LEVELED BOOK • U

What Happens When You Flush?

Multi Level O•R•U

Written by Lisa Meltzer

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Focus Question

Where does sewage go, and how is it treated?

Words to Know

aeration
clarifier
digester
drainage field
effluent
methane
organisms
percolates
septic system
sewage
sewage treatment plant
sewerage systems

Page 3: This pond at a sewage treatment plant helps bacteria grow. The bacteria in turn break down the sewage.

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Data Source: Page 5 (chart): DeOreo, W. B., P. Mayer, B. Dziegelewski, and J. Kiefer. 2016. *Residential End Uses of Water, Version 2*. Project #4309A. Denver, Colo: Water Research Foundation. © 2016 Water Research Foundation. Reprinted with permission.

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Correlation

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Reading Recovery	40
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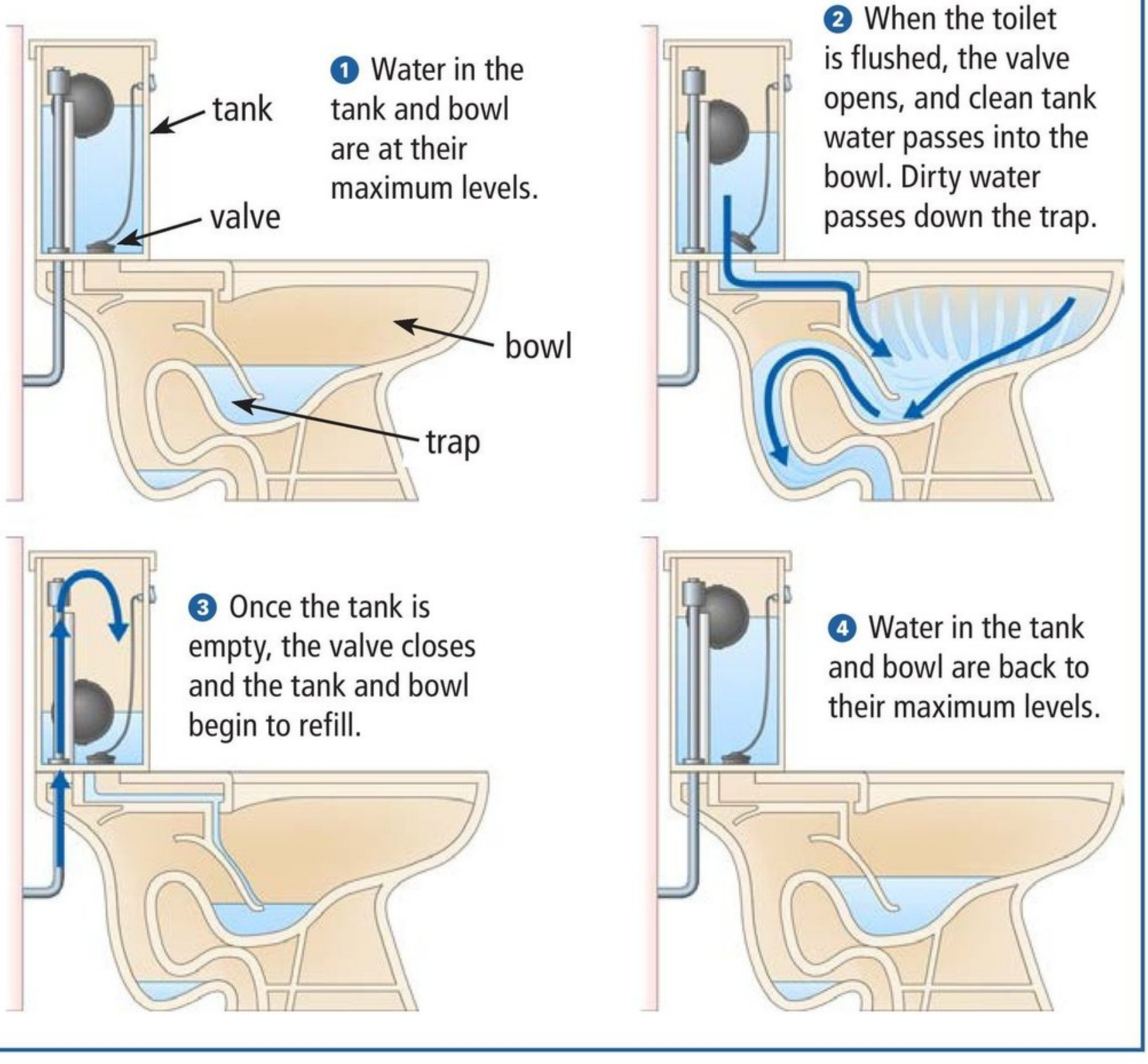
Table of Contents

Introduction

SWOOSH! You hear this sound every time you flush a toilet. Did you ever stop to wonder where everything that you flush down winds up?

