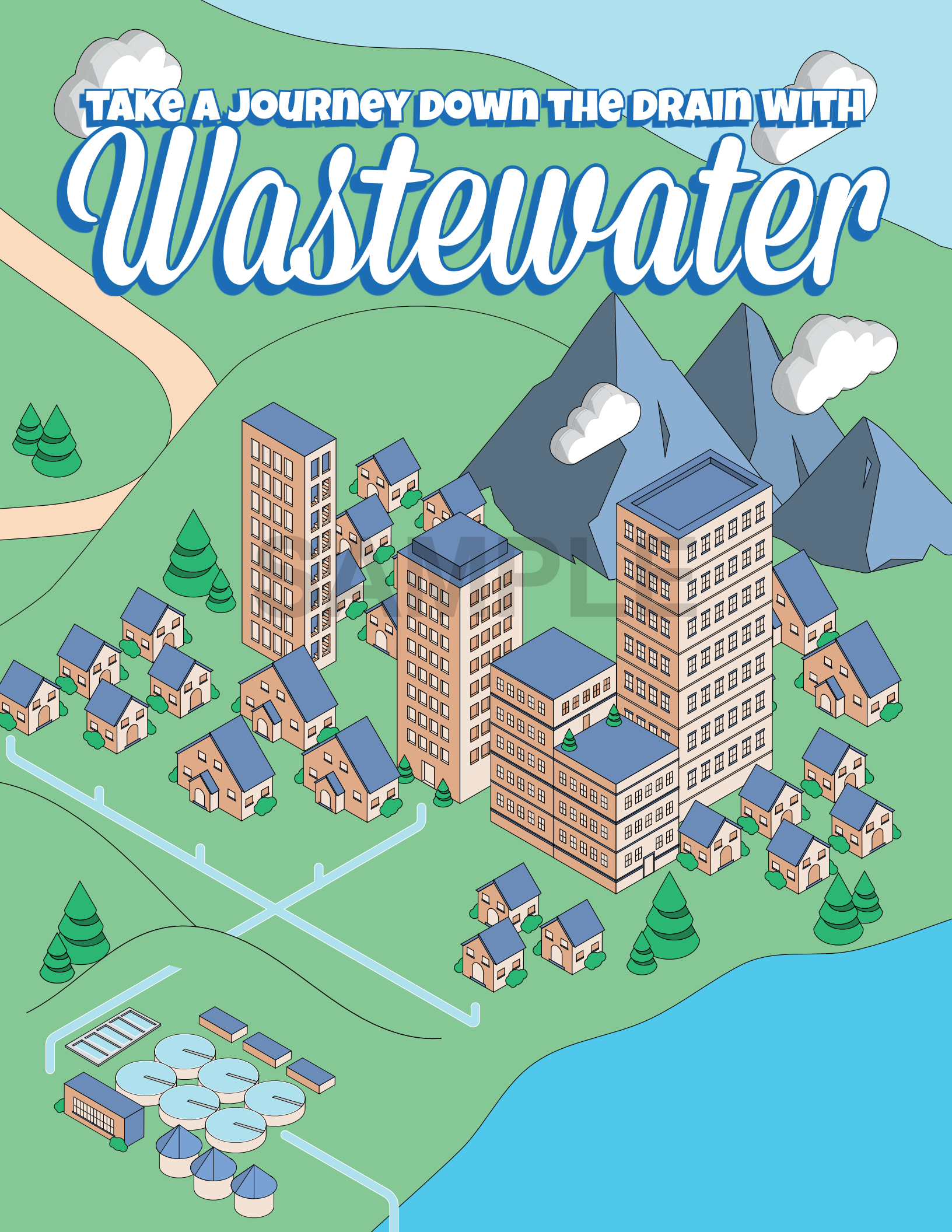

TAKE A JOURNEY DOWN THE DRAIN WITH
Wastewater
SAMPLE

WHAT IS WASTEWATER?

Clean water enters our home through one set of pipes. Every time we use the bathroom, bathe, wash our clothes, or cook our meals, the water we used becomes wastewater and exits our home through a different set of pipes. Before wastewater makes its way to our waterways, it needs to be cleaned.

The place where wastewater gets cleaned is called a wastewater treatment plant. It's a facility designed with specialized equipment and processes to remove waste from water so it can be released into our natural water system.

