

South Australian – Victorian Border Groundwaters Agreement Review Committee



Twenty Second Annual Report

To June 2007

Melbourne and Adelaide

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1. Groundwaters Agreement Designated Area

Along the Victorian/South Australian border, groundwater is the only reliable water source. There are two main aquifer systems comprising the Tertiary Confined Sand Aquifer¹ and the Tertiary Limestone Aquifer².

The Tertiary Limestone Aquifer is the principal source of groundwater for existing users. The use of the lower Tertiary Confined Sand Aquifer is generally limited to municipal supply, but there are increasing demands to use the aquifer where the Tertiary Limestone Aquifer is fully allocated.

In recognition of the need to cooperatively manage the groundwater resources on the border of South Australia and Victoria, the Border Groundwaters Agreement (the Agreement) was entered into in 1985. Following assent to the *Groundwater (Border Agreement) Act 1985* in each State, the Agreement came into force in January 1986. As the technical knowledge of the resource has improved and the demand for water increases, there is a need to manage the resource in a more targeted way to take account of aquifer characteristics and specific circumstances. The Agreement was therefore amended in 2005 and both States have passed amending legislation to give effect to the Amendment Agreement.

The Agreement established a 40 km wide Designated Area centred on the border and divided into 22 paired management zones (Figure 1).

The Tertiary Limestone Aquifer is the most extensive aquifer in South Australia and is the prime source of water in the South Australian Mallee. It is the major water supply source for Mount Gambier and is used extensively for high value horticulture, small seed and viticulture irrigation.

In the far western area of Victoria there are extensive areas of good quality groundwater. The Glenelg River is the only readily available surface water supply in the region. All significant towns are dependent on groundwater for their water supply, from Portland on the coast, to Kaniva in the Wimmera and to Murrayville in the Sunset Country. Agricultural and pastoral activities likewise are dependent on the Tertiary Limestone Aquifer for groundwater.

In the Designated Area, the Tertiary Limestone Aquifer has been sub-divided into three hydrogeological provinces as shown in Figure 1 and described below:

Province 1 occurs largely in the Otway Basin and is characterised by Quaternary calcareous sandstone overlying the Gambier Limestone forming one unconfined aquifer system;

Province 2 is located in the Murray Basin where the Murray Group Limestone is unconfined and either outcrops at the surface, or is overlain directly by the Pliocene Sand Aquifer; and

Province 3 is in an area of the Murray Basin where the Murray Group Limestone is confined by the Upper Tertiary Aquitard.

¹ The Tertiary Confined Sand Aquifer is the Dilwyn Formation in the Otway Basin and the Renmark Group in the Murray Basin.

² The Tertiary Limestone Aquifer is generally the Gambier Limestone in the Otway Basin and the Murray Group Limestone in the Murray Basin.

2. The Border Groundwaters Agreement

The Agreement operates in both States.

The Agreement establishes a Designated Area, which is a strip 40 km wide centred on the border and extending for its full length. It is divided into 22 zones, 11 in each State.

The Agreement provides that the available groundwater shall be shared equitably between the States and applies to all existing and future bores within the Designated Area, except domestic and stock bores.

The Agreement establishes the Border Groundwaters Agreement Review Committee (the Review Committee) with membership from both States, as the operating body for the effective implementation of the Border Groundwaters Agreement.

Extraction licences or permits may not be granted or renewed within the Designated Area other than in accordance with the management prescriptions set out in the Agreement. In any of the 22 zones, the prescriptions limit water use to that specified as the Permissible Annual Volume for total withdrawals from all aquifers, or to an average annual rate of lowering of potentiometric (water) levels as specified or a permissible level of salinity. The prescriptions also provide that, where appropriate, casing of new wells shall be sealed between aquifers to prevent inter-aquifer contamination.

The actual allocation of water is the responsibility of the licensing authorities in each State in accordance with the relevant groundwater management plan or water allocation plan prepared under the States' respective water resources legislation.

The approach taken by the States in developing management plans has included objectives to better quantify the resource, to establish appropriate mechanisms for allocating the resource or, if needed, to restrict the use of the resource. Plans are developed through consultative committees to maximise community and industry involvement in the making and implementation of the arrangements.

Table 1 sets out the management areas relevant to the Designated Area. The locations of the areas are shown in Figure 2.

Table 1 Management areas relevant to the Designated Area

South Australia (Prescribed Wells Areas)	Victoria (Water Supply Protection Areas)
Lower Limestone Coast Tatiara Mallee Noora	Apsley Glenelg Kaniva Murrayville Neuarpur Telopea Downs

3. Border Groundwaters Agreement Review Committee

3.1 Establishment, membership and appointment

During the year membership of the Review Committee comprised:

from South Australia

Mr N A Power	member
Ms B Cohen	member
Mr S Mustafa	deputy member

from Victoria

Mr R Nott	member
Dr J Cooke	member
Mr M Burns	deputy member

Mr N A Power was President.

Mr E Daniels was secretary and Ms L Schuyler minute secretary from 28 February 2007.

The Review Committee met six times during the year:

21 August 2006	Melbourne
12 October 2006	Melbourne
21 November 2006	Adelaide
15 December 2006	Melbourne
28 February 2007	Adelaide
16 May 2007	Melbourne

3.2 Functions

The Agreement provides that the Review Committee:

- may from time to time coordinate, or cause to be carried out, surveys, investigations and studies concerning the use, control, protection, management or administration of the groundwater in the Designated Area;
- may make recommendations to the Contracting Governments or to any authority, agency or tribunal of the Contracting Governments concerning any matter which, in the opinion of the Review Committee, may in any way affect the investigation, use, control, protection, management or administration of the groundwater within the Designated Area;
- shall review at intervals of not more than five years:
 - the permissible distance from the border between the two States in relation to a particular zone, sub-zone or aquifer within a zone or sub-zone;

- the Permissible Annual Volume of extraction in relation to a particular zone, or aquifer within a zone
 - the allowable annual volume of extraction in relation to a particular zone, sub-zone or aquifer within a sub-zone
 - the permissible rate of potentiometric surface lowering (drawdown); and
 - the permissible levels of salinity if any such levels have been declared;
- review the Agreement and, if in its opinion, amendments thereto are necessary or desirable, make recommendations to the Contracting Governments accordingly.

3.3 Powers

The Agreement provides amongst other matters that the Review Committee shall have the power to:

- alter the permissible distance; or
- the permissible annual volume; or
- allowable annual volume; or
- declare a period of restriction.

3.4 Annual reports

The Agreement provides that as soon as practicable after 30 June each year the Review Committee shall prepare a report on its activities during the year ended on the preceding 30 June.

The Review Committee shall give a copy of each report to the Minister of each Contracting Government, who in turn under the *Groundwater (Border Agreement) Act 1985* must lay the report before each House of Parliament.

4. Prescriptions at 30 June 2007

4.1 Permissible Annual Volumes, allocations and use

When the Agreement was made in 1985 the Permissible Annual Volumes were equal on both sides of the border. This reflected the limited understanding of the extent of the aquifers and the recharge to these aquifers at that time.

The Agreement empowers the Review Committee to amend the Permissible Annual Volumes. This has been done in the past in consultation with interested parties and the relevant agencies responsible for groundwater management in both States.

