5. Resource Management Plans

A. The Thirty Lakes Watershed District Philosophy Toward Managing its Water Resources:

Water management goals of the District are to ensure the development, use, control and conservation of the District's water resources. The Managers' intent is to accomplish these goals in a manner that is most beneficial to the general welfare of the District residents and to minimize adverse environmental impacts upon the District's water resources.

It is the intention of the Managers to cooperate with all federal, state and local units of government in the conservation of the District's natural water resources. The Managers also wish to coordinate with these governmental units in the development and implementation of policies, procedures and regulations concerning the District's water and related resources. Individual lake goals are included in the following Lake Management and Implementation Plans.

Lake Management Plans

The District has developed lake management plans for each of the 52 lakes in the District. The following process was followed prior to the development of lake management plans:

1. Determination of existing and/or potential conflicts between lake water quality and use. It may be necessary to collect water quality data prior to making this determination.

The impact of existing and future development on lake water quality will be determined during development of the lake management plans using the "Werring Procedure." The Werring Procedure is named after one of the founding members of the Thirty Lakes Watershed District Board of Managers. The procedure combines a model (WILMS), which predicts a lake's trophic status based on land use within the lake's watershed with a remote sensing image data collection and analysis system (Water Watch). The procedure involves the following steps:

(a) Delineating the lake's watershed.

(b) Collecting aerial photographs of the targeted watershed

(c) Classifying the image data and delineating current land use.

(d) Collecting and analyzing the dissolved and sediment-attached total phosphorus and nitrogen contained in the runoff from each delineated land use.

(e) Entering all the data into WILMS Model and running the model.

(f) Reporting the current trophic condition and predicting the trophic condition which would develop under different scenarios.

(g) Correlate current predictions with existing water quality.

The recommended preventive and corrective work to protect or restore lake water quality is an important part of the Lake Management Plan. Additional studies may be required before extensive preventive and corrective work can be determined.

The lake management plans will be revised as necessary in response to new water quality data and other information.

A. Definitions:

Eutrophication: The water quality problems caused by sediment and nutrients from a lake's watershed are described by the word eutrophication. Eutrophication, or lake degradation, is the process whereby lakes accumulate sediments and nutrients from their watersheds. The result is that a lake naturally becomes more fertile over time. It is converted from oligotrophic (nutrient-poor) to eutrophic (nutrient-rich) status as it is progressively enriched by nutrients and sediment. Nutrients serve as a catalyst for algae and weed growth in a lake. Biological production and sediment inflow from the lake's watershed eventually fill the lake's basin. Over a period of many years, the lake successively becomes a pond, a marsh and, ultimately, a terrestrial ("upland") site. The process of eutrophication is natural and results from the normal environmental forces that influence a lake. Cultural eutrophication, however, is an acceleration of the natural process caused by human activities. This acceleration may result from point-source nutrient loadings, such as effluent from wastewater treatment plants and septic tanks. It may also be caused by diffuse (i.e., nonpoint) sources of nutrients and sediments, such as stormwater runoff. Nutrients and sediments may be added to the lake via runoff from agricultural and/or urban watersheds. This accelerates the rate of water quality degradation. Unpleasant consequences of degradation include profuse and unsightly growths of algae (algal blooms) and/or the proliferation of rooted aquatic weeds (macrophytes).

Trophic States: Because the water quality of lakes can vary greatly from watershed to watershed, criteria have been established to evaluate lakes, such as those within the District, to denote their water quality. Four "trophic" descriptions are frequently

used to describe the effects of nutrients on a lake's general water quality and to denote its trophic status. They are:

1. **Oligotrophic:** (Greek for "food-poor") describes a clear lake with few weeds and little algae
2. **Mesotrophic:** describes a lake of intermediate algae and weed productivity.
3. **Eutrophic:** (Greek for "food-rich") describes a lake rich in nutrients with high algae and weed productivity.
4. **Hypereutrophic:** lakes are extremely rich in nutrients and have an extremely high algae and weed productivity.

The North American Lake Management Society (NALMS, 1988) has related concentrations of total phosphorus and chlorophyll a and Secchi disc transparencies to the trophic state of a water body. The four trophic status designations used for lakes are listed below with corresponding ranges of total phosphorus, chlorophyll a, and Secchi disc values.

