TINTINARA–COONALPYN PWA

GROUNDWATER LEVEL AND SALINITY STATUS REPORT

2011

DEPARTMENT FOR WATER

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Department for Water

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SUMMARY 2011

The Tintinara–Coonalpyn Prescribed Wells Area (PWA) is located in the Upper South East of South Australia, approximately 175 km south-east of Adelaide. It is a regional-scale resource for which groundwater is prescribed under South Australia's *Natural Resources Management Act 2004*. A Water Allocation Plan provides for sustainable management of the water resources.

Metered groundwater extractions for licensed purposes (excluding stock and domestic use) from both unconfined and confined aquifers in the Tintinara–Coonalpyn PWA totalled 23 157 ML in the 2010–11 water-use year. This represents a 32% decrease from the previous water-use year.

Lucerne (pasture/hay and seed) was the dominant irrigated crop type in the Tintinara–Coonalpyn PWA in 2010–11, accounting for 65% of the total licensed volume extracted for the purpose of irrigation. About 68% of the total irrigated area utilises centre pivot irrigation, with flood irrigation accounting for 30% of the area (mainly on the Coastal Plain where groundwater salinities are higher).

On the low-lying Coastal Plain, groundwater levels in the unconfined aquifer have displayed a long-term decline of up to 3.5 m since 1996, which corresponds to an increase in extraction and a prolonged period of below-average rainfall. Average rainfall in 2009–10 has stabilised the declining trend. Numerous irrigation wells are showing rising groundwater salinity trends due to the recycling of irrigation drainage water in the shallow aquifer. Salinity rises beneath areas of flood irrigation (up to 197 mg/L/y) are typically greater than those beneath pivot irrigation (about 28 mg/L/y) due to the greater volumes of irrigation drainage.

Beneath the Highlands, the widespread clearance of native vegetation has resulted in increased recharge rates and hence, rising groundwater levels in the unconfined aquifer which averaged 0.1 m/y. Most observation wells now show stable or declining trends in a delayed response to the below-average rainfall experienced since 1996. The increased recharge following clearing is also flushing salt, which was previously stored in the root zone of the native vegetation, down to the unconfined aquifer. This has caused salinity increases of up to 15 mg/L/y. In areas of low elevation and permeable soils near the Coastal Plain, the salt has almost been completely flushed and lower-salinity water is now recharging the aquifer resulting in falling salinity levels. However, in the eastern part of the PWA, where the depth to the watertable is 40–50 m, the impacts of clearing have yet to reach the watertable and no salinity rises have been observed.

The confined aquifer groundwater levels in the vicinity of Tintinara have recorded a declining trend since 1996, which mirrors the unconfined aquifer water level trend. This is most likely due to the process of hydrostatic unloading (see page 19) and not depletion of the resource, but investigations are underway elsewhere in the South East to examine leakage between aquifers. Some observation wells show a recovery in recent years due to the local rise in the overlying unconfined aquifer in response to wetter years in 2009 and 2010. Salinity trends in the confined aquifer throughout the Tintinara–Coonalpyn PWA are stable.

ASSESSMENT OF STATUS

The Tintinara–Coonalpyn PWA has been assigned a yellow status of "Adverse trends indicating low risk to the resource in the medium term" based on current trends. This status for 2011 is supported by:

- long-term decline in groundwater levels in the unconfined aquifer on the Coastal Plain, in response to below-average rainfall and extraction
- long-term rise in groundwater salinity levels in the unconfined aquifer caused by recycling of irrigation drainage water (Coastal Plain) and vegetation clearance (Highlands).

Although the watertable decline in the Coastal Plain unconfined aquifer represents less than a 10% reduction of groundwater volumes stored in the aquifer, the lower groundwater level may lead to the development of a cone of depression in areas of heavy extraction. This could result in flow reversal, bringing more-saline groundwater into the area from the west and a cessation of throughflow that would normally transport salt from beneath irrigated areas.

The rise in salinity levels in the Coastal Plain unconfined aquifer is not primarily caused by extraction, but rather, it is caused by application of water to the irrigated crop. As the dominant crop type (lucerne) is quite salt tolerant, the observed salinity rises are not expected to significantly affect production in the medium term.

The rise in salinity levels beneath the Highlands due to vegetation clearance is possibly showing signs of reaching its peak in some areas, where a decline is being observed. In other areas where the watertable is deep (>30 m), a salinity rise has not been observed.

STATUS 2011

No adverse trends, indicating a stable or improving situation

Trends are either stable (no significant change), or improving (i.e. decreasing salinity or rising water levels).

Adverse trends indicating low risk to the resource in the medium term

Observed adverse trends are gradual and if continued, will not lead to a change in the current beneficial uses of the groundwater resource for at least 15 years. Beneficial uses may be drinking water, irrigation or stock watering.

Adverse trends indicating high risk to the resource eventuating in the short to medium term

Observed adverse trends are significant and if continued, will lead to a change in the current beneficial uses of the groundwater resource in about 10 years.

Degradation of the resource compromising present use within the short term

Trends indicate degradation of the resource is occurring, or will occur within 5 years. Degradation will result in a change in the beneficial use (i.e. no longer suitable for drinking or irrigation purposes) and may take the form of increasing groundwater salinities, or a fall in the groundwater levels such that extractions from the aquifer may not be possible.

BACKGROUND

The Tintinara–Coonalpyn Prescribed Wells Area (PWA) is located in the Upper South East of South Australia, approximately 175 km south-east of Adelaide (Fig. 1). It is a regional-scale resource for which groundwater is prescribed under South Australia's *Natural Resources Management Act 2004*. A Water Allocation Plan provides for sustainable management of the water resources.

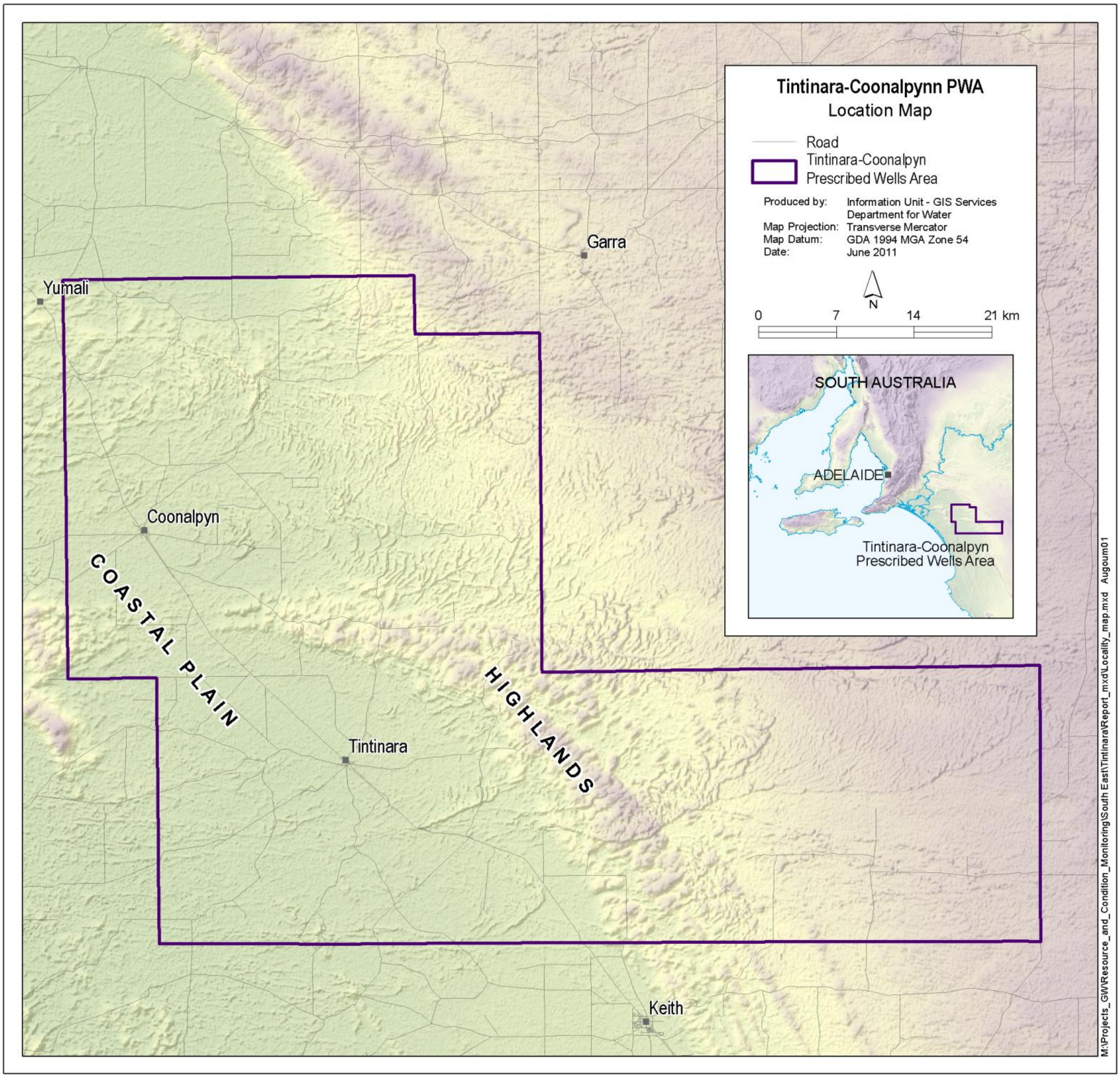

Figure 1. Location of the Tintinara–Coonalpyn PWA

HYDROGEOLOGY

The Tintinara–Coonalpyn PWA is underlain by sediments of the Murray Basin and can be divided topographically into two discrete landforms, each with different hydrogeological characteristics and different groundwater management issues. A low-lying Coastal Plain lies to the west, with Highlands located to the east. Both regions are underlain by two aquifer systems—an unconfined limestone aquifer and a deeper confined sand aquifer.

UNCONFINED AQUIFER

Coastal Plain

A marine transgression about one million years ago eroded away the Tertiary sediments and deposited a range of Quaternary sediment that formed the low-lying plain where the depth to the watertable is generally less than 5 m.

Padthaway Formation is the uppermost geological unit in the Quaternary sequence that occurs largely in the inter-dunal flats and reaches a maximum known thickness of 20 m. It mainly consists of an off-white, well-cemented, non-fossiliferous, fine-grained limestone with a well-developed secondary porosity.

Coomandook Formation consists of interbedded sandy limestones and shelly sandstones up to 15 m thick with moderate permeability.

Bridgewater Formation has been deposited in a series of topographic ridges that run sub-parallel to the coast with thicknesses of up to 90 m. Its lithology varies over the region but generally consists of a shelly and sandy aeolianite. In the inter-dunal flats it underlies the Padthaway Formation.

The Padthaway and Bridgewater Formations are highly transmissive and the resultant high well yields of up to 300 L/s have enabled irrigators to adopt flood irrigation practices.

