

Catchments and water cycles

» Lesson overview

In the previous lesson, students learned about their local catchment and local water sources. In this lesson, students learn about the water cycle, particularly as it applies to their local catchment. The natural water cycle and the water cycle with human impacts are compared; the human impacts on catchments are discussed. The students explore what happens when water changes state from liquid to gas and from gas to liquid. Refer to *Background Information for Teachers*, available at www.nrw.qld.gov.au/waterwise/education/units/teacher_background.html, for a general discussion of water treatment processes.

» Lesson objectives

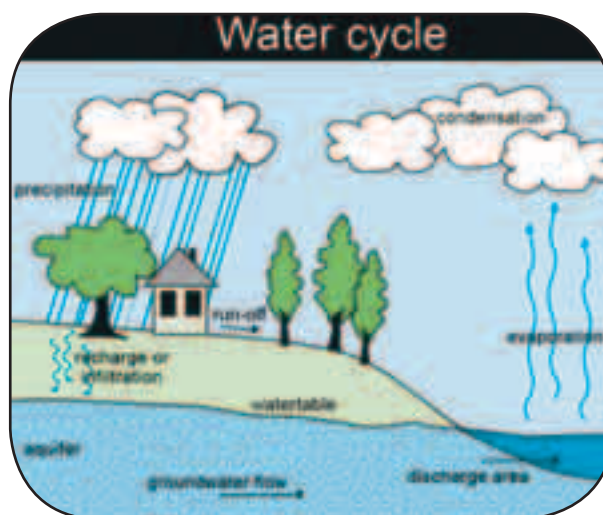
In this lesson, students:

- explore and outline the processes of the natural water cycle and the 'water cycle with human impacts' in their local area
- create a concept map of their local water cycle, including the human impacts.

» Preparation

Customise the information in 'The water cycle with human impacts (Concept map)' (Resource 7) to reflect the local water treatment process, or the water treatment process of a larger town or city with which the students are familiar. Contact the water management staff at the local council for this information. Add the names of the dams, water treatment plants, rivers and so on.

Recycled water and purified recycled water will become increasingly important, and the sharing of available water resources will assist in overcoming some of the complications and issues surrounding increased urban demand and climate variability.



» Equipment

For the class

- enlarge or make an overhead transparency of 'The water cycle' (Resource 6)
- enlarge or make an overhead transparency of 'The water cycle with human impacts (Concept map)' (Resource 7)

For each team

- a copy of 'The water cycle with human impacts (Concept map)' (Resource 7)
- an extra sheet of paper or card for arrows between cards
- scissors (to cut card)
- one A3 sheet of paper

» Lesson steps

1. Ask the students to recall how water flows through their catchment. Discuss how much of the water enters the catchment as rain. Some water enters the catchment as groundwater, which has previously entered the aquifer as rain that fell in a recharge area somewhere else.



Transpiration is the movement of water through plants. Plants take up most of the water they need from the soil through their roots. The water is sucked up through the plant and much of the water then escapes through tiny pores (stomata) in the leaves.

2. Where did the rain come from? Add the ideas to the 'what we think we Know' column in the KWL chart you began in Lesson 1. Ask the students for questions to add to the 'what we Want to learn' column.
3. Discuss how rain falls from clouds, and how clouds form by evaporation from water bodies such as oceans and lakes. Show students this simple diagram, or draw a version on the board, one step at a time. Ask students to explain why the diagram is called a 'water cycle'.
4. Make the link between the water cycle in the diagram and the water cycle in your catchment. Where does the rain fall? Where do the rain clouds come from? Discuss how water vapour condenses when it cools down. Where did the evaporation that formed the clouds take place? Discuss the fact that the water cycle takes place on a scale that is much larger than just one catchment.
5. Show students the diagram on 'The water cycle' (Resource 6). What new information does this diagram provide about how water cycles through a catchment?

» Optional activity

Select a clear plastic bag that has no holes in it and fasten it to a leafy branch, closing it with a tie. Leave the bag on the tree for a day to investigate the effects of transpiration. Exotic trees generally transpire greater volumes of water than native trees. You should get a small puddle of water in the bottom of the plastic bag. (This works better in summer months.) Explain that water transpired from plants is also part of the water cycle.

