Lake Score Cards Highlight Restoration Progress and Protection Needs

Leslie Matthews, Kellie Merrell, Mark Mitchell, Amy Picotte and Angela Shambaugh

Vermont Lake Score Card

Goals:

★Present a comprehensive perspective on Vermont lakes using easily interpreted graphics

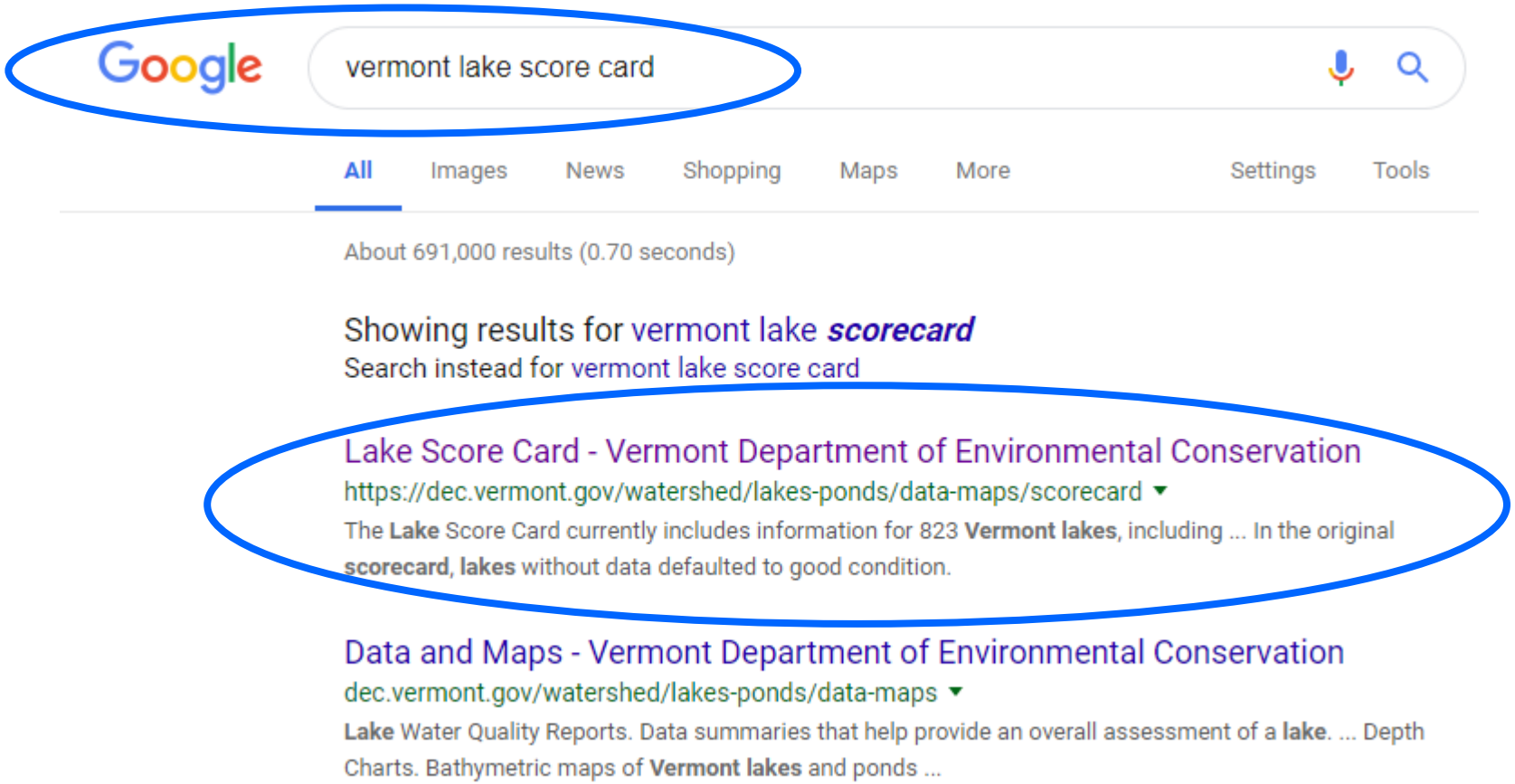
★Provide guidance on actions that residents can take to protect their lake

The Score Card

- is based on data we already collect
- is a public education tool based on science
- Uses PBJ backed with explanation

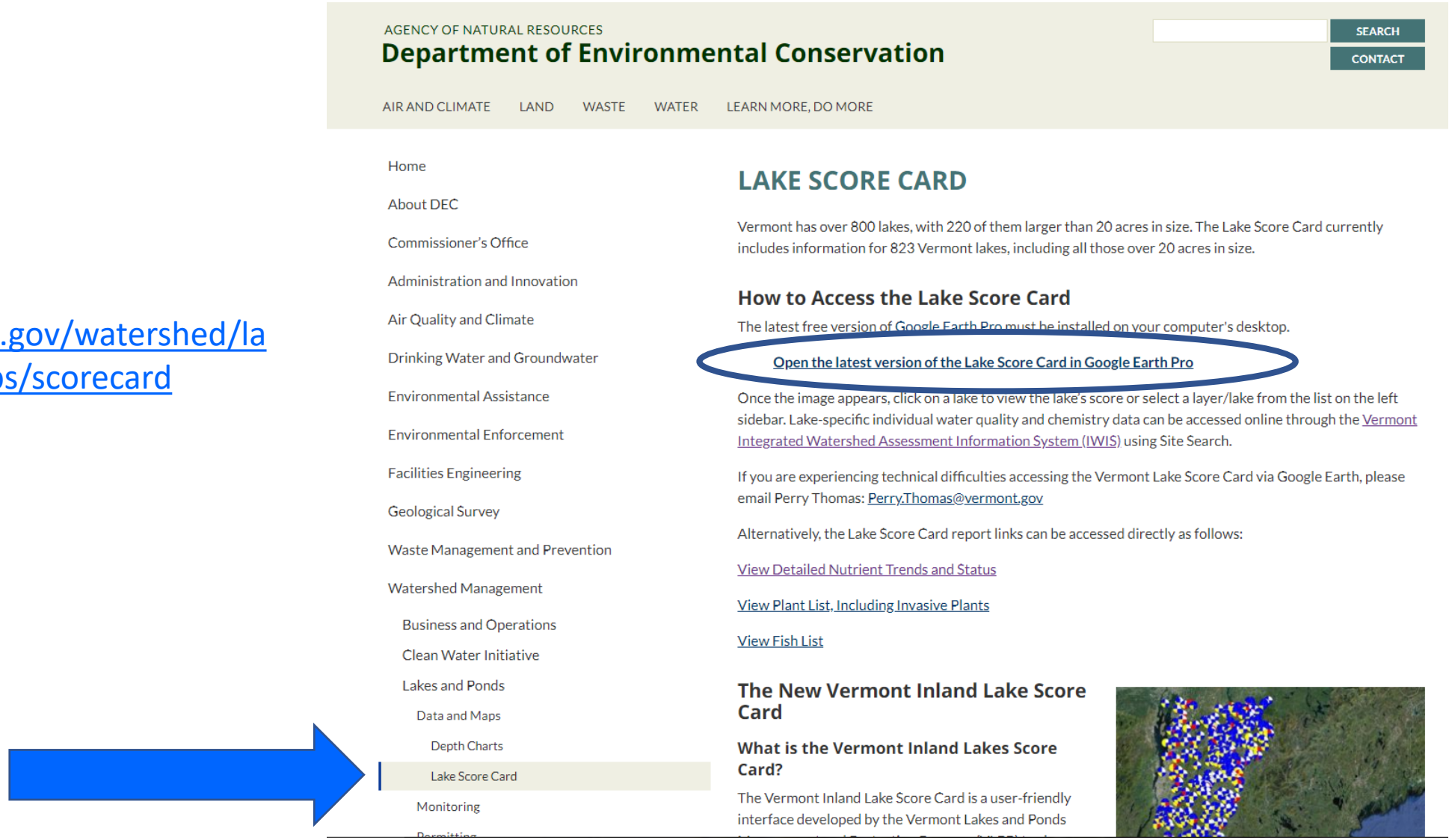
Amy Picotte

Getting There –
Google “Vermont Lake Score Card”

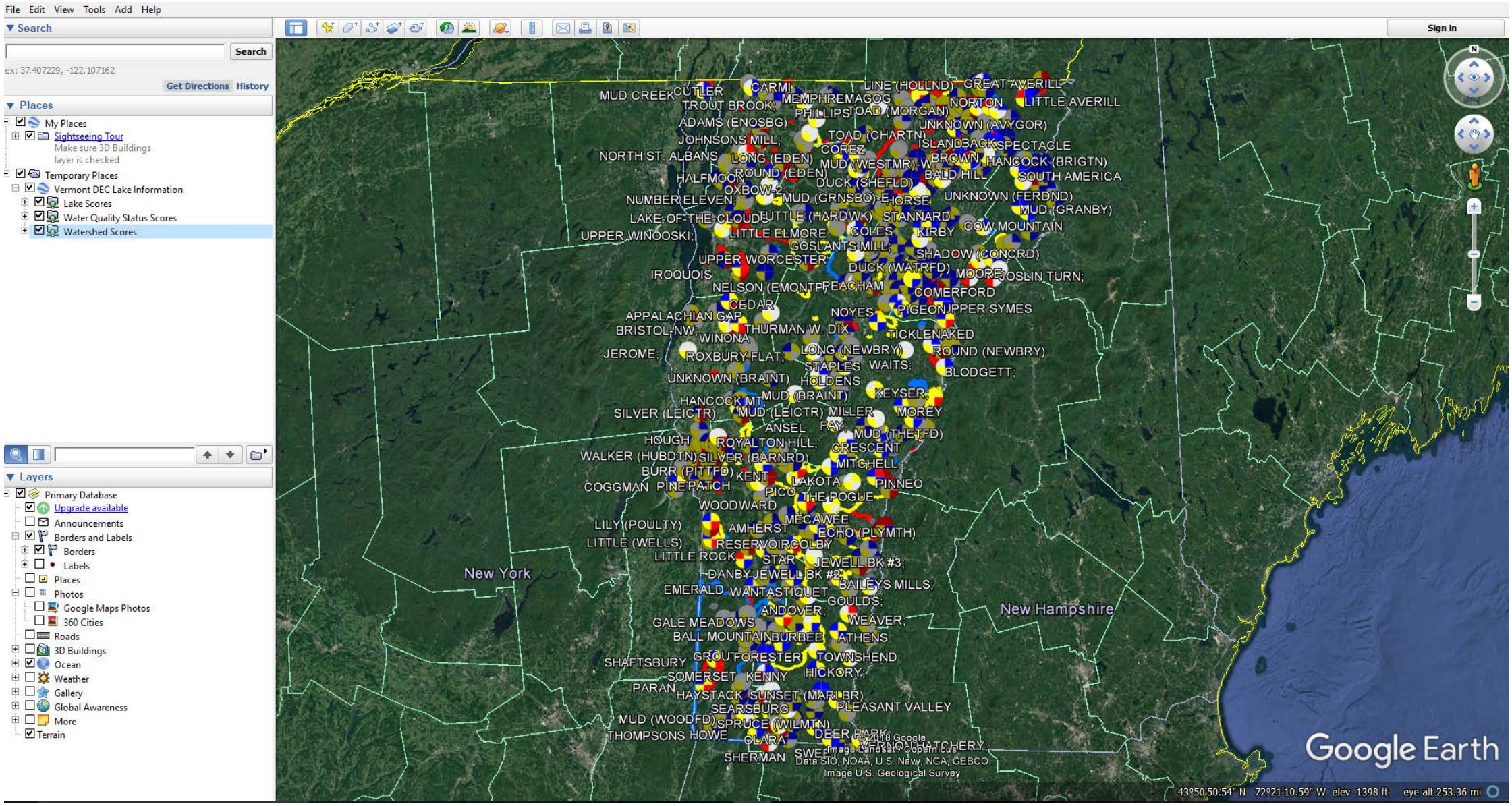


Getting There – Google Earth

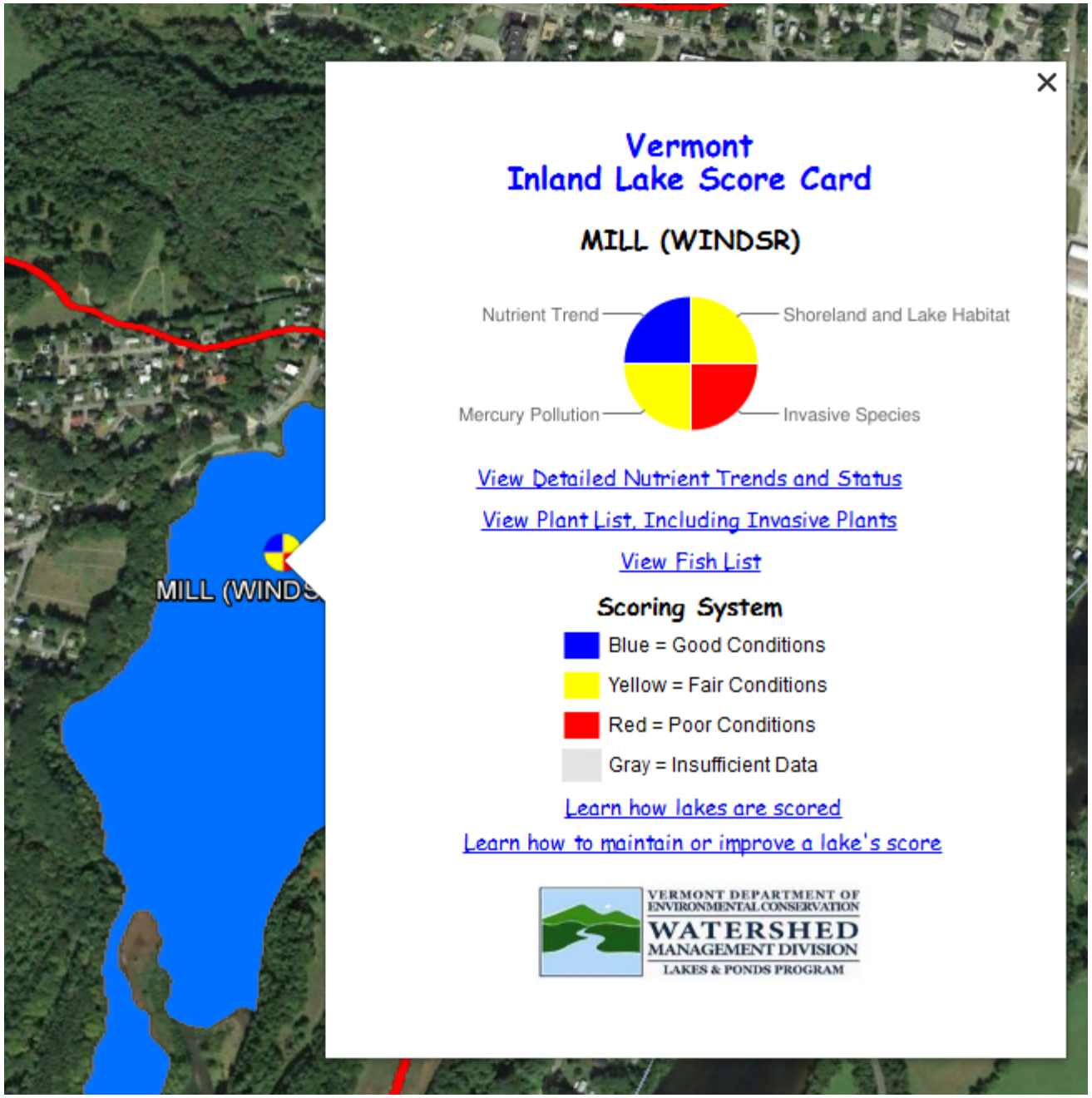
https://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard

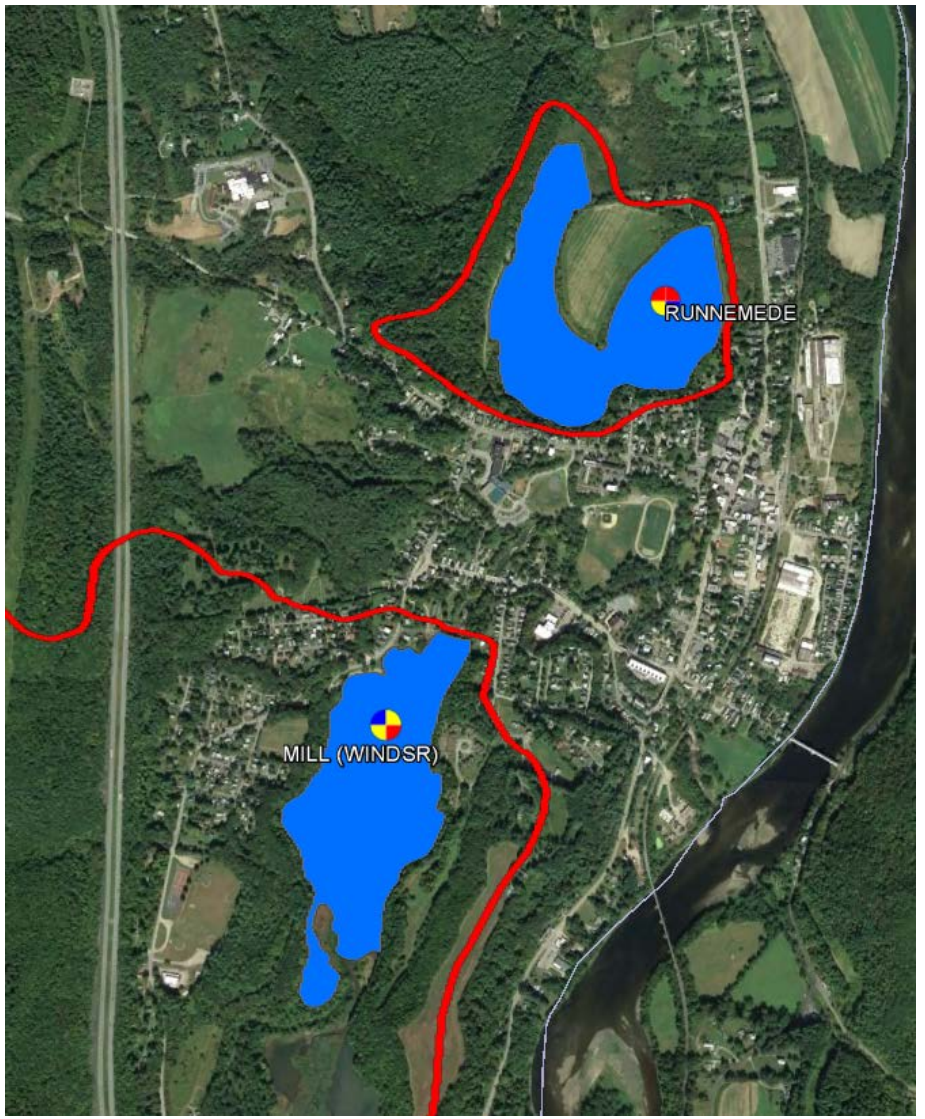


Google Earth

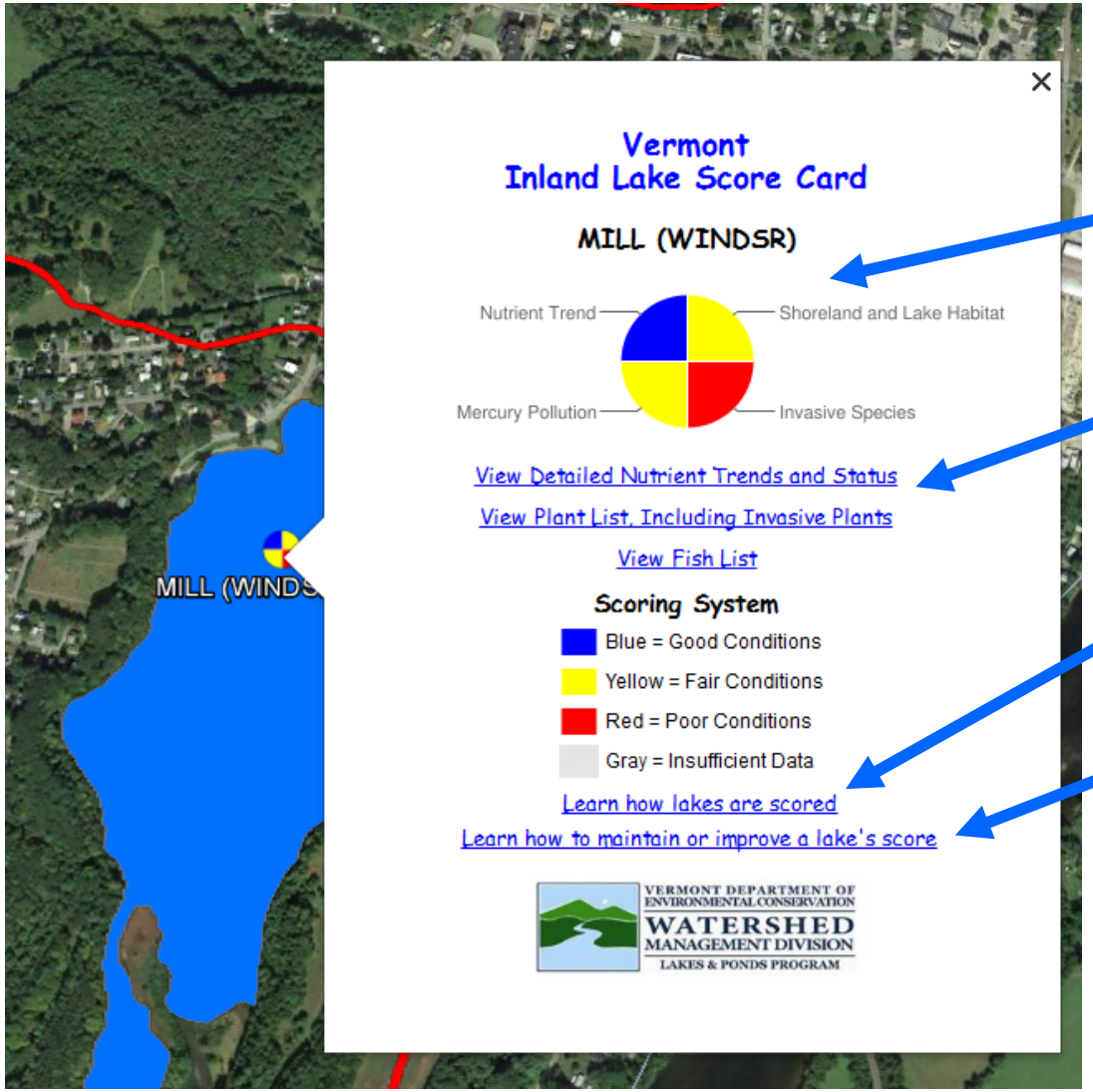


Zoom in!


