Marne Saunders PWRA

Murray Group Limestone aquifer

2015 Groundwater level and salinity status report

Government of South Australia
Department of Environment, Water and Natural Resources

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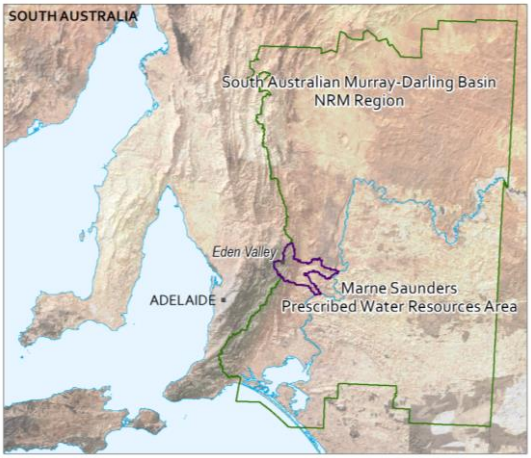
2015 Summary



The Marne Saunders Prescribed Water Resources Area (PWRA) is located on the eastern side of the Mount Lofty Ranges, about 60 km north-east of Adelaide in the South Australian Murray-Darling Basin Natural Resources Management Region. It is a regional-scale resource for which surface water and groundwater are prescribed under South Australia's *Natural Resources Management Act 2004*. A water allocation plan (WAP) provides for sustainable management of the water resources.

The Marne Saunders PWRA consists of two tributary catchments of the River Murray and can be divided into two distinct groundwater regions: the 'hills zone' to the west and the 'plains zone' in the east. The plains zone is underlain by unconsolidated sediments of the Murray Basin consisting of limestone, sand and clay layers up to 80 m thick. These sediments, which overlie basement rocks that are exposed in the hills zone to the west, comprise four units: Quaternary sediments; the Murray Group Limestone (MGL); the Ettrick Formation; and the Renmark Group. In general, the MGL is overlain by Quaternary sediments and underlain by the Ettrick Formation and the Renmark Group. The MGL aquifer is highly fossiliferous and sandy with solution cavities, and as it constitutes the main aquifer in the plains zone, it is the focus of this report. Around the hills zone in the west, the MGL aquifer is confined by the Quaternary-aged Pooraka Formation, but it becomes unconfined where the Pooraka Formation pinches out, to the east of Cambrai. Recharge to the MGL aquifer is via throughflow from the adjacent basement rocks in the hills zone and, during periods of flood, from streamflow in those locations where the aquifer is unconfined.

The intensity and timing of rainfall and subsequent extraction practices can have an effect on groundwater pressure levels and salinity in the MGL aquifer. For example, if the region experiences above-average rainfall during typically dry summer months, this could result in less groundwater being extracted from the MGL aquifer (for e.g. irrigation) and consequently there may be more modest declines in groundwater pressure levels and salinity may stabilise or decrease.

Rainfall is highest in the hills zone at the western edge of the PWRA, with a sharp gradient of declining rainfall towards the east due to the rain shadow effect of the Mount Lofty Ranges. The Kongolia rainfall station (BoM Station 24513) recorded 274 mm of rainfall in the 2014–15 water-use year, which is 17 mm below the long-term annual average rainfall of 291 mm and 30 mm below the five-year average annual rainfall of 304 mm (Figs 1 and 2). Across the region, a five-year trend of declining rainfall is evident (Figs 1 and 2).

Irrigation water in the plains zone is sourced from the MGL aquifer, predominantly along the Marne River valley. Metered extractions from the MGL aquifer totalled 1095 ML[1] in 2014–15, which is 1% less than the previous water-use year (Fig. 3) and 62% of the total groundwater extracted from the Marne Saunders PWRA.

In the Marne Saunders PWRA, groundwater level fluctuations in the MGL aquifer show a strong relationship with patterns of rainfall and stream flow[2]. Periods of below-average rainfall result in reduced stream flow and consequently, recharge rates for the unconfined MGL aquifer (downstream of Cambrai) are likely to be low. Conversely, periods of above-average rainfall result in higher stream flows, which likely lead to higher recharge rates. Gradual groundwater level declines in the areas where the aquifer is unconfined can be observed in the historical record but, these declines are not necessarily a cause for concern, as groundwater levels respond rapidly to occasional floods in the Marne River.

