

South Australian–Victorian Border Groundwaters Agreement Review Committee



Thirty-Eighth Annual Report

To 30 June 2023

Adelaide and Melbourne

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PREFACE

The Border Groundwaters Agreement Review Committee’s Annual Report for 2022-23 fulfils the requirement under clause 30(1) of the Border Groundwaters Agreement to report on its activities during the year to 30 June 2023. 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

During the year, the Review Committee continued its oversight of groundwater trends in the Designated Area to inform its 5-yearly review of management prescriptions required under the Agreement, with the objective of maintaining the ongoing sustainable and equitable use of groundwater along the South Australian-Victorian border.

Both signatory states have complied with their obligations under the Agreement, including the provision of their state annual reports in accordance with clause 27(1), and the Review Committee has considered the reports.

Extractions did not exceed the Permissible Annual Volumes or Allowable Annual Volumes for any zone or sub-zone of either aquifer for the year ending 30 June 2023. This includes Sub-zone 1A South, where the AAV was exceeded in the previous year (see *Thirty-Seventh Annual Report of the Border Groundwaters Agreement Review Committee to 30 June 2022* for more details). The Review Committee has continued to work with South Australia to understand the risks to the resource from groundwater extraction in this subzone, supported by the technical work underway in this area (groundwater numerical modelling and monitoring of salinity along the coast).

In Province 1, the Tertiary Limestone Aquifer in the Otway Basin is unconfined and located in the southern portion of the Designated Area (Figure 1). The Review Committee continued to progress its management review of Province 1 in readiness for consultation with regional water management authorities in each state regarding its findings and recommendations.

In Province 2, the Tertiary Limestone Aquifer is unconfined and located in the central portion of the Designated Area (Figure 1). In 2023, the Review Committee provided its management review of Province 2 to State Ministers and is preparing a work plan to implement the recommendations from the report.

The Review Committee has recently completed a comprehensive review of the Agreement and, following consultation with government agencies and regional management authorities, has finalised its recommendations for amendments to the Agreement for provision to the relevant state ministers. These recommendations include the need to provide for adaptive management of the water resources and the consideration of the needs of Traditional Owners and groundwater dependent ecosystems.

2. About the Agreement and the Review Committee

The South Australian–Victorian Border Groundwaters Agreement

Along the South Australian–Victorian border, groundwater is the principal source of reliable natural water. It is used extensively in both states for municipal supplies, domestic and livestock water supplies, industry, and irrigation of agricultural crops and recreational grounds.

The Border Groundwaters Agreement (the Agreement) was established to protect the groundwater resources adjacent to the border between South Australia and Victoria and to provide for the cooperative management and equitable sharing of those resources and to guard against their undue depletion or degradation. The Designated Area established by the Agreement (effective from 1986) is a 40-kilometre-wide strip centred on the border and extending for its full length. The Designated Area is divided into 22 zones, 11 in each state (Figure 1).

In the Designated Area, the main aquifer is the Tertiary Limestone Aquifer, which has been subdivided into three provinces based on the hydrogeological characteristics of each: from north to south, Province 3, Province 2, and Province 1 (Figure 3).

The Agreement provides that the available groundwater shall be shared equitably between both states and applies to all existing and future bores within the Designated Area. Bores that provide groundwater for domestic and livestock purposes are not subject to the Agreement.

New water licences, permits to take water or well construction 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 extraction to a Permissible Annual Volume for total withdrawals from all aquifers as well as to a permissible rate of potentiometric surface lowering and 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 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, establish appropriate mechanisms for allocating the resource and, if needed, restrict the use of the resource. Plans are developed through consultative regional committees or boards to maximise community and industry involvement in making and implementing the groundwater management arrangements.

The state groundwater management areas relevant to the Designated Area are listed in Table 1 and their location is shown in Figure 2.

Table 1. State groundwater management areas relevant to the Designated Area

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

Border Groundwaters Agreement Review Committee

The Border Groundwaters Agreement Review Committee (the Review Committee) with membership from both states is established under the Agreement as the operating body for the effective implementation and administration of the Agreement.¹

The Review Committee is required, at intervals of not more than five years, to review the management prescriptions – that is, the Permissible Annual Volume of extraction for each zone, the Allowable Annual Volume of extraction for sub-zones, the permissible distance from the border for referral to the other state, the permissible rate of potentiometric surface lowering (groundwater level drawdown), and the permissible level of salinity (if any such levels have been declared).

The schedule of recent reviews of the management prescriptions are as follows:

- Province 1 was approved by the Committee in 2018-19 and a new management review is expected to be completed in 2023-24.
- Province 2 was approved by the Committee in 2022-2023 following consultation with regional authorities. The Review Committee is now coordinating a technical work program based on the recommendations from the management review.
- Province 3 was approved by the Committee in 2020-21 and the Review Committee determined not to vary the current prescriptions.

The Agreement provides that the Review Committee shall have the power to alter the permissible distance, Permissible Annual Volume and/or 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 Committee.²

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;

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.

- make recommendations to the Minister of each Contracting Government 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, make recommendations to the Contracting Governments for amendments to the Agreement that are considered necessary or desirable.

The Review Committee met twice during the 2022-23 year as follows:

10 May 2023	Meeting 149	Teleconference
7 December 2022	Meeting 148	Teleconference

An additional meeting (Meeting 147) was held 23 June 2022 by teleconference.³

During the year the membership of the Review Committee comprised:

South Australia		Victoria	
From 1 July 2022		Ms A May	Member
Mr D Jordan	Member	Mr R Nott	Member
Mr N Power	Member	Mr M Hudson	Deputy member
Ms B Sorensen	Deputy member		
From 5 October 2022			
Mr D Jordan	Member		
Ms B Sorensen	Member		
Ms E Perkins	Deputy member		

In accordance with the operating protocols of the Review Committee, the position of president and the Committee's secretarial support is rotated between the two Contracting Governments every two years. At the first meeting of the 2022 calendar year, these responsibilities transferred from Victoria to South Australia and Mr Dan Jordan was appointed President by the Review Committee. These responsibilities will transfer to Victoria at the first meeting of 2024.

³ Meeting 147 was not reported in the *South Australian Victorian Border Groundwaters Agreement Review Committee Thirty-Seventh Annual Report to 30 June 2022* and has been included here.

3. General Information

Groundwater resources in the South Australian–Victorian border region

There are two main aquifer systems along the border, the Tertiary Confined Sand Aquifer and the overlying Tertiary Limestone Aquifer (Figures 3 and 4). A thin Pliocene Sands Aquifer overlies the Upper Tertiary Aquitard in parts of the Designated 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 the towns of Murrayville, Pinnaroo, Naracoorte, Penola, Nangwarry, Tarpeena and Mount Gambier, individual domestic and livestock water supplies, industry, and irrigation of agricultural crops and recreational grounds.

Groundwater salinity in the Tertiary Limestone Aquifer is mostly less than 3,000 EC (about 1,700 mg/L TDS) in the Designated Area, except in the north of Zone 11A where it exceeds 30,000 EC (about 18,000 mg/L TDS, or approximately half that of seawater). In the Pliocene Sands Aquifer of Zone 11A where the Murtho and Pike salt interception schemes operate adjacent to the River Murray, the schemes extracted 2,280 ML for the year ending 30 June 2023 (Table 7). The salinity of extractions ranged from 39 027 EC units to 56,912 EC units. The total salt intercepted from Zone 11A for the year ending 30 June 2023 is estimated to be 82,165 tonnes.

