Lake Memphremagog

Lake & Tributary Water Quality Trends & Aquatic Invasive Species Update

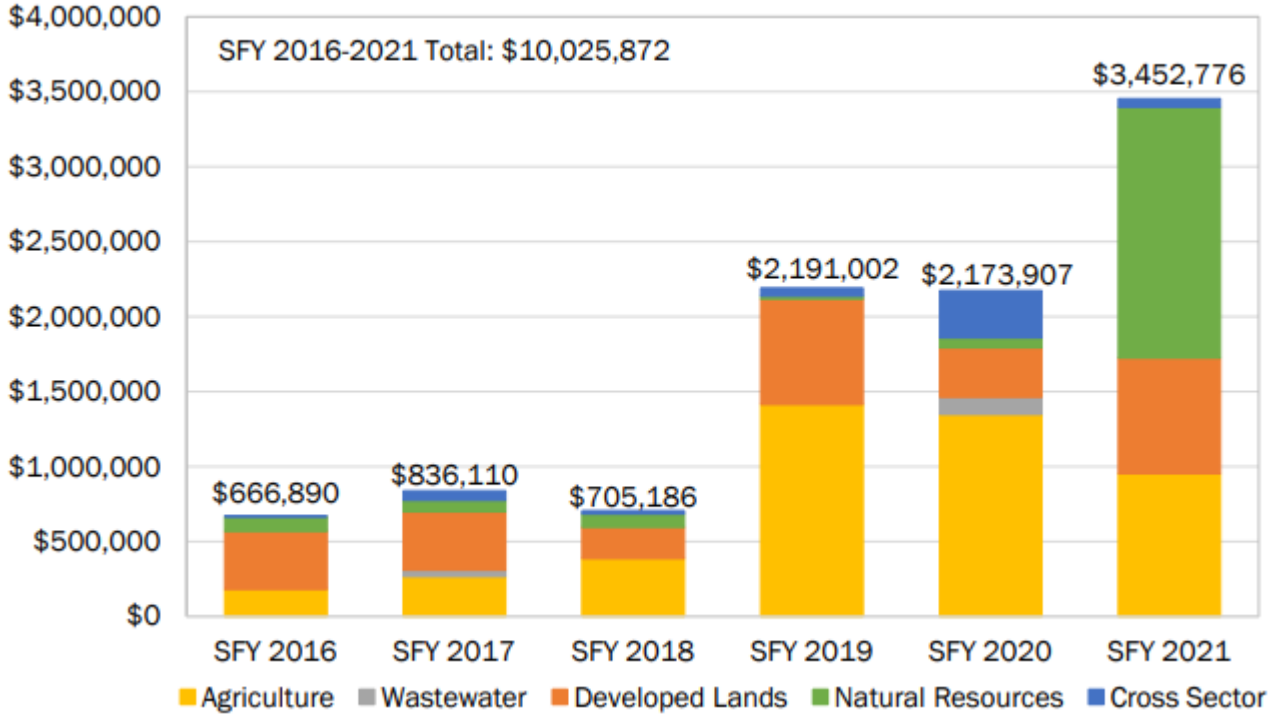
February 14, 2022

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
LAKES & PONDS PROGRAM

Lake Memphremagog Water Quality Background

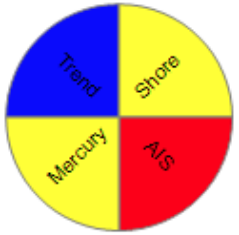
- Lake Memphremagog is an international waterbody with over 73% of its surface area in Quebec, while 27% is in Vermont (watershed is inverse)
- VT portion of the Lake does not meet applicable water quality standards
  - VT only section of Lake is impaired; September 2017 TMDL to restore lake

- Federal & state agencies invested $10 million in clean water projects in the Memphremagog Basin from 2016-2021
- Reduced phosphorus load to lake by ***estimated*** 1.8 metric tons, 12% of required TMDL reduction



