

File 28.3
Extension Bulletin E 1117
November 1979
Price \$2.00

A Riparian's Guide For Self-Help Inland Lake Water Quality Management

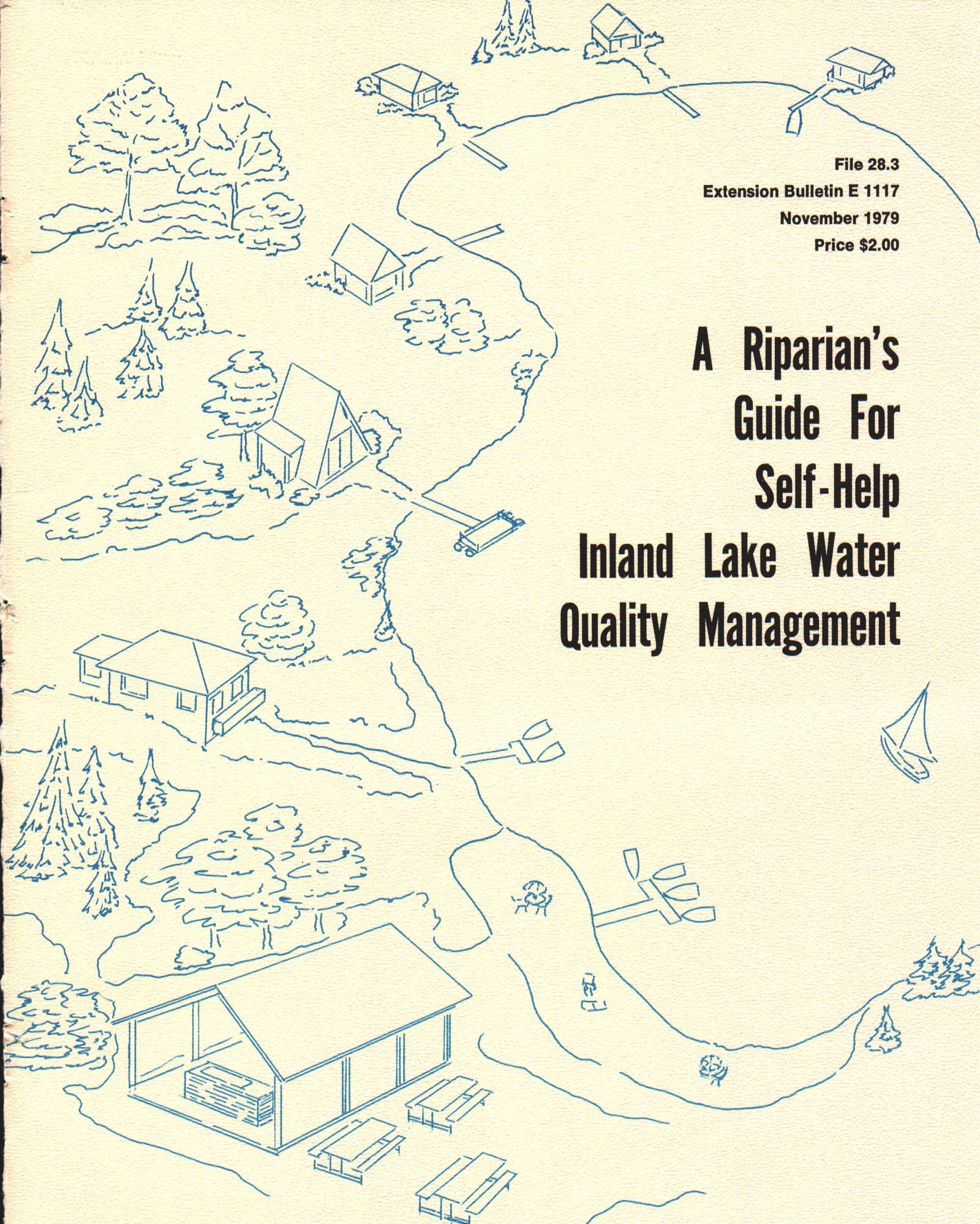


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A Riparian's Guide For Self-Help Inland Lake Water Quality Management

by

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INTRODUCTION

This publication is intended to provide recommendations to riparian* owners and lake associations wanting to protect or improve the water quality of their lake. It is not an all-inclusive summary of lake quality management, but consists of approaches which use "grassroots" implementation of lake management. This selection is based on relatively low cost, simplicity, and ease of application by residents (in most instances) on a self-help basis.

The major premise followed is that meaningful control of lake eutrophication (nutrient enrichment of the lake which generates algae and weed growth) in Michigan is the curtailment of nutrient effluents at their source. Thus, emphasis is placed on methods for the abatement of septic tank - tile field effluent

and surface runoff to the lake. Symptomatic control of algae and aquatic weeds is also discussed.

The publication is divided into two parts. The opening section is addressed to individual riparians, with a buyer's guide to the purchase and development of lake property, including nutrient abatement suggestions the owner can adopt. The second section deals with the organization of lake community residents into a formal association for lake quality management including self help and additional assistance from outside sources.

Hopefully this material will enable lake residents to do considerably more than just recognize their problems that they can, by their own efforts, do much to improve the conditions of their lake resource.

*The term riparian, in this text, is used in its broad sense to describe all the lake residents directly influenced by the lake, rather than the strict legal interpretation of water from property holders only.

PART 1 — INDIVIDUAL RIPARIAN EFFORTS

FACTORS TO CONSIDER WHEN SELECTING RECREATIONAL LAKE HOUSING

In recent years there has been a rising trend among the American public to seek out rural settings for either permanent or second home locations. This trend may be derived from increasing urban tensions, rising environmental awareness, leisure time available and rising real income levels.(4)

In many instances these second homes are purchased as weekend recreation and vacation sites, the expense being traded against alternative vacation travel to other states or countries. An added appeal of such purchases is that of retirement to the lake cottage as a permanent residence once the family has grown and dispersed. Thus, the purchase of

recreational property has economic significance. The buyer can reasonably expect to derive long term pleasure from the purchase; it's a viable residential alternative to an urban setting, and may generally assume a reasonable profit on the investment if there is a decision to sell.

Type of Lake Housing Desired

The buyer should seriously evaluate needs and aspirations when selecting the type and size of the home he wants. How large a house is needed to adequately provide for family and visitors? What type construction? How important is it to have a home right on the lake shore? Will a site located farther from the

water be acceptable? Does the buyer want both a house and a lot, a condominium, or a lot to build and expand on later? If the latter is the case, suitability of the site for construction and cost of local labor and materials are significant factors to consider with respect to location.

At any rate, the buyer must have some idea what type of home and purchase cost will be acceptable. In reaching this conclusion it is wise to look at a few homes in each price range on the market to realistically equate that which is desired with what can be afforded. Pricing the market in this respect should always include settlement fees, financing, title search, and other associated expenses which may not be readily evident in the advertised price of the property.

If the buyer has a clear and definite concept of what is wanted and is prepared to pay, many prospective home sites may be selected or eliminated from consideration on the basis of initial price alone, thus saving considerable shopping effort.

The Distance Factor

Once the buyer decides what to look for, the next consideration is where to look. To derive the most use from the property, it should be close enough to home to allow weekend use. This means that unless an unusually good deal arises or a specific use is in mind the second home should be within a two-to five-hour driving radius from the family's permanent residence(3). This distance factor should also be considered in light of gasoline costs, general quality of the roads, and available service facilities along the way.

Of considerable significance are the seasonal conditions of the prospective route to the vacation home. Well-traveled highways may involve regular traffic jams on Friday and Sunday afternoons during peak recreational seasons. On the other hand, less popular roads may be poorly maintained and inconvenient or dangerous during winter snow storms. This potential should be particularly investigated with respect to secondary "feeder" roads back to the lake area from the main arteries.

Aesthetic Considerations

Once the general market radius is determined, residences within the acceptable price range may be investigated. Since the buyer's objective is a recreational home, the appearance and setting should be seriously evaluated. If purchase is being considered in an established lake community, first impressions may very well be important to the purchase decision. These aesthetic considerations are one aspect of this

decision-making process where emotions, the general "feeling" about something, are a legitimate factor to consider. A good or bad impression should be recognized and investigated further to see what substantial factors may be causing it.

It would be wise to attempt to meet and observe some of the residents to determine if their interests and perhaps income levels, are compatible with one's own as an inducement to new friendships or the proximity to the vacation homes of friends or relatives.

If a recreation center is provided, it may suggest some insight into the general interests and activities of the community. Such facilities may or may not be of value to the individual buyer, and should be considered with respect to the personal utility of the property.

Similarly, the nature of lake use is a factor for consideration. The avid, quiet fisherman should think twice before locating on a small, poorly stocked lake heavily used by waterskiers. Likewise, anyone anticipating the peaceful solitude of a winter evening should avoid lakes which are popular snowmobile sites. On the other hand, if active water recreation is desired, a severely restricted lake or the absence of a marina would mitigate against the location as a potential home site.

In general the prospective buyer should carefully consider impressions of the overall lake setting and atmosphere, future neighbors, and evidence of prevailing use trends on the lake. Then physical evidence should be sought and used to determine if, in the long run, it will be a comfortable environment.

Quality of the Natural Resource

The dominant component of any lake community is obviously the lake itself. Its suitability to the needs of its users is the area's attractant. Tombaugh (1970) reports that almost 90% of Michigan vacation homes are located on or near a water body. In this respect, recognition of even a few basic indicators can help the prospective resident decide if the status of a given lake is suitable.

Highly eutrophic lakes tend to become algae-covered and weed-choked during mid or late summer, thus interfering with the peak season of swimming and boating activities. The fishing quality of such lakes is often poor, characterized by dense populations of stunted pan fish. In addition to dense weed beds and periodic algal blooms, such lakes are also often characterized by shallow waters and thick sediment deposits causing a soft muddy bottom. Quite often

(although not necessarily), these conditions accompany lakes having older, well established, intensive housing developments.

Maintenance of these lakes requires considerable chemical treatment with herbicides and algicides, mechanical harvesting of weeds, and sometimes large-scale dredging. Costs of such management operations must often be borne by the lake residents on a continuing basis to simply preserve already less-than-ideal conditions.

Another factor to be considered is that of lake level fluctuations. Periodic dry or wet seasons can cause considerable variation in the normal water line of a lake. Under such conditions, the waterfront resident must contend with a range of conditions extending from high water covering property to a broad expanse of knee-deep water which may be accompanied by rotting aquatic vegetation and winter fish kills. High water periods followed by a severe winter may also result in extensive ice damage to property.

To avoid these problems, many lake communities establish engineering structures such as dams, weirs, or injection wells to maintain a lake level. Such structures enhance the preferred seasonal optimum use of the resource but also entail a certain amount of expense and legal responsibility with which the buyer should familiarize himself.

Also associated with water levels is the suitability of the property in question, not only to support a house, but to provide adequate drinking water and sewage disposal. If sewer and water lines are not available, the most frequent alternative is individual septic tank systems and private water wells. Minimum conditions of soil type, slope of the land, and size of the lot must be met to insure that septic tank effluent does not contaminate drinking water supplies or the adjacent lake waters. Positioning of the septic system to protect both well water and the lake is not a simple matter, and local public health authorities should always be contacted before a purchase is made. These individuals can also advise as to the relative quality of the lake water with respect to public safety for swimming. In this respect, the firmness of the lake bottom near shore, weeds, and possible drop-off should also be considered. (If lake front property is not being considered, beach and landing facilities available to "out lot" holders should be investigated.)

In addition to the lake basin proper, the surrounding areas should be considered. The area should be visited during all seasons to determine what changes in user patterns and appearance occur. A visit to the local county or regional planning office should give the

buyer some idea of future land use for the area. Developments already on the drawing board could mean the loss of attractive open space, together with more intensive or incompatible use of the lake resource.

In summary then, the buyer should carefully consider the relative quality of the lake itself, suitability of the property for water and sewage facilities, and construction and general appeal of the area as it exists and as it is expected to exist in the reasonable future.

Local Services

A local service often overlooked by purchasers of lake property is the provision of first aid and hospital facilities. This should be a consideration for any water-based recreationist, and may be of even greater significance to retired couples having greater need of competent routine or emergency health care.

Similarly, the quality of local police and fire departments should be considered. Since it is reasonable to expect the occupants of a vacation home to be absent a good deal of the time, an attentive police department is essential to property security. Fire protection depends not only on the proximity of the apparatus and men, but also on nearby adequate fire hydrants, tank trucks, or siphon equipment capable of drawing from the lake. An insurance or underwriting agency should be able to provide ratings of these local services helpful in evaluating their proficiency, and in determining costs of insurance expenses associated with the property.

Other services which should also be investigated are the proximity and quality of shopping areas, garages and gas stations, and theaters or other cultural amenities which one may desire. Also the quality and nearness of schools may be a factor, as may the location of churches.

Local and regional government agencies should also be investigated. How well can the vacation resident expect to be represented? What are the tax rates, and what may be expected in return? What about road maintenance, especially winter plowing? Are new higher assessments anticipated, and will they provide increased services? The buyer should also determine if a local property owners or lake association includes his prospective property. If so, what services, can he expect, and does the association also have taxing or assessment authority?

Another concern should also be the provision of local utilities and, particularly in rural areas, their rates and quality of service. Telephone and lighting services usually exist together, but fuels (natural

gas, fuel oil, or liquified petroleum gas) may be very expensive and difficult to obtain.

Earlier, reference was made to the relative suitability of individual water and sewage facilities. However, if the local government is anticipating extension of water and sewer lines to the lake community, buyers may be obligated to connect with these services and should anticipate the associated future costs as well as benefits.

Property Value and Expenses

The sites, having met the various physical criteria discussed, should also be investigated with respect to operating and maintenance costs once purchased and potential resale value. If a house comes with the purchase, age, durability of construction, size, roof type, and extent of insulation will all be factors contributing to the relative expense or economy of maintenance.

Relative shelter from weather extremes provided by the site will also be a factor. Similarly, slope of the land and extent of undisturbed natural vegetation will influence the amount of erosion control, including bulkhead construction the owner will have to install and maintain.

The extent of natural vegetation between the house and shoreline can also be a factor controlling the relative efficiency of the septic tank disposal system on the property. Preservation of such "green belts" not only controls erosion, but this natural system may intercept sewage wastes which would otherwise enter the lake.

The site should also be reviewed with respect to its potential for remodeling or expansion of the house so that aesthetic and physical value is enhanced, rather than sacrificed. A point not to be overlooked in this respect is the provision of adequate parking for guests. Resale potential will depend not only upon physical improvements made, but also on the relative quality of the community.

Factors which should be evaluated with respect to the expense of maintaining a seasonal home obviously should include the tax assessment on that property. Real estate agents or the local tax office should be able to provide this information as well as estimates of future tax rates. Other expenses include insurance, utilities, food and gasoline associated with trips to the cottage, the possible need of a second car and its maintenance, and purchase of recreational facilities such as furniture, boat, and docking facilities.

Membership fees and special assessments for the lake or property owners association may also apply.

After considering all of these factors, if the buyer is confident that the lake property is affordable and the physical requirements of the site are met, before signing any contract the legal ramifications of the anticipated purchase should be thoroughly pursued.

Legal Rights

In 1968 two significant pieces of legislation were passed intended to protect the consumer and the environment from fraudulent land developers. Congress enacted the "Interstate Land Sales Full Disclosure Act," which is administered under the Department of Housing and Urban Development, and protects the consumer in land deals marketed through interstate commerce. The Michigan equivalent of this law, passed in the same year, is the "Subdivision Control Act."

Both laws go a long way toward protecting the consumer from vague and ambiguous property descriptions and hidden conditions. However, by using loop holes, unscrupulous developers are still able to circumvent the letter of either regulation. The purchaser should be familiar with these laws but should not put blind faith in the protection under them and should retain reputable legal council to investigate the sales agreement and title to the land, including the precaution of purchasing title insurance. In addition to a clear title, the buyer should also be assured of a legal riparian right to the lake water and retention of mineral rights to the land. Easements for utilities or roads should also be determined and considered. In addition to these "rights," the owner's liabilities should also be documented. This is particularly significant should a retention dam creating the lake fail and result in downstream flood damage. Investigation should also clearly reveal where and when the developer's responsibility ends, how and what responsibilities the lake community itself must assume, and which will be administered by the local government.

Summary

The major considerations which the prospective buyer of recreational lake property should investigate are: type and price range of property or housing desired; commuting distance from home and work; the aesthetic aspects of the property, i.e., pleasant appearance and compatible neighbors; the quality of the site itself to meet one's needs including construction, septic tank drainage, well water supply, existing and future land use for the area, and quality of the lake

itself, and adequate local amenities and services especially health care and fire and police protection.

If these physical criteria are met, the buyer should avoid rushing into the land purchase before very carefully reviewing, once again, the economic ramifications of the proposed purchase with respect to resale value, maintenance, and legal ramifications.

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ON-SITE SEPTIC TANK DISPOSAL OF HOUSEHOLD EFFLUENT

Introduction

In addition to the criteria used in the selection of lake property, as mentioned in Chapter I, the owner has a continuous responsibility to use and maintain the holding in such a way as to not contribute to the degradation of the lake.

A major factor of recreational lake degradation in Michigan is the enrichment and contamination of the waters by sewage effluent draining through the ground and into the lake from faulty septic tank systems.

Because many recreational lakes are in rural areas, municipal sewage systems are infrequent. Therefore, the riparian's responsibility for the safe disposal of household wastes is imperative. This chapter is intended to provide the property owner with an insight into the principles of septic tank operations. This information should assist in the optimal selection and maintenance of the on-site disposal process.

In some instances the soils and topography of the setting may significantly reduce the efficiency of septic tank systems no matter how carefully installed. Therefore, further information is provided for modifications and use procedures which will help reduce the environmental damage of the system under such circumstances. Next, in situations where the septic tank system is altogether inappropriate, alternative disposal methods are discussed. Finally, to lessen the impact of effluents on lake water quality, a system of vegetative buffer plantings is discussed.

Waste disposal by the septic tank-drain field system came into widespread use in this country during the post World War II period when the return of large numbers of GIs coincided with economic recovery and precipitated the building boom of the late 1940s and early 1950s. Housing developments and individual home sites expanded at a faster rate than public sewage disposal facilities, and individual on-site sewage disposal systems filled the gap. The most popular of these was the septic tank-drain field system. This consists of a large settling tank which initially receives waste-laden household waters. Here much of the solid material settles out as sludge, and bacterial decomposition of organic material begins.

Most septic tanks have a holding time of about 24 hours. The relatively clarified water from the septic tank then flows from here to the tile field, or sub-surface ground distribution system. The intent here is to trickle the effluent in as wide a dispersal pattern as is feasible to allow the bacteria of the soil and the soil matrix itself to serve as a filtration system.

The actual efficiency of a septic tank, however, is extremely variable depending upon the capacity of the facility, frequency of use, slope of the land, soil type, size of the disposal site, depth to groundwater, and proximity of the system to wells, streams, or lakes.

Design Principle of On-Site Septic Tank Systems

The system consists of two basic components, a holding tank to settle out solids and initiate anaerobic bacterial decomposition of organic compounds and a distribution system for effluent waste water, usually either a dry well, seepage bed, or tile field. In each distribution system the objective is to use the surrounding soil to filter and disperse the waste water from the septic tank. In the soil layer, natural bacterial populations continue the decomposition of the effluent while the soil structure itself is relied upon, by a physical filtering process, to entrap any remaining suspended material and bacteria contained in the wastes. These same soil particles also absorb much of the phosphates derived from the waste water. The result is purified water. This purified water is then safely available for use when it reemerges in streams or lakes and is withdrawn some distance away by drinking water wells.

Suitability to Recreational Lake Settings

As it turns out, the area surrounding popular recreational lakes rarely meets the criteria appropriate to the ideal functioning of on-site septic tank disposal systems. Nitrates and chloride ions are not effectively removed under even the best conditions. Often housing lots are too small to allow adequate removal of phosphates or bacterial organisms before the effluent enters the lake or groundwater system.

Nitrates and, particularly, phosphates derived from such sewage are important nutrients associated with plant growth. When they drain into lake waters because of inadequate treatment of wastes, proliferation of algae and aquatic weeds can result, with an associated decline in the recreational potential of the lake.

Septic tank effluent may also foster the entrance of bacterial and viral contaminants from human feces to those same lake waters, or to drinking water wells with attendant potential health hazards to local residents and swimmers. Dr. Walter N. Mack has demonstrated the presence of polio virus in well water in one instance in Michigan associated with septic tank contamination of groundwater.(7)

At present, regulations determining the design and location of residential septic tank disposal systems are established by individual sanitary codes set by

each Michigan county. The State Public Health Department authority applies only to larger-scale disposal systems generating 10,000 gallons per day or associated with housing developments built since 1968. Consequently, the individual lake resident, contemplating construction or modification of an on-site sewage system, must comply with the standards of that county.

Most Michigan counties require a minimum setback of 50 feet of both septic tank and drainage area from any well or surface water as a public health safety measure. This distance, however, may not adequately prevent the entrance of nutrients into these facilities. Ellis and Childs (4) recorded an instance of phosphate travel greater than 100 feet to Houghton Lake from a septic system. The embayment area of the lake in front of the suspect septic system was observed to support an unusually dense aquatic weed growth suggestive of localized enrichment. The generally existing sanitary codes pertaining to minimum setback requirements, together with the frequency of sandy soils adjoining many Michigan lakes in which rapid percolation test rates may quite often be obtained, create a condition permitting potential entrance of significant nutrient loading to these lakes.

In addition, many existing home sites of 10 years or older may often have saturated drain fields which in the past may have adequately intercepted phosphates, but now, due to clogging of the subsoil surfaces by organic matter, are contributing considerable phosphate to the lakes.(3)

This nutrient source from septic systems surrounding each lake together with lawn fertilizer runoff constitutes a cause of lake degradation which can be remedied by responsible landowners themselves.

Optimal Criteria for New Septic Tank Installations

Where a community sewage system is not available, individuals contemplating purchase should first consult the local county sanitary code to determine the suitability of the proposed site for septic tank disposal. This consultation should be made and a satisfactory soil percolation test completed before any sales agreement is signed. In addition, the conscientious buyer should strive to exceed existing minimum standards by incorporating as many of the recommendations as possible.

Septic Tank

Install the largest practical septic tank possible. Generally the smallest acceptable size has a 750 gallon capacity, while larger tanks are required as the number of bedrooms and household occupants in-

creases. The cost is not considerably greater for a 1,000 gallon capacity tank, and the margin of safety with respect to increased retention time is worth the expense. For larger homes, multiple tanks in series may be required, and here, too, it is wise to install the largest capacity practical. If a garbage grinder is part of the household plumbing, additional capacity is indicated. Steel septic tanks should be avoided as they are susceptible to corrosion and leakage. Concrete tanks should be preferred as they are sturdier and less prone to leakage. The following table provides a guide to minimum tank sizes which should be installed.

Location of the septic tank for easy inspection accessibility and cleaning is usually required by law, and is an additionally good family health and lake management practice. The resident should consider this in planning any landscaping or structural modifications of the residence. Under no circumstance should any structures of considerable weight or vehicle parking areas be located above or near either septic tank or drain field.

Dosage Chamber

An additional feature which, if properly designed and installed, can increase the efficiency of the system is the incorporation of a dosage (or dosing) tank between the septic tank and tile field (or seepage bed). It is equipped with either an automatic syphon or pump so that when the level in the chamber reaches a predetermined point, the water in the chamber is emptied into the drainage system. The dosage chamber is intended to retain effluent until a sufficient amount appropriate to the distribution capacity of the drainage field is reached. It then releases this measured amount to the distribution system. In this manner, the receiving soils are allowed some opportunity to drain and dry out between the wetting cycles, as opposed to a less interrupted flow of effluent when the drainage bed is connected directly to the septic tank.

The dosage chamber is particularly helpful in reducing massive "slugs" of effluent to the soil during periods of peak use such as weekend visitors or extensive use of washers or other large-volume water uses. The incorporation of a dosage chamber in the system, in effect, "buys time" for the soil to absorb and filter the household effluent.

Drain Field

Common drain fields used in Michigan are the tile field, seepage bed, and dry well. While all of these systems leave much to be desired with respect to lake communities, the tile field is usually least damaging(17)(12) and should be preferred to either of the

RECOMMENDED MINIMUM SIZE SEPTIC TANKS

Adapted from Vogt and Boyd, 1973

House Size	Tank Capacity Without Garbage Grinder	Tank Capacity With Garbage Grinder
2 bedrooms or less	1-750 gallon	1-1000 gallon
3 bedrooms	1-900 gallon	2-750 gallon
4 bedrooms	1-1000 gallon	1-1000 gallon plus 1-500 gallon

For each additional bedroom the tank capacity must be increased by 400 gallons. Remember, both the septic tank and tile field must be expanded if additional bedrooms are later added to the house.

other alternatives. This method of subsurface disposal incorporates the largest surface area exposure of the soil to effluent and thus offers the most promise of nutrient and bacterial interception before the effluent water enters the water table or surface water system.

Local codes will often stipulate the maximum length and minimum space between trenches for the tile field. Ideally, the run for each trench should be no more than 100 feet with a minimum space of 4 feet between trenches(17). More often, however, the size of the drain field will simply be stated as a minimum number of square feet based on the number of bedrooms in the home, slope of the land, and results of the percolation test. The longer the time for water to go down in the percolation test, the more area required for the tile field. It is generally reasonable to expect to need a minimum of about 225 square feet of absorption field for a three bedroom home(17). Residents near the lake shore should allow even more space, as soil absorption capacity is even more critical.

In considering local requirements, it is important to recognize that these laws, primarily designed to protect well-water supplies, are inadequate with respect to the special conditions of the lake environment. The spacing and percolation requirements appropriate to a large, remote lot in an upland setting may be completely ineffective when applied to small, sandy, lake shore lots. Thus, as a general rule, the lake property owner should try not only to meet, but to exceed local code requirements.

The required percolation test as a major determinant of soil suitability for a tile field and its necessary size has been criticized as being inadequate for measuring soil infiltration capacity(3)(5). Bouma states the field percolation test method overestimates the infiltrative capacity of the soil once an operating tile field is installed. Healy and Laak further suggest that size and shape of the hole as well as weather condition at the time of the test also affect the results.

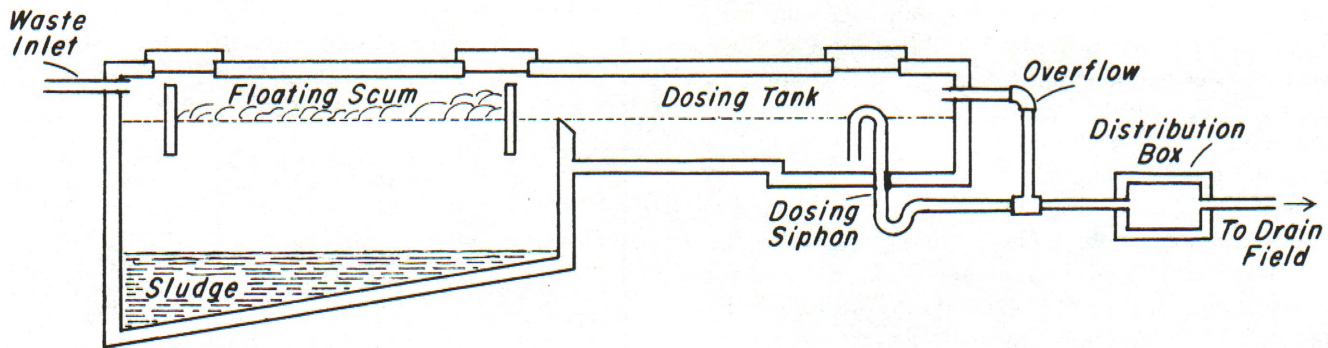


Illustration of the dosing chamber (or tank) with dosing siphon presented in schematic form. Adapted from "Manual of Septic-Tank Practice," 1963 by U.S. Dept. of Health, Education and Welfare (Publication number 526) p. 51.

However, since the percolation test remains a basic indicator of tile field suitability and size, several tests should be conducted throughout the general area in which the proposed field will be located, and then the tile field should be installed larger than the size anticipated as adequate on the basis of the percolation tests. An alternative to a percolation test in Lenawee County is to have the contractor dig a soil profile with a backhoe. This, together with site evaluation by County Health Department representatives, determines septic tank and drain field requirements of the individual property.

Once the size of the proposed drain field is determined, the resident should allow sufficient space on the property to later install a second tile field of the same size. Depending upon soil type and intensity of use of the septic system, the tile field will eventually decline in efficiency due to clogging of the soil spaces with an organic residue or "crust" on the trench walls. This is caused by the trapping of fine suspended material still in the septic tank effluent as well as an organic mat resulting from metabolic activity of aerobic bacterial organisms degrading the effluent at the soil-water interface(3). The life of the tile field will be variable, but generally effective water treatment should not be expected to last more than 10-15 years.

If the resident can afford it at the time of construction, a duplicate tile field should be installed along with the initial one. Both should be connected to the septic tank with a valve system. This makes it possible to alternate from one tile field to the other every few years, thus allowing the soil in the unused tile field to "dry out" and recover its infiltrative capacity. Standing water, the odor of sewage, or soggy sod above the tile field indicate degeneration of the field and the need for remedial action. The continued existence of a clogged drain field constitutes a direct health hazard and also insures the contamination and enrichment of nearby surface waters during unusually wet periods.

Criteria for Tile Field Installation

The septic system should be set as far as possible (in accordance with existing sanitary code requirements) from any well or surface water. In other words the resident should try to exceed, as much as possible, the minimum setback distances. When possible the tile field should be located on the far side of any slope leading toward the lake or well site. It is still possible, however, for effluent to collect beneath the leach field and drain back into the lake, or to intercept groundwater flowing toward the lake or well due to hydrostatic pressures independent of the surface contours. Nonetheless, the effort should be made to set the drain field(s) as far back as possible.

