

PELICAN RIVER WATERSHED DISTRICT

OVERALL PLAN

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THE OVERALL PLAN
FOR THE PELICAN RIVER WATERSHED DISTRICT

I.

Introduction

The chain of lakes (see below) comprising the Pelican River Watershed District was one of the early summer resort areas in Minnesota. The lakes within the District continue to be a popular resort area, and consequently the economy of Detroit Lakes depends, in large part, on the maintenance of the resort business. Of recent years the lake chain has deteriorated in quality with the increase in weed growth in the lakes and the river so as to interfere seriously with the use of the lakes for boating, fishing and other recreational activities, and in the increase of blue-green algae and larval forms of *Schistosoma* Riley which cause itch to swimmers so that during periods of larval development swimming must necessarily decrease.

The rapid growth of weeds and algae-plankton during recent years indicates that the lakes and the river connecting them are deteriorating. Therefore the purpose of this overall plan is to detail the problems and recommend means by which the problems may be isolated and analyzed and suitable programs initiated to regulate the water levels and to maintain the economic and esthetic values of the area as a center for recreation.

NOTE: The lakes in the chain are: Floyd Lake (Big and Little), Detroit Lake (Big and Little), and Lakes Sallie and Melissa.

It is obvious that as the program of study brings improved understanding of the nature of the problems, and the causes for the deterioration, the Plan may require adjustment from time to time. It is not the purpose of this Plan to spell out in detail the problems but to point to various sectors of problems in the large. For as the Board of Managers becomes more adequately informed through studies to be made, the particular items of necessary improvement may be selected with maximum wisdom, and item by item changes may be instituted and altered as better understanding is had and awareness of the problems increases.

II.

OBJECTIVES OF THE PELICAN RIVER WATERSHED DISTRICT

1. The General Objective is in Conserving and Making Provident Use of Water and other Resources:

Water is one of our most important natural resources and the conservation and improvement of the water resource is the paramount objective of the Watershed District. We are fortunate in having an ample supply of this precious resource in the District which is the headwaters of the Pelican River and its chain of lakes. The effective management and preservation of this water resource will have beneficial consequences not only within the Watershed District but also further down the River and the lower lake chains to and including the Red River of the North.

2. To Reduce the Pollution of the Water of the Pelican River Chain of Lakes:

With the building of cottages, and in recent years, of permanent homes on the lakes, and the increase of leisure bringing more and more people to the lake areas, the waters of this Watershed District have become and are becoming more and more polluted. One of our major objectives, ultimately, is to discover and eliminate all sources of pollution which may be either bacteriological or chemical or both.

3. To Slow Down the Eutrophication of the Lakes:

The lakes are vital economic factors in this area through their recreational value and use. As the lakes eutrophy they may well become an economic and recreational liability instead of an asset. While eutrophication is a slow natural process, it is accelerated by pollution and the increase of various nutrients in the water. If the District is to remain a major recreational area, it is imperative that we stop or reduce substantially the present rapid eutrophication of our lakes.

4. To Regulate the Water Levels in the Pelican River Chain of Lakes:

Regulation of the water levels in the Watershed District's chain of lakes is of great importance. Impounding water in reservoirs, and using the lakes as reservoirs, during both the spring run-off and at high precipitation periods and later releasing the waters gradually would benefit both the chain of lakes and the Red River. Such holding action would aid in water control and flooding on the Red River as it would assist in maintaining lake and river levels down the Pelican River during the late summer and early fall when water levels tend to lower. Water control of lake levels would materially aid in reducing ice damage to shore lines and property during the winter and would minimize erosion at other times.

5. To Enhance the District's Recreational Facilities:

The prerequisite of any recreation in our area is clean, unpolluted water. Among some of the many facilities needed are an expanded park system and a system of navigable waterways connecting our many lakes. Improvement in these natural assets would result in corresponding improvement in land and commercial values of the Watershed District.

6. To Protect and Improve the Scenic Beauty:

Tourists from prairie areas are drawn to the wooded areas and the lakes of the Watershed District not only for recreational purposes but also to enjoy the beauty of nature in our woods and waters. The Watershed District should, therefore, actively engage in planning for the future so as to retain and enhance the natural beauty of the District so far as is possible.

7. To Improve the Needed Drainage and to Provide Needed Soil and Water Conservation Practices on the Land:

Soil and water conservation are closely inter-related. It will be the policy of the Watershed District to cooperate in all practical ways with the Soil and Water Conservation District, in promoting sound water and soil conservation practices.

8. Other Purposes Found in the Minnesota Watershed Act:

Undoubtedly other purposes included in the Watershed Act, but presently unforeseen or unanticipated, will become of concern in the future. It is the purpose of the Board of Managers, and the Advisory Committee, to be alert to other and new needs which will be to the benefit of the people of Minnesota.