MILL (WINDS
Vermont
Inland Lake Score Card
MILL (WINDSR)
Nutrient Trend
Shoreland and Lake Habitat
Mercury Pollution
Invasive Species
View Detailed Nutrient Trends and Status
View Plant List, Including Invasive Plants
View Fish List
Scoring System
Blue = Good Conditions
Yellow = Fair Conditions
Red = Poor Conditions
Gray = Insufficient Data
Learn how lakes are scored
Learn how to maintain or improve a lake's score
VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
LAKES & PONDS PROGRAM


RUNNEMEDE
MILL (WINDSR)

The Score Card



Color-coded evaluation of 4 characteristics

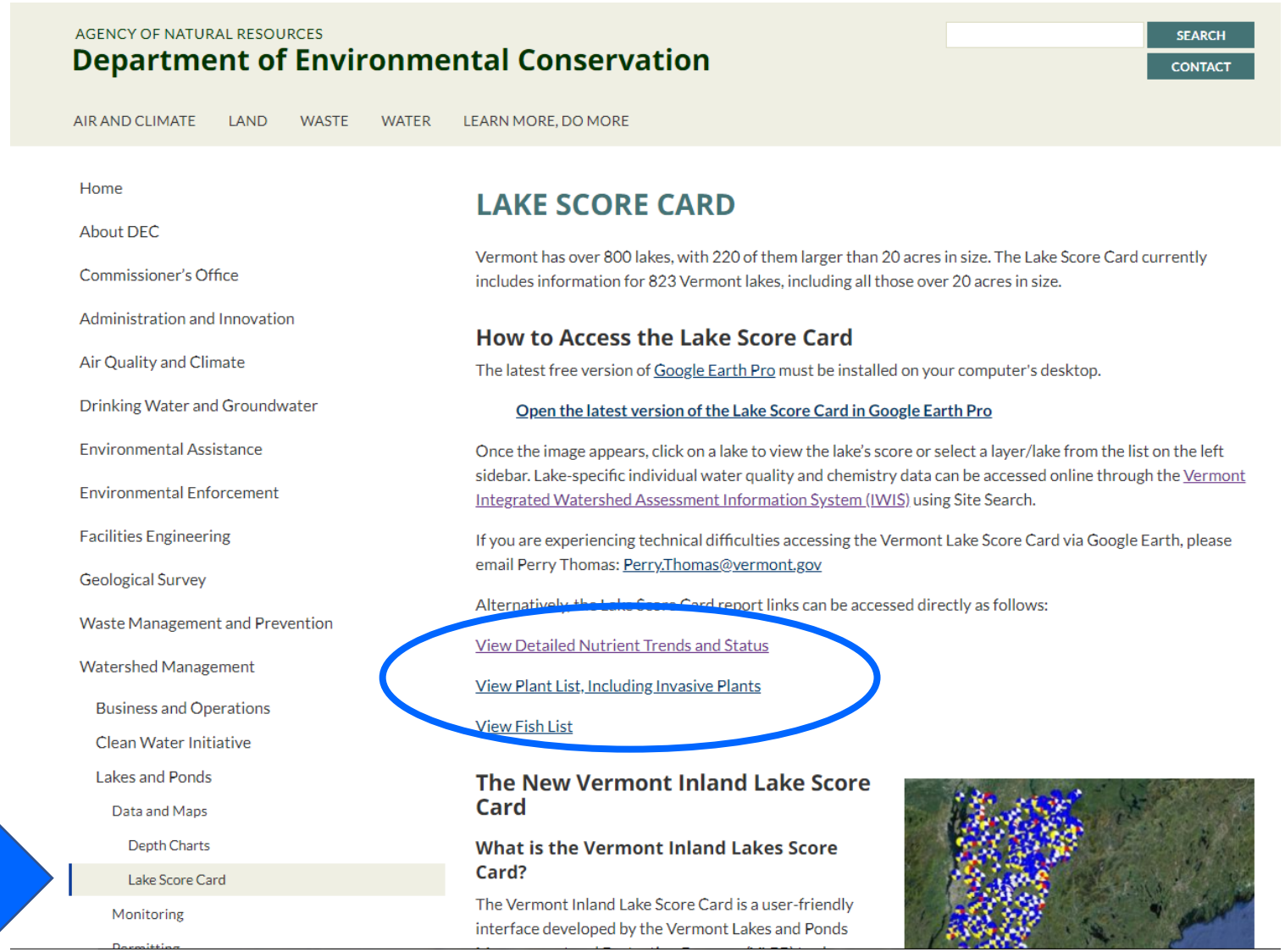
View the underlying data

Learn how scores are calculated

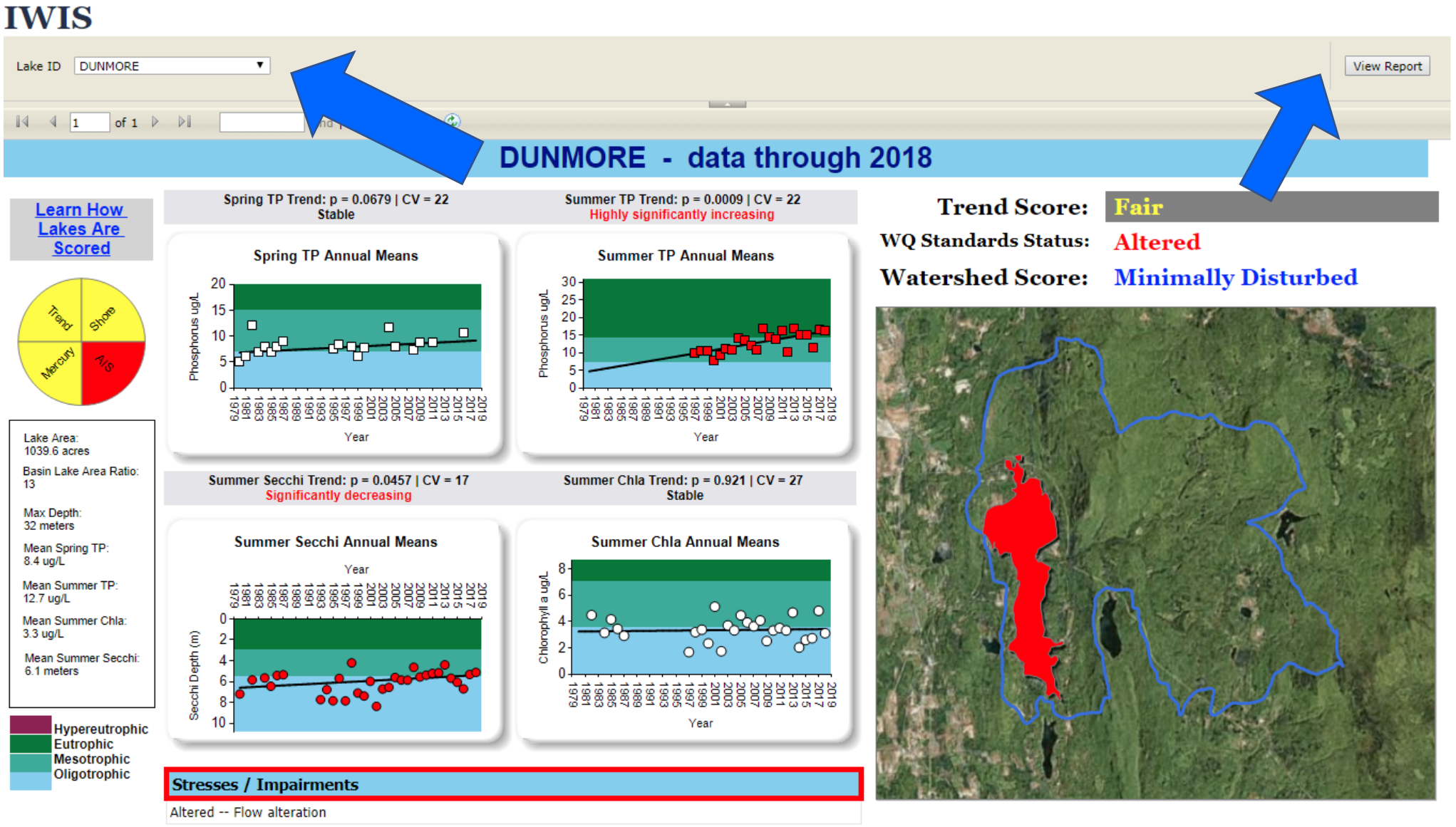
Checklist of steps you can take to protect and improve your lake

Getting There – VT IWIS

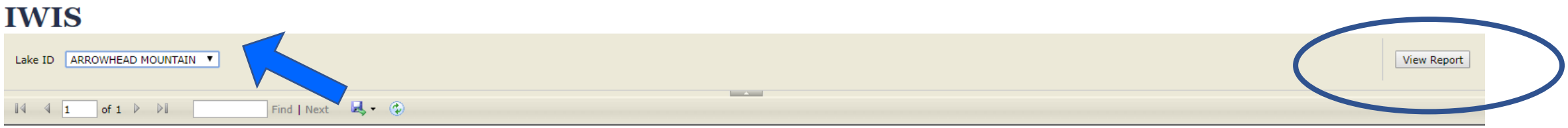
https://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard



Integrated Watershed Information Service (IWIS) Data Viewer



IWIS Data Viewer



ARROWHEAD MOUNTAIN

19 Records

Basin 07

Lake Area = 760 acres

			Rare, Threatened Endangered Info			
Species	Common Name	Most Recent Record	State Rank	Global Rank	State Status	Federal Status
Ceratophyllum demersum	coontail	9/24/1992				
Ceratophyllum sp.	hornwort	9/24/1992				
Elodea canadensis	common elodea	9/24/1992				
Elodea sp.	waterweed	6/22/1994				
Equisetum sp.	horsetail	9/24/1992				
Myriophyllum spicatum	Eurasian watermilfoil	6/22/1994				
Potamogeton amplifolius	big-leaf pondweed	6/22/1994				
Potamogeton natans	floating-leaf pondweed	9/24/1992				
Potamogeton perfoliatus	claspingleaf pondweed	9/24/1992				
Potamogeton pusillus	small pondweed	7/12/1988				
Potamogeton richardsonii	Richard's pondweed	6/22/1994				
Potamogeton robbinsii	Robbin's pondweed	7/12/1988				
Potamogeton sp.	pondweed	9/24/1992				
Potamogeton zosteriformis	flatstem pondweed	9/24/1992				
Sagittaria sp.	arrowhead	6/22/1994				
Scirpus sp.	bulrush	7/12/1988				
Sparganium sp.	bur-reed	9/24/1992				
Vallisneria americana	wild celery or eelgrass	9/24/1992				
Zosterella dubia	water stargrass	9/24/1992				

1. Select your lake from drop down menu

2. Click on “view report”

IWIS

Lake ID ARROWHEAD MOUNTAIN ▼ View Report

1 of 1 Find | Next

ARROWHEAD MOUNTAIN 13 Records

Basin Lake Area = acres

		Rare, Threatened Endangered Info			
Common Name	**Scientific Name**	**State Rank**	**Global Rank**	**State Status**	**Federal Status**
Brown bullhead	Ameiurus nebulosus				
Banded killifish	Fundulus diaphanus				
Common shiner	Luxilus cornutus				
Golden shiner	Notemigonus crysoleucas				
Logperch	Percina caprodes				
Northern pike	Esox lucius				
Pumpkinseed	Lepomis gibbosus				
Rock bass	Ambloplites rupestris				
Shorthead redhorse	Moxostoma macrolepidotum	S2	G5		
Smallmouth bass	Micropterus dolomieu				
Walleye	Stizostedion vitreum				
White sucker	Catostomus commersoni				
Yellow perch	Perca flavescens				

Viewing the Data

CURTIS - data through 2018

Learn How Lakes Are Scored

Lake Area:
76.2 acres

Basin Lake Area Ratio:
12

Max Depth:
9.5 meters

Mean Spring TP:
22 ug/L

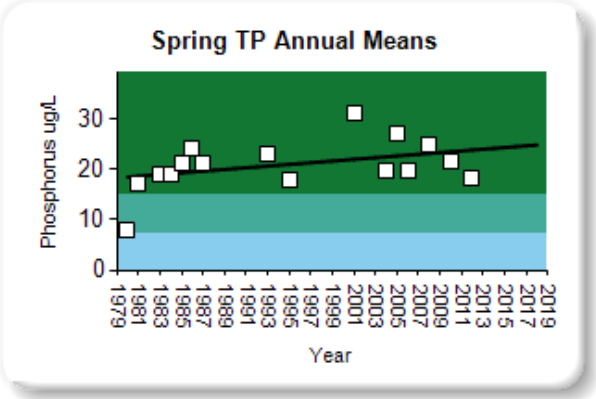
Mean Summer TP:
18.1 ug/L

Mean Summer Chla:
7.2 ug/L

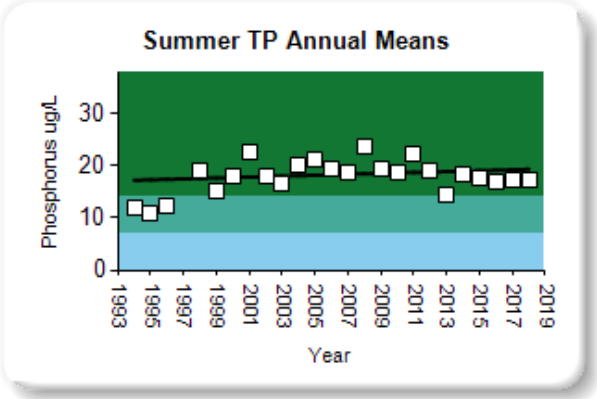
Mean Summer Secchi:
4.9 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

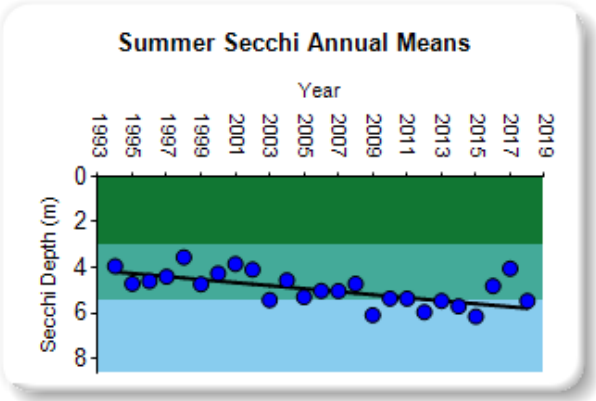
Spring TP Trend: p = 0.0865 | CV = 24
Stable



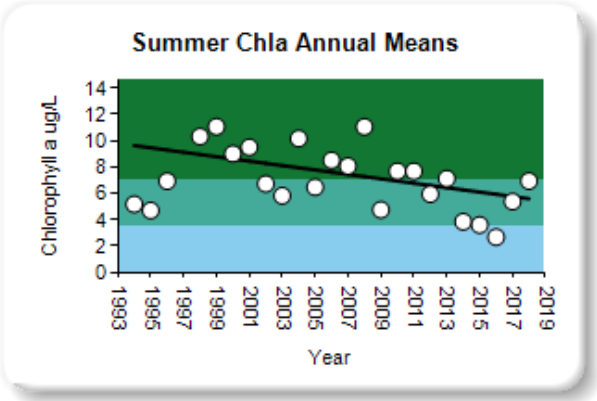
Summer TP Trend: p = 0.4718 | CV = 18
Stable



Summer Secchi Trend: p = 0.001 | CV = 15
Highly significantly increasing



Summer Chla Trend: p = 0.0593 | CV = 34
Stable



Stresses / Impairments

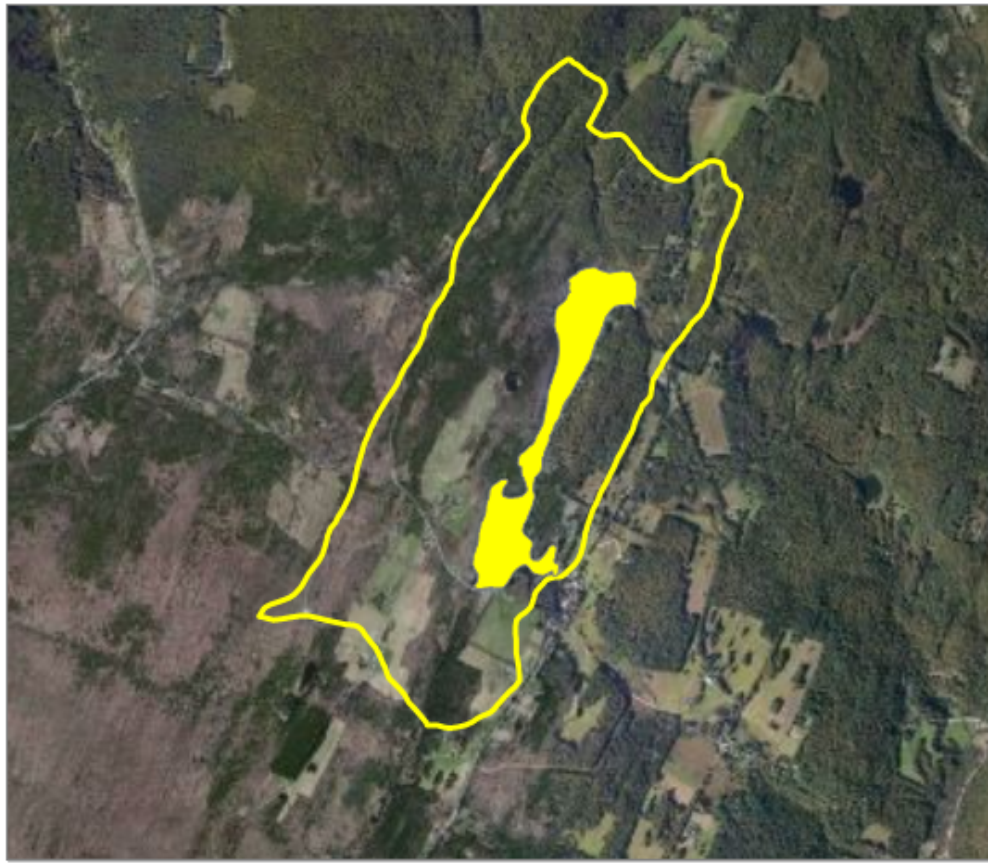
Stressed -- Nutrients

Stressed -- Phosphorus

Trend Score: Good

WQ Standards Status: Stressed

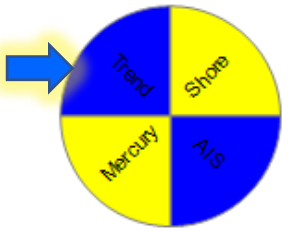
Watershed Score: Moderately Disturbed



The Nutrient Trend Score

CURTIS - data through 2018

Learn How Lakes Are Scored



Lake Area:
76.2 acres

Basin Lake Area Ratio:
12

Max Depth:
9.5 meters

Mean Spring TP:
22 ug/L

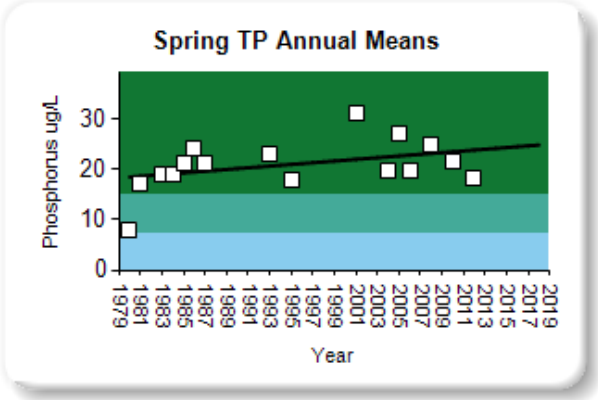
Mean Summer TP:
18.1 ug/L

Mean Summer Chla:
7.2 ug/L

Mean Summer Secchi:
4.9 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

Spring TP Trend: p = 0.0865 | CV = 24
Stable



Summer TP Trend: p = 0.4718 | CV = 18
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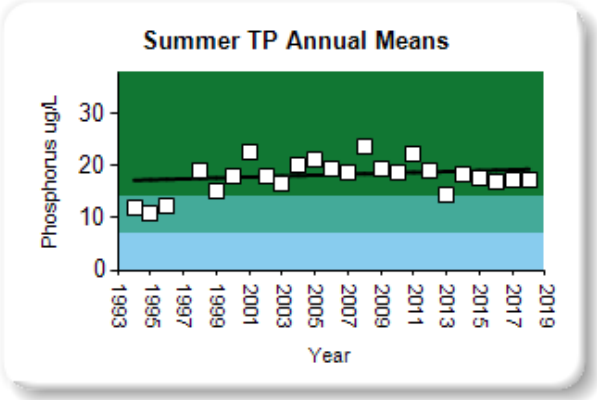
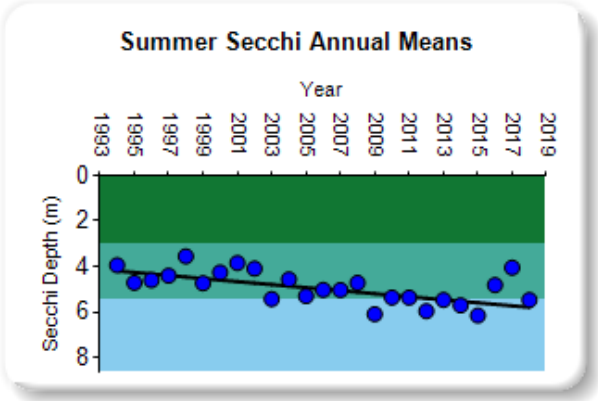
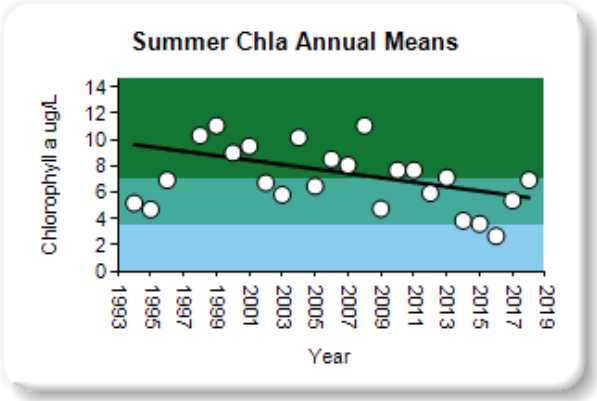


Summer Secchi Trend: p = 0.001 | CV = 15
Highly significantly increasing



Summer Chla Trend: p = 0.0593 | CV = 34
Stable



Stresses / Impairments

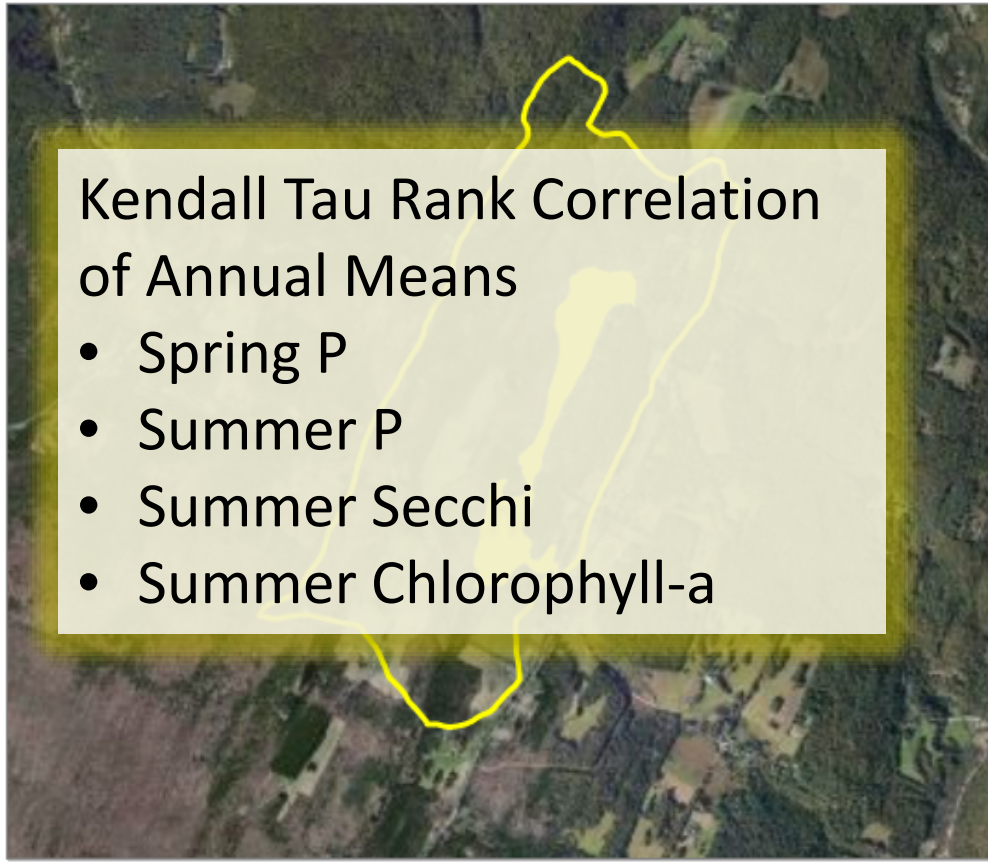
Stressed -- Nutrients

Stressed -- Phosphorus

Trend Score: Good

WQ Standards Status: Stressed

Watershed Score: Moderately Disturbed



Calculating Trend Score
Step 1 – Individual Trend Scores

- Spring TP
- Summer TP
- Summer Chla
- Summer Secchi

Kendall-Tau Statistical Probability	Trend Indication	Score 2 = good, 1= fair, 0=poor
> 0.05	Not significant (stable)	2
Between 0.01 and 0.05	Significant -with improving slope -with worsening slope	 2 1
< 0.01	Significant -with improving slope -with worsening slope	 2 0

Calculating Trend Score
Step 2 – Summer Final Score

Individual Summer Scores (TP, Chla, Secchi)
Summed and Rescaled from 0 to 2

Sum of Individual Summer Scores	Final Adjusted Summer Score
6	2
4, 5	1
< 4	0

Calculating Trend Score
Step 3 –Final Score

Spring TP Score + Summer Score

-or-

2 x Spring TP Score

Final Numerical Score	Trend Condition Score
4	Good
2 or 3	Fair
< 2	Poor

Example: Fair Trend Score

Summer Score (0 + 2 + 2) = 5 | Adjusted Summer Score = 1 | Spring TP Score + Adj. Summer Score (1 + 1) = 2 Fair

CASPIAN - data through 2018

Learn How Lakes Are Scored

Lake Area:
789.8 acres

Basin Lake Area Ratio:
5

Max Depth:
43.3 meters

Mean Spring TP:
7.6 ug/L

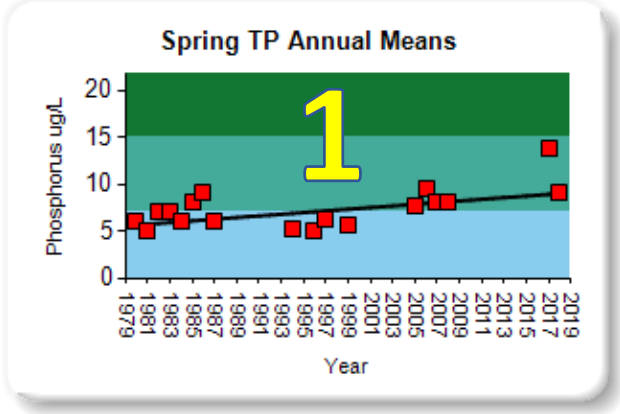
Mean Summer TP:
9.2 ug/L

Mean Summer Chla:
2.1 ug/L

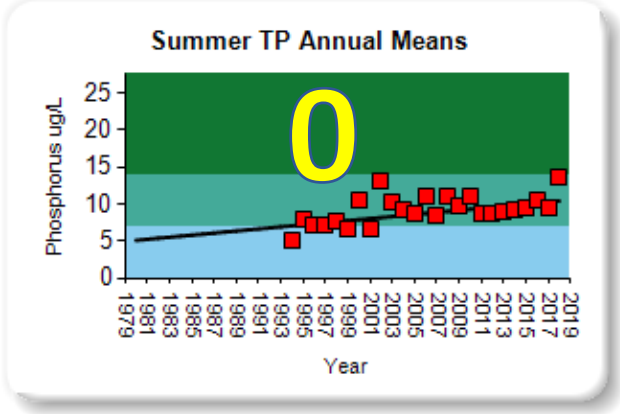
Mean Summer Secchi:
7.7 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

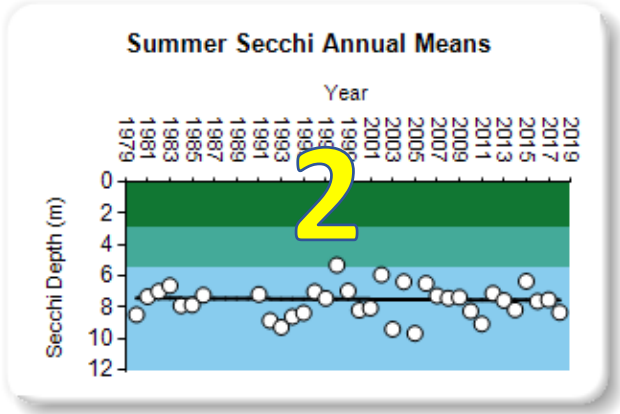
Spring TP Trend: p = 0.0182 | CV = 29
Significantly increasing



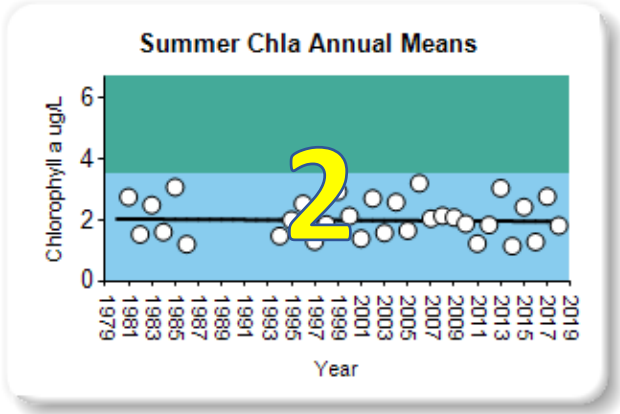
Summer TP Trend: p = 0.005 | CV = 22
Highly significantly increasing