The Permissible Annual Volumes have been adjusted recognising the extent of development in each zone and taking into account the amount of recharge and the potential impacts groundwater extraction could have on drawdowns and groundwater salinisation.

A management framework for the Tertiary Confined Sand Aquifer was developed by the Review Committee in its 5-year management review (1996-2000) and adopted by

both States to institute compatible management for the aquifer on a regional basis (Figure 3).

Table 2 sets out the Permissible Annual Volumes for each zone and the Permissible Annual Volumes for each aquifer of each zone for the year ending 30 June 2007. Tables 3 and 4 list the allocations and use for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer respectively.

The zones for the Tertiary Limestone Aquifer along the Designated Area within South Australia are fully allocated except Zone 2A where the total volume allocated is the volume specified for allocation in the Lower Limestone Coast Water Allocation Plan. The volume difference between the Permissible Annual Volume and the allocation available in the Water Allocation Plan is held in a Minister's reserve.

In Zone 4A the volume allocated has increased from 21,898 ML to 22,076 ML due to an allocation previously being incorrectly assigned to the Tertiary Confined Sand Aquifer.

Transferable water entitlement systems operate in accordance with water allocation plans prepared by the South East Natural Resources Management Board and the South Australian Murray Darling Basin Natural Resources Management Board. In Victoria a number of zones have become fully allocated and there is increasing demand for water allocations in other zones.

The South Australian Murray Darling Basin Natural Resources Management Board and the South East Natural Resources Management Board are currently reviewing the Mallee, Tatiara and Lower Limestone Coast Water Allocation Plans, which in part cover the border Designated Area. Preparation of these plans has been extended to 30 June 2008.

South Australia has instituted programs to install water meters in the Mallee Prescribed Wells Area (part of Zone 9A, Zones 10A and 11A) and in the South East (Zones 1A to part of 9A). Meters have been installed in the Mallee on all bores used for licensed water allocations and volumetric measurements of water extraction are now available. The implementation phase for the installation of meters in the South East was completed by 30 June 2007 and compliance checking of meter installations is underway.

Under the current allocation system South Australia is over-allocated in Zones 1A, 3A, 4A, 5A and 7A in the Tertiary Limestone Aquifer. Metered use in Zone 10A from the Tertiary Limestone Aquifer indicates that though water allocation under the crop area based system is within the Permissible Annual Volume actual extraction exceeds this volume.

As advised in the annual report up to 30 June 2006, South Australia has instituted a program to convert crop area based water allocations to volumetric allocations in both the South East and the Mallee. Conversion methodologies in both areas are being developed to provide a transparent process for the conversion of individual licence allocations.

The South East Natural Resources Management Board and the South Australian Murray Darling Basin Natural Resources Management Board will address the over-

allocation issues in the South East and over use in Zone 10A through the respective water allocation plans, which are to provide for the adjustment of allocation and use within permissible limits. A process has been initiated between the respective States' agencies to adopt agreed approaches to these issues for consideration by the Border Groundwaters Agreement Review Committee.

The allocations from the Tertiary Limestone Aquifer in the Victorian zones of the Designated Area are largely unchanged from the previous year. No groundwater has been allocated from the Tertiary Confined Sand Aquifer in Victoria in the year up to 30 June 2007.

The Agreement does not apply to bores for domestic and stock purposes. The estimated number of stock and domestic bores for each zone is listed in Table 5. The list provides an indication of the important role groundwater plays for domestic and stock purposes.

Table 2 Permissible Annual Volumes at 30 June 2007

South Australia			Victoria		
PAV Tertiary Limestone Aquifer (ML/yr)	PAV Tertiary Confined Sand Aquifer (ML/yr)	Zones	Zones	PAV Tertiary Limestone Aquifer (ML/yr)	PAV Tertiary Confined Sand Aquifer (ML/yr)
6861	0	11A	11B	1823	0
9400	320	10A	10B	6720	560
11595	570	9A	9B	5960	630
7700	340	8A	8B	6760	330
7500	350	7A	7B	6600	350
8850	360	6A	6B	9838	360
18500	540	5A	5B	11949	570
20000	710	4A	4B	14000	300
24000	1900	3A	3B	16500	1000
25000	2900	2A	2B	25000	5100
30900	9200	1A	1B	45720	14500

Table 3 Permissible Annual Volumes, allocations and metered use for Tertiary Limestone Aquifer at 30 June 2007

South Australia					Victoria				
Tertiary Limestone Aquifer				Zones	Zones	Tertiary Limestone Aquifer			
PAV (ML/yr)	Licensed Allocations					PAV (ML/yr)	Licensed Allocations		
	Total No of Licences	Total Volume Allocated (ML)	Total Volume Of Use ¹ (ML)				Total No of Licences	Total Volume Allocated (ML)	Total Volume of Metered Use (ML)
6861	17	6627	3243	11A	11B	1823	3	1600	225
9400	41	8624	14149	10A	10B	6720	14	6358	4819
11595	11	10230	2744	9A	9B	5960	2	5000	1285
7700	42	4854	753	8A	8B	6760	4	2538	2218
7500	102	8243	6375	7A	7B	6600	13	5692	625
8850	57	8758	7586	6A	6B	9838	13	9838	8615
18500	144	18999	12688	5A	5B	11949	36	11949	10338
20000	181	22076	14631	4A	4B	14000	5	2339	650
24000	268	24043	16754	3A	3B	16500	6	515	164
25000	132	21643	15005	2A	2B	25000	41	24586	10137
30900	374	31874	25156	1A	1B	45720	19	4780	4535

Note 1: Zones 10A and 11A are metered use and Zones 9A, 8A, 7A, 6A, 5A, 4A, 3A, 2A and 1A are estimated use.

Note 2. The figures for Zones 7B, 8B and 9B are being reviewed by the licensing Authority.

Table 4 Permissible Annual Volumes, allocations and metered use for Tertiary Confined Sand Aquifer at 30 June 2007

South Australia					Victoria				
Tertiary Confined Sand Aquifer				Zones	Zones	Tertiary Confined Sand Aquifer			
PAV (ML/yr)	Licensed Allocations					PAV (ML/yr)	Licensed Allocations		
	Total No of Licences	Total Volume Allocated (ML)	Total Volume of Metered Use (ML)				Total No of Licences	Total Volume Allocated (ML)	Total Volume of Metered Use (ML)
0	0	0	0	11A	11B	0	0	0	0
320	0	0	0	10A	10B	560	0	0	0
570	0	0	0	9A	9B	630	0	0	0
340	0	0	0	8A	8B	330	0	0	0
350	0	0	0	7A	7B	350	0	0	0
360	0	0	0	6A	6B	360	0	0	0
540	0	0	0	5A	5B	570	0	0	0
710	1	63	N/A	4A	4B	300	0	0	0
1900	0	0	0	3A	3B	1000	0	0	0
2900	2	150	N/A	2A	2B	5100	0	0	0
9200	4	1711	N/A	1A	1B	14500	0	0	0

Table 5 Number of stock and domestic bores

South Australia		Victoria	
Number of Stock and Domestic Bores	Zones	Zones	Number of Stock and Domestic Bores
18	11A	11B	17
28	10A	10B	243
9	9A	9B	47
12	8A	8B	113
74	7A	7B	104
80	6A	6B	56
233	5A	5B	162
253	4A	4B	339
244	3A	3B	79
228	2A	2B	577
545	1A	1B	625

NOTE: The numbers of stock and domestic bores are best estimates as made in 2004 based on State database records.

