

TACTICAL BASIN PLANNING

to Support Project Prioritization and Implementation

Neil Kamman

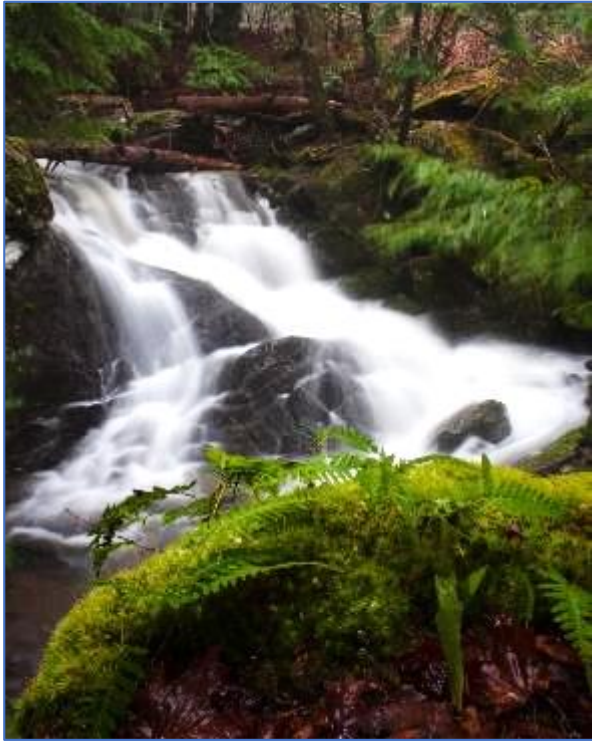
Monitoring, Assessment and Planning Program

