



Spokane Hill

Lakes Park

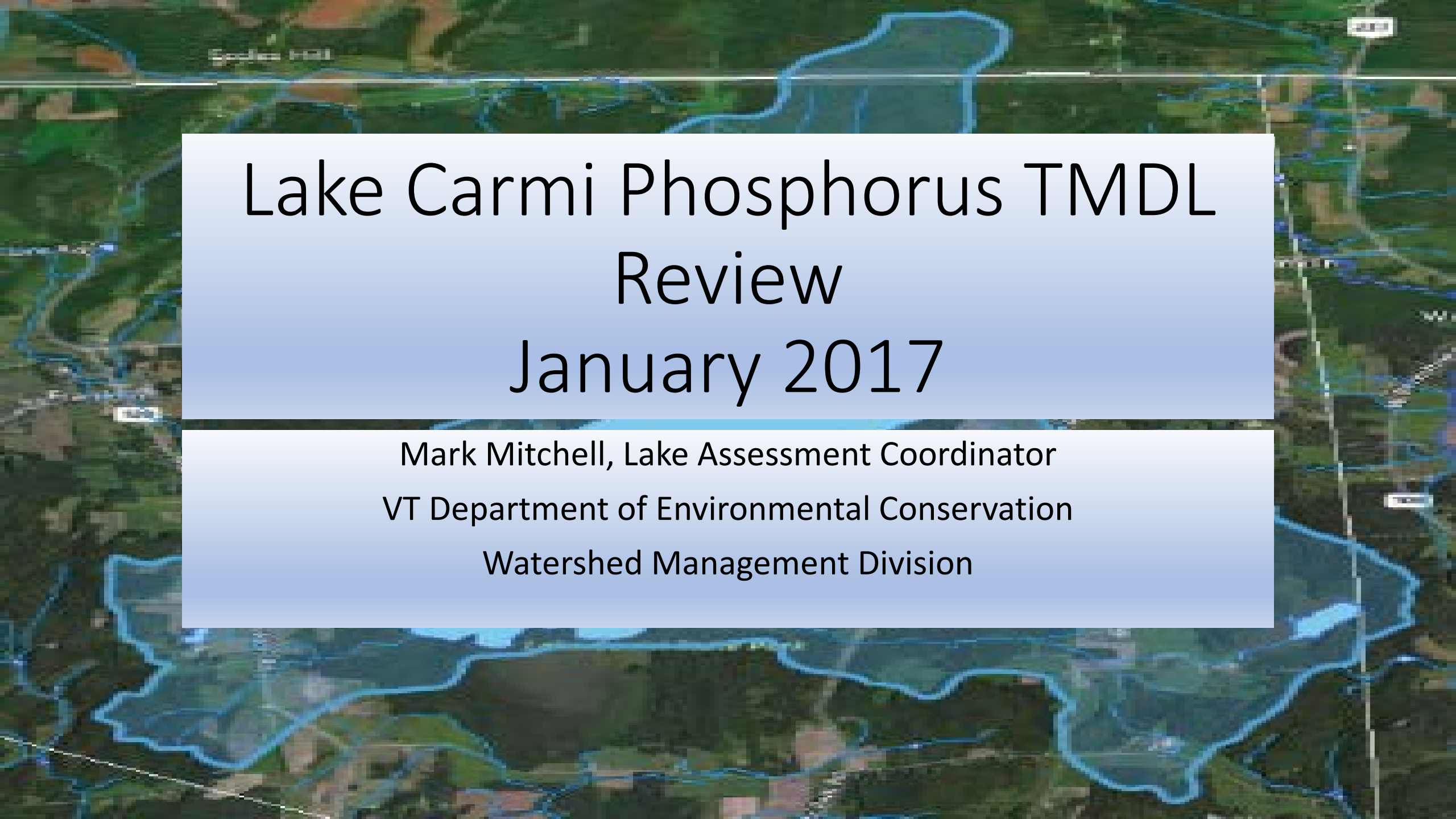
1500

1550

1600

1650

1700

An aerial photograph of a landscape with a blue outline tracing a watershed boundary. The terrain is green and brown, with some roads and buildings visible. A road marker '211' is visible in the top right corner.

Lake Carmi Phosphorus TMDL Review January 2017

Mark Mitchell, Lake Assessment Coordinator
VT Department of Environmental Conservation
Watershed Management Division

1. What is a TMDL and is Lake Carmi's Still Useful?

Phosphorus Total Maximum Daily Load (TMDL)

