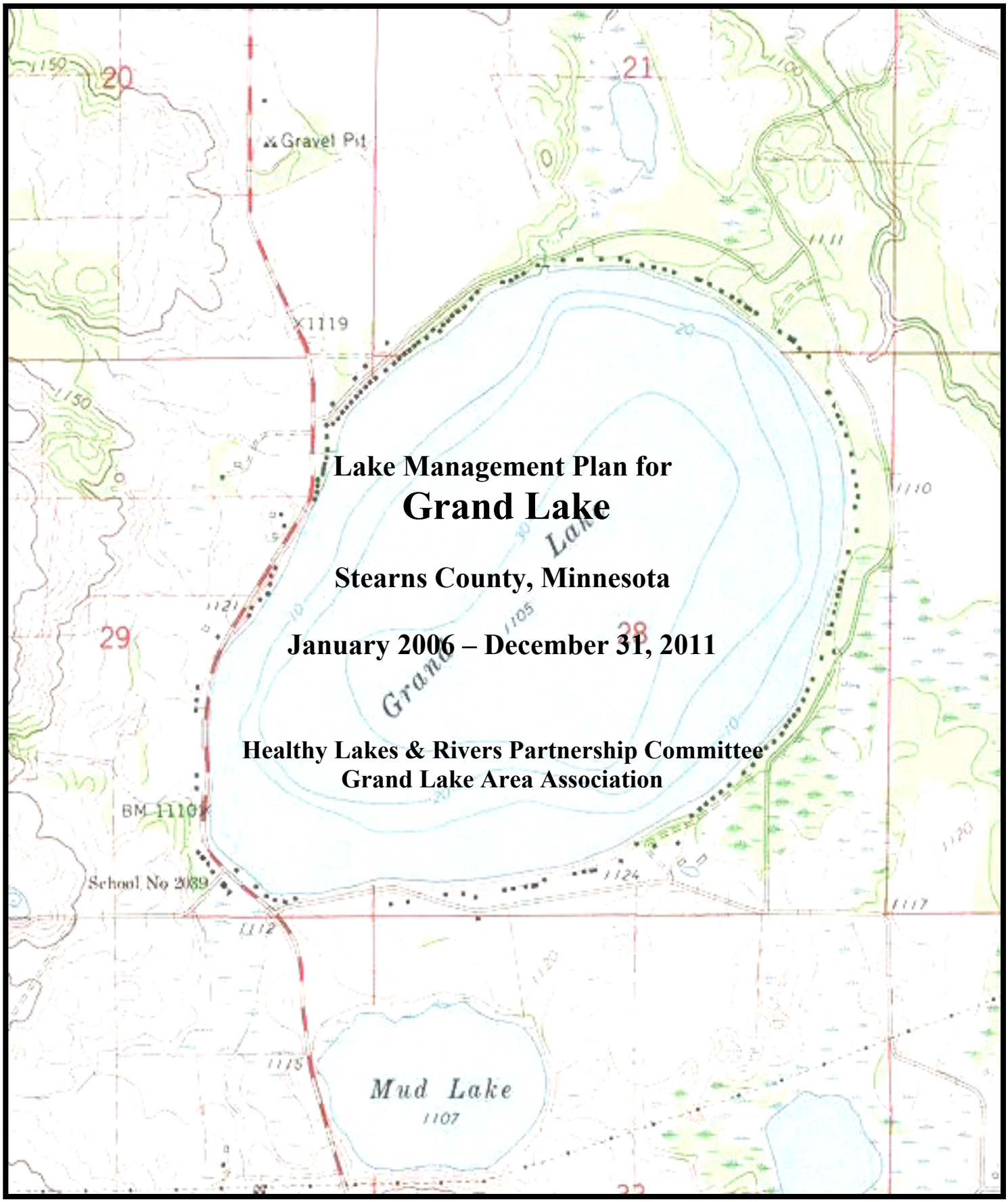

Lake Management Plan for
Grand Lake

Stearns County, Minnesota

January 2006 – December 31, 2011

Healthy Lakes & Rivers Partnership Committee
Grand Lake Area Association

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Management Plan for Grand Lake

Introduction

In January of 2005, a decision was made by the Board of the Grand Lake Area Association to update the Grand Lake Management Plan, originated in 2002 through the Initiative Foundation's Healthy Lakes and Rivers Partnership program. A decision to update this plan was made for three primary reasons:

- To update the mission, strategic goals, and action plans to reflect recent changes in the Grand Lake area due to the consolidation of the Grand Lake and Pleasant Lake areas into the city of Rockville.
- To engage citizens in the advocacy of healthy lakes and waters in central Minnesota, and to develop specific implementation projects that benefit the Grand Lake and Sauk River watersheds.
- To be proactive in our efforts to retain the rural, small town nature of the Grand Lake area and to enhance the quality of our water and watershed at a time when rumors about large-size residential developments near Grand Lake are becoming reality. Take a look at the St. Cloud Times article found at the bottom of the front page on Wednesday, December 7, 2005:

Rockville may add 304 homes

City to consider 160-acre development proposal that includes trails, parks

By Mackenzie Ryan
maryan@stcloudtimes.com

ROCKVILLE — City Council members will discuss a proposed development tonight that would increase the number of houses in Rockville by one-third.

A concept plan for a 304-lot development on the north side of Grand Lake was submitted to the city in November, and tonight will be the first time council members discuss the project.

"It's in its very infant stages," City Administrator Rena Weber said.

Some residents have expressed concern about the density of the development, Rockville Mayor Brian Herberg said.

The 160-acre proposed development would have 304 single-family homes. While lot sizes will vary, the development would average about two houses per acre, said David Hagen, a planner with Loucks Associates. The company was hired by Brooklyn Center-based developer Backes Companies Inc.

It could take five to 10 years for the development to be built, Hagen said. The company plans to sell individual lots, so housing styles and prices will vary.

The development also would feature a 17-acre park with mature trees on the east side and trails, he said.

"From what I can see and tell so far, everything fits with what our ordinance is. He's not asking for any favoritism or any special variance of any kind," Herberg said.

See ROCKVILLE, 7A ▶

If you go ...

When: 7 tonight.
Where: John Clark Elementary School media center (enter by southeast door).
Information: 251-5836.

Grand Lake Meadows development

Storm pond
Storm pond
Storm pond
Storm pond
Storm pond
8
Grand Lake
N
0 5
Miles
St. Cloud
Stearns County
94
Rockville
23
8

Times graphic by Lisa Mueller, lmueller@stcloudtimes.com

This Grand Lake Management Plan update is a five-year strategic plan to guide the Board and the members of the Grand Lake Area Association from January 1, 2006 through December 31, 2010. This Lake Management Plan is also intended to be a "living document" that includes the current mission statement of the Grand Lake Area Association, information on current water quality data, and our strategic goals and action plans. As new or better information becomes available, as we accomplish our goals, and as we discover that alternative strategies are needed, it is our intent to update this plan in the future so that it continues to serve as a useful guide to future leaders.

History of the Grand Lake Area Association's participation in the Healthy Lakes & Rivers Partnership Program

In April and March 2002 the Grand Lake Area Association was invited to participate in the Initiative Foundation's Healthy Lakes and Rivers Partnership program along with seven other Lake Associations in Stearns County. Under the coordination of Greg Berg (Stearns County Soil and Water Conservation District), representatives attended two days of training on strategic planning, communication, and nonprofit group leadership.

Representatives of many state and local agencies, as well as nonprofit organizations also attended the training sessions in order to offer their assistance to each group in developing a strategic Lake Management Plan. The Grand Lake Area Association was represented at the Healthy Lakes & Rivers training sessions by Thomas (Rudy) Ruether, Dave Ebnet, Paul Ludwig, Doug Malchow, Gil Otto, Ed Sheldon, and Scott Warzecha.

Following the training sessions, each Lake Association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Grand Lake Area Association held this planning session on June 22nd, 2002, facilitated by Larry Wannebeo. Approximately thirty five people were in attendance, with about fifty percent of the participants describing themselves as year round residents.

Purpose of the Grand Lake Management Plan

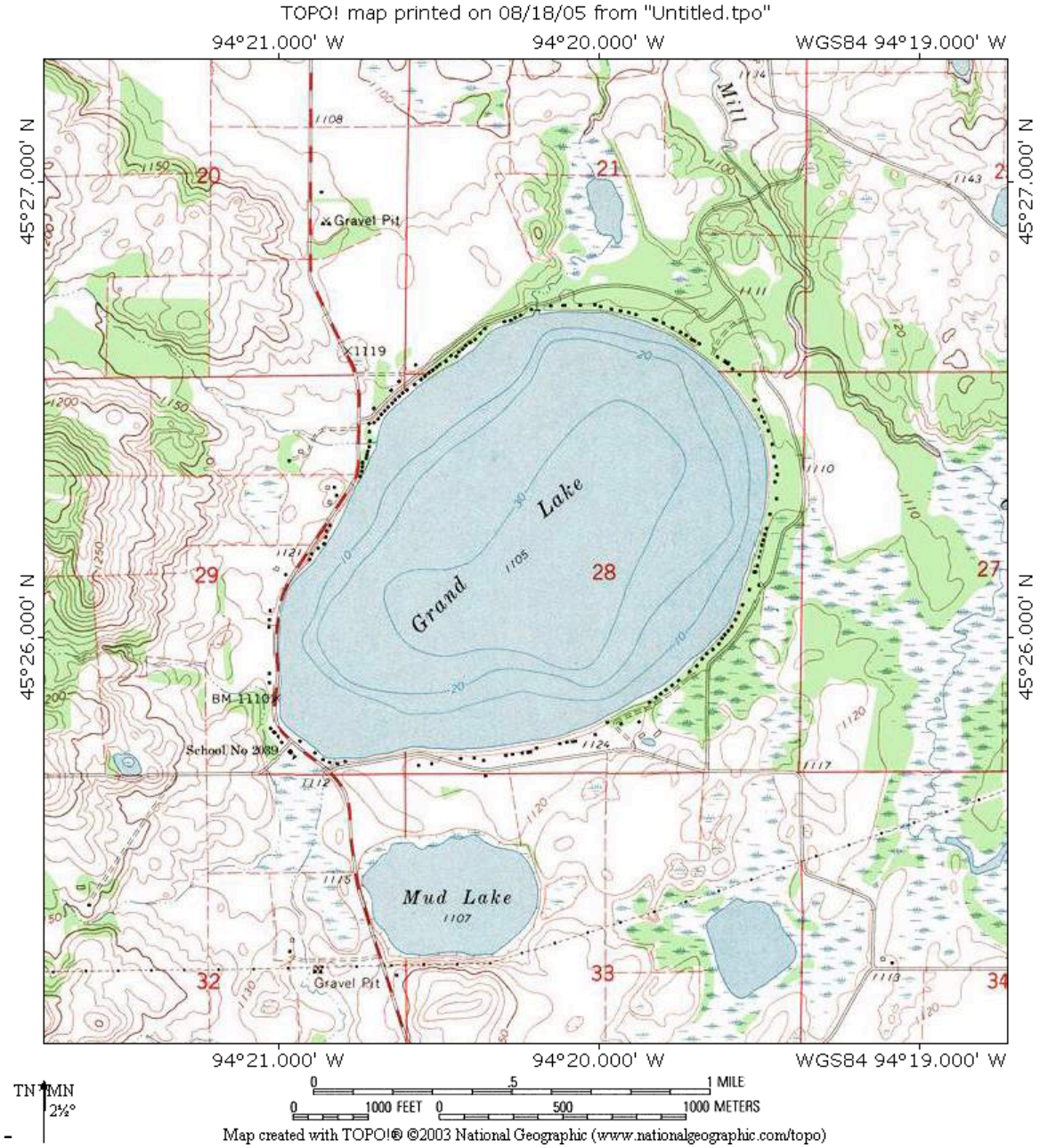
The purpose of the Grand Lake Management Plan is to create a record of historic and existing conditions and influences on Grand Lake, and to create a record of the strategic goals of the Grand Lake community. Ultimately, it is meant to guide leadership as goals are prioritized, and to help foster citizen action and engagement in the priority action areas. Clearly, the State of Minnesota, Stearns County, and the City of Rockville has a vital role and responsibility in managing surface waters and other natural resources, but above all else, this Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

