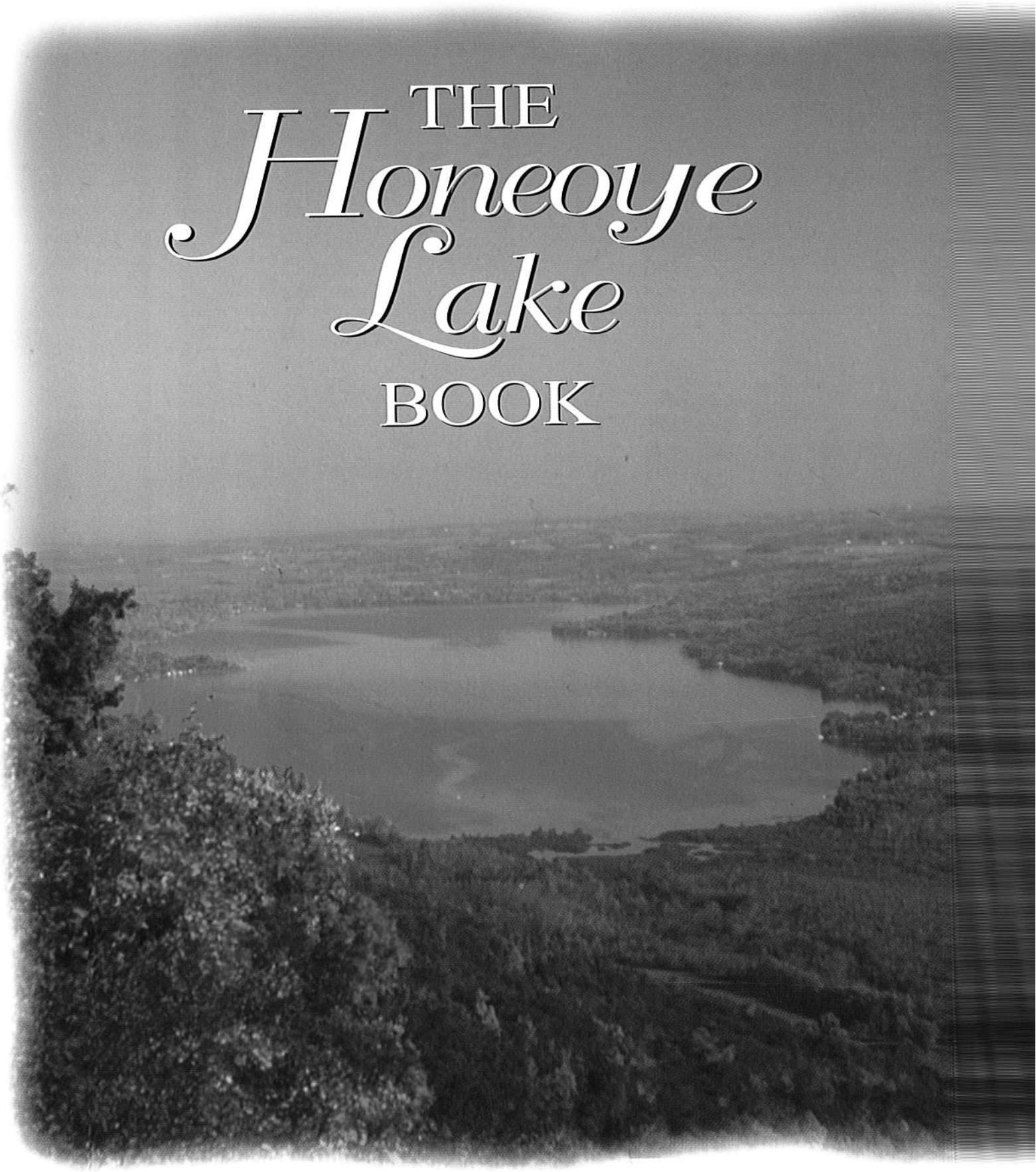
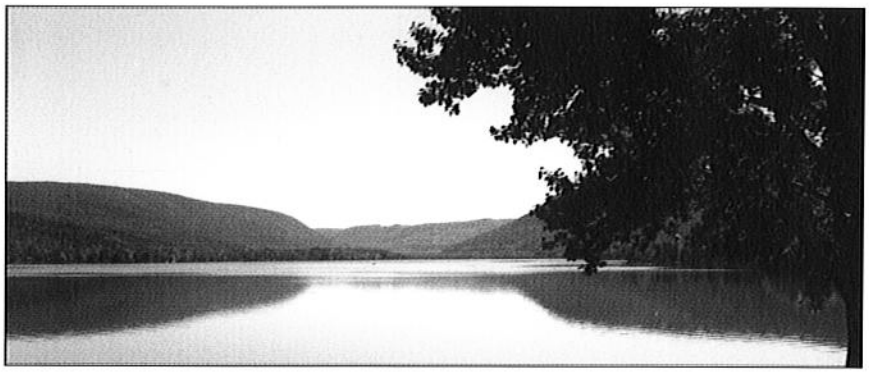


THE Honeoye Lake BOOK

• *A Guide For Protecting the Life of Our Lake* •

10 Things You Can Do To Protect Honeoye Lake

- **Wash with soap or shampoo away from water**
- **Wash pets away from water**
- **Dispose of fish heads and entrails away from water**
- **Dispose of ashes and yard wastes away from water**
- **Compost all yard wastes**
- **Minimize or eliminate fertilizer and pesticide use near the lake**
- **Reduce water usage with conservation practices and technology**
- **Inspect and pump septic tanks every 3-5 years**
- **Filter and disinfect all drinking water drawn from the lake**
- **Avoid feeding ducks, especially near swimming areas**



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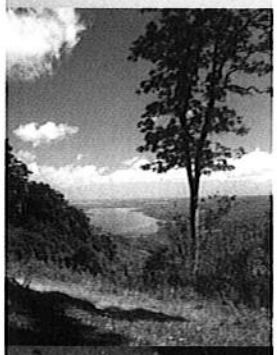
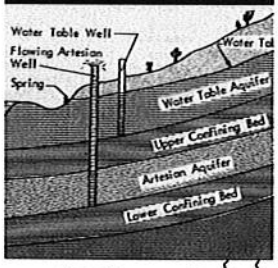
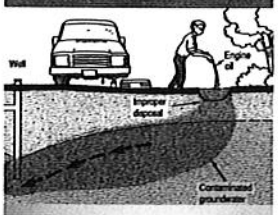
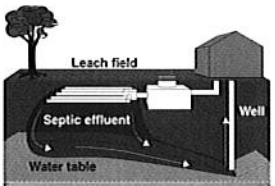
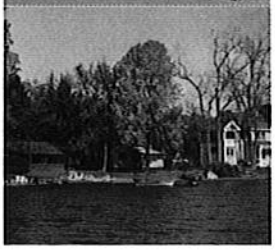
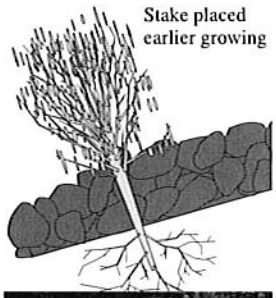






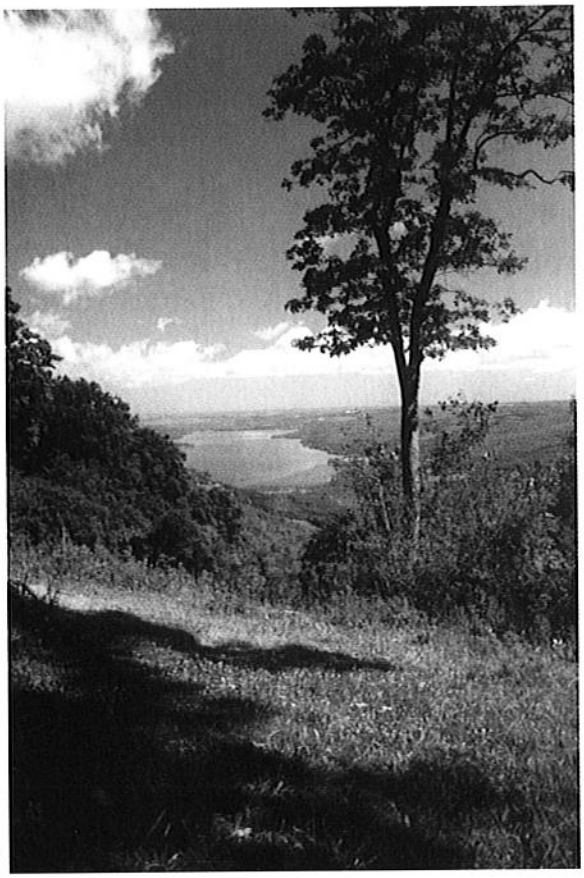






Introduction

Water is a precious resource. Without it, life could not exist. Water is used for everyday functions, including drinking, cooking, bathing and many forms of work and play. As water is so important for everyday life, it follows that we must help protect and preserve our largest water resource: Honeoye Lake and the watershed that surrounds it.



A watershed is the area of land that drains into a receiving water body. Honeoye Lake is the receiving water body for the surrounding 23526 acres. The lake is influenced by water running off the land in the watershed and therefore, by the human activities that take place in the watershed. Chemicals, bacteria and sediments are carried to the lake from the watershed. Pollutants such as these, that originate from general land use activities and have no well-defined point of entry, are referred to as non-point source pollution.

Residents in the Honeoye Lake watershed rely on the lake and groundwater for drinking water and recreation. While some regulations are in place to protect our water resources, it is largely up to individuals and organizations to pay attention to their activities and ensure that their day-to-day activities do not contribute to non-point source pollution that degrade water quality. Your use of the "best management practices", described in this book, will help protect the future and quality of Honeoye Lake.

We must also recognize that water does not abide by political boundaries. Numerous municipalities make up the Honeoye Lake watershed and it is vital that we work together to adopt policies that will help maintain water quality. One way to help protect the lake is to join or work with the Honeoye Valley Association and the Honeoye Lake Watershed Task Force, organizations devoted to protecting our lake.

Residents can also make a contribution by getting involved in local government in a number of ways — attending meetings, voicing opinions about watershed-related issues, or running for an elected office. We will be most successful in protecting our water resources through careful stewardship of our land and water.

This book is intended to provide information on what watershed residents can do to help protect water quality. It contains many "best management practices" that you can use as well as some general information about living in the Honeoye Lake watershed. It also provides a list of resources and contacts for those wishing for more information about the subjects.

Preface

Honeoye Lake is a valuable and beautiful natural resource that is enjoyed by lake residents and visitors to the area for the many activities it supports — fishing, swimming, boating, hiking, and more. All of these uses depend on maintaining the aesthetic quality of the lake, which is impacted by human activity anywhere within the watershed. In early 1998, concerned citizens recognized the need for a comprehensive watershed plan for Honeoye Lake and formed the Honeoye Lake Watershed Task Force (HLWTF). The goal of a watershed plan is to prevent any further degradation of the lake and improve water quality throughout the watershed.

It is recognized that we need to bring together all stakeholders to agree on a strategic plan of action that will require the cooperation of all the towns and their citizens. In this light, the voting members of the task force include one representative from each town in the watershed and one member from the Honeoye Valley Association. In addition, there are two permanent non-voting members: one from the Ontario County Soil and Water Conservation District and one from Finger Lakes Community College. As the need arises, the HLWTF will also rely on expertise from the New York State Department of Environmental Conservation (DEC), Ontario County Planning, Ontario County Water Resource Council, Honeoye Public Water District, Honeoye Sewer District, Honeoye Flood Control Committee and others.

We hope this publication will serve as a beneficial tool for our community in implementing the best lake management practices. You might look upon this as "good housekeeping guidelines" for this fragile resource we call Honeoye Lake.

The Honeoye Lake Book is the HLWTF's first effort to raise public awareness as to the effects of our actions on water quality. Other projects will be initiated in the near future. As good stewards, we must "listen to the lake" and do what we can to protect Honeoye Lake.

Jack Starke

Jack Starke

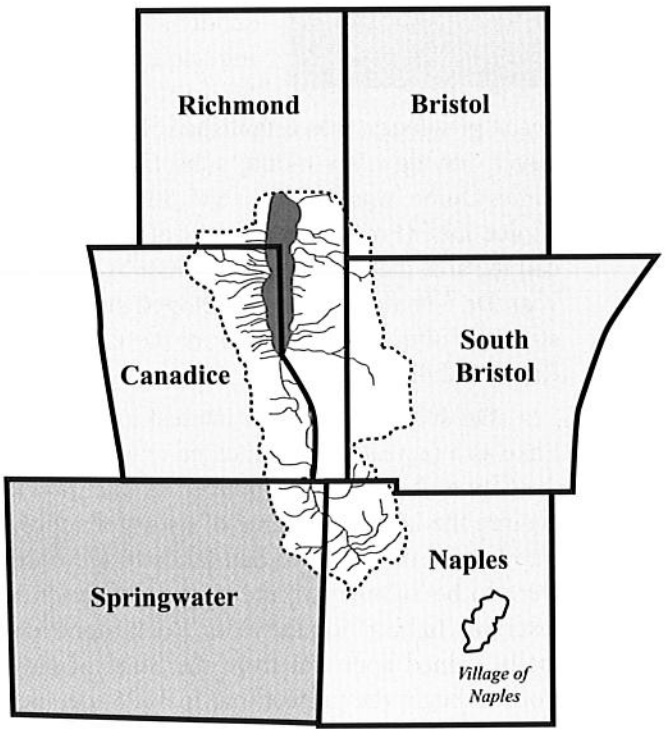
Chairman, Honeoye Lake Watershed Task Force

The Lake Book

Honeoye Lake Story

Chapter 1

Honeoye Lake is situated in the Finger Lakes region of New York State approximately 30 miles south of Rochester. Contributing to the water in the lake is a watershed area that covers 36.7 square miles. This area includes parts of six towns in two counties: Bristol, Canadice, Naples, Richmond, and South Bristol in Ontario County; and Springwater in Livingston County. Canadice and Richmond have frontage on the lake. Of the approximately 1500 homes in the watershed, 970 are located on Honeoye Lake. The watershed does not include any state highways, but does have numerous county and town roads. The Honeoye Inlet, flowing year around, is the largest tributary feeding the lake. Other major tributaries, flowing seasonally, include Briggs Gully Creek, Bray Gully Creek and Affolter Gully Creek. Honeoye Lake waters flow out through Honeoye Creek to the Genesee River, which then empties into Lake Ontario.



The Human History of Honeoye Lake

The first inhabitants of the Honeoye Lake watershed (circa 1000 BC) were the nomadic Point Peninsula people who buried their dead at the northeast end of the lake, called the Morrow Site by archaeologists. This burial ground proved to be a favorite residence also. The remains of several small villages of later cultures have been found on the west side. The Owascos, descendants of the Point Peninsulas, resided in this area 1500 years ago. They, like their predecessors, were dependent on hunting and fishing for food.

The Senecas, "Keepers of the Western Door" of the Iroquois Confederacy, followed the Owascos and introduced agriculture to the region. They cleared the flat land north of the lake and planted fruit trees, corn, squash and beans. It was the Senecas who gave the lake its name, Hannayaye, meaning "finger laying there". Their domain lasted until 1779 when Sullivan's Army, intent on destroying the power of the Iroquois, burned their village and crops.

Sullivan's soldiers, returning to their New England homes, had high praise for the beautiful land and fertile soil they had seen. After the end of the Revolutionary War, the Phelps and Gorham Purchase of two million

acres in western New York created much interest in acquiring land in the area. The subsequent Deighton Purchase led to settlement in the Bristol and South Bristol area. The Town of Bristol, named after Bristol County, Massachusetts, was formed in 1789. South Bristol divided from Bristol in 1838.

By lottery, Captain Peter Pitts drew 3,000 acres at the north end of the lake and on May 31, 1789, his sons, Gideon and William, became the first pioneers to settle the area. The remainder of the Pitts family arrived later and, for three years, were the only inhabitants. By 1795, others from New England and New Jersey had begun to migrate into the region. Among them were Aaron Hunt, after whom Hunt's Hollow is named, and Jacob Holdren, the first settler of Canadice.

Initially called Pittstown, then Honeoye, and finally Richmond in 1815, the town originally encompassed present-day Richmond, Canadice, Livonia and part of Conesus. Livonia became a separate township in 1808 and Canadice in 1829. From the earliest days, the main occupation of the inhabitants was farming. Pioneers hewed timber, cleared land and planted crops. The dense, virgin forest gradually disappeared, replaced by cultivated fields and pastureland.

A primary requisite in meeting the needs of an agricultural region was mills to grind grain and saw lumber. The first mill was constructed on Mill Creek. In 1812, a millrace was dug from the north end of the lake to the hamlet of Honeoye, which soon became the center of commercial trade. Hunt's Hollow and Canadice Corners were the only other concentrated residential areas in the watershed, but neither ever showed significant growth.

The population peaked in 1840 and declined thereafter. Early pioneers, who stayed, added to their acreage, became substantial landowners and passed their properties on to descendants. Several attempts were made in Richmond and Canadice to entice railroads through their towns to boost the economy and promote growth. Because of the steep countryside, however, efforts were futile. For nearly a century, residents remained relatively self-sufficient and primarily native-born.

A few spots on the lake, particularly Bray's Point on the east side, were popular for picnics, boating and fishing. By the early 1900's, a scattering of summer cottages dotted the water's edge, but most of the lands bordering the shoreline were still mainly agricultural.

In 1924, a syndicate known as the C.L.B. Corporation, which owned the Times Union Newspaper, purchased extensive property on the East Lake Road. A subdivision, comprising hundreds of 20 by 50-foot lots with beach privileges, was established. The cost to a buyer, having a six-month subscription to the Times Union, was $15.00 or $17.50 for the more choice lots. (For this reason, locals to this day call the area the "Times Union Tract".) The next year, Dr. Claude Burdette developed the first restricted subdivision, known as the California Ranch Subdivision.

On July 17, 1926, all interest in Honeoye Lake as a recreational area came to a halt when the City of Rochester announced its intention to acquire the lake as a source of its water supply. The hamlet of Honeoye and lands to the north were to be submerged, creating a sixteen-mile reservoir. In litigation for years, Rochester eventually gained approval from the State of New York to begin the project, but in 1935, decided

to obtain water from Lake Ontario instead. Almost immediately, there was an upsurge in demand for Honeoye Lake property. This trend continued until World War II erupted.

The era after the war's end marked the beginning of lakeside development. Improved roads and means of transportation contributed to this trend. By the mid-1950's, undeveloped frontage had nearly disappeared and summer cottages filled the shoreline. In the higher elevations of Canadice overlooking the lake, impressive homes and lodges appeared.

The years after WW II also signaled the end of agriculture as a principal occupation of the watershed. A booming economy and industrial expansion lured residents away from farms to higher paying jobs in Rochester. Mortgaged farms were abandoned. Descendants of longtime landowners commenced selling ancestral holdings. Buyers were mainly from urban or suburban communities. Houses rose behind lake frontage and on the slopes.

In 1962, the Chamber of Commerce organized a winter carnival to "put Honeoye on the map". The event became so popular that in 1971 over 50,000 visitors participated, tying up traffic for miles. Some cars never reached Honeoye. This was the last year the event was held, since it had become too large for the small community to support.

Harriet Hollister Spencer State Recreation Area, a 678-acre expanse in Canadice, opened in 1966. A state boat launch at the southeast end and town-owned Sandy Bottom Park at the north end provided public access to the lake. The completion of a perimeter sewer system in 1978 reduced the water pollution that had plagued the area for nearly a century. In the 1980's, conversion of summer cottages to year-round homes, demolition and rebuilding of structures, and construction of hillside residences escalated — a trend that has continued through the present decade.

Some second-growth timber has been thinned, yet much remains. On the east side, at the southern end of the lake and on higher elevations in Canadice and Hunt's Hollow, forests conserve water and protect against soil erosion.

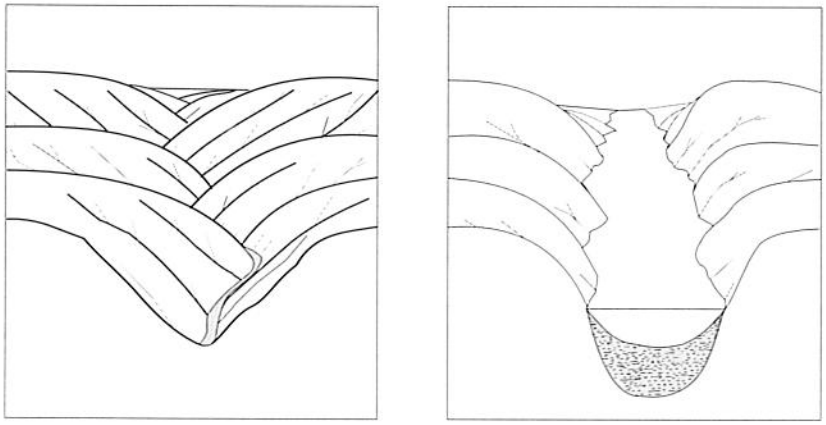
The Geology of Honeoye Lake

Bedrock Geology

To comprehend the bedrock geology of the Honeoye watershed, the story begins hundreds of millions of years ago. It is a tale of drifting continents. In our modern understanding of earth history, the global surface is viewed as a region of dynamic change. The surface consists of a series of crustal plates that "drift" or "float" on a semi-plastic lower layer. The plates are constantly moving, colliding, rifting apart or simply grinding by each other.

A basement of Precambrian rocks (over 1100-1300 million years old), ancient igneous and metamorphic rocks that anchor the North American crustal plate, underlies most of New York State. These ancient rocks were buried by eroded sediment swept into the region when early oceans covered it, a time when crustal plates had drifted apart. As sand, silt and mud built up, pressures transformed the sediment into sandstone, shale and limestone. Creatures of the early ocean environment were trapped and fossilized in these newly formed rocks. Crustal plate collisions produced continental uplift that exposed these layered rocks to weathering, and the slow cycle of eroding the landscape began anew. The lands of western New York rose almost horizontally with just a slight regional dip to the south. More resistant sedimentary rock layers produced escarpments, while the weaker rocks were weathered away. Stream and river patterns were cut into the landscape, with major east-west drainage channels at the base of the escarpments. The slow process of continental weathering was abruptly altered at the beginning of the Pleistocene, the Great Ice Age, approximately 2 million years ago. A new agent, moving ice, would be responsible for rapid change and a complete reworking of the local landscape.

Today this region is part of the hilly, glaciated Appalachian Plateau. The sedimentary bedrocks are Upper Devonian (360 - 375 million years old) and consist largely of shales, limestones, siltstones and sandstones belonging to the Genesee, Sonyea and West Falls Groups. The northern portion of the watershed rests on a



The streams and rivers of the Finger Lakes region were scoured by the advancing ice sheet, creating characteristic U-shaped glacial troughs. Today the Finger Lakes exist in those valleys.

layer of black petroliferous shales, gray silty shales and thin beds of fossiliferous limestone known as the Genesee Group. The harder limestones often form the cap rock of small waterfalls within the ravines that flow to the lake. Underlying the central watershed region is a foundation of light to dark gray shales interbedded with siltstone. This layer is known as the Sonyea Group. The watershed to the south rests on the West Falls Group, a series of gray shales, siltstones and sandstones. Resistant sandstone, source of a popular "flagstone" used by local residents, caps the highest elevations to the south.

Surface Geology and Topology

Throughout most of the Honeoye Lake watershed, a mantle of glacial till covers the sedimentary bedrock. These deposits vary in thickness, composition and surface topography. They give grim testimony to how different the Finger Lakes region was during the Pleistocene Ice Age. It is generally accepted that the Ice Age began about two million years ago and ended about 10,000 years ago. Over this long interval, at least four major advances of continental ice sheets were triggered by fluctuations in the Pleistocene climate. Erosional and depositional evidence for each major advance may be found in the northeastern states. However, well-preserved features of the most recent Ice Age advance (called the Wisconsin stage) are found in New York. Although this final surge of glacial ice undoubtedly fit the landscape pattern left by earlier advances, it obliterated any evidence that they may have left behind.

Honeoye Lake occupies a "trough", originally a southward flowing stream valley that was scoured by the slowly advancing ice. Believed to have been nearly two miles thick, this ice must have exerted a tremendous pressure on the landscape. Debris trapped beneath it served as an effective cutting edge on the landscape. What had been a narrow V-shaped stream valley was now transformed to a broad U-shaped trough. Later, as the ice margin waned away, the Honeoye valley flooded with glacial meltwater and overflowed to the southeast into the Canandaigua trough, at that time occupied by a periglacial water body known as Glacial Lake Naples. Further retreat of the ice margin uncovered lower drainage channels to the north, and eventually the modern stage of Honeoye Lake came into existence. Today, the lake drains northward through Honeoye Creek about 14 miles to Honeoye Falls, then turns westward for 8 miles eventually to join the Genesee River at Golah. Flow continues northward to Lake Ontario at Rochester, New York.

During the immediate post-glacial years, significant siltation occurred in the lake basin. Soil formation was just underway, vegetative cover was sparse and glacial meltwater was everywhere. Stream erosion began cutting gullies into the landscape, carrying materials to the lake and initiating the formation of points. Prominent bedrock exposures were present where erosion of the thin overlying glacial till was complete. Large glacial erratic boulders, impossible to move by water action, were left perched on higher ground throughout the watershed.

Soils to the north are derived from the Genesee shales and are fair agricultural lands. The landscape consists of rolling topography. To the south, agricultural value of the soil declines due, in part, to steeper terrain, shallower depths

and more acidic soil pH. The forested inlet wetlands are dominated by a thick accumulation of muck that is subject to repeated inundation during the growing season. Morainic fill of sand and gravel are found farther south in the Honeoye valley. Excessive stoniness limits their agricultural potential.

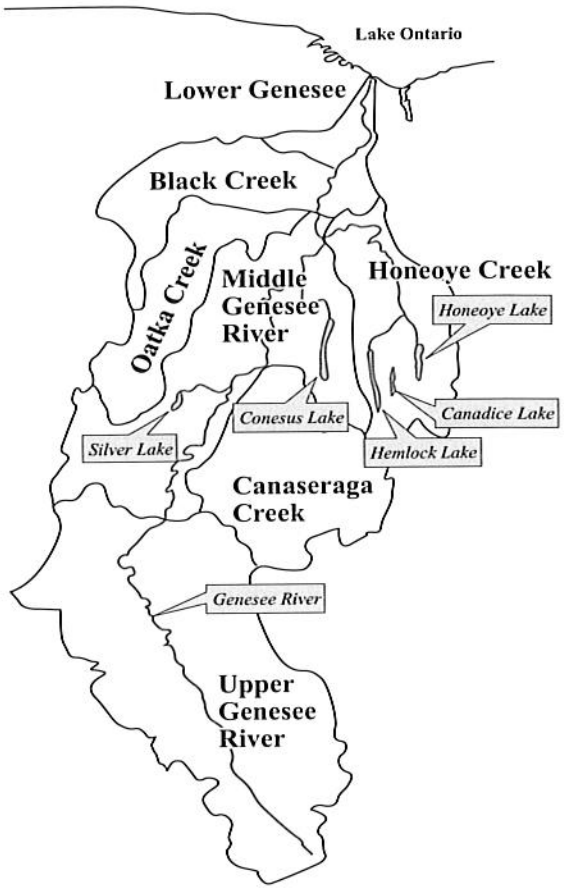
Honeoye Lake Ecology

Physical and Chemical Environment

Honeoye Lake is the smallest of the western Finger Lakes and is the relic of a much larger lake trapped in the Honeoye valley at the end of the Pleistocene era. The modern lake is over 4 miles in length, just under a mile in width and 30 feet maximum depth. Water moves through the lake quickly, totally replacing its volume in less than a year (hydraulic retention time is 292 to 352 days). This compares to 13 years for Canandaigua Lake. Below is a listing of detailed physical characteristics of the lake:

Mean elevation	803.4′ above sea level
Highest recorded level	806.9′ in 1972
Lowest recorded level	802.2′ in 1985
Maximum length	4.1 miles
Maximum width	0.9 miles
Maximum depth	30.2′
Total length of shoreline	8.5 miles
Total surface area	2.7 square miles
Volume	9.2 billion gallons

Physical properties of Honeoye Lake respond to seasonal changes. The lake is completely ice covered each winter but warms quickly, eventually reaching some of the highest summer water temperatures of the Finger Lakes. The lake is classified by limnologists as a cold, monomictic lake. This means that the lake is winter-stratified (shows temperature zonation under the ice), turns over in the spring and is mixed by wind action throughout the growing season. Summer temperatures are nearly uniform top to bottom. The lake is not summer-stratified and does not have a thermocline, as do the larger Finger Lakes. Strong winds may stir up bottom sediments leading to brief periods of reduced clarity. Surface dissolved oxygen levels are near 100% saturation, an excellent condition and critical to the survival of most aquatic organisms. However, during prolonged periods of calm summer weather, organisms inhabiting the bottom waters may deplete their dissolved oxygen supply, producing anoxic conditions that can stress lake creatures.

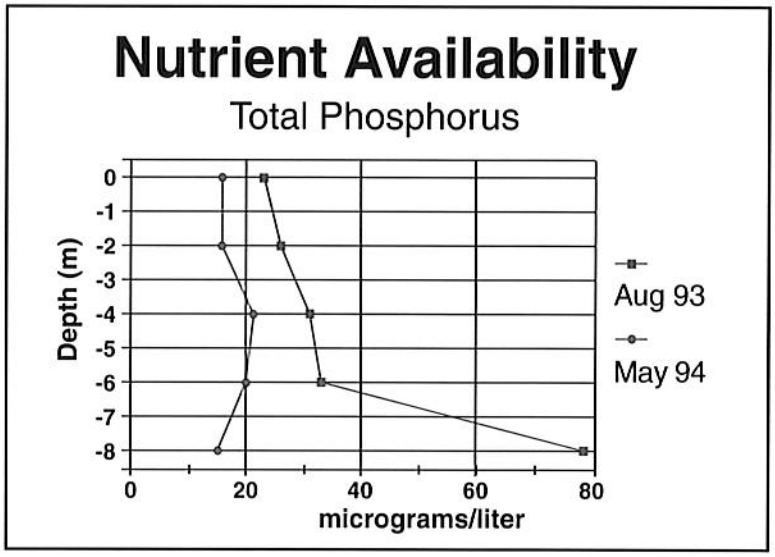


Genesee River Basin with sub basins

Lake health is related to eutrophication, a natural process involving the gradual accumulation of sediments and organic matter. As a lake basin slowly fills, nutrient levels and productivity increase. The rate of eutrophication and, hence, the life span of the lake, will depend on the depth of the lake basin, the susceptibility of watershed soils to erosion, and the impact of human activities that prematurely "age" the lake.

Typically a lake moves through a series of trophic stages: from oligotrophic (nutrient poor, biologically unproductive) through mesotrophic (intermediate nutrient availability and biological productivity) to eutrophic (nutrient rich, high productivity). Each stage is characterized by certain conditions. Useful water quality measurements include nutrient levels, water clarity and algal

abundance. Samples for dissolved nutrients are best collected during the winter months when biological activity is low. Total phosphorus is the nutrient usually measured. Water clarity and algal abundance are monitored during the summer months through Secchi disk readings and determination of chlorophyll *a*, the dominant pigment in algae.



Regular monitoring of these water quality conditions generally defines the trophic stage of the lake, enabling the assessment of lake health and identification of any long-term changes in lake ecology. Note that the higher the levels of chlorophyll *a* and nutrients, such as phosphorus, in a water body the more aquatic vegetation will be produced. The table below shows lake trophic stages in relation to readings for Honeoye Lake.

