COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

WATER QUALITY in KENTUCKY

Understanding the Water System

Tom Ilvento, former Extension Specialist, Sociology; Linda Heaton, Family and Consumer Sciences; and Joe Taraba, Biosystems and Agricultural Engineering. Revised by: Kimberly Henken, Agricultural Programs, and Linda Heaton, Family and Consumer Sciences

Water is essential for life. No other single substance is as important for our health, our economy, or our way of life. People can live for weeks without food but only five to 10 days without water. Experts say that people need 2 quarts of water a day to help digest food, cool bodies, lubricate joints, remove body wastes, and clean eyes.

Water is important for our economy as well. Agriculture is one of the largest users of water because plants and animals require large amounts of water. A dairy cow requires 3 gallons of water to produce 1 gallon of milk, and an ear of corn requires 25 gallons of water to grow.

Processing food also requires large amounts of water. For example, 35 percent of bread is composed of water. Some scientists estimate that a fast food meal of a hamburger, french fries, and a soft drink requires 1,400 gallons.

Industry is also a large user of water. Many products require large quantities of water during production. Producing one car requires more than 30,000 gallons of water including more than 2,000 gallons for the four tires.

No matter where we turn, water is an important part of our lives. It is a mode of transportation, a universal solvent in cleaning, a source of electricity, and a means of recreation. Thus, preserving and conserving water have become increasingly important in Kentucky. Droughts and pollution have made us realize that clean and abundant water is a limited resource. It can disappear if we do not manage it properly.

Kentucky has more than 89,000 miles of rivers and streams, and more than 5 percent of the land is in lakes and wetlands. It also has a supply of groundwater that, while not seen, is an important resource. Kentuckians rely on these supplies of water for drinking, farming, industry, and recreation. Increasingly, however, Kentucky's water resources are threatened by runoff pollution from farms, construction sites, and residential areas; illegal dumping; improper sewage disposal; oil and coal extraction; and poor management practices.

Each of us has a responsibility to protect the water supply. Consumers, farmers, and industries would suffer if the quality and quantity of the water supply deteriorate. This publication gives an overview of the basic issues in water quality. It describes the water cycle, sources of water, uses of water, and threats to the water supply. It provides the basis for individuals and groups to protect and conserve their own water source and that of their community and county.

Water Is a Natural Resource

Our society generates a high demand for an abundant supply of clean water. However, water is a natural resource. While it is found naturally in our environment, its supply is limited.

Water is not available at every location; deserts, for example, have a limited or nonexistent supply. In the past, humans settled only where water was naturally available, but in modern times, we can bring water to most locations through pipes or reservoirs.

Water systems go through periodic shortages because precipitation fluctuates. Droughts that affected Kentucky during the summers of 1999 and 2000 were a dramatic reminder of how the water supply can change over time.

Water is rarely found in a pure state. Because it is a universal solvent, it dissolves many minerals and chemicals. Thus, our water supply contains many components that affect its quality.

For human consumption, many minerals found naturally in water are not harmful and can improve taste. However, some microorganisms and chemicals can cause health problems and even death. Over time, we have developed standards for drinking water.

Industry also has standards for water, some of which may be even more stringent than those for human consumption. For example, water used by a pharmaceutical company for making drugs must be very pure.

Ultimately, the water supply at any given time depends on the quality demanded by users. A large supply of water contaminated by pollutants is useless for many applications.

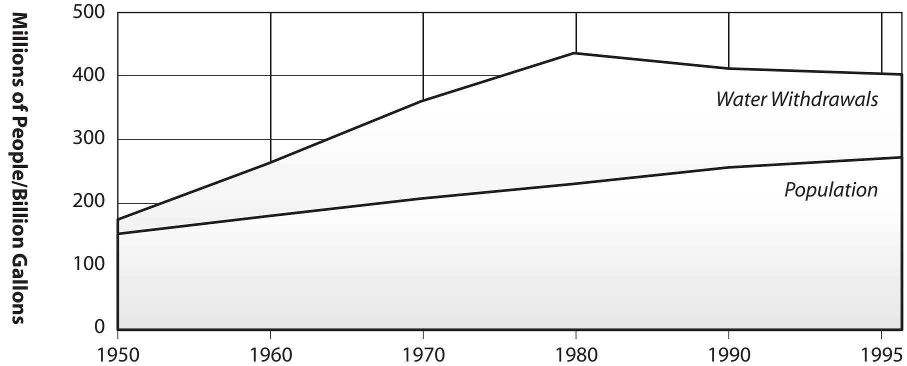
Cost

In the past, we viewed water as unlimited and cheap, and in many respects we were right about U.S. water. In most of the United States, we have been blessed with an abundant supply of water available at a relatively low cost. On average, water costs slightly more than $2 per 1,000 gallons. That cost does vary and tends to be higher in rural areas. In Kentucky, the average cost is approximately $4 per 1,000 gallons.