Once the location is selected and approved by the local sanitarian, the trench construction may be initiated. Depth and fill requirements are also covered in most codes and many counties may require inspection of the tile field before it is covered. The bottom of the tile trenches should be at least 4-6 feet above the water table at its highest level of the year and the tiles set no more than ½ inch apart in a level run. A plastic, perforated drainage pipe is also available and should be installed in accordance with local sanitation codes. Michigan State University Cooperative Extension Bulletin Number S77 provides an excellent guide to the homeowner with respect to the field construction and septic system maintenance.

Precautions Regarding Operation of On-Site Disposal Systems

To reduce the damaging potential of the lake front septic system, follow a policy of water conservation. The less flushed into the system, the less its chance of contaminating groundwater or the lake. Such a policy does not call for stringent water rationing, simply a little restraint and common sense. Similarly, the septic system is intended to accommodate the disposal of bodily wastes and, ideally, should be limited to this purpose only.

Try to avoid appliances which constitute an unnecessary burden to the system in terms of sediments, organic material, and volume of flushing water. Instead of using garbage disposals, alternate disposal methods should be used such as garbage pickup service or landfill disposal. By the same token, even where not specifically prohibited, home laundries should also be avoided. Washing machine or dishwasher effluent is often heavily laden with phosphate detergents which, even if biodegradable, place a strain on the system. If a washing machine is in use on the property, wash loads should always be a full load of laundry so unnecessary volumes of water are not flushed through the system.

Similarly, avoid once-a-week "wash days" to prevent massive slugs of water from entering the system, thereby reducing the exposure time of effluent to soil filtration. Instead, full wash loads should be done at intervals spaced throughout the week. (The same rationale applies to the use of automatic dishwashers.) Care should be exercised not to overload the system when visitors are entertained. Often the strain imposed on the household hot water heater will help curtail such abuses to the system, but again a little common sense to space out baths, dishwashing, etc. helps.

Moderate use of bowl cleaners and cleansing compounds should not adversely effect the bacterial cultures of the system, but the toilet should not be used as a common receptacle for large amounts of caustics, grease, oils, or volatile compounds. Nor should sanitary napkins or disposable diapers be flushed into the tank as these products break down into cellulose fibers which may accumulate at the soil interface of the tile field or, if intact, can clog plumbing or drain tiles. The same caution obviously applies to plastic products, paper towels, and cigarette butts.

The septic tank itself should be pumped by a licensed septic tank service about every other year depending upon the extent of use. Whenever the tank is pumped, it is wise to leave some sludge in the bottom to help restart the bacterial action.

In addition to the operational precautions mentioned above, the resident can also reduce the nutrient input from the property to the lake by landscaping to prevent erosion, avoiding the direct runoff of storm water to the lake, and leaving a strip of natural vegetation along the lake shoreline. The plants which naturally occur at the water's edge often have root systems which help stabilize the bank and also take up some of the nutrient laden groundwater which would otherwise enter the lake.

In this respect, lawn fertilization should also be held to a minimum, if practiced at all. Any fertilizer not taken up by the grass will drain into the lake and further contribute to aquatic weed problems and algal blooms. [Residents who feel a lush lawn is imperative should fertilize only during the spring growing season. A soil test by the County Cooperative Extension Service should first be made, and fertilizer applied strictly in accordance with the resultant recommendations.]

Investigation for Septic Tank Infiltration of Lake Waters

The individual property owner as well as the lake association can test a septic system for possible leakage by periodically flushing a fluorescein dye down the drain. These dyes serve as tracers of the path of the water from the system. They are commercially produced, harmless to the water or environment, and produce a bright red or green color. If a septic system is discharging directly to the lake, a noticeable color plume will usually result within a few to 24 hours. The dyes are often prepackaged in gelatin packets or as tablets in household size doses. Companies providing the dye preparations may be located through advertisements in sanitary engineering and water management journals, or via the regional public health department, county sanitarian, or plumbing supply company.

If a dye test indicates leakage, the septic system should be inspected and the problem corrected. This may entail anything from simply pumping the septic tank for repair, or replacement of tank or tile field. It should be noted that the dye test is not a definitive indicator of septic system efficiency. A positive test does not necessarily constitute proof of contamination (any more than a negative test implies absolute safety), but it does indicate the need for a careful investigation of the area to ascertain the nature of the discharge. In this respect, the assistance of the local sanitarian or a licensed septic tank serving company may be required.

From the standpoint of good lake management, the dye test is most effective if conducted regularly as a community project sponsored by the local property owners or lake association. An ideal time is Independence Day, Labor Day, or Memorial Day when the largest number of residents is expected. In relatively crowded lake communities, it may be necessary to organize sequential testing of adjacent homes or follow-up dye tests to determine which individual systems caused the positive results in a particular area of the lake. Any such project, to be successful, requires considerable preplanning, including the diplomatic

education of residents with respect to environmental and civic responsibility. An attitude of positive cooperation is essential if any indicated remedial follow-up action is to be successful.

ALTERNATIVES TO SEPTIC TANK DISPOSAL SYSTEMS

Currently there are three technologically feasible alternatives to the use of septic tank drain field systems. These are aeration chambers, holding tanks, and municipal sewage systems.

The aeration chamber consists of an elaboration on the basic septic tank wherein air is pumped into the standing tank effluent to introduce more oxygen. Digestion is more completely accomplished by aerobic bacteria as opposed to the anaerobic system of the traditional septic tank. The resultant effluent released to the tile field imposes considerably less strain on the soil biota and is lower in suspended solids and BOD. However, the nutrient component remains a factor of the dispersed effluent, and its ramifications in terms of potential lake enrichment are still viable.

Conversion to holding tanks entails the likely expansion of the holding capacity of the existing septic tank. (The impact of holding tank capacity restrictions can be reduced by installation of devices to reduce the amount of water used to flush the toilet each time it is used. This may consist of plastic inserts commercially marketed under the trade-name "Little John" or by placing a plastic jug full of water in the toilet tank to reduce its holding capacity and thus, the amount of water used for flushing.) However, all effluent is pumped from the tank by a contract disposal service, and the liquid waste and sludge is taken either to a municipal sewage treatment plant or approved land surface disposal site. This option would involve an expense to the residents for subscribing to a disposal service — Wisconsin studies indicate the cost to be about \$1,000 per year for a family of four(12) — and the constraint of judicious use of water to reduce the frequency of pumpage. It is feasible however, to envision an arrangement whereby the preexisting tile field could be incorporated as a back-up system in case of tank overflow.

Accompanying such a system would have to be some form of regulatory or economic constraint to prevent abuse of the "back-up privilege." Otherwise some residents could ostensibly subscribe to the philosophy and function of holding tank operations, while in reality simply continuing their original septic tank-drain field system. Perhaps establishment of flat-rate haulage with regularly scheduled pumping for each subscriber would accomplish this. This would

be similar to the system practiced by home heating oil companies where each customer is scheduled for service to keep that household's oil tank properly supplied.

The holding tank option has the added benefit of providing the incentive to local residents and local government alike to initiate the construction of a municipal sewage system. In all likelihood, annual costs to residents on a sewer line would eventually be less than the pumpage fees associated with a holding tank. While the township or county would benefit by no longer needing to contend with large scale land disposal sites; problems of groundwater contamination, licensing and administration of the haulers, and winter maintenance of disposal facilities would still exist. If the disposal site is an existing sewage treatment plant, increased use of the holding tank system will probably necessitate its expansion anyway. A note of caution: the lake community considering a sewage project should also plan for stringent development ordinances to prevent possible overdevelopment of the area as a consequence of the new sewer facilities.

An alternate approach is an on-site waste disposal authority. This idea is being developed at the University of Wisconsin-Madison. In this instance a local municipal authority would be created with assessment powers which could purchase the septic tank systems of all member households. Assessments on the properties provide the authority with the necessary funds for the purchases and operation. Thereafter, all responsibility for operation and maintenance of the systems would rest in the authority rather than with individual home owners. Ostensibly, the authority would have greater financial resources than any individual householder and could operate the systems in the most environmentally responsible manner. Its responsibilities would include the replacement or improvement of failing systems including conversion to holding tanks where indicated.

Another option to septic tank-drain field systems still in the early marketing stages is the use of self-contained disposal systems such as propane incinerator toilets and a variety of more recently developed self-contained systems such as the "Clivus Multrum" dry toilet based on the concept of organic material composting, or mineral oil recycling flush systems in which the oil is cleaned and reused while heavier wastes carried by it settle out in a holding tank.

The advantage of these systems over regular flush toilet plumbing is the reduced liquid volume of the wastes which, in turn, reduces the frequency of required pumping of the holding tank. Unfortunately, installation of the systems ranges from about \$800 to \$4,000 and often involves maintenance and operation

costs for recycling pumps and filters in addition to propane and/or pumpage fees. Pumping of these tanks, however, is required far less frequently than with a standard holding tank system.

For the individual riparian who can afford the initial expense, this option, if proven to be hygienically and aesthetically acceptable, may prove superior in long-run costs and environmental risks to the interim septic holding-tank approach. It must be noted, however, that these self-contained units, while showing great potential, remain to be proven technically effective or publicly acceptable.

Consequently, the holding tank option seems an appropriate short-term interim measure for providing relief to lake eutrophication. It also provides the needed incentive (including possible help in gaining federal support) to establish more permanent measures, such as municipal sewage treatment facilities. Eventually, the self-contained disposal systems may provide the answer to residential pollution of surface waters, but this option is yet to be sufficiently developed and tested.

THE USE OF VEGETATIVE BUFFER STRIPS TO REDUCE THE IMPACT OF SEPTIC TANK EFFLUENTS ON LAKE WATER QUALITY

Irrespective of on-site sewage disposal method, an additional way to limit nutrient input to the lake is to preserve a natural strip of phreatophytic ("moisture loving"), woody vegetation along the water's edge. This buffer zone of indigenous plants will help stabilize the lake shore as a precaution against erosion. It will intercept some of the nutrients which would otherwise enter the lake by surface runoff or such subsurface drainage as household drain fields.

This interception is accomplished by nutrient uptake via the root systems, with subsequent conversion of at least part of these nutrients by the tree's or shrub's tissues. This interruption and partial retention of effluent nutrients in shoreside trees and shrubs is a preferable alternative to the direct entrance of these nutrients to the lake where they may contribute to aquatic weed and algal growth. While much of the nutrient uptake by the vegetative buffer strip may be expected to return in leaf fall at the onset of winter, any interruption of the flow of effluent nutrients to algae and weeds during the spring and summer growing seasons helps. Raking of the fallen leaves for decomposition in a compost pile set well back from the shore (preferably on the reverse slope) will further help reduce the nutrient loading of the lake.

If the lake lot is just being developed, the owner should leave as wide a strip of undisturbed vegetation

as possible, particularly if a relatively steep slope is involved. In addition to heightened water quality protection, this practice also increases the aesthetics of the lake by preserving its natural appearance and provides the resident with more leisure time since less yard maintenance is required. In fact, the less the natural vegetation of the home site is disturbed, the better, so long as the initial cover is natural and thriving.

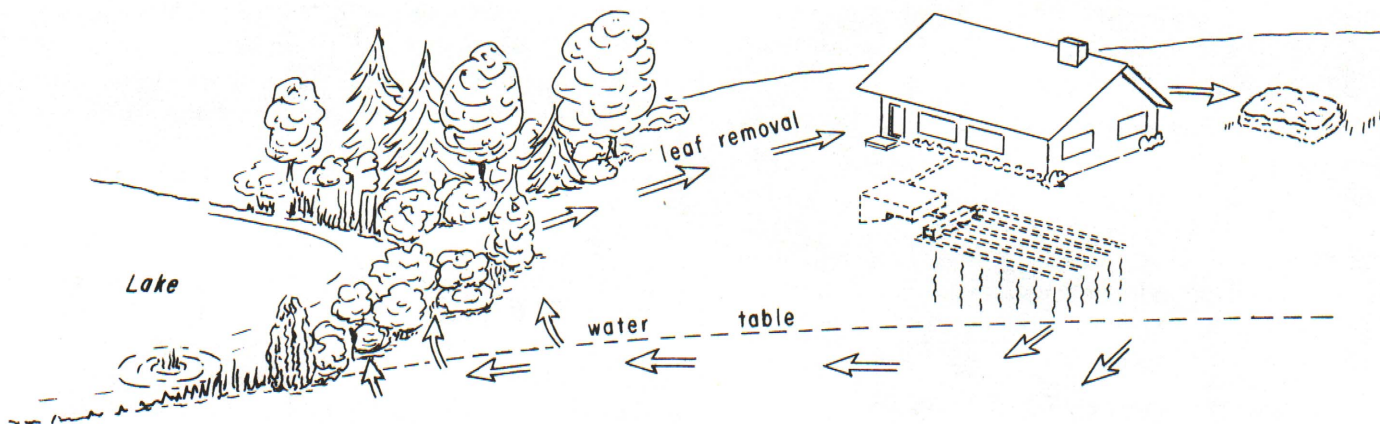
Where the property has already been extensively developed, the sculptured, manicured lawns right down to the water's edge should be modified by the reintroduction of locally common phreatophytic vegetation. This can be accomplished by the selective planting of terrestrial species observed growing in this zone at other sites around the lake where development has not yet occurred.

In surveying the surrounding habitats for selection of the species to be incorporated, attention should be paid to the comparison and contrast of the two areas with respect to soil type, moisture content, depth of water table, and slope. In selecting species for reintroduction, the assistance of the Department of Natural Resources regional forester can be invaluable. The accompanying guide to typical phreatophytic trees and shrubs found in Michigan may also be helpful.

In selecting species for incorporation in the buffer zone, a combination of deep-rooted and shallow-rooted plants should be considered for optimal drainage interception as well as inclusion of a suitable mixture of ground species. This will, ideally, result in a three-storied complex of tall trees, shorter trees and shrubs, and ground level vegetation, such as ferns, creepers, and grasses. When selecting the species to be used, their relative compatibility to one another must be considered.

The following table gives examples of tree and shrub compatibility, so the appropriate combination of canopy and understory species can be planted. This may entail planting some species at different seasons or time intervals to allow for differing growth rates. Similarly, the ultimate size of the plants should be considered with respect to their potential for screening unsightly structures on the property or the possibility that they would obstruct a preferred view. Cooperating personnel of the Michigan State University Extension Service in the Department of Horticulture and School of Urban Planning and Landscape Architecture may be approached for assistance in planning the best positioning of the species selected.

Once the choice of species is made, the appropriate plants must be acquired. Some of the species included in the accompanying list of suggestions may be ob-



The concept of the vegetative buffer zone, showing up take septic tank effluent from the ground water system is diagrammed here. The nutrients are theoretically intercepted by the root system of the shrubs, trees, and other plants and retained in their structure and leaves. Leaves should be raked and composted away from the lake shore to prevent release of phosphates to the lake upon their decomposition.

tained from the Michigan Department of Natural Resources Forestry Department under their wildlife planting program. Again, the regional forester should be of assistance in this respect. (An additional benefit of the buffer zone plantings is that most of the species listed are of direct benefit to wildlife and may enhance the natural aesthetics of the setting.) Stock obtained from the Department of Natural Resources will be of seedling size; if larger specimens are desired they may, in many cases, be purchased from local nurseries. Care should be taken to avoid the introduction of exotic species which may disrupt the local ecology. Similarly, wild species should not be removed from public land, as this is a violation of state law.

American homeowners appear to take considerable pride in their lawns, as indicated by the large market in home gardening supplies. This same pride, when applied to the lake property setting, however, must be redirected toward the more environmentally beneficial ramifications of vegetative buffer strip landscaping.

Suggested Woody Plant Species which May Be Appropriate To Lake Front Buffer Zone Planting

Reference: Fowell, H. A. 1965. *Silvics of forest trees of the United States Agriculture Handbook #271*. USFS, Dept. Agri., USGPO, Wash., D.C., 762 pp.

Ash, Black – All of Michigan.

Soil: Most common in peat, but also clays and sands or clay till; prefers high water table or standing water. Associated trees and shrubs:

Trees – American elm, red maple, white cedar, birch, spruce, hemlock, tamarack.

Shrubs – Alder, dogwood, sumac, blueberry, holly.

Growth conditions: Tallest of record is 79 feet in Wisconsin.

Ash, Green – All of Michigan.

Soil: Common on bottomlands, loams with neutral pH to slightly alkaline; successful plantings on spoil banks of strip mines; common in alluvial soils of river and stream banks.

Associated trees: Sugarberry, American elm, aspen, sugar maple, basswood, black willow, sycamore, box elder, red maple.

Growth conditions: 1-3 feet per year in first 6 or 7 years; intolerant to moderately tolerant.

Roots: "Fourth most extensive root system of all species studied" (Agri. Handbook #271 p. 188); trees 38 feet tall had roots 48 feet laterally and 3.6 feet downward; about equally distributed within top 3 feet of soil; highly resistant to wind damage.

Ash, White – All of Michigan except western Upper Peninsula.

Soil: Most common on fertile soils with high nitrogen content and moderate to high calcium content; grows best on moderately well-drained soils; rarely found in swamps, but tolerant of temporary flooding; rarely found in bottom lands where air drainage is poor.

Associated trees and shrubs:

Trees – White pine, northern red oak, basswood, red maple, sugar maple, hemlock, beech, birch, black cherry, elm.

Shrubs – Downy serviceberry, paw paw, American hornbeam, flowering dogwood, witchhazel, E. hop-hornbeam, dockmackie.

Growth conditions: 3-5 years to reach breast height; about 35-40 feet tall in 20 years; shades tolerant when young, but becomes intolerant with maturity; pioneer species but can survive in climax canopy.

Aspen, Bigtooth – All of Michigan.

Soil: Well-drained, sandy soils; needs water table lower than 18 inches from surface for adequate aeration; found along streams and lakes.

Associated trees and shrubs:

Trees – Quaking aspen, balsam poplar, paper birch, red maple (these most common).

Shrubs – Chokeberry (*Prunus virginiana*), downy serviceberry (*Amelanchier arborea*), sweet fern

(*Comptonia peregrina*), prairie willow (*Salix humilus*).

Ground cover – Blueberries (*Vaccinium* spp), checkerberry wintergreen (*Eaultheria procumbens*), dwarf bush honeysuckle (*Diervilla lonicera*) eastern bracken (*Pteridium latiusculum*) and blackberry (*Rubus* spp).

Growth conditions: Medium-sized tree usually not more than 30-40 feet tall; rapid growth until 40 years old; short-lived for about 60-70 years; highly intolerant.

Roots: Very shallow; good effluent interception probably, but subject to windthrow and topping; popular wild-life food of whitetail deer, beaver, grouse, porcupine.

Aspen, Quaking – All of Michigan.

Soil: Wide variety, but least successful in coarse sands; usually poor in sands because of low moisture and nutrient level (may do very well at lake sides with effluent).

Associated trees and shrubs:

Trees – Birch, white spruce, black spruce, jack pine.

Shrubs – Hazel, alder, raspberry.

Roots: 39-60 inches deep.

Basswood – All of Michigan.

Soil: Loams, sandy loam, silt loam with clay subsoil; should have minimum silt plus clay content of 35% and 3% organic matter in upper 7 inches of soil profile; pH 5.5-7.3; fairly sensitive to microclimate; apparently not "wet soil" tolerant, but leaves have high phosphorus and nitrogen content suggesting that it would take up effluent.

Associated trees: Paper birch, white pine, northern red oak, white ash, white pine, hemlock, yellow birch, sugar maple, beech, black cherry, white oak.

Growth conditions: About 5-12 or 18 inches per year; fastest growth in first 20 years; reaches 140+ feet tall.

Roots: Deep, widely spread system of strong lateral roots.

Beech, American – All of Michigan.

Soil: Preference is loamy soil with a high humus content; requires considerable water – 10 inches per year for growth and transpiration; will grow where water table is within 6-10 inches of surface, but is less tolerant than red maple or sweetgum; has shallower root system on poorly drained soils.

Associated trees: Sugar maple, yellow birch, basswood, black cherry, red spruce, hickory, oak.

Growth conditions: About 1 foot per year for first 40 years; mature height 60-80 feet; maximum 120 feet; very tolerant, similar to sugar maple.

Roots: Larger expanse of surface roots; thin bark makes it subject to fungal infection.

Birch, Paper – North and central Michigan.

Soil: Glacial soils, especially tills and outwash; generally requires well-drained soil; grows best in stands.

Associated trees: Jack pine, balsam fir, black spruce, yellow birch, aspen, sugar maple, white spruce, red spruce, white ash.

Growth conditions: Sensitive seedlings; mature trees – 70 feet tall; short-lived, 70-75 years; heavy mortality.

Birch, Yellow – All of Michigan.

Soil: Grows well on loams from good to poorly drained.

Associated trees and shrubs:

Trees – Hemlock, sugar maple, beech, red spruce, white cedar, basswood, black ash, white ash, aspen, white birch.

Shrubs – Mountain maple, dogwood (alternate leafed), ground hemlock.

Growth conditions: Rapid growth with moderate overhead sunlight; 8-10 feet in 6 years; about 50 feet high when mature.

Cedar, Red – Southern Michigan (Eastern red cedar)

Soil: Neutral to slightly acid soils; pH 4.7 - 7.8, but not very tolerant of upper pH.

Associated trees: Pine, oak.

Growth conditions: 40-50 feet tall; slow growth; rate of growth closely associated with water supply.

Roots: Seedlings have deep tap root, apparently maintained with maturity.

Cedar, White – Central and northern Michigan.

Soil: Best in neutral or alkaline soils especially of limestone origin; well-drained, but also grows in swamps.

Associated trees and shrubs:

Trees – White spruce, black spruce, red spruce, yellow birch, balsam fir, white pine, tamarack, red maple, American elm, aspen, sugar maple, basswood.

Shrubs – Red-osier dogwood, willow, chokecherry, cranberry, alder.

Growth conditions: Seedlings require constant summer moisture; medium size tree commonly 40-50 feet tall, 2-3 feet diameter; 28 feet tall in 40 years on good site.

Roots: Shallow, subject to windthrow.

Cherry, Black – Michigan Lower Peninsula.

Soil: Loamy to gravelly soils with silty to clayey subsoils; well-drained.

Associated trees: Sugar maple, white pine, northern red oak, white ash, hemlock, beech, yellow birch.

Growth conditions: Very rapid growth first 45-50 years; maximum height may reach 100 feet but is usually 80 feet or less; intolerant, common in canopy openings.

Roots: Predominantly spreading and shallow, usually restricted to upper 2 feet of soil; easily windthrown.

Dogwood, Flowering – Central and southern Michigan.

Soil: Upland to deep moist soils; common along stream-banks; do better on light soils than heavy ones; foliage high in mineral nutrients, hence significant in soil improvement; litter decomposes rapidly; especially good source of calcium; leaves concentrate flourine; range 40 to 100 ppm with site and season.

Associated trees: Oak-hickory forests, red maple, yellow poplar, white ash, beech, black gum.

Growth conditions: Maximum size 40 feet tall; in north is a many-branched shrub; very shade tolerant.

Hemlock, Eastern – Central to Upper Peninsula of Michigan.

Soil: Grows well in peat and muck soils and also on sandy loams in lake states.

Associated trees: White pine, yellow birch, yellow poplar, aspen, white spruce, paper birch, tamarack, sycamore.

Growth conditions: 16 feet in 40 years in Michigan; maximum – 60 feet in 140 years; highly tolerant of shading, but causes stunted growth.

Locust, Black – Not natural to Michigan, but has been introduced.

Soil: Does well on poor soils, but is a legume and with litter it produces significant nitrogen in the soil and environment (soluble nitrate occurs with rapid decomposition of locust litter).

Associated trees: Hardwood, yellow poplar, maple.

Growth conditions: Very rapid growth — 75 feet in 50 years; maximum height is 40-100 feet.

Roots: Extensive, shallow root system.

Maple, Red — All of Michigan.

Soil: Wide variety of soil; common along small, sluggish streams.

Associated trees: Black ash, American elm, aspen, paper birch, yellow birch, black spruce, sugar maple, beech, basswood.

Growth conditions: Rapid growth in early life; 3-3.5 inches dbh in 10 years; mature trees are 60-90 feet high.

Roots: Shallow or deep tap root, depending on weight; shade tolerant.

Maple, Silver — Central and southern Michigan.

Soil: Variety of soils, common on low, well-drained, river bottom land; sometimes along low lake shores.

Associated trees: American elm, red maple, basswood, sycamore, river birch, cottonwood, black ash.

Growth conditions: Rapid growth, especially in first 50 years; 70-120 feet high; moderately intolerant.

Maple, Sugar — All of Michigan.

Soil: All types; thrives on fertile, well-drained sites, especially loams; pH range 3.7-7.3; best is 5.5-7.3.

Associated trees and shrubs:

Trees — Beech, yellow birch, basswood, red spruce, red maple, hemlock, white spruce.

Shrubs — Beaked hazel, Atlantic leatherwood, scarlet elder, American elder, pagoda dogwood, dwarf honeysuckle, raspberry, blackberry.

Growth conditions: About 1 foot per year; at age 30 may be 35-40 feet tall; very tolerant of shade.

Roots: Deep and branching.

Oak, Northern Red — All of Michigan.

Soil: Soils range from clay to loamy sands, and from deep stone free to rocky, shallow soils; needs moist substratum within 1-4 feet of surface; best sites are fine, textured soils with high water table.

Associated trees and shrubs:

Trees — Ash, aspen, birch, cherry, elm, fir, hickory, maple, oak, pine, spruce, basswood, sycamore, northern white cedar, black locusts, and more.

Small trees — Flowering dogwood, holly, hornbeam, hophornbeam, redbud, pawpaw, sassafras, serviceberry, persimmon.

Shrubs — Greenbrier (*Smilax* spp.), Hydrangea, mountain laurel (*Kalmia latifolia*), rhododendron, and witch hazel (*Hamamelis virginiana*).

Growth conditions: Maximum 70-90 feet tall with 2-3 feet dbh; slow growth rate; intermediate tolerance.

Roots: Deep tap root.

Oak, Swamp White — Lower southern Michigan.

Soil: Commonly found in wet lowlands.

Associated trees: All trees common to wet or moist sites; basswood, black ash, hickory, pin oak, red maple, northern red oak, silver maple, sweetgum, sycamore, yellow poplar, white ash, willow.

Growth conditions: 60-70 feet high; fairly rapid growth; 2-3 feet dbh; intermediate intolerance with seedlings able to start in shade.

Roots: Shallow root system.

Pine, Red — Central and northern Michigan including Upper Peninsula.

Soil: Grows well in poorer soils; studies of litter in lake states show it to be high in phosphorus and nitrogen.

Associated trees and shrubs:

Trees — Jack pine, eastern white pine, quaking aspen, bigtooth aspen, scrub oak, maple, black cherry, balsam fir, black spruce.

Shrubs — Canada blueberry (*Vaccinium canadense*), lowbush blueberry (*Arctostaphylos uva-ursi*), prairie willow (*Salix humilis*), American hazel (*Corylus americana*), beaked hazel (*C. Cornuta*), striped maple (*Acer pensylvanicum*), dwarf bush honeysuckle (*Diervilla lonicera*), Jerseytea ceanothus (*Ceanothus americanus*), American fly honeysuckle (*Lonicera canadensis*).

Growth conditions: About 1 foot per year for first 60 years; live 100+ years.

Roots: Like white pine, very extensive root system; in some cases tap root may go down 9 feet or more.

Pine, White — All of Michigan.

Soil: Grows on variety of soils but most commonly associated with well drained sandy soils.

Associated trees and shrubs:

Trees — Northern red oak, white ash, hemlock, paper birch, red maple, pin cherry, sugar maple, beech, yellow birch, balsam fir, white spruce, white cedar.

Shrubs — *Oxalis*, *Mitchella*, *Aralia*, *Arisaema*, *Dennstaedtia*, *Cornus*, *Maianthemum*, *Pteridium*.

Growth conditions: Rapid growth — 20 inches annually; long-lived, up to 200 years; old trees may be 200 feet tall; tolerance: may be shaded out by aspens, oaks, maples and eventually die; but can dominate birches (thin leaf cover).

Roots: Form and distribution varies with soil characteristics; normally only vestige of a tap root with 3-5 large roots spread laterally outward and downward; gives tree firm anchor in soil; mass of smaller lateral roots spread from the major laterals; high concentrations of nitrogen, organic matter, and exchangeable bases stimulate formation of a concentration of fine roots.

Poplar, Balsam — All of Michigan.

Soil: Common along lake borders; excellent growth on sandy, gravelly soils; needs much moisture.

Associated trees and shrubs:

Trees — Balsam fir, aspen, white spruce, paper birch, black ash, red maple, tamarack.

Shrubs — Speckled alder (*Alnus rugosa*), American green alder (*A. crispa*), red-osier dogwood (*Cornus stolonifera*), bunchberry dogwood (*C. canadensis*), mountain maple (*Acer spicatum*), bearberry honeysuckle (*Lonicera involucrate*), beaked hazel (*Corylus cornuta*), American cranberry bush (*Viburnum trilobum*).

Growth conditions: Rapid growth during first 40-50 years — up to 70 feet tall; Short-lived; less shade tolerant than common associates: white spruce, balsam fir, northern white cedar, black ash, red maple; but equally intolerant as quaking aspen and paper birch; will not grow well in competition with other species unless it is dominant.

Poplar, Yellow — Lower central and southern Michigan.

Soil: Well-drained, loose textured soils; requires high nitrogen content and, consequently, often found with black locust.

Associated trees: Beech, sugar maple, black gum, dogwood, hickory.

Growth conditions: 120 feet tall in 50-60 years with dbh 18"-24"; very fast growth, but intolerant.

Roots: Rapidly growing, deeply penetrating tap root plus many strongly developed, wide spreading lateral roots.

Sycamore, American — Central and southern Michigan.

Soil: Excellent along lakes; tolerant of groundwater fluctuations.

Associated trees: Black elm, red maple, silver maple, black willow (moderately intolerant).

Growth conditions: Fast growing throughout its life, only black willow is faster; 70 feet in 17 years.

