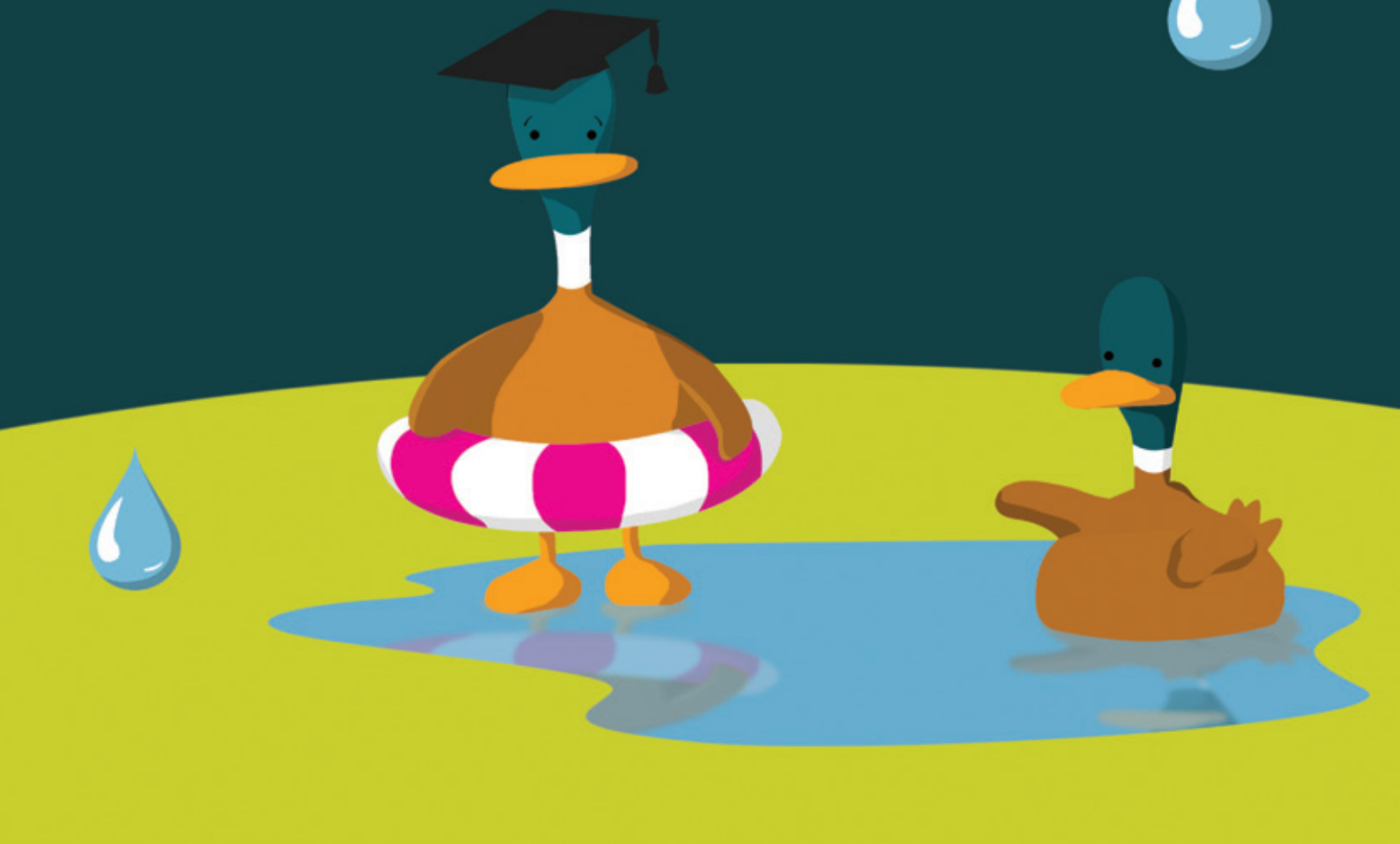
United Utilities

helping life flow smoothly

All about water

Teachers Information Pack



The Water Cycle

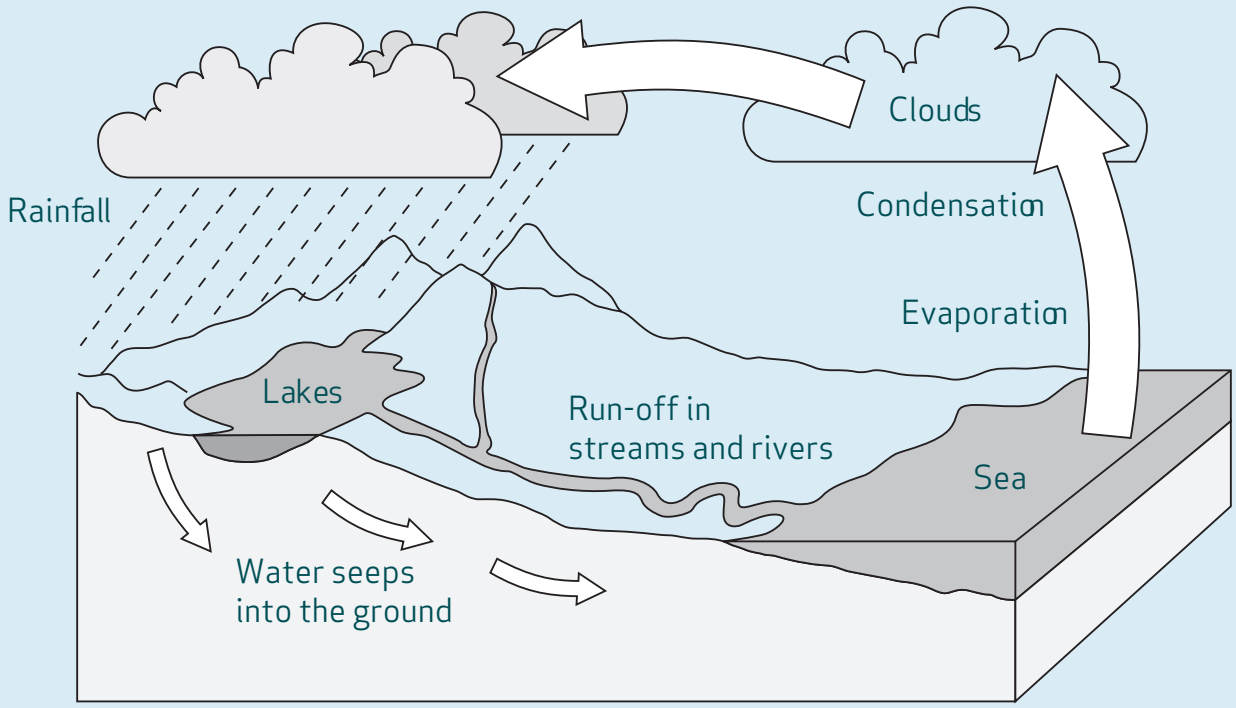
More than 70% of the earth's surface is covered with water, but 97% is in the oceans and 2% is frozen in the polar ice-caps...

...the remaining 1% is freshwater found in rivers, lakes and underground and it is on this 1% that we all depend for the water we need. This is equivalent to just 10 days rainfall, and thanks to the water cycle it doesn't get used up but goes round and round, continually getting recycled.

Let's start with the clouds. These are formed by water evaporating from the oceans and land and when water is given off into the atmosphere by plant transpiration (a process by which plants give out water through their leaves). The evaporated water rises into the atmosphere until the air temperature cools down enough for the evaporated water to form clouds. The clouds travel on air currents until natural cooling causes the water in the clouds to fall as rain.

The rain falls onto the ground. On mountains and hills the rain runs down into streams and rivers and into lakes. Some of it makes its way back to the sea. If the rain falls on land that soaks up water (porous rock such as sandstone) it will seep through until it cannot travel any further. It will then remain in the ground, as in a sponge, until it is pumped out.

The Natural Water Cycle



The Water Cycle

So now in effect, we have water stored in reservoirs, lakes, rivers and underground.

United Utilities breaks into this natural water cycle to provide drinking water. After the water has been used, it is cleaned before being returned to rivers and the sea to start the cycle all over again. Of the 2500 megalitres (2,500,000,000 litres) of water a day supplied to homes, industry, offices, shops and schools in the region, more than half comes from reservoirs. About a quarter is provided by rivers (especially the Dee in Cheshire) and about 10% comes from natural aquifers (the name given to the rocks which contain underground water).