House and Senate Committees on Transportation

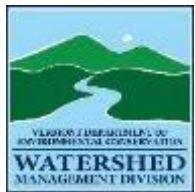
Senate Committee on Natural Resources

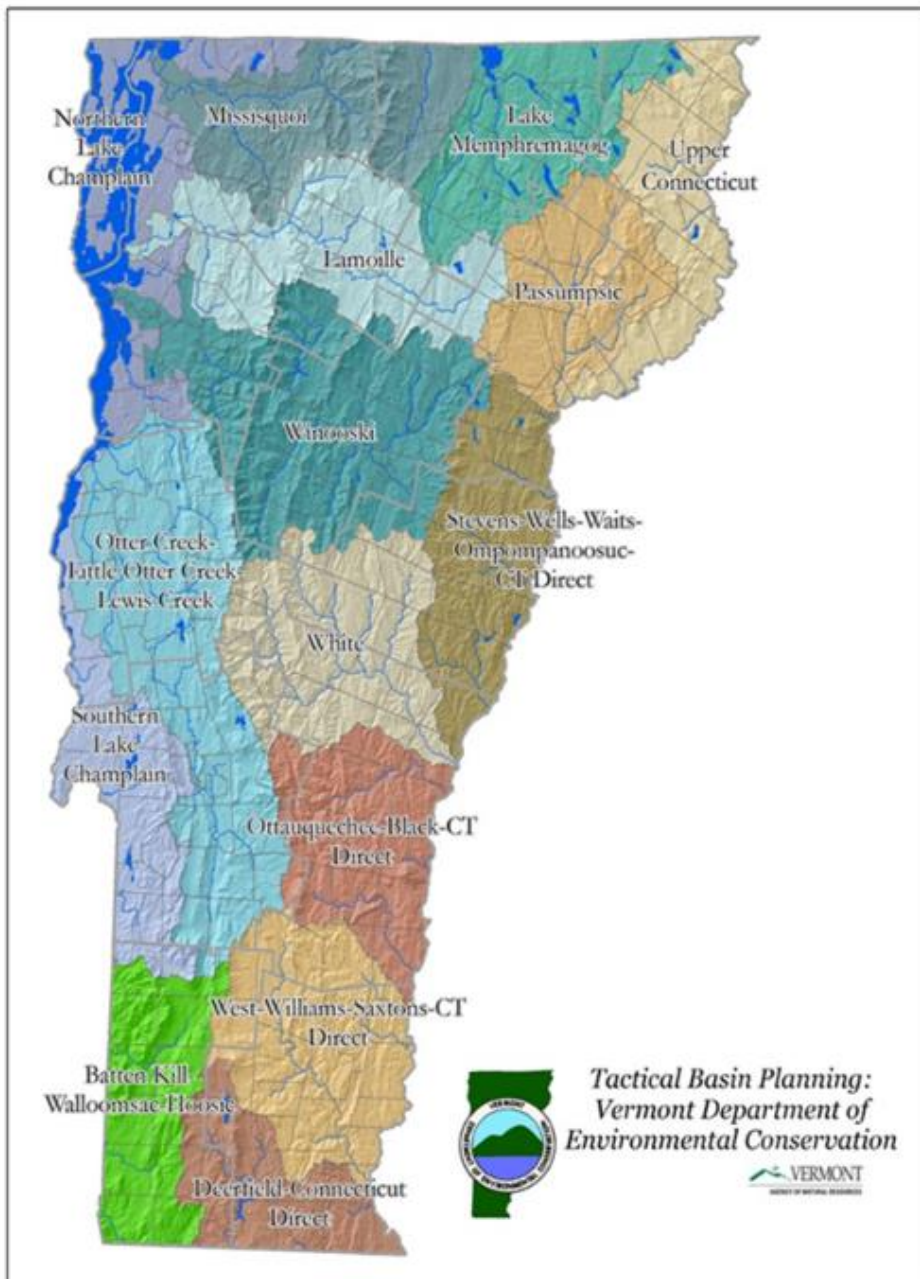
Tactical Basin Planning is a Process

- **Protect the Best**



- **Restore the Rest**

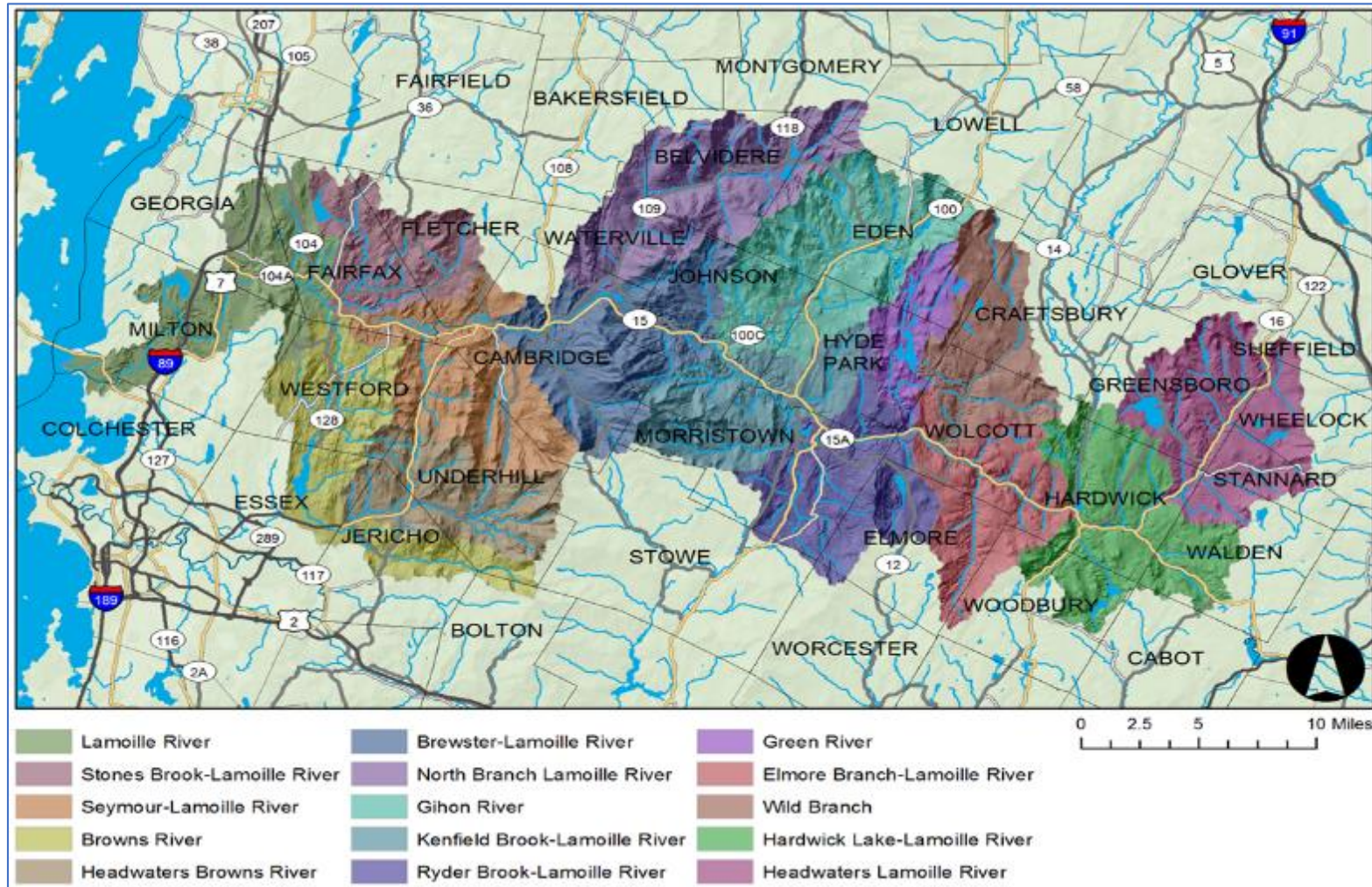




Tactical Basin Planning

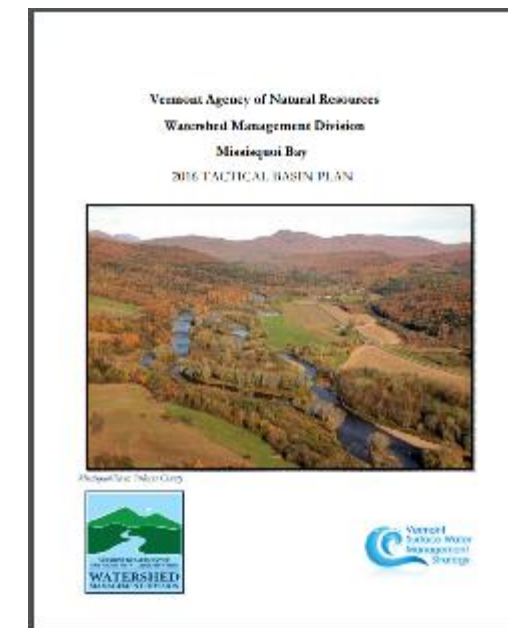
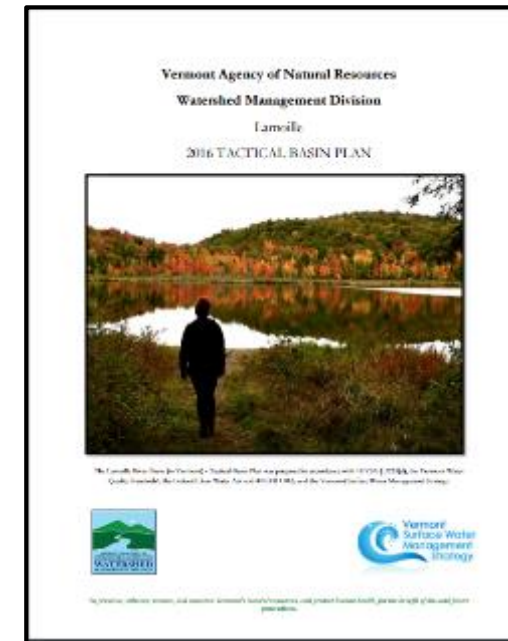
- 15 Planning Basins
- 5 Planners
- 5-year cycle
- 3 Phases:
 - Monitoring & assessment
 - Planning
 - Implementation

Watersheds...




Steps to Tactical Basin Planning

- Water testing results
- Stream condition studies
- Sector-specific assessments
- Phosphorus runoff models
- List actions and projects
- Prioritize
- Identify partners and funding
- Implement projects
- Continually update project status



Online Water Quality Data

Vermont Integrated Watershed Information System



Welcome to IWIS, The VTDEC-Watershed Management Division's new online data portal for water quality information. Here you can access water quality and chemistry testing information from throughout Vermont. Users may access data in one of two ways.

If you are new to IWIS, you may want to check out the [User Guide](#).

Site Search

Site Search allows for a Text based search the Division Database of Monitoring Sites. This will search by Waterbody Name, Town, Location Description, and a variety of other IDs. From there you will have access to a variety of reports for the found sites.