Highlands

Beneath the Highlands, the unconfined aquifer is contained within the Tertiary Murray Group Limestone aquifer that comprises a bryozoal limestone and averages 100 m in thickness. Due to the elevated topography, the depth to the watertable in the Murray Group Limestone can exceed 50 m and typical well yields range up to 60 L/s. Overlying the limestone aquifer is a considerable thickness of Pliocene Sands, which are dry.

CONFINED AQUIFER

The unconfined and confined aquifers are separated by a low-permeability aquitard comprising the Ettrick Formation (grey-green glauconitic marl) and the black lignitic clays at the top of the confined aquifer. The combined thickness of the aquitard is generally about 20 m.

Coastal Plain

The confined aquifer in this area is referred to as the Buccleuch Formation, which generally consists of a bryozoal limestone layer and series of interbedded sand aquifers separated by thin carbonaceous clay units. It lies at a depth of about 60 m below ground. The sand units of the aquifer can be fine grained and therefore difficult to screen. Well yields average 20–30 L/s with occasional supplies up to 50 L/s. At present, there are about 20 production wells drilled into the confined aquifer in areas where the salinity of the overlying unconfined aquifer is too high for irrigation use.

The Renmark Group, which consists of interbedded sands, silt and carbonaceous clay, underlies the Buccleuch Formation in the eastern part of the Coastal Plain and provides irrigation supplies for deeper irrigation wells.

Highlands

The Buccleuch Formation extends eastwards 10–20 km beneath the Highlands and provides stock and domestic supplies only. It is called the Upper confined aquifer for management purposes. Most irrigation from the confined aquifer occurs to the north of Tintinara from the Renmark Group, which can be subdivided into an upper sand unit from about 130 to 160 m depth (Middle confined aquifer) and a lower sand unit at about 180 m with limited areal extent (Lower confined aquifer).

A schematic cross-section of the Tintinara–Coonalpyn PWA is displayed in Figure 2.

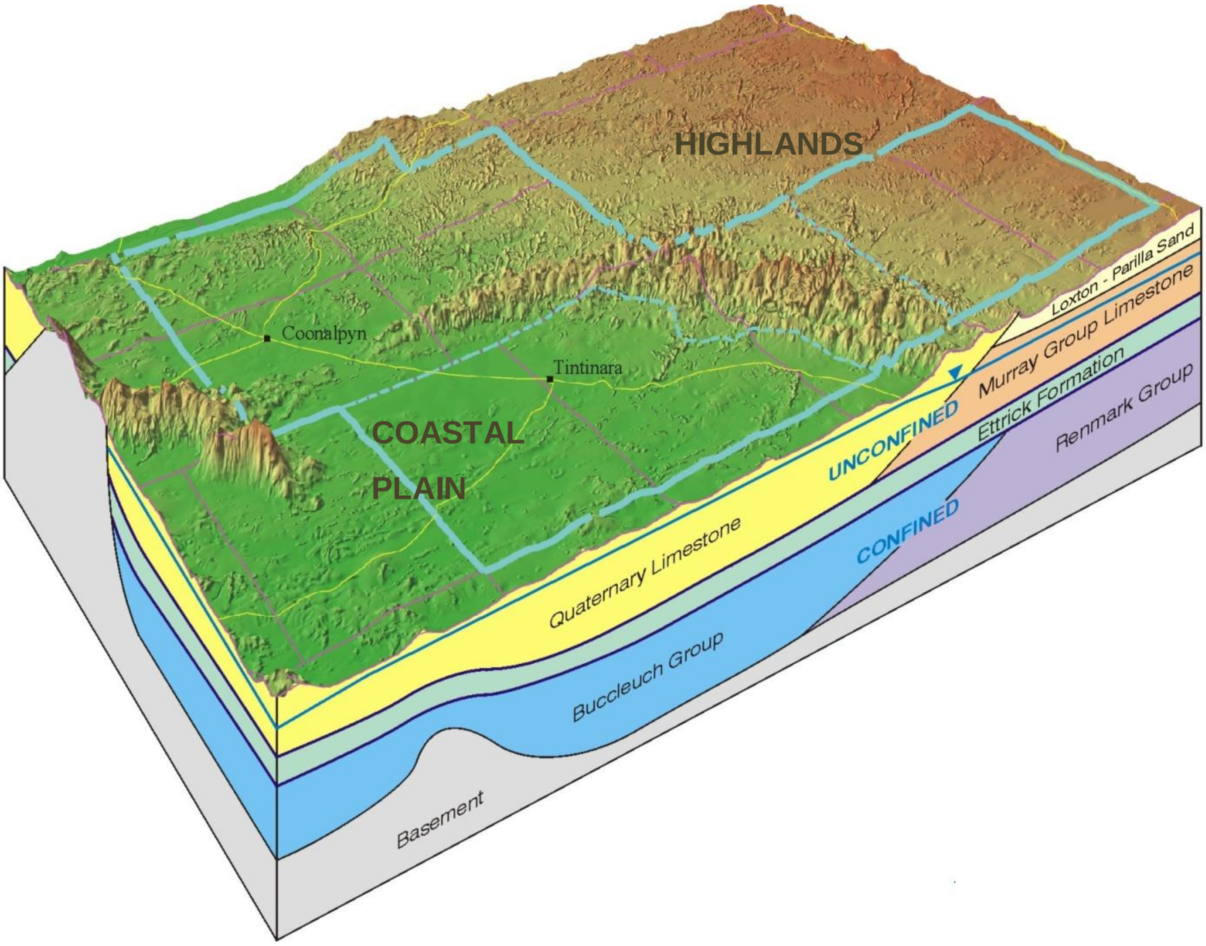

Figure 2. Geological cross-section of the Tintinara–Coonalpyn PWA

For a more detailed description of the hydrogeology of the Tintinara–Coonalpyn PWA, see: http://www.waterconnect.sa.gov.au/BusinessUnits/InformationUnit/Technical%20Publications/dwlbc_tech_report_2008_09_web.pdf

A summary of the hydrogeology is presented in Table 1.

Table 1. Hydrogeology of the Tintinara–Coonalpyn PWA

AGE	STRATIGRAPHY		HYDROGEOLOGY	
	Unit	**Lithology**	**Unit**	**Description**
COASTAL PLAIN				
Quaternary	Padthaway Formation	Off-white, well-cemented, fine-grained limestone deposited in inter-dunal flats	**Unconfined aquifer**	Mainly used for irrigation and stock supplies. High yields of up to 300 L/s enable flood irrigation. Depth to the watertable about 5 m. Salinity increases westward from 1500 mg/L to over 30 000 mg/L.
	Bridgewater Formation	Shelly and sandy aeolianite deposited in a series of topographic ridges		
	Coomandook Formation	Interbedded sandy limestones and shelly sandstones		
Tertiary	Ettrick Formation	Grey-green glauconitic marl	**Aquitard**	Confining layer
	Buccleuch Formation	Bryozoal limestone layer interbedded with sand and carbonaceous clay units	**Confined aquifer**	Mainly used for irrigation and stock supplies. Yields average 20–30 L/s. Salinity increases westward from <1500 mg/L to over 7000 mg/L.
	Renmark Group	Carbonaceous sands and clays		
HIGHLANDS				
Tertiary	Pliocene Sands	Unfossiliferous, non marine, fine to medium-grained clayey quartz sand with thin beds of sandy clay		Unsaturated
	Murray Group Limestone	White bryozoal and shelly limestone	**Unconfined aquifer**	Well yields range up to 60 L/s, salinities increase from 750 mg/L in the southeast, to over 10 000 mg/L in the northwest. Used for irrigation and stock supplies.
	Ettrick Formation	Grey-green glauconitic marl	**Aquitard**	Confining layer
	Buccleuch Formation	Bryozoal limestone layer found only in northwest of PWA	**Upper Confined aquifer**	Used for irrigation to the north of Tintinara. Salinities increase from 1000 mg/L in the east, to over 10 000 mg/L in the west. Yields average 20–30 L/s.
	Renmark Group	Carbonaceous sands and clays	**Middle and Lower Confined aquifer**	

GROUNDWATER FLOW AND SALINITY

UNCONFINED AQUIFER

The watertable elevation contours for the unconfined aquifer in the Tintinara–Coonalpyn PWA are displayed in Figure 3 and show groundwater movement is from east to west. The changes in hydraulic gradient are inferred to represent changes in hydraulic conductivity in the aquifer. The gradient becomes steeper near the eastern boundary of the Coastal Plain where the transition occurs from the Murray Group Limestone to the Bridgewater Formation. The gradient flattens in the west of the PWA and reflects high permeability in the Padthaway and Bridgewater Formations beneath the Coastal Plain.

The salinity distribution for the unconfined aquifer in the Tintinara–Coonalpyn PWA is also shown in Figure 3. Generally, the salinity ranges from approximately 600 mg/L in the east to more than 30 000 mg/L in the west where the watertable is close to the ground surface and dryland salinisation is occurring.