Man's effect on the water cycle

How it was

Man cannot live without water and early settlements were always close to natural water supplies. The Romans developed the art of distributing water using clay, wood, stone and lead pipes. By 312 BC, an aqueduct 10 miles long carried water from the River Tiber into Rome. After the Roman occupation of Britain and the Dark Ages, supply systems did not make progress until the coming of the monasteries. By the end of the 13th century, parts of some cities had a piped water supply, fed from watercourses or ditches. The poor often had to laboriously help themselves from rivers, ponds or streams. The rich could buy water from sellers who carried buckets or carted barrels.

By today's standards, water was untreated, often polluted and dirty. It was common for drinking water to be drawn from the same convenient sources already heavily polluted by untreated, raw sewage. Waterborne diseases, like cholera and typhoid, were common. It was, therefore, necessary to develop a system to prevent contamination and safeguard both health and life.

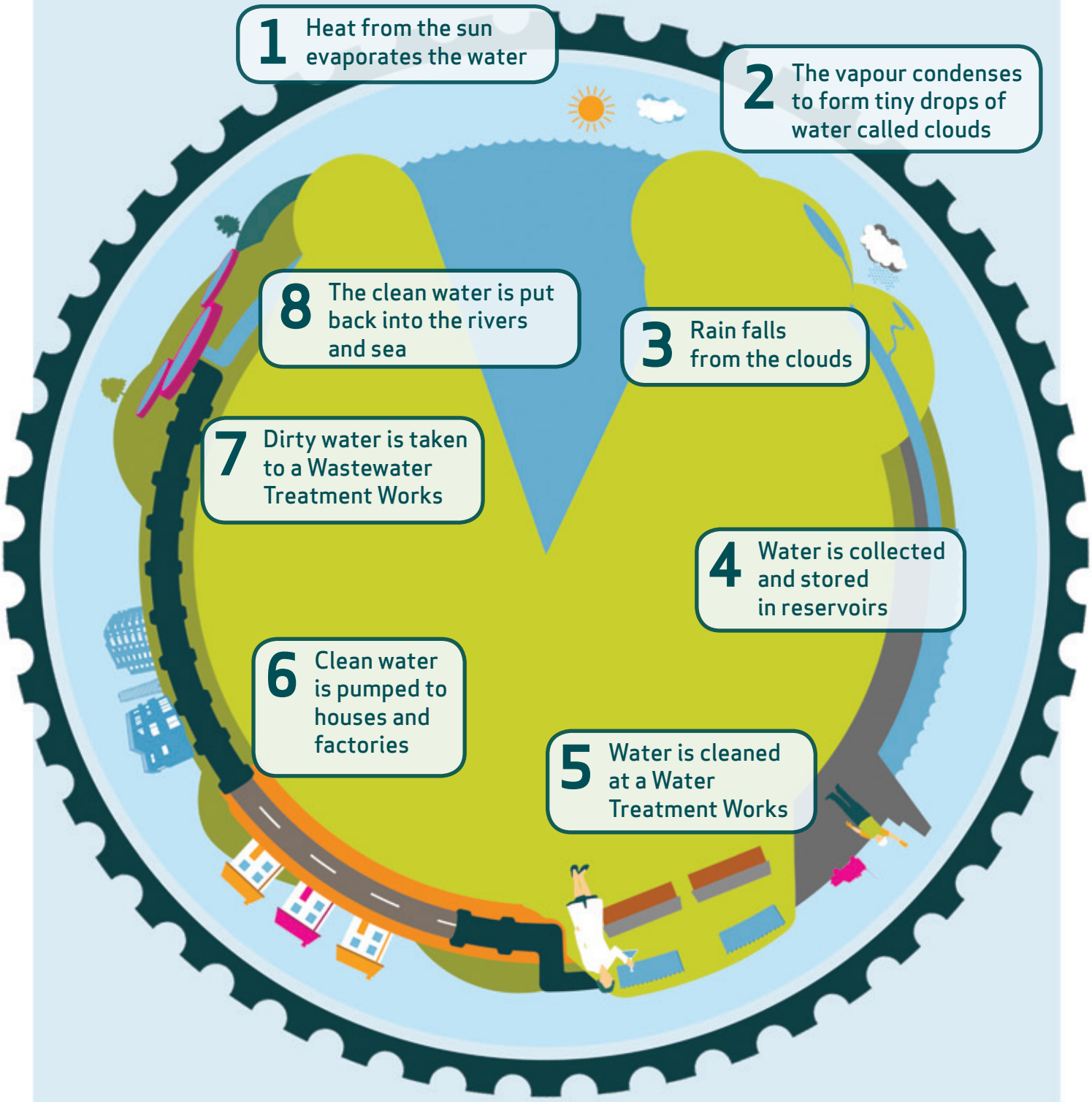
How it is today

Water is a natural resource, but it has to be treated before you can drink it.

What you see in a large reservoir is raw water - in its natural state. The water is not yet clean enough to drink. It needs to be cleaned and treated at the water treatment works.

After the water has been used in different ways, such as in the home, the factory, the farm or school, it has become dirty and is called wastewater or sewage. This is taken, by sewers, to the wastewater treatment works, where it is cleaned. After treatment it is clean enough to go into the river again, but not clean enough to drink. So we have developed our own water cycle: we take water from a natural source, use it, clean it and return it once again to the rivers and sea.

The Water Cycle

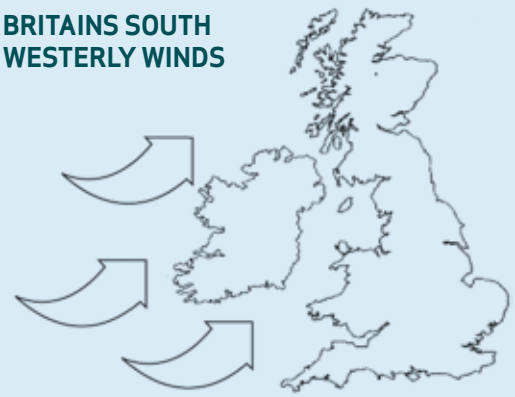


Water supply and distribution

Did you know that rainfall is higher in the North and West than in the rest of the country?

Rainfall in the British Isles

Winds from the Atlantic (south westerlies) bring moisture laden air from the Atlantic Ocean. This air blows over the high land in the North and West of the country bringing about rainfall. This is the reason why rainfall is higher in the North and West (about 1800mm per year) becoming less in the South and East (about 500mm per year).



Waterstorage

Over half the water supplies in the North West region of England come from the hills in the Lake District, North Wales or the Pennines. Reservoirs collect the water as it runs off the hills and store it until it is needed.

Here in the North West there are 138 reservoirs, mostly in the Lake District and the Pennines. Some of these sources have been made by damming natural valleys; others were once lakes which have been enlarged.

The plains of south west Lancashire, north Cheshire, the Fylde and north Cumbria are areas where water is stored in natural aquifers. Here there are about 240 boreholes, where water is pumped to the surface.

The Lake District is one of the wettest parts of England with an annual rainfall average of 2360mm. Like the reservoirs in North Wales, the comparative remoteness of the Lakeland reservoirs reduces the risk of pollution and, therefore, treatment to make the water safe to drink is fairly simple. The major reservoirs in the Lake District are Thirlmere, built in 1894 and Haweswater, the North West's largest, holding 84,500 megalitres (84,500,000,000 litres). Water is also abstracted from the natural lakes Ullswater and Windermere whenever more is needed.

The major sources in Cumbria and North Wales supply the majority of water we need. Of the 1900 million litres supplied every day, approximately 500 million litres comes from Wales and 600million litres from Cumbria. The rest is from the River Dee, Pennines, boreholes, streams and other sources.

Transporting water

Large tunnels and pipelines, called aqueducts, transport water from the water treatment works, where it is cleaned and made safe to drink, to where it is needed often many miles away. Smaller pipes then link into the aqueducts and carry water to homes, factories, schools and other places. Water often has to be pumped to send it on its journey but our Victorian ancestors were very clever engineers who designed a system which is still used today and allows water to flow by gravity from Thirlmere, in the Lake District, all the way to Manchester, nearly 160km (100 miles) away. Gravity is also used to allow water to flow from the East of our region to the West through an addition to the network (the West East link main). This supply enables us to provide water to Merseyside and Greater Manchester from non-traditional sources, Merseyside will be able to get water from the Lake District and Greater Manchester from North Wales. Pumps are also used to move water in the other direction.