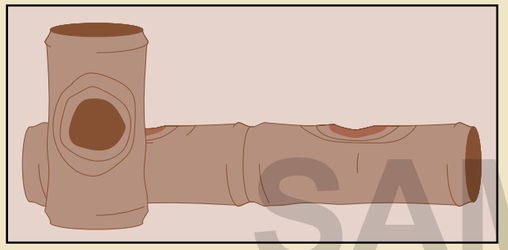
WHAT HAPPENS IF WE DON'T CLEAN WASTEWATER?

As you'll see on the next page, handling and treating wastewater has been a challenge for thousands of years. Untreated wastewater is a public health problem because it spreads diseases like dysentery and typhoid fever. It's a recreation issue because untreated wastewater can make our rivers and lakes unsafe to swim or fish in. And it's an olfactory (smelliness) concern because untreated wastewater can really stink. In fact, it was so bad in London in the 1800s that they called it the Great Stink! Our wastewater treatment workers protect our health, our rivers, and our nose!

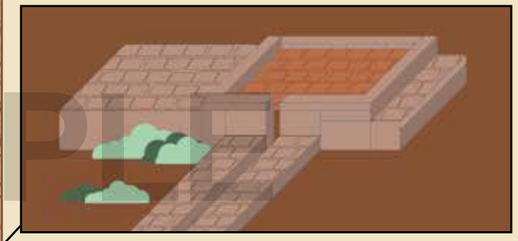
A HISTORY OF WASTEWATER

Humans have always had to deal with wastewater. To prevent disease and often the smell of wastewater, different societies came up with ingenious ways to remove wastewater from the places where people lived. More recent technological advances focused on cleaning wastewater so it no longer pollutes our waterways.

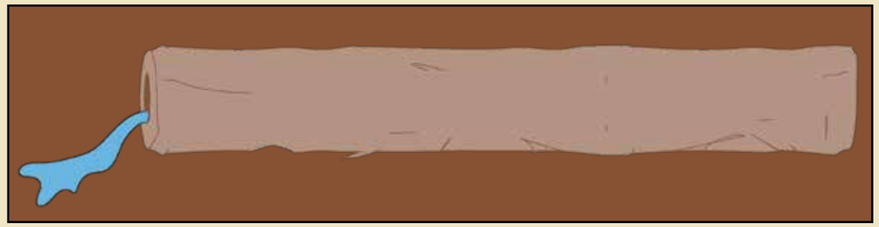
4000 BCE. Ancient Mesopotamia:
The people of ancient Mesopotamia built the world's first known sewer system. They used clay pipes to transport wastewater away from their homes and cities, improving hygiene and preventing diseases.



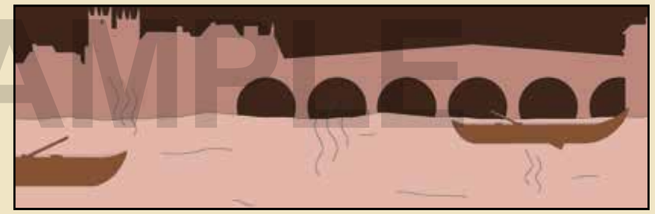
2500 BCE. The Indus Civilization:
People who lived in what are now India and Pakistan developed the first known example of wastewater treatment. They built special bathrooms with drains that carried away dirty water. The wastewater would go to collection areas, where the solids settled to the bottom and the liquids flowed on.



1700s. The United States:
The earliest sewer systems in the United States were built in cities and used hollowed-out logs to move water to the river.

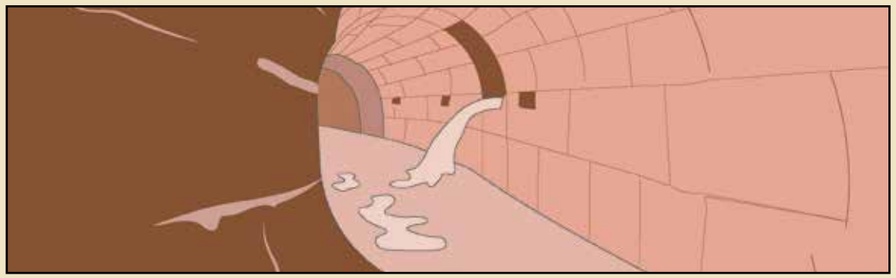


1858. London's Great Stink:
In the 19th century, London faced a major sanitation crisis. The River Thames became heavily polluted, causing a foul smell known as the "Great Stink." This event led to the construction of a modern sewer system, including the famous Thames Embankment, which greatly improved public health.



