

Restoring Ticklenaked Pond Water Quality: 10 Years After Alum Treatment and Watershed BMPs

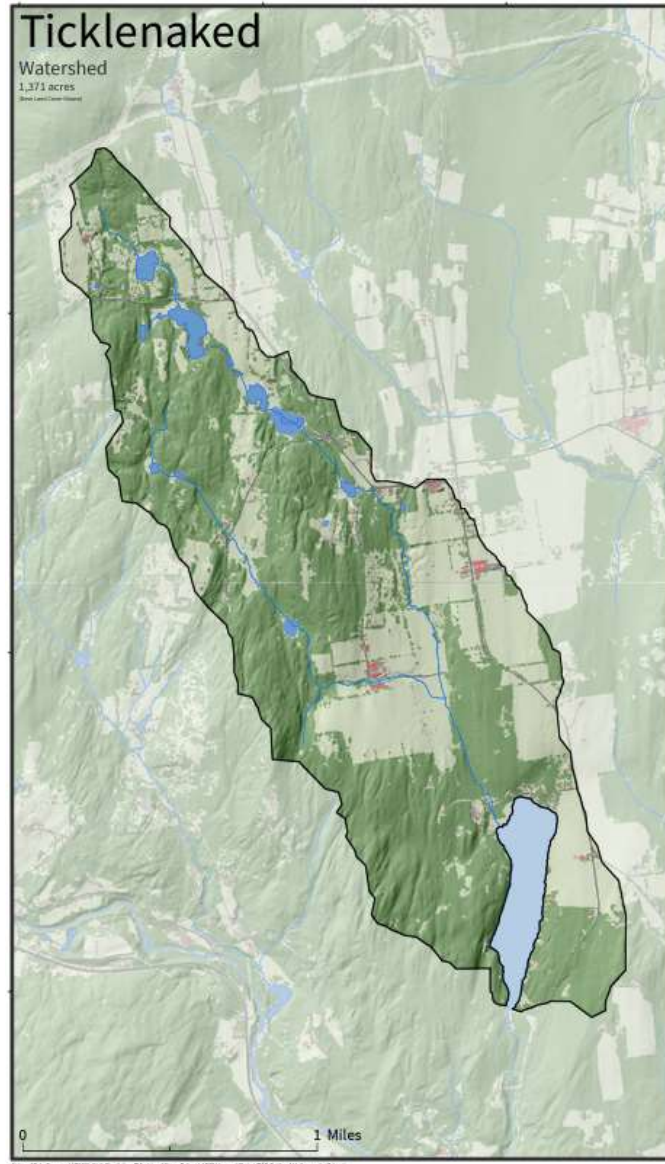
Mark Mitchell, Limnologist

Lake Monitoring and Community Outreach Coordinator

VT DEC Lakes & Ponds Program and UVM Lake Champlain Sea Grant

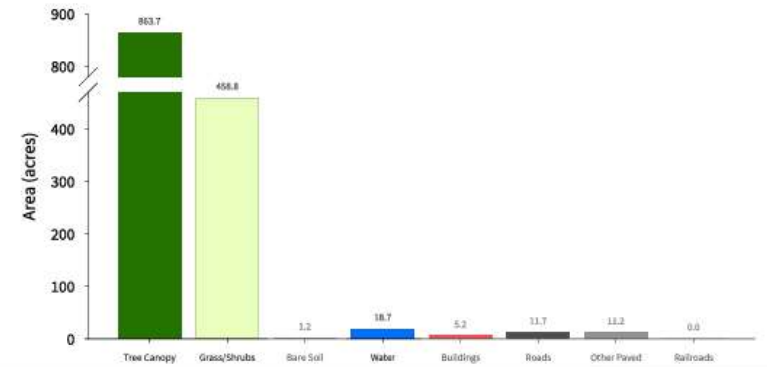
2021 Ticklenaked Loons - Pete Stangel





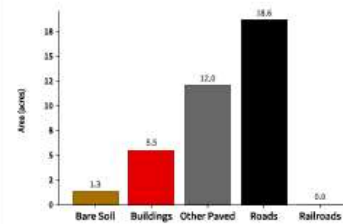
High-Resolution Land Cover Summary

Base Land Cover (Top-Down*)

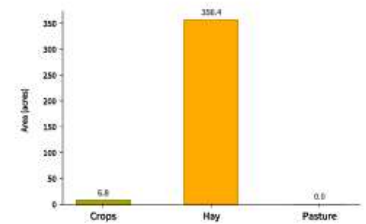


Supplemental Land Cover

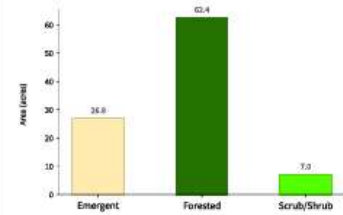
Impervious Surfaces (37.25 acres - 2.7% of total) (Bottom-Up**)



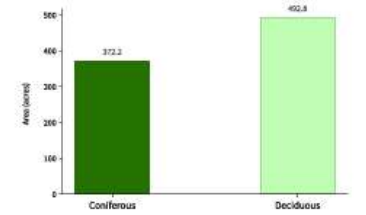
Agriculture (363.26 acres - 26.5% of total)



Wetlands (96.38 acres - 7% of total)



Tree Canopy (865.03 acres - 63.1% of total)



*Top-Down is a bottom-up land cover mapping approach. Land cover is aggregated to the appropriate land cover class.
 **Bottom-Up is a bottom-up land cover mapping approach. Land cover is mapped to the lowest level of land cover data. This approach results in improved mapping of features compared to the top-down approach.
 Source: USDA, National Wetlands Inventory (NWI), 2010; National Wetlands Inventory (NWI), 2010; National Wetlands Inventory (NWI), 2010.