Nutrient analyses have been conducted periodically for more than two decades. In 1974, total phosphorus levels averaged 31 µg/l for the year but ranged from 12 to 461 µg/l. More recently, concentrations have varied from 14 to 78 µg/L. Total phosphorus levels vary with depth and time of the year. Increases in this critical fertilizer element are associated with turbidity resulting from storm events and nutrient release from bottom substrates during periods of summer stagnation when dissolved oxygen levels are depleted. See the graph on this page.

Average summer chlorophyll *a* levels have ranged from 8 to 35 µg/l since 1985. Certain shoreline sites may experience higher concentrations of algae, especially during fall months. As zebra mussels become established in the lake, their filter feeding will remove algae and this should result in lower levels of chlorophyll *a*.

Average summer Secchi disk depths have varied from 1.8 to 4.8 meters. Research in aquatic weedbed communities suggests that lake clarity has improved since 1984 because vegetation now occurs in deeper water. The presence of zebra mussels could improve water clarity but, unfortunately, this will increase the amount of sunlight available for aquatic weedbed growth. All of these water quality measurements show variations from year to year, but do not indicate any significant long-term trends.

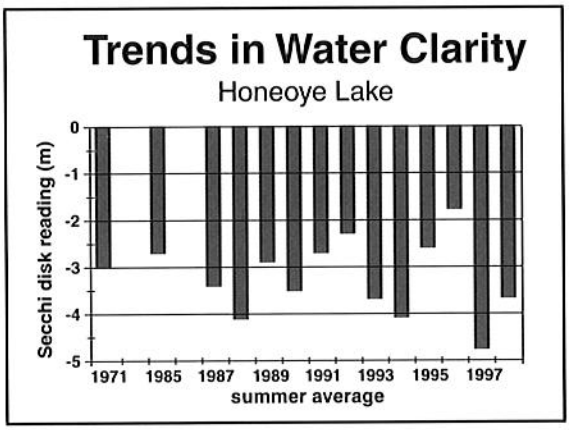
Honeoye Lake has moderately hard water with the major buffer compound being dissolved calcium bicarbonate. Water pH is in the neutral to slightly alkaline range.

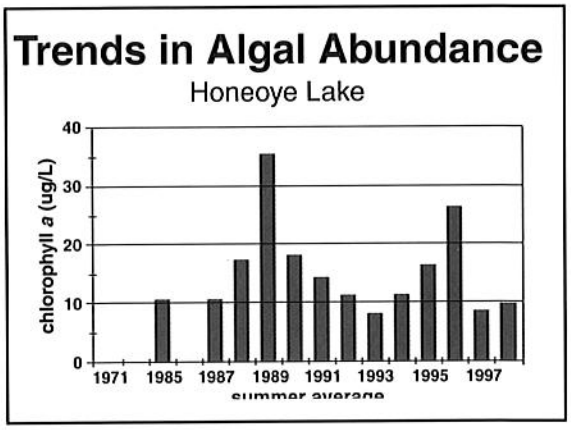
Biological Environment

Descriptive studies have been completed on the plankton, invertebrate, fish and plant communities found living in Honeoye Lake. Eighty species of plankton have been identified in the

	Trophic Stage			Honeoye Lake Readings
Water quality condition	**Oligotrophic**	**Mesotrophic**	**Eutrophic**	
Total phosphorus	< 10 µg/l	10 - 26µg/l	>26 µg/l	14 -78 µg/l
Secchi disk depth	> 4.6 m	1.9 – 4.6 m	< 1.9 m	1.8 – 4.8 m
Chlorophyll *a*	< 2 µg/l	2 – 8 µg/l	> 8 µg/l	8 - 35 µg/l

NOTE: µg/l = micrograms per liter; m=meters





lake, but little information is available on their ecology. Cyanobacteria (formerly called blue-green algae) dominate the phytoplankton at most times. Copepods, water fleas and rotifers comprise the majority of the zooplankton.

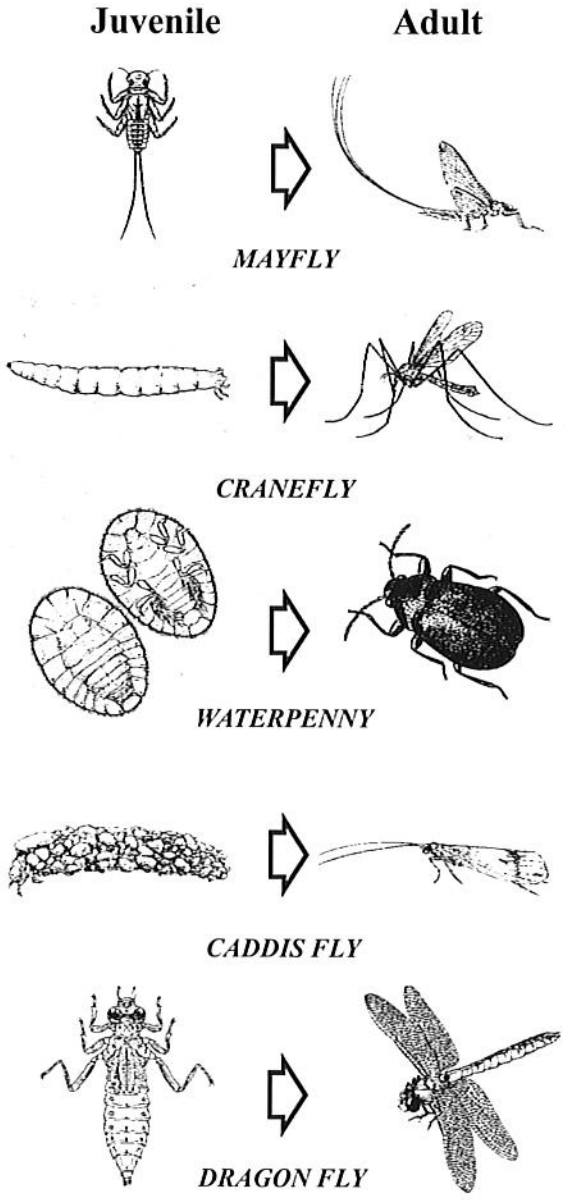
The plant community is diverse and contains 22 species of submersed macrophytes, 3 macroscopic algae, an aquatic moss, 2 species of free floating vascular plants and several emergent shoreline species. The most common aquatic plants are Eurasian milfoil, eelgrass, coontail, elodea and flat-stem pondweed. In the silty substrates near stream mouths, water stargrass, naiad, water marigold and white water buttercup become locally abundant. Curly pondweed is common throughout the lake and often dominates the weedbeds early in the growing season. Largeleaf pondweed is found primarily in deeper waters where it forms a canopy over other submersed plants like elodea.

The composition, distribution and productivity of these weedbeds have been studied since 1984. At that time, highly productive weedbeds were noted at the south end of the basin and near the Honeoye Park at the north east corner of the lake. Steep slope areas along the sides of the lake had low biological productivity. Aquatic plants generally did not extend beyond depths of 8 - 10 feet. In 1994, weedbed productivity was more uniform throughout the lake. This resulted from improved water clarity and colonization of deeper sites within the lake. Aquatic plants today extend to beyond 15 feet of water depth. The modern weedbed communities are diverse, providing nutrient absorption, food for other organisms and cover for juvenile fish communities. While these weeds are diverse and serve an important function in the health of the environment, they can also be a nuisance to certain Honeoye Lake users.

Eurasian Milfoil

Snails, mussels, crayfish and aquatic insects are abundant within the near-shore littoral community. Snails graze on algae attached to the submersed weeds. Mussels "walk" along the bottom filter feeding on suspended organic particles. Hiding on the bottom, crayfish grasp at nearby food items. Aquatic insects along the shoreline include water pennies that scrape filamentous algae from rocks, stoneflies that shred up leaves, caddis flies that collect organic remains and a myriad of other insects that prey on other invertebrates.

Aquatic invertebrates, or "water bugs," are an important part of the ecology of the lake and the streams that feed it. They indicate the health of their habitat because they have different sensitivities to the quality of their environment. High populations of organisms that thrive in healthy waters will appear in unpolluted environments, whereas other species will be found in poor water quality conditions. These organisms may live in the streams for a long period of time. Their presence or absence indicates conditions in the stream over a significant time span.



Juvenile mayflies, stoneflies, water pennies and caddis flies are examples of insects found in clean water where the oxygen content of the water is high. Organisms able to live in somewhat less ideal water conditions include cranefly larvae, dragonfly and damselfly nymphs, crayfish, scuds and some beetle larvae. These creatures can tolerate less oxygen and higher temperatures than their more sensitive counterparts. Improper sewage disposal, tree removal along stream banks, road salt or lawn chemicals entering the stream during runoff events, soil erosion and nutrient-laden runoff are factors contributing to the damage of stream environments.

The fish community of Honeoye Lake is dominated by warm-water game species including walleye, largemouth bass and a variety of pan fish. Pumpkinseed, bluegill, black crappie and yellow perch fishing has been noteworthy over the years with especially large sunfish in the last decade. In total, 26 species of fish inhabit the lake.

Lake Management Activities

Honeoye Lake serves as a domestic water source for some shoreline residents, is an integral component of the area's environment, and is intimately connected with the surrounding ecosystem. Population, agriculture, and land use in the watershed have a direct effect on the health of the lake. The rapid development after World War II brought a rash of problems that were highly evident in the appearance of the lake, the water quality and aquatic life. Heavy dense weedbeds, poor water quality, and seasonal "pea soup" algal blooms were obvious visual symptoms of the problem.

Studies, initiated by concerned citizens and authorized by the Ontario County Board of Supervisors, resulted in a period of intense clean up in the 1970's and '80's. This included the installation of a shoreline perimeter sewer system in 1978 and near-shore weedbed harvesting that began in 1987. The sewer system reduced nutrient input to the lake, resulting in improved water clarity. Weedbed harvesting made for more enjoyable boating and swimming, and reduced the nutrient level caused by decaying weeds.

The following table summarizes the weight of weeds removed and the rate of removal each year. The weight of weed removal per hour is indicative of the weedbed density and correlates with the yearly variation that is noticed by lake users.

Year	Tons	Tons per Hour
1987	381	1.55
1988	541	1.67
1989	456	1.51
1990	549	1.88
1991	504	1.77
1992	492	1.78
1993	444	1.59
1994	633	2.39
1995	453	1.56
1996	168	0.65
1997	474	1.65
1998	405	1.43

Harvesting Summary

Weed Harvester

Our Wetland Resources, Natural Water Purifiers

Freshwater wetlands are among the most biologically productive and valuable ecosystems in the state. Some of the functions and benefits that wetlands perform include surface and groundwater protection, erosion control, pollution treatment and nutrient cycling. In addition, they support healthy fish and wildlife habitat and provide open space and natural beauty for public recreation.

Because of their high value to the people and environment of New York, the State Legislature, in 1975, passed the Freshwater Wetlands Act, which protects wetlands greater than 12.4 acres in size. The main provisions of the Act seek to balance and regulate use and protection of wetlands through a permit system. While certain activities are exempt from regulation, other activities that could have a negative impact on wetlands are regulated. To conduct any regulated activity in a protected wetland or its 100-foot buffer, a permit is required. If a proposed activity will not seriously affect the wetland, a permit can be issued. If the activity will affect the wetland, a permit will be issued only if the benefits gained by the project out weigh the loss. The U.S. Army Corps of Engineers protects and regulates wetlands of any size and should be contacted before work in any wetland is undertaken.

Wetlands are ranked in four classes ranging from Class I, the most valuable wetlands, to class IV, those providing the fewest benefits. Maps showing the approximate boundaries of State-protected wetlands are on file at DEC offices and at the Town and County Clerks' offices.

The Honeoye Lake Watershed contains all or portions of three State-protected freshwater wetlands. A fourth, lying just outside the northern watershed boundary, will also be included in this discussion due to its size and close proximity to the hamlet of Honeoye. Most rank relatively low in terms of development pressure and are situated in rural areas.

The largest and functionally most significant wetland within the Honeoye Lake Watershed, designated "SP-3", is found at the south end of the lake surrounding the Honeoye Inlet and is located totally within the watershed in the Towns of Richmond and Canadice. This 837-acre wooded wetland occupies a majority of the valley and extends from the south end of the lake for approximately two and one-half miles. Because of its size, importance to wildlife and water quality attributes, SP-3 ranks as a Class I wetland. In addition, its position contiguous with the south end of Honeoye Lake makes this wet-

land uniquely important to the overall lake ecosystem — absorbing flood waters, filtering sediment and pollutants and providing important fish spawning habitat.

Channeling of a portion of the inlet in the early 1960's, however, may have affected the ability of SP-3 to provide some of these benefits. Done presumably to provide increased drainage for farm lands to the south, this straightening, deepening, and realignment of the original stream has increased flow rates and sediment loading from the inlet. This makes future efforts to protect this wetland and the functions and benefits it provides all the more important in any watershed protection plan.

Wetland BS-8 is a long, narrow wetland lying immediately west of and parallel to County Road 36 in the town of Naples. This 144-acre Class II wetland stretches approximately from Hunt Hollow Ski Center to just south of French Hill Road. Although about two and one-half miles long, its width rarely exceeds 500 feet. The Honeoye Lake Watershed encompasses the northern half of BS-8. This wetland contains several different structural habitat groups including emergent marsh, wooded swamp, shrub swamp, and open water—the shrub swamp and open water being the most prevalent. It feeds the Honeoye Inlet that meets the lake some six miles north. Because of its position at the headwaters of the inlet, it also performs important water quality functions for the inlet, lake, and watershed as a whole.

Wetland BS-2, a 196-acre Class II wetland, lies in a valley just west of Gulick Road in the Town of South Bristol. Predominately a wooded wetland with a small amount of shrub swamp, the northern half of BS-2 lies within the Honeoye Lake Watershed. It drains to the north into Briggs Gully, which empties into the lake near the State Boat Launch at the southeast end. Those familiar with Cumming Nature Center on Gulick Road will recognize the northern portion of this picturesque wetland, which is located on the property and is visible from a series of trails there. The extra attention BS-2 receives as part of a private nature center has a positive influence on the quality of the watershed and the public's understanding and appreciation of freshwater wetlands.

Wetland HO-4 is an 800-acre Class I wetland that extends from the north end of the lake for almost four miles following Honeoye Creek. It is composed primarily of emergent marsh habitat with lesser amounts of wooded and shrub wetland. It is an extensive wetland, but most people would only be familiar with its southern tip. This area extends from Sandy Bottom Park along the northern end of the lake.

Although technically outside the watershed, thus not contributing directly to lake water quality, it is nevertheless very important to Richmond and surrounding townships. It provides critical flood storage during the lake's regular high water periods, acting as a large sponge in soaking up floodwaters. Due to its high percentage of emergent vegetation, it is also particularly well suited to performing the erosion control and water cleansing functions of wetlands.

Equally important are the recreational and educational opportunities afforded by a wetland such as this, lying in close proximity to a population center. In 1993, a nature trail, complete with elevated boardwalks and footbridges, was built in and around the wetland just north of Sandy Bottom Park and is frequented by nature lovers and hikers. The state-owned Honeoye Creek Wildlife Management Area has wetland holdings, both within and to the North of the hamlet of Honeoye. It is used regularly for hunting, trapping, bird watching and other outdoor pursuits.

This increased human use does present a potential downside, however. Because of its location within the hamlet, the southern portion of HO-4 is especially vulnerable to negative impacts from human development and carelessness. The community must be aware of this danger and seek to educate itself about the benefits of wetlands and how to protect them. Protecting these natural water purifiers is essential to the maintenance of a quality water supply.

Land Protection

The Honeoye Lake Watershed is in the Western Lakes Chapter of the Finger Lakes Land Trust (FLLT). This land trust is a non-profit, grass-roots organization that started in Ithaca in 1989. Its goal is to work with private landowners to protect the natural resources of the Finger Lakes region. The FLLT currently protects more than 6000 acres. This area includes 17 preserves, holds over 30 conservation easements, and has many land steward registries among its members. As part of its mission, the Western Lakes Chapter sponsors the popular "Talks & Treks" series that will highlight the Honeoye Lake Watershed in the Summer 1999 Series. The FLLT has approximately 1000 members with about one hundred located in the western lakes region.

The Nature Conservancy, another non-profit conservation organization, is currently involved in a wetland project helping the DEC purchase and protect approximately 2000 acres at the southern end of Honoeye Lake including the wetlands, woods, farmlands and Honeoye Inlet.

Lake Protection

Over the years, concerned citizens have formed organizations to improve the environment of the Honeoye Lake region. These organizations included the Honeoye Lake Watershed Association (1950-1966), Genesee Valley Trappers (late 1950's to present), Honeoye Fish and Game Club (1947 to present), Honeoye Lake Cottagers Association (1966-1967) and the Honeoye Environmental Action League (1970-1988). The main priorities of these organizations were weeds, bacterial contamination, and flooding. Much has been done to clean up and protect the lake and its surrounding watershed, but the effort must be ongoing and community participation is essential. At this time, there are two organizations working to maintain the quality of the Honeoye Lake watershed: the Honeoye Valley Association (HVA) and the Honeoye Lake Watershed Task Force (HLWTF).

The HVA, which was formed in 1986, has nearly 400 members from throughout the watershed. The mission of the HVA is to be an advocate for the responsible use and enjoyment of the lands and resources of the Honeoye Lake area. It has been active in lake level control, boating safety, water testing, public water, weed control and public education.

The HLWTF, formed in 1997, brought together watershed stakeholders to devise a management plan to prevent further degradation of the lake and improve water quality throughout the watershed. The HLWTF is comprised of a voting member from each town, appointed by their town boards, and one voting member from the HVA. In addition, the task force includes professionals from the Ontario County Soil and Water Conservation District, Finger Lakes Community College, New York Department of Environmental Conservation, Honeoye Public Water District, and others who from time to time offer their professional advice. The major activity of the HLWTF is the development of a uniform approach to managing the environmental quality of the Honeoye Lake watershed through voluntary cooperation and education.

Community participation and cooperation in these efforts, as well as caring and informed land and water use, are essential to the protection of our watershed. Maintaining the positive practices that have been put in place over the past twenty years will go a long way toward keeping our lake healthy, honoring our history, and providing for future generations. But there's always more to do. It's a fact that times will continue to change. The population will grow. New chemicals will be introduced through industries, agriculture, lawn care, and other sources. The key will be constant and vigilant monitoring, evaluation and analysis, and education. Concerned, educated involvement is essential. Look in the Reference section at the back of this book for names, addresses and phone numbers of environmental organizations — and get involved.

The Future

All lakes undergo the natural aging process called eutrophication. This process, described earlier in this chapter, increases nutrient supply naturally through soil erosion and biological decomposition of aquatic life. However, man's activities can accelerate the process, causing "cultural" eutrophication. Failed septic systems, deforestation, and construction contribute to nutrient and sediment loading. Careful land use and good stewardship will minimize cultural eutrophication and directly affect the future of Honeoye Lake.

While the watershed is still heavily forested with little agricultural land, the population continues to increase. Recent trends around the lake include the conversion of summer homes into primary residences, the use of cottages as rental properties, and the construction of roads and homes in areas previously thought inaccessible. All these factors have the potential to adversely affect the watershed area unless best management practices are employed.

While there is no single manager of the lake or watershed lands, the towns, counties, State and HVA are all partners in an effort to prevent further degradation in the quality of the lake and its watershed. The goal of the HLWTF is to devise a management plan that all stakeholders can implement and use as a "good stewardship" guide. The future of the lake and watershed will largely be determined by the decisions made now.

This book is filled with information that will help watershed residents make better decisions and ultimately protect our beautiful lake.

For more information on land protection contact the following agencies:

Finger Lakes Land Trust (FLLT)
202 East Court Street
Ithaca, NY 14850
607/275-9487

FLLT Western Lakes Chapter
Box 653
Canandaigua, NY 14424
716/394-5436

The Nature Conservancy
Rochester, NY 14604-2614
716/546-8030

For more information regarding aquatic invertebrates contact:

Cornell Cooperative Extension, Ontario County
480 North Main Street
Canandaigua, New York 14424
716/394-3977 ext. 32

For more information on lake ecology, contact:

NYS DEC
Region 8 Office
6274 East Avon-Lima Road
Avon, New York 14414

Finger Lakes Community College
Natural Resource Conservation Department
4355 Lakeshore Drive
Canandaigua, New York 14424-8395
716/394-3500 ext. 255

Water Supply

Chapter 2

All watershed residents need a clean source of water for everyday life. The lake and groundwater are the principal sources of drinking water for everyone in the watershed with the exception of about 50 shoreline homes. These residences on West Lake Road are served by the Honeoye Public Water System. A properly constructed and maintained water system supplies an adequate quantity of potable water year round. It delivers water at a rate that meets the temporary large demands that occur each day, and provides enough water to fight small fires. Typical water needs for a variety of uses are listed in Table 2-1.

Groundwater is water in pore spaces of sand and gravel deposits or cracks found in bedrock. Precipitation that falls to the earth and soaks through the soil into permeable subsurface areas usually creates the safest and most reliable drinking water sources. Lakes, streams, and rivers that make up surface waters are not recommended sources for drinking water unless first filtered and disinfected.

Tapping Groundwater

Many people in the United States use a well to supply their drinking water. A well taps into groundwater that is pumped to the surface. The different types of wells are named for their method of construction. There are five common types of wells: dug, bored, driven, jetted and drilled. Dug, bored, jetted, and driven wells are very seldom more than fifty feet deep. Drilled wells, on the other hand, are often 75' - 300' deep. See Table 2-2 for a description of each type of well.

Use	Flow rate gal / min	Total use gal
Adult or Child	NA	50 - 100 / day
Baby	NA	100 / day
Automatic washer	5	30 - 50 / load
Non-automatic washer, hand tub	5	15 - 45 / load
Dishwasher	2	7 - 15 / load
Garbage disposer	3	4 - 6 / day
Kitchen sink[a]	3	2 - 4 / use
Shower or tub[a]	5	25 - 60 / use
Toilet flush[b]	3	4 - 7 / use
Bathroom sink	2	1 - 2 / use
Water softener regeneration[c]	5	50 - 100 / time
Backwash filters[c]	10	100 - 200 / backwashing
Out side hose faucet	5	-----
fire Protection[d]	10	1200 / 2 hr period

[a] Water flows restricting valves and shower heads can reduce flow and water use by up to 50%.

[b] Ordinary toilet; low flow toilets will reduce water usage by 40%-90%.

[c] Water hardness, softener size, etc. affect water use.

[d] For limited fire fighting; at least 10 gpm, with a "" nozzle at 30 psi for 2 hr/day. Preferred: 20 gpm at 60 psi - 2400 gal.

Table 2-1. Home and outdoor living water requirements.
Reprinted with permission from: *Private Water Systems Handbook*, MWPS-14, 4th edition, 1979, ©Midwest Plan Service, Ames, Iowa 50011-3080.

	Drilled cable tool or percussion	Drilled, rotary hydraulic	Jetted
Depth, ft. **Diameter, in.**	To 1000' 4" - 18"	To 1000' 3" - 24"	To 50' 2" - 12"
Construction method	A heavy drill bit and stem is raised and dropped in the borehole. The bit breaks rock and loosens other material, which is mixed with water and removed by a bailer. In unconsolidated formations, the casing follows the bit closely to keep the borehole open.	A rotating bit breaks up material which is mixed with drilling fluid ("mud"), carries it out of the hole, supports the wall of the borehole to prevent caving, seals the wall of the borehole to reduce fluid loss, and cools and cleans the drill bit. The mud flows to a settling pit and is recirculated. After the hole is complete, a metal or plastic casing is inserted.	Water under pressure is forced down a riser pipe and loosens the material around the washing point. The loosened material is drawn up as the riser is lowered into the ground. The drilling water carries the cuttings in suspension upward in the space around the riser. The water and cuttings flow to a settling pit and are recirculated. Casing fitted with a driveshoe is usually sunk as drilling proceeds.
Precautions	Little trouble with surface contamination. Upper portion of drill hole made 4" larger than casing and grouted. Depth of grout and casing varies with geological formation.	Little trouble with surface contamination. Upper portion of drill hole made 2" larger than casing and grouted. Depth of grout and casing varies with geological formation.	Install a protective casing to a depth of at least 25' to protect against surface water contamination.
Limitations	Can be used in all type formations. Is usually slower than rotary drilling. Must case well while drilling in unconsolidated materials.	Sometimes difficult to recognize water-bearing formations because of the drilling fluid. Difficult to drill in rock formations.	Can be jetted in only fine unconsolidated formations. Best for small holes of about 4" diameter.

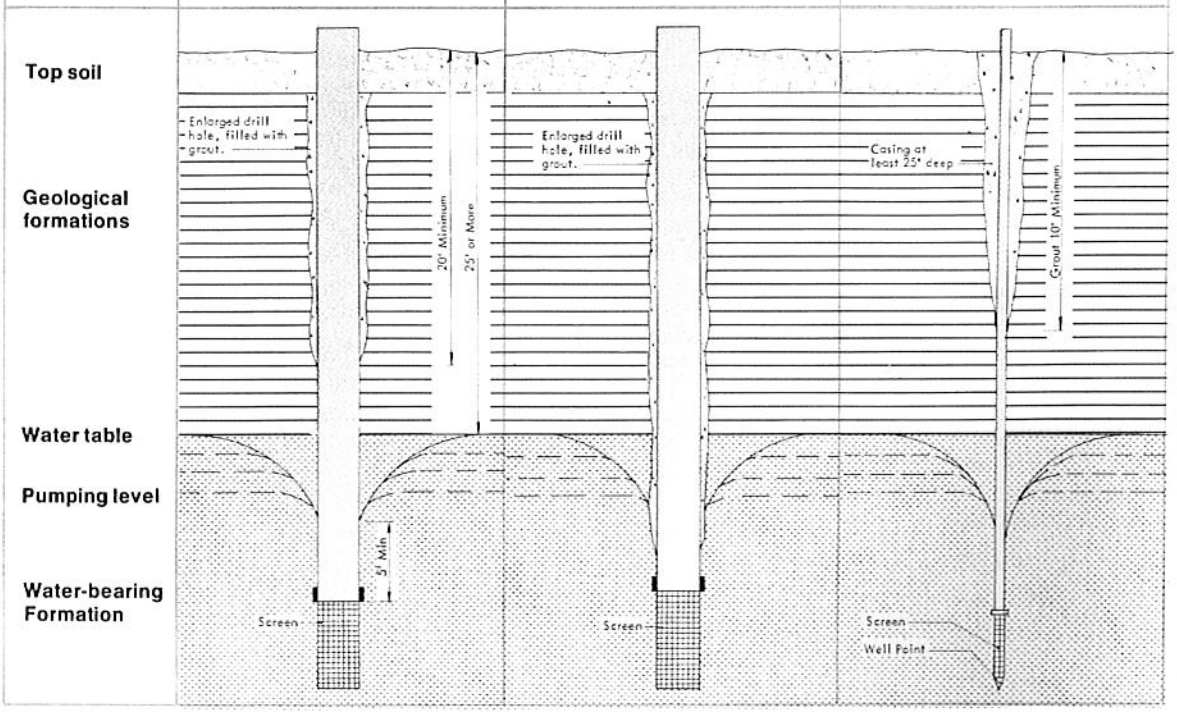


Table 2-2. Different Wells and their Characteristics.

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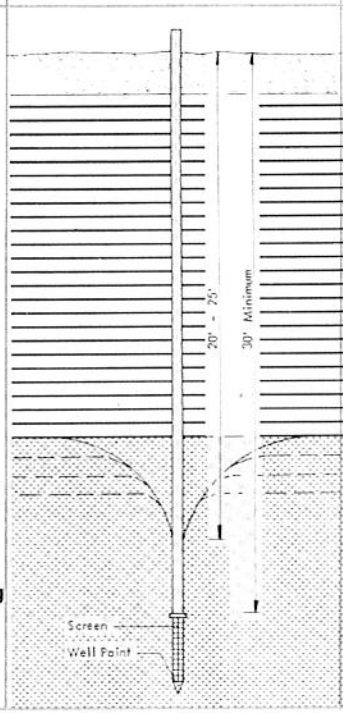
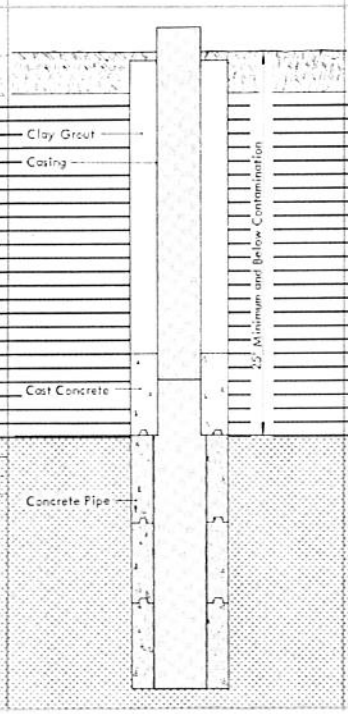
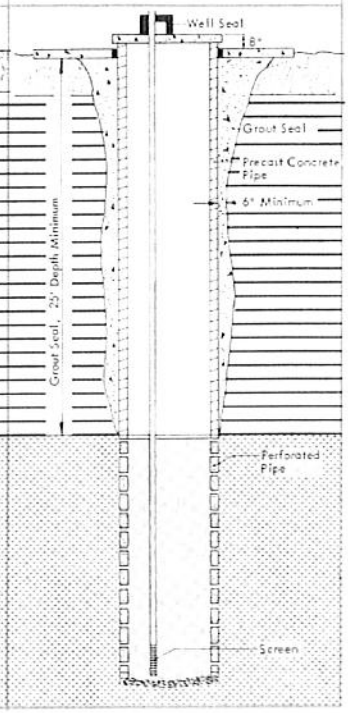
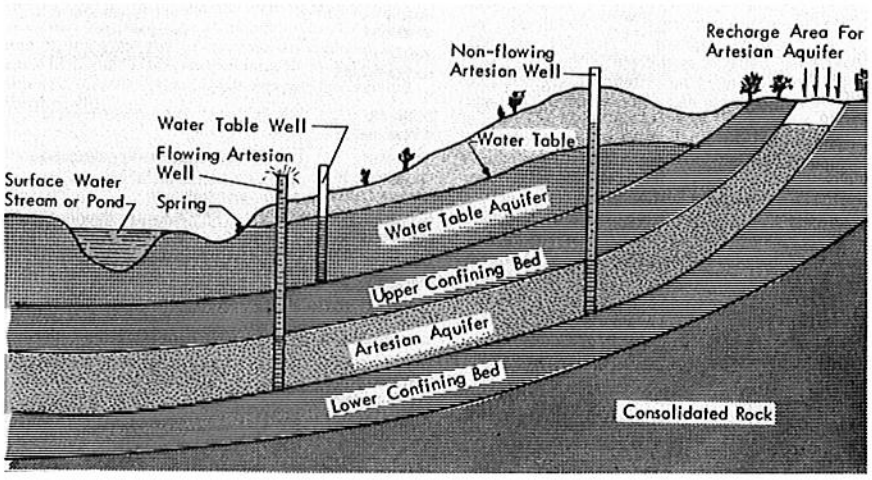
	Driven	Bored	Dug
Depth, ft. **Diameter, in.**	To 50' 1¼" - 12"	To 1000' 2" - 30"	To 50' 3 to 20 feet
Construction method	A special driving point with well screen on a series of short pipe sections is driven into the ground with a drive-block assembly or a post or pile driver. Pipe sections are added as the pipe is driven. A pilot hole, bored as deep as possible, reduces damage to the well screen during driving.	An earth auger, rotated by hand or power, bores the hole and carries the earth to the surface. Saturated sand must be jetted, not bored. The casing is usually steel, concrete, or plastic pipe.	The hole is dug the desired diameter and depth by hand or power. The hole may be shored; often casing is installed as digging progresses and is allowed to sink by its weight as the hole is excavated under the casing. The walls are often brick, stone, concrete or precast concrete pipe.
Precautions	Well screen can be damaged during driving. Maul not recommended for driving pipe—glancing blows may break or bend pipe. Turn riser pipe with wrench periodically to ensure that threaded fittings remain tight and that pipe is undamaged.	Seal casing against surface contamination by grouting the space around the casing. Somewhat easily contaminated.	Seal well lining tightly to prevent contamination. Case or shore the walls during construction. Needs careful backfilling. Ventilate deep holes while hand digging.
Limitations	Yields are small to moderate because of small pipe. Cannot be driven into coarse or cemented gravel, boulders, sandstone, limestone and dense rock. Cannot be grouted to prevent contamination from perched water tables.	Soils must have enough clay to keep the borehole open until casing is installed. Can be bored only a few feet into a watertable. Difficult to bore into boulders and dense rock. Cannot bore into cemented limestone or sandstone.	Many fail during droughts. Easily contaminated. Can be dug only a few feet below the water table. Cannot be dug in dense rock.
Top soil **Geological formations** **Water table** **Pumping level** **Water-bearing Formation**			

Table 2-2. Different Wells and their characteristics continued.



