Minnesota Pollution Control Agency

Prepared in cooperation with the
Minnesota Department of Natural Resources

Belle Lake

Meeker County

Sentinel Lakes

Minnesota Lake ID: 47-0049-01
Area: 826 acres
Watershed Area: 4,174 acres
Ecoregion: North Central Hardwood Forest (NCHF)

Trophic State: Eutrophic
Maximum Depth: 22 feet
Mean Depth: 14 feet
Mixing Status: Not Stratified (Polymictic)

Figure 1. Bell Lake 3D depth contour

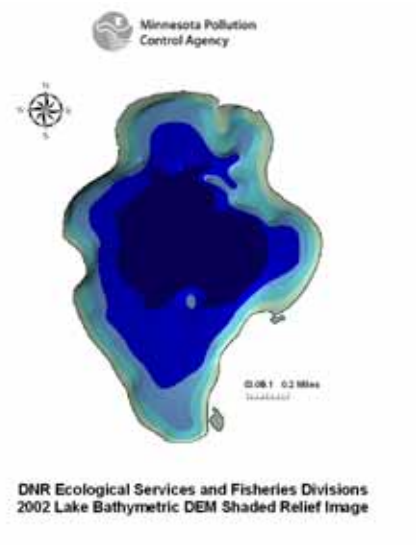

Figure 2. Belle Lake Watershed land use

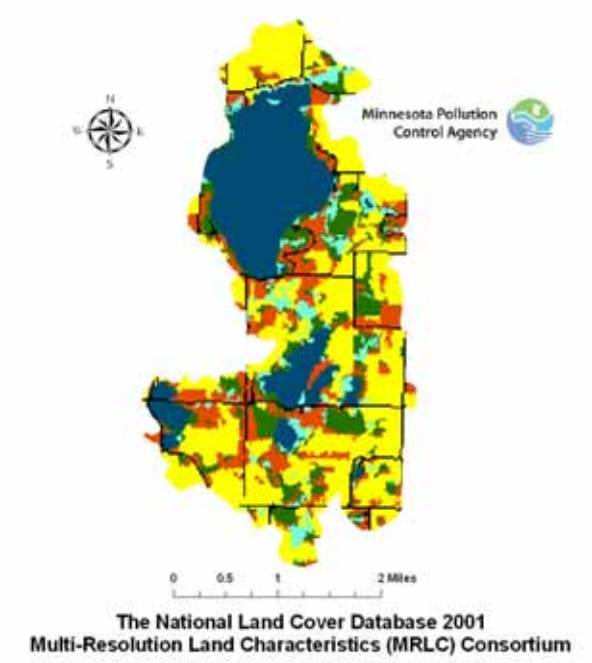

Table 1. Land use compositions

Land use	Belle Lake land use percentage	NCHF typical land use percentage
Developed	**5**	2 - 9
Cultivated (Ag)	**38**	22 - 50
Pasture & Open	**16**	11 - 25
Forest	**12**	6 - 25
Water & Wetland	**29**	14 - 30
Feedlots (#)	**4**	

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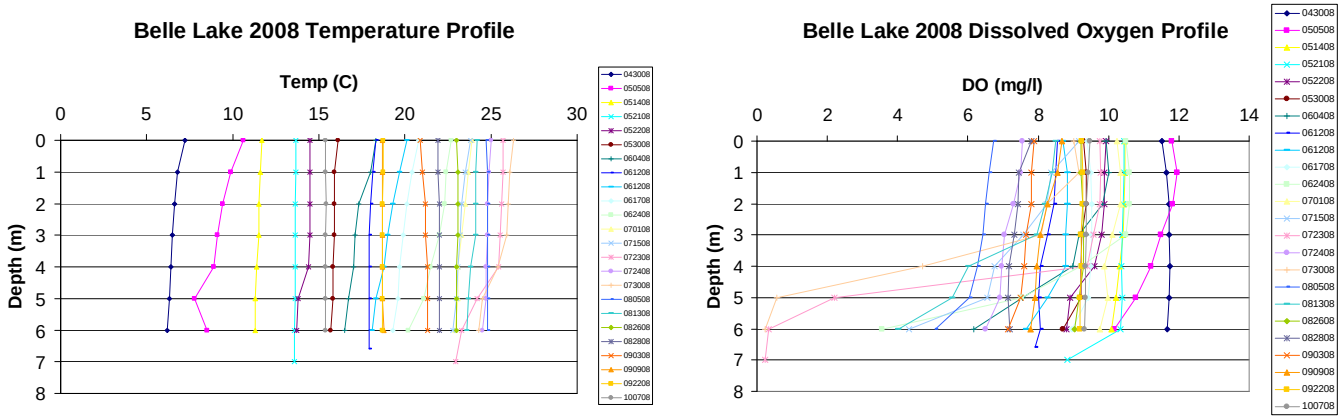
Table 2. Bell Lake summer-mean as compared to typical range for NCHF ecoregion reference lakes MPCA data based on 1985-86 and 2008 sample collections