Vermont Lake Score Card

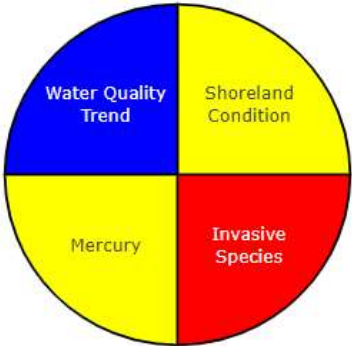
Ticklenaked Pond

Scores

Water Quality Data

Lake Information

https://anrweb.vt.gov/PubDocs/DEC/WSMD/Lakes/Lake_Score_Cards/TICKLENAKED.HTML



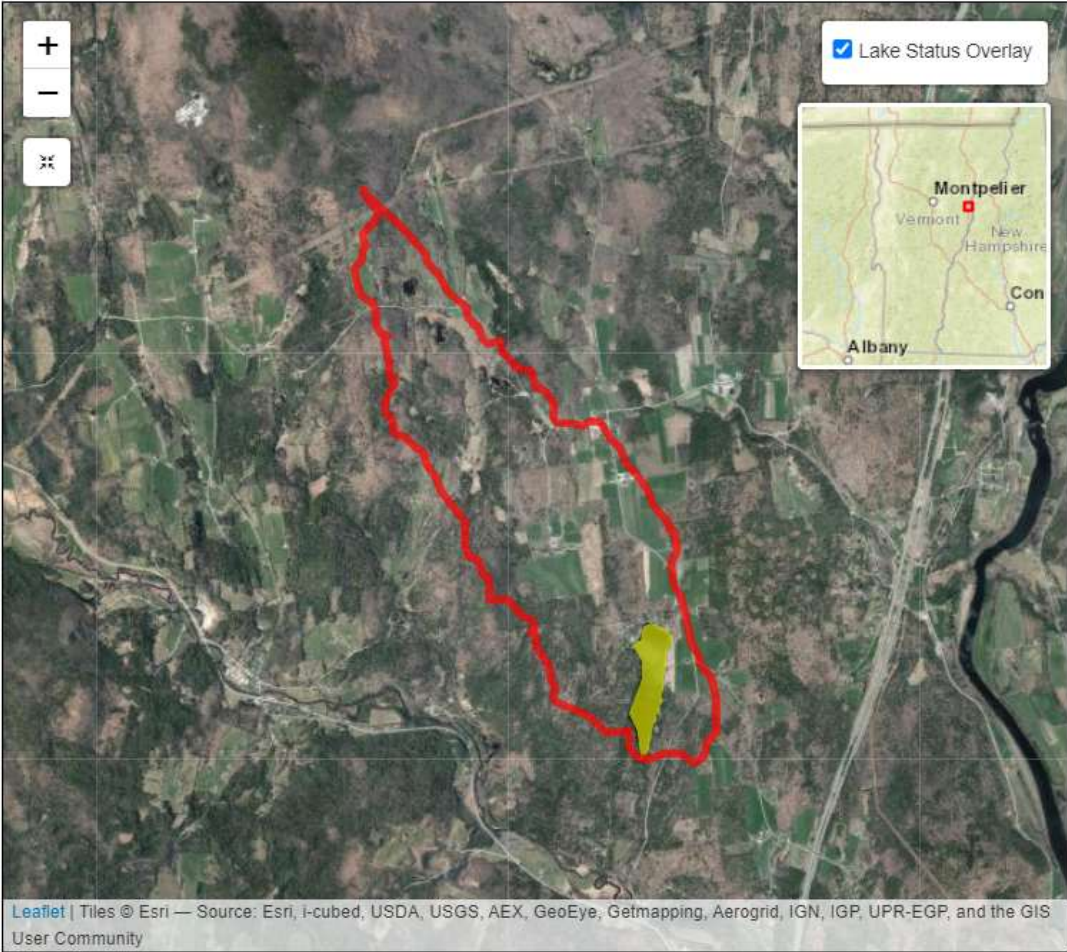
Watershed:	Highly Disturbed
WQ Standards:	Stressed

Details

Stressed - Phosphorus
Stressed - Organic Enrichment - DO

- Color Scoring System
- Good Conditions (Blue)
 - Fair Conditions (Yellow)
 - Poor Conditions (Red)
 - Insufficient Data (White)

[Learn How Lakes Are Scored](#)



Vermont Lake Score Card

Ticklenaked Pond

Scores	Water Quality Data	Lake Information
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Info

Town	Ryegate
Planning Basin	Stevens-Wells-Waits-Ompompanoosuc-CT
Surface Area	55 acres
Basin To Lake Area Ratio	26
Maximum Depth	51 feet
Elevation	885 feet

Known Invasive Species Infestations

Common Name	Scientific Name
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>

Long Term Means

Season	Long Term Mean	# Years Data
Total Phosphorus (ug/L)		
Spring	45.8	32
Summer	28.3	22
Secchi Transparency (m)		
Summer	2.4	22
Chlorophyll-a (ug/L)		
Summer	13.6	22

Scores

Water Quality Data

Lake Information

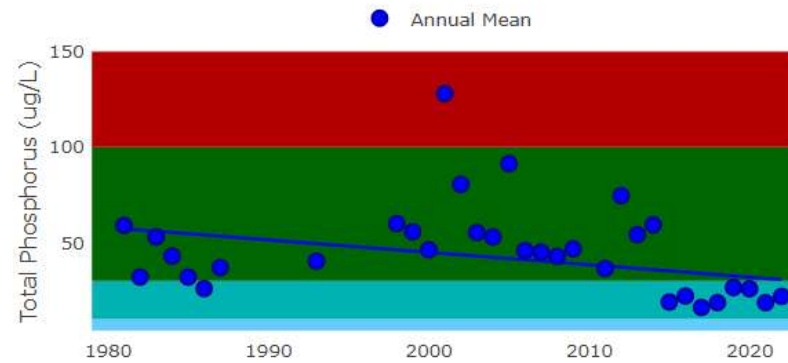
2009: Phosphorus TMDL & Action Plan 2014: In-Lake Alum Treatment 2020: Delisted for Phosphorus Impairment

Plots

- Trophic condition thresholds are indicated by shading:
 - Hypereutrophic ■ Eutrophic ■ Mesotrophic ■ Oligotrophic
- Click on “Daily Mean” or “Annual Mean” to toggle on or off the data layer.

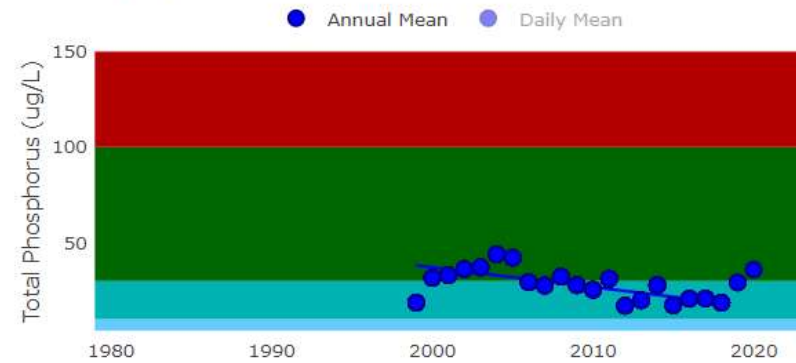
Spring Phosphorus

Trend: Significantly Decreasing (p-value = 0.0232)



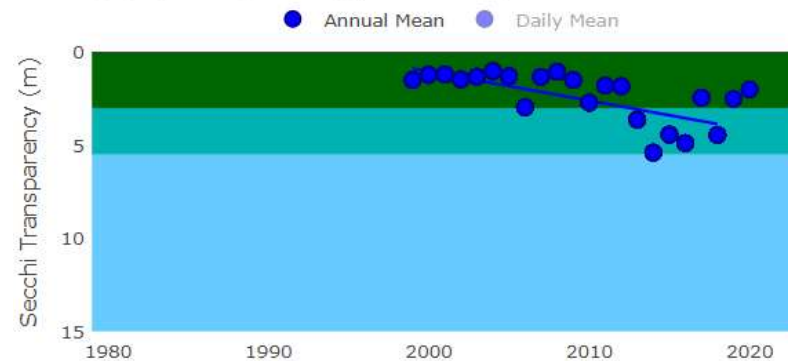
Summer Phosphorus

Trend: Highly Significantly Decreasing (p-value = 0.0057)