Nonetheless, water does have a cost sensitive to the quality and quantity demanded. Most of the water we use must be treated to remove harmful microorganisms or chemicals. As water becomes more contaminated and standards of quality rise, treatment costs increase.

Over time, water costs have increased as the demand for water rises. From 1950 to 1980, our demand for water was increasing at a faster rate than our population (see Figure 1). Since 1980, however, we have begun to see a decline in our withdrawal of water. Regardless, we are demanding more water today for personal consumption and to produce goods than we did 50 years ago. We must keep in mind that the water supply is limited. More and more, we are reminded through shortages or through periodic bouts of water contamination that water must be conserved and protected.

Figure 1. Trends in Water Withdrawals and Population, 1950 to 1995.



Source: "Estimated Use of Water in the United States in 1995," U.S. Geological Survey Circular 1200, (1998), U.S. Department of the Interior, Denver, CO.

The Water Cycle

Although water is a natural resource with a limited supply, it is also recycled. Nature's way of recycling water is called the *water cycle* or the *hydrological cycle.* This cycle is important to ways in which we find and use water.

Water that does not seep into the ground is called surface water. This includes streams, rivers, ponds, lakes, and oceans. Artificial sources of surface water are called reservoirs. When water reaches the surface, it can evaporate and once again be part of the water cycle.

Surface water evaporates and turns into a gas. Most evaporation comes from the oceans, which cover three-quarters of the earth's surface. As air with water vapor rises and cools down, it condenses in the atmosphere and forms clouds. Eventually, it returns to the earth in the form of precipitation, such as rain or snow. Water that hits the ground can either seep into the soil or run off into streams, rivers, and lakes. Some of the water that seeps into the ground is used by plants. The rest percolates through the soil and into the underlying sediments or rock and becomes groundwater.

Groundwater is under the earth's surface and is an important source of water for many individuals and communities. Groundwater generally moves slowly toward rivers, lakes, or oceans. Any way that groundwater leaves the ground is called a **discharge.** Discharges can take place naturally through springs, geysers, or contact with streams, rivers, lakes, oceans, or through artificial means such as wells.

The water cycle doesn't always distribute water evenly around the earth. Periodically, precipitation does not reach some areas, and the groundwater and surface water supplies drop. When the drop is serious and extended, it is called a drought. In other cases, when large amounts of precipitation fall in a short time, the ground and surface waters cannot handle the influx, and water pours over the land creating floods.

The water cycle purifies water (see Figure 2). Through evaporation most minerals and chemicals are left behind. Contaminated water flowing into larger bodies of relatively clean water can be diluted to acceptable levels. Surface water exposed to sun and air can also be cleansed as contaminants are broken down by the sun or by bacteria. Soil can filter organisms and chemicals from water as it seeps into the ground. Bacteria may also help to break down toxic chemicals. Rates of groundwater movement are normally much slower than surface water, and, as a result, cleanup is often more costly and difficult.

More about Groundwater

Although rivers, streams, and lakes are very visible sources of water, 95 percent of the U.S. fresh water supply is in groundwater. More than one-third of the people in the United States rely on public water systems supplied by groundwater. Groundwater wells provide water for more than 93 percent of households who do not have access to a public water system. In Kentucky, the numbers are quite similar. More than 30 percent of Kentucky's residents receive drinking water from a public water system supplied by groundwater. Ninety percent of rural Kentuckians who are not connected to public water systems rely on groundwater for their drinking water and everyday use.

What exactly is groundwater? As precipitation hits the ground, gravity pulls it down through the soil. How fast water travels through the soil depends on the soil itself. Because sandy soils are permeable, water travels quickly, but clay soils do not allow water to move very fast.

As water travels through the soil, it passes through the *zone of aeration.* This region may be moist at times, but the pores are only partly filled with water. As the water continues down through the soil or rock, it eventually reaches a zone where all the interconnected openings are filled with water—the saturated zone. The top of the saturated zone is called the water table. Water in this zone supplies wells and springs.