In discussing lake management issues, it is impossible to avoid all scientific or technical terms. We have tried to express our goals, measures of success, and other themes as simply and clearly as possible, but have included a glossary of common limnological terms at the end of the plan to assist the reader. *"Limnology"* is the state of lake conditions and behavior.

Finally, we would like to thank the funders of the Healthy Lakes & Rivers Partnership program for Stearns County, including The McKnight Foundation, Laura Jane Musser Trust, Stearns County Environmental Services, Stearns County Soil & Water Conservation District, Minnesota Board of Water & Soil Resources, Stearns Manufacturing, Inc., The U.S. Environmental Protection Agency, the State Bank of Kimball, the Lake Hubert Association and the Portage-Crooked Lakes Association of Crow Wing County, Karl and Gail Samp, Ashley Vargo, and Don Hickman & Sandra Kaplan. Additional support has recently been provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative Commission on Natural Resources (LCMR).

Physical Characteristics and location of Grand Lake

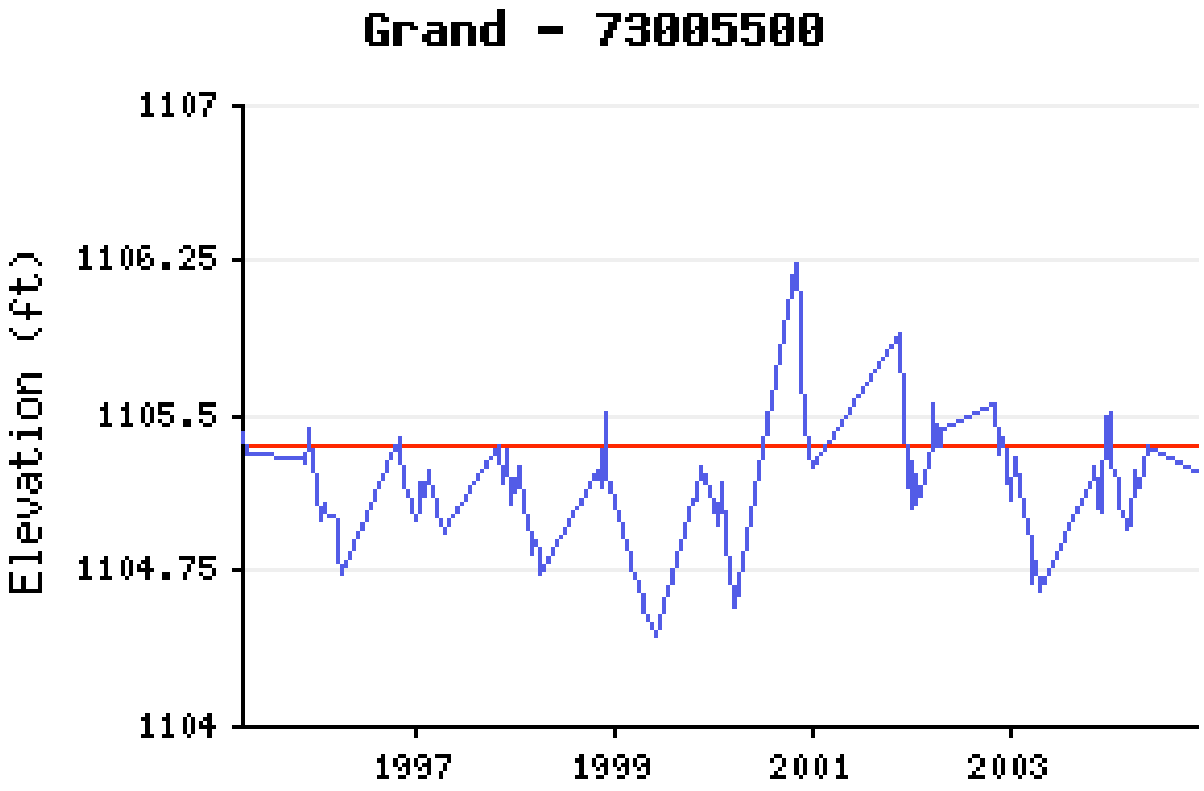
Grand Lake (DNR Lake ID# 73-0055) is located four miles east southeast of the City of Cold Spring in Stearns County. The lake has a surface area of 655 acres, of which 235 acres (36 percent) is in the littoral zone, meaning it has a depth of 15 feet or less. Grand Lake has a maximum depth of 34 feet, and average water clarity of 4 feet.



Lake Elevation

The MN Dept. of Natural Resources, Division of Waters has 850 records of Lake Elevation for Grand Lake dating back to August 16, 1937, with the following summary characteristics:

	Elevation[1]	Date
Highest Recorded Water Level	1106.8 ft	June 29, 1983
Lowest Recorded Water Level	1103.59 ft	Oct. 8, 1989
Average Water Level	1105.22 ft	
Ordinary High Water Level	1105.36 ft	



[1] Mean Sea Level in feet

Watershed Description

The surface area of Grand Lake is 660 acres with a watershed of 6,892 acres, entirely within Stearns County. The maximum depth of the lake is 35 feet, with very little structure except for a sand bar coming out from the east shore one third the distance of the lake.

The lake is unusual in that it has a natural occurring sand shoreline on northeast side for several thousand feet. Also unusual is the entire watershed is on the west half of the lake.

The watershed area is mostly agricultural with about one fourth being wooded or marsh. There are two major streams running into the lake. The larger one is Ploof creek in the southwest corner and Johannes Creek in the northwest corner.

The water level stays fairly constant; varying about 10 inches from high to low. No other lake or watershed flows into Grand Lake and its outlet flows into the Sauk River at Rockville. Grand Lake is zoned general development having about 188 cabins and year round homes with very few lots left undeveloped. It has one public access on the south shore with a concrete ramp and a roll-in dock.

Precipitation

In 1997 the Minnesota Pollution Control Agency (MPCA) completed a Lake Assessment Program (LAP) evaluation of Pearl Lake, near Kimball, and south of Grand Lake. The following characterization of precipitation was offered in this report:

> Based on State Climatology records, precipitation averaged 26-28 inches annually in this part of the state with about 18-19 inches of that amount in May through September.
>
> Evaporation typically exceeds precipitation in this part of the state and averages about 36 inches (0.91 m) per year. Runoff averages about 5 inches with 1-in-10 year low and high values (low and high runoff values which might occur with a frequency of once in ten years) of 1 inch and 8.0 inches, respectively for this area (Gunard, 1985).

History of Grand Lake Area Association

According to the recollections of Ed Zapp Jr. . . . .

The Grand Lake Property Owners Association began in the early 1950s, and provided an opportunity for lakeshore property owners to be able to address the mutual needs and concerns that they had about the lake and its surrounding areas. It was formed by the owners of property on the North East and East shores of the lake.

Its original main purpose was to address the road upon which all traveled to get to their properties. The original dirt road served the Mitchell farm that was located on the North East Shore of the Lake. As the years went by the Mitchells sold off all of the lake shore they owned, and at that time the old farm road was the main ingress and egress to the shore properties. It was a narrow road through the old pasture and consisted of two ruts with a grass patch in between them. If a vehicle approached, it was necessary to back up and pull over to let the auto pass.

The neighbors were also worried that the old farm land would be purchased by Bell Lumber in Cold Spring in order to supply them with the raw materials to make rail road ties and rough sawn lumber. The neighbors got together and formed what eventually grew into the lake association. This happened around 1950. The group discussed the future of the farm and the road. After much discussion, they took Ed Zapp Sr. up on his offer to purchase the woods to preserve it and the road. The group then went door to door, gathering members along the length of the road. There were no established dues at first. If money was needed for a purpose, the cost was established, and then most everyone gave their fair share.

Some of the first projects of the lake association were to tear down the old barn and out-buildings, and the old foundations were used to build the basis for the road to Grand Lake, where it was platted to be in the Second Addition to Agate Beach (the original road was actually just below the hill there). Funds were raised to put some gravel on the road (to fill the potholes). Dick Sporleder purchased an old horse drawn road grader and Ed Zapp and Ed Zapp Jr. spent many Saturdays grading the road by pulling it behind their Willis Jeep before they purchased an old motorized Alias Chalmers road grader.

Over the years, the road to Grand Lake was relocated in certain places to make it safer. It was extended to service the Whitney and Wheelock Shore Lots Addition to the west, and the road was relocated behind the properties in the First Addition to Agate beach on its southerly route. In 1977 Matt Ampe located an old rail road tank car at the car shops in Waite Park. The lake association purchased it for $832.00 and had it installed just East of the old bridge across Mill Creek (built in 1908). Martin Classen from Rockville was hired to build a new approach to the culvert and remove the old bridge. The cost of his services was $943.39. Ed Zapp supplied all the gravel.

Hub Bartelme worked on Northwestern Bell Telephone in order to get phone service for the residents of the lake. There were a number of doctors who owned lots and needed the service in case of emergencies. The first lines were all party lines and everyone had to learn their special ring. Later, Hub worked to establish pricing that would be the same as other Bell customers.

As the 50's gave way to the 60's and the 60's to the 70's, concerns were raised about the quality of the water in Grand Lake. In addition, the Molitors were developing lots for sale on the south shore of the lake. Some property owners on the northwest and south shores of the lake asked if the lake association could be expanded to include the whole lake, and at that point, membership

in the Grand Lake Property Owners Association was open to all who owned property on Grand Lake.

