

South Australian–Victorian Border Groundwaters Agreement Review Committee



Thirty-Seventh Annual Report

To 30 June 2022

Adelaide and Melbourne

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Errata

The errata corrections listed below apply to the *Border Groundwaters Agreement Review Committee's 37th Annual Report to 30 June 2022* (the report) as approved by the Border Groundwaters Agreement Review Committee in March 2023.

Revised tables and figures are included in this version of the report in accordance with the changes listed below. The reasons for the changes are included in the text on page 14.

| Page | Location | Revised content |
|------|---------------------------|--|
| 14 | 2 nd paragraph | Explanatory text regarding changes to extraction volumes reported for Zone 5A, Zone 1A and Sub-zone 1A South. |
| 15 | Table 4 | <p>Extraction volumes for:</p> <ul style="list-style-type: none">• Zone 5A revised from 12,803 to 12,819 ML• Zone 1A revised from 29,371 to 30,289 ML. <p>Allocation values for:</p> <ul style="list-style-type: none">• Zone 1A revised from 46,520 ML to 45,379 ML.• Zone 4A revised from 30,847 ML to 30,910 ML. <p>Explanatory text on revised allocations provided in footnotes to Table 4.</p> |
| 16 | Table 5 | Extraction volume for Sub-zone 1A South revised from 15,520 ML to 16,031 ML. |

PREFACE

The Border Groundwaters Agreement Review Committee's Annual Report for 2021-22 fulfils the requirement under clause 30(1) of the Border Groundwaters Agreement to report on its activities during the year to 30 June 2022. 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.

The Review Committee progressed its management review of Province 1 in the southern part of the Designated Area (Figure 1), in readiness for consultation with regional water management authorities in each state regarding its findings and recommendations.

In December 2021, the review Committee altered the Annual Allowable Volume for Sub-zone 1A South from 12,507 ML to 15,000 ML, to address an underestimation of the irrigation requirements when the area-based water entitlements were converted to volumetric entitlements in 2013, and developed an agreed approach to managing the risk of seawater intrusion in this subzone. The Annual Allowable Volume was exceeded at 30 June 2022 and the Review Committee will work with South Australia to understand the risks to the resource.

After completing its technical assessment of Province 2 in the central Designated Area (Figure 1), the Review Committee consulted with the regional authorities in both states and the responsible state agencies regarding its findings and management recommendations, including the need for increased monitoring in the transition area with Province 3.

The Review Committee has recently completed a comprehensive review of the Agreement. The review identified the need to consider emerging challenges such as the sustainability of groundwater dependent ecosystems, climate change and forest land use. During the year, the Review Committee sought comments from government agencies and regional water management authorities on the recommendations for amendments that evolved from its review of the Agreement, in order to finalise these and provide them to the relevant state ministers.

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 (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, as an acknowledgement of 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 extraction 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 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 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 regional committees or boards, to maximise community and industry involvement in making and implementing the groundwater management arrangements.

The groundwater 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">• 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 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, the extraction of Allowable Annual Volume 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 completed in 2018-19 and a management review is to be completed in 2022.
- Province 2 was completed in 2017-18 and the Review Committee is currently consulting with the regional authorities regarding its recent management review.
- Province 3 was completed 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, 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.
- 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.

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.

The Review Committee met three times during the 2021-22 year as follows:

| | | |
|-------------------|-------------|----------------|
| 23 April 2022 | Meeting 146 | Teleconference |
| 8 December 2021 | Meeting 145 | Teleconference |
| 29 September 2021 | Meeting 144 | Teleconference |

During the year the membership of the Review Committee comprised:

| South Australia | | Victoria | |
|-----------------|---------------|-------------|---------------|
| Mr N Power | Member | Ms A May | Member |
| Mr D Jordan | Member | Mr R Nott | Member |
| Ms B Sorensen | Deputy member | Mr K Wilson | 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.

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 where the Murtho and Pike salt interception schemes operate adjacent to the River Murray, and the average salinity of the observed extractions was 38,750 and 51,905 EC units respectively.

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 threatened 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 management zones due to recharge interception and direct groundwater extraction where the groundwater is at shallow depths. 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, the plantation forest licensed impacts are equivalent to 85 per cent of the Permissible Annual Volumes that can be extracted via bores in the Tertiary Limestone Aquifer in those zones. Areas under plantations are approximately equal in both States and have not changed significantly during the last decade (ABARES, 2021).

Commercial plantation forests in Victoria do not require a groundwater licence, however Victoria has adopted a consistent approach to account for commercial plantation forest impacts on groundwater resources. Victoria completed a review of commercial forested data which indicates there has not been a significant change in area under plantations in Zones 1B to 4B, the main areas where commercial forest developments have historically occurred in the Victorian Designated Area.

Data on commercial plantation area and groundwater usage in both states are provided in Table 11 (Area of plantation commercial forest at 30 June 2022) in Section 3 of this report.

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 technical review has re-affirmed this position.

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 has 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.

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.

The management regimes in place 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.

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 for each aquifer in each zone at 30 June 2022 are set out in Table 2.

Table 2. Permissible Annual Volumes at 30 June 2022

| 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) |
| 7763 | 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 |

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 2022 are set out in Table 3. The locations of the sub-zones are shown in Figure 5.

Table 3. Allowable Annual Volumes for the Tertiary Limestone Aquifer for year ending 30 June 2022

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

Allocations and volumes extracted

The allocations and the volumes extracted³ for the Tertiary Limestone Aquifer are listed in Tables 4 and 5. A total of 148,911 ML was extracted from the Tertiary Limestone Aquifer in the Designated Area, about 6 per cent higher than in 2020-21 and 7 percent above the 10-year mean (2013-22).

The total volume extracted from the Tertiary Limestone Aquifer was determined at March 2023 as 147,976 ML, however, this volume was increased to 148,911 ML after this date as a result of:

- accounting for 392 ML of water taken through a new meter installed in Sub-zone 1A which had not been reported
- a new water licence in Sub-zone 1A which provided a late reading of 119 ML
- a new meter in Zone 1A (outside Sub-zone 1A) which had failed to be recorded (408 ML)

which increased extraction in Zone 1A by 919 ML, and an additional extraction of 16 ML reported for Zone 5A.

