Water Allocation Plan

South East Catchment Water Management Board

Supported By
Government of South Australia

LACEPEDE KONGORONG PRESCRIBED WELLS AREA

Water Resources Act 1997

Water Allocation Plan

for the

Lacepede Kongorong Prescribed Wells Area

I, Mark Brindal, Minister for Water Resources, hereby certify that this plan is the Water Allocation Plan for the Lacepede Kongorong Prescribed Wells Area adopted by me on 29 June 2001 and amended pursuant to section 118 of the *Water Resources Act 1997*.

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Hon Mark Brindal MP
Minister for Water Resources

Date: 14/10/01

Prepared by

South East Catchment Water Management Board

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1 The Lacepede Kongorong Prescribed Wells Area

This document is the Water Allocation Plan for the Lacepede Kongorong Prescribed Wells Area, pursuant to Part 7, Division 3 of the *Water Resources Act 1997*. This Water Allocation Plan replaces the *Lacepede Kongorong Prescribed Wells Area Water Allocation Plan* dated the 30 June 1997 as varied by the Plan published in the Government Gazette on 27 July 2000.

The Lacepede Kongorong Proclaimed Wells Area was gazetted on 20 March 1997 under the provisions of the *Water Resources Act 1990*. Upon the introduction of the *Water Resources Act 1997* the Lacepede Kongorong Proclaimed Wells Area became known as the Lacepede Kongorong Prescribed Wells Area (PWA).

The Lacepede Kongorong PWA covers an area of approximately 9000km^2. It comprises the Hundreds of Duffield, Landseer, Peacock, Lacepede, Murrabinna, Minecrow, Woolumbool, Lochaber, Mount Benson, Bowaka, Townsend, Joyce, Spence, Waterhouse, Ross, Conmurra, Bray, Smith, Fox, Coles, Lake George, Symon, Kennion, Short, Rivoli Bay, Mount Muirhead, Riddoch, Mayurra, Hindmarsh, Benara and Kongorong in their entirety. The Lacepede Kongorong PWA also comprises the southwestern half of the Hundred of Marcollat (bound by the western boundary of the Padthaway Prescribed Wells Area), and the western portion of the Hundreds of Killanoola, Monbulla, Grey, Young, Blanche and MacDonnell, where the PWA is bound to the east by the western boundary of the Designated Border Area (*Groundwater (Border Agreement) Act 1985*), which extends twenty kilometres west from the South Australian/Victorian border.

The Lacepede Kongorong PWA incorporates the townships of Kingston (SE), Lucindale, Robe, Beachport, Millicent, Mount Burr, Tantanoola, Kalangadoo, Port MacDonnell and the localities of Cape Jaffa, Avenue, Greenways, Kangaroo Inn, Furner, Hatherleigh, Rendlesham, Snuggery, Glencoe, Kongorong and Allendale East (see Figure 1.1).

From an annual average of 788 mm at Mount Burr Forest Reserve, rainfall decreases in a northwesterly (Robe 632 mm) and northeasterly (Naracoorte 588 mm) direction, in the Lacepede Kongorong PWA. Potential evapotranspiration increases from about 1,400 mm per year in the south to 1,600 mm per year in the north.

A total of 22,958 hectares (ha) of irrigated crops were grown in the Lacepede Kongorong PWA in 1998-99, representing approximately 2% of the total land area of the PWA. Land use in the Lacepede Kongorong PWA is primarily grazing, cropping and pine forest plantations. Pasture crops make up 70% of the total irrigated area, with 88% of the total 15,728 ha being fully irrigated pasture. Irrigated pasture is primarily used for dairy, beef and prime lamb production. Other major uses of underground water include growing vines (1126 ha) and potatoes (1079 ha), each making up approximately 5% of the total irrigated area.

The northern and central portion of the PWA is characterised by sub-parallel northwest trending stranded beach-dune ranges, separated by flat lagoonal/lacustrine plains. These ranges coalesce to the south forming the more uniformly undulating area around Mount Gambier. The Mount Burr Range represents the early phase of volcanic activity in the area.

The Prescribed Resource

The prescribed water resource of the Lacepede Kongorong Prescribed Wells Area consists of two distinct underground water aquifer systems. The first of these is the Unconfined Tertiary Limestone Aquifer system (known generally as the unconfined aquifer), and the second is the lower Tertiary Confined Sand Aquifer (known generally as the confined aquifer).

Unconfined Aquifer

The regionally extensive unconfined aquifer consists mainly of calcareous sandstone and limestone deposited from the latter part of the Tertiary Period through to the Quaternary (~30 million years before present). It incorporates the Gambier Limestone and the Coomandook, Bridgewater and Padthaway Formations.

The unconfined aquifer thickens (in a westerly and southerly direction) from around 10 to 20 metres thick in the Nangwarry-Tarpeena area to more than 300 metres thick along the coast near Carpenters Rocks (see Figure 1.2). It thins north of Kingston as it overlaps the rising basement of Padthaway Ridge. There also appears to be evidence of thinning in the vicinity of Beachport, Lake Bonney and the Hundred of Conmurra, caused by structural highs. The depth to the water table varies from near ground level towards the west of the interdunal flats to more then 40 metres in the Mount Burr Ranges.

In general, underground water salinity in the unconfined aquifer, increases from south (less than 500 milligrams per litre (mg/L)) to north (more than 4000 mg/L) and away from the coast, reflecting the relative magnitude of annual rainfall (recharge) and evapotranspiration.

Confined Aquifer

In the Lacepede Kongorong PWA the unconfined and confined aquifers are separated by a low permeability aquitard, comprising mainly of glauconitic marl and dark brown carbonaceous clay. The combined thickness of the aquitard is generally more than 20 metres. Underground water salinity in the confined aquifer system is typically less than 500 mg/L in the south around Mount Gambier, but increases gradually northwards to over 10,000 mg/L as the aquifer thins north of Kingston.

The confined aquifer consists of non-calcareous quartz sands, interbedded with dark brown carbonaceous clays. Together these units make up the Dilwyn Formation. Deposition occurred during the early part of the Tertiary Period (approximately 50 million years before present). For management purposes, the confined aquifer is treated regionally as one aquifer, but it is in actuality, a complex multi-aquifer underground water system. Lack of data means there is little real understanding of the hydraulic connection between these sub-aquifers.

The confined aquifer is used quite extensively throughout the Lacepede Kongorong PWA. The majority (around 70%) being the total volume of 28,629 ML allocated as at 23 May 2001 from the confined aquifer, is allocated for use in the Kingston confined aquifer management area. Part of the reason for this is that many of the wells throughout this area are at least seasonally artesian. This means that the initial higher capital costs of drilling a well through the unconfined and into the confined aquifer system, is offset by a low or absent need to extract water by pumping. In other parts of the Kingston confined aquifer management area, there is no water of suitable quantity or quality available from the unconfined aquifer.

2 Assessment of the Needs of Dependent Ecosystems

The needs of ecosystems include both the local influence of underground water within an ecosystem and the influence on receiving environments downstream.

2.1 Ecosystem Water Needs

In ecosystems dependent on underground water currently undisturbed by the taking and use of underground water, the present underground water conditions (that account for natural patterns such as climate) can be considered as providing the water needs of the ecosystem in question. Where undisturbed ecosystems dependent on underground water have been identified, the underground water data available during October 2000 has been interpreted as the ecosystem water needs of dependent ecosystems (see Table 2.1). For ecosystems subject to changing underground water conditions, data that describes the most recent steady state underground water conditions have been interpreted from available records and adopted as the Ecosystem Water Needs (Table 2.1).

Water needs were collectively described for ecosystems sharing common environments, termed land units, in which current underground water conditions and trends were consistent. Thirteen land units were identified within the Lacepede Kongorong PWA (Figure 2.1). These land units are the:

- Rising Springs on the south coast near Port MacDonnell;
- Gambier Limestone, south west of Mount Gambier;
- Kongorong Forest, on a rise of Bridgewater Formation west of Kongorong;
- Lake Bonney;
- German Flat, comprising the Bridgewater Formation Range north west and south of Millicent;
- Mount Burr Range;
- Kalangadoo, comprising the largely flat areas west of Penola;
- Southern Watercourses, comprising of the dune/inter-dune area inland from Robe;
- Robe to Beachport, comprising of the coastal lake complexes, including Lake Eliza, Lake St. Clair and Lake George;
- Mount Benson on the Bridgewater Formation rise near Cape Jaffa;
- Coorong; and
- Northern Watercourses, comprising the dune/inter-dune complexes in the northern part of the PWA.

The quantity of underground water that ecosystems need was described in terms of water table elevation and underground water quality. Underground water quality was described in terms of salinity and nitrate (where available) levels.

Ecosystems Dependent on Underground Water in the Lacepede Kongorong PWA

Rising Springs Land Unit

The Rising Springs Land Unit comprises the coastal areas underlain by Gambier Limestone between the Comaum-Caroline Prescribed Wells Area and Lake Bonney. The water table is shallow (less than 2 metres) below most low lying parts of this land unit, and discharges to fen swamps, wetlands and streams via spring-fed karst features. The following ecosystems dependent on underground water were identified as present, or are likely to be present within the Rising Springs Land Unit:

- Karst Systems – There is no available data on the ecology of karst ecosystems in the Rising Springs Land Unit, which includes Black Fellows Caves. Given the significance of nearby karst features, including Ewens Ponds, Piccaninnie Ponds (both in the Comaum-Caroline PWA), The Shaft and Allendale Sinkhole, it is expected that they support similar biota, including stygobite syncarids, amphipods and mollusca.

- Springs, Wetlands and Phreatophytes – Wetlands are present in depressions, which receive both surface runoff from drains and creeks inland and underground water discharge from springs. The wetlands support Tea Tree woodlands and coastal sedges including *Lepidosperma* spp., *Eucalyptus* spp., *Melaleuca* spp. and *Leptospermum* spp.

  These ecosystems support several threatened plants and animals, including the Swamp Antechinus *(Antechinus minimus)*, Swamp Skink *(Egernia coventryi)* which are both listed as Endangered within South Australia, the Olive Whistler *(Pachycephala olivaceae)* and Rufous Bristlebird *(Dasyornis broadbenti)* which are listed as Vulnerable in South Australia, the Small Sickle Greenhood Orchid *(Pterostylis sp. aff. falcata [furcata])* which is Endangered in South Australia, and the Swamp Greenhood Orchid *(Pterostylis tenuissima)* which is listed as Nationally Vulnerable. These species rely on underground water, either directly or indirectly through other plant associations that are directly dependent on underground water. These ecosystems rely on very specific environmental conditions, and appear to be highly susceptible to water level changes.

  The area includes Nene Valley and Dingley Dell Conservation Parks.

- Streams – The Rising Springs area was drained for agriculture through the construction of a number of private drains, which are believed to drain underground water. The ecology of the drains and streams is not documented.

- Hypogean Ecosystems – These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Rising Springs Land Unit. However, they are likely to exist within this area.

Gambier Limestone Land Unit

The Gambier Limestone Land Unit comprises a low relief landscape at elevations of 10 to 20 m AHD and is underlain by Gambier Limestone. The following water dependent or ecosystems dependent on underground water were identified as present, or are likely to be present within the Gambier Limestone Land Unit:

- Wetlands – The water table is generally greater than 5m below the surface throughout this land unit, and while a number of wetlands are present they are considered to be perched, and are unlikely to interact with the underground water resource. The wetlands of the Gambier Limestone Land Unit are therefore not considered to be dependent on underground water.

- Karsts – Seven ecologically significant karst features occur within the Gambier Limestone Land Unit. These features include, The Shaft, Allendale Sinkhole, Gouldens Hole, Gum Road Cave, Morgans Cave, The Pines and Fossil Cave.

  The caves support aquatic stygobites endemic to the South East, including syncarids, amphipods and stromatolite communities. A number of karsts have a substantial surface expression of water, which supports wetland communities, including aquatic plants, phytoplankton, fish and water birds. Karsts extend downwards from depths of 5m (Morgans Cave) to more than 90m (The Shaft) and are dependent on the unconfined aquifer.

- Hypogean Ecosystems – These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Gambier Limestone Land Unit. However, they are likely to exist within this area.

Kongorong Forest Land Unit

The geology of the Kongorong Forest Land Unit comprises a dune of the Bridgewater Formation overlying the Gambier Limestone. The area has a locally high elevation of 20 to 40m AHD and is densely vegetated with timber plantations. The following ecosystems dependent on underground water have been identified as present or are likely to be present within the Kongorong Forest Land Unit:

- Karsts –Little is known of the extent of karsts in the area, whether they intersect the underground water table or the nature of the biota they support.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Kongorong Forest Land Unit. However, they are likely to exist within this area.

Lake Bonney Land Unit

The Lake Bonney Land Unit comprises the area between the Woakwine Range and the coast, including Lake Bonney and Canunda National Park. The range reaches elevations of up to 50m AHD while the lake shore lies just above sea level. The dune between the lake and the sea reaches an elevation of 20m AHD. The geology of the

area comprises the Bridgewater Formation in the dune and Quaternary sediments around the lake. The Gambier Limestone underlies the land unit.

The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Lake Bonney Land Unit:

- Wetlands and Phreatophytes – Lake Bonney is a freshwater lake which intersects the water table and also receives substantial surface water flows from Milnes Gap Drain, English Gap Drain, Stoney Creek and Benara Creek. The lake has been degraded by industrial discharges in the past but retains conservation significance, particularly as a migratory bird habitat. The vegetation on the western shore includes Tea Tree and Swamp Gum *(Eucalyptus ovata)* and swamp sedgelands. The remnant native vegetation is fed, in places, by springs. The Canunda National Park lies on the coastal dune between the lake and the sea, and is vegetated with low growing coastal species.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Lake Bonney Land Unit. However, they are likely to exist within this area.

German Flat Land Unit

German Flat comprises the inter-dunal flat between the Woakwine and Mount Burr Ranges. The geology of the area is Padthaway Formation underlain by Gambier Limestone. The water table is generally less than 5m below the surface, and is shallower at the base of the Mount Burr Range. The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the German Flat Land Unit:

- Wetlands and Phreatophytes – A network of drains removes the surface water from German Flat to Lake Bonney and has reduced the extent of wetland ecosystems. However, a number of wetlands remain on the eastern boundary at the base of the Woakwine Range, including Deep Swamp, Gillets Swamp and Benara Creek. These wetlands are fed primarily by surface water but may form underground water mounds. The most substantial areas of wetland vegetation in the area comprises *Gahnia filum* and *G. trifida* sedgelands.

- Karsts – The distribution and ecological significance of karsts in this area is unknown.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the German Flat Land Unit. However, they are likely to exist within this area.

Gambier Forest Land Unit

The geology of the Gambier Forest Land Unit comprises a dune of the Bridgewater Formation overlying the Gambier Limestone. The area has a locally high elevation of 70 to 80m AHD and is densely vegetated by timber plantations. The underground water

table lies generally more than 10m below the surface. The following water dependent or ecosystems dependent on underground water have been identified as present, or are likely to be present within the Gambier forest Land Unit:

- Wetlands – There are a number of significant wetlands within the Gambier forest Land Unit, but all appear to be perched above the water table. Honans Scrub and Diagonal Road Swamps lie at elevations of 68 and 75m AHD respectively, more than 10m above the water table. These wetlands are therefore not considered to be dependent on underground water.

- Karsts – There are many sinkholes and other karst features in the Gambier Forest Land Unit, of which the following are significant for their ecology:

    - Green Lake;
    - One Tree Sinkhole;
    - Little Blue Lake;
    - The Black Hole;
    - Bullock Hole;
    - Ten Eighty Sinkhole;
    - The Sisters;
    - Woolwash Cave;
    - Rubbish Cave;
    - Benara Sinkhole;
    - Alleyns' Cave;
    - Mud Hole; and
    - Tank Cave.

    Many of the flooded karst systems feature stromatolites, which are rare microbial formations. All support stygobite aquatic invertebrate communities that include mollusca, amphipods and syncarids. Many of the species found in these karst systems are undescribed and believed to be endemic to the South East. The depth of water in these features ranges from 16m at Benara Sinkhole to 50 and 60m at Little Blue Lake and Bullock Hole respectively. Some of these systems feature wetland habitats at their surface, including One Tree Sinkhole, The Sisters and Woolwash Cave.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Gambier Forest Land Unit. However, they are likely to exist within this area.

Mount Burr Range Land Unit

The geology of the Mount Burr Range comprises predominantly of a dune of the Bridgewater Formation overlying the Gambier Limestone. The topography is steep and undulating and generally lies at 80 to 120m AHD with peaks of more than 150m AHD. The area is densely vegetated with timber plantations. The water table is generally more than 10 metres below the surface.

The following water dependent or ecosystems dependent on underground water have been identified as present, or are likely to be present within the Mount Burr Range Land Unit:

- Wetlands– There are a number of significant wetlands within the Mount Burr Range, but all are believed to be perched above the water table. Examples include Gran Gran, Mt McIntyre, Mt Lyon and Woolwash Swamps. Some of the wetlands, including Woolwash Swamp, drain to sinkholes, indicating their perched position.

The wetlands of the Mt. Burr Range Land Unit are therefore not considered to be dependent on underground water.

- Karsts – There are likely to be several significant karst ecosystems in this area, but data on their ecology is not available.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Mount Burr Range Land Unit. However, they are likely to exist within this area.

Kalangadoo Land Unit

The Kalangadoo Land Unit comprises the dune and flat complexes lying east of the Avenue Range. The geology is primarily Padthaway Formation on the flats and Bridgewater Formation dunes, both underlain by Gambier Limestone. Ecosystems dependent on underground water occur typically on the flats, where the elevation ranges from 65m AHD near Kalangadoo to 25m AHD near Lucindale. The water table lies less than 2m below the surface for much of this area.

The following ecosystems dependent on underground water have been identified as present, or are likely to be present in the Kalangadoo Land Unit:

- Wetlands and Phreatophytes – The wetlands of the Kalangadoo land unit are generally located along the western edge of the inter-dunal flats, abutting the dune rises of the Bridgewater Formation. Most wetlands are shallow, temporary, isolated depressions which receive local runoff. They are likely to form underground water mounds, which will influence the duration and extent of flooding.

  Penola Conservation Park, which includes Green Swamp, has representative wetland vegetation: Tea Tree *(Leptospermum juniperum)*, Swamp Gum *(Eucalyptus ovata)* and Grass Tree *(Xanthorrhoea australis)* shrublands.

  There are substantial remnants of vegetation that are likely to be underground water dependent, including *Eucalyptus ovata*, *E. viminalis* Woodland, *Xanthorrhoea caespitosa, Leptospermum continentale* Open Shrubland, *Melaleuca brevifolia* Low Shrubland and *Eucalyptus camaldulensis* var. *camaldulensis* Woodland.

  The Marshes is a semi-permanent swamp located to the east of the Mt Burr Forest. The wetland lies at 76m AHD and is likely to receive underground water discharge from the elevated water table which lies under the higher ground to the west. The wetland supports heath vegetation of *Melaleuca squarrosa*, and *Leptospermum juniperum* with a sedge understorey on sandy plains and swamp communities within local depressions.

- Karsts – There are likely to be several significant karst ecosystems in this area, but data on their ecology is not available.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer

system. There are no records of such ecosystems within the Kalangadoo Land Unit. However, they are likely to exist within this area.

Southern Watercourses Land Unit

The Southern Watercourses Land Unit comprises the dunes and flats of the Bridgewater and Padthaway Formations respectively, which are underlain by the Gambier Limestone. The inter-dunal flats exhibit an north-westerly aspect, with an elevation of 20 to 34m AHD in the West Avenue Range Watercourse and less than 5 to 20m AHD in the coastal sediments near Kingston.

The water table is generally less than 5m deep in the south of the land unit and close to the surface in the north. The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Southern Watercourses Land Unit:

- Wetlands and Phreatophytes – The wetlands of this land unit are generally located along the western edge of the inter-dunal flats, abutting the dune rises of the Bridgewater Formation. Most wetlands are shallow, temporary depressions, which receive local runoff and may receive underground water discharge when the water table rises during the winter rainfall season.

  Surface water from the area is drained to Drain M and Reedy Creek – Mt Hope Drain via a network of subsidiary drains. Surface drainage has substantially reduced the extent and duration of flooding, but conditions can now be regarded as having reached a steady state.

  The waters of the wetlands are generally fresh inland, but become progressively more saline towards the north west. Inland wetlands, such as the Reedy Creek Watercourse, typically support sedge vegetation with fringing stands of species tolerant to water logging such as *Eucalyptus camaldulensis, Melaleuca* spp. and *Leptospermum* spp. Lake Hawdon is a brackish wetland complex near Robe. The salinity of this complex indicates that the area is a discharge point for underground water. The wetland supports the salt-tolerant underground water dependent shrub Melaleuca halmaturorum.

  Near Kingston, the elevation declines to less than 5m AHD. The underground water dependence of ecosystems in this area is indicated by the saline surface conditions of the wetlands and the presence of deep-rooted vegetation that requires fresh water. Hog Lake, Salt Lake and Butchers Lake have marine meadows and samphire flats dependent on saline surface water and are finged by *Leptospermum lanigerum* and *Melaleuca halmaturorum* that depend on fresher water, probably supplied by the underground water table. The salinity and water balance of the wetlands is likely to be strongly influenced by underground water discharge. Salt Lake and Butchers Lake lie within Butchers Gap Conservation Park.

- Streams – The Southern Watercourses Land Unit has a network of drains in which underground water discharge accounts for a significant component of total flow.

- Karsts – There are likely to be karsts in this area, but it is not known where they exist, whether they intersect the water table or the nature of the biota they support.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Southern Watercourses Land Unit. However, they are likely to exist within this area.

