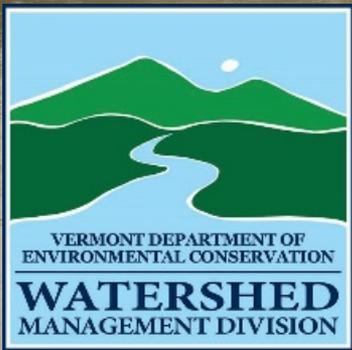


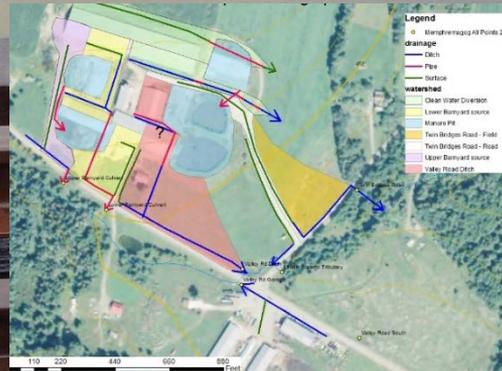
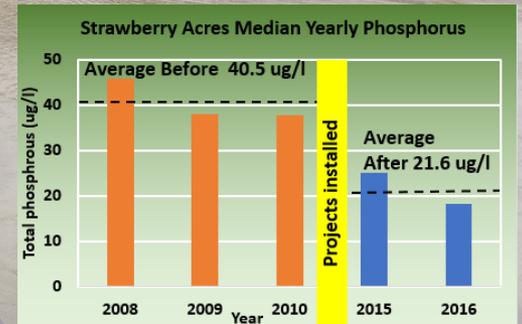


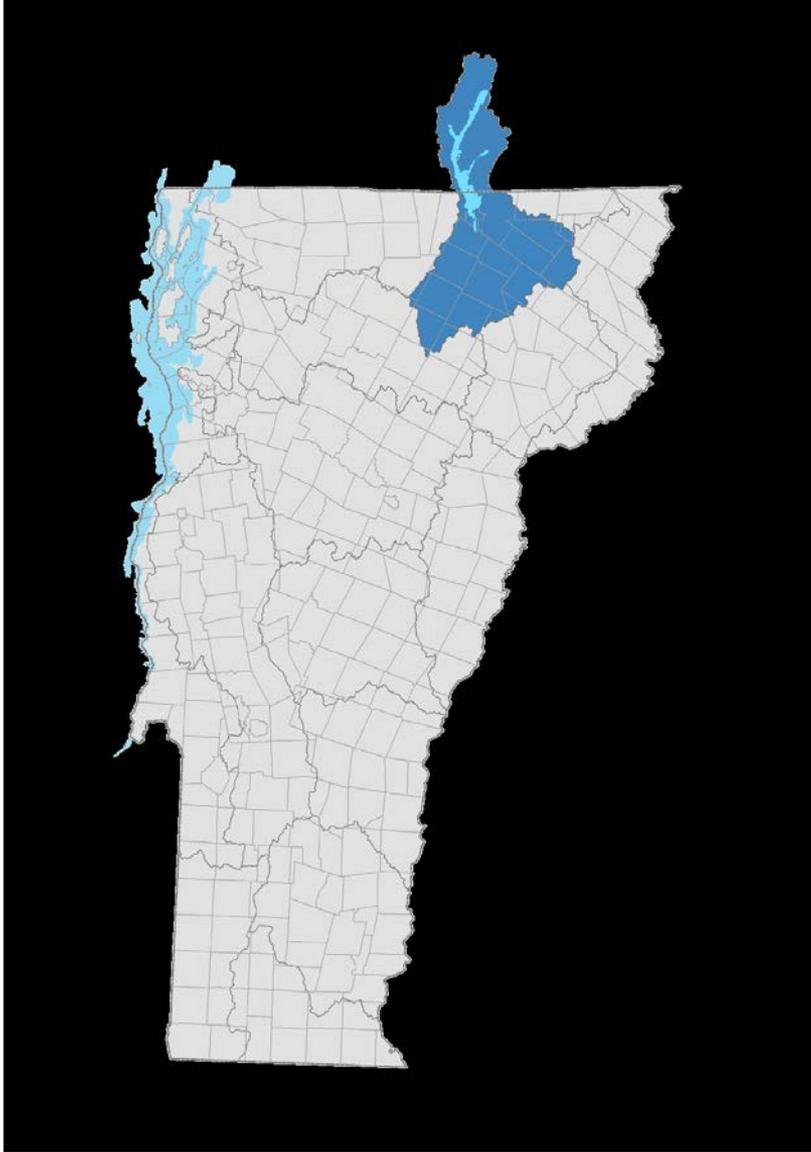
# Brown Bag Presentation on the Lake Memphremagog Tactical Basin Plan and Phosphorus TMDL



Ben Copans

Watershed Coordinator





## Brown Bag on the Lake Memphremagog Phosphorus Total Maximum Daily Load (TMDL) and Tactical Basin Plan

### What will be covered

- An overview of the Lake Memphremagog watershed and water quality challenges it faces.
- A summary of how modeling was done to calculate loading limits and set allocations between source sectors.
- How the TMDL will be implemented through the basin planning process:
  - Using volunteer water sampling for project identification, prioritization and evaluation.
  - Through the development of partnerships to support the use of water quality and other assessment data to maximize the impact of project implementation efforts.

# Lake Memphremagog Phosphorus Total Maximum Daily Load (TMDL)

- A TMDL is a phosphorus budget that sets a maximum daily (or in the case of phosphorus, yearly) load which allows the lake to meet its water quality standard (14 ppb for Lake Memphremagog).
- The TMDL identifies load reductions by source sector necessary to meet the target loading.
- The tactical basin plan includes actions for the first 5 years of the 20-year TMDL implementation timeframe to achieve phosphorus load reductions.
- Future iterations of the tactical basin plan will assess the effectiveness of the first 5-year effort and build upon this.

3

## LAKE MEMPHREMAGOG PHOSPHORUS TOTAL MAXIMUM DAILY LOAD

Approved: EPA Region 1, September 28, 2017

Environment Canada  
Department of Environmental Conservation

September  
2017

# The Lake Memphremagog Phosphorus TMDL was developed in an integrated effort with the tactical basin plan, along with the waste load allocation (WLA) for wastewater treatment facilities.



Vermont Department of Environmental Conservation  
Watershed Management Division  
1 National Life Drive, Room 2  
Montpelier, VT 05650-3522

Agency of Natural Resources

802-828-1535

## Final wastewater treatment facility wasteload allocations for communities in the Lake Memphremagog watershed: Barton, Brighton, Newport and Orleans

### Background

In conjunction with the development of the Lake Memphremagog phosphorus Total Maximum Daily Load (TMDL) in 2017, the Watershed Management Division (Division) also conducted the Agency of Natural Resources' Wasteload Allocation Process (Administrative Rule 87-46) to establish phosphorus allocations for four communities with wastewater treatment facilities in the Lake Memphremagog watershed – Barton, Brighton, Newport and Orleans. This document outlines the steps undertaken during that process to be consistent with the Rule.

### Wasteload allocation process

Watershed and lake modeling conducted in the development of the Lake Memphremagog TMDL was used to develop allocation scenarios consistent with nonpoint source allocations deemed feasible to remedy the phosphorus impairment in the lake. The Division presented four wasteload allocation (WLA) alternatives as part of the draft TMDL which included a Division preferred option that reduced permitted phosphorus loading from all facilities by a total of 33% (WLA-D in Table 1). The Division presented these alternatives in the Draft TMDL posted for public comment, a summary TMDL "fact sheet" and in several public meetings in the watershed. The four wasteload allocation alternatives are shown in Table 1.

*To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations.*

## LAKE MEMPHREMAGOG PHOSPHORUS TOTAL MAXIMUM DAILY LOAD

September 2017

Approved: EPA Region 1, September 28, 2017

Vermont Department of Environmental Conservation

### Vermont Agency of Natural Resources Watershed Management Division Basin 17 Lake Memphremagog, Tomifobia and Coaticook TACTICAL BASIN PLAN



The Lake Memphremagog Tomifobia and Coaticook Basin (in Vermont) - Tactical Basin Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards, the Federal Clean Water Act and 40 CFR 135.6, and the Vermont Surface Water Management Strategy.

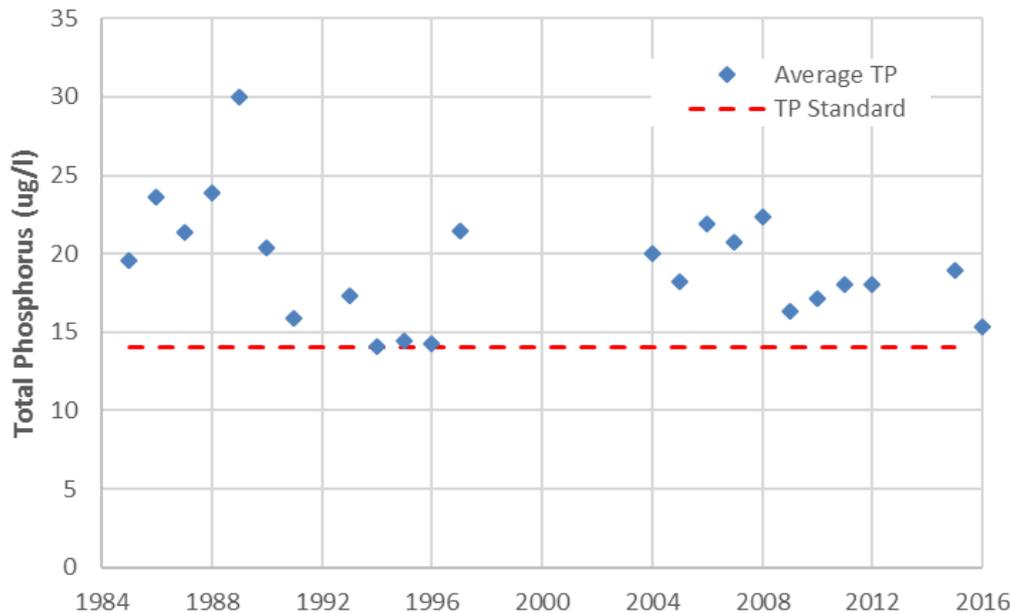


BASIN 17- LAKE MEMPHREMAGOG, TOMIFOBIA AND COATICOOK TACTICAL BASIN PLAN - DRAFT 2017 1

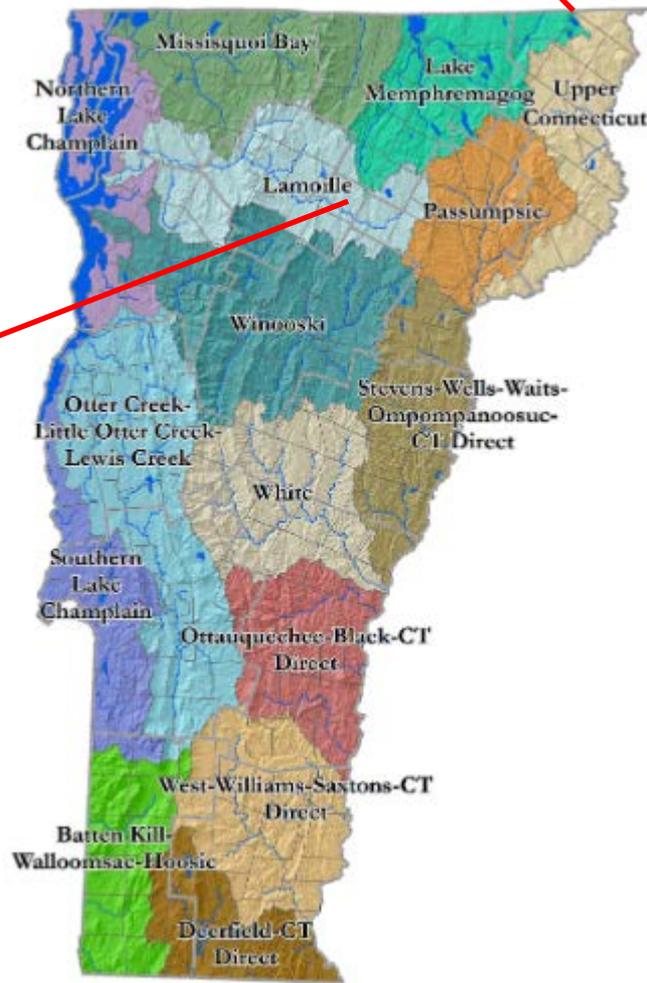
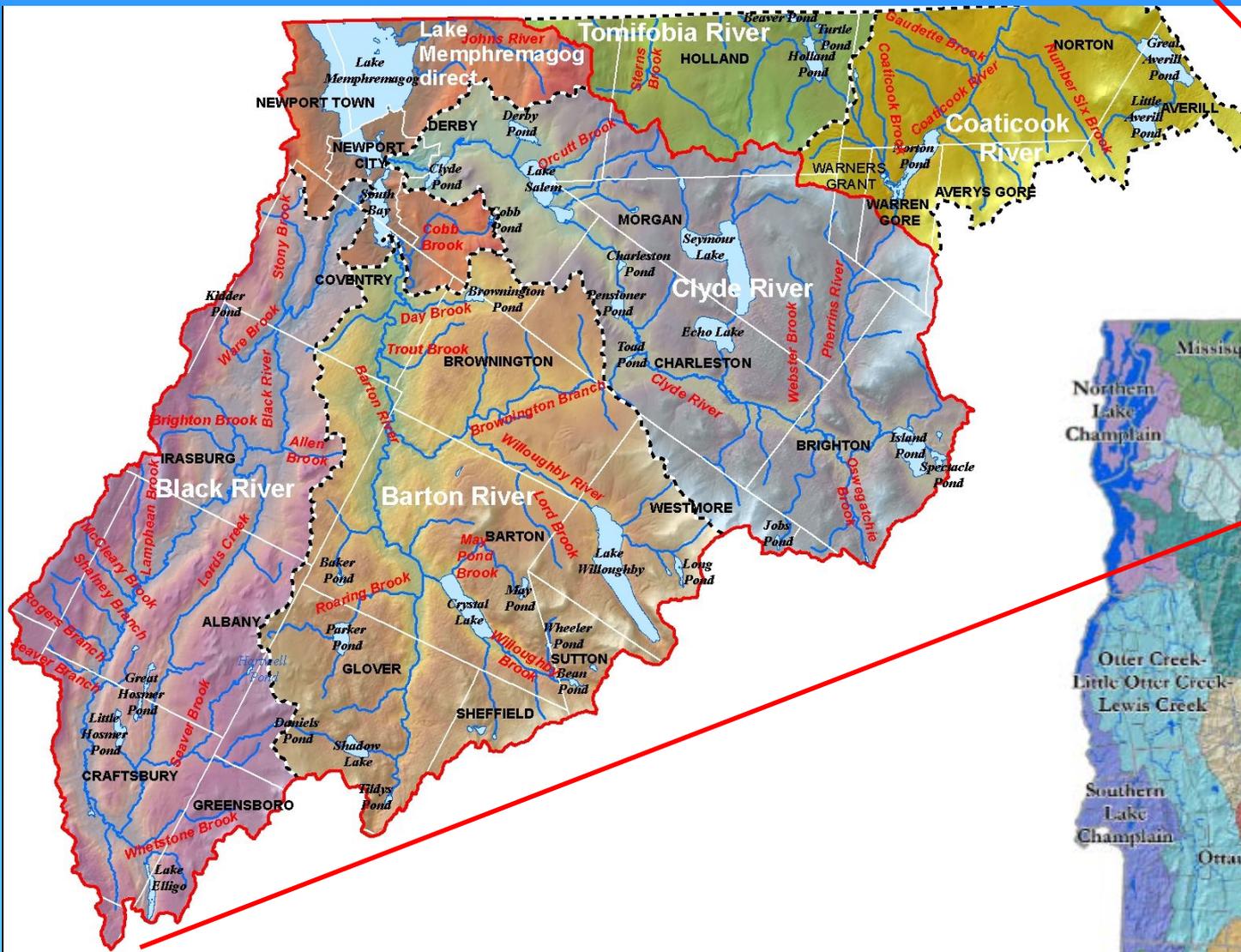
The TMDL was approved by EPA in September and the WLA and Tactical Basin Plan were signed in October and November.

