

# Sam and Flo's AMAZING WATERY ADVENTURE



**By Sally Smith**  
Illustrated by Emma Scheltema





**Sam and Flo's Amazing Watery Adventure**  
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# Sam and Flo's

## AMAZING WATERY ADVENTURE



By Sally Smith

Illustrated by  
Emma Scheltema



For curious children





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My busy morning made me  
so thirsty. I could really use  
a glass of water...



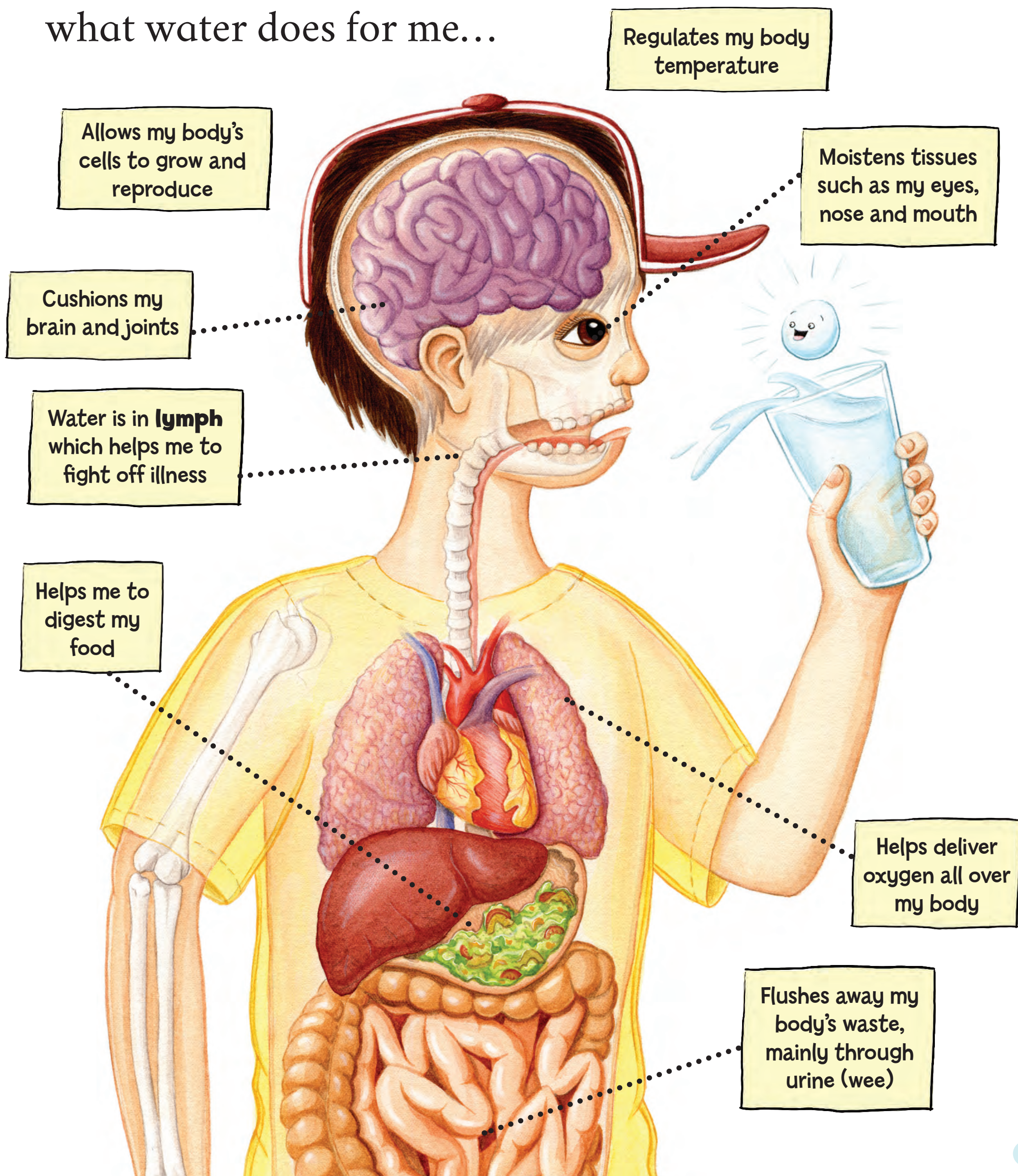
Who are you?  
Where did you  
come from?