ANR Atlas

A map based tool that will display the Divisions Monitoring sites, including the type of data (macroinvertebrates, fish, chemistry, habitat), and the most recently color-coded assessment for that type of data. Sites will not be visible until you zoom in. The Atlas is a powerful tool and can display a great deal of Agency geographical information. New users of the Atlas should refer to ANR's [orientation video](#) to understand the full functionality of the tool.

Other Vermont Watershed Management Division Sites

- Lake Data and Maps** - Data and Maps for Lakes and Ponds
- Stream Geomorphic Assessment** - Stream Geomorphic Assessment Data displayed on the ANR Atlas
- LaRosa Current Year Data Access** - Data for the current field season, for U

Other Water Data Sites

- Vermont Monitoring Cooperative** - Searchable database of projects, data, ecosystem monitoring in Vermont
- USGS Flow Monitoring Map** - A Map of US Geological Survey Real-t
- National Water Quality Portal** - National Water Quality Monitoring Co
- State Parks Swim Water Testing** - Vermont State Parks Swim Water Test
- Streams Project** - Vermont Streams Project Online Data

Monitoring Site Summary - River/Stream

Rice Brook

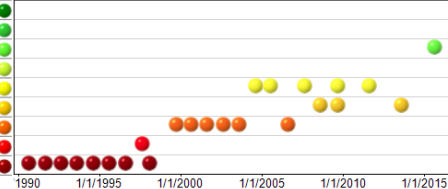
River Mile: 0.4
Located below WWTF, and Access Road about 100m.
Warren, VT (44.13773, -72.88632)

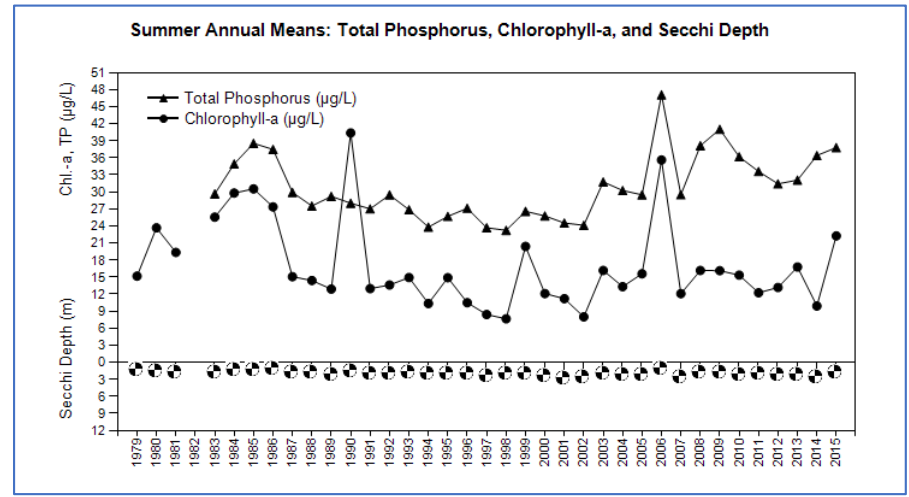
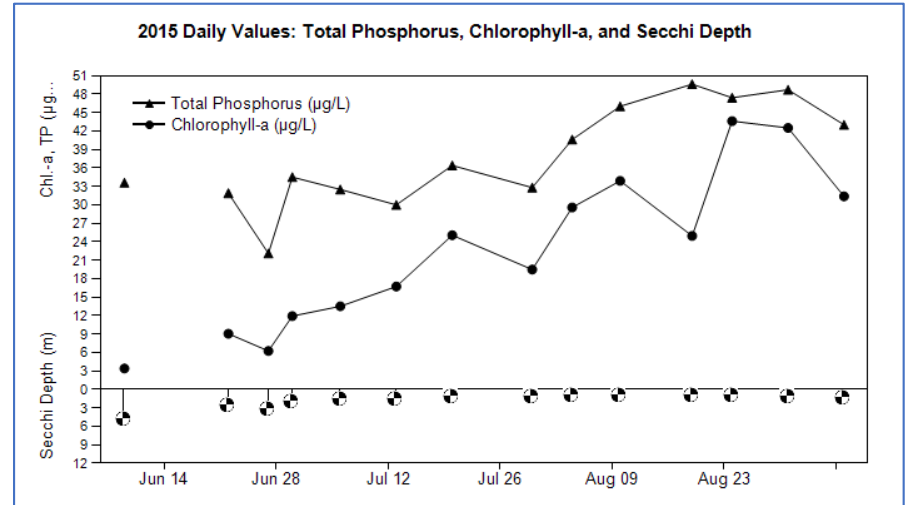
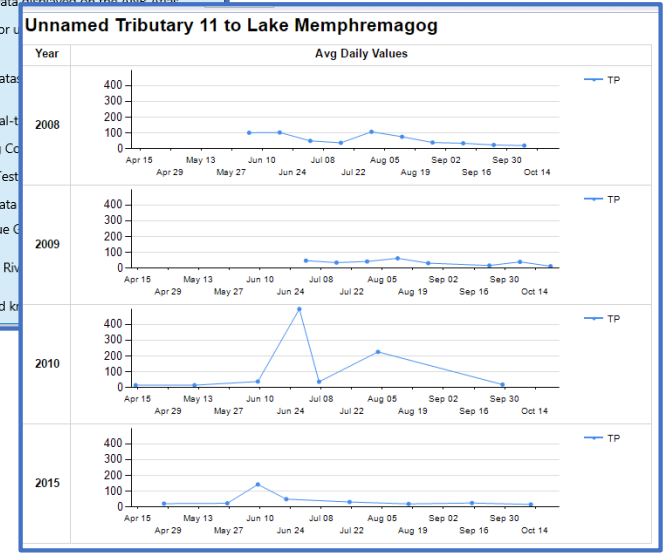
Macroinvertebrate Assessment

Macroinvertebrate population Assessments are a measure of the biological integrity of the macroinvertebrate community and an indicator of the health of the aquatic biota. (For More Details)

More Info

- Excellent (Green)
- Excellent - Very Good (Light Green)
- Very Good (Yellow-Green)
- Very Good - Good (Yellow)
- Good (Light Orange)
- Good - Fair (Orange)
- Fair (Red-Orange)
- Fair - Poor (Red)
- Poor (Dark Red)