Roots: Widely spread, strongly branched roots.

Tamarack — All of Michigan.

Soil: Variety of soils; high moisture tolerance; common on lake shores.

Associated trees and shrubs:

Trees — N. white cedar, red maple, black ash, aspen, black spruce, white spruce.

Shrubs — Alder, red-osier, dogwood, cranberry, birch.

Growth conditions: Seedlings need abundant light and constant water level — should not be shaded in early growth stages; relatively slow growth — 3 feet in 5 years; 16 feet in 15 years; 60+ feet in 45 years

Roots: Shallow, compact system, usually 1-2 feet deep; grows well if water table is 18 inches deep.

Willow, Black — Southern and central Michigan.

Soil: Flourishes in very wet areas; needs abundant and continuous supply of moisture during growing season; grows in almost any soil.

Associated trees and shrubs:

Trees — Black spruce, river birch, sycamore, red maple, locust, red mulberry.

Shrubs — Buttonbush, swamp privet.

Growth conditions: Very rapid growth, reaches 30-60 feet in north but short-lived.

Roots: Tends to have relatively shallow, extensive root systems.

Additional Lake Front Buffer Zone

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PART II — LAKE ASSOCIATION EFFORTS

The first part of this presentation was intended to provide suggestions for those who want to work individually on a lake issue. This second portion contains suggestions for organizing and implementing a group effort to expand that effectiveness.

Why Form An Association?

The first reason for group cooperation under any circumstances is probably efficiency and socialization. Because tasks we wish to perform are often simply too much for the individual, the help of others is sought.

A lake association offers the potential of far more significant management to protect the quality of the resource than any one individual alone could achieve. But, in return, association members must be prepared to concede some individual freedoms so that group coordination may be achieved to meet its purposes.

The second rationale often identified with organization is its social function. As a social animal, man may have an innate desire to "belong". In this respect, it is quite natural for members of the lake community, when facing their own environmental problems of lake degradation, to work together; it's generally pleasant to socialize with fellow riparians; the probability of success is greater, and the individual risk of failure is reduced.

The cooperative lake association may serve the function of accomplishing a mutually agreed-upon goal which cannot be successfully met by uncoordinated individual efforts. A good example in this respect is weed or algae control. Everyone may want to reduce the algae concentration in the lake, and each riparian may try in his own way. But the result is a mix of different types of chemical applications in the lake, at different concentrations, locations, and times. The objective could be much more efficiently approached if everyone contributed their cost of the treatment to a common fund used to hire a professional contractor to treat the entire lake.

Similarly, organization enhances any such project because the existence of a formally organized group will provide the opportunity for other users of the lake to help with its management. For example, property owners who use the lake but don't live directly on its shores would, as association members, be able to contribute to the algae abatement project. As non-riparian property owners, they would otherwise have no way to rightfully participate in the project.

If democratically run, the same organization can serve as a representative voice for the "lake people" in the local community. By serving as a forum for the lake residents and consequent voice of their majority interests, the lake association can readily lend itself to a political function. In this sense, it imposes peer pressure from within for social or physical compliance, i.e., social obligation to any "holdouts" who may not want to participate in a project. Outside of the organization, this political body can exert pressure on non-members to join or at least cooperate, influence local government with respect to lake interests, and lobby for state or federal aid or legislation favorable to the association.

On a strictly social basis, the association promotes communication between riparians, boosts one's sense of belonging to the lake community, and enhances recreation opportunities by sponsoring social events such as picnics, dances, card parties, or other preferred community events. This function may not only enhance one's sense of social satisfaction, but the communication links involved facilitate discussion of pertinent issues and can promote fund raising to help support association projects.

Thus, ample justification can be found for lake residents forming themselves into an association, but only if they are willing to trade some of their individual independence of behavior for a share in the satisfaction of common goals.

Informal Preliminary Discussions

A Chinese proverb states that all journeys begin with but a single step. Similarly, governments, large corporations, and lake associations all begin with but a single individual. The whole process leading up to a functioning lake association, actively managing the resource and espousing the causes of its members, begins with one riparian discussing ideas with another.

The first move toward organizing a lake association then, consists of an informal social gathering of friends and neighbors. As a result of these conversations, several of you may find that a common interest or concern is shared with respect to the lake or community. If so, an informal gathering in someone's home is in order.

At this time the possibility of a formal organization can be discussed. The important point to consider is whether the problems of concern can be efficiently dealt with in an informal, ad hoc way, such as by the

gathering taking place, or if a permanent, organized body might just as well be formed.

The advantage of forming a lake association is that its performance and organization can be as loose or structured as the members desire. It can serve a basic social purpose while also being available as an instrument, rising to the occasion, for problem-solving and on-going lake or stream management.

Admittedly, the formalization of community organization will entail the assumption of at least minimal record keeping, dues collection, and paper work by some of the members, i.e., elected officers. The importance of present and anticipated lake problems will determine just how willing the involved residents will be to participate. This is the question to be discussed at the informal gathering.

If no one appears willing at this time to take such a step, then perhaps informal gatherings to deal with problems in a "brush fire" manner are the only option. Often such approaches are necessary to demonstrate the worth of a more formalized approach. The major significance of a formally organized association is the authority it is able to bring to bear, beyond voluntary cooperation, to respond to problems and implement programs (see "Legislation for the Formation of Lake Associations").

In fact, before proceeding further with the idea of organizing into a lake association, it is perhaps wise to examine in more detail some of the particular characteristics and problems of such a body.

THE NATURE OF LAKE ASSOCIATIONS AND THEIR RELATIONSHIP TO THE LAKE COMMUNITY

Much of the character of a lake, as well as its association, may be considered in socio-economic terms as a "joint-impact good with high exclusion costs." A joint-impact good is like rainfall; everybody gets wet. Similarly, whatever happens to the lake affects everybody on it, in one way or another. The term "high exclusion costs" means it is extremely difficult, if not impossible in some instances, to keep others from benefiting from improvements that are made.

The high exclusion costs of recreational lakes result from both the social institutions of man and the physical nature of the resources as well. By law, all riparians have an equal right to use a lake. No individual riparian or group of riparians can exclude another from reasonable exercise of this right. Thus, if an association works to improve fishing, remove weeds, or improve local government services, it may not legally prohibit any other riparians from enjoying these benefits (if that is how they see it). Whether or

not they are members of the association, they still have a right to reasonable use of a lake. Further, because of the physical nature of a lake, it would be self-defeating for an association to pay for weed or algae control just in front of member cottages. If an entire lake or portion thereof is not treated, regrowth from untreated areas may seriously compromise the project.

Free Riders

Because of the high exclusion cost nature of most lake associations, it is often difficult to induce all riparians on the lake to join. Some of these people may reason that if they can reap the benefits anyway, why join? These "free riders" (9) may also avoid membership because they don't see any demonstrated accomplishments; or if the association is large, they may feel that their opinions as members will have little effect on its policy or performance. This latter form of apparent apathy is often further generated by associations that are dominated by a clique as opposed to being broadly represented.

However, free riders benefit from the actions of the association only in so far as they agree with its performance. For example, nonmember riparians may be very happy to accept the benefits of algae control at no expense to themselves, but enforcement of local building codes as a result of association pressures upon county officials may have a detrimental effect on them with no recourse (i.e., no voice in the association and none in local government either if they are seasonal residents).

With respect to this decision-making process in the lake community, another factor which must be considered is the question of relative rights possessed by riparians before and after joining a lake association. Much of the management efforts for lake water quality improvement require, or are greatly enhanced by, group cooperation.

For example, monitoring one's septic tank system to determine if it is discharging into the lake is something the individual can do completely independent of anyone else in the lake community. But, the monitoring of all septic systems along the lake shore promises far more potential for significant nutrient curtailment. An undertaking of this size requires the acknowledgement and cooperation of many riparians in conceding to a lake association the right to exert at least some authority over their exercise of riparian and real property rights. Prior to joining the association, the riparian may well have felt that the relative efficiency of the household plumbing was no one else's business. However, the association member may be subjected to more peer pressure to cooperate in having, for example, the septic system tested by

fluorescent dye injection, to reduce applications of lawn fertilizer, and perhaps to change property drainage patterns than he would be if not a member of the group. Thus, the association member, as opposed to the nonmember, tends to lose some rights to exercise discretion with respect to domestic activities. The option to conceal a potentially leaky septic tank is traded for what is perceived to be greater benefits in terms of the quality of the environment. To the contrary, the riparian who chooses not to join the association apparently concludes that its utility is not worth the costs in riparian rights and membership fees, particularly if "gains" as a free rider are included in this calculation.

Nonriparian Free Riders

Many Michigan lakes have access sites often owned by the Michigan Department of Natural Resources (DNR). These are usually small units of riparian land purchased to provide nonriparians with recreational accessibility to what would otherwise be exclusive lakes. The existence of such access sites often conveys a use right to nonriparians at the expense of riparians. Sites may be poorly regulated by the DNR resulting in overuse, litter, vandalism, trespass, and disturbance of the peace from the perspective of local residents. The riparians' only recourse when they feel damaged by the public, is to complain to the DNR for better enforcement or maintenance.

The existence of this particular free rider aspect of the lake resource, may constitute one of the major incentives (as previously discussed) to the organization of riparians into a lake association. If riparians believe a group effort will better induce the DNR to regulate the access site, the potential solution of this problem may overcome other benefit-cost conflicts in their minds with respect to organization.

The Social-Trap Problem

Perhaps a major impediment to water quality management by lake associations is the "social trap" into which most members may fall as soon as serious management programs evolve. The trap consists of individuals attempting to satisfy immediate personal, economic incentives when they conflict with the group's long-run goal. (9)

Most members may be expected to join in on projects to curtail roadside storm runoff to the lake, reduce lawn fertilization, or prevent additional development of the area. These are all proposals in which the pollution rights of others are being challenged, or the cost of compliance is low.

However, eutrophic inflow to these lakes may also be by discharge from riparian septic tanks. Any ap-

proach to water quality management should, therefore, include the modification or replacement of deficient septic tank systems. This requires considerable expenditure by each affected riparian, creating a conflict between desires for an improvement of the common resource and the cost each must pay without knowing how successful the effort will be. However, nutrient input to the lake will not be significantly reduced unless everyone cooperates to repair or replace their septic tank systems. Further, there is no assurance of the extent of cooperation to expect from fellow riparians. Thus, the individual must weigh the probability of successful cooperation which would make a considerable investment worthwhile (assuming it is affordable), against the temptation to be a free rider. As a free rider, the riparian gambles that everyone else will correct their contributions to lake contamination, thus improving the assimilative capacity for the free rider's continued abuse.

Summary

A major characteristic of inland lakes and of the services provided by the lake associations is their joint-impact nature. This, together with high exclusion costs, results in the opportunity for riparians to be free riders rather than supportive members of the association. Even though this free rider effect can be either positive or negative, many riparians may still prefer this to membership commitments.

Ironically, an outside free rider exercising individual rights via DNR public launching sites may force free rider riparians into the association. Resulting overuse and conflicts between resident and non-resident users of the lake can become the central issue which induces free rider riparians to join a lake association as an instrument of riparian rights' protection and enhancement.

The association may function fairly well with respect to issues of "us riparians" against "them outsiders" (including local government). However, regarding internal authority over members, particularly with respect to lake water quality improvement, the urge to be a free rider seems to reassert itself. This behavioral response may be made even more severe (from the perspective of the advocate of water quality improvements) because the riparian is tempted to withhold active support when the realization that nutrient abatement may cost considerable money in septic tank repairs sets in. Personal expenses and immediate interests tend to get in the way of overall, unanimously agreed-upon objectives for the lake.

This problem can be overcome and significant water quality management by lake residents implemented, but not without sacrificing some riparian and individ-

ual rights. A form of community authority must be assumed and responsibly administered by the lake association if goals are to be met. Thus, prospective organizers of any such association should recognize particular characteristics of their task and the obligations they assume.

THE INITIAL LAKE COMMUNITY MEETING

If it is concluded that an association is preferred, the organizers should carefully consider the various issues in the lake community and concentrate attention on the one which is most pertinent to the greatest number of residents. The selected issue may very well be the same one which first brought the informal organizing group together. The idea is to "hit a nerve" in the lake community, to publicize this initial meeting in such a way that residents will be motivated to attend.

While this presentation deals essentially with the water quality of lakes, there may be other problems that a given lake community, at this stage, considers more pertinent. Thus, the announcement of an initial meeting may very well concentrate on some other problem — litter, vandalism, road conditions, public access, development, fire protection, etc. The problem foremost in the community's mind should be presented and tackled first in order to gain support. The issue of eutrophication and water quality, if not already recognized, can be introduced later. In almost all lake communities it is sooner or later the central focus of attention since other social, political, or economic problems of the community will in one way or the other manifest themselves in an impact upon the lake.

In any respect, once the central issue is identified, the organizers should devise a proposed plan of attack which, at this stage, may consist entirely and logically of seeking more information on the subject. To this end, a qualified speaker to address the group should be engaged. It is important to select a competent and skilled speaker to constitute the major part of the audience's first impression of what may become the lake association. Potential sources of quality speakers are specialists from the area university or college, the extension service via the local county agent, and the Michigan Lake and Stream Associations, Inc. (An area lake association as well as the state-wide alliance of associations and its news publication, the "Michigan Riparian", can also help.)

In some instances, a speaker's fee or expenses may be required; if possible the organizers themselves should chip in for this rather than charge admission to the meeting which might reduce attendance. Since many lake riparians are vacation residents, it may be wise to schedule this initial meeting and presenta-

tion for an early summer weekend when a large attendance can be anticipated, while still leaving time for subsequent meetings during the season.

Once the topic, speaker, and date are arranged, an announcement one or two weeks in advance should be circulated to all potentially involved residents. It should be brief (one page) and to the point. State the issue, indicate its importance, the speaker, the proposal to form a lake association, and the time and place of the meeting. (Local churches, schools, halls, or community centers are usually easily obtained.) If a lake community directory is available and mailing expenses not a problem, the announcement may be mailed out, but mimeographed handbills placed in doors might be more expedient.

Accompanying the written announcement should be a vigorous word of mouth campaign by the organizers themselves. In this way, the handbill serves as a reminder and reinforcement for the verbal commitment made in face-to-face discussion. Generally, people who use their cottages to "get away from it all" usually do not wish to participate in meetings or clubs, so a certain degree of encouragement is necessary for a suitable turnout.

With respect to the meeting place, be sure everything is in order well in advance of the event: seating, microphone and audio visual equipment (if required), adequate parking facilities, and perhaps refreshments after the meeting to induce socialization and discussion. It is also wise to tentatively reserve the same facilities for a subsequent meeting so the date and time can be announced to everyone present.

A possible agenda for the initial meeting might be as follows: 1) an outline of the issue(s) or problem(s) which motivated the meeting presented by the organizing spokesman, 2) an address by the invited speaker concerning the issue(s), including suggestions for a solution, 3) a question and answer period, 4) using the speakers presentation as a lead-in, introduce the possibility of forming a lake association to expedite problem solving in this instance and as an instrument for future community action, i.e., as a clearing house for residents' complaints and proposals, as a representative in the local community, and as an on-going coordinator of self-help lake management projects.

It is also important to point out the social nature of such an association. The coordination and communication function of the association need not be restricted to problem solving. It can also function as a means for residents to get to know each other better and can sponsor picnics, winter carnivals, and other recreational projects. In fact, this sense of community fellowship, of social belonging, in addition to functional problem solving, often determines the success

of an organization in accomplishing its physical goals.(3)

Toward the end of the meeting, which should not last more than an hour or two, a sign-up sheet should be circulated requesting those in attendance to provide their name, address, and phone number, family composition and principal occupation, whether or not they are interested in forming the lake association, and if opposed, why.

The information derived will help with further communication, give an indication of the nature of the community, and provide a record of response to the proposal. The latter information is particularly important in case the proposal is voted down, as it will suggest what should be corrected to make an association more acceptable. In the preferred event that creation of a lake association is favored, those completing the sign-up sheet will have some sense of commitment which may induce greater participation as the association takes shape. The designation of occupation on the sheet will also provide an indicator of the association's talents and resources. For example, the assistance of a member who is a lawyer could be a great asset. A biologist or laboratory technician can help in planning and completing a water quality project on the lake, and tradesmen or contractors are essential to weed removal, construction, or erosion control programs.

However, it should be pointed out that no one likes to be taken advantage of, especially at the delicate formative stages. Thus, organizers should take care not to overplay the services perspective members can provide. Here again the sense of belonging demonstrates its importance. As the association takes shape, members who feel comfortable will more readily offer their respective talents.

If discussion and review of the sign-up sheet indicate a favorable attitude, a committee should be delegated before the close of the meeting to prepare a draft of the Lake Association articles of incorporation and bylaws.

A member of this committee should also be designated as the contact (whose phone number and address is made available at this time) to receive suggestions from the general membership for consideration in the articles and bylaws. This will help the committee incorporate some common interests of the membership as the document is prepared and may reduce the extent of future debate and rewriting.

LEGISLATION FOR THE FORMATION OF LAKE ASSOCIATIONS

The first step in the preparation of the association bylaws should be the determination of a legal right

justifying the formation and continued existence of that association. There are several state laws which convey this right of organization to the members of the community. The form of enabling legislation selected not only provides guidelines to the necessary components of the association's bylaws, but also indicates the nature and extent of administrative authority it may assume.

There are essentially five legal alternatives available to Michigan riparians for establishing a formal corporate entity to manage their lake or stream community resources. These are: The Michigan General Corporation Act as amended 1973; a set of three "Summer Resort Acts," each of which may apply to the formation of a lake association, and the common law practice of deed restrictions.

The Michigan General Corporation Act, as amended 1973

If utilized, most associations employ the provisions of this legislation appropriate to nonprofit corporations. Whether profit or nonprofit, however, all Michigan-chartered corporations must file an annual financial statement together with payment of a filing fee to the Michigan Treasury. Failure to do so for two years in a row results in the automatic dissolution of a corporation's charter.

As a corporation, the lake association may exist as a political entity capable of owning and selling land, physical property, or stock; accepting and paying out money and suing or being sued in the courts. However, under the act, before a nonprofit corporation can issue bonds, borrow money, or hold and sign mortgages, the action must be expressly authorized by the corporation's bylaws or a suitable resolution passed by the membership.

The nonprofit corporation may be created by as few as three individuals for any lawful purpose not involving pecuniary gain. The association may organize on the basis of either stock-share or non-stockholding memberships (M.C.L.A. 450.117), and specific conditions of membership may be stipulated in the association's bylaws provided that such rules are reasonable, germane, and equally enforced for all. The association is also empowered to fix the amount and schedule of fees or dues to be collected as a condition of membership and to make rules to enforce these conditions, including provisions for the cancellation and reinstatement of membership (M.C.L.A. 450.121).

The board of trustees or directors of the corporation is granted the authority to conduct the lawful business of the association and to manage its property in accordance with the stipulations of its bylaws. This

board must consist of a minimum of three individuals with at least one third of its composition up for election each year, or for the individual terms of office to be only one year long (M.C.L.A. 450.124-.125).

Members of the association are entitled to equal voice and vote in the organization except where the bylaws equate the number of votes to number of shares of stock held or other classes of membership (i.e., nonvoting memberships, etc.) (M.C.L.A. 450.1-2).

The General Corporation Act is a broad base form of enabling legislation. Its nonprofit provisions appear to readily lend themselves to social organizations of a community service nature. They are allowed the advantages of being a corporate entity without taxation, so long as the operation is non-profit oriented, as are many lake associations.

However, the provisions of the law restrict the authority of the association specifically to its membership, and the only remedy for noncompliance with association requirements is loss of membership (and any presumable benefits which may be involved). The law is highly compatible to associations which may be prestigious or exclusive in nature or that offer a service of sufficient value to members to alone compel their cooperation. It further recommends itself to small, special interest groups since only three people are needed to establish the corporation. There does not appear to be any constraint on the amount of land or stockholdings involved.

The Michigan Summer Resort Acts

A series of acts known as the Summer Resort and Park Association Acts each convey similar economic and political autonomy to the lake association as under the General Corporation Laws, but in addition, grant varying degrees of authority comparable to that of municipalities.

The first of these, **Act 39 of the public acts of 1889**, requires a minimum of ten people for incorporation for the purchase and improvement of lands to be occupied for summer homes or group assemblies by cultural, scientific, or religious organizations. If capital stock is provided for in the bylaws, it may not exceed \$50,000 in shares of \$25 each, and the corporation may not own or hold in excess of 350 acres of land. The corporation may sell, lease, or grant parcels of its land to members or others subject to any lawful provisions, reservations, or restrictions it may deem advisable. Each member is entitled to one vote in the association, and an annual meeting is required to be held on the corporation's property.

The law provides for a board of trustees to administer the corporation, and their terms are set at

one year each. The board's authority extends from the routine conduction of the associations' affairs for its lands and holdings to the waters on or in front of that land. The board may pass regulations to protect water quality, license commercial operations on the property, provide sanitary and fire protection, and lay out and maintain streets and sidewalks. They may also pass traffic and animal control regulations for the corporate lands. The law specifically forbids the corporation from constraining public access to any existing roads, and exempts the public, i.e., local or county governments, from any liability for roads laid out by the corporation. The corporation itself is responsible for the maintenance of these streets and sidewalks and may assess the membership for that purpose. The board may also pass orders and bylaws applicable to its responsibilities, but these may be rescinded by a majority vote of the membership at any annual meeting.

The association under this act may also hire its own policeman (with the authority of a constable) to enforce the regulations and bylaws of the association. Violation of these regulations or of the property rights of the association, i.e., damage to homes or structures, constitutes a misdemeanor (M.C.L.A. 455.60-455.63).

This law also grants to the association the opportunity to assume tax liability for all holdings under its administration. In this situation, the association pays local taxes on the property and then may collect the appropriate share from each member. This provision gives the association some measure of control over tax delinquent property of members and the right to place a lien on that property, payable with interest (M.C.L.A. 455.65-455.67). The provision of the act would appear to curtail the potential for local government acquiring land holdings within the lake association community, while also assuring that same local government a more reliable tax base. (However, it should be noted that the act makes no reference to state taxes.)

A subsequent act (**Act 230 of 1897**) is similar to Act 39 of 1889, but shifts in emphasis from supplemental lake recreation purposes of social and religious sponsors, to a more businesslike, recreational corporation. Under this act a corporation may form with a minimum of five members to own, maintain, and improve land and other property for purposes of a summer resort. The stock limitations under this law are \$100,000 with shares at a par value of \$25.

Under Act 230, voting rights are directly associated with ownership of shares in the association with one vote assigned per share of stock. (Thus, it is possible under this enablement for individual members, by stock purchases, to acquire considerable influence over

association policy and performance.) The corporation is allowed to acquire land up to 700 acres plus physical capital not to exceed \$200,000 in value and has the right to own a hotel, clubhouse, or similar facility for the comfort and convenience of its stockholders.

The board of directors serves staggered three-year terms of office and is elected by a simple majority. The board's authority is much the same as that described in Act 39 of 1889, but its autonomy with respect to accountability to the general membership seems considerably greater. Since power in the association may reside to a considerable extent in stockholdings as voting shares, this stock influence has the potential to be concentrated in the board of directors, thus giving that body even more autonomy. The act further grants the directors the possibility of enacting bylaws prohibiting the transfer of any capital stock without their prior consent (M.C.L.A. 455.12). By way of apparent concession to the membership, however, the law does require majority consent for the board to make expenditures greater than \$1,000 per year and requires an annual meeting every year between February and August. Nonetheless, this provision must be viewed from the perspective of the stock-voting provisions of the enablement.

Annual dues may be assessed the membership on a share basis, and the association, through the board, has the authority to attach a lien on delinquent shares with provisions to cancel a delinquent member's stock and resell it. The stockholders may also vote additional special purpose dues not to exceed \$25 per year. The association may also plot and assign property lots to its shareholders according to provisions of its bylaws. If this is done, stock in the corporation and title to the assigned lots become united and may not be severed (M.C.L.A. 455.21).

While the essence of membership under Act 230 is stock ownership, it is also possible (by a two-thirds voting stock majority) to establish special terms of nonstockholding associate membership (and thus, presumably, nonvoting, dues paying members). This provision is important because all stockholding members are jointly, severally, and individually liable for all labor and services performed by the corporation.

Public Act 137 of 1929, the last in this series of resort acts, conveys the most power and authority to the association over the lake community. It is also more applicable to the formation of an association where the community itself is already established. While the two preceding resort acts tend to rely heavily for their administrative authority on corporate ownership of the involved land, Act 137 conveys more regulatory authority to the association with less

emphasis on a corporate proprietary right in the community. Thus, it lends itself more readily to the bringing together of individual riparians of long standing who discover a common interest or problem requiring an organizational approach.

The conditions for organization in this instance require not less than ten individuals all of whom must be property owners. The corporation itself may provide for capital stock not to exceed \$50,000 in par value and may not own more than 320 acres of land. Buying and selling of land by the trustees requires approval by a majority vote of the organization's membership present at a given meeting.

Conditions of membership require that the individual be a freeholder of land in the same county as the association and that this property be reasonably adjacent to that recreation community involved. The trustees of the association are authorized to determine the proximity and common interest of perspective members of the association. Members may be assessed annual dues, and delinquent payment results in an association lien on the property involved. Membership terminates upon alienation of the property of a member.

However, the corporation also has a right of annexation which matures after two years of continuous functioning of the association in a given area of the community. Under this provision of the law, landowners in a particular area within the influence of the association who have not already voluntarily joined after two years, may be annexed by the association if a majority of the property owners in that area vote to join. All freeholders in the affected area are eligible to vote on the annexation issue (M.C.L.A. 455.206 as interpreted by the Michigan Supreme Court 384 Mich. 42, 1970).

An annual meeting of the association is required between the first of June and the thirty-first of August of each year. Members may vote on issues at this or any special meeting either in person or by proxy. Dues or special assessments may be levied only if approved by a majority vote of all members (not just members present at a meeting).

The administrative authority of the association is much the same as in the other two laws and includes a provision for the association to hire its own policeman, provide fire and sanitation protection, regulate traffic and public behavior, and lay out and maintain streets and sidewalks. In addition, all members must sign a written and recorded agreement granting the exercise of association jurisdiction over their property in accordance with the provisions of this act (M.C.L.A. 455.207). Violation of regulations or bylaws of the

association constitutes a misdemeanor. A further provision of authority provided by this law is the constraint that no city or village may annex any lands owned by the association or its members without the consent of a two-thirds majority of the association membership (M.C.L.A. 455.218).

With respect to all three of the Summer Resort Acts, filing of an annual report and payment of a special fee to the Michigan Treasury is required for continued existence of the corporation. This is similar to the provisions also required under the General Corporation laws (M.C.L.A. 450.81, 450.92). There are, however, legal provisions for a two- or three-year lapse in filing and for reinstatement of expired corporations (M.C.L.A. 455.25, 455.281, 450.92, and 455.283). Similarly, although all three resort acts stipulate a 30-year life of the corporation, Public Act 12 of 1901 (M.C.L.A. 455.251) also provides for the regular extension of its charter by any summer resort association.

Deed Restrictions and Covenants

This particular form of enablement rests in common law rather than the codified acts discussed. It is predicated on the belief traditionally accepted in English and American society that as a condition of sale, the seller of property may require certain performance of action or constraints upon particular actions by the buyer. It is not unusual, for example, for a constraint to be placed on the deed to a parcel of land stipulating that any subsequent owner keep it in agriculture, or that a parcel being granted to a city be used only as a public park. The use of these covenants or restrictions is sanctioned by both federal and state courts so long as the conditions so imposed do not violate constitutional rights or duly authorized law. For example, property may not be sold with the restriction that the buyer be only of a particular race or nationality; such discrimination is a violation of law and the deed restriction may be voided in court. However, the courts may also be called upon to enforce legitimate deed covenants when a buyer fails to comply.

A completely legitimate use of the deed restriction instrument is the stipulation that purchasers of lake property in a recreational development (i.e., sale of subdivision lots by a contractor or real estate company) be required, as a condition of purchase and continued ownership of the land, to join a lake or property owners association responsible for the management of that community and its resources. This technique is often used by contractors and land companies in situations where the local municipality is either unable or unwilling to assume maintenance responsibility for the new development. In this instance, the new resi-

dents themselves are obliged, as a condition of purchase, to organize and administer to their own needs. These deed covenants "run with the land," meaning that resale of the property does not relieve the new buyer of an obligation to belong to the association. So long as the covenant is legal and the association continues to exist, any new owner of that lake property must assume his membership responsibilities to the organization.

Obviously this form of enablement is most appropriate at the initial formative stages of a recreational community and has little utility as a means of enablement for a new association in an already established community. Given these circumstances, the deed restriction approach could be better used as an augmentation to an association established under one of the above mentioned enabling acts. Dedicated members who decide to sell their property could have a covenant written into their deed requiring subsequent owners to belong to the association so long as it exists. Exercise of this option by the membership of an association would have the effect of eventually perpetuating succeeding generations of members.

Summary

Of the five basic options for the incorporation of a lake association, deed restriction may have application only at the formative stages of the community. This leaves four alternatives generally available to individuals of an established lake community intending to form an association.

In evaluating the pertinence of these four laws, one set of criteria may be employed. Determine first how much actual power or authority the law grants to the association within the local setting. How much standing would such an association have in the community? What would be its clout in a local conflict involving more than just the membership? The second consideration may be to ask just where the individual member fits in terms of administration of the association. Will there be much participation? When decisions are being made, whose opinions will count? Is there potential for the association to be dominated by a select few members or by the board of directors? How responsive will the leadership be to the interests of the majority? Simply put, the criteria may be: how much power will the association have, and how democratic will it be? The more power conveyed to such an association, the more important that it function in a democratic way if the individual member's own interests are to be preserved.

If the four enabling acts are reviewed in this context, the nonprofit corporation under the General

Corporation laws is seen to produce a relatively powerless association within the community and with respect to its own membership. Conversely, such an association would pose little threat to individual riparian rights, and people should have less reservations about joining.