III.

GENERAL DESCRIPTION
OF THE PELICAN RIVER WATERSHED DISTRICT

A. Location and Size of the District.

The Pelican River Watershed District is in the central and southern part of Becker County and extends approximately one and one-half (1½) miles into the central part of Ottertail County. The District encloses an area about nineteen (19) miles long north to south, and about ten (10) miles wide east to west. It contains some 76,907 acres of which approximately 11,000 acres are open water. The boundaries of the District are fully described in Article IV of the Minnesota Water Resources Board's order establishing the District. The 1966 assessed value of the District for tax purposes is \$6,203,350.00 for that part which is in Becker County. The small part of the District which is in Ottertail County would add \$4,763.00 to this valuation making a total of \$6,208,114.00.

Land Areas Involved

The land area totals about 131 square miles as follows:

	Acres	Assessed Valuation
Detroit Township	21,640	\$1,141,360.00
(Detroit Lakes included in Detroit and Lakeview Townships)		3,320,944.00
Erie	7,160	69,390.00
Burlington	3,800	42,120.00
Lakeview	22,080	1,454,460.00
Lake Eunice	5,000	48,990.00
Holmesville	1,600	13,060.00
Richwood	13,880	113,040.00
Candor Twp. (Ottertail)	1,747	4,763.00
Total	76,907	\$6,208,114.00

B. Topography

1. General:

The Pelican River Watershed District lies within an area of extensive outwash gravel and sand deposited by retreating glaciers of the last great ice-age. Gravel knolls and lake basins occur in the outwash to present a hilly, rolling surface of fairly low relief, for with a few exceptions the relief is not over fifty (50) feet. The highest elevation within the District is Detroit Mountain at 1624 feet, and the lowest elevation is about 1300 feet above sea level where the Pelican River leaves the District.

2. Stream Pattern:

From its source in Richwood Township, the Pelican River meanders generally to the southwest. Considerable ditching to facilitate drainage along the upper portion of the river has been done in past years. (See No. 5 under Land Use for details).

A number of creeks and drainage ditches empty into the Pelican River within the Watershed District.

At the source the Pelican River has an elevation of about 1430 feet and drops to about 1300 feet where it leaves the District, which makes for a vertical drop of about 130 feet for the river's course within the District.

3. Run-off and Stream-flow:

Several marshes lie within the District, especially in the northern part where they form the main water

source for the river. The Pelican River also receives considerable run-off from the rolling countryside. On its downstream course in the district the river flows through three major lakes: Detroit, Sallie and Melissa. Also the river receives the outflow from Campbell Creek which flows through Campbell, Big and Little Floyd Lakes. The lake levels and stream flow are regulated by dams at the inlet to Lake Sallie and the outlet of Mill Lake. No accurate flow measurements are available.

4. Lakes and Marshes:

There are at least ten (10) major lakes (listed under D. following) within the Watershed District with public access which provide a variety of recreational opportunities: various water sports, fishing, boating and hunting. There are also some fifty (50) smaller lakes which offer fishing, boating, waterfowl hunting and, to some degree, swimming. Many of these also have public access. There are a number of marshes which are excellent waterfowl nesting and production areas.

C. Geology and Soils:

1. Geology:

The geology of the Watershed District can be separated into the sub-glacial and glacial strata. The sub-glacial stratum is composed of slates of the Animikian and older formations. They are found with other sediments in an undifferentiated form. These

undifferentiated sediments include some granites and minor intrusives, greenstones and cretaceous sediments. For the most part, the sub-glacial formations are covered deeply by Quaternary deposits of between 300 and 500 feet in depth. These are known as glacial depositions. The glaciers deposited clay loam till, sandy till, sands and gravels in the 3, 5 and 6 land resource areas. Land resource area 7 is an outwash plain with sand and gravel over till to depths varying from 5 to 50 feet. The land resource area descriptions are found in the Land Resource Map of the Becker Soil and Water Conservation District, a copy of which is in the appendix (No. 1). The land resource area map was prepared by the Soil Conservation Service, Soil Scientists and Soil Conservationists. The earth's crust or the root zone formed the soils used in agriculture during the long years of weathering. Land resource areas 3, 5 and 6 are soils with top soil texture ranging from a loam to a silty clay loam. These soils have good water holding capacity of two to three inches per foot in the five foot root zone. The topography shows gentle rolling to moderately steep hills. The hills are subject to erosion, consequently conservation practices are essential to such soils under cultivation to check erosion and water run-off. Sandy loam and gravels dominate the top soil and plant root zone of soils in land

resource area 7. These soils are susceptible to drouth conditions and are vulnerable to wind and water erosion. The natural soil fertility is low. Some shallow-to-deep peat and muck are found in the low areas throughout the watershed.

