

Fig. 105.—LAKE MEMPHREMAOG.

Scale 1 : 400,000.



Quebec - Vermont Steering Committee: Lake Water Quality Trends & Vermont Aquatic Invasive Species Update

May 11, 2023

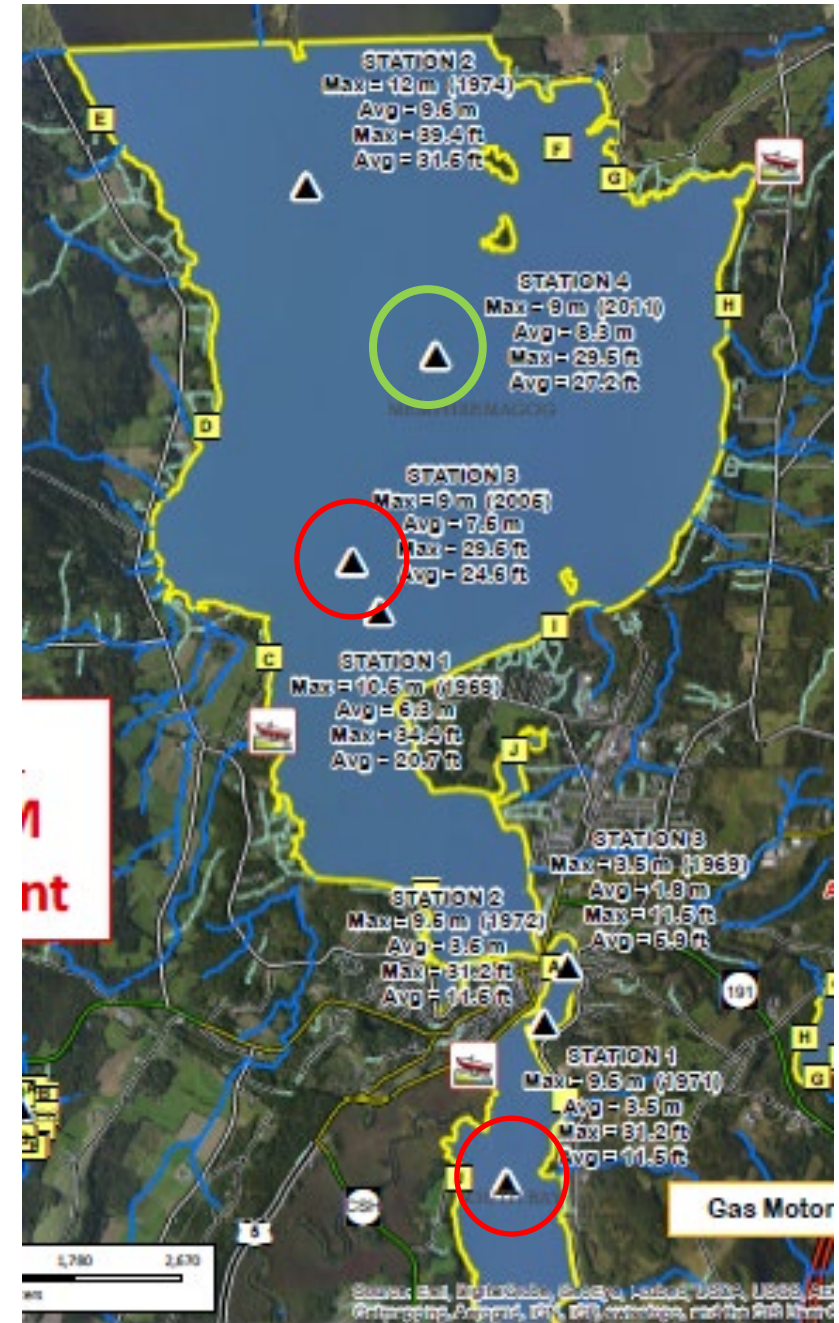


Lake Memphremagog Water Quality Background

- Lake Memphremagog is an international waterbody with over 73% of its surface area in Quebec, while 27% is in Vermont (watershed is inverse)
- Vermont portion of the Lake does not meet the VT standard of 14 ug/l
 - VT section of Lake is impaired; September 2017 TMDL to restore lake
 - Quebec portion of Lake meets applicable Provincial phosphorus guidelines
- The Quebec-Vermont Steering Committee has worked collaboratively to model P reduction requirements and implemented P loading reduction projects
- VT state agencies have invested over \$13 million in clean water projects in the Memphremagog Basin from 2016-2022 and reduced phosphorus load by almost 8.4 metric tons over this period, mostly from the Agriculture Sector

Lake Memphremagog Water Quality Monitoring

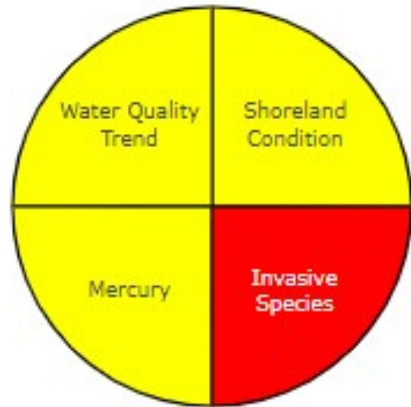
- Lay Monitoring Program Data
 - 1984 – 2020 (Red circles)
- TMDL Monitoring
 - 2017 to Present (Green Circle)



