

Barossa PWRA: Groundwater processes & status of the resources

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Department for Environment and Water



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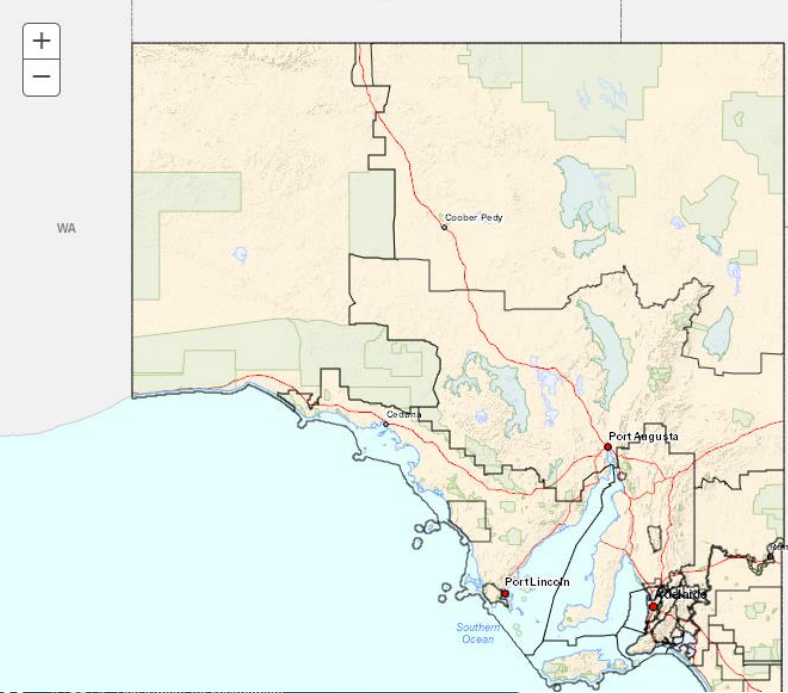
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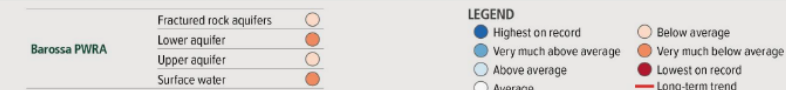
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 - Alinytjara Wilurara
 - Eyre Peninsula
 - Green Adelaide
 - Hills and Fleurieu
 - Kangaroo Island
 - Limestone Coast
 - Murraylands and Riverland
 - Northern and Yorke
 - Climate change
 - Groundwater
 - 3D Model
 - Prescribed areas
 - Barossa PWRA
 - [2009-10 Status report](#)
 - [2011 Status report](#)
- 2012 Status report
- 2013 Status report
- 2014 Status report
- 2015 Status report
- 2016 Status report
- 2017 Status report
- 2018 Status report
- [2018-19 Water resources assessment](#)



SOUTH AUSTRALIA
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Barossa Prescribed Water Resources Area

2019–20 surface water and groundwater status overview



Regional context

The Barossa Prescribed Water Resources Area (PWRA) relies on both surface water and groundwater resources that are managed under the Water Allocation Plan for the Barossa PWRA, which was adopted in 2009.

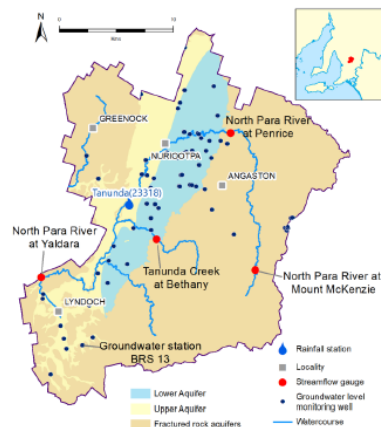
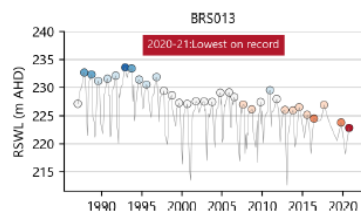
The Barossa PWRA consists of three major aquifers: two sedimentary aquifers (Upper and Lower) and fractured rock aquifers.

The North Para River is the main watercourse in the PWRA. All streams are ephemeral and feature seasonally disconnected permanent pools that are sustained predominantly by groundwater.

Groundwater level

93% of monitoring wells show 'below-average' to 'lowest-on-record' water levels

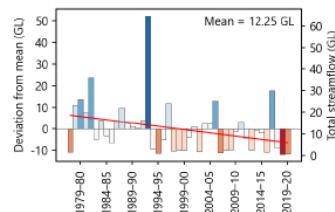
- In 2020, nearly half (47%) of wells with longer records show their lowest ever winter-recovered water level
- Five-year trends in water level indicate that the majority of wells show declining water levels
- The figure below shows long-term water levels at a monitoring site for a fractured rock aquifer near Angaston.



Streamflow

Lower-than-average streamflow was recorded at all 4 representative gauging stations

- There are four principal streamflow gauging stations operational in the Barossa PWRA, with Penrice recording the lowest streamflow on record for 2019–20
- Long-term data trends show a decline in streamflow (Yaldara data presented below).

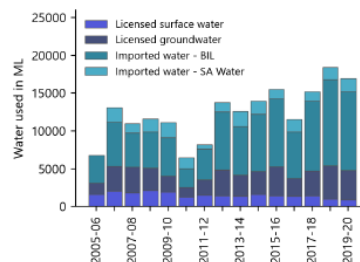


Barossa PWRA 2019–20 surface water and groundwater status overview

Water use

Approximately 67% of water use was from imported sources

- Water use for irrigation, commercial, stock and domestic purposes in the Barossa PWRA comes from a variety of sources. These include pumping and diversions from watercourses and aquifers, interception and storage by farm dams, imported water from the SA Water mains network and water supply from Barossa Infrastructure Ltd via SA Water infrastructure
- Water use in 2019–20 totalled 18 034 ML, which was the second-highest volume in the past 15 years
- Water use was high due to irrigation demand; this is likely to be due to below-average spring and summer rainfall.



Salinity

Surface water salinity in 2019–20 was high but values remained within historical ranges

- Surface water salinity levels in 2019–20 were above-average for the majority of the year, with peak levels at Yaldara reaching 3841 mg/L
- The higher salinity is likely to be the result of below-average rainfall and therefore reduced streamflow. However, values for 2019–20 remained within the historical ranges experienced at each site
- Groundwater salinity is highly variable within the Upper Aquifer and in 2020 ranged between 666 mg/L and 2704 mg/L, with a median of 1519 mg/L
- In 2020, the salinity of the Lower Aquifer ranged between 497 mg/L and 2504 mg/L, with a median of 1284 mg/L
- Groundwater salinity is also highly variable in the fractured rock aquifers – in 2020, salinity ranged between 727 mg/L and 2278 mg/L, with a median of 1140 mg/L

Climate-driven trends in water resources

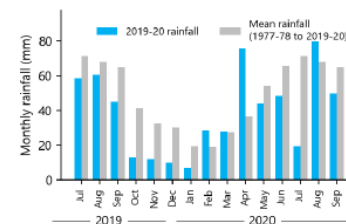
Climate is one of the main drivers of trends in the local water resources. Surface water and groundwater resources in the Barossa PWRA are highly dependent on rainfall.

Below-average winter rainfall results in a reduction in annual streamflow volumes. Below-average summer rainfall can increase the need for irrigation and therefore lead to higher water extraction. This can in turn lead to an increase in salinity. Conversely, increased rainfall results in increased surface water availability, decreased irrigation extractions, with potential decline or stabilisation of salinity.

Below-average rainfall also results in reduced recharge to shallow aquifers. Together with increased water extractions, this can cause groundwater levels to decline even in deeper confined aquifers. Conversely, above-average rainfall can cause increased recharge and lower irrigation extraction, which can cause groundwater levels to rise.

Rainfall below-average for 2019–20

- Rainfall is typically higher over the Tanunda and Jacobs Creek sub-catchments, decreasing to the north-east and south-west
- Rainfall at Tanunda measured 430 mm, which was lower than the average of 530 mm
- Reduced winter and spring rainfall was observed across the PWRA, consistent with observations across other areas in South Australia (data for Tanunda presented below)
- Long-term data at Tanunda indicate a stable trend in rainfall (1977–20) but the last 3 years have been below-average.



More Information

This fact sheet is a high level summary of information provided in the 2019–20 Water Resources Assessment for the Barossa PWRA. Full details of the assessment can be found at: <https://www.waterconnect.sa.gov.au>

Barossa Prescribed Water Resources Area 2019–20 water resources assessment

Department for
October, 2021

DEW Technical

5.2 Upper Aquifer - water levels

During 2019–20, the majority of Upper Aquifer monitoring wells recorded below lowest-on-record (50%) levels when compared to their respective historical levels. Those lowest-on-record levels are primarily located north of Nuriootpa and south of Lyndoch. Wells in the valley, near Tanunda, recovered to levels which were generally below average (Figure 5.1).

The change in water level over the past 20 years (Section 2.3.1) ranged from a decline of 7.12 m (the median change is a decline of 1.14 m). The majority of wells (78%) show a declining trend this period.

Five-year trends in water levels are declining in all wells, with rates of decline ranging from 0.01 m/y (the median rate of decline is 0.38 m/y) (Figure 5.2).

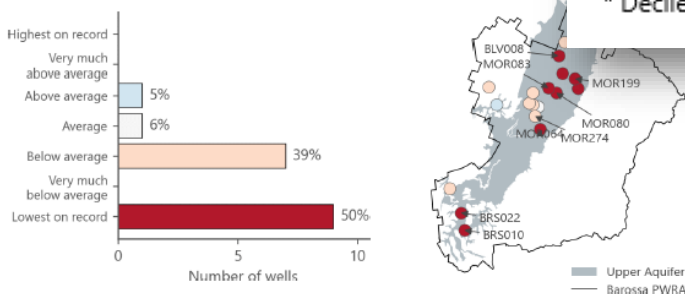


Figure 5.1. 2020 recovered water levels for wells in the Upper Aquifer

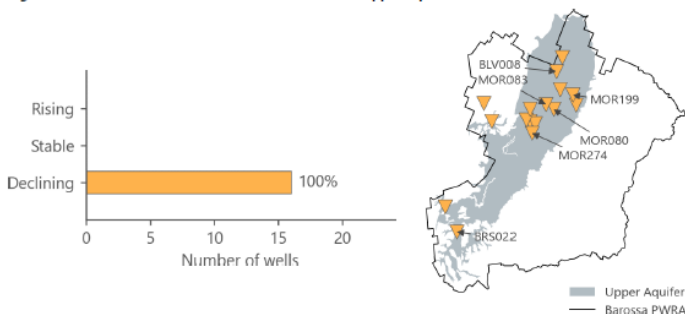


Figure 5.2. 2016–20 trend in recovered water levels for wells in the Upper Aquifer

Table 2.1. Percentile/decile descriptions^{*}

Decile	Percentile	Description	Colour
N/A	100	Highest on record	Dark Blue
10	90 to 100	Very much above average	Medium Blue
8 and 9	70 to 90	Above average	Light Blue
4, 5, 6, and 7	30 to 70	Average	White
2 and 3	10 to 30	Below average	Light Orange
1	0 to 10	Very much below average	Orange
N/A	0	Lowest on record	Dark Red

^{*} Deciles and descriptions as defined by the BoM⁵

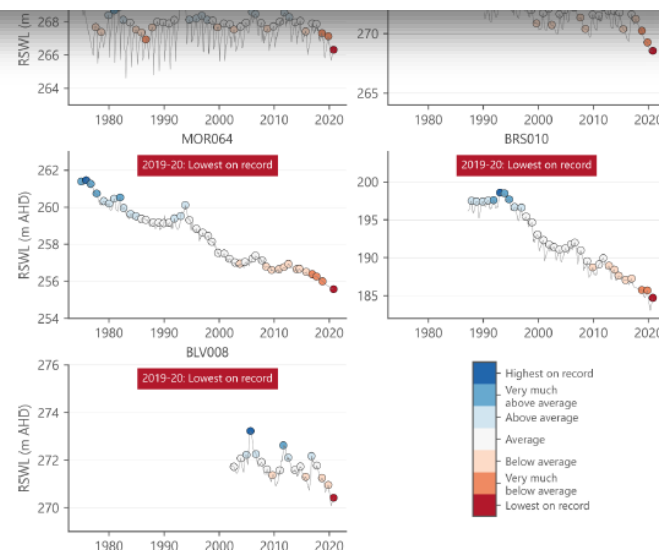
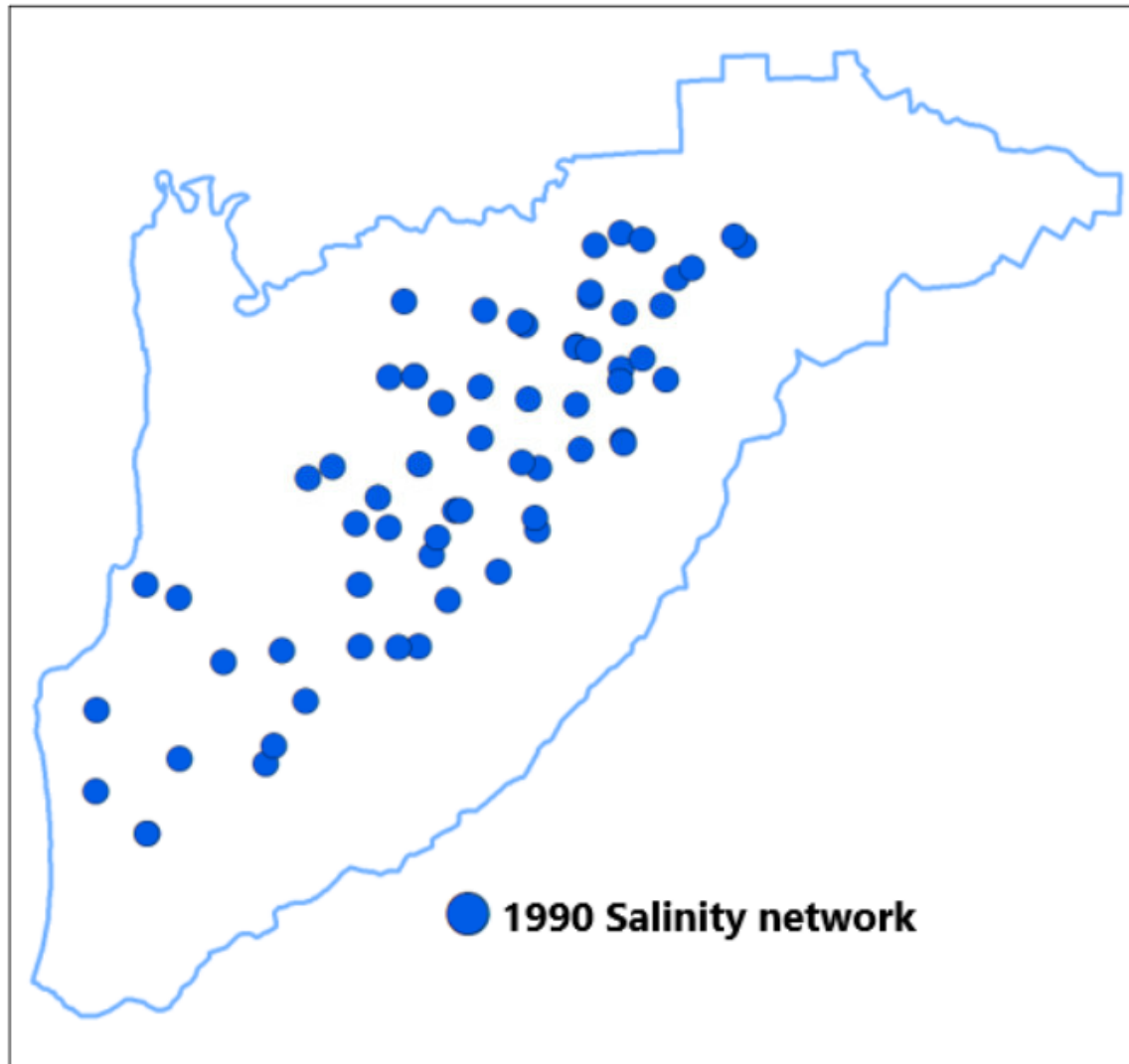