# Why are we concerned about phosphorus levels in Lake Memphremagog?

- Cyanobacteria blooms in the lake
- Increased algae and plant growth impact the recreational use of the lake



- Current levels are well above the water quality standard of 14 ppb. Ave. 17.6 ppb



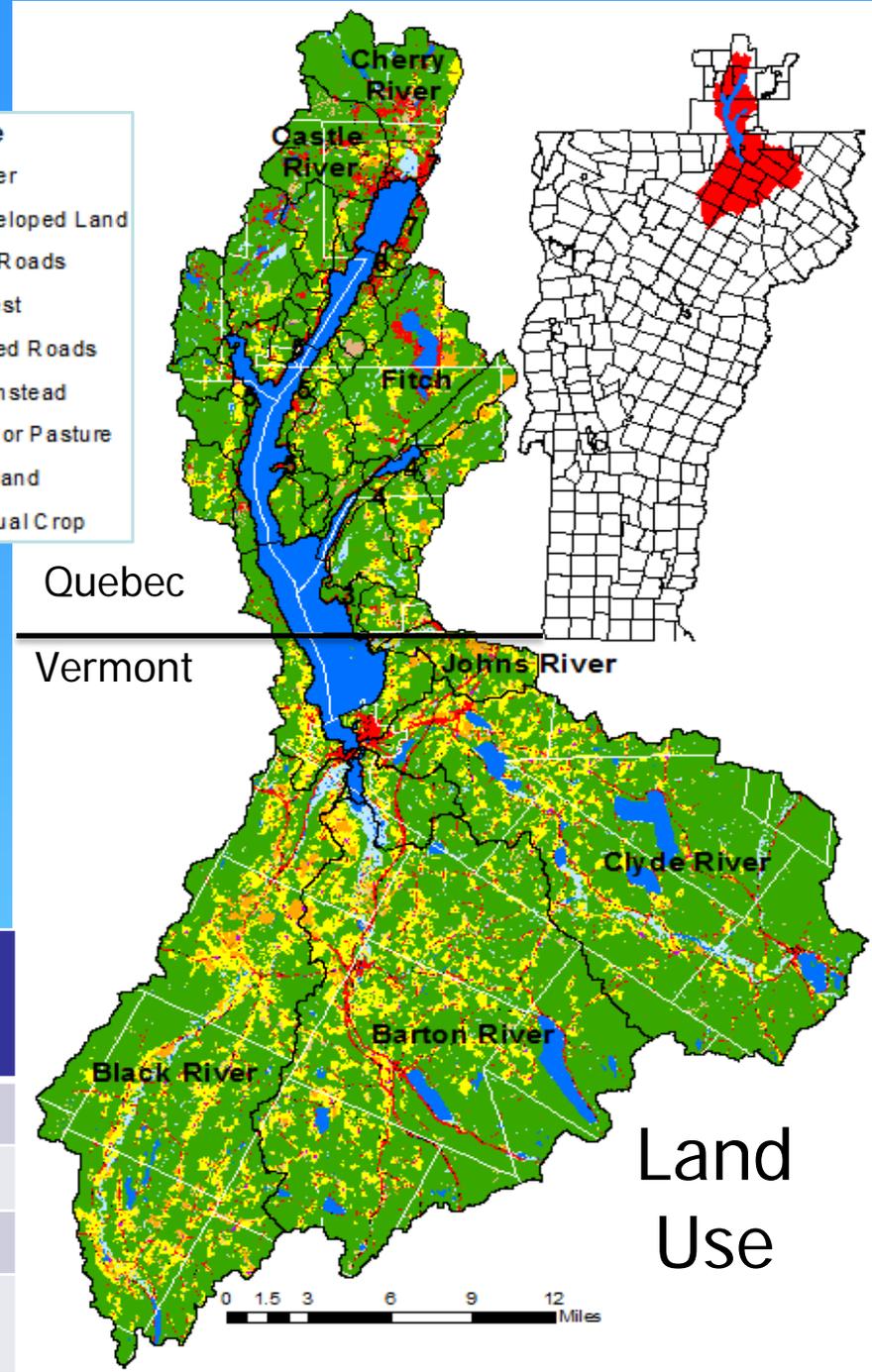
The Lake Memphremagog watershed is part of the St. Francis River Basin.

# Lake Memphremagog has an international watershed.

- A majority of Lake Memphremagog is in Quebec, but most of its watershed is in Vermont.
- The Quebec Vermont Steering Committee on Lake Memphremagog supports coordination across the watershed.
- Partners have supported WQ sampling and modeling necessary for the TMDL.



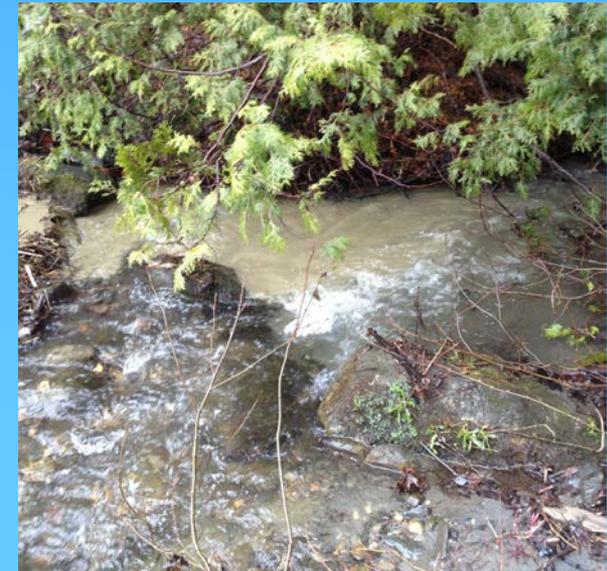
Land use	Percent of Vermont watershed
Developed	5%
Agricultural	17%
Forest/shrub	70%
Water/wetland	8%

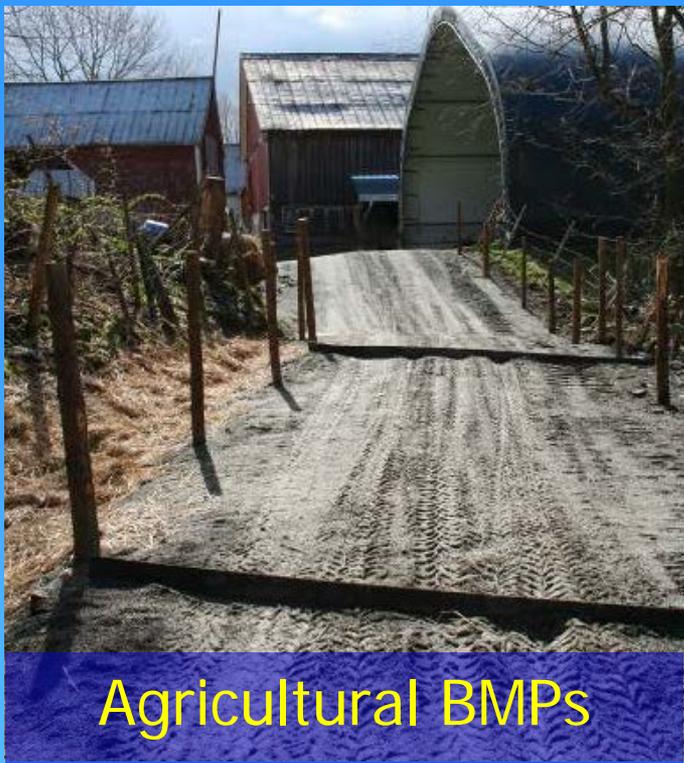


Land Use

A number of lakes and streams in this basin are stressed or impaired due to elevated levels of nutrients or increasing nutrient trends.

- Mud and Walker ponds are listed as stressed.
- Elligo, Little and Great Averill, Holland, Long, Parker, Norton, Salem, Seymour, Shadow, and Willoughby Lakes all have increasing nutrient trends.
- Roaring Branch and a tributary to Stearns Brook are impaired and others stressed due to nutrient runoff from farms.
- Efforts to reduce phosphorus loading from these watersheds will benefit both these waters and Lake Memphremagog.





Agricultural BMPs

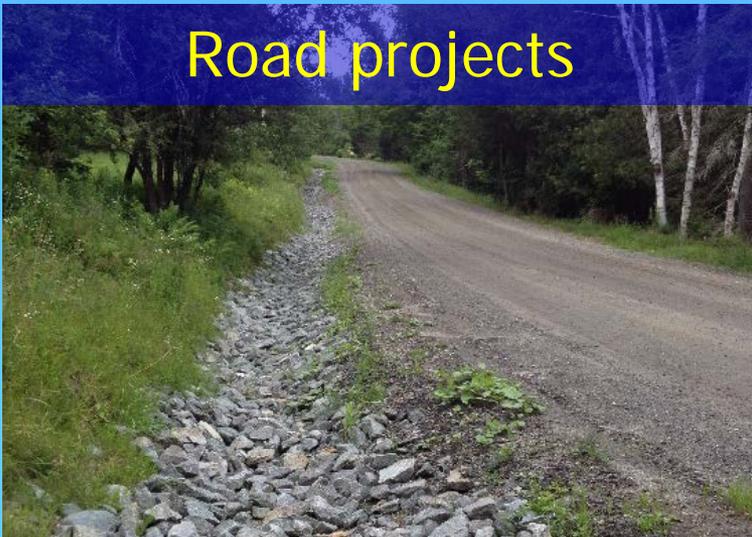
A lot of work is already focused on phosphorus reductions and we have seen indications of

Stormwater projects



lower levels of phos. in tributaries and the lake.

Road projects

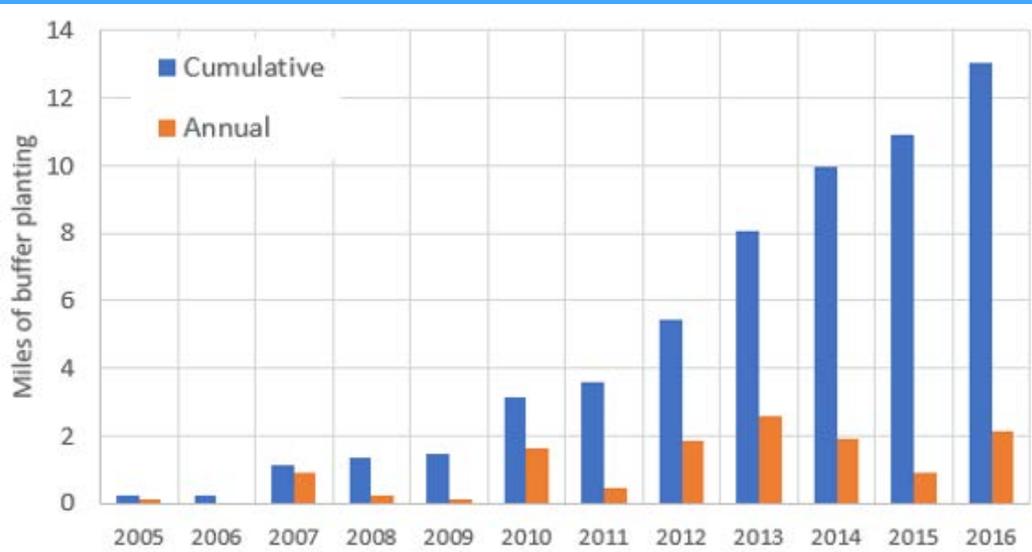


Buffer plantings



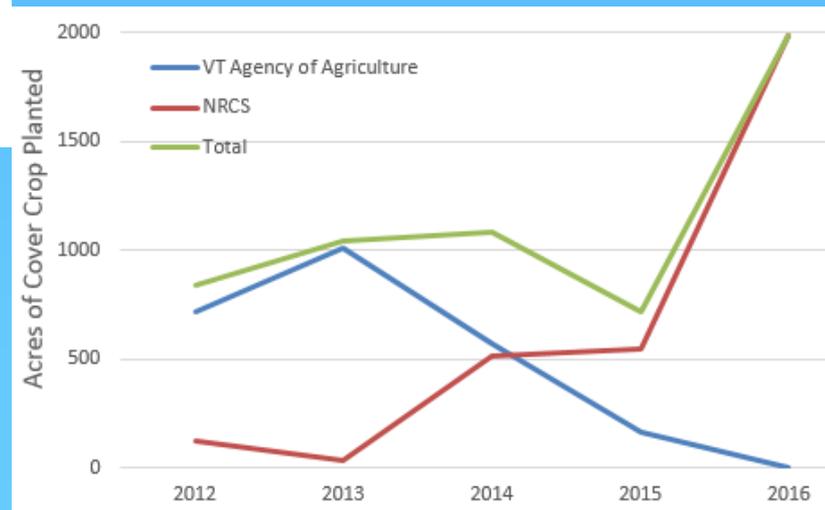
**Table 13. Practice summary in the Lake Memphremagog watershed in Orleans County 2012 – 2016**