# Water and my body

My body needs water to survive. Without it, my body would stop working properly. My body is around 60 per cent water. To stay healthy and feel good, I drink around six glasses of water a day. Take a look at what water does for me...





# The water cycle

The earth has a finite amount of water that goes around and around in a continuous cycle. This is called the water cycle.

## Evaporation

Up we go!

The heat from the sun warms up the sea. The water evaporates, turning from a liquid into a gas called **water vapour**. The water rises into the atmosphere. Salt and pollution are left behind.

Why is everything getting bigger?

Everything is not getting bigger, *you* are getting smaller. Now you are my size!

I'm Flo! I've been on a long journey to get to your tap. Come with me and I'll show you.



## Condensation

Water vapour turns back into water when it cools. This is called **condensation**.

The process of condensation makes the clouds.

## Precipitation

If condensed water drops bump into each other they stick together. Eventually they are too heavy to float and fall to the ground as **rain, hail, sleet** or **snow**. This is called **precipitation**.

Ahhhhh!  
We are falling!

Plants take up **groundwater** through their roots and **transpire** it through their leaves.

The water cycle provides us with the water that all living things need to stay alive.

I know that water goes around and around in a continuous cycle. But where does my drinking water come from?



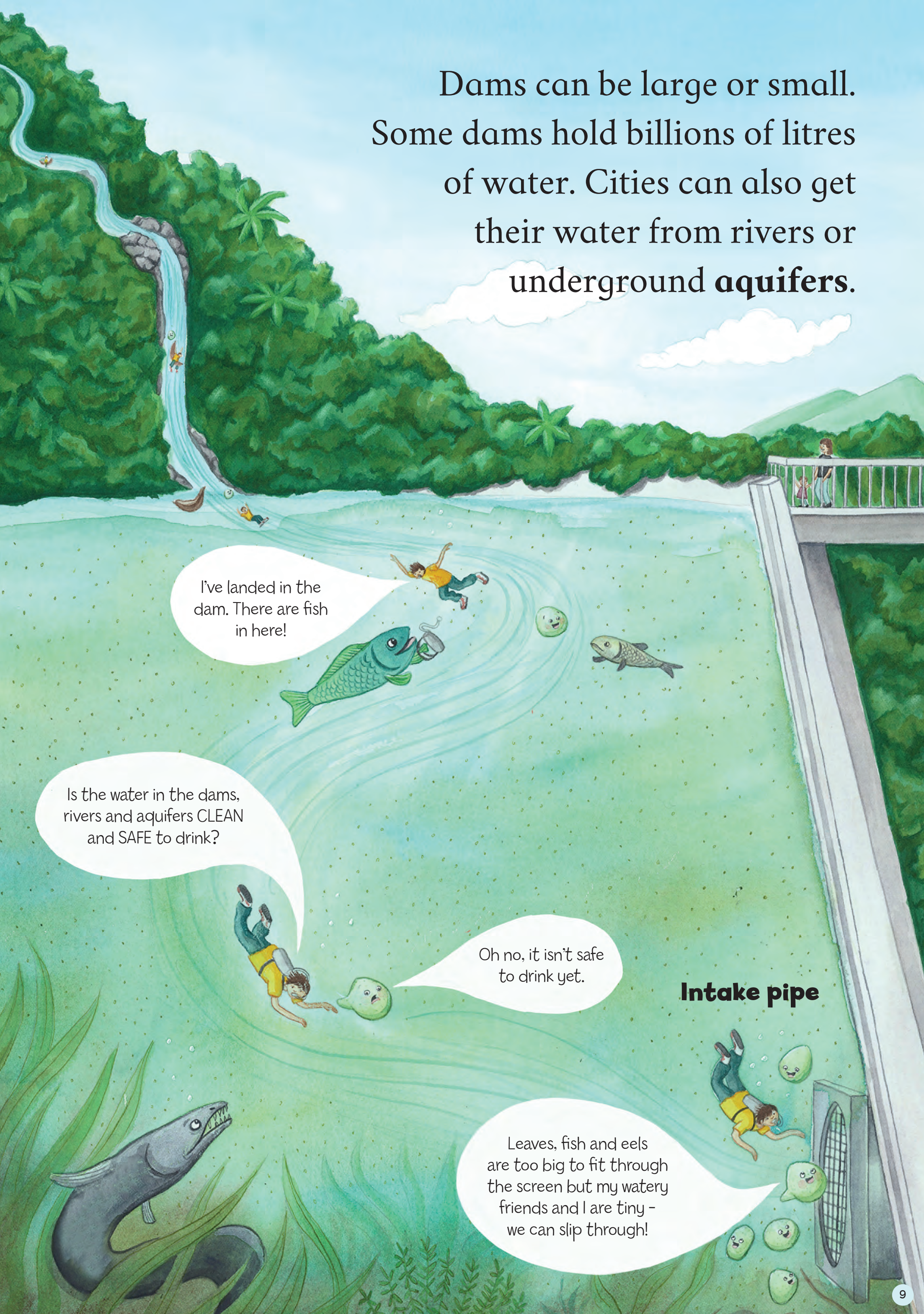
# Water sources

Many towns and cities get their water from storage dams. The water in the dams comes from the rain falling into streams and small rivers.

These dams are usually situated on land high above sea level, which has two advantages: they receive more rainfall than low-lying areas, and the water can flow to the city by **gravity**.







Dams can be large or small.  
Some dams hold billions of litres  
of water. Cities can also get  
their water from rivers or  
underground **aquifers**.

I've landed in the  
dam. There are fish  
in here!

Is the water in the dams,  
rivers and aquifers **CLEAN**  
and **SAFE** to drink?

Oh no, it isn't safe  
to drink yet.

**Intake pipe**

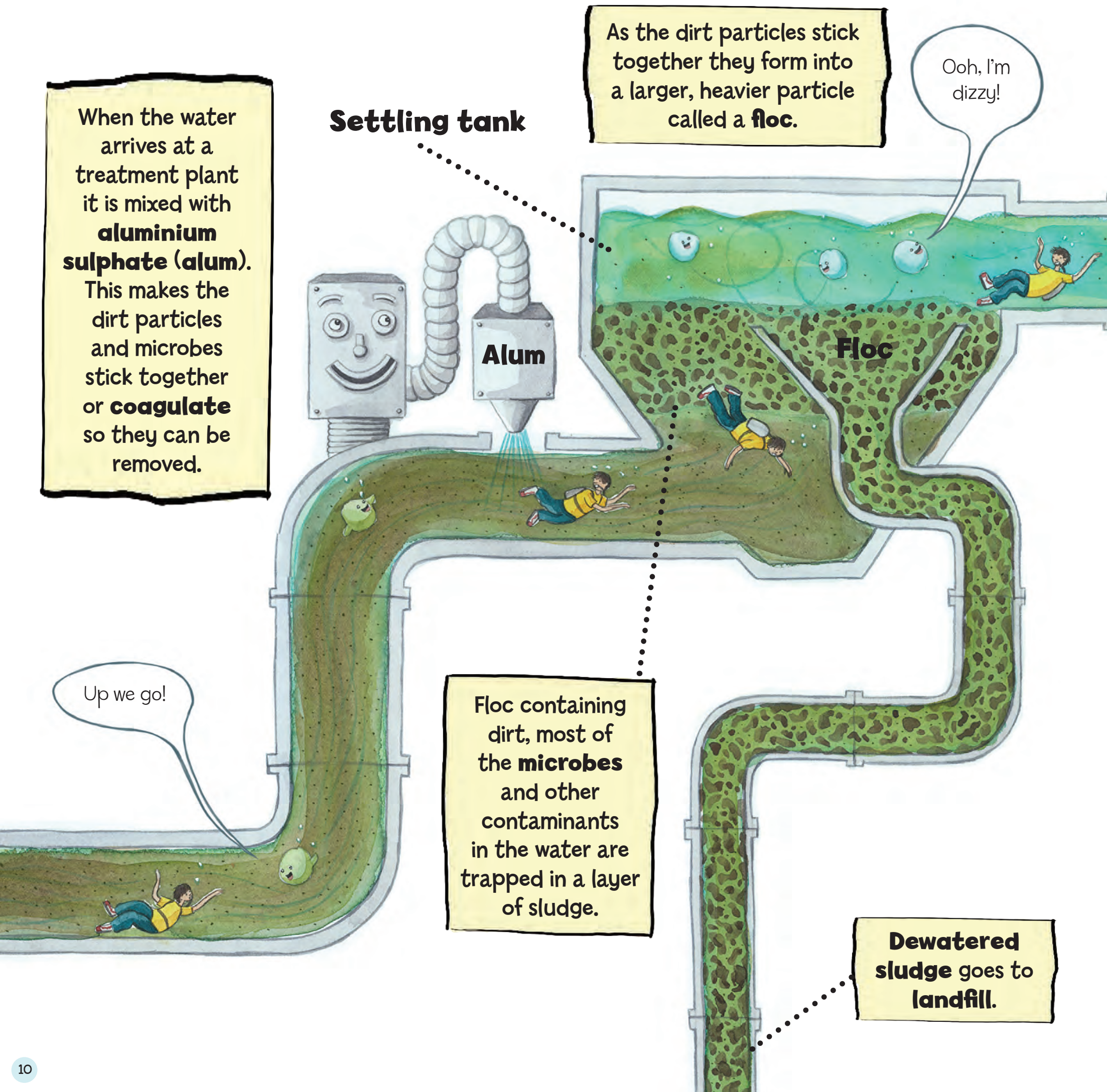
Leaves, fish and eels  
are too big to fit through  
the screen but my watery  
friends and I are tiny -  
we can slip through!