Summer Secchi Trend: p = 0.82 | CV = 13
Stable



Summer Chla Trend: p = 0.8517 | CV = 30
Stable

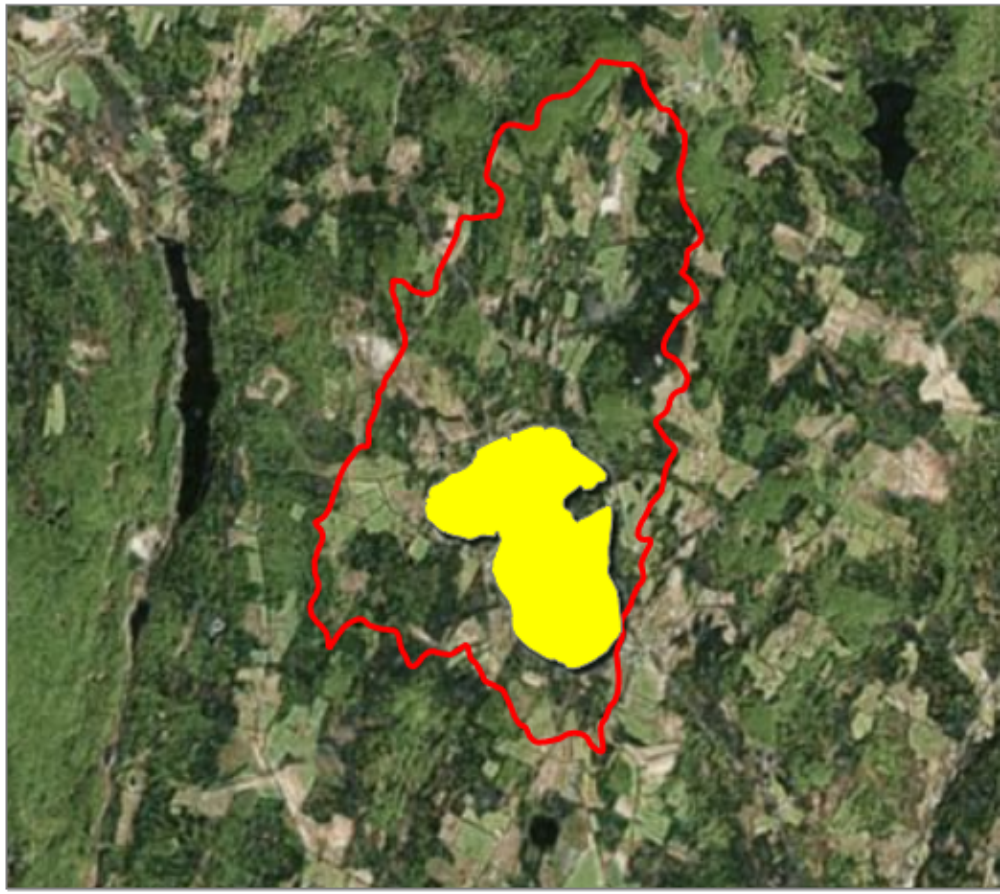


Stresses / Impairments

Trend Score: Fair

WQ Standards Status: Stressed

Watershed Score: Highly Disturbed



Example: Poor Trend Score

Summer Score (0 + 2 + 2) = 5 | Adjusted Summer Score = 1 | Spring TP Score + Adj. Summer Score (0 + 1) = 1 Poor

WILLOUGHBY - data through 2018

Learn How Lakes Are Scored

Lake Area:
1863.9 acres

Basin Lake Area Ratio:
7

Max Depth:
93.9 meters

Mean Spring TP:
7.5 ug/L

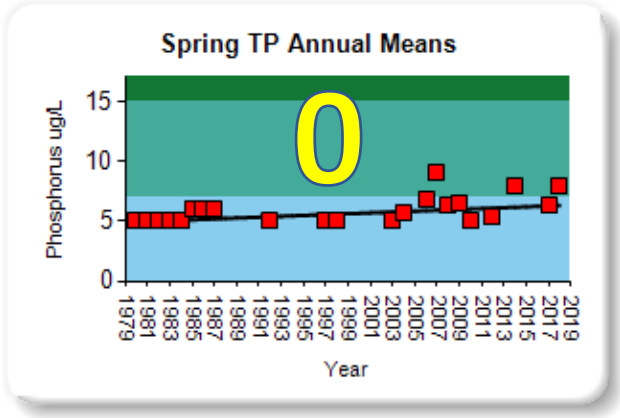
Mean Summer TP:
10.9 ug/L

Mean Summer Chla:
1.3 ug/L

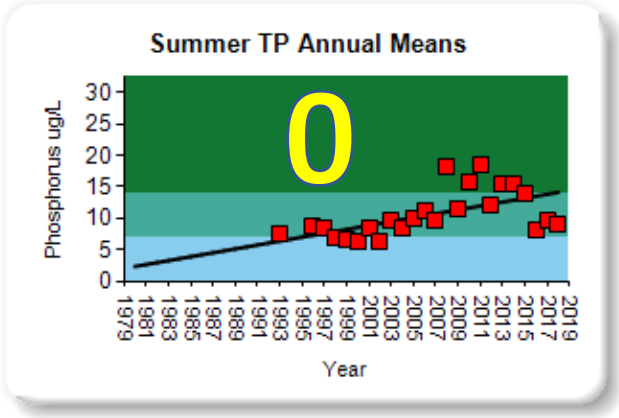
Mean Summer Secchi:
8 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

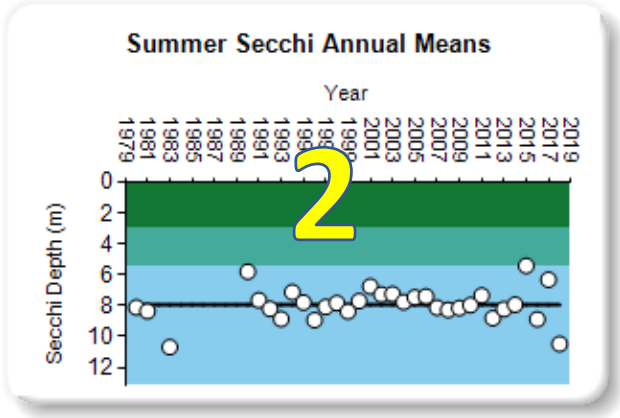
Spring TP Trend: p = 0.0015 | CV = 20
Highly significantly increasing



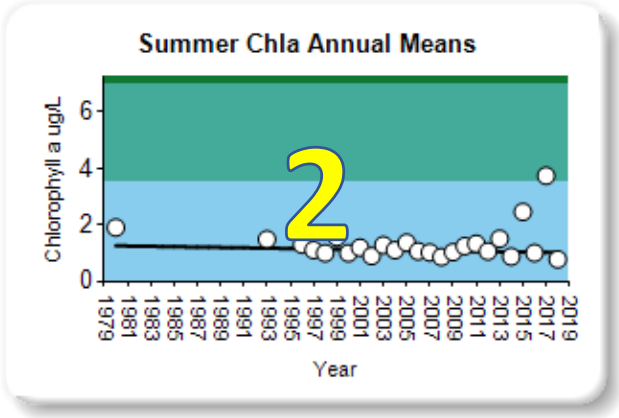
Summer TP Trend: p = 0.006 | CV = 35
Highly significantly increasing



Summer Secchi Trend: p = 0.8199 | CV = 14
Stable



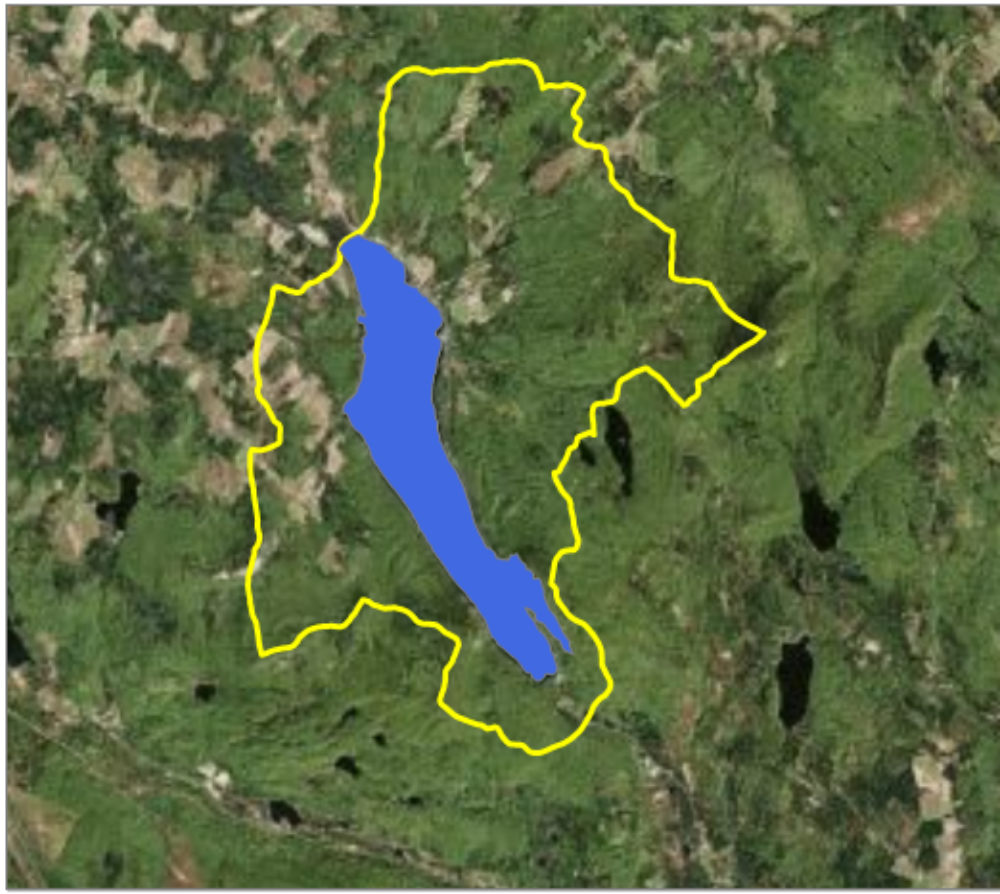
Summer Chla Trend: p = 0.5187 | CV = 48
Stable



Trend Score: Poor

WQ Standards Status: Meets Standards

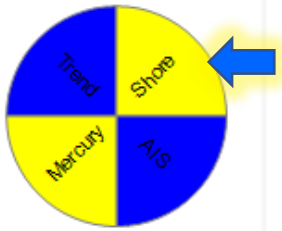
Watershed Score: Moderately Disturbed



The Shoreland and Lake Habitat Score

CURTIS - data through 2018

Learn How Lakes Are Scored



Lake Area:
76.2 acres

Basin Lake Area Ratio:
12

Max Depth:
9.5 meters

Mean Spring TP:
22 ug/L

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Mean Summer Chla:
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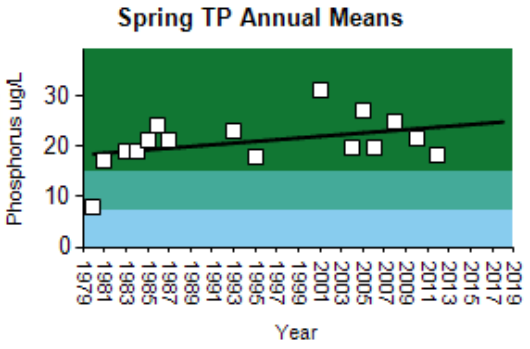
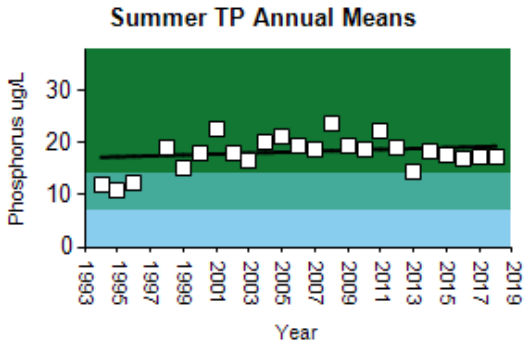
Mean Summer Secchi:
4.9 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

Spring TP Trend: p = 0.0865 | CV = 24
Stable



Summer TP Trend: p = 0.4718 | CV = 18
Stable



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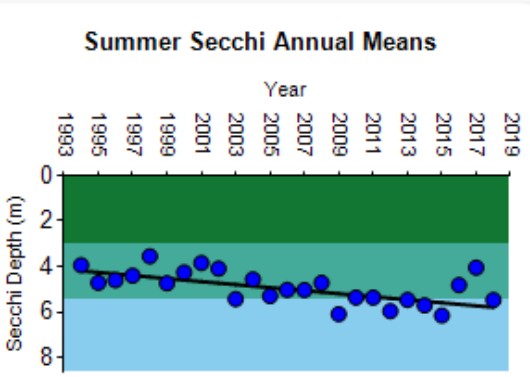
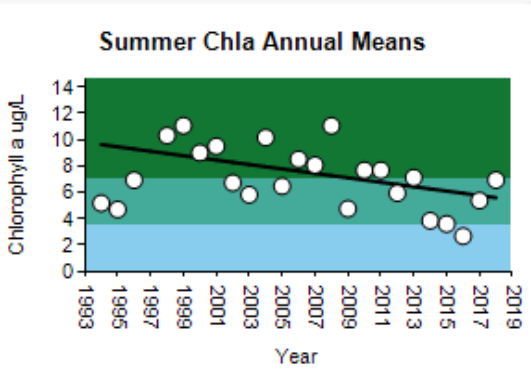
Highly significantly increasing



Summer Chla Trend: p = 0.0593 | CV = 34
Stable



Stresses / Impairments

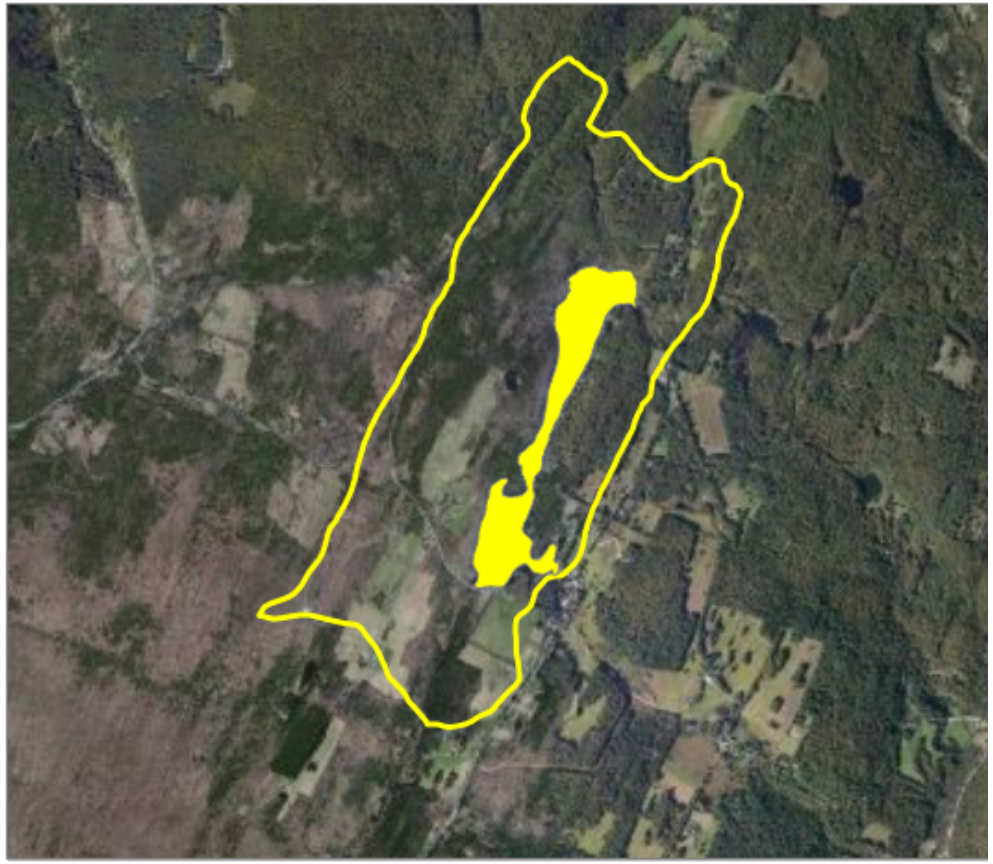
Stressed -- Nutrients

Stressed -- Phosphorus

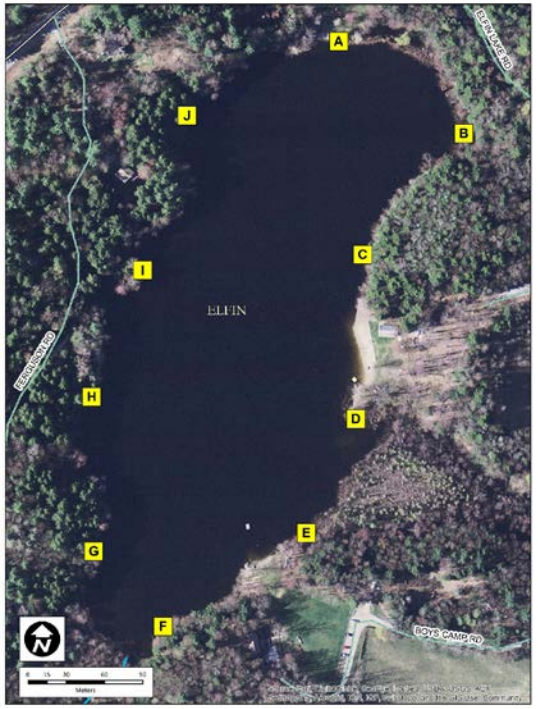
Trend Score: Good

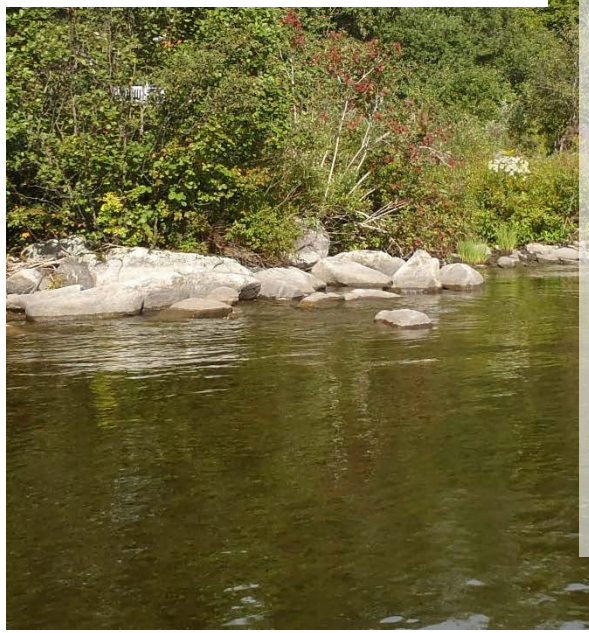
WQ Standards Status: Stressed

Watershed Score: Moderately Disturbed

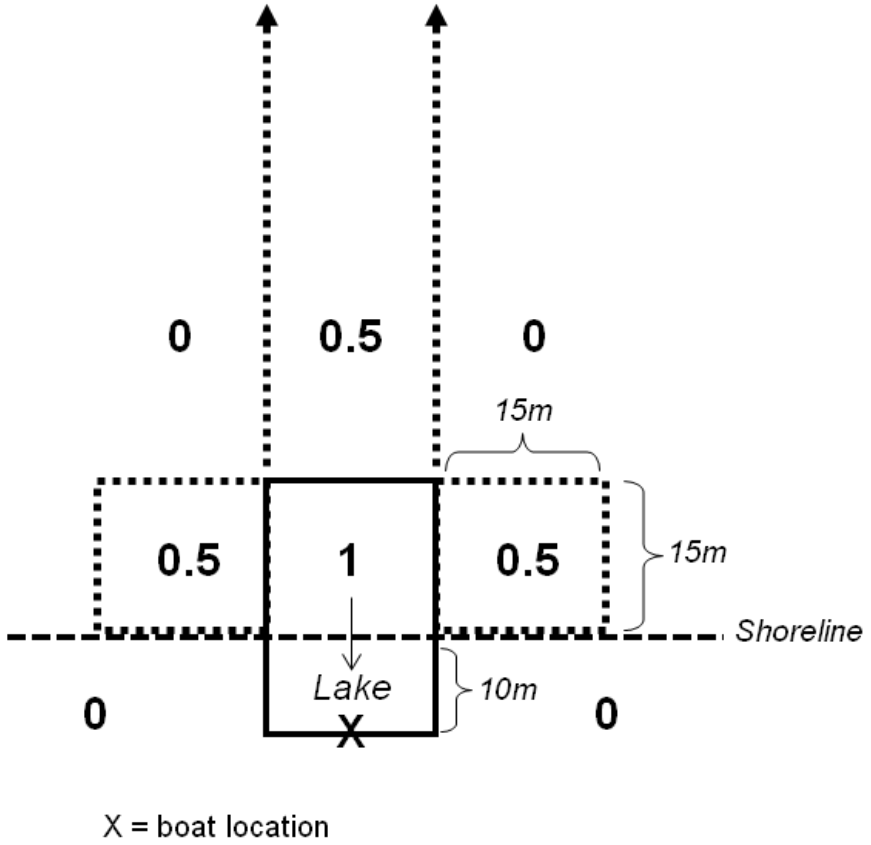


NLA Lakeshore Disturbance Index





- Buildings
- Commercial
- Crops
- Docks
- Landfill/trash
- Lawn
- Orchard
- Park
- Pasture/grassland
- Powerlines
- Roads
- Walls



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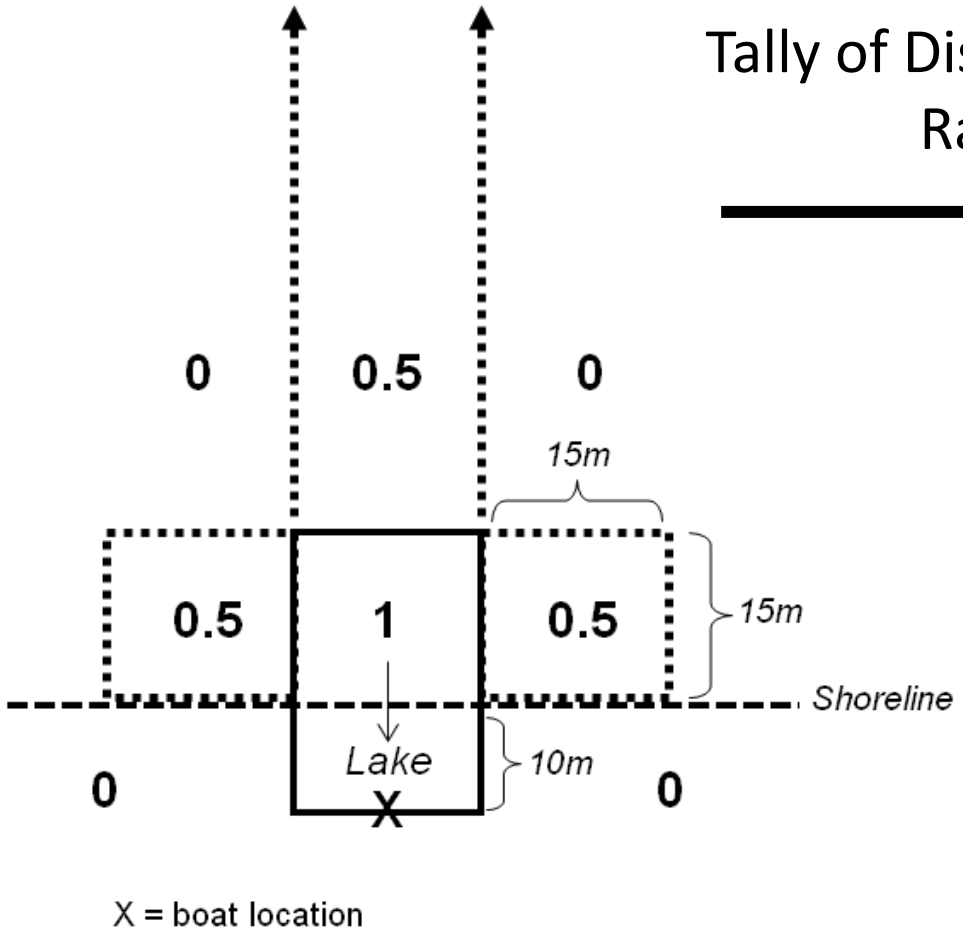


$$\frac{\text{Mean of the Proximity Weighted Tally of Disturbances at the 10 Random Sites} + \text{Proportion of the 10 Sites That Have at Least One Disturbance}}{2}$$

$$\frac{\text{INTENSITY} + \text{EXTENT}}{2}$$

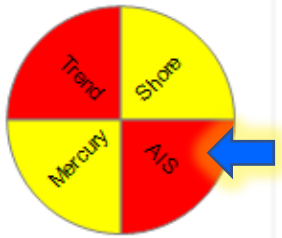
Scoring Shoreland and Lake Habitat

Lakeshore Disturbance Index	Shoreland and Lake Habitat Score
≤ 0.25	Good
0.25 – 0.75	Fair
≥ 0.75	Poor

The Aquatic Invasive Species Score

WILLOUGHBY - data through 2018

Learn How Lakes Are Scored



Lake Area:
1863.9 acres

Basin Lake Area Ratio:
7

Max Depth:
93.9 meters

Mean Spring TP:
7.5 ug/L

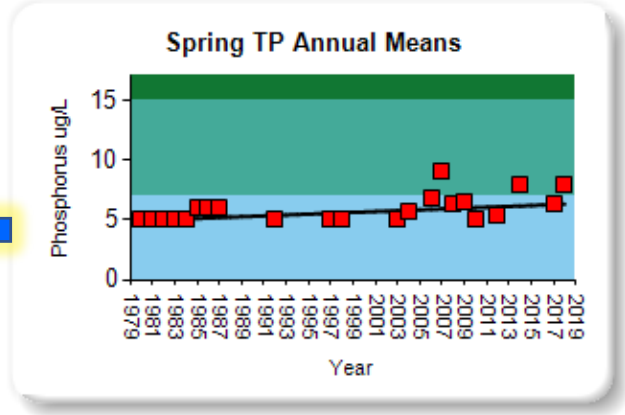
Mean Summer TP:
10.9 ug/L

Mean Summer Chla:
1.3 ug/L

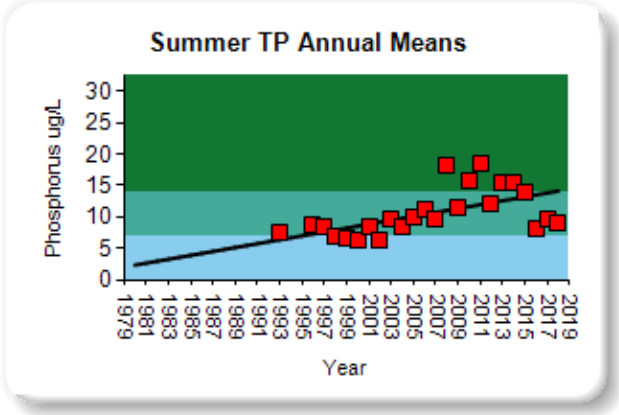
Mean Summer Secchi:
8 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