	AAFM		NRCS		Total	
	Cost	Acres	Cost	Acres	Cost	Acres
Agronomic Practices	\$77,554	4342	\$170,132	2996	\$252,028	7338
Grazing Practices	\$4,990		\$259,178		\$264,168	
Barnyard Improvement	\$217,683		\$684,022		\$901,705	
Erosion Control	\$8,877		\$142,783		\$151,660	
<b>Total</b>	<b>\$309,104</b>		<b>\$1,256,115</b>		<b>\$1,565,219</b>	



← Miles of buffer planted in the basin

Acres of cover crop planted in Orleans County →

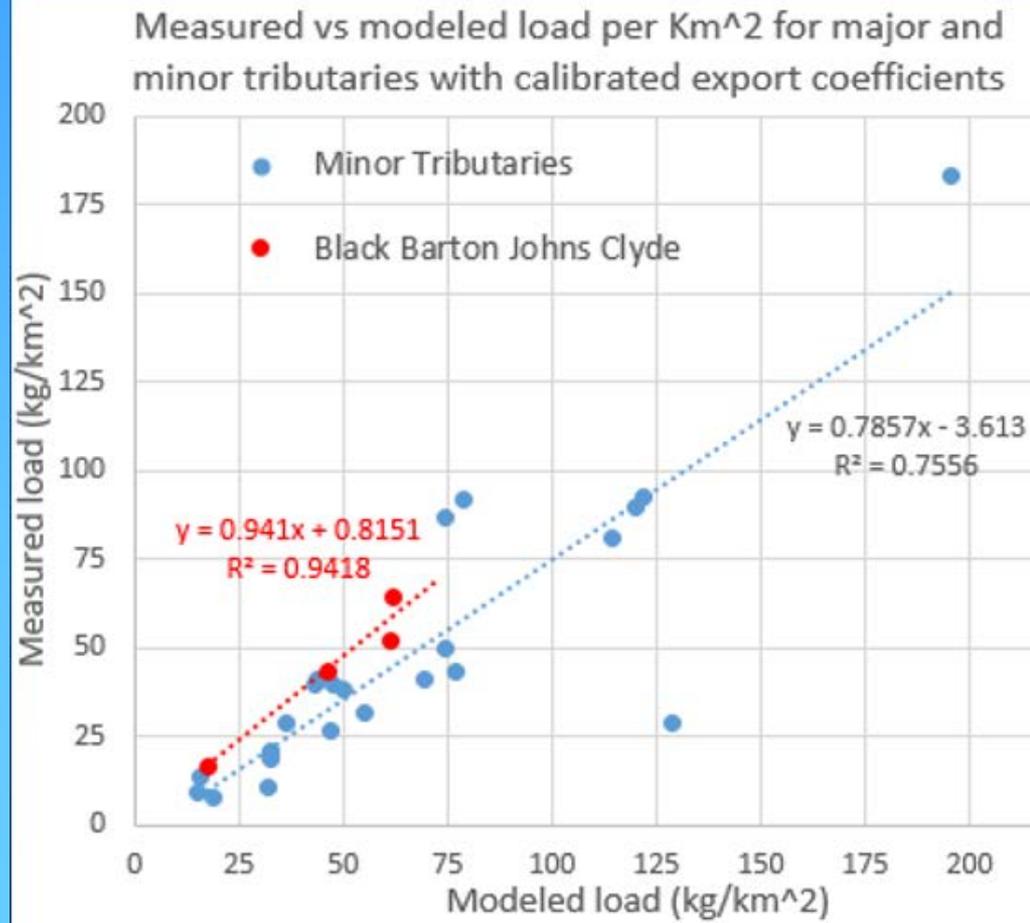




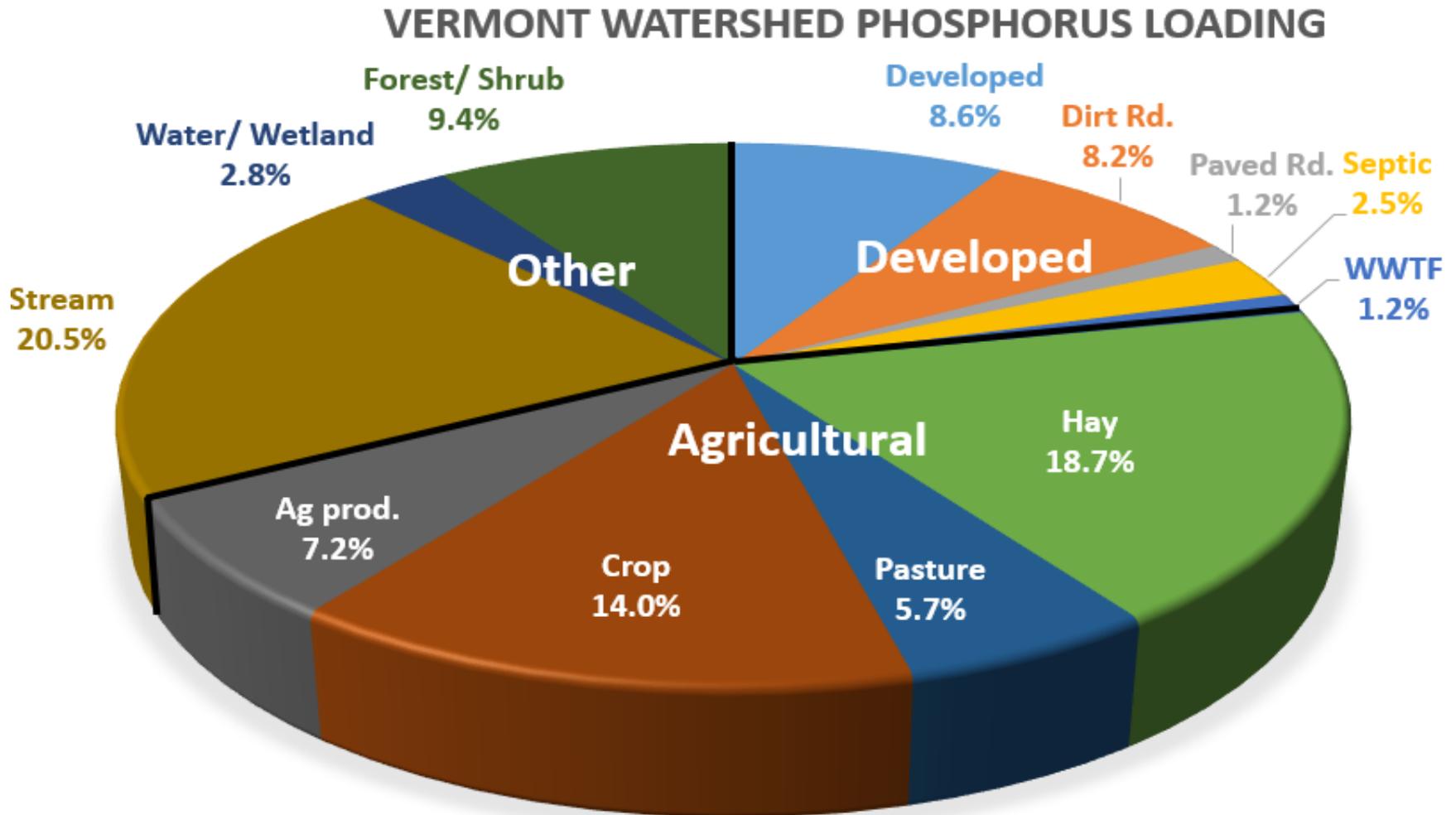
# Components of land use phosphorus export model:

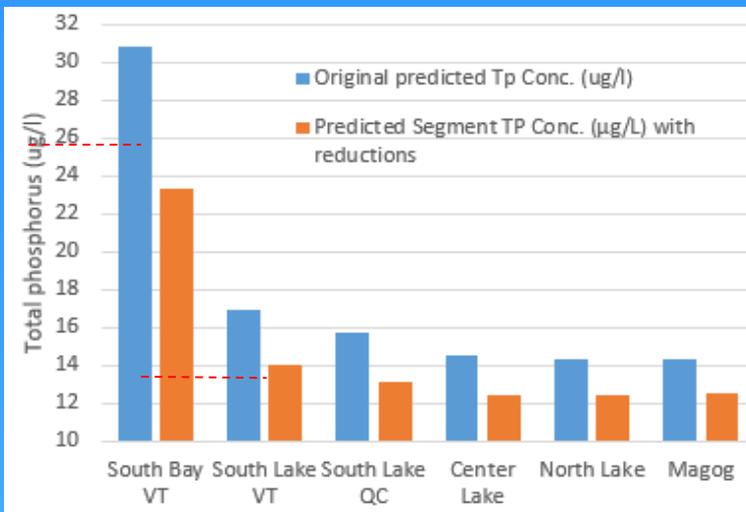
1. Loading from land uses based on an average export from that land use per land area from published studies.
2. Stream channel instability.
3. Septic system loading.
4. WWTF loading based on monitoring data.

- Loading from these sources are then reduced by sedimentation that occurs in lakes in the watershed.
- The model was calibrated by adjusting land use phosphorus export coefficients to best match modeled to measured loading at four major and 24 minor tributaries.

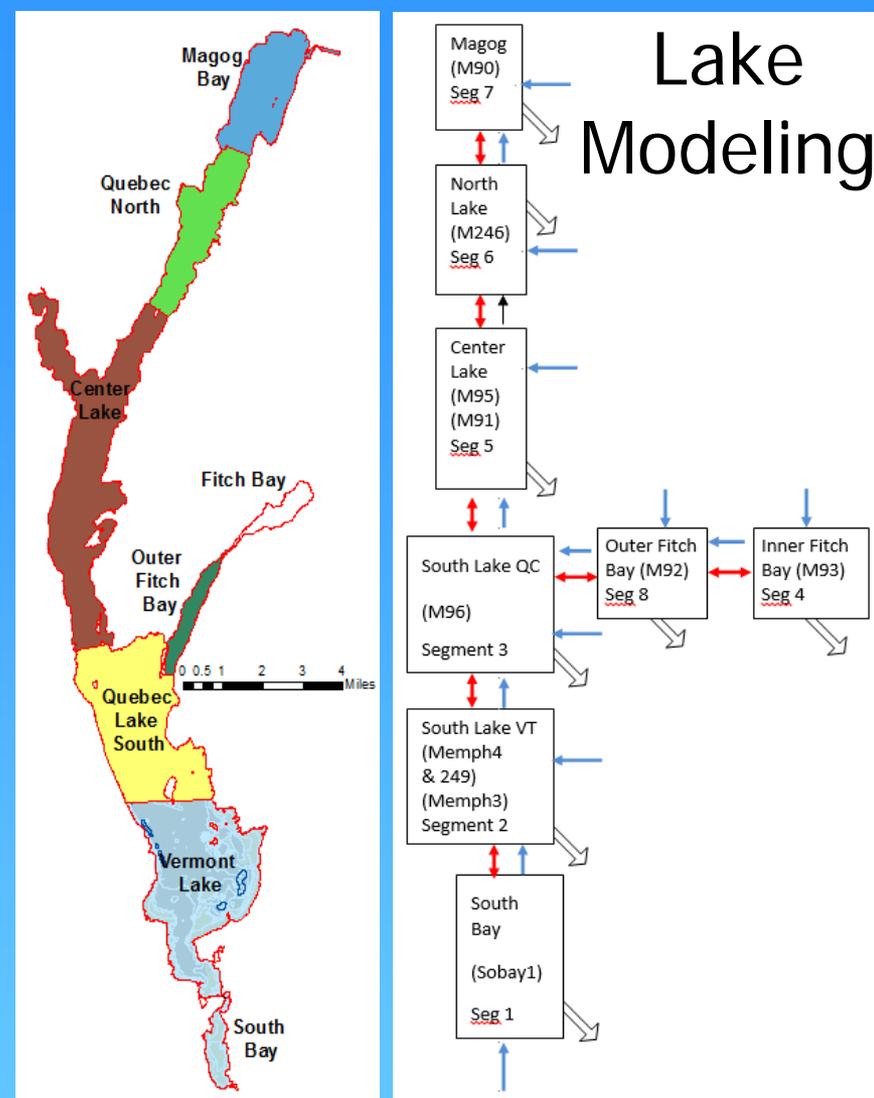


# Phosphorus loading from the Vermont portions of the Lake Memphremagog Watershed based on watershed export model





1. Breaks the lake into segments.
2. Calculates the amount of water that moves between lake segments (red arrows).
3. Calculates the amount of phosphorus that settles out in each segment (white arrows).
4. Model indicates that we need to reduce 29% of watershed loading to meet phosphorus standard for the lake and allow for an 8% margin of safety (MOS).