MEMPHREMAGOG - data through 2020

Learn How Lakes Are Scored



Lake Area:
5929.3 acres

Basin Lake Area Ratio:
70

Max Depth:
107 meters

Mean Spring TP:
18.4 ug/L

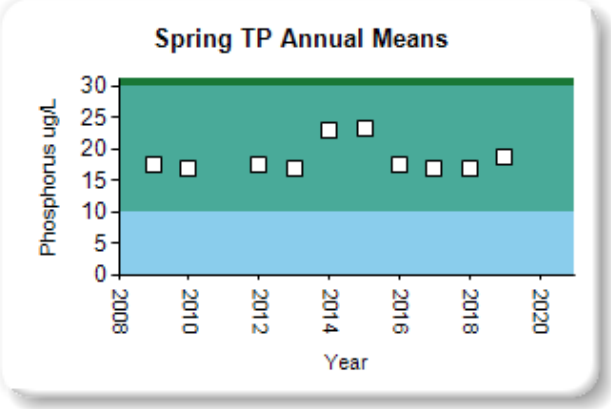
Mean Summer TP:
19.2 ug/L

Mean Summer Chla:
4.8 ug/L

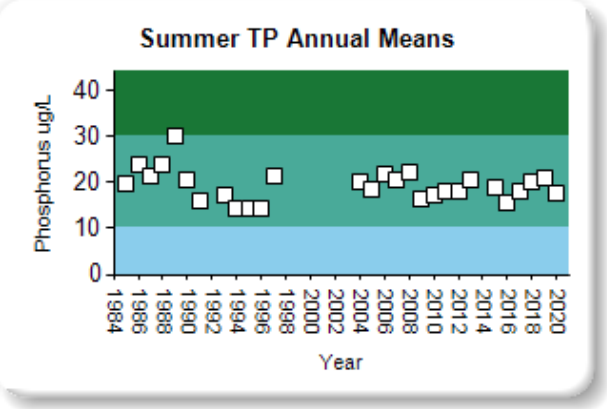
Mean Summer Secchi:
3.6 meters

Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic

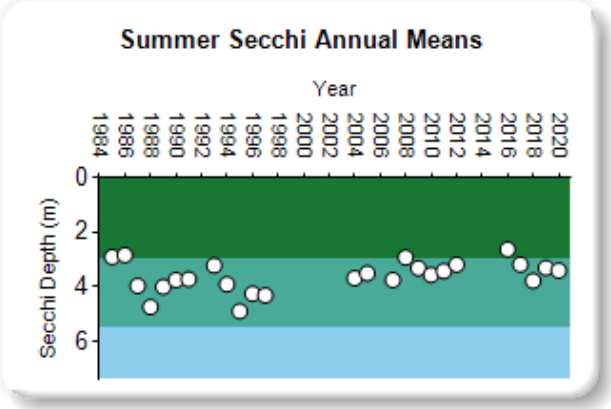
Spring TP Trend: p = 0.59 | CV = 13
Stable



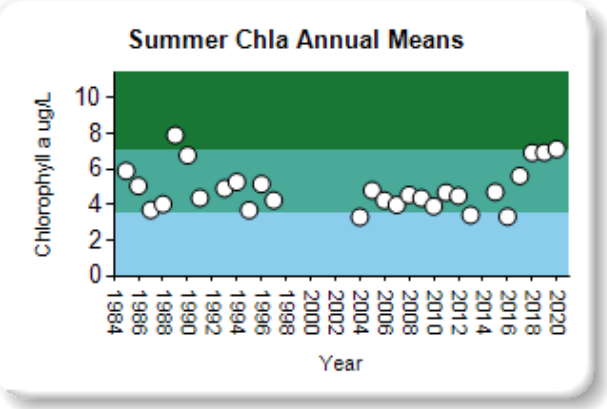
Summer TP Trend: p = 0.1885 | CV = 19
Stable