The DNR was approached about stocking the lake. They asked the Association to back the DNR's purchase of land for a public landing and said that they would stock the lake if they got the backing of the people on the lake (at the time, the only access to Grand Lake was at the old Elm Resort and the Grand View Resort.) The backing was given, the DNR purchased property from Paul Doerner, and a public access was constructed on the southwest side of Grand Lake.

Throughout the 60s'and into the 70', the Grand Lake Property Owners Association sponsored water quality tests, including a test of all septic tanks to determine if they were polluting the lake. Biocentric Inc. made a study of the lake in February of 1980, and Dr. Keith Knutson of St. Cloud State University presented the findings to the lake association at the August meeting in the Rockville Town Hall. Some ground water dikes were built along Ploof Creek to slow the flow of run off and to help filter the water before it entered the lake. Many meetings have been held about aquatic weeds and controlling pollution.

Pierre Hansen replaced the bridge over the lake's outlet (after it was destroyed by a mysterious fire in 1978) by using the old bridge girders and by welding old used plow sheers to them. The girders came from the old street car tracks of St. Cloud. They were originally used by the Whitney family (who owned the street car line) to build the bridge across the outlet so they could get to their cottage.

On one occasion the lake association hired Lawrence Hall, Attorney at Law, to speak on its' behalf at the Township meeting against a proposed mobile home park between Mud Lake and Grand Lake on the lake's south side. The park was never built.

As the years have gone by, the lake association has become more structured and formal. In 1977, officers were formally elected with Hub Bartelme being the President. This was done at the August 1980 meeting. Annual dues were established at $10.00 per year to cover the cost of mailing the new Newsletter. This was a natural progression as the issues became more complex and more Governmental Agencies became involved with lakes, cities, townships, etc.

More recently, the Grand Lake Property Owners Association changed its name to the "Grand Lake Area Association" to include and engage all property owners near the Grand Lake area. This name change also provided recognition to the important contributions of all citizens who own land in the Grand Lake watershed. The phrase "it takes a village" seems to apply as we are now working on implementation projects to reduce nutrient runoff into Grand Lake from our watershed, from Ploof and Johannes Creeks, from any proposed residential developments, and from our own lakeshore. The lake association has needed to partner with a number of agencies to accomplish our goals, including our neighbors in the Grand Lake watershed, the City of Rockville, the Sauk River Watershed District, the Soil and Water Conservation District, Stearns County Environmental Services, and the Department of Natural Resources.

There have been some wonderful traditions, new and old, in the history of Grand Lake and the Grand Lake Area Association . . . 4th of July flag-raisings ceremonies, 4th of July watercraft parades, 4th of July fireworks, sail boat races, the Stephen Sommers Great Grand Lake swim, fund raisers like the Grand Lake Fun Festival, and neighborhood get-togethers.

Currently there are approximately 80 members in the Grand Lake Area Association. At this time a newsletter, ***"The Scoop at Grand Lake",*** is mailed twice each year to all residents who have

property on or near Grand Lake, whether they are members or not. Annual membership dues at this time are $35.00, and membership dues have been used to pay the expenses for the newsletter, DNR permits and chemical treatments to manage curleyleaf pondweed, periodic fish stocking, water quality studies, and other projects associated with clean water. Recently, membership dues and fundraising dollars have been used to obtain legal counsel as our city sewer service, our close proximity to Rockville (less than 2 miles) and our scenic lake vistas have made our area a hotspot for new development. It is the intention of the Grand Lake Area Association to preserve our mission:

> The mission of the Grand Lake Area Association is to restore and preserve the Grand Lake watershed, returning Grand Lake to its mesotrophic state, creating the finest lake experience in central Minnesota.

For the record, some of the Officers of the organization over the years have included the following:

Presidents:	Hub Bartelme, Matt Ampe, Roger Schmidt, John Knutson, Tom Ruether, Ed Sheldon, Jeff Hagen, Scott Palmer, and others.
Treasurers:	Ed Zapp Sr., Ed Zapp Jr., James Schmid, James Hall, and others.
Secretaries:	Carole Lund, Mary Grams, Gil Otto, Sue Palmer, and others.

At this time, the Board members of the Grand Lake Area Association include the following:

President:	Scott Palmer
Vice President:	Robert White
Treasurer:	Jim Hall
Secretary:	Susan Palmer
Board Members:	Susan Dean, Jeff Hagen, Paul Ludwig, and Pat Sell

1. Water Quality

Citizen-Determined Water Quality Issues:

- The water quality of Grand Lake is in-between a mesotrophic and eutrophic state. Part of our mission is to return Grand Lake to a consistent mesotrophic state.
- Excess nutrient runoff from Ploof and Johannes Creeks has a negative impact on water quality.
- Excess nutrient runoff from impervious surfaces and use of fertilizers has a negative impact on water quality.
- Inadequate watershed buffer zones and shoreline practices fail to provide an adequate filter for nutrient runoff.
- High recreational boat use contributes to sediment disruption.
- Lakeshore owners need up-to-date education and information regarding shoreline management, the location of campfire pits, buffer zone practices, and rain gardens.
- Grand Lake, like all lakes, has the potential to get Eurasian milfoil with so many boats trailering on and off the lake.
- Sand is added to the beaches of many property owners on a regular basis without an understanding of the impact on water depth, aquatic vegetation, and shoreline stabilization.

Water Quality Monitoring

Citizen volunteers from Grand Lake have participated in the Minnesota Pollution Control Agency's (MPCA) Citizen Lake Monitoring Program (CLMP) since 1977, recording secchi disc transparency – a measure of water clarity. In recent years these data have been collected by: Jack & Harriet Lehner, Paul Ludwig, Ed Sheldon, and Norman Huser.

On the MPCA's web-site link, "Environmental Database Access," additional water chemistry data is reported, including total phosphorus and chlorophyll *a*, as well as other data collected from Grand Lake.

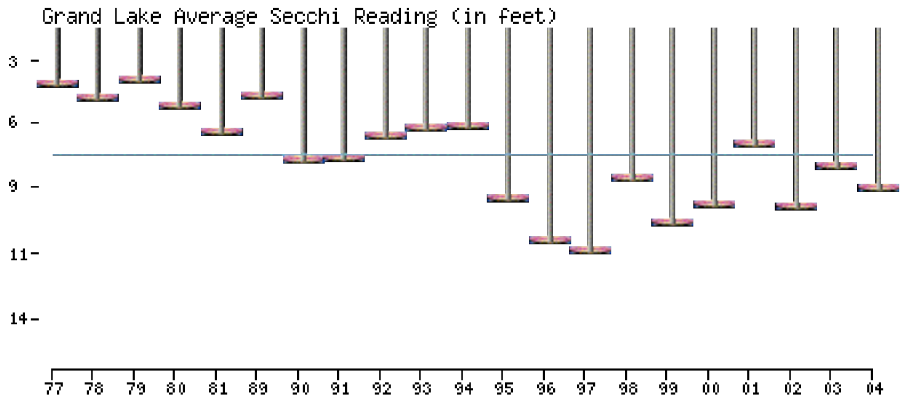
One application of secchi disc transparency data (as well as the phosphorus and chlorophyll a analyses) is to convert them into a Carlson Trophic Status Index (TSI) score. The Carlson Trophic Status Index (TSI) is a tool used to summarize several measurements of water quality into one index value, which can be used to compare a lake to other lakes, or to historic/future data as a measure of degradation or improvement. In many ways, the index can be viewed as a measure of the potential for algal productivity. Since most people value lakes with low algae productivity, the lower the TSI value the healthier the lake. Specifically:

TSI Range	Trophic Status	Characteristics
0-40	Oligotrophic	Clean Lake
41-50	Mesotrophic	Temporary algae & aquatic plant problems
50-70	Eutrophic	Persistent algae & aquatic plant problems
Greater than 70	Hypereutrophic	Extreme algae & aquatic plant problems

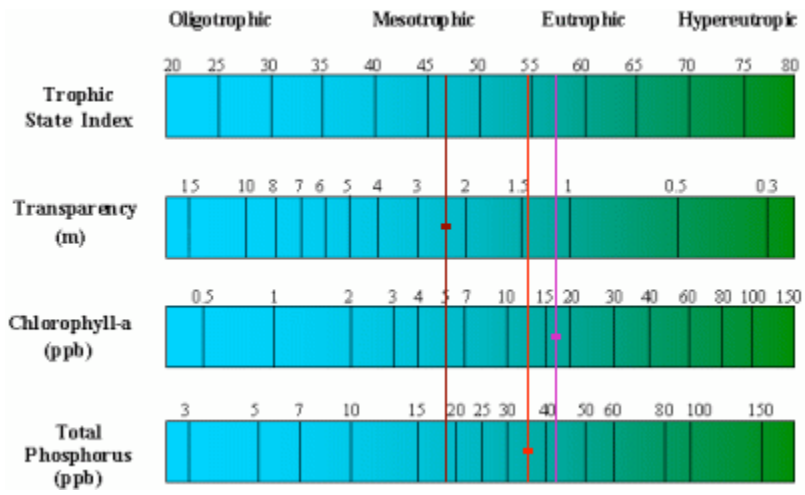
Based on the data provided on the MPCA website, an average concentration (or depth) for the key TSI parameters can be determined, and the associated TSI score calculated.

Year	Chlorophyll *a* (µg/L)	Total Phosphorus (µg/L)	Secchi Depth (feet)	Average TSI
1977	---	---	4.7	55.4
1978	---	---	5.3	54.4
1979	---	---	4.5	55.9
1980	---	---	5.6	53.2
1981	5.1	0.008	6.8	50.0
1989	---	---	5.2	54.4
1990	---	---	7.9	49.3
1991	---	---	7.9	49.2
1992	---	---	6.9	50.8
1993	---	---	6.6	51.9
1994	---	---	6.5	53.2
1995	15.5	0.033	9.0	47.0
1996	---	---	11.4	42.6
1997	---	---	11.9	43.1
1998	---	---	8.7	47.3
1999	19.8	0.040	9.4	47.5
2000	---	---	8.7	47.0
2001	5.6	0.111	7.3	50.0
2002	---	---	9.6	45.3
2003	---	---	8.1	47.3
2004	---	---	8.9	45.9

The secchi transparency data are summarized graphically in the chart below from the MPCA's Citizen Lake Monitoring Website. In general this shows a general trend towards improving clarity.