Getting rid of waste involves more than just pushing the lever on a toilet. In fact, it often involves a highly complex process. That process can stretch over (or under) many miles in your community.

First, the Flush

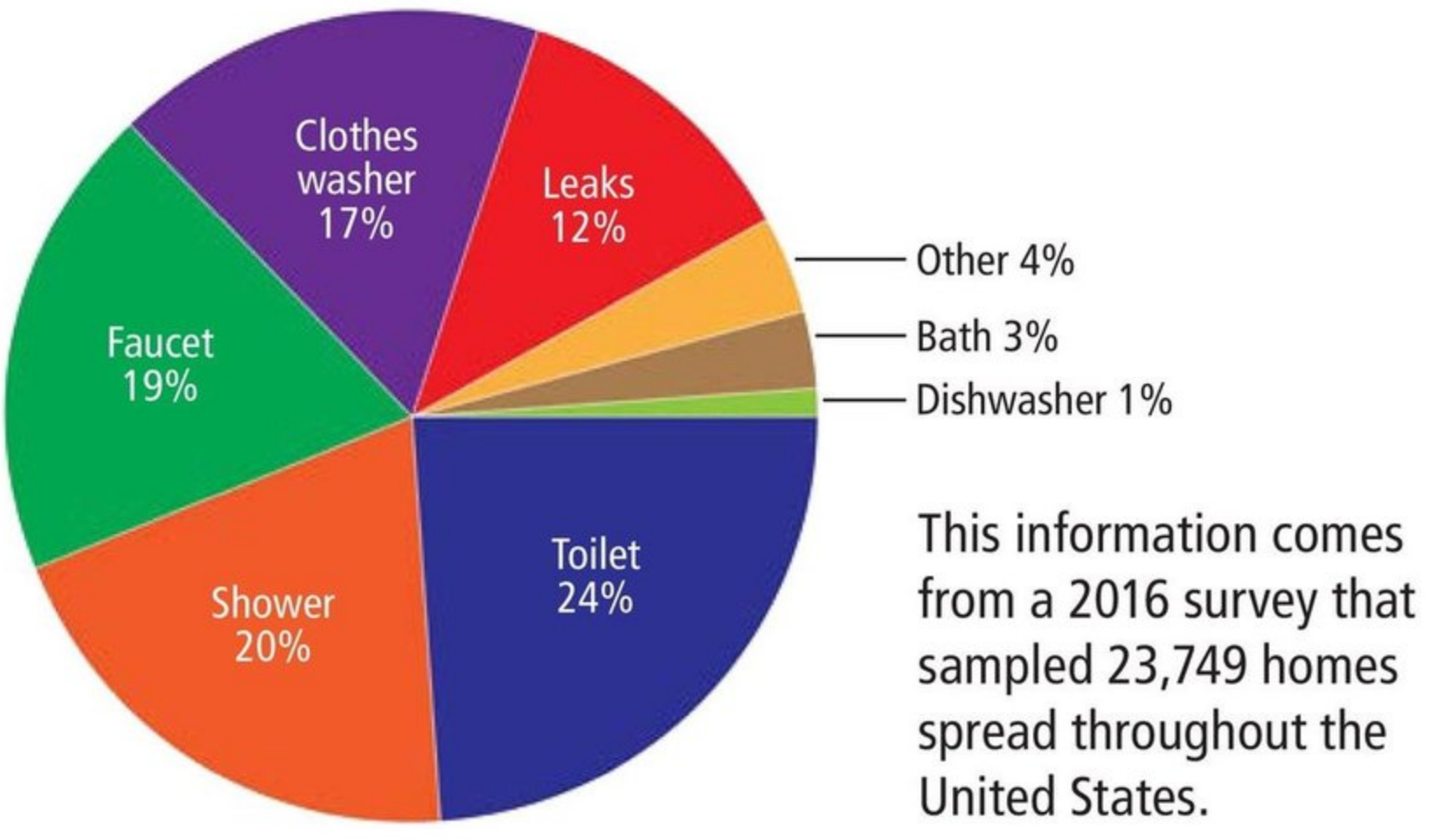


Where Does Waste Come From? Where Does It Go?