The Review Committee adjusted the Allowable Annual Volume (AAV) for Sub-zone 1A South from 12,507 ML to 15,000 ML on 1 July 2021, to address an underestimation of the irrigation requirements when the area-based entitlements were converted to volumetric entitlements in 2013, however the revised AAV was exceeded during 2021-22. The AAV was exceeded at 30 June 2022 and the Review Committee will work with South Australia to understand the risks to the resource.

The Permissible Annual Volume for Zone 1A was not increased and the water extractions in all zones in the Designated Area for 2021-22 are within the Permissible Annual Volumes.

³ 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 these uses.

Table 4. Permissible Annual Volumes, number of licences, allocations and annual volumes extracted for the Tertiary Limestone Aquifer at 30 June 2022

| 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) |
| 3 700 | 8 | 3 700 | 1 683 | 11A | 11B | 1 823 | 3 | 1 600 | 1 493 |
| 14 000 | 40 | 14 000 | 9 631 | 10A | 10B | 6 720 | 23 | 6 718 | 4 573 |
| 11 595 | 7 | 10 160 | 8 725 | 9A | 9B | 5 960 | 3 | 5 300 | 1 026 |
| 5 121 | 26 | 6 542 | 1 459 | 8A | 8B | 3 500 | 7 | 3 130 | 453 |
| 8 259 | 69 | 9 132 | 4 254 | 7A | 7B | 5 782 | 13 | 5 782 | 3 535 |
| 8 758 | 41 | 10 629 | 6 000 | 6A | 6B | 10 279 | 16 | 10 279 * | 6 772 |
| 18 943 | 121 | 23 704 | 12 819 | 5A | 5B | 12 833 | 36 | 12 833 * | 7 477 |
| 22 102 | 174 | 30 910 | 12 350 | 4A | 4B | 14 000 | 11 | 2 803 | 189 |
| 24 054 | 235 | 32 328 | 11 440 | 3A | 3B | 16 500 | 4 | 515 | 74 |
| 25 000 | 78 | 26 899 | 14 684 | 2A | 2B | 25 000 | 39 | 24 979 | 7 720 |
| 31 812 | 275 | 45379*** | 30 289 | 1A | 1B | 45 720 | 20 | 4 457 | 2 264 |

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

**Allocation in Zone 4A was incorrectly reported as 45 379 ML due to a transfer of an allocation component that had been surrendered by the transferee but not yet issued to the transferor.

***Zone 1A contains three separate management areas in the Lower Limestone Coast. Total allocation was incorrectly summed as 46 520 ML and has now been rectified.

Table 5. Allowable Annual Volumes, number of licences, allocations and annual volumes extracted for the Tertiary Limestone Aquifer at 30 June 2022

| 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 | 1 306 | 9A North |
| 7 760 | 5 | 7 760 | 5 720 | 9A South |
| 4 658 | 19 | 5 321 | 2 736 | 6A South |
| 15 000 | 49 | 20 086 | 16 031 | 1A South |

The allocations and volumes extracted for the Tertiary Confined Sand Aquifer are listed in Table 6.

Table 6. Permissible Annual Volumes, allocations and annual volumes extracted for the Tertiary Confined Sand Aquifer at 30 June 2022

| 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 | 50 | 4A | 4B | 300 | 0 | 0 | 0 |
| 1 900 | 2 | 259 | 149 | 3A | 3B | 1000 | 0 | 0 | 0 |
| 2 900 | 2 | 150 | 30 | 2A | 2B | 5100 | 0 | 0 | 0 |
| 9 200 | 4 | 1704 | 743 | 1A | 1B | 14 500 | 0 | 0 | 0 |

The Permissible Annual Volume and volume extracted for the Pliocene Sands Aquifer are listed in Table 7.

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 3968 ML of water extracted from the Pliocene Sand Aquifer in Zone 11A during

the year ending 30 June 2022, via the Murtho and Pike salt interception schemes, is estimated to contain 131,173 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 2022

| 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 | 3 968 | 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 ⁴ | Zone | Zone | Number of Domestic and Stock water bores ⁵ |
| 16 | 11A | 11B | 17 |
| 166 | 10A | 10B | 243 |
| 25 | 9A | 9B | 47 |
| 62 | 8A | 8B | 113 |
| 749 | 7A | 7B | 104 |
| 391 | 6A | 6B | 56 |
| 1 370 | 5A | 5B | 162 |
| 896 | 4A | 4B | 339 |
| 1 155 | 3A | 3B | 79 |
| 632 | 2A | 2B | 577 |
| 1 648 | 1A | 1B | 625 |

⁴ The numbers of domestic and livestock water bores are derived from spatial analysis of the state SAGEODATA borehole records. It does not necessarily indicate the bores in use.

⁵ The numbers of domestic and livestock water bores are based on a 2020 review of current registered bores.

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. The permissible distances at 30 June 2022 are specified in Table 9.

Table 9. Permissible distances at 30 June 2022

| 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 2022

| 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, 2018 and 2021 respectively) the Review Committee determined that there is no need to recommend that permissible salinity levels should be set.

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 the hydrological impacts of commercial plantation forest on the groundwater resources in the Tertiary Limestone Aquifer in Province 1 of the Designated Area in Table 11.