Vermont Lake Score Card

Lake Memphremagog

Scores | Water Quality Data | Lake Information



Watershed:	Highly Disturbed
WQ Standards:	Impaired

Details

Impaired – Phosphorus

Altered – flow

Color Scoring System

- Good Conditions
- Fair Conditions
- Poor Conditions
- Insufficient Data

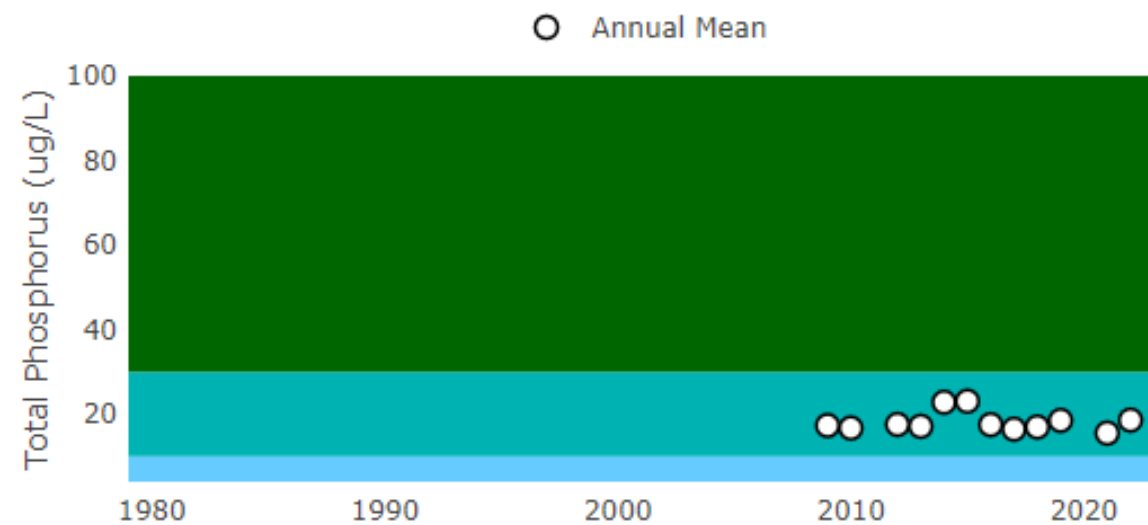
[Learn How Lakes Are Scored](#)

A satellite map of Lake Memphremagog with a red outline. A red area is visible at the bottom of the lake. An inset map shows the location of the lake in Vermont and New Hampshire, with labels for Montpelier, Albany, and Con. A checkbox labeled 'Lake Status Overlay' is checked. Navigation controls (+, -, x) are visible on the left side of the map.

Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community

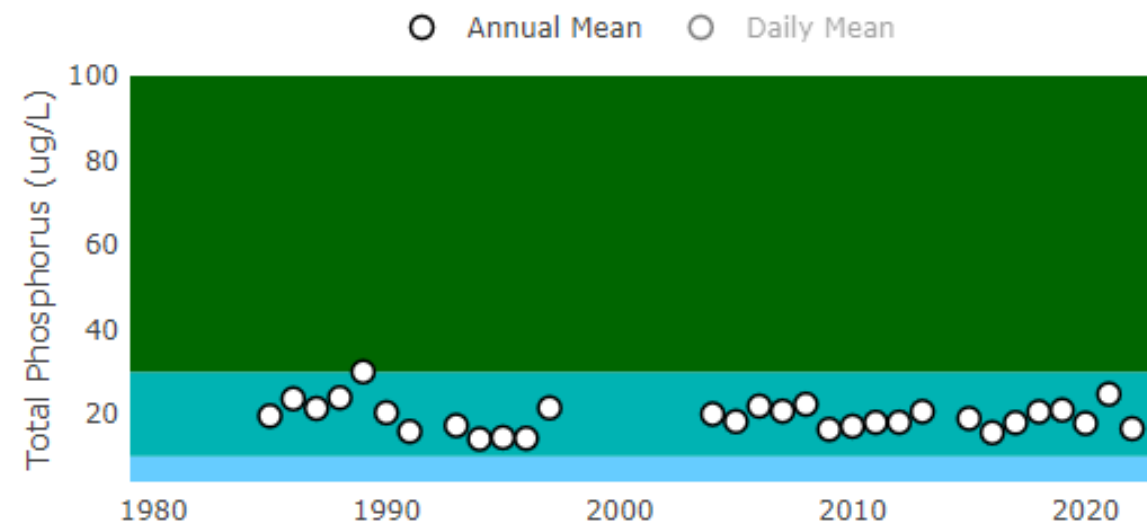
Spring Phosphorus

Trend: Stable (p-value = 1)



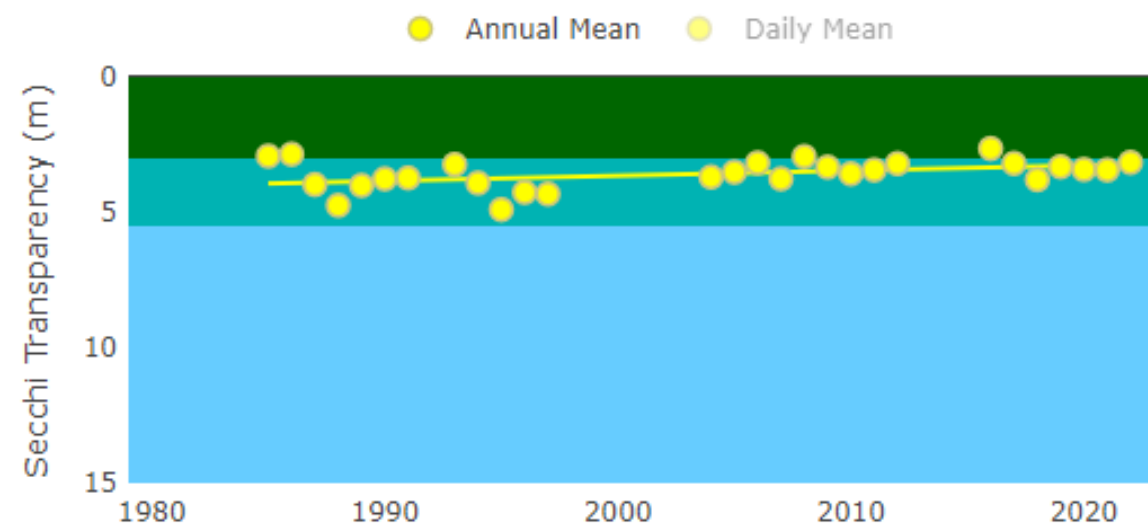
Summer Phosphorus

Trend: Stable (p-value = 0.4548)