In the Designated Area, the Tertiary Limestone Aquifer has been subdivided into three hydrogeological provinces as shown in Figures 3 and 4, and are described below:

- Province 1 occurs largely in the Otway Basin and is characterised by Quaternary calcareous sandstone overlying the Tertiary Limestone Aquifer forming one unconfined aquifer system.
- Province 2 is in the Murray Basin where the Tertiary Limestone Aquifer 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 is confined by the Upper Tertiary Aquitard. A thin Pliocene Sands Aquifer overlies the Upper Tertiary Aquitard in some parts of this province.

When the Agreement was introduced in 1986, the groundwater was shared equally (as Permissible Annual Volumes) between the adjacent state zones in the Designated Area. As more has been learnt about the groundwater resources and the risks to the resources from use, the extraction limits have been amended to protect existing entitlements, while managing undue depletion or degradation of the resource.

Management approach

Province 1 – Tertiary Limestone Aquifer

Province 1 is the southern portion of the South Australian-Victorian border, where the Tertiary Limestone Aquifer in the Otway Basin is unconfined, the water table is shallow and recharge is high where land is cleared and the soil is sandy. The Tertiary Limestone Aquifer is a high

yielding renewable resource replenished by rainfall, but parts of Province 1 have experienced long-term declines in groundwater levels.

The Review Committee has previously recommended that both states develop a consistent approach to account for the water used by plantation forests and 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 and the Tertiary Limestone Aquifer, the risk of sea-water intrusion in South Australian Coastal Region and aquifer depletion in the Lake Mundi area in Victoria. Lake Mundi is an area where the Tertiary Limestone Aquifer is thin, giving it a limited resource capacity and threatening ongoing access for existing users.

Plantation forest is a significant regional land use by area, with a hydrological impact in most of the Province 1 zones through recharge interception and, where the groundwater is at shallow depths, direct groundwater extraction. Areas under plantations are approximately equal in both states and have not changed significantly during the last decade (ABARES, 2021).

South Australia has implemented a process to account for, and manage, commercial plantation forest impacts on groundwater resources. In the South Australian Zones 1A to 4A, where most commercial plantations are located, the plantation forest licensed impacts are equivalent to 86 per cent of the Permissible Annual Volumes that can be extracted via bores in the Tertiary Limestone Aquifer in those zones (Table 11).

Commercial plantation forests in Victoria do not require a groundwater licence, however Victoria has adopted an approach consistent with South Australia's to account for commercial plantation forest impacts on groundwater resources. In the Victorian Zones 1B to 4B, where most commercial plantations are located, the plantation forest impacts are estimated to be equivalent to 90 per cent of the Permissible Annual Volumes that can be extracted via bores in the Tertiary Limestone Aquifer in those zones (Table 11).

Province 2 – Tertiary Limestone Aquifer

Groundwater in the Tertiary Limestone Aquifer is not being significantly replenished by modern recharge across most of Province 2. As such, for resource management purposes the groundwater resource is considered a non-renewable resource. The Review Committee formed this view during its management review of Province 2 in 2007 (Border Groundwaters Agreement Review Committee, 2007) and advised the states of the need to develop a common policy for water allocation and long-term groundwater management on the basis that this is a non-renewable resource. The recent Province 2 management review report has re-affirmed this position. The Review Committee is now coordinating a technical work program based on the recommendations from the management review.

This policy is considered important for the area of concentrated extractions in Zones 5A, 6A, 5B and 6B (which includes the Frances–Neuarpur area), where groundwater levels have declined up to three metres since 1996, primarily due to pumped groundwater extractions. While the longer-term declines have occurred and continue in some monitoring sites, there have been some periods of stabilisation in groundwater levels at other monitoring sites. This stabilisation is attributed to reduced extractions during periods of higher rainfall.

Province 3 –Tertiary Limestone Aquifer

The Tertiary Limestone Aquifer in Province 3 is not being replenished by modern recharge and has been managed as a non-renewable resource since 2001. The aquifer is confined by overlying formations and is distant from recharge areas. Consequently, the aquifer does not respond to seasonal recharge from rainfall. Intensive groundwater development began after 2001, particularly in Zones 9A, 10A, 9B and 10B, and the observed long-term water level trends and seasonal drawdowns are consistent with the pressure response to extractions from a confined aquifer. A cone of depression in the pressure levels has formed, with its centre located at Peebinga in Zone 10A, an area of intensive groundwater extraction. The overall rate of decline has reduced as the pressure levels tend towards a steady state.

A review of the management prescriptions in Province 3 was completed in 2020-21 and the Review Committee determined to maintain the current prescriptions. Groundwater levels are generally stable with no long-term declining trends since 2007 and groundwater use is low, except for small declines near areas of intensive development around the Murrayville Groundwater Management Area. There is no immediate risk of increased groundwater salinity, due to the lateral movement of groundwater, or the vertical leakage of saline water from the overlying Pliocene Sands Aquifer, however there is a need to continue to monitor these resource trends.

The management regimes in place in this Province in both South Australia and Victoria aim to ensure people relying on groundwater bores for domestic and stock purposes can still access the resource. The potential for localised areas of drawdown having adverse impacts on domestic and livestock users, dewatering the aquifer, or accelerating water quality change is low but should continue to be monitored. The states have implemented measures to prevent uncontrolled localised drawdowns arising from intense groundwater extraction.

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

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 Zone 11A 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 Sands Aquifer in Zone 11A to provide for salinity mitigation extractions for the Murtho and Pike salt interception schemes. The schemes intercept saline groundwater that would normally enter the River Murray or its adjoining flood plains. The Permissible Annual Volume was increased during 2017-18 to enable expansion of the salt interception scheme. This program aligns with the policies of the Murray–Darling Basin Plan.

Permissible Annual Volumes and Allowable Annual Volumes

The Permissible Annual Volumes (PAVs) for all zones remained unchanged for the year ending 30 June 2023 (Table 2).

Table 2. Permissible Annual Volumes at 30 June 2023

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)
7,763	3,700	0	11A	11B	1,823	0
	14,000	320	10A	10B	6,720	560
	11,595	570	9A	9B	5,960	630
	5,121	340	8A	8B	3,500	330
	8,259	350	7A	7B	5,782	350
	8,758	360	6A	6B	10,279	360
	18,943	540	5A	5B	12,833	570
	22,102	710	4A	4B	14,000	300
	24,054	1,900	3A	3B	16,500	1,000
	25,000	2,900	2A	2B	25,000	5,100
	31,812	9,200	1A	1B	45,720	14,500
	173,344	7,990	Total	Total	148,117	23,700

No changes were made to the Allowable Annual Volumes for the sub-zones that have been determined for the Tertiary Limestone Aquifer in Zones 1A, 6A and 9A (Figure 5) for the year ending 30 June 2023 (Table 3).

