McLaren Vale Prescribed Wells Area 2020–21 water resources assessment

Department for Environment and Water
December, 2022

DEW Technical Note 2022/15

Government of South Australia
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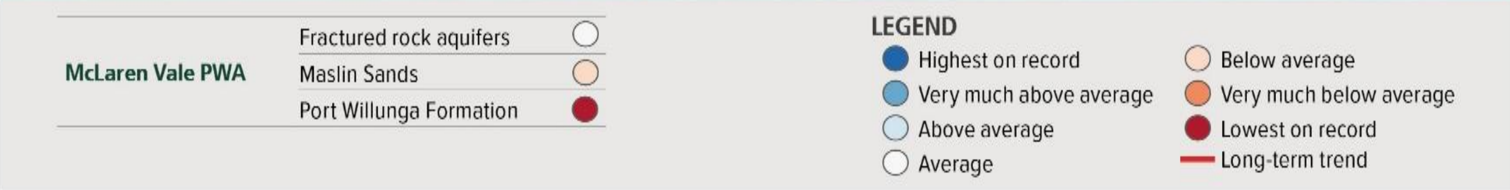
1 Summary



Rainfall

- Rainfall in the McLaren Vale Prescribed Wells Area (PWA) is typically higher along the ranges, decreasing towards the coast.
- Rainfall at Willunga measures 576 mm in 2020–21, which is 5% below the long-term average annual rainfall of 606 mm (1979 to 2021).
- Rainfall at Mount Bold Reservoir measures 755 mm in 2020-21, which is 6% below the long-term average annual rainfall of 806 mm (1979 to 2021).
- Rainfall data indicate that total annual rainfall has been relatively stable over the past 40 years.

Groundwater

- Water levels declined within the Port Willunga Formation in the north-east of the basin where the aquifer is unconfined, with most wells (63%) classified 'Lowest on record' in 2021.
- In 2021, water levels in 57% of monitoring wells in the Maslin Sands aquifer are classified 'Below average' or lower.
- In 2021, water levels in 47% of monitoring wells in the fractured rock aquifers are classified 'Average', while 41% are classified 'Below average' or lower.
- Over the past 15 years, salinity in the Port Willunga Formation aquifer shows an increasing trend in most wells (75%), at a median rate of 0.33% increase per year.
- Over the past 15 years, salinity in the Maslin Sands aquifer shows an increasing trend in the majority of wells (66%), at a median rate of 0.20% increase per year.
- Over the past 15 years, salinity in the fractured rock aquifers shows an increasing trend in the majority of wells (57%), at a median rate of 0.13% increase per year.

Water use

- Water use in 2020–21 is 4,186 ML, 6% lower than the preceding water-use year.
- Most of the groundwater extraction occurred from the Port Willunga Formation aquifer (61%), with 22% extracted from the Maslin Sands aquifer and 17% from the fractured rock aquifers.

1.1 Purpose

The Department for Environment and Water (DEW) has a key responsibility to monitor and report annually on the status of prescribed and other groundwater and surface water resources. To fulfil this, data on water resources are collected regularly, analysed and reported in a series of annual reports. Three reports are provided to suit a range of audiences and their needs for differing levels of information:

- **Technical Notes**: (this document) provide a detailed information and assessment for each resource area, helping to identify the resource condition in further detail.
- **Fact sheets**: provide summary information for each resource area with an Annual Resource Status Overview.
- **State-wide summary**: this summarises information for the main water resources across most regions in a quick-reference format.

This document is the Technical Note for the McLaren Vale Prescribed Wells Area (PWA) for 2020–21 and collates rainfall, groundwater and water-use data for 2020–21.

1.2 Regional context

The McLaren Vale Prescribed Wells Area (PWA) is located approximately 35 km south of Adelaide within the Hills and Fleurieu Landscape Region (Figure 1.1).

The McLaren Vale PWA is a regional-scale resource for which groundwater has been prescribed under South Australia's *Landscape SA Act 2019* and a water allocation plan, adopted in 2000, provides for sustainable management of the water resources. Groundwater occurs in three major aquifers: two sedimentary aquifers (Port Willunga Formation and Maslin Sands) and the fractured rock aquifers.

The McLaren Vale PWA constitutes the central area of the Western Mt Lofty Ranges (WMLR) Prescribed Water Resources Area (PWRA) - the groundwater and surface water resources of the northern and southern areas of the WMLR PWRA are the subject of a separate report.

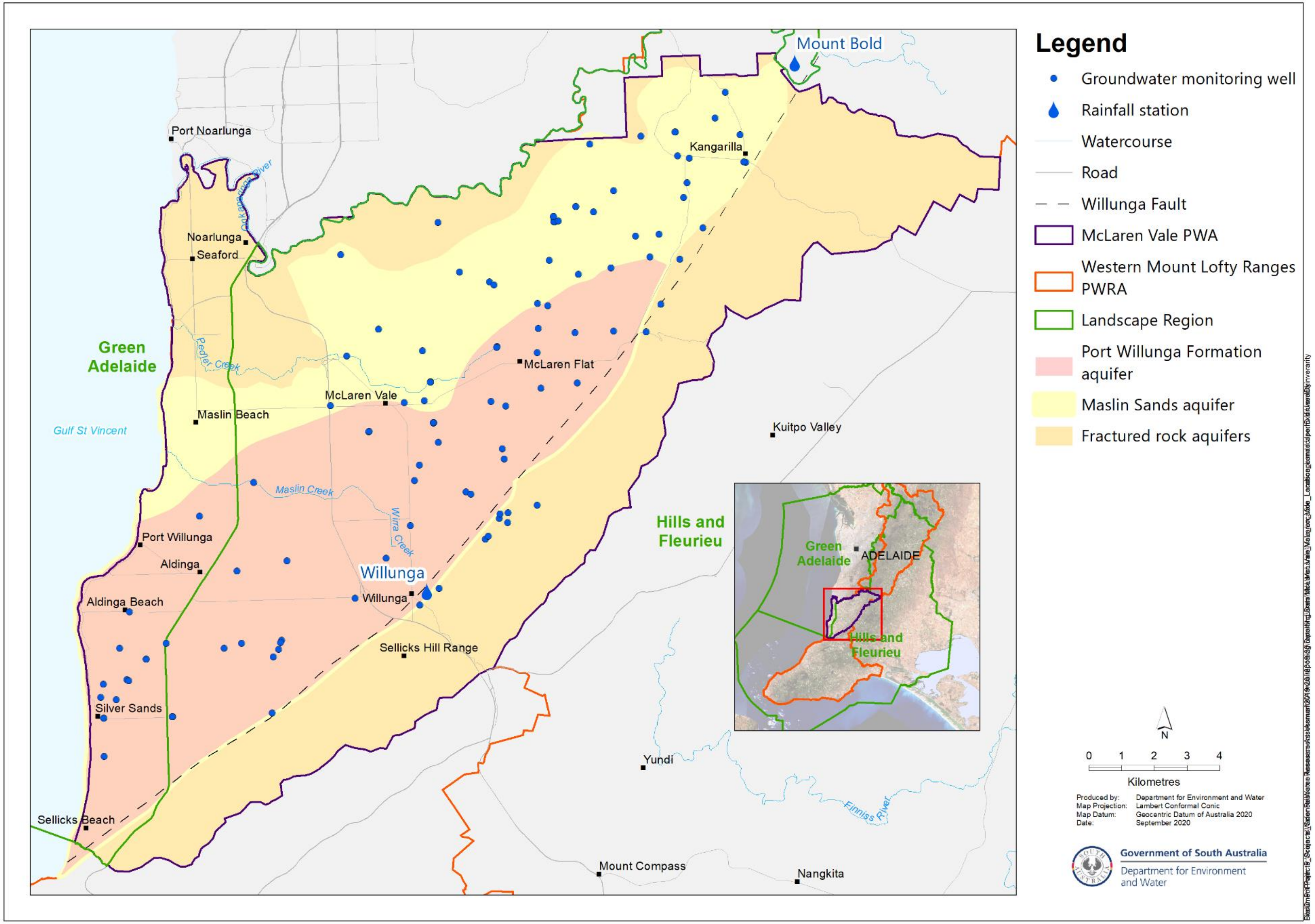


Figure 1.1 Location of McLaren Vale PWA

2 Methods and data

This section describes the source of rainfall, groundwater and water-use data presented in this assessment and the methods used to analyse and present these data. The period of data adopted for each parameter is shown in Table 2.1.

Table 2.1 Reporting period description

Parameter	Reporting period	Comment
Rainfall	1 July 2020 to 30 June 2021	Monthly data for July to September 2021 are also presented to provide additional context
Groundwater	1 January to 31 December 2021	Groundwater levels typically show a delayed response to incident rainfall and aggregate groundwater extraction, hence the lag in reporting period (See section 2.2.1)
Water use	1 July 2020 to 30 June 2021	In South Australia, water accounting is reported between 1 July through to 30 June of the following year

For rainfall and water-use data, the financial year or 'water year' was adopted, as defined in the BOM Australian Water Information Dictionary.

2.1 Rainfall

Daily rainfall observations have been used from selected Bureau of Meteorology (BoM) stations to calculate monthly and annual totals. The data have been obtained from the SILO Patched Point Dataset service provided by the Queensland Government, which provides interpolated values to fill gaps in observations (Figure 3.2 and Figure 3.3).

Rainfall maps were compiled using gridded datasets obtained from the BoM (Figure 3.1). The long-term average annual rainfall map (1986 to 2015) was obtained from Climate Data Online. The map of total rainfall in 2020–21 was compiled from monthly rainfall grids obtained for the months July 2020 to June 2021 from the Australian Landscape Water Balance website.

2.2 Groundwater

2.2.1 Water level

Water level[1] data were obtained from wells in the McLaren Vale Prescribed Wells Area (PWA) monitoring network from both manual and continuous logger measurements. All available water level data were verified and the maximum annual water level for each well was identified for further analysis. The maximum annual water level represents the unstressed or recovered water level following seasonal irrigation pumping and other uses. The amount of pumping can vary from year to year and the proximity of pumping wells to observation wells may affect the reliability of trends and historical comparisons. Therefore, the recovered water level provides a reliable indicator

[1] 'Water level' in this report refers to both the watertable elevation, as measured in wells completed in unconfined aquifers, and the potentiometric water level elevation, as measured in wells completed in confined aquifers where the water level or pressure in the monitoring well rises above the top of the aquifer. These are collectively referred to as the 'reduced standing water level' (RSWL).

of the status of the groundwater resource. The period of recovery each year was reviewed for each well. In general, the aquifers in the McLaren Vale PWA return to a maximum recovered level between September and November.

For wells with suitable long-term records, the annual recovered water level was ranked and described according to their decile range[2] from lowest to highest on record (Table 2.2). The definition of a suitable long-term record varies depending on the history of monitoring activities in different areas; for the McLaren Vale PWA, any well with 10 years or more of recovered water level data is included. For the most recent year, the number of wells in each decile range was then summarized for each aquifer (e.g., Figure 4.1). Hydrographs are shown for a selection of wells to illustrate common or important trends (e.g., Figure 4.3).

Five-year trends are calculated using annual recovered water levels for those wells which have at least five measurements (i.e., at least one measurement a year). The trend line was calculated by linear regression and the well is given a status of 'declining', 'rising', or 'stable', depending on whether the slope of this trend line is below, above or within a given tolerance threshold. This threshold allows for the demarcation of wells where water levels are changing at very low rates and the water level can therefore be considered stable. The threshold also accommodates very small measurement errors. The number of rising, declining and stable wells are then summarized for each aquifer (e.g., Figure 4.2).

Moderately-sized, sedimentary, confined and unconfined aquifers such as the Port Willunga Formation and Maslin Sands are given tolerance thresholds of 2 cm/y, while fractured rock aquifers with lower storages are given a tolerance threshold of 1 cm/y.

Thirty-year changes in water level were calculated as the difference between the average water level in a three-year period thirty years ago (i.e. 1991 to 1993) and the average water level in 2021.

Table 2.2 Percentile/decile descriptions*

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

* Deciles and descriptions as defined by the BoM[3]

2.2.2 Salinity

Salinity data were obtained from a network of irrigation wells. Since 2017, irrigators have submitted groundwater samples that DEW has tested for salinity. These samples are tested for electrical conductivity (EC) and the salinity (total dissolved solids measured in mg/L, abbreviated as TDS) is calculated. Measurement of electrical conductivity of a water sample is often subject to small instrument errors.

Where multiple samples were submitted from a well in a calendar year, the mean salinity is used for analysis. The results are shown for each aquifer (e.g., Figure 4.4).

