

THE CHARACTERISTICS OF LAKEFRONT
PROPERTY DEVELOPMENT ON SELECTED
INLAND LAKES IN MICHIGAN

Thesis for the Degree of M. S.
MICHIGAN STATE UNIVERSITY
Wayne Harris Verspoor
1965

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ABSTRACT

THE CHARACTERISTICS OF LAKEFRONT PROPERTY DEVELOPMENT ON SELECTED INLAND LAKES IN MICHIGAN

by Wayne Harris Verspoor

The State of Michigan, with its many thousands of developed inland lakes, can be divided into three regional areas showing characteristic lake use and development trends.

The Upper Peninsula lakes are, as yet, rather undeveloped and isolated. Location, access, and lack of population in the area is responsible for a large share of this characteristic but other local factors may also influence lack of development. Property values, type of development, and type of lake use all reflect the isolated nature of Upper Peninsula lakes and for the most part, very little platting is found on most lakes, with the exception of some larger lakes.

The northern Lower Peninsula is a transition zone between the characteristic lack of development in the Upper Peninsula and the extremely intense development of the southern Lower Peninsula. Most areas of the northern Lower Peninsula are within three or four hours driving time from most population centers in the southern part of the state and this, coupled with increasing population, demand and other factors has produced more rapid development of northern Lower Peninsula lakes. Property values,

quality and regularity of cottages , and a variety of lake uses show the transition from the single purpose and loner type of development in the Upper Peninsula.

Michigan's southern Lower Peninsula lakes show the ultimate in lake development. Almost all lakes are highly developed , a variety of recreational uses are found on every lake , and problems relating to this development are common. User conflicts , carrying capacity , pollution , aquatic plants , and overcrowding are the more common problems on southern lakes , especially in southeastern Michigan , but many local factors also influence lake development quality. Permanent residences on lakes are much more common in the southern Lower Peninsula than in other areas of Michigan and clubs , resorts , and other social service centers are found on most intensively developed lakes.

In summary , demand for frontage is increasing , especially in the Lower Peninsula , and use patterns of lakes reflect this demand. With increasing population , more leisure time , and better access , development of many more northern lakes can be expected to continue and increase. Adequate planning and management is required on all lake developments , whether old or new , in order to assure efficient use and conservation of lake resources. Ideal lake development , therefore , should be geared to this concept in order to prevent conditions similar to those found on many southern Lower Peninsula lakes. Good planning techniques , property and use restrictions , and maintenance of all lake developments will enhance rather than destroy Michigan's inland lakes , one of the state's most valuable resources.

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By

Wayne Harris Verspoor

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CHAPTER I

INTRODUCTION

Lake Activities and Development Trends

The State of Michigan has been blessed with thousands of lakes, rivers and streams, and the use of these water bodies for recreation has been and will continue increasing over the years. With the continuous growth of population and an increase in leisure time, this trend can be expected to continue. This can be seen especially when one considers some of the recent trends in the demand for water space and use. From 1950 to 1959, for example, the number of the nation's residential swimming pools increased from 3,600 to over 175,000.¹ Attendance at state parks in Michigan produces new records each year and the number of pleasure boats in the nation has more than tripled within ten years. In fact, as one writer has speculated, "If the boats of Michigan alone were strung bow to stern, they would encircle the entire length of Michigan's Great Lakes shoreline."² It is no wonder, then, that the demand for water-oriented recreation has increased so rapidly over the last few years.

Among the more important water-oriented activities found on Michigan lakes are boating, water skiing, swimming and wading, fishing, hunting,

¹C. H. Burton, "The Use of Reservoirs for Recreation" (unpublished report), p. 37.

²Ibid.

camping, and cottage development. Each of these activities, along with many minor uses, is consumptive of space and time — especially when many of these activities take place at the same time on the same lake. Without adequate management and planning, therefore, many conflicts and dissensions may occur with the result of inefficient use of Michigan's inland lakes.

Boating and water skiing are two very consumptive recreational activities on the actual water surface of the lake. With the development of high horsepower motors and improved boat design, a tremendous amount of water area can be covered in a very short period of time. This use of space is of course multiplied when many boats ply the lake at the same time, especially if the lake is small.

Cottage development along the shoreline of a lake is also very consumptive of space and may actually have a detrimental effect on many valuable recreational activities on a lake. Along with cottages are many accessories such as boat docks, boat houses, launching ramps, bathing beaches, and picnic areas. These, too, are consumptive of much space along the lake shoreline because the individual owner as well as the public require weed- and insect-free swimming and recreational areas for their own personal use.

Lakeshore development may take one or more forms depending upon the size, location, accessibility and other factors. Large commercial establishments, elaborate cottages, or small fishing and hunting cabins may

characterize any given lake. There is, therefore, a definite need for planning in order to maintain the quality of the lake and satisfy the individual's need for water-oriented recreation.

Statement of the Problem and Intentions of the Study

Property development on a lake appears to reflect the recreational uses of the lake. For example, some Northern Peninsula lakes are developed almost exclusively with small cabins or even shacks used solely for hunting and fishing. In contrast, many Southern Peninsula lakes are built up with very elaborate homes and cottages reflecting the general water sport uses such as swimming, sunbathing, and boating. Much of the development on some Southern Peninsula lakes is, in fact, of the nature of permanent homes. Northern Peninsula lakes are used mostly as seasonal lakes for the purpose of hunting and fishing, or, on some of the larger lakes, as summer cottage sites.

In the last few years, due to increases in vacation time and accessibility, many lakes have developed to such a degree that conflicts and problems have arisen of natural and especially man-associated origin.

There are many thousands of Michigan inland lakes that are now being used for recreation and cottage development, and many of these lakes are now beginning to face problems of overdevelopment. This is especially true in the more populated areas of southern Michigan where lakes have been developed for many years. Since Michigan is a state with so many lakes that are usable for water-oriented activities, there are many factors

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affecting their development. Some of these include: (1) accessibility to the lake from centers of population, (2) adaptability of the lake to the existing developmental requirements, (3) the scenic qualities of the lake and surrounding area, (4) the soil conditions and vegetative growth, (5) the depth of the water in the lake, and (6) a minimum of objectionable features.³ Of these factors, the most important aspects are probably accessibility, adaptability, and scenic qualities of the lake. The lakes in the Northern Peninsula, not being as intensively developed as Southern Peninsula lakes, have scenic qualities that abound. Much of the area is forested, giving a primitive and isolated feeling to the lake user. However, the facts that northern Michigan lakes are so far away from centers of population and the expense of crossing the Mackinac Bridge probably account for their generally undeveloped condition. This condition is changing rapidly, however, with the improvement of state highways and more rapid and easier means of travel. Furthermore, Southern Peninsula lakes are becoming overcrowded and hence are rapidly losing quality for recreational and developmental uses.

Northern Michigan lakes are, as yet, relatively free from many of the problems associated with southern Michigan lakes because of their lack of development. However, unless measures are taken, the time will come when they too will show signs of problems similar to those of southern Michigan lakes.

³C. H. Burton, "The Recreational Resources of the Squaw Rapids Reservoir Province of Saskatchewan, Canada" (unpublished Master's thesis, Department of Resource Development, Michigan State University, 1961), p. 46.

Some characteristic problems associated with development on Michigan's lakes that will be emphasized in this study can be placed in two main categories, namely, natural and man-associated. In the natural category are included such aspects as biological and physical problems. The man-associated category will include pollution, user conflicts, carrying capacity, and cottage development. The main emphasis will be placed on the man-associated aspects of these problems, especially to cottage development and related problems.

Property description in the state of Michigan is gradually shifting from the metes and bounds method to that of platting and subdividing. Because of the detailed descriptions and time consuming process involved in analyzing metes and bounds descriptions, the only property used in this study will be that described in terms of plats or subdivisions, although this has not been a primary criterion in choosing the eight lakes involved.

Much of the shoreline property on many Michigan inland lakes, especially in the Lower Peninsula, has been subdivided into lots by this method of platting. In general, the more desirable spots on the best lakes are developed first and the concentration of development centers in these areas.⁴ Lot sizes vary considerably depending upon the demand for the lake property, and many problems have evolved with respect to the lot size. Uncontrolled developments are common in some areas; this results

⁴J. J. Lynch, R. Poff, and C. W. Threinen, Improvement of Shallow Lakes for Recreational Use (Madison: Wisconsin Conservation Department, 1964), p. 1.

in overcrowding, conflicting uses, and aesthetically unattractive shoreline development. On the other hand, there are many lakes that have been developed with these problems in mind. This has resulted in nicely developed areas without too many undesirable effects. One of the main purposes of this study will be to show the characteristics of this lakefront property development in Michigan and from this analysis, an attempt will be made to produce a pattern of ideal lakefront property development that could conceivably be used on some of the lakes in Michigan.

Lake Descriptions

For the purpose of this study, eight inland lakes were chosen as examples of property and associated recreational development trends throughout the state. An attempt was made to choose these lakes from different geographical areas throughout the state in order to allow for different developmental characteristics common to the different areas of the state. Because of this, two of the eight lakes were selected from the Upper Peninsula, three from the northern Lower Peninsula, and three from the southern Lower Peninsula. For the purpose of this study, the northern Lower Peninsula is defined to include the area from a line running from Bay City to Ludington, north to the Straits of Mackinac. The southern Lower Peninsula includes the area south of this line to the Ohio and Indiana state lines. (See Table 1.)

Table 1. General Summary of Lakes Used in Study

Lake Name	Location	Origin	Size (Acres)	Inlet	Outlet	Maximum Depth	Predominant Fish Species	Shoretype	Vegetation	Climate	Public Access	Percent of Developed Shore*	Primary Recreational Activities
Camp Lake	T42N R35W Sec. 2, 7, 8, 17, 18 Stambaugh Twp. Iron County	Natural	101		X	42 feet	Panfish Pike Trout	95% Mineral 5% Organic	Upland: Spruce, elm, poplar, maple. Aquatic: water lily.	Minimal influence from Great Lakes. Winds prevail westerly. Average ppt. = 29.99". Average snowfall = 68.2". Ave. temp. = 42°.	Public fishing site	58%	Hiking, canoeing, water-skiing, swimming, fishing, boating, hunting, ice fishing.
Gulliver Lake	T41N R14W Sec. 2, 3 Doyle Twp. Schoolcraft Co.	Natural with dam	837		X	28 feet (water level controlled)	Panfish Pike	60% Mineral 40% Organic	Upland: Hemlock, birch, cedar, elm, poplar, maple, spruce. Aquatic: none seen.	Great Lake influence high. Ave. ppt. = 29.57". Ave. snow = 69.2". Heaviest rain in June. Ave. temp. = 42°.	Municipal and roadside parks	76%	Fishing, hunting, boating, hiking, sunbathing, ice skating, ice fishing, water-skiing, swimming.
Lake Esau	T34N R8E Sec. 21, 27, 28 Presque Isle Twp. Presque Isle Co.	Natural	275			29 feet	Panfish Trout?	100% Mineral	Upland: Spruce, elm, hemlock, poplar, maple, oak, birch. Aquatic: none seen.	Some Great Lake influence. Ave. ppt. = 29.95". Ave. snow = 65.1". Heaviest rain in September. Ave. temp. = 43°.	Public fishing site	13%	Waterskiing, swimming, fishing, boating, hunting, hiking, sunbathing.
Gaylanta Lake	T30N R1E Sec. 22 Vienna Twp. Montcalm Co.	Natural	115			50 feet	Panfish Pike	85% Mineral 15% Organic	Upland: Elm, maple, birch, white pine, larch. Aquatic: water lily, cattail.	Minimal Great Lake influence. Ave. rain = 27.40". Ave. snow = 62.8". Ave. temp. = 43°. Heaviest rain in September.	Public fishing site	54%	Swimming, fishing, sunbathing, hunting, boating, ice fishing, canoeing.
Sapphire Lake	T22N R8W Sec. 9, 10, 15 Lake Twp. Missaukee Co.	Natural	264			8 feet	Panfish Pike	75% Mineral 25% Organic	Upland: Deciduous dominant, some spruce. Aquatic: bullrush, Sagittaria, willow.	Great Lake influence mild. Ave. rain = 28.25". Ave. snow = 65.1". Ave. temp. = 43.5°. Heaviest rain in September.	Public fishing site	66%	Waterskiing, swimming, fishing, boating, hunting, hiking, sunbathing, ice skating, ice fishing.
Big Brower Lake	T3N R10W Sec. 34 Courtland Twp. Kent Co.	Natural with dam	85	X	X	27 feet (water level controlled)	Panfish	90% Mineral 10% Organic	Upland: Deciduous dominant, some pine. Aquatic: Myriophyllum, cattails.	Great Lake influence high. Ave. rain = 31.5". Ave. snow = 69.4". Ave. temp. = 49°. Heaviest rain in September.	Public walkway	95%	Waterskiing, swimming, fishing, boating, hiking, canoeing, sunbathing, ice fishing.
Silver Lake	T1N R6E Sec. 21, 22 Green Oak Twp. Livingston Co.	Natural with dam	152	X	X	42 feet (water level controlled)	Panfish Pike	20% Mineral 80% Organic	Upland: Deciduous. Aquatic: Myriophyllum, Sagittaria, bullrush.	Minimal Great Lake influence. Ave. rain = 29.93". Ave. snow = 30.2". Ave. temp. = 49°. Heaviest rain in May.		92%	Waterskiing, swimming, fishing, sailing, boating, canoeing, hiking, ice skating, ice fishing.
Cooley Lake	T2N R8E Sec. 1 T3N R8E Sec. 35, 36 White Lake Twp. Commerce Twp. Oakland Co.	Natural	86			56 feet	Panfish Pike		Upland: Deciduous. Aquatic: Myriophyllum, Sagittaria.	Great Lake influence mild. Ave. rain = 30.86". Ave. snow = 34.7". Ave. temp. = 48°. Rain heaviest in May & June.	Public fishing site Public beach	95%	Waterskiing, swimming, fishing, boating, sunbathing, ice skating, ice fishing.

*Determined by an average of responses on questionnaire.



Figure 1. Location of Eight Lakes by County

The following eight lakes were chosen for this study: (see Figure 1)

1. Camp Lake, Iron County (Upper Peninsula)
2. Gulliver Lake, Schoolcraft County (Upper Peninsula)
3. Lake Esau, Presque Isle County (northern Lower Peninsula)
4. Gaylanta Lake, Montmorency County (northern Lower Peninsula)
5. Lake Sapphire, Missaukee County (northern Lower Peninsula)
6. Big Brower Lake, Kent County (southern Lower Peninsula)
7. Silver Lake, Livingston County (southern Lower Peninsula)
8. Cooley Lake, Oakland County (southern Lower Peninsula)

Definition of Terms

At this point, an attempt will be made to define a number of terms that will be used throughout the study and may require some clarification.

- a. Back lots - "Platted lots lying back of the frontage lands of a lake and therefore having no direct water access to the lake."⁵
- b. Backshore - the land shoreward from the limit of the beach.⁶
- c. Beach - the limit on the shore reached by the waves.⁷
- d. Commercial area - an area along a lake built up with commercial establishments.

⁵J. O. Veatch and C. R. Humphrys, Lake Terminology, Water Bulletin No. 14 (East Lansing: Department of Resource Development, Michigan State University, n.d.), p. 12.

⁶N. M. Bowers, K. C. McMurry, and K. M. Stahl, Lake Shore Inventory and Classification, Vol. 27 (Michigan Academy of Science, Arts and Letters, 1942), p. 339.

⁷Ibid., p. 338.

- e. Foreshore - the land lakeward from the waterline.⁸
- f. Front lots - "Platted lots fronting directly on a lake. Front lots are normally riparian unless certain or all riparian rights were reserved by the vendor."⁹
- g. Full development - a lake with almost all the usable shoreline developed with cottages and commercial establishments.
- h. Inland lake (Michigan) - interior bodies of water lying back from the shore and waters of the Great Lakes.¹⁰
- i. Intensive park - a highly developed park area consisting of many buildings and facilities such as rest rooms, bath houses, beaches, and concessions.¹¹
- j. Low development - a lake with few residential structures, no commercial establishments, with some docking areas and camp grounds.
- k. Moderate development - a lake with many residential structures and some commercial establishments.
- l. Muck shore - a shore composed of organic materials resulting in a soft bottom and beach area which is of poor quality for water-oriented recreation but ideal for wildlife habitats.

⁸ Ibid., p. 339.

⁹ Veatch and Humphrys, op. cit., p. 90.

¹⁰ Ibid., p. 109.

¹¹ C. W. Threinen, Suggested Long-Range Development of Camp Lake, Kenosha County (Madison: Wisconsin Conservation Department, 1964), p. 4.

- m. Private lake - a lake dedicated to the use of the landowners only, and one which lacks public access.
- n. Public lake - "A lake to which the public has legal access, and the right to use the water only, or both the water and the shore, for one or more purposes such as navigation, fishing and hunting."¹²
- o. Residential - built up with housing.
- p. Sandy or firm shore - the type of shore composed wholly of sand or gravel which is optimum for water-oriented recreation.
- q. Semi-Wild area - an area along the shore of a lake that has been developed into a picnic grounds or park without disturbing the original primitive-like condition.
- r. Shoal - the area of water less than 15 feet in depth.¹³
- s. Undeveloped lake - a lake without commercial or residential structures.
- t. Waterline - a line along the edge of the lake where land and water meet.¹⁴
- u. Wild area - "Land dedicated to game and fish production."¹⁵

¹²Veatch and Humphrys, op. cit., p. 179.

¹³Ibid., p. 204.

¹⁴Bowers, McMurry, and Stahl, op. cit., p. 338.

¹⁵C. W. Threinen, Some Spacial Aspects of Aquatic Recreation, Miscellaneous Report No. 6 (Madison: Wisconsin Conservation Department, 1961), p. 9.

CHAPTER II

THE USE OF PLATTING FOR LAKESHORE DEVELOPMENT

Many of the inland lakes in Michigan, especially in southern Michigan are subdivided into one or more plats covering a great deal of the shoreline along the lakes. There are both advantages and disadvantages to this procedure and the final appearance of the lake depends upon the success or failure of the platting methods on the lake.

The greatest advantage to the use of platting on inland lakes goes to the real estate man and other persons and agencies involved in analyzing descriptions of property. A subdivision is very easy to describe and assess for taxes since each lot is numbered. The landowner also benefits from this because he is able to see where his lot begins and ends without going through the time-consuming procedure of deciphering long metes and bounds descriptions.

The development of a subdivision is a very involved process since the plat developer must go through a series of 25 steps before the subdivision is legally recognized. The following is a brief synopsis of the Michigan Platting Act and the 25 steps required in subdivision development.¹⁶

The Michigan Plat Act (Act 172, Public Acts of 1929) applies when any lot or tract of land is divided or developed into five or more lots unless the

¹⁶Michigan Plat Law (Act 172, Public Acts of 1929).

land area is ten or more acres in size. Once divided in this way, it shall not be further divided into more than two additional parts. The following steps show the procedure required for plat development:

1. The proprietor or owner of the land parcel to be subdivided employs a registered land surveyor or registered professional engineer.
2. This surveyor performs a survey on the land to be subdivided and makes up the preliminary plat.
3. The proprietor then files a copy of this preliminary plat with the clerk of the local governing body and also with the county road commission if the land is in an unincorporated area. The proprietor is also required to submit any related information that is pertinent to the review of the preliminary plat.
4. The local governing body then holds a meeting to review the preliminary plat and make any necessary recommendations in writing that are applicable to the plat. The preliminary plat is then returned to the proprietor with the necessary recommendations. If the preliminary plat does not conform with the Plat Act, the local governing body may reject it at this time.
5. The surveyor or engineer makes the necessary changes and drafts a final copy with four identical copies.
6. The proprietor places the certificate of dedication and acknowledgment on the plat.
7. The proprietor secures a certificate from the county treasurer

showing whether there are any tax liens against the land embraced in the subdivision.

8. If the land to be subdivided is located outside the city limits, the proprietor must first deliver the five identical copies of the plat to the county road commission.
9. The road commission then either: (a) reviews the plat and approves it within 30 days, or (b) rejects the plat and gives written notice of such action to the proprietor within five days.
10. The proprietor then submits the plat to the clerk of each local governing body that has jurisdiction over the land to be subdivided and pays the required fee.
11. The clerk of the municipality presents the plat to the governing body at the next regular meeting.
12. The governing body approves or rejects the plat within 30 days after it is filed with the clerk. If rejected, a written notice and reasons for rejection are presented to the proprietor.
13. If approved, the governing body places a certificate of approval on the plat.
14. The clerk of the municipality delivers the approved plat with the fee of \$10.00 to the clerk of the county plat board.
15. The clerk of the county plat board calls a meeting of the plat board within ten days of the receipt of the plat.
16. If the plat appears to include land located within the city limits

or on county roads within the jurisdiction of the county road commission, the county plat board notes this fact and forwards the plat to the commission for approval.

17. The county road commission reviews the plat and returns it to the county plat board. If it rejects the plat, it gives its reasons in writing to the plat board.
18. The county plat board performs the required examination of the plat, approves it or rejects it, and returns it to the proprietor if it is rejected.
19. If approved, the county plat board forwards all copies of the plat to the Auditor General with the fee of \$10.00.
20. If the plat is located on an inland lake or stream, the Auditor General forwards it to the Department of Conservation for review.
21. If the plat includes land along a state highway, the Auditor General forwards it to the State Highway Department for review.
22. The Department of Conservation and/or the State Highway Department approves the plat and returns it to the Auditor General or rejects it and returns it to the clerk of the municipality with a written notice of rejection and notifies the Auditor General of such action.
23. The Auditor General approves the plat and certifies it or rejects it and gives reason to the proprietor within five days. If approved, the Auditor General forwards it to the county register of deeds.
24. The county register of deeds certifies the time recorded, liber

and page, and enters the plat on record. Along with the plat are recorded any building or other restrictions specified by the proprietor. The recorded copy is then filed and a certificate of recording is then sent to the Auditor General.

25. The Auditor General: (a) places the recorder's certificate on four copies and inscribes on these copies the Auditor General's certificate; (b) sends one copy of the plat to the county treasurer, one copy to the clerk of the municipality, and one copy to the county road commission or city planning board; (c) certifies a sixth copy and sends it to the proprietor if one has been furnished; and (d) sends the register of deeds a \$5.00 registration fee.

In general, it appears that much of the development on inland lakes tends to reduce public access in order to protect the privacy of the lot owner. Many lakes are completely surrounded with private subdivisions, and dedications on original plats often state that all roads and access points are dedicated to the use of lot owners alone. Once a lake is cut off from public use, the area loses its popular appeal, "deterioration sets in, and economic growth stops."¹⁷ This may be desirable or undesirable depending upon the position of the individual. The private land owners will, of course, favor this in order to keep his lake from an overcrowded condition, whereas the tourist will take the opposite point of view because he wishes a place for boat launching, swimming, and camping. In numerous

¹⁷ Resources and Recreation in the Great Lakes Region, U. S. Department of Agriculture Task Force Report, p. 63.

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instances, one can sympathize with the private land owner in this respect. Public access points are often in a degraded condition, parking becomes a problem, and property values may drop because of intense public use of a lake. Many lot owners near public access points have complained about this very thing. Complaints range from parking on lawns or in private driveways to uncontrollable littering around the premises.

Lake Esau in Presque Isle County is an example of this problem (see Plate I). A public launching site was recently opened on the west side of the lake. It is a fairly large area with plenty parking space and since the lake is relatively isolated, parking will probably not be a problem for some time. However, when the author visited the access point, its condition was deplorable. Beer cans and a great deal of other litter was strewn from one end to the other. Only one trash barrel was provided and it was lying on its side, its contents spilled over much of the area. Many of the land owners in the area complained bitterly about this and one person even contemplated relocating to another private lake.

On the other hand, if too many of the lakes are held in private hands only, the lakes with public access will become extremely overcrowded leading to very undesirable conditions. The ever-increasing population desiring access to lakes and lack of access to these lakes will seriously restrict the public use of Michigan's inland lakes. As the U. S. Department of Agriculture Task Force points out,

With the exception of [a few areas], publicly managed



Plate I. Rubbish-strewn access point on Lake Esau,
Presque Isle County, Michigan



Plate II. Private access only — Cooley Lake,
Oakland County, Michigan

high-quality recreation lake and stream shoreline is comparatively scarce. Therefore, as long as unplanned and unzoned development of private shorelines continues, it is imperative that such publicly owned areas remain open for public use — unrestricted by lease or by special use permit. If this policy is not enforced, and current private development continues in the manner of the past decade, it is likely that public access and enjoyment of the region's water resources will be seriously restricted.¹⁸

One of the most acute problems in subdividing may be blamed on the real estate company or development corporation. A real estate company that does the original platting is usually interested in developing as many lots as possible with access to the lake in order that they may have more lots to sell. Because of this, many lake subdivisions are improperly laid out with very small lot widths. In some locations, lots with 25-foot frontages are common. This of course leads to very overcrowded conditions unless the prospective buyer purchases more than one lot. If each land owner owns only one lot and builds a cottage on the lot, it can be seen how overcrowded a lake can become. In some cases, a plat will be laid out with extra lots developed along a canal dug by the original platter in order that each lot owner will have riparian property on the lake. In another case, such as is found on Silver Lake, Livingston County (see Figure 8), one large riparian lot will be dedicated as an exclusive park for the sole use of adjacent lot owners, thereby surrounding it on the shoreward side. Here again is an example of an undesirable platting method. Fortunately, most areas develop adequate zoning procedures to prevent such occurrences.

¹⁸Ibid.

Multi-tiered development is common on many southern Michigan lakes. In this case, all of the back lots on the lake will have either no access or access only by a walkway, a beach, or boat launching site.

The above-mentioned problems are slowly being met by means of lake improvement associations or rural community leaders. New zoning rules and other controls are being used to reduce such problems, but there is still a great deal to be accomplished.