Table 3. Allowable Annual Volumes for the year ending 30 June 2023

South Australia	
Allowable Annual Volumes	
Sub-zone	Tertiary Limestone Aquifer (ML/y)
9A North	2,400
9A South	7,760
6A South	4,658
1A South	15,000

Allocations and volumes extracted

In the year to 30 June 2023, a total of 102,302 ML was extracted from the Tertiary Limestone Aquifer in the Designated Area, about 31 per cent lower than in 2021-22 and nearly 7 percent above the 10-year mean of 132,366 ML (2014-23).

Extractions did not exceed the Permissible Annual Volumes or Allowable Annual Volumes for any zone or sub-zone of either aquifer for the year ending 30 June 2023 (Table 4 and Table 5). This includes Sub-zone 1A South, where the AAV was exceeded in the previous year (see *Thirty-Seventh Annual Report of the Border Groundwaters Agreement Review Committee to 30 June 2022* for more details). The Review Committee has continued to work with South Australia to understand the risks to the resource from groundwater extraction in this subzone, supported by the technical work underway in this area (groundwater numerical modelling and monitoring of salinity along the coast).

A correlation between rainfall and groundwater extraction has been observed throughout the Limestone Coast in the past and higher levels of groundwater extraction when rainfall is low are expected. Consequently, the exceedance of the AAV for sub-zone 1A South can be attributed to the very dry conditions during the summer 2021-22 irrigation season⁴.

⁴ Rainfall for the summer months (Dec-Feb) 2021-22 was 24.8 mm at Mount Schank, the lowest summer total on record for that station (72% below average) and lowest since 2001. Bureau of Meteorology data showed that rainfall for the summer months (December to February) 202-23 was 81.8 mm at Mount Schank (Figure 4), only nine per cent below the average summer rainfall of 89.7 mm.

Table 4. Permissible Annual Volumes, number of licences, allocations and annual volumes extracted for the Tertiary Limestone Aquifer at 30 June 2023

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 ⁵	Volume Allocated (ML)	Volume Extracted (ML)	No. of Licences	Volume Allocated (ML)		Volume Extracted (ML)		
3,700	10	3,700	1,917	11A	11B	1,823	2	1,600	1,507
14,000	35	14,000	8,347	10A	10B	6,720	23	6,718	3,620
11,595	7	10,160	7,206	9A	9B	5,960	3	5,300	256
5,121	37	6,542	1,242	8A	8B	3,500	7	3,130	153
8,259	69	9,132	2,381	7A	7B	5,782	13	5,782	2,564
8,758	44	10,629	3,872	6A	6B	10,279	16	10,279 ⁶	2,570
18,943	122	23,696	7,928	5A	5B	12,833	36	12,833 ⁷	4,834
22,102	178	30,910	7,712	4A	4B	14,000	11	2,803	36
24,054	244	32,328	7,882	3A	3B	16,500	4	515	47
25,000	110	26,899	10,131	2A	2B	25,000	39	24,979	4,220
31,812	311	45,374	2,2071	1A	1B	45,720	20	4,457	1,806
173,344	1,101	213,370	80,689	Total	Total	148117	174	78,396	21,613

Table 5. Allowable Annual Volumes, number of licences, allocations and annual volumes extracted for the Tertiary Limestone Aquifer at 30 June 2023

South Australia				
Tertiary Limestone Aquifer				Sub-Zone
Allowable Annual Volume (ML/y)	Licensed Allocations			
	Licences	Volume Allocated (ML)	Volume Extracted (ML)	
2,400	2	2,400	1,313	9A North
7,760	5	7,760	5,893	9A South
4,658	19	5,321	1,642	6A South
15,000	47	20,082	12,057	1A South

⁵ The variability in the number of licences between reporting years is due to licence allocation consolidation or division from the transfer of entitlements or business entity restructuring. The changes in the number of licences do not reflect an increase in the volume of water allocated, as the water allocation plans preclude the allocation of additional water.

⁶ Neuarpur licensees within Zones 5B and 6B were restricted to 80% of licence entitlement volume which equated to 10,826 ML available for Zone 5B and 8,263ML for Zone 6B.

⁷ As per 4 above.

Table 6. Permissible Annual Volumes, allocations and annual volumes extracted for the Tertiary Confined Sand Aquifer at 30 June 2023

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	29	4A	4B	300	0	0	0
1,900	2	259	148	3A	3B	1,000	0	0	0
2,900	2	150	18	2A	2B	5,100	0	0	0
9,200	4	1 704	778	1A	1B	14,500	0	0	0

It should be noted that the groundwater from the Pliocene Sands Aquifer is highly saline and the extractions relate to the interception of groundwater that would normally enter the River Murray, or its riparian zone. While there is no formal licenced water allocation, salt interception schemes operated by the Government of South Australia are consistent with the Murray–Darling Basin Plan and in accordance with the Agreement and the relevant Permissible Annual Volume. The 2,280 ML of water extracted from the Pliocene Sand Aquifer in Zone 11A during the year ending 30 June 2023 via the Murtho and Pike salt interception schemes is estimated to contain 82,165 tonnes of salts.

Table 7. Permissible Annual Volume, number of licences, volume allocated and annual volume extracted for the Pliocene Sands Aquifer at 30 June 2023

South Australia				
Pliocene Sands Aquifer				
Permissible Annual Volume (ML/y)	Licensed Allocations			Zone
	No. of Licences	Volume Allocated (ML)	Volume Extracted (ML)	
7,763	0	0	2,280	11A

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

Table 8. Number of domestic and livestock bores

South Australia		Victoria	
Number of Domestic and Stock water bores ⁸	Zone	Zone	Number of Domestic and Stock water bores ⁹
16	11A	11B	17
94	10A	10B	243
20	9A	9B	47
33	8A	8B	113
358	7A	7B	104
324	6A	6B	56
904	5A	5B	162
419	4A	4B	339
369	3A	3B	79
363	2A	2B	577
1,090	1A	1B	625

Permissible distance from the border

The permissible distance is the distance from the South Australia–Victoria border within which all applications for a permit or licence must be forwarded to the Review Committee for approval (Table 9). No changes were made to the permissible distances in the year ending 30 June 2023.

⁸ The numbers of domestic and livestock water bores are derived from spatial analysis of the state SAGEODATA borehole records in August 2023. It does not necessarily indicate the bores in use.

⁹ The numbers of domestic and livestock water bores are based on a 2020 review of current registered bores.

Table 9. Permissible distances at 30 June 2023

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 (Table 10). No changes were made to the prescribed permissible potentiometric surface lowering rates for each zone in the year ending 30 June 2023.

Table 10. Permissible potentiometric surface lowering rates at 30 June 2023

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 management prescription reviews of Province 1, Province 2 and Province 3 (Border Groundwaters Agreement Review Committee 2019, 2023 and 2021, respectively) the Review Committee determined that there is no need to set permissible salinity levels.

Accounting for the impacts of plantation forests on groundwater resources

While the hydrological impacts of commercial plantation forests on groundwater resources are not covered under the Agreement, the Review Committee has decided to account for and report the hydrological impacts of commercial plantation forest on the groundwater resources in the Tertiary Limestone Aquifer in Province 1 of the Designated Area (Table 11).