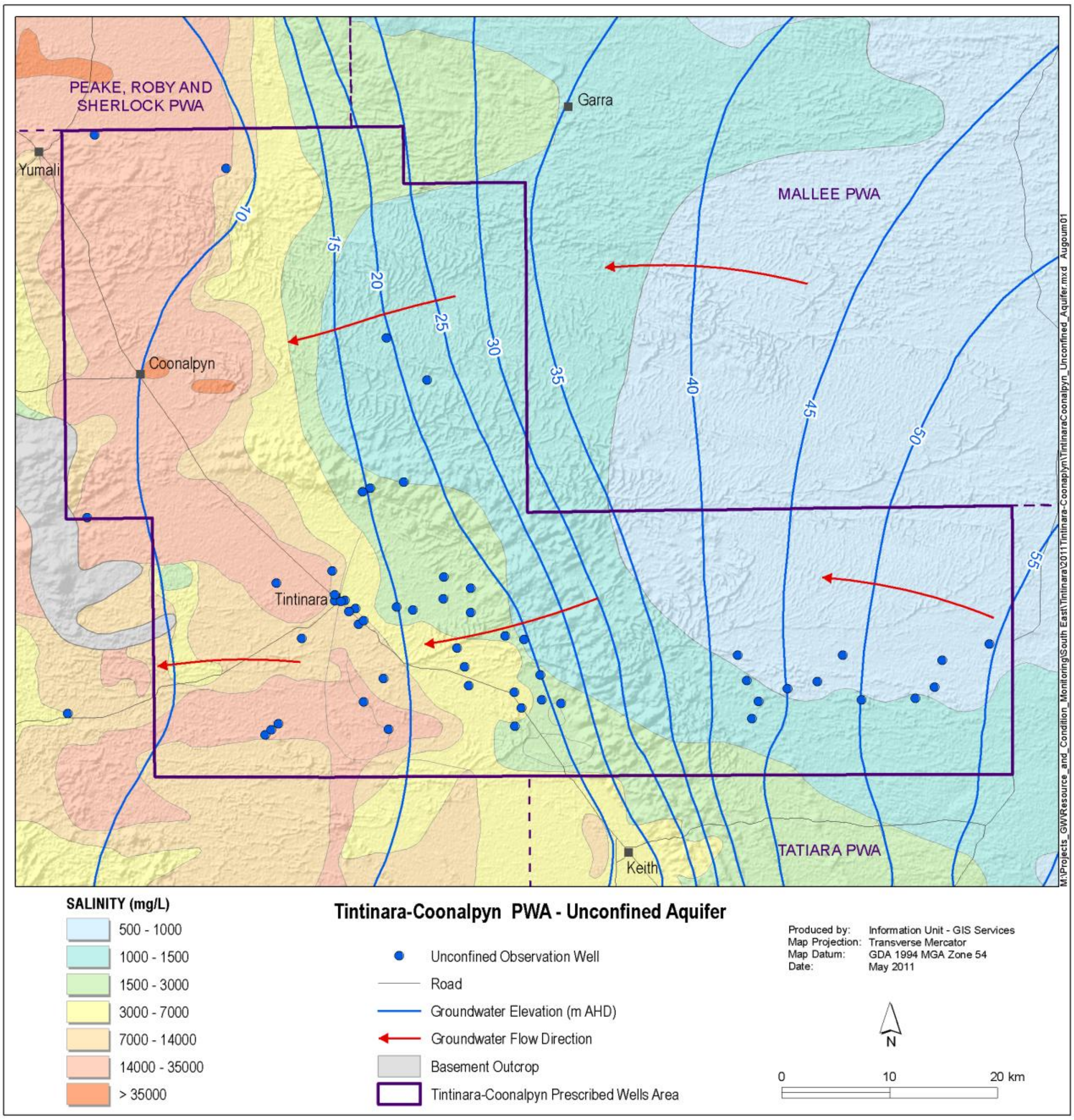

Figure 3. Groundwater flow direction and salinity distribution (winter 2010) for the unconfined aquifer in the Tintinara–Coonalpyn PWA*

*As there were no discernible changes in water levels or salinity, the potentiometric surface and salinity ranges from the previous year have been used.

CONFINED AQUIFER

The water level elevation contours for the confined aquifer (Buccleuch Formation and Renmark Group) are shown in Figure 4 which show groundwater movement is from east to west, similar to the overlying unconfined aquifer.

The salinity distribution in the confined aquifer is also similar to the overlying unconfined aquifer (Fig. 4). It ranges from approximately 600 mg/L in the east to more than 30 000 mg/L in the west where the aquifer wedges out against rising basement.

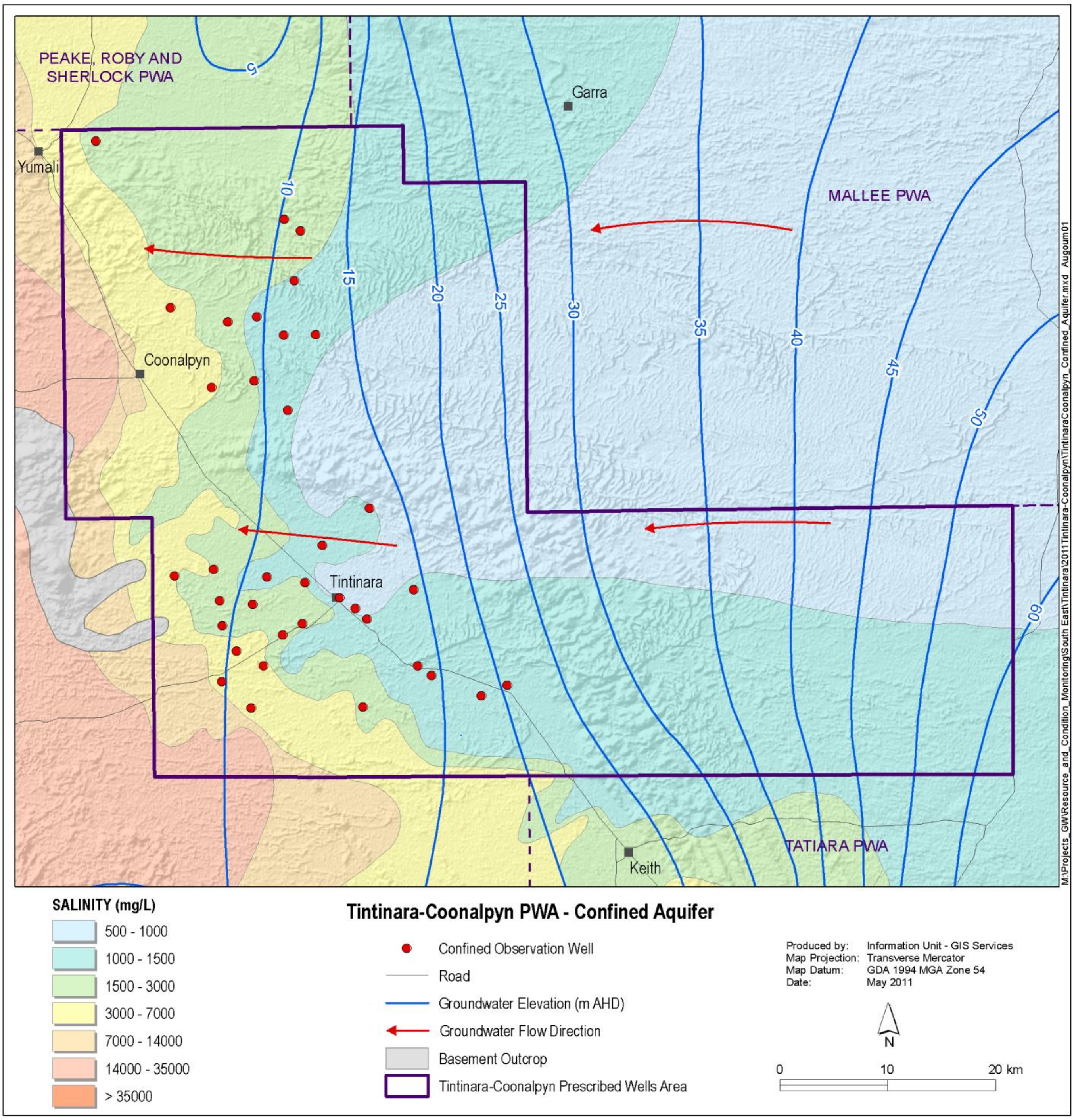

Figure 4. Groundwater flow direction and salinity distribution (winter 2010) for the confined aquifer in the Tintinara–Coonalpyn PWA*

* As there were no discernible changes in water levels or salinity, the potentiometric surface and salinity ranges from the previous year have been used.

GROUNDWATER DEPENDENT ECOSYSTEMS

Whilst groundwater dependent ecosystems (GDEs) have not been considered in the assessment of the annual status of the groundwater resource, it is important to note the presence and ecological characteristics of the GDEs found in the Tintinara–Coonalpyn PWA. Water Allocation Plans must include an assessment of the water required by ecosystems, including water from both surface water and groundwater resources. Groundwater dependent ecosystems can be defined as ecosystems where groundwater provides all or part of the water quantity, chemistry or temperature requirements, either permanently, seasonally or intermittently. It is generally considered that shallow watertables less than 10 m below the surface are more likely to support GDEs than deeper watertables. Shallow watertables are more susceptible to changes in groundwater levels that affect connectivity to GDEs and the ecological value of sites. The exception to this is stygofauna (animals that inhabit water-filled cracks and pools below the ground), which can be found at greater depths.

Ecosystems dependent on groundwater associated in the Tintinara–Coonalpyn PWA include wetland depressions and wetland flats, South Australian Blue Gum (*Eucalyptus leucoxylon*) and Pink Gum (*Eucalyptus fasiculosa*) woodlands and dissolution features (caves and holes). It is also likely that the Tintinara–Coonalpyn PWA would support hypogean (underground) environments. The greatest impacts to these ecosystems are from watertable rise in some areas due to the removal of native vegetation and subsequent waterlogging or increase in salinity or both.

RAINFALL

The climate in the Tintinara–Coonalpyn PWA is dominated by hot, dry summers and cool, wet winters with the average annual rainfall for Tintinara being 458 mm. The annual rainfall recorded at Tintinara rainfall station (25514, location Fig. 5) can be seen in Figure 6 in blue columns. The cumulative deviation is also plotted in orange and measures the difference between the actual measured rainfall and the long term average annual rainfall. An upward trend in this line indicates above average-rainfall and conversely, a downward trend indicates below-average rainfall.

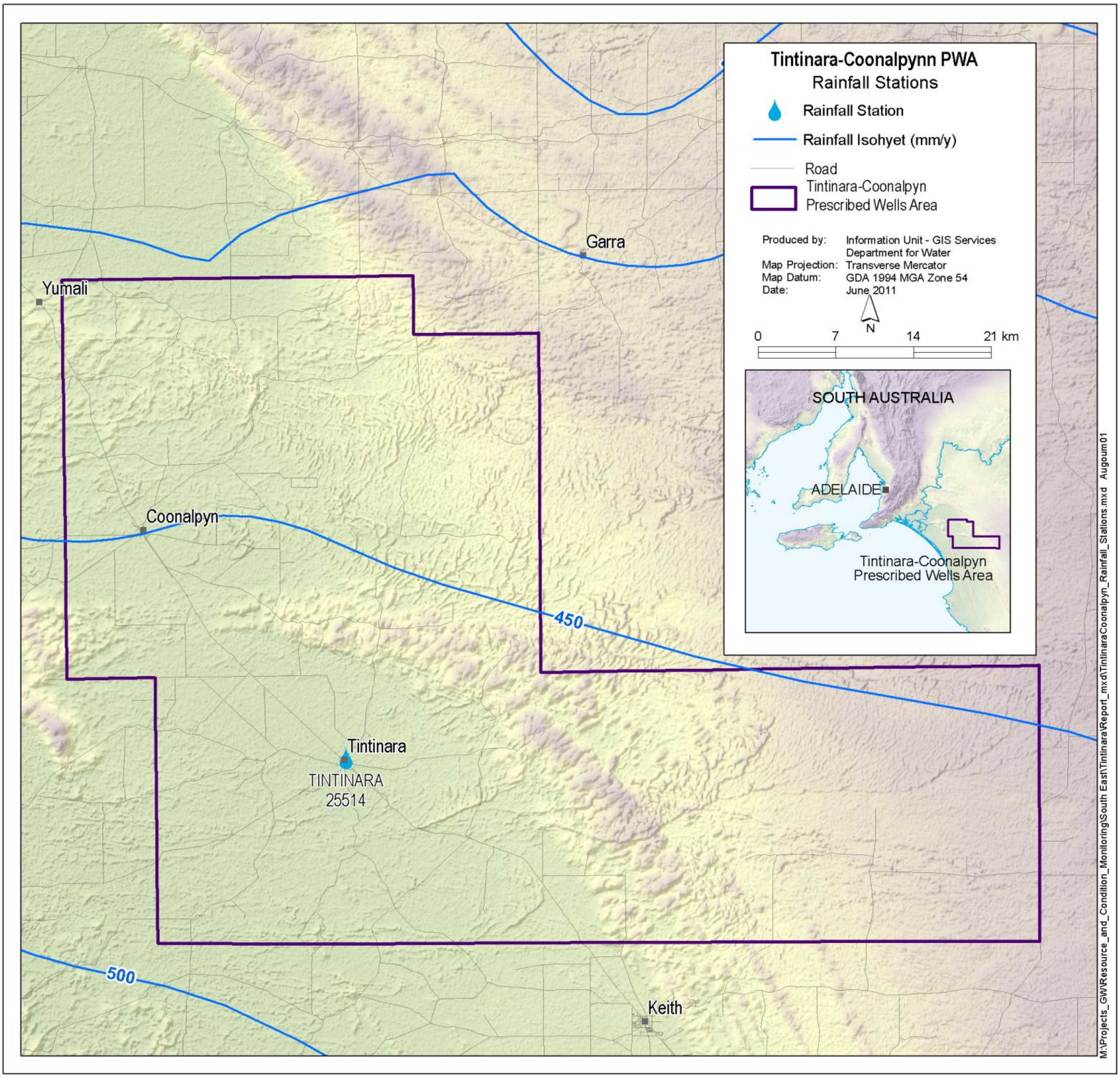

Figure 5. Location of rainfall station and rainfall isohyets in the Tintinara-Coonalpyn PWA

There are two very broad trends indicated in Figure 6. A long period of above-average rainfall was experienced from 1930 to 1956. Rainfall has been below-average since the mid 1990s, with the exception of above-average rainfall in 2000 and 2010.

