REVISED MANAGEMENT PLAN

2005

BOARD OF WATER AND SOIL RESOURCES ORDER

The Board hereby prescribed the attached Plan as the Revised Watershed Management Plan for the Pelican River Watershed District.

Dated at Saint Paul, Minnesota this 24th day of August, 2005

MINNESOTA BOARD OF WATER AND SOIL RESOURCES

BY: Jerome Deal, Chair.

ACKNOWLEDGEMENTS

Numerous persons have assisted in preparing this revised management plan, especially Brad Grant of the Becker Soil and Water Conservation District, George Zimmerman, U.S. Natural Resources Conservation Service, and Jarrod Christen, City of Detroit Lakes. Members of Melissa-Sallie Improvement Association, Floyd Shores Association, Pearl Lake Association, Lake Detroiters, Long Lake Association, and the Becker County Coalition of Lake Associations assisted in various ways, especially by providing input and review in the Lake Water Quality Management Areas sections. State agency officials from the Minnesota Pollution Control Agency, the Department of Natural Resources, and Board of Water and Soil Resources also have made notable contributions in guiding the thinking of staff and managers as this plan was revised. PRWD President Dennis Kral provided invaluable editing service, as did student intern Matt Lill, and Georgia Hecock.

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1.0 Introduction

The Pelican River Watershed District was established by the State of Minnesota, May 27, 1966 (Minnesota Water Resources Board). It covers approximately 120 square miles in Becker and Otter Tail Counties, and includes the upper reaches of the Pelican River which eventually drains to the Otter Tail and Red Rivers. According to the order prescribing the District, its general purposes are:

1. conserving and making provident use of waters and other natural resources
2. to reduce the pollution of the waters of the Pelican River Chain of lakes
3. to slow down the eutrification of the lakes
4. to regulate the water levels in the Pelican River Chain of lakes
5. to enhance their recreational facilities and to protect and improve the scenic beauty thereof
6. to improve the needed drainage
7. to provide needed soil and water conservation practices on the land
8. and for other purposes as found in the Minnesota Watershed Act

From inception, the District's focus has been to protect the water quality for about 30 lakes.

Seven managers are appointed by the Becker County Commissioners. Current Managers are as follows:

Names	Office	Telephone	Sub-Watershed	Service from	Term Expires
Dennis Kral	President	847-9187	Big Floyd	1989	2007
David Brainard	Member	847-8355	Long	1997	2006
Ginny Imholte	Treasurer	847-4236	Big Detroit	1991	2005
Orrin Okeson	Secretary	847-7983	Campbell	1987	2006
Robert Mullikin	Vice Pres	847-3376	Long	1995	2005
Janice Haggart	Member	846-1168	Muskrat	2005	2007
William Jordan	Member	847-3416	Melissa	1995	2007

The Attorney for the District is Charles Ramstad, of Irvine, Ramstad, Briggs, & Karkela, P.O. Box 683, Detroit Lakes, MN. Phone: 847-5653.

The Consulting Engineer for the District is Rod Ambrosie, Wenck Engineering, Maple Plain, MN.

The Advisory Committee, comprised of persons representing special constituencies within the District, together with people who have special expertise or influence over District lakes includes...

Bob Bristlin	Becker County Commission
Ted Heisserer	Izaak Walton League
John Holstad	Sallie/Melissa Lake Association
John Postovit	Becker County Coalition of Lake Associations
Bob Merritt	MNDNR, Division of Waters
Tim James	MPCA
Jarrod Christen	City of Detroit Lakes, Water and Waste Water Department
Tom Lynch	Curfman Lake Resident
Don McCaslin	Richwood Township Resident.

The Administrator is Tera Guetter, the Aquatic Plant Harvesting Supervisor is Terry Anderson and the office assistant is Denise Baer. Richard D. Hecock serves as Senior Advisor.

The office of the District is located at 801 Roosevelt Avenue, Detroit Lakes, MN. The District's mailing address is P.O. Box 1043, Detroit Lakes, MN 56502-1043. Office hours are 8:30 to 4:30 Monday through Friday. The District phone number is 218-846-0436 (fax is 218-846-0778).

The Board of Managers holds a regular meeting on the third Thursday of each month in the District Office in Detroit Lakes, MN at 7PM. Special meetings and hearings are held after posting the proper notification near the District Office doorway, or as otherwise required by statute (Appendix B).

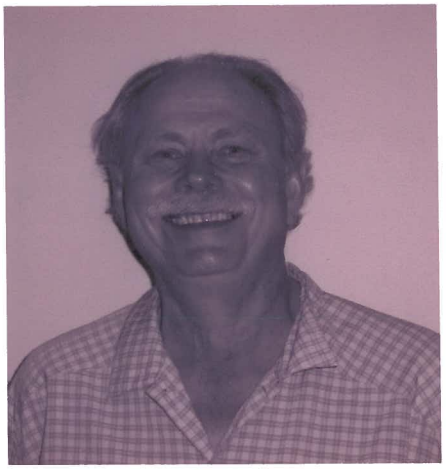
District Office Entrance


District Office Meeting area

MANAGERS, 2005

Okeson

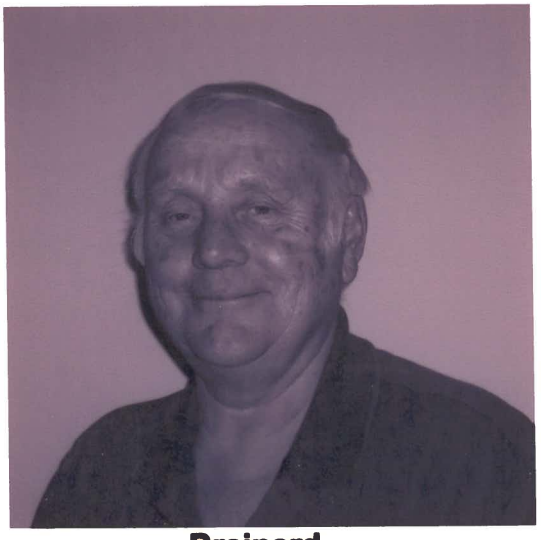
Mullikin



Kral

Jordan

Imholte



Brainard

Haggart

2.0 WATERSHED DISTRICT PLANNING

Minnesota Statute 103D.405 directs the managers and the Board of Water and Soil Resources to revise a district's watershed management plan at least once every ten years after the original watershed management plan is approved. The revised watershed management plan of the district must conform closely with adopted watershed management plan guidelines of the Board of Water and Soil resources. According to the statute (Minnesota Statutes 103d), the following items are to be included in the revised watershed management plan:

1. updates and supplements of existing watershed district hydrological and other statistical data
2. list of specific projects and programs to be considered for implementation;
3. a statement of the extent to which the watershed district's purposes have been accomplished;
4. a description of problems requiring future action by the watershed district;
5. a summary of completed studies on active or planned projects, including financial data; and
6. an analysis of the effectiveness of the watershed district's rules and permits in achieving its water management objectives in the watershed district.

A revised watershed management plan must be transmitted, reviewed, recommended and approved as follows:

- After ten years and six months from the date that the board approved the last revised watershed management plan (RWMP), the managers *must consider and adopt a new RMP outline including the items described above, and send a copy of the outline to the Board of Water and Soil Resources.*
- The managers must send a copy of the RWMP to the Board of Water and Soil Resources, the county board, and county auditor of each county affected by the watershed district, the Director of Department of Natural Resources Division of Waters, the governing body of each municipality affected by the watershed district, soil and water conservation districts affected by the watershed district.
- The Director of DNR's Division of Waters must review and make recommendations on the RWMP. By 60 days after receiving the proposed RWMP, unless the time is extended by the board, the director and the council must send the recommendations to the board, and a copy of the recommendations to the managers, the county auditor of each county affected by the watershed district, the governing body of each municipality affected by the watershed district, and soil and water conservation districts affected by the watershed district.
- The ***BWSR Board*** must give notice and hold a RWMP hearing by 45 days after receiving the director's recommendation.

- The BWSR Board must give notice of the RWMP hearing by publication in a legal newspaper published in counties affected by the watershed district. The last publication must occur at least ten days before the revised watershed management plan hearing.

- The BWSR Board must give notice of the RWMP hearing by mail to the auditors of counties and to the chief executive officials of municipalities affected by the watershed district; the notice must include:

  (1) a statement that a copy of the proposed RWMP has been filed with the board, ...the auditors of counties affected by the proposed watershed district, the commissioner, the director, the governing body of each municipality affected by the watershed district, and the soil and water conservation districts affected by the watershed district;

  (2) a general description of the purpose of the watershed district;

  (3) a general description of the property included in the watershed district;

  (4) a general description of the proposed RWMP;

  (5) the date, time, and location of the hearing; and

  (6) a statement that all persons affected or interested in the watershed district may attend and give statement at the RWMP hearing.

After the RWMP hearing, the BWSR Board must prescribe a new RWMP plan for the watershed district. The board must send a copy of the order and approved RWMP to the managers, the county board of each county affected by the watershed district, the commissioner, the director, and soil and water conservation districts affected by the watershed district.

3.0 HISTORY OF PRWD MANAGEMENT PLANNING

Acting on a nominating petition submitted on September 15, 1965, the Minnesota Water Resources Board (MWRB) established the Pelican River Watershed District (PRWD) on May 27,1966. In explaining its action, the Board found that the...

> *"principal bodies of water in the upper reaches of the watercourse of the Pelican River, Detroit Lake, Lake Sallie and Lake Melissa, have become at certain times during the summer recreational months, unhealthy and unsightly due to excessive weed and algae growths. Such undesirable growths along the shores of the above lakes have interfered with boating, fishing and swimming; and have denied lake home owners the enjoyment of water scenery. In addition, weeds and algae growths have affected lake property value." (MWRB, 1966)*

The perception that water quality conditions of area lakes were rapidly deteriorating was the primary motivation for proposing a watershed district, and guided formulation of the District's **1967 Overall Plan** and the subsequent efforts of the District Managers (PRWD, 1967). These efforts have included research, advocacy of sewer projects and improvement of sewage treatment facilities, aquatic plant harvesting activities, control of exotic aquatic species, and many other conservation and enhancement activities.

On March 17, 1994, the District Managers formally adopted a **new mission statement**. Rooted in its original MWRB charge, and sustained for over 31 years by 27 Managers and their advisors, the District affirms its central interest in the water quality of the Upper Pelican River chain of lakes:

> *"The mission of the Pelican River Watershed District is to enhance the quality of water in the lakes within its jurisdiction. It is understood that to accomplish this, the District must ensure that wise decisions are made concerning the management of streams, wetlands, lakes, groundwater, and related land resources which affect these lakes."*

Upon completion of the "Phase I" Clean Lakes study, funded by the State of Minnesota and the US Environmental Protection Agency to determine the nature and causes of problems in several District lakes and to outline a strategy for accomplishing solutions, attention in 1994 turned to the matter of preparing and submitting a **revised management plan**, as required by the Watershed District statute. This plan was approved by the Board of Water and Soil Resources in December, 1994 (PRWD, 1994).

3.1 Revised Management Plan, 1994

The 1994 Revised Management Plan identified the causes of water quality problems faced by District lakes as follows:

- **incomplete treatment of sanitary wastes, especially septage**
- **inadequately treated storm water effluent**
- **nutrient enriched surface discharges to lakes and streams**
- **nutrient enriched groundwater discharges to lakes and streams**
- **removal of wetlands which serve as natural sediment and nutrient buffers**
- **excessive aquatic plant biomass in lake littoral zones**
- **channelization of drainageways, and drainage of wetlands which enhances sediment and nutrient discharges to lakes**
- **existence of nutrient-enriched wetlands and lake-bottom sediments wherein nutrients are released under conditions of unusual runoff or anoxia**

The following specific goals were identified:

THE WATER QUALITY IN DISTRICT LAKES SHALL NOT BE FURTHER DEGRADED

LAKE WATER QUALITY FOR SALLIE, LITTLE DETROIT, AND NORTH AND LITTLE FLOYD LAKES WILL BE IMPROVED TO THE CONDITION OF OTHER NEARBY LAKES

In addition to calling for education and monitoring programs, the **1994 Revised Management Plan** described a three-approach strategy to achieving the District's water quality improvement goals:

1. ***Implement "Best Management Practices" throughout the District***; including measures aimed at improving District water quality in general, and an effective education program. Such measures were considered necessary in order for lake-specific measures to be successful.

2. ***Reduce upstream releases of stored sediments and nutrients***; restoration and/or improvements to wetlands; better ditch management.

3. ***Undertake in-lake treatments,*** including whole lake chemical treatments and continuation of aquatic plant removal.

3.2 1997 Amendments to the District's Revised Management Plan

Responding to changes in the Watershed District Statute, and Becker County's transfer of public ditches to District control, in 1997 the Managers proposed four Amendments to the ***1994 Revised Management Plan***. The Managers...

1) specified that the District's Basic Water Management project **is *to improve lake water quality by reducing nutrient loadings to District lakes,*** with the further understanding that past and present nutrient mismanagement has occurred throughout the District, that all District lakes have been adversely impacted, and that measures taken to solve lake nutrient enrichment problems will benefit the whole District.

2) added responsibility for Becker County Ditches 11, 12, 13, and 14 as ***"part of the general on-going business of the District and its staff".*** The District also signaled its intention to maintain and further develop the ditches in such a way as to minimize their past, present and future downstream impacts on the District's lakes. This will be accomplished by some combination of "best management practices", creation of runoff storage and treatment facilities, and in-lake treatments to ameliorate past damages to water quality.

3) specified that for purposes of establishing a ***Stormwater Utility,*** the following are considered to be stormwater treatment activities and facilities: collection systems, wetland restoration, sediment control devices, stormwater detention ponds, constructed wetlands, stormwater diversion, stormwater detention, streambank protection, buffer zones, flood easements, ditch plugs, culvert risers, storm sewers, in-stream chemical treatment, conservation pools, and other devices which are designed to reduce stormwater flows or the nutrients which are contained in them.

4) defined several water management districts, and described options for funding future water quality improvements, including grants, ad valorem taxes, assessments, and ***stormwater utility fees***. The Amendments also specified procedures to be used for establishing a stormwater utility fee structure.

The Board of Water and Soil Resources prescribed these amendments in July, 1997 (PRWD, 1997).

3.3 Watershed Management Rules

In accordance with MS 103D.341, the Managers previously had adopted rules aimed at preventing practices perceived to be detrimental to the water quality of District lakes. The Managers made numerous changes to these Rules in 1991, 1994 and 1998. Concluding that there had been changes in the regulatory environment and in District needs, the Rules were given a major overhaul in 2003 (Appendix A). The most prominent change was the adoption of a permit system in order to obtain more complete and fair rules enforcement.

Permits are required for:

a. alterations to land, impervious surface, or vegetation in Shore or Bluff Impact Zones, or on steep slopes in a Shoreland Zone;

b. additions to impervious surface resulting in total impervious surface (new and existing) in excess of 25% of lot area, or 10,000 square feet in the shoreland zone, or 1 acre elsewhere for any property draining to waters of the state, or draining to an existing storm sewer or stormwater treatment facility;

c. construction or re-construction of a private or public highway, road, street, parking lot, or public water access;

d. subdivisions, plats, developments based upon certified surveys or planned unit developments;

e. changes to stormwater infrastructure, including streets and public parking, inlets to waters of the state, bridges, or culverts;

f. de-watering of groundwater by discharges to waters of the state;

g. installation, repair, or replacement of rip-rap or beach sand blanket in the shore impact zone;

h. installation, repair, or replacement of retaining walls in the shore or bluff impact zone.

Conditions for granting permit:

a. Actions will not result in increases in stormwater discharge rates to adjoining properties or to waters of the state for the 5-year, 25-year, and 100-year- 24-hour rainfall events.

b. All actions must utilize standard procedures for controlling runoff rates, nutrients, and sediments

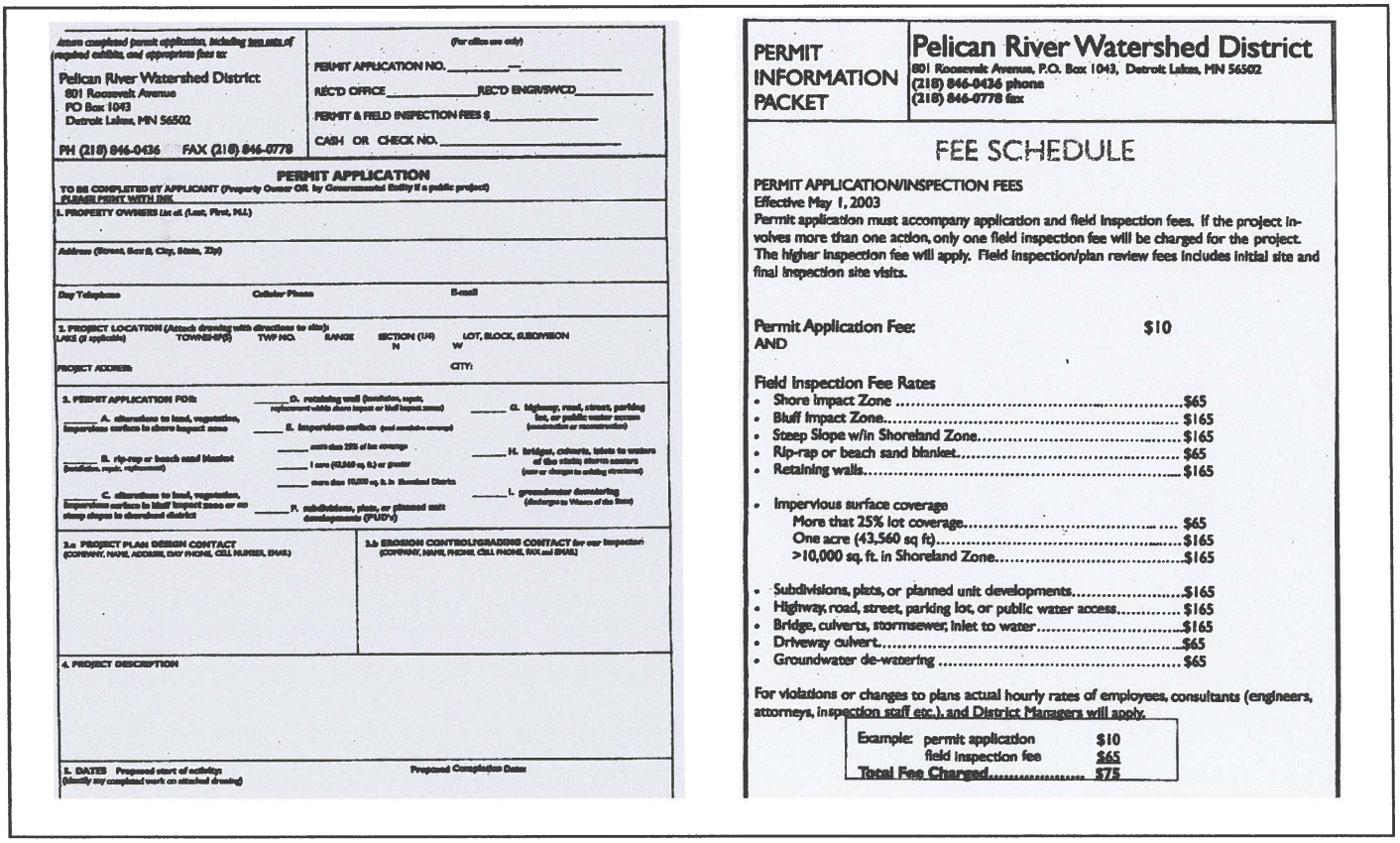
c. Permit applications for actions b, c, d, and e (above), must be accompanied by a stormwater management plan.

d. Actions involving ice ridges are allowed only for purposes of repairing existing shoreline damage; no ice ridge modifications which result in an increase of runoff to a lake or natural vegetation disturbance are allowed, except that a 4 foot wide walkway may be constructed upon an ice ridge.

e. Actions involving the stabilization of shorelines or stream banks (including rip-rap), or installation of beach sand blankets must use non-polluting fill.

f. Retaining walls in the shore impact zone are allowed only for the purposes of correcting existing slope instability or erosion; the base of such walls must be above the highest known water level.

Other 2003 changes in the Rules focused on avoiding duplication of responsibilities with other agencies.



Pelican River Watershed District
801 Roosevelt Avenue
PO Box 1043
Detroit Lakes, MN 56502
PH (218) 846-0436 FAX (218) 846-0778

PERMIT APPLICATION NO. _____
REC'D OFFICE _____ REC'D ENGR/SWCD _____
PERMIT & FIELD INSPECTION FEES $ _____
CASH OR CHECK NO. _____

PERMIT APPLICATION

1. PROPERTY OWNER

2. PROJECT LOCATION

PROJECT ADDRESS

CITY:

3. PERMIT APPLICATION FOR:

3a. PROJECT PLAN DESIGN CONTACT

3b. EROSION CONTROL/GRADING CONTACT

4. PROJECT DESCRIPTION

5. DATES Proposed start of activity

Proposed Completion Date

PERMIT INFORMATION PACKET

Pelican River Watershed District
801 Roosevelt Avenue, P.O. Box 1043, Detroit Lakes, MN 56502
(218) 846-0436 phone
(218) 846-0778 fax

FEE SCHEDULE

PERMIT APPLICATION/INSPECTION FEES
Effective May 1, 2003
Permit application must accompany application and field inspection fees. If the project involves more than one action, only one field inspection fee will be charged for the project. The higher inspection fee will apply. Field inspection/plan review fees includes initial site and final inspection site visits.

