REFLECTING ON LAKES

A GUIDE FOR WATERSHED PARTNERSHIPS

KNOW YOUR WATERSHED

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RECYCLED PAPER

WHAT MAKES YOUR LAKE SPECIAL?

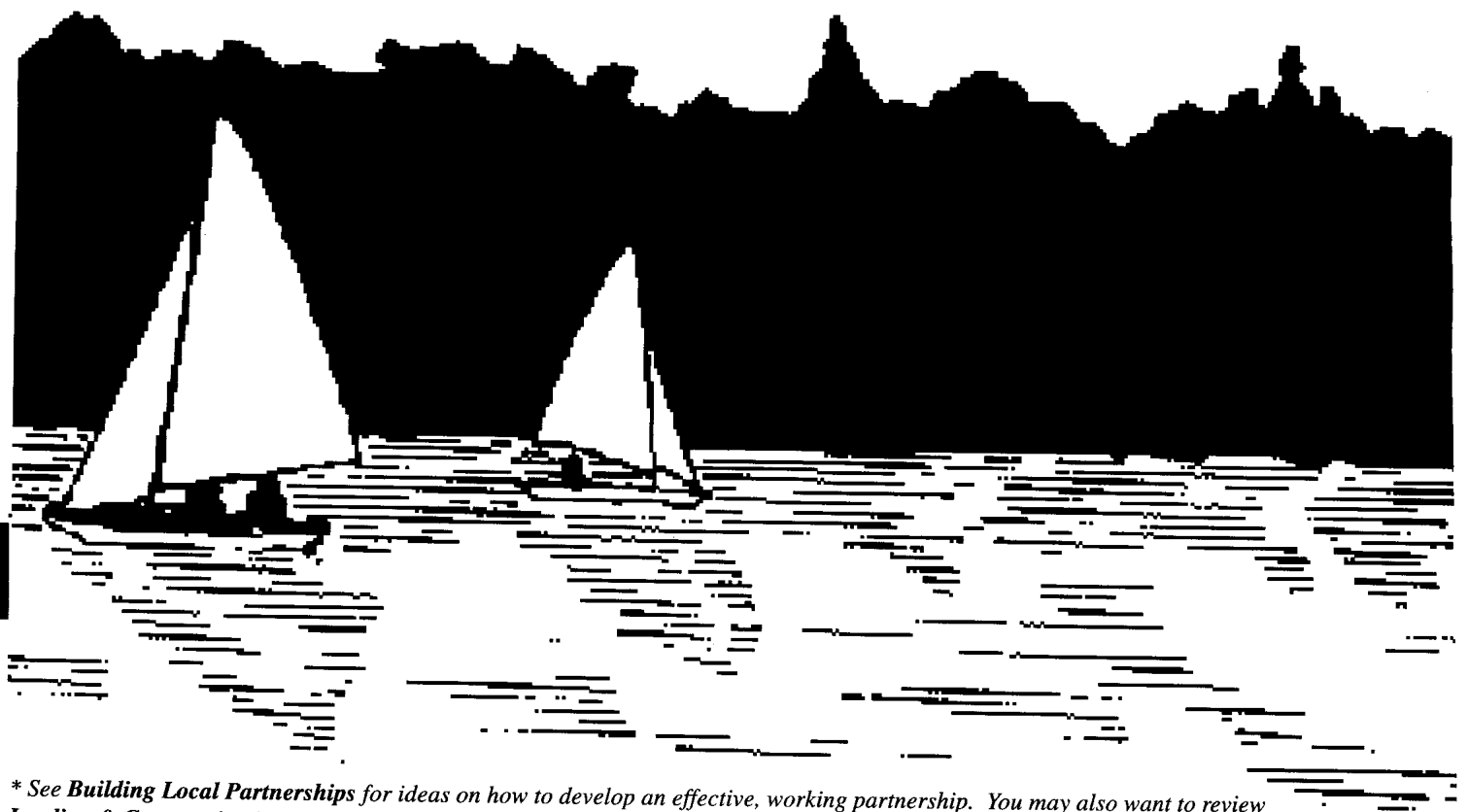
Lakes have different meanings to different people. Ask yourself and others in your partnership* if you value any of the following from your lake...

