Minnesota Pollution Control Agency

Prepared in cooperation with the
Minnesota Department of Natural Resources

Pearl Lake

Stearns County
Sentinel Lakes

Minnesota Lake ID: 73-0037
Area: 750 acres
Watershed Area: 18,237 acres
Ecoregion: North Central Hardwood Forests (NCHF)

Trophic State: Eutrophic
Maximum Depth: 18.2 feet
Mean Depth: 9.8 feet
Mixing Status: Not Stratified (Polymictic)

Figure 1. Pearl Lake 3D depth contour

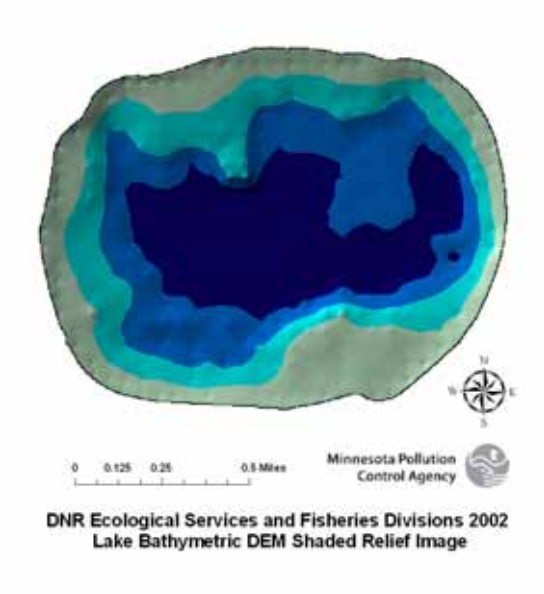

Figure 2. Pearl Lake Watershed land use

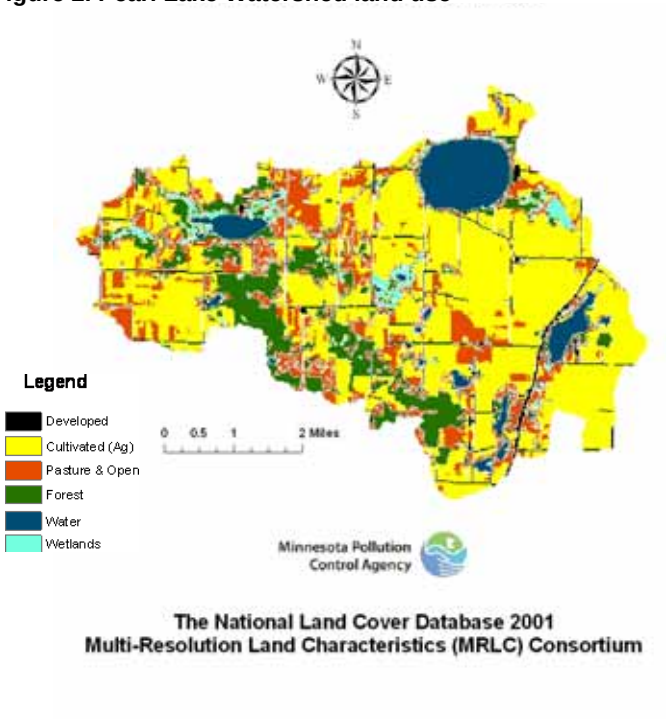

Table 1. Land use compositions

Land use	Pearl Lake land use percentage	NCHF typical land use percentage
Developed	4	2 - 9
Cultivated (Ag)	59	22 - 50
Pasture & Open	13	11 - 25
Forest	12	6 - 25
Water & Wetland	12	14 - 30
Feedlots (#)	51	

