

# The Lake Champlain TMDL, by the Numbers

Eric Smeltzer

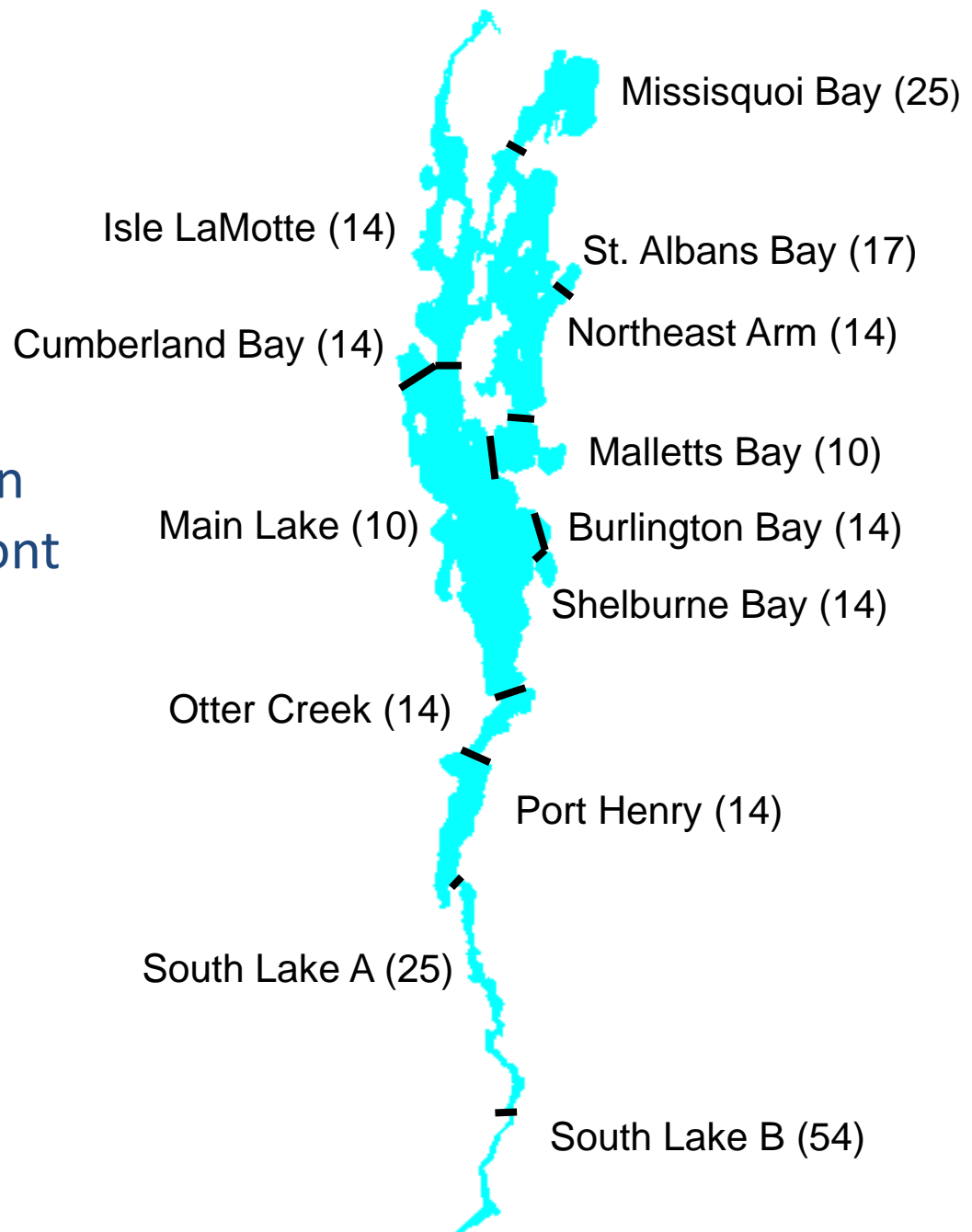
Vermont Department of Environmental Conservation

