

South Australian–Victorian Border Groundwaters Agreement Review Committee



Thirty-Second Annual Report

To 30 June 2017

Adelaide and Melbourne

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PREFACE

The Border Groundwaters Agreement Review Committee's Annual Report for 2016–17 fulfils the requirement under clause 30(1) of the Border Groundwaters Agreement to report on its activities during the year to 30 June 2017. This report has been compiled with reference to reports from South Australia and Victoria.

Clause 30(2) requires the Review Committee to forward a copy of the report to the appropriate Minister in each government.

Section 11 of the Victorian *Groundwater (Border Agreement) Act 1985*, and section 13 of the South Australian *Groundwater (Border Agreement) Act 1985* provides that the relevant minister shall cause a copy of the annual report to be laid before the parliament within fourteen sitting days of the receipt of the report.

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1. The year in summary

Along the South Australian–Victorian border, groundwater is the only reliable water source. It is used extensively in both states for irrigation, industry use and urban water supply, as well as farm stock and domestic use.

While groundwater supplies are relatively secure, the Border Groundwaters Agreement Review Committee (Review Committee) has sought to improve the technical understanding to inform a review of management responses to maintain the ongoing sustainable and equitable use of groundwater along the South Australian/Victorian border.

The Agreement requires the management prescriptions to be reviewed at intervals of not more than five years – that is, the Permissible Annual Volume, the Allowable Annual Volume for sub-zones, the permissible distance, the permissible rate of potentiometric surface lowering (drawdown) and the permissible level of salinity (if any such levels have been declared). The reviews of Province 1 and Province 2 are underway and the review of Province 3 was carried out during the 2015-16 operating year.

After thirty years of operation, the Review Committee is undertaking a comprehensive review of the Agreement, its usefulness, relevancy and suitability of the Agreement in terms of the future objectives for managing the groundwater resources along the border. The approach being taken is one of collaboration between the two Contracting Government and members of the Review Committee. This review is considering the outcomes delivered by the Agreement, and how these can be improved to better protect groundwater sustainability into the future. The Review Committee will provide advice and recommendations to the two Contracting Governments for building on the current arrangements to ensure the sustainability of the shared groundwater resource.

The Review Committee intend to complete the review and provide any recommendations by the middle of 2018.

2. About the Agreement and the Review Committee

The South Australian–Victorian Border Groundwaters Agreement

The groundwater resources along the South Australian–Victorian border is shared between the states. In recognition of the need to cooperatively manage these resources, the two states entered into the Border Groundwaters Agreement (the Agreement) in 1985. The Agreement was updated in 2006 and both states have agreed to a review of the Agreement and its operation.

The Agreement establishes a Designated Area, extending 20 kilometres either side of the border, and from the coast to the River Murray. The Agreement applies specifically to this Designated Area. The Designated Area is divided into 22 management zones with 11 zones in each state (Figure 1).

The Agreement provides that the available groundwater shall be shared equitably between the two states and applies to all existing and future bores within the Designated Area. Bores that extract groundwater for domestic and stock purposes are not covered by the 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. The prescriptions limit water use to a Permissible Annual Volume for total withdrawals from all aquifers or each aquifer, to a permissible rate of potentiometric surface lowering and to 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 allocation of water is the responsibility of the licensing agencies 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 making and implementing the arrangements.

The management areas relevant to the Designated Area are set out in Table 1. The location of the zones relevant to state water administration areas are shown in Figure 2.

Table 1: Management areas relevant to the Designated Area

South Australia	Victoria
<ul style="list-style-type: none">• Noora Prescribed Wells Area• Mallee Prescribed Wells Area• Tatiara Prescribed Wells Area• Lower Limestone Coast Prescribed Wells Area	<ul style="list-style-type: none">• Murrayville Water Supply Protection Area• West Wimmera Groundwater Management Area• Glenelg Water Supply Protection Area

Border Groundwaters Agreement Review Committee

The Review Committee¹, with membership from both states, is established under the Border Groundwaters Agreement as the operating body for the effective implementation and administration of the Agreement.

The Review Committee is required at intervals of not more than five years to review the management prescriptions – that is, the Permissible Annual Volume, the Allowable Annual Volume for sub-zones, the permissible distance, the permissible rate of potentiometric surface lowering (drawdown) and the permissible level of salinity (if any such levels have been declared). The reviews of Province 1 and Province 2 are underway and the review of Province 3 was carried out during the 2015-16 operating year.

The Agreement provides that the Review Committee shall have the power to alter the permissible distance, Permissible Annual Volume, Allowable Annual Volume and to declare a period of restriction. The relevant state ministers have the power to alter the permissible rate of potentiometric surface lowering and the permissible level of salinity, on the recommendation of the Review Committee².

The Agreement provides that the Review Committee may also:

- 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
- 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
- review the Agreement and, if in its opinion, amendments thereto are necessary or desirable, make recommendations to the Contracting Governments accordingly.

The Review Committee met three times during the year:

01 September 2016	Meeting 131	Teleconference
12 December 2016	Meeting 132	Adelaide
20 March 2017	Meeting 133	Melbourne

During the year membership of the Review Committee comprised:

South Australia		Victoria	
Ms J Grant	member	Dr G Mitchell	President
Mr N Power	member	Mr R Nott	member
Mr T Collins	deputy member	Mr T McDevitt	deputy member

Mr Neil Power was appointed in September 2016.

¹ The Review Committee does not manage or control any public finances or assets.

² A full list of Government Gazette notices relating to the current prescriptions is provided in Appendix A of this report.

3. General Information

Groundwater resources in the South Australian–Victorian border region

There are two main aquifer systems along the border comprising the Tertiary Confined Sand Aquifer and the overlying Tertiary Limestone Aquifer (Figure 3). A thin Pliocene Sands Aquifer overlies the Upper Tertiary Aquitard in parts of the area.

The Tertiary Limestone Aquifer is the principal source of groundwater throughout the Designated Area, with water being used for a range of purposes – municipal supplies for towns such as Mount Gambier, individual domestic and stock water supplies, industry and irrigation of agricultural crops and recreational grounds.

Groundwater salinity in the Tertiary Limestone Aquifer is mostly less than 3000 EC (about 1700 mg/L TDS) in the Designated Area, except in the north where it exceeds 30 000 EC (about 18 000 mg/L TDS).

In the Designated Area, the Tertiary Limestone Aquifer has been subdivided into three hydrogeological provinces as shown in Figure 4 and described below:

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

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

Province 3 is in an area of the Murray Basin where the Tertiary Limestone Aquifer (Murray Group Limestone) is confined by the Upper Tertiary Aquitard. A thin Pliocene Sands Aquifer overlies the Upper Tertiary Aquitard in some parts of this province.

Management approach

When the Agreement was introduced in 1985, the groundwater shares (Permissible Annual Volumes) between the two adjacent state Designated Area zones were equal. As more has been learned about the groundwater resources and the risks to the resources from use, the limits have been amended to ensure the protection of the existing entitlements and the protection of the resource from undue depletion or degradation.

In accordance with its role to advise the states, as outlined in the previous section, the Review Committee has taken the following management approach for each province.

Tertiary Limestone Aquifer – Province 1

The Tertiary Limestone Aquifer is a high yielding and renewable resource and is replenished by rainfall. Parts of Province 1 are experiencing long-term declines in groundwater levels. The current mix of land use and groundwater extractions is out of balance (in that outflows and extractions exceed inflows) and is not sustainable in the long term. The estimated quantity of water utilised by plantation forestry is a significant component of the regional water balance in Province 1. Without a change in the current land and water use, groundwater levels will continue to decline over parts of Province 1.

In 2008, following its management review of Province 1 (Border Groundwaters Agreement Review Committee 2008), the Review Committee recommended that a new management approach is needed to achieve long term sustainability. It was the view of the Review Committee at that time that this may require reductions in the area under plantation forestry and the volume extracted via bores under groundwater entitlements. In the meantime the Review Committee proposed a management strategy to address four key issues. These are:

- water accounting
- inter-aquifer connectivity
- sea-water intrusion
- aquifer depletion.