ANCIENT HISTORY — TODAY

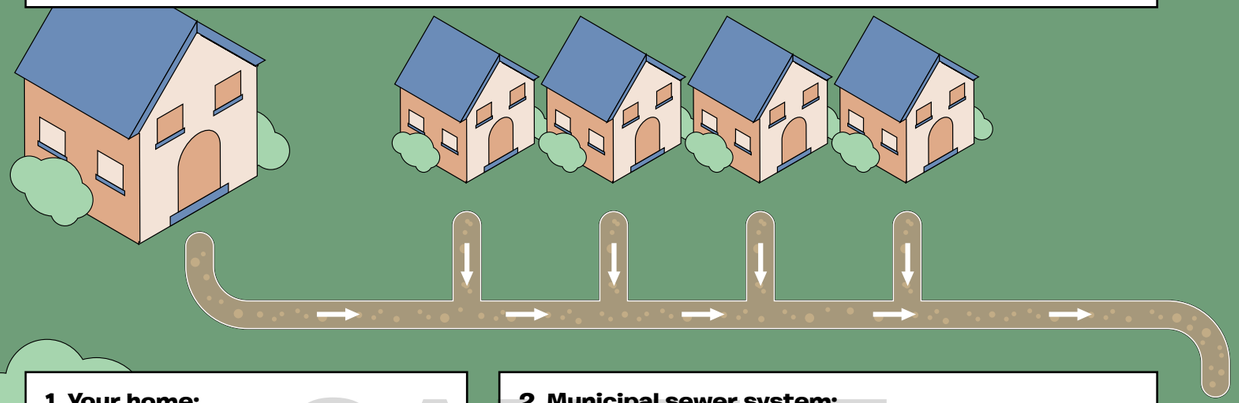
27 BC to 476 AD. Roman Empire:
In ancient Rome, engineers built incredible pipes for water and sewers, making sure to keep clean water separate from used water to keep everyone healthy. They were so resourceful that they even reused water from spas to flush their toilets! One of their most famous sewer systems was called the Cloaca Maxima, which used clever tricks to move used water far away from the city.



1860-1970. Laying the groundwork for modern wastewater treatment:
A combination of scientific progress and shifting viewpoints on pollution led to rapid scientific and technological development of wastewater treatment. Many of the modern approaches to wastewater treatment have their roots in this period.

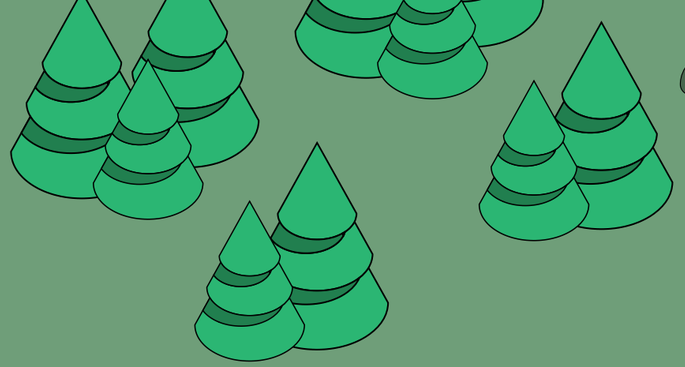
Take a Journey with Wastewater on the Gravity Superhighway

Wastewater needs to travel from your sink, shower, or toilet all the way to the wastewater treatment plant. That journey is powered by gravity (with occasional assistance from pumps to move the water to a place where gravity can take over again).

