Hon Emily Bourke MLC

Government of South Australia

DEW26/01226

Mr Andrew McConville
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Dear Andrew,

Thank you for your invitation to provide a submission to the Murray-Darling Basin Authority (the Authority) on its 2026 review of the Murray-Darling Basin Plan.

The South Australian Government welcomes this opportunity and acknowledges the breadth of work and community engagement that the Authority has undertaken.

As you would appreciate, the health of the Murray-Darling Basin and River Murray is critical to South Australians and underpins the environmental, social, cultural and economic well-being of the communities that rely upon its finite water resources.

On behalf of the South Australian Government, the attached submission outlines the key issues that need to be addressed as part of this Basin Plan review to ensure that we protect and restore the Murray-Darling Basin for future generations. The submission reflects input from across South Australian Government agencies, including key Landscape Boards with a connection to the Basin within South Australia, as well as input from stakeholders received during Basin Plan implementation and during the statutory consultation period itself.

I look forward to working with you as the Authority finalises its review of the Basin Plan and through any statutory amendment process that follows.

Yours sincerely

Hon Emily Bourke MLC
MINISTER FOR CLIMATE, ENVIRONMENT AND WATER

4/ 5 / 2026

Attachment 1 - SA Government Submission to the 2026 Basin Plan Review

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SOUTH AUSTRALIA

South Australian Government Submission

to the Murray-Darling Basin Authority's 2026 Basin Plan Review

Government of South Australia

Acknowledgment of Country

The South Australian Government acknowledges Aboriginal people as the First Peoples and Nations of the lands and waters we live and work upon and we pay our respects to their Elders past, present and emerging.

The lands, waters and sky of the South Australian Murray-Darling Basin have supported diverse and unique Aboriginal cultures since time immemorial.

We acknowledge and respect the Traditional Custodians of these lands and waters, and recognise their deep and ongoing spiritual, cultural, social and economic connections to Country, and the responsibilities to care for Country.

First Nations peoples is used throughout this paper in reference to Aboriginal and Torres Strait Islander peoples as the sovereign people of this land. It recognises various language groups as separate and unique sovereign nations. The Department for Environment and Water (DEW) respectfully acknowledges this term is not universally used by all First Nations peoples in South Australia.

First Nations peoples continue to practise their lore, maintain cultural heritage, and share their knowledge and languages, which remain of vital importance to the health of Country today.

This response to the 2026 Basin Plan Review supports meaningful and equitable engagement with First Nations peoples and respects their rights, interests and obligations in the management of land and water across the Murray-Darling Basin.

Executive Summary

The South Australian Government welcomes the opportunity to make a submission to the statutory Review of the Murray-Darling Basin Plan and acknowledges the breadth of work and community engagement that the Authority has undertaken leading into the Review discussion paper and its earlier Basin Plan Evaluation and Murray-Darling Basin Outlook.

The Murray-Darling Basin is Australia's largest and most iconic river system and its health underpins the environmental, social, cultural and economic well-being of the communities that rely upon its finite water resources.

The *Murray-Darling Basin Plan (2012)* and its implementation have offered a once-in-a-generation opportunity to rebalance the system, address historical over-allocation, help irrigation industries modernise and prioritise the health of the Basin for the long-term benefit of Basin communities and the nation.

The South Australian Government shares the Authority's view that the Basin Plan is delivering real benefits for the rivers, wetlands and communities of the Basin, whilst acknowledging that more needs to be done to advance the water interests of First Nations people across the Basin. The State also shares the Authority's concerns about the climate hazards facing the Basin, as outlined in its Outlook – which will make it more difficult to achieve environmental objectives under the Basin Plan, as well as the other aspirations of Basin communities.

Despite tangible evidence of environmental improvement as a result of Basin Plan water recovery, it is also clear that significant environmental challenges remain. For example, the Coorong South Lagoon remains in a degraded condition due to prolonged hypersaline and hyper-eutrophic conditions, putting waterbirds, fish, plants and invertebrates at risk if additional action is not taken.

This example is consistent with the Authority's broader finding that the South Australian River Murray is one of a number of water resource areas across the Basin 'where original Basin Plan environmental outcomes are at risk of not being met under full Basin Plan implementation' – a finding that aligns with the Commonwealth Minister for the Environment and Water's recent listing of the 'River Murray-Darling to Sea ecological community' as critically endangered under Australian environmental law.

However, the risk to the South Australian River Murray should not be seen as a state issue alone but rather as a broader southern Basin environmental water recovery and delivery issue.

In this context, the South Australian Government believes it is premature to consider 'whether Basin Plan outcomes for the Coorong, Lower Lakes and Murray Mouth (CLLMM) need to be adjusted over the next 10 years' – particularly when the original Basin Plan Environmental Watering Requirements (EWRs) for the CLLMM were internationally and expertly peer-reviewed and set for the purposes of maintaining a resilient wetland of international importance under the Ramsar Convention.

Similarly, based on analysis put forward in Chapter 3 of this submission, it is the South Australian Government's position that the Basin Plan Review has not yet gone far enough in assessing whether current or alternative Basin Plan Sustainable Diversion Limits (SDLs) comply with the *Water Act 2007 (Cth)* requirement for an Environmentally Sustainable Level of Take (ESLT), according to the best available science and having proper regard for climate risk.

As outlined in this submission, it is recommended that further hydrological modelling and climate analysis be undertaken by the Authority to assess whether increased water recovery and/or improvements in environmental water delivery could reduce risks for the CLLMM, as well as for other key sites across the Basin.

There is also a recommendation for further transparency on the validity of significant reductions in modelled long-term water availability, with pre-development end-of-system flows now modelled to be almost 2,000 GL per annum lower than previously estimated. If overall water availability is lower than previously estimated, then risks to the environment are also higher than previously determined – and it would be unreasonable for the environment to simply bear this impact without further consideration of Basin Plan diversion limits.

These continuing environmental risks under the current Basin Plan are of particular concern to the South Australian Government given the incomplete status of water recovery in the southern Basin. Whilst the Commonwealth has made significant progress against the additional 450 GL required by 31 December 2027 (as a result of active measures taken after passage of the *Water Amendment (Restoring Our Rivers) Act (2023)*), significant volumes of additional water recovery will be required to address an anticipated shortfall due to NSW's and Victoria's failure to deliver major Sustainable Diversion Limit Adjustment Mechanism (SDLAM) projects (with the water recovery shortfall assumed to be 300 GL in the Authority's Discussion Paper).

For South Australia, full Basin Plan water recovery against all Basin Plan targets remains non-negotiable.

Whilst the South Australian Government favours using on- or off-farm water use efficiency measures to meet Basin Plan targets for additional water recovery, voluntary buy back should continue to be pursued where necessary to achieve water recovery targets within statutory timeframes, along with structural adjustment support if there are significant socio-economic impacts due to that water recovery, including support for industry diversification. Additional support is also required for irrigators and the community to transition to a low water use future.

The South Australian Government also believes that water recovery against the SDLAM shortfall should be apportioned to NSW and Victoria. Unlike South Australia, which first capped water entitlements for the River Murray in 1969 and moved first on irrigation efficiency, the other two southern Basin States have historically over-allocated, failed to invest adequately in irrigation efficiency and failed to meet their commitments to deliver key SDLAM projects, including vital projects to address physical and operational 'constraints' to environmental water delivery.

Despite a lack of progress on constraints projects, the South Australian Government continues to support credible action by Basin governments to overcome physical and operational constraints to delivering environmental water in the southern Basin, which remains essential for restoring the health of floodplain environments, including in the South Australian Riverland. The South Australian Government strongly supports the key actions in the Constraints Relaxation Implementation Roadmap developed by the Authority. However, if the broader constraints reform agenda is not going to be pursued by Basin governments, then there would be merit in exploring increases in environmental outcomes that could be achieved from targeted action to address constraints to lower levels at specific locations.

More should also be done to support Environmental Water Holders to optimise the coordination and use of existing environmental water, including across multiple years to address environmental risks in extreme dry years, especially for the Coorong and Lower Lakes. This should be supported by more robust environmental planning frameworks under the Basin Plan and increased protection for held and planned environmental water across the Basin, as well as a continued focus on integrated catchment management and on the health of native fish. However, none of these actions are a substitute for water recovery.

The South Australian Government also supports the Authority's emphasis on addressing First Nations' interests and participation in water management, with the submission recommending a number of policy principles based on recent engagement with the Authority and First Nations communities in the lead-up to the Basin Plan Review. These principles also align closely with recent feedback from First

Nations in South Australia, received as part of the State Government's work in partnership with the South Australian Native Title Services Ltd (SANTS) to address the Inland Waters Target under Closing the Gap.

As recognised by the Authority, addressing Critical Human Water Needs (CHWN) is another important priority for Basin governments. The South Australian Government agrees with the Discussion Paper's findings in relation to effectiveness of the current Basin Plan provisions for CHWN within the River Murray system. In addition, and recognising the limits of what can be addressed by the Basin Plan, it is recommended that each Basin State be permitted to adjust critical human water needs volumes for state planning purposes, subject to those volumes being within the existing Basin Plan SDL and not affecting third parties.

The South Australian Government also continues to support the Authority's call for a significant uplift in investment in ageing River Murray system infrastructure to reduce the risk of asset failure and safety risks. Whilst critical for public and irrigation water supply, it is agreed that this can support Basin Plan environmental outcomes as well.

With respect to Basin Plan regulatory design, the South Australian Government would support exploring proposals to streamline water resource plan development and accreditation processes where this does not put water use compliance or SDL compliance at risk. However, the Basin Plan should be amended to remove or put a sunset clause on the current 'reasonable excuse' provisions, which seek to exempt Basin States from compliance if the Commonwealth has not met the relevant water recovery target. Similarly, legislative amendments are required to address a loophole whereby a Basin State is exempt from Inspector-General oversight where that Basin State has failed to receive accreditation for its water resource plans.

Finally, securing long-term funding for the Goyder CLLMM Research Centre remains a high priority for South Australia. This Centre has brought together several research institutions to provide independent science on climate adaptation in the CLLMM region and has a potentially important role to play in informing long-term management options for this internationally important site, as well as for the whole Basin.

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1 Context for Submission

1.1 One Basin

The Murray–Darling Basin is Australia's largest and most iconic river system.

The Basin supports estuarine, floodplain and wetland environments of national and international significance. There are over 30,000 wetlands including sixteen listed under the Convention on Wetlands of International Importance (the Ramsar Convention). Its health underpins the social, cultural and economic wellbeing of communities reliant on its finite water resources.

Across largely unregulated northern catchments and highly regulated southern catchments, the Basin does not stop at the end of the Murrumbidgee, the Goulburn, the Barwon-Darling or any other tributary, nor does it stop at the South Australian border. Over 77,000 km of rivers stretch from mountain ranges, through arid and semi-arid environments – to the sea.

Despite its geographic size, the rivers of the Basin carry by far the smallest volume of water of any major river system in the world and are therefore particularly vulnerable to any degree of change, whether by natural causes, regulation or unsustainable diversions for agricultural or other consumptive uses. The impacts of the Millennium Drought from 1997 to 2010, particularly in South Australia, were exacerbated by overallocation and overuse, but also of not holistically managing this river system.

The impacts in the final years of the Millennium Drought followed decades of overallocation and resultant low flows. It took parts of the River Murray in South Australia to the brink of collapse and the consequences were extreme.

Significant environmental devastation, including loss of habitat, species decline, hypersalinity and acidification, placed ecosystems such as the Coorong, and Lakes Alexandrina and Albert Wetland on the verge of ecological collapse. The health of floodplain vegetation drastically deteriorated and landscape salinisation increased.

For South Australia's irrigation and river communities, particularly below Lock 1, salinity levels exceeded all acceptable standards, rendering water unsuitable for stock, domestic or irrigation use. Water levels in the Lower Lakes receded hundreds of metres from banks, stranding infrastructure. Irrigation pumps could not reach the water, even if the water had been usable or palatable. Exposed acid sulfate soils generated vast quantities of sulphuric acid and released toxic metals into the water column – threatening both human health and aquatic ecosystems.

The water supply of Adelaide and country towns was also threatened, triggering construction of expensive infrastructure including the Adelaide Desalination Plant (ADP). Levee banks cracked and riverbank collapse became a significant issue, placing lives and property in danger whilst creating emergency management problems for many years after flows eventually returned.

Transport infrastructure, agriculture, tourism, recreation and related industries all suffered. Fishing, tourism and leisure industries declined, dairy farms closed and agriculture contracted, reducing employment with consequential impacts for local businesses. Business and consumer confidence was eroded and the social impacts were extreme.

The *Water Act 2007* (Cth) (Water Act) gave effect to Australia's international biodiversity, conservation and environmental obligations and treaties. For the first time, there was legislation for a national response to integrate and improve Basin water management. To meet its objectives, the Water Act required the preparation and implementation of a Basin Plan to ensure a return to environmentally sustainable levels of take.

The Basin Plan 2012 presented an historic opportunity to avoid a repeat of the devastating impacts of the Millennium Drought and to meet our international obligations to protect our unique and irreplaceable wetlands for the future. At the same time, securing the long-term environmental health of the Basin is vital for social, cultural and economic outcomes. It is not a binary choice.

This is what South Australia signed up for in 2012.

To date, the Basin Plan has delivered significant progress towards improving environmental outcomes but this task is not yet complete and the importance of delivering the current Basin Plan in full remains as relevant now as it was in 2012.

What comes next for the Basin Plan, matters greatly. The process and outcomes of the Basin Plan Review must be thorough, transparent and based on robust science. It must put forward a pathway for a new Basin Plan with updated and enhanced arrangements for a coordinated, Basin-wide approach to water resource management, to truly deliver: '*Rivers*, for generations'.

1.2 South Australia's Reform Legacy

South Australia's position at the end of the River has always left this State vulnerable to the impacts of overallocation, extraction and regulation upstream and the accumulated impacts of River degradation and drought. The burden borne by this State has been significant.

Since the mid-1880s, all State Governments pursued expanded irrigated agriculture activities. In the southern-connected Basin, the type and extent of irrigation development, and the subsequent establishment of each State's water rights, historically occurred in direct correlation to the reliability of water supply afforded under the water sharing rules under the *Murray-Darling Basin Agreement* (the Agreement).

Areas of permanent horticulture were predominately developed in close proximity to the River Murray in South Australia, to utilise the highly reliable but limited Entitlement volume provided.

In contrast, in New South Wales and Victoria, the much larger volumes of water available allowed irrigation development at greater distances from the River Murray and its major tributaries. In Victoria, the large and highly reliable annual volumes allowed the development of permanent horticulture and dairy. Whilst areas of permanent horticulture were also established in New South Wales, larger areas of annual crops (including pasture) were planted and grown to make use of much larger but less reliable volumes available to it.

In response to declining water quality and quantity levels in the 1960s, the South Australian Government set its own cap on entitlements in 1969. This was further reduced in 1979 and again in 1991. While South Australia managed diversions within its self-imposed cap and respected the River, other States continued to issue new licences. South Australians went without the economic opportunities enjoyed by the upstream States that arose from dramatic increase in water diversions.

Prior to the Basin Plan, water users in South Australia extracted 7.5 percent of the total water used for consumptive purposes across the southern-connected Basin – a total of 681 GL out of over 9,050 GL.[1] In comparison, New South Wales extracted over 4,500 GL (almost 50 percent) whilst Victoria extracted over 3,800 GL (around 42 percent).

Critically, between 1969 and the introduction of the Basin-wide Cap on Diversions in 1997, diversions across the Basin increased by around 3,500 GL per year. If other jurisdictions had taken the same steps

[1] MDBA BDL estimate as at 6 November 2025.
Found at: Murray–Darling Basin Baseline Diversion Limits - estimates for the 2024–2025 water year

as South Australia and capped entitlements in the 1960s, most of this increase in diversions would have been avoided.

A range of extra costs and unfair losses were borne by South Australians over many years. These extend to early expenditure on irrigation efficiency and foregone production, borne by both the public and private sectors, and included the costs of on-farm infrastructure upgrades and major infrastructure schemes. Over the 30 years before the Basin Plan, South Australian irrigation water delivery infrastructure was upgraded, mostly to fully piped pressurised systems, with a proportion of the water savings returned to the environment. The transition from open channel irrigation systems to best-practice pressurised piped systems reduced system losses to less than 10 percent. On-farm, South Australian irrigators also invested heavily in irrigation efficiency to maximise their water availability in the capped environment.

Whilst South Australia has a strong history of responsible water stewardship and consistent leadership in efficiently and sustainably managing the River, the 2012 Basin Plan did not recognise this.

Instead, South Australia has been required to deliver, and has delivered, as much as any other State under the Basin Plan.

Given this, South Australia will continue to pursue its rights in relation to Basin resources and to ensure that the next Basin Plan will be effective for meeting its requirements for healthy environments, sustainable industries and prosperous communities.

2 Basin Plan Implementation in South Australia

Key messages

- Implementation of the Basin Plan has brought significant changes and benefits to water management across the Murray-Darling Basin, delivering water for the environment and improving the health of aquatic ecosystems.
- In South Australia, the coordinated delivery of environmental water has led to measurable improvements in the condition of SA River Murray ecosystems – enhancing biodiversity, habitat quality and resilience.
    - Environmental water has been critical to maintaining flows along the entire length of the River Murray and through Lake Alexandrina to the Coorong and the Murray Mouth.
    - Water level management and seasonal water level cycling in the Lower Lakes has supported aquatic plant recruitment, improved habitat condition and food resources, increasing the abundance, distribution and breeding of waterbird communities.
    - Increased freshwater flows through the barrages have maintained and improved the extent of optimal salinity conditions, provided critical pathways for the movement and recruitment of key diadromous fish species and improved black bream and greenback flounder populations in the Murray Estuary and Coorong, as well as small-mouthed hardyhead in the Coorong.
    - Maintenance of southern Coorong water levels through spring and summer has improved the abundance and distribution of aquatic plants, including Ruppia tuberosa.
    - The operation of floodplain environmental regulators at Chowilla, Pike and Katarapko, in conjunction with targeted watering actions, has expanded the area of the floodplain over which targeted environmental watering can occur, improving the condition of river red gum and black box, supporting significant bird breeding events and the recruitment of Murray cod populations.
- The South Australian Government has delivered all requirements and obligations that it committed to under the Basin Plan.
- Despite improvements, challenges remain. Full implementation of the current Basin Plan (including the water recovery shortfall due to the failure of SDLAM projects) is essential, followed by sustained actions including the protection of environmental flows, addressing constraints to environmental water delivery and improved river operations must continue to be pursued as part of the next Basin Plan.

2.1 Implementation Activities

The South Australian Government has delivered all requirements and obligations that it committed to under the Basin Plan. All commitments have been implemented in good faith and it was expected that all Basin States would do the same. This has not always been the case.

2.1.1 Water Recovery and Efficiency Measures

The South Australian Government has supported water recovery via entitlement purchase and efficiency measures to meet the Basin Plan 'bridging the gap' target and to contribute towards the final 450 GL.[2]

- **Bridging the gap** – a water recovery target of 183.8 GL was mandated for the SA Murray SDL resource unit under the Basin Plan, comprising a 101 GL local reduction amount[3] and then an 82.8 GL SDL shared reduction amount.[4]

  Entitlements equivalent to 131.8 GL have been recovered towards this target, comprising 84.6 GL of water purchase, 40.9 GL from infrastructure programs and 6.3 GL recovered by the South Australian Government. The deficit is currently met by 52 GL of SDL offset.[5]

- **450 GL target** – as at 31 December 2025, entitlements equivalent to 12.7 GL had been recovered towards this target from the SA Murray, comprising 3.2 GL of efficiency measures and 9.5 GL of additional held environmental water (HEW) (water purchase and the transfer of 9.2 GL from water previously recovered towards the 'bridging the gap' target).

The South Australian Government has actively promoted and progressed programs for water recovery via efficiency measures to contribute towards both the 'bridging the gap' target and the 450 GL.

Highlights include:

- Recovering 1.94 GL under the Commonwealth On-Farm Further Irrigation Efficiency (COFFIE) program through upgrades to irrigation infrastructure and other activities that improved the productivity of farm businesses.
- Projects to more effectively utilise Adelaide's recycled water and stormwater capture and re-use networks such as upgrades and network extensions to Council stormwater and reuse schemes to supply open space irrigation to schools, council reserves and playing fields in preference to River Murray water.
- Combining investment in rural water use, management and efficiency, improved water knowledge and market reform and water purchase to recover 48.3 GL for the environment under the Sustainable Rural Water Use and Infrastructure Program (SRWUIP) and the South Australian River Murray Sustainability (SARMS) Program.

A unique element of the SARMS program and part of its success was that it pooled funds from multiple Australian Government programs into one integrated program that enabled multiple outcomes to be pursued and delivered together. A review of the SARMS regional economic development program found that the program had employed at least 120 FTE jobs and 80 casual jobs during the construction phase of the Regional Development and Innovation sub-program and supported the creation of more than 1000 long-term jobs across the region. It also resulted in the construction of various facilities that support opportunities for economic diversification as well as delivering training and professional development programs. Several of the businesses reported that the future sustainability of their operation would have

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[2] All volumes in this submission are expressed as long-term annual average equivalent.

[3] The local reduction amounts are specified in column 2 of the table in Schedule 2 of the Basin Plan. Each local reduction amount is the volume of water required to meet environmental water needs within the SDL resource unit where it is recovered. Basin-wide, the local reduction amounts equate to 1,668 GL of the total water recovery target of 2,680 GL (as revised from 2,750 GL following the Northern Basin Review). When deployed, this water may provide benefits to downstream environments.

[4] The shared reduction amounts are specified in section 6.05 of the Basin Plan. Each shared reduction amount is the volume required to meet, or contribute to meeting, the environmental water needs downstream of the SDL resource unit. Basin-wide, the shared reduction amounts equate to 1,012 GL of the total water recovery target of 2,680 GL (given the reduction from 2,750 GL due to the Northern Basin Review.

[5] As per S6A.02(2) of Schedule 6A, 52 GL of the total 605 GL total SDL offset was apportioned to South Australia as part of the operation of the SDL adjustment mechanism.

been uncertain without a program such as SARMS and that the program strengthened their business and market confidence and opportunity.[6]

Off-farm irrigation water delivery improvement projects included a large-scale reconfiguration and improvement for an irrigation trust, which also involved retiring irrigation blocks in floodplain areas (prone to salt damage), the development of new irrigation blocks off the floodplain and rehabilitation of a creek and linear park. There were several on-farm efficiency measure projects that involved the installation of netting over permanent horticulture to generate both water use efficiency benefits and yield quality and quantity benefits, including under the effect of climate change induced heat and water stress.[7]

2.1.2 SDL Adjustment Mechanism Projects

During negotiations on the draft Basin Plan, New South Wales and Victoria pushed for a mechanism to provide flexibility in how environmental outcomes could be delivered, thereby allowing the SDLs to be increased and water recovery targets to be reduced. The SDLAM was the political compromise.

The SDLAM was designed to operate in two ways: (1) to decrease the bridging the gap water recovery target of 2,750 GL and increase SDLs by implementing so-called 'supply' measures, thereby addressing the 2,100 GL water recovery target proposed by New South Wales and Victoria; and (2) to increase water for the environment and decrease SDLs through efficiency measures, thereby addressing South Australia's request for a 3,200 GL water recovery target.

While the SDLAM was designed to both increase and decrease SDLs, the provisions in the Basin Plan focus primarily on the increase to the SDLs via the determination of an 'SDL offset' and the method by which this will be determined. To achieve an SDL offset, supply measures are required to provide equivalent environmental outcomes with less water recovery or to make more water available to the environment via projects that reduce evaporation. In 2017, a package of 36 projects provided the basis for a total SDL offset of 605 GL. At the end of 2026, when a new SDL offset is determined for completed projects, the 605 GL is likely be reduced to between 255 and 355 GL.

The SDLAM is not simply about scoring environmental outcomes and then reducing water recovery. It is about increased environmental outcomes from projects being used to offset water recovery and/or projects using flows more efficiently. The equivalence of the flow-related outcomes via the Ecological Elements method was intended to provide the basis for the offset to ensure its conceptual and scientific consistency with the Environmentally Sustainable Level of Take (ESLT). The legal and technical basis for the SDLAM should not be overlooked and water equivalent to the SDL offset shortfall will need to be recovered due to the non-delivery of projects.

The South Australian Government participated in the development and operation of the SDLAM, bringing forward six supply projects as a sole proponent and working with other Basin Governments on ensuring the method used in SDLAM was as robust as possible. However, the operation of SDLAM essentially substituted upstream outcomes for reduced flows to the Lower Lakes and Coorong.

Five of SA's six supply projects have been formally completed and projects are fully operational. Through several assurance assessments, the Murray-Darling Basin Authority (Authority) evaluated whether the

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[6] DCCEEW (2024) *Commonwealth Water Reform in the Murray–Darling Basin: Report on the effect of the implementation of the Basin Plan on social and economic outcomes, 2020 to 2024*. Five-yearly report of the Department of Climate Change, Energy, the Environment and Water on Matter 3, Schedule 12, of the Basin Plan 2012, October 2024. Found at: Commonwealth water reform in the Murray–Darling Basin Report on the effect of the implementation of the Basin Plan on social and economic outcomes, 2020 to 2024

[7] BDO EconSearch (2019) *Regional Economic Analysis of SARMS 3IP*. A report to Primary Industries and Regions SA, Adelaide, December 2019.

expected environmental outcomes were capable of being delivered on time to validate the SDL offset. Though many of the projects were operationally complete some years ago, these projects were endorsed as completed for the purposes of the SDL adjustment mechanism by the Basin Officials Committee (BOC) at meetings in July and November 2025. The completed and operational South Australian projects are as follows:

1. **Chowilla Regulator Project** – a major environmental regulator on the Chowilla Creek and a range of complementary works were constructed to allow flows to be managed and enable inundation across the floodplain under relatively low river flow conditions. This was part of a program of works under The Living Murray (TLM) Program at River Murray icon sites to ensure environmental water recovered as part of the TLM program was used efficiently and for environmental benefit. The project was completed in December 2014.

   Since completion, the Chowilla Regulator has been operated on seven occasions since 2014 to push water onto the Chowilla Floodplain and promote lateral connectivity from the River. Regulator operations in 2014 and 2018, under river flows of 10,000 and 7,000 ML/day respectively, both resulted in the inundation of around 2,300 hectares of wetlands and floodplains. A similar, natural event would require 55,000 ML/day.[8,9] Many positive ecological responses were observed, including improvements in tree health, increases in floodplain understorey species richness and in aquatic vegetation (e.g. Moira Grass). At least 25 waterbird species were observed (e.g. Grey teal and Pacific black duck), fish surveys recorded up to seven species (e.g. golden perch) and eight species of frogs were counted (e.g. southern bell frog).

2. **Riverine Recovery Project (RRP)** – infrastructure works on high value wetlands along the SA River Murray have allowed the reinstatement of natural wetting and drying cycles to improve the wetland health and reduce evaporative losses. The RRP provided 7.2448 GL of South Australian Class 9 water access entitlements to the Australian Government. These entitlements receive a 100 percent allocation each year and are used for environmental purposes either within South Australia or upstream of the border. The project was completed in February 2019.

   The RRP has improved floodplain and wetland health and community partnerships have helped to build capacity and resilience and realise social and environmental benefits.[10] Just one example of improved environmental outcomes is at Hart and Ramco Lagoons in 2023-23. Following the drying and wetting phases, high abundances of waterbirds were regularly sighted foraging on aquatic plants and algae that germinated following the removal of carp. Black swans often dominated the counts and many dabbling duck species, including the Australasian shoveler, were also observed.[11]

3. **South East Flows Restoration Project (SEFRP)** – a combination of newly constructed drains and widened existing drains within the Upper South East drainage system to divert water from the Blackford Drain in the Upper South East into the Coorong South Lagoon. This is the most recent of a series of projects over the past 20 years to reconnect the original south to north flow paths in the South East of South Australia. The SEFRP contribution of 5 to 45.3 GL/y of environmental water (median of 26.5 GL/y) provides benefits for enroute wetlands and salinity improvements in

[8] DEW (2015), *South Australia's River Murray Environmental Watering Report 2014-15*, Department for Environment and Water, Adelaide.

[9] DEW (2019), *South Australia's River Murray Environmental Watering Report 2018-19*, Department for Environment and Water, Adelaide.

[10] DEW (2021), *Final Report for Riverine Recovery Project*, Department for Environment and Water, Adelaide.

[11] DEW (2024), *River Murray Environmental Watering Report*, Department for Environment and Water, Adelaide.

the Coorong South Lagoon. Since completion, over 100 GL of water from the South East has been released into the Coorong South Lagoon. The project was completed in February 2019.

4. **South Australian Riverland Floodplain Integrated Infrastructure Program (SARFIIP)** – a package of works and measures including major environmental regulators that enable floodplain inundation and groundwater management on the Pike and Katarapko floodplains. This project was completed in June 2022.

   Environmental regulators at the Pike Floodplain have been operated five times since construction finished in 2020, inundating 335 to 1,356 hectares of floodplain and wetland habitat during managed events, which would not have been watered under prevailing river flows. Over 80 terrestrial bird species now use the recovering floodplain woodlands and over 40 waterbird species been recorded at Pike wetlands, including conservation-significant species rarely seen in the Riverland, such as black-backed bitterns and spotless crakes. At least seven frog species, including the nationally vulnerable southern bell frog, have been recorded, with breeding by six riparian species regularly linked to environmental water delivery. Murray cod numbers – vulnerable across the Basin due to loss of critical flowing habitat – have also increased in the Pike anabranch following higher baseflows enabled by SARFIIP inlet upgrades.

   At the Katarapko Floodplain, environmental regulators have been operated five times since completion in 2020, inundating an additional 125 to 796 hectares of floodplain and wetland habitat that would not have been watered under the prevailing river flows. Watering has produced positive ecological responses, including improved condition of floodplain trees and lignum, and greater richness and abundance of understory species. Over 75 woodland bird species have been recorded, including regular flocks of vulnerable Regent Parrots. More than 35 waterbird species have also been observed among them conservation-significant species such as Common Greenshank and Wood Sandpiper, along with breeding pairs of Nankeen Night Herons and Australasian Darters. At least seven frog species have been recorded, including vulnerable southern bell frogs. Annual fish monitoring shows continued increases in Murray cod abundance and extent, driven by improved baseflows throughout the Katarapko-Eckert anabranch system.

5. **River Murray in SA – Constraints Measure** – capital works and other mitigation activities, including operational, policy and land management arrangements to address the physical and policy constraints to the delivery of regulated flows up to 80,000 ML/day at the South Australian border. These flows are important for achieving the environmental outcomes identified in the modelling for the 2012 Basin Plan and the Constraints Management Strategy developed by the Authority in 2013. The SDL offset policy component of the project was completed June 2024; Stage 2 works are to be completed by December 2026 to provide complementary outcomes.

   Numerous activities have been completed under the two works stages, including construction of regulators and culverts, upgrades to river vessel waste disposal stations, boat ramps and access tracks, installation of monitoring stations and bank stabilisation. These works enable effective water and flow management and enhanced floodplain connectivity, strengthened infrastructure resilience during high flows, safe and reliable road access, public safety and emergency preparedness, community resilience to high flow events, continuous safe access to public assets and improved water monitoring and reporting capabilities.

   By December 2026, community capacity building and co-design processes are scheduled to be underway, including the development of tools to help landholders understand and manage the impacts of high flows, an education program to promote environmental benefits and build community resilience to enhanced environmental flows and community co-design processes for potential future construction at privately owned sites.

Several environmental investigations and reports are also underway, including detailed floodplain assessment activities at priority sites to inform floodplain impediment removal works, the evaluation of additional ecological benefits of enhancing environmental flows, mapping of vegetation communities and a data register and a data repository to support enhanced flows risk assessments.

Modelling and documentation of the final project is underway and is scheduled to be considered by BOC in June 2026:

6. **Eastern Mount Lofty Ranges (EMLR) Flows for the Future Project** – works to reduce the interception of low flows by runoff dams and deliver and protect runoff from urban areas to restore critical environmental flows and counteract a decline in catchment health that has been detrimental to both communities and environments in the EMLR. The works involve a range of modifications to existing runoff dams and other infrastructure solutions. The return of environmental flows in the EMLR results in additional flows into Lake Alexandrina.

Of the total SDL offset of 605 GL, South Australia was apportioned 52 GL.[12] Despite the implementation of its own projects, the failure of upstream projects means that further water recovery of between 21 and 30 GL would potentially be required within South Australian after the Authority's SDLAM reconciliation determination. However, the South Australian Government believes that the resultant SDL adjustments and water recovery shortfall should be apportioned fully to NSW and Victoria – the two states that have historically over-allocated, failed to invest adequately in irrigation water-use efficiency and failed to meet their commitments to deliver key SDLAM projects.

2.1.3 Water Resource Plans

The South Australian Murray-Darling Basin comprises three water resource plan (WRP) areas – the SA River Murray, EMLR and the SA Murray Region. WRPs for all three areas were submitted within the timeframes required by the Authority and accredited in 2019.

As part of the development of the SA River Murray WRP, the Water Allocation Plan for the River Murray Prescribed Watercourse (River Murray WAP) was amended to include the first permanent water allocation framework for the River Murray in South Australia. This now provides for the distribution of South Australia's Entitlement to entitlement holders under all levels of water availability (including during extreme drought events). The framework was aligned with the rules and policies under baseline diversion limit (BDL) conditions to ensure consistency with the calculation of the BDL and hence the SDL for the SA Murray SDL resource unit.

Amendments were also made to the River Murray WAP to ensure that flow at the South Australian border above South Australia's Entitlement (as adjusted for trade) is protected as planned environmental water (PEW). This includes, but is not limited to, unregulated flow, Additional Dilution Flow (ADF), the Lindsay River Allowance and environmental water delivered from upstream.[13]

2.1.4 Environmental Water Protections

In 2019, a package of environmental water protection policy measures[14] was submitted to the Authority for review and assessment. Aligned with the principles of the River Murray WAP, the package of four

[12] Basin Plan, Schedule 6A, section S6A.02(2).

[13] River Murray WAP, Principle 6.

[14] SA environmental water protection policy measures were prepared to ensure the implementation of 'unimplemented policy measures' under section 7.15 of the Basin Plan, which are also known as Prerequisite Policy Measures (PPMs).

policies and five procedures ensure that HEW and PEW are preserved for environmental outcomes and cannot be used for any other purpose within the SA River Murray.[15]

Key policies and procedures within this suite are as follows:

- **Unregulated flow policy and procedure** – the River Murray WAP protects unregulated flow from extraction for consumptive use. This policy then guides the use of unregulated flow in the SA River Murray for environmental outcomes.[16]
- **Procedure for environmental water accounting in South Australia** – this includes the environmental water accounting spreadsheet designed to track the delivery of environmental water and associated actions from the South Australian border to the Coorong and Murray Mouth.
- **Transmission losses policy and procedure** – this sets out the steps for calculating and applying losses to environmental water. Calculated losses are recorded in the South Australian environmental water accounting spreadsheet and used for reporting purposes.
- **Return flow policy and procedure** – these guide the use and accounting of return flows from environmental watering actions in the SA River Murray, ensuring the accounting of return flows enables these to be used and re-used for environmental outcomes at multiple sites and are not available for consumptive use. The use of return flows must be managed consistently with the requirements of water holders and is documented in individual events watering schedules.

The suite of policies and procedures underwent its first biennial review and assessment by the Authority in June 2021 and then again in 2023. The next review is due by 30 June 2026.

2.2 Observed Environmental Outcomes

Implementation of the Basin Plan has led to measurable improvements in the condition of the SA River Murray ecosystems – enhancing biodiversity, habitat quality and resilience.

These improvements are demonstrated through the South Australian Government's evaluation of the environmental outcomes achieved under the Basin Plan, underpinned by 5-yearly reporting against Matter 8 'achievement of environmental outcomes at an asset scale', along with a contribution from reporting against Matter 12 'progress towards water quality and salinity targets'. South Australia's most recent Basin Plan environmental outcome evaluation and report was published in 2024.[17]

The approach taken in this evaluation recognised the linkages between the Basin Plan environmental objectives, environmental watering plans and strategies (State and Basin-wide) and asset-scale environmental outcome reporting. Reporting was completed across three water resource plan (WRP) areas (SA River Murray, SA Murray Region and EMLR) and included an evaluation of the extent to which environmental outcomes had been achieved, the extent to which the Basin Plan contributed to achieving outcomes and whether there had been any unanticipated outcomes.

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[15] Refer also: DEW (2019) *Prerequisite Policy Measures Implementation in South Australia – Overview of arrangements and mechanisms used to implement Prerequisite Policy Measures*. This outlines how the suite of policies and procedures, together River Murray planning, operating and reporting measures, ensure protection of environmental water in SA.

[16] Under the River Murray WAP, SA does not provide for supplementary access to unregulated flow.

[17] DEW (2024) *South Australia's evaluation of environmental outcomes under the Basin Plan (2024): Approach and Summary, South Australian River Murray Water Resource Plan Area*. Department for Environment and Water, Adelaide.

Reports are underpinned by assessments that use the best available scientific data and information, including state and federal monitoring programs,[18] along with technical expert input and peer review.

The outcomes described below focus on those in the SA River Murray – from the border to the Coorong and Murray Mouth – as environmental health across this WRP area is completely dependent on upstream water use and the quantity and quality of flow into South Australia. The importance of the Basin Plan in delivering environmental outcomes in this WRP area is paramount.

Key findings from South Australia's assessment and evaluation include:

- The recovery and coordinated delivery of water for the environment has been critical to maintaining flows along the entire length of the River Murray and through the Murray Mouth and across all South Australian priority environmental assets.
- Water for the environment under the Basin Plan has led to significant improvements in system connectivity, water quality and habitat conditions.
- The operation of South Australia's floodplain environmental regulators at Chowilla, Pike and Katarapko in conjunction with targeted watering actions has expanded the area of the floodplain over which targeted environmental watering can occur (within the capacity of current regulated flow delivery to the South Australian border), improving connectivity to support critical habitats and ecosystem functions.
- High (unregulated) flow events are vital for increased system connectivity, productivity and resilience of ecosystems.
- The 2022–23 River Murray flood event delivered significant environmental benefits along the SA River Murray but some improvements may be short-term if not followed-up with further watering.

Specifically for the SA River Murray Channel and Floodplain, the implementation of the Basin Plan is supporting continued improvement in environmental condition, including through the delivery of water for the environment, such as the following:

- Managed floodplain inundations, improving the condition of river red gum and black box and their capacity to respond positively to future high (unregulated) flows with new growth and population regeneration.
- As a result of water level raising at floodplain sites, inundation across significant additional areas of floodplain providing benefits to floodplain flora and fauna. In 2021-22 this included provision of significant habitat for wetland birds at Chowilla with 46 different species recorded including migratory waders and with a total of 5,614 birds recorded at just one floodplain wetland site (Coombool Swamp) during a single survey, and breeding recorded by seven wetland bird species.
- Increased densities and diversity of microinvertebrates, critical for channel and floodplain productivity and food webs, particularly in conjunction with managed inundations and overbank flow conditions.
- Provided spring-summer flows and more localised fast-flowing habitats, that likely facilitate recruitment and improved structure of Murray cod populations.
- Enabled targeted delivery of environmental water, creating conditions for the local-scale breeding and recruitment of frog species in the absence of sufficient natural flows.

[18] Including the Living Murray (TLM), *Healthy Coorong, Healthy Basin* (HCHB), Flow-Monitoring, Evaluation and Research (Flow-MER) Program, Sustaining Riverland Environments (SRE) Program.

Despite the improvement in observed environmental condition, risks remain for those areas unable to be watered with managed inundations.

For the Coorong, Lower Lakes and Murray Mouth (CLLMM), implementation of the Basin Plan and the delivery of water for the environment is providing significant benefits and has supported improved environmental conditions:

- Additional water has helped maintain optimal lake levels and increased barrage flows both inter and intra-annually to improve salinity levels in Lake Alexandrina and Lake Albert.
- Lake level management and seasonal water level cycling has supported aquatic plant recruitment, improving the condition of aquatic and littoral vegetation. This has improved habitat condition and food resources, supporting the abundance, distribution and breeding of waterbird communities across the Lakes.
- Increased freshwater flows through the barrages have maintained and improved the extent of optimal salinity conditions, provided critical pathways for the movement and recruitment of key diadromous fish species and improved black bream and greenback flounder populations in the Murray Estuary and Coorong, as well as small-mouthed hardyhead in the Coorong.
- Maintenance of southern Coorong water levels through spring and summer has improved the abundance and distribution of aquatic plants, including *Ruppia tuberosa*.