Robe to Beachport Land Unit

This land unit comprises the area between the Woakwine Range and the sea between Robe and Beachport. The geology of the range is Bridgewater Formation and rises to 50m AHD. The land falls steeply to flats surrounding the lagoonal basins with an elevation of approximately 1m AHD. The lagoons are separated from the sea by coastal dunes with an elevation of up to 20m AHD. The lagoon basins and coastal dunes comprise of Quaternary St Kilda Formation and overlie the Gambier Limestone.

The water table generally lies between 0 and 5m AHD. The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Robe to Beachport Land Unit:

- Wetlands and Phreatophytes – The Robe to Beachport Land Unit comprises saline wetlands and lakes and freshwater seeps. Underground water seeps along the base of the Woakwine Range are likely to be fed by local recharge on the range and support freshwater shrubs and trees on the fringes of the saline lakes, including *Melaleuca lanceolata, M. halmaturorum, Myporum insulare* and *Leptospermum lanigerum.*

  Lakes St Clair, Eliza, George and Robe were formed as marine lagoons which became isolated from the sea by the formation of beach dune systems. They are saline and are recharged by underground water flows, direct rainfall and a small quantity of local runoff.

  The area includes the Little Dip Conservation Park, Beachport Conservation Park and Lake Robe Game Reserve (which is on the register of National Estate), which are of high conservation significance.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Robe to Beachport Land Unit. However, they are likely to exist within this area.

Mount Benson Land Unit

The Mount Benson Land Unit comprises an area of relatively high elevation near Cape Jaffa (up to 50m AHD). The land unit's geology consists primarily of Bridgewater Formation over Gambier Limestone. The water table lies between 1.5m AHD near the coast and 7m AHD in the east. The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Mount Benson Land Unit:

- Karsts - The water table lies generally more than 10m below the surface. Therefore, the only underground water dependant ecosystems likely to occur are underground systems such as karstic biota. There are likely to be karsts within the area, but it is

not known where they exist, whether they intersect the water table or the nature of the biota they support.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Mt Benson Land Unit. However, they are likely to exist within this area.

Coorong Land Unit

The Coorong Land Unit extends from beyond the northern boundary of the study area to just north of Kingston. The geology is Quaternary St Kilda Formation. Underground water discharges to the Coorong, driven from the east by the regional hydraulic gradient. These flows are calculated to be in the order of 70 ML/year/km. Underground water flows may not be a significant factor in the salt and water balance of the Coorong, but they provide a fresh underground water environment for vegetation. The water table lies at approximately 1m AHD.

The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Coorong Land Unit:

- Wetlands – The Coorong Land Unit ephemeral salt lakes extend in a chain from just north of Kingston to Salt Creek. The lakes have been isolated in succession from the south east to the north west since the Pleistocene age.

  The area includes a number of permanent saline lakes and swamps which receive water from rainfall and underground water inflows. The Coorong comprises a southern and a northern lagoon on the coast formed behind a line of coastal dunes.

  The lakes fill by rainfall, or when the unconfined aquifer rises above the lake beds in the winter months, reflecting the local water table. In the winter and spring the lakes fill to a depth of between 0.4 and 1m. The variable quality of underground water inflows, controls the salinity and chemical composition of the lakes, which support a range of invertebrates and aquatic plants, including *Ruppia*, macro algae and phytoplankton.

- Phreatophytes – Underground water soaks support phreatophytes on the eastern side of the lakes, such as *Melaleuca halmaturorum*.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Coorong Land Unit. However, they are likely to exist within this area.

Northern Watercourses Land Unit

The Northern Watercourses Land Unit comprises the dune and inter-dunal complex between the Harper Range in the east and the Coorong in the west. The inter-dunal flats range in elevation from approximately 30m AHD in the east (Marcollat Watercourse) to 10m AHD in the west (Reedy Creek Watercourse).

The elevation of the water table closely matches that of the inter-dunal flats and is generally within 2m of the surface. The following ecosystems dependent on underground water have been identified as present, or are likely to be present within the Northern Watercourses Land Unit:

- Wetlands and Phreatophytes – The inter-dunal flats form watercourses, which flow northwards. Important wetland systems throughout this area include;
    - Drain E Watercourse;
    - Marcollat Watercourse which includes the Jaffray and Lever Swamp complexes;
    - Bakers Range Watercourse, including Deep Swamp vegetation complex, extending into the Water Valley Wetlands;
    - West Avenue Range Watercourse, which includes Smith Swamp; and
    - Reedy Creek Watercourse.

  The wetland systems generally consist of a series of depressions, which are linked by overflow. Flow through the watercourses has generally increased since drainage of the South East, but flow is more constrained within channel banks. Wetlands vary in their relationship to underground water. Wetlands may be permanent, semi-permanent or temporary, and have a range of salinities depending upon the depth to underground water and the salinity of the underground water.

  Wetland vegetation includes plants dependent on surface flooding, such as sedges, along with plants which are likely to be underground water dependent, including:
    - *Eucalyptus camaldulensis* swamps over *Callistemon rugulosus* and *Leptospermum continentale*;
    - Tea Tree woodland swamps of *Melaleuca halmaturorum* and *M. brevifolia* with a sedge layer of *Gahnia filum*; and
    - Sedgeland communities.

- Streams – Existing constructed drains constitute stream ecosystems that are dependent on underground water in this land unit.

- Hypogean Ecosystems - These macroinvertebrate and microbial ecosystems where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Coorong Land Unit. However, they are likely to exist within this area.

Water Needs of Identified Ecosystems Dependent on Underground Water

Table 2.1 sets out the quantity (elevation and annual range), quality (salinity and nitrate concentration) and timing (seasonality of maximum and seasonality of minimum) of water needed by the ecosystems identified in each of the thirteen land units of the Lacepede Kongorong PWA. The current conditions (as at October 2000) within each land unit have been included to provide a comparison with the identified ecosystem requirements (last observed steady state conditions).

Table 2.1: Requirements of Identified Ecosystems Dependent on Underground Water

Land Unit	Parameter	Conditions at October 2000	Ecosystem Water Needs	Most Recent Observed Steady State Period
Rising Springs	Salinity	no change	500-1000 mg/L	1970-2000
	Elevation of Water Table	minor decrease	0-5 m AHD	pre 1950
	Annual Range	no change	1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
Gambier Limestone	Salinity	possible minor increase	less than 500 mg/L	1970-1993
	Elevation of Water Table	decrease 0.1 to 0.2 m/yr since 1993	5-10 m AHD	1970-1993
	Nitrate	up to 20 mg/L	2-10 mg/L	Note A
	Annual Fluctuation	no change	0.5-2 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
Kongorong	Salinity	no change	450-550	1970-2000
	Elevation of Water Table	no change	5 to 10 m AHD	1970-2000
	Annual Range	no change	0.3 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
Lake Bonney	Salinity	no change	less than 500 mg/L	1970-2000
	Elevation of Water Table	no change	0-10 m	1970-2000
	Annual Range	no change	0.5-1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
German Flat	Salinity	no change	500-3000 mg/L	1970-1983
	Elevation of Water Table	no change	10–20 m	1970-2000
	Annual Range	no change	0.5-2 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
Gambier Forest	Salinity	no change	500–1000 mg/L	1980-1990
	Elevation of Water Table	decrease 0.1 m/yr since 1993	5-55 m AHD	1970-1993
	Annual Fluctuation	no change	<0.5 m	1970-2000
	Seasonality of Maximum	no change	Spring	1970-2000
	Seasonality of Minimum	no change	Autumn	1970-2000
Mt Burr Range	Salinity	no change	500-1000 mg/L	n.a.
	Elevation of Water Table	decrease 0.2 m/yr since 1993	20-75 m	1970-2000
	Annual Range	no change	<1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000
Kalangadoo	Salinity	no change	550-1000 mg/L	1970-2000
	Elevation of Water Table	no change	25-65 m AHD	1970-2000
	Annual Range	no change	1-2 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000

Land Unit	Parameter	Conditions at October 2000	Ecosystem Water Needs	Most Recent Observed Steady State Period
Southern Watercourses	Salinity	no change	550-1000 mg/L	1970-2000
	Elevation of Water Table	no change	34-6 m AHD	1970-2000
	Annual Range	no change	0.5-1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000
Robe to Beachport	Salinity	no change	1200-1600 mg/L	1990-2000
	Elevation of Water Table	no change	-1.5-0 m AHD	1970-2000
	Annual Range	no change	0.4-1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000
Mt Benson	Salinity	no change	<1000 mg/L	1990-2000
	Elevation of Water Table	no change	1.5-7m AHD	1970-2000
	Annual Range	no change	0-<1 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000
Coorong	Salinity	no data	no data	
	Elevation of Water Table	no change	0.5-1 m	1976-2000
	Annual Range	no change	0.4 m	1976-2000
	Seasonality of Maximum	no change	Spring	1976-2000
	Seasonality of Minimum	no change	Autumn	1976-2000
Northern Watercourses	Salinity	variable with local conditions	1500-7000 mg/L	1990-2000
	Elevation of Water Table	+0.04 m/year	30-10 m	1970-2000
	Annual Range	no change	1-1.5 m	1970-2000
	Seasonality of Maximum	no change	Spring	1996-2000
	Seasonality of Minimum	no change	Autumn	1996-2000
Note A: Historical nitrate data not available. Data indicates elevated levels of nitrate exist within the Gambier Limestone land unit when compared to other parts of the region.				

Glossary

Amphipod	A small (approximately 5mm long) aquatic crustacean found in fresh waters including cave environments.
Hydraulic gradient	Spatial variation in the effective elevation of the water table, which drives lateral flow in underground water.
Hypogean ecosystems	Macroinvertebrate and microbial communities that occur within the water filled pore spaces of the saturated zone.
Invertebrate	An organism with an external skeleton.
Karst Feature	Cavity or cave formed by the solution of limestone by naturally occurring acids.

Macroinvertebrate	An invertebrate greater than 0.5 mm in length.
Microbial	Bacteria, fungi etc. that are invisible to the naked eye.
Mollusca	A group of animals which have soft bodies and hard shells (e.g. snails) or no shell (e.g. slugs).
Phreatophyte	A plant that is dependent on underground water.
Recharge	Water that replenishes the aquifer by infiltration from the land surface.
Saturated zone	The zone in which voids within soils and rocks are completely filled with water, also known as the phreatic zone.
Stromatolite	Layered deposits of calcium carbonate and various other minerals which have been created by the action of living organisms such as microscopic algae, bacteria and other microbes.
Stygobite	An organism which exclusively inhabits underground habitats, such as caves and subterranean waters.
Syncarid	A small (approximately 3 mm long) aquatic invertebrate belonging to an ancient order of crustaceans, the Syncaridae. Their form has changed little over millions of years, and they are sometimes referred to as a living fossil. They are usually found in underground environments and are generally rare.
Through-flow	Lateral passage of underground water, driven by a hydraulic gradient.
Unsaturated zone	Region above the water table through which recharge infiltrates, also known as the vadose zone.
Water table	Upper surface of saturation in the unconfined aquifer.

3 Assessment of Effects on Other Water Resources

Section 101 (4) (b) of the Act requires the Plan to contain an assessment of whether the taking of water will have a detrimental effect on the quality and quantity of water available from any other water resource.

Other water resources within the Lacepede Kongorong PWA comprise a number of surface water bodies, they are:

- Lake Bonney;
- Lakes St Clair, Eliza, George and Robe, which are marine lagoons located in the Robe to Beachport land unit; and
- Lakes Leake and Edward in the Mount Burr Range, east of the township of Millicent.

In addition, as indicated in Section 2, there are numerous wetland areas in the Lacepede Kongorong PWA, as well as an extensive system of drains, which are believed to drain underground water as well as surface water, in many areas.

The potential detrimental impacts of taking, or using, water from the unconfined aquifer in the Lacepede Kongorong PWA on the quantity or quality of water in the confined aquifer resource, and the impacts taking or using water from the confined aquifer may have on the quantity or quality of water in the unconfined aquifer resource, were also considered, as well as the impacts of taking and use of underground water on other water resources in the PWA and in adjacent PWAs.

Surface Water Bodies

Lake Bonney, approximately 8 km southwest of Millicent, is essentially a freshwater lake, which intersects the water table and also receives substantial surface water flows. The underground water environment of Lake Bonney, as described by records from 1970 to present, appears to be in a long-term steady state. It is not expected that underground water use will increase significantly in the vicinity of Lake Bonney, therefore the taking and use of underground water will not have any detrimental effects on the lake.

Between Robe and Beachport several large, saline lagoons exist including Lakes Eliza, St Clair, George and Robe. These receive inflow water from surface runoff via the artificial drainage scheme established in the South East and from underground water seepage from the watertable. The lakes are evaporative sinks, that is, this is the only method of discharge. Lowering of the local watertable through extraction could reduce the gradient towards the lakes and hence underground water inflow to them. The extreme would be reversal of the gradient with the induction of lake water back into the underground water system. However, under the policies and criteria set out in this Plan, neither scenario is considered likely. Therefore the taking and use of water from the Lacepede Kongorong PWA will not have a detrimental effect on the quality or quantity of underground water available from these lagoons.

The volcanically derived Lakes Leake and Edward in the Mount Burr Ranges east of Millicent contain water generated by local rainfall runoff. The base levels of both lakes are above the regional watertable and the confined aquifer's potentiometric surface.

Their only interaction with underground water would be by seepage down to the watertable and therefore the taking and use of underground water will not have a detrimental effect on the quality or quantity of water available from Lakes Leake and Edward.

Springs, Wetlands and Drains

Wetlands in the Lacepede Kongorong PWA vary in terms of their relationship with, and reliance on, underground water. Wetlands in the Gambier Limestone Land Unit, Gambier Forest Land Unit and Mount Burr Range Land Unit are perched above the water table, and the taking and use of underground water will have no detrimental effect on the quality and quantity of water within these wetlands.

Wetlands in other areas of the Lacepede Kongorong PWA (the Southern Watercourses, Northern Watercourses and Kalangadoo land units) comprise dune-interdune complexes. Wetland depressions are fed primarily by surface runoff, but in the western parts of the interdunal flats the underground water is particularly shallow and is thought to discharge to the surface environment.

An extensive system of drains exists in the Lacepede Kongorong PWA, and underground water is believed to contribute to the flow of water in the drains, which constitute artificial ecosystems. The ecology of these drains is not documented.

Underground water extraction and use appears not to have had a detrimental effect on wetlands and drains in the Lacepede Kongorong PWA, up to the present time. While there has been a long term decline in water levels in the Gambier Limestone, Gambier Forest and Mount Burr Range Land Units, this is not attributed to underground water extraction, but to a long period of below average rainfall. It is not anticipated that the taking and using of underground water will have a detrimental impact on wetlands and drains under the policies and criteria set out in these Land Units.

A slight decline in water levels has been noted within the Rising Springs Land Unit. This slight decline can also be largely attributed to a period of consecutive dry years. Underground water extraction may be a contributing factor to this slight decline, but the extent of this contribution is unknown. It is recommended that further monitoring and assessment be implemented to determine if underground water extraction is contributing to this decline, and if so, to determine the degree to which these extractions are affecting the springs, wetlands and drains throughout this land unit.

Confined Aquifer

Over most of the PWA the confined and unconfined aquifers are separated by a low permeability aquitard (confining bed) generally of the order of 20 m thick. This aquitard also occurs at considerable depth except for localised highs in the Nangwarry–Tarpeena–Glencoe area. Under these circumstances it is unlikely there would be any detrimental impacts on the confined aquifer water resource caused by extraction in the unconfined aquifer. This is reinforced west of Lucindale–Millicent and south of Mount Gambier where an upward hydraulic gradient exists across the confining layer.

In the Nangwarry–Tarpeena–Glencoe area the confining layer is thin or absent and the watertable is at a higher elevation than the confined aquifer's potentiometric surface. Here recharge to the confined aquifer could be affected by lowering of the watertable through extraction or reduction in rainfall recharge by land use changes. However, on

the information available it is considered unlikely to have a detrimental impact on the confined aquifer, due to this recharge component constituting a small percentage of overall recharge to and flowthrough within the confined aquifer.

Unconfined Aquifer

Under normal circumstances extraction from the confined aquifer would have negligible impact on the overlying unconfined aquifer, as the confined and unconfined aquifers are separated by a low permeability aquitard (confining bed) generally of the order of 20 metres thick.

However, poorly constructed confined aquifer wells in the western portion of the PWA currently allow direct leakage of pressure water from the confined aquifer into the overlying unconfined aquifer. While this does detrimentally affect the confined aquifer by contributing to loss of pressure in the aquifer, it does not have a detrimental impact on the unconfined aquifer, as the salinity of water from the confined aquifer is lower than that of the unconfined aquifer, where the poorly constructed wells are located.

Water Resources in Adjacent PWAs

There are no intensive centres of unconfined underground water use adjacent to the eastern boundary of the Lacepede Kongorong PWA that would have a detrimental impact on water resources of the adjacent PWAs.

On a regional basis, with the exception of the Kingston Management Area, the proposed permissible annual volumes (PAVs) for the four confined aquifer management areas within the PWA are relatively small when compared to those of the unconfined aquifer. With the adoption of these PAVs it is expected that there will be no detrimental effects from the taking and use of water from the confined aquifer in the Lacepede Kongorong PWA, on other water resources in adjacent PWAs.

4 Assessment of the Capacity of the Resource to Meet Demands

4.1 The Capacity of the Resource

The capacity of the underground water resources of the Lacepede Kongorong PWA to meet demands on a continuing basis will depend on several factors. One of the main factors is the rate of extraction by underground water users. Systems for appropriately allocating underground water and managing its use are required for the protection of the long-term condition of the resource.

The Permissible Annual Volume (PAV) as defined by the *Groundwater (Border Agreement) Act 1985* in effect relates to the volume that can be allocated for licensed extraction within the Border Designated Area. In calculating the PAV for the Border Designated Area, stock and domestic use has been excluded, as a water licence is not required for these purposes.

It is now recognised that it is preferable to calculate the volume of water to allocate throughout the area covered by this Plan by making provision for stock and domestic use, along with the expansion of plantation forestry, and the environment. For this reason, the concept of Volume for Licensed Allocation (VLA) has been developed.

The VLA is the total quantity of water (in megalitres) available for **licensed** extraction on an annual basis within each management area. The VLA is calculated differently for each aquifer.

The Volume for Licensed Allocation in each management area for the unconfined aquifer is calculated as follows:

- The Permissible Annual Volume less provisions for the effect of forestry plantations on annual average vertical recharge, stock, domestic, and environmental demands, less a further 10% buffer in areas that were not fully allocated (or did not become fully allocated as a result of the buffer) at **date of adoption**.

The Volume for Licensed Allocation in each management area for the confined aquifer is calculated as follows:

- The Permissible Annual Volume less provision for the effect of leaking wells, stock, domestic, and future town use.

4.2 The Unconfined Aquifer

4.2.1 The Capacity of the Resource

The annual rate of net removal of underground water from the unconfined aquifer should roughly equate to the estimated annual average vertical recharge to the water table. Underlying this approach is the principle that lateral throughflow is maintained in the aquifer, thereby allowing any salts accumulated during recharge to be flushed down-gradient. The PAV estimates are conservative, allowing for water quality variations and the limited monitoring data in some areas.

The PAV has been estimated by calculating the annual average vertical recharge to the aquifer in accordance with the following formula:

PAV for all management areas (in ML per year) = (sum of $(A_n X R_n))X S_f$

Where:

- A_n is the land area (in square kms) of a defined recharge region within the individual management area;
- R_n is the annual average vertical recharge rate (in mm per year) of the defined recharge region A_n;
- S_f is the salinity factor adopted for the management area.

As shown in Figure 4.1, a management area can comprise one or more recharge regions, each of which is assigned an individual recharge rate. The recharge rate is determined by considering factors such as land use, soil type, depth to groundwater and seasonal groundwater level responses. The salinity factor is a proportional reduction of the total recharge in the management area, where the extraction of 100% of the annual average vertical recharge is expected to lead to unacceptable salinity impacts.

In 2000, the Department for Water Resources estimated the PAV for the Lacepede Kongorong PWA to be 525,100 ML. The PAV for each management area within the Lacepede Kongorong PWA is shown in Table 4.1.

Table 4.1: Lacepede Kongorong unconfined aquifer PAVs, and licensed allocations and estimated use for 1998-99 (all in ML)

Hundred	PAV (2000)	Licensed Allocations and Estimated Use 1998-1999			
		Total licensed allocations	Industrial allocation[2]	Recreational allocation	Total licensed use[5]
Benara	16100	4 650	36.7	–	2 786
Blanche[1]	7200	4 978	46.3	–	2 909
Bowaka	11200	8 837	–	–	4 953
Bray	10800	1 496	–	–	660
Coles	23400	7 221	17.4	–	1 288
Conmurra	26300	11 641	–	–	5 411
Duffield [3]	5900				
Fox	22400	3 673	–	–	1 614
Grey	13300	16 922	55.7	34	7 420
Hindmarsh[4]	9000	5 870	45.6	8	3 142
Joyce	17900	4 790	–	181	1 440
Kennion	21600	2 123	4.6	4	1 458
Killanoola	17400	6 471	–	–	2 348
Kongorong	11700	8 901	258.3	12	5 365
Lacepede	11400	848	0.6	156	312
Lake George	8600	713	–	–	242
Landseer	5800	1 094	–	–	1 039
Lochaber	12500	1 903	9.1	–	571
MacDonnell	13300	14 082	321.9	29	9 858
Marcollat	5000	312	–	–	109
Mayurra[4]	13500	1 857	18.3	8	1 708
Minecrow	15300	2 154	–	–	307
Monbulla	16600	5 307	13.6	–	3 203
Mt Benson	10000	1 511	–	–	557
Mt Muirhead	23500	896	–	23	335
Murrabinna	9400	63	–	–	6
Peacock [3]	8400				
Riddoch	13800	7 281	13.6	57	2 414
Rivoli Bay	12000	425	0.1	57	303
Ross	11300	2 921	1 144.6	–	1 265
Short	21700	8 250	–	–	6 742
Smith	14100	4 401	–	–	3 684
Spence	17000	3 085	20.6	150	1 443
Symon	16200	1 901	11.3	–	986
Townsend	14100	4 043	–	–	1 885
Waterhouse	11400	6 825	4.1	82	1 881
Woolumbool	16500	1 195	2.8	–	0
Young	9500	3 575	49.2	–	1 558
Totals	**525100**	**162 215**	**2 074.4**	**801**	**81 202**

1 Combined Compton, Blanche Central and Moorak Sub-areas
2 To the nearest 0.1 ML
3 No licences issued for Duffield and Peacock
4 These PAVs have been reduced by the volume extracted annually under indenture by Kimberly-Clark Australia Pty Ltd
5 Use does not include unlicensed use of the resource, for stock, domestic, town water supply and environmental purposes

4.2.2 Present Demand

General

The current level of allocation and use in the Lacepede Kongorong PWA gives a good indication of the present demands on the unconfined aquifer.