Not all soils allow water to flow freely. Soils and rocks that contain a considerable number of openings are **porous;** however, not all porous materials allow water to flow through. For example, Swiss cheese has many holes, but they are not connected. Materials that allow water to move through the pores are **permeable.**

An **aquifer** is a rock or soil unit sufficiently porous and permeable to yield water in usable quantities to a well or spring. Some aquifers are confined by layers of soil or rock that do not allow water to flow through freely. These are referred to as **confined aquifers.** Aquifers that are not confined are commonly known as **water table aquifers.**

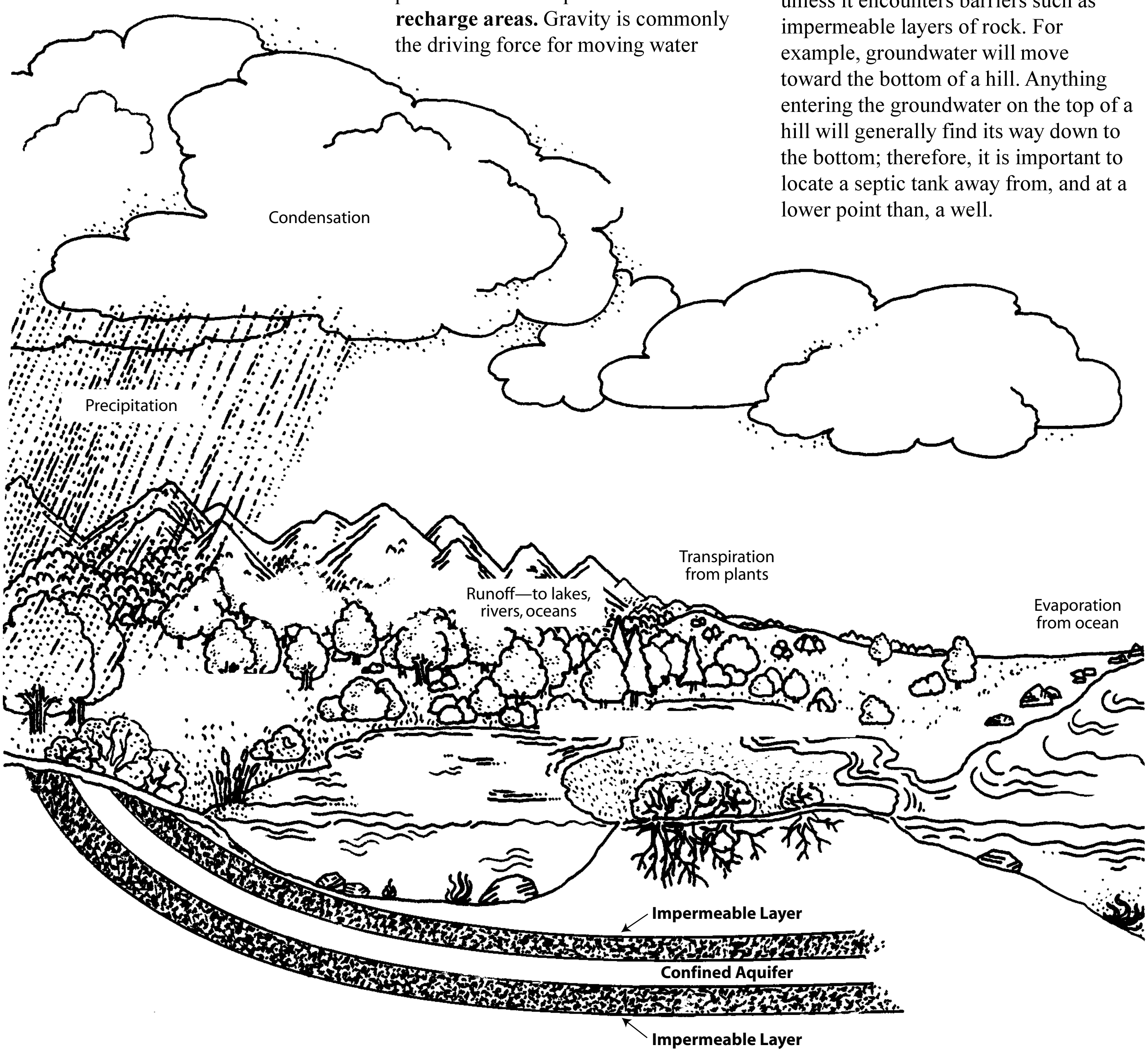
Aquifers represent major fresh water resources throughout the country. They can cover extremely large or very small areas. The Ogallala aquifer, the largest in the United States, extends from South Dakota to the central plains of Texas. Kentucky does not have any large aquifers.

