Review of the *Water Allocation Plan for the McLaren Vale Prescribed Wells Area*

August 2022

LANDSCAPE SOUTH AUSTRALIA HILLS AND FLEURIEU

Report prepared by the Hills and Fleurieu Landscape Board

Government of South Australia

August 2022

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Cover Photo: Reeds and redgums at Lot 50-Kanyanyapilla, McLaren Vale (Tom Mowbray)

Review of the

Water Allocation Plan for the McLaren Vale Prescribed Wells Area

The Hills and Fleurieu Landscape Board:

1. approves the 'Review of the Water Allocation Plan for the McLaren Vale Prescribed Wells Area' as the comprehensive review of the Water Allocation Plan for the McLaren Vale Prescribed Wells Area (2007) required by s. 54(1) of the *Landscape South Australia Act 2019*, and
2. approves the recommendations of this review as set out in section 2 – Recommendations.

David Greenhough

Presiding Member Hills and Fleurieu Landscape Board

Date: 1 August 2022

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List of acronyms and abbreviations

the Act	*Landscape South Australia Act 2019*
DEW	Department for Environment and Water
GDE	Groundwater dependent ecosystem
HFLB	Hills and Fleurieu Landscape Board. Depending on the context, this term may either refer to organisations or the governing board itself
HFWRSC	Hills and Fleurieu Water Resources Steering Committee - , which is made up of two board members, HFLB General Manager, HFLB Manager Planning and Engagement, and DEW directors/managers from its Water Policy, Science and Licensing branches.
KYAC	Kaurna Yerta Aboriginal Corporation
MV	McLaren Vale
MV WAP	*McLaren Vale Prescribed Wells Area Water Allocation Plan (2007)*
MVRWSP	McLaren Vale Regional Water Security Plan
PWA	Prescribed wells area
PWRA	Prescribed water resources area
WAP	Water allocation plan
WAPAC	Water allocation plan advisory committee. In the context of this document 'the WAPAC' refers to the McLaren Vale Water Allocation Plan Advisory Committee
WMLR	Western Mount Lofty Ranges

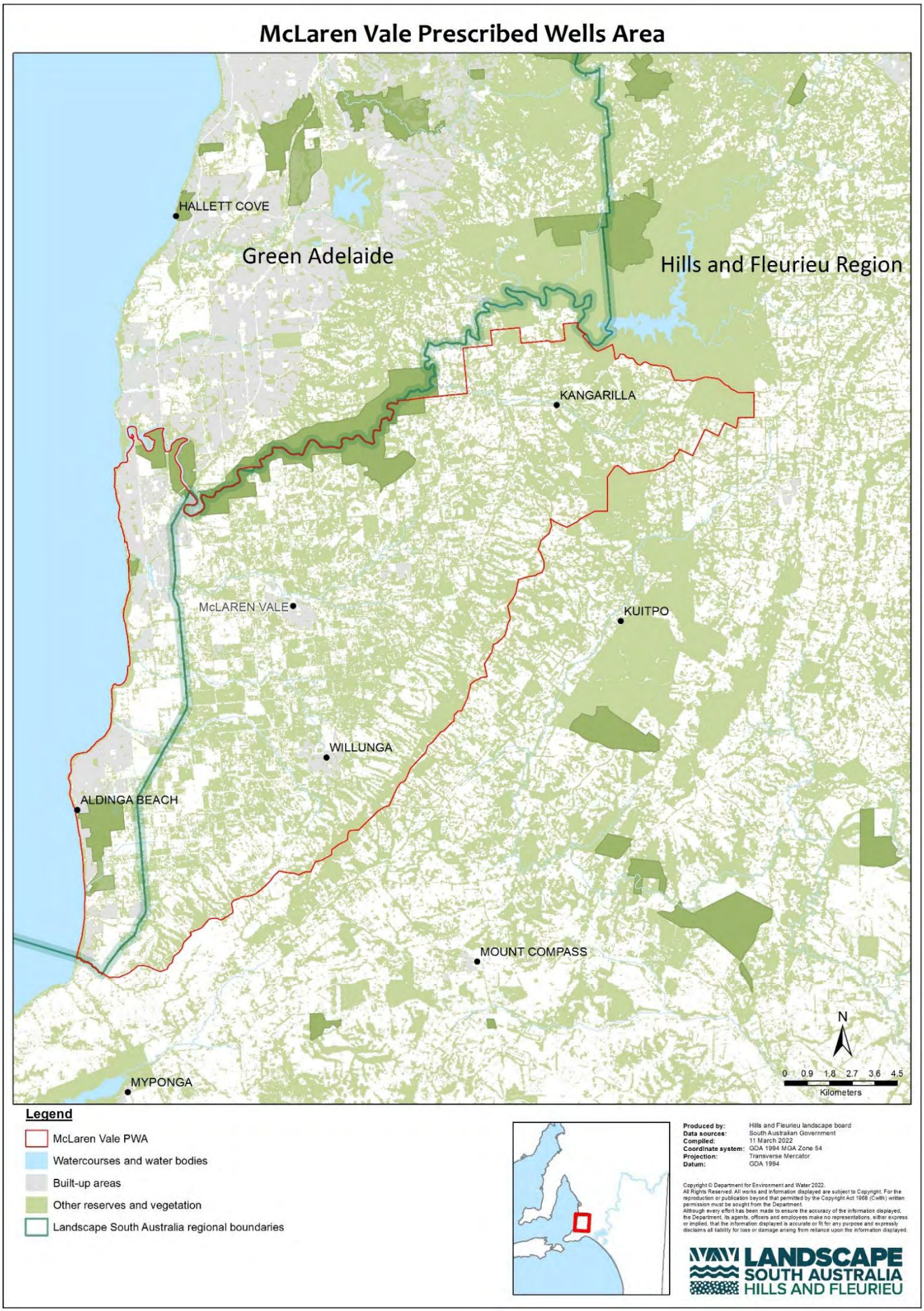


Figure 1 Map of McLaren Vale Prescribed Wells Area

1 Executive Summary

This document is the ten year review of the *Water Allocation Plan; McLaren Vale Prescribed Wells Area 2007* (the MV WAP) as required by s. 54 of the *Landscape South Australia Act 2019* (the Act). The MV WAP was adopted in 2007, and reviewed in 2011 without amendment. The MV WAP is a groundwater only plan, and manages the groundwater resources of the McLaren Vale Prescribed Wells Area (MV PWA) (see Figure 1).

Grapevines make up 96% of the gross value of irrigated agriculture in the area and underpin a local economy based on winemaking and tourism.

The review adopted a looking forward / looking back approach, examining the success of the MV WAP in achieving its objectives and assessing whether the MV WAP remains appropriate for managing the resource for the next ten years. The four main elements to the review process were:

- A water allocation plan advisory committee (WAPAC) was established to provide community views. The WAPAC conducted a risk assessment as part of the looking forward aspect, and was also a forum for discussing issues of interest to the community.
- A technical advisory group was formed which conducted an assessment of how well the objectives of the MV WAP had been achieved.
- The Kaurna Nation were engaged through workshops and provided a statement about their interests.
- A groundwater assessment report provided by the Department for Environment and Water (DEW) Water Science and Monitoring Branch

The groundwater assessment document reported small downward trends in aquifer water and pressure levels in four out of the five main aquifers. DEW has attributed more recent declines in aquifer water and pressure levels to being predominantly driven by rainfall trends rather than extraction. The report also described areas in two aquifers with a total of four salinity hotspots. The MV WAP has a single extraction limit. Introducing limits at aquifer and management zone scales could assist in managing these issues.

The MV WAP will feed into the proposed McLaren Vale Water Security Plan by setting allocation limits and therefore the volume of native groundwater available for use.

In an online community survey 59% of respondents agreed that the MV WAP is effectively managing groundwater in the region with the most important issues being supporting irrigated agriculture and sustainably managing groundwater dependent ecosystems (GDEs).

Kaurna provided a statement that emphasised their relationship with water being vital for maintaining cultural heritage and spirituality. They made a series of recommendations that will be further explored with Kaurna in the amendment phase.

The review found that there was little data on the condition and trend of GDEs, however most GDEs are connected to the aquifers which are less used for irrigation.

The review of objectives found that extraction was well within the limits set in the MV WAP and that there were no compliance issues with the rules relating to drilling wells or managed aquifer recharge. However the MV WAP did not have an overarching set of objectives. It was also found that the MV PWA had not

maintained groundwater at 2000 levels, but that in the context of climate change, that objective may not be achievable with the instruments available through a water allocation plan (WAP).

The risk assessment identified 6 medium to high risks, which related to some areas, which were assessed as being able to be influenced by factors regulated by the WAP. The risk source for all of these 6 risks was 'groundwater extraction'. In particular, the risk assessment discussions suggested that the concerning trends in salinity in some areas are likely to need to be treated by changes to WAP principles.

The WAPAC raised a range of issues, with those of greatest concern being the presence of salinity hotspots, downward trends in aquifer water and pressure levels and the need to determine the relative degree to which climate change and extraction are influencing trends.

Climate change projections indicate that over the long term, climate change will impact aquifers through a reduction in recharge, with unconfined aquifers and those aquifers with limited storage capacity being more vulnerable than confined aquifers and those with large storage.

The review provided an opportunity to discuss the WAP arrangements for the MV PWA. The WAPAC valued integrating surface water and groundwater management and the local focus and sense of community ownership of the MV WAP, suggesting that surface water be incorporated into the MV WAP.

The Hills and Fleurieu Water Resources Steering Committee agreed that there are resource management advantages from including surface water and groundwater within the same WAP, but that the cost, complexity, and timeframes of transferring surface water into a future MV WAP are prohibitive.

This review recommends that the Hills and Fleurieu Landscape Board consult further with the community to better understand concerns before making a decision about amalgamating the McLaren Vale Water Allocation Plan with the Western Mount Lofty Ranges Water Allocation Plan..

This review also makes a number of other recommendations relating to focus areas for the amendment process which are set out in the following section.

1 Vines in autumn, McLaren Vale region (Tom Mowbray)

2 Recommendations

The HFLB has adopted the recommendations of this review.
The HFLB:

		Discussed in section number:
1)	Approves the Review of the Water Allocation Plan for the McLaren Vale Prescribed Wells Area (this document) as the comprehensive review of *the Water Allocation Plan for the McLaren Vale Prescribed Wells Area (2007)* pursuant to s. 54 of the Act.	3.2
2)	Determines that the *Water Allocation Plan for the McLaren Vale Prescribed Wells Area (2007)* no longer remains appropriate and requires amendment.	5.4
3)	Notes that the reasons for (2) above are that:	
	a) the MV WAP does not recognise Kaurna interests in the resource,	4, 6.2.13
	b) the risk assessment identified that in some areas there are medium/high risks to the resource from extraction. These risks including the salinity hotspots arising in some areas, may potentially require treatment by amending the MV WAP,	5.4, 6.1, 6.2.1, 6.2.2, 6.2.3, 6.2.12
	c) the provisions of the MV WAP do not provide for management rules (including allocation limits) to be applied at an aquifer level or management zone level,	5.2, 6.2.11
	d) the MV WAP lacks of a set of overarching objectives, and	5.4, 6.2.15, 6.2.16
	e) the MV WAP does not consider impacts of climate change.	6.4
4)	In carrying out the amendment of the MV WAP that the supporting investigations will include:	
	a) working with Kaurna to explore ways to recognise and support Kaurna interests and values,	4, 6.2.13
	b) developing a set of overarching objectives,	5.4, 6.2.15
	c) examining the relative contribution of climate change and extraction to observed groundwater trends,	5.2, 6.1, 6.2.1, 6.2.2
	d) examining the appropriateness of the current extraction limit and the likely impact that changes to the extraction limit might have on observed groundwater trends,	5.2, 6.1, 6.2.1, 6.2.2, 6.2.4
	e) developing provisions that enable management rules (including allocation limits) to be applied at an aquifer level or management zone level,	5.2, 6.2.3, 6.2.11
	f) projecting a range of climate change scenarios and developing strategies that allow for adaptive management in the face of climate change and other factors, possibly including resource condition triggers and partial unbundling,	6.4

g) developing more detailed information on the location of GDEs, and the development of buffer zone principles for GDEs, — 5.3, 6.2.4

h) developing a GDE and groundwater monitoring evaluation and reporting process for the amended WAP, to be jointly developed with the DEW branches responsible for undertaking the monitoring, and to be accompanied by an implementation plan that has regard to available levels of resourcing, — 5.4, 6.2.4, 6.2.10

i) examining stock and domestic use, and whether it can be better accounted for in the WAP, — 6.2.5

j) developing clearer transfer principles, particularly in relation to stressed areas. — 6.2.8

5) With regard to the upcoming review of the Western Mount Lofty Ranges WAP the HFLB will have regard to groundwater recharge in its consideration of surface water rules. — 6.1, 6.2.12

6) Will consider the risks identified in Table 4 that are not able to be treated through amendments to the McLaren Vale WAP, and consider whether these risks can be mitigated through other HFLB programs or partnerships. — 6.1

7) Will consult further with the community to better understand concerns before making a decision about amalgamating the McLaren Vale Water Allocation Plan with the Western Mount Lofty Ranges Water Allocation Plan. — 6.3

2 Pedlar's Creek estuary (Tom Mowbray)

3 Introduction

3.1 Background

The MV WAP is a groundwater only WAP which sets out the water management rules for the MV PWA.

The MV PWA covers an area of approximately 320 square kilometres, with the Onkaparinga River forming part of the northern boundary, while much of the south-eastern boundary follows the ridge of the Sellicks Range. A locality map is provided at Figure 1.

The MV PWA lies entirely within the Kaurna Nation native title determination.

Surface expression of groundwater supports numerous wetlands in the region, with Blewitt Springs, Washpool, Aldinga Scrub and Maslin Creek Reed Swamp being significant examples. Base flow from groundwater supplements flow in a number of watercourses, which is significant during the drier months.

Grapevines make up 96% of the gross value of irrigated agriculture in the area and underpins a local economy based on winemaking and tourism. The McLaren Vale region represents more than $500 million in gross regional value to the State and national economy.

In the 2019-20 water use year there were 468 water licences with a total allocation of 6,488 ML making up 0.24% of South Australia's total water allocations. Actual use of licenced groundwater was around 5,000 ML, and currently the Willunga Basin Water Scheme (using recycled wastewater from the Christies Beach water treatment plant) provides an additional 7,120 ML/year for irrigation. Stock and domestic use of water is estimated to use a further 200-300 ML/year of groundwater.

