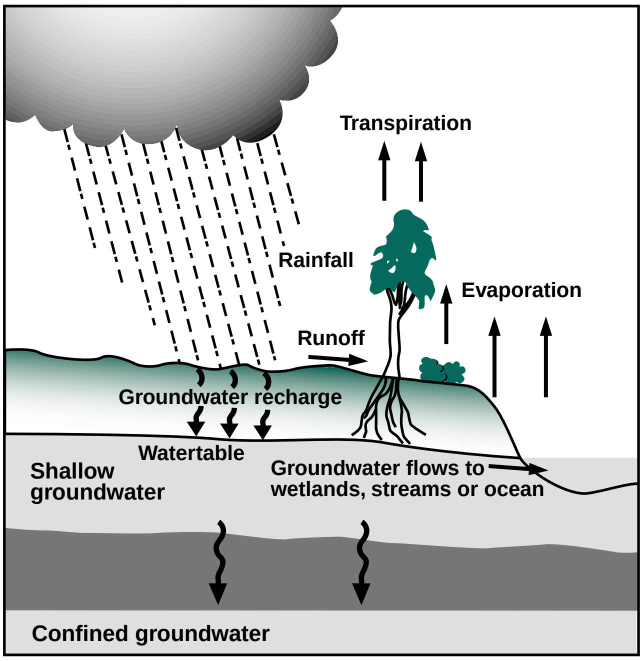
Water facts 8

GOVERNMENT OF WESTERN AUSTRALIA
WATER AND RIVERS COMMISSION DECEMBER 1998

What is groundwater?

Groundwater is the most important source of water for West Australians, supplying about 60 per cent of Perth's water and over eighty rural towns and communities, as well as the mining, pastoral and horticultural industries. Groundwater maintains wetlands on the coastal plain, and carries the dissolved salts that cause the dryland salinity problem. Understanding and managing groundwater are important for conservation of the environment and to protect future water supplies.

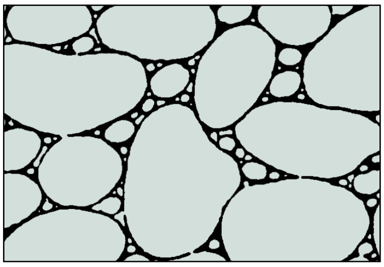
Groundwater is water that occupies the pores or crevices of soil or rock.



Many of Perth's lakes and swamps are surface expressions of the groundwater.

Rain that falls on the land evaporates, runs off into streams and rivers and eventually returns to the ocean, or soaks into the ground. Rainfall which soaks into the ground is not lost. What is not used by plants, and returned to the atmosphere by evapotranspiration, adds to the groundwater, moving slowly along the direction of groundwater flow to eventually reach the sea (see Water Facts 7: The water cycle).

Water stored beneath the ground



Some people picture groundwater as an underground lake but in reality the water is held in the pore spaces and fractures of soil and rock.

Sandy soils around Perth may contain from 10% to 35% by volume of water.

You can see how groundwater is formed by this simple experiment. Put clean gravel or marbles in a transparent container such as a glass jar. Slowly add water. You can see how the water occupies the spaces between the particles.

Groundwater accumulates very slowly. Some of the deep groundwater below Perth is over 40 000 years old, and groundwater in the centre of the state may be hundreds of thousands of years old.

Under natural conditions groundwater moves very slowly, a few metres to tens of metres each year. The water generally flows downhill under the influence of gravity, moving from where the rainfall soaks into *(recharges)* the groundwater, in some cases into wetlands and rivers, and eventually out to sea. It may also seep upward under pressure.

The watertable

The level of groundwater

The watertable is the saturated level of the groundwater.

The water in the gravel in your experiment will reach a certain level in the jar. Below this all the spaces are full of water. This is called the *saturated zone.*

The *watertable* is the top of the saturated zone. The water beneath the watertable is groundwater. The depth to the watertable varies according to location, season, and long-term climate variations.

