2025 Volunteer Lake Assessment Program

Individual Report: Lake Waukewan, Winona Station – Meredith

Water Quality Summary: Lake quality is generally representative of oligotrophic, or high quality, conditions, with low levels of phosphorus and algal growth. Epilimnetic (upper water layer) phosphorus levels remain slightly elevated since 2019. Historical trend analysis indicates worsening (increasing) epilimnetic conductivity, stable levels of chlorophyll, epilimnetic pH, epilimnetic phosphorus and hypolimnetic (bottom water layer) phosphorus and improving (increasing) levels of water transparency since monitoring began. On average, Lake Waukewan Winona Station has similar or slightly higher (better) water quality compared to the median NH lake and doesn't exceed any NH water quality standards.

Recommended Actions: Hypolimnetic phosphorus levels continue to be elevated in late summer indicating potential release of phosphorus from bottom sediments under anoxic (no dissolved oxygen) conditions. The increased intensity of storm events and fluctuating climate conditions resulting in shorter periods of ice cover, warmer water temperatures and longer periods of thermal stratification can impact pond quality over time and accelerate the eutrophication process. Spring tributary sampling continues to indicate elevated nutrient levels following spring snowmelt and runoff. Work to clean up roadside ditches and culverts of any leftover sand/salt mixtures applied to roads during winter months. Continue watershed management efforts to reduce nutrient loads and stormwater runoff. Continue efforts to monitor water quality in spring, fall and winter to better understand nutrient dynamics and effects on cyanobacteria growth. Keep up the great work and thank you for your continued participation in VLAP!

Historical Water Quality Trend Analysis

Table 1. Historical Water Quality Trends for Lake Waukewan, Winona Station – Meredith

Parameter	Trend
Conductivity (Epilimnion)	Worsening
Chlorophyll-a (Composite)	Stable
pH (Epilimnion)	Stable
Transparency	Improving
Phosphorus (Epilimnion)	Stable
Phosphorus (Hypolimnion)	Stable

Historical Water Quality Graphics - Deep Spot

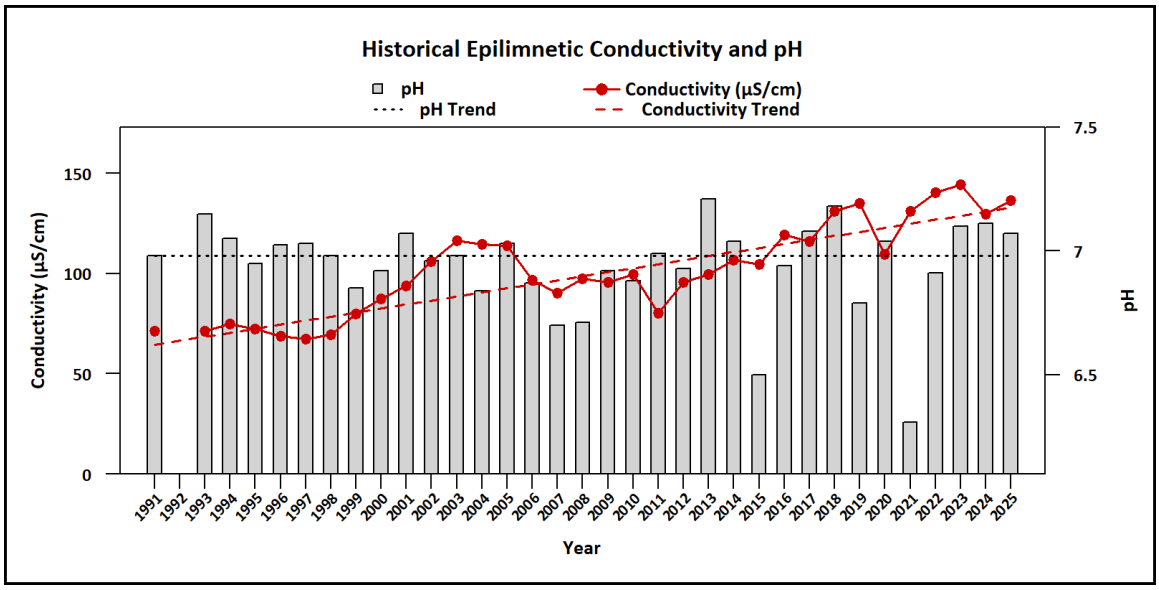

Figure 1. Median epilimnetic pH (red points) and conductivity (gray bars) by year, with corresponding trend lines shown as red and black dashed lines, respectively. Epilimnetic pH is stable and conductivity is worsening since monitoring began.