The McLaren Vale PWA was gazetted on 7 January 1999, under the provisions of the then *Water Resources Act 1997*, with the first WAP adopted in November 2000. The current MV WAP was adopted in February 2007 and was reviewed without amendment in 2011.

3 Autumn in McLaren Vale region (Jenny Woodley)

3.2 Legislative requirements

Section 54(1) of the Act requires that a landscape board must review a WAP on a comprehensive basis at least once every ten years (Appendix 1 provides the full WAP review requirements set out in s. 54). This document constitutes the comprehensive review of the *McLaren Vale Prescribed Wells Area Water Allocation Plan*.

Under s. 54(2) the purpose of a comprehensive review is to:

> *(a) provide a review of—*
>
> *(i) the principles reflected in the plan; and*
>
> *(ii) the success of the plan after taking into account the outcomes sought to be achieved by the water allocation plan; and*
>
> *(b) provide an assessment of whether the water allocation plan remains appropriate or requires amendment.*

Section 54 also provides that in undertaking a review, boards are to undertake such consultation as it determines to be reasonable, taking into account any regulations made pursuant to s. 54(5) or guidelines specified by the Minister pursuant to s. 54(4). While no such regulations or guidelines have been developed, general guidelines (DEW 2021) in relation to how landscape boards should engage with the community have been issued by the Minister, and consultation conducted for this review had regard to those guidelines. The consultation undertaken by HFLB is set out in 2.3 below.

3.3 Review approach

The Hills and Fleurieu Landscape Board (HFLB) took a two-step approach to the WAP Review that follows the *Guidelines for Review of water allocation plans* (DEW 2020).

A key focus of the review was to seek community views as to whether the WAP is effectively balancing social, cultural, environmental and economic needs for water. This was achieved with the following activities:

- HFLB established a WAP Advisory Committee (WAPAC) made up of 9 community and industry representatives. The Committee's role was to provide advice to HFLB during the review, including considering the condition of the resource, being involved in the risk assessment and advising HFLB on how to best engage the community. 8 meetings were held with the WAPAC during 2021 and 2022.

- Two workshops were held with representatives from the Kaurna Nation.
- A community survey was conducted to understand community views on the effectiveness of the WAP.

HFLB also undertook significant engagement with DEW in the review to understand the effectiveness of the WAP from the perspective of DEW in its implementation of the WAP through the water licensing system and in the views of DEW Water Policy and Water Science experts. A technical advisory group was formed consisting of representatives from HFLB and DEW with expertise in aspects of water science, management, planning and policy. DEW technical staff also presented information to the WAPAC.

The WAP review was overseen by the Hills and Fleurieu Water Resources Steering Committee, which is made up of two board members, HFLB General Manager, HFLB Manager Planning and Engagement, and DEW directors/managers from its Water Policy, Science and Licensing branches.

3.3.1 Looking back approaches

The review of the success of the WAP was undertaken through the following:

- Kaurna input on the effectiveness of the WAP in supporting cultural values (see section 4)
- A survey of community views (see section 5.1 of this review),
- Analysis of trends in the condition of the resource (see section 5.2)
- Examination of trends in the condition of groundwater dependent ecosystems (see section 5.3)
- A review of the success of the objectives of the plan by the technical advisory group (see section 5.4),

3.3.2 Looking forward approaches

Determining whether the MV WAP requires amendment was undertaken through the following:

- Kaurna input (see section 4)
- Risk assessment (see section 6.1)
- Issues raised by the WAPAC for consideration (see section 6.2)
- Consideration of WAP arrangements for the MV PWA (see section 6.3)

The assessment of whether the WAP remains appropriate is set out in the recommendations of this review (see section 2).

3.4 Description of resource

This section provides a brief outline of the nature and composition of the aquifers of the McLaren Vale Prescribed Wells Area. This information is sourced from the document *McLaren Vale Prescribed Wells Area groundwater resource assessment* (DEW 2022) which contains more detailed descriptions.

On the basis of recent study (Barnett & Bourman, 2022) this review considers the Pirramimma Sands to be a separate aquifer from the Port Willunga Formation for management purposes, even though they are hydraulically connected.

A cross section through the Willunga Embayment is shown at Figure 2.

3.4.1 Quaternary aquifer

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 infiltration of runoff provided by streams.

There are currently only six licences utilizing the Quaternary aquifer because of the predominantly low yields. They extract a total of about 6.5 ML/year from a total allocation of 10.8 ML.

3.4.2 Port Willunga Formation aquifer

The Port Willunga Formation aquifer consists of Tertiary marine limestones and is confined by Quaternary sediments over its full extent in the south-western part of the basin. This aquifer recharges by downward leakage from the Quaternary aquifer and possibly lateral flow across the Willunga Fault from the Fractured Rock aquifer.

Metered extraction from the Port Willunga Formation aquifer since 1996-97 has been fairly consistent and below 1,500 ML/year, with seasonal variations caused by variations in rainfall. It is close to the 2020 allocation volume of 1,683 ML.

3.4.3 Pirramimma Sands aquifer

This sand aquifer was previously considered to be part of the Port Willunga Formation aquifer. This aquifer comprises a fine-grained poorly consolidated sand which forms an unconfined aquifer extending over the central and north-eastern portions of the basin. It is recharged by rainfall and possibly lateral flow across the Willunga Fault from the Fractured Rock aquifer.

Metered extraction from the Pirramimma Sands aquifer since 2004-05 has been fairly consistent and below 1,750 ML/year, with seasonal variations caused by variations in rainfall. It is close to the 2020 allocation volume of 1,850 ML.

3.4.4 Maslin Sands aquifer

The Maslin Sands aquifer directly overlies basement rocks and comprises fine to coarse sands and clays. The aquifer is recharged by rainfall in the north-east of the PWA where it crops out. Elsewhere, the aquifer is confined and separated from the overlying Port Willunga Formation Aquifer by the Blanche Point Formation aquitard which consists of low-permeability marine mudstone and limestone.

Metered extraction from the Maslin Sands aquifer since 2004-05 has been fairly consistent and mostly below 1,000 ML/year, with seasonal variations caused by changes in rainfall. It is generally well below the 2020 allocation volume of 1,278 ML.

3.4.5 Permian Sand aquifer

Isolated occurrences of Permian Sands occur near the north-eastern and north-western boundaries of the PWA which are recharged from rainfall.

3.4.6 Fractured Rock aquifer

The Fractured Rock aquifer occurs throughout the whole PWA, either as unconfined aquifer where it outcrops at the ground surface on the margins of the Willunga Embayment, or as a confined aquifer underlying the Tertiary and Quaternary sediments. Infiltration of rainfall provides recharge to this aquifer.

Metered extraction from the Fractured Rock aquifer since 2004-05 has been fairly consistent and mostly below 1,000 ML/year, with seasonal variations caused by changes in rainfall. It is generally well below the 2020 allocation volume of 1,653 ML.

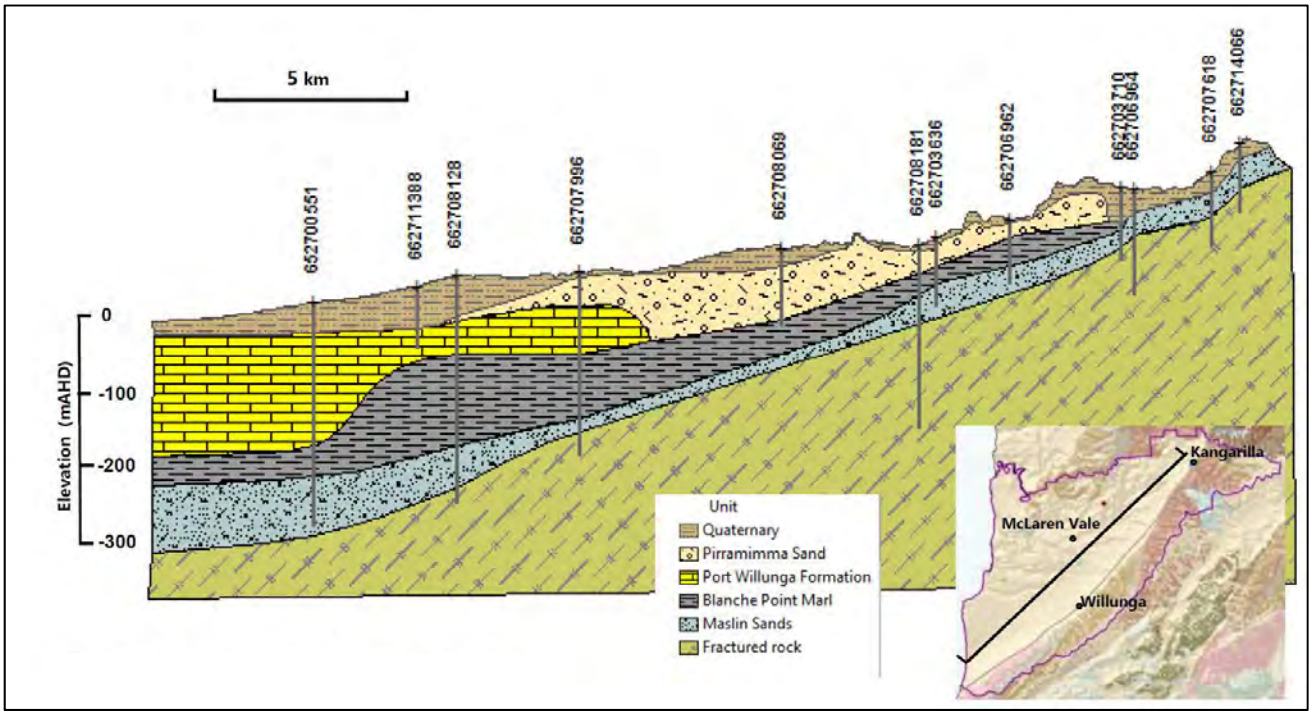


Figure 2 Geological cross-section of the Willunga Embayment

3.5 Connection to McLaren Vale Regional Water Security Strategy

In 2021-22, a collaboration between government, business, Traditional Owners, the wine industry and the local community was initiated to develop a McLaren Vale Regional Water Security Strategy for McLaren Vale. A working group has started the process of looking at current water sources, projected impacts of climate change and potential solutions for the region.

The region is unique with the multiple water sources, including recycled wastewater, water from the desalination plant, groundwater, recycled stormwater and River Murray water stored in the local reservoirs. Vignerons have been proactive in calling for a Strategy, based on an understanding that climate change is expected to increase average temperatures and decrease rainfall in the region.

The Strategy will be a long-term, non-statutory document. It will include:

- Community aspirations for the region, including First Nations interests;
- The availability of native surface and groundwater resources in a changing climate;
- The availability of recycled and other alternative water resources over the lifespan of the strategy;
- Existing and future demand for water;
- The ability of all water sources to meet current and future demand to 2070;
- Uncertainty in future water availability and demand, and how to plan for it; and
- Technical and economic feasibility of new or augmented supplies and the use of new water technologies.

The MV WAP sets the limits on extraction of native groundwater which will be one of the parameters for the Strategy. The Act requires that extraction limits balance economic, social, environmental and First Nations values.

4 Kaurna interests

The MV PWA lies entirely within the area of the Kaurna Nation's native title determination. Despite this the MV WAP does not include any discussion of Kaurna interests.

In the objectives of the Act, s. 3(a) states that in connection with achieving ecologically sustainable development for the purposes of this Act:

> *(a) recognition should be given to the spiritual, social, customary and economic significance of landscapes, and especially natural resources, to Aboriginal people;*

The Commonwealth Productivity Commission's September 2021 review of Australian, State and Territory governments' achievement of the objectives and outcomes of the National Water Initiative in one of its key findings stated that:

> *Much more needs to be done to include Traditional Owners' interests in water in jurisdictional planning and the management of water.*

HFLB engaged with Kaurna by conducting two workshops with Warpulai Kumangka (WK) to discuss water planning and the MV WAP review. As an outcome of those workshops, a (WK)subgroup developed a statement for this review which is presented below.

4.1 McLaren Vale WAPAC Review – Kaurna Statement for WAP

Kaurna's unwavering relationship with water is a vital factor in maintaining cultural heritage and spirituality. The absence of cultural flow considerations and lack of documentation associated with surface water and groundwater dismisses the cultural relationship between these core aspects of Kaurna being. Additionally, the capacity to develop and access water for cultural flows and practices is of paramount importance in sustaining Kaurna's connection to water, country and sky.

Working in a partnership built on reciprocity with the Hills and Fleurieu Landscape Board, Kaurna aspires to integrate cultural knowledge into the Department of Environment and Water legislative processes. Water features prominently in our Dreaming, our Stories and our Songlines, and unsustainable water usage/consumption impacts our ancient history, culture and sites of significance, while continuing to alter our landscape today. The knowledge of our Old People informing all works around surface and groundwater will ensure government practices are culturally safe as well as environmentally sustainable.

Despite a lack of historic consultation and effective engagement with Kaurna on previous water allocation plans, Kaurna has a strong desire to work in collaboration with the Landscape Board for the benefit of all residing on Kaurna land. Integrating ancient Kaurna knowledge of sustainable land management within the Water Allocation Plan will ensure we act in the best interest of the environment and future generations. Kaurna lived sustainably on this landscape for many thousands of years before European people arrived and damage to our environment could have been avoided if our Old People were listened to.

Kaurna makes the following recommendations for the MV WAP amendment process:

- Inclusion of a statement within the MV WAP recognising the water rights held by Kaurna as Native Title holders and the importance of cultural flows when discussing surface water and ground water distribution.
- Compulsory cultural competency training for the MV WAPAC and key Hills and Fleurieu Staff.
- Continual cultural development for all stakeholders working with and utilising McLaren Vale water allocations.
- Review data trends and projections to assess current sustainability threshold and projected impacts of climate change on groundwater requirements.
- Assess sustainability threshold against the functioning status of groundwater fed cultural springs.
- Review of license recipients for identification of industry bias.
- Review of instances of systematic, institutional, and intergenerational privilege and racism that has led to Kaurna having no rights to water as a traditional resource.
- Develop a partnership approach to MV WAP data collection, evaluation, and analysis programs (that includes Kaurna), with monitoring around identified cultural resources, values and interests.
- Explore opportunities to support Kaurna led cultural flow restoration within the MV WAP.
- Requirement for all MV WAP reporting to be supplied to both Warpulai Kumangka (WK) and the Kaurna Yerta Aboriginal Corporation (KYAC).
- Undertake annual assessment of culturally significant waterways within the MVWAP region in partnership with Kaurna.