Despite these improvements, challenges in the CLLMM remain, including:

- The southern Coorong is considered to be degraded due to prolonged hypersaline and hyper-eutrophic conditions, risking its ability to support key biota such as waterbirds, fish, plants and invertebrates if additional action is not taken.
- Recovery of waterbird populations, particularly shorebirds, requiring improved quality and availability of local, national and international wetland habitats.
- Improving the recovery and resilience of aquatic plants (including *Ruppia tuberosa*) in the southern Coorong.
- Maintaining an open Murray Mouth, without ongoing dredging.

In relation to continuing environmental risks identified in the evaluation, these findings align with the Commonwealth Minister for the Environment and Water's recent listing of the 'River Murray-Darling to Sea ecological community' as critically endangered under Australian environmental law.

Monitoring has provided valuable data and information to understand the condition of aquatic ecosystems and will continue to be important to ensure we respond effectively to changing environmental conditions for enhanced environmental outcomes over time.

South Australia's 2024 evaluation of environmental outcomes demonstrated that:

- Full implementation of the Basin Plan is vital to protect internationally recognised wetlands, including the Coorong, and Lakes Alexandrina and Albert Wetland and to maintain healthy aquatic environments that support irrigation, water supply, recreation and tourism.
- Water for the environment is essential to provide the varied flow regimes needed for ecosystems to survive and thrive and its coordinated delivery, including with upstream watering actions, has contributed to improved outcomes in the SA River Murray.
- Delivery of water for the environment has improved environmental outcomes during low flow conditions, likely preventing similar outcomes to those seen during the Millennium Drought and enhanced outcomes during medium and high (unregulated) flows.

- Whilst many environmental outcomes since adoption of the Basin Plan have generally improved, monitoring has also shown that additional water for the environment is required – particularly during dry years – and is critical for the ongoing recovery and health of aquatic environments in the SA River Murray.
- Operation of South Australia's environmental regulators has expanded water delivery areas across the floodplains, improved connectivity and supported critical habitats for native frog, vegetation and waterbird species. This must continue.
- High (unregulated) flows have provided system-wide environmental benefits including flushing salt and nutrients, breeding and feeding opportunities for fish and waterbirds and delivering water to wetlands and floodplains.
- The 2022-23 River Murray flood event delivered significant environmental benefits along the SA River Murray. However, improvements such as in tree health and seedling survival across the floodplains and salinity in the Lower Lakes and Coorong may be short-term if not followed-up with regular watering.

To achieve ongoing environmental improvements, South Australia's 2024 evaluation indicated that it was important that Basin Plan implementation:

- Recovers and delivers the final 450 GL, which remains critical to improving and maintaining environmental outcomes across the SA River Murray and as well as benefits to the connected floodplains in New South Wales and Victoria.
- Protects water for the environment throughout the Basin, ensuring return flows from environmental watering events support downstream environmental outcomes.
- Addresses physical and policy constraints for more effective delivery of water for the environment, whilst enhancing protection for landholders from higher-than-normal natural flows.
- Promotes efficient and effective use of water for the environment through innovative river operations and active management options.
- Improves monitoring and evaluation efforts to support adaptive management and improved outcomes aligned with the Basin Plan's intended environmental outcomes.

Since 2024, it has become clear that not all of the above will be completed by the end of 2026 and it is imperative that these actions be pursued as part of the next Basin Plan.

3 Environmentally Sustainable Level of Take (ESLT)

Key messages

- The South Australian Government's review of the Basin Plan modelling and supporting material shows the Plan has improved environmental conditions and that full implementation would enable further progress towards environmental outcomes.
- However, the results of this assessment and the Authority's initial SDL assessment do not demonstrate that current Basin Plan settings constitute an ESLT.
- The outcomes presented do not meet requirements of the Water Act and do not provide adequate protection for South Australia's priority environmental assets (including Ramsar wetlands) or key ecosystem functions.
- Sensitivity testing is essential when using modelling to inform policy, as it shows how key variables influence outcomes and guides policy or management adjustments.
- Of the four scenarios modelled, only two are true Basin Plan implementation scenarios (BP2024 and BPFI), and the only differentiating factor between these is the volume of water entitlements recovered. The seven climate sequences are also variations of the same factor: environmental water availability.
- Running models that vary only one key variable, then basing or advocating decisions on those results, does not reflect the use of best available science.
- Environmental outcomes at key priority assets in South Australia depend on system-wide flows across the Southern-Connected Basin; therefore, a cumulative SDL assessment at that scale should also have been undertaken.
- A substantial amount of further work is needed to test the sensitivity of key assumptions affecting environmental water delivery on the modelled environmental outcomes and initial SDL assessments. Several of these factors may need to be resolved before assessing whether current SDLs represent an ESLT.
- The approach to assessing future hydroclimate risks to priority environmental assets and ecosystem functions has not demonstrated the scientific rigour necessary to enable decision-making and the methods need to be substantially improved.
- The ESLT is a numerical limit and using an elicitation panel to provide a qualitative assessment to answer a quantitative question does not reflect best available science. The method lacks transparency and the results are impossible to replicate. Elicitation should complement robust science, not replace it.

The Water Act requires the Basin Plan to set Sustainable Diversion Limits (SDLs) that define the maximum volume of water that can be taken across the Murray-Darling Basin to reflect an Environmentally Sustainable Level of Take (ESLT). An ESLT must ensure that key environmental assets and outcomes, key ecosystem functions and the productive base are not compromised.

The ESLT is essentially an overlap of science with the law and to meet the legal requirements of the Water Act requires an inherently scientific approach.

Whilst the Water Act provides overarching objects and requirements, it does not prescribe specific environmental outcomes or ecosystem functions. Nor does it prescribe the method for determining an ESLT. Both require critical decisions and unbiased judgement to ensure the level of take is legally valid.

In 2012, the Authority set SDLs in the Basin Plan that it considered represented an ESLT. The Basin Plan Review is no different. Reviewing the current Basin Plan requires an updated assessment of the ESLT, based on the best available knowledge and science, to ensure the Basin Plan remains consistent with the Water Act.

The South Australian Government has reviewed the ESLT requirements of the Water Act and undertaken a detailed analysis of the information made available by the Authority for its initial SDL assessment. This included analysing the methods and outcomes for the current condition assessment, modelling of Basin Plan implementation scenarios under historical and future climate sequences and the achievement of environmental outcomes. The South Australian Government has also undertaken its own condition assessment and analysis of the modelled Basin Plan implementation scenario outcomes.

3.1 Requirements of the *Water Act 2007* (Cth)

The passing of the Water Act represented a significant achievement, a legislative recognition that the environmental degradation of the Basin needed to be addressed in the national interest and that the response must be based on science.

The South Australian Murray-Darling Basin Royal Commission (MDBRC) report (2019) contains detailed commentary on the objects of the Water Act, highlighting that its central purpose is to address overextraction of water resources in the Basin and to return extraction to an ESLT via implementation of a Basin Plan.[19]

Of the objects under section 3 of the Water Act, the following are of key importance, particularly in the context of this Review:

- Sub-section 3(b) requires that effect be given to the relevant international agreements to provide for measures to address the threats to Basin water resources. The Ramsar Convention and the Convention on Biological Diversity (CBD) are most significant and give primacy to environmental considerations.
- Sub-section 3(c) refers to promoting the use of the Basin in a way that 'optimises economic, social and environmental outcomes' but the introduction to this subsection, with the words 'in giving effect to those [international] agreements', is key.
- Sub-section 3(c) does not prescribe some other objective that is to compete with ss3(b) but describes the way ss3(b) must be achieved to preserve its primacy.
- Sub-section 3(d)(i) reinforces the primacy of ss3(b) by reference to the obligation to 'ensure the return to environmentally sustainable levels of extraction' whilst ss3(d)(ii) refers to protecting, restoring and providing for the ecological values and ecosystem services of the Basin.
- Whilst sub-section (d)(iii) refers to maximising the net economic returns to the Australian community, this is expressly made subject to ss(d)(i) and (ii).

The Water Act gives primacy to environmental considerations, with the primary objective of environmental sustainability and ensuring ecological health and biodiversity of the Basin at its core.

[19] SA MDBRC (2019) p129.

The Water Act specifies in detail the purpose of the Basin Plan, the basis for its development and its mandatory content. The Basin Plan must reflect the objects and purposes of the Water Act and conform to its governing provisions.

To fulfil the objects of the Water Act, the Basin Plan must set SDLs that define the maximum volume of water that can be taken without compromising the ESLT. By implication, the Basin Plan must also prescribe the amounts of water that shall be recovered to protect the Basin's water resources and its water-dependent ecosystems and associated biodiversity.

The ESLT is defined in the Water Act as 'the level at which water can be taken from that water resource which, if exceeded, would compromise:

(a) key environmental assets

(b) key ecosystem functions

(c) productive base

(d) key environmental outcomes of the Basin.

These are solely environmental criteria.

The Water Act further requires that water be used sustainably in a manner consistent with Australia's obligations under international agreements, including the CBD and the Ramsar Convention. This means that environmental outcomes must be achieved first, and only then may social and economic considerations be optimised.

The South Australian Government maintains that the objectives and outcomes of the Basin Plan should, at all times, correctly reflect this hierarchy and its purpose prescribed under the Water Act.

The MDBRC report contains a detailed consideration of the history and the scientific and legal basis of the Basin Plan and its implementation. It also found the current Basin Plan to be unlawfully made and, at least in part, invalid. One reason for this was that the determination of the ESLT was not based on the 'best available science'.

Against this background, suggestions from some interest groups that the focus of the Basin Plan Review should be on 'outcomes' rather than 'a number' is legally and scientifically unsound. ESLTs, as numerical thresholds, are required to ensure environmental outcomes are not compromised and the two are intrinsically linked.

Achieving sustainable environmental outcomes requires a transparent, science-based determination of water volumes, just as a farmer calculates irrigation volumes to maintain healthy crops and prevent irreversible damage. Basin environments, under the Water Act, are subject to the same principle, with the added legal requirement that outcomes be achieved through defined ESLTs.

In other words, for the Basin Plan to be legally valid, it must accurately reflect the objects of the Water Act, comply with international obligations and be informed by the best available science. It cannot continue to incorporate compromise at the expense of environmental sustainability.

It is noted that the implementation of the Basin Plan has potential social and economic impacts on Basin communities and these considerations help shape the delivery of environmental outcomes. Section 6 discusses these matters and argues that further work is required to help communities, irrigators and industries plan and adapt for reduced water availability, whilst maintaining water quality, due to climate change impacts or recovery of water entitlements under the Basin Plan.

3.2 Basin Plan 2012 – ESLT Determination

In 2012, the Authority undertook considerable hydrological modelling to underpin target recovery volumes in the draft Basin Plan.[20,21] This modelling did not directly determine the Basin-wide SDL or the water recovery volume of 2,750 GL. Rather, it simulated how pre-selected volumes of recovered water could be used and assessed the associated benefits and outcomes.

The Authority's assessment of the 2,750 GL water recovery scenario (with 2,400 GL and 3,200 GL scenarios as a sensitivity analysis) primarily focused on the achievement of flow indicators and environmental watering requirements (EWRs) considered representative of a hydrological regime required to deliver the key environmental outcomes. The draft Basin Plan proposed a 2,750 GL water recovery target and associated SDLs, which the Authority considered representative of an ESLT.

The South Australian Government analysed the modelling outcomes from the three water recovery scenarios and reviewed the suite of technical reports, focusing on hydrological and ecological outcomes and risks. This analysis indicated a water recovery scenario of 2,750 GL would not: deliver an ESLT; protect and restore key ecosystems, habitats and species reliant on Basin water resources; conserve declared Ramsar wetlands; or prevent long-term biodiversity decline in South Australia.[22] It therefore did not meet the requirements of the Water Act.

Conversely, analysis of the modelling outcomes from the 3,200 GL water recovery scenario, comprising an additional 450 GL of water recovery in the southern Basin, was shown to have the potential to achieve significantly more of the key environmental targets and reduce the risk of ecological decline. This is why the South Australian Government advocated for a 3,200 GL Basin Plan – to deliver priority environmental outcomes and ecosystem functions.

The South Australian Government acknowledges the MDBRC's finding that the original determination of the ESLT involved a 'fundamental failure' that has continuing consequences for the Basin Plan to achieve the objects and purposes of the Water Act.[23]

In its response to the Royal Commission, the South Australian Government indicated a willingness, in the short term, to set aside its concerns regarding the scientific legitimacy of the ESLT to focus on delivering the current Basin Plan's water recovery targets and environmental outcomes. It is therefore critical that, as part of this Review, the Authority credibly and transparently assesses whether full implementation of the current Basin Plan aligns with an ESLT in accordance with the Water Act and the MDBRC's guidance.

3.3 SDL Assessment Method – Surface Water

For the purposes of the Basin Plan Review, the South Australian Government understands that the Authority has used a surface water SDL assessment method[24] that is broadly based on the Environmental Outcomes Assessment Approach (EOAA). The general application of this approach to water

[20] MDBA (2011) *Modelling of the recovery of 2800 GL Basin-wide*. Unpublished Draft, MDBA, 5 September 2011.

[21] MDBA (2012) *Hydrologic modelling to inform the proposed Basin Plan – methods and results*. MDBA publication no: 17/12, Murray-Darling Basin Authority, Canberra.

[22] https://www.environment.sa.gov.au/topics/water-and-river-murray/projects-plans-security-and-legislation/legislation-and-policies/basin-plan

[23] SA MDBRC (2019) p188–189.

[24] MDBA (2026) *The SDL Assessment: Surface Water Technical Methods*. Murray–Darling Basin Authority, Canberra. Accessed: https://library.mdba.gov.au/data_product/the-sdl-assessment-technical-methods on 10 February 2026.

management was developed at the eWater Cooperative Research Centre and published in 2012.[25] The EOAA uses multiple lines of enquiry and a criteria-based rating of evidence and seeks to integrate various types of scientific data to provide a robust, transparent and defensible conclusion.

The Authority has proposed three lines of enquiry for its SDL assessment as shown in Table 1. These combine an evaluation of the current condition of environmental assets across six ecological themes with an analysis of modelling outputs from two Basin Plan implementation scenarios under historical and future climate sequences. The model outputs are used to determine whether the intended environmental outcomes have been achieved, or will be under full Basin Plan implementation, and thus whether the combined SDLs represent an ESLT.

Table 1 Lines of Enquiry for 2026 SDL Assessment

Line of Enquiry	Development or Policy Conditions	Source of Evidence	Focal Comparison Scenarios
1a	Basin Plan as implemented at 30 June 2024	Trend and condition analysis using on-ground monitoring data from various sources	Pre-Basin Plan (2009) scenario; without development (no infrastructure) scenario
1b		Hydrological modelling, with historical climate data 1895-2024; ecological evaluation via elicitation panel	Pre-Basin Plan (2009) scenario; without development (no infrastructure) scenario
2	Basin Plan fully implemented scenario but without relaxed constraints[26]	Hydrological modelling, with historical climate data 1895-2024; ecological evaluation via elicitation panel	Basin Plan as implemented at 30 June 2024; pre-Basin Plan (2009) scenario
3	Basin Plan fully implemented without relaxed constraints, under changing climate	Hydrological modelling, with scaled historical climate and flow sequences 1896-2024; ecological evaluation via elicitation panel	Basin Plan fully implemented, under historical climate;

Whilst the SDL assessment method references the EOAA in principle, it is loosely based on the EOAA in practice. The EOAA was designed to review and assess fully independent research themes relevant to the assessment questions, with high weightings given to careful controls or counterfactuals, replication and randomisation in experimental designs. Confirmation of a hypothesis requires three lines of highest-ranked evidence.

In the Authority's SDL assessment, three of the 'lines of evidence' or 'lines of enquiry' (LoE) from modelling are not independent but are all are based on the same model (using different climate, water recovery and flow management options). As with all modelling, this comes with high levels of 'experimental' uncertainty. In practice, there are only two lines of evidence with low to moderate confidence according to the EOAA standards: the monitoring data and modelling outputs.

With only two lines of evidence with low to moderate confidence, the SDL assessment method does not meet the standard requirements for an EOAA. This has implications for the overall scientific veracity of the method and the level of confidence in the conclusions drawn will be significantly reduced. This makes problematic any reliance on the outcomes from the SDL assessment to demonstrate that the current SDLs meet the legal requirements of the Water Act for an ESLT.

[25] Norris, R, Webb, JA, Nichols, SJ, Stewardson, MJ and Harrison, ET (2012) *Analyzing cause and effect in environmental assessments: using weighted evidence from the literature*. *Freshwater Science*, 31: 5-21.

[26] Noting that this extends BP2024 with one possible hypothetical representation of full Basin Plan implementation scenario.

3.4 Current Condition and Trend Assessment

A current condition and trend assessment provides a point-in-time evaluation of the state of a specific environmental theme or indicator and how its health is tracking over time. Benefits include providing a transparent and open evidence base for decision-making and highlighting critical knowledge gaps.

The Authority undertook a condition assessment to inform its initial SDL assessment. The South Australian Government has reviewed the method and outcomes, evaluating its confidence in this line of evidence as a contribution to fulfilling the legal requirements of the Water Act for an ESLT.

3.4.1 Overview of the Authority's Method

An 'expert elicitation process' involving Authority staff members was used to synthesise the latest (to 2024) reported condition and trend information for indicator species and other variables to assess the overall environmental condition and trend for six key Basin Plan themes: flows and connectivity, ecosystem function, vegetation, fish, birds and other species.

Reports and data were given to the Authority staff, who reflected and scored condition, trend and assessment confidence against five-point scales. The Authority staff then participated in group review to determine the degree of agreement and achieve consensus, where possible. Consensus or mid-point values formed the basis of the first part of the initial assessment report for each SDL resource unit.

While draft assessments were circulated to Basin States for review before finalisation and publishing, limited changes were made based on this feedback. The main change was to remove condition ratings for themes that had limited or no data since they were not the focus of water management in the specific SDL resource unit, were not monitored therein and/or were not reported anywhere.

3.4.2 SA River Murray Outcomes

The South Australian Government has reviewed the Authority's condition assessment method and the results for the SA River Murray.

For each of the six themes in the Authority's assessment, the condition results are presented as a rating from 1 to 5, representing Very Poor, Poor, Moderate, Good and Very Good condition, together with a confidence rating from 1 to 3 for low, medium and high confidence.[27]

The rating for each theme is dependent on the indicator(s) chosen. Whilst the method to determine condition ratings is described in a technical methods report, there is a lack of transparency in the calculation of each rating itself and line of sight to the indicators used within each theme.[28] This prevented analysis of the rationale for differences between these elicited conditions ratings and those previously evaluated by the South Australian Government for Basin Plan, Schedule 12 (Matter 8) reporting and the SA Murray Trend and Condition report cards.

To better understand the Authority's results, the South Australian Government undertook its own condition assessment of several themes for both the River Channel and Floodplain and the CLLMM. In line with the South Australian Government's methodology for determining condition and trend, a data driven and peer reviewed, quantitative methodology was used to determine a rating from 1 to 5,

[27] MDBA (2026) *Initial SDL Assessment, South Australian Murray (SS11)*.

[28] MDBA (2026) *The SDL Assessment: Surface Water Technical Methods*, MDBA, Canberra, February 2026.

representing Poor, Fair, Good, Very Good and Excellent.[29,30,31] Indicator (species) specific assessments also support targeted response actions. A comparison of findings from these two assessments is below.

3.4.2.1 SA River Channel and Floodplain

A comparison of findings for the native fish and native vegetation themes for the SA River Channel and Floodplain is shown in Table 2. Other themes could not be compared.

Table 2 Condition Assessment Comparison – River Channel and Floodplain

Theme	Assessment	Trend	Condition*	Source/Information
Native Fish	MDBA		**Poor** ●●○○○ **(2/5)**	MDBA source not confirmed
	SA 2024	Improved	**Poor** ●○○○○ **(1/5)**	Golden perch population age structure (**Poor**) Murray cod population age structure (**Very good**)
Native Vegetation	MDBA		**Moderate** ●●●○○ **(3/5)**	MDBA source not confirmed
	SA 2024	Improved	**Good** ●●●○○ **(3/5)**	River red gum scores (**Good**) Black box scores (**Good)**

*Only the number/dots indicate the alignment of condition between the two assessments, not the word description.

The Authority's condition rating for native fish does not align with the South Australian Government's assessment, in which the latter uses the population age structures of Murray cod and golden perch as key indicators and found the overall condition to be poor (equivalent to Authority's very poor). South Australia's overall condition rating reflects the precautionary adoption of the lowest condition rating within a theme. The approach to treat a system as if it is in the poorest condition identified is used to prevent irreversible damage and guide conservative decision making.

For native vegetation condition, the ratings align but it is not possible to determine if this is simply coincidental. The South Australian Government's condition assessment is based on black box and river red gum population tree condition within actively managed floodplains. It cannot be used to infer condition outside these areas, including at elevations within those floodplains that cannot be reached by environmental water.

The exact source of the Authority's information is not clear at the time of writing – noting that the SRA used the Tree Stand Condition Assessment Tool, which has been shown to provide outputs that are not well aligned with on-ground condition assessments in South Australia (see further at section 3.4.2.3).

[29] DEW (2020) *South Australian River Murray Basin Plan Environmental Outcome Evaluation: SA Channel and Floodplain Priority Environmental Assets*, DEW Technical report 2020/19, Government of South Australia, Department for Environment and Water, Adelaide. Found at: channel-floodplain-technical-report-gen.pdf.

[30] DEW (2020) *South Australian River Murray Basin Plan Environmental Outcome Evaluation: Coorong, Lower Lakes and Murray Mouth (CLLMM) Priority Environmental Asset*, DEW Technical report 2020/18, Government of South Australia, Department for Environment and Water, Adelaide. Found at: cllmm-matter-8-technical-report-gen.pdf

[31] DEW (2023) *Tracking changes in South Australia's environment: 51 trend and condition report cards - 2023*. Government of South Australia, Department for Environment and Water, Adelaide.
Found at: data.environment.sa.gov.au/Content/Publications/SA_2023_ReportCards_FullReport.pdf

3.4.2.2 Coorong, Lower Lakes and Murray Mouth

A comparison of findings for the native fish, native vegetation, ecosystem functions and waterbirds themes for the SA River Channel and Floodplain is shown in Table 3.

There is a general overstatement of condition in the Authority's assessment compared to the South Australian Government's data-derived assessment. For example, the Authority's native vegetation rating is moderate (3/5) compared to poor (1/5) from the South Australian assessment (i.e. equivalent to Authority's very poor condition). This also highlights an issue when evaluating condition at a site that has areas with distinct ecological diversity.

When undertaking the data-derived assessment for Matter 8 reporting, the Coorong and Lower Lakes are evaluated separately, which would have produced a good (3/5) rating for native vegetation in the Lower Lakes and poor (1/5) in the Coorong.

Table 3 Condition Assessment Comparison – Coorong, Lower Lakes and Murray Mouth

Theme	Assessment	Trend	Condition*	Source/Information
Native Fish	MDBA		**Moderate** ●●●○○ **(3/5)**	MDBA source not confirmed
	SA 2024	Improved	**Poor** ●○○○○ **(1/5)**	Black bream (**Fair**) Greenback flounder (**Fair**) Congolli (**Poor**) Common galaxias (**Poor**) Smallmouth hardyhead (**Good**)
Native Vegetation	MDBA		**Moderate** ●●●○○ **(3/5)**	MDBA source not confirmed
	SA 2024	Improved	**Poor** ●○○○○ **(1/5)**	Aquatic and littoral diversity in the Lower Lakes (**Good**) *Ruppia tuberosa* (**Poor)**
Ecosystem Functions	MDBA		**Moderate** ●●●○○ **(3/5)**	Murray Mouth Matter 8
	SA 2024	Improved	**Poor** ●○○○○ **(1/5)**	Murray Mouth openness (**Poor**)
Waterbirds	MDBA		**Poor** ●●○○○ **(2/5)**	MDBA source unknown
	SA 2024	Declined	**Poor** ●○○○○ **(1/5)**	Waterbird abundance in the Coorong (**Poor**)

*Only the number/dots indicate the alignment of condition between the two assessments, not the word description.

3.4.2.3 Overarching Confidence in Condition Assessment

Based on information currently available, the South Australian Government has concerns about Authority's condition assessment methodology.

For the SA Murray SDL resource unit (SS11), decisions by the Authority not to evaluate the River Channel separately from the Floodplain, or the Lower Lakes separately from the Coorong, likely impacted the results for each of these sites (e.g. good results in the Lower Lakes and poor results in the Coorong). Likewise, the absence of a data-derived assessment and a reliance on flawed evidence, such as the SRA reporting, further limits the utility of the results for informing the SDL assessment and decision-making.

The SRA also represents a coarse, river-focused, condition-based framework that lacks the spatial, hydrological and ecological resolution required to accurately assess a highly regulated, flow-dependent downstream system. This results in the underrepresentation of channel and floodplain dynamics, poor detection of threshold and episodic events, limited integration of EWRs and a constrained ability to link hydrological processes and environmental water delivery to ecological outcomes.

The expert elicitation panel used to qualitatively assess the condition of key indicators and themes also has several limitations. The experts in the elicitation were seven Authority staff members. There was no external participation by researchers or waterway managers with thematic or catchment-specific expertise. Moreover, using seven panel members from the same organisation is likely to introduce bias into the assessment and no independent peer review was undertaken.

At a Basin-scale, the information base for the elicitation was also highly heterogeneous and inconsistent. In most areas of the southern-connected Basin, there is a large amount of data that could have been used for a quantitative assessment. Each Basin State monitors and reports different themes (i.e. flow, vegetation, fish, birds etc.) using different indicators (i.e. trend, condition, outcome, risk). This inconsistency increases subjectivity and potential errors when the same method is used across 29 SDL units.

Although South Australia's assessment methodology differs and there is a misalignment of ratings, it demonstrates that a data-driven approach would have been more robust for providing clear, replicable and indicator-specific condition ratings to support a more robust SDL assessment and ESLT evaluation, as well as consideration of potential management responses.

3.4.3 Sustainable Rivers Audit (SRA)

The SRA was used as a foundational input for the current condition assessment for Line of Enquiry 1a. It was prepared by the Authority and reports ecological condition at broad spatial scales, typically at the valley or Basin level, using aggregated ratings such as 'good', 'moderate', or 'poor'.

The SRA's valley-scale assessments present a significant misalignment in spatial resolution when utilising results to inform SDL unit assessment, limiting the accuracy and reliability of environmental condition and evaluation of the ESLT. All South Australian SDL resource units form part of the 'Lower Murray' valley, which covers about 9 percent of the Basin and includes parts of north-western Victoria and south-western New South Wales. The River Murray in the Lower Murray Valley is approximately 1,000 km long and flows through mainly semi-arid mallee landscapes before reaching Lake Alexandrina, Lake Albert and the Coorong.[32]

The SRA has significant limitations that constrain its usefulness for understanding and adaptively managing Basin ecosystems, particularly in the Lower Murray. Its valley-scale framework aggregates spatial and rating data in a way that masks localised degradation and variability, which is pronounced in terminal systems such as the CLLMM.

The approach has low sensitivity to ecological thresholds and episodic events (e.g. hypoxic blackwater, fish declines, salinity spikes) and limited capacity to attribute observed condition to specific drivers such as flow alteration, water quality or habitat change. It does not consistently assess ecological outcomes against EWRs, reducing its ability to evaluate whether key ecological processes are being supported.

Further limitations include challenges with applying reference condition benchmarks in a highly modified system, reliance on metrics and/or indicators (e.g. tree stand condition) that are not representative of South Australian assets, as well as insufficient consideration of climate change and shifting hydrological baselines.

Collectively, these issues mean the SRA provides insufficient spatial, hydrological and ecological resolution to reliably evaluate condition or environmental water outcomes in the Lower Murray, limiting its suitability as a line of evidence for SDL and ESLT assessments in that part of the Basin.

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[32] MDBA (2025) *Sustainable Rivers Audit*. Murray-Darling Basin Authority, Canberra, 2025.
Found at: 2025 Sustainable Rivers Audit

3.5 Modelled Environmental Outcomes under the Basin Plan

Assessing policy or operational changes across a system as large and complex as the Basin is not straightforward and modelling is one of the most effective methods for considering the differences between scenarios.

Similar to the 2012 approach, the Authority's SDL assessment for the Basin Plan Review relies heavily on an analysis and comparison of modelled outputs from four development or 'policy' scenarios. These were used as input for Lines of Enquiry 1b, 2 and 3.

The scenarios are as follows:

1. **Without Development (WoD)** – river system with no water management arrangements (no dams, infrastructure, operational rules, consumptive use etc).
2. **Pre-Basin Plan (2009 conditions)** – reference scenario against which to assess Basin Plan implementation (includes water management arrangements as at 30 June 2009).
3. **Basin Plan 2024 implementation (BP2024)** – water recovery and Basin Plan implementation activities (completed SDLAM projects, operational constraints etc) as at 30 June 2024.
4. **Basin Plan full implementation (BPFI)** – potential full Basin Plan implementation as at 31 December 2026 (completed SDLAM projects, total Basin water recovery of 2,825 GL including 305 GL to meet SDLAM supply shortfall and the full 450 GL, without relaxed constraints).[33]

These policy scenarios were modelled using seven climate sequences over the 129-year period from 1895 to 2024: an historical climate sequence; three potential flow regimes under a warmer climate (+1.5℃ relative to pre-industrial era); and three potential flow regimes under a hotter climate (+2.0℃ relative to pre-industrial era). This results in 28 model run combinations of policy and climate settings.

A comparison of environmental outcomes between the pre-Basin Plan scenario and the BP2024 and BPFI scenarios was prepared by the Authority to inform its SDL assessment and ESLT determination. However, these environmental outcomes are dependent on factors other than Basin Plan water recovery volume and the level of constraints, which are the primary differences between the policy scenarios.

Importantly, assumptions about the distribution of environmental water entitlements across the Basin and the prioritisation and delivery of environmental watering actions directly affect the flows to key environmental assets and environmental outcomes in the model – and therefore, directly affect any conclusion about whether an ESLT is in place.

The South Australian Government has assessed the environmental outcomes prepared by the Authority from the modelled scenarios above. An analysis of the modelling results was also undertaken, including an assessment of the degree to which each scenario-based hydrological regime meets EWRs in the SA River Murray and what this means for South Australia's key environmental assets and ecological functions.

Given its importance for the ESLT assessment, a review of the key assumptions that influence the delivery of environmental water is presented in section 3.6. The climate change sequences and potential limitations are then discussed further in section 3.7.

Physical and operational constraints also continue to impact the delivery of environmental water in practice. Moreover, there have been changes to the level of constraints at some locations since the 2012

[33] Noting this is an extended BP2024 scenario with one possible hypothetical representation of full Basin Plan implementation.

ESLT assessment, which have further reduced the modelled hydrological regimes for the Basin Plan Review. These are discussed in section 3.8.

3.5.1 Authority Assessment – Environmental Outcomes

The modelled flow outputs for the 28 model run combinations were translated using EWRs and ratings or 'condition' scores for ecological objectives defined for each SDL resource unit in Basin States' Long-Term Watering Plans (LTWPs). These ratings were defined in terms of the modelled 'improvement' in the ecological objective under BP2024 and BPFI relative to Pre-Basin Plan conditions. The elicitation panel was then used to assess the ratings and likelihood that the modelled flow scenarios would support environmental outcomes for the six surface water themes, as well as the confidence in that assessment.

The results from the internal elicitation process are presented in the initial SDL assessment summary document[34] and an associated technical methods report.[35] The overall outcome presented by the Authority is that there is a risk that environmental outcomes are not being met in the SA Murray SDL resource unit and have poor prospects of being met under the scenarios used to represent climate change. The Authority concluded that it was unable to resolve whether the SDL continues to reflect an ESLT or is adequately supporting Basin Plan environmental outcomes.

For the combined SA River Channel and Floodplain Priority Environmental Assets (PEAs), under BPFI and the historical climate sequence, the modelled additional flows were assessed to:

- increase the likelihood of meeting objectives for native vegetation, waterbirds and other species to 'Likely' with a Moderate to High confidence.
- maintain the likelihood of meeting objectives for flows and connectivity, ecosystem functions and native fish as 'About as likely as not' with Low confidence.

For the combined CLLMM PEA, under BPFI and the historical climate sequence the modelled additional flows were assessed to:

- increase the likelihood of meeting objectives for flows and connectivity to 'More likely than not' with High confidence.
- maintain the likelihood of meeting objectives for native vegetation and native fish as 'Likely' with High confidence.
- maintain the likelihood of meeting objectives for ecosystem functions, waterbirds and other species as 'About as likely as not' with Low confidence.

This section of the Authority's SDL assessment concludes with a consequence assessment that is assumed to represent the risk should full Basin Plan implementation not occur. All South Australian PEA themes with an objective achievement considered 'About as likely as not' are listed as Critical, with Basin-wide or international (Waterbirds) consequences.

An assessment of potential climate change impacts was only undertaken for the combined River Channel and Floodplain PEA. There is Low confidence reported in the assessment of the likelihood of achieving environmental objectives, partly due to the spread of climate scenarios generating slightly higher flows to substantially lower flows. Even with BPFI, the modelled likelihood of achieving the thematic objectives is reduced, with none considered at or above 'Likely' and Ecosystem functions and Native Fish falling to 'Unlikely'.

[34] MDBA (2026) *Initial SDL Assessment, South Australian Murray (SS11)*.

[35] MDBA (2026) *SDL Assessment: Surface Water Technical Methods*, Murray-Darling Basin Authority, Canberra, February 2026.

No attempt was made to assess the potential climate change impacts for the CLLMM PEA due to the complexities of predicting the combined impact of rising sea levels on the estuarine and lagoonal nature of the Coorong and on barrage structures and operations. Despite this, comment is made in the Discussion Paper about the Authority considering whether the Basin Plan outcomes for the CLLMM will need to be modified to respond to climate change.

Overall, the expression of environmental outcomes as presented in the SDL assessment conveys very little about the actual environmental outcomes that are being achieved or are likely to be achieved.

There is no line of sight between the flows arriving at each PEA, the EWRs being assessed and the environmental outcomes being assessed. Given this, there can be no understanding gained from this assessment about the components of the hydrological regime that are not being met to inform further work or a management response.

For the Floodplain it is most likely that upstream constraints are impacting on outcomes at this PEA. The SDL assessment technical report also lists constraints as a significantly limiting factor that impacts on CLLMM outcomes. However, outcomes at the CLLMM are most impacted during dry periods when constraints to flow delivery are not an issue, so it is unclear what this attribution is based on.

There are also significant dependencies (and inter-dependencies) on the configuration of upstream environmental demands and prioritisation. Even with additional water recovered, South Australian PEAs do not necessarily receive more water and/or preferred timing of delivery in the model.

The use of an elicitation panel again creates significant uncertainty in the results, with the same issues and limitation as described in Section 3.4.2.3.

3.5.2 SA Assessment – Achievement of EWRs

The South Australian Government assessed the Basin Plan Review modelling results and the extent that each scenario-based hydrological regime meets the EWRs of the River Murray Channel, River Murray Floodplain and CLLMM PEAs.

In South Australia, the EWRs are defined to be holistic rather than fragmented, describing flows for net ecosystem outcomes rather than for single processes. For each PEA, the EWRs are descriptions of the hydrological regimes needed to sustain the ecological values of the PEAs at a low level of risk. They form a nested set of flow targets from more frequent (e.g. annual) relatively low flow rates and water levels to less frequent (e.g. 5 yearly or decadal) high flow rates and water levels. The EWRs are based on hydrological, hydraulic and hydrodynamic modelling outputs together with an understanding of the needs of different biota and ecological processes.

Outputs from each modelled scenario were analysed against the EWR metrics with daily and annual flow volumes also compared between scenarios.

3.5.2.1 SA River Channel and Floodplain

There is an improvement in the modelled delivery of flow and achievement of EWRs, and therefore the associated environmental outcomes, at the River Channel and Floodplain PEA under BP2024 and BPFI in comparison to pre-Basin Plan. However, the level of improvement indicated by the modelling results is lower than anticipated, particularly in comparison to the 2,750 GL water recovery scenario from 2012.

The flow to South Australia is a key driver of environmental outcomes at this PEA. On average, the flow increases under both BP2024 and BPFI in comparison to pre-Basin Plan, but not to the extent expected.

Key outputs and findings include:

- The increase in mean annual flow to South Australia under BP2024 compared to pre-Basin Plan is around 550 GL, despite over 2,100 GL of water recovery across the Basin, and the minimum annual flow increases by less than 30 GL.
- The difference in mean annual flow to South Australia between BP2024 and BPFI is also more modest than expected at 338 GL, despite around 700 GL of additional water recovery across the Basin. In this case, the minimum annual flow increases by around 180 GL.
- In terms of daily flows to South Australia, the largest increase across pre-Basin Plan, BP2024 and BPFI is in the proportions of days with flow rates around 20,000 ML/day.
- There is, however, an overall increase in the daily flows in the low flow band of <5,000 ML/day at the South Australian border. Pre-Basin Plan, around 5 percent of days under historical climate conditions were in this flow range. BP2024 reduces this number of extreme low-flow days by 50 percent and BPFI by a further 25 percent.
- A comparison between BPFI (total Basin water recovery of 2825 GL) against the 2,750 GL water recovery scenario from 2012 shows a reduction in the mean annual flow to South Australia of 1,300 GL with an annual reduction greater than 1,000 GL/yr in over 75 years within the 129-year modelling period. The modelled minimum annual flow to South Australia has decreased by around 500 GL.

The River Channel and Floodplain EWRs and the contribution of each EWR towards ecological targets are outlined in the Long-term Environmental Watering Plan for the SA River Murray.[36] The frequency of meeting the River Channel and Floodplain EWRs is shown in Table 4 and Table 5**.**

In terms of the benefits and impacts on modelled environmental outcomes:

- No River Channel or Floodplain EWRs are met, or are close to the target frequencies, under the modelled hydrological scenarios. Critical maximum time-intervals were exceeded for all EWRs at some point within the 129-year timeseries. For Floodplain EWRs, even under BPFI, more than 40 percent of years fall outside of the critical maximum time-intervals between EWR-defined inundation events.
- While the frequency of meeting all EWRs falls short of what is required, BP2024 yields greater improvement towards meeting the target frequency for River Channel EWRs than for Floodplain EWRs relative to pre-Basin Plan conditions. However, higher-level in-channel freshes to small overbank flow types are particularly constrained.
- The failure to meet River Channel EWRs flows is partly the result of timing of the flows to South Australia, with flow peaks occurring too early in the season or durations too short. The optimisation of the timing for flow delivery and a prioritisation of South Australian PEAs in the model may further improve the extent to which these requirements can be achieved, noting further investigation of environmental water availability, prioritisation and delivery is required.
- Where Floodplain EWRs are not met, this is the result of insufficient flow volumes.
- There are some improvements to the frequency of lower-discharge Channel EWRs (<IC4) and to the higher frequency of flow events (>FP1) under BPFI relative to both pre-Basin Plan and BP2024. However, the critical maximum time-intervals between events being exceeded occurs in more than 40 percent of years.

[36] DEW (2025) *Long-Term Environmental Watering Plan for the South Australian River Murray Water Resource Plan Area*, DEW Technical report 2025-2, Government of South Australia, Department for Environment and Water, Adelaide.

Table 4 River Channel EWR Assessment [37]

		Basin Plan Review Scenario: Percentage of years meeting EWR		
EWR	**Target**	**Pre-Basin Plan**	**BP2024**	**BPFI**
IC1	95%	50%	67%	76%
IC2	75%	23%	30%	33%
IC3	65%	16%	21%	22%
IC4	45%	13%	16%	18%

Table 5 Floodplain EWR Assessment [38]

		Basin Plan Review Scenario: Percentage of years meeting EWR		
EWR	**Target**	**Pre-Basin Plan**	**BP2024**	**BPFI**
FP1	60%	20%	21%	23%
FP2	45%	20%	22%	23%
FP3	35%	14%	17%	17%
FP4	25%	16%	17%	17%
FP5	15%	8%	9%	12%

[37] **IC1 (Baseflow; QSA ≥10,000 ML/day for ≥60 days; Max. interval 2 years):**
Supports in-channel connectivity, water quality and primary productivity, providing conditions for fish movement and contributing to the health and diversity of aquatic and low-lying amphibious vegetation.

IC2 (Small fresh; QSA ≥20,000 ML/day for ≥60 days; Max. interval 3 years):
Enhances ecological processes including fish movement and recruitment cues, frog breeding opportunities and aquatic invertebrate productivity, whilst supporting low-lying riparian and fringing vegetation; limited floodplain inundation.

IC3 (Large fresh; ≥30,000 ML/day for ≥60 days; max interval 4 years):
Provides stronger support for fish recruitment, frog breeding and invertebrate productivity and contributes to improved condition of River Red Gum and lignum through partial low-elevation floodplain connection.

IC4 (Bankfull flow; ≥40,000 ML/day for ≥60 days; max interval 5 years):
Delivers substantial ecological benefits, including enhanced recruitment opportunities for fish and frogs, high invertebrate productivity and low overbank flow and floodplain connection that supports River Red Gum, lignum and diverse aquatic and amphibious plant communities.