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[2]. 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.

[3] Bureau of Meteorology Rainfall Map information http://www.bom.gov.au/climate/austmaps/about-rain-maps.shtml

15-year salinity trends are calculated where there are at least six years of salinity data (i.e., at least one measurement per year). The trend line is calculated by linear regression and the percentage change in salinity is calculated through the following formula:

$$\text{Percentage change in salinity (\%)} = \frac{\text{Slope of linear trend line (mg/L/y)} * 15}{\text{Value of trend line at start of period (mg/L)}} * 100$$

The percentage of change over the trend period is then summarised in categories, depending on the range of change for each resource (e.g., Figure 4.5).

Salinity graphs are shown for a selection of wells to illustrate common or important trends (e.g. Figure 4.6)

2.3 Water use

Meter readings are used to calculate licensed extraction volumes for all groundwater sources in the McLaren Vale PWA.

2.4 Further information

Groundwater data can be viewed and downloaded using the *Groundwater Data* page under the Data Systems tab on WaterConnect. For additional information related to groundwater monitoring well nomenclature, please refer to the Well Details page on WaterConnect.

Other important sources of information on water resources on the McLaren Vale PWA are:

- summary reports on the groundwater resources of the McLaren Vale PWA and annual groundwater level and salinity status reports (Water Resource Assessments page on WaterConnect)
- the Water Allocation Plan for the McLaren Vale PWA (Adelaide and Mount Lofty Ranges NRM Board 2007)
- review of salinity trends in the McLaren Vale PWA (Herczeg and Leaney 2002; Villeneuve and Harrington 2012)
- review of groundwater recharge processes in the McLaren Vale PWA (Batlle-Aguilar and Cook 2012; Harrington 2002; Herczeg and Leaney 2002; Irvine et al. 2017)
- review of saltwater intrusion in the McLaren Vale PWA (Morgan et al. 2013; Post and Banks 2015; Post, Banks and Brunke 2018; Short et al. 2014)
- detailed description of the hydrogeology of the Willunga Basin (Smith, Fontaine and Lewis 2015).

3 Rainfall

The McLaren Vale PWA is characterised by a Mediterranean climate with warm to hot, dry summers and cool to cold, wet winters. Rainfall across the PWA is generally higher along the ranges in the north and east and lower in the west towards the coast.

Two stations were selected to capture the variation in precipitation across the McLaren Vale PWA. The Willunga station (BoM station 023753) is located near the base of the ranges towards the south of the PWA, while the Mount Bold Reservoir station (BoM station 023734) is situated immediately north of the PWA (Figure 3.1).

Total annual rainfall for 2020–21 ranges between 700 mm along the ranges to 450 mm towards the coast, which is considerably less than the respective long-term average annual rainfall (1986 to 2015) of 850 mm and 550 mm (Figure 3.1)[4].

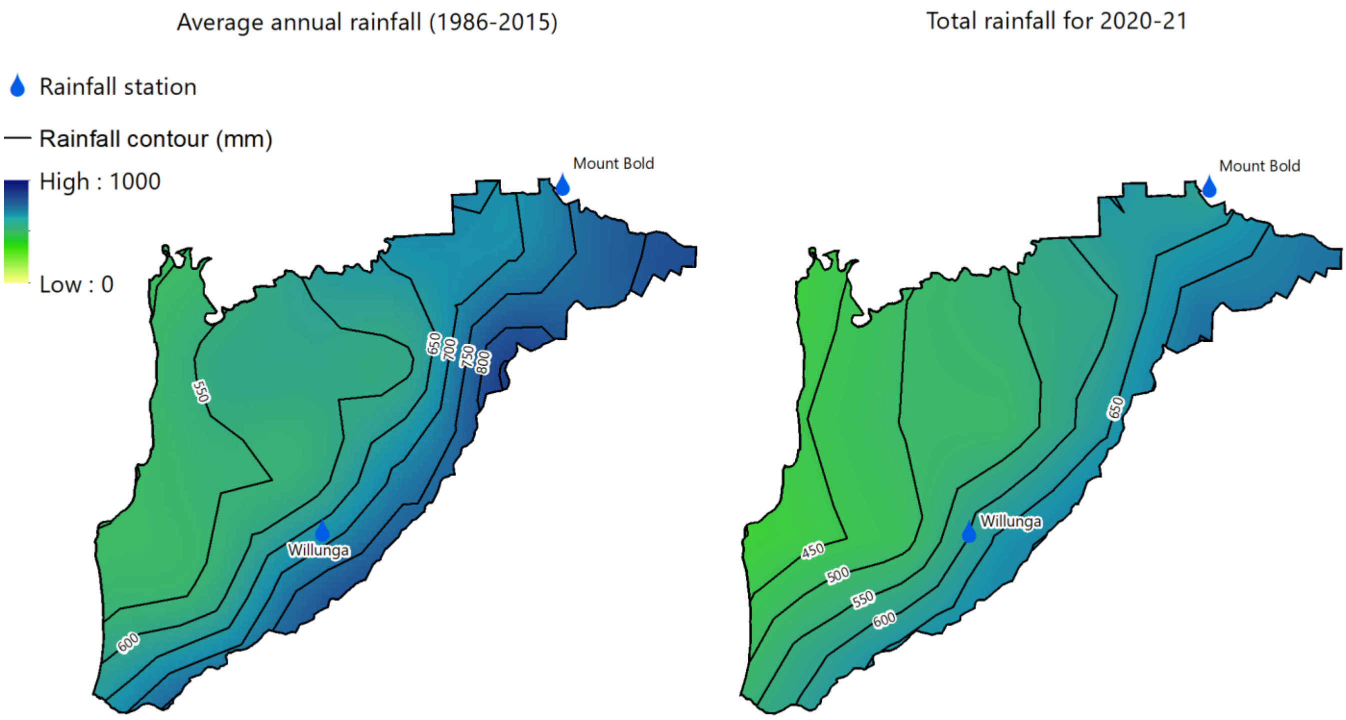

Figure 3.1 Rainfall in the McLaren Vale PWA for 2020–21 compared to the standard 30-year climatological average (1986 to 2015)

[4] Some differences may be noticeable between the spatial rainfall maps and the annual rainfall from individual stations. This is due to the use of different data sources and time periods (Section 2.1).

Total annual rainfall for 2020–21 is 576 mm at the Willunga station and 755 mm at the Mount Bold Reservoir station, both of which are around 5% below the respective average annual rainfall (1979 to 2021) of 606 and 806 mm (Figure 3.2 and Figure 3.4). Total annual rainfall data for the Mount Bold station over the past 40 years shows a marginally decreasing trend; however, only one out of the past 5 years shows below-average total annual rainfall. For the Willunga station, annual rainfall totals are stable over the past 40 years.

At both stations, above-average monthly rainfall occurred in October 2020 and February, June and July 2021, while the remaining months recorded average or below-average monthly rainfall (Figure 3.3 and Figure 3.5).

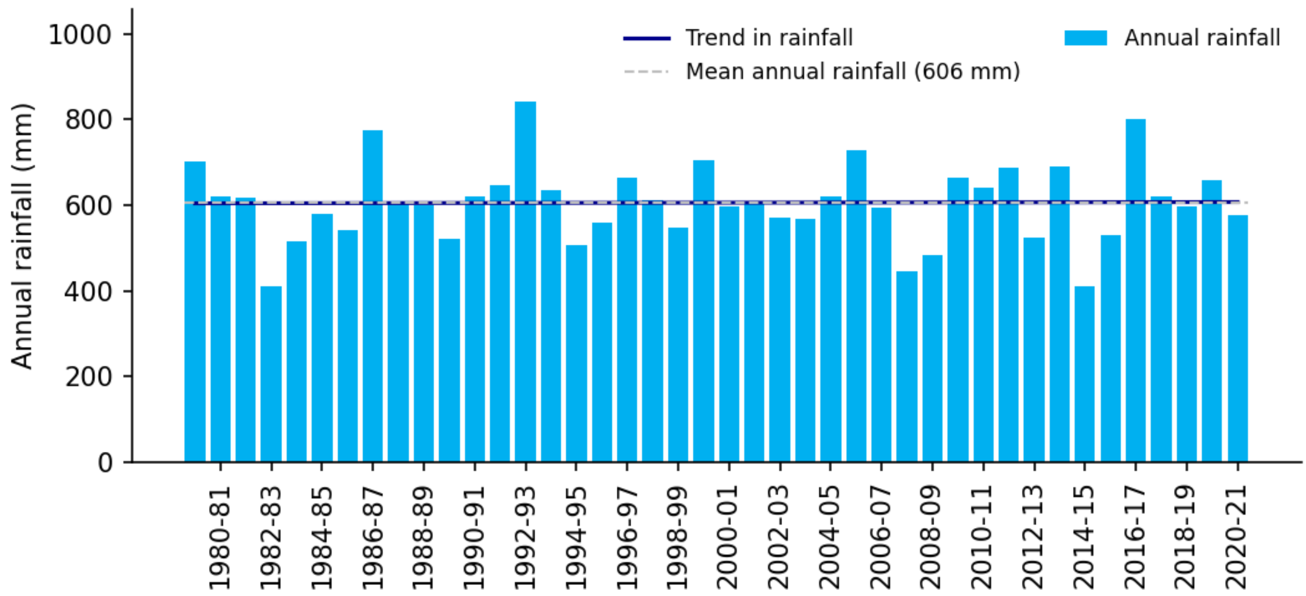

Figure 3.2 Annual rainfall from 1979–80 to 2020–21 at the Willunga rainfall station (BoM station 23753)

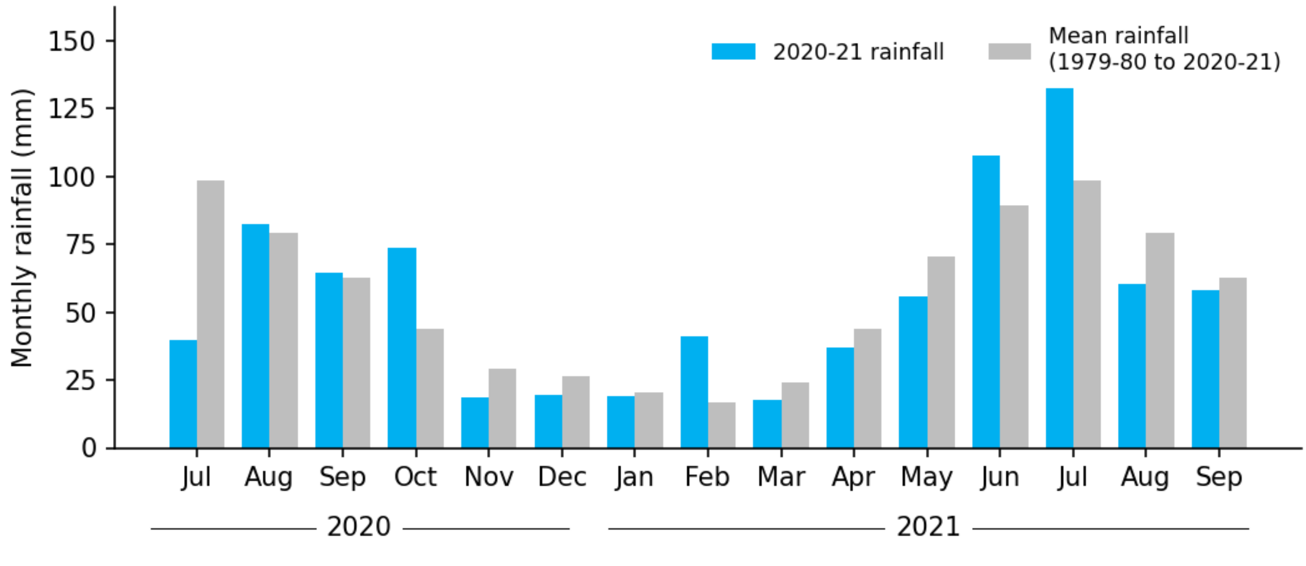

Figure 3.3 Monthly rainfall between July 2020 and September 2021, compared to the long-term monthly average at the Willunga rainfall station (BoM station 23753)