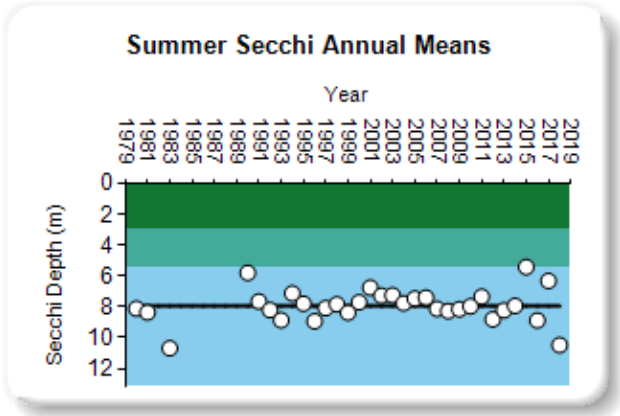
Spring TP Trend: p = 0.0015 | CV = 20
Highly significantly increasing



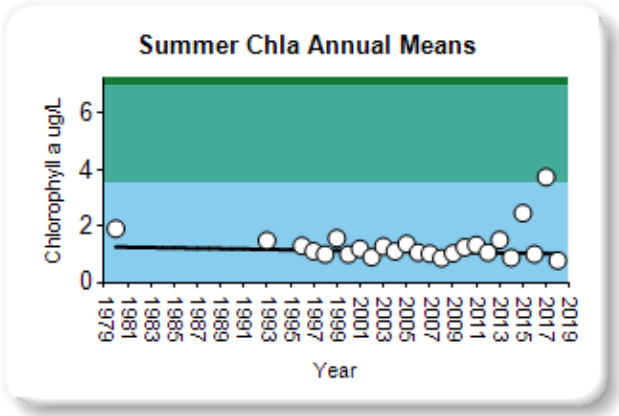
Summer TP Trend: p = 0.006 | CV = 35
Highly significantly increasing



Summer Secchi Trend: p = 0.8199 | CV = 14
Stable



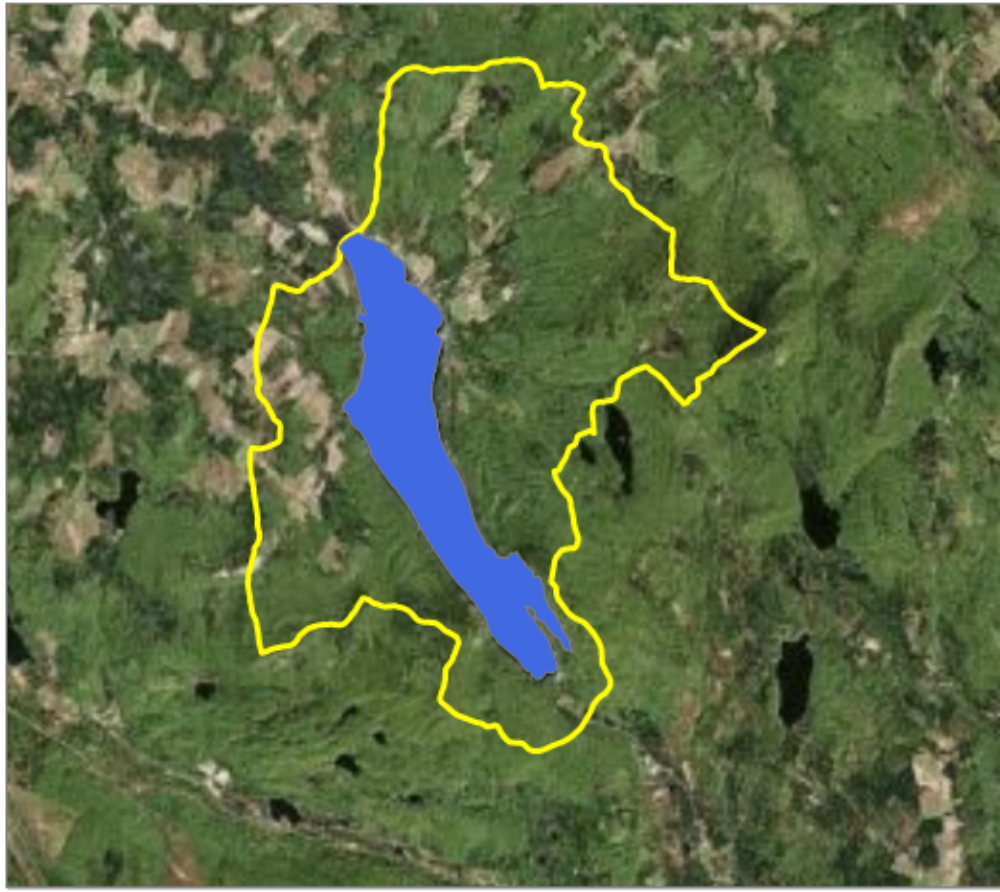
Summer Chla Trend: p = 0.5187 | CV = 48
Stable



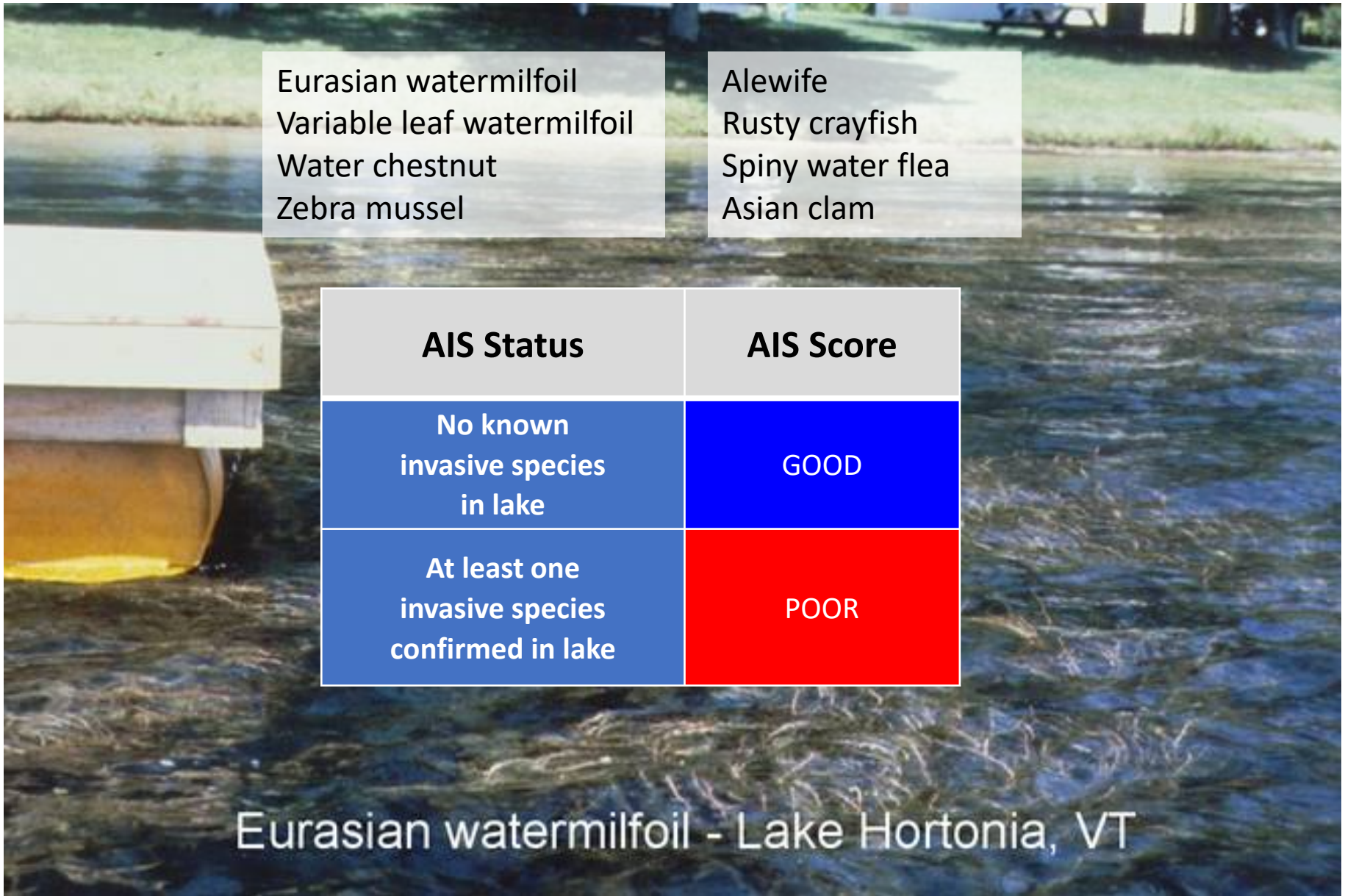
Trend Score: Poor

WQ Standards Status: Meets Standards

Watershed Score: Moderately Disturbed



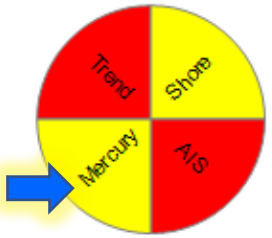
Scoring Aquatic Invasive Species



The Mercury in Fish Score

WILLOUGHBY - data through 2018

Learn How Lakes Are Scored



Lake Area:
1863.9 acres

Basin Lake Area Ratio:
7

Max Depth:
93.9 meters

Mean Spring TP:
7.5 ug/L

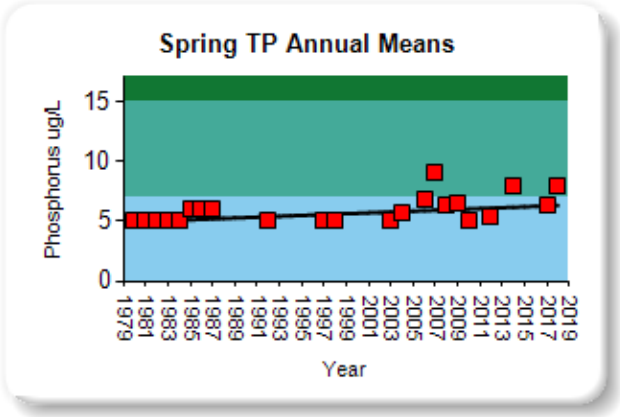
Mean Summer TP:
10.9 ug/L

Mean Summer Chla:
1.3 ug/L

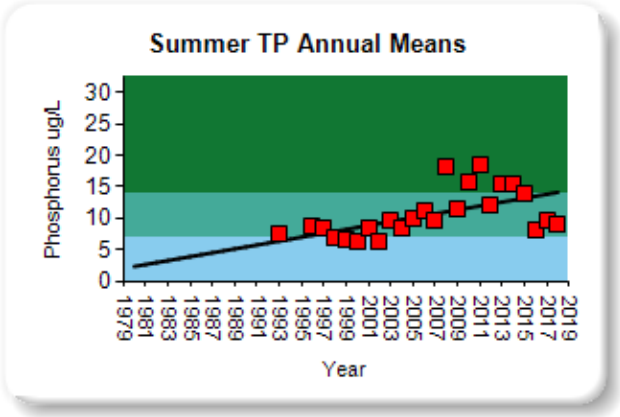
Mean Summer Secchi:
8 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

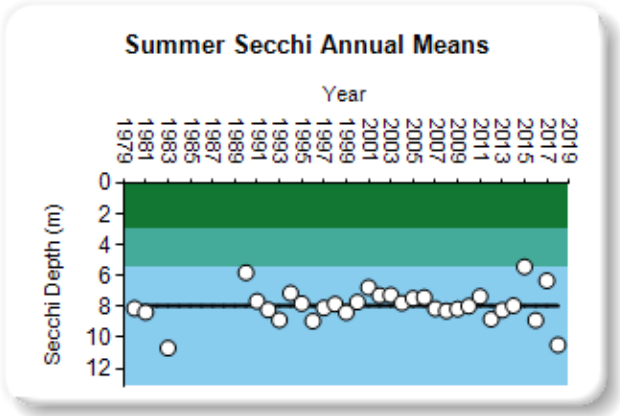
Spring TP Trend: p = 0.0015 | CV = 20
Highly significantly increasing



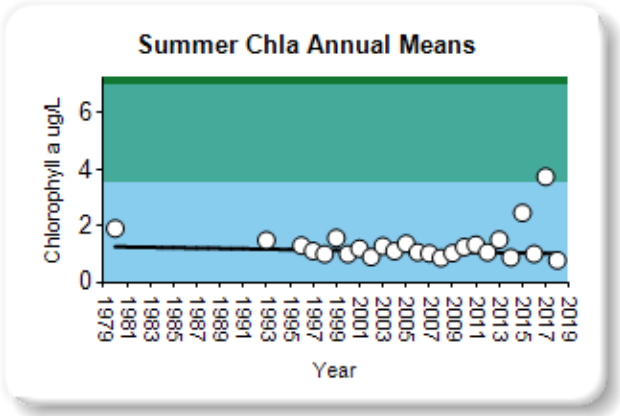
Summer TP Trend: p = 0.006 | CV = 35
Highly significantly increasing



Summer Secchi Trend: p = 0.8199 | CV = 14
Stable



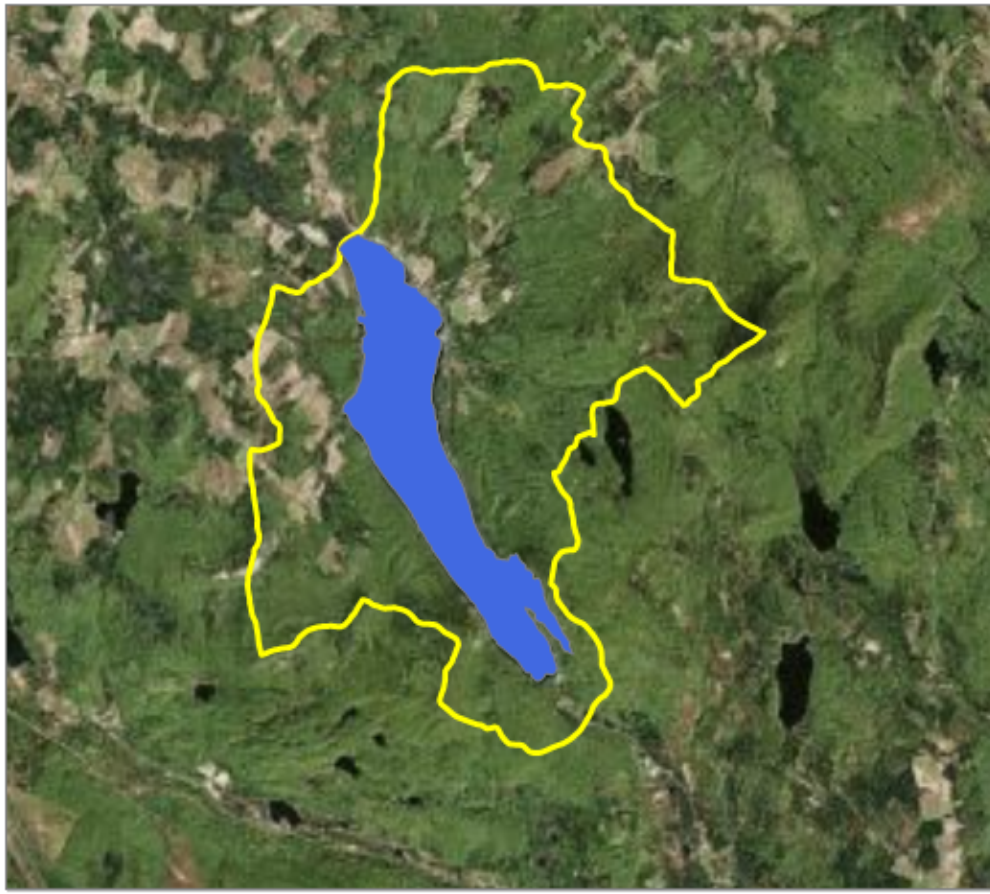
Summer Chla Trend: p = 0.5187 | CV = 48
Stable



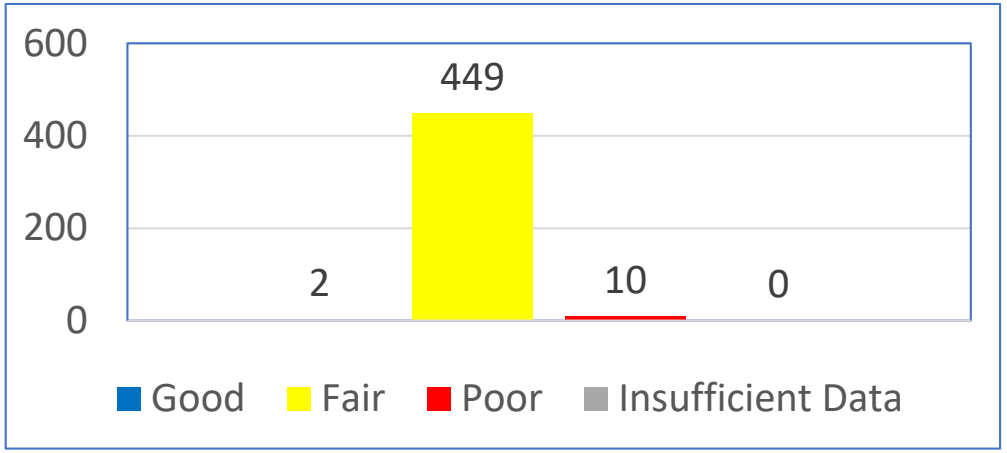
Trend Score: Poor

WQ Standards Status: Meets Standards

Watershed Score: Moderately Disturbed



Scoring Mercury in Fish



Mercury Thresholds

	Mercury Fish Tissue Contamination Score
low probability of Hg accumulation in fish tissue	Good
Hg accumulation in fish tissue is likely	Fair
Hg in fish tissue exceeds EPA guidelines	Poor

Based on a 2004 study conducted by the VT DEC

Water Quality Standards Status Score

CURTIS - data through 2018

- Directly related to water quality assessment (ADB)

  Impaired = POOR

  Altered = POOR (Flow Alteration only)

  Stressed = Yellow

  Meets Standards = Blue

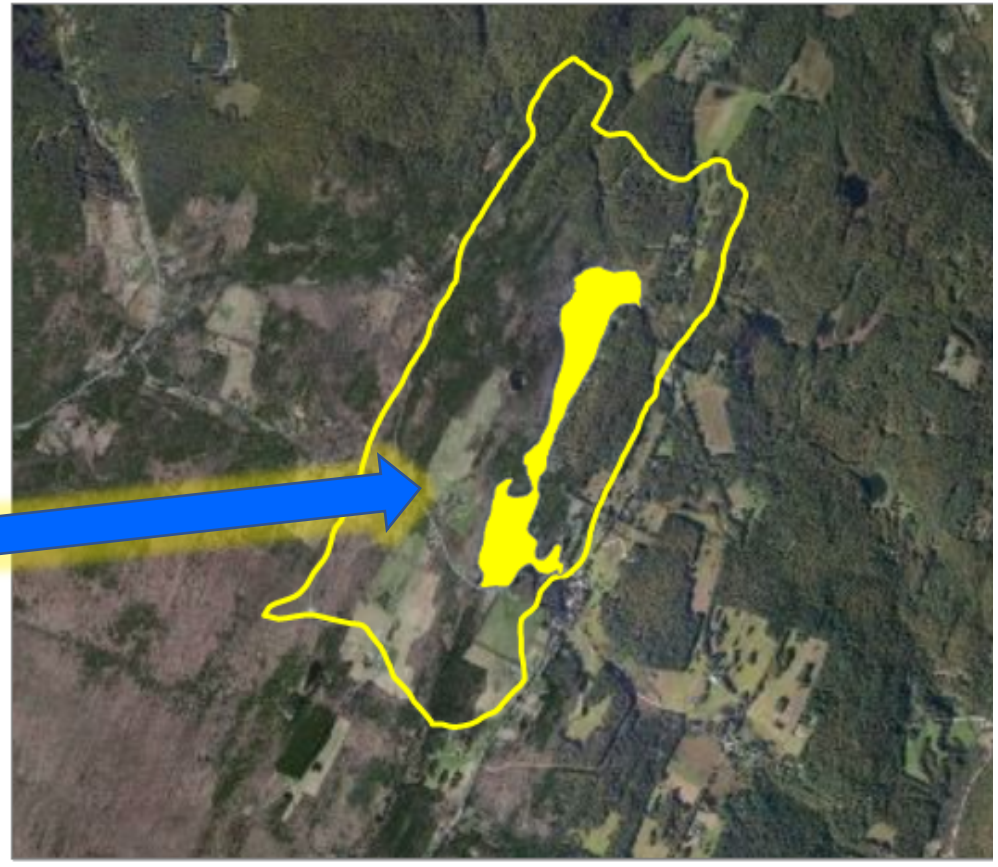
  Insufficient Data = Gray

- Poorest status for all uses is used for the score.
- Lake area is color-coded to correspond to Status Score.

Trend Score: Good

WQ Standards Status: Stressed

Watershed Score: Moderately Disturbed



Stresses / Impairments
Stressed -- Nutrients
Stressed -- Phosphorus

Water Quality Standards Status Score

CURTIS - data through 2018

Learn How Lakes Are Scored

Lake Area:
76.2 acres

Basin Lake Area Ratio:
12

Max Depth:
9.5 meters

Mean Spring TP:
22 ug/L

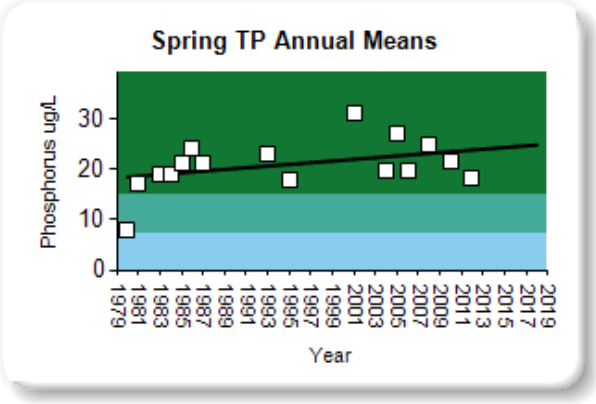
Mean Summer TP:
18.1 ug/L

Mean Summer Chla:
7.2 ug/L

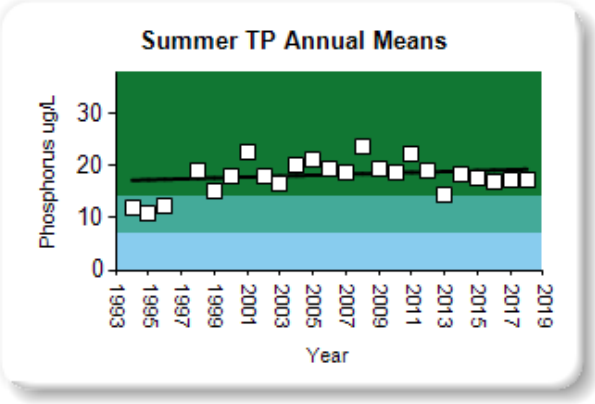
Mean Summer Secchi:
4.9 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

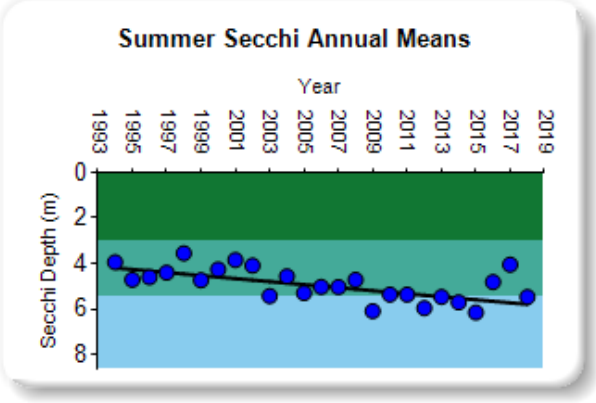
Spring TP Trend: p = 0.0865 | CV = 24
Stable



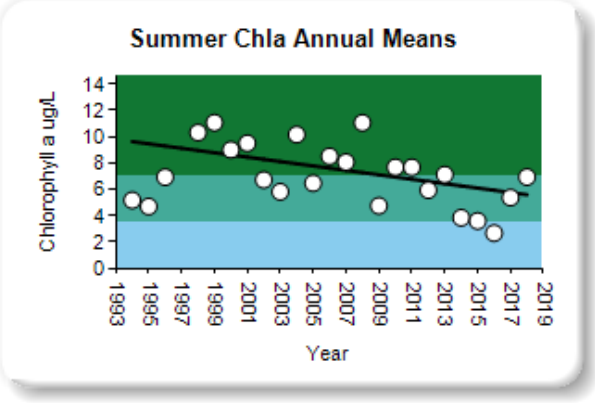
Summer TP Trend: p = 0.4718 | CV = 18
Stable