4.2 Permissible distance from the border

The permissible distance is the distance from the border within which all applications for a permit or licence must be forwarded to the Review Committee for approval. The Review Committee has the power to determine this distance. The Agreement provides for the permissible distance to be set for a particular zone, sub-zone or aquifer within a zone or sub-zone.

The radius of interference between pumping bores is greater in a confined aquifer than in an unconfined aquifer for a given discharge as the water level drawdown in a confined aquifer is a pressure response.

The Committee determined that the permissible distance should be varied to provide a separate Permissible distance for each zone for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer as provided for in the Amendment Agreement. The permissible distances are specified in Table 6.

The Review Committee considered no applications during the year up to 30 June 2007.

Table 6 Permissible distance at 30 June 2007

South Australia		Victoria	
Distance	Zones	Zones	Distance
3	11A	11B	3
3	10A	10B	3
1	9A	9B	1
1	8A	8B	1
1	7A	7B	1
1	6A	6B	1
1	5A	5B	1
1	4A	4B	1
1	3A	3B	1
1	2A	2B	1
1	1A	1B	1

4.3 Permissible potentiometric surface lowering

The Agreement provides for the potentiometric surface lowering to be set for a particular zone, sub-zone or aquifer within a zone or sub-zone.

A single simple rate of decline has meaning in the management of water levels in an unconfined aquifer. In the case of a confined aquifer this simple parameter is inadequate to describe the behaviour of the aquifer pressure response. Predictions of drawdowns using models have been used in such cases.

The Agreement originally provided that the permissible potentiometric surface lowering was a rate set at 0.05 m/yr. On the recommendation of the Review Committee the Ministers of the Contracting Governments agreed to amend the rates for some zones in 2001 and 2003. The prescribed permissible potentiometric surface lowering rates for each of the zones is shown in Table 7.

The water level trends in the Designated Area are described in Appendix A of this report. The observed trends are within the permissible potentiometric surface lowering rates.

Table 7 Permissible potentiometric surface lowering rates at 30 June 2007

South Australia		Victoria	
Rate (m/yr)	Zones	Zones	Rate (m/yr)
0.65	11A	11B	0.65
0.65	10A	10B	0.65
0.65	9A	9B	0.65
0.05	8A	8B	0.65
0.05	7A	7B	0.05
0.05	6A	6B	0.05
0.25	5A	5B	0.25
0.25	4A	4B	0.25
0.25	3A	3B	0.25
0.25	2A	2B	0.25
0.25	1A	1B	0.25

5. Management areas

The Review Committee has extended observer status to the regional water resource planning and management authorities to maintain the participation of the agencies in the Review Committee's work. The Review Committee has provided technical liaison between the State agencies for the 5-year review of the groundwater resources in the Murrayville and Neuarpur Water Supply Protection Areas in Victoria and in the prescribed wells areas in the Mallee and South East of South Australia.

In particular the Review Committee has also maintained an overview of groundwater levels in the Mallee (SA) and Murrayville (Victoria) areas in response to water extractions.

6. 5-year Management Review 2001 - 2005

The Review Committee continued the preparation of its 5-year Management Review 2001-2005 as required by the Border Groundwaters Agreement.

The Review Committee received three technical reports as listed in the Bibliography. These technical reports review the current status of the Tertiary Limestone Aquifer, groundwater level trends, salinity and hydrogeology of the regional aquifer systems.

In response to the current status of the resource and trends, the Review Committee made recommendations to both States on the management prescriptions specified in the Border Groundwaters Agreement and other influences affecting the availability of groundwater within the Border Designated Area.

The Review Committee adopted changes to the permissible distance from the border (see Table 8) for a number of zones to provide separate distances for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer.

Table 8 Proposed Permissible distances³

South Australia			Victoria		
TCSA (km)	TLA (km)	Zones	Zones	TLA (km)	TCSA (km)
3	3	11A	11B	3	3
3	3	10A	10B	3	3
3	1	9A	9B	1	3
3	1	8A	8B	1	3
3	1	7A	7B	1	3
3	1	6A	6B	1	3
3	1	5A	5B	1	3
3	1	4A	4B	1	3
3	1	3A	3B	1	3
3	1	2A	2B	1	3
3	1	1A	1B	1	3

The Review Committee did not vary the Permissible Annual Volumes of extraction.

The Review Committee did not recommend an alteration to the permissible potentiometric surface lowering in any of the zones.

A permissible salinity has not been set for any of the zones in the Designated Area.

The Review Committee continued its documentation of the key technical issues for each of the three hydrogeologic provinces along the Designated Area and identified specific resource management strategies to address these issues. Specific issues include declining groundwater levels in each of the provinces, the impact of forest plantations on groundwater levels in Province 1, salinity risks and changed understandings of the hydrogeology of the provinces and their implications for the management of the resources. These reports to the Ministers are yet to be finalised.

³ At the time of publication these adopted Permissible Distances are yet to be gazetted.

7. Condition of the resource

A review of water level trends based on the observation bore monitoring network (Figure 4) (a summary of which is contained in Appendix A) has identified:

- water level declines in two areas of the Tertiary Limestone Aquifer, (Zones 5A, 6A, 5B and 6B) and the southern region (Zones 1A, 2A, 3A, 1B, 2B and 3B);
- managed declines in groundwater levels in the Tertiary Limestone Aquifer in part of Zone 9A, Zones 10A, 10B and parts of Zones 11A and 11B; and
- stable groundwater levels in the remaining areas of the Tertiary Limestone Aquifer in the Designated Area. (Figures 5 and 6 illustrate the water level trends for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer, respectively.)

In the Mallee where the Tertiary Limestone Aquifer is confined, extraction results in a pressure response in the aquifer. The rate of recharge is very low and has been taken as zero, but the aquifer has a very large volume of groundwater in storage. The management prescription for the area provides for productive use of a small percentage of the resource. Numerical modelling predicted that with extraction groundwater levels would decline initially then flatten out over time. Monitoring of water levels shows that groundwater levels have stabilised since 2002 for the current level of extractions.

Groundwater declines in Zones 5A - 5B and part of 6A and 6B are attributed to groundwater extraction.

In the southern area there are three principal factors affecting water level decline: groundwater extraction, reduced rainfall and the effects of land use change, particularly the expansion of plantation forests.

The Review Committee is mindful of the declining trends in Zones 1A, 1B, 2A, 2B, the western part of 3A and south western part of 3B in Province 1, and Zones 5A, 5B, southern part of 6A and southern part of 6B in Province 2. The Review Committee is considering their implications and will propose strategies to address the situation in its technical and management reviews for each of the hydrogeological provinces as discussed under section 6. This will be done in collaboration with the water management authorities in each State.