The three resort acts all convey some measure of municipal authority to the association, but the most extensive authority is in Act 137 of 1929 with its annexation provisions, in addition to the municipal-like powers otherwise provided. In terms of democratic participation, Act 230 of 1897 with its provision for stock-share voting has the greatest potential for centralization and trustee dominance. This leaves Act 39 of 1889 and Act 137 of 1929 as the prime contenders for selection under this criteria, with a slight edge going to the 1929 legislation because of its greater potential power in the community.

However, this legislation has been reviewed by the Michigan Supreme Court (*Baldwin vs. North Shore Estates Association* 384 Mich. 42, 1970) and while its constitutionality was not at issue, the Court did . . . "note that the entire act borders on unconstitutionality by reason of its vagueness." The act was again questioned in the Michigan Appeals Court in 1974 (56 Mich. 162) in the case of *Ryan vs. Ore Lake*. The trial judge ruled the act unconstitutional, but the decision was overturned by the Appeals Court as premature because disposition could be reached on the question of the facts at issue alone.

Pending further judicial interpretation, this act at present appears to convey the most authority to a lake association, particularly with respect to the free rider problem already discussed. Its provision for imposing a property lien upon delinquent members, the annexation provision, and the granting of regulatory authority over private property use make it extremely difficult for a riparian to avoid paying his fair share for lake services. However, (in anticipation of a court challenge), any association organized under this legislation must be prepared to demonstrate the value of the services it provides before imposing any such sanctions.

None of the legislation discussed adequately addresses the other major problem of lake associations, that of self-centered lake residents. Organization and a sense of group commitment appear to be the basis for combating this obstacle irrespective of legal provisions of a given piece of legislation. The assessment criteria of Act 137 can augment the effort of a community (where all members are willing to make the necessary sacrifices) by drawing others into their program. But there is no legal cure-all for the problems of limited personal wealth, apathy, and self-

centered attitudes in any community. If a solution exists, it lies in a dynamic and highly representative performance by the association so that the membership becomes caught up in its momentum. The association may, in this way, do much toward escaping the inertia of the trap.

Thus, from the standpoint of conveyed authority, member participation potential, and the free rider problem, Act 137 of 1929 of the Summer Resort Acts seems most appropriate. However, the perspectives of the individuals proposing a lake association and the nature of the particular community involved may suggest other options. The final decision rests with the lake association members themselves who may very well benefit from further advice of a competent lawyer.

SUGGESTED COMPONENTS OF ASSOCIATION ARTICLES OF INCORPORATION AND BYLAWS

The Articles of Incorporation

The Articles of Incorporation are determined by the particular enabling legislation selected and are analogous to a constitution. Each law predetermines the form and content of the articles of incorporation; provisions must be strictly adhered to before the association may be legally incorporated.

Generally, the articles will include the official title of the association, its purposes stated definitely and distinctly, provisions for capital stock and share values, the county or township in which the association is incorporated, number of directors or trustees, and term of existence of the association.

Most associations take their name from the lake with which they are involved or use the name of their particular subdivision, i.e., Long Lake Association, Inc. or Meadowbrook Estates Property Owners Association, Inc. With respect to the use of lake names in the association title, it is wise to include the place name or county as well to avoid mailing confusion. For example, there are several "Long" Lakes in Michigan, and associations in Grand Traverse and Ionia Counties are both named "Long Lake Association, Inc." It is a small detail, but use of a specific title for an association will alleviate possible banking and correspondence problems.

The purposes of the association should be well thought out. Careful thought pertaining to short term as well as long term goals for the association is required. It is imperative that a consensus be reached among the association membership on this point since this statement of goals will be a major determinant of formal association policy and a measure by which performance may be judged.

Some objectives or purposes which may be appropriate are: the enhancement of the health, safety, and general welfare of members; protection and enhancement of property values and aesthetic setting of the community; the pursuit of practical lake management to protect and preserve the natural character and prolong the existence of that resource, and protection of surface and groundwater in both quantity and quality.

While the suggested objectives by no means constitute a complete list of alternatives and are intended only as a guide for consideration, it is strongly advised that the association not limit itself to too narrow a list of ambitions. Too limited a list of lake objectives could narrow its appeal to prospective members and lead to stagnation of efforts resulting in a "do nothing" association. On the other hand, while extensive objectives always give the association something to work for, they should not be overdone. A sense of never quite succeeding because the tasks are so great could set in. In other words, try to accomplish the extremely difficult, but hold off on the impossible.

The provisions for stock ownership in the association will be determined by the choice of enabling legislation and the limitations it imposes. While the sale of stock can provide the formative association with considerable capital (providing the membership views this as a wise investment), it may be prudent to defer such action. At a later date this option could be exercised to finance a significant management project, such as drain diversion, road maintenance, or sewage disposal.

The appointment of a board of trustees will also be directed to some extent by the enabling legislation. As mentioned, the structure of this governing body should be carefully considered and the provisions of the legislation in this respect thoroughly examined. The board of directors (or trustees) will conduct the bulk of the association's business, and it is imperative that their degree of autonomy and delegated authority be established in such a way that they be held responsible to the interests of the association as a whole. While the articles of incorporation may require only a designation of the offices to be held (President, Secretary, Treasurer), the selected legislation may require specific terms of offices and means of election or appointment, i.e., the guidelines for subsequent bylaws determining the administrative structure of the association.

The Bylaws

If the Articles of Incorporation are viewed as a constitution for the association, the bylaws should involve a bill of rights. They are the standing rules governing the regulation of the corporation in accord-

ance with the articles of incorporation set by the enabling state law. These stipulate in practice how the spirit of the articles is to be applied.

Board of Trustees or Directors

It is appropriate and necessary in the bylaws to designate how the board of directors is to be elected and the terms of office. Remember, no matter how honorable the candidates, the procedure should be designed to protect against corruption and the arbitrary assignment of power. For the sake of continuity of administration the association may prefer to designate that the terms of office (usually President, Secretary, and Treasurer) be staggered so there is not a complete change of personnel with each election. Further, if the community is large or diverse, it may be divided into voting districts each of which may elect a trustee representative. Length of terms should also be considered. In light of the often seasonal nature of the lake community, a two- or three-year term is probably optimal. Lesser terms may not allow sufficient time for the trustees to initiate and complete programs and obligations.

If desired, the association should also designate the number of terms an individual may hold office. In this respect, it is important to weigh the possibility of clique formation against the risk of writing a bylaw which would deprive the association of the extended tenure of a gifted and dedicated leader. (This dilemma also suggests the need for including a process for bylaw amendment, as well as one for removal from office before expiration of term and the interim replacement of that individual — perhaps by appointment from the membership by the remaining trustees.)

Another provision which might be considered is the stipulation of a limit on the amount of money the trustees may allocate in any given year or for any given purpose without first seeking approval of the membership at a general meeting.

Voting Procedures

One of the controversies involving the Summer Resort Act of 1929 is the designation of who may vote in an annexation issue. This points up the importance of considering not only individual rights of association members, but also those of other citizens in the community who may be influenced by the association. Generally, with respect to the internal affairs of the association, each ownership is assigned a vote. Thus each member family shares one vote irrespective of signatures on the property title, size of holding, or term of residence. Similarly, the Michigan Supreme Court has ruled (*Baldwin vs. North Shore Estates Association* 384 Mich. 42, Sept. 1970) that

absentee landowners must be allowed to vote in an annexation issue as provided in Act 137 of 1929. This being the case, it might be prudent to concede the same right to association members, i.e., no voting constraints on property owners who have not constructed a residence on their holding so long as that property qualifies them for membership. It might also be wise to provide for absentee or proxy voting.

A voting rule should also be stipulated, i.e., simple or two-thirds majority, or perhaps some combination, depending on the issue at hand. Perhaps a simple majority for elections, but a required two-thirds majority for amendments to the bylaws or monetary issues. A required quorum should also be designated for both trustee and general membership meetings.

Membership Criteria

The association should define as succinctly as possible those property holdings which qualify their owners for membership in the association. Riparian property (that land bordering the lake) would be an obvious candidate. The association would then have to determine to what extent other holdings not directly on the lake, but perhaps still pertinent to it, might also be included. Of particular consideration here would be owners of "out lots," property not directly on the lake or stream but vested with a use right through a designated piece of access property that is riparian.

It might also be wise to designate a form of associate or honorary membership to nonproperty holders, other organizations, or corporations which would not entail a voting privilege.

In addition to property ownership, voting should also be contingent upon satisfactory payment of dues. These dues requirements may be adjusted or even waived as per the mentioned type of membership assigned.

Dues and Assessments

The association should set a basic membership fee for a particular period, usually annual, with a stipulated date by which payment must be made before the member is designated delinquent. Penalties for delinquent members should be clearly indicated, particularly if the association is authorized to impose a lien upon that property.

Inquiries of several Michigan lake associations indicate a general range of annual dues varying from \$5 to \$25. The setting of dues should, of course, be initially established through consensus of the membership and any adjustments based on a vote of the association. Similarly, special additional assessments should be voted upon.

Meetings

Regular trustee meetings and the general membership meeting should be designated. Usually one or two general membership meetings per year are required by the enabling law, often with the time of year also stipulated. Trustee meetings should be more frequent, perhaps every two or three months in order to facilitate the orderly business of the association and prepare an agenda for the general meetings. A provision should also be made for required advance notice to members for each meeting.

Regulations

The extent of application allowed by the enabling law will set the regulatory authority of the association. Some areas of concern may be:

Boating — Speed regulations, designated times and areas for water skiing, sailing, canoeing, or fishing, restricted boating in swimming areas, and prohibitions against or limit to the horsepower and design of motors which may be used. **Snowmobiling** — Many associations in recent years have added regulations pertaining to areas of authorized use, speeds, and hours of operation for snowmobiles to enhance the safe enjoyment of the sport and protect the serenity of the lakes. With respect to both boating and snowmobiling, limits as to the numbers of vehicles allowed particularly with respect to "guest" boats or snowmobiles may also be indicated. **Litter and trash** — Types of storage and disposal, burning restrictions, and nuisance prohibitions, such as the accumulation of inoperable autos, and types of materials used for land fill in housing construction. **Animal control** — Leash laws or yard fencing regulations. Animals should be prohibited from community swimming areas. **Construction regulations** — Size, height, material, and color provisions for houses to preserve the aesthetics of the lake setting. The association may also wish to address questions of permanence of recreational habitats. Will tents, campers, or trailers be prohibited? Setback rules in addition to existing public health codes may also be stipulated. **Sanitation and public health** — Under Act 137 of 1929, association members must sign agreements to abide by regulations passed by and for the membership restricting certain property uses. In addition to litter control and housing construction and maintenance, such regulations may also require septic tank-tile field inspections and maintenance in a safe operating condition, dye testing for effluent discharge, and monitoring of well water to assure its quality. **Lake protection** — In addition to user restrictions mentioned

above, regulations may also be passed to curtail detrimental discharges or effluents to the lake. This could include prohibition or restriction of lawn fertilization, diversion of roof, property, utility, and footing drains away from the lake (or at least prevention of direct lake discharge by use of dry wells or other land distribution means), mandatory control of any erosion by property owners, and strict prohibition against the discharge or disposal of any foreign substance into or near the lake or its tributaries.

As references illustrating and expanding upon the above comments and suggestions, representative samples of lake association articles and bylaws are included in Appendix B. After considering these suggestions, consulting the specific letter of the enabling act involved, and reading the articles and bylaws of other associations, the organizational committee should be prepared to write an initial draft. As these ideas are being outlined, fellow members of the association should be encouraged to offer suggestions as to content. The more opinions considered at this stage, the greater the potential to reconcile differences and include all important provisions before general consideration of the document. Changes in the committee's work are almost inevitable, and the process is much easier on committee members in the formative stages than after the project is completed.

Once the committee works out an appropriate draft of the articles and bylaws, it should be reviewed by a qualified lawyer for his legal opinion. The document may then be submitted to the membership for comments, recommendations, and voting.

Perhaps the best procedure would be to mail copies to all who signed up at the initial meeting along with the reminder of the coming meeting. If the mailing is two weeks or more in advance of the meeting, interested members will have time to read the articles and bylaws and prepare comments and proposals beforehand.

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THE ORGANIZATIONAL MEETING

Before the association can begin to assume its responsibilities as a corporate and social body, it may be necessary for the founding members to perform one more guiding function. Unless the lake community members are unusually well acquainted with one another, a slate of officers for the association election may be difficult to nominate. A responsible initiative by those more familiar with the community and the project may be indicated. By the time of the organizational meeting, likely candidates (often from among the founders) probably will have informally evolved. The smooth transition from neighborly cooperation in this venture to a formal, representative body may require some pre-meeting discussion and canvassing in order to present a reasonable selection of candidates to the membership.

With this groundwork completed, the meeting agenda may then include at least the following items: (1) A vote on the bylaws and articles; (2) Election of officers and/or trustees; (3) Assessment of dues; (4) Discussion of priority projects for the association. The first three subjects of the agenda should proceed rather smoothly if the preparatory work has been done well, although refinements of the articles and bylaws may be topics of subsequent meetings. The essence of this meeting should be the expression of concerns for the lake and the planning of projects to be undertaken.

Lake Association Projects

The major goals of the association will be expressed in the Articles of Incorporation. These goals constitute the guidelines for the development and coordination of individual projects. Coincidental with whatever

specific projects the association chooses to undertake, it is important to always have something going on.

When substantive projects are delayed or at a low point of productivity, the association leadership should introduce something else more dynamic but ephemeral, e.g., litter pickup, beach party, a guest speaker, or community picnic. Such activities convey the essential public impression of an action-oriented association and can also be supplemental sources of funds.

From the standpoint of this presentation, however, the major drive of the association should be the preservation of lake quality and, where feasible or indicated, its restoration. Prominent among such activities should be efforts to abate nutrient inputs to the lake and the management of algae and aquatic weeds to keep their density in the lake at reasonable levels.

The association's approach to lake quality management should be pursued on two fronts. First is physical action. This includes sewage disposal investigation, the development of alternatives where septic tanks are shown to be deficient, algae and weed control programs, and lake water and groundwater quality monitoring for the development of a comprehensive plan of management, i.e., sources of nutrient and effluent input to the lake which should be dealt with first.

The second front of attack should be socio-political in nature. This involves the continuous recruitment of members, educational programs to inform the lake community of its environmental responsibilities, lobbying for legislation to advance the interests of lake quality protection, and publicizing the association's causes and its rational objections to laws or activities not in its interests.

This dual function of the association must be coordinated for maximum success. Tangible physical accomplishments give evidence to the social arguments, proposals, and persuasions advocated by the association. This vocalization in turn provides the membership, finances, and incentive for more substantive managerial self-help. Perhaps most importantly, it is the process by which the association may expand and broaden the scope of its impact and thus the significance of its work.

The organization processes discussed represent a social aspect of the attack; thus it is important to compliment this initial step with a corresponding physical approach. The next several pages will present information and proposals which are economically and physically feasible activities for the self-help approach of most lake associations. Following this material will be a brief introduction of broader scale social goals worth pursuing, especially coordinated lobbying with other associations at county and state levels.

FUNCTIONS OF LAKE ASSOCIATIONS IN LAKE WATER QUALITY MANAGEMENT

The ultimate destiny of a developed recreational lake will be a shift to greater eutrophy and the attendant symptoms of greater aquatic weed growth, algal increases, and sedimentation. All are the effects of human development. The greater the intensity of development and use, the more rapidly and extensive these symptoms of cultural eutrophication are likely to manifest themselves. Lake residents must concede these effects of their presence and bow to the inevitable.

However, there is much that a well-organized and dedicated association can do to slow the rate of degradation of the lake. Primarily, it can initiate remedial actions to lessen the major cause of these lake responses i.e., the curbing of man's impact upon the lake.

Predominant among the causes of cultural eutrophication is the input of nutrients to the basin. A report prepared by Michigan State University scientists at the W. K. Kellogg Biological Station states that 63 percent of the phosphorus in Gull Lake, Michigan comes from septic tanks and another 24 percent results from lawn fertilization. The remaining 13% of phosphorus loading includes other forms of runoff, contaminants, and natural groundwater phosphorus.(12)

Thus, the lake association's major contribution is to expand efforts to curb sewage effluents suggested earlier for the individual property owner and make a concerted effort to discourage residents from the unnecessary habit of fertilizing lawns. Each member should be encouraged to do everything possible to improve the efficiency of on-site sewage disposal systems. As mentioned, the holding tank alternative constitutes a viable and significant grass roots approach to this problem which is almost entirely dependent upon the cooperative effort of many residents. Since this option cuts off all septic tank input to the lake, it may well be preferable to septic tank repair and drain field improvements in critical areas.

Economically, the costs may also be less in the long run. But to get any such project going will require the commitment of many people. A pumping service is more likely to be induced if a large demand is indicated. The lake association could approach the potential contractor with the offer of a justifiably large market in return for reduced group rates.

To get the project started, a committee of association members should first put together the necessary feasibility information. Estimates should be obtained for holding tank installations, pumpage fees, service schedule, and an adequate disposal site.

The interested contractor may stipulate a minimum number of participants necessary to justify his commitment. Therefore, the association must next induce as many residents as possible to participate. This can be accomplished by a careful documentation of benefits and costs to be incurred. The costs will consist of possible tank installation and regular pumpage fees. It should be noted that once the initial costs of tank installation and septic system modification are met the subsequent expense of disposal will be far less and will be distributed over the season or year. Thus the disposal fee may be viewed in the same context as any other utility bill.

The derived benefits consist of a greater assurance of safe well water, individual and public health safety in safer swimming waters, and the knowledge that nutrient sources to the lake have been considerably reduced, thus increasing the life of the lake and its aesthetic quality. It is important to stress these long term environmental benefits, especially since many residents may view their vacation property as a future year-round retirement home. Consequently, the owner should realize that the project involves an investment in future equity, including the health and recreation of the family and their guests.

In essence, the association must sell the idea by educating the residents and presenting the arguments for its need — best done by word of mouth. However, once the project has been informally introduced by individual discussions, a public seminar or meeting is in order for more extensive discussion and evaluation in which technical consultants should be available to present the proposal and answer further questions. Following a full review of the issue and given time for careful reflection, the residents should then be asked to subscribe to the project. Here the initiative of the lake association members may be helpful. People are generally reluctant to get involved; yet, by the same token, they may be induced to commit themselves if they see that a neighbor, whose integrity and judgment they respect, is associated with and endorses the project.

If a holding tank project becomes established, the lake association must recognize its responsibility to follow through and actively encourage its expansion and maintenance as a responsible operation. This may entail bringing the weight of its influence to bear upon the contractor to insure efficient, reliable service. The association may also be obliged to take an advocacy role in local government if the county or township balks at the increased demand upon its waste disposal facilities. Throughout, the association must be prepared to serve as arbitrator in any disputes and should not be reluctant to exercise the initiative in

calling in local or state agencies to provide information or assistance to remedy problems.

Coincidental with nutrient effluent curtailment may be the administration of the vegetative buffer strip planting program. Even with the incorporation of an extensive holding tank disposal system, the buffer strip idea can be utilized to help intercept lawn fertilizer runoff and other contaminants associated with road drainage. It may also appeal to residents who do not initially convert to holding tanks. As with holding tanks, the association can serve as a coordinator for the planting program by arranging for consultants to advise a planting schedule, and the possible bulk acquisition of seedlings from private or public sources.

The association can also organize and sponsor septic tank dye testing programs where indicated and fund lake water sampling programs to monitor the variations in lake quality.

As a representative organization, the association can speak for its members in negotiations with the Department of Natural Resources for public access maintenance, fish management, and lake level management. These services are available, but their implementation by the agency is considerably dependent upon the expression of a unified desire for assistance.

This same expression of community concern can serve to expedite local accomplishments. The individual resident who may not listen to a neighbor's complaint about his leaking septic tank will have much more difficulty ignoring the same complaint voiced by an organization representing his entire community. Similarly, complaints to the local public health agency, which a neighbor might be reluctant to make alone, can be funneled through the association. Incidentally, the association can help that agency considerably in the performance of its duties. The Public Health Department is a locally involved agency and, in some instances, may be under political pressure to waive regulations to accommodate the plans of an influential developer. If the lake association expresses strong public opposition to expanded development, it also gives support to the other side of the waiver issue.

Development control should be a concern of paramount importance to any lake association. Quite often, developers will seek to expand the housing on an already popular lake. If the better home sites are already taken, additional construction may be proposed for steep grades or marsh areas previously avoided because of their incompatibility to sound construction or failure to pass a percolation test. In all likelihood, construction on such marginal areas will be detrimental for both the lake and future resident.

Only the developer is assured to gain from the project. Consequently, the lake association of an already populous lake should be skeptical toward such projects and should take it upon itself to thoroughly investigate for soundness and legality.

Furthermore, in anticipation of community sewer projects, which may induce expanded development in its own right, the lake association should cooperate with township officials in preparing a local zoning ordinance in advance to head off this unpleasant side effect of effluent abatement.

LAKE WATER QUALITY SAMPLING PROCEDURES

Any management efforts by a lake association, such as nutrient input curtailment, should first be preceded by an investigation of the lake's condition. Lake associations may obtain professional assistance in this respect by contacting their county extension agent. The agent, local public health sanitarian, or officers of other lake associations should be able to recommend state, university, or private facilities active in limnological and water resource investigation.

An optimal time for lake basin water quality sampling is in the early spring at the time of overturn. This condition is indicated by the absence of a thermocline i.e., temperature measurements in the deep water area of the lake are essentially constant from surface to bottom. This period of complete mixing usually follows shortly after the winter ice is off the lake. Water samples taken at this time will indicate the relative nutrient load of the lake available to the initial growth of aquatic vegetation and algae. Samples taken later in the summer may produce very low phosphate and nitrate concentrations, not because the nutrients are absent, but because they are rapidly being taken up by the flourishing algae and weeds.

However, this is not meant to imply that water sampling should be limited strictly to the period of spring overturn. To the contrary, this sampling provides base line data regarding the initial concentration of potential algae and weed growth already present in the basin. Later in the summer, additional, more specific sampling should be conducted to attempt to locate point sources of sewage or other nutrient and bacteriological inputs. This summer survey is highly pertinent to any management effort involving the curtailment of nutrient or bacterial contamination. In this instance, samples should be specifically directed at areas showing physical evidence of possible contamination sources.

A good procedure for such a survey is to select the sampling occasion during a period when recreationists will be most active at the lake, such as a warm summer

weekend or popular holiday, provided that the manpower and laboratory facilities can be arranged. Samples should be taken from all areas where streams, runoff, or drains enter the lake, at discharge points, beaches, and areas of housing or commercial concentrations. Reference samples should also be taken from the center of the lake or center of each of its lobes. Other areas to emphasize are lake shore areas near farm lots, cottages in low areas, congested housing on points of land, frontage for public parks, marinas where toilet facilities are located, clustered housing in coves or embayments, and boat canals. These latter areas should also be carefully sampled when algal blooms or dense weed beds are repeatedly evident.

Samples should be taken as near to shore as possible without disturbing the sediments. In the case of drain pipes, any water flowing into the lake should be sampled directly. Samples taken from influent streams and drains should be collected sufficiently upstream to insure that no backwash from the lake itself is collected. Generally, the sample should be taken from within the top 6 inches of water, although for specific studies variable depth sampling may be indicated.

At the time of sample collection, field observations should also be recorded, including water color and clarity, approximate depth, vegetation, shoreline and surrounding land use, and particularly, an accurate description of the sampling site, including names and addresses of the nearest occupants. This information can be most reliably and efficiently obtained by having a knowledgeable lake resident accompany the sampling party. The presence of an association representative also aids the purposes of the lake association in that riparians curious about the sampling operation may be informed of the associations' activities and significance. Concurrently, these same conversations may provide the investigators with additional information pertinent to the survey.

The sampling procedure up to this point, has described spring and summer activities only. Data collected at these times are probably the most important if the association can only afford a limited survey. However, when possible, the lake should be sampled on at least a seasonal, if not monthly, basis in order to get a more comprehensive view of the ecology. This more comprehensive monitoring program should also include measurements of the volume and flow of water in the lake.

Test Parameters

The parameters selected for analysis of lake water quality may constitute any number of measurements and are dependent upon the objectives of the research. They may include the full gamut of sediment, phyto-

plankton, benthic organisms, fish, and a host of bacterial and chemical measurements, as well as depth, area, and flow characteristics of a lake. The proposals here are not intended to be all-inclusive but are deliberately limited to general water quality tests which have traditionally demonstrated a reliable assessment of potential sewage effluent contamination. Similarly, the sampling and analytical approach presented is not expected to compete with scientific research but will provide information most directly applicable to the identification and general location of gross effluent discharge sites to the lake. With this limited objective in mind, the following water quality tests are recommended as the basic data source for the lake survey.

Nutrients

A variety of factors contribute to the growth and survival of algae and aquatic weeds: nutrients, light, carbon, pH, and various trace minerals. Of these nutrients (soluble or orthophosphate phosphorous and nitrate nitrogen), phosphorus has shown a consistent relationship to weed and algal growth, even though both are common to sewage effluents. Of the two, nitrogen is less pertinent to algal problems because the blue-green algae are able to fix atmosphere nitrogen in the absence of aquatic nitrogen and can thrive so long as their other required nutrients are present. Because much of the nitrogen present in a lake is assimilated from the atmosphere or groundwater and hence so ubiquitous, removal efforts have little promise of significant reduction. Consequently, from the standpoint of a lake association, the phosphorus concentration is of major significance (6). Its presence, in very small amounts as long as other growth constituents are also available, permits the extensive growth of aquatic vegetation. Most limnological texts suggest that, as a general rule, a threshold $PO_4\text{-P}$ concentration of about 0.01 mg/l is sufficient to promote expansive growth(2,10). The common source of the allochthonous i.e., nonlake produced phosphorus in recreational lakes is via sewage effluent and fertilizer runoff. Once phosphorus is in the lake it has the potential to recycle through algae and weeds which die and decompose. Bacterial action in the sediments may then release the phosphorus to the water for reassimilation by subsequent generations of vegetation.

From the standpoint of sewage and fertilizer nutrient curtailment, it would seem impractical to try to eliminate nitrates because (1) they are not significantly removed by effluent percolation through soil and (2) lake vegetation can derive its required nitrates from atmospheric nitrogen dissolving in the water,

by nitrogen fixation performed by some species, and from the decomposition of organic material in the lake. Theoretically, it would seem that phosphate curtailment would also be unnecessary, not because of any great abundance, but because it is believed to be readily assimilated by the soil when septic tank effluent is disposed of by drain field methods.

However, two factors argue strongly for the curtailment of the disposal of phosphate-laden effluents near lakes. The first is that very little phosphate is needed for the creation of weed and algae problems. Hence, since small amounts are significant and considered relatively rare in natural concentrations, it must be controlled to reduce weed and algae problems. Secondly, and partially contradictory to the preceding statement, is the problem associated with the intense shoreline development of many lakes. The large volume of effluents entering the groundwater, and hence the lake, together with the highly variable response of different soil types to phosphorus absorption, results in significant phosphate additions to lake waters. This condition was demonstrated by Ellis and Childs(1) in their study of Houghton Lake, Michigan septic disposal systems.

The reasons for recommending the testing for nitrate and phosphate is based on their common occurrence in sewage and fertilizer effluents and the fact that one or the other may be, at the time of sampling, bound up in growing aquatic organisms.

Chlorides

Chloride is not necessarily an essential growth component of aquatic vegetation but is, in fact, a universal component of water due to dissolving mineral salts in surface waters and groundwaters. However, it is also highly concentrated in sewage effluent as a component of urine. For this reason, chlorides should be tested, since high concentrations relative to other areas of the lake may indicate sewage inflow.

Another source of high chloride concentrations in a lake sample is the leaching and runoff of salts as a consequence of winter highway deicing practices. Extremely high salt concentrations can result from road drainage near a lake where excessive salting was practiced during the winter. It has been shown that the leaching of this salt from road shoulders can continue into the summer months.(7)

Hence, high chloride concentrations may indicate sewage effluent or road drainage which may include other contaminants as well. In some cases, a high chloride reading may indicate brine discharge from wells or unusually salty groundwater.

Bacterial Contaminants

Because of the public health threat from septic tank wastes or storm water runoff, water samples should be examined for at least three ecological types of bacteria: Total Coliform organisms, Fecal Coliform, and Fecal Streptococcus. These bacteria in high numbers indicate that excretory wastes recently entered the water. In the case of storm runoff, the source of fecal material may be rodents, wildlife, dogs, cats, or livestock.

Michigan state water quality standards originally set 1,000+ colonies of Total Coli bacteria in 100 mls of a water sample as the maximum acceptable level for body contact activities, i.e., swimming. If the geometric average of any series of 10 consecutive samples exceeded 1,000 colonies or if any 20% of the samples exceeded 5,000 colonies, the water was considered unsafe for recreational swimming. This criteria has since been dropped from the regulations in favor of a single fecal coliform standard requiring that waters considered suitable for total body contact not exceed 200 colonies/100 mls. Still, testing for total coliform remains a helpful index for the evaluation of bacterial water quality.

There are no present standards for Fecal Streptococcus in the Michigan law. However, the presence of Fecal Streptococcus bacteria specifically indicates fecal waste contamination by warm-blooded animals(3). Further, a correlation has been observed between the ratio of Fecal Coli to Fecal Streptococci, and the source may be inferred as follows: FC/FS= 4.0 (or greater than 4.0) is strong evidence of human wastes; FC/FS=0.7 or less implies livestock or poultry wastes; FC/FS= 2 to 4 suggests a mix of human and livestock wastes; FC/FS=0.7 to 1.0 suggests a mix of livestock and poultry wastes. If the ratio falls between 1 and 2, the interpretation is uncertain, and the sample was probably taken too far from the source of pollution to be indicative. If low fecal streptococcus concentrations (below 100 colonies/100 ml) are obtained, or the effluent exposure is more than 24 hours old, the ratio interpretation may be dubious (Geldreich, personal communication, 1975).