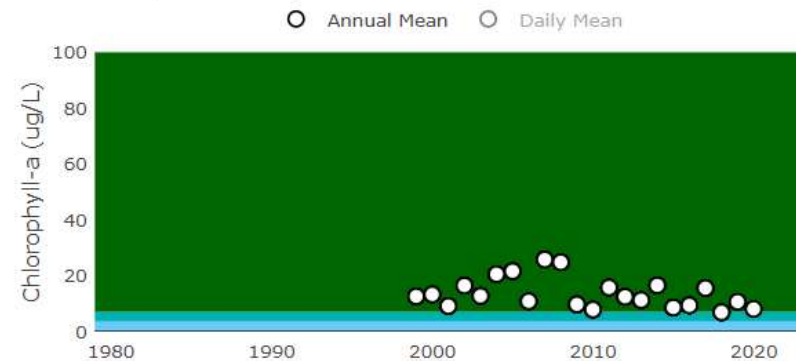
Summer Secchi

Trend: Highly Significantly Increasing (p-value = 7e-04)



Summer Chlorophyll-a

Trend: Stable (p-value = 0.1955)



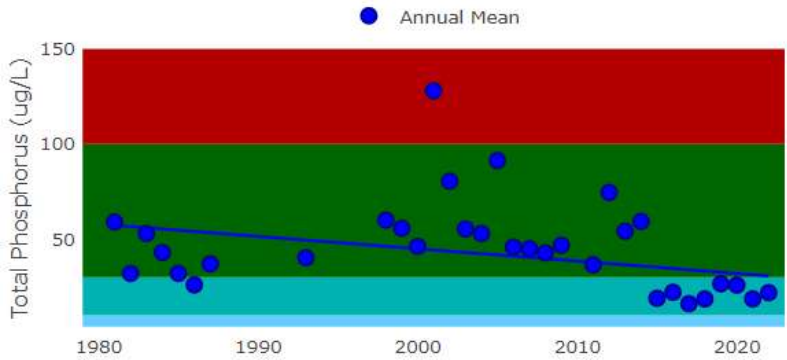
2009: Phosphorus TMDL & Action Plan 2014: In-Lake Alum Treatment 2020: Delisted for Phosphorus Impairment

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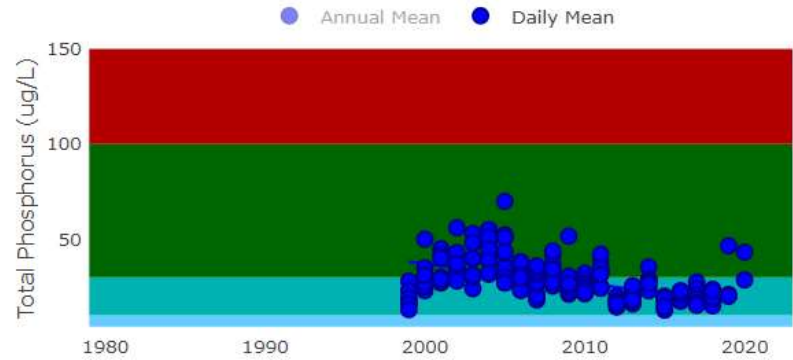
Spring Phosphorus

Trend: Significantly Decreasing (p-value = 0.0232)



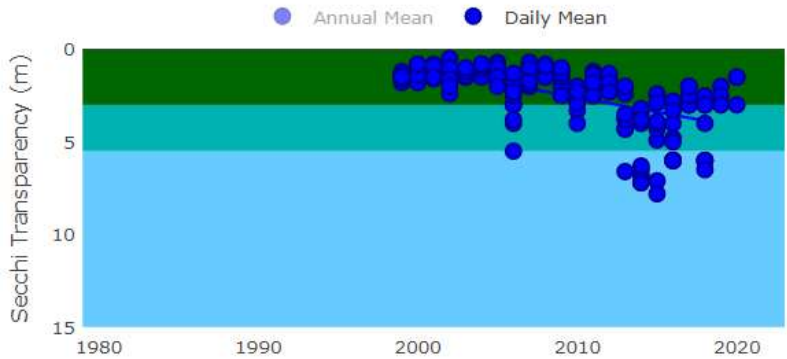
Summer Phosphorus

Trend: Highly Significantly Decreasing (p-value = 0.0057)



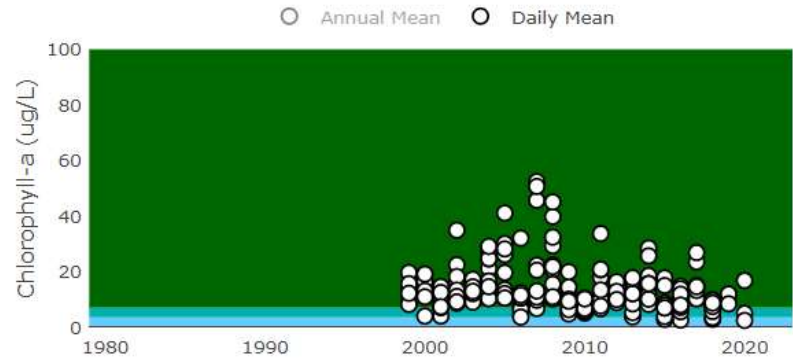
Summer Secchi

Trend: Highly Significantly Increasing (p-value = 7e-04)



Summer Chlorophyll-a

Trend: Stable (p-value = 0.1955)



VT DEC Lay Monitoring Report

TICKLENAKED POND

Annual Data (Station 1)

Year	Days Sampled	Secchi (m)	Secchi View Tube (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
1979						31.0
1981						59.0
1982						32.0
1983						53.0
1984						43.0
1985						32.0
1986						26.0
1987						37.0
1993						40.3
1998						60.0
1999	8	1.5		12.5	18.6	55.7
2000	7					46.3

Annual Data (Station 1)

Year	Days Sampled	Secchi (m)	Secchi View Tube (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
2001	9	1.2		9.1	33.0	122.0
2002	9	1.5		16.4	36.2	78.7
2003	9	1.3		12.7	37.1	55.3
2004	9	1.0		20.5	44.0	53.0
2005	9	1.3		21.6	42.1	91.3
2006	10	2.9		10.8	29.4	45.8
2007	9	1.3		25.7	27.7	45.0
2008	10	1.0		24.8	32.2	42.8
2009	10	1.5		9.7	27.8	46.8
2010	9	2.7		7.8	25.4	
2011	10	1.8		15.7	31.1	36.5
2012	8	1.8		12.4	17.0	72.4
2013	9	3.6		11.2	19.9	54.2
2014	9	5.4		16.5	27.8	59.3
2015	9	4.4		8.5	17.3	19.0
2016	9	4.9		9.3	20.7	22.0
2017	9	2.4		15.5	20.8	16.1
2018	9	4.4		6.8	18.6	19.2
2019	3					26.6
2020	3					25.9
2021						18.6
2022						21.9