- ❒ The solitude and reflection that contrasts the hectic pace of today's world.
- ❒ Recreational value for skiing, boating or fishing.
- ❒ Drinking water to area residents.
- ❒ Flood protection for downstream residents.
- ❒ Abundant wildlife habitat.
- ❒ Irrigation water for crops, golf courses, and lawns.
- ❒ Power generation.
- ❒ Tourism (restaurants, shops, hotels, entertainment, marinas, etc.).
- ❒ Others unique to your partnership's lake.

In fact some lakes are the focal point for millions, and in some cases billions, of dollars worth of food, tourism, transportation and recreation.

HOW PROTECTING YOUR WATERSHED CAN IMPROVE YOUR LAKE.

A high quality lake, valued for water supply, recreation and aesthetic appeal, can benefit all watershed residents (and nonresidents alike) by providing a healthy place to play and/or enjoy a quiet sunset. In other words, a high quality lake improves the quality of the community's life.



** See **Building Local Partnerships** for ideas on how to develop an effective, working partnership. You may also want to review **Leading & Communicating** to help you focus on the role of the "leader".*

Watershed residents, even those located a long distance from the lake, can benefit if the lake serves as a drinking water supply. A healthier lake lowers the cost of drinking water treatment. This savings to customers -- present and future -- can be immense.

Property values, not only on the lakeshore, but throughout the watershed community, can benefit from a desirable lake.

Economic development resulting from increased tourism and industrial development can increase the tax base for watershed communities. This could improve schools, roads and police protection.

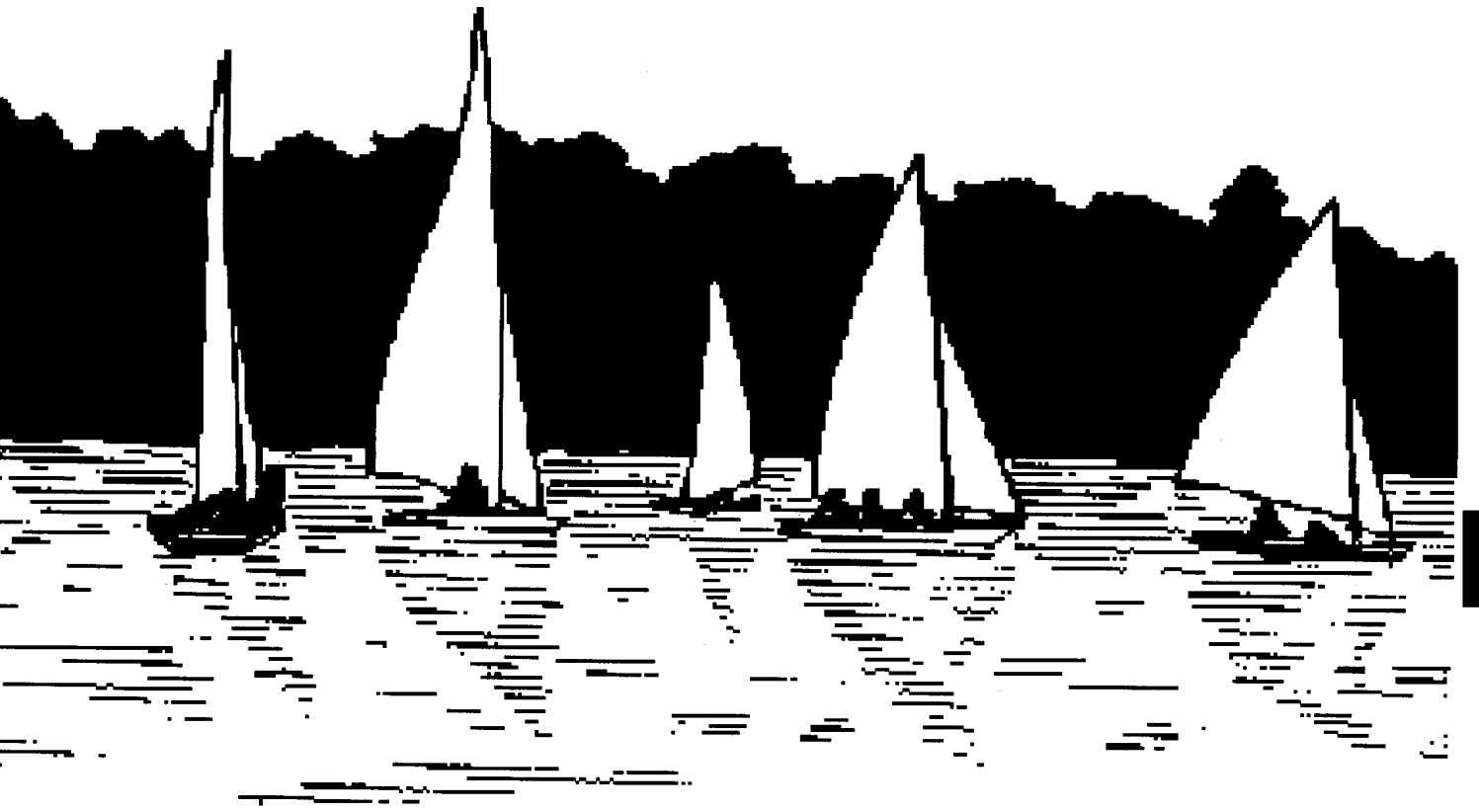
Well maintained and protected wildlife habitat areas attract birds and animals that add to the appeal of the lake and its watershed.

