A GUIDE TO

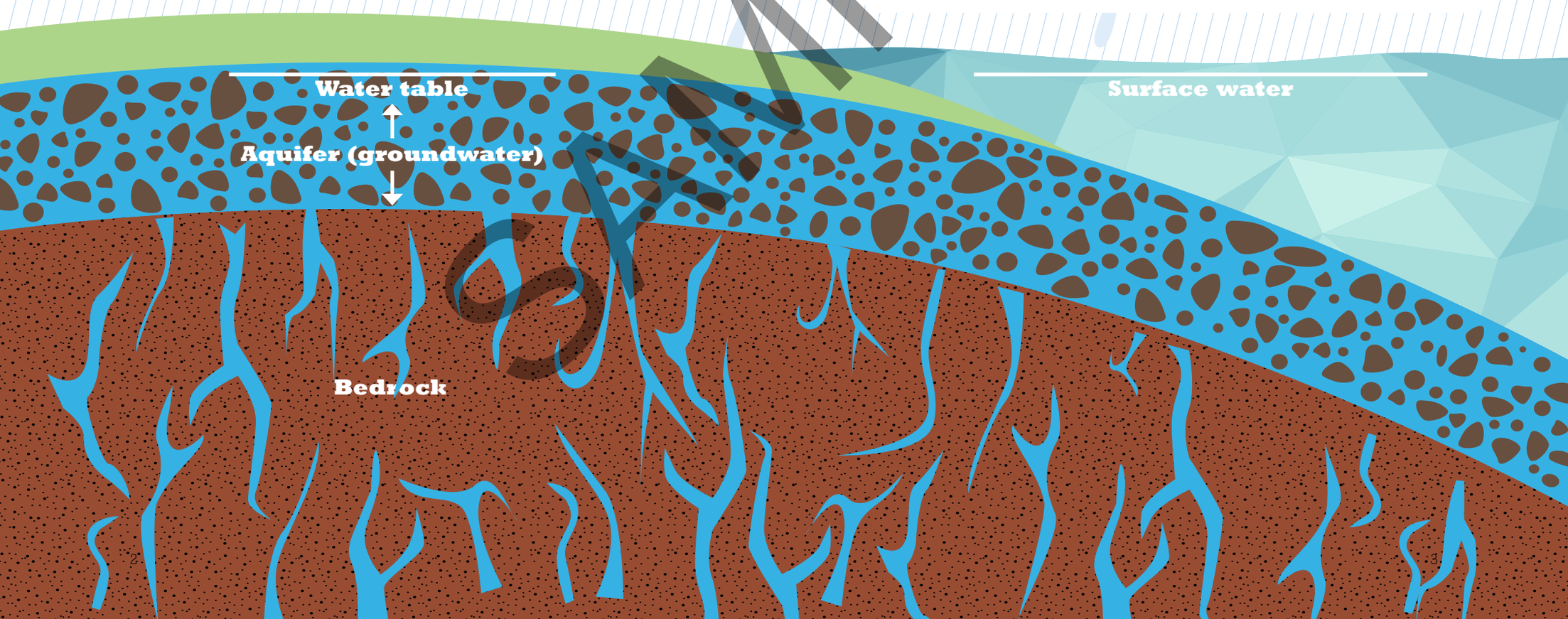
GROUND & STORM WATER

How to Protect Your Community's Natural Resources

Groundwater Basics

We rely on groundwater daily. We use it to fight fires, grow crops, and fill swimming pools. We also use it for drinking water and cleaning at home. In fact, more than half of all people living in the United States use groundwater for drinking. Groundwater is an integral part of our daily life, and each and every one of us can play a role in protecting it and keeping it clean.

Groundwater is the water stored beneath the Earth's surface in aquifers, permeable layers of silt, sand, gravel, or fractured rock that soak up water like a sponge. Runoff and leaching from lawns, roads, farms, and industrial sites can pollute the groundwater we use for so many important things. This book outlines what you can do to help protect this vital resource.