[38] **FP1 (Low-level inundation / managed watering; QSA ≥50,000 ML/day for ≥40 days; max. interval 4 years):**
Maintains condition and prevents decline in frequently inundated floodplain areas, particularly River Red Gum and Black Box in managed zones, by sustaining soil moisture and understorey vegetation. Provides localised productivity benefits, but limited impact on higher-elevation Black Box woodlands.

FP2 (Moderate inundation; QSA ≥60,000 ML/day for ≥ 20days; max. interval 5 years):
Improves vegetation condition and growth of River Red Gum and lignum, with potential benefits to Black Box where inundation reaches suitable elevations. Supports frogs, waterbirds, and invertebrate habitat. Recruitment is possible under favourable timing and recession patterns.

FP3 (Extensive inundation QSA ≥70,000 ML/day for ≥20 days; max interval 5 years):
Enables broad-scale floodplain connectivity, supporting strong recruitment of River Red Gum, Black Box and lignum. Drives increased in waterbird breeding, frog activity and aquatic productivity. Facilitates carbon, nutrient and biotic exchange between floodplain and channel.

FP4 (Large overbank; QSA ≥ 80,000 ML/day for ≥ 10 days; max interval 5 years):
Drives major ecological processes, including landscape-scale vegetation recruitment, floodplain condition reset and large-scale waterbird breeding events. Maintains long-term resilience of floodplain ecosystems and supports full expression of ecological functions.

FP5 (Extreme overbank inundation; QSA ≥ 80,000 ML/day for ≥ 30 days; max interval 8.5 days):
Drives whole-of-floodplain inundation, including the highest elevation floodplain areas and underpins long-term ecosystem resilience. Supports episodic but critical recruitment of River Red Gum and Black Box woodlands, resets soil moisture and salinity conditions and enables large-scale carbon and nutrient exchange. Triggers landscape-scale productivity responses, including major waterbird breeding events and widespread ecological recovery following extended dry periods.

In terms of the modelled future climate impacts on environmental outcomes:

- A warmer/hotter and drier climate is anticipated to have significant negative effects on modelled flow regimes by reducing the volume of water delivered to South Australia, decreasing the number of flow events within some flow bands and increasing the time between events. The reduced water availability is expected to have the most pronounced impacts on Floodplain EWRs as these rely on higher volume and higher flow rate events.
- Predicted hydroclimate changes will intensify the hyper-stressed conditions already affecting mid- to high-elevation floodplain vegetation, leading to reduced recruitment and regeneration, shifts in vegetation structure, species loss, increased habitat fragmentation and declining ecosystem services. Under future climate change, relaxing constraints becomes even more critical to maximise ecological outcomes from a smaller number of higher flow events.

The EWRs of all South Australian PEAs are flow-dependent. Given this correlation, it is not unexpected that several of the higher-flow dependent EWRs were not met with this modelling.

3.5.2.2 Coorong, Lower Lakes and Murray Mouth

There is an improvement in the modelled delivery of flow and achievement of EWRs, and therefore the associated environmental outcomes, at the CLLMM PEA under BP2024 and BPFI in comparison to pre-Basin Plan. However, the level of improvement indicated by the modelling results is lower than anticipated, particularly in comparison to the 2,750 GL water recovery scenario from 2012.

Flow through the barrages is a key driver of environmental outcomes at the CLLMM PEA and increases under both BP2024 and BPFI in comparison to pre-Basin Plan, but not to the extent expected.

Key outputs and findings include:

- The increase in mean annual barrage outflow under BP2024 compared to pre-Basin Plan is around 720 GL but, critically, the minimum flow only increases from 0 to 30 GL.
- The difference in mean annual barrage flow between BP2024 and BPFI is around 550 GL and, in this case, the minimum annual flow increases from 30 to 128 GL.
- A comparison of BPFI (total Basin water recovery of 2,825 GL) with the 2,750 GL recovery scenario from 2012 shows a 1,240 GL reduction in mean annual barrage flow. Within the 129-year modelling period, this reduction exceeds 1,000 GL/yr in over 70 years and 2,000 GL/yr in more than 20 years. The modelled minimum annual barrage flow has decreased by around 500 GL.

The CLLMM barrage flow EWRs and the EWR contribution towards ecological targets are outlined in the LTWP for the SA River Murray. The frequency of meeting CLLMM barrage flow EWRs is shown in Table **6.**

In terms of the benefits and impacts on environmental outcomes:

- The long-term modelled hydrological sequences indicate BP2024 has generated major improvements towards meeting the Lower Lakes water level EWRs, which require seasonal fluctuations between 0.4 to ≥0.83m AHD each year. BP2024 significantly improves the ability to maintain ecologically adequate minimum water levels relative to pre-Basin Plan conditions.
- Under the modelled historical climate sequence, the water level fell below the EWR minimum threshold of 0.4 m AHD in only two out of the 129-year sequence (during the most significant drought) under BP2024 conditions. However, this was likely due to the modelled barrage rules impacting the timing of maximum water levels. Additional water recovery under BPFI increases the confidence that water levels would remain above 0.4 m AHD, even during a major drought.
- The warmer/hotter and drier climate change scenarios with reduced River Murray inflows led to modelled water levels failing to meet the Lower Lakes water level EWRs. As an example, under

the +2 ºC hotter climate scenario and BP2024, there were periods when water levels fell below the critical 0m AHD threshold, at which point the risks from acid sulfate soils and hyper-salinity escalate. BPFI was shown to support water levels remaining above 0 m AHD.

- The barrage flow EWRs were not achieved with BP2024 or BPFI under the modelled historical climate sequence, and thus risks remain for the maintenance of salinity levels in the Lower Lakes and water and salinity levels in the Coorong.
- Modelled outcomes show that failing to meet the barrage-flow EWRs directly affects salinity in Lake Alexandrina. Under BP2024, modelled salinity stays below the 1,000 EC threshold in only 86 percent of years, short of the ecological target of 95 percent, though no exceedances of 1,500 EC are projected. In contrast, BPFI produces more years in which salinity remains below 1,000 EC, indicating improved performance against this threshold.
- Neither the BP2024 nor BPFI scenario under the modelled historical climate conditions was sufficient to meet the target frequency of water level EWRs for the Coorong South Lagoon. Hence, there are ongoing risks to both the Ruppia Community and the habitat of wading shorebirds. Under BPFI, average water levels in the Coorong South Lagoon may be only marginally (1 to 3 percent) higher than BP2024.
- Modelled water levels in the Coorong are projected to rise under all future climate scenarios due to sea level rise and increased seawater intrusion through the Murray Mouth. Whilst this may increase the frequency of meeting some South Lagoon water-level requirements, particularly under less extreme warming and drying scenarios, the changes are likely to negatively affect the Ruppia lifecycle, with reduced reproduction expected under suboptimal salinity conditions.

Table 6 CLLMM EWR Assessment [39]

		Basin Plan Review Scenario: Percentage of years meeting EWR		
EWR	**Target**	**Pre-Basin Plan**	**BP2024**	**BPFI**
CLLMM1	100%	43%	52%	51%
CLLMM2	50%	32%	37%	38%
CLLMM3	33.3%	20.3%	27%	29%
CLLMM4	14%	7%	8%	11%

[39] **CLLMM1 (Base connectivity; Barrage Flows ≥ 2,000 GL/yr; min flow ≥ 650 GL/yr; critical max interval of 0 years):** Maintains Lake Alexandrina and Lake Albert within target operating ranges, supporting freshwater habitat, water quality and connectivity through the barrages. Enables regular barrage flows, contributing to salinity management in the Coorong North Lagoon and supporting fish movement, estuarine function and baseline ecosystem processes.

CLLMM2 (Enhanced barrage flows / moderate connectivity; Barrage Flows ≥ 4,000 GL/yr; critical max interval of 3 years): Supports improved salinity gradients in the Coorong North Lagoon, enhances fish movement and recruitment (including diadromous species) and increases waterbird habitat availability. Contributes to aquatic productivity and nutrient exchange, supporting key ecological processes across the Lower Lakes and Coorong North Lagoon but limited influence on the South Lagoon.

CLLMM3 (Sustained high flows / strong connectivity; Barrage Flows ≥ 6,000 GL/yr; critical max interval of 5 years): Delivers significant freshwater inputs to the Coorong, reducing salinity in the North Lagoon and partially freshening the northern South Lagoon. Supports *Ruppia* lifecycle processes if seasonal water level conditions are suitable. Provides high-quality waterbird feeding and breeding habitat, increases aquatic productivity and maintains an open Murray Mouth, strengthening overall estuarine function.

CLLMM4 (Large, system-scale flushing events; Barrage Flows ≥ 10,000 GL/yr; critical max interval of 0 years): Drives major ecosystem resetting across the CLLMM, including substantial salinity reduction, strong recruitment of key species (*Ruppia* and fish), and large-scale waterbird breeding events. Supports long-term resilience and recovery from extended dry periods, maintaining the full expression of ecological and estuarine processes.

3.6 Model Limitations Impacting SDL Assessments

The Authority has used results from its model runs to determine environmental outcomes and inform the initial SDL assessments. The following sections describe some of the key factors, other than the volume of held environmental water and constraints, that affect the modelled delivery of flows to key environmental assets and the resultant environmental outcomes. These, therefore, directly affect any conclusion about whether an ESLT is in place.

3.6.1 Updated Model Calibration – Policy Implications

The models used for the Basin Plan Review have been significantly updated since 2012 and, in many cases, have been migrated from monthly time step to more complex daily time step models. Over time, there has also been an increase in the complexity and the number of policy, management and rule settings and assumptions applied within the models.

The current Basin Plan Review modelling results show a significant reduction in the volume of environmental water reaching the South Australian border and through the barrages to the Coorong, compared to the 2012 modelling. This is evident over the full modelled period from 1895 to 2024, impacting the achievement of EWRs and environmental outcomes for both the River Channel and Floodplain and the CLLMM PEAs. The impacts on the CLLMM during dry years are the most significant.

The Discussion Paper and the SDL Assessment technical report state that the modelled annual average end-of-system flows under without development (WoD) conditions are now almost 2,000 GL lower than the Authority previously estimated. This is understood to be due to the improvement and recalibration of the hydrological models used to inform the 2012 Basin Plan. The effects of these changes are carried into all Basin Plan implementation scenarios, which would explain some of the reduction in the modelled flows reaching South Australian PEAs under BP2024 and BPFI.

The South Australian Government has been advised by the Authority that the following model updates result in a cumulative and material impact on the modelled flows through the system.

- **Updated and recalibrated models in the northern Basin** – improvements to the modelled representation of hydrological and system behaviour in the tributaries has shown that the long-term average annual inflows from the northern Basin to the River Murray System were previously overestimated by around 200 GL.
- **Recalibrated Murrumbidgee model** – local average annual inflows to the Murrumbidgee River have been overestimated by around 500 GL, which translates to a significant reduction in inflows to the River Murray and subsequently to flows at the South Australian border. Despite the reduction in local inflows, modelled water use by entitlement holders is assumed to be protected.
- **Improved River Murray floodplain representation** – migration from the Monthly Simulation Model to the daily timestep Source Murray Model has allowed a more detailed representation of River Murray floodplains and more spatially appropriate climate data. Changes include the recalibration of Barmah-Millewa Forest, which has shown that the long-term annual average modelled loss was under-estimated by 200 to 300 GL.

Whilst the model changes may explain the reduction in end-of-system flows, the South Australian Government believes it would be unreasonable for the environment to bear this impact exclusively and believes that further work is required with the Authority and other Basin governments to consider the policy and management implications of these changes, including the implications for Basin Plan SDLs and whether they still meet the requirement for an ESLT.

Recommendation

It is recommended that:

- *The Authority prepare and release peer-reviewed technical reports to underpin the transparency and validity of the significant reductions in modelled long-term water availability.*
- *The policy and management implications of the identified modelling changes be further investigated, together with an assessment of the implications for environmental water delivery under the Basin Plan.*

3.6.2 Modelled Delivery of Environmental Water

The ESLT assessment is based on the achievement of environmental outcomes at PEAs, which is directly influenced by how the held environmental water entitlement portfolio and how the delivery of the annual allocations of environmental water is modelled.

The assumptions for recovering and delivering environmental water for the Basin Plan Review modelling provide just one hypothetical option. These assumptions must be tested to determine whether or not there are alternative options that could increase the environmental outcomes for given Basin Plan water recovery volume.

3.6.2.1 Environmental Water Portfolio Composition

The allocation volume available each year for the environment is a function of the volume of the entitlement types held (high security/reliability, low reliability, general security, supplementary access).

High reliability and security entitlements are generally more expensive per gigalitre but provide more secure allocations from year to year. These are likely to provide the primary source of allocations during periods of low water availability and hence are critical for the provision of water to sites such as the CLLMM at these times.

General security and low reliability entitlements generally provide limited volumes during drier times and supplementary access entitlements are usually only available during higher water availability periods, such as when unregulated flow is occurring. However, both provide for higher volumes when allocations are made or access is granted. Allocations against these entitlements provide the basis for higher flow events that benefit floodplain environments.

The flow rates required across the full spectrum of EWRs, particularly in South Australia, requires an appropriate mix of entitlement types to maximise the potential to deliver environmental benefits.

In the 2012 Basin Plan modelling, the volume recovered in each valley was divided between product type on a pro-rata basis. This assumed portfolio mix provided for a reasonable first estimate of the potential environmental benefits under the Basin Plan.

An examination of the sensitivity of environmental outcomes to the composition of the environmental water portfolio (to strategically inform water recovery) was recommended by the South Australian Government in its 2012 response to the draft Basin Plan. The same recommendation was made to the Australian Government when it was considering the 'utility' of various entitlement types for water purchases for the 450 GL.

It is unlikely that the current environmental water portfolio is consistent with the pro-rata assumptions from 2012. This may explain some differences between the 2012 and 2026 modelling results. However, more importantly, the current environmental water portfolio and the entitlement type targeted for the remaining water recovery remains critical for the achievement of environmental outcomes.

It is difficult to discern how the 2026 modelled portfolio has influenced modelled environmental outcomes because the volume of allocations available for the environment in each SDL resource unit for each year of the 1895 to 2026 modelling period was not publicly available at the time of writing. Making this information publicly available would allow an initial assessment of whether there are sufficient allocations available to meet the EWRs for South Australian PEAs, including the CLLMM.

If the volume of allocations available is too low, particularly in dry years, then an assessment of the environmental water portfolio is required – which should be used to inform the remaining water recovery task for the 450 GL (to achieve Schedule 5 outcomes), as well as for the shortfall under SDLAM.

Recommendation

It is recommended that:

- *The allocations available against environmental entitlements for each SDL resource unit and year of the modelling period are made publicly available.*
- *The Authority undertake a sensitivity analysis of the optional composition of the environmental water portfolio for delivering environmental outcomes under full Basin Plan implementation to inform current and future water recovery decisions.*

3.6.2.2 Prioritisation and Delivery of Environmental Watering Actions

In 2012, an Environmental Watering Simulation Tool (often referred to as 'Pick-a-Box') was developed to prioritise environmental watering actions at key environmental assets and co-ordinate watering events across multiple sites and valleys in the Basin. There were limitations including that it operated outside of the modelling framework.

The framework for prioritising and delivering environmental watering actions is now represented explicitly within the model. Entitlements held by environmental water holders are defined alongside other entitlements and available allocations are prioritised based on a hierarchy of actions. In general, whilst environmental flows from the TLM portfolio may be prioritised for Chowilla and the CLLMM, the delivery of environmental water from the CEWH portfolio to South Australian PEAs has the lowest importance ranking in the model compared with other actions in the system.

Despite what many stakeholders believe, the current model settings provide insufficient recognition of downstream environmental water needs both in terms of volumes and timing of delivery. Flow continuity through the Lower Murray to the Coorong is not adequately prioritised nor is connectivity to the floodplains and wetlands in South Australia. This creates a structural bias towards upstream outcomes, rather than Basin-wide optimisation.

Similarly, the CLLMM EWRs are not explicitly included as a key environmental asset demand in the model. The approach assumes that these are largely met by baseflows and return flows from upstream sites and assumes that the CLLMM is a lower priority than other upstream sites. As a result, it may not receive as great a volume of environmental water than if a different prioritisation process was assumed. In terms of the impacts of model assumptions on environmental outcomes, this needs to be tested.

This limitation is also preventing the modelled directed delivery of environmental water to South Australian PEAs outside of a multi-site watering event. This directed delivery of environmental water has occurred over several years and has supported water levels in the Lower Lakes and provided up to 150 GL/year of additional barrage flows.

The representation of environmental flow management within the Goulburn and Murrumbidgee River models also prioritises in-valley outcomes over shared outcomes, which also limits the delivery of environmental water to the River Murray to achieve downstream outcomes. It is understood that this reflects current practice and, in the Basin Plan Review modelling, no environmental water held in the

Goulburn SDL resource unit was permitted to be called for downstream PEAs, despite some of the Basin Plan water recovery having been explicitly recovered as a shared reduction amount. In the Murrumbidgee, it is understood that 80 to 90 percent is used for local outcomes.

Recommendation

It is recommended that:

- *The Authority undertake modelling and analysis to test the sensitivity of the environmental asset prioritisation to the achievement of environmental outcomes at the CLLMM under BPFI.*
- *The Source Murray Model is updated to include the explicit delivery of environmental water to South Australian priority sites outside of a multi-side watering event to reflect current practice.*
- *The Authority undertake modelling and analysis to test the sensitivity of the configuration of environmental water delivery within the Goulburn and Murrumbidgee River models.*

3.6.2.3 Inter-Annual Management of Environmental Water

There are several mechanisms that could be used for managing environmental water across years to improve environmental outcomes, including carryover provisions and accounts to manage PEW.

The explicit carryover of environmental allocations is likely to become an important mechanism for delivering water to key environmental assets during dry periods and/or when transitioning from a medium to dry year. In the same way that irrigators must manage available water across years, environmental water holders should be supported to do the same.

Accounts for PEW, such as for the Barmah-Millewa Forest, also allow for the inter-annual management of water. By allowing the accumulation of volumes in an account across years, potentially higher volumes are available each year to achieve outcomes that would not be possible with only the allocations of that year.

The operation of these types of arrangements may help secure critical flows during dry periods, such as at the CLLMM, and the potential benefits need to be evaluated via modelling and assessment.

Recommendation

It is recommended that the Authority undertake modelling and analysis of the environmental benefits from using inter-annual water management, via mechanisms such as carryover provisions or planned environmental water accounts, to allow environmental water allocations to be held between years and used in extreme dry years.

3.7 Climate Change Impacts and Hydroclimate Risks

Climate change represents an ongoing threat to human health, water and food security, the economy and the environment. The Water Act identifies the risks to the availability of the Basin water resources that arise from the effects of climate change as mandatory content of the Basin Plan.[40] It also requires strategies to be adopted to manage, or address, these risks.[41]

The determination of the SDLs, and hence the ESLT, for the 2012 Basin Plan did not consider climate change. The MDBRC was critical of this omission, stating that there was sufficiently robust scientific

[40] Water Act, section 22(1), item 3(a).

[41] Water Act, section 22(1), item 5.

knowledge available to include projections for climate change into the modelling for the Basin Plan at that time,[42] including from the 2008 CSIRO Sustainable Yields project (or 'SY1').[43]

The SY1 project produced a detailed Basin-scale assessment of the anticipated impacts of climate change on the availability and use of water resources. It included the modelling of rainfall-runoff across the entire Basin and linked modelling of all major river systems. The result was climate change projections and drivers incorporated directly into river system modelling to estimate the impact on flows at various points throughout the system. Whilst SY1 provided a strong foundation for determining new SDLs across the Basin, as required by the Water Act, climate change was ultimately not factored into the 2012 Basin Plan.[44]

In 2022, the South Australian Government wrote to the Australian Government to highlight the importance of ensuring that climate change considerations inform Basin Ministers' decision-making. The South Australian Government then supported the Australian Government's 2022 commitments to update Basin Plan science, including funding the CSIRO to update the SY1 to demonstrate the impacts of climate change on water availability to inform the Basin Plan Review. A 2022 funding commitment for this project to input into a 2026 Basin Plan Review ensured it was afforded more time than SY1.

3.7.1 Key Climate Change Impacts for South Australia

The South Australian Government recognises that climate change is already altering the Basin's hydroclimate and poses a material risk to the environmental, social, cultural and economic outcomes that the Basin Plan is intended to protect. As the driest and most downstream state, South Australia is particularly exposed to compounding impacts as reduced inflows, higher demands and more frequent extremes translate to lower and less reliable water availability at the end of the system.

The key climate change impacts identified for South Australia include:

- **Reduced and more variable River Murray inflows and allocations** – reduced yields from upstream catchments accumulate along the system, increasing downstream exposure and reducing the reliability of water available to South Australia and all environmental water holders, with flow-on risks to Basin Plan outcomes and prior investments in sustainability.
- **Hotter conditions and higher evaporative demand** – warming increases evapotranspiration, reduces soil moisture, runoff and groundwater recharge, and increases water requirements for irrigation, critical human water needs and the environment.
- **Higher risk of longer, more severe droughts and altered sequencing of extremes** – future wet and dry spell sequencing may not mirror the historical record, increasing the risk of unprecedented low-flow periods that cause critical end-of-system environmental degradation.
- **Changing extremes (floods, droughts, heatwaves) and compound events** – smaller but replenishing higher flow events may diminish in a drying climate, while larger floods may become more variable. Compound events (e.g., drought–heatwave; fire–flood) can amplify impacts.
- **Water quality degradation** – warming, drought and bushfire can increase risks including lower dissolved oxygen, higher salinity and nutrients, greater turbidity and more frequent algal blooms, affecting ecosystems, drinking water treatment and community amenity.

[42] MDBRC (2019), p 267.

[43] CSIRO (2008). *Water availability in the Murray-Darling Basin*. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project. CSIRO, Australia. 67pp.

[44] MDBRC (2019), p270.

- **Groundwater–surface water interactions and disconnections** – hotter, drier conditions increase the likelihood and duration of surface–groundwater disconnection and exacerbate low-flow risks, affecting groundwater-dependent ecosystems and water supplies.

3.7.2 Accounting for Climate Change in the Basin Plan Review

3.7.2.1 Hydroclimate Projections

The 2025 Sustainable Yields (or 'SY2') project comprised five modules including Basin-scale future hydroclimate projections (Module 1)[45] and River System Modelling (Module 2).[46]

Under SY2 Module 1, hydroclimate projections were provided at two time horizons[47] for three climate scenarios[48] at a 5x5 km grid scale across the Basin. These projections included changes in temperature, potential evapotranspiration, seasonal and annual rainfall, very heavy rainfall and annual rainfall variability. The projected change in daily rainfall and runoff was then calculated for the 5x5 km grid cells using historical and future climate series (and informed by climate signals).

Key findings included that:

- the Basin will be hotter with more variable annual rainfall and more intense heavy rainfall
- more severe and longer duration droughts may occur more often
- high rainfall and runoff variability across years will remain high and may increase
- the frequency of flood inundation will decline but flood intensity may increase.

In terms of projected changes in rainfall and runoff under 1.5°C global average warming (~2050) for the southern Basin, the mean annual rainfall is likely to reduce by 2.6 percent but vary between catchments from 1.8 to 4.4 percent. As expected, the impact on runoff is greater, with the mean annual runoff likely to reduce by 14.3 percent but vary between catchments from 5.8 to 19.3 percent. In addition to variation in annual rainfall and runoff between catchments, the results also show a significant seasonal variation both within and between catchments.

3.7.2.2 Applying Climate Change to Hydrological Modelling

The outputs from Module 1 were not used directly as input to the river system modelling in Module 2. Instead, the outputs from Module 1 were used to change climate and inflows by scaling them according to the amount of change expected. Different climate and inflow scaling factors are used for the northern and southern Basins and for the cool (Apr –Sep) and warm (Oct–Mar) seasons.

The decision to scale inflow sequences in this manner has significant implications for the utility of the resultant modelling and the validity of its application for the SDL assessment. Inflow scaling risks neglecting the effects of non-linear hydrological processes and generally leads to either an underestimation or overestimation of the impacts of climate change compared to modifying climate inputs to inflow producing models.

The approach adopted here with a high reliance on scaled inflow sequences generates reduced inflow scenarios with the same pattern of monthly and interannual variation as the historical sequence. These

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[45] Chiew FHS, Devanand A, Khan Z, Zheng H, Potter NJ, Robertson DE, Grose MR, Post DA and Fu G (2025) *Hydroclimate Projections for the Murray-Darling Basin*. CSIRO report from Module 1 of the MDB Sustainable Yields Project, 131 pp.

[46] MDBA (2026) *Murray-Darling Basin Sustainable Yields: River System Modelling Technical Report*. MDBA publication no. 10/26, MDBA, Canberra, February 2026.

[47] An increase in temperature of 1.0 °C around 2030 and 1.5 °C around 2050, relative to 1990.

[48] The three climate scenarios encompass projections between the 10th and 90th percentiles for each time horizon and have been referred to as forming a 'plausible range' of climate futures.

are not robust climate change scenarios as they do not incorporate the full suite of key projected changes, including more variable annual rainfall and more extreme events and floods. They simply scale the entire inflow sequence so all extreme events are reduced.

It is understood that a lack of coverage of rainfall-runoff models across the Basin contributed to the decision to largely rely on scaled inflow sequences. However, as the SY1 applied rainfall-runoff across the entire Basin, it is unclear why a similar or improved approach could not be applied.

In addition, the decision to limit the spatial resolution of the inflow scaling to the northern and southern Basins and the temporal resolution to two seasons reduced the applicability of this work further, particularly given the temporal and spatial variation in rainfall and runoff shown in Module 1.

- The changes in rainfall and runoff in the Basin headwaters and areas that generate the most runoff (including upstream of major storages) are key inputs for the purposes of the modelling changes in water availability and to the underlying flow regime under climate change. If the scaling factors are averaged across such a large area as the southern Basin, it is likely to mischaracterise the inflows to major storages and streams – reducing confidence in the outputs.
- Aggregating winter and spring together will mask the temporal variability of rainfall and flows across each of these two seasons; that is, it will average the seasonal variability and impact the modelled change on the flow regime. The same can be said for summer and autumn – averaging these together into one season averages the predominant 'dry' summer months with 'break-of-season' autumn months.

In the eighteen years since the release of SY1, it is astonishing that there was no alternative method other than to scale historical inflow sequences to assess the potential impact of climate change on water availability and the achievement of EWRs at Basin PEAs.

Noting the greater sophistication of SY1 in assessing the potential impact of climate change on water availability and the hydrological regime, it is doubtful that the latest approach incorporates or applies the best available science or knowledge.

The issues above were discussed with the Authority as the approach was being developed. Basin States were advised at the time that an initial and broadbrush approach was being undertaken, that any results would be 'ring-fenced' for the purposes of an initial exploration of insights and risks due to climate change and should not be used for water planning purposes.

A paper recently provided to Basin States outlines key limitations and circumstances for applying the results from the Basin Plan Review scenarios and of the hydroclimate data used in SY2 analysis. This included the caveat that 'as the data is only developed for a whole of Basin scale, it is not recommended to be applied to assess local hydrological responses'. However, this is exactly what it has been used for.

The reporting of modelled climate change impacts across the Outlook report, Discussion Paper and SDL assessments has not been clear as to which part of SY2 – Module 1 or Module 2 – has be used. The Outlook and Discussion Paper describe the likely changes in climate and associated impact on flow events, including for extreme events and floods, from Module 1. However, it is not made explicit that the environmental outcomes under the 'plausible climate futures' in the SDL assessments (using Module 2) do not reflect the Module 1 climate change outcomes described.

3.7.2.3 Incorporation of Climate Change into Basin Plan Settings

Climate change was identified in the Early Insights Paper as being one of the four major themes of the Basin Plan Review. Despite this, the Discussion Paper only describes an expected change in water availability and the associated impact on environmental outcomes.

The outcomes from Module 1 are not materially different to many previous climate projections. It is accepted that the climate will generally become hotter and drier and that extreme events will likely be more severe. The same can be said for the outcomes from Module 2. Aside from the limitations of the approach used, it is a logical conclusion, even without detailed modelling, that less rainfall and lower inflows would put pressure on both environmental outcomes and irrigated agriculture.

The narrative appears to imply that climate change risks and vulnerabilities only primarily to environmental water and assets and the Authority's primary recommendations in this area are for the adaptation and revision of environmental objectives and targets, including the CLLMM.

However, the proposed need for revision of environmental objectives or targets implies that the current SDLs do not reflect an ESLT, at least under future climate scenarios. Any suggestion that changes to environmental objectives and targets are warranted must explicitly address whether an ESLT is in place and whether or how it can be maintained into the future. If an ESLT is assessed as not currently in place, then SDLs must be revisited – or other mechanisms identified to ensure that available environmental water can be delivered to priority environmental assets.

From a South Australian perspective, the Basin Plan Review should consider what is needed for a fully resilient Basin. This includes promoting adaptive approaches that enable irrigation industries and communities to thrive under a changing climate, an essential component of any adaptation discussion. The Basin Plan should also set out a framework for holistic adaptive management informed by monitoring and evaluation across environmental, economic, cultural and social outcomes. Relying solely on the 10-year review cycle to consider climate is insufficient, particularly if solutions are not explored until it is potentially too late to act.

Basin-scale hydroclimate risk assessment must also be strengthened so that Basin Plan settings remain robust under a hotter, drier and more variable climate. This includes stress-testing Basin Plan settings against plausible extreme and compound hydroclimate events, such as high-impact, low-likelihood drought and flood sequences that may not be reflected in historical records. This work should be supported by transparent, trusted modelling, with clear documentation of methods and assumptions, independent peer review and accessible datasets that enable replication and scrutiny. Building capability in stochastic approaches and complementary fit-for-purpose models would also improve the exploration of uncertainty and inform adaptive, trigger-based responses between review cycles.

Recommendation

The following actions are recommended to strengthen Basin-scale hydroclimate risk assessment so that Basin Plan settings and implementation remain robust under a hotter, drier and more variable climate:

- *Institutionalise a holistic, risk-based approach to climate change – embed iterative risk analysis, evaluation, mitigation and communication in Basin planning, consistent with the Water Act requirement to identify and manage climate change risks to Basin water resources and outcomes.*
- *Explicitly address hydroclimatic non-stationarity and low flows – ensure methods do not assume the future will resemble historical daily sequencing, improve representation of drought-driven shifts in rainfall–runoff behaviour and the risk of prolonged low/cease-to-flow conditions that are critical for end-of-system needs.*
- *Plan for extremes and high-impact, low-likelihood futures – incorporate climate extremes, compound events and plausible high-impact hydroclimate storylines to stress-test Basin Plan settings and inform adaptive, trigger-based responses.*
- *Improve transparency, data governance and capability – support trusted modelling (clear documentation, peer review and accessible data).*

3.8 Physical and Operating Constraints

The SA River Murray is geomorphologically wide due to it receiving the combined flows from both the southern and northern Basins.[49] As a result, a flow of greater than 40,000 ML/day at the border is required to generate overbank flow and create lateral connectivity with the floodplain. In a regulated system, this requires the coordinated delivery of flows from multiple rivers and, for higher flows, relaxed constraints.

The limitations on the delivery of water throughout the River Murray system for both consumptive and environmental outcomes due to physical and operating constraints is well established. Current system constraints have been applied in the BP2024 and BPFI scenarios. In some cases, flows are constrained more than under pre-Basin Plan conditions, which has reduced the ability to deliver environmental flow to key assets compared to what was expected in 2012. The sensitivity of all of the restrictions outlined below need to be explored to understand the impact on environmental outcomes and therefore the potential improvements if they are addressed.

3.8.1 Barmah-Millewa Reach – Regulated flows

The most significant constraint on regulated flow delivery in the River Murray System is the through the Narrows, which lies downstream of Yarrawonga Weir and traverses the Barmah-Millewa Forest icon site. Flows at Yarrawonga Weir during summer are restricted to minimise unseasonal flooding of the Barmah Millewa Forest, which would lead to increased losses and potential environmental harm.

The modelling to inform the 2012 Basin Plan assumed within channel flows of up to 12,000 ML/day at Yarrawonga Weir, which resulted in between 8,500 and 10,000 ML/day through the Narrows. For the Basin Plan Review modelling, a flow threshold of 8,500 ML/day through the Narrows has also been assumed for Pre-Basin Plan conditions. In comparison, the BP2024 and BPFI scenarios have assumed 7,000 ML/day, reflective of the current channel capacity at the Narrows.

Over a six-month period, this equates to 270 GL that cannot be delivered. This not only impacts the delivery of water for consumptive purposes but also reduces the opportunity for environmental water to deliver local and downstream outcomes.

3.8.2 Barmah-Millewa Reach – Environmental Water Delivery

During winter and spring (June to December), environmental water managers can choose to deliver overbank flows through the Barmah-Millewa Forest. The modelling to inform the 2012 Basin Plan assumed environmental water deliveries of up to 22,000 ML/day at Yarrawonga Weir, consistent with historical practice.

For the Basin Plan Review modelling, a flow threshold of 18,000 ML/day during environmental water delivery has been assumed for Pre-Basin Plan conditions. For BP2024 and BPFI, the current limitation of 15,000 ML/day has been applied. The current restriction of 15,000 ML/day is due to landholder access issues and concerns.

Over the six-month period, this restriction equates to 1,260 GL that is unable to be delivered. This represents a major impediment to the management of environmental water and diminishes the environmental outcomes that can be achieved throughout the River Murray System. It also highlights what is likely a major contributing factor to not achieving environmental outcomes in South Australia.

[49] Flows from the southern Basin including the River Murray and its tributaries (Murrumbidgee, Goulburn, Ovens, Kiewa, Broken, Loddon and Campaspe Rivers), as well as flows from the northern Basin including Barwon-Darling River and its tributaries, via Menindee Lakes.

3.8.3 Goulburn River

The Goulburn River is a hydrologically important tributary of the River Murray for achieving ecological outcomes at downstream floodplains, including in the SA River Murray, given the almost one-to-one relationship between flow from the Goulburn and flow at the South Australian border. This means that flows from the Goulburn can be managed to provide short-term flow pulses into the River Murray (of 1 to 2 weeks). The Goulburn River junction with the River Murray is also downstream of the Narrows, which is beneficial for both environmental and consumptive water delivery (through the Intervalley Trade mechanism).

The 2012 Basin Plan modelling focused on maximising environmental benefits to the downstream River Murray floodplains with an assumed maximum flow rate at McCoy's Bridge of 20,000 ML/day. In comparison, a significantly reduced upper flow limit of 9,500 ML/day at Shepperton was used for the Basin Plan Review. This modelling also incorporates flow rules about the rate of increase, recession and duration, which are associated with new operating rules for the Goulburn that commenced in July 2022.[50]

The flow rules are more restrictive than the upper limit itself and apply equally to inter-valley trade, which means that environmental water is competing against the delivery of water traded to the River Murray. This, and an inability to directly deliver environmental water from the Goulburn for a downstream priority asset, means that environmental flows from this system have been significantly restricted.

3.8.4 Other Major Constraints

Constraints along the Murrumbidgee and Lower Darling Rivers also limit environmental flows into the River Murray. In comparison to the flow through the River Murray and Goulburn River that are important for creating higher peaked flow events, flows from the Lower Darling and Murrumbidgee Rivers are important to provide longer duration base flows (over 20 to 100 days). These base flows are valuable both from a bulk water management perspective to support intervalley trade but also for providing an underlying base flow to support an environmental flow event from the River Murray or Goulburn River.

3.8.4.1 Murrumbidgee River

Along the Murrumbidgee River, regulated water delivery is limited to 9,000 ML/day at Balranald Weir and 30,000 ML/day at Gundagai. These flow rates were assumed for both the 2012 Basin Plan modelling and for the Basin Plan Review. The flow at Balranald is not necessarily the limiting constraint on flows from the Murrumbidgee River reaching the River Murray. It is included to provide an indication of the limits on flow to the River Murray due to releases above Gundagai.

There are no major storages between Gundagai and Balranald so a change in flow at Gundagai can be expected to change the flow at Balranald, noting that the relationship between storage releases and flow reaching the River Murray is not linear due to the winding and narrow nature of these systems with low lying floodplains and terminal wetlands. Progress on relaxing the Gundagai constraint has progressed well in recent years and it is critical that this work continues.

[50] These rules were designed to overcome damage to riverbanks, loss of important vegetation and a reduction in native fish habitat that occurred during 2017-18 and 2018-19 when there were record volumes of water delivered down the Goulburn River in an unseasonal pattern, with sustained high flows over summer, to support trade into the River Muray. https://www.waterregister.vic.gov.au/water-trading/trading-rules/operating-rules-for-the-lower-goulburn-river

3.8.4.2 Lower Darling River

The modelling that informed the 2012 Basin Plan used a flow limit of 9,300 ML/day at Weir 32 to represent the regulated flows into the River Murray. The 2026 Basin Plan modelling used 9,000 ML/day for all scenarios, which is reflective of current practice.

This is based on minimising losses during the delivery of consumptive water by preventing water entering and flowing through the Great Darling Anabranch or creating access restrictions for riparian landholders. However, additional flows through the Anabranch are likely to provide benefits to the local environments, particularly during the delivery of higher environmental flows.

Lifting this operational constraint for the purposes of delivering environmental water in the Lower Darling, as well as for those downstream in the River Murray, should be considered. This has the potential to increase the flow rate and volume of environmental water delivered for downstream environmental outcomes.

3.8.5 Effect of Constraints on Flow Delivery and the ESLT

The ability to quantify the effect of constraints on modelled environmental water delivery has been limited, in the first instance, by the absence of annual environmental water allocations over the full 129-year modelling period. It was therefore not possible to conclude whether the environmental outcomes are water availability-limited, system constraint-limited or a combination of both.

The relationship between flows, constraints and environmental outcomes within the River Murray System is such that there will be ceiling for the efficient and effective use of any water recovered. Additional environmental water above this ceiling is unlikely to deliver additional outcomes because of system constraints. Whilst it is accepted that this relationship will exist, it is not currently possible to define that ceiling through the modelling results for the Basin Plan Review.

As recognises by the Authority, upstream constraints relaxation has not progressed significantly over the last 14 years, despite the added protections during comparable natural flow events that could benefit landholders and communities. Despite this, it is important to understand the level of impact that specific constraints are having on the deliverability of environmental water – and whether targeted constraints relaxation could deliver material improvements in the achievement of environmental outcomes.

Recommendation

It is recommended that the Authority undertake modelling and analysis to test the sensitivity of different constraints to the achievement of environmental outcomes under BPFI and to quantify the increase in environmental outcomes that could be achieved from targeted constraints relaxation, including if flows at Yarrawonga Weir were reinstated to 22,000 ML/day.

3.9 Coorong, Lower Lakes and Murray Mouth

There is a significant focus on the CLLMM in the Authority's Discussion Paper and SDL assessment documents, with statements that Basin Plan outcomes around barrage flow, salinity in the Coorong South Lagoon and Murray Mouth openness are not being met.

However, as outlined above, there are shortcomings in the modelling and assessment, including the lack of real consideration of how the available environmental water could be delivered differently to improve outcomes at the CLLMM. It is not necessarily the case that Basin Plan water recovery cannot deliver the key environmental outcomes for the CLLMM.

From a South Australian Government perspective, any suggested changes to current objectives and outcomes for the CLLMM are premature. In the context of Australia's international commitments (see

next section), any review of CLLMM objectives and outcomes should include consideration of: whether environmental water delivery can be better targeted; how current infrastructure and operational rules limit effectiveness; whether modelling assumptions reflect contemporary science; and, most importantly, what is the volume of water required to achieve these objectives and outcomes.

The Discussion Paper also suggests that the relationship between barrage flows and environmental outcomes requires reconsideration. However, the flow EWRs for the Coorong and Lower Lakes, as for all EWRs in the SA River Murray, have been developed with scientific experts using the best available data, information and knowledge relating to eco-hydrological relationships. The method was based on ecological first principles, which involved setting ecological objectives and outcomes to '[Maintain] a healthy, productive and resilient wetland of international importance under the Ramsar Convention'.[51] The EWRs describe a desired long-term and variable hydrological regime needed to support healthy, functioning ecosystems whilst enabling adaptive management in response to climate and ecological condition, and have been internationally and expert peer-reviewed. These EWRs are now incorporated into the LTWP for the CLLMM.

It is also recognised by the South Australian Government that maintaining the long-term ecological health of the Coorong South Lagoon may need new management levers that can be implemented along with restoration actions, interventions, and the continued optimisation of the delivery of water for the environment.