The annual underground water allocation in the 1998–99 irrigation season for the Lacepede Kongorong PWA was 162,215 ML as shown in Table 4.1, which represents 42% of the VLA. Licensed underground water usage for the same period was estimated to be 81,202 ML which represents about 50% of the total allocation. Unlicensed use of the resource, for stock, domestic, town water supply and environmental purposes, has not been included in Table 4.1. A pro-rata roll out of water (holding) allocations was undertaken during 2000, and as a result total licensed allocations in Lacepede Kongorong have increased to 308,104 ML as at 23 May 2001, which represents 79% of the VLA, as shown in Table 4.3 and Table A, annexed hereto.

While the figures on allocation and use for 1998-99, as presented in Table 4.1, would indicate that the demand for water is low, there are localised areas within the Lacepede Kongorong PWA where demand is high, such as the Hundred of Grey and the Hundred of MacDonnell, where licensed allocations exceeded the PAV in 1998-99. In contrast, in the northern part of the Lacepede Kongorong PWA, demand for underground water is expected to remain low, due to the high salinity of the underground water in this area (5,000 to 10,000 mg/L). For example, in the Hundreds of Duffield and Peacock there was no demand for underground water and as a result no water was allocated in these Hundreds in 1998-99, and very little during the pro-rata roll-out of 2000.

However, underground water usage must be interpreted carefully, due to the method in which use for irrigation purposes is calculated. Historically, allocation of water licences for irrigation have been based on area and the irrigated crop water use requirement relative to a reference crop. The water usage volume is then estimated from annual seasonal returns supplied by water users and correlation with aerial photography. The volume of water used by crops is calculated by converting the area of irrigated crops to megalitres, using crop area ratios. The Lacepede Kongorong PWA has been divided into five zones with different crop area ratio values. The irrigated crop water requirement method does not reflect the actual volume of underground water extracted from the aquifer, and estimation of the volume used by each licensee relies on the veracity of the water user, and the irrigated crop requirement method. A suitable method of measuring actual underground water use is required.

In contrast, allocations of water licences for industrial and recreational purposes are issued volumetrically. However, there is no recorded usage of these allocations. Even though allocations exist and some wells are equipped with meters, there is no regular meter reading program.

Irrigation

Irrigation is by far the largest user of underground water in the PWA. Irrigated pasture crops form the vast majority of area irrigated, and pasture is primarily used for dairy, beef and prime lamb production. Other larger areas of irrigation include vines and potatoes.

Recreation

The recreational allocations of 800 ML are assumed to be fully utilised and hence included in the use figure for 1998–99 in Table 4.1. The licences in the recreation category are largely held by sporting clubs (for watering sports fields, greens and gardens) and Local Government (for the watering of parks and gardens.)

Industry

The industrial allocations of 2,074 ML are assumed to be fully utilised and hence included in the use figure for 1998–99 in Table 4.1.

The Kimberly-Clark Australia Pty Ltd pulp and paper mills at Snuggery use approximately 14,400 ML per annum, from the Hundreds of Hindmarsh and Mayurra. The *Water Resources Act 1997* is subject to the *Pulp and Paper Mills Agreement Act 1958* and the *Pulp and Paper Mill (Hundreds of Mayurra and Hindmarsh) Act 1964* under which these mills were established. Therefore the company is not required to have a water licence at present (the indenture expires in 2014). However, the calculated PAVs for the Hundreds of Mayurra and Hindmarsh have been reduced by the extracted volume and it is these PAVs that are shown in Table 4.1.

Stock and Domestic

Total annual stock underground water use from the unconfined aquifer for the PWA is estimated to be 9,905 ML (as shown in Table 4.3). These figures are based on stock numbers for the 1996-97 season in the Lacepede Kongorong PWA, which were obtained from the Australian Bureau of Statistics, and multiplied by the average daily stock consumption figures from data supplied by the New South Wales Department of Agriculture. The stock underground water use estimates are to the nearest 5 ML.

Underground water use from the unconfined aquifer for domestic purposes has been estimated, and is shown in Table 4.3.

Town Use

SA Water supplies Millicent and Mount Burr from the unconfined aquifer with the past three years metered extractions being given in Table 4.2.

Table 4.2: Town water supply extraction, unconfined aquifer

Town	Extraction in ML		
	1997–1998	1998–1999	1999–2000
Millicent	482	496	525
Mount Burr	98	107	94

Forestry Commitments

At the time of estimating the PAV for each management area, the reduction in vertical recharge due to forestry expansion was calculated. Forestry expansion was estimated by including any forestry proposal not yet commenced but which had an approval under the *Development Act 1993* to commence development. In addition, industry

provided estimates of firm proposals for developments that had not yet obtained approval under the *Development Act 1993*. These proposals were also included. A summary of the reduction in annual average vertical recharge due to forestry commitments is included in Table 4.3 and has been estimated at 28,370 ML.

Environmental Commitments

An allowance of 10% of the PAV was made for environmental requirements in the Lacepede Kongorong PWA. A summary of these environmental commitments is made in Table 4.3.

4.2.3 Future Demand

Irrigation

The majority of underground water is used for irrigation and hence use will vary on an annual basis depending on weather, market conditions and individual property management regimes.

Significant expansion of specific crops such as vines is not anticipated in the short term. For example, the area planted to vineyards in the Mount Benson area is not expected to change significantly.

The recent expansion in interest in olive grove establishment in South Australia may result in some development in the Lacepede Kongorong PWA. However, it is more likely that any such development will be to the northeast, outside of the Lacepede Kongorong PWA.

Recreation

The future use for recreational purposes is expected to stay the same as current use. In 1998-99 800 ML was allocated for this purpose.

Industry

There is anticipated to be some increase in demand for specific aquaculture projects eg. yabbie and marron farming.

No immediate significant future industrial users of underground water are known.

However, with the large expansion in bluegum planatations in recent years in the South East of South Australia and Western Victoria, the establishment of a world class hardwood bleached kraft pulp mill, which could produce around 500,000 tonnes per annum of pulp, has been mooted for the region. This would enable on-shore value adding of the bluegum resource, of which approximately 16,000 ha (net planted area) is located in the South East of South Australia. An operational pulp mill would not be required until around 2008 or 2009, when a critical mass of the bluegum plantations reaches harvestable age. If located within the South East of South Australia, the two most likely PWAs are Lacepede Kongorong or Comaum-Caroline. Such a pulp mill would require around 20,000 to 25,000 ML of water per year

Stock and Domestic

Stock and domestic usage is not anticipated to vary much from current use.

Town Use

SA Water consider that both Millicent and Mount Burr's water use has essentially stabilised and forecast a maximum annual use over the next five years at 580 and 130 ML per year respectively. SA Water may soon be issued with water licences for extraction of water for town water supply purposes, therefore 580 ML for Millicent and 130 ML for Mount Burr's licensed town water supply use has been included in the column titled 'Total Licensed Allocations' in Table 4.1 and Table A.

Forestry Commitments

The forestry industry is in the process of preparing a strategic plan outlining its expected plantation expansion in the South East. However, until this plan is completed, the estimated forestry commitment of 28,370 ML (as shown in Table 4.3) is the current best estimate of future demand.

Environmental Commitments

An allowance of 10% of the re-assessed PAV was made for environmental requirements in the Lacepede Kongorong PWA, as shown in Table 4.3. Environmental commitments are not expected to increase in the future.

Table 4.3: Licensed and Unlicensed demands for the unconfined aquifer in the Lacepede Kongorong PWA (all in ML)

Management Area	PAV ML	Forestry Commit-ment ML	Stock Use ML	Domestic ML	Environ-ment ML	VLA(a) ML	Total Licensed Allocations at 23/05/01(b) ML
Benara	16,100	0	305	80	1,610	12,695	10,438
Blanche Central	2,300	0	85	222	230	1,763	1,865
Bowaka	11,200	0	150	90	1,120	8,856	7,255
Bray	10,800	0	250	58	1,080	8,471	5,980
Coles	23,400	11,210	355	58	2,340	8,493	7,366
Compton	1,700	0	45	161	170	1,192	615
Conmurra	26,300	875	305	154	2,630	20,102	15,888
Duffield	5,900	0	150	50	590	4,599	1,429
Fox	22,400	1,210	285	82	2,240	16,725	13,606
Grey	13,300	0	240	130	1,330	11,600	16,688
Hindmarsh	9,000	0	195	381	900	6,772	6,138
Joyce	17,900	384	430	222	1,790	13,567	11,998
Kennion	21,600	2	340	108	2,160	17,091	12,303
Killanoola	17,400	935	200	87	1,740	12,994	10,430
Kongorong	11,700	0	300	394	1,170	8,852	8,753
Lacepede	11,400	0	150	162	1,140	8,953	5,351
Lake George	8,600	0	145	166	860	6,686	3,616
Landseer	5,800	0	190	14	580	4,514	4,478
Lochaber	12,500	0	230	84	1,250	9,842	6,147
MacDonnell	13,300	0	410	381	1,330	11,179	14,615
Marcollat	5,000	0	175	36	500	3,860	1,631
Mayurra	13,500	0	200	234	1,350	10,544	6,550
Minecrow	15,300	0	280	54	1,530	12,092	7,633
Monbulla	16,600	2,006	190	83	1,660	11,395	9,319
Moorak	3,200	0	85	305	320	2,241	2,222
Mount Benson	10,000	0	225	98	1,000	7,809	6,773
Mount Muirhead	23,500	0	260	704	2,350	18,167	13,443
Murrabinna	9,400	0	220	40	940	7,380	3,490
Peacock	8,400	0	335	48	840	6,459	3,951
Riddoch	13,800	142	280	106	1,380	10,703	9,584
Rivoli Bay	12,000	0	255	289	1,200	9,230	5,145
Ross	11,300	0	260	16	1,130	8,905	7,245
Short	21,700	10,173	390	92	2,170	8,875	9,028
Smith	14,100	0	265	72	1,410	11,118	10,725
Spence	17,000	1,327	290	106	1,700	12,219	8,065
Symon	16,200	0	365	88	1,620	12,714	9,139
Townsend	14,100	106	455	108	1,410	10,819	7,864
Waterhouse	11,400	0	125	306	1,140	8,846	7,126
Woolumbool	16,500	0	330	64	1,650	13,010	8,080
Young	9,500	0	160	244	950	7,331	6,131
Total	**525,100**	**28,370**	**9,905**	**6,177**	**52,510**	**388,666**	**308,104**

4.2.4 Current Status of the Unconfined Aquifer

The current status of the unconfined aquifer in the Lacepede Kongorong PWA also gives a good indication of the capacity of the resource to meet the demands that are currently being placed on it.

Underground water flow

The direction of underground water flow is generally from the South Australian/Victorian border in the east towards the coast in the west and south.

The Nangwarry–Tarpeena watertable high that dominates the Comaum-Caroline PWA extends westwards into the Lacepede Kongorong PWA to the Mount Burr Ranges and controls the directions of underground water flow for this southern area. Through the northern two-thirds of the PWA the unconfined underground water flow direction is more uniform.

Water-level trends

Water levels have been monitored for over 30 years in a significant number of wells in the PWA. For those currently measured, and with over five years of data, most wells show negligible change or a small annual decline in the watertable particularly since the end of 1992 that is attributed to a series of below average winter rainfalls and hence recharge. Larger negative trends are evident around the concentrated underground water extraction centre for industrial purposes at Snuggery. Two wells in the Hundred of Lochaber show significant declines but the reason(s) for this is unclear.

Salinity distribution

The unconfined aquifer's salinity distribution, based on data from the monitoring well network, is shown in Figure 4.2 and should be considered a generalisation. The aquifer shows distinct vertical and short-range lateral variations in salinity that cannot be characterised by the spread of the monitoring wells.

In general, underground water salinity increases from south (less than 500 mg/L) to north (more than 4,000 mg/L) and away from the coast, reflecting the relative magnitude of annual rainfall (recharge) and evapotranspiration.

Salinity trends

Whilst the number of suitable monitoring wells is small, most of those with a long recorded history show no overall trend in salinity. Increasing salinity trends are shown by ROS5 (38 mg/L/yr) in the Hundred of Ross, MTM60 (8 mg/L/yr) near Millicent in the Hundred of Mount Muirhead, and PEC5 (5 mg/L/yr) in the north of the PWA, in the Hundred of Peacock.

Two wells show decreasing salinity trends, MRB8 (11 mg/L/yr) in the Hundred of Murrabinna and MAR20 (5 mg/L/yr) in the Hundred of Marcollat are both in the north of the PWA.

Conclusion

The results from the unconfined aquifer monitoring network and history indicate that the unconfined aquifer can sustain the current demands. While there may be localised shortages in management areas with excellent soils, and high quality water (which may be sought after for irrigation or plantation expansion), the overall capacity of the resource is considered sufficient to meet future demands, with the exception of the demand for water for a large development such as a world class pulp mill.

It would be difficult to source water from the unconfined aquifer for the establishment of a world class pulp mill in the Lacepede Kongorong PWA, given the large volume required, and the current level of allocation in management areas central to the bluegum resource. While theoretically it would be possible if the pulp mill purchased all or some of its allocation requirement from existing licensees, the logistics and time involved in doing this would make this option unattractive. It is unlikely that a world class pulp mill could be accommodated within the Lacepede Kongorong PWA without an alternative source of water being found and utilised.

4.3 Confined Aquifer

4.3.1 Capacity of the Resource

The PAV for the confined aquifer in the South East is the volume of underground water that can be used on an annual basis from the confined aquifer without causing significant adverse water level or water quality impacts to the underground water resource.

The PAV for each confined aquifer management area in the South East region was estimated by the Department for Water Resources in 2000 and is shown in Table 4.5. The confined aquifer management areas are different to those of the unconfined aquifer, and are shown in Figure 4.3.

Due to the confining layer (aquitard) the underground water in the confined aquifer is under pressure, and in some parts of the Lacepede Kongorong PWA is artesian (ie flows to the surface without pumping). Also, unlike the unconfined aquifer, the confined aquifer receives very little direct rainfall recharge. Therefore the proposed PAVs have been developed for each management area for the confined aquifer using a combination of underground water throughflow determinations and computer flow modelling. Various extraction scenarios were modelled to examine the longer term change in aquifer pressure and changes in leakage between the confined and unconfined aquifers.

Other key considerations in determining the PAV included:

- Limiting the magnitude of head decline as a result of increased withdrawals from the confined aquifer, and the impacts to existing users of the confined aquifer;
- Ensuring that there is no reversal in potentiometric levels between the confined and unconfined aquifers, which could result in more saline water from the unconfined aquifer impacting on water quality in the confined aquifer through downward leakage;
- The impact on the unconfined aquifer of increased use of the confined aquifer for irrigation purposes (Confined aquifer water excess to crop requirements returns to the unconfined aquifer. This has the potential to increase salt accessions and water levels within the unconfined aquifer);
- Consideration of the impact of increased extractions from the confined aquifer on marine discharges. However, such impacts are difficult to assess given the lack of present understanding of these processes;
- Modelling limitations in terms of uncertainty in the levels of extraction from the aquifer, and limited extraction data in some areas; both affect calibration of the model.

After consideration of all the above factors, a precautionary approach to the specification of the management prescription for the Tertiary Confined Sand Aquifer has been taken. Limiting the water available for allocation to a proportion (0.75) of the groundwater throughflow volume would adequately allow for the current limited technical understanding of the resource and the lack of knowledge of the environmental significance of the marine discharges from the confined aquifer.

The South East Catchment Water Management Board considered the regional declines in potentiometric (pressure) levels across the aquifer that would be acceptable based on its consultation with the community. The Board considered that a decline in the potentiometric level of generally 2 metres in the next 20 years, with a limited area of 4 metres in the Kalangadoo management area, would be acceptable at this time.

The PAV has therefore been set at 50% of the upper limit of the proportion (0.75) of the groundwater throughflow to maintain recovered seasonal potentiometric levels within this acceptable range of 2 to 4 metres, for all management areas except Kingston.

The management prescription recommended for the Kingston Management Area sets the PAV at the current level of allocation and use of water in this area. While this level of allocation is considered to be too high based on the current level of assessment and understanding of the resource, measures will be put in place to improve water use efficiency, and reduce underground water use, over the next five years. Such measures include introducing metering to gain a clear picture of extraction levels from the aquifer, and reducing water wastage through well rehabilitation. If after this time a review indicates that the level of allocation and use is not sustainable, then it is likely that the PAV for the Kingston management area will be reduced, and management strategies introduced to decrease allocations and use to the revised PAV, over the following five year period.

The management prescription for the confined aquifer in the South East is shown in Table 4.4.

Table 4.4: Management Prescription for the Confined Aquifer

AREA	MANAGEMENT PRESCRIPTION
Border Designated Area - Zones 1A-11A	PAV = 50 % x (0.75 x throughflow volumes)
Outside Border Designated Area	PAV = 50 % x (0.75 x throughflow volumes)
Kingston Management Area	PAV = 25,000 ML/annum

Table 4.5: PAV, VLAs and Licensed and Unlicensed Demands for the Confined Aquifer in South Australia (all in ML)

Management Area	PAV	Stock & Domestic Use	Future Town Use	Allowance for Leaking Wells	VLA (a)	Total Licensed Allocations at 23/05/01 (b)	Irrigation Extraction Factor (c)
Fairview	290	6	0	0	284	0	0
Kalangadoo	3,900	78	0	0	3,822	1,993	386
Keith	2,500	50	0	0	2,450	130	0
Kingston	25,000	500	360	1,761	22,379	19,755	2,935
Lucindale	3,600	72	90	0	3,438	1,325	123
Millicent	10,800	216	0	0	10,584	4,376	676
Taratap	330	7	0	0	323	16	3
Wirrega	960	19	0	0	941	300	0
Zone 1A	9,200	184	210	0	8,806	404	81
Zone 2A	2,900	58	0	0	2,842	50	0
Zone 3A	1,900	38	0	0	1,862	0	0
Zone 4A	710	14	0	0	696	280	56
Zone 5A	540	11	0	0	529	0	0
Zone 6A	360	7	0	0	353	0	0
Zone 7A	350	7	0	0	343	0	0
Zone 8A	340	7	0	0	333	0	0
Zone 9A	570	11	0	0	559	0	0
Total	**64,250**	**1,285**	**660**	**1,761**	**60,544**	**28,629**	**4,259**

Notes:

1. SA Water may soon be issued with water licences for extraction of water for town water supply purposes. However, SA Water did not apply for the full estimated maximum annual usage in some areas. Therefore 560 ML in the Kingston management area, 90 ML in the Lucindale management area and 210 ML in Zone 1A has been set aside in the column titled 'Future Town Use'. Licensed town water supply volumes are included in the column titled 'Total Licensed Allocations'.

2. Stock and domestic use has been estimated at 2% of PAV, across all confined aquifer management areas.

3. An allowance of 10% of total irrigation use (Ha IE irrigation licences converted to a volume using CARs plus the irrigation extraction factor) has been made for loss from confined aquifer leaking wells in the Kingston management area.

4. As area based HaIE licences represent the irrigated crop water requirement, and not the actual volume extracted from the aquifer, a further 20% of HaIE irrigation licences (converted to a volume using CARs) was considered to be extracted from the confined aquifer and recharged to the unconfined aquifer through irrigation root zone drainage, in the column titled 'Irrigation Extraction Factor'.

4.3.2 Present Demand

General

The current levels of allocation and use in the Lacepede Kongorong PWA give a good indication of the present demands on the confined aquifer. Part or all of the following six confined aquifer management areas cover the Lacepede Kongorong PWA as shown in Figure 4.3; namely Millicent, Kalangadoo, Lucindale, Kingston, Fairview and Taratap management areas.

Demand for confined aquifer water has been high in the Kingston management area, where the VLA has been exceeded. The majority (around 70%) of the total volume of 28,629 ML allocated as at 23 May 2001 from the confined aquifer, is allocated for use in the Kingston confined aquifer management area. Part of the reason for this is that many of the wells throughout this area are at least seasonally artesian. This means that the initial higher capital costs of drilling a well through the unconfined and into the confined aquifer system, is offset by a low or absent need to extract water by pumping. In other parts of the Kingston confined aquifer management area, water of suitable quantity or quality is unavailable from the unconfined aquifer.

In other areas, such as the area between Mount Gambier and Glencoe, it can be difficult to obtain large supplies from the unconfined aquifer and the demand for confined aquifer water is therefore higher in these areas.

In contrast, demand for confined aquifer water in the Taratap and Fairview management areas is very low, and non-existent in some areas. In these management areas the quality of confined aquifer water deteriorates rapidly to the north and north east, generally having a salinity level in excess of 2000 mg/L, and as high as 10,000 mg/L in the northern parts of these management areas.