Table 11. Area of plantation commercial forest at 30 June 2023

South Australia			Victoria		
Area of commercial plantation (ha) ¹⁰	Forest water use (ML) ¹¹	Zone	Zone	Area of plantation (ha) ¹²	Forest water use (ML) ¹³
406	69	6A	6B	-	-
57	18	5A	5B	-	-
3805	2 259	4A	4B	5 600	3 325
12 221	25 104	3A	3B	19 000	39 029
18 981	29 656	2A	2B	9 200	14 374
19 763	29 413	1A	1B	23 500	34 975
55 233	86 519	Total	Total	57 300	89 757

Supplementary information

Aggregate annual groundwater extractions in the Designated Area from the Tertiary Limestone Aquifer from 2006-07 to June 2023 are shown in Figure 6.

Details of the potentiometric level trends from representative observation bores for the Tertiary Limestone Aquifer and the Tertiary Confined Sand Aquifer are shown in Figures 7 and 8. Compared to the relatively stable groundwater levels of the early 1990s, levels continue to decline in the central and southern regions of Province 2, however there have been periods of reduced rates of decline and some periods of stable levels observed since 2010, particularly when extractions have been lower. Similarly, declines in groundwater levels are evident in

¹⁰ Data from commercial plantation forest licensee reports.

¹¹ This is an estimate of the plantation forest hydrological impact using the deemed annualised values from the Water Allocation Plan for the Lower Limestone Coast Prescribed Wells Area. The deemed values take into account the reduction in groundwater recharge under the reported plantation forested area (for 2022-2023) and the groundwater extraction by the plantation forest from shallow groundwater, as defined by the water allocation plan.

¹² Data from Victorian Spatial database as Victoria does not licence plantation forest groundwater impacts. The latest review of plantation areas was in 2018 and based on Australia's state of the Forests report 2018.

¹³ Estimated by applying the South Australian methodology. Victoria does not licence commercial forest groundwater use.

many parts of Province 1, primarily due to a combination of plantation forest hydrological impacts, irrigation extractions and rainfall variability.

In order to address the risk of seawater intrusion along the southern coast of the Limestone Coast region including Zone 1A South, South Australia has intensified its seawater intrusion monitoring program. The state has increased its monitoring network in the South Australian coastal region for observing groundwater level and salinity trends to a total of 13 wells and has conducted an aerial geophysical survey of the area to better understand spatial variability in coastal groundwater salinity and investigate the position of the seawater interface. This work is due for completion in mid/late 2024. In addition, the outcomes of a recently completed coastal subregional model will help inform sustainable resource condition limits for this sub-zone as part of the review of the region's water allocation plan.

FIGURES

Figure 1. Designated Area and zones



Figure 2. Relationship of water management regions in South Australia and Victoria to the Designated Area