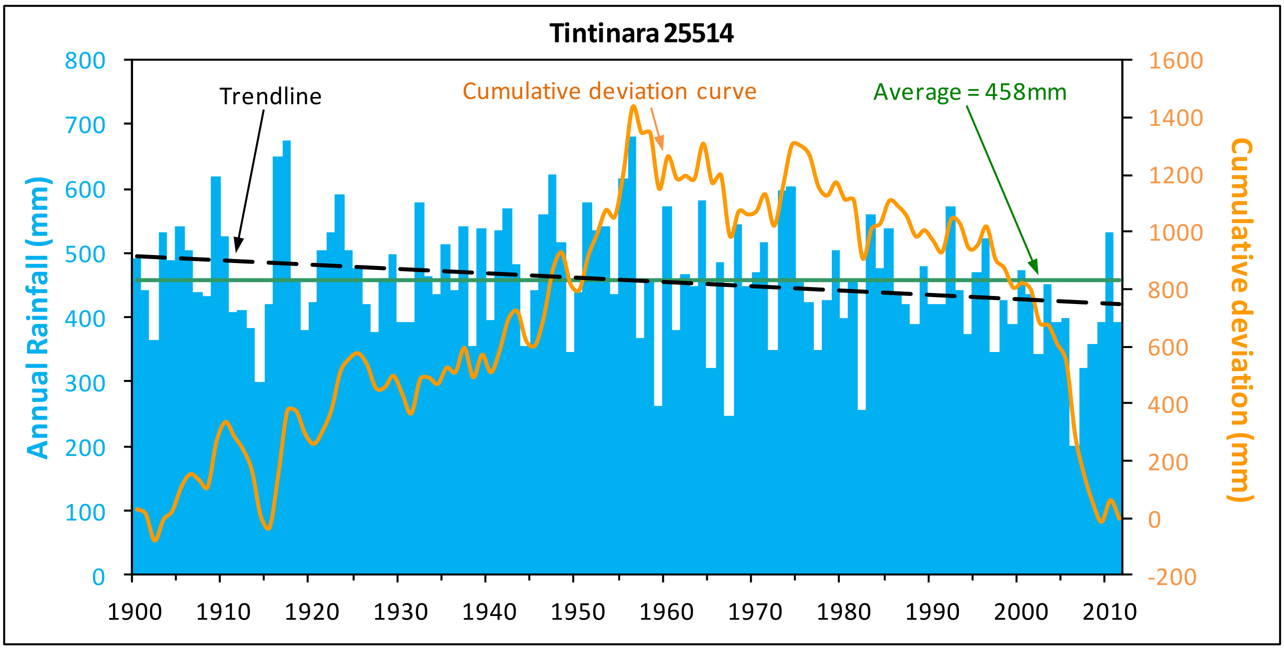

Figure 6. Annual rainfall and cumulative deviation for average annual rainfall for Tintinara

The response of shallow watertables on the low-lying Coastal Plain in the west shows a strong correlation with the timing and magnitude of rainfall events.

GROUNDWATER USE

Metered groundwater extractions for licensed purposes (excluding stock and domestic use) in the Tintinara–Coonalpyn PWA totalled 23 157 ML in the 2010–11 water-use year (Fig. 7). This represents a 32% decrease from the previous water-use year and is a combination of extractions from both unconfined and confined aquifers.

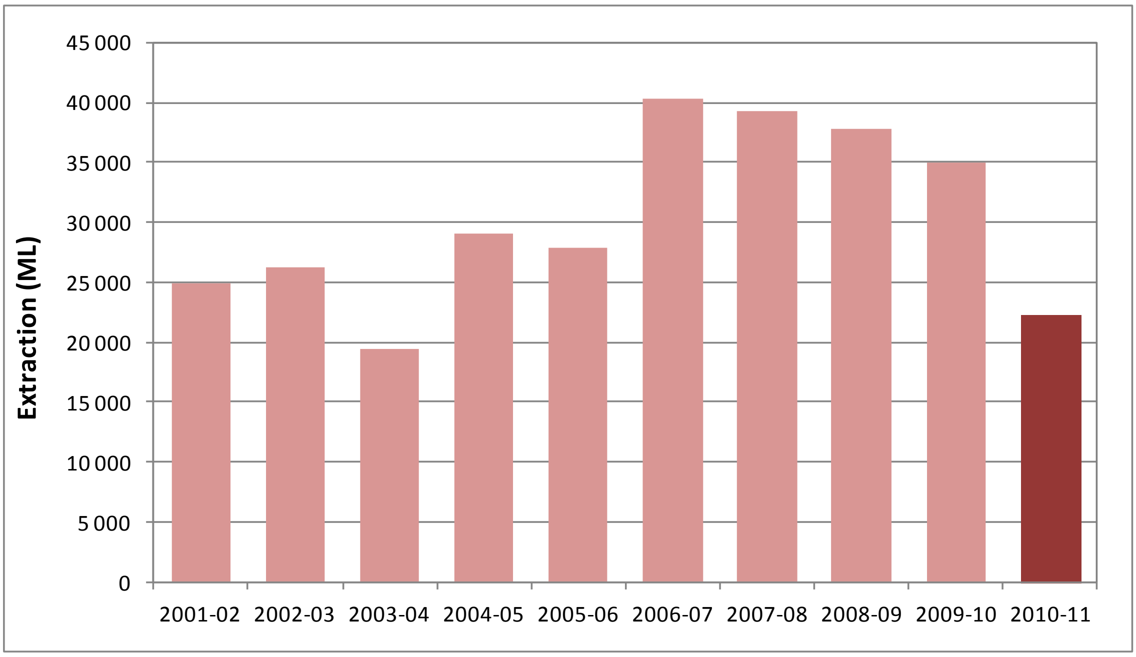

Figure 7. Historical licensed groundwater use for the Tintinara–Coonalpyn PWA

The extractions from each aquifer are presented in Figure 8 together with the allocation limits as per the current Water Allocation Plan (90 500 ML/y for the unconfined aquifer and 18 600 ML/y for the confined aquifer). The majority of extractions are from the unconfined aquifer, with similar trends in pumping shown for both aquifers. Current extraction levels are below the allocation limits in both aquifers.

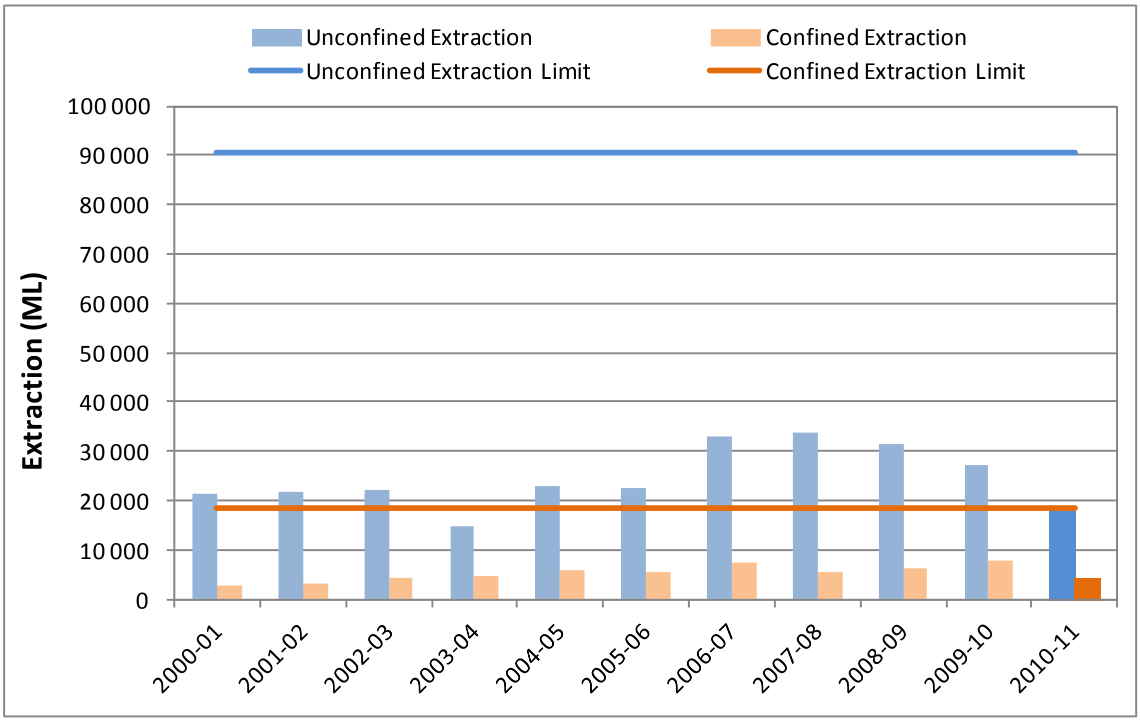

Figure 8. Historical licensed groundwater use for each aquifer in the Tintinara–Coonalpyn PWA

The description of water use presented in Table 2 shows that the majority of the licensed extractions are for irrigation purposes in the Tintinara-Coonalpyn PWA. Previous surveys indicate about 68% of the total irrigated area utilises centre pivot irrigation, with flood irrigation being used for 30% of the area (mainly on the Coastal Plain where groundwater salinities are higher).