Groundwater levels in monitoring wells around Cambrai were declining until around 2009–10, and many have stabilised or risen since this time. However, further east along the Marne River, groundwater levels have generally continued to decline. In the five years to 2015, this general trend has continued—half of monitoring wells show a declining trend (mostly east of Cambrai), and are declining at a median rate of 0.21 m/y (Fig. 4). The remaining wells, located around Cambrai, show a five-year trend of rising or stable groundwater levels.

[1] The licensed groundwater extraction volume for the 2014–15 water-use year is based on the best data available as of May 2016 and may be subject to change, as some extraction volumes are in the process of being verified.
[2] Surface Water Data for South Australia can be found online at WaterConnect https://www.waterconnect.sa.gov.au/Water-Resources/Surface-Water/SitePages/Home.aspx.

Increases in salinity represent a risk to industries and communities that rely on the resource. During the past 10 years, there has been a gradual increase in salinity. Each year, irrigators in the Marne Saunders PWRA submit a salinity sample from their irrigation wells to the Department of Environment, Water and Natural Resources (DEWNR) for analysis. Results of the analyses have been included in this report to augment measurements from DEWNR's salinity monitoring network (Fig. 5). In 2015, salinities measure from 1188 to 3725 mg/L, with most wells showing salinities of less than 3000 mg/L (21% show salinities less than 1500 mg/L) (Fig. 5). In the five years to 2015, all monitoring wells that sample the Marne Saunders PWRA MGL aquifer show stable salinities (Fig. 6).

The Water Allocation Plan (WAP) for the Marne Saunders PWRA has identified resource condition indicators that apply to the MGL aquifer in the Confined Zone A Groundwater Management Zone (located immediately west of Cambrai) and the Unconfined Zone 1 Groundwater Management Zone (located immediately east of Cambrai). These limits are designed to give early warning of unfavourable trends in water levels and salinity that may impact users of the resource.

Confined Zone A: The water-level trigger is defined as a reversal of the pressure gradient between pumping seasons that would result in higher-salinity groundwater flowing into the area from the east. In the 2014–15 water-use year, during the non-irrigation season the pressure gradient maintained throughflow and as such, the resource conditions limit is not exceeded. The salinity trigger is defined as an increase in salinity of greater than 2% per year, averaged over the past 5 years, in greater than 50% of monitoring wells. In the 2014–15 water-use year, these threshold criteria have not been breached, therefore the resource condition limit is not exceeded.

Unconfined Zone 1: The water-level trigger is defined as a decline below the minimum water level experienced between 1998 and 2002, in any of the monitoring wells in the management zone. In the 2014-15 water-use year, water levels in four of the five monitoring wells show water levels below these minimum levels, thereby breaching the resource condition limit. This breach retains the status quo since the WAP was adopted in 2010. The salinity trigger is defined as a long-term increase in salinity within the management zone. Since the WAP was adopted in 2010, salinity in three of the five monitoring wells has increased by up to 53%, while two have decreased in salinity by around 14%. In the period 2010–15, there was a median 8% increase in salinity, which may be considered a breach of the resource condition limit.

Investigations have shown that in Unconfined Zone 1, groundwater levels and salinity are strongly controlled by Marne River streamflow, particularly high-flow events. The evidence suggests that reduction in allocations alone is unlikely to markedly change any declining trends in groundwater levels. Groundwater levels in the MGL aquifer declined during the dry period of 2006–08, and the opportunity for water levels to recover has been limited, with rainfall from only one year (2010) delivering above-average streamflow. Groundwater extraction volumes on the plains have been below the combined allocation limit for the MGL aquifer of 2156 ML. Impacts on groundwater-dependent ecosystems in Unconfined Zone 1 as a result of recent low streamflow have not been reported.

To determine the status of the MGL aquifer for 2015, the trends in groundwater pressure levels and salinities over the past five years (2011 to 2015, inclusive) are analysed. This is a new approach, in contrast to the year-to-year assessments that have been used in past *Groundwater level and salinity status reports*. Please visit the Frequently Asked Questions on the *Water Resource Assessments* page on WaterConnect for more detail on the current method of evaluating the status of groundwater resources.