Figure 5.3. Selected Upper Aquifer hydrographs

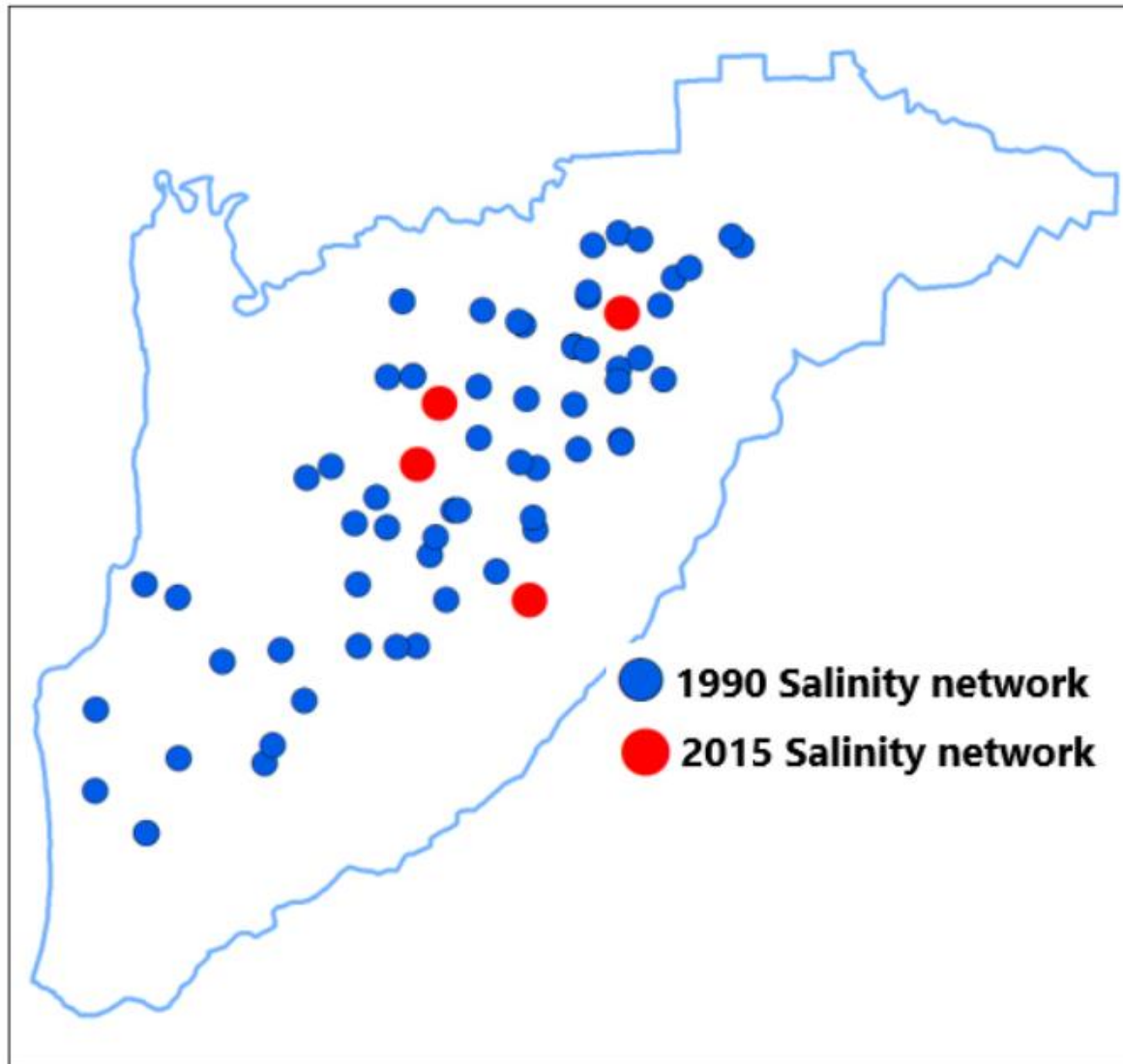
Salinity sampling: citizen science



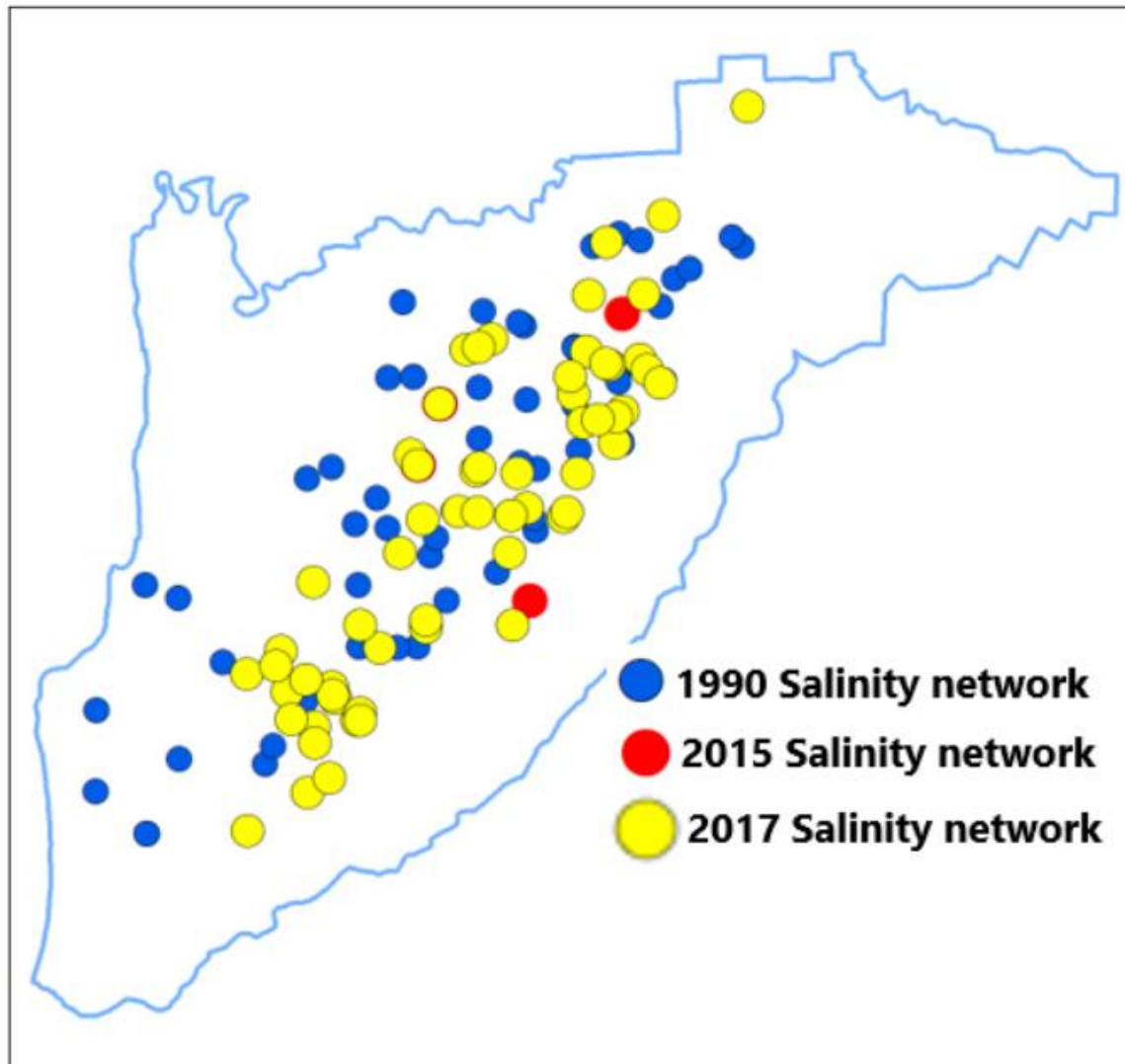
Salinity sampling: citizen science



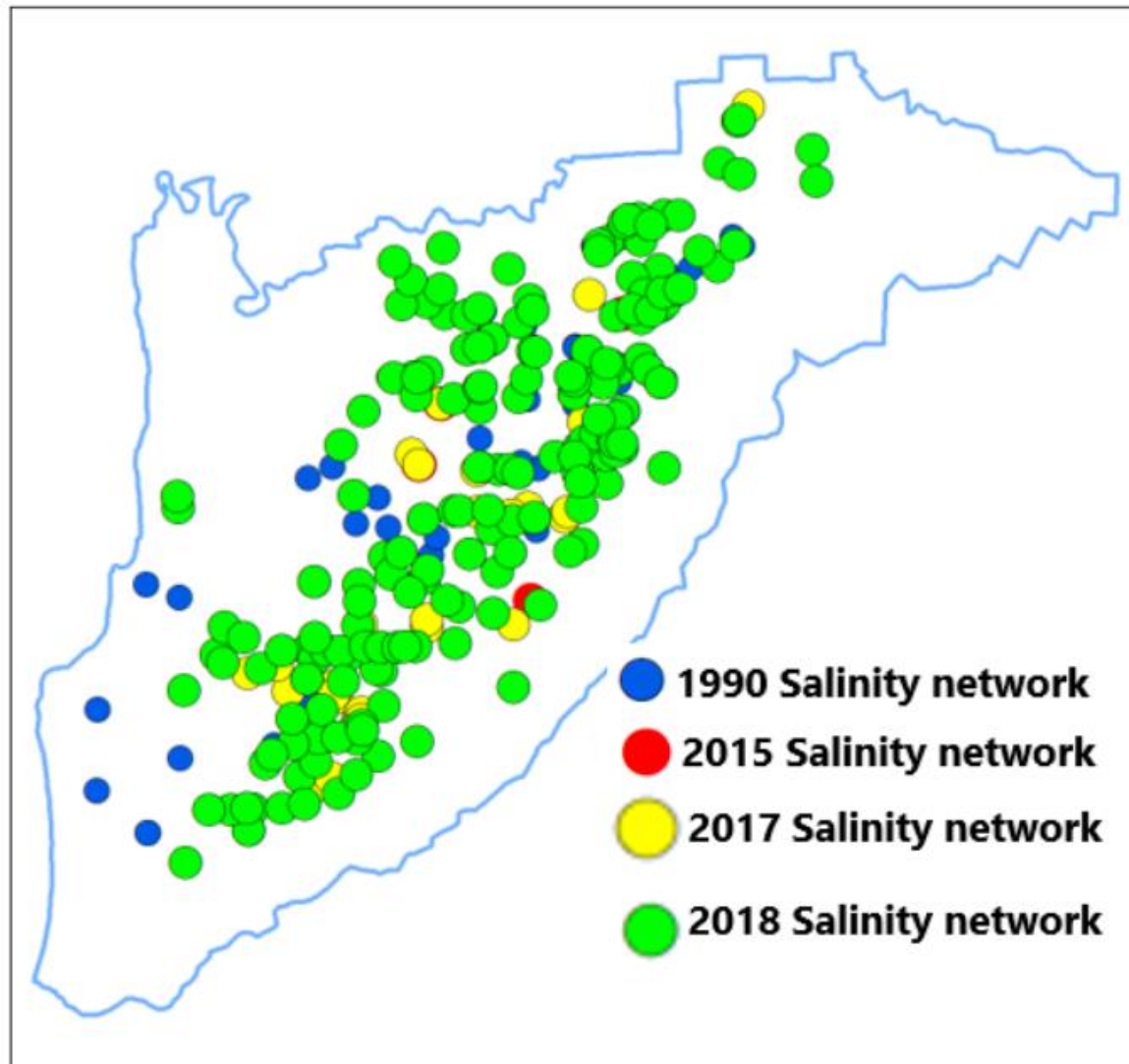
Salinity sampling: citizen science



Salinity sampling: citizen science



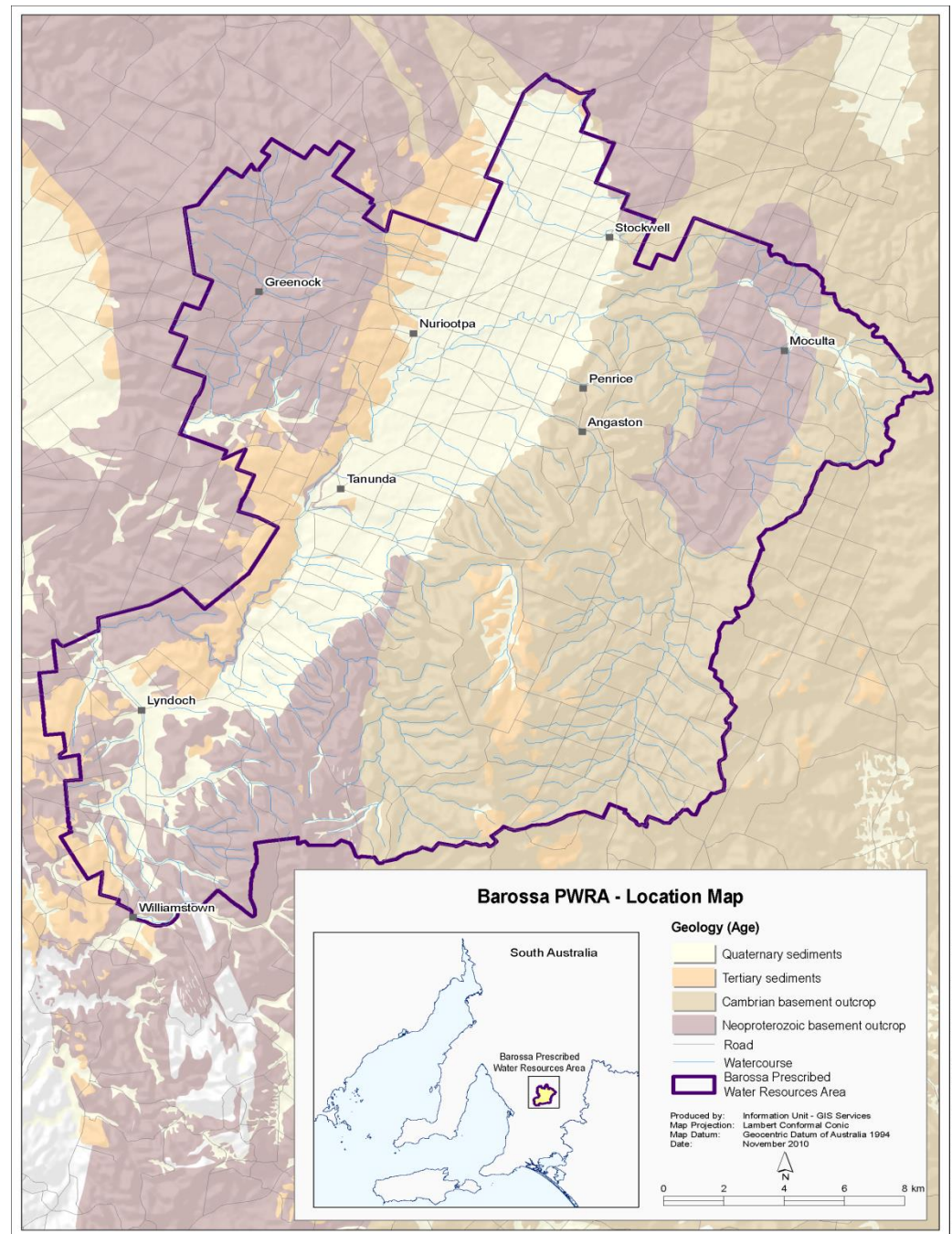
Salinity sampling: citizen science



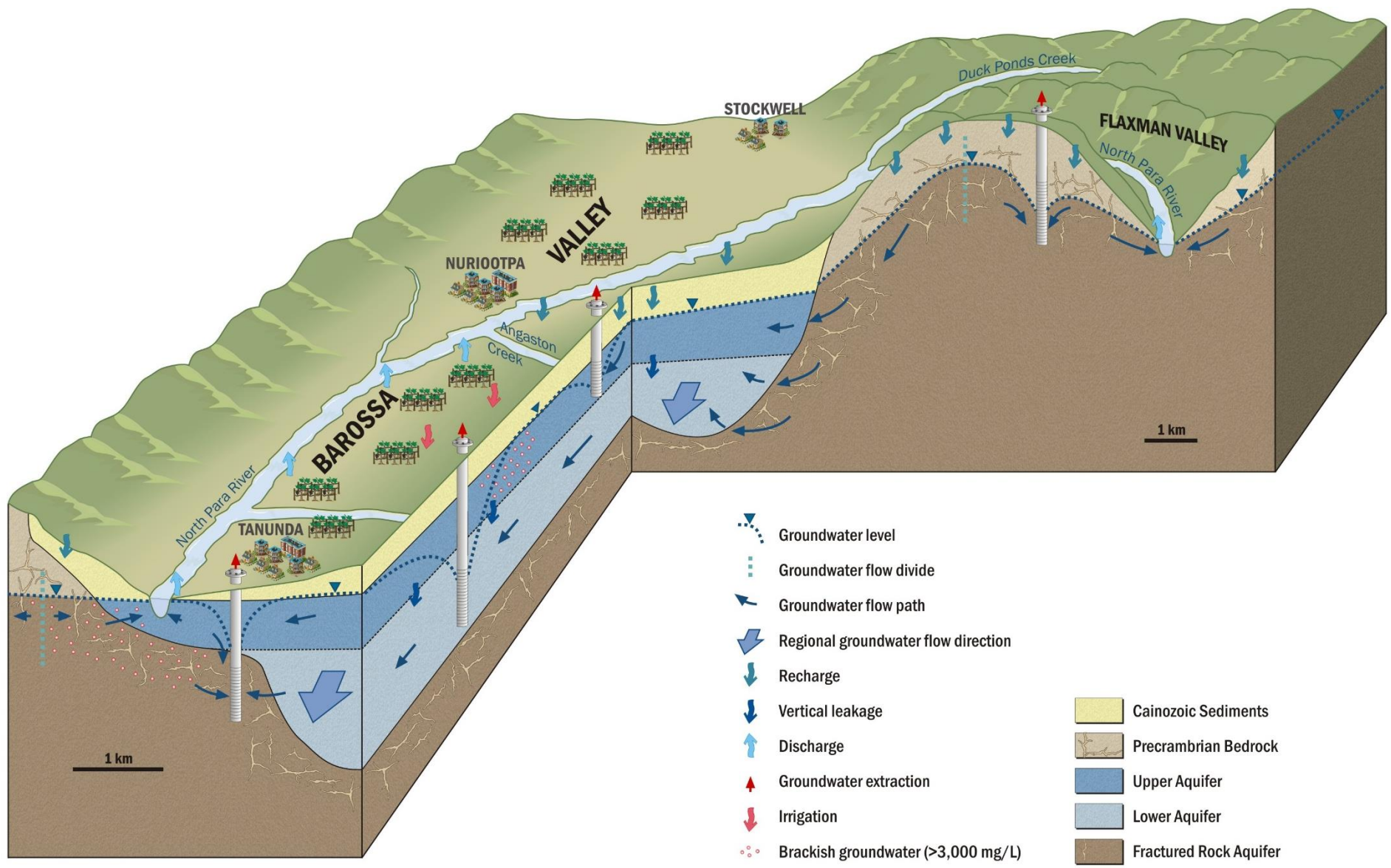
Salinity sampling: citizen science