In reviewing the management prescriptions in its 2013 Management Review (Border Groundwaters Agreement Review Committee, 2013), the Review Committee resolved to leave all the management prescriptions unchanged.

In respect to water accounting the Review Committee proposed that an integrated water accounting system encompassing all major water users is essential. It recommended the states develop a consistent approach to account for the water used by plantation forests. The matter is under review in Victoria. South Australia has implemented arrangements to account for plantation forestry on water resources. Since July 2014, forest managers in South Australia are required to register existing (or approved proposed) forest compartments to enable granting of forest water licences. All future plantation forest developments are required to offset their hydrological impacts with a licensed water allocation.

The Review Committee recommended that each of the states undertake studies into the risks arising from long term declines in groundwater levels. These included studies on the inter connection between the Tertiary Confined Sand Aquifer on the Tertiary Limestone Aquifer, sea water intrusion and aquifer depletion in the Lake Mundi area in Victoria. Lake Mundi is an area where the Tertiary Limestone Aquifer is thin. The studies have been undertaken and the Review Committee has brought forward its review of management prescriptions for Province 1 to consider the management implications of these studies.

Tertiary Limestone Aquifer – Province 2

Groundwater in the Tertiary Limestone Aquifer is not being significantly replenished by modern recharge across most of Province 2. As such the groundwater resource is considered a non-renewable for water allocation and management purposes.

In the area of concentrated extractions in Zones 5A, 6A, 5B and 6B (Frances and Neuarpur) groundwater levels are declining due to extraction (~0.2 m/y since 1996). These declines in groundwater levels appear to be manageable, with respect to the capacity of the resource in the short term. However, as part of its management review of Province 2 in 2007 (Border Groundwaters Agreement Review Committee 2007) the Review Committee advised the states of the need to develop a common policy for the long-term management and use of groundwater on the basis that this is a non-renewable resource, and this was also the recommendation of the Management Review in 2013 (Border Groundwaters Agreement Review Committee 2013).

Victoria introduced staged reductions in licence allocations in Zones 5B and 6B in 2010. South Australia implemented a similar program in 2016-17 in Province 1 and Province 2. The Review Committee continues towards developing a common policy approach for managing the groundwater as a non-renewable resource.

Tertiary Limestone Aquifer – Province 3

Groundwater is not being replenished by modern recharge and has been managed as a non-renewable resource since 2001. The aquifer is confined and distant from recharge areas. Consequently the aquifer does not respond to seasonal recharge from rainfall. Intensive groundwater development began after 2001 and the observed long-term water level trends and seasonal drawdowns are consistent with pressure response of pumping in a confined aquifer. A cone of depression in the groundwater pressure levels has formed with its centre located at Peebinga, an area of intensive groundwater extraction.

The Review Committee reviewed the management prescriptions for Province 3 during the year. Overall the Tertiary Limestone Aquifer appears to have responded acceptably to the level of use in terms of drawdowns and salinity. The full response of the aquifer is yet to be realised as groundwater extraction in Victoria has been less than Permissible Annual Volume. Further drawdowns in groundwater levels are expected as groundwater extractions increase. Schemes are in place in both South Australia and Victoria to ensure people relying on groundwater bores for domestic and stock purposes can still access the resource. The impacts on domestic and stock bores need to continue to be managed by the States.

There is no immediate risk of increased groundwater salinity due to the lateral movement of saline groundwater or the vertical leakage of saline water from the Pliocene Sands Aquifer. There is a need to continue to monitor.

There are no environmental assets or ecosystems associated with the confined aquifer which are compromised by the volumes being extracted under these management arrangements.

There is potential for localised “hot spots” of drawdown, which could increase the impact on domestic and stock users, or increase the risks of dewatering the aquifer or accelerating water quality change. States have implemented measures to prevent uncontrolled localised drawdowns arising from intense groundwater extraction.

In giving consideration to the above, the Review Committee determined that the management prescriptions relating to Province 3 remain unchanged.

Tertiary Confined Sand Aquifer

Management prescriptions for the Tertiary Confined Sand Aquifer in the Designated Area remain unchanged since 2001.

Pliocene Sands Aquifer

The Pliocene Sands Aquifer overlies the Tertiary Limestone Aquifer in the Murray Basin mainly in the northern part of the Designated Area. The groundwater in the Pliocene Sands Aquifer is generally saline. In 2007, the Review Committee determined a Permissible Annual Volume for the Pliocene Sand Aquifer in Zone 11A to provide for salinity mitigation extractions for the Murtho Salt Interception Scheme. The scheme intercepts groundwater that would enter the Murray River.

Permissible Annual Volumes and Allowable Annual Volumes

The Permissible Annual Volumes for each aquifer in each zone at 30 June 2017 are set out in Table 2.

Table 2: Permissible Annual Volumes at 30 June 2017

South Australia				Victoria		
Permissible Annual Volume			Zone	Zone	Permissible Annual Volume	
Pliocene Sands Aquifer (ML/y)	Tertiary Limestone Aquifer (ML/y)	Tertiary Confined Sand Aquifer (ML/y)			Tertiary Limestone Aquifer (ML/y)	Tertiary Confined Sand Aquifer (ML/y)
2144	3700	0	11A	11B	1823	0
	14000	320	10A	10B	6720	560
	11595	570	9A	9B	5960	630
	5121	340	8A	8B	3500	330
	8259	350	7A	7B	5782	350
	8758	360	6A	6B	9943	360
	18943	540	5A	5B	13609	570
	22102	710	4A	4B	14000	300
	24054	1900	3A	3B	16500	1000
	25000	2900	2A	2B	25000	5100
	31812	9200	1A	1B	45720	14500

The Allowable Annual Volumes for the sub-zones that have been determined for the Tertiary Limestone Aquifer in Zones 1A, 6A and 9A at 30 June 2017 are set out in Table 3. The locations of these sub-zones are shown in Figure 5.

Table 3: Allowable Annual Volumes for the Tertiary Limestone Aquifer for year ending 30 June 2017

South Australia	
Allowable Annual Volumes	
Tertiary Limestone Aquifer (ML/y)	Sub-zone
2400	9A North
7760	9A South
4658	6A South
12507	1A South

Allocations and volumes extracted

The allocations and the volumes extracted³ for the Tertiary Limestone Aquifer are listed in Tables 4 and 5.

Table 4: Permissible Annual Volumes, number of licences, allocations and volumes extracted for the Tertiary Limestone Aquifer at 30 June 2017

South Australia					Victoria				
Tertiary Limestone Aquifer				Zone	Zone	Tertiary Limestone Aquifer			
Permissible Annual Volume (ML/y)	Licensed Allocations					Permissible Annual Volume (ML/y)	Licensed Allocations		
	Licences	Volume Allocated (ML)	Volume Extracted (ML)				No. of Licences	Volume Allocated (ML)	Volume Extracted (ML)
3700	13	3699	2259	11A	11B	1823	3	1600	1064
14000	34	14000 ⁴	7924	10A	10B	6720	20	6718	3665
11595	11	10160 ⁵	7145	9A	9B	5960	3	5300	430
5121	24	6542	714	8A	8B	3500	8	3430	261
10435	78	9133	3076	7A	7B	5782	14	5782	5160
8758	43	10629	4024	6A	6B	9943	16	10279 ⁶	7500
18943	123	23723	9318	5A	5B	13609	42	12833	5673
22102	175	30320	15164	4A	4B	14000	12	2880	300
24054	239	32476	9003	3A	3B	16500	5	515	58
25000	84	27043	9337	2A	2B	25000	40	24127	3142
31812	307	45460 ⁷	20164	1A	1B	45720	17	4409	1567

Table 5: Allowable Annual Volumes, number of licences, allocations and volumes extracted for the Tertiary Limestone Aquifer at 30 June 2016

South Australia				
Tertiary Limestone Aquifer				Sub-Zone
Allowable Annual Volume (ML/y)	Licensed Allocations			
	Licences	Volume Allocated (ML)	Volume Extracted (ML)	
2400	3	2400	834	9A North
7760	8	7760	6311	9A South
4658	19	5321	2056	6A South
12507	59	20 086	9894	1A South

³ Note that the 'volume extracted' is the volume of groundwater extracted under a permit/licence and does not take into account the volume extracted for domestic and stock use or the impacts of plantation forests. The Agreement does not apply to bores for domestic and stock purposes.