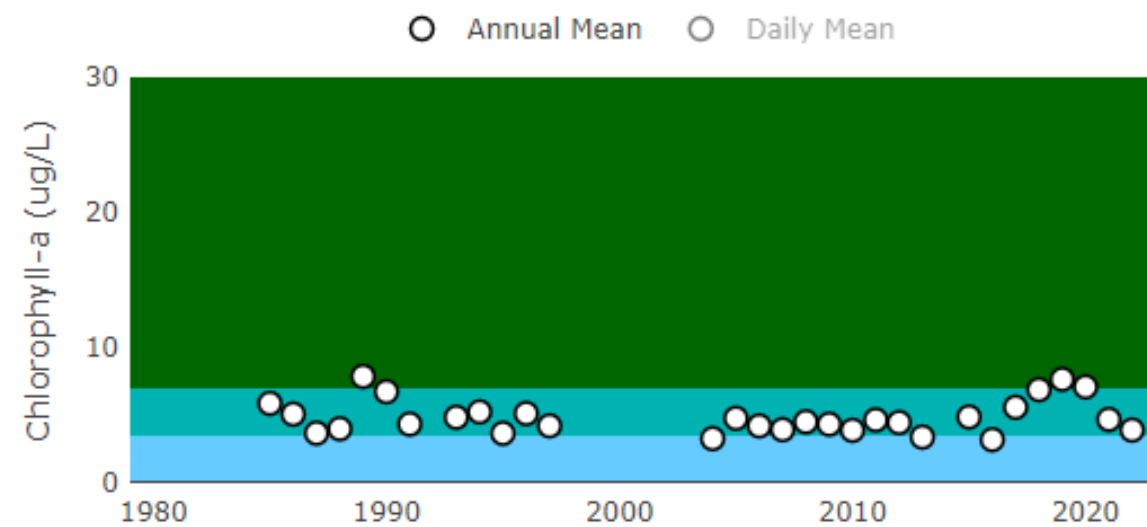
Summer Secchi

Trend: Significantly Decreasing (p-value = 0.0257)

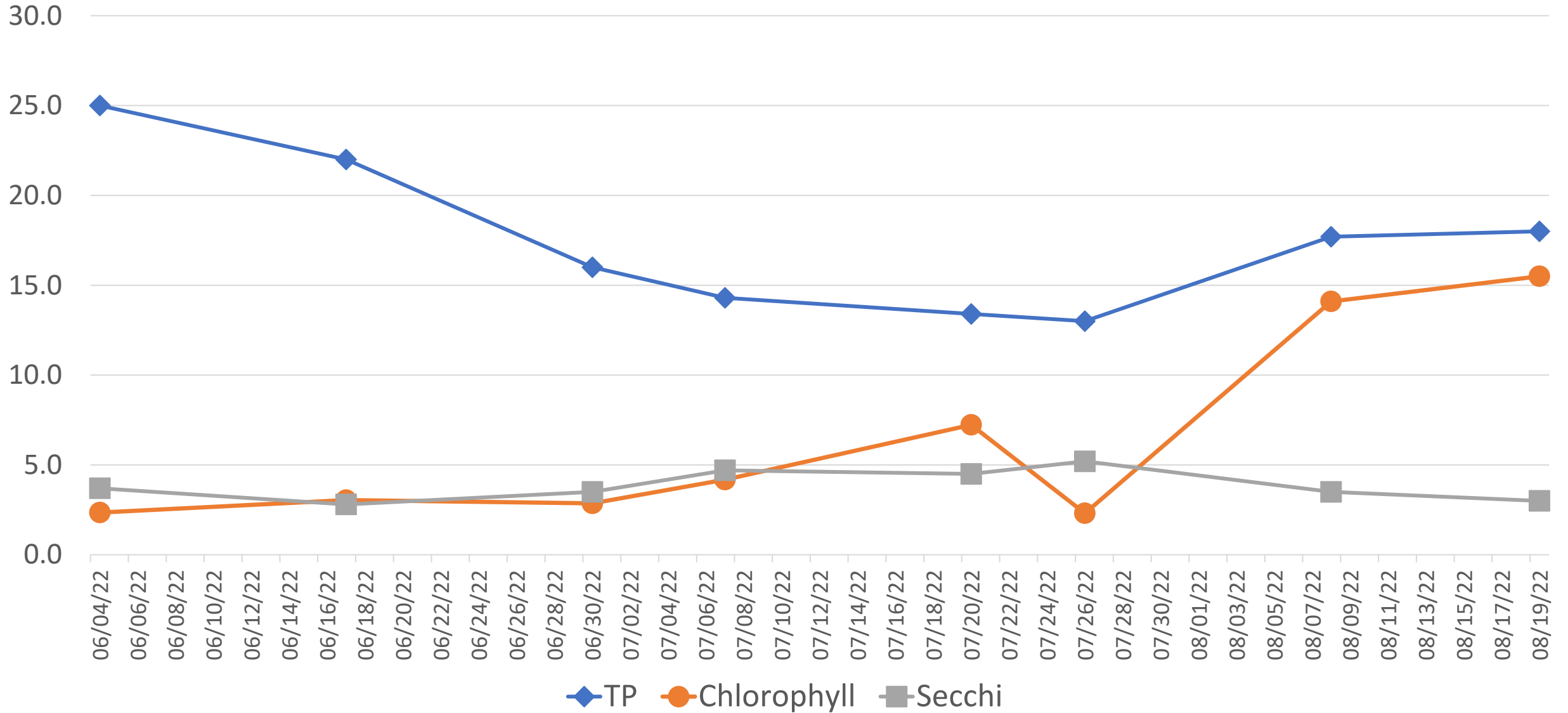


Summer Chlorophyll-a

Trend: Stable (p-value = 0.9834)