Total Phosphorus (TP), (mg/L)

1. Oligotrophic -- [TP $\leq$ 0.010]
2. Mesotrophic -- [0.010 < TP $\leq$ 0.030]
3. Eutrophic -- [0.030 < TP $\leq$ 0.060]
4. Hypereutrophic -- [TP > 0.060]

Chlorophyll a (Chl a), (mg/m3)

1. Oligotrophic -- [Chl a $\leq$ 2]
2. Mesotrophic -- [2 < Chl a $\leq$ 10]
3. Eutrophic -- [10 < Chl a $\leq$ 30]
4. Hypereutrophic -- [Chl a > 30]

Secchi Disc (SD) Transparency (ft)

1. Oligotrophic -- [SD $\geq$ 15.7]
2. Mesotrophic -- [15.7 > SD $\geq$ 5.5]
3. Eutrophic -- [5.5 > SD $\geq$ 2.6]
4. Hypereutrophic -- [SD < 2.6]

Thermal Stratification: A lake is thermally stratified when its water temperature varies from the water surface to the bottom of the lake. When the ice melts in the spring, the water temperature is a lake is usually around 39 degrees Fahrenheit from top to bottom, at which point the lake is not thermally stratified.

Epilimnion: The warm surface layer of the lake.

Hypolimnion: The cooler, deeper water layer of the lake.

Metalimnion: The transitional layer of water between the warm epilimnion and the cool hypolimnion.

A table of the lakes in the District can be found on the next page.

DNR-Protected Waters in the Thirty Lakes Watershed District
(Larger than 10 Acres)

	Lake Name	DNR Inventory Number[1]	OHW[2]	Use Class[3]	Acres (*DNR Waters*)	Acres (*DNR Fisheries*)	Depth (*Max.*)	Lake Class[4] (*DNR Fisheries*)	Maximum TSI[5] Goal (*DNR Fisheries*)
1.	Bass	18-256P	1207	RD	386	309	21	29	49.3
2.	Bass	18-402W		n/l	34	n/l	14	36	39.6
3.	Bonnie	18-259P	1206.9	NE	83	n/l	32	29	43.9
4.	Clark	18-374P	1198.7	GD	309	343	31	29	44.1
5.	Crystal	18-341P		RD	98	n/l	6	n/l	
6.	Douglas	18-350	1209.1	n/l	27	n/l	n/l		
7.	Edward	18-305P	1207.3	GD	2,844	2,032	75	22	41.9
8.	Garden	18-329P	1205.7	NE	262	n/l	6	n/l	
9.	Gladstone	18-338P	1201.2	GD	457	407	36	29	44.2
10.	Guida (*Hardy*)	18-332P		NE	50	n/l	n/l	n/l	
11.	Hartley	18-392P	1199.6	RD	142	n/l	20	36	51.3
12.	Horseshoe	18-251P	1209.3	RD	974	855	55	43	43.0
13.	Hubert	18-375P	1198.7	GD	1,344	1,294	83	27	42.2
14.	Hubert, Little	18-340P	1199.8	RD	193	185	41	38	46.7
15.	Johnson	18-328P		NE	129	n/l	n/l	n/l	
16.	Lougee	18-342P	1208.4	RD	217	186	31	29	45.3
17.	Lynch	18-347P	1212.2	n/l	85	n/l	n/l	n/l	
18.	Mallard	18-334P	1204.1	NE	73	n/l	n/l	n/l	
19.	Markee	18-343P	1208.4	GD	121	106	33	29	42.6
20.	Markee, Little	18-324P		NE	15	n/l	n/l	n/l	
21.	Moberg	18-389W		RD	41	n/l	n/l	n/l	
22.	Mollie	18-335P	1206.8	NE	421	270	7	39	49.1
23.	Moody	18-339W		NE	43	n/l	n/l	n/l	
24.	Mud	18-326P		NE	82	n/l	n/l	n/l	
25.	North Long	18-372P	1198.6	GD	6,178	5,998	97	22	44.9
26.	Pelican	18-308P	1207.4	GD	8,468	8,253	102	22	40.5
27.	Pelican, Little	18-351P	1207.4	GD	402	283	34	29	41.3
28.	Perch	18-304P		NE	181	n/l	5	n/l	
29.	Rice	18-327P		NE	181	n/l	6	n/l	
30.	Shaffer	18-348P	1211.7	NE	117	n/l	n/l	n/l	