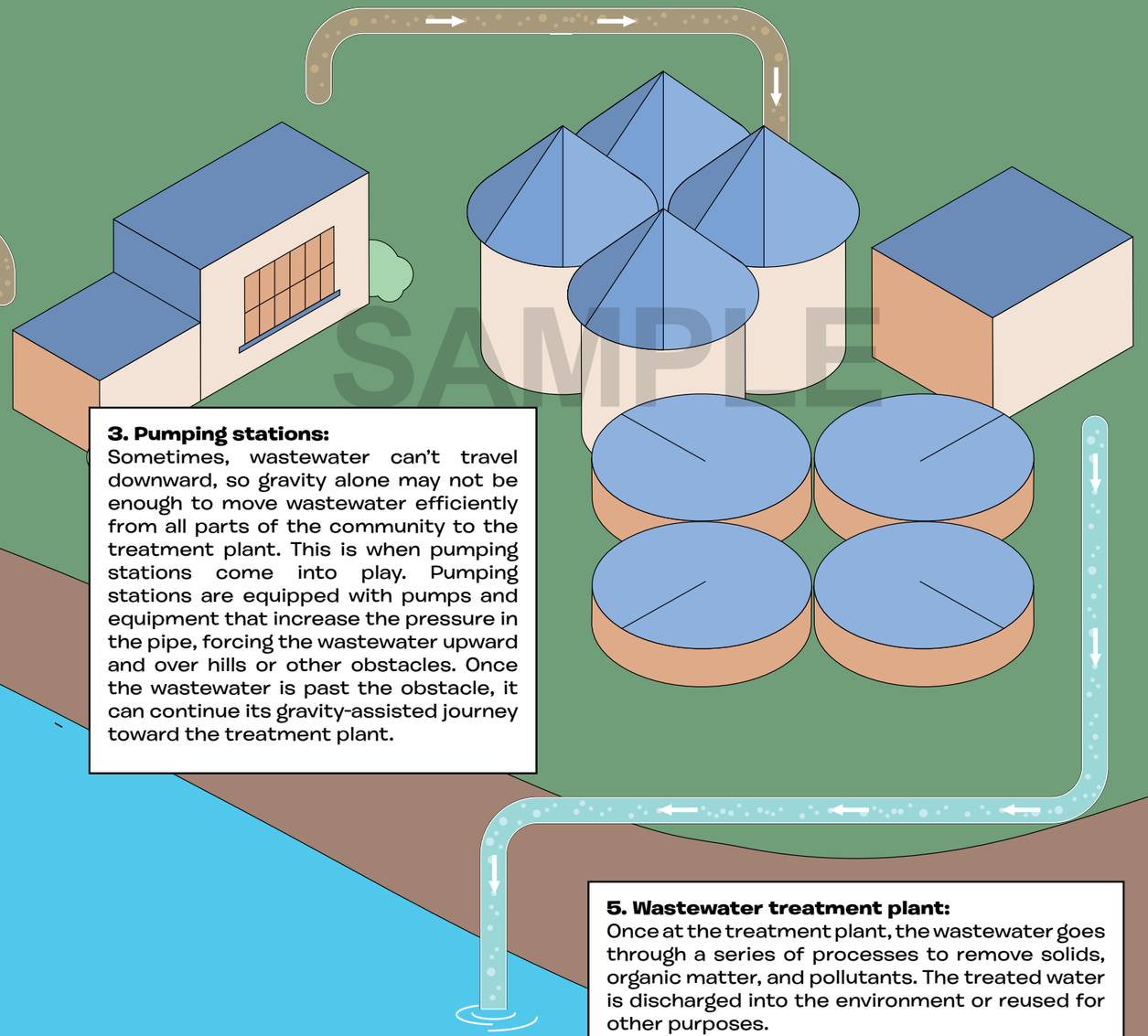


1. Your home:
The plumbing in a house is designed so water and waste flow down pipes due to gravity. When you flush a toilet or drain your sink, the water enters your home's wastewater line. The line is typically angled downward, away from the house, to let gravity do the work of moving the water.

2. Municipal sewer system:
Once wastewater leaves the house, it enters the municipal sewer system, which is a network of larger pipes. These are also angled downward for the same reason: to take advantage of gravity. Gravity carries the wastewater to the treatment plant. That's one of the reasons why most wastewater treatment plants are built in a low area. This system connects all the houses in a neighborhood or area to a main sewer line, which carries the waste to the wastewater treatment plant.

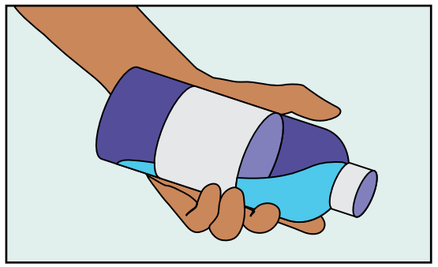


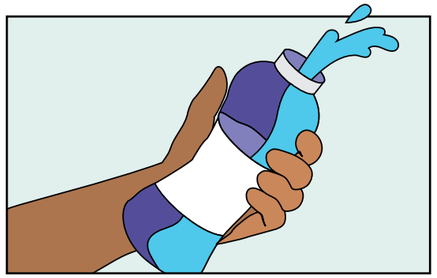
4. Force mains:
Force mains are sections of pipe where wastewater is moved under pressure (usually from pumping stations). They're typically used when the wastewater needs to be lifted to a higher elevation, or when it's more cost-effective to use a pressurized pipe than to follow the natural topography for gravity flow.



3. Pumping stations:
Sometimes, wastewater can't travel downward, so gravity alone may not be enough to move wastewater efficiently from all parts of the community to the treatment plant. This is when pumping stations come into play. Pumping stations are equipped with pumps and equipment that increase the pressure in the pipe, forcing the wastewater upward and over hills or other obstacles. Once the wastewater is past the obstacle, it can continue its gravity-assisted journey toward the treatment plant.