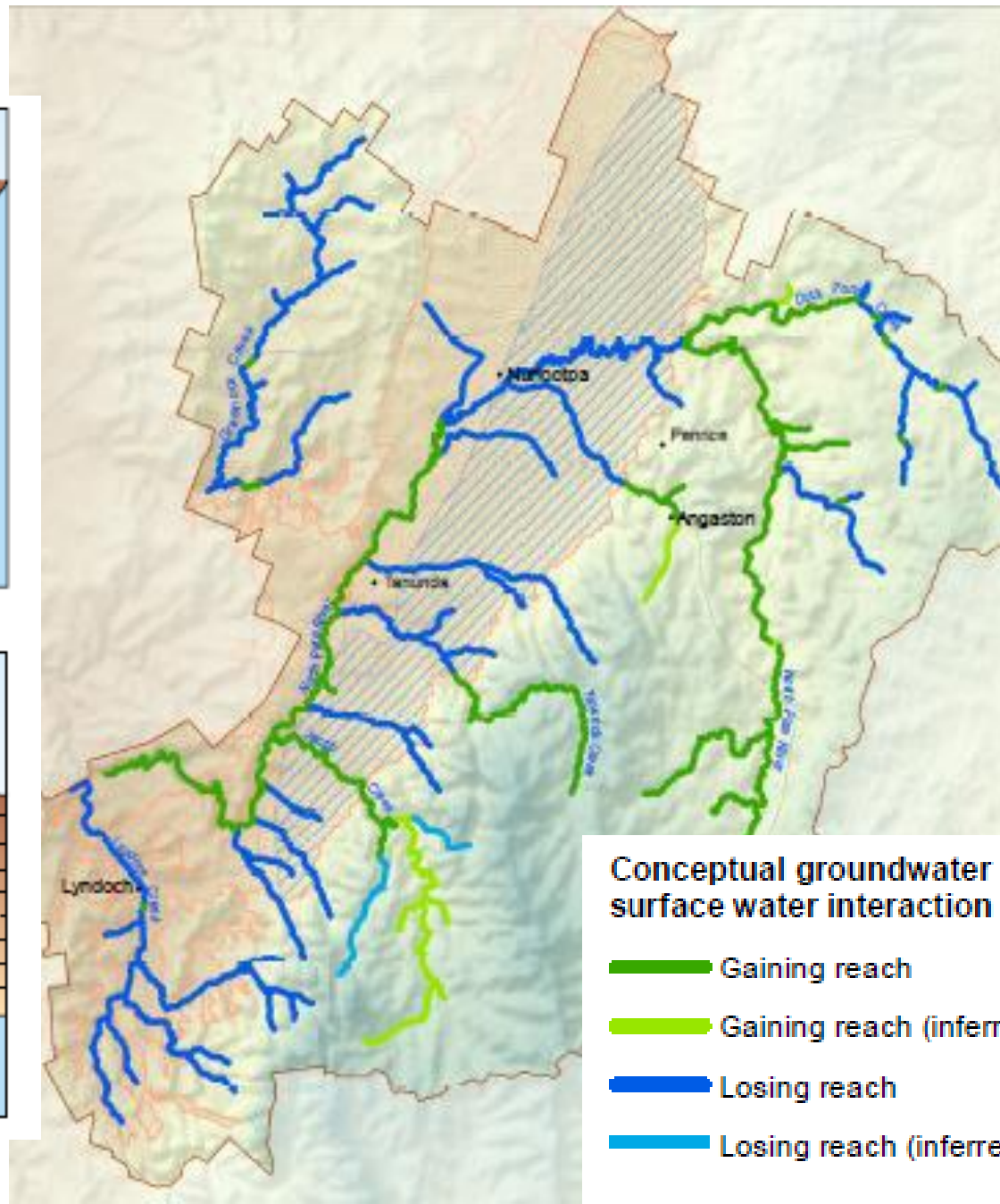
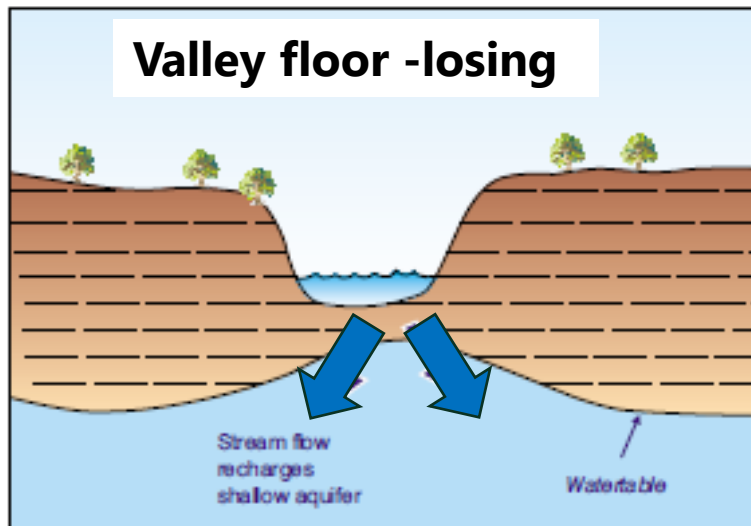
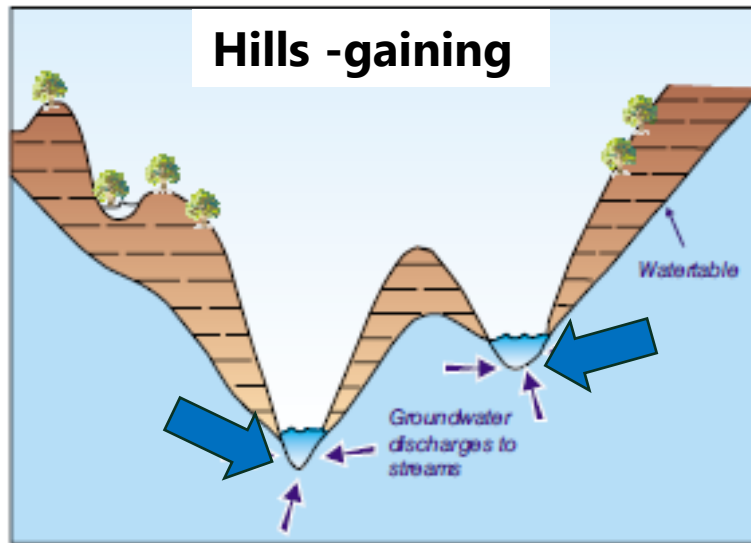
Barossa PWRA



Groundwater processes



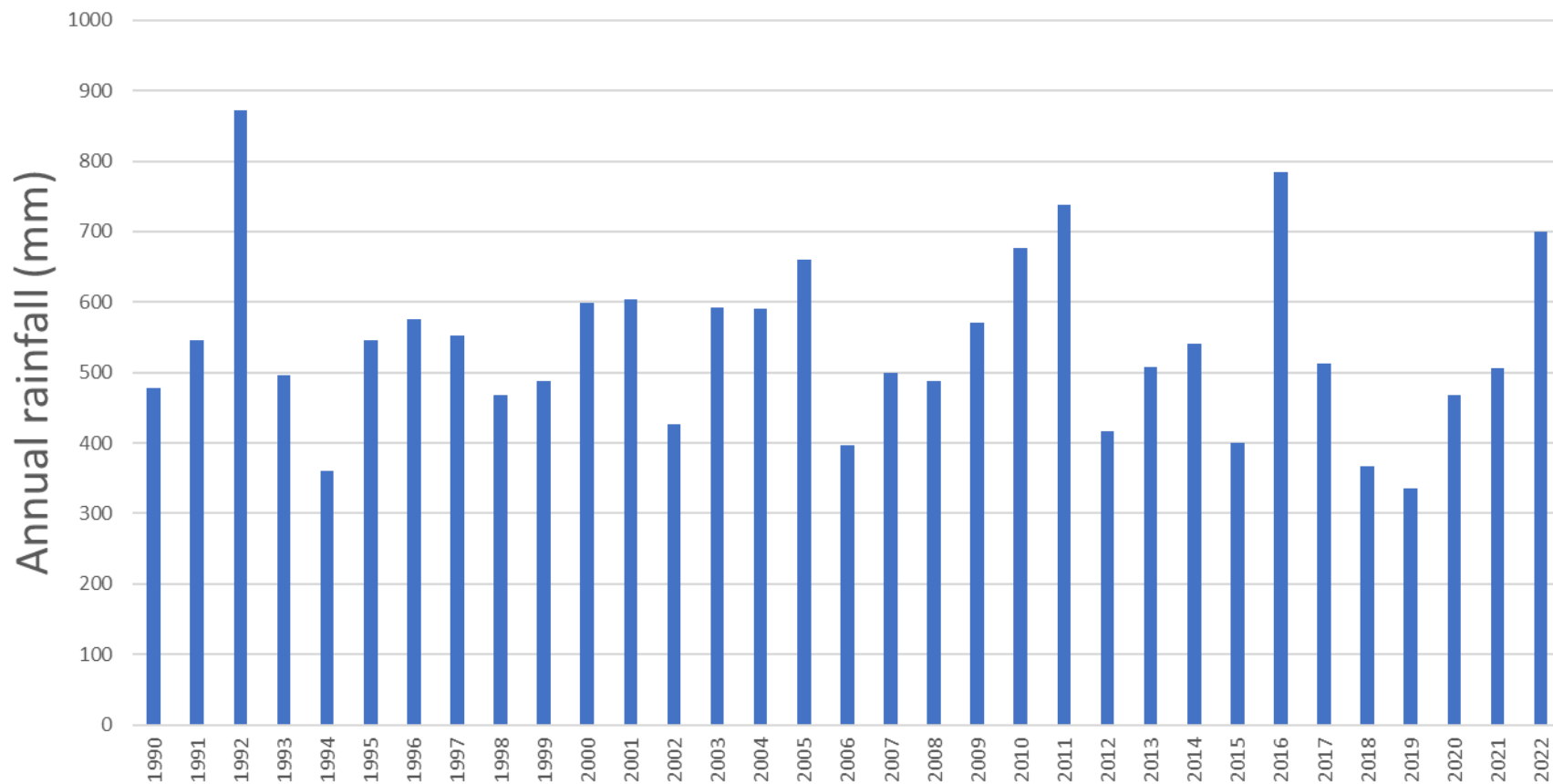
Groundwater/Surface water interaction



Rainfall

Sum of Rainfall amount (millimetres)

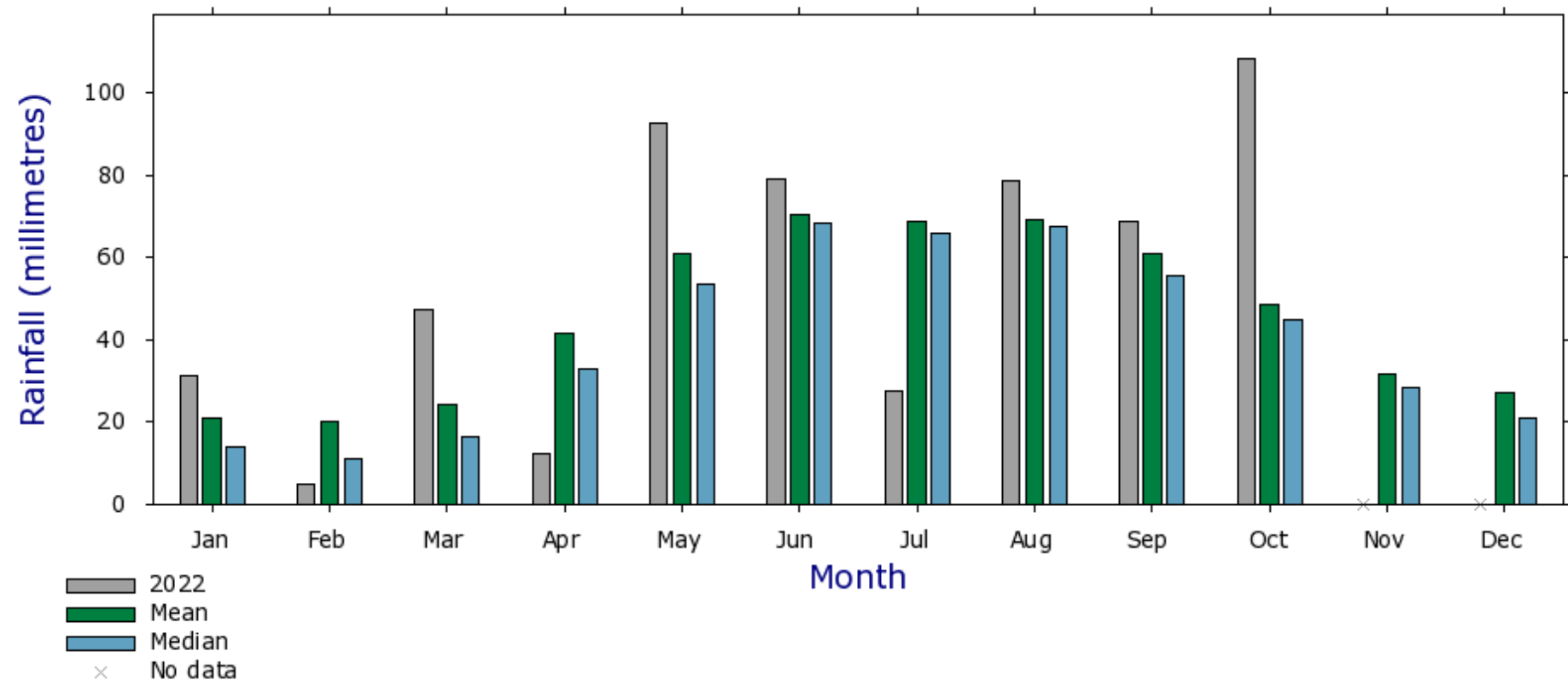
Annual rainfall Tanunda (BoM 023318)



Year ▼

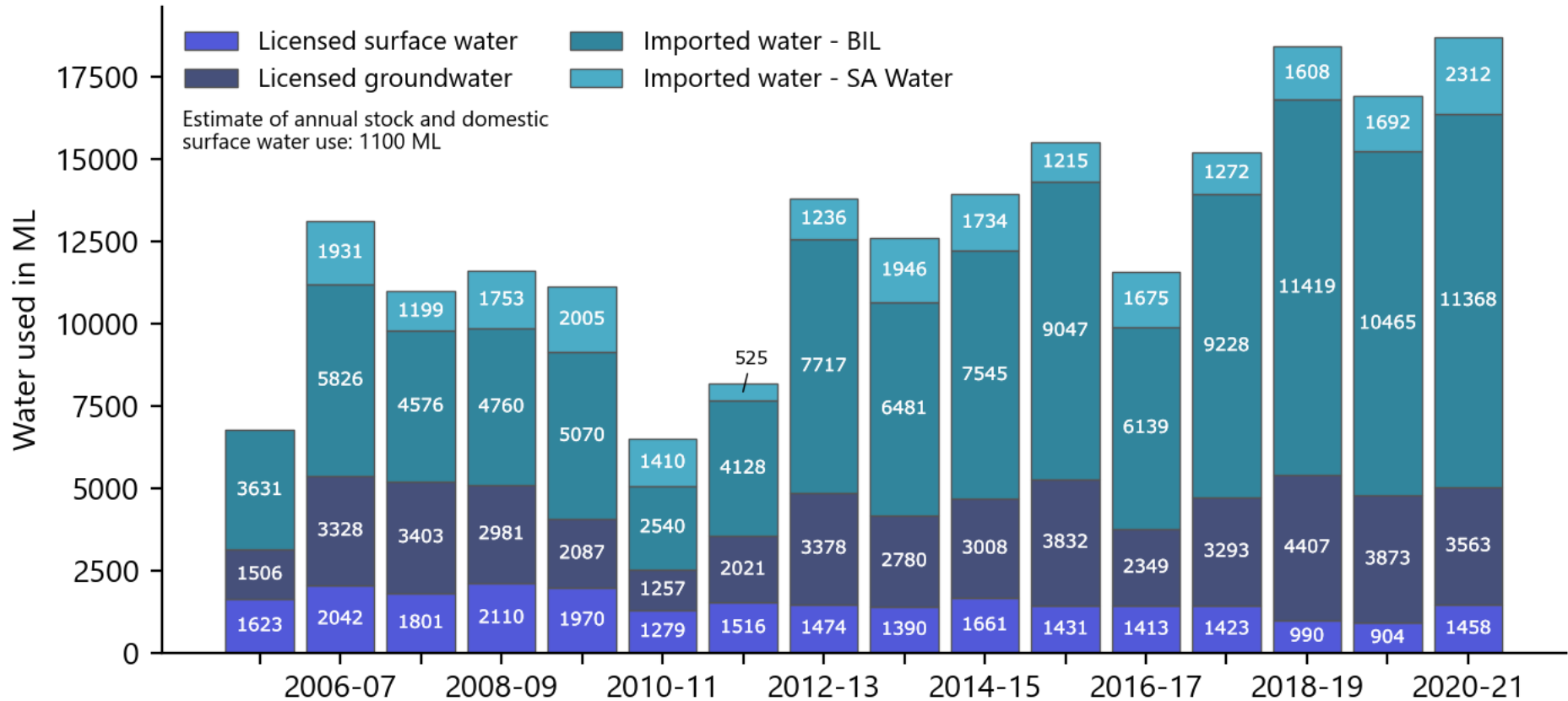
Rainfall

Tanunda (023318) 2022 Rainfall (millimetres)