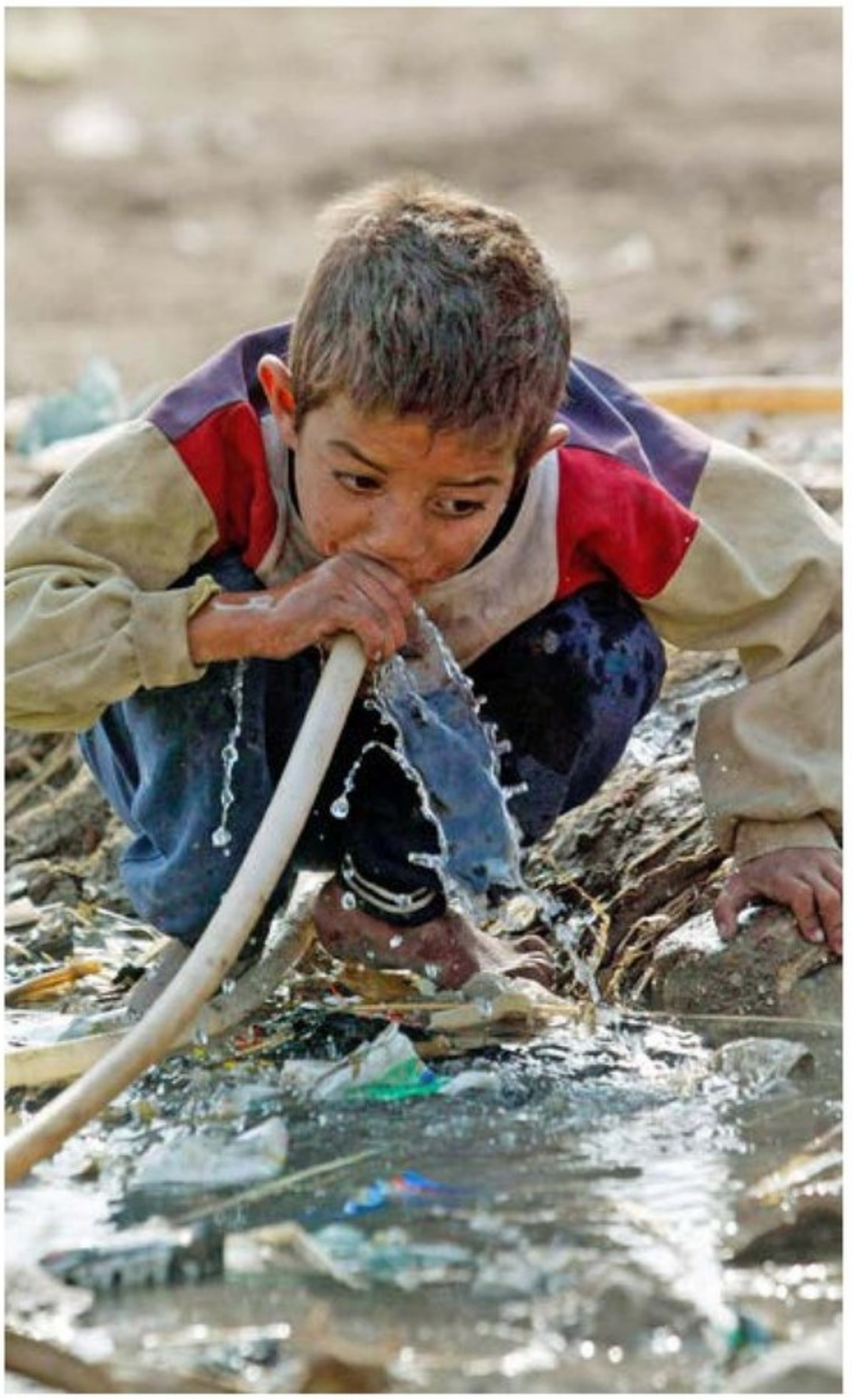
Human waste comes in many forms and from many different places. It is all referred to as **sewage**. In typical households, it is created by using the toilet, taking showers, doing the dishes, washing clothes, and by other activities that make water dirty. The average American turns about 100 gallons (380 L) of water into sewage each day.

Many factories use chemicals, some of them toxic, to make their products, and chemical waste becomes sewage, too. Restaurants create waste when they use chemicals to wash dishes or pour grease down the drain. This waste could eventually reach our rivers, reservoirs, and groundwater—the fresh water we rely on every day—making them unsafe to drink.

What Makes Up My Sewage?