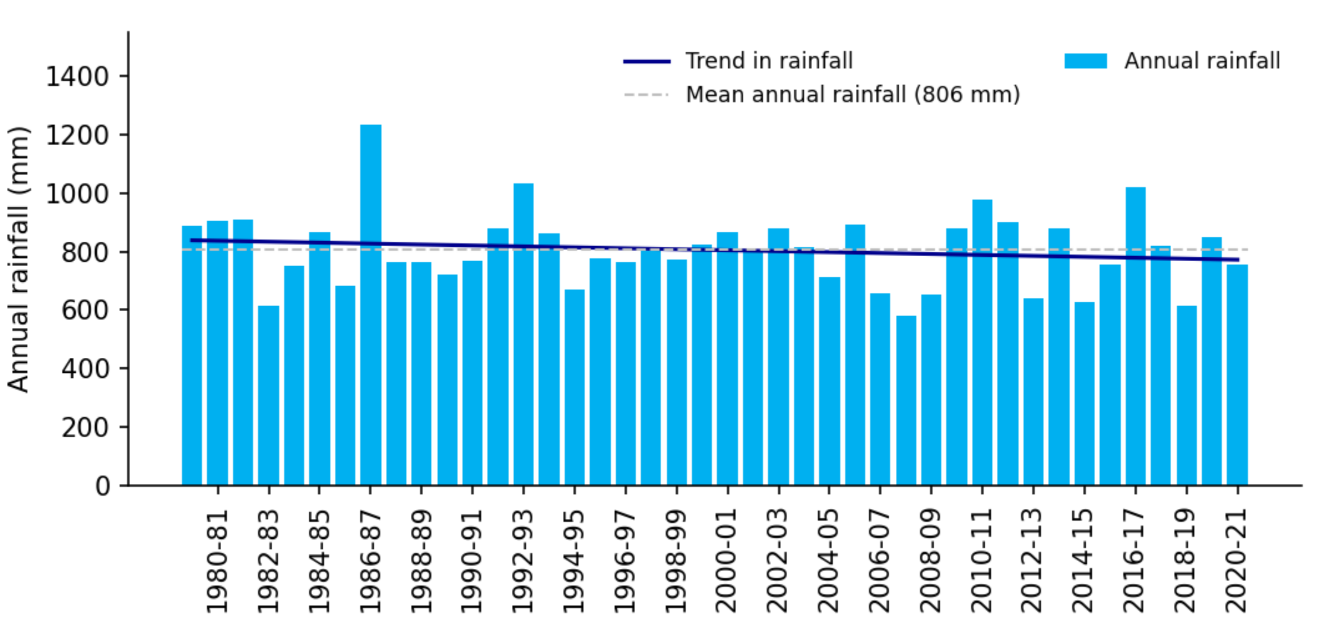

Figure 3.4 **Annual rainfall from 1979–80 to 2020–21 at the Mount Bold Reservoir rainfall station (BoM station 23734)**

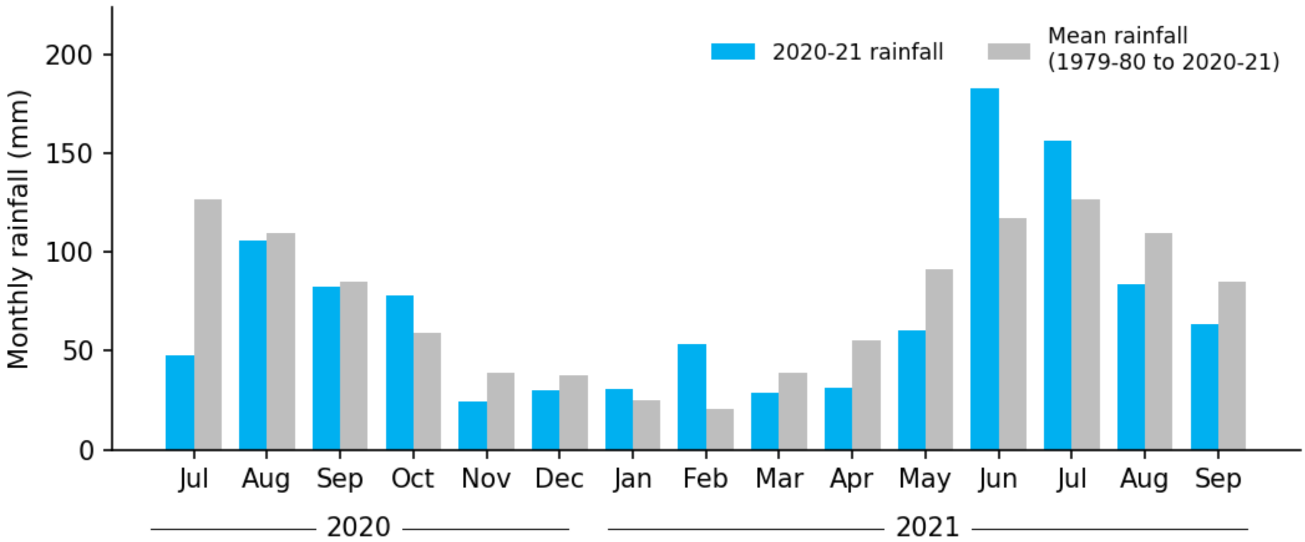

Figure 3.5 **Monthly rainfall between July 2020 and September 2021, compared to the long-term monthly average at the Mount Bold Reservoir rainfall station (BoM station 23734)**

4 Groundwater

4.1 Hydrogeology

The McLaren Vale PWA encompasses sedimentary aquifers of Quaternary and Tertiary age within the Willunga Basin and a fractured rock aquifer which forms the hills in the north of the PWA and east of the Willunga Fault (Figure 1.1). The Willunga Basin is a structurally controlled trough bounded in the south-east by the Willunga Fault and to the north by basement outcrop. The depth of the basin increases toward the southeast and reaches a maximum depth of approximately 250 m near the Willunga Fault. Groundwater occurs in four major aquifers, namely the:

- Quaternary aquifers
- Port Willunga Formation (including the Pirramimma Sand)
- Maslin Sands aquifer
- fractured rock aquifers.

4.1.1 Quaternary aquifers

Sands and interbedded clays form shallow unconfined aquifers which are generally low yielding and provide mostly stock and domestic supplies, with limited extraction for irrigation. Recharge is predominantly derived from local rainfall and runoff through drainage features. In the north-east of the Willunga Basin, the Pirramimma Sand lies unconformably alongside the Port Willunga Formation and is hydraulically connected to it. For the purpose of the water allocation plan and this report, the Pirramimma Sand is currently considered to be part of the Port Willunga Formation with regard to groundwater extraction and resource status.

4.1.2 Port Willunga Formation

The Port Willunga Formation aquifer is the main water supply aquifer in the Willunga Basin. It consists of sand and limestone, which are confined by Quaternary sediments in the south and south-western parts of the McLaren Vale PWA. Elsewhere, to the north near McLaren Vale and McLaren Flat, the Port Willunga Formation is unconfined. Well yields are generally between 2 L/s and 16 L/s. Recharge to the Port Willunga Formation primarily occurs where the aquifer is unconfined or outcrops in the north-east of the basin and groundwater flow occurs in a south-westerly direction towards the coast. Groundwater residence times range up to 2,000 years. Marls, mudstone, silts, clay and marly limestone of the Blanche Point Formation aquitard separate the Port Willunga Formation from the underlying Maslin Sands.

4.1.3 Maslin Sands

The Maslin Sands aquifer comprises the North Maslin Sands and South Maslin Sands geological units and directly overlies basement rocks. The North Maslin Sands unit comprises upward-fining cross-bedded quartz sands with poorly sorted gravel deposited in a braided river environment (Smith, Fontaine and Lewis 2015). The South Maslin Sands unit comprises fine to coarse carbonaceous and pyritic sand, clay and glauconitic marginal marine deposits (Smith, Fontaine and Lewis 2015). The Maslin Sands aquifer is recharged by rainfall in the north-east of the McLaren Vale PWA where the aquifer outcrops near Kangarilla and Mount Bold. Groundwater flow is towards the south-west with groundwater residence times ranging from 5,000 to more than 20,000 years. Elsewhere, the aquifer is confined and separated from the overlying Port Willunga Formation by the Blanche Point Formation, an aquitard consisting of low-permeability marine mudstone and limestone.

4.1.4 Fractured rock aquifers

The fractured rock aquifers occur in basement rocks (slate, quartzite, shale and limestone) which underlie the sedimentary aquifers within the Willunga Basin, and form the ranges both to the east of the Willunga Fault and to the north along the Onkaparinga Gorge. Infiltration of incident rainfall provides recharge to the fractured rock aquifers in these areas and groundwater flow generally follows the topography from high elevations around the basin margin towards the centre of the basin. Beneath the sedimentary formations, groundwater flow in the fractured rock aquifers bears south-west towards the coast.

4.2 Port Willunga Formation aquifer water level

In 2021, winter-recovered water levels in 13 out of 16 (82%) of the monitoring wells in the Port Willunga Formation aquifer are classified 'Below average' or lower. These wells are predominantly in the central to northern portion of the aquifer where the Port Willunga Formation aquifer is unconfined and where most groundwater extraction occurs (Figure 4.1).

Over the past 20 years, variations in water level in 15 wells range from a decline of 4.45 m to a decline of 0.12 m (median is a decline of 2.70 m).

Five-year trends show that water levels are declining in the majority of wells (87%), with rates of decline ranging between 0.32 and 0.02 m/y (median is a decline of 0.20 m/y). (Figure 4.2).

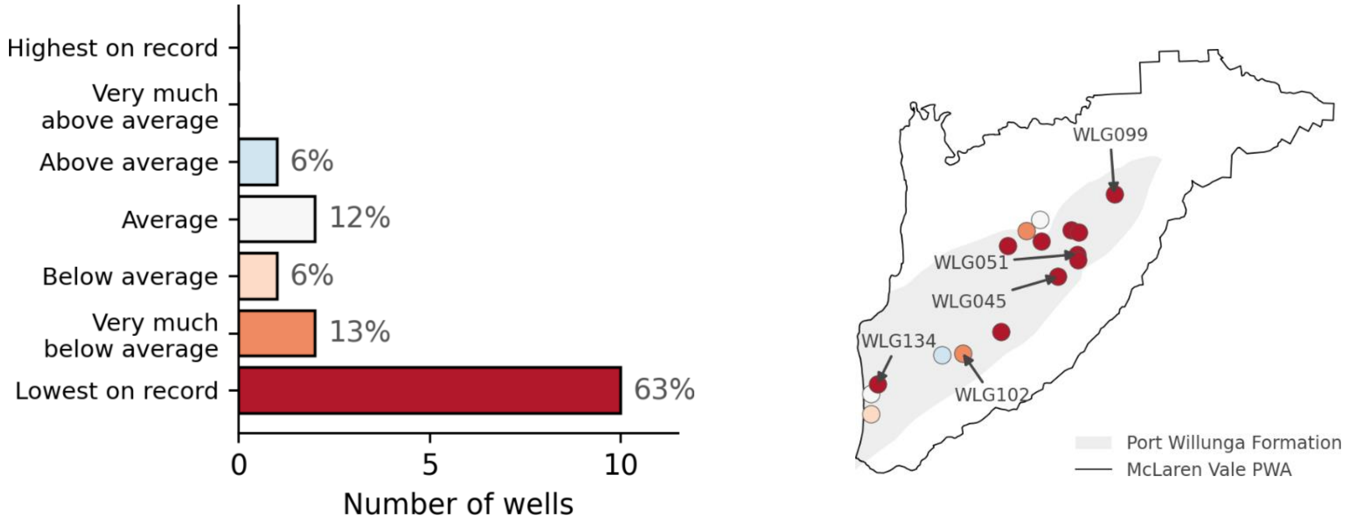

Figure 4.1 2021 recovered water levels for wells in the Port Willunga Formation aquifer

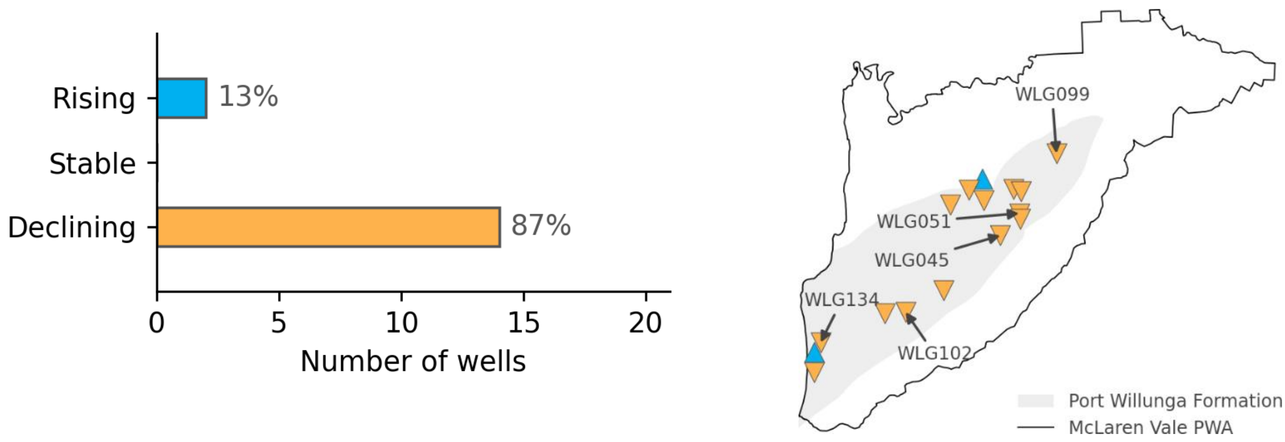

Figure 4.2 2017 to 2021 trend in recovered water levels for wells in the Port Willunga Formation aquifer

Hydrographs from a selection of representative monitoring wells are shown to illustrate common or important trends in the Port Willunga Formation aquifer (Figure 4.3). Long-term water level declines are observed in most wells and in 2021, water levels in 4 of the 5 wells are classified 'Lowest on record' (WLG134, WLG045, WLG051, and WLG099).