Ground and surface water sources.
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When designing or reclaiming a well, there are several sanitary measures recommended to prevent future contamination and protect the water users. See Figure 2-1.

- Make sure the casing of the well extends at least 12 inches above the ground surface and above any known flood level. For existing wells, find out if it has ever been flooded.
- Check that the casing has a watertight cover to prevent anything from getting into the well.
- For existing wells, take off the cap and look down the well. Make sure that the casing, cap, and seal are free of cracks, holes, etc.
- Check that the ground or grout is tight against the casing.
- Make sure the ground slopes away from the casing on all sides, so that water cannot pond around the well and run down the casing.
- Check that the air vent pipe (if visible) is screened and faces down to prevent insects and rain from entering.

Commercially Dug Wells

If you plan to have a well constructed, make sure to have a written contract between yourself and the well driller. A written agreement can help avoid costly misunderstandings. The contract should describe the work to be done, the cost and terms of payment, and should also include:

- Statement that all work is to comply with existing county and state well codes;
- Size of well hole and methods of eliminating surface contamination;
- Casing specifications — i.e., the casing is to be at least 4 inches in diameter and extend at least 25 feet below the ground surface;
- Type of well seal and grout seal around the casing;
- Type of screen to be installed, where needed;
- Test-pumping procedure to be used;
- Disinfection procedure to be used;
- Date for completion of well and delivery of well log and test-pumping report;
- Guarantee of materials and workmanship;

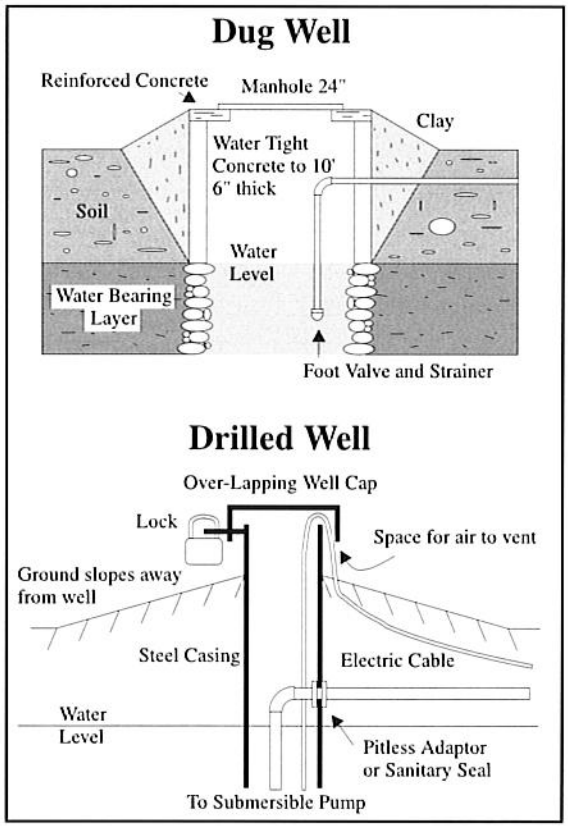

Figure 2-1. Safe, contamination-free well design

Suggested Minimum Distances Between Water and Sewerage Units (in feet)			
Unit	**To Well or Suction Line[a]**	**Unit**	**To Well or Suction Line[a]**
Sewer to septic tank, water tight	25 if cast iron pipe otherwise 50	Chlorine Contact-Inspection Tank	50
Septic Tank	50	Dry Well (for roof or footing drainage or clean water only)	50
Lines to Distribution Box and Disposal System	50	Privy, Pit	100
Distribution Box	100	Privy, Watertight Vault	50
Subsurface Disposal Field	100[b]	Barnyard, Silo, Barn Gutters, Animal Pens	100 minimum
Sand Filter	50		
Leaching or Seepage Pit or Cesspool	150[b] more in coarse gravel	Drains - Footing, Pumphouse, Floor[c]	25

[a] Water service and sewer lines may be in the same trench if cast iron sewer with lead caulked joints is laid at all points 12" below water service pipe; or sewer may be on dropped shelf at one side at least 12" below water service pipe, provided sound sewer pipe is laid below frost with tight and root-proofed joints and is not subject to settling, superimposed loads or vibration. Water service lines under pressure shall not pass closer than 10 feet of a septic tank, tile field, leaching pit, privy or any other part of a sewage disposal system.

[b] Wells located of necessity down grade and in the general path of drainage from a sewage disposal system should be spaced 200 feet or more away; they should also be cement grouted.

[c] Drainage ditches should be free-flowing and not less than 25 feet from a well.

Table 2-3. Minimum distance between water supplies and seweage units.

-From *Rural Water Supply*, New York State Department of Health

- Cost — an itemized list including cost of drilling per foot, charges for other materials per unit, and charges for other operations such as grouting, developing, and test-pumping;
- Liability insurance for owner and driller.

Siting a Well

A well should provide adequate water for family needs and be protected from contamination. While local and state codes require proper siting and construction for an onsite wastewater treatment system, they do not have specifications for siting a drinking water supply. New York does not regulate the siting of a well, but it does give recommendations for its location. These guidelines specify the minimum distance between obvious sources of contamination such as wastewater systems, road salt storage piles, underground gasoline tanks, fertilizer or pesticide storage areas or landfills. In general, a well should be located in an area higher than and 100 feet away from any potential source of pollution. See Table 2-3 for these separation distances. The recommended setback distances help ensure that the natural filtration capacity of the soil is capable of removing contaminants from groundwater. This filtering action is dependent on the type of material through which the water moves; little filtration occurs in limestone or fractured shale. In certain types of soil, such as stony outwash

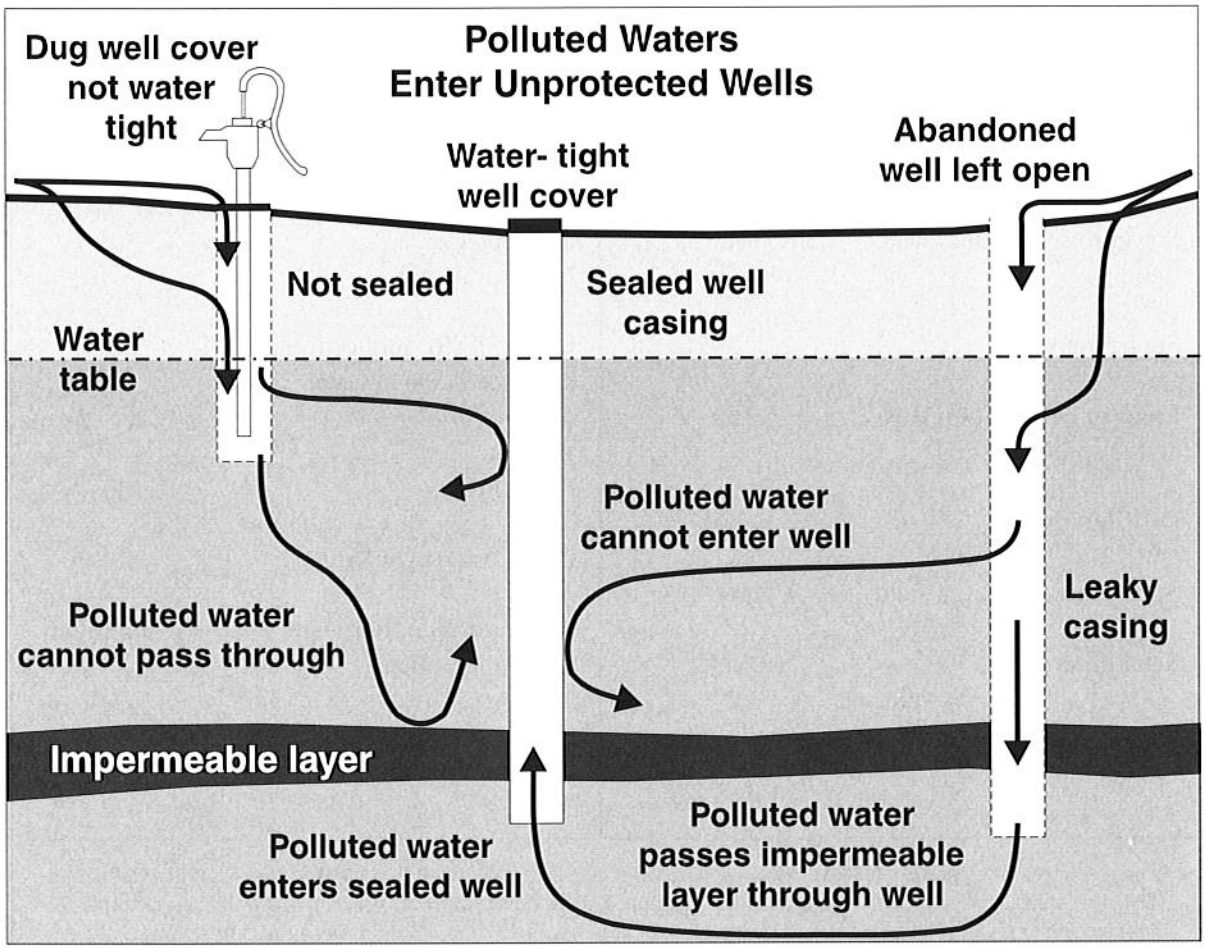

Figure 2-2. Contamination of aquifer through unprotected, unsealed and abandoned wells.
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soils found in stream valleys, the distances between the drinking water supply and the wastewater treatment system should be more than the state's minimum recommendation.

Well Abandonment

Unsealed, abandoned wells are potentially hazardous to children and pets who may fall into them. They are also a potential pathway for groundwater contamination. Abandoned wells should be filled with concrete, cement grout, or clay material. A dug or bored well should have as much of the lining removed as possible to prevent surface water from reaching the underlying aquifer through cracks or openings in the lining material. If the well cannot be filled in this manner, it should at least be tightly capped. Abandoned wells should never be used for waste disposal. See Figure 2-2.

Well Maintenance

The area around a well should be protected from animals, chemicals, and any activity that might contaminate groundwater. Before it is first used, and anytime following work on it, the well should be disinfected by shock chlorination. For information on shock chlorination see *Failed Bacteria Tests* in Chapter 3: *Water Testing and Treatment*. If bacteriological problems persist following shock chlorination, a continuous chlorination system or other method of bacteriological treatment should be used.

Well water should be tested annually for coliform bacteria and nitrate and any other potential contaminants determined by activity near the well or more distant activities occurring in the aquifer recharge area. Iron, manganese, hydrogen sulfide, and hardness are frequently

associated with groundwater supplies, but are not considered to be health hazards. Treatment for these problems is available and your local Cornell Cooperative Extension office or health department office can usually provide information about treatment options. Also read Chapter 3: *Water Testing and Treatment*.

A well may fail to provide an adequate supply of water due to a faulty pump, decline in water level, plugged or deteriorated screens, or an accumulation of sand or sediments in the well. A well driller or a Cornell Cooperative Extension agent can help determine the cause of failure and provide information concerning possible remedies. When consulting the experts about troubles with the water supply, you need to know the details of your system. **For your convenience there is a form where you can record the information in the back of this publication.** By completing the form, you will have all the important information at your fingertips when you contact the experts.

Drinking Surface Water

Water from lakes, streams, ponds and creeks are "open" systems and are subject to contamination. Summer water samples from around Honeoye Lake have at times shown high fecal bacteria numbers. These results confirm that, while the lake is clean most of the time, there are days when the water would be considered nonpotable and therefore should be disinfected. While many people living on the lake use it as a source of drinking water, most do not use a disinfection system to kill bacteria. It is highly recommended that drinking water from these sources be continuously treated. Please see Chapter 3: *Water Testing and Treatment* for further details.

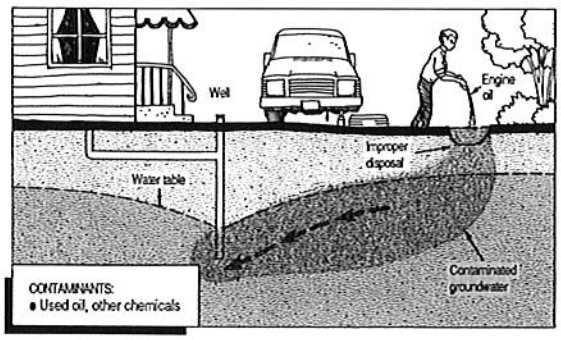
The Lake Book

Water Testing & Treatment

Chapter 3

Most Americans take water for granted. They have clean, safe water supplied by a municipal water facility where the quality is regulated by state and federal authorities. The forty million Americans who draw water from a spring, lake, well or cistern have a responsibility to monitor, maintain, and treat the water they drink. This chapter will explain how people with private water systems should operate, test and treat their water to ensure a safe, potable source of drinking water.

Water is known as a symbol of purity and is essential for life. It can also be the carrier of



Source: *Groundwater Contamination,* Bulletin No. 2, by Lyle S. Raymond. Published November 1988 by the NYS Water Resources Institute, Cornell University, Ithaca, NY.

disease if not properly protected and treated. The great plagues that decimated world populations in the Middle Ages were caused by contaminated drinking water. Waterborne diseases such as cholera, dysentery and hepatitis A are still common in undeveloped countries and occasional outbreaks in our country still take place. Recently, a large outbreak of cryptosporidium (a waterborne parasite) in Milwaukee infected more than 400,000 people and led to over 100 deaths from contamination of the city's public water supply by cattle in feedlots. This catastrophic event drew national attention to the treatment of public water and a heightened awareness to the susceptibility of our water supplies to contamination.

Public water systems are state and federally regulated and use extensive treatment technology to ensure a potable water supply. Homeowners with personal water supply systems make the critical decisions about treatment and maintenance on their own. Many of the residences around Honeoye Lake report that they do not treat their water, "Haven't in the past — don't need to now!" They assume that Honeoye Lake is pure and uncontaminated. The reality is that a waterline in Honeoye or any of the other Finger Lakes is subject to drawing water, which at times may be unsafe to drink.

We don't know the true extent of waterborne disease from private water supplies because most cases of individuals getting sick from their water goes unreported. People often attribute their illnesses to other causes, such as the flu or food poisoning, not realizing their water supply has been contaminated. To protect the public, the New York State Department of Health (NYSDOH) has created health laws (State Sanitary Code Subpart 5-1) regulating the treatment of water for public water systems. These laws regulate municipal water systems, businesses, and any system that services at least 5 homes or 25 individuals. Any camps, trailer parks, and small clusters of homes in the Honeoye Lake area using a single water source are

subject to this regulation. Under these laws the minimum treatment for ground water is through chlorination or other disinfection methods described by the NYSDOH. Surface water systems come under the Surface Water Treatment Rule, which requires slow sand filtration and disinfection of the water before distribution to the users.

Private Water Sources

Homeowners who do not have a municipal water supply available are responsible for properly testing, treating, and maintaining their water. This requires an understanding of the potential sources of contamination and knowing how they cause problems for water supplies.

Groundwater is the source for wells, spring boxes, and surface waters, such as streams and lakes, and are subject to contamination from many sources. Leaky underground storage tanks, failed septic systems, manure spread on frozen soil, too much fertilizer on a lawn, fuel spills, etc. . . . are all sources of pollution that can seep through the soil and bedrock to groundwater or flow overland into streams and lakes. For these reasons, shallow wells, particularly old wells with unsealed linings of rock or stone, and surface water supplies are the most susceptible to contamination, but even deeper wells are at risk.

Table 3-1. Minimum treatment for your water source

Water Source	Minimum Treatment[a]
Cistern, controlled catchment, spring box	Continuous disinfection and filtration; corrosion control
Community water system	None needed by user
Drilled well	None, unless tests indicate or contamination likely
Dug, jetted, driven, or bored well	Continuous disinfection; filtration
Hauled water	None if safely stored, but disinfection desired
Lake	Continuous disinfection; filtration; **zebra mussel control** (see Chapter 4)
Stream	Streams are not recommended for domestic use without extensive treatment

[a] Recommended minimum treatment for domestic use. Additional treatment may be needed depending on water quality test results and desired water quality.

Testing Your Water

Private water supplies should be tested on a regular basis. The frequency of testing depends on well location, construction, and on previous test results. Testing every two to three years may be sufficient for wells that have no history of contamination, are isolated from pollution sources, and have at least 50 feet of watertight casing. Shallow wells, wells that have been previously contaminated, and wells without a watertight casing (such as dug wells or springs) should be tested at least once per year, preferably in the spring. Lake water tests should be interpreted with caution because there can be small plumes of contaminated water moving about the lake. The water quality may be fine the majority of the time, but can change very quickly as a plume moves into the area of the intake. Because of this uncertainty in water quality, testing the lake for potability is not necessary. The following section describes the process of selecting what types of tests to have done and how to go about testing your water.

Testing water for every contaminant is possible, but very expensive and usually not necessary. It is more important to test on a regular basis for a few indicators of contamination and to maintain a record of water quality. This helps to identify changes in the supply, contamination of the water source or deterioration of the water system. Good records of water quality are also important should you need to prove that your water has been contaminated by some outside activity such as mining or waste disposal. Standard laboratory procedures identify the amounts of specific bacteria, chemical compounds and other components that affect water quality. Most important are routine annual water tests even if no obvious water problems exist. It is recommended that household water be tested for total coliform bacteria, nitrate, pH,

and total dissolved solids. The Honeoye Valley Association annually makes water testing from a local laboratory available to its members at reduced rates.

Potential for Contamination

Many situations may lead homeowners to suspect that their water supplies are contaminated. Routine water tests, as described previously, are especially important if the supplies are threatened by nearby activities. Both past and current land use practices are important considerations when deciding which tests to perform. They provide a clue as to the most likely pollutant to test for. One way to obtain information on previous land use is from the local planning or zoning board. The effects of previous land uses can give long-lasting impacts on the quality of underlying water. Some contaminants will adhere to certain soil types and be released slowly into percolating water. Table 3-2 lists activities that may affect water supplies and offers guidance on which laboratory tests to request if a problem is suspected.

Land use practices within the area contributing to the water supply should be investigated. For groundwater supplies, the direction of groundwater flow and the aquifer properties have an impact on the area contributing to the well or spring. The soils in the area, the depth to groundwater, and the underlying geology affect the connection between the land surface and the water supply.

Individual sewage treatment systems that are properly designed and maintained will not

Table 3-2. Which tests to request when specific contaminants are suspected.

If you suspect contamination from . . .	Request these tests
Feedlots or land application of manure	• nitrate • pH • total dissolved solids • total coliform bacteria
Field cropping or fruit cropping	• nitrate • chloride
Heavily salted roads, road salt storage sites, signs of corrosion near pipes, or water that tastes salty	• sodium • pesticide scan • total dissolved solids
Household plumbing with lead, copper, or galvanized pipes, fittings, or solder joints	• pH • metals (cadmium, copper, lead, zinc) • Langlier saturation index
Individual sewage disposal systems (septic tanks, cesspool, privies)	• nitrate • surfactants • fecal coliform bacteria • fecal streptococcus bacteria
Land spreading of municipal sludge	• nitrate • metals (lead, cadmium) • total coliform bacteria
Landfills, junk yards, factories, or dry cleaning operations	• chloride • pH • total dissolved solids • chemical oxygen demand (COD) • volatile organic scan • metals (aluminum, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, zinc)
Leaking underground fuel storage tanks	• hydrocarbon scan

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contaminate drinking water supplies. Systems that are too closely spaced, poorly maintained, located in poor soils, or located in areas with shallow depths to groundwater pose the greatest danger to drinking water supplies.

Fuel storage tanks are a potential source of groundwater contamination. They occur in virtually every community, on many farms, and in other areas. Underground storage tanks are particularly dangerous, because their leaks may not be noticed until it is too late.

Groundwater that has been contaminated by hydrocarbons has a characteristic oily odor. Since hydrocarbons are lighter than water, they tend to drift along the top of the aquifer's saturated zone in the direction of groundwater movement. A hydrocarbon scan can verify the existence of hydrocarbons in groundwater. If a leak is discovered, it does not necessarily mean that local groundwater is contaminated. Unsaturated soil between the tank and the water table may absorb the initial discharge of fuel.

Proactive maintenance is called for on underground storage tanks. Tank owners are encouraged to have their tanks tested to determine if they are leaking. Old, unused tanks should be dug up and removed. New tanks should be installed above ground where they can be monitored.

Contaminants

Bacteriological — The presence of coliform bacteria, which are not harmful themselves, is a good indicator of the presence of other, pathogenic (disease causing) bacteria. The inexpensive and simple test for coliform bacteria determines if a water supply is potable or bacteriologically safe to drink. This test identifies drinking water that has been contaminated by human wastes, animal wastes, soil, or plant materials. A positive test result indicates the presence of coliform bacteria and requires further tests to determine their source. The coliform bacteria test is easily performed by laboratory professionals and can be run routinely at a low cost.

It is strongly recommended to run a bacteriological test when:

- There is any noticeable change in color, odor, or taste of the water
- High water or flooding covers the top of the well
- Family members or house guests have recurrent incidents of gastrointestinal illness
- The water is going to be used by a pregnant mother
- There has been any maintenance on the water supply system
- A well is newly constructed or repaired
- A neighbor's well is found to be unsafe
- You are about to start using a well that has not been in use for a long time

Nitrate — Nitrates are tasteless and odorless and may be a problem for at-risk individuals. A water test is the only way to determine if nitrate is in the water supply. Testing for nitrate should be done if any of the following are in the area of the water supply: livestock facilities, fertilizer storage or handling sites, septic systems, or other nitrogen sources. Spreading manure or municipal sludge on land and over-application of fertilizer to agricultural crops also may lead to nitrate contamination.

Babies are most sensitive to excessive nitrates in drinking water. If a newborn is expected in a household and there is a potential for nitrate contamination, testing for nitrate is recommended in the early months of pregnancy. Testing should also be done before bringing an infant home and again during the first six months of the baby's life. The possible consumption of water with a concentration of nitrate greater than the 10 ppm (the maximum contaminant level) puts the baby at-risk of developing methemoglobinemia, also called blue-baby syndrome.

pH — pH is an indicator of the acid or alkaline condition of water. Water with a pH less than 6.5 tends to be corrosive, while water with a pH greater than 8.5 tends to be alkaline. A pH of less than 4.5 dissolves metals such as copper and lead, a real health concern, and may affect the efficiency of water treatment units.

Total Dissolved Solids — The total dissolved solids (TDS) is a comprehensive indicator in routine water testing. An increase in the TDS concentration indicates an increase in one or more compounds. If water test records indicate that the TDS concentration has changed, further tests are required to identify the substance(s) causing the change.

A significant change in the TDS concentration may result from several practices. Mining activities, heavily salted roadways or unprotected salt storages can lead to increased TDS concentrations in nearby water supplies.

Improperly lined landfills, junkyards, industrial activities, or chemical spills also could cause an increase in the TDS concentration.

Nuisance Contaminants

Many of the substances that stain fixtures, color the water, create unusual tastes or odors are not health hazards. These nuisance chemicals may make water unpleasant to drink or prevent soap from lathering the way we are accustomed to, but no harm will come from drinking these waters. Common nuisance chemicals such as various forms of calcium, chlorine, iron, magnesium, and sulfur can be removed or treated to improve the aesthetics of the water. See table 3-3.

Table 3-3. Water tests suggested for specific nuisances.

Water Problem	Suggested Test
Deposits in pipes or pitting of pipes	
· deposits or pitting	· Langlier saturation index
	· pH
	· metals (cadmium, copper, lead, zinc)
Off-color water	
· cloudy	· turbidity
· black	· hydrogen sulfide (no test if odor exists)
	· manganese
· red	· iron
· brown or yellow	· iron
	· humic and tannic compounds (for lakes and streams)
Reddish brown slime or gelatinous discharges from the top	
· iron bacteria	· no test required
Stained fixtures and clothes	
· red or brown	· iron
· black	· manganese
· green or blue	· copper
	· Langlier saturation index
Unusual taste or odor	
· rotten-egg	· hydrogen sulfide (no test required)
· metallic	· pH
	· Langlier saturation index
	· metals (cadmium, copper, iron, lead, zinc)
· salty	· total dissolved solids
	· chloride
· septic, musty, or earthy	· total coliform bacteria
	· methane
· alkaline	· pH
	· total dissolved solids
· gasoline or oil	· hydrocarbon scan
· soapy	· surfactants
· phenol (chemical) order	· volatile organic scan

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Hard water is a common problem that makes it difficult to produce suds or rinse out soap. Caused mainly by the presence of dissolved calcium and magnesium bicarbonates, hard water is also responsible for the hard mineral deposits--commonly referred to as milk stone or lime scale — occurring when these minerals precipitate out of solution.

Hydrogen sulfide, a dissolved gas, dissipates when exposed to air with a distinctive, rotten egg odor. Because the gas escapes from water very quickly, measurements of hydrogen sulfide concentrations must be made immediately.

Iron stains laundry and fixtures; causes a bitter, metallic taste; and can leave a red-brown sediment.

Iron bacteria is a nuisance bacteria that feeds on iron in the water or in the pipes. It can create a gelatinous mass capable of clogging pipes, but again, is not harmful to water consumers. A water test is not needed to identify iron bacteria because they form a very obvious slime on the inside of pipes and fixtures. A reddish brown slime on the inside of a toilet tank

or where water stands for several days identifies the problem. Differentiating between slime and stains that result from oxidation of iron in the water is important when treating the problem.

Water Sampling

Water should be sampled when the supply is most susceptible to contamination, usually after spring thaw or heavy rainfall. It's recommended to sample both before and after water goes through any treatment equipment to assure that the device(s) is working properly. Proper collection, handling, and preservation of a water sample are crucial for an accurate water test. One of the best ways to preserve water is with refrigeration, depending on which tests are being done. Always contact the laboratory before sampling. They will provide clean water sample bottles, information on how much water they need to run the tests, what type of container to use, what preservation methods to use and how soon after sampling they need to have the water in their hands. Only use a certified laboratory licensed by the State of New York. Call the Department of Health for a listing of certified labs.

Treating Your Water

There are two ways of treating water for consumption — disinfection and filtration. Disinfection controls biological contaminants by killing or rendering the organism inactive. Filtration eliminates particulate, chemical and biological contaminants by removing them from the water. Many home systems use both to ensure potable water. This section describes the major treatment devices used. See table 3-4 for a comprehensive listing of treatment devices and the problems they address.

Failed Bacteria Tests

When a water sample comes back with greater than 1 coliform colony per 100 ml of water the Department of Health recommends:

1. **Perform Sanitary Survey** — Search for and correct all sources of pollution.
2. **Shock Chlorinate** — using liquid chlorine bleach.
3. **Resample** — After you are sure all chlorine is gone, resample the well, using a certified laboratory and use sanitized bottles from the lab.

Note: Lake water samples are inherently susceptible to bacteria contamination and shock chlorination is not effective. All sources of water from surface waters should be continuously disinfected by an approved water disinfection system (chlorination, U.V., distillation, ozonization, etc.).

Shock treatment is most easily achieved by pouring enough household liquid bleach into the well, cistern, holding tank, or other structure to disinfect the water. See the table that follows for details on chlorine amounts for well water disinfection.

Depth of well in feet	Diameter of well in inches							
	2 in	3 in	4 in	5 in	6 in	8 in	10 in	12 in
5'	1 cup	1 cup	1 cup	1 cup	1 cup	1 cup	1 cup	1 cup
10'	1 cup	1 cup	1 cup	1 cup	1 cup	1 cup	2 cup	
15'	1 cup	1 cup	1 cup	1 cup	1 cup	2 cup		
20'	1 cup	1 cup	1 cup	1 cup	1 cup			
30'	1 cup	1 cup	1 cup	1 cup				
40'	1 cup	1 cup	1 cup	2 cup				
60'	1 cup	1 cup	2 cup					
80'	1 cup	2 cup						
100'	1 cup	2 cup						
150'	2 cup							

Source: U.S.EPA, 1973

Pour the chlorine into the structure to be disinfected. After mixing, open ALL taps and outlets, including washing machines and dishwashers, and let run until the water issuing forth has a strong chlorine odor. Then close all the taps and allow the chlorine solution to remain in the piping system for at least 8 hours.

Table 3-4. Possible treatments for water with known contminants.

Problem	US EPA Standards[a]	Possible Water Treatment Methods[b]
Coliform Bacteria (total)		· chlorination · iodination · ultraviolet light
Iron Bacteria		· shock chlorination · continuous chlorination
Iron (dissolved)	0.3 mg/l-SMCL	· water softener (0.3-3.0 mg/l)[c] · oxidizing filter (3.0-10.0 mg/l)[c] · chlorination, followed by filtration (greater than 10.0 mg/l)[c]
Lead	0.05 mg/l-MCL	· distillation · reverse osmosis · corrosion control[d]
Chloride	250 mg/l-SMCL	· distillation · reverse osmosis
Chlorine		· activated carbon filter
Hydrogen Sulfide		· oxidizing filter · chlorination or aeration, followed by filtration
Nitrate (as N)	10.0 mg/l-MCL	· distillation · reverse osmosis · anion exchange
Hydrocarbons (petroleum products)		· activated carbon filter
Pesticides and PCBs		· activated carbon filter
Trihalomethanes (THMs)	0.10 mg/l-MCL	· activated carbon filter
Volatile Organic Chemicals		· air stripping · activated carbon filter
Radon		· air stripping · activated carbon filter
pH	less than 6.5-SMCL	· neutralizing filter (pH 5.5-6.5 only) · soda ash injection (pH less than 6.5)
pH	greater than 8.5-SMCL	· acid injection
Langlier Saturation Index (LSI)		· neutralizing filter (less than -0.5) · soda ash injection (less than -0.5)
Hardness		· water softener
Total Dissolved Solids (TDS)	500 mg/l-SMCL	· distillation · reverse osmosis
Turbidity		· particle filtration

[a] When the United States Environmental Protection Agency (USEPA) has set an MCL (Maximum contaminant level) and or an SMCL (Secondary Maximum Contaminant Level), the values are listed.

[b] The water treatment recommendations in this table are general. The water pH, total dissolved solids, other dissolved or particulate substances or other water quality or water distribution system factors may impact the effectiveness of a treatment device. Be sure to investigate the limitations of a device before purchasing.

