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CARING FOR OUR LAKES
A Management Guide

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Lakes are important for water supply and recreation, and in some cases, for power generation and flood control. They are also appealing places on which to build homes and cabins. Yet the existence of communities near water, and recreational uses of water, can pose a real threat to the quality of that water. If you live on or near a lake or river, the ways in which you manage your land may directly affect the quality of the nearby water. If you fish, ski, swim or pleasure boat on a lake or stream, or camp near these water sources, the way you handle your wastes can affect the quality of the water.

People wonder why weeds grow and lakes turn green with algae. They seldom realize that what they do on land may be the cause. Most water pollution begins on land. Land management is an integral part of water management. *The worst place to manage a lake is in the lake itself.*

What is a Lake?

Whether naturally occurring or created by humans or animals damming a stream, a lake is much more than just a body of water. It is an **ecosystem**, a community of interaction among animals, plants, microorganisms, and the physical environment in which they live.

Lake Quality - What Does it Mean?

A lake has physical, chemical and biological properties that relate to its quality. These properties are affected by almost everything in and around the lake because they make up an integral part of the total ecosystem. A very clear lake is not necessarily one of high quality. Certain physical and chemical conditions are necessary for biological activity. Such things as light, temperature, wind, precipitation and nutrients affect both plant and animal production in a lake and the lake quality

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itself. A certain level of dissolved oxygen is one of the most critical conditions for fish survival. Sewage or other organic wastes can deplete dissolved oxygen and cause fish to die. Deposition that affects lake quality must come from either the lake's watershed, shoreline, atmosphere or from direct discharges to the lake itself.

What is a Watershed?

The surrounding land area that drains into a particular lake is that lake's **watershed**. Most lake water is constantly replenished by natural rainfall and runoff that drains over and through the surface layers of the earth. Water which percolates into the ground and flows back to the land surface at lower elevations, provides the base flow to many streams and lakes during low rainfall periods.

When well managed, the surrounding watershed and shoreline of a body of water can protect and enhance the quality of that water. When improperly managed, that same watershed and shoreline can decrease the level of water quality by allowing the unrestricted flow of sediment, nutrients, and wastes from the land into the water.

How do Watershed Activities Affect Lakes?

What happens in a watershed is critical to the ecosystem of any lake. A road, a housing development, a drainage project, a forest fire, sewage or other waste disposal, acid rain or acid mine drainage, or just about anything that disturbs a watershed or impacts the quality of the water draining from the watershed can alter the delicate balance of a lake ecosystem.

Lakes are constantly undergoing evolutionary change, reflecting the changes that occur in their watersheds. Some changes occur relatively fast, as from season to season or year to year, while other changes may occur over decades or even hundreds or thousands of years. Most lakes are destined to fill in with sand, silt and topsoil washed in by floods and streams. This usually takes thousands of years, but human activities can sometimes accelerate it to a single generation.

Short-term events, like a single **algal bloom** (an unusual or excessive abundance of algae), may not signal a long-term problem. On the other hand, changes in land use or other activities in the watershed may not produce immediate visible effects on the lake. It may take a decade or more, for example, for changes in agricultural practices or urbanization to result in weed problems or fish kills.

Effects of land development. The cumulative effect of paving, filling and compacting the soil over extensive areas in a watershed can be enormous. The balance between stormwater runoff and natural absorption changes. If the soil is compacted or paved, less water can infiltrate and the total quantity of runoff increases: more water runs off the land and at a much faster rate. Streams experience more rapid flows and higher volumes; banks erode as the channel changes its contours to accommodate the increased velocity and amounts. Peak flooding may double, but because replacement of groundwater has been reduced, streams may actually cease to flow during dry periods. This can disrupt all downstream environments.

Land development seriously accelerates erosion, and erosion rates from construction sites may be as great as 40,000 times that of undeveloped land. The greater velocity and turbulence of runoff from non-vegetated land further increases water's ability to erode and transport sediment. When the water slows and the solids settle, the resulting deposition begins a treacherous pattern of biological destruction. Damaging effects of sediment include the following:

- it clogs the gills of fish
- covers fish spawning areas
- blocks light transmission needed for photosynthesis in lake waters
- increases lake water temperatures
- reduces depth, storage capacity and use of channels, lakes and reservoirs, and
- serves as a transport mechanism for other pollutants.

How do Shoreline Activities Affect Lakes?