Summer Secchi Trend: p = 0.001 | CV = 15
Highly significantly increasing



Summer Chla Trend: p = 0.0593 | CV = 34
Stable



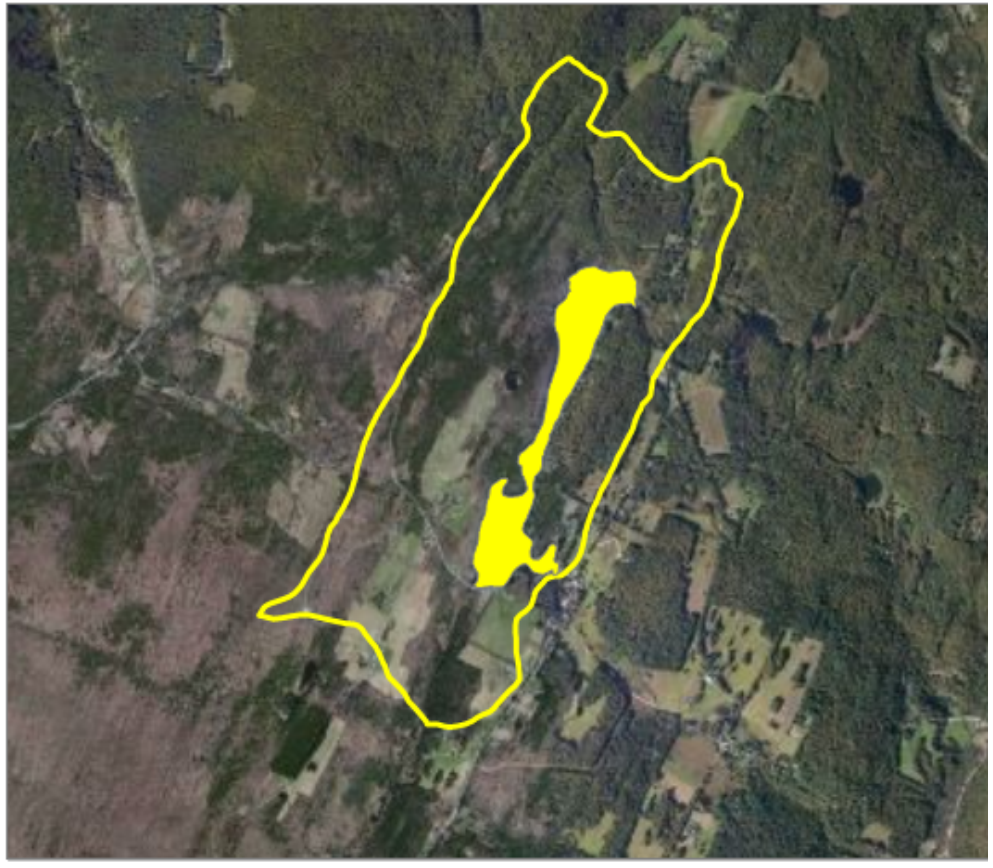
Stresses / Impairments

Stressed -- Nutrients
Stressed -- Phosphorus

Trend Score: Good

WQ Standards Status: Stressed

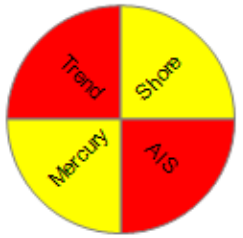
Watershed Score: Moderately Disturbed



Water Quality Standards Status Score

WILLOUGHBY - data through 2018

Learn How Lakes Are Scored



Lake Area:
1863.9 acres

Basin Lake Area Ratio:
7

Max Depth:
93.9 meters

Mean Spring TP:
7.5 ug/L

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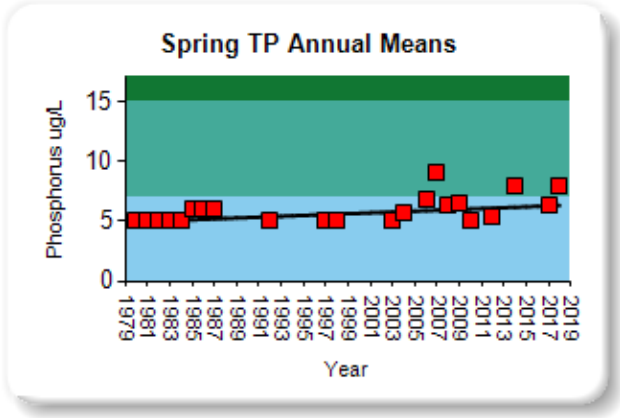
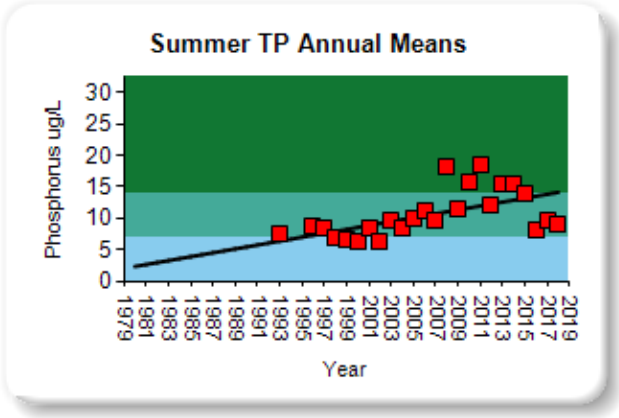
8 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

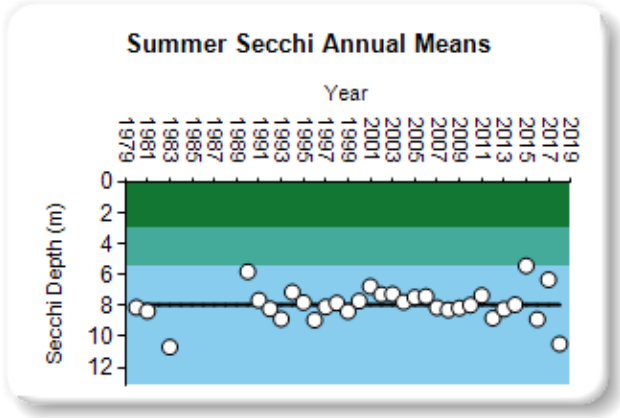
Spring TP Trend: p = 0.0015 | CV = 20
Highly significantly increasing



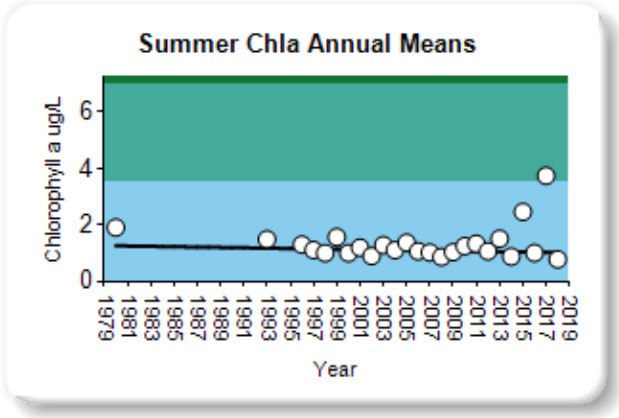
Summer TP Trend: p = 0.006 | CV = 35
Highly significantly increasing



Summer Secchi Trend: p = 0.8199 | CV = 14
Stable



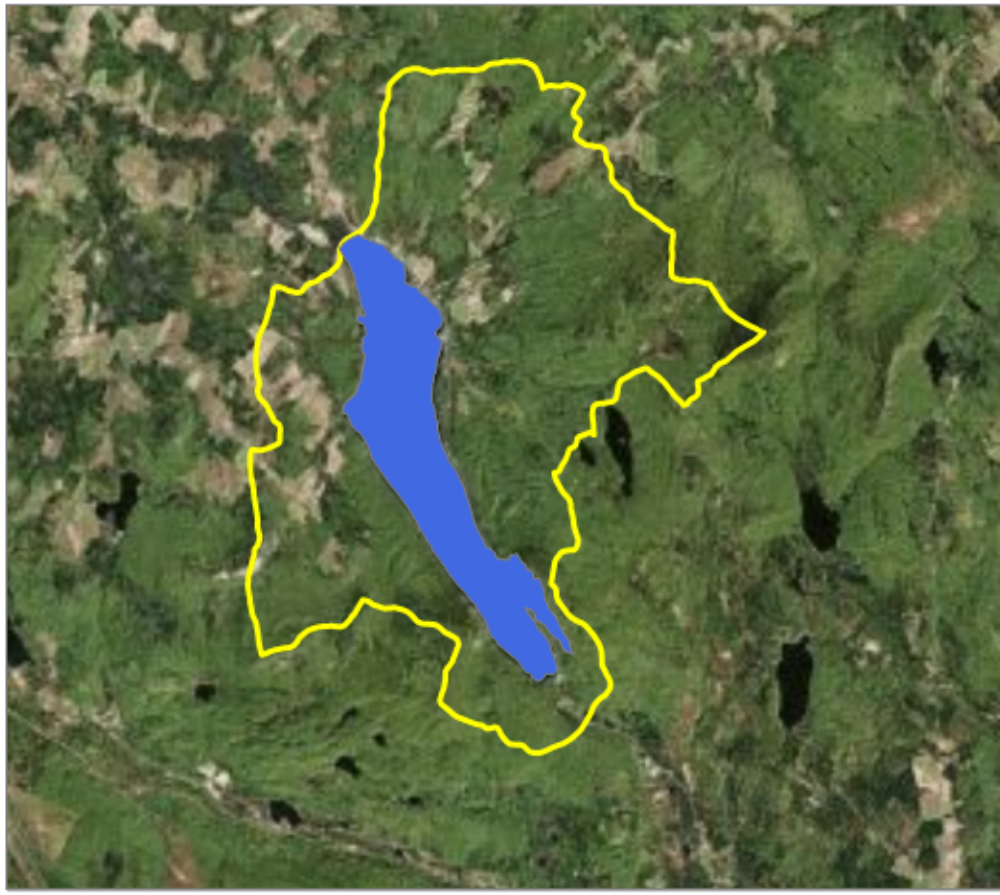
Summer Chla Trend: p = 0.5187 | CV = 48
Stable



Trend Score: Poor

WQ Standards Status: Meets Standards

Watershed Score: Moderately Disturbed



The Watershed Disturbance Score

CURTIS - data through 2018

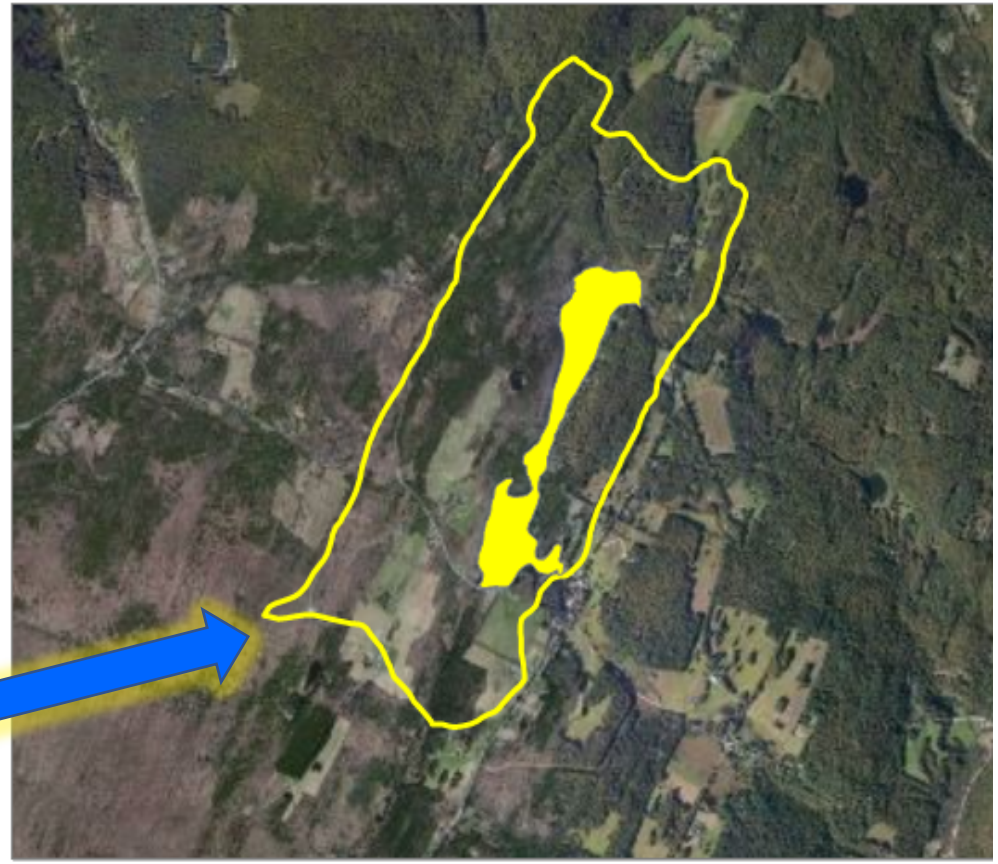
Landscape Development Intensity Index (Brown and Vivas (2005)

- GIS imagery is used to quantify various land uses in the watershed
- Each land use type is weighted according to the degree to it's intensity – i.e. the degree to which it can negatively influence water quality
- Final Index is a weighted average of the various land use areas and their disturbance intensities

Trend Score: Good

WQ Standards Status: Stressed

Watershed Score: Moderately Disturbed



Highly Disturbed = Red
Moderately Disturbed = Yellow
Minimally Disturbed = Blue
Insufficient Data = No outline

Watershed Disturbance Index

Trend Score:	**Good**
Lake Status:	**Meets Standards**
Watershed Score:	**Minimally Disturbed**

Highly Disturbed > 1.7

Moderately Disturbed LDI >= 1.3 and <= 1.7

Minimally Disturbed LDI < 1.3

NLCD Land Class	Description	Landscape Development Intensity (LDI) Coefficient
11	Open water	1
21	Developed, open space	6.92
22	Developed, low intensity	7.47
23	Developed, medium intensity	7.55
24	Developed, high intensity	9.42
31	Barren land	8.32
41	Deciduous forest	1
42	Evergreen forest	1
43	Mixed forest	1
52	Shrub/scrub	2.02
71	Grassland/herbaceous	3.41
81	Pasture/hay	3.74
82	Cultivated crops	4.54
90	Woody wetlands	1
95	Emergent herbaceous wetlands	1

Environmental Monitoring and Assessment (2005) **101:** 289–309

LANDSCAPE DEVELOPMENT INTENSITY INDEX

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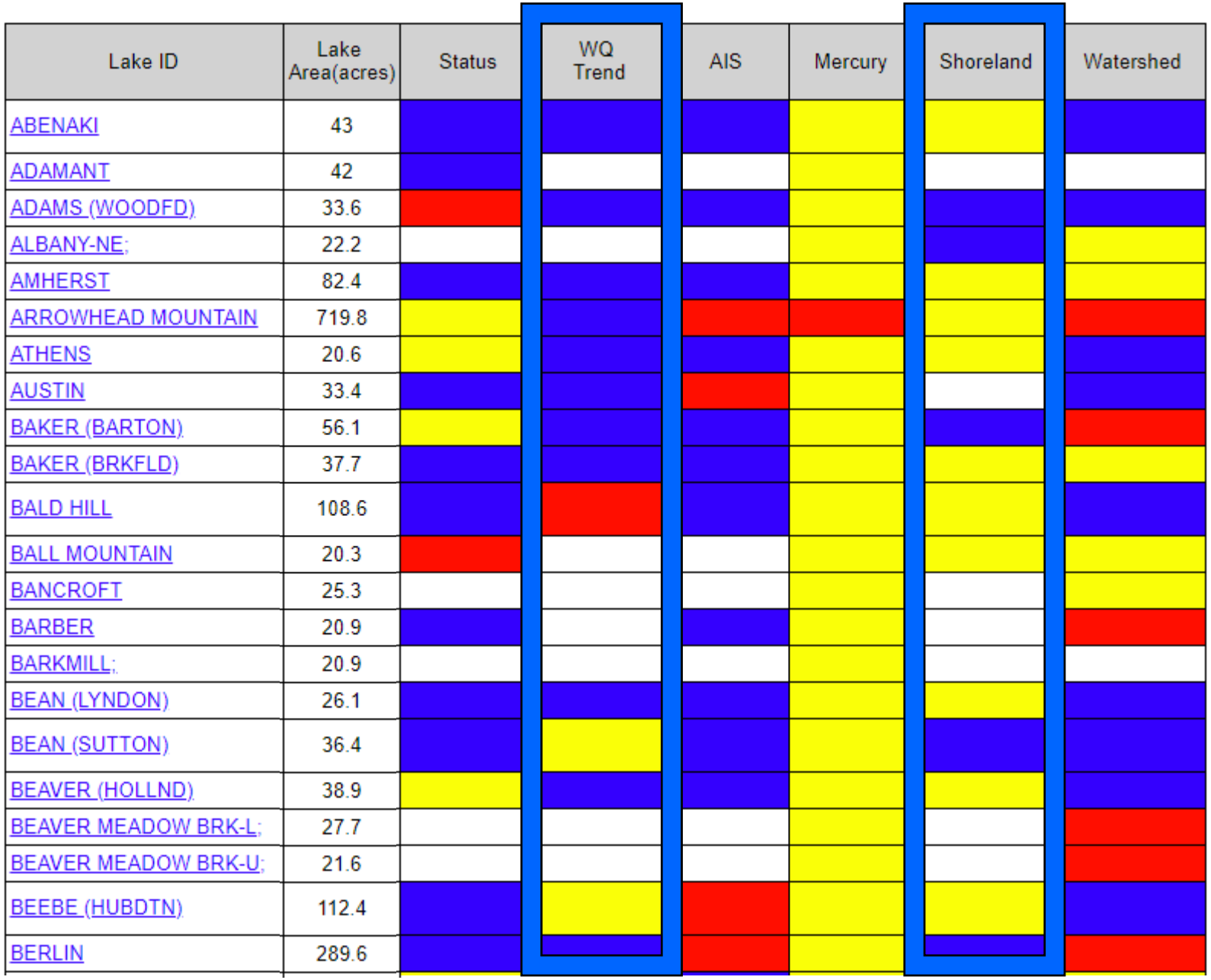
Center for Environmental Policy, Department of Environmental Engineering Sciences, University of Florida, Gainesville, Florida, U.S.A.
*(*author for correspondence, e-mail: mtb@ufl.edu)*

How we use the Score Card

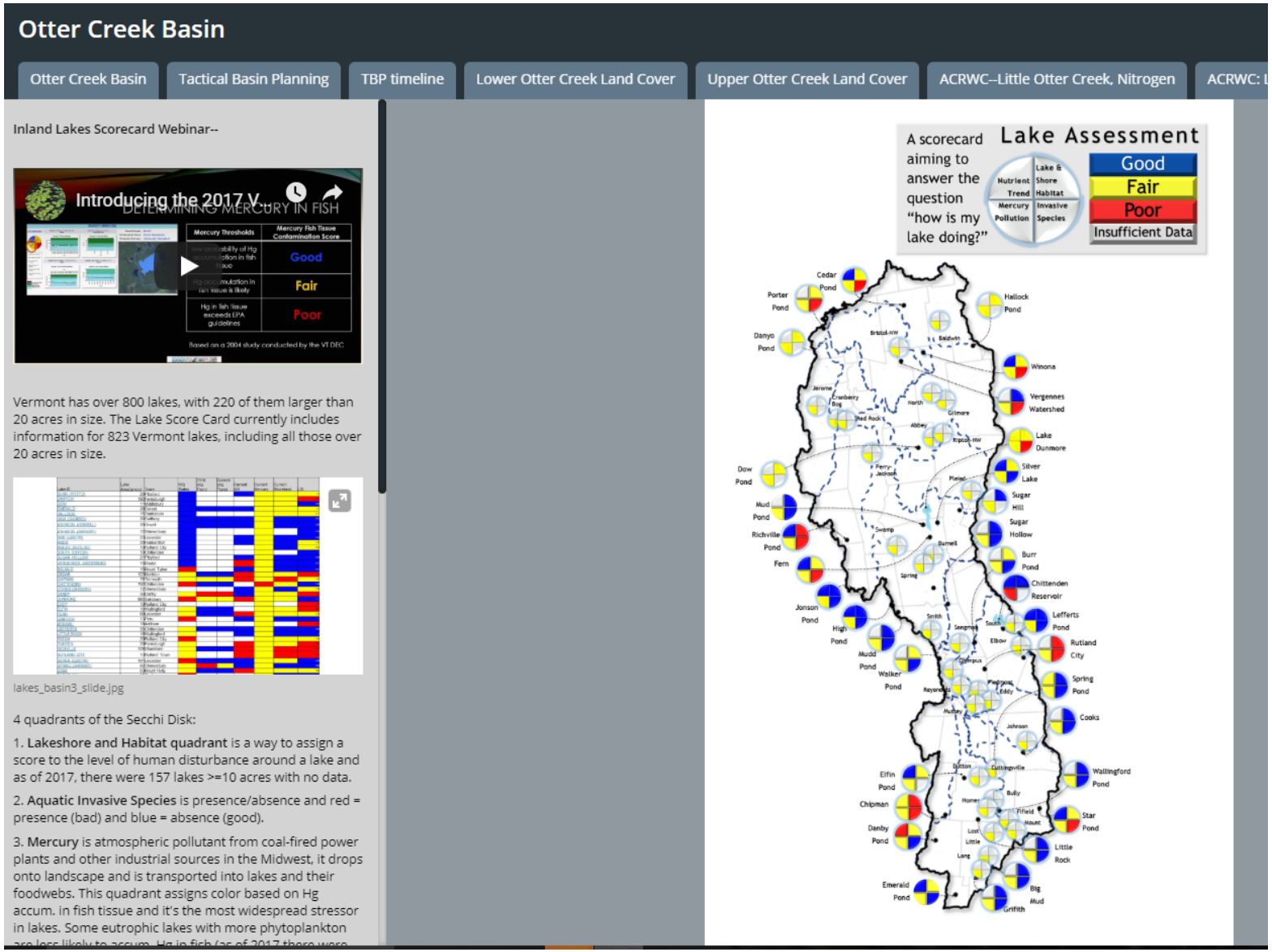


Lake ID	Lake Area(acres)	Status	WQ Trend	AIS	Mercury	Shoreland	Watershed
ABENAKI	43						
ADAMANT	42						
ADAMS (WOODFD)	33.6						
ALBANY-NE	22.2						
AMHERST	82.4						
ARROWHEAD MOUNTAIN	719.8						
ATHENS	20.6						
AUSTIN	33.4						
BAKER (BARTON)	56.1						
BAKER (BRKFLD)	37.7						
BALD HILL	108.6						
BALL MOUNTAIN	20.3						
BANCROFT	25.3						
BARBER	20.9						
BARKMILL	20.9						
BEAN (LYNDON)	26.1						
BEAN (SUTTON)	36.4						
BEAVER (HOLLND)	38.9						
BEAVER MEADOW BRK-L	27.7						
BEAVER MEADOW BRK-U	21.6						
BEEBE (HUBDTN)	112.4						
BERLIN	289.6						

Lake Program Planning

- Where is more data needed?
- Where is more education needed?
- Where do we need on-the-ground action?

How we use the Score Card



Watershed Planning

See the Otter Creek Basin Story Map

- https://www.arcgis.com/apps/MapSeries/index.html?appid=36fbc4d844a349f4912decb31efe1b02

Checklist of Lake Protection Actions

This checklist provides guidance on actions that help protect Vermont lakes and is based on the Lake Score Card.

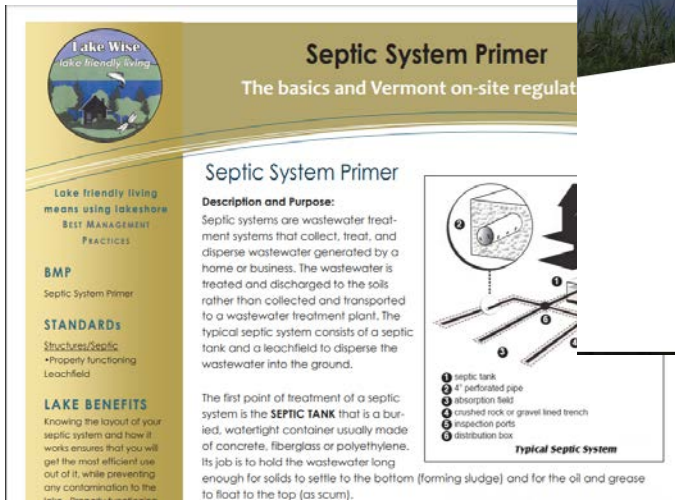
Check-off all the helpful actions occurring around your lake. For those items not checked, decide which steps to take to maintain or help improve lake conditions. For more information, follow the links below, or contact the Lakes and Ponds Program at 802-490-6198.

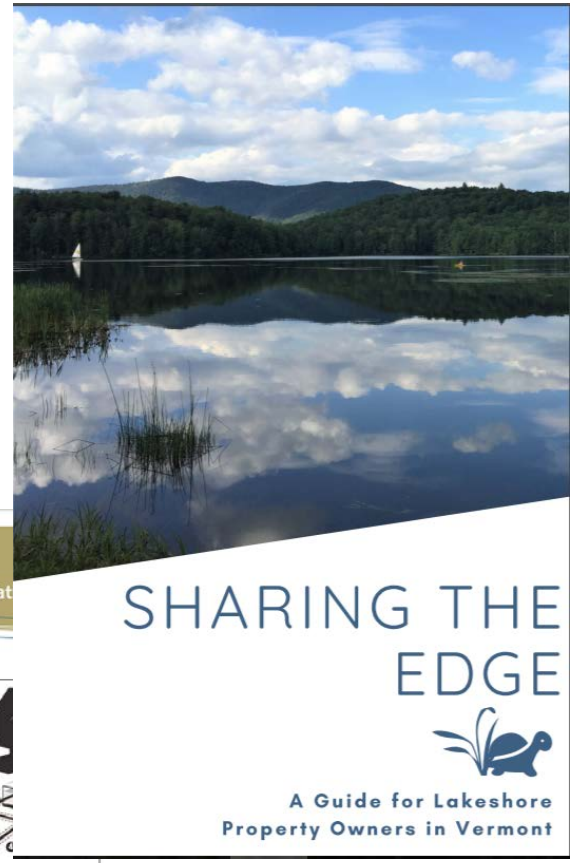
Nutrient Trend and Shoreland Conditions Management Programs and Actions	✓
Does your lake have a Lake Association? Many lakes and ponds have associations dedicated to taking care of the lake. Join yours or consider starting one. Locate a lake association here.	
Do you know if your lake is sampled by the Spring Phosphorus monitoring program? Spring phosphorus data can predict the amount of algal growth that will occur during the summer and show if a lake's water quality is changing. To learn more, click here.	
Does your lake participate in the Lay Monitoring Program? Volunteers collect water clarity and nutrient enrichment data during the summer to document the conditions of the lake and show how the lake may be changing over time. Read more.	
Does your lake community work with the local town officials? Town Select Boards, Planning and Conservation Commissions make good partners for lakes.	
Does your lake participate in the Lake Wise Program? Shoreland owners are taught lake friendly practices which leads to earning the Lake Wise Award for excellent shoreland management. To learn more, click here.	
Does your lake community practice Shoreland BMPs? Shoreland Best Management Practices and Fact Sheets are available to explain the best techniques for developing and living along a lake. Click here for BMPs.	
Are private roads and driveways maintained according to the standards of the Better Roads Program? Read more.	
Are most septic tanks around the lake pumped every 3 to 5 years? A poor or overloaded system can introduce disease-causing organisms into the lake, resulting in a human health threat and can introduce nutrients into the lake. Here's more.	
Has your lake held a Septic Social? Septic socials are fun gatherings that showcase septic system care and improvements.	

Permitting Required for Lakes	✓
Are your lake residents informed on the Shoreland Protection Act? Vermont's Shoreland Protection Act regulates land use within 250 feet of the lake's mean water level. Click here to learn more.	
Are your lake residents aware of the Lake Encroachment Permit? A Lake Encroachment permit is required for many activities occurring in the water, including seawalls, riprap, and fill. Click here to learn more.	