Online Geomorphic Condition Data

- Reach Break
- Sensitivity (VTANR protocols, 2006)
- ▬ Extreme
- ▬ Very High
- ▬ High
- ▬ Moderate
- ▬ Very Low
- ▬ NA
- ▬ Major Surface Waters (Not Assessed)
- ▬ County Boundary
- ▬ Town Boundaries
- ▬ Major Lakes
- ▬ Mettewee River Watershed



Natural Resources Atlas
Vermont Agency of Natural Resources

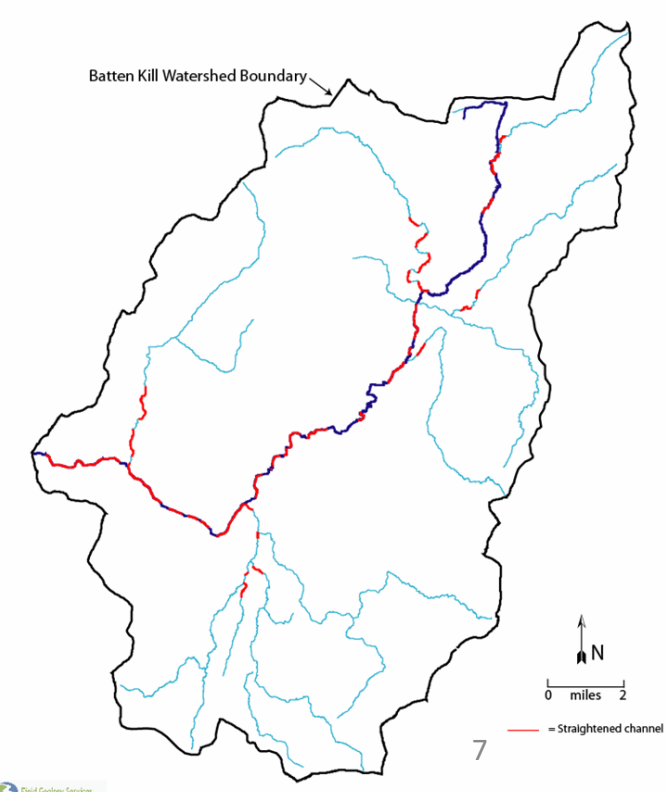
Map Tools: Navigation, Map Data, Draw, Identify, Query, Select, Measurement

Layers: Rivers Program

- Grade control
- Gully
- Migration
- Head Cut
- Steep Riffle
- Stormwater Input
- Stream crossing
- Mass Failure
- Armoring or Revetment
- Buffer less than 25'
- Development
- Encroachment
- Erosion
- Straightening
- SGAT Assessment Layers
- Phase 2 Reach Segment Br...

Map showing aerial imagery of an industrial area with a stream. The stream is highlighted with a yellow line, indicating a 'Very High' sensitivity level. A red line indicates a 'Reach Break' near a road labeled 'M07'. The map interface includes a search bar, navigation controls, and a scale bar.

Channel Straightening in the Batten Kill Watershed



Sector-specific assessments:

Water Quality Monitoring

Macroinvertebrate Site Summary

Year	Sample	Energy	Substrate	PFC	PM10	TP	Chl a	PFC	PFC	Assessment
1981/82	15	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1982/83	16	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1983/84	17	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1984/85	18	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1985/86	19	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1986/87	20	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1987/88	21	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1988/89	22	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1989/90	23	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1990/91	24	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1991/92	25	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1992/93	26	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1993/94	27	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1994/95	28	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1995/96	29	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1996/97	30	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1997/98	31	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1998/99	32	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
1999/00	33	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2000/01	34	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2001/02	35	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2002/03	36	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2003/04	37	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2004/05	38	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2005/06	39	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2006/07	40	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2007/08	41	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2008/09	42	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2009/10	43	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2010/11	44	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2011/12	45	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2012/13	46	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2013/14	47	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2014/15	48	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2015/16	49	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good
2016/17	50	15.0	8.0	60.0	1.0	1.0	1.0	1.0	1.0	Good