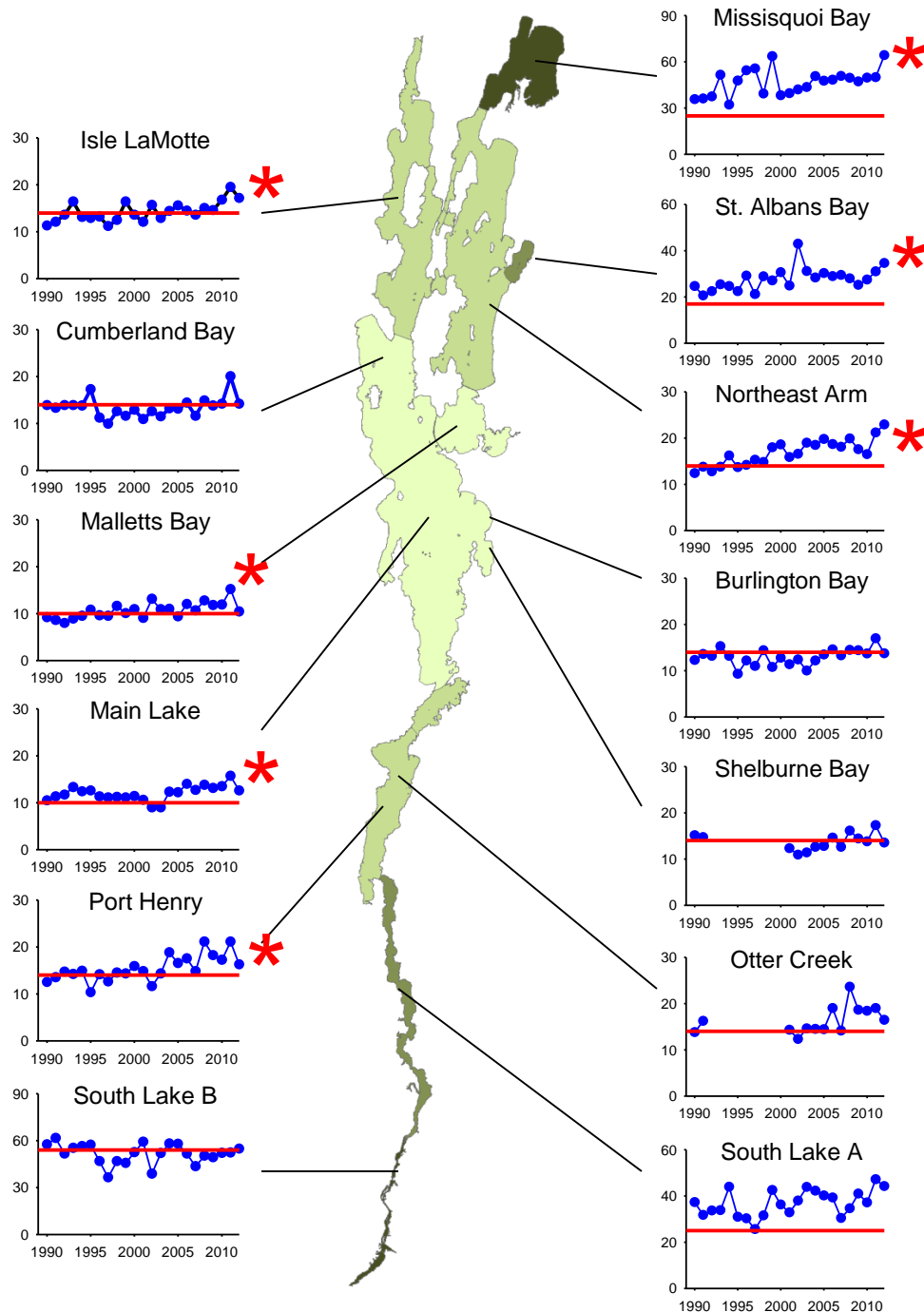
Vermont Environmental Consortium Water Quality Conference  
June 4, 2014

13




Number of Lake Champlain  
phosphorus management segments

# Lake Champlain Total Phosphorus Concentration Criteria ( $\mu\text{g}/\text{L}$ ) in the Vermont Water Quality Standards





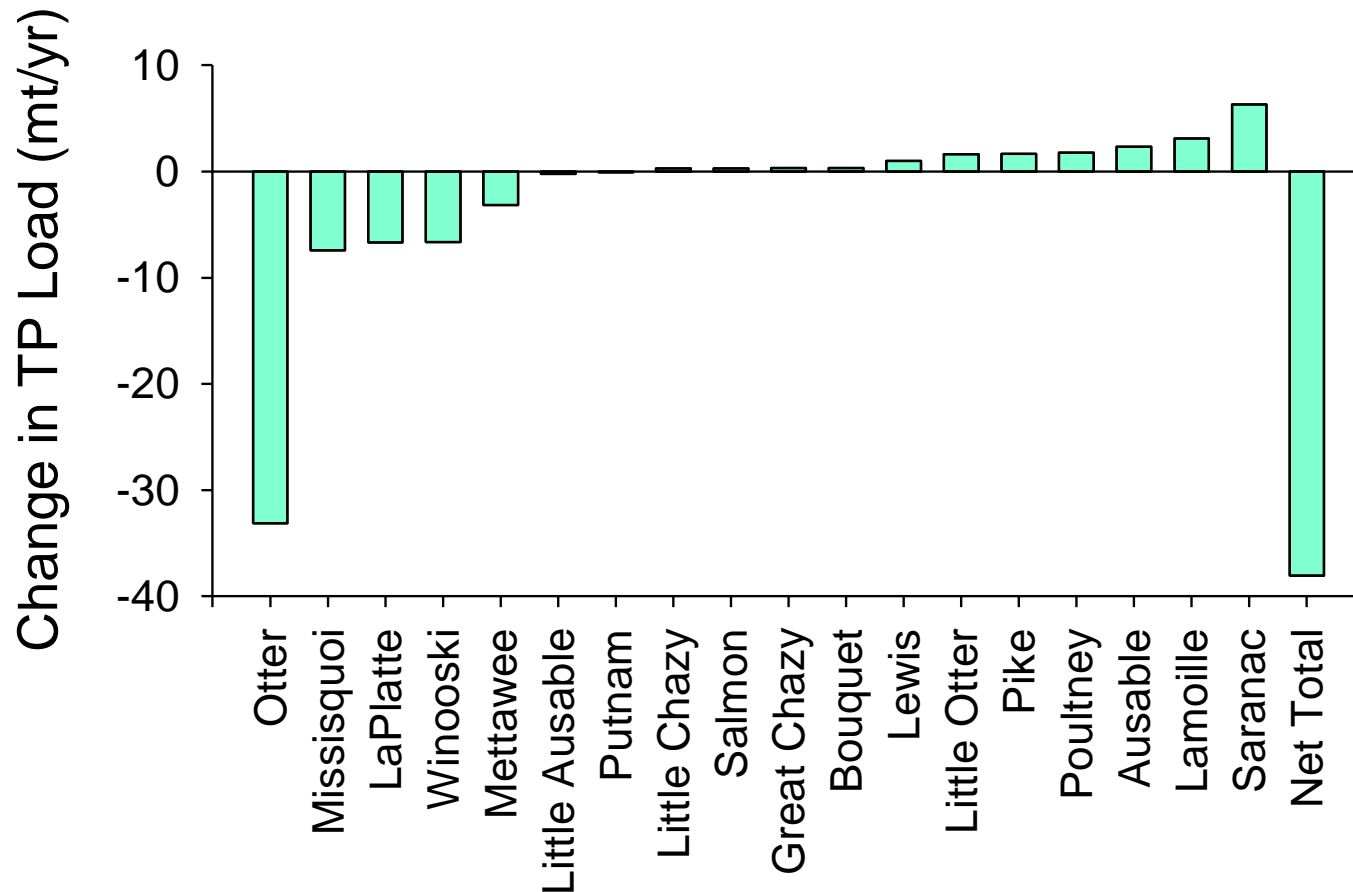
## Trends in Lake Champlain Phosphorus Concentrations, 1990-2012