In addition to the type of pollution indicated by any particular result, high results for all three bacterial cultures, plus high nutrient and chloride concentrations for the sample, strongly indicate the presence of sewage effluent. Test results of such proportions should arouse the investigator or lake association to further investigate that portion of the lake or stream with respect to a suspected source of contamination.

Incidentally, in his 1970 report Geldreich also reported that the sediment-water interface of lake bottoms can be a form of reservoir, holding fecal

pollution "fallout" from contaminated waters. This suggests the need for sediment management of lakes especially in swimming areas as stirring up of the soft bottom by swimmers could further aggravate public health risks associated with existing bacterial contamination of the water.

Conductivity

Another evaluative procedure helpful in the investigation of possible water pollution is the measurement of water conductance. If the initial survey suggests several "hot spots" based on bacterial, nutrient, and chloride data, the sampling site may be carefully and slowly cruised in a small boat and sampled with a field conductivity meter to attempt to delineate the shape and size of the effluent plume. Conductivity is the electrical measurement in mhos of the dissolved ions in water. Sewage effluent tends to contain a greater concentration of these ions than the higher quality receiving waters they enter. Consequently, until the sewage becomes mixed and diluted by the lake or stream waters, it may be possible to identify its source and distribution by noting the higher conductivity readings relative to the receiving water. However, in estuarine or very hard water lakes and streams this technique may be ineffective due to the naturally high conductivity of these waters.

Dissolved Oxygen

The amount of oxygen in the lake water may or may not reflect organic pollution, but it is of major significance to the survival of fish populations. Where fishing is of particular importance to the community, representative dissolved oxygen (D.O.) studies for all lake depths, taken at all seasons of the year, are imperative. Generally, if the concentration of D.O. falls below 5 milligrams per liter, game fish populations will suffer. This is especially true under winter ice conditions when oxygen is not readily replenished and the fish may suffocate resulting in a "fish kill."

Evaluation of Test Results

Drastically high test results in any one spot should cause further pursuit of information from that area. It is important not to arrive at hasty conclusions on the basis of only one sample; but the presence of such data suggests the need to repeat that sample and to collect others from the same vicinity. In this respect, the association should critically review the terrain and land use of the area with the objective of selecting strategic and significant adjoining sampling sites. It may also be important to time the sampling occasion to coincide with the incidence of possibly suspect activities i.e., active habitation of a given residence or public facility.

If subsequent data supports the initial suspicions, the parties who might be responsible should be approached and diplomatically informed of the problem. Most likely an individual, once aware that pollutants may be discharging into the lake, will implement responsible, corrective measures. However, the lake association should also convey its information to the local public health agency to further facilitate remedial action. The order of approach i.e., first the health department or first the possible offending party, will depend upon the circumstances and personalities involved.

Some lake associations have found that the use of peer pressure and publicity also helps elicit correction of septic tank drainage problems. Publication of the water quality report, complete with map references, not only induces remedial action to clear one's environmental reputation, but demonstrates to the community a function of the lake association.

In those instances where the test results fail to demonstrate strong evidence of pollution, yet suggest some unsettlingly high "borderline" conditions, further sampling is needed. Any low test result in an area demonstrating physically suspicious symptoms, i.e., discolored or smelly water, dense algal or weed concentrations, open drains, or crowded conditions, etc., should be repeated with additional sampling as well. As mentioned, low nutrient counts may result from active plant and algal uptake. Low bacterial results can also be obtained, even in sewage effluent, if toxins or chlorine are present.

In some instances, putrescent material may enter the water from an anaerobic source. Since the millipore filtration techniques of bacterial analyses are based on oxygen-utilizing organisms, the cultures may appear negative because they are not appropriate to the particular species present. Hence, unless the tests are augmented by further anaerobic analytical techniques, they should not be considered all-inclusive. The information derived should be evaluated and balanced with physical observations of the sampling site.

A marginal sample could also reflect the dilution effect of sampling too far from the source of pollution. A repeat sample taken closer to shore or a little more to one side or the other may produce more significant results. The use of the conductivity meter may help in repeat sample site selection in this case and in the preceding example of more graphic data results.

Negative results should be a source of encouragement to the lake community. Indeed, a high proportion of water samples from a given lake, particularly

in light of this form of deliberate sample design (where sources of possible contamination are specifically selected for sampling), should indicate high quality recreational waters.

However, the maintenance of safe swimming waters and low enrichment depends upon constant vigilance. Hence, the lake should be surveyed at least every summer, with a rotating system using new and old stations as indicated. As critical evidence evolves, the association should press for alleviation of the problem at the suspected source. This concept of investigation (ultimately expanded to a year-round sampling program), action, and continued surveillance should be an on-going, primary function of the lake association.

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ALGAE CONTROL FOR RECREATIONAL LAKES

Algal Ecology and its Significance for Man

The term "algae" is derived from the latin name for "sea wrack" and has come to be applied to all relatively simple aquatic and marine vegetation. Algae in fact constitute vegetative plants of the simplest construction; "morphologically they are cellular plants growing as single cells or aggregations of cells and sometimes even forming paranchymatous thalli, although these are still relatively undifferentiated into organs and only in the most complex genera are elementary connecting tissues found."(17)

Hence, algae are basically one-celled organisms which may exist in the water singularly or in aggregations or colonies. As such, the algae commonly found in lakes and ponds may exist as discrete microscopic, one-celled organisms floating in the water i.e., planktonic blue-green or green algae, to large plant-like colonies such as chara. In between these extremes are the filamentous forms of algae such as *Cladophora* which form attached mats of string-like growths or filaments.

"Algae are common inhabitants of all surface waters and are encountered in virtually all waters which are exposed to sunlight(16)." Though their major center of distribution is water, they are worldwide and can also occur on all types of soil and on permanent ice and snowfields(17). They are the major primary producers of the aquatic environment, carrying on 90% of its photosynthesis and are of considerable value as oxygenators and food to many animals and fish.(9)

Being such a ubiquitous organism, it is understandable that many recreational lakes often encounter nuisance algae "blooms." A bloom is an unusually large number of cells (usually only one or a few species) per unit of surface water, which often can be discerned visually by the green, blue-green, brown, or even bright red discoloration of the water(11). The ever present nature of the algae plus human enrichment of lakes by sewage and fertilizer runoff, together with the warm sunny days of spring and summer, creates the ideal conditions for the rapid growth and multiplication of algae and the subsequent bloom.

There are several taxa of algae, but the two major phyla or divisions common to recreational lakes are the Cyanophyta or blue-green algae and the Chlorophyta or green algae. Of the two, the blue-greens constitute the greater nuisance because a bloom of blue-greens continues to float in the water even after death of the algae. Thus, appearance, smell, and enrichment of the lake waters from decomposing algal cells continues long after the original components of the bloom have

died. Conversely, green algae sink with death. Thus, the lake recovers faster and nutrients associated with the green algae biomass precipitate to the lake bottom, can become trapped in the sediment, and are less likely to recirculate in the lake enrichment cycle.

In both cases, however, oxygen depletion associated with the bloom and its subsequent decomposition may result in localized fish kills. The bloom may also generate significant levels of toxins in the water. These metabolic by-products of the algae may poison wildlife and livestock if they drink water infested with sufficiently dense concentrations of algae. The toxic effects can also apply to the fish population in the water. The algae responsible for such poisonings are all species of the blue-green algae group, Cyanophyta. The particular genera most often associated with animal deaths are: *Microcystis*, *Aphanizomenon*, *Anabaena*, *Nodularia*, *Coelosphaerium*, and *Gloeotrichia*(11). The toxins generated by these organisms can also poison humans, and Mackenthun and Ingram (1967) document several case histories of gastrointestinal and respiratory illnesses associated with ingestion or exposure to algae infested water. Gorham (1964), however, concludes that although algal blooms constitute a serious hazard to livestock and fish, the blooms are more a nuisance and economic hazard than a public health threat, since the offensive odor and appearance of a lethal concentration of algae-infested water would repel humans from drinking it.

Nutrient Requirements of Algae

In the quest for control of algal blooms, considerable research has been directed to the study of their basic life needs — the objective being to find a critical component essential to algal survival and growth. If such research should succeed, then by simply depriving the lake or water system of the particular essential item(s), algae could be controlled.

Unfortunately, such research has yet to generate a workable management technique. The factor apparently controlling algal growth does not seem to be any single component, but rather a combination of multiple factors, among them carbon, light, phosphorus, nitrogen, iron, and pH. The ratio of these components necessary to algal growth appears to vary with each particular environment, i.e., the particular combination of circumstances and nutrients necessary to an algal bloom on one lake are not necessarily the same for another, nor will the species of algae causing the problems always be the same.

In fact, it may be that a greater algal species diversity is to the advantage of lake residents because the inter-competition between them can prevent any

one species from gaining an advantage, resulting in a bloom.

Further complicating the management issue is the fact that most of the nutrients needed by algae are readily available and are subject to little human control. The one area that does offer some hope is the curtailment of sewage effluent or fertilizer runoff to lakes, both of which tend to be rich in nutrients, particularly phosphorus. Although the role of phosphorus as a limiting factor in both algal and weed growth is debated by researchers, restricting this source of nutrition may help. At least it is a controllable factor, unlike light, carbon or many other components of the "diet" of algae and vegetation. Hence, while removal of phosphorus may not put an end to algae blooms, it should help reduce the problem.(19)

Algal Control Feasibility

In any reasonably enriched lake, periodic algal blooms may be expected. It is impossible to remove all algae from the system, just as it would be impossible to obliterate bacteria. The organisms and their reproductive spores are simply too numerous and well distributed. Consequently, control has been traditionally directed at efforts to restrict the extent of blooms when they occur or to reduce their potential to develop.

Chemical Methods of Controls

A traditional and temporary approach to algal control has been the application of copper sulfate (CuSO_4), commonly known as blue vitrol, to the lake surface. The copper sulfate interferes with physiological processes of the cells resulting in their death and decomposition, often beginning within hours of the application. The mechanism of the copper toxicity is not precisely known, but various researchers have suggested that it interferes with photosynthesis, respiration, and/or cell division(5). The copper sulfate may be applied by liquid spray or by towing fabric bags of the dissolving crystals behind a moving boat. The rate of application recommended to control blue-green planktonic algae is usually about $5\frac{1}{2}$ lbs/acre, or a one part per million (ppm) concentration in the upper 2 feet of water.(10)

Copper sulfate is also toxic to fish and many invertebrates but in higher concentrations than the approximate 1 ppm effective against blue-green algae. Further, in hard water lakes, the copper sulfate quickly reacts with carbonate ions to form relatively biologically inert copper carbonate which precipitates to the bottom sediments. Thus, it has been generally considered that copper sulfate is a "safe" chemical for the treatment of nuisance algal conditions, as well as

"swimmers itch," by killing the intermediate snail host of the troublesome skin parasite.

However, it must be emphasized that such control measures are only temporary, and the treatment process must be frequently repeated throughout the summer, in some instances as often as every few weeks. As a result, large concentrations of copper may eventually accumulate in the bottom sediments of problem lakes which have received long term copper sulfate treatment. Some lakes, such as Monona and Waubesa in Wisconsin, have received hundreds of tons of this compound over the years(10). Michigan's Houghton Lake has also received a considerable amount of copper sulfate.

One possible benefit associated with the continued addition of copper compounds to lakes is in the reduction of nitrogen fixation by blue-green algae. Bioassays conducted by Horne and Goldman (1974) suggest that the addition of copper sulfate ($\text{CuSO}_4\text{-Cu}$) in 5 to 10 ug/l (thousandths of a ppm) concentrations significantly reduces the nitrogen fixation rate of the blue-green algae, *Aphanizomenon* and *Anabaena*. They propose that the application of trace amounts of copper to lakes might help control late summer and fall blooms of blue-green algae by suppression of their nitrogen fixation potential. However, they caution that such management potential is supplemental to the need to curtail sewage effluent entrance to lakes.

Concern for the possible long term adverse effects of the accumulation of copper salts in sediments include an apparently developing resistance of some forms of blue-green algae, particularly *Aphanizomenon*(16) and the risk to other life forms if the treatment dosage is too great, making the use of copper sulfate a less than ideal algal control technique. Its potential hazard to humans may further increase as our growing needs for drinking water supplies extend to the use of recreational lakes as reservoirs as well.

Because of this growing concern over the possible ramifications of indiscriminate chemical treatment of recreational lakes, the Michigan Department of Natural Resources requires that anyone proposing to chemically treat such waters first obtain a permit from their agency. Further, the actual application process should be conducted by a reputable firm licensed with the state. [For particular information contact the Fisheries Division, Dept of Natural Resources, Stevens T. Mason Building, Lansing, Michigan 48926]

A recent study(16) suggests that two new compounds might be environmentally safer than either copper sulfate or "Cutrine," a commercial copper preparation also commonly used and considered superior to copper sulfate because smaller doses pro-

vide effective treatment(13). These are 2, 5-Dichloro-3, 4- dinitrothipene (experimental compound 23), and p-chlorophenyl-2-hienyliodonium chloride (experimental compound 73). Both are reported to be 94 to 100% active against two common forms of blue-green algae (*Microcystis aeruginosa* and *Anabaena flos-aquae*) in concentrations of 0.2 ppm and 0.8 ppm respectively. Compound 23, under initial experimental studies, demonstrated no known environmental or human hazards under ordinary safe handling procedures, and compound 73 appears to have very low environmental and human hazards. Prows and McIlhenny suggest that, economically, both compounds also may prove to be cheaper than copper sulfate or "Cutrine" for lake treatment. Much of the research on the two alternative compounds was conducted by the Dow Chemical Corporation, and if further testing proves satisfactory, they may well be marketed under Dow brand names. However, their use will probably also be (and justifiably so) restricted by state licensing regulations.

The problem remains that the use of chemical substances to kill algae may result in fish kills from lowered dissolved oxygen content of the lake waters. This results from the decomposition of the algal cells which consume oxygen that would otherwise be available to fish and other life forms. As mentioned, the decomposing algae may release, in a short period of time, relatively high concentrations of toxic substances rendering the water poisonous to some forms of life including livestock and humans(6). However, neither of these problems are inevitable nor frequent, and can, in fact, occur subsequent to an algal bloom where no algacides have been applied. The large concentration of algae which constitute the blooms, while generating oxygen by photosynthesis during the day, will consume oxygen from the water at night or during periods of cloudy weather. The net result in the long run can be an oxygen deficiency. The eventual death and decomposition of the algal bloom, whether naturally or artificially induced, may still cause oxygen depletions and the generation of toxic substances.

Biological Controls

Due to the growing concern over the release and accumulation of man-made chemicals in the environment, it is important that natural control measures for nuisance algae be investigated. However, in many instances this approach may, like chemical treatment, generate a problem where the cure is worse than the original ailment. A good example is the disagreeable consequences resulting from the introduction of carp to American surface waters for weed control. Now many people view the carp as a greater nuisance than

the original problem. More recently, the white amure or grass carp, has made news as a new approach to aquatic weed control. However, biologists and the public as well, both appear to be wary because of the potential problems that the introduction of a new biological species may create. This concern, based on past experiences, is justifiable, and any research in biological control must proceed with considerable caution.

Nuisance algal blooms are often the result of an ecological upset associated with cultural eutrophication — man's introduction of unnaturally high concentrations of nutrients to the aquatic ecosystem — together with the fact that more recreational importance is now attached to lake resources than may have been the case in the past. Consequently, man has tended to emphasize technical solutions, i.e., chemical treatments to mitigate the nuisance created by technical disruptions (sewage enrichment).

The quest for technical solutions may also be induced by the rapid and massive cycling of algal blooms. Their response to enrichment is so rapid that often the density of the algae themselves causes their own demise by modification of the water quality before natural, biological organisms can respond to crop them.

Some research is proceeding with respect to discovery and possible development of control organisms to stem the growth of algal blooms. Cook(3) reported the presence of an amoeboid organism in lakes of northeast Georgia which appears to feed voraciously on *Anabaena* species of blue-green algae. However, as a result of its feeding methods, the green scum on the water surface is replaced by a milky white scum. Hence, this form of biological control at the present may simply replace one form of aesthetically displeasing appearance with another. However, Prows and McIlhenny(16), while working on the development of a more acceptable algacide, also discovered the apparently ubiquitous presence of a biflagellate protozoan *Ochromonas ovalis* which preys upon *Microcystis* species of blue-green algae with sufficient efficiency to have disrupted their studies of the algacidal effects of the compounds being tested. They do not report any aesthetically displeasing side effects, and continual research with the organism would seem promising. On the whole, however, while biological control techniques may eventually provide a safer and more convenient form of algae control, at this time they do not constitute a viable alternative to chemical treatment.

Mechanical Control

The large colonial forms of algae which look very much like aquatic plants i.e., chara, may be controlled

by mechanical cutting and will be discussed in the following section on aquatic weed nuisances.

Because planktonic forms of algae float within the water mass and are microscopic in size, they are too small for efficient mechanical removal. Harvest would have to consist of seining the organisms by pulling a fine mesh net through the water. To be efficient, such nets would have to be large and durable. After one or two passes, the net would have to be removed from the lake area and either disposed of, or laboriously washed to remove the entrapped algae. Either alternative would be expensive in terms of material and labor costs. Further, the attendant benefits might be short-lived and negligible since algae not removed would be able to reestablish the bloom in a short time as long as environmental conditions were appropriate.

At present, algal control is a difficult and incomplete procedure. The only practical approach, until further research is accomplished, is the combined method of judicious chemical treatment with copper compounds for short term cosmetic effects together with a concerted effort to reduce the amount of nutrients, particularly from sewage, storm and agricultural drainage, and from fertilizers (both lawn and agricultural) entering the lake.

Particular caution should be exercised in the chemical control of algae, not only because of the potential environmental risks, but also because a dynamic stability often exists between species of algae and between the algae and aquatic plants. The removal of one form of algae may result in subsequent replacement by the more noxious forms. By the same token, removal of the algae in general may mean that nuisance aquatic weeds will thrive in their place.

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AQUATIC WEED CONTROL

Aquatic Weed Ecology

Like algae, the higher plant forms serve a valid function in the aquatic ecosystem and become nuisances only when they exist in superabundance. They also constitute a source of oxygenation to the water, and provide both food and shelter to a variety of fish and other organisms. Emerging aquatic vegetation, such as cattails, are often of value in stabilizing and intercepting nutrient-enriched water of influent streams and marshes.

However, the lush growth of emergent vegetation and aquatic weed beds is also indicative of the lake enrichment process, which may often be symptomatic of cultural eutrophication. Once again the source of recreational problems may be traced back to sewage, barnyard runoff and lawn or agricultural fertilizers.

In moderate densities, the weed beds are a source of good fish habitat and, consequently, good recreational fishing. However, too much of a good thing is counterproductive. When too prevalent, the weeds

reduce the efficiency of predatory fish consumption of prey species. Consequently, sunfish, bluegills, and associated species are not adequately cropped by bass or pike. The result is a decline of game fish and an abundance of small, stunted pan fish (because the crowded bluegills are undercropped and at the same time readily feed on recently hatched pike and bass). The fisherman must settle for a less than optimal sport, while the waterskiier, boater, and swimmer find their pursuits hindered by a reduction of clear water areas.

Over sufficient time, the expanded weed beds will also change a firm, sandy lake bottom to soft, mucky, organic sediments. This results from the annual dieback and decomposition of each crop of weeds. Last year's weeds decompose and contribute to the mulch for this year's renewed nuisance.

By extending this process over many years, it becomes evident that eutrophication and the expansion of aquatic weed growth can contribute heavily to the filling-in process of a lake.

Common Aquatic Weeds in Michigan Lakes

Submerged Aquatic Weeds

1. Plant-like algae

Chara — Produces stems and branches and often feels bristly, due to calcium carbonate precipitated by the algae in hard water. Also called muskgrass or stonewort. Has a characteristically musty odor, unlike most other submerged aquatic plants; hence, it can be identified by its distinctive smell. Is an excellent producer of fish food especially for large mouth and small mouth black bass.

Nitella — Has an appearance superficially similar to *Chara* but lacks the musty odor. Both susceptible to mechanical harvesting.

2. Aquatic Plants

Potamogeton — "Curly leaf, or broad leaf pond weed." Is a submerged plant, rooted to the bottom and generally confined to shallow waters of less than ten feet depth (15). However, thin filament-like leaf forms also occur (commonly *P. pectinatus*). Most conspicuous feature is the "pencil-like erect emerged spikes" which bear the flowers in early summer (5). Provides food and shelter to fish; leaves are eaten by bluegills. Also eaten by waterfowl, muskrat, and deer.

Oncharis (Elodea) — Leaves whorled around branching stems, forming large masses near the bottom with bases embracing the stem.

Ceratophyllum (Coontail) — Similar appearance with leaves in whorls, but are stiff and repeatedly forked and more crowded toward the tips of the stems. Good shelter for young fish and supports insects valuable as fish food.

Myriophyllum (Milfoil) — More spindly appearance than either coontail or *Elodea*, but has the same whorled leaf arrangement. Eurasian milfoil (*M. spicatum*) is a recent addition to native Michigan milfoils. Is very tolerant and spreads rapidly. Its leaves consist of 12-16 pairs of close together leaflets which give them the appearance of weather beaten feathers. Provides shelter and is a valuable food producer for fish, supporting many insects. Roots of *M. exalbescens* preferred by black bass for nesting.

Floating Aquatic Weeds

Duckweed (Lemna species, most common is L. minor) — Small leaf clusters symmetrically arranged. Often windrowed on rivers and lakes. Can form a dense green surface covering on still water surfaces. Important wildfowl food; also attracts muskrat.

Salvinia — Free floating fern. Common species is *Azolla caroliniana*, also called water velvet. Entire plant is about ½-1 inch in diameter. Larger than duckweed and leaves have a velvety appearance. No apparent significance to fish or wildlife.

Arrowhead (Sagittaria) — Celery-like stalk with pointed, arrowhead-like leaves. May provide some shelter and shade for young fish. Muskrat and beaver may eat the tuberous roots.

Cattail (Typha) — Typical erect stems with narrow leaves and brown sausage-like fruiting structure. Have extensive network of underground stems and appear in almost any wet place. Roots are food for muskrats, beaver; attract marsh birds, waterfowl and song birds.

Bulrush (Scirpus) — Long stems with characteristically sedgelike, triangular cross-section with a sheath at the base. Used for nesting by bluegills and largemouth black bass; good food and cover.

From this brief description of some of the more common aquatic weeds it is evident that even though they may be a nuisance to boaters and swimmers, in controlled numbers these plants constitute an important component of the natural lake ecosystem. A weed-choked lake is quite obviously detrimental to man and fish alike, and represents the advanced stages of lake evolution to a marsh and eventually a terrestrial habitat. But complete removal of all aquatic weeds from a lake would result in the destruction of a natural and beautiful habitat. In seeking to control aquatic weeds, a judicious approach must be taken if the fish, wildlife, and birds are to be preserved as a part of the system. The overzealous eradication of aquatic weeds can be disastrous for fishing and nature appreciation.

Thus, aquatic weed control, as with algae control, should be conducted in a careful and systematic manner. The first step should be the mapping of weed beds, their extent, and dominant species. Next, in consultation with a fish and wildlife biologist, the areas to be treated and those to be protected should be designated. Once the plan of control is formulated, the method of control should be selected. Currently in Michigan the alternatives for plant control are: chemical treatment with herbicides, mechanical harvesting with weed cutters, and environmental manipulation such as lake drawdown and dredging. Biological control techniques, as with algae, remain essentially experimental.

Chemical Control

It is not uncommon for a lake to have both algae and weed problems. To avoid trading one for the other, it is advisable to treat both. Since algae control will consist of essentially chemical treatment, the additional use of other chemicals to treat aquatic weeds may serve to compound environmental risks. Thus, it is wise to consider the possibility of using a compound that may solve both floating algae and weed-type problems. For example, if blue-green algae are to be treated with a copper compound (preferably "Cutrine"), and there are also areas plagued with the plant-like *Chara* or *Nitella* algae, the cutrine treatment should be applied first and allowed to take its toll of the *Chara* and *Nitella* as well. Once algacidal effects are observed, a decision can then be made about the extent and nature of herbicide application for weed control.

Chemical control techniques vary in cost from \$15 to \$90 per acre at 1972 rates(10), involve possible environmental hazards including poisoning of fish or wildlife, are difficult to control, and may entail restricted swimming or similar recreation for some time after application. On the other hand, the method of treatment tends to be simple and fast, many compounds are species specific (meaning a particular weed in an area can be killed while others beneficial to fish or wildlife are spared), and Michigan licensing restrictions make most approved chemical compounds relatively safe in terms of public and environmental health.

It is imperative that the manufacturer's instructions for the chemical selected be followed to the letter. The chemical treatment of lakes, as with the taking of medicine **does not** coincide with the old adage "... if a little is good, a lot is better."

Before any chemical treatment is initiated, the District Fisheries Biologist and/or the Inland Lakes Management Section in Lansing should be contacted

for information about acquiring a permit. Michigan Department of Natural Resources regulations require a permit for any chemical control of aquatic weeds in public waters or waters which flow into public waters (Act 165 P.A. 1929, as amended; Act 41 P.A. 1955).

Mechanical Control

Mechanical control is essentially the lowering of a power driven agricultural-type cutting bar from the front of a barge to a depth of 6-10 feet and cutting swaths through the weed beds. The process can consist of simply cutting off the weeds and leaving them behind; cutting the weeds and removing them in the same operation, usually by a conveyor belt and attendant barge to carry the material ashore, or cutting and later removing them by raking or another approach. Costs vary, but generally the average is about \$30 per acre.(10)

The advantages of mechanical harvesting are that no chemical residue is involved, area control is complete (weeds are cropped only where the operator takes the equipment), recreational uses can be restored immediately after treatment, and the severed weed biomass together with its nutrient components can be removed from the lake. With chemical treatments the vegetation dies and decomposes in the lake, releasing its nutrients back to the system.

The disadvantages of mechanical harvesting are that it has no specificity, anything in the path of the cutting bar is harvested; the process is slow; often shallow areas (2 feet or less) cannot be treated with the same equipment, thus requiring a second, smaller machine or laborious hand cutting, and since the cut weeds should be removed to fully benefit from mechanical harvesting, additional labor and expense may be involved in trucking the sodden material to a landfill or other suitable disposal site. If cut weeds are not removed, there is the risk that floating particles of some species may take root elsewhere and spread the weeds to other portions of the lake.

Environmental Manipulation

This method of weed control relies on changing some aspect of the plant's habitat, making it unsuitable for continued proliferation. Some of the techniques attempted include: staining the water with dye to deprive plants of sunlight; shading by covering the water with floating sheets of plastic; covering the vegetation with a layer of sand; dredging, and winter drawdowns of the lake.

The dye technique has shown promise in small ponds and a recently marketed product "Aquishade" (an aesthetically pleasing shade of blue) is presently

Herbicides registered with the Michigan Department of Agriculture and the Environmental Protection Agency for use in the aquatic environment.*

Brand Name	Manufacturer	Percent Active Ingredient	Liquid or Granular
COPPER SULFATE PRODUCTS			
Cito Copper Sulfate	Cities Service Co.	99.0%	G
E-Z F10 MO Copper Sulfate	E-Z Flo Chemical Co.	99.0%	G
Haviland Copper Sulfate	Haviland Agricultural Chemical Co.	99.0%	G
Rootex	Relance Chemicals Corp.	86.2%	G
Envirocap - C	3 - M Co.	5.3%	G
Diamond Copper Sulfate	United Co-operatives Inc.	99.0%	G
CHELATED COPPER PRODUCTS			
A & V - 70	A and V Inc.	1.8%	G
A & V - 70	A and V Inc.	7.0%	L
Cutrine	Applied Biochemists Inc.	1.1%	G
Cutrine	Applied Biochemists Inc.	7.1%	L
Cutrine - Plus	Applied Biochemists Inc.	9.0%	L
Cutrine - Plus	Applied Biochemists Inc.	3.7%	G
KS - 9	Aqualar	7.0%	L
Sequestrine Copper	Geigy Agricultural Chemicals	13.0%	G
Mogul 7431	Mogul Corporation	7.1%	L
Purina Algae Check	Ralston Purina Co.	5.0%	L
Herbicide System M	3 - M Co.	55.8%	G
Moriner System A	3 - M Co.	7.0%	L
Algae - Rhap Cu-7	Transvaal Inc.	7.0%	L
Mogul PC-1330	Mogul Corp.	7.1%	L
Algimycin PLL-C	Great Lakes Biochemical Co., Inc.	5.0%	L
ENDOTHALL PRODUCTS			
Mogul AG - 434	Mogul Corp.	66.7%	L
Mogul AG - 432	Mogul Corp.	40.3%	L
Mogul A - 433	Mogul Corp.	10.1%	G
Mogul A - 435	Mogul Corp.	17.5%	G
Aquathol Granular	Pennwalt Corp.	10.1%	G
Aquathol K	Pennwalt Corp.	40.3%	L
Potassium Endothall	Pennwalt Corp.	40.3%	L
Hydrothol 47 Granular	Pennwalt Corp.	17.5%	G
Hydrothol 47	Pennwalt Corp.	66.7%	L
3-M Brand System E	3 - M Co.	22.1%	G
Hydrothol 191	Pennwalt Corp.	53.0%	L
Hydrothol 191	Pennwalt Corp.	11.2%	G
ENDOTHALL & SILVEX PRODUCTS*			
Mogul AG-436	Mogul Corp.	22.1% Endothall 25.3% Silvex	L
Mogul A-437	Mogul Corp.	5.1% Endothall 5.6% Silvex	G
Aquathol Plus	Pennwalt Corp.	22.1% Endothall 25.3% Silvex	L
Aquathol Plus Granular	Pennsalt Chemicals Corp. (Pennwalt Corp.)	5.1% Endothall 5.6% Silvex	G

*Source List of herbicides registered with the Michigan Department of Agriculture and Environmental Protection Agency for use in the aquatic environment, Inland Lakes Management Section, Michigan Department of Natural Resources, 1978.