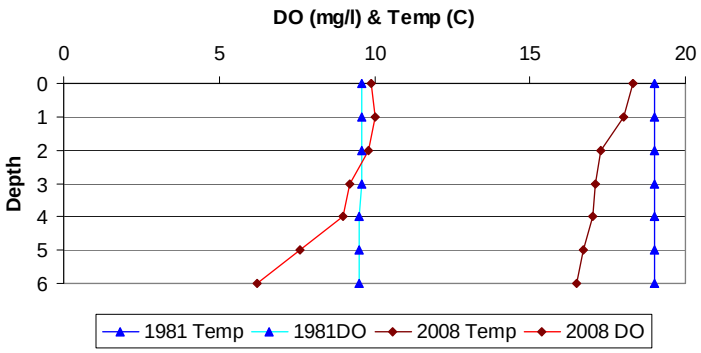
Parameter	Belle Lake	NCHF
Number of reference lakes		35
Total Phosphorus (µg/L)	58	23 – 50
Chlorophyll mean (µg/L)	22.5	5 – 22
Secchi Disk (meters)	1.1	1.5 – 3.2
Total Kjeldahl Nitrogen (mg/L)	1.6	< 0.6 – 1.2
Nitrite + Nitrate-N (mg/L)	0.06	< 0.01
Alkalinity (mg/L)	150	75 – 150
Color (Pt-Co U)	5	10 - 20
pH (SU)	8.6	8.6 – 8.8
Chloride (mg/L)	14	4 – 10
Total Suspended Solids (mg/L)	12	2 - 6
Total Suspended Inorganic Solids (mg/L)	7.6	1 - 2
Conductivity (umhos/cm)	325	300 - 400
TN:TP ratio		25:1 - 35:1

µg/L = micrograms per liter
mg/L = milligrams per liter
umhos/cm = micromhos per centimeter

Pt-Co-U = Platinum Cobalt Units
SU = Standard Units

Figure 3. Belle Lake 2008 Monthly dissolved oxygen (DO) and temperature profiles





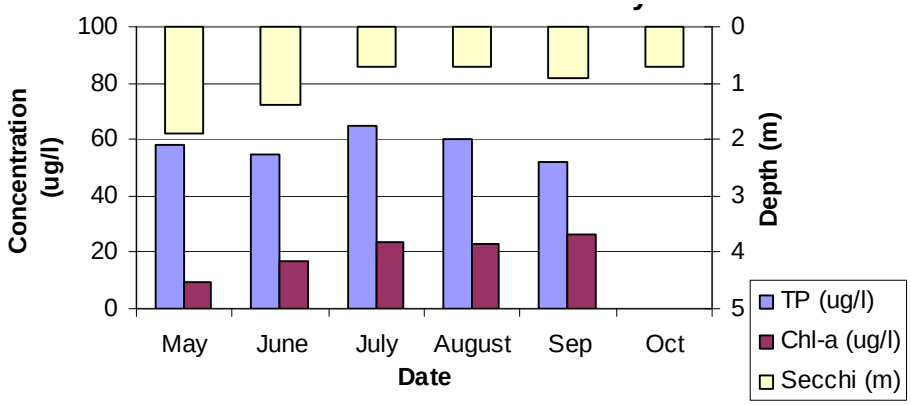
Watershed and water quality summary

Belle Lake is a large, shallow lake with a relatively small watershed (5:1 watershed: lake ratio) that is located just northwest of Hutchinson, Minnesota. Its land use composition is characterized by a mixture of cultivated, pasture, forest and wetland that is typical of a lake in the North Central Hardwood Forest (NCHF) ecoregion (Table 1). The lake has an active lake association and county park located on the eastern shores of the lake. Water level alteration and illegal aquatic plant removal have been documented on the lake and may be contributing to the low diversity of fish in the lake.