The MGL aquifer in the Marne Saunders Prescribed Water Resources Area has been assigned a yellow status for 2015:

2015 Status Minor adverse trends have been observed over the past five years

The 2015 status for the Murray Group Limestone aquifer is based on:

- half of monitoring wells showing a five-year trend of declining groundwater levels
- water level and salinity resource condition limits are exceeded in Unconfined Zone 1 Groundwater Management Zone.

To view descriptions for all status symbols, please visit WaterConnect.

To view the *Marne Saunders PWRA Groundwater Level and Salinity Status Report 2011*, which includes background information on hydrogeology, rainfall and relevant groundwater-dependent ecosystems, please visit the *Water Resource Assessments* page on WaterConnect.

To view or download groundwater level and salinity data from observation wells within the Marne Saunders PWRA, please visit Groundwater Data on WaterConnect.

For further information about the Marne Saunders PWRA, please see *The Water Allocation Plan for the Marne Saunders Prescribed Water Resources Area* on the Natural Resources SA Murry-Darling Basin website.

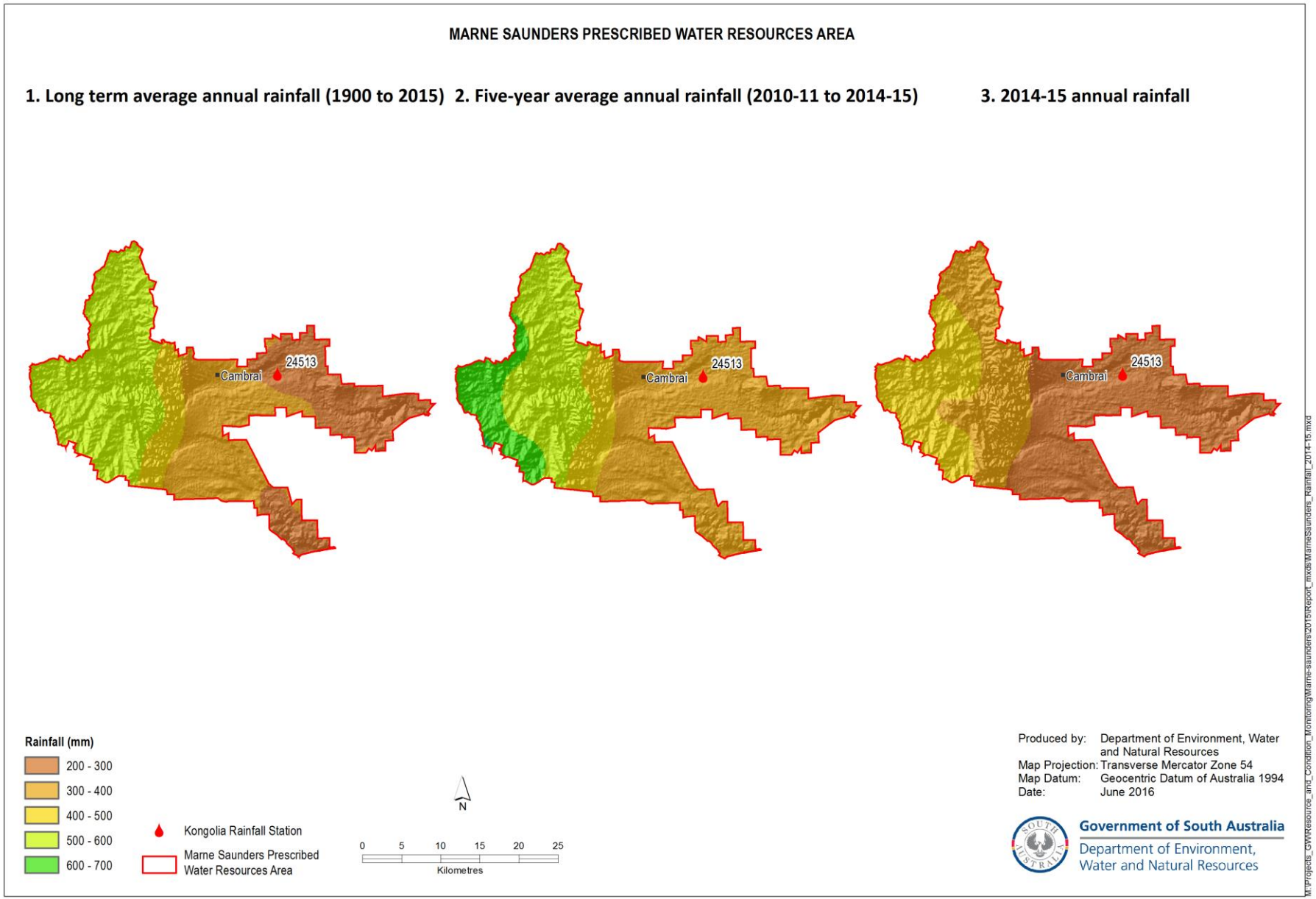


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2014–15 water-use year in the Marne Saunders Prescribed Wells Resources Area[3]

[3] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

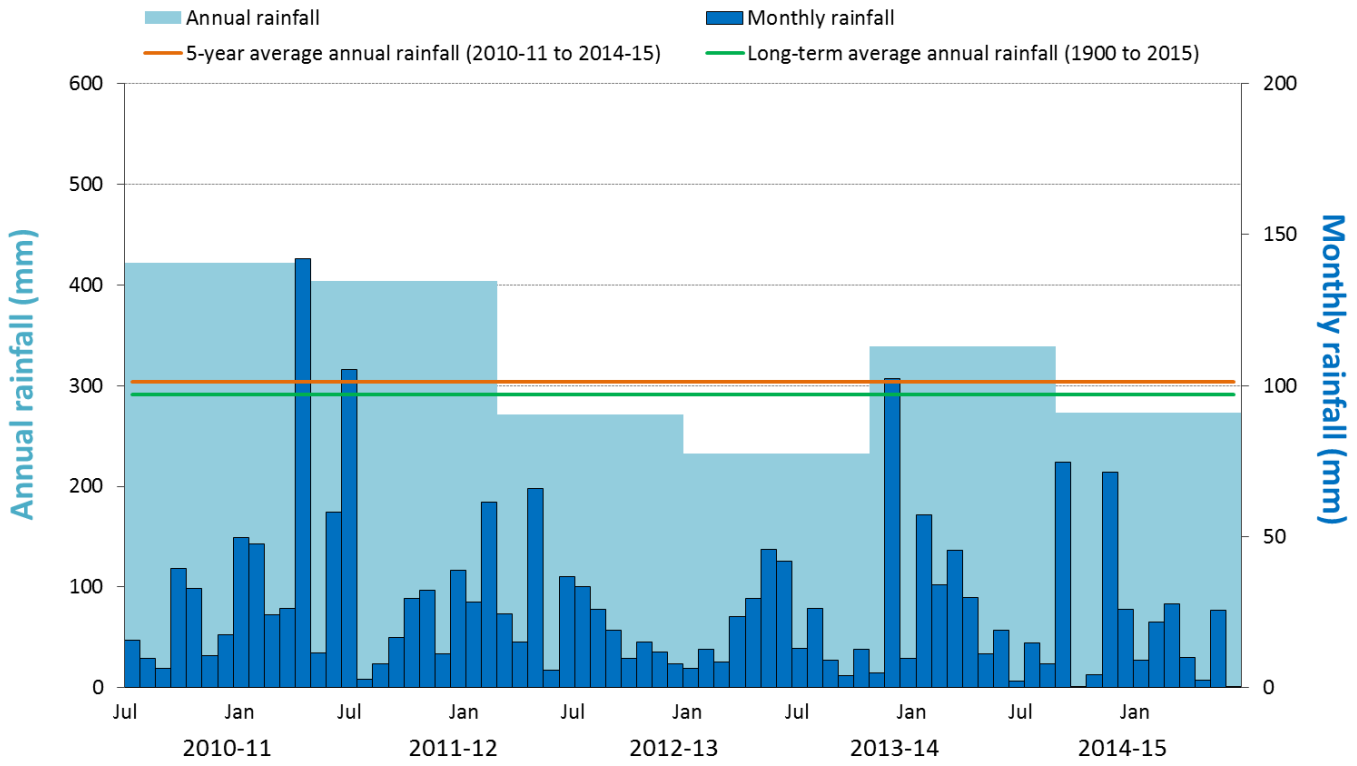


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Kongolia (BoM Station 24513)[4]