Town Use

The confined aquifer is an important source of town water supply, due to its protected nature (which means it is less susceptible to contamination), and generally high water quality. SA Water uses the confined aquifer for six town water supplies with the recent consumption figures given in Table 4.6.

Table 4.6: Town water supply extraction, confined aquifer

Town	Extraction (ML)		
	1997–98	**1998–99**	**1999–2000**
Beachport	135	133	174
Kalangadoo	28	34	29
Lucindale	0	0	39
Kingston	254	299	337
Robe	247	328	366
Pt. MacDonnell	84	102	107
TOTAL	**748**	**896**	**1052**

Stock and Domestic

Current stock and domestic use of the confined aquifer has been estimated at 2% of PAV across all confined aquifer management areas. Although use is considered to be small, the confined aquifer is an important source of water for stock and domestic use in areas where the salinity of the unconfined aquifer is too high for this purpose.

Leaking Wells

One hundred and forty leaking or poorly constructed confined aquifer wells have been identified in the Kingston – Lucindale - Robe area. These wells were constructed from the 1960's with either insufficient casing or casing that was not cemented to prevent inter-connection between the confined aquifer and the upper unconfined aquifer. Corrosion of the steel casing is now allowing extremely high quality confined aquifer water to leak into the more saline unconfined aquifer. Local well owners, to address this problem, have initiated the South East Confined Aquifer Well Rehabilitation Scheme. Under this scheme, the wells will be replaced, rehabilitated or abandoned, using specialist abandonment procedures. Twenty-one wells had been replaced, rehabilitated or abandoned at March 2001.

To account for loss of water from the confined aquifer due to leaking or poorly constructed confined aquifer wells in the Kingston management area, an allowance of 10% of total calculated irrigation use has been made.

Irrigation and Irrigation Extraction Factor

The majority of allocations, for the Millicent, Kalangadoo, Kingston, Fairview and Taratap confined aquifer management areas are allocated for irrigation purposes, as shown in Table 4.7. In the Lucindale management area, around half the total licensed allocations are for irrigation purposes.

As area based HaIE licences represent the irrigated crop water use requirement, and not the actual volume extracted from the aquifer, a further 20% of HaIE irrigation licences (converted to a volume using Crop Area Ratios (as described under section 4.3)) was considered to be extracted from the confined aquifer and recharged to the unconfined aquifer through irrigation root zone drainage, under the Irrigation Extraction Factor in Table 4.5. Unlike the unconfined aquifer, where a portion of the excess irrigation water filters back down through the soil and back into the aquifer, no excess irrigation water extracted from the confined aquifer returns to the confined aquifer.

Table 4.7: Confined Aquifer Licensed Allocations by Allocation Type, as at 23 May 2001 (all in ML)

Management Area	PAV	Licensed Allocations at 23 May 2001				
		Industry	Recreation	Town Use	Irrigation	Total Licensed Allocations
Fairview	290	0	0	0	0	**0**
Kalangadoo	3,900	13	0	50	1,930	**1,993**
Keith	2,500	130	0	0	0	**130**
Kingston	25,000	4,330	0	750	14,675	**19,755**
Lucindale	3,600	0	0	710	615	**1,325**
Millicent	10,800	708	57	290	3,320	**4,376**
Taratap	330	0	0	0	16	**16**
Wirrega	960	300	0	0	0	**300**
Zone 1A	9,200	0	0	0	404	**404**
Zone 2A	2,900	0	0	50	0	**50**
Zone 3A	1,900	0	0	0	0	**0**
Zone 4A	710	0	0	0	280	**280**
Zone 5A	540	0	0	0	0	**0**
Zone 6A	360	0	0	0	0	**0**
Zone 7A	350	0	0	0	0	**0**
Zone 8A	340	0	0	0	0	**0**
Zone 9A	570	0	0	0	0	**0**
Total	**64,250**	**5,482**	**57**	**1,850**	**21,240**	**28,629**

Industry

At 23 May 2001, 4,330 ML in the Kingston management area, 708 ML in the Millicent management area, and 13 ML in the Kalangadoo management area, were allocated for industrial purposes. The volume allocated for industrial use in the Kingston management area is being used for the purpose of aquaculture.

Recreation

57 ML at 23 May 2001 was allocated for the purpose of recreational use, in the Millicent management area. The licences in the recreational category are largely held by sporting clubs (for watering sports fields, greens and gardens) and Local Government (for the watering of parks and gardens).

4.3.3 Future demand

Irrigation and Industrial Use

There is unlikely to be a significant increase in demand from the confined aquifer for irrigation or industrial use in the foreseeable future because of the general availability of adequate unconfined underground water. In areas with no available pro rata allocations from the unconfined aquifer, that is the Blanche Central, Grey, Kongorong and MacDonnell management areas, demand for confined aquifer allocations may arise or increase.

Increased demand for aquaculture can be expected (eg. Barramundi aquaculture), because of the constant and elevated water temperature available from the confined aquifer that allows for year round fish growth.

The water requirement to establish a world class pulp mill referred to in section 4.2.3 for the unconfined aquifer, could not be accommodated by the confined aquifer in the Lacepede Kongorong PWA without using the remainder of the VLA for the entire PWA. The requirement would greatly exceed the VLA in any one of the six confined aquifer management areas in the Lacepede Kongorong PWA.

Stock, Domestic and Town Usage

Stock and domestic usage is not expected to change significantly.

Table 4.8 shows the forecast maximum annual usage and anticipated trend over the next five years for town water supplies in the PWA as estimated by SA Water. SA Water may soon be issued with water licences for extraction of water for town water supply purposes. However, SA Water did not apply for the full estimated maximum annual usage in some areas. Therefore 560 ML in the Kingston management area, 90 ML in the Lucindale management area and 210 ML in Zone 1A has been set aside in the column titled 'Future Town Use' in Table 4.5. Licensed town water supply volumes are included in the column titled 'Total Licensed Allocations' in Table 4.5.

Table 4.8: Predicted township water use for the confined aquifer in the Lacepede Kongorong PWA

Township	Forecast max. annual use (ML)	Anticipated trend
Beachport	180	Usage increasing
Kalangadoo	50	Usage stabilised
Kingston	560	Usage increasing
Lucindale	100	Usage increasing
Port MacDonnell	110	Usage increasing
Robe	550	Usage increasing

Leaking Wells

The program to abandon or replace the leaking or poorly constructed confined aquifer wells is well underway. When the 2001 work program has been completed, 26 or almost 19% of wells will have been completed. As the South East Confined Aquifer Well Rehabilitation Scheme progresses, the volume of water which can be attributed to loss from these wells, will progressively reduce.

4.3.4 Current Status of the Confined Aquifer

The current status of the confined aquifer in the Lacepede Kongorong PWA also gives a good indication of the capacity of the resource to meet the demands which are currently being placed on it.

Underground water flow

Within the confined aquifer underground water flow is in both a southerly and a westerly direction. The potentiometric head drops from approximately 45 metres AHD at the eastern boundary of the PWA on the Nangwarry–Tarpeena high to about 2 m AHD at Port MacDonnell in the south and 5 m AHD at Kingston SE in the northwest.

In the east the watertable is at a higher elevation than the confined aquifer's potentiometric surface while the opposite occurs in the west (see Fig. 1.2). In the Kingston-SE, Beachport and Lucindale areas, the confined aquifer is artesian; that is confined aquifer wells flow at the land surface.

Water-level trends

Figure 4.4 shows the trend in the confined aquifer's potentiometric surface from monitoring-wells with a suitably long history. Wells in the central artesian area, (e.g. Hundred of Ross), show significant annual fluctuations of the order of 15 m with these fluctuations decreasing in magnitude radially away from there. Superimposed on this are overall negative trends in the potentiometric surface elevation e.g. ROS10 in the Hundred of Ross with an overall trend of minus 34 cm per year.

Away from this stressed area water levels tended to be relatively stable until 1993 or 1995 after which downward trends are evident. It is this latter data that provides most of the negative trends evident in Figure 4.4.

In the far south in the Hundred of MacDonnell, MAC57 has shown no discernible change in the potentiometric surface since 1977.

Salinity distribution

Underground water salinity in the confined aquifer is quite uniform and less than 1,000 mg/L over the southern three-quarters of the PWA (Fig. 4.5). In the north of Lacepede Kongorong the salinity increases rapidly to the north and northeast as the aquifer thins and becomes restricted by the Padthaway Ridge.

Salinity trends

Salinity monitoring to date has revealed no discernible trend in either an increasing or decreasing salinity. However long-term data is only available in the west of the PWA. Significant changes in salinity are not anticipated except where attributed to poor well construction.

Conclusion

The results from the confined aquifer monitoring network indicate that the aquifer can sustain the current demands, and it is anticipated that additional demands can be met, apart from the water demands of a major industrial development such as a world class pulp mill.

The ability of the confined aquifer to sustain current and additional future demands is less certain for the confined aquifer in the area of intense use (Kingston management area), but the well rehabilitation program should assist in minimising (pressure) head losses.

5 Definitions

Any terms used in this Plan that are defined in the *Water Resources Act 1997* have the definitions set out in that Act and in addition for the purposes of this Plan the following terms have the definitions set out below:

"Adjoins" or **"Adjoining"** means in relation to an allotment or management area that the allotment or management area, or any part of the allotment or management area, is contiguous with another allotment or management area and includes allotments or management areas that are separated only by a road, street, footpath, railway or thoroughfare.

"AHD" means the Australian Height Datum, which is the datum used for the determination of elevations in Australia. The determination used a national network of bench marks and tide gauges, and set mean sea level as zero elevation.

"Allotment" means:

(a) the whole of the land comprised in a certificate of title including a community or development lot or common property within the meaning of the *Community Titles Act 1996* or a unit or common property within the meaning of the *Strata Titles Act 1988*;

(b) the whole of the land comprised in a registered conveyance of land that has not been brought under the provisions of the *Real Property Act 1886*;

(c) a separately defined piece of land that is delineated on a public map and separately identified by a number or letter (not being a piece of land that is identified in a Treasury receipt, certificate or other document or instrument of title as being part only of an allotment);

(d) two or more separately defined pieces of land that are delineated on a public map and that are identified in a Treasury receipt, certificate or other document or instrument of title as forming one allotment for the purposes of the *Real Property Act 1886*;

(e) a separately defined piece of land delineated on a plan of division for the purpose of enabling the separate ownership in fee simple of that land;

(f) a separately defined piece of land identified as an allotment for the purposes of the Real Property Act in a plan prepared by the Registrar-General and accepted for filing in the Lands Titles Registration Office;

(g) where a primary plan of community division has been cancelled under Part 7 Division 3 of the *Community Titles Act 1996* or a strata plan has been cancelled under Part 2 Division 7 of the *Strata Titles Act 1988* – the land comprising the former community parcel or site shown on the plan.

"Aquaculture" means the propagating or keeping of stocks of any aquatic or marine organism.

"Aquifer storage and recovery" means the process of drainage or discharge of water directly or indirectly to a well for the purposes of refilling or replenishing the aquifer or storing water in the aquifer for subsequent extraction.

"Confined Aquifer" means the saturated sands and gravels of either the Dilwyn Formation or the Mepunga Formation in the Otway Basin, or the Renmark Group in the Murray Basin.

"Draw down" means the occasional, seasonal or permanent lowering of the water table or reduction in pressure (head) of an aquifer resulting from the extraction of underground water.

"Exceptional circumstances" means the death or serious illness of or serious injury to the licensee or, where the licence is held by a company, partnership or incorporated body, the death or serious illness or injury to a director, partner or office holder respectively, that prevents the licensee from using the allocation with the minimum of delay and in any case within 3 years of the date of the granting of the allocation.

"Flood irrigation" means irrigation where underground water is pumped or directed onto an irrigation bay or levelled land and flows uniformly across the bay or the land without the aid of sprinklers, drippers or other infrastructure.

"Imported water" means water which has been brought into a management area by means of a pipe or other channel, and the water (including surface water) has been extracted and piped, or directed into a channel, under licence or permit under the *Water Resources Act* 1997, or *Groundwater (Border Agreement) Act 1985* from the originating management area or zones within the border Designated Area.

"Industry" means the carrying on, in the course of a trade or business, of any purposes for, or incidental to:

(a) The making of any article (or part thereof); or

(b) The altering, repairing, ornamenting, finishing, assembling, cleaning, washing, packing, bottling, canning or adapting for sale, or the breaking up or demolition of any article; or

(c) The getting, dressing or treatment of materials.

"Management area" means for the unconfined aquifer, a part of a Prescribed Wells Area as shown in Figure 1.1 and for the confined aquifer, a part of a Prescribed Wells Area shown in Figure 4.3.

"Permissible Annual Volume (PAV)"

The Permissible Annual Volume for the unconfined aquifer in the South East, is the volume of water that can be sustainably used or assigned from the unconfined aquifer on an annual basis, in a particular management area. For the purpose of this definition, "assigned" means the volume set aside for environmental and future forestry commitments.

The Permissible Annual Volume for the confined aquifer in the South East, is the volume of underground water that can be used from the confined aquifer without

causing significant adverse water level or water quality impacts to the underground water resource, on an annual basis.

"Pollution" includes any solid, liquid, gas or heat (or any combination thereof) that directly or indirectly causes or has the potential to cause harm to the environment, structures, persons or organisms.

"Potentiometric level" means the level to which water rises in a well due to water pressure in the aquifer. May also be referred to as the "potentiometric surface" or the "potentiometric head".

"Public water supply" means the supply of water by reticulation primarily for domestic purposes.

"Recharged water" means water which has been drained or discharged directly or indirectly into a well in accordance with a permit granted under the *Water Resources Act 1997*.

"Recreational use" means the use of water for the irrigation of parks, gardens and sports grounds, whether publicly or privately owned.

"Rotational crop" means a crop or plantation of a species/cultivar that produces one harvest per planting and requires an inter-rotational break period of three years or greater from the date of the previous planting before the same crop or plantation can be replanted at the same location.

"Same ownership" means any allotment or allotments where the registered proprietor is, or proprietors are, a member of the same family. For the purpose of this definition, "same family" includes a company where the director, directors or shareholders are members of the family or a trustee of a trust where the beneficiaries of that trust are one or more members of the family.

"Specific Yield" means the ratio of the volume of water a rock or soil will yield by gravity drainage, to the volume of the rock or soil.

"Unconfined Aquifer" means the saturated sequence of rocks occurring above the aquitard on top of the Dilwyn Formation or the Mepunga Formation in the Otway Basin, or the Renmark Group in the Murray Basin, whether occurring within the Gambier Limestone of the Otway Basin, the Murray Group Limestone of the Murray Basin, or some other younger geological unit.

"Volume for Licensed Allocation (VLA)" means the total quantity of water (in megalitres) available for licensed extraction on an annual basis within each management area (see table A, annexed hereto).

The **Volume for Licensed Allocation in each management area for the unconfined aquifer** is calculated as follows:

The Permissible Annual Volume less provisions for the effect of forestry plantations on annual average vertical recharge, stock, domestic, and environmental demands, less a further 10% buffer in areas that were not fully allocated (or did not become fully allocated as a result of the buffer) at **date of adoption**.

The Volume for Licensed Allocation in each management area of the confined aquifer is calculated as follows:

The Permissible Annual Volume less provision for the effect of leaking wells, stock, domestic, and future town use.

"Water use year" means a period of 12 months commencing on the 1 July in any year.

"Wild flooding" means flood irrigation where no adequate system such as land levelling, or irrigation bays is used to ensure uniform distribution of water.

6 Allocation Criteria – Unconfined Aquifer

The present and future needs for water by the occupiers of land in the Lacepede Kongorong Prescribed Wells Area have been outlined in section 4. The present needs for water of the occupiers of land in the Lacepede Kongorong Prescribed Wells Area are mainly irrigation, stock and domestic water use, town water supplies, and industrial use. Stock, domestic and town water use is expected to remain relatively stable or slightly increase. Irrigation is expected to remain the largest water user by landholders in the Lacepede Kongorong Prescribed Wells Area, with some expansion in water use for aquaculture and other industrial developments anticipated.

An assessment of irrigated crop potential of the land in the Lacepede Kongorong Prescribed Wells Area indicates that some areas have limitations for irrigation development. Such areas may remain dryland-farming areas, or may develop some other activity. Irrigation will tend to concentrate in areas that combine good quality water with suitable soils. The productive capacity of the land will also depend on land management practices and standards directed at avoiding land degradation issues such as erosion and water logging.

The overall capacity of the water resources in the Lacepede Kongorong Prescribed Wells Area are considered to be sufficient to meet all existing and reasonably foreseeable future demands for water, considering the capacity of the land. Locally, in areas that combine the availability of good water quality with suitable soils, the demand for water may exceed the capacity of the water resources. In some management areas demand has already exceeded the capacity of the water resources. However, improvements in irrigation efficiency (where allocations are expressed volumetrically), more active use of trade of licensed water allocations, and the use of imported water, may accommodate further development of water–based enterprises in these areas.

Some of the policies contained within this plan may have potential impacts on land values. The policies with this potential generally relate to the protection of the resource from degradation through over allocation, the concentration of water extraction and use, or inappropriate water use and management. It is considered that any potential impacts on the value of land are outweighed by the benefits of protecting the condition of the resource, so that it may continue to be used on a sustainable basis.

Land suitable for irrigation in an area with good quality underground water will tend to have a higher value than land that is not suitable for irrigation, or land located in an area where access is limited to underground water which is low yielding, unsuitable or marginal, for irrigation.

The SE Catchment Water Management Board has taken the above aspects into account in setting the policies and criteria within this plan.

6.1 Objectives

1. To ensure that underground water extractions remain within the sustainable limits of the unconfined aquifer by preventing over allocation of the resource at the local and management area scale and throughout the entire Prescribed Wells Area;

2. To protect the resource locally, throughout each management area and the entire Prescribed Wells Area, by ensuring that the taking and use of underground water does not cause a significant increase in the salinity of underground water, or cause a significant decrease in the elevation of the water table.

3. To provide flexibility and equity in access to the underground water resource of the unconfined aquifer;

4. To minimise constraints to economic activity throughout the region that result from the under use of water allocations;

5. To protect ecosystems dependent on underground water by ensuring that the taking and use of underground water from the unconfined aquifer does not cause significant degradation of the ecology and biodiversity of the region;

6. To protect the environment generally by ensuring that the taking and use of underground water from the unconfined aquifer does not cause significant degradation of any other resource such as soils or other water resources;

7. To manage the underground water resource of the unconfined aquifer so that it may continue to be utilised by future generations;

8. To encourage and expedite an active water market so that water allocations are readily available for future economic development;

9. To promote the active and efficient use of water allocations according to current industry best practice standards; and

10. To minimise the potential negative impacts of aquifer storage and recovery on underground water quality, and the integrity of the unconfined aquifer.

6.2 Principles

Limit to total allocation

1. Water shall not be allocated from the unconfined aquifer (by water (holding) or water (taking) allocation) where the allocation would cause the total amount allocated on all licences for the relevant management area to exceed the Volume for Licensed Allocation (VLA) for the relevant management area (see Table A), except where:

   (a) Water is to be allocated to existing non-licensed water users in accordance with principles 6.2.2 and 6.2.3 (Unlicensed pre-existing water use);

   (b) A water allocation is to be taken from another management area in accordance with principals 6.2.28 (Crop rotations) or 7.2.14 (Applications to transfer water taking allocations – destinations); or

   (c) Water is allocated above the VLA in the relevant management area at the **date of adoption,** in which case the taking of water will not cause significant adverse impacts on the unconfined aquifer within the relevant management area, and provided that where water is allocated above the VLA, the total amount

allocated on all licences within the relevant management area does not exceed the PAV for that management area (see Table A). Where water is allocated above the VLA in the relevant management area at **date of adoption**, no further water will be allocated, except where principles 6.2.1 (a) or 6.2.1 (b) apply.

Unlicensed pre-existing water use

2. Water may be allocated to existing non-licensed water users where:

   (a) It can be demonstrated that the water use in its present form at the date of application, was also in existence during the year prior to 10 April 1997;

   (b) Water is used for the following:

   - Operation of a dairy licensed by the Dairy Authority of South Australia at the date of application, (including wash down, washing up and milk cooling);
   - Intensive animal keeping;
   - An intensive plant production system such as greenhouses, hydroponics or nurseries;
   - Industry; or
   - Recreation;

   (c) The source aquifer nominated on the application is the aquifer from which the unlicensed water was being taken at 12th February 2001; and

   (d) An application for a water allocation is received no earlier than 5 p.m. on 30th June 2002 and no later than 5 p.m. on the 31 July 2002.

3. Water shall be allocated for unlicensed pre-existing water use in the following manner:

   (a) Where water remains available, or becomes available for allocation within a management area, up to 200ML shall be reserved for the purposes of allocation to unlicensed pre-existing water use, subject to 6.2.2 and 6.2.3 (b) – (d), until 5p.m. on the 31 July 2002;

   (b) The water allocation shall meet the applicant's reasonable requirements up to 10 megalitres per annum, except for dairies which milk in excess of 300 cows in which case the allocation shall meet the applicant's reasonable requirements;

   (c) In the case of dairies, the water allocation shall be calculated as whichever is the greater of, the reasonable requirements of the water user at the time of application, or the average of the annual reasonable requirements over the preceding three year period; and

   (d) Allocations granted under section 6.2.2 are exempt from sections 6.2.4 (Unallocated water), 6.2.11 (Quantity of allocation), 6.2.14 to 6.2.18 (Active and expeditious use of water), and 6.2.19 to 6.2.23 (Hydrogeological effects).

Where the 200 ML set aside in accordance with this principle has not been allocated then any remaining water shall be available for allocation in accordance with this Plan.