# Making water safe to drink

## Treating water from the dams

Water in a water storage dam may look clean at first glance but it can contain dirt, **bacteria** and other **contaminants** that can only be seen under a **microscope**. It needs to be treated to make it **CLEAN** and **SAFE** to drink.





I've been clarified!

## Sand filter

Floc, giardia and cryptosporidium are trapped here.

Settled or clarified water

Giardia

Cryptosporidium

Is the water CLEAN and SAFE yet?

**Chlorine** is added to the water to kill harmful bacteria like e.coli that could make people sick. This makes it safe to drink.

**Chlorine**

E.coli

Yippee! That got rid of the bacteria.

Now the water is CLEAN and SAFE to drink.

**Lime**

**Lime** is added to reduce acidity.

**Fluoride** is added to the water.

**Fluoride**

Why does some river water need to be treated in a different way?

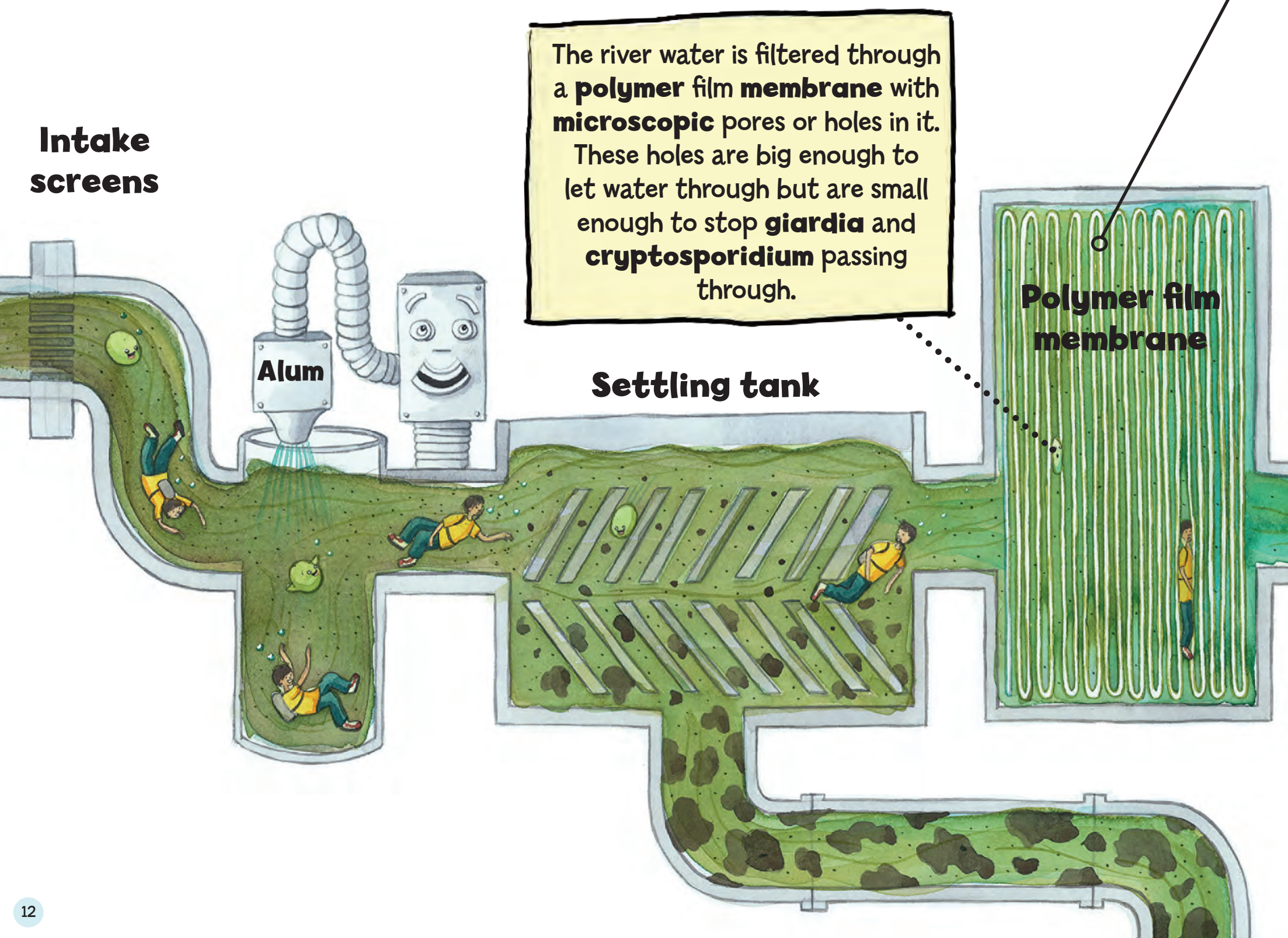




## Treating river water

Water from a river may travel for hundreds of kilometres before it arrives at a drinking **water treatment plant**. Along the way it can pass through cities, towns and farms where different types of **contaminants** can enter the river.

