

Minnesota Lake ID: 81-0003
Area: 89 acres
Watershed Area: 189 acres
Ecoregion: Western Corn Belt Plain (WCBP)

Trophic State: Mesotrophic - Eutrophic
Maximum Depth: 33 feet
Mean Depth: 14.5 feet
Mixing Status: Dimictic



Figure 1. St. Olaf Lake Watershed land use

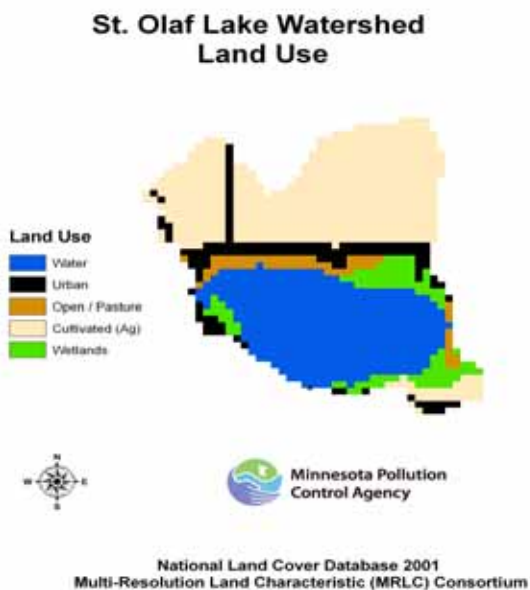


Figure 2. St. Olaf Lake bathymetric map

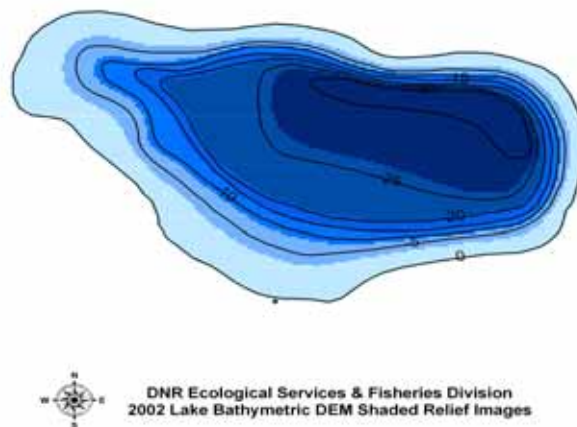


Table 1. Land use compositions

Land use	St. Olaf Lake land use percentage	WCBP typical land use percentage
Developed	10	0 – 16
Cultivated (Ag)	44	42 – 75
Pasture & Open	5	0 – 7
Forest	0	0 – 15
Water & Wetland	7	3-26
Feedlots (#)	0	

**Table 2. St. Olaf Lake 2008 as compared to typical range for WCBP ecoregion reference lakes
MPCA data based on 2008 sample collections**

Parameter	St. Olaf 2008	WCBP
Number of reference lakes		16
Total Phosphorus (µg/L)	45	65 – 150
Chlorophyll mean (µg/L)	25	30 – 80
Secchi Disk (feet) (meters)	1.0	1.6 – 3.3
Total Kjeldahl Nitrogen (mg/L)	1.3	1.3 – 2.7
Alkalinity (mg/L)	136	125 – 165
Color (Pt-Co U)	8.3	15 – 25
pH (SU)	7.9	8.2 – 9.0
Chloride (mg/L)	20.5	13- – 22
Total Suspended Solids (mg/L)	5.8	7 – 18
Total Suspended Inorganic Solids (mg/L)	2.2	3 – 9
Conductivity (umhos/cm)	337	300 – 650
TN:TP ratio	16:1	17:1 – 27:1

µg/L = micrograms per liter	Pt-Co-U = Platinum Cobalt Units
mg/L = milligrams per liter	SU = Standard Units
umhos/cm = micromhos per centimeter	

