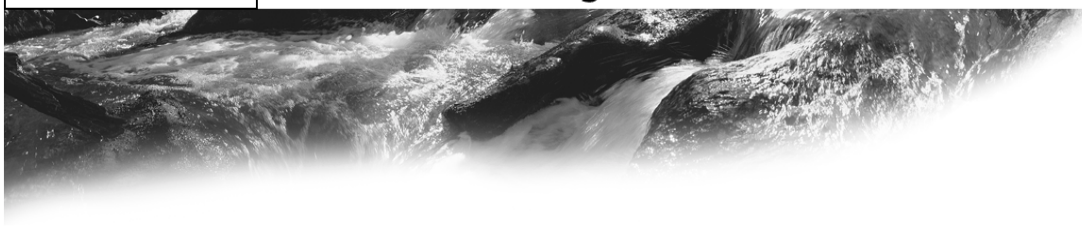
Advice to Water Management Committees

NSW Government



No. 9 Groundwater Dependent Ecosystems

What is a groundwater dependent ecosystem?

Groundwater dependent ecosystems are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater.

Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.

Ecosystems vary dramatically in how they depend on groundwater, from having occasional or no apparent dependence through to being entirely dependent. The unique ecosystems which depend on the mound springs of the Great Artesian Basin, for example, are entirely dependent on groundwater which makes them very vulnerable to local changes in groundwater pressure.

Threats and Values

Groundwater extraction by humans disrupts the hydrologic cycle. It lowers and alters the natural variability of groundwater levels which, in turn, alters the timing of availability and volume of groundwater to its dependent ecosystems.

Groundwater dependent ecosystems are threatened by contamination and over-extraction. Particular threats include urban development, contamination from industry, intensive irrigation, salinisation, clearing of vegetation and filling or draining of wetlands. In some caves and peat bogs, scientific research into past environments relies upon the fossil record. Fluctuating water levels and changes in water quality can destroy this record.

Groundwater dependent ecosystems have many values:

- some are rare or unique - for example, the plants and animals in the Great Artesian Basin's springs - or are threatened;
- the ecosystems surviving in aquifers and caves may be the amongst the oldest surviving on earth – eg. invertebrates in caves;
- they have water quality benefits - microfauna in groundwater help 'clean up' contaminants;
- they have biodiversity value - many species do not live in surface water habitats;
- they add to the ecological diversity of a region. Australia is biogeographically distinct in its groundwater fauna;
- they can be bio-indicators, (ie. indicators of biological health of an overall system);
- they may play an important, but not yet fully understood, role in maintaining river health;
- they are likely to be connected to other non-groundwater dependent ecosystems and thus integrated into the broader regional environment;
- sites may have cultural significance especially for indigenous Australians: and
- they can have social and economic values (eg. recreation and tourism).

Types of Groundwater Dependent Ecosystems

Terrestrial Vegetation

Shallow groundwater can support terrestrial vegetation, such as forests and woodlands, either permanently or seasonally. Examples occur both on the coast (eg. Melaleuca communities, Blackbutt or Sydney Redgum forests on sand dunes), in some types of hilly country (eg. rainforest plants along spring-fed creeks) and inland (eg. River Red Gums along river banks and on floodplains of large rivers in the Murray-Darling Basin).

There are fauna which depend on this vegetation and therefore indirectly depend on groundwater. Koala populations in some areas of inland NSW may only be able to survive through drought in trees which have reliable groundwater access and can continue to produce sufficient nutritious foliage.

Base flow in streams

River flow is often maintained largely by groundwater, which provides base flows long after rainfall runoff ceases. It is estimated that on average up to 40% of many rivers' flow is made up of groundwater fed base-flow. The base flow typically emerges as springs or as diffuse flow from sediments underlying the river and banks, and may be crucial for in-river and near-river ecosystems. For example, platypus feed upon invertebrates, such as dragonfly and mayfly larvae, which live in the riffle habitats. Reducing the base flow to groundwater–fed rivers could dry out the riffles and reduce the invertebrate populations.

Below many rivers, especially those with sand and gravel beds, water exchanges between the surface and groundwater. This exchange zone is an important habitat for many invertebrates, a refuge during droughts and floods, and a vital biological filter capable of improving the water quality of rivers.

Aquifer and cave ecosystems

Life exists within aquifers and in underground caves in conditions of total darkness, limited space and limited oxygen. Limestone caves, for example, support fauna such as crustacea. The ecosystems which exist in aquifers are entirely dependent on groundwater.