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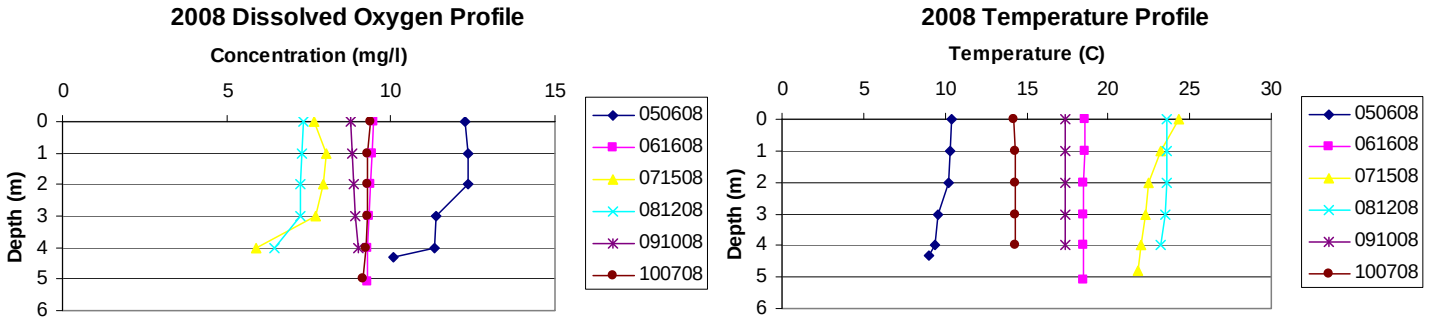
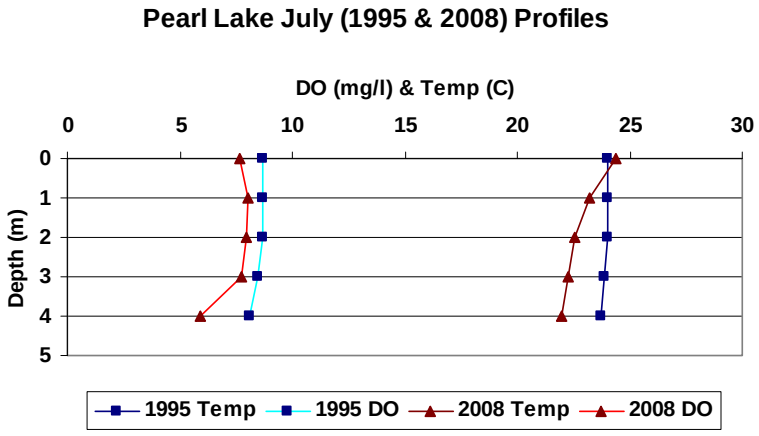
Table 2. Pearl Lake summer-mean as compared to typical range for NCHF ecoregion reference lakes MPCA data based on 1985-86 and 2008 sample collections

Parameter	Pearl Lake	NCHF
Number of reference lakes		35
Total Phosphorus (µg/L)	52	23 – 50
Chlorophyll mean (µg/L)	16.2	5 – 22
Secchi Disk (feet) (meters)	1.7	1.5 – 3.2
Total Kjeldahl Nitrogen (mg/L)	0.9	< 0.6 – 1.2
Nitrite = Nitrate-N (mg/L)	< 0.05	< 0.01
Alkalinity (mg/L)	140	75 – 150
Color (Pt-Co U)	5	10 - 20
pH (SU)	8.4	8.6 – 8.8
Chloride (mg/L)	19.8	4 – 10
Total Suspended Solids (mg/L)	4.8	2 - 6
Total Suspended Inorganic Solids (mg/L)	4	1 - 2
Conductivity (umhos/cm)	355	300 - 400
TN:TP ratio	17:1	25:1 – 35:1

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. 2008 temperature and dissolved oxygen profiles and trophic status measurements