Summer Secchi Trend: p = 0.0522 | CV = 16
Stable



Summer Chla Trend: p = 0.9648 | CV = 26
Stable

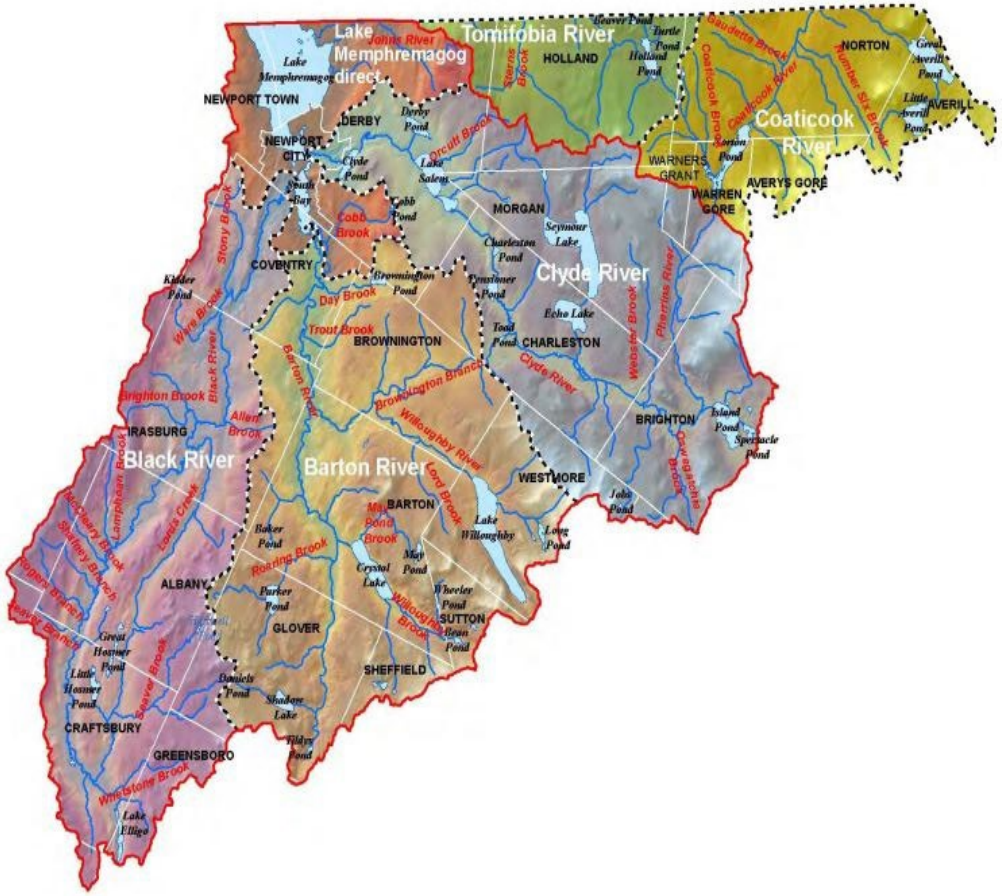


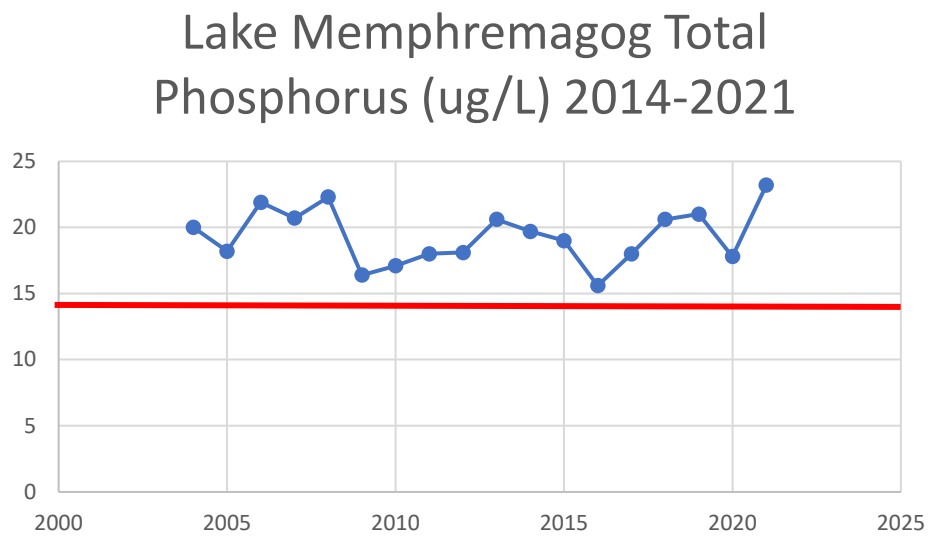
Stresses / Impairments
Impaired -- Phosphorus
Altered -- flow