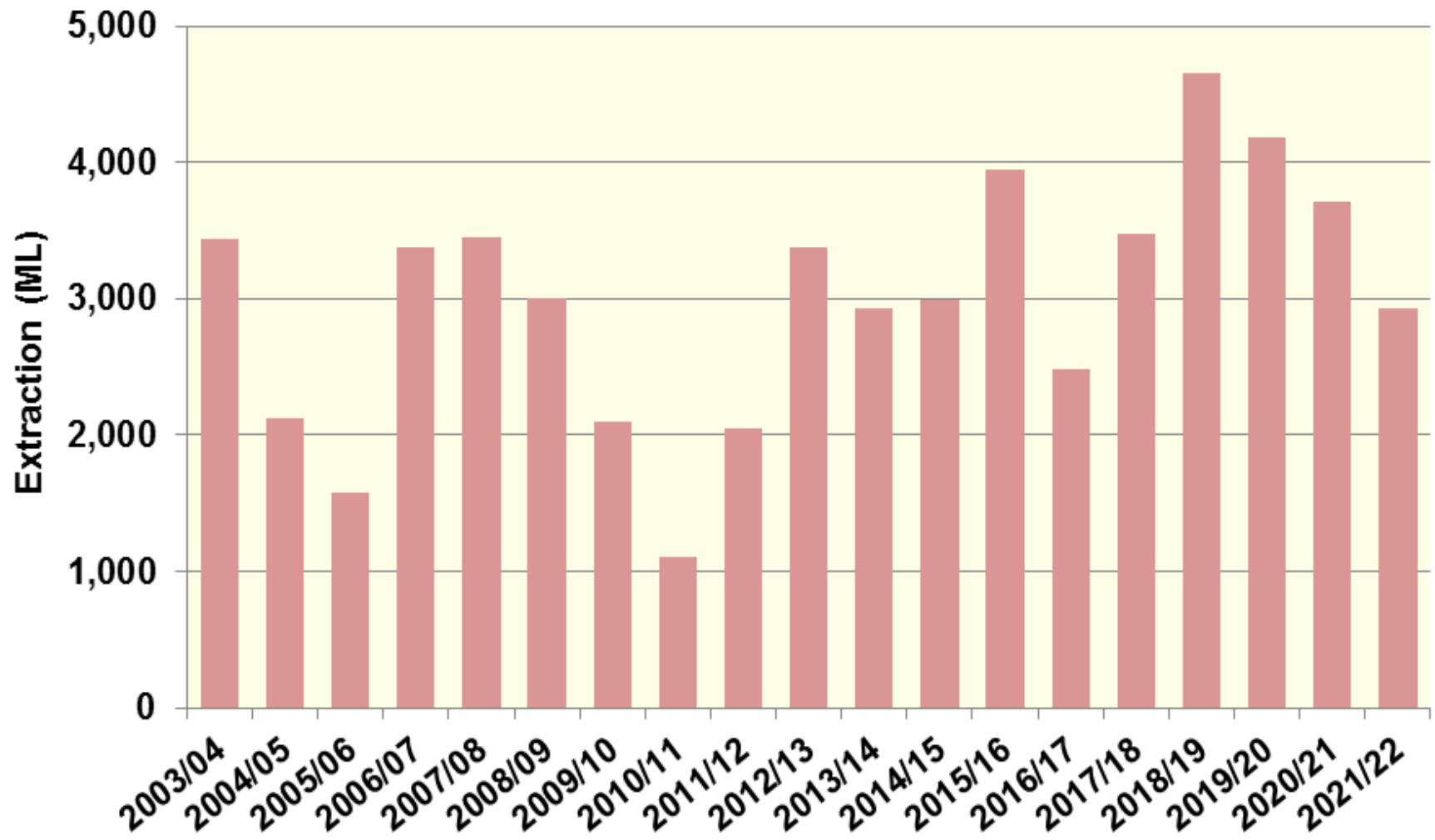


Climate Data Online - Bureau of Meteorology

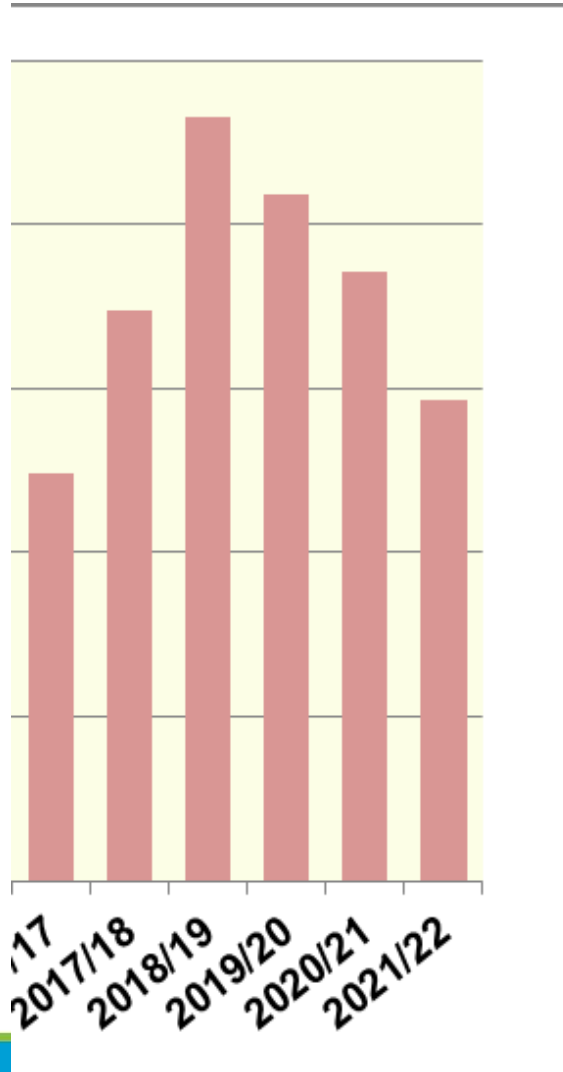
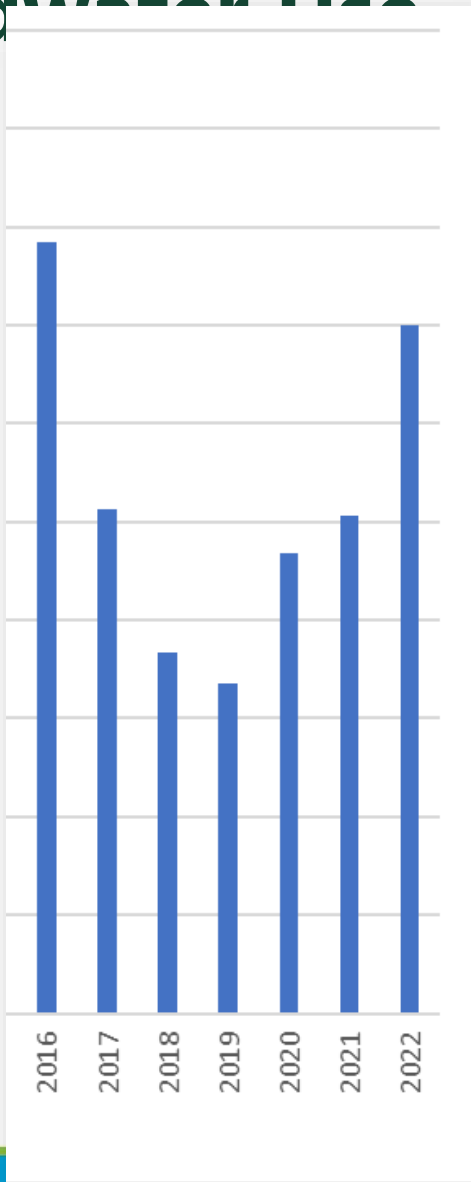
Total Water Use



Groundwater Use



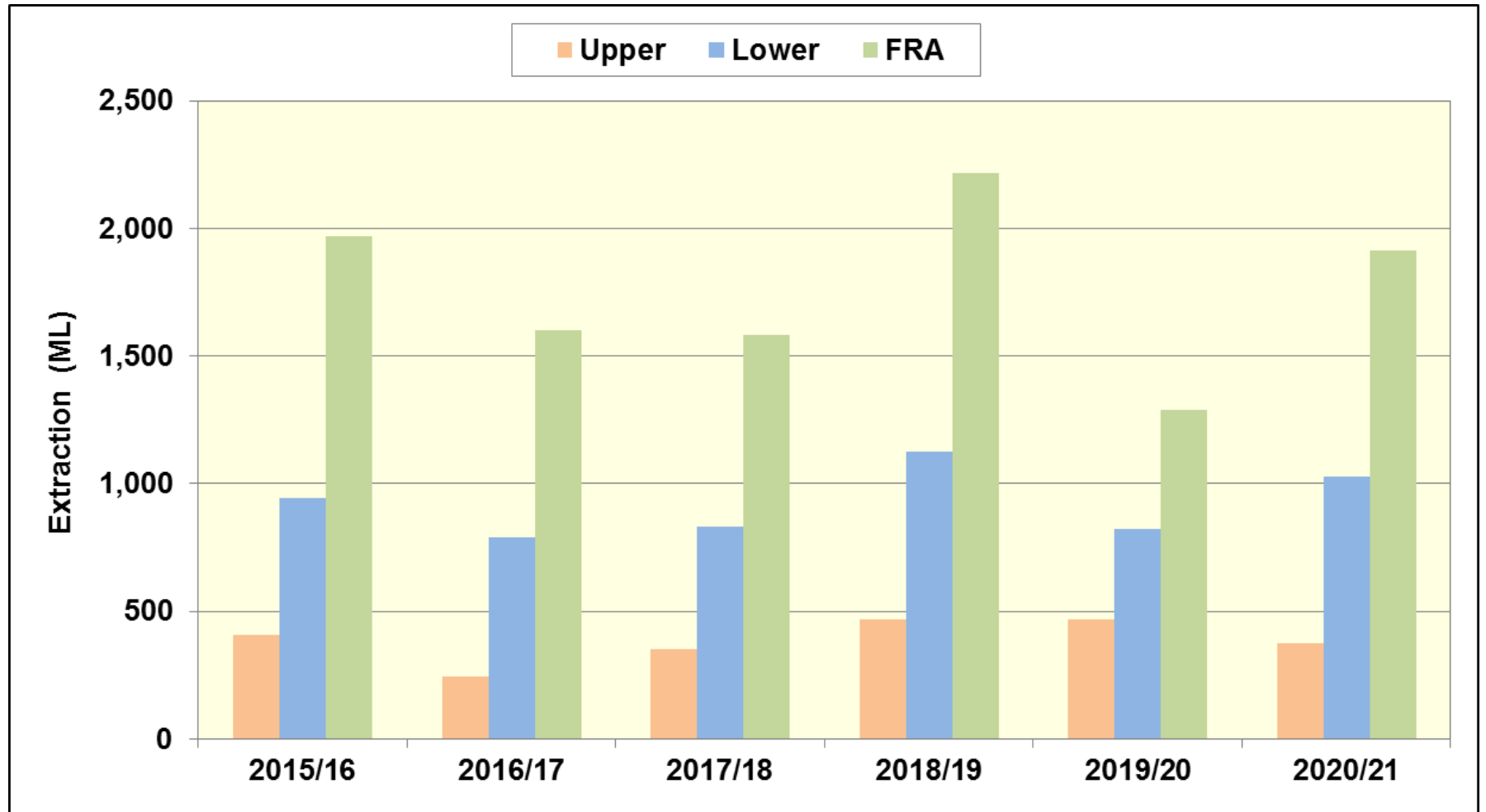
Groundwater Use



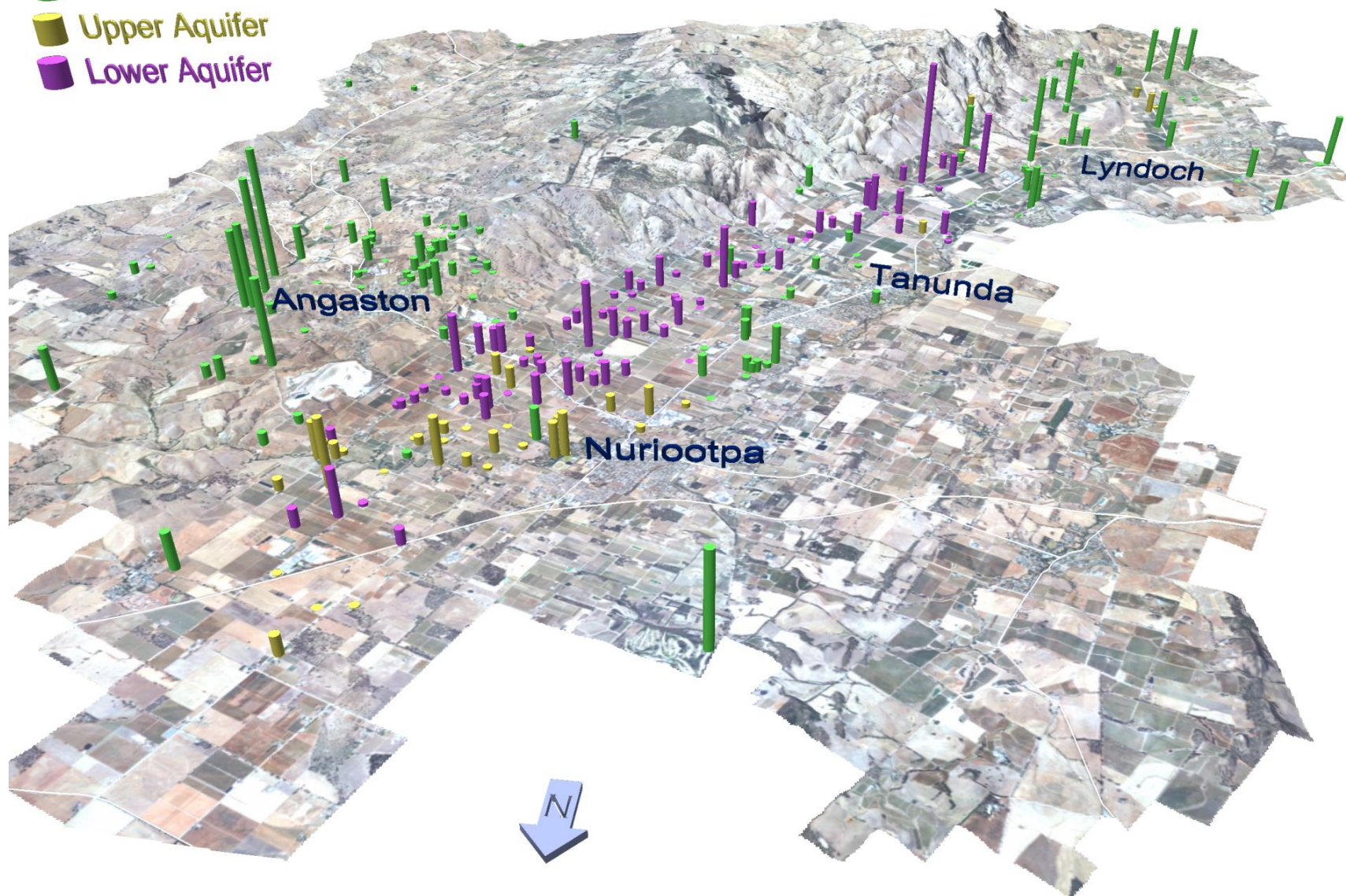
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Groundwater Use by Aquifer



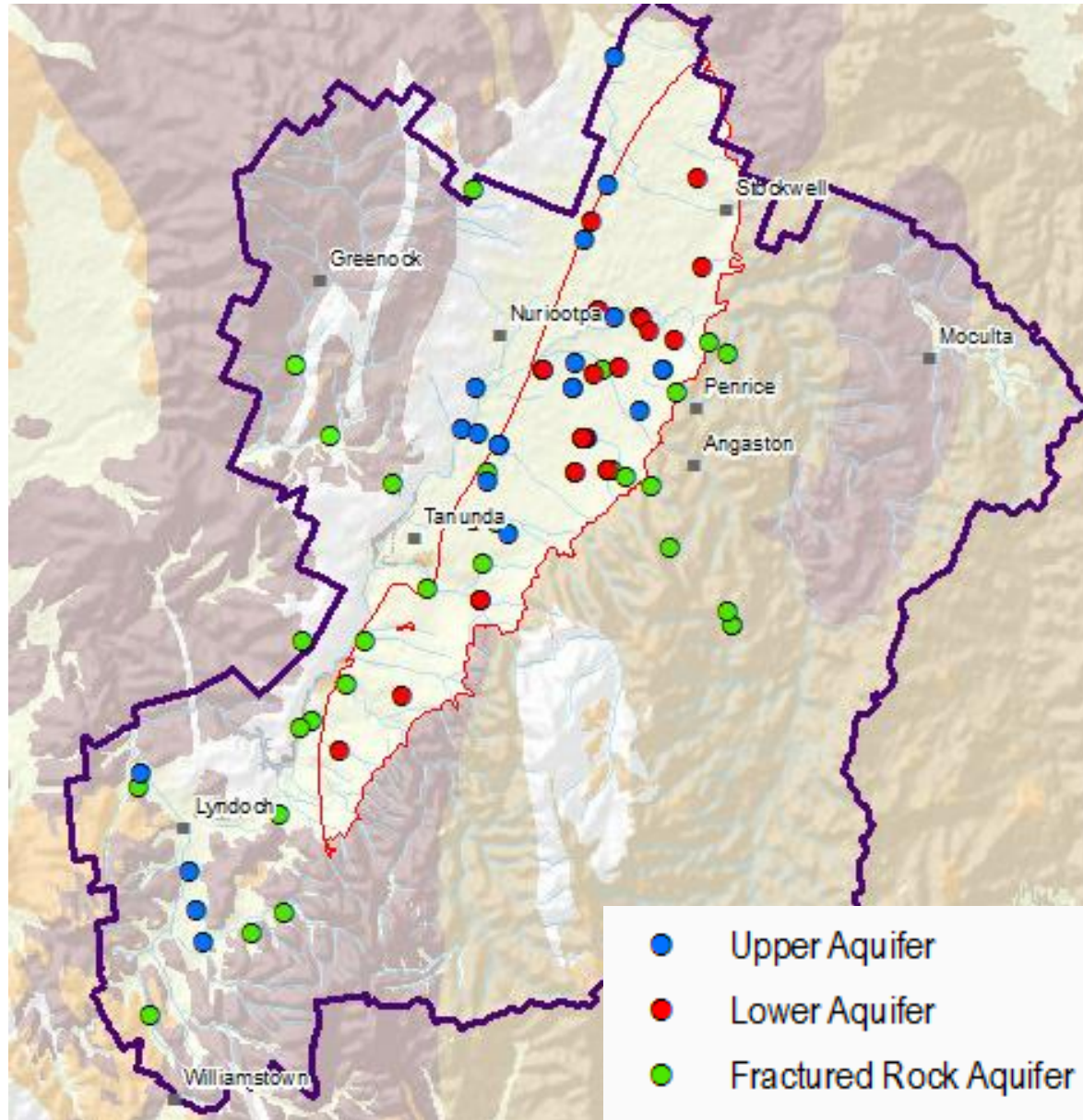
- Fractured Rock
- Upper Aquifer
- Lower Aquifer