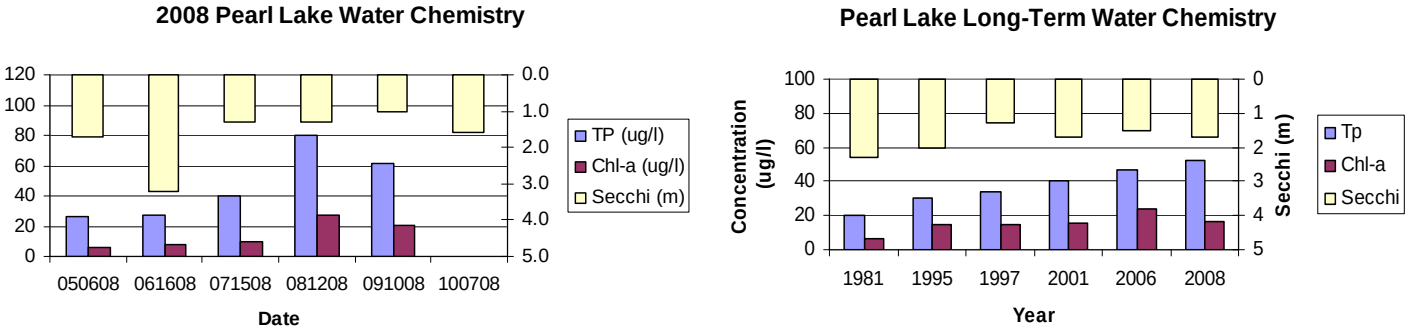


Watershed, water quality, and fishery summary

Pearl Lake is a shallow lake located south of Rockville, Minnesota. The lakeshore is heavily developed. The watershed is large relative to its surface area (25:1 watershed:lake ratio). Land use is dominated by agricultural uses (cultivated and pasture) but its overall composition is within the typical for a lake in the NCHF ecoregion (Table 1). Pearl Lake was previously sampled by the Minnesota Pollution Control Agency (MPCA) through the Lake Assessment Program in 1997.

Pearl Lake was sampled six times during the summer of 2008 by MPCA staff and five times by the Sauk River Watershed District. Secchi depth and temperature and dissolved oxygen (DO) profiles were collected at each visit. The lake did not thermally stratify and DO levels remained above the 5 mg/l necessary to support game fish (Figure 3). A comparison of mid-summer profiles from 1995 and 2008 revealed a very similar pattern with sufficient oxygen to support game fish throughout the water column.

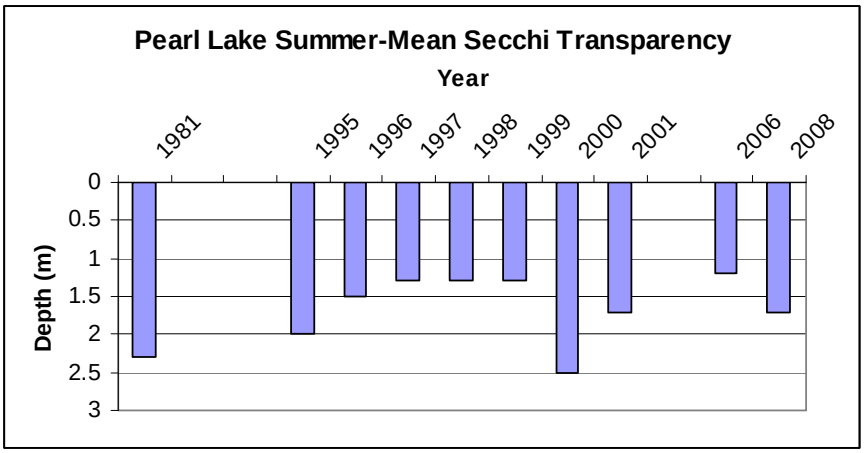
Figure 4. Pearl Lake total phosphorus, chrlorophyll-a and secchi



The trophic status indicators and other water quality data for Pearl Lake were generally within the typical range for minimally-impacted NCHF ecoregion lakes, with the notable exceptions of total phosphorus (TP) and chloride (Table 2). TP and chlorophyll-a increased throughout the summer months – a common pattern in many shallow lakes (Figure 4). Secchi was variable over the summer, with lowest transparency during mid to late summer. Over the six-year data record, there is a very distinct increase in total phosphorus and chlorophyll-a levels. The recent (2001 and 2006) increases in TP and chlorophyll-a contributed to the lake being assessed as non-supporting of aquatic recreational uses and being placed on Minnesota's 2008 303(d) "Impaired Waters" for nutrient impairment. A TMDL (total maximum daily load) study is underway addressing Pearl Lake and its tributary, Mill Creek.