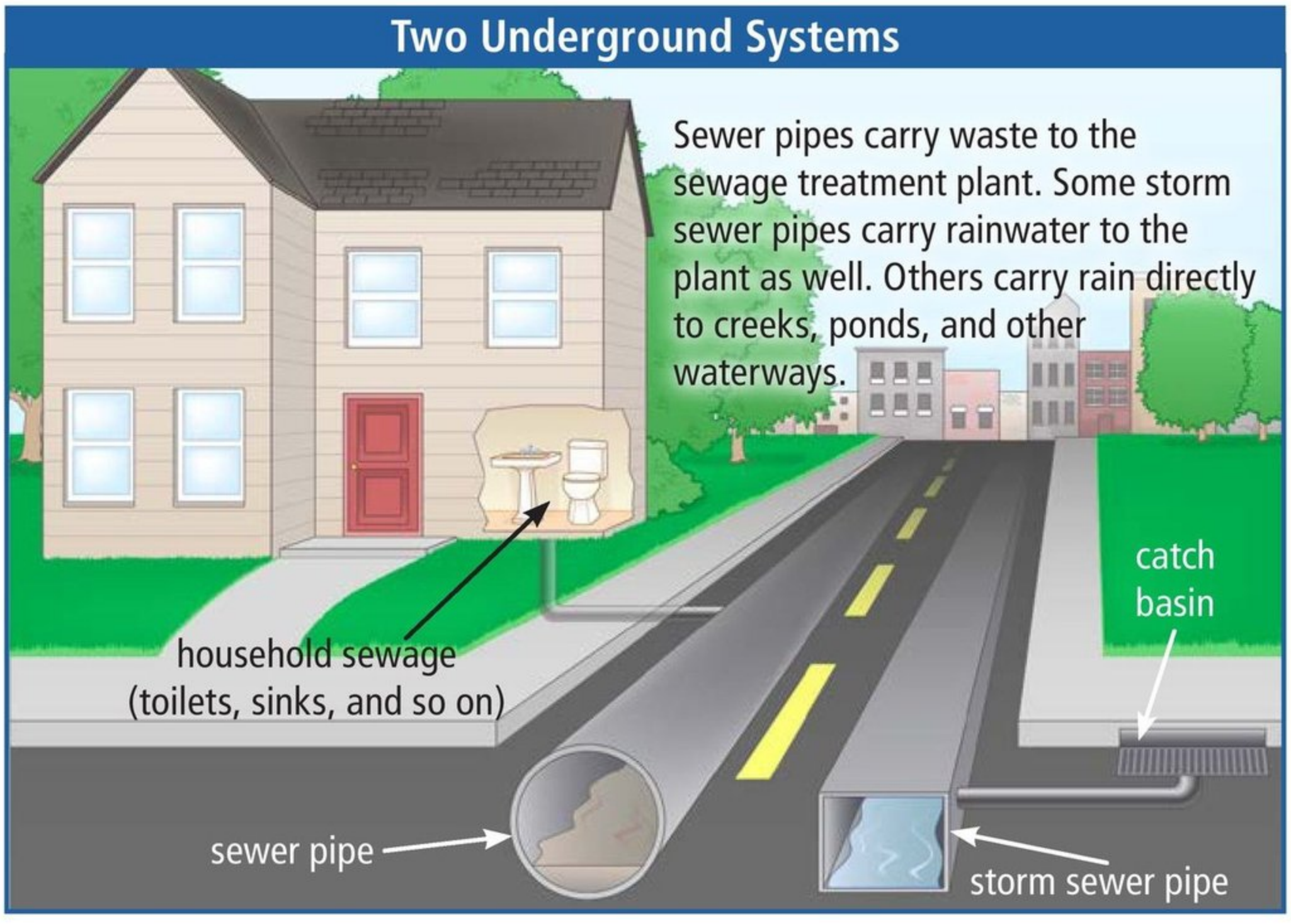
This information comes from a 2016 survey that sampled 23,749 homes spread throughout the United States.



A boy drinks from a water pipe crossing an uncovered sewage canal.

More than two billion people around the globe have no flush toilets or **sewerage systems**. Most of their waste either piles up on the land or runs into lakes and rivers. This creates dangerous environments full of terrible diseases. In fact, millions of people die each year from diseases that come from untreated sewage. Experts are working hard to solve this problem, but it is a huge task.

Fortunately, the sewer pipes in our homes, schools, and stores don't just empty into our sources of drinking water. Instead, in many cities and towns, all of this dirty water swirls down drains and ends up in the local sewerage system. Small sewer pipes join up to form bigger and bigger pipes. Some are so big that humans can walk through them!