Movement of Groundwater

Surface areas that allow water to percolate into an aquifer are called **recharge areas.** Gravity is commonly the driving force for moving water through an aquifer. Ponds, creeks, streams, and rivers normally act as discharge areas for groundwater flow. Groundwater constantly encounters resistance to flow from the surrounding materials (soil and rocks). As a result, groundwater's movement is slower and somewhat different from surface water. These differences are important because pollutants travel and disperse more slowly in groundwater.

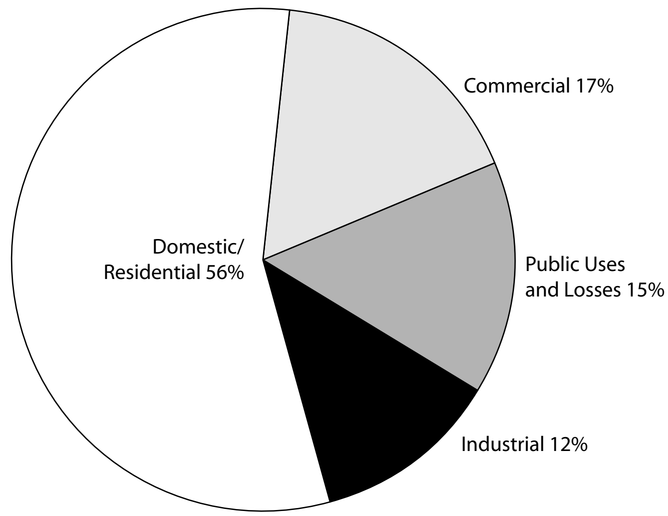
Groundwater moves slowly, only a few feet per year in some cases. Its movement is affected by the land's topography and geology. Topography is the contour of the surface land. Groundwater tends to follow the land's contour unless it encounters barriers such as impermeable layers of rock. For example, groundwater will move toward the bottom of a hill. Anything entering the groundwater on the top of a hill will generally find its way down to the bottom; therefore, it is important to locate a septic tank away from, and at a lower point than, a well.

Figure 2. The Water Cycle.



The geology of underground sediment and rock also influences the movement of groundwater. Groundwater can travel quickly in porous and permeable material, particularly if the rock has large cracks and fissures. For example, water travels quickly through underground rivers and streams in the karst limestone areas of central Kentucky. However, in most cases, the movement of groundwater is very slow. Slow moving contaminants in groundwater travel in plumes that may take weeks, months, or even years to dissipate. By the time a plume reaches a well site, it may be difficult to tell where it came from, when it was released into the groundwater, and how long it will affect the well site.

Figure 3. Users of Public Water.



What Affects Groundwater?

Many types of human activity can affect the quantity and quality of water in an aquifer. For example, too much pumping from wells can deplete an aquifer faster than it can be recharged. This leads to a decline in water levels that can extend to other areas served by the same aquifer. Constructing buildings, paving roads, and draining wetlands can affect recharge to an aquifer and limit its ability to replenish itself. Groundwater quality can be affected by waste disposal and use of toxic chemicals, especially in sensitive recharge areas.

How Water Is Used

Water for personal, agricultural, and industrial consumption comes from a variety of sources. Most consumers in the United States get their household water from public water systems. Under federal law a **public water system** is any system that provides service to 25 people (or 15 connections) for at least 60 days a year. These systems use water from wells, springs, rivers, lakes, or a combination as their source.

Personal

The largest consumers of public water systems are residential users (see Figure 3). Households use an estimated 56 percent of all public water for bathing, cooking, washing, watering, recreation, etc. The second major user is commercial establishments (17 percent), followed by public uses and losses (15 percent), and industry (12 percent). Of the 15 percent in public uses and losses, almost two-thirds is lost and unaccounted for, most often through leaky pipes. Unaccounted loss of treated water is estimated to be much higher in smaller, more rural public water systems.

Public water systems are of two main types: (1) a **community water system,** which provides year-round service and (2) a **noncommunity system,** which provides service for less than a year. A campground with its own water system is a noncommunity water system.