Northern Michigan Development

In order to illustrate lakefront platting procedures used by large development agencies, Petticoat Lake in Baraga County, Michigan is used as an example. The Celotex Corporation of Chicago, Illinois has recently undertaken a large platting development on this Northern Peninsula lake. This development, which illustrates good planning and platting procedure, consists of approximately 200 front lots, each with a frontage of 100 feet. Every lot provides the owner with riparian rights to the lake and allows adequate area for cottage development. According to the brochure prepared by Celotex Corporation, the lots sell for \$2,000 and up. A limited number of "lake view" lots (back lots) are also available at lower prices. To provide access to the lake for these lot owners, a boat and swimming dock and beach are provided. This may cause some problems, but no details are available to substantiate this claim. The lake itself is 160 acres in size and at present does not appear to have any serious pollution or aquatic problems. Previous to 1963, the lake was inaccessible by road and hence was not used to any degree by the public.

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A number of restrictions have been established on this lake in order to prevent overdevelopment. Only single family residences are allowed. No commercial or industrial establishments are allowed and trailers and mobile homes are permitted only on the back lots.¹⁹ An attempt has been made to preserve as many of the natural characteristics of the area as possible by clearing away only the vegetation necessary for building summer homes. Celotex Corporation is also advertising cottages built to the owner's specifications.

In comparison to the usual lake community, the Celotex plat appears to have many of the qualities necessary for a desirable lake development and time will possibly tell how successful this will be. Since the area is relatively distant from population centers, it seems that development will be slow and overcrowded conditions will not occur for some time. The large lot sizes also provide low density use thus reducing the threat of pollution and enrichment by domestic wastes. Careful planning has assured that the scenic qualities of the shoreline will be maintained and the recreational potential of the lake will remain high.²⁰

Southern Michigan Development

In contrast to the well-planned development on Petticoat Lake, another development by a real estate firm has taken place on Lake LeAnn, an artificial lake in Hillsdale County. This development is typical of many

¹⁹ Celotex Corporation Brochure (Celotex Corporation, Chicago, Illinois), Advertisement.

²⁰ U. S. Department of Agriculture, op. cit., p. 64.

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southern Michigan lakes in the sense that lot sizes are small and multi-tiered, thus producing a high potential for overcrowded conditions. Eight large plats have been established, each with relatively few front lots and an extremely large number of back lots. Access to the lake by back lot owners is limited to a few private parks located along a number of the bays on the lake. The lot frontages are approximately 60 feet wide, and hence adequate room for cottage development is lacking unless two or more lots are purchased. Even the islands in the lake have been platted.

Although a number of building restrictions have been established for this development, no information is provided with respect to sewer facilities, water supply or other health standards. It appears, therefore, that this development has been poorly planned, and laid out solely for the benefit of the real estate company. It is very probable that before long this lake, like so many other southern Michigan lakes, will become overdeveloped and crowded with summer cottages, and a lack of adequate sewage facilities may cause pollution-enriched waters. Conflicts in recreational uses may also appear and controls will have to be initiated to prevent overuse.

The Development of Inland Lakes — A Historical Analysis

Inland lakes can be classed into three types based on their size:

small lakes being less than 100 acres in size, medium lakes being 100 to 1,000 acres in size, and large lakes being over 1,000 acres in size.²¹

²¹C. W. Threinen, An Analysis of Space Demands for Water and Shore (Madison: Wisconsin Conservation Department, 1964), p. 22.

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Small lakes are usually considered the least desirable for recreation and property development because they are generally surrounded by a boggy or marsh-like shore due to a lack of wave action. Medium-sized lakes may have some areas of good, well-developed beaches because of wave action. The beaches, however, are found only on the windward side of the lake where wave action is the greatest. The large lakes are, for the most part, considered optimum for recreation and property development because wave action is quite extensive, this allowing for well-developed beaches around the whole shoreline with the exception of sheltered bays or coves.²²

In general, it may be said that large lakes and some medium-sized lakes were the first to be used by the recreation-minded population. Since these lakes require little attention to the shoreline and most of the back-shore is relatively firm, cottage development is easily accomplished without the necessity of dredging and filling of shorelines at considerable expense to the property owner. When the demand for lake property increases, and the more desirable lakes become intensively developed, and lake frontage becomes scarce, developers will, of necessity, be forced to turn to the smaller, less preferable lakes.²³ This transition has already taken place to a great extent in southern Michigan where the demand for lake-front property is greatest. Northern Michigan's small lakes are still rather isolated and lack development.

²² Ibid.

²³ Lynch, op. cit., p. 337.

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From a historical standpoint, lake development can be classed into four eras or stages of development from the time of the white man's settlement in Michigan. C. W. Threinen, Administrative Assistant of the Wisconsin Department of Conservation, has very adequately outlined these eras as follows:

For an appreciation of the impact that this has on recreation it is well to take a hypothetical example through its historical evolution within the time of the white man. Such a picture is available in Wisconsin because of the large supply of lakes and varying distances of them from centers of population. The medium-sized lake has gone or will go through four distinct eras beginning with pre-settlement. In the first era when the wild shores were intact the fish and game use of the shores and littoral area was undisputed.

The second era may be termed the estate era because the entire shore or large parts of it could be held by a few individuals. There was little human pressure on the shoreline and fish spawning, wildlife and aesthetic opportunities remained intact. Public use opportunities were generally available because pressure was light.

The third era marked or will mark the transition of prime frontage into residential property on both large and medium-sized lakes. Large blocks of frontage cannot or will not be held because of increased tax burdens on the property and also the possibility of high returns on lot sales. This era marks some deterioration in aesthetic opportunities [sic] but much of the fish and wildlife habitat remains intact on the frontage of secondary value and the steep slopes are still not disturbed. Small lakes either go undeveloped or remain in the estate era.

The last stage in the normal evolution of human developments, assuming normal functioning of the free market is to ring the entire shore with human habitations and to provide improved shoreline which best serves the swimming and boating activities. This marks the passing of certain species of fish and wildlife, and the destruction of aesthetic monuments such as the bulrush stand or water lily bed — the most obvious symbols of a varied aquatic environment.

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The shoreline and shallow areas, usually considered the nursery grounds for fish and wildlife, are converted to a monotype of bare sand. As this occurs an increased rate of eutrophication may set in and water quality deteriorates, especially if fertile originally.²⁴

In reference to Michigan, it is probably true that lakes of the southern Lower Peninsula have entered the fourth era of development. All large and medium-sized lakes are intensively developed and many of the small lakes are even characterized by full development. Farther north, the lakes of the northern Lower Peninsula can be classed as being in the third era of development. It is true that many of the large and medium-sized lakes are developed either moderately or fully, but the small lakes are as yet quite free from human inhabitation.

The Northern Peninsula lakes, on the other hand, may generally be classed between the second and third era of development. For the most part, only the large lakes are developed to any degree with the exception of a few larger medium-sized lakes. In fact, many of the lakes in northern Michigan are still isolated from all access points and have been, for the most part, untouched by human hands. The small lakes in the Upper Peninsula are, almost without exception, free from development of any kind unless owned by one or two individuals. Many of these lakes are publicly owned and hence are open to public access because the desire for frontage is quite low.

²⁴C. W. Threinen, Some Spacial Aspects of Aquatic Recreation, Miscellaneous Report No. 6 (Madison: Wisconsin Conservation Department, 1961), p. 8.

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CHAPTER III

METHODOLOGY

From the large number of platted lakes in Michigan, eight were chosen to show recreational and property development trends. Of the eight lakes, only two were chosen to represent the Upper Peninsula, Camp Lake and Gulliver Lake, because of the lack of development in the form of platting and subdivisions in this northern area. Camp Lake in Iron County was chosen because, for its size, it is rather unique with respect to development. Almost the whole lake has been platted and some of the shoreline has been developed with either fishing and hunting shacks or good quality summer homes. This is rather unusual for a small Upper Peninsula lake since most of the small lakes are as yet undeveloped or are owned by one individual or by the state. Gulliver Lake, on the other hand, is somewhat typical of the larger Upper Peninsula lakes in the sense that it is developed with many nice summer homes.

Three lakes were chosen from the northern Lower Peninsula, and each of these lakes was chosen to show as many of the lake development characteristics common to that part of the state as possible. Lake Esau is in a near primitive condition, and is as yet in a state of extremely low shoreline development; Gaylanta Lake is in an area with a rather high demand for water-oriented recreation but it is one of the less desirable lakes;

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Sapphire Lake is in an area of high recreational pressure from people of Southern Michigan desiring to go north for their vacation. These lakes, when analyzed together appear to reflect a good share of the lake development problems common to the northern Lower Peninsula.

Of the three southern Lower Peninsula lakes, Silver Lake in Livingston County and Cooley Lake in Oakland County were chosen as representatives of the many undesirable patterns of lake development common to much of the highly populated Southern Michigan areas. Big Brower Lake in Kent County was chosen because of its ideal plat systematization, its shoreline being all within one section and being ringed completely with plats.

During a six-week period in June and July of 1965, investigations of these eight lakes were carried out by the author in as much detail as possible. During that time, the data from the Register of Deeds and Treasurer's offices with regard to lake platting was examined and obtained. Field studies covering such items as use, accessibility, public access, dredging or filling, upland and aquatic vegetation, and other general characteristics were undertaken at each lake. Photographs (see Plates I-XXIII) were also taken during the course of these field studies. Personal discussions were held with many property owners on the lakes regarding past and present problems associated with each lake. Questionnaires (see Appendix A) were sent to a random sample of property owners on each lake in order to determine their dislikes and preferences with respect to many lake development characteristics.

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The Register of Deeds and Treasurer of each county was instrumental in supplying plat names, lot numbers, frontages of front lots, and the assessed valuations of each lot on the lake in question (see Tables 4-11 in Appendix B). From this information, assessed front foot values of the developed and undeveloped lots on each lake were determined by a simple division of the assessed valuation by the frontage. The assessed front foot value was determined for each lot, each plat, and each lake as a whole. Back lots were not used in this study because of their varying influence on lake development trends. The importance of back lots in lake development is explained in Chapter V, however, but their actual analysis with regard to value and size analysis is beyond the scope of this study.

Figures 2-9 (Chapter V) are a series of sketches drawn up by the author in order to illustrate the eight lakes used in the study and the approximate locations of the various plats on the lakes. No claim is made with respect to the accuracy of the dimensions and lot sizes on these drawings since they are for illustrative purposes only. The source of these sketches are U. S. Geological Survey topographic maps (one inch per mile) and copies of the actual plats themselves. From the descriptions on each plat, their approximate location along the shoreline of each lake was determined.

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CHAPTER IV

NATURAL AND MAN-ASSOCIATED CHARACTERISTICS AFFECTING LAKES AND LAKEFRONT PROPERTY DEVELOPMENT IN MICHIGAN

Natural and man-associated characteristics are, of course, the determining factors affecting lake development. Without adequate planning and management of the resources of the lake area with respect to these natural and man-associated aspects, lake development problems may continue to increase considerably. The natural characteristics of a lake in part determine the aesthetic nature of the lake. These are extremely important virtues of any lake and should be maintained to the highest degree possible. On the other hand, man-associated aspects may or may not be desirable depending upon the degree of planning involved by the occupants of the lake area.

Natural Characteristics

Among the more important natural lake characteristics is upland and aquatic vegetation. There are many benefits as well as problems that may be associated with vegetation around and in a lake. Upland vegetation is generally one of the more aesthetically desirable aspects of any lake. A shoreline surrounded by trees and shrubs gives the lake a "wilderness" atmosphere that is desired by most people who live near the lake.

Upland Vegetation

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the lake shoreline. A pine, spruce, hemlock forest, or a white birch hardwood association characteristic of the sandy or sandy loam soil of the Upper Peninsula, are generally considered to be the most optimum upland vegetation types because of their beauty and wilderness-like nature. These types of forest cover are common on many of the most northern lakes. A deciduous forest cover may also be desirable, especially if the trees are large enough and provide a good deal of shade. This cover is common in the southern Lower Peninsula. A mixture of the two types of forest is found in the northern Lower Peninsula.

A good upland forest cover is not only aesthetically attractive, but also provides other benefits to the lake user. A stand of mature trees, for example, reduces the wind over a lake, thereby reducing wave action and allowing for more recreational uses on the lake even on windy days. The presence of a forest cover, therefore, will prevent excessive wave action, supply refuge and feeding areas for game fish, and prevent excessive evaporation from the lake surface.

Many lakefront property developers make the mistake of cutting too many of these trees when developing a subdivision. They pay no regard to the possibility of erosion and filling-in processes that may occur as a result of this cutting. It is true that in building, some of the upland vegetation must be removed; however, the aesthetic benefits as well as the problems associated with their removal should be taken into account before wholesale cutting and removal is accomplished.

There are a number of disadvantages associated with an upland forest cover. If the land around the lake is swampy in nature, the mosquito problem may develop to such a degree that the conservation of the forest cover may be a disadvantage rather than an asset. Also, the lack of wind on a lake due to heavy forest cover reduces the wave action necessary for the self-cleaning process of the waves on the shoreline, thereby leading to a more rapid deposition of inorganic and organic materials that fill in the lakeshore. A lack of good beaches and swimming areas may be a partial result of this, especially on the windward side of the lake where no wave action is developed at all and mucky shorelines are present; however, this may be a good wildlife habitat area. A good stand of terrestrial vegetation produces more advantages than disadvantages, however, and the benefits overrule the disadvantages. As the Wisconsin State Planning Board says, "Lake management, therefore, implies that conservators of lakes must also be conservators of forests, and assist in protecting and replacing forests on open and wind-beaten shores."²⁵

Aquatic Vegetation

There are many controversies regarding aquatic vegetation. The swimming, boating, and waterskiing enthusiasts desire a lake free from aquatic vegetation because of its interference with these activities, whereas the hunter and fisherman desire aquatic plants for game and fish habitats. Fish and game habitats, of course, are among the more important attributes of aquatic

²⁵ Wisconsin State Planning Board, Inventory of Northern Wisconsin Lakes (Madison: Division of Land Economic Industry, 1939), p. 19.

vegetation. Most game, fish, and waterfowl require many species of aquatic plants as a source of food and as a place for nesting and propagation. The sportsman will benefit from this type of lake because of an increase in fish and game production brought about by this natural habitat.

Aquatic plants are commonly considered as one of the greatest problems associated with lake developments. Their control and eradication is one of the foremost concerns of the majority of lake property owners. The aquatic weed problem is one of fairly recent origin on many lakes and may be attributed in part to the increase in population and use of the land. As F. F. Hooper says,

Weed problems in the early days were probably not at all what they are today. Intense cultivation, the addition of fertilizers, and the disposal of waste through septic tanks all tend to charge our . . . waters with nutrients.²⁶

In other words, the lake itself is not the sole producer of many of the nutrients necessary for the intense development of the aquatic weed problem, although plants may be present in a lake without outside enrichment. Runoff from farm lands and surrounding soils, along with inefficient waste disposal practices are the main factors involved in this problem since Michigan soils alone are not exceptionally rich in the essential nutrients such as nitrogen and phosphorus compounds.²⁷

²⁶W. S. Siefert et al., Aquatic Weeds and Their Control (n. p., no pub., n. d.), p. 1.

²⁷Ibid.

Aquatic plants may be classed into higher aquatic plants and algae. Of the higher aquatic plants, the submerged type is usually not as undesirable as the emergent type which commonly clogs shorelines to such a degree that use of the lake from the shore is practically impossible. Algae are often responsible for dense blooms, toxic by-products resulting in fish kills or odors, and other aesthetically undesirable characteristics.

Aquatic weeds are thus one of the main problems interfering with water-oriented recreation and lakefront property development. As can be seen from Table 1, the most desired recreational values on lakes are swimming, fishing, boating, waterskiing and aesthetics. All of these are modified at least to some degree by a high concentration of aquatic plants. For the fisherman, aquatic plants may be either desirable or undesirable depending upon the concentration. A large concentration may cause a condition of stunted growth of fish. This condition is especially common with bass, bluegills, sunfish, and perch. With a considerable number of stunted fish, the food supply in the lake is seriously diminished for the larger fish resulting in an over-population of fish under the legal size.²⁸ Sapphire Lake in Missaukee County is a good example of this. The lake is very shallow and since the photosynthetic property of the sunlight is useful all the way to the bottom of the lake, aquatic plants, both submerged and emergent, grow in large numbers. As a result, due to the concealment and food supply produced by these aquatic plants, the fish in the lake are extremely runty and stunted. This was one of the

²⁸Wisconsin State Planning Board, op. cit., p. 18.

main complaints received by the author on the questionnaire sent out to Sapphire Lake property owners.

Swimming, boating, and waterskiing are, of course, limited to a great extent by a large buildup of aquatic plants, especially along the shoreline. Beaches are ruined and become mucky, the lake bottom becomes filled with silt and organic debris, and motors on motorboats become clogged with weeds. This condition appears to be especially true in the southern Lower Peninsula lakes; Silver Lake, Livingston County (see Plate III) and Cooley Lake, Oakland County are examples of this situation.

The filling in of lakes is also related to plant growth since plants are capable of collecting and holding fine silt particles and organic debris from dead and decaying plants and animals. Rather than being washed away, much of this material settles to the bottom where it is held in place by the roots of the aquatic plants. This material also contains nutrients that become available for further plant growth by recycling, thereby leading to a worsening condition.

Once heavy concentrations of aquatic plants have developed to any extent on the lake, control measures must be taken. The use of chemicals such as copper sulfate for killing off aquatic plants and algae, and rotenone to eradicate stunted fish is rather extensive for this purpose. The application is usually a costly procedure and is successful only when applied by experienced personnel. Following the treatment, unless extensive preventive measures are taken, the problem may rapidly recur. Effective



Plate III. Weed-choked shoreline of Silver Lake,
Livingston County, Michigan



Plate IV. Low water levels — Cooley Lake,
Oakland County, Michigan

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sewage disposal systems, controlled application of fertilizers, and erosion control are probably the best preventative measures that can be used.

Of the eight lakes used in this study, only Gulliver Lake, Schoolcraft County, and Lake Esau, Presque Isle County appeared to be relatively free from aquatic weed problems. This was especially true of Lake Esau where the lake bottom appeared to be composed wholly of a sand and gravel mixture. Myriophyllum appeared in Gulliver Lake in a few areas, but the concentration was not built up to any great extent. Since Lake Esau is only about 13 percent developed at the present time, this weed-free condition will probably continue for some time until the lake becomes enriched with nutrients from septic tanks or other uses of the land surrounding the lake. Presently, however, since there is so little property developed, this source of eutrophication is probably very slight. (See Plate VI.) Gulliver Lake, on the other hand, is about 76 percent developed and effluents or fertilizer runoff, if allowed to enter the lake, may produce some undesirable weed problems in the future.

Of the remaining six lakes, Cooley Lake, Oakland County and Silver Lake, Livingston County are burdened with the greatest aquatic plant problem. This condition is probably brought about by intensive land use around the lakes and the high shoreline development of the lakes themselves. (See Plate V.) The main complaint from property owners referred to this problem and to the resultant muck shoreline and lake bottom. At present, steps are being taken in both lakes to remove this vegetation



Plate V. Characteristic full development on Michigan's Lower Peninsula lakes.



Plate VI. Characteristic low development on Michigan's Upper Peninsula lakes.

and improve the shore and bottomland in order to restore the lakes for more intensive recreational and aesthetic uses.

In summary, it may be stated that inland lakes in Michigan with high property development and land use adjacent to the lake appear to be plagued with aquatic plant problems, whereas lakes without development or with a sparse development have fewer problems. Other factors such as soil type, water level, lake location, and water quality also play a part in aquatic weed development, but land use involving the addition of nutrients favorable to plant growth appears to be the main causative factor.

Aquatic Fauna and Associated Problems

The availability of high quality fishing and fish problems, as has been mentioned before, have caused numerous complaints among property owners on Michigan lakes, especially in the southern Lower Peninsula. Much of this problem has been associated with aquatic plant over-development but many property owners claim that excess fishing and winter spearing have also lowered fish populations on many lakes.²⁹ Every lake used in this study has been affected by diminishing fish populations or by over-population of stunted fish. Restocking procedures have been developed to a great extent by the Michigan Department of Conservation. One example of this was the poisoning of Reeds Lake, Grand Rapids, Michigan with rotenone and the subsequent restocking of the lake with trout, Northern pike, and bass. However, this problem is so extensive

²⁹ Camp Lake, Sapphire Lake, and Big Brower Lake questionnaire response.

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in the state that a complete restocking program cannot be satisfactorily initiated. This procedure was paid for in part by the landowners and the Michigan Department of Conservation. Many complaints were received by the author from property owners desiring more and larger fish in their lakes. A great many of these people, however, do not seem to realize the cost and procedure involved in this process and thus are really not in a position to criticize. One big problem that has developed is the intrusion of rough fish, especially carp, into many Michigan lakes. Here again the prevention of overenrichment of the lake would be a good control method for these rough fish.

Aquatic invertebrate pests have caused problems on many of Michigan's lakes, the more prevalent being swimmer's itch, mosquitoes, and leeches.

Swimmer's itch, an infestation of an area of a lake with certain larval trematode worms (schistosome cercariae) that have emerged from a population of snails, is a very irritating problem to bathers of that lake. The cercariae, a parasite of certain birds and mammals, depend upon the snail as an alternate host for their development. Upon emergence from the snail host, they become free-swimming and seek to locate an adequate vertebrate into which they penetrate for completion of their life cycle. This life cycle may be interrupted by the human swimmer with the penetration of the cercariae into the skin of the bather, resulting in an inflammatory skin reaction causing a burning and itching sensation. This condition can be very annoying to the swimmer for a period of up to a week.

Infestation of these cercariae commonly appear during the summer months in the warmer water along the sandy areas of the shore of the lake. These areas are, of course, the most desirable swimming spots and thus the swimmers are subjected to attack and penetration by the cercariae.³⁰

Many very desirable recreation areas may be shunned as a result of this problem even though the infestation may last only for a few days. This problem appeared in 1964 in Gulliver Lake, Schoolcraft County, and the resort on the lake lost popularity for some time as a result. The Michigan Conservation Department stepped in when the problem appeared and corrected the condition by chemical means.

Mosquitoes have long been a problem in lake areas especially in southern Michigan. Since most mosquitoes breed in still water, the shallow edges of lakes with a great deal of emergent aquatic vegetation serve as perfect habitats for them. As Mackenthun, Ingram and Porges of the United States Department of Health, Education and Welfare say,

The mosquito production of a lake or reservoir appears to be directly proportional to the amount of intersection line between plants (or flottage) and the water surface. Likewise, the relative mosquito production potential of different plant types is in direct proportion to their relative amount of intersection line per unit area of water surface, other factors remaining equal. Situations with an abundance of intersection line provide mosquito larvae with food and natural protection from enemies and also

³⁰U. S. Department of Health, Education and Welfare, Limnological Aspects of Recreational Lakes (Cincinnati: Technical Advisory and Investigations Section, Technical Services Branch, Division of Water Supply and Pollution Control, Robert A. Taft Sanitary Engineering Center, 1964), pp. 106-118.

furnish adult mosquitoes with an ideal environment for the deposition of eggs.³¹

On many southern lakes all mosquito habitats are sprayed in spring and fall to prevent their reproduction and this has proved to be quite successful. Removal of aquatic plants, especially the emergent type, along shores of a lake also plays a part in the reduction of the mosquito population.

Leeches are more of a nuisance than of a parasitic nature. Almost all lakes have some problems with leeches but they are usually not of the blood sucking variety. Many ideal recreational areas are avoided by the public because of their repulsive nature even though they rarely cause problems.

Other Natural Characteristics of Lakes

Receding water levels in the past few years in Michigan have been a source of many inland lake development problems. Decreasing water levels may be either of natural or man-made origin. Lack of precipitation, unsealed lake bottoms, and rapid evaporation are three main natural causes that may produce a drop in water level. Drainage structures and over-pumpage are generally the two main artificial methods for lowering water levels.

There are many effects of drops in water levels on a lake. Muddy bottomland and exposed and decaying vegetation is one result with serious consequences to the property owner. (See Plate IV.) Beaches are ruined

³¹Ibid., p. 98.

for swimming and other recreational uses, aesthetic values are decreased, and odors are produced by the decaying vegetation. Much lakeshore development is geared to the water level present at the time of building. With lowering water levels, docks become exposed, sedimentation increases, water sport possibilities are reduced, launching areas are ruined, and many aesthetic values are lost. Unsanitary conditions along the shoreline abound and afflictions such as ear and eye infections may increase.³² The problem is especially acute on lakes with many shallow bays and inlets. In this case, much more bottomland will be exposed resulting in more muck and decaying vegetation on the shoreline. Property values are also adversely affected by falling water levels. Considerable sums of money are required to clean up the condition and anyone trying to sell his property will have to take a significant loss due to this situation.

Of the eight lakes used in this study, only three have not experienced water level problems. Of these three, Gulliver Lake, Schoolcraft County, and Big Brower Lake, Kent County, have formerly had problems but have since added water level control structures to correct this. (Plates VII and VIII.) These structures have met with good success and the property owners appear to be pleased with the results. Lake Esau, Presque Isle County, is the only lake that has maintained a fairly stable water level without artificial correction.

³²Cooley Lake questionnaire response.



Plate VII. Water level control structure, Big Brower Lake, Kent County, Michigan



Plate VIII. Water level control structure, Gulliver Lake, Schoolcraft County, Michigan

Of the lakes that have been affected, Silver Lake, Livingston County, and Cooley Lake, Oakland County, appear to be the most seriously affected. (Plate IV.) Three years ago, a gravel company dug a number of very deep excavations near Silver Lake. Apparently the lake does not have a sealed bottom and water has seeped through into the gravel excavations. Water from the lake is also used for gravel washing operations and is then diverted into streams running away from the lake. Many property owners have complained excessively to the gravel contractors, apparently without success. As one property owner wrote,

The water level situation is extremely critical. Complaints to the gravel excavation contractor have no effect. Their very deep excavations are much too near our lake and they are apparently continuing along a route that appears to be sure to aggravate the situation. They divert surplus water [sic] to streams that flow in the other direction — where a portion of that water, we believe, could be directed into Silver Lake.³³

Steps are presently being taken to correct this situation by legally forcing the gravel company contractor to modify their operation.

Cooley Lake has had water level problems that seem to stem from natural causes — lack of precipitation and evaporation. Much of the shoreline has been exposed to some degree and many unsightly areas are in evidence (see Plate IV). The western quarter of the lake has, in fact, become isolated because of this considerable drop in water level. Boat traffic, which is quite prevalent on this heavily populated lake, has become dangerous because of lack of water depth in many parts of the lake.