Unallocated water

4. Water may be allocated in the following manner:

   (a) All applications for a water licence and/or a water (taking) allocation (not including any application that involves the surrender of a water licence, water (taking) allocation or part thereof) received by the Minister after 5.00 p.m. on **adoption date**, will be given a serial number and dealt with in the following manner:

      (i) Applications from the same management area will be accumulated together;

      (ii) At 5.00 p.m. on the last Friday of each month, all applications received for that month will be anonymously given a random rank number for that management area;

      (iii) After any application for an allocation under 6.2.4 (b), (c) and (d) received in that month has been determined, the Minister will consider and determine applications for each management area by commencing with the lowest rank number within each management area first, and then in order of increasing rank number until all applications received in that month have been determined;

      (iv) Any applications received in successive months will be dealt with in the same manner;

      (v) Only one application per allotment for each management area will be determined by the Minister each month; and

      (vi) Where, in any month, more than one application is made in relation to the same allotment, if one of those applicants is the registered proprietor of the land, then that proprietor shall have his or her application determined before any other applicant, regardless of the rank number of his or her application.

   (b) Where a confined aquifer licence endorsed with a water (taking) allocation or the whole or part of a confined aquifer water (taking) allocation is surrendered by the licensee to the Minister under section 31 of the *Water Resources Act 1997* after 5p.m. **adoption date**, then an unconfined aquifer water (taking) allocation and/or water licence may be granted to that licensee within the unconfined aquifer management area that corresponds with the relevant confined aquifer management area. Such allocations shall not exceed the volume or area surrendered to the Minister, and shall be in accordance with the provisions of this Plan, except that the provisions of principles 6.2.10 and 6.2.11 (Quantity of allocation) and 6.2.14 – 6.2.18 (Active and expeditious use) shall not apply to such an allocation and/or licence.

(c) Where a confined aquifer licence endorsed with a water (taking) allocation or the whole or part of a confined aquifer water (taking) allocation held within the Kingston confined aquifer management area is surrendered by the licensee to the Minister under section 31 of the *Water Resources Act* 1997 after 5p.m. **adoption date**, then an unconfined aquifer water (taking) allocation and/or water licence may be granted to that licensee within any management area that lies within the Lacepede Kongorong PWA. Such allocations shall not exceed the volume or area surrendered to the Minister, and shall be in accordance with the provisions of this Plan, except that the provisions of principles 6.2.10 and 6.2.11 (Quantity of allocation) and 6.2.14 – 6.2.18 (Active and expeditious use) shall not apply to such an allocation and/or licence.

(d) Where a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation granted prior to **adoption date**, originates from a management area adjoining a zone within the Designated Border Area, but is taken and used in the Border Designated Area on an allotment that is divided by a Designated Border Area zone boundary, water may be allocated within the zone within the Border Designated Area to the applicant provided that a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation is surrendered by the licensee to the Minister under section 31 of the *Water Resources Act 1997* in the originating management area. Such allocations shall not exceed the volume or area surrendered to the Minister, and shall be in accordance with the provisions of this Plan, except that the provisions of principles 6.2.10 and 6.2.11 (Quantity of allocation) and 6.2.14 – 6.2.18 (Active and expeditious use) shall not apply to such an allocation and /or licence.

Underground Water Resource condition

5. The taking and use of water shall not cause, or be likely to cause:

(a) A mean (arithmetic) increase in salinity of the underground water resource of greater than 10 mg/L per year (measured over the preceding 5 years) within the vicinity of the point of use (including neighbouring properties and the nearest salinity monitoring wells), or within the relevant management area;

(b) A mean (arithmetic) decrease in underground water levels within the vicinity of the point of taking (including neighbouring properties and the nearest underground water level monitoring wells), or within the relevant management area of greater than 0.1 metres per year (measured over the preceding 5 years), except where the taking and use of water is for the purposes of industry or energy generation;

(c) A decline in underground water levels over a period of greater than 3 years within the vicinity of the point of taking (including neighbouring properties and the nearest underground water level monitoring wells), or within the relevant management area, before a new stable equilibrium water level is achieved, where the taking and use of water is for the purposes of industry or energy generation.

Water (holding) allocations

6. No water (holding) allocation shall be endorsed on a licence after **adoption date** except where a water (taking) allocation, either in whole or part, endorsed on a licence, is converted to a water (holding) allocation, with the exception that any water (taking) allocation on a licence that is subject to a condition or conditions requiring the expeditious use of water (including a requirement that the equipment, or land by which or on which the water is used be developed in a certain time), shall not be converted to a water (holding) allocation, if the condition has, or conditions have, not been satisfied.

Basis of allocation

7. Allocations of water granted after 5.00 p.m. on adoption date will be expressed volumetrically except for:

   (a) Allocations granted in accordance with principles 6.2.4 (b), (c) and (d), which shall be expressed in the same units of measure as those on the water licence endorsed with a water(taking) allocation, or the whole or part of a water (taking) allocation, surrendered to the Minister under section 31 of the *Water Resources Act 1997*.

   (b) Allocations that have been obtained through transfers, which shall be expressed in the same units of measure as those used prior to the transfer;

   (c) Allocations varied through conversion from a water (taking) allocation to a water (holding) allocation, which shall remain expressed in the same units of measure as those used prior to conversion; and

   (d) Allocations varied through conversion from a water (holding) allocation to a water (taking) allocation, which shall remain expressed in the same units of measure as those used prior to conversion.

Purpose of use

8. Water shall not be taken and used for the purposes of wild flooding.

9. Water shall not be taken from the unconfined aquifer and used for the purpose of aquaculture unless:

   (a) The volume of tail water produced for disposal does not exceed an amount reasonably produced according to current best industry practice; and

   (b) The disposal of tail water does not result in an increase (above seasonal fluctuations) in underground water levels in the unconfined or confined aquifers at the boundary of the allotment or, at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal;

   (c) Disposal of tail water does not result in an accelerated increase in salinity of the unconfined or confined aquifers, or result in pollution of these aquifers by any other substance; and

(d) The ponds, tanks, vessels or other places for the keeping of any water for the aquaculture process have no significant hydraulic connection with the unconfined or confined aquifers.

Quantity of allocation

10. Where water is to be used for irrigation purposes, the allocation shall not exceed the amount reasonably required to irrigate the area of the particular crop type, on the dominant soil type and given the local average meteorological conditions applicable to the relevant allotment.

11. Where water is to be used for purposes other than irrigation, the allocation shall not exceed the amount reasonably required (applying current industry best practice standards) for the purpose proposed.

Efficient use of water

12. Water shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstance for and in which the water is to be used in accordance with current industry best practice standards.

13. For the purposes of principle 6.2.12 the particular circumstances for the use of water for irrigation include (but are not limited to):

    (a) The plant type;

    (b) The climate, dominant soil type and topography of the allotment;

    (c) The location of remnant native vegetation and/or other permanent structures such as powerlines, which may limit the method of application of water; and

    (d) The salinity of the water to be used.

Active and expeditious use of water

14. All water (taking) allocations granted on or after **adoption date**, excluding allocations which have been obtained through transfers shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

15. All water (taking) allocations granted before **adoption date**, with a condition requiring active and expeditious use, shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

16. All water (taking) allocations granted after 5pm 1 September 2000, resulting from the conversion of a water (holding) allocation, shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

17. For the purposes of principles 6.2.14, 6.2.15 and 6.2.16, the use of an allocation includes the development of the land and equipment upon or by which the water is used, to a capacity that enables the water (taking) allocation to be utilised at its maximum lawful rate.

18. Without in any other way affecting the operation of principles 6.2.14, 6.2.15 and 6.2.16, where **exceptional circumstances** apply to the licensee, the maximum period may be increased to 4 years from the granting of the allocation.

Hydrogeological effects

19. The taking of water for industrial, energy generation or public water supply use shall not adversely affect to a significant extent:

    (a) The quality of water in the unconfined aquifer by (including but not limited to) an increase in salinity by exceeding the rate specified in principle 6.2.5 (a);

    (b) The water level of the unconfined aquifer by causing or contributing to a long term decline in underground water levels by exceeding the rate specified in principle 6.2.5 (c) for industrial or energy generation use, or 6.2.5 (b) for public water supply use; and

    (c) The structural integrity of the aquifer.

20. The taking of water for all purposes other than those mentioned in principle 6.2.19 shall comply with the 4 kilometre square test and the taking and use of water shall not adversely affect to a significant extent:

    (a) The quality of water in the unconfined aquifer by (including but not limited to) an increase in salinity by exceeding the rate specified in principle 6.2.5 (a);

    (b) The water level of the unconfined aquifer by causing or contributing to a long term decline in underground water levels by exceeding the rate specified in principle 6.2.5 (b)

    (c) The structural integrity of the aquifer;

    (d) Any other water resource (including but not limited to the confined aquifer, or any relevant surface water resource), both within and beyond the Lacepede Kongorong Prescribed Wells Area; and

    (e) Ecosystems dependent on underground water, by contravening principle 6.2.24.

21. The "4 kilometre square test" requires that the granting of a water (taking) allocation shall not cause the total volume of water (taking) allocations within a square with 4 kilometre long sides to exceed 1.25 times the amount of annual average vertical recharge for the management area.

22. The 4 kilometre square shall be centred on the specified point of taking of the water or, where the precise point of taking is not specified, the 4 kilometre square shall be centred on the centremost point of the nominated allotment involved in the application. Where the point of taking of the water is not specified the well shall be constructed for the taking of the water within a 1 kilometre radius of the centremost point of the nominated allotment.

23. For the purposes of the 4 kilometre square test, the amount of annual average vertical recharge is whichever is the lesser of:

    (a) The annual average vertical recharge rate set out in Table C (annexed hereto) for the relevant management area multiplied by 16km^2; or

(b) The amount determined by the following formula **–** Specific yield within the 4 kilometre square multiplied by long term seasonal underground water level fluctuation.

Ecosystems dependent on underground water

24. Water shall not be taken and used if to do so may create a significant adverse affect on ecosystems that depend on the underground water by causing:

    (a) The mean water table elevation within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to drop below that identified for the relevant land unit as specified in Table 2.1;

    (b) The seasonal water table range within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to exceed the range identified for the relevant land unit as specified in Table 2.1;

    (c) The seasonality of the minimum or maximum water table level within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to vary from that identified for the relevant land unit as specified in Table 2.1; and

    (d) Salinity of underground water within the vicinity of the point of use or within the relevant land unit (see Figure 2.1) to exceed the range identified for the relevant land unit as specified in Table 2.1.

25. Factors that will be considered in assessing the likelihood of significant adverse impacts include, but are not limited to the:

    (a) Distance of the proposed extraction point from ecosystems that depend on the underground water; and

    (b) Local hydrogeology.

Piping of water more than 2km

26. Where water is to be taken from one point and transported by pipe or other means to be used at another point at least 2 kilometres from the point of taking, both the taking and use of water shall comply with principles 6.2.19 and 6.2.20 (Hydrogeological effects). The 4 kilometre square test shall only apply at the point of taking.

Divided allotments

27. Where an allotment is, or two or more adjoining allotments held by the same owner are, divided by a management area or prescribed wells area boundary, but a water allocation is held in only one of the management areas or prescribed wells areas, the allocation may be taken and used anywhere throughout the allotment or adjoining allotments, provided that:

    (a) The taking and use of water meets the hydrogeological criteria defined in principles 6.2.19 – 6.2.23 (Hydrogeological effects); and

(b) The point of extraction is not moved more than 2 kilometres into an adjacent management area or prescribed wells area unless it can be demonstrated that the allocation (or part thereof) was being extracted at the current location in an adjoining management area or prescribed wells area prior to **adoption date**;

(c) An allocation from another management area is not taken in a border zone designated under the *Groundwater (Border Agreement) Act 1985* unless it can be demonstrated that the allocation (or part thereof) was being taken at the current location in a zone within the border Designated Area prior to **adoption date**;

(d) The allocation remains referenced to, and accounted for in the originating management area and prescribed wells area; and

(e) The allocation will not be available for further transfer within the receiving management area and prescribed wells area.

Crop rotations

28. Subject to principles 6.2.29 to 6.2.30, an allocation of water from a management area may be taken from another management area ("the receiving management area") for the purposes of irrigating a rotational crop for a maximum period of 5 years (from the date that the application to take the allocation of water from a receiving management area is approved) provided the taking of water from the receiving management area complies with principles 6.2.19 – 6.2.23 (Hydrogeological effects) of this Plan.

29. For the purposes of principle 6.2.28, water may not be taken from another unconfined aquifer management area for the purposes of irrigating a rotational crop, where a receiving management area lies within the Padthaway Prescribed Wells Area. An allocation granted for the purposes of irrigating a rotational crop after **adoption date,** may not be taken from a receiving unconfined aquifer management area that lies in a zone within the area designated under the *Groundwater (Border Agreement) Act, 1985*.

30. Where the receiving management area is fully allocated on **adoption date**, or the sum of the amount of water proposed to be taken in the receiving management area and the amount allocated in the receiving management area at the date of application, exceeds the Volume for Licensed Allocation (VLA) for the receiving management area, the allocation of water may only be taken provided that:

    (a) The taking and use of water in the receiving management area complies with principles 6.2.19 – 6.2.23 (Hydrogeological effects) of this Plan; and

    (b) The level of water use in the year preceding the year ending 30 June did not exceed 90% of the VLA of the receiving management area.

The Allocation of Recharged Imported water from Aquifer Storage and Recovery Schemes

Principles 6.2.31 to 6.2.35 apply to the allocation of imported water recharged for the purpose of aquifer storage and recovery, pursuant to a permit under section 9(3)(c) of the *Water Resources Act 1997*

Basis of Allocation of Recharged Imported Water

31. The basis for allocating recharged imported water will be an entitlement to take, during a water use year, a percentage (not exceeding 80%) of the measured volume of imported water recharged in the previous water use year under a permit issued under section 9(3)(c) of the *Water Resources Act 1997.*

32. Imported water that is used for recharge under an aquifer storage and recovery scheme will not be available for allocation where it is considered that it would have contributed to the natural vertical recharge of the unconfined or confined aquifer systems. Imported water that is recharged within the Lacepede Kongorong Prescribed Wells Area will only be available for allocation where:

    (a) Underground water that has been imported for the purposes of aquifer storage and recovery has been extracted from the originating management area or a zone within the border Designated Area under a licence issued under the provisions of the *Water Resources Act 1997,* or the *Groundwater (Border Agreement) Act 1985*; or

    (b) Surface water that has been imported for the purposes of aquifer storage and recovery has been extracted under a licence issued under the provisions of the South Australian *Water Resources Act 1997* or the Victorian *Water Act 1989*. Imported water that is recharged within a management area that lies in a zone within the area designated under the *Groundwater (Border Agreement) Act, 1985* will not be available for allocation.

33. An allocation of recharged imported water must be taken and used within a period of three years calculated from the 1 July in the year in which the allocation is granted.

34. An allocation of recharged imported water shall only be taken from the original well of discharge of the imported water to the aquifer, or from a well within 500 metres radius of it.

Criteria for Allocation of Recharged Imported Water

35. Recharged imported water shall only be allocated where the taking and use of the recharged imported water will not cause, or will not be likely to cause:

    (a) Detrimental effects on the underground water resource (including but not limited to increased salinity or pollution);

    (b) A decrease in the productive capacity of the land;

    (c) Perched watertables;

    (d) Waterlogging;

    (e) A decrease in the depth of water exceeding two metres when compared to the prevailing water level at the date of the granting of the permit, in a well within a 500 metre radius of the point from which the recharged imported water is extracted, when the well is owned by someone other than the applicant for allocation of recharged imported water; and/or

    (f) Significant adverse impacts on ecosystems.

7 Transfer Criteria – Unconfined Aquifer

7.1 Objectives

1. To protect ecosystems dependent on underground water by ensuring that the taking and use of underground water from the unconfined aquifer does not degrade the ecology and biodiversity of the region;

2. To protect the environment generally by ensuring that the taking and use of underground water from the unconfined aquifer does not significantly degrade any other resource such as soils or other water resources;

3. To provide flexibility and equity in access to the underground water resource of the unconfined aquifer;

4. To encourage and expedite an active water market so that water allocations are readily available for future economic development;

5. To promote the active and efficient use of water according to industry best practice standards;

6. To manage the underground water resource of the unconfined aquifer so that it may continue to be utilised by future generations;

7. To ensure that extractions remain within the sustainable limits of the unconfined aquifer by limiting the concentration of underground water use from the unconfined aquifer that may result through the transfer of water allocations; and

8. To minimise constraints to economic activity throughout the region that result from the under use of water allocations.

7.2 Principles

Transfers of water (holding) allocations

1. A licence endorsed with a water (holding) allocation, or the whole or a part of a water (holding) allocation may be transferred to any person or legal entity, but will continue to be recognised as being held from the same management area from which the allocation was originally granted.

Transfer of water (taking) allocations

2. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, from the unconfined aquifer, may not be transferred to the confined aquifer.

Applications to transfer water (taking) allocations – Purpose of use

3. Transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, will not be granted where water is to be taken and used for wild flooding.

4. Transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation that is to be used for the purpose of aquaculture will not be granted unless:

   (a) The volume of tail water produced for disposal does not exceed an amount reasonably produced according to current best industry practice;

   (b) Disposal of tail water does not result in an increase above seasonal fluctuations in underground water levels in the unconfined or confined aquifers at the boundary of the allotment or, at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal;

   (c) Disposal of tail water does not result in an accelerated increase in salinity of the unconfined or confined aquifers, or result in pollution of these aquifers by any other substance; and

   (d) The ponds, tanks, vessels or other places for the keeping of any water for the aquaculture process have no significant hydraulic connection with the unconfined or confined aquifers.

Applications to transfer water (taking) allocations – Efficient use of water

5. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, shall only be transferred where the water shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstances for, and in which the water is to be used in accordance with current industry best practice standards.

6. For the purposes of principle 7.2.5, the relevant circumstances for the use of water for irrigation include (but are not limited to) the:

   (a) Plant type;

   (b) Climate, dominant soil type and topography of the allotment;

   (c) Location of remnant native vegetation and/or other permanent structures such as powerlines, which may limit the method of application of water; and

   (d) Salinity of the water to be used.

Applications to transfer water (taking) allocations – Hydrogeological effects

7. The transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, for industrial, energy generation or public water supply use shall not adversely affect to a significant extent:

   (a) The quality of water in the unconfined aquifer by (including but not limited to) an increase in salinity by exceeding the rate specified in principle 6.2.5 (a);

   (b) The water level of the unconfined aquifer by causing or contributing to a long term decline in underground water levels by exceeding the rate specified in principle 6.2.5 (c) for industrial or energy generation use, or 6.2.5 (b) for public water supply use; and

   (c) The structural integrity of the aquifer.

8. Subject to principle 7.2.9, a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, that is to be used for all purposes other than those mentioned in principle 7.2.7, shall only be transferred where the taking of water complies with the 4 kilometre square test (as defined in sections 6.2.21 to 6.2.23) and the taking and use of water shall not adversely affect to a significant extent:

   (a) The quality of water in the unconfined aquifer by (including but not limited to) an increase in salinity by exceeding the rate specified in principle 6.2.5 (a);

   (b) The water level of the unconfined aquifer by causing or contributing to a long term decline in underground water levels by exceeding the rate specified in principle 6.2.5 (b);

   (c) The structural integrity of the aquifer;

   (d) Any other water resource (including but not limited to the confined aquifer, or any relevant surface water resource), both within and beyond the Lacepede Kongorong Prescribed Wells Area; and

   (e) Ecosystems dependent on underground water, by contravening principle 7.2.10.

9. A transfer application shall be deemed to have complied with the 4 kilometre square test (as defined in sections 6.2.21 to 6.2.23) without further assessment, where:

   (a) A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, is to be transferred but will continue to be taken from the same well, or is replaced by a new well within 1km of the original well, and is to be used on the same allotment or allotments; or

   (b) An application to renew a temporary transfer (of the same quantity) that proposes taking the water allocation from the same well (or a well that replaces the original well, but lies within 1 kilometre of the original well), and the use of the allocation on the same allotment or allotments, is received and processed prior to the date and time of expiry of the original temporary transfer.

Ecosystems dependent on underground water

10. Transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation will not be granted if to do so will create a significant adverse effect on ecosystems that depend on the underground water by causing the:

    (a) Mean water table elevation within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to drop below that identified for the relevant land unit as specified in Table 2.1;

    (b) Seasonal water table range within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to exceed the range identified for the relevant land unit as specified in Table 2.1;

(c) Seasonality of the minimum or maximum water table level within the vicinity of the point of taking or within the relevant land unit (see Figure 2.1) to vary from that identified for the relevant land unit as specified in Table 2.1; and

(d) Salinity of underground water within the vicinity of the point of use or within the relevant land unit (see Figure 2.1) to exceed the range identified for the relevant land unit as specified in Table 2.1.

11. Factors that will be considered in assessing the likelihood of significant adverse impacts include, but are not limited to the:

(a) Distance of the proposed extraction point from ecosystems that depend on the underground water; and

(b) Local hydrogeology.

Applications to transfer water (taking) allocations – piping of water more than 2km

12. A transfer application that proposes the taking of water from one point and transporting it by pipe or other means to be used at another point at least 2 kilometres from the point of taking, both the taking and use of water shall comply with principles 7.2.7 to 7.2.8 (Hydrogeological effects). The 4 kilometre square test shall only apply at the point of taking. Where the proposed point of taking and point of use is the same as those being utilised prior to transfer, the proposed transfer of water shall be deemed to have complied with the 4 kilometre square test at both the extraction and discharge sites without further assessment.

Applications to transfer water (taking) allocations – Destinations

13. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, may be transferred either permanently or temporarily where the proposed location of the point of extraction lies within the same management area as the existing location of the point of extraction from which the allocation may lawfully be taken.

14. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, may be transferred from a management area to an adjacent management area, where the proposed point of extraction and use is less than or equal to a maximum of 2 kilometres inside that adjacent management area, on an allotment which adjoins the management area boundary, consistent with the following criteria:

(a) The maximum period of transfer shall be 5 years;

(b) The provisions of this principle shall not apply where the receiving management area lies within the area designated under the *Groundwater (Border Agreement) Act 1985* or in the Padthaway PWA;

(c) The allocation shall continue to be deemed to be taken from and accounted for in the management area of its origin;

(d) Water transferred for extraction and use up to a maximum of 2 kilometres into an adjacent management area will not then be available for subsequent transfer elsewhere in the receiving management area except to other allotments adjoining the same management area boundary and where the proposed point of extraction and use lies less than or equal to a distance of 2km from the boundary of the original management area;

(e) Use and extraction shall be consistent with the relevant Water Allocation Plan for the receiving management area.

(f) The transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, up to 2 kilometres into an adjacent management area, shall not cause the total allocations that may be used in the receiving management area to exceed 110% of its Volume for Licensed Allocation (VLA). An application to transfer a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, up to 2 kilometres into an adjacent management area, which would cause the total allocations that may be used in that adjacent management area to exceed 110 % of its VLA, shall not be permitted and subsequent applications to transfer a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, up to 2 kilometres into that adjacent management area, shall not be permitted unless and until the total allocations that may be used in that management area become less than or equal to 105 % of its VLA.

(g) The transfer shall be subject to principles 7.2.2 (Transfers of water (taking) allocations), 7.2.3 and 7.2.4 (Purpose of use), 7.2.5 and 7.2.6 (Efficient use of water), 7.2.7 - 7.2.9 (Hydrogeological effects), 7.2.10 and 7.2.11 (Ecosystems dependent on underground water) and 7.2.15 (Development of allocation before transfer).

For the purposes of this clause, an “adjacent management area” includes all management areas that adjoin the management area from which the allocation or licence was initially granted, including those that may lie within an adjoining prescribed wells area.

Applications to transfer water (taking) allocations – Development of allocation before transfer

15. For licences granted by the Minister with a condition or conditions imposed requiring the expeditious use of water (including a requirement that the equipment, or land by which or on which the water is used be developed in a certain time), the following applies:

(a) The allocation (or part thereof) or licence may be transferred where the equipment or land has been fully developed to allow use of the water at its maximum lawful rate; or

(b) Where the expeditious use conditions have not been fully satisfied, only the portion of the allocation that may be used in accordance with the extent of development at the date of receipt of the application to transfer by the Minister may be transferred.

(c) Where the licence or allocation is to be transferred in its entirety, but will be taken and used on the same allotment, it may be transferred whether or not the land or equipment has been fully developed in accordance with the condition(s), provided that the new landholder fully develops the land and equipment to allow use of the allocation at its maximum lawful rate, in accordance with the original conditions.

Applications to transfer water allocated from aquifer storage and recovery schemes

16. Water allocated from aquifer storage and recovery schemes may only be transferred where the water will continue to be taken from the same point of extraction, or the proposed well of extraction is within a 500 metre radius of the well to which the imported water was discharged.

8 Allocation Criteria - Confined Aquifer

8.1 Objectives

1. To ensure that underground water extractions remain within the sustainable limits of the confined aquifer by preventing over allocation of the underground water resource at the local, and management area scale and throughout the entire Prescribed Wells Area;

2. To protect the resource locally, throughout each management area and the entire Prescribed Wells Area, by ensuring that the taking and use of underground water does not cause a significant decrease in the elevation of the potentiometric level of the confined aquifer.

3. To cautiously manage the confined aquifer, due to it being an ancient resource, with limited recharge;

4. To ensure that underground water from the unconfined aquifer is allocated and used in precedence to underground water from the confined aquifer;

5. To protect ecosystems dependent on underground water by ensuring that the taking and use of underground water from the confined aquifer does not significantly degrade the ecology and biodiversity of the region;

6. To protect the environment generally by ensuring that the taking and use of underground water from the confined aquifer does not significantly degrade any other resource, such as soils or other water resources;

7. To manage the confined aquifer underground water resource so that it may continue to be utilised by future generations;

8. To encourage and expedite an active water market so that water allocations are readily available for future economic development; and

9. To promote the efficient use of water according to industry best practice standards.

8.2 Principles

Except where otherwise expressly stated, all of the following principles apply to the allocation of water (taking) allocations from the confined aquifer.

Limit to total allocation

1. Water shall not be allocated from the confined aquifer where the allocation would cause the total amount allocated on all licences for the relevant management area plus the Irrigation Extraction Factor, to exceed the Volume for Licensed Allocation (VLA) for the relevant management area (as shown in Figure 4.3), except where:

   (a) Water is to be allocated to existing non-licensed users in accordance with principles 8.2.2 and 8.2.3 (Unlicensed pre-existing water use); or

   (b) The total amount allocated on all licences plus the Irrigation Extraction Factor exceeds the VLA in the relevant management area at the **date of adoption**, in which case the taking of the water will not cause significant adverse impacts on

the confined aquifer within the relevant management area and provided that where the total amount allocated on all licences plus the Irrigation Extraction Factor exceeds the VLA in the relevant management area, the total amount allocated on all licenses plus the Irrigation Extraction Factor within the relevant management area, does not exceed the PAV for that management area (see Table B). Where the total amount allocated on all licences plus the Irrigation Extraction Factor exceeds the VLA in the relevant management area at **date of adoption**, no further water will be allocated, except where principles 8.2.2 and 8.2.3 apply.

Unlicensed pre-existing use

2. Water may be allocated to existing non-licensed water users where:

   (a) It can be demonstrated that the water use in its present form at the date of application, was also in existence during the year prior to 10 April 1997;

   (b) Water is used for the following:

   - Operation of a dairy licensed by the Dairy Authority of South Australia at date of application, (including wash down, washing up and milk cooling);
   - Intensive animal keeping;
   - An intensive plant production system such as greenhouses, hydroponics or nurseries;
   - Industry; or
   - Recreation;

   (c) The source aquifer nominated on the application is the aquifer from which the unlicensed water was being taken at 12th February 2001; and

   (d) Applications for a water allocation are received by no earlier than 5 p.m. on 30 June 2002 and no later 31 July 2002.

3. Water shall be allocated for unlicensed pre-existing use in the following manner:

   (a) The water allocation shall meet the applicant's reasonable requirements up to 10 megalitres per annum, except for dairies which milk in excess of 300 cows in which case the allocation shall meet the applicant's reasonable requirements;

   (b) In the case of dairies, the water allocation shall be calculated as whichever is the greater of, the reasonable requirements of the water user at the time of application, or the average of the reasonable requirements over the preceding three year period;

   (c) Allocations granted under section 8.2.3 are exempt from sections 8.2.4 and 8.2.5 (Taking and Use of water), 8.2.13 (Quantity of allocation), 8.2.16 to 8.2.20 (Active and expeditious use of water) and 8.2.21 to 8.2.23 (Hydrogeological effects).

Taking and Use of Water

4. Up to 50% of the volume available for allocation in the Millicent and Kalangadoo confined aquifer management areas at **adoption date** may be allocated for the purposes of industry.

5. Subject to principle 8.2.4, there shall be no further allocations of confined aquifer water in the Lacepede Kongorong PWA, except:

   (a) Where principles 8.2.2 and 8.2.3 (Unlicensed pre-existing use) apply;

   (b) For the purpose of public water supply; or

   (c) Where an allocation is permanently transferred into the Millicent confined aquifer management area in accordance with principle 9.2.6 (Transfer of water (taking) allocations) of this Plan.

Underground Water Resource Condition

6. The taking and use of water shall not cause or be likely to cause a mean (arithmetic) decrease in the potentiometric level of the confined aquifer within the vicinity of the point of taking (including neighbouring properties and the nearest potentiometric level monitoring wells), or within the relevant confined aquifer management area, of greater than 0.1 metres per year (measured over the preceding 5 years).

Water (holding) allocations

7. No water (holding) allocation shall be endorsed on a licence after **adoption date** except where a water (taking) allocation, either in whole or part, endorsed on a licence, is converted to a water (holding) allocation, with the exception that any water (taking) allocation on a licence that is subject to a condition or conditions requiring the expeditious use of water (including a requirement that the equipment, or land by which or on which the water is used be developed in a certain time), shall not be converted to a water (holding) allocation, if the condition has, or conditions have, not been satisfied.

Basis of allocation

8. Allocations of confined aquifer water granted after 5 p.m. on **adoption date** will be expressed volumetrically, except for:

   (a) Allocations that have been obtained through transfers, which shall be expressed in the same units of measure as those used prior to transfer;

   (b) Allocations varied through conversion from a water (taking) allocation to a water (holding) allocation, which shall remain expressed in the same units of measure as those used prior to conversion; and

   (c) Allocations varied through conversion from a water (holding) allocation to a water (taking) allocation, which shall remain expressed in the same units of measure as those used prior to conversion.

9. All allocations of confined aquifer water will be expressed volumetrically by 1 January 2005.

Purpose of use

10. Water shall not be taken and used for the purposes of wild flooding.

11. Water shall not be taken from the confined aquifer and used for the purpose of aquaculture unless:

    (a) The volume of tail water produced for disposal does not exceed an amount reasonably produced according to current industry best practice;

    (b) Disposal of tail water will not result in an increase (above seasonal fluctuations) in underground water levels in the unconfined or confined aquifers at the boundary of the allotment where the tail water is disposed of or, at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal ;

    (c) Disposal of tail water will not result in an accelerated increase in salinity of the unconfined or confined aquifers, or result in pollution of these aquifers by any other substance; and

    (d) The ponds, tanks, vessels, or other places for the keeping of any water for the aquaculture process have no significant hydraulic connection with the unconfined or confined aquifers.

Quantity of allocation

12. Where water is to be used for irrigation purposes, the allocation shall not exceed the amount reasonably required to irrigate the area of the particular crop type, on the dominant soil type and given the local average meteorological conditions applicable to the relevant allotment.

13. Where water is to be used for purposes other than irrigation, the allocation shall not exceed the amount reasonably required (applying current industry best practice standards) for the purpose proposed.

Efficient use of water

14. Water shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstances for and in which the water is to be used in accordance with current industry best practice standards.

15. For the purposes of principle 8.2.14, the relevant circumstances for the use of water for irrigation include (but are not limited to) the:

    (a) Plant type;

    (b) Climate, dominant soil type and topography of the allotment;

    (c) Location of remnant native vegetation and/or other permanent structures such as powerlines, which may limit the method of application of water; and

    (d) Salinity of the water to be used.

Active and expeditious use of water

16. All water (taking) allocations granted on or after adoption date, excluding allocations which have been obtained through transfers shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

17. All water (taking) allocations granted before **adoption date**, with a condition requiring active and expeditious use, shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

18. All water (taking) allocations granted after **adoption date**, resulting from the conversion of a water (holding) allocation, shall be used with the minimum of delay and in any case within 3 years of the granting of the allocation.

19. For the purposes of principles 8.2.16, 8.2.17 and 8.2.18 the use of an allocation includes the development of the land and equipment upon or by which the water is used, to a capacity that enables the water (taking) allocation to be utilised at its maximum lawful rate.

20. Without in any other way affecting the operation of principles 8.2.16, 8.2.17 and 8.2.18, where exceptional circumstances apply to the licensee, the maximum period may be increased to 4 years from the granting of the allocation.

Hydrogeological effects

21. The taking and use of water shall not adversely affect to a significant extent:

    (a) The quality of water in the confined aquifer by (including but not limited to) an increase in salinity

    (b) The potentiometric level of the confined aquifer by causing or contributing to a long term decline in the potentiometric level by exceeding the rate specified in principle 8.2.6;

    (c) The structural integrity of the aquifer;

    (d) Any other water resource (including but not limited to the unconfined aquifer, or any relevant surface water resource), both within and outside the Lacepede Kongorong Prescribed Wells Area; and

    (e) Ecosystems dependent on underground water.

22. The taking of water from the confined aquifer shall not cause a seasonal draw-down at any point beyond the 2 km radius from the well(s) of greater than 2.0 metres, except where water is taken and used for the purpose of public water supply by SA Water Corporation or a local government authority and that Corporation or authority had supplied the public with water from the well(s) on or before adoption date.

23. The taking of water from the confined aquifer shall not occur if it is likely to cause the potentiometric level in the confined aquifer to permanently fall below the potentiometric level in the unconfined aquifer in areas where the existing potentiometric level of the confined aquifer is greater than the potentiometric level of the unconfined aquifer.

Piping of water more than 2km

24. Where water is to be taken from one point and transported by pipe or other closed vessel to be used at another point at least 2 kilometres from the point of taking, the taking of water shall comply with principles 8.2.21 to 8.2.23 and use of the water shall comply with principle 8.2.21.

25. Confined aquifer water (taking) allocations granted after **adoption date** shall not be transported from the point of taking by means of an open channel.

9 Transfer Criteria – Confined Aquifer

9.1 Objectives

1. To protect ecosystems dependent on underground water by ensuring that the taking and use of underground water from the confined aquifer does not degrade the ecology and biodiversity of the region;

2. To protect the environment generally by ensuring that the taking and use of underground water from the confined aquifer does not significantly degrade any other resource, such as soils or other water resources;

3. To promote the efficient use of water according to industry best practice standards;

4. To manage the underground water resource of the confined aquifer so that it may continue to be utilised by future generations;

5. To ensure that extractions remain within the sustainable limits of the confined aquifer by limiting the concentration of water use that may result through the transfer of water allocations;

6. To enable permanent transfers out of the Kingston management area.

9.2 Principles

Except where otherwise expressly stated, all the following principles apply to the transfer of a water (taking) licence or the whole or part of a water allocation of a licence, from the confined aquifer.

Transfer of a water (holding) allocation

1. A licence endorsed with a water (holding) allocation, or the whole or a part of a water (holding) allocation may be transferred to any person or legal entity, but will continue to be recognised as being held from the same management area from which the allocation was originally granted.

Transfer of a Water (Taking) Allocation – Purpose of Use

2. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, shall not be transferred where water is to be taken and used for wild flooding.

3. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, may only be transferred for the purpose of flood irrigation where the water will continue to be taken from the same well (or a well that replaces the original well, but lies within 1 kilometre of the original well) and is to be used on the same allotment or allotments.

4. The transfer of a licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, that is to be taken from the confined aquifer for the purpose of aquaculture will not be granted unless:

(a) The volume of tail water produced for disposal does not exceed an amount reasonably produced according to current industry best practice;

(b) Disposal of tail water will not result in an increase (above seasonal fluctuations) in underground water levels in the unconfined or confined aquifers at the boundary of the allotment where the tail water is disposed of, or, at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal;

(c) Disposal of tail water will not result in an accelerated increase in salinity of the unconfined or confined aquifers, or result in pollution of these aquifers by any other substance; and

(d) The ponds, tanks, vessels, or other places for the keeping of any water for the aquaculture process have no significant hydraulic connection with the unconfined or confined aquifers.

Transfer of a water (taking) allocation

5. A licence endorsed with a water (taking) allocation or the whole or a part of a water (taking) allocation from the confined aquifer may be transferred either permanently or temporarily only where the proposed point of extraction is in the same confined aquifer management area as the existing point of extraction from which the allocation may lawfully be taken.

6. Existing water (taking) allocations which may lawfully be taken from the confined aquifer in the Kingston management area may be permanently transferred into the Millicent, or Zone 1A confined aquifer management areas, where the transfer will not cause the VLA to be exceeded in the receiving management area.

Applications to transfer a water (taking) allocation – Efficient use of water

7. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation shall only be transferred where the water shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstances for and in which the water is to be used in accordance with current industry best practice standards.

8. For the purposes of principle 9.2.7, the relevant circumstances for the use of water for irrigation include (but are not limited to):

   (a) The plant type;

   (b) The climate, dominant soil type and topography of the allotment;

   (c) The location of remnant native vegetation and/or other permanent structures such as powerlines, which may limit the method of application of water; and

   (d) The salinity of the water to be used.

Applications to transfer water (taking) allocations – Hydrogeological effects

9. A licence endorsed with a water (taking) allocation, or the whole or a part of a water (taking) allocation, shall only be transferred where the taking and use of water shall not adversely affect to a significant extent:

   (a) The quality of water in the confined aquifer by (including but not limited to) an increase in salinity;

   (b) The potentiometric level of the confined aquifer by causing or contributing to a long term decline in the potentiometric level by exceeding the rate specified in principle 8.2.6;

   (c) The structural integrity of the aquifer;

   (d) Any other water resource (including but not limited to the unconfined aquifer, or any relevant surface water resource), both within and outside the Lacepede Kongorong Prescribed Wells Area;

   (e) Ecosystems dependent on underground water.

10. The transfer shall not cause the taking of water from the confined aquifer from the proposed well(s) of extraction to result in a seasonal draw-down at any point beyond the 2 km radius from the proposed well(s) of greater than 2.0 metres.

11. The transfer shall not occur where the taking of water from the confined aquifer from the proposed well(s) of extraction is likely to cause the potentiometric level in the confined aquifer to permanently fall below the potentiometric level in the unconfined aquifer, in areas where the existing potentiometric level of the confined aquifer is greater than the potentiometric level of the unconfined aquifer.

12. A transfer application shall be deemed to have complied with principle 9.2.10, and 9.2.11 without further assessment where:

   (a) A licence endorsed with a water (taking) allocation or the whole or a part of a water (taking) allocation is to be transferred but will continue to be taken from the same well, or is replaced by a new well within 1 kilometre of the original well and is to be used on the same allotment or allotments; or

   (b) An application to renew a temporary transfer (of the same quantity) that proposes taking the water allocation from the same well (or a well that replaces the original well, but lies within 1 kilometre of the original well), and use of the allocation on the same allotment or allotments, is received and processed prior to the date and time of expiry of the original temporary transfer.

Applications to transfer water (taking) allocations –Piping of water more than 2km

13. Transfer applications where water is to be taken from one point and transported by pipe or other closed vessel to be used at another point at least 2 kilometres from the point of taking, the taking of water shall comply with principles 9.2.9, 9.2.10 and 9.2.11 and use of the water shall comply with principle 9.2.9.

14. Transfer applications that propose transporting confined aquifer water from the point of taking by means of an open channel shall not be granted.

Applications to transfer water (taking) allocations – Development of allocation before transfer

15. Licences from the confined aquifer with a condition or conditions imposed requiring the expeditious use of water (including a requirement that the equipment, or land by which or on which the water is used be developed in a certain time):

(a) The allocation (or part thereof) or the licence may be transferred where the equipment or land has been fully developed to allow use of the water at its maximum lawful rate;

(b) Where the expeditious use conditions have not been fully completed, only the portion of the allocation that may be used in accordance with the extent of development at the date of receipt of the application to transfer by the Minister may be transferred; or

(c) Where the licence or allocation is to be transferred in its entirety, but will be taken and used on the same allotment, it may be transferred whether or not the land or equipment has been fully developed in accordance with the condition(s), provided that the new landholder fully develops the land and equipment to allow use of the allocation at its maximum lawful rate, in accordance with the original conditions.

10 Permits

10.1 Wells

The following objectives and principles apply to permits for activities pursuant to section 9(3)(a) & (b) of the *Water Resources Act 1997* comprising drilling, plugging, backfilling or sealing a well and the repairing, replacing or altering the casing, lining, or screen of a well.

10.1.1 Objectives

1. To ensure the drilling, plugging, backfilling or sealing of a well occurs in a manner that will protect the quality of underground water resources.
2. To minimise the impact of repair, replacement or alteration of the casing, lining or screen of wells on the underground water resources.
3. To protect the underground water resources from pollution, deterioration and undue depletion.
4. To ensure the integrity of the headworks of wells are maintained.
5. To ensure that wells are constructed in the correct aquifer system.

10.1.2 Principles

Impact of well works on water quality & integrity of the aquifer

1. The equipment, materials and method used in the drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of the underground water resource.
2. Aquifers shall be protected during the drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of an aquifer.

Seals between aquifers

3. Where a well passes, or will pass through two or more aquifers, an impervious seal shall be made and maintained between such aquifers.

Design of headworks

4. The headworks of a well from which a licensed allocation is to be taken shall be constructed so that the extraction of water from the well can be metered without interference.

Wells for artificial recharge

5. The headworks of a well for the draining or discharge of recharged water shall be constructed so that recharge and draining or discharge operations can be metered without interference.

10.2 Draining or Discharging of Imported Water into a Well – Artificial Recharge

10.2.1 Objective

To provide for the draining or discharging of imported water directly or indirectly into a well in a manner that does not adversely affect the underground water quality, the aquifer or any ecosystem that depends on that water.

10.2.2 Principles

The following principles apply to permits, pursuant to section 9 (3) (c) of the Act, for the activity of draining and discharging of **imported water** directly into a well.

1. Imported water may be drained or discharged into the confined or unconfined aquifers.

2. Subject to principles 10.2.2.4 and 10.2.2.5 imported water may be drained or discharged into a well for the purpose of aquifer storage and recovery where the concentrations, levels or amounts of the substances, materials or characteristics set out in clause 4 below, in the water to be drained or discharged, do not exceed the concentrations, levels or amounts of those substances, materials or characteristics in the native underground water.

3. For the purposes of principles 10.2.2.2, 10.2.2.4 and 10.2.2.5, the relevant concentrations, levels or amounts shall be measured by sufficient representative samples of:

   (a) The water to be drained or discharged, collected either from an existing dam or directly from the source; and

   (b) Native underground water collected from the proposed point of injection, or as near as possible to the proposed point of injection, and from the same aquifer as that in which storage is proposed.