Monitoring network – water level

58 wells in total

- 18 in the Upper
- 16 in the Lower
- 24 in the FRA



Upper aquifer: groundwater levels

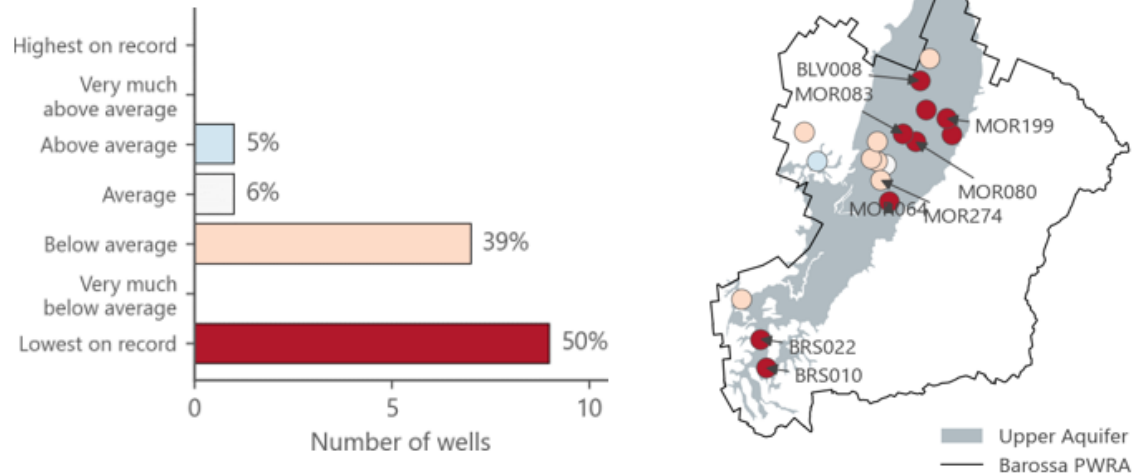


Figure 5.1. 2020 recovered water levels for wells in the Upper Aquifer

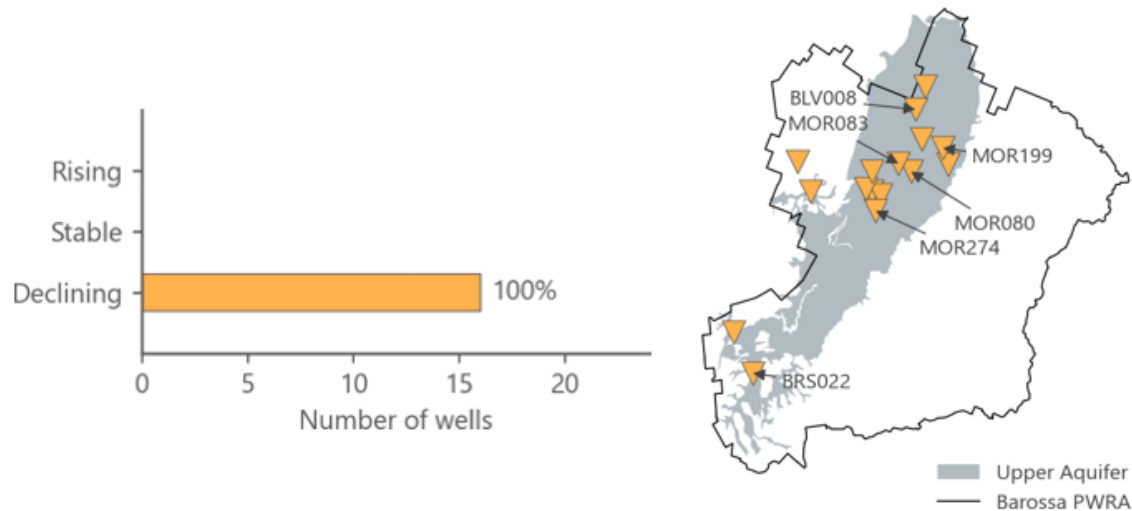
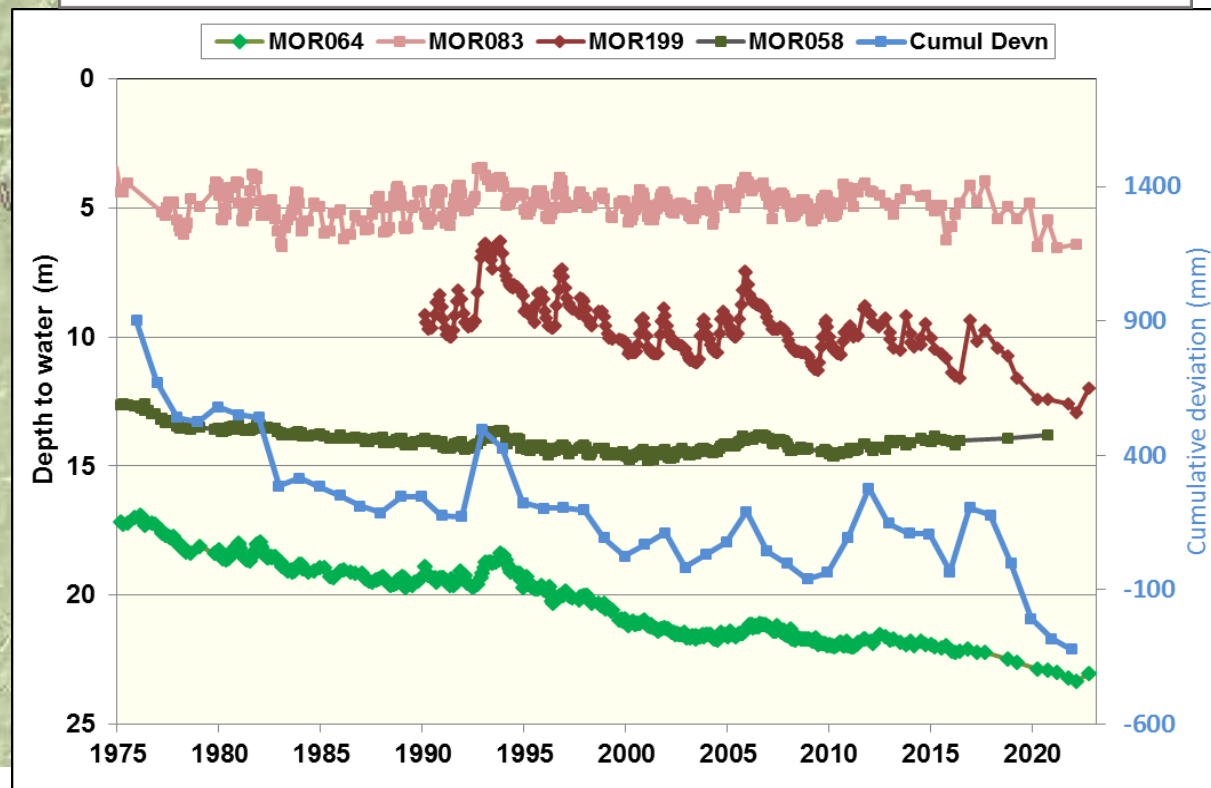
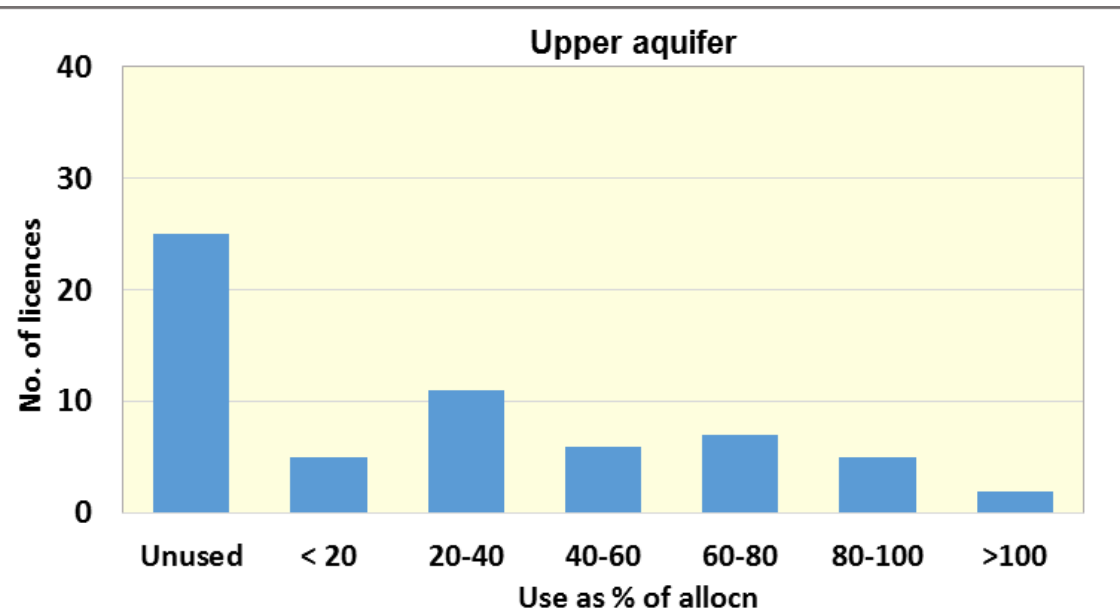
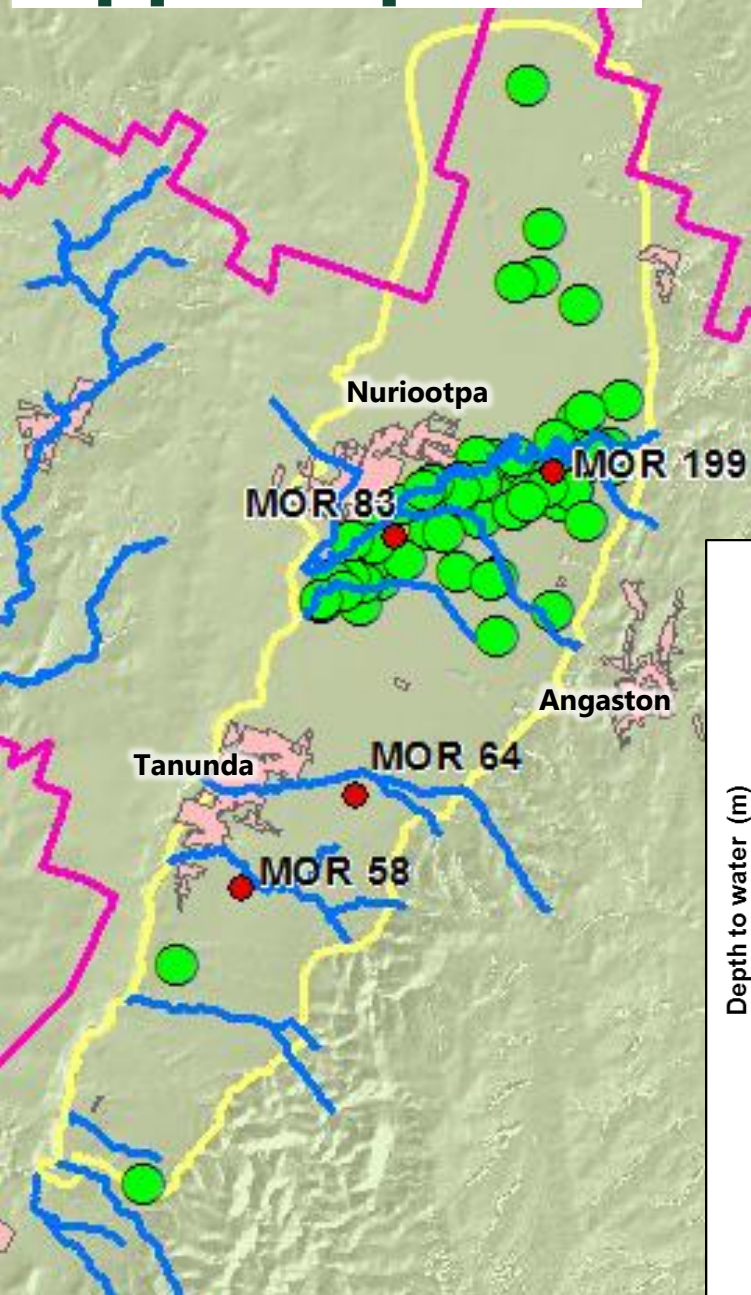


Figure 5.2. 2016–20 trend in recovered water levels for wells in the Upper Aquifer

Upper aquifer



Upper aquifer salinity

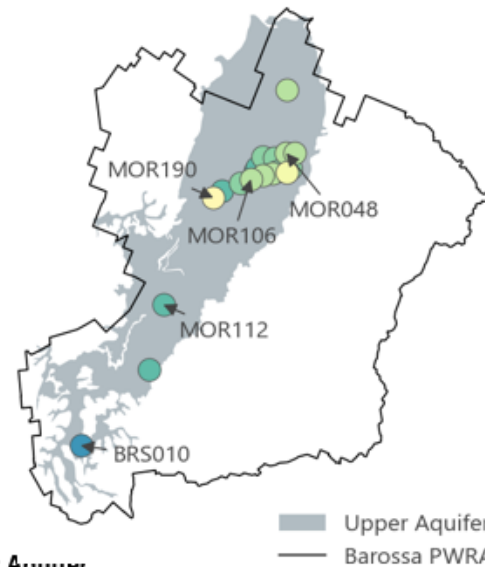
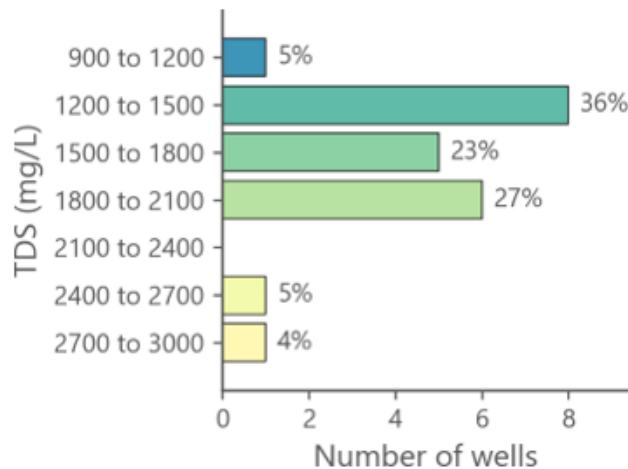