³³ Silver Lake questionnaire response.

Swimming rafts have been moved farther out into the lake, thus reducing the surface area even more. Waterskiing is limited to an area 300 feet in width due to this lack of space, and other recreational interests have also been debased to a considerable extent. Swimming, for example, can take place only from a raft out in the lake due to the exposed muck bottomland.

Many property owners have become alarmed at this condition and have since contracted to clean the lake out by means of dredging, although this procedure will not correct the low water level.

Sedimentation, another natural problem of lakes, may be caused either by precipitation of chemicals such as salts, borax, calcium carbonate, and others, by erosion of the shoreline, or by dead and decaying plant and animal material.³⁴ This problem is especially acute on older lakes where plant life has had the time to develop extensively or on lakes with water of high mineral content. Plants die, sink to the bottom of the lake and decay. Much organic debris is released by this process and since it is held in place by other plant life, produces a marl, muck, or peat bottom. This condition is very undesirable for many water-oriented recreational uses such as swimming and wading due to the fact that the bottom becomes soft and unstable. Erosion, another factor of sedimentation, may be natural due to wave action on the shoreline of the lake, by overuse of the land, or by unwarranted cutting of the shoreline vegetation.

³⁴I. D. Scott, Inland Lakes of Michigan (Michigan Geological and Biological Survey Publication No. 30, 1921).

The nature of the shoreline is an important determining factor in the riparian and recreational uses of a lake. Depending upon the recreational use of a lake, a deeply indented shoreline or a shoreline without any significant bays or inlets may be most desirable. As C. H. Burton sums it up,

The nature of the shoreline is of more than passing interest for it is tied in closely with the relative value of the reservoir for recreation. Aside from aesthetic considerations, the lack of any significant bays, inlets or islands can be a detrimental factor influencing boating use, in that no protection is offered from any of the prevailing winds. This also increases shoreline erosion. An irregular shoreline offers considerably more scope for the development of a park and more frontage is available for other riparian uses. From the standpoint of water sports, a deeply indented shoreline can be an advantage in that there is a quicker warming of the inlet waters to a degree suitable for use.³⁵

Some disadvantages are also associated with a shoreline composed of many bays and inlets. Since there is more shoreline frontage for riparian uses, there is a tendency to utilize this land for cottages or other uses. This is especially true if the lake is rather small because it can lead to overcrowding, user conflicts and other associated problems. Related to this is the fact that numerous shallow inlets tend to develop stagnant conditions resulting in heavy plant growth and mosquitos. Decreasing water levels will produce unsightly conditions in these areas by exposure of soft bottom and decaying aquatic plant life.

Natural characteristics of lakes, then, are important in determining

³⁵Burton, op. cit., p. 19.

the pattern of development. They may vary to a large degree from lake to lake and area to area. Good lake management, therefore, must consist of careful consideration of natural characteristics and problems in order that optimum development of the lake shore as well as of the lake itself can be obtained and the merits of the lake maintained in their optimum condition.

Man-Associated Characteristics

Perhaps of more importance than the natural features of a lake are the man-associated characteristics affecting lake development patterns. Man has greatly modified many features of lakes and, in fact, has occasionally introduced factors that influence natural problems.

There are many man-associated features of lake development, some of which may cause very serious lake use problems and others that may improve the quality of the lake for both recreational and developmental purposes. In this section, an attempt will be made to delineate a number of the more important of these man-associated characteristics and to explain their significance and relation to lake development.

Carrying Capacity

The carrying capacity of a lake is an extremely important lake feature relating to its development. Carrying capacity is the measure of the capacity of the lake for all recreational and developmental uses. A given lake may have a considerable number of uses — waterskiing, boating, fishing, cottage development — and all of these uses, when put together,

determine its carrying capacity. The size of the lake and the intensity of use are the two main limiting factors. A small lake with many uses has a very low carrying capacity since space is limited for all of these uses. However, if this small lake is in a state of low development, it may be of sufficient size to support all of the uses without any dissensions between them. A large lake, on the other hand, even if intensively developed, may be of sufficient size to permit all of the uses without any conflicting problems. As a rule, the smaller the lake, fewer uses are compatible unless it is not highly developed. Hence a larger lake may be able to adequately support all water-oriented recreational uses and a small lake, if intensively developed, may be able to support only one of these recreational uses, and even this one use may have to be limited.³⁶

User Conflicts

Closely pertaining to carrying capacity is the user conflict problem — a problem that has increased considerably over the past few years with an increase in population, leisure time, and accessibility. A user conflict may be defined as a clash or discord between the various recreational or developmental uses of a lake. For example, a fisherman wants a relatively quiet area free from motorboats and waterskiers whereas a high-speed motorboat operator and waterskier desire much of the lake's surface.

³⁶Michael Chubb, "Outdoor Recreation Land Capacity: Concepts, Usage, and Definitions" (unpublished Master's thesis, Department of Resource Development, Michigan State University, 1964).

(See Plate X.) This clash between these two uses often leads to arguments and perhaps even severely dangerous conditions. The relation between this problem and carrying capacity is close because a lake, geared to the correct carrying capacity will very likely not experience user conflicts whereas an overcrowded lake will experience the problem simply because of lack of space.

Traffic and Accessibility

Lake accessibility, within the past few years, has proven to be one of the main factors in the rapid shoreline development and use of many lakes, even Northern Peninsula lakes. Ten years ago, much of the Upper Peninsula was unaccessible by car and consequently, many of the lakes remained undeveloped. With the continued improvement of state highways and secondary roads, people are no longer required to spend long hours on the road to get to a northern lake. Many lakes, therefore, formerly untouched, are now being developed, and this trend appears to be continuing.

Because so many lakes are reaching the full and intensive development stages, traffic problems around lakes are increasing. Many cottage owners complain of parking problems around their property, especially near public access points. There is also high speed driving along roads encircling lakes and near public bathing areas. This poses a potentially dangerous problem to small children and even adults. Many complaints from cottage owners along Big Brower Lake, Kent County, and Camp Lake, Iron County, were received regarding this problem.



Plate IX. Intensive development on Cooley Lake,
Oakland County, Michigan

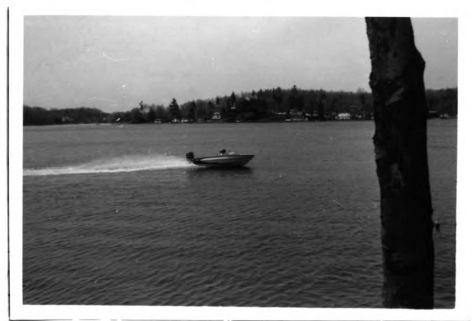


Plate X. High speed outboard motorboat — one of the
main complaints related to user conflicts.

Waste Disposal and Pollution Problems

One of the greatest man-associated problems on Michigan lakes is the problem of waste disposal and pollution. Almost all lake cottage development, as intensive as it may be, utilizes septic tanks as a means of waste disposal. On some lakes with well-drained sandy soils, this may be a very efficient means, and no problems may be encountered; on crowded lakeshores with poor soil conditions, the waste disposal problem can lead directly to a rapid degeneration of the lake in both water quality and the buildup of aquatic weed populations and algae blooms.

A septic tank, when first installed, is generally quite an efficient means of waste disposal. However, since little or no attention is generally paid to the system until it overflows, much of the effluent may leak out, totally untreated, and drain into the lake. High nutrient concentrations and possible dangerous bacteria and viruses accompany this effluent into the lake resulting in waters potentially dangerous for swimming and other water sports. Aquatic plants rapidly pick up the nutrients and before long, dense accumulations of aquatic weeds and algae may run rampant. This shows the increasing necessity of newer and more efficient means of sewage disposal. Probably the best and most feasible method would be the installation of central sewage disposal systems for all lake developments. In this way, an efficient means of disposal can be achieved and lakes can be maintained and kept free from overenrichment and resultant eutrophication.

Cottage Development

Cottage development on inland lakes may vary from a few fishing and hunting cabins which may be found in the Upper Peninsula to multi-tiered development patterns similar to some Southern Peninsula lakes. (See Plates XI and XII.) Many problems are associated with cottage development such as overcrowding, lack of zoning, encroachment on lake shorelines, lakefront accessories, and lot sizes, to name a few. All of these could be eliminated with adequate planning and management.

Overcrowding is the most serious problem that has been plaguing Michigan lakes for many years. Cottages built on small lots may be squeezed together to such a degree that the natural beauty of the entire shoreline of the lake may be ruined. (See Plates V and IX.) In many cases this is true not only for front lots but also for tier upon tier of back lots. Stemming from this are problems of overuse of the lake itself by exceeding the carrying capacity of the lake with resultant user conflicts. Lot sizes play a big part in this problem. Too often, developers, being unaware of this situation, design lots with frontages of 50 feet or less. Unless the buyer purchases two or more lots, which rarely happens, overcrowded conditions become eminent.

On many lakes, one may find a large, expensive summer home flanked on both sides by fishing shacks or small, unkempt trailers. This condition, due to inadequate zoning or plat restrictions, may be both unsightly and unappealing.



Plate XI. Small shacks and cabins typify many of the smaller Upper Peninsula lakes



Plate XII. Overcrowded conditions on southern
Lower Peninsula lakes

Every cottage owner requires additional waterfront accessories to fulfill his personal recreational desires. These accessories may take the form of boat docks, boat houses, rafts or boats, swimming ladders, walks, breakwaters, lawns, and innumerable other facilities.³⁷ The shoreline of a lake may become completely modified by a congregation of these accessories with a resulting congested shoreline condition.

Commercial establishments are commonly found on the more intensively developed lakes. (See Plates XIII and XIV.) Gas stations, grocery stores, bars, boatyards, and resorts are common. Many cottage owners feel that much of the commercial development, with the exception of a service area or two, is unnecessary especially on a lake that is excessively used for recreation and private summer home development. Commercial areas on a lake may tend to allow for shabby development and draw too much of the public sector into an area that may already be overdeveloped.

Dredging and Filling

Dredging and/or filling is a method commonly employed by many lake property owners to either improve their beach, reduce erosion, or, in some cases, to enlarge their property size. In some instances dredging and filling, used as a method of improvement is warranted especially if the shore and lake bottom is of an organic or marl nature and beach improvement is necessary. (See Plate XV.) On the other hand, some property owners extend their property lines out into the lake with the use of a sand

³⁷ All lakes, questionnaire responses.



Plate XIII. A summer resort on Gulliver Lake,
Schoolcraft County, Michigan



Plate XIV. A row of commercial establishments (commercial
area) on Cooley Lake, Oakland County, Michigan



Plate XV. Filling of lake shore with rocks on Big Brower Lake, Kent County, Michigan

or rock fill. This is a highly undesirable and now an illegal practice since the shoreline of the lake becomes so unnaturally modified. Artificial filling not only robs the lake of its natural beauty, but also tends to deprive other lake users of their rights to the surface waters of the lake. Stringent laws and strict enforcement are necessary in this case. Dredging and filling may be accomplished in many instances where the use of such a procedure is warranted but wholesale dredging and filling resulting in objectionable modification of shorelines is not sanctioned.

Management Problems

Good lake management implies careful consideration of all of the above natural and cultural characteristics and problems of lake developments and the use of all techniques and control measures necessary to

maintain adequate and efficient lake development. On an undeveloped lake, techniques such as zoning, control and limitations on property size and location are probably the best possible methods to develop a lake consistent with all uses. On a developed lake, controls on recreational uses may be employed to prevent overuse and user conflicts, and additional research may be required to reduce or arrest other lake problems.

CHAPTER V

AN ANALYSIS OF EIGHT LAKES USED AS EXAMPLES OF LAKE DEVELOPMENT CHARACTERISTICS IN MICHIGAN

Table 1 describes many of the general characteristics of the eight lakes used in this study. There are, however, a number of features that must be explained in more detail in order that a more accurate picture of each lake may be attained. It is the purpose of the following section, therefore, to describe these features.

Camp Lake, Stambaugh Township, Iron County, Michigan

This 101-acre lake is a rather small but very beautiful Northern Peninsula lake. It is located in the western part of Michigan's Upper Peninsula only a few miles from the town of Iron River, Michigan. Much of the property on the lake is of a private nature, but the presence of a public fishing site (see Plate XVI) enables launching privileges for the public. As a rule, however, the lake is not overly used by the public because of its "out of the way" nature. It is accessible by means of a graveled county road which encircles much of the lake. Most of the property owners are from Michigan although there are a few from states as far away as Florida and Arizona. The owners from Michigan are mostly from the Upper Peninsula and generally use the lake in a seasonal manner. The most intensive use of the lake is in the summer months but some use is made



Plate XVI. Public access point on Camp Lake,
Iron County, Michigan



Plate XVII. Public park on Gulliver Lake,
Schoolcraft County, Michigan

during the fall hunting season. The basic recreational trends are water-skiing, boating, fishing, and hunting during the summer and fall, and ice skating and ice fishing during the winter months.³⁸ Since the lake is, as yet, a little more than half developed with cottages and other structures, much of the shoreline has remained wooded and serves as the greatest attribute to the lake.

Gulliver Lake, Doyle Township, Schoolcraft County, Michigan

This 837-acre lake is the largest lake used in this study. The lake is located near the town of Manistique, Michigan, in the east central part of the Upper Peninsula. There is ample public access to this lake in the form of parks, launching sites, walkways, and resorts, although many of these access points, especially the parks, are rather run down in nature. (See Plate XVII.) The majority of the lakeshore is developed with summer homes and cottages and most of the property owners are members of the Gulliver Lake Property Owners Association, through which most of the improvements on the lake are made. Access to the lake is easy, being in the form of a paved county road that leads directly from highway U.S. 2, the most frequently traveled highway in the Upper Peninsula. Public pressure is, therefore, quite heavy in the summer months. The property owners are from the Midwestern states, Michigan, Illinois, and Indiana. Of the owners in Michigan, many have permanent homes on the lake since the access is so easy. The remaining owners use the lake during

³⁸ Camp Lake questionnaire response.

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the summer months only.³⁹ The cottages on the lake are generally of quite high quality, and no fishing shacks or other small structures were observed. The primary recreational activities on the lake consist of waterskiing, swimming, fishing, hunting, and boating in the summer months, and ice skating and ice fishing in the winter.

Lake Esau, Presque Isle Township,
Presque Isle County, Michigan

This 275-acre lake is located about 40 miles south of the city of Cheboygan, Michigan, just inshore from Lake Huron. It is undoubtedly one of the most beautiful lakes in Michigan's northern Lower Peninsula since most of the shore is as yet undeveloped and in a wooded state. The lake itself appears to be almost virtually free from aquatic vegetation and the beach is composed of clean sand and gravel. The development that is present is all private with the exception of a boys' camp (see Plate XVIII) and a recently opened launching site. Public pressure is probably extremely light because access to the lake is very difficult, the roads being no more than rutted sand and gravel trails. The property owners are all from Michigan and use the lake only on weekends and in the summer months.⁴⁰ Winter use of the lake is limited since access is impossible by car during the winter. Many of the existing structures on the lake are of a small, cabin-like nature, although some modern, summer cottages are now being built. The basic recreational trends on the lake

³⁹ Gulliver Lake questionnaire response.

⁴⁰ Lake Esau questionnaire response.



Plate XVIII. Protestant Church-sponsored boys' camp on Lake Esau, Presque Isle County, Michigan



Plate XIX. A private campsite on Gaylanta Lake, Montmorency County, Michigan

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are swimming, fishing, boating, and hunting. Problems relating to user conflicts are non-existent at the present time since the lake is so isolated and only 13 percent of the shoreline is developed.

Gaylanta Lake, Vienna Township,
Montmorency County, Michigan

This 115-acre lake is located in the northeast central part of Michigan's northern Lower Peninsula. The lake appears to be quite eutrophic in nature due to the presence of many submergent and emergent aquatic vegetation along the shoreline. Most of the lakeshore property is in the hands of private owners with the exception of one fairly large access point. Little of the property is developed with permanent structures due to the fact that taxes are extremely high and lack of water supply is critical.⁴¹ Wells must be dug to depths greater than 200 feet before any water is obtained. Much of the shoreline is heavily wooded, and trailers and tents are common. (See Plate XIX.) The lake is accessible by means of a graveled county road that completely circles the lake. Most of the property owners are from Michigan and use the lake during the summer months only. Fishing, hunting, and boating are the main recreational activities on the lake. Since the lake is so lightly developed, the use pressure, both public and private is minimal.

Sapphire Lake, Lake Township,
Missaukee County, Michigan

This 264-acre lake is located in the southwest central portion of

⁴¹ Gaylanta Lake questionnaire response.

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Michigan's northern Lower Peninsula. The lake is extremely shallow, its deepest spot being only eight feet in depth.⁴² Consequently, much of the lake bottom is exposed to the photosynthetic properties of the sun; the entire lake bottom is thus in the littoral zone and covered with vegetation. About two-thirds of the shoreline is developed with private cottages and one public access point is located on the south side of the lake. Much of the developed portion of the lake is private. Most of the property owners are from Michigan and use the lake for the most part during the summer months only.⁴³ There are few permanent homes, but the ones that are present are of high quality. A state highway is the only public access route to the lake, and this access is limited to the southern edge only. The remaining roads around the lake are private and dedicated to the use of lot owners only. (See Plate XX.) The lake is quite heavily utilized for recreational activities such as waterskiing, swimming, and fishing, although they are limited to a considerable degree by the aquatic plant problem. During the winter, the lake is used to some extent for ice fishing and ice skating.

Big Brower Lake, Cortland Township,
Kent County, Michigan

This 85-acre lake is located about ten miles north of Grand Rapids in an area of many small highly developed lakes. Almost all of the lakefront

⁴²C. R. Humphrys, Michigan Lake Inventory Bulletin No. 57 (East Lansing: Department of Resource Development, Michigan State University, 1962), p. 57a.

⁴³Sapphire Lake questionnaire response.



Plate XX. Private development on Sapphire Lake,
Missaukee County, Michigan

property is developed with homes and cottages. The only public access is in the form of two walkways, 15 feet in width but lacking car or trailer access. (See Plate XXI.) Most of the property owners are from the Grand Rapids area and many of the homes are of a permanent nature. The Brower Lake Cottage Owners Association is active in improvement work on the lake. Access to the lake is easy; well-kept, paved, county roads service the entire area. Many well-kept lawns grace the lakefront but there is an almost complete lack of swimming beaches. The primary recreational activities are waterskiing, swimming, fishing, and boating during the summer and ice fishing during the winter.

Silver Lake, Green Oak Township,
Livingston County, Michigan

This highly developed 152-acre lake is located about 30 miles north of Ann Arbor. It is of natural origin and has a dam to control its water level. Aquatic plants have run rampant in the past few years and practically the entire shoreline is overgrown causing a very undesirable condition. (See Plate III.) This weed problem and the decreasing water level by seepage into nearby gravel pits has nearly ruined the lake for many recreational uses.⁴⁴ Although the lake is developed, much of it two tiers deep, with private homes and cottages, no public access point was apparent. A large trailer park is located on the northern edge of the lake. (See Plate XXII.) Most of the landowners are from Michigan and from

⁴⁴Personal interview, Silver Lake property owner, July 10, 1965.



Plate XXI. One of two public walkways on Big Brower Lake, Kent County, Michigan. Note trees that prevent access by car or trailer.



Plate XXII. Trailer camp area along the shore of Silver Lake, Livingston County, Michigan



Plate XXIII. Lake property development with trailers is common on Northern Peninsula lakes.

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neighboring states such as Ohio and Indiana. Access to the lake is good with county roads both tarred and graveled completely encircling the lake. Much of the lake is developed with homes of a permanent nature although many summer cottages are also present. Lakefront accessories such as docks, boat houses, breakwaters and steps are found in front of practically every lot on the lake. The primary recreational activities, water-skiing, swimming, fishing and boating, have been limited considerably by aquatic plant and water level problems.

Cooley Lake, White Lake and Commerce Townships,
Oakland County, Michigan

This small but intensively developed 86-acre lake is located about five miles from the city of Pontiac on the east side of the southern Lower Peninsula. Its development is almost entirely made up of permanent homes, and public access is limited to one public fishing site and beach although commercial establishments such as motels, summer resorts and nightclubs flank part of one side of the lake. This lake, like Silver Lake, has had considerable trouble with aquatic weeds and water levels; much of the usable surface area of the lake is now rendered useless. As a result, many user conflicts have arisen regarding recreational uses on the lake. The primary recreational activities on the lake are waterskiing, swimming, fishing, and boating during the summer and ice skating and ice fishing during the winter. Access to the lake is good, but the county roads serving the lake are unsurfaced and in very poor condition.

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Lakefront Property Development Characteristics
of Eight Michigan Lakes

General Features Influencing Michigan Lake Developments

Property development trends on Michigan lakes vary considerably according to numerous factors, the nine more important ones being: (1) the size of the lake, (2) the accessibility to the lake and from the lake to the neighboring lakes and streams or the Great Lakes, (3) the location of the lake with respect to population centers, (4) the natural characteristics of the lake, (5) the type of development already present on the lake, (6) the price of the lots, (7) the public facilities on the lake, (8) the restrictions on the lake, and (9) the social and economic status of the lake property owners. These factors, along with numerous other local factors, play a vital role in the overall development, lot size, and frontage values of lakefront property.

The importance of the size of the lake varies with respect to its location. Upper Peninsula lakes are numerous and the demand for frontage is not nearly as high as it is in the southern Lower Peninsula. Hence, only the larger lakes in the Upper Peninsula are platted and developed to any extent with cottages. In southern Lower Michigan, on the other hand, the demand for frontage on water greatly exceeds the amount of frontage on large bodies of water, and all lakes, large or very small, are developed quite extensively.⁴⁵ The northern Lower Peninsula is somewhat in between these two extremes. Some small lakes are quite highly developed here also but the majority of the developed lakes are over 200 acres in size.

⁴⁵Threinen, loc. cit.

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Accessibility to the lake is an important factor in its development. This is especially true of lakes in the Upper Peninsula where access to many lakes is limited to foot trails or by rough roads suitable for jeeps only. Lakes close to main highways are generally developed with cottages and resorts first. After this more desirable frontage is used up, some of the more undesirable areas will be opened up to access and developed. Accessibility from the lake, either by water or car to other neighboring lakes is often an important factor in the desirability of the lake for development. Many small lakes have a critical lack of space for water-oriented recreational activities and thus access to neighboring lakes, streams, or a Great Lake is important.

Lakes located in close proximity to population centers are generally much more intensively developed than those more isolated.⁴⁶ The southern Lower Peninsula lakes are good examples of this. Lakes in counties near Detroit, Grand Rapids, and Flint are much more highly developed with cottages, resorts, and commercial establishments than those in the northern Lower Peninsula and the Upper Peninsula. The distance people are willing to travel makes a great deal of difference in this respect also. Some people are willing to travel 200 or 300 miles to a summer resort on a lake farther north but the majority require a lake in close proximity to a job or permanent home so they can commute easily without taking too much driving time. This trend may change, however, with the continued improvement of major highways and a reduction in driving time.

⁴⁶Burton, op. cit., p. 76.

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Natural and aesthetic characteristics are among the most important factors influencing property and cottage development. A lake relatively free from aquatic vegetation and with a nice stand of shoreline timber influences many people. This is exceptionally true in the northern areas where demand for lakefront property is not as high as in the southern areas. Even the lake name will affect its desirability to a great extent. For example, Lake-of-the-Clouds in Ontonagon County, Michigan, is one of the main tourist attractions in Michigan's Upper Peninsula. This same lake, however, was quite universally rejected a number of years ago when its name was Carp Lake.⁴⁷

The fish species and the quality of fishing in the lake determine its development to a great degree especially by the sportsman. Much lake development in the Upper Peninsula is geared to the fishing quality. Trout, bass and northern pike are the most sought after species and the lakes supporting them are often rapidly developed.⁴⁸ This is not as true in southern Michigan where demand for water frontage as such often exceeds all other requirements.

The type of development already present often determines the lake's desirability for further development. Shabby, unkempt and crowded developments often repel people from wanting frontage on a lake. Few people desire to build or buy a summer home on a lake crowded with shacks and run-down developments. Commercial establishments are often another

⁴⁷ Personal interview with C. R. Humphrys, Department of Resource Development, Michigan State University, September 7, 1965.

⁴⁸ All lakes, questionnaire response.

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factor that may or may not draw further property development. Some people feel that grocery stores, gas stations and restaurants are a desirable feature, while others prefer to get away from this and want more isolated and private conditions.

The price of frontage lots often limits many people in their choice of lakes. Lots selling for \$100 per front foot, which is common on many southern Michigan lakes, often limit most people to smaller, and less desirable frontage or even back lots. In general, Upper Peninsula lake lots are not as expensive as southern Lower Peninsula lots because of the difference in intensity of demand for frontage.

The controversy between public and private lakes is often a deciding factor in development trends. Many property owners require private conditions with a lake free of any public access, whereas others tolerate public access or are not influenced one way or another. The public desire for a lake, of course, is often governed by the quantity and quality of lake facilities. Beaches, boat rentals, restaurants, cottage rentals and other commercial features are among the more important facilities. As a rule, most Michigan lakes are open to public access but the quantity and quality of public facilities often differ considerably.

Property restrictions on a lake often influence to a great degree the property and cottage development of a lake. Restrictions may take the form of easements, rights-of-way, oil and gas leases, use restrictions, building restrictions and plat vacations. Many lakes, especially those

in the Upper Peninsula and northern Lower Peninsula, are quite free from any property restrictions. Southern Lower Peninsula lakes, however, often have many restrictions, especially relating to building and plat vacations. Prospective buyers often hesitate to buy property clouded by numerous restrictions. On the other hand, the development of a lake may be greatly benefited by building, use, and other property restrictions. Many of these restrictions, especially those relating to building and land use, are very elaborate and prohibitive. An example of a very tight control of property use and the building of structures is found on Reeds Lake, a rather exclusive lake located in Grand Rapids, Michigan. This restriction, which is recorded along with the deeds to the property, in the Manhattan Beach Plat, reads as follows:

A. Special Land Use.

Lot 9 of said plat [Manhattan Beach Plat] shall be used for private purposes in accordance with the rules and regulations of Manhattan Beach Association. No dwelling, boat-house, beach house or structure of any nature whatsoever shall be erected on lot 9 of said plat. Title to said lot 9 shall be vested in the owners of lots 10-23 inclusively of Manhattan Beach Plat and said title shall be held in conjunction with membership of said owners in Manhattan Beach Association. Should said lot 9 be no longer used for private bathing beach purposes or maintained purposely by the aforesaid Manhattan Beach Association, title of lot 9 shall revert to Richard D. Brooks.