Additionally, the committee notes that the MV WAPAC has requested a Kaurna representative to sit on the committee. It is our recommendation that a male and female Kaurna representative be appointed to this committee to align with cultural protocols.

Recommendation

It is recommended that the HFLB:

- Note that the reasons that the MV WAP requires amendment include that:
    - the MV WAP does not recognise Kaurna interests in the resource,
- In carrying out the amendment of the WAP that the supporting investigations include:
    - working with Kaurna to explore ways to recognise and support Kaurna interests and values.

5 Looking back

5.1 Community survey

In partial satisfaction of ss. 54 (2)(a)(ii) and 54(4)[1] of the Act, a short survey was developed to better understand the high level views on the MV WAP and whether the MV WAP requires amendment. The survey consisted of an online anonymous questionnaire via Survey Monkey. To reach a broad group of community perspectives a multi-pronged strategy was implemented. A link to the survey was sent via email directly to groundwater licence holders and to local community groups and stakeholders identified by the WAPAC including:

- Willunga Environment Centre Management Committee and Youth Group
- Aldinga Arts Eco Village
- Friends of Willunga Basin
- Aldinga Washpool and Silver Sands Heritage Group
- Nature Glenelg Trust
- Aldinga Washpool Working group
- Willunga Hills Face Landcare Group

In addition, agencies distributed the survey link through newsletters and web pages including:

- Onkaparinga Council 'Your Say' internet page
- HFLB Facebook page
- Southern Cultural Immersion
- Cropwatch - SA Research and Development Institute (SARDI) e-newsletter, and
- McLaren Vale Grape Wine and Tourism Association newsletters.

The survey was open from 18th November to 3rd December 2021. The questionnaire consisted of seven multiple choice questions with additional open end questions inviting respondents to expand on their perspectives for two of the multiple choice questions. There were 41 responses to the survey in total. Open ended text responses were received from a smaller number of respondents, and offer some insight as to their perspectives.

The response to this survey provides the following insights;

- While around half (49%) believe the resource is being used sustainably, there was a relatively high degree of concern for the resource (37%).
- More than half of the total respondents (59%) agreed that the WAP is effectively managing groundwater in the region. Current licence holders were found to be more likely to agree with this statement than non-licence holders.

[1] The full text of s. 54 is provided at Appendix 1

- Regarding possible improvements to the WAP, a near equal level of support for economic and environmental policy aspects was observed. There was an observed lack of understanding and awareness for First Nations cultural water policies.

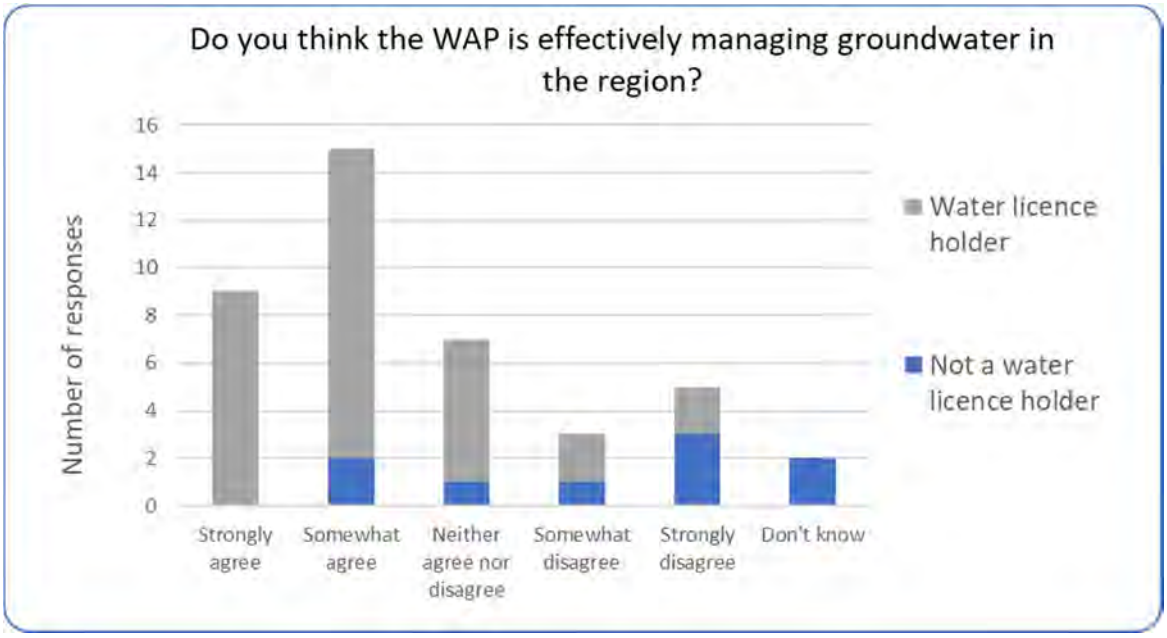
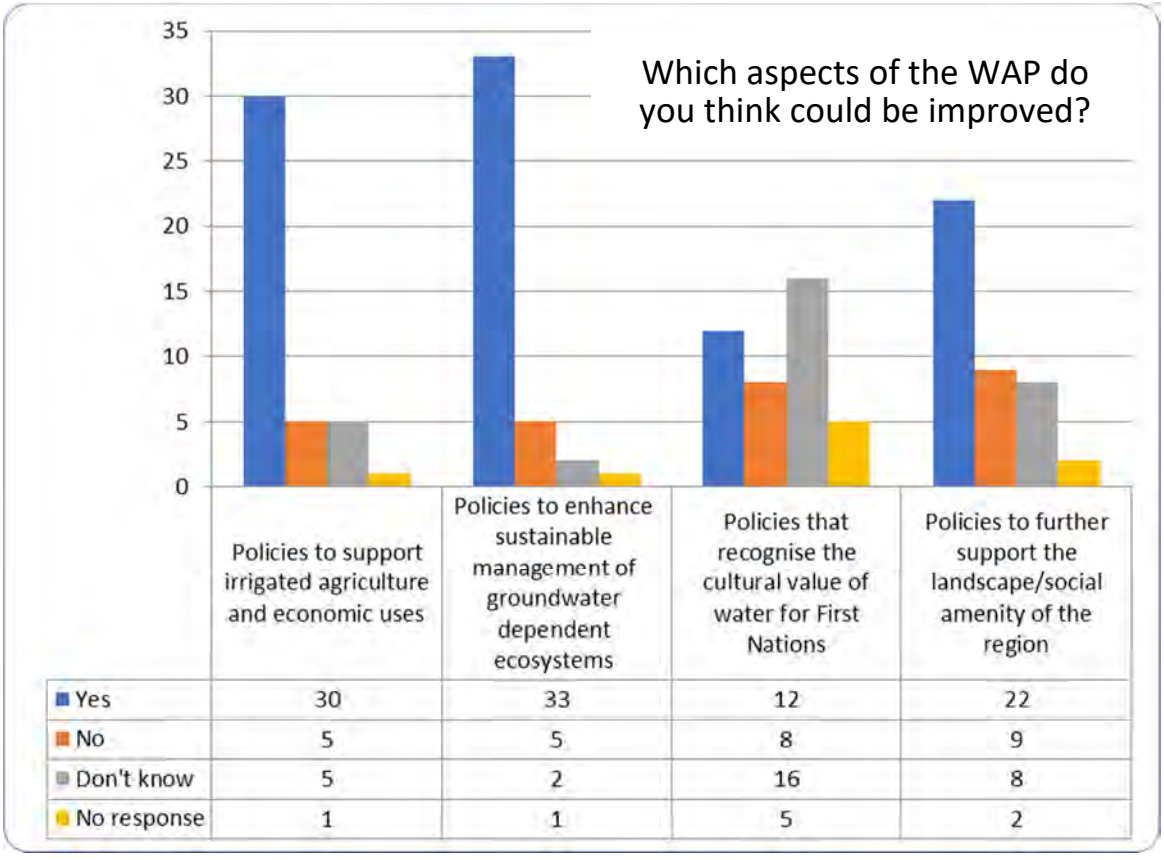


Figure 3 Breakdown of total responses for question 1, with licence holder status identified



	Policies to support irrigated agriculture and economic uses	Policies to enhance sustainable management of groundwater dependent ecosystems	Policies that recognise the cultural value of water for First Nations	Policies to further support the landscape/social amenity of the region
Yes	30	33	12	22
No	5	5	8	9
Don't know	5	2	16	8
No response	1	1	5	2

Figure 5 Breakdown of total responses for question 2

5.2 Groundwater trends

This section summarises information on key groundwater parameters provided by DEW, including salinity trends, water level and pressure level trends and connectivity to GDEs. Trend data is set out in Table 1 at the end of this section. More detailed information, including information on other parameters is available in the report *McLaren Vale Prescribed Wells Area groundwater resource assessment* (March 2022, DEW Technical note 2022/08).

5.2.1 Water level and pressure level trends

There have been gradual declines in water levels and pressure levels observed since the mid-1990s in most aquifers which corresponds with the period of below average rainfall experienced since 1975. In the long term and noting the impacts of climate change, there is a risk to the sustainability of the resource if these declines continue. However, given the large volume of groundwater stored in the aquifers, the risk to groundwater availability over the next ten years is low.

The gradual decline in watertable levels over the last 15 years also is predominantly driven by rainfall trends and not significantly by extraction. Preliminary advice has been that due to the complex interactions between rainfall, recharge and natural outflows, that reducing levels of extraction is unlikely to significantly alter these trends. However the question of the degree to which changing levels of extraction could influence water level and pressure level trends has not yet been examined in detail.

5.2.2 Salinity trends

Salinity levels are generally stable, except for 'hot spot' areas in two aquifers where significant rises have occurred due to upward leakage from underlying layers in areas where the unconfined Maslin Sands and Pirramimma Sands aquifers are thinner.

Pirramimma Sands

Barnett and Judd (2019) attributed the cause of the rise in salinity to the east of McLaren Flat to the increase to be upward leakage from the underlying Blanche Point Marls aquitard. This was in turn driven by long term increases in extraction and the local drawdowns associated with pumping from individual irrigation wells. Salinities in the Blanche Point Marls aquitard appear to be in the range 1500 – 2000 mg/L, which provides an upper limit for potential salinity rises due to this upward leakage.

Figure 5 shows salinity trends in representative irrigation wells in two areas within the Pirramimma Sands salinity stress zone. Wells in Area A display a significant rise in salinity levels during the 1990s and early 2000s to over 1500 mg/L, however these have stabilized after 2009. This is due to a decline in extraction and the fact that salinities in the Blanche Point Marls are not too much higher than those in the Pirramimma Sands aquifer.

Wells in Area B are showing a different response. Because extraction levels were initially lower than in Area A, the salinity levels showed very little increase prior to 2009. However, as the extractions have increased after 2009, the salinity levels have also started to rise.

To a certain extent, Figure 5 indicates that this sustainability issue in Area A could be self-managing – as salinity levels rose above the salinity tolerance for wine grapes (nominally 1500 mg/L), irrigators reduced groundwater extraction and may have reverted to alternative water sources (such as recycled

effluent). This reduction in extraction and pumping from individual wells has led to the stabilised salinity levels. This scenario does not apply to Area B where salinity levels are still generally quite suitable for vineyard irrigation despite recent increases. However based on current salinity trends at current levels of extractions salinities are expected to increase further.

The high degree of development of allocations suggests that a reduction in allocations within the areas of rising salinities could result in lower extraction volumes that will stabilize salinity levels as shown in Area A and limit future increases in extraction that may occur if salinities reduce to more useable levels.

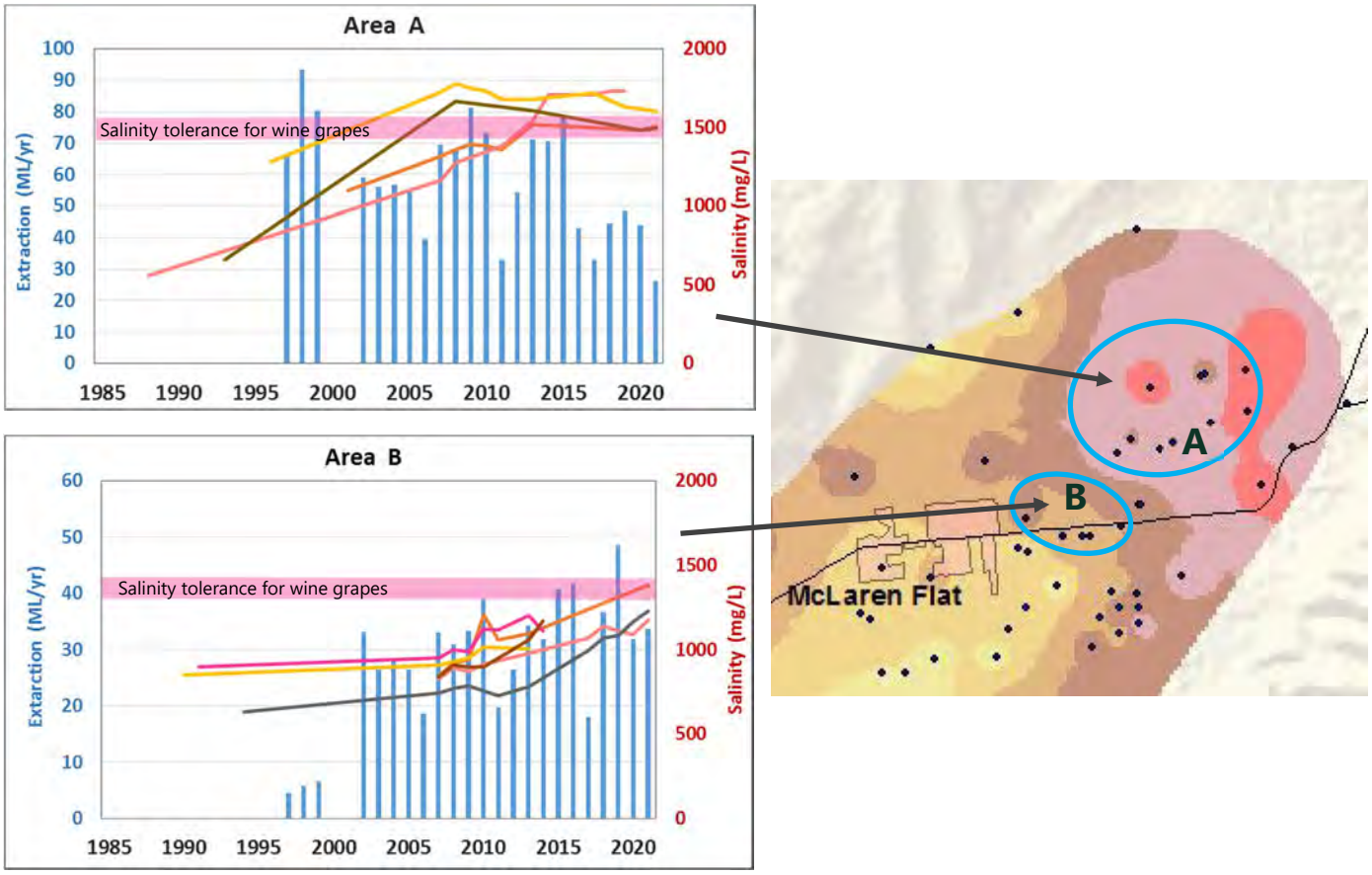


Figure 6 Representative rising salinity trends and extraction in the Pirramimma Sands aquifer

Maslin Sands

Barnett and Judd (2019) attributed the cause of the rise in salinity along the northern margin to the northwest of McLaren Flat to be upward leakage from the underlying Fractured Rock aquifer which was similarly driven by long term increases in extraction and the local drawdowns associated with pumping from individual irrigation wells. The salinities in the Fractured Rock aquifer range up to 6000 mg/L. These salinities are much higher than those in the Blanche Point Marls aquitard which are contributing to salinity rises in the Pirramimma Sands aquifer, resulting in ongoing rising trends in the Maslin Sands aquifer with no sign of stabilization in some wells.