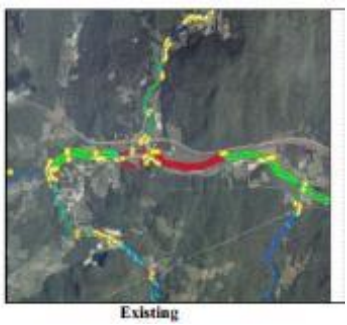
Road Inventory and Erosion Risk



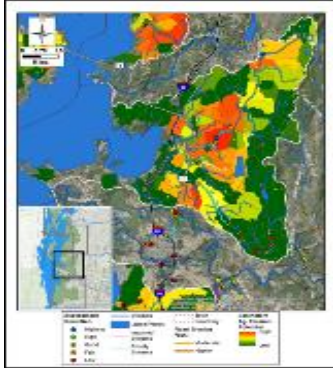
Stormwater Master Plans



Stream Geomorphic Condition



Agricultural Assessments



Town Zoning and Corridor Protection

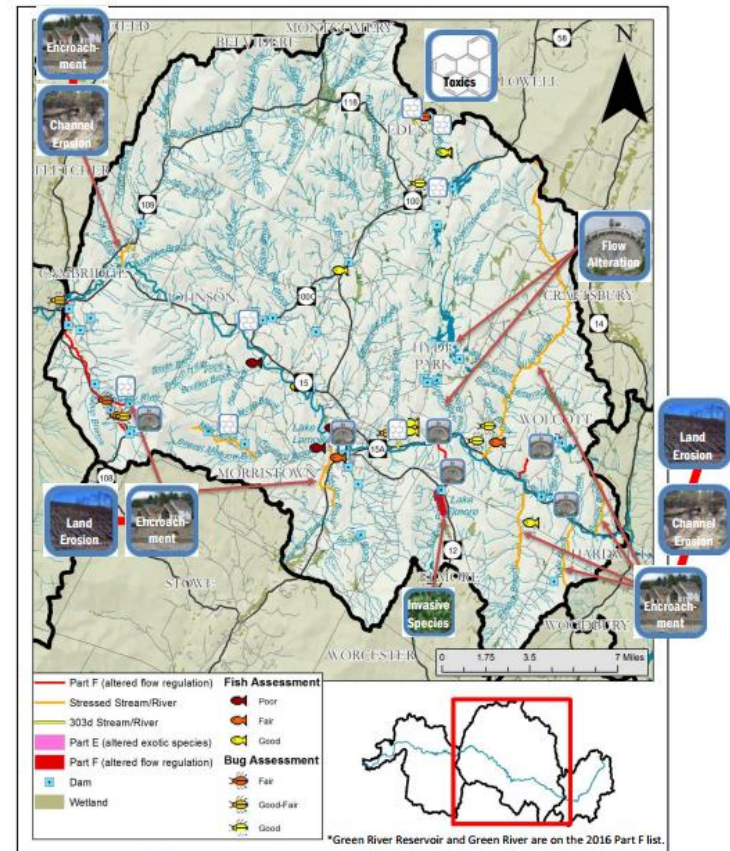
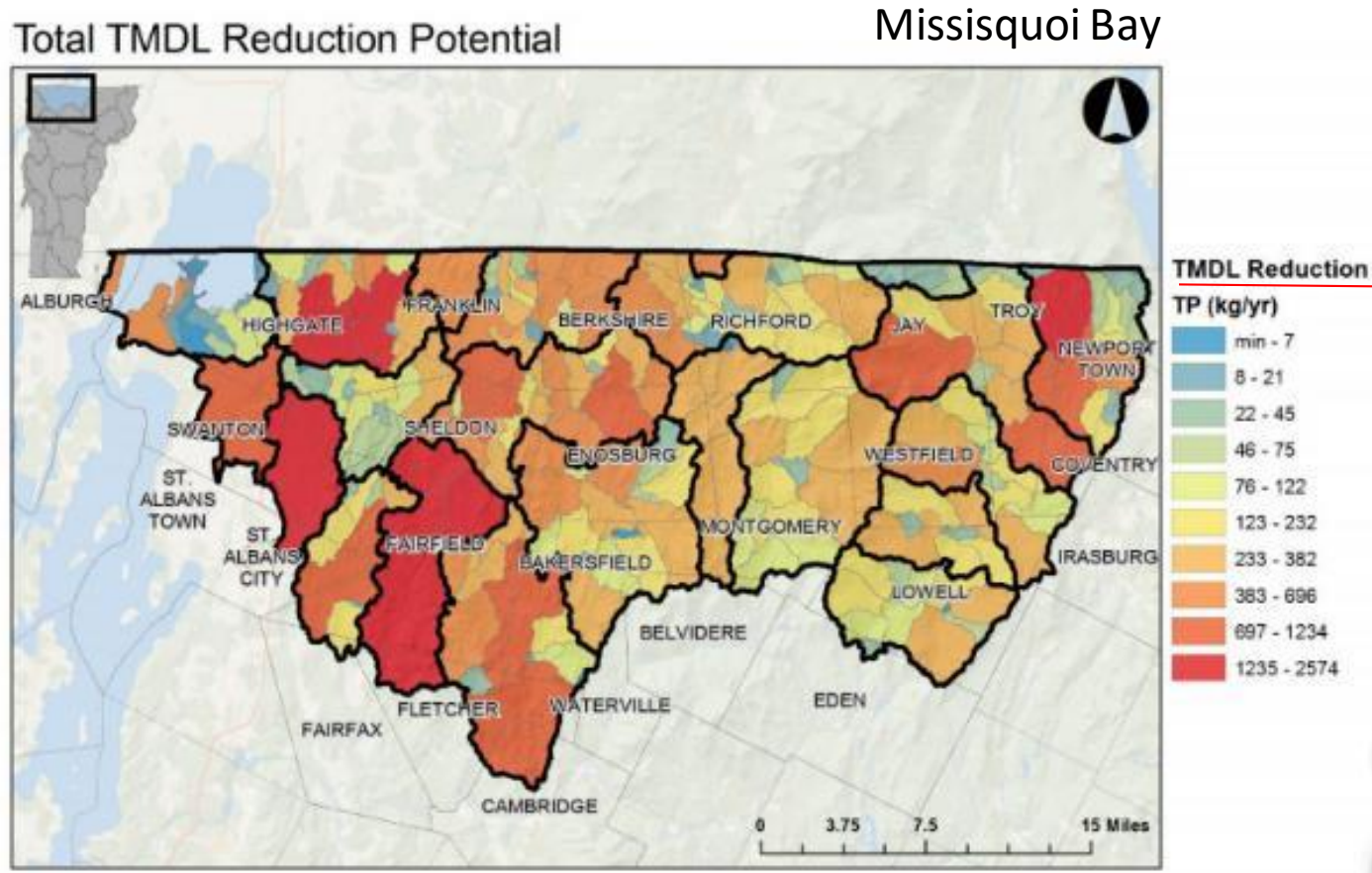


Figure 5. Middle Lamoille basin priority surface waters and related water quality stressors.



Phosphorus models to support Lake Champlain TMDL



Tactical plans describe phosphorus control opportunities to achieve the Lake Champlain TMDL

- Municipal roads
- State Roads and developed lands
- MS4 communities
- Other developed lands
- Agriculture
- Forestry