Land Resource Area Table - in acres

<u>Land Resource Area</u>	<u>Cropland</u>	<u>Hay, pasture, woodland</u>	<u>Swamps and potholes</u>
Area 3	2,705	377	342
Area 5	5,478	1,982	3,496
Area 6	3,305	2,300	2,612
Area 7	20,715	9,416	7,533

D. List of Meandered Lakes of the Pelican River Watershed

District:

<u>Lake Name</u>	<u>Legal Description</u>	<u>Acreage</u>
Schultz Fisher	Twp. 139 N., R. 40 W., Sec. 19, 20, 29, 30 8	118.25 47.75
Spring	Twp. 140 N., R. 40 W., Sec. 7, 8	46.55
No. Momb	Twp. 140-141 N., 40 W., Sec. 35, 3	72.35
Eagen	Twp. 140 N., R. 41 W., Sec. 32	64.45
Moon	2, 11	75.75
Houg	9, 10	106.95
Campbell	14	92.75
Sands	22, 23, 26, 27, 28	657.95
	27, 34	177.85
	16, 21	22.25
	16, 21	64.10
	20, 21	83.65
	20	62.25
	21	92.25
	20, 29	60.90
	29, 32	60.25

<u>Lake Name</u>	<u>Legal Description</u>	<u>Acreage</u>
Detroit (Big and Little)	Twp. 139 N., R. 41 W.,	3,022.90
St. Clair		591.25
Long		485.10
	Sec. 19, 30	45.40
	19	42.00
Brandy	19, 20	53.00
Rice	20, 21	316.55
Big Floyd and Mud	3, 4, 9, 10, 15, 16	1,233.50
Little Floyd	2, 3, 10, 11	237.85
Tamarack	4, 5	50.25
Kennedy	5, 8	46.35
	Twp. 138 N., R. 41 W.,	
Nottage	Sec. 21, 22	69.02
Reeves	22, 26, 27, 34, 35	323.45
Abbey	14, 23	277.55
Glawe	10, 15	44.00
Corfman	9, 10	104.40
Sallie	7, 8, 9, 16, 17, 18,	
	19, 20	1,261.55
Fox	17, 18	154.55
Mud	19	82.70
Munson	5, 6, 8	131.60
Meadow	21	74.25
Melissa	19, 20, 21, 28, 30,	
	31, 32	1,791.15
	Twp. 138 N., R. 42 W.,	
Spear	Sec. 11	63.00
Mix	1, 12	36.00
Pearl	11, 12, 13, 14	282.75
Holstad	14, 23	35.25
Loon	13, 14	228.35
	Ottertail County (Candor Twp.)	
	Twp. 137 N., R. 41 W.,	
Cooks	Sec. 2, 3	72.10

Authority: Gazetteer of Meandered Lakes of Minnesota
Department of Drainage and Waters,
State of Minnesota

E. Climate:

The U. S. Weather Bureau has maintained a weather station within the watershed district at Detroit Lakes since December 1, 1895. Weather records also have been kept at Hawley since 1948, at Frazee since 1939, and at

Pelican Rapids since 1940. The mean annual precipitation at Detroit Lakes prior to 1931 was 25.14 inches, while between 1931 and 1952 the mean annual precipitation was 23.34 inches. Prior to 1931 the mean annual snowfall at Detroit Lakes was 37.4 inches, while between 1931 and 1952 the mean annual snowfall was 45.9 inches. The mean annual temperature at Detroit Lakes is about 39 degrees. The highest temperature recorded was 107 degrees, and the lowest was 53 degrees below zero.

F. Land Ownership:

By far the greater part of the land within the watershed district is in private ownership. The State owns some 920 acres, in the district, in the State Fish Hatchery grounds on Lake Sallie. The County holds some 480 acres of tax forfeited land also within the district. The City of Detroit Lakes is within the district and the city owns parks and recreation areas, and the municipal golf course located between Lakes Sallie and Melissa. Other than these, the land is privately owned. Appendix II is a land ownership map of Becker County.

G. Land Use:

1. Overall:

As suggested in the Land Resource Area description and map, the major land use within the district is agriculture. The second most important land use is for recreation which includes the lakes, the parks, the golf courses, one of which is privately owned,

the winter recreational areas, and other camp and wild areas. The third ranking land use is residential, and the fourth is commercial and industrial.

2. Forestry:

The forested part of the district consists of upland and lowland hardwoods with scattered stands of spruce, tamarack and pine covering approximately 18,870 acres. The common species present are basswood, paper birch, red burr and white oak, ash, aspen, water and rock elm, maple and ironwood. These are mainly pole-sized timber with saw-sized trees scattered throughout the stands. These timber and brush areas serve not only in erosion control but they also provide slack-time employment, and provide areas for recreation. The forest areas are an asset, also, in that they assist in slowing down the run-off in the spring and after heavy rains to retain the water so that it seeps into the soil with consequent building up of the water table. Further, the forest areas afford both food and shelter for wild life.