Belle Lake was sampled for chemistry six times during the summer of 2008 by Minnesota Pollution Control Agency (MPCA) staff. Secchi depth, temperature, and dissolved oxygen (DO) profiles were collected by both staff and volunteer monitor Roger Nieland. The lake remained well-mixed throughout the summer, with no thermocline developing (Figure 3). In July DO dropped below 5 mg/l, a level necessary to support game fish, near the bottom sediments. A comparison of profiles from 1986 and 2008 show a similar pattern for both temperature and dissolved oxygen (Figure 3).

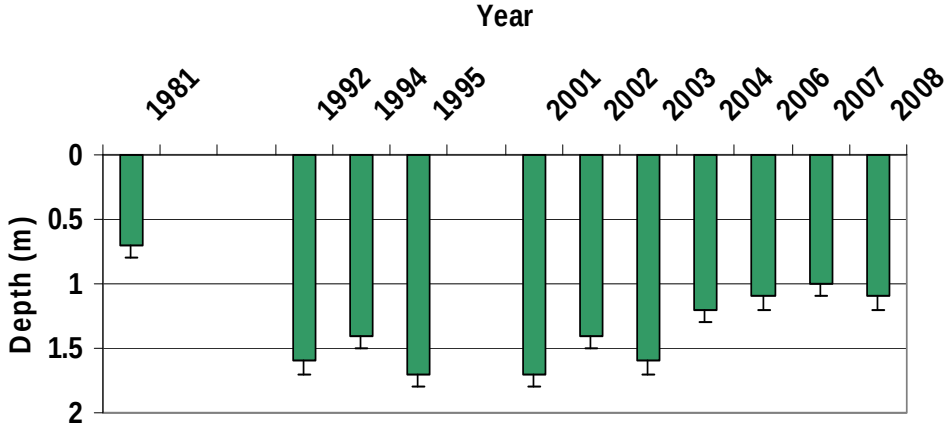
The trophic status indicators and other water quality data for Belle Lake were just above the typical range for minimally impacted NCHF lakes with the exception of alkalinity, pH, and conductivity (Table 2). Total phosphorus (TP) remained high throughout the summer; chlorophyll-a increased and Secchi transparency decreased (Figure 4). Total suspended inorganic solids were high relative to minimally impacted lakes and this may have contributed to reduced Secchi transparency.

Figure 4. Belle Lake trophic state parameters for 2008



The long-term Secchi disk record is discontinuous, with data in 1981, 1992, 1994-1995 and 2001 to present (Figure 5). Based on this record, summer-mean Secchi typically ranges from 0.7 to 1.7 meters, which is within or below (worse than) the typical range for a lake in the North Central Hardwood Forests ecoregion. Based on available data, a strong declining trend in transparency is evident on Belle Lake for the period 2001-2008.

Figure 5. Belle Lake long-term summer-mean secchi transparency



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	Trend	Size
Walleye*	Y	High	Variable	Average
Northern pike	N	Average	Variable	Large
Largemouth bass	N	Low	Variable	N too small
Bluegill	N	Low	Variable	Average
Black crappie*	N	Average	Variable	Average
Yellow perch	N	Low	Variable	Average
White sucker	N	Low	Variable	N too small

*Management emphasis on this species

Table 4. Aquatic Plant Summary

Percent cover of aquatic plants ≤ 15ft deep:	9.7%
Lake depth at which most vegetation disappeared:	3.5 ft
Frequency of *Chara*	1%
Infested with non-native plants	Curly-leaf pondweed (lightly)

Belle is primarily managed for walleye through supplemental stocking of fry. Walleye numbers of acceptable size to anglers are much higher in Belle compared with other lakes in its lake class. The northern pike population is typical for this class of lake, producing relatively low numbers but larger-sized fish. Black crappie catch rates are average for a class 24 lake and fishing for this species has often been reported as excellent. Overall, results from a survey of the fish community " biotic integrity" in 2008 demonstrated a score of 32.1, which was well below average compared with other lakes of similar productivity and indicates depauperate fish community dominated by common carp and black bullhead. Turbid water and sparse aquatic plant growth tends to favor these species over a many native game and non-game species. Clearer-water conditions that favor more abundant aquatic plant growth, especially Chara, could benefit a greater range of native fish species including largemouth bass, bluegill, northern pike, and yellow perch.

Figure 4.

Watershed, water quality, and fishery summary

Fishery and plant narrative