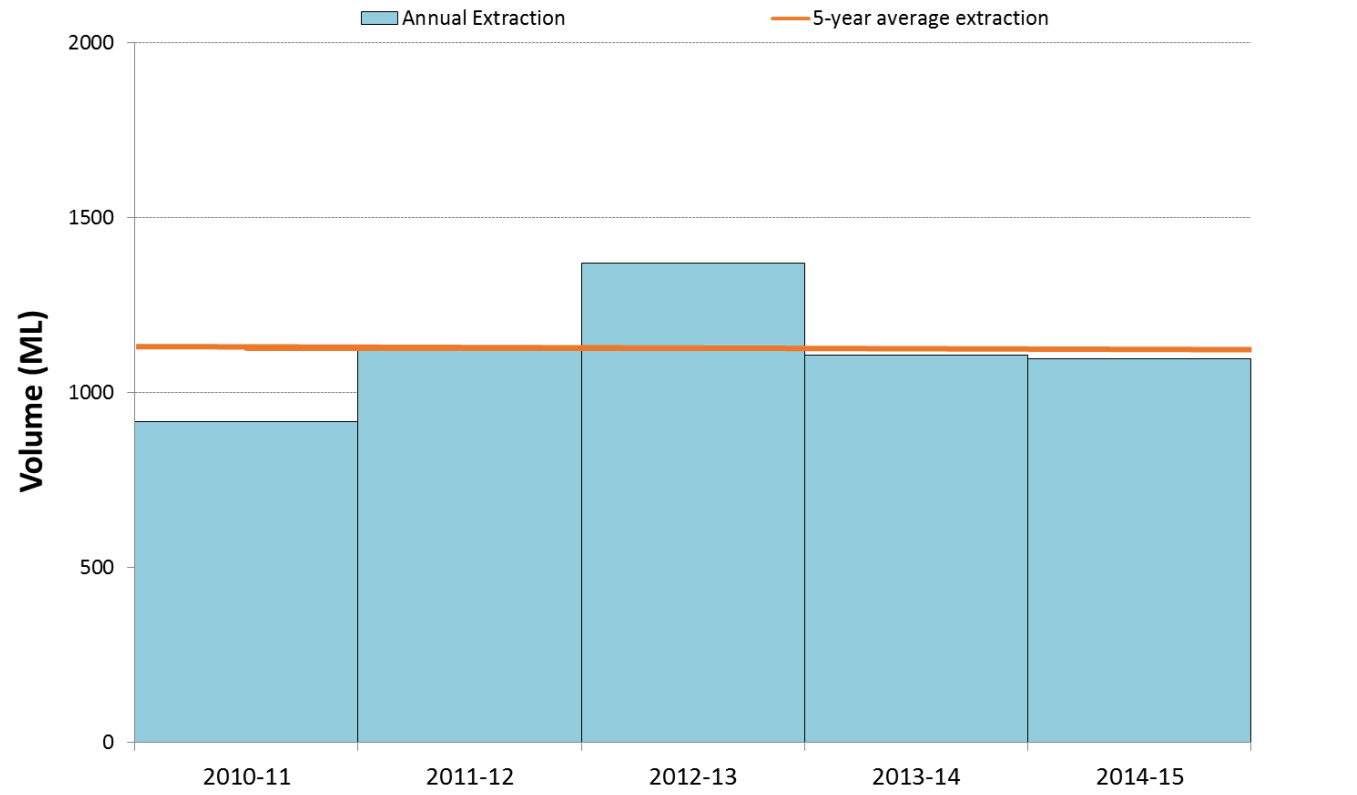


Figure 3. Licensed groundwater extraction volumes[5] for the past five water-use years, for the Murray Group Limestone aquifer in the Marne Saunders Prescribed Water Resources Area[3]

[4] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

[5] The licensed groundwater extraction volume for the 2014–15 water-use year is based on the best data available as of May 2016 and may be subject to change, as some extraction volumes are in the process of being verified.