3. Agriculture:

The major land resource area in the watershed is of the Esterville soil series and is, therefore, somewhat droughty. Its economic value for agriculture is somewhat limited at present farm produce price levels. The average yield of corn is about

30 bushels per acre, alfalfa hay yields about 1½ tons per acre. The many low, wet areas and the rolling hills hinder the use of modern machinery. However, supplemental irrigation is feasible because of the high water table. High return crops, such as truck gardening, are being developed on a limited scale with the aid of irrigation.

Dairying is one of the major agricultural enterprises within the district. The economics of specialization has brought about the elimination of many small herds. At the present time there are approximately ten herds of thirty (30) or more cows and approximately three times that number of smaller dairy herds.

4. Recreation:

Some areas of the watershed district offer fine prospects for parks and campgrounds - one has been suggested adjacent to the dam on Lake Sallie.

Within the watershed there is one public park which is within the city limits of Detroit Lakes. This park is quite crowded, especially on weekends during the summer season, being used by family and other social groups for picnics, and the city maintains an active youth recreation program there during the season. There are other areas within the district which are advantageously placed for public parks.

H. Water Use

1. Water Supply:

About 21 square miles of the watershed area consists of lakes ranging in size from about 4 acres to over 3,000 acres. In the area of nearly 80,000 acres, about 50% of the land is on an Esterville soil. This coarse subsoil has a perched water table of from 7 to 20 feet in depth. Consequently water supply is economically available for shallow wells for home and irrigation use. Subterranean water varies from about 50 to 300 feet deep. Much of the eastern side of the watershed is of heavy soil with a limited perched water table. Here the subterranean water varies from 50 to 400 feet deep. The surface lake area in ratio to the drainage area is about 1 to 7 which should provide indefinitely for maintenance of water levels except, of course, during periods of prolonged drouth.

2. Recreation:

At least 10 lakes within the watershed district provide a variety of recreational opportunities: fishing, hunting, boating--motor and sailing, swimming, water skiing and skin diving. Most other lakes provide hunting and fishing, some swimming, while the numerous marshes and sloughs provide waterfowl hunting during the season. The Pelican River provides fishing, and may now be used for lake-to-lake travel, especially by canoe.

3. Navigation:

Above the City of Detroit Lakes the Pelican River is barely navigable by small boat or canoe. Below Detroit Lakes, the river is navigable by small boat down to Lake Sallie where watercraft must be portaged over the dam at the fish hatchery. From Lake Sallie the river is navigable to Buck's Mill where another portage must be made. All lakes within the watershed area are usable by small craft.

4. Fish and Waterfowl:

The lakes and river are excellent fishing spots. Game fish are: Walleye, northern pike, trout, large and small mouth bass, sunfish and crappies. Non-game fish caught are: bullhead, perch, rock bass, dogfish, whitefish and suckers. The lakes are well stocked and are heavily fished. The marsh areas generally have adequate waterfowl for good hunting.

5. Drainage, Diversions and Impoundments:

The main drainage system of the watershed district is the Pelican River, with drainage ditches which enter, or connect lakes, and creeks which enter into several of the lakes. The drainage system begins with County Ditch #11 which drains into Campbell Lake from the northeast. Below Campbell Lake it is joined by a drainage ditch from Tovson, Bean and Fish Lakes. This is then named Drainage Ditch #12, or Campbell Creek and it enters Floyd Lake. Pelican River proper begins north of Little Floyd Lake.

It receives the flow from Big and Little Floyd Lakes and below the Lakes it is called Drainage Ditch #13 or the Pelican River. About 1915 the Pelican River south of Little Floyd Lake was straightened by a drainage ditch (#13) which also drained lakes in the area, among them Rice Lake. County ditch #14 drains some of the area of St. Clair Lake and enters the Pelican River just west of the city of Detroit Lakes. Farmers within the watershed area have carried out some on-the-farm drainage with outlets either into the county ditches, or into the Pelican River, or into one of the lakes. Lake level control structures have been built at the outlets of Little Floyd, Sallie, and Mill Lakes. The dam on the Pelican River outlet of Lake Sallie and the Buck's Mill dam on the Pelican River are both owned and operated by the Minnesota Conservation Department, Division of Lands and Waters. Lake levels have been established in cooperation with the Sallie and Melissa Lakes Association. The dam on the Pelican River outlet of Muskrat Lake is state-owned and is regulated in cooperation between the City of Detroit Lakes and the State Conservation Department, Division of Lands and Waters. The dam on Campbell Creek below Little Floyd Lake is owned and operated by the State Department of Conservation, Division of Lands and Waters.