Permit Application Fee: $10
AND

Field Inspection Fee Rates
- Shore Impact Zone $65
- Bluff Impact Zone $165
- Steep Slope w/in Shoreland Zone $165
- Rip-rap or beach sand blanket $65
- Retaining walls $165

- Impervious surface coverage
  - More that 25% lot coverage $65
  - One acre (43,560 sq ft) $165
  - >10,000 sq. ft. in Shoreland Zone $165

- Subdivisions, plats, or planned unit developments $165
- Highway, road, street, parking lot, or public water access $165
- Bridge, culverts, stormsewer, inlet to water $165
- Driveway culvert $65
- Groundwater de-watering $65

For violations or changes to plans actual hourly rates of employees, consultants (engineers, attorneys, inspection staff etc.), and District Managers will apply.

Example: permit application $10
field inspection fee $65
Total Fee Charged $75

PRWD permit application form and fee schedule

3.4 Relationship to Other Water Management and Planning Organizations

From its inception the District has taken the position that its role with respect to other agencies is primarily that of "coordinator" in so far as lake water quality issues is concerned. The table below offers examples of how the District is directly involved with specific agencies.

-

Agency	Water Quality Management Activities in District	Examples of District interaction with Agency
MN DNR - Waters	Responsibility for public waters; oversee shoreland standards,	Review permit applications; coordinate rules with shoreland regulations; obtain assistance for hydrological measurements and modeling; provide data
MN DNR – Fisheries	Enhance fisheries, supervise aquatic plant harvesting	Coordinate harvesting activities; collaborate on habitat enhancements
MN DNR – Ecol. Services	Supervise aquatic plant harvesting	Coordinate harvesting activities with ES staff; assist in writing exotic species management plans
MN PCA	NPDES (stormwater and sewage treatment), impaired waters assessments, CLMP,	Coordinator Rules with NPDES; use PCA expertise in designing monitoring and lake restoration programs; provide data
MN DOT	Road Building and Maintenance	The District has a formal "Memorandum of Understanding" which outlines procedures for reviewing projects involving MNDOT; MNDOT is responsible for maintaining certain ditch culverts within the District.
Becker County	Regulate land development by zoning ordinances, comprehensive planning, highway construction and maintenance	Coordinate District rules with BC zoning ordinance; participate in review of development proposals, including EAW technical review panel; participate in preparation of comprehensive plan; County must maintain some ditch culverts.
City of Detroit Lakes	Regulate land development by zoning ordinances, comprehensive planning; waste-water treatment, stormwater treatment	Coordinate District rules with zoning ordinance; comment on development proposals; participate in comp plan, comment on waste-water and stormwater treatment and other city projects.
Becker SWCD	WACA regulation; cost-share for conservation projects; prepare water plan	SWCD assists in evaluating District permits; coordinate rules with WACA regulations; participate in cost-shares, assist with writing Water Plan

The District works with many other state and local agencies and groups, including, townships, sportsman clubs, lake associations, and service organizations.

Conflicts

District policy and practice is to avoid regulatory and other activities which duplicate those of other agencies or jurisdictions. There have been occasional controversies, generally having to do with District rule-making authority which requires new developments to meet higher standards for stormwater treatment and related protections. These conflicts have been temporary, and largely resolved through communication.

4.0 PRWD'S 2004/2005 MANAGEMENT PLANNING PROCESS

Guiding Principles

Managers adopted the following guidelines for revising the District's Management Plan:

a. *The plan should build on existing goals and programs*

b. *The plan should serve as a progress report and a reference document for those interested in the District's history or data*

c. *Water quality estimates will be based upon data from the District's monitoring program*

d. *Wherever feasible, goals will be expressed in quantitative terms (e.g. TMDL reductions).*

e. *The RMP will provide overall programmatic guidance, with implementation details left to annual work plans*

f. *Constituents will be encouraged to participate in plan formulation (including problem identification, goal setting and implementation strategies)*

g. *Professionals will be encouraged to provide detailed inputs and review*

h. *The plan will be disseminated to local governments, state officials, lake associations, and interested citizens.*

General Approach

PRWD Staff prepared a review of the relevant statutory requirements for the RMP, then outlined a proposed timetable which was approved by the Managers at their October, 2003 meeting. A meeting was held with BWSR staff, where Phil Belfiori and Jeff Hrubes described a "new philosophy of planning" emerging at the state level; these new ideas grow from the understanding that 3rd generation plans (as contemplated by PRWD) should not have the same characteristics as earlier, so-called "library" plans which were mandated in the past. Plans now must be more flexible, and emphasize implementation. He pointed to several recent RMP and other planning documents which have been prepared in accordance with this new philosophy, to a greater or lesser degree, (including Thirty Lakes WD, Bois d' Sioux, Sauk River WD, and Carver County). Special mention was made of the Capitol District WD's RMP as a good "template" for the planning enterprises contemplated by BWSR and other agencies.

However, these new concepts about local water plans have not been incorporated into a formal set of *"water management plan guidelines"* as required by 103D.405, nor have they been written down in any other official document. Moreover, it was acknowledged that statutory requirements for County Water Plans are significantly different from those required in 103D and elsewhere, and that the rationalization of these differences among various existing statutory requirements has not been completed owing to problems within state government. Nevertheless, the general ideas for these new concepts were contained in materials that were discussed at a workshop conducted by BWSR and other state agencies, and seem to be relevant to the District's own preferred planning strategy. As understood by the District this new water planning concept urges local water plans (including RMP updates), to incorporate the following concepts and attributes:

- Build on past plans and their implementation – emphasis should be given to focusing attention on what has worked and what has not. We should build from our strengths, and repair our weaknesses.
- More general, less detail; the RMP should be a guidance document. More emphasis should be given to setting general goals and strategies, with less emphasis on specifying the details of implementation tasks.
- Emphasis on sub-watershed problem-identification and implementation strategies; recognize that different parts of the District face different problems which are susceptible to different solutions
- Shift emphasis towards annual work plans; the details of implementing the RMP should occur in that context.
- More coordination with planning efforts of other agencies – local water plans, comprehensive plans (county and city) as well as DNR and PCA planning programs should be integrated within the RMP.
- Modularity – an effort should be made to develop various sections of the plan so that they can be published and disseminated on their own.
- More public involvement, aimed at garnering political support from among those who will be expected to pay for the projects and programs of the WD

BWSR staff suggested that only modest emphasis should be put on the detailed inventories described in 103D, Section 425. Since BWSR, DNR and other agencies have signed on to the new planning concept, plan reviewing agencies, including the Division of Waters would be expected to be flexible concerning the requirements in this section. It can reasonably be expected that the specific contents of an RMP will be adjusted to meet the particular needs of each watershed district.

Timeline overview

December 2003 – Managers decided to proceed with in-house revision of RMP, with Dr. Richard D. Hecock taking the lead role in preparing the plan.

- Winter and Spring 2004 – A first draft of the technical sections was prepared; Managers adopted a two-tiered approach to goal-setting and implementation strategies: It was decided to differentiate between District-wide plan elements, and those that relate to specific Lake Water Quality Management Areas within the District.

- Summer, 2004 – District wide and LWQMA goals and implementation strategies were completed; comments were solicited.

Revised Management Plan Public Input Activities

- *A letter was sent to state, city, township, and county officials, to lake associations, sportsmans' groups, and to interested citizens.*

- *Staff and Managers met with Lake Associations: Pearl, Lake Detroiters, Melissa-Sallie Improvement Association, Long Lakers, Floyd Shores, (those in attendance were provided information on their LWQMA, and invited to provide written comments on those plans).*

- *Staff met with Detroit Lakes City Staff*

- *An open meeting was held at the Detroit Lakes City Council Chamber after newspaper and radio announcements, and after letters were sent to city, township, and county officials, to lake associations, sportsmans' groups, and to interested citizens.*

- Fall, 2004, Winter 2005 – Based upon public and manager comments, the draft was re-written and submitted to BWSR staff for comment.

- Spring, 2005. A final draft was prepared and submitted to BWSR and the Director, DNR's Division of Waters.

- Summer, 2005. Based upon suggestions from BWSR staff, and managers' comments, final revisions were made. A hearing before the BWSR Board was held on August 24, 2005.

5.0 WATERSHED OVERVIEW

5.1 Location and Accessibility

The Pelican River Watershed District is located in West Central Minnesota, about 50 miles east of the North Dakota border (figure 1).

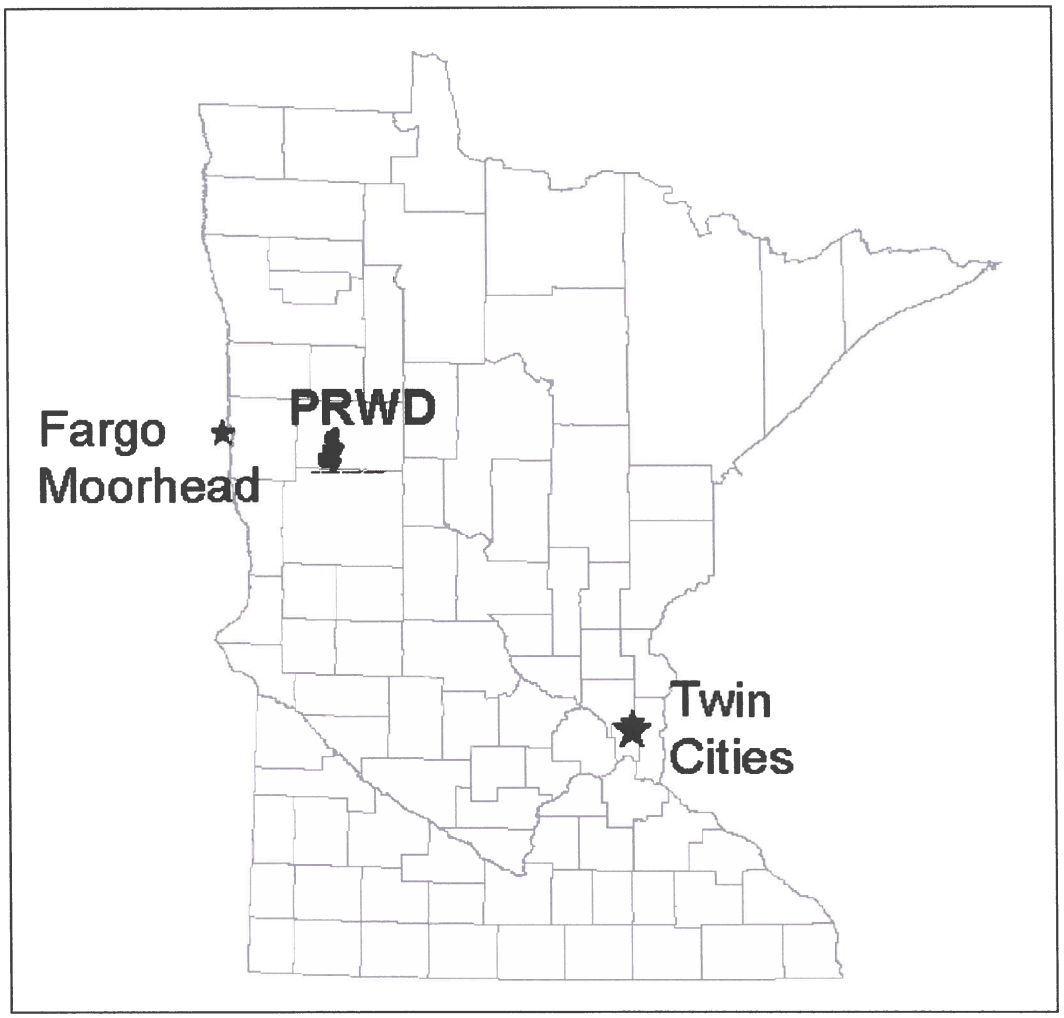


Figure 1 General Location of the Pelican River Watershed District

The District lies almost wholly within Becker County. It includes about 76,000 acres, 120 square miles (32,500 hectares or 316 square kilometers). Of these amounts, approximately 5% is located in Otter Tail County. The majority of District lands are contained in Richwood, Detroit and Lake View Townships, and the City of Detroit Lakes (Figure 2). Other governmental units found wholly or

partially within District boundaries include Lake Eunice, Erie, Holmesville, Burlington, and Candor (Otter Tail County) Townships, and Independent School District #22.

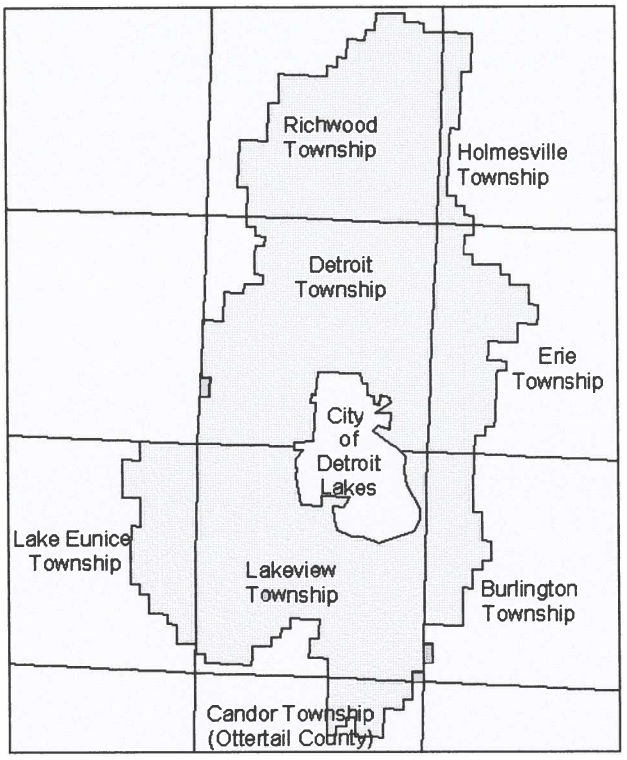
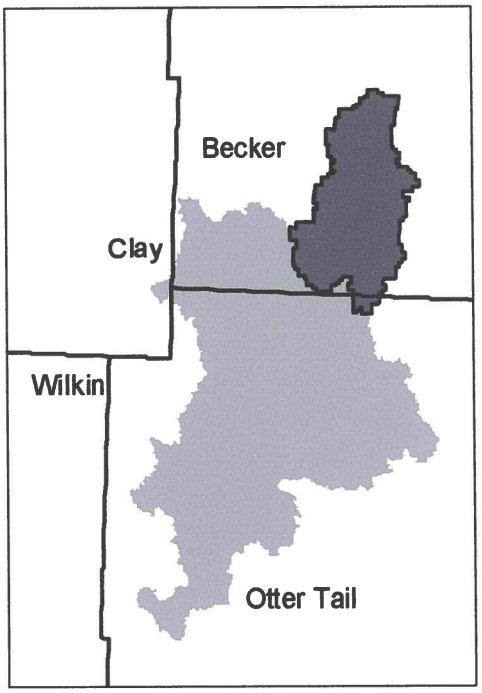


Figure 2. Principal Governmental Units compared to District



The Pelican River is a tributary to the Otter Tail River, and ultimately drains to the Red River of the North. Only the upper portions of the Pelican River are included in the Pelican River Watershed District (Figure 3). The topographic limits of the upper portions of the Pelican River's watershed deviate in minor ways from the boundaries of the District.

Figure 3. PRWD Boundaries compared to the extent of Pelican Watershed and Counties

Accessibility

The District's location in West Central Minnesota is not only important from an environmental standpoint, but it also is significant in terms of its human resources. The District is well-served by land transportation routes. Major state and federal trunk highways intersect with district boundaries, as do the routes of the transcontinental Burlington Northern and north-south Soo railroads. A superior road network within the District also is noteworthy, as very few parts of the District lie more than one mile from a road (Figure 5).
The District is accessible to all major population centers of the state by rail, road and air. The four-hour drive to the Twin Cities puts the District within reach of a large number of weekend visitors.

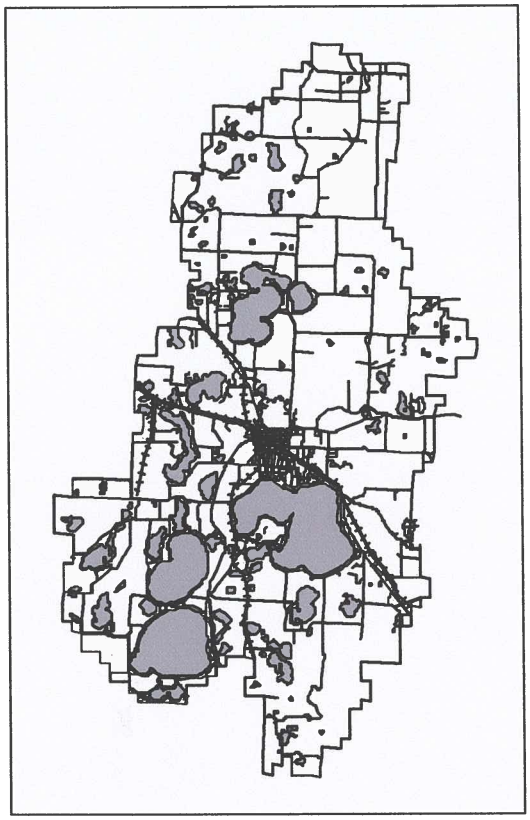


Figure 4 The District's Transportation network

The District's relative location is especially enhanced by the lack of comparable physical resources to the west. Lakes in the Pelican chain represent closest lake-based recreational opportunities to the Fargo-Moorhead and Grand Forks metropolitan areas as well as to the large parts of the population of western Minnesota and North Dakota. In recent years, the lakes and other amenities of the area have attracted full-time residents who commute to the Fargo Moorhead area for employment.

5.2 Terrain

The region owes its physical appearance to a thick blanket of material deposited about 10,000 years ago and consisting of gravel, sand and clay deposits. Outwash surfaces are pitted with numerous "ice-block" lakes and wetlands. Most of the main District lakes are found in the outwash areas. The higher morainal areas feature sand gravel deposits, as well as perched lakes and wetlands. Overall the relief of the area is about 300 feet, but local relief rarely exceeds 50 feet; stream gradients in the District are mostly low and the drainage is naturally poor.

The whole of the area is covered by glacial material which generally exceeds 400 feet in the vicinity of the District. This moraine drift is largely undifferentiated and unsorted material deposited by retreating glaciers. The underlying geological structure has little significance to the District's natural or human systems.

Two main types of surface glacial deposits are exposed in the District. Around the periphery, morainic material accounts for higher elevations (Figure 5). These contain some small lakes and wetlands which are only poorly connected to the District's main drainage system and lakes.

Outwash gravels ranging in depth from a few feet to as much as 100 feet are found in the central part of the District. The Pelican River flows across this outwash. Melting of large blocks of glacial ice buried in the outwash created depressions which when subsequently filled with water formed lakes. In this manner, most of the large District lakes were formed in the outwash zone, or adjacent to it.

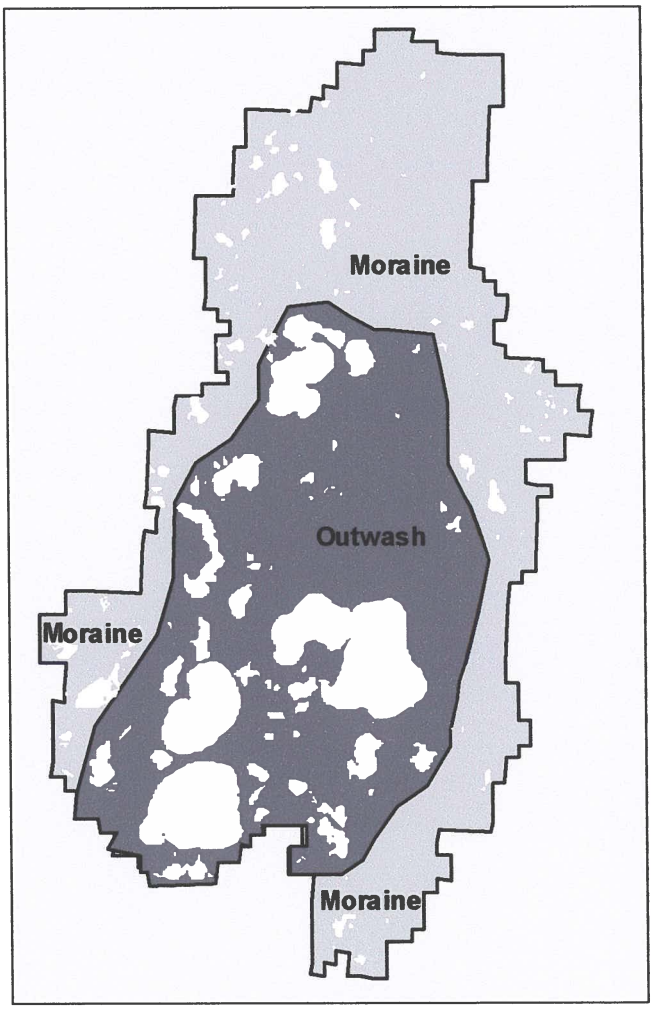


Figure 5 Surficial Glacial Deposits in the PRWD

5.3 Climate and Vegetation

The area's climate has short summers with long cold winters; it is transitional between the humid moisture regime to the east and south, and semi-arid conditions to the west. During 80 years of record, the area has received an annual average of about 24 inches of precipitation. Approximately 70% of this precipitation falls during the May to September period. Average snowfall is 42 inches. Estimated average annual evaporation from area lakes is slightly more than average precipitation. Monthly mean precipitation amounts as well as the average monthly ranges in temperatures are depicted below.