Table 11. Area of plantation commercial forest at 30 June 2022

| South Australia | | | Victoria | | |
|---|-------------------------|--------------|--------------|--------------------------------------|------------------------------------|
| Area of commercial plantation (ha) ⁶ | Forest water use (ML) * | Zone | Zone | Area of plantation (ha) ⁷ | Forest water use (ML) ⁸ |
| 465 | 79 | 6A | 6B | - | - |
| 57 | 18 | 5A | 5B | - | - |
| 3 806 | 2 267 | 4A | 4B | 5 600 | 3 336 |
| 12 201 | 25 111 | 3A | 3B | 19 000 | 39 104 |
| 19 790 | 31 090 | 2A | 2B | 9 200 | 14 453 |
| 19 648 | 29 070 | 1A | 1B | 23 500 | 34 769 |
| 55 967 | 87 634 | Total | Total | 57 300 | 91 662 |

* 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 2021-2022) and the groundwater extraction by the plantation forest from shallow groundwater, as defined by the water allocation plan.

Supplementary information

Aggregate annual groundwater extractions in the Designated Area from the Tertiary Limestone Aquifer from 2006-07 to June 2022 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 many parts of Province 1, primarily due to a combination of plantation forest hydrological impacts, irrigation extractions and rainfall variability.

⁶ Data from commercial plantation forest licensee reports

⁷ Data from Victorian Spatial database as Victoria does not licence plantation forest groundwater impacts

⁸ Estimated by applying the South Australian methodology. Victoria does not licence commercial forest groundwater use

FIGURES

Figure 1. Designated Area and zones

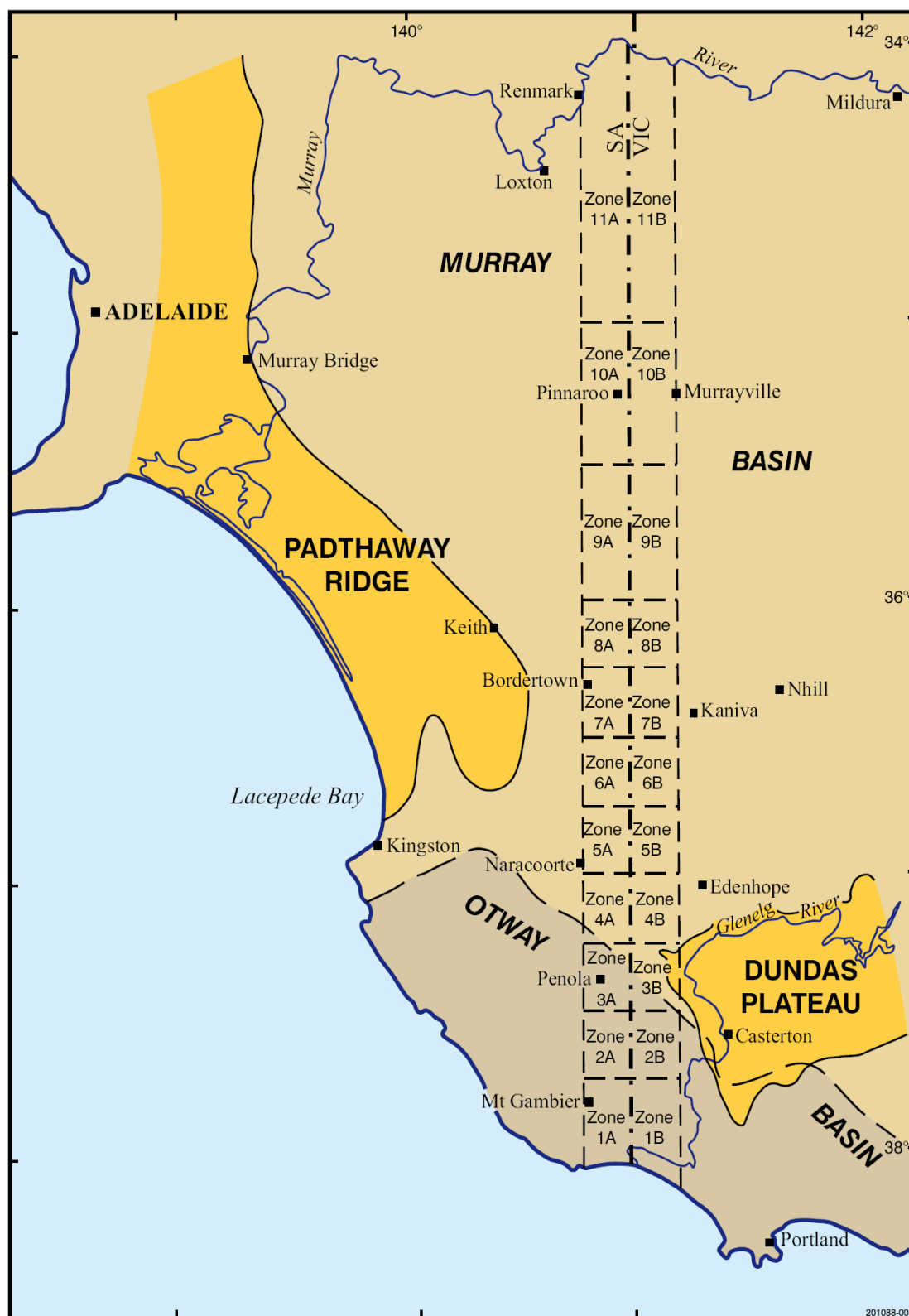


Figure 2. Relationship of management areas in South Australia and Victoria to the Designated Area