B. Architectural Control.

No building shall be erected, placed or altered on any lot until the construction drawings, specifications, and a plot plan showing the location of the structure have been approved by the architectural control committee as to quality of workmanship and materials, harmony of

external design with existing structures, and as to location with respect to topography and finish grade elevation. No fence, hedge or wall shall be erected except on lot 1 without approval of the architectural control committee. . . .

C. Dwelling Cost, Quality and Size.

No dwelling shall be permitted on any lot at a cost of less than 34,000 dollars, based upon cost levels prevailing on the date these covenants are recorded [1961], it being the intention and purpose of the covenants to assure that all dwellings shall be of a quality of workmanship and materials substantially the same or better than that which can be produced on the date these covenants are recorded at the minimum cost stated herein for the minimum permitted dwelling size. The living floor area of the main structure exclusive of open porches and garages, shall not be less than 1600 square feet.

D. Building Location.

On lots 1-8, the distance between the structure and the street lot line shall not be less than 35 feet and the distance between the structure and the concrete markers at the lake front shall not be less than 75 feet.

E. Easements.

All easements shall be reserved as required.

F. Nuisances.

No noxious or offensive activity shall be carried on . . . which may be or may become an annoyance or nuisance to the neighborhood.

G. Temporary Structures.

No structure of a temporary character, trailer, basement, tent, shack, garage, barn, or other out building shall be used on any lot at any time as a residence, either temporarily or permanently.

H. Signs.

No sign of any kind shall be displayed to the public view on any lot.

I. Livestock and Poultry.

No animals . . . of any kind shall be raised, bred or kept on any lot, except that dogs, cats or other

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household pets may be kept, provided they are not kept, bred, or maintained for any commercial purposes.

J. Garbage and Refuse Disposal.

No lot is to be used for dumping and all incinerators and other disposal units must be kept in a sanitary condition.⁴⁹

The above restrictions are unusually strict but there are many restrictions, on many lakes, which are similar in their intent. Restrictions as to use of a lake for recreational purposes are employed on a number of southern Lower Peninsula lakes where overcrowding and user conflicts abound. This type of restriction may divide the time of day or week for certain recreational uses on the lake. For example, waterskiing may be allowed from 10:00 A. M. to 2:00 P. M. on one day, whereas fishing may be allowed during the hours of 6:00 A. M. to 10:00 A. M. Often, this may apply to all recreational uses on a lake and may be very effective and useful in cases of extreme overcrowding.

The procedure for obtaining such a restriction is rather involved. The property owners on a lake, either individually, or in the form of an association, may appeal directly to the circuit court in the county in which the lake is located. The resultant hearing then determines the necessity of such a restriction. If approved, a copy is sent directly to the County Clerk who stamps it and immediately sends it to the County Register of Deeds where it is filed with the deeds to the lots in the plat.

⁴⁹Kent County Register of Deeds, Manhattan Beach Plat, liber 1970, 1121.

An additional certified copy is also forwarded to the Auditor General's office when it is recorded.⁵⁰

In summary, a restriction may produce a very desirable pattern of development on a lake by prohibiting certain patterns of property development and uses. On the other hand, if too strict, it may prevent many individuals from their right to use a lake, and their ability to purchase and build according to their own liking. The restriction is, therefore, a tool that may be used to improve, maintain, and correct patterns of lake property development and recreational use.

The social and economic status of the property owner is, at times, a determining factor in lake property development. Property on most lakes, of course, is owned by people of all ways of life no matter what their social or economic status. There are cases, however, where an entire lake may be owned by professional men only. Silver Lake, Kent County, Michigan, is an example of this situation. All of the property on the lake is developed with \$30,000-plus summer homes, and all of the owners are professional businessmen — doctors, lawyers and business executives. Occasionally, a lake will be developed by a group of doctors or lawyers only, although this is not too common.

Development Patterns of Eight Lakes in Michigan

The eight lakes used in this study represent some of the varying patterns of development throughout the state. Each lake, therefore, will be

⁵⁰Personal interview with Ruth E. Webber, Kent County Register of Deeds, September 3, 1965.

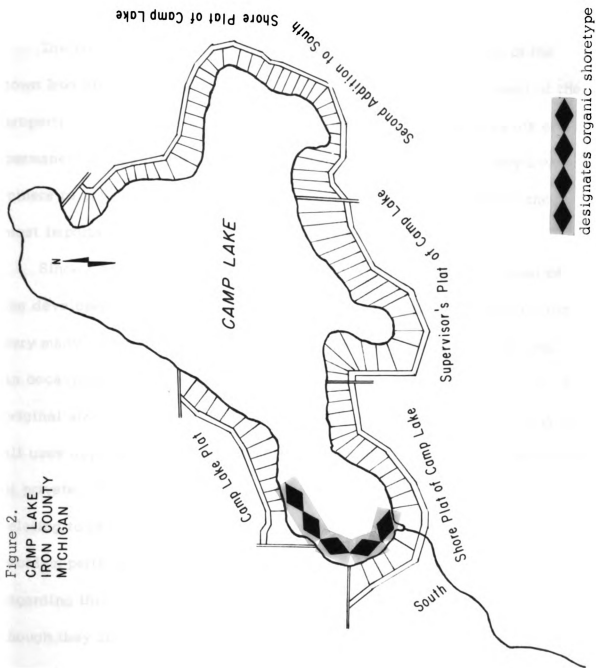
analyzed, according to its own particular mode of development, using all of the above factors and any local factors that affect each lake. Each lake was chosen to represent some of the features of lake property development common to the particular area of the state in which it is located, and hence, should be considered exemplary of the lakes in the same area although some characteristics of the lakes used in the study are peculiar to the lake in question.

Upper Peninsula Lakes

Camp Lake, Iron County, is a lake that has been developed fairly recently. It is somewhat atypical of most Northern Peninsula lakes in the sense that it is quite highly developed for its size. (See Figure 2.) A little more than two-thirds of its shoreline is platted, and numerous small cottages and shacks dot about one-half of the shoreline. There is a public fishing site on the lake, but it is not heavily used at the present time. Only a small part of the western shore is organic in nature and apparently it is not very serious because a few lots have been developed along this part of the shore.

There are four subdivisions that have been platted along the shore of Camp Lake, all of which are of recent origin (1953-1959). As can be seen by Appendix Table 1, all lots are approximately 100 feet in width at the shoreline. Most of the property is as yet undeveloped with cottages, and those that are present are mostly hunting and fishing shacks. There are about 20 cottages on the lake; most are used only during the weekends of

Figure 2.
CAMP LAKE
IRON COUNTY
MICHIGAN



summer months and during the fall hunting season. Since the lake is as yet so undeveloped, frontage values are still low, the average developed assessed front foot values on the lake being \$7.05 and the undeveloped assessed front foot value only \$2.62 (see Appendix Table 1).

The present development of Camp Lake is probably a result of the town Iron River, Michigan, which is only a few miles away. Most of the property owners on the lake are from this town and have businesses and permanent homes in the surrounding area. Their occupations vary from miners to professional businessmen. Location, then, is probably the most important factor influencing the development of this lake.

Since Camp Lake is still in the low development stage and most of the development is not oriented to strong recreational use, there are not very many lakefront accessories. There are a few docks for boats and an occasional swimming beach, but much of the shoreline remains in its original state. Lake use varies from waterskiing to hunting and, at present, all uses appear to be compatible due to the lack of pressure, either public or private. There are, however, a number of problems that have arisen relating to or resulting from the development already present. The main problem pertains to the fishing on the lake. Many complaints were received regarding this problem. The lake is considered to be a trout lake even though they do not propagate naturally in the lake. The Michigan Department of Conservation has maintained the fish population in the lake by planting trout, bass and bluegills. Many property owners have complained

that the amount of planting is far too small and that fishing is good only during a few weeks in the spring of the year. Many also feel that a greater variety of fish would help to eliminate this problem.⁵¹

Another problem that has been plaguing the lake for some time is the nature of the lake bottom and the aquatic plant population. Nymphea sp. and other emergents have caused problems during the summer months, especially on the wind-free side of the lake. In addition, a muck bottom has limited much of the shoreline for recreational use; as a result, some owners have dredged the shoreline and filled the beach area with sand.

The roads that encircle the lake are also a source of numerous complaints from the property owners. Since they are unsurfaced and no ditches line the side of the road, they are frequently washed out in the spring and become extremely dusty in the summer. During the winter months, they are virtually impassible.

The biggest deterrent to property development on Camp Lake at the present time is the tax rate. Apparently the tax rate on improved lake-front property is rather high in the county. This may be a result of lack of industry and other important tax bases, but the fact remains that people are unwilling to improve their property to any degree for fear of increasing their tax rate to higher levels. In fact, property owners list this as the main problem that may lead to the relocation of their cottage sites.

In summary, Camp Lake shows some features in common with many

⁵¹ Camp Lake questionnaire response.

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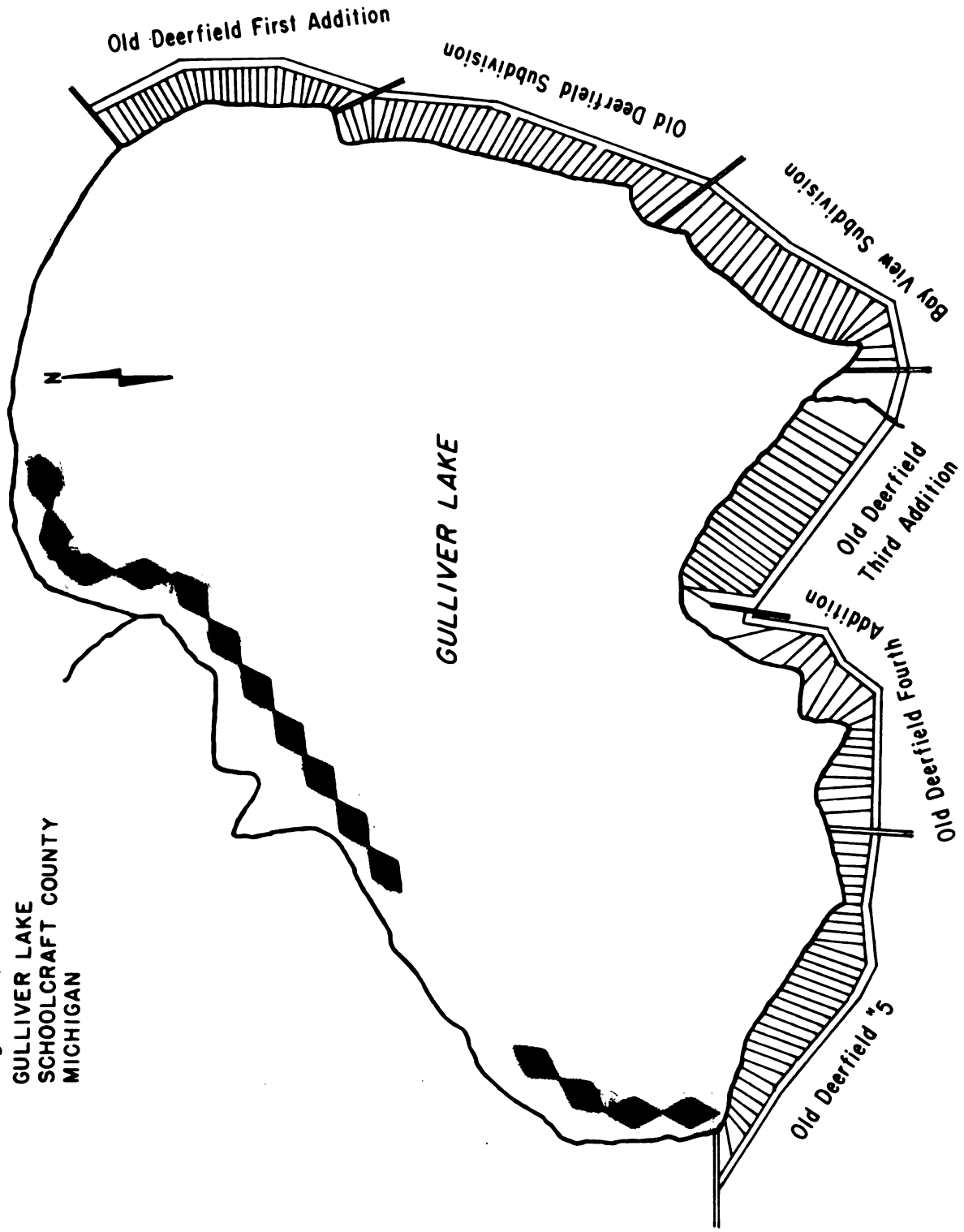
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Upper Peninsula lakes as well as some problems peculiar to the lake itself. Since it is an Upper Peninsula lake, the demand for frontage is not high at the present time. This is due to both its relative isolation with respect to population centers and the lack of tourists in the area due partly, perhaps, to the Mackinac Bridge toll rate. It appeared, therefore, that at the present time, Camp Lake is relatively free from many of the man-associated problems such as overcrowding, user conflicts and pollution common to many southern Michigan lakes. If the present use trends continue, however, Camp Lake will also be faced with many of these problems unless planning and management of the lake resources is initiated within the next decade.

Gulliver Lake, Schoolcraft County, Michigan (see Figure 3), is one of the larger Upper Peninsula lakes with a development in common with other large Upper Peninsula lakes. About half of its shoreline has been platted and much of this subdivided property has been developed with cottages. There are numerous public access points in the form of parks and walkways, and the presence of a summer resort makes the area quite popular for public recreational use especially since access to the lake by the major state highway in the Upper Peninsula is so easy. The south and east side of the lake has been developed and since the remaining shoreline is organic in nature, a correlation can be made between this and the lack of development on the north and west side of the lake.

Figure 3.
GULLIVER LAKE
SCHOOLCRAFT COUNTY
MICHIGAN



Gulliver Lake is probably one of the first lakes to be developed in the Upper Peninsula since the platting records of Old Deerfield Subdivision goes back to 1931. Development of the lake is due at least in part to the easy access from highway U.S. 2 and to its size. Since it is a rather large lake and the beauty of the lake is supreme, its early development can be explained quite easily.

The lot sizes as well as the assessed valuations of the lots vary considerably (see Appendix Table 2). Some of the older plats have lot sizes varying from 50 feet to over 200 feet. Old Deerfield #5, the newest plat on the lake, has frontage widths consistently close to 100 feet, thus showing the trend of Upper Peninsula lakes and the necessity of larger lot widths for adequate cottage development. The assessed valuations also vary considerably, this of course depending upon the quality of development. Valuations vary from \$200 for lots that are not developed to over \$4,000 on a few lots with large modern summer homes. Front foot values for both developed and undeveloped property show the higher demand for frontage on larger lakes in the Upper Peninsula. (See Appendix Table 2.)

Cottage development on the lake is more summer resort oriented than Camp Lake. Most of the approximately 60 cottages are of the small ranch or bungalow type, although there are a few large modern permanent homes. The occupants are for the most part from Michigan, and use of the lake is confined mainly to the summer months since over half of these property

owners are from areas other than the county in which the lake is located. Many of these owners are retired and have chosen the lake as a retirement site since the aesthetic beauty and accessibility to the lake is attractive.

The Gulliver Lake property owners have formed an association through which all of the necessary improvements are made. This association has been active in many improvements such as water level stabilization, development and maintenance of public access points and in the prevention of problems relating to the public use of the lake. This has been a very satisfactory arrangement on Gulliver Lake and the property owners appear to be satisfied with it.

Most of the recreational activities on the lake, waterskiing, boating, swimming, and fishing, are summer oriented. The size of the lake, of course, allows for considerable use of the lake without too many user conflict problems. However, since waterskiing and fishing are two of the biggest recreational uses, a number of conflicts between them have recently developed. Numerous property owners have complained that waterskiing and high speed boating has ruined much of the lake's fishing potential.

As with Camp Lake, fishing in Gulliver Lake is the largest source of complaint. Apparently, spear fishing in the winter has reduced the fish population to a low level, especially walleye and pike. The sportsmen claim that they have been trying to persuade the Michigan Department of Conservation to restock the lake for the past several years, but without success.

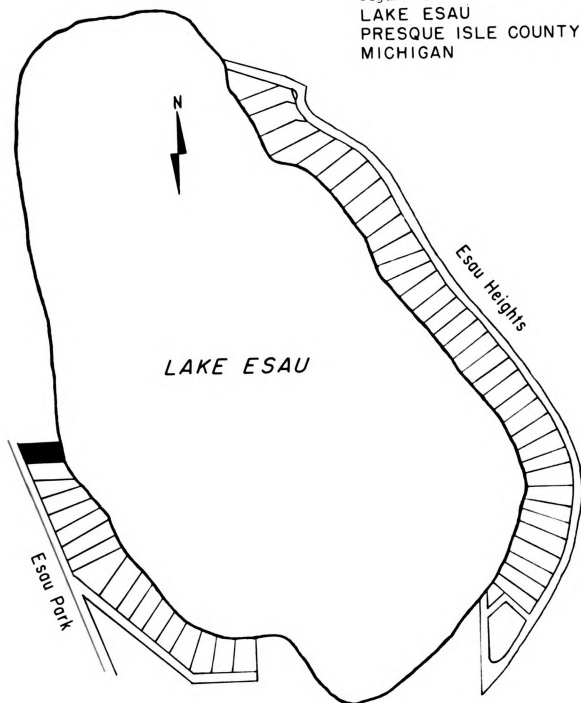
In the past few years, a moderate aquatic weed problem has developed in some areas along the shores of the lake. This problem, which may be caused by overenrichment from the inlet stream or septic tank effluent has produced a number of large populations of Myriophyllum sp. When the author visited the area, the problem did not appear to be too severe along most of the shore, but in the area adjacent to the water level control structure large masses of Myriophyllum had washed up on the beach and over the dam into the outlet creek. If overenrichment could be controlled by careful attention to septic tank efficiency, much of this problem could probably be eliminated.

In summary, Gulliver Lake's development and problems appear to be quite representative of most larger Upper Peninsula lakes. The demand for frontage is higher on this lake than on Camp Lake, thus showing the preference of large lake development in the Upper Peninsula.

Northern Lower Peninsula Lakes

Lake Esau, Presque Isle County, Michigan (see Figure 4) is probably one of the most isolated lakes in the northern Lower Peninsula. Access to the lake is difficult and, as a result, very little of the shoreline has been developed with cottages. None of the shore is organic in nature, so the potential for development is high. Public access to the lake is limited to one fairly large launching site, although public use is presently not too great. The 13 to 16 cottages on the lake are, for the most part, small cabins and fishing shacks, although there is presently a good deal

Figure 4.
LAKE ESAU
PRESQUE ISLE COUNTY
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of building going on. All property owners are from Michigan although few live in Presque Isle County.

Frontage size of the lakefront lots range close to 100 feet and the assessed front foot values are very low. (See Appendix Table 3.) This lack of development is probably due to the isolated nature of the lake and to its location with respect to Lake Huron. Access to the lake in the winter is impossible and thus prevents its use for ice fishing and ice skating. The main recreational activities are geared to the sportsman and good fishing and hunting is the biggest attribute to the lake area. Since pressure is so light, this trend will probably continue for some time. Very few lake accessories are associated with the present cottage development with the exception of a few buoys and one or two docks that have been placed by the church-sponsored boys' camp on the north side of the lake. (See Plate XVIII.)

Because of its low development and light public pressure, Lake Esau is virtually free of problems. The recently opened public access site was the only source of complaints received from the property owners, and these complaints referred not to overuse of the lake but to the messy conditions of the access point. As one property owner says,

We bought a lot on Lake Esau with the intent to build a retirement home. However, we consider the opening of the public launching site as such a detriment and nuisance (irresponsible boat operators, illegal fishing, beer bottles and junk all over) that we doubt if we will ever build on the lake. . . . The state is eager to open up lakes to the

public but is very lax in educating and policing the public in the proper use of our resources.⁵²

Lake Esau, therefore, can be classified as a lake in the first stage of development, and is illustrative of early development trends in the northern Lower Peninsula.

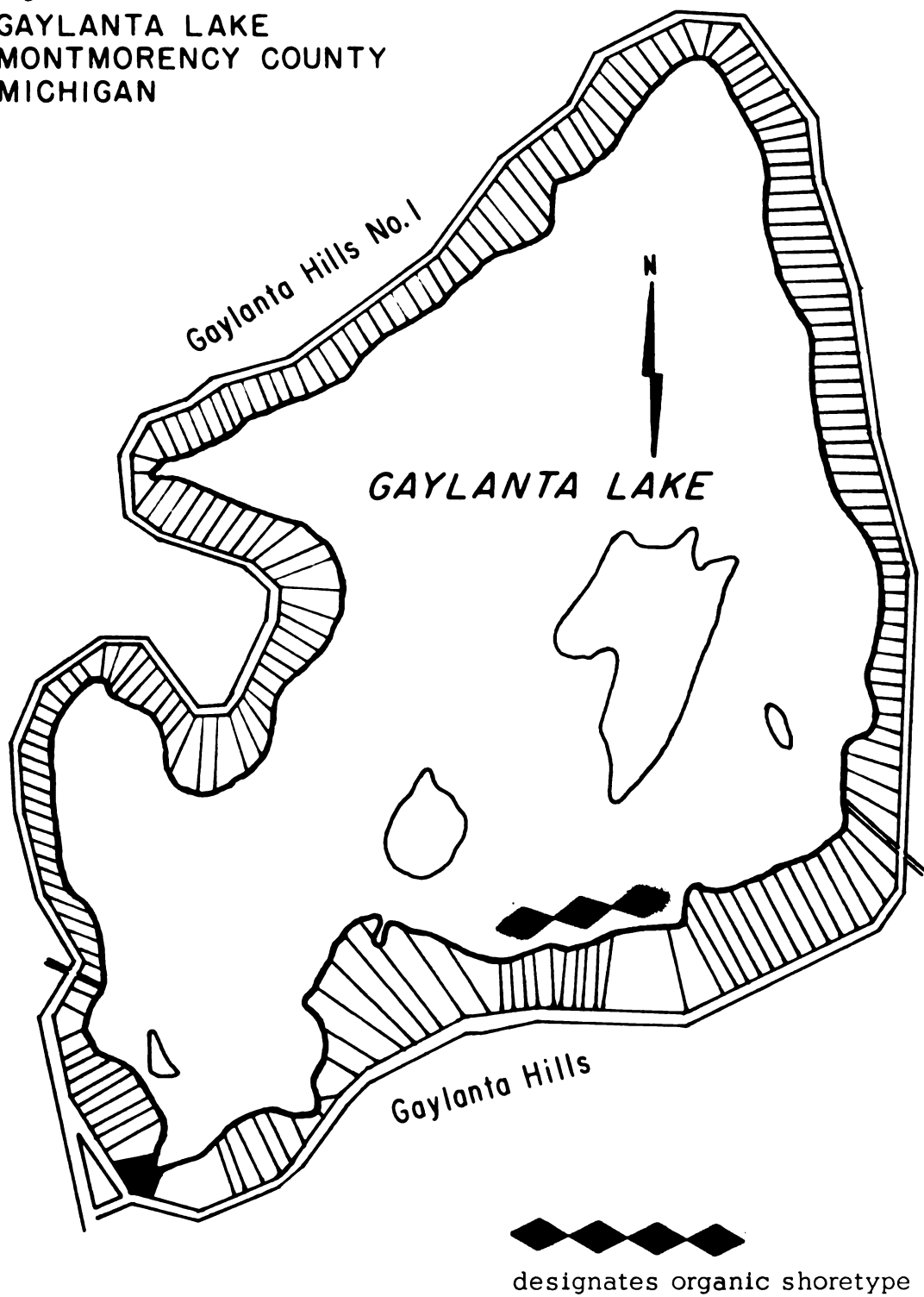
Gaylanta Lake, Montmorency County (see Figure 5), has a shoreline that has been completely platted, but there is an absence of cottages on the lake. This development can be attributed to two factors, namely, high taxes and a lack of water supply.⁵³ Wells have been drilled to depths of over 250 feet without success in locating water. This condition is probably due to the fact that the lake has a sealed bottom and the ground water table is probably far below the bottom of the lake. Since the cost of locating the water is high, most of the cottages that have been built are without a water supply unless it is transported in from other sources. In addition to this lack of water supply, the improved lakefront property taxes in Montmorency County deter further property development.

Most of the lots in the two plats on the lake have frontage widths that vary from as low as 50 feet to as high as over 200 feet. Since this lake was platted during the 1940's and early 1950's, the trend of more uniform and wider lots has not been felt. Assessed valuations are generally rather low since the property is not highly in demand. (See Appendix Table 4.)

⁵²Lake Esau property owner, personal interview, June 16, 1965.

⁵³Gaylanta Lake questionnaire response.

Figure 5.
GAYLANTA LAKE
MONTMORENCY COUNTY
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Property owners are all from Michigan but from counties other than Montmorency County. The cottages present on the lake are of the small ranch or bungalow type and the remaining developed property consists of house trailers and tents for temporary use during the summer months. Lakefront accessories such as docks, boathouses and swimming beaches are infrequent and found only with some of the 30 to 40 permanent summer cottages on the lake.