J. Population of the Area:

The population of the townships within the watershed district is given as follows, from the 1960 Bureau of the Census Report:

Richwood	555
Holmesville	273
Audubon	424
Detroit	1,910
Erie	635
Detroit Lakes City	5,633
Lake Eunice	474
Lake View	1,555
Burlington	<u>537</u>
Total	11,996

However no one of the townships is wholly within the watershed district. It is estimated that the population within the district approximates 10,000. There is a substantial increase during the summer months when those who live at a distance but own summer homes on the lakes spend the summer months here. Also the resorts receive a considerable influx of people who come for a week or longer. The enclosed chart (Appendix III) taken from the Detroit Lakes Planning Commission's Basic Study suggests the projected growth of the city itself. The chart uses the Bureau of Census figures for 1940, 1950 and 1960 and projects the growth down to the year 2000. Line A of the graph suggests the possible growth rate if the city utilizes its potential minimally. Line B suggests the projected growth if the community utilizes its potential normally. Line C suggests the projected growth if the community utilizes its potential maximally. A substantial portion

of the city population lives outside the city limits in housing developments and around adjacent lakes. It seems likely that the building of permanent homes on lake shore lots will continue and will even increase. This building of permanent homes on lake shore lots is at once an asset and a potential liability in that the drainage from a larger number of cesspools may well increase the nutrients in the lake waters and so increase the rate of eutrophication. The housing is an asset in that people from other communities may prefer to live here and commute to work. The other townships in Becker county indicate a population loss due to changes in agricultural development.

K. Transportation:

Detroit Lakes, the center of the watershed area, is served by three highways: two Federal and one State. State Highway #34, a route from Barnesville to Duluth, cuts across the district. Federal Highway #59, a north-south state line to state line road runs through the district and is a much traveled road in summer months. Federal Highway #10 crosses the district east to west; it is one of the early coast-to-coast highways and carries heavy traffic all the year.

Four long-distance and two local truck lines serve the city. The city is also served by two railroads: the Soo which is now a freight only line between the Twin Cities and Winnipeg, and the Northern Pacific which operates both passenger and freight service between

Chicago and the West Coast. The Greyhound Bus lines run on Highway 410. Another bus line is in prospect between Detroit Lakes and Winnipeg. The city is also served by two airlines: Fleet Airways which operates between Roseau and the Twin Cities, and Command Air which runs between Detroit Lakes and eastern and central North Dakota communities. The airport was recently improved and made suitable for night landings. The county has an adequate network of improved county roads.

IV.

CURRENT ECONOMIC ASSETS
AND ECONOMIC DEVELOPMENT POTENTIALA. Agriculture:

The land in the watershed area for the most part is sandy loam soil over gravel. The topography is rolling to steep hills with small tillable land areas that do not lend themselves very well to most agricultural crops. The agricultural economy is changing toward mink and turkey ranching with some feed lots for cattle and sheep. There are also some dairy farms. It is not likely the dairy industry will increase in numbers due to the limited forage yield potential of most soils in the district. Dairy products processing consists of dry milk, butter churning and cottage cheese made by the Lakes Dairy Cooperative. Grade A market outlets are available to dairy farmers. The larger herds in the district produce Grade A milk. The most likely potential for future agricultural expansion is in truck gardening which would require irrigation and an expansion of present markets.

It also seems possible that agricultural development may become a varied industry: poultry and mink ranches may also have the normal farm crop production. Such development, however, may conflict with recreational aspects of land use. This should be of concern to the planning groups.

B. Tourism and Recreation:

Tourism and recreation are a substantial part of the economy of the watershed area. Residences dot the shores of the lakes in the district. Many of these are maintained and occupied by summer residents. However the newer homes are for year-round use, and many live within the district and commute to work.

There are eighty (80) resorts, motels, campsites and trailer camps in the district which depend on tourists and vacationers coming to the area for recreational purposes. It is estimated that about 90,000 people visit the area in the summer and remain for varying periods, spending between \$2,500,000 and \$3,000,000 to bolster the local economy. These people come here for fishing, golfing, water-sports, sight-seeing, resting and to benefit by the cool climate. For these people the district offers at least sixteen (16) fishing lakes, many picnic and park sites, three golf courses, points of interest, forestry projects, wild life propagation, two game farms and a winter ski area. Many acres of hunting grounds are here for upland game and waterfowl. There are several youth camps, a state fish hatchery, a fishing bridge and two dams where elderly and children may fish. Also, the city of Detroit Lakes spent more than \$250,000 in 1966 to improve the beach front within the city limits. The economy of the community depends on income derived from the tourist and resort business attracted here by the recreational facilities of the

watershed district. In recent years winter sports has begun to attract winter vacationers and week-end sport-seekers. An excellent ski development has been made on Detroit Mountain, and in other areas there are trails for motor-skiers. Also some have begun to come just to ski through the forest areas. The winter recreational potential is just past its birth. It is patent that the preservation of the watershed district's natural assets, and the expansion of present facilities will result in an increase in the number of visitors to the community with consequent improvement in the local economy.