Water supply and distribution

Water availability

Although there is usually enough water in our part of the country, we still need to use it carefully. Conservation of water means thinking about how it can be best used to make sure there is enough to go round.

Each person uses about 150 litres a day. A lot of water is used by industry. For instance, to make half a kilogram of instant cw

In order to supply these demands, rivers and their flow have to be monitored. If too much water is taken out,

ITEM	WATER CONSUMPTION
Hosepipe	540 litres per hour
Shower	30 litres
Power shower	60 litres
Bath	75 litres
Running tap	9 litres per mintute
Washing machine	70 litres
Modern toilet flush	6 litres
Standard toilet flush	9 litres
Standard toilet with saving device	8 litres

the fish downstream could be harmed by the drop in water level and the flow, and the quality of the river water would be affected.

To make sure there is enough water near to where it is needed, local storage reservoirs - usually large underground tanks - hold the treated water before it is piped on the last lap of its journey.

Storage reservoirs and water towers are topped up during the night to make sure the water pressure is good enough to meet everyone's needs during the day.

Water supply to houses

Pipes which transfer water to the various points in the distribution system can vary in diameter from 7.5cms (the size of a mug) to 2.3m, in which a man could stand and still not be able to touch the top. These pipes are called 'water mains'. The size of the water main depends upon the size of the community which it serves.

TOWN POPULATION	SIZE OF MAIN
1/2 million	1.05m to 1.20m
200,000	0.75m
5000 - 20,000	0.2m to 0.3m

When a new house has to be connected to the water supply, the supply pipes are usually 18mm in diameter. At the boundary to the house a 'stop cock' (like a tap) is fixed, so that the supply to the house can be shut off if necessary while any repairs are carried out.

Water treatment

There are 92 water treatment works operating every hour of every day to provide clean, safe, drinking water.

Water in reservoirs, lakes, rivers and aquifers needs treating before it is fit to drink. Each of these sources affects the quality and chemical make - up of the water, and therefore each source will require a different type of treatment.

Water from aquifers

The water we obtain from aquifers is usually very pure. One of the reasons for this is that after water has travelled a long distance through soft, porous rock, most of the impurities have been filtered out. This can be likened to a strainer; the larger particles are caught and the filtered liquid is allowed to flow through. On removal from the rock the water usually only needs disinfecting with chlorine to kill any harmful bacteria.

Water from rivers

The quality of water from rivers varies quite widely, as rivers are affected by flooding, low flows, temperature change and weed growth, as well as more complex problems of pollution from communities, businesses and farms. Water from the River Dee in Cheshire needs to be treated in several stages to remove leaves, suspended matter, dissolved chemical substances and colour. The water is also treated to ensure that it is free from unpleasant odours or tastes and disinfected before leaving the treatment works.

Water from upland areas

Water obtained from upland areas is collected in reservoirs and is usually of low mineral content due to contact with hard rocks. This water needs to be treated to remove colour the water has absorbed from the peaty gathering grounds, and also to remove iron and manganese.

How is water treated?

The first stage is natural separation in the reservoirs. The stillness of the water allows bigger solid impurities to settle, and the large surface area allows oxygen in the air to get to work on the other impurities. From here the water is taken for treatment.

Sedimentation and coagulation

As a first step a chemical compound, usually ferric sulphate, is added to the water. Water then flows very slowly through a settlement tank. The addition of the chemical makes small particles join together to form large particles, (this is called coagulation). These particles become too heavy to hang in the water and so sink to the bottom of the tank (this process is called sedimentation). Sometimes pressurised dissolved air is introduced into the water to carry the particles to the surface. The coagulated material forms a blanket layer which is then drawn off leaving the water much cleaner.

Water treatment

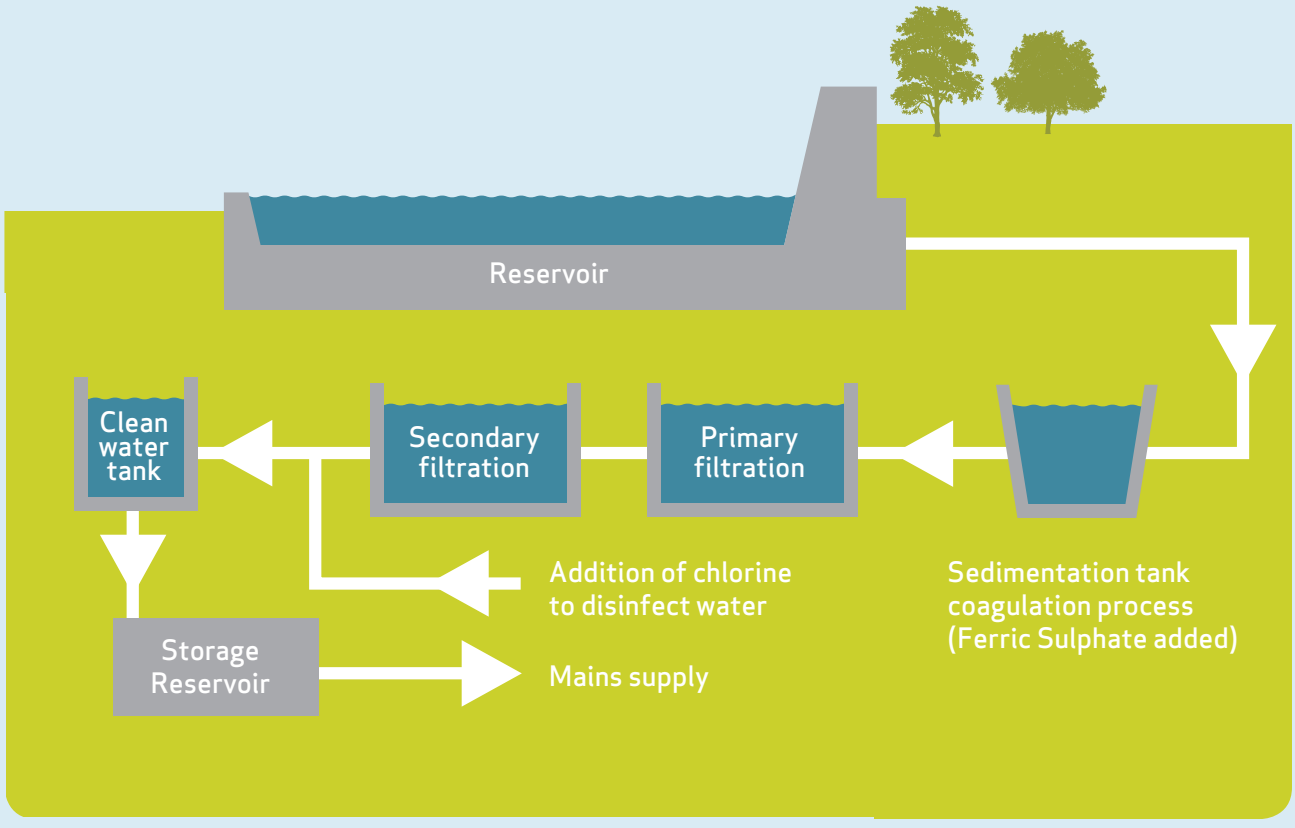
Filtration

After sedimentation, the water passes through filter beds to remove any remaining material, including iron and micro - organisms. When the water enters the second stage filtration process chlorine is added and the pH is corrected, which enables the manganese to be filtered out. The filters usually consist of layers of sand and gravel. The filtered water is collected in perforated pipes and taken on to the next stage of treatment.
Every day the filter beds are washed by pumping clean water upwards through the sand, and then the process starts all over again.

Chlorination

Water is taken to the final stage of treatment. Here, all the water passes through a covered tank where chlorine is added to kill any remaining bacteria.
The water is now clear, safe to drink and ready for putting into the system.