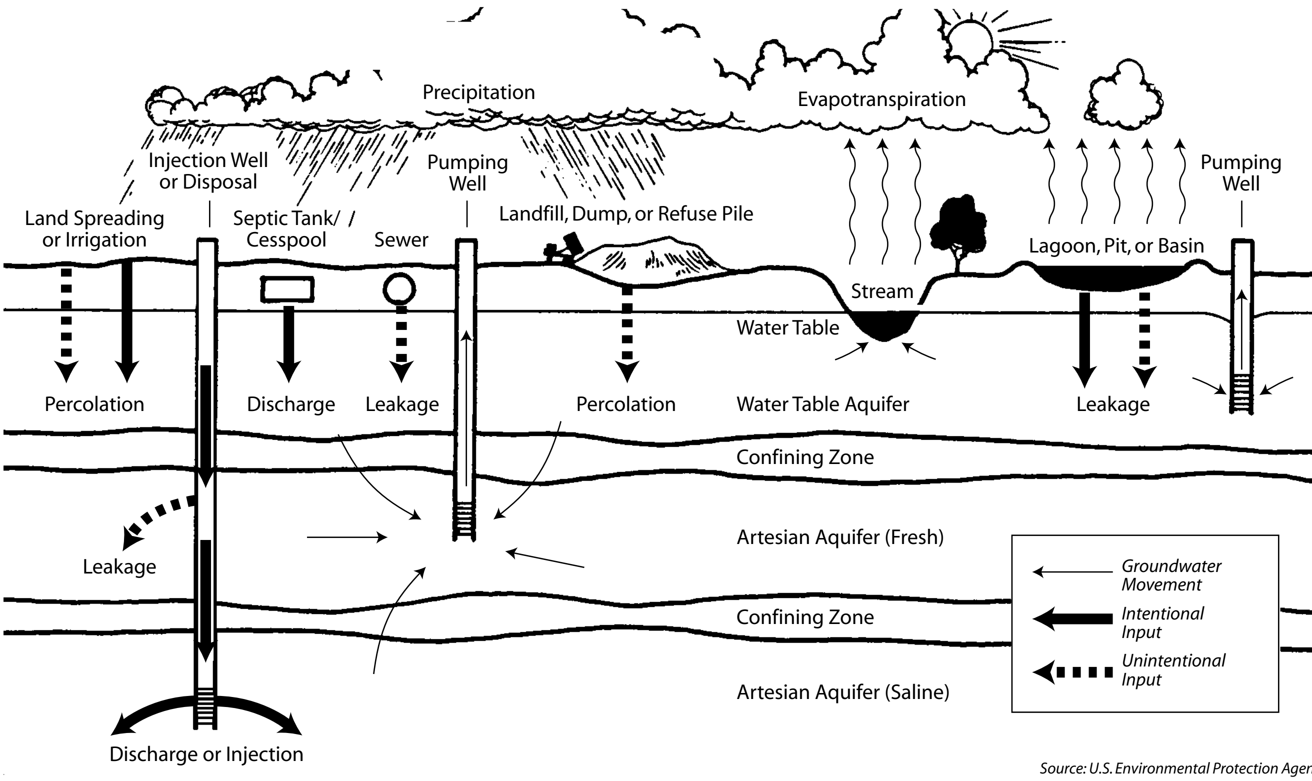
Most people in the United States get their water from medium to large drinking water systems (those serving more than 3,300 people). However, the majority of the nation's water systems serve fewer than 500 people and are primarily located in rural areas. Nationwide, 59 percent of the community water systems serve fewer than 500 people. In Kentucky, only five of the 483 community water systems serve more than 50,000 people.

Small systems often have more problems than larger systems because they lack sufficient economies of scale. Maintaining equipment, testing for contaminants, and treating the water is more expensive for small systems than for large ones. Small systems often have difficulties keeping a qualified workforce; thus, issues surrounding water quality are compounded in smaller systems.

For more than 16 million households in the United States, private water systems are the primary source, with the most common being a **well.** People relying on well water live mostly in rural areas, where the dispersed population makes public systems prohibitive. These systems are unregulated by federal and state laws, although most states (including Kentucky) regulate new well construction. Instead, consumers are urged to have their water tested and their wells checked for proper construction and maintenance.

Another private system used by a significant number of rural consumers is a **cistern,** a rainwater collection system that stores water in a tank. It is used primarily in areas that lack a sufficient aquifer to support wells. Parts of central, south central, and eastern Kentucky rely heavily on cisterns for home water. Like wells, they are unregulated.

Figure 4. Sources of Groundwater Contamination.



Source: U.S. Environmental Protection Agency

Agriculture and Industry

Agriculture and industry rely a great deal on groundwater. Of the more than 77 billion gallons of groundwater withdrawn each day in the United States, two-thirds is used for agriculture. Farmers use water primarily for **irrigation,** particularly in the western and southwestern United States. The amount of these withdrawals has sometimes been faster than the aquifer's ability to recharge, and the supply has begun to deplete in some areas.

Contamination of the Water Supply

Because water is a natural resource, it must be managed properly to protect it for future generations. One of the greatest threats to the water supply is contamination from pollutants. Because water is a natural solvent, it can carry minerals and chemicals that may be harmful to humans.