8. Funding

In Victoria:

- the Department of Sustainability and Environment is responsible for the overarching management of the State's water resources and requirements to meet State priorities and interstate and national obligations. The Department undertakes investigations, groundwater monitoring and the State Water Inventory; and
- The water authorities in the Designated Area, Grampians Wimmera Mallee Water Authority and Southern Rural Water Authority, are responsible for licensing of groundwater extractions and bore construction. The Authorities

provide direct contact with groundwater users in allocating the resource, managing areas of intense development and resolving complaints.

In South Australia:

- Investigation, monitoring, water allocation licensing and resource management are the responsibility of the Department of Water, Land and Biodiversity Conservation; and
- Community based policy, management and water allocation planning are conducted in South Australia by the South Australian Murray Darling Basin Natural Resources Management Board and the South East Natural Resources Management Board.

Table 9 sets out the level of funding for 2006-2007.

Table 9 Funding for 2006- 2007

State	Investigations	Monitoring	Resource Management	Agreement Management	Total
Victoria	\$93,445	\$56,805	\$105,650	\$71,880	\$327,780
South Australia	\$166,800	\$129,300	\$130,000	\$138,400	\$564,500
Totals	\$260,245	\$186,105	\$235,650	\$210,280	\$892,280

12. FIGURES

Figure 1 The Designated Area, zones and hydrogeological provinces

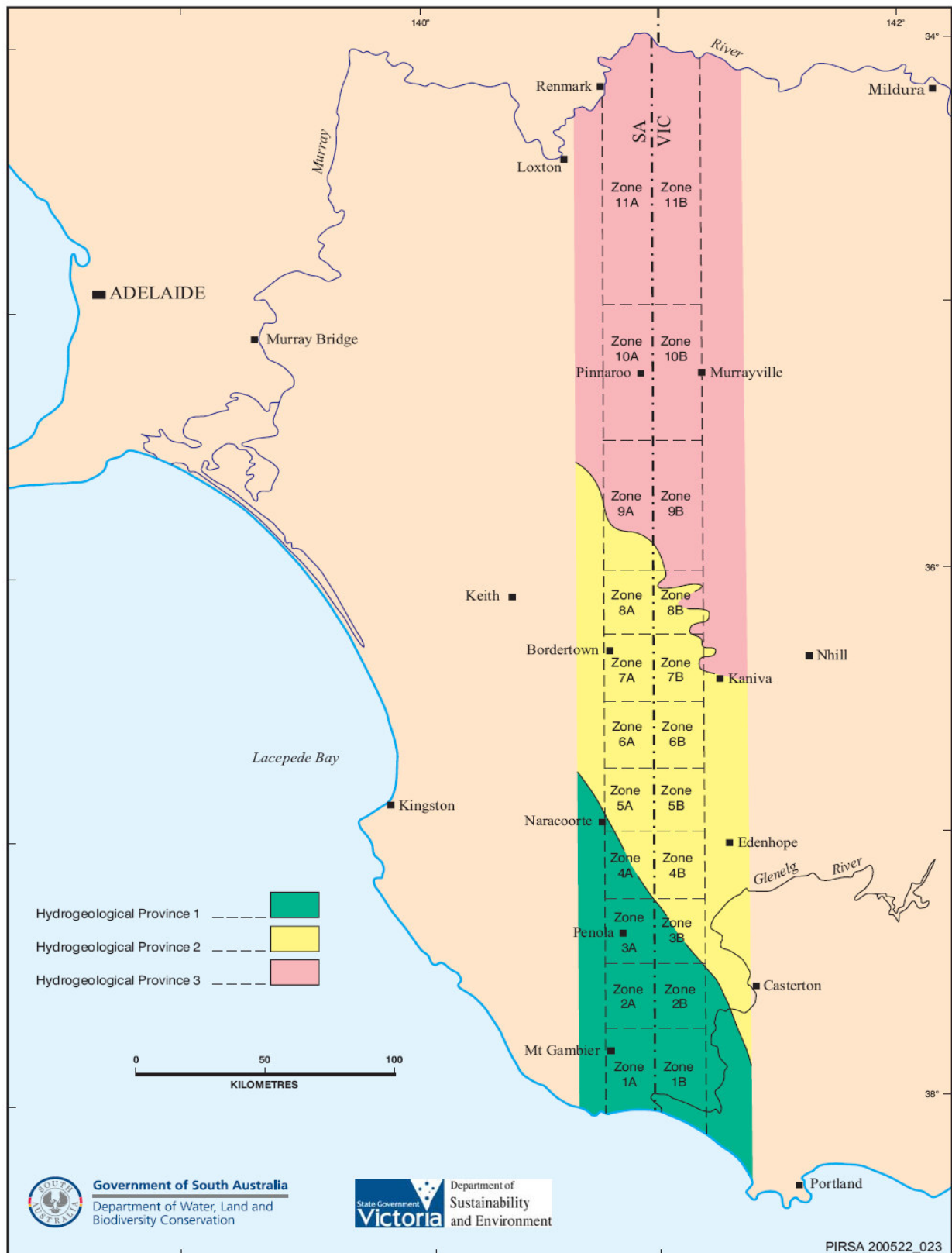


Figure 2 Relationship of other management areas in Victoria and South Australia to the Designated Area