LET'S GET STARTED...

The good news is that if you and your partners have come to consensus on the ways lake users value your lake, you're already well on your way.

SIX KEYS TO PROTECTING LAKES

- ❒ Valuing high quality lakes
- ❒ Understanding the link between the lake and its watershed
- ❒ Understanding in-lake processes
- ❒ Recognizing and preventing threats to lake quality
- ❒ Forming partnerships with lake-watershed members
- ❒ Knowing where to go for help



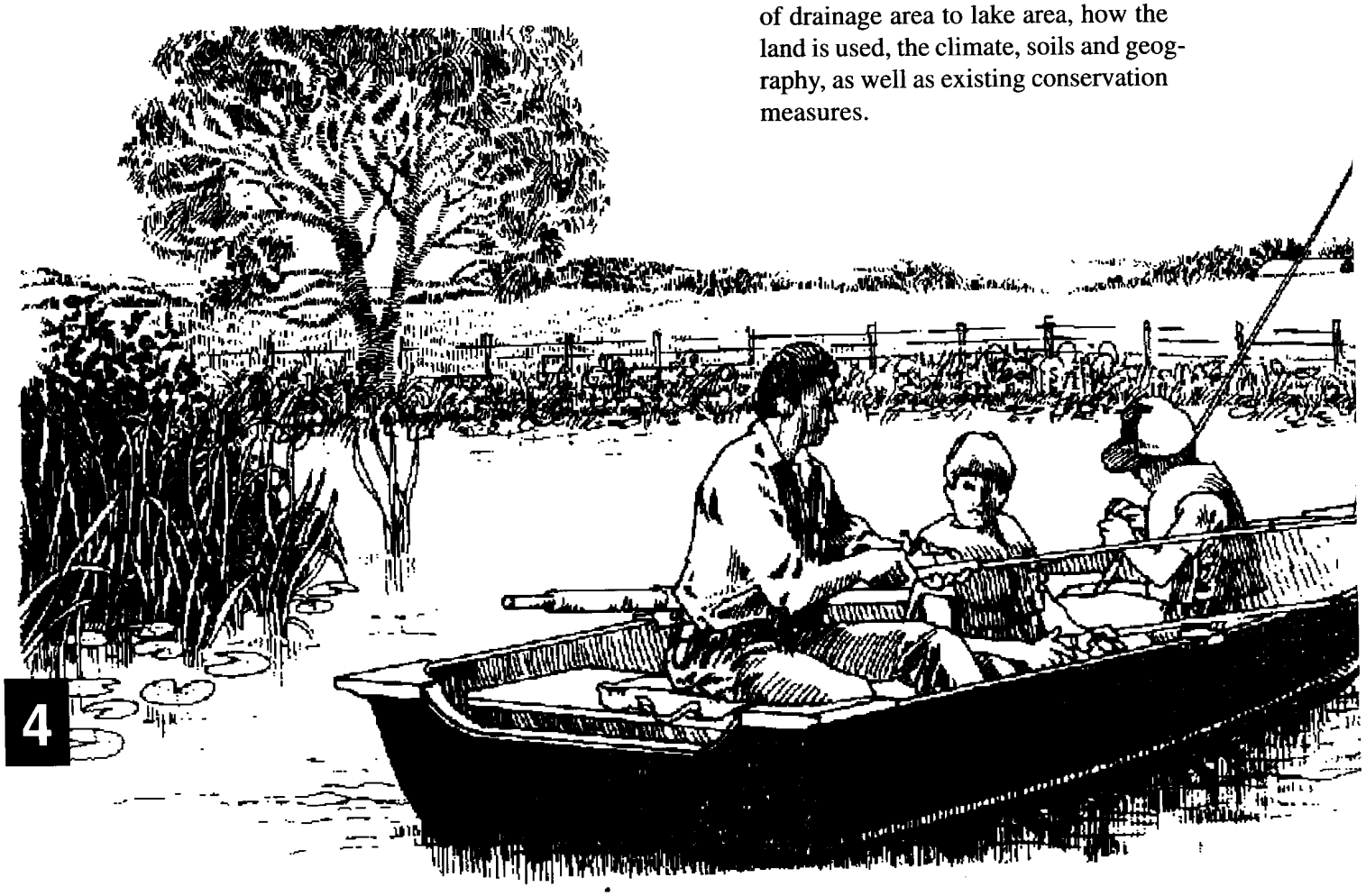
THE LAKE-WATERSHED LINK.