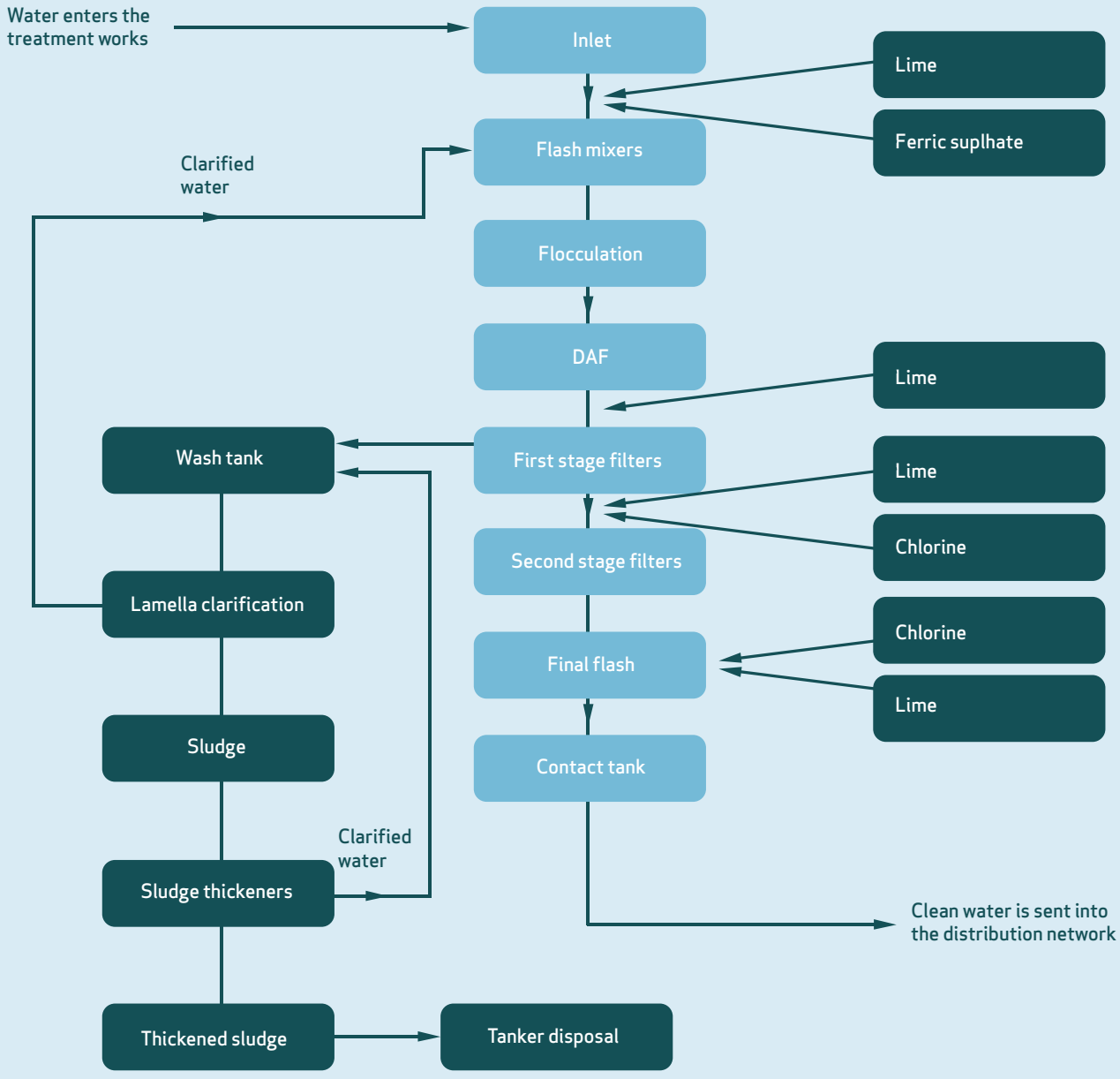
United Utilities has 92 water treatment works and every day samples of untreated and treated water are tested in the laboratories



Water treatment advanced

This is an advanced flow diagram of the water treatment process in a typical water treatment works.

Some treatment processes change depending upon the quality of water flowing into the works and what exactly needs to be done tomake it clean enough to drink taking into consideration very strict standards.



Water treatment advanced

Glossary

LIME	is an alkaline substance that alters the pH of the water
FERRIC SULPHATE	is a coagulant which is used to encourage solids to stick together
CHLORINE	is a chemical used to disinfect water and also used to help separate out manganese
FLASH MIXERS	where the chemicals are mixed together
FLOCCULATION	large paddles stir the water to encourage the solids to coagulate then the solids are separated from the water
DAF	(Dissolved Air Floatation process) a small volume of water is saturated with air under high pressure. This water is introduced to the water that will be filtered, the release of air pressure causes thousands of bubbles to rise forcing unwanted particles to the surface where a sludge blanket forms and is scrapped off
1ST STAGE FILTERS	impurities and solids are trapped only allowing clean water to flow out
2ND STAGE FILTRATION	water from the 1st stage is disinfected and the pH is raised to remove manganese
CONTACT TANK	water is held here that has been treated before it is sent on to the network
WASH TANK	water that is used to clean the filters is stored here
LAMELLA CLARIFICATION	water is dosed with chemicals to remove unwanted particles
SLUDGE	unwanted and filtered out particles
SLUDGE THICKENERS	is an alkaline substance that alters the pH of the water
TANKER DISPOSAL	the sludge is sent by road tanker to the wastewater treatment works
CLARIFIED WATER	in this process, sludge is separated from the water, the water goes back through the system to be cleaned again. This ensures we do not waste water throughout the treatment process.

Wastewater treatment

Have you ever thought what happens to all the water and waste when you take a bath or flush the toilet?

This is called wastewater or sewage. Like the wastewater from factories, farms, schools and even the rain falling on the streets, it has to be taken away for cleaning.
First, it runs into a drain and then into underground pipes called sewers. There are about 44,000km of sewers in the region, some of which were built a long time ago and are now too small to cope with demands.

Drainage from new housing developments, more and bigger roads, replacing grass with paving and climate change brings more rainfall to the pipes, quickly filling them and causing flooding.

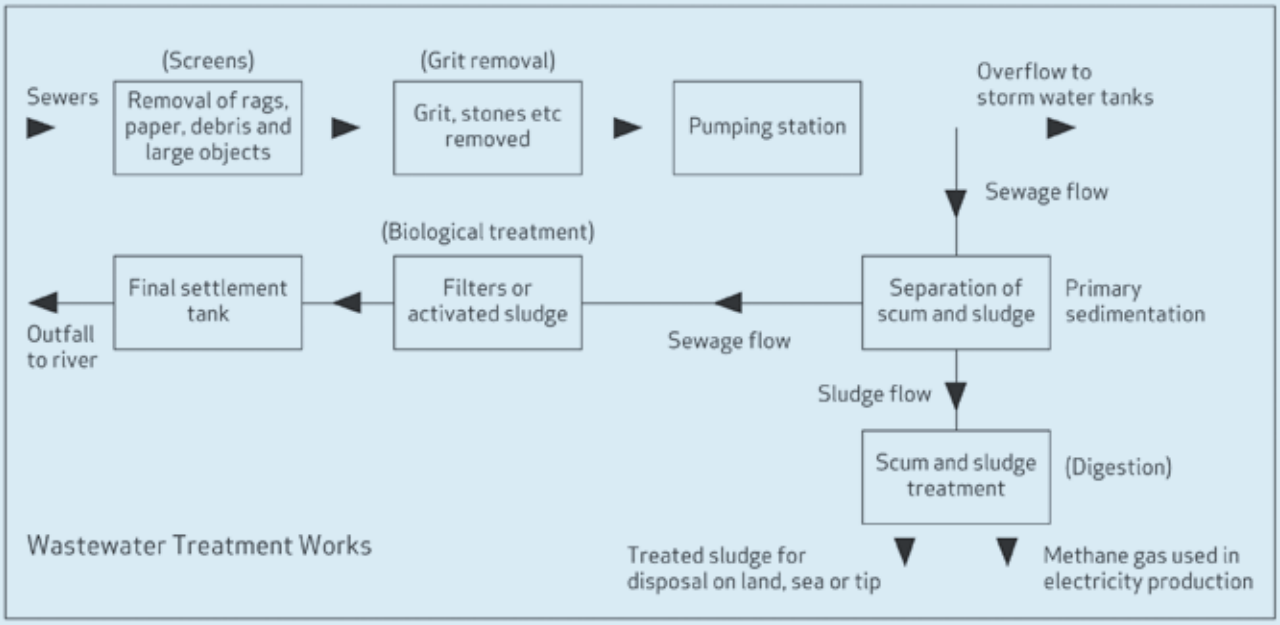
In our region some sewers are combined carrying rainwater. During storms the pipes need to let the huge quantities of extra water overflow into rivers and streams.