In the south-west of the Port Willunga Formation near the coast where the aquifer is confined and rates of extraction are low, recovered water levels are broadly stable (e.g., WLG134). Further inland, but still in the south-western confined part of the aquifer, winter-recovered water levels have declined by around 2 m over the last 20 years (e.g., WLG102)

Towards the central and northern parts of the Willunga Basin, where the aquifer is unconfined and more intensive extraction occurs, recovered water levels have declined over the last 20 years by between 3 to 5 m (e.g., WLG051, WLG045 and WLG099).

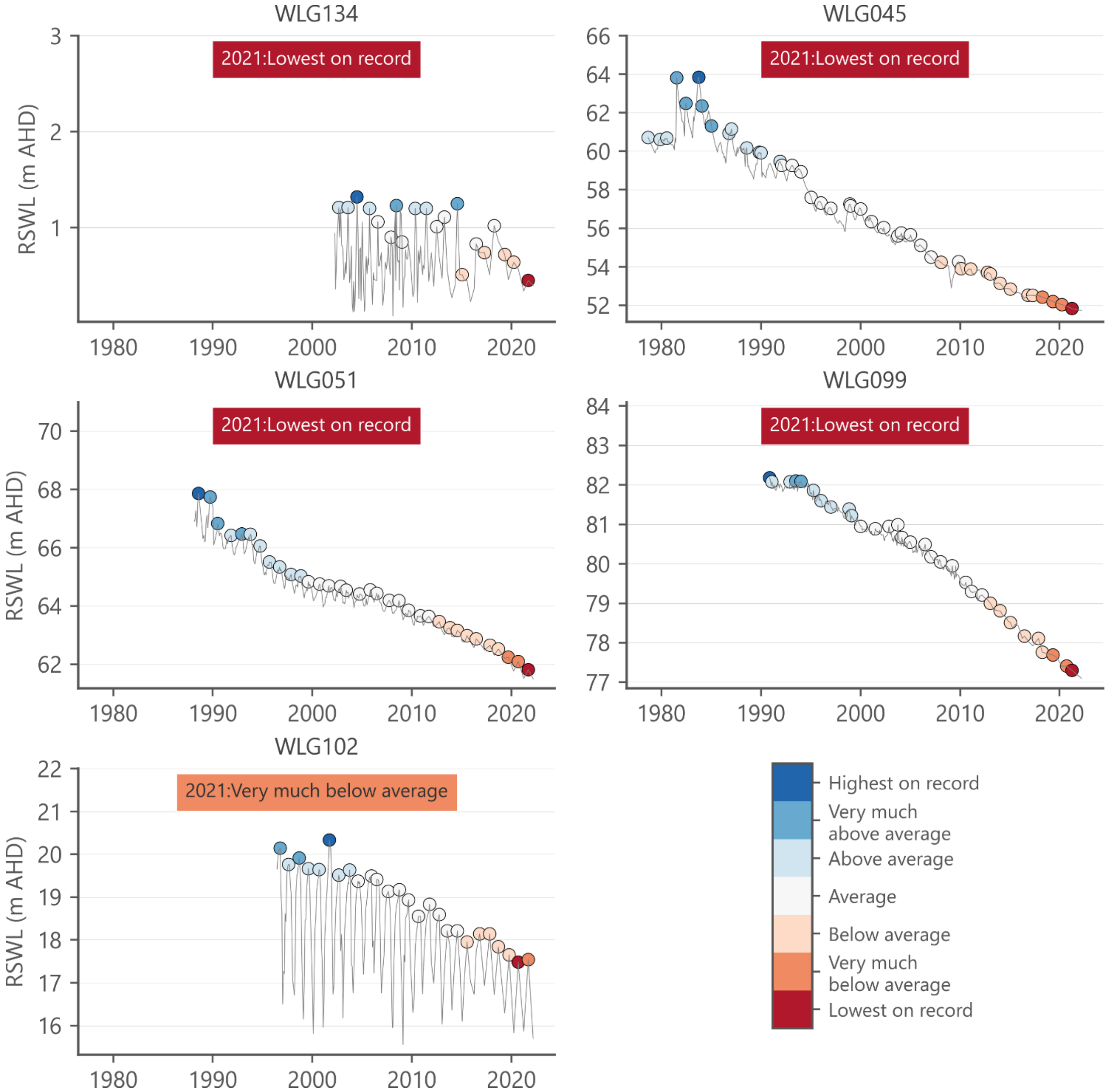

Figure 4.3 Selected Port Willunga Formation aquifer hydrographs

4.3 Port Willunga Formation Aquifer salinity

Since 2017, irrigators in the McLaren Vale PWA have submitted groundwater samples that DEW have tested for salinity concentration, to augment DEW's state-wide monitoring network. In 2021, sampling results from 132 irrigation bores in the Port Willunga Formation aquifer range between 475 mg/L and 3511 mg/L with a median of 1,127 mg/L (Figure 4.4). Typically, salinities are lower (<1,000 mg/L) in the centre of the basin, for example in the vicinity of WLG070 and WLG073. Salinity in the Port Willunga Formation increases to approximately 2000 mg/L towards the coast and to the north-east.

In the 15 years to 2021, 55 of 73 wells (75%) show an increasing trend in salinity. The 15-year trends in salinity vary from a decrease of 1.6% per year to an increase of 3.6% per year, with a median rate of 0.3% increase per year. (Figure 4.5).

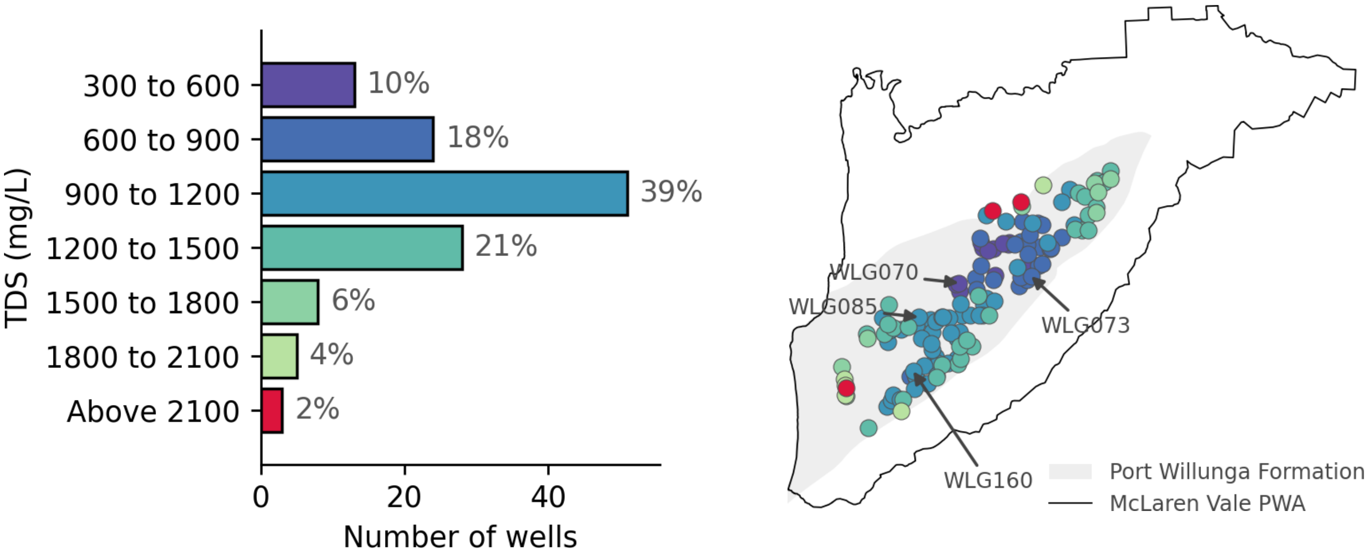

Figure 4.4 2021 salinity observations from wells in the Port Willunga Formation aquifer

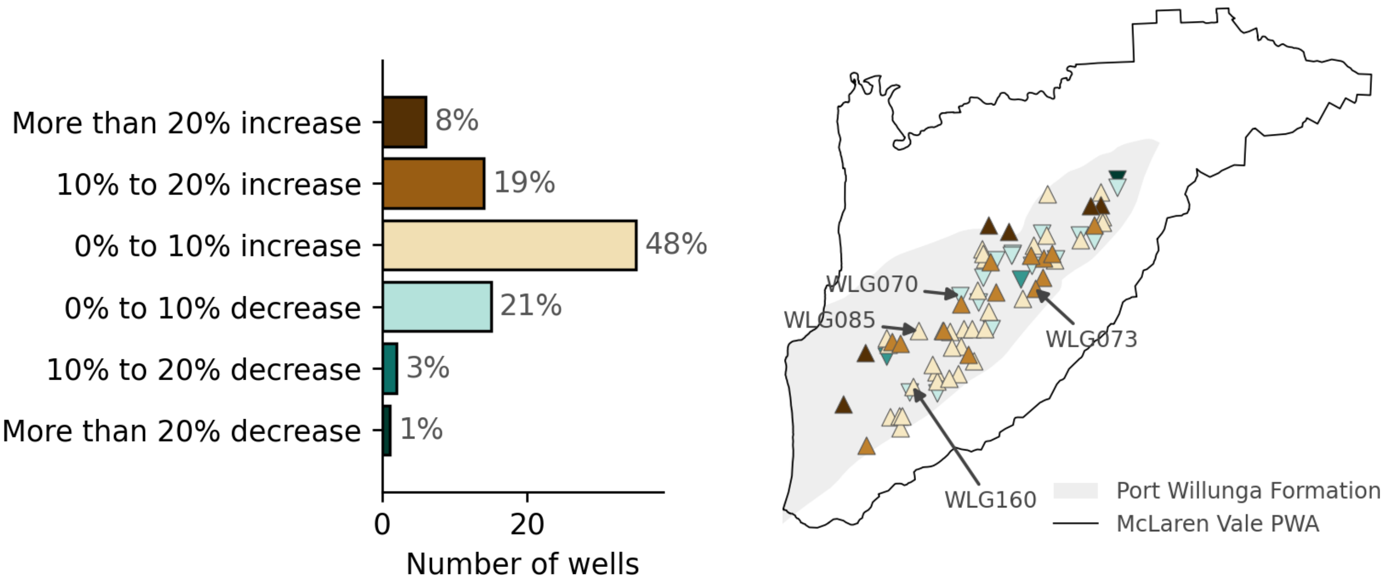

Figure 4.5 Salinity trend in the 15 years to 2021 for wells in the Port Willunga Formation aquifer

Selected monitoring wells (Figure 4.6) generally show an increasing trend in salinity in the decade between 2000 to 2010,

Monitoring wells WLG073, WLG070 and WLG085 show decreases in groundwater salinity from the 1990s until around 2007, after which salinity increased (Figure 4.6). Some of the trends in salinity may be explained by low rainfall and greater rates of extraction during latter stages of the Millennium Drought (2001 to 2009), although increasing salinity in some wells has persisted after the drought ended (Barnett and Judd 2019).