5. Wastewater treatment plant:
Once at the treatment plant, the wastewater goes through a series of processes to remove solids, organic matter, and pollutants. The treated water is discharged into the environment or reused for other purposes.





How Does It Work?

Imagine you have a water bottle.

When you tilt it, gravity causes all the water to rush to the lower end. Wastewater pipes work the same way: they're tilted downward to send the wastewater to the treatment plant.

But what happens when the pipes need to go over a hill or other incline? That's when pumps use water pressure to send the water over the obstacle.

Now imagine your bottle is upright. If you squeeze it, pressure will push the water up to the top. The wastewater system uses pumps in the same way to move wastewater efficiently to the wastewater treatment plant.

OUR WASTEWATER TREATMENT PLANT

Welcome to a wastewater treatment plant. The workers at the plant clean our water after we use it. Every time water goes down the drain or toilet, it travels through a series of pipes to the wastewater treatment facility. Check out this diagram, and learn how our wastewater is cleaned.

Wastewater from all over town begins its journey here.

GRIT FILTER
This is where big, solid materials, such as sticks and rocks, are removed. Garbage trucks take these solid materials to landfills.

CLARIFIER

CLARIFIER
The water flows into tanks to let it settle. During this step, solids fall to the bottom and grease rises to the top. The grease gets skimmed off, and then trucks take it to landfills. The solid waste is called sludge. It goes into another series of tanks for storage and treatment.

AERATION BASIN

AERATION BASIN
This step brings the wastewater in close contact with air, which helps microbes bind nutrients to solids, making them easier to remove.

FINAL CLARIFIER

FINAL CLARIFIER
Sludge settles and is removed, while clear water is moved to filters or ultraviolet disinfection.

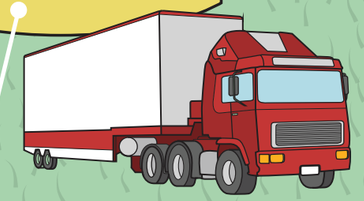
SLUDGE DIGESTER

SLUDGE DIGESTER
Sludge breaks down naturally over time. The job of this step is to speed up that process. It reduces the size and smell of the sludge and stabilizes it for the next step in its journey.

DEWATERING

DEWATERING
Dewatering removes the remaining liquid from the sludge, making it easier and less costly to store, transfer, or dispose of.

SOLIDS HOLDING TANK



SOLIDS HOLDING TANK
After all the water has been removed and the sludge has been treated, the final product is called sludge cake. It's stored in the solids holding tank until trucks take it to landfills. Sometimes farmers use sludge cake as fertilizer.

ULTRAVIOLET (UV) DISINFECTION

ULTRAVIOLET (UV) DISINFECTION
UV light inactivates disease-causing microorganisms. To do so the light cannot be blocked by solids in the water, which is why this step happens later in the wastewater process.

LOCAL WATERWAY
At the end of the process, the clean water can go back into lakes, rivers, and oceans.

DID YOU KNOW?

Using a lot of water can overwhelm a wastewater treatment plant, especially on a rainy day. So saving water can actually help our wastewater professionals do their jobs more efficiently.

What You Can Do to Protect Our Wastewater System

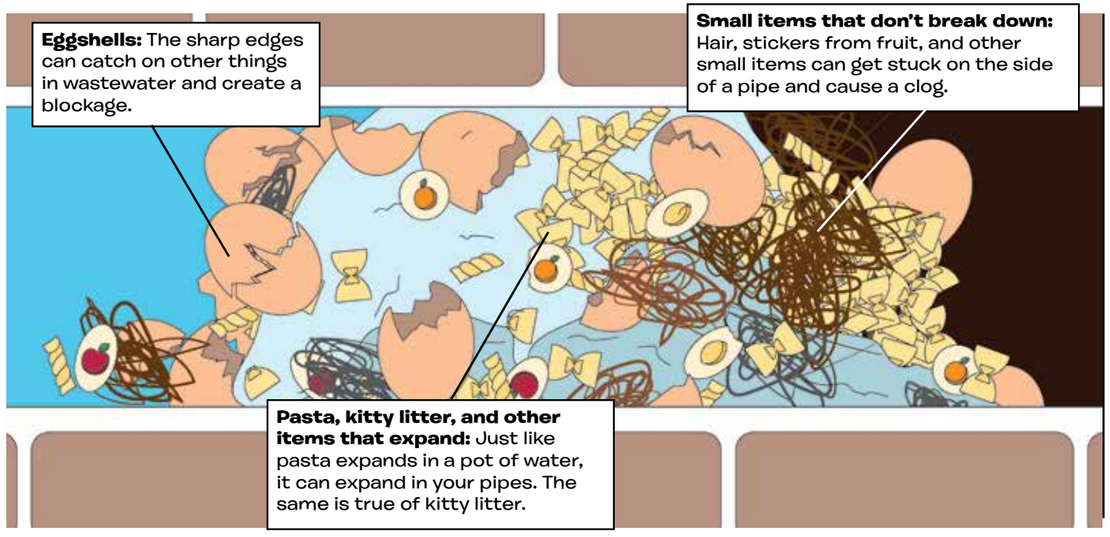
Now that you know how important our wastewater system is, you play an important role in protecting it and our waterways, not to mention the pipes in your own home. Because what enters our wastewater system is up to you. You run the sink and flush the toilet. You control what goes down the drain. And not everything should go down the drain.