Estimated Road TP

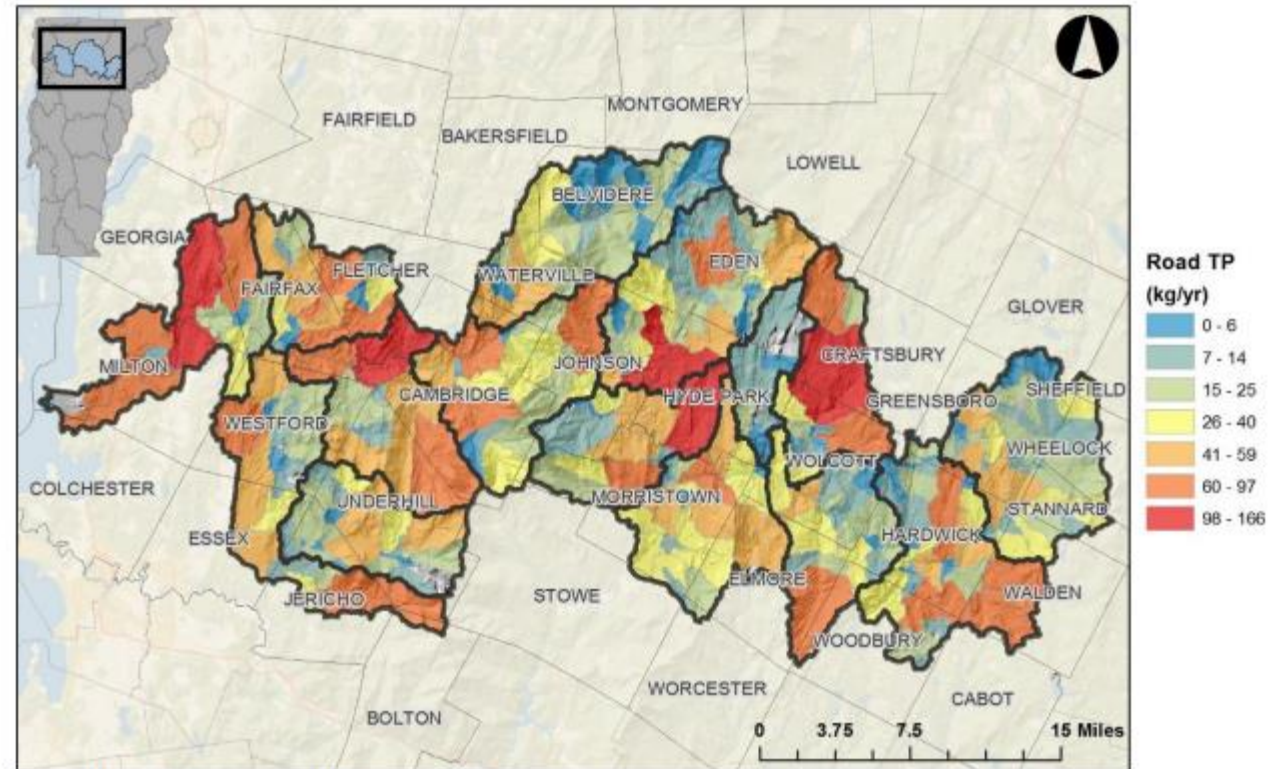
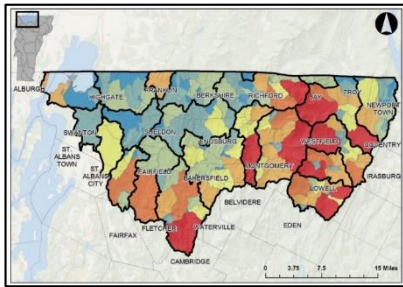


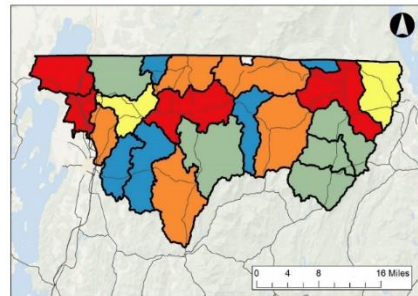
Figure WLA-2. Estimated SWAT loading from all paved and unpaved roads in the Lamoille basin at the catchment scale. Bolded lines represent the HUC12 watersheds.

We use the modeling to assist implementation of regulatory programs that control nutrient pollution

Forests



State roads/facilities



“MS4” communities

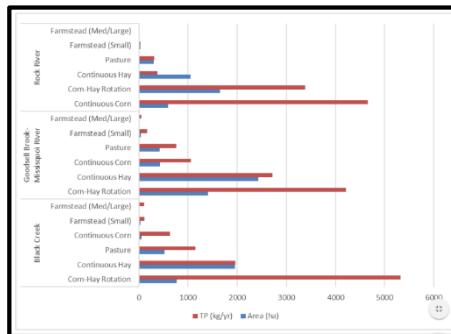
represents portions of the municipality that drain to the Lamonts basin.

MS4 Municipality	Paved road (excluding Vtrans managed roads) (kg/yr)	Unpaved roads (kg/yr)	Other developed lands (kg/yr)
Essex	30	37	260
Milton	181	18	373

Three-acre parcels

Town	Parcels (#)	Impervious (acres)
Eden	1	0.1
Highgate	8	75.5
Jay	4	74.0
Lowell	2	22.0
Montgomery	2	15.8
Richford	4	25.6
Swanton	8	38.1
Troy	1	3.6
Total	30	254.7

Agriculture



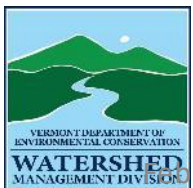
Local roads

Town	Paved Roads (kg/yr)	Unpaved Roads (kg/yr)	Town	Paved Roads (kg/yr)	Unpaved Roads (kg/yr)
Bakersfield	332.5	263.4	Jay	249.5	70.1
Belvidere	---	---	Lowell	316.6	67.4
Berkshire	291.5	144.4	Montgomery	302.7	119.3
Cambridge	108.4	53.3	Newport	256.2	104.4
Eden	4.7	---	Richford	280.3	81.0
Enosburgh	357.8	177.4	Sheldon	240.9	56.7
Fairfax	0.1	---	St. Albans	87.1	43.5
Fairfield	398.4	232.5	Swanton	398.6	27.0
Fletcher	11.0	10.6	Troy	210.2	58.1
Franklin	247.8	59.4	Westfield	196.7	43.9
Highgate	402.9	66.4			
Total loading from all roads (kg/yr)	6374				
Total reduction based on overall	2180				

Wastewater treatment facilities

Facility (permit ID)	Permit expiration date	Planned permit re-issuance year	Design flow MGD	WQC TSS10 /LMM	Current permitted load (mt P/yr)	TMDL WLA (mt P/yr)	2015 flow (MGD) / Percent of Design flow	Treatment type	# of CDOs	Receiving water
Fairfax (D-1194)	9/30/10	2017-18	0.078	0.001/0.001	0.539	0.539	0.033 / 42%	Aerated lagoon	0	Lamolle River
Jeffersonville (D-1323)	3/31/10	2017-18	0.077	0.001/0.001	0.532	0.532	0.036 / 47%	Aerated lagoon	0	Lamolle River
Johnson (D-1149)	3/31/09	2017-18	0.270	0.029/0.012	0.224	0.224	0.120 / 44%	Sequential batch reactor	0	Gihon River
Morrisville (D-1155)	12/31/13	2017-18	0.550	0.018/0.007	0.352	0.352	0.221 / 40%	Sequential batch reactor	0	Lamolle River
Milton (D-1203)	12/31/10	2017-18	1.000	0.010/0.004	0.829	0.829	0.245 / 25%	Sequential batch reactor	0	Lamolle River
Hardwick (D-1143)	12/31/09	2017-18	0.371	0.023/0.009	0.410	0.410	0.220 / 59%	Aerated lagoon	0	Lamolle River
PBM Nutritionals (D-1209)	6/30/12	2017-18	0.425	NA	0.352	0.352	0.125 / 29%	Activated Sludge upgrade to Movable Bed Bio Reactor	0	Lamolle River

- Allows each tactical basin plan to express the estimated total load, and “sub-allocation” associated with each regulated sector within the TMDL.
- Produce estimates of P loss by land use AND regulatory program
- These estimates are expressed at appropriate geographic scales.
- “Critical Catchment maps” for each regulated sector
- Great planning and communication tool.
- Underlain by massive HRU database.