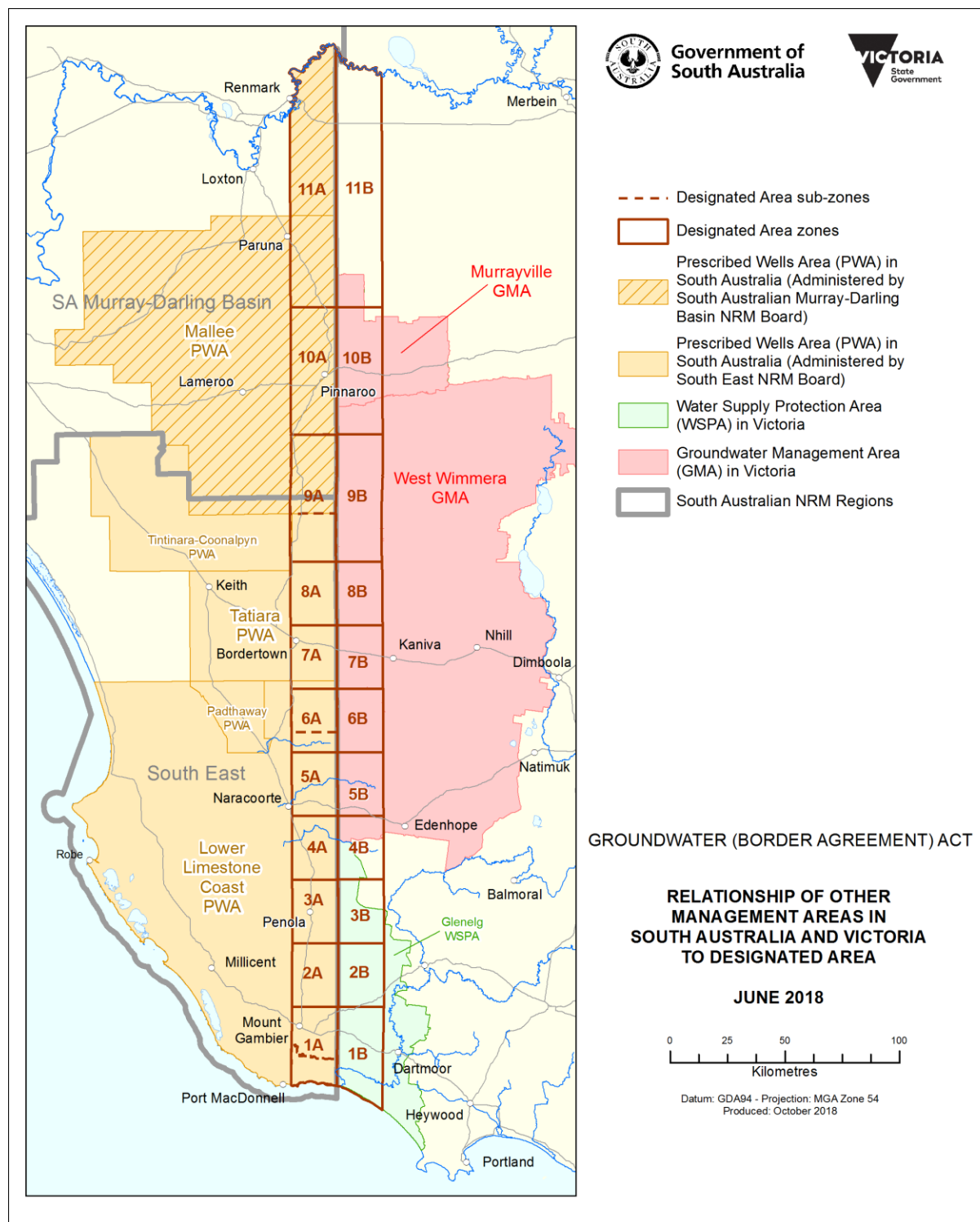


Figure 3. Hydrogeological provinces

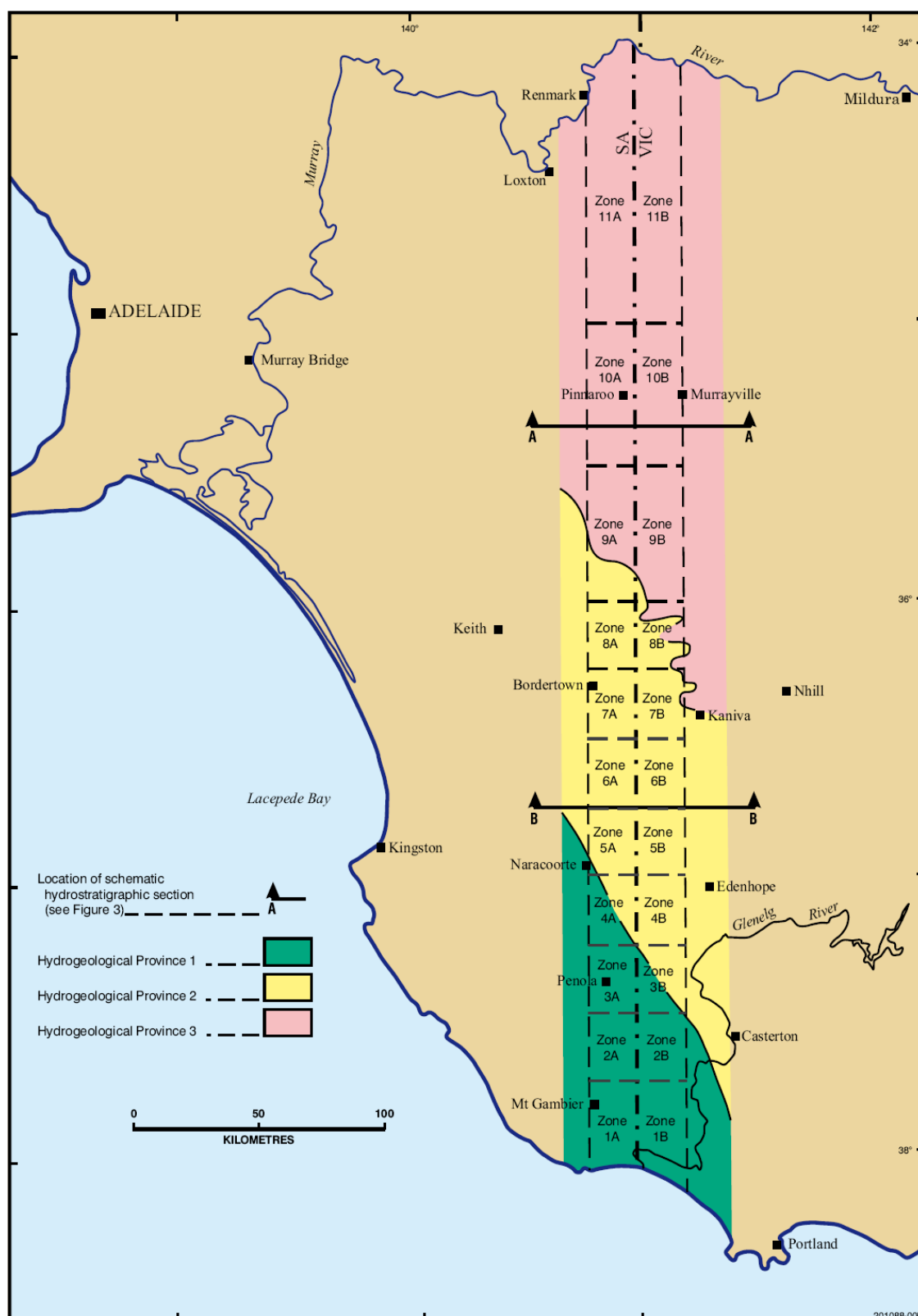


Figure 4. Schematic hydrostratigraphic cross-sections relating to Figure 3