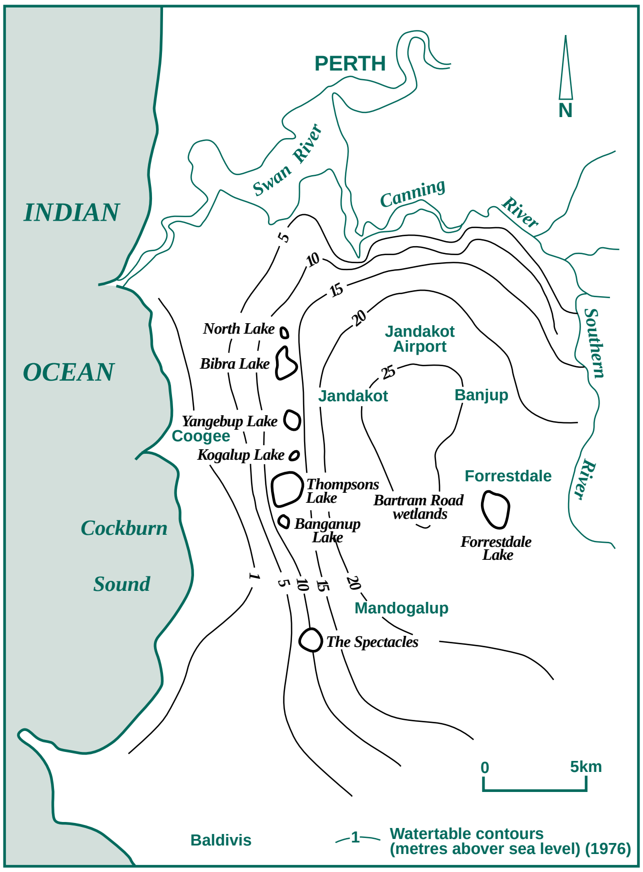
It may be damp for a short distance above the watertable. Some of the pore spaces are filled with water and some with air. This is the *unsaturated zone.*

Using information from bores drilled over a wide area, a picture of the *regional watertable* can be drawn. The watertable in some places is a toned-down reflection of the surface contours or topography. The watertable is highest under hills and this height difference makes the water flow downhill. In other areas the watertable can be quite independent of the surface topography.

The shape of the watertable may also be affected by the geology. For example, in sandy sediments around Perth, the watertable follows the surface contours, but in the coastal limestone belt the watertable drops rapidly to near sea level because the groundwater can move faster through the limestone.

Groundwater mounds

In areas of deep sand on the coastal plain, where recharge from rainfall is high, water may form a *groundwater mound.* It is called a mound because the watertable slopes away from a high central area. An example is the Gnangara Mound in the sand and limestone soils to the north of Perth. The watertable is 70 metres above sea level at its highest point, and the water flows outwards to the ocean and rivers. The Gnangara Mound stores about 19 500 million cubic metres of water — over 200 times the capacity of Canning Dam. The Jandakot Mound, to the south of Perth, holds about 2700 million cubic metres and is another important water source.



Watertable contours of the Jandakot Mound.

Changes with the seasons

In the dry season (summer in southern Western Australia), the watertable drops in response to the increased rate of evaporation from soil and evapotranspiration by plants. The watertable can drop by three metres by the end of summer.

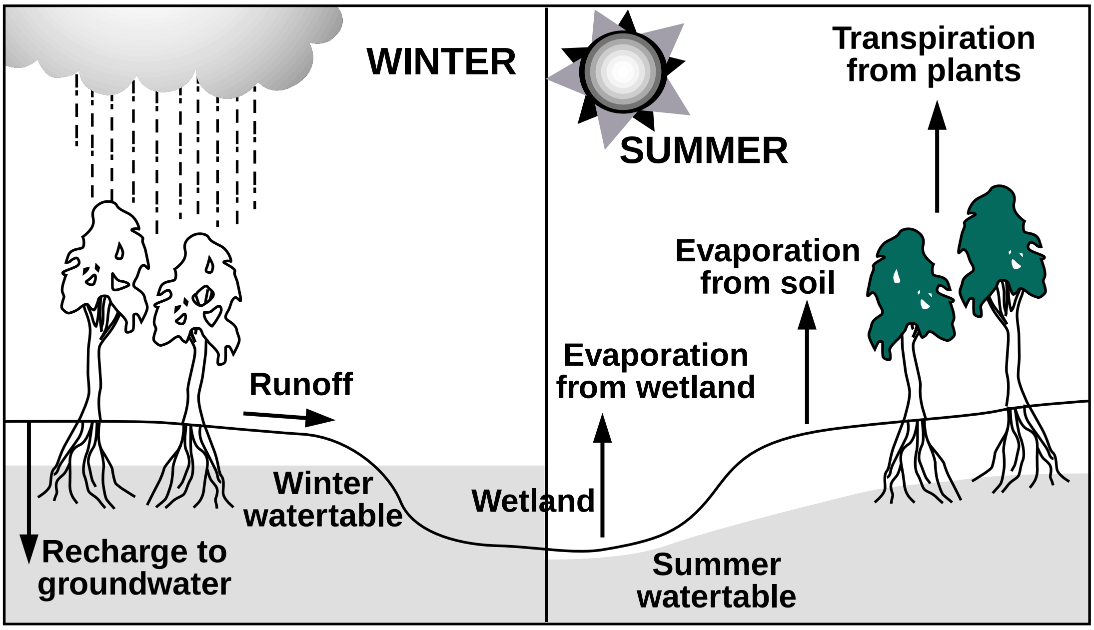
When the wet season arrives, rainfall replenishes the groundwater and the watertable rises, coming up to the surface in some low-lying areas. Many south-west wetlands are surface expressions of the watertable.