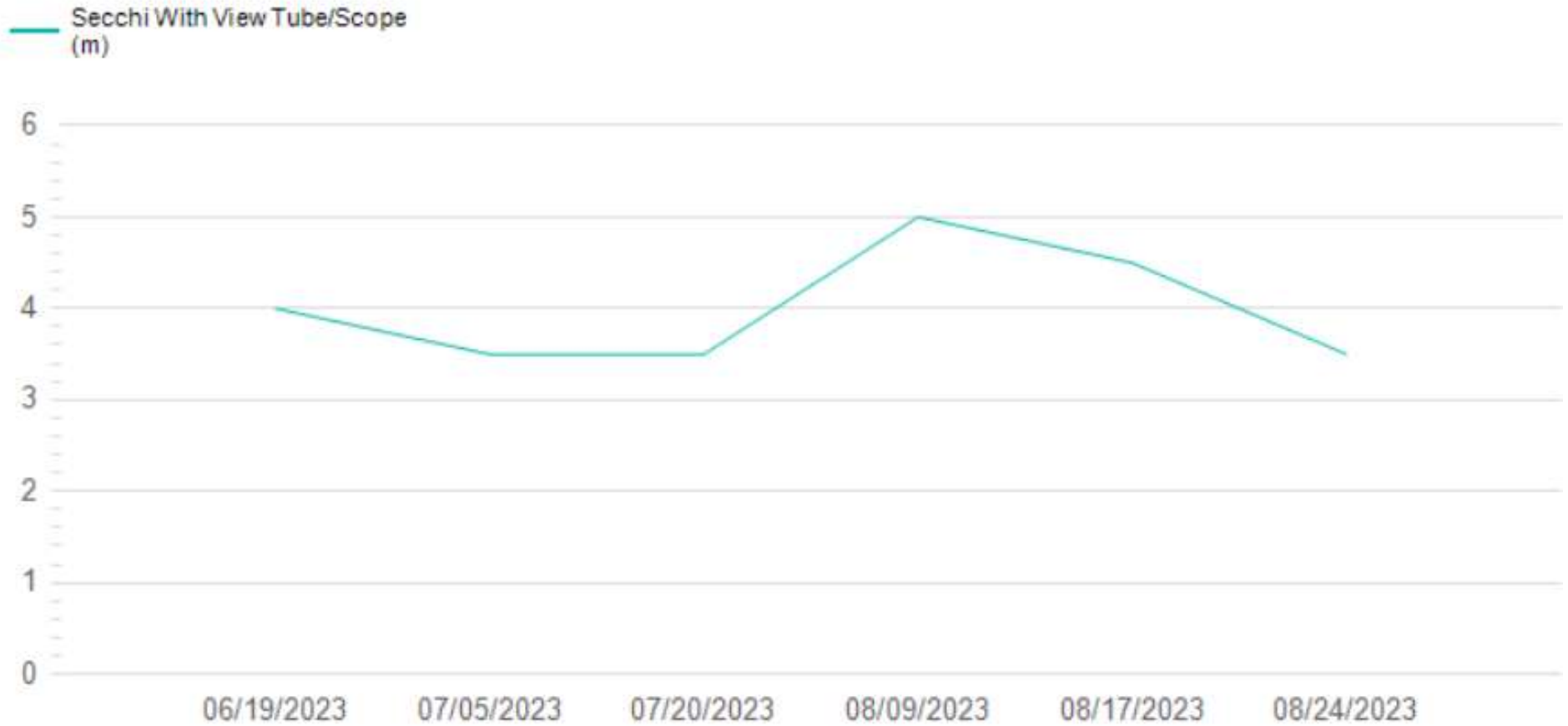
***Ticklenaked Pond Summer TP Standard = 24 µg/l (Euphotic Zone)**

2023 Summary (Station 1)

Parameter	Days	Min	Mean	Max
Secchi With View Tube/Scope (m)	6	3.5	4.0	5.0
Epilimnetic Chlorophyll-a ($\mu\text{g/L}$)	6	3.0	5.2	8.9
Metallimnetic Chlorophyll-a ($\mu\text{g/L}$)	5	22.1	44.9	71.5
Hypolimnetic Chlorophyll-a ($\mu\text{g/L}$)	5	8.6	9.8	10.9
Epilimnetic Total Phosphorus ($\mu\text{g/L}$)	6	14.3	17.3	21.3
Metallimnetic Total Phosphorus ($\mu\text{g/L}$)	5	31.7	64.9	156.0
Hypolimnetic Total Phosphorus ($\mu\text{g/L}$)	5	37.1	40.2	43.1

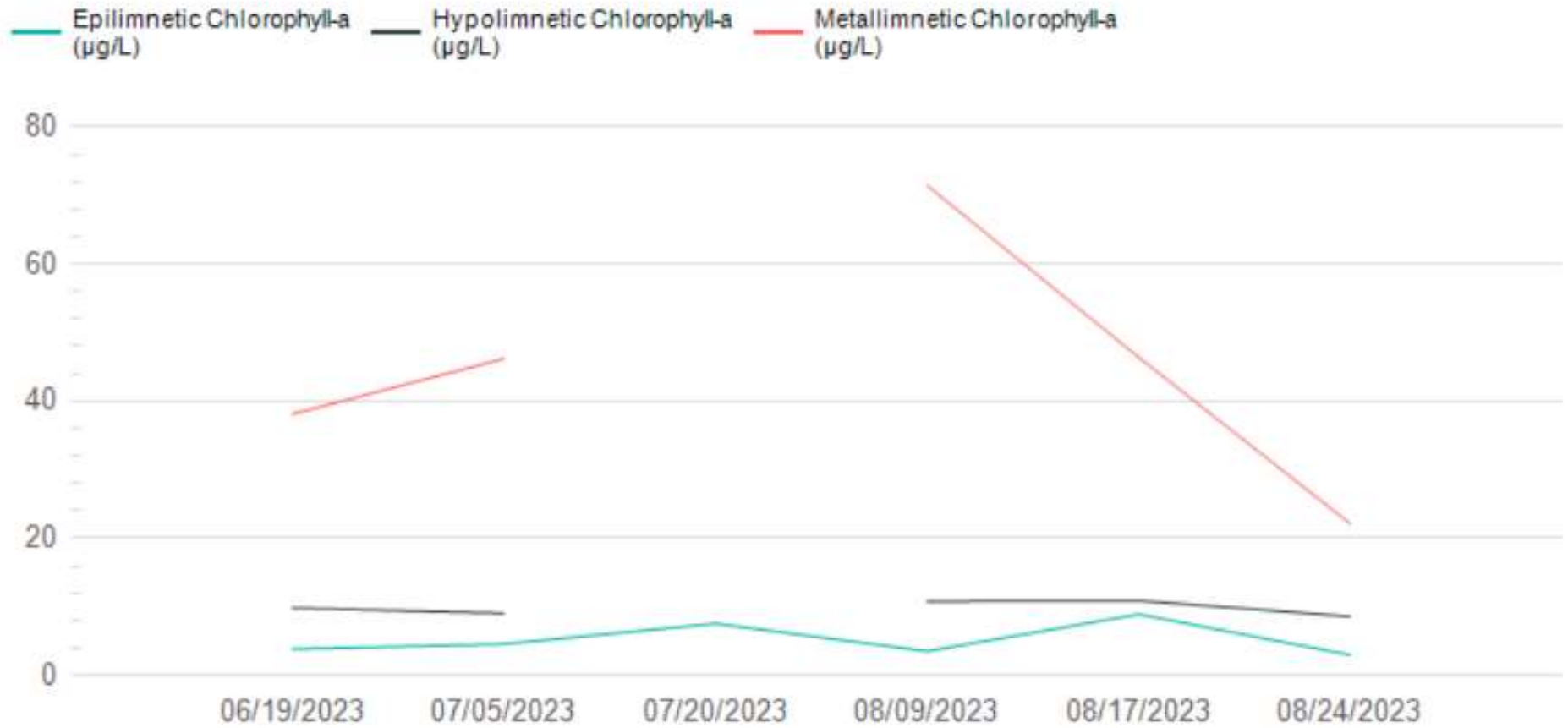
<https://anrweb.vt.gov/DEC/IWIS/ReportViewer.aspx?Report=LayMonLakeReportTEST&ViewParms=False&LayMonID=TICKL>