With the storm water combined with rivers and streams that are already full, flooding happens and can become worse.

The water then reaches one of the many wastewater treatment works in the North West which keep working around the clock, 365 days a year.

Each works differs, depending upon the type of waste, such as human waste, animal waste, vegetable waste or industrial waste. Wastewater is still about 99.9% water. There are three different types of solid waste in wastewater - those solids that float, those that sink and those that are so small that they neither float nor sink but simply hang in the water. These forms of solids are removed in different ways.

FLOW DIAGRAM OF WASTEWATER TREATMENT



Wastewater treatment

Because of the variation in methods of wastewater treatment, the main processes are dealt with here:

Screening

The first task at the wastewater treatment works is to remove rags, wood and large objects (which would block or damage pumps and other machinery) by using grills or sieves which are cleaned by brushing with water. This process deals with much of the floating material.

Grit removal

A large amount of grit gets into wastewater, mainly from roads and other hard surfaces. This again will damage pumps and machinery if it is not removed. By letting the wastewater flow slowly through shallow tanks or channels, the grit will fall to the bottom. It is then removed with a scraper, and after cleaning can be used to fill holes in the ground.

Primary settlemen t

The next job is to remove as much of the fine solid matter as possible. The wastewater is fed into large tanks (primary settlement) where solids (called raw sludge) settle to the bottom. Electrically driven scrapers sweep away this raw sludge to a hopper and it is then transferred to a sludge digestion plant (this is explained later). The remaining wastewater looks a lot cleaner than it did when it came into the plant. The treatment process is not over however, because there are still a lot of harmful chemicals and bacteria present in the water and these need to be removed.

Aeration

In the waste matter. They need a lot of oxygen to turn the wastewater into biomass, gases and water. There are several ways this can be done, these include:

a) The settled wastewater is sprayed onto a bed of coke, gravel or clinker contained in a large tank. The beneficial microbes live on the surface of the material in the bed and as the wastewater passes through this material it takes up oxygen from the air. These beds are called biological filters.

b) In another method air is pumped through special tiles called diffusers, in the bottom of a tank containing wastewater and added microbes. These tiles, which have very small holes in them, allow the air to form small bubbles which travel up through the wastewater, allowing the microbes to do their work. It takes about 8 hours to convert most of the impurities. Once this process has taken place the wastewater is comparatively clean and so it is fed to a series of tanks to undergo a final settlement. One other method that can be used is membrane micro filtration techniques. These are really effective huge membranes used to filter out any waste matter.

Final settlement and discharge to river

The final settlement process is similar to the primary settlement but the water is then clean enough to be returned to rivers and the sea. Sometimes extra treatment is needed to protect shellfish, inland fisheries and other protected rivers and streams. When this is required, the treated water can be filtered through sand-beds or treated with ultra-violet light to kill an remaining micro-organisms.

Sludge digestion

The raw sludge from the primary settlement tanks is transferred to a heated digestion tank where a different microbe destroys the unpleasant 'smelly' materials. The process takes about three weeks and one of the bi-products is a gas which contains methane. This is like North Sea gas and is burnt as a fuel to generate electricity which can be used to run the wastewater treatment works or can be connected into the National Grid for supplying electricity.

Sludge disposal

The sludge from the digestion tanks is now called digested sludge. Disposing of the huge amounts of digested sludge can be a big problem. About 124,700 tonnes (dry solids, around 4 million wet tonnes) are produced each year in the North West. 24% is used by farmers as fertilizer. The remainder is disposed of to sea, landfill or by incineration.

So now the sludge has been disposed of, water can be returned to rivers. Eventually it will evaporate again and fall as rain and the cycle starts again.

Creating a cleaner environment

Meeting the challenge for a cleaner and healthier environment ....

How it was

During the 18th and 19th centuries, towns and cities grew quickly. New industries began and people moved to be near the work. More water was needed and more wastewater was produced after both people and industry had used it. Our Victorian ancestors built sewers and some wastewater treatment works although not everywhere - but these are now worn out and too small to meet today's needs.

Many of the rivers in the North West were dirty because years ago people just poured untreated waste from factories and homes into a nearby river and forgot about it. Bathing waters along our coast were dirty for the same reason. We now know that all the wastewater, or sewage, must be properly treated if the environment is not to be harmed and rivers are to be clean again.

United Utilities cares for the environment in a number of ways.

Rivers

Huge amounts of money are being spent on new sewers and treatment works to make rivers cleaner so fish can live in them. Remember that fish and other living things need dissolved oxygen in their water. A good example of how rivers can be improved is the River Mersey. Lots of small rivers - called tributaries flow into the Mersey and as these have become cleaner, through new sewers and

improved wastewater treatment, they in turn have made the water in the River Mersey downstream much cleaner. Liverpool now has its first-ever wastewater treatment works and this, too, has made a big improvement. The estuary - the wide part of the river where it flows into the sea - has once again become a haven for wildfowl and wading birds and fish.

The Mersey Estuary has been designated as both a Special Protection Area (SPA) and a Ramsar Site in recognition of its conservation value, especially for birds, as well as the designation as a SSSI (Site of Special Scientific Interest). The Mersey Estuary has attracted thousands of internationally important wintering wildfowl and waders.

Water quality improvements now mean the Mersey supports a wide range of fish species, including fish such as salmon, trout, lamprey and dace. The increase in the numbers of fish in the river has encouraged a number of other animals to return to the Estuary. These include porpoises, grey seals and even octopus. www.merseybasin.org.uk (2009).

Coastal waters

Bathing waters along our coast have come in for a lot of criticism. They are not clean enough although many of the sunshine areas in the Mediterranean are far worse! Again, huge amounts of money are being spent to make these waters cleaner, in the same way as rivers. For example, work costing many hundreds of millions of pounds has started to make the sea cleaner at Southport, Blackpool and in West Cumbria. These are big projects which will take several years but a cleaner and healthier environment will be the reward.

Enjoyment

Reservoirs and the land surrounding them are also there to be enjoyed. Lotking after the 140,000 acres of land the company owns, is a pleasant responsibility for United Utilities, although it can be a worrying one when there is a conflict of interest. One person's idea of recreation may not be another's. Some people like quiet enjoyment such as walking or sailing; other people like more noisy recreation such as power boat racing or motor bike scrambling. We also have to make sure that the reservoirs - which are our source of drinking water are protected from pollution.

By working with sporting, nature and environmental organisations, United Utilities tries to ensure that everyone's interests are provided for and the environment is protected for future generations to enjoy.

Saving water

If water keeps going round and round in the water cycle, why do we need to save it?

Even though water keeps going round and round, we still need to be careful not to waste it. We take water from rivers, reservoirs and underground and clean it before getting it to your taps. If we have really hot weather and no rain and the climate changes with unexpected weather patterns our rivers and reservoirs may run dry. Because of this we need to make sure we don't waste water.

We use 70% more water than we did 30 years ago ... but why?

There are more homes with more people, using more appliances and more water than ever before. The regions demand is equivalent to 93,000 glasses of water a second. Cleaning and treating water uses valuable energy and resources. By making a change in your every day routine/life you can help in saving precious resources, protecting the environment and even save money if you have a water meter.

Every drop of water you use has to be taken from the 'natural' environment. So every drop you save, means that you're really helping the environment.

To understand why saving water is important it may help you to see how we interpret the water cycle and to see the processes involved in collecting, storing, treating and piping water. (Fact sheets 1 to 4).

Water and your carbon footprint

Our demand for water, how we use it and the amount of dirty water that goes into the sewer system, all have a big impact on our CO2 emissions.

United Utilities uses enormous amounts of energy to collect, treat and transport water to your home 24 hours a day. We then have to take away your wastewater and treat it before returning it to our rivers and seas.

Any reduction in the amount of water that United Utilities supplies to your home or school will result in less energy needed. This is great for the environment as it directly reduces the amount of CO2 emissions from power stations.

How does your water usage affect your carbon footprint?