[c] Ranges refer to iron concentrations.

[d] Corrosion control is an appropriate treatment method if the contaminant enters water as a result of corrosive water dissolving the household plumbing.

Portions reproduced with permission from: *Private Drinking Water Supplies*, NRAES-47, by K. Mancl, M. Sailus, and L. Wagenet, Northeast Regional Agricultural Engineering Service, Ithaca, NY, 1991.

Recirculating the water back to the well or reservoir with a hose, for example, insures good mixing and affords a means of washing down the walls of the structure with the chlorinated water. After 8 hours, open all the taps and flush the system thoroughly until the water is reasonably free of the taste and odor of chlorine. Assuming that the source of pollution had been identified and removed, the system should be completely disinfected.

If it ever becomes necessary to use water from a source of unknown sanitary quality, all drinking water and water used for cooking, cleaning food and dishes needs to be treated. Two suggested ways to treat water are boiling and chlorine bleach.

Boiling: Water may be made safe for drinking purposed by bringing the water to a rolling boil for five minutes. The resulting "flat" taste may be removed by pouring the water from one clean contained to another several times.

Liquid Bleach: Add 8 drops of a chlorine bleach for every gallon of water. After mixing, let the solution stand for at least 30 minutes before consuming. "Clorox", and other commonly available laundry bleaches containing 5% chlorine by weight may be used.

Disinfection should not be attempted on dirty or discolored water except in an emergency. The particles in dirty water can interfere with disinfection, preventing adequate treatment. If dirt is present, first let the water stand, then pour off and treat the clear water or filter before disinfection. Water from an approved source (i.e.. commercially bottled water or water from a public water system) should be used until the contaminant is removed, steps are taken to prevent further contamination, and the water is analyzed and is proven safe.

Water Disinfection

The major water disinfection options include chlorination, ultraviolet radiation and ozone. Each has advantages and limitations. All are intended for use only on clean, clear water.

Chlorination

Chlorination is the oldest method of continuous disinfection for public water supplies. Disinfection by chlorination has been studied extensively, and there is a lot of experience upon which to draw. Chlorination is the standard by which other disinfection procedures are judged.

Chlorine is a strong oxidizing agent. It is cheap, reliable, easy to use and monitor — and it is safe. A dose of chlorine large enough to be harmful smells too bad to drink. Chlorine is also easy to remove. Exposure to the atmosphere, heating, or filtering through activated carbon will remove chlorine from water.

Chlorination may be done in many ways. It may be injected into the water supply stream for continuous disinfection or added to a known volume of water as a batch treatment procedure. Chlorine is also used for sanitizing wells and plumbing systems whenever a new system is put into operation or when an existing system has been exposed to contamination.

Chlorine does have some drawbacks. It requires time to react and organisms vary in their resistance to chlorine. Most bacteria are relatively easy to kill. Viruses as a rule are more difficult to kill and many cysts and worms are relatively unaffected. Chlorine also attacks reduced forms of iron, manganese and organic matter, which is common in many water supplies. If the chlorine is consumed in reacting with these elements, it is not available to attack the pathogens for which it was intended. Also, the reaction of chlorine with organic matter may produce trihalomethanes (THM) which are known carcinogens. Finally, many people do not like the taste or smell of chlorine in the water.

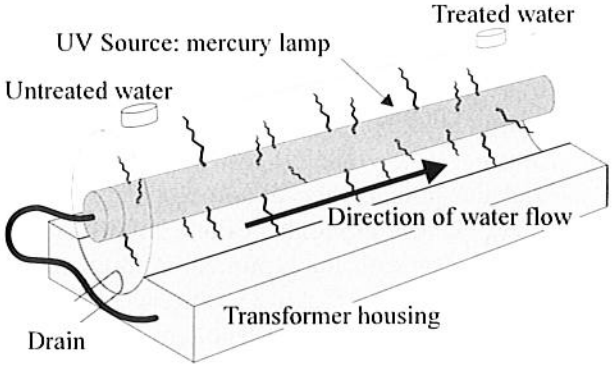
The amount of chlorine should be checked by residual tests. A water source that requires routine disinfection requires routine checking. Simple, do-it-yourself test kits are available and the homeowner should test periodically. Frequent testing should be done initially to gain experience with the treatment equipment and the test procedure. After a time, weekly or bi-weekly testing should be enough. Testing is the

only way to be sure the treatment procedure is working. A residual of 0.1 to 0.5 ppm at the point of use is acceptable and indicates that everything is working.

Ultraviolet Radiation

Ultraviolet (UV) light has long been known to have germicidal properties, but equipment using this principle in private water systems is quite new. Common low-pressure mercury arc lamps produce a high percentage of their ultraviolet light in the spectral range of 260 nanometers (a nanometer is one billionth of a meter), which is just below visible light. Most microorganisms are affected by radiation between 200 and 300 nanometers. UV does not kill Giardia lamblia cysts or Cryptosporidium parvum oocysts, which must be removed by filtration or boiling. Nor is UV recommended for water exceeding 1000 total coliform or 100 fecal coliform per 100 ml of water.

Ultraviolet treatment has the advantage of adding nothing to the water and not requiring the addition of treatment materials as long as the lamp is maintained in good operating condition. The major disadvantage is that there is no residual for treatment beyond the device. If contamination occurs after treatment, another disinfection method such as chlorination will have to be used to sanitize the system and treat the water. Some pathogens deactivated by UV light may be reactivated when exposed to oxygen, as there is no residual to counteract recontamination. Water or reconstituted drinks stored for extended times in the refrigerator should be boiled or treated with a small amount of disinfectant if UV is the primary disinfection process.



For UV to work properly, the light must come in contact with the organism. Therefore, all surfaces that the light must pass through need to be kept clean. The UV bulbs do not burn out — they gradually lose power with use. Replacing the bulb at least once per year will help ensure proper treatment of the water. If the system is shut down for several days or longer, any water left in the system should be drained and the entire plumbing system flushed.

Ozone Treatment

Ozone, like chlorine, is a strong oxidizing agent and is used in much the same manner. The major difference is that ozone is unstable so it cannot be produced and transported to the point of use. It must be generated at the point of use. Ozone, a triatomic form of oxygen, is the product smelled near an electric spark or lightening strike. For water treatment, ozone is produced by an electrical corona discharge or ultraviolet irradiation of dry air or oxygen.

Ozone is unstable and extremely active as a disinfectant. The required contact time is so short that it is not a consideration in the design. Municipal systems in Europe have used the procedure for many years but only recently has the technology been applied to public systems in the United States. Now small units are available for the homeowner. The benefits are the strength of the disinfection and the lack of potentially harmful by-products like trihalomethanes (THM).

Like chlorine, ozone may not kill cysts and some other large organisms, so these should be eliminated by filtration or other procedures prior to treatment.

Ozone has an active residual effect measured in minutes while the residual for chlorine is measured in hours. This lack of long residual is probably the greatest drawback for use in public water systems in the United States.

The home devices are a "black box" approach to water treatment. They are installed in the plumbing system and connected to the electrical power supply. Raw water enters one opening and treated water emerges from another. Inside, ozone is produced and mixed with the

Table 3-5. Water treatment methods and the problems they address.

Water treatment device or method [a]	Problems addressed by the water treatment method	Point-of-use (POU) Point-of-entry (POE)
Physical treatment		
Activated alumina	Fluoride, arsenic, selenium, and chromium.	POU or POE
Activated carbon	Tastes and odors; chlorine and iodine residuals; radon gas; certain organic chemicals, including some volatiles, pesticides, and trihalomethanes (THMs). May be designed for lead removal.	POU or POE
Boiling	Coliform bacteria, *Giardia lamblia* and *Cryptosporidium parvum*, some volatile organic chemicals (VOCs).	POU
Cartridge sediment filter	Turbidity, particles, and sediment; oxidized iron, manganese, and hydrogen sulfide Some may remove *Giardia lamblia* and *Cryptosporidium parvum.*	POU or POE
Distillation	Coliform bacteria, *Giardia lamblia* an *Cryptosporidium parvum*, most metals and inorganic chemicals, some organic chemicals and pesticides, total dissolved solids (TDS).	POU
Media filter	Turbidity, particles, and sediment; oxidized iron, manganese, and hydrogen sulfide.	POE
Multimedia filter	Turbidity, particles, and sediment; oxidized iron, manganese, and hydrogen sulfide.	POE
Precoat filter	Turbidity, particles, and sediment; oxidized iron, manganese, and hydrogen sulfide. Some may remove asbestos, *Giardia lamblia* and *Cryptosporidium parvum.*	POE
Reverse osmosis	Most inorganic components of total dissolved solids (TDS), including nitrate and lead. May remove some organic chemicals.	POU
Ultraviolet light	Viruses and coliform bacteria if coliform levels do not exceed 1,000 total coliforms per 100 milliliters or 100 fecal coliforms per 100 milliliters.	POU or POE
Chemical treatment		
Acid injection	Corrosive water and "soda" taste due to high pH (alkalinity)	POE
Aeration	Volatile organic chemicals (VOCs), radon, other dissolved gases.	POE
Anion exchange	Nitrate, sulfate, and arsenic.	POU or POE
Chlorination	Certain viruses and bacteria; dissolved iron, manganese, and hydrogen sulfide[c]; iron, manganese, and sulfur bacteria.	POU or POE
Iodination[d]	Bacteria, some viruses.	POU or POE
Neutralizing filter	Corrosive water due to low pH (acidity)	POE
Oxidizing filter	Dissolved iron, manganese, and hydrogen sulfide	POE
Ozonation	Certain viruses and bacteria, Giardia lamblia cysts, and other microorganisms; dissolved iron, manganese, and hydrogen sulfide[c]; some metals; color, odor and many tastes.	POE
Phosphates[e]	Hardness (calcium and magnesium, small amounts of dissolved iron.	POE
Potassium permanganate	Dissolved iron, manganese, and hydrogen sulfide; iron bacteria.	POE
Soda ash/sodium hydroxide injection	Corrosive water due to low pH (acidity)	POE
Water softening (cation exchange)	Hardness (calcium and magnesium), barium, radium, and small amounts of dissolved iron and manganese.	POE

[a] The recommendations in this table are general. Water pH, total dissolved solids (TDS), other particulate substances, or other water quality or water distribution system factors may affect the effectiveness of a treatment device. Before purchasing a device, be sure to investigate its limitations.

[b] Fluoride concentrations in the range of 1 mg/l are desirable in drinking water for protection against tooth decay. For this reason, fluoride may be added to a municipal water supply. Fluoride concentrations greater than 2 mg/l may have negative effects.

[c] This treatment method oxidizes dissolved iron, manganese, and hydrogen sulfide. The resulting particles must be removed with a mechanical postfiller.

[d] The US Environmental Protection Agency approves iodination only for emergency or temporary use due to possible health effects. Nevertheless, some states allow routine iodine disinfection.

[e] Phosphates are not allowed in some states.

Portions reproduced with permission from: *Private Drinking Water Supplies*, NRAES-48, by L. Wagenet, K. Mancl, and M. Sailus, Northeast Regional Agricultural Engineering Service, Ithaca, NY, January 1995.

water whenever the water pump is running. At the present time, all home systems use dry air to produce the ozone. A system to clean and remove the humidity from the air must be included, and such a system requires routine maintenance. At present, there are no general guidelines so the manufacturer's recommendations should be followed carefully. Test equipment for residual ozone is now available and should be purchased with the unit. The only way to know if the unit is working is to test for ozone residual or have bacterial tests conducted on the treated water.

Water Filtration

Activated Carbon

How Does Activated Carbon Work? — Activated carbon filtration is a method of removing certain organic chemicals passing water through a granular or block carbon material that adsorbs hazardous organic compounds as well as chemicals causing unpleasant tastes and odors (Adsorption is the attraction and holding of one substance on the surface of another, often involving the attraction of molecules in gases and liquids to the surface of a solid). The contaminant is accumulated and retained (adsorbed) at the surface of the carbon particles. The characteristics of the carbon material influence the efficiency of adsorption.

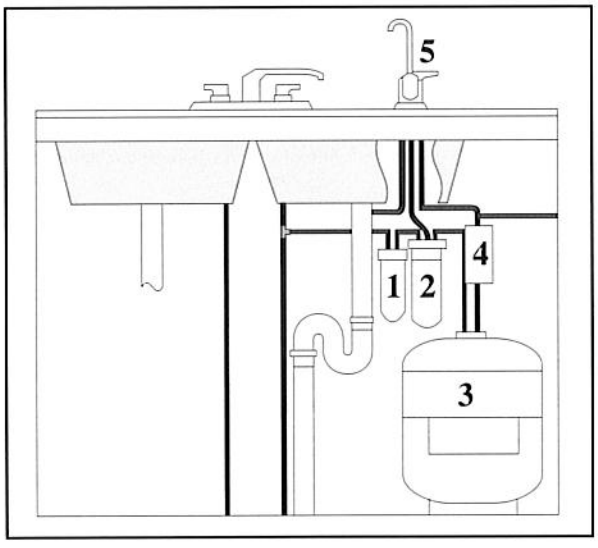
Choosing an Activated Carbon Unit — When purchasing an activated carbon filtration device, the individual should consider the amount of carbon contained in the unit, initial and replacement filter costs, frequency of filter change, and operating convenience. Other important considerations are the potential water pressure drop in the home system after installation of a unit, and the daily quantity of treated water supplied by the device.

Activated carbon treatment has limitations. It will not soften water or remove bacteria, viruses, dissolved metals, hydrogen sulfide, chloride, fluoride, or nitrate. It will remove limited quantities of rust, but particulate matter or high iron levels cause frequent fouling of the unit. Activated carbon is not a recognized method for bacteria removal. Specific recommendations on which type of activated carbon unit should be used are obtained from local health departments.

Reverse Osmosis

Reverse osmosis (RO) has been used extensively to convert brackish or seawater to drinking water, clean up wastewater, and recover dissolved salts from industrial processes. Its growing popularity in the home market is due to homeowners increasing concerns about hazardous contaminants, as well as simple nuisance chemicals, in their drinking water. RO removes a variety of chemicals from water and is an alternative to buying bottled water or locating another water source.

Contaminants Removed by RO — Reverse osmosis treatment decreases the dissolved impurities in water. It treats water with high salt content, cloudiness, dissolved minerals such as sulfate, calcium, magnesium, sodium, potassium, manganese, aluminum, silica, bicarbonate, chloride, nitrate, fluoride, boron, and orthophosphate. RO also effectively removes some detergents, some taste, color and odor-producing chemicals, certain organic contaminants, and specific pesticides.



A typical home Reverse Osmosis system consists of (1) particle filter, (2) RO membrane unit, (3) pressurized treated water container, (4) carbon adsorption post-filter, and (5) separate treated-water tap.

Source: *Reverse Osmosis Treatment of Drinking Water*, Water Treatment Notes, Fact Sheet 4, Cornell Cooperative Extension (1988).

Although the RO membrane is capable of rejecting virtually all microorganisms, it can develop pinholes or tears that allow bacteria or other microorganisms to pass into the treated water. Therefore, RO is recommended for bacteriologically safe water only.

Reverse osmosis will not remove all contaminants from water and is not an effective treatment for dissolved gases and certain organic chemicals, including some pesticides and solvents.

Home RO units are often small, cylindrical devices approximately 5 inches in diameter and 25 inches long, excluding and pre- or post-filtration apparatus. It is not practical to treat all water entering a residence with RO since small devices do not produce enough water to meet household needs. Often, the unit is placed beneath the kitchen sink to treat water used for cooking and drinking. Recent technology has developed membranes that reject large amounts of impurities and reduce pressure needs. When consulting a water treatment specialist, one should examine test results that show the percentage removal of specific contaminants at typical home water pressures.

Evaluating an RO System — Evaluation of an RO system should consider contaminant rejection (percent of contaminants not passing through the membrane), contaminant passage (percent of contaminants passing through the membrane to the treated water), and water recovery (percent of treated water obtained from the feed water), and water recovery (percent of treated water obtained from the feed water). High pressure, industrial RO systems reject 80 to 90 percent of many contaminants. Home RO units are very effective in rejecting specific impurities, but their percent rejection of contaminants should be evaluated at typical home line pressures.

Important — When choosing a system to treat your water, remember, **different treatment systems do not always remove the same contaminants equally**. It is possible that, in order to remove a number of different organisms or pollutants, more than one system is required. An independent nonprofit organization, NSF, tests and certifies drinking water units for different contaminants.

Questions about water testing and treatment can be answered by Cornell Cooperative Extension (CCE):

Ontario County CCE
480 N. Main Street
Canandaigua, New York 14424
716/394-4110

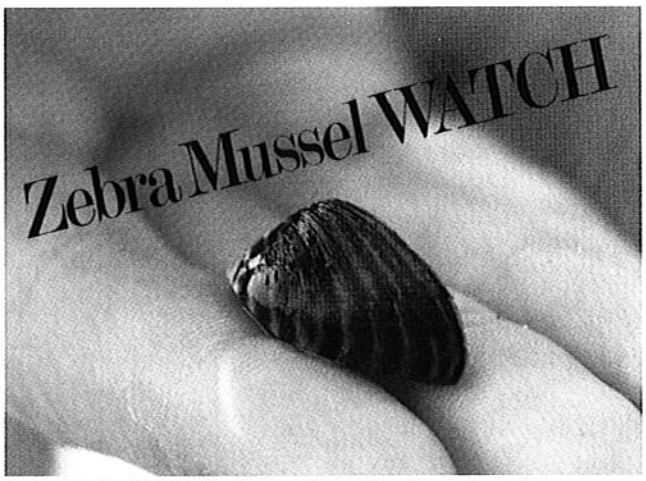
Livingston County CCE – 716/658-3250

Livingston County Soil and
Water Conservation District
129 Main Street
Box 152
Leicester, New York 14481
716/382-3214

Zebra Mussels

Chapter 4

Zebra mussels from Eastern Europe have recently invaded North America and are colonizing many inland lakes of New York, including most of the Finger Lakes. They were first detected in Honeoye Lake in the spring of 1998. Zebra mussels have the potential to clog water intake facilities, disrupt food webs and ecosystem balances, and interfere with sport and commercial fishing, navigation, recreational boating, beach use, and agricultural irrigation. Most importantly for homeowners, they can clog residential water intakes.



Source: *Zebra Mussel Watch*, Great Lakes Sea Grant Network.

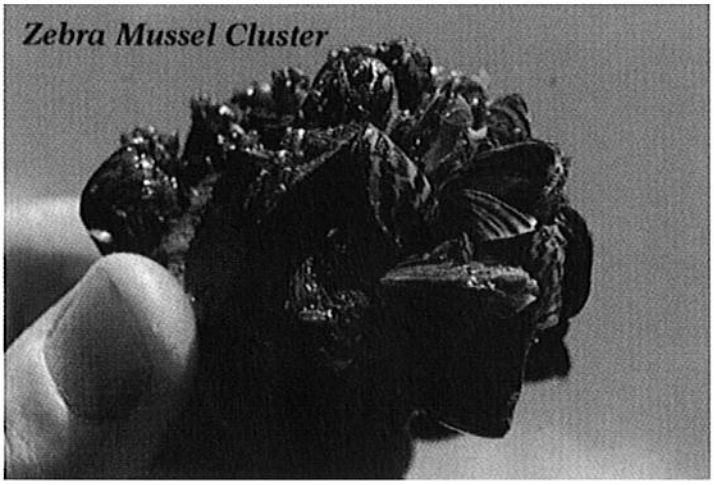
The zebra mussel is a small bivalve mollusk (a clam-like shellfish with two matching shell halves. Mussel spawning can take place anytime during the year when surface waters are approximately 54-63°F. Larvae, called veligers, hatch from eggs and are approximately 70 microns in length. They grow to an adult size of about 2 inches. Zebra mussels enter water intakes via several mechanisms: as veligers carried by water flow; as juveniles they can crawl; and as adults they can break loose from colonies and travel in lake currents. Zebra mussels attach themselves to hard surfaces by using a tough elastic fiber tipped with an adhesive, similar to that of barnacles. Once attached the mussels can form a dense colony within water intake pipes. The waterline is an ideal habitat providing a continuous source of food and oxygen while carrying away mussel wastes and protecting the mussels from predators and storm waves.

Once the waterline is infested, zebra mussels can colonize from the mouth of the intake to the plumbing inside the house. Since mussel spawning takes place when the waters are above 50°F, homeowners on infested waters should assume their intake will draw mussel veligers during much of the year.

Water System Protection

When considering the potential clogging of a water intake system, homeowners should view the system in two parts. Part 1 is the **onshore component**, that part of the system from the pump to the distribution pipes and faucets inside the residence. Part 2 is the **offshore component**, that is, the pipe from its intake end in the lake or river to the pump. (Fig. 4-1).

The onshore component will, in most cases, be the simplest and least expensive section to protect but the most difficult and costly to clean out if infested (because of the difficulty of physically removing plugged pipes from within the walls of a house). On the other hand, in



Source: *Zebra Mussel Watch*, Great Lakes Sea Grant Network.

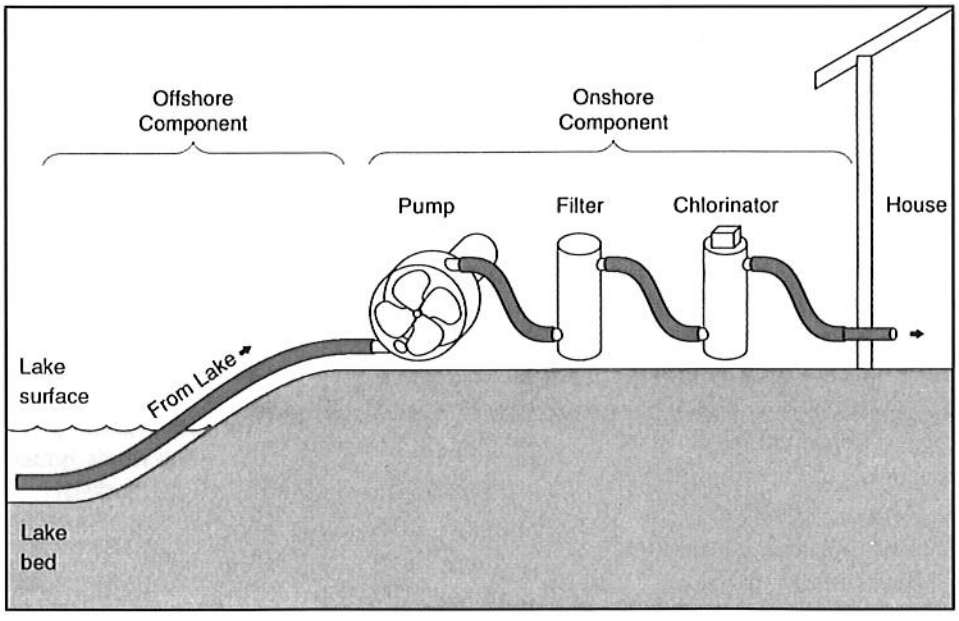
most situations, the offshore component will be the most difficult and expensive section to protect against clogging by zebra mussels but the least difficult section to clean out once it does become infested. As control of the mussels is more easily accomplished in the onshore rather than offshore component, this area will be addressed first.

Protecting the Onshore Component

Homeowners using a zebra mussel infested water body as a water source are advised to take early action to keep the mussels out of the onshore component of their systems to prevent infestation. Alternatives for accomplishing this goal include installation of a replaceable or cleanable in-line filter, chlorination, or a combination of filtration and chlorination. Shoreline wells, shoreline cisterns, and normal deep wells may also be used, but are not discussed here.

In-line Filtration

While screening or straining the water at the offshore intake end of the system is possible, in-line filtration in the onshore component is a more effective and far more easily accomplished control alternative. This method involves the installation of a "whole house" in-line filter on the water line prior to the pipe's entrance to the in-the-house plumbing system (Fig. 4-1). All water used by the residence passes through the filter before distribution. Such a filter must be capable of handling the estimated maximum gallons of water per day (gpd) used by a private residence (250 to 400 gpd for a full-time residence of a family of four, or perhaps as little as 25 gpd for a seasonal weekend cottage). The filter must also be capable of removing all particulate matter larger than approximately 50 microns. Flow rates of 6-20 gallons per minute will be needed to serve the needs of a year-round residence.



The combination of a 25-50 micron (absolute) in-line filter capable of filtering (250-400 gpd for a year-round home of a family of four) installed in combination with an in-line chlorine injection system, dosing at 0.25 ppm TRC whenever the pump runs, should ensure that the onshore component will remain mussel-free and will improve the quality of the water in the process.

Fig. 4-1. Onshore/offshore water protection system

In-line whole house filters come in a variety of configurations:

- Single-media filters — fiber media capable of removing particles down to 25 to 50 microns.
- Dual-media filters — fiber media surrounding a center section of activated charcoal capable of filtering down to 20 microns or smaller and removing many flavors and odor.
- Backflushable filters — can be backflushed by reversing the water flow and flushing the trapped particles from the filter, much like a swimming pool filter — thus eliminating the need to change filters.

All in-line filters require either periodic media replacement or back flushing. The amount of time between cleanings will depend upon: (1) the amount of silt, algae, zebra mussel veligers, and other materials drawn into the system; (2) the location the water body; and (3) the time of year. Caution should be used when cleaning or replacing filter media to ensure that none of the trapped material is inadvertently allowed to bypass the filter, thus contaminating the system.

At the time of this publishing, a good single-media filter can be obtained from plumbing supply houses for less than $200. Dual-media filters cost approximately $300 and backflushable filters can cost from $200 to $400 or more. Installation by a plumber adds to the initial cost of in-line filtration systems. The replacement of clogged filter refills is an ongoing cost and time commitment for the homeowner.

Chlorine Injection

Another method of preventing colonization in the onshore portion of a residential water system is the installation of an in-line chlorine injector after the pump and before the water storage tank that is part of the in-house distribution system. Such systems add a small amount of potable chlorine to the incoming water every time the pump runs. The amount of chlorine injected is comparable to that added to municipal water for disinfection purposes prior to being pumped to consumers, about 0.25 ppm TRC (parts per million total residual chlorine). This amount, added each time water is drawn from the lake or river, is sufficient to kill zebra mussel veligers, juveniles, and adults being drawn into the system with the water, and will keep the in-house plumbing clear of zebra mussels. This may have the added benefit of improving the water potability by destroying other pathogens, such as bacteria. Homeowners should check with their county health department or Cooperative Extension Service for guidelines on human consumption of lake or river water.

A chlorinator will not, however, keep shells and shell fragments drawn in from the lake or river from clogging faucets; a filter should be used in conjunction with a chlorinator for the best results.

Control of Zebra Mussels in Offshore Component

A number of offshore filters are now coming onto the market. The potential for clogging by silt, algae, debris, and mussels must be considered by homeowners researching such systems. Enclosing filters in metal, plastic, or other types of containments in an effort to protect them from the elements may actually provide a very suitable, protected habitat for mussel growth around the filters. The filters themselves, being hard, will also serve as attachment substrate for the mussels, leading to fouling and clogging. The use of a copper screen around a filter does not guarantee that zebra mussels will not attach to the filter, since veligers can pass through openings in the screen and, as the screen oxidizes, attach to the screen itself.

Homeowners considering such new systems should request that sellers provide detailed information on the following:

- How, how long, when, and where the systems were field-tested;
- Names of clients who have had such systems in the water for a reasonable length of time;
- What the seller will do in the event that the system clogs.

Purchasers should be aware that product testing should be performed spring through the fall when veligers are in the water — not in winter, when they pose little or no threat to intakes. Good old North American know-how

will most likely combine with our 1990's market economy to produce some form of high-tech offshore mechanical filtration devices over the next several years. But until then, the best advice is "buyer beware."

Sand Filtration for Offshore Controls

A different, proven approach for filtration of water at the source end of a pipe is the use of buried intakes and sand filters. These types of filters are used in Europe and parts of the Great Lakes for small municipal and industrial water supplies with flow requirements of up to approximately 20 million gpd but can be down sized to handle the flow requirements of groupings of private residences or even single residences. There are several options available: infiltration galleries, raised fill sand filters, and enclosed prefabricated sand filters. Only the prefabricated sand filter will be described here since it is the least expensive and most practical for home-owners without large water needs. For a more detailed description of all approaches consult "Sea Grant — Control of Zebra Mussels in Residential Water Sources".

Since these approaches all require placing something into the lake with possible environmental impacts, permits may be required by the DEC.

Enclosed or Prefabricated Sand Filters

In this approach, a concrete, steel, or plastic box, with a perforated pipe running lengthwise through it, is filled with coarse sand, placed into the water body, and hooked up to the residence's intake pipe (Fig. 4-2). General dimensions are: 4 to 6 feet of perforated pipe or well screen with 6 inches of gravel beneath, above, and on both sides of the pipe and 24 to 36 inches of sand above the pipe. A sheet of filter cloth should be used between the sand and gravel. Existing concrete castings, such as septic tanks or burial vaults, could be used as the containment structure. The top would not be placed on the container in this case, allowing water to be drawn downward through the sand into the pipe excluding mussel veligers and other particulate material. Since zebra mussels do not normally attach to sand, colonization of the open top surface should be minimal. Unless the filter is placed in water deep enough to be below storm wave scour, some riprap (large rocks) should be placed around it to prevent undermining or shifting. Enclosed or prefabricated sand filters should be less expensive to construct than infiltration galleries or raised fill beds. Their smaller capacity makes them more suitable for seasonal cottages than for year-round residences.

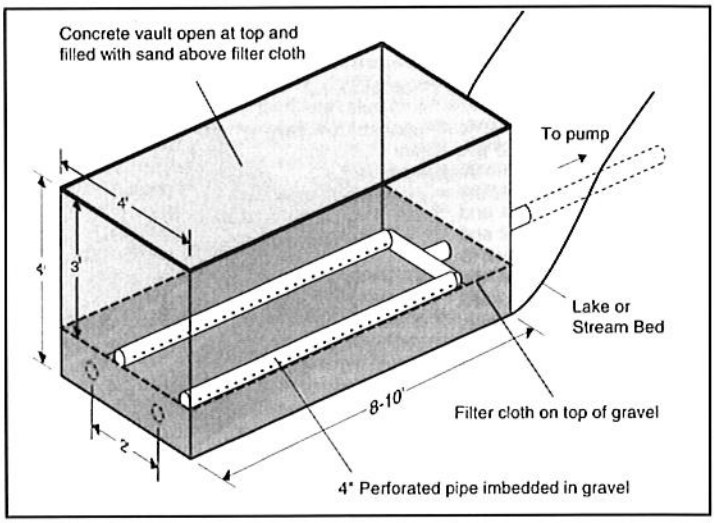


Fig. 4-2. An enclosed or prefabricated sand filter constructed of a perforated pipe running lengthwise through a concrete, steel, or plastic box filled with coarse sand and placed into a waterbody is a lower cost alternative suitable for seasonal weekend cottages.

Infiltration galleries, raised fill sand filters, and prefabricated sand filters should be designed to be periodically backwashed.

A number of commercial prefabricated sand filters are now on the market. No independent review of these filters is available; however, the concept they utilize (drawing water through sand into a porous pipe) is sound, suggesting such filters may have a good likelihood of success. Once again, readers should investigate any such product to determine where and when it has been used and what the rate of success has been. It is important that the filters have been tested or installed (and in operation for a season) in

waters infested by zebra mussels and not merely tested against silt and algae.

In-the-lake sand filtration should prove successful for removal of zebra mussels and other larger planktonic animals and plants, but by itself is not intended to provide potable water. Additional treatment at the house end of the pipe, by chlorination, may still be needed to disinfect for bacterial contamination. Readers should consult their county Cooperative Extension Service or Health Department for more information on potable water supplies.