Inside the Treatment Plant

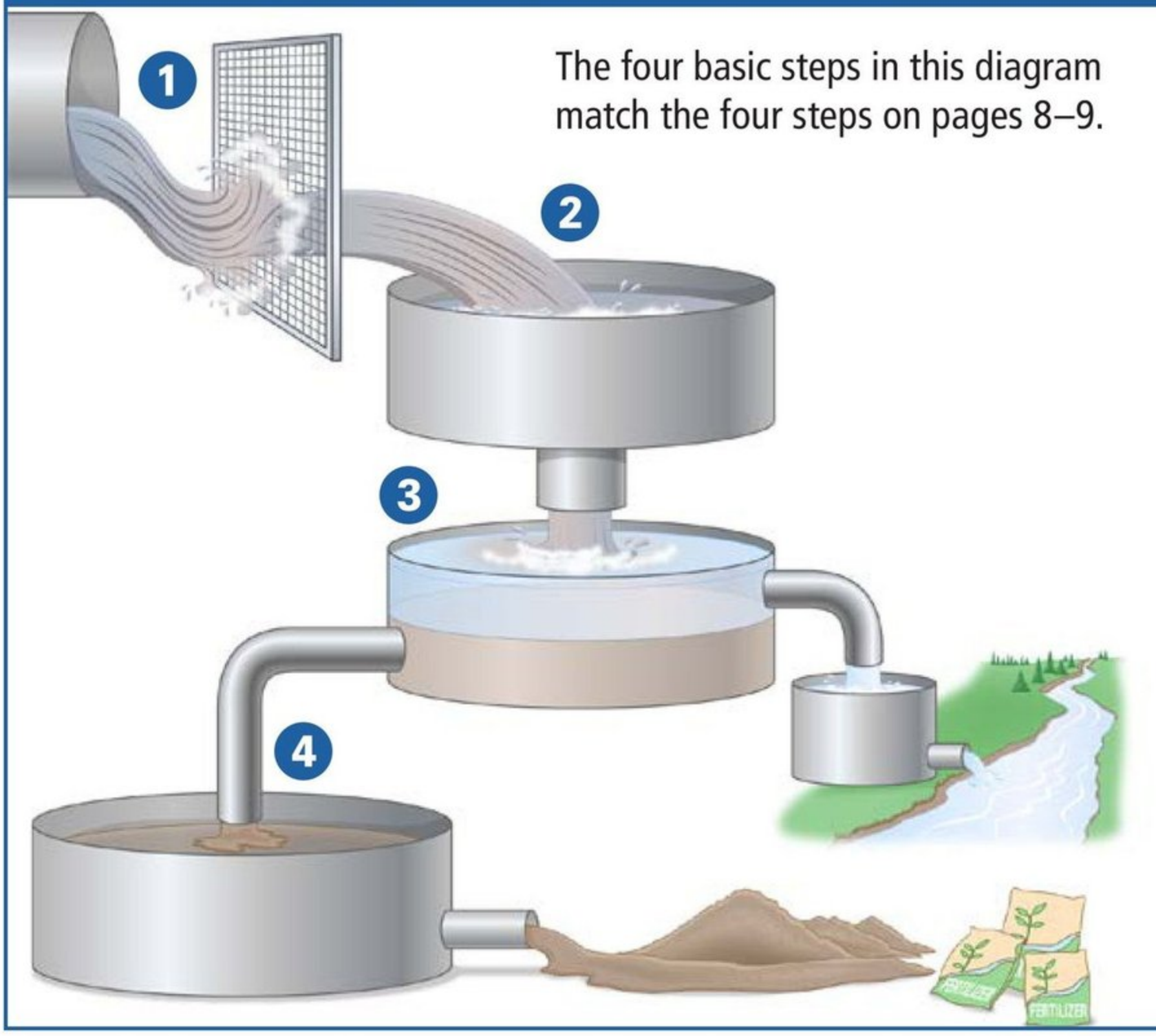
This large network of pipes carries all the wastewater to a **sewage treatment plant**. Here, the wastewater is cleaned for reuse. Once broken down, most of what makes up the sewage is safe for the environment—fertilizers, **methane**, and water. First, though, **organisms** that can cause disease and other pollutants in the wastewater need to be removed.

Not all sewage treatment systems are alike. The type of treatment depends on the location and number of people in the area. One common type of treatment plant, which is often found in areas with lots of people, cleans sewage in the following way:

STEP 1 A big screen (think of a giant kitchen strainer) removes large objects such as rocks, sticks, and garbage so that they don't jam the treatment plant's machines.

STEP 2 What is left over after the screening process is called *sludge*, which is thick, dirty water. The treatment plant pumps air into the sludge, which promotes the growth of helpful bacteria—a process called **aeration**. These bacteria eat the sludge and break it down.