Figure 6 shows salinity trends in representative irrigation wells within two areas where Maslin Sands salinities are increasing. Wells in Area A display a significant rise in salinity levels commencing during

the mid 2000s to over 1500 mg/L in response to increasing extraction. Despite a decline in extraction due to the high salinities, the trend shows no sign of stabilisation. Wells in Area B also displayed a rising trend commencing during the mid 2000s, but because extraction levels have been declining gradually, the salinity levels appear to have stabilised.

As with the Pirramimma Sands aquifer, a reduction in extraction within the areas of Maslin Sands salinity increase would stabilize salinity levels. The high degree of development of allocations suggests that a reduction in allocations within the areas of Maslin Sands salinity increase could result in lower extraction volumes and prevent future increases in extraction that may occur if salinities reduce to useable levels.

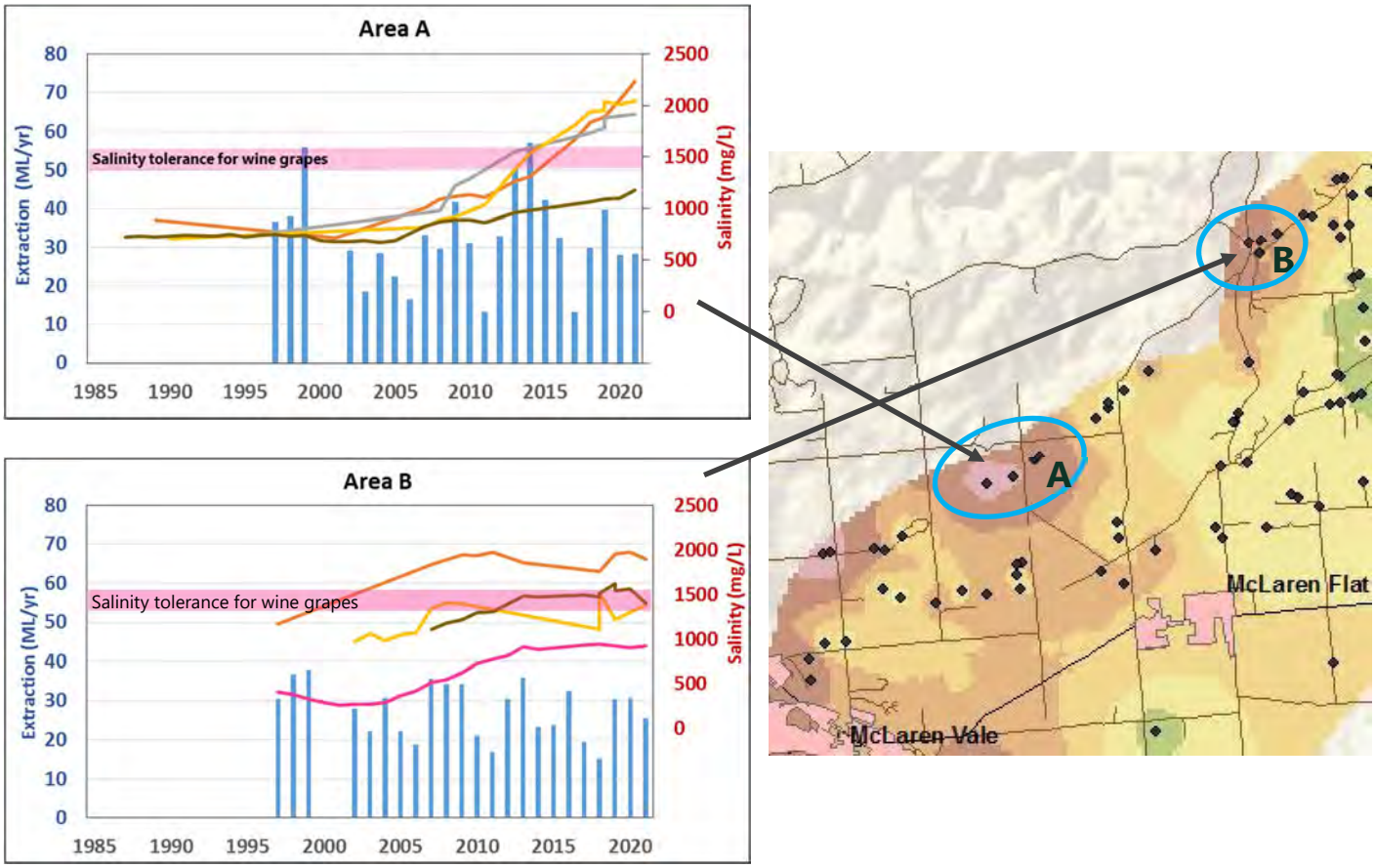


Figure 7 Representative rising salinity trends and extraction in the Maslin Sands aquifer

5.2.3 Limits at aquifer and management zone level

Currently the MV WAP has a single allocation limit that applies to the whole MV PWA. The administration of allocation transfers between locations rely on principles that prohibit transfers into 'stressed' areas to prevent concentrated areas of extraction having a negative impact on particular aquifers. However having aquifer level, and management zone level, allocation limits would simplify this process and enable management to respond to the characteristics and trends in individual aquifers.

The ability to set management zone level allocation limits would provide options if it was decided to manage salinity hot spots by reducing extraction.

Implementing adaptive management policies in response to climate change impacts would be easier if there was an ability to set management zone level allocation limits

4 Irrigation bore headworks (Steve Barnett)

Table 1: Summary table of groundwater trend information from McLaren Vale Prescribed Wells Area groundwater resource assessment

For reference the allocation limit for the whole McLaren Vale Prescribed Wells Area as set out in the 2007 WAP is: 6,560 ML/yr

Aquifer	Confined / Unconfined	Allocations (2020) (ML)	Metered extraction average (ML)	Connected to GDEs?	Water/pressure level decline trend	Level/pressure trend comment	Salinity trend	Salinity comment
Quaternary	Unconfined	10.8	6.5	Yes -high connectivity to surface water	Water level 0.09 to 0.14 m/yr.	Overall 2 to 3 m decline in water level since 2000	No regular monitoring	
Port Willunga Formation	Confined	1,677	1,300	No - completely confined therefore no connection to surface water	Pressure level 0.005 to 0.15 m/yr.	Decline from 1988-2020. Levels still 10-15m above top of aquifer which averages 100m in thickness	Generally stable	
Pirramimma Sands	Mostly unconfined	1,850	1,400	Possibly – only in vicinity of Pedlar Ck. Elsewhere no connection due to depth of watertable (over 20m)	Water level 0.07 to 0.15 m/yr.	Aquifer is 80m thick close to Willunga Fault and mostly over 40 m thick elsewhere	Stable in low salinity zone in south west, but significant increases in north east due to upward leakage	Upward leakage occurs where aquifer decreases in thickness to less than 40m in the northeast.
Maslin Sands	Confined except for small unconfined areas in the north and east	1,278	750	Yes – only Blewitt Springs and low lying area northwest of Kangarilla. Elsewhere no connection due to depth of watertable (over 20m)	Unconfined – water level 0.04 to 0.07 m/yr. Confined – pressure level 0.05 to 0.10 m/yr.	Unconfined trend observed since 2005 Confined trend observed since 1990	Stable in main area, but significant increases along the northern margin due to upward leakage	Upward leakage occurs where aquifer decreases in thickness to less than 30m to the north

Aquifer	Confined / Unconfined	Allocations (2020) (ML)	Metered extraction average (ML)	Connected to GDEs?	Water/pressure level decline trend	Level/pressure trend comment	Salinity trend	Salinity comment
Permian Sands	Two isolated locations, one confined, one unconfined	?	160 from confined			No monitoring wells in Permian Sands aquifer in the MV PWA		The extraction is for industrial purposes and is highly saline (4,000 to 9,000 mg/L)
Fractured Rock Hills Face Bakers Gully Northern	Part unconfined, Part confined	1,653	800	Two main locations: most significant is groundwater discharge into Onkaparinga Gorge, baseflow into number of small creeks – including Wirra Ck and Kangarilla Ck.	Relatively stable to gradual decline	Lower levels of extraction relative to allocations due to variable yield of wells and higher salinities than other aquifers. In fractured rock, impacts of extraction are generally localised.	Relatively stable	
Totals		6,469	4,167					

Recommendation

It is recommended that the HFLB:

- Note that the reasons that the MV WAP requires amendment include that:
    - the risk assessment identified that in some areas there are medium/high risks to the resource from extraction. These risks including the salinity hotspots arising in some areas, may potentially require treatment by amending the MV WAP
    - the provisions of the MV WAP do not provide for management rules (including allocation limits) to be applied at an aquifer level or management zone level.
- In carrying out the amendment of the WAP that the supporting investigations include:
    - examining the relative contribution of climate change and extraction to observed groundwater trends,
    - examining the appropriateness of the current extraction limit and the likely impact that changes to the extraction limit might have on observed groundwater trends,
    - developing provisions that enable management rules (including allocation limits) to be applied at an aquifer level or management zone level

5.3 Groundwater dependent ecosystems

The MV WAP lists 12 'priority underground water dependent ecosystems' (see Table 2). However it is understood that there are likely to be many GDEs in the region that have not been identified or mapped. More comprehensive identification and mapping of GDEs would assist with understanding the impacts of changes to aquifer levels.

The MV WAP includes a Monitoring, Evaluation and Reporting section which has largely not been implemented. Despite monitoring requirements in the WAP and acknowledging the need for better understanding of GDEs in the 2011 WAP Review, no ecological monitoring of GDEs has occurred. However there has been comprehensive monitoring of groundwater outside of the context of the Monitoring, Evaluation and Reporting section.

Most GDEs are connected to the aquifers that are less used for irrigation (such as the Quaternary), and these aquifers are likely to be strongly impacted by reduced rainfall and recharge. Climate change will lead to a long term decline in aquifer water levels and consequently GDE ecological health. Changes in aquifer level that are small relative to total aquifer depth can be significant relative to above ground expression of groundwater, and consequently significantly impact on GDE health.

While there is little ecological trend data for GDEs, there is regional trend data for the aquifers they are connected to. However, these regional trends may not reflect the actual water level changes at individual GDEs.

Table 2: The 12 'priority' underground water dependent ecosystems from the MV WAP with naming updated to reflect a better understanding of wetland complexes

	Name	Type	Aquifer	Regional Aquifer Decline Trend
1	Blewitt Springs	Phreatophytes[2]	Maslin Sands	0.04 to 0.07 m/yr
2	Pedler Creek floodplain	Watercourse	Quaternary	0.09 to 0.14 m/yr
3	Pedler Creek permanent pools	Watercourse	Quaternary	0.09 to 0.14 m/yr
4	Maslin Creek Reed Swamp (including California Road wetland)	Wetland	Quaternary	0.09 to 0.14 m/yr
5	Maslin Creek upper catchment	Watercourse	Fractured Rock	relatively stable to gradual decline
6	Maslin Creek estuary	Estuary	Quaternary	0.09 to 0.14 m/yr
7	Washpool	Wetland	Perched aquifer	
8	Aldinga Scrub	Wetland	Perched aquifer	
9	Springs in the outcropping Fractured Rock aquifer	Seeps and springs	Fractured Rock	relatively stable to gradual decline
10	Kangarilla Creek	Watercourse	Fractured Rock	relatively stable to gradual decline
11	Peter Creek	Watercourse	Fractured Rock	relatively stable to gradual decline
12	Kangarilla/Baker Gully	Watercourse	Fractured Rock	relatively stable to gradual decline

Extraction from wells often has a localised draw down effect, particularly in fractured rock aquifers. Implementing a policy that requires buffer zones around GDEs, that applies to new wells and allocation transfers would protect GDEs from draw down effects and would be relatively easy to implement.

Recommendation

It is recommended that the HFLB:

- In carrying out the amendment of the WAP that the supporting investigations include:
  - developing more detailed information on the location of GDEs, and the development of buffer zone principles for GDEs
  - developing a GDE and groundwater monitoring evaluation and reporting process for the amended WAP, to be jointly developed with the DEW branches responsible for undertaking the monitoring, and to be accompanied by an implementation plan that has regard to available levels of resourcing

[2] plants with a deep root systems that draws their water supply from near the water table

5.4 Objectives review

Section 54(2)(a) of the Act requires that a comprehensive review:

> *(a) provide a review of—*
>
> *(i) the principles reflected in the plan; and*
>
> *(ii) the success of the plan after taking into account the outcomes sought to be achieved by the water allocation plan*

A technical advisory group made up of DEW, Green Adelaide and HFLB expert staff conducted a review of the objectives of the MV WAP to satisfy these provisions.