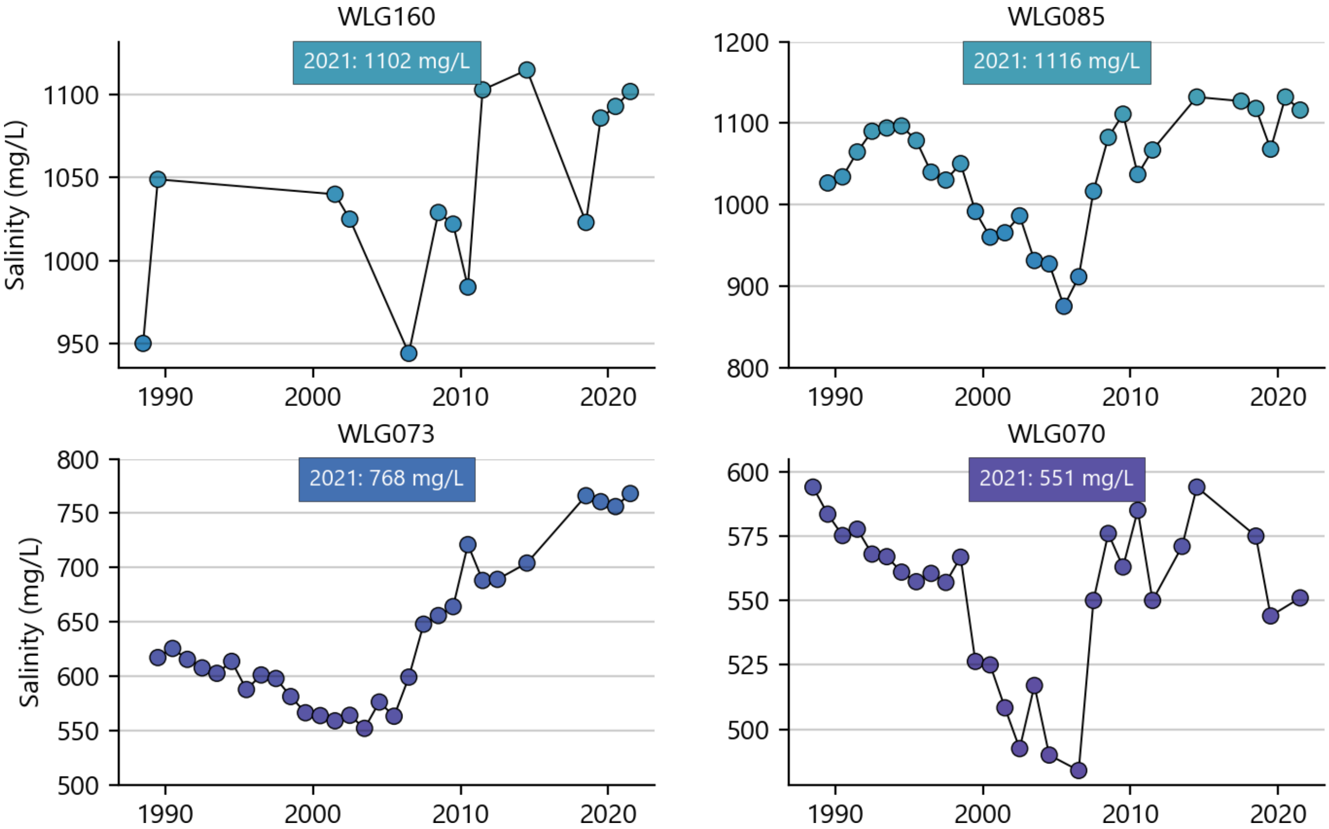

Figure 4.6 Selected Port Willunga Formation aquifer salinity graphs

4.4 Maslin Sands aquifer water level

In 2021, winter-recovered water levels in 9 out of 16 (57%) of monitoring wells in the Maslin Sands aquifer are classified 'Below average' or lower (see Section 2.2.1 for details of the classification; Figure 4.7).

Over the past 30 years, variations in water level in 13 wells range from a decline of 4.51 m to a rise of 2.03 m (median is a decline of 0.70 m).

Five-year trends show water levels are declining in the majority of wells (81%), with rates of decline ranging between 0.33 to 0.03 m/y (median is a decline of 0.13 m/y) (

Figure 4.8).

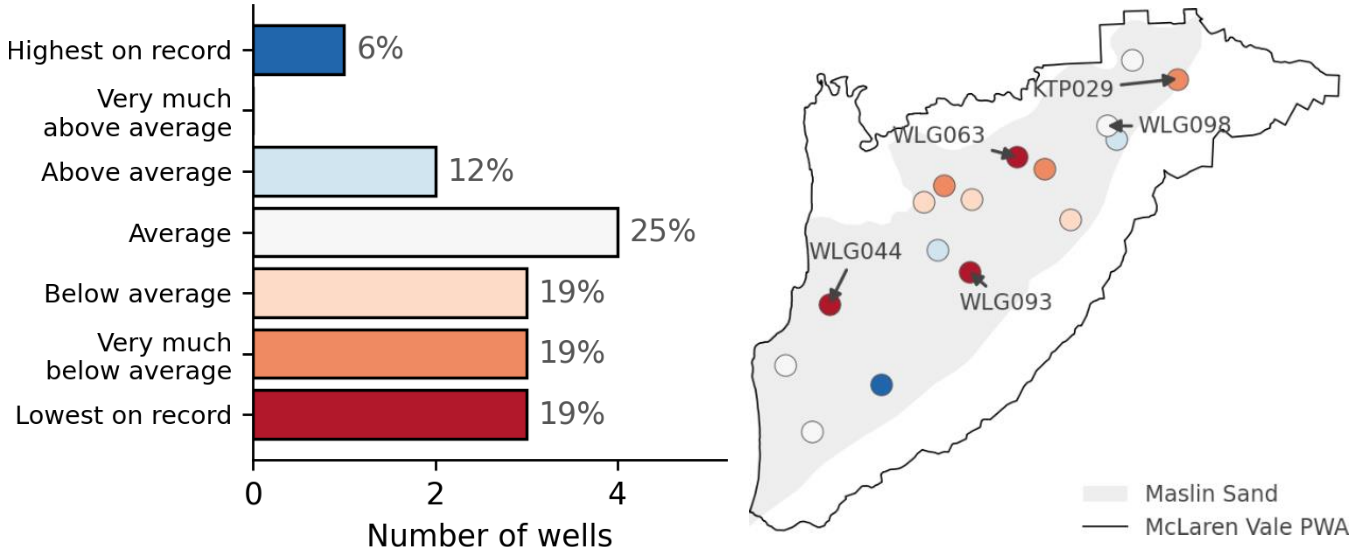

Figure 4.7 2021 recovered water levels for wells in the Maslin Sands aquifer

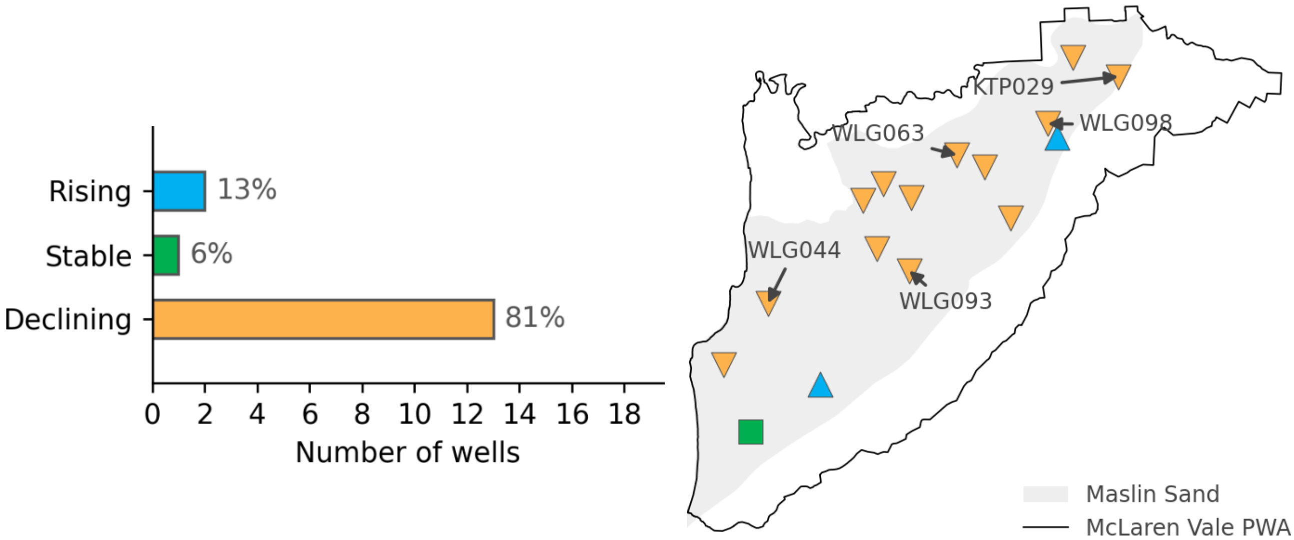

Figure 4.8 2017 to 2021 trend in recovered water levels for wells in the Maslin Sands aquifer

Hydrographs from a selection of representative monitoring wells are shown to illustrate common or important trends in the Maslin Sands aquifer. In 2021, water levels in 3 of 5 representative monitoring wells (WLG044, WLG063 and WLG093) are classified 'Lowest on record' (Figure 4.9), while KTP029 is classified 'Very much below average'.

In the western part of the basin, a long-term water level decline has been observed since around 1990 (e.g., WLG044). This long-term water level trend is also observed in the central part of the basin but with a period of relative stability between approximately 2000 and 2016 (e.g., WLG063 and WLG093). All 3 hydrographs show declining water level trends over the last 5 years.

In the northeast of the basin, current water levels are variable – water level trends have been relatively stable since around 2000 (e.g., KTP029 and WLG098).

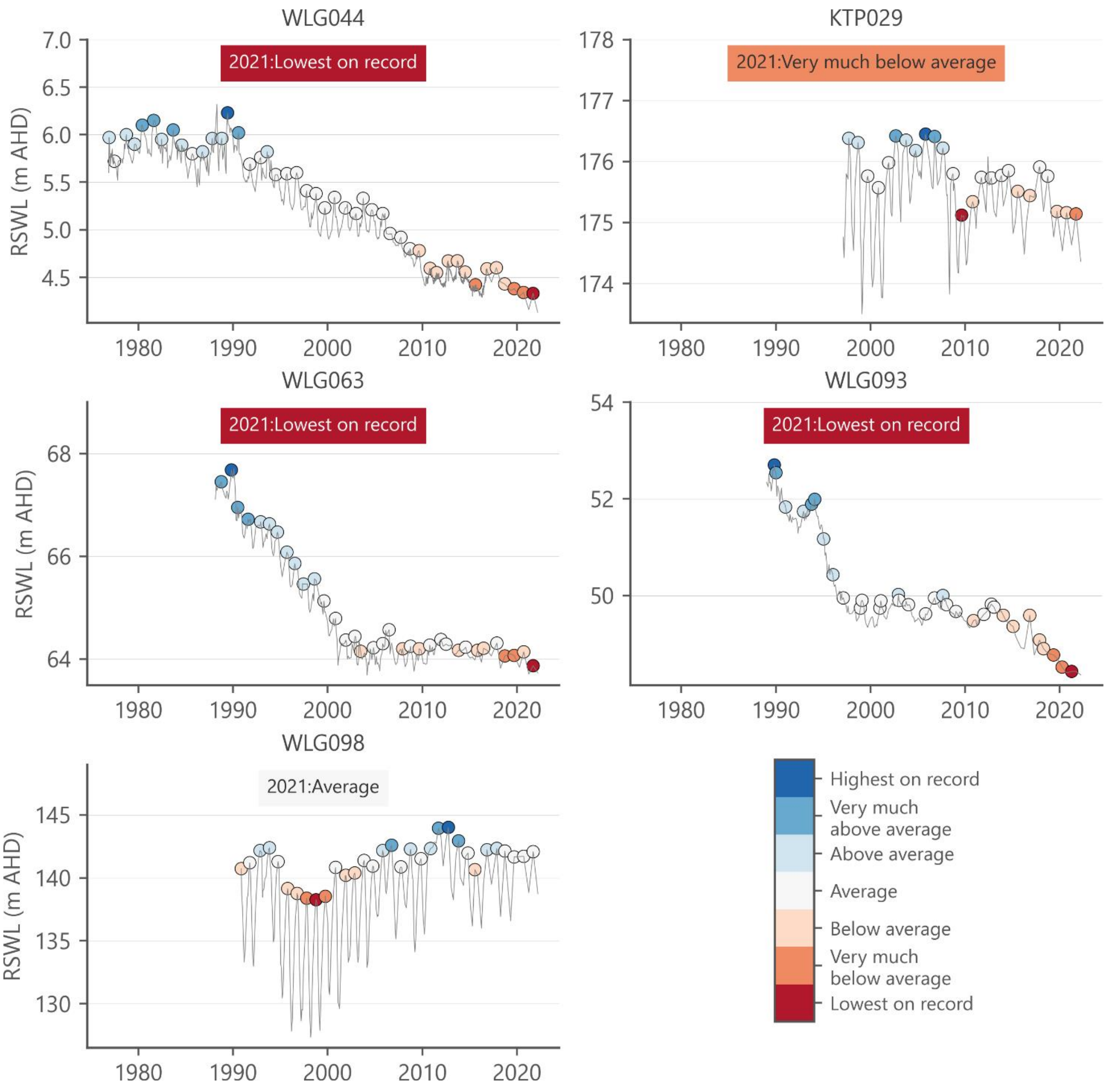

Figure 4.9 Selected Maslin Sands aquifer hydrographs

4.5 Maslin Sands aquifer salinity

Since 2017, irrigators in the McLaren Vale PWA have submitted groundwater samples that DEW have tested for salinity concentration, to augment DEW's state-wide monitoring network. In 2021, sampling results from 61 wells in the Maslin Sands aquifer range between 265 mg/L and 2,239 mg/L with a median of 869 mg/L (Figure 4.10).