C. Industrial Development:

Detroit Lakes presently has nine (9) industries: a large turkey fowl processing plant employing over a hundred persons, a cooperative dairy selling on the local market and processing milk for national distribution, a furnace and pipe-fitting manufacturer engaged in the national and export markets, an ice company which also bottles carbonated beverages for the regional market, a machine shop which specializes in the manufacture of animal-feeding machines for the local and regional market, a concrete products company which serves the local market, a machine shop which specializes in building pontoon craft for pleasure boaters, and a milk food producer who serves the regional market.

A few years ago the city appointed a City Planning Commission which has now completed its study, formed a twenty-year plan, and is engaged in seeking to achieve the outlined goals. A new zoning code has been adopted by the City Council which permits control of housing, commercial and industrial growth based on the Planning Commission recommendations. The county has also appointed a County Planning Commission which is now in the process of drawing together the materials, and studies upon which to work out a county plan for the future. It is expected that the city and county planning commissions will cooperate in areas where they have mutual interests. Long-range planning and guide lines are essential for the orderly and progressive development of resources, and the economic and social improvement of both county and city.

Detroit Lakes is the district headquarters for the highway department, as for the telephone company, as it is the central distributing point for the federal post office. An industrial development Corporation is at work seeking to interest industries to locate here.

A natural gas line provides gas to the community, a municipal light and water plant meets the city needs, Ottertail Power and the Wild Rice and Lake Region R.E.A. serve the rural areas.

D. Population:

The population of Detroit Lakes has shown a consistent growth. The rural areas of the county have undergone a population adjustment, typical of rural areas generally as farms have increased in size. Detroit and Lake View townships, particularly, have shown a considerable growth in population due to the building of permanent homes around the lake. Appendix III indicates the population movement of the Detroit Lakes area, and the projected growth as suggested by the firm of consultants engaged by the City Planning Commission. A recent survey indicated that the county, as a whole, has gained in population since the 1960 census; it is assumed that this growth is contained within the watershed district. The increase in population of Detroit Lakes, and the watershed district should continue indefinitely as more and more permanent homes are built around the lakes, and as Detroit Lakes continues to be a recreation center for the area.

E. Forestry:

The forested area, of approximately nineteen thousand (19,000) acres, consists primarily of northern and lowland hardwoods. The timber stands vary in size from farm wood lots up to stands of about 400 acres. Most of these stands are of pole size, from five to ten inches in diameter at breast height. There are larger trees scattered through many tree stands which are of value for saw, veneer and tie timber.

The forest areas constitute a potential asset of considerable value to the watershed economy. Under good management these woodlots and forests could return a substantial income to the community. Harvesting of forest products: pulpwood, firewood, fence posts and wood rails could provide winter employment on private and public lands. Maple stands could offer spring employment in the making of maple syrup. With good management these areas will provide additional income to the community, as they would also provide more areas for recreational activities.

F. Transportation:

The improvement in highway #59 now in process, and the planned improvement on highway #10 in extending the four-lane road to the east will provide easier and safer access to the lake area.

G. Water Supply:

A plentiful water supply is obtainable from artesian wells drilled to a depth of 234 feet. Outwash gravel varies in depth from 20 to 40 feet. Below the outwash gravel, clay varies in depth from 100 to 170 feet. Sand and gravel aquifers below the clay have been found to vary in depth from 8 to 50 feet and these aquifers yield substantial quantities of good water which will flow to an elevation of approximately 1350 feet which is 16 feet above the normal water level of Detroit Lakes. The water supply seems quite adequate for any foreseeable economic or industrial development. Additional records on wells supplying water for the city

of Detroit Lakes may be had from the City Engineer, or the Department of Conservation, State of Minnesota.

The major use of water, at present, is for recreation. As the resort and tourist business grows there will be added danger of increase in the pollution of the lakes and river and of the eutrophication of the lakes. It will be of major concern to the Board of Managers to seek all means for the maintenance of the lake waters for recreation by control of pollution and nutrients entering the lakes.

The excellent perched water table supply makes possible irrigation for truck gardening which offers an opportunity for development in the watershed district.

V.

