Groundwater

When rain falls to the ground, some of it flows along the land into surface waterways, creeks and rivers, and some seeps into the ground. The amount of water that runs off, compared to the amount that seeps into the ground, depends on the nature of the surface. In urban areas, with impermeable roads and buildings, runoff is high and only a minor portion seeps into the soil. In rural areas far more water penetrates the soil and the amount depends on the nature of the soil and vegetation.

Water that penetrates the surface initially passes through the root or soil zone. Water not used or captured by the plants seeps deeper into the ground through natural openings between the particles of unconsolidated soil-like material such as sand, gravel and silt.

Air and some water are trapped between soil particles near the surface but at increasing depth, the soil becomes more saturated. Descending water moves down and sideways. The water table lies at the depth where the ground is saturated.

Water passes through consolidated rocks made up of particles that have been fused together by pressure and heat. Some of these may be either naturally porous or fractured, for example sandstone, limestone, granite and lava.

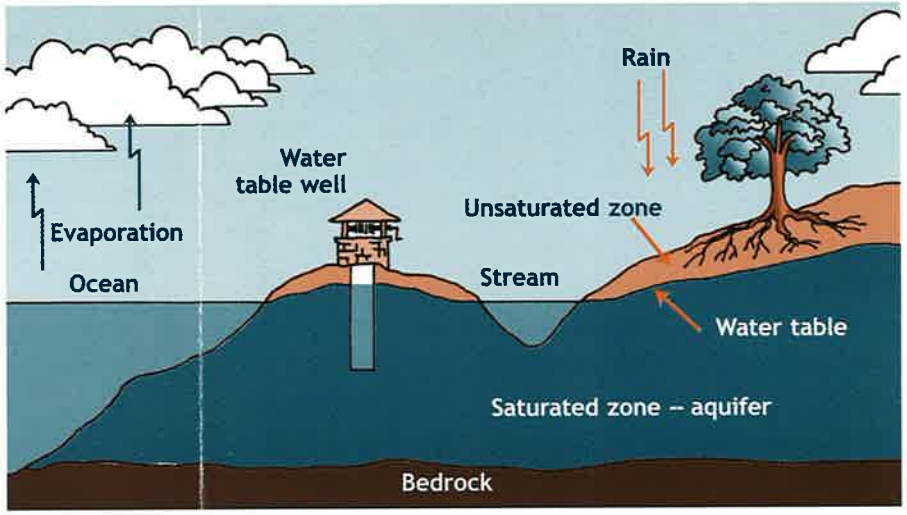
Water can move through pores in the rocks but its progress is slow, typically at a rate of several centimetres to a metre or more annually. The rate at which water penetrates depends on the size of the pores in the rocks – its porosity or permeability.

Unconsolidated material and porous rocks that contain water are called aquifers. An aquifer works like a sponge, the water being held in the tiny pores between the particles.

Unconfined aquifers

If a well is bored into an unconfined aquifer, water collects in the bottom of the well, flowing in through small holes or slits in its casing. As water is pumped out of the well, more flows in. If water is pumped out faster than it flows in, the well dries up. Water pumped out of the well lowers the water table. Such a situation can affect surface waterways. Water that was once discharging from a spring into a creek will be 'pulled' into the well.

An unconfined aquifer contains water that is at atmospheric pressure. The water table is at the top of the aquifer.