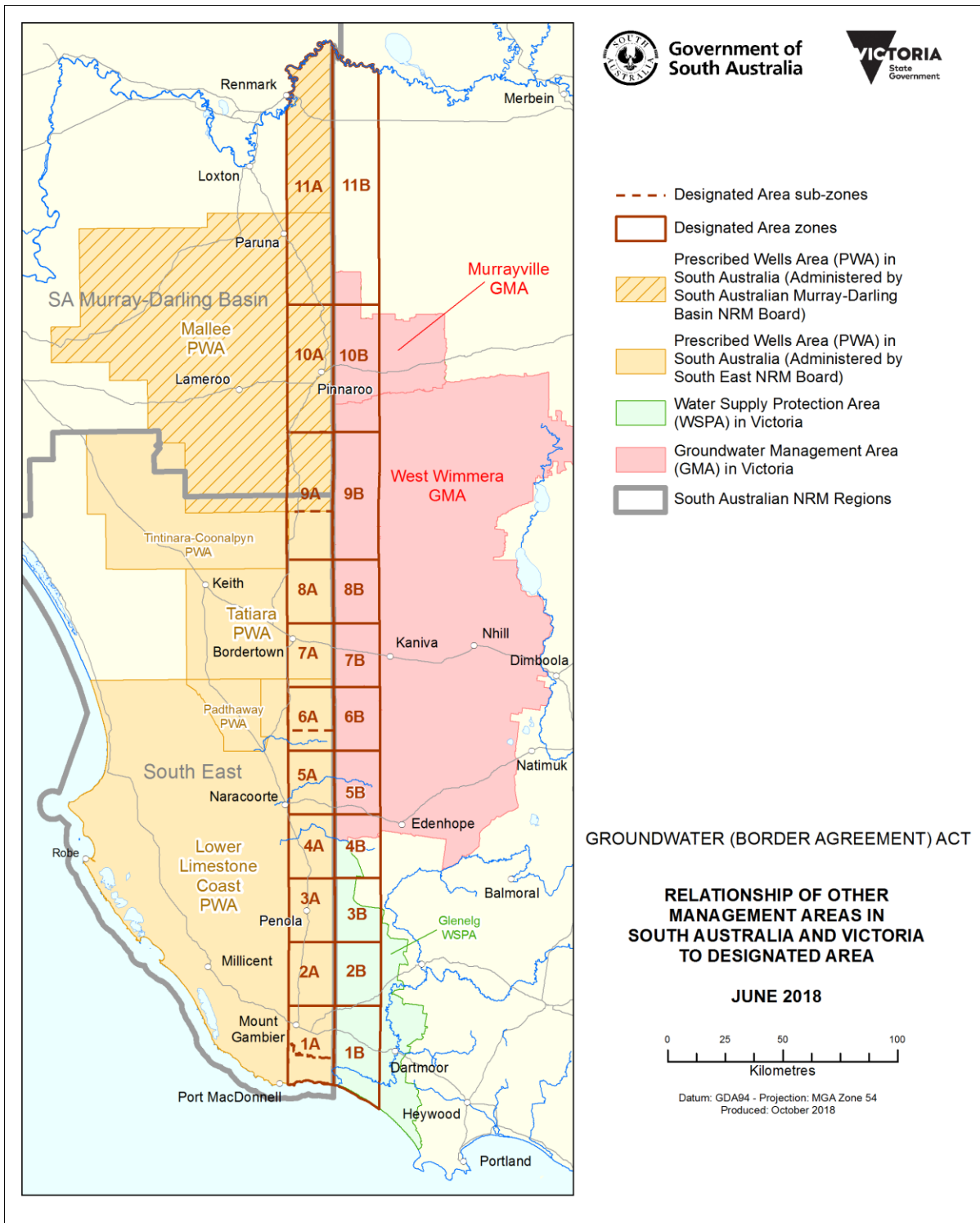


Figure 3. Hydrogeological provinces

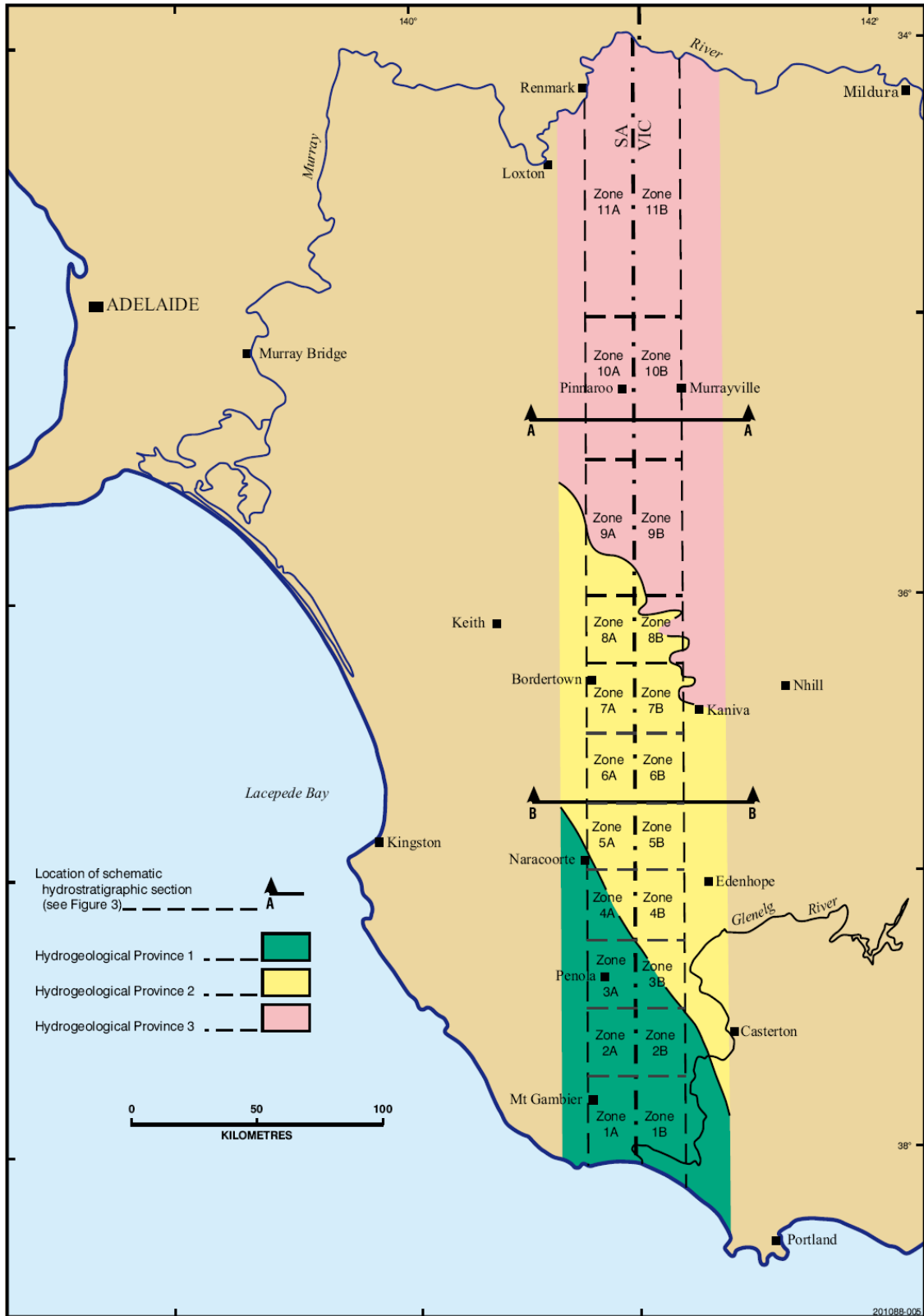


Figure 4. Schematic hydrostratigraphic cross-sections relating to Figure 3

(Locations of the cross-sections are shown in Figure 3)

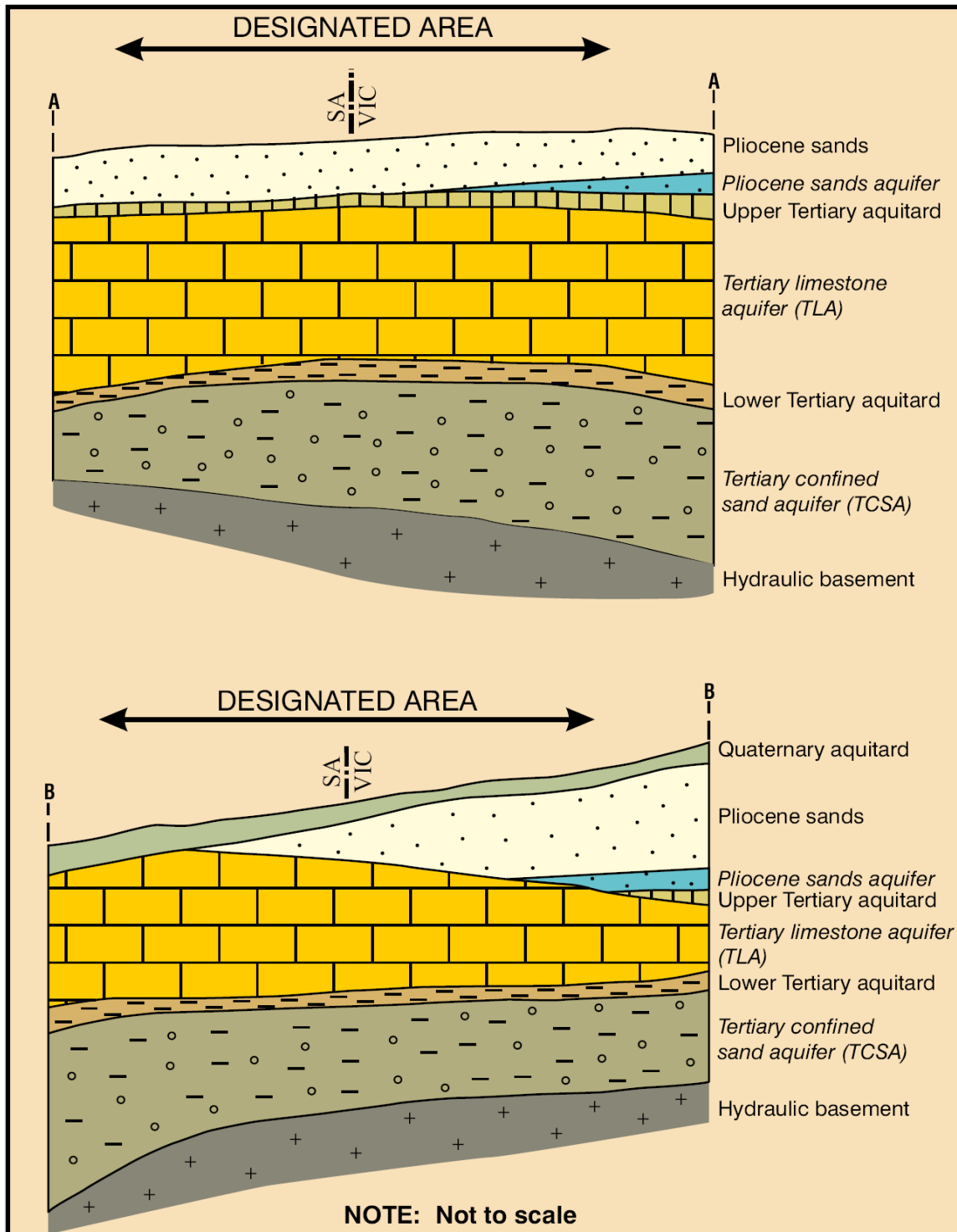
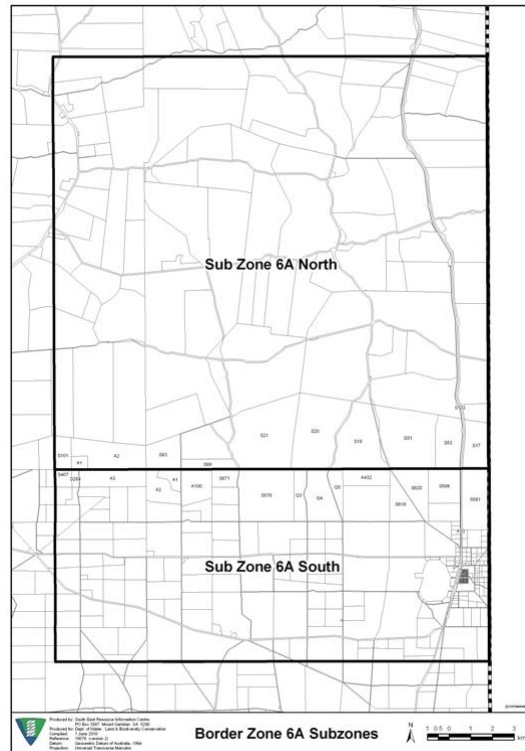
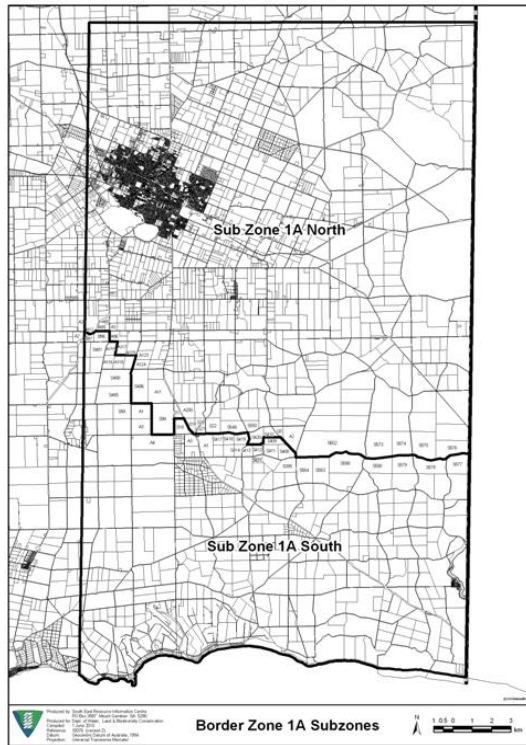