Water levels in these wetlands rise and fall seasonally with the watertable. Levels are highest in late winter and lowest in late summer. Seasonal drying is natural for many wetlands. The plants and animals have ways of coping, and drying out can be beneficial, or even necessary for some to survive.

Wetland plants and animals are adapted to normal seasonal fluctuations of the groundwater level. Larger variations can damage wetland environments and vegetation in low-lying areas.

Climatic effects

The watertable and wetlands also respond to longer-term climate trends. For example, in south-west Western Australia a long run of unusually dry years from 1976 to 1990 lowered the watertable, leaving many previously 'permanent' lakes dry.



Groundwater is held in aquifers

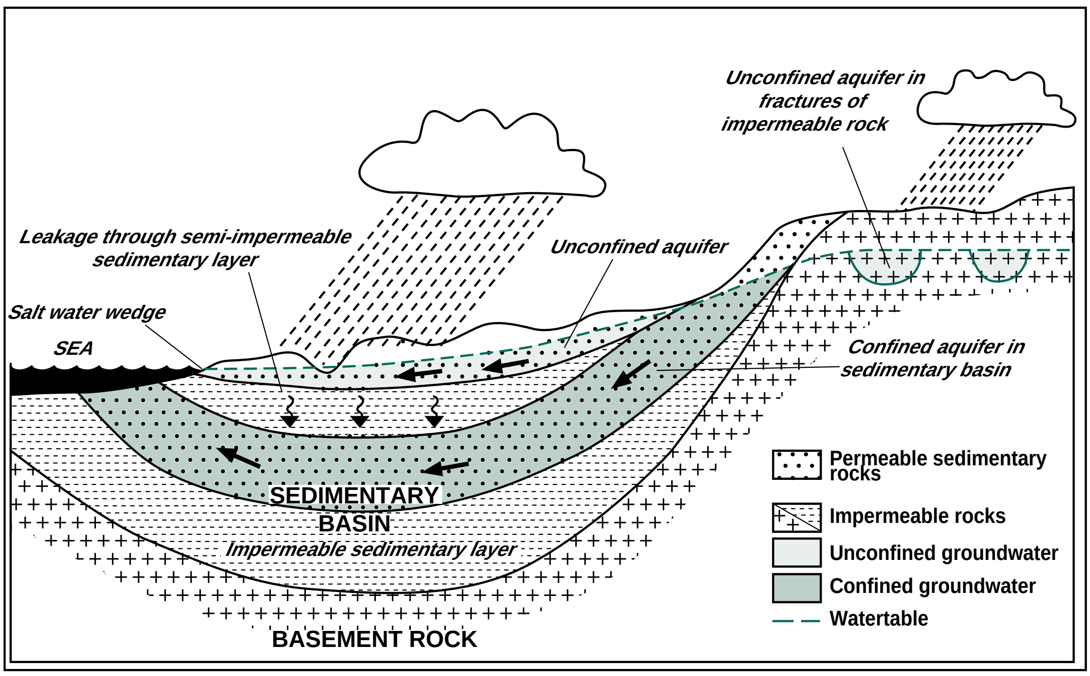
An aquifer is a geological formation or group of formations capable of storing and providing significant quantities of water.

Geological formations that are good aquifers have highly connected pore spaces or fractures that allow water to move through at volumes high enough to produce a water supply from bores.

An aquifer close to the surface which receives direct recharge from rainfall is called an *unconfined aquifer.*

Household garden bores draw water from unconfined aquifers.

Aquifers deeper under the ground which are overlain by impermeable materials such as rock or clay that do not transmit water are called *confined aquifers.* Groundwater in confined aquifers is under pressure and the water will rise up a borehole. An *artesian flow,* where water flows out under its own pressure, may occur in low-lying areas. Confined groundwater is a very important source of public water supply.



Schematic diagram showing occurrence of groundwater.

The role of the Water and Rivers Commission

The Water and Rivers Commission manages Western Australia's water resources to enable sustainable development and maintain environmental and social values. For our groundwater resources, this involves balancing the needs of people and the environment by:

- carrying out *research, investigations and monitoring* to provide the information needed to guide planning and management
- *allocating* and *licensing* use of groundwater to make sure that it is shared fairly between users and the environment is protected
- ensuring *efficient use* of our precious resources by education and training
- *protecting* water resources earmarked for water supplies
- *conserving wetlands* and *waterways* through land use planning and management
- investigating *contamination* and *regulating land use* to protect water supplies
- supporting *community awareness* and *involvement*

Further reading

Groundwater pollution, Water Facts 10, Water and Rivers Commission, 1998.

Hydrogeology and groundwater resources of the Perth Metropolitan Area, Geological Survey of Western Australia, Bulletin 142.

The water cycle, Water Facts 7, Water and Rivers Commission, 1998.

Western Australia's groundwater resources, Water Facts 9, Water and Rivers Commission, 1998.

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This Water Facts sheet is one in a series providing information on water issues of interest to the community.

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