A discontinuous record of Secchi disk data is available from 1981 to 2008 (Figure 5). Based on this record, summer-mean Secchi typically ranges between 1.2 and 2.5 meters, several of the years are below (worse than) the typical range for a lake in the North Central Hardwood Forest ecoregion. No trend is apparent based on this data.

Figure 5. Pearl Lake summer-mean secchi transparencies



Fishery and Aquatic Plant Survey Summary

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
Walleye*	Y	Average	Large	Declining
Northern Pike*	N	High	Small	Increasing
Black Crappie	N	High	Small	Stable
Largemouth bass	N	Average	Large	
Pumpkinseed	N	Average	Large	
Bluegill	N	Average	Average-large	Stable
Yellow perch	N	Low		Stable
White Sucker	N	Average	Large	

*Management emphasis on these species

Table 4. Aquatic Plant Summary

Percent cover of aquatic plants ≤ 15ft deep:	53%
Lake depth at which most vegetation disappeared:	8.5 ft
Number of common species (i.e., > 10% cover):	2
Infested with non-native plants:	Curly-leaf pondweed (heavy)
Frequency of Chara:	47%

Surveys of the "biotic integrity" of the fish community in 2008 demonstrated that Pearl harbors a fish community that is more diverse than other lakes of similar productivity (Score of 96). Pearl is primarily managed for walleye through stocking fingerlings. Numbers of walleye are average but the average size of individuals is well above average for Pearl's lake class. Large individuals of largemouth bass are also common in the lake as of the last electrofishing survey. In contrast, small northern pike and black crappie are moderately abundant. Disconcertingly, yellow perch, an important forage fish have not been detected in gillnets during the last two assessments spread ten years apart. Sustained low numbers of yellow perch will hamper any improvements in pike size and threaten the sustainability of quality walleye and largemouth bass populations. Low numbers may be a result of a combination recent eutrophication and a top-heavy predator community.

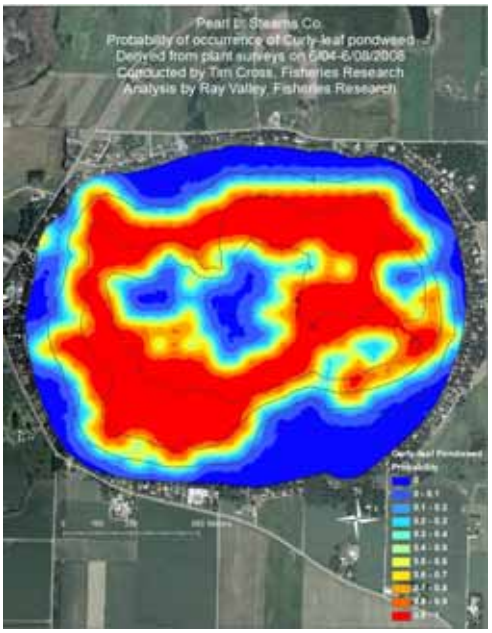


Figure 6. Curly-leaf Pondweed Occurrence

In addition to lake eutrophication, Pearl Lake has seen the increasing cover and abundance of the non-native curly-leaf pondweed (Figure 6). Curly-leaf pondweed thrives in nutrient-rich conditions and at some threshold of nutrient levels (exact quantity unknown), can become a self-sustaining internal driver of poor water quality conditions. In addition the senescence of curly-leaf likely contributes to the midsummer pulse in TP and chlorophyll-a (Figure 4).

Chara, a planktonic algae-filtering benthic plant is abundant in the lake, providing an important resilience mechanism that may be opposing internal and external forces pushing the lake towards an undesirable turbid-water regime. Reducing first the external forces (i.e., nutrient loading from the watershed) will be critical to restore habitat and clear-water conditions in Pearl Lake. Restoring water quality in the lake will be critical to prevent the extirpation of blackchin and blacknose shiners, banded killifish, and Iowa darter; four species currently present in Pearl but intolerant of eutrophication. These species have disappeared from many Twin City lakes that have become more eutrophic over time.