⁴ Mallee Water Allocation Plan provided for water to be allocated up to the PAV and this allocation has now occurred

⁵ One existing irrigation operation in 9A North was incorrectly assumed by SAMDB NRM to be a 9A South activity which is managed by SA SE NRM Board. This has now been corrected by including this pre-existing licensed activity into the 9A North sub zone. It had not been previously accounted for in 9A South.

⁶ The allocation in Zone 6B is above the PAV due to improved location information that identified an existing extraction point previously considered outside Zone 6B was in this Zone.

⁷ Increase to allocated volume in 1A of 51 ML is attributed to minor corrections to 5 existing activities in 1A North

Most of the zones are fully committed in the Tertiary Limestone Aquifer, in that the volumes licensed have reached the Permissible Annual Volumes. In South Australia, there has been a process of converting all existing area-based irrigation allocations to volumetric allocations. While not granting any new allocations it has resulted in allocations exceeding the Permissible Annual Volumes in eight zones and the Allowable Annual Volume in two sub-zones.

The Review Committee has sought to assess the risk of sea-water intrusion and water quality deterioration for groundwater users or groundwater dependent ecosystems (eg Piccaninnie Ponds). South Australia has enhanced its groundwater monitoring program along the coast. The Review Committee has determined to bring forward the technical and management review of Province 1 to determine the risks to the resource, management options and responses.

There is un-allocated water in the Tertiary Limestone Aquifer in Zones 1B, 3B and 4B. There is a moratorium on new licences and permanent transfers of groundwater entitlements in Zones 1B, 2B, 3B and part of Zone 4B under Victoria's water legislation.

The allocations and volumes extracted for the Tertiary Confined Sand Aquifer are listed in Table 6. A moratorium exists under the Victorian *Water Act 1989* on issuing groundwater licences for the Tertiary Confined Sand Aquifer in Zones 1B, 2B and 3B.

Table 6: Permissible Annual Volumes, allocations and volumes extracted for the Tertiary Confined Sand Aquifer at 30 June 2016

South Australia					Victoria				
Tertiary Confined Sand Aquifer				Zone	Zone	Tertiary Confined Sand Aquifer			
Permissible Annual Volume (ML/y)	Licensed Allocations					Permissible Annual Volume (ML/y)	Licensed Allocations		
	No. of Licences	Volume Allocated (ML)	Volume Extracted (ML)				No. of Licences	Volume Allocated (ML)	Volume Extracted (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	102	0	4A	4B	300	0	0	0
1900	1	250	0	3A	3B	1000	0	0	0
2900	2	150	1	2A	2B	5100	0	0	0
9200	4	1584	670	1A	1B	14500	0	0	0

The allocation and volume extracted for the Pliocene Sands Aquifer are listed in Table 7.

Table 7: Permissible Annual Volume, number of licences, volume allocated and volume extracted for the Pliocene Sands Aquifer at 30 June 2016

South Australia				
Pliocene Sands Aquifer				
Permissible Annual Volume (ML/y)	Licensed Allocations			Zone
	No. of Licences	Volume Allocated (ML)	Volume Extracted (ML)	
2144	1	2144	1002	11A

While the Agreement does not apply to bores for domestic and stock purposes, the large number of bores in the Designated Area indicates the important role groundwater plays for these purposes. The estimated number of domestic and stock bores for each zone are listed in Table 8.

Table 8: Number of domestic and stock bores

South Australia		Victoria	
Number of Domestic and Stock Bores ⁸	Zone	Zone	Number of Domestic and Stock Bores ⁹
16	11A	11B	17
166	10A	10B	243
25	9A	9B	47
62	8A	8B	113
749	7A	7B	104
391	6A	6B	56
1370	5A	5B	162
896	4A	4B	339
1155	3A	3B	79
632	2A	2B	577
1648	1A	1B	625

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 permissible distances at 30 June 2016 are specified in Table 9.

⁸ The numbers of domestic and stock bores are derived from spatial analysis of the state SAGEODATA borehole records. It does not necessarily indicate the bores in use.

⁹ The numbers of domestic and stock bores are best estimates made in 2004, based on State database records.

Table 9: Permissible distances at 30 June 2016

South Australia			Victoria		
Tertiary Confined Sand Aquifer Distance (km)	Tertiary Limestone Aquifer Distance (km)	Zone	Zone	Tertiary Limestone Aquifer Distance (km)	Tertiary Confined Sand Aquifer Distance (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

Permissible potentiometric surface lowering

The Agreement provides for a rate of drawdown that must not be exceeded. The prescribed permissible potentiometric surface lowering rates for each zone are shown in Table 10.

Table 10: Permissible potentiometric surface lowering rates at 30 June 2016

South Australia		Victoria	
Rate (m/y)	Zone	Zone	Rate (m/y)
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	Sub-zone 6A North	6B	0.20
0.20	Sub-zone 6A South		
0.20	5A	5B	0.20
0.25	4A	4B	0.25
0.25	3A	3B	0.25
0.25	2A	2B	0.25
0.25	1A	1B	0.25

Permissible salinity

The Agreement allows for the setting of Permissible salinity levels. Following the reviews of Province 1, Province 2 and Province 3 (Border Groundwaters Agreement Review Committee 2013, 2012 and 2015 respectively) the Review Committee has determined that there is no need to recommend that permissible salinity levels should be set.

Reports from the states

The Agreement requires that the Contracting Governments provide an annual report to the Review Committee detailing the number of permits or licences issued, volumes authorised, and details of potentiometric surface levels in each zone. In addition, the states also reported on a number of other activities that related to groundwater management in the Designated Area, as follows.

South Australia - Volumetric licence conversion

The volumetric conversion of all the area based irrigation licenses in the South East of the state has been completed, and all appeals have been dealt with and licences issued. The volumetric conversion process has been finalised.

South Australia - Groundwater monitoring

In 2016, the Department of Environment Water and Natural Resources finalised a major review of the State-wide water monitoring network. This review incorporated groundwater and surface water monitoring across the State and was undertaken in a collaborative manner through engagement with the relevant Natural Resources Management Boards. The Department is now commencing the implementation phase which will result in changes to the spatial and temporal characteristics of the State's water monitoring network.

The recommendations for network change will be prioritised and subject to funding, will be implemented. It is intended that implementation will continue through 2017-2020.

South Australia - Sea-water intrusion

Following the identification of elevated salinity risk along the coast from sea water intrusion in the Review Committee's Province 1 review in 2008, the Review Committee recommended studies into the risks of adverse impacts from sea water intrusion. As an initial precaution, the Review Committee divided Zone 1A into two sub-zones to help prevent further intensification of extractions in Sub-zone 1A South by setting an Allowable Annual Volume to limit the transfer of allocations to the risk area.

Recent monitoring of the aquifer where the sea water interface was detected has recorded no significant increase in water salinity over the last two years. This is interpreted as due to tidal effects and seasonal variation. Further study is needed to investigate the possible level of use that would protect the aquifer from active sea water intrusion but this work may be costly and provide limited confidence due to the karstic nature of the environment.

Victoria - Management plan development

Victoria has projects underway to improve the understanding of the groundwater resource behaviour and management for the Tertiary Limestone Aquifer in South West Victoria and

the monitoring of salinisation from mobilisation of salt in the unsaturated soil zone of Zones 2B to 7B.

Grampians Wimmera Mallee Water is reviewing the management plans for the West Wimmera Groundwater Management Area and the Murrayville Groundwater Management Area. The Murrayville Groundwater Management Area Local Management Plan is expected to be approved early in the 2017-2018 period.

Southern Rural Water has approved the South West Limestone Local Management Plan and is preparing an Otway Lower Aquifers Local Management Plan.

A draft Wimmera-Mallee Water Resource Plan has been prepared to respond to the requirements of the Murray-Darling Basin Plan and was released for public consultation in May 2017.