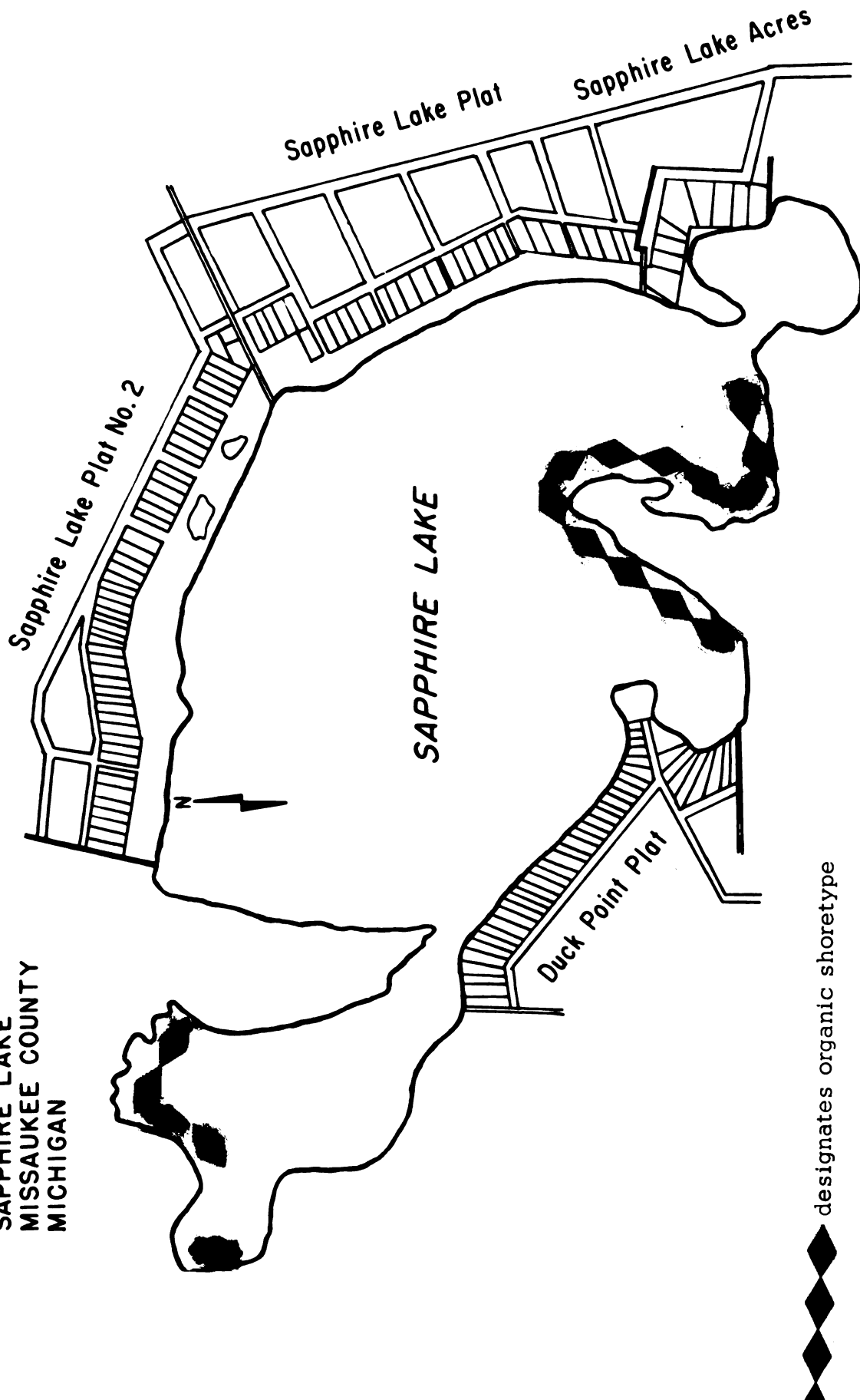
User conflicts are few on Gaylanta Lake but large motors on small boats is considered a big source of vexation to other lake users. Since some of these boats are capable of high speed and large wakes, much of the surface area of the lake can be riled up very rapidly thereby causing discomfort and undesirable fishing conditions.

As with Lake Esau, Gaylanta Lake has had problems with a comparatively new opening of a public launching site. Since its opening in 1963, many cottages near the launching site have been vandalized.

Since Gaylanta Lake is in only a moderate stage of development, few problems of a man-associated nature have developed to any degree and, because of its undesirable nature for cottage development, will probably not develop as rapidly as many of the other lakes in the northern Lower Peninsula.

Sapphire Lake, Missaukee County (see Figure 6), is probably one of the shallowest developed lakes in Michigan. The lake, however, acts as a transition between characteristic northern Lower Peninsula trends and southern Lower Peninsula development trends since it is highly developed

Figure 6.
SAPPHIRE LAKE
MISSAUKEE COUNTY
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but yet lacks many of the characteristic problems common to the extreme southern Lower Peninsula lakes. About two-thirds of the shoreline is platted and cottages have been developed on almost every lot. The remainder of the shoreline is generally organic in nature, thus showing the reason why this part of the lake is not platted. (See Figure 6.) The four plats are all completely private and the roads leading around and through them are all maintained by the property owners and the Missaukee Lands Company, the original developers of the lake. Most of the cottages are small bungalows, log cabins and the like, since many of the lots on the lake have frontage less than 35 feet in width. Assessed valuations vary according to improvements but in general, undeveloped property is assessed at about \$400. (See Appendix Table 5.) Assessed front foot values show the more southern lake development characteristics of high demand for lake frontage.

Since Sapphire Lake is, at the most, a three-hour drive from most larger population centers in southern Michigan, many of the cottage owners are from cities such as Lansing, Detroit and Grand Rapids. Lake City and Cadillac, two of the smaller population centers farther north are also sources of a number of property owners. This, along with the lake's easy access, is probably the main explanation for its full development. Another desirable feature of the lake which undoubtedly plays some role in its development is the presence of numerous restrictions such as, no commercialism, no unfinished housing or open pit privies, and no trailers, shacks or tents.

Another characteristic which classifies this lake with many southern Michigan lakes is the presence of numerous lakefront accessories associated with almost every cottage, and since waterskiing, swimming and fishing are the main recreational trends on the lake, they are quite heavily used.

Public access to the lake is in the form of a roadside park and no launching site appeared to be present. Since the remainder of the lake is completely closed off to the public, few protests have been voiced by the property owners with respect to nuisances or overuse of the lake by the public.

The largest problem on Sapphire Lake involves its shallow nature. Aquatic plants both submergent and emergent have choked a great deal of the central and southern portions of the lake especially during July and August. Large quantities of silt have also drifted in along the southern shoreline of much of the platted area. Decreasing water levels have intensified this problem in the past few years to such an extent that many parts of the lake have become inadequate for water-oriented recreational activities. Very little of the shoreline has been dredged to improve this condition and if the trend continues, dredging and subsequent sand fill will be required to enable further use of the lake.

In the past, very little care has been taken to maintain the roads that encircle the lake and, as a result, they have become almost impassible by car especially in the spring and fall when heavy rains make them muddy and inaccessible.

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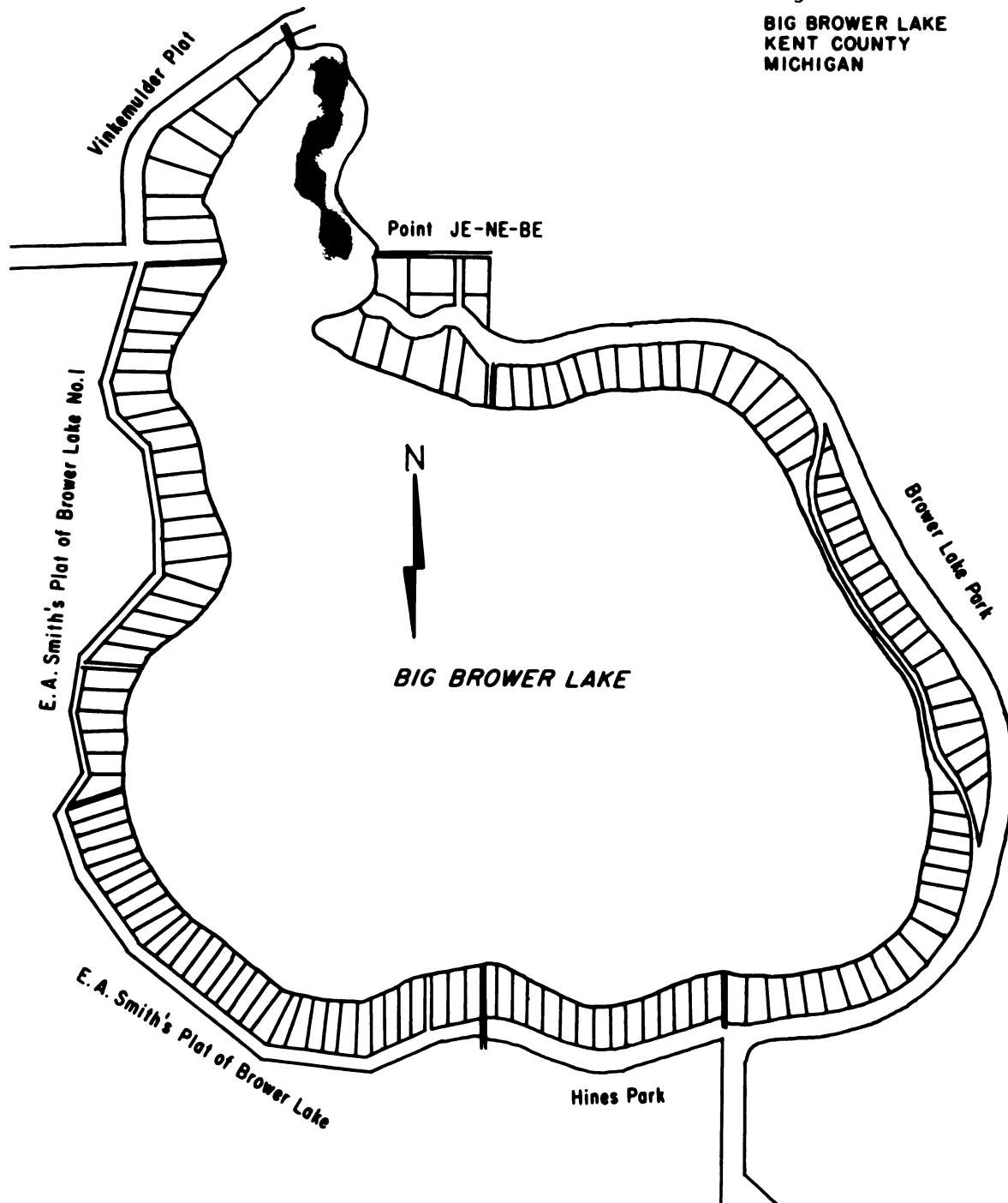
The traditional fishing problem has been an additional source of complaints from the property owners since fishing is the priority of recreational activities. Stunted fish and overfishing appear to be the main causes for this problem. The shallow nature of the lake and its weed-choked condition also contribute to the situation. Possible solutions include the use of more controls with respect to fishing and poisoning with rotenone with subsequent restocking of more desirable species.

In general, Sapphire Lake may be considered one of the more highly developed lakes in the northern Lower Peninsula, partly due to the fact that it is closer to large population centers than many of the other lakes. The lake appears to be going through a transition stage where further development will undoubtedly force more controls and the improvement of services and facilities already present on the lake.

Southern Lower Peninsula Lakes

Big Brower Lake, Kent County (see Figure 7), is one of the better developed southern Lower Peninsula lakes. Most of its development is of a two-tiered nature and public access is limited to two small walkways along the south side of the lake. All of the lake is platted and for the most part, developed with cottages with the exception of the extreme northeast corner which has not been platted due to the organic nature of the shoreline. (See Figure 7.) Lot sizes are quite consistent around the 50-foot width, and since the lake is near a large metropolitan community and demand for lake frontage is high, assessed valuations are rather high.

Figure 7.
BIG BROWER LAKE
KENT COUNTY
MICHIGAN



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Assessed front foot valuations are also indicative of this higher demand for frontage as compared with many of the more northern lakes. (See Appendix Table 6.) Most of the cottages are neat, one story bungalows since lot widths prevent larger homes unless two or more adjacent lots are purchased. Many of the homes are of a permanent nature since the city of Grand Rapids is only ten miles away and the commuting time to a job is small and access to and from the lake is very easy.

Many of the property owners along the lakefront have dredged and filled much of the shoreline along the south side of the lake and have thereby developed many attractive lawns directly along the shore (see Plate XV). Recreational use is quite intensive during both the summer and winter months since the county roads servicing the lake are kept open the year round.

The primary reason for Brower Lake's high development is undoubtedly due to the influence of the large metropolitan area just to the south of the lake. Since Grand Rapids is 40 miles from the nearest state park on Lake Michigan, many people in the area have turned to some of the smaller lakes in the Kent County region. Big Brower Lake is located in an area of many small lakes all of which are highly developed. The water level of the lake has recently been stabilized through the action of the Big Brower Lake Cottage Owners Association. This action and the fact that the lake is almost free from public intrusion due to a recent vacation restriction of a public park and drive has made the lake very desirable for private home and cottage development.

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Since Big Brower Lake is so highly developed for its 85-acre size, there are a number of problems that have arisen regarding both its recreational use and property development. Demand for frontage being as high as it is has produced extreme overcrowding in the cottage developments on the lake. (See Plate XII.) This has been followed by extensive overuse of the lake and resultant user conflicts. High speed motor boats and waterskiers have taken over most of the time used for recreational activities during the summer months, and fishing has almost been eliminated during the daylight hours. A type of control, similar to that of Silver Lake, Kent County, is required to regulate these conflicts.

Since there are so many cottages and homes on the lake and thus, just as many septic tanks, overenrichment of the water has increased the aquatic weed problem in recent years. In these more developed areas, a central sewage disposal system may be the only plausible answer to this problem.

Brower Lake, therefore, for its size and high development may be considered an example of a rather good trend of lake development. It is true that there have been many unwarranted problems, especially in the form of overcrowding, but the property owners, through their association, have recognized many of these and have subsequently set out to correct them.

Silver Lake, Livingston County (see Figure 8), and Cooley Lake, Oakland County (see Figure 9), have so many characteristics in common with

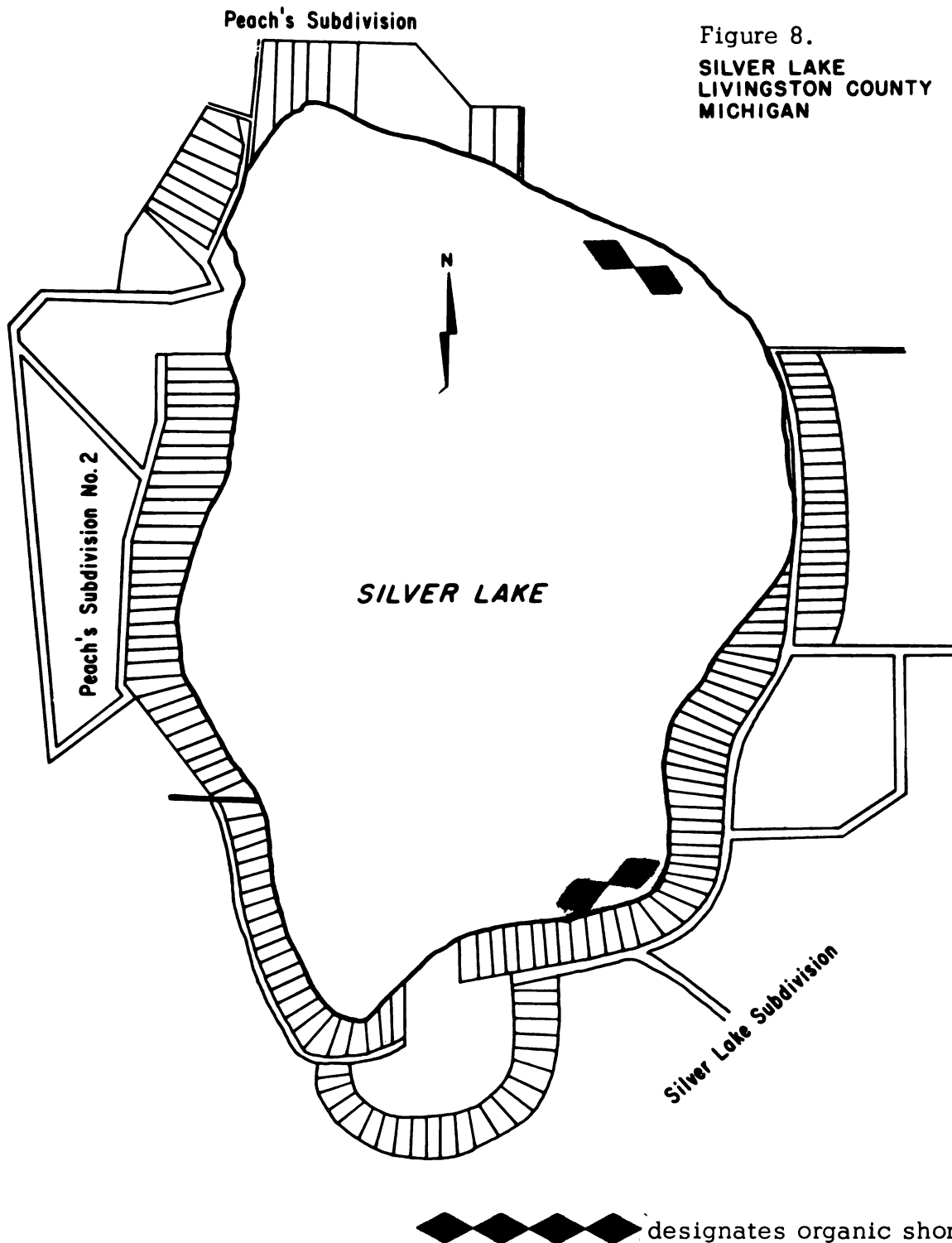
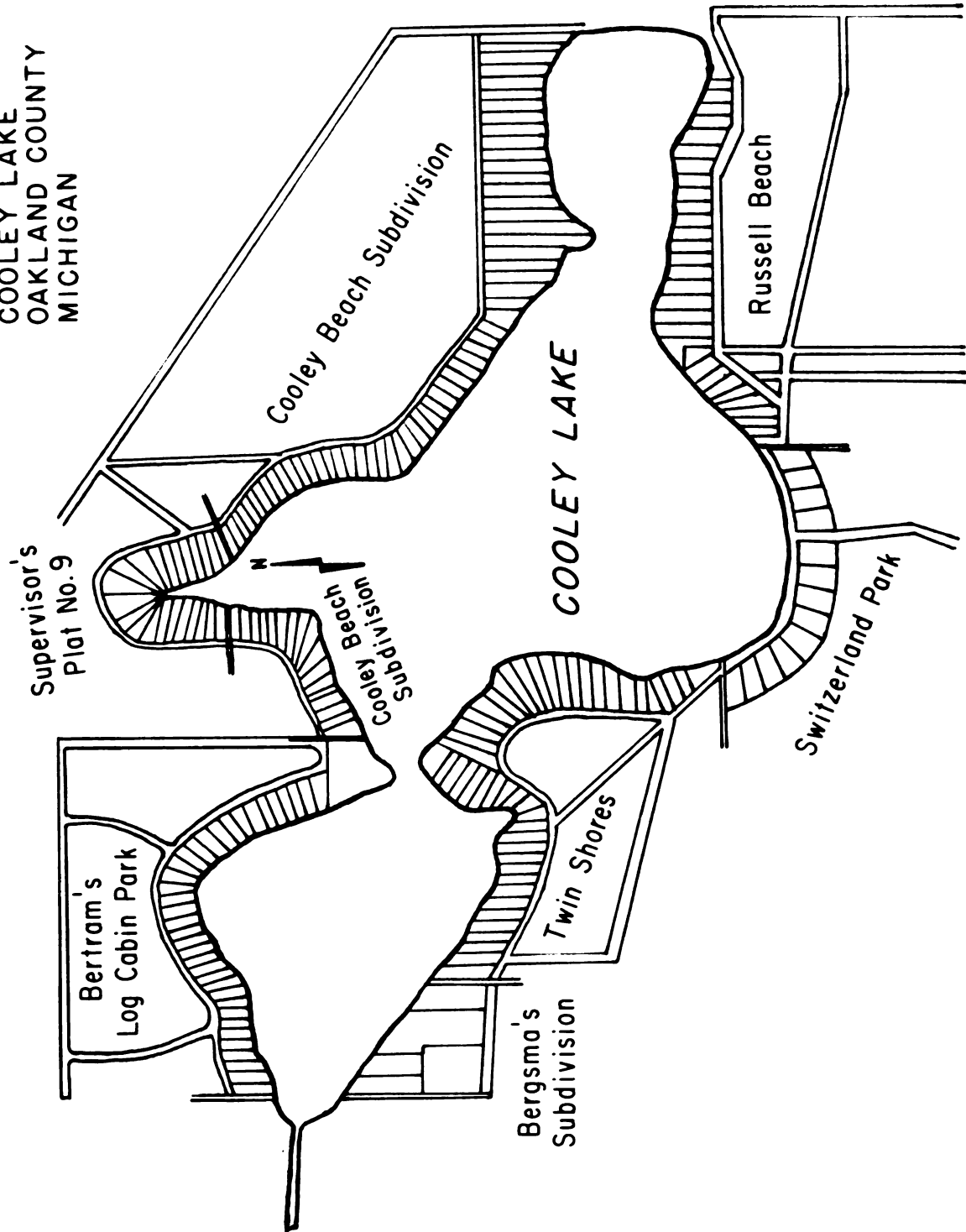


Figure 9.
COOLEY LAKE
OAKLAND COUNTY
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each other, as well as with numerous other southern Lower Peninsula lakes, that they will be analyzed together with respect to their property development and recreational characteristics and problems. Both lakes are intensively developed with cottages and subdivisions on both lakes encircle the entire shorelines with the exception of a small area on the northeast side of Silver Lake where the shore type is organic and hence undesirable for development. (See Figures 8 and 9.)

Both lakes were platted in the early 1920's and thus show how important the demand for lakefront property was even then. The lot sizes reflect this early development in that frontage widths on both lakes are as low as 35 to 40 feet on some lots although most frontages are about 50 feet in width. The actual cottages also reflect this early development since many are rather old, two story frame houses. Many of the structures on both lakes are of a permanent home nature although this is especially true on Cooley Lake. Most of the property owners on the lakes are from the highly populated Detroit and Pontiac metropolitan areas. The mode of development on both lakes is related to their location. Lake frontage is in extremely high demand even though property on Lake Huron and Lake St. Clair is also occasionally available. Furthermore, with the exception of Oakland County and a few other areas, most of Michigan's extreme southern Lower Peninsula has a limited supply of lakes available for platting and property development. The lakes that are capable of being developed are so keenly in demand that frontage values go very high. This is evident

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on both lakes where undeveloped assessed front foot values are approximately \$11, whereas developed assessed front foot values range from \$27 on Silver Lake where many of the cottages are rather old, to over \$50 on Cooley Lake where some of the development is quite new and modern.

The highest use patterns on both lakes are found during the summer months when fishing, waterskiing, boating, sailing and canoeing are prevalent. Many lakefront accessories are associated with almost every cottage, and shorelines are often aesthetically disfigured by their presence.

Silver Lake and Cooley Lake also have many problems in common. Probably the most important concerns carrying capacity and user conflicts. This is especially true on Cooley Lake where public access is available by means of a public launching site and many commercial establishments such as summer resorts, a night club and rented cottages. Since each lake is so intensively developed with as many as three tiers of cottages, the carrying capacity is undoubtedly exceeded to such an extent that use patterns become highly incompatible. If present use trends continue, the high space consumption uses such as waterskiing and high speed motor-boating will have to be controlled to allow for other important recreational uses.

Water level problems on both lakes have become critical in recent years with the lack of precipitation and other local factors. This decrease in water levels has also aggravated the already present aquatic plant problem by exposing much of this vegetation to decay and other undesirable

aesthetic annoyances. Cooley Lake has experienced a severe limitation of recreational use space since much of the formerly usable lake surface area is now unnavigable. Lakefront accessories such as docks and swimming beaches have been left high and dry, and much and other organic materials have been exposed. This problem has been aggravated on Silver Lake with the additional drawdown of water levels by seepage into nearby gravel pits.

Cooley Lake has experienced a problem that is generally quite unique to southern Michigan lakes, namely, access. Roads serving the lake are in extremely poor condition as they are not surfaced and contain many ruts and potholes. The property owners are aware of the problem but are unable to correct it since the maintenance of the roads is in the hands of the county.⁵⁴

Cooley Lake and Silver Lake may therefore be considered exemplary of many development and use patterns and associated problems conventional to most southern Lower Peninsula lakes in heavily populated areas. The intense demand for lakefront property in these locations often exceeds all other considerations of good lake development resulting in many problems and conflicts that seriously alter many potentially beautiful inland lakes.

⁵⁴Personal correspondence, Cooley Lake property owners, July 15, 1965.

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CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The conclusions of this study will be divided into four categories: Upper Peninsula, Northern Lower Peninsula, Southern Lower Peninsula, and Statewide. Table 2 is a summary showing variances in lake development factors with respect to location.

Upper Peninsula

1. The Upper Peninsula is a low population area. No large cities are present throughout the whole area, and thus, high concentrations of people are absent.
2. Since the population of the Upper Peninsula is low, demand for lake frontage is also low. Since so many lakes are available for development, both public demand for use and private demand for frontage is light.
3. Since demand for frontage is very low, large lakes, with few exceptions, are the only lakes that are developed to any extent in the Upper Peninsula. In some areas, even large lakes show an almost complete lack of development.
4. As a rule, Upper Peninsula lake frontage is of lower value than other areas of the state, this being caused by low demand and numerous lakes.