The shoreline is the most sensitive and unstable zone of a lake or stream. Shorelines provide a rich meeting ground for plants and animals that will feed and breed there. The shoreline is subject to flooding, chemical contamination, erosion, and agitation from wind, water and ice. The shoreline is the lake's first line of defense against man-made pollution.

Altering the slope, other soil conditions or vegetation along a shoreline may drastically affect a lake. Heavy development and improper land use along shorelines can contribute to deteriorating water quality through accelerated runoff, erosion, stormwater and sewage drainage. Improper disposal of solid and liquid wastes along shorelines can lead to direct chemical and biological contamination of the water.

As with watersheds, stable shorelines protect water quality primarily by absorbing nutrients and preventing soil movement. Stable watersheds and stable shorelines depend on sound land management practices.

How do Direct Discharges Affect Lakes?

Lakes have no defense against direct disposal of solid or liquid wastes or inadvertent discharge of other pollutants directly into them. Lake impact may be minor or extremely severe, depending on the nature of the pollutant and level of contamination. The effects of some pollutants are reduced through the natural processes of dilution and decomposition, while others are not. Even so, this takes time. Some biodegradable wastes, although very unsightly, may decompose in a few weeks, months or even years, while others such as metals, glass, and plastics take much longer.

In general, lake discharges may be physical, chemical or biological in nature. Unfortunately, all three types of pollution may go unnoticed or be ignored until a lake has been severely damaged.

Recreational areas in many lakes have been closed to swimming and other water contact sports because of broken glass, high bacteria counts from human sewage or animal wastes, reduced depth from sediment, or because of pollution from toxic chemicals. Accelerated aquatic weed growth, an indirect effect of pollution, has also led to beaches and other recreational areas being closed to boating and water contact sports.

What Can go Wrong with Lakes?

Eutrophication is the process by which lakes are fertilized with nutrients (chemicals absorbed and used by plants for growth). It is a natural aging process, but human activities can speed it up. Aquatic weeds from nutrient enrichment may reduce water contact and boating sports. Although some water plants are essential for fishes and other animal species, too much and too rapid a growth cycle can lead to major problems in lakes. Nutrients such as nitrogen, phosphorus and potassium wash into lakes in runoff water or by soil erosion to fertilize lakes, allowing algae and weeds to grow. Most aquatic plants are digested by other organisms or die and decompose with some remains going to the bottom as muck. Under natural conditions the lake turns into a marsh or bog. This normally takes hundreds or thousands of years.

Human activities can enhance this nutrient enrichment, thus making a lake "old" before its time. Nutrients washed from agricultural areas, stormwater runoff from urban areas, municipal and industrial wastewater, runoff from construction sites, and even recreational activities, contribute to accelerated eutrophication.

Closely associated with eutrophication is **sedimentation**, another natural process of aging for a lake. Wind and water transport soil material from the surrounding watershed down into a lake. Soil erosion from raindrop impact and sediment movement in stormwater runoff does most of the damage in the humid Southeast. As this sediment settles to the bottom, the lake becomes increasingly shallow. This allows light to reach the bottom where nutrients are available, and nuisance weeds begin to grow. Sedimentation is greatly accelerated by human activities that leave the soil exposed without vegetation for extended periods.

Excess levels of **toxic substances** from industrial and municipal point source discharges, urban stormwater runoff, agricultural stormwater runoff, and even domestic sites in some areas, can cause pollution problems in lakes. Toxic contamination may be dramatic--such as fish kills that eliminate all or part of a lake's fish population. Less obvious impacts may include decreased reproduction or slower growth rates for certain fishes.

One particularly dangerous impact of synthetic chemicals is the possible build-up or **bioaccumulation** of toxic substances in fish flesh. The toxic effect may be passed on to humans eating the fish.

How do You Care for a Lake?

Taking care of a lake involves at least three somewhat related but separate components--**lake stewardship**, **lake management**, and **lake restoration** or corrective actions, when needed. If good stewardship and management practices are followed, corrective actions may not be necessary.

Lake stewardship. Lake stewardship deals with human attitudes, and thus, people's willingness to accept and consider that what they do in the water, around the shoreline, and throughout the watershed can have negative impacts on a lake. Good stewardship by the individual citizen, whether a lake homeowner, land manager or homeowner in the lake watershed, or simply a lake user, can do much to care for a lake.