The Water for Victoria Water plan, which is Victoria's strategic plan for management of our water resources, now and into the future, was released in October 2016.

South Australia and Victoria - Condition of the resource

Groundwater extraction in the Designated Area from the Tertiary Limestone Aquifer is shown in Figure 6. This was lower than the previous year for most zones in the Designated Area in part due to above average rainfall in December and January. Declines in groundwater levels are continuing in parts of Province 2 associated with irrigation. In parts of Province 1 ongoing declines in groundwater levels are associated with plantation forestry and stable trends associated with other land uses.

Details of the potentiometric levels trends from representative observation bores for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer are shown in Figures 7 and 8.

FIGURES

Figure 1: The Designated Area and zones

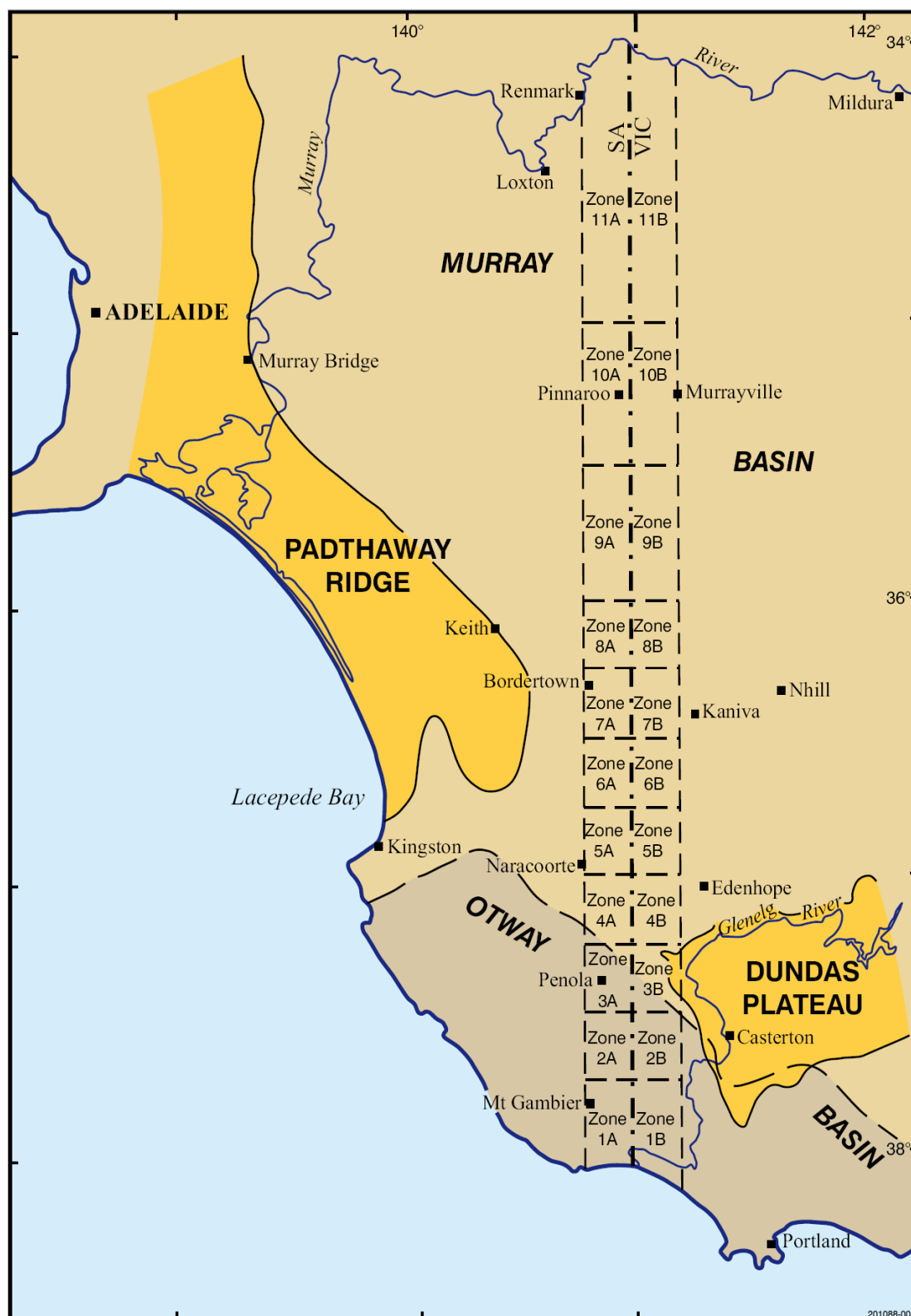


Figure 2: Relationship of management areas in South Australia and Victoria to the Designated Area

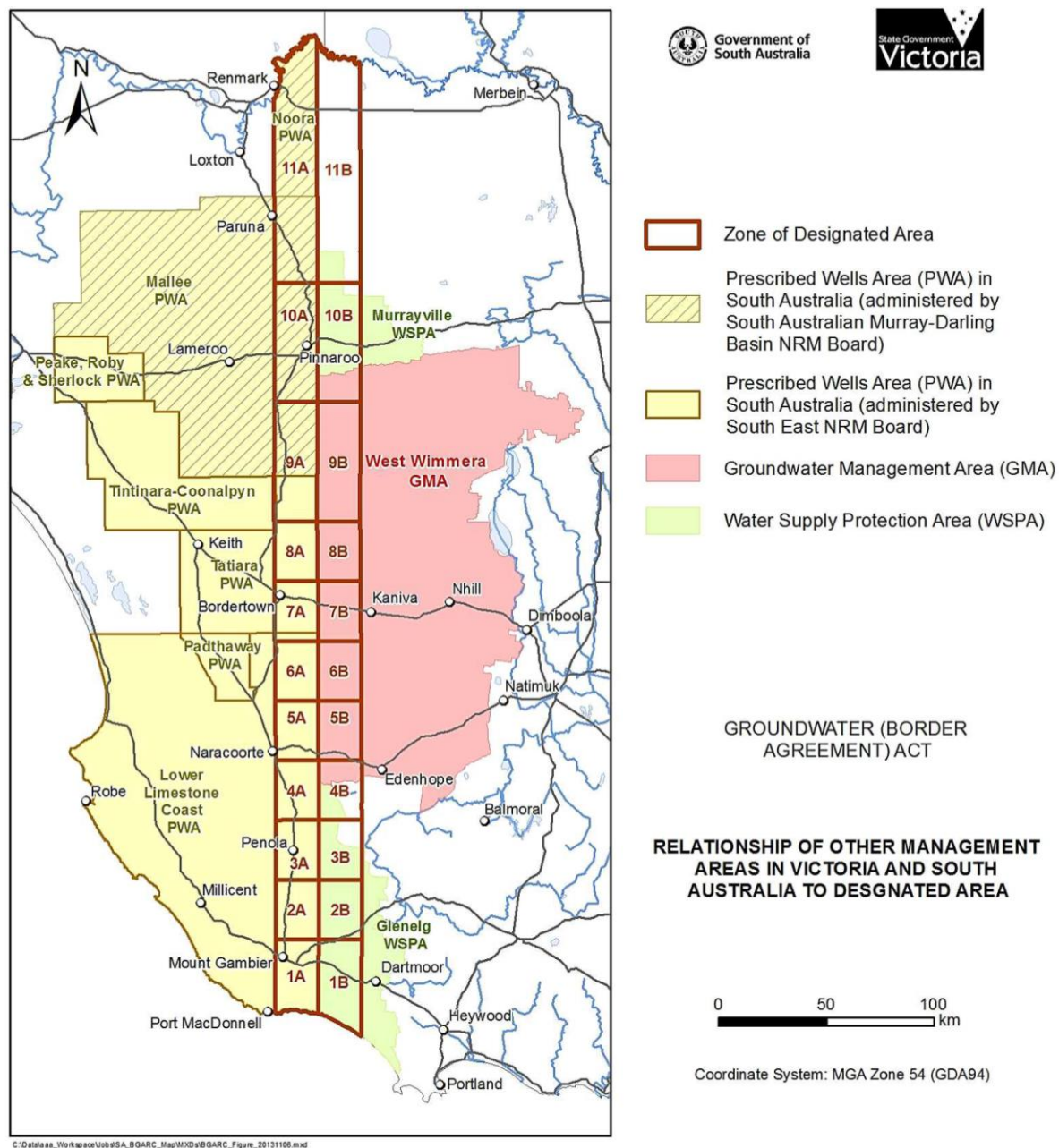


Figure 3: Schematic hydrostratigraphic cross-sections relating to Figure 4

(The locations of the cross-sections are shown in Figure 4)