Table 2. Variance in Lake Development Factors
with Respect to Location

Lake Feature Related to Development	Upper Peninsula Lakes	Northern Lower Peninsula Lakes	Southern Lower Peninsula Lakes
Size of lake	Very important determining factor in extent of lake development.	Moderately important determining factor in extent of lake development	Of little importance in determining the extent of lake development, especially in the most southern areas.
Accessibility	Few smaller Upper Peninsula lakes accessible by car.	Most lakes accessible but some very isolated.	Almost all lakes accessible by county side roads or state highways.
Location with respect to population centers	Distance factor and cost of bridge reduce lot value and use.	Some lakes highly developed as summer resorts for city people.	Nearness to large metropolitan centers produces high demand for lake property and high lot values.
Present development	Fishing and hunting shacks on small lakes but many nice summer homes on large lakes.	Mixture between small cabins and modern summer homes. May vary depending upon location.	Many homes of a permanent nature although much development oriented to summer lake use. Many older developments on southern lakes.
Restrictions	Very few restrictions on the rather undeveloped Upper Peninsula lakes.	Some restrictions relating to land use found on a few lakes.	Many restrictions concerning building, vacations, easements and land use common on many lakes.
Public facilities	Common on many lakes but not too heavily used at present.	Found on most lakes and use may be very intensive in some areas.	Access points as well as commercial establishments found on many intensively developed lakes.
Natural characteristics	Desirable natural features abound on most lakes. Aquatic plants of some concern.	Upland vegetation usually preserved. Some aquatic weed problems present.	Much natural shoreline modified by lakefront development. Water level and aquatic plant problems common.
User conflicts	Carrying capacity of most lakes exceeds present use.	Many problems have developed on the more highly developed lakes.	User conflicts common due to intensive property development on most southern Lower Peninsula lakes.
Water levels	Problems have been experienced on some lakes. Control structures utilized.	Many problems have accompanied lack of precipitation in last few years.	Many problems have accompanied lack of precipitation in last few years. Has decreased carrying capacity of many lakes.
Use characteristics	Hunting, swimming, fishing, and boating most common lake uses.	Waterskiing, swimming, fishing, and hunting most common lake uses. Sportsman oriented.	Waterskiing, swimming, fishing, sailing, and canoeing most common lake uses. Lakes mostly resort oriented.
Lot size, assessed valuations and front foot values	More recent developments show larger lot widths. Frontage values generally low. Taxes high due to lack of tax sources.	Some lakes with older developments have narrow lot widths. Others are more recent and lot widths show greater widths. Frontage values vary.	Lot sizes smaller due to old developments and high demand. Frontage values high in many areas of intensive development.
Time of use	Most lake property is not used during winter months when access is difficult.	Lake property used during winter months in some areas and is left idle in other areas.	Most lake property used both summer and winter throughout much of the southern Lower Peninsula.

5. Since most Upper Peninsula lakes show much more recent subdividing and platting, plats are more modern in the sense that lot widths are larger and overall lot sizes are larger, thus permitting larger and more modern cottage development.
6. Development on Upper Peninsula lakes is extremely irregular. A large, modern summer home may be flanked on one or both sides by small fishing shacks, trailers, or even tents. As a rule, therefore, most development is of a lower quality and less uniform than in other parts of Michigan.
7. Due to a lack of access and hence, isolation, most Upper Peninsula lakes are limited to a seasonal use. Summer months are generally the only months in which cottages and other lake facilities are utilized; however, the fall hunting season produces some use of lakefront structures although actual lake use is nil.
8. Coupled with low development and limited seasonal use is the fact that there are few lake service centers. Large resorts, clubs and other public facilities are absent.
9. Almost all lakes in the Upper Peninsula encounter very little public use of access points. This fact, along with characteristic low development, produces few user conflict problems. Consequently, use controls are nonexistent.
10. Since development of cottages and use of Upper Peninsula lakes is low, natural lake characteristics are of high quality. Overenrichment

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and pollution are practically non-existent, many shorelines are virtually unmodified by man, and most all lakes show near primitive qualities that are rare in most other parts of Michigan.

11. The initial lake user or the original lake invader is of the loner type in Upper Peninsula areas. Many lakes, especially the smaller lakes, may be owned either fully or partially by one person and the only development is in the form of one cabin or shack. The remaining shoreline is completely undeveloped or unmodified.
12. Group recreational activities such as yacht clubs, night clubs, sailing regattas and waterskiing clubs are not prevalent on Upper Peninsula lakes. Large lakes may have some variety of use but almost all small lakes are single purpose lakes.
13. Most lake property owners on Upper Peninsula lakes are against further development. Since they are of the loner type, they desire isolated conditions and oppose more cottage development or public use. On the other hand, public officials such as mayors and congressmen along with local businessmen desire more development of resort facilities.
14. There are three factors impeding further Upper Peninsula lake development. In the first place, the distance to northern lakes is often too great for people from many of the large population centers in southern Michigan. Secondly, the toll of the Mackinac Bridge is higher than most tourists are willing to pay. Finally, Canadian

competition has induced many vacationers to the nearness of Ontario's many undeveloped lakes.

Northern Lower Peninsula

1. Michigan's northern Lower Peninsula may be considered a transition zone between the characteristic low development of the Upper Peninsula and the high development of the southern Lower Peninsula.
2. Most northern Lower Peninsula lakes are within three or four hours drive from large southern Michigan population centers. Consequently, demand for frontage is much higher than in the Upper Peninsula.
3. Frontage widths and overall lot sizes vary from location to location depending upon the age of lake developments and subdivisions. Frontage values are generally higher than Upper Peninsula areas.
4. Since access is easier and demand is higher, some larger northern Lower Peninsula lakes have very elaborate and exclusive lake service centers such as resorts, stores and gas stations.
5. Some lakes may have high social groupings in the form of clubs, regattas, and resorts from cities such as Grand Rapids, Flint or Lansing.
6. As a rule, basic community services (electricity, telephone and gas) are easily available on northern Lower Peninsula lakes. This fact influences use of lakes by families rather than loner types as is common in the Upper Peninsula.
7. Cottage development is, as a rule, of higher quality and more regularity due to the presence of restrictions and zoning in some areas.

8. Single purpose lakes are uncommon in the northern Lower Peninsula.
 - Lakes are used for a large variety of seasonal recreational uses and seasonal use is not limited to summer months in some areas.
9. Since demand for recreational use is greater, public access points are more moderately used in the northern Lower Peninsula. Because of this, and the overall higher development, a few instances of user conflicts have appeared and the use controls may soon be required in these cases.
10. Depending upon the extent of development on any given lake, natural lake characteristics may or may not be modified. Pollution and enrichment is not too prevalent but the more southern areas have experienced some overenrichment.
- 11. Continued development should be expected to continue with more population pressure, easy access, shorter driving time from population centers, and less competition from Canadian areas.

Southern Lower Peninsula

1. A high percentage of usable lake shoreline on southern Lower Peninsula lakes is utilized for permanent homes and full-time residents. Frontage values on this property, especially in a metropolitan vicinity, is very high.
2. Demand for lake frontage, even on very small lakes, is extremely high throughout all of the southern Lower Peninsula.
3. Most lake subdivisions are old and lot widths and overall size is

often small. Demand for frontage may produce this same effect in many newer subdivisions to allow for more available lots.

4. Public access points are used very intensively during summer months.

Weekend use is massive on almost every lake in the southern Lower Peninsula.

5. Single purpose lakes are non-existent in southern Michigan and a great variety of recreational uses are found on almost all lakes.

User conflicts are common and many use, location, and time controls are used on numerous lakes.

6. Small lakes are even developed to high degrees with multi-tiered subdivisions common in all areas.

7. Lake service areas, public facilities, and social and group organizations are common throughout the southern Lower Peninsula. Restaurants, grocery stores, gas stations, night clubs, yacht clubs and other social organizations are found on a large number of lakes, especially those in close proximity to metropolitan areas.

8. Due to high development with cottages and other structures, natural shoreline characteristics of most lakes are highly modified. Over-enrichment and pollution are prevalent. Aquatic plants have become a problem in most areas and muck lake bottoms are of great concern.

Statewide

1. With the exception of the southeastern part of the southern Lower

Peninsula, only large lakes have many service facilities and socially-oriented developments.

2. The continually expanding demand for frontage and overcrowded conditions will cause higher development and more public use of Michigan's lakes.
3. All lake developments, even on the most isolated lakes, should be zoned and restricted in order to control the desired type of development.

Recommendations

Since lake developments vary considerably with respect to location, accessibility, size, use and many other factors, it is difficult to determine, for any given lake, the actual preferred development pattern. There are, however, a number of important desirable values that can apply to most lakes in order to give a lake its most optimum use and development pattern. The more important of these values are recreation, aesthetics, and property. All lake developments, with the exception of certain commercial lakes, should be geared to the best application of these values in order to preserve and maintain the natural resources in the lake area and the purpose for which the lake is developed.

Since recreation is one of the primary reasons for most lake developments it is important that lakes be of such a quality for their utilization for water oriented recreation. There are many types of water recreation, some of which, when undertaken together are compatible, and others which

are not. For this reason, it is necessary to predetermine use patterns of a lake before extensive development is executed. There are a number of factors that may determine this, all of which should be studied when planning for recreational lakes.

Location is the first factor determining the use of a lake. Northern lakes, for example, have many qualities such as water temperature, accessibility, and distance from centers of population that may influence recreational preferences. Cold water discourages such sports as swimming, skin diving, and waterskiing and encourages uses such as fishing, hunting, and boating. A lake with poor access roads may also encourage some activities and discourage others that depend upon good access for trailers and other accessories that may be too bulky or heavy to carry in. Southern lakes, on the other hand, have warmer waters and generally better access, thereby attracting some of the resort oriented recreational activities such as waterskiing and swimming.

Another factor affecting recreational use is adaptability. Some lakes with much organic shoreline may be suited for use completely contrary to lakes with a high mineral shore type. Lakes with firm, well drained shores are, of course, much more suitable to cottage development and swimming beaches than are lakes with muck shores. Some lakes, therefore, are naturally suited for wildlife preservation, fishing, and similar natural lake uses whereas others may be more suited to resorts and associated activities.

A third factor to be considered is the presence or absence of other nearby recreational areas. For example, it is useless to develop a lake with resorts and certain correlated recreational activities in an area where demand for such a development has already been satisfied by another lake development only a few miles away. Other, more pressing demands for lake use should be analyzed in this case before development is encouraged.

There are numerous other factors that influence use patterns for any given lake such as lake shape and size, depth of water, fertility, existing developments, and water quality, but it is beyond the scope of this study to analyze each factor individually. The important point is that one should recognize that there are a number of aspects in relation to lake use patterns and lack of regard for any one of them may lead to unwise lake development.

Recreational uses of a lake are very consumptive of both water and shore.⁵⁵ The most intensive uses such as waterskiing, boating, swimming, and fishing are generally classified as being more consumptive than all other uses on a lake. It is for this reason, that on smaller lakes, conflicts between such uses have emerged. Swimming and cottage development are more consumptive of shore space than of actual water area but even here, conflicts may arise since both require the same sandy and well-drained soil conditions for their development. Waterskiing, boating and fishing are, of course, many times more consumptive of water surface area and hence, especially on many overdeveloped small lakes, they must

⁵⁵Threinen, An Analysis of Space Demands for Water and Shore, p. 1.

compete for the limited space available for their execution. In planning a lake development, therefore, care should be taken to classify lakes as to their best adaptability to recreational uses. One lake may, for example, be suited for fishing whereas another may be suited for activities such as waterskiing, boating and swimming. Because demand for water-oriented recreation is steadily increasing, future lake developments should be geared to this lake classification and should be fashioned in a manner that makes best use of the lake resources for recreational use. This is the only way outside of time, location and user controls that will inhibit the user conflict problem. This can also be applied to public and private use of lakes. In areas of high population where demand is great, some lakes can be developed for private use only, whereas some of the larger lakes with a high carrying capacity can be developed for public use. This can only be accomplished, of course, where numerous lakes are available for development.

Incompatible recreational uses are ever on the upswing and with this increase, the need for good planning is becoming more and more critical. As J. R. Wright says, "No two lakes are the same and each area requires its own planning, analysis, and solution."⁵⁶

The aesthetic quality of a lake is one of the main determinant of its value for property development and recreational use. It is essential, for this reason, that utmost care is taken to preserve high quality aesthetic

⁵⁶J. R. Wright, "Lake Shore Beach Development" (Department of Resource Development, Michigan State University, 1963). (Unpublished report.)

features of any lake when planning for development. Crowding of lake-shore with cottages and lakefront accessories not only detracts from the natural beauty of the shoreline, but it defeats the primary purpose for which lakes are developed, namely, its recreational potential. Once a lake has reached the stage of extreme development, it is no longer a place for relaxation and enjoyment, but becomes no more than a metropolitan-like suburban development. To destroy a beautiful shoreline by removal of the forest cover would in essence, destroy the whole lake of its natural beauty. As C. W. Threinen says, "In reality, the flat surface of water alone has little aesthetic value without the contrast of shore and water and the element of space."⁵⁷

The carrying capacity of a lake is limited by the space available for cottage development and recreational use. Property development is thus a direct influence upon the type of lake use and upon the ultimate appearance of the lake. Well-planned lake property development and improvement is an attribute to any lake but complete modification of lake shores without due consideration to its impact on the overall attributes of the lake is a source of many problems.

Lake frontage is becoming more and more scarce and valuable, especially in Michigan's populous Southern Peninsula. Real estate companies are recognizing this fact and many lakes are becoming rapidly overdeveloped with unplanned and crowded subdivisions. The amount of frontage

⁵⁷Threinen, loc. cit.

that can be used for developmental purposes has a definite limit on any lake and growth must taper off at some point before the lake in question is ruined by aesthetically unattractive shorelines, overcrowded access points, user conflicts, and overenrichment from inadequate sewage disposal practices.⁵⁸ Any lake development, therefore, should be planned to prevent these destructive practices. The number of lake lots should be limited to keep within the lake's carrying capacity and to maintain the beauty of the shoreline. Lot sizes should be large enough to allow for building without congestion. Lot locations should be kept away from natural shorelines. Public access points should be of sufficient size to allow for adequate public use but should be held to a size in keeping with the best use potential of the lake. It is granted that lake frontage demand is increasing but congested lake developments and overuse of lakes tends to destroy their original and intended purpose, namely, relaxation, recreation, and summer enjoyment.

When development of a lake exceeds the area and volume of water in the lake that is capable of being used for recreational purposes, overdevelopment is produced and associated user conflicts come into being.⁵⁹ Since so many southeastern Michigan lakes have already reached this point, and are thus the center of the biggest problems associated with lake development, procedures are necessary to prevent further deterioration of lakes already developed beyond their intended limitations.

⁵⁸U. S. Department of Agriculture Task Force, op. cit., p. 63.

⁵⁹Veatch and Humphrys, op. cit., p. 160.

One of the most useful methods for prevention of conflicts is the use of controls. There are three main types of controls relating to recreational use of lakes — time controls, location controls, and user controls.

A time control, the limiting of certain recreation uses to a certain time of day or week, has been practiced quite extensively on a number of southern Michigan lakes with a great deal of success. This method reduces, and often curtails, conflicting uses by rendering it impossible for two or more recreational uses to compete for space on a lake used for recreation.

Location controls may be used in conjunction with time controls, or if the lake is not too overcrowded, may be effectively used alone. This method, which limits a certain area of a lake to one use, another area of the lake to another use, and so on, may adequately halt user conflicts if the lake in question is of sufficient size to permit all recreational uses at the same time.

Finally, user controls may be effectively used in cases of extreme overcrowding or overuse of a lake where other controls would not adequately reduce conflicting uses. This control is especially useful on smaller lakes and makes use of the fact that some lakes are naturally capable of only one use whereas another lake may be adapted for another use. Therefore, for example, one lake may be restricted for waterskiing, another for fishing, and yet another for swimming, skin diving and sunbathing. This control is, of course, limited to areas with many small lakes that can be used for single purposes.

Controls, then, are potentially an effective tool for use in the proper management of overcrowded and overused lakes.

Another method similar to a control is zoning. Zoning is useful to prevent undesired property development along a lakeshore by preventing such practices as using property for temporary structures such as out-houses, trailers and tents. It is effective in reserving and protecting a portion of the lake shoreline for wildlife and aesthetics, and even restricting the type of building that may be erected on lakefront lots. Well-planned zoning can therefore be used in maintaining a lake by the use of power maintained in the name of health, safety or welfare.

Health problems and overenrichment often plague many lake developments. Because of the seasonal nature of lake use, many developers and property owners may disregard some of the acceptable methods for sewage and garbage disposal. Expense of such ideal practices is a major factor for people are unwilling to spend large sums of money on a cottage or area where residence is only temporary. Because of this, inadequate and improperly maintained disposal systems often are a cause of concern since leaks or improperly treated effluents from septic tanks or other disposal structures may run into lakes resulting in overenrichment and possible pollution. Since these problems are so common on overcrowded lakes, there are a number of requisites for a safe and healthful environment that have been prescribed by the U. S. Department of Health, Education and Welfare that should apply to all lake developments. Some of the more

important of these aspects that apply directly to lake developments are as follows:

1. Development of sources, treatment, and distribution of water supply to meet quality standards for domestic and culinary use.
2. Proper collection, treatment, and disposal of sewage wastes to prevent pollution hazards that may cause disease or produce other undesirable effects.
3. Proper storage collection and disposal of garbage and other refuse.
4. Adequate and safe housing, including campsites, cabins, . . . and other public use buildings.
5. Elimination of accident hazards and promotion of safety.⁶⁰

Of these five standards, the second entry is probably the most crucial in present lake developments. If future lakefront property development patterns follow present use, central sewage disposal systems will be essential for all lake developments.

Many potential lake developments are held back on some of the less desirable lakes due to the nature of lake bottom, shoreline, and beach. Although it has not been practiced too extensively, dredging and subsequent filling of lakeshores may open up numerous lakes that are now considered undesirable for property or recreational development. Dredging a muck shoreline down to a solid surface and then filling the area with a gently sloping sand fill often produces a very desirable beach as well as a good

⁶⁰ U. S. Department of Health, Education and Welfare, Environmental Health Practice in Recreation Areas (Cincinnati: Robert A. Taft Sanitary Engineering Center, n.d.), p. 1.

cottage site. Although the process is expensive, it is still a possible solution to satisfy future high demands for lake frontage.

Figure 10 and the following summary illustrates a recommended ideal type of lake development on small Michigan lakes. The development postulated in this sketch is but one of numerous forms for possible ideal lake developments since many factors such as location, size, and accessibility play an important part in determining a design to fit any particular situation. An attempt is made, therefore, to analyze some of the more important characteristics of lake development that may be desirable in planning for the utilization of any lake.

Table 3. Ideal Lake Development: A Summary

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1. Access Road — The access road to any lake should not encircle the entire shoreline because certain areas of the lakeshore should be reserved to its natural characteristics. The road itself should be maintained in a paved condition and should be designed to prevent high-speed driving. It should run behind the public beach area to keep it from severing the beach from the lake. The end of the road should be supplied with a cul-de-sac to permit cars with trailers the ability to have easy maneuvering room for the launching area.
 2. Private Road — The private road should diverge from the access road and should be limited to the use of the lot owners in the cottage development area only. It, too, should be kept in a paved condition in order to minimize dusty and muddy conditions. It should run through

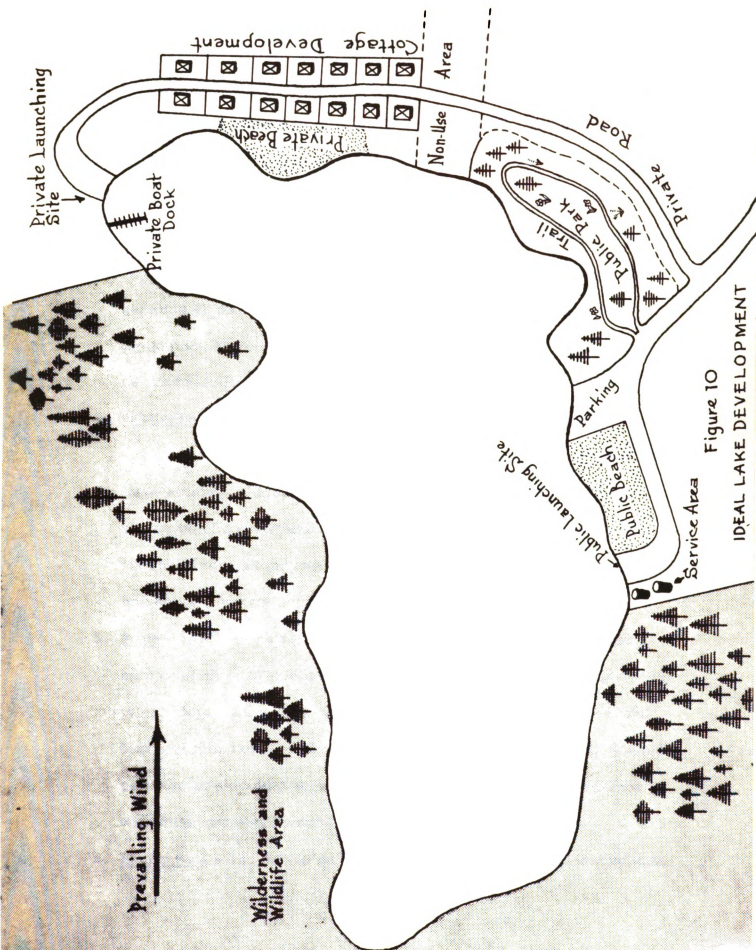


Figure 10
IDEAL LAKE DEVELOPMENT

the cottage development area thus allowing each property owner access to his cottage. The road should, as with the access road, end at the private launching site where a turn-around should be provided.

3. Parking Area — This area should be in such a position so as to permit easy access to both the public beach and the public park. It should be of sufficient size to allow for car and trailer parking but should be limited to the largest possible crowd that the lake is capable of handling so as not to permit an overcrowded condition. The size of the parking area, along with the size of the beach and park, would be the basic limiting factor to public use of the lake.
4. Public Beach — The public beach should be developed on the windswept side of the lake in order to allow for the self-cleaning process of wave action. It should be composed of a highly porous sand and should be of such a size to allow for uncongested public use. It should be located far enough away from all private developments to prevent bothersome noises and nuisances for private owners.
5. Private Beach — The private beach should be developed in the same manner as the public beach but should be dedicated to the use of private lot owners only. Its size is dependent upon the size of the lake and thus the size of the cottage development area. Care should be taken in providing access to the beach to minimize interference with other property owners.
6. Public Park — The public park should be kept in a semi-wild condition

and access by car or other vehicle should not be allowed. A walking trail should be provided to allow for access to the area from the parking lot. The size of the park and the number of picnic tables and other picnicking facilities should reflect the size of the lake. Its location should allow for easy access to and from the public beach so that there would be no necessity to drive from place to place.

7. Public Launching Site — The public launching site should be located on the outer edge of the public portion of the lake development in order to minimize traffic problems and danger of accident. The size of the lake should influence the number of launching sites that should be available for public use. As a rule, "In an area where boating is popular, one boat launching facility for trailered boats should be provided for each 160 acres of boating water."⁶¹ A service area may be provided to supply gas and other boating needs but should be limited to this use only and not become a general concession area.
8. Private Launching Site — The private launching site should be constructed to the same general specifications as the public launching site but should be dedicated to the use of the private property owners only. A service area would not be necessary in this case because the private lot owners would be able to obtain such supplies from the service area at the public launching area. Private boat docks adjacent to the private launching area is an optional feature but may

⁶¹Ibid. , p. 104.

be desired by private owners using their cottages during the whole summer. Under no circumstances should docks be built along the private beach area or the remaining shoreline in front of the cottage development area.

9. Cottage Development — The size of the lake is the main determining factor in the amount of cottage development. There is no set number of cottages that must be developed on a lake of a certain size but all cottage development should be limited to one area of a lake. The best location for cottage development is along the windswept side of the lake so that shorelines are kept free from aquatic plants and organic material by means of waves produced by prevailing winds. The lots themselves should be no less than 200 feet from the lake-shore to prevent aesthetically unattractive shoreline conditions. Lot sizes should be no less than 100 feet in width and no more than two tiers of lots should be allowed. Building, health, property use and similar restrictions should be utilized to prevent shabby housing, pollution and other development problems. Parking space could be provided adjacent to each cottage for owners' cars and boat trailers.
10. Wilderness and Wildlife Area — An area comprising about 50 percent of the shoreline of any lake should be dedicated to primitive wilderness areas and for the protection of wildlife for the purposes of keeping the lake in a natural state and prevent overcrowding and overdevelopment. No access to this area should be allowed by either the public or private owners.

11. Shoreline — No development of any kind, with the exception of beaches and launching facilities, should be permitted within at least 200 feet of the lake shoreline in order to effectively maintain the natural beauty of the lake.

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APPENDIX A

QUESTIONNAIRE AND ACCOMPANYING CORRESPONDENCE

MICHIGAN STATE UNIVERSITY EAST LANSING

DEPARTMENT OF RESOURCE DEVELOPMENT

May 20, 1965

Dear Property Owner:

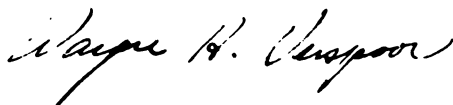
The Department of Resource Development at Michigan State University is conducting a statewide study of lakefront property development for the State of Michigan. Very little is known about the trends or economic importance of this development in the state and in order to obtain this information, the enclosed questionnaire has been developed to supply data concerning lakefront property use, trends, and preferences.

Your lake, along with eight others throughout the state, has been selected purely at random from all of the developed lakes in Michigan in order to obtain a cross section of lakefront property development information. Please note that the information you supply will be held strictly in confidence and will be tabulated without any personal references. You are thus not required to give your name.

ONLY YOUR FULL COOPERATION WILL MAKE THIS STUDY A SUCCESS!!! Please fill out the enclosed questionnaire and mail it as soon as possible in the enclosed self-addressed, stamped envelope. Only those postmarked by June 30, 1965 can be included in the study.

Your assistance in helping to accurately reflect lakefront property development trends in this state is greatly appreciated.

Sincerely yours,



Wayne H. Verspoor
Graduate Research Assistant

WHV:dm
Enclosures (2)

LAKEFRONT PROPERTY DEVELOPMENT QUESTIONNAIRE

County _____ Lake _____ Date _____

I. Personal

1. Where do you live? (permanent address)

City _____ County _____ State _____

2. What is your voting registration address? (check one)

a. ☐ same as otherb. ☐ other _____

3. How many in your family? (include yourself) _____

4. Age of your family:

children

adults

a. ☐ 0-10d. ☐ 21-40b. ☐ 11-15e. ☐ 41-60c. ☐ 16-20f. ☐ 61 and over

5. Years of school completed: (check one for each spouse)

husband

wife

_____ Elementary

_____ Secondary

_____ College

_____ Graduate

_____ Technical

6. Occupation: (check one for each spouse)

husband

wife

_____ Professional or Technical

_____ Manager, Official, Owner

_____ Clerical, Sales

_____ Craftsman, Foreman

_____ Machine Operator

_____ Assembly Line Worker

_____ Farmer, Farm Worker

_____ Laborer

_____ Protective (police, army, etc.)

_____ Student

_____ Housewife

_____ Retired

_____ Other _____

II. Property

1. Type of cottage: (check one)

a. ☐ two storyb. ☐ one story ranchc. ☐ one story bungalowd. ☐ other _____

2. Do you: (check one)

a. ☐ own the cottage? b. ☐ rent the cottage?