As an individual, you can minimize polluted runoff and properly dispose of waste products so that they do not contaminate the lake. Some of the most important individual actions deal with siting houses and other facilities, waterfront disturbance, yard care and maintenance, and septic system maintenance. Some common guidelines to follow are listed below:

- Don't let your house or other buildings intrude on the lake.
- Don't clear all natural vegetation between the house and lake that filters sediment and nutrients out of surface runoff.
- Don't build septic systems or wells too close to a lake (get the necessary permits and follow proper standards and regulations).
- Don't depend on contractors to follow all guidelines and recommendations--some lots are not suitable for conventional septic tanks and drain-fields.
- Don't let your septic tank pollute the lake due to poor maintenance. Have it checked at least every three years.
- Use non-phosphate detergents, wash only full loads of clothes, and use water saving showers and toilets to avoid stressing your septic system.
- Do not use a garbage disposal, and keep solvents, plastics and other non-degradable products out of your septic system.
- Don't put a wide road or path down to a lake. Use curved, narrow paths or wooden steps on steep slopes.
- Don't dump sand to build your own private beach, buy a beach lot.
- Make docks and boat houses as unobtrusive as possible. Avoid structures that require much clearing, excavating, or filling.
- Don't store petroleum products or toxic chemicals on docks or in boat houses, keep them at a safe distance from lakes.
- A lawn is not essential for a lake setting. If you must have one, maintain as wide a buffer zone of natural vegetation as possible between the lawn and water's edge.

- Minimize the use of pesticides and fertilizers on lawns which can harm a lake.

- Don't burn leaves, brush or trash where the ashes can readily blow or wash into a lake.

One of the most important things an individual can do is get involved with other concerned citizens. Collective efforts will always yield greater dividends in protecting a lake.

Lake management. Lake management is generally much broader than lake stewardship. It involves the willingness to study a lake and its watershed in detail and determine how to maximize the lake's potential without degrading its quality.

Lake management can be as simple as fostering good stewardship practices among lake homeowners and lake users. Or it can include taking action to alter or prevent activities within the lake and its watershed to make a lake healthy and keep it that way. Effective lake management requires the coordinated efforts of a group of individuals in the form of a lake association, sportsman club, or some other type of conservation organization.

When concern over a lake's condition leads to a meeting of concerned citizens, the first step has been taken: formation of a lake association. An effective lake association includes not only lakeshore property owners but also people who have various other interests in the lake. There are four primary steps for a lake association to follow.

Set goals: The goals of a lake management program are set according to what the members expect the lake to be. Environmental, technical, institutional, and financial aspects of the program may have to be modified over time.

Make commitments: Financial and time commitments must be made by the association.

Get background information: Members of a lake management association need to understand the relationship of a lake to its watershed in order to make effective management decisions. Many organizations including colleges or universities, county planning and zoning offices, and state and federal agencies that deal with land and water resources can be of assistance. Local soil and water conservation districts can provide information on soils and assist in mapping the watershed boundaries.

Determine current lake status: It is very important to determine the current water quality status of the concerned lake. This will provide a baseline for assessing changes in water quality over time, and will be useful in determining the effectiveness of management practices. Some lake associations have initiated citizen lake-monitoring programs.

Corrective and preventative actions. Deteriorated lakes can be restored but the task is difficult, very expensive, and the results of restoration may not be apparent for years. For these reasons, the preventive action approach should be the top priority for lake communities. Lake deterioration can be prevented by managing the watershed and by protecting the shoreline.

The financial resources of a lake association and the willingness of its members to participate are critical considerations for lake restoration. Financial resources and statutory authority beyond that of a lake association is generally required for lake restoration. However, that authority may exists within local units of government such as a sanitary district or soil and water conservation district, or within state agencies, or within special authority to form a watershed management district.

There are also a variety of governmental units that can assist in lake restoration, to include in-lake treatment techniques and watershed techniques. Many in-lake and some watershed techniques require a permit, and in some cases, will require working with the state department of environmental management and other state or federal agencies.

Watershed Treatment

Watershed treatment is usually the key to helping a lake recover or maintain its long range vitality. Many pollutants generated in a watershed are of a nonpoint source nature, which means they do not come through a discreet conveyance as do point sources of pollution. Watershed management techniques focus on **best management practices**, commonly referred to as **BMPs**, and include **on-site** techniques and **off-site** techniques.

Common land cover or land uses in a watershed may include the following:

- roads and highways with their ditches and banks
- cleared or non-cleared rights of way
- farmland made up of cropland, pasture land and animal operations
- forest land
- grassed or brush land
- streams, stream banks and wetland areas
- urban land made up of commercial, industrial and residential areas, and
- areas under active disturbance, primarily mining and construction sites.