-  Annual mean TP ( $\mu\text{g/L}$ )
-  Water quality standard
-  Statistically significant increasing trend

# 5

Number of Vermont Lake Champlain tributaries (out of 18) showing reductions in flow-normalized phosphorus loadings.

# Change in flow-normalized phosphorus loads from Lake Champlain tributaries, 1990-2011 (USGS, 2013)



# Multiple considerations in setting phosphorus reduction priorities

---

- Magnitude of the source
- Intensity of the source (critical source areas)
- Equity across source sectors
- Cost-effectiveness

# 817

Current phosphorus load to Lake Champlain from Vermont, New York, and Québec (mt/yr)

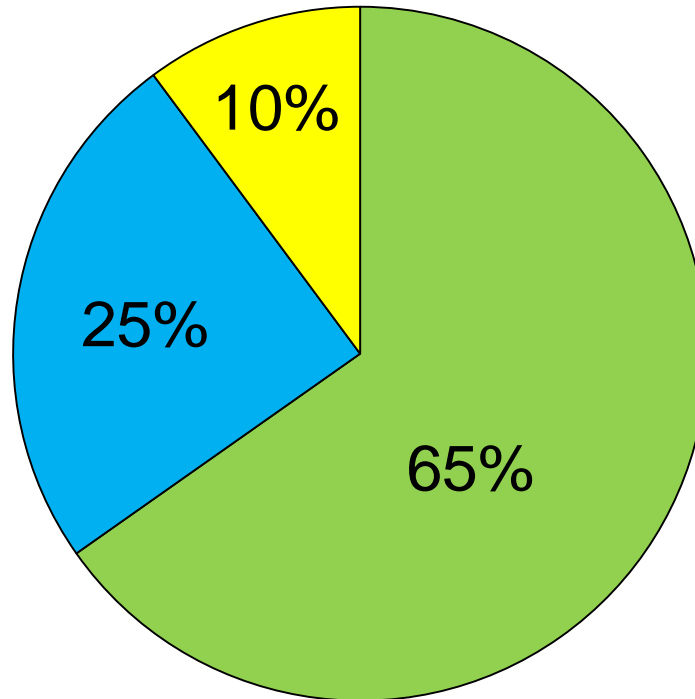
Preliminary EPA estimate for the TMDL, 2001-2010 average load