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

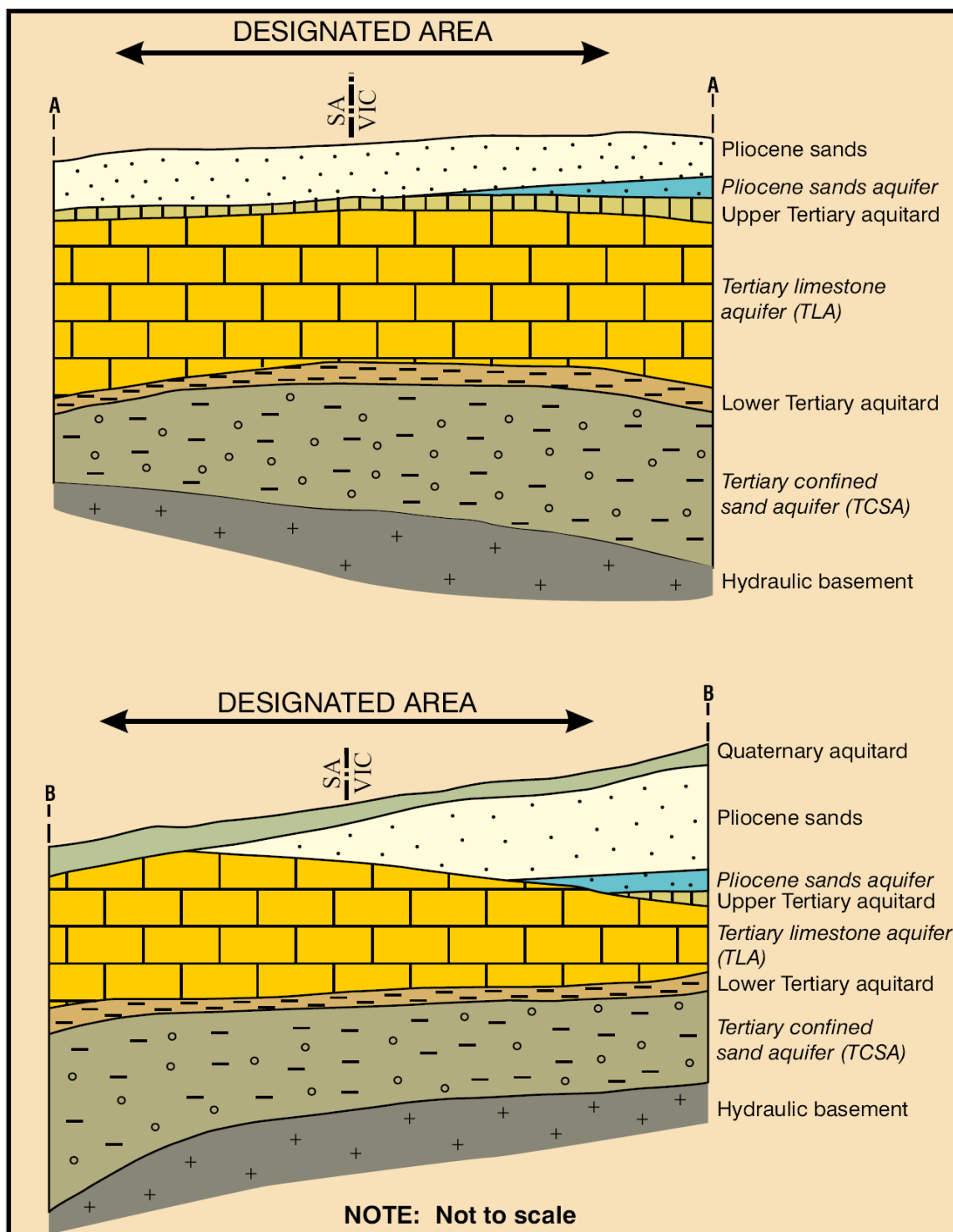
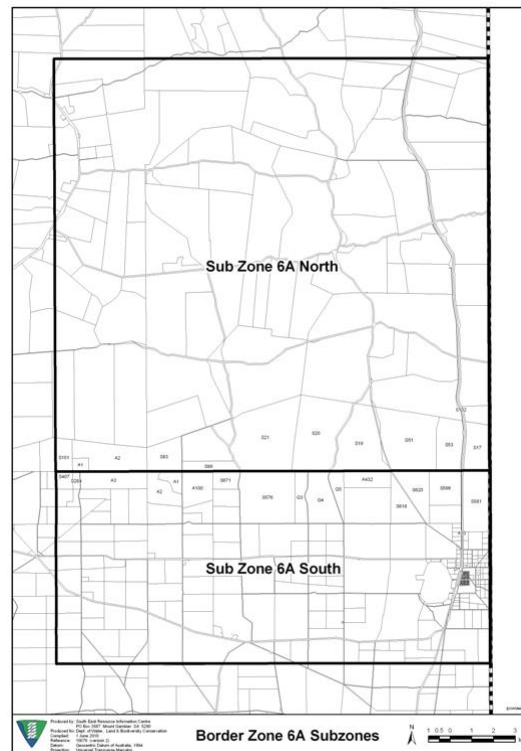
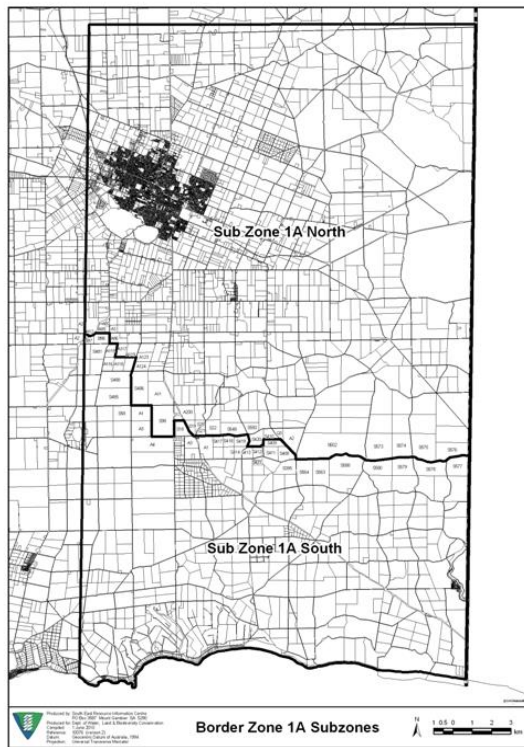