Trend Score: Good

WQ Standards Status: Impaired

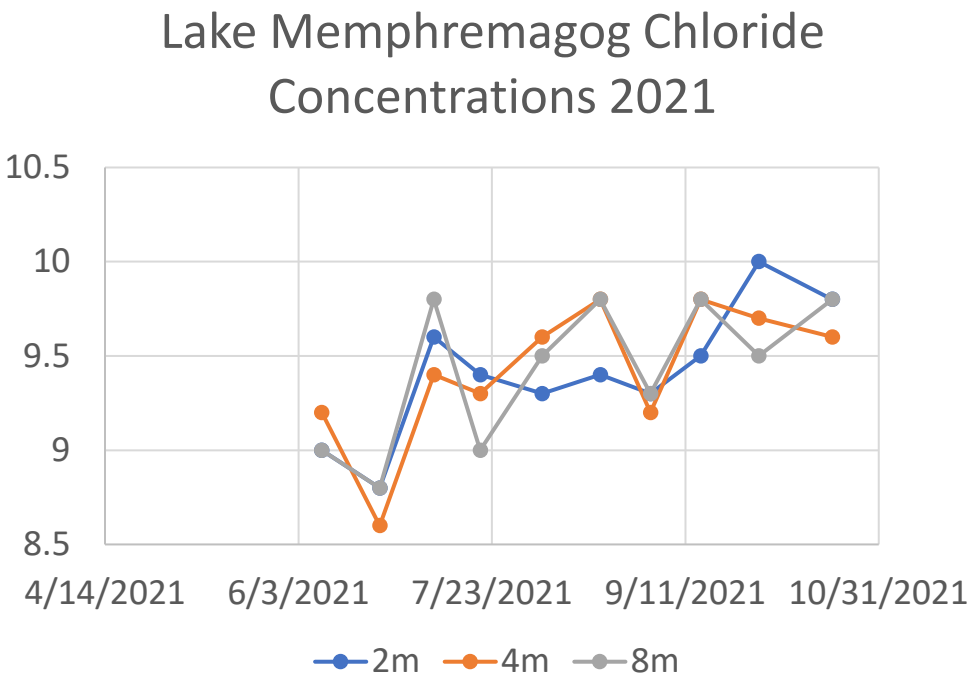
Watershed Score: Highly Disturbed





Average Total Phosphorus Concentration is 19.2 ug/L

- Stable trend, no significant increase or decrease
- TMDL Target for Main Lake is 14 ug/L
- Additional work, funding needed to meet TMDL
- Water clarity and chlorophyll A meet standards