Figure 3. St. Olaf Lake 2008 temperature profiles

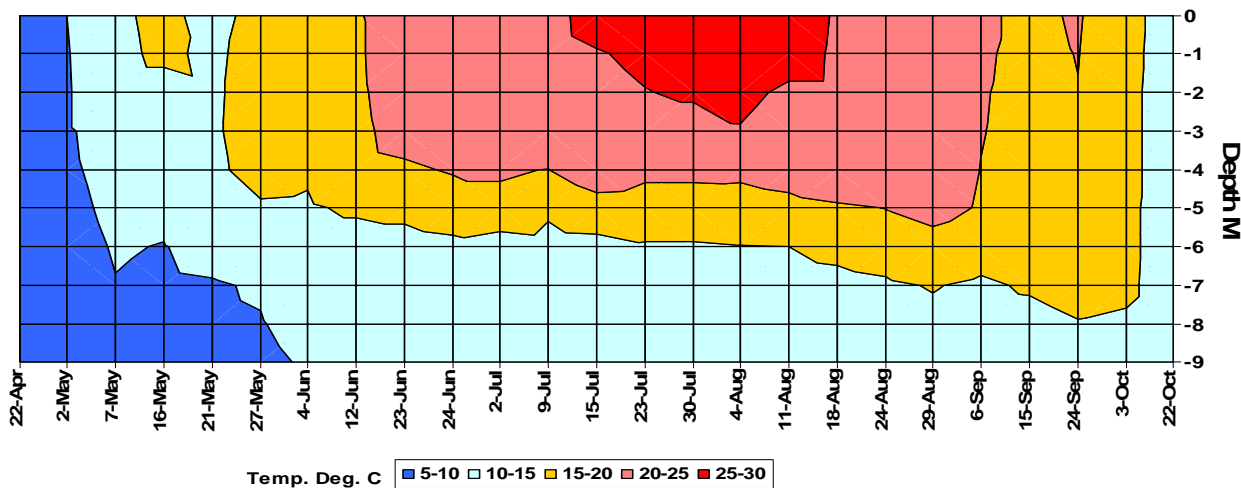


Figure 4. St. Olaf dissolved oxygen (DO) profiles

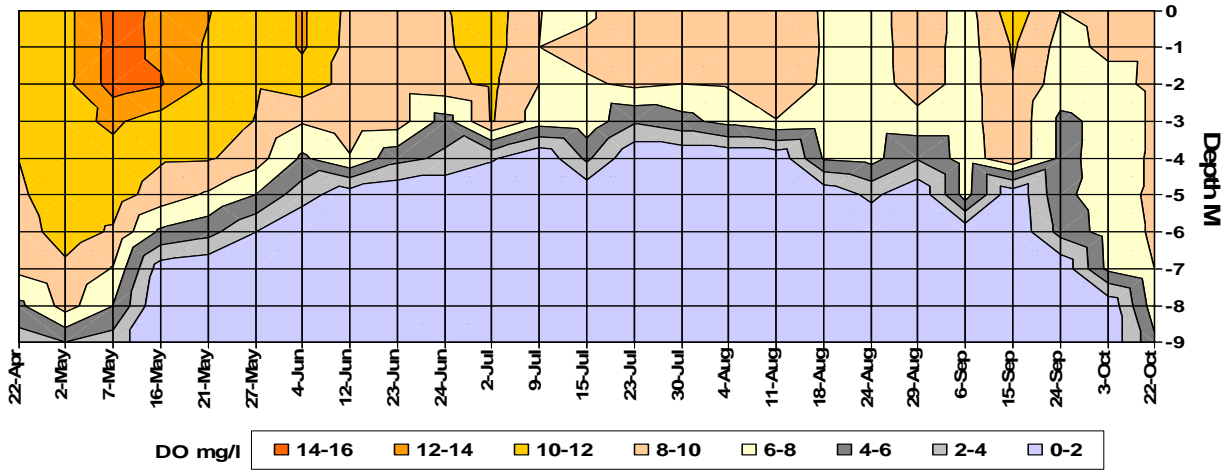


Figure 5. St. Olaf summer 2008 total phosphorus (TP), chlorophyll-a (Chl-a), and secchi