Your next step is to begin to understand the characteristics of your particular lake and its associated watershed. This will become the basis for developing the most appropriate and effective management strategies for achieving your group's goals. (See *Putting Together a Watershed Management Plan* for additional assistance.)

A lake is the reflection of its watershed (the land that drains -- eventually -- into it) and the everyday actions that take place on the watershed. The importance of the relationship between a lake and its watershed cannot be over emphasized when protecting, managing or restoring a lake.

The lake-watershed "system" is a functioning unit with interacting biological, physical, chemical and human components. If a lake suffers from problems such as extensive weed growth or algal scum, fish kills, or filling in with sediments, often the cause of the problem can be linked to a source or sources within the watershed.

The characteristics of lake-watershed interaction depend on a number of variables. Some variables include the ratio of drainage area to lake area, how the land is used, the climate, soils and geography, as well as existing conservation measures.

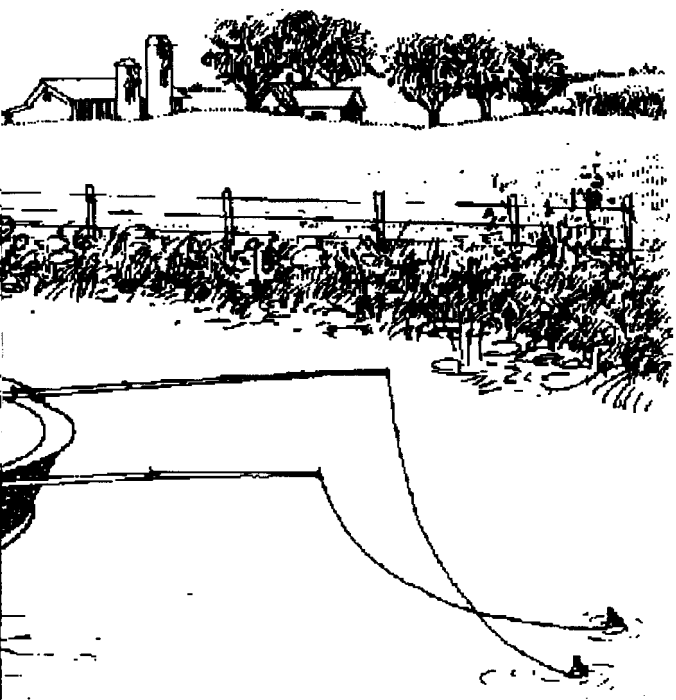


The interplay between these and other variables varies from region to region and even from lake to lake. That's why each lake and its watershed are a unique system.