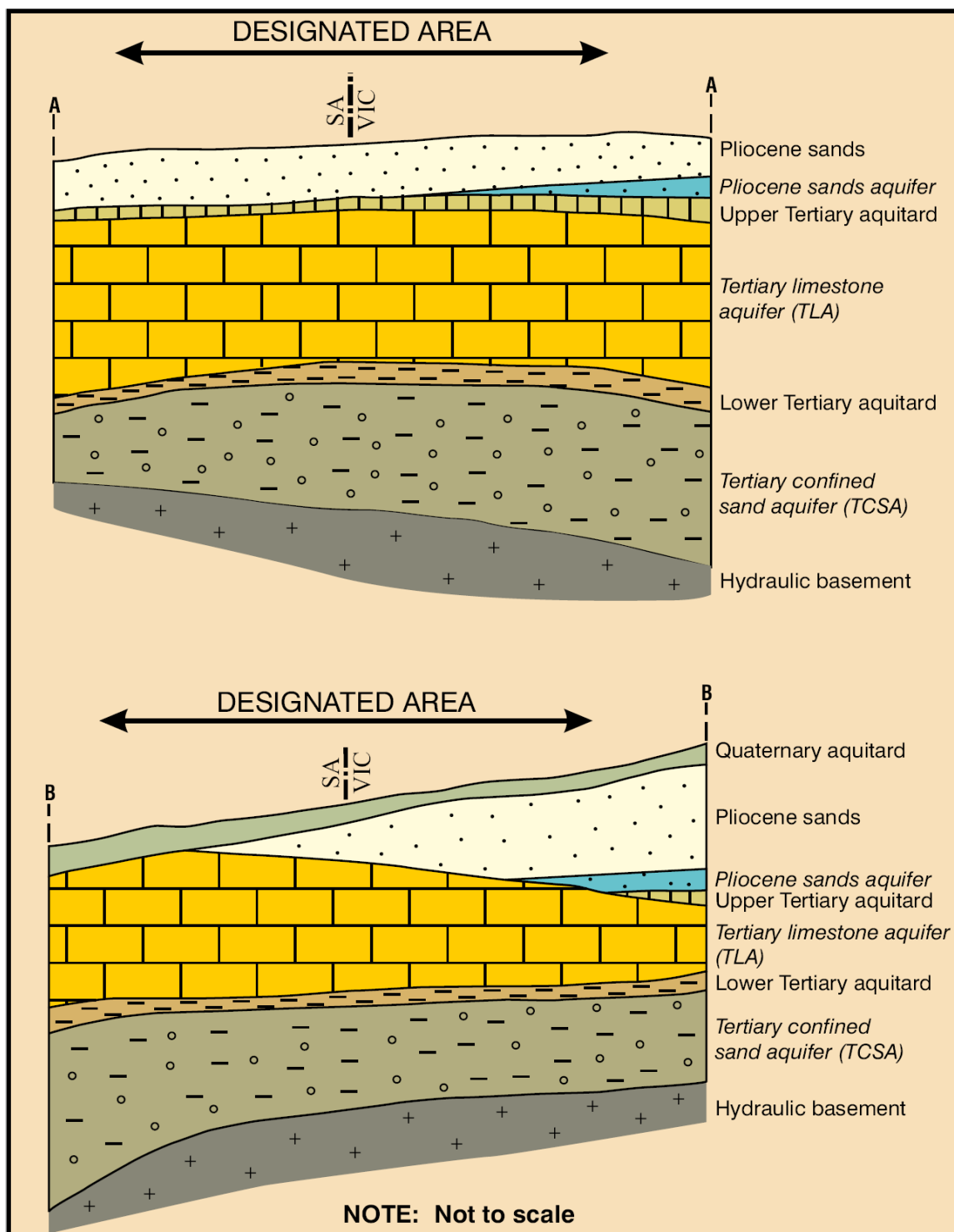


Figure 4: Hydrogeological provinces

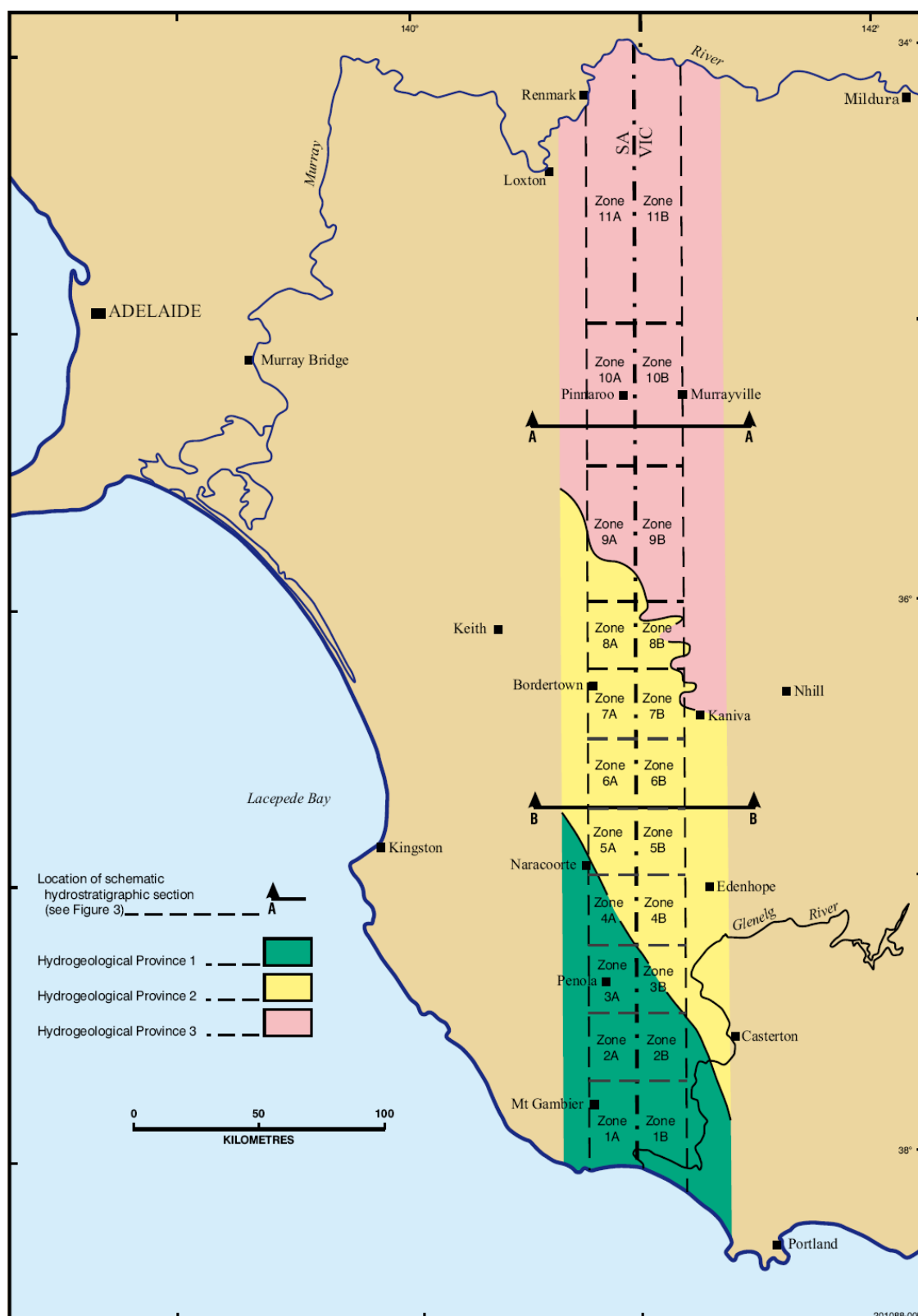
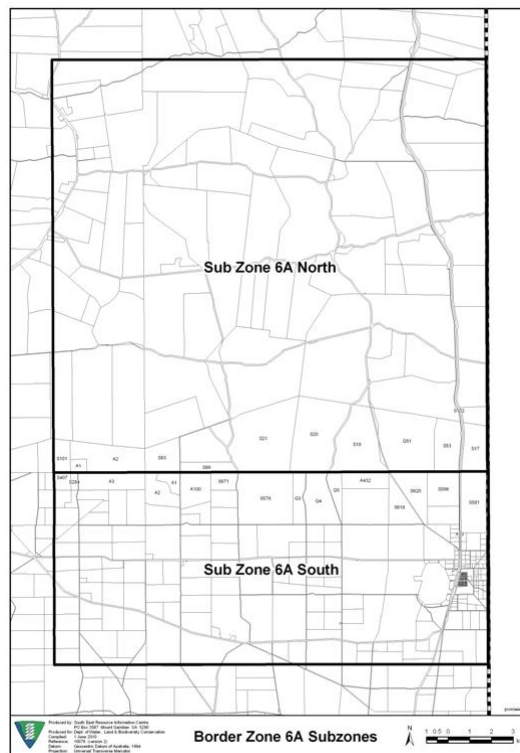
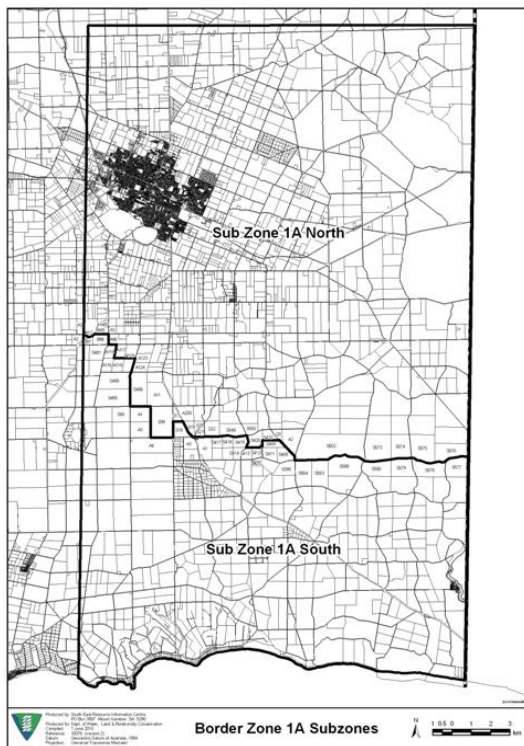