This listing has been prepared by the Inland Lake Management Unit as a public service based on information currently available. Listing or omission should not be construed as an endorsement or disapproval of services offered.

Brand Name	Manufacturer	Percent Active Ingredient	Liquid or Granular
DIQUAT PRODUCTS**			
Aqua - Kleen	Abbott Supply Co.	1.85%	L
Agro - Chem Aqua - Kill #101	Agro-Chem Inc.	1.85%	L
Diquat	Allied Chemical Co.	35.3%	L
A.R.C. DR-AC	American Research Corp.	1.85%	L
Ortho - Diquat Water Weed Killer	Chevron Chemical Co.	35.3%	L
Aquatate	Certified Laboratories Inc.	1.85%	L
Del Aquatic Weed Killer	DEA Chemical Corp.	4.35%	L
Globe Eradicate	Globe Chemicals Inc.	1.85%	L
Liquid Vegetation Control	Lad Chemicals	1.85%	L
Le Bro Liquid Vegetation Control	Le Bro Chemical Co.	1.85%	L
ConKill	Lion Industrial Chemical Corp.	1.85%	L
Aqua - Kill M	Modern Research Corporation	1.85%	L
Aqua - Kill	Muni Chem Corp.	4.35%	L
Watrol Herbicide	National Chemsearch Corp.	1.85%	L
Di - Kill	Precision Laboratories Inc.	1.85%	L
Veg - Go	Scientific International Research Inc.	1.85%	L
Super Aquatic Weed Control	Shore Corp.	1.85%	L
Statebrand Formula 268 Aqua-Guat	State Chemical Mfg. Co.	2.36%	L
Thoroughbred Liquid Vegetation Control	Thoroughbred Chemical Corp.	1.85%	L
Envirocop - D	3 - M Co.	17.4%	G
Holcomb Cut-Off	J. I. Holcomb Mfg. Co.	1.85%	L
Aqua-cide	Aim International Chemicals	1.85%	L
Vegetrol Herbicide	Mantek	1.85%	L
2,4 - D PRODUCTS			
Aqua - Kleen 20	Amchem Products Inc.	20.0%	G
Amoco 2,4 - D Granules	American Oil Co.	31.1%	G
Amoco 2,4 - D LV Ester	American Oil Co.	69.7%	L
Aquacide	Aquacide Co.	20.0%	G
Crop Rider 20% Aqua Granular	Diamond Shamrock Chemical Co.	30.2%	G
Hercules Weed - Rhap Amine A-4D	Hercules Inc.	49.5%	L
Hercules Weed - Rhap LV Ester 4D	Hercules Inc.	69.9%	L
Hercules Weed - Rhap Amine A-60	Hercules Inc.	69.1%	L
Hercules Weed - Rhap LV Granular D	Hercules Inc.	30.2%	G
Hercules Weed - Rhap LV Ester 6D	Hercules Inc.	94.2%	L
Hercules Visko Rhap LV Ester 2D	Hercules Inc.	36.6%	L
Parsons 2,4 - D Granules	Parsons Chemical Works	30.1%	G
Chipman 2,4 - D Gran. 20	Rhodia Inc.	30.2%	G
Rhodia Visko - Rhap LV Ester 2D	Rhodia Inc.	37.1%	L
Weed - Rhap 2,4 - D Amine A-4D	Transvaal Inc.	49.5%	L
Weed - Rhap LV - 4D	Transvaal Inc.	69.9%	L
Weed Rhap A - 6 D	Transvaal Inc.	69.1%	L
Weed Rhap Low Volatile Granular D	Transvaal Inc.	30.2%	G
Vegatrol LV-4D	Velsicol Chem. Corp.	69.9%	L
Vegatrol LV-6D	Velsicol Chem. Corp.	94.2%	L
Vegatrol BE-4D	Velsicol Chem. Corp.	65.7%	L
Vegatrol A-4D	Velsicol Chem. Corp.	49.5%	L
Weedtrine II	Applied Biochemists, Inc.	30.2%	G
SIMAZINE PRODUCTS***			
Aquazine	Ciba - Geigy Corp.	80.0%	G

**Diquat products are restricted for all aquatic uses, except in small ponds such as farm ponds that have no outflow and are under the control of the user. This means that you must be licensed by the Michigan Department of Agriculture as a certified aquatic pest control applicator to purchase and use this material in all water bodies except small ponds under the control of the user.

***For use only in small private ponds without an outlet.

being tested by the University of Wisconsin, but definitive results are not yet available.(10)

The use of black plastic sheeting would seem more appropriate to small ponds than recreational lakes, as its placement is subject to wind disruption and obviously hampers recreationists while in place.

Sand blanketing consists of spreading a layer of sand 6-10 inches deep over winter ice which will settle to the bottom with the spring thaw. Often the covering is spread over black plastic sheeting. When successfully accomplished, it creates a good sandy beach area free of weeds. However, a University of Wisconsin study using this technique in 1971 showed that by 1973 more weeds were growing on the new surface than were originally there. Consequently, it would appear that further long term studies are needed before this technique can be confidently recommended.

Dredging, when conducted on a large scale with considerable deepening of the lake basin, can significantly rejuvenate a lake(10,14). This technique deepens the lake, and by lowering the bottom by more than 10 feet from the surface, makes it inhospitable to most aquatic vegetation. Eurasian milfoil (*Myriophyllum spicatum*) may resist dredging because it has considerable depth tolerance(7). The method employed is usually hydraulic dredging, but on small lakes, shore-based drag lines may also be used. The process has the added advantage of removing nutrient-laden sediments from the lake but is extremely expensive and generally beyond the means of most lake communities.

To be effective the dredged spoils must be trucked or piped to an area away from the lake to keep the material or its nutrients from draining back into the basin. This necessity further adds to the costs. Simply depositing the dredged sediments in a nearby marsh or low area as fill may reduce the expense involved, but also reduces the effectiveness of the operation, thus giving the lake community less return on their investment.

Further, since deep dredging is necessary to effectively reduce the weed growth, extensive treatment would require modification of the shoreline to create a rapid, steep drop-off. This could result in a hazard to swimmers and a possibility of subsequent erosion problems. The process, if adequately funded, does, however, offer a long term control for the center of shallow, weed-filled lakes. Other control techniques would still have to be maintained along the shore.

Winter drawdown for lakes having suitable dams or other lake level control structures offers an inexpensive method of controlling some aquatic weeds(1,10). The plants are exposed to frost damage and drying when the water level is lowered. Coontail (*Cerato-*

phyllum demersum), water lilies (*Nuphar* species), milfoil (*Myriophyllum* species), and pondweed (*Potamogeton amplifolius* and *P. robbinsii*) are among those forms most responsive to this technique.

However, 1975 studies by Nichols on the Mondeaux Flowage in Wisconsin indicate some constraints. He found the successive annual drawdowns may lead to reinvasion by drawdown-tolerant species which replace the original vegetation and restore the original problem. A risk of fish kills due to low DO is a possibility during drawdown, and increased concentrations of nutrients from exposed sediments and decaying vegetation may result. Nichols' studies with respect to dissolved oxygen and nutrient concentrations at the Mondeaux Flowage were inconclusive, and he recommended further research.

The aquatic plant reinvasion response was evident from Nichols' sampling of the flowage for species frequency and stem densities. He observed significant control with the first drawdown, a repeat drawdown a year later gained little additional control, and rapid reinvasion occurred within two years after drawdown ceased. Nichols contends that drawdown is a useful technique for aquatic plant management if conducted no more frequently than every other or third year and if combined with other management techniques.

Before any drawdown attempt is made (presuming the weed species composition, lake basin configuration, and refilling rate are appropriate to drawdown management), it is imperative that the lake community be fully informed and in accord with the proposal. This consensus is particularly important to those Michigan lakes having an established legal lake level in order to avoid possible law suits associated with impaired recreation or dry wells.

If the practice is adopted, supplemental projects can also be incorporated. Depending upon its extent, dragline dredging, weed removal, beach renovation, litter control, and fish management projects may be appropriate.

Remember, however, that complete eradication is neither feasible nor appropriate as the lake vegetation, in proper balance, is an essential component of the ecosystem and of recreational fishing and aesthetics.

Deep water dredging, if properly conducted, is an effective control technique but is prohibitively expensive for most lake communities. A reasonable and cheap alternative is the practice of winter drawdown, and some lake associations may want to consider the possibility of installing engineering structures where they do not already exist to make this possible.

The combined practice of summer weed control by mechanical harvesting and removal, together with

periodic drawdown and its opportunity for incidental management projects seems a wise approach. This option may be labor intensive, but it also involves the least negative environmental risks.

Such a program would involve the costs of the rental or purchase of weed harvesting services and removal only. An approach to this service, which is growing in popularity, is the cooperative purchase of the necessary equipment by county or municipal governments with the costs reimbursed by rental fees paid by cooperating lake associations of that area.

Summary

Many of the nuisance problems of Michigan's inland lakes are associated with the cultural eutrophication created by fertilizers and septic tank effluents draining into the lake. The effect of these added nutrients is the increasingly common complaint of excessive algae and weed growth.

There are many varied alternatives for the in-lake treatment of these nuisance growths, most of which are only cosmetic in nature. From the standpoint of environmental safety and cost, a preferred combination of algal treatment with "Cutrine," weed removal by mechanical harvesting, and periodic winter drawdown for further weed control and basin management appears to be the most appropriate approach at this time.

Whatever the management approach taken, the basic, long term, overall objective should be the curtailment of nutrient runoff to the lake. This should include the vigilant monitoring of lake water quality, upgrading of on-site disposal systems, strongly discouraging residents from fertilizing their lawns (which entails no costs, and is, in fact, a personal saving in fertilizer expenses and labor), development of phreato-phytic vegetation buffer strips, and the eventual development of an acceptable community sewerage system. This eventual goal should always be kept foremost, because it will not only reduce lake eutrophication, but will also abate a serious potential public health hazard.

The effluents entering the lake readily demonstrate their ability to induce nuisance weed and algae growth. Less obvious, but of greater human significance, is the possibility that this same effluent may

transmit disease pathogens to drinking and recreational water alike.

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POLITICAL MOBILIZATION OF THE LAKE ASSOCIATION

Once the association is organized and functioning, the expansion of its influence beyond the immediate lake community should be considered. The paramount concern of the association should always be the interests of its members with respect to the lake resource, but often the accomplishment of this objective requires making the association's views known to others not directly affiliated with the lake community. Township, county, or state agencies, sometimes considerably removed from the lake environment, are often the sources of important policy decisions. For example, land use planning, road construction and maintenance operations, zoning laws and amendments or exceptions, tax proposals, and environmental legislation can all have considerable impact upon lake communities.

To effectively respond to these external effects, influence their application, or initiate regulation or legislation, the lake association should be aware of the institutional "tools" at its disposal. Donald Holtrop of the Continuing Education Service at Michigan State University has written a concise pamphlet on sociopolitical influence called "Changing Things: A Citizen's Guide" (1973). In it he documents six "tools" available to people who want to peacefully and legally achieve change in their communities. These are: information, education and persuasion, legal power, public exposure, economic power, and political power. The following descriptions of these tools are an elaboration and interpretation of Holtrop's concepts as applied to lake associations.

Obviously, before embarking on any concerted program to cause change, the association must be sure of the facts of the matter and of the validity and justification of its position. The information tool is simply the process of being secure in these facts and presenting them to the appropriate people. Quite often in matters of social or political dispute, one side (or both) is concealing the truth or facts of the matter to protect their position. If you have nothing to hide, the informational tool derived from careful and accurate research is a potent instrument. If you can support a position by indisputable fact and present facts contrary to the allegations of your opponent, honest public decision-makers may be able to handle the matter. Unfortunately, decisions often are not made in favor of a just cause, thus the importance of the other five social tools.

Education and persuasion are an extension of information. When the simple presentation of the facts does not change things, it is necessary to apply some interpretation and assessment in a well-

constructed argument. For example, the information that septic tank effluent enriches lake waters and may create a health hazard may not alone convince your neighbors or local government that such systems should be checked and, where necessary, modified. But, they may be convinced by a presentation of this same information by an invited speaker who is a recognized authority on water management or limnology, especially if he backs up his statements with data, photographs, or a demonstration of a positive dye test.

Legal power, as the term implies, is the process of bringing the force of the law to bear when a violation of rights has occurred. In a straightforward instance of illegality, this kind of law enforcement should be readily utilized. However, if court action is implied, particularly with respect to civil suits, two basic rules of thumb should be observed. The first of these is that the courts should be used as an instrument of last resort. Prosecution of a court case can be expensive, and the outcome may not always be favorable. Further, the additional expense of entanglement in long drawn-out appeals processes could mollify the importance of the final outcome. The continuing court history of the annexation provisions of the 1929 Summer Resort Act is an example of this consequence. It is wise, therefore, to apply the other tools for change first, reserving court suit or the threat of going to court as an option. The second rule of thumb to remember is if an association is planning to sue, it should always be sure to approach the bar with "clean hands." There is little cause to take a developer into court for a zoning violation if any association members are also remiss in their own construction practices.

Public exposure is perhaps one of the most effective tools available to the lake association, particularly when faced with a bureaucratic run-around by public agencies. If the association has scrupulously followed the prescribed channels in pursuit of a legitimate objective and been repeatedly frustrated, the release of their story to the media can often achieve near miraculous results. Politicians, bureaucrats, and businessmen alike are sensitive to disclosure of performance discrepancies in their public image.

News releases are also an excellent way to publicize association projects and generate interest or concern for the lake. Similarly, the expression of viewpoints in the editorial section of the local paper can stimulate action, particularly with respect to voter issues in the lake community. This approach is often used in school millage controversies to sway the vote. In a recent Lansing election, millage had been defeated by the electorate. A few months later the same proposal

was again offered. However, this time balloting was preceded by daily editorials in the Lansing paper written by teachers and favorable parents arguing, often emotionally, in favor of preserving quality education for the children. This letter-writing campaign (perhaps bolstered by other canvassing and "get out the vote" approaches) succeeded in swaying the voters, and the issue passed.

The economic tool is another approach readily available to the well-organized lake association. Local townships may or may not be concerned with the interests of the "lake people" but are influenced by the spending power of that community for groceries, sundries, and ancillary recreation products. The selective patronization (or boycott) of a store owned by an influential member of the township government can have considerable impact on the services provided the lake community.

Another aspect of the economic power available to the lake community is the influence wealthier members may have through contributions to local, social, or religious organizations. The significance of their monetary support provides a right to a forum for their views on public matters involving such organizations and the lake community.

The sixth social tool available is political power. Lake people often feel disenfranchised in the lake community government because they are vacation residents. This is not an unsolvable problem because the individual's voting address may be changed from the "home" to the lake residence, so as to participate in the local political processes. For those members close to making the lake community their retirement home, this option should require little trade-off of voting interests. They could then function as political spokesmen for the other nonvoting riparians. In either instance, the lake community should encourage and support the local political candidacy of their qualified members. While the local voting strength of the association may or may not be significant, these social tools can still be used to support or oppose particular candidates or policies in the local political arena.

In the broader sector of state politics, voting address is less of a handicap. The lake association should keep its membership advised, via newsletter, of all pending legislation pertinent to their interests and of its policy toward such proposals (information, education and persuasion internalized). The members may then write or call their respective state delegates and inform them of their position, as constituents, on the given legislation. It is imperative, in this respect, that members establish a working communication with their elected representatives. A politician's performance is always enhanced by the certain know-

ledge that constituents are interested in voting records and legislation sponsored.

A further augmentation of association influence on legislation and policy can be derived by the organization of the many discrete lake associations into a state-wide body. Lake associations, like individual riparians, can be most effective if organized, and again, if they have a commonality of interests and problems. The Michigan Lakes and Streams Association, Inc. (MLSA) represents one example of this type of organizing. It has a membership of over a hundred associations and publishes its own magazine, "The Michigan Riparian," which contains articles dealing with lake and stream management issues. In particular, The Riparian serves as an inter-association communication link with respect to laws and regulations pertaining to their interests. Membership in this organization provides the potential for like-minded riparians to be represented before the state legislature and state agencies, such as the Department of Natural Resources, Department of Agriculture, and the Highway Department. Because of its growing membership and the increasing environmental strain on recreational waters, the MLSA shows promise of becoming a significant voice on behalf of the lake and stream property owners of Michigan.

The direction this organization takes, and how well it represents the interests of its member associations will be determined to a great extent by how actively they participate in it. It seems certain that if riparian interests at the state level are to become politically significant, some form of organization with lobbying potential, such as MLSA, will have to be supported.

In considering the six options to implement social change, remember that they may be employed in concert, not just individually or in sequence. The coordination of any of these approaches is dependent upon broad communication within and among the lake or stream associations, particularly by keeping members informed of policy and programs through the regular circulation of newsletters or similar motivational correspondence.

In any such political involvement, honest, forthright reasoning with the opposition should not be presumed as out of the question. All the tools mentioned are legitimate social means to accomplish a particular goal. As one goal leads to another, the use of the social tools becomes repetitive, and the same people will be encountered again. Therefore, it is wise to preserve the opportunity for on-going, reasonable discussion throughout the procedure. This facilitates intelligent compromise and trade-offs, which are the essence of long run political success.

APPENDIX A

The following are brief descriptions of selected state and federal laws which may be pertinent to recreational lake riparians. Interpretations of these statutes as provided are not intended to be authoritative but descriptive of the apparent purpose(s) of the acts. Competent legal authorities should be consulted before any activities pursuant to the subject legislation are initiated.

Legislation preceded by an asterisk (*) is quoted from "State Statutes Administered by the Water Resources Commission," 1975. A mimeograph provided by the Water Resources Commission of the Michigan Department of Natural Resources, Lansing.

LAWS DEALING WITH MICHIGAN INLAND WATERS

Organizational

Act 137, 1929. (Summer Resort Act of 1929.) This act is subsequent to an original law written in 1897 (Act 230) and expands the authority of voluntary organizations of recreational landowners. Under this act, ten or more owners may organize a corporation for the welfare of the community and the purpose of purchasing and improving land for summer homes and resort purposes. The law defines the necessary steps for organization and grants police powers to the corporation over its membership. This authority applies to matters of public health and welfare, including the quality of all waters within or bordering the corporations' lands.

Act 327, 1931. Provides for the definition of conditions of organization, regulation, and classification of Michigan corporations.

Act 200, 1957. (Intermunicipality Area Problem Study Committee Act.) Two or more incorporated Michigan political subdivisions, i.e., villages, townships, etc., may form a committee to conduct and finance studies pertaining to their mutual problems. The committee may accept gifts and make claims for state and federal aid.

Water and Sewage Facilities

Townships are provided the authority to install and maintain water lines and sewage disposal systems under the following acts: Act 107, 1941; Act 88, 1919; Act 47, 1941; Act 116, 1923.

* *Act No. 211, 1956. (Sewage Disposal and Water Supply District Act.)* Act No. 211 provides the following duties and functions to the Water Resources Commission:

- a. To foster and encourage the organization of sewage disposal and water supply districts and to act as

the administrative agency in the proceedings incident to the formation thereof.

- b. To cooperate and negotiate and enter into contracts with other governments in matters concerning water supply systems and sewage disposal systems, and to take advantage of any Federal Act which may make available funds to carry out the purposes of Act 211.
- c. To act as the fiscal agent for the state to make available money for such purposes.
- d. To coordinate duties and functions with similar duties and functions performed by other state agencies.

Before a sewage disposal or water supply district is formed, a petition must be filed with the Commission. The Commission must hold a public hearing to determine the desirability and necessity for the creation of the district and determine after such hearing whether or not the petition shall be denied or approved. Sections 8 through 12 of the act deal with the district powers.

* *Act No. 13, 1956.* Act No. 13 authorizes the Water Resources Commission to comply with the provisions of United States Public Law 660 of the 84th Congress (the Water Pollution Control Act Amendments of 1956). The act specifically authorizes the Commission to expend funds available under such law for development of a State program for the prevention and control of water pollution.

* *Act No. 294, 1965. (Regulation of Water Well Drillers.)* Section 15 of Act No. 294 creates an advisory board of nine members which includes an employee of the Water Resources Commission as appointed by the Executive Secretary.

* *Act No. 222, 1966. (Exemption of Water Pollution Control Facilities from Certain Taxes.)* Act 222 requires the State Tax Commission to seek approval from the Water Resources Commission before issuing a certificate exempting a waste treatment facility from personal property taxes pursuant to Act No. 206 of the Public Acts of 1893, sales tax pursuant to Act No. 167 of the Public Acts of 1933, and use taxes pursuant to Act No. 94 of the Public Acts of 1937.

* *Act No. 329, 1966, as amended (state grants).* Act No. 329 establishes a State water pollution control fund to assist local governmental units in financing construction of wastewater treatment works. The act authorizes the Commission to develop a priority list of eligible projects to be submitted to the Legislature

for approval. It outlines percentages of eligible assistance of State grants for such construction activities and lists the qualifications necessary for such assistance. Section 7 provides that effective July 1, 1968, a grant shall not be made unless the local agency has adopted and submitted to the Commission a comprehensive long-range plan for the control of pollution in the area of its jurisdiction (Official Plan). The Commission must approve a local agency's plan before such agency can be eligible for grant funds. If local agencies do not agree, the Commission is authorized to develop the necessary Official Plan. Rules may be promulgated to carry out the provisions of the act.

* *Act No. 288, 1967, as amended (the Subdivision Control Act)*. Act No. 288 provides that the Water Resources Commission shall approve any preliminary plat if a subdivision lies wholly or in part within a floodplain of a river, stream, creek, or lake. The approval of any preliminary and final plat within a floodplain is conditioned upon compliance with rules of the Commission adopted pursuant to Act No. 288 and on other restrictions specifically outlined in Section 194.

* *Act No. 136, 1969 (Liquid Industrial Waste Haulers Act)* Act No. 136 gives the Water Resources Commission the authority to license all persons engaged in the business of removing liquid industrial wastes from the premises of another, including the licensing of all trucks or other vehicles used to transport or carry the liquid industrial wastes. The act further gives the Commission the authority to notify a licensee of hazardous or nuisance conditions and require correction thereof and to correct the situation itself if necessary by utilizing surety bond monies set aside by the licensee upon application. The Commission may designate specific locations where the industrial wastes may be discharged.

* *Act No. 226, 1971 (Cleaning Agents and Water Conditioners Act)*. The Cleaning Agents and Water Conditioners Act limits the amount of elemental phosphorus which may be contained in a cleaning agent after July 1, 1972, to 8.7 percent. In addition, the act authorizes the Water Resources Commission to promulgate rules to further restrict the nutrient content or other contents of cleaning agents and water conditioners to prevent unlawful pollution. Section 6 of the act requires the Commission to enforce the act and to seek court enforcement of its orders.

Act No. 342, 1939. The county may establish water or sewer lines and treatment facilities within or between cities, villages, or townships within the county. The county may also establish and manage refuse and garbage collection services and disposal facilities.

Weed Control

Act No. 41, 1955. Township boards may, upon request of 25 landowners residing within the township, appropriate money for weed control in public inland lakes.

Parks

Act No. 157, 1905. Authorizes townships to establish and control public recreation areas and maintain them by a limited tax program.

Act No. 261, 1965. Authorizes the creation and duties of county and regional parks and recreation commissions, including land acquisition for recreation, conservation, and flood control purposes.

Construction

Act No. 286, 1923. Townships may construct piers or landing sites for public benefit.

Act No. 156, 1851. The county board of supervisors has the power to permit or prohibit the construction of any dam or bridge on any navigable stream. The law also implies the authority of the county to define and remove stream obstructions.

Act No. 184, 1963. Construction of dams in streams. No dam may be constructed which impounds more than 5 acres without permission of the Department of Natural Resources. Exceptions are public utilities subject to regulation by the Michigan Public Service Commission.

Act No. 184, 1963. Amended by Act 68, 1970. Dams impounding more than 5 acres or with a head of 5 feet require DNR permit before construction. (Permittee must petition court for legal lake level and notify DNR in writing of level.)

The Drain Code of 1956

Act No. 40, 1956. This act modifies the laws pertaining to drainage districts, construction and maintenance of drains, sewers, flood control projects, and water management districts and projects within them.

Water Management

* *Act No. 40, 1956, Chapter 22*. Chapter 22 of the Drain Code of 1956 provides for three or more contiguous counties to form a water management district for flood control, public health protection, or conservation within a single drainage basin involving those counties. This is done by petition to the Michigan Director of Agriculture.

The Water Management District establishes a five-member Water Management Commission of resident property owners. The Commission holds hearings on proposed projects, selects water management projects, and levies assessments for the projects conducted.

The Water Resources Commission

Act No. 167, June 27, 1968 Amends Act 245, 1929. This act creates the Water Resources Commission which has control over natural and present water-courses (all rivers and streams) to prevent encroachment on floodways and plains.

It is unlawful to occupy floodplains for residential, commercial, or industrial purposes without a permit. A permit is also required for fills or grading.

Floodplains are defined as lands expected to be flooded at least once in 100 years.

Act No. 200, 1970. Amends Sections 6, 7, 8, and 10 of Act 245, 1929. Requires payment for a "surveillance fee" to the Water Resources Commission by industries for certain industrial effluents discharged and monitored in receiving waters. Industries must also submit an annual report to the Water Resources Commission of the nature and amount of effluents they put into the waters. It does not apply to sanitary sewage systems.

Act No. 245, 1970. (Shorelands Protection and Management Act of 1970.) Provides the Water Resources Commission with broad authority for the management and protection of shorelands of the Great Lakes and interconnecting waterways. This authority includes the right to review all local shoreland zoning ordinances, to designate sensitive environmental areas and regulate accordingly, and to prepare and implement an overall shoreland management program for Michigan.

Inland Lake and River Management

* *Act No. 58, 1959 (The Swimmers' Itch Control Act.)* Act No. 58 of the Public Acts of 1959 authorizes the Water Resources Commission to supervise the chemical treatment of waters of the state for the control of swimmers' itch. The Commission may conduct experiments to ascertain the best methods for control and may purchase equipment and materials. The act further authorizes the Commission to adopt rules to implement the purposes of the act. All work in the State's waters to control swimmers' itch is required to be undertaken under conditions and with safeguards as required by the Commission. It further authorizes the Commission to develop a permit program for applicants who desire, at their own expense, to treat a body of water for swimmers' itch.

Act No. 203, 1962. Amends Act 146, 1961. Any artificial lake greater than 5 acres requires a permit from the county board of supervisors for construction.

Act No. 146, 1961. (The Inland Lake Level Act of 1961.) This act provides for the determination and maintenance of the normal level of the waters of an

inland lake upon petition by two-thirds of landowners abutting the lake to the county board. The objective is maintenance of a lake level consistent with public health and welfare, protection of natural resources, and protection of property values.

Act No. 20, 1964. (Surplus Waters Act of 1964.) Any county board, board of commissioners, or local unit of government may petition the Water Resources Commission to determine whether there is a surplus of water, and if so, how it may be conserved and used. Surplus water is that amount which may be impounded without decreasing the flow of a river or stream below optimum.

The act does not apply within the boundaries of any river management district created under the local river management act.

Act No. 253, 1964. Amended 1966 by Act 119. (The Local River Management Act.) Three or more local governments (cities, villages, townships) associated with a given river, may organize themselves into a watershed council with the approval of the Michigan Water Resources Commission.

The watershed council may establish a river management board comprised of member representatives for the purpose of conducting management studies, funding these projects, and implementing management proposals on their defined portion of the river.

Act No. 345, 1966. (The Inland Lake Improvement Act of 1966.) This act provides for the establishment of local lake boards consisting of representatives from local, county, and state governments for the purpose of improving inland lakes by dredging or removal of undesirable materials. The board is authorized to acquire land and levy taxes or special assessments and to have lake management studies conducted.

Private lakes may utilize the services of the local lake board by petition of two-thirds of the landowners abutting the lake.

The State of Michigan may intervene in inland lake improvement projects for the protection and conservation of the natural resources of the state.

Act No. 231, 1970. (Natural River Act.) The Natural Resources Commission can designate a river or portion thereof as a natural river in order to preserve and enhance water conservation, fish and wildlife, boating, aesthetics, floodplain, historic, or recreational use. This also includes designated adjoining lands.

The Commission may fund required studies and planning projects to cooperate with local governments for the protection of the designated river by acquisition, lease, easement, or other means to establish the needed zoning.

Act No. 127, 1970. (Environmental Protection Act.) This act allows private citizens and groups to sue industries and government agencies which pollute the environment.

The complainant may be required to post a \$500 bond for court costs in the event the decision is rendered against him.

Industries may not be charged with a specific type of pollution a second time if originally cleared on that charge.

* *Act No. 167, 1970. (Watercraft Pollution Control Act.)* The Watercraft Pollution Control Act strengthened and expanded Michigan's watercraft pollution control program which had been in effect under Water Resources Commission administrative rules. Effective January 1, 1971, all toilet-equipped watercraft moored or operated on the State's waters, including cargo-carrying vessels, interstate and international vessels, documented vessels, and pleasure watercraft must be equipped with self-contained marine toilets or incinerating devices to prevent any and all overboard discharge of sewage wastes. In addition, the act requires that all marinas capable of handling 15 or more watercraft be equipped with marine toilet pump-out facilities. Further provisions of the act pertain to oil and litter discharges from vessels. The law may be enforced by any police or peace officer of the state, including employees of the Water Resources Commission.

Act No. 346, 1972. (Inland Lakes and Streams Act of 1973.) Requires a permit from the DNR for any construction, dredging, or modification of any inland lake or stream bottomland, the construction, maintenance, and operation of a marina, or any interference with natural drainage excepting agricultural and some other specified drains. Waste collection and treatment facilities as approved by Public Health or the Water Resources Commission are exempt from the act. Seasonal, private, recreational structures and reasonable beach sanding are also exempt. A permit application fee of \$25 is required. Violation is a misdemeanor. Permit applications shall be reviewed for protection of riparian rights and environmental impact on inland lakes and streams by the DNR, the Public Health Department, local municipalities, the local soil conservation district, and watershed council.