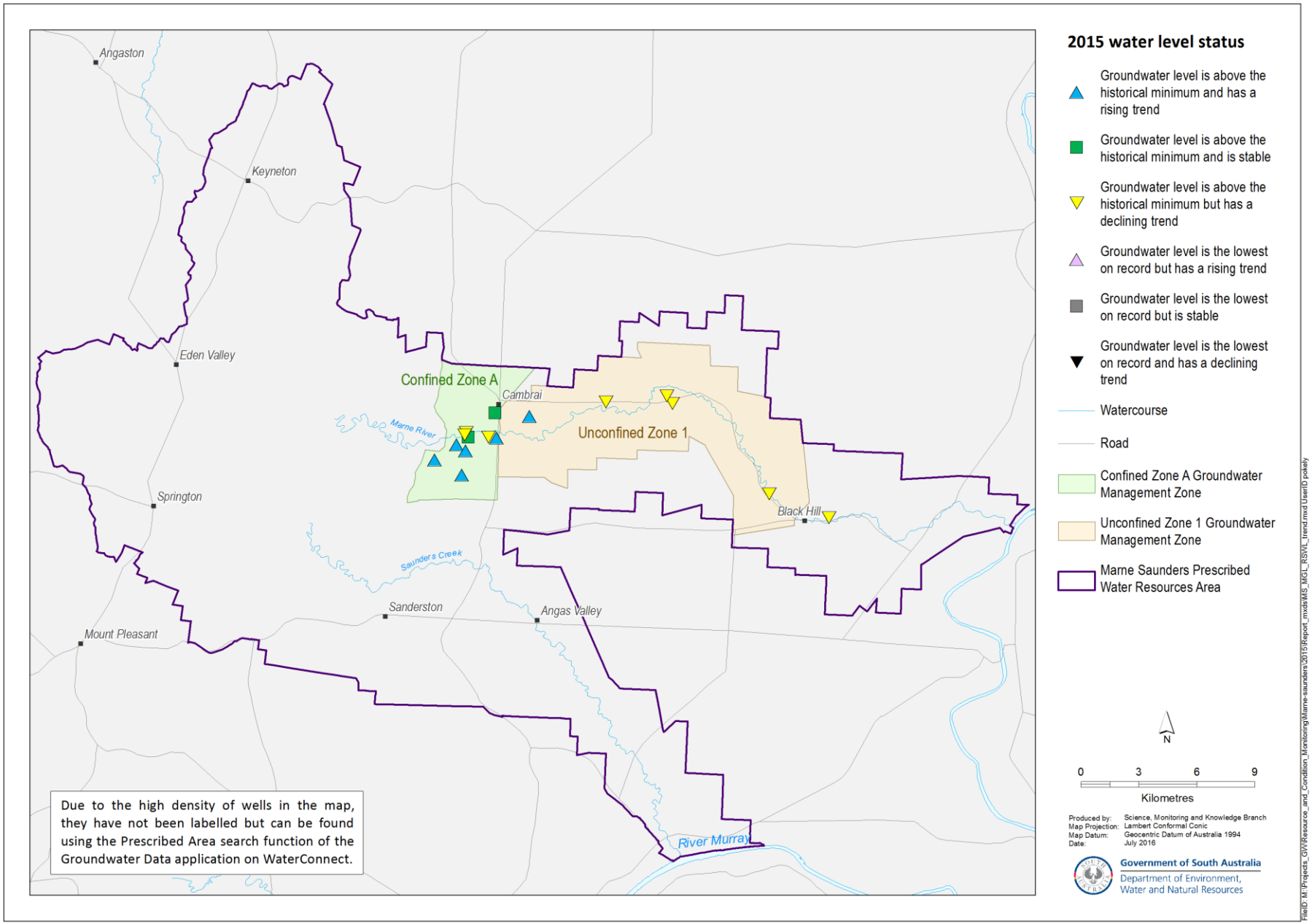


Figure 4. 2015 status of groundwater level in the Murray Group Limestone aquifer of the Marne Saunders Prescribed Water Resources Area, based on five-year trends from 2011 to 2015