The MV WAP does not include specific high level objectives, but does include a number of statements about the purpose of the WAP. These statements were assessed as well as lower level objectives that relate to specific sets of principles.

5.4.1 Findings

The technical advisory group found that many of the objectives of the MV WAP had been achieved, including that:

- water take had been well within the limits set in the MV WAP,
- there were no significant issues with the rules relating to drilling of new wells and that there was a high level of compliance, and
- while the level of activity was low, they were not aware of any issues relating to the conduct of managed aquifer recharge. Although within the MV WAP's principles relating to managed aquifer recharge, there is room for clarifying the respective roles of EPA and DEW, and to consider whether any rules could be improved in line with the principles recently adopted in the Adelaide Plains WAP.

There were four main areas where objectives have not been met.

OBJECTIVE: The aim of the (2000) WAP was to ensure that underground water levels and underground water salinity levels were maintained at the levels measured when the WAP was prepared and to ensure that the resource could be used sustainably.

This text is included in the 'Background' section of the current 2007 MV WAP describing the previous WAP. In the context of other statements and the principles, it is inferred that this is also an aim of the 2007 MV WAP. A similar aim is implied in a number of other places in the MV WAP.

At the time that the 2000 WAP was written there had been a decline observed in groundwater levels. The long-term rainfall and recharge trends were steady, and extraction was understood to be driving decline. The approach at the time was that aquifer levels could be maintained by setting allocations to an appropriate level. Since then, the effects of reduced rainfall (likely due to climate change) on recharge have significantly increased. DEW has attributed more recent declines in aquifer pressures and levels to being predominantly driven by rainfall trends rather than extraction.

The technical advisory group agreed that in the context of climate change, the objective to maintain levels at 2000 levels is not achievable with the instruments available through a WAP.

OBJECTIVE: The underground water requirements of ecosystems can be provided by controlling activities which will significantly change the underground water environment around the priority underground water dependent ecosystem.

On the basis of DEW advice on the relative impacts of rainfall trends and extraction on recharge, the use of groundwater is having limited impacts on the amount of water available to ecosystems in the McLaren Vale region. That is not to say that the GDEs of the region have not declined over the WAP period. However, it appears this decline would not have been able to be mitigated by reduced extraction limits.

The technical advisory group suggested that policies requiring buffer zones around GDEs for new wells and transfers would assist in mitigating negative impacts.

OBJECTIVE: Manage the impact of taking underground water by preventing the transfer of an allocation to stressed areas.

This objective succeeded in preventing the transfer of allocation into stressed areas, however the efficient administration of the supporting principles was hampered by 'stressed areas' not being clearly defined in the WAP.

Monitoring, Evaluation and Reporting

The advisory group noted that there was a comprehensive monitoring evaluation and reporting section in the MV WAP, however the monitoring of the resource had been largely conducted outside of that framework. Detailed long term monitoring of the groundwater resource is ongoing.

There is no ecological monitoring data available for GDEs. Nevertheless an understanding of the likely trends in GDEs can be gained from the monitoring of groundwater levels and a conceptual understanding of GDEs. However without ecological monitoring data there is no way to directly report on ecological condition.

The technical advisory group suggested that in an amended WAP that the monitoring, evaluation and reporting section for the amended WAP be jointly developed with the DEW branches responsible for undertaking the monitoring. It also suggested that an implementation plan that has regard to resource availability be developed at the same time.

5.4.2 Overarching objectives

The fact that there were not clearly defined overarching objectives in the WAP is in itself a clear area for improvement. While defining an appropriate set of objectives is beyond the scope of the objectives assessment and the MV WAP Review, the objectives from the recently adopted *Adelaide Plains Water Allocation Plan: 2022* are a good example.

5.4.3 Conclusion

A number of the objectives of the plan have not been achieved, consequently:

- In relation to s. 54(2)(a)(i) of the Act, the principles that relate to those objectives are no longer appropriate resulting in a need to amend the principles of the WAP.
- In relation to s. 54(2)(a)(ii) of the Act, the plan has not been successful in achieving all the outcomes sought to be achieved by the MV WAP.

The technical advisory group agreed that in the context of climate change the objective to maintain levels at 2000 levels is not achievable with the instruments available to a WAP.

The MV WAP does not have a set of clearly defined overarching objectives.

Recommendation

It is recommended that the HFLB:

- Determine that the *Water Allocation Plan for the McLaren Vale Prescribed Wells Area 2007* no longer remains appropriate and requires amendment.
- Note that the reasons that the MV WAP requires amendment include that:
  - the MV WAP lacks of a set of overarching objectives,
- In carrying out the amendment of the WAP that the supporting investigations include:
  - developing a set of overarching objectives,
  - developing a GDE and groundwater monitoring evaluation and reporting process for the amended WAP, to be jointly developed with the DEW branches responsible for undertaking the monitoring, and to be accompanied by an implementation plan that has regard to available levels of resourcing,

6 Looking forward

The Act requires that a comprehensive review of a WAP includes an assessment of whether the WAP remains appropriate or there are matters that can be better managed by making amendments. This is the 'looking forward' part of the assessment process.

The review addressed this question formally by conducting a risk assessment which examined the likely risks to the resource into the future and whether the MV WAP is able to control those risks. Matters discussed by the WAPAC are included in this section as much of the discussion was forward looking. This section also considers future arrangements for assigning the MV PWA to a WAP.

6.1 Risk assessment

A risk assessment is a technique to systematically consider current and future risks to the resource and takes into consideration the ability of existing management and regulatory arrangements to adequately control those risks. Assessment of risk assumes the continuation of existing arrangements. Where uncontrolled risks are identified, this information guides future management.

The risk assessment of the MV WAP was undertaken by the WAPAC in conjunction with technical experts from DEW, Green Adelaide and HFLB.

The generation of risk statements was based on the 'bow tie' technique [set out in *Risk management – Risk assessment techniques* (ISO document IEC 31010:2019) and DEW *Guidelines for Review of Water Allocation Plans*. Forty risk statements were generated using the bow-tie method (Appendix 2).

The generation of risk statements treated climate change as a driver of risk that affected all risk sources, rather than as a separate source. Consequently all risk statements were assessed in the context of climate change.

The WAPAC found that the traditional risk evaluation technique required substantial technical information, was time consuming and implied a higher level of rigour in the results than the WAPAC believed was justified. A modified fit-for-purpose process was adopted recognising that the purpose of the review was to determine whether the MV WAP requires amendment, and to suggest focus areas for potential amendment. Under the modified process, the assigning of probabilities and consequence levels to each risk statement was replaced by simpler categorisation. The categories used were:

1. Low risk
2. Medium or high risk – (A) treatable by WAP
3. Medium or high risk – (B) not treatable by WAP

For some risks it was noted where there were deficiencies in the data available.

The risks assessed as *Medium or high risk – (A) treatable by WAP* are risks able to be influenced by factors regulated by the WAP and therefore potentially be mitigated by amendments to the MV WAP. Consequently the existence of any risks within this category could be a reason to amend the MV WAP.

Where risks were assessed as *Medium or high risk – (B) not treatable by WAP,* these risks will still be identified for the HFLB's consideration of whether there are other mechanisms or landscape management programs that will help mitigate these risks, outside the regulatory powers of the WAP.

The WAPAC assessed the risks collectively after consideration of expert advice, rather than through individual scoring. Risks in categories (2) and (3) are set out in the tables below. The full risk assessment table is provided as Appendix 2.

5 Cyperus sp. at Lot50-Kanyanyapilla, McLaren Vale (Tom Mowbray)

6.1.1 Category (2) Medium or high risk – (A) treatable by WAP

Table 3 shows the six risk statements assessed as *Medium or high risk – (A) treatable by WAP*. It is significant that all of these risks have *groundwater extraction* as the risk source. Two of these were noted as being data deficient.

Table 3: List of risk statements assessed as Medium or high risk – (A) treatable by WAP

Risk Num	Risk Source	Event	Consequence	Data deficient	Assessment comment
RS-01	groundwater extraction	change in water level	impacts on amenity values	-	Amenity values arise from phreatophytic vegetation and surface expression of groundwater as GDEs, also from base flows in watercourses. Most GDEs are in the Quaternary aquifer with little licenced use (only 6 licences). In the Fractured Rock aquifer out on the hills and onto the plains there are more licences, but the impact of take in fractured rock aquifers is localised. Blewitt Springs – currently low risk but location of extraction could change - could increase risk if new bores put in. Many GDEs are not identified. Need better identification and mapping of GDEs. Amenity definition: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non-human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers.
RS-02	groundwater extraction	change in salinity/quality	impacts on amenity values	-	As above

Risk Num	Risk Source	Event	Consequence	Data deficient	Assessment comment
RS-17	groundwater extraction	change in water level	impacts on economic and social values	yes	This risk is in the northern parts of the **Pirramimma Sands** and **Maslin Sands** aquifers, where bores are accessing water from the thinner parts of a wedge shaped part of the aquifer which are more impacted by declines in the level of the aquifer. In these area productivity from the aquifer will decline. The risk may or may not be treatable by WAP (using local scale reductions in allocation). Some WAPAC members were of the view that a groundwater model is needed to determine potential impact of extraction, and that the scale of the risk could be assessed by mapping the number of licensees using water from the thinner parts of these aquifers.
RS-18	groundwater extraction	change in salinity/quality	impacts on economic and social values	-	Extraction of water from the overlying fresher aquifer has reduced the head pressure which has allowed upward leakage from underlying saltier aquifers. This has created salinity hotspots in **Pirramimma Sands** and **Maslin Sands**.
RS-25	groundwater extraction	change in water level	impacts on groundwater dependent ecosystems	yes	Most GDEs are in the **Quaternary** aquifer with little licenced use (only 6 licences). In the Fractured Rock aquifer out on the hills and onto the plains there are more licences, but the impact of take in fractured rock aquifers is localised. Blewitt Springs – currently low risk but location of extraction could change - could increase risk if new bores put in. Many GDEs are not identified. Need better identification and mapping of GDEs.
RS-34	groundwater extraction	change in salinity/quality	impacts on soil health	-	Soil health concerns arise from use of high salinity water. There is a complex interplay between individual choices of landholders to irrigate with high salinity water, and the role of the WAP in limiting increases in aquifer salinity, and the availability of lower salinity water.

6.1.2 Category (3) Medium or high risk - (B) NOT treatable by WAP

There were 12 risk statements assessed as being *Medium or high risk - (B) NOT treatable by WAP*. Two risk sources accounted for all of these risk statements: reduced rainfall leading to reduction in recharge and changes to surface water flow regime.

Table 4: List of risk statements assessed as Medium or high risk – (B) NOT treatable by WAP

Risk Num	Risk Source	Event	Consequence	Data deficient	Assessment comment
RS-03	reduced rainfall leading to reduction in recharge	change in water level	impacts on amenity values	-	Climate change is the most likely driver of this risk. The impacts are as above, i.e.: amenity values arise from phreatophytic vegetation and surface expression of groundwater as GDEs, also from base flows in watercourses. Same logic for GDEs also applies to amenity values. Amenity definition: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non-human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers."
RS-04	reduced rainfall leading to reduction in recharge	change in salinity/quality	impacts on amenity values	-	As above
RS-07	changes to surface water flow regime	change in water level	impacts on amenity values	-	For this risk, impacts on amenity are the same as impacts on GDEs, i.e. reductions of flows could impact on recharge, surface flows are managed by the Western Mount Lofty Ranges (WMLR) WAP.
RS-19	reduced rainfall leading to reduction in recharge	change in water level	impacts on economic and social values	-	Climate change is the main driver of this risk.
RS-20	reduced rainfall leading to reduction in recharge	change in salinity/quality	impacts on economic and social values	-	Climate change is the main driver of this risk.

Risk Num	Risk Source	Event	Consequence	Data deficient	Assessment comment
RS-23	changes to surface water flow regime	change in water level	impacts on economic and social values	-	The surface water rules are set out in the WMLR WAP which does not allow any new surface water take, biggest risk is through climate change. Further info could potentially be gained from an integrated surface water/groundwater model. The risk is high in the **Pirramimma Sands** aquifer.
RS-24	changes to surface water flow regime	change in salinity/quality	impacts on economic and social values	-	As above.
RS-27	reduced rainfall leading to reduction in recharge	change in water level	impacts on groundwater dependent ecosystems	-	Mainly affects the **Quaternary** aquifer, also impacts on **Maslin Sands** aquifer (Blewitt Springs wetlands). The impact on wetlands is due to reduced rainfall recharging wetlands. Large potential impacts in aquifers that GDEs depend on; already seeing declines in water table due to climate change.
RS-28	reduced rainfall leading to reduction in recharge	change in salinity/quality	impacts on groundwater dependent ecosystems	yes	Most wetland species have some natural tolerance to groundwater salinity.
RS-31	changes to surface water flow regime	change in water level	impacts on groundwater dependent ecosystems	-	Reductions of flows could impact on recharge, surface water rules are managed by WMLR WAP
RS-36	reduced rainfall leading to reduction in recharge	change in salinity/quality	impacts on soil health	-	Soil health concerns arise from use of high salinity water. There is a complex interplay between individual choices of landholders to irrigate with high salinity water, and the role of the WAP in limiting increases in aquifer salinity, and the availability of lower salinity water.
RS-40	changes to surface water flow regime	change in salinity/quality	impacts on soil health	-	If an aquifer increases in salinity (due to reduced recharge because of changed surface water flows), there is a potential risk to soil health. Surface water rules are managed by WMLR WAP.

6.1.3 Analysis

The assessment identified 12 medium or high risks not treatable by the MV WAP. Of these risks, 7 have a risk source of *reduced rainfall leading to reduction in recharge*. This risk source was worded so as to include both seasonal variations in rainfall and long term trends due to climate change. Seasonal variation is inherently untreatable. Similarly climate change is not able to be treated within a WAP.

The other 5 medium or high risks not treatable by the MV WAP, have a risk source of *changes to surface water flow regime*. Surface water within the McLaren Vale area is managed under the Western Mount Lofty Ranges (WMLR) WAP. Changes to surface water regime may have a range of causes, for example seasonal variation, climate change or extraction of surface water. The surface water rules within the WMLR WAP made allowances for groundwater recharge when they were developed, however it was considered important that the recharge be carefully considered during the upcoming review and amendment of the WMLR WAP.