Memphremagog Main Lake LMP Data 2022

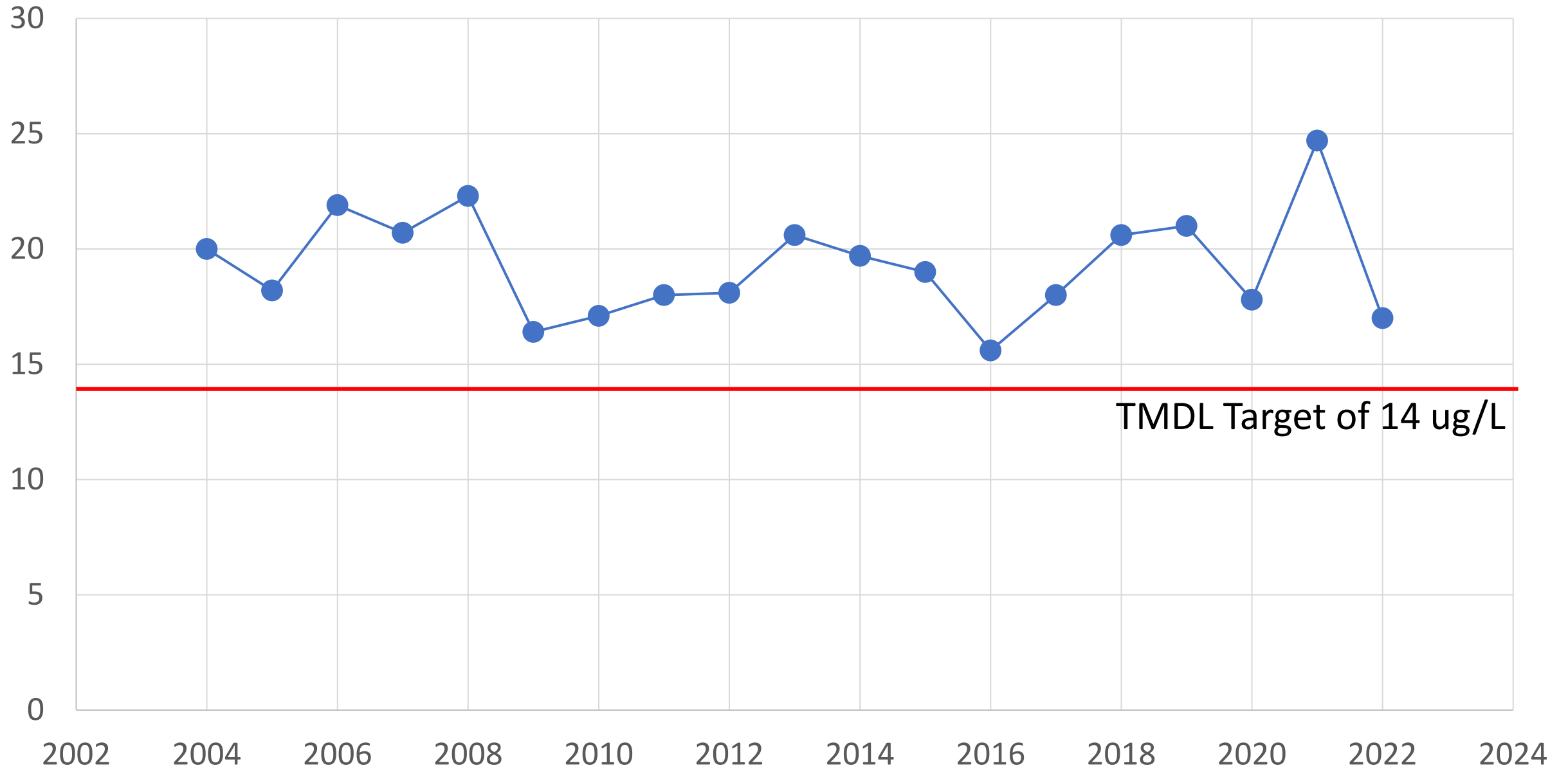


Mean TP: 16.6 ug/L

Mean Chl A: 3.9 ug/L

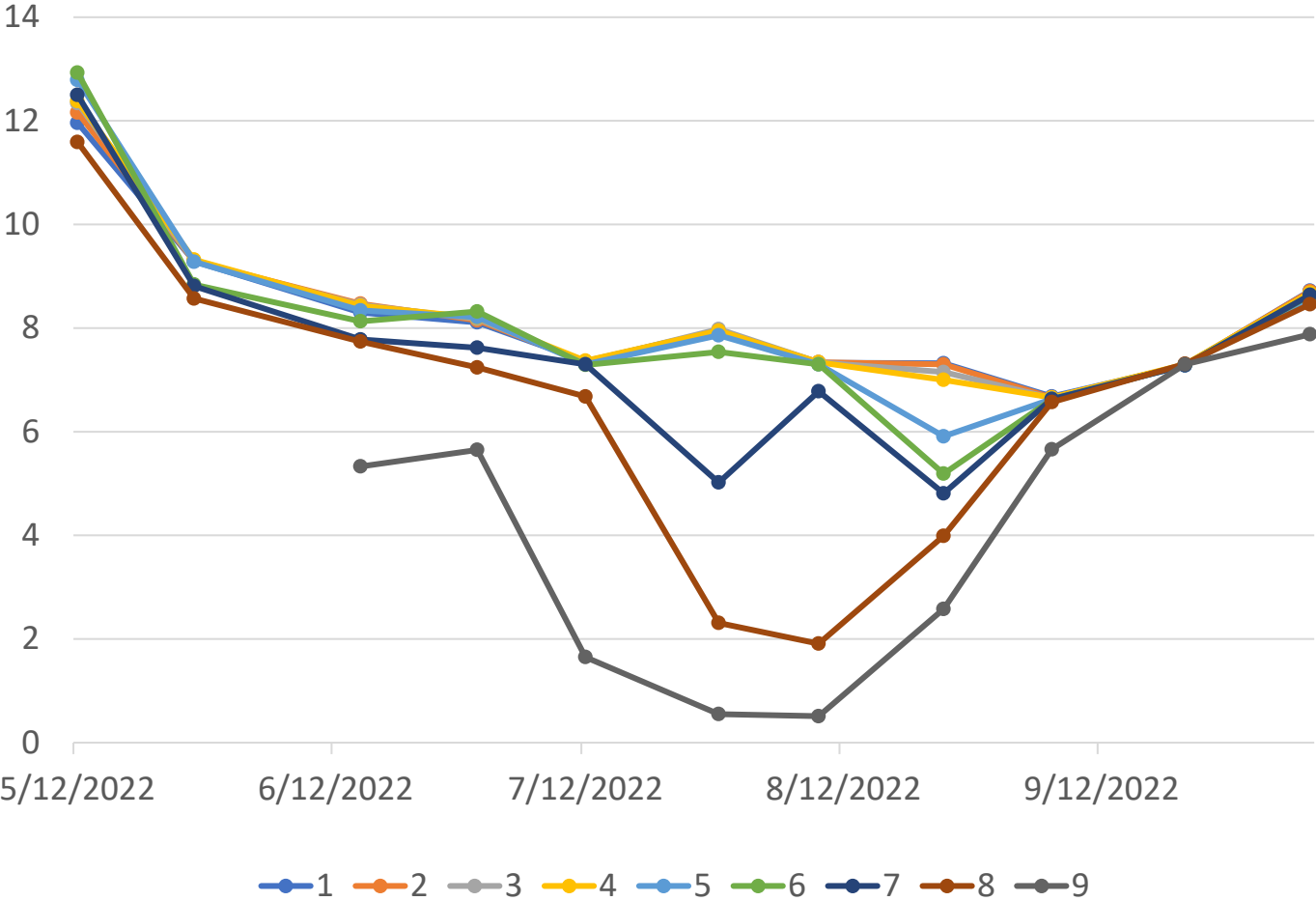
Mean Secchi: 3.2 m

Lake Memphremagog Total Phosphorus (ug/L) 2014-2022

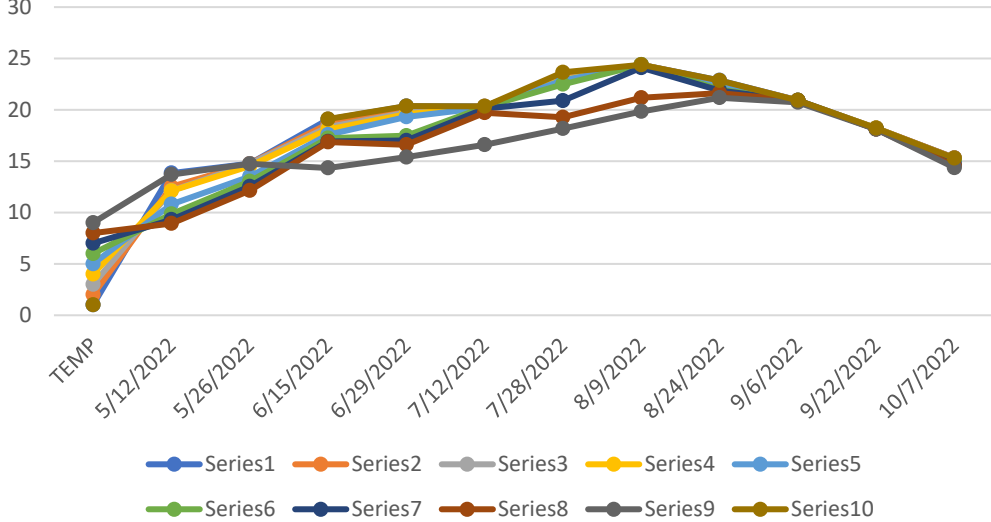


2022: Evidence of Lake Stratification in Dissolved Oxygen, Temperature Data

2022 Dissolved Oxygen Data at Station 4 (mg/L)



2022 Temperature Data at Station 4 - Celsius