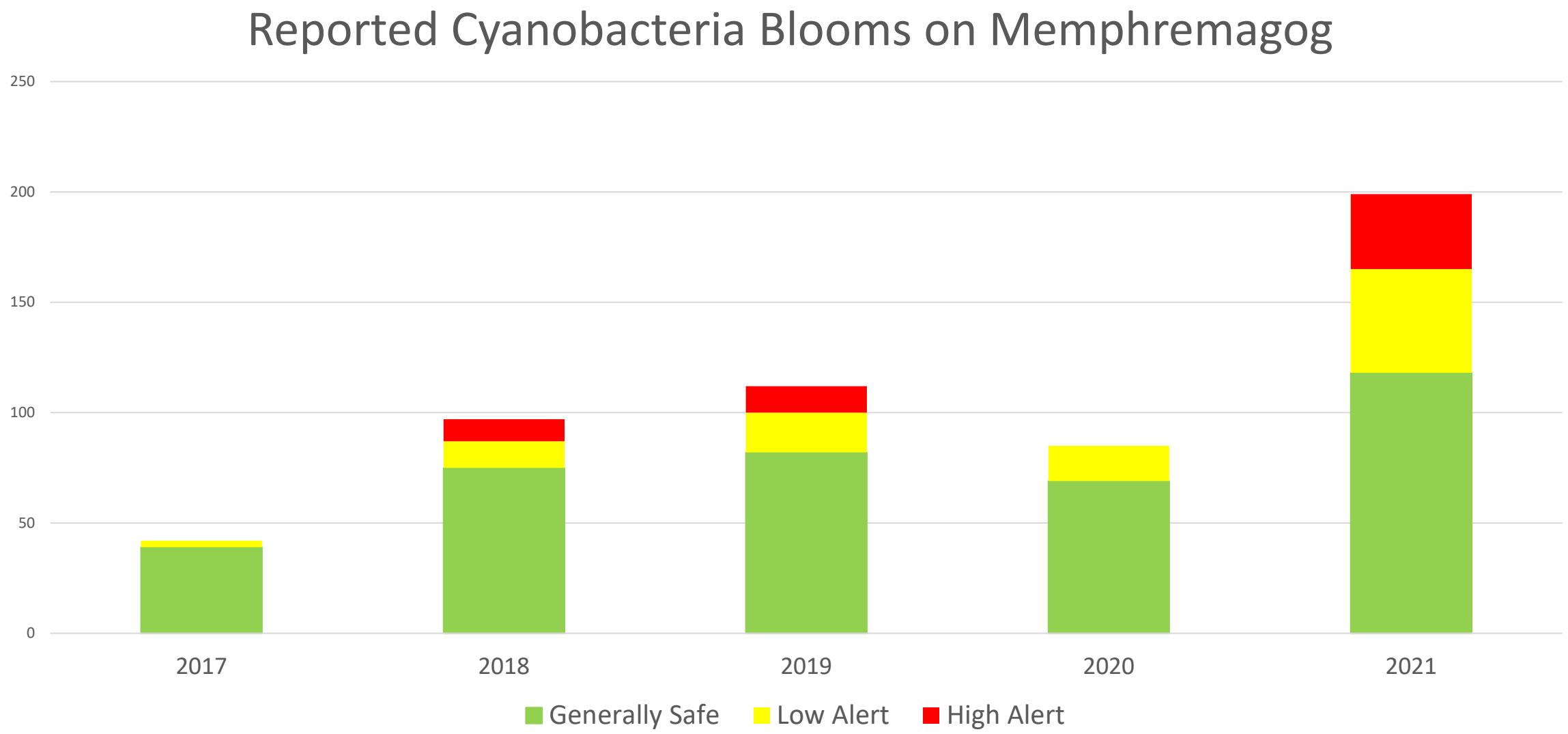
Chloride concentrations around 9.5 mg/L

- Well below upper limits in VT WQS
- Champlain values range from 6 to 40 mg/L but are mostly around 12-15 mg/L
- DEC is not overly concerned about Chloride

Surface Water & Effluent PFAS Results – 2021 Testing

- **Only (2) of the (36) PFAS** analyzed were detected above the Reporting Limits at the 10 sites sampled 3X
- **PFOS** was detected once at Main lake (Site 2) at a concentration of **2.22 ng/L**
- **PFBA** was detected above the Reporting Limit at (3) river sites
  - The concentrations of the (2) PFAS detected were extremely low, less than 1.0 ng/L (ppt) above the Reporting Limit
- **PFBA** values were low ranging from **1.84 ng/L to 2.74 ng/L** (not regulated in VT)

- **Effluent**: 10 PFAS detected above Reporting Limit at each sampling event
  - Sum of 5 Regulated PFAS remained close to 20 ppt (+/-) in the effluent
  - These are effluent values before mixing with the river, river affords a 5-fold dilution at Low Median Monthly flows



***Note**: 2021 saw an increase in the total number of observations, and all categories of reports, likely due to increases in number of trained volunteers and the number of blooms*

Major tributary sampling program (Black, Barton, Clyde and Johns Rivers)

- DEC collecting tributary samples for 2020 and 2021 to target BMPs, eventually estimate loading to lake
- We missed spring sampling in 2020 due to COVID so we can't compare 2020 data to other years
- This winter we hope to have enough data (200 samples + 10 years) to estimate loading to lake
- Highest TP concentrations come around spring snowmelt / runoff, rain events, suggests majority of external TP loading occurs between March and May
- BMPs should target particulate phosphorus, high flows

Aquatic Invasive Species Program

- Memphremagog poses a unique regional risk; located in two countries, three municipalities, has four fishing access areas
- Zebra mussels *(Dreissena polymorpha)* in Quebec, moving south, none yet in US waters, calcium levels are adequate
- Curly leaved pondweed *(Potamogeton crispus)* moving north
- Banded mystery snails (*Viviparus georgianus*) in southern lake
- Starry stonewort *(Nitellopsis obtusa)* has fluctuated each season for the past four years but appeared reduced in 2021
- A VT Public Access Greeter Program was stationed at the Newport Center with limited hours
- Clean, Drain, Dry Signage replaced at public boat launches; decon unit was removed due to maintenance issues
- FUNDING NEED: AIS Prevention in Lake Memphremagog

