



Upper Hay Lake

DNR ID: 18-0412

Vitals		Physical Characteristics	
MN Lake ID:	18-0412-00	Surface area (acres):	596
Zoning Authority:	Crow Wing County, City of Jenkins	Littoral area (acres):	269
Lake Classification:	Recreation Development (RD)	% Littoral area:	45%
Major Drainage Basin:	Pine River Watershed	Max depth (ft):	42 ft (12.8 m)
Latitude/Longitude:	46.64453, -94.302349	Mean depth (ft):	N/A
Water Body Type:	Public	Inlets / Outlets / Accesses:	1 / 1 / 1
Invasive Species	None	Lakeshed to lake area ratio:	4:1

Total Phosphorus

Upper Hay Lake is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus. Total phosphorus was evaluated in Upper Hay Lake in 1997, 2003-2005, 2007-2010. The data increase somewhat toward the end of the season. The two sites appear to have similar concentrations. In 2005 and 2008 there were some very high single data points.

Chlorophyll *a*

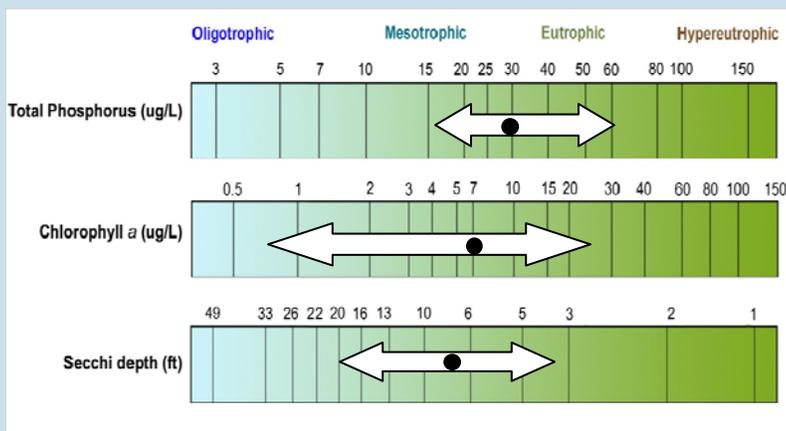
Chlorophyll *a* is the pigment that makes plants and algae green. Chlorophyll *a* is tested in lakes to determine the algae concentration or how "green" the water is. Chlorophyll *a* was evaluated in Upper Hay Lake in 2003-2005, 2007-2010. Chlorophyll *a* concentrations reached 10 ug/L most years, indicating minor algae blooms.

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 for Upper Hay Lake ranges from 5.8 to 9.8 feet. The transparency throughout the lake appears to be relatively uniform, with the means for both sites showing the same year-to-year seasonal variability. Both sites seem to hover pretty tightly around the long-term mean. No trend was detected in the transparency data at sampling at sampling site 101. There was insufficient data to calculate trends for total phosphorus and chlorophyll *a*.

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 for Upper Hay Lake falls on the border between mesotrophic and eutrophic (49-51). Lakes on the mesotrophic/eutrophic border are characteristic of moderately clear water throughout the summer with late summer algal blooms.



Upper Hay Lake total phosphorus, chlorophyll *a* and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 101). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