In this respect, under the HCHB program, the South Australian and Australian Governments are seeking to implement actions and investigate other management options to reinstate critical ecological processes at the site. The initial phase of HCHB (2019-2022) focused on filling critical scientific knowledge gaps and conducting early feasibility assessments for infrastructure to achieve desired outcomes in the Coorong and regional wetlands. These works have delivered a clearer understanding of the current environmental problems and potential actions needed to establish a pathway to recovery for the Coorong. HCHB is actively refining existing tools and operations to improve site management and the South Australian Government is working to further investigate and implement an integrated suite of management activities to help repair ecosystem functions in the Coorong.[52] These include:

- Regional wetland management to provide regional-scale complementary shorebird foraging habitat in the Lower Lakes and South East whilst restoration is underway in the Coorong.
- Potential long-term operational infrastructure to provide broad-scale hydrological remediation of the Coorong by exporting excess salt and nutrients and initiating system recovery.
- Ecological restoration actions, including local-scale nutrient management, sediment remediation and aquatic plant restoration to augment active system recovery.

Securing long-term funding for the Goyder CLLMM Research Centre also remains a high priority for South Australia. This Centre has brought together a number of research institutions to provide independent science on climate adaptation in the CLLMM region and has a potentially important role to play in informing long-term management options for this internationally important site.

[51] Lester RE, Fairweather PG, Heneker TM, Higham JS and Muller KL (2011), *Specifying an environmental water requirement for the Coorong and Lakes Alexandrina and Albert: A first iteration*. Report prepared for the SA Department of Environment and Natural Resources, Adelaide.

[52] DEW (2024) *Healthy Coorong, Healthy Basin: Coorong Restoration Roadmap*. Found at: Coorong-Restoration-Roadmap-HCHB-2024_FINAL-892879.pdf

3.9.1 Ramsar and Ecological Significance

The Coorong and Lakes Alexandrina and Albert Wetland was designated as a Wetland of International Importance under the Ramsar Convention in 1985, meeting eight of the nine criteria. The site provides significant economic and social value to the region and wider South Australia, supporting a thriving tourism industry, commercial fishing, recreation, Traditional Owner uses and other social activities.

With a unique mix of freshwater, estuarine and marine wetland habitats, the region supports threatened wildlife, rare plants and nationally and internationally significant species such as the Murray hardyhead, fairy tern, southern bell frog, hooded plover and Australasian bittern. This mix of aquatic habitats also means that the area is rich with many species of fish, with approximately half of all the Basin's native fish species being found in the region. The area plays an essential role for species that need to move between the fresh, estuarine and marine waters in their lifecycle, including pouched lamprey, common galaxias and congolli.

The region also plays a significant role in supporting waterbirds in the Basin and forms an important breeding site for many species, including the Australian pelican, straw-necked ibis and Australian fairy terns. The site supports 37 species of migratory birds that travel from as far as Siberia and Alaska to visit the wetland each year, the importance of which is recognised in numerous international migratory bird agreements.

The Water Act explicitly recognises Australia's obligations under the Ramsar Convention on Wetlands and as part of implementing its legislative obligation to give effect to relevant international agreements, the Basin Plan is specifically required to promote the conservation of declared Ramsar wetlands in the Basin and take account of the ecological character descriptions of all declared Ramsar wetlands in the Basin.[53] The primacy of declared Ramsar wetlands and those linked to other defined international conventions and agreements – relative to other water-dependent ecosystems throughout the Basin – is reflected in various provisions throughout the Basin Plan, including the criteria for identifying PEAs, principles to be applied in environmental watering and the subsets of environmental and water quality objectives for water-dependent ecosystems.[54]

The Water Act requires that the Basin Plan be implemented to protect key environmental assets, including Ramsar wetlands, by maintaining their ecological character through adequate environmental water. This is reinforced by obligations under the Ramsar Convention and given legal effect domestically through the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), which identifies Ramsar wetlands as matters of national environmental significance and prohibits actions that would lead to their degradation. Any failure to deliver sufficient flows to sites such as the CLLMM would risk significant ecological decline and expose governments to potential non-compliance with both national legislation and international treaty commitments.

This creates a non-discretionary obligation to deliver sufficient environmental water for sites, such as the Coorong and Lower Lakes, which are highly flow dependent. As a result, the full and timely implementation of the Basin Plan, including agreed water recovery targets and robust environmental watering arrangements, is essential not only for ecological outcomes but also to ensure compliance with both national legislation and international treaty commitments.

[53] Water Act, sections 3(b) and (c)(i).

[54] Refer: Schedule 8; section 8.41; sections 8.05(2)(a)-(b); and section 9.04.

4 Maximising the Benefits of Water for the Environment

Key messages

- A significant portfolio of held environmental water now exists across all Basin catchments, but recovering environmental water entitlements is only one step toward achieving the outcomes envisaged in 2012.
- A strong environmental water management framework is essential for effective governance, planning, prioritisation, delivery, protection, monitoring, evaluation and reporting. It must remain flexible and adaptive to respond to climate, water availability and river management conditions whilst supporting the long-term Basin Plan environmental outcomes.
    - Changes to the current framework are required to ensure the environmental outcomes necessary to achieve an ESLT are delivered.
    - The Basin Plan must be amended to elevate the BWS as the central instrument for environmental watering. Given its significance, any review or update must be subject to public consultation and require approval from the Commonwealth Minister.
    - The BWS must set end-of-catchment and end-of-system targets across the Basin to ensure minimum flow requirements are prioritised, particularly during dry periods. It must also establish a clear framework for annual prioritisation, decision-making and trade-offs, and support the assessment of multi-year objectives.
    - Basin Plan amendments are also needed to the content and governance of Basin AEWPs to improve their utility as the Basin's annual environmental watering plan.
- The Authority and Basin States must holistically review existing operational rules and procedures to integrate the management and delivery of operational and environmental water.
- The Basin Plan must be amended to require effective and enduring arrangements for the protection of held environmental water.
- The Water Act and Basin Plan must be amended to ensure the definition provided for planned environmental water can be applied consistently across the Basin to support the baseline hydrological regime upon which Basin Plan water recovery depends.
- Integrated catchment management and complementary measures have value but cannot substitute for water recovery and restoring flow regimes – the core purpose of the Basin Plan.
- The relaxation of constraints remains a priority – in a form decoupled from the SDLAM. If full constraints relaxation cannot be achieved, then lower rates or targeted actions should be pursued as far as practicable.

4.1 Environmental Water Management Framework

The current Basin Plan environmental water management framework is a complex web of objectives, outcomes, targets and planning documents. Despite extensive evolution in environmental water planning and delivery over the past 14 years, challenges and barriers to achieving the Basin Plan's environmental objectives and outcomes remain. Reform is needed to manage emerging risks, support

climate adaptation and ensure all available water is used efficiently to optimise environmental outcomes.

4.1.1 Overarching Legislative Context

Section 28 of the Water Act requires the Basin Plan to have an environmental watering plan to safeguard existing environmental water, plan for the recovery of additional environmental water and coordinate the management of this environmental water to:

- protect and restore wetlands and other environmental assets of the Basin
- protect biodiversity dependent on the Basin's water resources and achieve other environmental outcomes.[55]

The environmental watering plan is required to specify the overall environmental objectives for water-dependent ecosystems and the targets by which to measure and evaluate progress, as well as include methods to determine priorities for applying environmental water. It is also required to include an environmental management framework for planned and held environmental water,[56] and may specify targets for water resource health, water flow and water levels.[57]

Chapter 8 of the Basin Plan, together with Schedules 7 to 9, constitute the environmental watering plan. Four key documents make up the environmental water management framework for planned and held environmental water, as outlined in Chapter 8, Part 4:

- The Basin-wide environmental watering strategy (BWS), prepared by the Authority, is intended to provide a long-term, Basin-scale plan to coordinate environmental water management, set priorities and guide environmental watering decisions.[58]
- LTWPs, prepared by Basin States for each WRP area, outline long-term objectives for environmental water delivery by identifying priority environmental assets and ecosystem functions, their objectives and targets and the EWRs required to achieve them.[59] There are also requirements for consistency with the BWS, co-operative arrangements between environmental water managers, and identifying and managing long-term risks and operational constraints.[60]
- Basin Annual Environmental Watering Priorities (AEWPs), prepared by the Authority each year, guide Basin-scale environmental water management for that year.[61]
- State AEWPs, prepared by Basin States for each WRP area, set out annual watering actions for priority environmental assets and ecosystem functions.[62] Following consultation with local stakeholders and First Nations groups, site-based environmental watering proposals for PEAs and other sites are developed and submitted to the Southern Connected Basin Environmental Watering Committee (SCBEWC) and environmental water holders including the CEWH.

Underpinning the assessment of whether an ESLT is in place across the Basin is a modelled assessment of whether the EWRs are met (for South Australia, the current EWRs are reflected in LTWPs). To ensure

[55] Water Act, section 28(1).

[56] Water Act, section 28(2).

[57] Water Act, section 28(3).

[58] Basin Plan, Chapter 8, Part 4, Division 2 (ss 8.13 to 8.17).

[59] Basin Plan, Chapter 8, Part 4, Division 3 (ss 8.18 to 8.22).

[60] Basin Plan, sections 8.19(3)-(6).

[61] Basin Plan, Chapter 8, Part 4, Division 5 (ss 8.27 to 8.31).

[62] Basin Plan, Chapter 8, Part 4, Division 4 (ss 8.23 to 8.26).

that an ESLT is in place in practice, the components of the environmental watering plan must work together to deliver the flow regimes required to meet those EWRs.

4.1.2 Basin-wide Environmental Watering Strategy

A robust and appropriately focused BWS should be the critical and focal document of the environmental watering plan defined by the Water Act and Basin Plan. It should be the blueprint for how environmental watering objectives for water-dependent ecosystems can be met to enable the identified environmental outcomes that support achievement of the ESLT to be realised.

To do this, a BWS needs to:

- bring together the objectives for the protection and restoration of water-dependent ecosystems and ecosystem functions via the identification of the priority environmental assets and ecosystem functions that will be managed with environmental water under the Basin Plan.
- outline the ecological objectives and targets for those assets and functions and the EWRs needed to meet those targets and achieve the objectives (as above, for South Australia, the current EWRs are also reflected in LTWPs).
- outline multi-site watering objectives and associated flow regimes to support the delivery of the identified ecological objectives and targets across multiple years.
- provide a robust decision-making framework for transparently assessing competing environmental demands and trade-offs when available allocations are limited. Critically, this framework must not be inconsistent with the relevant international agreements by ensuring the prioritisation of assets recognised under those agreements.[63]

In practice, the current BWS is not fit for purpose:

- it provides very little practical guidance for annual environmental water planning and delivery. Beyond high-level principles, it offers no specific direction on inter-valley coordination, setting priorities or resolving trade-offs between competing priorities or actions.
- it does not identify priority environmental assets or ecosystem functions or end-of-system targets for environmental outcomes that would drive annual watering priorities and trade-offs.
- although it provides some guidance on matters that States must consider in LTWPs, it is not a document routinely used by water managers for decision making. Nor has it driven the development of consistent LTWPs, despite this being one of its intended purposes.[64]
- it does not meaningfully coordinate or inform the coordination of water delivery across the Basin, which is largely undertaken by environmental water holders via bilateral discussions with Basin States or local authorities and/or through relevant inter-jurisdictional committees such as SCBEWC and Northern Basin Environmental Watering Committee (NBEWG).
- it describes several Expected Environmental Outcomes (EEOs) to be achieved by environmental watering. The EEOs attempt to quantify the high-level environmental targets set under Schedule 7, thereby enabling the monitoring of progress towards Basin Plan environmental objectives and outcomes. However, EEOs are not cited in the Basin Plan or Water Act and there is no regulatory obligation to inform the process to develop EEOs.

[63] Basin Plan, section 8.53.

[64] Basin Plan, section 8.13(2)(c).

- given the absence of a clear framework for their development, some existing EEOs are inconsistent and set well below both established and achievable levels for critical environmental outcomes. For example, EEOs FC8 (flow) and FC10 (salinity) for end of Basin flows are misaligned: FC10 (salinity) reflects an expected outcome of the Basin Plan, yet FC8 (flow) – which should be its equivalent – is set far below the level required to achieve FC10 (salinity).[65]
- whilst the EEOs are described in the BWS as linking to Basin-scale environmental objectives and outcomes under Chapter 8 to the targets under Schedule 7, their development does not consider nor link to the EWRs, objectives, outcomes or targets set out in Basin State LTWPs. As Basin State environmental watering actions are undertaken in accordance with their LTWPs, the mechanism for pursuing EEOs is unclear.

The strategic intent, structure, requirements and use of the BWS needs to change if the use of environmental water recovered under the Basin Plan is to be realised. It is suggested that the BWS:

- Identify the priority environmental assets and functions for the delivery of environmental water, which must include declared Ramsar wetlands and other water-dependent ecosystems listed under international conventions and agreements.[66]
- Explicitly link to the original EWRs that informed the Basin Plan and the associated requirements of LTWPs, as this should provide the foundational management information, objectives, targets and hydrological requirements.
- Include multi-site watering objectives and associated flow regimes that provide for system-scale coordination for environmental water delivery across the southern-connected and northern-connected Basins (noting that the approaches will likely be different). For the southern-connected Basin, this can be informed by the modelling framework used for the SDL assessment and experience in environmental water delivery since the Basin Plan was signed.[67]
- Include a transparent and strengthened framework for prioritising State AEWPs under different inflow and climate scenarios, and the associated trade-offs, to develop Basin AEWPs.
- Identify end-of-catchment and end-of-system targets throughout the Basin for environmental outcomes to ensure minimum flow targets are prioritised during dry periods to protect refugia and prevent exceedance of thresholds for irreversible changes to key environmental assets (including, but not limited to, Lower Darling and barrage outflow targets).
- Ensure linkages to the environmental outcomes used to demonstrate an ESLT are in place across the Basin through assessment of EWR achievement.

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[65] EEO FC8 (end of Basin flows): barrage flows are greater than 2,000 GL/yr on a 3-year rolling average basis for 95% of the time, with a two-year minimum of 600 GL at any time.

EEO FC10 (end of Basin flows): salinity in the Coorong and Lower Lakes remains below critical thresholds for key flora and fauna including salinity in Lake Alexandrina is lower than 1,000 EC 95% of the time and less than 1,500 EC all the time.

The flow regime required to deliver the FC10 expected salinity outcome forms part of the EWRs in the LTWP for the SA River Murray. The modelling undertaken by the MDBA in 2012 for the draft Basin Plan – the modelling used to determine whether the proposed SDLs represented an ESLT – showed that the required rolling average flows were achievable, without constraints relaxation. It also showed that a 2,750 GL water recovery scenario provided for a minimum end of system flow of 450 GL (during the Millenium Drought) and a minimum flow of 785 GL under a 3,200 GL scenario.

[66] Section 8.05(2) provides an objective to protect and restore a subset of all water-dependent ecosystems of the Murray-Darling Basin, including by ensuring that (a) declared Ramsar wetlands that depend on Basin water resources maintain their ecological character; and (b) water-dependent ecosystems that depend on Basin water resources and support the life cycles of species listed under the Bonn Convention, CAMBA, JAMBA or ROKAMBA continue to support those species.

[67] The Authority has stated that the modelling for 2026 Basin Plan Review includes the best representation of the current behaviour of environmental water holders, which should provide a solid first iteration for multi-site watering objectives and associated flow regimes.

- Include a mechanism for multi-year environmental water portfolio planning to ensure minimum flow targets can be met during dry periods and a framework for considering trade-offs between delivering and carrying over environmental water.
- Include requirements for annual reporting that documents State AEWPs, how these translated into the Basin AEWPs and which Basin AEWPs were delivered.

The governance arrangements for the BWS under the Basin Plan – and how they operate in practice – also requires review. The BWS is prepared and approved by the Authority, which *must* consult with Basin States and the CEWH, including on the identification of assets or functions and the associated EWRs.[68] However, where disagreement arises, the Authority's view prevails, limiting shared decision-making .[69]

Recommendation:

It is recommended that:

- *Given the importance of the BWS to achieving the EWRs that informed the assessment of an ESLT and the Basin Plan SDLs, the Authority be required to consult publicly on any review of and update to the BWS and be required to seek approval for any amendments from the Commonwealth Minister.*

4.1.2.1 Expected Environmental Outcomes

The Basin Plan specifies requirements for determining the EWRs to be set out in Basin States' LTWPs, including the need to draw on information about the physical and geomorphic processes that underpin the flow-ecological relationship. In contrast, the development of EEOs under the BWS is not subject to a prescribed methodology beyond an intention to translate the Schedule 7 qualitative targets and by implication, the objectives and outcomes of the Basin environmental watering plan.

Based on explanations across BWS iterations, EEOs were developed in 2014 using the 'best available science and modelling' at that time and were intended to reflect how the Basin's water-dependent ecosystems were expected to respond to environmental watering and Basin Plan implementation. It was suggested that environmental water planning and management should support achievement of EEOs.

Development of EEOs needs to follow a methodology that ensures consistency across spatial scales and aligns with the EWRs and environmental outcomes used to demonstrate the Basin-wide ESLT. This would require that priority environmental assets and ecosystem functions, and their EWRs, collectively inform environmental watering needs at larger spatial scales and therefore underpin the EEOs guiding the BWS.

4.1.2.2 Maintaining Appropriate Scope

There have been suggestions that cultural, social and economic outcomes should be a key focus for environmental water managers and explicitly included in the BWS. Environmental water delivery has demonstrably achieved environmental outcomes whilst also generating economic, social and cultural benefits. Whilst these are recognised Basin Plan objectives, environmental water management and delivery is facing increasing scrutiny regarding the extent to which these broader outcomes are achieved.

The South Australian Government supports the economic, social and cultural benefits that can be achieved alongside environmental outcomes through the delivery of environmental water. However, these outcomes cannot become a primary focus for environmental water managers, as doing so risks undermining the environmental outcomes the Basin Plan is designed to achieve.

[68] Basin Plan, section 8.15(1)-(2).

[69] Basin Plan, section 8.15(3).

If the Basin Plan objectives and outcomes[70] are applied consistently alongside the principles for managing water for consumptive use,[71] the planning and delivery of all water would naturally take a holistic approach that incorporates environmental, cultural, social and economic considerations (refer section 4.3).

Recommendations

It is recommended that:

- *The Basin Plan must be amended to explicitly require the BWS to identify all matters currently outlined in section 8.14(2)(a) of the Basin Plan, namely priority environmental assets and priority ecosystem functions, multi-site watering objectives and associated flow regimes for the southern-connected system and end-of-system targets for environmental outcomes.*
- *The BWS must:*
    - *prioritise key environmental assets and ecosystem functions under different inflow scenarios, including the delivery of environmental water to the Coorong during dry periods to sustain key vegetation communities, species and ecosystem functions.*
    - *ensure linkages to the environmental outcomes used to demonstrate an ESLT is in place across the Basin.*
    - *include multi-site watering objectives and associated flow regimes that provide for the system-scale coordination for the delivery of environmental water across the southern-connected Basin.*
    - *include a transparent and strengthened framework for delivering State AEWPs under different inflow and climate scenarios and the associated trade-offs to inform Basin AEWPs.*
    - *include end-of-catchment and end-of-system minimum flow targets throughout the Basin, including a minimum barrage flow from Lake Alexandrina to the Coorong (end-of-system flow) and from the Lower Darling to the River Murray, to ensure the prioritisation and delivery of environmental water during dry periods.*
    - *provide a framework for prioritisation and decision-making for the delivery of environmental water (including trade-offs) each year that ensures the primacy of environmental assets recognised under relevant international agreements, including the evaluation of multi-year objectives (such as carryover to provide for dry periods).*
- *Alternative governance arrangements for the development and approval of the BWS are considered.*
- *A structured review of EEOs and Schedule 7 targets is undertaken to ensure consistency between EEOs and whether improvements are necessary.*

[70] Basin Plan, section 5.02.

[71] Basin Plan, section 8.43 requires the management of water for consumptive use should, where possible, be undertaken in a way that is consistent with achieving the objectives in Part 2.

4.1.3 Long-term Watering Plans

LTWPs are required to identify priority environmental assets and ecosystem functions, set ecological objectives and targets for those assets and functions and specify the EWRs needed to meet those targets and achieve the objectives.[72] As LTWPs are developed by Basin States, they provide an opportunity for ecological objectives, targets and watering requirements at local and asset scales to reflect the extensive work by scientists and water managers over many decades. This local expertise captures nuances that may not be visible at a Basin scale with LTWPs seeking to be transparent, collaborative and technically sound, forming a basis for continual improvement.

At present, Basin States apply differing approaches to defining EWRs within LTWPs. EWRs represent the flow regimes required to maintain ecological assets and functions at a low level of risk. South Australia's EWRs have been developed to reflect the hydrological needs of the identified PEAs, enabling a clear understanding of the potential risks to environmental outcomes if elements of those flow regimes cannot be delivered. However, other Basin States use different approaches, including defining EWRs based on deliverability rather than ecological need.

There are also inconsistencies in the way Basin States define PEAs (e.g. Victoria uses individual wetlands and South Australia uses landscape scale assets). These differences lead to inconsistencies in how EWRs can be used for setting Basin AEWPs, system-scale delivery planning and assessing achievement of outcomes, including whether an ESLT is in place.

In the Discussion Paper, it is proposed to change the specification of EWRs, citing a need for 'feasible' objectives and targets to support future SDL assessments. However, there is a fundamental contradiction in defining EWRs based on feasibility whilst also using them to support SDL assessments. SDL assessments determine whether an ESLT is in place and the ESLT is defined as the level of take that does not compromise key environmental assets, ecosystem functions and environmental outcomes. Therefore, the EWRs used in SDL assessments must reflect the flow regimes required to restore, improve and protect those assets, functions and outcomes – not a reduced or 'feasible' subset of them.

Current inconsistencies in how Basin States develop EWRs – particularly where they are shaped by deliverability rather than ecological need – mean that any assessment of their achievement across state boundaries is not based on a consistent benchmark. This undermines the ability to evaluate the effectiveness of the Basin Plan in achieving its objectives and targets. It also creates inequity in the use of EWRs for SDL assessments and risks driving inappropriate proposals to change objectives and targets.

It is acknowledged that some EWRs for South Australian PEAs, particularly those requiring longitudinal connectivity between the River and its floodplain, may require flow rates above what is currently achievable under regulated conditions, given existing operational constraints and available environmental water. However, these outcomes were intended to be achievable under full Basin Plan implementation and remain possible if targeted constraints relaxation were pursued.[73] In contrast, it is understood that EWRs for Victorian assets have been developed to reflect ecological outcomes considered achievable within a regulated system and within current operating constraints.

The Basin's ecological assets evolved naturally over centuries under the natural, pre-development flow regime. Whilst the Basin Plan does not seek to return to pre-development conditions, it is inevitable that some assets will have EWRs that exceed what the Basin Plan can deliver on its own. For these assets, ecological outcomes may be as dependent on natural hydrological variability as they were pre-

[72] Basin Plan, sections 8.19(1)-(2).

[73] MDBA (2012) *Hydrologic Modelling of the Relaxation of Operational Constraints in the Southern Connected System: Methods and Results*. Murray-Darling Basin Authority, October 2012. Found at: https://www.mdba.gov.au/publications-and-data/publications/hydrologic-modelling-relaxation-operational-constraints-southern

development. It is not the needs of the assets that have changed but rather the prevailing flow regime, which has been fundamentally altered by river regulation.

EWRs must not simply reflect what is achievable with the remnant volume after consumptive is prioritised, nor be limited to outcomes achievable under current management or operational constraints. Additionally, given the essential role of unregulated flows in supporting ecological outcomes, EWRs cannot be confined to what is achievable within a regulated flow regime. Where EWRs cannot be met with managed flow delivery, they may still be achieved through natural filling and spilling of storages, with or without the addition of environmental water to enhance outcomes.

Improved guidelines and requirements are needed to increase consistency in LTWPs across Basin States, provided the primary basis for their development remains the flow regimes required to maintain ecological assets at a low level of risk. To ensure scientific rigour, EWRs should also be independently peer reviewed.

In this context, the South Australian Government does not support amending the Basin Plan to require 'feasible' objectives and targets for EWRs and LTWPs, as this would introduce subjectivity and may be inconsistent with the Water Act. Similarly, the proposal to require LTWPs to be consistent with the BWS is not supported.

A LTWP must be developed consistently with Chapter 8, Part 4, Division 6, which sets out the principles for environmental watering. However, these principles relate primarily to the delivery of environmental water rather than long-term planning. Line of sight between LTWPs and Basin AEWPs would be improved if LTWPs also referred to the principles for determining the priorities for applying environmental water under Part 6, Division 1, noting that these principles may require refinement to make them suitable for planning across different timescales.

It is also important to recognise that the Basin Plan prioritises maintaining the condition of Ramsar sites over other environmental assets. LTWPs should list all EWRs, whilst identifying those that contribute to Ramsar sites.

The Discussion Paper proposes linkages between co-operative arrangements and addressing environmental water delivery constraints and opportunities but the intent of the proposal is unclear. The Basin Plan already requires LTWPs to address co-operative arrangements, though these currently relate to coordination between holders of HEW, managers of PEW and the owners or managers of environmental assets for the delivery of environmental water.[74] A more useful addition would be for LTWPs to consider how cooperative arrangements account for LTWPs in neighbouring and downstream WRP areas, improving alignment and system-scale planning.

Similarly, the identification of operational constraints affecting environmental watering in the WRP area, and strategies to address them, is a distinct requirement for LTWPs.[75] Further analysis is needed to clarify the ongoing scope of this requirement to ensure it only applies to constraints *within* a WRP area that affect environmental watering in that area. Where constraints *outside* a WRP area influence environmental watering, their identification and the strategies to address them should instead be incorporated into the BWS. This would appropriately capture operational constraints within the southern-connected Basin, including those referenced in the Objectives and Outcomes document under the Agreement for operational constraints specific to the River Murray System.

Removing the arbitrary 5-yearly review timeframe for LTWPs is supported. LTWPs specify the EWRs and ecological objectives and targets for PEAs and any review should be driven by evidence and expert knowledge, not a fixed legislative timeframe. Given the achievement of EWRs is used to assess whether

[74] Basin Plan, section 8.19(4).

[75] Basin Plan, section 8.14(6)

SDLs reflect an ESLT – and that the Basin Plan itself is reviewed every 10 years – unnecessary changes to EWRs within that cycle risk creating inconsistencies between the EWRs and the assumptions underpinning the SDLs. This effectively shifts the goal posts and undermines future SDL assessments.

The need for LTWPs in systems with no held environmental water (e.g. the EMLR WRP area) and/or negligible environmental water connectivity (e.g. the SA Murray Region WRP area) is unclear. In these areas, LTWPs and State AEWPs create an administrative burden but provide little practical value beyond demonstrating compliance with Chapter 8. Without HEW or system scale storages to support adaptive management, LTWPs cannot meaningfully influence environmental watering outcomes.

Recommendations

It is recommended that:

- *the Basin Plan is amended:*
    - *to include improved requirements for developing EWRs, including obligations at an asset scale, for consistency between Basin States.*
    - *to require that EWRs reflect the flow regime(s) required to protect key environmental assets, ecological functions and environmental outcomes at a low level of risk for use in future SDL assessments and ESLT determinations.*
    - *to link LTWPs with the principles under Chapter 8, Part 6, Division 1, refined to apply for planning at different timescales, in preference to the principles under Chapter 8, Part 4, Division 6.*
- *no amendment of the Basin Plan is pursued to include the option for 'feasible objectives and targets' in LTWPs, as this would potentially undermine environmental outcomes that may be achievable with changes to operational practices, amongst other things.*
- *an analysis and risk assessment of management arrangements is undertaken in all WRP areas with no held environmental water and/or negligible environmental water connectivity, identifying those areas where a LTWP has limited benefit and an exemption could be given, subject to the protection of planned environmental water.*
- *the arbitrary review timeframe for LTWPs[76] is removed and replaced with flexibility to update based on evidence and expert knowledge as needed. The requirement to consider if EWRs are fit for purpose after a Basin Plan Review should be retained.*

4.1.4 Annual Environmental Watering Priorities

The Basin Plan currently requires two AEWPs each year: Basin AEWPs prepared by the Authority and State AEWPs prepared by Basin States. The Discussion Paper proposes removing the requirement for Basin AEWPs, assuming that State AEWPs and the CEWH's annual plan meet annual planning needs.

State AEWPs are valuable to support annual environmental water delivery and targeting of environmental outcomes. They incorporate local environmental conditions, LTWP EWRs and targets, outline potential watering actions under a range of Annual Operating Outlooks (AOOs)[77] and support consultation with local stakeholders and First Nations communities. They also consolidate proposed watering actions across a region and link them with priorities elsewhere.

[76] Basin Plan, section 8.22(1e).

[77] Annual Operating Outlooks (AOOs) describe the potential operating strategies for the year ahead under a range of possible climatic conditions. It is an integral part of the planning process for river operations and outlines the actions river operators may need to take to run the river under each scenario. It is not a fixed plan but a tool to inform adaptive management.

In contrast, Basin AEWPs offer limited value in their current form. Their timing and overlap with State AEWPs mean that they change little from year to year and key watering decisions are already made through SCBEWC or via bi-lateral agreements with environmental water holders by the time they are produced. Basin AEWPs do not currently provide any additional planning function.

Rather than removing Basin AEWPs, their purpose, content and governance should be redefined. Basin AEWPs should synthesise State AEWPs to optimise system-scale and multi-site watering and transparently show trade-offs, guided by a framework in the BWS. These functions are currently absent.

If the BWS is the blueprint for Basin-scale environmental watering and annual prioritisation, Basin AEWPs should represent the application of the BWS and State AEWPs to produce a coherent annual watering plan. They should be prepared collectively by Basin States and the CEWH, with Authority input on river operations and AOOs.

4.1.4.1 Environmental Water Holder Decision-making

The functions of the CEWH are established under Part 6 of the Water Act, which are to be performed for the purpose of protecting or restoring environmental assets of the Basin to give effect to relevant international agreements.[78] The CEWH is required to manage the Commonwealth environmental water holdings in accordance with the environmental watering plan.[79]

Despite these obligations, the Basin Plan imposes a lower requirement on how these holdings are to be used; environmental watering need only be undertaken 'having regard to' the Basin AEWPs.[80] This falls short of the level of obligation needed to ensure delivery of environmental water to key sites, including those relied upon in determining the ESLT. To give effect to the intent of the Basin Plan, the use of Commonwealth environmental water should be done 'in accordance with' the Basin AEWPs.

The increase in sophistication and adaptability of the CEWH in managing its environmental water portfolio over the last 12 years is commended. South Australian Government officials work closely with CEWH officials to coordinate and deliver environmental outcomes at South Australian PEAs. However, reliance on bilateral conversations, event-specific plans and watering schedules does not necessarily optimise outcomes at a system scale and provides limited transparency around how trade-offs are made. This lack of visibility constrains confidence in the decision-making process and limits the ability to ensure that environmental water is directed to the sites of highest Basin-wide priority.

Together with Basin AEWPs, a strengthened BWS that prioritises key environmental assets and ecosystem functions under different inflow scenarios and minimum flow targets would more effectively guide CEWH decisions to deliver its water to meet those outcomes (particularly in the southern-connected Basin to the end of the Lower Darling and from Lake Alexandrina to the Coorong). This would not fetter the discretion of the CEWH; rather, it would provide a clearer framework for how that discretion is exercised to achieve defined outcomes and create the necessary link between the ESLT determination and the real-world achievement of the key environmental outcomes and ecosystem functions.

Carryover is an essential tool for water entitlement holders to plan for future dry years and environmental water holders should similarly use it to ensure that sufficient water is available to meet critical environmental demands during dry periods – just as irrigators manage their own water between years.

Environmental water holders should be supported to use carryover in the framework for preparing Basin AEWPs, as should accounts for planned environmental water (refer section 3.6.2.3). Both mechanisms

[78] Water Act, section 105(3).

[79] Water Act, section 105(4)(a).

[80] Basin Plan, section 8.33.

provide the flexibility needed to achieve environmental outcomes that may not be possible using only the allocations available in a single year.

Recommendation

It is recommended that:

- *the Basin Plan is amended to:*
    - *revise the content and governance arrangements for Basin AEWPs to improve the utility of this document as an annual environmental watering plan and clarify roles and responsibilities.*
    - *ensure that environmental watering by the CEWH and the other environmental water holders in the Basin is undertaken in accordance with the Basin AEWPs.*
- *the CEWH and other environmental water holders are supported to use carryover and other arrangements to manage available water between years to support the delivery of objectives and outcomes in the BWS.*

4.2 Program for Monitoring and Evaluating the Effectiveness of the Basin Plan

4.2.1 Regulatory Context

Within Basin water management, an effective MER program is expected to support adaptive management by generating targeted information on the outcomes of Basin Plan actions (monitoring), synthesising that information in relation to Basin Plan objectives (reporting), assessing the effectiveness of actions in progressing those outcomes (evaluation) and applying the knowledge gained to improve future management actions (improvement).

Section 22 of the Water Act requires the Basin Plan include a program for the monitoring, evaluating and reporting on its effectiveness. Whilst effectiveness is to be assessed against the objectives and outcomes set out in Chapters 5, 8 and 9 of the Basin Plan,[81] the value of MER activities depends on the information generated about progress and performance against those outcomes and objectives.

The Basin Plan also requires MER programs include reporting on the matters used to monitor and evaluate its effectiveness.[82] These matters, against which Basin States, environmental water holders and the Authority must report and review, are set out in Schedule 12 of the Basin Plan.

4.2.2 Monitoring and Evaluating the Environmental Watering Plan

The management of water to achieve environmental outcomes is arguably the most important Basin Plan implementation activity and, as such, the Environmental Water Management Framework must include a robust MER program. MER information is essential for assessing performance and supporting adaptive management to improve Basin Plan implementation.

Despite expectations that reporting against Schedule 12 matters would provide clear information on progress towards Basin Plan objectives and outcomes, Basin stakeholders widely acknowledge that the current reporting framework has not enabled an effective adaptive management approach.

[81] Basin Plan, section 13.01(3).

[82] Basin Plan, section 13.01.

Chapter 13 and Schedule 12 implicitly assume that reporting, review and evaluation activities will be sequenced in a way that aligns the temporal and spatial scales of MER outputs with the Basin Plan's objectives and outcomes. For example, Schedule 12, Matters 7 to 10 represent reporting activities at different temporal and spatial scales that are intended to inform the Authority's five-yearly review of the environmental watering plan and the broader Basin Plan Evaluation and Review.

In practice, the existing cycle of Schedule 12 reporting and five-yearly reviews has not enabled the Authority to undertake meaningful evaluations of Basin Plan implementation. For example, the 2020 Basin Plan Evaluation was conducted in parallel with Basin States' five-yearly matter reporting, preventing the Authority from drawing on that information.

This issue was recognised ahead of the 2025 Basin Plan Evaluation, when Basin States agreed under subsection 13.15(2)(c) to bring their five-yearly matter reporting forward from 2025 to 2024 so it could be inform the Authority's Evaluation. However, this was a one-off arrangement and the underlying sequencing problem within the current Basin Plan remains unresolved.

4.2.3 Governance

In addition to sequencing issues, there remains a lack of clarity around roles and responsibilities for MER. Section 13.03(2) of the Basin Plan establishes that the Authority is responsible for leading all evaluations of Basin Plan effectiveness, with reporters[83] expected to enable these evaluations by collecting, analysing and reporting information in a fit-for-purpose manner.

These issues are acknowledged in the 2025 Basin Plan Evaluation, which notes that the separation of the evaluation (Authority) and compliance and oversight (IGWC) functions is not reflected in Chapter 13. Current arrangements also do not allow for the IGWC to set reporting requirements needed to support its compliance activities.

Recommendation

It is recommended that the Basin Plan is amended to:

- *improve the utility of Schedule 12 matter reporting by removing unused or duplicative matters and providing clearer expectations of what each matter must report on.*
- *require the Authority to publish detailed guidelines for each Schedule 12 matter, which reporters must have regard to.*
- *clarify that Basin State annual reporting on environmental watering and implementation of the environmental management framework (Matters 9 and 10) provides the information needed to support Basin State five-yearly reporting on asset scale outcomes (Matter 8).*
- *sequence the Authority's five-yearly reporting on Basin-scale environmental outcomes (Matter 7) to occur after, and draw on, Basin State five-yearly reporting asset scale outcomes (Matter 8).*
- *move the arbitrary 31 October Schedule 12 reporting deadline to later in the water year to allow more time for meaningful reporting and, where necessary, sequence reporting deadlines so that dependant matters can be completed in a logical order (Matters 7 through 10).*
- *Clarify the emerging role of IGWC in Basin Plan reporting to ensure reporting by all parties is complementary and not duplicative, including formalising these arrangements in the Basin Plan and removing the need for a separate Memorandum of Understanding between the Authority and IGWC.*

[83] Defined under s13.13 of the Basin Plan, *reporter*, for a matter listed in Schedule 12, means the person or body listed as the reporter for the matter.

4.3 Holistic Approach to Water Delivery – River Murray System

The Basin Plan environmental watering plan cannot be considered in isolation from the O&O document[84] for river operations in the River Murray System, which is set by BOC and establishes the rules under which the Authority directs river operations.

The River Murray system has long been managed as a supply system designed to maximise water capture, minimise losses and meet consumptive demands. The introduction of environmental water has challenged these expectations by actively seeking delivery at times and in ways that have not traditionally been part of 'normal' river operations.

There are five general objectives and outcomes that the Authority must achieve when performing its river operation function. In summary:

- **Water storage and delivery and accounting** – operate the system efficiently and effectively to deliver State water entitlements and to maximise the water available to the Southern Basin States after providing for operating commitments.
- **River Murray Operations (RMO) assets** – ensure that the RMO assets allow the Authority to manage and deliver water that is fit for the purpose for which it is to be used, efficiently, effectively and safely.
- **People and communities** – contribute to the safety of communities along the River Murray, have regard for the economic, social, environmental and cultural activities and values of people using the River Murray System and the provision of water to meet critical human water needs.
- **Environment** – contribute to the protection and, where possible, restoration of priority environmental assets and ecosystem functions within the River Murray System.
- **Communications and information management** – ensure the Authority uses the best available data, tools and systems, keeps all stakeholders with an interest in river operations well informed of its plans and activities and acts transparently.

There has been a range of improvements and adaptations to support the delivery and protection of environmental water but there is more to be done.

The above general objectives and outcomes are not required to be achieved in any particular order However, the delivery of operational water[85] and maximising system resources, remains the primary focus for river operators. Environmental water delivery is therefore impacted by that prioritisation.

Further development of policies and rules relating to channel capacity access for environmental water is required to improve the effectiveness of environmental water management and ensure the achievement of environmental outcomes in a way that has mutual benefits for consumptive water.

There are several examples of how environmental water has been used in conjunction with operational water delivery and/or where benefits for consumptive water users have arisen from the delivery of environmental water, including:

- Transfers of operational water from Menindee Lakes via the Great Darling Anabranch can occur at times that also suit environmental watering, with the additional losses accounted for using held environmental water. This approach delivers environmental outcomes using less

[84] Basin Officials Committee (2025) *Objectives and Outcomes for River Operations in the River Murray System*. Found at: Objectives and outcomes for river operations in the River Murray system | Murray–Darling Basin Authority

[85] Broadly, operational water is water in the River Murray System that is in transit between storages or being released to meet downstream commitments, including water orders for consumptive water users, delivery of inter-valley trade and for South Australia's Entitlement under the Agreement.

environmental water whilst enabling greater operational transfers from Menindee Lakes without increasing conveyance losses that would otherwise affect system resource.

- Delivery of operational water through the Narrows, in conjunction with environmental water when it is ecologically beneficial to water the Barmah-Millewa Forest, to support downstream demands as well as transfers to Lake Victoria.
- Improved opportunity for overbank flows and variability in flow delivery, which may otherwise be considered inefficient, to reduce risks such as bank-full flows that cause bank erosion. Environmental water has been used to shorten bank-full flow periods during operational transfers and introduce variability, such as through Goulburn flow pulses.
- Environmental water has been used to shape hydrographs during high flow event recessions to achieve outcomes for native fish and reduce the risk of bank erosion and weir instability.
- Releases of environmental water from major storages ahead of natural high inflow events have created 'airspace' and reduced flood risk whilst boosting system resources.
- Shifting the timing of demand for some environmental water delivery away from summer when it would have previously been required for irrigation, has reduced peak-season irrigation delivery pressure and provides channel capacity benefits for operators.