Some dams, on the other hand, are surrounded by forest where there is little human activity and less exposure to contaminants.



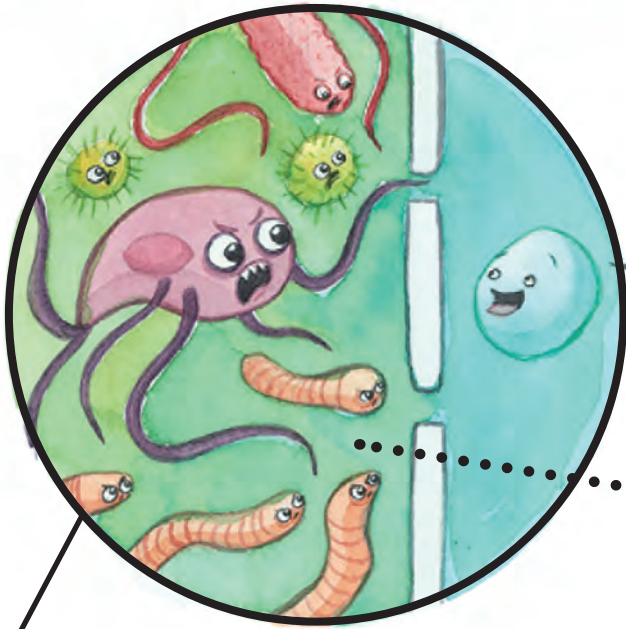


City

Lake

Town

Treatment plant



Ha Ha! I can get through the holes and you can't!

Giardia and cryptosporidium are tiny **parasites** that live in water and can give people sore tummies, headaches and fevers.

Chlorine



The water goes through granular **activated carbon filtration**. The carbon has a very large surface area to **adsorb** pollutants. It can also remove smells, odours and parasites that can resist chlorine **disinfection**.

**Activated carbon filter**

Fluoride



Lime



I now know where my water comes from and how it is made CLEAN and SAFE for me to drink. But how does the water get to my house?



# The water network

The ancient Romans built **aqueducts** to carry water from distant sources to cities and towns. These aqueducts ran slightly downhill, allowing the water to flow by **gravity**. Today, gravity is used to make the water flow from the water treatment plants to homes, shops, factories and schools.

It's great being in here with all of my friends!