Groundwater Contamination & Quality

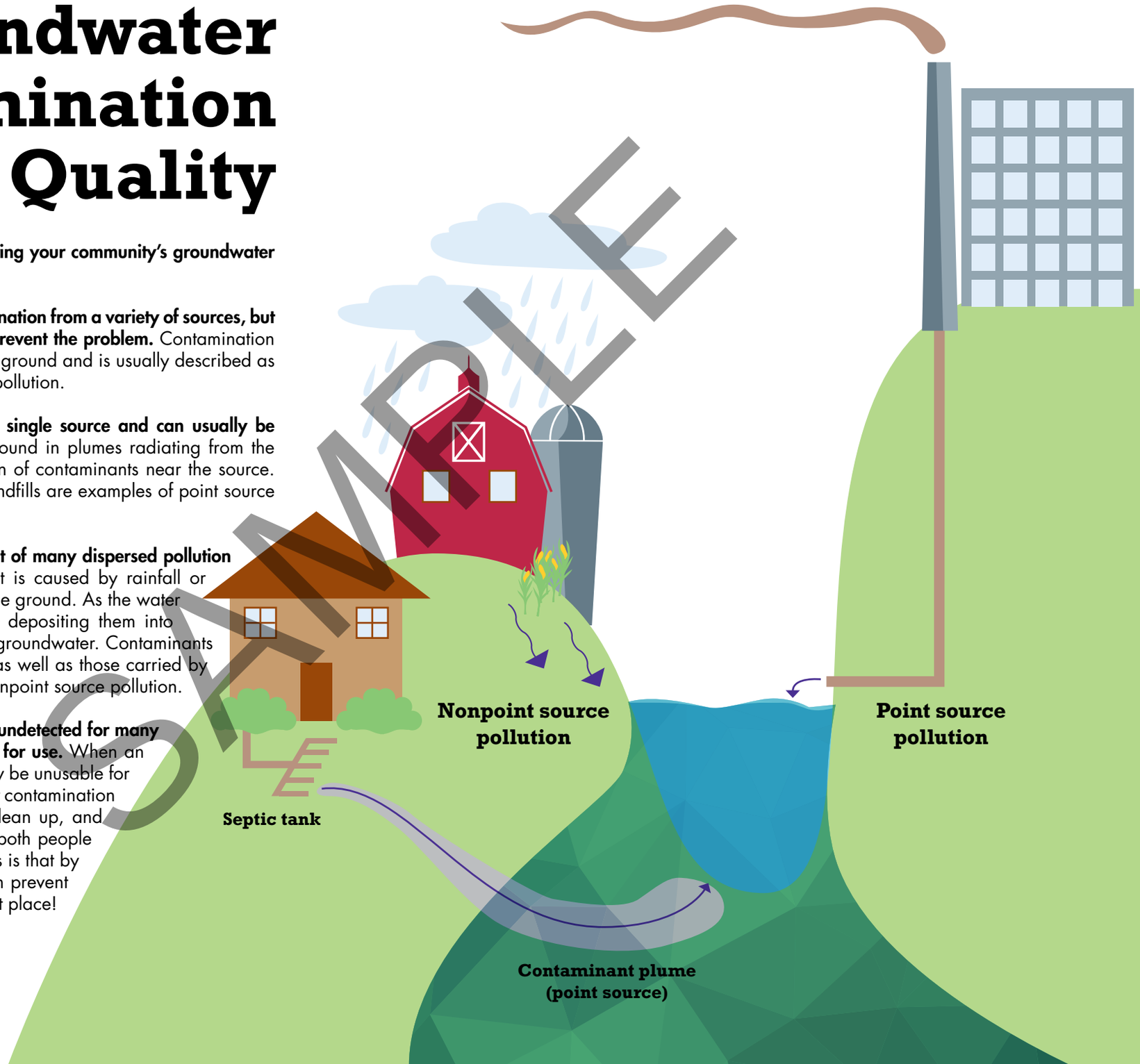
You can take an active role in protecting your community's groundwater supplies.

Groundwater is vulnerable to contamination from a variety of sources, but there are many ways you can help prevent the problem. Contamination can originate on the surface or in the ground and is usually described as "point source" or "nonpoint source" pollution.