3. How often is the cottage used? (check one or more)

a. ☐ weekends onlyb. ☐ summer months onlyc. ☐ winter months onlyd. ☐ permanent homee. ☐ other _____

4. How many of your family generally stay at the cottage?

5. Do relatives and friends frequently stay at the cottage?

If yes, for what length of time? (check one)

a. ☐ one dayc. ☐ one weekb. ☐ weekendd. ☐ more than a week

6. How many more people stay at the cottage on weekends as opposed to during the week?

7. Do you rent the cottage while you do not use it?

If not, would you? _____

8. What other waterfront accessories are associated with your cottage? (check one or more)

a. ☐ dock or pierd. ☐ walk or stepsb. ☐ boathousee. ☐ swimming ladderc. ☐ swimming beachf. ☐ raft or floatg. ☐ other _____

9. If you have no cottage on your property, what are your future plans for the use of that land? (check one only)

a. ☐ sell the landd. ☐ use for campingb. ☐ plan to builde. ☐ build a commercialc. ☐ leave as is

establishment

f. ☐ other _____

10. If not developed, do you use your property for anything at the present time? If yes, please specify use _____

11. How much lakefront property is developed with cottages? Approximately how many cottages are on the lake? _____

12. Why did you select this particular site? (check one or more)

a. ☐ good fishinge. ☐ location near homeb. ☐ good huntingf. ☐ retirement sitec. ☐ isolationg. ☐ cooler climated. ☐ aesthetic beautyh. ☐ friends nearbyi. ☐ other _____III. Activities

1. What recreational activities do you participate in most on the lake or in the area? (check one or more)

a. ☐ waterskiingh. ☐ racingb. ☐ swimmingi. ☐ hikingc. ☐ fishingj. ☐ sun bathingd. ☐ sailingk. ☐ skin divinge. ☐ huntingl. ☐ ice skatingf. ☐ ice boatingm. ☐ ice fishingg. ☐ canoeingn. ☐ other _____

2. Do you own a boat? How many? _____

3. Please classify the boat used most according to the following: (check one)

a. ☐ 8 ft. & undera' ☐ cabin cruiserb. ☐ 9-12 ft.b' ☐ houseboatc. ☐ 13-16 ft.c' ☐ run about with motord. ☐ 17-20 ft.d' ☐ rowboat without motore. ☐ 21-24 ft.e' ☐ sailboatf. ☐ 25-29 ft.f' ☐ canoeg. ☐ 30 ft. & overg' ☐ other _____

4. Is there public access to your lake? _____
If yes, how? (check one)
a. ☐ public launching site
b. ☐ public swimming beach
c. ☐ commercial establishments
d. ☐ state forests or other public land
e. ☐ other _____
5. Type of commercial establishments on lake, if any:
(check one or more)
a. ☐ grocery store g. ☐ public beaches
b. ☐ other retail store h. ☐ entertainment areas
c. ☐ gas dock or station (night club, yacht
d. ☐ motel or hotel club, etc.)
e. ☐ rented cottages i. ☐ boatyard or marina
f. ☐ boat rentals j. ☐ other _____
- IV. Miscellaneous
1. Type of water supply: (check one only)
a. ☐ well c. ☐ other _____
b. ☐ municipal
2. Type of sewage disposal system: (check one only)
a. ☐ septic tank c. ☐ municipal
b. ☐ out house d. ☐ other _____
3. Has any of the shoreline been dredged or filled? _____
4. Have you filled or dredged any of the shoreline in front of
your property to improve the waterline? _____
5. How would you describe the local (county) roads in the
area of your property? (check one)
a. ☐ better than one would expect for this area
b. ☐ about average for this area
c. ☐ below average for this area
d. ☐ poor condition and must be improved
6. How would you describe the State Highways in the area
of your property? (check one)
a. ☐ better than one would expect for this area
b. ☐ about average for this area
c. ☐ below average for this area
d. ☐ poor condition and must be improved
7. Are you satisfied with the services that the county (in
the area of your lake) provides for your taxes? _____
8. Are there any particular traffic problems in your area of
the lake? _____
9. Do you have water weed problems? _____
10. Have you had any water level problems? _____
11. Do you consider the lake overcrowded? _____ If so,
when? (check one)
a. ☐ all the time
b. ☐ on weekends only
c. ☐ on holidays only
d. ☐ in the summer only
e. ☐ other _____
12. Do you feel that the lake is in need of improvement? _____
If so, please explain. _____

13. Are there any problems that you foresee that may force
you to relocate your cottage? _____ If yes, please
explain. _____

The following space is provided for more detailed answers to any of
the above questions. Please indicate the number of the question you
wish to expand on before writing. Any comments will be appreciated.

THANK YOU FOR YOUR COOPERATION!!

APPENDIX B

LAKEFRONT PROPERTY PLATTING CHARACTERISTICS,
APPENDIX TABLES 1-8

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Low	Camp Lake Plat	1	158	\$ 600		X		\$ 3.80
		2	100.72	500		X		4.96
		3	99.52	500		X		5.02
		4	98.02	1000	X		\$ 10.20	
		5	98.77	200		X		2.02
		6	100.12	600		X		5.99
		7	97.93	400		X		4.09
		8	98.03	400		X		4.08
		9	101.55	1000	X		9.85	
		10	128.72	500		X		3.88
		11	191.88	500		X		2.61
		12	96.90	500		X		5.16
		13						
Plat Totals:			1785.95	\$ 6700	199.57'	1170.69'	\$ 10.02	\$ 4.02
Developed Assessed Valuation = \$2000								
Undeveloped Assessed Valuation = \$4700								
Supervisor's Plat of Camp Lake		1	100	\$ 400		X		\$ 4.00
		2	100	300		X		3.00
		3	100	200		X		2.00
		4	139	400		X		2.88
		5	100	400		X		4.00
		6	100	200		X		2.00
		7	101	200		X		1.98
		8	100.68	300		X		2.98
		9	100	700	X		\$ 7.00	
		10	100.64	200		X		1.99
		11	100	600	X		6.00	
		12	132	200		X		1.52
		13	122.44	300		X		2.45
		14	100	200		X		2.00
		15	100	400		X		4.00
		16	100	200		X		2.00
		17	100	600	X		6.00	
		18	100	200		X		2.00
		19	97.19	200		X		2.06
		20	100	200		X		2.00
		21	100	500	X		5.00	
		22	100	600	X		6.00	
Plat Totals:			2292.95	\$ 7500	500'	1792.95'	\$ 6.00	\$ 2.51
Developed Assessed Valuation = \$3000								
Undeveloped Assessed Valuation = \$4500								
South Shore Plat of Camp Lake		1	134.36	\$ 400		X		\$ 2.98
		2	120	1000	X		\$ 8.33	
		3	100	200		X		2.00
		4	110.05	400		X		3.64
		5	150	300		X		2.00
		6	67.86	300		X		4.42
		7	76.89	300		X		3.90
		8	100	300		X		3.00
		9	100	200		X		2.00
		10	100	400		X		4.00
		11	100	400		X		4.00
		12	100	800	X		8.00	
		13	99.77	300		X		3.01
		14	99.77	600	X		6.00	
		15	100	200		X		2.00
		16	100	600	X		6.00	
		17	100	600	X		6.00	
		18	102.77	200		X		1.95
		19	102.78	400		X		3.89
Plat Totals:			1964.25	\$ 7900	419.77'	1544.48'	\$ 7.15	\$ 3.17
Developed Assessed Valuation = \$3000								
Undeveloped Assessed Valuation = \$4900								

Appendix Table 1--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
	Second Addition to South Shore Plat of Camp Lake	1	100	\$ 200		X		\$ 2.00
		2	100	200		X		2.00
		3	100	200		X		2.00
		4	91.45	200		X		2.19
		5	100	200		X		2.00
		6	138.99	200		X		1.44
		7	100	200		X		2.00
		8	100	200		X		2.00
		9	100	200		X		2.00
		10	100	200		X		2.00
		11	100	600	X		\$ 6.00	
		12	108.93	200		X		1.84
		13	100	200		X		2.00
		14	100	200		X		2.00
		15	100	200		X		2.00
		16	100	200		X		2.00
		17	100	200		X		2.00
		18	100	200		X		2.00
		19	100	200		X		2.00
		20	100	200		X		2.00
		21	100	200		X		2.00
		22	100	200		X		2.00
		23	100	200		X		2.00
		24	130	200		X		1.54
		25	136.72	200		X		1.46
		26	100.24	200		X		2.00
		27	96.67	200		X		1.91
		28	100	200		X		2.00
		29	100	350		X		3.50
		30	100	250		X		2.50
		31	104.88	200		X		1.91
		32	100	200		X		2.00
		33	159.92	500		X		3.13
		34	100	200		X		2.00
		35	150	200		X		1.33
		36	108.97	200		X		1.84
		37	100	200		X		2.00
Plat Totals:			3926.77	\$ 8300	100.00'	3826.77'	\$ 6.00	\$ 2.01
				Developed Assessed Valuation = \$600				
				Undeveloped Assessed Valuation = \$7700				
LAKE TOTALS:				Total Platted Frontage = 9969.92'				
				Total Assessed Valuation = \$30400				
				Total Developed Feet = 1219.34				
				Total Undeveloped Feet = 8334.89				
				Total Developed Assessed Valuation = \$8600				
				Total Undeveloped Assessed Valuation = \$21800				
				Assessed Front Foot Value (developed) = \$7.05				
				Assessed Front Foot Value (undeveloped) = \$2.62				

*All assessed valuations are from 1964 tax rolls.

Appendix Table 2. Platting Characteristics of Gulliver Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Moderate	Old Deerfield Plat (Block 1)	1	97.5	\$ 300		X		\$ 3.07
		2&3	100	2725	X		\$ 27.25	
		4	50	1175	X		23.50	
		5&6	101.64	2700	X		26.56	
		7&8	101.64	400		X		3.94
		9	50.82	2325	X		45.75	
		10	50.82	400		X		5.90
		11-13	152.46	1750	X		11.48	

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		14	51.27	\$ 300		X		\$ 5.85
		15	51.27	650	X		\$ 12.68	
		16&17	100.84	2625	X		26.03	
		18&19	100.84	1450	X		14.38	
		20	52.3	300		X		5.74
		21-24	200	3325	X		16.63	
		25-34	500.38	6650	X		13.29	
		35&36	100.38	400		X		3.99
	Plat Totals:		1862.16	\$27375	1408.25'	453.91'	\$ 18.09	\$ 4.19
				Developed Assessed Valuation = \$25475				
				Undeveloped Assessed Valuation = \$1900				
	Old Deerfield First Addition	1&2	100	\$ 1850	X		\$ 18.50	
		3	50	275		X		\$ 5.50
		4&5	100	1650	X		16.50	
		6-8	150	3725	X		24.84	
		9	50	1900	X		38.00	
		10	50	1850	X		37.00	
		11&12	100	1125	X		11.25	
		13&14	100	2775	X		27.75	
		15&16	100	1525	X		15.25	
		17&18	100	1750	X		17.50	
		19	50	1700	X		34.00	
		20&21	100	375		X		3.75
		22	50	3100	X		62.00	
		23	50	275		X		5.50
		24	50	1650	X		33.00	
		25	50	1700	X		34.00	
		26	50	1550	X		31.00	
	Plat Totals:		1300	\$28275	1100'	200'	\$ 24.86	\$ 4.63
				Developed Assessed Valuation = \$27350				
				Undeveloped Assessed Valuation = \$925				
	Bay-View Subdivision	4	210	\$ 9300	X		\$ 44.29	
		6	100	4550	X		45.50	
		7	50	1125	X		22.50	
		8	47	300		X		\$ 6.38
		9-12	200	5400	X		27.00	
		13	50	300		X		6.00
		14	50	300		X		6.00
		15-17	150	5150	X		34.33	
		18-22	200	2300	X		11.50	
		23&24	70	1350	X		19.29	
		25-28	185	2050	X		11.08	
	Plat Totals		1312	\$32125	1165'	147'	\$ 26.80	\$ 6.12
				Developed Assessed Valuation = \$31225				
				Undeveloped Assessed Valuation = \$900				
	Old Deerfield Third Addition	1	51.6	\$ 200		X		\$ 3.80
		2	50.6	550	X		\$ 10.87	
		3&4	101.10	400		X		3.96
		5-9	258.15	950		X		3.68
		10-11	113.6	425		X		3.74
		12	53.4	300		X		5.62
		13	51.5	300		X		5.83
		14-16	154.5	2825	X		18.29	
		17-19	154.2	4150	X		26.91	
		20	50.23	3150	X		62.71	
		21	50.23	300		X		5.97
		22	50.23	300		X		5.97
		23-25	151.97	3100	X		20.40	
		26&27	102	1725	X		16.91	
		28-30	153	600		X		3.92
		31&32	198.2	2050	X		10.34	
		33	247.9	350		X		1.41
	Plat Totals:		1992.56	\$21675	1120'	872.56'	\$ 16.52	\$ 3.64
				Developed Assessed Valuation = \$18500				
				Undeveloped Assessed Valuation = \$3175				

Appendix Table 2--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
	Old Deerfield	1	50	\$ 300		X		\$ 6.00
	Fourth Addition	2	50	300		X		6.00
		3	50	2100	X		\$ 42.00	
		4	50	300		X		6.00
		5	50	300		X		6.00
		6	50	300		X		6.00
		7&8	100	400		X		4.00
		9	50	300		X		6.00
		10-13	200	800		X		4.00
		14&15	100	3000	X		30.00	
		16&17	100	1900	X		19.00	
		18&19	100	1875	X		18.75	
		20-22	150	575		X		3.83
		23&24	150	400		X		2.67
		25&26	100	400		X		4.00
		27-28	100.08	2500	X		24.98	
		29	50	1950	X		39.00	
		30-32	164.15	2400	X		14.62	
		33	328.09	500		X		1.52
		34	345.37	500		X		1.45
Plat Total:			2292.69	\$21100	664.23'	1628.46'	\$ 23.67	\$ 3.30
Developed Assessed Valuation = \$15725								
Undeveloped Assessed Valuation = \$5375								
	Old Deerfield	35	100	\$ 375		X		\$ 3.75
	#5	36	100	375		X		3.75
		37	100	375		X		3.75
		38	100	1600	X		\$ 16.00	
		1/2-39	50	500	X		10.00	
		1/2-39	50	200		X		4.00
		40	100	1300	X		13.00	
		41	100	1550	X		15.50	
		42	100	375		X		3.75
		43	100	375		X		3.75
		44	100	375		X		3.75
		45	100	1225	X		12.25	
		46	100	375		X		3.75
		47&48	200	750		X		3.75
		49	100	400		X		4.00
		50	100	1550	X		15.50	
		51	100	375		X		3.75
		52	100	1550	X		15.50	
		53	100	375		X		3.75
		54	100	1725	X		17.25	
		55	100	1750	X		17.50	
		56	100	350		X		3.50
		57	100	350		X		3.50
		58	100	350		X		3.50
		59	100	350		X		3.50
		60	100	350		X		3.50
		61	100	350		X		3.50
		62	100	350		X		3.50
		63	96.95	350		X		3.61
Plat Totals:			2896.95	\$20225	800'	2096.95'	\$ 15.25	\$ 3.83
Developed Assessed Valuation = \$12200								
Undeveloped Assessed Valuation = \$8025								
LAKE TOTALS:								
Total Platted Frontage = 11656.36'								
Total Assessed Valuation = \$150775								
Total Developed Feet = 6257.48								
Total Undeveloped Feet = 5398.88								
Total Developed Assessed Valuation = \$130475								
Total Undeveloped Assessed Valuation = \$20300								
Assessed Front Foot Value (developed) = \$20.85								
Assessed Front Foot Value (undeveloped) = \$3.76								

*All assessed valuations are from 1964 tax rolls.

Table 3. Platting Characteristics of Lake Esau

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Low	Esau Park	1	100	\$ 800	X		\$ 8.00	
		2	100	200		X		\$ 2.00
		3	100	100		X		1.00
		4	100	1500	X		15.00	
		5	111.1	100		X		.90
		6	101.5	1000	X		9.85	
		7	102.7	500	X		4.87	
		8	53.8	1300	X		22.16	
		9	100	1500	X		15.00	
		10&11	202.8	200		X		.99
		1/2-12	51.25	500	X		9.75	
		1/2-12	51.25	500	X		9.75	
		13	101	100		X		.99
		14	58.6	100		X		1.71
		15-17	308.4	2000	X		6.49	
		Plat Totals:			1642.40	\$10400	968.9'	673.5'
Developed Assessed Valuation = \$9600								
Undeveloped Assessed Valuation = \$800								
Esau Heights		1	Exempt					
		2	Exempt					
		3	Exempt					
		4	100.19	\$ 100		X		\$ 1.00
		5	100.19	100		X		1.00
		6	100.19	100		X		1.00
		7	100.19	100		X		1.00
		8	100.19	100		X		1.00
		9	105.25	100		X		.95
		10	127.74	100		X		.78
		11	146.38	200		X		1.37
		12	123.88	200		X		1.61
		13	130.39	200		X		1.53
		14	142.21	200		X		1.41
		15	99.65	1500	X		\$ 15.05	
		16	92.68	100		X		1.08
		17	100.97	100		X		.99
		18	101.11	100		X		.99
		19	95.44	200		X		2.10
		20	74.17	100		X		1.35
		21	80.47	100		X		1.24
		22	80.07	100		X		1.25
		23	105.39	200		X		1.90
		24	105.54	200		X		1.90
		25	134.48	100		X		.74
		26	140	100		X		.71
		27	132.74	100		X		.75
		28	138.69	100		X		.72
		29	107.91	100		X		.93
		30	126.60	100		X		.79
		31	109.51	100		X		.91
		32	87.15	100		X		1.15
		33	87.55	100		X		1.14
		34	89.08	100		X		1.12
		35	92.52	100		X		1.08
		36	90.41	100		X		1.11
		37	87.30	100		X		1.15
		38	84.89	100		X		1.18
		39	98.43	100		X		1.02
		40	100.09	100		X		.99
		41	100.09	200		X		2.00
		42	100.09	200		X		2.00
		43	100.09	100		X		1.00
		44	100.16	100		X		1.00
		45	100.16	100		X		1.00
		46	100.90	100		X		.99
		47	100.90	100		X		.99
		48	100.90	100		X		.99

Appendix Table 3--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		49	101.83	\$ 100		X		\$.98
		50	100	100		X		1.00
		51	100	100		X		1.00
		52	100	100		X		1.00
		53	100	100		X		1.00
		54	100	100		X		1.00
	Plat Totals:		5672.22	\$ 7700	99.65'	5572.57'	\$ 15.05	\$ 1.11
			Developed Assessed Valuation = \$1500					
			Undeveloped Assessed Valuation = \$6200					
	LAKE TOTALS:		Total Platted Frontage = 7314.62'					
			Total Assessed Valuation = \$18100					
			Total Developed Feet = 1068.55					
			Total Undeveloped Feet = 6246.07					
			Total Developed Assessed Valuation = \$11100					
			Total Undeveloped Assessed Valuation = \$7000					
			Assessed Front Foot Value (developed) = \$10.39					
			Assessed Front Foot Value (undeveloped) = \$1.12					

*All assessed valuations are from 1964 tax rolls.

Appendix Table 4. Platting Characteristics of Gaylanta Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Moderate	Gaylanta Hills	31	50.97	\$ 300		X		\$ 5.89
		32	50.97	300		X		5.89
		33	76.97	300		X		3.90
		34	50.80	300		X		5.91
		35	80.80	300		X		3.71
		36	80.80	300		X		3.71
		37	70.67	300		X		4.25
		38	43.78	1000	X		\$ 22.84	
		39	59.78	300		X		5.02
		40	50	300		X		6.00
		41	50	1000	X		20.00	
		42	67.75	300		X		4.43
		43	84.85	300		X		3.54
		44	71.24	150		X		2.11
		45	42	300		X		7.14
		46	53	200		X		3.77
		47	100	State Owned - Exempt				
		47	158.53	1500	X		9.46	
		48	40	200		X		5.00
		49	46.3	800	X		17.28	
		50	40	200		X		5.00
		51	40.33	200		X		4.96
		52	76.38	200		X		2.62
		53	100.22	200		X		2.00
		54	73.83	200		X		2.71
		55	148.4	200		X		1.35
		56	124.96	200		X		1.60
		57	93.71	900	X		9.60	
		58	65	200		X		3.08
		59	83.43	300		X		3.60
		60	50	300		X		6.00
		61	50	900	X		18.00	
		62	107.20	300		X		2.80
		53	93.18	300		X		3.22
		54	41.95	200		X		4.77
		65	40	200		X		5.00
		66	38.45	900	X		23.41	
		67	60.33	300		X		4.97
		68	64.9	800	X		12.33	

Appendix Table 4--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		69	86.42	\$ 900	X		\$ 10.41	
		70	91.68	300		X		\$ 3.27
		71	44.6	300		X		6.73
		72	38.10	1100	X		28.87	
		73	55.16	300		X		5.44
		74	229.77	300		X		1.31
		75	72.11	300		X		4.16
		76	72.11	300		X		4.16
		77	72.11	300		X		4.16
		78	62.71	300		X		4.78
		79	62.71	300		X		4.78
		80	65.44	300		X		4.58
		81	93.84	300		X		3.20
		82	51.76	900	X		17.39	
		83	51.76	300		X		5.80
		84	51.76	800	X		15.46	
		85	50	800	X		16.00	
		86	50	300		X		6.00
		87	50	1000	X		20.00	
		88	50	300		X		6.00
		89	31.98	1000	X		31.27	
		90	50.33	300		X		5.96
		91	60.82	1000	X		16.44	
		92	30	300	X		10.00	
		93	29.20	1000	X		34.25	
Plat Totals:			4325.85	\$28750	1025.71'	3200.14'	\$ 16.18	\$ 3.80
Developed Assessed Valuation = \$16600								
Undeveloped Assessed Valuation = \$12150								
<hr/>								
Gaylanta Hills #1		130	58	\$ 200		X		\$ 3.45
		131	58.27	200		X		3.43
		132	50	200		X		4.00
		133	50	200		X		4.00
		134	59	1000	X		\$ 16.95	
		135	59.58	200		X		3.36
		136	66	1000	X		15.15	
		137	66	1200	X		18.18	
		138	66	1200	X		18.18	
		139	50	1000	X		20.00	
		140	40	300		X		7.50
		141	65	300		X		4.62
		142	50	300		X		4.62
		143	113.5	300		X		2.64
		144	68.55	300		X		4.38
		145	80	300		X		3.75
		146	80	1000	X		12.50	
		147	74.65	300		X		4.02
		148	95	1000	X		10.53	
		149	95.5	300		X		3.14
		150	116.37	300		X		2.58
		151	117.17	200		X		1.71
		152	150.25	200		X		1.33
		153	100	200		X		2.00
		154	100	300		X		3.00
		155	98.44	1000	X		10.16	
		156	80	200		X		2.50
		157	80	200		X		2.50
		158	60	300		X		5.00
		159	65	300		X		4.62
		160	65	300		X		4.62
		161	80	1200	X		15.00	
		1/2-162	53.28	400	X		7.51	
		1/2-162	53.28	200		X		3.43
		163	55	1000	X		18.18	
		164	65	1200	X		18.47	
		165	70	200		X		2.86

Appendix Table 4--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		166	100	\$ 1000	X		\$ 10.00	
		167	95.53	300		X		\$ 3.14
		168	50	1000	X		20.00	
		169	50	1000	X		20.00	
		170	70	500	X		7.14	
		171	108.05	1000	X		9.25	
		172	209.07	400		X		1.91
		173	80	1000	X		12.50	
		174	110	300		X		2.73
		175	97.86	300		X		3.07
		176	75	1000	X		13.33	
		177	75	300		X		4.00
		178	75	300		X		4.00
		179	75	300		X		4.00
		180	75	1000	X		13.33	
		181	60	300		X		5.00
		182	105	300		X		2.86
		183	90	300		X		3.33
		184	90	300		X		3.33
		185	139	1000	X		7.19	
		186	75	400		X		5.33
		187	75	1200	X		16.00	
		188	73.5	300		X		4.08
		189	60	300		X		5.00
		190	102.65	300		X		2.92
		1/2-191	147.33	200		X		1.36
		1/2-191	147.33	200		X		1.36
		192	75	200		X		2.67
		193	80	200		X		2.50
		194	90	200		X		2.22
		195	86.95	700	X		8.05	
		196	75	500	X		6.67	
		197	80	1000	X		12.50	
		198	65	1000	X		15.39	
		199	82.42	300		X		3.64
		200	90	1200	X		13.33	
		201	70	300		X		4.29
		202	60	300		X		5.00
		203	60	300		X		5.00
		204	282.78	400		X		1.41
		205	150	300		X		2.00
		206	194.63	300		X		1.54
		207	100	300		X		3.00
		209	136.63	1200	X		8.78	
		210	85	300		X		3.53
		211	60	300		X		5.00
		212	60	200		X		3.33
		213	100	300		X		3.00
		214	63	200		X		3.18
		215	100	300		X		3.00
		216	100	300		X		3.00
		217	100	300		X		3.00
		218	66.1	300		X		4.54
		219	100	300		X		3.00
		220	60	300		X		5.00
		221	50.75	300		X		5.91
		222	107.02	300		X		2.80
		223	187.85	1000	X		5.32	
Plat Totals:			8387.28	\$47000	2261.20'	6126.08'	\$ 11.63	\$ 3.38
			Developed Assessed Valuation = \$26300					
			Undeveloped Assessed Valuation = \$20700					
LAKE TOTALS:			Total Platted Frontage = 12713.13'					
			Total Assessed Valuation = \$75750					
			Total Developed Feet = 3286.91					
			Total Undeveloped Feet = 9326.22					
			Total Developed Assessed Valuation = \$42900					
			Total Undeveloped Assessed Valuation = \$32850					
			Assessed Front Foot Value (developed) = \$13.05					
			Assessed Front Foot Value (undeveloped) = \$3.52					

*All assessed valuations are from 1964 tax rolls.