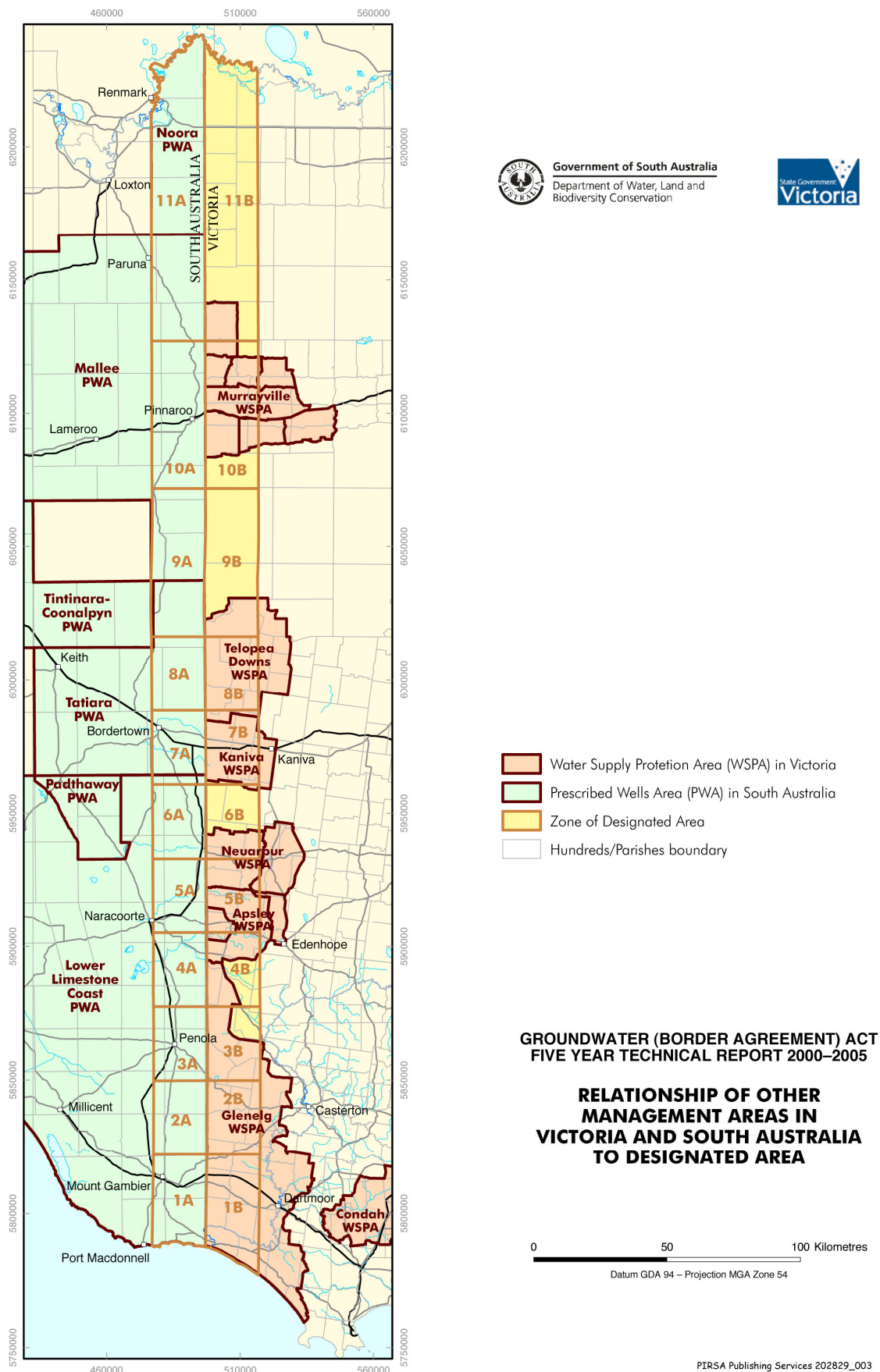


Figure 3 Tertiary Confined Sand Aquifer groundwater management zones

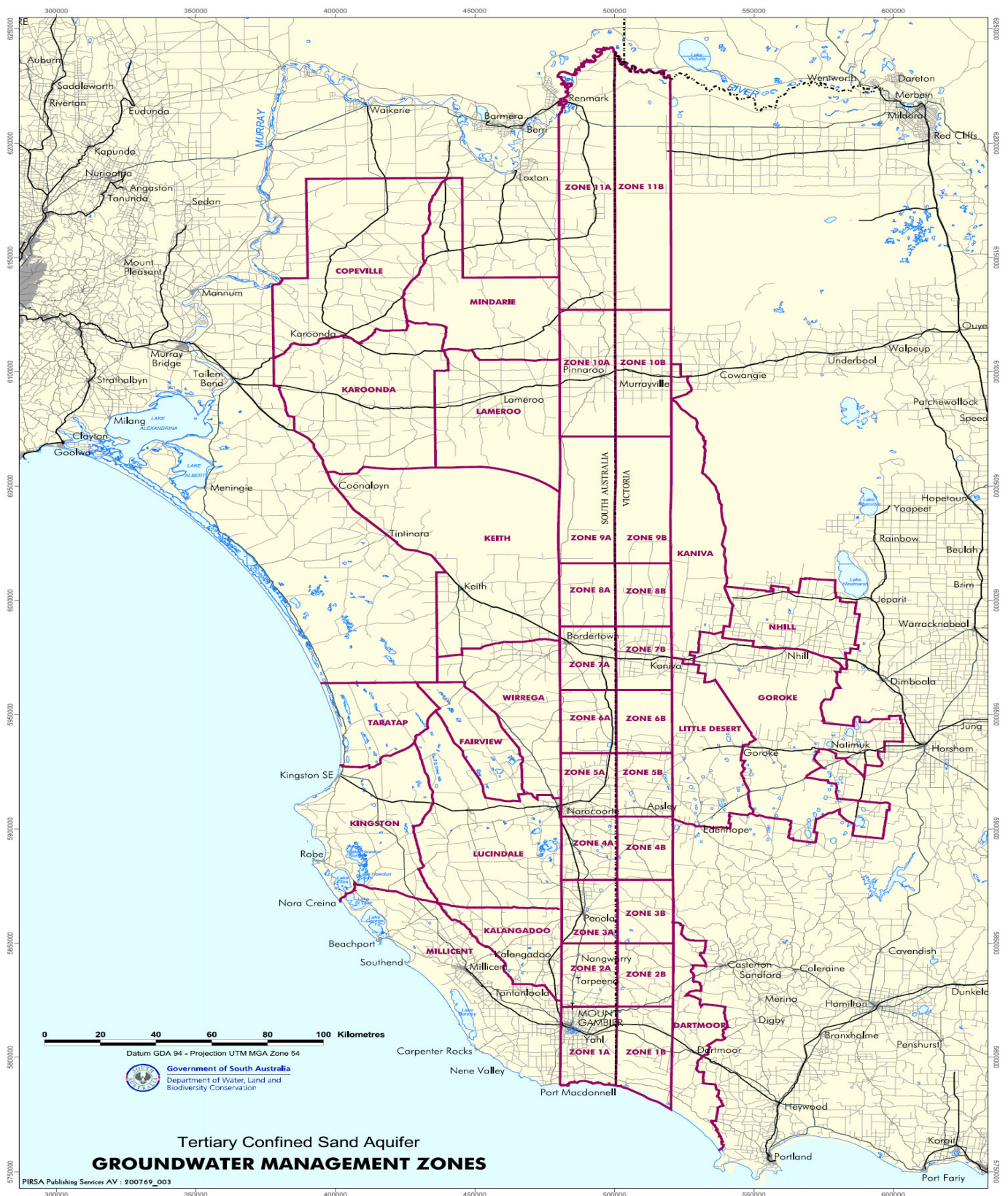
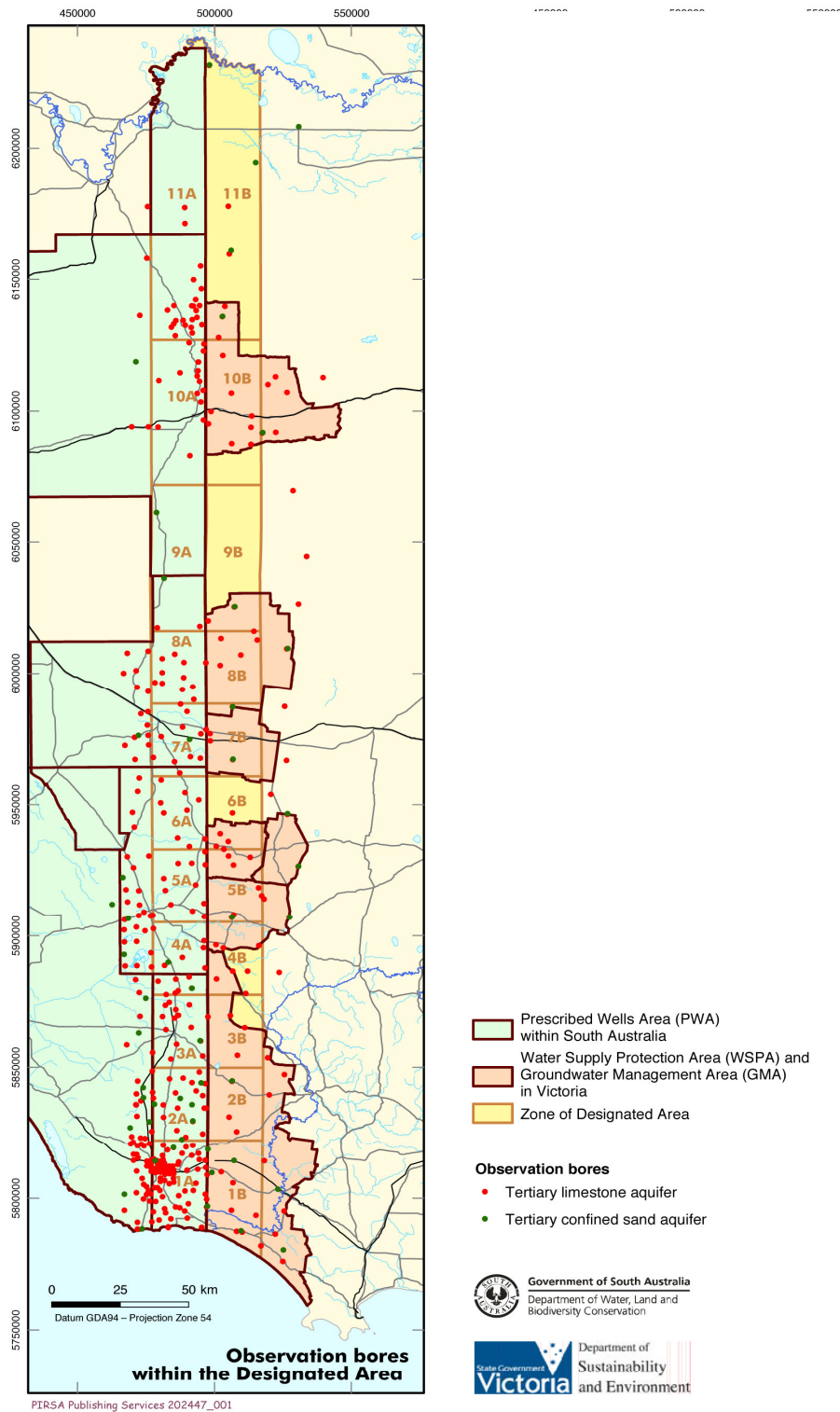