   "Sufficient representative samples" means suitable samples, collected with equipment appropriate for the substance, material or characteristic to be measured and taken at suitable locations and times to accurately represent the quality of the relevant water.

4. Imported water may be drained or discharged directly or indirectly into a well (despite principle 10.2.2.2) where the concentrations, levels and amounts of the substances, materials or characteristics of, or in the water set out in principle 10.2.2.6 are not sufficient to degrade the ecosystems dependent upon underground water within the prescribed water resource or to reduce the suitability of the underground water for other purposes for which it might reasonably be used.

5. The draining or discharge of imported water directly or indirectly into a well may not be granted (despite principles 10.2.2.2 and 10.2.2.4) where the cumulative effects of the discharge of water to the aquifer are considered sufficient to degrade the ecosystems dependent upon underground water within the prescribed water resource, or to reduce the suitability of the underground water for other purposes for which it might reasonably be used.

6. For the purposes of principles 10.2.2.2, 10.2.2.4 and 10.2.2.5 above, the list of substances, materials and characteristics comprises substances, materials and characteristics that may reasonably be expected to be present in the imported water to be drained or discharged and have the potential to degrade the native underground water and the ecosystems that depend upon the native underground water, including where relevant (but not limited to):

   (a) pH, TDS, turbidity, ammonia, nitrate, nitrite, total phosphorus, sodium, chloride, sulphate, calcium, magnesium, bicarbonate, iron, total arsenic, total boron, total cadmium, total chromium, total lead, total manganese, total zinc, total coliforms and faecal coliforms; and

   (b) Pesticides, *Giardia*, *Cryptosporidium*, volatile organic compounds and petroleum hydrocarbons (including but not limited to water from land used for intensive agriculture or industrial purposes) those substances, materials and characteristics likely to be present in the source of the water; and

   (c) Trihalomethanes where the water to be drained or discharged has been treated by chlorination.

7. The draining or discharging of imported water directly or indirectly to a well must not detrimentally affect the ability of other persons to lawfully take from that underground water or damage any ecosystem that depends on the underground water.

8. Draining or discharging imported water directly or indirectly into a well may only occur where:

   (a) The headworks of the well are constructed such that both recharge and recovery operations can be metered without interference;

   (b) Continued recharge of water at the site will not result in detrimental impacts on water quality or on the integrity of the aquifer, for example, but not limited to:

      (i) Unacceptable interference with the water supply from neighbouring wells constructed to current industry standards,

      (ii) An increase in salinity of the underground water,

      (iii) Secondary water quality issues such as increased susceptibility to dryland salinity,

      (iv) Increased secondary porosity, which may affect the stability of the aquifer and result in land subsidence,

      (v) Perched water tables, or

      (vi) Waterlogging.

9. For the purposes of this plan the term "native underground water" means the underground water (as that term is defined in the *Water Resources Act 1997*) that exists in the relevant aquifer absent any such water drained or discharged to that aquifer by artificial means.

10. Licence or permit holders draining or discharging imported water into a well will be required to implement an ongoing water quality monitoring program, with the following minimum analysis of the water to be drained or discharged into the well:

    (a) Minimum of four (4) samples per season during which the drainage or discharge to the well occurs; and

    (b) At least one sample per ten (10) megalitres of water drained or discharged to the well.

    Parameters to be analysed will be determined after assessment of the quality of the water to be drained or discharged directly or indirectly into the well and of the underground water into which the drainage or discharge is to occur, as undertaken at 10.2.2.6.

10.3 Importation of Water

Except for the purpose of public water supply, a permit is required for the activity prescribed by the Regulations pursuant to section 9(4)(k) of the *Water Resources Act 1997* comprising using water in the course of carrying on a business at a rate that exceeds 1 megalitre/annum where the water has been brought into a management area by means of a pipe or other channel ("use of imported water").

10.3.1 Relevant Authority

The relevant authority for determining a permit application for the activity of using water in the course of carrying on a business at a rate that exceeds 1 megalitre per annum where the water has been brought into the management area by means of a pipe or other channel is the Minister responsible for the administration of the *Water Resources Act 1997*.

The following objectives and principles apply to the use of imported water:

10.3.2 Objective

To ensure that the use of imported water occurs in a manner that does not adversely affect the prescribed underground water resource, or ecosystems dependent on underground water.

10.3.3 Principles

1. Use of imported water shall not cause a rise in the underground water levels that detrimentally affects a structure or ecosystem.

2. For the purposes of principle 10.3.3.1, "structure" is defined as, but is not limited to, a building, fence or wall.

3. Use of imported water shall not adversely affect the quality of the prescribed underground water resource.
4. Use of imported water shall not adversely affect the productive capacity of the land by causing salinity, waterlogging or perched watertables or other such impacts.
5. The salinity of imported water shall not exceed native background underground water salinity levels or 1500 mg/L, which ever is the lower.

11 Monitoring

Section 101 (4) (e) of the Act requires the Plan to assess the capacity of the resource to meet the demands for water on a continuing basis and provide for regular monitoring of the capacity of the resource to meet those demands.

11.1 Monitoring the capacity of the underground water resource - water level and salinity monitoring network

The Department for Water Resources and its predecessors have undertaken regular water-level and confined aquifer pressure monitoring in the Lacepede–Kongorong PWA since the late 1960s to early 1970s. Salinity monitoring has been less comprehensive.

Unconfined Aquifer

At December 2000 the unconfined aquifer water level monitoring network in the Lacepede Kongorong PWA consisted of 187 wells. A significant number have been monitored for around 30 years, providing an invaluable database. The unconfined aquifer salinity monitoring network in the Lacepede Kongorong PWA consisted of 112 wells at December 2000. Monitoring is generally undertaken quarterly for both salinity and water level.

Confined Aquifer

At December 2000, 62 water-level/pressure confined aquifer monitoring wells are situated within the PWA with most concentrated around and southeast of Kingston SE, either side of the Princes Highway. This reflects the artesian nature of the aquifer in this area. The salinity monitoring network consists of 37 wells (at December 2000) historically heavily biased to the artesian area in the vicinity of and southeast of Kingston SE. Monitoring is undertaken twice a year for both salinity and water level/pressure.

Table 11.1: Underground water monitoring

What	Where	When
Underground water levels in the unconfined aquifer	Unconfined aquifer water level monitoring network locations in the Prescribed Wells Area	Quarterly
Underground water salinity in the unconfined aquifer	Unconfined aquifer salinity monitoring network locations in the Prescribed Wells Area	Quarterly
Underground water level/pressure in the confined aquifer	Confined aquifer water level/pressure monitoring network locations in the Prescribed Wells Area	Every six months
Underground water salinity in the confined aquifer	Confined aquifer salinity monitoring network locations in the Prescribed Wells Area	Every six months

11.2 The strategy for regular monitoring of the demands placed on the underground water resource

The strategy for regular monitoring of the demands placed on the underground water resource is provided below. The monitoring program will include:

11.2.1 Annual Water Use Report

An Annual Water Use Report is to be prepared by each licensee and submitted to the Department for Water Resources, Mount Gambier office, on or by 5 pm 31 July each year. Each licensee will provide the following information in the Annual Water Use Report:

(a) The volume of water and/or HaIE allocated on the licence;

(b) For licences expressed volumetrically, the volume of water actually used by the licensee and recorded on each meter during the water-use year (ie. opening and closing meter readings);

(c) The period of water use (eg. from 12 November to 30 April);

(d) The purpose for which water has been taken;

(e) The salinity reading, date and well number of any underground water salinity measurements taken during each water use year;

(f) The total amount of imported water recharged for each meter for the purpose of Aquifer Storage and Recovery in the water-use year (where applicable); and

(g) Where the water taken by the licensee is used for irrigation:

  (i) The area of each crop type irrigated;

(ii) An estimate of the quantity of water taken from each licensed well (in megalitres) and a description of the method used to calculate extraction(s);

(iii) A sketch plan of the area irrigated, the plant type, and how many hectares were irrigated;

(iv) The number of irrigations;

(v) The irrigation method; and

(vi) The nature of services used to schedule when irrigation is required. (eg. neutron probes, external irrigation scheduling service, tensiometer etc)

Table 11.2: Monitoring the use of underground water

What	Where	When
Underground water use and extraction	The wells used by all licensed users by way of an annual water use report	Submitted by 5.00pm 31 July each year
The salinity of underground water	The wells used by all licensed users by way of an annual water use report	Submitted by 5.00pm 31 July each year

11.2.2 Monitoring of the Water Needs of Ecosystems Dependent on Underground Water

The water needs of ecosystems dependent on underground water are described in Table 2.1. Monitoring arrangements must be established to evaluate whether the policies in this Plan protect the water needs that have been identified.

This requires monitoring of critical hydrogeological and ecosystem parameters that can be used for this evaluation. These parameters include:

- Mean underground water levels;
- Seasonal underground water fluctuations;
- Underground water salinity;
- Species composition and abundance;
- Species recruitment; and
- Specific vegetation health measures such as canopy density.

A detailed program to monitor the parameters listed above will be formulated and implemented through the investigations program detailed in the Catchment Water Management Plan.

12 Miscellaneous

The preparing the policy, the Board has had regard to the issues set out in section 6 (2) of the *Water Resources Act 1997,* the *Groundwater (Border Agreement) Act 1995* and the *South Easter Water Conservation and Drainage Act 1992*.

The Plan also shows relevant benefits of consistency with the following plans and policies as listed in Section 101(9) of the Act:

(a) Relevant management plans under the *Coast Protection Act 1972*;

(b) Relevant Development Plans under the *Development Act 1993*;

(c) Relevant environment protection policies under the *Environment Protection Act 1993*;

(d) Relevant plans of management under the *National Parks and Wildlife Act 1972*;

(e) Relevant district plans under the *Soil Conservation and Land Care Act 1989*;

(f) Guidelines relating to the management of native vegetation adopted by the Native Vegetation Council under the *Native Vegetation Act 1991*;

(g) State Water Plan.

Table A: Volume for licensed allocation (VLA) for the unconfined aquifer management areas of the Lacepede Kongorong PWA

Management Area	PAV ML	VLA(a) ML	Total Licensed Allocations at 23/05/01(b) ML	Difference (a - b) ML	Volume Reserved for Allocation to Unlicensed Pre-Existing Use ML	Volume Available for Allocation to other uses at 23/05/01
Benara	16,100	12,695	10,438	2,256	200	2,056
Blanche Central	2,300	1,763	1,865	-102	0	0
Bowaka	11,200	8,856	7,255	1,601	200	1,401
Bray	10,800	8,471	5,980	2,490	200	2,290
Coles	23,400	8,493	7,366	1,127	200	927
Compton	1,700	1,192	615	577	200	377
Conmurra	26,300	20,102	15,888	4,214	200	4,014
Duffield	5,900	4,599	1,429	3,170	200	2,970
Fox	22,400	16,725	13,606	3,118	200	2,918
Grey	13,300	11,600	16,688	-5,088	0	0
Hindmarsh	9,000	6,772	6,138	634	200	434
Joyce	17,900	13,567	11,998	1,569	200	1,369
Kennion	21,600	17,091	12,303	4,788	200	4,588
Killanoola	17,400	12,994	10,430	2,564	200	2,364
Kongorong	11,700	8,852	8,753	100	100	0
Lacepede	11,400	8,953	5,351	3,602	200	3,402
Lake George	8,600	6,686	3,616	3,070	200	2,870
Landseer	5,800	4,514	4,478	36	36	0
Lochaber	12,500	9,842	6,147	3,696	200	3,496
MacDonnell	13,300	11,179	14,615	-3,436	0	0
Marcollat	5,000	3,860	1,631	2,229	200	2,029
Mayurra	13,500	10,544	6,550	3,994	200	3,794
Minecrow	15,300	12,092	7,633	4,459	200	4,259
Monbulla	16,600	11,395	9,319	2,076	200	1,876
Moorak	3,200	2,241	2,222	19	19	0
Mount Benson	10,000	7,809	6,773	1,036	200	836
Mount Muirhead	23,500	18,167	13,443	4,725	200	4,525
Murrabinna	9,400	7,380	3,490	3,890	200	3,690
Peacock	8,400	6,459	3,951	2,508	200	2,308
Riddoch	13,800	10,703	9,584	1,119	200	919
Rivoli Bay	12,000	9,230	5,145	4,085	200	3,885
Ross	11,300	8,905	7,245	1,660	200	1,460
Short	21,700	8,875	9,028	-153	0	0
Smith	14,100	11,118	10,725	393	200	193
Spence	17,000	12,219	8,065	4,155	200	3,955
Symon	16,200	12,714	9,139	3,576	200	3,376
Townsend	14,100	10,819	7,864	2,955	200	2,755
Waterhouse	11,400	8,846	7,126	1,720	200	1,520
Woolumbool	16,500	13,010	8,080	4,931	200	4,731
Young	9,500	7,331	6,131	1,200	200	1,000
Total	**525,100**	**388,666**	**308,104**	**N/A**	**6,755**	**82,585**

Please Note: At **date of adoption** the PAV and VLA figures in this table cannot be altered during the life of this Plan. The figures shown in the columns titled 'Total Allocations', 'Difference' and 'Volume Available for Allocation' may change during the life of this Plan.

Table B: Volume for Licensed Allocation (VLA) for the confined aquifer management areas in South Australia (all in ML)

Management Area	PAV	VLA (a)	Total Licensed Allocations at 23/05/01 (b)	Irrigation Extraction Factor (c)	Difference (a)-(b)-(c)	Volume available for allocation at 23/05/01
Fairview	290	284	0	0	284	284
Kalangadoo	3,900	3,822	1,993	386	1,443	1,443
Keith	2,500	2,450	130	0	2,320	2,320
Kingston	25,000	22,379	19,755	2,935	-311	0
Lucindale	3,600	3,438	1,325	123	1,990	1,990
Millicent	10,800	10,584	4,376	676	5,532	5,532
Taratap	330	323	16	3	304	304
Wirrega	960	941	300	0	641	641
Zone 1A	9,200	8,806	404	81	8,321	8,321
Zone 2A	2,900	2,842	50	0	2,792	2,792
Zone 3A	1,900	1,862	0	0	1,862	1,862
Zone 4A	710	696	280	56	360	360
Zone 5A	540	529	0	0	529	529
Zone 6A	360	353	0	0	353	353
Zone 7A	350	343	0	0	343	343
Zone 8A	340	333	0	0	333	333
Zone 9A	570	559	0	0	559	559
Total	**64,250**	**60,544**	**28,629**	**4,259**	**N/A**	**27,967**

Table C: Annual Average Vertical Recharge Rates for the Unconfined Aquifer Management Areas in the Lacepede Kongorong PWA.

Management Area	Annual Average Vertical RechargeRate (mm)
Benara	75
Blanche Central	50
Bowaka	50
Bray	50
Coles	100
Compton	50
Conmurra	75
Duffield	25
Fox	100
Grey	75
Hindmarsh	75
Joyce	50
Kennion	100
Killanoola	100
Kongorong	75
Lacepede	50
Lake George	75
Landseer	25
Lochaber	50
MacDonnell	75
Marcollat	25
Mayurra	75
Minecrow	50
Monbulla	100
Moorak	50
Mount Benson	50
Mount Muirhead	100
Murrabinna	50
Peacock	25
Riddoch	75
Rivoli Bay	75
Ross	50
Short	100
Smith	75
Spence	50
Symon	75
Townsend	50
Waterhouse	50
Woolumbool	50
Young	75

Figures

LACEPEDE-KONGORONG PRESCRIBED WELLS AREA

UNDERGROUND WATER MANGEMENT AREAS FOR THE UNCONFINED AQUIFER

AV3: 200454_032

Figure 1.1

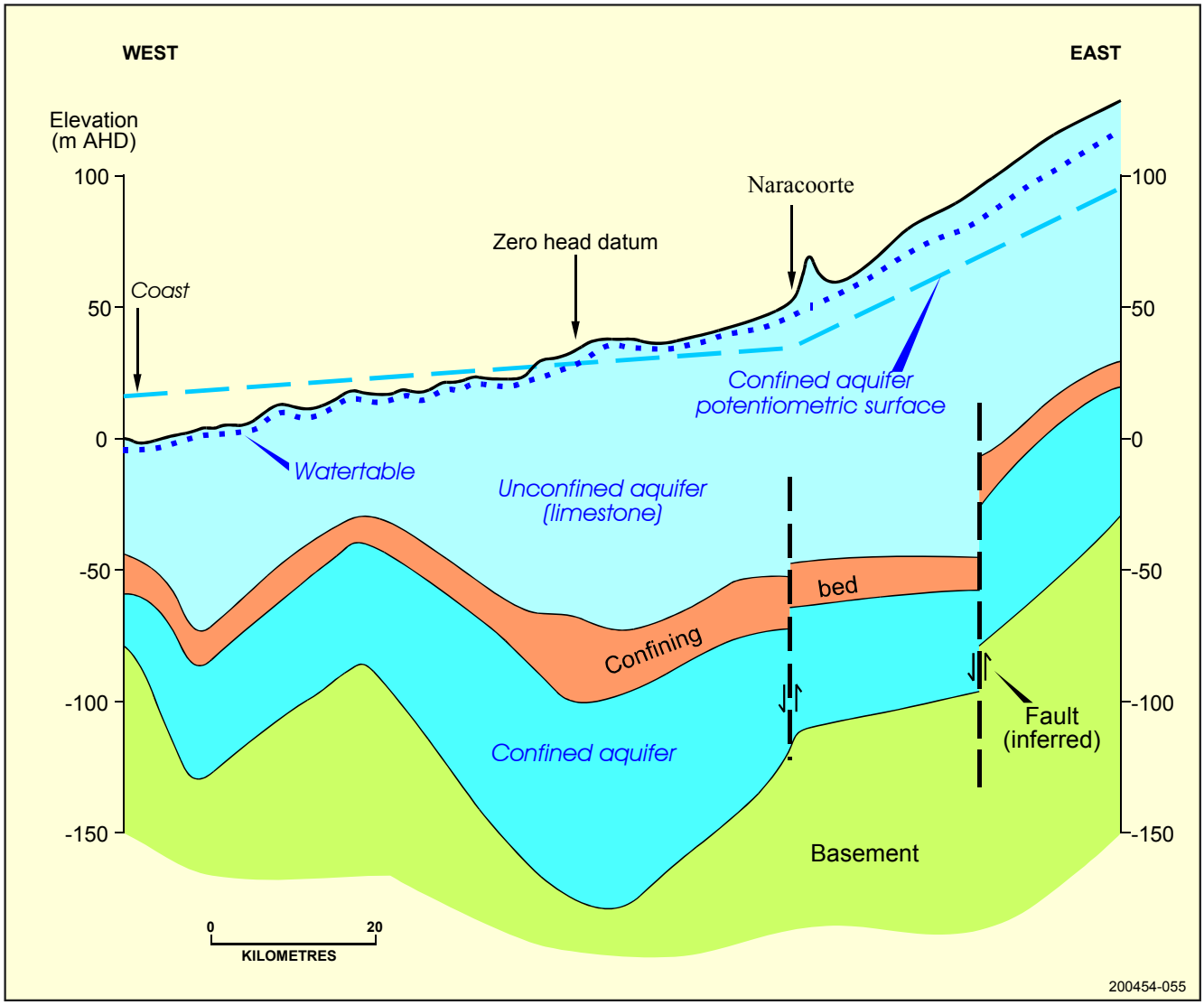
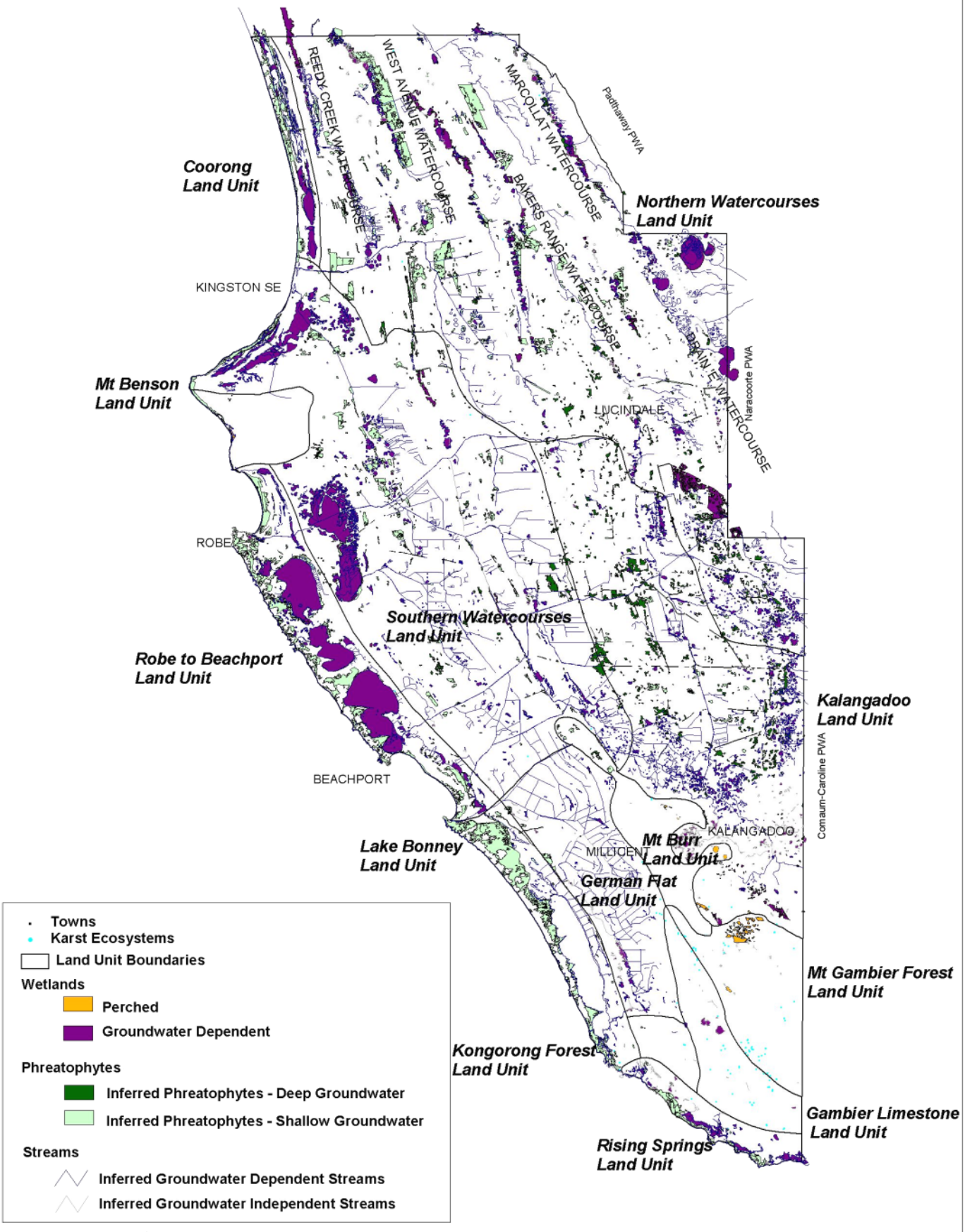