Ceramic and Cartridge Filters

Several ceramic and cartridge filters, intended for use on the intake (lake) end of the pipe, are now on the market. Readers interested in these products should ascertain:

- How long they have been in service in mussel-infested waters
- What the porosity is (it should be a small enough opening that no life stages will be passed live into the intake pipe)
- How often they need to be backwashed (some need to be manually backwashed, some are automatic)
- How often they need to be replaced with new material

Removing Zebra Mussels from the Offshore Component

Another approach to controlling zebra mussels in the offshore component is to allow a certain amount of clogging in the intake pipe followed by periodic mechanical cleaning of the system. (Remember, the onshore component is always protected by its own filtration/chlorination system.) Such cleaning may be mechanical or thermal and the on-shore component must be protected from contamination during cleaning. To facilitate mechanical cleaning of an intake pipe, it would be advisable to install a clean out "Y" at the shore end of the pipe to provide access to the intake. It should be noted that many people have replaced older metal pipes with new, more easily worked with PVC pipe. In terms of zebra mussel control, this may pose a major problem; researchers have found that zebra mussel larvae tend to have a preference for settling on PVC materials. PVC is even used for settlement plates in many experiments and monitoring systems. For the long term, readers might consider the use of copper or galvanized pipes.

Snaking

For pipes that are short enough and that have easy access from the shore end, cleaning can be as simple and low-tech as running a modified plumber's snake through the pipe on a periodic basis. This may not be possible for very long pipes. Once the pipe is snaked, the debris must be removed by pumping the pipe at a high rate, and the debris-laden water must not be allowed to enter the household distribution system. The effectiveness of this method depends upon the design of the pipeline and the intensity of the infestation. Snaking is not effective in pipes with sharp, short radius bends or anywhere the infestation is so great that the amount of dislodged mussels might prevent their effective removal from the pipe or obstruct the progress of the snake through the pipe.

Suffocation and Desiccation

Since zebra mussels "breathe" oxygen as they draw water over their gills, oxygen deprivation (suffocation), accomplished by sealing off pipes long enough for the water to lose all of its dissolved oxygen, can be used as a control method. Mussels' demand for oxygen is greatest in warm water; therefore, oxygen deprivation tends to work best in summer. Two or three day's exposure to water with no dissolved oxygen at 73.5°F to 75°F should result in 100 percent zebra mussel mortality. Unfortunately, this means that any pipe treated in this manner must be able to be shut down and sealed for a number of days. To use this control strategy in year-round residential water systems, a second intake pipe should be added, allowing one pipe to be closed down for cleaning while water is pumped through the second.

A similar use of dual piping, most useful for seasonal cottages not using their intakes

during the wintertime, is the installation of short dual pipes laid above the bed of the lake. When one pipe becomes clogged, it can be pulled from the water body, allowed to dry out completely, killing the mussels in it, and cleaned while pumping continues through the second pipe. To utilize this method in a year-round home, the main pipe, buried for protection against freezing, would be used only after the water temperature has dropped below the temperature needed for mussel spawning (approximately 50°F). Two short pipes, which could be alternately pumped and cleaned, would be added to the system for use during the summer spawning season.

Some people have advocated the movement of intakes to deeper water in the hopes that this would prove too cold for zebra mussel colonization and lack sufficient supplies of mussel food to sustain large numbers of mussels. There is little data, however, to support this idea. Zebra mussels easily survive near-freezing water temperatures through Great Lakes winters with little damage to established colonies below the ice zone. Zebra mussels have been found colonizing down to about 200 feet and veligers have been found as deep as 220 feet in Lake Ontario. For residential systems, deeper intakes would seem, therefore, to hold little potential for success.

For a weekend cottage using only small amounts of water for non-potable uses, the use of a very short plastic pipe that could be disconnected and laid on the shore at the end of a weekend and reattached when the cottage is next inhabited might be a very practical control strategy. A "last resort" mechanical control for any extreme situation is the removal and replacement of clogged piping.

Thermal Treatment

Another effective and environmentally sound method of controlling zebra mussels in intake pipes is systematic, periodic flushing of intakes with heated water. Local resource management agencies should, however, be consulted to determine whether the amount of hot water that might get into the environment would require any type of discharge permit.

Water temperatures must exceed 98.6°F for about one hour to ensure 100 percent mortality for mussels acclimated to 50°F (10°C) water. Water temperatures greater than 131°F will result in almost immediate death of most mussels of most sizes. After the thermal flush, mussels will remain attached to the inside of the pipe for several days. They must then be removed by pumping the pipe at a high rate of flow.

A more suitable alternative would involve the use of a long steam hose connected to a portable steam generator set up at the shore end of the pipe. This steam hose would be tipped with a multidirectional nozzle and would be fed into the pipe through the cleanout, treating the inside of the intake pipe with live steam. Many plumbing contractors are using this technique to clean intake pipes up to 200 feet long in the Finger Lakes. One caution: steam lines cannot be sent through pipes that have tight bends.

Chemical Treatment of the Offshore Component

At the time of this printing, there are no reliable chemical treatment systems suitable for use in the offshore component of residential water intakes. There is great concern about potential negative effects of chlorine or other chemicals on fish or other aquatic organisms in lakes and rivers should any of those chemicals be released into the environment. Homeowners **should not** pour or backflush any chemicals down their water intake pipes. Such chemicals could be illegal if discharged into surface waters, might be environmentally harmful, might be harmful to human health, and might not even be effective in controlling zebra mussels. Before using any chemical treatment method, readers are strongly advised to check with local environmental regulatory agencies.

Long-term Socioeconomic Control Alternatives

Most, if not all, of the alternatives described in this chapter could be scaled up to meet the needs of more than one residence. Multi-residence zebra mussel control systems would have the benefit of reducing an individual's installation costs and might also have the environmental benefit of eliminating a proliferation of smaller, less efficient (possibly poorly installed) systems. Taken to a large enough number, multi-residence

systems might facilitate the establishment of special taxation districts to pay for the installation and operation of a community-wide water treatment and zebra mussel control system.

A long-term social solution to the problem of zebra mussel fouling of residential water systems might be the extension of public water to those areas not already serviced by public water. This alternative would be more costly and would take some time to implement.

For more specific details on the different types of zebra mussel control systems, contact your local Cornell Cooperative Extension (CCE) office and ask about three publications: the New York State Sea Grant Coastal Resources Fact Sheet, 1996 entitled "Control of Zebra Mussels in Residential Water Systems" by Charles R. O'Neill, Jr., "Stop! No Zebra Mussels Allowed"; and the Zebra Mussel Product Information List by Peter Landre, CCE.

Regulations on Installation of Zebra Mussel Protection Devices

The work that needs to be done to install an offshore component for protection against zebra mussels may require a permit from the DEC if you intend to disturb the near shore area or the lake bottom. Your regional DEC office can help you with permit requirements. Call or write to the Regional DEC office for help. The following list describes the regulated activities:

- Excavation, fill and placement of materials in navigable waters, which includes streams and lakes
- Disturbance of the bed or bank of a protected stream
- Filling, excavating, and construction in a protected wetland
- Excavation, dredging and construction within a Natural Protective Feature or Structural Hazard Area of a Coastal Erosion Hazard Area
- Any discharge of chemicals such as chlorine or hot water to surface waters

How Long Will It Take and How Do I Apply? — Contact your regional DEC office to obtain an application package. Follow the instructions carefully and ensure that you submit a complete application package. Be sure you include project plans and a location map (refer to the back of the application form, it lists the information the DEC needs), sign the application form, and mail it to your DEC office. There is no longer an application fee. The DEC has 15 days to determine if the application is complete. Once all of the information is together, the DEC has 45 days to issue or deny your application.

Can I get a permit in less time? — In DEC Region 8, a Standard Activity Permit has been developed for several generic systems that are used to protect residential water intakes from zebra mussel colonization. The systems that are covered by the Standard Activity Permit are:

- Beach wells, drilled or driven wells in the nearshore area at or below the mean high water line (MHWL)
- Infiltration galleries in the nearshore area or in the lake bottom. Area of disturbance less than 150 square feet below MHWL
- Combinations of beach wells and infiltration galleries that extend out into the lake
- Area of disturbance less than 150 square feel below MHWL

In general, your permit application will need to show that you will:

- Minimize disturbance to the nearshore area and lake bottom with a system that will reasonably meet your needs. The project can be done without placing motorized equipment in the water.
- Restore surface contours of the lake bottom and nearshore areas
- Prevent/control erosion during the site work, reseed/revegetate immediately
- Not place extensive amounts of fill in the lake

Permits for these systems can usually be issued within seven days of the receipt of a complete permit application. Your permit will receive an expedited review if you provide a complete application package that the DEC can use to issue a decision.

Do I Need Other Permits or Approvals? — You may need to obtain a permit from the U.S. Army Corps of Engineers for excavation and fill in a regulated Federal wetland. When you apply to the New York State Department of Environmental Conservation, they will send one set of the applications to the Corps of Engineers.

You should also check with your local government, the county and/or State Health Department. The regional office for Ontario County is (315) 789-3030. The Health Department can give you advice on how to protect your water supply and ensure its use for drinking and cooking. They can also help you determine if your water supply is far enough away from your sewage wastewater disposal system to avoid contamination.

Acknowledgments

This chapter is adapted from:

New York State Sea Grant Coastal Resources Fact Sheet, 1996 entitled "Control of Zebra Mussels in Residential Water Systems" by Charles R. O'Neill, Jr.

For information on zebra mussels, contact your local Cornell Cooperative Extension Office
New York Sea Grant, and or the
New York State Department of Health
624 Pre-Emption Road
Geneva, New York 14456
315/789-3030

New York Sea Grant
SUNY College at Brockport
Brockport, New York 14420-2928
716/395-2516

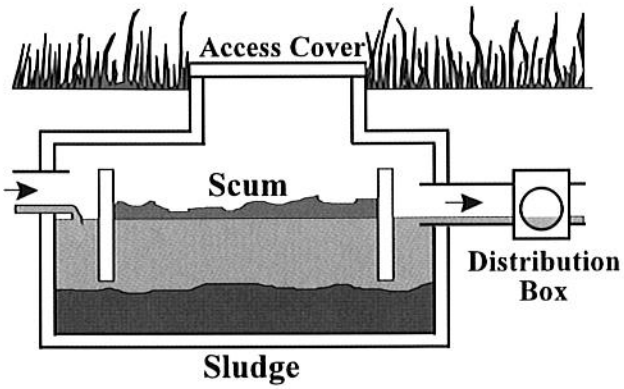
For more information on permit requirements or to obtain an application package, please write or call the New York State DEC Region 8 Office.
NYS DEC
Region 8 Office
6274 East Avon-Lima Road
Avon, New York 14414

Septic Systems

Chapter 5

Historically, we simply buried or dumped our sewage into rivers and lakes, believing in nature's ability to "wash away" our refuse. We discovered these methods of disposal produced lasting negative effects on the environment and changed from disposal to treatment of septage. Currently, all Honeoye Lake shoreline properties are connected to sewers that prevent the discharge of sewage into the lake. However, nearly all other homes in the watershed depend on individual on-site septic systems to cleanse their wastewater. At the time of this printing the municipalities within the county are in the process of adapting a Local Sanitary Law. This law will regulate septic systems by requiring an inspection for new construction and upon property transfer. These inspections will help assure that the systems are properly designed, built, and managed in a manner that prevents ground water contamination. At this time however, existing homes are not required to have any regular inspection and are a potential source of ground water contamination.

Years of experience have proven that properly designed, sited, installed, and maintained septic systems have, with the exception of nutrient runoff, little adverse effect on the environment. Local regulations have been developed to ensure septic systems conform to strict standards. Working in conjunction with a reputable contractor, the County Septic Inspector, and your Local Code Enforcement Officer, you can insure that your system will be properly installed. Homeowners have a major influence on how well their septic system functions. This chapter will describe how septic systems function and how homeowners can maintain proper functioning.



Common Septic Tank
The baffles on the inside of the septic tank keep the layer of scum from leaving the tank and clogging the leach lines of the absorption field. The port on the top is used for pumping and inspecting the baffles.

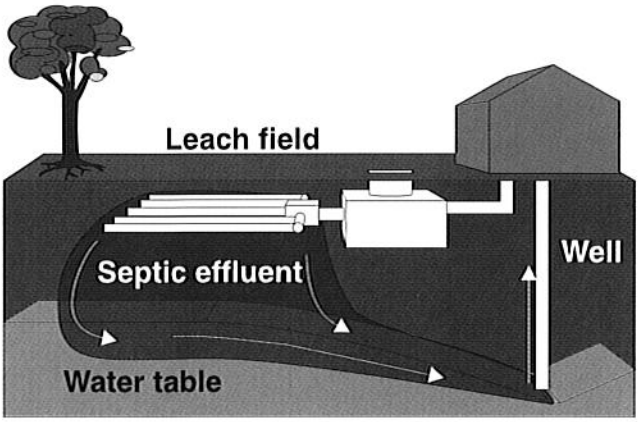
How Septic Systems Function

Septic systems have two major components: a septic tank and a soil absorption system. The septic tank is typically a concrete container, usually prefabricated according to a standardized design, that receives wastewater from the bathroom, kitchen, and laundry room. Here heavy solids settle and are partially decomposed by bacteria to form sludge. Light solids and grease float to the top forming a scum layer.

The soil absorption system (drainfield or leachfield) consists of a distribution box, perforated distribution lines made of plastic, and an area of well-drained soil. Wastewater from the septic tank filters

through the soil where soil particles, bacteria, and other organisms remove harmful, disease-causing microorganisms, organic matter and some nutrients. For the system to function properly, it must be carefully designed and constructed for the site's soil conditions.

The soil also needs time to filter out these harmful materials from the wastewater. Suitable soils do not include pure sand, which allows wastewater to pass through too fast, or clay, which is too dense to allow for proper wastewater percolation. State and local regulations that determine what constitutes suitable soil have been developed after careful consideration of many factors that affect a soil's ability to adequately treat domestic wastewater. These factors specify four feet of usable soil with no bedrock, high water table or other limiting layer on slopes of less than 15%. Before a septic system is built, municipalities require a percolation, or "perc test," to determine if the soil meets these criteria. The soil is further examined using a deep-hole test of 6-8 feet to determine the capacity of soil to accept wastewater.



Septic effluent entering groundwater supply.

Why Worry?

The threat of disease is the chief concern in treating human wastewater. The epidemics that killed millions of people in the Middle Ages were caused by mixing of human waste with drinking water supplies. Domestic wastewater contains bacteria and viruses that cause dysentery, hepatitis, typhoid fever and many other significant diseases. To protect human health, it is important to exclude these organisms from both surface and ground water supplies used for drinking water. Fortunately, soil and soil bacteria effectively remove disease-causing microorganisms from wastewater in properly-functioning septic systems. It takes time for these natural processes to work so there are regulations dictating separation distances between septic systems and water sources to prevent contamination before the wastewater is fully treated. Sewage treatment plants, in order to protect the waterbody receiving the effluent use chlorine and/or bacteria to remove pathogens.

Nutrients, such as nitrogen and phosphorus, in domestic wastewater can cause both health and nuisance problems if allowed to reach surface or groundwater supplies. Nitrogen in the nitrate form poses the most significant threat. When ingested by infants, nitrate can interfere with the blood's ability to carry oxygen, causing "blue-baby" syndrome. Nitrogen carried in septic tank wastewater is usually in the form of ammonia. Ammonia is readily transformed into nitrate, which can easily become part of ground and surface water supplies.

Excess nutrients, in particular phosphorus, in surface water cause algal blooms. Throughout the bloom, algae die and decay, depleting oxygen in the water and reducing the amount available to other organisms. This process has been responsible for fish kills all over the world and is one reason for the efforts to reduce the amount of nutrients entering the environment from point and non-point sources.

System Failures

Septic systems do not last forever. The expected life is 20 to 30 years under the best conditions. Eventually, soil in the absorption field becomes clogged with organic material, making the system unusable. Symptoms of a serious problem include:

- Sewage backup in your drains or toilets;

- Slowly draining sinks, bathtubs, and toilets not cured by plungers or drain cleaning products;
- Surface flow of wastewater;
- Lush green grass over the absorption fields, even during dry weather;
- The presence of nitrates or bacteria in your drinking water well;
- Excessive growth of aquatic weeds or algae in lakes or ponds adjacent to your home;
- Unpleasant odors around your house.

Many other factors can cause the system to fail well before the end of its "natural" lifetime. Pipes blocked by roots, soils saturated by high water tables, crushed distribution pipes, improper location, poor original design or poor installation can all lead to major problems.

By far the most common reason for early failure, however, is improper maintenance by homeowners. When a system is poorly maintained by not pumping out on a regular basis, solids build up in the septic tank, allowing solids to flow into and clog the absorption field.

What You Can Do To Prevent Failure

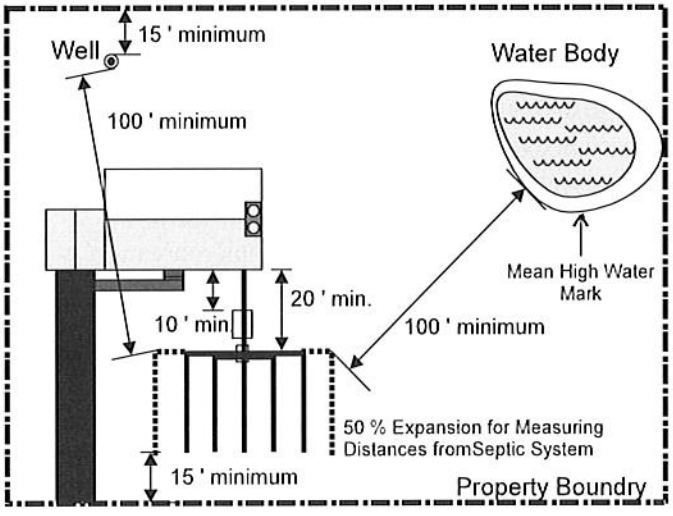
Maintenance and use of water conservation fixtures are the most important factors a homeowner can control to make sure a septic system will function properly over a long period of time. Too often homeowners forget what goes down the drain ultimately finds its way into the soil and then the lake.

The following maintenance practices will keep the system running smoothly.

- Know the location of all components of the septic system. Keep heavy vehicles away from the system.
- Don't plant trees or shrubs near drainage fields since their roots can clog the pipes. Willow trees are particularly troublesome.
- Dispose of household chemicals properly. Do not pour them down the toilet or drain. Even common cleaning products like bleach and drain cleaner, if used in excess, can temporarily disrupt septic tank function.
- Distribute laundry chores throughout the week to avoid overloading the system on any given day.
- Don't use garbage disposals. They contribute unnecessary solids and grease to the septic system.
- Conserve water whenever and wherever possible by using water conservation fixtures.
- Don't use toilets as trash cans.
- Monitor the septic tank yearly and have a DEC licensed pumper remove sludge and scum every three to five years. This helps ensure that there is enough space in the tank for wastewater and prevents solids from escaping into the absorption system.
- Consider using the laundromat periodically to lessen the burden on your septic system.
- Be careful of commercial septic tank "cleaning" products. They may do more harm than good.

Other Types of Treatment Systems

Sometimes, a conventional leach field cannot be constructed on the property to meet Health Department standards. For example, soils at the location of a building site may not have proper drainage for conventional systems. Inadequate separation distances or steep slopes may also restrict the site for a conventional installation. These situations present problems for the



Minimum distances between the septic system and any water bodies or water source including those of your neighbors.

Pumping your septic system every 3-5 years increases the life-span of the system.

homeowner and may require the assistance of the Watershed Manager, State Health Department and/or a professional engineer. There are several alternative systems available for difficult sites.

A built-up or mound system is used where the water table is too close to the surface. The absorption field is built up with at least 4 ft. of usable soil between the distribution pipes and the water table. Near a lake or river it is recommended that there be at least 4 feet of soil above the 10-year flood level (805.3 feet above mean sea level). This may require a considerable amount of time, money and trucked in topsoil.

Another alternative is a sand filter. This system uses a bed of sand to treat the effluent. Current standards do not allow discharge from these systems so an absorption system must follow the sand filter to treat the sand filter effluent. Sand filters, like all alternatives, must be designed by a qualified engineer and meet appropriate health requirements.

Aerobic waste treatment systems have recently been successfully used to replace failing systems on undersized waterfront lots. Aerobic systems use aerators to introduce oxygen to greatly improve the quality of effluent discharged to the absorption field. Effluent from aerobic systems must be discharged to a leach field. See Figure 5-1.

Holding tanks can only be used as an absolute last resort, if no other kind of waste system can be installed for an existing residence. Holding tanks are not allowed for new constructions.

Buying, Building, or Selling

Whether you are buying, building or selling a home, it is important to consider the condition of the septic system. Replacing an old or inadequate system can be an expensive proposition. As a buyer and builder, you need to make sure you know what you are getting, and as a seller,

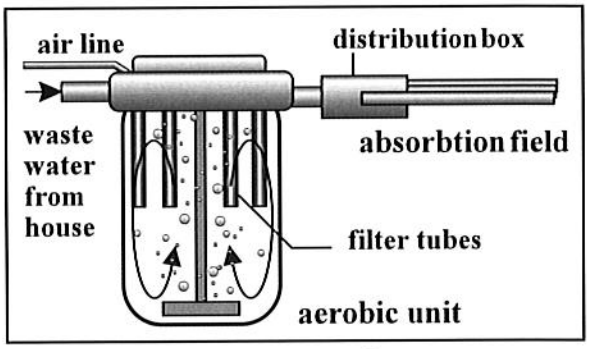


Figure 5-1. Aerobic Treatment System

Example of an alternative system being put in on a steep slope.

you need to make the prospective buyers aware of what they are getting. **Keeping good records of all of this information is important so, for your convenience, there is a Septic System Record Sheet in the back of this book.** It includes a place for a map of the location of the system; system specifications and size; maintenance records; information about the installer; and information about the septic system pumper.

For those considering purchasing a new home or selling an old one, it is a good idea to

have the septic system evaluated. By clearly informing buyers before hand, a previous owner is protected from liability if the system fails. Financially strapped new homeowners avoid the surprise that a new septic system is needed. Useful information for evaluation includes: the age of the system — if properly maintained, septic systems can last 20 to 30 years; the size of the system — systems are typically designed to accommodate 150 gallons per day per bedroom, assuming two persons per bedroom; the maintenance history of the system — a properly maintained system will function better and longer; and the historical and current condition of the system — Are there wet spots? Does it have a history of flooding? What material is the septic tank made of? What is the condition of the plumbing? Most of this information is revealed during the required septic inspection by the county septic inspector and Code Enforcement Officer. Further information regarding on-site septic inspections is described later in this chapter in the "Uniform Procedures Program" section.

Just as the prospective homeowner needs to be aware of current and future septic needs, builders or owners replacing a failed or inadequate system need to plan for the future. Besides proper siting, good percolation tests, permits, and having a reputable contractor to install the new system, the design of the system needs to fit the intended use. The NYS Department of Health's Public Health Law, section 75-A.6 (1), revised in 1990, sets the minimum tank capacities and minimum liquid surface area requirements. For homes with 1 to 3 bedrooms the minimum septic tank capacity is 1000 gallons with a minimum liquid surface area of 27 square feet. If the home is going to have a garbage disposal or other device that generates significant waste and/or wastewater, each of these units is considered another bedroom.

As with any construction, use a certified and reputable contractor. Be certain to have a written agreement with the installer that stipulates that final payment will not be made until the system has received approval from a county septic inspector.

Uniform Procedures Program in Ontario County

Septic systems are prevalent throughout the Honeoye Lake Watershed because the sewer only extends around the perimeter of Honeoye Lake, at East and West Lake Roads, and serves mostly the lakeside portion of residences. Due to the realization that non-point source pollution stemming from failed septic systems is a major contributor to water quality degradation, the Ontario County Soil & Water Conservation District (SWCD), under a DEC grant, developed a septic management program for Ontario County residents. The Conservation District created the septic management program, referred to as the **Uniform Procedures Program**, to provide consistent service and testing for all residents of Ontario County. As part of the Uniform Procedures Program, septic system inspections are provided on request upon deed changeover. Overall, the Uniform Procedures Program under the Ontario County Soil & Water Conservation District provides information and assistance to homeowners on septic system repair and maintenance. This in turn aids in protecting our natural resources by reducing non-point source pollution attributed to onsite wastewater treatment systems.

For information about septic systems and inspections contact your local Code Enforcement Officer and/or Joshua Bossard at the Ontario County Soil and Water Conservation District (716/396-1450 ext.21)

The Lake Book

Shoreline Development

Chapter 6

Honeoye Lake offers residents and visitors beautiful scenery, clear blue waters, outstanding fishing, and an excellent lake for water sports. Much of the lake development occurred when there was little understanding about the effects of development on lake water quality. Building along Honeoye Lake has continued since then and today there are around 970 seasonal and year-round lakeside residences.

Increasing building densities and aging septic systems within the watershed could potentially damage Honeoye Lake's water quality. In an effort to protect public health and safety, and to address potential environmental impact that building and altering the landscape might have, the municipalities around Honeoye installed perimeter sewers in 1978 and adopted regulations that govern design and construction around the lake. Town ordinances provide guidance for site development including building distance from the shoreline or neighboring buildings, maximum building height, etc. Ordinances vary from town to town, so it is important to check with your Code Enforcement Officer for the specific regulations in your town. They will also know which other agencies it will be necessary to contact before building. Depending on the condition of your building site and proposed project, it may be necessary to obtain construction permits from the town, state, or even federal agencies.

Any excavation at or below the mean high water level (MHWL), 804.5 feet above mean sea level for Honeoye Lake, requires a permit from the DEC. An example would be the construction of a dock anchored to shore by a breakwall. A DEC permit would be required for the breakwall and possibly a separate local permit would be necessary for the dock. If you have any doubts about whether or not a permit is needed for a project, call your local Code Enforcement Officer and/or the DEC. It is always better to discover a permit is not needed than to be cited for a violation.

Municipalities in NYS use local laws to protect public health, safety, welfare and the environment. The protection of Honeoye Lake water quality is important to the shoreline residents and visitors. These laws also help preserve the clarity of the water, scenic views, fisheries, and many of the other characteristics that draw people to the lake. Everyone on and around the lake is part of the whole community, and each individual has an impact.

The next three sections provide information on shoreline development: residences, docks, and beach erosion protection. The fourth section provides important information on lake levels and flooding that should be taken into account before any construction.

Sediment Control for Building and Property Improvements

A negative impact that construction can have on the lake is increased sedimentation due to increased runoff over disturbed soils. Sediments in the lake can muddy the water, smother fish eggs, increase cost of water filtration and bring in nutrients that cause undesirable algae blooms. Simple erosion control practices can reduce the amount of soil reaching the water by reducing the amount and velocity of water washing downhill.

Before the Project Begins

A little forethought and understanding of how erosion prevention works will make sediment control easier. In nature, plant leaves and branches slow the impact of rain before it reaches the soil. Plant roots hold soil in place during storms and heavy snow melts. Debris, grasses and underbrush slow overland flow, allowing water more time to infiltrate into the soil. When developing a lot, preserve as much soil and as many trees and plants as possible to minimize erosion. Deflecting "clean" water away from the construction site will also help to reduce erosion and can be accomplished with seeded and mulched swales (shallow diversion ditches) and dikes. The "clean" water should be directed into an area where it can slowly filter into the soil.

Adding temporary sediment barriers prior to excavation will intercept and remove sediment from construction runoff. Straw bales, firmly staked into the ground and across the slope, slow water flow and allow suspended particles to settle. A second option is a silt fence made of landscaping fabric, which can be used on steeper slopes. Both need to be checked after rainstorms to make sure they are working properly. Swales and dikes can be used to divert sediment-laden water to settling ponds or other sediment trapping devices. These are usually used on larger construction projects in conjunction with bales and fences.

Once erosion prevention and sediment control measures are in place, excavation and construction can begin.

During Construction

During construction, save as much of the topsoil as possible. Stockpile it out of the way and protect it by covering or seeding. Replacing a layer of topsoil after construction provides a good base for replanting and reduces the need for irrigation and fertilizer.

Check the sediment control devices and adjust as necessary. As grades change during construction, the direction and force of runoff can change as well. This could make previous efforts for control ineffective.

Protect existing vegetation, including trees, from additional damage. Keep the area of impact contained in the smallest area reasonable. It often takes a year or more to reestablish vegetation on a construction site and many years to replace trees.

After Construction

It is important to stabilize the disturbed areas upon completion of the project. This can include replacing saved topsoil, seeding or planting and finally mulching. Placing mature sod is another option, although it is quite expensive. When selecting a seed mixture or other replacement plants, consider light and moisture conditions, the angle of the slope, and whether the site is to be mowed. It is wise to replant with native vegetation because these plants have proven to be well suited to the site conditions.

Mulch is used to stabilize the soil, provide moisture and nutrients for the seedlings, and prevent seeds and seedlings from washing away. Some examples of different types of mulches are sawdust, wood chips/bark mulch, compost, hay or straw, peat moss, gravel or stone, and plastic. Each has its advantages and drawbacks. A local nursery, Cornell Cooperative Extension, or a landscape contractor can help you decide which materials are best for your project.

Once plants have established a sufficient root system to prevent erosion, the controls installed prior to construction can be removed. Sediment accumulated in basins and traps should be carefully disposed of to prevent it from washing down into the lake. Sometimes it is desirable to leave the erosion prevention dikes and/or swales in place permanently.

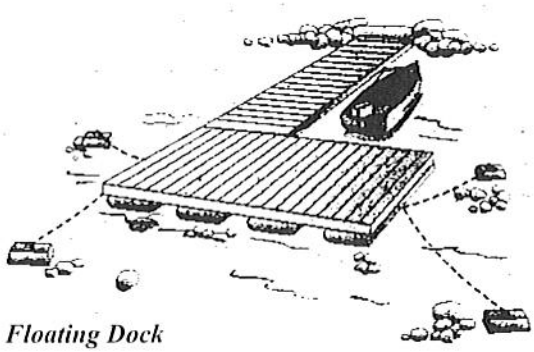
Before beginning any project, remember to contact the local Code Enforcement Officer about zoning ordinances and permits. Also, discuss erosion and sediment control measures with your contractor to make sure control measures will be installed.

Docks

Many lake residents desire a dock for easy access to the water for boating, fishing, swimming and other forms of recreation. They can be permanent — anchored to the lakebed and left in place year-round; or temporary — a seasonal structure. Floating swimming platforms, ski jumps and other recreational platforms placed in the lake are regulated by the New York State Office of Parks, Recreation, and Historic Preservation.

Two common dock designs are the floating and post-supported docks. Floating docks are decks supported by buoyant materials such as clean, sealed plastic drums or rigid, plastic foam. The dock should be kept in place by chains attached to weights in the lakebed. Post-supported docks are held in place by posts vertically resting on or sunken into the lakebed. The narrow posts allow natural wave action, fish and other wildlife to pass freely around it.

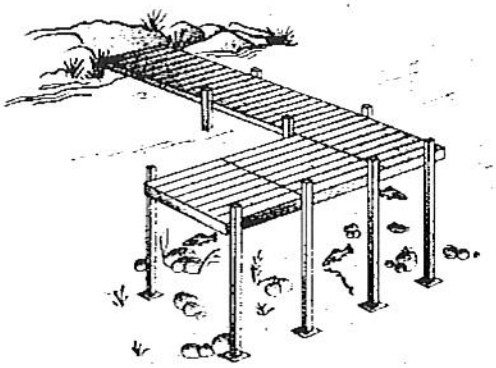
Both of these structures have a minimal impact on the lake bottom during and after construction. In addition, they can be designed to be removable for the winter. Removal prevents ice damage and reduces the need for repair each spring. It also allows the dock to be maintained on land, reducing the amount of paint or sealer entering the lake. The design and materials need to be sturdy and able to withstand strong winds and heavy wave action.