In the 15 years to 2021, 27 of 41 wells (66%) show an increasing trend in salinity. Fifteen-year trends show that rates of change in salinity vary from a decrease of 18.0% per year to an increase of 4.5% per year, with a median rate of 0.2% increase per year (Figure 4.11).

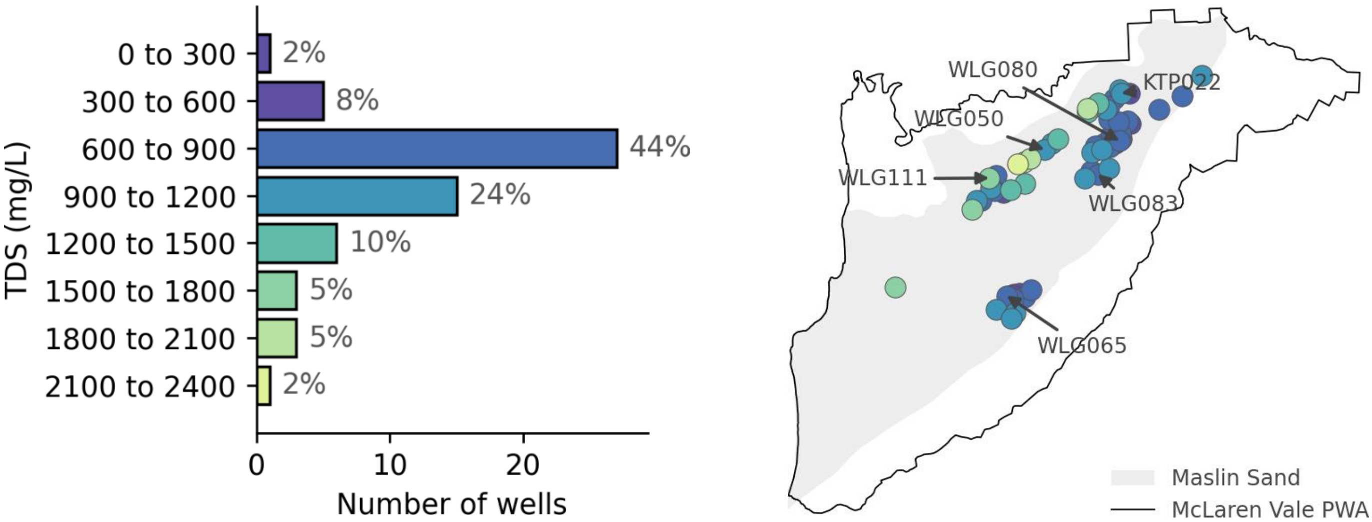

Figure 4.10 2021 salinity observations in the Maslin Sands aquifer

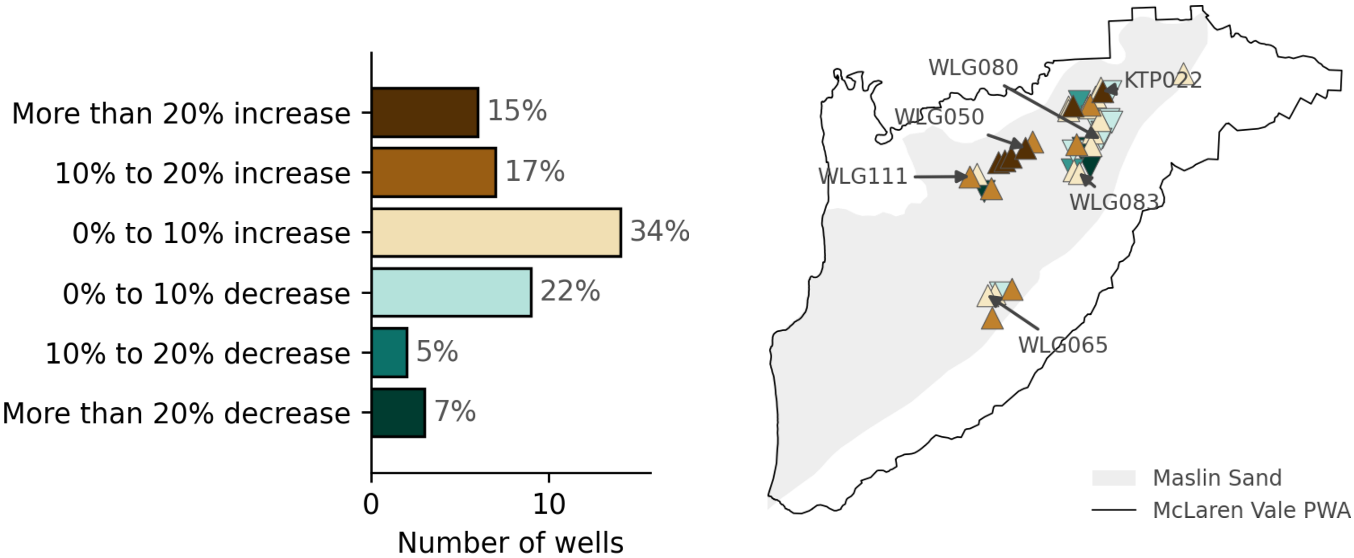

Figure 4.11 Salinity trend in the 15 years to 2021 for wells in the Maslin Sands aquifer

Salinity charts from a selection of representative monitoring wells are shown to illustrate common or important trends in the Maslin Sands aquifer (Figure 4.12). Towards the centre of the aquifer, WLG065, WLG080, WLG083 show decreasing groundwater salinity from the 1990s until 2006, after which salinity typically increases until around 2010, before stabilising.

In the past 20 to 30 years, salinity has been increasing north of McLaren Vale and McLaren Flat (e.g., WLG050, WLG111, and KTP022) where the Maslin Sands aquifer outcrops and overlies basement rocks. Monitoring data suggests a stabilisation in some wells (e.g., KTP022) while persistently increasing salinity is observed in others (e.g., WLG050). A possible source of high-salinity groundwater is the underlying confined fractured rock aquifer that has a greater hydraulic head relative to the Maslin Sands aquifer. This can lead to inter-aquifer leakage, especially when extractions from the Maslin Sands aquifer cause drawdown, thereby increasing the gradient between aquifers (Barnett and Judd 2019).

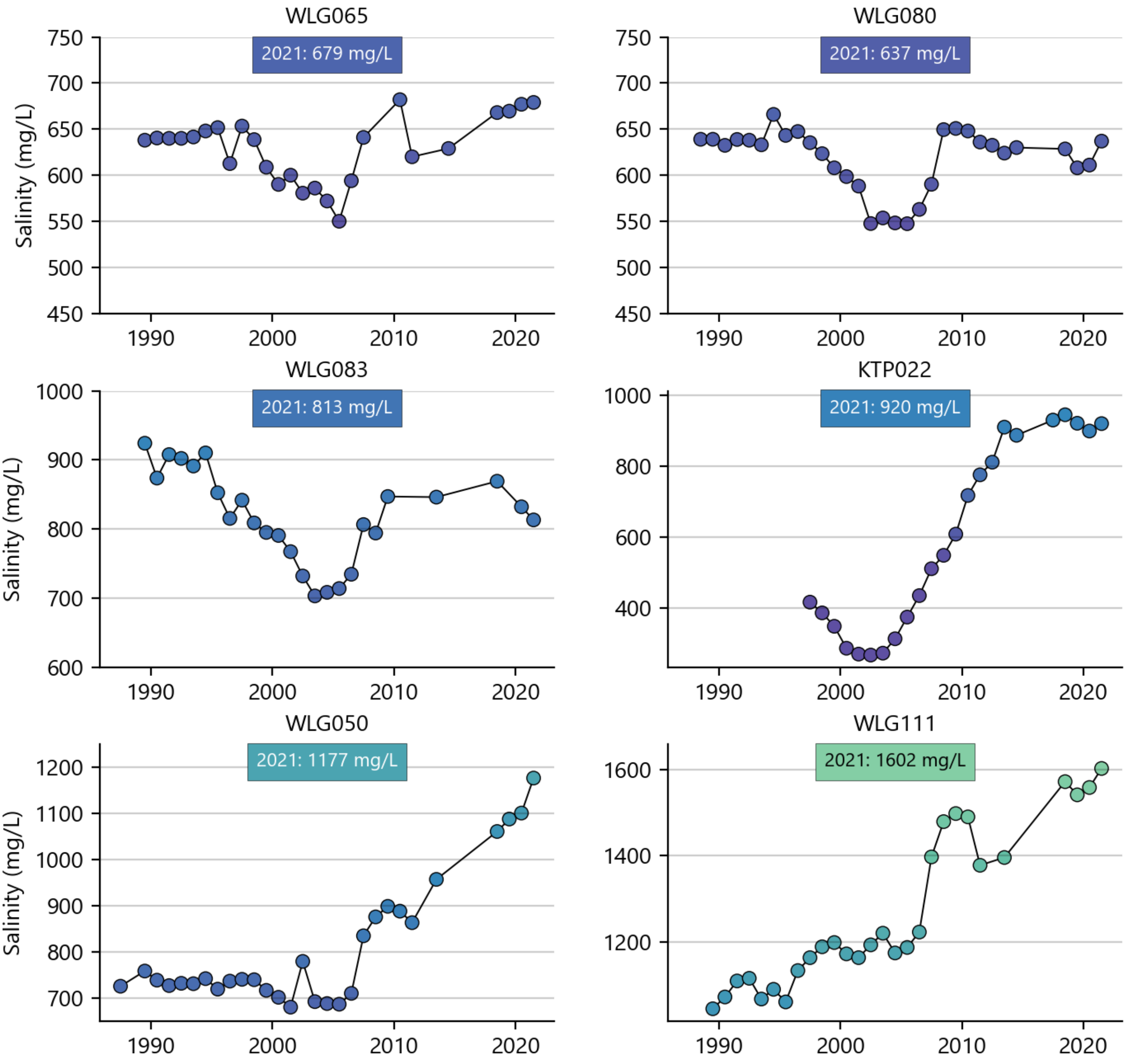

Figure 4.12 Selected Maslin Sands aquifer salinity graphs

4.6 Fractured rock aquifer water level

The wells monitoring the fractured rock aquifers are located primarily along the ranges east of Willunga Fault and along Onkaparinga Gorge, that is, the eastern and northern margins of the basin respectively. In 2021, winter-recovered water levels in 8 out of 17 (47%) of monitoring wells in the fractured rock aquifers are classified 'Average' while 41% of wells are classified 'Below average' or lower (see Section 2.2.1 for details of the classification; Figure 4.13).

Over the past 20 years, variations in water level in 17 wells range from a decline of 15.78 m to a rise of 0.93 m (median is a decline of 0.90 m).

Five-year trends show declining water levels in the majority of wells (92%), with rates of decline ranging between 1.60 to 0.05 m/y (median is a decline of 0.28 m/y) (Figure 4.14).

