

1979 LAKE MICHIGAN DISTRICT
LAKE MONITORING ACTIVITIES

LMD Water Quality personnel monitored ten lakes on a quarterly basis in 1979. In addition, three bench mark lakes were monitored for the Bureau of Inland Lake Renewal. The purpose was to provide a data base on lakes that did not have quarterly chemistry data in the past five years. There were two exceptions: John Lake in Oconto County has been monitored by the District for Central Office the past few years and the Machikane Flowage has been monitored for the past two years in conjunction with the Scott Paper settlement. Area fish managers requested the additional eight lakes. A supplement to the 1979 Preliminary Basin Assessment outlines the purpose for monitoring each lake. Each lake will be individually summarized.

Nutrient concentrations, particularly dissolved or ortho-phosphorus and the inorganic forms of nitrogen ($\text{NH}_4+\text{NO}_3+\text{NO}_2$ as N) will be related to lake productivity or the abundance of algae and vegetation. The relative abundance of vegetation was assessed for each lake during the summer. In addition, chlorophyll a was measured to indicate the concentration of algae. Nitrogen and phosphorus concentrations will be related to Sawyer's (1947) levels of 0.015 mg/l for ortho-phosphorus and 0.3 mg/l for inorganic nitrogen to predict increases in algae and/or vegetation. Nitrogen-phosphorus ratios, chlorophyll a concentrations for summer and fall and secchi disc readings are used to indicate the trophic level of each lake. The DNR task force committee on lake studies has arrived at total nitrogen/total phosphorus ratios greater than 11, chlorophyll a concentrations less than 14 ug/l, and mid summer secchi disc readings greater than 1.5 M. to indicate very good or oligotrophic lake conditions. A reduction in any of these criteria progresses toward a more mesotrophic, or in extreme cases, eutrophic state. These criteria will be interpreted for each lake to assess the particular trophic level of the lake.

Dissolved O₂ - TEMPERATURE C° Dissolved O₂ mg/L. - TEMPERATURE C°

Boat Lake
Columet Co.

X TEMPERATURE C°
O OXYGEN mg/L.