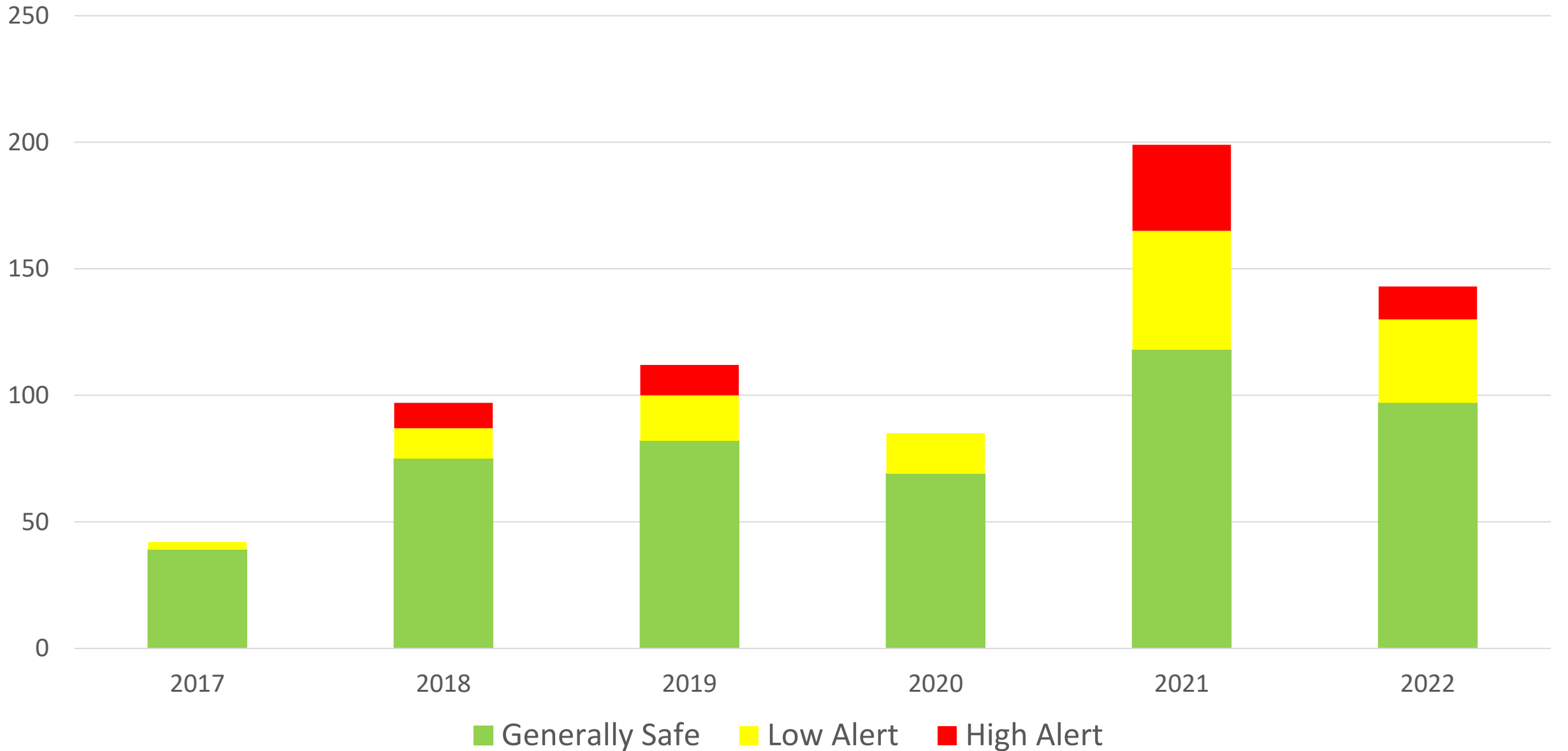


- Lake not as well mixed in 2022
- Anoxia likely leads to internal phosphorus loading
- Highest TP Values at 8M depth were when DO was low, 25 ug/L
- 2023: Sample DO in deeper Canadian waters

682.97 ft - May 09, 2023 12:15:00 AM EDT



Reported Cyanobacteria Blooms on Memphremagog 2022



Summary of Data Observations for Lake in 2022

Main Lake:

- Trend from 1984 to Present: TP, Secchi, and Chl-A are all relatively stable
- US Lake stratified! Evidence of Anoxia and potential internal phosphorus loading
 - Significant as not contemplated in TMDL, may make achieving targets more difficult
- 2022 mean TP back down to 16.6 ug/L, after all-time high value of 23 ug/L in 2020
 - TMDL Target of 14 ug/L
 - Wetter Summer in '22, higher lake levels
- Lower number of High Alert Cyanobacteria Blooms reported (13 compared to 34 in '21)