Sizes and shapes. The origin of a lake often determines the size and other characteristics of the lake.

"Natural" lakes are those that were formed by geological processes such as receding glaciers (kettle lakes), volcanoes and earthquakes, eroding limestone (solution lakes) and river activity (oxbow lakes).

"Man-made" lakes, often referred to as impoundments or reservoirs, are those that were formed by damming a drainageway, stream or river. Man-made lakes can range in size and shape from the smallest farm pond to huge "run-of the-river" reservoirs such as Lake Mead formed by the Hoover Dam or those found in the Tennessee Valley. (For simplicity we refer to both "man-made" and "natural" lakes as "lakes".)



Lake-watershed size relationship. If a lake is small relative to its watershed, the potential is greater for the lake to fill in with sediment or be affected by nutrients tied to the soil particles, than a large lake with a relatively small watershed.

Climate and soils. Lakes in areas with more rainfall and steep, erosive, nutrient-rich soils will have greater potential for algae blooms and plant growth than those in dry climates with infertile soils.

Topographic. In general, the greater the slope of the land in the lake's watershed, the greater the potential of pollutants reaching the lake.

Wetlands. Adjacent wetlands often filter out pollutants before they enter a lake, improving the water quality of the lake. Wetlands also provide habitat for plants and animals.

THE IN-LAKE ENVIRONMENT.

Understanding the relationship between the lake and its watershed is just the beginning. In order to carry out appropriate actions for lake protection, it is also important to understand key in-lake processes.

The in-lake environment is determined by a variety of factors including:

- Volume of water flow into and out of the lake, or lake hydrology,
- Hydraulic residence time,
- Lake stratification,
- Internal cycling of lake nutrients (particularly phosphorous and nitrogen),
- Lake habitat for plants and animals.

Lake Hydrology. Watershed features will have a great influence on lake hydrology. The volume of water entering the lake via precipitation, groundwater flows, surface land runoff, and streams in relation to the water exiting the lake via evaporation, uptake by plants (transpiration), groundwater seepage, and surface streams will determine the concentration of nutrients, sediments and other potential pollutants within the lake.

Hydraulic Residence Time. The average period of time required to completely renew a lake's water volume is called the hydraulic residence time. As an example, if the lake volume is relatively small and the flow of water is relatively high, the hydraulic residence time will be short. This can cause any nutrients -- which may lead to algal blooms -- to be quickly washed out of the lake. On the other hand if the lake has a long hydraulic residence time, algae have more of a chance to grow, bloom, and flourish given adequate nutrient input and sunlight.

Lake Stratification. In most lakes, seasonal differences in temperature between the air and water can cause the water to "turnover," or mix from top to bottom. In other lakes, turnover can be

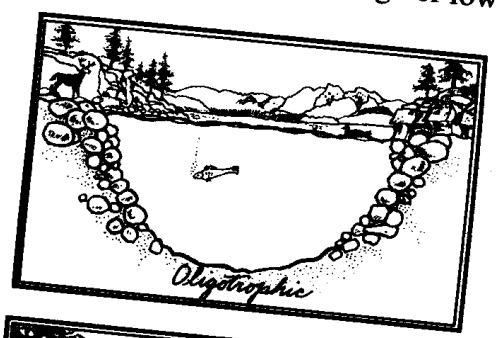
caused by wind mixing the lake. The significance of this phenomenon is that plant nutrients -- commonly stored in sediment on the lake bottom -- can be stirred up and become fertile water for algae and aquatic plant growth.