Appendix Table 5. Platting Characteristics of Sapphire Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value			
							Dev.	Undev.		
Full	Sapphire Lake Plat	1&2	99.78	\$ 1800	X		\$ 18.04			
		3	51.47	1500	X		29.14			
		4	51.47	1500	X		29.14			
		5	51.47	400		X		\$ 7.77		
		6	51.47	2200	X		42.74			
		7	51.47	1700	X		33.03			
		8	51.47	1700	X		33.03			
		9	50	400		X		8.00		
		10	50	2200	X		44.00			
		11	50	2200	X		44.00			
		12	50	2200	X		44.00			
		13	50	1300	X		26.00			
		14	50	2400	X		48.00			
		15	50	2500	X		50.00			
		16	50	1500	X		30.00			
		17	50	2400	X		48.00			
		18	50	400		X		8.00		
		19	50	2700	X		54.00			
		20	50	1800	X		36.00			
		21	50	2400	X		48.00			
		22	50	1700	X		34.00			
		24	50	1800	X		36.00			
		25&26	100	3500	X		35.00			
		Plat Totals:			1258.60	\$43400	1107.13'	151.47'	\$ 38.11	\$ 7.92
		Developed Assessed Valuation = \$42200								
		Undeveloped Assessed Valuation = \$1200								
Sapphire Lake Acres		1	88.95	\$ 700	X		\$ 7.87			
		2	60	400		X		\$ 6.67		
		3	65	400		X		6.15		
		4	65	1000	X		16.67			
		5&6	96.53	600		X		6.22		
		7	38.10	200		X		5.25		
		8	60	1500	X		25.00			
		9	60	1200	X		20.00			
		10	50	300		X		6.00		
		11	170.06	1100		X		6.47		
		Plat Totals:			753.64	\$ 7400	293.95'	459.69'	\$ 14.97	\$ 6.53
Developed Assessed Valuation = \$4400										
Undeveloped Assessed Valuation = \$3000										
Duck Point Plat		1	50.54	\$ 400		X		\$ 7.92		
		2	50.54	400		X		7.92		
		3&4	109.86	800		X		7.28		
		5&6	122.2	3000	X		\$ 24.55			
		7	66.25	400		X		6.04		
		8	50.25	400		X		7.96		
		9	50.25	1400	X		27.86			
		10	50.25	400		X		7.96		
		11&12	100.50	800		X		7.96		
		13	50.25	2500	X		49.75			
		14	50.03	1300	X		25.98			
		15&16	100.06	1000	X		9.99			
		17	50.03	2400	X		47.97			
		18&19	100.06	2600	X		25.98			
		20	50.03	1600	X		31.98			
		21&22	100.06	2600	X		25.98			
		23	50.03	400		X		8.00		
		24	50.03	1100	X		21.99			
		25&26	61.02	4000	X		65.55			
		27&28	80.66	2000	X		24.80			
		29	50.64	1400	X		27.65			
		30	50.64	400		X		7.90		
		31&32	101.28	2600	X		25.67			
		1/2-33	107.83	1200	X		11.13			
		34	64.82	700	X		10.80			

Appendix Table 5--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		35	60.39	\$ 1600	X		\$ 26.50	
		36	48.41	1600	X		33.05	
		37	45.57	700	X		15.36	
		38	42.25	400		X		\$ 9.47
		39&40	65.62	700		X		10.67
		41&42	75.27	400		X		5.31
		43&44	85.05	400		X		4.70
	Plat Totals		2298.50	\$42000	1394.16'	904.34'	\$ 25.61	\$ 6.97
Developed Assessed Valuation = \$35700								
Undeveloped Assessed Valuation = \$6300								
<hr/>								
Sapphire Lake								
Plat No. 2								
		99	50	\$ 2000	X		\$ 40.00	
		100	50	1500	X		30.00	
		101&102	100	800		X		\$ 8.00
		103	50	1500	X		30.00	
		104	50	400		X		8.00
		105	50	400		X		8.00
		106	50	400		X		8.00
		107-109	150	1200		X		8.00
		110	50	400		X		8.00
		111&112	100.55	400		X		3.98
		113	60.90	1000	X		16.42	
		114	60	400		X		6.67
		115	64.4	400		X		6.21
		116&117	115	3800	X		33.04	
		118	50	4500	X		90.00	
		119	20	400	X		20.00	
		120	44.6	2000	X		44.84	
		121	49.6	2000	X		40.32	
		122	49.6	1500	X		30.24	
		123&124	110.14	2300	X		20.88	
		125	55.07	400		X		7.26
		126	55.07	1700	X		30.87	
		127	55.07	400		X		7.26
		128	53.66	400		X		7.45
		129&130	107.32	2100	X		19.57	
		131	53.66	400		X		7.45
		132	53.66	400		X		7.45
		133	50	400		X		8.00
		134-136	150	3500	X		23.33	
		137	50	400		X		8.00
		138	50	400		X		8.00
		139	50	1900	X		38.00	
		140	50	400		X		8.00
		141	40	400		X		10.00
		142	39.29	400		X		10.18
		143	50.66	2000	X		39.48	
		144	50.66	2700	X		53.30	
		145	50.66	400		X		7.90
		146	51.48	2500	X		48.56	
		147	51.85	400		X		7.72
		148	51.85	400		X		7.72
		149	51.85	400		X		7.72
		150	51.85	2000	X		38.57	
		151&152	103.74	2200	X		21.21	
		153	51.85	2300	X		44.36	
		154	51.85	2200	X		42.43	
	Plat Totals		2855.85	\$58400	1526.13'	1329.12'	\$ 31.45	\$ 7.83
Developed Assessed Valuation = \$48000								
Undeveloped Assessed Valuation = \$10400								
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LAKE TOTALS:								
			Total Platted Frontage = 7166.59'					
			Total Assessed Valuation = \$151200					
			Total Developed Feet = 4321.17					
			Total Undeveloped Feet = 2845.22					
			Total Developed Assessed Valuation = \$130300					
			Total Undeveloped Assessed Valuation = \$20900					
			Assessed Front Foot Value (developed) = \$30.15					
			Assessed Front Foot Value (undeveloped) = \$7.35					

*All assessed Valuations are from 1964 tax rolls.

Appendix Table 6. Platting Characteristics of Big Brower Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Full	Hines Park	1&2	95	\$ 4000	X		\$ 42.11	
		3	47	3500	X		74.47	
		4	50	2700	X		54.00	
		5	50	2000	X		40.00	
		6-8	156	6350	X		40.71	
		9&10	92	4000	X		43.48	
		11	50	600		X		\$12.00
		12	50	2000	X		40.00	
		13	52.25	2000	X		38.28	
		14	50	2000	X		40.00	
		15	50	2100	X		42.00	
		Plat Totals:	750.5	\$31250	692.5'	58'	\$ 44.26	\$10.35
		Developed Assessed Valuation = \$30650						
		Undeveloped Assessed Valuation = \$600						
Point JE-NE-BE		1	269	\$ 2800	X		\$ 10.41	
		2	83.5	4000	X		47.90	
		3	75	2800	X		37.33	
		4-6	225	2500	X		11.11	
		10&11	56.7	3200	X		56.43	
		12&13	Exempt					
		Plat Totals:	724.20	\$15300	724.20'	0'	\$ 21.13	\$ 0.00
		Developed Assessed Valuation = \$15300						
		Undeveloped Assessed Valuation = \$000						
Vinkemulder Plat		31&32	120	\$ 4500	X		\$ 37.50	
		33	60	2000	X		33.33	
		34	60	400		X		\$ 6.67
		35	60	1900	X		31.67	
		36	130	600		X		4.62
		37	144.70	1800		X		12.44
Plat Totals:			574.70	\$11200	240'	334.70'	\$ 35.00	\$ 8.37
		Developed Assessed Valuation = \$8400						
		Undeveloped Assessed Valuation = \$2400						
E. A. Smith's Plat of Brower Lake		1	45	\$ 3200	X		\$ 71.11	
		2	45	4000	X		89.89	
		3	45	2800	X		62.22	
		4-6	120	2500	X		20.83	
		7	40	2500	X		62.50	
		8	40	1200	X		30.00	
		9	40	550		X		\$13.75
		10-11	65	3200	X		49.23	
		12-13	85	2000	X		23.53	
		14	40	2000	X		50.00	
		15	40	1600	X		40.00	
		16	35	2500	X		71.43	
		17	45	3050	X		75.00	
		18-19	80	4500	X		56.25	
		20-21	80	2700	X		33.75	
		22-23	60	1800	X		30.00	
		24	55	2200	X		40.00	
		25	40	500		X		5.50
		26&1/2-27	60	1800	X		30.00	
		1/2-27&28	55	600		X		10.91
		29-30	70	2200	X		31.43	
		31	40	500		X		12.50
		32	40	500		X		12.50
		33	40	700	X		17.50	
Plat Totals:			1305	\$49100	1085'	220'	\$ 42.77	\$12.27
		Developed Assessed Valuation = \$46400						
		Undeveloped Assessed Valuation = \$2700						
E. A. Smith's Plat of Brower Lake No. 1		34-35	110	\$ 2400	X		\$ 21.82	
		36	60	1900	X		31.67	
		37	50	600		X		\$ 2.00

Appendix Table 6--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		38	60	\$ 3500	X		\$ 58.33	
		39	60	1100	X		18.33	
		40	60	1600	X		26.67	
		41	60	675		X		\$11.25
		42	60	3500	X		58.33	
		43	70	3500	X		50.00	
		44-45	146	4000	X		27.40	
		46	60	3200	X		53.33	
		47&1/2-48	90	1800	X		20.00	
		1/2-48&49	90	2000	X		22.22	
		50	60	1850	X		30.83	
		51	50	2500	X		41.67	
		52	60	675		X		11.25
		53	60	2000	X		33.33	
		54	60	675		X		11.25
		55	55	2800	X		50.91	
		56-57	Exempt					
		58-59	123.20	3400	X		27.60	
Plat Totals:			1619.20	\$43675	1274.20'	230'	\$ 32.22	\$11.41
Developed Assessed Valuation = \$41050								
Undeveloped Assessed Valuation = \$2625								
Brower Lake Park		1	50	\$ 1400	X		\$ 28.00	
		2	50	2000	X		40.00	
		3	50	1200	X		24.00	
		4-5	100	2250	X		22.50	
		6	50	1800	X		36.00	
		7	50	1800	X		36.00	
		8-9	110	3800	X		34.55	
		10&1/2-11	75	4500	X		60.00	
		1/2-11&1/2-12	50	2650	X		53.00	
		1/2-12&13	75	4200	X		56.00	
		14	50	1400	X		28.00	
		15-16	100	2000	X		20.00	
		17	50	2050	X		41.00	
		18	50	200		X		\$ 4.00
		19	47.6	200		X		4.20
		20	50	200		X		4.00
		21	50	1400	X		28.00	
		22	50	3800	X		76.00	
		23	50	500		X		10.00
		24	50	1600	X		32.00	
		25	50	2100	X		42.00	
		26	50	1400	X		28.00	
		27	50	1600	X		32.00	
		28-29	100	2700	X		27.00	
		30	50	1800	X		36.00	
		31	50	2800	X		56.00	
		32	50	2800	X		56.00	
		33	50	2150	X		43.00	
		34	50	2150	X		43.00	
		35	80	2000	X		25.00	
		36	Exempt					
		37	60	500		X		8.33
		38	Exempt					
		39	50	1600	X		32.00	
		40	50	3800	X		76.00	
		41	50	2500	X		50.00	
		42	60	4800	X		80.00	
		43	40	2200	X		55.00	
		44	62	3200	X		51.61	
		45-46	88	3200	X		36.86	
		47	50	1400	X		28.00	
		48&1/2-49	75	3250	X		43.33	
		1/2-49&1/2-50	50	3000	X		60.00	
		1/2-50&51	75	2900	X		38.67	
		52	45	1600	X		35.56	

Appendix Table 6--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		53	55	\$ 2000	X		\$ 36.36	
		54	50	5000	X		100.00	
		55	50	3500	X		70.00	
		56	62	3500	X		56.45	
	Plat Totals:		2799.60	\$108700	2492'	307.6'	\$ 42.98	\$ 5.20
			Developed Assessed Valuation = \$107100					
			Undeveloped Assessed Valuation = \$1600					
	LAKE TOTALS:		Total Platted Frontage = 7773.20'					
			Total Assessed Valuation = \$259225					
			Total Developed Feet = 6507.90					
			Total Undeveloped Feet = 1150.30					
			Total Developed Assessed Valuation = \$248900					
			Total Undeveloped Assessed Valuation = \$10325					
			Assessed Front Foot Value (developed) = \$38.25					
			Assessed Front Foot Value (undeveloped) = \$8.98					

*Assessed valuations are from 1964 tax rolls.

Appendix Table 7. Platting Characteristics of Silver Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Full	Silver Lake Sub- division	1/2-21	20	\$ 1100	X		\$ 55.00	
		1/2-21&22	70	1100	X		15.71	
		23	Exempt					
		24	60	1500	X		25.00	
		25	50	1400	X		28.00	
		26&27	100	2200	X		22.00	
		28	50	1200	X		24.00	
		29	50	400		X		\$ 8.00
		30	50	1000	X		20.00	
		31	50	700	X		14.00	
		32	50	1000	X		20.00	
		33-35	160	1600		X		10.00
		36	50	130		X		2.60
		37	50	1200	X		24.00	
		38	45	400		X		8.88
		39	40	1600	X		40.00	
		40	40	2200	X		55.00	
		41	45	1600	X		35.56	
		42	35	1750	X		50.00	
		43	55	1750	X		31.82	
		44	45	1000	X		22.22	
		69	50	1600	X		32.00	
		70	50	1200	X		24.00	
		71	50	1400	X		28.00	
		72	50	1400	X		28.00	
		73	50	1300	X		26.00	
		74	50	1300	X		26.00	
		75	50	1200	X		24.00	
		76	50	1500	X		30.00	
		77	50	2200	X		44.00	
		78	50	500		X		10.00
		79	50	1200	X		24.00	
		80	50	2000	X		40.00	
		81	50	1400	X		28.00	
		82	50	1200	X		24.00	
		83	50	1200	X		24.00	
		84	50	1400	X		28.00	
		85	50	2400	X		48.00	
		86	50	1400	X		28.00	
		87	50	1400	X		28.00	
		88&1/2-100	75	200		X		2.67

Appendix Table 7--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		1/2-100	25	\$ 200		X		\$ 8.00
		101	50	2000	X		\$ 40.00	
		102	35	1600	X		45.71	
		103	50	1600	X		32.00	
		104	50	2500	X		50.00	
		122	50	2000	X		40.00	
		123	50	3000	X		60.00	
		124	50	2000	X		40.00	
		125	60	2500	X		41.67	
		126&127	100	1000		X		10.00
		128	50	600		X		12.00
		129	50	1600	X		32.00	
		130	50	2500	X		50.00	
		131	50	3500	X		70.00	
		132	50	3500	X		70.00	
		133	50	3500	X		70.00	
		134	50	1000	X		20.00	
		135	65	1600	X		24.62	
		136&137	85	1600	X		18.82	
		138	50	1600	X		32.00	
		139	50	2500	X		50.00	
		140	50	1600	X		32.00	
		141	50	1800	X		36.00	
		142	50	3500	X		70.00	
		143	50	1500	X		30.00	
		144	50	2000	X		40.00	
		145&146	110	3000		X		27.27
		147	70	2000	X		28.57	
		148	60	1500	X		25.00	
		149	70	1500	X		21.43	
		150	75	1600	X		21.33	
		151	Exempt					
Plat Totals:			4170.0	\$114130	3464.0'	706.0'	\$ 29.89	\$15.06
Developed Assessed Valuation = \$103500								
Undeveloped Assessed Valuation = \$10630								
Peaches Sub- division		1	50	\$ 1100	X		\$ 22.00	
		2	50	1100	X		22.00	
		3&4	100	1100	X		11.00	
		5	50	1200	X		24.00	
		6	50	1300	X		26.00	
		7	50	200		X		\$ 4.00
		8	50	1000	X		20.00	
		9&10	418	2000	X		4.79	
		11&12	100	1200	X		12.00	
Plat Totals:			918.0	\$10200	868.0'	50'	\$ 11.52	\$ 4.00
Developed Assessed Valuation = \$10000								
Undeveloped Assessed Valuation = \$200								
Peaches Sub- division No. 2		54&55	23.30	\$ 1600	X		\$ 68.67	
		56	210.5	1200		X		\$ 5.70
		57-60	Assessed in acreage					
		61	50	200		X		4.00
		62	50	200		X		4.00
		63	50	1300	X		26.00	
		64	50	250		X		5.00
		65	50	800		X		16.00
		66	50	250		X		5.00
		67	50	1000	X		20.00	
		68	50	1400	X		28.00	
		69	50	1200	X		24.00	
		70	50	1200	X		24.00	
		71	50	800		X		16.00
		72	50	1300	X		26.00	
		73&1/2-74	75	1200	X		16.00	
		1/2-74&1/2-75	50	1400	X		28.00	
		1/2-75&1/2-76	50	1400	X		28.00	

Appendix Table 7--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		1/2-76&1/2-77	50	\$ 2000	X		\$ 40.00	
		1/2-77&78	75	2000	X		26.67	
		79	50	1600	X		32.00	
		80	50	1600	X		32.00	
		81	50	1500	X		30.00	
		82	50	1600	X		32.00	
		83	50	1400	X		28.00	
		84	50	1400	X		28.00	
		85	50	1200	X		24.00	
		86	50	1400	X		28.00	
		87	50	1400	X		28.00	
		88	50	1600	X		32.00	
		89	50	500		X		\$10.00
		90	50	1400	X		28.00	
		91	50	1500	X		30.00	
		92	50	2500	X		50.00	
		93	50	2500	X		50.00	
		94	50	1800	X		36.00	
		95	50	2000	X		40.00	
		96	50	100		X		2.00
Plat Totals:			2245.8	\$47700	1423.3'	610.5'	\$ 30.49	\$ 7.04
			Developed Assessed Valuation = \$43400					
			Undeveloped Assessed Valuation = \$4300					
LAKE TOTALS:			Total Platted Frontage = 7333.80'					
			Total Assessed Valuation = \$172032					
			Total Developed Feet = 5755.30					
			Total Undeveloped Feet = 1366.50					
			Total Developed Assessed Valuation = \$156900					
			Total Undeveloped Assessed Valuation = \$15130					
			Assessed Front Foot Value (developed) = \$27.26					
			Assessed Front Foot Value (undeveloped) = \$11.07					

*Assessed valuations are from 1964 tax rolls.

Appendix Table 8. Platting Characteristics of Cooley Lake

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
Intensive	Twin Shores	1	57	\$ 1000	X		\$ 17.54	
		2	57	2400	X		42.11	
		3	57	2200	X		38.60	
		4	57	2300	X		40.35	
		5	50	2700	X		54.00	
		6	50	2100	X		42.00	
		7	100	2100	X		21.00	
		8	35	800	X		22.86	
		9	35	2700	X		77.14	
		10	35	3100	X		88.57	
		11	50	3400	X		68.00	
		12	50	3350	X		67.00	
		13	50	3250	X		65.00	
		14-16	378	5600	X		14.81	
		17	Community lot - exempt					
		18-24	405	11500	X		27.41	
		25	60	1100	X		18.33	
		26-27	120	2600	X		16.67	
		28	50	5400	X		108.00	
		29	50	3700	X		74.00	
		30	45	3800	X		84.44	
		31-32	80	3100	X		38.75	
		33	75	3500	X		46.67	
		34	50	3800	X		76.00	
		35-36	100	3100	X		31.00	
		37	Community lot - exempt					
Plat Totals:			2096.00	\$78200	2096.0'	0'	\$ 34.84	\$ 0.00
			Developed Assessed Valuation = \$78200					
			Undeveloped Assessed Valuation = \$000					

Appendix Table 8--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
	Switzerland	12-14	118.8	\$ 2400	X		\$ 20.20	
	Plat	15	39.6	2000	X		50.51	
		16	39.6	2000	X		50.51	
		17	39.6	300		X		\$ 7.58
		18-20	<u>118.8</u>	<u>4600</u>	<u>X</u>		<u>38.72</u>	
	Plat Totals:		356.4	\$11300	316.8'	39.6'	\$ 34.79	\$ 7.58
Developed Assessed Valuation = \$11000								
Undeveloped Assessed Valuation = \$300								
Bertram's Log		1	41	\$ 3000	X		\$ 73.17	
Cabin Park		2	41	2950	X		71.95	
		3	41	3100	X		75.61	
		4	41	2850	X		69.51	
		5	41	2500	X		60.98	
		6	41	3400	X		82.93	
		7	41	2750	X		67.07	
		8	42.5	3250	X		76.47	
		9	33.4	3350	X		100.30	
		10	34.5	3350	X		97.10	
		11	36.9	3700	X		100.27	
		12	37.5	3350	X		89.33	
		1/2-13	State owned - exempt					
		1/2-13&1/2-14	35.25	400		X		\$11.35
		1/2-14&1/2-15	53.25	600		X		11.27
		16	State owned - exempt					
		1/2-17	State owned - exempt					
		1/2-17-19	124.3	1000		X		8.05
		20	State owned - exempt					
		21&1/2-22	67.6	500		X		7.40
		1/2-22&1/2-23	43.25	3500	X		80.93	
		1/2-23	20.75	2400	X		115.66	
		24	42.1	2900	X		68.88	
		25	43.4	2500	X		57.60	
		26	46.1	4600	X		99.78	
		27	46.5	2950	X		63.44	
		28	42.5	2950	X		69.41	
		29	42.5	3880	X		89.41	
		30	41.9	3400	X		81.50	
		31	41.05	3100	X		75.52	
		32	<u>90.25</u>	<u>2600</u>	<u>X</u>		<u>28.81</u>	
	Plat Totals:		1252.50	\$74830	972.10'	280.40'	\$ 74.41	\$ 8.92
Developed Assessed Valuation = \$72330								
Undeveloped Assessed Valuation = \$2500								
Cooley Beach		1	70	\$ 3000	X		\$ 42.86	
Subdivision		2	70	2800	X		40.00	
		3	70	3100	X		44.29	
		4	70	2450	X		35.00	
		5	56	2500	X		44.64	
		6	50	750		X		\$15.00
		7	50	2800	X		56.00	
		8&9	100	4900	X		49.00	
		10	50	2300	X		46.00	
		11	50	3650	X		73.00	
		12	65	4500	X		69.23	
		13&14	110	5200	X		47.27	
		15	50	3100	X		62.00	
		16	50	4000	X		80.00	
		17	50	1950	X		39.00	
		18	40	3600	X		90.00	
		19	40	4100	X		102.50	
		20	50	3400	X		68.00	
		21	50	4300	X		86.00	
		22	60	2500	X		41.67	
		23&24	120	2900	X		24.17	
		25-45	Replatted - see Supervisors Plat No. 1					
		46	50	500		X		10.00
		47	50	5000	X		100.00	
		48	60	1550	X		25.83	
		49	70	1900	X		27.14	

Appendix Table 8--Continued

Development	Plat Name	Lot Number	Frontage (feet)	*Assessed Valuation	Dev.	Undev.	Assessed Front Foot Value	
							Dev.	Undev.
		50&51	152	\$ 3200	X		\$ 61.54	
		1/2-52	50	600		X		\$12.00
		1/2-52	50	600		X		12.00
		53	70	8100	X		115.71	
		54	60	2700	X		45.00	
		55	70	2100	X		30.00	
		56	70	4600	X		65.71	
		57	75	2450	X		32.67	
		1/2-85	24	350		X		14.58
		1/2-85&86	84	4550	X		54.17	
		87	51	4200	X		82.35	
		88	53	5850	X		100.38	
		89	57	4400	X		77.19	
		90	70	4400	X		62.86	
		91	105	5900	X		56.19	
		92	70	1200		X		17.14
		93	57	1000		X		17.54
		94	Exempt					
		95	55	6700	X		121.81	
		96	51	5500	X		107.84	
		97	51	3600	X		70.59	
		98&99	101	7600	X		75.25	
		100	Exempt					
		101&102	152	9600	X		63.16	
		103&104	173.6	6500	X		37.44	
		105	111	5000	X		45.05	
Plat Totals:			3413.60	\$177450	3062.60'	351.0'	\$ 56.31	\$14.25
Developed Assessed Valuation = \$172450								
Undeveloped Assessed Valuation = \$5000								
Bergsma's		1	80.68	\$ 900	X		\$ 11.16	
Subdivision		2	148.52	7200	X		48.48	
Plat Totals:			229.2	\$ 8100	229.2'	0'	\$ 35.34	\$000
Developed Assessed Valuation = \$8100								
Undeveloped Assessed Valuation = \$000								
Supervisors		1	73.37	\$ 1700	X		\$ 23.17	
Plat No. 1		2&3	100.84	4100	X		40.66	
		4	21.91	2800	X		127.80	
		5-7	94.67	7400	X		78.17	
		8-13	120.99	4950	X		40.91	
		14-1/2-18	174.76	1750		X		\$10.01
		1/2-18	33.36	800	X		23.98	
		19&20	117.69	2900	X		24.64	
		21	64.76	3150	X		48.64	
Plat Totals:			802.35	\$ 29550	627.59'	174.76'	\$ 44.30	\$10.01
Developed Assessed Valuation = \$27800								
Undeveloped Assessed Valuation = \$1750								
Russell Beach	Data not available							
LAKE TOTALS:	Total Platted Frontage = 8150.05' Total Assessed Valuation = \$379430 Total Developed Feet = 7304.29 Total Undeveloped Feet = 845.76 Total Developed Assessed Valuation = \$369880 Total Undeveloped Assessed Valuation = \$9550 Assessed Front Foot Value (developed) = \$50.64 Assessed Front Foot Value (undeveloped) = \$11.29							

*Assessed valuations are from 1964 tax rolls.

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