What happens on any of these lands in terms of disturbance and management can impact an associated lake. Many of the same soil and water conservation practices are effective in preventing or reducing pollution from rainfall runoff and stormwater transport of sediment and associated pollutants from any of these land uses.

On-site watershed BMPs for agricultural lands. These practices are designed primarily to keep soil, nutrients and pesticides on farms, where they are important production components, and out of lakes, where they are pollutants. Practices include:

- Nutrient management
- Integrated pest management
- Proper pesticide use
- Irrigation water management
- Conservation tillage
- Crop rotations
- Strip-cropping
- Filter strips
- Field borders
- Cover crops
- Contour farming
- Pasture management
- Ag waste management systems
- Runoff management systems (especially from feedlots and other areas where animals or animal wastes are concentrated)
- Grassed waterways
- Terracing
- Diversion
- Water and sediment control basins
- Livestock exclusion (fencing)
- Grade stabilization structures
- Streambank protection
- Sealing abandoned wells

- On-site sewage disposal systems

- Sinkhole protection

Information on most of these practices is available from the local soil and water conservation district office, the extension service, or the U. S. Department of Agriculture, Soil Conservation Service.

On-site watershed BMPs for forest land. Erosion and sediment discharge from forest land is associated primarily with harvesting operations. Those practices that prevent short-term erosion and sediment movement from harvested areas, harvesting roads and drag lanes, and those practices which protect streams and stream banks from deterioration during harvesting, are of primary importance. Information on forest harvesting BMPs are available from local soil and water conservation district offices, state forestry association, state forestry commission, and USDA Forest Service.

It is the conversion of forest land to other permanent uses that rapidly accelerates lake deterioration. The best way to protect a lake is to keep a major portion of its watershed in permanent forest cover, especially that land in close proximity to the lake and its major streams.

On-site watershed BMPs for urban lands. Many of the same practices that apply to fertilizer management, pesticide management and erosion control on farmland also applies to residential and recreational areas in urban environments. The practices listed here are directed at controlling pollutants in stormwater runoff from streets, parking lots and other paved areas from which leaves, chemicals, oils, sediment and nutrients are washed into lakes. Practice categories include the following:

- Detention basins such as dry or wet ponds with outlets at the bottom

- Retention devices such as infiltration basins, infiltration trenches, dry wells and porous pavement

- Vegetative controls such as basin landscaping, wetlands, grassed swales, and filter strips

- Exclusion of inappropriate discharges to storm sewers by eliminating inappropriate connections to storm drains, by cleaning storm sewers and catch basins, by street sweeping and cleaning, by controlling littering and improper waste disposal practices, by encouraging proper use and disposal of materials by homeowners, and by controlling airborne pollutants

- Erosion control on undeveloped and park land

- Land use planning and zoning regulations to limit directly connected impervious areas and encourage cluster housing, buffer strips, open space, grassed swales and other drainage in preference to gutters and piped drains, and other patterns of development to reduce the quantity of runoff from the site, and

- Measures to control leaks and spills where gasoline, oil, grease, and chemicals are used, transferred, and stored.

On-site watershed BMPs for construction projects. These practices are directed primarily at the control of erosion from land disturbed during construction, or the prevention of eroded materials from leaving the site. Where erosion and sediment control ordinances do not require an approved site plan, the most effective practice is education of architects, engineers, contractors and public works personnel about the need for practical methods of erosion control, sediment control, and site waste management and disposal.

Many standard soil and water conservation practices can be used for erosion and sediment control from construction sites. Some other recommendations include the following:

- Limiting amount of bare areas exposed to rainfall at any one time
- Use of natural and synthetic ground covers to prevent erosion on steep slopes and other very susceptible areas
- Use of sediment traps and filter fences to prevent sediment movement off site, and
- Use of detention and diversion structures to direct runoff to on-site holding areas.

Off-site watershed BMPs. These practices are designed to intercept pollutants between their origin and the lake. Some recommended practices include:

- Building sediment and debris basins
- Maintaining wetlands, and
- Re-establishing or creating new wetlands.

It is now recognized that wetlands serve not only a vital role for fish and wildlife habitat, but filter much of the sediment and nutrients from runoff waters that enter them. The capacity of a wetland or sediment basin to handle pollutants is limited, and can become ineffective in removing nutrients or fill in with sediment if overburdened. That is why on-site management practices are essential to maximize lake protection.