The 2004 Intergovernmental Agreement on a National Water Initiative requires held environmental water to retain the same 'rights' to allocation, trade and use as consumptive entitlements. Yet there are many instances where environmental water has not been able to be delivered (or the volume delivered has been reduced) but where a comparable consumptive trade would have proceeded, including:

- Spring and summer environmental water delivery to South Australia (including as a direct trade) being constrained or reduced due to capacity concerns in the Barmah-Millewa Reach, even though this water was previously deliverable when held as a consumptive entitlement downstream of this constraint and was delivered alongside other consumptive demands.
- Intervalley trade (IVT) or other demands being given priority for tributary capacity, often limiting the volume or timing of when environmental water can be ordered from tributaries.
- When environmental water is ordered from tributaries it can be 'rebadged' during the event as an IVT or operational transfer (as these are prioritised) impacting on downstream benefit through re-regulation in Lake Victoria.
- Large transfers of operational water to Lake Victoria reducing the capacity for environmental water delivery during spring and summer, sometimes for multiple months at a time.
- Operational constraints in the Murrumbidgee system impacting on proposed changes to the timing of delivery, meaning delivery could not be optimised for downstream outcomes.
- Limited ability for re-regulation of environmental return flows (e.g. in Lake Victoria) for later release for increased environmental outcomes.
- Restrictions on the volume of release from Hume Dam based on a desire for releases to be equally accounted for as New South Wales and Victorian water when similar restrictions are not placed on irrigation orders.
- The use of environmental water to mitigate poor water quality events over system resources, which reduces the volume that is available to achieve ecological outcomes.

Environmental water can be 'squeezed out' when operational and consumptive demands are prioritised. Greater consistency is needed in the rules and principles governing water delivery, and environmental

water should not be assumed to be a lower priority than consumptive demands, except for conveyance reserves and critical human water needs (CHWN).

Discussions about trade-offs between consumptive and environmental outcomes are often framed as a binary choice between supporting a productive agricultural industry and maintaining healthy rivers. These are not mutually exclusive. Long-term productive and sustainable agriculture depends on a healthy functioning river system with adequate water availability and good water quality. Environmental outcomes must be recognised as complementary to sustainable industries.

Environmental water delivery has long been seen as an 'add on' to operational and consumptive demands. It is time to review the management of the River Murray System and its tributaries to consider operational and environmental water holistically, integrating the management and delivery of flows for these two distinct but interconnected objectives.

Recommendation

It is recommended that:

- *The Authority and Basin States holistically review existing operational rules and procedures to integrate the management and delivery of operational and environmental water, and develop fit-for-purpose rules and principles that apply consistently across all types of water orders and demands.*
- *Operational practices are improved to remove existing known impediments for the delivery of environmental water to achieving optimal outcomes.*
- *The full set of levers currently available to River Operators for consumptive demands and system resources are made available to environmental water deliveries to achieve optimal outcomes.*

4.4 Protection of Held Environmental Water

In 2010, the Authority proposed an ESLT range of 3,000 GL (high uncertainty of success) to 7,600 GL (low uncertainty) in its Guide to the Basin Plan. Following consultation, the Australian Government announced several key policy decisions for water recovery under the Basin Plan, including recovering water entitlements through purchases from willing sellers and investment in infrastructure upgrades and efficiency programs.

This decision enabled the Authority to adopt a modelling approach that targeted the delivery of HEW when determining the volume of water recovery required for an ESLT. This targeted approach assumed that return flows of HEW would be available for use at downstream sites and that HEW could be called from storage during un-regulated flow events. By modelling the more efficient and optimistic use of environmental water, this approach was used to support reducing the recovery target to 2,750 GL.

Given this, protecting environmental return flows as they move through multiple sites is critical to achieving Basin Plan outcomes and minimising the total volume of water recovery required to meet an ESLT. However, instead of embedding this key protection within WRPs, it was designated as an 'unimplemented policy measure' or 'Prerequisite Policy Measure' (PPM) and linked to SDLAM under section 7.15(1)(b)(ii) of the Basin Plan.

Under section 7.15(2), any unimplemented policy measures not expected to come into effect by 30 June 2019 were to be removed from the benchmark model used to determine the total SDL offset. This created significant issues, particularly because it tied environmental water protections to a time-limited mechanism. Whilst the Authority assessed that PPM arrangements would be in place in New South Wales, Victoria and South Australia by 1 July 2019, delays upstream of South Australia have resulted in missed opportunities to protect environmental water between catchments. At times, re-regulation has allowed environmental water it to be taken for consumptive use or cause downstream impacts.

One example occurred in late 2023 during a release of 1,000 to 5,000 ML/day of environmental flows in the Murrumbidgee system for local outcomes. These flows were expected to be protected as return flows into the River Murray. However, whilst in transit, part of these return flows were re-categorised as operational water and, as a result, not protected. Instead of providing benefits to PEAs in South Australia, the water was re-regulated in Lake Victoria. This not only reduced environmental flows but also caused water put aside for critical human water needs to spill.

Several PPM arrangements remain non-enduring and continue to limit the protection of HEW upstream of South Australia. This includes the arrangements between Victoria and New South Wales under clause 113(2) of the Agreement, which allow the Authority to adjust bulk water accounts to protect return flows from NSW tributaries when entering the River Murray. Without protection, this water is re-regulated in Lake Victoria and made available for reallocation. These arrangements expire on 30 June 2027.

Another issue relates to the calculations of losses (water used) for each environmental watering event. Trials typically begin with a conservative loss estimate, which are refined over time as data improves. Whilst this approach reduces the risk of underestimating losses and affecting system resources (state shares), it can create a windfall gain for state shares when initial estimates are overly conservative. Further work is required to establish effective and enduring protections for return flows and ensure consistent, robust methods for determining environmental water use are based on the best available information.

Most environmental water arrives at South Australian PEAs as return flows from upstream watering actions. Protecting these return flows is therefore essential to achieving environmental outcomes in South Australia.

Additionally, some pre-Basin Plan environmental water products – such as the Barmah–Millewa Forest Environmental Water Allocation – do not have return flow protection. Given their interaction with other HEW, these arrangements should be reviewed and strengthened to support whole of system outcomes.

Recommendation

It is recommended that:

- *the Basin Plan is amended so that Basin States are required to have effective and enduring arrangements for the protection of held environmental water.*
- *regular audits are undertaken to ensure that there are consistent and robust approaches to determining environmental water use that is based on best available information.*
- *the arrangements for other environmental water products are reviewed to ensure no impact on Basin Plan HEW and consider additional protections.*

4.5 Protection of Planned Environmental Water

PEW is water preserved for achieving environmental outcomes and, to the extent committed by the relevant legislative instrument, cannot be taken or used for any other purpose.[86] PEW effectively establishes the hydrological baseline (i.e. pre-Basin Plan conditions) against which the additional watering needs of PEAs were assessed when the Basin Plan water recovery target was set. Any reduction in PEW, or any compromise in its protection, directly undermines the ESLT.

The Basin Plan requires no net reduction in the protection of PEW under existing State water management laws. This protection is currently given effect through the accreditation of WRPs, which

[86] Water Act, section 6(1).

must identify the PEW in the WRP area and the rules and arrangements that apply to it. Ongoing protection therefore depends on maintaining these requirements within an accredited instrument.

However, despite these statutory protections, differing jurisdictional interpretations of PEW continue to undermine their effectiveness. The Matter 18 report found that significant time was spent negotiating these differences between individual Basin States and the Authority, and that they remain unresolved in the current suite of accredited WRPs.

South Australia was among the first of the States to submit WRPs and define PEW. The Authority required the SA River Murray WRP to classify all water not allocated and/or used for another purpose as PEW. This approach was not applied consistently to upstream WRPs. The inconsistency is clear in Basin States' Schedule 12 reporting, where water treated as PEW in South Australia appears to be 'generated' at the border. For example, unregulated flows moving through New South Wales and Victoria are not reported as PEW until they reach South Australia.

These inconsistencies should be resolved so that the intent of maintaining baseline flows can be applied within the legislative frameworks of all Basin States prior to commencing drafting and assessment for the reaccreditation of WRPs. This may require an amendment to section 6 of the Water Act to ensure the definition provided for PEW can be applied consistently across Basin States.

Recommendation

It is recommended that the Water Act and Basin Plan are amended to ensure the definition provided for PEW can be applied consistently across Basin States to support the baseline hydrological regime upon which Basin Plan water recovery depends.

4.6 Integrated Catchment Management

The interdependence between the Basin's terrestrial and aquatic ecosystems has long been recognised. In 2001, acknowledging that environmental and economic outcomes are shaped by both land and water management, the Murray-Darling Basin Ministerial Council released the Integrated Catchment Management (ICM) Policy Statement as the Basin's framework for natural resource management (NRM). Under this policy statement, ICM is defined as:

> *A process through which people can develop a vision, agree on shared values and behaviours, make informed decisions and act together to manage the natural resources of their catchment: their decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment*.[87]

ICM provides a framework for holistic management of land, biodiversity, water and community resources at the catchment scale. A core element of ICM is the use of complementary measures – non-flow based actions that enhance the environmental benefits achieved through water management. Measures such as infrastructure works, vegetation management and pest control can reduce barriers to ecological recovery and strengthen environmental outcomes supported by the hydrological regime.

The Discussion Paper notes that the Authority is exploring ways for the Basin Plan to better support coordinated land and water management, whilst recognising the Basin Plan's legal limits and that catchment management is a State responsibility. One idea is to prioritise environmental water delivery where land and water management are 'already working together well'.

Whilst the Authority has acknowledged that Basin States are well progressed in integrating land and water management, it is unlikely to have full visibility of how ICM is embedded within broader State NRM frameworks. A clear understanding of the historical and current role of ICM within these frameworks is

[87] MDBC (2001) *Basin Salinity Management Strategy 2001-2015*. Murray-Darling Basin Commission, August 2001.

therefore essential. Without this, embedding ICM considerations into Basin Plan implementation risks duplicating existing arrangements or extending beyond the Authority's remit.

4.6.1 Basin Salinity Management Strategy 2001-2015

The first instrument under the Ministerial Council's ICM Policy Statement was the *Basin Salinity Management Strategy 2001-2015* (BSMS), developed in response to rising salinity risks to water quality, environmental values, regional infrastructure and productive agricultural land.

Prepared by the Murray-Darling Basin Commission in partnership with Basin States and communities, the BSMS established a shared commitment to manage salinity, setting river salinity targets in each tributary valley and a Basin Salinity Target.[88] Basin States and communities worked to meet these targets through nine strategic elements, including improved knowledge, asset risk assessment, optimal mixes of land management, engineering and river flow measures, regional salinity and catchment management plans aligned with ICM, vegetation and land rehabilitation, and research into new industries suited to salinised resources.

Key elements and accountability arrangements were embedded in Schedule B to the Agreement, requiring Basin States to submit Programs of Actions, monitor progress and report annually. These reports informed the Authority's annual Basin-scale implementation report and were independently audited by the Independent Audit Group for Salinity (the IAG). The IAG's final 2016 audit confirmed major achievements, including a sustained decline in salinity at Morgan and consistent achievement of the Basin Salinity Target from 2010.[89]

South Australia contributed through a salinity zoning policy directing irrigation to lower-risk areas, integration of Salt Interception Scheme management into broader River Murray operations, long-term protection of more than 22,000 hectares of native vegetation through the Bush Bid program and continued revegetation in priority areas via the River Murray Forest Project (CLLMM Recovery Project).

4.6.2 Integrated Catchment Management in South Australia

South Australia's experience demonstrates that the principles of Integrated Catchment Management (ICM) are not only effective at the interjurisdictional scale, as evidenced by the success of the Basin Salinity Management Strategy, but are also deeply embedded within the State's own natural resource management framework. The *Landscape South Australia Act (2019)* (Landscape Act)[90] establishes an integrated scheme for the sustainable use and management of the natural resources that shape the State's landscapes, explicitly reflecting ICM principles.[91]

Central to this framework are regional 'Landscape Boards',[92] which serve as the primary agent for integrated natural resource management across South Australia with a mandate spanning land management, water resource management, and pest animal and plant control.[93] Landscape Boards work collaboratively with State and local government agencies, research institutions, First Nations and community groups, reinforcing the multi-stakeholder approach to ICM and holistic decision making.[94]

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[88] The Basin Salinity Target is to maintain the salinity at Morgan at less than 800 EC for 95 percent of the time as established under the Agreement (Schedule B of the Agreement, clause 7(1)).

[89] MDBA (2016) *Report of the Independent Audit Group for Salinity 2014-15*. Murray-Darling Basin Authority, Canberra.

[90] Formally the *Natural Resources Management Act 2004* (SA).

[91] *Landscape South Australia Act (2019)*, section 7(1).

[92] Formally NRM Boards under the NRM Act.

[93] *Landscape South Australia Act (2019)*, Part 2, Division 2, ss25(1)(a).

[94] *Landscape South Australia Act (2019)*, Part 2, Division 2, ss25(3)(c).

Implementation of the Landscape Act has enabled a management approach for South Australia's Basin environments that includes a range of complementary measures, enhancing the outcomes achieved by environmental watering and supporting long-term resilience.

4.6.2.1 CLLMM Recovery Project

South Australia responded to the severe impacts of the Millennium Drought and long-term over-extraction on the CLLMM by partnering with Basin communities, Landscape Boards (then NRM Boards), First Nations groups and academic experts to deliver the CLLMM Recovery Project. Between 2011 and 2020, the project implemented 24 initiatives spanning strategic planning, research, vegetation restoration, acid sulfate soil and salinity management, fishway construction, water resource management, habitat restoration and extensive community engagement and partnerships.

The final project report documents the outcomes of each initiative[95] with key achievements including establishing a regional supply network that propagated and planted 4.6 million plants from 200 species across 72 sites covering 975 hectares, the installation of more than 100 kilometres of shoreline and revegetation fencing involving 45 participating landholders, and pest and weed control across 61 sites spanning 14,432 hectares. The project also improved ecological connectivity through the design and construction of six new fishways across five barrages, supported native fish recovery by breeding and releasing more than 15,540 threatened and small-bodied species across 10 sites, strengthened long-term conservation efforts through the establishment of two captive maintenance facilities for southern purple-spotted gudgeon and the use of three surrogate breeding sites to prepare fish for reintroduction into the wild.

4.6.2.2 Sustaining Riverland Environments – Bookmark Creek Restoration Project

Bookmark Creek is an eight-kilometre anabranch that bypasses Lock 5, along with 13 kilometres of the SA River Murray channel. Once a natural high-flow creek it was heavily altered by the development of Australia's first irrigation district in the late 1880s and the construction of Lock 5 in 1927, which permanently inundated its inlet.[96] The creek was subsequently used as an irrigation reservoir and later as an irrigation disposal basin, leading to long-term ecological decline.

In 2010, the Australian and South Australian Governments established the Sustaining Riverland Environments (SRE) program to address this deterioration. Bookmark Creek was selected as one of three priority Riverland sites, combining complementary measures such as habitat restoration, upgraded river infrastructure and community collaboration to deliver environmental, social and economic benefits.

Extensive stakeholder and community consultation in 2021 and 2022 informed detailed project designs, including targeted 're-snagging', new infrastructure and fishways and a Wetland Management Plan. Construction was completed in October 2025, including a new regulator that increases flow through the creek five-fold, creating fast-flowing habitat and restoring fish passage. Its fishway now enables turtles and large-bodied native fish such as the Murray cod, to move between the river and the creek for the first time in decades.[97] A canoe channel and pedestrian footbridge allow these improved environmental outcomes to be enjoyed in parallel with enhanced recreational opportunities for tourists and the local community, demonstrating the multi-faceted outcomes achievable through ICM.

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[95] DEW (2021) *Coorong, Lower Lakes and Murray Mouth Recovery Project Final Report*. Department for Environment and Water, Adelaide.

[96] DEW (2026), *Bookmark Creek Complex*. Department for Environment and Water, Adelaide. Found at: Department for Environment and Water - Bookmark Creek Complex

[97] DEW (2025), *Bookmark Creek upgrades complete*. Department for Environment and Water, Adelaide. Found at: Department for Environment and Water - Bookmark Creek upgrades...

4.6.3 Opportunities to Drive ICM through the Basin Plan

Basin States, including South Australia, have long demonstrated that aligning land management with environmental water delivery can enhance ecological outcomes. However, ICM and complementary measures cannot replace the flows required to sustain the Basin's environmental assets. Investment in non-flow measures must be guided by robust science showing where they can *enhance* – not substitute for – environmental watering.

The Basin Plan's environmental objectives and outcomes each explicitly relate to the protection and restoration of water-dependent ecosystems, which implies that water is the primary limiting factor. Complementary measures must not divert attention from full Basin Plan implementation, including proposals to prioritise water delivery only where land management is already aligned. Land management is the responsibility of NRM Boards, CMAs, Landscape Boards and State conservation agencies, and the Basin Plan has no regulatory authority over their activities.

In South Australia, ecological condition is driven principally by flow pattern and volume. Complementary measures can support local outcomes but cannot replace water. For example, grazing management improves vegetation response *when water is available*; fish restocking offers only temporary benefits without suitable flows. The Authority's SA River Murray SDL Assessment confirmed that insufficient flow volume and frequency remain the key drivers of decline.

During the lead-up to the 2017 SDLAM determination, complementary measures were proposed to increase the SDL offset. The South Australian Government has consistently maintained that complementary measures cannot substitute for water recovery, as this would undermine the fundamental concept of an ESLT. The ESLT is about restoring flow regimes and the integrity of SDLAM lies both conceptually and scientifically in its consistency with this ESLT approach. Complementary measures cannot be scientifically linked to flow substitution, and even measures like fish passage do not reduce water requirements. Accordingly, the Ministerial Council's 2017 method excluded complementary measures from SDL offsets.

In this context, the Authority engaged CSIRO in 2017 to develop an evidence-based method for assessing the relative environmental benefits of complementary measures. When tested on seven measures affecting native fish abundance, the method produced results that diverged from expert expectations and standard river-rehabilitation practice, highlighting the difficulty of reliably quantifying the benefits of complementary measures. The project ultimately concluded that investment in complementary measures must be grounded in a scientifically robust conceptual basis.

ICM and complementary measures have value, but they cannot substitute for water recovery or the restoration of flow regimes – which is the fundamental purpose of the Basin Plan.

Recommendation

It is recommended that:

- *ICM and complementary measures cannot be used to offset the remaining water recovery required under the current Basin Plan, including to meet the shortfall in the SDL offset due to the failure of SDLAM projects.*
- *Environmental water delivery could support areas where land management and water management are 'already working together well' in the context of the requirements for identified PEAs, particularly those recognised through Australia's relevant international agreements.*
- *If LTWPs are updated to identify dependencies between environmental water delivery and complementary measures, these dependencies must be founded on a scientifically robust conceptual basis that demonstrate where, when and how the implementation of non-flow related measures will be most effective for environmental watering outcomes.*

4.7 Improving Connectivity

4.7.1 Vulnerabilities of the Northern Basin

The Discussion Paper notes the declining trend in river connectivity, particularly in the highly ephemeral northern Basin. Extended periods of low rainfall and flow, driven by climate variability, climate change and increased development, storage and extraction, have reduced longitudinal connectivity throughout the northern Basin, through to the Lower Darling and into the River Murray.

Connectivity affects not only local conditions but also downstream water quality and ecological outcomes. In the Darling (Baaka), poor water quality at the end of the northern Basin has weakened ecosystem resilience, most notably above Weir 32 on the Lower Darling, where multiple fish-death events have occurred over the past decade.

For decades, the Menindee Lakes system was managed primarily as a water storage. When New South Wales developed the lakes in the early 1960s, it traded off the ecological values of a large ephemeral wetland in favour of water security for the southern Basin. Combined with declining inflows from the north, this has contributed to water quality problems and ecological decline. In recent years, stakeholders have increasingly called for a more balanced approach to managing the Menindee Lakes system. This will be examined through the Menindee Review, noting that any changes may involve trade-offs for other Basin values.

4.7.2 Opportunities to Improve Connectivity Outcomes

The South Australian Government agrees that connectivity is essential for the northern Basin and its communities. However, given the ephemeral nature of most northern Basin tributaries, it is difficult to maintain connectivity when flows are absent due to lack of rainfall.

The Basin Plan's objective to restore longitudinal connectivity in the northern Basin has not been consistently met. Current flow regimes do not always provide the baseflows and low flows needed for river health and ecosystems at key times, particularly in the lower Barwon-Darling, despite more than 50 Government initiatives aimed at improving connectivity.

End-of-system connectivity depends on flows from all upstream catchments, yet no clear end-of-catchment flow objectives exist. Many northern systems are unregulated and entitlement recovery alone cannot maintain connectivity. Rule-based protections, such as commence-to-pump rules, are required to safeguard the critical flows.

The Basin Plan's environmental watering plan lacks a requirement for LTWPs to document end-of-system flow needs to maintain water quality, ecosystem health and downstream connectivity. This gap is most acute in the northern Basin but also relevant for the Murrumbidgee, Goulburn and Lower Darling. Identifying the environmental water requirements that support connectivity during dry periods is essential to ensure water management decisions prioritise system-scale connectivity.

4.7.3 Recovery of the 450 GL in the Northern Basin

In recent years, some stakeholders have advocated for the recovery of part of the 450 GL in the northern Basin to improve connectivity. However, for the reasons above, water recovery alone is unlikely to achieve the desired connectivity outcomes. The 2016 Northern Basin Review instead recommended reducing northern Basin recovery by 70 GL, supported by a suite of 'toolkit' measures to protect environmental flows, remove constraints, improve fish passage and coordinate low-flow delivery. Despite their importance, the effectiveness of the Northern Basin Toolkit was not assessed in detail in the Authority's 2025 Evaluation, nor does it appear to have informed the Authority's current recommendations on recovering water for the 450 GL in the northern Basin.

Recovering water for the 450 GL in the northern Basin undermines its original purpose: to enhance environmental outcomes in the southern Basin.

Whilst the Discussion Paper focuses northern Basin connectivity, connectivity in the southern Basin should not be overlooked. Better connection of tributary inflows with regulated releases and improved longitudinal and lateral connectivity between the river and its floodplains remain essential.

Recommendation

It is recommended that:

- *The Basin Plan be amended to require the identification of end of system flow targets for all major surface water SDL resource units and ensure that mechanisms are in place through the environmental water framework to ensure these flows can be met.*
- *The management of the Menindee Lakes system continues to be reviewed as part of the Menindee Review to improve connectivity between the northern and southern Basins.*
- *Programs to improve connectivity in the northern Basin should continue; however this should not include a reallocation of water recovery and effort that was originally planned to improve outcomes in the southern Basin.*

4.8 Constraints Relaxation

The South Australian Government's position on the value of constraints relaxation, including the vital role that it plays in ensuring the achievement of an ESLT, is outlined in Chapter 3.10 of this report.

The health of the Basin is dependent on rivers being able to connect to floodplains and wetlands. Lateral connectivity is critical for:

- Flushing sediment and nutrients
- Native vegetation maintenance and regeneration
- Native fish breeding and migration
- Improving water quality

4.8.1 Progress on Constraints Relaxation

There has been limited to no progress over the last 12 years to relax constraints, particularly in the River Murray upstream of the South Australian Broder and in the Goulburn, despite the commitments made under the SDLAM for a significant offset to the water recovery target. In comparison, South Australia is ready to receive flows up to 80,000 ML/day at the border.

The 2025 Basin Plan Evaluation found that only small amounts of environmental water are currently reaching floodplains. Initial SDL assessments have also indicated that current barriers to connectivity will have significant effect on floodplains and wetland health if minimum water requirements are not delivered.

4.8.2 Constraints Relaxation Implementation Roadmap

The Constraints Relaxation Implementation Roadmap was developed by the Authority in 2024 to assist the Australian Government and Basin States to identify, develop and implement measures to relax constraints to the delivery of water for the environment.

The Constraints Relaxation Implementation Roadmap states that delivery must put landholders and communities at the centre, provide stable funding and build trust through gradual, practical

demonstrations of benefit. The Roadmap also provides alternative target flow rates for the Goulburn and River Murray systems.

Whilst the South Australian Government supports the recommendations for implementation made in the Authority's Roadmap, it does not support that the 'Goulburn and Murray flow rates proposed previously were conceptual and lacked community support and that the 80,000 ML/day operational target at the South Australian border is no longer practical'. The Goulburn and River Murray target flow rates were based on the best available science at the time and supported by hydrological modelling. These flow rates were also supported by New South Wales and Victorian Governments through commitment to the 2013 Constraints Management Strategy as part of SDLAM.

There is a misconception within some parts of the southern-connected Basin that the delivery of flows of up to 80,000 ML/day at the South Australian border directly correlates to flooding in areas upstream. The flow at the South Australian border comprises cumulative flows from the various upstream systems and can be created in many ways and the proposed lower flow rates in the Roadmap do not require abandoning the 80,000 ML/day target at the South Australian border.

As recommended by the Roadmap, an Independent Panel has been established to investigate and provide advice to Ministerial Council on how to progress constraints along the River Murray (from Hume Dam to the South Australian Border) and the Goulburn River. An interim report is due in June 2026.

There are also options for the partial relaxation of constraints that could materially increase the deliverability of environmental water. This includes the increase to 22,000 ML/day at Yarrawonga Weir during winter and spring when environmental water is being delivered to the Barmah-Millewa Forest. Ministerial Council was advised in December 2019, that previous investigations had identified that this restriction could be eased by resolving a relatively small number (less than 20) of access issues. Ministers agreed that the Authority would lead the development of a proposal for works, considering property access and inundation concerns, to restore the capacity downstream of Yarrawonga Weir to previous operational thresholds to allow expanded delivery options during periods when it is desirable to inundate parts of the Barmah Millewa forest. This proposal was not progressed at the time due to interactions with the SDLAM constraints relaxation project.

Recommendation

It is recommended that:

- *The relaxation of constraints remains a priority for Basin States in a form decoupled from the SDLAM and via an alternative funding stream.*
- *If full constraints relaxation cannot be achieved then lower rates should be pursued as far as practicable. These must be accompanied by a set of on-ground works that focuses on reducing commence-to-flow thresholds for connected wetlands and looks at alternative ways of delivering overbank flows.*
- *The recommendations of the Roadmap should continue to be progressed, including pursuing constraints relaxation up to the proposed flow rates as a minimum, and without abandoning the 80,000 ML/day target for the South Australian border.*

5 Addressing First Nations' Water Interests

Key messages

- There is a strong and enduring First Nations' connection to the River Murray in South Australia, to the Lower Lakes, the Coorong and Murray Mouth.
- Structural reform is required to advance First Nations' water rights and interests across the Basin and to move beyond consultation.
- The South Australian Government continues to integrate First Nations' knowledge into water planning, monitoring and management and is co-designing a state Framework to Advance First Nations' Water Interests.
- South Australia supports embedding clear, measurable First Nations' objectives and outcomes in the Basin Plan.

5.1 Traditional Owners of the SA Murray-Darling Basin

First Nations people of the South Australian Murray-Darling Basin have occupied, enjoyed and managed their lands and waters since time immemorial. Their deep cultural, social, environmental, spiritual and economic connection to Country continues today.

The Traditional Owners of the lands and waters within the South Australian Murray-Darling Basin span across a number of First Nations groups, including the First Peoples of the River Murray and Mallee, Ngarrindjeri, Peramangk, Nganguruku, First Nations of the South East, Ngadjuri, Kaurna, Adnyamathanha and Wilyakali Peoples. It is recognised that there are language groups within these First Nations groups. The collective knowledges, values and perspectives shared by these First Nations groups overtime have been crucial to improving outcomes for the Basin's environmental, social and cultural values.

Each of these First Nations groups has been involved in the development of South Australia's water resource plans. The South Australian Government engages with the First Nations in the South Australian Murray-Darling Basin through various mechanisms based on the needs, interests and capacity of each Nation. Engagement in water resource planning and management is well-progressed for those First Nations closely associated with Murrundi (the River Murray) given the significant Commonwealth and State investment in restoring environmental flows to the River as well as the profound cultural significance of Murrundi to the River Nations. However, it is recognised that all waters within the South Australian Murray-Darling Basin are essential to the health of Country and communities.

5.2 Opportunities to Improve First Nations' Outcomes under the Basin Plan

5.2.1 Objectives and Outcomes for First Nations' Basin Communities

The South Australian Government supports the Authority's proposal to develop a specific set of First Nations' objectives and outcomes as well as to integrate First Nations' matters into the existing Basin Plan provisions.

Whilst further discussion and planning with First Nations communities will need to occur before reaching the next stage of drafting of explicit objectives and outcomes, the South Australian Government agrees

that the effectiveness of this process could be supported by establishing an agreed set of principles that provide policy guidance in the development process. Based on engagement with the Authority and First Nations communities in the lead-up to the Basin Plan Review, the South Australian Government recommends that this process be guided by the following:

- Objectives and outcomes sufficiently address all elements of the new First Nations purpose of the Basin Plan.
- Objectives and outcomes can be translated into measurable and meaningful indicators of progress against each of the elements of the First Nations purpose, including at the local, catchment and Basin scales.
- Objectives and outcomes are established with sufficient flexibility to accommodate differences between First Nations groups' values, priorities and practices, but are prescriptive enough to ensure Basin Governments are accountable for meeting their obligations to support progress towards First Nations outcomes.
- Objectives and outcomes and supporting MER activities for the purposes of tracking progress do not duplicate, but are consistent with and complement, existing agreements between Governments and First Nations peoples.
- Objectives and outcomes and the activities required to support their progress are established proportionate to the levels of resourcing and capacity available to Basin States.

These measures will need to be complemented by substantive provisions if they are to translate into enforceable rights, including in relation to cultural objectives. Further, whilst First Nations groups are invited to participate in planning, they have no real authority over where, how or when water is used; that power sits with governments. Structural reform is required to properly address these limitations, with this being discussed in more detail in section 5.2.2, below.

5.2.2 Beyond Basin Plan Objectives and Outcomes

The South Australian Government supports the Authority's proposals to address First Nations' water interests through amendments to Basin Plan objectives and outcomes. However, it is also acknowledged that the broader water governance in the Basin continues to operate through complex cross-jurisdictional frameworks that risk the subordination of First Nations' peoples, including where First Nations' cultural values and relationships with Country are inadequately reflected in legal and institutional arrangements.

Environmental water allocation is primarily governed by the Water Act, Basin Plan and Basin State legislative frameworks, which prioritise ecological over cultural outcomes. This creates a fundamental tension whereby Indigenous cultural objectives can only be pursued when they align with environmental targets or after all environmental requirements are met.

The *Water Amendment Restoring Our Rivers Act 2023* (Cth), and the corresponding changes to the Water Act, has broadened opportunities for First Nations' involvement in environmental watering and associated activities, yet structural barriers persist. First Nations' water dispossession has created significant ongoing inequalities, with limited recognition of 'cultural flows' or First Nations' knowledge systems within existing legal frameworks.

A fundamental shift is required in how Basin water management incorporates First Nations' rights and interests. To respectfully and effectively progress this shift, the South Australian Government recommends that the Authority considers the initiatives below. These initiatives would contribute to Outcome 15 of Closing the Gap, which is for '*Aboriginal and Torres Strait Islander people to maintain a*

distinctive cultural, spiritual, physical and economic relationship with their land and waters'.[98] They would also contribute to implementation of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), which Australia adopted at the United Nations General Assembly in 2009.

- **Addressing legal barriers:** Genuine self-determination cannot be readily realised within the context of existing legal frameworks in the Basin. The Basin Plan Review is required to consider a range of issues relevant to First Nations' water rights and interests. Accordingly, the Authority should fully explore opportunities for reform that facilitate Traditional Owner aspirations across the Basin.
- **Indigenous-led MER:** There is currently no formal framework led by First Nations groups for assessing the effectiveness of initiatives that seek to improve outcomes for those groups throughout the Basin. This ought to be remedied, starting with Traditional Owners being appropriately supported to develop a set of indicators against which to measure and report program success.
- **Indigenous knowledge and cultural indicators:** Whilst it is widely acknowledged that there is often an overlap between environmental and cultural outcomes, they are not one and the same. The development of cultural indicators based on cultural knowledge that is then formally embedded in law and policy, is necessary to improve broader outcomes under the Basin Plan and water initiatives more generally.
- **Identifying immediate opportunities for decision-making authority:** The Authority should work with interested Traditional Owners to identify immediate opportunities within the current water law and governance framework for their communities to exercise decision-making authority in relation to their Country. This will help to build on the strengths of the current water governance arrangements in the short term (whilst working on longer-term, systemic changes).
- **Establishing genuine partnership arrangements:** Closing the Gap calls for the formation of genuine partnerships between First Nations' peoples and governments, which are characterised by an equal distribution of rights and decision-making power. While strong partnerships and relationships have been developed between Basin States and First Nations groups throughout the Basin, there is room to enhance these arrangements.

The next iteration of the Basin Plan should work towards establishing more formal partnership arrangements with Traditional Owner groups. This will require, in some instances, resources to be directed to these groups to augment their capacity to engage on a level playing field, as well as to implement specific projects and initiatives. The Authority should seek to identify both partnership opportunities that can be implemented within the short-term under existing frameworks, as well as those that require structural change.

- **Resourcing and capacity:** To ensure that proposed regulatory and/or management changes are targeted and effective, the Authority should consider the areas where Basin States already have a level of First Nations' involvement within their Basin management frameworks. Embedding First Nations' involvement in further aspects of Basin Plan implementation will require additional resourcing and capacity for Basin States and importantly for First Nations' representatives. Long-term resourcing needs to be made available to support this increased effort and to build capacity within First Nations groups to ensure meaningful involvement.

It is also critical to acknowledge that the desired level of involvement, existing capacity and knowledge continues to vary between First Nations groups. Arrangements will need to be flexible to suit the needs

[98] Department of the Prime Minister and Cabinet (2020), *The National Agreement on Closing the Gap – Objectives and outcomes*. Found at: Closing the Gap targets and outcomes | Closing the Gap

and preferences of First Nations' peoples and avoid increasing the burden on the same individuals. Principles of Free, Prior and Informed Consent and self-determination should drive the involvement of First Nations peoples in delivery of Basin Plan objectives and outcomes.

Without adequate resourcing and genuine commitment to reform, proposals to advance First Nations' water interests remain theoretical. Implementation of changes to Basin water management regulation and practices must respect First Nations' self-determination principles, allowing Nations to determine their own priorities and governance processes while working toward the shared goal of caring for Country and achieving Indigenous social, cultural and economic aspirations.

5.3 First Nations' Knowledge embedded within Water Management in South Australia

This section outlines South Australia's initiatives which incorporate First Nations' knowledge in water planning, monitoring and management. As noted above, broader structural reform – legal, institutional and financial – is required to ensure that these initiatives can be expanded into a coherent and enduring framework that recognises and gives effect to First Nations rights and interests across all levels of water governance.

5.3.1 Preparation of Long-term Watering Plans

The objectives, targets and environmental watering requirements outlined in the South Australian River Murray LTWP are deeply intertwined with South Australian First Nations' cultural values for maintaining the connection between the River and Land and people across the River Murray and the CLLMM. In the 2025 review of the SA River Murray LTWP, input was sought from the First Nations groups of the region via working groups, workshops and On Country tours, enabling conversations about the influence of the SA River Murray LTWP on their cultural values and the results from delivering water at various times and locations. Accordingly, the planning and delivery of environmental water in the SA River Murray considers the outcomes sought by First Nations' people, including a desire to see flows that mimic the natural rhythms of the River Murray and the protection of culturally significant species.

5.3.2 Annual Environmental Water Planning and Delivery

First Nations groups play an ongoing role in shaping the development of annual environmental watering plans and priorities each year for the SA River Murray. Early in each planning cycle, On Country workshops are held with each Nation to identify cultural values and outcomes relevant to potential watering actions across the River Murray channel, floodplains and wetlands.

During the planning and delivery phases, site managers regularly seek input from First Nations, including RMMAC, NAC and the First Nations of the South East, to ensure cultural priorities and local knowledge are incorporated into environmental watering planning and delivery. Cultural values identified through yarning circles are a valuable source of information and were built on through this engagement process.

5.3.3 Cultural Monitoring

In South Australia, First Nations' involvement in environmental watering is not limited to planning processes and Nations are active in contributing their sciences, knowledges and values to operational decision-making and data collection throughout the year.

5.3.3.1 Aboriginal Waterways Assessments

Aboriginal Waterways Assessments (AWAs) are a tool used by Traditional Owners to assess the cultural values of wetlands and other important sites to support environmental water and wetland management

planning. AWAs are being undertaken across a range of wetland and floodplain sites in South Australia and provide a valuable means of furthering Connections to Country, as well as sharing knowledge and informing watering and other management activities. The exchange of information between Traditional Owners and site managers during these assessments continues to influence real-time water delivery and provides useful context for future water planning. Whenever feasible, these assessments are undertaken prior to, during and following environmental watering.

5.3.3.2 Fauna Monitoring

The Ngarrindjeri community, in conjunction with scientists and water managers, undertake a range of cultural monitoring programs and activities on culturally significant fauna including the thukabi (turtle), kaltuwari (yabby), Pondi (Murray cod) and lokeri (freshwater mussel). Establishing cultural monitoring programs for each of these faunae has led to new knowledges and outcomes that have informed updated objectives, targets and complementary actions recommended as part of the 2025 review of the CLLMM PEA.[99] These recommendations were subsequently embedded in the SA Murray LTWP.[100]

5.3.3.3 Thukabi Monitoring Project

The thukabi monitoring project, co-developed by the NAC and Adelaide University, emerged from Ngarrindjeri Yarning Circles in 2021, where thukabi was identified as a culturally significant Ngatji (totemic species) under threat and in need of dedicated monitoring. Annual monitoring has been undertaken since 2023 to assess thukabi abundance, condition and recruitment.[101] Monitoring began at 10 wetland sites in February 2023, with two Ngarrindjeri community members participating on rotation. Strong community interest and additional funding from the Murraylands and Riverland Landscape Board enabled expansion to 16 sites and increased community involvement. Early results were dominated by mature adults, indicating potential recruitment issues and the need for continued monitoring.

5.3.3.4 Kaltuwari Monitoring

Kaltuwari is a Ngartji (totemic species) for the Ngarrindjeri and an important cultural food. Since 2022, kaltuwari monitoring data has been collected annually by the Ngarrindjeri community members, including measurements of kaltuwari sizes to examine links between recruitment and water levels and other environmental factors (e.g. annual variations in spring water temperatures).[102] To assist in promoting the restoration of kaltuwari abundance, the 2025 updates to the SA Murray LTWP include complementary actions that include improved management of take of kaltuwari populations from recreational activities.[103]

5.3.3.5 Pondi Monitoring

Pondi (Murray cod) is culturally central to First Nations people and monitoring its health was identified as a priority by the NAC and RMMAC. With support from Cultural Advisors and the CEWH, South Australian Research and Development Institute (SARDI) scientists worked with NAC and RMMAC rangers

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[99] DEW (2025), Review and update of the ecological objectives and targets for the Coorong, Lower Lakes and Murray Mouth priority environmental asset. Department for Environment and Water, Adelaide.

[100] DEW (2025), Long-term environmental watering plan for the South Australian River Murray Water Resource Plan Area. Department for Environment and Water, Adelaide.

[101] DEW (2025), South Australian River Murray Water for the Environment Report 2023-24. Department for Environment and Water, Adelaide.

[102] DEW (2023), SA River Murray Flow Report. Department for Environment and Water, Adelaide.
Found at: RM-Flow-Report_2023 03 10_FINAL.pdf

[103] DEW (2025), Long-term environmental watering plan for the South Australian River Murray Water Resource Plan Area. Department for Environment and Water, Adelaide.

to co-design a monitoring program that also engaged Elders and community. In February 2025, six rangers and two SARDI researchers undertook collaborative Pondi monitoring across multiple sites, where fish were measured, weighed, tagged, sampled for DNA and released near their capture point.[104] With data contributing to the Flow-MER Program to inform environmental water management, this project exemplifies genuine partnerships between First Nations groups, scientists and water managers, demonstrating the value of combining cultural knowledge and Western science.

5.3.4 *Healthy Coorong, Healthy Basin*

In recognition of the intrinsic link between the health of the Coorong and the wellbeing of the Ngarrindjeri and First Nations of the South East, the *Healthy Coorong, Healthy Basin* (HCHB) First Nations Partnership project was established to improve opportunities for First Nations' knowledge, values and interests to inform natural resource management approaches in the region. First Nations partnerships are integral to the success of HCHB, bringing together local, cultural knowledge and perspectives.

Since 2018, the HCHB Program has supported a suite of initiatives that strengthen the integration of First Nations' knowledge in Coorong management and further enable First Nations groups to meet their cultural obligation to care for and manage Country. Some of the key HCHB projects that have improved the integration of First Nations' science and knowledges in water management are described below.