**Reservoir**

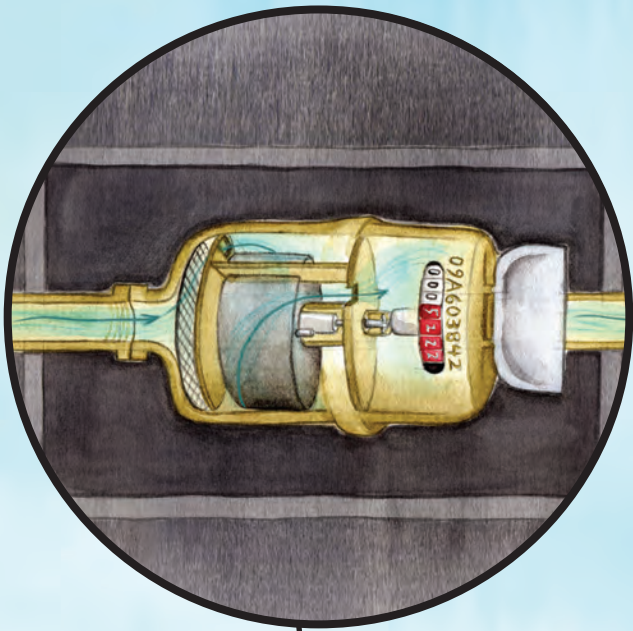
From the reservoirs, smaller pipes carry the water to homes, shops, factories and schools.

From the treatment plants, large pipes carry the water to large holding tanks called reservoirs. Occasionally the water needs to pass through a **pump station** to push it uphill to the **reservoir**.

**Pump station**







Before the water enters a home, shop, factory or school, it passes through a **meter**. As the water moves through the meter it turns a **piston** that is connected to a **numeric dial**. The dial measures the amount of water used.

How can anybody tell how much water my family uses?

Wait and see - we are heading to your house now!

How does the water get to my tap?



A meter reader is a person who looks at the meter and records the numbers. It is then quite easy to work out how much water each family has used.



# Water inside the home

Water flows into a home, shop, factory or school through a privately-owned pipe. It is usually cold or cool, depending on the time of year.

Inside a home there are three sets of pipes. One set of pipes carries cold water, one set carries hot water and one set carries **wastewater**.



Water gets hot in the water heater. We don't want to go in there - it is too hot for us.

A **water heater** is needed to make hot water. Some are gas-powered and provide instant hot water. Others are electric-powered and slowly warm the water in a **cylinder**.

Some taps in my house have hot water and some have cold water. How does that happen?





## How much water?



Flushing the toilet  
uses up to **11L**



5 minute shower  
uses around  
**65L**



A soak in the  
bath uses  
up to **200L**



Brushing your  
teeth with the  
tap off uses **1L**



Running your  
dishwasher uses  
up to **40L**



Running your  
washing machine  
uses up to **150L**

Everything is  
getting smaller!

No - you are  
getting bigger  
again!

Once the water has been used  
for cooking, bathing, washing  
or flushing it goes down into a  
wastewater pipe.

Wastewater pipes carry the  
wastewater to a treatment plant  
so that it can be cleaned and safely  
released back into the environment.



Wow! What an amazing watery adventure.  
Now I know I can't drink any old water, just water that's **CLEAN** and **SAFE** straight from my tap.  
I'm ready for a glass of water now.



What happens to the water that goes down the plughole?

Well that is another story...



# THE WATER JOURNEY





# GLOSSARY

**Adsorption** - The process by which a substance, usually a gas, forms a very thin layer on the surface of another substance.

## **Alum/aluminium sulphate**

- A chemical compound that is used to coagulate particles in water when it is processed for drinking.

**Ancient** - Very old.

**Aqueduct** - A structure that looks like a bridge and is used to carry water over a valley.

**Aquifer** - An underground layer of water-bearing rock. Water-bearing rocks are permeable. This means they have openings that liquids and gases can pass through. Sedimentary rock such as sandstone, as well as sand and gravel, are examples of water-bearing rock.

**Bacteria** - Very small living organisms made of only one cell that are present everywhere (the air, the soil, on the skin). Many types of bacteria can cause diseases but others can be very helpful to humans.

**Chlorine** - A non-metallic element that is found alone as a heavy greenish yellow gas with a strong odour. It is used as a bleach and disinfectant in swimming pools.