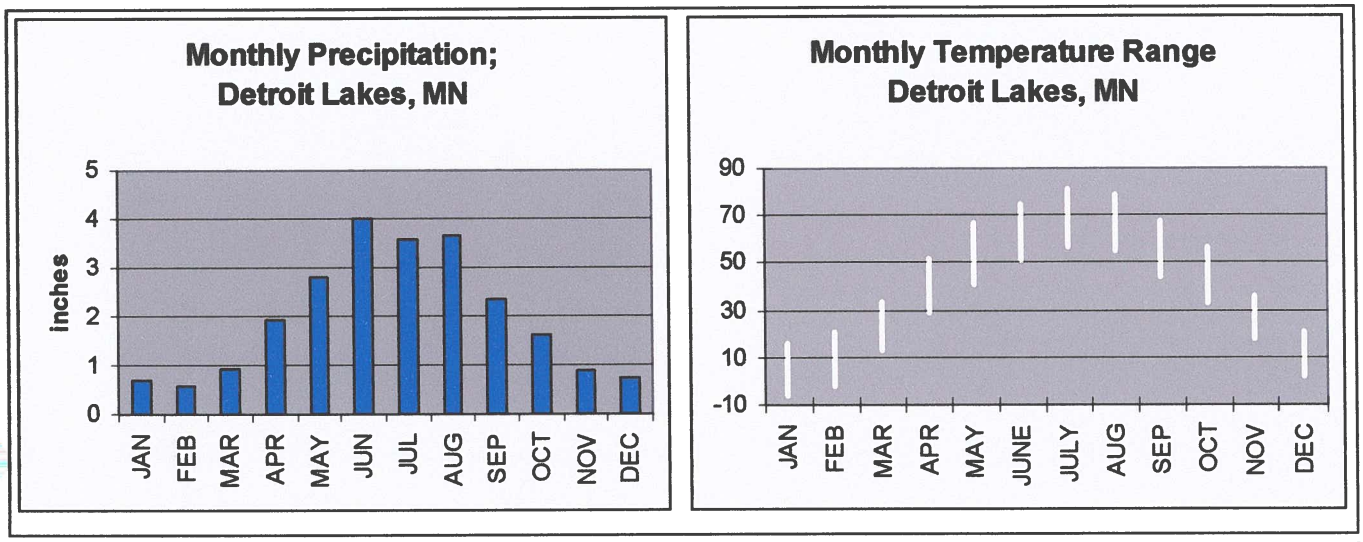


Figure 6a,6b: Average monthly precipitation and temperature ranges based upon 80 year record

Departures from these averages are considerable. For example, nine of the last ten years have exceeded the long-term average; in 1997 total precipitation was 35 inches, and in 2004 there was almost 34 inches. In the winter of 1996-97, snowfall exceed the long-term average by more than 100%. Similarly it is common for monthly precipitation to be more than double the average monthly precipitation.

Considerable variation in precipitation events also has been observed within the District. Total 2002 precipitation in 2002 ranged from 19.7 inches to 25.3 inches at different locations.

The frost-free season averages 125 days, with the last killing frost about May 20 and the first frost about September 22. As indicated by a 110 year record available for Detroit Lakes, the ice-on season averages 153 days, with freeze-up occurring on November 18 and open water returning on April 20. These conditions also are highly variable from year to year, and many recent years have seen relatively shorter ice-over periods, early ice-off dates, and relatively little snow-cover.

Detroit Lakes Winter Data

	First Frost	Ice-out	Ice-over	Ice-free	Length of Ice-cover
1993/4	9/26	4/19	11/8	203	144
1994/5	10/24	4/18	11/29	226	161
1995/6	9/21	4/23	11/11	202	144
1996/7	10/2	5/5	11/12	191	176
1997/8	10/16	4/28	11/15	200	168
1998/9	10/31	4/10	12/7	241	145
1999/00	10/2	4/13	12/16	247	135
2000/01	9/24	4/3	11/20	231	110
2001/02	10/6	4/28	12/7	223	158
2002/03	9/24	4/16	11/25	223	130
2003/04	9/30	4/15	11/7	207	160
2004/05	10/4	?	12/13	243	?
AVERAGE	9/23	4/20	11/18	210	153

Sources: KDLM Weather Reports, DL Tribune Ice Conditions

Natural Vegetation

The Minnesota Pollution Control Agency (MPCA) utilizes and eco-region concept based upon general vegetation patterns when describing or classifying lakes. Though lakes in Becker County are found in two of these eco-regions, the North Central Hardwood Forest Region, and the Northern Forests region, the Pelican River Watershed District is wholly within the former.

More precisely, the District lies astride an ecotone which displays the transition between the northern pine forests to the east, the hardwoods to the southeast, and the prairies associated with the Red River Valley, and beyond, to the west.

At the time of European immigrant settlement a large portion of the District was covered by dense and continuous forests. Upland varieties were mainly hardwood climax species, especially oak and maple. Basswood, birch, and white and yellow poplar were also found. There may have been some white pine in the northeastern part of the District. In wetland areas there was a wide range of grasses and shrubs and some hemlock and spruce bogs.

Modifications of the Natural Environment.

The Watershed District's natural environment has been considerably modified. While numerous Native American groups were found in the area prior to European settlement, their landscape impacts were negligible. Early contact with European immigrants came with travelers on the Red River Ox Trail which passed near Detroit and Monson Lakes. A trading post was built in 1854 near the mouth of the Pelican River on Big Detroit Lake. The Northern Pacific Railroad arrived in 1871, and with it permanent settlement, at Tylerville, within the present site of the Detroit Lakes Industrial Park.

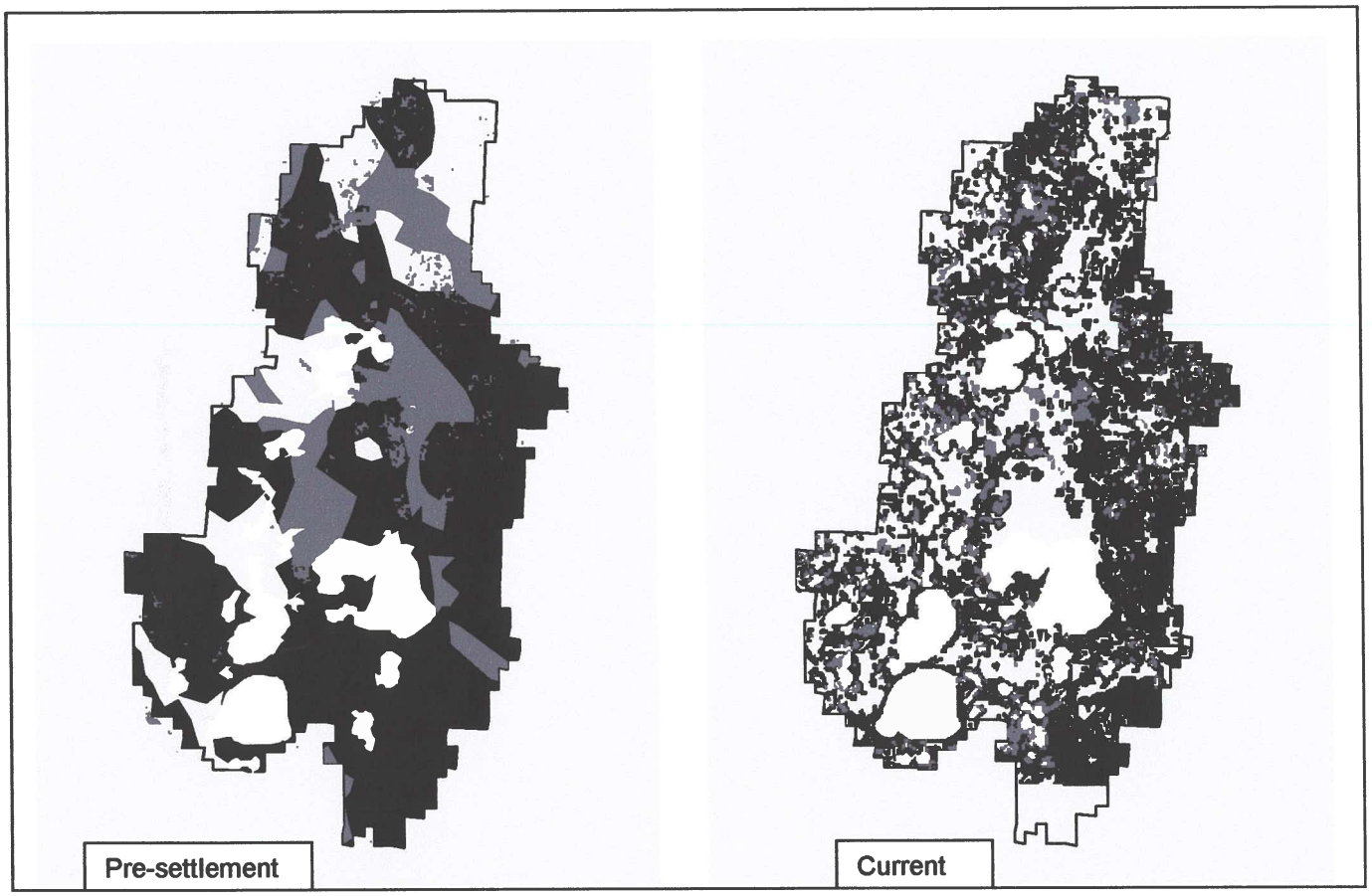


Figure 7a,b. Pre-settlement vs. Current Forested and Wetlands (forests= black, wetlands= stippled)

After that time, most of the District's original oak-maple-basswood, and oak-aspen forests were cleared for agriculture and pasturage. Little remains of the old-growth forest. Where forests remain, second and third growth stands contain relatively greater numbers of pre-climax species, especially poplar. Much of the swamp spruce and hemlock stands were also removed and some of the marginal wetland areas drained for cropland or grazing. Further, as a result of drainage projects intended to enhance agriculture and urbanization, some "meandered" lakes, and many natural wetlands, were drained, mostly before 1920. In certain parts of the District, impervious surfaces and storm sewers have enhanced and redirected drainage into surface waters; those practices continue.

Alteration of habitat, and other human activities resulted in the endangerment of a number of species in the District. At present time the rare species include Colonial Waterbird Nesting sites, Lake Sturgeon, Trumpeter Swan, Bald Eagle, and Pugnose Shiner. The Federal endangered species list for Becker County includes the Piping Plover. Sterile Sedge, Ram's Head Lady's-slipper, Hair-like Beak-rush, and Whorled Nut-rush also are on the State's "threatened" list for Becker County. There are numerous other species which carry the state designation "special concern".

While a full biological survey of the District has not been completed, a preliminary survey conducted by the DNR in 2003-2004 indicated 23 sites that warranted further investigation (DNR personal correspondence). As of this writing, field surveys have been completed on 13 of those sites; two of these, both straddling the eastern boundary of the District, have been determined to have considerable biological significance.

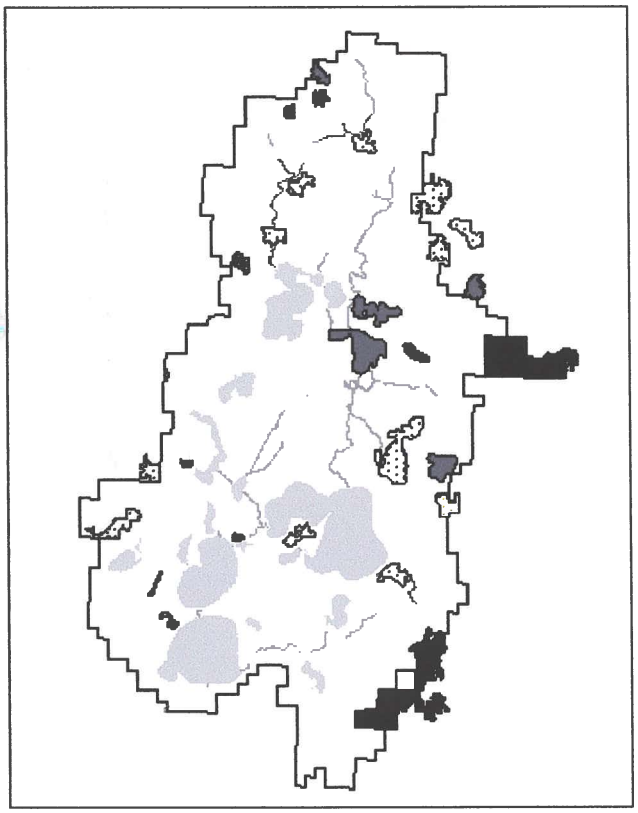


Figure 8 . Status of sites investigated by DNR for possible designation as having biological significance.

Stippled pattern = survey not completed

Dark Grey = no significance

Black = Moderate or High (contains significant occurrences of rare species or disturbed native plant communities)

The exotic species, Purple loosestrife, Flowering Rush, and Curly Leafed Pondweed have been introduced, and are found in abundance, in parts of the District, and will be more thoroughly discussed in Section 6.5.

On the other hand, it seems likely that forests are making a comeback. Much cropland and grazing land has been planted, often in conifers. Some acreage has simply been allowed to return to forest. Also comparison of old aerial photographs with current ones, show more extensive and dense tree canopies in many areas, including those in some highly developed shoreland areas.

5.4 Economic Base

The region's economic base is diverse. Even before major logging operations ended in the area, and modern agriculture took hold, several of the area's lakes became popular destinations for cottage and resort development. The Pelican River was altered to permit navigation in 1889. By 1901 steamships carried 4000 tourists per year along the Pelican River between Detroit Lakes and Sallie. In 1904 a boat-train service connected Fargo with Lake Sallie via Detroit Lakes, and by 1909 there were 3 daily passenger boats each way from the north shore of Detroit Lakes to Shoreham. Indeed, by 1915 there were reported to be 250 cottages near Shoreham, between lakes Melissa and Sallie. Today, the region's economy is mixed, with agriculture, trade, manufacturing, tourism and services all playing prominent roles.

While data are not separately available for the district, Becker County employment patterns are more or less representative:

2003 Becker County Employment by Major Industry Group

Major Industry Group	2003 Employment	%
Trade/Transportation/Utilities	2766	23
Government	930	9
Manufacturing	1787	15
Education/Health Services	3028	25
Leisure/Hospitality	1195	10
Construction	718	5
Other Services	497	5
Professional/Business Services	436	3
Financial Services	297	2
Forestry/Agriculture/Mining	257	2

Source: Minnesota Department of Employment Security

County employment growth has been occurring at ½ % per year, or perhaps a little more, but state forecasts suggest an acceleration of that growth in the next 10 years with transportation/communication/utilities, education, and government leading the way. Agricultural, financial services, and leisure hospitality sectors has dropped relative to other portions of the economy.

From the district's point of view, the decline in full-time farmers, farm employment, farm-based population, and cropped acreage, and the increase in forests brushland and CRP, are especially important because they are associated with significant reductions of nutrient and sediment loadings to District waters. On the other hand, conversion of cropland, forests and pastureland to urbanization, including housing developments leads to more impervious surface, and greater challenges to water quality..

Employment directly linked to the tourist sector is getting smaller in absolute terms, and relative to other segments of the Becker County economy. The traditional resort business has continued to deteriorate. On the other hand, overall tourist expenditures have greatly expanded.

Also, residential, and especially water-oriented developments in the last few years have had very important employment impacts and is likely to have long-term economic multiplier effects.

In this connection, an indication of the general condition of the District's economy can be discerned from the growth in the District's market valuations from 1985 to 2005.

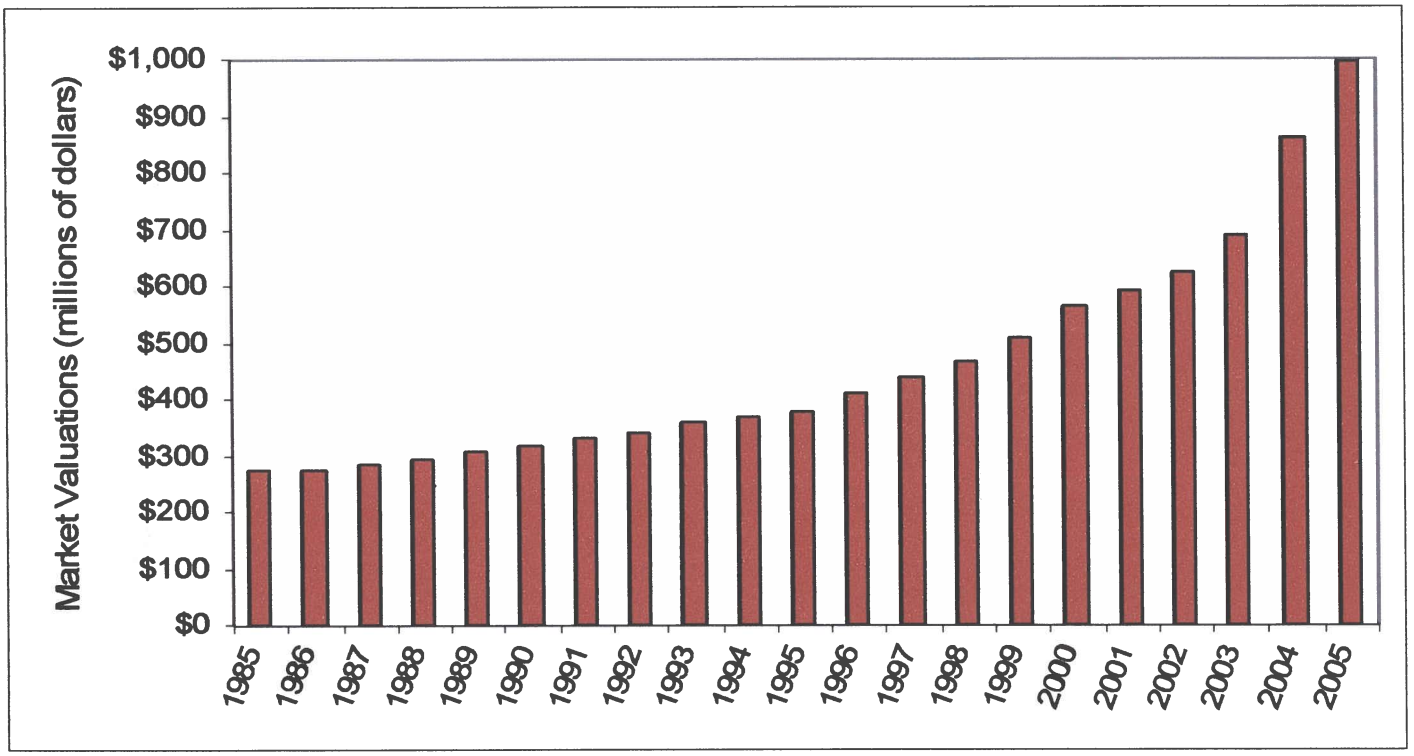


Figure 9. Pelican River Watershed District Market Valuations, 1985-2005.

At the same time, the overall economy of the region, as indicated by per capita and household incomes and the proportion of households living below the "poverty level", lags behind that of the State of Minnesota and adjacent counties. Moreover the gap seems to be widening (Minnesota Extension Service).

This gap is a symptom of an important economic reality for PRWD. Over 40% of the District's total market valuations involve lakeshore. The proportion has gradually increased, especially so in the last five years.

5.5 Population

Census data are not separately available for the Watershed District, but its population history can be represented by changes which have taken place in the three townships and the city which comprise most of the District's territory (Figure 10). After growing steadily since the arrival of the railroad, there was a decline in the 1980's, followed by a small growth spurt in the 1990's. Based upon examination of more detailed U.S. Bureau of Census reports, actual 2000 resident population within PRWD is estimated to be about 13,000. Official population projections for the area suggest that the population now is growing by over 1.3% per year.