Point source pollution comes from a single source and can usually be traced back to its origin. It is often found in plumes radiating from the source, with the highest concentration of contaminants near the source. Faulty septic systems and leaching landfills are examples of point source pollution.

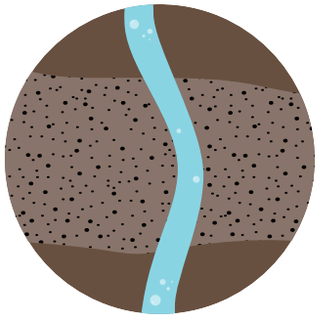
Nonpoint source pollution is the result of many dispersed pollution sources and may be called runoff. It is caused by rainfall or snowmelt moving over and through the ground. As the water moves, it picks up pollutants, finally depositing them into lakes, rivers, wetlands, oceans, and groundwater. Contaminants that originate from agricultural land as well as those carried by stormwater runoff are examples of nonpoint source pollution.

Groundwater contamination may go undetected for many years until the water supply is tested for use. When an aquifer becomes contaminated, it may be unusable for many years or decades. Groundwater contamination is often very difficult and costly to clean up, and may cause adverse health effects in both people and local ecosystems. The good news is that by reducing sources of pollution, we can prevent groundwater contamination in the first place!



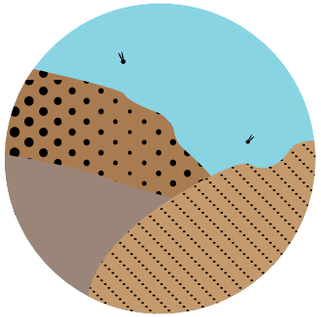
Sources of Groundwater Contamination

Contamination is most common in cities, agricultural areas, and industrial complexes. Groundwater contamination may come from a variety of sources.



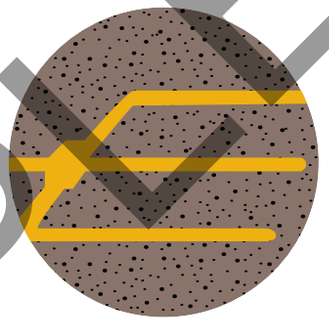
Natural Sources
Naturally occurring minerals, salts, and organic and inorganic compounds can degrade the quality of groundwater. These compounds may enter groundwater as the water moves through soil or sedimentary rock. When found in high concentrations exceeding safe drinking water standards, the aquifer may not be usable without treatment.

Improper Disposal of Waste and Hazardous Materials
Many substances and chemicals should not be disposed of through household systems. Motor and cooking oils, paint and paint thinners, medicines, and lawn and garden chemicals may lead to groundwater contamination when disposed of improperly. Check the label on household chemicals for instructions on how to properly dispose of them. Read the label thoroughly and follow the instructions to ensure safety.



Dumps and Landfills
Many older municipal and industrial landfills were not built with safeguards to prevent groundwater contamination. At these landfills, nitrates, organic compounds, and heavy metals may leach into the groundwater. Newer landfills are lined with a synthetic membrane over a layer of compacted clay, and must have a leachate collection and removal system to protect the groundwater.

Sewers and Stormwater Runoff
Stormwater runoff may contain a variety of pollutants, including fertilizers, animal waste, heavy metals, and volatile organic compounds (VOCs) that enter the groundwater though surface waters and infiltration. Stormwater runoff is especially harmful in cities with large areas of impervious surfaces.



Septic Systems
Improperly installed or maintained septic systems may cause groundwater contamination through the leakage of raw sewage into the ground. If you have a septic system on your property, use the tips on page 11 to maintain it properly and prevent groundwater contamination.

Overapplication of Fertilizers and Pesticides
Chemical fertilizers and manure containing nitrogen, phosphorus, and potassium are applied to plants and soils to support growth. Nitrogen and phosphorus cause the greatest concern for water quality. Improper application and management of these nutrients can lead to degradation in downstream water quality and groundwater contamination. Use the tips on pages 12–13 to properly care for your lawn and garden.

Road Salt
The use and storage of road salt for winter weather may cause water quality concerns for human health and aquatic ecosystems. Applying salt just before a storm hits is generally more efficient than applying salt after the snow has fallen.