Figure 4 Observation bores within the Designated Area



GROUNDWATER (BORDER AGREEMENT) ACT

Figure 5 Map of groundwater level trends for the Tertiary Limestone Aquifer

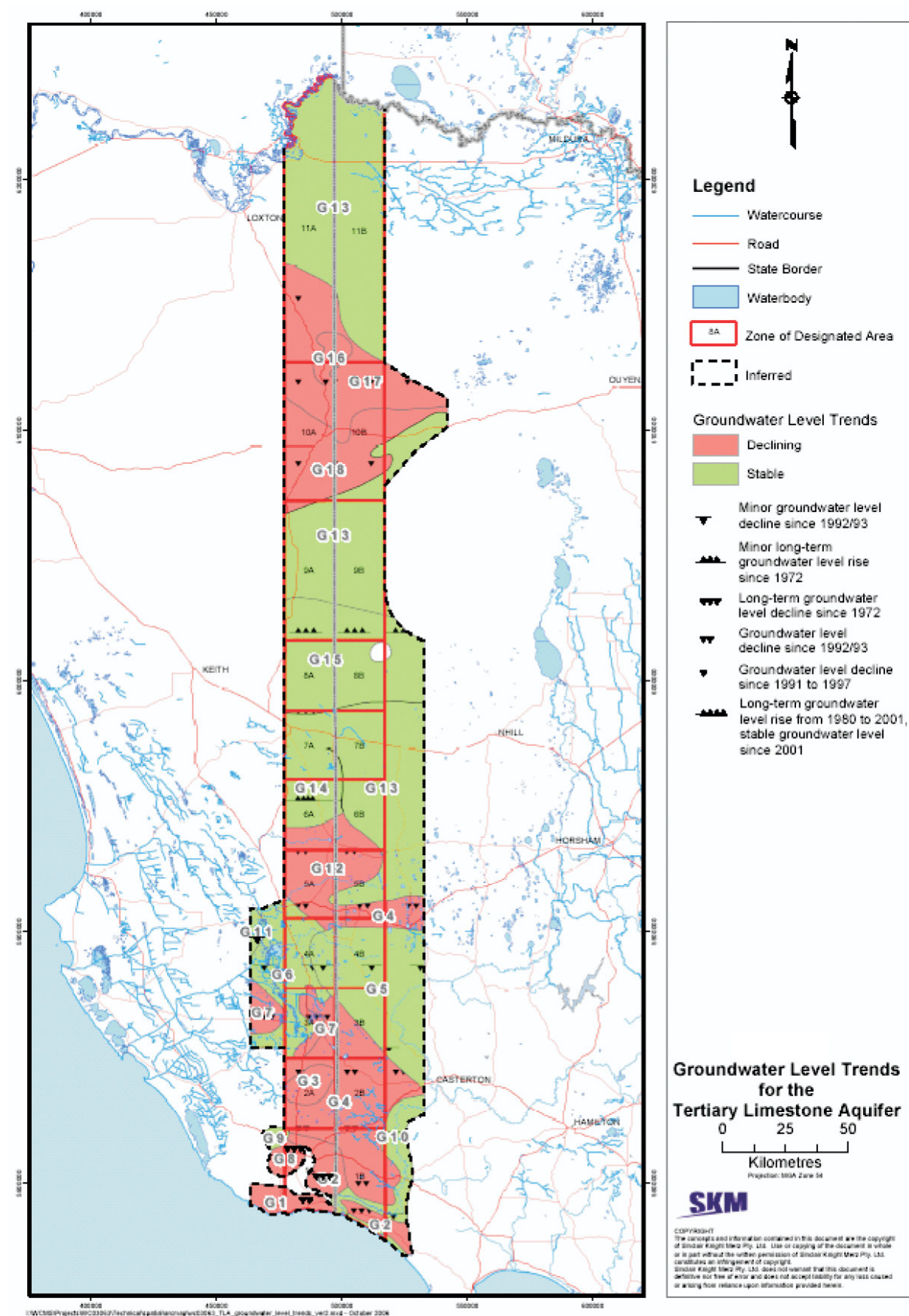


Figure 6 Map of groundwater level trends for the Tertiary Confined Sand Aquifer

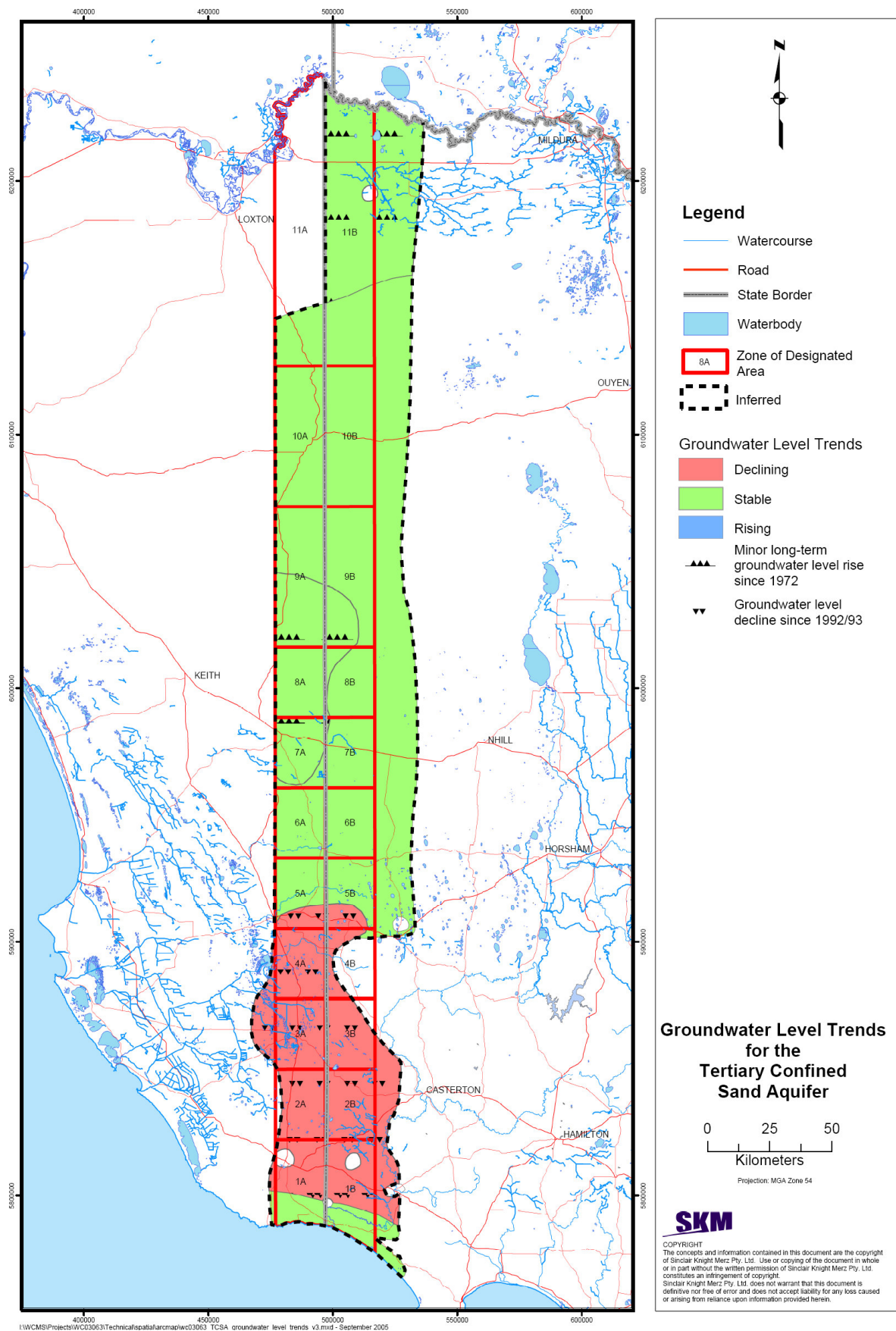
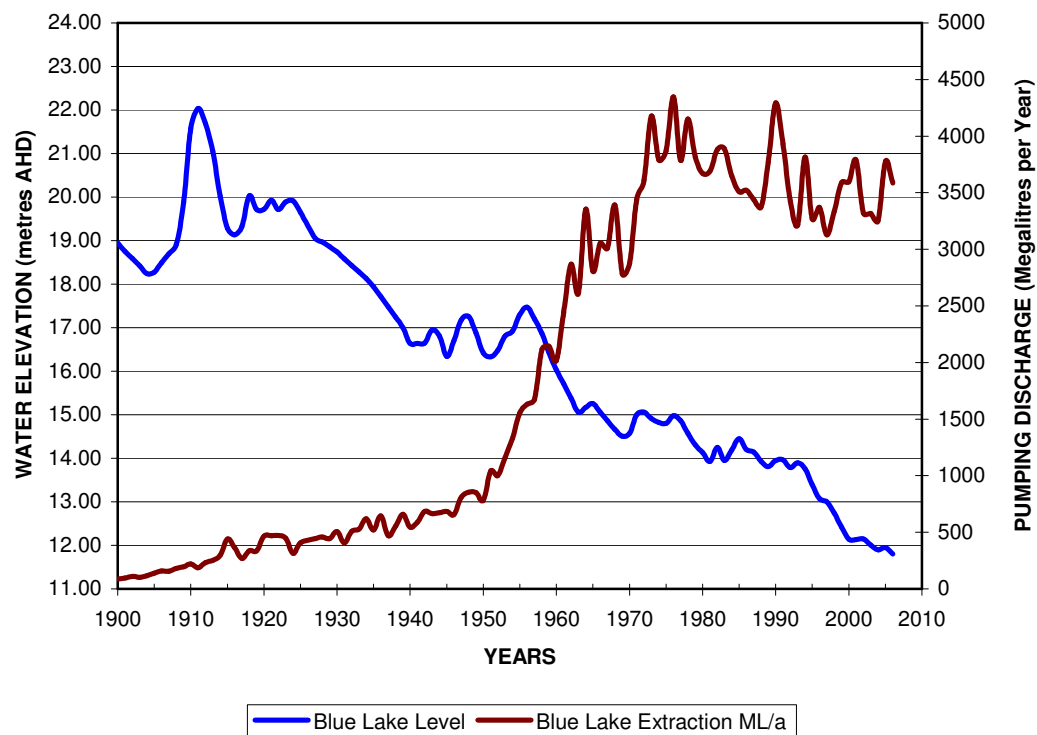


Figure 7 Water levels in Blue Lake, Mount Gambier, South Australia



Appendix A - Groundwater level trends

Groundwater level trends⁴ in the Designated Area are assessed annually as part of the Review Committee's work program. As part of the current 5-year review, a technical review of groundwater level trends was undertaken on all observation bores (~ 300, see Figure 4) in the Designated Area.

The assessments involved grouping bores of similar water level patterns and were sorted according to whether the long-term trends in recovered water levels were stable, declining or rising. Figures 5 and 6 illustrate the distribution of the water level trends for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer, respectively.

The pertinent findings of the review are summarised below.

TERTIARY LIMESTONE AQUIFER

Stable water level trends (Shown in green on Figure 5)

Stable groundwater level trends occur over a significant portion of the Designated Area.

Where these areas occur in the Mallee (Zones 11B, 11A (the northern part), 8A, 8B, 7A, 7B and 6B (northern part) there is low groundwater extraction either because the groundwater quality is unsuitable or due to land use (eg Murray-Sunset National Parks, Little Desert National Park, Big Desert Wilderness).

In Zones 6A (northern part) and 7A groundwater levels rose by 2m during the period 1980 to 2001. The rise has been attributed to increased recharge following historic clearance of native vegetation (BGARC, 2004). Levels have stabilised since 2001.