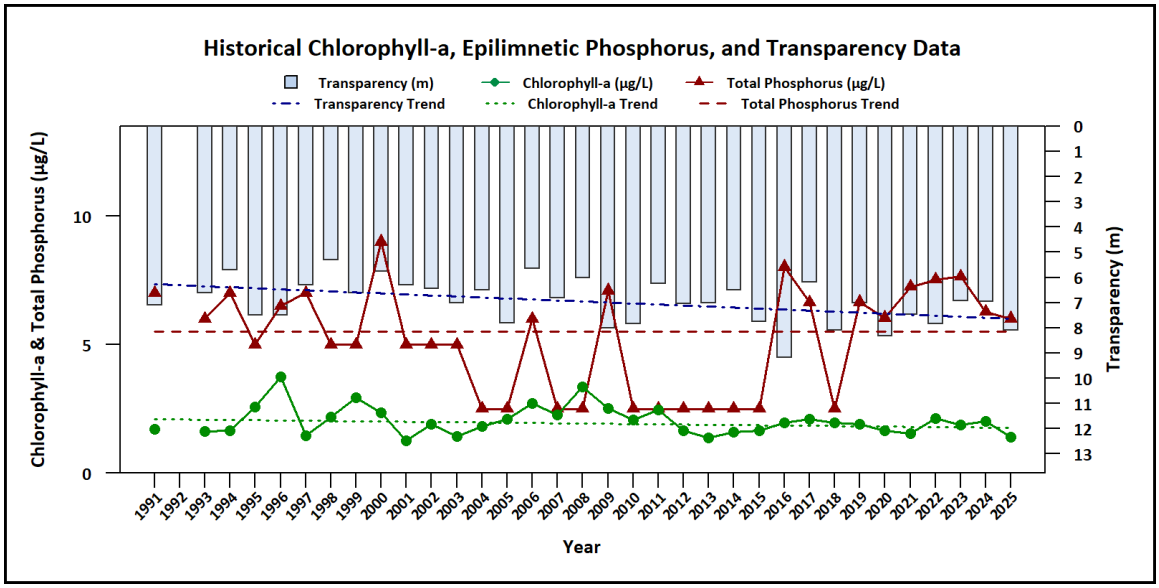

Figure 2. Median Secchi disk transparency (blue bars), epilimnetic phosphorus (red triangles), and chlorophyll-a (green points) by year, with corresponding trend lines shown as blue, red, and green dashed lines, respectively. Water transparency is improving, phosphorus is stable, and chlorophyll-a is stable since monitoring began.