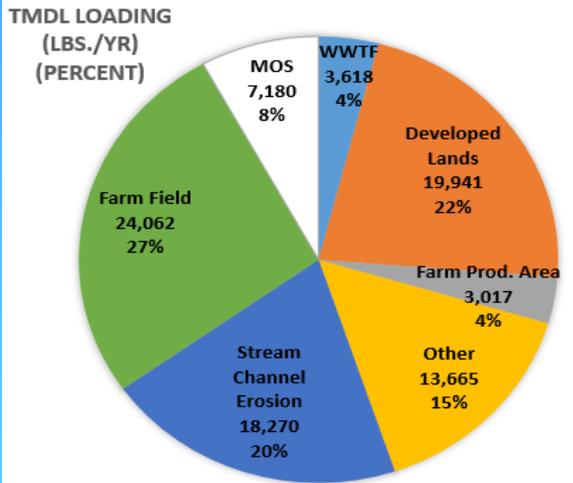
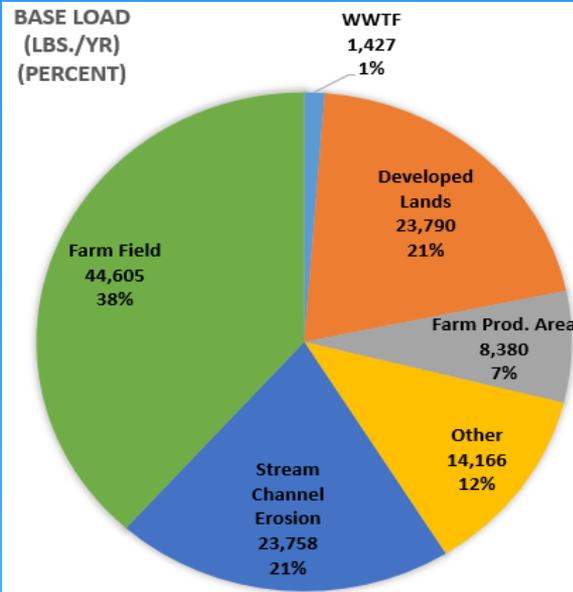


# Lake Memphremagog Scenario Tool

Land Use	Area in Acres	Load to Lake (lbs.)	BMP	Percentage Applied	Acres Treated	BMP Efficiency	Load Reduction (lbs.)
Developed Pervious	9,166	3,978	Ban on P Fertilizer Use on Turf	12%	1,100	50.0%	239
Developed Pervious	9,166	3,978	Riparian buffer	5%	458	67.0%	133
Developed Impervious	3,618	5,781	Riparian buffer	5%	181	67.0%	194
Developed Impervious	3,618	5,781	Surface Infiltration Practices .5"	8%	289	77.0%	356
Forest	211,240	10,021	Stream Crossing Erosion/Sedimentation Control	100%	211,240	5.0%	501
Road Paved	1,607	1,367	Infiltration Trench.5"	10%	161	77.0%	105
Dirt Road Combined	2,391	9,507	Roadside Erosion Control	65%	1,560	50.0%	3,574
Farmstead	974	8,380	Barnyard Management	80%	779	80.0%	5363
Hay	35,657	21,680	Ditch buffer or 10 ft Manure spreading setback	40%	14,263	51.0%	4423
Hay	35,657	21,680	Riparian buffer or 25 ft Manure spreading setback	30%	10,697	67.0%	4358
Hay	35,657	21,680	Gully stabilization and- 25 ft Riparian Buffer/setback	3%	1,070	84.0%	546
Pasture	10,880	6,616	Fencing/livestock exclusion with out riparian buffer	25%	2,720	55.0%	910
Pasture	10,880	6,616	Fencing/livestock exclusion with riparian buffer	25%	2,720	73.5%	1215
Pasture	10,880	6,616	Managed Intensive Grazing	25%	2,720	24.0%	397
Cropland Combined	6,021	16,309	Cover crop - Conservation tillage - Grassed Waterways - Ditch Buffer	31%	1,859	84.0%	4,357
Cropland Combined	6,021	16,309	Change in Crop Rotation - Grassed Waterways - Ditch Buffer	4%	238	74.0%	727
Cropland Combined	6,021	16,309	Cover crop	12%	735	27.3%	543
Cropland Combined	6,021	16,309	Conservation tillage - Manure injection	6%	374	20.0%	219
Cropland Combined	6,021	16,309	25 ft Riparian buffer	13%	805	67.0%	1,318
Cropland Combined	6,021	16,309	10 ft Ditch buffer	13%	805	51.0%	1,004
Cropland Combined	6,021	16,309	Grassed Waterways	10%	602	40.0%	527
Streambank	-	23,758	Restoration of Equilibrium Condition	42%	-	55.0%	5488
total	271,047	105,474			262,355		36496

# Proposed allocations for Lake Memphremagog TMDL

- Phosphorus loads need to be reduced by over 35,000 pounds to meet TMDL target (including 7,180 pound margin of safety).
- TMDL reduction percentages tied directly to the TMDL scenario across each land use sector.



	Waste Load Allocation (WLA) in lbs./yr				Load Allocation (LA) in lbs./yr				Total lbs./yr	8% MOS lbs./yr	Total lbs./yr
	WWTF Permit to Lake	Average WWTF Load	Future Devel.	Farm Production Area	Other	Stream Channel Erosion	Farm Fields				
Base Load	5,420	1,427	23,790	8,380	14,166	23,758	44,605	116,126		116,126	
Draft TMDL	3,618		19,451	489	3,017	13,665	18,270	24,062	82,572	7,180	89,753
<b>% Reduction</b>	<b>33.2%</b>		<b>18.2%</b>		<b>64.0%</b>	<b>3.5%</b>	<b>23.1%</b>	<b>46.1%</b>	<b>28.9%</b>		<b>23%</b>

# How to we make these phosphorus reductions happen across all these different land uses?

- In 2015, the Vermont Legislature passed Act 64, the Vermont Clean Water Act, which strengthens statutes related to water quality in the State addressing:
  - Farms through new Required Agricultural Practices and small farm regulations
  - Municipal and state roads through new stormwater permits
  - Updating stormwater regulations including previously unpermitted developments with over 3 acres of impervious surfaces
  - Updating acceptable management practices for forestry
  - Act 64 also establishes the requirement that all water quality improvement actions undertaken by the State be integrated by means of **tactical basin plans**, and establishes **partnerships** with regional planning commissions, conservation districts, and other organizations to support this work.



Basin plan has  
66 summary  
actions + 350  
specific projects

Table 24. Summary implementation actions for the Basin 17 Tactical basin plan

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix D)
<i>Strategies to address runoff from Developed Lands. Priority Sub-basins include high phosphorus export watersheds in the Lake Memphremagog Basin (Figure 2) Tributary to Stearns Brook, lake watersheds with elevated nutrient levels or increasing trends.</i>			
1. Map parcels that will come under the 3-acre stormwater permit in the basin and do outreach to landowners that will be required to seek permit coverage.	land erosion, channel erosion, encroachment	VDEC, NVDA, Towns	

WDP

Projects

Name

Project Type

Basin Plan

Grade Type

Status

County

Town

Grade

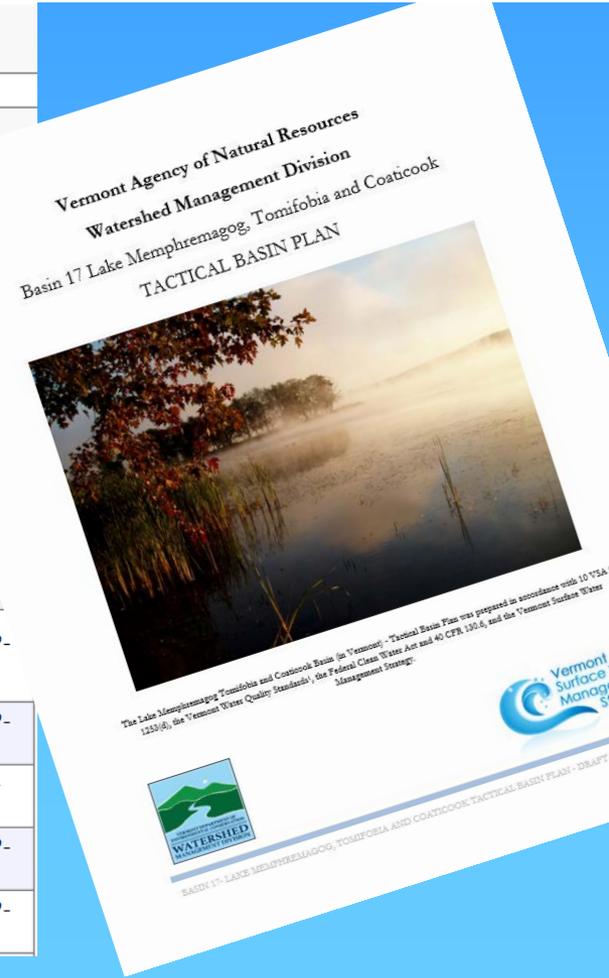
FED Step

Grant Num'

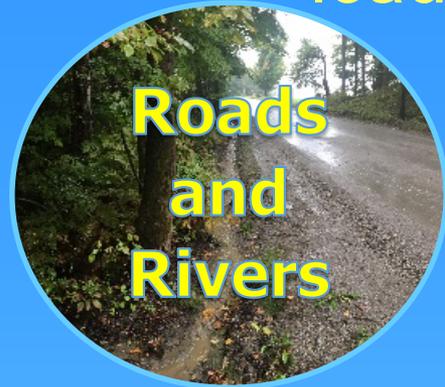
Proj ID

Search Clear Add To Report

		ID	Project Name	Project Type	Status	FED Step	Grant Num'
<a href="#">Edit</a>	<a href="#">View</a>	12	Whitney Brook and Black River Riparian Buffer Restoration	River - Planting	Completed	3	2016-12-02
<a href="#">Edit</a>	<a href="#">View</a>	40	Lake Shoreland and River Buffer Restoration in the Memphremagog Basin	Lake Shoreland - Implementation	Completed	3	2015-ER-2-13
<a href="#">Edit</a>	<a href="#">View</a>	48	Town of Brighton Stormwater Management Retrofit Planning and Design	Stormwater - Final Design	Completed	2	2015-ERP-1-19
<a href="#">Edit</a>	<a href="#">View</a>	64	Stormwater Treatment Study for the Memphremagog Watershed	Stormwater - Preliminary Design	Completed	1	2015-ERP-1-07
<a href="#">Edit</a>	<a href="#">View</a>	65	Memphamagog Illicit Discharge Detection and Elimination Completion	Stormwater - IDDE	Completed		Contract-28937
<a href="#">Edit</a>	<a href="#">View</a>	141	Town of Brighton Storm Water Retrofits	Stormwater - Implementation	Funded	3	2016-ERP-2-16
<a href="#">Edit</a>	<a href="#">View</a>	143	Lake Shoreland and River Buffer Restoration in the Memphremagog Basin	River - Planting	Funded	3	2016-ERP-2-18



# Memphremagog Stormwater Collaborative leads stormwater efforts and Magog RCMP coordinates farm efforts.



**Roads  
and  
Rivers**



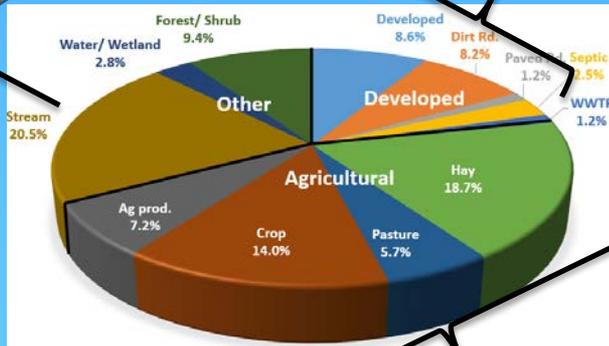
**Memphremagog  
Stormwater  
Collaborative  
(MWA Lead)**



**Large scale  
stormwater  
projects**



**Stream  
Geomorphic  
Assessments**



**Stormwater  
Outreach**

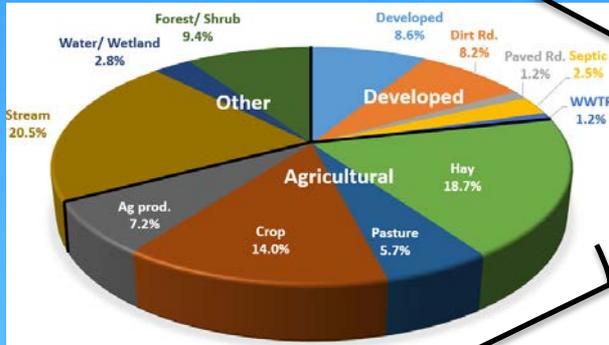
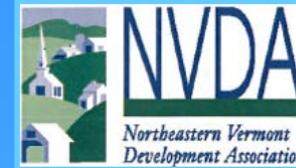


**Lake  
Wise  
BMPs**



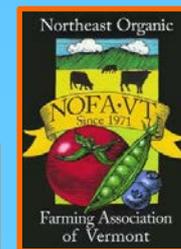
**\$674,000  
Memphremagog  
Regional  
Conservation  
Partnership Program  
(OCNRCD Lead)**

Both efforts are defined by partners working together to identify, fund and install priority practices.



**NORTHWOODS STEWARDSHIP CENTER**

Common Partners for both projects

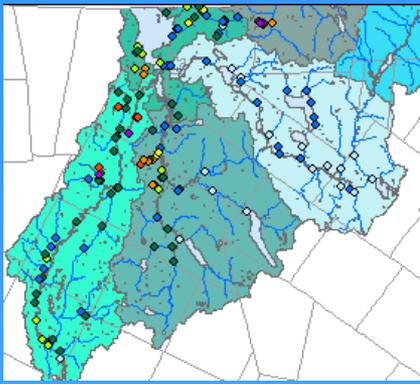


# Memphremagog Regional Conservation Partnership Program



- \$674,000 in funding over 5 years to support a nutrient management planning course, provide technical assistance to farmers and install practices.