In the past, the biggest threat to water supplies was microorganisms, which caused diseases like dysentery, typhoid, and giardiasis. While these diseases are still present to a small degree, the larger issue today for water quality comes from contamination by organic and inorganic chemicals. Inorganic chemicals include metals and nutrients, while organics include pesticides and industrial solvents. Many of these chemicals have been linked to cancer, liver and kidney disease, and nervous system damage.

A major difficulty in identifying contaminants is knowing their source. **Point sources** are those that can be readily identified, such as wastewater from sewage treatment or a manufacturing plant. Point sources of pollution have decreased in recent years because of federal and state laws. Enforcement of these laws tends to be straight forward because the source of pollution can be determined.

A second major source of pollutants is **nonpoint sources.** Nonpoint sources are scattered over a large geographic area and come from a variety of places. These include sediments, animal wastes, pesticides, and other materials carried by water from agriculture, municipal dumps, and runoff. With nonpoint pollution, identifying a single responsible polluter is more difficult because it can come from a variety of sources. Hence, regulation is less effective and tends to rely on voluntary compliance.

Where do the chemical contaminants come from? Actually, there are a variety of sources. The major sources that have been identified are manufacturing industries, agriculture, municipalities, and individuals (see Figure 4).

Manufacturing Industries

In the past, the media has focused most closely on pollution from industrial wastes and their by-products. Extractive industries, such as mining and forestry, produce acid mine drainage, brine, and soil erosion. Although legislation has reduced the impact of these industries, by-products still pollute the water supply.

Manufacturing industries often use toxic chemicals during production. Proper disposal of these chemicals can be very costly, and the temptation is great to dump them illegally. Even legal disposal of industrial by-products in landfills and toxic dump sites can cause problems. Over time, regulators have found that even the best prepared sites can leak harmful chemicals into the groundwater.

Agriculture

Another source of pollution of water supplies is from agriculture. A farm operation may use many pesticides and fertilizers in producing a crop. Once applied, these chemicals can percolate through to the groundwater. Animal wastes can also contaminate the water supply, particularly in feedlots where a large number of animals are kept in a relatively small area. Unless the wastes are dispersed over a large area or stored in a contained lagoon, ground and surface waters can be contaminated from runoff. Another agricultural contaminant is excessive soil erosion, which clogs rivers and streams.

Municipalities

Cities and towns also contribute to water quality problems in many ways. Contaminants can leach from municipal landfills as rain filters through the solid wastes and percolates into the ground. While new landfill construction standards limit this possibility, problems still often exist with old landfills and open dumps. Sewage treatment plants produce sludge that contains heavy metals and organic chemicals. The sludge is often spread over soil and can find its way into the groundwater. Urban runoff from roads, parking lots, and storm sewers can also contribute to water pollution as it picks up chemicals, soil, trash, and oil products. Municipalities also use pesticides and herbicides in parks and golf courses and along roads to control pests and weeds. These chemicals also find their way to the groundwater.

Finally, commercial activities in cities and towns contribute to water quality problems. Many businesses use chemicals as sales products (gasoline stations), in processing (dry cleaners), and as cleaning agents (restaurants). One particularly important problem is storage tanks, either above or below the ground, which can leak chemicals into the groundwater.

Individuals

A final source of water pollution is individuals. Within the home a number of toxic chemicals are used for cleaning, painting, and car care. Often people do not consider the potential damage to ground and surface water when they dispose of these chemicals in the sink, toilet, or trash. About 25 percent of all homes use septic systems for sewage disposal. These systems can leach harmful chemicals into the groundwater, particularly if they are poorly constructed or maintained. Homeowners also use lawn and garden products that can get into the ground or surface waters. Research indicates that homeowners use 10 times more chemical fertilizers and pesticides per acre than farmers use on farmland.

Impacts of Pollution

Ill health from contaminated drinking water supplies is a primary concern. Bacteria, viruses, heavy metals, and chemicals in water have been related to many diseases, such as gastroenteric diseases, cancer, and nervous system disorders. Some of these diseases are fatal. At present, the risks are relatively small, and by and large the drinking water supply is safe. However, many questions remain unanswered concerning water quality's long-term effect on health. One thing is certain: the situation will not improve unless positive and proactive steps are taken to maintain the quality of the water supply.

Besides health effects, contaminants also pose other problems. Some cause bad odors and taste, increase water hardness and acidity, and lead to water cloudiness. Although these effects are not harmful *per se,* they do reduce water quality and limit some of its uses. For example, water that tastes bad may still be used for cleaning but would have little use for drinking.