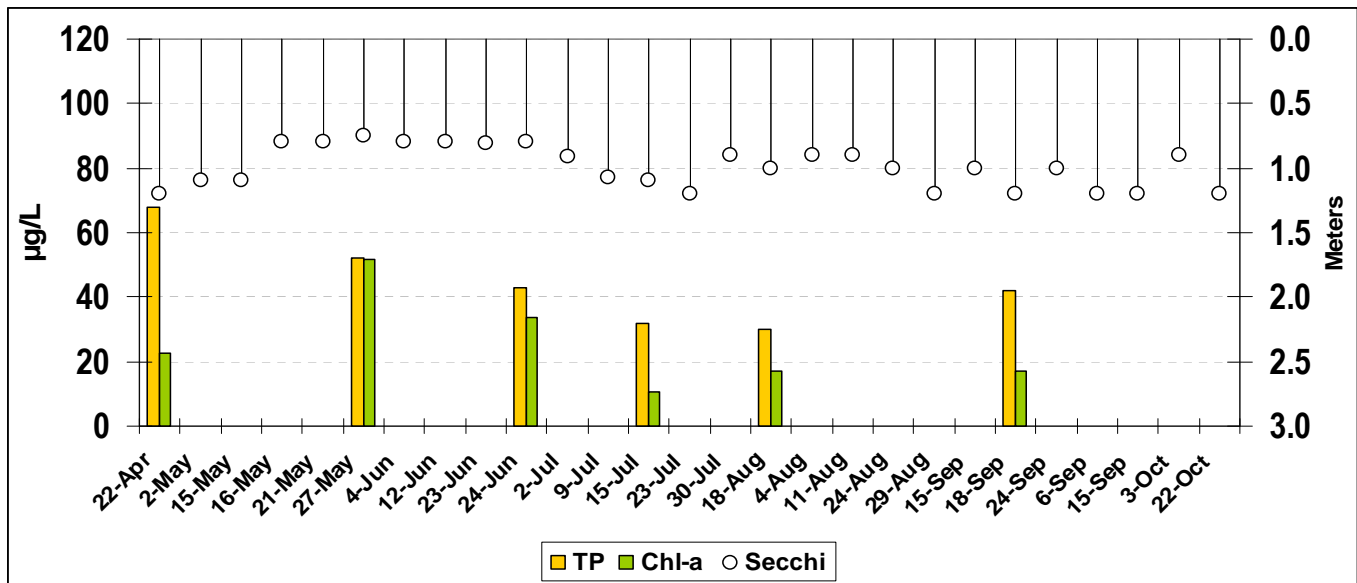
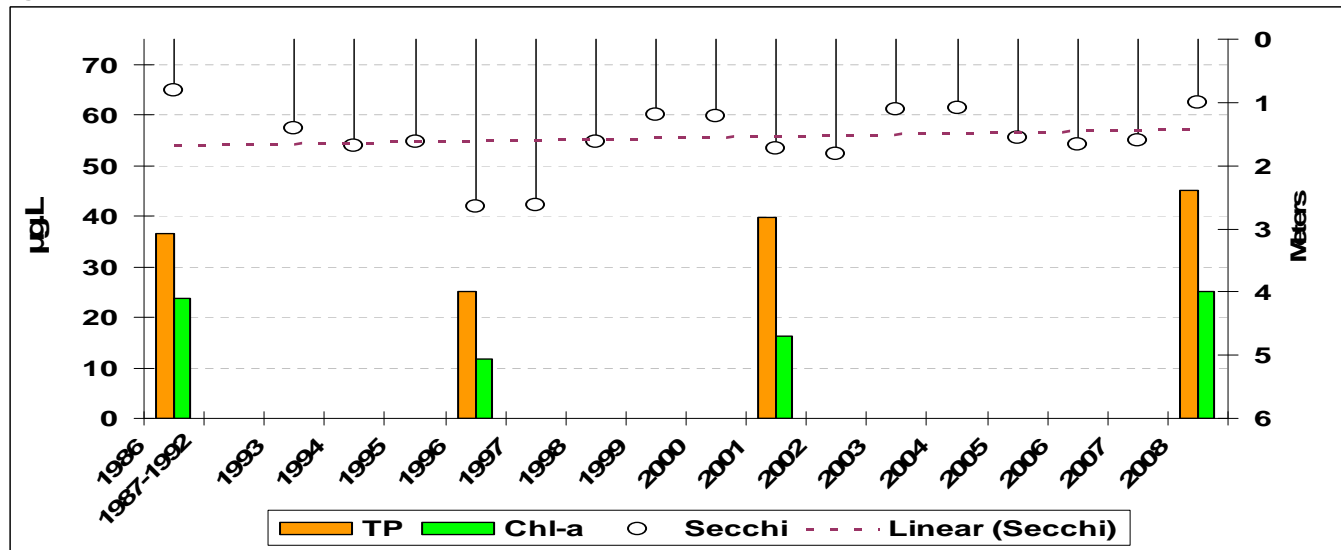