Floating Dock

Materials

Pressure-treated wood is the most commonly used material for building docks. There are two readily available types of this wood that use different chemicals to provide resistance against rot, decay and insect damage. The most commonly available type uses chromated copper arsenate which is a human carcinogen. The other type uses alkaline copper quat which is not a human carcinogen and is preferable from an environmental standpoint.



Post Supported Dock

There are many alternatives to pressure-treated wood such as cedar and redwood which are naturally resistant to water immersion. Aluminum is a strong and light material that will last as a dock material. Polyvinylchloride (PVC) and recycled plastic also offer a lightweight option with plenty of strength. These and other alternative building materials may initially be more expensive than pressure-treated wood; however, plastics and metals will last years longer and require less maintenance over time.

Floating docks and platforms must be anchored to prevent them from blowing or washing away. Traditional anchors include concrete

or stone-filled steel drums. Even if they appear perfectly clean, used drums often contain chemical residues potentially harmful to the lake. The same is true for using empty drums and barrels as floats. If these types of containers are used, buy them new or make sure that the previous contents were not toxic.

Remember: before constructing a dock, mooring or other shoreline structure, consult the Code Enforcement Officer and/or DEC. Also, talk to neighbors about what designs and materials work or do not work for your area. Their experience can help eliminate unforeseen problems.

Shoreline Erosion

Shorelines are vulnerable to erosion caused by waves and ice. Waves, caused naturally or by boats, beat against the shore and eat away at the shoreline. Waves, wind, and expansion pressure grind ice along the shore. The size of the waves and the stability of the shore are the largest factors influencing the amount of erosion. The average size of the waves varies around the lake. Protected shores experience small waves while those shores exposed to prevailing westerly winds tend to be subject to the largest waves. The type and size of material making up the shore and the slope of the land determine the stability of the shore. Honeoye's shoreline, made up of small stones, is easily eroded by wave action, especially on steeper slopes. With low angle slope, the energy of the wave is gradually dissipated as it washes over the shore. Much more of the wave's energy impacts a steeper slope when a wave crashes against it.

Increasing resistance to wave action, reducing wave impact or a combination of the two can protect a shoreline. This protection can be achieved through structural and nonstructural modifications to the existing shoreline.

Nonstructural Controls

Beach sloping — The area near the lakeshore can be made less susceptible to erosion by flattening the slope of the shore. A flatter slope allows waves to dissipate their erosive energy without damaging the shoreline. The ideal slope ratio is approximately 10:1. Essentially, the shore area from the MHWL (804.5 ft) inland the distance that waves wash up would become a gravel beach without much vegetation. The gravel serves as additional protection.

Landscaping — Using plants to stabilize a shoreline is a simple way of reducing erosion. Plant roots help to hold soil in place and the plants themselves act as buffers absorbing wave energy during storm events and flooding. This method works best in conjunction with other methods such as a low-angled slope. In sheltered areas, vegetation can be grown right to the water's edge. In exposed areas, plants and trees are not able to withstand the constant battering by waves and should be planted out of reach from continuous wave action.

Trees are one of the most effective plants at reducing erosion. The roots are strong and far-reaching, solidifying large areas. At times it is necessary to remove a dying or problematic tree. Leaving the stump will help hold the soil until other vegetation can grow or the tree is replaced.

Shoreline Erosion along west side of lake

Structural Controls

Structural controls, otherwise known as revetments,

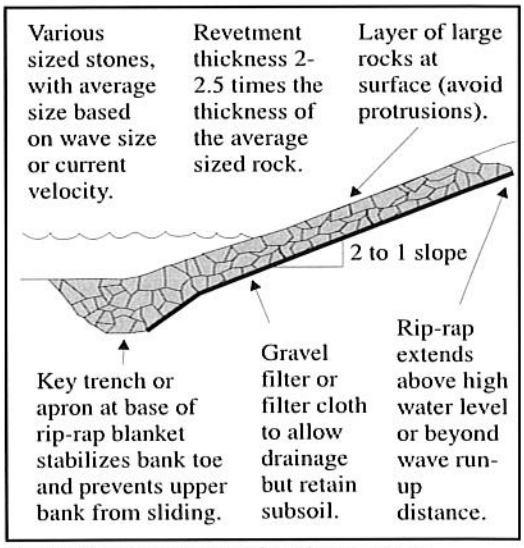
protect shoreline by covering the area susceptible to erosion. The rocks, logs, metal and concrete that these structures are made of are able to withstand the force of waves.

In determining what type of structural control to use, a few criteria must be taken into consideration. The main concern is the average wave height at the MHWL. In lakes, the wave height is measured from the trough to the crest and is determined by wind speed and the distance the wind travels across the lake. Structures are usually designed to be higher than the expected height a wave will climb up the shore or structure, otherwise known as run-up.

Other factors that need to be taken into consideration before construction are the MHWL, the stability of the shoreline, and angle of slope. If the shoreline contains fairly loose soil, it is necessary to compress the soil before construction. Revetments perform better and last longer if placed on lower angled slopes. Do not forget to check with the local Code Enforcement Officer and the DEC about ordinances and permits needed.

When designing a revetment, there are several critical areas of the structure that need to be protected. It is important to

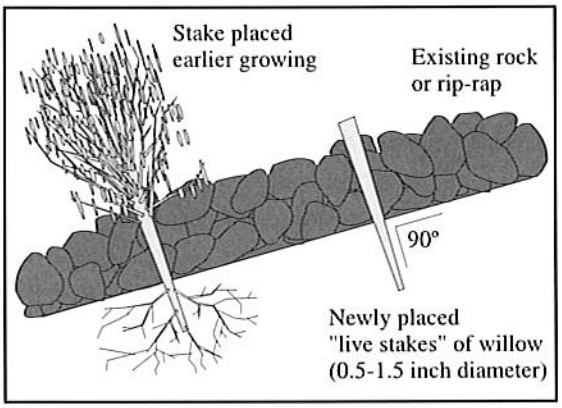
- Protect the toe (or base) from scouring due to waves. An undercut structure will eventually fail and need replacement.
- Protect the revetment from being flooded under normal lake conditions by making sure it is tall enough. Water splashing on unprotected ground can cause erosion behind the protection, creating the potential for failure.
- Protect the flanks from erosion to prevent failure.
- Allow for seepage from behind the structure by using filter cloth or a sand filter behind the revetment. Most shoreline protection structures are not built to withstand major storms and water will get behind the structure. When that does happen, there needs to be a mechanism for the water to leave without undermining the revetment.



Typical cross section of rock revetment.

Riprap and rootrap — Riprap is constructed with large stone or gravel that is placed on the natural or artificially graded shoreline slope. Often, the larger stones are "chinked" with smaller stones to fill crevices and enhance coverage and stability. Rootrap is constructed just like riprap, but topsoil is placed over the rocks, and vegetation is planted. The roots from the plants hold the soil in place and stabilize the movement of the riprap. When designing a riprap, it is important to remember these specific criteria.

- Extend riprap up the shore at least 0.5 feet above the height the average wave travels at MHWL.
- Extend riprap at least the same distance below the MHWL, including base protection at the "toe" of the bank.
- The median size of the riprap stone is determined according to the wave heights and the slope of the shoreline. Consult the Natural Resource Conservation Service (formerly the Soil Conservation Service) or your local Soil and Water Conservation District for technical assistance.
- Allow for a minimum thickness of 2.5 times the median rock size.
- Bedding material, such as gravel, should be at least 6 inches thick, or use filter fabric.
- Anchor the riprap if the shore has slopes of 6:1 or steeper.



Live stakes installed through rip rap.

Gabions — Gabions are rectangular or square wire baskets that are filled with stones 4 to 8 inches in diameter. Once the shoreline is prepared, the baskets are put in place and filled with stones. Typical baskets are three feet wide and are available in lengths of six, nine, or twelve feet. The height or thickness ranges from nine inches to three feet.

Individual baskets are wired together, filled with stone and wired shut. Gabions are ideal in areas where they won't be used as a footpath. The baskets might require some occasional maintenance. It is vital that the stones are packed inside the baskets in order to make the structure rigid.

Interlocking blocks — Interlocking blocks are simple, pre-made concrete blocks that lock together. There are several styles available. Local contractors or landscaping supply companies can provide more detailed information. In building an interlocking block structure, usually one layer of blocks is sufficient. The interlocking mechanism gives the structure stability but allows it to move and settle without breaking. Depending on the conditions of the site, the blocks weigh anywhere from 30 to 100+ pounds. In many cases, the blocks can be put into place by hand.

Retaining walls — Retaining walls, also known as sea walls, bulkheads, or breakwalls, are rigid structures that are placed vertically or at a slight angle inland to form a barrier between the shore and water. Retaining walls are either cantilevered or anchored. A cantilevered retaining wall is a sheet pile supported entirely by the ground. Sheet piles are typically sheets of steel bent like a stretched out "Z" and are driven into the ground. They also can be wooded planks set on end. An anchored wall is similar to the cantilevered wall, but there are anchors holding the upper portions of the wall.

The following list gives some of the design criteria for retaining walls that the Natural Resource Conservation Service recommends:

- Steel sheet piles can be driven into hard soil and soft rock. Aluminum and timber sheet piles can be driven into softer soil.
- For cantilevered retaining walls, the sheet piling should be driven deep enough to resist overturning, which usually requires a depth of two to three times the free standing height, depending on the foundation characteristics at the site.
- For an anchored retaining wall, sheet piling should be embedded to a depth one and a half to two times the freestanding height. Again, the foundation characteristics may indicate shallower or deeper penetration.
- The top of the retaining wall should be at least one foot above the height a wave reaches when it breaks against such a structure.
- Wing walls should be used to prevent flanking (erosion at the end of the wall). If the ends are not protected, erosion could produce a retreating shoreline at each end of the wall.
- The suggested minimum thickness for metal sheets is 0.109 inches; for wood planks, 2 inches; for wood poles, 4 inches.

Many of the shoreline properties around Honeoye Lake have streams running through them. Stream erosion control structures are subject to different standard than lake structures. Running water can be much more destructive than wave action and the measures used to prevent erosion need to reflect this reality. Ontario County Soil and Water Conservation District personnel are available to provide erosion control recommendations. Please contact the office for more information.

Figure 6-1 Earthen Weir – 1998

Lake Level Control

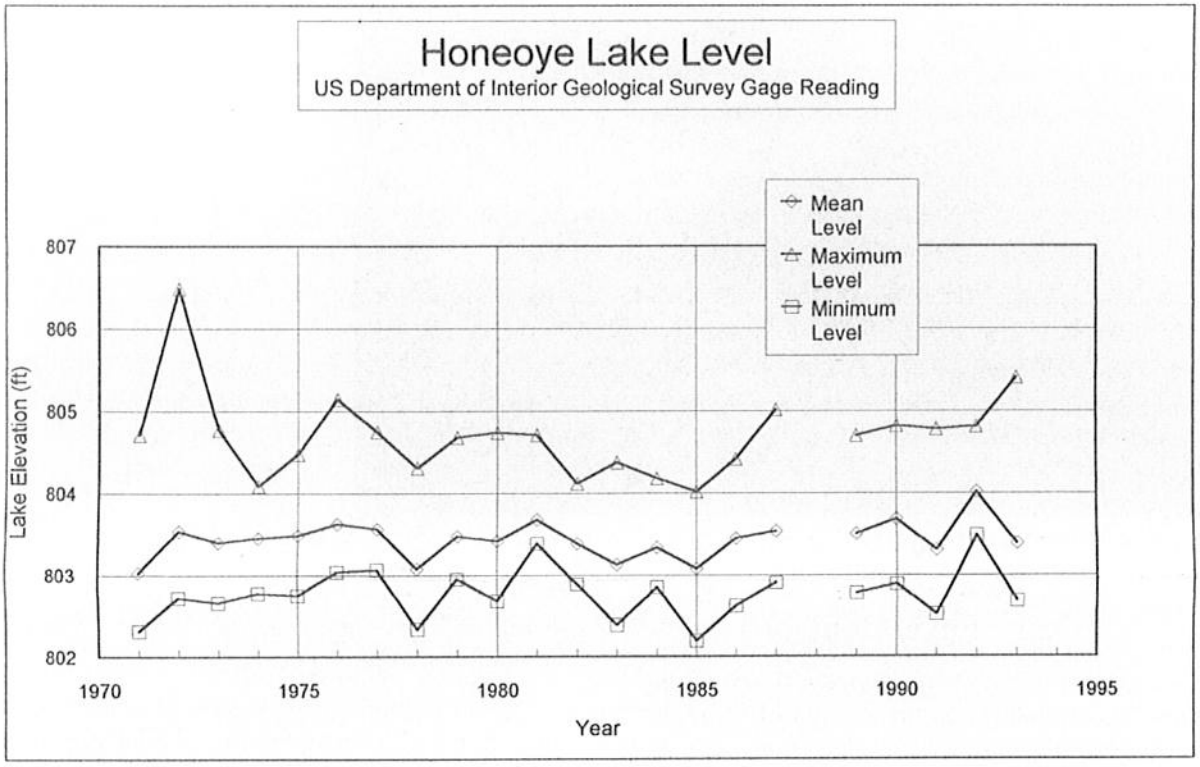
The water level in Honeoye Lake during the year depends upon the amount of water entering and leaving the lake. The Honeoye Lake watershed is approximately 36.7 square miles and feeds a lake of only 2.7 square miles. Water exits the lake through the Honeoye Outlet to Honeoye Creek, flows to the Genesee River, and to Lake Ontario.

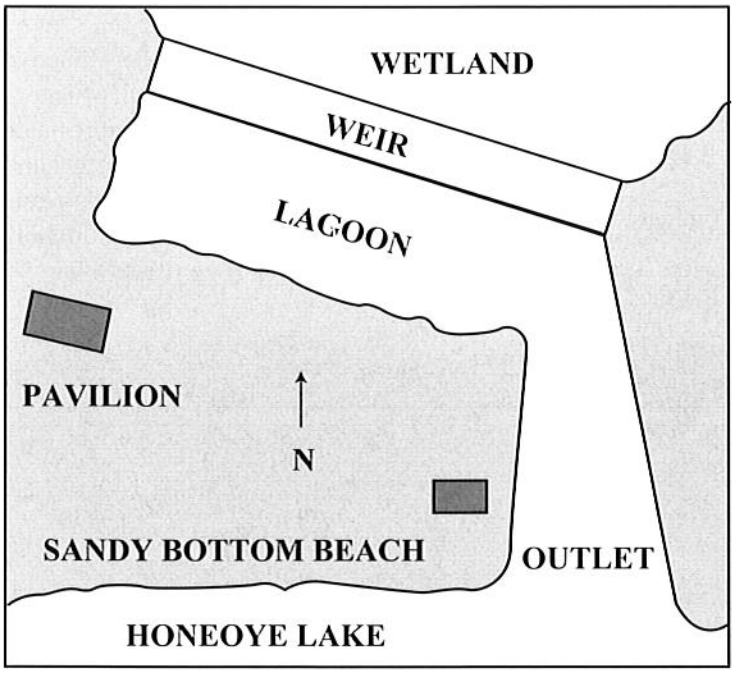
From 1971 through 1993, the US Department of Interior Geological Survey, had a gage in place on Honeoye Lake that measured the level of the lake on a continuous basis. Due to budget cuts, this gage was removed in 1994.

The graph on the following page shows the yearly mean, maximum, and minimum lake levels averaged over a 24-hour period. Over the 23 years represented in the graph, the average lake level was 803.4′ above sea level, the lowest daily average was 802.2′ in 1985 and the highest was 806.5′ during hurricane Agnes in 1972. During Agnes, the instantaneous peak reached 806.9′. The graph also shows that there have been no major long-term changes in lake levels and that there is about a 2-foot variation in the level during an average year.

Throughout history, citizens have been concerned with flood control. The lake level is controlled by a passive system that includes a channel leading from the lake into a lagoon, originally with an earthen weir on the north end. (See Figure 6-1) In 1994, the towns of Richmond and Canadice and the Honeoye Valley Association agreed on the design of a more permanent, easy-to-maintain weir structure made of concrete. The project was funded in 1997 and completed in 1999. The present weir is a stone structure fixed at an elevation of approximately 803.5 feet above sea level. (See figure 6-2)

Figure 6-2 Stone Weir just after construction – 1999





For information about NYS regulations, contact the NYS Department of Environmental Conservation at 716/226-2466.

For information about protecting against shoreline erosion, contact your local Soil and Water Conservation District:

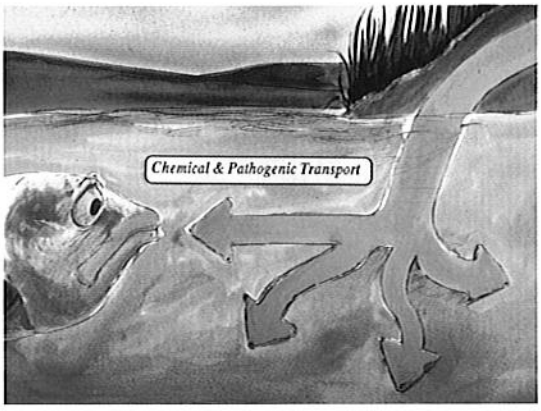
Ontario County – 716/396-1450
Livingston County – 716/382-3214

Natural Resources Conservation Service: 716/394-0525 Ext. 3

Drainage & Runoff

Chapter 7

How water moves over and through the ground is important to those of us who have experienced flooded basements, wet yards, or broken septic systems. Solving the problems associated with surface water runoff and poorly drained soil is also important in improving the health of Honeoye Lake.



Rain from roofs, driveways, and fields runs off, often eroding yards, destroying plants and washing away soil. Much of the soil is carried into streams and eventually reaches the lake, visible in the sediment plumes spreading from the stream mouths after any significant rain. The added sediment decreases water clarity, allowing less sunlight to penetrate the water. Fish and their eggs can be smothered and destroyed by sediment plumes.

There are over 50 streams and gullies that enter Honeoye Lake, of which Honeoye Inlet, Bray, Briggs, and Affolter are the largest. These streams receive substantial amounts of sediment, due to human influences on the land, and then deposit it in the lake. Vegetation buffers, riprap, or infiltration devices installed by homeowners and farmers help to decrease the amount of sediment in streams and ultimately Honeoye Lake. Nutrients, such as nitrogen and phosphorus, are needed in small amounts in the lake to support the food chain. Excessive amounts carried in runoff can cause algae blooms and deplete oxygen needed by the lake's animals. Runoff may also contain pesticides, oil, antifreeze, and other substances that are toxic to life in the lake.

Pollution also occurs when the soil is too wet to filter septic outflow. Effluent can percolate into the groundwater without proper filtration, or it can rise to the surface and be carried into streams and the lake.

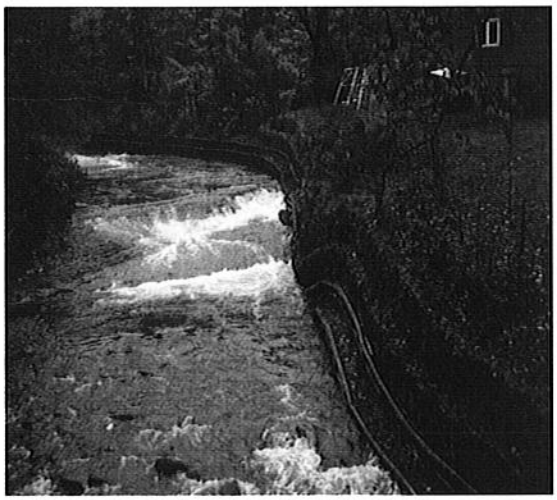
Surface Runoff

There are inexpensive ways you can control excess runoff created by roofs, patios, driveways, sidewalks, and swimming pools. Whatever the soil drainage condition in your neighborhood, swales (a depression in the ground that moves drainage water but doesn't prevent traffic from easily crossing), berms (a slight

Example of a sediment plume

An example of a swale– intercepts runoff and controls erosion across a steep slope.

"bump" in the ground surface that controls water), and basins can control runoff on your property by reducing its speed and increasing the time over which the water is released. For example, land immediately adjacent to your



Gabion baskets have been installed to slow erosion.

house should slope away from your home, removing water that could collect around and seep through the foundation. Once the water has been carried ten feet from the house, using a gentler grade slows the water and allows infiltration into the soil.

On properties where drainage is poor, you can regrade the land to create a basin which holds all runoff and allows it to infiltrate into the soil over a longer period of time. The effectiveness of a basin depends on the soil's ability to absorb and filter the surface water. Soils may not have sufficient infiltration capacity if they: have less than two feet of depth to bedrock or one foot of depth to a seasonally high water table; have a high clay content or a clay hardpan beneath the surface; or are low-lying and receive runoff from a large land area. In these situations, the soil will rapidly become saturated, and water that is intended to filter down through the soil will collect on the surface and can create health, safety, and use problems or move across the surface as excess runoff.

Persistent wet patches in your yard could indicate that the soil around your house has settled, preventing proper infiltration. Filling these pockets with topsoil and seeding them with grass will usually solve the problem by eliminating the depression. Another possible solution is a installing a subsurface drainage system, for example, using tiles. These systems are essentially porous underground pipes that collect water as it seeps into the ground and shunts it down grade to the end of the pipe. By providing a place for the water to go, the water is prevented from pooling. In situations where the water causing problems originates elsewhere, a system of berms and/or swales might be considered. These systems redirect the surface flow

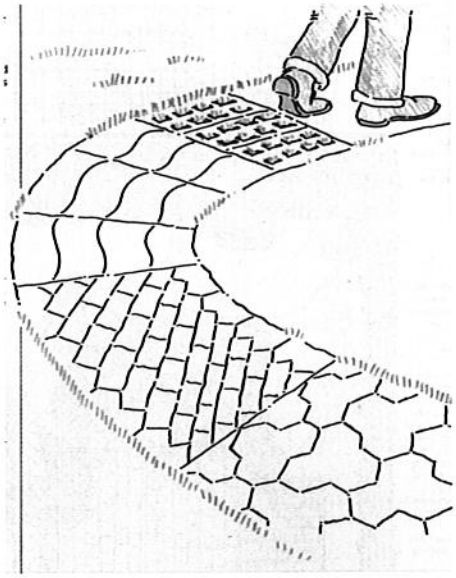
Stream banks are eroding due to flows and lack of vegetation.

away from areas of concern or restrict the flow to a specific area of your property.

When manipulating flows, it is always important to make sure that while solving one problem you are not creating another. Because runoff control can be such a complex issue, it is recommended that you contact the local Soil and Water Conservation District Office for solutions to water problems or before undertaking any major projects that will have an impact on existing runoff conditions.

Installing Infiltration Devices

The installation of various infiltration devices can enhance infiltration even on sites with well-drained soils. It is important to remember that surface runoff cannot infiltrate certain soils. Under these conditions, surface runoff cannot infiltrate the soil even with an infiltration device.



By using berms and swales, you can speed site infiltration by channeling surface runoff into a gravel-filled seepage pit, a French drain, or a gravel-lined detention basin. You can also spread runoff over the land surface by using a series of terraces or runoff spreaders, which promotes greater infiltration by slowly spreading runoff in a fan-shaped pattern across a vegetated land surface. Seepage pits, gravel-lined recharge basins, and terraces lose their effectiveness as infiltration devices when the land surface is clogged with clay, silt, or fine sand particles. Infiltration devices for large parcels of land are often constructed along with sediment traps, basins, or grassed sediment filters. These traps and filters remove fine particles from runoff before they reach the infiltration device. Sediment traps are usually needed for most residential lots. Most homeowners can use a system of swales or basins leading to the infiltration device as a sediment filter.

Permeable Paving Surfaces

As homeowners, we can't live without driveways, sidewalks, or patios. Water landing on paved surfaces and rooftops carries much of the pollutants on these surfaces and can degrade nearby streams. The stream may be out of sight, but underground storm drains often carry rainwater runoff from the impervious surfaces surrounding your home directly into a nearby stream. By using paving surfaces that allow rainwater to soak into the ground, you can reduce excessive rainwater runoff and help prevent erosion.

A paved surface that allows water to soak in may seem impossible, but there are many materials that provide the durability of concrete while allowing rainwater to filter down into the ground. If you are planning a new patio, walkway, or driveway, and your home site has favorable soil conditions, there are several attractive alternatives to concrete.

Wood decks, usually installed for their functional good looks, can serve as a form of porous pavement. Redwood and treated southern pine (the two most commonly used deck materials in this region) are as durable as most other paving surfaces. Decking allows rainwater to soak into the ground beneath it, and the space between the planks provides ample room for precipitation to drain directly onto the soil surface. As long as minimal air space is maintained between the soil surface and the decking, wood rot can be minimized.

If you are installing a new patio or rebuilding a crumbling sidewalk, you don't need to use the typical slab concrete. Using bricks, interlocking pavers, or flat stones (flagstone, bluestone, or granite), you can construct an attractive, durable walkway. If placed on well-drained soil or on a sand or gravel bed, these

modular paving materials allow rainwater infiltration. Although chemicals are sometimes used to control weeds growing in the joints between the paving modules, Corsican mint or moss can crowd out weeds and add beauty to the paved area.

Pre-cast concrete lattice paving blocks also rest on a bed of sand and gravel and allow rain to soak slowly into the ground. These paving materials can be used wherever natural soil drainage is good and there are no problems with either bedrock near the surface or seasonal high water. Lattice paving won't work on clay or other soils that are already saturated with water.

Significant strides have been made in developing porous asphalt pavement in the last three decades. This material is similar to conventional asphalt in durability, but it contains a much smaller percentage of very fine particles. As a result, the asphalt allows water to soak through to the base material and into the soil below. Almost twice as much porous asphalt must be applied to achieve the same strength as conventional asphalt. The finished surface must be protected from excess silt and fine sand so that its pores don't become clogged. You can use porous asphalt on your new driveway or encourage its use on streets and parking lots in your community.

Diverting Rain From Paved Surfaces

For many years, pavement construction standards called for any rain reaching a paved surface to be controlled and directed by a system of pavement and pipe drains. Roof down- spouts spill onto driveways that are graded down to street gutters, which, in turn, lead to storm drains that dump the accumulated rainwater directly into streams. The destructive torrents of this collected rain have helped erode countless miles of stream banks.

In places with good soil drainage, you can capture, spread, and infiltrate rainwater from paved areas and roofs to minimize the erosive force of the flowing water. Though many side-walks and driveways are appropriately graded to spread runoff onto lawn areas where it can soak in, steep slopes, poor grading, or concentrated flow from down-spouts can sometimes cause destructive and unsightly erosion. In these cases, stabilizing the eroding area where runoff leaves the pavement can dissipate the water's erosive force and allow infiltration. Dense vegetation, mulch (possibly held in place by netting), or gravel can serve this purpose.

If the volume of runoff can't be effectively controlled, it can be captured as it leaves the paved surface. The water can be channeled and spread to either a low-lying grassy area or a series of terraces, both of which allow gradual absorption into the soil. In more severe cases, gravel-filled seepage pits along the pavement's edge or French drains can be used to take in large volumes of runoff and encourage infiltration.

Questions about controlling runoff should be directed to your local Soil and Water Conservation District.

Ontario County: 716/396-1450
Livingston County: 716/382-3214

Landscaping & Gardening

Chapter 8

Watershed residents may not realize that rain falling on homes, lawns and driveways in the watershed eventually ends up in the lake, often carrying pollution with it. Proper landscaping is one activity to help reduce the erosive force of runoff and attached pollutants.

Some activities can unintentionally change the volume, velocity, and timing of surface runoff that flows from a property. Everyday activities can add to the amount of toxic chemicals and nutrients that flow into the lake. As the volume of runoff increases, so does the danger of surface flooding. Runoff also increases soil and channel erosion and delivers more sediment to the lake.

If everyone in our watershed followed a few simple procedures, we could retain more rainwater on our properties, replenish our groundwater supplies, reduce our reliance on household chemicals and fertilizer, and improve lake quality. This chapter provides some tips for achieving these benefits while at the same time beautifying your surroundings.

Landscaping your yard reduces the erosive force of rainwater runoff and increases the value of your home. By planting trees, shrubs, and ground cover, you encourage excess rainwater to filter slowly into the soil instead of flowing directly into storm-drains or nearby streams.

Choosing Appropriate Plants

Planting trees can protect private property and the lake from damage caused by excessive runoff and erosion. People appreciate trees for their beauty and the shade they provide, but few realize that trees help reduce runoff and minimize erosion. Planting shrubs, trees and ground cover has many environmental benefits, and enhances the appearance and value of watershed properties.

Plants can block cold winter winds and provide shade in summer. Well planned landscaping can reduce heating and cooling costs by as much as 30 percent. Shrubs and trees may attract birds and wildlife and require less maintenance than grass. Because they require less fertilizer and fewer herbicides than grass, there is less chance of polluting the lake.

All plants require soil, nutrients, water, and exposure to the sun to flourish. The most common mistake people make when landscaping their yards is to buy plants that need much more or far less moisture

than the native soil provides. Plants that need a lot of water will not grow well on dry sites unless you supply the water they need. Plants with high nutrient requirements will only grow in poor soils if you apply additional fertilizer. Plants susceptible to insect and disease problems will flourish only when these pests are controlled by some biological, chemical, or mechanical means. Choosing plants appropriate to the property conditions can reduce inputs and maintenance costs.

Fortunately, nature has given us a partial solution to the problem of plant selection. Over time, plants native to a particular locale have adapted to the growing conditions they encounter. Plants that grow near the shore have adapted to the air and or soil moisture through a variety of physiological mechanisms. Plants that grow naturally in the forests of our region are bothered less by common disease and insect problems than are plants introduced from other areas. Ask a competent, professional nursery to help you select plants, trees and shrubs appropriate for your yard and soil type.

Caring for your Lawn

Healthy Lawns — Most people want a dense, healthy lawn. A healthy lawn not only makes your home more attractive and valuable, but it also has important environmental benefits. When combined with trees, shrubs, and ground cover, a lawn can help prevent erosion, moderate summer heat, and act as a filter for rainwater from roofs, down spouts, and driveways. A healthy lawn also benefits the soil by adding organic matter to improve soil structure and infiltration. Local streams and the lake will benefit from the reduced runoff and filtering capacity provided by proper landscaping.

There are an estimated 20 million acres of lawn in the United States. Well managed and planted with shrubs and ground cover, lawns can be part of a healthy environment. If fertilizers and pesticides are used indiscriminately, lawns can be a source of pollution. The basic premise of environmentally sound turf grass management is to maintain a vigorous stand of grass that will out compete most weeds and be able to withstand damage from fungus and insects.

Test the Soil — To help ensure a healthy lawn, test the soil before seeding or applying fertilizers. Call the county Cornell Cooperative Extension office for assistance or purchase a soil test kit at a local garden store. The results of the soil test will tell you how much fertilizer and lime a soil requires. Compost, if mixed into the soil, can provide some of the organic matter and nutrients your soil needs. (See the composting section on pages 61–63 for more information.)

Lawn Fertilization

The nutrients in fertilizers can contribute to pollution problems in the lake. That is why it is important to apply fertilizer according to instructions — at the proper time and rate — to prevent additional water quality problems. Avoid getting fertilizer on sidewalks and driveways, where it can easily be washed into storm drains and, eventually, into the lake.