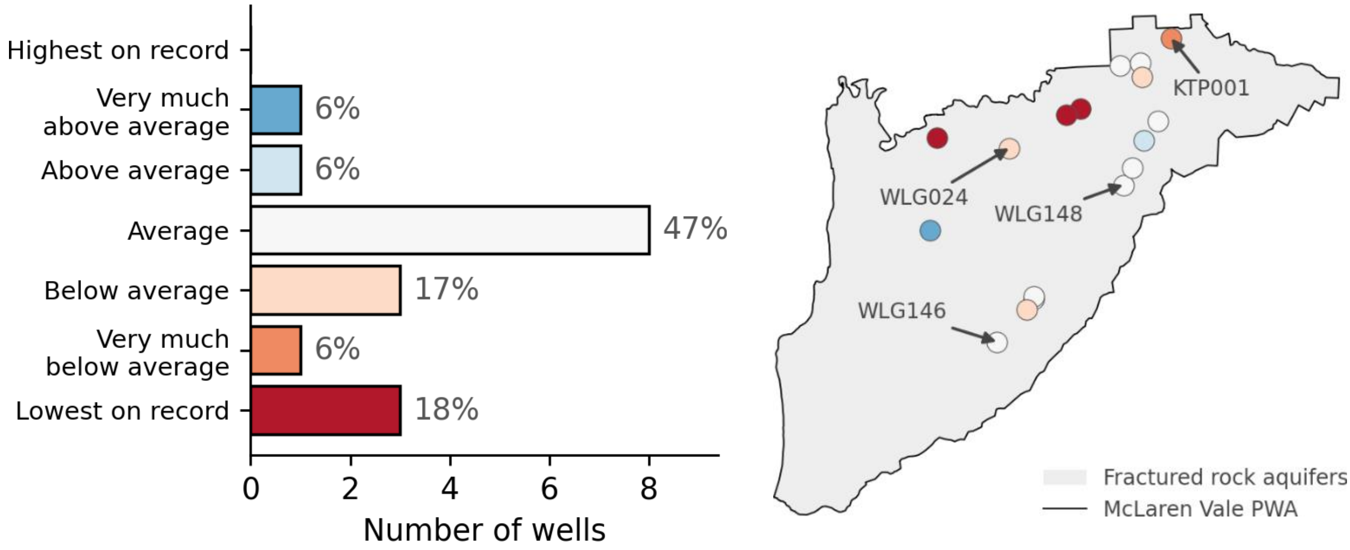

Figure 4.13 2021 recovered water levels for fractured rock aquifers

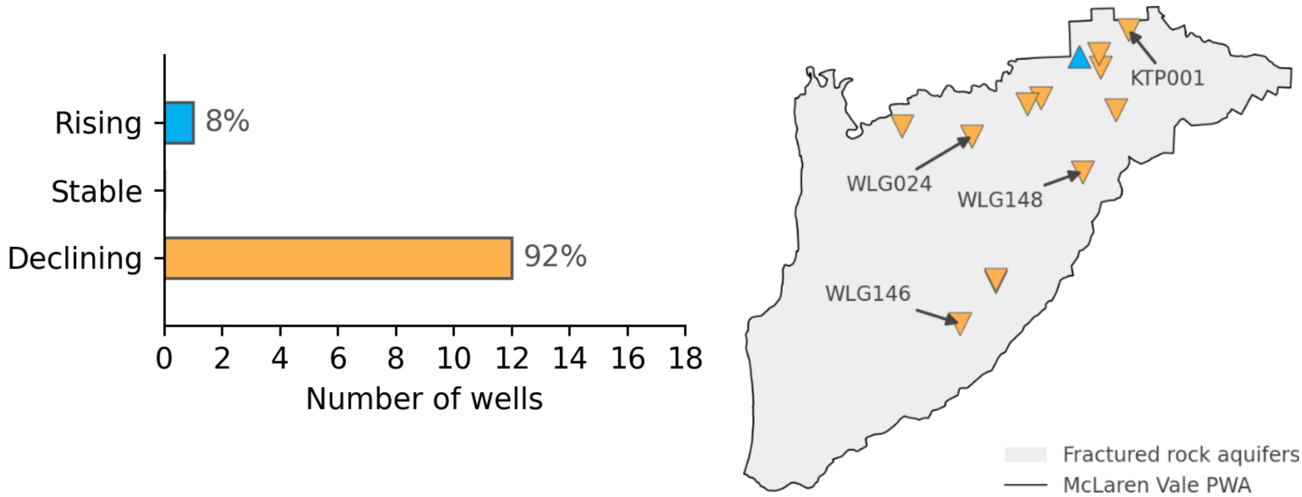

Figure 4.14 2017 to 2021 trend in recovered water levels for wells in fractured rock aquifers

Hydrographs from a selection of representative monitoring wells are shown to illustrate common or important trends in the fractured rock aquifers. Groundwater levels in the fractured rock aquifers are generally very responsive to incident rainfall (Figure 4.15), especially where basement rock outcrops and receives direct rainfall recharge.

East of Willunga, water levels in the fractured rock aquifer have been relatively stable over the longer term (e.g., WLG146). Over the past five years, the water level recovered from 'Lowest on record' in 2015, and has since stabilised.

East of McLaren Flat, there have been large water level declines of up to 25 m (e.g., WLG148), although water levels have stabilised in recent years. North of McLaren Flat (e.g., WLG024) and north of Kangarilla (e.g., KTP001), water levels in the fractured rock aquifer have declined by over 5 m since the mid-1970s.

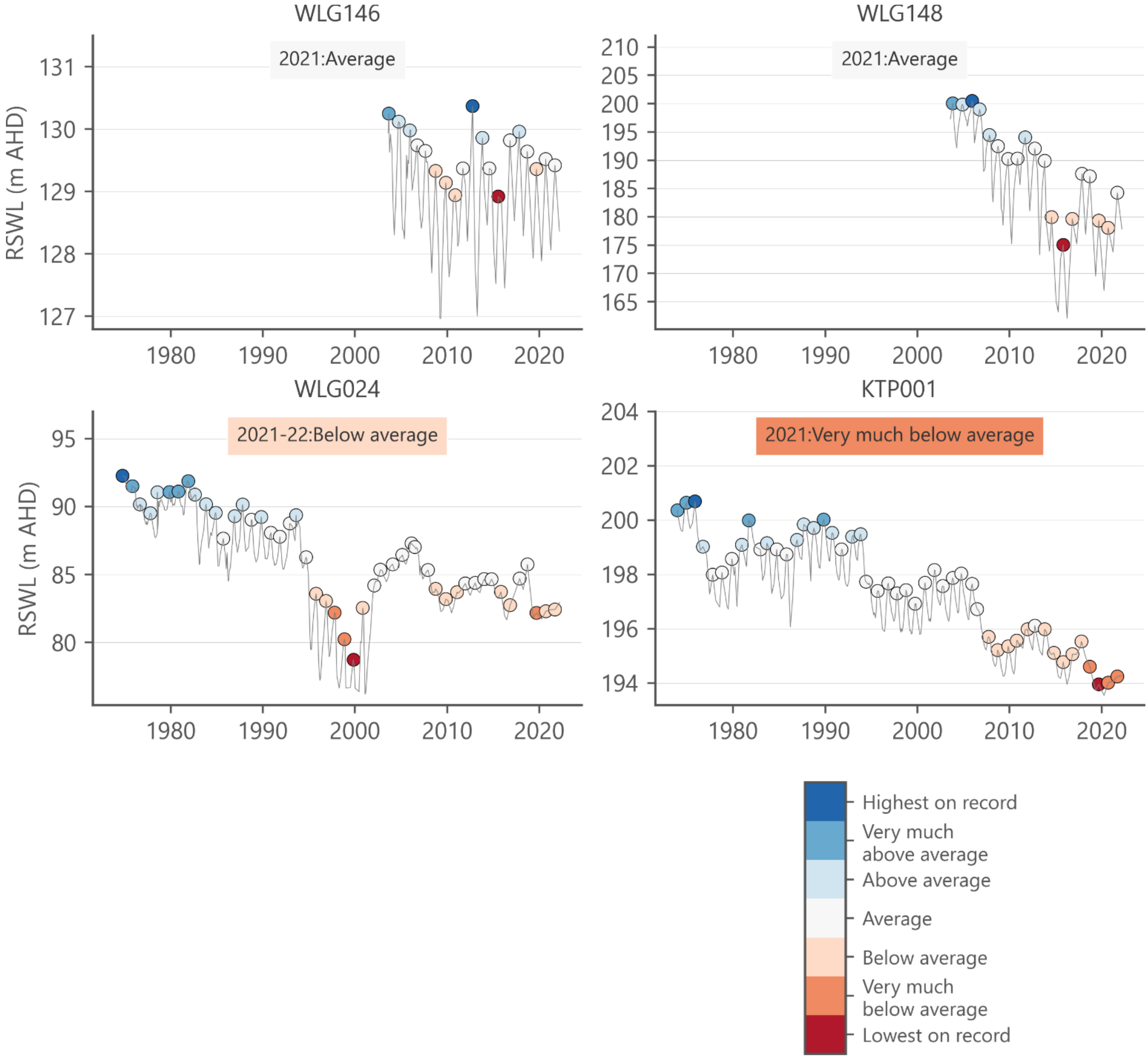

Figure 4.15 Selected hydrographs for wells in fractured rock aquifers

4.7 Fractured rock aquifer salinity

Since 2017, irrigators in the McLaren Vale PWA have submitted groundwater samples that DEW have tested for salinity concentration, to augment DEW's state-wide monitoring network. In 2021, sampling results from 51 wells in the fractured rock aquifers of the McLaren Vale PWA range between 377 mg/L and 2,602 mg/L with a median of 1,434 mg/L (Figure 4.16).

In the fifteen years to 2021, 17 of 30 wells (57%) show an increasing trend in salinity. Fifteen-year trends show that rates of change in salinity vary from a a decrease of 3.1% per year to an increase of 1.7% per year, with a median rate of 0.1% increase per year (Figure 4.17).

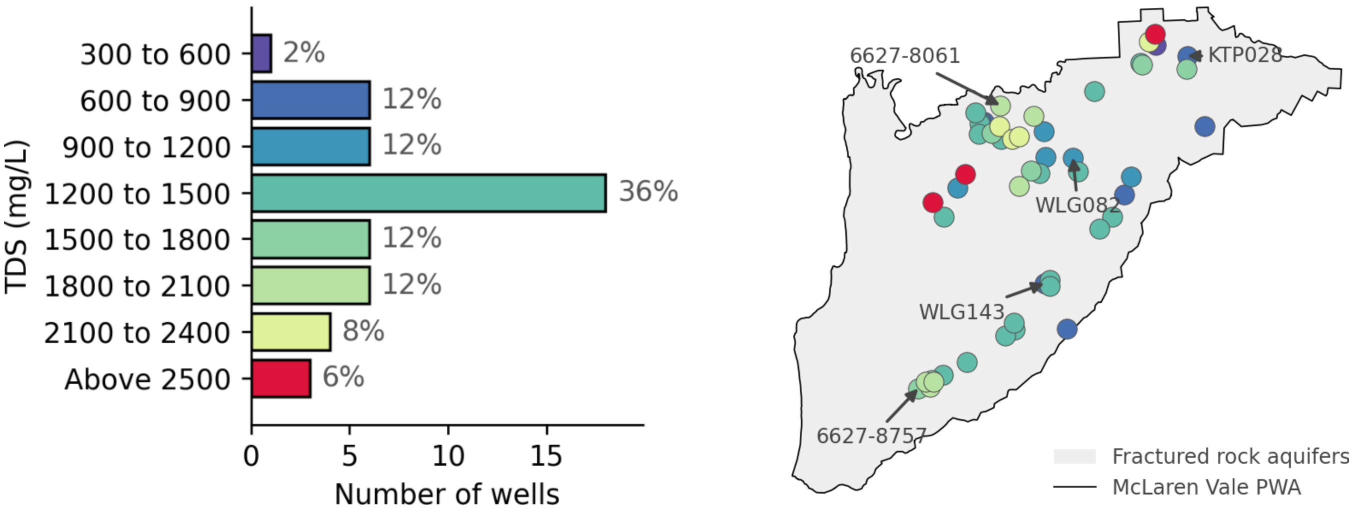

Figure 4.16 2021 salinity observations in fractured rock aquifers

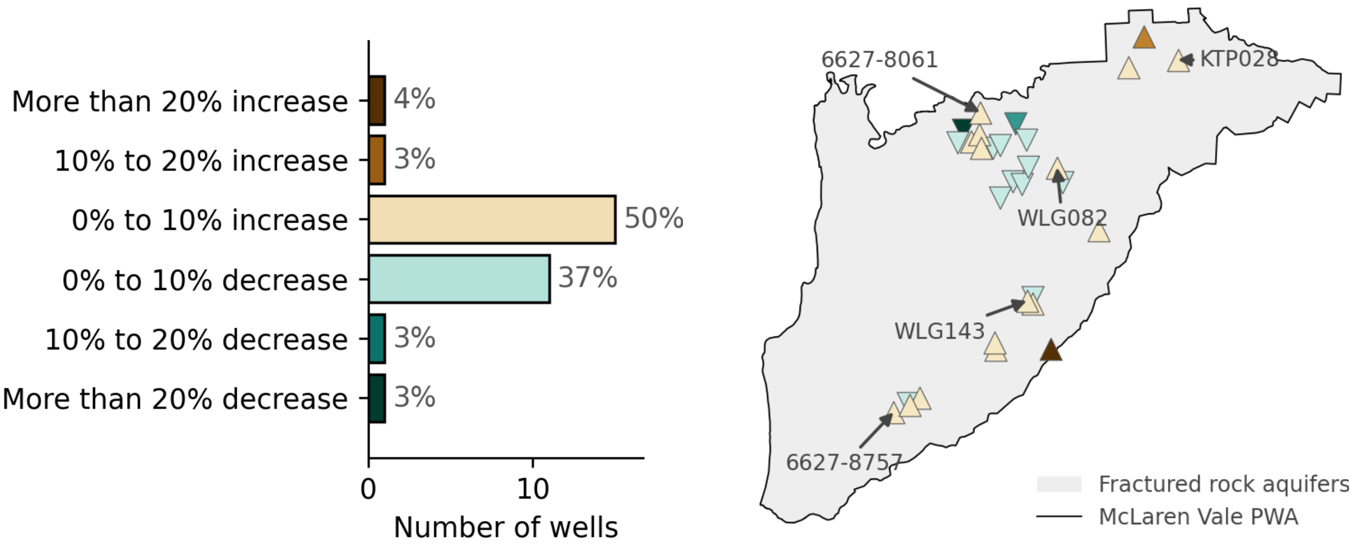

Figure 4.17 Salinity trend in the 15 years to 2021 for wells in fractured rock aquifers