Use the online carbon calculator to show the CO2 emissions of the water you use.

http://www.unitedutilities.com/watercalculator.htm

Ways to save water

In the kitchen:

- Use a plug in the sink or a bowl instead of using a running tap will save a litre of water every 6–7 seconds.
- If it takes a long time for the water in your hot tap to heat up, don't let the water run to waste, save it in a bowl to water the garden.
- An average washing machine uses around 70 litres of water per cycle. If you wait until you have a full load before you use it you'll not only save water but save electricity too.
- A dishwasher uses around 30 litres of water per cycle so again, try and use it only when you have a full load.
- Get into the habit of filling the kettle only as full as you need. Heating a small amount of water will save you money on your electricity bill too.
- Keep a container of drinking water in the fridge. If you do this you won't have to run the tap for a long time for a cool refreshing drink!
- It's about saving energy too. When you consider that more than 50% of the water that you use in the home requires electricity or gas, it makes sense to ensure that you use energy efficient equipment. Not only will this save you money in the long run, but it will also help to reduce your carbon footprint.

In the bathroom:

- Put a plug in the basin when you wash your hands and face – saves 10 litres of water with each wash.
- Turn the tap off whilst brushing your teeth – saves another 18 litres.
- Take a shower instead of a bath. The average bath uses more than double the amount of water as the average shower.
- It costs much more to heat the amount of water needed for a bath – so showers save energy too.
- A power shower uses around the same amount of water as a bath.

Did you know we flush a third of our daily water down the toilet?

- Modern toilets with a low or dual flush use less water than older models – they can save around four litres of water with each flush.
- You can also save water by fitting a Save-a-Flush cistern device, which will save around one litre of water with every flush. If you would like a Save-a- Flush, free of charge, call us on 0845 746 2200 or order one via our website www.unitedutilities.com/saveaflush

In the garden:

- Use a watering can instead of a hose.
- Cut down on the digging.
- Treat your garden to a layer of mulch – this retains moisture in the soil during the growing season.
- Let the lawn grow longer, it will wear better during dry periods.
- Consider drought resistant plants such as geraniums, which need less water.
- Rainwater is better for plants than tap water because it is very rich in natural minerals. So why not fit a water butt to collect rain from the roof to use in the garden?

How much water do you use?

Could you be a water waster?

Use Activity sheet 6 to work out your water usage either as a household, class or individual. The average per person per day is 150 litres. How do you compare?

ACTIVITY	NUMBER OF LITRES USED
Bath	75
Shower	30
Power shower	60
Toilet flush	9
Toilet flush with water saving device	8
Modern toilet flush (installed since 2001)	6
Basin taps	9 per minute
Washing up bowl	10
Washing machine	70
Dishwasher	30
Kitchen taps	9 per minute
Watering can	10
Hosepipe/sprinkler	540 per hour

How much water do you use?

Now think about how you could save some water.

Make a promise

Make a promise of how you can save water and try to keep it. Use the poster in this pack to keep a record of your promise and others at home or in your class. Record every day if the people listed have kept their promise. If you all can keep your promises you will all become water savers and help the environment.

These are just a few examples of promises you could make. You may even wish to think of other ideas to help save energy or reduce your waste.

I promise to:

- Turn off the tap whilst brushing my teeth
- Use a watering can instead of a hosepipe
- Turn off dripping taps
- Have short showers instead of baths

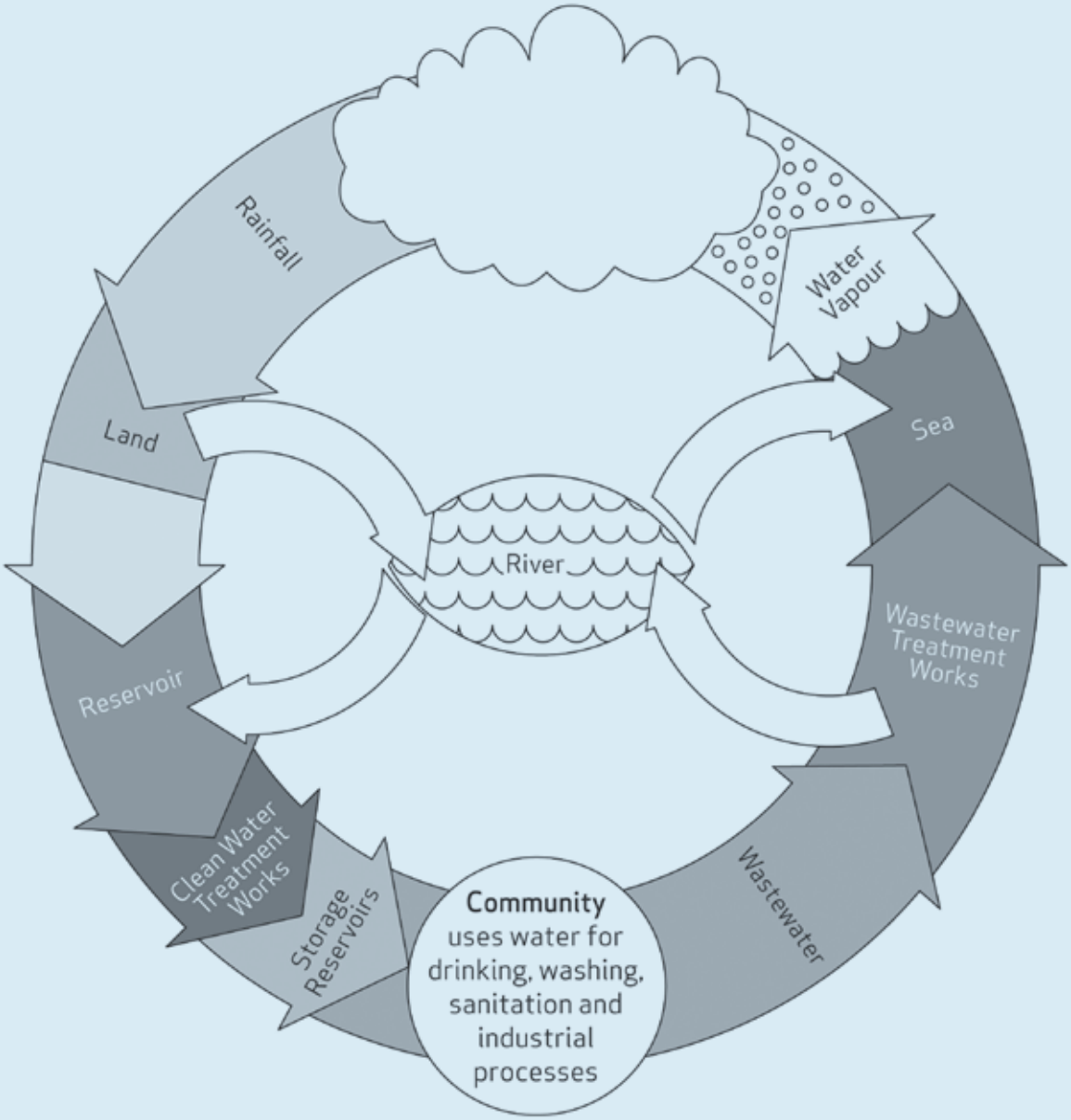
Activity Sheet 1

The water cycle

Carefully study the water cycle below. Imagine you are a water molecule in a drop of rain.

Describe your journey through the water cycle. You can use the words in Activity Sheet 2 to help you.

Don't forget that you will end up where you began!



Activity Sheet 2

Fit the words in the boxes

From the list of words, choose the one which you feel best fit the numbered boxes 1-16 on the diagram below.