2023 Lay Monitoring Secchi Transparency



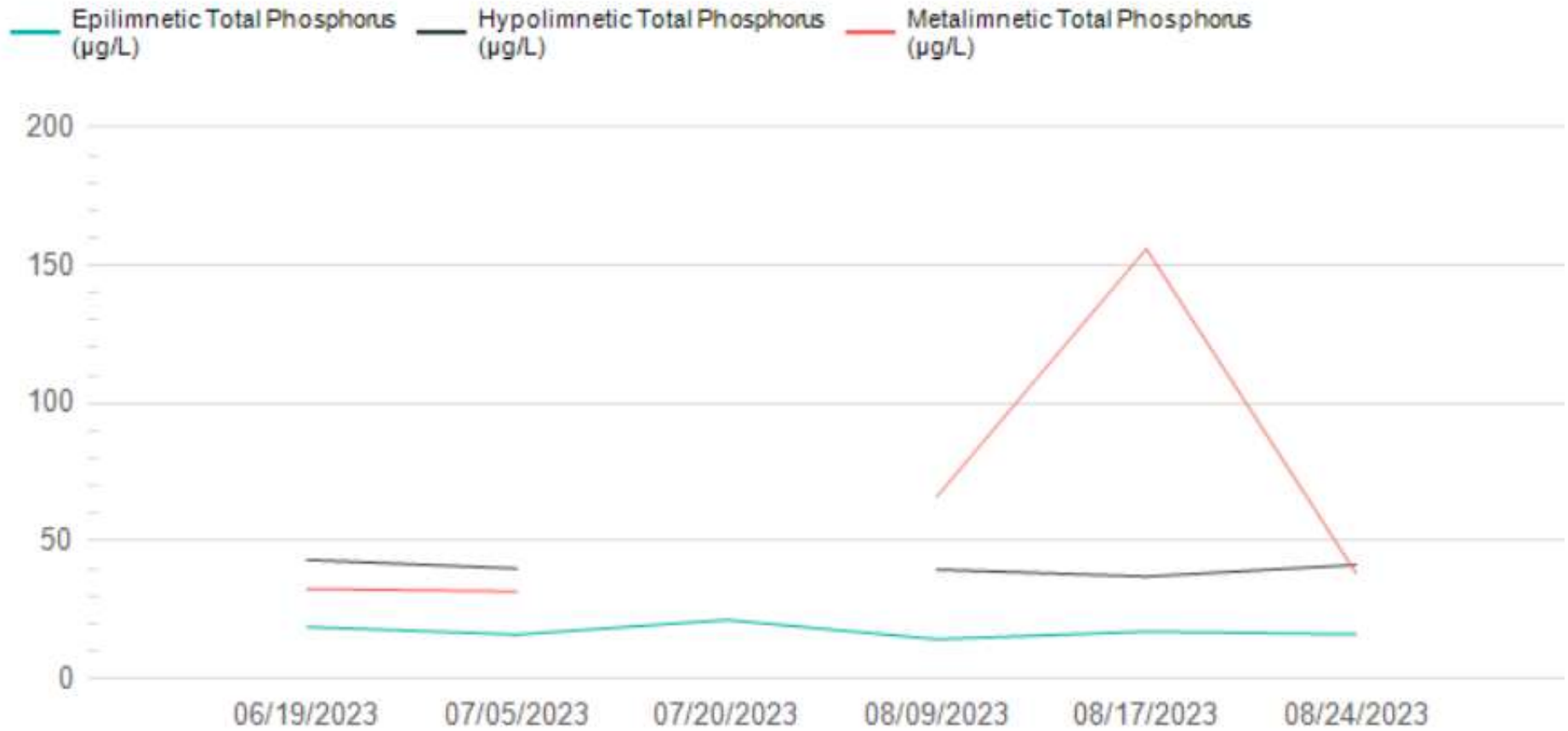
<https://anrweb.vt.gov/DEC/IWIS/ReportViewer.aspx?Report=LayMonLakeReportTEST&ViewParms=False&LayMonID=TICKL>