FEBRUARY 13, 1979

MAY 1, 1979

AUGUST 20, 1979

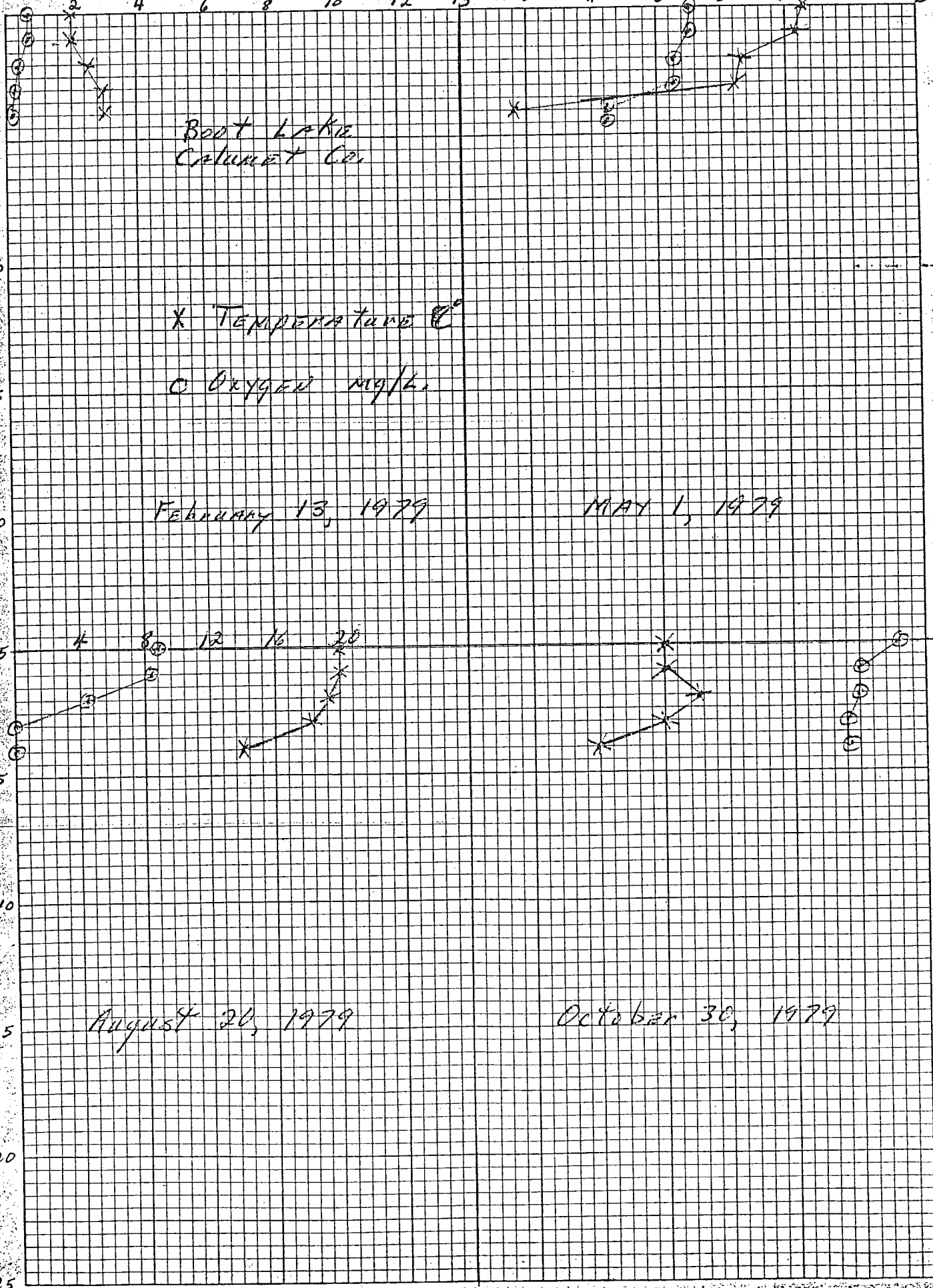
OCTOBER 30, 1979

DEPTH IN METERS

DEPTH IN METERS

SQUARE 10 X 10 TO THE INCH AS-0007-00

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Boot Lake - Calumet County

Boot Lake in northeast Calumet County, Township 19 North, Range 20 East, Section 1(4), is a 10 acre maximum 15 feet deep hard water seepage lake. Quarterly water chemistry samples were taken in 1979 by Lake Michigan District DNR personnel. Alkalinities ranged from a low of 120 mg/l to a high of 151 mg/l, the average was 133 mg/l. Alkalinity or carbonate hardness, that portion of the hardness attributed to the bicarbonate plus carbonate, is used to differentiate soft from hard water lakes. Concentrations less than 80 mg/l will be designated soft water, 80-125 mg/l moderately hard water, and greater than 125 mg/l hard water. Alkalinity can indicate gross pollution, but for the most part it is a reflection of the geology or soils of the watershed. Boot Lake is a hard water lake with alkalinities typical of other surface waters in the area.

Nutrient or phosphorous and nitrogen concentrations were excessive on all quarterly samples. Sawyer (1947) set limits, referred to in the introduction, for the spring turnover; when they are exceeded there is a potential for increases in algae or rooted vegetation. The effect on Boot as a result of high spring nutrient concentrations was an increase in organic matter. Chlorophyll a concentrations were extremely high 94 ug/l on the August 20 sample date. The correction for pheophyton was 79 ug/l. Pheophyton is a natural degradation product of chlorophyll and often occurs in significant quantities in phytoplankton. The excessive concentration of algae reduced the summer secchi reading to only 0.8 m. A vegetation survey on this sample day revealed an abundance of Milfoil and Arrowhead. Coontail, Duckweed, Cattail, Sedges and Flatstem pondweed were all common. There was a mixture of emergent as well as submerged vegetation. Milfoil was present as a nuisance restricting some use of the water for recreational purposes.

Stratification during the winter and summer did occur. Dissolved oxygen depletion in the hypolimnion was significant. Dissolved oxygen readings on February 13, 1979, fell below 1 mg/l (see figure 2). Partial winter kill of the Boot Lake fish population is possible at this critical dissolved oxygen level. The decomposition of organic matter by oxygen consuming bacteria as well as reduced penetration of the sun from ice and snow cover is the reason for these low oxygen readings.

Nitrogen-phosphorous ratios greater than eleven indicate oligotrophic conditions. The May nitrogen-phosphorous ratios were 2.7 in the epilimnion and 6.6 in the hypolimnion indicating phosphorous exists in excess. This is verified later in the summer by high chlorophyll a concentrations and increased vegetation numbers. Boot Lake is in a very advanced state of eutrophication. The abundance of agriculture in the watershed appears to be the source of nutrients during periods of runoff. SCS and SWCD should be made aware of the problem on Boot Lake.

TR:ct
2/8/80