# Source of phosphorus loading to Lake Champlain by state/province

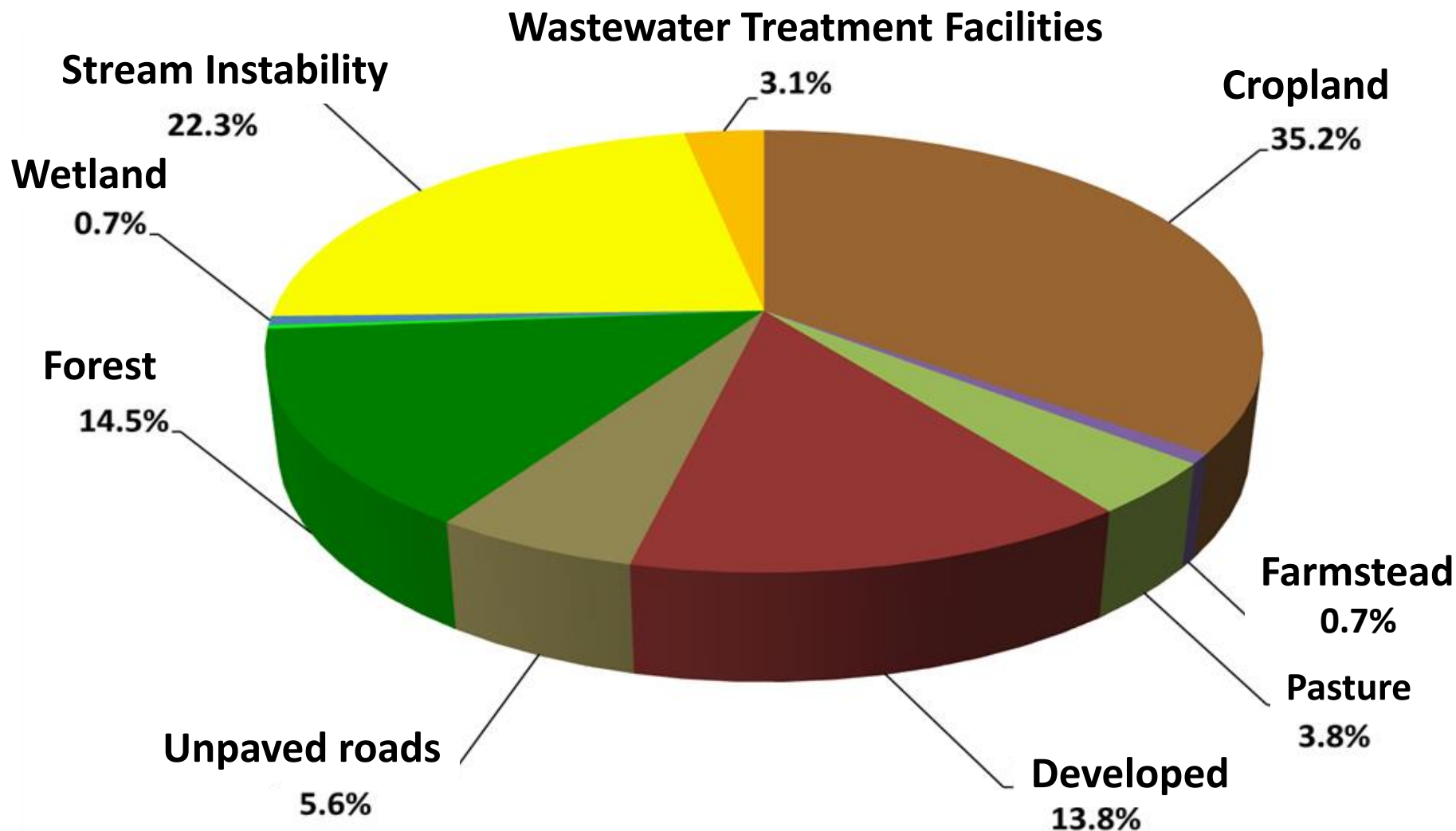
 Vermont  New York  Québec

Current (2001-2010) Load  
817 metric tons per year