The Water Treatment Process

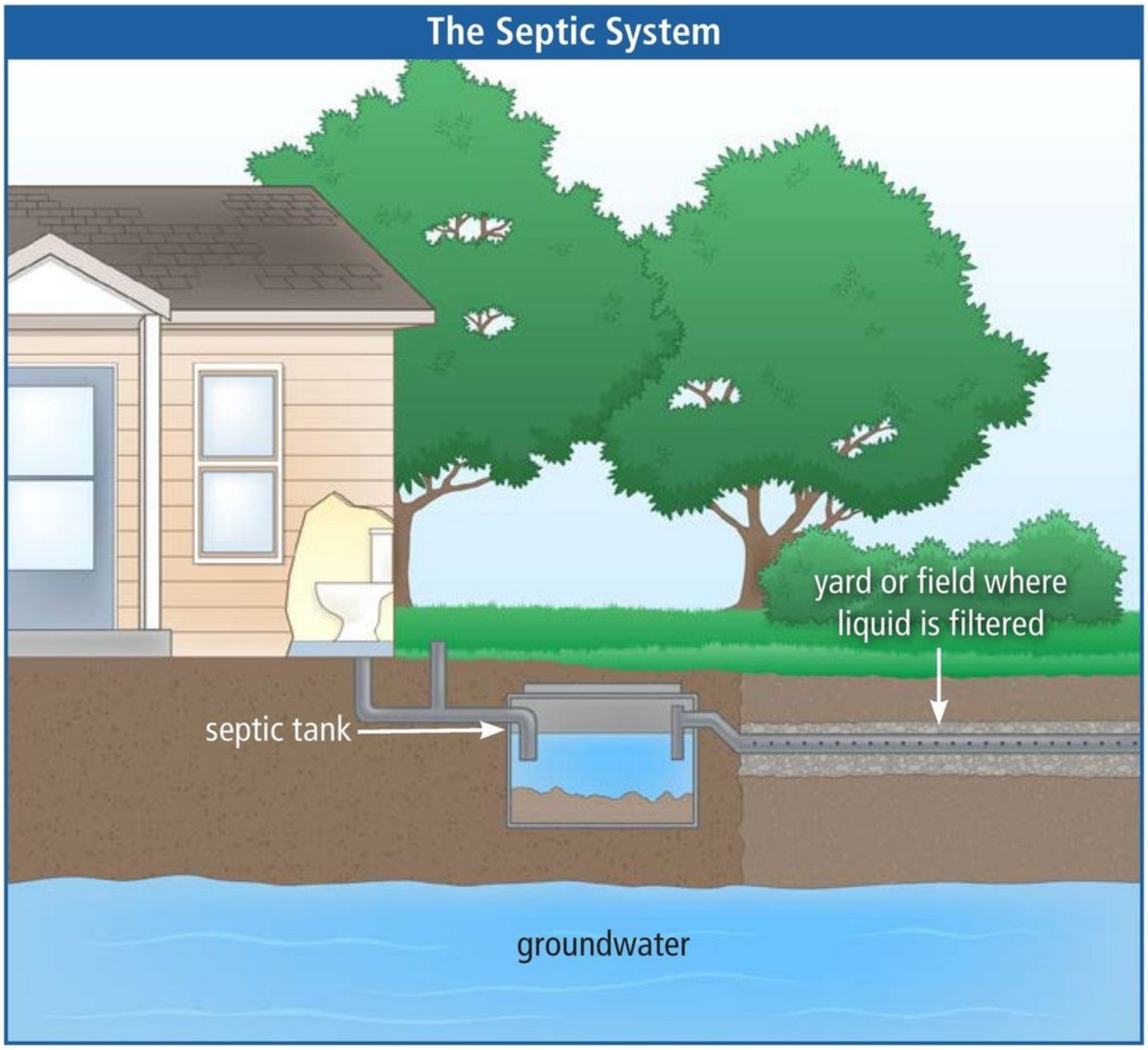


The tanks many city plants require are huge. San Francisco, California, has a water treatment plant that handles 60 million gallons (227 million L) a day and 250 million gallons (946 million L) on rainy days.

STEP 3 Once aeration is complete, the broken-down sludge is sent to a **clarifier**. In this machine, all of the solid waste settles to the bottom. The water at the top is sent to another filter that cleans it further. Once it's safe, this water can be sent to a local waterway—a stream, lake, or the sea—or used to water crops.

STEP 4 Meanwhile, the solids are sent to a giant, enclosed tank called a **digester**. Here, a second kind of helpful bacteria eats—and digests—much of the sludge. This process is called *anaerobic digestion* because the digestion takes place without oxygen.

The digester breaks down the solid sludge even further and pulls more water from it. It converts the sludge into carbon dioxide and methane gas. About half of the sludge is converted into these gases. The other half is dried and becomes a material similar to soil. The treatment plant uses methane gas as a source of energy that helps power its machines. The leftover sludge is often used on farm fields because it adds organic matter and fertilizer to poor soils. Other times, the sludge is sent to a landfill.