Internal Cycling. Nutrients can also "cycle" in a lake when a lack of oxygen at the bottom creates conditions that allow phosphorus to be released from the sediment. This can stimulate algae and aquatic plant growth.

Lake Habitat. Lakes provide important habitat for many plants, animals, fish and waterfowl. Many of these species are dependent upon the lake to complete their life cycles. Lakes are often viewed only as places of recreation for many people, but to wildlife and fish, lakes are essential for their survival.

LAKE PRODUCTIVITY STAGES.

In-lake factors combined with the lake-watershed relationship, determine how "productive" a lake will be. The biological productivity of a lake is based on the availability of plant nutrients and is referred to as the lakes "trophic" condition. Extremely high or low productivity usually limits aquatic life. High productivity leads to lots of algae and other aquatic plants. Low productivity leads to very little aquatic life.



The trophic condition of lakes ranges from the least productive (oligotrophic) to moderately productive (mesotrophic) to highly productive (eutrophic). Hypereutrophic lakes are the most productive of all.

The process of moving from an oligotrophic state to an eutrophic state, is a natural process that can take thousands of years, as sediment from the watershed carries nutrients slowly into the lake.

However, where human activity has affected a watershed, lake productivity can dramatically increase over a relatively shorter period of time. This type of eutrophication--as a result of watershed disturbance by humans -- is known as "cultural" eutrophication.

WHAT THREATENS LAKES?

In addition to understanding how to make your lake-watershed healthier it is important to understand how activities on the watershed and in or around the lake can threaten the lake's health.

MAJOR THREATS TO LAKES

The major threats to lake water quality in the United States are:

An overabundance of nutrients. This leads to algal blooms and excessive plant growth which ultimately deplete oxygen supplies for fish and some other aquatic life.

Organic wastes. When organic wastes assimilate they cause a lack of oxygen needed for fish and some other aquatic life to survive.

An overabundance of sediment. This "runoff" soil can fill lakes and destroy habitat for plants and animals, as well as clog fish gills and smother fish eggs.

Metals and other organic chemicals such as polychlorinated biphenyls (PCBs), contaminating fish and shellfish.

Rapid raising and lowering of water levels for power generation, irrigation and other uses.

POLLUTION SOURCES

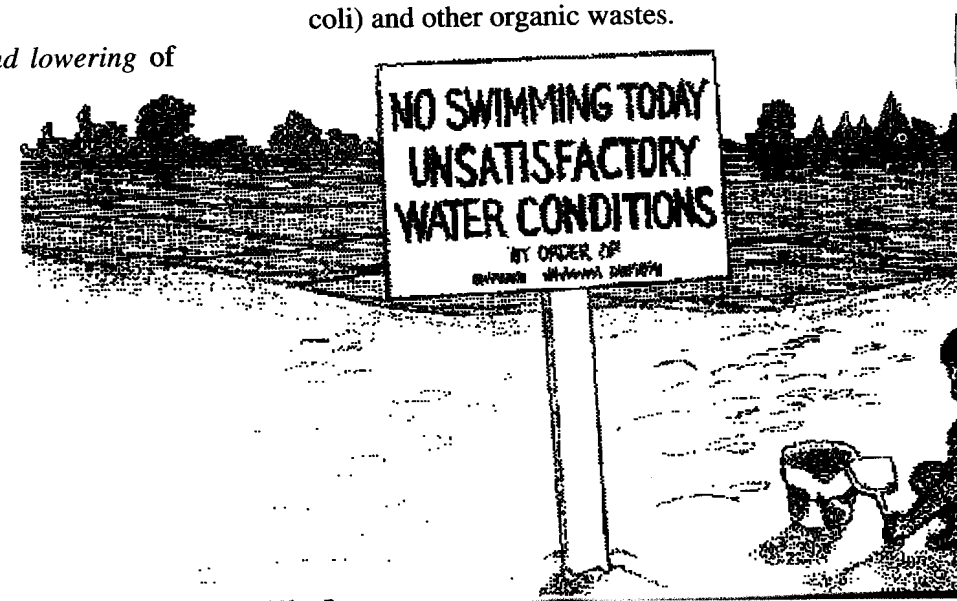
Although in-lake sources of pollutants like sediment and nutrients can exist, the primary pollutant sources can be found in the watershed. Some include:

Agricultural management practices (activities) can lead to pollutants like nitrogen, phosphorous, sediment, pesticides and organic matter entering the lake.