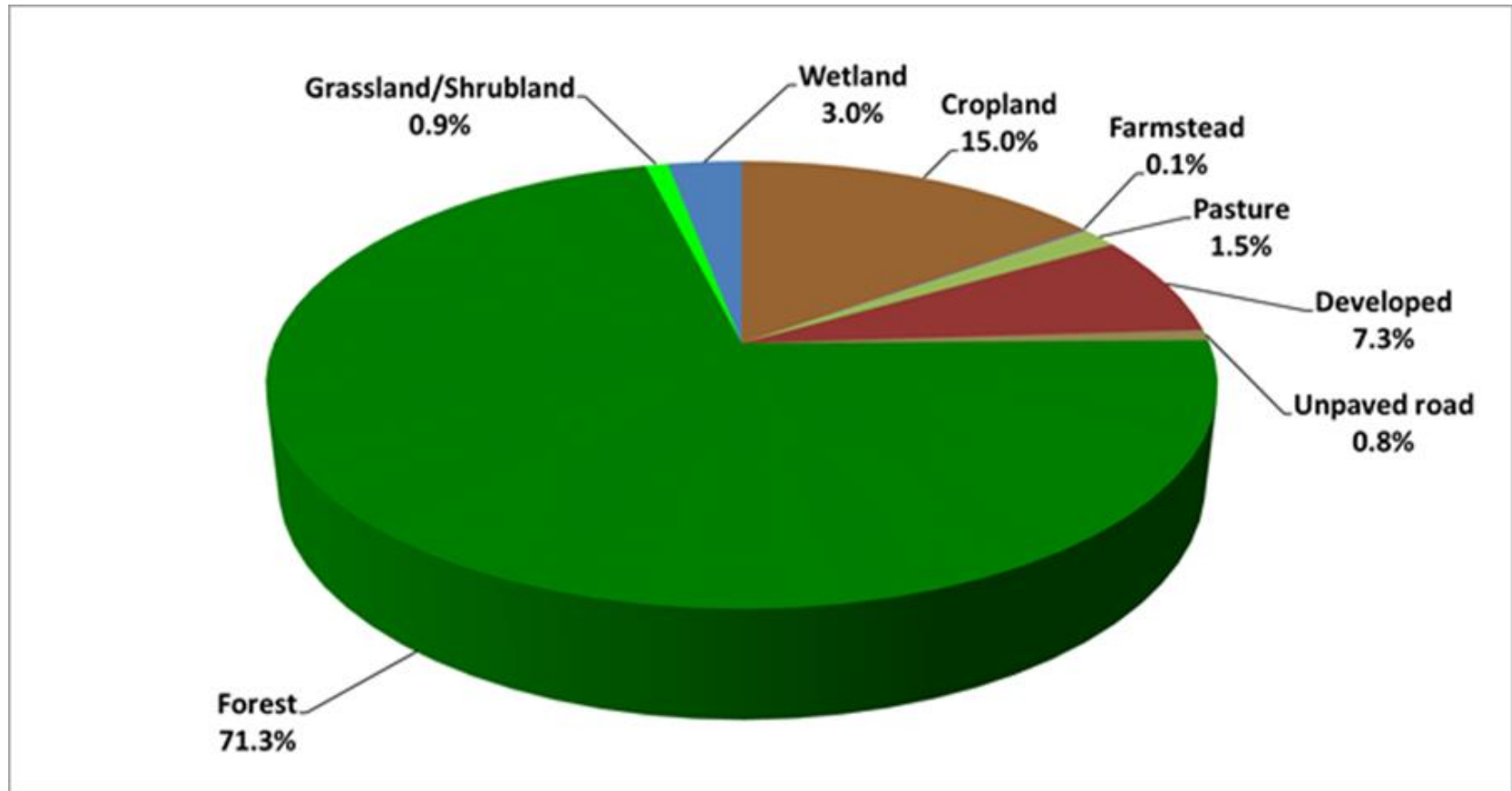


# Sources of phosphorus in the Vermont portion of the Lake Champlain Basin

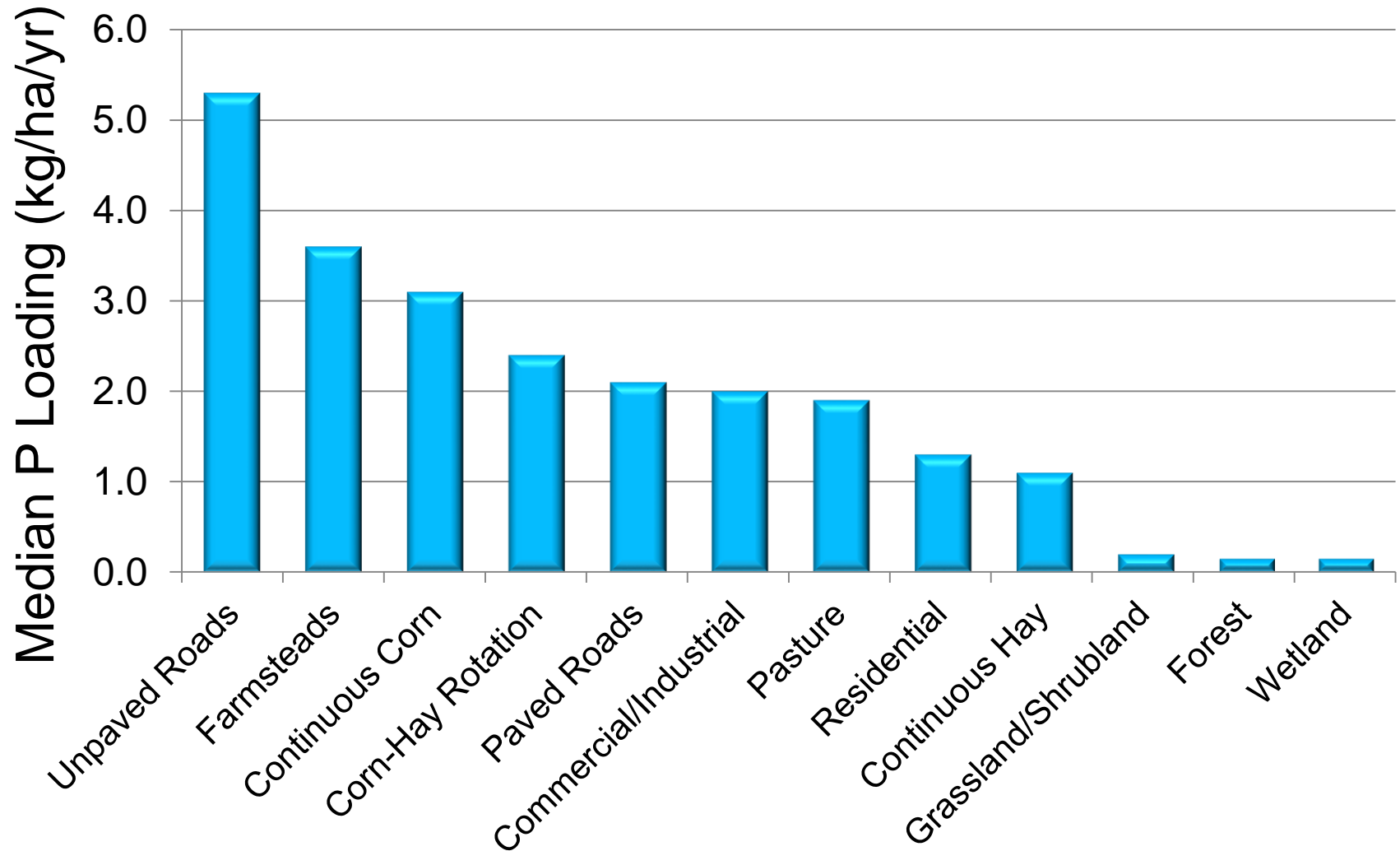
(Preliminary estimates from EPA/Tetra Tech, 2013)