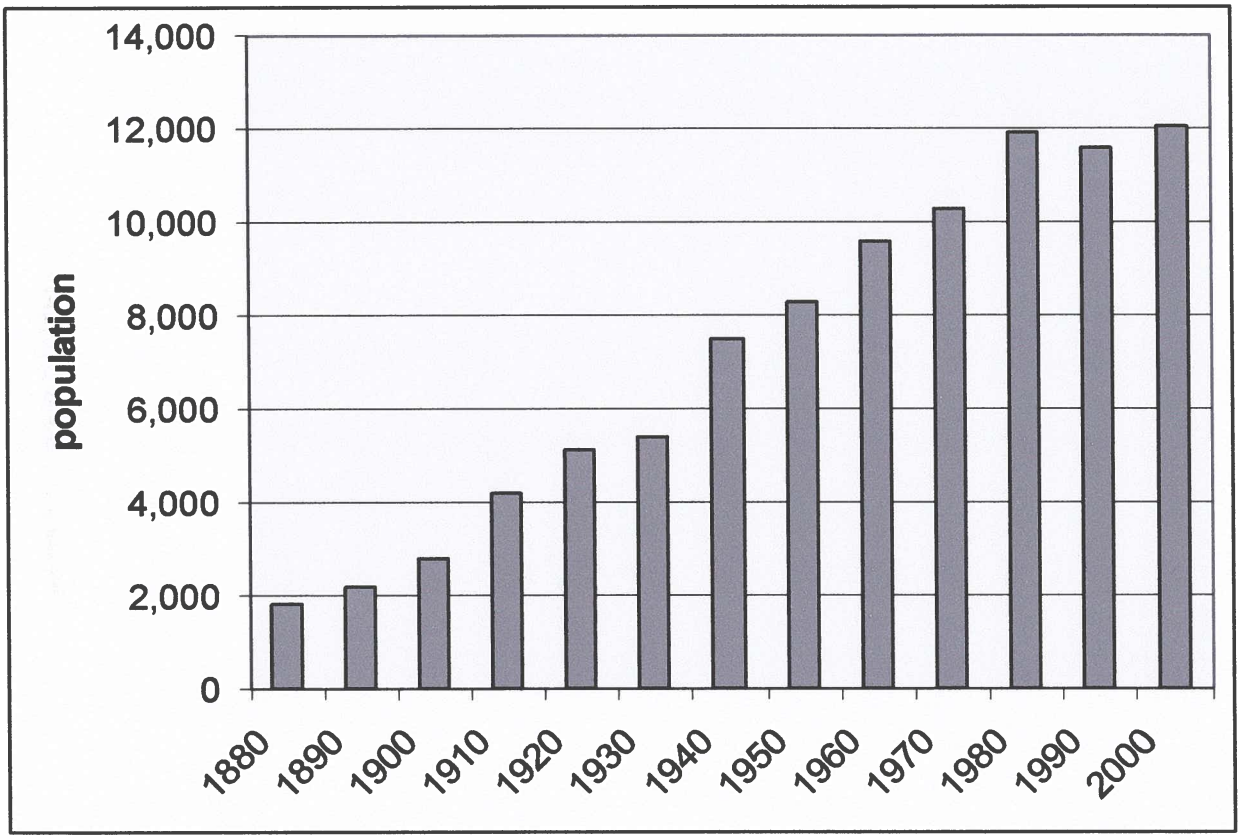


Figure 10. Population Change: City of Detroit Lakes, and Lakeview, Detroit and Richwood Townships

However several other aspects of the population situation are relevant to understanding the District's recent development. First, the region undergoes a pronounced annual seasonal shift in population. By inference from data on vacant housing, the occasional resident population adds at least 15, and perhaps as much as 30% to populations reported by the Bureau of the Census, depending upon what assumption is used concerning housing unit occupancy levels. Transient visitors add even more people on a temporary basis, and there are some "snow-birds" who live in the region much of the year, but who are counted somewhere else on Census-day (April 1).

A further indication of the dynamic character of District populations is indicated by the fact that about 19% of the total population (over 5 years) moved into the county since 1995.

2000 Population and Household Data trends for City of Detroit Lakes, and surrounding Census Tracts

Population	11,873
Occupied Housing Units	5,050
Vacant Housing Units	1,354
Housing Units built in previous 10 years	980
Persons living in a different Mn. county 5 years before Census date	1,205
Persons living in different state 5 years before Census date	1,059
Average household size	2.56

Second, the data on housing units themselves are important. Indeed it can be argued that housing units are a better indicator of pressure on District resources than population. In terms of environmental impacts, each housing unit consumes space and other resources that are relevant to District planning. The vast majority of vacant housing is located in the shoreland zones around District Lakes.

Thirdly, the number of housing units in the District appears to be increasing at a rate in excess of that of population. A significant part of the total housing stock (15%) has been built since 1990. Unlike population, the number of housing units has increased in each of the last four censuses (U.S. Bureau of Census, Census of Population and Housing, 1970, 1980, 1990, 2000).

Finally, there appears to be a persistent tendency of regional populations to move toward the periphery. Rural non-farm populations grew from 60 to 68% of total Becker County populations in the 1990's, while both urban and rural (farm) populations declined. The data strongly support that which is visible in the landscape; the District is becoming "suburbanized" by permanent residents who have chosen to live in the District's woodland and lakeshore zones. Since 1990 housing units built in the non-urban areas, exceeded those in the City of Detroit Lakes by a ratio of 4:1. Also lending support to this notion is the fact that while population and housing units increased significantly in the watershed district, the City of Detroit Lakes lost both population and housing units in the 1990's.

5.6 Land Use, Land Ownership and Change

The cultural imprint on the District's land is complex. Most of the land is still devoted to agriculture, which tends to decrease in concentration from northwest to southeast. Residential and other urban developments are heavily concentrated in a few areas – around the area's lakes, and in the City of Detroit Lakes. The previously noted tendency towards scattered isolated residential development is confirmed as well. Woodland is scattered throughout the District, but is dominant in the eastern and southern parts.

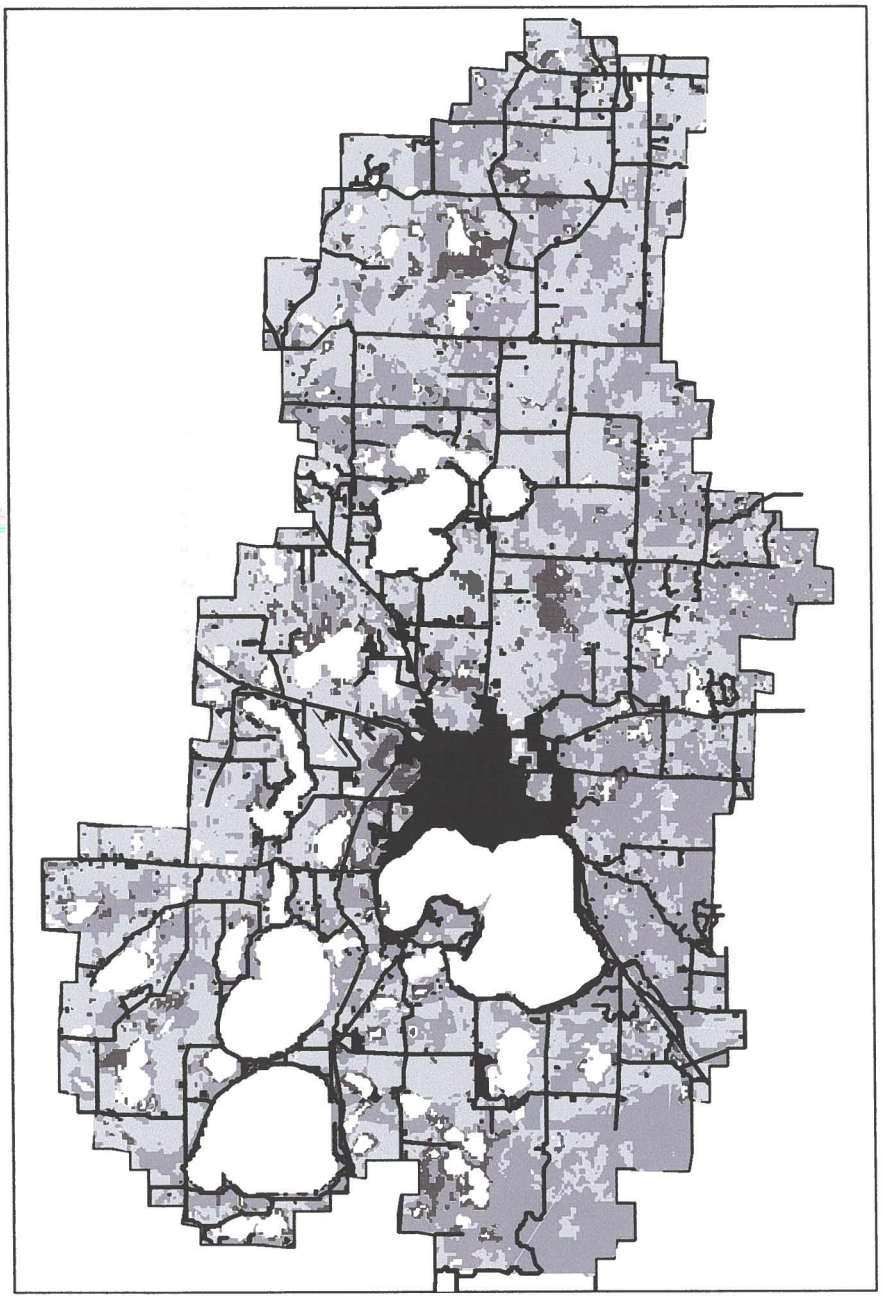


Figure 11. Generalized 2001 Land Use

LAND COVER CHANGE, 1988 -2001

	1988	2001
Urban, Industrial	5.4%	6.2%
Ag Land (incl. cropland, grasslands, pasture)	44.2%	40.8%
Open Water	16.1%	16.1%
Wetland	5.0%	5.0%
Forest	30.1%	33.2

black = urbanized (residential, road, commercial, industrial),

dark grey = woodland,

light gray = cultivated, grassland, pasture,.

Source: DNR data files

Landownership and Special Management Arrangements

Most of the District's land is held in small private tracts. Only about 20 tracts exceed 200 acres. Aside from meandered lakes which belong to the State, there are about 40 parcels, totaling about 5100 acres (about 7% of District land) which are publicly held. The majority of public land is currently managed for wildlife enhancement, though there are park areas within the city of Detroit Lakes, and a large public park and a golf course complex near lakes Sallie and Melissa.

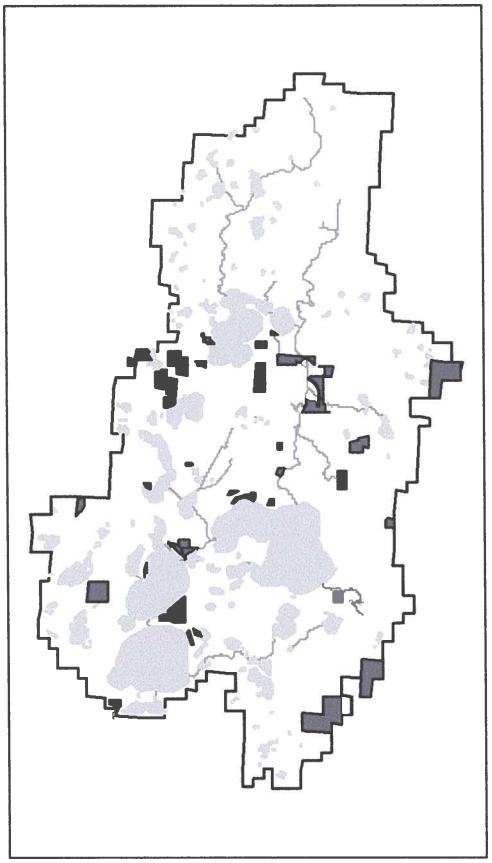


Figure 12. Federal, State and Local Public Lands and Water

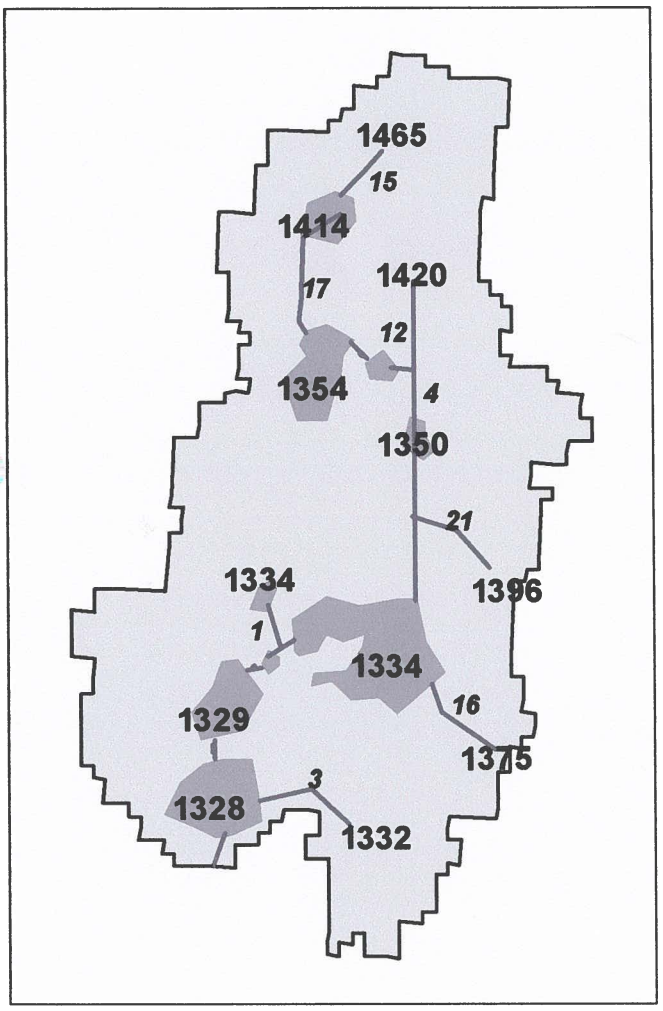
Source: DNR data base

In addition to public ownership, there are numerous District parcels currently enrolled in the Conservation Reserve Program (CRP). Participation in this program requires that the landowner refrain from cultivating the land for a specified period of time. In some instances, buffer strips, or trees are planted. In addition, the U.S. Fish and Wildlife Service has obtained easements on 10 parcels, within the District. The locations of some of these restrictions on District land utilization are depicted in Figure 12.

6.0 DISTRICT WATERS

Overview

The Principal hydrologic feature of the Watershed District is a chain of lakes connected by the Pelican River and its tributaries. The flow is from north to south. Gradients in this system are low, except in the margins of the watershed. Representative elevations and gradients are depicted below.



Lake elevations in feet above mean sea-level

Gradients in feet per mile

Figure 13 District Lake Elevations and Stream Gradients

6.1 Runoff and Discharge

The District as a whole has average annual runoff of 4.3 inches (USGS, 1969). The typical pattern shows low flows during the winter, followed by rapid increases in the spring, with spring rains supplementing the snowmelt. Summer flows are quite variable, depending upon rainfall patterns. Flows diminish in the fall. However any given year can bring important deviations from this pattern.

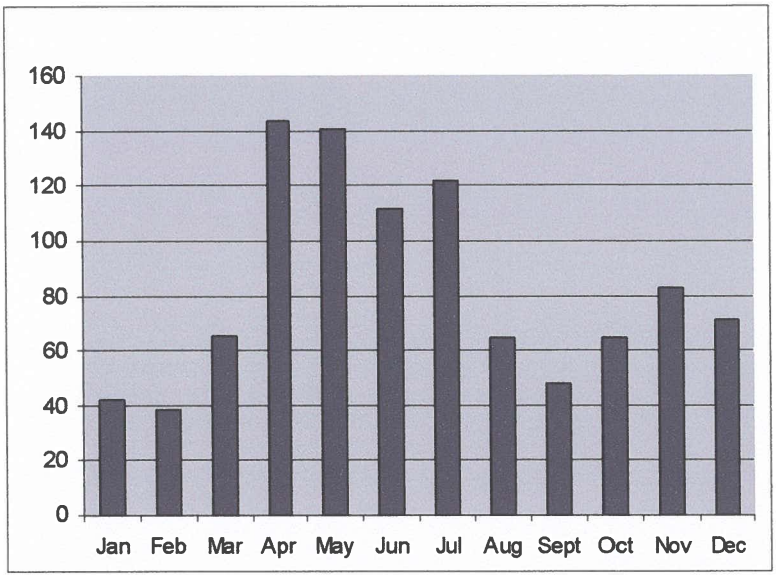


Figure 14. Average Monthly Discharge from PRWD.

However, there are significant deviations from the average pattern, and as noted elsewhere, precipitation varies considerably from season to season, and from place to place within the District. The 1990's were considerably wetter than average; record lake levels and discharges were recorded in 1993 and again in 1997. Sallie reached 1330.9 feet above Mean Sea Level (MSL) in August, 1993, and 1330.8 MSL in April 1997. Detroit Lake reached its peak in 1997 at 1335.6 above MSL. After a four-year decline, there was much higher-than-average precipitation, and runoff-producing precipitation events.

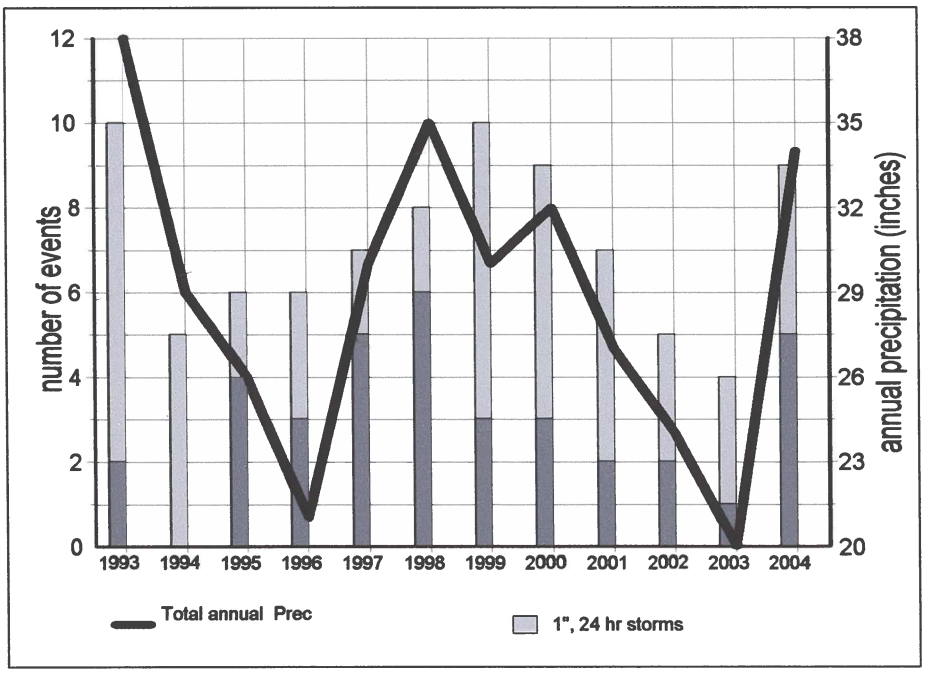


Figure 15 – Precipitation events

In April, 1997 The DNR measured a flow of 138 cubic feet per second (cfs) in the Pelican River at Highway 34; predicted flows reached 167 cfs later that month. In contrast, average annual flows from 1995-2000 ranged from 29 cfs to 49 cfs.

Flooding is not a serious problem in the Pelican River basin. After a record (100 year 10-day) rainfall episode in the summer of 1993, and on another occasion of a record snowmelt coupled with an early April rainstorm in 1997, the Pelican River and several of its main tributaries (Ditch 11 and Campbell and Sucker Creeks), overflowed their banks in several places, causing some property and tree damage as well as bank erosion. Wind-driven waves during the high lake levels in April and May, 1997 caused erosion and some property damage along the shores of Melissa and Lake Sallie. Generally high lake levels during the 1990's also were responsible for considerable shoreline erosion on all District lakes.

It also is noteworthy that until 2004 annual discharges had decreased each year for the previous six years. Annual discharges are represented by Figure 16.

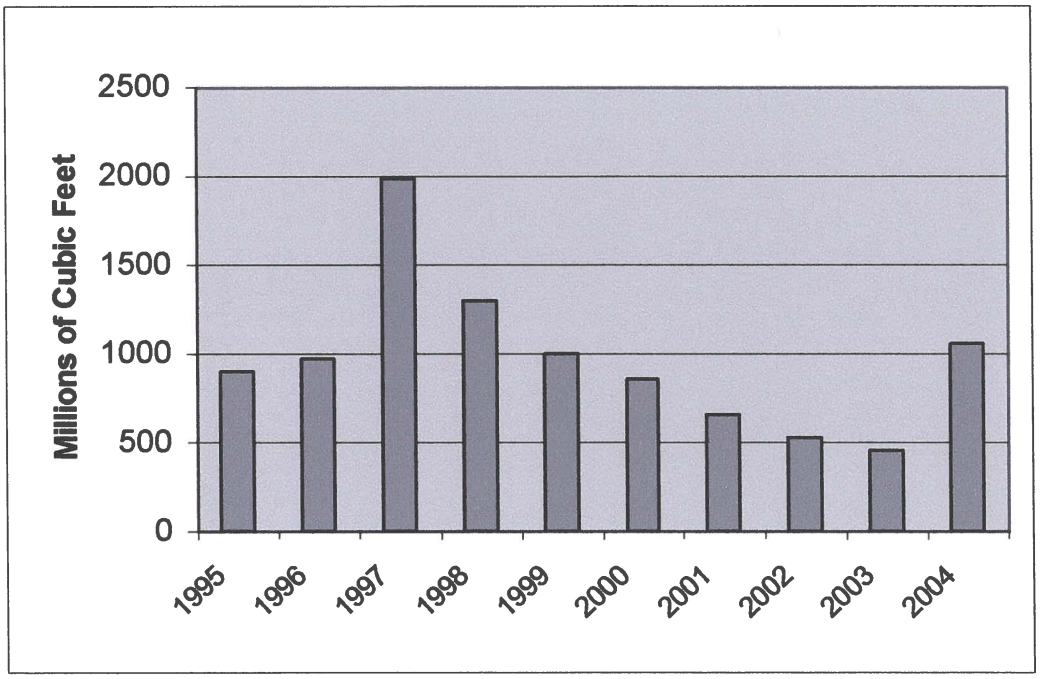
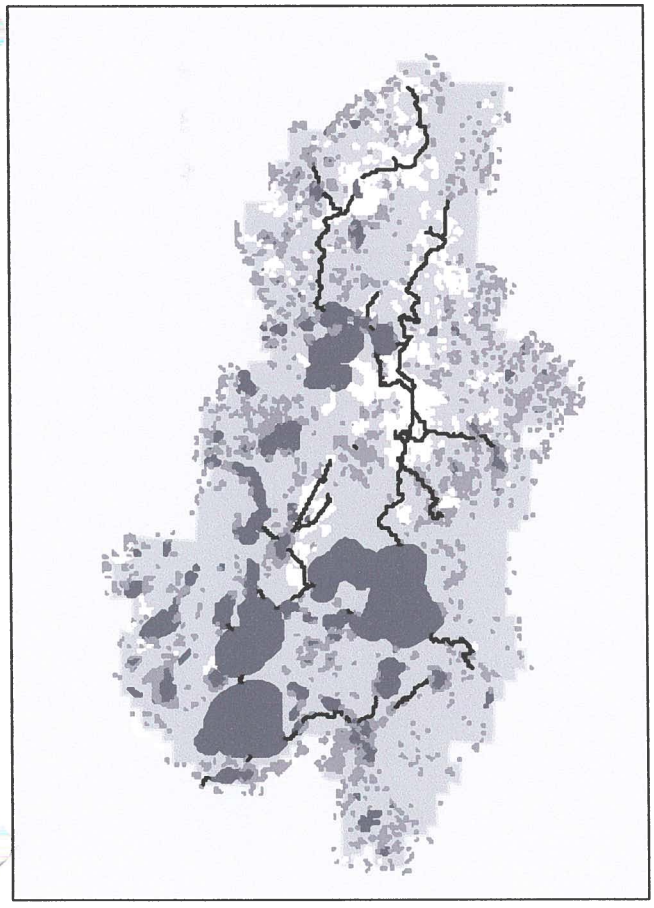


Figure 16. Average Annual Discharge at Dunton Rapids

6.2 Surface Features

Surface water features in the District are summarized in the following table.