Table 2. Description of groundwater use for the Tintinara–Coonalpyn PWA

WATER USE	2010–11 (ML)	% of use	2009–10 (ML)	% of use	2008–09 (ML)	% of use	2007–08 (ML)	% of use
Irrigation	**23 077**	**99.65**	33 687	99.5	33 078	99.6	47 053	97.1
Industrial	**44**	**0.19**	89	0.3	65	0.2	26	0.44
Recreation	**36**	**0.16**	74	0.2	74	0.2	85	0.41
Aquaculture	**0**	**0**	0	0	0	0	368	1.64
Town Water Supply	**0**	**0**	0	0	0	0	0	0
Total use (ML)	**23 157**	**100**	33 850	100	33 217	100	47 532	100

Figure 9 presents the proportion of water applied to the various irrigated crops in 2010–11, expressed as a percentage of the total volume extracted. Lucerne for both seed and pasture or hay was the dominant irrigated crop type in the Tintinara–Coonalpyn PWA in 2010–11, accounting for 65% of the total licensed volume of water extracted for the purpose of irrigation. It should be noted that not all purposes of use are recorded by licensees and consequently, these figures should be used as a guide only.

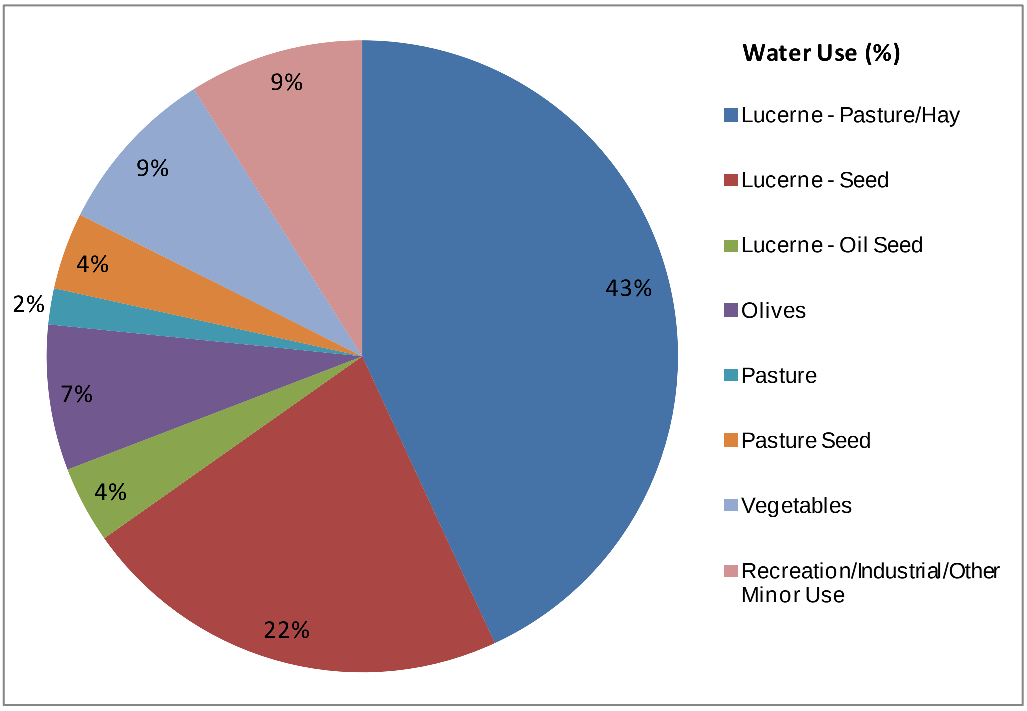

Figure 9. Groundwater proportions used per type of crop for the Tintinara–Coonalpyn PWA in 2010–11

The spatial distribution of extractions from licensed wells within the Tintinara–Coonalpyn PWA is presented in Figure 10. The view is looking toward the north-east, with the extractions from the various aquifers colour coded. The height of the column shown in the figure relates to the volume extracted from each well during the 2010–11 irrigation season, i.e. the greater length, the greater the volume extracted.

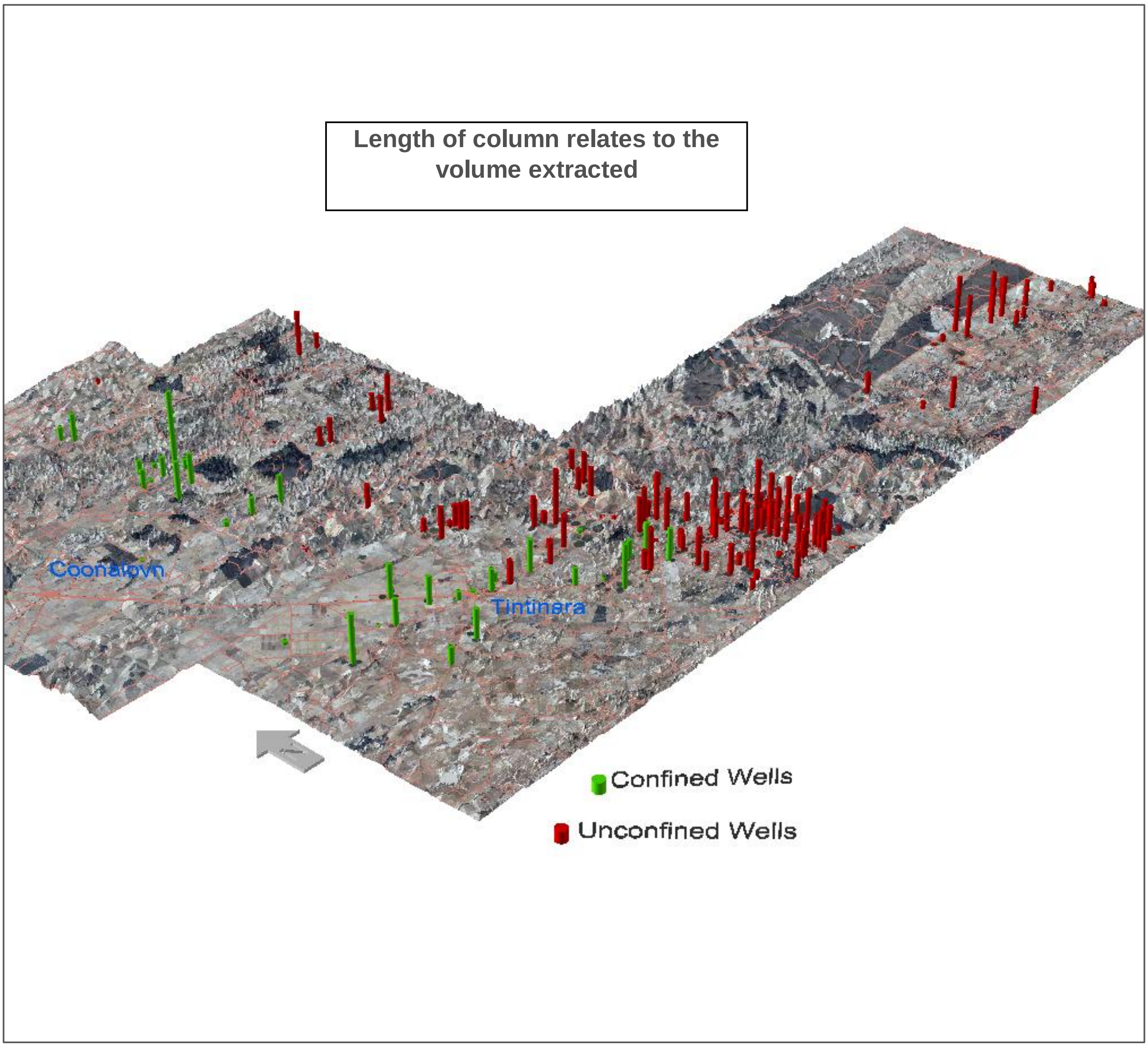

Figure 10. Spatial distribution of licensed groundwater extraction from each well during the 2010–11 irrigation season in the Tintinara–Coonalpyn PWA

GROUNDWATER OBSERVATION NETWORKS

WATER LEVEL NETWORK

The groundwater level observation network for both the unconfined and confined aquifers in the Tintinara–Coonalpyn PWA is shown in Figure 11. Groundwater level monitoring began in 1983 when concerns were first expressed about falling watertables in the area. Whilst most monitoring has so far been concentrated in areas of better quality groundwater where irrigation is occurring, the network has been expanded to include areas of saline groundwater where risks to vegetation health and dryland salinity arise from shallow watertables. There are currently 95 wells within the monitoring network, 54 wells monitoring water levels in the unconfined aquifer and 41 wells monitoring water levels in the confined aquifer which are monitored at least at six monthly intervals.

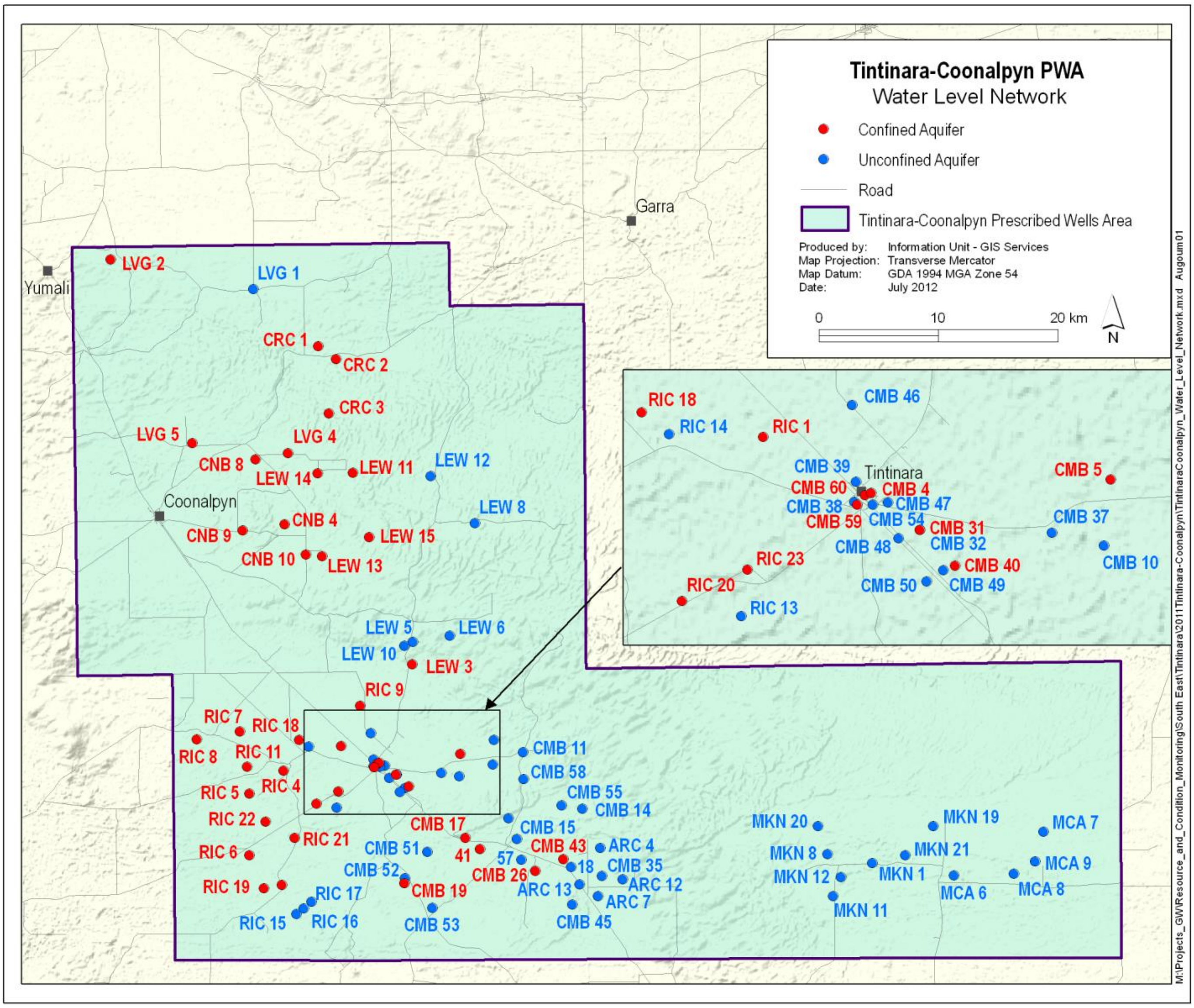

Figure 11. Location of water level observation wells in the Tintinara–Coonalpyn PWA

SALINITY NETWORK

The groundwater salinity observation network for both the unconfined and confined aquifers in the Tintinara–Coonalpyn PWA is shown in Figure 12. There are 32 wells in the network that currently monitor salinity, 18 monitor the unconfined aquifer and 14 monitor the confined aquifer. In addition to these wells, up to 40 irrigation wells completed within the unconfined aquifer are sampled when required.