# Land use in the Vermont portion of the Lake Champlain Basin



# Phosphorus loading rate per unit of area for different land uses

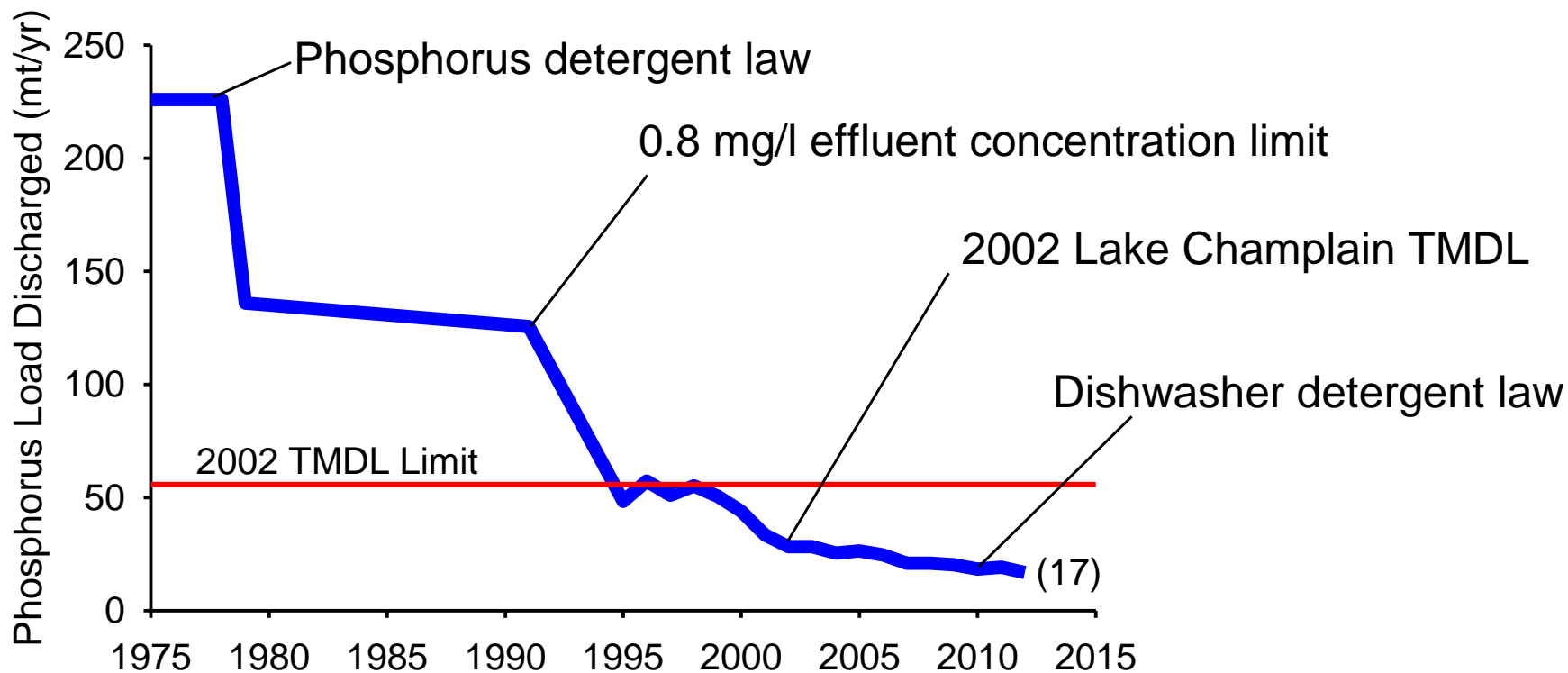


Preliminary estimates for the Vermont Lake Champlain Basin (from EPA/TetraTech, 2013)

# 17

Current (2012) phosphorus load (mt/yr) from Vermont's 60 wastewater treatment facilities in the Lake Champlain Basin