Figure 5. Sub-zone boundaries for Zones 1A, 6A and 9A

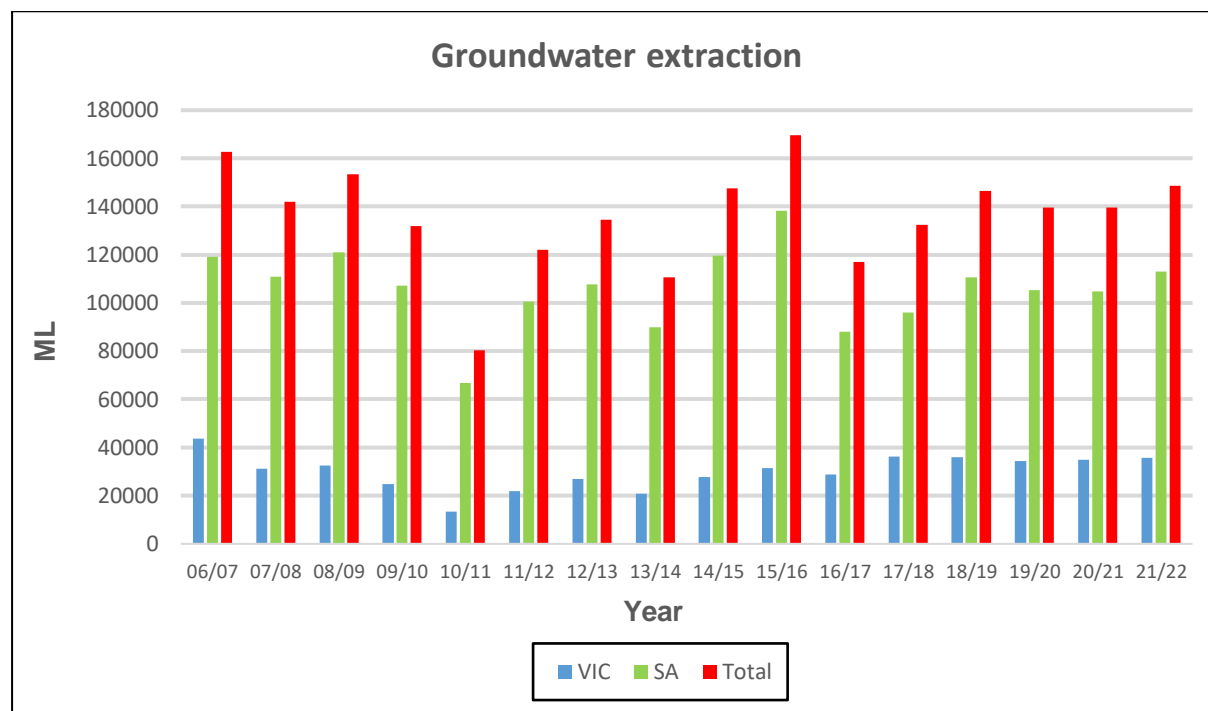


Boundaries of sub-zones are registered on:

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

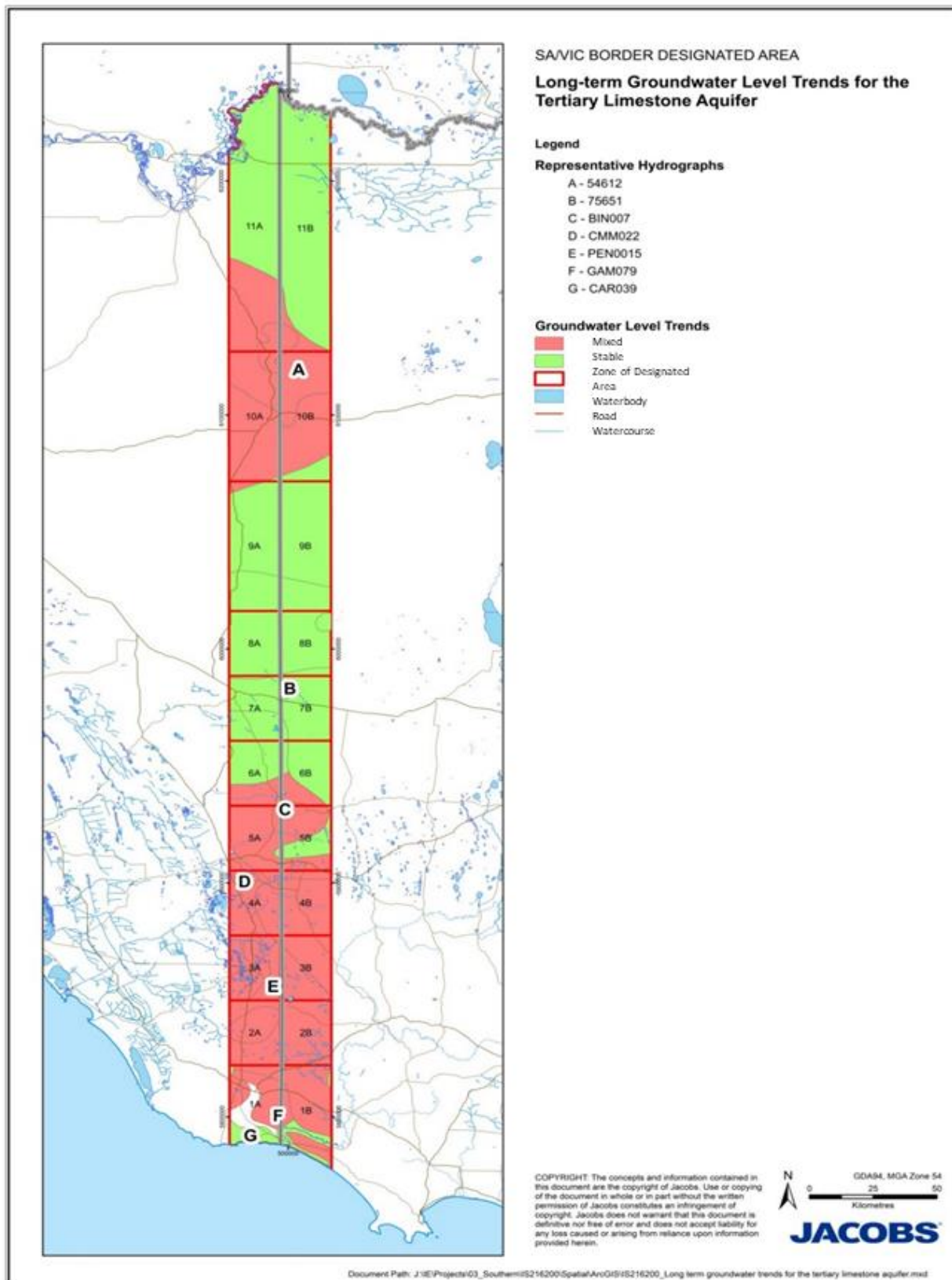
Plans can be viewed at Lands Services and
Lands Titles office at
101 Grenfell Street, Adelaide

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)

