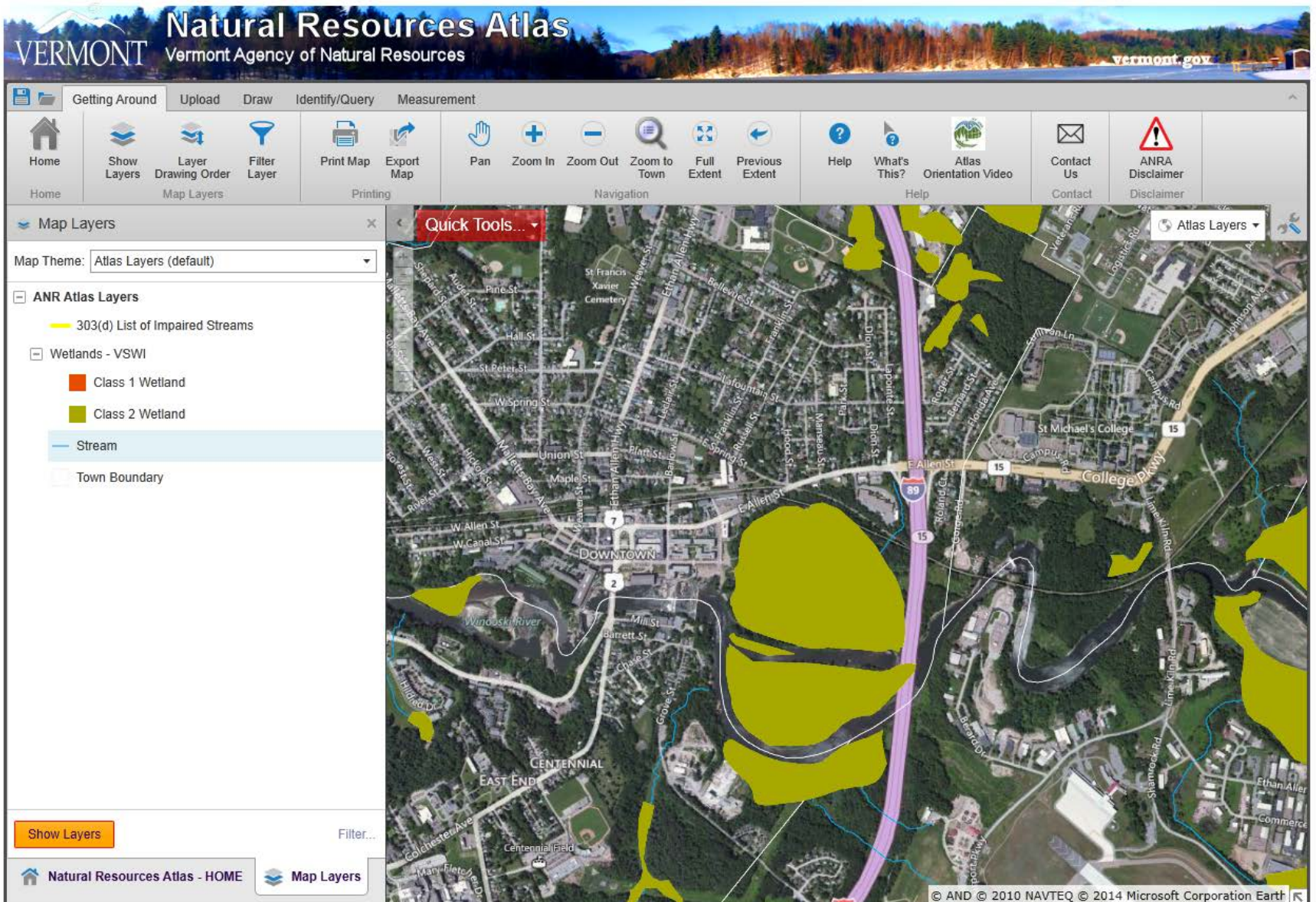
Protecting floodplain connectivity

- Diffuses stream power

Monitoring, Assessment, and Planning Program



ANR Natural Resources Atlas



Vermont ANR Natural Resources Atlas