Septic systems send liquid to the soil, which filters it. Solids stay in the tank.

The Septic System—Another Way to Deal with Waste

Many homes in rural areas are far apart from each other. Building a sewerage system large enough to service homes so far away from one another would be expensive and impractical. Instead, these homes need another way to manage human waste. Each home sends waste to a **septic system**, which is a mini sewage-treatment system that serves only one home. It consists of a septic tank and a **drainage field**.

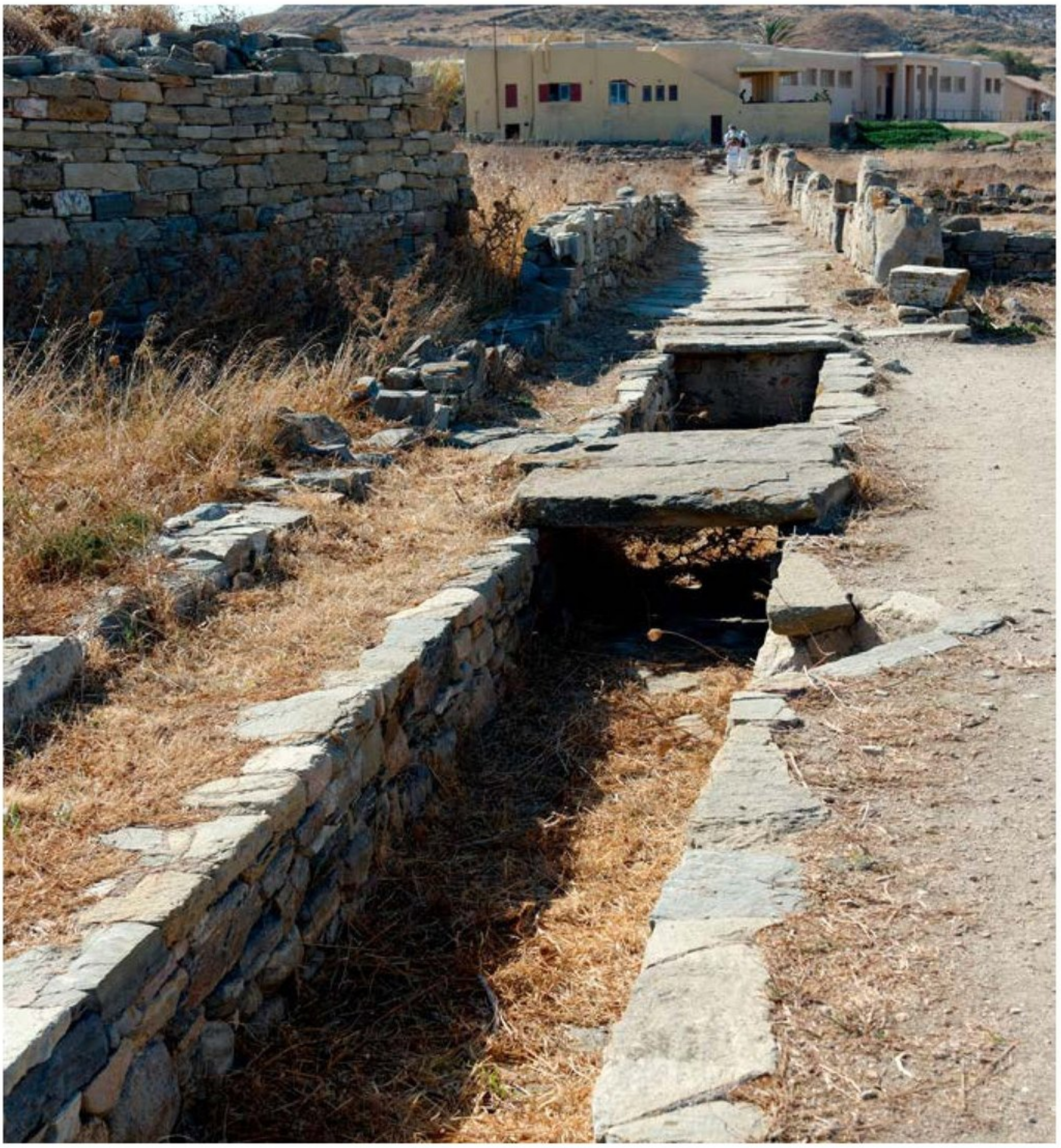
Both the septic tank and drainage field are located in the homeowner's yard. The concrete septic tank is buried underground. Any waste from the home runs straight into the tank. Inside the tank, the solids settle to the bottom and separate from the liquids. The liquids, called **effluent**, run out through a series of underground pipes into the drainage field and spread into the soil. The soil filters the effluent as it **percolates** through the ground, naturally removing harmful pollutants before they reach groundwater.