2023 Lay Monitoring Chlorophyll-a



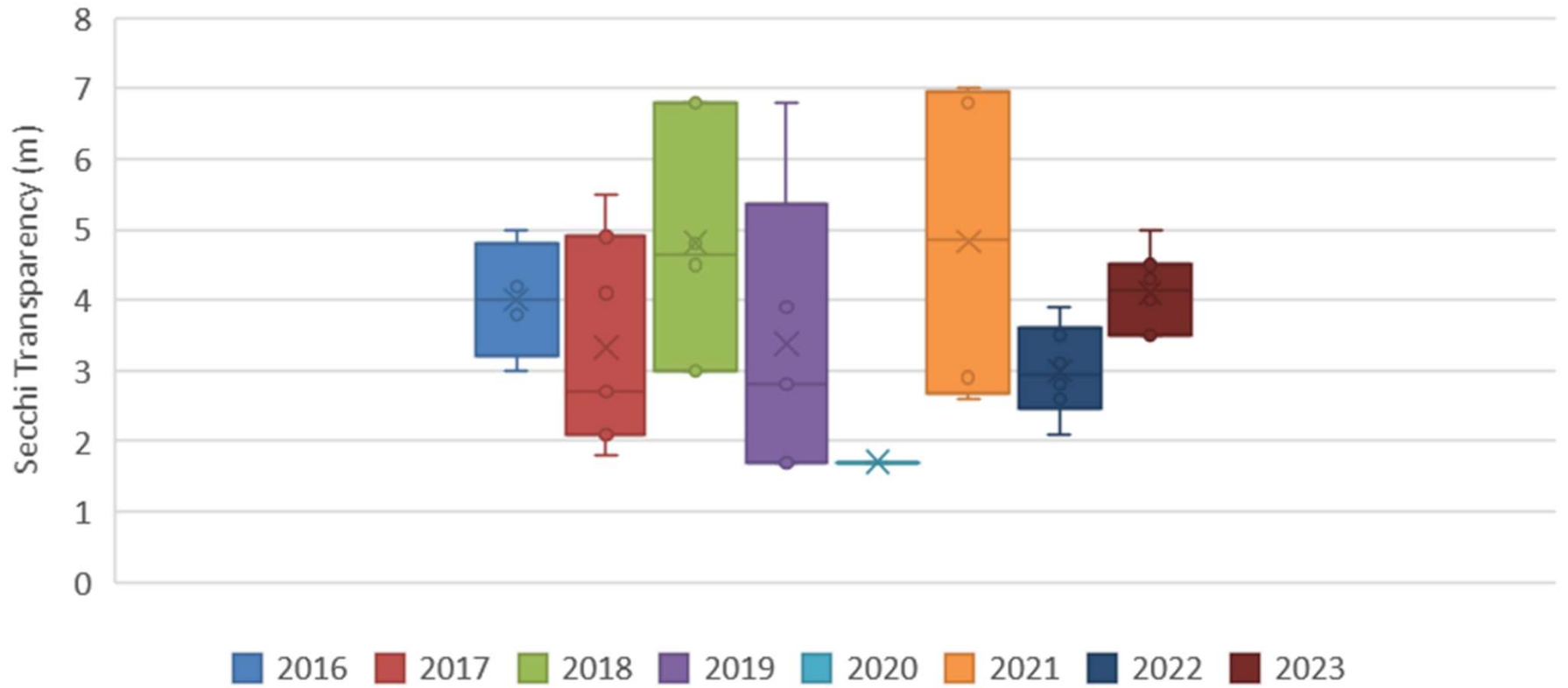
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2023 Lay Monitoring Total Phosphorus

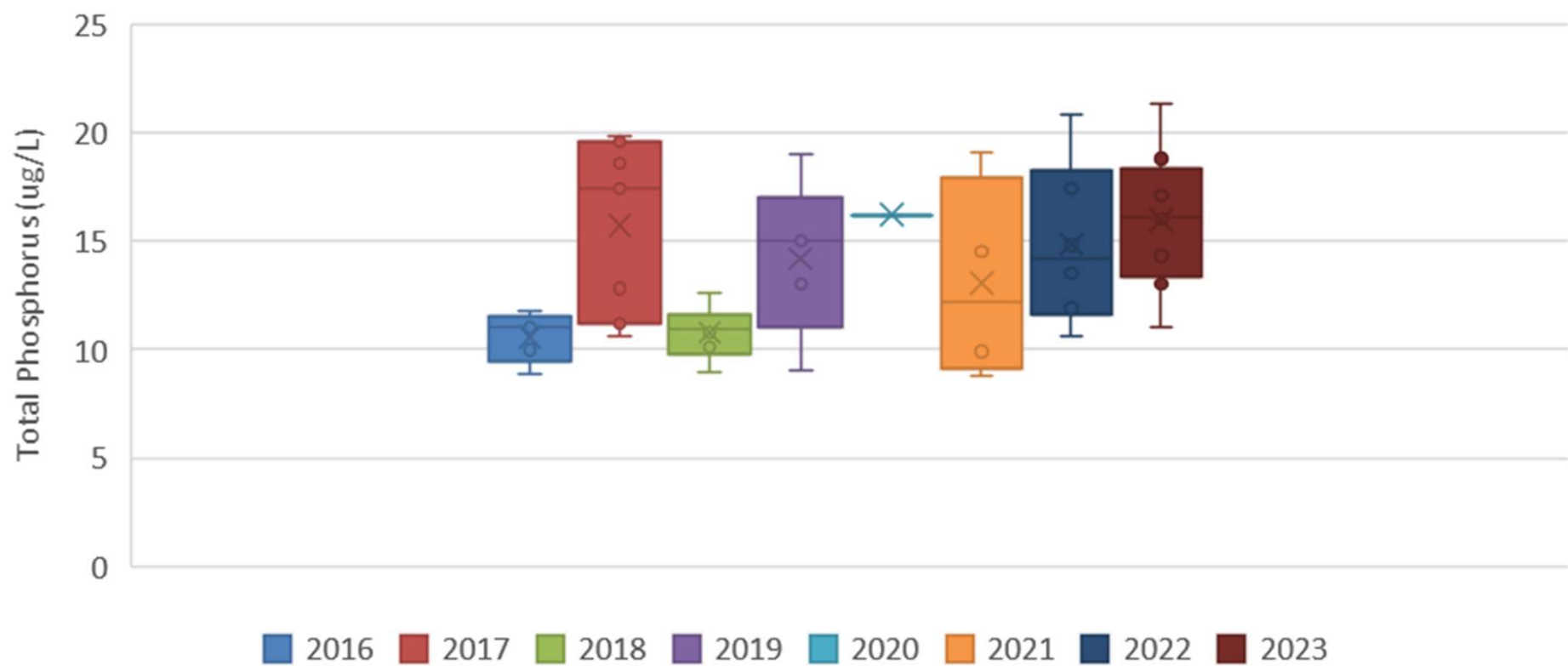


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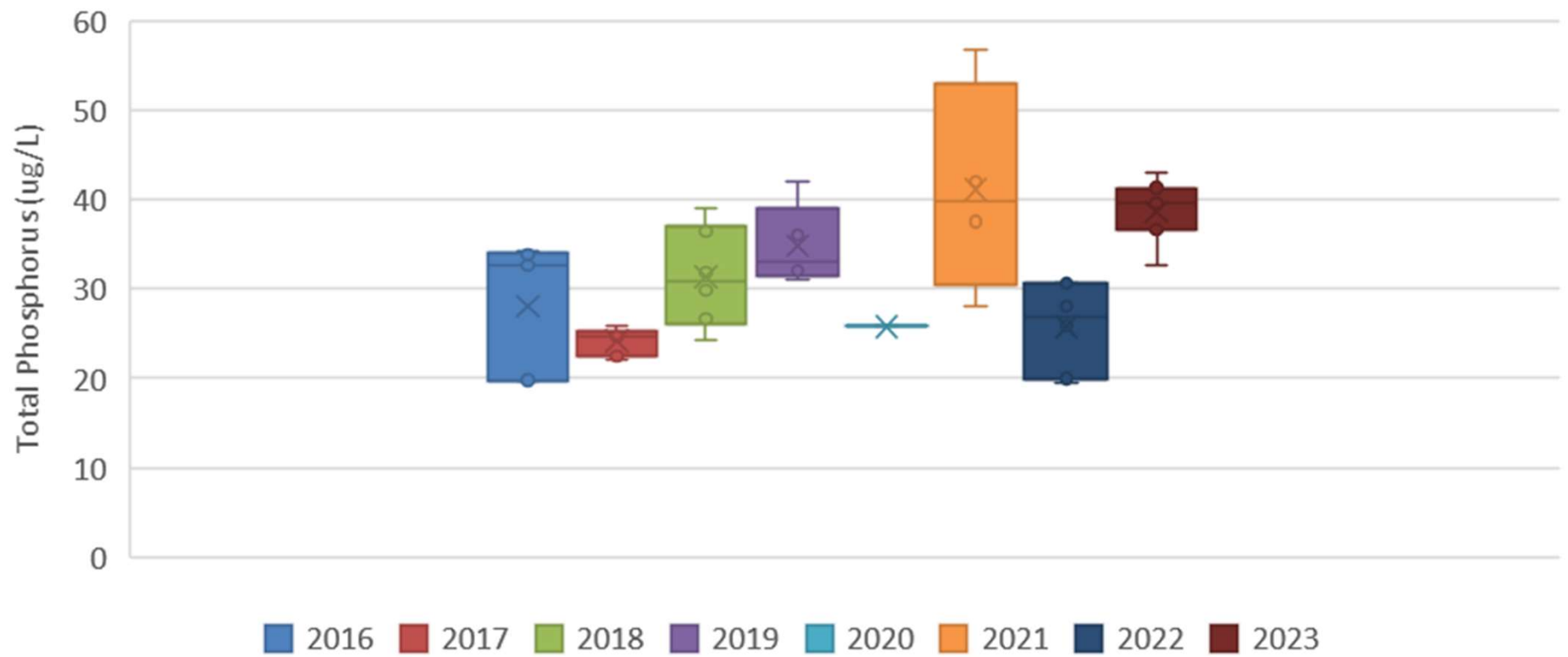
2016-2023 Ticklenaked Pond Secchi Transparency