Contaminants in water increase the cost of the water supply. Greater concern over quality leads to more frequent and more extensive testing and treatment. The treatment process is becoming more and more complex as new chemical compounds are detected in water systems each year. Further, the treatment process can lead to other problems. For example, chlorine is often added to water as a disinfectant. However, it has been discovered recently that chlorine can react with natural organic materials found in water to form trihalomethanes, a substance linked to cancer.

Another way contaminants increase water cost is by reducing the supply of water usable for consumption. Contaminated water cannot be used for some purposes. Any reduction in the supply of water when demand remains the same results in an increase in the cost of water. Protection of the water supply will help keep the cost of water down and the supply up.

What Can Be Done?

Most of the problems of water quality and quantity can be managed provided the industries, farmers, and consumers are committed. Technology and knowledge are available. The question is, are we willing to make the changes and sacrifices needed to protect the water supply? Here are some suggestions.

Industry

Federal regulations enacted through the Water Pollution Control Act and the Clean Water Act have assisted industries in greatly reducing their pollution of the nation's waters. However, some violations continue. Industries can improve their record by conserving water, treating and reusing water in production, and reducing their use of toxic chemicals. These simple methods can go a long way toward improving the water system.

Agriculture

In recent years, federal policies and programs have encouraged farmers to implement **best management practices** to protect water quality. Cost-share programs have provided funding incentives to assist farmers in changing their management strategies and practices. In Kentucky, the Agriculture Water Quality Act requires all landowners with 10 or more acres involved in agriculture or forest production to implement a water quality plan. This plan includes best management practices designed to reduce the impact of agriculture on surface and groundwater resources. While progress is being made, there is still room for improvement, and farmers need to be aware of new and emerging practices that can protect water quality.

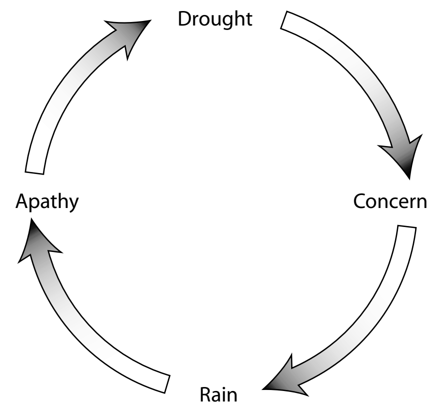
Municipalities

Many small water systems in cities and towns could benefit from increased maintenance of existing facilities, such as the treatment plant or the pipe distribution system. In many small systems, leakage through underground pipes can be 30 percent or more of the flow. Municipalities can also sponsor programs to clean up local streams and ponds. Finally, municipalities can work with local businesses to guard against threats from improper disposal of chemicals or from leaky storage tanks. New programs are assisting municipalities and water systems in protecting their water supply source, whether it is a surface water body or a groundwater well. Source water assessments aid water systems in identifying any pollution sources that may impact their supply. These systems are encouraged to take action to reduce or eliminate potential impacts. Programs like wellhead protection are proving effective in protecting water supplies.

Individuals

Although individuals are not the largest water users, they can make an impact on conserving water and improving its quality. Most households could easily conserve 20 percent or more of their use by reducing flow in toilets, using low-flow faucets and showerheads, and being judicious in watering lawns and washing cars. Individuals can also make an impact by safely and properly disposing household chemicals and automobile fluids and taking actions to prevent runoff pollution from their property.

Figure 5. Hydro *ILL*-Logical Cycle.



Most important is to foster a climate of understanding and concern. Too many people are part of the hydro-*ill*-logical cycle (see Figure 5). When problems arise over quality or quantity of water, there is great concern. Once problems diminish, however, apathy returns. The present *reactive* approach to water quality needs to shift toward a *proactive* stance. Until people are aware of water's importance on a continuous basis, present conditions will get worse. Kentucky cannot afford to squander this precious resource.

Water Quality Terms

Aquifer: an underground rock zone or layer of soil that contains usable amounts of groundwater.

Best Management Practice: recommended practice that lowers or limits the adverse impact an activity may have on the environment.

Cistern: a water collection system where rain water is captured (usually from a roof) and stored in a tank. Cisterns are often found in rural areas where public water or well water is not available.

Community Water System: any public water system that has year-round service.

Confined Aquifer: an aquifer that is overlain by a confining bed.

Confining Bed: a rock or soil layer that, because of its low permeability, restricts water's movement into or out of adjacent aquifers.

Discharge: any of several ways in which groundwater comes back to the surface, including springs, creeks, and wells.