	Number	Amounts
Total Lakes	**144**	**12,014 acres**
Main District Lakes	**18**	**10,212 acres**
Wetlands	**4777**	**11957 acres**
drained	**527**	**3,844 acres**
Pelican River Main Channel	**1**	**8.3 miles**
Perennial tributaries	**39**	**33 miles**
Public Ditches	**3**	**14 miles**
Private Ditches	**5**	**5 miles**
Roadside Drainage	**NA**	**267 miles**
Impervious Surface	**NA**	**Abt.12,000 acres**



District lakes comprise about 12,104 acres (19 square miles), about 16% of the total area of the District (Figure 17). However, only 18 of the 144 water bodies defined as lakes by the DNR lakes exceed 100 acres, and the District gives most of its attention to these. Taken together these eighteen account for about 85% of the District's surface water, and have about 74 miles of shoreline. Some important attributes of these lakes are depicted in the table on the following page.

Numerous small wetlands are important features of the District's landscape. Of the nearly 12,000 wetland acres, almost one-third have been drained, mostly for agricultural purposes.

Figure 17. Lakes, Streams, Wetlands and Drained Wetlands
(wetlands gray, drained wetlands white)

Source: DNR data bases

Some Attributes of Main District Lakes

	Type	Acres	Shore miles	Avg. Depth	Max Depth	% less than 15' deep	Mixing Pattern	inlets /outlets	Trophic Status
Munson	Lake, outlet control	139	2.2	14	26	49	Dimictic	0/1	Mesotrophic
Pearl1	Lake	218	4	13	54	77	Dimictic	1/0	Mesotrophic
Fox	Lake	149	1.9	10	24	65	Dimictic	0/0	Mesotrophic
Meadow	Lake	68	1.3	25	81	43	Dimictic	0/0	Mesotrophic
Brandy	Lake	498	3.4	5	7	100	Polymictic - subject to winterkill	1/0	Eutrophic
Long	Lake	434	6.5	20	65	35	Dimictic	1/1	Mesotrophic
Johnson	Lake	186	3.1	12	30	65	Polymictic	1/0	Mesotrophic
Reeves	Lake	98	1.9	12	43	87	Polymictic	1/0	Mesotrophic
Abbey	Lake	286	3.4	5	7	100	Polymictic - subject to winterkill	1/1	Eutrophic
Muskrat	Reservoir	65	1.7	6	17	96	Dimictic - subject to winterkill	1/1	Borderline Eutrophic
St.Clair	Partially drained	242	2	5	7	100	Polymictic - subject to winterkill	2/1	Eutrophic
Sallie	Lake, outlet control	1287	5.5	16	52	43	Polymictic	2/1	Borderline Eutrophic
Melissa	Lake, outlet control	1827	7.3	18	32	51	Dimictic	2/1	Borderline Mesotrophic
Big Floyd	Lake, outlet control	862	5.5	12	26	70	Dimictic	1/1	Mesotrophic
North Floyd	Lake, outlet control	298	3.6	16	34	60	Dimictic	2/1	Borderline Eutrophic
Little Floyd	Lake, outlet control	231	2.2	15	32	47	Dimictic	1/2	Mesotrophic
Big Detroit	Lake, outlet control	2076	7.7	18	82	40	Dimictic	4/1	Borderline Mesotrophic
Little Detroit	Lake, outlet control	941	4.8	9	18	90	Polymictic	1/2	Mesotrophic
Curfman	Lake, outlet control	122	1.7	11	21	95	Polymictic	0/1	Borderline Eutrophic

Public Ditches

Much of the Pelican River and its tributaries has been ditched. Four major public ditches were constructed in the 1912-1918 period; since that time, numerous private systems have been connected to the ditch systems, including much of the stormwater system of the City of Detroit Lakes.

Starting in 1997, Becker County turned over administration of the Ditch Systems to PRWD. It is the District's responsibility to maintain ditch functionality, and the drainage rights belonging to the "benefited property owners".

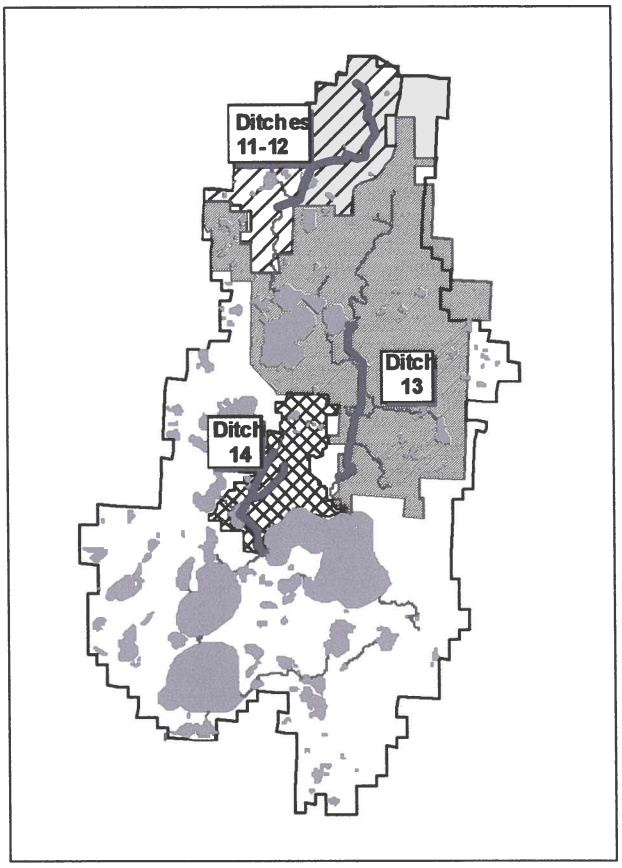
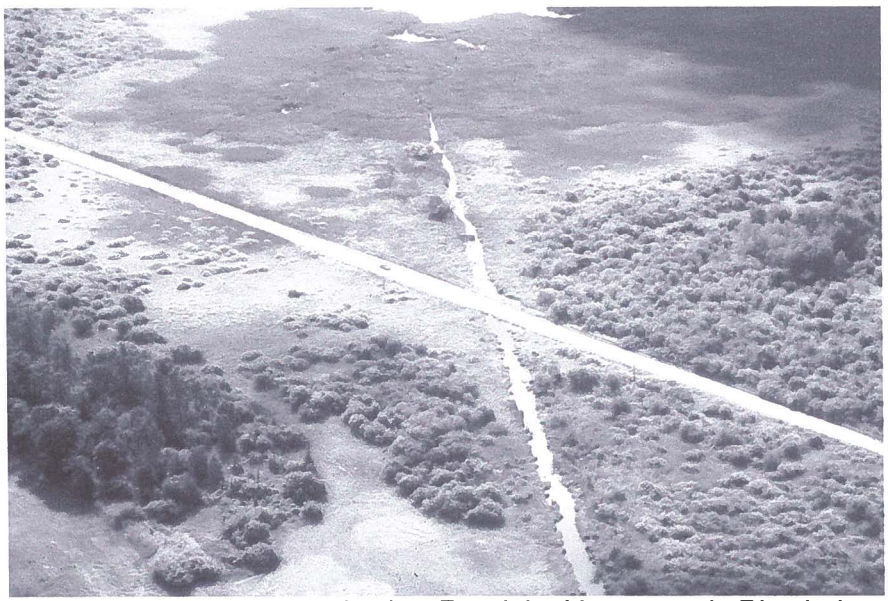


Figure 18. PRWD ditch systems, and their benefited areas.



Ditch 13, cutting across Anchor Road, looking towards Rice Lake

Water Control Structures.

At one time, commercial navigation was possible through a series of streams and locks from Little Detroit Lake through lakes Sallie and Melissa as far downstream as Pelican Lake. Levels of the main District lakes are controlled by structures. It is believed that these structures permitted raising lake levels of Detroit Lakes, Sallie and Melissa about 2 feet above natural conditions to serve navigation purposes before 1900; thus "ordinary high water levels" as designated by the DNR, are somewhat above natural levels that would have pertained prior to implementation of these controls. As a result of these actions, Muskrat Lake was created from what previously had been a tamarack swamp, and the land connection which separated Big and Little Detroit Lakes no longer exists.

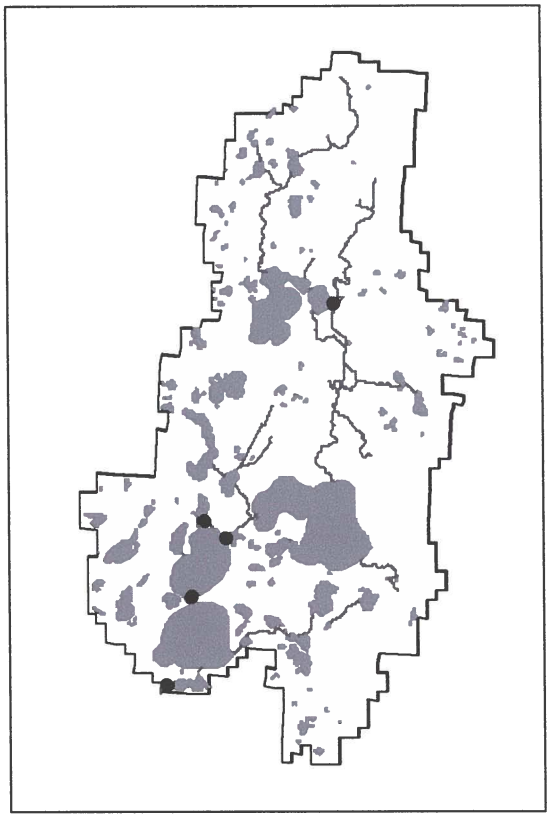


Figure 19 Control Structures.

In 2001, the Dunton Locks Dam between Muskrat and Sallie lakes, was replaced with an engineered rapids. Similarly, in 2004, the low-water dam between Melissa and Sallie was replaced. The main purpose of these changes was to promote the natural migration of fish, particularly Sturgeon and Muskies, through the Pelican Chain.

At the present time, no structures are used to manage District water levels.

Dunton Rapids replaced a lock and dam structure between Muskrat and Sallie Lakes in 2002

Other surface drainage features

There are a number of other landscape features which have an impact on surface drainage in the District. Much of the City of Detroit Lakes is served by stormwater collection systems which eventually discharge to the Pelican River, to Detroit Lake, or to the wetlands which are drained by Ditch 14 to the Pelican River. Most of the road systems also incorporate drainage which eventually is discharged to public ditches, streams, or lakes.

The impervious surfaces which these devices serve increases the total runoff, and the rate of runoff to surface waters of the District. While it is estimated impervious surface covers only about 2% of the total watershed, in some locations the proportions are much greater.

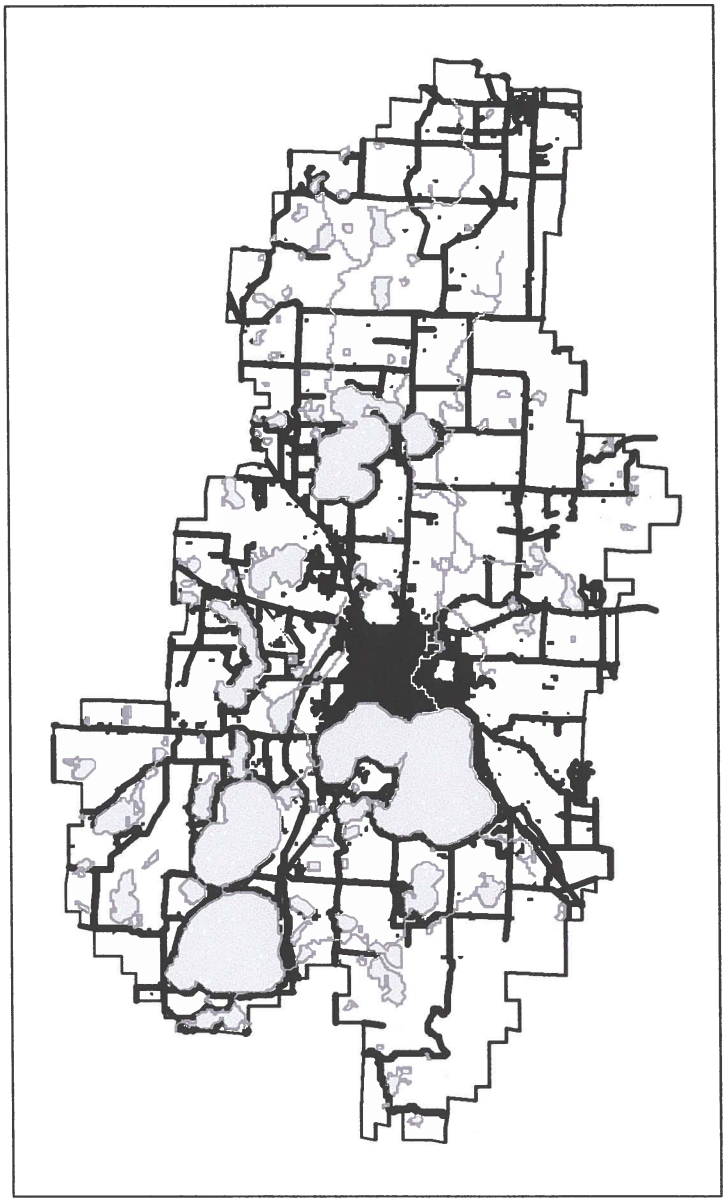


Figure 20 Impervious surfaces

Source: DNR data bases

6.3 Groundwater

Underlying most of the watershed is the Pelican River Sand-Plain Aquifer, a surficial aquifer which is closely associated with the zone of outwash sands and gravels (see 5.1 Terrain). In the portions of this aquifer located within the watershed, the saturated portions of the main aquifer mostly range from 20 to 60 feet, but saturated layers may extend to 100 feet of thickness (Minnesota DNR, Otter Tail Regional Hydrogeologic Assessment). In several District shoreland zones, local water tables are within a few feet of the surface. The aquifer is recharged from spring snowmelt and precipitation, as well as from regional aquifers which extend far beyond the boundaries of the District. Based upon several monitoring wells within the District, depth to groundwater responds to precipitation patterns with variations of up to several feet.

The Sand plain is discharged in significant amounts to the Pelican River as well as to local wetlands and lakes (Miller). Some flowing springs are found in depressions and along streams and lakeshores. This groundwater source plays a significant role in the hydrology of the District's surface waters, providing, for example, amounts in the range of 5 to 30% of annual water budgets for some lakes (Neel, McMann and McBride) and on the order of 10 percent of the discharge of the Pelican River as it leaves the District.

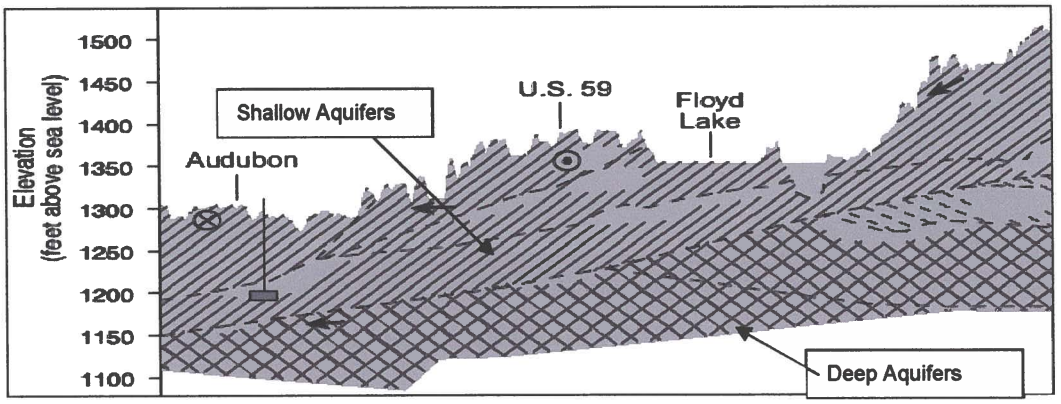


Figure 21. Ekman and Berg Schematic showing aquifers relative to PRWD.

Below the surficial aquifer is a deeper, somewhat confined, aquifer approximately 100 feet thick. This aquifer has been shown to be comprised of "old" water (Ekman and Berg) and is not significantly impacted by surface precipitation conditions. However, it is increasingly used for drinking water sources. After intensive study a ***well-head protection zone*** has been established by the city of Detroit Lakes to protect its drinking water supply. This zone provides for special controls over certain land uses and other activities which might impact the deeper aquifer.

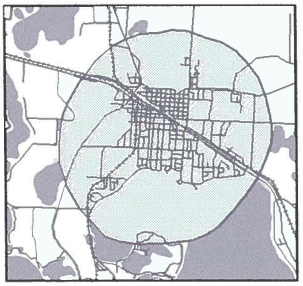


Figure 22. City of Detroit Lakes Well-Head Protection Zone

In 1998 the District commissioned a study of nutrient loadings from surficial groundwater in a small portion of the District (Barr Associates). The study followed up on some work done by PCA's Joe Magner who suspected some involvement of nutrients from the Detroit Lakes Waste-Water treatment facility (DLWWTF) which uses spray irrigation to dispose of much of its treated effluent. Their modeling failed to predict any groundwater pathways from the sewage disposal areas to Lake Sallie or the Pelican River. However, Barr reported some suspicion concerning movement of groundwater through coarse-grained fill along Highway 59.

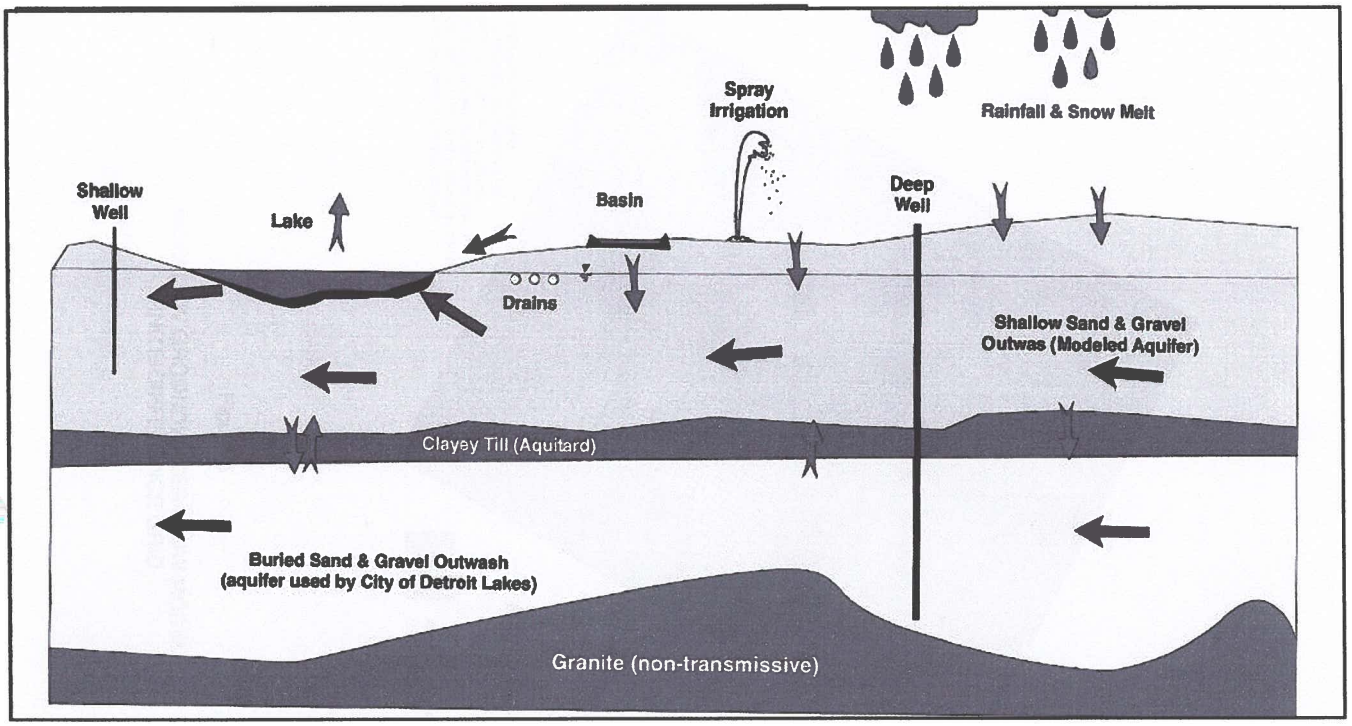


Figure 23. Barr Engineering schematic of groundwater situation in the vicinity of Lake St. Clair

In subsequent evaluation of the DLWWTF there is some indication of elevated nutrient levels in groundwater in the vicinity of the spray irrigation sites. The current waste water disposal permit requires a further evaluation of this condition; preliminary results do not suggest any increase in groundwater nutrients.