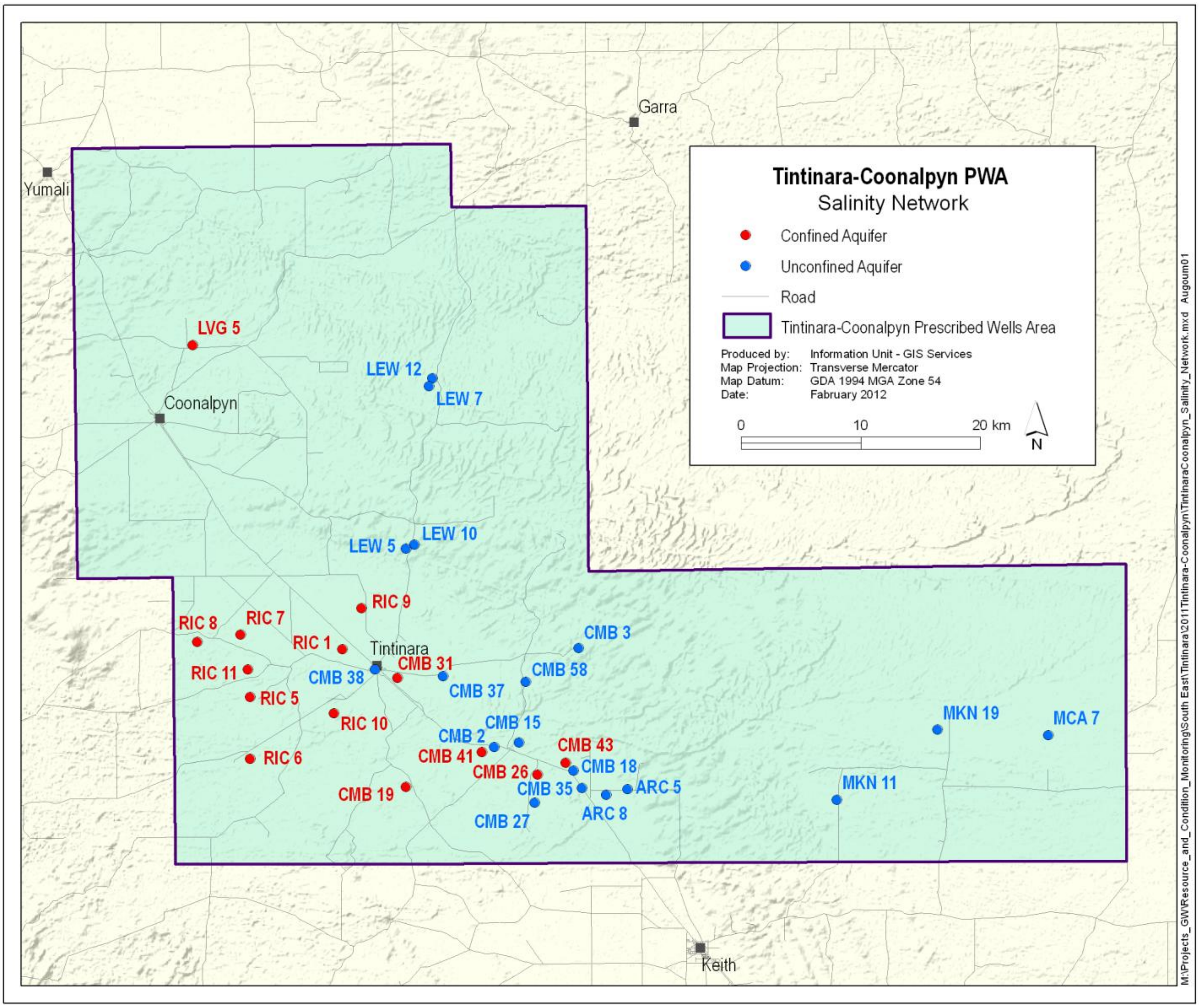

Figure 12. Location of salinity observation wells in the Tintinara–Coonalpyn PWA

UNCONFINED AQUIFER

COASTAL PLAIN

The shallow depth to the watertable of 5 to 10 m in the unconfined aquifer on the low-lying Coastal Plain results in the groundwater level trends being very responsive to rainfall. Figure 13 depicts representative long-term trends which show a declining trend in water levels since 1996 which corresponds with an increase in extraction and the prolonged period of below-average rainfall shown by the cumulative deviation from average annual rainfall graphed in orange. Very little (if any) recharge occurred during the 2006 drought. Water level declines of up to 3.5 m have been observed since 1996 until above-average rainfall in 2010 stabilised the declining trend and has led to a slight recovery in the water table.

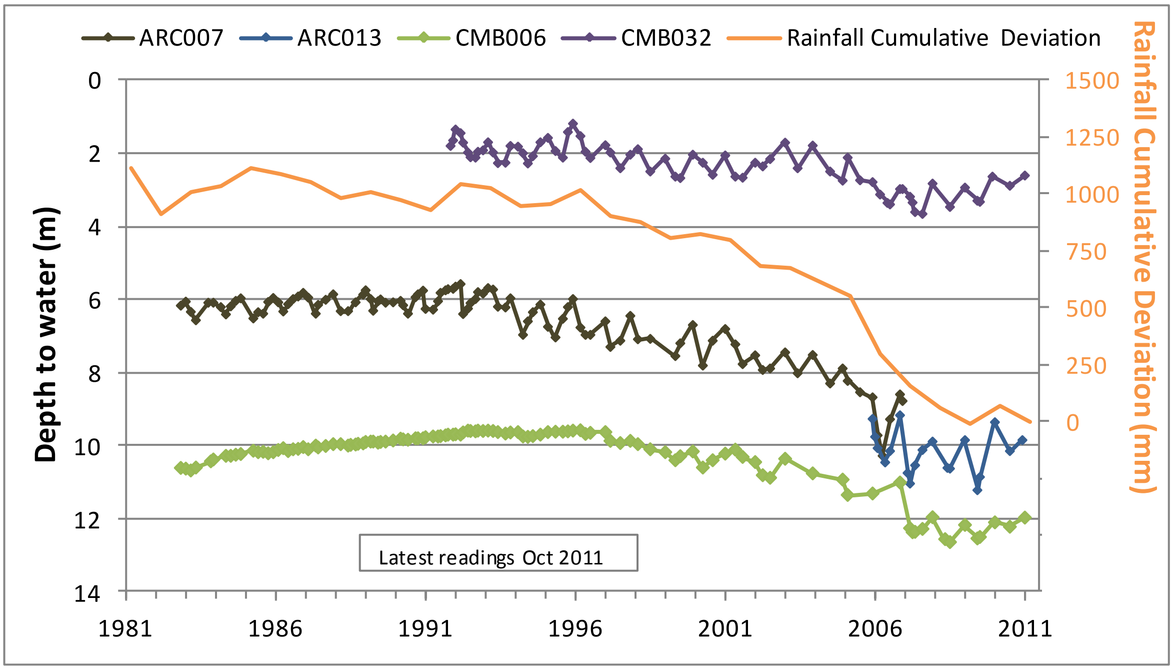

Figure 13. Groundwater level trends for the Coastal Plain unconfined aquifer in the Tintinara–Coonalpyn PWA

HIGHLANDS

In the unconfined aquifer beneath the Highlands where the depth to the watertable is more than 10 m, groundwater level trends are responding to very different processes to those found on the Coastal Plain. The widespread clearance of native vegetation has resulted in increased recharge rates and hence rising groundwater levels across the Highlands zone. Figure 14 presents the gradual rising trend averaging 0.1 m/y for several representative observation wells. This rising trend persisted for several years after the prolonged period of below-average rainfall that commenced in the mid 1990s, as shown by the cumulative deviation from annual average rainfall graphed in orange.

Most observation wells now show stable or slightly increasing trends in a delayed response to the above-average rainfall in 2010, with the lag time varying depending on the depth to the watertable and the permeability of the sediments.