The area between Penola and Naracoorte in Zone 4A has stable water level trends but large seasonal drawdowns due to groundwater extraction. It is considered that groundwater use in this area is sustainable in respect to yields, as the long-term trends in recovered levels are stable.

Declining water level trends (Shown in red on Figure 5)

There are three regions where water levels have declined. These are:

- Zones 10A, 10B and 11A (southern part) of Province 3
- Zones 5A, 5B and 6A (southern part) and 6B (southern part) in Province 2; and
- Zones 1A, 1B, 2A, 2B, 3A (western part) and 3B (south western part) in Province 1.

⁴ "Water level/potentiometric level" -Throughout this review the term "water level" is used to mean potentiometric level either as a standing level, relative level or total hydraulic head. This has been done for convenience, noting that in:

- (i) confined aquifers it represents the level that water will rise in a bore; and
- (ii) in unconfined aquifers it is the water table.

The Tertiary Limestone Aquifer is confined in Province 3 and is distant from recharge areas. Consequently the aquifer does not respond to seasonal recharge from rainfall. The decline in groundwater level and the cone of depression that has formed in this region centred at Peebinga (eastern part of 10A), is an area of concentrated irrigation development.

The drawdown is a pressure response for which the Review Committee has established management targets documented in the 5-year management review (BGARC, 2001). Monitoring of water levels shows that groundwater levels have stabilised since 2002.

In Zones 5A, 5B, 6A (southern part) and 6B (southern part) in Province 2 water levels have declined in the order of 0.18m/yr since 1992-93. The decline is attributed primarily to the area of concentrated groundwater extraction. The aquifer is approximately 70 m to 100m thick in this area providing a large groundwater storage volume.

Zones 1A, 1B, 2A, 2B, 3A (western part) and 3B (south western part) in Province 1.

There are a number of distinctive declining water levels trends across this region.

Long-term declining groundwater trends (30 years as observed by the hydrographs) occur in the eastern part of Zone 1A and the area south of the Glenelg River in Zone 1B. Since 1972 the total change in water level over that period is ~3.5m, which equates to a rate of decline of 0.11m/yr. The seasonal fluctuation in water levels is negligible indicating little recharge from rainfall or seasonal extraction from groundwater extraction. These areas are located beneath plantation forests and are indicative of the impact that plantation forests have on rainfall recharge.

At Nangwarry (the eastern part of Zone 2A), water levels rose after the plantation forests were burnt during the 1983 bushfire (Stadter 1992). The water level information collated since then shows that groundwater levels are in decline under the plantations and a cone of depression is forming in response the re-establishment of the plantations.

In the Mount Gambier area (the north western part of Zone 1A) the groundwater levels have been in long-term decline since 1925, as observed by the water level in Blue Lake (Figure 7). The hydrographs for the bores show that the water levels have declined ~3.5m since 1972.

The declines at Mount Gambier have occurred even though over the interval 1925 to 1992 there have been periods of above average rainfall. Above average rainfall has not resulted in a long-term stabilisation of water levels.

The coastal area in South Australia (the southern part of Zone 1A) is the area south of Mount Gambier and includes sites of groundwater discharge such as Piccaninnie Ponds. The water levels in the coastal area were relatively stable up until 1997 with negligible seasonal fluctuation. Since 1997 groundwater levels have fluctuated seasonally. The seasonal drawdown is indicative of water level response to groundwater development and extraction. There is a small declining trend in recovered levels since 1997. It is considered that while the rate of decline in the recovered levels is low, the seasonal fluctuations are large and given the proximity to

the coast and the potential risk of seawater intrusion, this warrants further investigation and should be given special attention.

The declining water level trends in Zones 2A (west and southern parts), 1B (parts north of the Glenelg River), 2B and 3B began in 1992-93 and since then have declined ~1.5 - 2m (0.12 - 0.16m/yr). Prior to 1992 water levels were elevated and ~1m above the level of the previous period 1979-85. Consequently water levels since 2004 are ~1m lower than levels observed during the early 1980s. Water levels were stable in 2004 and 2005. Since then water levels have continued to decline with a marked absence of the seasonal recovery over winter which characterise the earlier water level pattern in the late 1980s to early 1990s.

TERTIARY CONFINED SAND AQUIFER

Stable water level trends (Shown in green on Figure 6)

Groundwater level trends in the Tertiary Confined Sand Aquifer have been stable throughout Province 2 and Province 3 of the Designated Area. There is negligible groundwater extraction from the Tertiary Confined Sand Aquifer in these provinces.

Groundwater levels have been stable in the coastal area in Province 1. This area is where the potentiometric level of the Tertiary Confined Sand Aquifer is higher than the water table of the Tertiary Limestone Aquifer.

Declining water level trends (Shown in red on Figure 6)

Declining water level trends began in Province 1 of the Tertiary Confined Sand Aquifer in 1993 and by 2004 water levels had fallen 2m. The water level trend in the Tertiary Confined Sand Aquifer is reflected by the declining trends in the Tertiary Limestone Aquifer.

The cause of the declining water level trends in the Tertiary Confined Sand Aquifer is of interest. There is little extraction in the Tertiary Confined Sand Aquifer. The declines are attributed to either a pressure response or a leakage response arising from reduced groundwater in storage in the overlying Tertiary Limestone Aquifer. The cause of the declines is being investigated.

GLOSSARY

“Aquifer”. Means a geological structure or formation or an artificial landfill permeated or capable of being permeated permanently or intermittently with water.

“Allowable Annual Volume”. Means the allowable volume of extraction specified for a particular sub-zone or aquifer within a sub-zone as has been determined by the Committee under clause 28(6) of the Agreement.

“Designated Area”. Means the area comprising part of the State of South Australia and part of the State of Victoria as specified in the First Schedule of the Act. This is an area 40 km wide and centred on the South Australia - Victoria Border and is the area to which the *Groundwater (Border Agreement) Act 1985* applies.

“Permissible Annual Volume”. Means the Permissible Annual Volume of extraction specified for each zone of the Designated Area.

“Permissible distance”. Means the distance from the border in which all applications for licences must be referred to the Review Committee to determine whether the licence should be issued.

“Permissible potentiometric surface lowering”. Means an average annual rate of potentiometric surface lowering within a zone as prescribed under the Agreement or has been agreed by the Minister for each Contracting Government.

“Permissible salinity”. Means a certain level of salinity within a zone as has been agreed by the Minister for each Contracting Government.

“Prescribed Wells Area”. Means an area declared to be prescribed under the South Australian Natural Resources Management Act 2004. Prescription of a water resource requires that future management of the resource be regulated via a licensing system.

“Tertiary Limestone Aquifer”. Comprises aquifers in the Murray Group, Heytesbury Group, Coomandook Formation, Bridgewater Formation and Padthaway Formation, called collectively the Tertiary Limestone Aquifer, the base of which is identified as marl or black carbonaceous silt, sand or clay.

“Tertiary Confined Sand Aquifer”. Comprise aquifers in the Wangerrip Group and Renmark Group, below the Tertiary Limestone Aquifer.

“Water Supply Protection Area”. An area declared under the Victorian Water Act 1989 to protect the area’s groundwater or surface water resources through the development of a management plan, which aims for equitable management and long-term sustainability.

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