However, Barr and other studies (McComas, 1999, 2000, 2001), indicate that groundwater containing phosphorus may be discharged seasonally to the Ditch 14 system. This process involves complex internal loading of nutrients from the enriched wetland systems during periods of low pore-water oxygen.

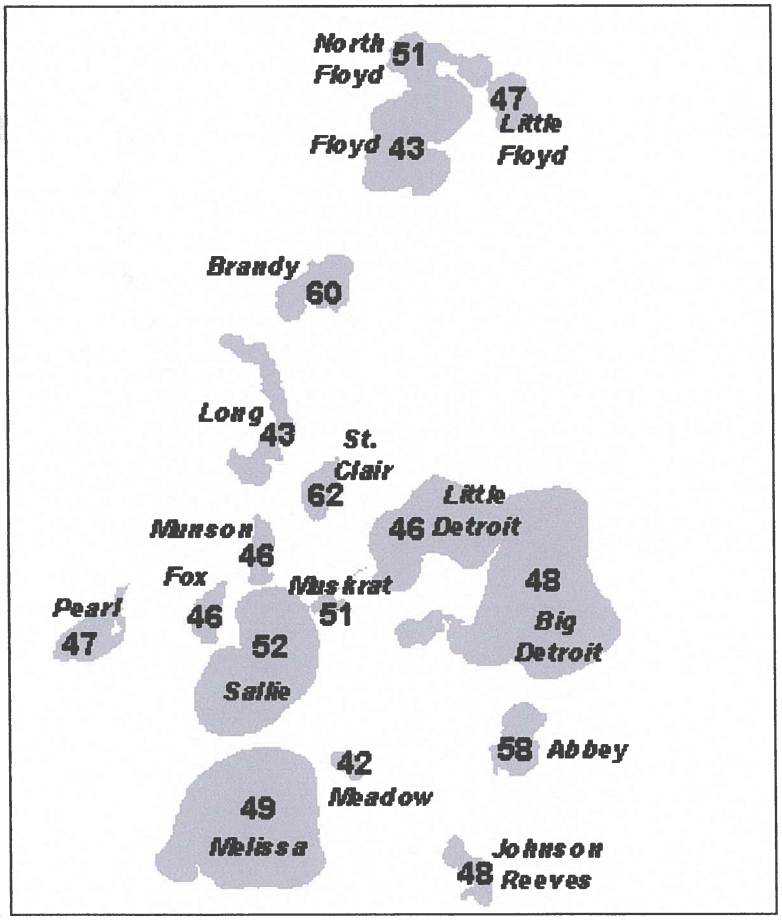
Some wells, especially in the vicinity of Long Lake, have shown arsenic levels that exceed drinking water standards; according to the Minnesota Department of Health, these incidents appear to be natural in origin. Some contaminants from surface sources, including nitrates, also have been found in isolated cases.

6.4 Water Quality

The District enjoys good water quality relative to many parts of Minnesota. On the other hand, water quality standards perceived by local residents are generally higher than in other parts of Minnesota. Accordingly though no District lakes or streams are classified as "impaired" by the State of Minnesota, residents and officials see plenty of local water quality issues and problems.

As described previously, the District's mission is to protect and enhance lake water quality, so an elaborate monitoring program has been implemented to assess and track conditions, and to evaluate any District actions aimed at impacting water quality. The district has more than 10 years of records on many lakes, and at least five years of data on nineteen District lakes.

Lake conditions are generalized in the map below.



Based upon the Carlson Trophic State Model, these trophic indexes are averages of indexes for in-lake phosphorus, clarity and chlorophyll-a measurements. The higher the index, the poorer the conditions. Since the index is based upon a logarithmic scale, an increase of 10 index points reflects a doubling of phosphorus levels and/or a halving of clarity. An index of 50 is considered to divide "good" and "deteriorating" lake water quality.

Figure 24. Estimated Trophic Status Indexes for Main District Lakes

While the Carlson model provides some guidance, it does tend to mask the seasonal and year-to-year variability i lake water quality conditions. Data needs are therefore considerable, and even with good data it is difficult to ascertain trends, as illustrated in the data on Big Detroit transparencies.

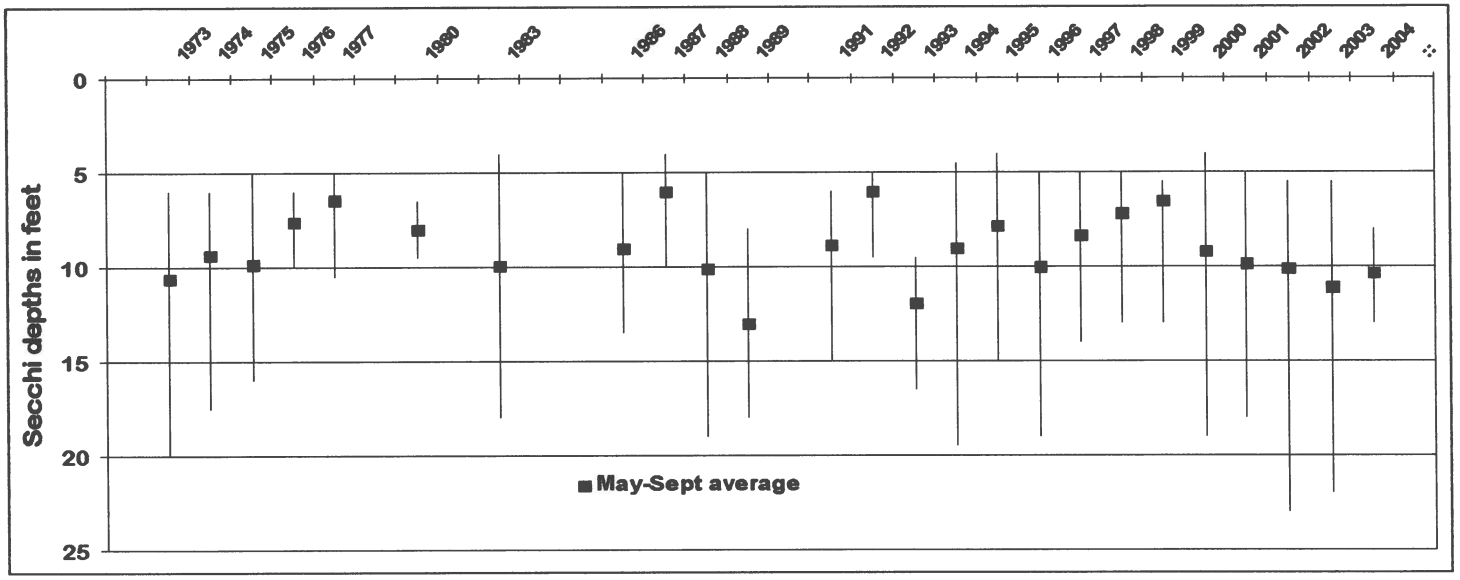


Figure 25. Variability in Transparencies, 1973-2004, Big Detroit Lake.

Complicated patterns such as this are common for District lakes, making trend analysis very difficult. . Also, for some of the smaller lakes we have insufficient years of records to identify trends. That said, here are some generalizations about water quality changes.

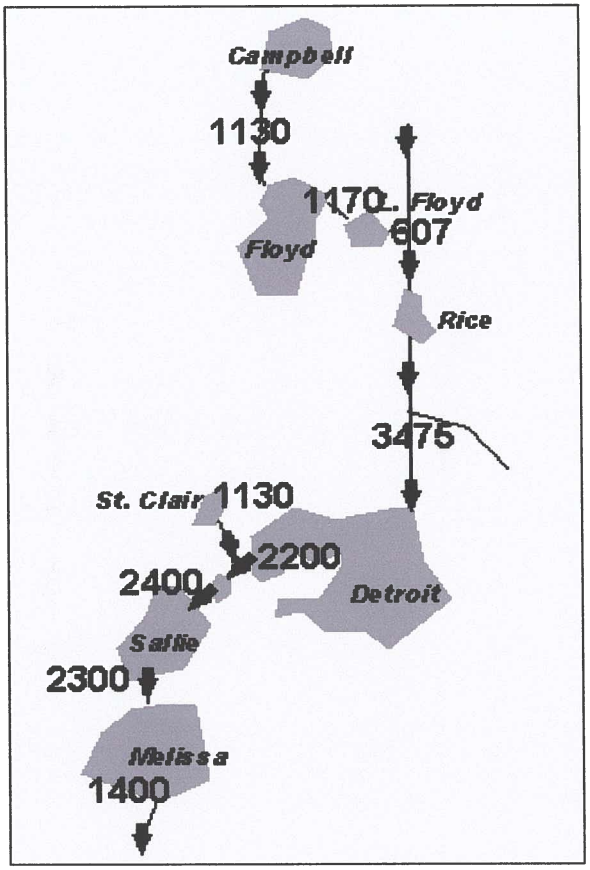
	Data since ... 1/	Trends?
Munson	1998	No detectable trend
Pearl	1998	No detectable trend
Fox	1994	No detectable trend
Meadow	1998	No detectable trend
Brandy	1998	No detectable trend
Long	1975	Pre-1995 averages better than since
Johnson Reeves	1998	No detectable trend
Abbey	2000	No detectable trend
Muskrat	1998	No detectable trend
St. Clair	1995	Marked improvement after 1998 alum treatment
Sallie	1965	Much improved since 1960's;' no detectable trend since mid-1990's.
Melissa	1985	No detectable trend
Big Floyd	1982	No detectable trend
North Floyd	1982	No detectable trend
Little Floyd	1982	No detectable trend
Big Detroit	1982	No detectable trend
Little Detroit	1982	Possible improvement since mid-1990's.
Curfman	2003	Insufficient data

1/ Since 1995 consistent data are available for each year; prior to that time data were neither consistent or available for each year.

The District has determined that there are two general causes of District lake water quality problems, upstream nutrient loadings, and shoreline development.

Upstream Nutrient Loadings

Considerable attention has been given to the flow of nutrients in and out of the main District lakes. The schematic below indicates the main sites of interest, and shows some definite trouble spots. Upstream nutrient problems are associated with general urban and agricultural runoff, stormwater, and internal loading associated with ditched wetlands.



This figure, compiled from ten years of data, represents average pounds of phosphorus moving in and out of main District lakes. However, yearly loadings vary significantly, and are especially sensitive to the amount of runoff. The averages includes some of the wettest years in history. Depicted below are the annual upstream loadings to Big Detroit.

Figure 26. Upstream Phosphorus Loadings to District Lakes

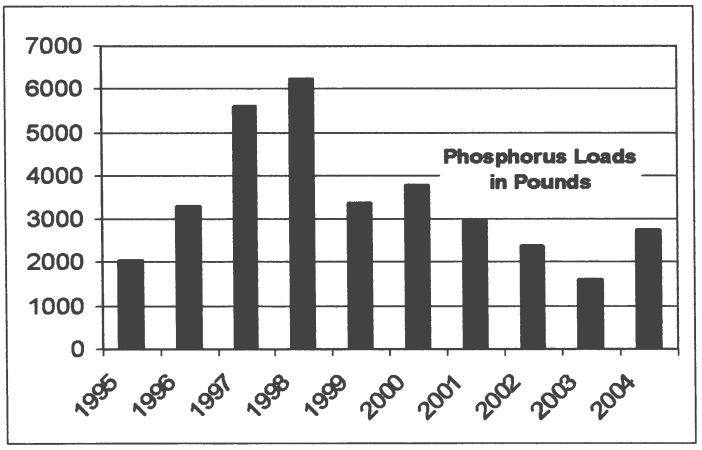


Figure 27 Phosphorus Loading to Big Detroit Lake

Shoreline Development

Another general category of water problems has to do with shoreline management. Modifications to natural shorelines have negative impacts on lake ecosystems in general, and lake water quality in particular. Recent research shows that development of shorelines with more impervious surface and other modification near lakeshores cause increases in runoff and nutrient loads on the order of six to ten times over natural conditions. District staff have monitored shoreline changes on many District lakes.

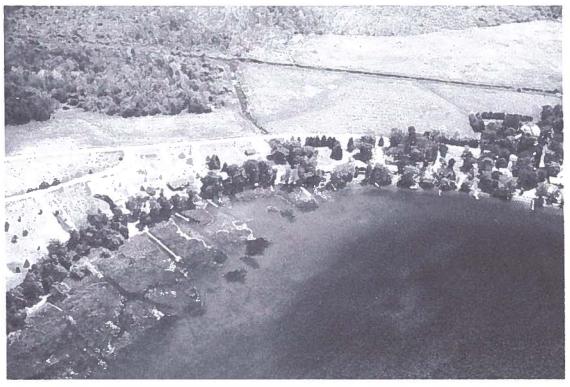
For example with 602 first and second tier residential structures (not including resorts) Melissa is a more densely settled lake than nearly all other District lakes. And though there was only a 1 percent increase in such residences between 1997 and 2003, there were numerous changes, including...:

- much of the natural vegetation has been removed from 75% of all the parcels around the lake.
- since 1997 the proportion of the land along the shore which is "modified" or "highly" modified has increased from 19 to 35%. Here we are talking about removal of ice-ridges, addition of sand blankets, rip-rap, or retaining walls, or other topographic changes to the shoreline.
- whereas 31% of the shoreline was rip-rapped in 1997, 44% is now rip-rapped. 169 of the 374 shoreline properties are now treated in this manner.
- the number of parcels with retaining walls has increased from 65 to 76.
- ten structures (storage sheds, fish-cleaning houses, etc.) have been added to the shore impact zone, bringing to 41 (11%) the parcels with such structures.

These are typical of changing shoreline conditions of District lakes. Such changes increase runoff and nutrient discharges, destroy natural habitat, and promote shoreline erosion. Intensive shoreline development also is associated with discharge of septic effluents into ground waters which may interact with the lake.

Specific lake water quality problems will be dealt with fully in later sections of this plan.

Intensive shoreline development including destruction of emergent aquatic vegetation.



6.5 Aquatic Plants

Aquatic plants are important components of the habitats of District lakes and streams. Rooted plants are prominent in determining the fish and wildlife habitat in most lakes and play significant roles in providing water quality, shoreline protection and erosion control. The native emergent and submergent species found in some littoral areas of District lakes are protected; Muskgrass (chara), Northern Watermilfoil, Coontail, Wild celery, Sago Pondweed, Flatstem pondweed and Cabbage are more common.

Common Aquatic Plants

Native Species	Type
Bladderwort	S
Bushy Pondweed	S
Canada Waterweed	S
Claspingleaf Pondweed	S
Common Cattail	E
Coontail	S
Filamentous Algae	S
Flatstem Pondweed	S
Hardstem Bulrush	E
Largeleaf Pondweed	S
Lesser Duckweed	E
Muskgrass	S
Northern Water Milfoil	E
Reed Canary Grass	E
Sago Pondweed	S
Sedge	E
Star Duckweed	E
White Waterlilly	E
Wild Celery	S
Yellow Waterlilly	E
Water Moss	S
Water Marigold	S
Stonewort	S

Non-Native Species	Type
Flowering Rush	S,E
Curly-leafed Pondweed	S
Purple Loosestrife	E

S = submergent
E = emergent

(DNR 1969)

Nuisance Native Species

A large algae, Muskgrass (chara), is abundant in shallow areas of some District lakes. It traps silt, thereby rendering swimming an unpleasant experience, and occasionally is thick and deep enough to hamper boat operation. When it dies it often blows to a shoreline. The plant is associated with water that is moderately enriched with phosphorus, hence the abundance in certain District Lakes such as Big and Little Detroit, Muskrat, Sallie and Melissa, and streams, such as the Pelican River between Ditch 14 and Muskrat Lake.

The emergent plant, *common cattail*, is found in large concentrations in shallow areas of some lakes and stream sections, and more commonly in wetlands. During episodes of high water levels in the mid-nineties, some very large mats of cattails, some measuring in excess of 10,000 square feet, broke from their normal locations, and floated to other shorelines causing considerable damage to those shorelines, and interfering with boating and other normal recreational uses of beaches. .

Northern milfoil has occasionally caused problems on account of its habit of growing in deeper waters. As the plant matures in late summer, masses of long-stemmed plants occasionally break loose in storms, floating around the lake, eventually reaching a shoreline.

Non-Native, Exotic Species.

Much more serious than the nuisance plant problems described above, are two exotics, *Flowering Rush* and *Curlyleaf Pondweed*. Flowering Rush was introduced into Curfman Lake (Deadshot Bay) in the 1970's, and has gradually spread throughout that Bay, and downstream via the Pelican River, through Big and Little Detroit to Muskrat, Sallie and Melissa. On the State of Minnesota's Harmful Aquatic Species list, it has been very aggressive in invading other aquatic plant areas, as well as areas previously without aquatic plants. It destroys and replaces natural shoreline plant communities, traps sediments, and causes damage to lake and stream habitat. It interferes with boating and swimming.

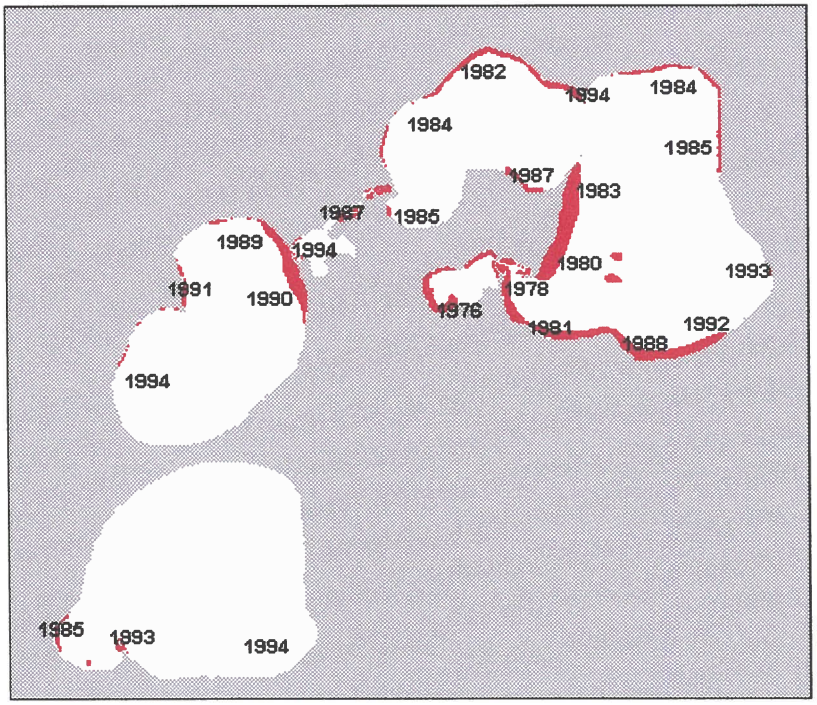


Figure 28 Spread of Flowering Rush through Detroit, Muskrat, Sallie and Melissa, 1976 - 2004.

Some research was conducted on the plant during the 1990's. It is known to have originally come from greenhouse stock, is sterile, and is spread mainly by its very rapidly expanding tuberous root system. There is some suspicion that the corms can be moved significant distances by floating ice associated with the spring break-up.

During the 1990's The Minnesota DNR's Management Plan called for aggressive harvesting as the means of controlling the abundance and spread of this species. Recent observations, albeit anecdotal, suggest that, at best, the harvesting approach has not been effective, and there is some evidence that harvesting contributes to the plant's spread. Weed-rollers also are believed to promote the plant's propagation.

Curly-leafed Pondweed. Unlike Flowering Rush, Curley-leaf Pondweed is common to lakes of Minnesota. It has been an episodic nuisance on some District Lakes for at least 35 years. Big Detroit, Little Detroit, Muskrat and Sallie are more affected than other lakes. It also is found in great abundance in the Pelican River between Little Detroit and Muskrat.

Curly-leaf Pondweed has an unusual growth habit; an annual plant, it germinates from seed in October and November, grows very rapidly soon after ice-out, reaches maturity, distributes its seed, then dies in June. The dead plants accumulate in large mats in the middle of lake, then move ashore in overwhelming quantities.

June, 1968

June, 2002

Figure 29. Big Detroit Lake, Curly-leafed pondweed blow-in's, 1968 and 2002.

While floating in the lake the mats are hazardous to boaters, but the main problem is associated with the impacts on the shorelines on which they are deposited. Plant debris build-ups can extend 50 feet out into the lake; they rapidly decompose in the warm water temperatures and summer heat, causing a malodorous condition, and unpleasant swimming; the plant debris can also cause fish kills and habitat destruction.

6.6 Fisheries Management

Lakes and streams within the District have varied and important fisheries. Nearly all the main lakes support game fishing, especially pan fish, Walleye, and Northern pike. A good deal of effort has been given to re-establishing Sturgeon and Muskie fishing in Detroit Lake. Sucker Creek, a tributary to Big Detroit, is a designated trout stream. Several of the smaller lakes, including St. Clair, and Muskrat, are subject to winterkill.