Toilets

The three P's: pee, poop, and (toilet) paper
That's it. Really, that's it. Don't flush anything else down the toilet. Our wastewater system is designed to handle only those items. Toilet paper breaks down. But what about flushable wipes? They say "flushable," don't they? But they don't break down the same way and can get caught on other items, leading to sewer backups. The same is true of Q-tips, dental floss, diapers, and anything else that gets used in the bathroom. Stick to the three P's.

Don't Clog the Pipes!

Inside the pipe, you're mixing lots of different things. They can get caught on each other and create a blockage. Certain things are particularly problematic if they go down the drain.



Preventing blockages is easy. Just make sure you use a screen over the drain in your sinks and showers. The screens will collect the hair, stickers, and food remnants so you can safely throw them away.

Chemicals, Medicines, and Hazardous Materials

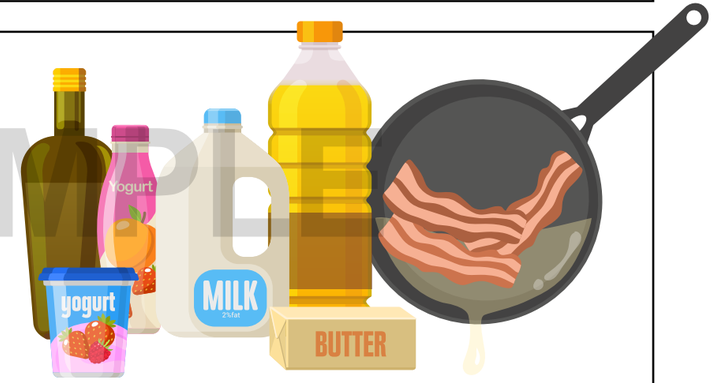
Our wastewater systems are designed to break down biological waste. But chemicals and medicines can cause damage or get through our systems and into our waterways.

Medicine: Always dispose of medicine safely. Never flush it or pour it down the drain.

Chemicals and hazardous materials: Dispose of chemicals and hazardous materials safely and in accordance with your solid waste department's guidelines. They don't go down the drain.

Paint: Paint can't go down the drain either.

FOGS



What are FOGS?
FOGs is a short way of saying fats, oils, and grease. FOGs come from things like meats, cooking oils, butter, salad dressings, and other yummy foods that are high in fat. When FOGs go down our kitchen sinks, they can stick to the insides of pipes and cause them to clog. FOGs can also make it harder for the wastewater treatment process to work properly. It costs a lot of money every year for cities to clean up the buildup of fats, oils, and grease.

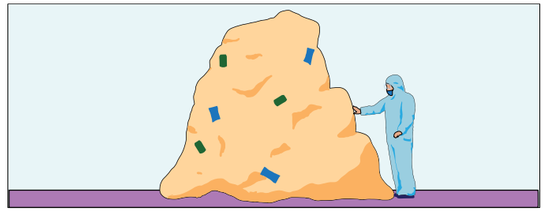
Dispose of FOGS by pouring any leftover liquid grease into an aluminum can. When the grease cools, it will harden and become a solid. Then, just throw it away in the trash, and all our pipes stay clean!

Fatbergs!
You've probably heard of those big, floating chunks of frozen water in the ocean called icebergs, but have you ever heard of fatbergs?

Fatbergs are made up of things like oils, greases, and a bunch of stuff that shouldn't be flushed down the toilet, like baby wipes. They keep collecting and growing until they block the whole sewer system. Removing a fatberg is no small task. A team of special workers wearing gas masks and protective suits use super-strong hoses with lots of power to break up the fatberg. Then, they use a hose that acts like a vacuum cleaner to suck up all the pieces.