The risk assessment identified 6 medium to high risks which the WAPAC assessed as being able to be mitigated by amending the WAP. The risk source for all of these 6 risks is groundwater extraction. Consequently it is recommended that the MV WAP be amended and that the amendment process examine whether changes to extraction rules can mitigate the identified risks. In particular, the risk assessment discussions suggested that the high risks associated with the salinity hotspots in Pirramimma Sands and Maslin Sands are likely to require treatment through amendment of the rules of the WAP.

Recommendation

It is recommended that the HFLB:

- Note that the reasons that the MV WAP requires amendment include that:
    - the risk assessment identified that in some areas there are medium/high risks to the resource from extraction. These risks including the salinity hotspots arising in some areas, may potentially require treatment by amending the MV WAP.
- In carrying out the amendment of the WAP that the supporting investigations include:
    - examining the relative contribution of climate change and extraction to observed groundwater trends,
    - examining the appropriateness of the current extraction limit and the likely impact that changes to the extraction limit might have on observed groundwater trends,
- With regard to the upcoming review of the Western Mount Lofty Ranges WAP that HFLB examine the risks to groundwater recharge in its consideration of surface water rules.
- That the HFLB consider the risks identified in Table 4 that are not able to be treated through amendments to the McLaren Vale WAP, and consider whether these risks can be mitigated through other HFLB programs or partnerships.

6.2 Matters raised by the WAPAC

The WAPAC met seven times between August 2021 and March 2022 to consider the MV WAP review and were provided with technical and policy briefings. The WAPAC discussed a broad range of water management issues related to the McLaren Vale groundwater resource. The WAPAC's views are reflective of the broader community and the discussions have been instrumental in identifying areas of concern. These discussions have contributed to the development of the recommendations and areas for supporting investigations set out in section 2.

There was often considerable overlap between concerns discussed by the WAPAC and technical advice. Most of the recommendations listed at the end of this section are also supported by other advice set out in other sections of this report.

There were often a range of views expressed by members. The key themes from those discussions are summarised below.

6.2.1 Aquifer levels and sustainability of the resource

Groundwater monitoring has shown downward trends in the levels in the unconfined aquifers and the pressure levels in the confined aquifers. DEW has advised that these declines are small relative to the size of the aquifer. Members expressed strong concerns that levels are trending downwards.

The WAPAC heard from an independent groundwater specialist that recovery from these declines, if hypothetically extraction was reduced to zero would take in the order of 100 years without artificial recharge. Some members were supportive in principle of injecting water into aquifers which was available outside of the irrigation season from the Willunga Basin Water Scheme, subject to environmental and economic feasibility.

Members considered the long-term sustainability of the resource to be of paramount importance.

6.2.2 Relative degree to which climate change and extraction are influencing trends

Technical advice from DEW indicated that the observed negative trends in aquifer level and pressure are due to climate change impacting on aquifer recharge, and that due to the dynamics of aquifer function, reducing extraction is not likely to significantly alter these trends.

The opinion of an external expert was that extraction and negative trends in aquifer levels are closely linked.

Members were of the view that the degree to which climate change and extraction are influencing trends is a critical question and that it is important that there is clarity on the issue. The information will have a significant influence on determining appropriate WAP policies. Members asked that this question be carefully examined during the amendment stage, and that consideration be given to developing a groundwater model to support the investigation.

6 Vines in autumn, McLaren Vale region (Tom Mowbray)

6.2.3 Salinity hotspots

The WAPAC was advised that in each of the Maslin Sand and in the Pirramimma Sands aquifers there are 'salinity hotspots'. These have formed in areas where the aquifer is thinner, and the decline in aquifer pressure has resulted in upward leakage from the saline underlying aquifer, increasing the salinity in the production aquifer. The appropriate management is to locally reduce extraction in areas.

It was recommended that, while this issue had been self-managed in some parts, an amended WAP include provisions that would enable extraction to be reduced at a management zone scale to manage these hot spots. It was noted that the MV WAP contains a single allocation limit for the whole PWA and there is no capacity within the rules of the WAP to manage the resources at an aquifer or management zone scale.

WAPAC members commented that in these hot spots there was a risk of significant assets being stranded due to a lack of usable water.

The WAPAC supported management action being taken to control salinity increases in these areas, including making amendments to the WAP that would allow management provisions to apply to specific aquifers or management zones, including rules relating to transfer between aquifers or management zones.

6.2.4 Groundwater dependent ecosystems

The WAPAC heard from DEW that climate change will be a major driver of the health of groundwater dependant ecosystems over the next thirty years. Over that time ecosystems will change to a new steady state. We may well be unable to preserve all of what is here but we can build the resilience of the system that will persist into the future.

The WAPAC noted that the MV WAP was drafted in 2007 and contained a list of 12 priority groundwater dependent ecosystems. It is likely that there are numerous other GDEs within the PWA. The WAPAC expressed a view that given the limited number of GDEs remaining in the region, they should all be considered 'significant'.

The WAPAC expressed disappointment that the monitoring and surveys previously identified in the WAP and reviews has not been implemented, and there is not better data available about GDEs. They strongly advocated that broader scale surveys and monitoring of GDEs is required in the region.

They expressed the view that a revised WAP should be supported by more detailed GDE information, including identification of GDEs not listed in the MV WAP. The WAPAC also supported the concept of using buffer zone provisions for transfers and new wells to protect GDEs against local draw-down impacts (for example around the Blewitt Springs wetlands connected to the Maslin Sands aquifer).

6.2.5 Stock and domestic use

Stock and domestic use is currently not prescribed in the MV PWA, and consequently does not require a licence. DEW advised WAPAC members that approximately 10% of groundwater use was for Stock and domestic use, with the remaining 90% being from licensed use.

WAPAC members expressed a number of concerns regarding stock and domestic use, including:

- a need to improve the level of detail in the data supporting estimates of stock and domestic use, both the number of active bores and the estimate of average use per bore,
- the possibility that stock and domestic use is higher than estimated and impacting on the availability of the resource,
- anecdotal evidence that the regulatory rules on stock and domestic use are not well understood within the community and that there is use of stock and domestic water for commercial purposes (e.g. watering cellar door lawns),
- some members expressed the philosophical position that all water is important and therefore it would be more equitable if stock and domestic use also required a licence,
- anecdotal reports of declining levels in stock and domestic wells and the impacts of aquifer trends on ability of stock and domestic users to access water

WAPAC members encouraged HFLB to examine stock and domestic issues in more detail as part of any WAP amendment.

6.2.6 Soil health

Some WAPAC members raised concerns about the possibility of increases to soil salinity arising from either:

- increases in the salinity of the groundwater used for irrigation, or
- the transport of salt in recycled water from the Willunga Basin Water Scheme.

Members were concerned both with the potential for salt to accumulate in the soil profile and the potential for salt to percolate to underlying aquifers. They supported more work being done to monitor soil salinity and to raise awareness of the issue.

Other members expressed a view that the WAP doesn't have a role to play in relation to soils as soil management is the responsibility of individual landholders.

6.2.7 Long term impacts of use of recycled effluent water

WAPAC members raised questions about the long-term impacts of using recycled effluent water on soil and on the water quality in underlying aquifers. Recycled water contains a certain amount of salinity as well as macronutrients and there was uncertainty about whether there was a risk of them accumulating over time.

6.2.8 Transfer rules and defining 'stressed'

WAPAC members noted that in the MV WAP transfer rules appropriately prohibit the transfer of allocation into 'stressed' areas. However, the WAP does not contain a map of stressed areas, and definition of 'stressed' relates to negative changes in the last three years, which creates a possibility of longer term trends (both positive or negative) not being taken into account. This lack of clarity makes it difficult for licence holders to know whether an application for transfer is likely to be approved.

6.2.9 Lifespan of the plan

Some members expressed concern that the controls in the WAP will be in place for 10 years before the next review. Members supported a mid-term review to see how the resource is tracking. They also expressed a view that the water management rules need to have a degree of flexibility so that management can adaptively respond to trends.

The WAPAC also emphasised the importance of taking a long term view (50-70 years) in decision making to avoid a significant negative impact arising from the cumulative result of a number of small impacts.

6.2.10 Monitoring

Some members of the WAPAC would like to see a requirement in the WAP for monitoring of bores.

6.2.11 Requirements for policies that apply to specific aquifers or management zones

Given the differences in characteristics between aquifers, members supported having different policies for different aquifers. One suggestion was aquifer-wide extraction limits with risk areas for specific areas.

The WAPAC agreed to move away from the current situation of one limit applying to the whole system.

6.2.12 Impact of surface water take on recharge

During discussion of the risks arising from surface water management impacting on recharge, while it was understood that the WMLR surface water rules currently make allowances for recharge to groundwater, the WAPAC asked that during the review and amendment of WMLR WAP that particular attention is paid to the role of surface water in aquifer recharge.

6.2.13 Kaurna values

Members expressed a desire to better understand the cultural significance of groundwater dependant ecosystems, and hoped that Kaurna knowledge of these sites could assist with their protection.

Kaurna provided a statement for inclusion in the review (section 4). The WAPAC recognised a need for further discussion regarding the Kaurna Statement during the amendment process. These discussions would clarify how the recommendations contained in the statement could be implemented. There was agreement that some are shorter-term objectives and some are longer-term for discussion with HFLB as some may be outside the WAP's ability to influence.

6.2.14 Social science

There was a request that information from social sciences be used to supplement physical and biological science to inform policy.

6.2.15 Review of the objectives of the McLaren Vale Water Allocation Plan

The WAPAC considered a briefing on the review of the objectives of the MV WAP. One of the main findings of the objectives review was that the implicit objective to maintain aquifers at 2000 levels had not been achieved and that with the impacts of climate change, it was not achievable with the instruments available to a WAP.

Some members did not agree that the 2000 levels were not achievable and expressed a view that not retaining the objective of maintaining 2000 levels implied accepting resource decline. The WAPAC does not accept a resource decline.

Members noted the objectives review finding that the MV WAP lacks an overarching set of objectives and supported any amendment process developing a clear set of objectives.

6.2.16 Defining sustainability

Members felt that it was important for the WAP to provide a definition of 'sustainability'. This aligns with the Act [sub-paragraph 53(1)(b)(ii)] requires that a WAP must set out principles such that the rate of take and use of water is sustainable.

After considering a number of definitions used by various national and international bodies, the WAPAC expressed concerns with the definition contained in s. 7(2)of the Act and preferred some elements in the United Nations definition.

The WAPAC proposes the following definition, which contains elements of definitions from both declaration 33 of the UN 2030 Agenda for Sustainable Development and s. 4(2) of the *Water Act (2007) (Cwth)*.

> *We recognise that social and economic wellbeing depends on the sustainable management of our planet's natural resources. That human's anthropogenic responsibility is to co-exist with the natural world, recognising the unparalleled complexities nature's systems in order to protect and restore its diversity in perpetuity. We will therefore conserve and sustainably use oceans and seas, freshwater resources, as well as forests, mountains and drylands and to protect biodiversity, ecosystems and wildlife.*
>
> *The following principles are the principles of ecologically sustainable development:*
>
> *a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;*
>
> *b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*
>
> *c) the principle of inter-generational equity—that the present generation should ensure that the health, biodiversity and productivity of the environment is maintained or enhanced for the benefit of future generations;*
>
> *d) the conservation of biodiversity and ecological integrity should be a fundamental consideration in decision-making;*
>
> *e) improved valuation, pricing and incentive mechanisms should be promoted*

7 Inundation of Maslin Creek reed swamp, Lot 50-Kanyanyapilla 2017 (Gavin Malone)

Recommendation

It is recommended that the HFLB:

- Note that the reasons that the MV WAP requires amendment include that:
    - the MV WAP does not recognise Kaurna interests in the resource,
    - the risk assessment identified that in some areas there are medium/high risks to the resource from extraction. These risks including the salinity hotspots arising in some areas, may potentially require treatment by amending the MV WAP,
    - the provisions of the MV WAP do not provide for management rules (including allocation limits) to be applied at an aquifer level or management zone level,
    - the MV WAP lacks of a set of overarching objectives, and
- In carrying out the amendment of the WAP that the supporting investigations include:
    - working with Kaurna to explore ways to recognise and support Kaurna interests and values,
    - developing a set of overarching objectives,
    - examining the relative contribution of climate change and extraction to observed groundwater trends,
    - examining the appropriateness of the current extraction limit and the likely impact that changes to the extraction limit might have on observed groundwater trends,
    - developing provisions that enable management rules (including allocation limits) to be applied at an aquifer level or management zone level,
    - developing more detailed information on the location of GDEs, and the development of buffer zone principles for GDEs,
    - developing a GDE and groundwater monitoring evaluation and reporting process for the amended WAP, to be jointly developed with the DEW branches responsible for undertaking the monitoring, and to be accompanied by an implementation plan that has regard to available levels of resourcing,
    - examining stock and domestic use, and whether it can be better accounted for in the WAP, and
    - developing clearer transfer principles, particularly in relation to stressed areas.
- With regard to the upcoming review of the Western Mount Lofty Ranges WAP that HFLB have regard to groundwater recharge in its consideration of surface water rules.

6.3 Water allocation plan arrangements for the McLaren Vale Prescribed Wells Area

The groundwater resources of the McLaren Vale region are prescribed as the McLaren Vale Prescribed Wells Area (MV PWA). This was one of the earlier prescribed water resources in South Australia. In later years the groundwater and surface water (including the surface water overlying the MV PWA) on the western slopes of the Mount Lofty Ranges from Gawler to Cape Jervis and Victor Harbor were prescribed as the Western Mount Lofty Ranges Prescribed Water Resources Area (WMLR PWRA)[3].

Under the *Landscape South Australia Act 2019* (the Act), when a water resource is prescribed, the relevant landscape board must develop a WAP for that resource. A WAP may include more than one prescribed resource. Consequently it is the decision of the board to decide which prescribed areas are included in particular WAPs. The Act does not provide for prescribed areas to be split across multiple WAPs.

This review has examined whether the current arrangement remains appropriate.

The MV PWA is currently managed through the MV WAP which is a groundwater only WAP. The surface water that overlies the MV PWA is managed under the WMLR WAP. The WMLR WAP covers both surface water and groundwater for other areas of the WMLR.