The DNR is responsible for, and is very active in the fish management in these waters. At the present time, 14 District lakes have management plans, several more are involved in Walleye rearing. Lake Sallie is used for commercial bullhead netting, and several small ponds are used for commercial bait production.
Long Lake is among Minnesota lakes included in a major DNR research initiatives (F-26R, Study 635, See DNR Long Lake Fish Management Plan), Evaluation of walleye stocking in 80-400 hectare Minnesota Lakes, the objective of which is to determine which walleye stocking regime is most effective in certain Minnesota lake classes. The DNR uses various survey techniques to assess fish populations, and to set management goals and plans. For most District lakes plans are updated every five years (DNR fish management plans).

Stocking has been a prominent part of the DNR's management strategy, and in the past this has meant stocking of a large range of fish, including Bluegill, Black crappie, Largemouth bass, Northern pike and Walleye. Acquisition, protection and operation of Northern pike spawning areas adjacent to several lakes (e.g. Floyds, Detroit, Fox, Meadow) also has been a prominent feature of DNR management activities.

Lakes having DNR Fisheries Management Plans

Detroit (incl Big, Little and Curfman)	Meadow
Long	Johnson
Floyd (incl. N. Floyd)	Reeves
Pearl	Muskrat
Munson	Sallie
Fox	Melissa

Abbey, Brandy, Strunk, Loon and Sand are currently used as walleye-rearing ponds.

Other small lakes, currently including Oar and Wine, are used by private bait dealers, for rearing suckers. (communication from Dave Barseness, DNR Section of Fisheries).

In recent Management Plans, DNR emphasis has shifted towards public education efforts aimed at protecting habitat and improving knowledge about water quality, exotic species and fish-management. Otherwise, the DNR Fishery management efforts rely heavily upon the stocking of Walleye. Trout is stocked on Meadow lake on account of its depth and favorable water quality conditions. Commercial rough fish netting has been, and continues to be permitted on some lakes (including Sallie and Detroit). Slot limits to manipulate the size of Northern pikes (and their impacts on other species), are employed on the Floyds, Melissa, and Sallie. Muskellunge and Sturgeon have been introduced to Detroit Lake, and are expected to migrate downstream to Muskrat, Sallie and Melissa.

Under state law, the DNR can no longer engage in stocking activities on a lake which has no public access. The provision of such access is part of the management goal or stated plan for Fox, Johnson, and Reeves.

In order to promote migration of fish (among other goals), the DNR's Section of Fisheries has urged the removal of some dams on the Pelican-Otter Tail-Red watershed. This effort has resulted in the replacement of the lock and dam at the inlet to lake Sallie with a rock slope or rapids. There is some concern by the DNR, shared by the District, that modification of the Buck's Mill Dam, would permit the migration of Carp into upstream streams and lakes.

The District works closely with DNR's Section of Fisheries in the areas of habitat protection, shoreland regulations, and exotic species control and management.

The relationship between water quality and fisheries is well known. The chart indicates the impact of water quality improvements on the ratio between Yellow and Black bullheads, one of the sensitive species indicators.

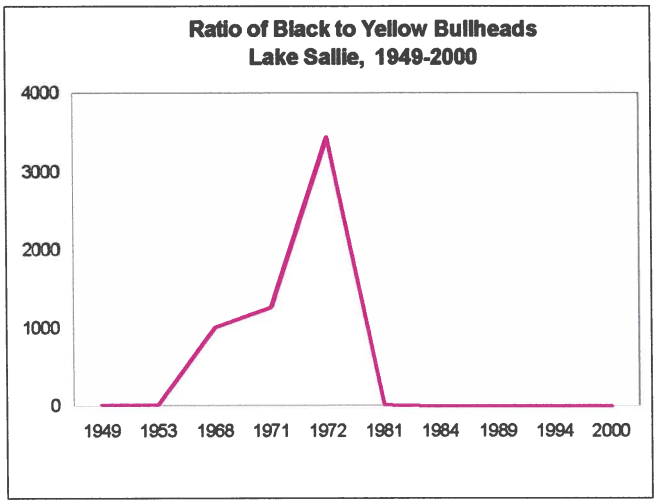


Figure 30. Water Quality and Fish Species Ratios

Lakes	Main *Past* DNR Management Activities	Main *Current* DNR Management Activities
Little Floyd, Big Floyd, North Floyd	Fish stocking (bluegill, black crappie, largemouth bass, northern pike and walleye), fish removal (bullheads, white suckers, bowfin), construction of northern pike spawning area	Walleye stocking; slot regulations for Northern pike; reduce blue-gill abundance; close Northern pike spawning area
Big Detroit, Little Detroit, Curfman	Fish removal (bullheads); cisco netting, species stocking (bluegill, crappie, lake sturgeon, lake trout, bass, northern pike, muskellunge, and walleye); slot and possession limits on northern pike	Muskellunge, Walleye, Sturgeon stocking
Long	walleye and northern stocking; bullhead removal,	Walleye stocking
Johnson, Reeves	Stocking (walleye, largemouth bass, northern pike and black crappie	
Fox	Stocking (Black crappie, largemouth bass, northern pike and walleye); removal (bullheads and suckers), protection of bass spawning areas; acquisition of uncontrolled northern pike spawning areas	
Pearl	Stocking (northern pike, sunfish, largemouth bass, crappie and walleye); bullhead removal	Walleye stocking
Munson	Commercial removal (bullheads, yellow perch and bowfin), other removal (bluegill, crappie and bass) , stocking (bluegill, crappie, bass, northern pike and walleye); darkhouse spearing prohibition	Walleye stocking
Melissa	Stocking (bluegille, crappie, bass, largemouth bass, northern pike and walleye), northern pike slot limits	Walleye stocking, rough-fish removal, Cisco netting,
Muskrat	Promiscuous fishing, stocking, removal, special regulation, habitat manipulation (by water level changes)	
Sallie	Stocking, slot regulations, minnow harvest, darkhouse spearing closings, fish-spawning beds, rough-fish removal	Walleye
Meadow	Stocking, removal	Rainbow and brown trout stocking

Source: DNR Section of Fisheries, Fish Management Plans

7.0 History of Watershed Activities/ Projects/Accomplishments

Not so many years ago the lakes in the Pelican River chain were highly regarded for their crystal clear water and fine sandy beaches. People came from many places in Minnesota and North Dakota, joining visitors from other states and provinces, to enjoy our outstanding boating, fishing and swimming opportunities.

Many still come to our region to enjoy area lakes, which by most standards continue to be clear and clean. Yet long-time lake watchers know that our lakes have lost some of their pristine qualities, and that the conditions continue to deteriorate. Some lakes exhibit large amounts of weed growth and sediments which detract from boating and swimming; in others the once-clear waters have become so clouded with algae that fish are sometimes killed. The introduction to some of our lakes of harmful exotic weeds has begun to destroy native fish habitat.

Local residents began to report these and other unpleasant symptoms more than fifty years ago; long-time residents report that the condition of our lakes has been growing steadily worse since that time.

It was these circumstances that lead several community leaders in the early 1960's to investigate options for dealing with such problems. Some of the causes were obvious, others were not. It was clear that some organization would have to identify all of the causes and plan a course of action.

Since no single township or city had jurisdiction over all the lakes, and since the problem was not perceived to be a county responsibility, it was decided to pursue the formation of a watershed district, a type of entity previously authorized by the state of Minnesota in 1955.

The watershed district approach also seemed preferable since the lakes' problems were known to involve physical, chemical and biological processes interacting among several lakes. Thus it made sense to focus on a physical region, rather than a political or administrative one. A region which includes all the affected lakes, plus those areas which contribute water to those lakes seemed to be the relevant physical region.

After some months of negotiations with local and state officials, on June 13, 1966, the Pelican River Watershed District of Becker and Otter Tail Counties held its first meeting. According to the original petition calling for the District's establishment, and the State Order which created it, a principal goal of the District was to address water quality problems in District streams and lakes. Specific mention was made of the need to protect and improve the District's natural beauty and to implement sound soil conservation practices.

The Pelican River Watershed District (PRWD) was the first watershed district in Minnesota whose primary concern was with water quality of lakes. Indeed, PRWD has a history of "*firsts*"! It was the *first* to conduct a scientific study

on the role of septic tanks on the pollution of lakes, and the *first* to evaluate the effects of weed cutting on nutrient budgets of a lake. It was the *first* watershed district to assess properties on the basis of recreational benefits. In 1969, it sponsored the *first* statewide conference dealing with lake eutrophication.

Major Events in PRWD History

Year	Event
1965	Petition to form District to Water Resources Board
1966	Order to establish PRWD
1967	Established Harvesting Project, Melissa and Sallie
1967	Completed Water Management Plan
1969	Sponsored Lake Eutrophication Conference
1983	Study of Main District Lakes by Instrumental Associates
1988	Expanded Board of Managers to 7 Members
1989	Clean Water Grant
1990	Established Detroit harvesting Project
1991	Appointed full-time Administrator, Peter Waller
1993	Appointed Administrator, Richard Hecock
1994	Revised Management Plan
1994-1999	Built Stormwater treatment facilities
1995	Established monitoring program
1997	County assigned Ditch management to PRWD
1997	Amended Management Plan
1998	Established Stormwater Utility
1999	Appointed Assistant Administrator, Tera Guetter
2001	Appointed Administrator, Tera Guetter
2003	Revised Rules, adopted permit system
2004/5	Revised Management Plan

In its early years, the District was engaged in detailed studies of water quality, and also employed specific measures to improve the situation. In 1967 it established a project aimed at removing excess aquatic plant growth from Lakes Sallie and Melissa. It also began to press for reduction of nutrient flows from the Detroit Lakes sewage treatment plant. In 1975, the City of Detroit Lakes began construction of a state-of-the-art system which greatly reduced nutrient discharges to surface waters and resulted in significant improvements of conditions for Lakes Muskrat, Sallie and Melissa.

In the 1980's, The District faced important changes in the understanding of the nature and extent of lake problems, and their causes. Data gathering efforts were expanded, and more detailed and improved diagnoses of problems were obtained. The first comprehensive assessment of all the major District lakes was completed in 1983 (Instrumental Research), and numerous suggestions for addressing specific lake problems were subsequently debated. In 1988, the District received federal Clean Water Act funds, to support a detailed "diagnostic and feasibility study" for Lakes Detroit and Sallie (PRWD, 1990). It identified the following conditions producing water quality problems in District Lakes:

- Incomplete treatment of sanitary wastes, especially septage
- Inadequately treated stormwater effluent
- Nutrient-enriched surface discharges to lakes and streams
- Nutrient enriched groundwater discharges to lakes and streams
- Removal of wetlands which serve as natural sediment and nutrient buffers
- Excessive aquatic plant biomass in lake littoral zones
- Channelization of drainageways, and drainage of wetlands resulting in sediment and nutrient discharges to lakes
- Existence of nutrient-enriched wetlands and lake-bottom sediments wherein nutrients are released unde conditions of unusual runoff or anoxia.

In addition to setting realistic water quality goals for the two water bodies, numerous specific steps aimed at addressing the above problems were specified in the final diagnostic report of 1994 (PRWD, 1994). These understandings of the problems, the goals, and the measures to address them were expanded and generalized somewhat and were incorporated into the District's 1994 Revised Management Plan as a set of general strategies and specific tasks (PRWD, 1994).

In order to accommodate the transfer of three public ditch systems from Becker County to the District, and to take advantage of changed legislation which permitted the District to create and fund a storm water utility, the District's Management Plan was amended in 1997 (PRWD, 1997). Since that time, the activities of the District, have been organized around seven thematic efforts.

7.1 Water Quality Initiatives

The District's Revised Management Plan (1994) and its Amendments (1997) focused on stormwater and runoff treatment, agricultural best-management practices, in-lake treatments, and streambank protection. The following are highlights of the District's accomplishments in these areas:

- Construction of three wet-basin stormwater treatment ponds
- Construction of one dry-basin stormwater treatment pond
- Construction of one ditch impoundment system, to reduce storm runoff to Long Lake
- Research on wetland discharges of nutrients
- St. Clair Alum treatment (reduced nutrient discharges to the Pelican River by 50 percent)
- Bio-manipulation of Muskrat Lake aimed at reducing phosphorus exports to Lake Sallie
- Assist in the implementation of numerous agricultural BMP's in upstream areas
- Working with governments and private developers, numerous on-site stormwater treatment facilities have been constructed

Many of these activities were partially paid for by grants through DNR, PCA or BWSR. Also the PCA has made available loans which are being repaid by revenues obtained from fees levied by the District's Stormwater Utility. Other important activities are underway, most notably in connection with PL566 Project which is aimed at addressing upstream nutrient discharges in the Campbell and Rice Lakes areas.

7.2 Regulating Impervious Surface and Shoreline Activities

The District understands that nutrient-laden runoff reaching lakes poses a serious threat to their water quality. Accordingly, 1998 and 2003 revisions to the District's Water Management Rules considerably tightened District requirements for erosion and stormwater management. In the 2003 revisions (see Appendix A), permits were required under the following circumstances:

- Alterations in the shore or bluff impact zone, or on steep slopes in the shoreland zone
- Installation of rip-rap, beach sand blankets, or retaining walls in shore impact zone
- Alterations where cumulative impervious exceeds 25% of lot coverage, or 10,000 square feet in the shoreland zone (1 acre elsewhere)
- Subdivisions, plats, planned unit developments, roads, bridges, parking lots or public water access
- Groundwater dewatering.

Permits are granted only for actions which meet the following conditions

1. actions will not result in substantial increases in discharge rates to adjoining properties or to waters of the state
2. activities must utilize accepted procedures for controlling runoff rates, nutrients and sediments; a stormwater management plan is required.
3. actions involving ice ridges are only allowed for purposes of repairing existing shoreline damage, and must not result in increased runoff to a lake or in natural vegetation disturbance
4. retaining walls only for purposes of correcting existing slope instability or erosion, and have a base above the highest known water level.

Enforcement of this permit system and other District rules is carried out by District staff with the assistance of SWCD staff, and the District's engineer. A permit application fee and field inspection fee is used to pay the costs of administering the permit system.

7.3 The District's Monitoring Program.

Prior to 1994 the District obtained data for specific purposes. In the 1960's and 1970's a good deal of data was gathered in connection with research projects on Lake Sallie's nutrient situation, and the efficacy of the District's aquatic plant harvesting programs. In the 1980's detailed data were obtained for the District's major lakes at several different times. Also, some volunteers collected valuable clarity data, most notably for Floyd and Long lakes. Some of these efforts continued sporadically into the early 1990's.

In 1994 the Managers authorized a permanent and comprehensive monitoring program aimed first at assessing eight of the larger, more populated lakes, and identifying and characterizing stream nutrient loads that might be harming them. In 1998 the effort was expanded to include nine additional lakes. The District now collects data at numerous lakes and streams as indicated in the map.

At these sites many thousands of observations are made each year (many more if the automatic monitoring equipment is taken into account). Lake transparency, gage elevations, dissolved oxygen and temperature readings are among those which are recurring measurements. Analyses of total- and ortho-phosphorus, as well as total suspended solids are performed by the City of Detroit Lakes.

The District coordinates its data collection efforts with the PCA's Citizen's Lake Monitoring Program, the DNR's stream and lake level measurement program, and the Becker County Coalition of Lake Associations.

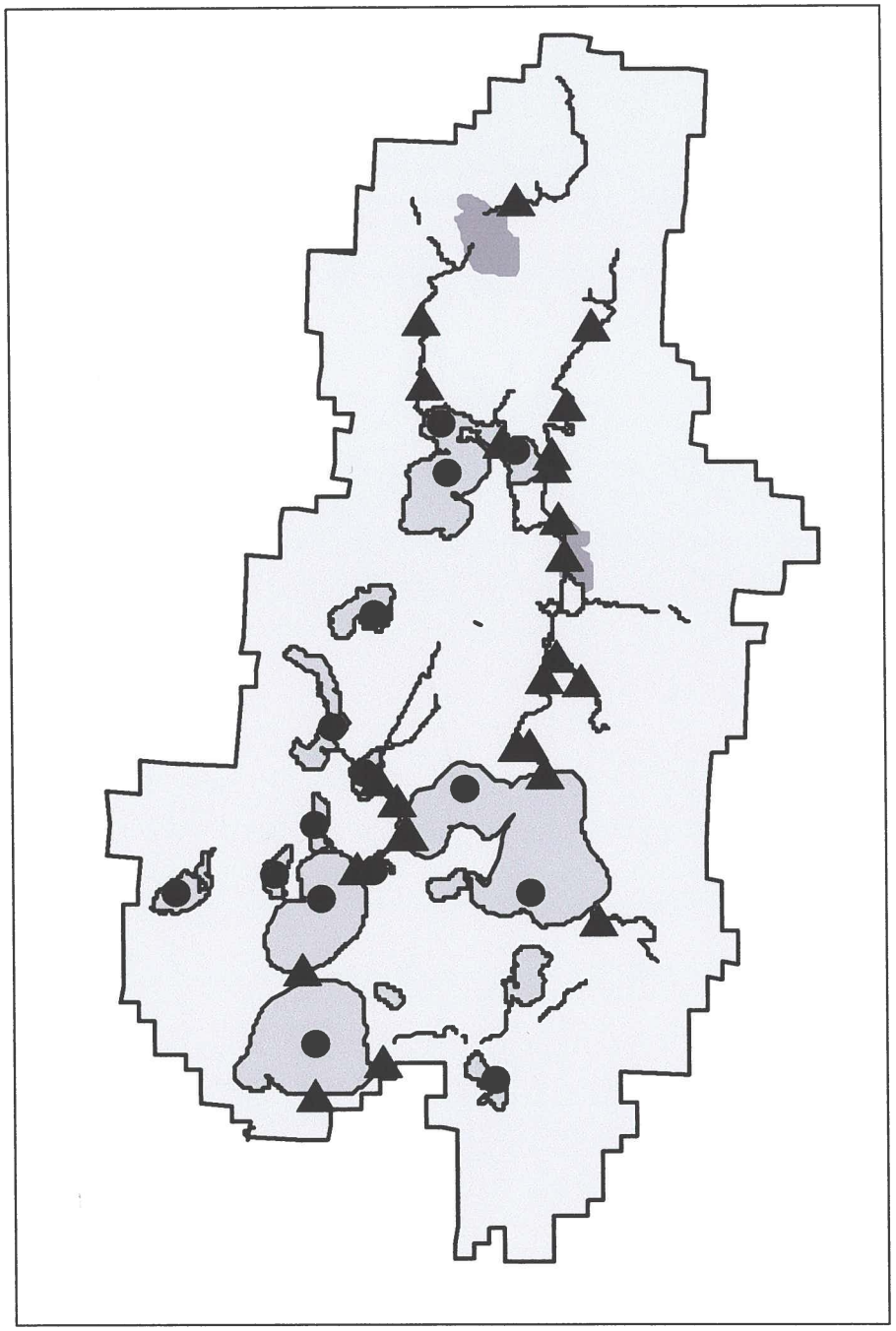


Figure 31. District Monitoring Sites

7.4 Education.

The District accepts the premise that maintenance of water-quality in area lakes requires a citizenry that is well informed. The District's education initiatives have taken numerous forms. A primary thrust has been the wide dissemination of published progress reports. For several years "Annual Summaries" have been printed in large numbers and distributed to schools, lake association memberships, and to the general public.

Many special publications, brochures, press-releases, and newspaper articles have been distributed on special topics, as in the cases of fertilizer problems, harvesting, or special watershed activities such as the alum treatment of Lake St. Clair.

The District has also given technical and monetary help to various education groups, most notably the Detroit Lakes High School in support of its prize-winning interdisciplinary ***Water Watch*** program. For many years staff have served as mentors to the 4th grade Water Festival programs at Rossman and Holy Rosary schools, to the Envirothon program and to the 5th Grade outdoor education program held each spring at a nearby farm. Classes from Bemidji State University and North Dakota State University have been assisted.

District staff also speak to numerous groups – service groups, local government officials (township, city and county), and lake associations. The District also works closely with the Becker County Coalition of Lake Associations by providing programs and technical assistance. In 2004 an internet website was introduced.

Finally, the District has made it a practice to provide internships for high school and college students. These students assist with water quality monitoring, water analysis, and other activities. Several of these students have gone on in careers that relate directly to their watershed experience.

7.5 Ditch Management.

Beginning in 1997, Becker County elected to turn over responsibility for the County Ditches 11-12, 13 and 14 to the District. The 1997 Amendments to the District's 1994 Revised Management Plan acknowledged the fundamental conflict between managing ditches and streams to reduce nutrient discharges for water quality purposes, and maintaining the ditches for the purposes and the benefited properties for which they were dug. The Managers were specific as to their intent to manage ditches in such a way as to resolve the conflict. Accordingly, they advised that the District intends to maintain and further develop the ditches in such a ways as to minimize their past, present and future downstream impacts on the District's lakes. This was to be accomplished by some combination of "best-management practices", creation of runoff storage and treatment facilities, and in-lake treatments to ameliorate past damages to water quality.

The District continues to follow this precept in carrying out its ditch management responsibilities. Most of these have to do with inspecting ditch alterations, ensuring that proposed culvert installations or alterations provide unobstructed flows, and debris and beaver management.

Since 1999 the District has had a policy of attempting to minimize beaver- and debris-dam removal during the summer months in order to avoid discharges of sediments and nutrient loads during the period when downstream lakes are particularly vulnerable.