Runoff from pavement and lawns in urban areas picks up oil, metals, bacteria (including E-coli), nutrients, and transports them through the storm sewer system.

Municipal sewage treatment plants in some cases can combine sewage with stormwater in what is called a Combined Sewer Overflow (CSOs). This can lead to nutrients, organic wastes, toxic household substances and other types of pollution.

Septic systems also contribute to lake pollution when they leak into the shallow groundwater. This can also increase the load of nutrients, bacteria (including E-coli) and other organic wastes.



Destruction of shoreline vegetation by construction, wave action, and other activities, also increases chances of degrading lake quality as well as plant and animal habitat.

Atmospheric deposition, air pollution that is carried to the ground via rain, is also a major threat in some areas of the country. Some types are referred to as acid rain.

Urbanization of agricultural or forested land increases hard surfaces like roads, parking lots, and rooftops. This increases the velocity of runoff reaching the lake and causes streambank erosion, turbidity, and degraded wildlife habitats. Urban runoff also carries oil, bacteria, nutrients, sediment, and metals into lakes.

ACTIVITIES THAT THREATEN LAKES.

Today many of the traditional polluting activities such as building and road construction, commercial farming, and factory discharges have environmental requirements they must meet. That's why it's the smaller scale activities that can be the most detrimental to a lake's health. For example:

Household Activities:

Leaking septic systems can contribute to nutrients and bacteria getting into nearby waterways, streams and, eventually, the lake. Some nutrients can also be carried through the shallow aquifer and reach spring-fed lakes. Either way, it can prevent the lake's use for drinking water or recreational activites. It can also cause overenrichment and algae blooms.

Using detergents containing phosphorous to wash boats, cars, and pets in locations where the waste water can run off into the lake adds unneeded nutrients.

Overfertilizing your lawn or fertilizing at the lakeshore can also contribute excess nutrients to the lake...potentially affecting drinking water and recreational activities. (Remember a green lawn creates a green lake.)

Clearing vegetation near and on the lake shore removes a natural buffering system which can help absorb nutrients and sediment runoff.

Boating Activities:

Using powerful outboard motors in shallow areas can churn up nutrient laden sediments to support algae growth and destroy aquatic life.

Poorly maintained powerboat engines can leak oil and grease into the lake.

Farm Activities:

"Clean" cropping practices that leave the fields clean in the fall also leave soil vulnerable to snow, wind and rain. Nutrients and some herbicides attach to the soil particle and are carried with it, ultimately, to the lake.

Mixing herbicides near wells or tile lines can leak chemicals into the shallow groundwater which, ultimately, resurfaces into springs or streams which carry it into the lake.

Treating manure like a waste rather than a fertilizer source can contribute to nutrients and bacteria getting into nearby waterways, streams and, eventually, the lake. Some nutrients can also be carried through the shallow aquifer and reach spring-fed lakes. Either way, it can prevent the lake's use for drinking water or recreational closings. It can also cause overenrichment and algae blooms.

Although it may seem that one house, one boat, or one farm alone cannot harm a lake, the cumulative impacts of hundreds of boats, homes, and farms can add up to poor lake quality. Every action you take affects the lake!

WHAT YOU CAN DO.

Because lakes and their watersheds are interrelated, watershed management is essential for achieving and maintaining a healthy lake. In many cases, in-lake treatments (like algae treatment) may also be required to achieve a desirable and balanced system.

Form a partnership between citizens and government agencies, as well as anyone else with a vested interest in the lake and its watershed. Be sure to involve all key players in the effort at the initial planning stages and continue to seek active participation through implementation. This helps identify and avert future conflicts and is often the key to success.