The World's Biggest Fatberg

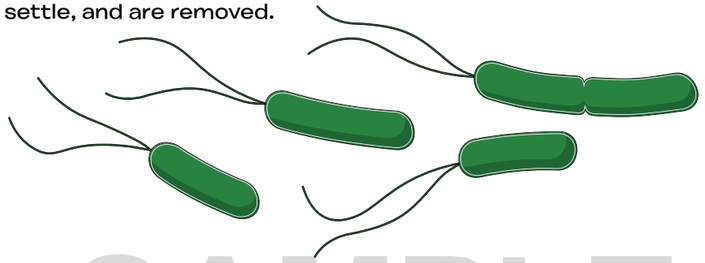
The king of fatbergs was discovered in London, England, in 2017. It was so massive that it became famous around the world and was given the nickname Fatty McFatberg. Pieces of it are on display in the Museum of London.



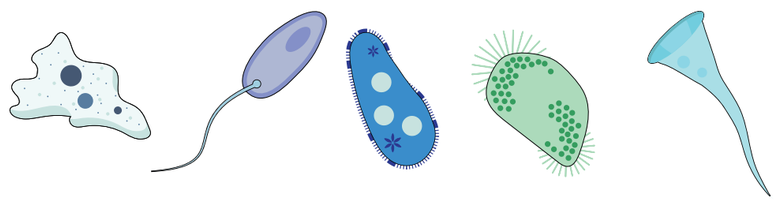
MICROSCOPIC WORKERS

To remove the rest of the waste in wastewater, wastewater treatment plants turn to microscopic organisms that swim, crawl, and float through the wastewater eating tiny bits of organic matter. About 95% of the organisms are bacteria, 4% are protozoa, and 1% are metazoa. The three types each play a role in the process of cleaning our water.

Bacteria make up the vast majority of the microbial population in wastewater. They are one-celled microorganisms that do most of the work. They eat the biodegradable material in the wastewater. While they have food to eat, they multiply rapidly. As the water gets cleaner, they stop swimming to conserve energy and start sticking together as they bump into each other. Eventually they form a thin slime layer, settle, and are removed.

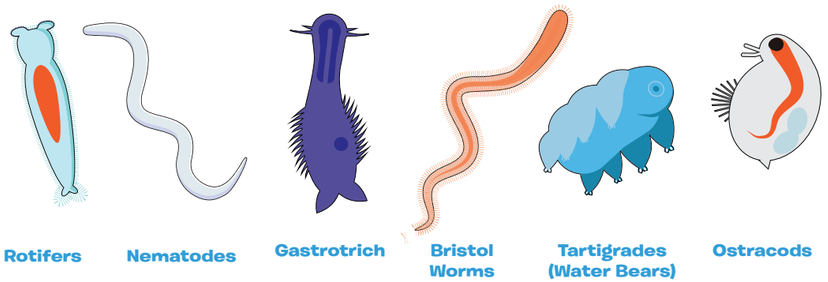


Protozoa are slightly larger microorganisms. They can eat biodegradable material, but they also eat the bacteria population, keeping the bacteria in check and catching the ones that don't settle in the slime layer. Five types of protozoa are typically used in wastewater treatment. They're categorized based on how they move.