6.3.1 Current surface water management arrangements

The WMLR WAP was developed by the then Adelaide and Mount Lofty Ranges Natural Resource Management Board with input from DEW, a water allocation plan advisory committee and extensive public consultation. The development of the plan used a surface water model. The WMLR WAP contains a sophisticated set of rules based on a system of surface water management zones with take limits for each zone. This system enables local scale management.

The WMLR WAP makes allowance for surface water flows to recharge the aquifers of the MV PWA, as is required by the *Landscape South Australia Act 2019*. Section 53(9) states:

> *If the taking, or the taking and use, of water from a water resource has, or is likely to have, a detrimental effect on the quantity or quality of water that is available from another water resource, the water allocation plan for the first mentioned resource must take into account the needs of persons and ecosystems using water from the other resource as well as the needs of persons and ecosystems using water from its own resource and may, to achieve an equitable balance between competing interests, include provisions designed to prevent or reduce those detrimental effects.*

6.3.2 Potential arrangements

This review has explored three possible arrangements for assigning prescribed water resources to WAPs:

[3] Technically the WMLR PWRA consists of three separate prescriptions; WMLR—Surface Water Prescribed Area, WMLR—Prescribed Watercourses, WMLR—Prescribed Wells Area.

- OPTION A: Retain the current arrangement whereby the groundwater in the MV PWA is covered by the MV WAP and the prescribed surface water and watercourses in the same area are covered by the WMLR WAP.
- OPTION B: Incorporate the MV PWA into the WMLR WAP.
- OPTION C: Amend the prescription for the surface water resources that lie above the MV PWA and move them out of the WMLR WAP and into the MV WAP.

6.3.3 McLaren Vale Water Allocation Plan

The current 2007 MV WAP anticipates the inclusion of the MV PWA into the WMLR WAP. It states:

> *The McLaren Vale PWA falls within the Western Mount Lofty Ranges Prescribed Water Resources Area. The Adelaide and Mount Lofty Ranges Natural Resources Management Board is currently preparing a water allocation plan for the entire area. This water allocation plan will include policies for the McLaren Vale PWA and will replace this plan.*

6.3.4 Recommendation of 2011 MV WAP review

The 2011 review of the WAP contains the following recommendation:

> *That the Adelaide and Mount Lofty Ranges Natural Resources Management Board informs the Minister for Sustainability, Environment and Conservation that:*
>
> *as the McLaren Vale Prescribed Wells Area is located wholly within the boundaries of the Western Mount Lofty Ranges Prescribed Water Resources Area, the Board does not propose to develop a new separate Water Allocation Plan for the McLaren Vale Prescribed Wells Area and recommends that the regulation for the Western Mount Lofty Ranges Prescribed Water Resources Area be amended to include the McLaren Vale Prescribed Wells Area. This would enable the next iteration of the Western Mount Lofty Ranges Water Allocation Plan to include the McLaren Vale PWA.*

6.3.5 Scope for differing surface water management arrangements

The important consideration regarding the regulatory arrangements for a surface water area is the effectiveness of the policies, rather than the particular document that the policies sit in.

Most reasons for changing the rules for surface water in the McLaren Vale region would also apply to surface water in the wider WMLR PWRA. Consequently it is unlikely that bringing surface water into the MV WAP would result in differences in surface water rules that would not have otherwise been made. Most rules would apply across the WMLR PWRA, however in the event that there are local factors which make it appropriate to have rules that apply to a limited area, a WAP can accommodate such rules. For example in the Tookayerta area of the Eastern Mount Lofty Ranges WAP, the surface sediments are highly porous and there is an almost continuous connection between surface water and groundwater. In that area surface water and groundwater use are managed under a joint limit.

8 Reeds in autumn, McLaren Vale Region (Tom Mowbray)

6.3.6 WAPAC views

The WAPAC discussed WAP instruments a number of times over the course of the review. Members expressed a range of views.

Members valued the local focus and sense of ownership of the MV WAP, and appreciated the relative simplicity of the plan. The simplicity of the plan was compared to the complexity of the WMLR WAP. However it should be noted that much of the complexity of the WMLR WAP arises from rules relating to the management of surface water, so including surface water in the MV WAP would result in a document with a level of complexity similar to the WMLR WAP.

The comments made by members include:

- It would be advantageous to bring surface water and groundwater under the one plan. This would allow surface water and groundwater discussions to be held together.
- A preference to resist McLaren Vale WAP becoming part of the WMLR WAP.
- With limited resources it could be better to amalgamate with the WMLR WAP.
- Groundwater and surface water interaction is critical and would suggest they be managed in the same plan. This is particularly important for providing for recharge of groundwater from surface water flows.
- Good to have a simple, community owned plan for McLaren Vale.
- It is important for the timing of the reviews to be together so that science and policies for groundwater and surface water can be considered together
- It is hard for us to determine if the instruments should be together because we don't know enough about how surface water is managed in the McLaren Vale region.
- Willunga Basin as a geographic entity should have one instrument for surface water and groundwater together.
- I do not support the amalgamation of the MV WAP with the WMLR WAP.
- I agree that the surface water and groundwater should be managed together.

6.3.7 Community ownership

There is a distinct community of water users within the McLaren Vale region with nearly all licenced use being for vine irrigation. Historically the community has been proactive on water management issues and has developed a strong sense of community ownership over local water resources.

All WAP arrangements options enable a continuation of that sense of community ownership, and engagement on WAP amendments will always recognise the communities within the area of a water allocation plan. If the MVWAP was amalgamated into the WMLR WAP (Option B) the WAPAC could work with the board to determine whether there is a need for any principles that apply specifically to this area to manage local characteristics of water resources.

Community ownership of water resources relies on a willingness for individuals within that community (licensees, stock and domestic users, First Nations and interested people) to come together and discuss water issues. For example, within the area managed by the Eastern Mount Lofty Ranges WAP, the water users of the Langhorne Creek wine region form a distinct community with its Angas Bremer Water Management Committee recently marking its fortieth year. In the case of McLaren Vale, there is a well-established grower organisation in the McLaren Vale Grape Wine and Tourism Association, and strong cohesion amongst stakeholders about the importance of sustainable water use as demonstrated through their initiation of the regional water security strategy planning process. This interest and commitment from water users, and other members of the community, will ensure that they continue to be active participants in water allocation planning discussions.

6.3.8 Resource management considerations

Water Dependent Ecosystems

Groundwater and surface water regimes are often not independent of each other, and changes in one can significantly alter the other. For many of the water dependent ecosystems of the McLaren Vale region, it is the interaction between surface and groundwater that drives the function and condition of water dependent ecosystems (e.g. Pedler Creek). With consideration of this, the ability to manage both surface and groundwater resources in the same plan offers advantages in controlling risks to water dependent ecosystems, and meeting desired environmental outcomes.

Groundwater Recharge

Surface water provides recharge for aquifers. While the surface water rules in the current WMLR WAP take into account the critical role of surface water in recharging groundwater resources, there is an advantage in being able to hold discussions of surface water trends and management options within the same process as discussions on groundwater trends and changes in recharge.

6.3.9 Analysis

There are resource management advantages from including surface water and groundwater within the same WAP (Options B and C).

The Hills and Fleurieu Water Resources Steering Committee was of the view that the cost, complexity, timeframes of Option C is prohibitive. These arise from the process to amend regulations, which would be required to implement Option C. Additionally Option C does not have resource management advantages above those contained in Option B.

The high level of community ownership of water resources in the McLaren Vale region is recognised, which arises from the willingness of individuals to come together to discuss water issues.

Where this question has been considered in previous processes (the 2007 WAP and the 2011 review), Option B has been recommended.

Recommendation

That the board consult further with the community to better understand concerns before making a decision about amalgamating the McLaren Vale Water Allocation Plan with the Western Mount Lofty Ranges Water Allocation Plan.

6.4 Climate change

The MV WAP acknowledges that climate may impact on the resource:

> *It is acknowledged that in the longer term (beyond the life of this plan) changes to climate may necessitate a review of the sustainable yield and a review of the capacity of the resource to meet demand.*

However it does not contain provisions to manage the impacts of climate change.

Willunga has experienced an extended period of below average rainfall since 1975, with the exception of wet years in 1992–93, 2000 and 2016-17. The trend line in Figure 7 shows that the average annual rainfall is declining.

Climate change projections carried out by the Goyder Institute (Charles and Fu, 2014) indicate that by 2050, the Adelaide and Mt Lofty Ranges NRM Region could experience a decrease in average annual rainfall by between 6.3% and 8.4%, and an increase in average annual maximum temperature by between 1.3 and 1.8^{o}C.

These projections indicate that over the long term, climate change will impact predominately unconfined aquifers through a reduction in recharge, with those aquifers with limited storage capacity being more vulnerable than those with large storage. The higher temperatures may increase irrigation demand, however extraction limits and metering will mitigate this risk.

Declines in pressure or water level have been observed in a number of aquifers (see section 5.2). The decline is attributed predominantly to be driven by rainfall trends rather than extraction. As discussed earlier in this review, further investigations are required to better understand the relative impacts of climate-driven changes in recharge versus the impacts of extraction, on groundwater levels.

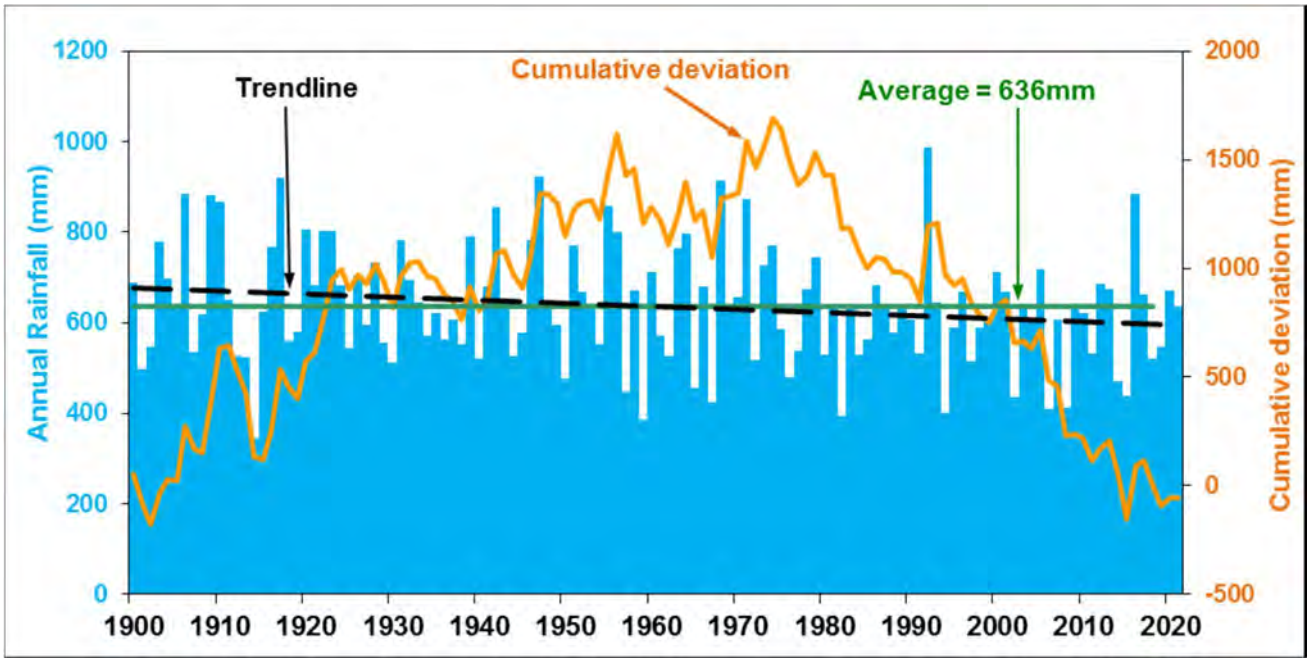


Figure 7 Rainfall data from the Willunga rainfall station

While climate modelling can make projections about long term trends, there is a level of uncertainty in those projections. When taken together with the usual variation in rainfall from season to season, future levels of recharge are difficult to predict. Therefore, even with further understanding from investigations about the relative impact of extraction on water levels, it is good practice to build in adaptive management approaches to support the sustainability of the groundwater resources of the McLaren Vale PWA. These could include partial unbundling of water licenses, and the ability to set allocation limits at the aquifer and management zone scale..

Recommendation

It is recommended that the HFLB:

- Note that the reasons that the MV WAP requires amendment include that:
    - the MV WAP does not consider impacts of climate change, and
    - the provisions of the MV WAP do not provide for management rules (including allocation limits) to be applied at an aquifer level or management zone level.
- In carrying out the amendment of the WAP that the supporting investigations include:
    - projecting a range of climate change scenarios and developing strategies that allow for adaptive management in the face of climate change and other factors, possibly including resource condition triggers and partial unbundling, and
    - developing provisions that enable management rules (including allocation limits) to be applied at an aquifer level or management zone level.

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8 Appendices

Appendix	Title
1	Water allocation plan review requirements as set out in s. 54 of *the Landscape South Australia Act 2019*
2	Bow tie diagram
3	McLaren Vale Water Allocation Plan review risk assessment outcomes table

Water allocation plan review requirements as set out in s. 54 of the *Landscape South Australia Act 2019*

54—Review of plan

(1) A designated entity must review a water allocation plan on a comprehensive basis at least once in every 10 years.

(2) The purpose of a comprehensive review under subsection (1) is to—

(a) provide a review of—

(i) the principles reflected in the plan; and

(ii) the success of the plan after taking into account the outcomes sought to be achieved by the water allocation plan; and

(b) provide an assessment of whether the water allocation plan remains appropriate or requires amendment; and

(c) assess or address any other matter prescribed by the regulations.

(3) A designated entity may also review any aspect of a water allocation plan at any time.

(4) In undertaking a review under subsection (1) or (3), the designated entity will undertake such consultation as the designated entity determines to be reasonable after taking into account any guidelines specified by the Minister for the purposes of this section.

(5) The consultation referred to in subsection (4) must also comply with any requirements prescribed by the regulations.