for

Lake Carmi

Waterbody VT05-02L01

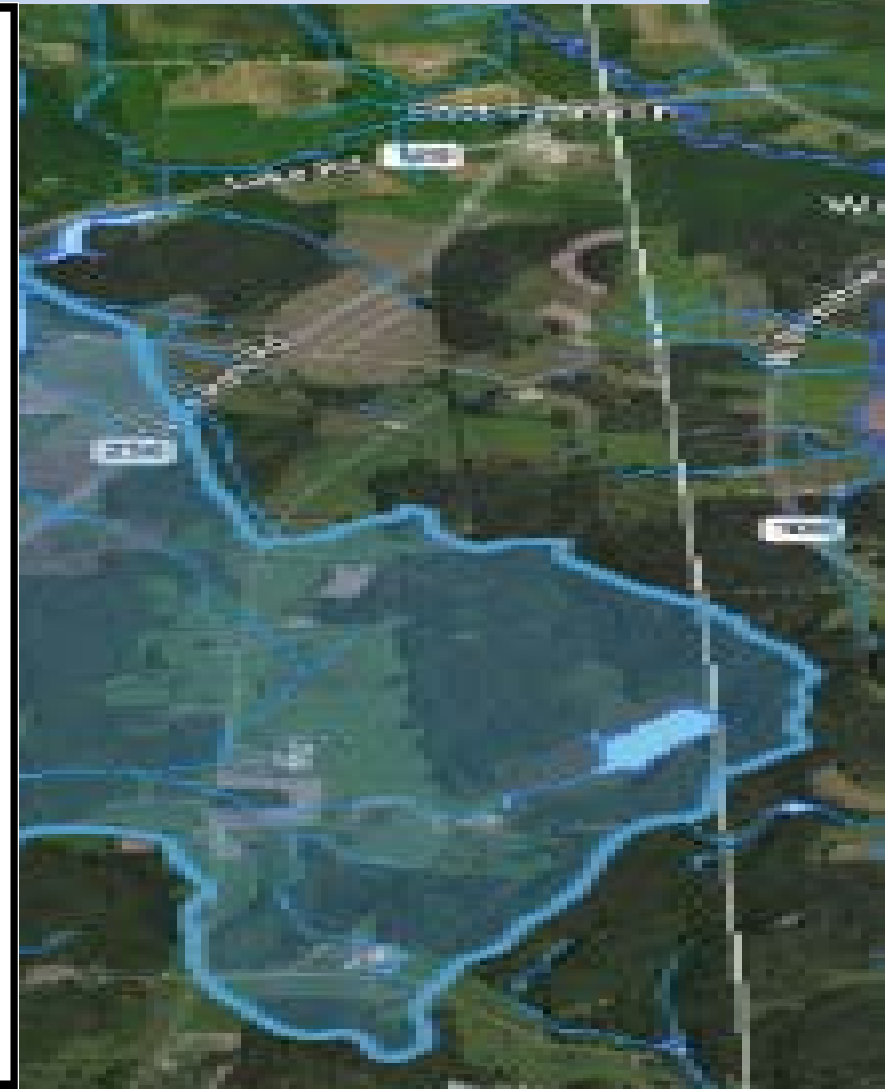
October 2008

-Approved by EPA Region 1 on April 8, 2009-

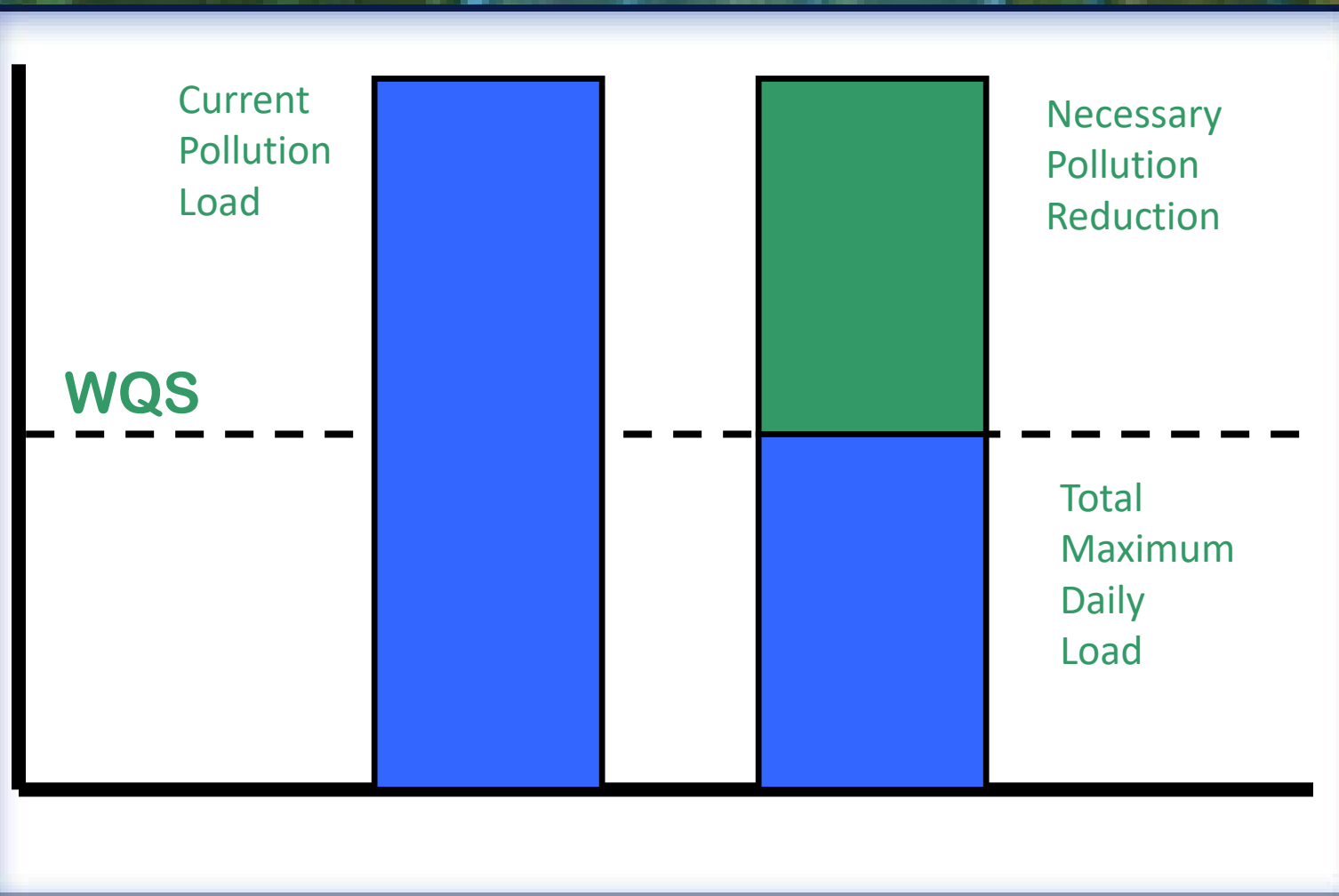
Prepared by the Vermont Agency of Natural Resources
103 South Main St.
Waterbury, VT 05671-0408

with guidance from:

Franklin Watershed Committee
Lake Carmi Campers Association
Natural Resources Conservation Service
Missisquoi River Basin Association

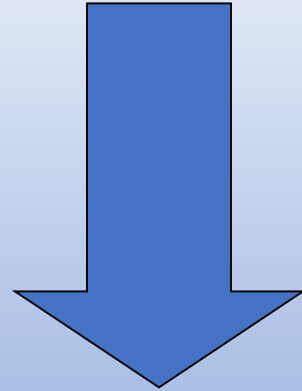


2. What is a TMDL?



3. What is a TMDL?

- Establishes a loading target - Science



- Sets up implementation plan - Policy

4. What are the pollution issues at Lake Carmi?

Algae bloom in progress

Lake Carmi

Franklin

Little Pond

Image © 2017 DigitalGlobe

Google Earth

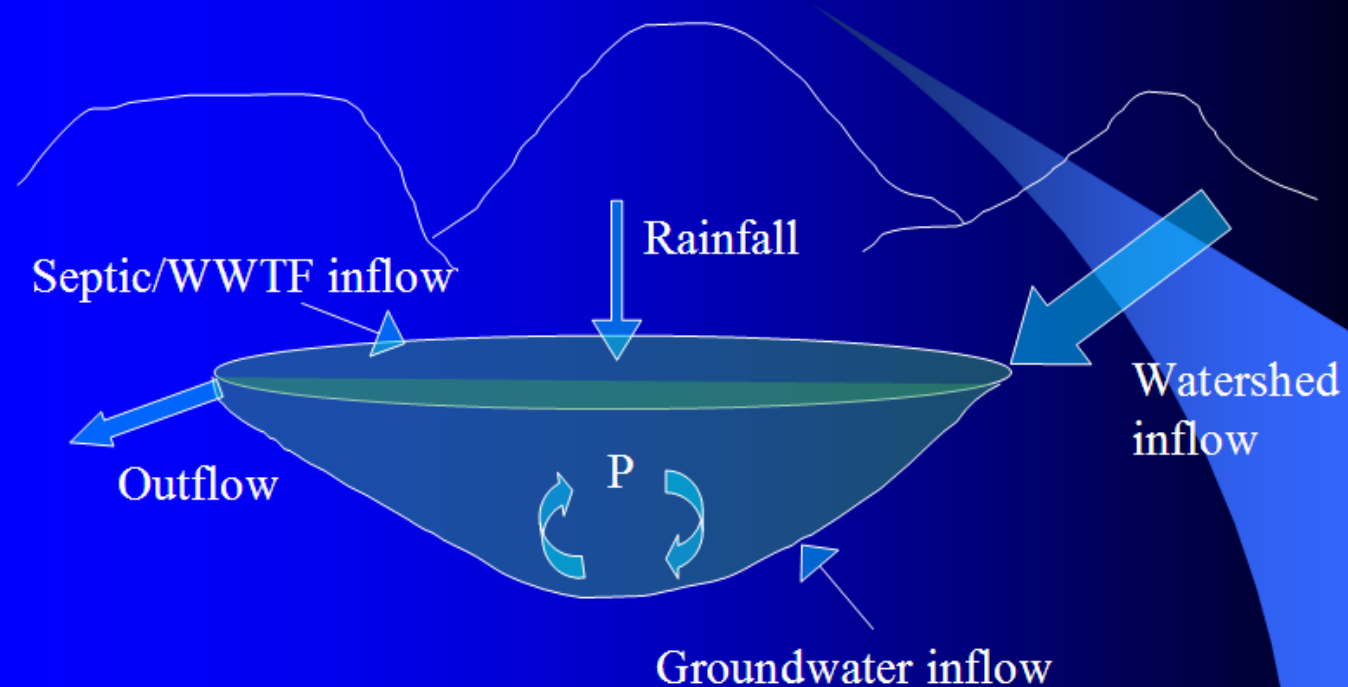
Imagery Date: 9/30/2017 44°59'06.18" N 72°54'49.26" W elev 0 ft eye alt 26887 ft

Tour Guide

1995

5. What are the pollution issues at Lake Carmi?

Phosphorus in watersheds



Target in-lake total phosphorus concentration is 22 ppb based on best three years of Lay Monitoring data (1994, 1997, 1998).