Improper Storage of Hazardous Products
Storage tanks are often used at service stations and other industrial sites to store toxic chemicals or wastes containing hazardous compounds. Both aboveground and underground storage tanks may leak their contents into the environment due to tank and pipeline corrosion caused by age or exposure to weather. Improper storage of tanks and faulty installation may also lead to leaks and spills.

Animal Waste
Runoff from poorly managed animal facilities can carry various pathogens such as bacteria and viruses, and can transport other nutrients that have the potential to cause water quality problems. If not properly managed, the presence of livestock and animal waste on farms may contribute to nutrient and pathogen pollution of surrounding surface and groundwater. Farmers can limit nutrient loss and leaching by properly storing and managing livestock and animal waste.

Accidental Spills
Accidents happen and spills will never be completely avoidable. But with the right tools and a quick response, spills can be handled in a way that limits their impact on the environment.

Groundwater Protection: How You Can Help

The best way to protect the groundwater in your area is to properly manage or eliminate the sources of pollution. Here are some easy ways you can help!

Spread the word. Everyone wants access to clean drinking water. Educating your community about groundwater, water quality, and local contaminated sites can make a huge impact. Work with your local water authority to set up community outreach events or cleanup days.

Follow safe disposal and storage practices. Learn how to store and dispose of household products and chemicals properly.

- Safely store household chemicals and fuels. Carefully read and follow label instructions.
- Don't dump hazardous wastes on or in the ground. The wastes may contaminate the soil, leach down into the groundwater, or travel into storm drains.
- Don't pour hazardous wastes down the drain. Harmful chemicals, medicines, and certain oils poured or flushed down the drain can eventually contaminate local groundwater supplies.
- Don't leave storage tanks exposed to weather, and make sure they are sealed tightly.

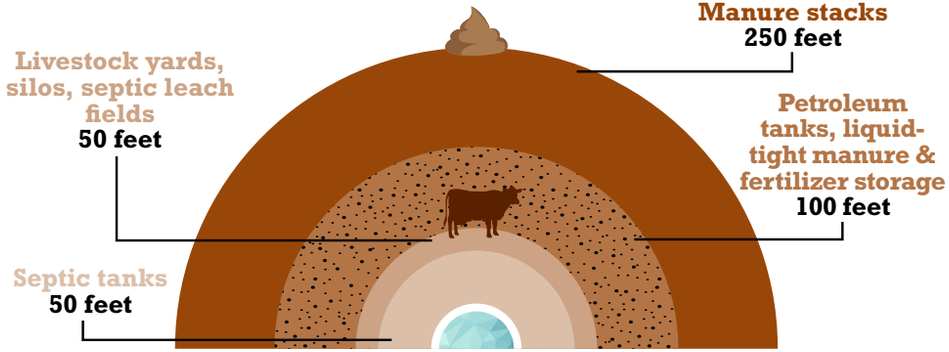
Keep up with maintenance. Maintain your household systems to prevent contamination.

- Have your septic system pumped and inspected regularly.
- Have your well checked and serviced by a qualified contractor, and occasionally test for water quality. See the well maintenance tips on page 10.

Use less. Reducing the amount of harmful chemicals in the environment lowers the chance of groundwater contamination.

- Practice water conservation every day, especially if your area is experiencing a drought.
- Buy and use only what you need. This will reduce the amount of waste that goes to the landfill and protect the water supply.
- Use pesticides and fertilizers in moderation. And try not to apply them right before a storm!
- Plant trees and shrubs around your home and decrease the area of impervious surfaces like blacktop to help reduce runoff and erosion.
- Use deicing salt sparingly and apply it before a storm hits.