Life within aquifers may be as rich in diversity as it is above ground, and such ecosystems may be quite ancient. Some cave fauna may have changed very little over the last hundreds of millions of years. Fluctuating water levels and changes in water quality can degrade these ecosystems and destroy their fossil record.

As well, some micro-organisms in groundwater systems are important because they can exert a direct influence on water quality. Particular microbes are capable of transforming dissolved nutrients, organic matter and possibly contaminants. The fauna in groundwater may also play an important role in maintaining the physical structure of an aquifer by keeping the pore spaces free of fine organic matter and grazing on microbes.

Wetlands

Groundwater plays a role in most of Australia's wetlands. This includes inland wetlands, coastal dunal wetlands, as well as tidal-flat and coastal inshore waters whose ecosystems may also depend on groundwater discharge. This may be as base flows at the mouth of rivers, or as direct discharge as is the case for some seagrasses which predominantly grow in areas where groundwater seeps up from the sea floor. The mound spring vegetation of the Great Artesian Basin is also included in this group.

Peat bogs have traditionally been highly stable environments which may contain fossil material that provides insights into past environments. Over-extraction of water, like the practice of draining wetlands for agriculture and other development, can destroy this valuable source of scientific data as peat can combust as it dries, and can become more susceptible to erosion.

The Principles of the Groundwater Dependent Ecosystems Policy

The State Groundwater Dependent Ecosystems Policy is specifically designed to protect our valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of their dependent ecosystems are maintained or restored, for the benefit of present and future generations.

The following five principles are to be applied in the management of groundwater-dependent ecosystems in NSW.

Principle One

Groundwater-dependent ecosystems can have important values for groundwater users, ecosystem managers, scientists and the wider community and

for the protection of our biodiversity and cultural heritage. These values, and how threats to them may be avoided, should be identified and action taken to ensure that the ecosystems are protected.

Principle Two

Groundwater extractions should be managed within the sustainable yield of aquifer systems, so that the ecological processes and biodiversity of their dependent ecosystems are maintained and/or restored. This will involve consideration of threshold levels that are critical for ecosystem health.

Principle Three

Priority should be given to ensuring that sufficient groundwater of suitable quality is available at the times when it is needed:

- for protecting ecosystems which are known to be, or are most likely to be, groundwater dependent; and,
- for ecosystems where there is an immediate or high degree of threat.

Principle Four

Where scientific knowledge is lacking, the precautionary principle should be applied to protect groundwater dependent ecosystems. The development of adaptive management systems and research to improve understanding of these ecosystems is essential to their management.

Principle Five

Planning, approval and management of developments and land use activities should aim to minimise adverse impacts on groundwater systems by:

- maintaining natural patterns of recharge and minimising disruption to groundwater levels that are critical for ecosystems;
- not polluting or causing changes in groundwater quality; and
- rehabilitating degraded groundwater systems where possible.

The Government Role

The Department of Land and Water Conservation will assist the committee in identifying and describing groundwater dependent ecosystems, their location and dependency and will draft model provisions to assist the committees in developing their recommendations. Other agencies may also assist.

The DLWC will also provide the committee with the estimates of the average annual recharge and will put forward its analysis of current groundwater rules and their effectiveness, and recommend where changes would be of most benefit.

The DLWC will also supply the committee with estimates of the impact of proposed water sharing rules, incorporating ecosystem protection.

The Committee Role

In preparing their recommendations for the draft groundwater sharing plans, committees need to recommend a bulk environmental water provision (that is, a proportion of recharge reserved for the environment), and water level or other management rules to minimise localised impacts on dependent ecosystems.

The size of the environmental provision will vary according to the characteristics and dynamics of each system and the significance of any groundwater dependent ecosystems. It may vary from a very small proportion where the aquifer is deep and has little connection to the surface, to a significant proportion where the connection is strong, and/or if there are high conservation value dependent ecosystems relying on the aquifer.

More localised rules for protecting groundwater dependent ecosystems may include:

- establishing buffer zones around dependent ecosystems, within which extraction is excluded or limited;
- establishing maximum limits to which water levels can be drawn down at a specified distance from a dependent ecosystem; and
- establishing a minimum distance from a connected river, creek or other dependent ecosystem from which a bore could be sited.

The social and economic costs of the recommended water sharing rules need to be considered by the committee.