Sludge

Fine sand

Large stones

Biological filtration

Settlement tank

Underground reservoir

Return to source

Rain

Chlorination

Small pebbles

Wastewater

Primary settlement tank

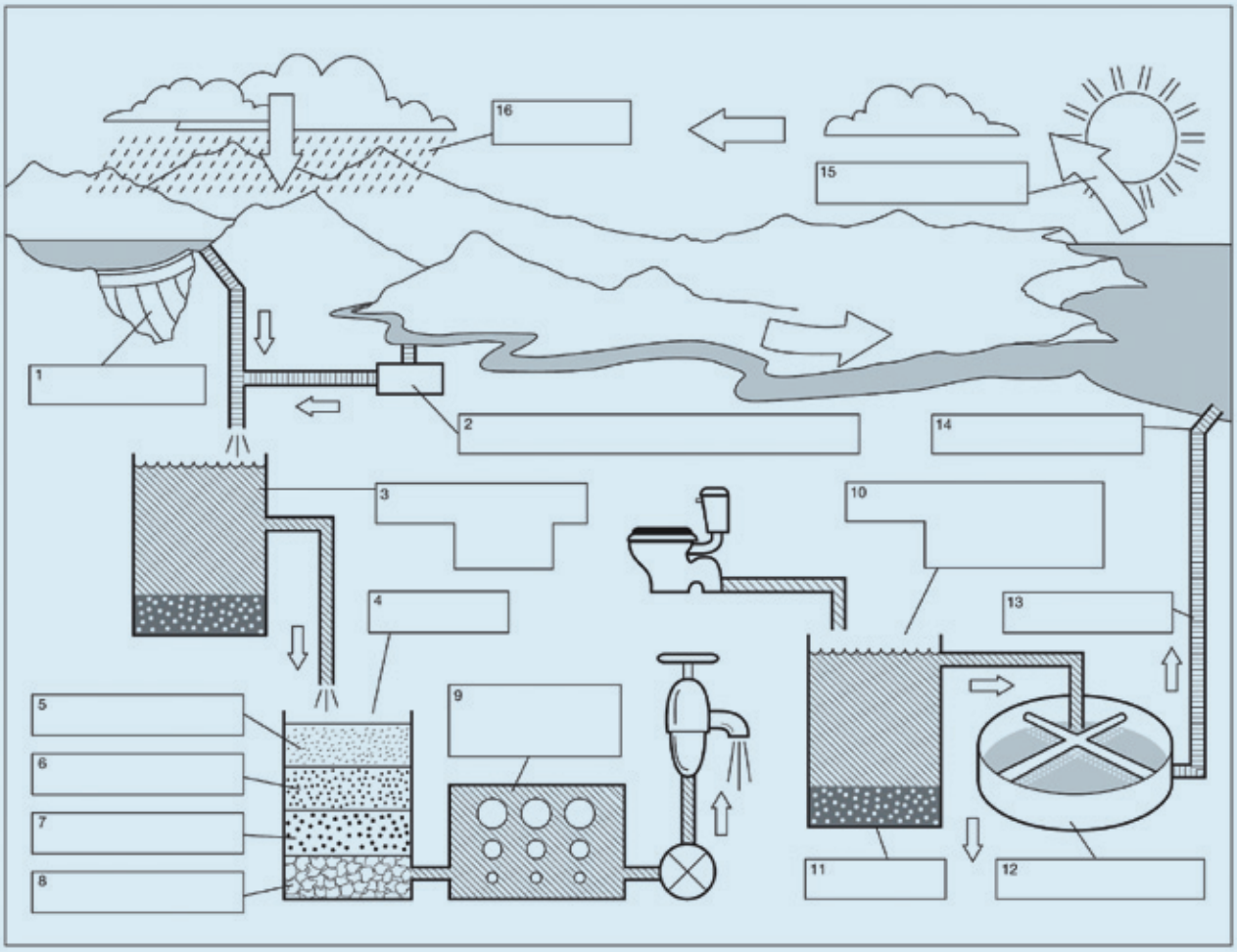
Storage reservoir

Final settlement

Filter

Evaporation

Coarse sand



Activity Sheet 3

The water cycle

Measuring rainfall

Make a rain gauge to find out how much rain falls in your area. To use the rain gauge properly you must take measurements at the same time each day.

You will need

• A plastic lemonade bottle • scissors or knife

• A measuring cylinder

• A ruler

What to do

1 Carefully cut through the top of the lemonade bottle and turn the top part upside down to make a funnel. (An adult might help you with the cutting). (fig 1).

2 Find an open space of ground in your school or garden, away from trees and buildings. Dig a small hole, to stand your rain gauge in.

3 Check the rain gauge each day and pour any water into a container and measure the depth with a ruler. (fig 2).

4 Write down how much rainfall each day.

5 Design a chart to keep your record on. (fig 3).

6 After a week, or a month, check your total rainfall.

7 How would you decide which days are "wet" and which "dry"?

Fig. 1

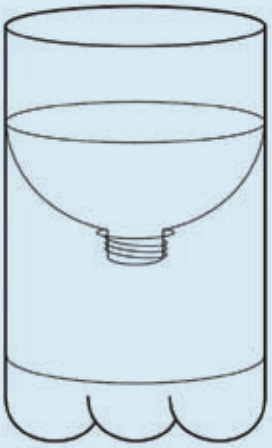


Fig. 2

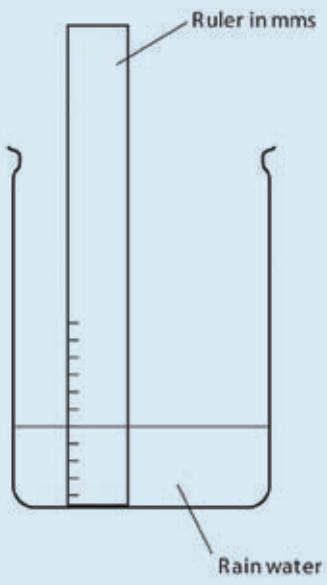
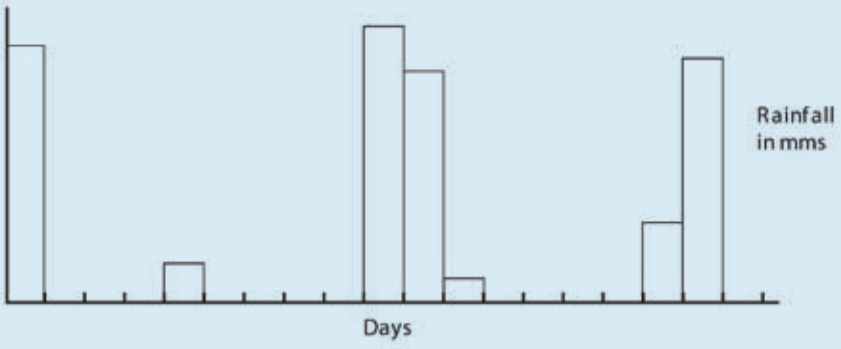


Fig. 3 Rainfall Chart



Sometimes, the monthly rainfall can be found in newspapers or a local meteorological station has this information. Check your results with theirs.

Activity Sheet 4

How we use water

How we use water

On average a person in the UK uses 150 litres of water a day.