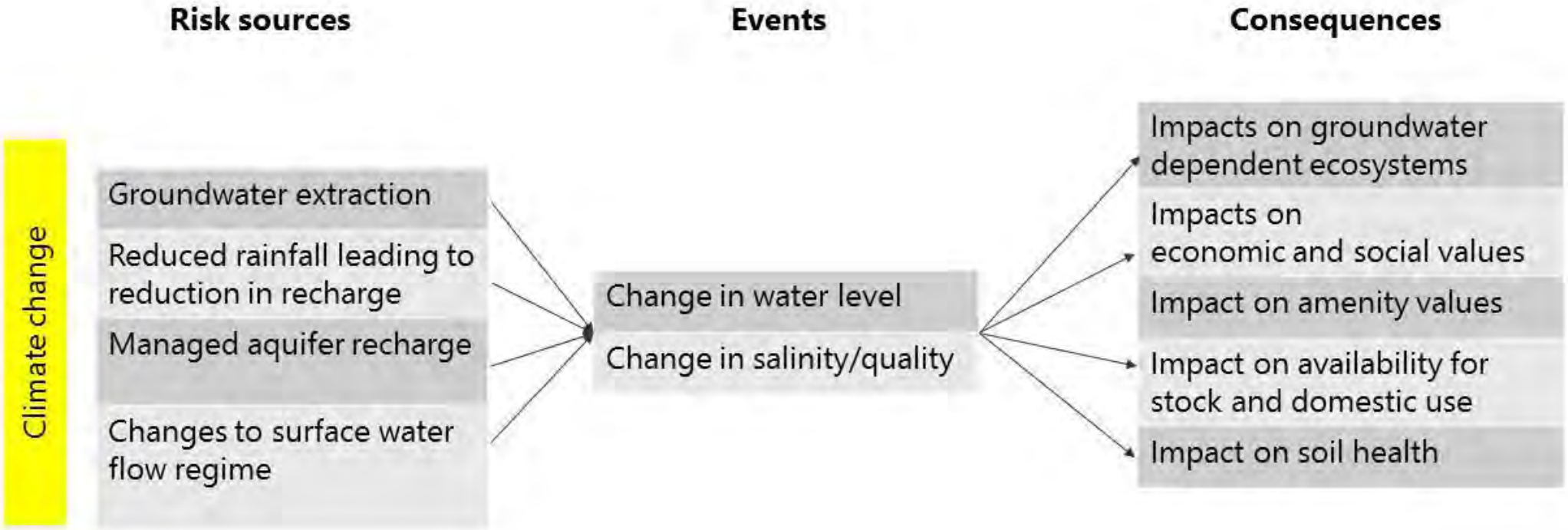
(6) At the conclusion of a review under subsection (1), the designated entity must—

(a) report to the Minister on the outcome of the review; and

(b) make a public statement about the outcome of the review in such manner, and to such extent, as the designated entity thinks appropriate.

APPENDIX 2

Bow tie diagram used to generate risk statements



Aquifers:
Adopt a convention that the risk assigned is that of the highest risk aquifer, however note in commentary where the level of risk in other aquifers is lower.

First Nations input into the review will be through workshops held with the Kaurna nation

LANDSCAPE SOUTH AUSTRALIA HILLS AND FLEURIEU

McLaren Vale Water Allocation Plan review risk assessment outcomes table

Risk Statement Number	Risk Source	Event	Consequence	Assessment outcome		Data deficient?	Assessment Comment	Policy Comment
RS-01	groundwater extraction	change in water level	**impacts on amenity values**	Medium or high risk - (A) treatable by WAP			Amenity values arise from phreatophytic vegetation and surface expression of GW as GDEs, also from base flows in watercourses. Same logic for GDEs also applies to amenity values. Amenity defn: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non-human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers.	
RS-02	groundwater extraction	change in salinity/quality	**impacts on amenity values**	Medium or high risk - (A) treatable by WAP			Amenity values arise from phreatophytic vegetation and surface expression of GW as GDEs, also from base flows in watercourses. Same logic for GDEs also applies to amenity values. Amenity defn: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers.	
RS-03	reduced rainfall leading to reduction in recharge	change in water level	**impacts on amenity values**	Medium or high risk - (B) NOT treatable by WAP			Climate change is the most likely driver of this risk. The impacts are as above, i.e: Amenity values arise from phreatophytic vegetation and surface expression of GW as GDEs, also from base flows in watercourses. Same logic for GDEs also applies to amenity values. Amenity defn: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non-human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers.	
RS-04	reduced rainfall leading to reduction in recharge	change in salinity/quality	**impacts on amenity values**	Medium or high risk - (B) NOT treatable by WAP			Climate change is the most likely driver of this risk. The impacts are as above, i.e:Amenity values arise from phreatophytic vegetation and surface expression of GW as GDEs, also from base flows in watercourses. Same logic for GDEs also applies to amenity values. Amenity defn: (G. Malone pers com) *Amenity is whole of landscape appearance and function e.g. vegetation, stream flows, spring water sources and things that they support, human and non human.* Difficult to quantify change. Feedback from Barossa is that if country looks healthy, people feel better. In Adelaide Plains they have managed risk with buffers.	
RS-05	managed aquifer recharge	change in water level	**impacts on amenity values**	Low risk			MAR will increase water levels, rather than decrease, so not a risk.	
RS-06	managed aquifer recharge	change in salinity/quality	**impacts on amenity values**	Low risk			MAR will increase water levels, rather than decrease, so not a risk.	
RS-07	changes to surface water flow regime	change in water level	**impacts on amenity values**	Medium or high risk - (B) NOT treatable by WAP			For this risk, impacts on amenity are the same as impacts on GDEs, i.e. reductions of flows could impact on recharge, surface flows are managed by WMLR WAP.	
RS-08	changes to surface water flow regime	change in salinity/quality	**impacts on amenity values**	Low risk		Data deficient	For this risk, impacts on amenity are ths same as impacts on GDEs, i.e. salinity unlikely to be driven by driven by surface water coming into the system.	

Risk Statement Number	Risk Source	Event	Consequence	Assessment outcome		Data deficient?	Assessment Comment	Policy Comment
RS-09	groundwater extraction	change in water level	**impacts on availability for stock and domestic use**	Not assessed			After a discussion that included a number of issues related stock and domestic water, it was agreed that the concerns of the committee were largely around the impact **from** stock and domestic use **on the resource**, rather than the impacts **on stock and domestic availability**. Consequently risk statements with the consequence *impacts on availability for stock and domestic use* were not assessed. The WAPAC asked that further information on the impacts of stock and domestic use be provided separately.	A buffer zone provision could be introduced to manage stock and domestic bores to ensure they are not affecting the groundwater system or other values to be protected.
RS-10	groundwater extraction	change in salinity/quality	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-11	reduced rainfall leading to reduction in recharge	change in water level	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-12	reduced rainfall leading to reduction in recharge	change in salinity/quality	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-13	managed aquifer recharge	change in water level	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-14	managed aquifer recharge	change in salinity/quality	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-15	changes to surface water flow regime	change in water level	**impacts on availability for stock and domestic use**	Not assessed			As above	
RS-16	changes to surface water flow regime	change in salinity/quality	**impacts on availability for stock and domestic use**	Not assessed			As above	

Risk Statement Number	Risk Source	Event	Consequence	Assessment outcome		Data deficient?	Assessment Comment	Policy Comment
RS-17	groundwater extraction	change in water level	**impacts on economic and social values**	Medium or high risk - (A) treatable by WAP		Data deficient	This risk is in the northern parts of the Pirramimma Sands and Maslin Sands aquifers, where bores are accessing water from the thinner parts of a wedge shaped part of the aquifer which are more impacted by declines in the level of the aquifer. In these area productivity from the aquifer will decline. The risk may or may not be treatable by WAP (using local scale reductions in allocation). Some WAPAC members were of the view that a GW model is needed to determine potential impact of extraction, and that the scale of the risk could be assessed by mapping the number of licensees using water from the thinner parts of these aquifers.	Mitigating the decline might be achieved by reducing extraction but uncertain. Can't measure recharge directly due to the high variability of aquifer material. There is limited evidence to suggest that extraction is contributing to water levels compared to climate change.
RS-18	groundwater extraction	change in salinity/quality	**impacts on economic and social values**	Medium or high risk - (A) treatable by WAP			Extraction of water from the overlying fresher aquifer has reduced the head pressure which has allowed upward leakage from underlying slatier aquifers. This has created salinity hotspots in Pirramimma Sands and Maslin Sands.	It is recommended that an amended WAP creates management zones to limit/reduce extraction in the area of Pirramimma Sands and Maslin's Beach where salinity is increasing.
RS-19	reduced rainfall leading to reduction in recharge	change in water level	**impacts on economic and social values**	Medium or high risk - (B) NOT treatable by WAP			Climate change is the main driver of this risk.	
RS-20	reduced rainfall leading to reduction in recharge	change in salinity/quality	**impacts on economic and social values**	Medium or high risk - (B) NOT treatable by WAP			Climate change is the main driver of this risk.	
RS-21	managed aquifer recharge	change in water level	**impacts on economic and social values**	Low risk			MAR increases water levels, so no risk from declining levels. The risk of over pressurisation is low.	Need to bring in standard MAR rules from more recent GW plans
RS-22	managed aquifer recharge	change in salinity/quality	**impacts on economic and social values**	Low risk			MAR tends to reduce rather than increase salinity	
RS-23	changes to surface water flow regime	change in water level	**impacts on economic and social values**	Medium or high risk - (B) NOT treatable by WAP			The surface water rules are set out in the WMLR WAP which does not allow any new surface water take, biggest risk is through climate change. Further info could potentially be gained from an integrated surface water/groundwater model. The risk is high in Pirramimma Sands.	
RS-24	changes to surface water flow regime	change in salinity/quality	**impacts on economic and social values**	Medium or high risk - (B) NOT treatable by WAP			The surface water rules are set out in the WMLR WAP which does not allow any new surface water take, biggest risk is through climate change. Further info could potentially be gained from an integrated surface water/groundwater model. The risk is high in Pirramimma Sands.	

Risk Statement Number	Risk Source	Event	Consequence	Assessment outcome		Data deficient?	Assessment Comment	Policy Comment
RS-25	groundwater extraction	change in water level	**impacts on groundwater dependent ecosystems**	Medium or high risk - (A) treatable by WAP		Data deficient	Most GDEs are in the Quaternary aquifer with little licenced use (only 6 licences).In the Fractured Rock aquifers out on the hills and onto the plains there are more licences, but the impact of take in fractured rock aquifers is localised.Blewitt Springs – currently low risk but location of extraction could change - could increase risk if new bores put in.	Most newer water allocation plans apply buffer zones for GDEs,need to adopt buffer rules for transfers and new wells
RS-26	groundwater extraction	change in salinity/quality	**impacts on groundwater dependent ecosystems**	Low risk		Data deficient	Highly localised – not an existing impact. Vegetation at Blewit Springs has some tolerance to increase in salinity. Reduced flow has greater impact on GDE health than extraction of groundwater. Extraction is not driving change in the aquifers linked to GDEs. Most wetland species have some tolerance to groundwater salinity.	It would be prudent to introduce transfer policies into the new WAP to manage potential risks to GDEs in the Fractured Rock aquifer near Blewitt Springs. Buffers around GDEs key. Under the current transfer rules impact on GDEs must be taken into account.
RS-27	reduced rainfall leading to reduction in recharge	change in water level	**impacts on groundwater dependent ecosystems**	Medium or high risk - (B) NOT treatable by WAP			Mainly affects the Quaternary aquifer, also impacts on Maslin Sands (Blewitt Springs wetlands). The impact on wetlands is due to reduced rainfall recharging wetlands. Large potential impacts in aquifers that GDEs depend on; already seeing declines in water table due to climate change.	
RS-28	reduced rainfall leading to reduction in recharge	change in salinity/quality	**impacts on groundwater dependent ecosystems**	Medium or high risk - (B) NOT treatable by WAP		Data deficient	Most wetland species some tolerance to groundwater salinity.	
RS-29	managed aquifer recharge	change in water level	**impacts on groundwater dependent ecosystems**	Low risk			MAR increases water levels	
RS-30	managed aquifer recharge	change in salinity/quality	**impacts on groundwater dependent ecosystems**	Low risk			The aquifers that are suitable for MAR aquifers are not same as the aquifers connected to GDEs.	
RS-31	changes to surface water flow regime	change in water level	**impacts on groundwater dependent ecosystems**	Medium or high risk - (B) NOT treatable by WAP			Reductions of flows could impact on recharge, surface water rules are managed by WMLR WAP	
RS-32	changes to surface water flow regime	change in salinity/quality	**impacts on groundwater dependent ecosystems**	Low risk		Data deficient	Salinity unlikely to be driven by driven by surface water coming into system	

Risk Statement Number	Risk Source	Event	Consequence	Assessment outcome		Data deficient?	Assessment Comment	Policy Comment
RS-33	groundwater extraction	change in water level	**impacts on soil health**	Low risk			The impact of water availability on soil health is limited.	
RS-34	groundwater extraction	change in salinity/quality	**impacts on soil health**	Medium or high risk - (A) treatable by WAP			Soil health concerns arise from use of high salinity water. There is a complex interplay between individual choices of landholders to irrigate with high salinity water, and the role of the WAP in limiting increases in aquifer salinity, and the availability of lower salinity water.	
RS-35	reduced rainfall leading to reduction in recharge	change in water level	**impacts on soil health**	Low risk			The impact of water availability on soil health is limited.	
RS-36	reduced rainfall leading to reduction in recharge	change in salinity/quality	**impacts on soil health**	Medium or high risk - (B) NOT treatable by WAP			Soil health concerns arise from use of high salinity water. There is a complex interplay between individual choices of landholders to irrigate with high salinity water, and the role of the WAP in limiting increases in aquifer salinity, and the availability of lower salinity water.	
RS-37	managed aquifer recharge	change in water level	**impacts on soil health**	Low risk			In extreme cases, excessive MAR could lead to localised water logging/artesian conditions but unlikely considering existing controls	
RS-38	managed aquifer recharge	change in salinity/quality	**impacts on soil health**	Low risk			In extreme cases, excessive MAR could lead to localised water logging/artesian conditions but unlikely considering existing controls	
RS-39	changes to surface water flow regime	change in water level	**impacts on soil health**	Low risk			Not a direct link.	
RS-40	changes to surface water flow regime	change in salinity/quality	**impacts on soil health**	Medium or high risk - (B) NOT treatable by WAP			If an aquifer increases in salinity (due to reduced recharge because of changed surface water flows), there is a potential risk to soil health. Surface water rules are managed by WMLR WAP.	

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