Discharge Area: the zone where groundwater moves to the land surface; for example, streams.

Geology: types of sediment and rocks on and below the land's surface. The geology of an area influences the movement of groundwater.

Groundwater: any water found under the earth's surface. More than 95 percent of the fresh water supply and the source of drinking water for more than half of the U.S. population is found as groundwater.

Hardness: a measure of the minerals dissolved in water that affect its soap-neutralizing characteristics and the formation of scale on pipes and in boilers.

Hydrologic Cycle: the way in which the earth recycles water from the atmosphere down to and through the earth and back to the atmosphere.

Karst Area: an area whose geology is predominantly limestone, which leads to large cracks and fissures in the underground rock. The Mammoth Cave area in Kentucky is a karst area.

Leachate: any liquid that has leaked from a landfill or dump that contains dissolved substances from waste materials.

Noncommunity Water System: a public water system that does not provide service year round, such as a campground.

Nonpoint Source Pollution: a source of pollution that cannot be directly identified, such as pesticide runoff from farm fields.

Overwithdrawal: a situation where too much groundwater has been pumped from an aquifer.

Perched Water Table: a local source of water occurring above the main water table because water's downward percolation is limited by an impermeable layer of rock or soil.

Percolate: to filter or ooze through a porous material.

Permeable: allowing the passage of fluids. Porous materials that allow water to easily pass through are called permeable.

Plume: a slow moving contaminant in groundwater.

Point of Entry Treatment: treatment of water at the entry to a home or business.

Point of Use Treatment: treatment of water at the source of use, such as the kitchen tap.

Point Source Pollution: a source of pollution that can be identified directly, like a discharge pipe from a factory.

Porous: having open spaces, holes, or voids through which water can pass.

Primary Drinking Water Standards: standards for maximum limits of pollutants in drinking water that have been set by the Environmental Protection Agency. Public water systems must meet these standards.

Public Water System: water that comes from a public utility or municipality that serves a minimum of 25 people for at least 60 days a year. Public water systems are regulated and monitored for pollutants at the treatment plant.

Recharge: water that comes back into the groundwater system, such as rain soaking into the ground.

Recharge Area: surface areas that allow water to percolate into an aquifer.

Saturated Zone: the area below the water table that is filled with groundwater.

Secondary Drinking Water Standards: standards for contaminants in drinking water that cause problems in odor, taste, color, and corrosivity but do not pose health risks. Secondary standards are encouraged by the Environmental Protection Agency but are not enforced.

Septic Tank: a sewage treatment system using an underground tank for decomposing some of the waste and a drainfield through which liquid waste filters through the soil.

Spring: water that seeps out of the ground because the water table intersects the ground surface.

Surface Water: water found on the earth's surface, such as streams, rivers, ponds, lakes, and oceans.

Toxic Substances: chemicals that can make people or animals ill, even to the point of death.

Topography: the surface land's contour. Topography is one factor in the movement of groundwater.

Unsaturated Zone: the area between the ground surface and the water table in which the pores are not completely filled with water. This zone is also referred to as the zone of aeration.

Water Conservation: any methods that reduce the unnecessary waste of water, such as reducing consumption, reducing water flow, or recycling water.

Water Table: the plane where the unsaturated zone meets the saturated zone. The water table is represented by the level of water in unused wells.

Water Table Aquifer: an aquifer only partly filled with water. The upper surface of the saturated zone is free to rise and decline in water table aquifers in response to variations in the amount of recharge. Water table aquifers are also known as unconfined aquifers.

Well: a drilled or dug entry into the groundwater to discharge water. A well must reach past the water table to have a sufficient supply.

Zone of Aeration: the soil region above the water table that may be moist but only partially contains water.

More Reading

Kentucky Division of Water web site. <http://water.nr.state.ky.us/dow/dwhome.htm>.

* It's Your Water: Get to Know It and Protect It! U.S. Environmental Protection Agency (EPA). Washington, D.C. 1999. <http://www.epa.gov/safewater/consumer/itsyours.pdf>.

* Liquid Assets 2000: America's Water Resources at a Turning Point. U.S. EPA. Washington, D.C. 2000. <http://www.epa.gov/ow/liquidassets/>

* Water on Tap: A Guide to the Nation's Drinking Water. U.S. EPA. Washington, D.C. 1997. <http://www.epa.gov/safewater/wot/ontap.html>.

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We greatly appreciate the assistance of Concern, Inc. for Figure 5 and the Kentucky Geological Survey for their technical editing.

This material is based on work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under special project number 99-EWQI-1-0565.