6. Ask the students to identify in the diagram the human impacts on the water cycle. They could talk about the dam, which creates an artificial lake. Focus on the impacts that the city would have on the flow of water through the water cycle. What are the effects of prolonged drought on the flow of water through this system? Discuss the impact that recycling projects, such as the Western Corridor Water Recycling Project and desalination projects, that South East Queensland might have on the cycling of water through the system (Refer to *Background Information for Teachers*). The benefits of rainwater tanks and greywater reuse can also be highlighted. This is another opportunity to add any new strategies for managing your local water resources sustainably.
7. Divide the students into teams of three. Explain that they are going to create a concept map showing the different parts of the water cycle with human impacts for your local area, including various parts of the area's infrastructure (Resource 7).

Students cut out the boxes in Resource 7, and draw and cut out arrows to link the terms to form a concept map. On each arrow, students show the relationship between the boxes.

8. The students can move the terms around until the team is happy with the arrangement. You might need to model this process for the students with three or four basic terms such as 'precipitation', 'bulk storage dam', 'home, business or industry' and 'sewage' to get them started on the task.

Information included in Resource 7

Bulk storage dam	Sewage
<ul style="list-style-type: none"> › The water that falls in the dam catchments runs into the dam and is caught behind the dam wall. 	<ul style="list-style-type: none"> › Household and industrial waste, known as sewage, is transported (via pipes) to a sewage treatment plant.
Bore water/groundwater	Evaporation
<ul style="list-style-type: none"> › Some areas need groundwater, which is supplied through construction of a bore. 	<ul style="list-style-type: none"> › Water evaporates into the atmosphere and rises, eventually cooling to form clouds.
Sewage treatment plant	Stormwater drains
<ul style="list-style-type: none"> › Water that is used in the home, industry and city businesses is treated for release into the creek or ocean. 	<ul style="list-style-type: none"> › Stormwater runs into drains and is piped to a waterway or the ocean.
River for discharge	Home, business or industry
<ul style="list-style-type: none"> › Treated water (effluent) is discharged into creeks, rivers or the ocean. 	<ul style="list-style-type: none"> › Water is piped from the water treatment plant to homes, businesses and industry.
Water recycling	Precipitation
<ul style="list-style-type: none"> › Treated recycled water is used for a range of agricultural and industrial purposes such as power stations. 	<ul style="list-style-type: none"> › When rain falls, it may be harvested in catchments as run-off into the dams that provide communities with a water supply.
Water treatment plant	Waterways
<ul style="list-style-type: none"> › Water is piped from dams to water treatment plants and treated for drinking. 	<ul style="list-style-type: none"> › Water in catchments flows down creeks and rivers and into the sea.

9. The students then add the arrows and write linking terms on them. For instance, on the arrow linking 'Precipitation' and 'Bulk storage dam', you could add the term run-off. This task provides an excellent opportunity to check the students' understanding of the terms and the water cycle process.

10. When the teams complete their arrangements of terms and arrows, check their concept maps. Ask the team Speaker to justify their team's reasoning. Identify any misconceptions and discuss with the team. Once you have checked the concept map, the students can glue their terms and arrows on a blank sheet of A3 paper.

Encourage students to add graphics to their concept map to give it a local identity. They could:

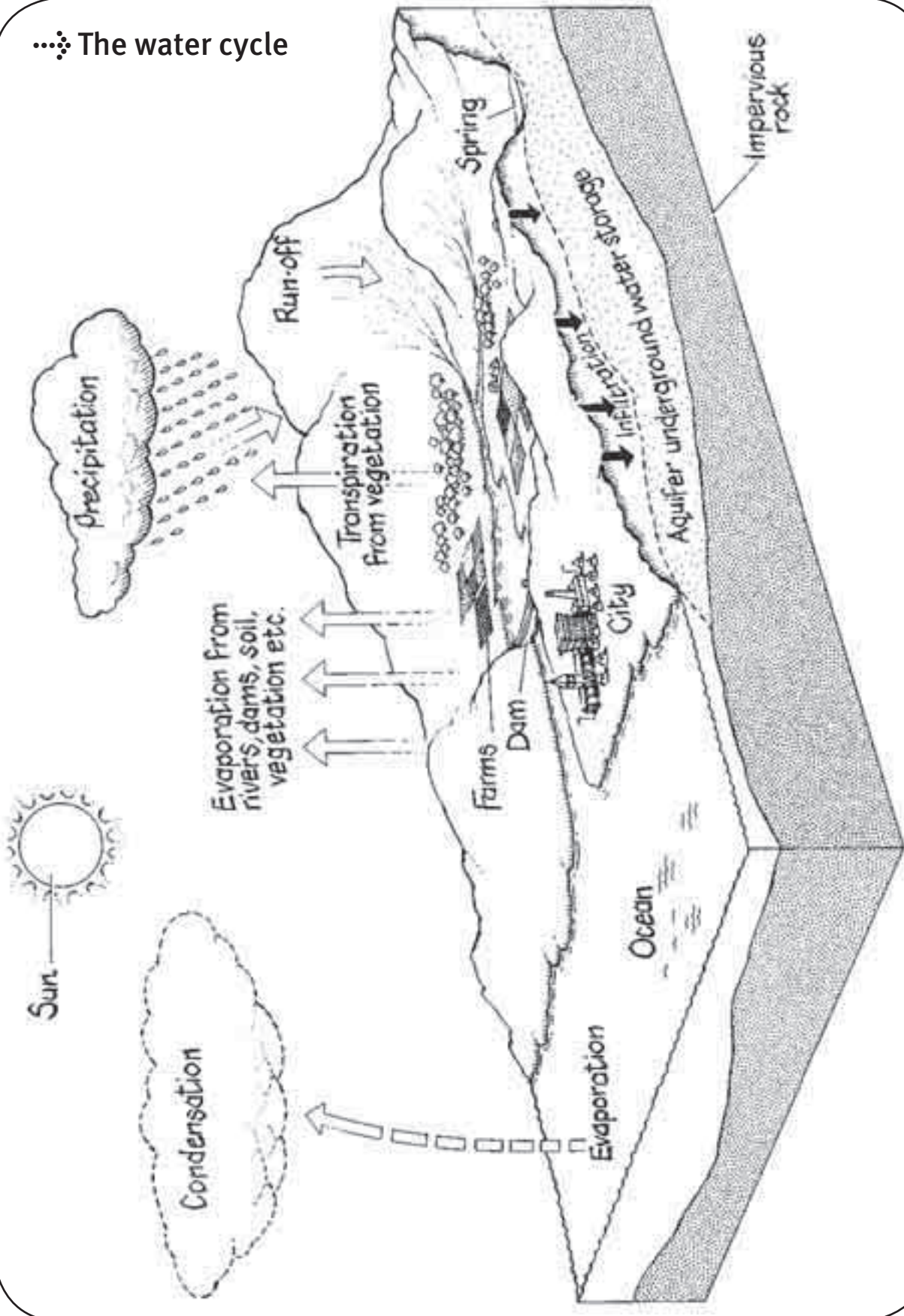
- sketch a simple map of the local river catchment
- make a collage
- add photographs
- draw local landmarks.

11. The Speaker from each team explains their concept map to the rest of the class. Lead the whole-class discussion to resolve any differences of opinion that arise about the water cycle.

12. Ask the students to record in their journals their explanation of how the water cycle works in their catchment and beyond.

Resource 6

❖ The water cycle



Resource 7

❖ The water cycle with human impacts (Concept map)

Bulk storage dam

- › The water that falls in the dam catchments runs into the dams and is caught behind the dam wall.

Bore water/groundwater

- › Some areas need groundwater, which is supplied through construction of a bore.

Sewage treatment plant

- › Water that is used in the home, industry and city businesses is treated for release into waterways or the ocean.

River for discharge

- › Treated water (effluent) is discharged into creeks, rivers or the ocean.

Water recycling

- › Treated recycled water is used for a range of agricultural and industrial purposes such as power stations.

Water treatment plant

- › Water is piped from dams to water treatment plants and treated for drinking.

Sewage

- › Household and industrial waste, known as sewage, is transported (via pipes) to a sewage treatment plant.

Evaporation

- › Water evaporates into the atmosphere and rises, eventually cooling to form clouds.

Stormwater drains

- › Stormwater runs into drains and is piped to a waterway or the ocean.

Home, business or industry

- › Water is piped from the water treatment plant to homes, businesses and industry.

Precipitation

- › When rain falls, it may be harvested in catchments as run-off into the dams that provide communities with a water supply.

Waterways

- › Water in catchments flows down creeks and rivers and into the sea.