Figure 5.4. 2020 salinity observations from wells in the Upper Aquifer

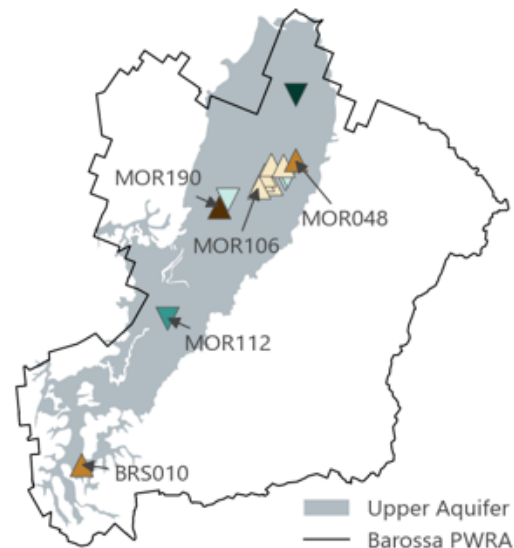
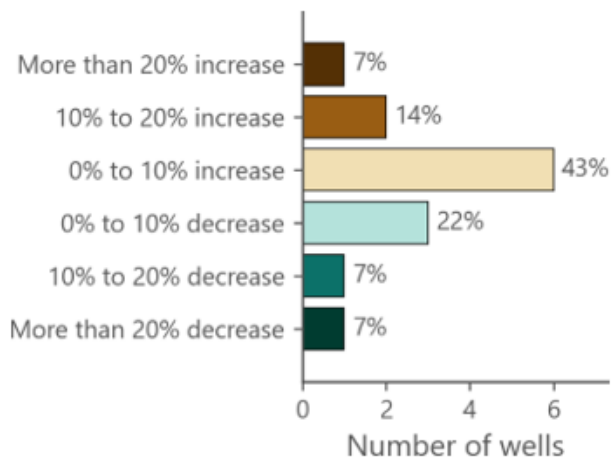
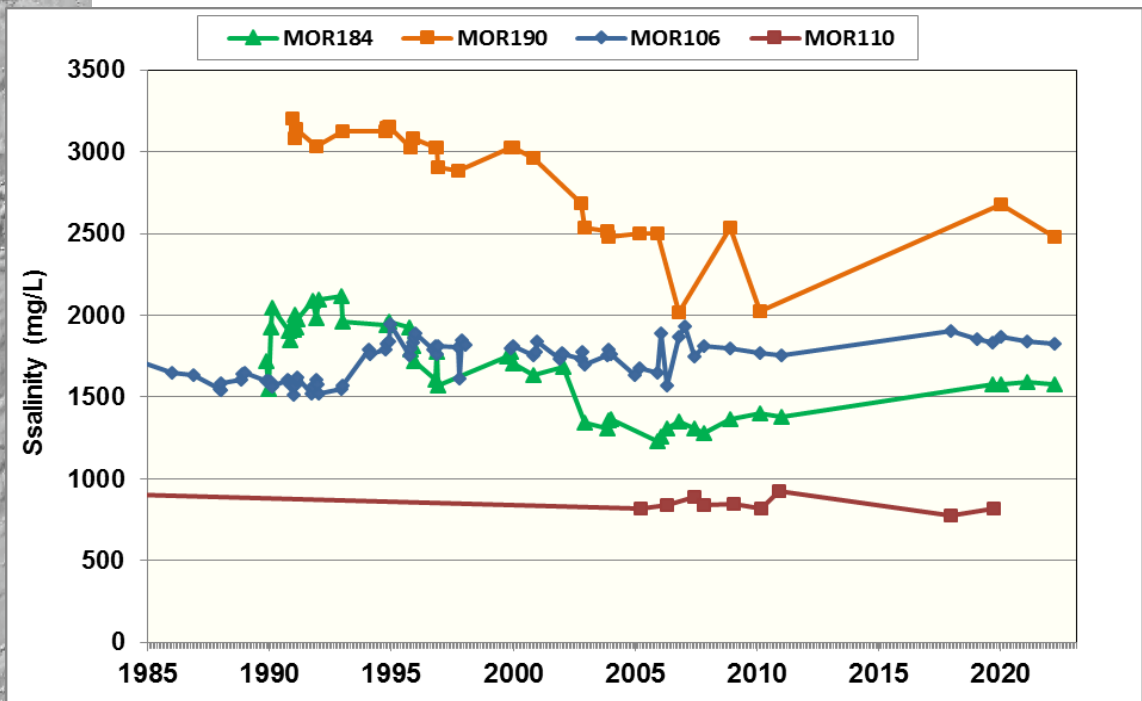
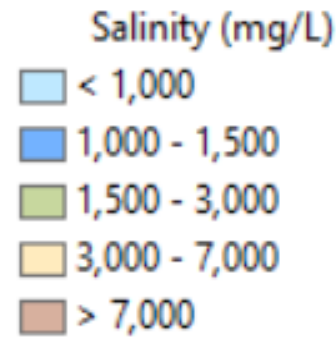
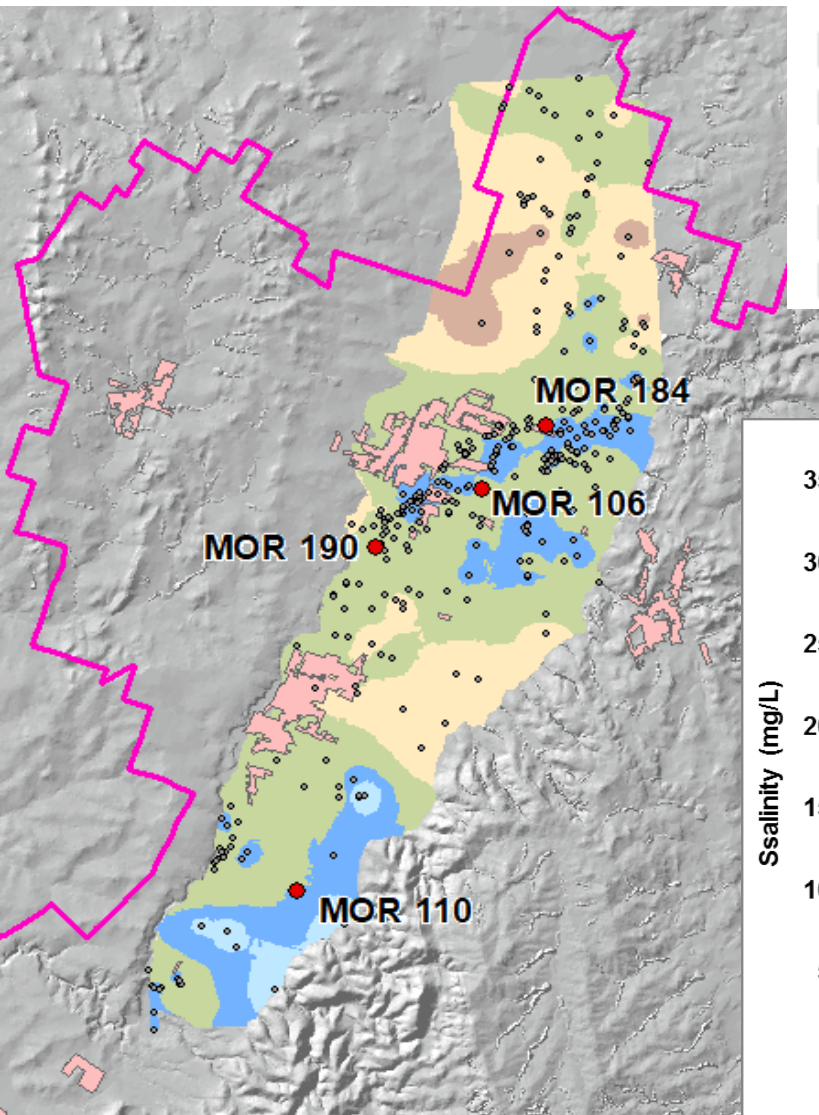


Figure 5.5. Salinity trend in the 15 years to 2020 in the Upper Aquifer

Upper aquifer salinity



Lower aquifer: groundwater levels

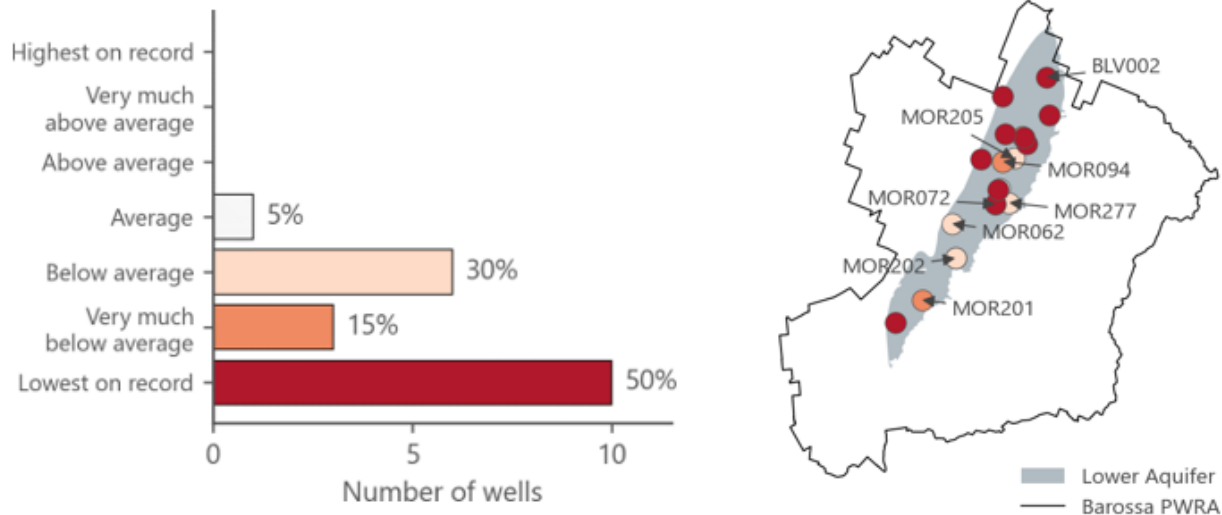


Figure 5.7. 2020 recovered water levels for wells in the Lower Aquifer

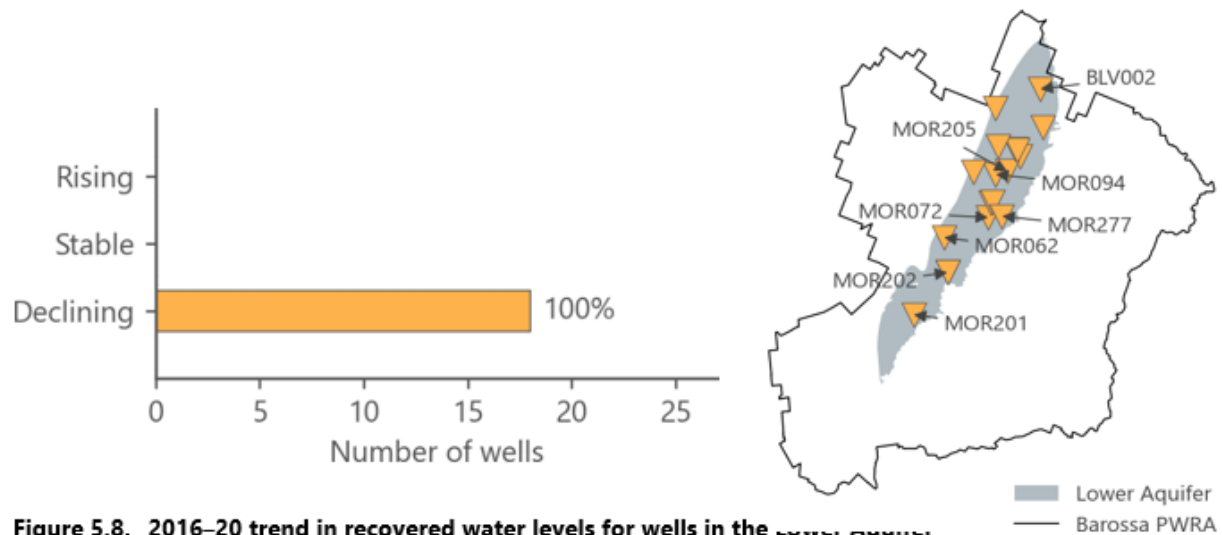
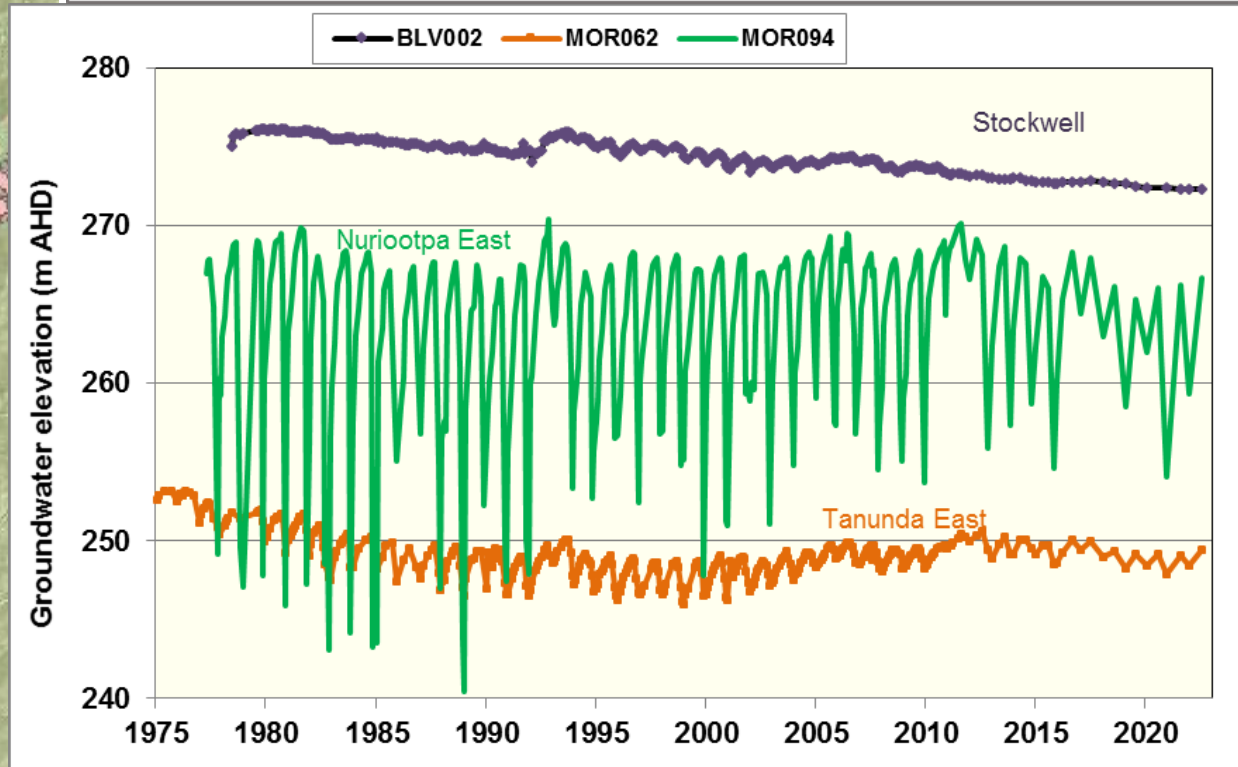
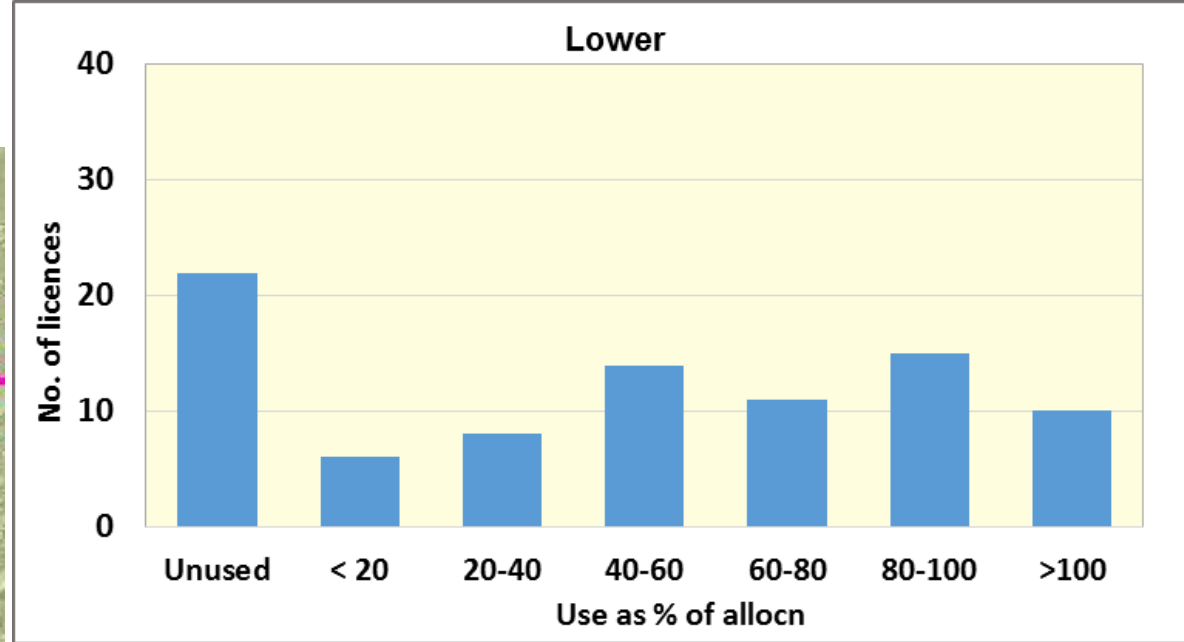
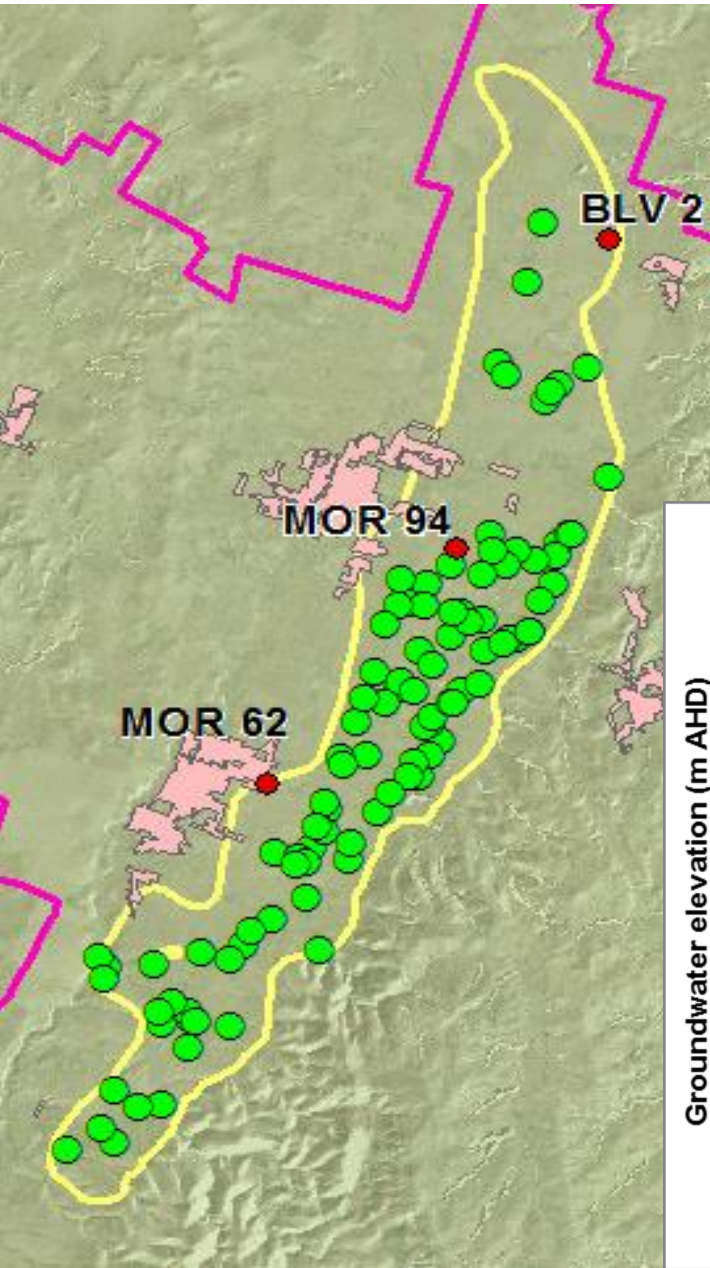