- An additional \$674,000 in significant contributions has been committed by partners across the watershed.
- Water Quality sampling identifies target areas for project instillation and will allow for evaluating impact.
- Farmers that need to meet required agricultural practices or MFO/LFO permits may benefit from this technical assistance



## Water Quality Testing in the Lake Memphremagog Basin

- 166 sites sampled over 11 years.
- 8 sample events with 2+ rain per year.
- Sample for total phosphorus, nitrogen and turbidity.
- Fritz Gerhardt has led sampling efforts with support from MWA, NorthWoods Stewardship Center, VT DEC, OCNRCD
- Funded through the LaRosa Volunteer Partnerships, Ecosystem Restoration funding, 604(b), 319, MCI.
- Results are presented to the lake Memphremagog Agricultural Partners Workgroup which supports BMP implementation

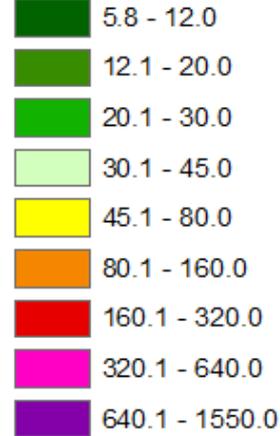


# Identification of high phosphorus export watersheds

Target areas:  
Yellow  
Orange  
Red  
Purple

## Legend

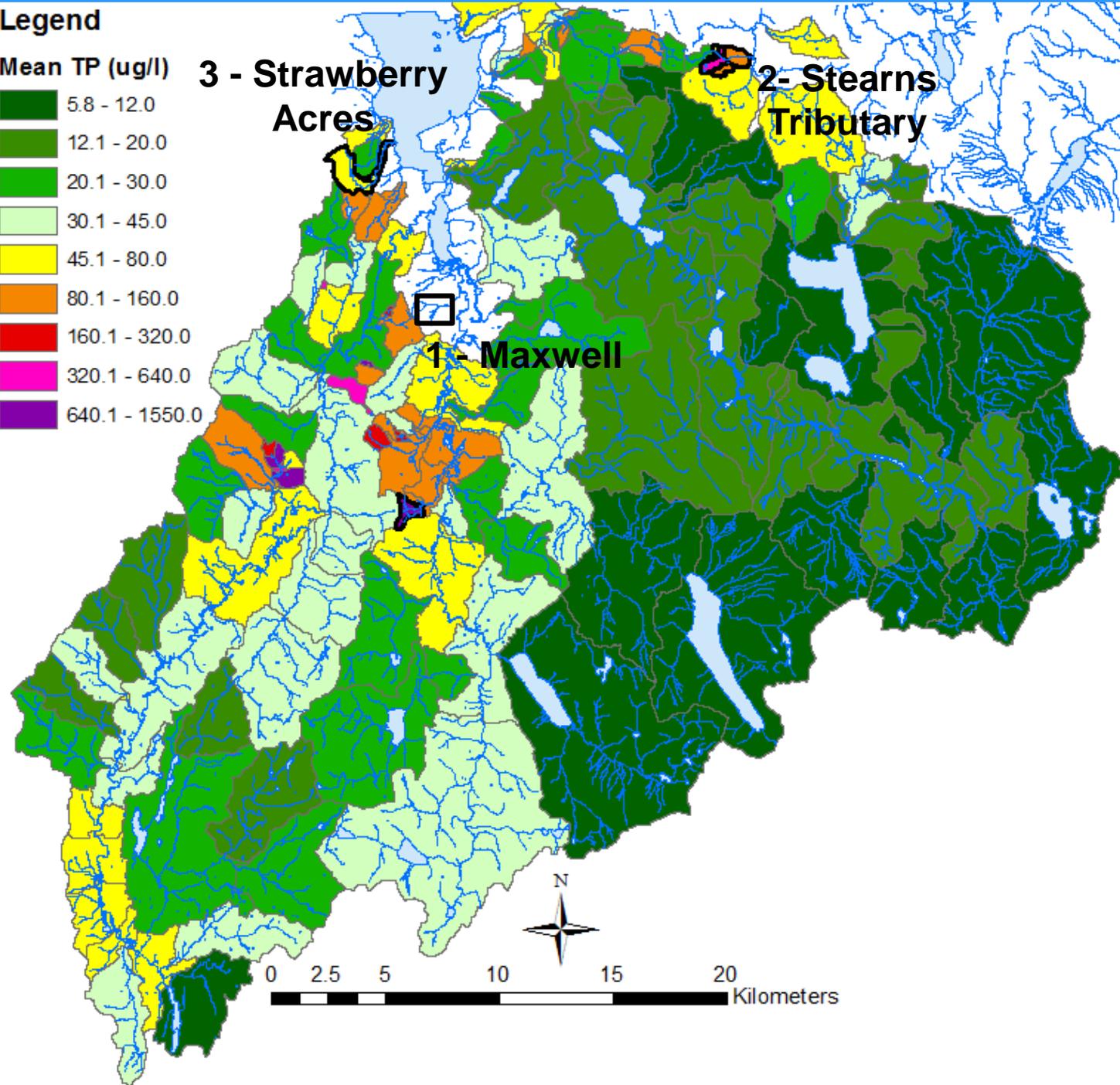
Mean TP (ug/l)



3 - Strawberry Acres

2 - Stearns Tributary

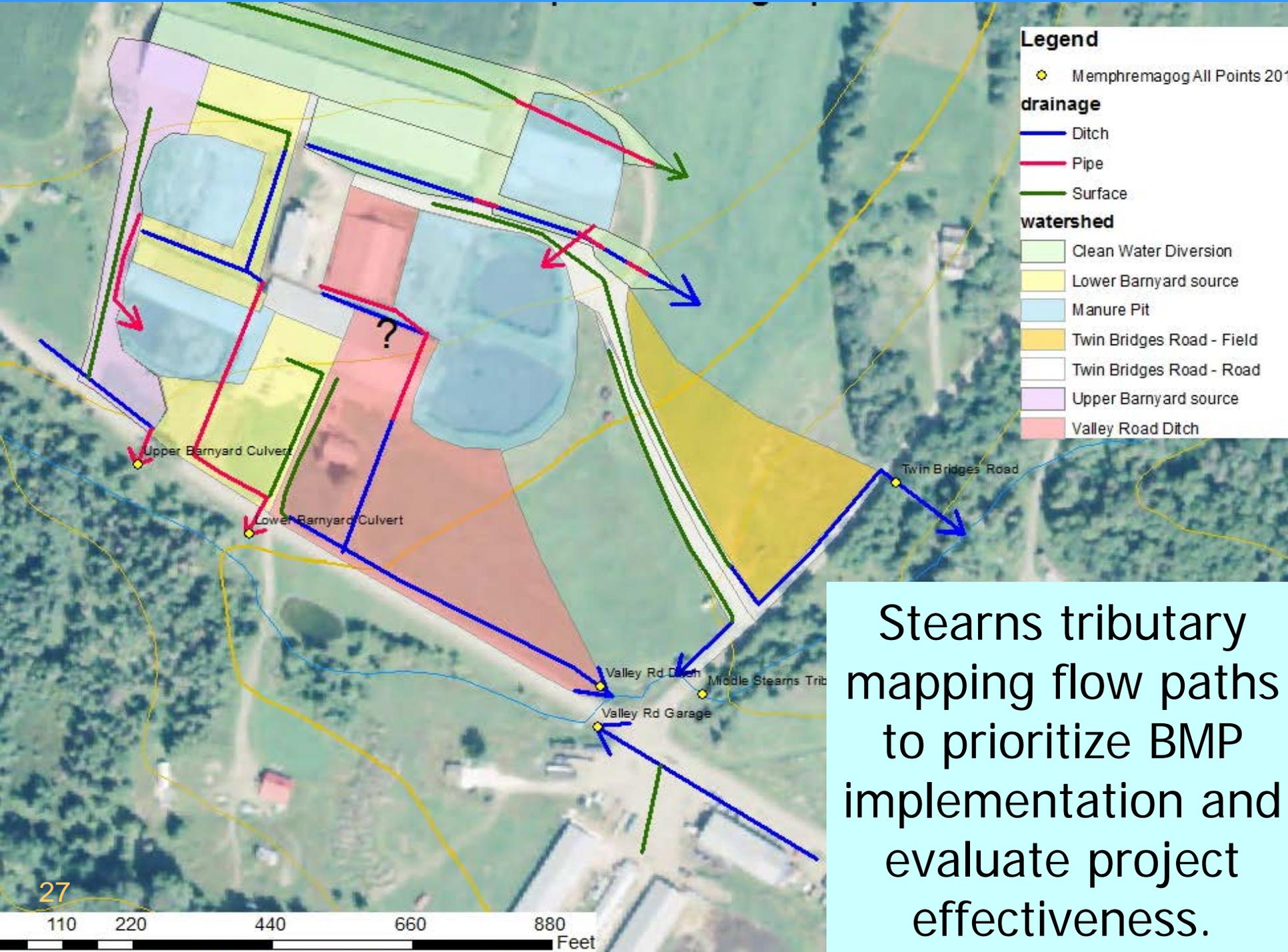
1 - Maxwell



# 2017 Water Quality sampling efforts are being done in coordination with 8 farms in the watershed.

- Sampling at 3-8 sites per farm where farmers are in target watersheds or where farmers are interested in installing BMPs.
- Data will inform BMP locations and evaluate phosphorus reduction effectiveness.

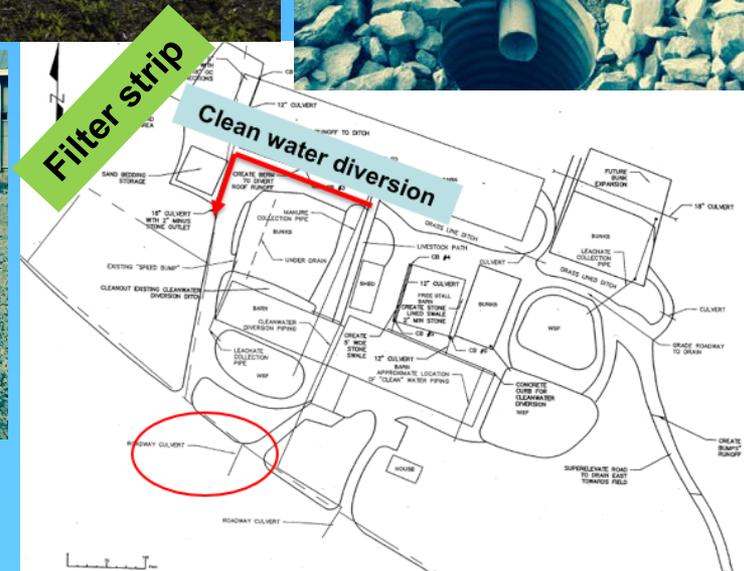
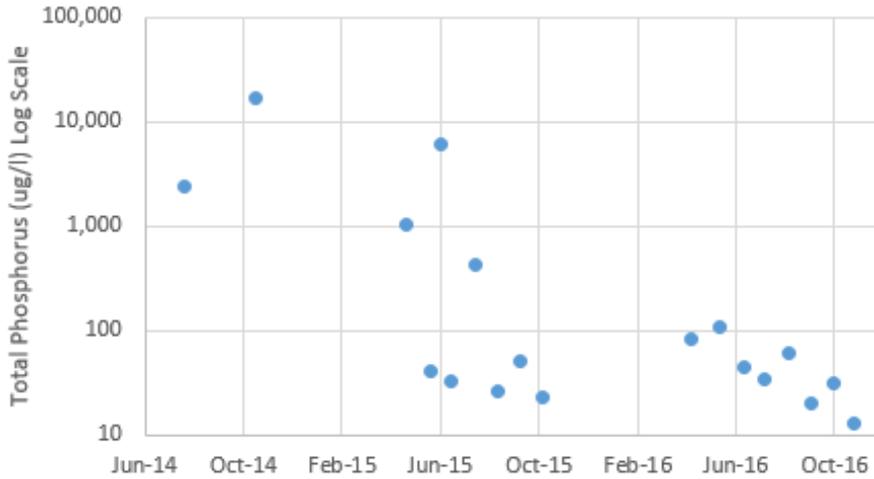




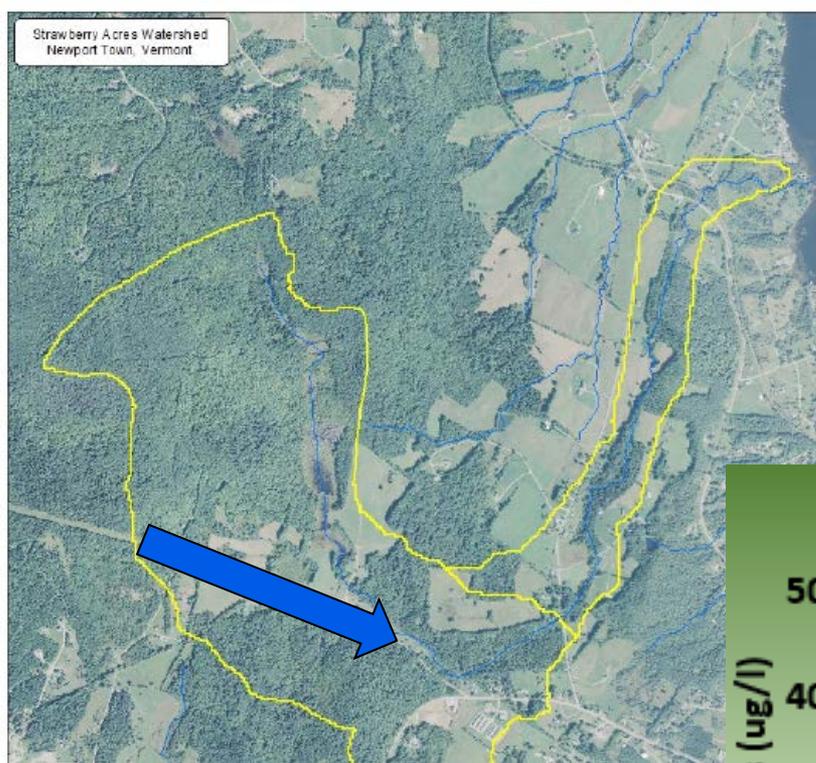
Stearns tributary mapping flow paths to prioritize BMP implementation and evaluate project effectiveness.

# New clean water diversion and 9-acre filter strip installed in 2015 with average annual phosphorus concentration dropping by two orders of magnitude.