5.3.4.1 Ngarrindjeri Knowledge Research Project

Ngarrindjeri philosophies and knowledge are built on generations of cultural knowledge that has been passed down through generations, which give an understanding of the region's ecology and how it has changed and adapted over time. To ensure the preservation and recognition of the value of Ngarrindjeri peoples' deep understanding of the Coorong, the Ngarrindjeri Knowledge Project documents an understanding of the methods, knowledge and cultural values of the Ngarrindjeri people, enabling this knowledge to inform current and future management of the Coorong.[105]

Ngarrindjeri Information Management System

Led by the NAC with support from DEW, Flinders University, Environmental Systems Solutions and Nature Glenelg Trust, the Ngarrindjeri Knowledge Research project will deliver a culturally appropriate, Ngarrindjeri-owned Information Management System (database) that can be applied to Coorong management decisions. The secure, user-friendly database enables Ngarrindjeri to collect, map, store, present, summarise, protect and selectively share cultural and environmental information, supporting their involvement in research and decision-making. Outcomes envisaged include increased opportunities for Ngarrindjeri people to participate and engage in the systematic collection of new knowledge and respectful application of Ngarrindjeri Knowledge to site decision-making.[106]

Teringie Wetlands On-Ground Works Project

The Teringie Wetlands form part of the TLM CLLMM Icon Site and sit beside the Coorong and Lakes Alexandrina and Albert Wetland Ramsar site. Their shallow-water and mudflat habitats provide critical foraging areas for shorebirds. The wetlands comprise three basins that have become increasingly degraded due to reduced connectivity, infrequent inundation, groundwater salinity, pest plants and

[104] Ye Q, Giatas G, Bice C, Brookes J, Gibbs M, Nicol J, Gervais C, Giles S, Hipsey M, Hoang V, Kartinyeri A, Kurucz K, Montazeri M, Sutcliffe M, Wallace C, Wilson W, Zampatti B and Zhai S (2026). *Lower Murray and Coorong, Lower Lakes and Murray Mouth Annual Report 2024-25*. Flow-MER Program, Department of Climate Change, Energy, the Environment and Water, Canberra.

[105] DEW (2023), *Healthy Coorong, Healthy Basin Trials and Investigations Project key findings*. Department for Environment and Water, Adelaide. Found at: HCHB-TI-Project-Key-Findings-2023.pdf

[106] Australian Water Partnership. Coorong management embracing Ngarringdjeri Knowledge. Found at: https://waterpartnership.org.au/news-item/coorong-management-embracing-ngarrindjeri-knowledge/

biodiversity loss. The wetlands hold deep cultural significance to Ngarrindjeri people and support several Ngartji (totemic species) including migratory shorebirds and other waterbirds such as wa:nyi (ducks), no:ri (pelicans), and kungari (swans), as well as wunggi (native aquatic plants that shelter fish), ngamurunyi (Ruppia), pantanuki (water ribbons) and bilbili (weaving rushes).

Through collaboration between the NAC, Raukkan Community Council and the Murraylands and Riverland Landscape Board, the HCHB Teringie Wetlands On-Ground Works project aims to restore wetland habitat using small-scale water infrastructure, guided by Ngarrindjeri Knowledge.[107] The works now allow water levels to be managed to mimic natural pre-regulation conditions, increasing inundation extent and duration and expanding foraging habitat by 82 percent (an additional 18 hectares). Completed in 2024, these improved connectivity outcomes will support ongoing Coorong restoration and Ngarrindjeri wellbeing.

The Coorong Freshwater Soaks Project

In 2023, the South Australian Government commissioned a collaborative study to address critical knowledge gaps in the condition and status of the CLLMM region's freshwater soaks, led by the Ngarrindjeri and First Nations of the South East.[108],[109] These Nations have maintained soaks in the Coorong region for thousands of years and caring for their health and wellbeing is an important part of First Nations' obligations in caring for Country. The soaks are vital refuges for native wildlife, including wallabies, wombats, emus, spotted marsh frogs and herons but also attract feral cats and fallow deer.

Using scientific research from the 1980s–2000s, the project combined literature reviews, cultural assessments, citizen science and ecological and geohydrological studies to assess the condition of Coorong soaks, integrating First Nations knowledge with contemporary science through workshops and fieldwork. Building on the initial project, the CLLMM Research Centre continues to work with the Ngarrindjeri and First Nations of the South East to protect important freshwater resources in the CLLMM region, including those on the Younghusband Peninsula under a changing climate.[110]

Yarning circles with senior Ngarrindjeri men, project staff and Meningie Indigenous Rangers have added cultural insight, documenting major changes in Ruwe (Country) over time. Elders noted that many soaks have dried, shifted or expanded, kunggari (black swans) now breed year-round, and migratory bird patterns and water quality have changed significantly.[111]

5.4 Co-designing the South Australian Framework to Advance First Nations' Water Interests

Over the course of South Australia's history in managing the River Murray System, the initiatives described above provide an indication of the progress that has been made in recognising the value of

[107] DEW (2024) *Restoring wetland habitat at Teringie Wetlands*. Department for Environment and Water, Adelaide. Found at: https://www.environment.sa.gov.au/topics/water-and-river-murray/projects-plans-security-and-legislation/water-projects/coorong/current-projects/on-ground-works/ogw-teringie

[108] A soak, or soakage, is a source of water often stored below ground, sometimes as part of an ephemeral river or creek. The name 'soak' refers to the way water seeps into the sand. Freshwater soaks exist provide a critical source of fresh water for Coorong fauna like kangaroos, emus and other coastal and woodland bird species.

[109] DEW (2023) *Coorong Freshwater Soaks project*. Department for Environment and Water, Adelaide. Found at: https://www.environment.sa.gov.au/topics/water-and-river-murray/projects-plans-security-and-legislation/water-projects/coorong/completed-projects/coorong-soaks

[110] Goyder Institute for Water Research (2025) *Hydrology of freshwater soaks on the Younghusband Peninsula in a changing climate*. Found at: Hydrology of freshwater soaks on the Younghusband Peninsula in a changing climate

[111] Goyder Institute for Water Research (2025), *Sharing Knowledge on Country: Freshwater Soaks Workshop*. Found at: Sharing Knowledge on Country: Freshwater Soaks Workshop | CLLMM Research Centre

First Nations' unique perspectives and contributions to water management. However, it is also acknowledged that there is a need to build on the outcomes and momentum generated through previous efforts to further advance the water interests of South Australia's First Nations groups, particularly to ensure opportunities across the whole of the state.

Throughout 2025, the South Australian Government hosted a series of in-person workshops with First Nations' peoples to inform the co-design of a South Australian Framework to Advance First Nations' Water Interests (the Framework) with Traditional Owners. With representation from each of South Australia's Prescribed Body Corporates (PBCs) and First Nations general community members, the workshops sought to understand the issues, concerns and aspirations of First Nations peoples regarding access to water for spiritual, cultural, social, environmental and economic purposes.

Facilitated by South Australian Aboriginal-owned business KSJ Consulting Service Pty Ltd, feedback was captured via a variety of formats to ensure full opportunity to participate, including in-session notes, feedback workbooks and Mentimeter (a web-based platform allowing anonymous questions and feedback). Following Round 1 (January to April 2025) and Round 2 (July to August 2025), Listening Reports were published to present the feedback received throughout the workshops as well as a synthesis of common themes and challenges.

Drawing on the concerns, aspirations and priorities for water planning and management shared by Aboriginal peoples during the workshop phase, the Framework will include a set of guiding principles for working together along with directional strategies that need to progress to recognise Aboriginal water rights and interests and secure access to water – to improve the spiritual, cultural, environmental, social and economic conditions of Aboriginal peoples. It will also set out actions needed to progress state and national commitments, including under the National Agreement on Closing the Gap.

Specifically, the Framework will identify actions to:

- Strengthen recognition of cultural authority in water planning and management.
- Secure access to water for economic, social, environmental, spiritual and cultural purposes.
- Increase First Nations' ownership of water entitlements.
- Secure safe and reliable access to water for regional and remote communities.
- Ensure there is a consistent approach to First Nations' water interests within the state, while allowing for flexibility to meet individual group needs.

6 Social and Economic Issues and Outcomes

Key messages

- Water reform and recovery have had a significant influence on Basin communities, but broader external market forces remain the biggest driver of socio-economic change. However, it is essential to acknowledge that impacts have varied significantly between regions, industry sectors and communities.
- Basin Plan water efficiency programs have delivered major economic, social and environmental benefits in South Australia.
- Where on-farm infrastructure upgrades have occurred, there have been benefits from increased economic activity at a broader regional scale, stimulated by the construction phase as well as the increased intensity of agricultural production.
- Where socio-economic impacts are attributed to water recovery, there is a need for well-planned structural adjustment programs to ensure the broader community is supported to thrive and adapt to reduced water availability and climate change. Additional support is also required for irrigators and the community to transition to a low water use future.
- A long-term socio-economic monitoring program is required to consistently capture the data needed to identify socio-economic changes at local scales across the Basin, including the combined effects of climate change, water recovery and water market dynamics on future water availability and community resilience.

6.1 The River Murray: Sustaining South Australian Communities

The River Murray is the lifeblood of South Australia – it is essential to the economic, social, cultural and environmental wellbeing of South Australians.

As the largest reliable surface water resource in South Australia, the River Murray supplies drinking water to metropolitan Adelaide and regional towns and communities across the state, as well as water for irrigation, industry, tourism, recreation and vital wetlands and ecosystems. It is also of significant cultural, spiritual, social and economic value to First Nations people.

The River Murray flows through the Murraylands and Riverland region and is home to more than 70,000 people in seven major centres. The region supports over 6,500 businesses and employment for 32,300 people.[112] It includes several of South Australia's premium tourism destinations along the River Murray and the Coorong.

The region supports an extensive agricultural industry, with a strong focus on primary production, including broadacre grains, livestock, dairy and horticulture (fruit, nuts and wine grapes). A significant economic contributor to the region, agriculture accounts for 33 percent of the total 'value-added' or net output.[113] Irrigated agriculture, in particular, drives direct employment and revenue in communities and stimulates broader economic activity through job creation and business turnover, supporting other important industries such as food processing, tourism, marketing, transport, and logistics.

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[112] Regional Development Australia, Murraylands and Riverland regional profile, 2023. Found at: https://rdamr.com.au/wp-content/uploads/2023/04/RDAMR-Regional-Profile_2023-01-31-REDUCED.pdf

[113] Regional Development Australia, Murraylands and Riverland community and economic profile. https://profile.id.com.au/rda-murraylands-riverland

6.2 Socio-Economic Outcomes across the Basin

Notwithstanding the crucial role of water in underpinning the prosperity of Basin industries and communities, recognition of the finite and increasingly scarce nature of Basin water resources over time has informed limits on the amounts of water that can be taken for consumptive purposes. However, whilst it is widely understood that the overallocation and overextraction of water resources represent threats to the full suite of the Basin's economic, social, cultural and environmental values, significant concerns have persisted about the impacts of water take limits and associated water reform initiatives on the livelihoods of Basin communities and industries.

6.2.1 Socio-Economic Changes across the Basin

In 2007, the Australian Government commenced purchasing Murray-Darling Basin water entitlements to address over-allocation and restore environmental health. Since this time, communities across the Basin, including in South Australia, have undergone significant changes. The purchase of water entitlements for the environment has reduced the volume available for consumptive uses. These impacts have been one of several complex and compounding pressures being experienced by the agricultural sector and Basin communities, including climate variability, global market changes and climate change adaptation and response.

Irrigated crop types have changed since the commencement of water purchasing due to water availability, water trade and broader economic, environmental and social factors. In the Murraylands and Riverland region, the change in plantings between 2003 to 2024 is as follows:[114]

- Almond plantings – 3,150 to 14,480 ha (increase)
- Wine grape plantings – 30,280 to 26,175 ha (decrease)
- Citrus plantings – 7,420 to 6,740 ha (decrease)
- Stone fruit plantings – 1,565 to 485 ha (decrease)
- Field crops – 13,705 to 9,200 ha (decrease)
- Vegetable crops – 6,000 to 6,405 ha (increase)

Wine Grape plantings have further decreased, with latest Wine Australia data indicating the Riverland currently has approximately 22,032 ha, a decrease of over 25% during this period. Langhorne Creek region plantings are currently at just over 5,500ha, this being relatively stable over the same period.

Agriculture currently contributes nearly $750 million in farm-gate value within the River Murray corridor of South Australia. This estimate reflects primary production only and excludes the substantial additional value created through niche cropping, food, wine and beverage processing, logistics, and other downstream value-adding activities.[115]

At a whole of Basin scale, the Basin Plan Evaluation and Basin Plan Review have found that the gross values of agricultural production, gross value of irrigated agricultural production and business turnover have grown and are trending upwards. Regional economic conditions and trajectories across the Basin (including population and unemployment) are also largely consistent with the rest of regional Australia

[114] SunRISE Mapping and Research (2025) *Irrigated Crop Area Data for the Lower Murray-Darling 2003 to 2024: Final Report*. Found at: https://www.mdba.gov.au/sites/default/files/publications/final-report-irrigated-crop-area-data-for-the-lower-murray-darling-2003-to-2024.pdf

[115] RDA Adelaide Hills, Fleurieu and Kangaroo Island Economy, Jobs, and Business Insights | Regional Exports, Industries | REMPLAN

and reflect broader trends across regional areas as well as most Organisation for Economic Cooperation and Development (OECD) countries.

Whilst these findings suggest that the Basin Plan and water recovery have had limited impact on the overall Basin economy and socio-economic conditions, it is essential to acknowledge that impacts have varied significantly between regions, industry sectors and communities. Overall, the Basin Plan reforms have been a factor in structural change in communities, with some regions and individuals impacted more than others.

Large regional centres with bigger populations and greater economic diversification have generally been less impacted and have adjusted better to lower water availability than smaller communities with a heavy focus on irrigated agriculture. Individual experiences have also varied greatly depending on specific circumstances and whether they participated in buy backs or on-farm efficiency programs. Specific impacts on local value-added food, wine and beverage sectors are also not captured if irrigated agriculture production is used as the key benchmark.

Water recovery has also had implications for irrigation infrastructure operators (IIOs) which have had to deal with a reducing customer base and income stream. IIOs have had to adapt to a new operating conditions and utilising capital and other funding sources to ensure the ongoing viability of their organisations, as well as their customers who are reliant on the delivery of water through the networks of pumps and pipelines in which they have made significant investment.

6.2.2 Identifying Drivers of Socio-Economic Outcomes

Since the commencement of Basin water reforms, including the purchase of water entitlements across the Basin and the unbundling of water entitlements from land, a substantial body of evidence has developed on the drivers and distribution of social and economic impacts across Basin communities. However, identifying and modelling the socio-economic outcomes from the Basin Plan is a difficult and often contested space.

Through socio-economic monitoring and evaluation activities undertaken by the Authority and the Australian Government, as well as findings from independent studies and reviews (including the MDBRC[116] and a review of the economic literature on the outcomes of water recovery in the Basin undertaken for the Authority[117]), the prevailing consensus is that majority of the changes to socio-economic conditions throughout the Basin have been driven by factors other than water reform. These have included: international trade dynamics, fluctuations in commodity and input prices, farm consolidation, technology and innovation, climate variability and evolving lifestyle preferences among regional populations.

Likewise, the Regulation Impact Statement (RIS) prepared in 2012 for the purposes of informing the Minister's decision to adopt the Basin Plan expressly states that:

> *the socioeconomic implications of the Basin Plan need to be considered in the context of the long-run economic, demographic and social changes occurring across Basin communities. The effects of the Basin Plan need to be distinguished from these changes... With or without a Basin Plan, in the longer-term, social and economic outcomes in the Basin will be driven largely by external factors*.

[116] MDBRC (2019), p 390.

[117] Wheeler SA, Xu Y, Zuo A, Haensch J, and Seidl C. (2022) *Exploring the economic values of the Murray-Darling Basin and rating the quality assessment of water recovery economic studies*, The University of Adelaide.
Found at: https://www.mdba.gov.au/sites/default/files/publications/mdb-outlook-economic-literature-review2.pdf

The socio-economic benefits from Basin Plan implementation and environmental water recovery and use are often overlooked and rarely quantified. These benefits have substantial value and will only be seen with the delivery of environmental water, including decreased incidence and severity of water quality events, improved ecological populations and habitats and improved aesthetics.

Early adopters engaged in environmental water delivery and river-based tourism are beginning to mature, supported by increased certainty around environmental water availability and a growing recognition of the resulting environmental benefits. This has strengthened connections with non-government organisations and river-based operators seeking to utilise and optimise the positive social, economic and environmental outcomes associated with environmental watering.

The realisation of these benefits will also deliver the outcomes for the environment that agricultural communities in South Australia expected from Basin Plan water recovery.

To appropriately consider how the impacts have varied significantly between regions and communities, there is a need to considerably improve how socio-economic impacts are transparently and independently monitored and reported at a localised scale across the Basin. While aggregate indicators (including those used in the Basin Plan Evaluation) may assist in identifying broad trends, they may be less effective in reflecting localised impacts on industry corporatisation, sector employment, service demand, use of shared infrastructure, business activity and community confidence. This may be relevant in considering how policy settings support communities to adjust to change, retain economic activity and maintain social and economic stability.

Whilst the presence of external drivers has made it difficult to attribute the specific contributors and magnitude in which water reform has impacted Basin communities, the South Australian Government recognises that its Basin communities, including those in the Murraylands and Riverland Region, have been exposed to significant changes over the last two decades.

In the 2020 *Independent assessment of social and economic conditions in the Murray–Darling Basin* ('the Sefton Review'), it was found that water recovery programs rolled out over the course of implementing the Basin Plan, including infrastructure efficiency measures and voluntary water entitlement purchases (i.e. 'buy backs'), had caused disproportionate impacts for some of the Basin's smaller, more remote and irrigator-dependent communities.[118]

It is important that where there are demonstrated adverse impacts on communities, well-planned structural adjustment programs are implemented to ensure the broader community is supported to thrive. These programs should be delivered in a coordinated and integrated manner with other government support programs to mitigate the socio-economic impacts of climate change and general regional transition to maximise benefits to the community.

6.3 Building Resilience through Efficiency Measures

Despite the findings presented in the Sefton Review, the potential for socio-economic impacts from water recovery among South Australian communities have often been avoided or mitigated through the implementation of well-planned investment in infrastructure programs that recover water savings for the environment.

South Australia has a long history of implementing improvements to irrigation efficiency along the River Murray to reduce water use and to address land degradation and salinity impacts. Since the 1970s, key

[118] Sefton R, Peterson D, Woods R, Kassebaum A, McKenzie D, Simpson B and Ramsay M (2020) *Final Report: Independent assessment of social and economic conditions in the Murray–Darling Basin*. Panel for Independent Assessment of Social and Economic Conditions in the Murray Darling Basin, Melbourne.
Found at: https://www.mdba.gov.au/sites/default/files/publications/seftons-report-september-2020.pdf

efficiency actions have included the replacement of irrigation delivery channels with pipes, upgrading irrigation systems from flood and furrow to sprinkler and drip, development of Land and Water Management Plans, promotion of irrigation efficiency through education and training, and implementing water use efficiency criteria through successive Water Allocation Plans for the River Murray Prescribed Watercourse.

Since the 2008 Intergovernmental Agreement on Murray-Darling Basin Reform, improvements in irrigation efficiency in South Australia have been driven through on-farm and off-farm efficiency infrastructure projects delivered under Commonwealth water recovery programs including the Sustainable Rural Water Use and Infrastructure Program (SRWUIP), South Australian River Murray Sustainability (SARMS) program, Commonwealth On-Farm Further Irrigation Efficiency (COFFIE) program and Water Efficiency Program (WEP).

On-farm efficiency projects have benefited both individual irrigators and broader regional communities through increased productive capacity and climate resilience, whilst off-farm efficiency projects have better prepared the water delivery networks for the future, to underpin climate-resilient primary production.

Throughout the Basin, infrastructure and efficiency projects have recovered around 720 GL of water for the environment whilst generating significant benefits for individual irrigator businesses, communities and the broader Basin agricultural sector.[119] Socioeconomic analyses of the impacts of water reform at the Basin scale have shown that grant recipients of on-farm infrastructures upgrades have benefited from significant expansion of irrigated area, farm gate production and water use.

Beyond the farm gate, regions where on-farm infrastructure upgrades have occurred have also benefited from increased economic activity at the broader regional scale, stimulated by the construction phase as well as the increased intensity of agricultural production. Overall, the benefits generated through infrastructure efficiency projects have meant that, despite concerns about the potential impacts of water recovery on Basin communities, the Basin economy and agricultural sector have continued to grow over the course of Basin Plan implementation.

6.3.1 Water Efficiency Programs in South Australia

6.3.1.1 SA River Murray Sustainability Program and Sustainable Rural Water Use and Infrastructure Program

Consistent with the trends identified at the Basin scale, the implementation of infrastructure efficiency programs and projects has consistently generated social, economic and environmental benefits for South Australian regional businesses and communities.

Through the SRWUIP and SARMS programs, 47.3 GL was recovered through efficiency and infrastructure projects within South Australia. The programs invested in rural water use, management and efficiency, including improved water knowledge and market reform and water purchase for the environment.

By pooling funds from multiple Australian Government water reform programs, the SARMS program comprised $240 million of funding under the Irrigation Industry Improvement Program (SARMS 3IP) and $25 million under the SARMS Regional Economic Development (RED) Element. This was a unique element of the SARMS program and part of the reason for its success. In addition to water recovery through on and off farm projects and water purchase, the program included:

[119] DCCEEW (2024) *Commonwealth Water Reform in the Murray–Darling Basin: Report on the effect of the implementation of the Basin Plan on social and economic outcomes, 2020 to 2024*. Five-yearly report of the Department of Climate Change, Energy, the Environment and Water on Matter 3, Schedule 12 of the Basin Plan 2012, October 2024.

- $7.5 million to redevelop the Loxton Research Centre
- $5.0 million for an Industry-led Research Sub-program
- $12.5 million for a Regional Development and Innovation Sub-program.

Implementation of the SARMS 3IP provided grant opportunities for 255 infrastructure efficiency projects for South Australian irrigators. By investing in irrigation efficiencies, water returns, irrigation industry assistance and regional economic development, the SARMS program sought the following outcomes committed under the National Partnership Agreements:

- increased productivity of all irrigation businesses that received funding under the program
- improved water efficiency of irrigation operations in South Australia
- the creation of opportunities for economic diversification and regional development for Basin communities in South Australia

SARMS 3IP Regional Impact Analysis

Under the funding agreements, the South Australia Government was required to report on progress against the program outcomes with reference to prescribed performance indicators, including evidence of industry and community participation, changed practices or investment that support economic diversification and regional development for Basin communities.

In addressing this requirement, an independent regional economic impact analysis was undertaken on SARMS 3IP at the conclusion of the program in 2019. The analysis follows and compares the outcomes of cost benefit analysis and regional impact analysis undertaken in 2013 prior to the commencement of the program, based on modelling of the intended efficiency projects at the time. To represent the breadth of efficiency projects funded, the analysis presents outcomes across four project categories as well as for the overall region. The outcomes reported across these key indicators include:

- Regional outcomes: overall, the program will provide substantial benefits to the South Australian community with an aggregate net present value (NPV) of $253 million over 20 years.
- Permanent netting: all netting case studies returned a positive NPV, indicating that each project will generate a net benefit to the community of between $0.26 million to $6.09 million per project over 20 years.
- Off-farm improvement projects: across the twelve grants awarded to irrigation trusts, infrastructure upgrade projects resulted in reduced incidence of leakages and pipe bursts, delivered technological improvements that reduced water demand and improved production both in terms of quantity and quality.
- Value-adding equipment projects: eleven of the twelve case studies returned a positive NPV, ranging from rom -$0.37 to $14.35 million per project over 20 years.
- On-farm irrigation efficiency and operating improvements: 87 percent of case studies returned a positive NPV and are expected to generate a net benefit of $193 million over 20 years.

Benefits Beyond the Numbers – SARMS Case Studies

Complementing the quantitative program outcomes detailed in the economic analyses, monitoring and reporting activities were also undertaken to capture the lived experience of individual program participants.

Illustrating the efficiency and productivity benefits generated through permanent netting activities, in 2018 SARMS 3IP funded a three-year crop monitoring study undertaken across two netted orchard trial

sites at Loxton (apple) and Pyap (citrus).[120] Supported by the University of Adelaide, instrumentation was established at each of the sites to enable the monitoring and comparison of a range of climatic and soil water indicators between netted and control sites. Based on the monitoring results and observations reported from orchard site owners, the trial demonstrated a range of efficiency gains and business improvements associated with the use of permanent netting, including but not limited to:

- Reduced exposure to wind speeds resulting in reductions in wind blemish and improvements in fruit appearance. Significantly, observations during the trial identified a case where wind exposure was reduced by 125km/hr to 18km/hr between the control and netted trials, respectively.
- Reduced exposure to solar radiation inputs and associated evapotranspiration impacts.
- Reduced use of irrigation water of between 10 to 15 percent, paired with up to a 30 percent increase in crop yield.
- Overall improvements in consistency and fruit marketability, ultimately informing considerations to expand the netted areas of the orchard site.

Another example is an irrigation efficiency upgrade. Jubilee Almonds is a major contributor to the South Australian agricultural industry and received $5.6 million of funding under SARMS 3IP to undertake major infrastructure upgrades across its orchards. Prior to the upgrade, it was considered that the original system did not provide the orchard with a high level of water security, which relied on two manual 500kW electric pumps supplemented with a diesel booster pump to boost water flow and pressure.

Through the upgrade, the original system was replaced with four 280 kW turbine pumps with variable speed drives ranging between 40 and 650 GL per second, which improved flexibility in addressing different levels of water demand across the orchard and enabling elimination of the diesel pump altogether. As well as improved water security and flexibility, the funding was also used to achieve water efficiencies through the replacement of low throw sprinklers with a dual drip and micro sprinkler system across the orchard. The efficiencies gained through the new system included soil stabilisation, frost control, fertiliser distribution and more targeted water use.[121]

6.3.1.2 Commonwealth On-Farm Further Irrigation Efficiency (COFFIE) Program

The first efficiency measures program established as part of progressing water recovery towards the 450 GL Basin Plan target, the South Australian Pilot of the COFFIE Program operated between 2016 and 2018. The COFFIE program funded upgrades to irrigation infrastructure and other activities that improved the productivity of farm businesses. In total, the program invested $12.1 million (GST exclusive) in 66 projects to return 1.94 GL, with a median project cost of $62,533.30 and median water return of 10.8 ML.

To support the project, the Murraylands and Riverland Landscape Board undertook monitoring and an evaluation of the socio-economic outcomes of the COFFIE Program. The methodology included surveying eligible participants to review impacts of the program and measure how well key performance indicators were met. Key findings included:

- All participants reported that their projects had increased the reliability, performance and efficiency of their irrigation system.

[120] Citrus Australia. Netting more dollars for citrus growers. 2018.
Found at: https://citrusaustralia.com.au/latest-news/2018/03/netting-more-dollars-for-citrus-growers/

[121] Utility Magazine. Irrigation innovation: putting water back in the Murray. 2016. https://utilitymagazine.com.au/irrigation-innovation-putting-water-back-in-the-murray/

- Over 90 percent of participants reported that the anticipated economic benefits had been realised after completing their project.
- Over 78 percent of participants indicated that infrastructure upgrade projects had increased the quality and quantity of production outputs (i.e. crop yield).

6.3.1.3 Water Efficiency Program (WEP)

The WEP replaced COFFIE and furthered water recovery towards the 450 GL. In total, the WEP funded 28 projects in South Australia and returned 668.1 ML LTAAY for a total cost of $10,812,321 (GST inclusive). The program recovered water from on-farm, off-farm, urban, industrial and water metering infrastructure projects with project funding available for up to 1.75 times the current market value of the transferred water rights. Some case studies from the WEP can be viewed at:

https://www.dcceew.gov.au/water/policy/programs/completed/water-efficiency/case-studies

6.3.1.4 Urban Water Projects

The South Australian Government has also progressed opportunities to more effectively utilise Adelaide's recycled water and stormwater capture and re-use networks to reduce reliance on the River Murray and recover water towards the Basin Plan. In 2024, DEW and the City of Marion completed upgrades and network extensions to the existing Oaklands Park stormwater and reuse scheme to supply schools, council reserves, Flinders University and the Women's Memorial playing fields. The scheme extensions replaced 143.49 ML per year of River Murray water used for open space irrigation at these locations and returned 126.56 ML towards the 450 GL.

6.4 Restoring Our Rivers Framework

In August 2023, following advice from the Authority that the Basin Plan would not be delivered in full within the legislated 2024 deadline, Basin States (excluding Victoria) agreed a new pathway forward under the *Agreement of Murray-Darling Basin Ministers to deliver the Basin Plan in full*.

Later that year, the Australian Government passed the *Water Amendment (Restoring Our Rivers) Act 2023*, which amended the Water Act and the Basin Plan to provide more options, more time, more funding and more accountability to deliver the current Basin Plan.

As detailed in the *Restoring Our Rivers: Framework for delivering the 450 GL of additional environmental water*, the amendments have enabled the Australian Government to establish three programs as part of delivering the 450 GL by the extended deadline of 31 December 2027. Informed by consultation with Basin communities and socioeconomic research, the programs include:

- **Resilient Rivers Program** – infrastructure upgrades, rule changes, land and water partnerships, commercial mechanisms.
- **Voluntary Water Purchase Program** – a range of purchase methods including open tender, limited tender, multi-stage approaches and other alternative methods.
- **Sustainable Communities Program** – funding to help communities adapt and reduce impacts alongside water purchase programs.

6.4.1 Restoring Our Rivers Framework Implementation in South Australia

6.4.1.1 Alternative Water Supply Efficiency Measures (AWSEM) Program

Building on the success of the Marion project, the South Australian Government is currently delivering the $32.6 million Alternative Water Supply Efficiency Measures (AWSEM) Program under the Resilient Rivers Water Infrastructure Program.

The AWSEM Program is supporting local governments to build infrastructure that reduces the amount of water they draw from the Basin and offsets River Murray water use. The projects will allow councils to use alternative water sources – such as captured storm water or treated wastewater – to irrigate parklands, ovals and to supply some industries, helping to save quality potable water.

As part of the AWSEM Program, the South Australian Government will return 1,769 ML of SA River Murray High Security Water on behalf of local government authorities to contribute towards the 450 GL.

6.4.1.2 South Australian Sustainable Communities Program

It has been established that, even without accounting for the impacts of water reform, broader structural shifts will continue put pressure on the social and economic fabric of regional communities throughout Australia. Regardless of industry type, improved economic efficiency and business amalgamation often forms part of these broader structural shifts, whilst challenging the traditional composition of economies at the local scale.

As part of supporting River Murray communities exposed to the combined impacts of water reform and the broader regional economic restructure, the South Australian Government is delivering the South Australian Sustainable Communities Program, which aims to support the transition of River Murray communities and mitigate the socio-economic impacts of water recovery.

Grants will fund projects that drive economic diversification, innovation and growth, enhance liveability, and bolster community resilience in South Australia's most vulnerable River Murray communities. Investment will be targeted and outcome-focused to meet the unique needs of South Australia's most affected River Murray communities.

A total of $14 million was available in round one of the SCP, which closed to applications on 31 March 2026 and included the following conditions:

- up to $1 million total funding for Investment Feasibility grants for amounts of $50,000 to $275,000.
- up to $13 million total funding for Investment Ready grants from $50,000 – with no single application being granted more than 35% of the total funding available for round one.

Given the current status of water purchases towards the 450 GL and the South Australian SCP, it is too early to assess whether payments made under paragraph 86AD(2)(c) of the Water Act have been effective in addressing any detrimental social or economic impact on the wellbeing of any community in the SA River Murray associated with water recovery projects under the Restoring Our Rivers framework.

6.5 Next Steps

Given South Australia's long history of implementing water efficient irrigation practices along the River Murray, as well as its more conservative historical allocation policies, it is likely that there will be fewer water efficiency opportunities in the SA River Murray in the future compared to other parts of the Basin, for a given level of Australian Government investment. It has also become increasingly difficult for the

South Australian Government to develop and implement on- and off-farm projects and programs under the Resilient Rivers Water Infrastructure Program due to prescriptive frameworks and the requirements for state governments to be effectively responsible for delivering an Australian Government program.

Separately, South Australian irrigators and communities are calling for recognition of their significant efforts and commitment to sustainable water management (both pre- and post-Basin Plan) and are seeking certainty and stability to be able to make important decisions about future opportunities and transition.

The South Australian Government considers that further work is required to help communities, irrigators and industries plan and adapt for reduced water availability whilst maintaining water quality due to climate change or recovery of water entitlements under the Basin Plan. This could include, but should not be limited to, making climate change and water market data publicly available, and delivery of new economic structural adjustment programs in consultation with communities and industries and undertaking climate adaptation planning.

Recommendation

It is recommended that the following actions to improve the identification of and response to socio-economic impacts from water recovery and implementation of the Basin Plan:

- *Improve existing socio-economic monitoring and assessment frameworks to fully capture the localised impacts of water recovery and Basin Plan implementation in irrigation-dependent communities across the Basin, including incorporation of the value-added food, wine and beverage sectors and measures of economic output and value creation per unit of water, to better reflect the true contribution of irrigated agriculture.*
- *Develop and implement a long-term socio-economic monitoring program to consistently capture the data needed to identify socio-economic changes over time at a local scale across the Basin including the combined effects of climate change, water recovery and water market dynamics on future water availability and community resilience.*
- *Coordinate Australian Government funding through multiple programs and provide a one stop shop for grant applications for eligible entities instead of requiring multiple applications for different programs.*
- *Improve coordination, planning and governance across federal, state and local governments including targeted investment in enabling infrastructure such as energy, digital connectivity and water delivery systems, to support communities to thrive and adapt to reduced water availability and climate change.*
- *Undertake a review of the co-design framework to enhance genuine co-design on the development of initiatives and funding programs to ensure that they are appropriately targeted to address regional needs and are co-owned and supported by communities.*

7 Native Fish

Key messages

- At a Basin-scale, native fish have been assessed as being in poor condition but at a local scale there have been many instances of local recovery and a positive native fish response to environmental water delivery.
- River flows and connectivity are critical determinants for native fish recovery, in conjunction with complementary measures such as removing barriers to fish passage.
- Mass fish deaths across the Basin highlight the vulnerability of native fish to low flows and poor water quality and an over-reliance on non-flow measures to respond to declining native fish populations is concerning.
- Monitoring limitations and data gaps have reduced confidence in Basin scale reporting and can undermine messaging about positive local outcomes.

The Basin is home to over 60 species of native fish, including freshwater, estuarine, diadromous and marine species, and most are endemic to Australia.[122] Native fish are iconic components of the Basin's ecosystem and a key sign of ecosystem health. They play key roles in aquatic food webs and provide numerous ecosystem services. Recreational fishing provides social, cultural and health benefits, whilst also providing an important economic contribution to local Basin communities. For First Nations' communities in the Basin, native fish hold deep cultural, economic and spiritual significance, forming a vital link to their land and waters and heritage, which is fundamental to their wellbeing and identity.

7.1 Regulatory Context

The Water Act requires the Basin Plan to establish an environmental watering plan that includes environmental objectives for water-dependent ecosystems of the Basin and targets to measure progress towards those objectives.[123] The Basin Plan also includes a target that provides for *improvements in the recruitment and populations of native water-dependent species, including vegetation, birds, fish and macroinvertebrates*.

The BWS establishes four categories of metrics of water-dependent species and ecosystem health: river flows and connectivity, native vegetation, waterbirds and native fish. The Authority considers that these hydrological and ecological indicators are representative of Basin-scale health as they are responsive to environmental watering and valued by communities of the Basin.

The 2025 Basin Plan Evaluation concluded that native fish populations were in poor condition and declining, stating:

> *Native fish populations in the Basin have continued to decline in recent years. There have been poor fish breeding and movement outcomes across the Basin, except for estuarine species in the Coorong, Lower Lakes and Murray Mouth.*[124]

[122] MDBA (2025) *Basin Plan Evaluation*. Murray-Darling Basin Authority, Canberra. Found at: 2025 Basin Plan Evaluation Report, p47.

[123] Water Act, section 22(1), item 9 and section 28.

[124] Basin Plan, Schedule 7, Target (2)(f).

7.2 Native Fish Decline

River regulation and water extraction have combined to change the timing and volume of flows through the Basin, which have negatively affected native fish. Other key threats include barriers to migration (dams/weirs), reduction in habitat from de-snagging and wetland destruction, cold water pollution, poor water quality (e.g. hypoxic blackwater events) leading to mass deaths and the spread of European carp.

The declining trajectory of fish health sits within the backdrop of a low ecological baseline and long-term trend in native fish decline across the Basin, prior to the commencement of the Basin Plan. An assessment on the status of Basin fish communities at the time found that:[125]

- Native fish populations represented 10 percent of levels prior to European settlement.
- Exotic fish species accounted for 80-90 percent of fish biomass in the Basin.
- More than half of the Basin's native fish species were listed as threatened or of conservation concern.

7.2.1 Large-Scale Fish Death Events

The summer of 2018-19 saw three significant fish death events in the Darling (Baaka) River, where it is estimated between hundreds of thousands to over a million fish died over a series of seven weeks. At the time these were the most serious fish deaths on record due to the extent of the river and species affected, including an important population of iconic Murray cod. The Australian Government established an independent panel to assess the fish death events and to identify causes, evaluate management responses and provide recommendations.

The panel made 27 recommendations for policy makers and water managers to prevent similar events from recurring and protect and restore native fish populations in the Basin. These included the protection of low flows and first flushes, maintenance of hydrological connectivity, removal of barriers to fish movement, review of northern Basin SDLs and improved fish and water quality monitoring.[126,127]

With respect to hydrological connectivity, the panel examined the potential impacts of water management in the northern Basin and the operation of the Menindee Lakes system. One of the main impacts on the frequency, magnitude and duration of low flows in the Barwon–Darling River is the use of Class A diversion licences. Changes to the Barwon-Darling Water Sharing Plan in 2012 and to licencing arrangements is considered to have led to significant increases in the extraction of water during low flow periods.

Between October 2019 and May 2020, record drought conditions and subsequent bushfires led to sudden changes in water quality following rain. These effects culminated in more than 65 fish deaths events, primarily across the southern Basin, in which over a million fish were estimated to have died.

In March 2023, another mass fish death occurred in the Darling (Baaka) River, with an estimated 20 to 30 million fish dying. Community concern at these unprecedented fish deaths led stakeholders to question water and environmental management in the Basin.

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[125] Lintermans M (2007), *Fishes of the Murray-Darling Basin: An introductory guide*. MDBC Publication 10/07, Murray-Darling Basin Authority, Canberra.

[126] Independent Panel (2019) *Independent assessment of the 2018-19 fish deaths in the lower Darling: Final report*. Found at: Final-report-independent-panel-fish-deaths-lower-darling.pdf

[127] In December 2021, the Australian Government published an update on the implementation of these recommendations, including that 9 had been implemented, 7 were underway and 11 were subject to state actions or not supported.

7.2.2 Basin-wide Native Fish Recovery Strategy 2020

In response to the Lower Darling fish kill events, the Australian Government committed $5 million to develop and implement a Basin-wide strategy to enhance the management of native fish populations – the Native Fish Recovery Strategy (NFRS). The NFRS provides a high-level framework to guide future investment. It emphasises community engagement and ownership, focusing on recovering rivers of Basin-scale significance in a way that complements existing initiatives. Initial funding was available for five years and key achievements over this period included:

- Completion of the *Native Fish Status Assessment* to establish a baseline assessment of fish health.
- Small grants to support native fish recovery actions at local scales.
- Addressed threats to fish through the 'Recovery Reach' program at key locations along the Lower Darling (Baaka), Mid-Murray Floodplain, Upper Condamine and the Upper Murrumbidgee.
- Emergency funding to support state responses to fish death events.
- Support for knowledge sharing, engagement, communication and awareness-raising with and between First Nations People and the wider community.

The 'Recovery Reach' program and the small grants to support native fish actions provided the mechanism for community involvement and on-ground actions in NFRS implementation.

In November 2025, the Authority held a native fish options workshop with Basin States to help inform how this issue could be addressed through the 2026 Basin Plan Review. The workshop sought the following outcomes:

- confirm the problem definition for native fish in the Basin
- share knowledge among Basin States on what is working well within individual jurisdictions
- at the Basin-scale, identify investment options or actions that would make tangible progress towards addressing the problem.

Discussion at the November workshop emphasised Integrated Catchment Management (ICM) strategies, such as habitat restoration and pest control. However, the South Australian Government maintains that ICM strategies can only be effective if full environmental water recovery is achieved, native fish management objectives are fully integrated with River Murray operations, asset management, environmental water planning and delivery, and the actions delivered are complementary to the environmental watering requirements of native fish.

7.3 Native Fish Outcomes from the Basin Plan

7.3.1 Evaluation of Outcomes in South Australia

Alongside the 'Basin-scale' narrative of the Discussion Paper that native fish remains on a trajectory of decline, there is extensive contrasting evidence of the benefits that Basin Plan implementation has had for native fish outcomes at local scales and across Basin States. The South Australian Government's evaluation of native fish outcomes under Basin Plan highlighted several key themes.[128,129]

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[128] DEW (2024) *South Australian evaluation of environmental outcomes under the Basin Plan: South Australian River Murray Water Resource Plan Area*. Department for Environment and Water, Adelaide.
Found at: BP-Evaluation_Matter8_SA-River-Murray-Evaluation_2024.pdf

[129] DEW (2024) *South Australian evaluation of environmental outcomes under the Basin Plan: Eastern Mount Lofty Ranges Water Resource Plan Area*. Department of Environment and Water, Adelaide.