Minimum Distance from Well to Avoid Contamination



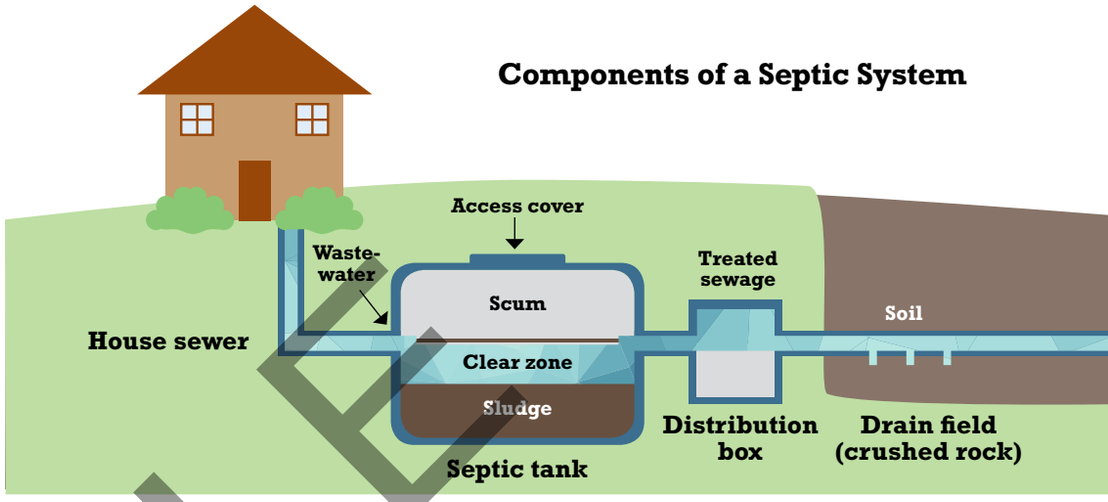
Groundwater Protection: Water Wells

Groundwater is extracted and brought to the surface by using well pumps. A modern well is simply a hole (usually drilled), lined with a metal or plastic pipe, used to access the groundwater within an aquifer.

Many homes have private wells to supply water for drinking and other household use. If you have a well on your property, it's important to take care of it. Try these tips to maintain your well:

- **Make sure your well is properly built.** Poorly constructed wells may lead to groundwater contamination. Well contractor licensing agencies, local health departments, or local water system professionals can provide information on well construction.
- **Keep a log.** Save all documents relating to your well's history, construction details, water-testing results, inspections, maintenance, and repairs.
- **Occasionally have your well checked and serviced by a qualified contractor.** Make sure the condition of the well covering, casing, and cap is thoroughly inspected. The top of the well should sit about one foot above the ground, and the ground around the well should be sloped away from the well for proper drainage.
- **Periodically have your well water tested for quality.** The most common tests are for nitrates and bacteria.
- **Do not use or store chemicals or other hazardous materials such as paint, fertilizers, pesticides, road salts, manure, and motor oil near your well.** Make sure to properly dispose of these items by taking them to a hazardous waste collection site or recycling center.
- **Be careful when working or mowing around your well.** The wellhead, the structure built over the well, may be damaged easily by heavy equipment. Do not pile snow or leaves around your well.

Components of a Septic System



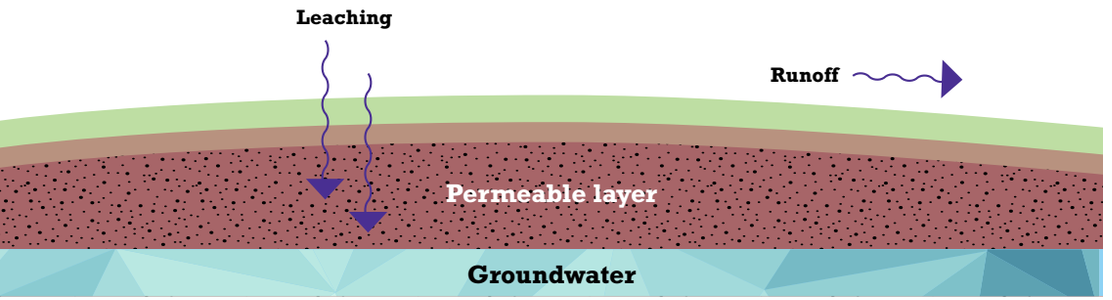
Groundwater Protection: Septic Systems

Septic systems are a safe and effective way to manage household waste, and about one-quarter of U.S. homes dispose of waste using septic systems. However, when improperly installed or maintained, septic systems may cause groundwater contamination through the leakage of raw sewage into the ground.