This is how it is divided up: 30% Flushingthetoilet 21% Bathsandtaps

13% Clotheswashing 12% Showers

8% Washing up 7% Outside

4% Drinking

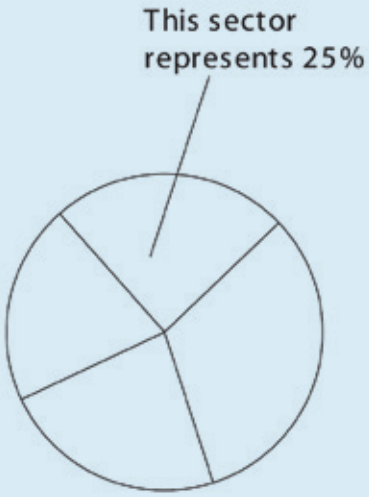
5% Other

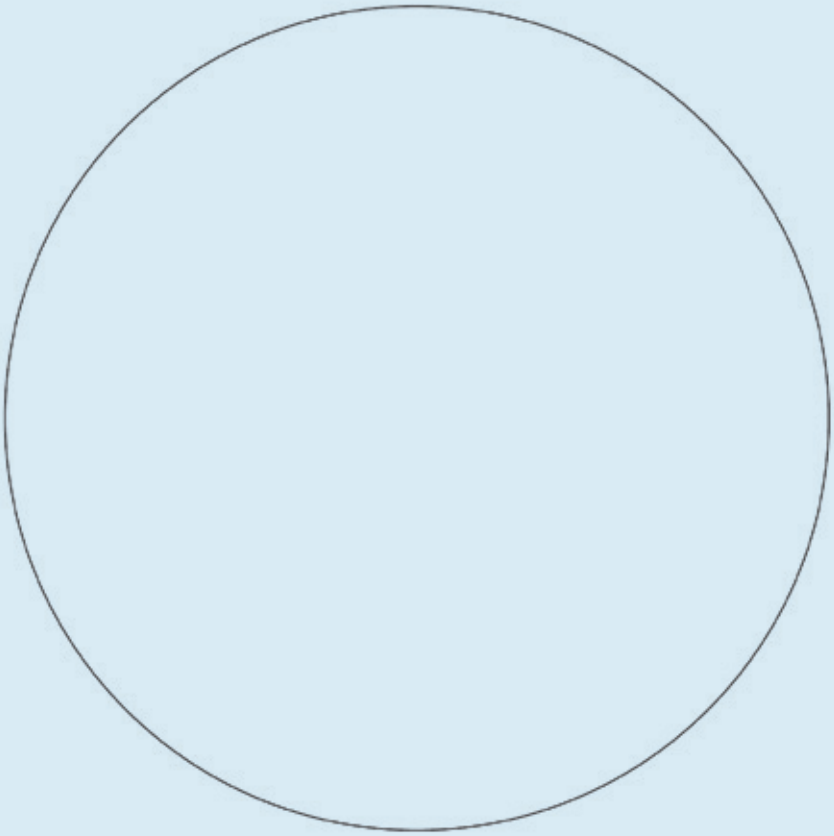
What to do

1 Work out how many litres of water a day the average person uses for each of the following: flushing lavatories; baths/showers; washing machines; drinking.

2 Draw a pie chart to show the main uses for water in the home using the percentages given to the left.

Example of a pie chart





Activity Sheet 4

How we use water

Test your knowledge on water use ...

How much water do you think is needed to make each of these everyday items? Don't forget things that are included like packaging and growing.

(Figures taken from www.waterfootprint.org product gallery] 2009)

Q1 An average size car

a. 1,000 litres

b. 12,000 litres c. 148,000 litres

Q2 One slice of bread

a. 1 litre

b. 25 litres c. 40 litres

Q3 One A4 sheet of paper

a. 0.5 litres b. 10 litres c. 17 litres

Q4 One bottle of water

a. 1 litre b. 7 litres c. 9 litres

Q5 A takeaway coffee

a. 2 litres

b. 20 litres c. 200 litres

Q 6 One beefburger

a. 27 litres

b. 200 litres c. 2,400 litres

These are other everyday things that use surprising amounts of water...

30 litres - cup of tea

5,000 litres - 1kg cheese

2,700 litres – cotton shirt

1,500 litres – 1kg cane sugar

1,000 litres – 1 litre of milk

15,500 litres – per kg of beef

3,900 litres – per kg of chicken

Activity Sheet 5

Understanding filtration

Treating water

These two experiments show the effect of filters.

Experiment 1

Can be done at home.

What you need:

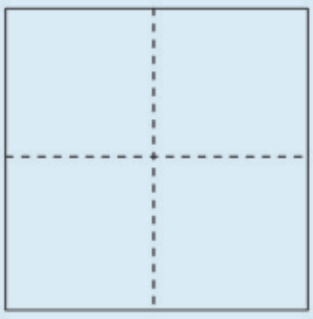
- the top of a plastic bottle
- some kitchen roll paper or coffee filter papers
- a beaker of muddy water
- a cup or glass

What you do:

1 Shake or stir the muddy water to mix it up well.

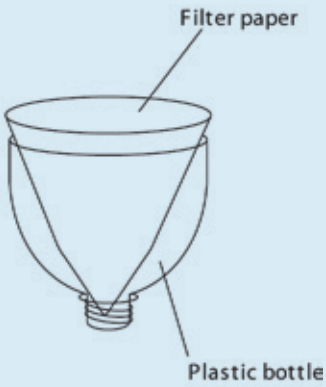
2 Fold the paper (fig 1) to fit the plastic bottle, or use the coffee filter.

Fig. 1



Square of kitchen roll

Fig. 2



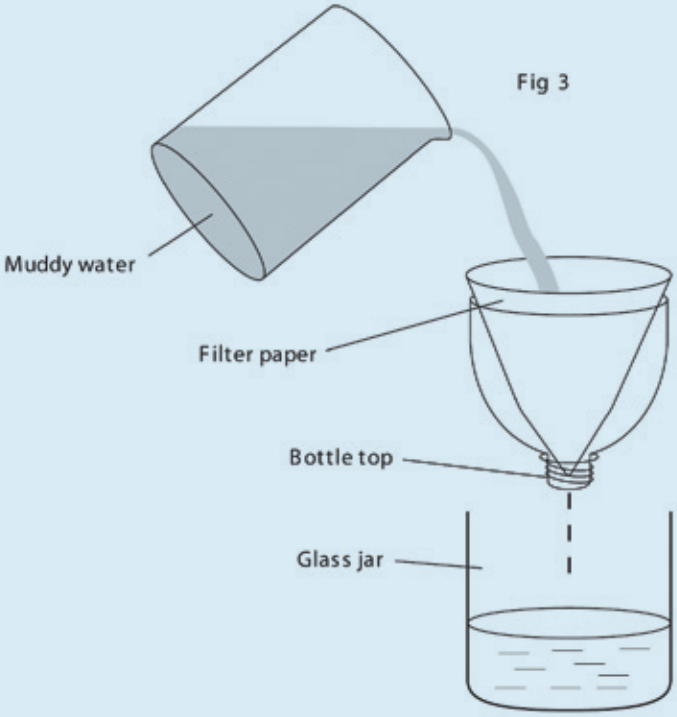
3 Place the filter paper in the plastic bottle (fig 2) and hold the funnel over the cup or glass (fig 3).

4 Filter the muddy water by pouring it through the filter paper as shown below.

5 What stays behind in the filter paper?

6 What goes through the filter paper into the beaker?

Fig 3



Activity Sheet 5

Understanding filtration

Experiment 2

Is best done in school

What you need:

•3 samplesofmuddywater(identical)

• 2 funnels

• fine sand, gravel, small stones, largestonesorwiremesh

• alum crystals (aluminium sulphate)

The method

One of the samples will be filtered, the second will be treated with chemicals and then filtered. The third sample is for you to compare with the other two.

What you do:

1 Make two filters using funnels.

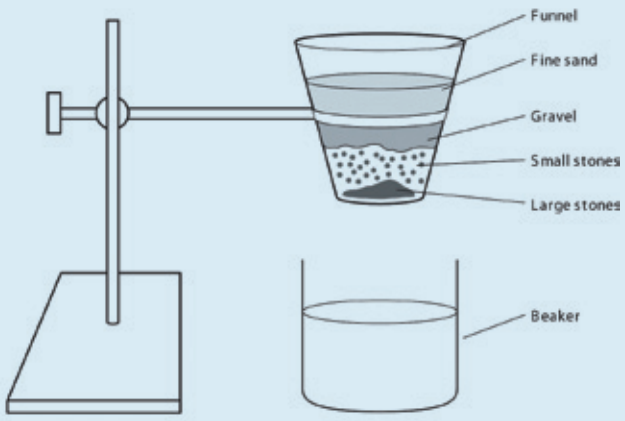
2 Put a large stone or a piece of wiremesh in the bottomof each funnel.

3 Add a layer of small stones, one of gravel and, finally, a layer of fine sand.

Remember to wash the sand, gravel and stones before you put themin.

4 Make up a solution of alumcrystals in water. (Wash your hands afterwards!)

Now you are ready to begin.



5 Add some of the alumsolution to one of your samples ofmuddy water and stir it in.

6 Wait a fewminutes.

7 Write down what you see happening to the water.

8 Now pour this treated water into one filter, and a sample ofmuddy water intothe other one.

9 Wait until the water samples have filtered through.

10 Compare the filtered samples with each other and with themuddy water.

(Don't drink any of the water!)

11 What do your results tell you?

Activity Sheet 6

How much water do you use each day?

Use Fact Sheet 8 to help you complete this.

Write down the activities you do every day involving water. Look up the amount of water used for each activity. Write down the number of times you do each activity per day.

Total all these up to work out if you are a water waster or a water saver? Do you use more than average or less than average?

Name _____

I USE WATER TO...	NUMBER OF TIMES PER DAY		NUMBER OF LITRES USED PER ACTIVITY		TOTAL USED
List the things you do that use water	Write down the number of times you do these things in one day		Write down the number of litres that are used for each activity		Multiply the number of times per day by the number of litres used per activity
Example: Have a shower	2	x	30	=	60
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
				Grand total used in one day