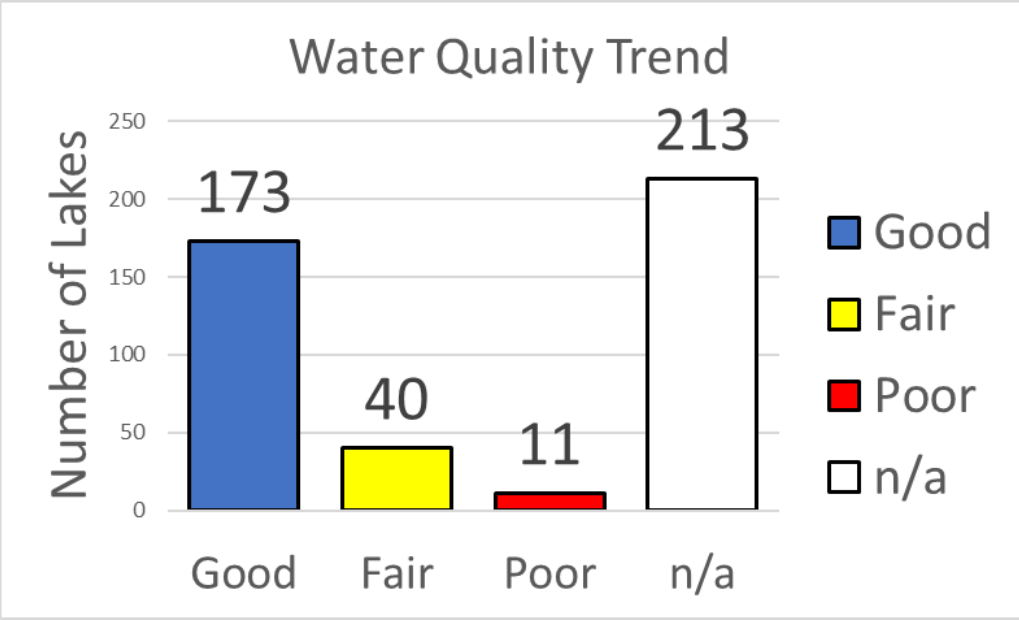
How our partners can use the Score Card

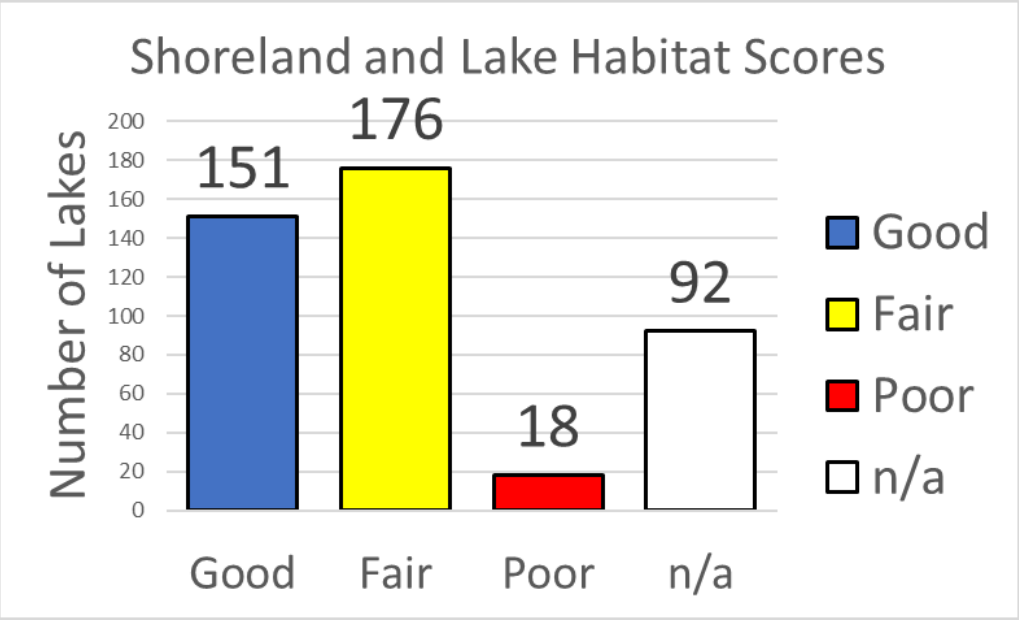
Richard Harter, LMP

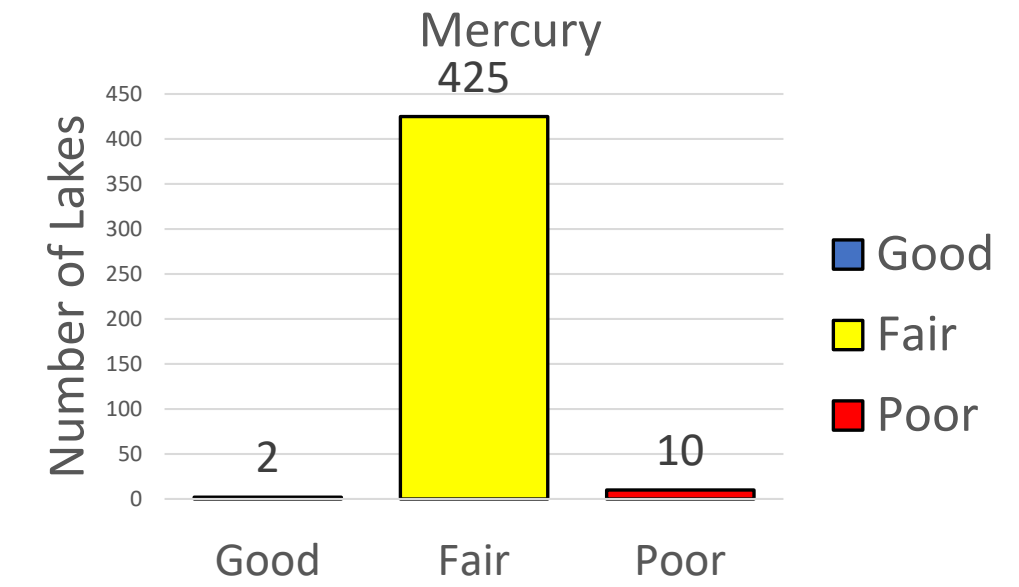


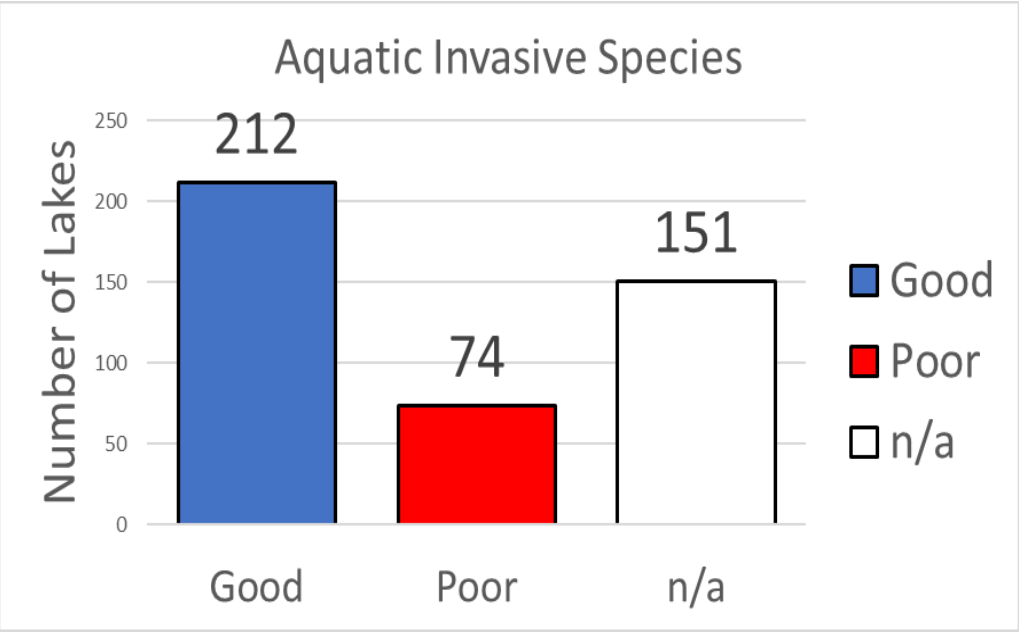


How are we doing?









How we use the score card – Digging Even Deeper

WILLOUGHBY

Learn How Lakes Are Scored

Lake Area:
1687 acres

Basin Lake Area Ratio:
7

Max Depth:
94 meters

Mean Spring TP:
5.5 ug/L

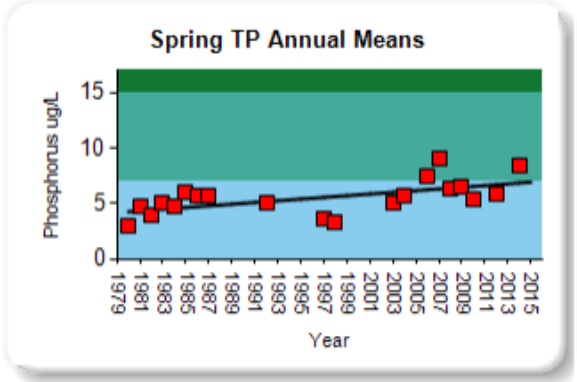
Mean Summer TP:
11 ug/L

Mean Summer Chla:
1.2 ug/L

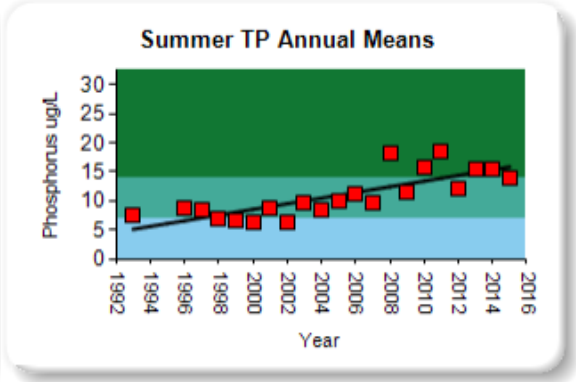
Mean Summer Secchi:
7.9 m

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

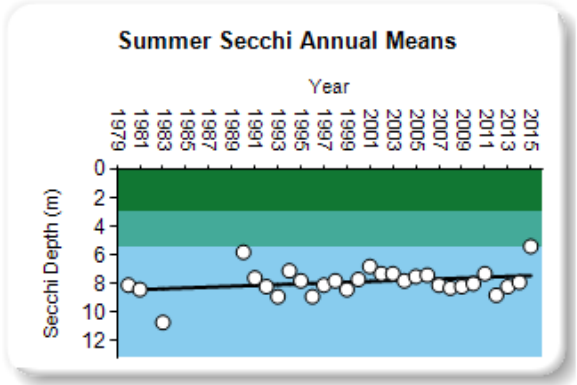
Spring TP Trend: p = 0.003 | CV = 28
Highly significantly increasing



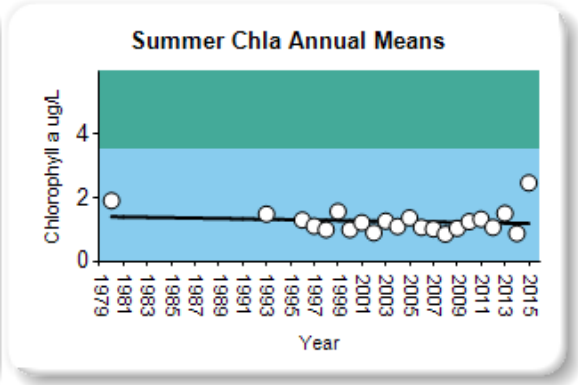
Summer TP Trend: p = 0.0002 | CV = 36
Highly significantly increasing



Summer Secchi Trend: p = 0.4294 | CV = 12
Stable



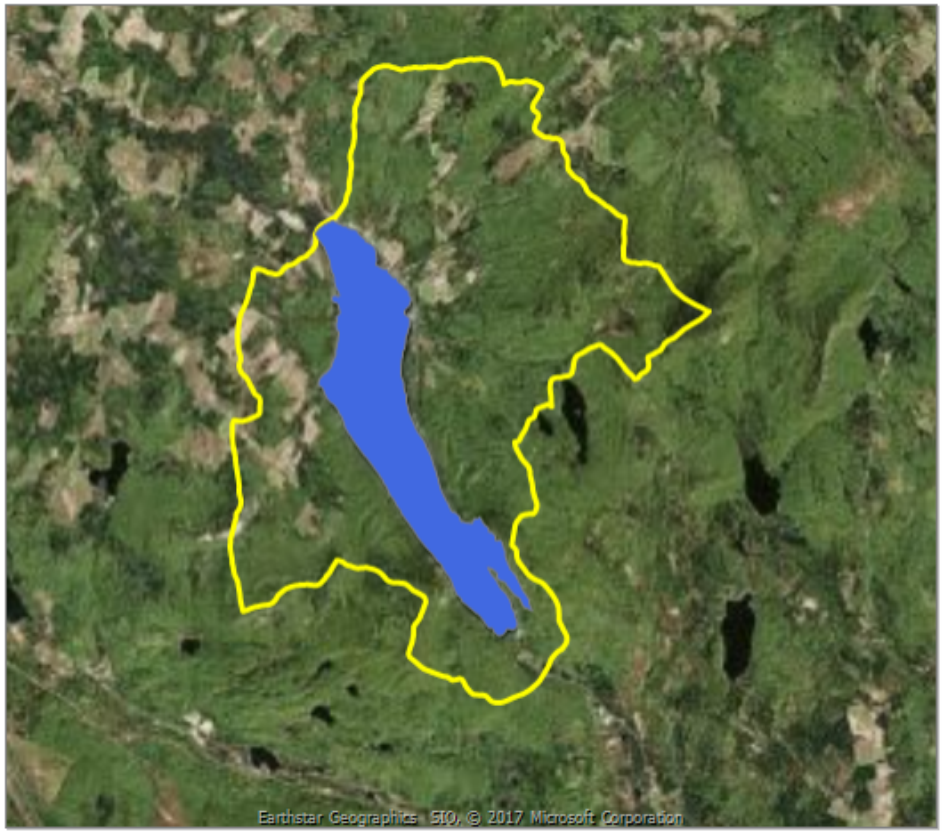
Summer Chla Trend: p = 0.4805 | CV = 30
Stable



Trend Score: Poor

WQ Standards Status: Meets Standards

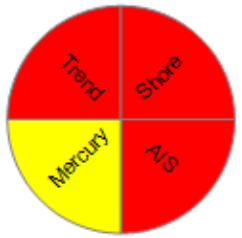
Watershed Score: Moderately Disturbed



Vermont Lake Score Card

SHADOW (GLOVER)

Go To Main Menu



Lake Area: 210 acres

Max Depth: 42 meters

Mean Spring TP: 8.3 ug/L

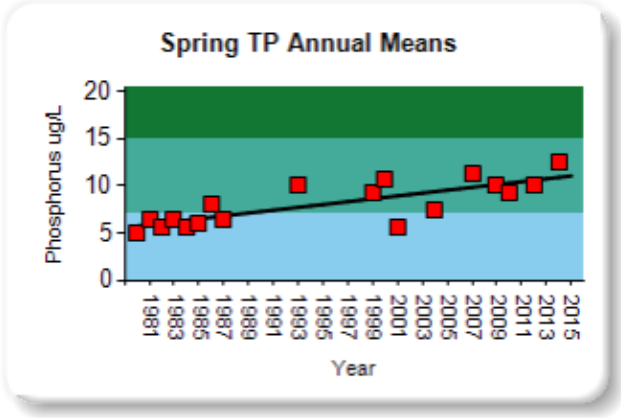
Mean Summer TP: 8.6 ug/L

Mean Summer Chla: 2.4 ug/L

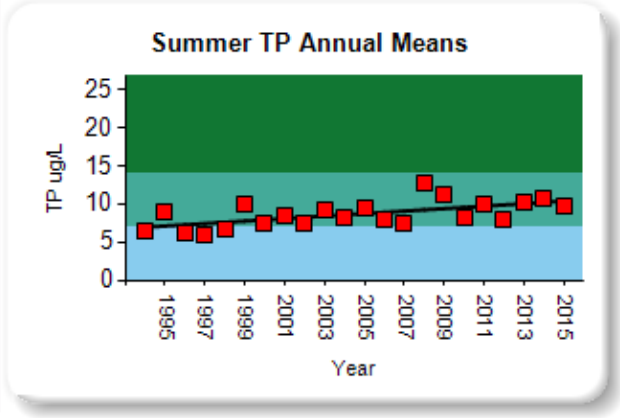
Mean Summer Secchi: 7.7 ug/L

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

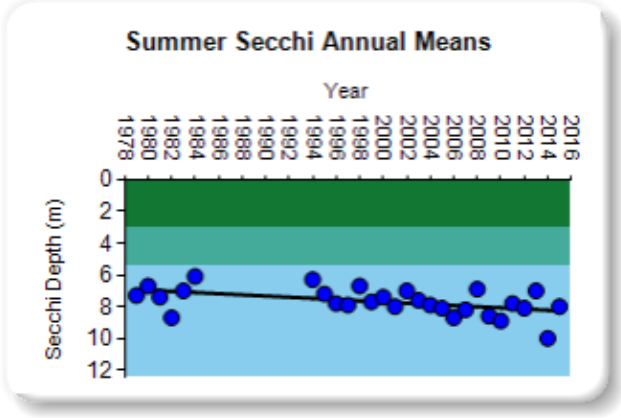
Spring TP Trend: p = 0.001 | CV = 29
Highly significantly increasing



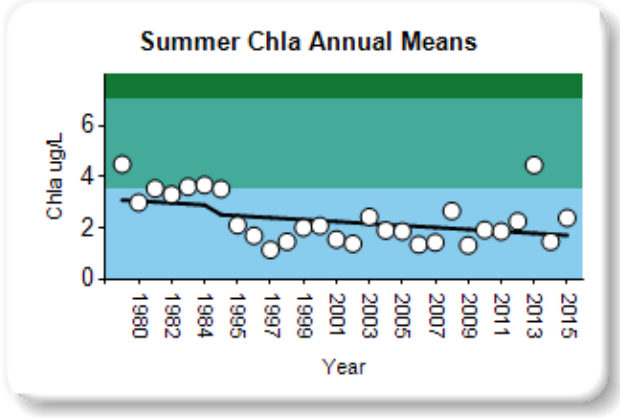
Summer TP Trend: p = 0.0048 | CV = 20
Highly significantly increasing



Summer Secchi Trend: p = 0.01 | CV = 11
Significantly increasing



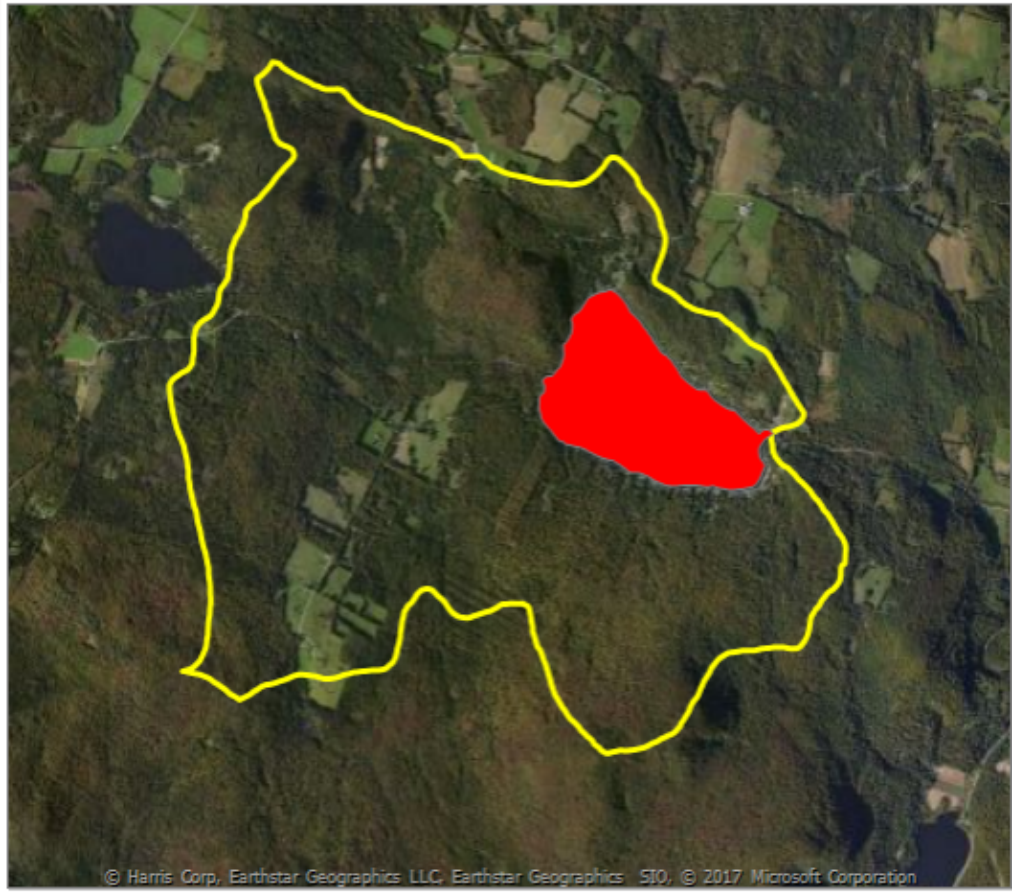
Summer Chla Trend: p = 0.1178 | CV = 40
Stable



Trend Score: Poor

WQ Standards Status: Altered

Watershed Score: Moderately Disturbed



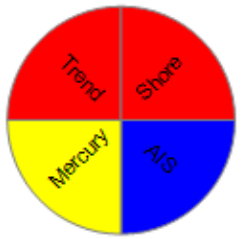
Stresses / Impairments

Altered -- Flow alteration

Vermont Lake Score Card

MAIDSTONE

Go To Main Menu



Lake Area: 745 acres

Max Depth: 37 meters

Mean Spring TP: 6.1 ug/L

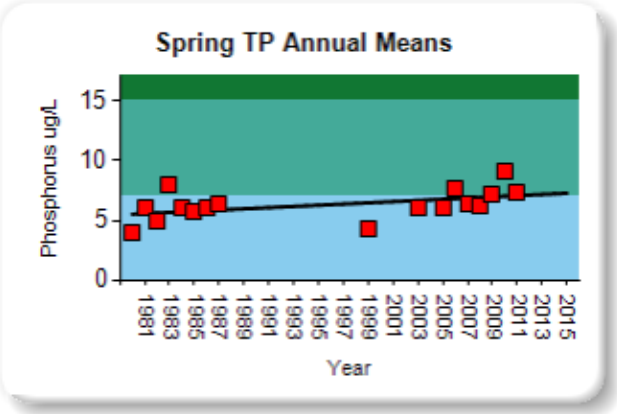
Mean Summer TP: 6.6 ug/L

Mean Summer Chla: 1.6 ug/L

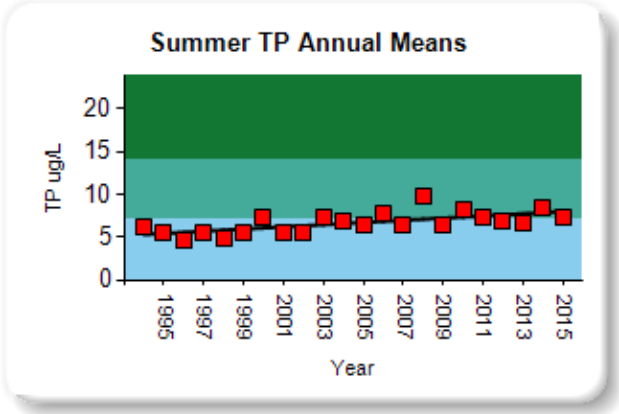
Mean Summer Secchi: 8.7 ug/L

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

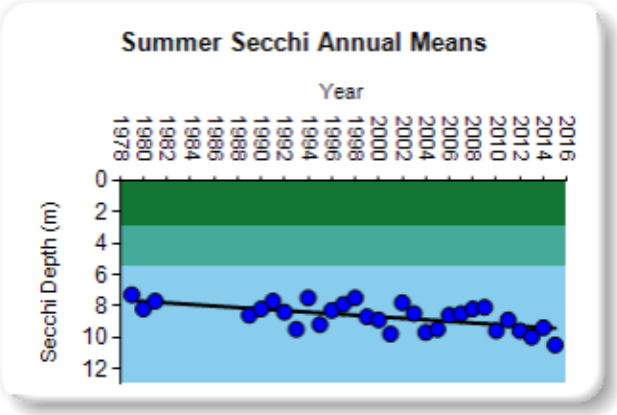
Spring TP Trend: p = 0.0037 | CV = 20
Highly significantly increasing



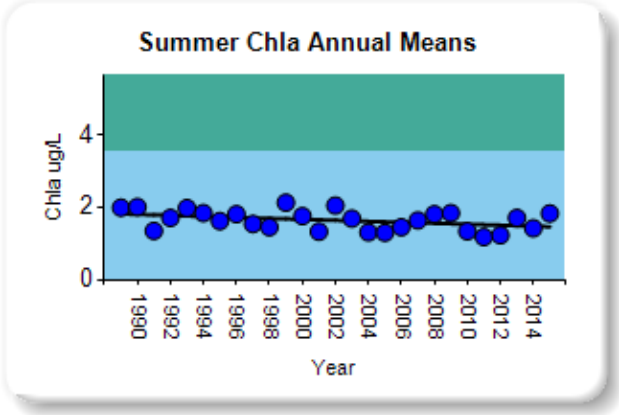
Summer TP Trend: p = 0.0008 | CV = 19
Highly significantly increasing