The Role of the Community



- ✓ Identify water quality issues – what did we miss?
- ✓ Assist in targeting strategies
- ✓ Formulate a collaborative approach
- ✓ Be Involved in implementation.

Tactical basin plans present continually-refreshing lists of actions and projects

WDP

Projects

Name Status Grant Number

Project Type County Project ID

Basin Plan Town

Grade Type Grade

	ID	Project Name	Project Type	Status	Grant Number(s)	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	18	Kedron Brook Agricultural Nutrient Management Planning and Flood Resiliency	Agricultural Pollution Prevention	Design Funded	2016-ERP-1-23
<input type="button" value="Edit"/>	<input type="button" value="View"/>	19	Enhancing Nutrient Management Plan Implementation with goCrop Software	Agricultural Pollution Prevention	Scoping Completed	2016-ERP-2-10
<input type="button" value="Edit"/>	<input type="button" value="View"/>	22	Agricultural Best Management Practice Implementation in South Lake Champlain and Beyond	Agricultural Pollution Prevention	Implementation Funded	2016-ERP-2-07
<input type="button" value="Edit"/>	<input type="button" value="View"/>	46	Crooked Creek Gully Restoration Designs	Agricultural Pollution Prevention	Design Completed	Contract-28911
<input type="button" value="Edit"/>	<input type="button" value="View"/>	53	Agricultural BMP Project Identification in Critical Source Areas of Hungerford Brook	Agricultural Pollution Prevention	Scoping Completed	2015-ERP-1-17
<input type="button" value="Edit"/>	<input type="button" value="View"/>	67	Implementing Precision Agriculture Tech to Improve Application and Minimize Nutrient Loss of Manure	Agricultural Pollution Prevention	Completed	2015-ERP-2-16
<input type="button" value="Edit"/>	<input type="button" value="View"/>	68	Equine Manure Runoff Management Program	Agricultural Pollution Prevention	Implementation Completed	2015-ERP-2-10
<input type="button" value="Edit"/>	<input type="button" value="View"/>	72	Agricultural Runoff Mitigation Project on a tributary to Beaver Brook	Agricultural Pollution Prevention	Implementation Funded	2015-ERP-2-02
<input type="button" value="Edit"/>	<input type="button" value="View"/>	73	Agricultural Water Quality BMP Implementation Project	Agricultural Pollution Prevention	Implementation Funded	2015-ERP-2-24
<input type="button" value="Edit"/>	<input type="button" value="View"/>	154	Crooked Creek Gully Restoration	Agricultural Pollution Prevention	Implementation Funded	Contract-31018
<input type="button" value="Edit"/>	<input type="button" value="View"/>	233	Implementation of Farmland Treatment Solutions around Lake Cami	Agricultural Pollution Prevention	Implementation Completed	2014-ERP-2-24
<input type="button" value="Edit"/>	<input type="button" value="View"/>	234	Implementation of Farmland Treatment Solutions along the Missisquoi River	Agricultural Pollution Prevention	Implementation Completed	2014-ERP-2-23
<input type="button" value="Edit"/>	<input type="button" value="View"/>	294	Potential Agricultural BMP Sites, Seymour River area	Agricultural Pollution Prevention	Scoping Completed	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1151	Browns River Corridor Plan #6 Westford pasture project	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1198	Browns River Corridor Plan Jericho fence project #31	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1314	Lamolle River SGA Greensboro buffer project	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1337	Upper Lamolle Agricultural Mapping for Cover Crops and Conservation Tillage	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1368	NRCS watershed planning for Pike River	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1371	agricultural pollution prevention projects with 31 agricultural producers	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1382	BC-05 (Shenang Rd, just north of Rt.36 junction) animal exclusion	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1384	EB-01 (Lost Nation Rd just west of Taylor Rd junction) animal exclusion project	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1390	Wanzer Brook WB-01 (Dodd Rd just south of Chester A Arthur Rd junction)	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1462	Swanton M06 - animal exclusion13 (18)	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1464	Swanton M09A - animal exclusion, Agricultural Pollution prevention19 (21)	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1466	Swanton M3T1.01B animal exclusion, Agricultural Pollution prevention17 (22)	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1468	Swanton M3T1.02 - Agricultural Pollution prevention18 (23)	Agricultural Pollution Prevention	Not Graded	
<input type="button" value="Edit"/>	<input type="button" value="View"/>	1470	Swanton M3T1.04B - animal exclusion - river, Agricultural Pollution prevention14 (25)	Agricultural Pollution Prevention	Not Graded	

- Online Projects and Tracking
- Projects are prioritized with partner input (RPCs, NRCDs).
- Database summaries are publicly available at appropriate scale.
- Ready projects meeting key criteria become the highest priority for funding.

<https://anrweb.vt.gov/DEC/IWIS/ARK/ARKReportViewer.aspx?Report=ImplementationReady>

Tactical basin plans identify key partners and funding, when known

WDP

Project ID 1464
Project Name Swanton M09A - animal exclusion, Agricultural Pollution prevention19 (21)
Grant Number(s)

Project Events Measures Grading Related Projects

Project Edit

Project Name Swanton M09A - animal exclusion, Agricultural Pollution prevention19 (21)

Description
Tree/buffer planting project combined with cattle fencing to reduce nutrient inputs and enhance sediment and nutrient attenuation, may also need stream crossing and/or watering systems for cows

Project Type Agricultural Pollution Prevention
Stage
SGA Reach M09A - Fair - Very High
Latitude Longitude

Notes
19 (21) Need to confirm if cattle access still an issue. Good project to reduce sediment/erosion impacts from trampling the stream banks. ///// Reach has planform and may be good area to plant. Should plant back from bank planform adjustments. Feasible; medium watershed priority