# Long-term trends in Vermont wastewater phosphorus loads to Lake Champlain



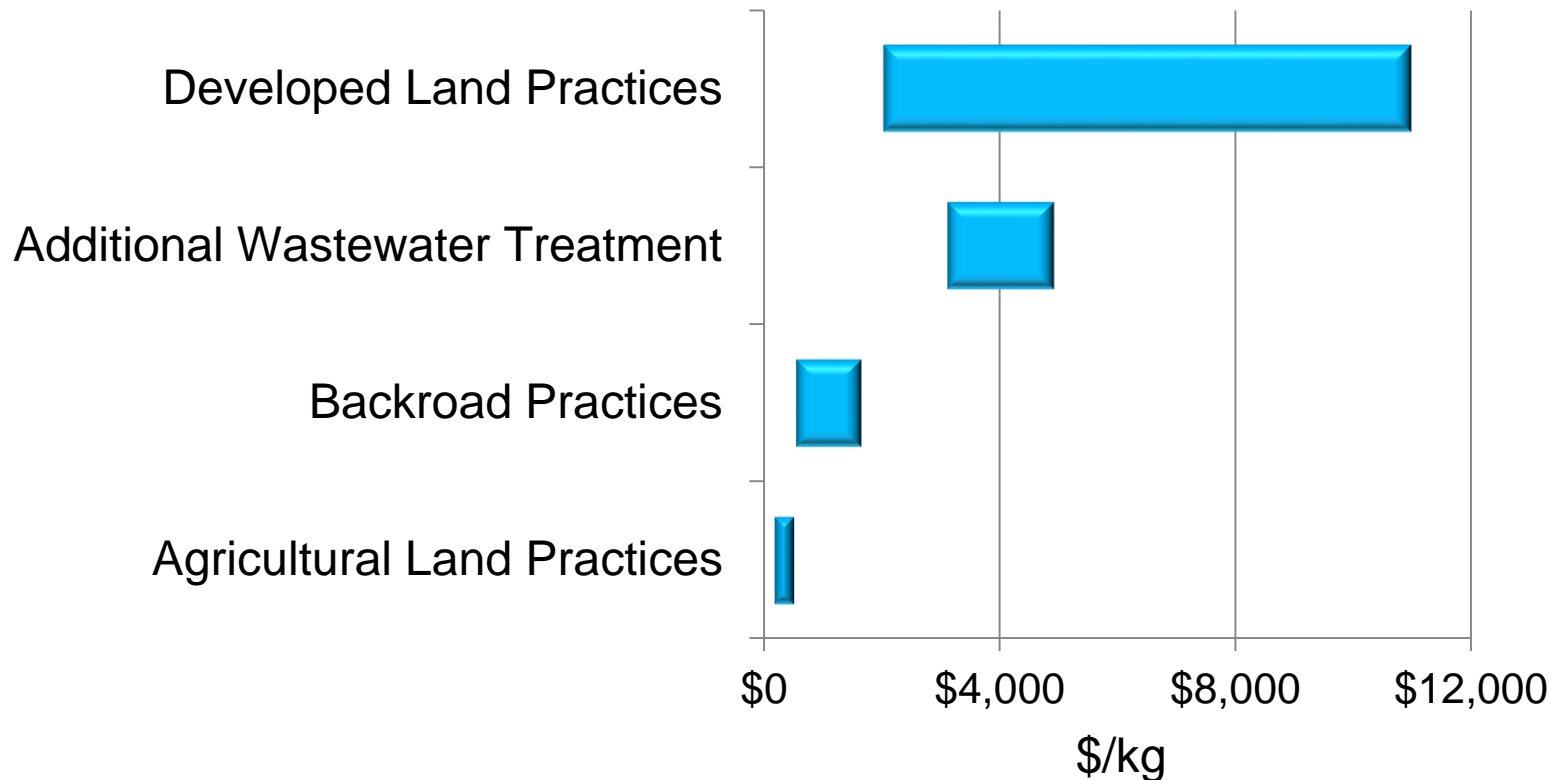
**\$200 – \$11,000**

Range of cost-effectiveness of phosphorus reduction practices (dollars per kilogram of phosphorus reduced)

From preliminary EPA estimates for the Lake Champlain TMDL

# Relative Cost-Effectiveness of Phosphorus Reduction Practices

(Range of annualized cost per kilogram P reduced annually)



Nonpoint source practice costs are from preliminary EPA estimates for the Lake Champlain TMDL. Wastewater costs are from VT DEC. Estimates include capital costs only, annualized over 20 years at 2% interest.



# 495

Lake Champlain's total loading capacity for phosphorus (mt/yr)

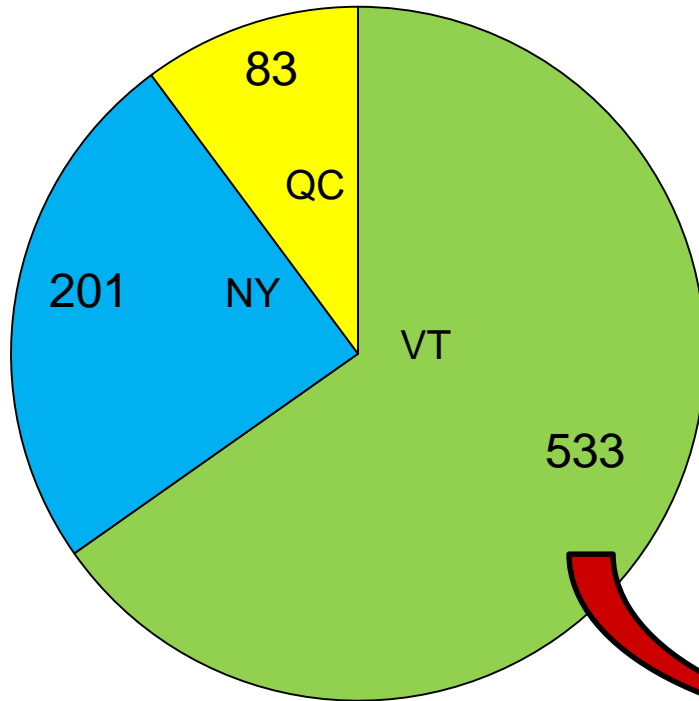
Preliminary EPA modeling estimate

# Total Loading Capacities

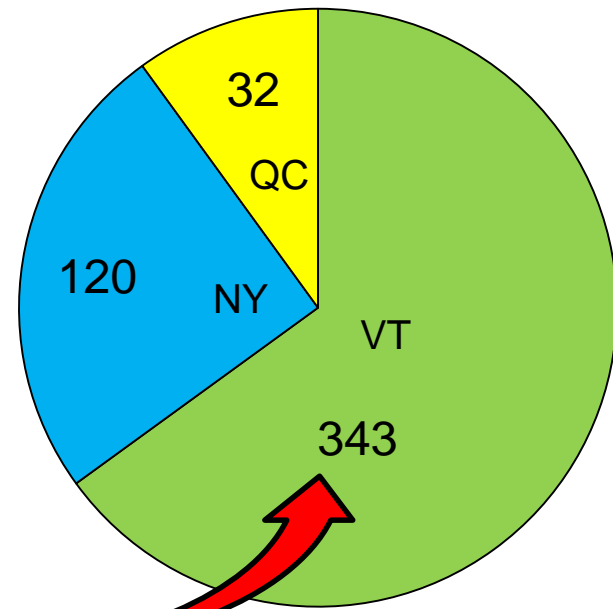
(Preliminary EPA estimates)



Current (2001-2010) Load  
817 metric tons per year



Total Loading Capacity  
495 metric tons per year



Vermont Reduction Required = 190 mt/yr (36%)

$$\text{TMDL} = \text{WLA} + \text{LA} + \text{MOS}$$

Total Maximum Daily Load  
(Total Loading Capacity =  
343 mt/yr from Vermont)