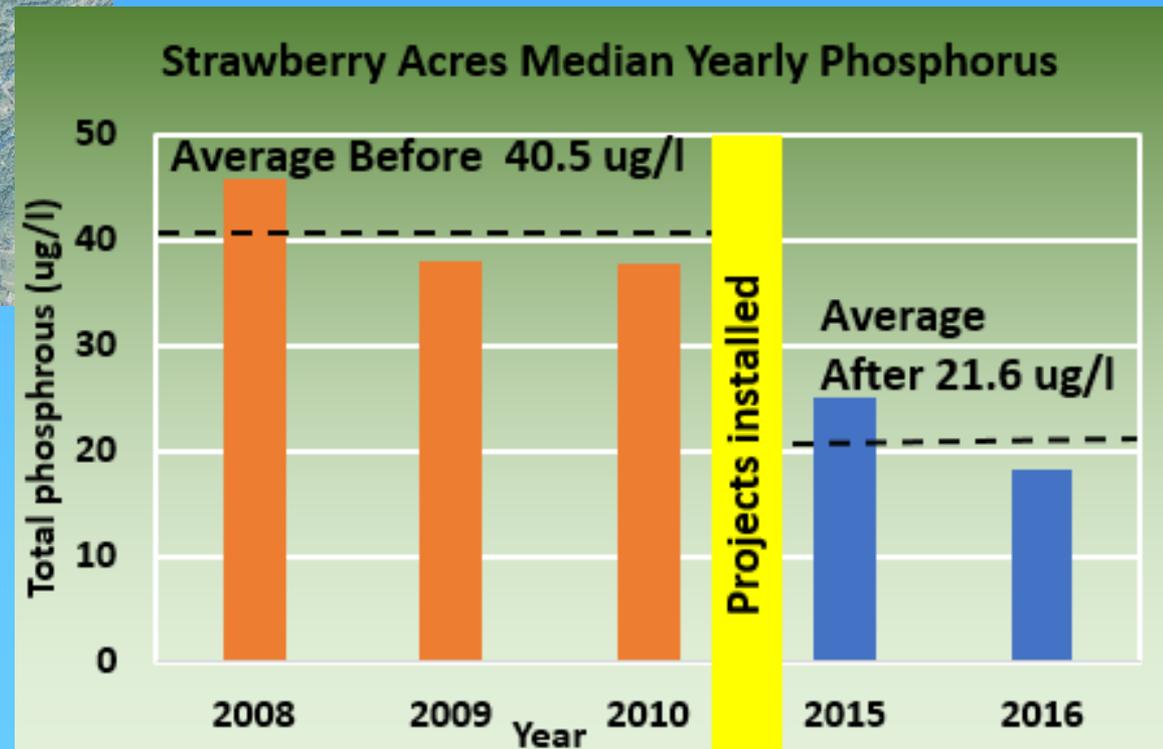
Upper Barnyard Culvert



# Strawberry Acres Tributary BMP success story...



Estimated 80 kg & 50% reduction in annual phosphorus loading to Lake



# Farmer WQ success story being published!



**MEMPHREMAGOG  
WATERSHED  
ASSOCIATION**



**NONPOINT SOURCE  
POLLUTION SUCCESS STORY**

## LOCAL FARMERS PLAY A PART IN MAKING PROGRESS FOR IMPROVED WATER QUALITY

**PROBLEM:** Lake Memphremagog has been classified as impaired due to elevated levels of phosphorus, a nutrient delivered to the lake through rivers and tributaries. Recent efforts by state and local partners have been focused on improving water quality by implementing best land use practices throughout the watershed.

The unnamed tributary called Strawberry Acres flows into the southwest corner of Lake Memphremagog in Newport Town and Coventry, and is one of the many streams shown to be a source of phosphorus. Its watershed encompasses 818 acres of agricultural and residential areas along with extensive forests and wetlands, especially at the headwaters.

Elevated levels of phosphorus in Strawberry acres were discovered through the Orleans County Conservation District water quality monitoring program with assistance from by the Memphremagog Watershed Association volunteers. Samples were collected 8-10 times annually from 2008 to 2016 in two locations along the tributary.

**PROJECT HIGHLIGHTS:** Since 2012 Chad and Amanda McCormick have operated a 55 cow small organic dairy in Newport, VT, located within the Strawberry Acres watershed. Both grew up in Orleans County around dairy; Amanda raised on a farm in Troy and Chad worked on farms during his youth in Barton and they have been a couple since high school.

Amanda has a degree in business and was a stay at home mom before taking on managing the dairy operation. Chad holds a full-time job and they both enjoy coaching a variety of youth sports teams. When starting to farm, the outdated facility made the day-to-day farm operation challenging with inadequate systems like manure pit required shoveling manure twice daily and a broken pipe causing the barn to flood. The herd went out to pasture that was accessed by a muddy lane with a stream crossing that the cows were reluctant to travel and their udders were dirty. Consequently, it was difficult to move the cows out of the barnyard and improve milk quality.

Another local farmer told Chad and Amanda about Natural Resource Conservation Service (NRCS) funding opportunities to assist with farmstead improvement projects that can help make their operation more efficient. In 2013 - 2014 they worked with NRCS to develop and implement a conservation plan to install a new manure pit along with a concrete barnyard and pasture infrastructure including laneways and fencing around the stream.

Since these projects, the McCormicks have seen management improve dramatically. They are conserving water, recycling the milk house waste to clean the gutters, capturing all waste in the manure pit, cows travel lanes are easier, reduced expenses, improved herd health and increase milk quality all while minimizes runoff into the tributary.

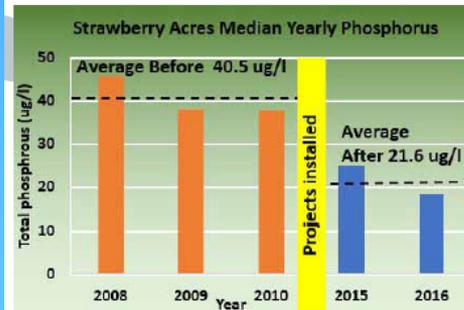


For additional information contact:  
VT DEC Watershed Coordinator, Ben Copans 802.751.2610  
Orleans County NRCD Manager, Sarah Damsell 802.334.6090 x118

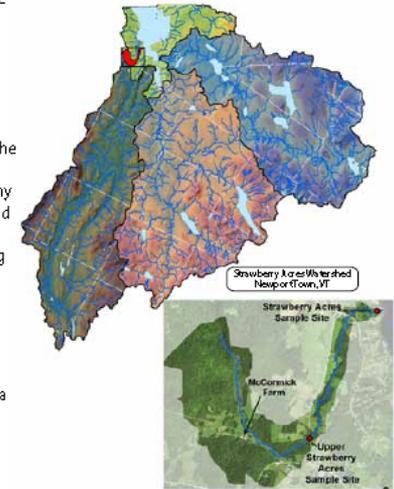
**RESULTS:** In 2015 and 2016 water quality sampling was repeated at the two sites along the Strawberry Acres tributary to gauge if these projects had measurably improved water quality in this tributary. Total phosphorus concentrations at both sites were substantially lower after these practices had been installed. The graph below shows the reductions in annual median values at the sample site where at the stream outlet. An analysis of the phosphorus loading in this tributary suggest a reduction of over 175 pounds of phosphorus per year which was a reduction of more than 50% of the estimated loading from this tributary before the projects were installed. Before this project, the McCormicks said they had so many issues that they couldn't focus on the learning about their cows and how to improve herd health. They have more paddocks and a rational plan, a new laneway, a new barn yard and pasture watering system which has increased herd health and resulted in herd happiness. "Since the project, we have learned so much about animal husbandry."

Chad said "We are getting more milk and better quality since we completed all this work; this is their third year of getting a quality milk award. Over all the project "has brought us closer together as a family."

### WQ Sampling Results



### Map of Watershed

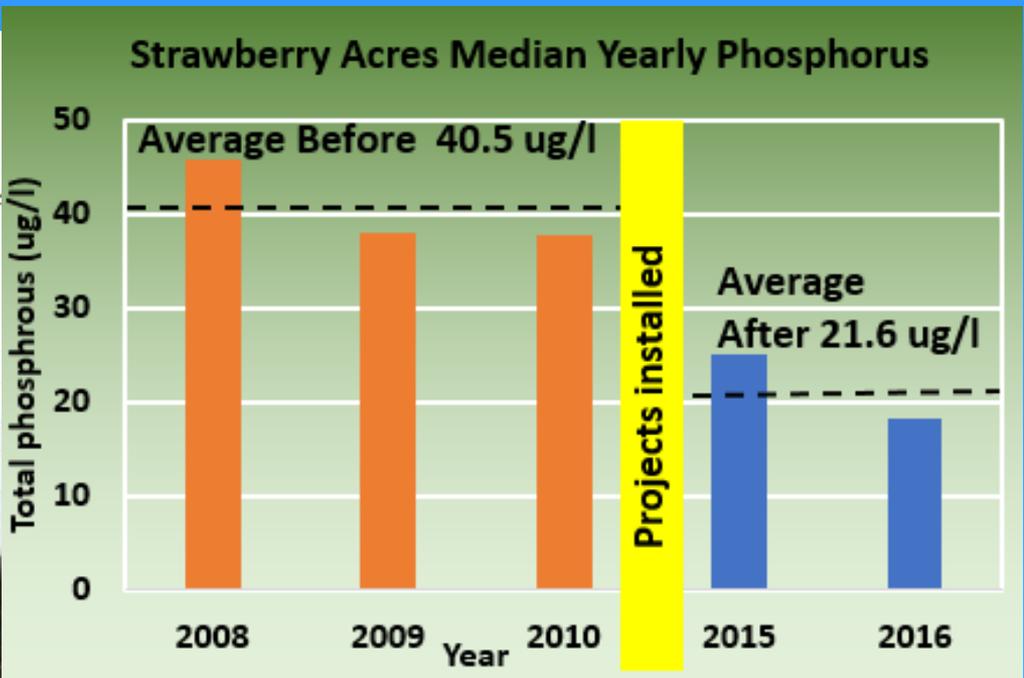
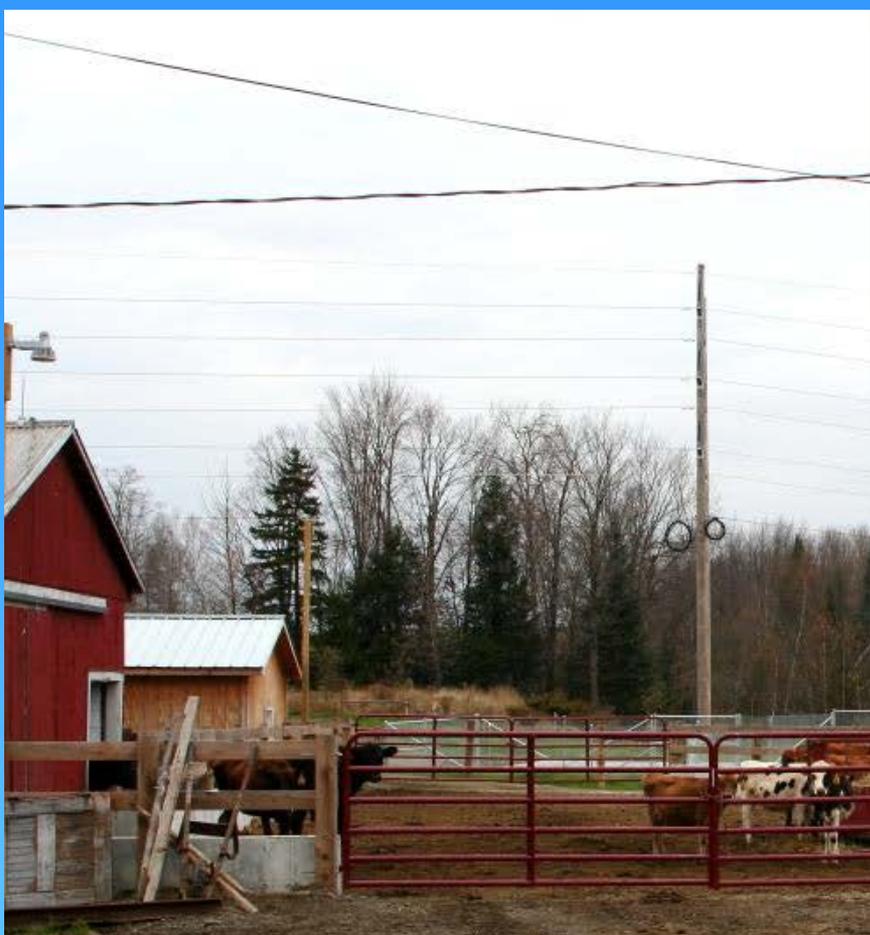


**REQUEST FOR ACTION:** Like Amanda said, "I don't think people realize the effect that these projects can have on the environment." Knowing that she had a positive impact on the lake felt really rewarding. Since this project, that are more aware of the water quality impairments and I hope that their story can inspire other farmers to plan their part.



For additional information contact:  
VT DEC Watershed Coordinator, Ben Copans 802.751.2610  
Orleans County NRCD Manager, Sarah Damsell 802.334.6090 x118

*Partners and Funding:* This project was funded through the National Resources Conservation Service (NRCS). The Water Sampling was supported by the Orleans County NRCD with funding support from the VT Ecosystem Restoration program and the VT Lake Sampling part the rslip.