Keeping up with the maintenance of your septic system may prolong its life span and prevent groundwater contamination. Try these tips to maintain your septic system:

- **Do your research.** Make sure your septic system is designed by a licensed engineer and installed by a qualified contractor.
- **Locate your septic system away from wells.** System leach fields should drain away from wells.
- **Have your septic system inspected and pumped out regularly.** The frequency of pumping depends on your specific use, but an average tank is pumped every 1 to 3 years.
- **Minimize the material entering the system.** Avoid using a garbage disposal and keep nonbiodegradable materials out. Materials such as coffee grounds, cigarette butts, feminine hygiene products, and chemicals like paints, solvents, oil, pesticides, bleach, and drain cleaners may cause harm to your septic system and contaminate groundwater. Instead of using harsh chemicals to unclog drains, try boiling water or a plumbing snake.
- **Limit the amount of water entering the system.** Use water-saving fixtures and appliances, fix leaky faucets and toilets, take shorter showers and baths, and don't let faucets run while brushing your teeth or washing dishes.

Fertilizer & Groundwater



Groundwater Protection: Lawn & Garden Care

Overapplication of pesticides and fertilizers can cause groundwater contamination.

Pesticides

Pesticides are chemical substances used to kill pests such as weeds, insects, or plant diseases. When improperly applied, pesticides can be a concern for groundwater quality.

Proper pesticide application will help you save money and protect local water resources. Try these tips:

- **Follow label instructions.** Pesticide application instructions have been developed, tested extensively, and approved by the U.S. Environmental Protection Agency. The label will tell you how to use the product correctly, what safety measures you will need to take, and how to properly dispose of wastes.
- **Avoid sensitive areas.** Identify vulnerable areas such as sinkholes, wells, streams, ponds, or storm sewers, and avoid pesticide applications near these areas. Don't apply pesticides when a storm is on the way; rainwater can wash the chemicals into vulnerable areas.
- **More is not better.** Applying more pesticide than recommended will not lead to a healthier lawn or garden, and will not do a better job of controlling pests. Overapplication will only increase your cost and the chance of contaminating local groundwater supplies.

Fertilizers

Just like us, plants need nutrients to grow. Nutrients like nitrogen, potassium, calcium, zinc, magnesium, iron, and manganese are naturally found in soils. Sometimes fertilizers containing these nutrients are used to help promote plant growth, but they are not always used properly. Chemical fertilizers and manure containing nitrogen and phosphorus are the greatest concern for water quality.

Properly managing your land's nutrients will help you save money and protect local water resources. Try these tips:

- **Know what you have.** Test your soil. An inexpensive do-it-yourself kit will measure the amount of nitrogen, phosphorus, and potassium in your soil, as well as its acidity to determine its specific nutrient needs.
- **Know what and how much you are applying.** Understand the nutrient content of chemical fertilizers, manure, compost, or other materials you use. Apply only the recommended amount for the plant you want to grow. Applying too much, especially at the wrong time, can increase runoff and pollution.
- **Know how and when to apply.** It's best not to apply fertilizers or manure when the soil is saturated, frozen, or snow covered, or when a storm is on the way. Applying nutrients at the right time and place can maximize uptake by the plant and reduce loss to the environment. Try splitting the total amount of fertilizer into two or more applications during the growing season, rather than applying it all at once.

Groundwater Protection: Conservation

Not only is it important to protect groundwater from contamination, it's important to use the water wisely too. Groundwater is used at home for drinking, washing, bathing, food preparation, flushing toilets, and watering lawns and gardens. Saving water is always beneficial, and is especially important during drought conditions. Year-round water conservation allows aquifers to recharge.

Long-term trends in an area's climate, such as a drought, may impact groundwater storage. Years of below-normal precipitation or drought conditions can cause a decrease in available groundwater. During a drought, maintaining clean surface water and groundwater, and implementing water-saving practices at home, is essential.