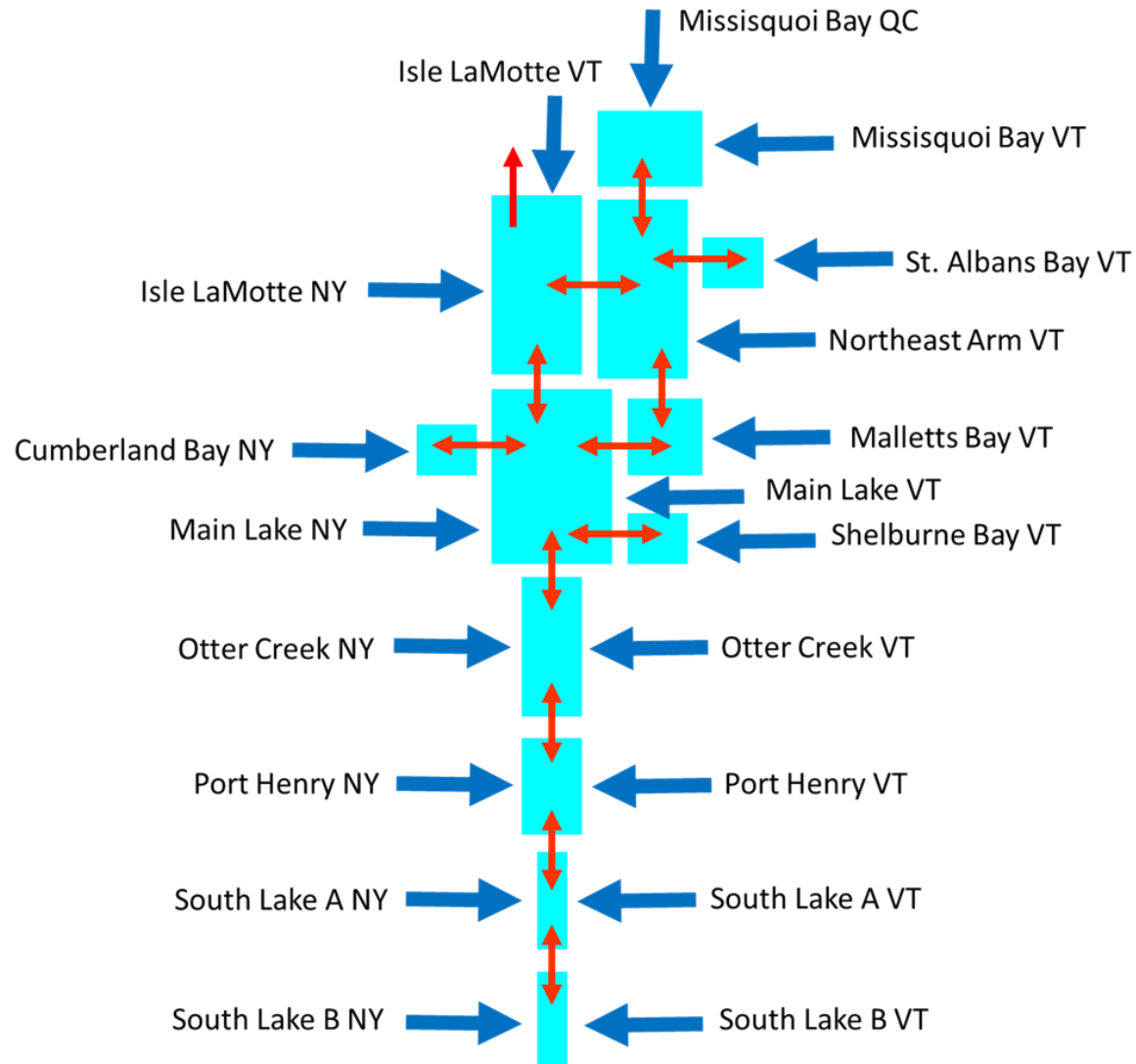
Wasteload Allocation  
(Point Sources)

Load Allocation  
(Nonpoint sources)

Margin of Safety

# Lake Champlain Phosphorus Model Wiring Diagram

---



$$\sqrt{-1}$$

(Imaginary number)

# Preliminary lake modeling results

Total Vermont loading capacities (mt/yr) from one example scenario

Lake Segment	Current Vermont Load	Load Reduction Required	TMDL	WLA	LA	MOS (5%)
1. South Lake B	41.2	17.3	23.9			1.2
2. South Lake A	3.7	1.6	2.1			0.1
3. Port Henry	2.8	0.7	2.1			0.1
4. Otter Creek	137.1	31.6	105.5			5.3
5. Main Lake	143.9	39.5	104.4			5.2
6. Shelburne Bay	9.0	2.5	6.5			0.3
7. Burlington Bay	3.0	0.1	2.9			0.1
9. Malletts Bay	53.6	11.9	41.7			2.1
10. Northeast Arm	1.2	0.2	1.0			0.1
11. St. Albans Bay	9.3	3.9	5.4			0.3
12. Missisquoi Bay	124.7	80.4	44.3			2.2
13. Isle LaMotte	3.5	0.8	2.7			0.1
<b>TOTAL</b>	<b>533</b>	<b>190</b>	<b>343</b>			<b>17</b>

Preliminary EPA estimates

26.2