Figure 5.8. 2016–20 trend in recovered water levels for wells in the Lower Aquifer

Lower aquifer



Lower aquifer: salinity

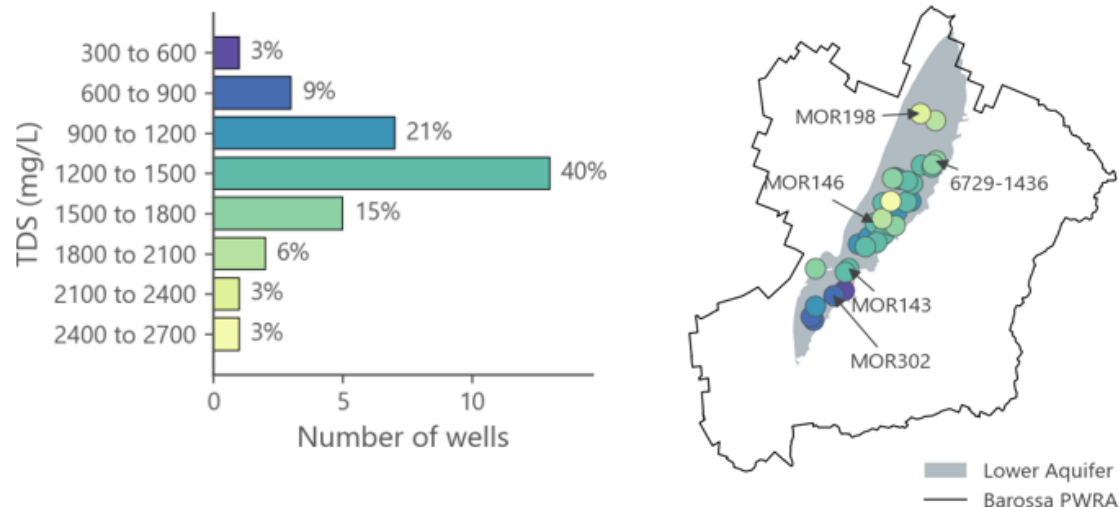


Figure 5.10. 2020 salinity observations in the Lower Aquifer

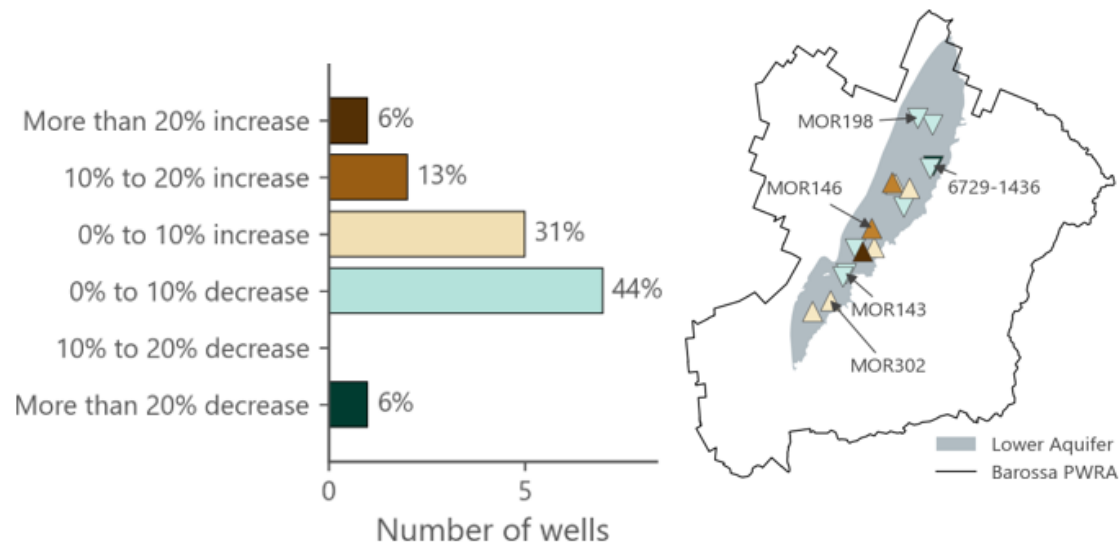
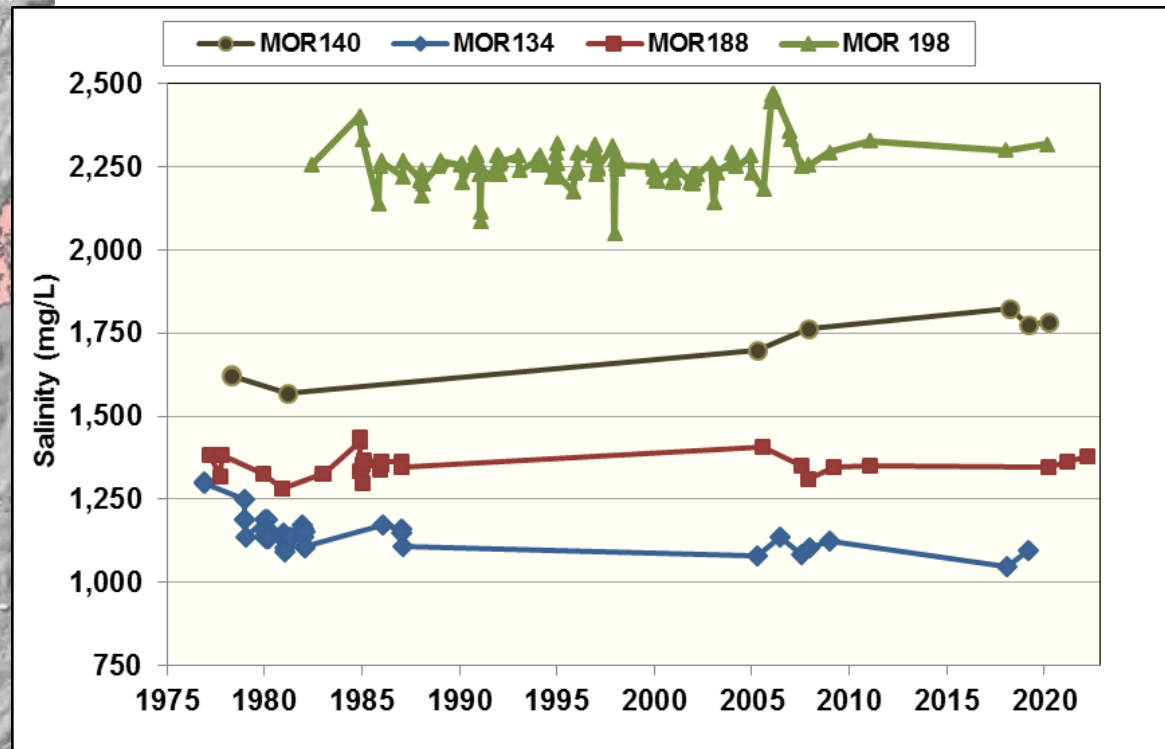
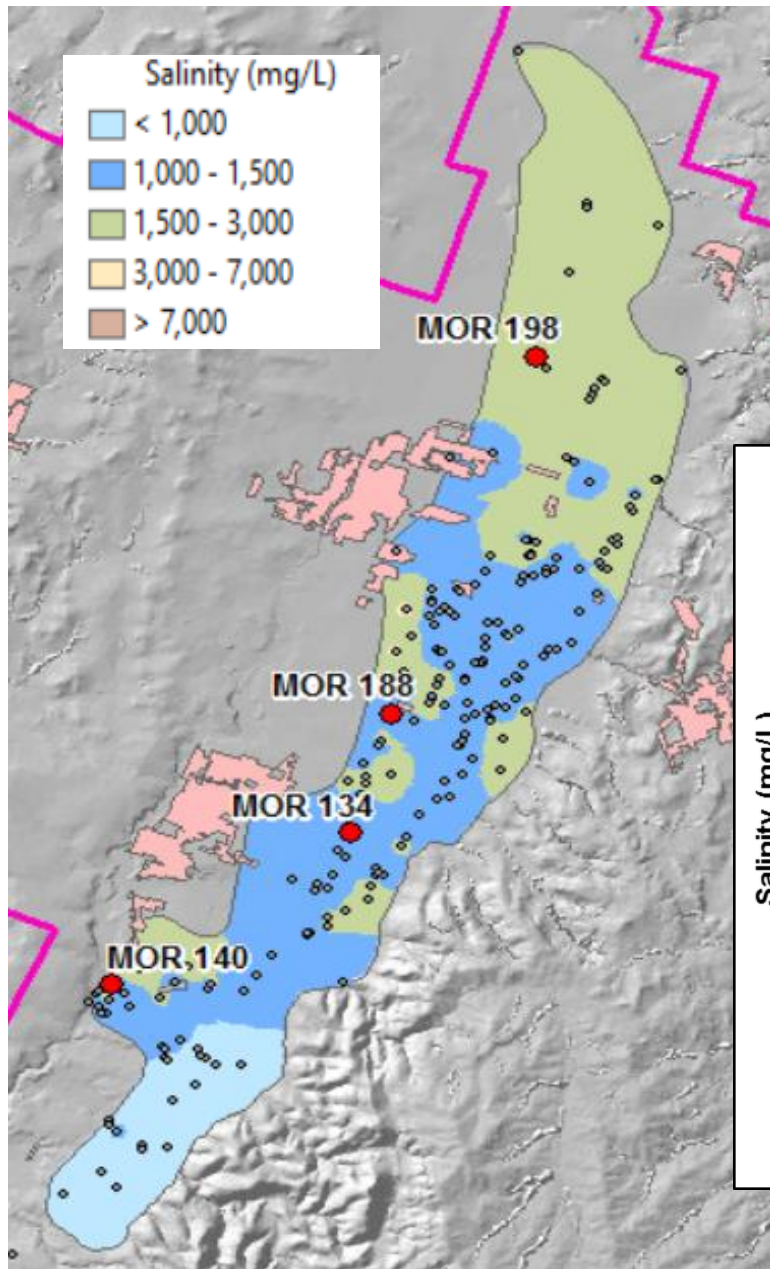