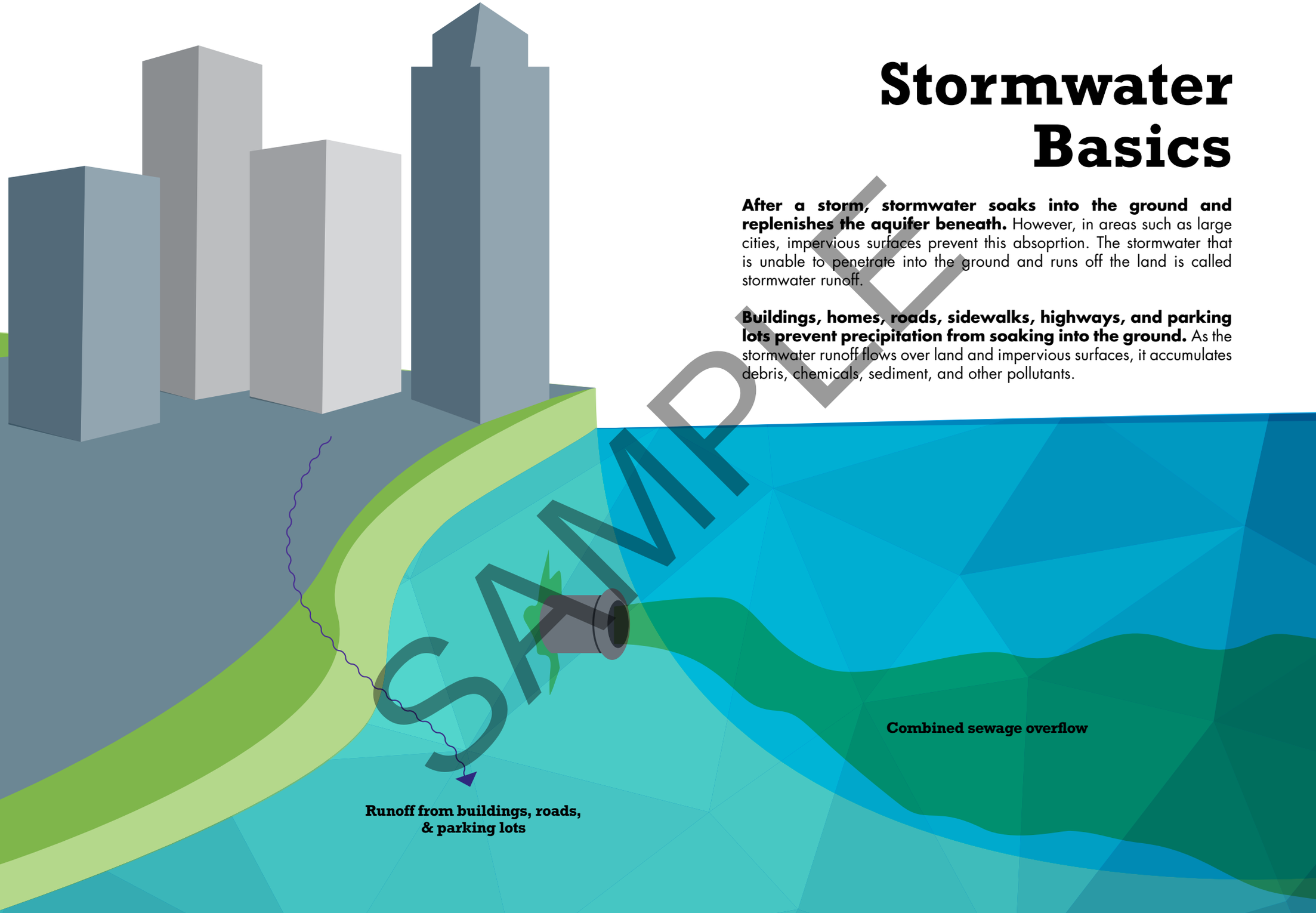
Regardless of whether or not your area is experiencing a drought, it's best to use water wisely all year round. Check your family's water usage on your next monthly bill and talk about setting conservation goals. Start by making small changes—no matter your situation, these small changes can really add up. Try these tips to save water at home:

- Check your toilets and sinks for leaks.
- Install low-flow showerheads and faucet aerators.
- Use water- and energy-effiecient appliances.