Figure 5: Sub-zone boundaries for Zones 1A, 6A and 9A

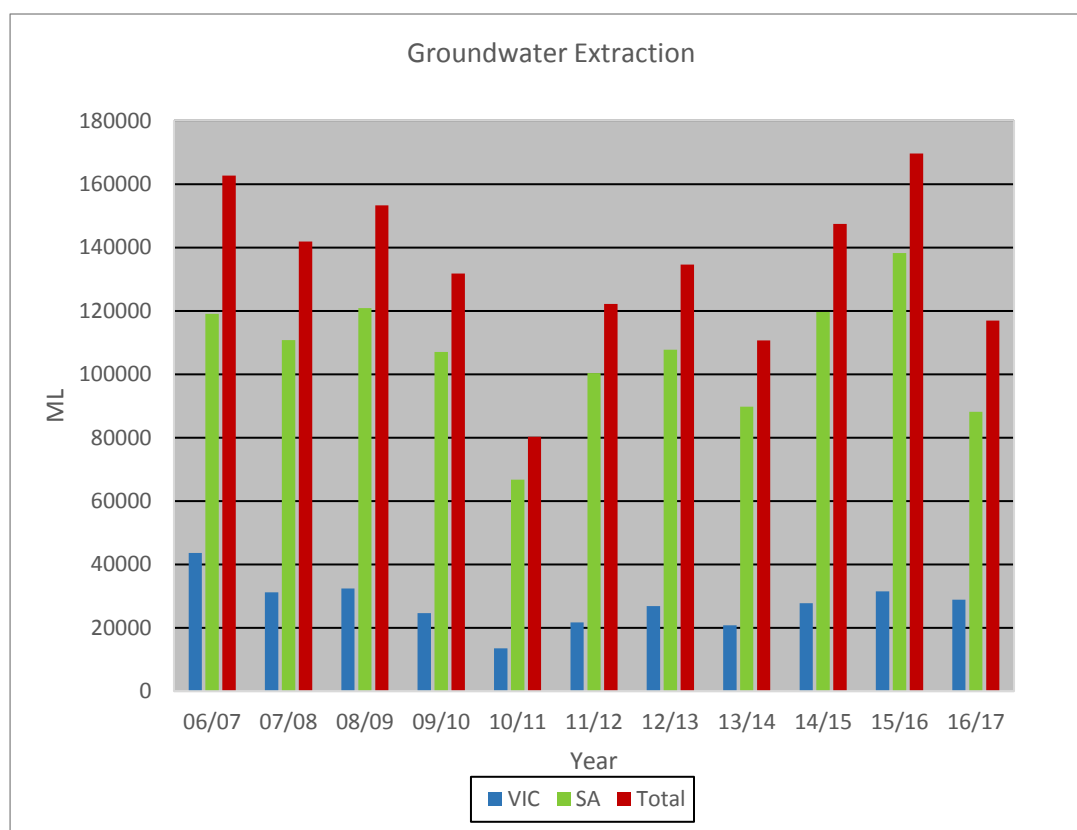


Boundaries of sub-zones are registered on :

Plan number 35/2010 (Zone 1A)
Plan number 34/2010 (Zone 6A)
Plan number 36/2010 (Zone 9A)

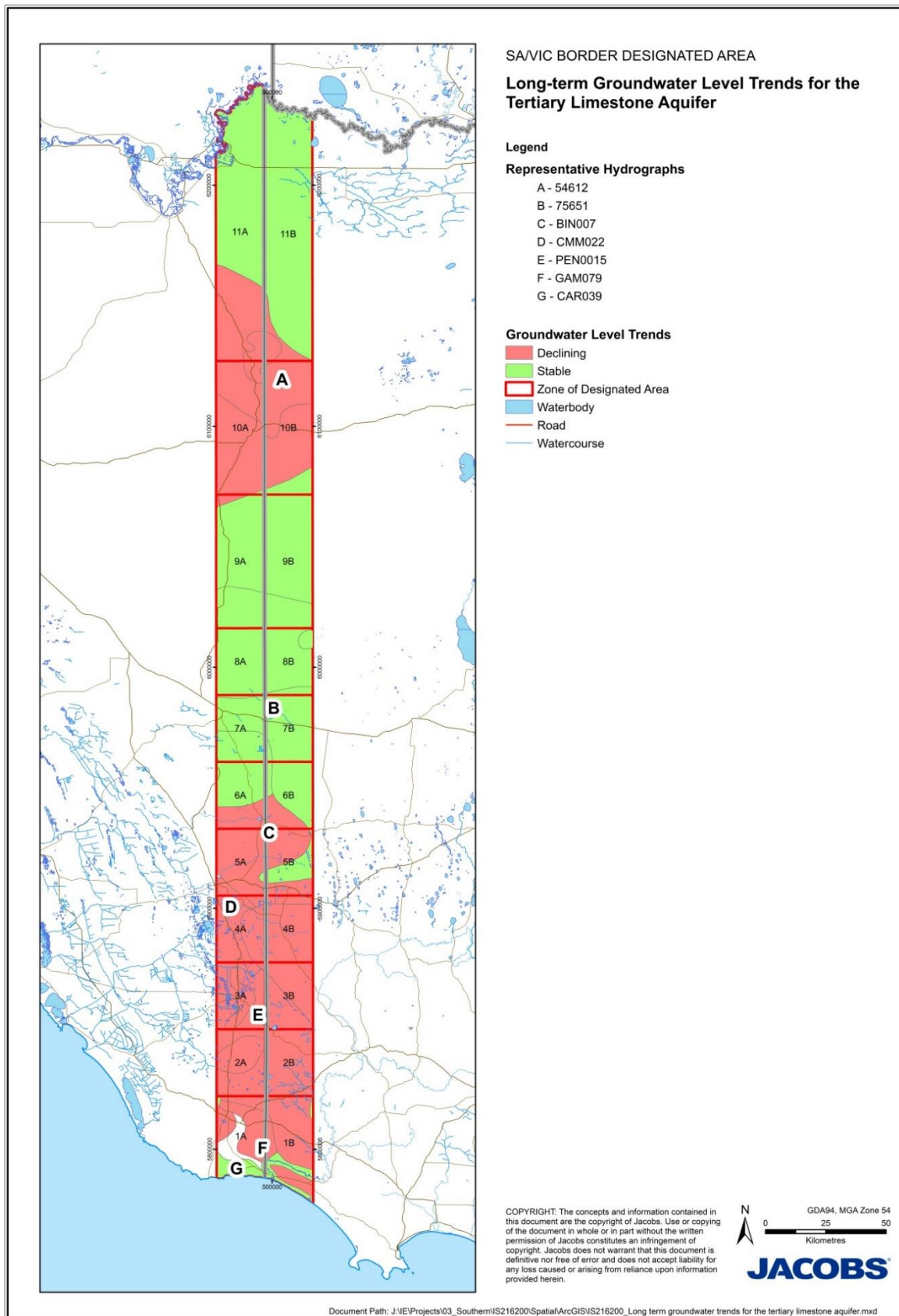
Plans can be viewed at Lands Titles Office at
101 Grenfell Street Adelaide