Remember, conflict can be healthy. Although it is not always possible to avoid conflict in partnerships that involve groups with seemingly divergent interests, finding and building on common goals -- a healthy, balanced lake and watershed -- will help overcome differences.*

Clear communication and strong leadership will also help assure a successful lake-watershed partnership.*

WHAT ABOUT EXISTING LAKE ASSOCIATIONS?

Lake associations are voluntary organizations that usually are comprised of lakeshore property owners. Often these organizations find participation and limited financial commitment from those who do not reside on the lakeshore, but who may have an impact on the lake quality. This is why it's very important to have a strong lake-watershed partnership.

ANY OTHER ADVANTAGES?

Other advantages of voluntary organizations include the ability to:

- ❒ Detect and begin to address potential stresses to the lake system before a government representative does.
- ❒ Represent members' interest to state and local governments.
- ❒ Educate decision makers regarding land use in the watershed and protection of the lake.
- ❒ Act as an early warning signal for potential threats to the lake.
- ❒ Undertake projects to help protect the lake.
- ❒ Educate newcomers and visitors about the value of practicing wise use of the lake and surrounding watershed.

SET A REALISTIC GOAL.

As your group becomes more familiar with the lake, its link with the watershed, and the desires of those who use the lake and live in the watershed; you and the group should re-evaluate the goals.

Let's assume your lake is naturally highly productive due to a combination of factors that occur even without human presence, such as a warm climate, shallow lake, and highly productive soils. In this situation, a plan that has a goal of returning the lake to an oligotrophic, pristine clear water condition would be impossible.

Setting realistic goals based on existing conditions in addition to social and economic considerations is a key to success.

** See **Conflict Management** to better understand how conflict can be healthy. You may also want to review **Leading & Communicating** to brush up on your communication skills.*

SOURCES OF INFORMATION.

This guide is one of a series of publications developed and distributed by the Conservation Technology Information Center pertaining to watersheds and their local, voluntary management. Please call 317-494-9555 for the latest listing. A small fee is charged to cover handling and postage of shipments. The center does not copyright these guides so they may be used and copied freely.

The author acknowledges the following sources of information that were used in developing this guide. You may also find these publications helpful.

Beyond the Estuary, The Importance of Upstream Wetlands in Estuarine Processes; July, 1990, U. S. Environmental Protection Agency, Office of Water; 20W-5003.

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National Water Quality Inventory, 1992 Report to Congress; March 1994. EPA 841-R-94-001. U. S. Environmental Protection Agency, Office of Water, 401 M St. SW, Washington, D.C., 20460.

WHERE TO GO FOR HELP

Contact your local or state water quality agency, state lake association, local natural resource agency, local conservation district or local extension office for assistance.

About this guide....

This guide is one of a series for people who want to organize a local partnership to protect their watershed. This series will not solve all your problems. They were designed to provide guidance for going through the process of building a voluntary partnership, developing a watershed management plan and implementing that plan.

Because the characteristics of each watershed are unique, you may wish to select and use the portions of this guide that are applicable to your particular situation.

Although the series is written for watershed-based planning areas, the ideas and process can be used for developing other types of plans (such as wildlife areas) to match the concerns of the partnership.

Regardless of the area, remember a long-term, integrated perspective — based on a systematic, scientific assessment — can be used to address more than one concern at a time.

Special thanks...

Special thanks to Susan Kaynor, Environmental Scientist, Coconut Grove, Florida, who dedicated long hours to writing this guide. Without her help this guide would not be possible.

Special thanks also go to the professionals (listed to the right) who carefully reviewed this guide. Their experience and thoughtful guidance enriched it. Their time and insight is deeply appreciated.

The University of Wisconsin Cooperative Extension Service provided the illustrations used throughout this guide. Watershed partnerships can obtain a copy of the full set of illustrations (clip art) by calling 608-262-0020. Thank you.

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The Know Your Watershed campaign is coordinated by the Conservation Technology Information Center (CTIC), a nonprofit public/private partnership dedicated to the advancement of environmentally beneficial and economically viable natural resource systems. It provides information and data about agricultural and natural resource management systems, practices and technologies. The center was established in 1982 under the charter of the National Association of Conservation Districts.

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