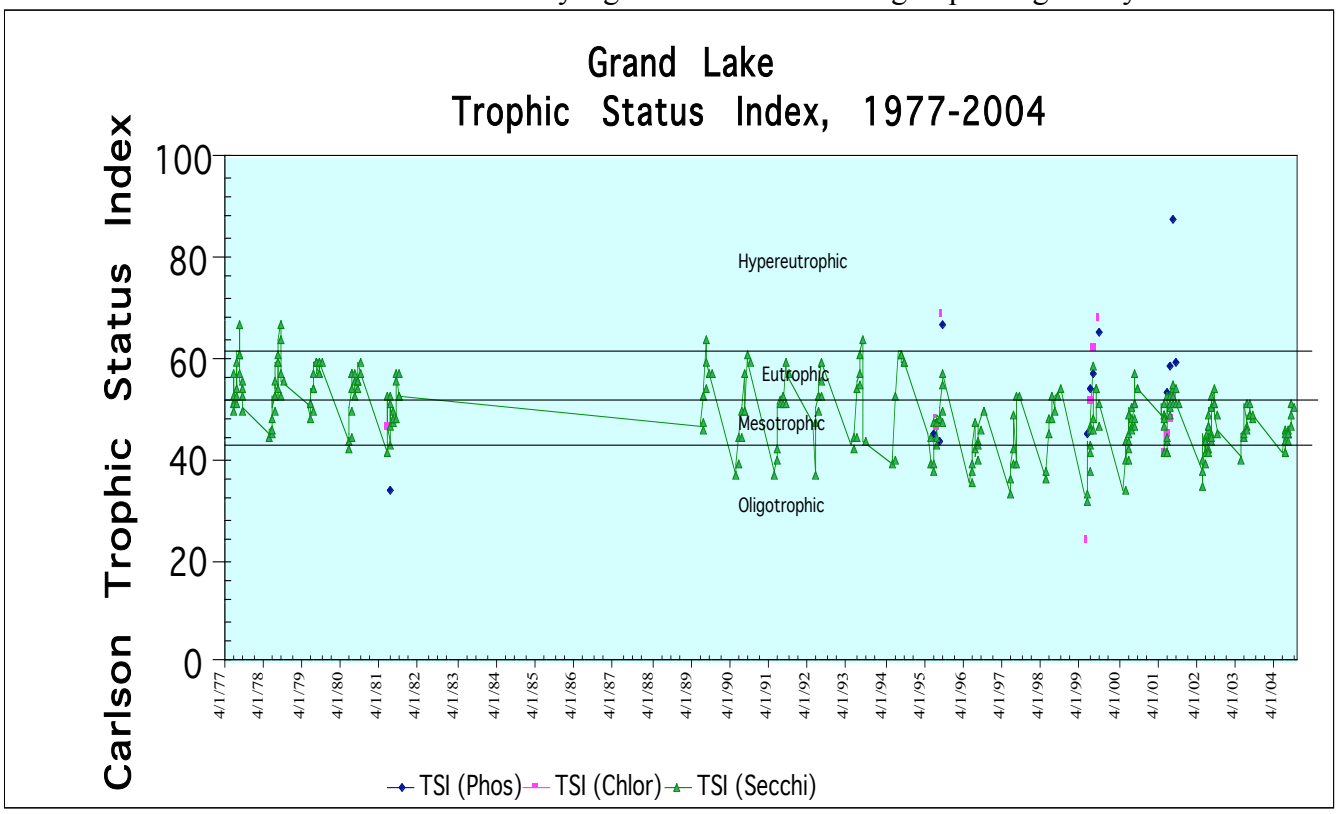


A review of Carlson's Trophic State Index suggest that water quality in Grand Lake routinely exhibits conditions in the upper "mesotrophic" range (a TSI score above 40 but below 50) and lower "eutrophic" range (above 50 but below 70).



The next chart shows the long-term trends in Trophic Status Index values the years for which data are available. The variation observed within a single year reflects naturally occurring affects of temperature, precipitation and water level; the important 'take home message" of this graph is that the data suggests a fairly stable range within the upper mesotrophic or lower eutrophic range since data were first collected in 1977.

In April 2005, scientists at the MPCA conducted statistical analysis on the Grand Lake secchi data. Specifically, they ran a Kendall trend analysis using WQ Stat Plus™ software, and concluded that Grand Lake has a statistically significant trend showing improving clarity.



A second method of evaluating water quality data and determining whether your water body is the "best that it can be" is to compare it to other lakes of similar morphology, geology, and land uses. Listed below are ranges of common measures of water quality based on many years and locations of water quality. The tables below are adapted from the MN Pollution Control Agency "Environmental Data Access" database, and compare Grand Lake results to common water quality ranges for lakes within the North Central Hardwood Forest Eco-region.

Average Summer Water Quality and Trophic Status Indicators

Parameter	Typical Range: North Central Hardwood Forest Eco-region (25th-75th Percentile)	Grand Lake Average ± Standard Deviation
Total Phosphorus (_g/L)	23 – 50	56.9 ± 82.6
Chlorophyll *a* (_g/L) mean	5 – 22	13.0 ± 16.2
Chlorophyll *a* (_g/L) maximum	7 – 37	48.7
Secchi disc (feet)	4.9 – 10.5	7.6 ± 3.7
Total Kjeldahl Nitrogen (mg/L)	< 0.60 – 1.2	0.70 ± 0.20
Nitrite + Nitrate Nitrogen (mg/L)	<0.01	0.02 ± 0.01
Alkalinity (mg/L)	75-150	160 ± 10
Color (Pt-Color units)	10 – 20	10.0 ± 6.1
pH	8.6 – 8.8	8.48 ± 0.33
Chloride (mg/L)	4 – 10	<10
Total Suspended Solids (mg/L)	2 – 6	17.6 ± 19.0
Total Suspended Inorganic Solids (mg/L)	1 – 2	
Conductivity (_mhos/cm)	300 – 400	322.5 ± 18.9
Total Nitrogen/Total Phosphorus ratio	25:1 – 35:1	

A third application of these data is to compare phosphorus concentrations to the Minnesota Pollution Control Agency water quality criterion for swimming and other recreational contact.

Full-support of swimmable use is set at a phosphorus concentration of 40 micrograms per liter, which ensures that conditions associated with "impaired swimming" would occur less than ten percent of the summer. Phosphorus concentrations above criteria levels would result in greater frequencies of nuisance algal blooms and increased frequencies of "impaired swimming."

The Central Hardwood Forests ecoregion phosphorus criteria level of 45-50 micrograms per liter (µg/L) serves as the upper threshold for partial support for swimmable use. This concentration corresponds to Carlson's TSI values of 57-59.

Name	Mean Total Phosphorus (µg/l)	Carlson's Trophic Stratus Index (phosphorus)	MPCA Swimming Criterion[1]
Grand Lake	33.0	54.0	Full-Support

The Stearns County website identifies three additional technical studies on conditions and influences upon water quality of Grand Lake:

Knutson, Keith M. 1980. A Review of Significant Facts and Data for the Development of Better Understanding of Grand Lake's Ecology. St. Cloud, Minnesota.

Knutson, K.M. 1979. Grand Lake Study: 1979 Study for the Grand Lake Association. St. Cloud State University, St. Cloud, Minnesota.

Sauk River Watershed District, 2000. Grand Lake Preliminary Water Quality Study, 1999. Sauk River Watershed District, Sauk Centre, Minnesota.

2. **Fisheries:**

Grand Lake supports a warm/cool water fish population. The angler harvest consists primarily of northern pike, yellow perch, walleye, black crappie, bluegill, yellow bullhead, pumpkinseed sunfish and largemouth bass. The goal of the Grand Lake Fisheries Management Plan (1999) is to "provide a walleye and northern pike fishery where relative abundance of both species is 6-8/gill net and the average weight is greater than two pounds." Specific operational plans and recommended projects are included in the body of the plan (Appendix 1, pp. 29 - 32).

Currently, Grand Lake is considered an "impaired water" due to excess levels of mercury, and as a result, there is a fish consumption advisory developed by the Minnesota Department of Health for the eating of northern pike and walleye taken from Grand Lake.

The Minnesota Department of Natural Resources conducts a periodic creel census to help provide an update on the "status of the fishery" in Grand Lake. The most recent survey (as of August 17, 1998) includes the following report:

> Relative abundance estimates of fish from 1998 gill net sets consisted of three target fish species: northern pike (18.83/lift), yellow perch (13.17/lift), walleye (9.50/lift); and four non-target species: black crappie (7.50/lift), bluegill (12.17/lift), yellow bullhead (8.50/lift), and pumpkinseed sunfish (8.00/lift). Walleye, northern pike and black crappie catch per lift were above upper-range expected values, while yellow perch catch per lift was between the low and mid-range expected values for lakes similar to Grand Lake.
>
> The gill net catch rate for northern pike significantly increased from 8.50/lift in 1992 to 18.83/lift in 1998; however, mean weight per fish decreased from 2.50 lbs to 1.75 lbs., respectively. Northern pike sampled in 1998 ranged in length from 9.0 to 33.0 inches, with a mean length of 19.5 inches. Growth was above average for Minnesota lakes as Age I, II, III, and IV individuals reached 14.72, 18.99, 21.95, and 25.60 inches, respectively.
>
> The gill net catch rate for yellow perch has appeared to decrease from 19.17/lift in 1992, to 13.17/lift in 1998, and mean weight per fish increased from 0.10 to 0.13 lbs., respectively. Yellow perch sampled in 1998 ranged in length from 5.0 to 8.5 inches, with a mean length of 6.7 inches. Yellow perch growth was average compared to other Minnesota lakes as Age II, III, and IV individuals reached 5.88, 6.51, and 7.66 inches, respectively.
>
> The gill net catch rate for walleye has appeared to decrease from 11.30/lift in 1992 to 9.50/lift in 1998; however, mean weight per fish has remained similar at 1.83 lbs. and 1.85 lbs., respectively. Walleye sampled in 1998 ranged in length from 7.0 to 28.0 inches, with a mean length of 16.4 inches. Growth was average for Minnesota lakes as individuals reached 16.08, 17.26, 19.41 and 22.61 inches by Age IV, V, VI and VIII, respectively. Walleye fingerlings stocked in 1990, 1992 and 1994 were represented in the catch, however, the 1997 stocking may not have been vulnerable to the gear in 1998.
>
> The gill net catch rate for black crappie has appeared to decrease from 18.50/lift in 1992 to 7.50/lift in 1998; however, mean weight per fish increased from 0.18 to 0.44 lbs., respectively. Black crappie sampled in 1998 ranged in length from 4.5 to 11.5 inches, with a mean length of 8.3 inches. Growth was above average compared to other

Minnesota lakes as individuals reached 4.80, 5.70, 8.82, 10.46, and 11.00 inches by Age I through V, respectively.

Relative abundance estimates of fish from trap nets in 1998 consisted of four primary fish species: bluegill (12.10/set), pumpkinseed sunfish (8.60/set), hybrid sunfish (1.10/set), and white sucker (1.40/set). Pumpkinseed sunfish and white sucker abundance were above the upper-range expected values for lakes similar to Grand Lake, while bluegill abundance was between the low and mid-range expected values.

The trap net catch rate for bluegill has significantly decreased from 51.60/set in 1992 to 12.10/set in 1998; however, mean weight per fish has remained similar at 0.07 lbs. Bluegill sampled in 1998 ranged in length from 3.0 to 7.0 inches with a mean length of 4.4 inches. Growth was average as Age I through VI individuals reached 3.17, 4.09, 5.01, 6.24, 6.77, and 7.22 inches, respectively.