Lake Name	DNR Inventory Number[1]	OHW[2]	Use Class[3]	Acres (*DNR Waters*)	Acres (*DNR Fisheries*)	Depth (*Max.*)	Lake Class[4] (*DNR Fisheries*)	Maximum TSI[5] Goal (*DNR Fisheries*)
31. Sorenson	18-323P	1214.6	RD	92	72	46	32	39.1
32. Stevens	18-325W	1208.2	NE	41	n/l	n/l	n/l	
33. Twin	18-336P		RD	75	n/l	7	n/l	
34. Twin, East	18-257W		NE	32	32	28	n/l	
35. Twin, West	18-258W		NE	23	n/l	n/l	n/l	
36. Young	18-252W	1208.8	NE	71	n/l	n/l	n/l	
37. Unnamed (N. of *Horseshoe*)	18-250P		n/l	28	n/l	n/l	n/l	
38. Unnamed (E. of *Johnson*)	18-330W		NE	26	n/l	n/l	n/l	
39. Unnamed (W. of *Johnson)*	18-331W		NE	40	n/l	n/l	n/l	
40. Unnamed (*Near Hubert*)	18-333P		NE	46	n/l	n/l	n/l	
41. Unnamed (*Off Mollie*) James Lake	18-337P		NE	41	n/l	n/l	n/l	
42. Unnamed (*Near N. Long)*	18-390W		RD	50	n/l	n/l	n/l	
43. Unnamed (E. of Gladstone)	18-449P		n/l					
44. Unnamed (W. of Mollie)	18-451P		n/l					
45. Unnamed (E. of Y-Store)	18-555W		n/l					
46. Unnamed (S. of *Edward*)	18-556W	1207.6	n/l					
47. Unnamed (N. of North Long)	18-557W		n/l					
48. Unnamed (SE of *Gladstone*)	18-558W		n/l					
49. Unnamed (E. of *Bonnie*)	18-571W		n/l					
50. Unnamed (W. of *Pelican*)	18-593W		n/l					
51. Unnamed (W. of Moose O Bay)	18-594W		n/l					
52. Unnamed (*NE of Lougee*)	18-596W		n/l					

(1) DNR inventory number; Crow Wing Co. lakes & wetlands are assigned number 18, followed by the inventory number; P - Protected Lakes; W - Protected Wetlands.

(2) OHW = Ordinary High Water Elevation

(3) DNR classification which determines the minimum standards for shoreland development:
- NE = Natural Environment
- RD = Recreational Development
- GD = General Development
- n/l = Not listed

(4) Fishing lakes surveyed and classified by DNR Fisheries; n/l - not listed.

(5) TSI = Trophic State Index.

The flow chart used by the District is completing Lake Management Plans is listed below:

Lake Management

Profile Summer Winter	Lake Condition	TSI Summer
Compliant Maps Residence	Nutrient Sources	Aerial Lake Analysis
In Lakes Nutrient Positioning in Lake Dispersion	Source Qualification "Mass Balance"	Measure Loading of Sources "In Pounds"
Modeling Property Purchase	Watershed Analysis	Land use Loading Zoning Current Build-out Future Build-out

Goal Setting

Reaction Plan	Lake Management Plan	Monitoring

Implementation Strategies Definitions

EDUCATION:	Educate District Managers and Lake Associations.
WWP:	Wastewater Management Plan – is the management of wastewater generated from individual homes, municipalities and industries within the boundary of the Thirty Lakes Watershed District refer to Table 3 – Administrative Studies, District Sewer Project.
SWP:	Storm Water Management Plan – is the management of storm water runoff from land uses within the boundary of the Thirty Lakes Watershed District according to Table 3 – Administrative Studies, District GIS Systems
TSI:	Trophic Status Index Testing – is the testing of Total Phosphorus, Chlorophyll a and collection of Secchi readings to determine a water quality index to aid in the continuing water quality management of the Watershed District as identified in Table 3 – Administrative Studies, Water Quality Data Collection
Winter:	Winter sampling consists of sampling of the epilimnion and hypolimnion to further in the continuing water quality data collection of the watershed district as identified in Table 3 – Administrative Studies, Water Quality Data Collection
Over flight:	Conducting an Environmental Assessment of lakes in the District, from an aircraft, the Assessment includes identifying and recording illegal activities, environmental concerns and permit documentation. As identified in Table 3 – Administrative Studies, Verify permit activities and identify unpermited and illegal activities
Werring/TMDL:	A procedure by which the land use is mathematically modeled to determine the nutrient loading to the lake. TMDL (total maximum daily load) is the maximum amount of nutrients the lakes watershed can transfer to the lake in order to stay at or below the lake's TSI goal. As defined in Table 3 – Administrative Studies, District Storm Water Runoff Program
TSI Goal: and public	The level of eutrophication, which is acceptable to the fisheries use of the lake. This applies to Table 3 – Administrative Studies, maintain lake management plans

Struc. M:	Structure Management is flow structure monitoring such as ditches and control structures. This applies to Table 3 – Administrative Studies, Storm Water Runoff
Lake Chg:	Lake Change is requesting the Minnesota Department of Natural Resources to change the classification of the lake. This applies to Table 3 – Administrative Studies, Maintain Lake Management Plans
Aquatic Plant MP:	Aquatic plant management plan is designed to manage and protect aquatic plants both valuable and nuisance species throughout the watershed district. This applies to Table 3 – Administrative Studies, Maintain Lake Management Plans