



**Scottish  
Water**

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## Second level

### Description of module

This module looks at the practicalities of laying down water and waste water pipe systems. The first two activities are intended to establish some background information. The main activity is a practical decision-making challenge about locating pipes, with due regard to environmental and cost issues. This activity requires some low cost items to be available to pupils.

### Main experiences and outcomes

#### **Expressive arts**

I have experienced the energy and excitement of presenting/performing for audiences and being part of an audience for other people's presentations/performances.

[EXA 2-01a](#)

#### **Health and wellbeing**

Opportunities to carry out different activities and roles in a variety of settings have enabled me to identify my achievements, skills and areas for development. This will help me to prepare for the next stage in my life and learning.

[HWB 2-19a](#)

#### **Literacy and English**

When I engage with others, I can respond in ways appropriate to my role, show that I value others' contributions and use these to build on thinking.

[LIT 2-02a](#)

As I listen or watch, I can make notes, organise these under suitable headings and use these to understand ideas and information and create new texts, using my own words as appropriate.

[LIT 2-05a](#)

I can select ideas and relevant information, organise these in an appropriate way for my purpose and use suitable vocabulary for my audience.

[LIT 2-06a](#)

When listening and talking with others for different purposes, I can: share information, experiences and opinions, explain processes and ideas, identify issues raised and summarise main points or findings, clarify points by asking questions or by asking others to say more.

[LIT 2-09a](#)

#### **Sciences**

I have investigated different water samples from the environment and explored methods that can be used to clean and conserve water and I am aware of the properties and uses of water.

[SCN 2-18a](#)

#### **Social studies**

I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally-responsible way.

[SOC 2-08a](#)

I can consider the advantages and disadvantages of a proposed land use development and discuss the impact this may have on the community.

[SOC 2-08b](#)

#### **Technologies**

Having evaluated my work, I can adapt and improve, where appropriate, through trial and error or by using feedback.

[TCH 2-14b](#)

Having analysed how lifestyle can impact on the environment and Earth's resources, I can make suggestions about how to live in a more sustainable way.

[TCH 2-02a](#)



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## Activity 1

### Learning intention

- To revise, or introduce, the main facts about household water supply process.

### Success criteria

- Pupils are able to contribute to the discussion of the text – and get the answers right!
- Alternatively, pupils can draw a diagram to illustrate the main points.

## Suggestions for teachers

This is a basic comprehension activity, which can be done straight, or more interactively. It will be needed if no previous work has been done on water.

### 1 What do we know?

Give out resource sheet 1 to each group of pupils. Ask pupils 'what do we know about water?' and 'where does it come from?', then fill in the gaps with the facts. Show resource sheet 2 and 3. Check pupils have understood the key points.

### 2 Follow-up

Alternatively, or as a follow-up, pupils could do the exercise individually and write the answers.

### 3 Label a diagram

Pupils could show understanding by drawing a schematic, labelled diagram of water's journey from source to home.

The main features are:

- water source in a hilly area
- river
- reservoir/dam
- water treatment works
- water mains under-ground
- houses, schools and businesses





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## Activity 2

### Learning intention

- To give the pupils background information about clean and waste water pipe networks. This is background information the pupils will need before the more active work that follows.

### Success criteria

- These are dependent on which variation of the activity is chosen. Simple completion of the quiz would be adequate for the first suggestion, otherwise:
- Pupils are able to explain their section of text clearly to the rest of the group.

## Suggestions for teachers

### 1 True or false?

Give out resource sheet 4 to groups and ask pupils to circle the correct answers to the questions. Show resource sheets 5 and 6 on the whiteboard. This exercise can be done individually, as is quite undemanding. Alternatively, the true/false activity on resource sheet 4 could be done orally, as a class, after the main text has been read and discussed.