Act No. 347, 1972. (Soil Erosion and Sedimentation Control Act of 1972.) Provides for the establishment of land use plans and policy by the Water Resources Commission of the DNR for the purpose of sedimentation and erosion control to protect the state's inland waters. Rules and regulations derived from the Commission's studies are to be enforced at the county, township, and city levels based on a permit system incorporated after June 30, 1974. Local municipalities may write their own land use regulations but must meet minimum requirements set by the Commission. Logging and mining are exempt, and agricultural activities are exempt until 1979.

APPENDIX B

EXAMPLES OF LAKE ASSOCIATION BYLAWS

Articles and By-Laws of Coon Lake Hills Association, Inc.

ARTICLE I — NAME

This Association, having been duly incorporated under Public Act No. 137 (1929) of the State of Michigan, as amended, shall henceforth be known as Coon Lake Hills Association, Inc.

ARTICLE II — PURPOSE

Section 1: To promote the welfare of the members of the organization represented herein in regard to housing, transportation, sanitation, taxation, building restrictions, streets, public nuisance, and all other matters of public interest; to promote and advance the interests of this organization in person and property, and to advance the welfare of the section embraced in the territory covered by this organization. To exercise police powers over lands, waters, roadways, streets, and parks within the jurisdiction of said corporation; to enact By-Laws as authorized by statute for health, safety, and welfare; to levy and collect dues and assessments; to provide penalties for the violation of By-Laws; and in general, to do any and all things authorized or permitted under the law.

Section 2: To maintain the proper water level, weed control, removal of navigational hazards, and enforcement of dam maintenance.

Section 3: This Association shall further have the powers and exercise the jurisdiction conferred by Act No. 137 (1929), as amended, of the State of Michigan over lands owned by said Corporation or within its jurisdiction.

ARTICLE III — TERRITORY

The North boundary will start at the intersection of the centerlines of Westhill Drive and East Coon Lake Road; thence Easterly along the centerline of East Coon Lake Road to the Marion-Genoa Township line; thence South to the Southern boundary of Coon Lake Hills No. 2; thence West to the Center of Adria thence in a Southerly direction to the centerline of Brighton Road. Starting at the intersection of Westhill Drive and East Coon Lake Road following the centerline of Westhill Drive in a general Southerly direction to the end of the existing Westhill Drive; thence in a line due South to the center of Brighton Road; thence East along the center of Brighton Road to intersect the East boundary.

ARTICLE IV — MANAGEMENT

The business of this Corporation shall be managed and controlled by a Board of Trustees consisting of seven members, to be elected by qualified members; three to be elected for a term of one year, and four to be elected for a term of two years.

Thereafter, three trustees shall be elected one year and four the next year, all for two year terms. Trustees shall be installed during annual meetings each year. A meeting of the newly-elected Board of Trustees shall be called within ten (10) days of the Annual Meeting for the purpose of electing officers for the coming year.

The Board of Trustees each year shall elect from said Board a President, a Vice-President, a Secretary and a Treasurer, and such other officers as said Board may determine necessary. The Board shall have power to transact the corporation's business and to make minor improvements requiring expenditures up to Two Hundred Dollars (\$200.00) annually, provided funds are on hand to cover same. For expenditures exceeding this amount, approval of majority of the membership shall be required.

ARTICLE V — MEMBERSHIP AND MEETINGS

Section 1: Meetings of the Board of Trustees and committee chairmen shall be called at least once each two months by call of the President or Secretary. A special meeting of the Board of Trustees may be called by the President or a majority of the Board of Trustees at any time upon five days' notice to each member. General meetings of the membership shall be called upon two weeks' notice by the President or Secretary or by any four members of the Board of Trustees to all members. There shall be not less than one general meeting of the membership held annually, which shall be known as the Annual Meeting, to be held during the first two weeks in June, for the purpose of transacting necessary business. Notice of any special meeting shall contain a statement of the purpose of such meeting.

Section 2: To be eligible for membership in the Coon Lake Hills Association, a person must own an equitable or legal interest in one or more lots within the territory described in Article III.

Section 3: Each member shall be entitled to cast one vote upon each and every question properly coming before any meeting of the members of said Association; provided that no one person shall be entitled to more than one vote because of ownership of more than one lot; husband and wife owning jointly shall each be entitled to one vote. Members may vote in person or by Proxy filed with the Secretary. A majority approval shall be required to pass an order of business.

Section 4: The presence of ten members of the Association, and five members of the Board, shall constitute a quorum at any regular, special or annual meeting called by the Secretary, with the authority of the Board or the President. In the event that any one meeting should fail to meet the quorum requirement as set forth in this section, another meeting shall be called in which those present shall automatically constitute a quorum.

Section 5: The Secretary will give two weeks' written notice to each member of all special meetings and the Annual Meeting of the members of the Corporation. All notices shall contain the time and place of the meeting.

Section 6: Two-thirds of the Board of Trustees shall constitute a quorum for the transaction of business of the Board.

Section 7: Vacancies on the Board of Trustees shall be filled by appointment by the remaining members of the Board.

Section 8: No member or officer of the Corporation shall receive compensation, or derive financial gain in any manner, from corporation activities.

Section 9: The fiscal year of the corporation shall be July 1st to June 30th.

ARTICLE VI — OFFICERS

Section 1: The President shall be the chief executive of the Board of Trustees, and shall have general control and management of its business in the recess of the Board and shall make appointments of the standing committees. He shall preside at all meetings of the Board of Trustees and of the Corporation.

Section 2: It shall be the duty of the Vice-President to perform all the duties of the President during his disability or absence. His term of office and manner of election shall be the same as for the President.

Section 3: The Secretary shall keep the minutes of all meetings of the Board of Trustees or Corporation in books provided for that purpose. He shall attend to the giving and receiving of all notices of the Corporation. He shall sign with the President or Vice-President, in the name of the Corporation, all contracts authorized by the Board of Trustees, and when necessary shall affix the corporate seal thereto. He shall perform such other duties as may be designated by the Board of Trustees. His term of office and manner of election shall be the same as for the President and Vice-President.

Section 4: The Treasurer shall have custody and keep account of all money, funds and assets of the Corporation. He shall render such accounts and present such statements to the Board of Trustees as required. He shall deposit all funds of the Corporation which may come into his hands in such bank or banks as the Board of Trustees may designate and shall be under bond in an amount to be determined from time to time by the Board of Trustees. He shall keep the bank accounts in the name of the Corporation, shall pay out money only by check, duly co-signed by the Corporation President or Vice-President upon order of a majority of the Board of Trustees. His books shall be audited not later than March 15th of each year by not less than three members of the Board of Trustees. He shall be allowed a reasonable petty cash fund for the necessary office expenses, the amount to be approved by the Board of Trustees. All books and records of the Corporation shall be subject to examination upon petition of any twenty (20) members of the Corporation. His term of office and manner of election shall be the same as for the President and Vice-President.

Section 5: The Board of Trustees shall have such powers as are granted in Act No. 137 of the Public Acts of 1929, as amended, and such powers as shall be granted by these By-Laws and any amendment thereto.

ARTICLE VII — FINANCE

Section 1: There shall be due and payable each year, by July 1st, a regular annual assessment in the following amounts:

- (a) Ten Dollars (\$10.00) per owner of developed property
- (b) Five Dollars (\$5.00) per owner of undeveloped property
- (c) Maximum payment not to exceed \$10.00 per owner
- (d) Above dues shall be pro-rated for membership of less than one year.

Section 2: A special assessment may be levied by the Board of Trustees in an amount not to exceed Ten Dollars (\$10.00) per owner, per calendar year for purposes of improvements. Such assessments are to be due and payable within sixty (60) days of the date of the mailing of written notice by the Secretary. Husbands and wives shall be required to pay only a single assessment.

Section 3: Any dues not paid by September 30th of the year for which assessed shall become a lien upon the lot or property against which they are assessed.

Section 4: Any costs incurred for the purpose of upholding these By-Laws shall be the responsibility of the property owner who is in violation of said By-Laws.

ARTICLE VIII — COMMITTEES

Section 1: Standing committees shall be appointed by the President as deemed necessary by the Board of Trustees for the purpose of promoting the general welfare of the corporation and its members. They shall include the following committees:

- (a) Hospitality and Membership
- (b) Roads
- (c) Public Relations
- (d) Architectural, Improvement and Civic Projects
- (e) Social Activities
- (f) Nominating
- (g) Any other committees designated by the Board

Section 2: Standing committee chairmen, (except nominating committee) shall be appointed by the President of the Board of Trustees within 30 days of his election. The Committee Chairmen shall be responsible to the Board of Trustees and shall attend meetings of the Board of Trustees whenever requested.

Section 3: Members-at-large of the various standing committees will be appointed by the respective committee chairmen.

Section 4: The duties of the various standing committees are as follows:

- (a) Hospitality Committee will greet new residents and encourage their active participation in the corporation.
- (b) The Roads Committee will deal with the County in matters pertaining to County roads within the Corporation limits, arrange for the placing of "Speed," "No Dumping," "Private," and such other signs as the Board may direct, and to obtain same from the County when possible.
- (c) The Public Relations Committee will handle all business and social publicity pertaining to the Corporation.
- (d) The Architectural, Improvement and Civic Projects Committee will handle contracts with private contractors, federal, state and local government agencies, assist the Board of Trustees in the planning of civic improvements, and recommend approval or disapproval of building plans to the Board of Trustees.
- (e) The Social Committee will promote friendly and cordial relations by planning social events.
- (f) The Nominating Committee shall consist of two (2) members appointed by a majority of the Board of Trustees. The appointment of the Committee is to be made at least two months prior to the Annual Meeting. This Committee shall select qualified members of the Association to be nominated at the Annual Meeting to serve as trustees. Nominations may also be made from the floor.
- (g) The Board of Trustees may appoint any special committees it deems necessary.

ARTICLE IX — BOATING RULES

Section 1: Purpose. The following rules are set up, not to curtail anyone's personal liberty, but to enable property owners to more fully enjoy their homes in peace, health and safety.

Section 2: The following regulations shall apply to all water craft operating on Coon Lake:

- (a) State of Michigan pleasure craft laws as prescribed by the Michigan Marine Safety Act of 1967 (Act 303, Public Acts of 1967) shall be in effect.
- (b) The Buoy system for the ski course will be used. Buoys will be placed in a manner to permit all skiers and boaters to observe a safe course. The course to be followed will be inside the buoys (toward the lake center) and will be counterclockwise.
- (c) No skiing or speed boating before 10:00 a.m. or after *one hour before sundown*.
- (d) No skiing at the southern end of the lake except for entrance to the ski area and exit to the owners property or lake access.
- (e) Speed in all channels is restricted to 5 miles per hour.
- (f) No guest boats will be allowed on the lake as we already have a traffic problem.

ARTICLE X — HEALTH

Section 1: Dumping of tin cans, bottles, glass, rubbish, garbage of any kind or polluting liquids into lake waters or upon any of the roads, streets, parks, beaches, easements or private property is hereby prohibited.

Section 2: All garbage shall be kept in a tightly closed plastic or metal container. Accumulation of garbage or rubbish in excess of two (2) weeks is prohibited.

Section 3: The burning of rubbish or garbage upon any property within the corporate limits is hereby prohibited, except in proper incinerators that eliminate nauseating odors that invade the privacy of adjacent property owners.

Section 4: No person shall be allowed to use any chemical in the lake without written permission from the Board of Trustees.

Section 5: All road maintenance of other than County roads shall be the responsibility of people owning property on those roads or use same for ingress or egress. Maximum speed limit on any road within the jurisdiction of the Corporation shall be fifteen (15) miles per hour. All commercial and construction vehicles, using other than county roads, shall be the responsibility of the property owner requesting their services, for any damage resulting from their use.

ARTICLE XI — ENFORCEMENT

Section 1: The Board of Trustees shall be empowered to enforce any of the provisions contained in these By-Laws and shall have authority to designate agents therefore.

Section 2: The Board of Trustees shall have power to appoint a marshal for the purpose of enforcing applicable laws and the rules of the Corporation as contained in these By-Laws. Said Marshal shall be bonded in the amount of not less than One Thousand Dollars (\$1,000.00). The cost of his bond shall be an expense of the Corporation. His compensation shall be set by the Board of Trustees.

ARTICLE XII — SEAL & NEW MEMBERS

Section 1: The Board of Trustees shall have power to procure a suitable corporate seal which shall be kept by the Secretary and shall be used by him.

Section 2: New members of the Corporation shall be deemed to assent to these By-Laws and shall furnish the Secretary with the address to which he desires notices sent. Failure to do so shall be deemed a waiver of notice.

ARTICLE XIII — BY-LAWS

Section 1: Authority. These By-Laws may be altered, amended, added to or repealed by a majority vote of the members of the corporation at any regular or special meeting providing 25% of said members are in attendance. A copy of a proposed amendment must be sent to each corporation member at least twenty (20) days prior to the special meeting at which the vote will be taken.

Section 2: Effective Date. All By-Laws, or amendments thereto, shall take effect ten (10) days after passage of same and each shall be posted conspicuously in three (3) public places within the jurisdictional area of such corporation at least five (5) days before the time for taking effect of same and proof of such posting shall be made by an officer of such corporation and entered on the records of the corporation. Complete and accurate copies of all By-Laws shall be kept by the Secretary of the corporation, for public inspection. Copies of the above shall be mailed to all members.

ARTICLE XIV — PROTECTIVE COVENANTS AND RESTRICTIONS

All subdivisions and areas within the territory described under Article III shall comply with the following restrictions:

(1) The restrictions herein shall be in addition to any and all restrictions in any zoning ordinance and any building code covering property in Marion Township, Livingston County, Michigan.

(2) The purpose of these restrictions is to insure the use of the property for attractive residential purposes only, to prevent nuisances and to prevent the impairment of the attractiveness of the property.

(3) Said lands and premises shall only be used for single family residential purposes.

(4) No buildings or other structures shall be erected, or placed upon said lands and premises other than one single family dwelling of not less than 1,200 square feet of livable floor space. *This does not include:* porches, breezeways, garages, or other rooms which are not ordinarily considered to be living rooms, and shall not include any rooms on any second floor level above the ground level of said dwelling. (This paragraph does not apply to existing dwellings.)

(5) No temporary structures, tents, house trailers or garage homes shall be located upon said premises. Recreational vehicles may be stored on the premises.

(6) No old or used structure shall be moved upon said lands and premises.

(7) Outside finish on all buildings shall be natural wood, stone, brick, aluminum siding, Perma Stone, or any other stone facing products. No uncovered cement block or cinder block may be used in exposed surfaces. No stucco may be used on any exterior surface.

(8) The exterior wall of any building or structure, other than a multi-level dwelling, facing any road shall be of brick or stone, except for decorative or ornamental trim which may be of wood.

(9) No house trailer, travel trailer, basement, garage, shed, temporary structure, tent or other out building erected upon said lands and premises shall be used at any time as a residence, either temporarily or permanently.

(10) No detached garage may be built upon said lands and premises. All garages must be attached to the main residence.

(11) All buildings shall be built on continuous solid foundations of cement block, stone, brick or other similar hard material.

(12) No residential structure shall be erected or placed nearer than sixty (60) feet from any road.

(13) No building or other structure of any nature shall be erected or placed nearer than six (6) feet from any side line of said lands and premises. No dwelling shall be erected or placed nearer than ten (10) feet from any side line of said lands and premises.

(14) All structures of any nature, including residence and garage, shall be of conventional design and subject to the provisions of paragraph fifteen (15) as hereinafter set out.

(15) No buildings or other structures of any kind or character shall be erected, altered, or placed upon the above described lands and premises or any part thereof until the building plans, specifications, and plot plan showing the location of such building or other structure have been approved in writing *by the Board of Trustees* as to conformity and harmony of external design with existing structures in the immediate vicinity (immediate vicinity shall be construed as meaning within seven hundred fifty (750) feet of said lands and premises), and as to location of such building or other structure with respect to topography and finished ground elevation. *A copy of all plans shall be submitted to the Architectural Committee. The Architectural Committee shall submit their recommendations of approval or disapproval to the Board of Trustees. Approval or rejection of the plans will be sent to the owner in writing. The Board of Trustees must act within 60 days of receipt of plans.*

(16) No signs, billboards, advertising devices or any unsightly objects of any kind shall be erected or displayed upon said lands or premises or any building or structure thereon, nor in or over Coon Lake, except "FOR SALE" signs.

(17) No fence shall be erected or placed upon said lands and premises or any part thereof which shall exceed five (5) feet in height, and all fences shall be approved by the architectural committee in writing, before such fence is placed upon said lands and premises.

(18) Disposal of sewage shall be through suitable septic tanks or other approved methods and the overflow from such disposal units shall not drain into Coon Lake. There shall be no unsanitary drainage whatsoever draining into said Coon Lake.

(19) No animals shall be kept or maintained on said lands and premises or any part thereof except cats and dogs. No cats or dogs shall be raised, kept, or maintained upon said lands or premises or any part thereof as a commercial enterprise. Dog kennels for the use of such household pets may be built only integral with the garage or residence structure, and not offensive to neighbors.

(20) All noisy machinery or apparatus are prohibited. All continued excessive noise is prohibited.

(21) No boat livery, profession of any kind, or any business enterprise or any manufacturing shall be conducted upon said lands and premises, or any part thereof.

(22) No owner of said lands and premises, or any part thereof, nor anyone claiming under, by, or through, such owner, shall keep or maintain a houseboat in or on Coon Lake. No owner of said lands and premises, or any part thereof nor anyone claiming under, by, or through such owner, shall keep or maintain a boat house in, on, or adjacent to Coon Lake. No building or structure of any kind shall be erected or placed upon said lands and premises nearer than forty-five (45) feet from the shoreline of Coon Lake.

(23) Should the owner or owners of said lands and premises, or any part thereof, commence the erection of any building or any other structure upon said lands and premises, or any part thereof, such owner or owners shall complete the construction of such building or such other structure within one year following the date of commencement of the same. Should such owner or owners fail to fully complete such building or such other structure within said one year period of time, the partially completed building or other structure shall be removed by such owner or owners within thirty (30) days following the close of said one year period of time. Should any building or other structure, either in process of construction, or fully constructed, be damaged, destroyed, or be left in a ruined condition by fire, wind, or any other cause, the owner or owners of the same shall remove all ruins and debris within one year following the date of such damage or destruction. However, at the option of said owner or owners, such building or other structure may be repaired and in such case the building or other structure shall be fully completed within one year from the date of such damage or destruction.

**By-Laws
of
Emerald Lakes Village Home Owners Association**

**ARTICLE I
NAME**

The name of the Association shall be known as the Emerald Lakes Village Home Owners Association.

**ARTICLE II
JURISDICTION**

The area of jurisdiction embraced by the activities of this Association shall be all real property in Emerald Lakes Village Subdivisions Numbered 1 through 8 which are a part of Section 2, T2N, R11E, located in the City of Troy, Oakland County, Michigan.

**ARTICLE III
PURPOSE**

The purpose of this Association shall be to engage in any lawful activities which will enhance the efficient and economic progress of the City of Troy; to promote the best interest of the property owners and residents within the area named and in a broad way to foster, further, advocate and protect the best interests of the areas as residential sections, to analyze, compile, and disseminate information on laws and regulations of interest to the members, and to determine and make known to government the views of the community relating to such matters.

**ARTICLE IV
MEMBERSHIP**

Membership in this Association is limited to persons, firms, and corporations owning real property in Emerald Lake Village Subdivisions, as defined in Article II. All such property owners shall automatically become Members of this Association upon acquiring any real property in said Subdivision whether by purchase, gift, adverse possession or any other means whatsoever. Membership in said Association shall automatically terminate upon the Member ceasing to own any such real property. The owner of such real property shall be determined to be the legal title holder as registered in the Oakland County Register of Deed.

**ARTICLE V
VOTING AND PROXIES**

Section A. WHO IS ENTITLED TO VOTE. The owner or owners of each building site in Emerald Lakes Village Subdivisions shall be entitled to two votes in person or proxy for each such building site. If a building site is owned by one member, he shall be entitled to both of said votes. If a building site is owned by two members, then each shall be entitled to one vote. If the building site is owned by more than two members, then each member shall have a fractional vote proportionate to their number.

Section B. PROXY VOTE. A proxy vote shall not be operative unless and until signed by the Member and filed with the Association. Each proxy shall extend to all meetings of the members and shall remain in force three years from its date, absent limitation to the contrary contained in the proxy. In no event however, shall such proxy extend for more than three years from its date.

ARTICLE VI OFFICERS AND DUTIES

Section A. The officers of this Association shall consist of the following: President, Vice President, Recording Secretary, Corresponding Secretary, and Treasurer.

Section B. PRESIDENT. The President shall be the chief executive officer of the corporation and shall preside at all meetings of the Association and Board of Directors meetings. He shall appoint, with the approval of the Board, the Chairperson of any special committee and shall cooperate with that Chairperson, when necessary in appointing members of that committee. He shall call any meetings of the Board of Directors at such time as he may deem advisable or on request of no less than three members of the Board. It is his duty to carry out the will of the Board and the Association as expressed at their respective meetings, and, in general, conduct the affairs of the Association in a manner consistent with the authority and responsibilities of his office. The President or his assigned representative must have the prior approval of either the Board of Directors or the Membership; without such approval, the President or his assigned representative speaks as a private citizen. The President shall countersign all checks with the Treasurer.

Section C. VICE PRESIDENT. The Vice President shall perform the duties and exercise the powers of the President during the absence or inability of the President to serve. He shall also be an ex officio member of all committees, and shall serve as Sergeant of Arms at all meetings of the members to specifically determine the eligibility of all persons to vote, and the number of votes each person is entitled to according to Article V, Sections A and B.

Section D. RECORDING SECRETARY. The Recording Secretary shall attend all regular business meetings and meetings of the Board of Directors and keep and preserve a true and accurate record of the proceedings herein in books of the corporation. It will be the duty of the Recording Secretary to read the minutes of all said meetings at the regular business meetings. The Recording Secretary shall file the Annual Report to the State of Michigan for Non-Profit Corporations as it concerns this Association. He shall safely keep in his custody the seal of the corporation and shall have authority to affix the same to all instruments where its use is required. He shall perform such other duties as may be delegated to him by the Board of Directors.

Section E. CORRESPONDING SECRETARY. The Corresponding Secretary shall give all notices required by statute, by-law or resolution. He shall carry on the correspondence of the Association as directed by the Board. He shall be responsible for preparing the periodic Association Newsletter. He shall perform all such other duties as may be delegated to him by the Board of Directors.

Section F. TREASURER. The Treasurer shall be responsible for collecting all monies due the Corporation. He shall have custody of all corporate funds and securities and shall keep full and accurate accounts of all receipts and disbursements in books belonging to the Association. He shall deposit all monies, securities and other valuable effects in the name of the Association in such depositories as may be designated for that purpose by the Board of Directors. He shall disburse the funds of the Association as may be ordered by the Board, taking proper vouchers for such disbursements, and shall render to the President and Directors at the regular meetings of the Board, and whenever requested by them, an account of all transactions and of the financial condition of the Association.

Section G. BONDING. The Treasurer and any other persons entrusted with the handling of funds or property of the Association shall, at the discretion of the Board of Directors, furnish at the expense of the Association a fidelity bond approved by the Board, in such a sum as the Board shall prescribe.

Section H. COMPENSATION OF BOARD OF DIRECTORS. Officers and Directors shall serve without material compensation. The Association or the Board of Directors may provide from Association funds for such necessary incidental expenses as may be incurred by such Officers or Directors in the transacting of Association business.

ARTICLE VII BOARD OF DIRECTORS

Section A. ELECTION OF DIRECTORS. The business, property, and affairs of this Association shall be managed by a Board of Directors consisting of eleven members. The Board of Directors shall be comprised of the Officers of the Association plus six (6) additional members. The members of the Board shall be elected by ballot of the Members of the Annual Meeting. Each Board Member shall be elected to fill a specific position on the Board.

Section B. TERM OF DIRECTORS. All Directors elected at an Annual Meeting shall hold office for a period of one (1) year or until their successors are duly elected, provided however, if a Director shall cease to be a member of said Corporation, he shall cease to be a Director.

Section C. VACANCIES. The Board shall have the power to fill any vacancy of any office occurring for any reason whatsoever. Vacancies in the Board shall be filled by appointment made by the remaining directors, provided however, that said appointment shall be approved by two-thirds (2/3) of the remaining directors. Each person so appointed to fill a vacancy shall remain a director until his successor has been elected by the members at their next Annual Meeting or by any special meeting duly called for that purpose and held prior thereto.

Section D. ACTION BY UNANIMOUS WRITTEN CONSENT. If and when the Directors shall severally or collectively unanimously consent in writing to any action to be taken by the corporation, such action shall be a valid corporate action as though it had been authorized at a meeting of the Board of Directors.

Section E. DUTIES AND POWERS. It shall be the duty of the Board of Directors to care for the property and interest of the Association and to determine the policies for the conduct of its affairs consistent with such specific instructions as the Board may receive from the Association Members. The Board shall have the power to raise and expend funds to promote the welfare of the Association and to employ all such means, not in conflict with these By-Laws or with the laws of the land, as it may deem proper and expedient to secure the objectives for which the Association is organized.

Section F. POWER TO APPOINT OTHER OFFICERS AND AGENTS. The Board of Directors shall have the power to appoint such officers and agents as the Board may deem necessary for transaction of the business of the Corporation.

Section G. REMOVAL OF OFFICERS AND AGENTS. Any officer or agent may be removed by the Board whenever, in the judgement of the Board, the interests of the Corporation will best be served thereby.

Section H. DELEGATION OF POWERS. For any reason deemed sufficient by the Board of Directors, whether occasioned by absence or otherwise, the Board may delegate all or any of the powers and duties of any officer to any other officer or director, but no officer or director shall execute, acknowledge, or verify any instrument in more than one capacity.

Section I. QUORUM.

(1) *Quorum of Members.* Twenty percent (20%) of the voting members of the Association either present in person or by proxy shall constitute a quorum of the Members at any meeting.

(2) *Quorum of Directors.* Sixty percent (60%) of the Directors present in person shall constitute a quorum at any meeting of the Board of Directors.

**ARTICLE VIII
MEETINGS**

Section A. ANNUAL MEETING OF MEMBERS. An annual meeting of the Members shall be held in each year on the second Monday in October, unless otherwise ordered by the Board of Directors, but no later than November First. Such meeting shall be held at a time and place as determined by said Board of Directors. The agenda of said meeting shall include the election of officers and directors, the approval of the annual budget and such other business as necessary.

Section B. NOTICE OF ANNUAL MEETING OF MEMBERS. The Board of Directors shall give notice of the Annual Meeting to all Members delivered to their address of record not less than five (5) days prior to the meeting. Said notice shall include a proposed agenda for said meeting. Any defect in said notice may be waived by any Member adversely affected by said defect, but only as to his notice.

Section C. ORDER OF BUSINESS. The order of business at the Annual Meeting of Members shall be in such sequence as the presiding officer, in his discretion, may determine.

Section D. SPECIAL MEETING OF MEMBERS. A Special Meeting of the Members may be called at any time by the President, a majority of the Board of Directors, or by a signed petition of twenty percent (20%) of the Members presented to the Board for verification, with the Board calling for the meeting designating the date, time and place of said meeting. The Corresponding Secretary shall prepare, sign and have delivered notices requisite to such meeting. Such notice may be signed by stamped, typewritten, or printed signature of the Corresponding Secretary.

Section E. NOTICE OF SPECIAL MEETING OF MEMBERS. At least five (5) days prior to the date fixed for the holding of any special meeting of Members, the Board of Directors shall give written notice of the time, place, and purposes of said meeting to each Member entitled to vote at said meeting. No business not mentioned in the notice shall be transacted at said meeting.

Section F. REGULAR MEETINGS OF BOARD. Regular meetings of the Board shall be held not less frequently than once in each month at such time and place as the Board of Directors shall from time to time determine. No notice of regular meetings of the Board shall be required. In the event the Directors in their discretion shall determine that monthly meetings are unnecessary, then the Directors, by majority vote, may dispense with such meetings.

Section G. SPECIAL MEETINGS OF BOARD. Special meetings of the Board may be called by the President or a majority of the Board at any time. A written or an oral notice of said meeting stating the date, time, place and purpose of said meeting shall be given to each member of the Board.

Section H. Unless otherwise stated in these By-Laws, a majority vote of the members voting in person or by proxy shall prevail at all voting situations in general meetings.

Section I. Absent provisions herein to the contrary, the meetings of the Association shall be conducted in accordance with the latest edition of Robert Rules of Order.

**ARTICLE IX
MAINTENANCE AND OPERATING FUND**

Section A. All of the building sites in the Emerald Lakes Subdivisions shall be subject to an annual maintenance charge for the purpose of creating a fund to be known as the Maintenance and Operating Fund. The annual charge for each year shall be determined each year by the Board of Directors, and approved at the Annual Meeting by a two-thirds (2/3) majority of the Members voting in person or by proxy. Such annual charge may be adjusted upward or downward

from year to year as the needs of the Association may require. Such charge shall be mailed to the property owner at his last known address and shall be paid annually in advance on or before the first day of April in each year. Such assessment shall be binding upon all of said building sites and the owners thereof constituting the membership of this Association. For purposes of this Section, the Member responsible for said annual charge shall be the person or persons in whose name the deed for said building sites is recorded in the Oakland County Register of Deeds on the first day of each calendar year.

Section B. The Board of Directors, its successors and assigns, shall apply the total amount arising from said annual charge to the payment of any expenses incurred for maintaining, landscaping and otherwise improving the building sites designated or available for use by the Members for recreational purposes, the entrance gates, the street islands and gardens, the waters of any lakes in the Subdivisions, and other operating expenses.