Summer Secchi Trend: p = 0.0038 | CV = 9
Highly significantly increasing



Summer Chla Trend: p = 0.043 | CV = 17
Significantly decreasing



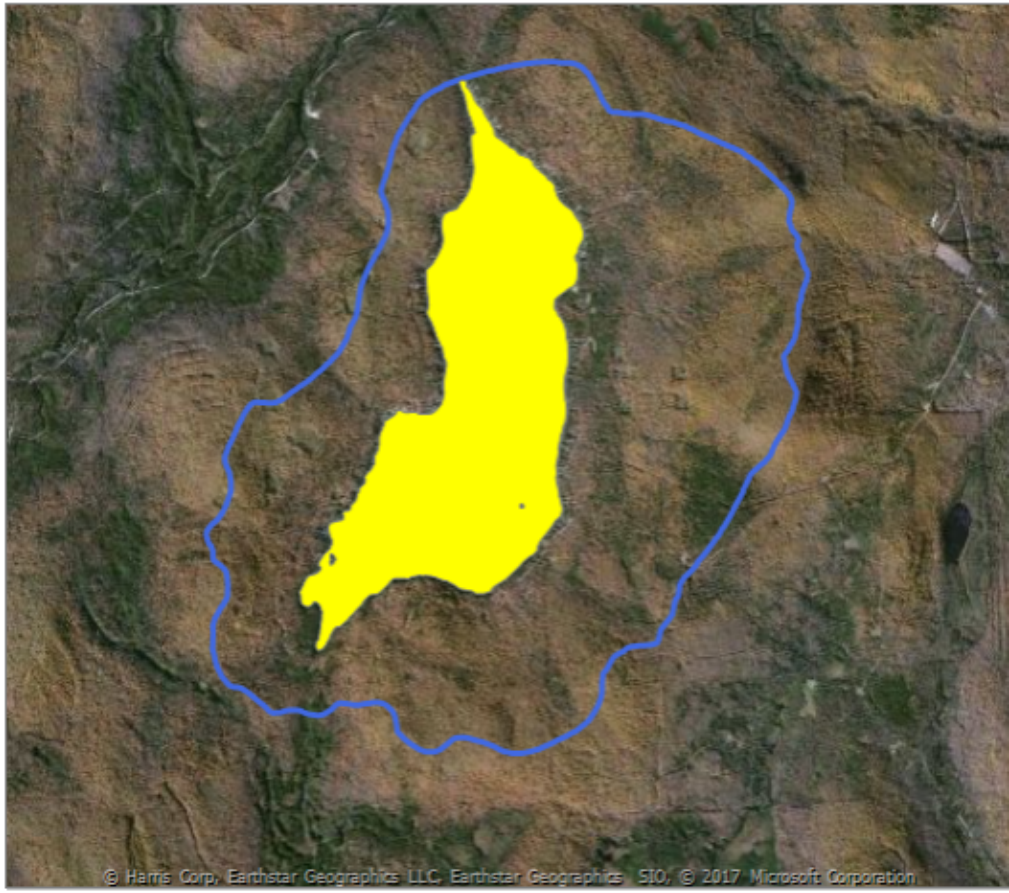
Stresses / Impairments

Stressed -- pH

Trend Score: Poor

WQ Standards Status: Stressed

Watershed Score: Minimally Disturbed



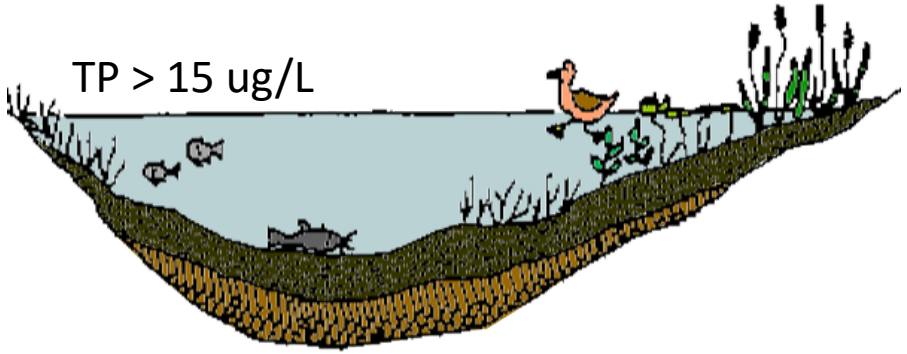
A deeper dive:

Spring TP Long Term Dataset

153 Lakes >= 20 acres

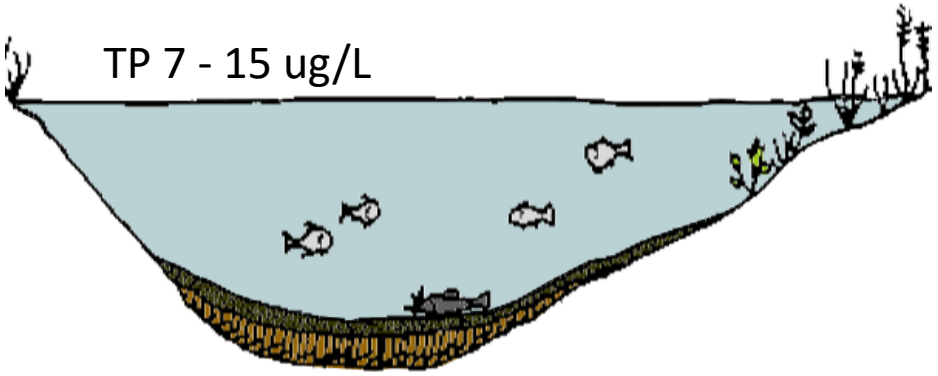
- Sampled at least 3 times (median=11)
- Sampled at least once in 1980s and once since 2000

Lake Trophic Status – Average TP concentration in the 1980s



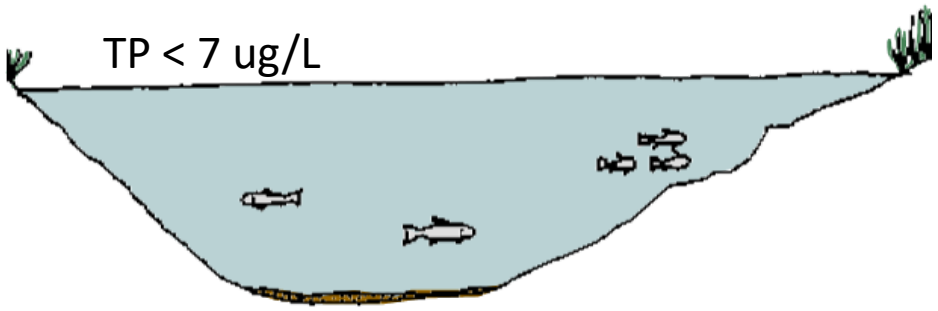
<u>Eutrophic n = 41</u>

- high nutrient enrichment
- abundant algae and plant growth
- only supports warmwater fish species



<u>Mesotrophic n = 89</u>

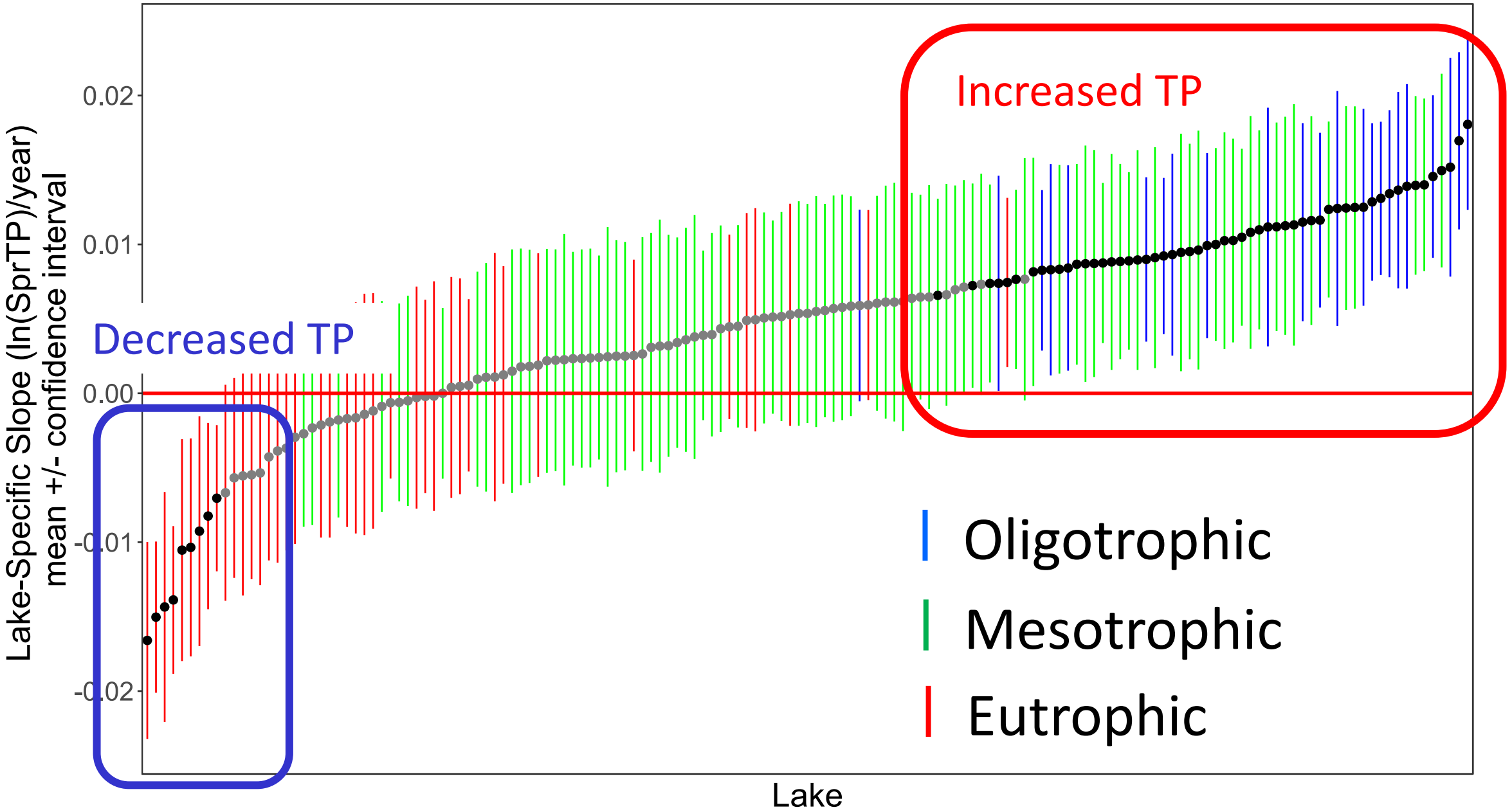
- moderate nutrient enrichment
- moderate algae and plant growth
- usually supports warmwater fish species



<u>Oligotrophic n = 23</u>

- low nutrient enrichment
- deep, clear water
- well oxygenated to the bottom
- supports coldwater fish species

Estimated rate of change (slope) from linear mixed effects model



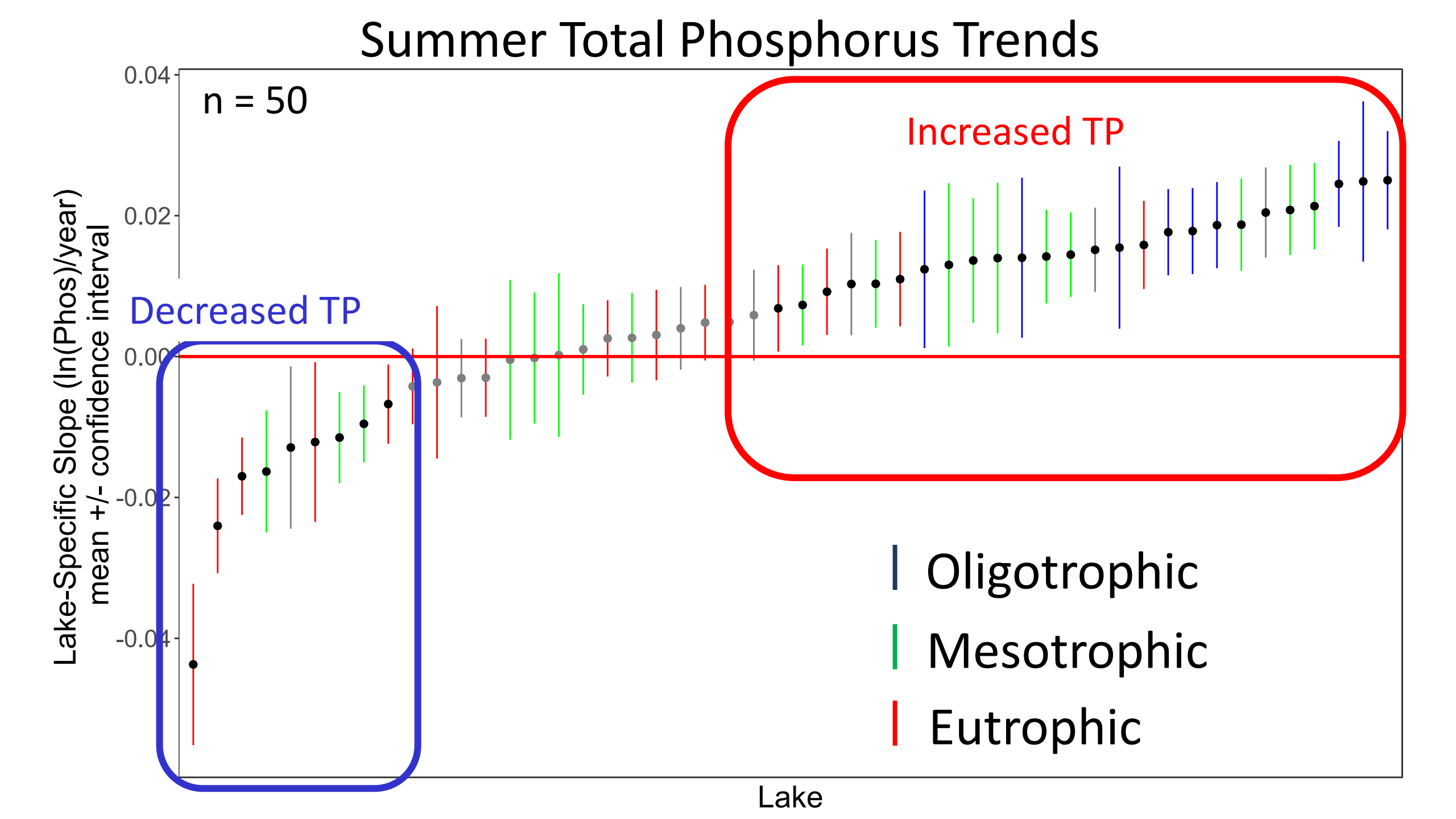
Percentage of lakes for which Total Phosphorus is estimated to have increased, decreased or stayed the same over 38 years.

Trophic Status ~ 1980s	Increased %	Decreased %	No Change %
Eutrophic n=41	2	22	76
Mesotrophic n=89	38	0	62
Oligotrophic n=23	96	0	4

Summer Total Phosphorus

43 Lakes with continuous TP data going back to the late 1980s or 1990s:

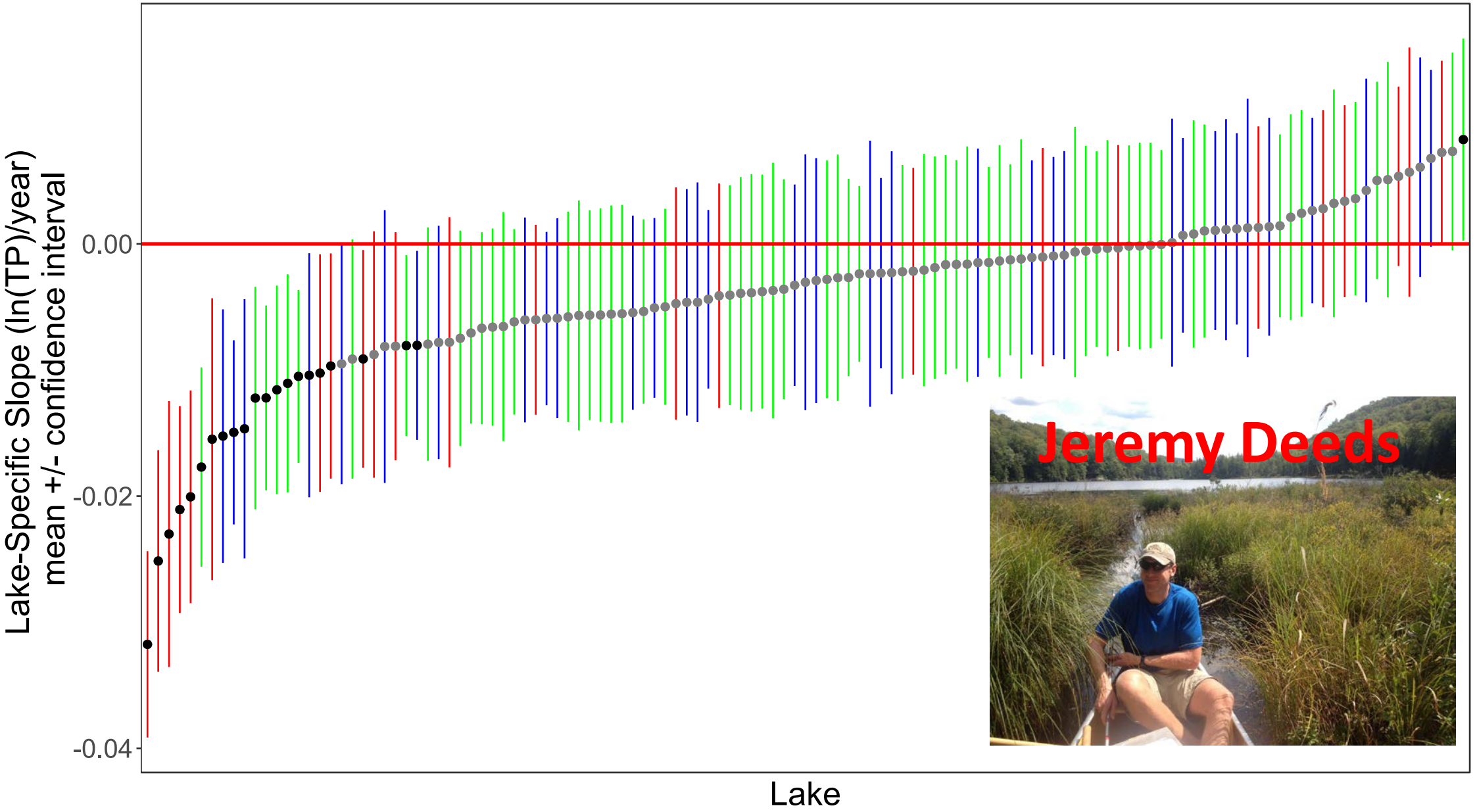
15 Eutrophic
19 Mesotrophic
9 Oligotrophic


Summer Total Phosphorus Trends
n = 50
Increased TP
Decreased TP
0.04
0.02
0.00
-0.02
-0.04
Lake-Specific Slope (ln(Phos)/year)
mean +/- confidence interval
Oligotrophic
Mesotrophic
Eutrophic
Lake

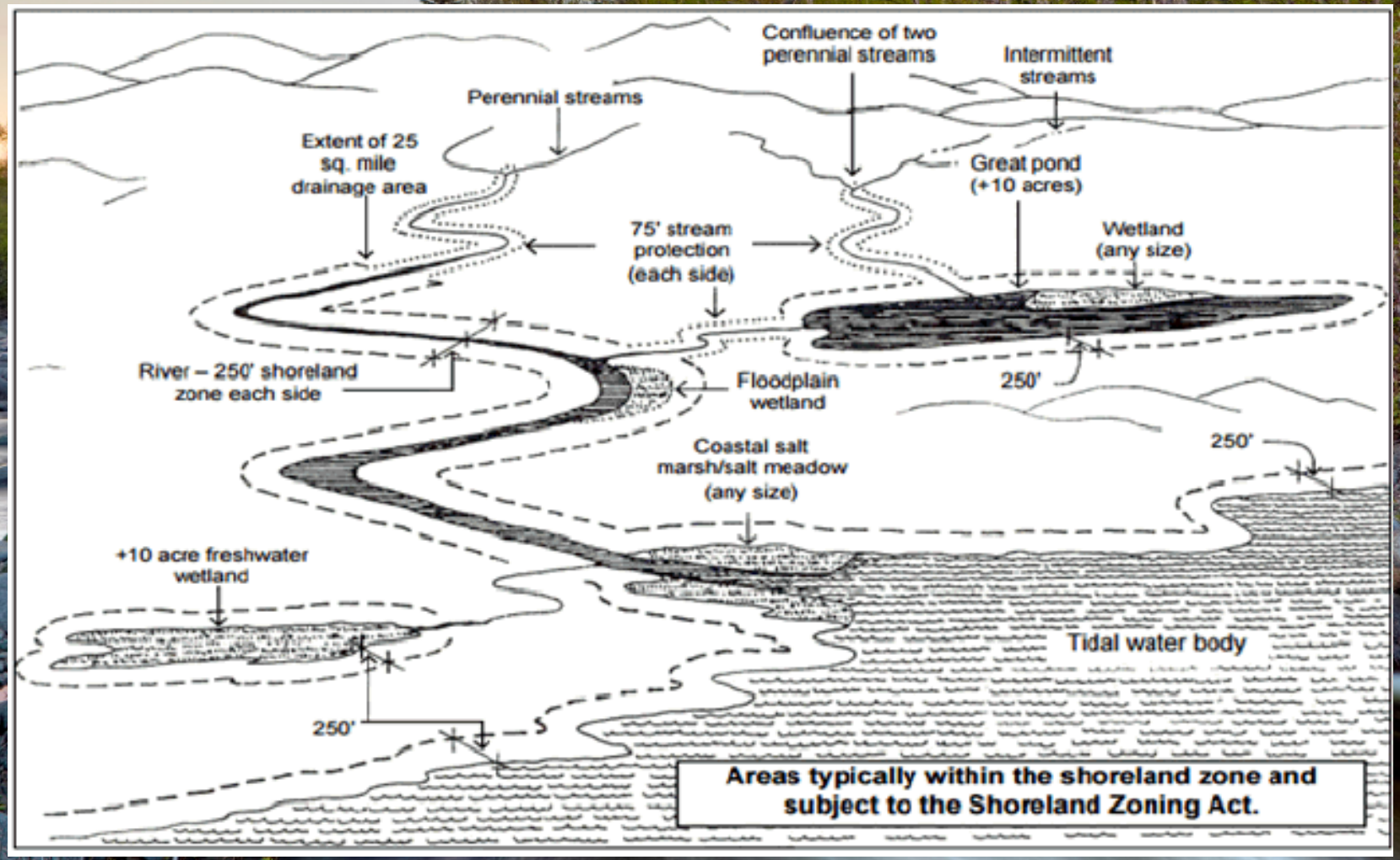
Why are so many of Vermont's low nutrient lakes increasing in phosphorus?

- Recovery from acid rain?
- Climate change?
  - Longer duration of stratification?
    - More net internal loading?
  - More run off/increased intense precipitation?
- Land use?

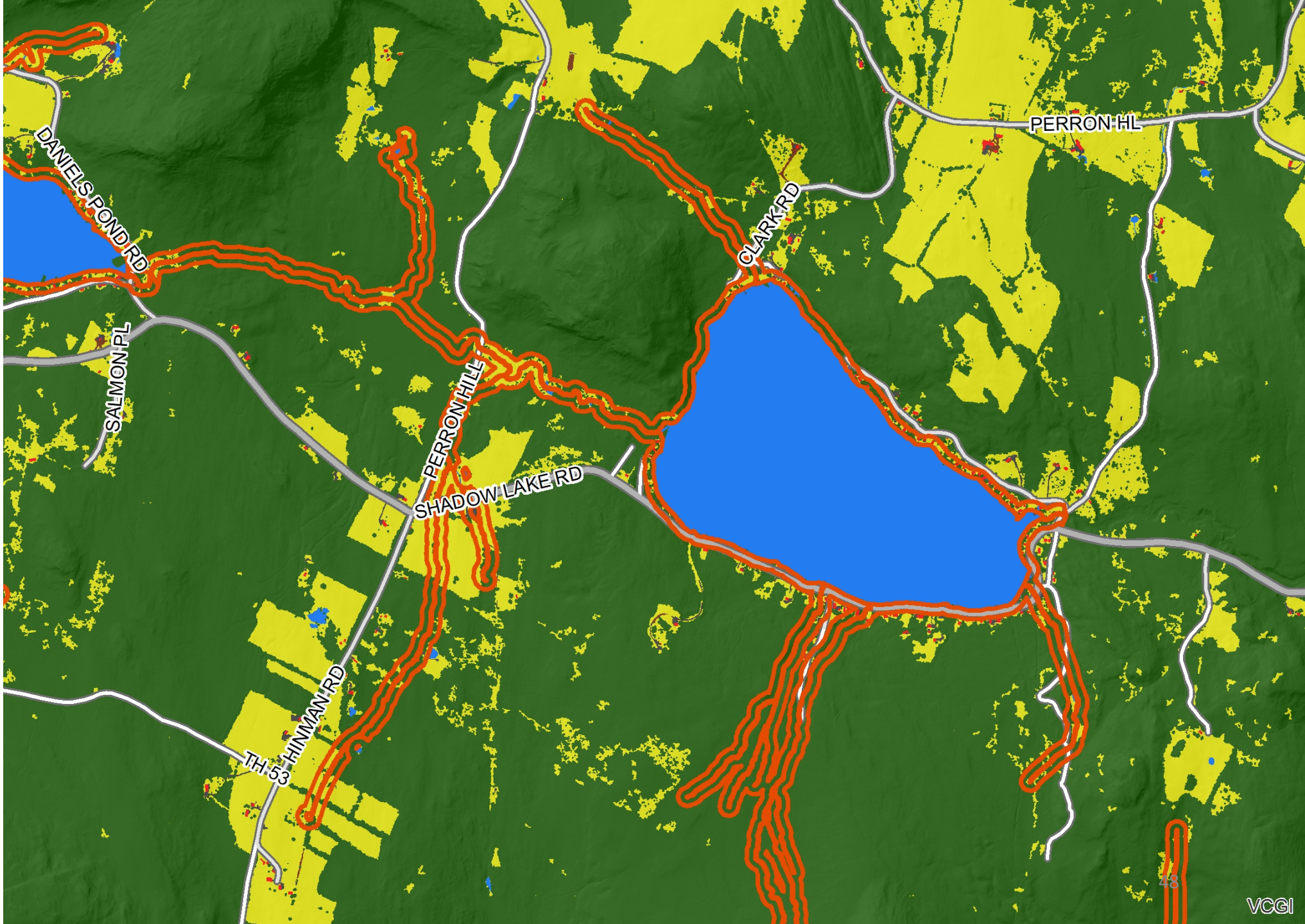
Almost none of Maine's lakes have increasing phosphorus trends!