Link

Save Exit

Towns & Regions

Add Town/Region

Town
Swanton

Basin/Sub Basins

Add Basin

Sub Basin
Tributaries to Lower Missisquoi

Partners

Add Partner

Partner	Status
Natural Resources Conservation Service	Potential

Potential Funding Sources

Add Funding Source

Funding Source
CREP Grants

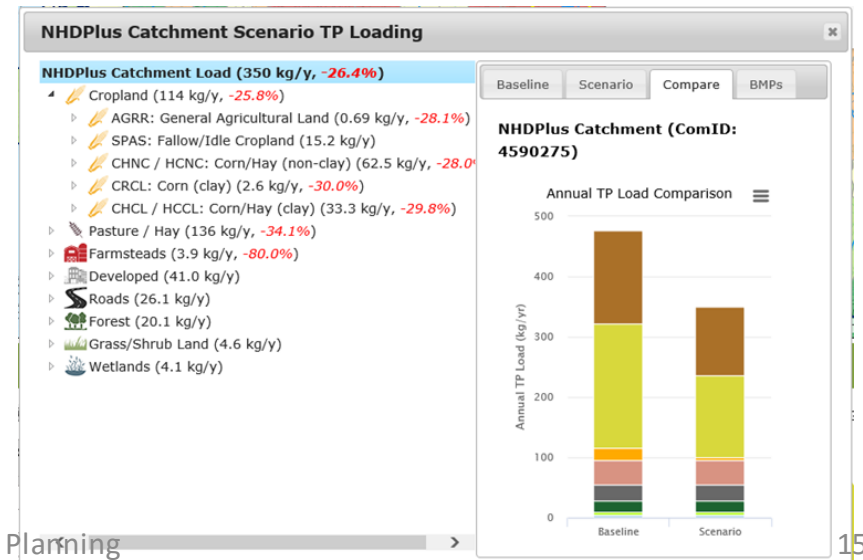
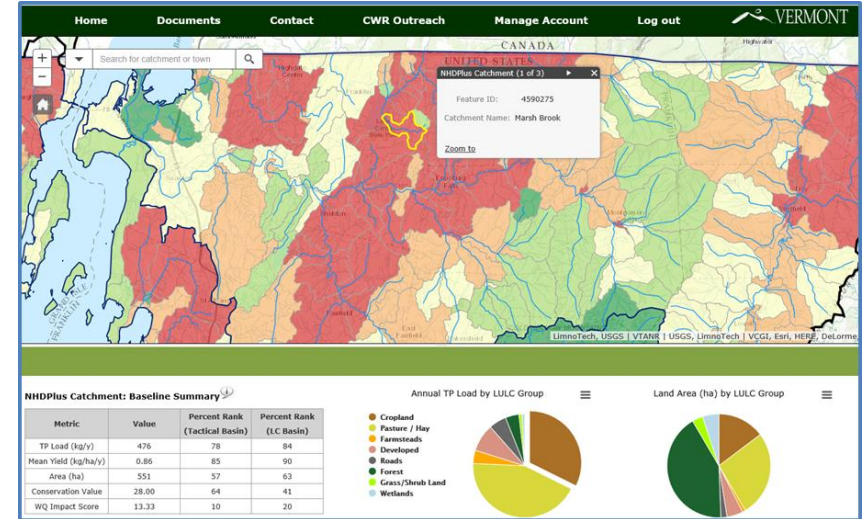
Program Highlights

- Online phosphorus planning/mapping program - coming in March, 2017
- Funded by Keurig GMCR with support from TNC, DEC, and others
- Presents online maps of phosphorus pollution and appropriate reduction practices.
- Can be used to map phosphorus reduction projects from DEC's database for public.



February, 2017.

Clean Water Roadmap



MAPP has evolved the planning program to deliver fully-integrated, online basin plans supporting funding.

Online Basin Plan Documents



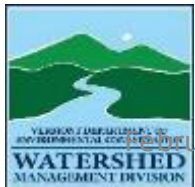
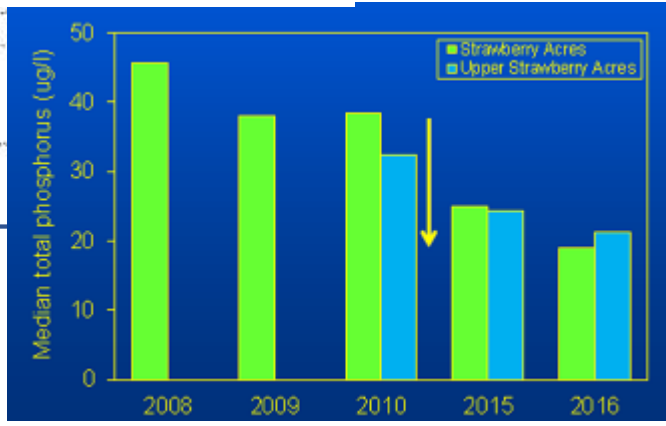
- Hudson River Drainage Basin: [Rattletail, Hoosic, Willamantic](#)
- Lake Champlain Drainage Basin: [Southern Lake Champlain](#), [Otter, Little Otter, Lewis Creeks](#), [Northern Lake Champlain](#)
- Missisquoi Bay: [Lamoille](#), [Winooski](#)
- Connecticut River Drainage Basin: [White](#), [Orpauqueshee, Black](#), [West, Williams, Saxtons](#), [Doverfield](#), [Stevens, Wells, Waits, Ompemuncogus](#), [Passumpsic](#), [Upper Connecticut River](#)
- Lake Memphremagog Drainage Basin: [Lake Memphremagog, Coatcook, Tomifolia](#)

Online Implementation Tables

ID	Project Name	Project Type	2014	2015	2016	2017	2018	2019	2020
14	Upper Otter Creek Watershed	Water Quality	Priority						
15	Upper Otter Creek Watershed	Water Quality	Priority						
16	Upper Otter Creek Watershed	Water Quality	Priority						
17	Upper Otter Creek Watershed	Water Quality	Priority						
18	Upper Otter Creek Watershed	Water Quality	Priority						
19	Upper Otter Creek Watershed	Water Quality	Priority						
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43	Upper Otter Creek Watershed	Water Quality	Priority						
44	Upper Otter Creek Watershed	Water Quality	Priority						
45	Upper Otter Creek Watershed	Water Quality	Priority						
46	Upper Otter Creek Watershed	Water Quality	Priority						
47	Upper Otter Creek Watershed	Water Quality	Priority						
48	Upper Otter Creek Watershed	Water Quality	Priority						
49	Upper Otter Creek Watershed	Water Quality	Priority						
50	Upper Otter Creek Watershed	Water Quality	Priority						

Funded projects

Phos. reduction



For additional information



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See what we're up to on our [blog](#).