PROBLEMS

A. Eutrophication:

Eutrophication, or aging of the lakes, is due to increase in chemical fertility of lake waters and the growth of water weeds and algae produced by this increase. All surface and ground waters carry such plant nutrients as phosphates and nitrates, and lakes have been fertilized by natural processes as long as they have been in existence. However, continuous additional fertilization of lakes from such sources as sewage effluent, industrial wastes, run-off from fertilized lands increases the proportion of nutrients in the waters and so promotes the growth of algae and water weeds. Under such conditions, the lakes are being "fed" throughout the growing season. Such excess growth makes for more rapid weed growth. More rapid weed growth makes the lakes unsuitable for recreational uses. Eutrophication of the lakes is the most pressing problem of the watershed district. As recently as 25 years ago for example, Lake Sallie was one of the major summer recreational lakes in the watershed. Local residents reported that in the 1940's, the lake water remained clear throughout the summer. Now, however, Lake Sallie is a well-fertilized lake: it is unfit for swimming during July and August because the weeds are too dense, and the blue-green algae cover the lake.

During the hot days the odor of decaying algae on the shore is very offensive and the odor is strong on the golf course which is adjacent to the south shore of the lake. Lake Sallie has lost much of its appeal to vacationers and fishers for the weed growth makes boating and fishing very difficult. Lake Sallie is becoming an economic liability rather than an asset. And what has happened on Lake Sallie is beginning to occur on other lakes: Detroit Lakes is also an algae-filled lake, and the weeds in it seriously interfere with good boating. It is not as advanced as Lake Sallie but this lake and other lakes within the district are beginning to show clear evidence of the rapid eutrophication caused by the increase of nutrients in the water. It is, therefore, urgent that studies be made and action instituted to understand and to correct, so far as is possible, the rapid eutrophication of the lakes within the district before the economy of the district suffers irreparable damage.

B. Pollution:

Pollution is one important aspect of eutrophication, both directly and indirectly as pollution affects the ground water which drains into the lakes. Pollution poses two aspects: 1) the economic which affects the economy, and 2) the problem of the health of people in the community. At present the district has little industrial pollution but it has a considerable amount of agricultural and residential pollution. Some of

the areas of concern at present are the Pelican River which flows into Detroit Lake, and the drainage ditch which flows into the Pelican River a short distance below the outlet of Little Detroit Lake. There have been times when the Pelican River carried raw sewage and industrial wastes into Detroit Lakes. The drainage ditch, referred to above, has also carried polluted water out of St. Clair Lake into the Pelican River. It is believed that the lakes are also being polluted by septic tanks serving the many homes situated around the lakes. No reliable data are available at this time to indicate what proportion of pollution comes from this latter source. The rapid eutrophication of the lakes of the district subsequent to the building of the many homes on the lake shores strongly suggests that they are contributing, perhaps major factors, in the accelerated deterioration of the lakes.

C. Erosion:

Soil erosion occurs in areas where intensive agriculture is practiced and along the lake shores where the pitch of the shore is steep. Much sloping land is farmed to row crops, and grain land is summer fallowed without regard to wise conservation practices. On hills where the rows run parallel to the slope between fifty (50) and one hundred (100) tons of top soil can be eroded per acre during the growing season. This erosion adds silt to the lakes. On the lakes, where the pitch of the shore is steep, up to ten (10) feet of shoreline

can be undermined and eroded away in a short time by wave action during times of high water.

D. Water Supply:

In several of the housing developments adjacent to the city limits, the wells supplying water to the homes have been contaminated by seepage from the septic tanks most noticeably in the presence of foaming caused by detergents, soluble in water, and undigestible by the soil bacteria. Recently some of the housing developments have been forced to seek inclusion in the city in order to avail themselves of the city water and sewer systems. Ground water pollution will become an increasingly serious problem unless corrective measures are taken.

E. Navigation:

In past years there was regular navigation between Detroit and Pelican Lakes. At present, navigation of the chain is difficult because of dams and bridges. With the increase in pleasure boating in recent years it is desirable that navigation between these lakes be reinstituted.

F. Park Areas:

The summer resort industry ranks second in the area in producing income. Therefore, additional parks and recreational areas are matters for serious consideration. The city of Detroit Lakes has an excellent public park on the lakeshore, and the city, at considerable expense, has recently improved the waterfront within the city limits. The main public park in Detroit Lakes

is overcrowded on many occasions during the summer and there is need for other strategically located park areas and recreational facilities.

G. Drainage:

The Pelican River watershed has an average precipitation of twenty-four (24) inches per year. It is estimated by soil scientists that, on the average, about 2.5 inches of water runs off the land into the streams and lakes along natural water trails each year. Much of this runoff carries fertile top soil and dissolved fertilizer into the waters of the district.

Lake levels have fluctuated considerably over the years, during drouth years the lake levels have fallen. There is an annual problem of the spring runoff which ultimately contributes to a flood condition on the Red River. Extreme high water can effect marked damage in the lakes by erosion of banks and top soil which adds to water fertility and turbidity.

H. Irrigation:

There is little commercial irrigation in the district at the present time. In the future, through development of truck gardening irrigation may become a problem.