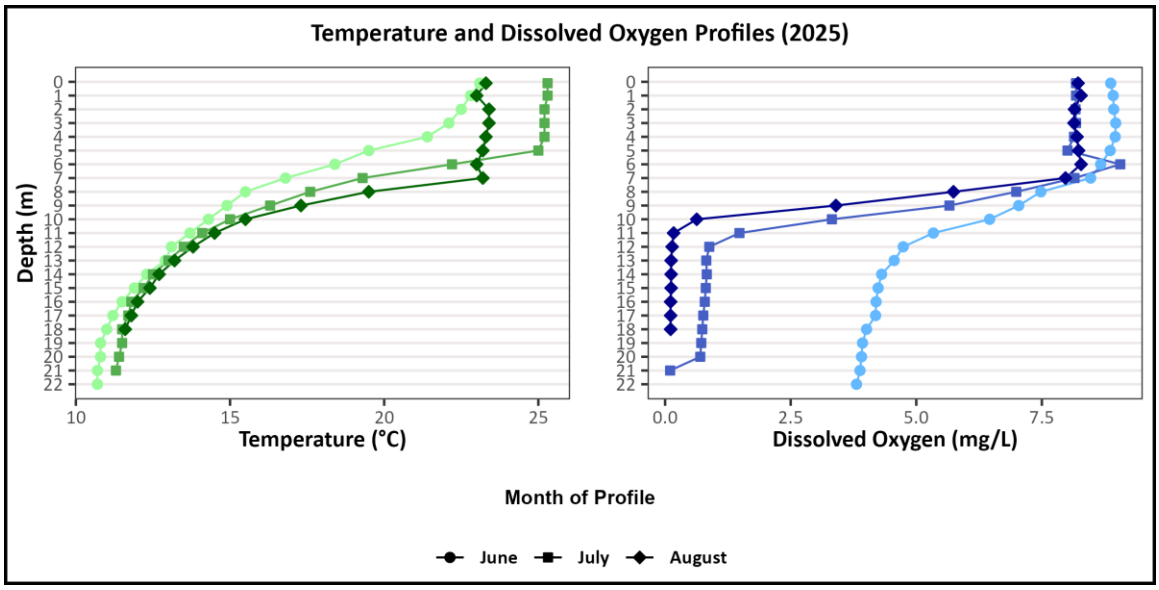

Figure 3. 2025 vertical profiles of temperature (°C; green points, left plot) and dissolved oxygen (mg/L; blue points, right plot) plotted against depth (m). Profile month is indicated by point shape and color intensity, with lighter shades representing earlier-season samples and darker shades representing later-season samples.

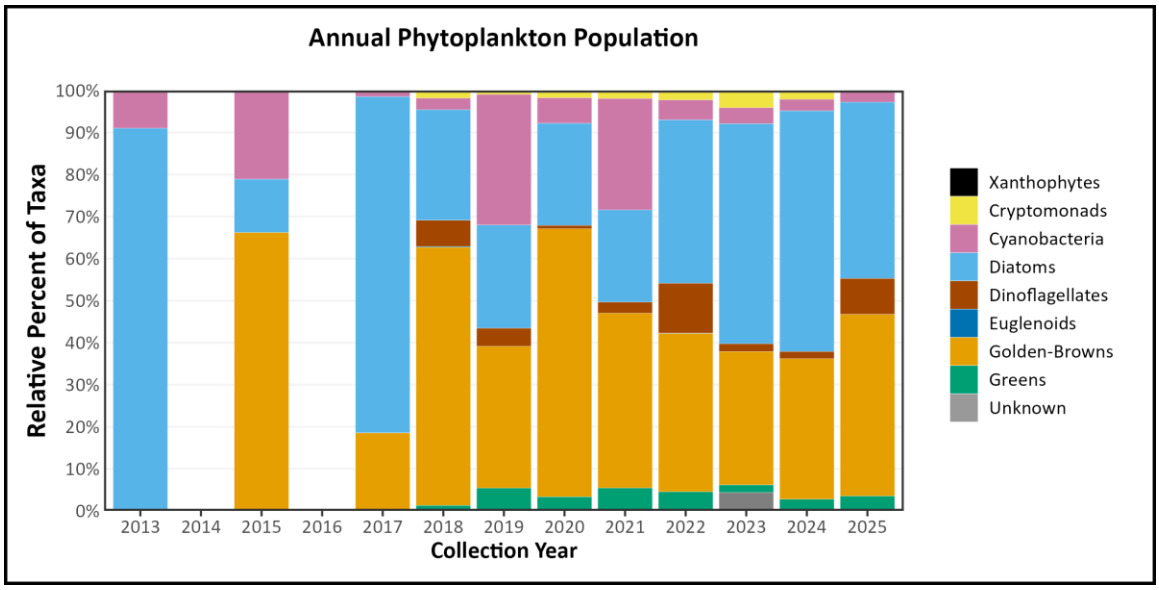

Figure 4. Phytoplankton community composition over time, expressed as relative abundance of major taxonomic groups.

Table 2. 2025 Average Water Quality Data for Lake Waukewan, Winona Station – Meredith

Station	Alk. (mg/L)	Chlor-a (µg/L)	Chloride (mg/L)	Color (pcu)	Cond. (µS/cm)	Total P (µg/L)	Trans. NVS (m)	Trans. VS (m)	Turb. (ntu)	pH
Epilimnion	8.57	1.36	28.8	16	134.53	5.00	7.78	8.03	0.53	7.07
Metalimnion	No Value	No Value	No Value	No Value	132.47	9.51	No Value	No Value	0.56	6.77
Hypolimnion	No Value	No Value	No Value	No Value	137.27	12.69	No Value	No Value	1.35	6.35

Station	Alk. (mg/L)	Chlor-a (µg/L)	Chloride (mg/L)	Color (pcu)	Cond. (µS/cm)	Total P (µg/L)	Trans. NVS (m)	Trans. VS (m)	Turb. (ntu)	pH
Boat Launch	No Value	No Value	311	No Value	1,121.00	15.70	No Value	No Value	2.04	6.57
Monkey Pond Culvert	No Value	No Value	106	No Value	417.70	10.90	No Value	No Value	0.88	6.89
Outlet	No Value	No Value	28.7	No Value	137.67	7.26	No Value	No Value	0.74	7.03
Reservoir Brook	No Value	No Value	107	No Value	410.60	10.60	No Value	No Value	0.64	7.01