6. How did the TMDL estimate phosphorus entering the lake and from what sectors?

Wisconsin Lake Modeling Suite

File Models Options Help

Phosphorus Loading Data Setup

General Hydrologic & Morphometric Module **Phosphorus Module (NPS)** Phosphorus Module (PS) Total Loading

Reset Defaults **0 Total Drainage Area Assigned A Land Cover**

Land Use	Area (acre)	Loading (kg/ha-year)			Loading %	Loading (kg-year)		
		Low	Most Likely	High		Low	Most Likely	High
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0.0	0.0	0.0
Mixed AG	0.0	0.30	0.80	1.40	0.0	0.0	0.0	0.0
Pasture/Grass	0.0	0.10	0.30	0.50	0.0	0.0	0.0	0.0
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0.0	0.0	0.0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0.0	0.0	0.0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0.0	0.0	0.0
Wetlands	0.0	0.10	0.10	0.10	0.0	0.0	0.0	0.0
Forest	0.0	0.05	0.09	0.18	0.0	0.0	0.0	0.0
User Defined 1	0.0				0.0	0.0	0.0	0.0
User Defined 2	0.0				0.0	0.0	0.0	0.0
User Defined 3	0.0				0.0	0.0	0.0	0.0
User Defined 4	0.0				0.0	0.0	0.0	0.0
User Defined 5	0.0				0.0	0.0	0.0	0.0
User Defined 6	0.0				0.0	0.0	0.0	0.0
Lake Surface	0.0	0.10	0.20	1.00	0.0	0.0	0.0	0.0

% NPS Change: 0%

Set User Defined Leave Write Results Help Select A Graph

Phosphorus Prediction and Uncertainty Analysis Module

Date: 3/21/2008 Scenario: 13

Observed spring overturn total phosphorus (SPO): 25.0 mg/m³

Observed growing season mean phosphorus (GSM): 28.0 mg/m³

Back calculation for SPO total phosphorus: 22 mg/m³

Back calculation GSM phosphorus: 22 mg/m³

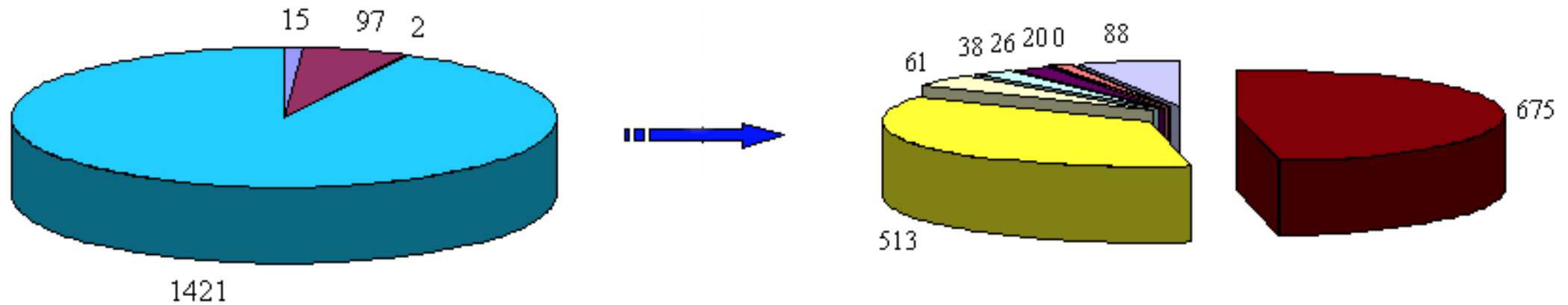
% Confidence Range: 70%

Nurnberg Model Input - Est. Gross Int. Loading: 0 kg

Predicted	Lake Phosphorus Model	Low	Most Likely	High
		Total P (mg/m ³)	Total P (mg/m ³)	Total P (mg/m ³)
-Observed				
(mg/m ³)				
Walker, 1987 Reservoir		13	47	56
19 68				
Canfield-Bachmann, 1981 Natural Lake		18	47	53
19 68				
Canfield-Bachmann, 1981 Artificial Lake		17	40	44
12 43				
Rechow, 1979 General		6	24	28
-4 -14				
Rechow, 1977 Anoxic		27	101	119
73 261				
Rechow, 1977 water load<50m/year		12	46	54
18 64				
Rechow, 1977 water load>50m/year		N/A	N/A	N/A
N/A N/A				
Walker, 1977 General		19	70	82
45 180				
Vollenweider, 1982 Combined OECD		16	46	53
20 75				
Dillon-Rigler-Kirchner		10	36	43
11 44				
Vollenweider, 1982 Shallow Lake/Res.		12	39	45
13 49				
Larsen-Mercier, 1976		17	63	74
38 152				
Nurnberg, 1984 Oxidic		10	38	44
10 36				

7. How did the TMDL estimate phosphorus entering the lake and from what sectors?

Estimated annual phosphorus loads (kg) Lake Carmi, with breakout of loads from the watershed



- Septic loads
- Internal loads
- Load from Lake Carmi State Park WWTF
- Watershed tributaries

- Agriculture - Row Crop
- Agriculture - Pasture/Grass
- Residential - lakeshore
- Residential - low density
- Wetlands
- Forest
- Other water
- Lake Surface

8. Using a new tool to compare watershed loading.

Home Documents Contact Log In VERMONT

Clean Water Roadmap Tools

Overview Topics

Visualize Basin Results

Select map options:

Map type: Baseline

Basin scale: None

Land type(s): All Land Types

Variable: TP Yield (kg/ha/y)

Color scheme: Green to red

Select Scenario

Baseline mode

Scenario mode

Export Options

Map Layers

Streams

Village Boundaries

Town Boundary

County Boundary

Lake Champlain Basin

Tactical Basins

HUC-12 Basins

NHDPlus Catchments

Water Quality Blueprint (WQB): Conservation Value

Water Quality Blueprint (WQB): Water Quality Impact

Water Quality Blueprint (WQB):

Search for catchment or town

Switch Basemap

NHDPlus Catchment

Feature ID: 4590275

Catchment Name: Marsh Brook

Zoom to

LimnoTech, USGS | USGS, LimnoTech | Earthstar Geographics, CNES/Airbus DS | Esri...