Section C. Upon the recommendation of the Board of Directors, a special assessment may be approved at the Annual Meeting of the Members or at any Special Meeting of the Members by a favorable vote of no less than two-thirds (2/3) of the votes cast in person or by proxy at said meeting. Said assessment shall be in addition to the annual maintenance charge and shall be binding on all building sites in the Subdivisions and enforceable in the same manner as the annual maintenance charge. Said Special Assessment shall be for a specific purpose to be designated at the Meeting and shall run for not more than one year.

ARTICLE X COMMITTEES

Section A. The STANDING COMMITTEES of this Association shall be:

- (1) Lakes Committee
- (2) Maintenance Committee
- (3) Restrictions Committee
- (4) Social Committee
- (5) Audit Committee
- (6) Nominating Committee

The Board of Directors may also designate any special committees it deems necessary, specifying in its designation the purpose of such committee. Unless otherwise provided, the chairperson of each committee shall be a member of the Board of Directors. The members of each committee shall be appointed by the Board of Directors at their first regular meeting following the Annual Meeting of the members, or in the case of special committees, at the time the committee is designated. Vacancies in any committee shall be filled in the same manner as soon as possible after the vacancy occurs.

Section B. STANDING COMMITTEES. The purpose of each standing committee is as follows:

(1) *LAKES COMMITTEE.* The Lakes Committee shall maintain the health and cleanliness of all lakes within Emerald Lakes Village Subdivisions, arrange for lake treatment as required, investigate lake environmental problems including lake levels and fish life.

(2) *MAINTENANCE COMMITTEE.* The Maintenance Committee shall arrange for and supervise the maintenance of lake access lots, entrance ways, cul-de-sac's and landscaping of newly created public areas in the subdivisions.

(3) *RESTRICTIONS COMMITTEE.* The Restrictions Committee shall respond to questions or complaints and recommend action relative to such items as landscaping, nuisances, driveways, animals and livestock, signs, fences etc., and generally enforce the restrictive agreements.

(4) *SOCIAL COMMITTEE.* The Social Committee shall organize, promote and publicize social activities for and among the Members. The committee shall also personally meet and welcome all new residents of the Subdivisions and acquaint them with all facets of the Association.

(5) *AUDIT COMMITTEE.* An Audit Committee composed of two (2) persons shall be elected at the Annual Meeting. Neither member shall serve in any other Association capacity during their term on this committee. The Audit Committee shall audit all financial records of the Association, and present its report to the Members at the Annual Meeting in writing. The Audit Committee shall carefully examine all insurance policies to determine the amount and kind of insurance in force and include this information in its report.

(6) *NOMINATING COMMITTEE.*

a) The purpose of the Nominating Committee shall be to evaluate and select qualified candidates for election as officers and members of the Board of Directors at the Annual Meeting.

b) The Nominating Committee shall be composed of three members who shall be elected at the Annual Meeting from nominations made at large.

c) The members of the Nominating Committee shall serve for the year following their election. They shall meet and consider the qualifications of the potential candidates and shall secure the consent of each potential candidate to serve, if elected.

d) The candidates of the Nominating Committee shall be made known to the Membership in conjunction with the announcement of the Special or Annual Meeting at which the election is to take place.

e) A vacancy in the Nominating Committee among those elected at the Annual Meeting shall be filled by action of the Board in appointing a non-Board member to serve the remainder of the term.

Section C. SPECIAL COMMITTEES. The Board of Directors may designate any special committees it deems necessary, specifying in its designation the purpose of said committee. The President with the approval of the Board shall appoint the chairperson and any other members of all special committees.

**ARTICLE XI
AMENDMENTS**

Section A. The articles of incorporation and By-Laws may be amended at any Annual Meeting or special meeting called for the purpose, by a majority of those present at said meetings, provided that written notice of said meetings shall have been delivered to all members as per Article VIII, Section B, at least twenty (20) days prior to the date of said meeting, which notice shall include the proposed amendment.

Section B. AMENDMENT, HOW EFFECTED. Any Member or group of Members may file with the Recording Secretary such amendment as he deemed advisable. The Recording Secretary shall submit this amendment to the Board of Directors who shall give due and thorough consideration and report to the Members at said meeting specified in Section A of this Article, with a recommendation for or against adoption, or the Board may recommend alterations, additions, or omissions.

**By-Laws
of
Lake Le Ann Property Owners Association**

ARTICLE I

Name: The name of this Association shall be Lake LeAnn Property Owners Association.

ARTICLE II

Purpose: The purpose of the Association is to promote the health, safety and welfare of the residents within Lake LeAnn's subdivisions in Somerset Township, County of Hillsdale, State of Michigan and future additions thereto and for this purpose to: own, acquire, build, operate and maintain parks, streets and recreational facilities in said subdivisions or additions thereto; to establish, alter and enforce building and use restrictions for the Lake LeAnn subdivisions and to do all things necessary and incidental to promote the common benefit and enjoyment of the residents of the subdivisions of Lake LeAnn and additions thereto.

ARTICLE III

Length of Existence and Dissolution

- a) Length of Existence: The term of the corporation existence is perpetual.
- b) Dissolution: The Association may be dissolved only with the assent given in writing and signed by the members entitled to cast two-thirds of its membership vote. Written notice of a proposal to dissolve, setting forth the reasons therefore and the disposition to be made of the assets shall be mailed to every member at least ninety days in advance of any action taken.

ARTICLE IV

Membership

Section 1 Members

- a) Every person or entity who holds an equitable interest or undivided equitable interest in any ownership unit or living unit within the Lake LeAnn subdivisions as platted, whether as land contract vendee or fee holder, shall be members of this Association. All persons or entities possessing such an interest shall be subject to the recorded restrictions for Lake LeAnn, its subdivisions, properties and uses thereof.
- b) All persons or entities possessing such an interest as set forth in the preceding paragraph who are in compliance with such restrictions and uses, the covenants contained in these By-Laws and paid all assessments called for by said restrictions and under these By-Laws shall be members in good standing of this Association.
- c) Any person or entity who holds an equitable interest or undivided equitable interest merely as a security for the performance of an obligation shall not be a member of the Association.
- d) Persons not holding an interest in any ownership unit or living unit may not become members of the Association.
- e) The privileges of an individual member in good standing shall extend to his spouse and his immediate family except for voting and holding of Association offices as set forth under these By-Laws.

Section 2 Membership Rights and Privileges

- a) Voting Rights: The Association shall have one class of voting membership. Voting members shall be all those members in good standing as defined in Article IV. When more than one person holds such interest or interests in any ownership or living unit, only one vote shall be exercised as they among themselves determine. Each individual or entity owning a part of more than one lot, is limited to one vote, to be cast in a manner hereinbefore set forth. No fractional votes are permitted.
- b) Each member in good standing shall be entitled to the use and enjoyment of the common properties and facilities of the Association, but not to the exclusion of other members.
- c) A member in good standing can hold any office of the Association in accordance with these By-Laws, if duly elected or appointed, in accordance with these By-Laws.

d) A member shall have the right to be heard by the Board by submitting his request in writing to a Director or the President three days prior to a regular Board meeting to be properly included on the Board's agenda. The request must include stated business. The Director or President shall present such written request to the presiding officer of the Board at or before the commencement of such Board meeting.

e) Association members are welcome to visit all open Board meetings.

Section 3 Suspension of Membership in Good Standing Status

a) The membership rights and privileges of any person or entity may be suspended for misconduct by action of the Board of Directors by a two-thirds vote. Violation of the restrictions, covenants, regulations or By-Laws shall constitute misconduct, as well as other acts of omission or commission that are harmful to the health, safety and welfare of other Association members.

b) Any claim of misconduct against a member of the Association must be stated in written form, signed by not less than ten members of the Association who are in good standing and presented to the Board of Directors.

Upon receipt of such a claim of misconduct, the Board shall cause the same to be investigated and efforts shall be made to resolve the claim without a Board hearing.

If such claim is not resolved by the next regularly scheduled Board meeting, the Board shall then forward by certified mail, or cause to be personally delivered to the person or persons against whom such misconduct claim is made, a notice that a hearing will be held on such claim by the Board at a special meeting called for that purpose at least ten (10) days after such notice is mailed or delivery made personally to the person or persons against whom the misconduct claim is made. Such notice shall inform said person or persons of the nature of the misconduct claim and the date and time of the Board hearing thereon. Said notice shall also inform such person or persons of his, her or its right to a full hearing and opportunity to answer such claim of misconduct.

The Board shall make its determination of the misconduct claim in written form. Should the Board by a two-thirds vote find such person or persons to be guilty of misconduct as defined in these By-Laws, it may suspend the membership rights and privileges of such person or persons for a period of time to be determined by the Board. If the misconduct claimed involves a violation of the restrictions or uses and violation is remedied to the satisfaction of the Board, it may, upon a two-thirds vote, restore such person or persons to good standing at any regularly scheduled Board meeting, provided such person or persons is otherwise in compliance with the membership in good standing requirements.

c) Non-payment of dues or assessments by March 31 of each year shall constitute an automatic suspension of a membership in good standing status. No action by the Board of Directors or a written request for such action is required for a non-payment suspension. Upon payment of said assessments, both present and delinquent, rights and privileges shall be automatically restored.

ARTICLE V

Association Powers and Duties

The Association shall have the following supervisory powers and duties which shall be exercised for the mutual benefit of all members.

Section 1 Association Properties and Lake

To keep and maintain common properties in a clean and orderly condition, to cut and remove weeds, dead trees and grass therefrom, to control the weed level of the lake, to pick up loose materials, refuse, etc., and to do all other things necessary or desirable to keep the same neat in appearance and in good order. To control the lake level in the best interest of the property owners and in accordance with all laws and court orders or judgements.

Section 2 Roadways and Outlots

a) To exercise such control over streets as may be deemed necessary or desirable within the Association's powers, subject at all times to such control of County, Township or other proper officers as may have jurisdiction over streets.

b) To repair and maintain streets and pedestrian ways owned by the Association. (Note: Private waterways and roadways must be maintained by the owner.)

c) To provide for the removal or erection and maintenance of gateways or entrances and other ornamental features now existing or hereafter to be erected or created.

d) To maintain recreational facilities owned by the Association in the subdivisions or any additions thereto.

Section 3 Environmental

To do all things necessary or incidental to the protection of plant and wildlife in the common properties and in and about the subdivisions.

Section 4 Enforcement of Restrictions

To enforce, either in its own name, or in the name of any property owner or owners, as may be necessary, all building and other restrictions which have been, are now, or may hereafter be imposed upon any of the real estate in said Lake LeAnn Subdivisions or any additions thereto. This Association shall have full power and authority to bring proceedings in the names of any of the owners to enforce the restrictions; the expenses and costs of such proceedings, however, are to be paid out of the general fund of the Association, if such costs are not obtainable from the outcome of the proceedings.

Section 5 Rules and Regulations

The Board of Directors shall establish reasonable rules and regulations concerning the use of the lakes and of the properties and facilities of the Association, and to enforce these rules and regulations as may be necessary.

Section 6 Conduct of Association Business

The management, affairs and policies of the Association shall be vested in the Board of Directors whose powers and duties shall be those stipulated by these By-Laws.

Section 7 Fiscal Year

The Association shall conduct business on a yearly basis which shall be from March 1st to March 1st of the following year.

Section 8 Audit

An annual audit of the Association's financial records by a certified public accountant approved by the Board shall be completed by May 1st of each year and the findings of said audit presented to the Board of Directors.

ARTICLE VI

The Board of Directors

Section 1 Powers and Duties

The Board of Directors shall constitute the governing body of the Association and is empowered to act in representing the Association in all matters including, but not limited to the following:

The Board of Directors shall:

- a) have the authority to borrow funds, to mortgage, pledge or otherwise encumber the assets of the Association as security for the properties of the Association, together with the right to assign, as further security, assessments due or to become due the Association, which total amount of indebtedness shall not exceed \$15,000;
- b) at a special Board of Directors meeting, within fifteen days from the annual meeting of the membership, select a President, one or more Vice-Presidents, a Secretary and a Treasurer;
- c) have the power to appoint such other officers and agents and to hire such employees as may be necessary for the carrying out of the purposes of this Association;
- d) appoint or authorize the President to appoint from their own number or from members of the Association such committees as not stipulated by these By-Laws as the Board deems necessary to carry on the affairs of the Association, and it shall define the powers and duties thereof. Said committees shall hold office during the pleasure of the Board;
- e) have such other powers as are set forth in these By-Laws or as are necessary and incidental in carrying out the general affairs of the Association and the Declaration of Restrictions, except as herein prohibited.

Section 2 The Board Composition

The Board of Directors shall consist of one Director representing each of the following fifteen subdivisions:

Cherry Park	Greenbriar	Lakeview
Crystal Lake	Highland Green	Maquago Hills
Fairway Hills	Highland Hills	Plaza
Grand Point	Indian Hills	Royal Shores
Grand View	Laguana Park	Westdale

Section 3 Directors

1. Requirements of a Directorship

- a) A Director shall be a property owner in the subdivision to be represented. However, if there are no nominations from the said subdivision, the Directorship shall be opened to the general membership for a one year term.
- b) A Director shall be a member in good standing as set forth under these By-Laws.
- c) Members on the Board of Directors shall be restricted to only one member of an immediate family.
- d) A Director shall have reached the age of majority before the annual meeting in which he seeks office.
- e) Membership on the Board of Directors shall be limited to only one member or associate of any corporation, company, agency, business or other commercial enterprise or organization which has, is, or may be likely to be engaged in, involved with or doing business with the Association or is deemed to be involved with the Association or transaction of business involving Association properties.

2. Nomination and Election of Directors

a) Nomination

The Directors shall appoint a nominating committee which shall place in nomination for Directors at least as many names as there are nominees to be elected at the annual meeting. The committee shall be composed of members of the Association in good standing. The nominated slate shall not be proposed to the general membership prior to the annual meeting.

Members of the Association in good standing may nominate other candidates for Directors from the floor.

b) Election

The Directors shall be elected to a three year term, unless otherwise specified in these By-Laws, by the general membership at the annual meeting. Only members in good standing may cast a vote. The Directors shall be elected in three rotating groups as follows:

Elected in 1969 and every three years thereafter:

Grand Point, Grand View, Cherry Park, Fairway Hills and Highland Hills.

Elected in 1970 and every three years thereafter:

Crystal Lake, Highland Green, Lakeview, Plaza and Westdale.

Elected in 1971 and every three years thereafter:

Greenbriar, Indian Hills, Laguana Park, Maquago Hills and Royal Shores.

3. Resignation or Vacancy

A Director may resign at any time subject to his continuance in office until his successor not only be elected and qualified but shall actually undertake the duties of his office. Resignation shall be in writing.

Upon receipt of a resignation or vacancy (due to illness or death), the remaining members of the Board of Directors may elect a successor to fill the vacancy until the next annual meeting, at which time a successor shall be elected by the general membership to fill the remaining portion of the vacated term.

4. Removal of a Director

Misfeasance, non-feasance, neglect or other inattention to or incompetence in the performance of duty on the part of a Director shall be grounds for his removal as such. Charges shall be entertained in writing to the Board of Directors and signed by not less than eight members in good standing of the Association. The Board shall then, upon due notice to him against whom the charges are preferred, conduct a special board meeting duly called for the purpose of disposing of the charges. At such meeting the accused shall have full and ample opportunity to be heard, and the final status of the accused determined by a vote of the Board of Directors, whereby a two-thirds vote of the Directors is necessary for removal of the Director. (Note: only elected Board members may participate in this meeting.)

The Director, if removed, may appeal to the general assembly by presenting to the Board a written request for appeal at least forty-five days in advance of the next annual meeting. However, the Director in this instance shall be suspended from participating as a Director until disposition of the charges have been made by the general assembly and the Board may at its discretion, name a replacement for the suspended Director.

5. Substitute Director

Members of the Board who are unable to attend a regularly scheduled meeting should send as representative, another association member in good standing from the same subdivision to the meeting, if available.

6. Director Attendance

Directors will not be allowed to miss more than three consecutive meetings nor more than a total of five regular meetings per year.

7. Undertaking the Duties of the Directorship

The newly elected Director shall be installed into office as the last order of business of the September meeting of the Board, except the newly elected Director shall be allowed to vote for the Officers of the Board of Directors, in place of the Director they are replacing. No other duties or responsibilities shall be held by the new Director until he is installed in office.

Section 4 Conduct of Business

1. Meeting

The Board of Directors shall meet to conduct the business of the Association on the fourth Friday of every month, unless otherwise agreed upon by the Board. The presiding officer shall set the time and place of the meeting.

2. Quorum

A quorum of nine members of the Board of Directors is necessary for the transaction of any business.

3. Presiding Officer

The President shall chair the meeting. In the event the President is incapable of chairing the meeting, the following order of precedence shall be used for determining a chairman protem: First Vice-President, Second Vice-President.

4. Rules of Order

Roberts rules of order shall be used as a guideline for the conduct of business.

5. Association Member Participation at the Board Meeting

A visitor to the Board meeting may or may not be heard at the pleasure of the Board.

ARTICLE VII

Membership Meetings

Section 1 Annual Meeting

a) The regular annual meeting of the Association shall be held on the third Saturday of June at 2:30 pm in the State of Michigan at such time and place as the Board of Directors may determine.

b) Thirty days notice of the annual meeting of the members shall be given to each member by mail, addressed to his last known address as recorded with the Association.

c) If for any reason, the annual meeting of the members shall not be held on the day hereinbefore designated, for lack of a quorum or otherwise, such meeting may be called and held as a special meeting and proceedings may be held thereat as at an annual meeting, provided, however, that the notice of such meeting shall be the same as required for the annual meeting, not less than thirty days notice.

Section 2 Notice

a) The notice shall set out in reasonable detail the business to be brought before the meeting and each meeting shall be limited to the items set out in the notice. Members present may make suggestions covering items which they feel should be brought before the membership. If any such suggestions are approved by proper resolution of those members present, it shall be the duty of the Secretary to present such resolutions to the Board of Directors for resolution at the next regular or special meeting.

b) It shall further be the duty of the Secretary to include with the notice of any regular or special membership meetings such suggestions or requests as may be properly presented in writing and endorsed by fifty or more members in good standing, providing such requests are received at least forty-five days prior to the meeting date.

Section 3 Special Meetings

a) Special meetings of the Association may be called by the President, Secretary or the Board of Directors, or shall be called by the President whenever requested in writing by fifty or more members in good standing. Such request shall clearly state the purpose for which the meeting is to be called and such meeting shall be called by the President, providing said purpose is germane to the purpose for which this Association is organized and for the improvement thereof; otherwise the Board of Directors, by a two-thirds vote, may refuse to call said meeting. Provided, however, that when special meetings are called pursuant to a petition of members, the Board of Directors may authorize a submission of additional matters for the consideration of the members at such meetings.

b) At least thirty days notice of any special meeting shall be given to each member by mail, at his last known address recorded with the Association.

Section 4 Order of Business

The order of business at the annual meeting of the members shall be as follows, provided, however, that this order of business may be changed by the Chairman or by a majority of the members present:

- a) Roll call
- b) Reading of the minutes of the previous meeting
- c) Reports of the officers
- d) Reports of the committees
- e) Election of Directors
- f) Unfinished business
- g) Stated new business (Business as called for by due notice to the membership.)
- h) Suggestions and/or resolutions by the general assembly.

Section 5 Participation at Annual or Special Meetings

a) A member must be in good standing as specified under Article IV of these By-Laws to participate in the affairs of the annual or special meetings.

b) Voting shall be by majority vote, unless otherwise specified under these By-Laws, of those members in good standing present in person at the annual or special meeting.

c) It shall be the duty of the Secretary to prepare a list of the members entitled to participate and vote at each meeting against which list all members voting shall be checked, either by the Secretary or by some individual designated by the Board of Directors.

Section 6 Quorum

The presence of fifty voters in person shall constitute a quorum for the transaction of business at the annual or special meeting.

Section 7 Presiding Officer

The President elect shall chair the annual or special meeting. In the event the President is incapable of chairing the meeting the following order of precedence shall be used for determining a chairman protem: First Vice-President, Second Vice-President.

Section 8 Rules of Order

Roberts rules of order shall be used as a guideline for conduct of business.

ARTICLE VIII

Association Officers

Section 1 Enumeration

The officers of the Association shall be a President, one or more Vice-Presidents, a Treasurer and a Secretary.

Section 2 Selection

The officers shall be elected by the Board of Directors at a special meeting, held within fifteen days of the annual meeting. A majority vote is required to be elected to office.

Section 3 Term

The term of all officers shall be for one year. The officers shall be installed as the last order of business at the September meeting.

Section 4 Resignation

An officer may resign at any time subject to his continuance in office until his successor not only be elected and qualified but shall actually undertake the duties of his office. Resignations shall be in writing.

Upon receipt of a resignation or vacancy due to death, the Board of Directors shall elect a successor to fill the vacancy for the remaining term of office.

Section 5 Removal

An officer may be removed for misfeasance, non-feasance, neglect and other inattention to or incompetence in the performance of duty. Charges may be preferred in the manner specified in Article VI, Section 3, paragraph 4 of these By-Laws by not less than ten Board members. The action of the Board shall be final.

Section 6 Duties and Responsibility

a) President

The President upon election shall be a member of the Board of Directors. He shall have general and active management of the business of the Association and shall see that all orders and resolutions of the Board are carried into effect. He shall sign all legal documents authorized for his signature by the Board of Directors. The President shall be an ex-officio member of all committees. He shall not be eligible to succeed himself for more than two consecutive terms in office. The President shall also perform such other duties as necessary and incidental to promote the common benefit of the Association and as delegated by the Board.

b) Vice-President

The Vice-President upon election shall be a member of the Board of Directors. He shall act in the place of the President in his absence or in the event the office of the President shall become vacant by death, resignation or otherwise, or due to the inability of the President to discharge the duties of his office and the Vice-President shall also perform such other duties as may be delegated by the President or the Board of Directors.

c) Secretary

The Secretary or acting Secretary shall be present at all meetings of the Board and shall keep the minutes of all meetings of the Association and the Directors and executive committee, and shall preserve in the books of the Association true minutes of the proceedings of all of such meetings. He shall give all notices required by statute, By-Law or resolution. He shall keep a record of the names and addresses of all members of the Association, the real property owned by each, of all transfers of membership and shall be custodian of the Association's seal. He shall send to the lot owners all notices as to amounts due the Association for annual and special assessments. He shall advise the Board as to all delinquencies and shall keep the Board informed regarding the properties of the Association, the liability insurance thereon and shall perform such other duties as are delegated to him by the Board of Directors or the President.

d) Treasurer

The Treasurer shall have custody and keep accounts of all money, corporate funds and securities of the Association and shall keep in books belonging to the Association full and accurate accounts of all receipts and disbursements; he shall deposit all moneys, securities and other valuable effects in the name of the Association in such depositories as may be designated for that purpose by the Board of Directors. He shall disburse the funds of the Association as may be ordered by the Board, taking proper vouchers for such disbursements, and shall render to the President and Directors at regular meetings of the Board and whenever requested by them, an account of all his transactions as Treasurer and of the financial conditions of the Association. If required by the Board, he shall deliver to the President of the Association and shall keep in force a bond in form, amount and with surety or sureties satisfactory to the Board, conditioned for faithful performance of the duties of his office and for the restoration or removal from office of all papers, books, vouchers, money and property of whatever kind in his possession or under his control belonging to the Association. He shall perform such other duties as are delegated to him by the Board of Directors.

ARTICLE IX

Committees

Section 1 Standing Committees

The standing committees are responsible for the operational affairs of the Association and shall be directed by the Board of Directors and as stipulated in these By-Laws.

1. General

a) Chairman

Appointment of the Chairmanship shall be made by the President of the Association and shall be ratified by the Board of Directors. Removal of a standing committee chairman requires a majority vote of the Board.

b) Committee members

Members shall be appointed by the Committee Chairman and shall be ratified by the Board of Directors.

c) Duration

Standing committees shall exist from the October Board meeting of one year to the October Board meeting of the following year.

2. Budget and Finance

The following duties and responsibilities of this committee shall be, but are not limited to:

a) To prepare and present to the Board of Directors a budget for the fiscal year by the February meeting.

b) To have the audit made of the financial records as required by Article V, Section 8 of these By-Laws.

c) To collect delinquent assessments in a manner approved by the Board.

d) To recommend proper contractual procedures to the Board.

e) To maintain a budgetary control system over the finances of the Association and to inform the Board if the budget is being exceeded.

f) To perform other functions as the Board so wishes.

(The Treasurer of the Association shall be a standing member of this committee, but may not be its chairman.)

3. Rules and Regulations

a) The duties and responsibilities of this committee shall be to review, update, delete and/or augment those rules and regulations that are necessary for the good and welfare of the Association and to present these rules to the Board for approval.

b) To recommend appropriate methods and actions with which these rules may be enforced.

c) To perform such other functions as the President or Board of Directors request.

4. Lake Control

The duties and responsibilities of this committee shall be, but are not limited to the following:

a) To maintain the lake levels as directed by the Board of Directors.

b) To recommend for Board approval and maintain a program for boat usage on the lakes and to prevent persons not belonging to the Association from using the lake and its properties.

c) To perform such other functions as the President or Board of Directors request.

5. Building Committee – Self-perpetuating – separate entity

The duties and responsibilities of this committee shall be the following:

a) To review and approve or disapprove all structures that are proposed by Association members for conformance to Lake LeAnn building restrictions.

b) To uphold and enforce Lake LeAnn restrictions.

c) To maintain records of all approved building plans.

d) The Building Committee shall consist of three members of the Association.

6. Maintenance Committee

The following duties and responsibilities of this committee shall be, but are not limited to the following:

a) To prepare and present to the Budget and Finance Committee a maintenance budget for the fiscal year by January 30th of each year.

b) To establish and implement a weed control program, approved by the Board, for both lakes.

c) To maintain the parks and outlots as directed by the Board.

d) To keep and maintain common Association properties in a clean and orderly condition as directed by the Board.

- e) To maintain all dams and drainage tiles owned by the Association.
- f) To perform such other functions as the President or Board of Directors request.

7. Nominating Committee

The following duties and responsibilities of this committee shall be, but are not limited to the following:

- a) Preparation of the annual slate of Directors for election at the annual meeting.
- b) To present in nomination replacement Directors as vacancies on the Board occur.
- c) To present in nomination a slate of officers at the Board meeting following the annual meeting.
- d) To perform such other functions as the President or Board of Directors request.

ARTICLE X

Miscellaneous Articles

Section 1 Amendment to the By-Laws

The Association By-Laws may be amended, altered, changed, added to or repealed by a two-thirds vote of the Association membership at any annual or special Association meeting. Proposed amendments shall be presented to the membership in accordance with Article VII of these By-Laws.

Section 2 Building "Restriction" Amendment

No recorded "Restrictions" for any subdivision may be rescinded, repealed, altered or amended by the Association *unless* so ordered by the Circuit Court for the County of Hillsdale or unless by final judgment or judicial determination such restriction is declared unlawful. Approval to petition the Circuit Court for a revision to the "Restrictions" requires a two-thirds vote of the Association membership present at any annual or special Association meeting. Proposed revisions shall be presented to the membership in accordance with Article VII of these By-Laws.

Section 3 Hunting

No Hunting is permitted on or within Lake LeAnn's subdivisions or on the waters of Lake LeAnn.

Section 4 Vehicle Parking

Parking of motor vehicles in residential districts shall be limited to passenger vehicles, and not more than one commercial vehicle of the light delivery type, not to exceed three-fourths ($\frac{3}{4}$) ton shall be permitted per dwelling unit. The parking of any other type of commercial vehicle, except for those parked on school or church property, is prohibited in a residential zone.

Section 5 Special Assessments

Special assessments may be made (above the present \$20 operating assessment), with the approval of two-thirds of the membership present at the annual or special membership meeting. All requirements of these By-Laws are to be in accord for such action to be brought before the general membership. A quorum of one hundred members in good standing is necessary at either an annual or special meeting before action on any special assessment may be voted upon.

Section 6 Renters

Persons renting or leasing property within the Lake LeAnn subdivisions are entitled to the privileges of a member only if the owner is a member in good standing and the owner has conveyed in writing to the Association his willingness to allow his privileges to be extended to the renters or leasees. No voting rights or the right to hold an Association office can be transferred to the renter or leasees.

Section 7 Boats, Rafts and Docks

All boats, rafts and docks are to be removed from all outlots before December 15th of each year. Any boats, rafts or docks remaining on the outlots after that date will be removed by the Association at the owner's expense. The removal fee shall be set by the Board of Directors. Before any boats, rafts or docks are released to the owner, all fees must be paid.

APPENDIX C

This appendix consists of a partial listing of Michigan State University Cooperative Extension personnel and affiliates whose services are available to the public and who may be of particular assistance to lake riparians or associations.

Michigan State University Cooperative Extension Service or associates whose field of expertise may apply to lake community problem solving.

Department	Address and phone number	Specialty
Entomology	Natural Science Building Michigan State University East Lansing, Michigan 48824 (517) 355-4662	<ul style="list-style-type: none"> - Insect carriers of plant diseases and pest management implementation - Pesticide residue analysis - Household and structural product insects; homeowner insect pest problems - Mosquitoes, recreational and public health entomology
Fisheries & Wildlife	Natural Resources Building Michigan State University East Lansing, Michigan 48824 (517) 355-4477	<ul style="list-style-type: none"> - Conservation education - Aquatic ecology, water pollution, fisheries management
Park & Recreation Resources	Natural Resources Building Michigan State University East Lansing, Michigan 48824 (517) 353-5190	<ul style="list-style-type: none"> - Private and public recreation policy - Recreation resource development - Tourism and commercial recreation - Park management - Environmental interpretation - Park planning
Resource Development	Natural Resources Building Michigan State University East Lansing, Michigan 48824 (517) 355-3414	<ul style="list-style-type: none"> - Watershed management, soil and water conservation - Water resource and water quality management - Community resource development - Land and water use law - Resource economics and public policy

The Michigan Department of Natural Resources and the Michigan Public Health Department also have offices which may be of some help to the riparian. The Department numbers are as follows: the Michigan Department of Natural Resources, (517) 373-2199; and the Michigan Public Health Department, (517) 373-1343.