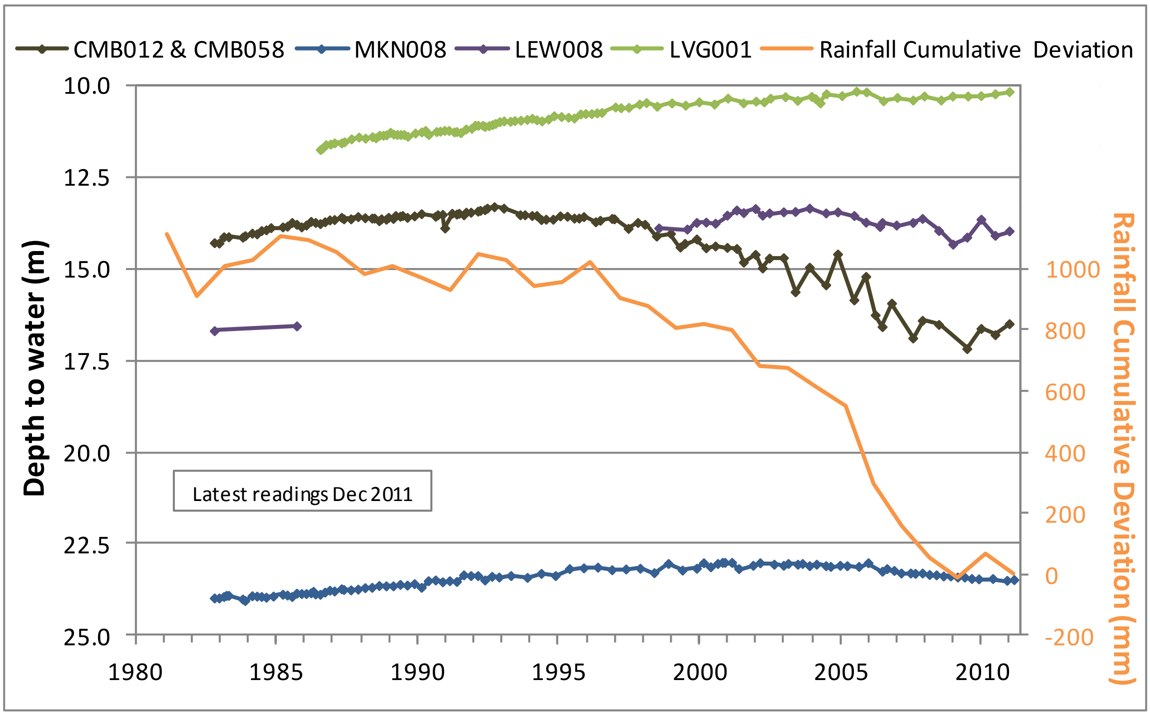

Figure 14. Groundwater level trends for the Highlands unconfined aquifer in the Tintinara–Coonalpyn PWA

CONFINED AQUIFER

COASTAL PLAIN

There are two processes that are likely to be affecting groundwater level trends in the confined aquifer, hydrostatic loading and extraction. Hydrostatic loading causes the confined pressure levels to closely match the trends in the overlying unconfined aquifer. For example, a rising watertable results in more water being stored in the unconfined aquifer and therefore more weight is pressing down on the confining layer, which increases both the hydrostatic pressure in the underlying confined aquifer and the observed water levels. Conversely, a falling watertable will result in declining confined aquifer levels. It should be noted that investigations are underway elsewhere in the South East to examine the contribution of leakage between aquifers in causing these falling trends.

Figure 15 presents representative trends for confined aquifer observation wells on the Coastal Plain. The declining trend since 1996 mirrors the unconfined aquifer water level trend (Fig. 13), which is likely due to hydrostatic unloading rather than resource depletion. Wells RIC004 and CMB031 show a recovery in recent years due to the local rise in the overlying unconfined aquifer in response to above-average rainfall in 2010.

The impacts of groundwater extractions are shown as seasonal fluctuations in water levels which vary by up to 8 m in areas of concentrated pumping near Tintinara.

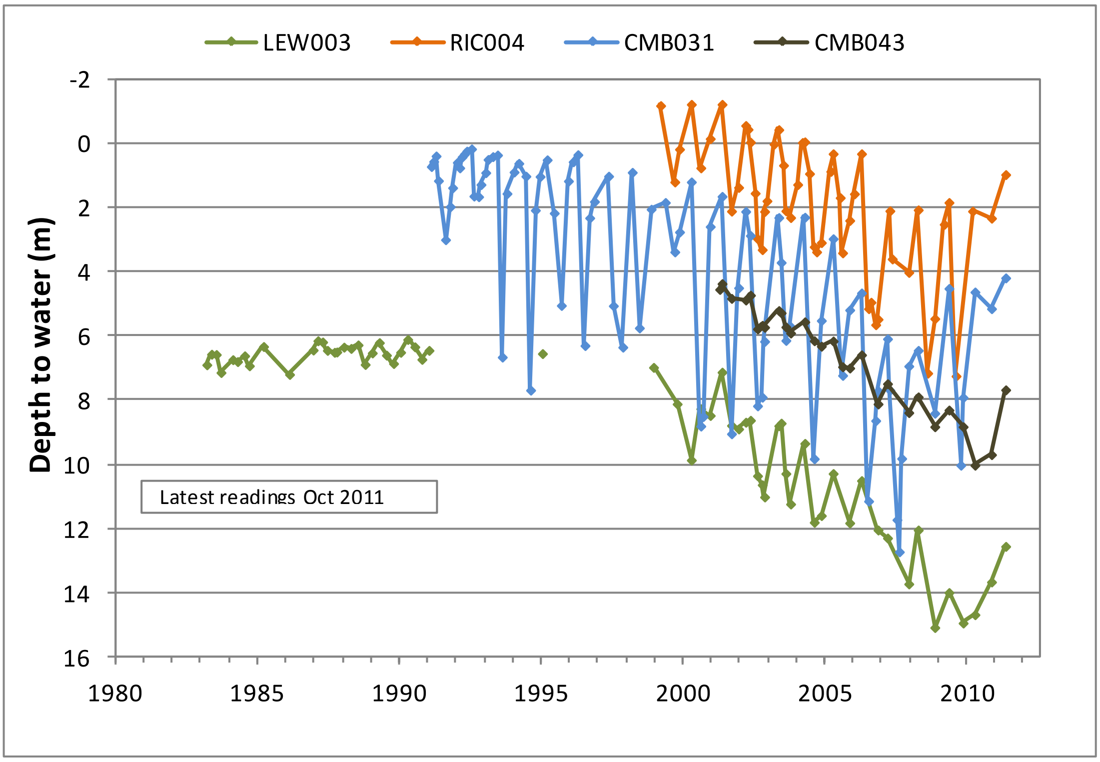

Figure 15. Groundwater level trends for the Coastal Plain confined aquifer in the Tintinara–Coonalpyn PWA

HIGHLANDS

The majority of irrigation extractions (east of Coonalpyn) occur from the deeper sand aquifers within the Renmark Group (Middle and Lower) confined aquifers, with virtually all stock and domestic use from the shallower Buccleuch Formation (Upper) confined aquifer. Representative trends are presented in Figure 16. The greater depth to the watertable in this area means that there is likely to be a lower watertable response to changes in recharge to the unconfined aquifer than on the Coastal Plain and consequently, hydrostatic loading is unlikely to have a significant impact.

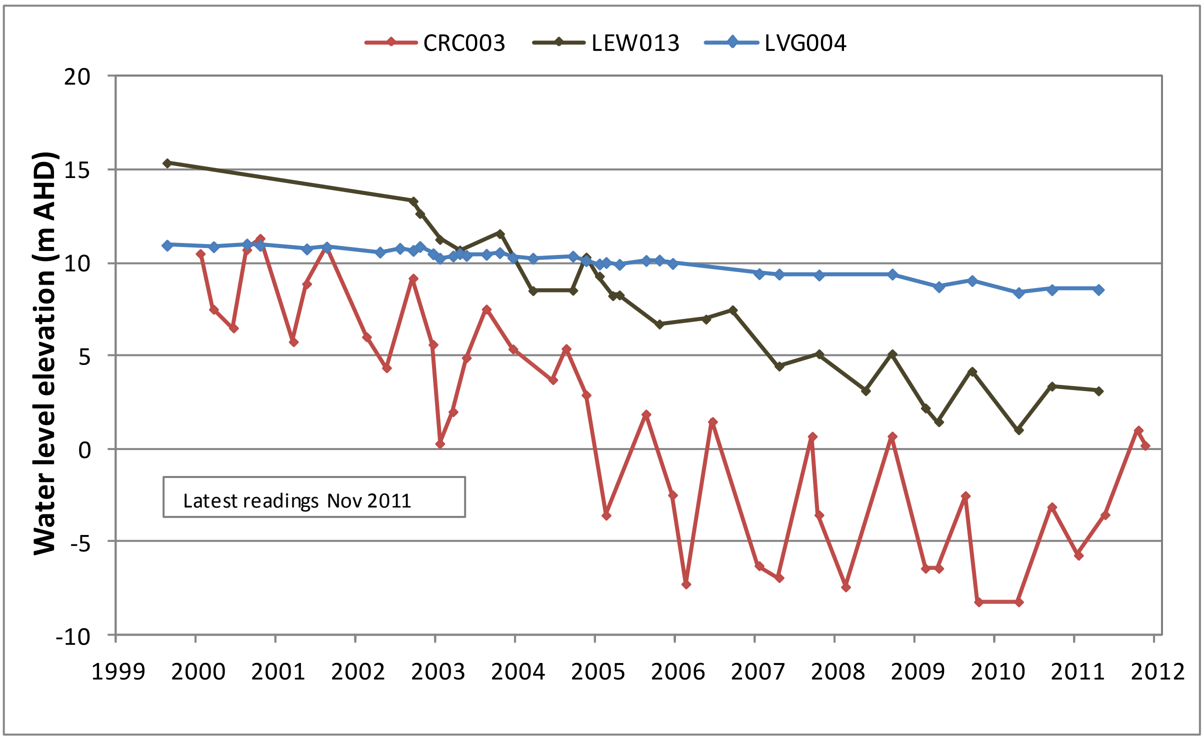

Figure 16. Groundwater level trends for the Highlands confined aquifer in the Tintinara–Coonalpyn PWA

Well LVG004 is completed in the Buccleuch Formation (Upper) confined aquifer and is located 3 km west of an intensive irrigation area. The water level has only fallen one metre since the irrigation began, indicating there is minimal (if any) impact on most stock and domestic groundwater users.

LEW013 intersects the Renmark Group (Middle) confined aquifer. A drawdown of 10 m has been observed since irrigation began. Apart from LEW013, there are only two other stock and domestic wells completed in this aquifer and both are being monitored (CNB001 and LVG005).

Well CRC003 is an unequipped irrigation well within the Renmark Group (Lower) confined aquifer and displays a seasonal drawdown of almost 10 m and a long-term drawdown trend due to increasing extractions. A recovery observed during 2011 is most likely due to a reduction in extractions.

UNCONFINED AQUIFER

COASTAL PLAIN

Groundwater salinity trends of irrigation wells in the unconfined aquifer are quite variable as shown in Figure 17. Numerous irrigation wells are showing a rising salinity trend due to the recycling of irrigation drainage water in the shallow aquifer. Salinity rises beneath areas of flood irrigation are typically greater than those beneath pivot irrigation due to the greater volumes of drainage. In Figure 15, the rising trend for well 6926-396 (flood) of 197 mg/L/y is considerably greater than that of 28 mg/L/y for well ARC008 (pivot). Some wells are showing stable salinity levels (well 6926-399), while decreasing trends have been observed on the eastern margin of the irrigated areas on the Coastal Plain because drawdowns have increased the inflow of lower-salinity groundwater from the Highlands to the east (well 6926-586).