Observations *(Refer to Table 2 and Historical Deep Spot Data Graphics)*:

- **Chlorophyll-a (Chlor-a):** Chlorophyll levels were low in June and increased slightly as the summer progressed. The median chlorophyll level decreased from 2024 and was less than the state median and the threshold for oligotrophic lakes. Historical trend analysis indicates relatively stable chlorophyll levels since monitoring began.
- **Conductivity (Cond.)/Chloride:** All stations' conductivity and/or chloride levels remained slightly elevated and greater than the state median. Historical trend analysis indicates significantly worsening (increasing) epilimnetic conductivity levels since monitoring began. Boat Launch conductivity and chloride levels were greatly elevated and chloride levels exceeded the state chronic chloride standard.
- **Color**: Apparent color measured in the epilimnion indicates the water was clear with little to no tea, or brown, coloring.
- **Total Phosphorus (Total P):** Epilimnetic phosphorus levels fluctuated within a low range. The median epilimnetic phosphorus level decreased from 2024, though remains elevated since 2019 and was less than the state median and the threshold for oligotrophic lakes. Metalimnetic phosphorus levels fluctuated within a low range. Hypolimnetic phosphorus levels were elevated in August likely due to release of phosphorus from bottom sediments under anoxic conditions. Historical trend analysis indicates stable epilimnetic and hypolimnetic phosphorus levels since monitoring began. Boat Launch phosphorus level decreased from 2024 but was still slightly elevated. Monkey Pond Culvert, Outlet and Reservoir Brook phosphorus levels were slightly elevated.
- **Transparency (Trans.)**: Transparency measured without the viewscope (NVS) fluctuated within a high (good) range and was highest (best) in July and lowest (worse) in June. The median NVS transparency improved from 2024 and was much higher (better) than the state median. Viewscope (VS) transparency was higher than NVS transparency and a better measure of conditions.
- **Turbidity (Turb.):** Epilimnetic, Metalimnetic, Monkey Pond Culvert, Outlet and Reservoir Brook turbidity levels were within a low range. Hypolimnetic turbidity level was elevated in July and August indicating formation and accumulation of organic compounds under anoxic conditions. Monkey Pond Culvert and Boat Launch turbidity levels were elevated.
- **pH:** All stations, except Hypolimnion, experienced pH levels within the desirable range of 6.5-8.0 units. Historical trend analysis indicates stable, yet variable, epilimnetic pH levels since monitoring began. Hypolimnetic pH levels were slightly acidic and less than desirable.
- **Temperature/Dissolved Oxygen (DO) Profile:** The lake thermally stratified in June, July and August at the time of sampling. Epilimnetic water temperatures were approximately 25 °C, with DO concentrations around 7.5 mg/L. The

metalimnion (thermocline) began at approximately 6.0 m, where temperature declined rapidly. The lake remained oxygenated through the hypolimnion in June but DO declined rapidly in the metalimnion in July and August. By 11.0 m (the hypolimnion), temperatures stabilized at around 10 °C and DO concentrations dropped to 0.0 mg/L. Although the hypolimnion was well oxygenated in June, low oxygen conditions in July and August are likely contributing to elevated hypolimnetic phosphorus levels through internal phosphorus loading.

- **Phytoplankton Community:** Since 2016, the phytoplankton community has remained fairly stable and has been dominated by Golden-Brown algae and Diatoms. Cyanobacteria have appeared throughout the years and were abundant in 2015, 2019 and 2021. Continue collecting phytoplankton samples to track changes in cyanobacteria abundance.

How does your lake compare to New Hampshire lakes and water quality standards?

Table 3. New Hampshire Median Lake Water Quality Values. Median values generated from historic lake monitoring data.

Parameter	Median Value
Alkalinity	4.5 mg/L
Chlorophyll-a	4.39 µg/L
Chloride	5 mg/L
Conductivity	42.3 µS/cm
Total Phosphorus	11 µg/L
Transparency	3.3 m
pH	6.6

Table 4. New Hampshire Water Quality Standards. Numeric criteria for specific parameters. Water quality violation occurs if thresholds are exceeded.

Parameter	Threshold
Chloride	> 230 mg/L (chronic)
E. coli (beach)	> 88 cts/100 mL
E. coli (surface water)	> 406 cts/100 mL
pH	between 6.5-8.0 (unless naturally occurring)
Turbidity	> 10 NTU above natural