### 2 Explain to the group

More challengingly, instead of displaying the text of resource sheets 5 and 6 on a whiteboard, groups of four pupils could study it. Each pupil could take a quarter of the text:

**Pupil 1:** The water supply pipe network from the beginning up to "... not damaged by frost"

**Pupil 2:** The water supply pipe network from "Where the pipe enters your home..." to the end of the page

**Pupil 3:** The waste water pipe network from the start of the page to "...goes down the drain"

**Pupil 4:** The waste water pipe network last two paragraphs

Each pupil could be tasked with explaining their section to the rest of the group, and explaining what the diagram shows. They are allowed to make notes beforehand, but must not simply read back the sheets or their notes to their colleagues. You could set a limit of five words only that pupils are allowed to refer to as prompts: a good note-making skill.

It is also valuable to have one member of the group as a Chair, to ask each pupil in turn to present their piece, and to thank each afterwards.





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## Activity 3

### Learning intention

- To give pupils a basic understanding of the water distribution network and some of the challenges that need to be overcome

### Success criterion

- Pupils complete and present their own models of a water distribution network

## Suggestions for teachers

Before the activity starts, recap the journey of water from rivers, reservoirs and underground sources, to water treatment works and through a network of pipes to houses, schools and businesses.

Ask the class about some of the difficulties involved in moving water, e.g. moving water uphill, avoiding digging up areas of natural beauty and major roads to lay pipes.

### 1 Drawing maps

Using large sheets of paper (A1 if available), pupils draw their own maps. One corner should be coloured blue to represent the reservoir. A rectangle in the middle represents the water treatment works. Houses, schools and businesses etc. are located in the corner diagonally opposite the reservoir. Roads are added connecting the settlement to other areas off the edge of the paper. Pupils add patches of green to represent woods and other areas of natural beauty (but not so large that they cover the area entirely).

### 2 Building the pipe network

Pupils stick straws representing pipes coming from the reservoir, going to the water treatment works and on to the settlement. The straws must not bend, though they can be cut, and all joins must be at right angles. Roads and green areas must be avoided if possible.

### 3 Cost

Teachers may choose to introduce the issue of cost to show the level of financial investment required to build a water network, and to link to work in numeracy. Each pipe could be given a nominal cost of say £1000, but pupils should be made aware that in 'real life' laying down water pipes costs a lot more.

### 4 Recap main points

At the end, the teacher can emphasise the main points about the importance of having a water distribution network. How does our efficient water infrastructure compare with the situation of many countries in the developing world? This can lead on to further work contrasting people's access to safe water in the developed and developing worlds (link to the role of WaterAid).

Pupils can present their water network models to the class and explain how successful, or not, they were in avoiding roads and woods. Why is it important to try to avoid laying pipes across major transport routes and through the countryside?

If the pipes were costed, how much did each network cost in total? Who designed the cheapest and the most expensive networks? Can pupils explain the differences in cost?



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## Resource sheet 1

### Water, all the way from the hills to your home

- 1 What do we call a natural or man-made loch which stores water for us?
- 2 Which areas of the country get the most rainfall?
- 3 Why is the dam made of thick, strong concrete?
- 4 Why does the water in a reservoir need to be cleaned?
- 5 Give an example of a natural loch that is used as a reservoir.
- 6 Some rocks are very good at soaking up water and holding it like a sponge. Name two of these kinds of rocks
- 7 How do we get water out of an aquifer?
- 8 Where is water made safe and clean?
- 9 What are the big pipes called, the ones that take water from the treatment works?



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## Resource sheet 2

### How is water collected for us to use?

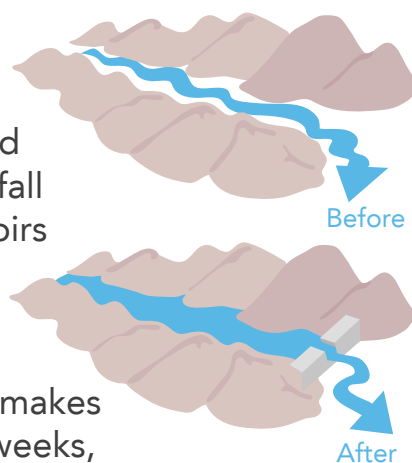
1

It is easy to turn on the tap to get clean water, but a lot of things have to happen to allow us to do that.