The numbers on a bag of fertilizer refer to the percentages of plant nutrients — nitrogen, phosphates, and potash — in the material. In a 100-pound bag of a 5-10-10 mixture, for example, there would be 5 percent (5 pounds) nitrogen, 10 percent phosphate, and 10 percent potash.

The wrong amount of fertilizer applied at the wrong time can cause disease and weed problems, poor root growth, or excessive top growth. Incorrect fertilization can reduce a lawn's ability to withstand extremes of temperature and moisture. Use fertilizer specifically formulated for lawns. Garden fertilizers will generally not be suitable for a lawn.

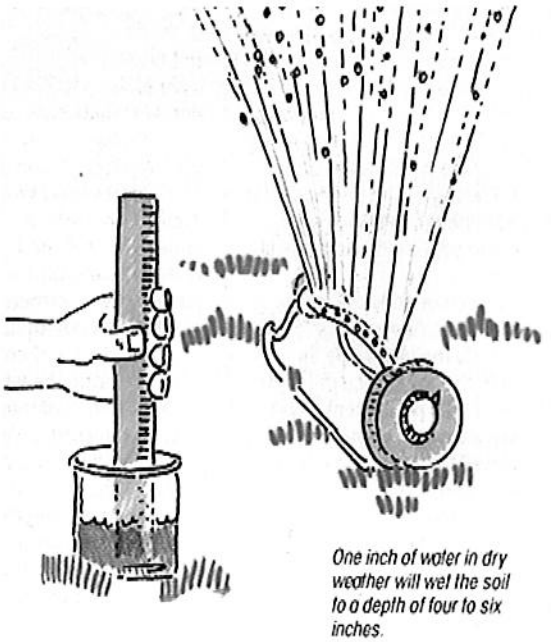
Lawn Pests

Both weeds and insects are considered by most homeowners to be harmful to the lawn. However, 90 percent of the insects in your lawn are not harmful. Even a healthy lawn will have some weeds, which should not be a problem unless the turf becomes weakened and thin. For example, sheep sorrel is an indicator that the soil pH needs adjusting. Crabgrass can be effectively controlled with a pre-emergent herbicide.

Study the lawn before applying any herbicides or insecticides. If you suspect a problem,

ask your local Cornell Cooperative Extension agent to help you identify the problem and determine whether special treatment is necessary. The preferred long-term strategy for a healthy lawn includes using sound management techniques, especially proper mowing and fertilization. Some aspects of Integrated Pest Management (IPM), especially hand weeding, can also help.

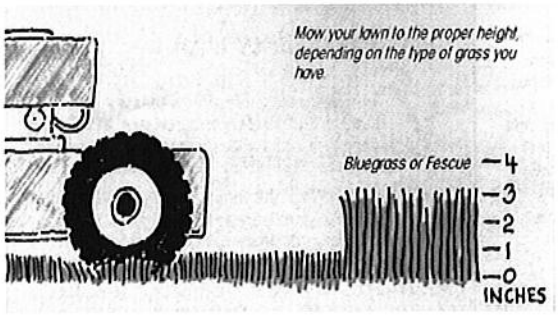
Occasionally, certain insect activity may reach a level where the use of an insecticide is considered. Careful spot application of insecticides may be necessary when high populations are discovered, if other control methods are not effective. Choose an insecticide that is least harmful to other creatures.



One inch of water in dry weather will wet the soil to a depth of four to six inches.

Watering and Mowing

Over-watering and mowing too closely are the most common mistakes a person can make with their lawn. Once a lawn is established, water it only during very dry periods, giving it only as much water as the soil can absorb. Moisten the soil to a depth of four to six inches, which means using about an inch of water. Avoid frequent shallow watering on established turf. It causes shallow rooting, invites crabgrass invasion, and encourages disease. A lawn should be watered in the early morning hours. This will reduce the amount of water that evaporates due to the heat of the sun and decreases the chance of burning the lawn. Watering in the evening or after dark helps contribute to the growth of fungus and disease.



Mowing is also crucial to the health of a lawn. According to turf specialists, mowing height is probably the single most important factor in the formation of healthy turf. Bluegrass or fescue should be cut to a height of two to four inches in height and cut frequently enough that no more than a third of the leaf area is removed. Mulching mowers deposit chopped grass in the lawn, replenishing nutrients and adding organic matter to the soil.

Lawn Services — Lawn services are an increasingly popular alternative for lawn maintenance. Some companies operate on a mass-production basis, with a fixed number of treatments a year in which customers are given a standard

mixture of fertilizer and pesticides to deal with problems that might occur. We recommend a lawn company that will customize its service to an individual's lawn needs.

Many of the lawn companies follow programs that have been prescribed by turf grass specialists and use products that you can buy and apply yourself. Misuse of these chemicals can pose health risks to people, pets, and wildlife around your home. Herbicide misuse can cause damage to susceptible plants.

Gardening

Many people enjoy growing their own vegetables, fruits, flowers, and herbs. By using the proper gardening techniques, plants will prosper, while preserving soil fertility, enhancing the absorption of rainfall, and protecting local streams from sediments and chemicals.

To get the most out of a garden, it's important to pick the right spot for planting. Choose a sunny location with good natural drainage. Plant the garden on a fairly level site. Avoid sloping areas and drainage channels, which let topsoil wash away during heavy rains.

Dealing with Slopes — If your garden is located on a slope you can use the same techniques farmers use on hilly fields to ensure food crops. Plant across the slope, not up and down the hill. This way, each row acts like a ridge (what farmers call contour planting) to trap rainfall. Contour planting prevents soil and plant nutrients from washing downhill. On long slopes, it's a good idea to leave strips of grass that also run perpendicular to the slope. This helps keep the rainwater and soil where it belongs by forcing runoff to slow down and soak in. These grass strips should be wide enough to allow easy access to your plants and vegetables.

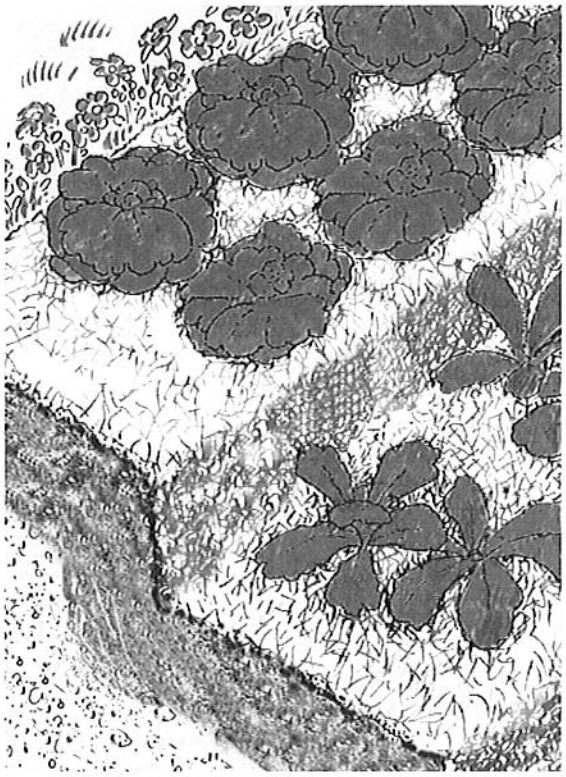
Less Toxic Pest Control Products

When used according to label instructions, the four products listed below are less toxic to the environment than other commercially available products. The products are available at garden stores with large inventories.

Insecticide Soap — This natural soap destroys pest membranes. It is effective against aphids, mealybugs, white flies, scales, earwigs, rose slugs, crickets, spittlebugs, and many more.

BT (Bacillus Thuringiensis) — BT is particularly effective against leaf-eating caterpillars. It kills them by paralyzing the digestive tract.

Milky Spore — Milky spore is a natural bacterium that kills the grub phase of Japanese Beetles. The milky spore actually remains alive in the soil, preventing new infestations for a few years.



Gardening on slopes can be a problem. Create contours with plants in rows perpendicular to the slope to prevent erosion.

Dormant Oil Sprays — Oil sprays can be used either during the dormant or growing season to control scale insects, red spider mites, mealybugs, and whitefly larvae on shrubs, evergreens, wood plants, fruit trees, shade trees, azaleas, roses, and other ornamentals.

Fertilizer

Fertilizers are designed to supplement the nutrients already present in your soil. Test your

soil for nutrient levels so that your know what your soil requires before you apply any fertilizer.

Too much fertilizer can damage roots, and the excess can reach your local stream and lead to water pollution problems. Avoid applying fertilizer on windy days or just prior to a heavy rain. For best results, always apply commercial fertilizers according to the directions on the bag.

Controlling Pests

Among the many ways you can control garden pests, consider the following:

- Use pest-resistant flowers, plants, and vegetables whenever possible.
- Handle minor pest problems by hand weeding and destroying insects.
- Wrap tomato stems in aluminum foil to stop cut worms.
- Plant borders to repel insects.
- Encourage ladybugs, praying mantises, and other insects that eat garden pests.
- Use pesticides only when other methods have failed, and use them according to the manufacturer's instructions.
- Seek expert advice if none of the above measures works. Your local Cornell Cooperative Extension office can help you.

Using Your Garden Wastes

Gardening creates wastes (vegetable garden debris, leaves, twigs and branches, etc.) that can be converted into a valuable resource by composting. Dumping these valuable and recyclable materials in a gully, stream, lake, or storm sewer endangers the health of the water for plants, animals and for people using it as a source of drinking water.

Mulching

Yard wastes such as leaves and wood chips can be used as mulch. Adding mulch to a garden will conserve water, moderate soil temperature, and reduce weed growth. Eventually, nutrients within the mulch will be released, and the decomposed organic matter will improve soil structure. It is best to leave grass clippings lawn to recycle their plant nutrients directly back into the growing grass. Improved recycling or mulching lawn mowers are widely available today and do not contribute to thatch problems as is commonly believed.

Composting

Compost is the end product of organic decomposition and consists of a dark, crumbly, and earthy-smelling material that is made from decomposed yard and food wastes. It is estimated that as much as 20 percent of our yard and food wastes end up in the landfill. Instead of burying this material at a great expense ($80-100/ton), homeowners can easily produce a rich organic material that will help garden plants grow. Compost can loosen heavy clay soils by improving soil structure, aeration and water infiltration.

In sandy soils, compost will increase the water and nutrient-holding capacity. One pound of organic matter can hold up to seven pounds of water. The organic matter and its microbial populations will increase the soil's ability to hold

Composting yard wastes using fencing.

Materials That Should and Shouldn't Be In a Compost Heap			
Yes		**No**	
Aquatic Weeds	Leaves	Butter	Meat
Bread	Paper	Bones	Milk
Coffee Grounds	Sawdust	Cat Manure	Oils
Egg Shells	Straw	Cheese	Peanut Butter
Evergreen Needles	Sod	Chicken	Salad Dressing
Fruit	Tea Leaves	Dog Manure	Sour Cream
Peels	Vegetables	Fish Scraps	Vegetable Oil
Garden Wastes	Wood Ash	Lard	Mayonaise
Grass Clippings	Wood Chips		

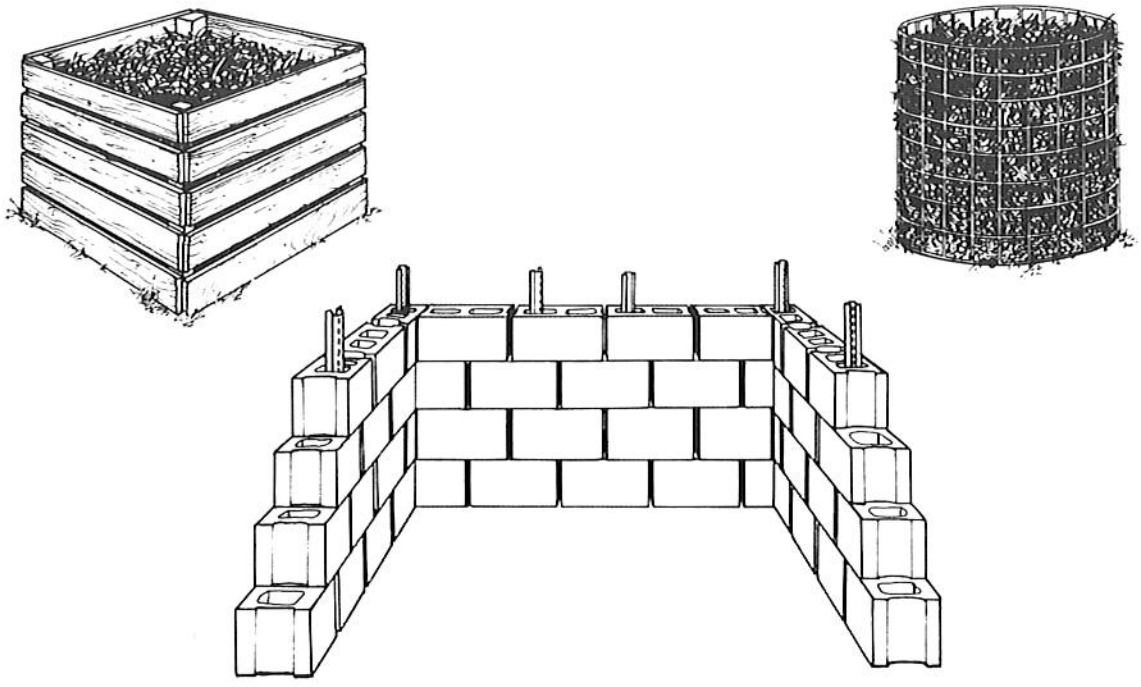
and break down certain groups of pesticides. Soils rich in organic matter also provide a favorable environment for many beneficial organisms, such as insects, worms, and microorganisms.

What Can Be Composted — All organic materials can be composted. Large pieces of twigs, branches and the like, should be chipped or shredded into smaller pieces to speed up the breakdown process. Shredding leaves with a rotary mower is a good idea.

Herbicide treated grass clippings, if collected, should be composted until completely decomposed (possible up to a year) to eliminate potential secondary herbicide problems.

Diseased plant parts, as well as perennial weeds and weeds with seeds, should not be placed in a compost pile unless a large amount of organic matter is to be added at the same time. A large pile of properly managed decomposing biomass can provide high enough temperatures to kill weeds, seeds and pathogens.

How to Get Started — To get started composting, first decide where to locate your compost heap. The space requirement for a typical



Examples of three different types of holding units.

Source: *Composting to Reduce the Waste Stream,* NRAES - 43, Northeast Regional Agricultural Engineering Service.

compost heap is three feet by three feet. The location should be away from waterways and wells. The site should be located in an area that has good drainage. If the drainage is good, a shady spot will keep the compost heap from drying out. If the drainage is poor, choose a sunny spot.

When installing a compost heap, you should consider enclosing the heap. This is not to say that you must use a container, but using one will help keep the heap neat, efficient and manageable. The heap should be covered to help control the dampness. The ideal dampness is about the same as a squeezed out sponge.

If you want to build your own compost heap, you can make one out of a three-foot square box made from wood and wire mesh. You can also use chicken wire, some types of snow fencing, or old wooden pallets set on end. A garbage can (with the bottom removed and holes drilled in the sides) is good for small composting purposes. Plans for constructing a compost bin are available from your local Cornell Cooperative Extension office.

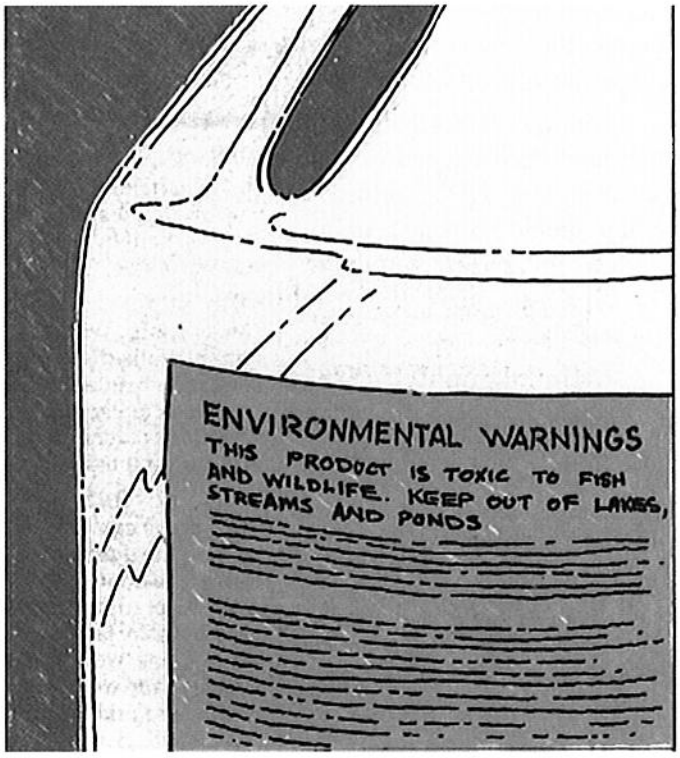
Once you have purchased or built your compost container, it's time to start composting. To do this, it is necessary to layer the materials in the container. Start with a layer of leaves or yard waste. Then add a layer of kitchen waste and grass clippings. Next add a layer of soil or some commercial compost or manure. This layer starts the process of decomposition. Continue layering the rest of the container the same way. You also need to turn the heap every so often (usually monthly) with a pitch fork or shovel to aerate the pile and mix the compost together. The more often the heap is turned, the faster you will have finished compost.

Compost is ready for use when the compost heap produces a material that is dark and crumbly. Bits and pieces of nut shells, egg shells and woody materials may still be identifiable. These can be removed by using a wire mesh screen to separate the finer from the coarser material.

The composted material can be used in a variety of ways including on your flower or vegetable garden. Mix the compost into garden soil to improve the soil structure, water retention, aeration, and nutrient content. Compost can also be used as a top dressing for lawns that need reseeding and for starting potted plants. It is not recommended that compost be used for a seed starting mixture because seedlings might be harmed by fungi or disease in the compost.

Pesticides

To many homeowners, pest control is synonymous with chemicals, and quick eradication is the goal. "Pesticide" is an umbrella term that includes herbicides, insecticides, fungicides, and rodenticides. Designed to kill "pests," this big family of chemicals can also be dangerous to human health and the environment. There is considerable controversy about the potential risks associated with pesticides. Some toxicologists believe that pesticides can trigger allergic reactions or cause chronic health problems. Others



A common pesticide label, gives all the important information needed in regard to the pesticide. Before using a pesticide, the label should be read completely and all instructions should be read completely and all instructions should be followed exactly.

say that if used properly, pesticides pose no significant risks to human health unless a person is exposed to an intense amount either through a large exposure, such as a spill, or through small exposures over a long period of time, particularly if no protective clothing is used.

Pesticides first became an environmental issue for many people with the publication of Rachel Carson's book Silent Spring in 1962. Since then, the regulatory approach to pesticides has been changed by Congress, which amended the 1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in 1972. FIFRA gave the Environmental Protection Agency the job of registering all pesticides on the market. The registration process includes a detailed examination of data on safety as well as both short-term (acute) and long-term (chronic) health effects. To date, about 120 of the 600 principal active chemical ingredients in commercially available pesticides have been registered. Therefore, it is not correct to assume that because a product is available in your local hardware or garden store, it has undergone the new environmental and health effects evaluation procedure.

Some pesticides that were once widely used have now been banned or severely restricted. These include DDT, chlordane, aldrin, heptachlor, dieldrin, lindane, silvex, and 2,4,5-T. If you have any of these products, check with the Cornell Cooperative Extension office about proper disposal.

Minimizing Pesticide Hazards

To minimize the potential hazards of pesticides, follow these guidelines

- Read the label carefully. It is a violation of federal law to use a pesticide in a way that is not stated on the label.
- Buy only the quantity you will need.
- Wear any protective clothing specified on the label. Remember, the label is the law.
- Wash your hands immediately after applying the pesticide.
- Apply only the amount of pesticide specified on the label and only to the plants and areas listed in the instructions.
- Make sure people and pets are out of the area during application and until the spray has dried.
- Cover or remove exposed foods, fish tanks, and pet food and water dishes during and after application.
- Never apply near wells, streams, ponds, or marshes unless the instructions specifically allow for such use.
- Never apply to bare ground or eroded areas. When it rains, many pesticides bind tightly to the soil and can be carried along with sediments to storm sewers and streams.
- Don't apply if rain is forecast unless otherwise specified on the label. Some pesticides do need to be watered after application.
- Choose the least toxic pesticide. Those with the signal word "CAUTION" on the label are considered less toxic whereas the signal word "WARNING" indicates moderate toxicity. A label bearing a skull and crossbones is considered highly toxic.

A respirator should be worn whenever working with or around pesticides. It can help prevent harmful damage to internal organs from exposure.

Storing Pesticides

Poisonings and environmental contamination have occurred where pesticides were stored improperly. To be safe, you should store unused pesticides in an area well away from living areas. The place you choose should have a cement floor, be well lit and well ventilated, insulated from temperature extremes, out of direct sunlight, and out of a child's reach. For exam-

ple, a locked metal cabinet in your garage is usually a good storage place for pesticides. Always keep pest control products in their original containers with labels intact. Most pesticides stored under these conditions should remain effective for about two years, although this varies widely.

Pesticide Spills

It can be extremely difficult to completely clean up an area when a pesticide has been spilled. For this reason, you should never store these products in the kitchen or other living areas.

If a pesticide leaks or is spilled in the garage, on the driveway, or other outdoor areas, do not hose down the spill. This will cause further contamination and may carry the pesticide to storm sewers or other water sources. The best way to clean a small spill is to

- Surround the contaminated area with soil.
- Sprinkle sawdust, kitty litter, vermiculite, or some other absorbent material over the spill.
- Shovel or sweep the absorbent material into a sturdy plastic garbage bag and put it in the trash.
- Wear rubber gloves, long pants, and rubber boots while cleaning up to protect yourself from exposure to the chemicals.
- Keep pets and people away.
- Wash down the area with a solution of water and bleach, ammonia, or a strong detergent if the spill is on an impermeable surface.

What to Do With Leftovers

Pesticides should never be buried in your yard, burned, or poured into storm drains or your toilet. Some pesticides and their containers release toxic fumes when burned or wetted, and sewage treatment plants do not use the kinds of microbes that would neutralize the pesticide's harmful effects. Septic systems can be harmed by pesticides as well. The best method for safely disposing of pesticides is to buy only as much as you plan to use within a two-year period, and to use them up according to label instructions.

Federal law now requires that pesticides made for home use be labeled as to the appropriate disposal method. Again, it is essential that you read the label carefully and follow its directions. Consult a Cornell Cooperative Extension agent for guidance in disposal of older pesticides with unreadable labels.

For any questions on landscaping, lawncare, gardening, pesticides or to receive advice on disposal, contact your local Cornell Cooperative Extension agent.
Steuben Co. Cornell Cooperative Extension
(607) 776-9631
Yates Co. Cornell Cooperative Extension
(315) 536-5123

Household Chemicals

Chapter 9

Some of the products found in American homes have chemical ingredients that are potentially harmful. Look under the kitchen sink, in the bathroom, the garage, and the basement for examples. There you'll find oven cleaners, paint removers, bug killers, solvents, drain cleaners, and more. These products are potentially harmful to people and to the environment and should be used with care.

Public concern about the use and disposal of hazardous chemicals has grown dramatically in recent years. Several federal laws regulate the generation and disposal of hazardous materials in industry. There is, however, no regulation of household hazardous wastes that must be properly disposed of by the individual consumer.

The following is a description of the different types of products commonly used at home and the appropriate disposal methods for each.

Household Cleaners

Many of the products used at home, such as soaps and detergents, are meant to be washed down the drain. These products are biodegradable and, if the wastewater from your home is properly treated, they pose little threat to the environment.

There are, however, products commonly found on kitchen shelves that are toxic to people and to the environment. Oven cleaners and spot removers are examples. Check the labels of products such as these for the toxic components lye, phenols, petroleum distillates, and trichlorobenzene. Products containing these chemicals pose a potential threat to health if improperly used and may also pose environmental hazards when discarded.

It is often possible to use an alternative, less toxic method to clean and polish. Ovens, for example, can be cleaned by applying table salt to spills, then scrubbing with a solution of washing soda and water. A combination of lemon oil and linseed oil makes a good furniture polish. Clogged drains can sometimes be cleaned with a metal "snake" instead of toxic chemical cleaners.

When you feel that it is absolutely necessary to use a product containing toxic chemicals, the following cautions should be observed. As with pesticides, the rule of thumb is to read the label and to use the product only as directed. Some products become even more dangerous when mixed with others. For example, chlorine bleach mixed with ammonia can produce deadly chloramine gas. Protective clothing and rubber gloves may be necessary. Good ventilation is a must.

A Word About Detergents — One of the most used home cleaning products is detergent. Many of the detergent products formulated for automatic washing machines and dishwashers contain phosphorus, which has been shown to cause water quality problems in streams and lakes. The detergent industry has responded to this problem by developing products that contain little or no phosphate. For example, all liquid detergents are phosphorus-free, as are some

powders. Again, the label will clearly tell you the phosphorus content. The range is from about 13 percent, in some automatic dishwasher detergents, to none. When you have a choice, buy the low phosphorus product. In New York State, the amounts of phosphorous allowed are .5% by weight for laundry detergents and 8.7% by weight for dishwasher detergents.

Car Care

Motor oil, battery acid, gasoline, car wax, engine cleaners, antifreeze, degreasers, radiator flushes, and rust preventatives are examples of automotive products containing toxic chemicals. Some car owners do their own maintenance work. Twenty-five percent change their car's oil and many of these people pour the used oil down the storm drain. One quart of oil can contaminate up to two million gallons of drinking water. The oil from one engine — four to six quarts — can produce an eight-acre oil slick on the lake.

The only recommended way to dispose of used oil is to put it in a sturdy container, like a plastic milk jug, and take it to your neighborhood garage or oil recycling center. State law requires sellers of oil to have facilities to accept used oil.

Disposing of antifreeze is also a problem. Antifreeze contains ethylene glycol, which is poisonous to people, fish, and wildlife. Many cats and dogs have died after drinking sweet tasting puddles of antifreeze they find on driveways in the winter. Some antifreeze/coolants on the market such as Sierra Antifreeze are not as harmful to the environment.

Instead of pouring antifreeze down the drain or washing it into storm drains, ask your local service station to add the liquid to their used antifreeze storage drum.

Disposing of Household Toxins

The kinds of household toxins described in this section should not be disposed of "down the drain" or on the ground. Your drain leads either to a home septic system or a municipal treatment plant, neither of which is designed to completely remove toxic chemicals from wastewater. At least some of the toxins pass through the treatment process and end up in a stream, river, or groundwater. Substances poured on the ground or into a gutter can seep into groundwater or storm sewers that often dump into the nearby stream.

Effective sewage treatment is essential for treating the large volume of wastewater coming from our homes. Well-run treatment plants remove some nutrients, organic materials, and heavy metals from wastewater. Chlorine, used to disinfect, can be removed by a process called dechlorination. Individuals and communities should insist that the publicly owned treatment plants that serve them are maintained and operate at peak efficiency. This may mean added cost to consumers, but is essential for good water quality.

In many areas, local landfills or transfer stations are the only disposal sites available. While probably better than flushing a toxic chemical down the drain, landfills are not a good long-term solution to our waste disposal problems. One solution is to request a household hazardous waste collection day in your county.

Where household hazardous wastes must be sent to a landfill, a couple of steps can be taken to reduce the environmental risk. First, wrap the product in its original container in newspaper and then wrap in an old plastic bag. Liquids can be poured into containers filled with absorbent kitty litter, then wrapped in plastic for disposal.

Recreation

Chapter 10

There are numerous reasons we take pleasure in our Honeoye Lake watershed. The multiple resources support many recreational opportunities for year-round fun. Whether it's swimming, boating, parasailing, water skiing, fishing, hunting, or hiking in the warm months, or ice fishing and ice boating, snowmobiling, skating or skiing in the winter, there's something for everyone all year. Just enjoying the spectacular views, anytime, can ease the many stresses of a hectic life. However, in using these resources we have a responsibility to protect our safety and the ecological integrity of the watershed.

Lake Access

Public access to Honeoye Lake for recreational activities is available at Sandy Bottom Park and the State Boat Launch.

Sandy Bottom Park

Sandy Bottom Park is located at the scenic north end of Honeoye Lake. It is nestled between Honeoye and the Canadice Hills, within walking distance to the hamlet of Honeoye. The park is a wonderful place to take your family and enjoy the quiet surroundings. It offers a variety of activities and facilities: two playgrounds, beach volleyball, two pavilions, a softball field, shuffleboard courts, restroom facilities, a half-mile long nature trail with decks and bridges, and six hundred feet of sandy beach with lifeguards on duty from the third week in June through Labor Day. Open year around from sunrise to sunset, the park is conveniently located to surrounding towns and is only a thirty-five minute drive from Rochester. There is a nominal fee for non-Richmond Town residents on weekends and holidays from mid-June to Labor Day. Pavilions can be reserved any time during the year for a nominal fee.

The park first opened in 1964 to those with memberships. In 1973 the Town of Richmond purchased the six hundred feet of park lakefront and about twenty-five surrounding acres for $120,000. From the 1970's through the 1990's many people and organizations helped the park to expand and improve. The Honeoye Rotary has made many contributions such as constructing the two pavilions and shuffleboard courts. The Sandy Bottom Park Committee recruited supporters to create the softball fields that are used regularly by the children's recreation program and adult softball leagues. Swimming lessons and arts

and crafts activities are sponsored by the Town. In 1993 a generous donation allowed for the construction of a nature trail that winds through the wetlands at the north end of Honeoye Lake. The trail beckons to the nature lovers with its wildflowers, open fields, woods, rambling creeks, and wildlife that includes blue herons, fish, deer, turtles, and bull frogs.

State Boat Launch

On the east side of the lake at the south end a boat launch with two ramps, rest room facilities, and limited parking for cars and trailers is maintained by the New York State Finger Lakes Regional Parks, Recreation, and Historic Preservation Commission. On weekends and holidays from mid-June through Labor Day there is a nominal fee to launch a boat and park your car.

Swimming

Swimming in Honeoye Lake is perhaps one of the most common and pleasurable summer activities. It can be dangerous, however, if the proper precautions aren't taken. If you swim without the presence of a lifeguard, always know the weather conditions and your own physical limitations. Children should always wear life jackets when they are in the water or on a boat.

Another consideration while swimming is the quality of the water; and this book discusses many ways to do this. Feeding the ducks and geese may be fun, but it encourages an increase in their populations which in turn results in increased concentration of their wastes, a source of bacteria and the nutrients on which they thrive.

In addition, feeding waterfowl can interrupt normal migration patterns, cause waterfowl to concentrate in large numbers, and increase disease. Also, feeding moldy or rotten bread will cause avian botulism. **So please, to protect our health and theirs, don't feed the waterfowl!**

Boating

Recreational boating provides relaxation and enjoyment for hundreds of residents each year. Certain precautions must be taken to maintain safety on the lake. Lake activities require boaters to be alert, operate at safe speeds and respect weather conditions. In addition, careful boating will contribute to the welfare of the total lake environment.

Boating Laws

Regulations for the safe operation of vessels (including personal water craft) on Honeoye Lake are part of the Consolidated Laws of New York State and Local Laws that have been enacted to preserve the enjoyment and safety of

boating. Taking a boat safety course is the best way to understand the rules of boating. The lake is patrolled by the Ontario County Sheriff's Department. The major laws that apply to Honeoye, listed below, are strictly enforced.

Age Restrictions

- Operator must be at least sixteen to operate a boat alone or
- Be at least 10 and possess a safety certificate issued by the conservation commissioner.