Figure 6. St. Olaf Lake Summer-mean TP, Chl-a, & Secchi



Watershed and Water Quality Summary

St. Olaf Lake is located 3 miles east of New Richland in Waseca County. The lake is small and relatively deep (Figure 1) with a maximum depth of 33 feet and about 50 percent of the lake considered littoral. The watershed-to-lake ratio is small (2.1 :1) with agriculture as the dominate land use (Figure 2). A sizable floating plant bed developed on the lake in mid-summer. The lake was used as a WCBP ecoregion reference lake and has a good quality data going back 1986.

Temperature profile measurements were done weekly in 2008 with help of volunteer monitor, Mr. Al Grabau. The lake was well-mixed in April, but stratified shortly thereafter (Figure 3), with a thermocline forming between 4-6 meters. Fall mixing was underway by late October. Hypoxic conditions (DO <2.0 mg/L) were evident in the hypolimnion from May through the end of September (Figure 4). At its peak, the hypoxic conditions extended to within 4.5 meters of the surface.

Summer mean water quality measurements were better than the ecoregion reference lake range for the WCBP ecoregion (Table 2). Chl-a and TP levels were at their lowest in mid-July and August (Figure 5). Changes in Secchi corresponded well with Chl-a changes through the summer. The highest TP occurred in April, following ice out and spring overturn. Trophic indicators since 1997 suggest a decline in water quality (Figure 6).

Table 3. Focal species captured during recent surveys and their size and abundance compared with other lakes in its lake class.

Species	Stocked	Abundance	Size	Trend
Northern Pike*	Y	Average	Large	Decreasing
Black Crappie	N	High	Small	Increasing
White Crappie	N	High	Large	Decreasing
Largemouth bass	N	High	Large	Increasing
Bluegill*	N	High	Small-average	Increasing
Pumpkinseed	N	Low	N too small	Decreasing
Yellow perch	N	Average	Small	Uncertain

*Management emphasis on this species

Table 4. Aquatic plant summary

Percent cover of aquatic plants ≤ 15ft deep	26%
Number of common species (i.e., ≥ 10% cover)	2
Lake depth beyond which most vegetation disappeared	3.6ft
Non-native plant infestation	Curly-leaf pondweed (heavy)

Narrative

Despite its small size, St. Olaf currently has high quality populations of northern pike, white crappie, largemouth bass, and a diverse assemblage of non-game species as indicated by a high index of biotic integrity; however, because of its small size, this lake has limited capacity to consistently sustain high quality populations of game species. Northern pike size structure seems to have benefited from a 30-in minimum length regulation implemented in 1998, although recruitment is propped up through biennial fry stocking. Interestingly, in 2008 both black and white crappie were abundant in trap nets, but size structure of white crappie was larger than average and size of black crappie was smaller than average compared with other lakes in St. Olaf's lake class. These species are known to hybridize producing large hybrids that resemble white crappies. Bluegill size-structure has consistently been poor through the years. St. Olaf is heavily infested with the non-native curly-leaf pondweed; however, this species may be providing spawning opportunities and foraging benefits for northern pike and largemouth bass. Natural summer die-offs of curly-leaf pondweed may expose juvenile bluegill to predators, having benefits both to predator and bluegill populations (although exposure to predation does not currently appear to be sufficient to curb bluegill numbers).