Stormwater Basics

After a storm, stormwater soaks into the ground and replenishes the aquifer beneath. However, in areas such as large cities, impervious surfaces prevent this absoprtion. The stormwater that is unable to penetrate into the ground and runs off the land is called stormwater runoff.

Buildings, homes, roads, sidewalks, highways, and parking lots prevent precipitation from soaking into the ground. As the stormwater runoff flows over land and impervious surfaces, it accumulates debris, chemicals, sediment, and other pollutants.

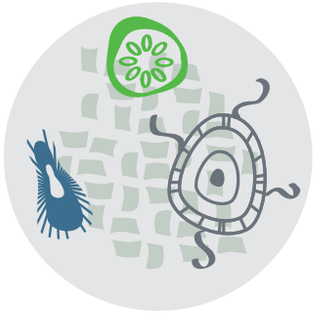


The Effects of Stormwater Runoff

Stormwater runoff can cause erosion, flooding, ecosystem degradation, and contamination of drinking water supplies.

Pollution

As stormwater runs over surfaces such as roads, lawns, and agricultural land, it may pick up pollutants like oils, pesticides, sediment, trash, and animal waste. These pollutants travel with the stormwater and may end up in the ocean, in nearby waterways such as streams, rivers, and lakes, or within aquifers.

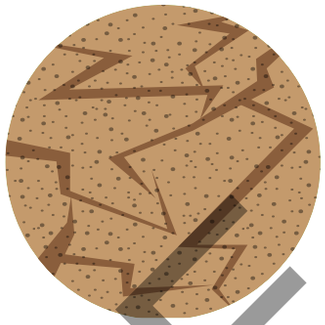


Human Health

Stormwater runoff may not only carry harmful pollutants but also bacteria and viruses from animal waste and raw sewage. Bacteria and other pathogens can wash into swimming areas or drinking water and create health hazards.

Ecosystems

Polluted stormwater runoff may have adverse effects on plants, fish, and animals living in aquatic ecosystems. Garbage such as plastic bags, six-pack rings, plastic bottles, and cigarette butts may wash into waterways and injure or kill fish, birds, and other small animals. Stormwater runoff carrying sediment can cloud the water, causing eutrophication (excess nutrients) and algal blooms, which depletes the water of oxygen and can cause large die-offs of aquatic life.



Erosion

The displacement of soil from one location to another by water or wind can cause property damage and may be harmful to local ecosystems and groundwater quality.

Flooding

Flooding often occurs in areas with impervious surfaces. Flooding may lead to property damage and groundwater contamination.

Stormwater Runoff: How You Can Help

Whether you live in the suburbs, on a farm, or in a big city, there are many ways you can help prevent contamination due to stormwater runoff.

Reduce erosion

- Add vegetative cover such as trees, shrubs, and grasses to slow stormwater runoff and increase infiltration. If you live in a city, request that more trees be planted on your block, and conserve your community gardens!
- Keep your soil healthy. Uncompacted healthy soils allow stormwater runoff to absorb more easily.
- Protect your soil from wind and water erosion by spreading mulch on the surface.
- Prevent overgrazing. Overgrazed pastures can lead to erosion and the deposition of sediment into nearby water bodies.

Reduce flooding

- Plant native trees and plants. Vegetate any bare spots in your yard.
- Promote infiltration. Reduce areas with impervious surfaces.

Reduce pollution

- Sweep up garbage from sidewalks, driveways, and parking lots, especially around storm drains. And always makes sure to dispose of your trash responsibly.
- Don't dump anything down a storm drain that you wouldn't drink.
- Direct downspouts away from impervious surfaces and consider installing a rain garden.
- Check your car for fluid leaks, and recycle motor oil.
- Be a responsible pet owner and pick up after your pet.
- Keep livestock away from stream banks, and keep their water source away from streams and rivers.
- Apply fertilizers and pesticides in moderation. To minimize pollution, always follow the label instructions. Never apply these chemicals before a storm.

REFERENCES

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epa.gov

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Water Resources
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