Figure 6: Annual volume extracted from the Tertiary Limestone Aquifer since 2006/07



Note: 2006/07 was the first year that complete metering records were obtained.

Figure 7: Groundwater-level trends for the Tertiary Limestone Aquifer with some representative hydrographs



Sample of groundwater level hydrographs as located in opposite map (Fig. 7)

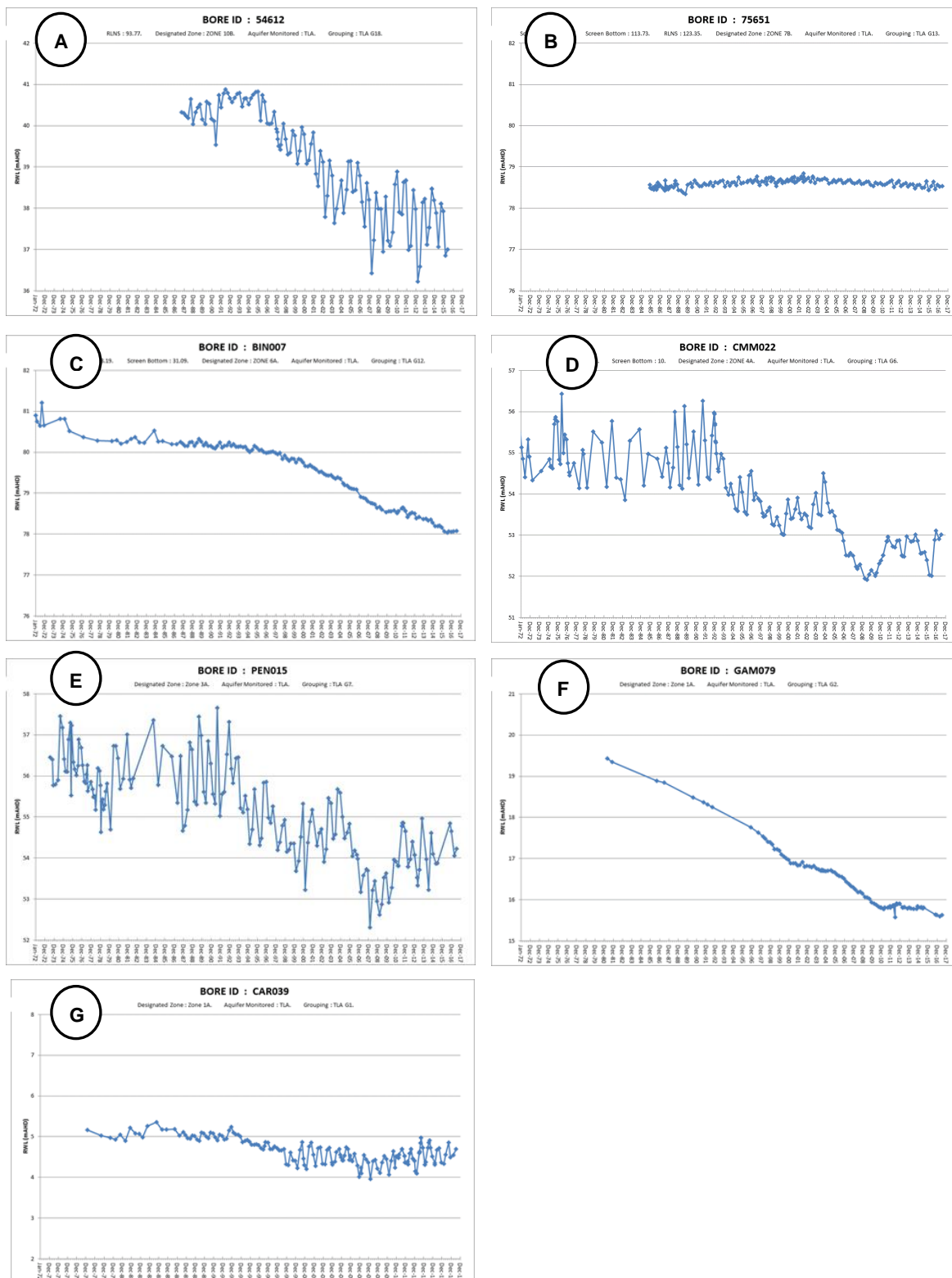
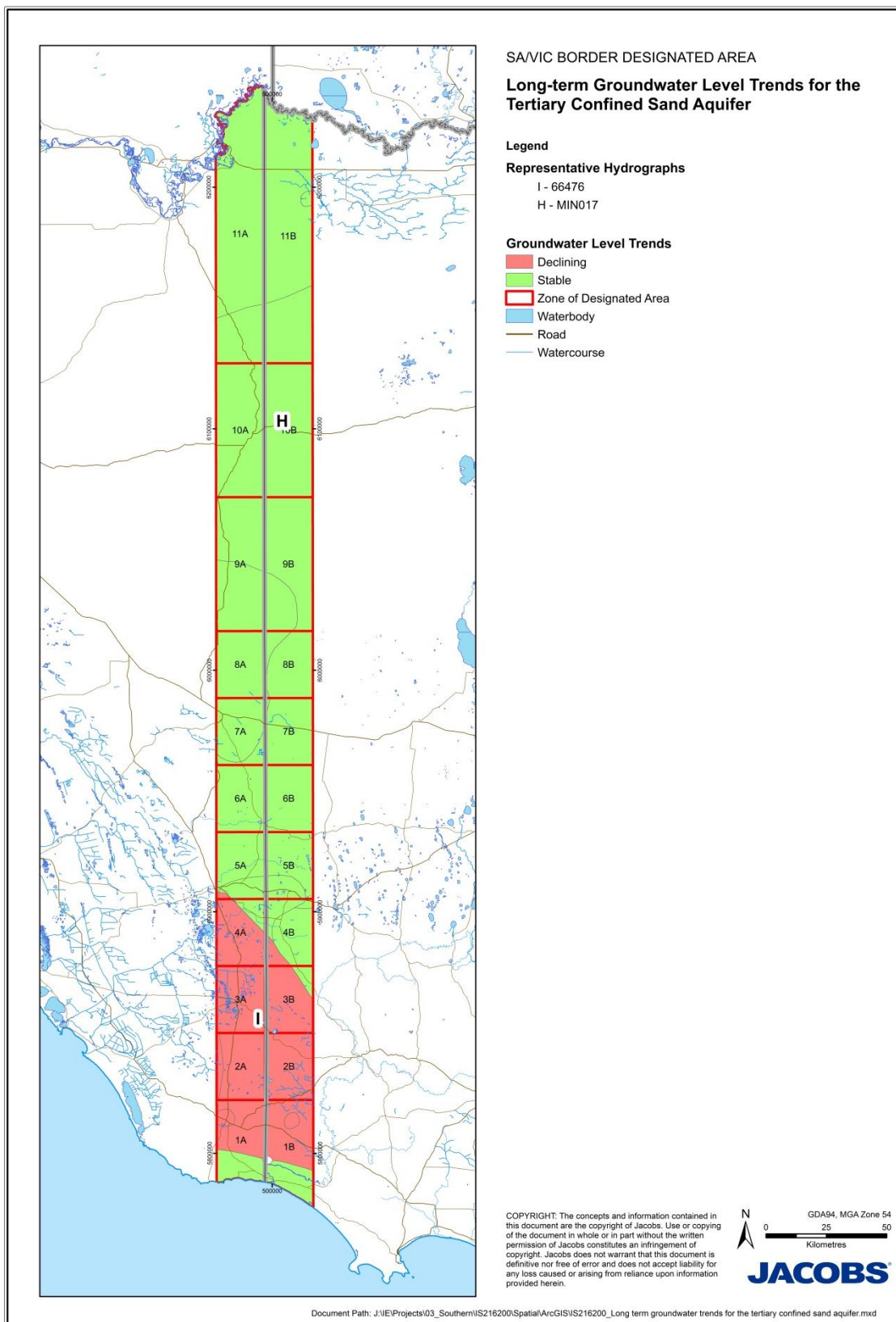
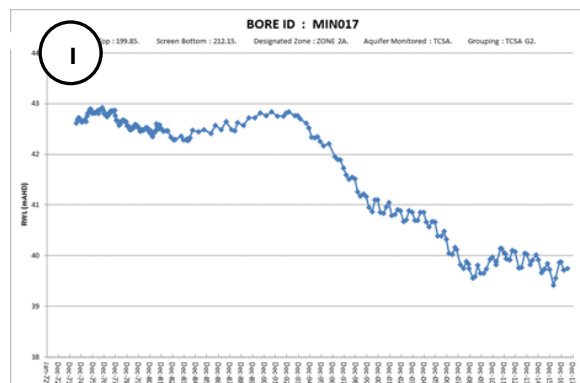
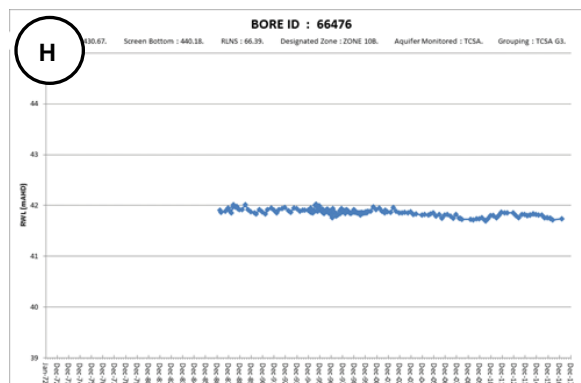