Figure 5. Sub-zone boundaries for Zones 1A, 6A and 9A

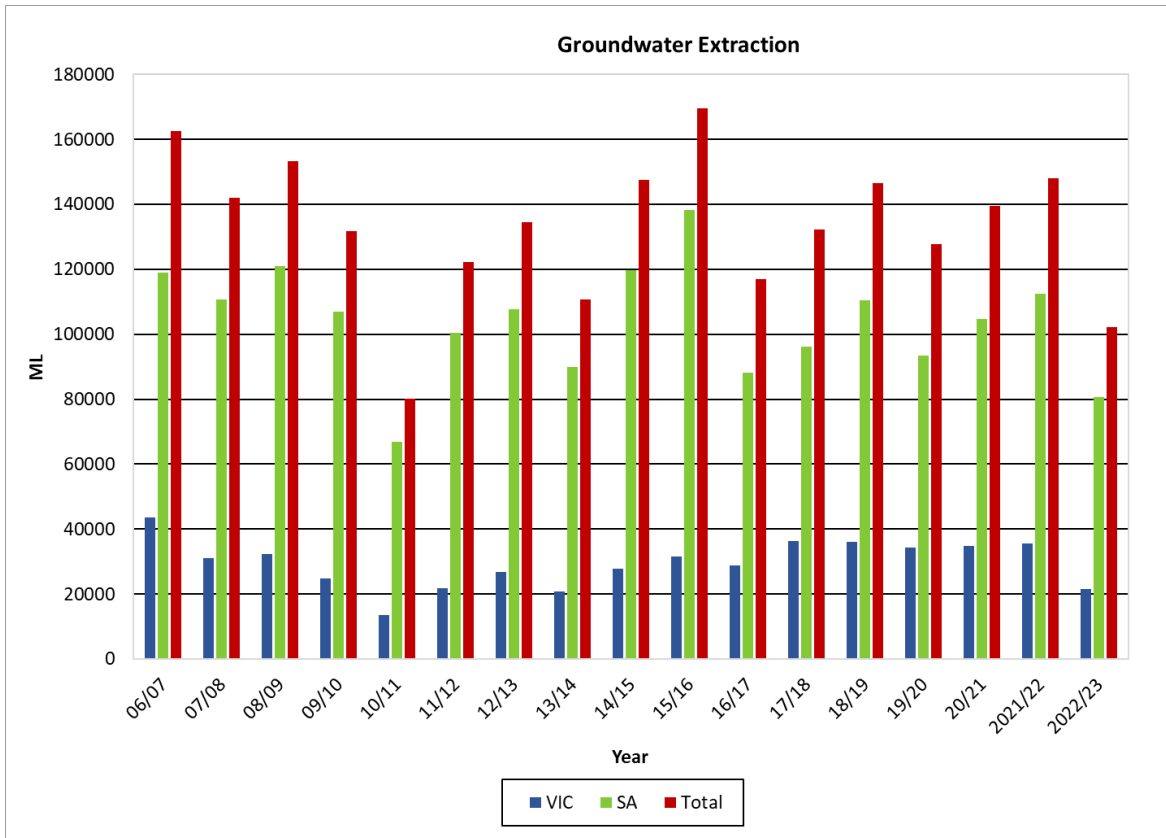


Boundaries of sub-zones are registered on:

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

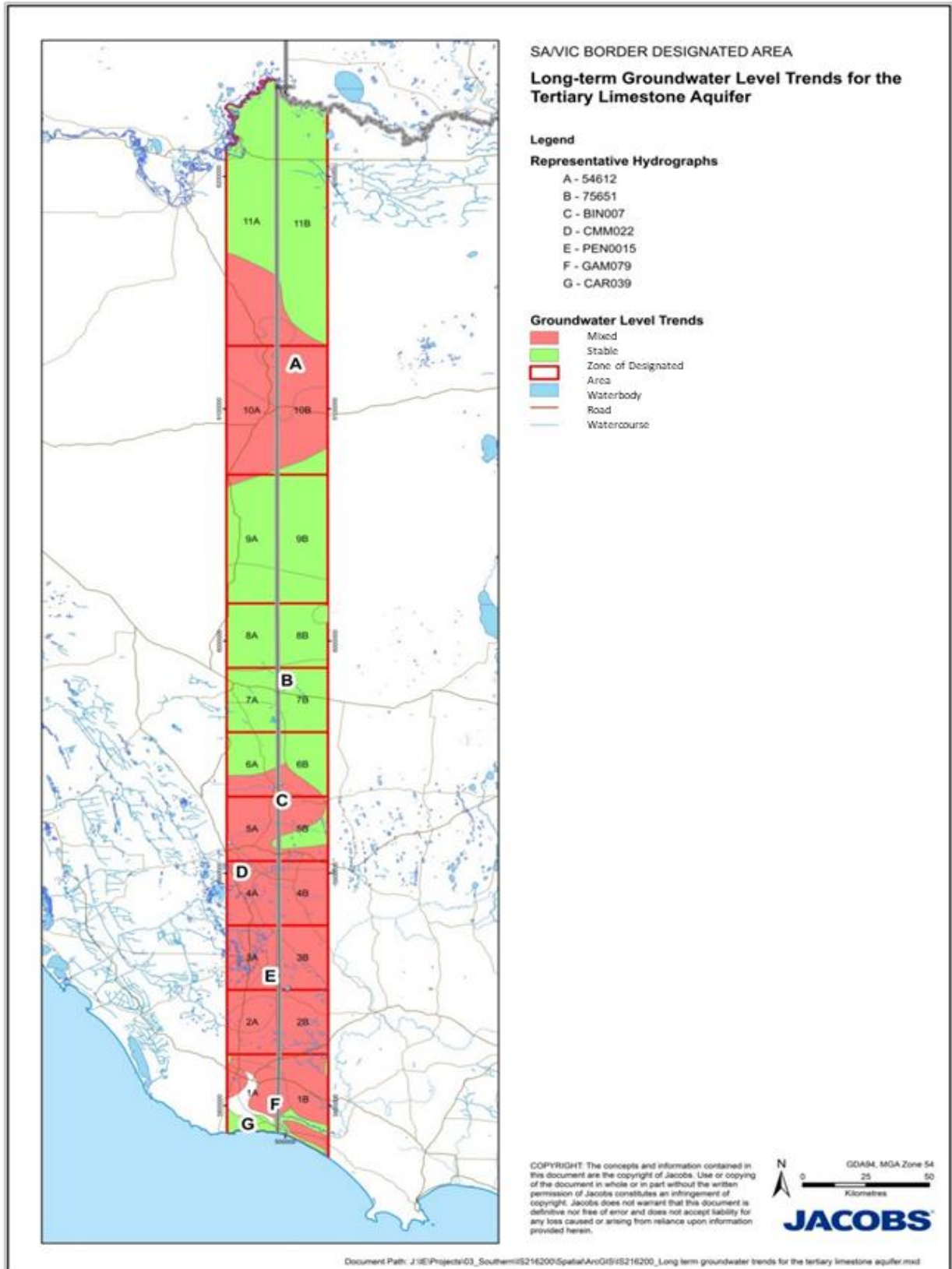
Plans can be viewed at Lands Services and
Lands Titles office at
101 Grenfell Street, Adelaide

Figure 6. Annual volume extracted from the Tertiary Limestone Aquifer since 2006–07



Note: 2006-07 was the first year that comprehensive metered groundwater extraction 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)