The trap net catch rate for pumpkinseed sunfish has remained similar at 8.70/set in 1992 and 8.60/set in 1998. Fish sampled in 1998 ranged in length from 3 to 7 inches, with a mean length of 4.9 inches. The trap net catch rate for hybrid sunfish has appeared to decrease from 4.10/set in 1992 to 1.10/set in 1998. Hybrid sunfish sampled in 1998 ranged in length from 3 to 7.5 inches, with a mean length of 5.1 inches.

Largemouth bass in Grand Lake were sampled by night electrofishing during spring. The electrofishing catch rate for largemouth bass was 38.40/hour on-time which was similar to the Montrose area mean of 41.50/hour. Fish sampled in 1998 ranged in length from 7.0 to 14.1 inches, with a mean length of 9.0 inches. Of the catchable largemouth bass (larger than 8 inches), the proportion larger than 12 inches was 7%.

At this time, there are a number of challenges in the effort to maintain or improve the fisheries in Grand Lake. Many of these challenges are related to the amount of fishing pressure (both during the summer and winter), the extent of recreational boat use, and the lack of natural structure that provides protection and cover to the fisheries.

The Department of Natural Resources reports that summer fishing pressure on Grand Lake is estimated at 25.1 hours per acre, and all other recreational use is at 7.2 hours per acre (estimates were taken during the summer 1988 creel census). At the time of their survey, most of the angling was done from boats.

Winter angling is estimated at 45.8 hours per acre and spearing is estimated at 3.5 hours per acre (estimates were taken during the winter 1991 creel census). The winter pressures are considered to be high. Counts of fish houses have been conducted since the late 1970s. Counts have been made early in the winter fishing season, late in the winter fishing season or both. Since the winter of 1981-82 there have been 12 early season counts and 12 late season counts. The counts average 107 and 102 houses respectively.

For Stearns County, the DNR Area Fisheries Manager is Paul Diedrich, Area Fisheries Manager, 7372 State Highway 25 SW, Montrose, MN 55363, (763) 675-3301, paul.diedrich@dnr.state.mn.us.

3. Aquatic Vegetation

Aquatic plants are beneficial in many ways. Areas with plants produce shelter, spawning habitat, and more food items for fish. Aquatic plants further benefit lakes by producing needed oxygen and by absorbing nutrients from runoff, such as phosphorus and nitrogen. Emergent plants also protect shorelines and bottoms by dampening wave action and stabilizing sediments.

In Grand Lake, a total of 39 species of aquatic plants have been identified. Aquatic plant surveys were conducted by the Department of Natural Resources in 1975, 1987, 1997 and 1998. Submerged species grew to a maximum depth of 18-20 feet, 20 feet and 18 feet according to the 1975, 1987 and 1998 surveys respectively. The plants include 13 emergent species, 3 floating leaf species, 3 free flowing species and 20 submerged species. In the surveys, the most abundant submerged species were coontail, muskgrass and bushy pondweed. The emergent vegetation stands were mapped with GPS technology in 1998.

Aquatic species in need of particular protection include largeleaf pondweed (*Potamogeton amplifolius*), hardstem bulrush (*Scirpus acutus*), wild rice (*Zizania aquatica*) and water lilies (*Nuphar spp*.) Paul Diedrich, the Area Fisheries Manager for DNR has a 1998 map which shows the distribution of wild rice, cattail, water lily, and bulrush.

<u>The Value of Aquatic Vegetation in the Ecosystem</u>
Aquatic plants have intricate relationships in the ecosystems where they exist and with the people who use lakes and streams. The relationships, or effects, may be positive or negative. The effects may be quite localized or widespread. The relationships may be related to the physical, chemical or biological aspects of an ecosystem. They may also relate to human consumption, agricultural benefits or use as raw materials in various human activities. Aquatic plants may have medicinal benefits, be irritating to the skin or actually poisonous. Invasive, non-native plants can replace the native species with a resultant loss of the benefits native plants provide. Finally, their mere abundance may cause extreme difficulties in pursuing water oriented recreational activities like swimming, fishing and boating.

Aquatic and wetland plants have effects on the physical component of lake and stream ecosystems in several different ways. These include functioning as wave breaks, acting to stabilize sediments and soils and providing shoreline stabilization and protection against erosion. At least 43 species of Minnesota plants can have this physical relationship in the environment. Plants which function as wave breaks include threeway sedge (*Dulichium arundinaceum*), spikerush (*Eleocharis smallii*), hardstem and softstem bulrush (*Scirpus acutus and S. validus*) and wild celery (*Valisneria americana*). The stems of these plants, and others, reduce the energy in waves and protect shorelines. A number of plants have the ability to stabilize shoreline soils or bottom sediments. Among these are sedges (*Carex spp.*) and muskgrass (*Chara spp*.), duck potato (*Sagittaria latifolia*) and wild rice.

Aquatic plants influence the chemical aspects of lakes and streams. These influences include aeration, nutrient use and absorption of metals, wastewater treatment and as water quality indicators. Twenty aquatic plants found in Minnesota have some documentation related to chemical relationships in ecosystems. Muskgrass (*Chara spp.*) removes lime from the water and often has calcium deposits on it. Threesquare (*Scirpus pungens*) and Canada waterweed (*Elodea canadensis*) remove metals such as lead, mercury and cadmium. Additionally, Canada waterweed has been used experimentally to remove oil. Northern watermilfoil (*Myriophyllum sibiricum*) is an efficient users of nutrients in the water. Several plants are especially effective in

aerating water. They include northern watermilfoil and bushy pondweed (*Najas flexilis*) Aquatic plants are sometimes used for treating sewage effluent in wastewater systems. Several plants that have proven efficient are hardstem and softstem bulrush (*Scirpus acutus* and *validus*) and several species of duckweeds (*Lemna minor, Lemna trisulca and Spirodela polyrhiza*). Specific aquatic plant species may be indicators of good water quality. Among Minnesota plants with this characteristic are wild celery and white water buttercup (*Ranunculus spp)*.

Virtually every aquatic plant found in Grand Lake has an ecological value for some species of bird. Aquatic and wetland plants may provide cover, food, nesting material or nesting sites for a wide variety of bird species. For instance, hardstem and softstem bulrush, threesquare (*Scirpus pungens*), common cattail (*Typha latifolia*), narrowleaf cattail (*Typha angustifolia*) and wild rice all provide cover for a variety of waterfowl, shorebird, marsh bird and songbird species. Cattails and bulrushes also provide both sites for nesting and materials to construct the nests. Aquatic plants such as wild rice, wild celery, sago pondweed (*Stuckenia pectinatus*) and bushy pondweed are among the very best foods for waterfowl.

Aquatic plants are also valuable to several species of mammals. Whitetail deer, as an example, utilize pondweeds (*Potamogeton spp*.) and yellow waterlily (*Nuphar variegata*) as a regular part of their diet. Beaver also eat these plants in addition to duckweeds (*Lemna spp*.). Muskrats utilize hardstem and softstem bulrush and cattails for food, cover, nesting material and sites for their houses.

Fish are benefited by aquatic plants in several ways. Bluegill, largemouth bass and northern pike are all afforded shelter (cover) by plants such as coontail (*Ceratophyllum demersum*), muskgrass, Canada waterweed, bushy pondweed, claspingleaf pondweed (*Potamogeton richardsonii*) and flatstem pondweed (*Potamogeton zosterformis*), among others. Northern pike may use cattails and threesquare as spawning sites. Many aquatic plants serve as the substrate on which fish food organisms (insects, other invertebrates) live.

When too much vegetation is present or if exotic species predominate, management efforts are needed. With respect to Grand Lake, a curlyleaf pondweed survey was conducted by the Department of Natural Resources in 2005, and this survey indicated that there are 79 acres of "near surface" curlyleaf pondweed (*Potamogeton crispus*). This represents 33.6 percent of the lake's littoral area, and is considered by the DNR to be of nuisance proportions. Citizens who recreate on Grand Lake express concern that curlyleaf pondweed is overly abundant and feel intervention is necessary to allow unimpeded navigation and lake access for recreational activities.

In response to citizen concerns, the Board of the Grand Lake Association developed the Grand Lake Aquatic Vegetation Management Plan, a plan that was approved in January 2006 and is in effect through December, 2011. This plan, developed with the assistance of Ed Feiler from the Department of Natural Resources, provides a strategic plan for the management of aquatic vegetation on Grand Lake. This plan is included in Appendix 2.

Citizen-Determined Aquatic Vegetation Issues:

- Lakeshore owners need up-to-date education and information regarding the identification and management of aquatic plants and invasive exotic vegetation.
- Emergence and spread of invasive exotic vegetation, especially curlyleaf pondweed.
- Curlyleaf pondweed has taken over certain parts of Grand Lake, especially in the southwest corner. This prevents swimming, fishing, waterskiing, sailing, and other water activities. This growth is further fueled by nutrient runoff from Ploof and Johannes Creek. Boat usage (cutting off plants) and southerly winds spread these plants to other parts of the lake causing floating mats of plants. Also, it's possible that some of these aquatic plants can emerge in other areas of the lake due to the spread of turion beds.
- Tall aquatic plants that were once abundant in Grand Lake, like bulrushes, should be restored.
- Lakeshore owners need to have more information and understanding of what is needed for a healthy lakeshore, including buffer zones and aquatic plants that restore the ecological functions of the lakeshore.
- In areas of Grand Lake, mats of curlyleaf pondweed and other aquatic plants negatively impact recreation and esthetics, and make it necessary to clean up the shoreline on an ongoing basis.
- In the late summer and early fall, algae blooms and scums from decomposing aquatic plants are odorous, unsightly and impact lake use.
- Property owners on Grand Lake and within the Grand Lake watershed need up-to-date information on the proper use of chemicals on lawns, especially near the shoreline and streams, in order to avoid the negative impact of these chemicals on aquatic plants, fisheries, and water quality.

4. Wildlife

The "Blue Book," *Developing a Lake Management Plan* notes that:

> "Minnesota's lakes are home to many species of wildlife. From our famous loons and bald eagles to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife.
>
> The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and wild rice along the shoreline provide both feeding and nesting areas for wildlife. Loons, black terns and red-necked grebes are important Minnesota birds that are particularly affected by destruction of this vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young.

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section. In Stearns County, the DNR Area Wildlife Manager is Fred Bengston, 940 Industrial Drive, Suite 103, Sauk Rapids, MN 56379, (320) 255-4279.

Trends in the Grand Lake area are positive, with reports of successful nesting of bald eagles in the area. As many as seven bald eagles have been spotted in one tree during the late fall, just as the ice is forming on the lake. Blue heron and loons are observed daily on Grand Lake during the summer months.