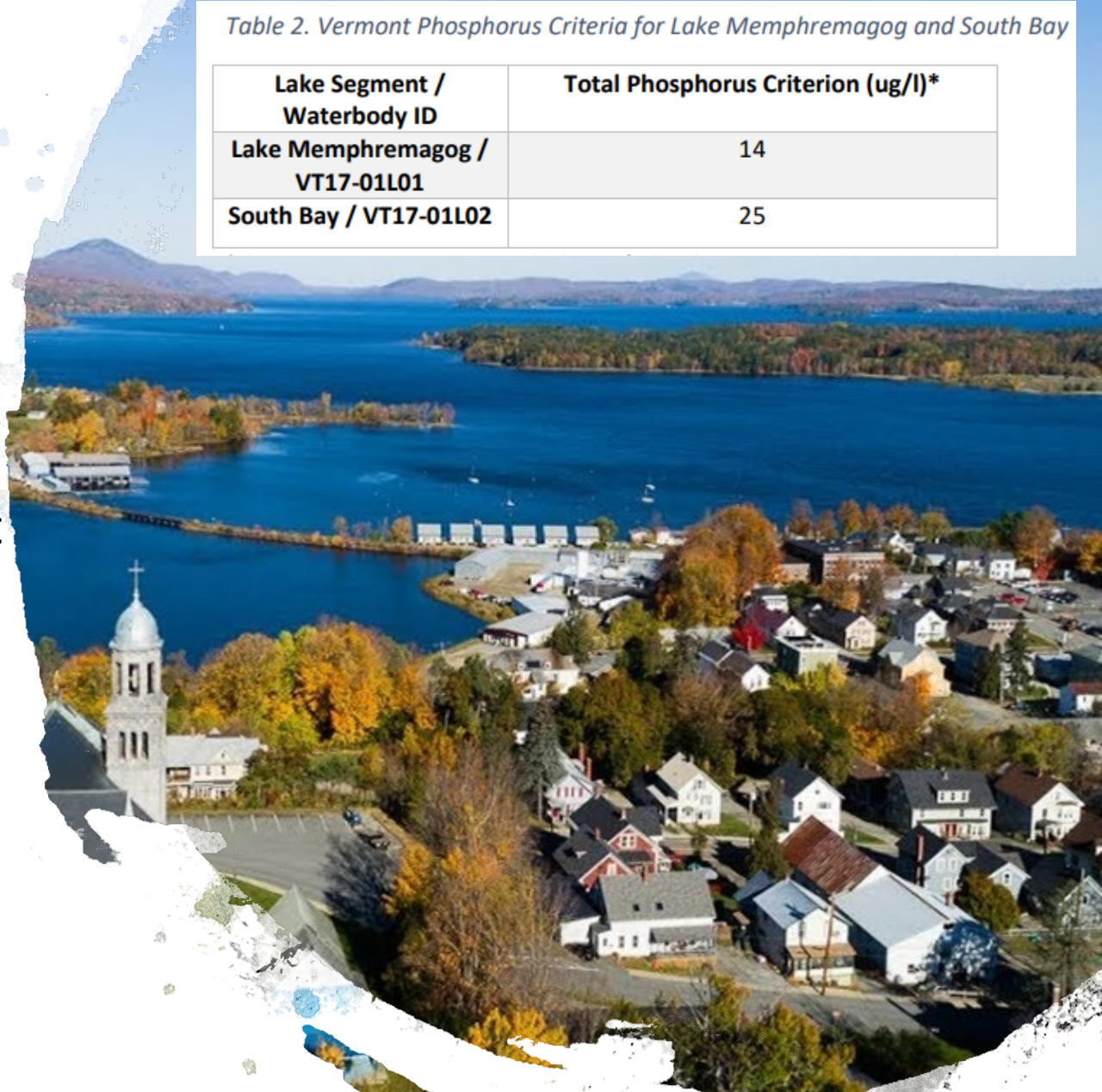
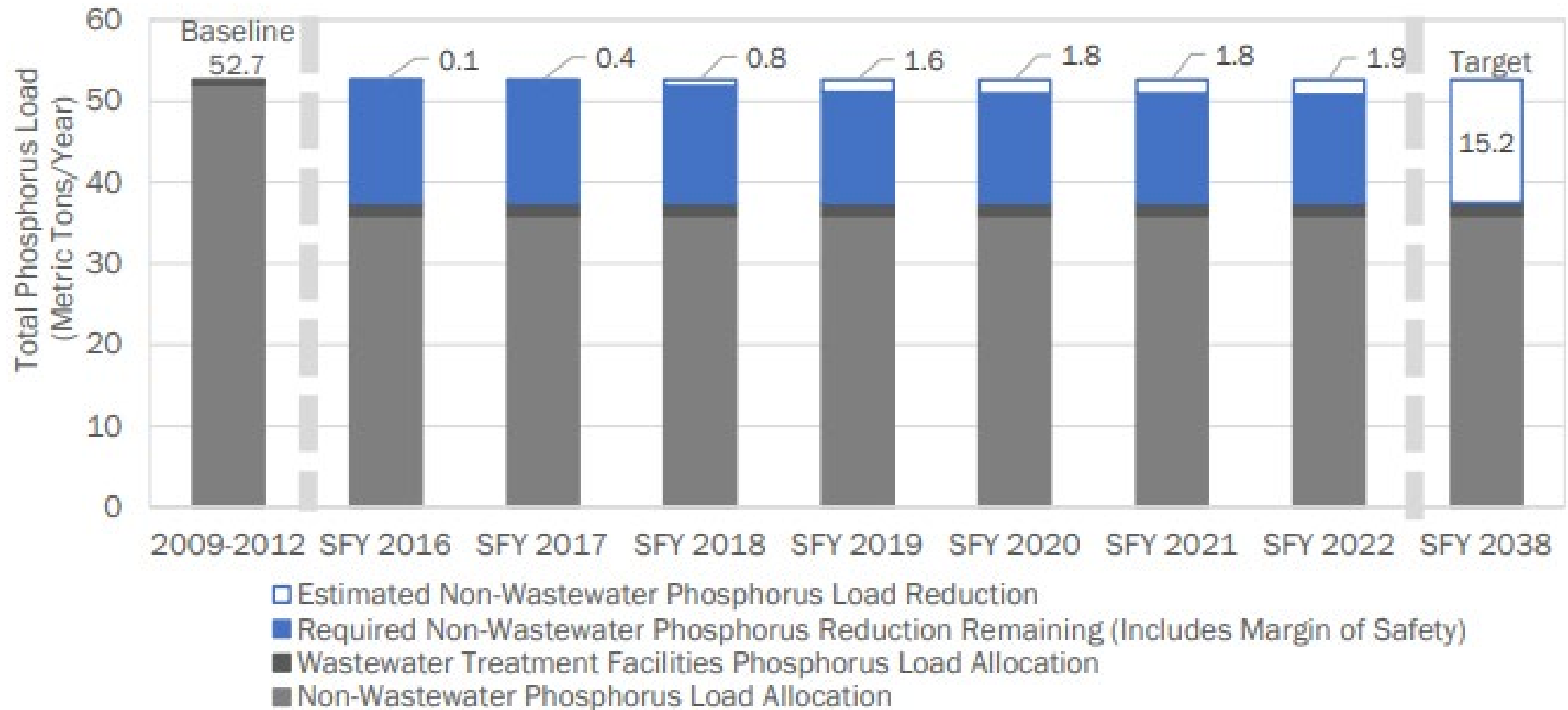


Table 2. Vermont Phosphorus Criteria for Lake Memphremagog and South Bay

Lake Segment / Waterbody ID	Total Phosphorus Criterion (ug/l)*
Lake Memphremagog / VT17-01L01	14
South Bay / VT17-01L02	25



- State, federal, and regulatory clean water programs are estimated to have reduced 1.9 metric tons of phosphorus loading through SFY 2022, which represents 13% of required reduction
- P reductions will increase as we ramp up, account for P reduction progress from all projects

