Environmental Services
CROW WING COUNTY
BRAINERD, MINNESOTA 56401

Crow Wing County Water Quality Factsheet Series

Middle Cullen Lake

DNR ID: 18-0377

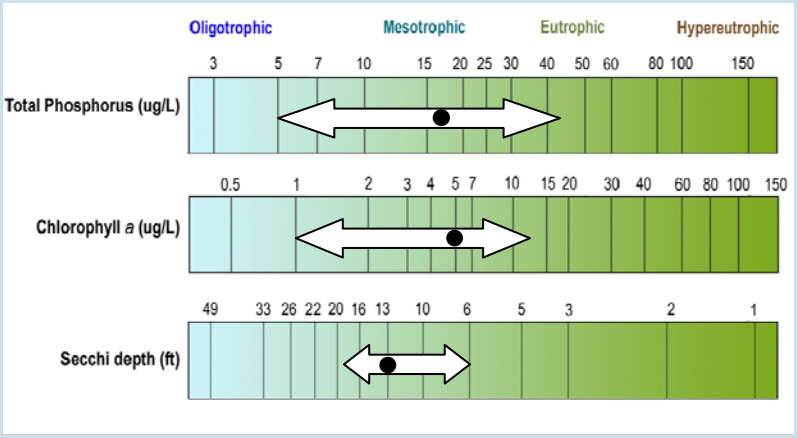
Vitals		Physical Characteristics	
MN Lake ID:	18-0377-00	Surface area (acres):	397
Zoning Authority:	Crow Wing County	Littoral area (acres):	137
Lake Classification:	General Development (GD)	% Littoral area:	35%
Major Watershed:	Crow Wing River	Max depth (ft):	46 (m): 14
Latitude/Longitude:	46.5525 / -94.2621	Mean depth (ft):	N/A
Water Body Type:	Public	Inlets / Outlets / Accesses:	1 / 1 / 1
Invasive Species	Curly-leaf pondweed	Lakeshed to lake area ratio:	4:1

Total Phosphorus

Middle Cullen Lake is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus. Total phosphorus was evaluated in Middle Cullen in 1991, 1995, 2000-2001, & 2003-2008. The data show that phosphorus increases as the summer progresses which could be due to internal loading. The majority of the data points fall in the mesotrophic range.

Chlorophyll *a*

Chlorophyll a is the pigment that makes plants and algae green. Chlorophyll *a* is tested in lakes to determine the algae concentration or how "green" the water is. Chlorophyll *a* was evaluated in Middle Cullen at sites 201 and 204 during 1991, 1995, 1998, 2000-2001, and 2003-2008 and remained below 10 ug/L on all sample dates except for two, indicating clear water most of the summer.



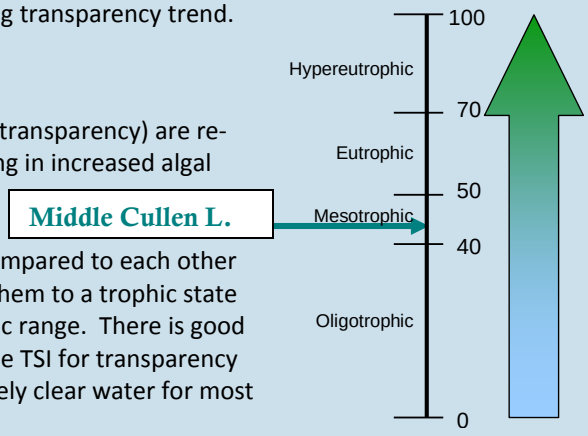
Middle Cullen Lake total phosphorus, chlorophyll *a* and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 204). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes, it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, so they are only able to grow in areas of lakes where the sun penetrates. Water transparency depends on the amount of particles in the water. An increase in particulates results in a decrease in transparency. The annual mean transparency ranges from 10.8 to 14.8 feet with the transparency throughout the lake appearing to be relatively uniform. Middle Cullen shows evidence of a declining transparency trend. There was no trend in phosphorus or chlorophyll a data.

Trophic State Index (TSI)

Phosphorus (nutrients), chlorophyll *a* (algae concentration) and Secchi depth (transparency) are related. As phosphorus increases, there is more food available for algae, resulting in increased algal concentrations. When algal concentrations increase, the water becomes less transparent and the Secchi depth decreases. The results from these three measurements cover different units and ranges and thus cannot be directly compared to each other or averaged. In order to standardize these three measurements, we convert them to a trophic state index (TSI). The mean TSI (44) for Middle Cullen Lake falls into the mesotrophic range. There is good agreement between the TSI for phosphorus (45) and chlorophyll *a* (47) with the TSI for transparency (40) being lower. Mesotrophic lakes (TSI 40-50) are characterized by moderately clear water for most of the summer and can be good walleye lakes.



Local association info: Cullen Lakes Association www.cullenlakes.org