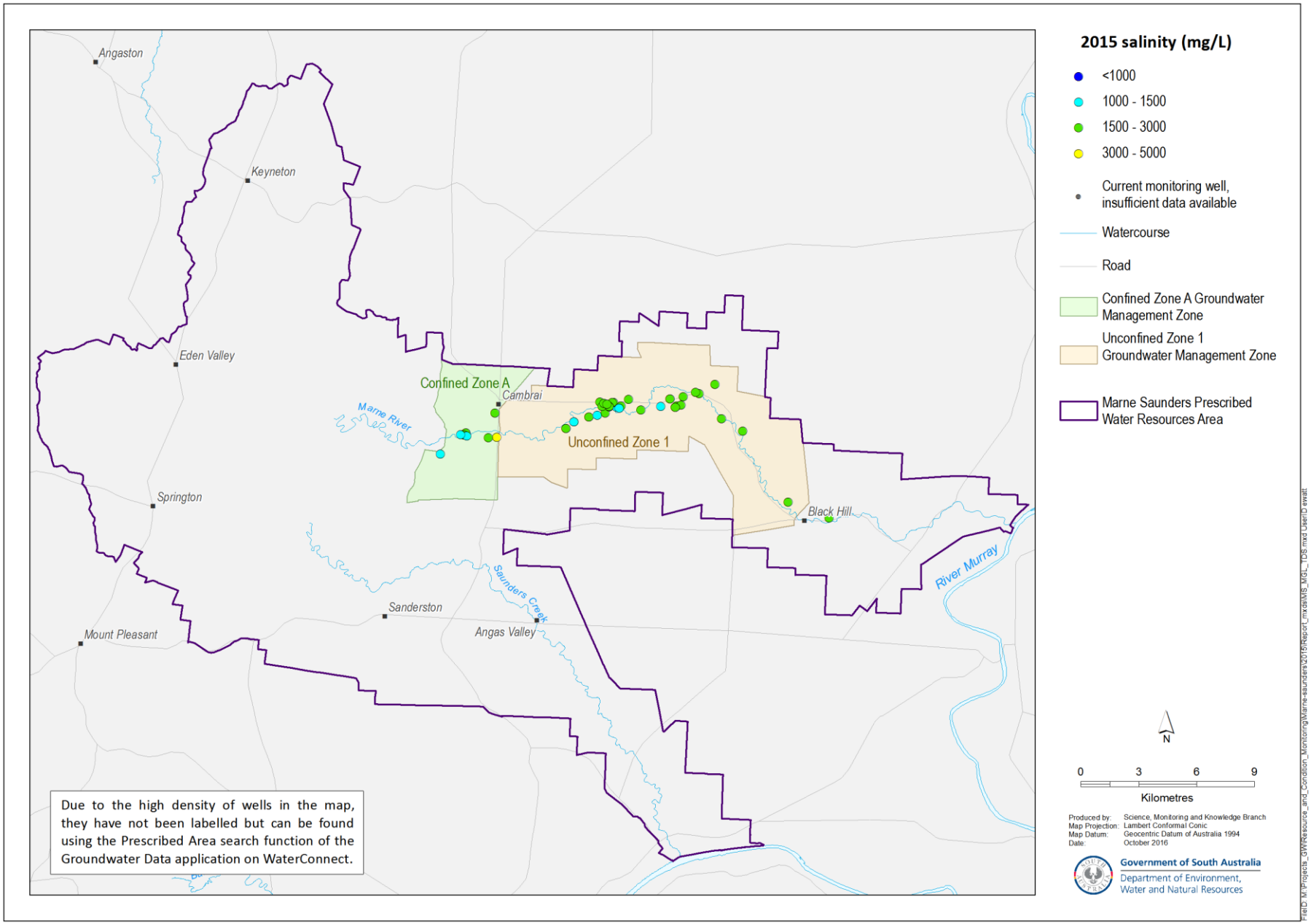


Figure 5. 2015 groundwater salinity of the Murray Group Limestone aquifer in the Marne Saunders Prescribed Water Resources Area