POWERED BY esri

Catchment Dashboard

NHDPlus Catchment (ComID)
Marsh Brook (4590275)

HUC-12 Basin
Pike River (041504081001)

Tactical Basin Name
Missisquoi

About the dashboard...

NHDPlus Catchment: Baseline Summary

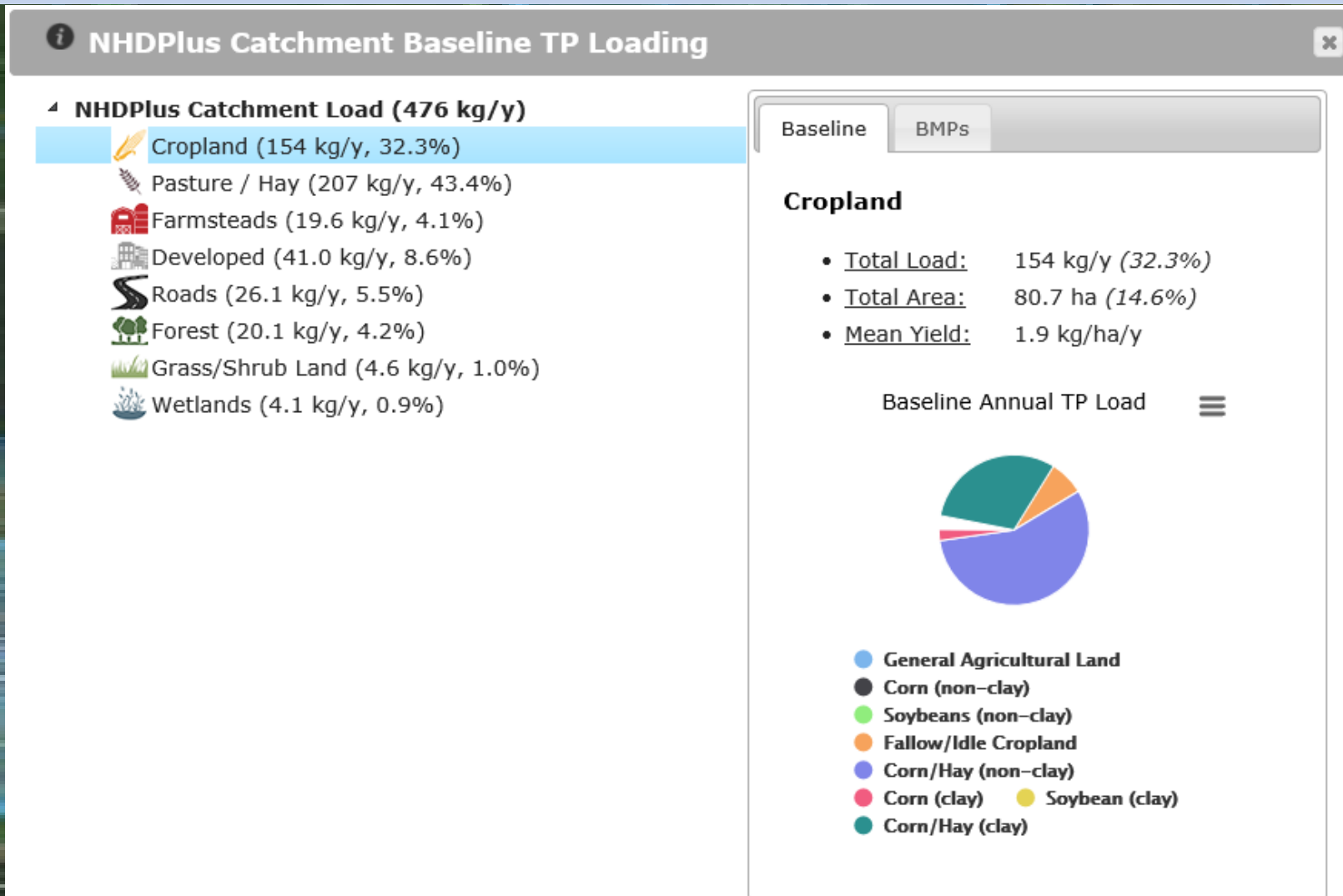
Metric	Value	Percent Rank (Tactical Basin)	Percent Rank (LC Basin)
TP Load (kg/y)	476	78	84
Mean Yield (kg/ha/y)	0.86	85	90
Area (ha)	551	57	63
WQB Conserv. Value	28.00	64	41
WQB WQ Impact	14.86	55	67
WQB Combined Score	43.64	74	63