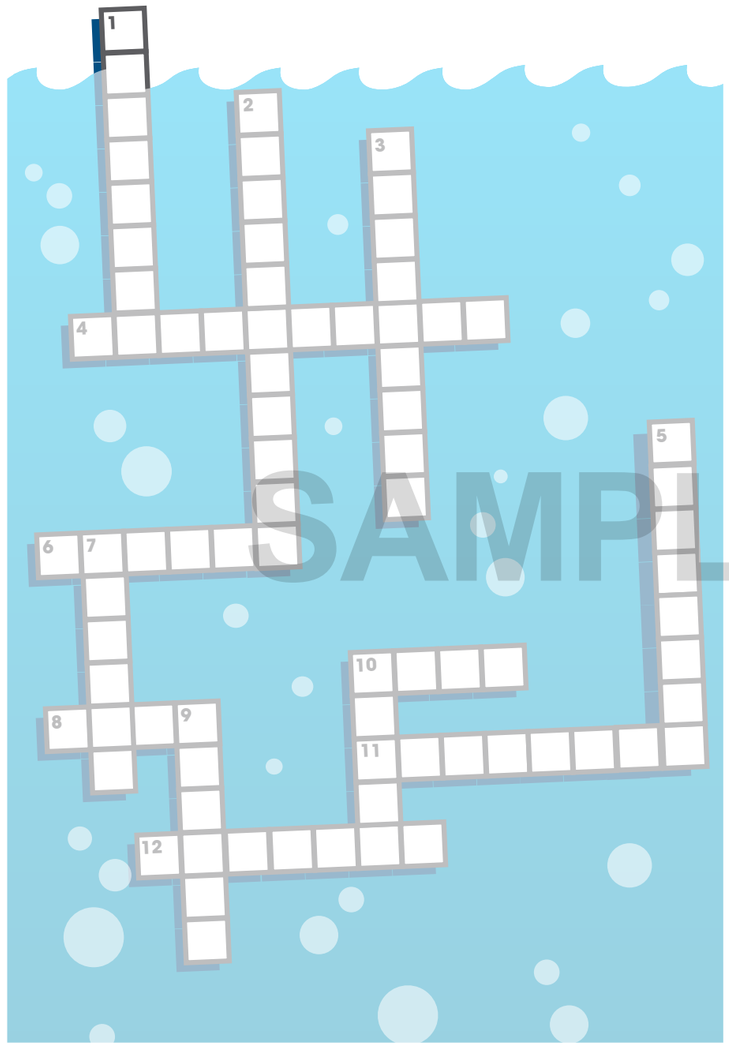
Amoebas | Flagellates | Ciliates: Free-swimming | Ciliates: Crawling | Ciliates: Sessile

Metazoa are the largest multicelled organisms in the wastewater ecosystem. They feed on the bacteria and protozoa. They help by removing the leftover bacteria, algae, and protozoa before the water is released.



Rotifers | Nematodes | Gastrotrich | Bristol Worms | Tartigrades (Water Bears) | Ostracods

WASTEWATER CROSSWORD



ACROSS

4. Water that goes down the drain is called _____

6. Solid waste that is removed from water is called _____

8. Fats, oils, and greases that clog pipes

10. This is used to move water through pipes, especially if the water has to be moved uphill

11. If you squeeze a water bottle, the water might come out. That's because you're creating water _____

12. When FOGs get in our sewers they can clump together, forming one of these disgusting things

DOWN

1. Microscopic workers that help clean water

2. This ancient civilization built a network of sewers to move wastewater

3. Cleaning wastewater is called wastewater _____

5. This can make you feel better when you're sick, but don't pour it in a drain or flush it

7. This city is known for Big Ben and the "Great Stink"

9. Another word for wastewater is _____

10. There are 3 P's that can go in the toilet: pee, poo, and (toilet) _____

ANSWERS

Medicine
FOGs
Pump
London
Roman Empire
Wastewater
Paper
Sewage
Fatberg
Treatment
Bacteria
Sludge
Pressure

Be a Wastewater Superhero!

The people who work for our wastewater treatment plants are superheroes in our cities and towns. You can be a wastewater superhero too!

Make a list of what you can do to protect our wastewater system:

Draw yourself as a wastewater superhero!

Careers in Wastewater

The professionals who work in the wastewater industry help ensure that our sewage doesn't pollute our waterways. It's because of these dedicated workers that we can swim in a lake or fish in a river. Our towns and cities are always in need of people to work in wastewater treatment plants! Here are just a few careers you may find exciting.

Water Resource Recovery Plant Operator

Water resource recovery plant operators, also known as wastewater treatment operators, are in charge of removing pollution from the water. Their goal is to clean water from sewers and drains before releasing it. Operators split their time between the indoors and outdoors, working with chemicals, computers, and machinery.

Wastewater Collections Operator

Wastewater collections operators ensure that wastewater flows safely to the plant for treatment. Operators also help ensure public health by preventing sewage blockages and overflows. They're in charge of repairing, cleaning, inspecting, constructing, and maintaining wastewater collection systems. Wastewater collections operators usually work outdoors, operating power equipment and heavy machinery even in challenging weather conditions.

Water/Wastewater Engineer

Water/wastewater engineers oversee and design projects involving provision of potable water, prevention of flood-related damage, or disposal of wastewater and sewage. They prepare environmental documentation, data, and analyses. On the job, water/wastewater engineers review plans, proposals, or designs related to water and wastewater treatment systems.

Resources

For more information, check out these great sites!

U.S. Geological Survey

water.usgs.gov/edu

Environmental Protection Agency

www.water.epa.gov

National Oceanic and Atmospheric Administration

www.education.noaa.gov

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