Speed Limits

- 10 MPH from one-half hour after sunset to one-half hour before sunrise
- 5 MPH within 200 feet of dock, pier, raft, or anchored/moored vessel — except to allow a skier to land or take off

Pilot Rules

- When approaching head-to-head, keep to your right, just like cars.
- When approaching at an angle, yield to the vessel on the right.
- Powered vessels must yield right-of-way to non-powered vessels.

Water Skiing

- In addition to the operator, must have one other person, at least 10 years old, to observe person being towed.

Light Requirements

- From sunset to sunrise, power boats, while under power, must have a bright white light aft and a combined light fore showing green on starboard (right) and red on port (left) side.
- From sunset to sunrise all vessels must continuously display a white light.

Equipment Requirements

- One personal flotation device for each passenger
- Whistle or horn
- Fire extinguisher on mechanically propelled vessels except outboard boats less than 16 feet long
- Carburetor backfire flame arresters on all mechanically propelled vessels

Moorings, Buoys, and Swim Floats

- No more than one float and not more than 100 feet from shore within property boundaries
- Commissioner has authority to alter location in the interest of navigation

Noise Limits

- 90 dB (A) with a stationary sound test
- 75 dB (A) with a moving sound test

Boating and the Environment

Boat owners can play a major role in preserving water quality in the lake by minimizing their impacts. The first step is to understand the potential negative effects of boating activities.

Boat wakes contribute to shoreline erosion. While this loss of land is a problem for shorefront property owners, it also affects boaters. Eroded sediments increase nutrient introduction and decrease clarity. As the clarity of the water decreases, fish populations are affected. All this creates problems for the lake ecosystem.

The extent of shoreline erosion caused by boat wakes depends on the wake's energy. A wake's energy depends on four factors: distance from the shore, hull size, boat speed, and water depth. A boat speed only a few miles per hour above the typical five miles per hour, near shore, creates a wake with great erosive force. The impact of a boat's wake on shorelines can be greatly reduced if the boat slows down near shore. Speed limits are designed to protect both the boater and the aquatic environment.

Boaters can also help prevent lake damage by buying a boat that is compatible with the lake. Choose a boat that is appropriate for the size and depth of the lake. This applies to both length and horsepower. Try to buy an engine with good fuel-burning efficiency. Make sure the engine and boat complement each other. Be sure the engine meets current air emission standards to prevent smelly clouds of exhaust. To aid in this, use the correct gasoline and oil mixtures. Handle gasoline carefully to avoid spills. Have your engine tuned up regularly and fix engine leaks to avoid contaminating the lake. Leftover oil and gas in a boat is called bilge waste. Small amounts of bilge waste,

because of its toxic nature, can cause significant damage to the lake if it is not properly handled. Many times this damage will not be immediately tangible, but the cumulative effects will cause lasting negative impacts.

While boating, drive at safe and fuel-efficient speeds. Operate the boat away from shallow areas since motors can churn up bottom vegetation and habitat, scare nesting birds off their nests, and resuspend phosphorus rich sediments, creating ecological problems. Stay away from birds, animals and their nests. Following or chasing wildlife in a boat may separate parents from their young, or frighten the animals from their natural habitat. It's also illegal!

Dispose of all wastes generated on your boat in the proper manner. Keep a trash bag handy and make sure nothing is thrown into the lake. Don't leave cut fishing line or plastic materials in the water. It is required by law to dispose of boat sewage and wastewater by keeping it in a sealed holding tank and pumping it out at a marina or dumping station. Remember to take home all trash.

Many people may not be aware that noise can also be an environmental problem. While boating, try enjoying the natural quiet of being on the lake. Avoid playing loud radios especially since sound travels easier over water. Also minimize using a motor boat during the morning and evening hours when people are enjoying the quiet. Consider other, quieter alternatives such as canoeing, sailing and rowing during these times.

Maintenance of a boat can also harm the lake. Boats are normally serviced once a year for repairs, painting, and general maintenance. Many of the cleaning, dissolving, and painting agents used for maintenance are toxic to aquatic life. A few simple precautions can prevent these chemicals from unduly harming the lake.

Copper and tributyltin (TBT) bottom paints, used to prevent fouling, cause particular environmental damage and are not necessary in fresh water. However, if you know your boat bottom paint contains these elements, you can control the amount that enters the lake by scraping and carefully disposing of any chips or flakes.

Zebra Mussels

Boaters should also have a concern about zebra mussels. Zebra mussels have been found in Honeoye Lake and are now a concern for lake residents. Boaters can help protect their boats from damage caused by zebra mussels and prevent the spread of zebra mussels to other bodies of water. The following suggestions may help to control zebra mussel damage to boats.

Motor Maintenance

- Flush out the motor by letting it run at a high speed for about 10 minutes at least twice a week in the summer and at least once a week in the spring and fall.
- Tip outboard motors out of the water when not in use so that the water can drain out. Raising the motor also keeps mussels from attaching to it. Remove any mussels that might be attached to the motor, particularly near the cooling water intakes and propellers.
- Pull out filter screens and check intakes regularly.
- Watch your temperature gauge. If the temperature is increasing, check the cooling water intakes for zebra mussels.

Your Boat

- Check the outside of your boat often and scrape off zebra mussels regularly. If the hull of your boat seems to have a grainy texture, zebra mussel larvae or veligers, have attached themselves to the boat. Before launching your boat in the lake, wash them off using a high-pressure washer that is 110°F or hotter which will kill the zebra mussels.
- Remove your boat from the water when you're not using it to prevent mussels from establishing a home it.
- When taking your boat out of the water, drain the propulsion system, bilge, bait well, coolers, and anchor locker. Flush everything with hot water to remove the veligers.
- When your boat is out of the water, the sun will kill the adult zebra mussels on the exposed part of the boat, but you will need to scrape them off. On the bottom of the boat zebra mus-

sels may still be alive. You may have to manually scrape off the zebra mussels and leave them in the sun to die. See Chapter 4 for further information on Zebra Mussels.

Fishing

Honeoye Lake is one of New York State's most popular fishing spots. A 1996 survey showed that Honeoye was the 28th most fished water body in New York, with an estimated 11,930 anglers and 90,730 angler hours. If rivers and the Great Lakes are excluded, then Honeoye ranks 13th. Honeoye Lake supports an active year-round fishery. What brings anglers to Honeoye in these numbers? Great fishing!

Honeoye has long been noted for its bluegill and pumpkinseed sunfish, chain pickerel, yellow perch, walleye, brown bullhead, smallmouth and largemouth bass fisheries. Fish from Honeoye reach good size. Walleye average a little over one pound and often reach weights of 4.5 pounds. Bullhead can be caught in the 1.5 to 3 pounds range, while Honeoye's pumpkinseed and bluegill are some of the biggest in the Finger Lakes, weighing up to one pound. While fish sizes are impressive, it does not take an angler long to catch them. According to volunteer angler diary keepers, during the 1997-1998 fishing season it took only 2.77 hours to catch a legal-sized game fish compared with the nine year, 1989 to 1997, average of 3.81 hours. Only the walleye population is supported by stocking 8.6 million fry per year. All other species are dependent on natural reproduction.

The status of fish populations appears stable with the exception of chain pickerel and black crappie. The crappie population dropped off in the 1980's and has remained low. Chain pickerel populations have decreased according to anglers' catch diaries over the past four years. Alewives, which were increasing in Honeoye and could have affected the lake's food chain and catchability of gamefish, experienced a major winter die-off in 1995-1996. There has been no sign of alewives since the die-off. This has helped the walleye fishing as hungry walleye are taking lures more readily.

Although eating fish is good for you, New York State posts a general health advisory on all freshwater fish and more stringent advisories for certain waters where known contamination exists. Honeoye Lake is one of the cleanest Finger Lakes in regard to fish contaminates. Fish from Honeoye have been sampled over the years for potential contamination, with none being found. People should follow the general New York State health advisory when consuming fish from Honeoye Lake. This advisory recommends that you eat no more than one meal (8 ounces) per week of any freshwater fish. Updates to the Department of Health's fish consumption advisory can be viewed at "http://www.health.state.ny.us". People can further reduce the risk of bio-accumulation of contaminants by properly trimming, skinning and cooking your catch. Remove the skin and trim all the fat from the belly flap, the line along the sides, and the fat along the back .

The future is uncertain for the Honeoye Lake Fishery. In 1998, zebra mussels were found for the first time in Honeoye Lake. It is not known if the zebra mussel population will reach a level large enough to affect the lake's ecosystem, including its fishery. The amount of calcium in Honeoye Lake's water is near the lower threshold for zebra mussels. Zebra mussels are filter feeders, with individual mussels able to filter up to one liter of water per day. This filtering action could have several effects on the lake and its fishery. Possible effects include the direct competition for algae and small zooplankton with larger zooplankton or smaller bait fish. This could lead

to fewer and smaller bait fish (prey) and consequently fewer and smaller game fish. Another possible effect would be an increase in water transparency. This could have the effect of increased weed growth, making it more difficult for anglers to reach fishing areas. Increased macrophyte growth could also effect the survival of certain species of fish, some negatively, some positively. For example, largemouth bass and pickerel populations could increase since both species associate with aquatic plants, whereas smallmouth bass populations, which like rocky shorelines, could decrease. One possible positive effect of zebra mussel colonization could be an increase in walleye spawning habitat as was found in Lake Erie. The DEC plans to survey the fish populations and water quality of Honeoye over the next few years to determine the effects, if any, the introduction of zebra mussels could have on the lake and its fishery.

Hunting

The DEC rules and regulations for hunting are followed in the watershed and a proper hunting license is required. A hunting license can be obtained from Town Clerks. A copy of all the rules and regulations is given to you when you receive a hunting license. Hunting opportunities include small (squirrel) and large game (deer), waterfowl (ducks and geese) and game birds (pheasant, grouse and turkey). Much of the land within the watershed is in private ownership and property owners post no-hunting signs. Some property owners will grant permission if asked.

Winter Sports

Honeoye Lake provides as much recreational opportunity in the winter as it does in the summer. It's one of the few lakes in the area that freezes over consistently each winter and thus provides a wide variety of snow and ice activities. Ice fishermen's huts dot the lake all winter long. In fact, the lake is fished more during the winter months than during the summer. In addition to this favorite past time, the lake draws skaters, cross-country skiers, snowmobilers, ice boaters and more!

For those interested in keeping an angler diary, contact:
New York State Department of Environmental Conservation (DEC)
Region 8 Office
6274 East Avon-Lima Road
Avon, New York 14414

Glossary

In discussing environmental issues, it is impossible to avoid the technical terminology that is used. The following glossary gives a few of the terms presented in this book as well as some of those that you might encounter when dealing with environmental topics.

adsorption- The adhesion of thin layers of gas and or liquid molecules to the surface of a solid object.

aerobic- Living or active only in the presence of oxygen (atmospheric air).

algae- Nonvascular plants, usually aquatic and capable of using carbon dioxide by photosynthesis; algae can also survive in damp soil.

anaerobic- Living or active in the absence of oxygen.

aquifer- A geologic formation that can hold and provide large quantities of water readily. Aquifers can be classified as confined or unconfined.

Best Management Practices (BMP's)- Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants yet are compatible with the productive use of the resource to which they are applied. BMP's are used in both urban and agricultural areas.

Biochemical Oxygen Demand (BOD)- A laboratory measurement of the "strength" or potency of an organic or inorganic waste. The test determines the amount of oxygen used by microorganisms as they biochemically degrade (reduce to simple byproducts) the waste. BOD values provide a somewhat standard measure of how much oxygen will be required to degrade a waste, and therefore reflect the effect the waste may have on fish or other aquatic organisms that require oxygen to live.

biomass- Any organic matter or living material in the environment. Biomass is often regarded as a potential energy source.

buffer strips- Strips of grass or other close-growing vegetation that separate a waterway (ditch, stream, creek) from an intensive land use area (subdivision, farm); also refereed to as filter strips, vegetated filter strips, and grassed buffers.

Chemical Oxygen Demand- An indirect measure of the amount of oxygen used by inorganic and organic matter in water. The measure is a laboratory test based on a chemical oxidant and therefore does not necessarily correlate with biochemical oxygen demand.

chlorination- One method of disinfecting water (either drinking water or wastewater). There is some concern that chlorine used in wastewater disinfection may be harmful to sensitive aquatic organisms inhibiting the waters that receive the treated wastewater.

chlorine residual- The total amount of chlorine remaining in water, sewage, or industrial wastewater following chlorination.

coliform bacteria- Coliform bacteria typically inhabit the intestines of warm-blooded animals, as well as the surfaces of plants and soil. It is used as an indicator of human influence on water quality.

confined aquifer- An aquifer whose upper, and perhaps lower, boundary is defined by a (confining) layer of natural material that does not transmit water readily.

Cornell Cooperative Extension- A local agency that is an offshoot of Cornell University. Cornell Cooperative Extension provides educational information and services that have been developed from ongoing research at Cornell and land grant colleges nationwide.

denitrification- The biochemical conversion of nitrate and nitrite nitrogen in the soil or dissolved in water to gaseous nitrogen.

disinfection- A process whereby most microorganisms in or on a substance are killed. There is a high probability that pathogenic (disease causing) bacteria are killed in the process but depending on the process, destruction of viruses is not as certain.

dissolved oxygen- Oxygen dissolved in water and readily available to fish and other aquatic organisms.

diversion- A structural conveyance (or ditch) constructed across a slope to intercept runoff flowing down a hillside, and divert it to some convenient discharge point.

drainage- A technique to improve the productivity of some agricultural land by removing excess water from the soil. Surface drainage is accomplished with open ditches. Subsurface drainage uses porous conduits (drain tile) buried beneath the soil surface.

ecosystem- An interactive group of organisms that exist in the same natural community or environment.

effluent- Wastewater as it leaves some type of treatment system, such as septic tank effluent or municipal wastewater treatment plant effluent.

erosion- Wearing away of soil by running water, wind, or ice. Erosion is the process by which the earth's surface is shaped and occurs even in remote, uninhabited areas at a slow rate (geologic erosion). Of more concern is accelerated erosion caused by people's activities.

eutrophication- The natural aging process of surface waters (such as rivers, streams, reservoirs) through enrichment by nutrients. Eutrophication is accelerated by people's activities. In the end, eutrophication results in the complete filling and drying up of a water body.

evapotranspiration- Loss of water to the atmosphere from the earth's surface by evaporation and transpiration through plants.

fecal coliform- Coliform bacteria that originate in the intestinal tract of humans and other warm-blooded animals. Fecal coliform are not harmful to humans by themselves, but are used to indicate the potential presence of other harmful bacteria.

floodplain- The flat or nearly flat land on the floor of a stream valley or tidal area that is covered by water during floods.

Giardia- Giardia lamblia, a protozoa that moves in a liquid by a whip-like tail and causes diarrhea in humans.

groundwater- Water beneath the earth's surface at varying depths.

hardness- Condition of water, caused mostly by naturally occurring mineral impurities, that prevents suds formation by soap. Typically caused by calcium and magnesium.

hydrologic cycle- A term used by scientists to describe the constant movement of water in and on the earth and atmosphere. Numerous processes (such as precipitation, evaporation, runoff) comprise the hydrologic cycle.

infiltration- The entry of water (from precipitation, irrigation, or runoff) into the soil profile.

integrated pest management (IPM)- The control of crop or garden pests by methods that minimize harmful effects. This is done by monitoring the population of pests and taking control measures when it is estimated that the value of the crop of garden plants will be diminished by the presence of the pests.

Leachate- Water containing dissolved substances that moves downward through some specified material, such as landfill leachate — subsurface drainage from a landfill.

leachfield- The part of a septic system that allows for the degradation of wastewater by oxygen-using bacteria and filtration through soil. The leachfield is connected to the distribution box and is the last part of the septic system.

leaching- The removal of soluble materials from a substance as water moves through it.

littoral- Zone occuring at the edge of aquatic ecosystems and extending inward from the shoreline to the innermost populations of organisms attached to the bottom surface.

microorganism- A simple form of life with microscopic dimensions; microbes.

Natural Resource Conservation Service (NRCS)- (used to be known as the Soil Conservation Service.) An agency of the United States Department of Agriculture that provides technical assistance for resource conservation to farmers, other Federal, state and local agencies, and to local soil conservation districts.

nitrification- The biochemical transformation of ammonium nitrogen to nitrate nitrogen.

non-point source pollution- Pollution of surface or ground water supplies originating from land-use activities and.or the atmosphere, having no well-defined point of entry.

organic chemicals- Any number of natural or synthetic chemical compounds containing the element carbon in combination with other elements (such as hydrogen, chloride, phosphorus). Organic chemicals are use in a variety of everyday applications from fuel to pest control. Many are safe but some may be toxic and also carcinogenic.

percolation test- An analysis of the amount of water that will seep into the soil. Percolation tests are performed when designing a septic system.

pH- A measure to indicate and acid or alkaline condition. pH values can range from zero (extremely acid) to 14 (extremely basic or alkaline). pH near 7 (neutrality) is preferred by many aquatic organisms. pH measurements use a non-linear scale such that pH 6 is 10 times more acidic than pH 7, and pH 5 is 100 times more acidic than pH 7. Seawater has a pH of approximately 7.5 to 8.5, coffee has a pH slightly above 5.

point-source pollution- Pollution of ground or surface water supplies at well-defined, usually manufactured, "points" or locations. Discharges of treated wastewater from municipal and industrial treatment plants are common point sources of pollution.

pollution- The occurrence of contaminating materials in the environment (water, soil or atmosphere) above natural, background levels.

receiving waters- All distinct bodies of water that receive runoff or wastewater discharges, such as streams, rivers, ponds, lakes, and estuaries.

recharge area- Land over which precipitation infiltrates into the soil and percolates downward to replenish an aquifer. For unconfined aquifers, essentially the entire land surface overlaying the aquifers is a recharge area. For confined aquifers, recharge areas may be only a small part of the overlaying area.

runoff- The portion of precipitation, snow melt, or irrigation that flows over and through the soil, eventually making its way to surface water supplies (such as streams, rivers, ponds). Runoff includes surface runoff, interflow and ground water flow.

sheet erosion- The washing away of soil in layers from barren, sloping land by rainfall.

sediment- Eroded soil and rock material, and plant debris, transported and deposited by runoff.

septic system- An onsite system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives wastes from a residence o business and a system of tile lines for disposal of the liquid effluent that remains after decomposition of the solids by bacteria in the tank.

sewer- An underground system of conduits (pipes and/or tunnels) that collect and transport wastewaters and/or runoff. Gravity sewers carry free-flowing water and wastes. Pressurized sewers carry pumped wastewaters under pressure.

sludge- In wastewater treatment, the semisolid part of sewage and bacterial mass that has been acted upon by bacteria and settled and/or been removed from the treated wastewater.

Soil and Water Conservation District (SWCD)- A local government agency within a defined water or soil protection area, typically a county, that provides assistance to farmers and other local residents in conserving natural resources, especially soil and water.

soil profile- A vertical section of the earth's highly weathered upper surface often showing several distinct layers, or horizons.

surface runoff- Precipitation, snow melt, or irrigation in excess of what can infiltrate the soil surface and be stored in small surface depressions. Runoff is a major transporter of nonpoint source pollutants.

Suspended solids- Organic or inorganic particles that are suspended in and carried by the water. The term includes sand,

mud, and clay particles (and associated pollutants) as well as other solids in stormwater.

swale- A low place in a piece of land where vegetation tends to grow thicker. Sometimes water concentrates in the low areas of a swale.

Total Dissolved Solids (TDS)- All material that passes a filter of a specified size.

Total suspended solids- one of the standard pollutants characterizing urban runoff, as defined by the EPA.

turbidity- A condition in water or wastewater caused by the presence of suspended material resulting in scattering and absorption of light rays.

unconfined aquifer- An aquifer whose upper boundary (the water table) is made up of relatively loose, unconsolidated natural material that transmits water readily. Unconfined aquifers also are often referred to as water table aquifers.

underground storage tank - A container buried in the soil designed to store various liquids, especially fuels.

veligers- Zebra mussel larvae.

volatization- Loss of a substance through evaporation.

wastewater- Literally, water that has been used for some purpose and discarded, or wasted. Typically liquid discharged from domestic residential, business and industrial sources that contains a variety of wastes (fecal matter, byproducts).

wastewater treatment plant- A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts. Known by the acronyms WWTP (wastewater treatment plant), STP (sewage treatment plant), and POTW (publically owned treatment works).

watershed- An area of land that contributes runoff to one specific delivery point. Large watersheds may be composed of several smaller "subsheds", each of which contributes runoff to different locations that ultimately combine at a common delivery point.

water table- The upper level of a saturated zone below the soil surface, often the upper boundary of a water table aquifer.

References

Alliance for the Chesapeake Bay. *The Bay Book,* Baltimore Md.: Alliance for the Chesapeake Bay, 1989.

Bloomfield, Jay, et al.. *Lakes of New York State, Volume 1, Ecology of the Finger Lakes.* New York: Academic Press, 1978.

Burns, Max. *Cottage Water Systems.* Toronto Canada: Cottage Life Books, 1993.

Burnes, Pauline. *The Inventory of Significant Geological, Geographical, Historical, Cultural and Scenic Resources of the Canandaigua Lake Watershed.* Syracuse, N.Y.: Institute for Environmental Policy and Planning, 1991.

Canandaigua Lake Watershed Task Force. *Prescription for a Healthy Lake.* Canandaigua, N.Y.: Canandaigua Lake Watershed Task Force, 1994.

_____. *The Home Siting Handbook.* Canandaigua, N.Y.: Canandaigua Lake Watershed Task Force, 1989.

Canandaigua Lake Watershed Task Force, and Cornell Cooperative Extension. *Soil Erosion Control for Single Family Dwelling Construction.* Canandaigua, N.Y.: Cornell Cooperative Extension, 1995. Also available on videotape.

Canandaigua Lake Watershed Task Force Ad Hoc Committee. *The State of the Canandaigua Lake Watershed - 1994.* Canandaigua, N.Y.:Canandaigua Lake Watershed Task Force,1994.

Cornell Cooperative Extension. *Your Septic System.* Ithaca, N.Y.: Cornell Cooperative Extension, FS-1, 1990.

Cornell Cooperative Extension, and Ontario Co. Soil and Water Conservation District. *A Homeowner's Guide to Septic Systems.* Canandaigua, N.Y.: Cornell Cooperative Extension, 1994.

Dumas, Frances. *A Good County, A Pleasant Habitation.* Penn Yan, N.Y.: Keuka Lake Enterprises, 1990.

Empire State Chapter, NYS Soil and Water Conservation Society, U.S.D.A. Natural Resources Conservation Service. *New York State Guidelines for Urban Erosion and Sediment Control.* Syracuse, N.Y.: U.S.D.A. NRCS, 1991.

Federation of Lakes Associations, Inc., and New York State Department of Environmental Conservation. *Diet for a Small Lake, A New Yorker's Guide to Lake Management.* Rochester, N.Y.: FOLA, 1990.

Hamilton County Soil and Water Conservation District, and Cornell Cooperative Extension. *Shoreline Management In The Adirondacks.* Lake Pleasent, N.Y.: Hamilton Co. SWCD.

Kansas State Cooperative Extension. *Water Quality - Disinfection of Private Water Supplies.* Manhattan, Kans.: Kansas State Cooperative Extension Service, 1989.

Landre, Peter. *Stop! No Zebra Mussels Allowed!, A guide to selecting a household zebra mussel control system.* Penn Yan, N.Y.: Yates Co. Cornell Cooperative Extension, 1996.

Magette, William L. *Citizen's Guide to Environmental Terminology.* College Park, Md.: Cooperative Extension Service, University of Maryland.

Mancl, Karen, Martin Sailus, and Linda Wagenet. *Privite Drinking Water Supplies: Quality, Testing, and Options for Problem Waters.* NRAES-47. Ithica, NY: Northeast Regional Agricultural Engineering Service, 1991.

Midwest Plan Service. *Private Water Systems Handbook.* Ames, Iowa: Midwest Plan Service, MWPS-14, 1979.

New Hampshire Department of Environmental Services. *Answers to Common Lake Questions.* Concord, N.H.: New Hampshire Department of Environmental Services, 1992.

New York State Department of Health, 1966. *Rural Water Supply*. Albany, N.Y.: New York State Department of Health, 1966.

_____. *Health Advisory - Chemicals in Sportfish and Game*. Albany, N.Y.: New York State Department of Health, 1994.

New York State Department of Environmental Conservation. *Reducing the Impacts of Stormwater Runoff from New Development*. Albany, N.Y.: NYS DEC, April 1992.

_____. *1990 Statewide Survey of Boating Use at Public Waterway Access Sites in New York State*. Albany, N.Y.: NYS DEC, 1992.

New York State Sea Grant. *Great Lakes: Great Gardening*, Fact Sheet No. 4. Ithaca, N.Y.: The Research Foundation of State University of New York.

Northeast Regional Pesticide Coordinators. *Pesticide Applicator Training Manual*. Ithaca, N.Y.: Chemical Pesticides Program, Cornell University, 1990.

Northeast Regional Agricultural Engineering Service. *Home Water Treatment*. Ithaca N.Y.: NRAES, Cooperative Extension, NRAES - 48, 1995.

_____. *Home*A*Syst - An Environmental Risk-Assessment Guide for the Home*. Ithaca, N.Y.: NRAES, Cooperative Extension, NRAES-87, 1996.

O'Neill, Charles R. *Protecting Residential Water Systems from Zebra Mussel Infestation*. Brockport, N.Y.: New York Sea Grant Program, State University of New York at Brockport and Cornell University.

Ontario (Canada) Ministry of Environment and Energy. *Volume 2 Environmental Living: Protecting the Environment...in Your Yard and Garden*. Toronto: Ontario Ministry of Environment and Energy.

_____. *Volume 4 Environmental Living: Protecting the Environment...at the Cottage*. Toronto: Ontario Ministry of Environment and Energy.

_____. *Volume 5 Environmental Living: Protecting the Environment...in the Great Outdoors*. Toronto: Ontario Ministry of Environment and Energy.

Smardon, Dr. Richard, et. al., *Protecting Floodplain Resources: A Guidebook For Communities*. Washington D.C.: Federal Interagency Floodplain Management Task Force, 1995.

State University of New York at Oneonta, 1991. *The Lake Book - A Guide to Reducing Water Pollution at Home*. Oneonta, N.Y.: Biological Field Station, Occasional Paper No. 22, Otsego Lake Watershed Planning, Report No. 1. Biology Department, State University of New York at Oneonta, 1991.

Stewart, John Cary. *Drinking Water Hazards - How to Know if There Are Toxic Chemicals in Your Water and What to Do if There Are*. Hiram, Ohio: Envirographics, 1990.

Trancik, Roger. *Yates County Looking Ahead, A Planning and Design Guide*. Penn Yan, N.Y.: Yates County Department of Economic Development and Planning, 1990.

United States Environmental Protection Agency, 1993. *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters*. Washington, D.C.: U.S. EPA, 820-B-92-002, 1993.

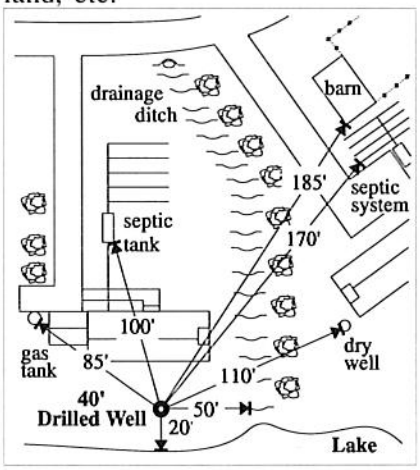
Wagenet, Linda and Ann Lemley. *Water Treatment Notes - Private Household Water Supplies*. Ithaca, N.Y.: Cornell Cooperative Extension Fact Sheets. Cornell Cooperative Extension, FS-8, 1991.

_____,1987. *Water Treatment Notes - Activated Carbon Treatment of Drinking Water*. Ithaca, N.Y.: Cornell Cooperative Extension, FS-3, 1987.

Wagenet, Linda, Karen Mancl, and Martin Sailus. *Home Water Treatment*. NRAES-48. Ithaca, NY: Northeast Regional Agricultural Engineering Service, 1995.

Water System Records

Draw a sketch of your property. Use permanent landmarks and record distances. Include both your and your neighbor's: buildings, wells, abandoned wells, septic tank, leach field, dry well, fuel storage tanks, source of animal wastes, ditches, streams, slope of land, etc.



Example

A well log, which includes details about each well such as depth and geologic formations that the well passes through, should be provided by the driller at the time of installation. This information should be kept as part of the file on your water system. If the water coming from the well becomes contaminated, the persons trying to locate the source will need this information.

Year constructed _____ *Depth (ft)* _____ *Diameter (in)* _____

Casing depth (ft) _____ *Casing material* _____

Location of pump _____

Name of contractor who installed the well _____

Address _____

_____

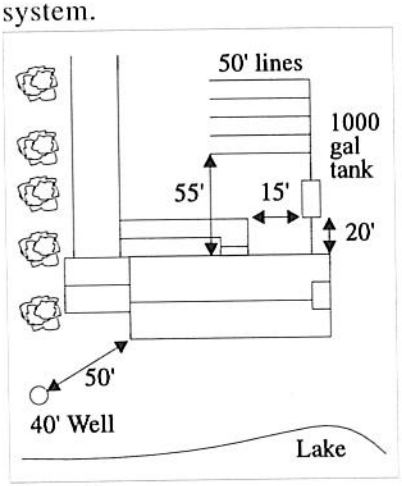
Phone number _____

Keep records of water tests and any construction performed to the well and water system.

Date	Work Done / Test Results	Company	Cost

Septic System Records

Make a rough sketch of your property showing the location and distances between your septic tank, the nearest corner of the absorbtion field, home, and water source. Including landmarks such as trees, rocks, roads, and fences can help when trying to locate your system.



Example

Maintenance Record

Record any maintenance or work done to the septic system. These records keep all of the necessary information in one location and can be used to anticipate when a system may need to be cleaned.

Size of Tank _____ *No. Bedrooms* _____ *Date Installed* _____

Septic System Installer

Name _____
Address _____
_____
Phone _____

Septic System Pumper

Name _____
Address _____
_____
Phone _____

Date	Work Done	Company	Cost

Watershed Manager 110 Court St, Penn Yan, NY 14527 Phone (315) 536-5110

Municipalities and Agencies within the Honeoye Lake Watershed

Municipalities

Town of Bristol
Clerk (1999) 716/229-2400
Supervisor 716/222-2135
6740 CR 32
Canandaigua, NY 14424

Town of Canadice 716/367-2050
5949 CR 37
Springwater, NY 14560

Town of Naples 716/374-2111
P.O. Box 535
196 South Main Street
Naples, NY 14512

Town of Richmond 716/229-5757
20 East Main Street
Honeoye, NY 14471

Town of South Bristol 716/374-6341
6500 Gannett Hill Road
Naples, NY 14512

Town of Springwater 716/367-2545
8022 Main Street
Springwater, NY 14560

Agencies and Associations

Cornell Cooperative Extension
Ontario County 716/394-4110
480 N. Main Street
Canandaigua, NY 14424

Livingston County 716/658-3250
158 S. Main Street
Mount Morris, NY 14510

Soil and Water Conservation District
Ontario County 716/396-1450
480 N. Main Street
Canandaigua, NY 14424

Livingston 716/382-3214
129 Main Street
Box 152
Leicester, NY 14481

NYS DEC 716/226-2466
Region 8 Office
6274 East Avon-Lima Road
Avon, NY 14414

Honeoye Valley Association
P.O. Box 165
Honeoye, NY 14471