Annual TP Load by LULC Group

Land Area (ha) by LULC Group

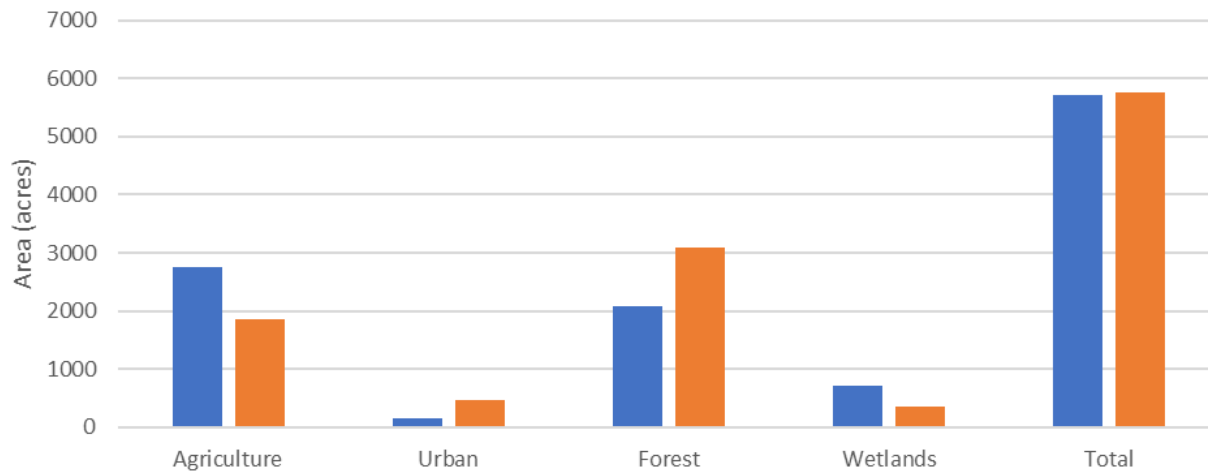
- Cropland
- Pasture / Hay
- Farmsteads
- Developed
- Roads
- Forest
- Grass/Shrub Land
- Wetlands

9. Using a new tool to compare watershed loading.



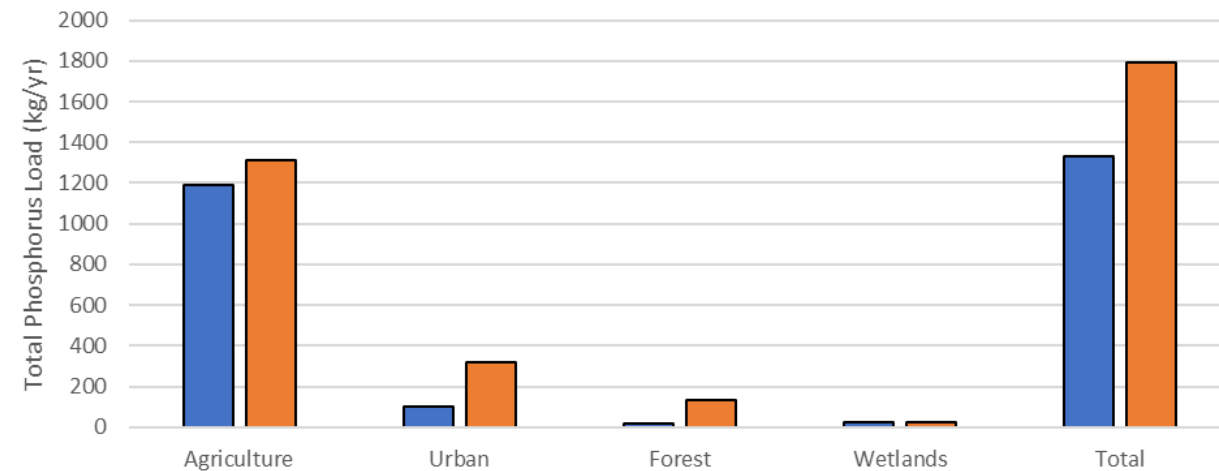
10. What assumptions went into the Lake Carmi TMDL? Modeled estimates used best available data.

Comparison of Land Use Areas Used in Modeled Estimates of Total Phosphorus Loading to Lake Carmi



■ Lake Carmi TMDL (WILMS Model, USGS National Land Cover Database 2001)
■ Clean Water Roadmap for Lake Champlain TMDL (SWAT Model, USGS National Land Cover Database 2006)

Comparison of Modeled Estimates of Total Phosphorus Loading to Lake Carmi by Land Use



■ Lake Carmi TMDL (WILMS Model, National Land Cover Database 2001)
■ Clean Water Roadmap for Lake Champlain TMDL (SWAT Model, National Land Cover Database 2006)

Load estimates corroborated with VT Clean Water Roadmap.

11. How did we account for uncertainty in the development of the TMDL?

TMDL Component	kg/yr	
Current load	1,535	
Wasteload allocation	0	
Load allocation	924	
Margin of safety	103	
Total loading capacity	1,027	
Load reduction required	611	40%

12. How are projects being implemented to meet the TMDL?

- Act 64 Regulations & Missisquoi Bay Tactical Basin Plan
 - Roads
 - Other developed landscapes
 - Septic Systems
 - Natural resource restoration
 - Agriculture
- With local, state and federal technical and financial resources
- Internal phosphorus loads are being addressed by contractor