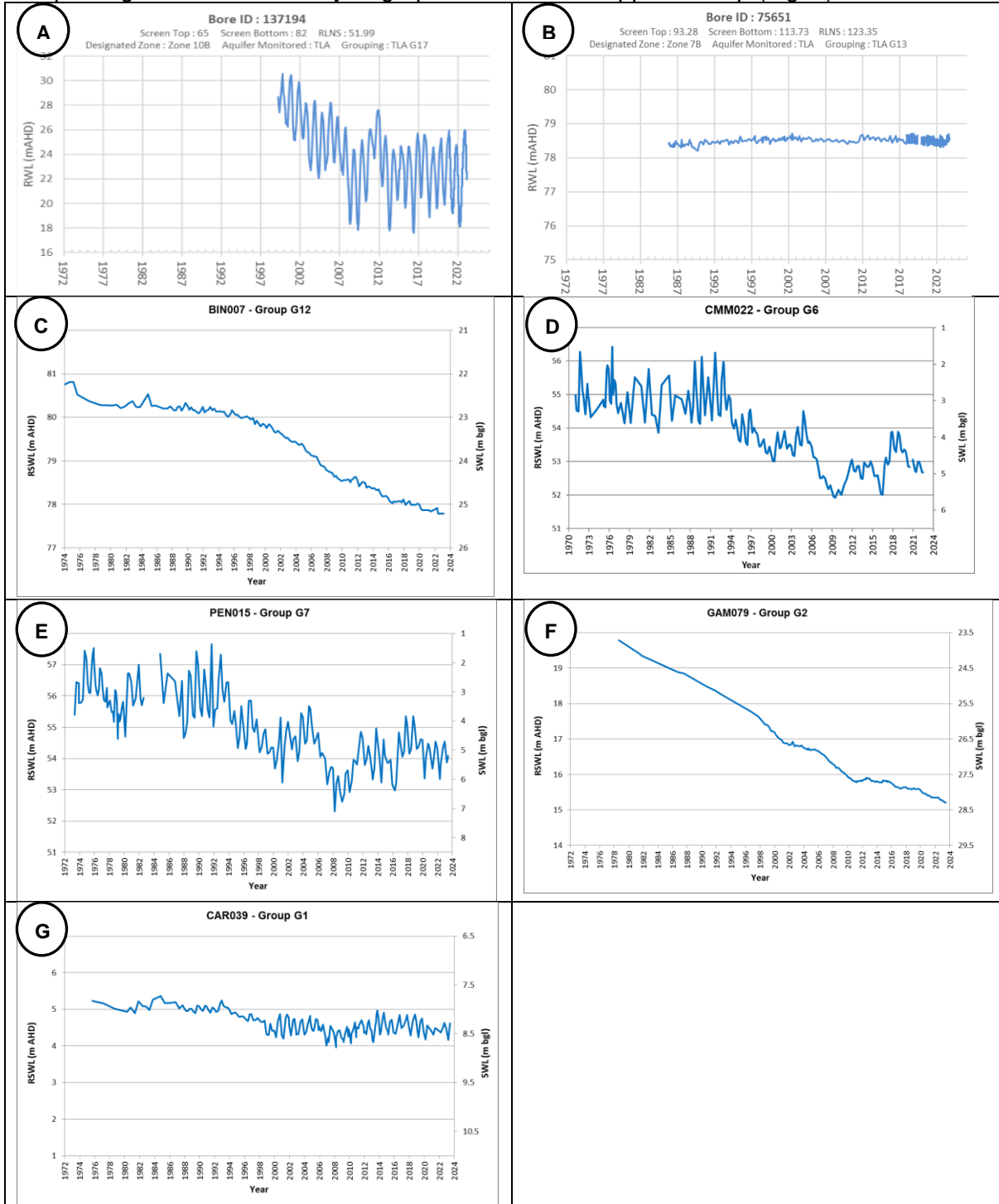
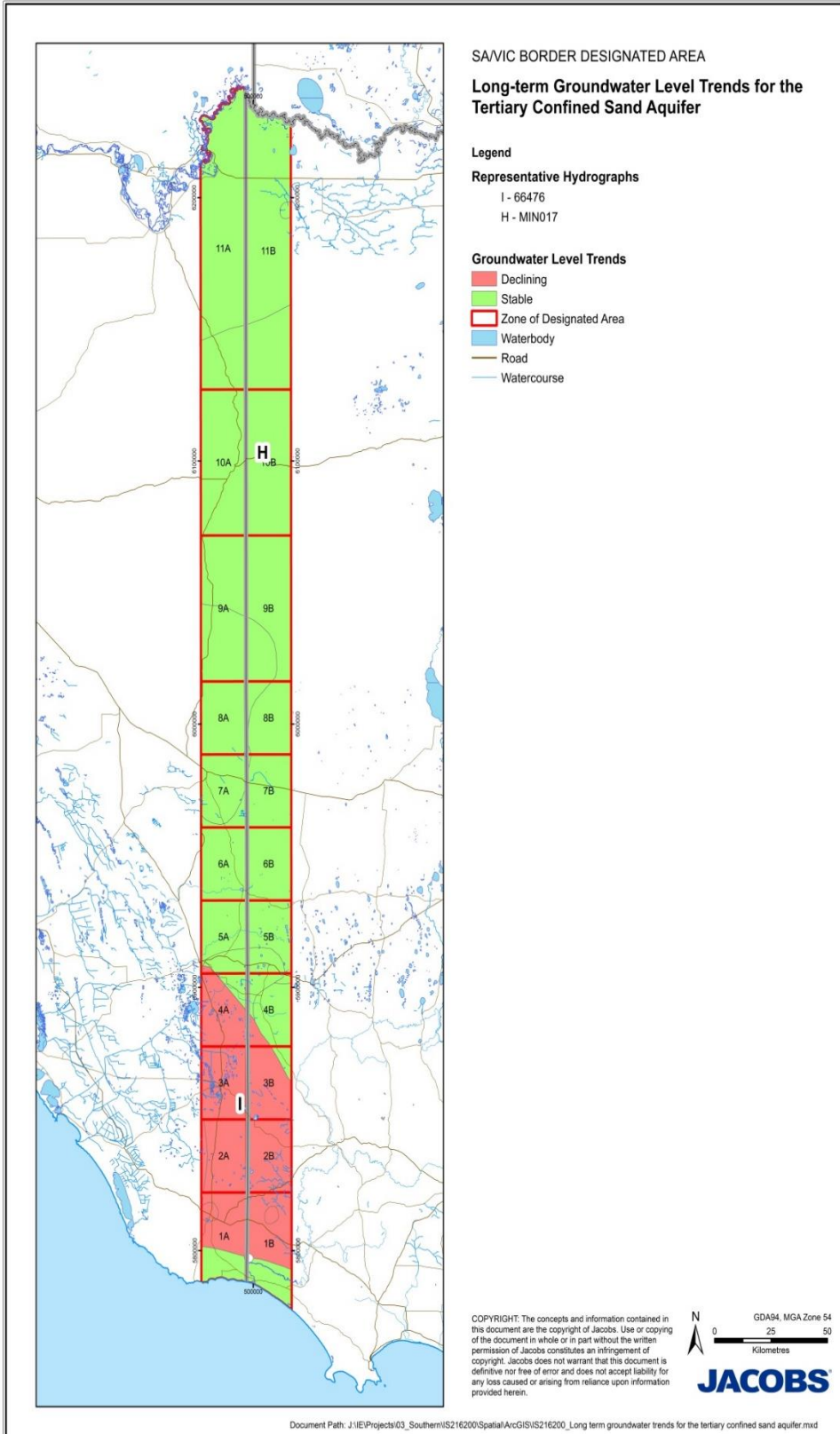
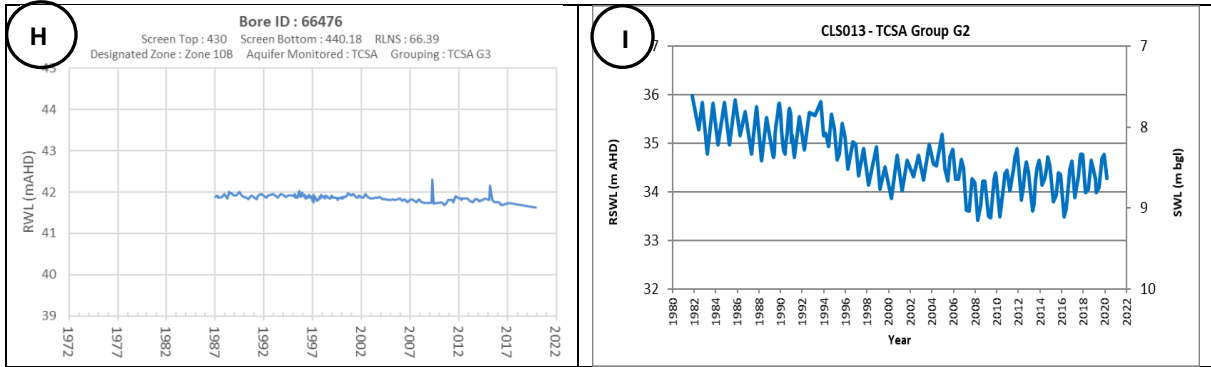


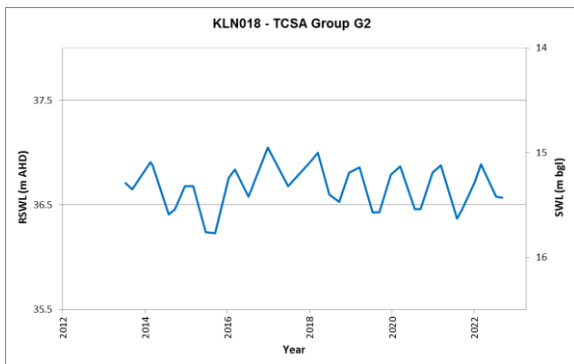
Figure 8. Groundwater level trends for the Tertiary Confined Sand Aquifer with some representative hydrographs



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



CLS013 is outside of the Designated Area (about 25 km west of Coonawarra) but is considered indicative of the potentiometric level in the Tertiary Confined Sand Aquifer in Zone 3A. While of lesser magnitude, this site exhibits a similar trend characteristic to PEN015 in Zone 3A, suggesting there may be a hydraulic connection with the overlying Tertiary Limestone Aquifer, or influenced by hydrostatic loading by the overlying aquifer. The structural integrity of the Monitoring well CLS013 has failed and was backfilled and replaced with a new confined well in April 2023. Data to 2021 is considered representative of the Tertiary Confined Sand Aquifer in the area.



KLN018 in the Tertiary Confined Sand Aquifer is located on the western boundary of Zone 4A and about 5 km north of Zone 3A. Whilst the monitoring record is short, the pressure level is relatively stable since monitoring at the site commenced. The trend characteristics are reasonably consistent with the trend observed at CLS013 (prior to its failure) over the same period.

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.

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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
1 August 2017	Noora Prescribed Wells Area revocation of declaration as a prescribed water resource
21 June 2018	Alteration of Permissible Annual Volume for the Pliocene Sands Aquifer in Zones 11A
1 July 2021	Notice of Alteration of Allowable Annual Volume – Sub-zone 1A South

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
27 June 2020	Alteration of Permissible Annual Volume for the Tertiary Limestone Aquifer in Zones 5B and 6B

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