Figure 5.11. Salinity trend in the 15 years to 2020 in the Lower Aquifer

Lower aquifer salinity



Fractured rock aquifer: GW levels

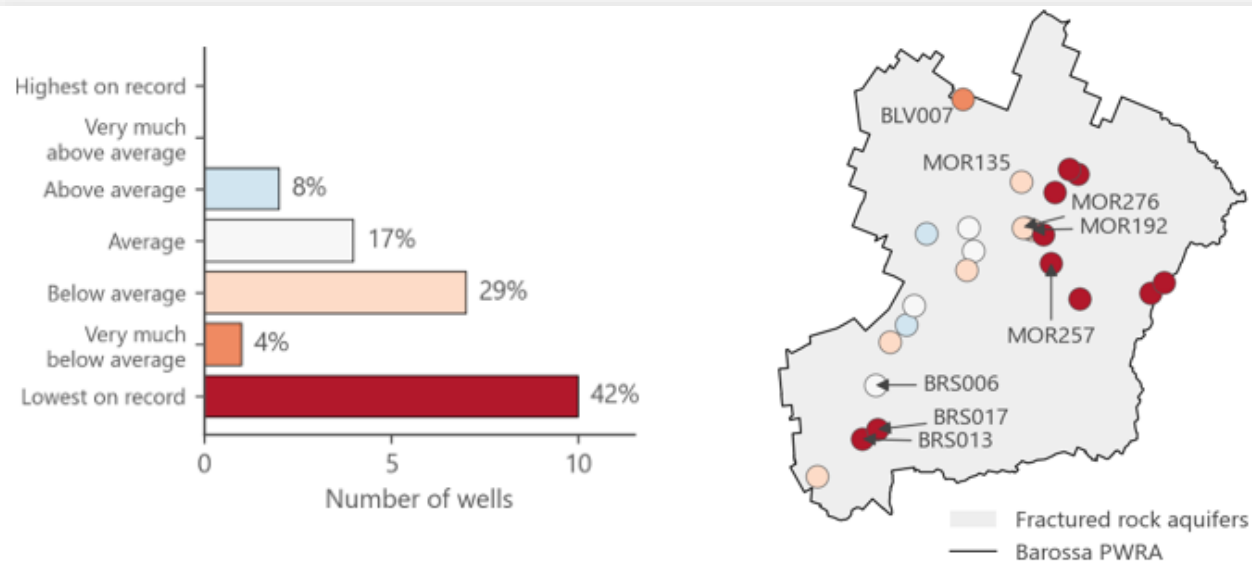


Figure 5.13. 2020 recovered water levels for fractured rock aquifers

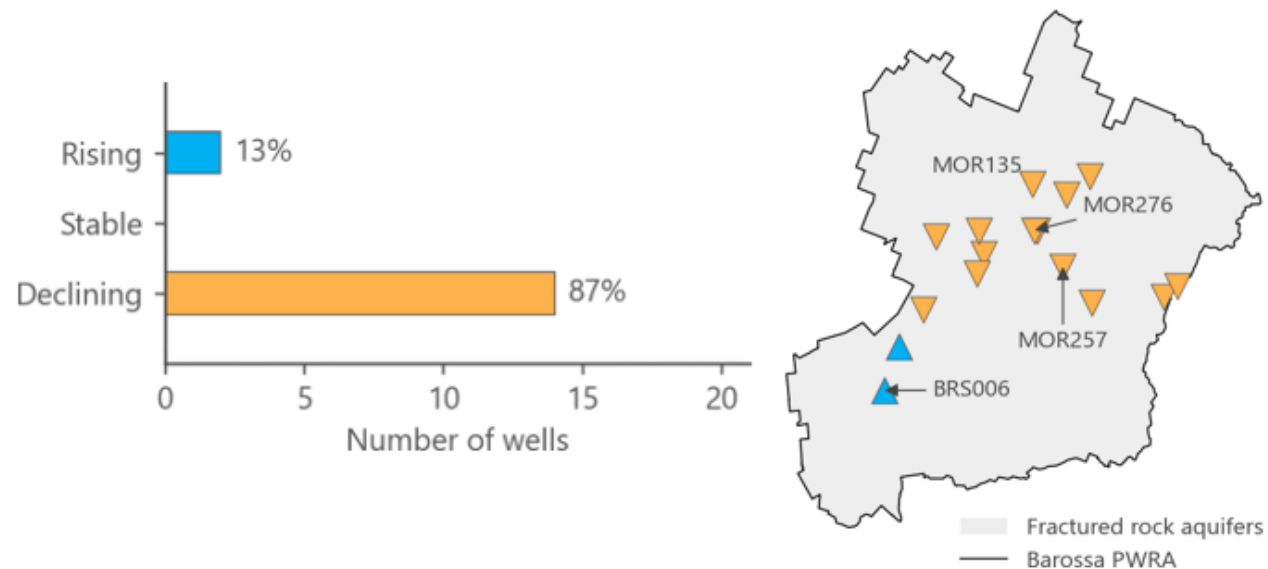
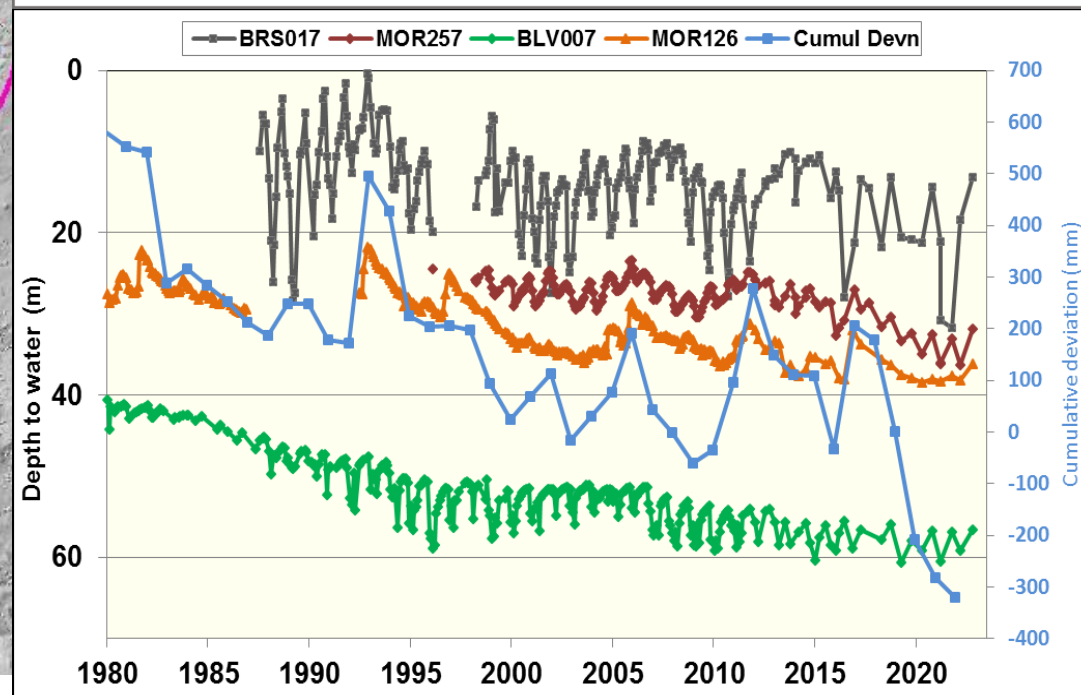
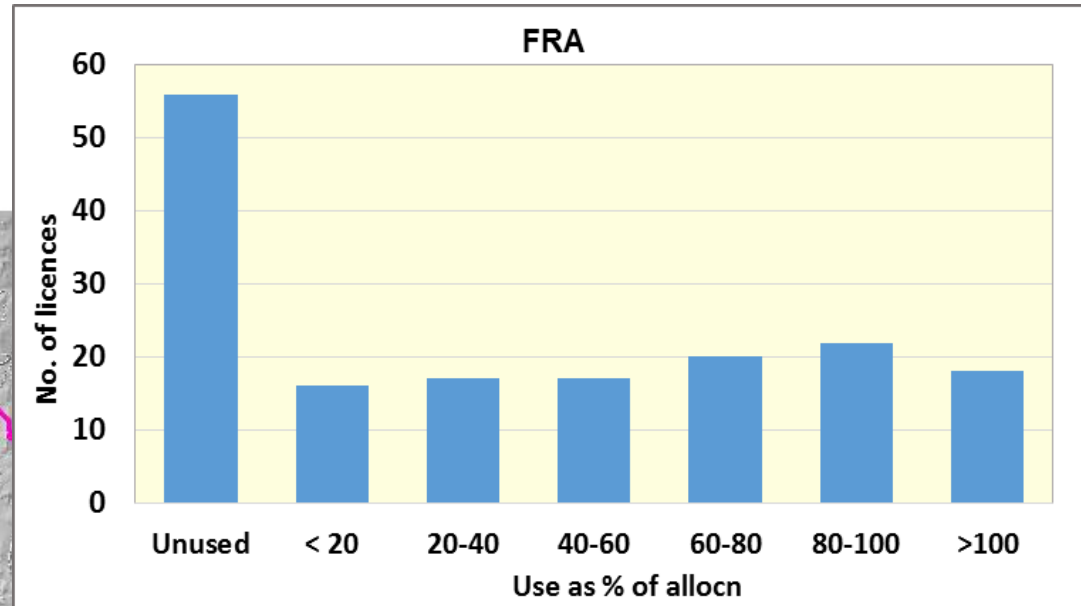
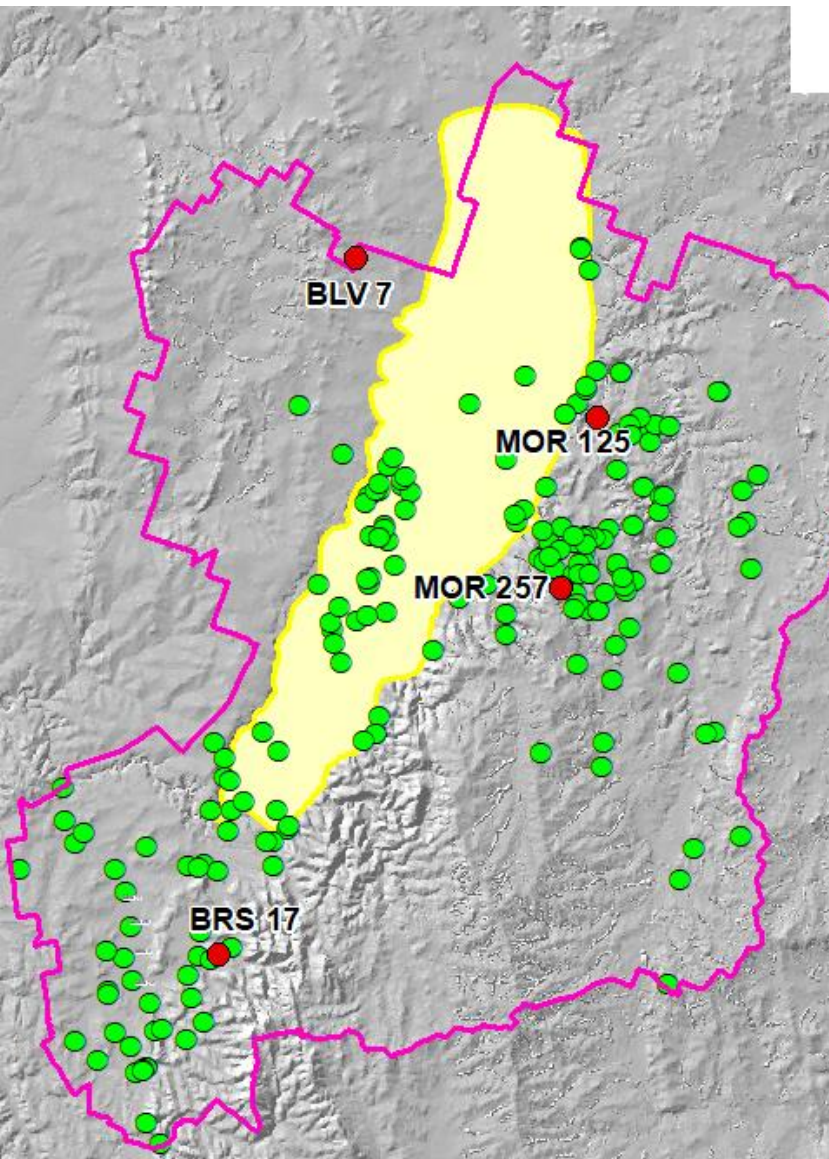


Figure 5.14. 2016–20 trend in recovered water levels for wells in fractured rock aquifers

Fractured rock aquifer



FRA: salinity

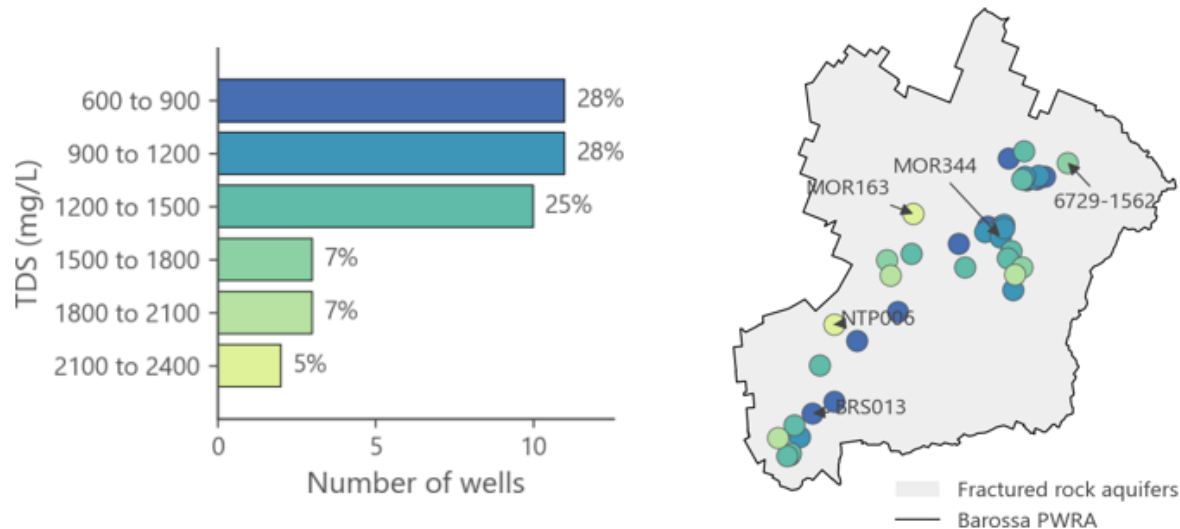


Figure 5.16. 2020 salinity observations in fractured rock aquifers

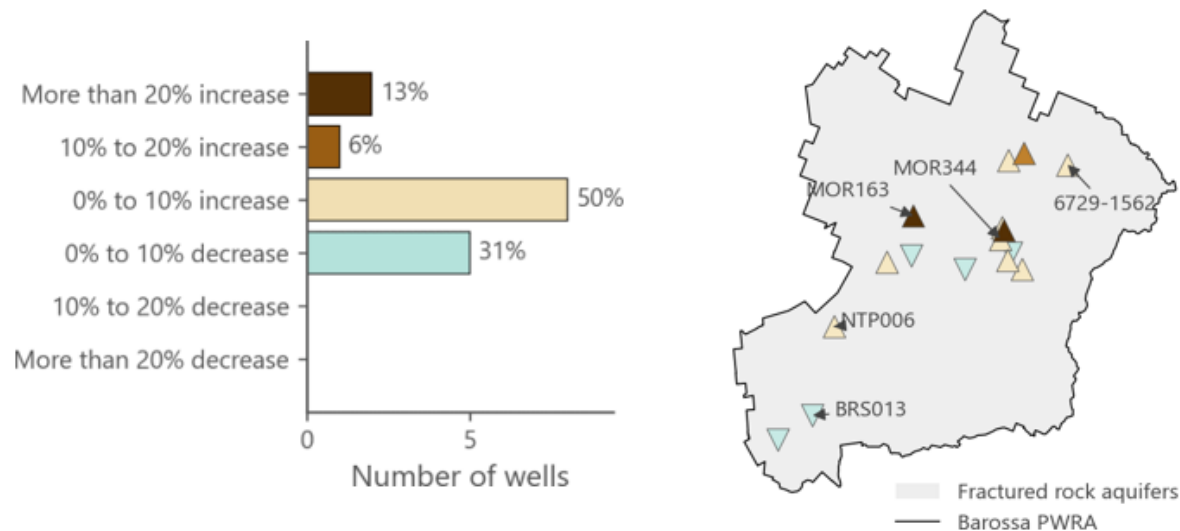
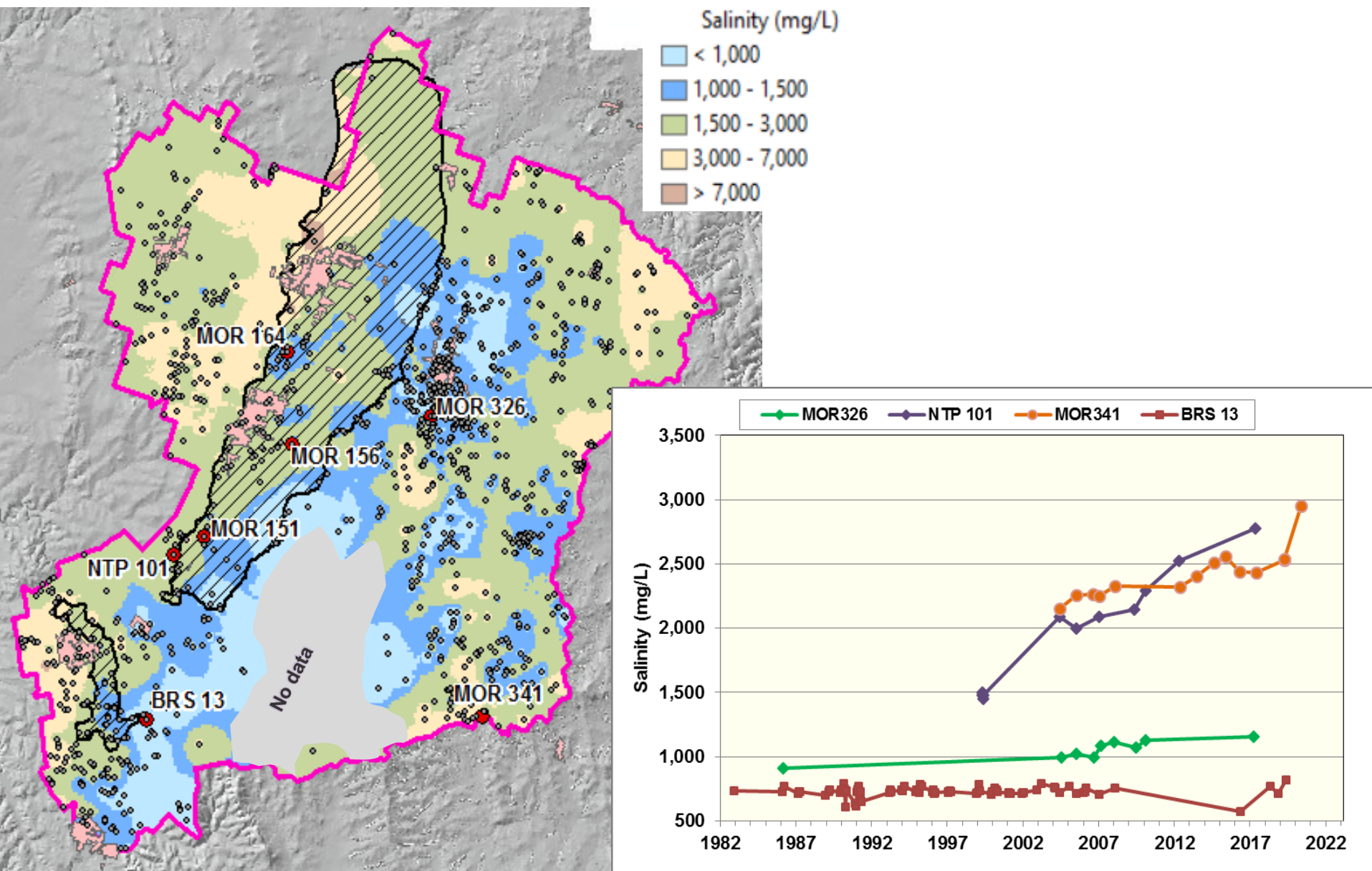


Figure 5.17. Salinity trend in the 15 years to 2020 in fractured rock aquifers

FRA salinity



Statewide summary

STATUS OF SOUTH AUSTRALIA'S PRESCRIBED WATER RESOURCES FOR 2011-2020

Status of South Australia's prescribed water resources

Prescribed surface water resources are assigned a status by expressing the annual flow of the prescribed area as a percentile of the total annual streamflow for the period of record. The overall status of the groundwater resource is assigned by ranking all the wells in the area from lowest to highest decile and selecting the median well as a description.

Note that evaluation of the sustainable limits of the resource, their management and monitoring occur separately through reviews of Water Allocation Plans (WAPs) and monitoring networks.



Decile	Percentile ¹	Streamflow/groundwater level ²	Colour
N/A	100	Highest on record	Dark Blue
10	90 to 100	Very much above average	Blue
8 and 9	70 to 90	Above average	Light Blue
4, 5, 6, and 7	30 to 70	Average	White
2 and 3	10 to 30	Below average	Orange
1	0 to 10	Very much below average	Red-Orange
N/A	0	Lowest on record	Red

¹ The *n*th percentile of a set of data is the value at which *n*% of the data is below it. For example, if the 75th percentile annual flow is 100 ML, 75% of the years on record had annual flow of less than 100 ML. Median streamflow: 50% of the records were above this value and 50% below. Decile: a division of a ranked set of data into ten groups with an equal number of values. In this case e.g. the first decile contains those values below the 10th percentile.

² A description of the deciles and their descriptions can be found in Bureau of Meteorology Annual Climate Statement 2019

Groundwater status

Prescribed area	Report / aquifer	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central Adelaide PWA	T1 aquifer										
Kangaroo Flat region	T2 aquifer										
Northern Adelaide Plains PWA	T1 aquifer										
	T2 aquifer										
Baroota PWRA	All aquifers										
	Fractured rock aquifers										
Barossa PWRA	Lower Aquifer										
	Upper Aquifer										
Clare PWRA	Fractured rock aquifers										
Angas Bremer PWA	Murray Group Limestone										
	Fractured rock aquifers										
EMLR PWRA	Murray Group Limestone										
	Permian sand										
	Finliss										
	Tookajarta										
Musgrave PWA	Bramfield										
	Polda										
	Coffin Bay										
	Lincoln South										
Southern Basins PWA	Uley South										
	Uley Warilla										
Far North PWA	GAB (J-K) aquifer										
Mallee PWA	Murray Group Limestone										
Peake, Roby and Sherlock PWA	Confined aquifer										
Marne Saunders PWRA	Fractured rock aquifers										
	Murray Group Limestone										
	Fractured rock aquifers										
McLaren Vale PWA	Maslin Sands										
	Port Willunga Formation										
Lower Limestone Coast PWA	Confined aquifer										
Padthaway PWA	Confined aquifer										
Tatara PWA	Confined aquifer										
Tintinara-Coonalpyn PWA	Confined aquifer										
	Unconfined aquifer										
Lower Limestone Coast PWA	Lowlands										
	Unconfined aquifer										
Padthaway PWA	Highlands										
	Unconfined aquifer										
	Flats										
Tatara PWA	Unconfined aquifer										
	Range										
	Unconfined aquifer										
	Highlands										
	Unconfined aquifer										
	Plains										
Tintinara-Coonalpyn PWA	Unconfined aquifer										
	Mallee										
	Highlands										
	Unconfined aquifer										
	Plains										
	Unconfined aquifer										
	Fractured rock aquifers										
WMLR PWRA	Permian sand										
	Tertiary limestone										

Surface water status

Prescribed area	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Barossa Valley PWRA										
Clare Valley PWRA										
EMLR PWRA										
	Angas and Bremer									
	Finliss and Currency									
Mame Saunders PWRA										
Morambro Creek PA										
WMLR PWRA										
	Tomerns and Onkaparinga									
	Fleurieu									
Kangaroo Island										

The surface water status is based on streamflow data collected for each water reporting year (i.e. July – June). This assessment excludes the River Murray as this is reported separately. The groundwater status is based on water level data collected for each calendar year (January – December).

Prescribed water areas of South Australia



Statewide summary

Groundwater status											
Prescribed area	Report / aquifer	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Barossa PWRA	Fractured rock aquifers										
	Lower Aquifer										
	Upper Aquifer										

Surface water status										
Prescribed area	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Barossa Valley PWRA										

Take home messages...

- 85% of groundwater wells show below-average water levels
- Five-year trends in water level indicate 96% of wells show declining water levels
- Approximately 67% of water use was from imported sources
- Projections of future climate indicate climate variability will intensify
 - Has implications for approach to water resources management



Government
of South Australia

Department for
Environment and Water