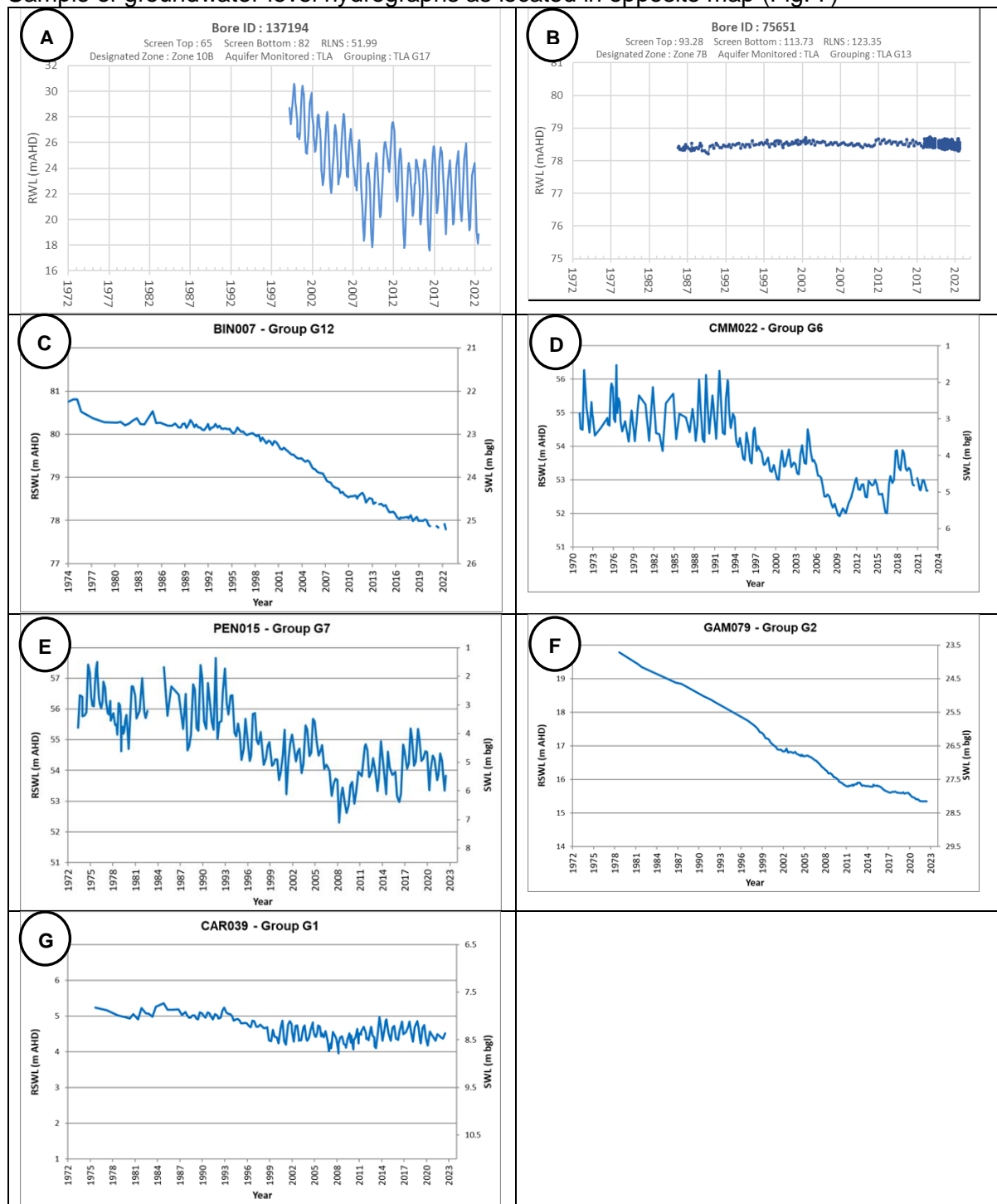
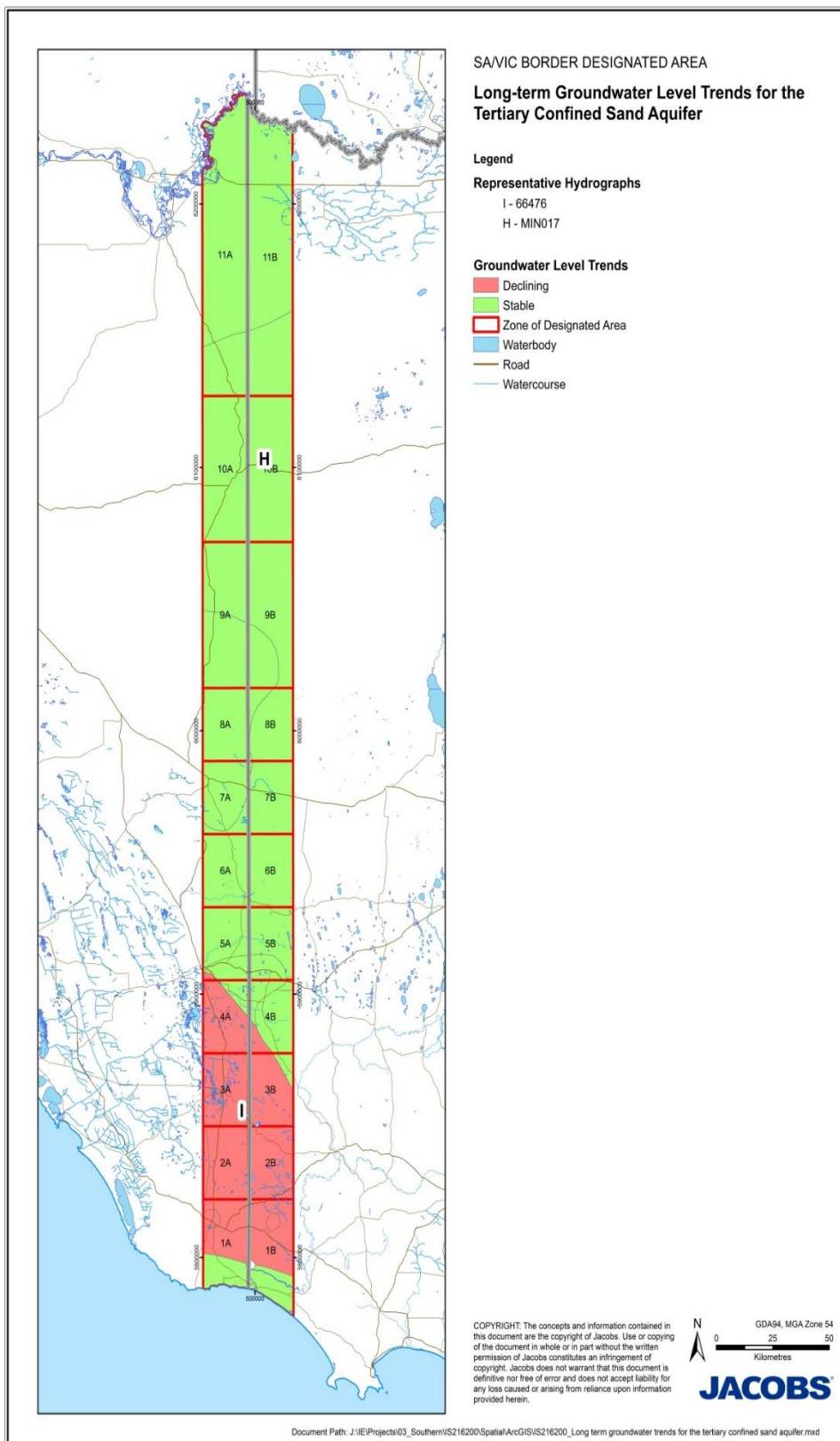
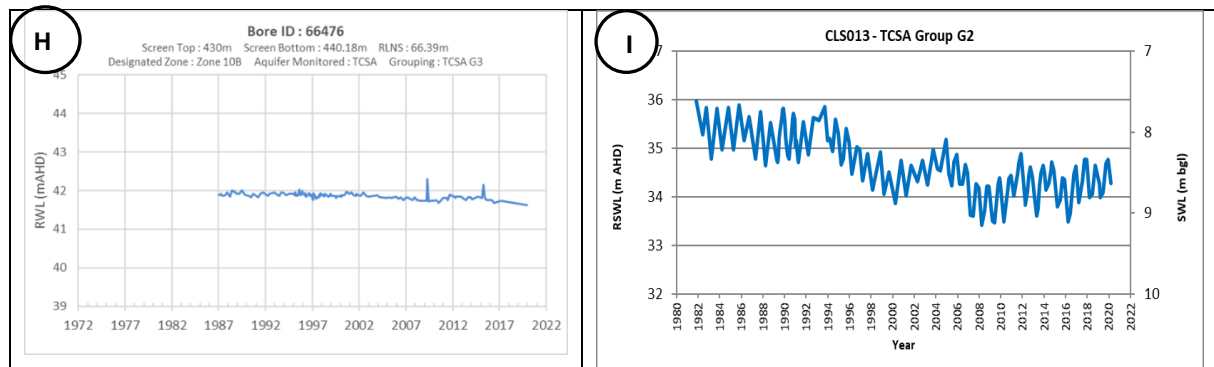


Figure 8. Groundwater-level trends for the Tertiary Confined Sand Aquifer with some representative hydrographs



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



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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