Salinity charts from a selection of representative monitoring wells are shown to illustrate common or important trends in the fractured rock aquifer (Figure 4.18). Groundwater salinity in fractured rock aquifers can be highly variable due to the complex system of preferential flow paths that influence recharge and groundwater flow through the aquifer.

Monitoring wells located near McLaren Flat (e.g., WLG082) and Kangarilla (e.g., KTP028) show decreases in groundwater salinity from around 1990 until the mid-2000's, after which, salinity has generally increased. The salinity at WLG143, located south-east of McLaren Vale has also shown a generally rising trend since the mid-2000's.

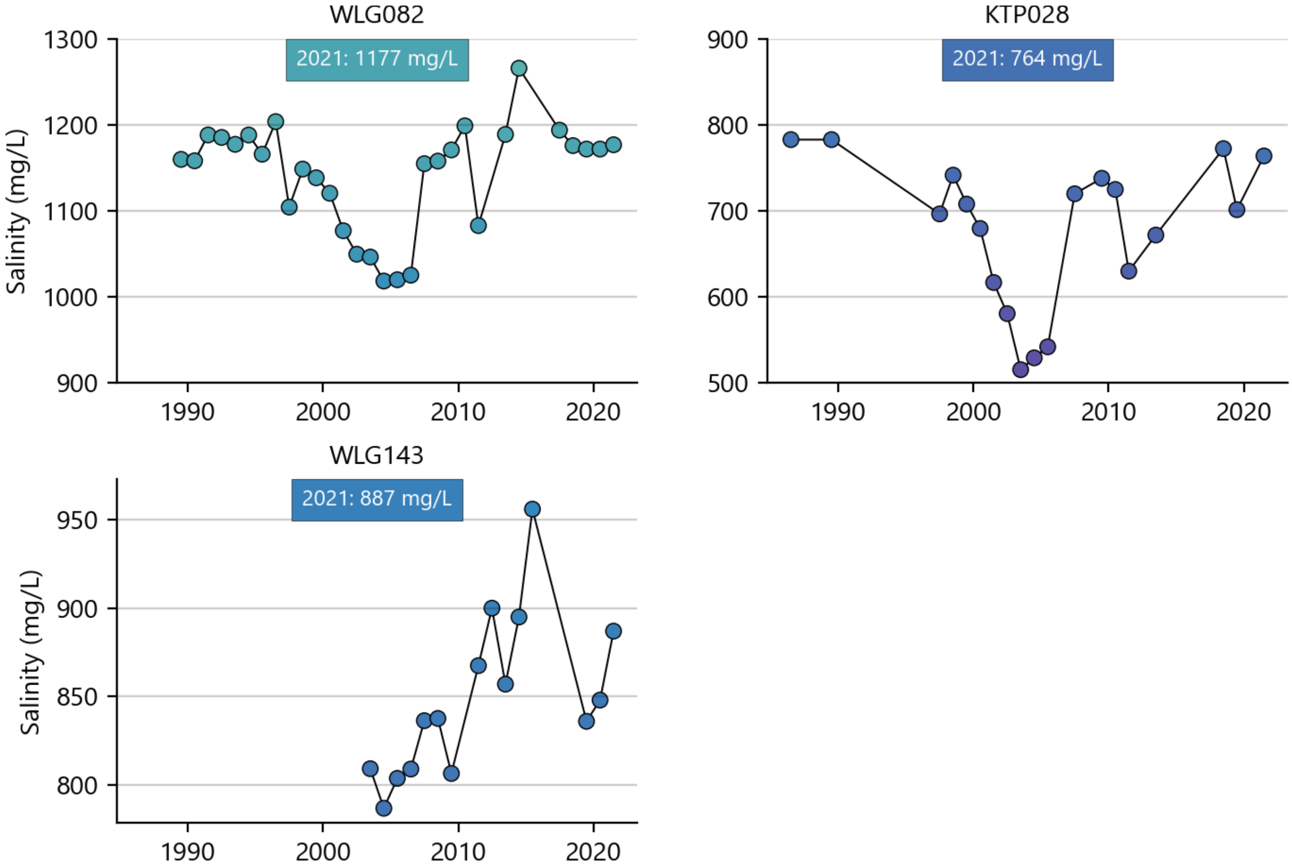

Figure 4.18 Selected salinity graphs for wells in fractured rock aquifers

5 Water use

Metered groundwater extraction in the McLaren Vale PWA totals 4,186 ML for 2020–21 (

Figure 5.1), a decrease in extraction of 288 ML (6%) from the preceding water-use year and 67 ML higher than the long-term average annual volume of groundwater extraction (4,119 ML from 2004–05 to 2020–21). In 2020–21:

- 714 ML (17% of the total extraction) is sourced from the fractured rock aquifer, which is approximately 12% lower than the average annual extraction from the fractured rock aquifer over the long-term average.
- 914 ML (22% of the total extraction) is sourced from the Maslin Sands aquifer, which is approximately 29% higher than the average annual extraction from the Maslin Sands aquifer over the long-term average.
- 2555 ML (61% of the total extraction) is sourced from the Port Willunga Formation aquifer, which is just 2% below the average annual extraction from the Port Willunga Formation over the long-term average (Figure 5.2).

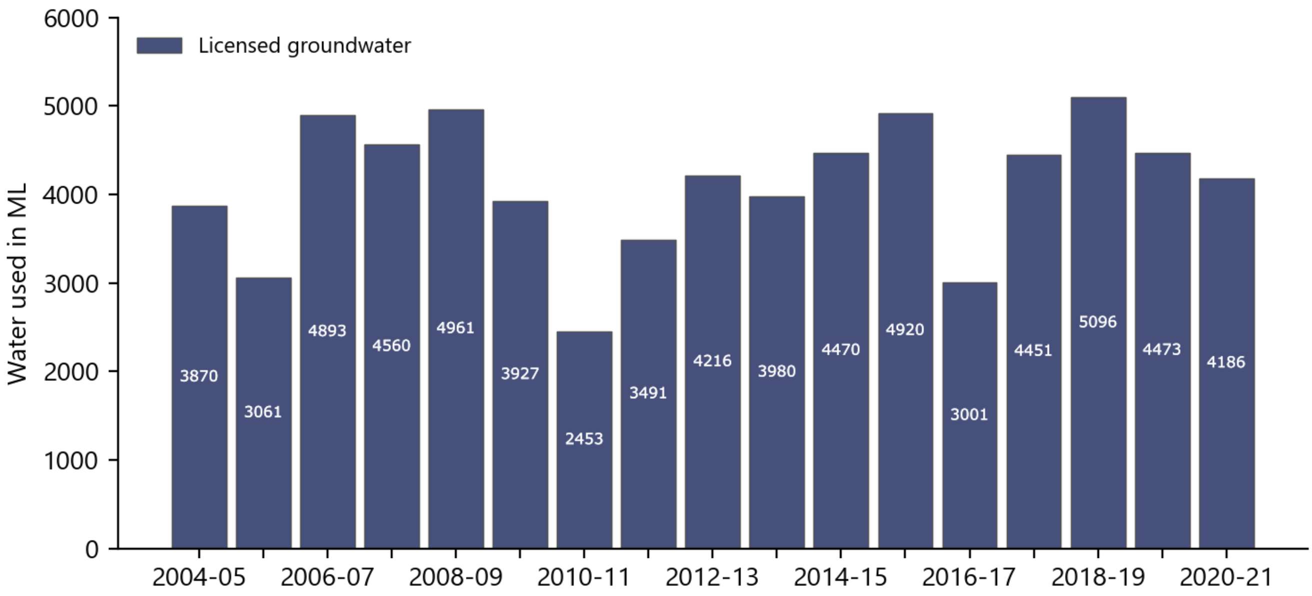

Figure 5.1 Water extraction for 2004–05 to 2020–21 for the McLaren Vale PWA

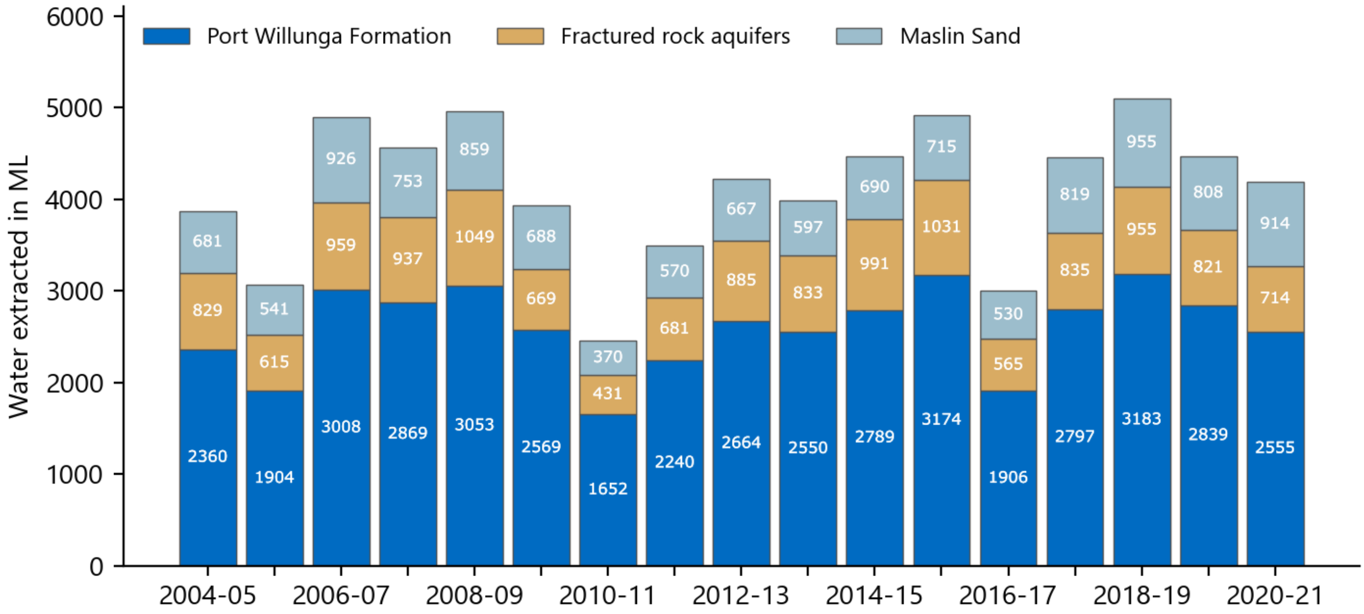

Figure 5.2 Metered groundwater extraction in aquifers of the McLaren Vale PWA

Two managed aquifer recharge (MAR) schemes operate in the McLaren Vale PWA. Reclaimed water provides an alternate source of water for irrigation and relieves pressure on the groundwater system. The two schemes around Aldinga have design capacity to inject up to 550 ML/y into the Port Willunga Formation.

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