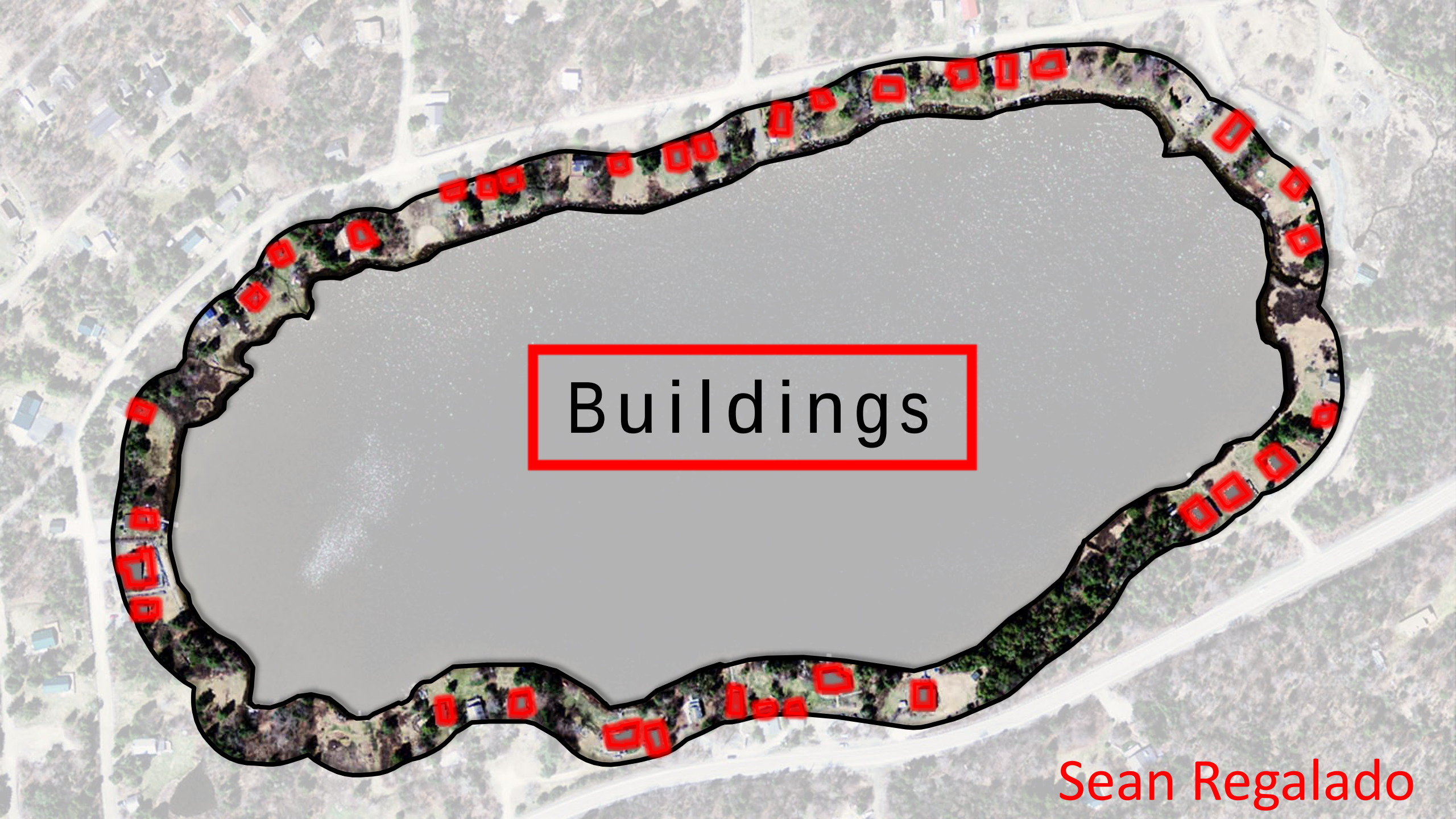


Maine Shoreland Zoning Act



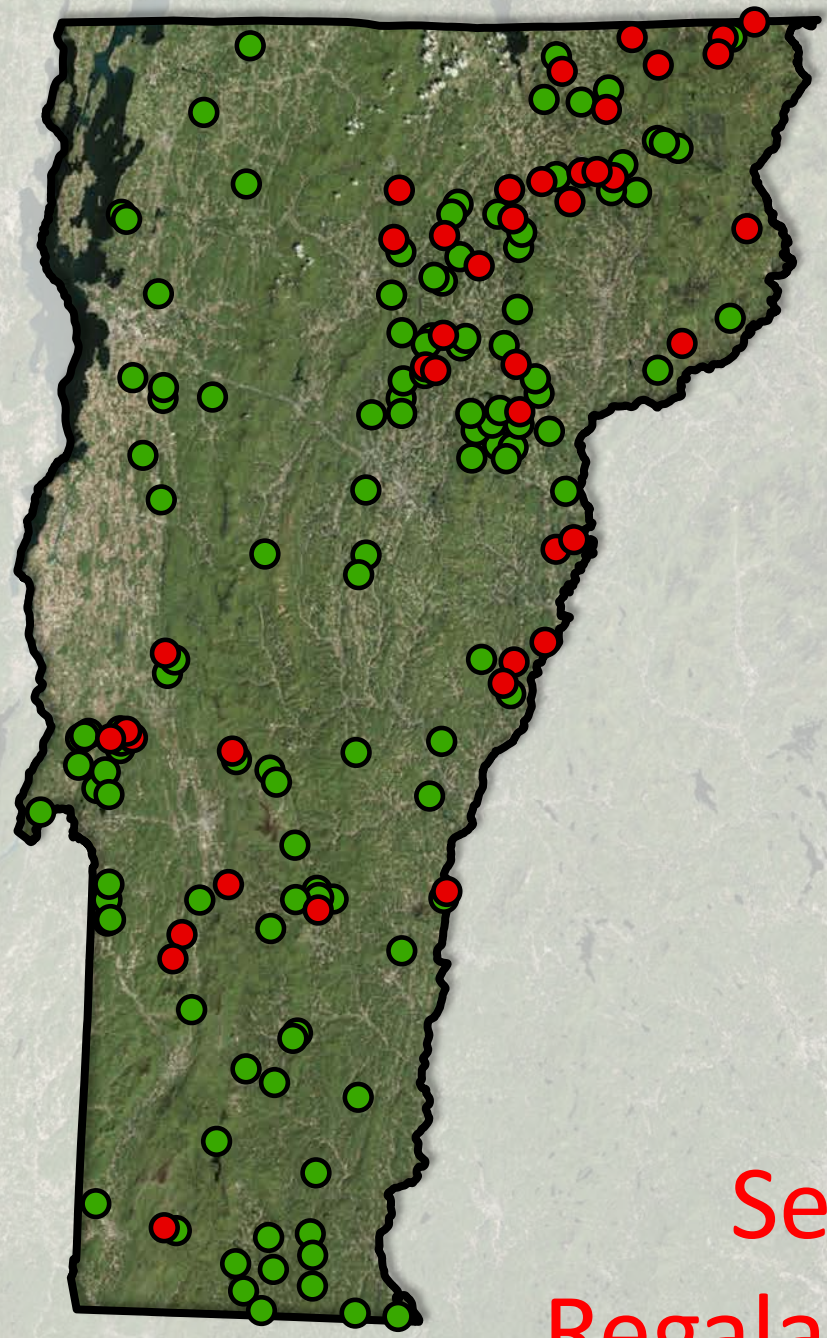
- 1 m Resolution Land Use
- 100 foot buffers around lakeshores and inlets
- $$$



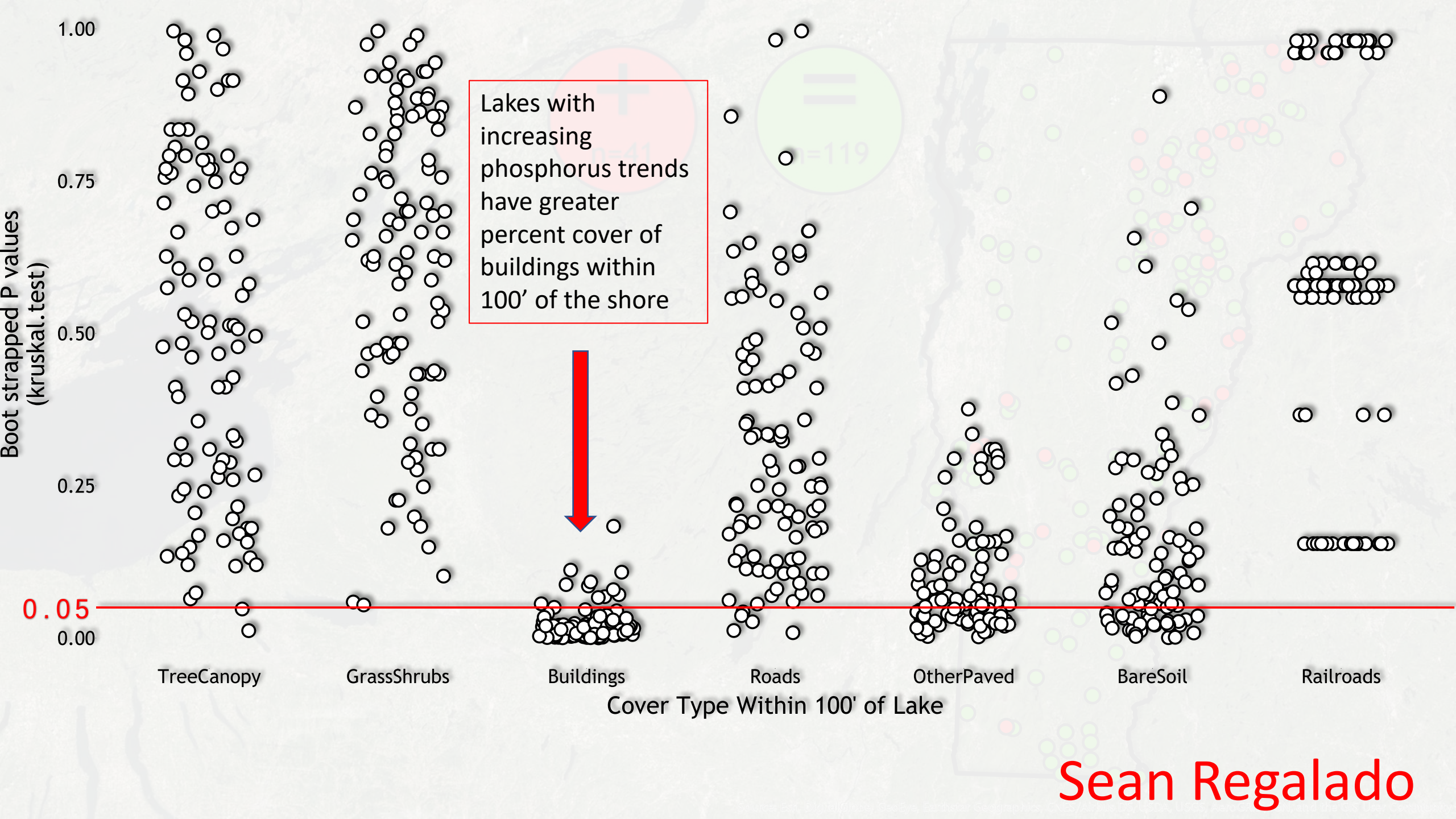


Sean Regalado

Spring or Summer Total Phosphorus Trend



Sean Regalado



Sean Regalado

Shoreland BMPs

April 30, 2011
Shoreline Erosion at North Point of Isle LaMotte, Lake Champlain
Photo: Lake Champlain Basin Program

Vegetative
- Infiltrate
- Filter
- Benefit Wildlife

Structural
- Infiltrate
- Filter

Amy Picotte

Driveway

Standards
- Defined and minimized driveway
- Minimized soil compaction
- No erosion
- Runoff channeled away from the lake

BMPs
- Crowned drive-ways, good gravel, & rock or grass-lined drainage ditches
- Open-top culverts & rock aprons
- Infiltration trenches
- Vegetated Swales
- Turn-outs
- Waterbars
- Pervious pavement

Recreation Area

Yards, Footpaths, Gardens, Patios

Standards
- Minimum of 15 ft of vegetation from shoreline
- Minimal lawn area
- Soil erosion is not occurring on site
- No pet waste accumulation
- No solid waste scattered
- No pesticide, fertilizer, or runoff to lake

BMPs
- Infiltration steps
- Rain gardens
- Waterbars
- Vegetative swales
- **Vegetated Berms**
- Establishing no-mow zones
- Planting and main-taining vegetative zones
- Planning pathways
- Lake-friendly yard maintenance

Structures/Septic

Standards
- Less than 20% of property contains impervious sur-faces
- Properly functioning leach field
- No uncovered oil tanks
- No erosion caused from impervious surface runoff

BMPs
- Dripline trenches
- Infiltration trenches
- Rooftop downspout disconnection **and drywells**
- Rain gardens
- Vegetated swales
- Septic system primer
- Ensuring septic system quality
- Non-structural

Shorefront

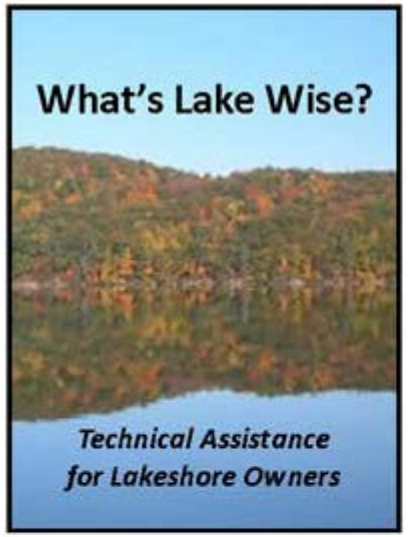
Standards
- Natural conditions
- Stable bank
- Minimum of 15 ft width of vegetation area for developed sites
- Minimum of 100 ft width for undevel-oped sites
- No unfiltered runoff to the lake
- Shallow water areas natural and not "cleaned up"

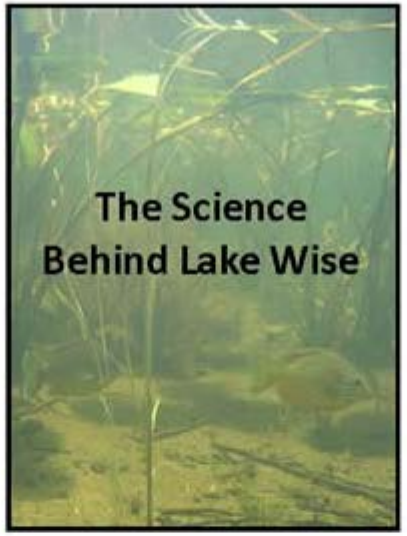
BMPs
- Conserving lake-shores
- Managing shoreland vegetation
- Resloping, rock toe & riprap
- Live staking
- Establishing no-mow zones
- Planting and main-taining vegetated areas
- Planning pathways
- Waterbars
- Permits needed?

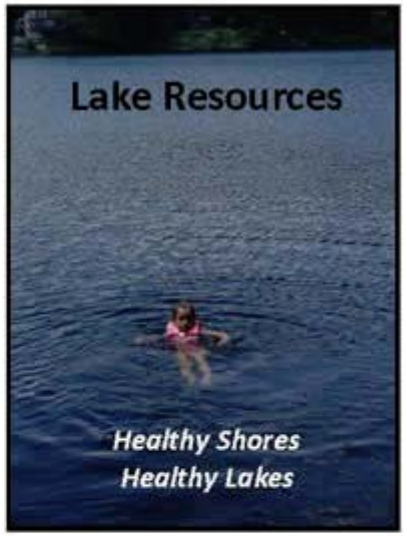
Amy Picotte

Living Shorelands Restored with Encapsulated Soil Lifts

https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise







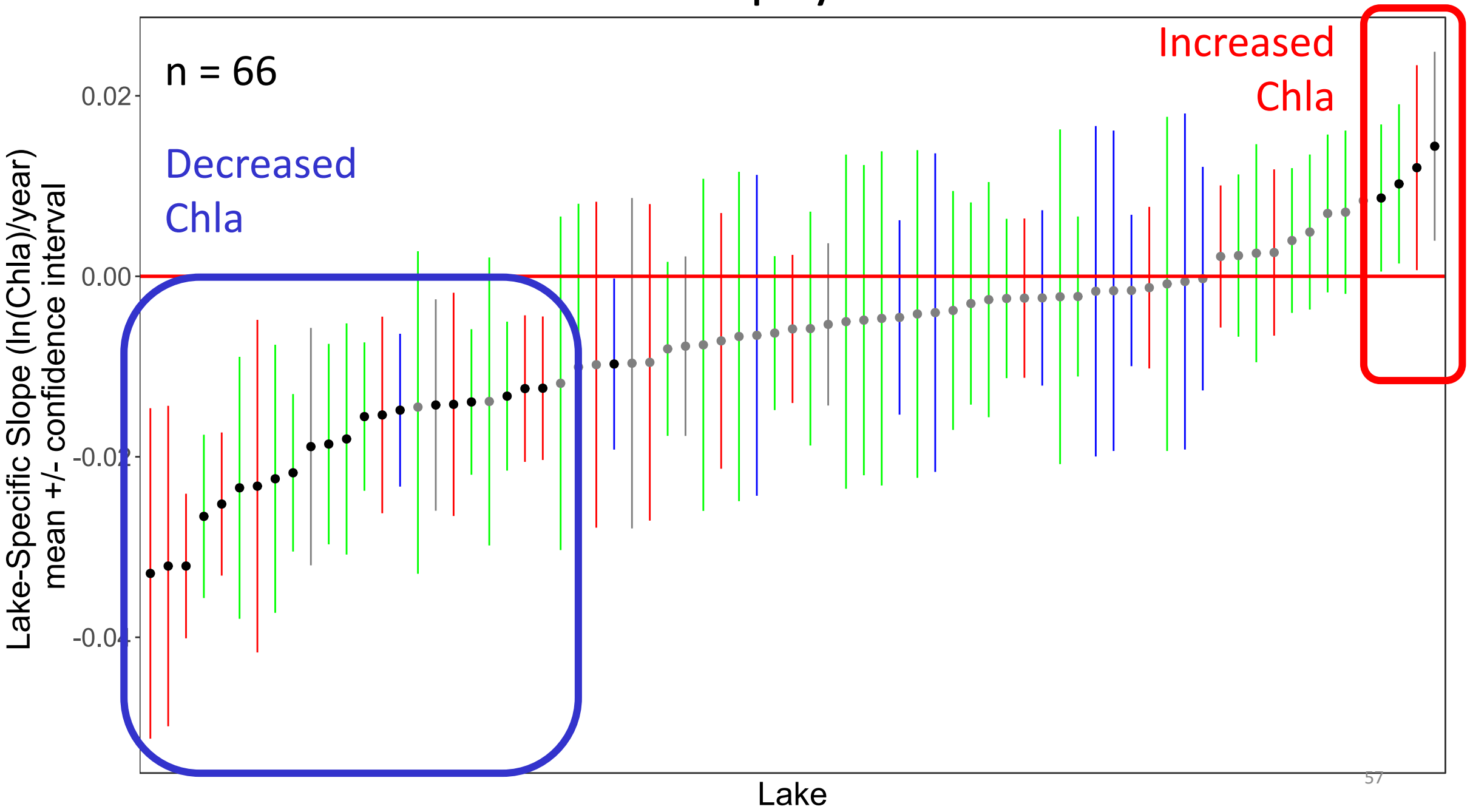
Amy Picotte

amy.picotte@vermont.gov

Summary

- The Vermont Lake Score Card summarizes and interprets multiple datasets to help us understand each lake's trends and status
- Long-term monitoring data is critical for identifying both our successes and challenges over time
- Long-term trends for our most nutrient-polluted lakes suggest improvement efforts may be paying off
- A renewed focus on our precious oligotrophic lakes is needed to reverse the disturbing trends our long-term data has revealed

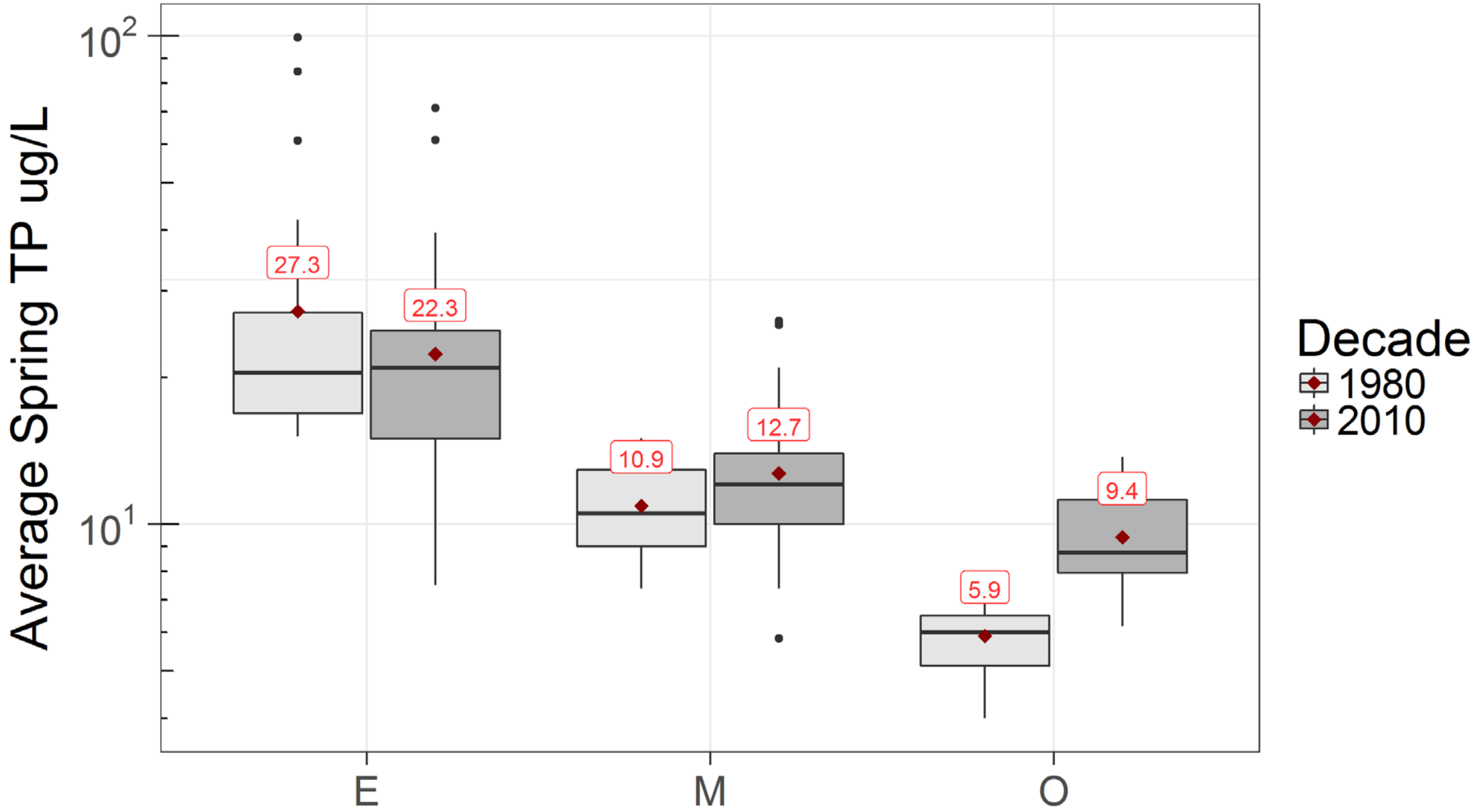
Summer Chlorophyll a Trends

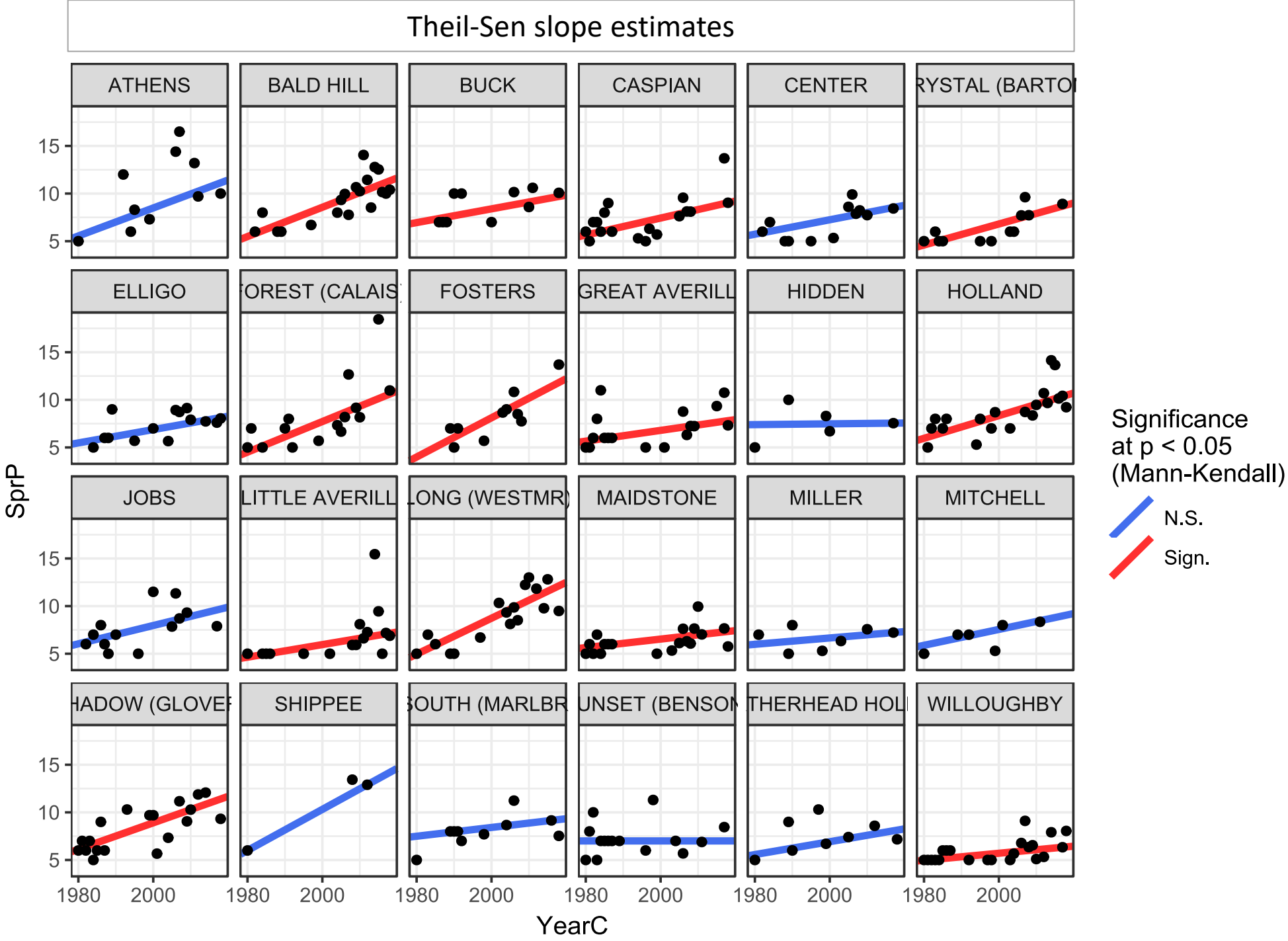


Could the tipping point be changing?

- Shifting to more cyanobacteria relative to green algae?
- Browning?

Median and average Spring TP during the 1980s versus since 2010




Theil-Sen slope estimates
ATHENS
BALD HILL
BUCK
CASPIAN
CENTER
RYSTAL (BARTO
ELLIGO
OREST (CALAIS
FOSTERS
GREAT AVERILL
HIDDEN
HOLLAND
JOBS
LITTLE AVERILL
ONG (WESTMR)
MAIDSTONE
MILLER
MITCHELL
HADOW (GLOVE
SHIPPEE
OUTH (MARLBR
UNSET (BENSON
THERHEAD HOL
WILLOUGHBY
SprP
15
10
5
1980
2000
YearC
Significance
at p < 0.05
(Mann-Kendall)
N.S.
Sign.