14. Lake Carmi TMDL Action Plan

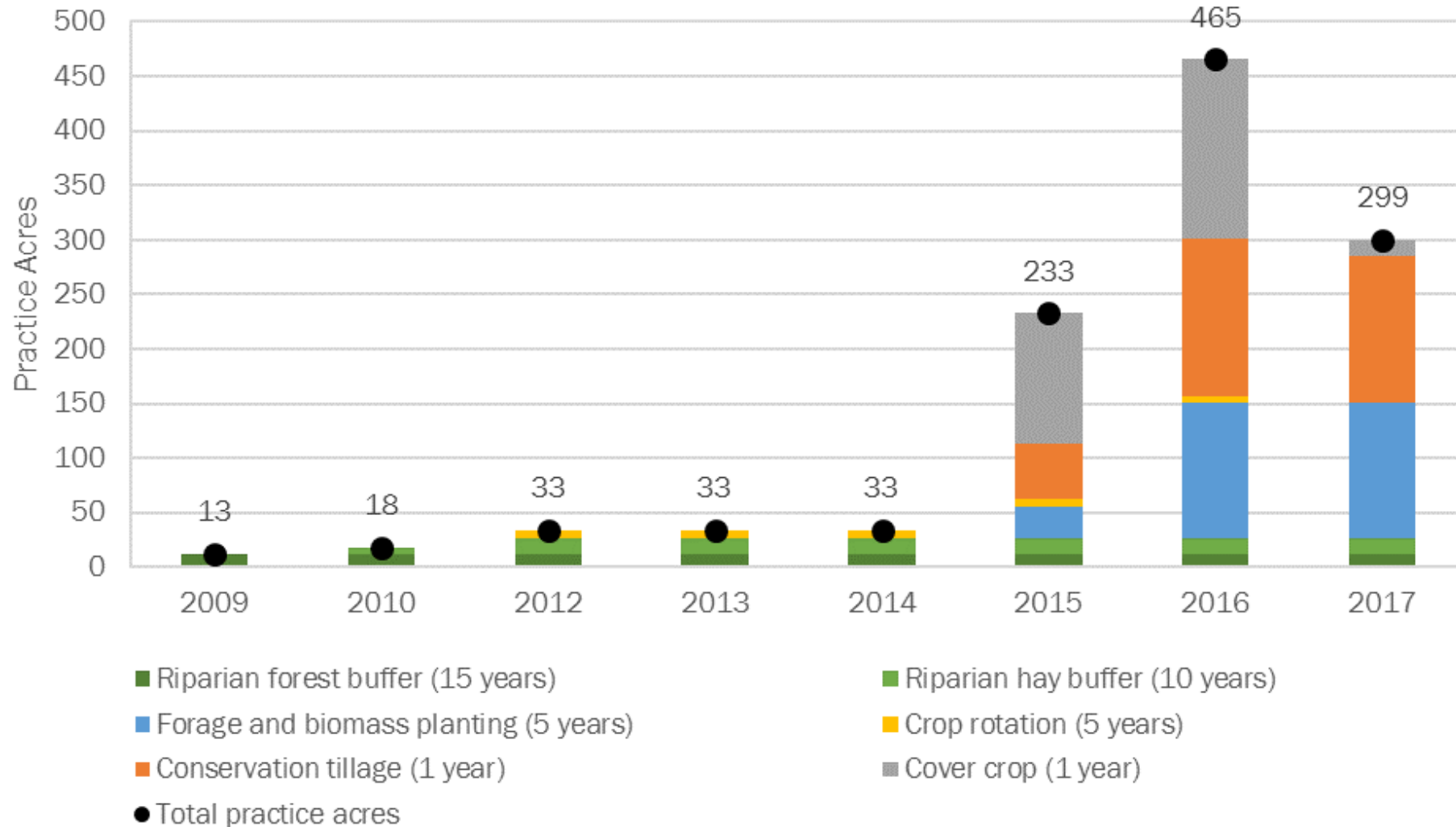
Lake Carmi Watershed Projects In Progress or Planned by Partners: Sources include The Agency of Natural Resources Lake Carmi Phosphorus TMDL Action Plan, Missisquoi Watershed Tactical Basin Plan, NRCS Pike River Watershed Plan (Additional resources for addressing phosphorus loading to Lake Carmi include State and federal regulations and technical and financial resources that are described in the Lake Champlain Phosphorus TMDL Implementation Plan (http://dec.vermont.gov/sites/dec/files/wm/wp/docs/160915_Phase_3_Implementation_Plan_Final.pdf).

Color Key for responsible party

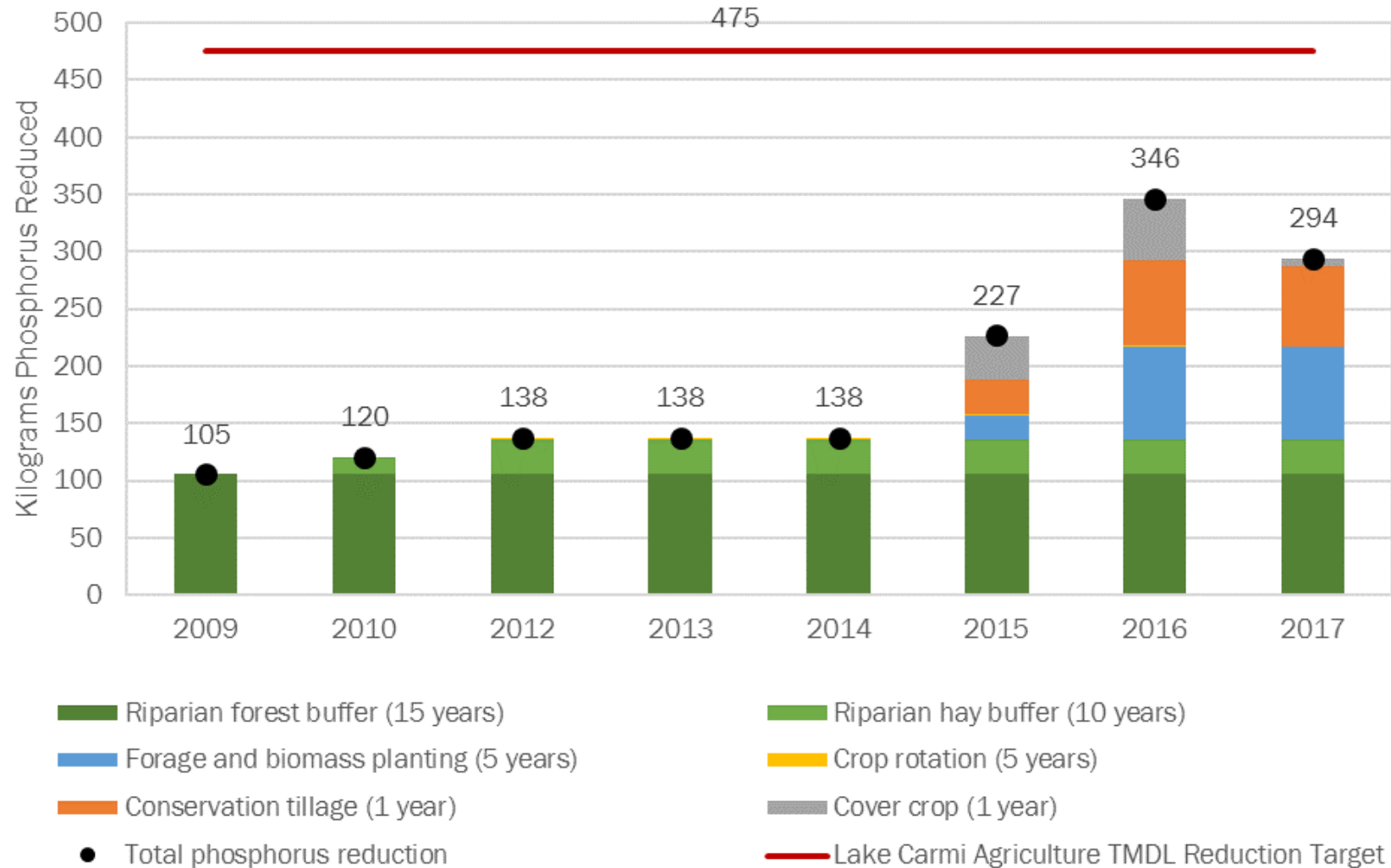
- Franklin Watershed Committee (FWC)
- VT Department of Environmental Conservation (DEC)
- VT Agency of Agriculture, Food and Markets (AARM)
- ROADS - State, Town or private
- USDA Natural Resources Conservation Service (NRCS)