VI.

MANAGEMENT AND SOLUTIONS

A. Eutrophication:

Water fertility has a direct relationship to weed and algae growth. The watershed management will have to use all practicable means to reduce the fertility of the water in the Pelican River chain. There appears to be no adequate solution to this problem at the present time. The watershed management will have to work by intelligent application of sound scientific principles to the problem. There will have to be basic research and the accumulation of scientific data. Further, the watershed management will have to be alert to constantly adapt its methods to new scientific data as they become available. The watershed district and management will have to rely on the counsel, help and guidance of the State Universities and other governmental agencies.

B. Pollution:

Every effort should be made to remove all sources of pollution by all practicable means at the management's disposal.

C. Erosion:

Erosion studies need to be made and wise programs initiated to reduce the erosion of soil and to prevent the erosion of shorelines.

D. Water Supply:

One obvious solution to the problem of water supply, of course, is extension of the city water and sewer systems as far as is practicable. In the outlying areas the answer may be in strict regulation of the location and type of septic tanks and lot sizes, according to the Minnesota State Department of Health recommendations, or in the development of new district sanitary sewer systems.

E. Navigation:

With a relatively small expenditure, navigation could be restored between Detroit Lake and Buck's Mill. This would necessitate the rebuilding of locks in the channel and some deepening of the river bed. Ideally, the river channel should have a minimum depth of four (4) feet, and bridges should have a clearance of eight (8) feet. In the future, additional navigable channels may be developed.

F. Park Areas:

There are a number of places which would make excellent parks within the watershed district. The Detroit Lakes Planning Commission has suggested that a parkway be established along the Pelican River both north and south of the Northern Pacific Railroad right-of-way. Another area which would be a fine park is along Muskrat Lake across from the Fish Hatchery. Still another possible park is the Buck's Mill area where trees are abundant and the land is not suitable for other purposes.

In these areas there could be picnic spots, camping areas, riding and hiking trails, and launching ramps for small boats. These areas are presently undeveloped and could easily be made into park areas. There are other locations along the river bed which could also be made, quite easily, into park sites.

G. Drainage:

Most of the runoff water in the district can be made to percolate into the soil if good conservation practices are used. Subterranean springs and water courses will provide clear water for the lakes and streams if the water is allowed to percolate into the soil. Runoff water should be diverted into and spread over meadows and pastures and other flat agricultural land wherever possible to permit the water to seep into the land and so into the water table.

Conservation measures now being used for control of soil erosion provide for holding waterflow back to permit seepage into the soil. Water impoundments of various sizes can also be formed to store excess water runoff during the spring thaw and early summer rains. This water could be released into the watershed during times of minimal rainfall and during the high evaporation rate of the late summer. This holding back of the spring runoff could also be an aid in times of flood.

A uniformly regulated waterflow should be maintained to provide clear water in the lakes and streams of the district. Although the control of lake levels is now

exercised by the Conservation Department and the city of Detroit Lakes, this control should, we feel, ultimately be transferred to the watershed district management. Areas that were wet and marshy in the past should be re-examined and re-evaluated in terms of objective use. Some of these, Rice Lake for example, would best serve the watershed if restored as lakes and regions for wild rice beds, fish spawning, siltation basins, flood control impoundments, or reserve water supply for irrigation.

In the urban areas or other heavily populated sections where there are storm sewers, the sewers could be diverted to pass through impoundments or marshes so to eliminate the fertilizers washed from lawns and other debris and silt from passing directly into the main water course. By such filtration, the runoff water would be cleaner and its nutrients removed before entering the main water course.

H. Irrigation:

The use of water from the lakes or streams for irrigation installations should be watched very closely although a permit from the State Department of Conservation is required before irrigation may be allowed. Excessive use of water for this purpose could create a low water level during the summer months and could increase the proportion of nutrients in the water.

Policy of the Board of Managers

The Managers of the Pelican River Watershed District acknowledge the responsibilities which are imposed on them by law.

The Board of Managers will cooperate with government agencies, and with all other persons and groups to the extent consistent with their responsibilities.

The Board of Managers expresses concern about the problems of the watershed district, and will, within its responsibilities, endeavor to achieve the solution to these problems.

The January meeting of the Board of Managers will be an organizational meeting at which the officers for the succeeding year will be elected.

Summary

The foregoing proposed overall plan offers a description of the District, its several problems, and contains a suggestion of possible solutions. However, it must be remembered that the individual landowners in the district must, by proper petition, institute specific projects to carry out the overall plan for the district. It must also be recognized that water management beneficial to the landowner is dependent on the voluntary cooperation of each individual landowner within the district.

The Board of Managers can only correlate, assist, and see that the various projects are carried out, as required by law, to proper completion after the desire for improved conditions has been expressed by the respective landowners of the district.

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