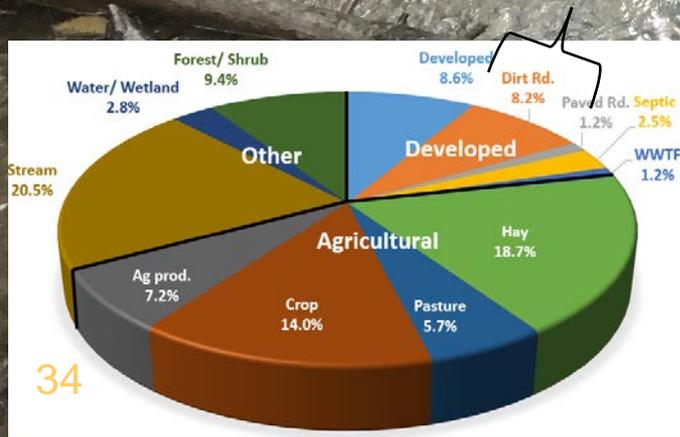
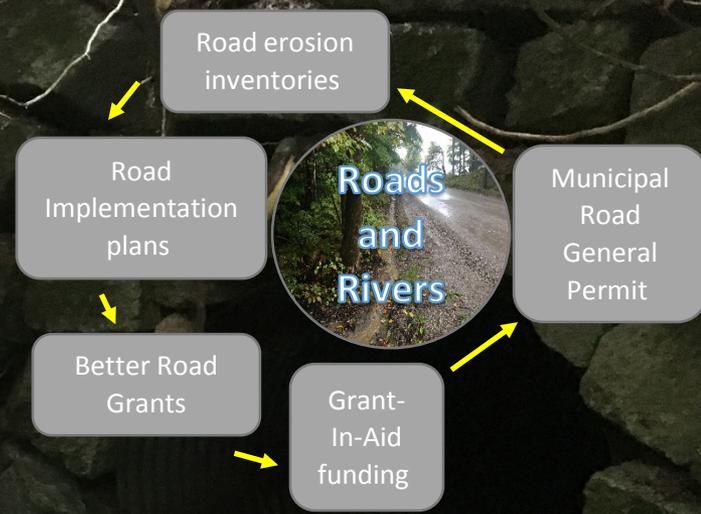
<u>Land Use</u>	<u>Project(s) and/or Practice(s)</u>	<u>Area (ha)</u>	<u>Load Reduction (kg)</u>	<u>% Reduction</u>
<u>Projects and Practices Implemented to Date</u>				
Developed	Ban on phosphorus fertilizer (pervious)	1.4	0.4	0.3
Farmstead	Barnyard management	2.3	20.8	15.6
Pasture	Livestock fencing (no buffer)	4.1	1.8	1.3
<b>Total</b>		<b>7.7</b>	<b>23.1</b>	<b>17.3</b>

# Memphremagog Stormwater Collaborative



The Memphremagog Stormwater Collaborative is led by the Memphremagog Watershed Association, which was able to hire a staff member through a \$40,000 High Meadows Fund Grant, with the goal of making this position self-sustaining over the life of the 18-month grant and through strong local partnerships.

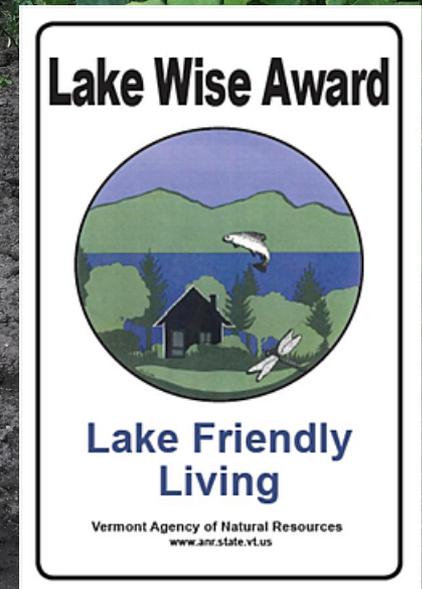
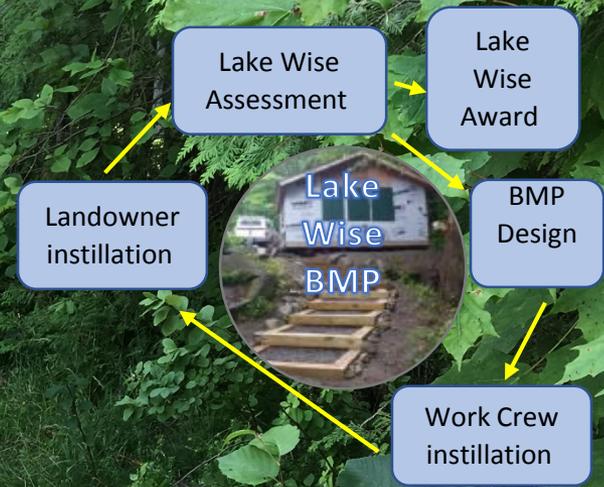
TOWN	Inventory date	MRGP compliant	Active partner or Consultant	Target MRGP date
Brighton	2015	N	ECNRCD	2019
Albany	2018	Y	NVDA	2019
Barton				
Brownington	2017	Maybe	David Antone	
			NVDA?/	
Charleston	2018	y	NorthWoods	2018
Coventry	2017	Y	OCNRCD	2018
Craftsbury	2018	Y	NVDA	2019
Derby	2018	Y	OCNRCD	2018
Glover				
Greensboro				
Holland	2018	Y	OCNRCD	2018
Irasburg	2015	N	NVDA	
Morgan	2015	N	MWA?	
			East	
Newport City	2018	Y	Engineering	2018
Newport Town			OCNRCD	2019
Westmore	2015	N		



Better road practices

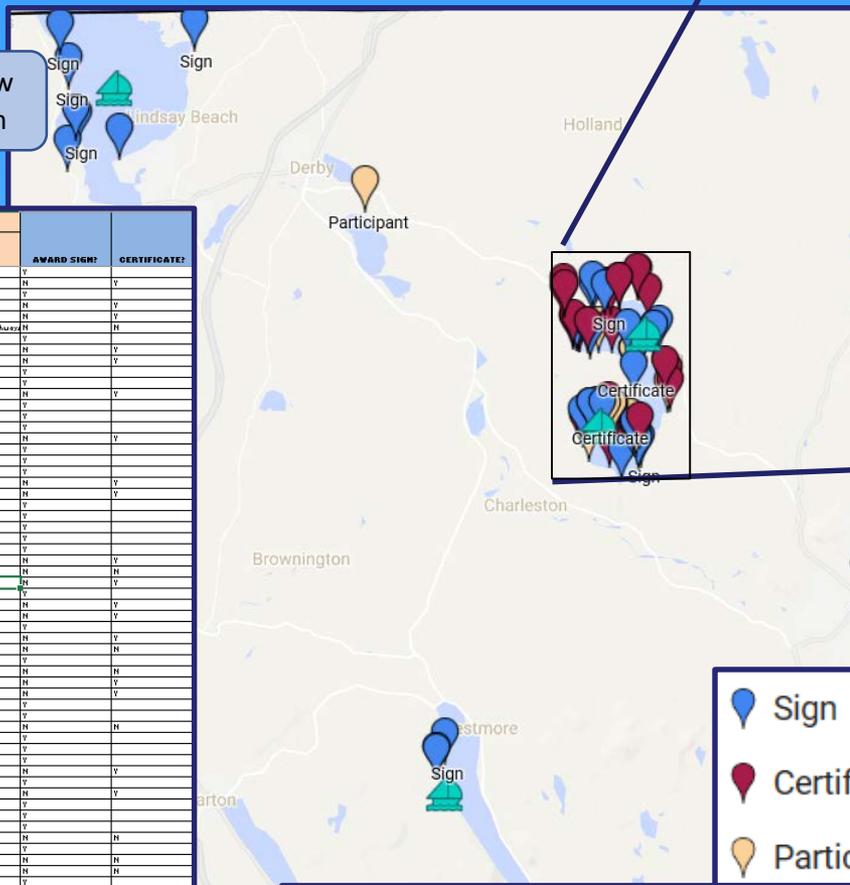
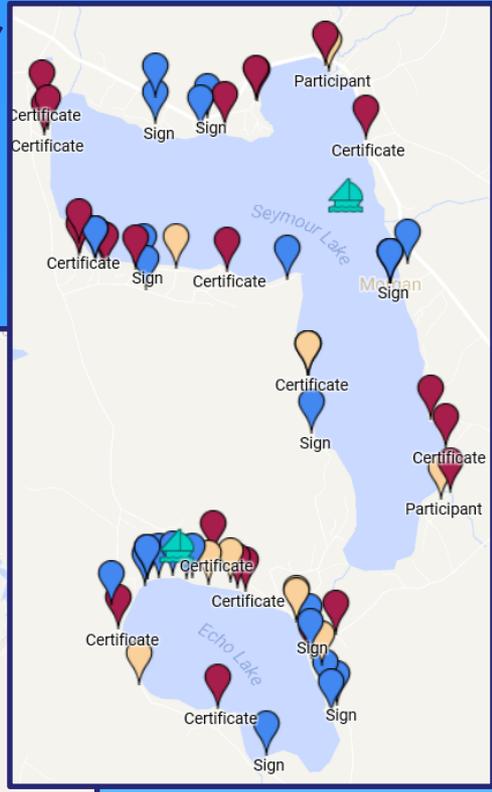


Echo and Seymour Lakes  
are the first two Lake  
Wise lakes in the state!

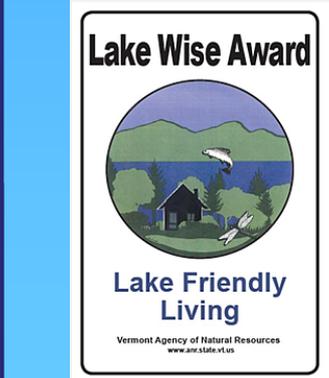


Lake Wise BMP installed at  
the Shadow Lake beach

# Using Lake Wise assessments to target BMPs



Year-round Address	Lake Property Address	Recommendation	AWARD SIGN:	CERTIFICATE?
TR Line 1	LP Line 1			
2441 Devereux Rd	Wart Echo Lake Rd	Planting shoreland	Y	Y
1504 East Echo Lake Rd	1504 East Echo Lake Rd	Planting and renaturalizing shoreland	Y	Y
PO Box 271	151 Apple Tree Lane		Y	Y
PO Box 271	1700 East Echo Lake Rd.	Planting and renaturalizing shoreland	N	Y
PO Box 271	55 Whitcomb Lane	Planting and renaturalizing shoreland	N	Y
Wart Echo Lake Rd	Wart Echo Lake Road	Planting and renaturalizing shoreland, Vegetated berm (driveway), pathways	N	N
Wart Echo Lake Rd	Wart Echo Lake Rd	Planting and renaturalizing shoreland, no mow zone	Y	Y
501 Corral Hill Rd		Rock lined trench	N	Y
124 Jordan Rd		Wides no mow zone	N	Y
152 Paylor St	88 Boudabry Way		N	Y
1164 East Echo Lake Rd	1164 East Echo Lake Rd	Planting and renaturalizing shoreland	Y	Y
16 Northgate Hill Rd	45 Buzzell Lane	Planting and renaturalizing shoreland	N	Y
900 Rt 111	300 Outlook Road		Y	Y
1611 Prince St.	900 Rt 111	Native plantings	Y	Y
	1617 Marston Charlton Rd		Y	Y
	721 Marston Charlton Rd	Planting and renaturalizing shoreland, waterbar	N	Y
	127 Spaulding Rd	Installing check dam in settling pond	Y	Y
	84 Weyacee Shara West		N	Y
PO Box 164	13 King Lane		Y	Y
27 Fair St	555 Rt 111	Retainage dam, planting and renaturalizing shoreland, no mow zone	N	Y
1700 Rockbury Pk Road	1492 Camp Winago Rd	Retainage dam, planting pathways	N	Y
PO Box 156	21 King Lane		Y	Y
	94 Weyacee Shara West		Y	Y
	6249 Rt. 111	Wides no mow zone, Check Septic	Y	Y
	276 Big Rock Rd	Planting vegetation in an established berm	Y	Y
	73 Trailly End	Waterbar	Y	Y
	76 Trailly End	Planting and renaturalizing shoreland, waterbar, no mow zone	N	Y
132 North Geneva Ave	19 Brook Rd	Planting and renaturalizing shoreland, retainage dam, waterbar	N	N
572 Rt 111	572 Rt 111	Waterbar, Planting and renaturalizing shoreland	N	Y
223 Snow Hill Rd	1400 Camp Winago Rd.		N	Y
	292 Hinokubak Rd.	Planting and renaturalizing shoreland	N	Y
	1400 Hinokubak Rd.	Planting and renaturalizing shoreland, no mow zone	N	Y
	243 Birch Point South	Waterbar	Y	Y
433 Therrish Hill Rd.	59 Barker Lane	No mow zone, Planting and Renaturalizing Shoreland, Waterbar	N	Y
433 Therrish Hill Rd.	57 Barker Lane	Planting and Renaturalizing Shoreland, No mow zone	N	N
433 Therrish Hill Rd.	555 Rt 111	Waterbar	Y	Y
	324 Camp Winago Rd	Planting and renaturalizing shoreland, no mow zone, waterbar	N	N
	313 Weyacee Drive	Planting and renaturalizing shoreland	N	Y
11 Springs St.	41 Hickey Rd	Planting and renaturalizing shoreland, no mow zone	N	Y
801 Wilson Road	189 Janus Rd		N	Y
	320 Big Rock Road		Y	Y
	24 Weyacee Shara West	Planting and renaturalizing shoreland, no mow zone, waterbar	N	N
	491 Louie Road		N	Y
	491 Louie Road		Y	Y
	540 Rt 111		Y	Y
PO Box 165	246 Louie Road	Planting and renaturalizing shoreland, no mow zone	N	Y
	562 Seymour East	Head v-dip cover on prep work tank	N	Y
	Breaker Rd		Y	Y
	218 Louie Rd		Y	Y
P.O. Box 124	142 Birch Point Rd	Planting and renaturalizing shoreland, vegetated berm	N	N
	6209 Rt 111		Y	Y
1504 Rt 114	44 Barker Lane	Driveway, No mow zone	N	Y
1504 Rt 114	963 Marston-Charlton Rd	Waterbar, dripline trench, infiltration step	N	N
	963 Marston-Charlton Rd	Waterbar, vegetated berm, renaturalizing shoreland	N	N
		Manage invasive plants	Y	Y
		Planting and renaturalizing shoreland, Dripline Trench	Y	Y
PO Box 14	1041 Camp Winago Rd	Planting and renaturalizing shoreland, No mow zone	N	Y
124 Highland Ave	629 Elliot Acorn Rd	Driveway/ Dripline Trench, Planting and renaturalizing shoreland	N	N
132 Mont Shara Rd	132 Mont Shara Rd	No mow zone, outcrop planting	N	Y
1523 Camp Winago Road	1523 Camp Winago Road	Infiltration step, planting and renaturalizing shoreland, no mow zone	N	Y
1803 Battula Drive	180 Outlook Rd.	Planting and Renaturalizing Shoreland	N	Y



- Sign
- Certificate
- Participant

**Drywells/ Dripline Trench, Planting and renaturalizing shoreland**  
**No mow zone, native plantings**  
**Infiltration steps, planting and renaturalizing shoreland, now mow zones**  
**Planting and Renaturalizing Shoreland**