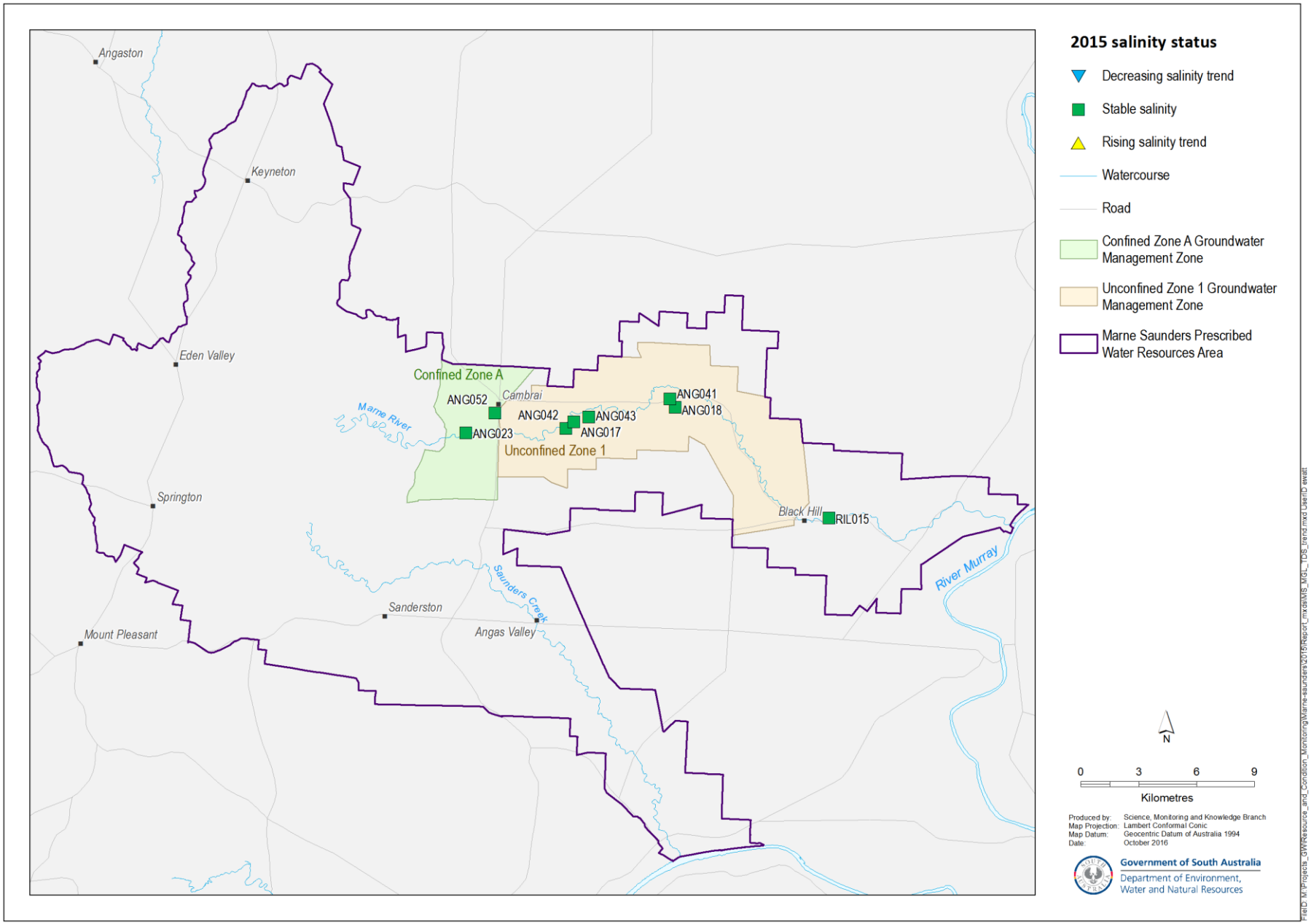


Figure 6. 2015 status of salinity in the Murray Group Limestone aquifer of the Marne Saunders Prescribed Water Resources Area, based on five-year trends from 2011 to 2015

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