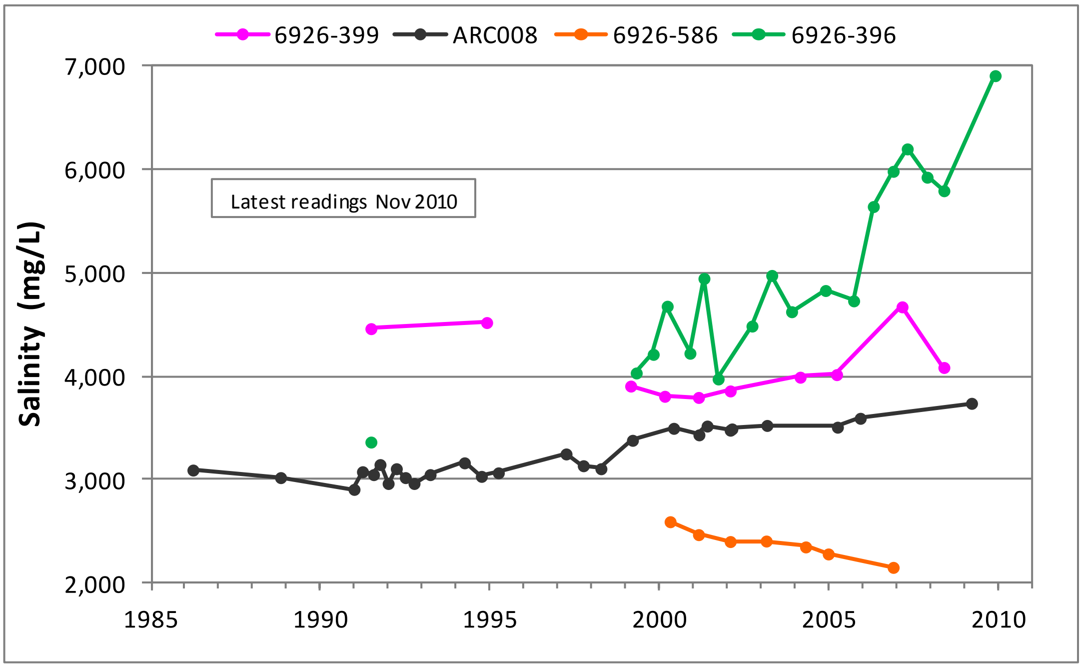

Figure 17. Groundwater salinity trends for the Coastal Plain unconfined aquifer in the Tintinara–Coonalpyn PWA

HIGHLANDS

Groundwater salinity trends in the Highlands are responding to a very different process to that found on the Coastal Plain. The widespread clearance of native vegetation has resulted in increased recharge rates and the flushing of salt, which was previously stored in the root zone of the native vegetation, down to the watertable, thereby increasing the salinity of the aquifer. This process is occurring independent of any irrigation activity, although drainage from irrigated areas will accelerate the process locally.

After this process has occurred for some years, most of the unsaturated zone salt is eventually flushed into the aquifer. Lower-salinity recharge water will then start entering the aquifer, causing a decrease in groundwater salinity. This freshening of the groundwater following a salinity increase is well documented in the Padthaway PWA to the south. For further information refer to:

http://www.waterconnect.sa.gov.au/BusinessUnits/InformationUnit/Technical%20Publications/ki_report_2005_35.pdf

Figure 18 shows a variety of trends. Well MKN019 is located in the eastern part of the PWA where the depth to the watertable is 40–50 m and the impacts of clearing and flushing of salt have yet to reach the watertable. Consequently, the trends in this area are stable with no significant rises in salinity. Well CMB003 is in a dryland setting and is showing a rise of 15 mg/L/y, indicating that salt flushing is still occurring in some areas. Irrigation well 6926-395 is rising at 20 mg/L/y, which may be a combination of recycling and clearing impacts as the depth to the watertable is about 15 m.

Well CMB058 displays a decreasing trend over the last 10 years, which may indicate that in areas of lower topography near the boundary with the Coastal Plain, the unsaturated zone salt has almost been completely flushed and lower-salinity water is now recharging the aquifer.

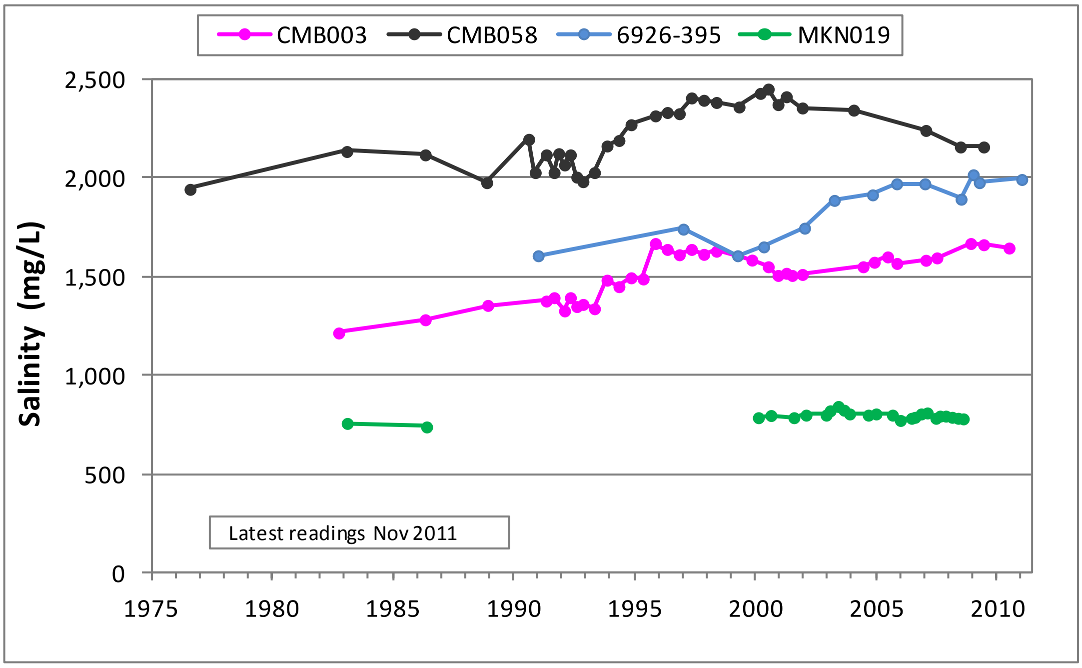

Figure 18. Groundwater salinity trends for the Highlands unconfined aquifer in the Tintinara–Coonalpyn PWA

CONFINED AQUIFER

COASTAL PLAIN

Rising salinity in the western portion of the PWA due to groundwater flow reversal is the greatest risk resulting from irrigation extraction from the confined aquifer. Figure 19 shows that salinity trends for the confined aquifer on the Coastal Plains are stable.

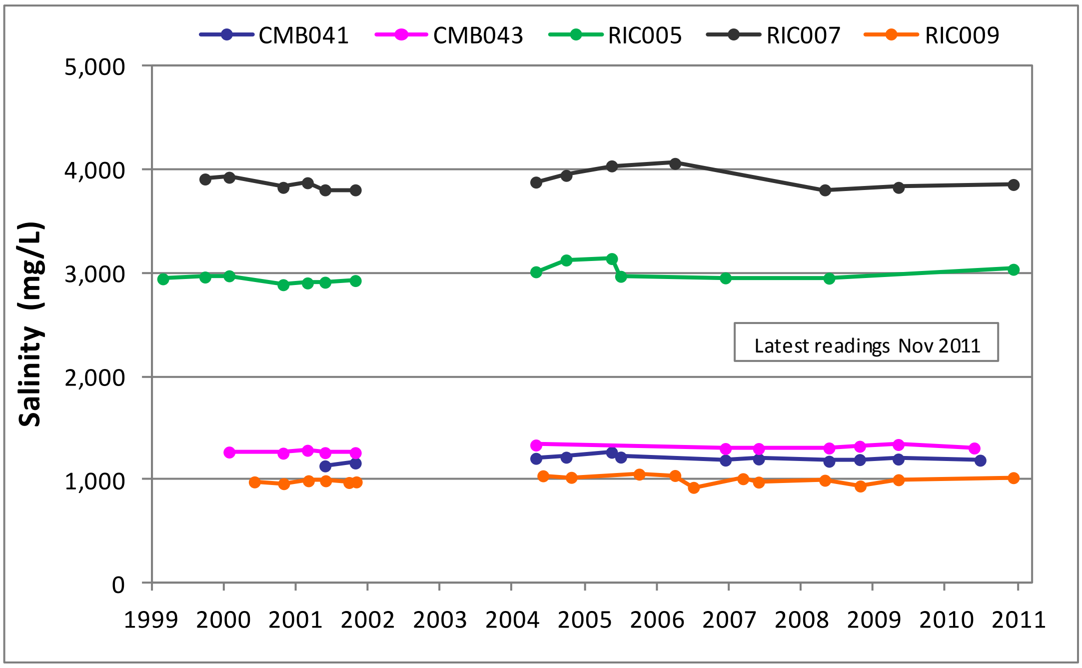

Figure 19. Groundwater salinity trends for the Coastal Plain confined aquifer in the Tintinara–Coonalpyn PWA

HIGHLANDS

There is only one observation well monitoring salinity in the Renmark Group (Middle) confined aquifer from where most irrigation extractions occur in this area. Figure 20 indicates that trends are stable.

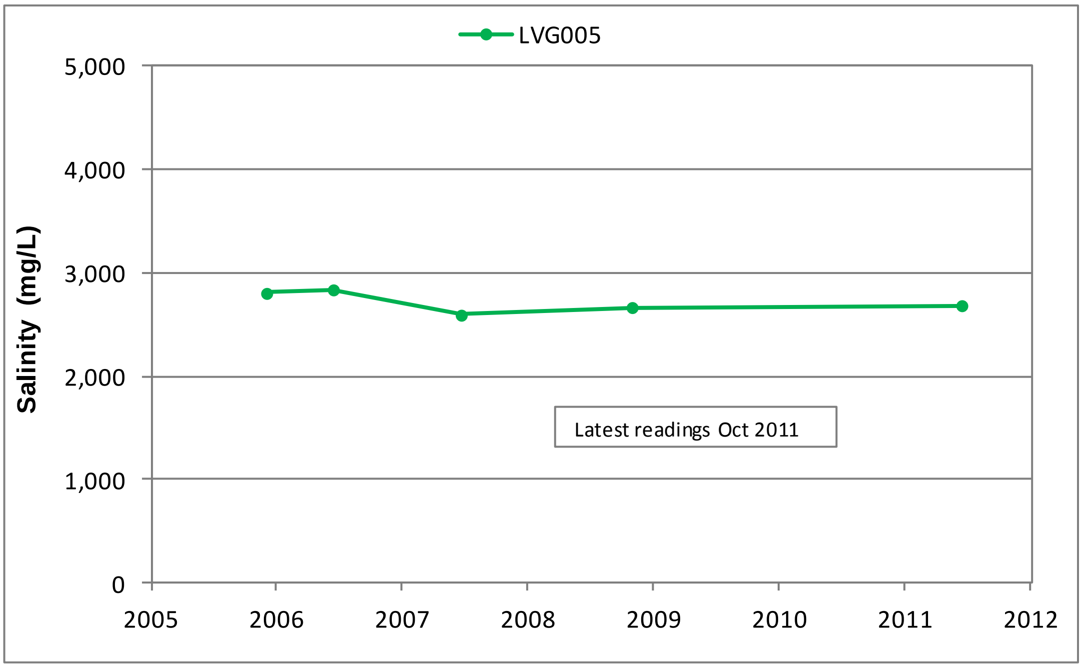

Figure 20. Groundwater salinity trends for the Highlands confined aquifer in the Tintinara–Coonalpyn PWA