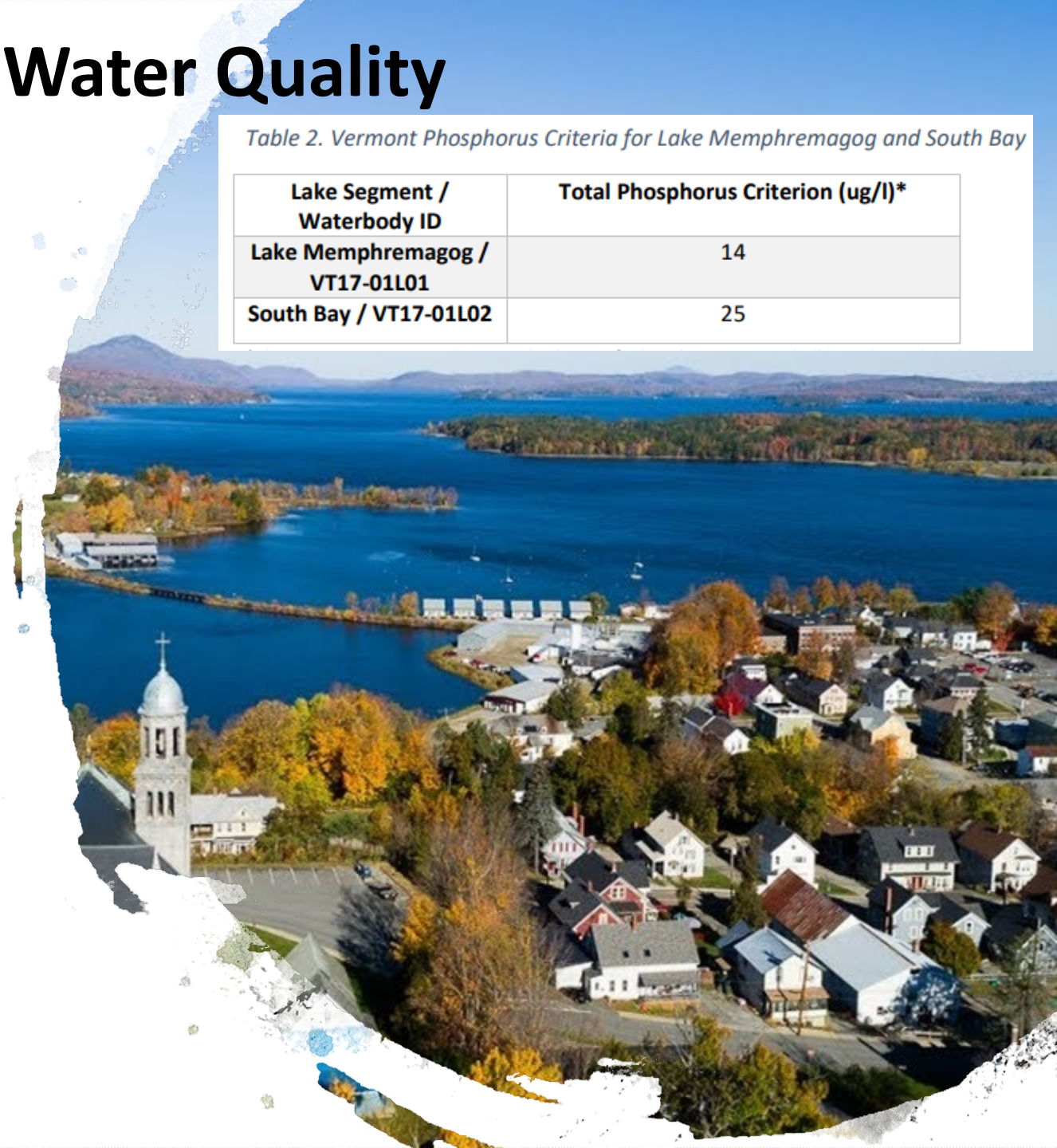
Summary of Memphremagog Water Quality

- Main Lake:
  - Trend from 1984 to Present: TP, Secchi, and Chl-A are all stable
  - Lake is well-mixed, no anoxia, no detected internal loading
  - 2021 LMP data had highest recorded mean TP concentration of 23 ug/L
  - 2021: Highest number of High Alert Cyanobacteria Blooms reported (34)

- South Bay:
  - No statistically significant trends 2021
  - Mean Summer TP at 22.6, meets TMDL Target of 25, slight increase since 2008

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



Concluding Points on Lake Memphremagog Crisis Designation

- Water Quality, AIS, & Cyanobacteria data show a lake that is impaired but with stable trends; a crisis designation is debatable
- Additional funding is needed for BMPs in lake watershed to achieve TMDL targets and for AIS prevention
- Lakes in crisis designation carries requirement to direct $50K or more from Clean Water Fund into lake specific fund, develop a crisis intervention plan
- However, those $50K are subject to 35% local cost share, can be challenging to program as a result
- CWSPs start up in SFY23, and it can be anticipated that more than $500K will be available to support nonregulatory work for CWSP in Memph (VHCB) with no local cost share (additive funds)

Merci pour votre attention!