Future In-Lake Monitoring Efforts

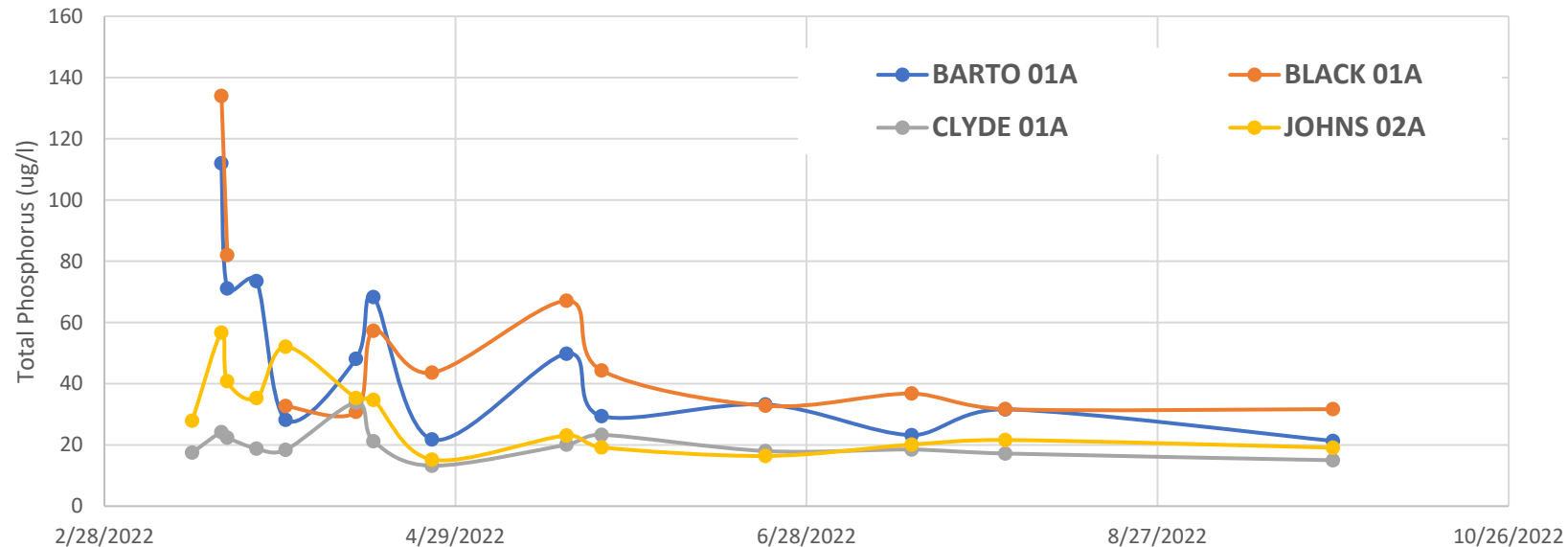
- Lay Monitoring in Main Lake & South Bay
- Continue TMDL Monitoring Visits
- Train additional Cyanobacteria Monitors and VT Invasive Patrollers (see our [website](#) for more info)
- Seek funding for a high-frequency monitoring buoy in US waters, to contribute to the data collection effort led by the Observatoire in Quebec
- Sample DO in Canadian Waters to assess internal phosphorus loading



Tributary monitoring

- Black, Barton, Clyde and Johns Rivers
- 15 dates sampled in 2022 by OCNRCD
- 2-3 more sample dates likely depending on rain events- freezing conditions
- Will review data this winter though the WRTDS program again
- Continued LaRosa volunteer monitoring to evaluate BMP's at farms

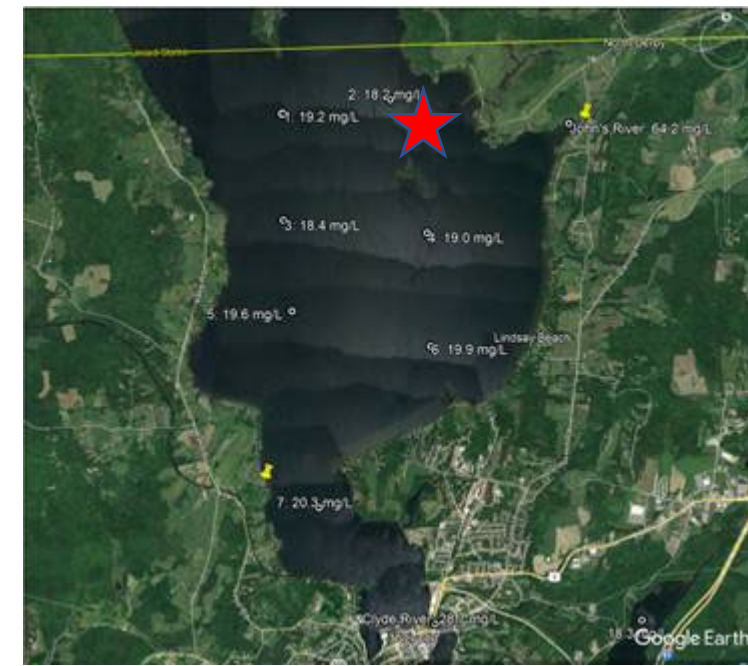
Preliminary phosphorus concentrations in 2022



Aquatic Invasive Species Program

Memphremagog Zebra Mussel Surveys

- Analysis of the plankton net tow samples in US waters for Zebra mussel (*Dreissena polymorpha*) from 2022 found low densities of veligers in 3 of 9 samples from late July & August
- Environmental DNA Samples were collected June 30 at the locations of two reported Zebra Mussel infestations
- Samples were collected from the expected low concentration locations first and progressed to the final sample sites at the mapped infestation sites.
- Generally, higher concentrations were found near the reported infestations, but high concentrations in all samples, including MM62-0, (over a mile from the target site, suggests that the Zebra Mussels are present at additional locations and/or at large populations
- Water temperatures in the lake were 21-23.5 °C
- Conclusion: Likely ZM are in Vermont waters, we just don't know where yet.



Aquatic Invasive Plants and Other Species

- DEC secured funding to support an AIS decontamination unit at a boat launch; unit ordered, delivery end May
- Unit will be part of greeter program expansion to Whipple Point w/ Newport Town & MWA
- In 2022, DEC developed a Vermont Invasive Patroller for Animals Program, and presented on-line workshops and an in-person training in Newport
- **What about starry stonewort? *Chara à été***
 - **Lake Derby / Scott's Cove: decreasing in population & infestation level since 2017 (now in one shallow bay)**
 - **Milfoil Infestation in Lake Salem (Derby) has worsened**
 - **SLPA seeking DEC approval to use herbicide**



Vermont
Invasive
Patrollers
for
Animals





Merci pour votre attention!