Status	Project Name	Project Type	Project Description	Source	Lead Partner	Supporting partners	Funding source	DEC Notes	FWC Notes
On going	Lake Carmi Tributaries volunteer water quality sampling program	Assessment	Continue to support and consider adopting sampling site recommendations as shown in Gerhardt study (remove 5 sites, add 4)	Fritz Gerhardt recommendations (http://dec.vermont.gov/sites/dec/files/docs/wm/wm/MO_MAFF_Phosphorus%20Lake%20Carmi%20Tributaries%20TMDL%20Day_2015.pdf) TMDL Action#8	FWC	DEC	DEC LaRosa partnership	Ongoing by FWC and AmeriCorps member and coordinator when available, April - October. Fritz' recommendations have not been adopted yet	
On going	Lake Carmi Lay Monitoring Program	Assessment	Continue to support (see results at: http://dec.vermont.gov/watershed/lake-ponds/data-maps/lcomcard)	DEC	FWC	DEC	DEC	FWC continuing lake sampling beginning end May to October. Fritz Gerhardt has contract to summarize 2017 data	
Action required	Determining phosphorus loading from lake sediments (Internal loading)	Assessment	Study Internal loading – lake bottom coring:	Lcarmi TMDL Action#8	DEC	FWC			FWC interested in contracting with UVM to do this study
Action required	Streams Geomorphic Assessments	Assessment	Complete Stream geomorphic assessments on all streams either full or lite version to identify projects	Lcarmi TMDL Action#7 & 8	DEC, Volunteers	FWC	ERP, DEC	Marsh Brook, Dewing, Hammond north have assessment info. Remaining streams are small. Karen and Staci will continue to review/discuss needs for geomorphic assessments with FWC	FWC INTERESTED IN APPLYING FOR ERP GRANT OR WATERSHED (CON PLATE) GRANT TO COMPLETE
Action required	Riparian Plantings	Riparian plantings	Consider Marsh Brook below State Park Road, above Towle Neighborhood Road (in addition to plantings already completed under CREP), Alder Run.	Lcarmi TMDL Action#6	FWC		ERP	Karen Ratte discussed with FWC to Franklin NRCD would be interested in assisting. Need to figure out landowner interest	The Franklin Natural Resource Conservation District would be interested in assisting with outreach and planting. Unless willing landowners are identified first, LCSP education/outreach may be a suitable grant.
on-going	Implementation of NRCS watershed plan for Pike	agriculture BMP	Providing funding priorities for field practices in the Pike river watershed and education and outreach to agriculture	NRCS https://www.nrcs.usda.gov/wps/PA_NRCSContentPages/download?cid=ecspd1257452&ext=pdf Lcarmi TMDL #12	NRCS	AARM, UVM Extension	USDA	David Blodgett, NRCS is contact. BMPs implemented to date through NRCS, presented to implementation team, including FWC and LCCA Summer 2016. Handout developed	
Action required	Wastewater Feasibility Study followup	Wastewater	Determine interest in using study to identify additional strategies including development of a community wastewater system	Lcarmi TMDL action#9	DEC	LCCA, DEC staff		Possible idea: Use of Fire Districts to fund community water treatment facilities if pursued. Limited studies to identify impact from inadequate wastewater treatment to date. None show contamination to lake.	

15. Estimated total acres of agricultural conservation practices implemented on crop/pasture fields in the Lake Carmi watershed with AAFM and USDA-NRCS funding.



16. Estimated total phosphorus pollution reduced by agricultural conservation practices implemented on crop/pasture fields in the Lake Carmi watershed with AAFM and USDA-NRCS funding.



Thank you!

dec.vermont.gov/watershed/cwi/restoring/carmi