5. Invasive Species

When we talk about aquatic vegetation, what are the Invasive or "Exotic" Species?
"Exotic" species -- organisms introduced into habitats where they are not native -- are severe world-wide agents of habitat alternation and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Is there any invasive or "exotic" aquatic plant species in Grand Lake?

Unfortunately, the answer is yes. Curlyleaf pondweed is found in Grand Lake, and is considered of nuisance proportions. Curlyleaf pondweed is an exotic plant that forms surface mats that can interfere with aquatic recreation. The plant is usually senescent (dies back) by early July. Curlyleaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared.

In a survey documenting the distribution of curlyleaf pondweed in Grand Lake (June 2, 2005), the MDNR notes that there are 79 acres of "near surface" curlyleaf, representing 33.6 percent of the lakes littoral area. In 2005 the curlyleaf pondweed was observed primarily in 6 to 12 feet of water. Herbicide treatments to control curlyleaf pondweed were conducted in the springs of 2003 through 2005.

Year	Acres Treated
2003	8.4
2004	22.5
2005	5.4

Thus far, Eurasian watermilfoil (*Myriophyllum spicatum*) is not found in Grand Lake. The infestation closest (within 12 miles) of Grand Lake is Clearwater Lake. Purple loosestrife (*Lythrum salicaria*) is not reported from the Grand Lake watershed. It is found in the Sauk River watershed. The nearest known location is approximately 1.25 miles northeast of Grand Lake.

What are the major "exotic" aquatic plant species found in Minnesota and how did they get here?
Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian watermilfoil (*Myriophyllum spicatum*)
Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and also by waterbirds, it reached Midwestern states between the 1950s and 1980s.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Purple loosestrife (*Lythrum salicaria*)
Purple loosestrife is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marches and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Round goby (*Neogobius melanostomus*) is a bottom-dwelling fish, native to Eastern Europe, which entered the eastern Great Lakes in ballast water. They can spawn several times per year, grow to about 10 inches, are aggressive, and compete with native bottom-dwellers like sculpins and log perch. They are expected to be harmful to Great Lakes and inland fisheries.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

White perch (*Morone americana*) are native to Atlantic coastal regions and invaded the Great Lakes through the Erie and Welland canals. Prolific competitors of native fish species, white perch have the potential to cause declines of Great Lakes walleye populations.

6. Land Use and zoning

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. While the specific impacts to a lake from various land uses vary as a function of local soils, topography, vegetation, precipitation, and other factors, it is ultimately the land uses which citizens have the most control over through prudent zoning.

Grand Lake, formerly within Rockville Township, is now within the "new" City of Rockville following a consolidation agreement in which the old city of Rockville merged with Rockville Township and the City of Pleasant Lake in 2002. As a result, land uses are now regulated by the City of Rockville's Comprehensive Plan and zoning ordinances. Because the City of Rockville is relatively new, land uses within the 1000 feet "shoreland overlay" have been regulated "by reference" using the shoreland ordinances of Stearns County.

On Tuesday, January 31, 2006, the St. Cloud Times announced that "a proposed moratorium on land within1,000 feet of lakes and 300 feet of rivers in Rockville is temporarily halting a 160-acre development on the north shore of Grand Lake." This moratorium, initiated by the Board of the Grand Lake Area Association, was passed on a unanimous vote by the city council on Wednesday, February 1st, giving the city of Rockville time to develop its own shoreland ordinances. In addition, public input at the city council and planning commission meetings called for the city to address the following concerns:

- To clarify in the comprehensive plan what is meant by "low density" development in land designated as such just north of Hubert Lane on Grand Lake. This clarification is needed since the comprehensive plan also calls for land use that preserves the rural character of the land in this section.
- To respond to citizen determined concerns that there should be no 2nd tier development around Grand Lake, and that if the city council permits 2nd tier development, that the development utilize the Planning Commissions concept plan that calls for a "conservation design" with ample buffer zones, open spaces, preservation of existing trees, and the utilization of native grasses in the buffer zones to reduce nutrient runoff.

Many zoning regulations are based upon the Shoreland Management Act and/or the Minnesota Department of Natural Resources (DNR) classification of a given lake. The DNR has classified all lakes within Minnesota as General Development (GD), Recreational Development (RD), or Natural Environmental (NE) lakes, and assigned a unique identification number to the lake for ease of reference. Counties in turn have used these classifications as a tool to establish minimum lot area (width and setbacks) that is intended to protect and preserve the character reflected in the classification. Similar classifications exist for rivers; in Stearns County the Mississippi River is considered Class II. Clearly any local municipal jurisdiction may have additional (and usually more restrictive) standards as well.

The Stearns County web-site provides a link to the Planning and Zoning ordinances for the county: http://www.co.Stearns.mn.us/department/pandz/forms. On any shoreland the permissible density and setbacks for virtually all new use are determined by the lake or river classification standards established by the Department of Natural Resources. Grand Lake (#73-0055) is a **General Development** Lake.

The Stearns County zoning standards for unsewered lakes for each of the respective classifications are:

Standards:	**General Development**	**Recreational Development**	**Natural Environment**	**River – Agriculture**
Structure setback from NOHW	75 feet	100 feet	200 feet	100 feet
Structure setback from Bluff Height	30 feet	30 feet	30 feet	30 feet
Lot Size	20,000 sq ft	40,000 sq ft	80,000 sq ft	40,000 sq ft
Lot Width	100 ft	150 ft	200 ft	150 feet
Height (other than water oriented accessory structure)	30 ft	30 ft	30 ft	30 ft
Elevation of lowest floor above highest known water level	3 feet	3 feet	3 feet	3 feet
Water Oriented Accessory Structure setback from NOHW	10 feet	10 feet	25 feet	10 feet

The Stearns County zoning standards for sewered lakes for Recreational Development lakes are:

Standards:	**Recreational Development**
Structure setback from NOHW	100 feet
Structure setback from Bluff Height	30 feet
Lot Size	20,000 sq ft
Lot Width	75 ft
Height (other than water oriented accessory structure)	30 ft
Elevation of lowest floor above highest known water level	3 feet
Water Oriented Accessory Structure setback from NOHW	10 feet

Most lakes have numerous properties that are "grand fathered," or developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment, or are destroyed by natural, accidental causes or in association with significant renovation.

Stearns County has a web site which offers helpful contact information regarding planning and zoning matters: http://www.co.stearns.mn.us/index.html. Details on shoreland standards and restrictions and answers to "frequently asked questions" regarding best management practices, resources of education or information, and additional assistance are provided through the Environmental Services Department, Stearns County Environmental Services, 705 Courthouse Square, Administration Center Room 343, St. Cloud, MN 56303, Phone: 320/656-3613, E-mail: dave.nett@co.stearns.mn.us

Grand Lake has experienced significant challenges since it hooked up to city sewer services, beginning in 2005. Cost estimates for the city sewer services were significantly higher than initial estimates, and to pay for the additional costs, the City of Rockville made a decision to allow for additional sewer hookups along County Road 8 from Grand Lake to the city proper. A 304 home "Grand Meadows" development has been proposed on the north side of Grand Lake,

and an organized Grand Lake Area Association and citizen input resulted in over 430 letters that were sent to the city council and planning commissioners calling for the moratorium, residential development that is less dense, and development that utilizes a conservation design. Copies of two petitions submitted to the City Council by the Grand Lake Area Association are included in Appendix 4. In addition, a copy of the Comprehensive Plan and existing ordinances can be found on the City of Rockville web page at http://www.rockvillecity.org/

7. Managing water surface use conflicts

The goal of lake management is to ensure that the lake can continue to provide the benefits that attract homeowners and users. However, conflicts among uses arise almost invariably. Successful resolution of conflicts lies in the ability of the users to work collaboratively to arrive at acceptable compromises.

The primary agency responsible for managing surface water use conflicts is the Minnesota Department of Natural Resources, Bureau of Information and Education. The Boat and Water Safety Section within the Bureau oversees surface water use and is in charge of administering the Water Surface Use Management (WSUM) program. The goal of this program is to enhance the recreation use, safety and enjoyment of the water surfaces in Minnesota and to preserve these water resources in a way that reflects the state's concern for the protection of its natural resources.

Within this context, any governmental unit may formulate, amend or delete controls for water surface use by adopting an ordinance. Submit the ordinance for approval by the MDNR Boat and Water Safety Coordinator by calling 1 (800) 766-6000 or (651) 296-3336. To gain approval the ordinance must:

- Where practical and feasible accommodate all compatible recreational uses;
- Minimize adverse impacts on natural resources
- Minimize conflicts between users in a way that provides for maximum use, safety and enjoyment, and
- Conform to the standards set in WSUM Rules.

From a practical standpoint, any community considering this action should also consult with their local law enforcement agency (that will largely enforce the local ordinance) to ensure that any restrictions can be effectively enforced.

An alternative or complementary approach is to encourage education and a "community standard" of acceptable behavior. Annual distribution of state standards for hours of operation, setbacks from shorelands, loon nests, swimming areas, and other hazards or sensitive areas helps create "peer pressure" to minimize the types of behavior that tend to lead to the most conflicts.

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8. Public water access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80 percent of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources, Trails and Waterways Unit. They are responsible for the acquisition, development and management of public water access sites. The DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government such as townships and municipalities. The DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

According to the 1998 Minnesota Department of Natural Resources Fisheries Survey, there is one public access on Grand Lake, as shown below:

Public Access Information

Ownership	Type	Description
Minnesota DNR	Concrete	Public Access on Southwest Corner

At this time, the public access at Grand Lake is provisioned with a dock, portable restroom facilities, and signs that assist in traffic control and the identification of invasive aquatic plant species. Citizen determined issues pertaining to the public access include the following:

- Concerns about the spread of additional invasive plant species, with Eurasian Watermilfoil being a major concern.
- Concerns about traffic congestion during holidays, with some people ignoring "no parking" signs on Grand Lake Road.

Volunteer prop inspections have been conducted infrequently, and may be a worthy lake association activity on busy holiday weekends.

LAKE MANAGEMENT PLAN PRIORITY GOALS FOR GRAND LAKE

The following objectives and goals were selected for initial investigation and implementation. They are subject to review and revision on an annual basis.

1. WATER QUALITY OBJECTIVES AND GOALS

Water quality is central to the mission of the Grand Lake Area Association, which calls for the association to restore and preserve the health of the Grand Lake watershed and to return Grand Lake to its mesotrophic state. In order to accomplish this mission, several pieces of a whole will need to come together through a process of citizen collaboration and engagement. Current objectives and specific goals in the area of water quality include the following:

Objective: Grand Lake will consistently exhibit water quality that is in a "mesotrophic" range or better (a TSI score below 50) as measured by Carlson's Trophic Status Index. To accomplish this objective, the following goals will be accomplished:

1. Citizen volunteers from the Grand Lake Area Association will participate in the Minnesota Pollution Control Agency's (MPCA) Citizen Lake Monitoring Program (CLMP) to gather annual recordings of secchi disc transparency, which is needed to establish current measures of the Trophic Status Index.