First of all, water has to be taken away from its natural cycle.

Most of the water used today is collected and stored in man-made or natural lochs called reservoirs. Rainfall is highest in hilly areas, so this is where most reservoirs are.

Reservoirs are made by building a dam across the upper part of the river. The water then collects and makes a huge loch. So, even if it does not rain for several weeks, there will still be water available.

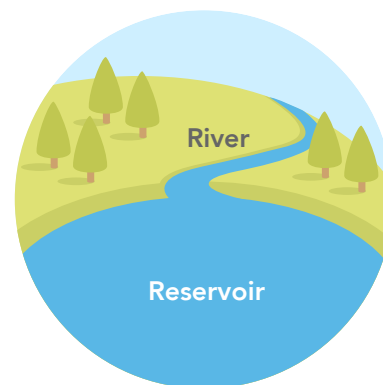


2

The dam has to be made of very strong, thick concrete to hold back the huge amount of water behind it. The amount of water flowing through the dam is controlled by opening and closing valves.

The Scottish Environment Protection Agency (SEPA) set minimum compensation flow rates from the dam to protect the environment such as fish, wildlife and plants downstream.

The water in the reservoir needs to be cleaned before it is ready for us to drink. The river has carried lots of bits of grit and dirt down with the water. Some of this grit and dirt will sink to the bottom of the reservoir as silt. This happens because the water in the reservoir is deep and still. The rest is removed at the water treatment works which makes the water clean and safe to drink.





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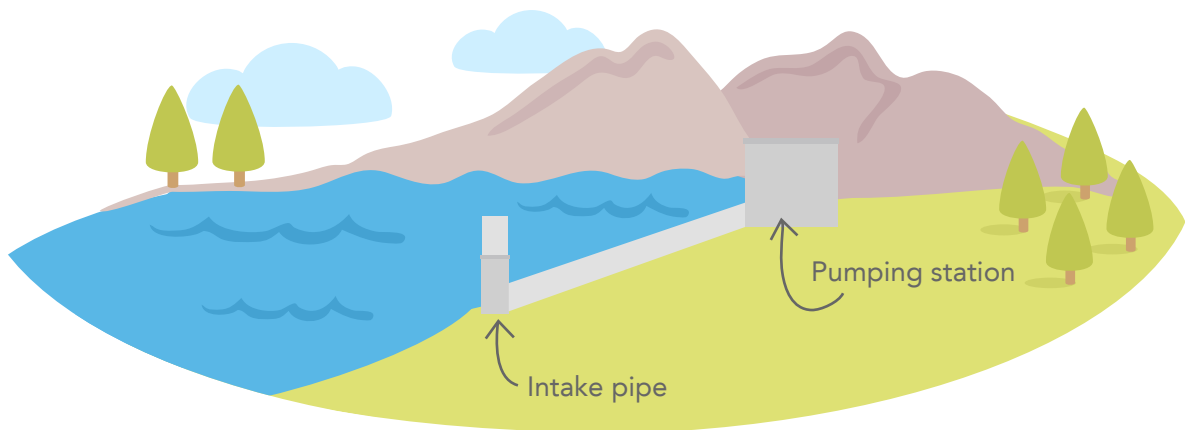
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## Resource sheet 3