**Coagulate** - To become or cause to become thickened into a compact lump or mass.

**Condensation** - The process by which matter changes from a gas (or vapour) phase into a liquid state.

**Contaminants** - A substance that is where it shouldn't be and may be at high enough levels to have a negative effect on our health or on the health of animals or plants.

**Corrosion** - The breaking down or destruction of a material, especially a metal, through chemical reactions.

**Cryptosporidium** - A microscopic **parasite** that can cause an infection of the intestines that often results in diarrhoea.

**Cylinder** - A geometric solid tube that is very common in everyday life, such as a soup can.

**Dewatered sludge** - Sludge after it has been spun in a machine to remove the water.

**Dial** - A usually flat, round part of a piece of equipment with numbers or marks to show some measurement, usually by means of an arrow.

**Disinfection** - A process resulting in the destruction of micro-organisms or the prevention of the growth of organisms capable of causing infection.

**E.coli** - A bacterium commonly found in the intestines of humans and other animals, some strains of which can cause severe food poisoning.

**Evaporation** - The process by which a liquid changes into a gas.

**Filter** - Material through which liquids can be passed in order to separate the fluid from solid pieces of matter.

**Floc/flocs** - A heavier mass of solids created by coagulation.

**Fluoride** - A chemical that is sometimes added to drinking water and toothpaste to help keep teeth healthy.

**Giardia** - A microscopic parasite found worldwide, especially in areas with poor sanitation and unsafe water.

**Granular activated carbon** - A highly porous adsorbent material, produced by heating organic matter, such as coal, wood and coconut shell, in the absence of air, which is then crushed into granules.

**Gravity** - The force of attraction between all masses in the universe, especially the attraction of the earth's mass to bodies near its surface. The further a body is from the earth's surface, the less the gravitational force acting on it.



**Groundwater** - Water within the earth that supplies wells and springs.

**Hail** - Precipitation in the form of small balls or clumps usually consisting of layers of clear ice and compact snow.

**Landfill** - An area where waste is buried under the ground.

**Lime** - A white, caustic alkaline substance consisting of calcium hydroxide, used to reduce acidity in water.

**Lymph** - An almost colourless fluid containing white blood cells that protect the body against illness and disease.

**Membrane** - A thin sheet or layer of material that can be natural or man-made.

**Meter** - A device for measuring the number of cubic metres of water that pass through a pipe into a house, school or other building.

**Microbes** - Microscopic living things that cause disease.

**Microscope** - An optical instrument used for viewing objects too small to be seen by the unaided eye.

**Microscopic** - An object so small it cannot be seen without the use of a microscope.

**Parasites** - An animal or plant that lives in or on another animal or plant and gets food or protection from it.

**Percolate** - To pass slowly through something that has many small holes in it.

**Piston** - A tightly-fitting disc inside a cylinder that moves around and around.

**Polymer** - A long or larger molecule consisting of a chain or network of many repeating units formed by chemically bonding together many identical or similar molecules called monomers.

**Precipitation** - Water that falls to the ground as rain, snow, hail or sleet.

**Pump station** - A building with machinery for pumping liquids from one place to another.

**Rain** - Water that falls in drops from clouds in the sky.

**Reservoir** - An artificial lake that is used to store a large supply of treated water for use in people's homes or in businesses.

**Romans** - People who lived in Rome, a city in the centre of Italy.

**Settling tank** - A tank for holding liquid until the solids in it settle to the bottom.

**Sleet** - A mixture of snow and rain as well as raindrops that freeze on their way down from the sky.

**Snow** - Soft, white pieces of frozen water that fall to the ground from the sky in cold weather.

**Transpire/transpiration** - The loss of water from parts of plants, especially leaves, stems, flowers and roots.

**Wastewater** - Water that has been used, such as for washing, flushing, or in a manufacturing process, and so contains waste products.

**Water heater** - A household appliance consisting of a gas or electric heating unit under a tank in which water is heated and stored.

**Water treatment plant** - A place where water is processed to improve its quality so that it is clean and safe to drink.

**Water vapour** - Water in its gaseous state, produced from liquid water by evaporation.

**Watercare Services Limited** - New Zealand's largest company in the water and wastewater industry.



Join Sam as he goes on an  
adventure with Flo to find out  
where his drinking water comes from.

Travel with them through the  
water cycle to the treatment plant  
and beyond.