The septic tank collects all of the solid sludge, which builds up over time. When there is too much sludge in the tank, the homeowners must have a septic business pump out the tank.

Groundwater and Sewage: A Dangerous Combination

Groundwater is water that collects naturally underground. Much of it comes from surface water—such as rain and melted snow—that seeps down into the ground and settles in the spaces between soil particles. The water sinks until it hits a hard layer of rock that it cannot get through. When enough water collects underground, it can rise back up to the surface in the form of springs, streams, lakes, and wetlands.

Groundwater is a major source of our drinking water. Cracked underground sewer pipes can leak sewage into the soil and, in time, the groundwater. Sewage is full of very harmful microorganisms, which make people very sick and can even cause death.



An ancient sewer canal still remains in modern Greece.

Sewage Through the Ages

Think the modern sewerage systems are gross? Think again. The first sewerage systems were built thousands of years ago in places such as ancient Greece and Rome. These early systems were a simple series of pipes and canals. They sent human waste and storm water away from cities and directly into nearby waterways.

This was a great improvement on flinging buckets of waste out of windows and onto the streets (and sometimes people). However, it polluted the nearby water sources with harmful bacteria that carried deadly diseases. The water made people sick.

Over the centuries, sewage management improved little by little. Large cities, such as New York, still had a hard time managing waste, though, even in the 1800s. Because New York City was growing so fast, there were no sewage treatment plants. Sewage piled up all over the city. There were too many people and too much waste!

People's homes had a privy or outhouse, which was sometimes just a hole in the ground. Since there was no way to flush, human waste would pile up in the hole. When the privy was full, a night-soil man came to remove the backed-up waste. He came at night so people would not have to see him hauling buckets to the street and dumping them in his horse-drawn cart to be taken away. When the night-soil man's cart was full, he would usually dump it in the nearest river. Sometimes the shorelines became so thick with poop that they had to be dug out before ships could dock!

A night-soil crew moves waste in Rochdale, England, around 1870.

As if dumping poop into local rivers wasn't bad enough, some of the night-soil men got lazy. They dumped their carts into the streets. Some people would allow their privies to overflow and wash into the streets. There were no storm sewers back then for the waste to wash down, so it would pile up where people walked and children played. The stench was unbearable.

Do You Know?

Human waste wasn't New York City's only problem in the 1880s. It was common to see pigs, cows, and sheep roaming freely. These animals added huge amounts of manure to the streets, but horses were the city's biggest animal problem. Before the automobile, there were thousands of horses in the streets. A single horse produced about 24 pounds (11 kg) of manure each day!

Men work in the New York City sewer around 1911.

In the mid-1800s, experts began to realize that streets flowing with waste were also flowing with deadly diseases. New York began building sewer systems so the waste would have somewhere to go. By 1914, New York City had nearly 850 miles (1,368 km) of sewers. These laid the foundation for our modern sewage treatment systems.

Today in the United States, most people take the sewerage system for granted. Waste disappears down toilets and sinks as if by magic, but now you know how it really works. So, the next time you flush, take a moment to appreciate the wonders of the modern sewerage system!

Glossary

aeration *(n.)* the process of pumping oxygen into sewage to help break it down (p. 8)

clarifier *(n.)* a tank in which solid sewage settles to the bottom (p. 9)

digester *(n.)* a large tank in a sewage treatment plant where microorganisms break down solid waste (p. 9)

drainage field *(n.)* an open area of land where the liquid waste from a septic tank drains (p. 10)

effluent *(n.)* liquid waste (p. 11)

methane *(n.)* an invisible, odorless, flammable gas; also called "natural gas" (p. 7)

organisms *(n.)* living things (p. 7)

percolates *(v.)* trickles slowly through something with small holes or openings (p. 11)

septic system *(n.)* a system for treating and disposing of sewage that uses a septic tank and drainage field (p. 10)

sewage *(n.)* human waste that is carried away from buildings through a system of pipes (p. 5)

sewage treatment plant *(n.)* a place where sewage is cleaned and processed to make it safe for the environment (p. 7)

sewerage systems *(n.)* networks of drains, pipes, and pumps that collect water and sewage and carry it away (p. 6)

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A Reading A–Z Level U Leveled Book
Word Count: 1,310

Connections

Writing and Art

Draw a diagram of the route sewage takes after a toilet is flushed. Label your diagram and write a step-by-step explanation of the process.

Social Studies

Write a paragraph describing how modern sewerage systems have solved sewage problems of the past. Discuss your ideas with a partner.