### How is water collected for us to use?

1

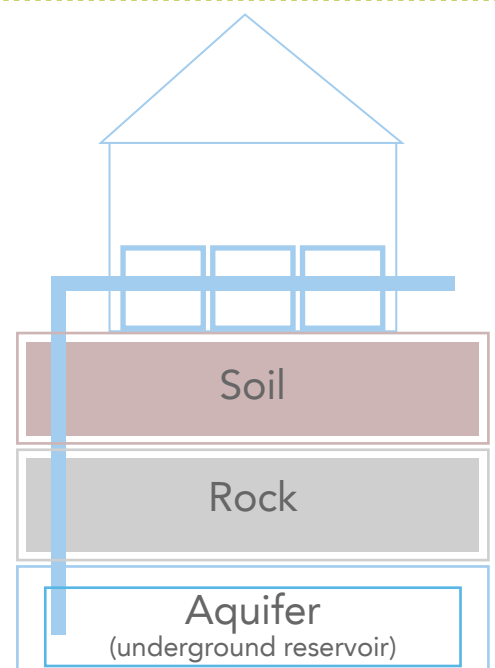
Sometimes we take water from natural lochs like Loch Lomond.



Sometimes a reservoir forms naturally underground. Rainwater soaks into the ground and through the rock below. It happens where there are rocks like chalk and limestone. They soak up a lot of water. They are a bit like underground sponges. The water then collects in a space between layers of rock. We call this an aquifer.

2

We collect water from the aquifer by drilling boreholes in the rock. The water is then pumped out. Wherever we get it from, all water must go to the water treatment works to be made safe and clean before it is piped to our taps. When clean water leaves the water treatment works it travels through large pipes called water mains which are buried underground. There is a water main under the road near your house and the water in your tap comes through a water supply pipe from that water main.





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## Resource sheet 4

### Pipe networks quiz

Are these statements true or false? Circle the answer.

**1** Water is delivered through the water mains network by pressure?  
**True**    **False**

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**2** Scottish Water put their large water storage tanks at a low level.  
**True**    **False**

---

**3** Drinking water enters a house through a pipe called the water supply pipe.  
**True**    **False**

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**4** The flow of water in the water supply pipe is controlled by a stop cock which can be found on the street corner.  
**True**    **False**

---

**5** The communication pipe takes the water from the main pipe to your home.  
**True**    **False**

---

**6** You pull a lever in the house to control the water supply to your home.  
**True**    **False**

---

**7** The cold water storage tank is usually high up or in the roof space of the building.  
**True**    **False**

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**8** The cold water storage tank supplies drinking water.  
**True**    **False**





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## Resource sheet 5

### The water pipe network

- 1 Water is delivered to homes through the **water mains** network by pressure.
- 2 Scottish Water get this pressure either by using gravity or pumping the water through the network. Scottish Water normally put their large storage tanks at high level so the water can flow downhill. This saves energy and keeps the cost of delivering the water through the network of pipes to the taps in your home down.
- 3 Drinking water enters your home through a pipe called the **water supply pipe**. This pipe is controlled with a **stop cock** and **water meter** (if you have one) which is found at the end of the **communication pipe**.
- 4 The **water main** is laid below ground to make sure that it is not damaged by frost.
- 5 The **communication pipe** takes the water from the **main pipe** to your home.
- 6 Where the **water supply pipe** enters your home, usually in the kitchen, it is fitted with a **stop valve** which controls the water coming in from the **water main**.

The diagram below shows which of the pipes around a home Scottish Water and the homeowner are responsible for.



| Water and waste pipes |                          | Responsibility |
|-----------------------|--------------------------|----------------|
| ①                     | — The water supply pipe  | Homeowner      |
| ②                     | ✕ Stop valve             | Homeowner      |
| ③                     | — Private drain          | Homeowner      |
| ④                     | ● Stopcock/meter         | Scottish Water |
| ⑤                     | — The communication pipe | Scottish Water |
| ⑥                     | — The water main         | Scottish Water |
| ⑦                     | — Sewer                  | Scottish Water |



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## Resource sheet 6

### The waste water pipe network

Waste water is anything which flows through a sewer including bath water, industrial waste and toilet waste. Rain water from the roads, roofs and gardens is known as surface water.