   Action 1: Identify citizen volunteers to participate in the Citizen Lake Monitoring Program.

   Action 2: Provide the membership of the Grand Lake Area Association with an annual report of the lake's Trophic Status Index. This information will be made available through the Grand Lake Area Association's web page, newsletter, and association meetings.

2. The Grand Lake Area Association will actively engage and collaborate with area landowners in the Grand Lake watershed to reduce nutrient runoff. This includes landowners who are on or near Grand Lake, and all property owners within the Grand Lake watershed. To accomplish this goal, the following action steps will take place:

   Action 1: The Grand Lake Area Association will collaborate with the Stearns County Soil and Water Conservation District, the Sauk River Watershed District, the Minnesota Department of Natural Resources, the Stearns County Environmental Services, the Initiative Foundation, and the City of Rockville in educational and implementation projects that will improve the health and best management practices in identified ecologically sensitive areas within the Grand Lake Watershed. Representatives from these environmental or governmental agencies will be invited to meet with the Board of the Grand Lake Area Association in an effort to identify areas of concern and opportunities for implementation projects.

   Action 2: The Grand Lake Area Association will enter into an agreement with Stearns County Soil and Water Conservation District and Pheasants Forever in an effort to promote and implement the USDA Conservation Reserve Program (CRP) and related best management practices in identified ecologically sensitive areas within the Grand Lake watershed. This agreement, the *CRP Promotion and Implementation Agreement for the Grand Lake Association* is included in Appendix 3.

As part of this agreement, the following goals will be accomplished:

1. Priority sites in the Ploof Watershed and Johannes Subwatershed will be identified.
2. Promotional meeting materials and letters will be mailed to all landowners in the Grand Lake watershed. These promotional materials will include an introductory cover letter, CRP brochure, site specific map, and rental rates.
3. The Pheasant's Forever Farm Bill biologist will conduct follow-up visits to interested landowners to encourage landowner participation in the CRP.
4. The Pheasant's Forever Farm Bill biologist will provide the Grand Lake Area Association with an end-of-agreement summary.
   Total cost of Action 2: $3,811 for a one-year agreement

Action 3: The Grand Lake Area Association will generate interest and educate all landowners in the Grand Lake watershed about available best management practices and the USDA Conservation Reserve Program (CRP). This goal will be accomplished by the following steps:

1. All landowners in the Grand Lake watershed will receive mailings about the Conservation Reserve Program and best management practices.
2. All landowners in the Grand Lake watershed will be invited to an all-you-can-eat fish fry on Thursday, February 23rd, 2006. At this meeting, we have invited experts from the Natural Resources Conservation Service, Soil and Water Conservation District, and Pheasants Forever to give an overview of water quality conservation practices and available programs that provide financial incentives to landowners for implementation.
   Total Cost of Action 3 (fish fry): $800 per event

Action 4: All landowners who have shoreline property on Grand Lake will comply with the requirements of the City of Rockville to be hooked up to city sewer services by the end of the summer, 2006. This will effectively eliminate any nutrient runoff from failing septic systems.

Action 5: All landowners in the Grand Lake watershed will reduce phosphorous nutrient runoff through compliance with State of Minnesota law that limits or prohibits fertilizers with phosphorous, and through education and best management practices pertaining to yard waste and fire pits. This goal will be accomplished by the following steps:

1. Education and information on fertilizers, yard waste, and fire pits will be provided to all Grand Lake area residents through the Grand Lake newsletter.

2. FISHERIES OBJECTIVES AND GOALS

The Grand Lake Area Association and the Department of Natural Resources recognize that there are a number of challenges in the effort to maintain or improve the fisheries in Grand Lake, including the amount of fishing pressure, the extent of recreational boat use, and the lack of natural structure that provides protection and cover to the fisheries. It is also understood that the most effective way to protect and enhance the fish populations is to protect and enhance fish habitats.

Objective: The Grand Lake Area Association will take steps to fulfill the major goal of the Grand Lake Fisheries Management Plan, developed in 1999. The goal is to "provide a walleye and northern pike fishery where relative abundance of both species is 6-8 per gill net and the average weight is greater than two pounds."

To accomplish this objective, the following goals will be accomplished:

Action 1: The Department of Natural Resources (DNR) will conduct a resurvey in 2008, and will include an assessment of the largemouth bass population by electrofishing.

Action 2: The Department of Natural Resources will stock walleye fingerlings at a rate of one pound per littoral acre every third year, 235 pounds, or a minimum of 4700 fingerlings, 2006, 2010, 2012. The Grand Lake Area Association will stock in 2008.

Action 3: The Department of Natural Resources will issue a b-permit for commercial removal of bullheads on a demand basis.

Action 4: Improve and protect spawning areas by utilizing best management practices. This goal will be accomplished by the following steps:

1. Map the likely spawning areas of the lake and document best management practices for protecting and improving spawning areas.
2. Report conditions that threaten spawning areas to the Minnesota Department of Natural Resources, requesting corrective action if necessary.
3. Educate property owners regarding the best management practices for protecting and improving spawning areas.
4. Educate property owners on benefits of selective harvesting and catch-and-release of game fish.
5. Work with the DNR to limit the number of contests and fishing leagues, or to restrict the harvesting of game fish that are a result of these contests/leagues.

3. AQUATIC VEGETATION MANAGEMENT OBJECTIVES AND GOALS

Objective: The Grand Lake Area Association will recognize the important contribution of aquatic vegetation, and will provide intervention when aquatic vegetation is overly abundant, prevents lake access or interferes with recreational activities. To accomplish this objective, the following goals will be accomplished:

1. Complete and implement an Aquatic Vegetation Management Plan as a collaborative effort with the Department of Natural Resources.

2. Reduce the turion bank for curlyleaf pondweed from its current 79 acres. This goal will be accomplished by the following steps:

   Action 1: Explore long-term funding mechanisms for management of curlyleaf pondweed, including the possibility of creating a special taxing district.

   Action 2: Maintain a curlyleaf pondweed management program as outlined in the Aquatic Vegetation Management Plan (Appendix 2). Specific guidelines include the following:

   a. Curlyleaf pondweed will be controlled by means of an early application of herbicides as described in Appendix 4 of the Aquatic Vegetation Management Plan, *Considerations When Doing Early Season Treatments for Curlyleaf Pondweed.*

   b. Control of curlyleaf pondweed by the Grand Lake Area Association will be in the nearshore and offshore areas labeled A, F, G, H, I and J in Figure 10 of the Aquatic Vegetation Management Plan. Control under the permit issued to the Grand Lake Area Association will be limited to 30 acres.

   c. When curlyleaf pondweed is treated in nearshore areas, the control area for each landowner will be 50 feet along shore OR half the lot width, whichever is less, by 50 feet lakeward. If necessary, a channel to open water up to 15 feet wide may be treated. The width of the channel will be included in the shoreline distance allowed (Figure 11). Please note that the location shown in Figure 11 is for illustration purposes. Each owner will determine the precise location of the treatment area. The location of control may not change from year to year.

   d. Individual landowners may treat curlyleaf pondweed in nearshore areas in the areas labeled B, C, D, and E in Figure 10 of the Aquatic Vegetation Management Plan. The control area for each landowner will be as described in (c) above. Total treatment in this area may not exceed 5 acres. Individual landowners are responsible for obtaining the permit for this control.

   Action 3: The DNR (Fisheries or Ecological Services) will conduct a quantitative survey in 2010 to determine the effectiveness of the control program to reduce areas of curlyleaf pondweed. Since treatment with herbicides could interfere with the survey, treatment in 2010 should take place after the completion of the survey. A comparison will be made using data from 2005 and 2010 to determine changes in the curlyleaf pondweed occurrence.

   Estimated Annual Cost of Goal 2: $10,000 for DNR permit fees and herbicide costs.

3. The Grand Lake Area Association will encourage all shoreline property owners to establish buffer zones and other shoreline best management practices, including the restoration of desirable aquatic vegetation. This goal will be accomplished by the following steps:

   Action 1: Information on available programs that provide financial incentives for best management practices will be provided through the newsletter, the Grand Lake Area Association web page, and at association meetings.

   Action 2: Shoreline property owners will be invited to tour buffer zone/aquatic vegetation demonstration projects on Grand Lake.

   Action 3: An annual environmental award will be presented to the shoreline property owner who makes the greatest improvement in shoreline best management practices.

   Action 4: The Grand Lake Area Association will purchase copies of the *Restore Your Shore CD* and make it available to all lake owners.

Total Cost of Goal 3: $500 for award costs and *Restore Your Shoreline CDs*.

4. The Grand Lake Area Association will provide information and education on aquatic vegetation and non-native exotic plant species to all people within the Grand Lake watershed area. This goal will be accomplished by the following steps:

   Action 1: The Grand Lake Area Association will provide education on curlyleaf pondweed, Eurasian watermilfoil, and purple loofestrife. This will be provided to all lakeshore owners through pictures and information on the Grand Lake Area Association web page, newsletter, and plant identification cards obtained through the Department of Natural Resources.

   Action 2: Grand Lake will host an Aquatic Vegetation Identification workshop in July 2006, coordinated through the Sauk River Watershed District.

   Action 3: Conduct an annual assessment of non-native exotic plant species with the assistance of the licensed contractor that provides annual treatment for curlyleaf pondweed.

   Total Cost of Goal 4: $300 for mailings and plant identification cards.

4. **LAND USE AND ZONING**

Objective: The Grand Lake Area Association recognizes the important contribution it can make in being a resource to the City of Rockville as zoning ordinances are being developed for the shoreland overlay, the city's comprehensive plan is being reviewed, and residential developments near Grand Lake are being proposed. To achieve this objective, the following goals will be accomplished:

1. Grand Lake Area Association will actively engage lake association members in issues pertaining to residential development near Grand Lake, city zoning ordinances, the comprehensive plan, and opportunities for citizen input. This goal will be accomplished by the following action steps:

   Action 1: Information to be communicated by postcards, newsletters, and telephone calling trees as needed.
   Total Cost of Action 1: $900 that includes
   3 newsletters (4 pages each in full color, 200 copies, plus postage for 3 mailings)
   3 postcard mailings to announce opportunities for citizen engagement.

2. Grand Lake Area Association will be proactive in asking the city to develop zoning ordinances for the shoreland overlay. This goal will be accomplished by the following action steps:

   Action 1: Grand Lake Area Association will present a petition to the City Council that requests a moratorium on new residential development until concerns are addressed (including but not limited to the development of city shoreland ordinances).

   Action 2: Grand Lake Area Association will present a petition to the City Council requesting that the city prohibit lake access lots, controlled access lots, or access easements for use by owners of nonriparian lots or parcels.