Figure 1.2 *Schematic east-west geological cross section through the Lacepede–Kongorong PWA*

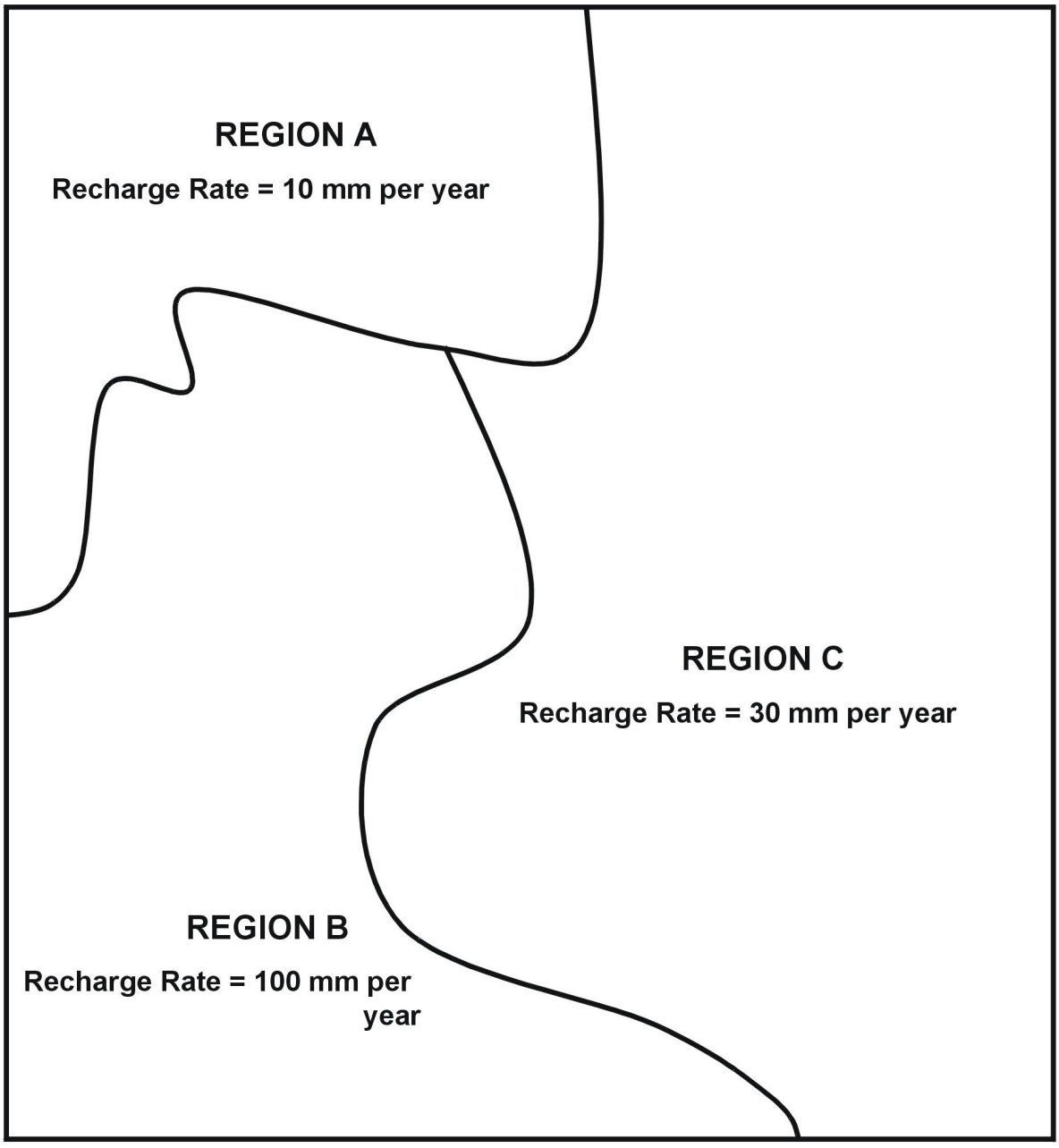


SOUTH EAST CATCHMENT WATER MANAGEMENT BOARD

URS

Figure 2.1:
Ecosystems Dependent on Underground Water
Lacepede-Kongorong PWA

Figure 4.1: Example Determination of Permissible Annual Volume (PAV) for the Unconfined Aquifer in an Example Management Area

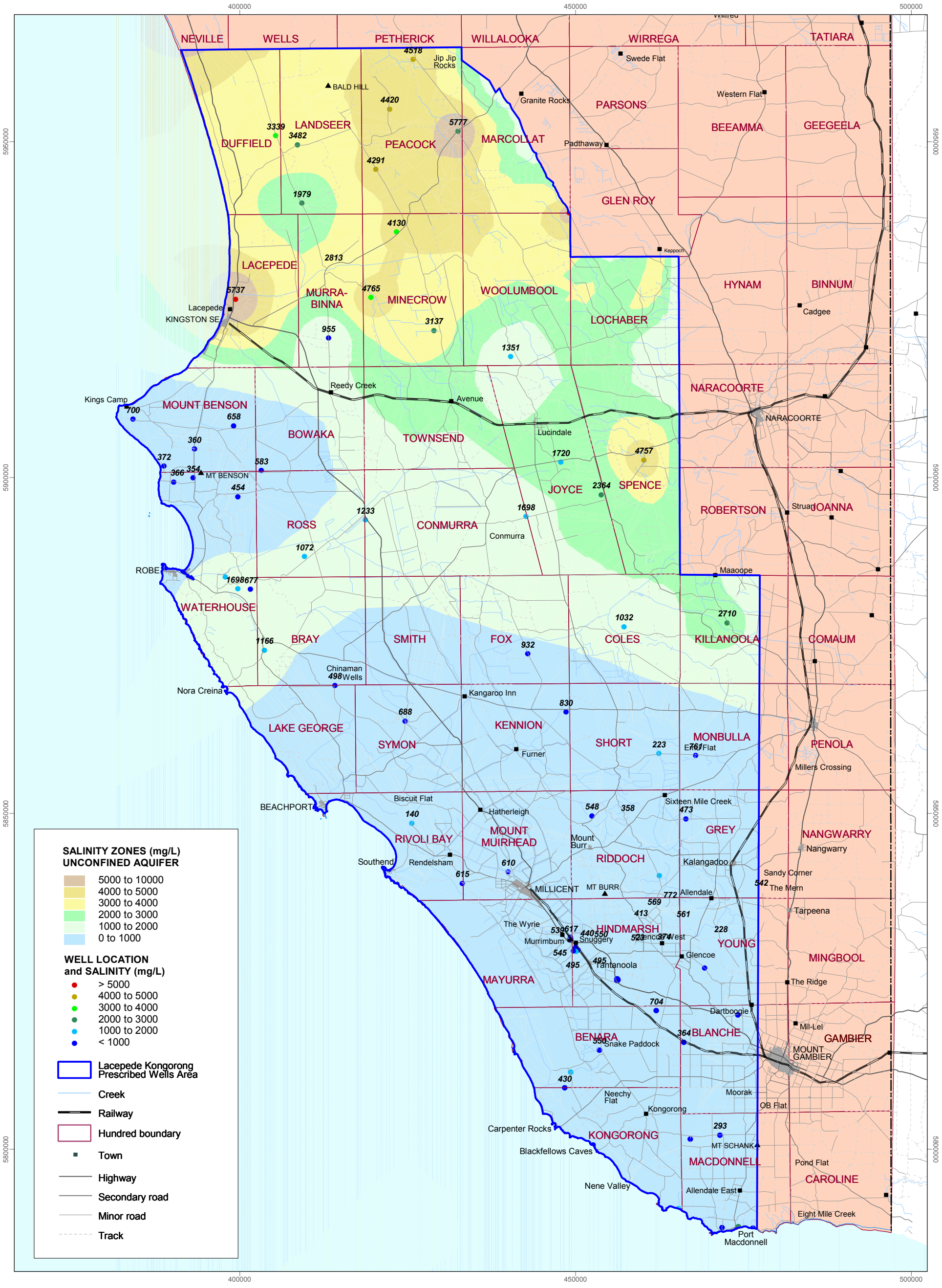


PAV (in ML per year)

= (Sum of all recharge in regions A, B and C) x Salinity factor

= ((Land area of A (km^2) x 10) + (Land area of B (km^2) x 100)

+ (Land area of C (km^2) x 30)) X Salinity Factor



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LACEPEDE-KONGORONG PRESCRIBED WELLS AREA

GENERALISED SALINITY DISTRIBUTION IN THE UNCONFINED AQUIFER

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Department for Water Resources

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GDA GEOCENTRIC DATUM OF AUSTRALIA

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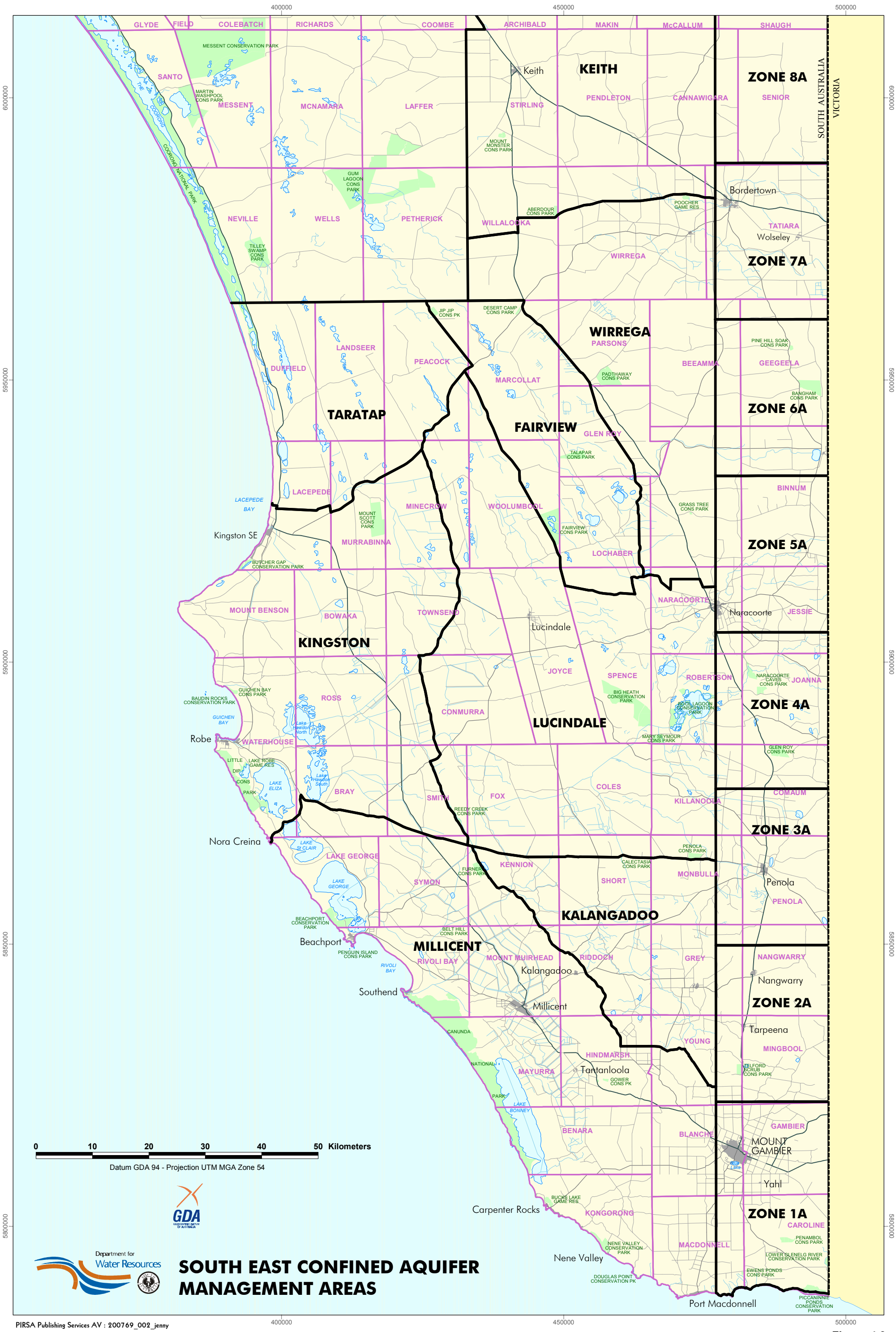
Figure 4.2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FIELD
COLEBATCH
RICHARDS
COOMBE
ARCHIBALD
MAKIN
McCALLUM
SHAUGH
MESSENT CONSERVATION PARK
SANTO
MARTIN WASHPOOL CONS PARK
MESSENT
MCNAMARA
LAFFER
STIRLING
Keith
KEITH
PENDLETON
CANNAWIGARA
ZONE 8A
SENIOR
SOUTH AUSTRALIA
VICTORIA
THE COORONG
COORONG NATIONAL PARK
MOUNT MONSTER CONS PARK
GUM LAGOON CONS PARK
Bordertown
POOCHER GAME RES
ABERDOUR CONS PARK
NEVILLE
WELLS
PETHERICK
WILLALOOKA
TATIARA
Wolseley
TILLEY SWAMP CONS PARK
WIRREGA
ZONE 7A
JIP JIP CONS PK
DESERT CAMP CONS PARK
WIRREGA
PARSONS
LANDSEER
PEACOCK
DUFFIELD
MARCOLLAT
BEEAMMA
PINE HILL SOAK CONS PARK
GEEGEELA
PADTHAWAY CONS PARK
BANGHAM CONS PARK
ZONE 6A
TARATAP
FAIRVIEW
GLEN ROY
TALAPAR CONS PARK
LACEPEDE
LACEPEDE BAY
MINECROW
WOOLUMBOOL
MOUNT SCOTT CONS PARK
GRASS TREE CONS PARK
FAIRVIEW CONS PARK
BINNUM
Kingston SE
MURRABINNA
LOCHABER
ZONE 5A
BUTCHER GAP CONSERVATION PARK
NARACOORTE
Naracoorte
JESSIE
MOUNT BENSON
BOWAKA
TOWNSEND
Lucindale
KINGSTON
JOYCE
SPENCE
ROBERTSON
NARACOORTE CAVES CONS PARK
JOANNA
GUICHEN BAY CONS PARK
BAUDIN ROCKS CONSERVATION PARK
ROSS
CONMURRA
BIG HEATH CONSERVATION PARK
POOL LAGOON CONSERVATION PARK
ZONE 4A
GUICHEN BAY
LUCINDALE
Robe
WATERHOUSE
MARY SEYMOUR CONS PARK
GLEN ROY CONS PARK
LITTLE DIP CONS PARK
LAKE ROBE GAME RES
LAKE ELIZA
BRAY
SMITH
FOX
COLES
KILLANOOLA
COMAUM
REEDY CREEK CONS PARK
ZONE 3A
Nora Creina
LAKE ST CLAIR
LAKE GEORGE
KENNION
SYMON
SHORT
MONBULLA
PENOLA CONS PARK
CALECTASIA CONS PARK
FURNER CONS PARK
Penola
PENOLA
KALANGADOO
BEACHPORT CONSERVATION PARK
BELT HILL CONS PARK
Beachport
PENGUIN ISLAND CONS PARK
MILLICENT
RIVOLI BAY
MOUNT MUIRHEAD
RIDDOCH
GREY
NANGWARRY
Kalangadoo
Nangwarry
Southend
Millicent
ZONE 2A
Tarpeena
CANUNDA
YOUNG
MINGBOOL
HINDMARSH
NATIONAL PARK
MAYURRA
Tantanloola
TELFORD SCRUB CONS PARK
GOWER CONS PK
LAKE BONNEY
BENARA
BLANCHE
GAMBIER
MOUNT GAMBIER
Yahl
BUCKS LAKE GAME RES
Carpenter Rocks
KONGORONG
ZONE 1A
CAROLINE
PENAMBOL CONS PARK
NENE VALLEY CONSERVATION PARK
MACDONNELL
LOWER SLENELG RIVER CONSERVATION PARK
Nene Valley
EWENS PONDS CONS PARK
DOUGLAS POINT CONSERVATION PK
Port Macdonnell
PICCANINNIE PONDS CONSERVATION PARK
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GEOCENTRIC DATUM OF AUSTRALIA
Department for Water Resources
SOUTH EAST CONFINED AQUIFER MANAGEMENT AREAS
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Figure 4.3

0 10 20 Kilometers

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POTENTIOMETRIC SURFACE TRENDS IN THE CONFINED AQUIFER

Prepared November 2000

Figure 4.4

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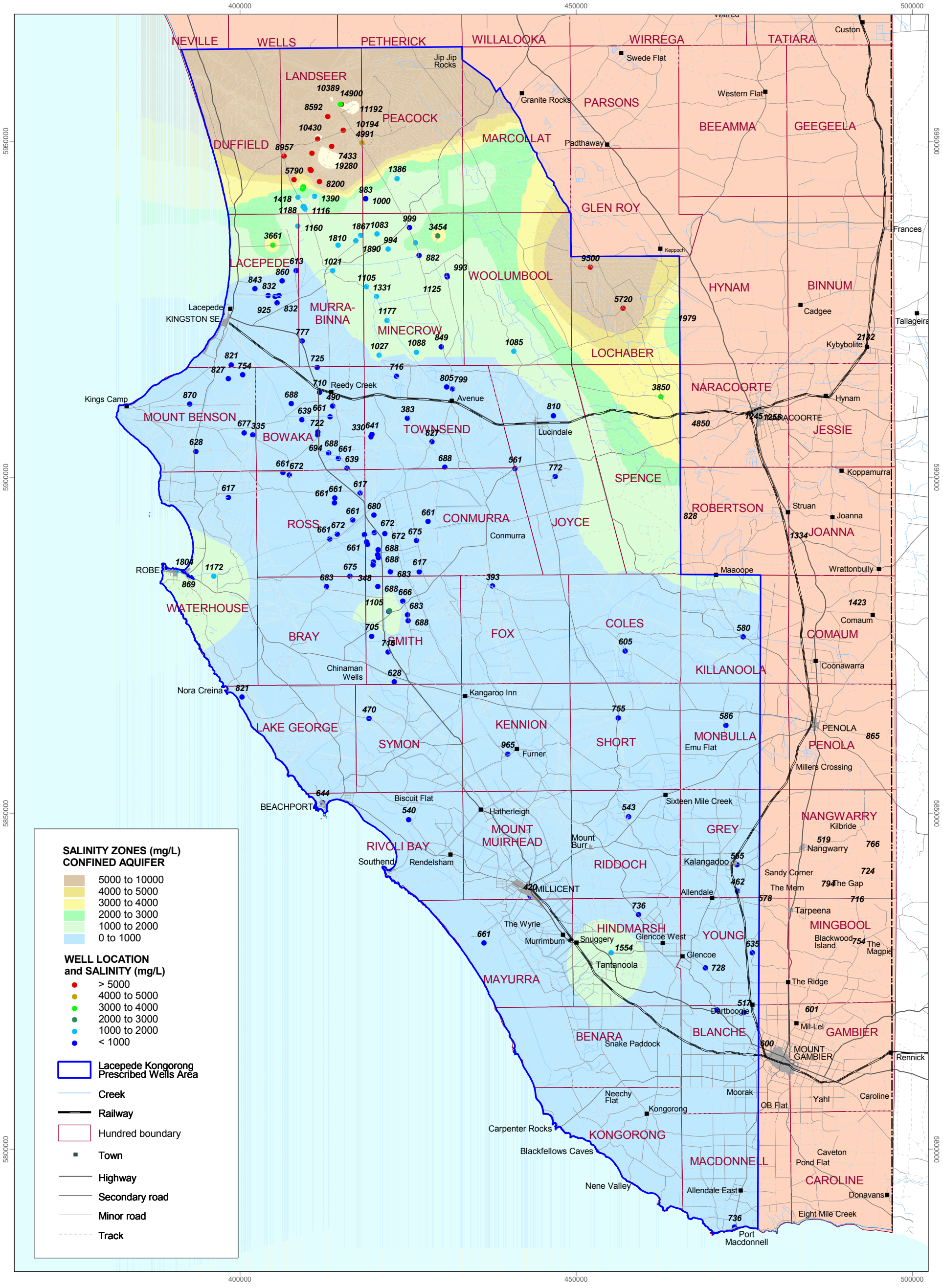

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LACEPEDE-KONGORONG PRESCRIBED WELLS AREA

GENERALISED SALINITY DISTRIBUTION IN THE CONFINED AQUIFER

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Figure 4.5