Figure 8: Groundwater-level trends for the Tertiary Confined Sand Aquifer with some representative hydrographs



Sample of groundwater level hydrographs as located in opposite map (Fig. 8)



GLOSSARY

Aquifer – A geological structure or formation or an artificial landfill permeated or capable of being permeated permanently or intermittently with water.

Allowable Annual Volume – The allowable volume of extraction specified for a particular sub-zone or aquifer within a sub-zone as has been determined by the Review Committee under clause 28(7) of the Agreement.

Designated Area – 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.

EC (ECU) – Electrical conductivity; 1 EC unit = 1 micro-Siemen per centimetre ($\mu\text{S}/\text{cm}$) measured at 25°C; commonly used as a measure of water salinity as it is quicker and easier than measurement by TDS.

Management Prescriptions – The prescriptions provided under the Border Groundwaters Agreement. That is; Permissible Annual Volume, Allowable Annual Volume, Permissible distance, Permissible potentiometric surface lowering, and Permissible salinity.

Permissible Annual Volume - The Permissible Annual Volume of extraction specified for a particular zone or aquifer in a particular zone in the Designated Area.

Permissible distance – 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 – An average annual rate of potentiometric surface lowering (drawdown) within a zone as prescribed under the Agreement or has been agreed by the minister for each Contracting Government.

Permissible salinity – A certain level of salinity within a zone as has been agreed by the minister for each Contracting Government.

Prescribed Wells Area – 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 an approved water allocation plan and extraction of water be licensed.

TDS – Total dissolved solids, measured in milligrams per litre (mg/L); a measure of water salinity.

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.

REFERENCES

Border Groundwaters Agreement Review Committee (2001). *Five Year Management Review Report 1996 – 2000*. September 2001.

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Border Groundwaters Agreement Review Committee (2008). *Management Review Tertiary Limestone Aquifer and Tertiary Confined Sand Aquifer in Province 1 of the Designated Area*. May 2008.

Border Groundwaters Agreement Review Committee (2010). *Management Review Tertiary Limestone Aquifer in Province 3 of the Designated Area*. January 2010.

Border Groundwaters Agreement Review Committee (2012). *Management Review of the Tertiary Limestone Aquifer in Province 2 of the Designated Area*. June 2012.

Border Groundwaters Agreement Review Committee (2013). *Management Review of the Tertiary Limestone Aquifer in Province 2 of the Designated Area*. April 2013.

SKM (2012). Review of groundwater level trends in the SA-Vic Designated Area.

APPENDICES

APPENDIX A

Notices in Government Gazette relating to the current amendments to the prescriptions

The Agreement requires that notices of the amendments be made in papers circulating in the area and the Government Gazette. The amendments took effect from the date nominated in the notice. The list of the notices in Government Gazette since May 2008 relating to the current amendments to the prescriptions is provided below.

South Australia

Publish date of Gazette	Notice
22 May 2008	Alteration of Permissible Annual Volumes for Zone 11A (sets a Permissible Annual Volume for the Parilla Sands Aquifer, Tertiary Limestone Aquifer and Tertiary Confined Sands Aquifer) (Note the Permissible Annual Volume for Tertiary Limestone Aquifer was superseded by the notice on 1 July 2010)
15 October 2009	Alteration of Permissible Annual Volume – Zone 6A
15 October 2009	Alteration of permissible distance – Zones 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A, 9A, 10A and 11A
15 October 2009	Notice of the alteration of Permissible Annual Volume – Zones 7A, 8A and 9A. (Note the Permissible Annual Volume for Zone 7A was superseded by the 1 July 2010 notice and Permissible Annual Volume for Zone 8A was superseded by 2 December 2010 notice)
1 July 2010	Sub-zoning of the Tertiary Limestone Aquifer in Zone 1A (also sets an Allowable Annual Volume for Sub-zone 1A South)
1 July 2010	Sub-zoning of Tertiary Limestone Aquifer in Zone 6A (also sets an Allowable Annual Volume Sub-zone 6A South and sets a permissible rate of potentiometric surface lowering for Sub-zones 6A South and 6A North)
1 July 2010	Sub-zoning of the Tertiary Limestone Aquifer in Zone 9A (also sets an Allowable Annual Volume Sub-zone 9A South and Sub-zone 9A North)
1 July 2010	Alteration of permissible rate of potentiometric surface lowering -Zone 5A
1 July 2010	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zones 1A, 3A, 4A, 5A, 7A, 10A and 11A
2 December 2010	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zone 8A
30 January 2014	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zone 7A

Victoria

Publish date of Gazette	Notice
15 October 2009	Alteration of Permissible Annual Volume – Zones 7B and 8B
15 October 2009	Alteration of permissible distance – Zones 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, 9B, 10B and 11B
15 July 2010	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zone 8A
15 July 2010	Alteration of permissible rate of potentiometric surface lowering - Zones 5B and 6B
23 November 2015	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zones 5B and 6B