# Large scale stormwater practices

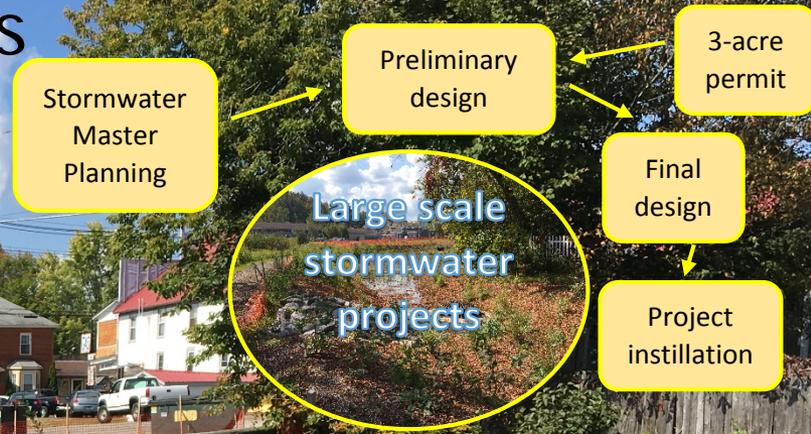


Table 26: Top 20 Sites – Final Ranking Table with BMP Type and Retrofit Description

Site ID	BMP Type	Retrofit Description	Total Score	Rank
CVY_001	Underground Chambers	10x26 MC-4500 Stormtech Chambers	80	1
DTB_009	Infiltration Trench	400'x15x3' deep infiltration trench	76	2
Numia	Underground Chambers	16x35 MC-4500 Stormtech Chambers	66	3
NPC_013	3x41 MC-4500 Stormtech Chambers	3x41 MC-4500 Stormtech Chambers located in City-owned pull-out area	63	4
ORL_006	Dry Basin and Infiltration Trench	66'x46'x4' deep dry basin with 3:1 sides outletting to a 400'x10'x3' deep infiltration trench with 2:1 sides	62	5
BRT_New_c	Underground Chambers	5x33 MC-4500 Stormtech Chambers	55	6
ORL_005	Infiltration Trench	175'x3'x3' deep infiltration trench with 2:1 sides	53	7
ORL_002	Underground Chambers	7x14 5C-740 Stormtech Chambers	52	8
DTB_007	Dry Basin	146'x70'x4' deep infiltration basin	49	9
NPC_School_a and NPC_School_b	Gravel Wetland	150'x10'x5' deep gravel wetland with 2:1 sides at outlet of larger stormwater system between two parcels	39	10
NPC_School_c	Underground Chambers	5x10 Stormtech MC-3500 Chambers	39	10
NPC_008	Gravel Wetland	220'x17'x2' deep narrow gravel wetland	36.5	11
Northpoint Auto	Underground Chambers	4x14 MC-4500 Stormtech Chambers	36	12
GLV_001	Bioretention - Swale	100'x5'x2' deep bioretention swale	35	13
NPC_009	Bioretention	60'x3'x2' deep bioretention with 3:1 sides in pedestrian area	35	13
DTB_Vtrans	Gravel Wetland	75'x20'x2' deep gravel wetland	34	14
Rte_5_Erosion_a	Pipe Storage	200' long 36" perforated pipe embedded underneath the road right of way with new catchbasin inlets installed to trap runoff	33.5	15
NPC_Main_School_Parking_Lot	Bioretention	50'x5'x2' deep with 3:1 sides bioretention	32	16
NPC_012	Bioretention	40'x6'x1' bioretention bump-in with 1:1 sides	32	16
BRT_New_a	Hydrodynamic Separator	10' HydroInternational Downstream Defender	31	17
NPC_010	Bioretention	20'x2'x2' with 3:1 sides bioretention in pedestrian path swale	31	17
Rte_5_Erosion_b	Bioretention	110'x3'x2' deep bioretention with 3:1 sides located on private property	23.5	18

Memphremagog Watershed Association – Stormwater Master Plan  
 Derby, Vermont  
 FINAL REPORT  
 October 31, 2018

Prepared for:  
 Memphremagog Watershed Association  
 P.O. Box 3073  
 Derby, VT 05828

Prepared by:  
 Watershed Consulting Associates, LLC  
 430 Shelburne Road P.O. Box 4413  
 Burlington, VT 05406  
 P: 802.497.2367  
 info@watershedca.com

**WATERSHED**  
 CONSULTING ASSOCIATES, LLC

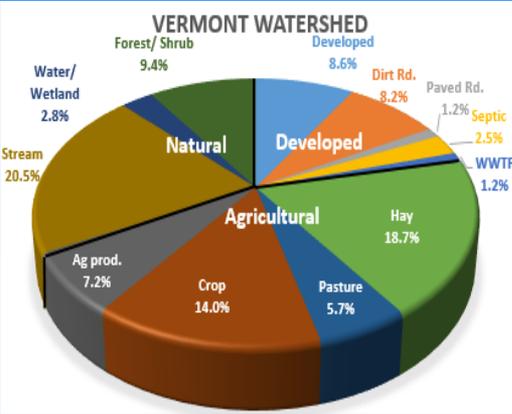
Don't "P" on Your Lawn!

and other lawn care tips for green lawns, not green lakes



# Increasing community understanding of stormwater BMPs





The wastewater treatment facility wasteload allocation was revised to reduce each facilities annual phosphorus loading by 33%.

Table 2. Final adopted wasteload allocations.

Municipality	Permit Flow (MGD)	TMDL WLA (TP lbs./ <sup>ww</sup> yr)
Barton	0.265	542
Brighton	0.150	1,532
Newport	1.300	2,125
Orleans	0.190	388
<b>Total Load</b>	<b>1.905</b>	<b>4,587</b>

- WWTF loading reductions will be required in next round of permits, but will not require major investments
- Facilities will be required to optimize phosphorus reductions

Vermont Department of Environmental Conservation  
Watershed Management Division  
1 National Life Drive, Main 3  
Montpelier, VT 05602-3523

Agency of Natural Resources  
June 2018 602-828-9525

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### Final wastewater treatment facility wasteload allocations for communities in the Lake Memphremagog watershed: Barton, Brighton, Newport and Orleans

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#### Background

In conjunction with the development of the Lake Memphremagog phosphorus Total Maximum Daily Load (TMDL) in 2017, the Watershed Management Division (Division) also conducted the Agency of Natural Resources' Wasteload Allocation Process (Administrative Rule 87-46) to establish phosphorus allocations for four communities with wastewater treatment facilities in the Lake Memphremagog watershed – Barton, Brighton, Newport and Orleans. This document outlines the steps undertaken during that process to be consistent with the Rule.

#### Wasteload allocation process

Watershed and lake modeling conducted in the development of the Lake Memphremagog TMDL was used to develop allocation scenarios consistent with nonpoint source allocations deemed feasible to remedy the phosphorus impairment in the lake. The Division presented four wasteload allocation (WLA) alternatives as part of the draft TMDL which included a Division preferred option that reduced permitted phosphorus loading from all facilities by a total of 33% (WLA-D in Table 1). The Division presented these alternatives in the Draft TMDL posted for public comment, a summary TMDL "fact sheet" and in several public meetings in the watershed. The four wasteload allocation alternatives are shown in Table 1.

---

*To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations.*

# TMDL and Tactical Basin Plan Outreach

- Restoring Lake Memphremagog Fact Sheets
  - Describe the Memphremagog watershed, phosphorus targets, and why action is needed
  - Outline specific actions to reduce phosphorus by land use

## Restoring Lake Memphremagog

Phosphorus pollution threatens clean water in Lake Memphremagog and throughout the watershed.

**A Commitment to Clean Water**

Land Area	Watershed Area
27%	75%
71%	20%

**Phosphorus Pollution Sources by Land Use in the Memphremagog Watershed**

Land Use	Watershed Area
Development	1%
High Intensity	1%
Medium Intensity	1%
Low Intensity	1%
Forestlands and Wetlands	77%
Agriculture (lands)	17%

**To achieve clean water we must meet new phosphorus pollution limits.**

In September 2017 the US Environmental Protection Agency approved new phosphorus pollution limits (or Total Maximum Daily Loads—TMDL) for Lake Memphremagog. The Lake Memphremagog, Coaticook and Tomfoote Rivers Basin Plan identifies specific pollution reduction actions to implement.

**All in—we are all part of the solution.**

Whether you are a landowner, farmer, municipal official, developer, or legislator in Vermont, we all have a responsibility to ensure a legacy of clean water for this and future generations. Our efforts to achieve clean water require a long-term commitment.

Learn more at [de.vermont.gov/watershed/cwa/restoring\\_memphremagog](http://de.vermont.gov/watershed/cwa/restoring_memphremagog)  
ben.coppins@vermont.gov • (802) 490-6143

## Restoring Lake Memphremagog

Over the last 5 years, farmers have taken action to reduce the water quality impacts of their farms, including:

- Planting cover crops on more than 2,300 acres
- Installing 44 miles of fencing to keep livestock out of waterways
- Planting trees and shrubs along 9 miles of rivers and streams to stabilize banks
- Taking nutrient management courses

**Phosphorus pollution sources by land use in the Memphremagog Watershed**

Land Use	Watershed Area
Development	1%
High Intensity	1%
Medium Intensity	1%
Low Intensity	1%
Forestlands and Wetlands	77%
Agriculture (lands)	17%

**Runoff from agricultural fields and production areas contributes 48% of the phosphorus load to Lake Memphremagog. To meet phosphorus targets, significant reductions are required.**

**Financial and technical resources are available to support individual management planning and best management practices implementation on all size farms in the watershed through the Memphremagog Long-Term Water Quality Partnership.**

**TAKE ACTION:**

- Comply with Required Agricultural Practices that set standards for nutrient, manure, and waste storage, nutrient management planning and soil conservation, and vegetated buffer zones and livestock exclusion from surface water
- Increase State inspections of Permitted Medium Farm Operations
- Learn more at [agriculture.vermont.gov/waterquality](http://agriculture.vermont.gov/waterquality)

**Financial and technical resources are available to support individual management planning and best management practices implementation on all size farms in the watershed through the Memphremagog Long-Term Water Quality Partnership.**

**TAKE ACTION:**

- Contact the Orleans County Natural Resources Conservation District at (802) 338-4000 x7000 or by email at [sarah.damien@nrcd.net](mailto:sarah.damien@nrcd.net) to learn more about the U.S. Department of Agriculture regional conservation partnership Program (RCPP) grant.

Learn more at [de.vermont.gov/watershed/cwa/restoring\\_memphremagog](http://de.vermont.gov/watershed/cwa/restoring_memphremagog)  
ben.coppins@vermont.gov • (802) 490-6143

## Restoring Lake Memphremagog

Forestlands contribute 9% of the phosphorus pollution load to Lake Memphremagog, but cover more than 75% of Memphremagog's watershed.

**TAKE ACTION:**

- Follow the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs, including reducing soil erosion along logging roads
- Support forest conservation, restore forested river corridors and lake shorelines, and expand developed land forest cover
- Promote strategies that improve forest resilience to climate change

**Upland lakes are good measures of progress toward clean water goals.**

**TAKE ACTION:**

- Ensure shoreline development is lake-friendly by following State Shoreland Regulations and voluntary Lake Wise best management practices

**Healthy wetlands retain phosphorus and sediment, and enhance flood resilience.**

**TAKE ACTION:**

- Protect critical wetlands
- Restore wetlands in coordination with local, state, and federal partners

**River instability contributes 20% of the phosphorus pollution load to Lake Memphremagog. Protecting and restoring river corridors and their floodplains minimizes erosion and flooding damage.**

**TAKE ACTION:**

- Protect river corridors and floodplains through riparian planting and conservation easements
- Stabilize stream channels and restore river corridors by planting native trees and shrubs along waterways

Learn more at [de.vermont.gov/watershed/cwa/restoring\\_memphremagog](http://de.vermont.gov/watershed/cwa/restoring_memphremagog)  
ben.coppins@vermont.gov • (802) 490-6143

## Restoring Lake Memphremagog

Stormwater from developed lands and roads contributes 21% of the phosphorus load to Lake Memphremagog. The restoration plan calls for an 18% reduction in phosphorus inputs to the lake through regulatory and voluntary actions.

**STATE STORMWATER PERMITS:**

- Municipal Roads General Permit (MRGP)
- Transportation Separate Storm Sewer System (TS4) General Permit
- Operational General Permit, including 3-acre sites
- Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activity

For more information, visit [de.vermont.gov/watershed/stormwater](http://de.vermont.gov/watershed/stormwater).

**Phosphorus pollution sources by land use in the Memphremagog Watershed**

Land Use	Watershed Area
Development	1%
High Intensity	1%
Medium Intensity	1%
Low Intensity	1%
Forestlands and Wetlands	77%
Agriculture (lands)	17%

**Sewage treatment plants contribute just 1% of the phosphorus load to Lake Memphremagog. A new wasteload allocation for wastewater treatment facilities in the watershed reduces permitted loading by 33%.**

For more information, visit [de.vermont.gov/watershed/map/basin-planning/basin17](http://de.vermont.gov/watershed/map/basin-planning/basin17)

**Memphremagog Stormwater Collaborative**

- Strategic planning to increase partner coordination in the implementation of stormwater best management practices
- For more information, visit [mwcvt.org](http://mwcvt.org)

Learn more at [de.vermont.gov/watershed/map/basin-planning/basin17](http://de.vermont.gov/watershed/map/basin-planning/basin17)  
ben.coppins@vermont.gov • (802) 490-6143

- Targeted workshops and presentations of the TMDL and tactical basin plan
- One on one meetings through stormwater collaborative & targeting farmers through the RCPP

Questions or  
Comments?



**Ben Copans**

***Watershed Coordinator***

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St. Johnsbury VT 05819

(802) 751-2610 Cell (802) 490-6143

[ben.copans@vermont.gov](mailto:ben.copans@vermont.gov)

[www.watershedmanagement.vermont.gov](http://www.watershedmanagement.vermont.gov)

Basin 17 webpage:

<http://dec.vermont.gov/watershed/map/basin-planning/basin17>