7.3.1.1 Long-term Recovery since the Millennium Drought

Across the SA River Murray, there is clear evidence of partial but ongoing recovery of native fish following the Millennium Drought. Improvements in age structures and abundance of large-bodied species, including Murray cod and golden perch, indicate rebuilding population resilience after severe drought-related declines. In the CLLMM, fish community condition has improved, supported by increased freshwater inflows, more favourable salinity regimes[130] and improved connectivity.[131]

Despite this, the condition of native fish populations remains variable across catchments and among species. Populations of several small-bodied threatened species remain imperilled throughout the SA River Murray. Persistence has been supported by reintroduction efforts, and in many cases, localised environmental water delivery.

Overall, recovery has been variable across the system with populations of some species (e.g. Yarra pygmy perch) remaining below pre-drought levels whilst others exhibit strong evidence of improvement (e.g. Murray cod).

7.3.1.2 Recruitment Remains Episodic and Flow-driven

The fish fauna of the SA River Murray is comprised of species with differing life histories, and for many, recruitment is strongly linked to the flow regime (i.e. the timing, magnitude and duration of flow events). For species like golden perch and silver perch, recruitment is often episodic and associated with spring–summer flow pulses that provide hydrological cues, support spawning and enhance larval survival and dispersal. Specifically, Basin-scale flows that occur across 100s–1000s km see the strongest responses and movement of both adult and larval/juveniles among different rivers (e.g. the lower and mid-Muray and Darling rivers). Smaller-scale flow pulses result in more modest recruitment events that help maintain local recruitment dynamics and diverse age structures.

Across the SA River Murray, including the CLLMM, freshwater inflows also regulate salinity gradients and productivity, influencing fish recruitment, community composition and persistence. Environmental water contributes by enhancing and extending these conditions but cannot fully replicate the ecological functions of large natural flow events.

7.3.1.3 Connectivity is Critical at Multiple Scales

Connectivity is a fundamental driver of native fish outcomes across the SA River Murray. For riverine fishes (e.g. golden perch), longitudinal connectivity supports juvenile/adult movement and downstream larval drift. These movements are often reproductive in nature and represent critical life history processes required to support populations. Lateral connectivity between the river channel and floodplains further underpins productivity and nutrient exchange, and recruitment processes in some species.

BP-Evaluation_Matter8_Eastern-Mount-Lofty-Ranges-Evaluation_2024.pdf

[130] Ye, Q., G. Giatas, C. Bice, J. Brookes, D. Furst, M. Gibbs, J. Nicol, R. Oliver, B. Zampatti, L. Bucater, D. Deanne, K. Frahn, M. Hipsey, P. Huang, Z. Lorenz, J. Mills, R. Shiel and P. Zhai (2025). *Commonwealth Environmental Water Holder Monitoring, Evaluation and Research Project 2019-2024: Lower Murray Technical Report*. A report prepared for the Commonwealth Environmental Water Holder by the South Australian Research and Development Institute, Aquatic Sciences., A report prepared for the Commonwealth Environmental Water Holder by the South Australian Research and Development Institute, Aquatic Sciences.

[131] Bice, C. M., B. P. Zampatti and J. Fredberg (2025). *Condition monitoring of fish movement and recruitment at the Murray Barrages 2023/24*. South Australian Research and Development Institute (Aquatic and Livestock Sciences), Adelaide. SARDI Publication No. F2011/000186-14. SARDI Research Report Series No. 1241. 58pp.

At a regional scale, connectivity is often constrained by barriers such as in-stream dams and weirs, particularly in tributary systems like the Angas and Bremer Rivers. Reducing these barriers is critical to support dispersal and migration for fish species, including common congolli.

Connectivity between freshwater, estuarine and marine environments, facilitated through barrage and fishway operations, and an open Murray Mouth, is essential for life-cycle completion of diadromous species (e.g. pouched lamprey). Fishways play a key role in restoring and maintaining functional connectivity across the system.

7.3.1.4 Environmental Water Supports Native Fish Outcomes

In riverine reaches, environmental water is demonstrably beneficial for fish, particularly in supporting natural flow cues and connectivity and promoting lotic ('flowing water') conditions. This includes sustaining channel velocities suitable for spawning, facilitating fish movement and breeding responses, maintaining refuge habitats and supporting connectivity within and between riverine, floodplain and estuarine environments.

In the CLLMM, environmental water is essential for maintaining lake levels, supporting barrage flows and regulating salinity gradients that underpin estuarine function. Environmental water cannot fully substitute for large-scale hydrological processes, which makes coordinated, Basin-scale water management essential for sustained recovery.

7.3.2 Response to Environmental Watering Events

Since 2019, the Commonwealth Environmental Water Office (CEWO) Flow-Monitoring, Evaluation and Research (Flow-MER) Program has undertaken ecological monitoring at sites in the Lower River Murray to evaluate the ecological response to Commonwealth environmental water delivery.[132]

In 2021-22, over 1,200 GL of environmental water was delivered to the Lower River Murray to supplement an already high in-channel flow event of 25,000 to 40,000 ML/day at the South Australian border. Nine ecological indicators were established to inform the evaluation of this event, with key outcomes relating to native fish including:[133]

- Environmental water delivery increased longitudinal connectivity by an additional 3,119 km days and contributed to increased downstream transport of fish eggs and larvae.
- High abundances of eggs and larval golden perch and silver perch were collected during spring and summer. Subsequent sampling demonstrated the 2021-22 cohort of golden perch being the strongest since the high flow period from 2010–2014.
- Without the environmental watering event, modelling indicates that the area of suitable habitat for key fishery species (mulloway, yelloweye mullet, black bream and greenback flounder) would have declined by 2, 5, 8 and 5 percent, respectively. Habitat for ecologically important species including the congolli and smallmouth hardyhead would have also reduced by 5 percent.

[132] In the Lower Murray, the CEWO MER Project focuses on the main river channel between the South Australian border and Wellington, with one indicator extending to the Lower Lakes and Coorong. The riverine monitoring sites cover three geomorphic zones (floodplain, gorge and swamplands).

[133] Ye Q, Giatas G, Bice C, Brookes J, Furst D, Gibbs M, Nicol J, Oliver R, Zampatti B, Bucater L, Deane D, Frahn K, Hipsey M, Kok C, Huang P, Lorenz Z, Mills J, Shiel R and Zhai S (2023) *Commonwealth Environmental Water Office Monitoring, Evaluation and Research Project: Lower Murray 2021-22 Technical Report*. A report prepared for the Commonwealth Environmental Water Office by the South Australian Research and Development Institute, Aquatic Sciences.

7.3.2.1 Habitat Condition Remains an Important Co-driver

Native fish outcomes across the SA River Murray are primarily driven by flow, which strongly influences the availability and quality of habitat. In-channel habitat features such as woody debris and hydraulic diversity also provide critical spawning, feeding and refuge opportunities, whilst floodplain and wetland habitats contribute to productivity and recruitment when inundated. Limitations in habitat condition can constrain native fish responses, highlighting the importance of habitat restoration and protection as complementary management actions.

7.3.2.2 Ongoing Vulnerability under Low-flow Conditions

Despite observed improvements, the SA River Murray system remains highly vulnerable to periods of low flow. Native fish populations are still below historical levels and are sensitive to reductions in flows that limit connectivity, reduce habitat availability and constrain recruitment opportunities.

In more intermittent systems, insufficient low flows can also result in the loss of refuge habitats and declining water quality during critical summer periods.

In the CLLMM, reduced inflows can lead to increasing salinity, particularly in the South Lagoon, along with declines in habitat quality and ecological function. In addition, pressures from invasive fish species remain a significant ongoing threat, contributing to competition and resource limitation for native species. These combined pressures can result in reduced recruitment, lower survival and shifts in community composition. This ongoing vulnerability underscores the system's continued reliance on Basin Plan water recovery and protection, effective and coordinated environmental water delivery, improved connectivity and active management of invasive species.

7.3.2.3 Contribution of Basin Plan Implementation Activities to Native Fish Outcomes

As water-dependent species (as per the definition of a water-dependent ecosystem in the Water Act), native fish throughout the Basin are dependent on minimum volumes, frequencies and durations of water for their distribution, abundance, recruitment and survival. As such, it has primarily been Basin Plan implementation activities relating to the planning and delivery of water for the environment that have contributed to improvements in native fish outcomes described in the following sections.

Measures that are actively improving native fish outcomes through a combination of large-scale habitat restoration, reintroduction programs for threatened species and targeted water management within the SA River Murray include:

- **Fish passage:** Many fishways have been built along the SA River Murray and its floodplains to support native fish migration, including Murray cod, pouched lamprey and golden perch. Specifically at the Barrages, 11 fishways facilitate native fish movement between the Coorong estuary and Lake Alexandrina.
- **Floodplain reconnection and lotic habitat restoration:** Fourteen new regulators and blocking banks on the Pike and Katarapko (Katfish Reach) floodplains are reconnecting these areas to the River Murray. The fishways incorporated into new floodplain infrastructure and the increased flows through the anabranches have supported native fish movement and recruitment.
- **Habitat enhancement:** A new regulator at Bookmark Creek reinstates connectivity between the Lock 4 and Lock 5 weir pools and increases water flow by about five times, creating fast-flowing habitat, which benefit large-bodied native fish species.[134] There have been 53 snag habitats

[134] https://www.environment.sa.gov.au/topics/water-and-river-murray/projects-plans-security-and-legislation/water-projects/sustaining-riverland-environments/bookmark-creek-complex

installed along the River Murray in the Riverland region,[135] including 15 large woody debris structures downstream of the inlet regulator at Bookmark Creek and six snag piles at Banrock Station to support breeding, feeding and shelter for native fish.[136]

- **Weir pool lowering:** Investments to lower weir pools help restore more natural river flows. Grants have supported irrigators in the Lock 6 to 7 reach to modify pumps so they remain functional when water levels are lowered, improving conditions for native fish such as Murray cod.
- **Irrigation impact research:** Research into irrigation offtakes found that between 1.8 and 4.9 million fish may be lost each year due to fish being drawn into irrigation pumps in the SA River Murray. The study also worked with irrigation communities to identify barriers to using more fish-friendly pump technologies.
- **Threatened species recovery:** Targeted recovery programs support threatened species such as Murray hardyhead, southern pygmy perch, and southern purple-spotted gudgeon through the protection of critical water levels in Lower Lakes wetlands, translocations and artificial habitat creation. In 2025, 250 captive-bred Murray crayfish were released into the SA River Murray.

Operation of South Australia's network of environmental regulators has expanded water delivery areas across the floodplains, improved connectivity and supported critical habitats for native fish, vegetation and waterbird species.

7.4 Impact of Limited Basin-scale Monitoring and Assessment

Interpretations of Basin-scale native fish decline should account for evidence of different outcomes at local scales and recognise that limited Basin-wide monitoring currently obscures where management efforts are occurring and most needed.

The 2025 Basin Plan Evaluation found that Basin scale outcomes were difficult to assess, with many Schedule 7 targets reported as inconclusive. The 2025 SRA found that gaps in floodplain, wetland and Ramsar site data and changes in sampling methods has reduced confidence in assessing native fish condition, resulting in all fish indicators being rated with low confidence.

Basin States interpret and report on environmental conditions differently and better methods are needed to combine local monitoring data for Basin scale assessments. In the absence of an effective Basin-scale monitoring and evaluation program, there is a risk that reporting at the Basin scale could conceal environmental signals that are evident at smaller scales, such as assets or catchments.

7.5 Issues and Options to Improve Outcomes for Native Fish

The South Australian Government is concerned about the potential downplaying of the importance of environmental water recovery and delivery for achieving positive outcomes for native fish. This is not the case and the case studies above go some way to describing this.

In part, the 'poor status' of fish populations put forward in the Discussion Paper is due to the Murray-Darling Basin Fish Survey (an extension of SRA) and metrics used therein. Many metrics were based on estimates of pre-regulation population status and their presence and/or absence and distribution metrics included species not seen for many years. The status of native fish is generally more positive.

[135] https://www.environment.sa.gov.au/topics/water-and-river-murray/projects-plans-security-and-legislation/water-projects/sustaining-riverland-environments/native-fish-outcomes/re-snagging

[136] https://www.environment.sa.gov.au/news-hub/news/articles/2025/08/re-snagging-at-banrock-station

Regardless, many of the options put forward to support native recovery are valid. However, they are not a substitute for water delivery, finalising the water recovery commitments under the current Basin Plan or better coordination of water delivery in future.

The South Australian Government has concerns about whether the Authority's proposed options will effectively address the decline of native fish. Whilst the review acknowledges that multiple reviews link mass fish deaths to low river flows, and that many local successes are due to environmental water delivery and increased flows, these approaches appear to be absent from the proposed response options.

In the response options featured in the Discussion Paper, the Authority notes that many of these actions are already in place but suggests they could be improved through better prioritisation and investment. However, this proposal lacks detail and many of the proposed options fall outside the Basin Plan's scope. Measures such as invasive species control, breeding and reintroduction programs and habitat restoration are not actions that can be effectively delivered through the Basin Plan nor are they a substitute for an appropriate flow regime.

Recommendation

It is recommended that:

- *Ensure that the environmental watering and flow requirements of native fish species are sufficiently met in parallel before integrated catchment management or complementary measures are implemented.*
- *Basin States to agree to a standardised risk assessment process to inform prioritisation of native fish management actions at the Basin-scale. Priority actions should be consolidated and used to inform a scope works that ensures clarity in governance, resourcing requirements and regular and transparent monitoring of management effectiveness.*
- *Significant uplift is progressed towards improving monitoring and evaluation capability at the Basin-scale.*

8 Water Quality and Salinity

Key messages

- The Basin salinity management program has been highly effective, but broader water quality outcomes across the Basin are lagging.
- South Australia is highly vulnerable to the cumulative impacts of upstream water quality.
- Basin water quality management is reactive and overly reliant on environmental water.
- There is a need for a coordinated Basin-wide, prevention-focused approach to water quality management.

8.1 Regulatory Context

Basin Governments have a long and successful history of working together to manage salinity. In response to increasing salinity levels and associated economic impacts to industries and communities, the Murray-Darling Basin Ministerial Council agreed to the *Salinity and Drainage Strategy* (1988-2001).

Basin Governments expanded this initiative into a whole-of-Basin response through the adoption of the Basin Salinity Management Strategy (BSMS) . By implementing actions that control the rise in salt loads in all Basin tributaries, the strategy sought to maintain the quality of water resources, protect aquatic and terrestrial ecosystems, control land degradation and protect productive farm land, cultural heritage and built infrastructure. Consistent with the principles of integrated catchment management, this strategy established targets for river salinity in each tributary valley and the Basin to reflect the shared responsibility for action between valley communities and States. Actions included joint investment in Salt Interception Schemes[137] to reduce salt entering the river system, salinity accountability arrangements and other activities such as improved irrigation efficiency.

The *Basin Salinity Management 2030* (BSM2030) strategy built on the legacy of the preceding initiatives whilst maintaining the cap on salinity through the existing Basin Salinity Target and accountability framework, salinity targets and monitoring, auditing and reporting requirements. In support of BSM2030, Schedule B (Basin Salinity Management) to the Agreement establishes the legal framework for Basin salinity management, requiring Basin States to manage river salinity through accountability, monitoring and a credits and debits register.

Significant outcomes from these programs have been realised and Basin salinity management is one of the most successful natural resource management programs across the Basin and Australia during the last 50 years.

The Water Act sought to bring together the management of broader water quality parameters with salinity management in a consistent, Basin-wide framework. It requires the Basin Plan to include: management objectives and outcomes that address water quality and salinity; a water quality and salinity management plan that identifies the key causes of water quality degradation in the Basin; and water

[137] Salt Interception Schemes (SIS) in the Murray-Darling Basin are large-scale groundwater pumping operations designed to intercept highly saline water before it enters the river system. These schemes use over 200 bores and 250 km of pipelines to divert around 500,000 tonnes of salt annually into disposal basins, protecting water quality for agriculture and communities.

quality and salinity objectives and targets for the Basin water resources and provisions for 5-yearly reviews of these targets.[138]

Chapter 5 of the Basin Plan includes an objective and outcome to maintain appropriate water quality, including salinity levels, for environmental, social, cultural and economic activity in the Basin.[139] Chapter 9 establishes the water quality and salinity management plan to set out the key causes of water quality degradation, water quality objectives for Basin water resources and water quality targets. The primary mechanism for implementing the framework is through Water Quality Management (WQM) Plans within the WRPs.

Mechanisms other than the Basin Plan, such as Basin salinity management strategies, land use planning, environmental protection policies and catchment management, have historically been much stronger drivers of water quality outcomes across the Basin and in South Australia. Point source pollution from wastewater treatment plants, industries, agriculture and urban development in South Australia is effectively managed through regulatory instruments such as the *River Murray Act 2003*, *Environmental Protection Act 1993*, *South Australian Public Health (Wastewater) Regulations 2013*, *Planning, Development and Infrastructure Act 2016* and associated policies and procedures.

8.2 Water Quality Drivers and Issues

Due to its location at the end of the river system and the cumulative impacts from upstream, the SA River Murray is particularly vulnerable to high salinity levels and adverse water quality events. Low flow periods and times with inadequate dilution or flushing flows increase the risk of poor water quality and high salinity, negatively affecting aquatic ecosystems, irrigators and critical human water supplies.

The drivers of poor water quality are complex and often difficult to manage. Water quality is influenced by a variety of factors including, but not limited to, flow conditions, water availability, land use, nutrient inputs, salinity processes and climate variability. Observed adverse water quality events in South Australia are generally episodic, event-based and short-lived. Flow and non-flow related interventions that might address events such as low dissolved oxygen, blackwater events or blue-green algae are not easily deployed on the scale at which these occur.

Whilst the occurrence and impact of adverse water quality events in South Australia may be partially reduced due to the increased dilution effects of environmental water delivery under the Basin Plan, many still typically result in a short-term water quality target exceedance or water quality issues, even if an exceedance target is not reached.

In other cases, the impacts last much longer, such as the algal bloom that closed Lake Alexandrina to swimming, diving, and fishing between mid-March to early August 2024, and then again from early May to early August 2025, due to the presence of *Raphidiopsis raciborskii* (formerly identified as *Cylindrospermopsis raciborskii*). Bloom formation was favoured by the lake's long water residence times, low flushing rates and elevated nutrient loads, which allow buoyant cyanobacteria to accumulate near the surface and exploit light efficiently.[140] While optimal growth occurs at warmer temperatures, this type of blue-green algae can proliferate during the temperate autumn conditions typical of the Lower Lakes, and residual populations can re-establish when hydrological and climatic conditions improve, explaining recurrent blooms across consecutive years. Mitigating these blooms requires integrated water management, including maintaining continuous and sufficient system flows to reduce water

[138] Water Act, section 22(1) (items 4(b), 10 and 13) and section 25

[139] Basin Plan, section 5.04(1)

[140] Huisman J, Codd GA, Paerl HW, Ibelings BW, Verspagen JH and Visser PM (2018), *Cyanobacterial blooms*. Nature Reviews Microbiology, 16(8), pp.471–483.

residence times, coordinated barrage and inflow operations to improve flushing and upstream nutrient load reductions to limit bloom-supporting conditions.

Whilst there have been isolated events of poor quality water entering South Australia through upstream management actions, there is also no evidence that environmental water delivered under the Basin Plan as part of environmental watering events has resulted in any target exceedances.

There is also no clear trend of improved water quality outcomes associated with implementation of the Basin Plan, largely due to the episodic and occasional exceedance of water quality targets. However, environmental water recovered and delivered under the Basin Plan has been critical in providing for water quality outcomes along the length of the SA River Murray and influencing the end of system conditions at the CLLMM. The importance of maintaining end-of-system flows through the Murray Mouth for managing water quality both in South Australia and the broader Basin cannot be understated, particularly during dry periods.

8.3 Effectiveness and Options for Improvement

The Basin Plan water quality and salinity management framework is broad and there has been limited additional contribution to improving water quality and salinity in practice. Despite this, many of the water quality targets are considered effective indicators of whether water quality is being maintained at an appropriate level – with the exception of the default fresh water-dependant ecosystems targets in Schedule 11, which need to be reviewed to ensure that they align with the ecological thresholds in all areas.

Despite the general suitability of targets, water quality outcomes have not been able to be materially influenced through WQM Plans, particularly where the driver for an adverse water quality event is from a non-water management action. In some cases, the WQM Plan and state arrangements outlined in a WRP may have played a role in improving water quality and salinity management but it is rare that water quality improvements were specifically targeted via flow management or environmental watering events. Rather environmental water managers must 'have regard' to flow management and water quality targets.[141]

The findings and recommendations of the Basin Plan Evaluation and those within the Discussion Paper on water quality and salinity management are generally supported by the South Australian Government and many of the options proposed appear to be reasonable and practical.

The most significant gap in addressing water quality threats across the Basin is the management of broad-scale diffuse agricultural nutrient pollution, which can be difficult given the scale and size of the risk. However, there are strategies that can be considered such as the management of fertiliser inputs, creation of interceptive activities that can filter an/or capture nutrients (such as buffer zones and wetlands) and catchment management actions such as fencing off watercourses and revegetation, noting that these are not currently in the remit of the Basin Plan.

Regardless of the ability of the Basin Plan and Water Act to influence water quality management across the Basin, there is a need to develop a shared and coordinated Basin-wide program to address water quality. As the downstream state, South Australia relies heavily on collaboration and actions across the Basin to manage water quality.

The proposal to identify the key sources and areas of diffuse nutrient pollution and improve evidence for preventative actions is supported. This work is seen as fundamental to addressing the major cause of algal blooms and poor water quality and should be one of the first actions undertaken by Basin governments.

[141] Basin Plan, section 9.14(5)(c).

Strengthening joint capability for prevention and early intervention, including through flow-related decision making and streamlining regulatory and administrative processes, is an important priority. Building on existing River Murray operational committees and processes that already consider water quality when making flow management decisions, particularly to provide dilution or flushing flows, is seen as a practical action. However, there is a significant gap in identifying and coordinating action to address the sources of diffuse pollution.

WQM practices are biased towards response rather than prevention and there is an over-reliance on environmental water. To materially improve water quality conditions across the Basin, targeted investments are needed in preventative measures and mechanisms. The South Australian Government considers that opportunities to develop a Basin-wide inter-governmental water quality program and accountability framework similar to BSM2030 and the associated arrangements under Schedule B of the Agreement is worth investigating to manage diffuse pollution. Such a program would need to be developed and managed via the Joint Programs and would likely lead to higher accountability and improved outcomes over time.

Equally, incentives for primary producers and land managers to improve water quality should be considered together with voluntary industry-led initiatives designed to improve sustainability and profitability whilst reducing nutrient sediment and chemical runoff. One example is Reef Credits,[142] which are an innovative, market-based solution offering a new way to improve the quality of water entering the Great Barrier Reef. Reef Credits enable landholders to undertake projects that improve water quality through changes in land management activities and generate a tradeable unit of pollutant reduction or 'Reef Credit'. A Reef Credit represents a quantifiable volume of nutrient, pesticide or sediment prevented from entering the Great Barrier Reef catchment.

Separately, there is an ongoing need for the holistic management of all water (environmental, consumptive and conveyance) to create flow that minimise adverse water quality issues that culminate at the end of each river system, as outlined in Section 4.3. The management of water quality issues that cannot be resolved through point source solutions (e.g. bush fires) needs to be holistic and a program should prioritise improvements in the coordination between river operators and environmental water managers, consider how all water can be used and not rely solely on environmental water to manage or 'fix' salinity and other adverse water quality issues or events.

Recommendation

It is recommended that:

- *opportunities to develop a Basin-wide intergovernmental water quality program and accountability framework to strengthen links with catchment management and develop options to manage diffuse nutrient sources are investigated.*
- *flow management targets are expanded across the Basin (including to the Coorong) and environment water managers and river operators are collectively required to meet.*
- *flow management guidelines are reviewed to clarify expectations around the use of all water (environmental and consumptive) to address water quality events and ensure that decision makers are recording how water quality outcomes and impacts have been considered.*
- *Basin Plan default fresh water-dependant ecosystems targets in Schedule 11 should be reviewed to ensure that they align with ecological thresholds in all areas.*

[142] Reef Credit Scheme | Environment, land and water | Queensland Government

9 Water Infrastructure and Critical Human Water Needs (CHWN)

Key messages

- It is essential that the Joint Governments collectively increase funding to address the identified asset and program delivery risks identified by the Authority and state constructing authorities.
- The Basin Plan should continue to support arrangements for CHWN where there are cross border implications and interactions or where agreements are required.
- Where a Basin State has sole control for providing CHWN and this is not impacted by another, it should be up to that Basin State to put in place arrangements to ensure CHWN can be met within the take permitted under the relevant SDL. The arrangements do not necessarily need to be outlined in the Basin Plan.
- There should be no reduction to the volumes specified in the Basin Plan to meet CHWN in the River Murray System. However, each Basin State should be permitted to adjust the CHWN volume for its own share of the resource within the River Murray System for state water planning purposes, subject to the resultant volume being within the existing SDL and any increase not affecting third parties.
- An analysis of South Australia's storage rights be undertaken under the Joint Programs.

9.1 Water Infrastructure

The Discussion Paper outlines the Authority's concerns about the condition of River Murray infrastructure and the need for a significant uplift in investment. The South Australian Government shares these concerns.

Water infrastructure is not an issue that the Basin Plan is required to address – it is an issue for the Joint Governments under the Agreement. However, having well maintained and operable infrastructure is essential to support effective water management, including the delivery of Basin Plan outcomes.

The current risks to River Murray infrastructure and operational assets are significant and reflect long-term under-investment in maintenance and renewal. Risk of failure levels are not only high but are actively increasing. For some assets, the current deterioration could lead to catastrophic failure and severe consequences, impacting all those who are dependent on water in the River Murray system.

In 2025, the Authority recommended a four-year uplifted budget that identified a significant uplift in operations and maintenance expenditure for River Murray assets and an increase in construction and investigation expenditure to address unacceptable risks to infrastructure. This included replacing and upgrading major assets, including the Lake Victoria outlet regulator structure, Hume Dam outlet structures and Mildura Weir. The 30-year plan for River Murray assets also indicates significant increases are required in operating and capital expenditure beyond the multi-year budget period.

The possible consequences of a failure to deliver an uplifted multi-year budget and work plan include an:

- increasing risk of structural failure of major water storage, supply and river management assets, with implications for water delivery for water supply and irrigation, environmental and social outcomes and downstream flooding.

- increasing operational and maintenance costs from deferred investments and an increase in safety risks to staff, leading to higher financial liabilities for Joint Governments.

Given this, it is essential that the Joint Governments collectively increase funding to address the identified asset and program delivery risks identified by the Authority and state constructing authorities. Failure to do this would put water security and people's safety and lives at risk.

The South Australian Government supported the Authority's recommended multi-year uplifted budget in 2025 and continues to support an increase in funding as a prudent and efficient means to address known risks to health and safety, water supply and asset performance challenges. Continued operation of the Joint Programs under a constrained budget is not supported by South Australia and the identified uplift is needed urgently.

9.2 Critical Human Water Needs

The Agreement defines how available water in the River Murray System is shared between New South Wales, Victoria and South Australia. Until the Millenium drought, these arrangements worked well. There had been enough water to run the system (conveyance), supply urban, stock, domestic and industrial demands with limited restrictions, and provide at least some water for irrigation and the environment.

In 2006-07, the lowest annual inflows to the River Murray System were recorded and it became clear that water sharing rules in the Agreement were failing to provide security for water users along the River Murray. In response to this, and the projected continuation of low inflows, New South Wales, Victoria and South Australia entered special water sharing arrangements from 2007-08. These ensured that each State was able to provide its critical human water needs (CHWN) before providing water for other uses.

Under the arrangements, each State was responsible for setting aside its annual CHWN volume in advance of the following water year through the volume of River Murray water available to it for allocation. If this was not possible, then water was required to be 'loaned' from one State to another to meet CHWN and conveyance requirements, with differing effects. The States advancing water had reduced or delayed access to water under the Agreement. The States receiving the advances had immediate access to water for CHWN but then had to wait for inflows to occur to repay the advance before access to water for other uses would be available.

This put additional pressure on communities reliant on general allocations for their livelihoods.

Special sharing arrangements for the River Murray System water were intended to be an interim solution to a short-term issue. Whilst they allowed scarce water resources to be managed effectively, it quickly became apparent that explicit arrangements would be required for times with low water availability, rather than negotiating special arrangements each year. As part of the overall change in management of water resources in the Basin, the Water Act was amended to include provisions for CHWN in the River Murray System as well as associated requirements to which the Basin Plan must have regard.

CHWN are defined as (a) the minimum amount of water required to meet core human consumption requirements in urban and rural areas; and (b) those non-human consumption requirements that a failure to meet would cause prohibitively high social, economic or national security costs.[143]

Chapter 11 of the Basin Plan works together with the Agreement to prioritise water for CHWN in the River Murray System – defining the volume of CHWN for each state, requiring each state to set aside the volumes required to meet its own CHWN, defining and requiring volumes for conveyance, requiring a Conveyance Reserve to be set aside to deliver CHWN and establishing a tiered approach to water sharing when conditions are dry or water quality is impacting CHWN. In recognition of the agreement of Basin

[143] Water Act, section 86A(2).

States that CHWN are the highest priority water use for communities dependent on Basin water resources, a storage right was also provided for South Australia in the Agreement.

The context above is key for understanding why the Basin Plan explicitly deals with CHWN for the River Murray System. It reflects that these arrangements rely on cross-jurisdictional agreements whereas in most other areas of the Basin providing CHWN to communities in one Basin State does not require agreement with, or is not impacted by, another.

There have been concerns that the Basin Plan failed the northern Basin because it has failed to ensure CHWN for those communities. The South Australian Government recognises that some areas of the Basin outside of the River Murray System were significantly impacted by the Tinderbox drought of 2017-2019 and empathises with those communities, particularly in the Barwon-Darling and its tributaries in New South Wales, who face ongoing risks of unreliable and poor-quality town water supplies.

Section 10.51 of the Basin Plan requires that WRPs set out how water resources will be managed to meet CHWN during an extreme dry period and during a water quality event of an intensity, magnitude and duration sufficient to render water acutely toxic or unusable. However, the provisions of section 10.51 have had limited effect in addressing stakeholder concerns about how Basin States plan for and provide CHWN outside of the River Murray System. This is not solely a northern Basin issue.

The South Australian Government is supportive of developing proposals to improve transparency and confidence in providing for CHWN in the northern Basin and other areas. However, where a Basin State has sole control for providing CHWN and this is not impacted by another Basin State, the South Australian Government maintains that it is up to individual Basin States to put in place arrangements (such as flow rules) to ensure CHWN can be met within the take permitted under the relevant SDL. As this should not require action by another Basin State or impact another Basin State, the arrangements do not necessarily need to be outlined in the Basin Plan.

The South Australian Government would not support any reduction to the currently defined volume for CHWN in this state. However, consideration should be given to providing flexibility for a Basin State to increase its CHWN requirements in the River Murray system for state water planning purposes, so long as overall water use remains within the current SDL (i.e. any increase does not increase the SDL) and does not impact third parties.

Whilst the arrangements for CHWN in the River Murray System are critical and largely fit for purpose, there remains an inconsistency between the Water Act and the Agreement. CHWN is the highest priority water use and each Basin State is required to provide for its own CHWN under the Act but there is a storage hierarchy in place that effectively erodes the primacy of this category of water for South Australia. This is exacerbated by the fact that Hume Dam spills quite frequently, which means that at least some of South Australia's deferred water, which is first to spill, cannot be used when needed most.

South Australia's right to store water was agreed in 2007. However, the nature of these arrangements was not finalised until the amendments to the Water Act and Agreement in 2008 to allow South Australia to store part of its annual Entitlement in the upper River Murray storages for CHWN in future years.

- For all Basin States to agree to this, South Australia's stored water must not adversely affect water availability for New South Wales or Victoria. This means that, despite being the highest priority, South Australia's CHWN spills first, including before any held environmental water.
- When South Australia holds water in storage for CHWN it benefits all states in dry years as it is less likely that there will be a requirement for upstream states to provide a 'loan'.
- The storage conditions mean that South Australia is in a continuous cycle of deferring part of its annual Entitlement and then watching it spill from storage when conditions are wetter.

- Water is required to be deferred from the unallocated part of South Australia's Entitlement to rebuild storage volumes during lower water availability years when it would be of benefit to the environment.[144] When South Australia's stored CHWN spill, it is preserved for the environment but delivered at a time when there are generally significant volumes of unregulated flow and it provides limited additional benefits in comparison to the foregone benefits when it was stored.
- Changing operational arrangements, including due to environmental water delivery, have highlighted that there is a limited and reducing window for South Australia to defer Entitlement and have it transferred to upstream storages such as Hume and Dartmouth Dams.
- Recently proposed amendments to the Agreement have included an option for South Australia to store deferred Entitlement in Snowy Storages. Whilst this may provide increased security, it is unclear whether the arrangements can be dynamic enough to support CHWN. South Australia will likely have to compete for access to storage and delivery with non-CHWN water.

The erosion of the primacy of CHWN under the Water Act due to the storage hierarchy means that, somewhat surprisingly, future CHWN security for South Australia can be lowest following a wet period. An analysis of South Australia's storage rights for CHWN should be undertaken and consider:

- The ongoing ability for South Australia to store and hold water for CHWN, including due to the current river operations settings and the significant volumes of environmental water held in storage at times when those storages are likely to spill.
- The potential impact on all Basin States should South Australia not be able to accumulate sufficient CHWN, particularly under future climate change.
- Evaluation of the materiality of any impact on upper states' water availability from allowing South Australia to store and permanently hold water for CHWN in a manner similar to the upper states' storage rights.
- The foregone environmental benefits from the timing of storing water and whether a change to the order of spill would likely results in increased environmental benefits.

Recommendation

It is recommended that:

- *the Basin Plan should continue to support arrangements for CHWN where there are cross border implications and interactions or where agreements are required.*
- *there be no reduction to the volumes specified in the Basin Plan to meet critical human water needs in the River Murray System.*
- *each Basin State be permitted to adjust the CHWN volume for its own share of the resource within the River Murray System for state water planning purposes, subject to the resultant volume being within the existing SDL and any increase not affecting third parties.*
- *an analysis of South Australia's storage rights be undertaken under the Joint Programs.*

[144] Under the Water Allocation Plan for the River Murray Prescribed Watercourse, the unallocated component of South Australia's Entitlement – excluding any deferred water – is classified as planned environmental water.

10 Basin Plan Regulatory Design

Key messages

- Current arrangements for Water Resource Plans (WRPs) have created delays in accreditation, discouraged updates and innovation, and are a barrier to adaptive management.
- Reforming WRPs to a more targeted and risk based model is supported.
- The requirements for SDL compliance and the protection of planned and held environmental water must be regulated through an accredited statutory compliance instrument.
- There are several areas for improvement in the SDL accounting and reporting framework related to ambiguity, differing interpretations, lack of transparency and inconsistent reporting across Basin States.
- Floodplain harvesting and runoff dams remain a major integrity risk to SDL compliance and improved mapping and modelling are essential to protect downstream flows and the ESLT.
- Water trading rules are broadly fit for purpose and are underpinning one of the world's most mature water markets.

10.1 Water Resource Plans

Water Resource Plans (WRPs) were one of the key mechanisms established under the Water Act to give effect to the primary purpose of the Basin Plan: to establish SDLs for the consumptive use of the Basin water resources commensurate with an ESLT.

The aim of WRPs was to ensure that Basin State water management rules supported Basin Plan objectives and outcomes for surface water and groundwater resources. At a time when there was limited trust in the water management arrangements between Basin States, the requirements for WRPs were intended to promote greater transparency in the water management for Basin States and stakeholders alike. They were also designed to enable differences between Basin State legislative frameworks to be visible and provide for the standardised, transparent and accountable operation of Basin States in managing Basin water resources in accordance with the Basin Plan.

In South Australia, the implementation of WRPs has resulted in very few changes to South Australia's water planning and management practices compared to pre-Basin Plan arrangements. This is understood to be consistent with the experience reported by other Basin States.

Water management in the South Australian Murray-Darling Basin is controlled by multiple state water management legislative instruments, plans and other policy documents. As such, WRPs were able to reflect those controls to demonstrate compliance with most obligations or, where required, State instruments were amended to meet WRP obligations. With the requirements specified in WRPs mostly enforced through these state legislative instruments, the WRPs themselves have seldom been used following accreditation.

To an extent, WRPs have also been ineffective at supporting the ongoing achievement of Basin Plan objectives because they are based on point-in-time accreditation, have been difficult to amend and much of the Basin Plan does not amount to binding provisions. This may have unintentionally limited improvements in state water management laws, or more likely, improvements have occurred and have not been incorporated into WRPs.

The complex nature of the WRP accreditation and amendment process is also concerning when juxtaposed with the emphasis of the Basin Plan Review on the importance of adaptive management, including for enabling resilience to emerging climate and water availability risks in the Basin.

Accordingly, re-examining the intent, form and content of WRPs, as outlined in the Discussion Paper, is supported by the South Australian Government.

Recommendation

It is recommended that WRP accreditation processes remain robust whilst being more enabling of adaptive management outcomes and that requirements be clearly articulated to support Basin States in achieving accreditation in a timely and efficient manner.

10.1.1 WRP Requirements

To meet the requirements of the Water Act, [145] Chapter 10 outlines 55 requirements across 13 themes that Basin States must meet for a WRP to be accredited.

It is unclear how individual requirements may have been interpreted by each Basin State and the Authority to account for variability between systems or even between different Authority staff responsible for assessment of evidence that the accreditation requirements are met.

All WRP requirements currently need to be met to the same 'standard', irrespective of the nature of the water resources being managed and the relative level of associated risks (e.g. regulated river systems, unregulated catchments and groundwater management areas). In areas with limited to no water use and/or where risks are low, water use is generally not licenced or metered and it can be more difficult to provide the evidence to meet the WRP requirements in these areas. In some cases, extensive processes were required to develop new arrangements that have added little to no value towards delivering Basin Plan outcomes. It has also led to delays in accreditation, which have ultimately delayed implementation and compliance of the core component of SDL compliance.

The Discussion Paper proposes two options to streamline and improve Basin Plan outcomes with reference to eight core areas. These options are broadly combinations of the above.

- Option 1 would limit the requirements of an accredited WRP instrument to those critical to Basin Plan implementation and would be streamlined to focus on a smaller, high-priority set of requirements addressing core areas. The Inspector-General of Water Compliance (IGWC) would retain its role in ensuring Basin state compliance with WRPs and existing pathways for legal review and challenge would be retained.
- Option 2 would apply to Basin states with 'mature and effective water planning arrangements'. SDL compliance arrangements would continue to be accredited by the Australian Government with compliance oversee by the IGWC. For the remaining core areas, Basin states would demonstrate consistency with Basin Plan criteria through standardised assurance reporting, rather than detailed WRP accreditation.

Whilst the South Australian Government would support working towards a tiered approach to WRP regulation (in line with option 1), the requirements need to be explicit. In contrast, any option where the Authority would be responsible for assessing the 'maturity level' of Basin States' water planning arrangements and determining the WRP option that each Basin State is required to operate under (option 2) would not achieve this. Even with detailed criteria of how the maturity assessment would maintain objectivity and avoid adding unnecessary administrative burden it is not clear how the assessment would have regard to the inherent risk and characteristics of each WRP area in question.

[145] Water Act, section 22.

The South Australian Government supports exploring a reduced WRP scope that includes the core components of SDL compliance and the protection of PEW and HEW within an accredited instrument, combined with an assurance reporting model that requires Basin States to demonstrate implementation of many of the remaining components listed under Chapter 10. The magnitude of effort required to demonstrate implementation should be proportionate to the level of impact of the management requirement on water resource outcomes locally and in other connected resource units.

Consideration should also be given to whether the requirement has been duplicated under other parts of the Basin Plan, as has been recognised in the case of Part 8 of Chapter 10 (trade of water access rights). An explicit explanation of South Australia's position on how each of the existing WRP components should be regulated under a reformed model is provided below.

The South Australian Government has considered the existing requirements for WRPs as follows:

- **SDL Compliance** – the Basin Plan WRP framework provides for the statutory enforcement of SDL compliance and accounting requirements that otherwise did not exist under pre-Basin Plan arrangements. These arrangements are generally not part of Basin States' existing legislative frameworks and, without an accredited WRP, SDLs are not in effect.