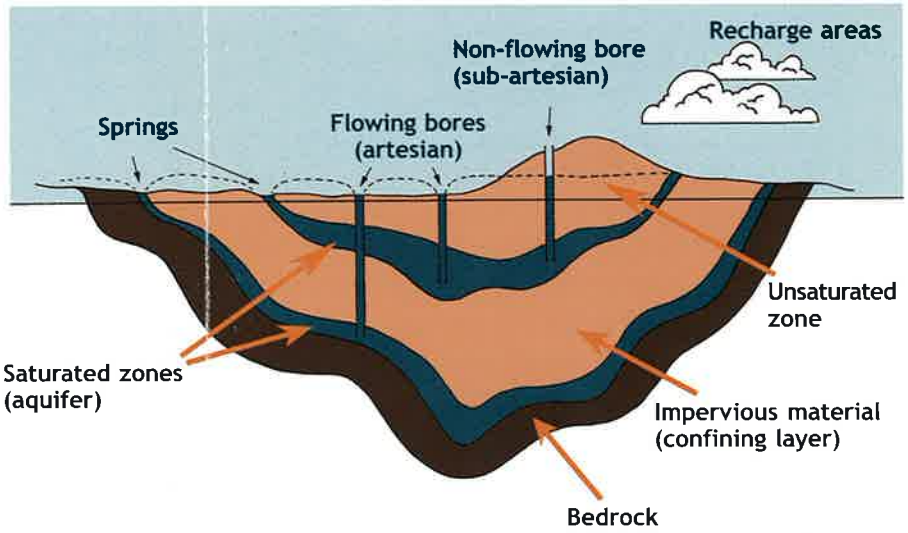


Unconfined aquifer: water is at atmospheric pressure. The water table is at the top of the aquifer.

Confined aquifers

Over the course of geological time, earth movements can create layers of impermeable rock overlying more porous rocks. Such layers are known as 'confining units'. If the layers are not level, water in the aquifer flows to the lowest point. Trapped by the upper and lower layers of impermeable rock, the water sits at pressures greater than atmospheric pressure. Such aquifers are known as confined aquifers or artesian aquifers.

When confined aquifers are bored, water will rise up the well shaft because of the artesian pressure. If the pressure raises the level of the water above the land surface the well is called an artesian well. Water will flow freely from it without pumping. If the water does not reach the surface, it is called a sub-artesian well.



Confined or artesian aquifers: trapped by the upper and lower layers of impermeable rock, the water sits at pressures greater than atmospheric pressure.

Aquifer discharge and recharge

Water may be discharged from aquifers naturally when it flows from a spring (a place where groundwater naturally comes to the surface at the intersection of the water table and land surface) into a lake or river. Water can be pumped or may flow freely from artesian aquifers.

Aquifers are recharged when water filters down through the rock or soil – this occurs naturally when it rains. An aquifer can also be recharged by spreading water over a permeable surface where it can seep into the ground or by pumping water down a well (injection). Rivers and creeks may also recharge aquifers, depending on the conditions. It is important to avoid their being contaminated by septic systems.

Salt water intrusion

If too much water has been pumped from an aquifer in a coastal zone, it may be replaced by seawater, thus making it unsuitable as a fresh water supply.

Salinity

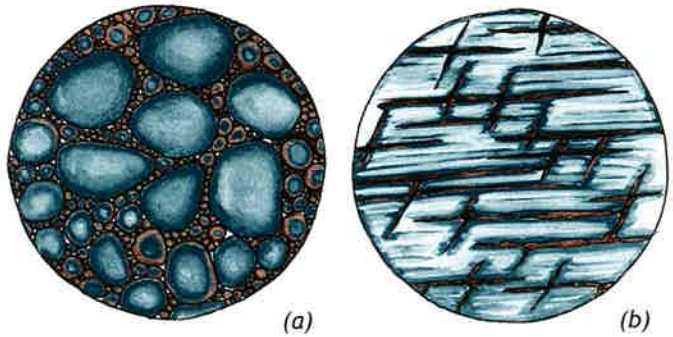
In many parts of Australia groundwater is saline. The salt is mainly derived from ancient marine deposits.

Rising water tables have caused saline groundwater to discharge to the surface in some areas. Salt accumulates when the water evaporates from the surface. Water tables in many parts of Australia are higher today because the deep-rooted trees and shrubs whose roots once absorbed water at many metres below the surface, have been cleared and replaced with annual grasses and pastures. Increased irrigation is another contributing factor. The link between clearing and salinity is well-documented and long-term observations of water table levels clearly show they have risen by tens of metres since clearing began.

Salinity has become a serious problem in all semi-arid agricultural areas of Australia. Western Australia was estimated to have had nearly 2 million hectares of land damaged by salination (9.4% of cleared land) in 1994.

This area is likely to cover 3.3 million hectares by 2020 (17.1%). Salination is now of major concern in the Murray/Darling Basin, Western Australia and some areas of Queensland.

Efforts are being made to replant native vegetation and control wasteful irrigation but many feel the measures are too little and too late. In the short term, salinity is increasing.



Aquifers are layers of
(a) unconsolidated material or
(b) fractured rock.
They have pores or cracks containing water in a similar way to a sponge.

AUSTRALIAN WATER ASSOCIATION

Natural Heritage Trust
Helping Communities Helping Australia

Sunshine Coast Environment Council

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We all use water:

A users' guide to water and wastewater management

3 Groundwater

This flyer is part of a series on *We all use water*