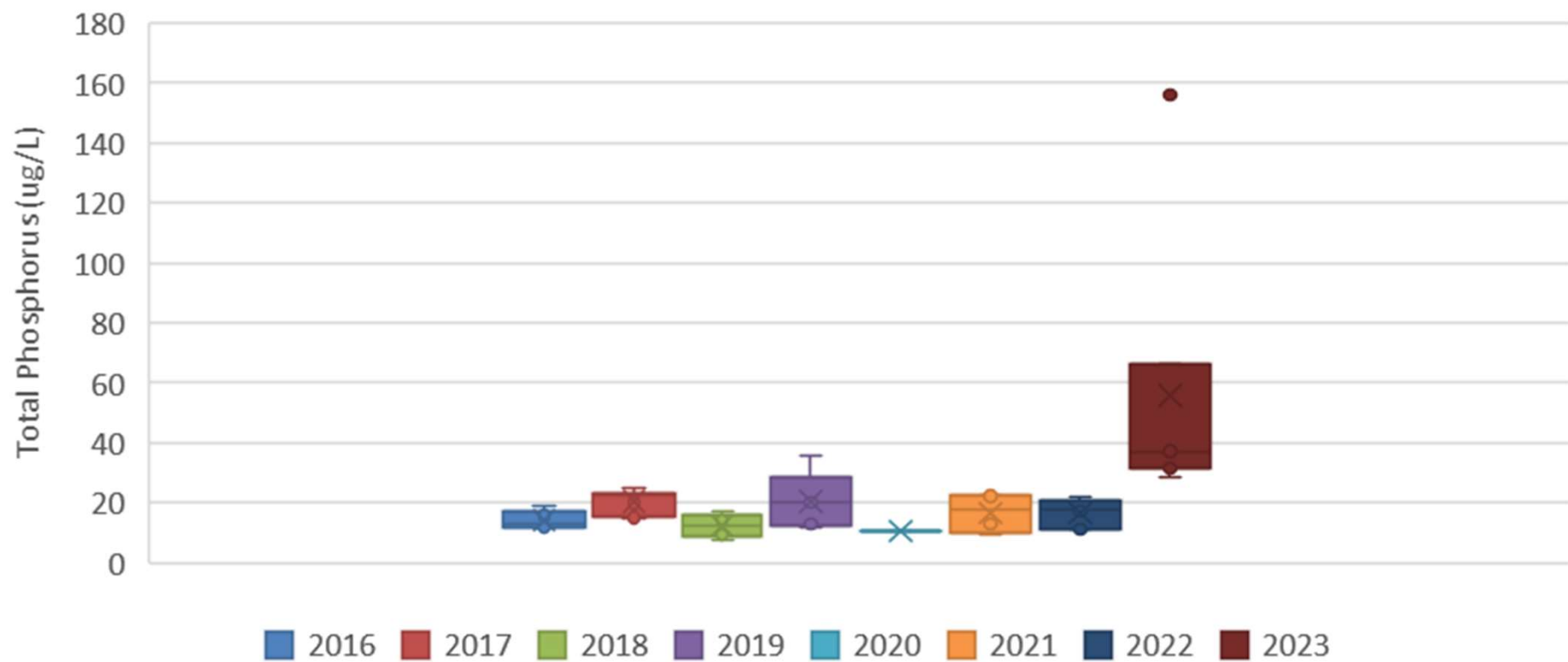
2016-2023 Ticklenaked Pond Epilimnetic (0.2m) Total Phosphorus



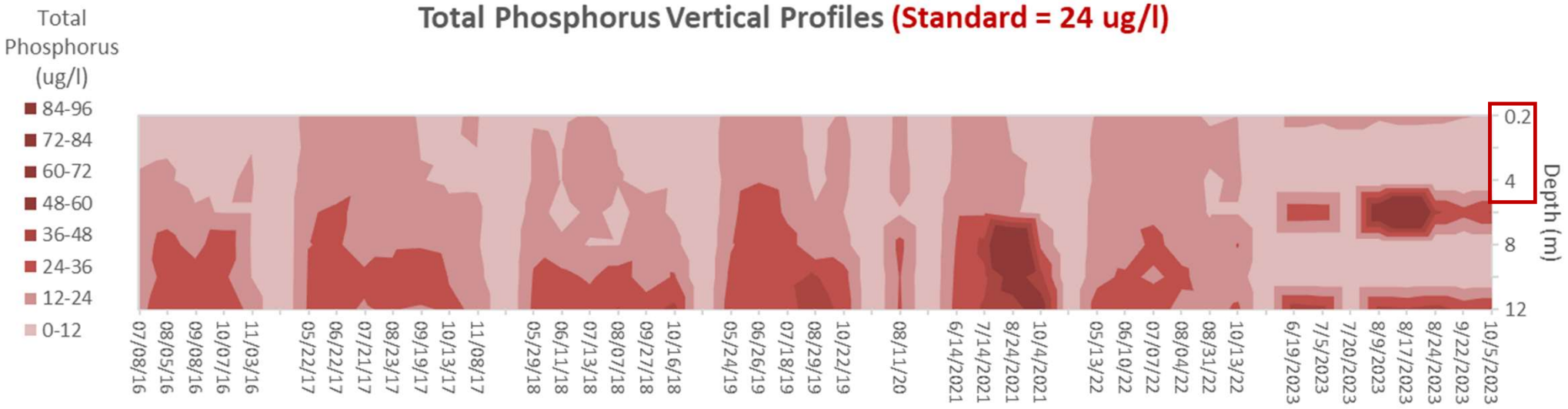
2016-2023 Ticklenaked Pond Hypolimnetic (12m) Total Phosphorus