  SDL implementation is underpinned by the requirements related to methods and accounting for permitted and actual volumes of water take, water access rights and environmental water. It must ensure accountability, compliance and transparency and it is necessary that these arrangements continue to be regulated under an Australian Government accredited instrument, given their explicit role in ensuring an ESLT.

- **Protection of Planned Environmental Water** – the volume committed to PEW and the timing of delivery forms part of the baseline from which the additional watering needs of environmental assets are determined. Any compromise on its protection would undermine the ESLT and, therefore, the protection of PEW must continue to be enforced through an accredited instrument.

  Despite the statutory protections in place for PEW, the effectiveness of these protections has been undermined by an inability to reconcile differences in jurisdictional interpretations of PEW. Any future re-accreditation of WRPs should seek to resolve and avoid these inconsistencies so that the intent of maintaining baseline flows can be applied within the legislative frameworks of all Basin States prior to commencing drafting and assessment. This may also require an amendment to section 6 of the Water Act to ensure the definition provided for PEW can be applied consistently across Basin States (refer Section 4.5).

- **Protection of Held Environmental Water** – the arrangements for the protection of HEW are as critical for those of PEW, given the direct linkages with the determination of the ESLT. This key protection is not currently part of the requirements for WRPs and was instead linked to the operation of the SDL adjustment mechanism. Given its ongoing importance for delivering Basin Plan environmental outcomes and the difficulties in ensuring arrangements are enduring, it must now be included as a core component of WRPs and enforced through an accredited instrument (refer Section 4.4).

- **Environmental Watering** – the current provisions require WRPs to demonstrate how they provide for environmental watering consistent with the BWS and Basin AEWPs and for the coordination of environmental watering between connected surface water WRP areas. However, there is no requirement for Basin States to improve coordination and it is unclear how compliance of these requirements would be assessed. Given the linkages with the BWS and Basin AEWPs, it would be preferable to strengthen these instruments (refer Section 4.1) and avoid any duplication.

- **Connectivity** – the connectivity requirements for WRPs include demonstrating connections between water resources but the requirements themselves have had limited impact on driving improvement in managing water to promote connectivity either within or between WRP areas. Stand-alone requirements for 'connectivity' are not useful within an accredited instrument. Minimum flow targets are required at key locations throughout the system to maximise hydrological connectivity.

- **Interception Activities** – interception activities include take by runoff dams, forestry plantations, floodplain harvesting and basic rights. The management of take from these activities forms part of the SDL compliance arrangements and should continue to be within an accredited instrument.

  WRPs are also required to identify processes for monitoring medium and/or high risks to connectivity from interception activities and identify actions to be taken when monitoring shows an increased impact. Meeting these requirements in current WRPs reflect a point-in-time assessment of risks that have not been updated since WRPs were accredited. Whilst monitoring may show a change in risk, there appears to be no current lever to require review of the risk assessment or actions. This requirement would be better incorporated within an assurance framework where regular updates on the processes, actions and risks can be declared and assessed.

- **Water Quality** – the arrangements for water quality require WRPs to demonstrate regard to risks to water quality and identify measures for medium and high risks. However, there are no requirements to monitor these risks or put in place actions should risks increase, noting that state-based statutory instruments are often used to undertake risk assessments on an ongoing basis. It also does not recognise that water quality risks in a Basin State may not be able to be managed solely by that Basin State. Given the above, water quality arrangements outlined in WRPs have generally been ineffective.

  Given the importance of monitoring and addressing water quality issues (refer Section 8.2), it is recommended that water quality issues be managed separately from an accredited instrument. In addition to any Basin Plan or Joint Governments water quality management framework, reporting on water quality risks and actions could be included within an assurance framework and potentially replace the current requirements for Matter 12 reporting.

- **Water Trade** – these WRP provisions duplicate the Chapter 12 requirements and are not required.

- **Risk Identification** – the current provisions require WRPs to include an assessment of the risks to the condition and availability of water resources. Basin Governments have indicated that state-based statutory instruments are used to undertake risk assessments on an ongoing basis. State-based risk management frameworks allow for the identification of emerging risks and reflect the fact that the process for identifying and assessing risk is fundamentally iterative.

  To support adaptive management, risk management frameworks need to be able to respond to evolving and potentially unforeseen issues and, as such, an instrument as inflexible as the WRP is not appropriate for governing risk management requirements. It is also worth addressing that

  whilst WRPs are intended to provide for consistent approaches to water management between Basin States, it does not require states to apply a uniform approach to risk assessment and thus the methodologies applied across the current accredited WRPs are inconsistent.

  This requirement would be better incorporated within an assurance framework where regular updates on the risks and actions can be declared and assessed.

- **Measuring and Monitoring** – these requirements relate to the metering of take and the monitoring of water resources to enable Schedule 12. The metering of take requirements should remain within an accredited instrument WRP.

  In terms of monitoring for Schedule 12 reporting, the onus is on Basin States to be able to undertake this reporting and it is unclear how including monitoring information in a WRP adds material value. If necessary, these requirements could be incorporated into an assurance reporting framework.

- **Critical Human Water Needs and Extreme Events** – WRPs are required to describe measures to meet CHWN under extreme circumstance such as drought and adverse water quality events but the requirement does not extend to the effectiveness of the measures. The Basin Plan should support arrangements for CHWN where there are cross border implications and interactions or where agreements are required (refer Section 9.2). Otherwise, Basin States should be required to provide for CHWN under state management frameworks and reporting should form part of an assurance framework, rather than be included in an accredited instrument.

- **First Nations** – WRPs are required to identify First Nations peoples' objectives and outcomes for management of water resources based on the values and uses for those resources gained through consultation. In some Basin States, this has led to improved engagement with and participation by First Nations peoples' in water planning and implementation. These requirements are considered in Section 5.

Recommendation

It is recommended that:

- *the value and effectiveness of all requirements in Chapter 10 are evaluated to remove duplication with other Basin Plan provisions and identify where management arrangements can be addressed through other provisions of the Basin Plan.*
- *the current Chapter 10 requirements relating to SDL compliance and the protection of planned and held environmental water continue to be regulated through an accredited statutory compliance instrument.*
- *the Basin Plan places obligations for identified non-core but important components of Chapter 10 with an associated assurance reporting model that requires Basin States to regularly demonstrate the sufficiency of state-based arrangements in meeting the requirements of the Basin Plan whilst allowing for updated arrangements to accommodate adaptive management.*

10.1.2 WRP Amendment Process

Compounding the complexities associated with WRP development and accreditation processes, the statutory framework for reviewing and amending WRPs has been a significant barrier to adaptive management. Whilst the Water Act provides separate re-accreditation pathways for WRP amendment (according to the materiality of the change), South Australia's experience has been that the process for considering even non-material changes has been inflexible and onerous.

South Australia's accredited WRPs reference parts of several statutory instruments that have since been amended or replaced. In 2022, the South Australian Government commenced the process of updating its three WRPs due to the change from the *Natural Resources Management Act 2004* (NRM Act) to the Landscape Act. As the accredited provisions from the NRM Act remained largely unchanged – including no change to the intent or obligation of the provisions – it was the view of the South Australian Government that changes to these references were minor and that most, if not all, changes would

constitute minor amendments as per section 66 of the Water Act.[146] There were no changes affecting SDL compliance related provisions.

The provisions in the NRM and Landscape Acts relevant to the various components of each WRP were mapped and the changes outlined in accordance with the Authority's WRP Amendment Guidelines. Meetings were held with relevant Authority and IGWC staff to discuss the significance of the changes and a pathway to WRP amendment. Whilst initial suggestions were that the updates appeared minor, advice from the Authority following further review was that full re-accreditation would likely be required.

Given the resources and timeframes required for re-accreditation for all parties, it was agreed that re-accreditation process was not a priority at that time. In the interim, to provide clarity and increase transparency, an annotation was developed in consultation with the Authority and IGWC that has been included on the WRP web pages of the South Australian Government and the Authority – informing the public that there have been legislative changes since the WRPs were accredited but that the plans are still in effect and the South Australian Government and the Authority will continue to work towards re-accreditation.

Consistent with the South Australian Government's experience, the 2025 Basin Plan Evaluation found that ambiguities and concerns about the administrative burden associated with the WRP amendment process were deterring Basin Governments from pursuing updates. Despite developments in new knowledge and resource management strategies, there has not been a WRP amendment executed since the initial accreditation phase in 2019-20.

The pathways for WRP re-accreditation need to accommodate the importance of adaptive management, including for enabling resilience to climate, water availability and water quality risks in the Basin – noting that a reduced scope for WRP content, as being considered through the Basin Plan Review, should ultimately lead to more straightforward re-accreditation pathways and processes. Once the future WRP content is settled, the pathways and requirements for the re-accreditation of WRPs will need to be outlined clearly and transparently to allow efficient implementation across Basin States.

Recommendation

It is recommended that WRP re-accreditation processes remain robust whilst being more enabling of adaptive management outcomes and that requirements be clearly articulated to support Basin States in achieving re-accreditation in a timely and efficient manner.

10.2 SDL Accounting and Reporting Framework

The central purpose of the Water Act is to address the overextraction of water resources in the Basin and return extraction levels to an ESLT via implementation of SDLs defined in a Basin Plan.[147] A robust SDL accounting and reporting framework – based on the best available information – is therefore fundamental to ensuring that compliance with SDLs is robust, transparent and certifiable so as not to undermine the intended outcomes of the Basin Plan.

Several areas for improvement in the SDL accounting and reporting framework are as follows:

- Better information is required to improve the accuracy and integrity of SDL accounting through better accounting for forms of take such as floodplain harvesting (and associated take) and runoff dams. Where the APT is adjusted to equal the Annual Actual Take (AAT) (e.g. floodplain

[146] Section 2.11A of the *Water Regulations 2008* describes the type of amendment that may constitute a minor or non-substantive amendment.

[147] Water Act, s 3(d), s 20(b).

harvesting) or long-term averages are used for both the APT and AAT (e.g. runoff dams), it is structurally impossible to produce an SDL exceedance, regardless of how much is taken.

- Its implementation has raised instances of ambiguity, differing interpretations, lack of transparency and inconsistent reporting across Basin States related to Basin Plan and Water Act terms relevant to SDL accounting.
- More must be done to increase the transparency and understanding of the components of the SDL accounting and reporting framework, ensure consistency between the Water Act and Basin Plan and reduce the administrative burden on Basin States, the Authority and the IGWC.

10.2.1 Accounting Framework

When the Basin Plan came into effect in 2012, a reasonably robust accounting and reporting framework was already in place for the Cap on Diversions under Schedule E of the Agreement. The Cap was agreed by the Ministerial Council in 1996, came into effect from 1 July 1997 and comprised long-term limits on the volume of surface water that could be taken for consumptive purposes from designated rivers and streams across the Basin.

The requirements of the Cap include establishing long-term caps on surface water use, the preparation of methods or models to determine annual Cap limits, annual monitoring and reporting arrangements and actions to ensure compliance. Methods and models for annual compliance were provided to all Basin States for review and approval, ensuring understanding and transparency. Annual independent audits were also designed to ensure collective confidence in Cap compliance.

In 2013, the South Australian Government, Authority and other Basin States commenced the transition from the existing Cap accounting and reporting framework to one for Basin Plan SDLs. Models and methods were expanded to areas not covered by the Cap and to forms of take not previously included, such as water use from runoff dams, by commercial plantations, for basic rights, via floodplain harvesting and from groundwater.

SDL compliance is underpinned by an annual system of credits and debits, which are accumulated by comparing the AAT with the APT and tracking the difference on the Register of Take.[148] Basin jurisdictions report annually to the Authority in accordance with the requirements of sections 32 and 71 of the Water Act and Matter 9 of Schedule 12 of the Basin Plan, using methods for calculating the AAT and APT as outlined in accredited WRPs. The Register of Take is prepared by the Authority and provided to the IGWC to undertake compliance activities if required.

For the most part, the SDL accounting framework is centred around modelled estimates of the APT. It is arguable that there is now less understanding and transparency, particularly among Basin States, of the models and assumptions that are used for this purpose as compared to the arrangements that were used to inform Cap implementation.

A review of the SDL accounting framework in 2019 identified the need to increase the transparency of the hydrological models used in the SDL accounting framework. As these models are being used for compliance purposes, it is reasonable for Basin States and other stakeholders to be given transparency on how decisions are made and how compliance is enforced using these models.

This does not just relate to the broad approach and how hydrological modelling is used, but also how these models compare to real world water use and what limitations modelling has in terms of water use

[148] As per Basin Plan sections 6.08 to 6.11. Similarly, Cap compliance is underpinned by comparing annual diversion limits (or annual Cap targets) with annual diversions and tracking the difference on the Cap Register.

accounting. This includes increasing the availability of documentation and understanding of how the assumptions, uncertainties, limitations and inaccuracies in these models may affect SDL compliance.

Recommendation

It is recommended that models used for annual and long-term SDL compliance be readily available to all Basin States and additional documentation about how the assumptions, uncertainties, limitations and inaccuracies in these models may affect SDL compliance be made available to all stakeholders.

10.2.2 Updates to Surface Water BDL Descriptions and Estimates

The validity of a change to a BDL estimate that gives effect to an equal increase in the SDL, in the absence of an amendment to the Basin Plan, has been raised repeatedly since 2012.

Section 23(2) of the Water Act states that an SDL may be specified in one of three ways, namely (a) a particular quantity of water; (b) a formula used to calculate a quantity per year; or (c) in any other way that the Authority determines to be appropriate. In Schedule 2 of the Basin Plan, the Authority has specified that the SDL in each surface water SDL resource unit (covering all or part of a WRP area) is calculated using the formula:

$$SDL = BDL - \begin{pmatrix} local \\ reduction \\ amount \end{pmatrix} - \begin{pmatrix} SDL\ resource \\ unit\ shared \\ reduction\ amount \end{pmatrix} + \begin{pmatrix} SDL\ adjustment \\ amount \end{pmatrix}$$

A surface water SDL is therefore directly related to its BDL.

10.2.2.1 BDL Descriptions – Surface Water

The Basin Plan sets out descriptive formulas – not fixed volumes – for calculating BDL estimates (referred to as the BDL) for each form of take in each SDL resource unit. These descriptions, listed in column 2 of Schedule 3, define the quantity of water taken or permitted to be taken under State water management laws or at a defined reference date, usually 30 June 2009. BDL descriptions can only be changed through a Basin Plan amendment, which restricts the average annual permitted take within an SDL resource unit to the forms of take that existed at that reference date. All forms of take in place as at 30 June 2009 should therefore be included.

Under section 100 of the Landscape Act, South Australians have a statutory right to take water for stock and domestic purposes, equivalent to 'take under basic rights'. This unlicensed, unmetered form of take existed prior to 30 June 2009 but was inadvertently omitted from the original BDL description and estimate for the SA Murray SDL resource unit.

The accredited WRP identifies the BDL estimate for this form of take as 6.062 GL. Because the Basin Plan requires all forms of take to be accounted for under the SDL, South Australia has had to account for this 6.062 GL under the existing SDL since 1 July 2019. This omission has effectively denied more than 36 GL to the SA Murray on the Register of Take.

Recommendation

It is recommended that:

- *The BDL description for the SA Murray SDL resource unit (SS11) must be updated to explicitly and separately include basic rights, with an associated increase to the BDL estimate of 6.062 GL.*
- *The application of this revised BDL description for the SA Murray SDL resource unit (SS11) should be applied through the SDL compliance framework to the Register of Take from 1 July 2019.*

10.2.2.2 BDL Estimates – Surface Water

A BDL estimate should reflect how much water was (or could) be used by all forms of take prior to the reference date of 30 June 2009 (in most cases). When the Basin Plan was prepared in 2012, an estimate of each BDL volume was included as a note under its BDL description. Whilst a BDL description is fixed and cannot change without an amendment to the Basin Plan, the BDL estimate – as a note – is not considered by the Authority to be legally binding.

A key reason for this approach was that some diversions were not historically measured or were not able to be accurately estimated (with available technology). This included water taken via floodplain harvesting and overland flows but also some take under basic rights.

The process to update a BDL must be robust and transparent. The relevant clauses of the Water Act and the Basin Plan support a change to an SDL via a revision to a BDL without an amendment of the Basin Plan. However, any update to a BDL must reflect its BDL description under Schedule 3 of the Basin Plan and it must be demonstrated that there has not been any growth in use since the reference date.

If consistency with the BDL description is maintained and the BDL estimate does not include any growth in use, there should be no reduction in water available for the environment from the change. This is due to the use of hydrological models to determine the BDL. These models represent the main components of the water balance (including inflow, outflow, losses and water take) and the water management infrastructure and rules (including allocation rules, rules and limits for take).

The water balance parameters are generally calibrated and validated using observed climate and streamflow data. The streamflow data used during model calibration implicitly reflects all take and losses upstream of the recording location and a key part of the calibration process is to parametrise the loss functions. If an estimate of one form of take is improved – such as by more accurately representing water management rules or including improved measurements in the calibration process – then another component must change to maintain the water balance. This may be another form of take, or as occurs, in many cases, the estimate of losses is refined.

This is the case for the change made to the SA Murray BDL when the SA River Murray WRP was accredited, as well as the additional change for basic rights. There is no more water being taken from the SA River Murray, nor less water reaching the Lower Lakes and Coorong. This take is currently part of the overall net loss from the system, which has been calibrated based on flow records and via a water balance approach. Determining this volume simply means that the average annual net loss is 6.062 GL less than previously thought.

There have been many changes to BDL estimates as water resource plans have been accredited, resulting in an increase in the BDL for the Basin of 359 GL – from 13,623 to 13,982 GL. For transparency, Schedule 3 of the Basin Plan needs to be updated with the latest estimates. Additionally, a report (or similar) should be prepared to document and explain, in one place, the updates to all BDL estimates and the rationale – similar to one of the many reports prepared to support the draft Basin Plan.[149] It is not sufficiently transparent to have this information contained in many different documents, many of which are difficult to find.

Recommendation

It is recommended that:

- *Schedule 3 of the Basin Plan is updated to reflect the current BDL estimate for each form of take for each SDL resource unit, as outlined in the relevant accredited water resource plan.*

[149] MDBA (2011) *Comparison of watercourse diversion estimates in the proposed Basin Plan with other published estimates: Supporting information for the preparation of the proposed Basin Plan*. MDBA technical report 2011/01, November 2011.

- *a technical report is prepared which outlines the volumetric change to the BDL estimate for each form of take for each SDL resource unit and the evidence for this change, and which robustly demonstrates no growth in use since the reference date.*

10.2.3 Improvement to APT and AAT Methods

The methods for calculating the APT and AAT are described for each SDL resource unit in accredited WRPs. APT methods are generally a mix of estimated and modelled values and vary based on the inter-annual variability of take, water availability and the relative risk to the resource.[150] The AAT may be calculated using a combination of measured, estimated and modelled values.

The Discussion Paper highlights that better information is required to improve the accuracy and integrity of SDL accounting, including interception by forestry plantations and floodplain storages, whilst a review of methods for better estimating water take by runoff dams is currently underway.

The South Australian Government supports continuous improvement and increased accuracy in methods for calculating the APT and AAT, noting that not all forms of take necessarily need to be calculated using the same method or to the same standard.

Some forms of take are difficult to measure. In principle, the complexity and accuracy of APT and AAT methods should be proportional to the volume of take and risk to the local, downstream or connected water resources. In some areas, current methods that use long-term averages may be fit for purpose, including for forestry plantations.

10.2.3.1 Take by Runoff Dams

Historically, take from runoff dams is one form of take that has not been accurately managed or monitored in many areas of the Basin. Whilst the impact of an individual dam on overall take may be relatively small, the cumulative impact of all dams on streamflow may be very significant.

The risk from runoff dams is not a new issue in the Basin, having been identified in 2006 as a significant risk to the shared resources.[151] The level of impact depends on factors including the timing and volume of water extracted, the size of the dam and its position in the landscape.

It has been estimated that there are over 700,000 runoff dams with take constituting approximately 20 percent of total water use across the Basin.[152] Yet despite the importance of the above factors in the take by runoff dams, the APT and AAT generally remain as long-term averages based on dam volume, with this based on dam surface area. There is no meaningful assurance that these estimates reflect actual take by runoff dams.

Improving estimates of take by runoff dams was identified as a priority issue in an independent review of the SDL accounting framework in 2019,[153] and was subsequently included in the Authority's SDL Accounting Improvement Strategy.[154] However, whilst there is broad acceptance that runoff dams

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[150] Most groundwater resource units have a fixed annual APT that is aligned with the SDL whilst the APT for watercourse diversions is often modelled and accounts for local climate conditions and water availability over the previous water year.

[151] Van Dijk A, *et.al.* (2006) *Risks to the Shared Water Resources of the Murray-Darling Basin*. MDBC Publication No. 22/06, Murray-Darling Basin Commission, Canberra.

[152] Peña-Arancibia JL, Chiew FHS, Yu Y, and Fu G (2023) *Hydroclimate and catchment processes impacting runoff in the northern Murray–Darling Basin*. CSIRO Technical report for the Murray Darling Basin Authority. CSIRO, Australia.

[153] Turner G, Vanderbyl T and Kumar S (2019) *Final Report of the Independent Panel's Review of the Sustainable Diversion Limit (SDL) Water Accounting Framework*.

[154] MDBA (2020) *Sustainable diversion limit (SDL) accounting framework improvement strategy 2020 – 2025*. Murray-Darling Basin Authority, Canberra, May 2020.

impact the availability of surface water for downstream users, the scale and materiality of the impact across the Basin has been contested.

Given the number of runoff dams and the large proportion of the total Basin water use, it is important that more is done to accurately account for this form of take to maintain the integrity of the ESLT and the SDL compliance framework. Accurate mapping of dams and modelling of the hydrological impacts is needed, particularly in medium to high rainfall areas that flow into the major tributaries of the Basin.

An example of where this has occurred is in the EMLR and Marne-Saunders SDL resource units of South Australia. Over a decade before the Basin Plan, the South Australian Government commenced the process to identify and model the impacts of all runoff dams, which led to the licensing and metering of take for consumptive purposes. The SDLs for each of these resource units were determined using hydrological modelling and the APT is modelled each year based on the prevailing climate. The process to map, model and licence runoff dams took over 10 years but this has improved local environmental outcomes and limited future decreases in downstream flows.

For several years, the Authority and Basin States have been undertaking a pilot study aimed at evaluating new technologies for estimating take by runoff dams, funded as part of the SY2 project (Module 3b). Following this pilot study, the intention is to prepare a business case for investment in a long-term program.

Recommendation

It is recommended that:

- *fit for purpose methods for calculating the APT and AAT for some interception activities are permitted, subject to robust assessments of the estimated level of take and risk to downstream resources.*
- *improved estimates of take by runoff dams and floodplain storages, in areas where these activities impact downstream resources, are actively pursued over the next ten years to underpin a requirement for more robust arrangements for these APT and AAT methods by the next Basin Plan Review.*

10.2.4 Reporting Scale and Timeframes

10.2.4.1 Reporting Scale

Inconsistencies exist between the Water Act and Basin Plan with respect to the scale of annual reporting of the APT and AAT, as follows:

- Section 71 of the Water Act – requires reporting for each water resource plan area
- Sections 10.10, 10.15 and 6.10 of the Basin Plan – requires the APT and AAT (within an accredited water resource plan) to be determined for each form of take for each SDL resource unit
- Section 6.11 of the Basin Plan – assesses SDL compliance for each SDL resource unit.

Options to address this include an amendment to section 71 of the Water Act or the preparation of guidelines under section 215V to which Basin States 'must have regard'. Given the nature of the change, an amendment to the Water Act would be the most straightforward and effective option.

Given the requirement to calculate the APT and AAT for each form of take for each SDL resource unit for the purposes of SDL compliance, this would be the most logical scale for reporting and, importantly, would ensure uniformity across SDL resource units. No change in scale for the Register of Take for assessing SDL compliance is needed.

Recommendation

It is recommended that section 71 of the Water Act be amended to require the reporting of water information to occur for each form of take at an SDL resource unit scale.

10.2.4.2 Reporting Timeframes

Reporting under section 71 of the Water Act is required to be submitted to the Authority by 31 October each year. This timeframe has been problematic for many years.

The APT for the SA River Murray is determined by the Authority using model inputs from New South Wales and Victoria. Model inputs from New South Wales also require inputs from Queensland. The sequential nature of the running of APT models has created delays in most years and extensions have had to be requested.

The Integrated River Modelling Uplift program was intended to provide a platform to bring together the models used for planning and compliance across the Basin. Given this, options to increase efficiencies should be pursued.

The amount of data required to be collated and validated for AAT calculations is substantial. Validation processes, as well as the investigation of data issues, also causes delays. Extending the timeframe for the submission of section 71 reporting would allow more accurate and verified data to be provided and reduce the instances of data updates.

Recommendation

It is recommended that:

- *section 71 of the Water Act be amended to extend the reporting timeframes.*
- *the Authority takes steps to reduce the timeframes for running the Source Murray Model, as much as practicable, by working with Basin States to optimise the timing of upstream inputs to downstream states through the Integrated River Modelling Uplift platform.*

10.2.5 Clarifications and Other Updates

10.2.5.1 'Water Available'

Section 71 of the Water Act requires Basin States to report annually for each WRP area using methods set out in the accredited WRP. The exception is for section 71(1)(a), which requires reporting on the 'water available' from the water resources within each WRP area. Neither the Water Act nor the Basin Plan explicitly define this term. Across Commonwealth and Basin State water legislation, 'water available' appears frequently but with no consistent meaning and its interpretation depends heavily on context.

The lack of a definition has been an ongoing issue for Basin States since reporting under section 71 commenced following the 2012-13 water year. During the transitional period from 2012-13 until SDL compliance commenced in 2019-20, various expressions of water available were used for annual reporting purposes. These expressions often varied between surface water and groundwater as well as between Basin States.

In an attempt for consistency, an interim agreement between Basin States and the Authority was made to report on the 'water available' as the 'Water Lawfully Accessible for Take', which refers to the volume of water that can be accessed for take by entitlement or rights holders each year for all forms of take.[155]

[155] MDBA (2025) *Sustainable Diversion Limit Accounting and Reporting Framework*. Murray-Darling Basin Authority, Canberra.

Recommendation

It is recommended that the Water Act is amended to define 'water available' as the 'Water Lawfully Accessible for Take'.

10.2.5.2 'Zero or less'

Section 6.12 of the Basin Plan sets out how non-compliance with an SDL is determined for a surface water SDL resource unit. These provisions apply if the cumulative balance on the Register of Take reaches a debit of 20 percent or more of the SDL. If this occurs, and the Basin State is assessed as having a reasonable excuse, section 6.12(5) requires the Basin State to outline the steps it will take to return the cumulative balance to 'zero or less' – commonly referred to as actions to 'make good'.

Requiring the cumulative balance to return to a debit of 'zero or less' does not align well with the annual debit and credit system of the Register of Take or the broader principles underpinning SDL compliance. The system recognises that the APT is often modelled and will not perfectly reflect real-world water use in any given year. The Basin Plan does not require the cumulative balance to remain permanently in credit, which raises questions about whether 'zero or less' accurately reflects the intent of the provision.

Nonetheless, once a debit of 20 percent of the SDL is reached, it is highly likely that a growth in use has occurred and corrective action is needed. Returning the cumulative balance to 'zero or less' may take time and may have impacts, depending on water availability over the timeframe required.

Expectations for how section 6.12(5) should operate – including process, required actions and timeframes – should be made more explicit in the Basin Plan. Whilst a fixed deadline may not be appropriate, a staged approach warrants consideration.

Recommendation

It is recommended that:

- *to address situations in which the cumulative balance on the Register of Take reaches a debit of 20 percent or more of the SDL, the Basin Plan should be amended to better frame expectations about actions and timeframes to reduce the cumulative balance (potentially to a 15 percent cumulative debit level, as a minimum).*
- *guidelines be prepared under section 215V of the Water Act to set out expectations for processes and timeframes for reducing the cumulative balance closer to zero or at least to a point where any growth in use is being managed.*[156]

10.2.5.3 Reasonable excuse

Section 6.12(4) outlines the circumstances where there is a 'reasonable excuse' if the cumulative balance is a debit equal to or greater than 20 percent of the SDL on the Register of Take, these being: (a) the operation of the water resource plan for the SDL resource unit (i.e. where a Basin State has operated consistently with the rules in a WRP); and (b) where there are circumstances beyond a Basin State's control.

Section 6.12(4)(b) describes the situation where, for reasons beyond the Basin State's control, the Australian Government has not achieved the water recovery target that it set for itself in relation to the SDL resource unit.

In the lead-up to the commencement of SDL compliance and the development of the first SDL compliance and reporting framework, there was concern about the ability of the SDL accounts to

[156] It is noted that a water resource plan must account for a range of matters including 'growth in use'.

determine the portion of the cumulative debit that resulted from incomplete water recovery – given that it may take some years before a situation arose under which section 6.12 would apply.

For this reason, section 6.11(5) was included in the 2018 amendments to the Basin Plan. The rationale was that it would be more effective to determine the 'incomplete recovery' component on an annual basis and adjust the cumulative balance accordingly.

At that time, it was not envisaged that the Australian Government would not complete the Bridging the Gap water recovery target, nor that any shortfall in the SDL offset would not be recovered. To preserve the integrity of the Basin Plan SDLs into the future, it is imperative that the adjustment for incomplete recovery does not continue in perpetuity.

Recommendation

It is recommended that the Basin Plan is amended to remove, or make time limited, the adjustment under section 6.11(5) and the reasonable excuse provision under section 6.12(4)(b) for incomplete water recovery.

10.2.5.4 Temporary Take Restrictions

The Authority has identified that commence to pump trigger thresholds in some unregulated systems are a more significant limitation on AAT volumes than licencing rules (e.g. NSW Barwon- Darling SDL resource unit). Given this, an amendment to section 10.12 of the Basin Plan to add a requirement that APT methods include a mechanism to adjust an APT for 'temporary take restrictions' on an annual basis has been proposed during inter-jurisdictional discussions.

It is unclear why existing and accredited APT methods would not be reflective of relevant commence to pump rules. It would be more appropriate that these rules be factored into the APT models directly, rather than requiring a subsequent step to adjust the APT based on an annual restriction. These types of annual adjustments reduce transparency.

Any change to the requirements for incorporating temporary restrictions into APT calculations cannot undermine the ability of a Basin State to utilise a temporary restriction to reduce the AAT to reduce debits on the Register of Take.

Recommendation

It is recommended that:

- *any change to the Basin Plan to include an additional requirement that APT methods account for temporary take restrictions on an annual basis must be clear on the scope of temporary restrictions included.*
- *there should be no requirement to require APT methods to account for a temporary take restriction resulting from deliberate action(s) taken by a Basin State to reduce the AAT.*
- *additional requirements for an APT method to account for a temporary take restriction should only occur if it is not possible for such a restriction to be included in the existing APT method.*

10.3 Water Trading Rules

The Water Act requires the Basin Plan to include rules for the trading or transfer of tradeable rights (the 'water trading rules') in relation to Basin water resources.[157] These includes rules, terms, processes, restrictions and areas related to the water trading and the availability and reporting of information.[158] The

[157] Water Act, section 22(1), item 12.

[158] Water Act, section 26.

rules must contribute to achieving the Basin water market and trading objectives and principles as set out in Schedule of the Water Act.

Schedule D (transferring water entitlements and allocations) of the Agreement operates to account for interstate and intervalley trade in the southern Basin and ensure the delivery of State entitlements in a way that reflects trades approved by Basin States.

The South Australian Government supports the findings outlined in the Basin Plan Evaluation report and the Discussion Paper that the Basin Plan water trading rules are working as intended and that limited changes are required. The water trading rules set out in the Basin Plan have set the standard for water trading rules and regulations, with the Basin considered to be one of the most mature and effective water markets in Australia and across the world.

South Australia has very straightforward water trading rules within the River Murray with limited restrictions. There are no restrictions imposed on intra-state or inter-state water trade related to Class 3 (High Security) water access entitlements and allocations, which is the main class of water right used by irrigation industries in the SA Murray.

Trade rules and decisions in other Basin States across the southern-connected Basin, including the opening and closing of inter-valley trade and other trade restrictions, may limit access to upstream trading opportunities for South Australian consumptive water users as well as the delivery of environmental water for broader system outcomes. There are also implications for consumptive water deliveries to South Australia, such as where inter-valley water transfers do not match the volume of approved water trades or the timing for delivery. This is also an issue that impacts the timing and use of water traded from tributaries to the River Murray.

The Basin Plan water trading rules provide for trade to occur with limited defined restrictions, reporting of trading prices, making water announcements generally available, restricting trade when information is not generally available (insider trading) and specifying rules for irrigation infrastructure operators. These rules have helped to ensure that water can move to higher value uses by supporting efficient water markets and reducing transactions costs.

The water trading rules have improved transparency and reduced restrictions to water trade. This has given water users greater flexibility to respond to changing conditions, supported more efficient water use and longer-term investment planning.

Since the commencement of the Basin Plan water trading rules there have been numerous reviews on the operation of Murray-Darling Basin water markets. The most significant of these was the Australian Competition and Consumer Commission's (ACCC) Murray–Darling Basin water markets inquiry, which led to the development of the independent Water Market Reform: Final Roadmap report and the implementation of water market reforms through amendments to the Water Act.

The current water market reforms build on the existing water trading rules under the Basin Plan and Agreement to improve the availability and accuracy of water trade data and water market decisions, strengthen insider trading and market manipulation regulations, and set new rules for water market intermediaries.

Basin State governments have committed significant resources and funding to a review and update of Schedule D of the Agreement as well as the implementation of water market reforms, especially with regard to data and system reforms.

The South Australian Government is generally supportive of the water market reform agenda. However, there are concerns that some measures may increase water trading costs and red tape and require significant upgrades to state and irrigation infrastructure operators water licensing systems. The real and tangible benefits of some of these upgrades is yet to be demonstrated. Whilst these initiatives are being

implemented, there is currently no strong case for any further significant reform to water trading rules or other water market arrangements.

However, the South Australian Government does support targeted minor refinements to the Basin Plan water trading rules such as those proposed in the Discussion Paper that improve clarity, transparency and compliance visibility. These include clarifying exemptions for environmental water delivery, amending trade restriction notification provisions to support compliance by the IGWC, enabling trade restrictions to protect First Nations' Cultural heritage and technical changes for consistency with recent water market reforms.

The Basin Plan's water trading rules recognise that environmental water requires unique delivery and accounting arrangements to maximise outcomes from use of environmental water (including the protection of environmental water through return flows and active management and the ability to call environmental water from a specified storage). Without these arrangements, more water for the environment may need to be recovered to achieve equivalent Basin Plan environmental outcomes.

There is a risk that these special delivery arrangements may be treated as a trade and then be in breach of the Basin Plan water trading rules, as has been raised previously by the IGWC and ACCC. Options to clarify the exemption through amendments to the Basin Plan is required to avoid a situation where environmental water managers are unable to continue using and developing efficient delivery methods that optimise environmental outcomes. Implementation of Recommendation 18 from the Water Market Reform Roadmap to improve the transparency, communication and management of held environmental water in the Basin will also be critical to supporting the change.

For amendments to reflect the Water Act[159] settings that allow Basin States to impose trade restrictions to manage features of major indigenous, cultural heritage or spiritual significance, these provisions should be developed with First Nations peoples' to ensure they are practical, culturally appropriate and supported. This includes considering any impacts such restrictions may have on culturally significant features belonging to other Nations, including those downstream.

Amending trade restriction notification provisions to support compliance by the IGWC is also welcomed, particularly on the definition of a 'necessary' restriction so that it is not left open to interpretation. Any restriction needs to be justifiable and able to be used to simply restrict the movement of water. It is not clear whether some recent restrictions on the trade of consumptive and environmental water are consistent with a 'necessary' restriction.

Recommendation

It is recommended that:

- *options be considered to clarify and exclude special delivery and accounting arrangements for environmental water from the Basin Plan rules to improve transparency and ensure that future situations do not arise where these delivery mechanisms could be perceived as conflicting with the trade rules.*
- *the definition of a 'necessary' restriction to trade should be explicitly defined and unambiguous, such that it is not open to multiple and differing interpretations and to support compliance.*
- *guidelines or minimum requirements for notifying the IGWC of a trade restriction are prepared.*
- *further investigation is needed into the alignment of the delivery and extraction of water traded from tributaries into the River Murray for consumptive use.*

[159] Water Act, Schedule 3, clause 4(e).

Acronyms

SY1	2008 CSIRO Sustainable Yields
SY2	2025 Sustainable Yields
AAT	Annual Actual Take
ACCC	Australian Competition and Consumer Commission
ADF	Additional Dilution Flow
ADP	Adelaide Desalination Plant
AEWP	Annual Environmental Watering Plan
AOO	Annual Operating Outlooks
APT	Annual Permitted Take
AWA	Aboriginal Waterways Assessments
AWSEM	Alternative Water Supply Efficiency Measures
BDL	Baseline Diversion Limit
BOC	Basin Officials Committee
Basin Plan	*Basin Plan 2012*(Cth)
BP2024	Basin Plan 2024 implementation
BPFI	Basin Plan full implementation
BSMS	Basin Salinity Management Strategy
BSMS2030	Basin Salinity Management 2030
BWS	Basin-wide environmental watering strategy
CMA	Catchment Management Authority
CEWH	Commonwealth Environmental Water Holder
COFFIE	Commonwealth On-Farm Further Irrigation Efficiency
CBD	Convention on Biological Diversity
Ramsar Convention	Convention on Wetlands of International Importance
CLLMM	Coorong, Lower Lakes and Murray Mouth
CHWN	Critical Human Water Needs
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEW	Department for Environment and Water
EMLR	Eastern Mount Lofty Ranges
EOAA	Environmental Outcomes Assessment Approach
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cth)
ESLT	Environmentally Sustainable Level of Take
EWR	Environmental Watering Requirements
EEO	Expected Environmental Outcomes
FPRMMR	First Peoples of the River Murray and Mallee Region

FPWG	First Peoples Working Group
FLOW-MER	Flow-Monitoring, Evaluation and Research
HCHB	Healthy Coorong Healthy Basin
HEW	Held Environmental Water
IAG	Independent Audit Group for Salinity
IGWC	Inspector-General of Water Compliance
ICM	Integrated Catchment Management
IRMU	Integrated River Modelling Uplift
IVT	Intervalley Trade
SARMS 3IP	Irrigation Industry Improvement Program
IIO	Irrigation Infrastructure Operators
KPI	Key Performance Indicators
Landscape Act	*Landscape South Australia Act (2019)*
LoE	Lines of Enquiry
LTAAY	Long Term Average Annual Yield
LTWP	Long-Term Watering Plans
MoU	Memorandum of Understanding
MER	Monitoring, Evaluation and Reporting
the Basin	Murray-Darling Basin
the Agreement	*Murray-Darling Basin Agreement*
the Authority	Murray-Darling Basin Authority
Ministerial Council	Murray-Darling Basin Ministerial Council
MDBRC	Murray-Darling Basin Royal Commission
MRLB	Murraylands and Riverland Landscape Board
NAP	National Action Plan for Salinity and Water Quality
NWI	National Water Initiative
NFRS	Native Fish Recovery Strategy
NRM	Natural Resource Management
NRM Act	Natural Resources Management Act 2004
NPV	Net Present Value
NAC	Ngarrindjeri Aboriginal Corporation
NBEWG	Northern Basin Environmental Watering Committee
NBR	Northern Basin Review
OECD	Organisation for Economic Cooperation and Development
O&O	Objectives and Outcomes
PEW	Planned Environmental Water
PPM	Prerequisite Policy Measure

PEA	Priority Environmental assets
PBC	Prescribed Body Corporates
RIS	Regulation Impact Statement
RRWIP	Resilient Rivers Water Infrastructure Program
RMO	River Murray Operations
RMOC	River Murray Operations Committee
RRP	Riverine Recovery Project
SA	South Australia
SARDI	South Australian Research and Development Institute
SARMS	South Australian River Murray Sustainability
SARFIIP	South Australian Riverland Floodplain Integrated Infrastructure Program
SEFRP	South East Flows Restoration Project
SCBEWC	Southern Connected Basin Environmental Watering Committee
SCP	Sustainable Communities Program
SDL	Sustainable Diversion Limit
SDLAM	SDL Adjustment Mechanism
SRA	Sustainable Rivers Audit
SRE	Sustaining Riverland Environments
SRWUIP	Sustainable Rural Water Use and Infrastructure Program
TLM	The Living Murray
RMMAC	The River Murray Mallee Aboriginal Corporation
Water Act	*Water Act 2007* (Cth)
River Murray WAP	Water Allocation Plan for the River Murray Prescribed Watercourse
WEP	Water Efficiency Program
WQM	Water Quality Management
WRP	Water Resource Plan
WSP	Water Sharing Plan
WoD	Without Development

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