7.6 Harvesting Projects

The impetus for the formation of the District was the perception that water quality on several lakes was severely impaired. The leaders were especially alarmed by the increase in aquatic plant ("weed") growth, so not long after the District was authorized a project (1) was established to remove aquatic plant material from Lakes Melissa and Sallie. With the assistance of federal and local funds, as well as grants from the District, equipment was purchased and harvesting began in 1967. The Melissa-Sallie harvesting project was re-authorized in 1978 (1a) and 1985(1b), and in 1989 an additional project (1c) was begun on Detroit Lake.

Project purposes for the original projects include nutrient reduction (on the theory that harvesting plant debris containing nutrients would be beneficial), as well as removing the plants considered a recreation nuisance. Research (Neel, 1973) showed that the nutrient reduction component was relatively small compared to the available in-lake nutrients, so that purpose was given less attention in subsequent projects. Current projects 1b (Sallie-Melissa) and 1c(Detroit) are aimed at specific aquatic plant nuisance conditions, especially the exotics, Flowering Rush and Curly-leafed Pondweed.

Three harvesting machines are currently employed to cut and gather plant debris, and account for about two/thirds of the total harvest. Roadside and shoreline pickup (of plant debris which washes up on the shore) accounts for th rest, and taken together have gradually become more somewhat more prominent. In 2003, the District began a chemical testing program to attempt to deal more effectively with Flowering Rush, which has greatly increased in abundance and distribution, especially in Detroit Lakes.

Harvesting, including costs and assessments data, are summarized in the table.

PELICAN RIVER WATERSHED DISTRICT HARVEST PROJECTS HISTORY

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Harvest (tons)																
Sallie	123	130	111	92	65	585	307	32	6	5	98	68	20	110	80	35
Melissa	143	140	137	113	118	60	105	33	71	39	75	71	53	116	251	153
Detroit	186	200	630	660	560	490	520	402	802	900	1,040	1,458	1,348	1,878	1,232	1,250
Muskrat									185	146	23	171	16			
Roadside Pickup	325		338	375	403	480	525	550	429	396	602	741	649	892	808	649
Shoreline Pickup	165		300	350	300	280	385	225	55	45	58	16	32	42	19	12
Harvest/Removal Total Tons	942	800	1,516	1,590	1,446	1,895	1,812	1,242	1,548	1,218	1,896	2,525	2,118	3,019	2,390	2,099
Financial Attributes Total Assessment (in 1000's)	$25	$26	$53	$81	$79	$77	$55	$51	$47	$44	$49	$59	$88	$95	$113	$113
Average Assessment 1/	$43	$44	$67	$72	$64	$61	$45	$42	$40	$32	$35	$47	$68	$67	$75	$77
Total Expenditures (in 1000's)2/	$24	$52	$70	$66	$69	$88	$54	$61	$53	$50	$62	$80	$89	$82	$96	$105
Expenditures per ton	$25	$65	$46	$42	$48	$46	$30	$49	$34	$41	$33	$32	$42	$27	$40	$50

1/ residence with 75 foot lake frontage (averaged for all lakes)
2/ includes depreciation/administrative, lease, etc.

7.7 District Administration and Finances

The District employs only one full-time staff member. Tera Guetter has served as the District's administrator since 2002, and as Assistant Administrator prior to that time. She currently is assisted by Denise Baer, Office Manager and by Senior Advisor, Dick Hecock (one-quarter time). Terry Anderson has been the District's half-time Harvest Project Supervisor since 1995.

Student and seasonal employees are hired as needed to assist with the Harvest programs, monitoring activities, and special programs.

District funds

The District receives revenues from several sources, and maintains funds in accordance with M.S. 103d,905 as follows:

1. ***General Fund.*** An annual District-wide ad valorem levy is used to pay most of the general operating costs of the District. It is supplemented by fees collected in connection with the District's permit program.
2. ***Survey and Data Acquisition Fund.*** Revenues from a District-wide ad valorem levy in 2000, together with grant money are used to underwrite the District's monitoring program, and to pay consultants for special analyses.
3. **Stormwater Utility Fund.** An annual fee is charged to each landowner in the District based upon contributions to runoff. Revenues are used to build stormwater treatment facilities.
4. **Harvest Project Funds.** Annual assessments are made against shoreline properties on Lakes Detroit, Melissa, and Sallie for purposes of maintaining and operating the two District Projects 1-b and 1-c. Project Implementation Funds receive money from the Harvest Projects and (earlier) from the General Fund, to purchase and maintain equipment.
5. ***Special Project Funds.*** These are created as needed to hold and distribute grant funds acquired for special District programs.

Audits are conducted each year by an external auditor.

Summary of District Funds, Expenses, Revenues and Balances

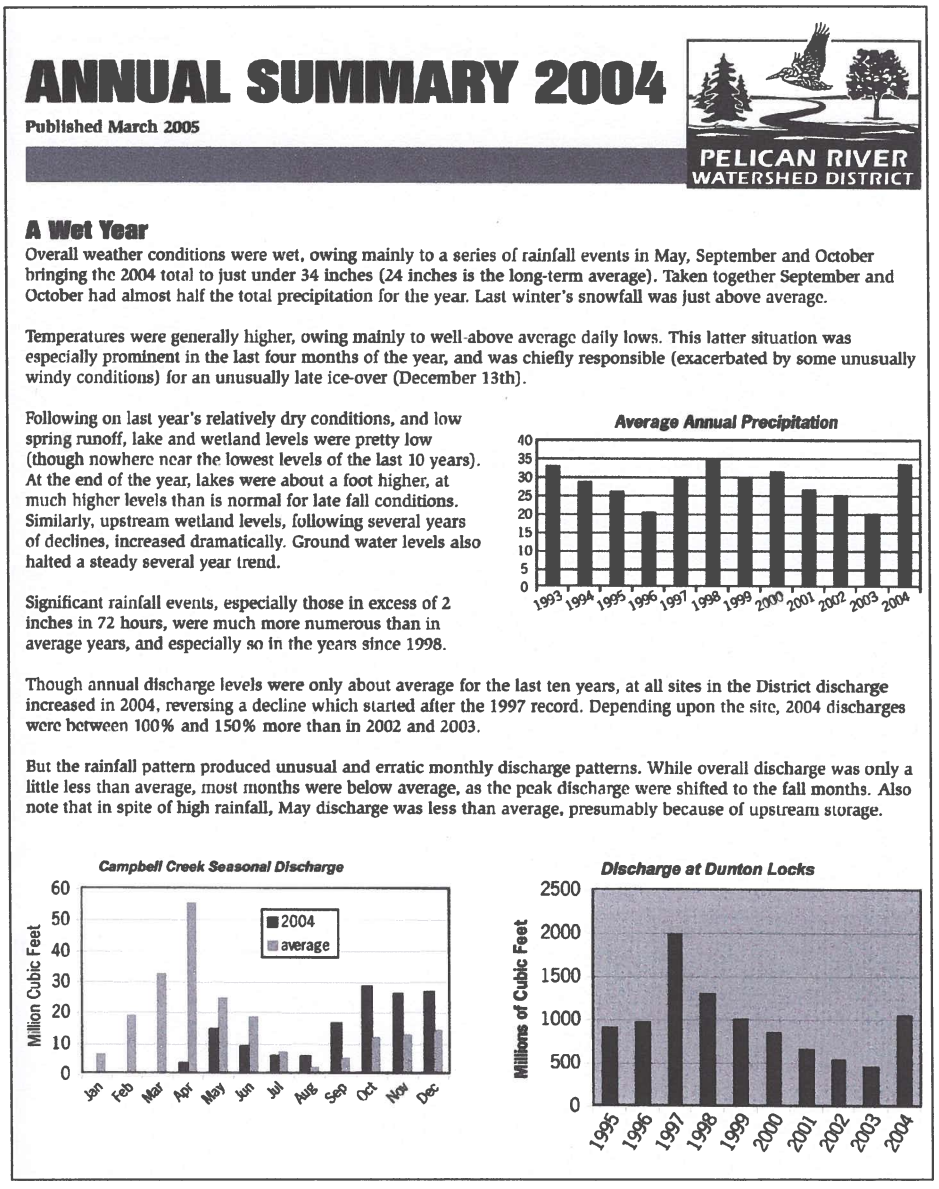
Funds	*2004 Expenses*	*2004 Revenues*	*Year-end Balance*
General	*$167,567*	*$204.186*	*$136,447*
SADAF	*$16,849*	*$123*	*$10,293*
Storm Utility	*$83,971*	*$81,288*	*$90,927*
Harvest Project	*$57,773*	*$66,500*	*$20,013*
Ditches	*$6,912*	*$9,400*	*$35,272*

By-Laws.

District Managers have adopted by-laws to govern their organization and meetings. See appendix B.

Annual Reporting.

Prepared at the close of each year, an Annual Summary containing information on lake water quality monitoring results, and important events taking place in the District, is distributed widely (PRWD Annual Summaries, 1999-2004). Later in the year, after the District's audit has been completed, an Annual Report is submitted to BWSR and other state officials, in accordance with M.S. 103D (PRWD Annual Reports).



ANNUAL SUMMARY 2004

Published March 2005

PELICAN RIVER WATERSHED DISTRICT

A Wet Year

Overall weather conditions were wet, owing mainly to a series of rainfall events in May, September and October bringing the 2004 total to just under 34 inches (24 inches is the long-term average). Taken together September and October had almost half the total precipitation for the year. Last winter's snowfall was just above average.

Temperatures were generally higher, owing mainly to well-above average daily lows. This latter situation was especially prominent in the last four months of the year, and was chiefly responsible (exacerbated by some unusually windy conditions) for an unusually late ice-over (December 13th).

Following on last year's relatively dry conditions, and low spring runoff, lake and wetland levels were pretty low (though nowhere near the lowest levels of the last 10 years). At the end of the year, lakes were about a foot higher, at much higher levels than is normal for late fall conditions. Similarly, upstream wetland levels, following several years of declines, increased dramatically. Ground water levels also halted a steady several year trend.

Significant rainfall events, especially those in excess of 2 inches in 72 hours, were much more numerous than in average years, and especially so in the years since 1998.

Though annual discharge levels were only about average for the last ten years, at all sites in the District discharge increased in 2004, reversing a decline which started after the 1997 record. Depending upon the site, 2004 discharges were between 100% and 150% more than in 2002 and 2003.

But the rainfall pattern produced unusual and erratic monthly discharge patterns. While overall discharge was only a little less than average, most months were below average, as the peak discharge were shifted to the fall months. Also note that in spite of high rainfall, May discharge was less than average, presumably because of upstream storage.

Cover of 2004 Annual Summary

8.0 Water Quality Issues, Concerns, Problems and Causes

With almost 40 years of water quality management, and 12 years of intensive data collection and analysis added to inputs from state and federal agencies, and taking into account the insights and opinions of lakeshore residents, local governments, community leaders, various conservation and sportsman groups, and other interested citizens, the District has formed an understanding of the nature and dimensions of lake water quality problems and their causes.

The District's general *Lake Water Quality Problem* is that its lakes are in various stages of eutrophication. Eutrofication refers to the natural aging process of lakes. As lakes pass through the very natural stages of eutrophication from oligotrophic to eutrophic (see box below), the elapsed time is usually measured in thousands of years. However, man's activities near District Lakes have accelerated the natural eutrophication process at an alarming rate. Changes that would ordinarily take 1000's of years are now occurring in decades.

In the table below, the Carlson model is used to produce lake categories, for which generalizations about current and potential lake conditions can be made (Carlson, 1977). The approach also lends itself to identifying levels of protection or remediation.

TSI Index	Lake Attributes	PRWD Lakes
Less than 35	Low nutrients and algae, very clear water, oxygen throughout the year at all depths, and cold water, oxygen-loving fisheries in deep lakes	*None*
35-45	Good clarity, few and only moderate algae blooms, low plant growth; in shallow lakes episodes of low oxygen may begin to limit the game fishery; ***best management practices needed to preserve conditions***.	*Big Floyd, Long, Meadow,*
46 – 50 "At Risk"	Increased incidence of nuisance algae blooms, phosphorus levels in the 25-30 ppb range, moderate to nuisance plant growth, transparencies under 10 feet during mid-summer; low oxygen in deep water imposes limitations on fish species; ***mixture of best management practices and shoreline protection required to prevent further damage***	*Melissa, Big Detroit, Little Detroit, Munson, Fox, Pearl, Johnson, Reeves, Little Floyd*
51 – 55 "Problem"	High incidence of nuisance algae blooms; luxuriant weed growth; summer transparencies usually less than 7 feet; phosphorus levels often over 35, shift to warm water fishery; ***without intervention, deteriorating conditions will accelerate.***	*North Floyd, Muskrat, Sallie, Little Floyd*
Over 56 "Damaged"	Algae scum probable and frequent; blue-green algae dominant; luxuriant aquatic plant growth; undesirable for water-based recreation; deteriorating or absent game fishery; ***high probability of further declines in quality***	*St. Clair, Perch, Brandy, Abbey,*

As noted elsewhere, while the Carlson model provides some guidance to estimating trophic status, it does tend t mask the seasonal and year-to-year variability in lake water quality conditions.

The specific problems of District lakes will be addressed further in later sections; it is sufficient here to say that poor clarity, associated with persistent and heavy summer algae blooms, caused by high concentrations of available phosphorus are the main symptoms. [1/] The linkage between these symptoms is direct. Phosphorus is the "limiting factor" in algae growth; and while temperatures, sunlight, zooplankton populations, and other factors play a role, the more phosphorus that is available the more algae there will be, and the less clarity. The general rule is that one pound of phosphorus can cause the production of 500 pounds of algae.

Another problem facing some District Lakes is the growing abundance of nuisance exotic species, especially Flowering Rush, and Curly Leafed Pondweed. As noted elsewhere, these plants replace native species, alter shoreline sedimentation patterns, interfere with boating, swimming and fishing, cause shoreline damage, and hardship to shoreline residents.

Flowering Rush was probably introduced by accident in the mid-1970's in Dead Shot Bay (Curfman Lake). From there it has spread throughout Big and Little Detroit, down the Pelican River into Muskrat, and now into Sallie and Melissa. Flowering Rush, declared an "Undesirable Exotic Species" by the State of Minnesota in 1993, is found in only a few other places in the state. It has a very aggressive root system, and apparently spreads by the accidental transplant of root-fragments. For almost 15 years the District has tried to manage this problem by repeated harvesting without much success. In 2003 a herbicide testing program was begun.

Curly-Leafed Pondweed is found in many lakes in Minnesota, and is widespread in District Lakes, including Big and Little Detroit, Muskrat, Sallie and Melissa and is well-established in the Pelican River between these lakes. An annual plant with an unusual growth habit, it germinates from seed in the fall, grows under the ice in the winter, and matures in May or June. When it dies the plants break off from their stem, float to the surface, form large mats, and eventually reach shore, causing great hardship to shoreline residents, boaters and fishermen.

In extreme cases, the decaying weed masses can deplete oxygen and cause the deaths of many small fish.

[1/] other nutrients are also required for plant growth in lakes. Nitrogen is very important. However in District lakes there is a large surplus of nitrogen, and an abundant supply is assured because it is available in precipitation. Nitrogen is not a limiting factor in plant growth in lakes.

The District continues to see the cause of the lake water quality problem largely in terms of the amount of phosphorus that is available to the lake.

Phosphorus is available from four sources:

1. Atmosphere.

Based upon rainfall amounts and earlier research, it is estimated that for District lakes between five and thirty percent of phosphorus is introduced from the atmosphere by the rain and snow that falls directly on the lake. Atmospheric sources of phosphorus generally represent a larger share of that available to lakes with few other nutrient sources, than for lakes with other external or internal sources.

Little can be done by the District to change these conditions (though regional, national and international programs to ameliorate airborne pollution could have some advantageous impacts).

2. Ground Water

While it is well established that groundwater can contribute some nutrients (as well as other contaminants) to lakes, the extent of movement of phosphorus by means of ground water is debated.

In most cases phosphorus ions attach readily to clay and other particles found in soil, so that phosphorus in soluble form does not move readily with groundwater. However, there are some exceptions to that general rule; in particular, it appears that soil can be saturated with phosphorus compounds, as may be the case in and around septic drainfields, or in overly fertilized soils. In such cases phosphorus may not only be carried by groundwater, but can even be leached from soil and carried into streams and lakes.

The amount of phosphorus entering directly from groundwater may be as high as thirty percent of total available phosphorus in some lakes. Soil types, elevation in relation to the lake, and poor septic management practices seem to be associated with high phosphorus from ground water.

3. *Surface water*

As a general rule surface waters are known to be the principal means by which phosphorus is introduced into District lakes. In the Pelican River Watershed District, runoff from various urban and agricultural activities is a reasonably rich source of phosphorus to some of the main District lakes.

Runoff from cropland is known to contribute more than twice as much nutrient load to streams as does grassland and more than six times as much as native cover. The practice of discharging urban runoff into lakes and streams also adds significantly to the nutrients reaching lakes. As little as 12% impervious surface

in a watershed can have detrimental impacts to the receiving waters downstream. There are many subwatersheds discharging to District lakes that greatly exceed that amount of impervious surface.

Lake	Average Annual Phosphorus Load Entering lake via stream
North Floyd	1134
Big Detroit	1632
Sallie	2296
Melissa	2332

The elimination of wetlands which help to absorb some nutrients and sediments exacerbates these situations in most cases. Moreover, in the 1990's the District discovered that certain ***ditched wetlands,*** including those involving Ditches 13 and 14 are major sources of lake nutrients. It appears that this condition is caused by the flushing of wetlands through disturbed wetland systems.

In recent years research has shown that shoreland areas contribute a larger share of the nutrients to lakes than had previously been thought. The removal of natural shoreline vegetation and the addition of impervious surfaces tend to promote greatly increased runoff and runoff rates from shoreline areas. It has been shown that increases over naturally-occurring nutrient and sediment discharges are on the order of six to ten times. While it is not possible to measure these amounts, the District believes that In some of our main District Lakes, Long and Big Floyd, as examples, shoreland development may be responsible for a majority of phosphorus loads.

Other shore area changes tend to exacerbate the nutrient problem and cause other subtle lake changes. As examples, replacing natural shore area vegetation with non-native species tends to increase fertilizer use, increase near-shore runoff, shoreline vulnerability to erosion, and lake water temperatures. Topographic changes, such as ice-ridge removal, also increase drainage (and nutrient discharges) to the lake. Use of rip-rap and retaining walls tend to do long-run damage to shoreline habitats, alter wave dynamics, and also may aggravate nutrient problems if improperly constructed.

It is obvious that great care must be given to manage nutrients and sediments originating on the surface of the land and ultimately reaching streams and rivers. Also episodes of rapid runoff, as in the instances of summer rainfall events or springtime snowmelt, introduce unusually large amounts into the system in a short period.

4. Internal Loading

Phosphorus contained in aquatic vegetation, or in sediments which flow into lakes does not usually cause problems for lakes. This is so because phosphorus in these forms is not soluble under normal conditions. However, when oxygen is depleted from lakes, as can happen at certain times during the summer or during the winter when ice is covered by snow, the compounds of phosphorus may become soluble and then serve as a usable nutrient for algae or rooted aquatic plants. These conditions are usually associated with the most serious episodes of algae blooms and detract enormously from the recreational and aesthetic values of some lakes.

For most lakes in the District this process rarely occurs, and when it does it is for a short-time, or in limited amounts. Lakes that are shallow or contain relatively few phosphorus-enriched bottom sediments escape the internal-loading phenomenon because they are usually rich in oxygen. In very deep lakes, those with strongly differentiated temperatures from deep to shallow areas, a thermal barrier tends to prevent phosphorus-enriched water at the bottom of the lake, from reaching the surface zones where algae live. Long and Meadow are lakes which fit this pattern.

In moderately deep lakes (15 to 35 feet deep) with thick phosphorus-rich bottom sediments, and where the summer or winter thermoclines are weak or of short-duration, sediments release phosphorus to the surrounding water; by means of natural circulation processes this biologically available phosphorus is carried to the surface where it is available to stimulate algae growth. Lake Sallie is the premier instance of this situation; North Floyd and Big Detroit Lake also exhibit internal-loading tendencies.

Treatments for these conditions are difficult to implement, and expensive. Because certain ecological risks are involved, particularly if they must be repeated, internal loading treatments are not attempted unless surface sources of phosphorus have been brought under control.

9.0 The District's Water Quality Mission, Goals and Two-tiered Action Strategy

The mission of the Watershed District is to protect the water quality of District Lakes. It is understood that to accomplish this mission, the District must ensure that wise decisions are made concerning the management of streams, wetlands, lakes, groundwater, and related land resources which affect these lakes.

The District's overriding water quality goals are as follows:

THE WATER QUALITY IN DISTRICT LAKES SHALL NOT BE FURTHER DEGRADED

WATER QUALITY FOR ANY LAKES CLASSIFIED AS EUTROPHIC SHALL BE IMPROVED TO MESOTROPHIC

The achievement of these goals will take a long time, involving a broad array of measures aimed at countering decades of poor stewardship of streams, rivers, ditches, wetlands, groundwater, and lakes, as well as the lands which drain to these water bodies.

In order to reach these goals, the District has adopted a two-tier strategy in designing its action plan.

District's Action Plan to be based upon "Two-Tier Strategy"

Tier 1. District-wide Actions

Tier 2. Actions targeted towards and undertaken for specific subwatersheds, called Lake Water Quality Management Areas (LWQMA).