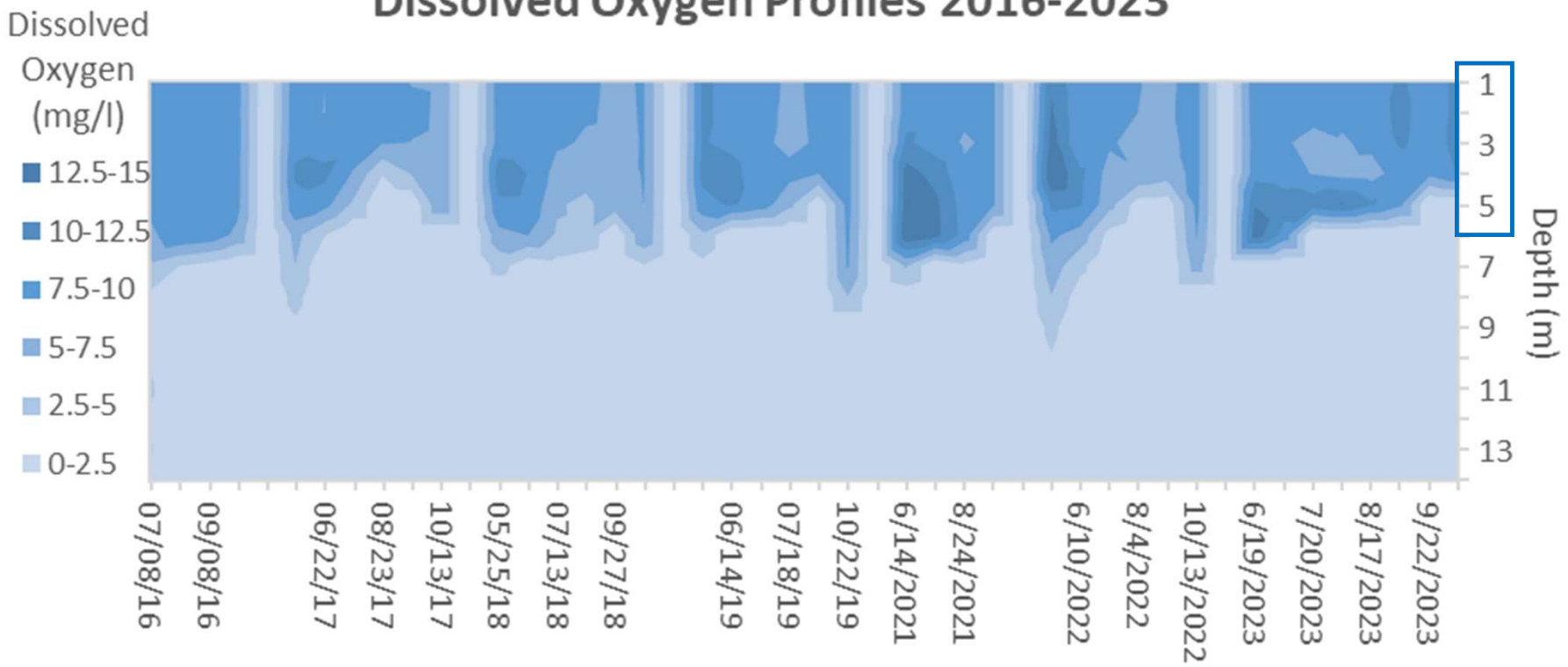
2016-2023 Ticklenaked Pond Metalimnetic (6m) Total Phosphorus



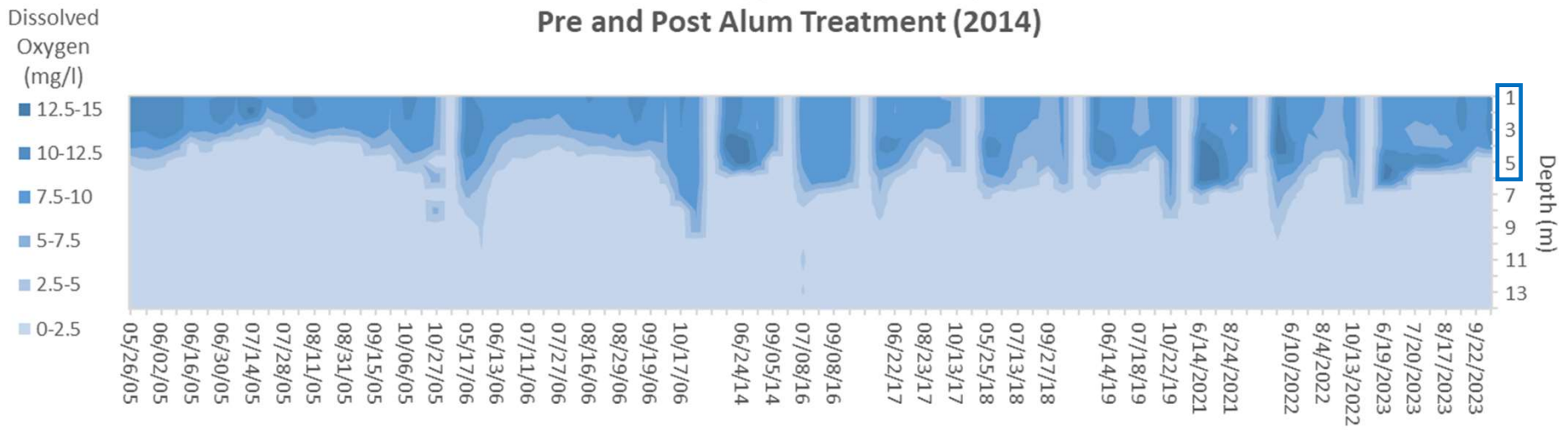
2016-2023 Ticklenaked Pond Station #1 VTDEC TMDL Monitoring Total Phosphorus Vertical Profiles (Standard = 24 ug/l)



Ticklenaked Pond Station # 1 VTDEC TMDL Monitoring Dissolved Oxygen Profiles 2016-2023



Ticklenaked Pond Station # 1 Dissolved Oxygen Profiles May-Oct 2005-2006 and 2014-2023: Pre and Post Alum Treatment (2014)



2023 Monitoring Summary & Next Steps

- Mean Secchi transparency continues to be in mesotrophic range
- Mean epilimnetic chlorophyll-a is in mesotrophic range
- Mean epilimnetic total phosphorus continues to meet standard (24 ug/L)
- Hypolimnetic chlorophyll-a and total phosphorus in meso-eutrophic range
- Metalimnetic chlorophyll-a and total phosphorus now in eutrophic range
- Dissolved oxygen remains high at deeper depths than before alum (2014)
- Continue biweekly monitoring: epilimnetic, metalimnetic, hypolimnetic
- Collect phytoplankton samples and monitor for potential cyano blooms



Thanks!

Questions?

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