   Action 3: Representatives from the Grand Lake Area Association will volunteer time to work with a subcommittee of the planning commission to develop shoreland zoning ordinances. In addition, Grand Lake Area Association will seek out input from experts who know the Stearns County shoreland ordinance and the new alternative shoreland ordinance (Department of Natural Resources, December, 2005)

3. Grand Lake Area Association will seek out clarification of the city's comprehensive plan that calls for the preservation of the rural character of the land near Grand Lake while also calling for "low density" development for land along County Road 8 from Grand Lake to the city proper. This goal will be accomplished by the following action steps:

   Action 1: Grand Lake Area Association will seek out legal counsel as needed.

   Action 2: Representatives from the Grand Lake Area Association will volunteer time to serve on a subcommittee of the Planning Commission to develop a vision of a concept plan that helps maintain the integrity of the city's comprehensive plan for any proposed residential development near Grand Lake. This vision will incorporate less density, the preservation of the rural feel of subdivision 5, and a conservation design with open spaces and ample buffer zones that reduce nutrient runoff and preserve the water quality of Grand Lake.

Action 3: The Grand Lake Area Association will request that the city council deny a change in zoning from AG 40 to R1 (single family residential) in parcels of land adjacent to Grand Lake.

Action 4: The Grand Lake Area Association will request that the city council seek out public input for all new residential developments within one mile of Grand Lake, and that the city utilize Planned Unit Developments (PUDs) or other special zoning ordinances that allow the city to maintain control of any proposed development while preserving the vision contained in the City's comprehensive plan.

Total Cost of Goal 3: $6,000 (attorney fees and mailings to association members, city council members, and members of the planning commission).

5. GRAND LAKE AREA ASSOCIATION MEMBERSHIP

Objective: The Grand Lake Area Association recognizes the importance of citizen engagement in an effort to accomplish the objectives of its mission statement. To achieve this objective, the following goals will be accomplished:

1. Residents in the Grand Lake watershed will receive education and information on topics important to the Grand Lake area through a full-color newsletter, *The Scoop at Grand Lake*, at an interval of two or three times per year. In addition, residents will receive post cards that contain information on important lake association, city council or planning commission meetings on an as-needed basis.

2. Membership in the Grand Lake Area Association will increase to 125 members, and will include a majority of lakeshore property owners and a representation of neighbors in the Grand Lake watershed. The addition of new members and the ability to maintain existing members will occur through the following incentives:
   a. Water quality and lake management goals will be met and will be reported at membership meetings and *The Scoop at Grand Lake* newsletter.
   b. DNR aquatic vegetation management permits will be paid by the lake association for members who pay their association dues by designated due dates.
   c. The Grand Lake Area Association will become an active voice in land use and zoning issues that pertain to the Grand Lake watershed.
   d. The Grand Lake Area Association will maintain a web page that contains important information pertaining to Grand Lake as well as links to the Department of Natural Resources, the Sauk River Watershed District, Stearns County Environmental Services, the Soil and Water Conservation District, the Initiative Foundation, and the Minnesota Lakes Association.
   e. Special incentives will be available to members a limited basis. Recently, paid association members received a full-color Grand Lake print by artist Ed Zapp, Jr.

3. Residents in the Grand Lake area will appreciate the sense of community and the proactive goals that are shared by an engaged association. This engagement will foster a sense of satisfaction that the lake association "makes a difference", as well as the desire to belong to the Grand Lake Area Association.

   Signs of an engaged membership are evidenced by the participation in activities throughout the year, including the 4th of July fireworks, the flag-raising ceremony, the flotilla parade, the late Stephen Sommers Great Grand Lake Swim, the Rockfest food booth, the fundraisers, the secchi disk readings, membership on the city planning commission or city council, and the involvement in various implementation projects along Ploof and Johannes Creeks.

Glossary

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bioaccumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll a: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevents groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and non-point source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

Common Biological or Chemical Abbreviations

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

Guide to common acronyms

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
LCMR	Legislative Commission on Minnesota Resources
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

ACCL	Association of Stearns County Lakes
AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LARA	Stearns County Lakes & Rivers Alliance
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

110B	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five "Injection" well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Rural Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code

Appendix I

NA-01570-01

DNR LAKE MANAGEMENT PLAN

DEPARTMENT OF
MINNESOTA
NATURAL RESOURCES

Region	**Area**	**D.O.W. Number**	**County**	**D.O.W Lake Name**	**Acreage**
III	Montrose	73-55	Stearns	Grand	655

Long Range Goal:
Provide a walleye and northern pike fishery where relative abundance of both species is 6-8/gill net and the average weight is greater than two pounds.

Operational Plan:

1. Conduct a resurvey in 2008. Include an assessment of the largemouth bass population by electrofishing.
2. Stock walleye fingerlings at a rate of one pound per littoral acre every third year, 235 pounds, or a minimum of 4700 fingerlings, 2006, 2010, 2012. The lake association will stock in 2008.
3. Issue b-permit for commercial removal of bullheads on a demand basis.

Mid Range Objective:
Continue to evaluate walleye stocking.

Potential Plan:

Year round creel survey

TOTAL $12,000

Primary Species Management	**Secondary Species Management**	**FOR CENTRAL OFFICE USE ONLY**	
Walleye, Northern pike	Largemouth bass, Panfish		
Area Supervisors Signature	**Date** __ __ / __ __ / __ __	**Entry date**	**Year Resurvey**
Regional Supervisors Signature	**Date** __ __ / __ __ / __ __	**Stock species - Size - Number per Acre Pr./Sec**	

NARRATIVE: (Historical perspectives - various surveys; past management; social considerations; present limiting factors; survey needs; land acquisition; habitat development and protection; commercial fishery; stocking plans; other management tools; and evaluation plans)	**Schedule**	**Year Beginning**
	Population Manipulation 9 YES 9 NO Year __ __	
	Development 9 YES 9 NO Year __ __	
	Creel or Use Survey 9 YES 9 NO Year __ __	
	Other	

Surveys: Lake surveys 1998, 1987, 1975 and 1949. Population assessments 1981, 1992. Statewide creel survey 1971-75. Recreational use survey 1988. Annual winter fish house counts 1976-93, and every third year thereafter. Winter creel survey 1990-91. Vegetation Management Plan, 1998 (draft).

Past Management: The lake was closed to darkhouse spearing 1944-50 and the southwest bay was closed to all fishing 1921-49. A spawning area was posted for largemouth bass until 1969. Largemouth bass, crappies, walleye and northern pike have been periodically stocked since 1910. Since 1972 the only stocking has been walleye fingerlings. Recently the lake association has collaborated with the DNR so that walleye stocking is done every other year.

Social Considerations: Grand Lake is heavily developed and attracts anglers from St. Cloud and Cold Spring. There is one resort on the lake. The Rockville Sportsmen's Club has an active interest in the lake and polices the public access. An active lake association is also present.

Fishing Pressure: Angling pressure was estimated at 25 hours per acre during the 1988 summer season. Most (96%) fishing occurred from boats during the first two months of the season. Non-fishing recreational use was seven hours per acre. Winter angling and spearing pressure were heavy in 1991, 45.8 and 3.5 hours per acre, respectively. The following table shows the harvest estimates, rates and mean weight of angler caught fish:

Species	Number Harvested	Pounds Harvested	Harvest rate (#/hr)	Mean weight(lb)
Walleye	274	320	0.009	1.6
NOP(ang)	865	1,989	0.029	2.5
NOP(sp)	304	1,393	0.131	2.9
B. crappie	11,654	4,709	0.388	0.4
Bluegill	9,137	1,801	0.304	0.2

Limiting Factors: Sunfish are abundant and slow growing. Walleye do not reproduce successfully. Results of water quality testing indicated total phosphorous, chlorophyll *a*, and secchi disc values of .036 ppm, 19.6 ppb, and 4.0', respectively. Carlson TSI values for the three metrics were 57, 60 and 57, respectively. The lake status is eutrophic.

Survey Needs: Regular surveys on a 10 year rotation are needed to determine the success of stocking and natural reproduction. An assessment of the largemouth bass should always be part of the netting (see operational plan).

Historical net catches of some important species (1st-3rd quartile values are for lake class 27):

Species	1949	1975	1981	1987	1992	1998	2008	1st-3rd
Northern pike	2.63	1.50	12.30	3.67	8.50	18.8		2.8 – 9.0
Bluegill	9.25	1.83	4.25	74.40	51.60	12.1		4.4 – 48.9
Black crappie	-	0.17	-	9.10	3.10	0.0		-
Yellow perch	97.80	66.00	58.70	3.67	19.17	13.2		7.0 – 46.3
Walleye	17.90	5.75	7.83	3.83	11.33	9.5		3.3 – 8.8

During 1998 catches of bluegill and yellow perch were within the range of expected values. The catches of northern pike and walleye were above the third quartile value while the catch of black crappies was below the first quartile.

Largemouth bass in Grand Lake were sampled by night electrofishing during spring. The electrofishing catch rate for largemouth bass was 38.40/hour on-time which was similar to the Montrose area mean of 41.50/hour. Fish sampled in 1998 ranged in length from 7.0 to 14.1 inches, with a mean length of 9.0 inches. Largemouth bass PSD was 7, and RSD-15 was 0.

Land Acquisition: No acquisition appears necessary.

Vegetation Management Plan: 25 species of plants are present. Submerged species grow to a maximum depth of 18 feet. The most abundant submerged species are coontail, muskgrass and bushy pondweed. Species to protect include hardstem bulrush, wild rice and water lilies. The emergent vegetation stands have been mapped with new GPS technology (1998). Curled pondweed is thought to be a problem of nuisance proportions.

Commercial Fishery: Commercial removal of bullheads has been allowed under b-permit. This will continue to be allowed as long as there are no detriments to the fisheries.

Stocking Plan: See operational plan for details. Stock walleye fingerlings every other year. It appears that it will be possible to reach the long range goal of 6-8 walleye per gill net by stocking at that frequency. During three of the past four assessments the gill net catch of walleye exceeded seven/lift. The high abundance of northern pike might negatively affect walleye management.

Other Management Tools: Use as a source of bluegills for restocking winterkill lakes.

Evaluation Plans: A creel survey is part of the potential plan in order to gain information about the open water season harvest. It would be most desirable to have a year round creel survey.

Watershed Considerations: Work with local units of government to reduce non-point pollution sources. Stearns County Environmental Services has the local authority to regulate septic systems; and the Stearns County Soil and Water Conservation District can suggest best management practices for area agriculturalists. The immediate watershed of the lake has been mapped and land uses identified. Land use in the Grand Lake watershed was forest,26%; water/wetlands,4%; cultivated lands,51%; residential,3%; pasture/grassland,16%. Watershed size is 6,634 acres and the land to water ratio is: 10.1:1. Since Grand lake is one of the larger most important lakes in the area it will be recommended for MPCA type lake assessment programs.

Appendix 2

Aquatic Vegetation Management Plan

Appendix 3

CRP Promotion and Implementation Agreement for the Grand Lake Association

Appendix 4

Petitions