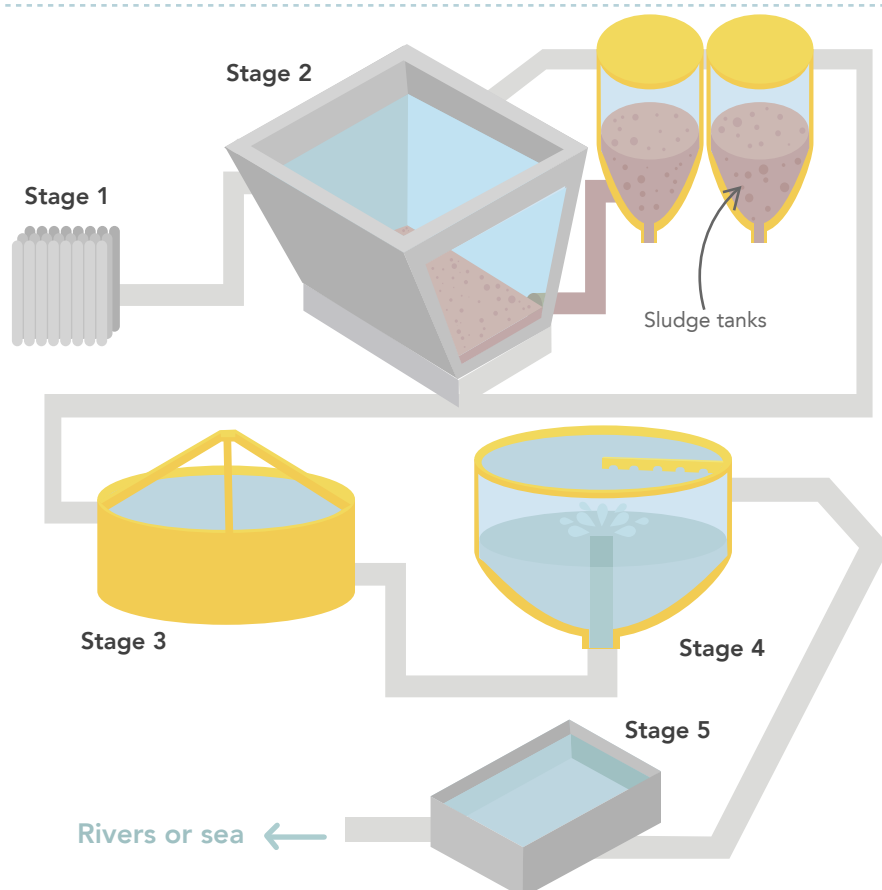
The more clean water we use, the more dirty water we produce.

So that the natural environment can be protected and to control the possible spread of waterborne diseases, waste water is treated by Scottish Water before it is returned to the environment.

From your home, the dirty water flushed down the toilet, wash hand basin and kitchen sink all goes into the private drain.

This private drain carries the water through to the public sewer which takes it to the waste water treatment works.

Underneath every road and street there is a network of sewers, pipes and pumps that carry waste water to where it can be treated and returned to the environment. Sewers vary in diameter.



#### The five stages of waste water treatment

**Stage 1:** Screens trap rubbish like rags, bits of wood and plastic.

**Stage 2:** Stones and grit are removed so they don't damage machinery.

**Stage 3:** The waste water rests in these tanks where any solids in the water sink to the bottom. The solids make a slimy mud called sludge. The sludge is pulled out into other tanks to be treated and made harmless. It can be used to make the soil better for growing plants or for burning to make electricity.

**Stage 4:** Good bugs (bacteria) grow in the tanks. They eat up any chemicals and other waste which could harm plants and animals.

**Stage 5:** The waste water is allowed to rest again. Large stirrers gently mix the liquid and the left over bits sink to the bottom of the tank.

Now that the treated waste water is much cleaner, it can be poured back in the river or the sea.