

2015-16 Annual Environmental Watering Priorities for the South Australian River Murray Water Resource Plan Area

The information contained in this document is prepared for the purpose of complying with South Australia's obligations in respect of annual environmental watering priorities for the South Australian River Murray Water Resource Plan Area, as set out in Chapter 8 of the Murray-Darling Basin Authority Basin Plan (Environmental Watering Plan).

1. Introduction

This document has been prepared to fulfil obligations related to the preparation of Annual Environmental Watering Priorities (the priorities) as specified in the Basin Plan Chapter 8 Division 4. Chapter 8 (Environmental Watering Plan) of the Basin Plan requires Basin States to identify the priorities for the following year and submit these to the Murray-Darling Basin Authority (MDBA) by 31 May. The principles and method described in Chapter 8 Part 6 of the Basin Plan have been applied in developing the priorities. Per previous years, the due date for submission of the priorities provides insufficient time for the completion of the detailed documentation relating to the priorities. Comprehensive documentation will therefore be provided in the 2015-16 Annual Environmental Watering Plan for the South Australian River Murray (the Annual Plan). This document will provide further technical information that underpins the priorities, including additional information as to how the principles and methods were applied. This document will be published later in 2015.

2. Identification of priorities

Annual environmental watering priorities for environmental assets and functions

The priorities for the South Australian River Murray Water Resource Plan Area (WRP Area) for 2015-16 have been developed in accordance with the Basin Plan requirements. Key considerations include asset identification, ecosystem functions within those assets and assessment of the environmental water requirements (EWRs) of those assets against likely water availability.

As a long term watering plan for this WRP area is currently being drafted (for completion by November 2015), a final list of priority environmental assets and ecosystem functions is not yet available. Therefore, the priorities as summarised in **Table 1** are based on the current draft list of environmental assets (i.e. based on best available information at this point in time). The assets outlined in this document, their EWRs and the planned actions for 2015-16, have been developed by considering the ecosystem functions relevant to each site and therefore separate priorities for ecosystem functions are not described here.

The priority assets for environmental water delivery in 2015-16 include:

- the Lower Lakes, Coorong and Murray Mouth (LLCMM);

- the South Australian River Murray Channel (the channel); and
- the South Australian River Murray Floodplain (the floodplain).

Although the Coorong is located within the SA Murray Region WRP area, it is addressed in this document (for the SA River Murray WRP Area) as its primary source of surface water is the River Murray.

Proposed watering actions for each asset have been developed using three water availability scenarios; these scenarios are based on the MDBA multi-history plot (**Figure 1**): 90%, 75% and 50%. These percentages refer to the likelihood of occurrence of different water availability levels based on previous records and current volumes in storage. The proposed actions have not yet been put into rank order because (at the time of writing) it is too early to know the likely resource scenario for 2015-16. This ranking will be undertaken in July 2015 and will be described in the Annual Plan.

The Basin Plan contains several objectives and targets specific to the LLCMM (**Appendix 1**). In order to meet these and other ecological objectives, the long-term EWRs for the LLCMM identify the need for a rolling average annual barrage outflow of at least 2,000 GL per three year period (i.e. not less than 6,000 GL over three years) with no less than 650 GL in any one of the three years (Heneker, 2010; Lester et al. 2011).

The estimated total barrage outflow was 1,300 GL in 2013-14 and (as at April 2015) is 905 GL for the 2014-15 water-year. Due to these antecedent conditions, should resource conditions in 2015-16 eventuate per either the 90% or 75% planning scenarios, then the long-term EWRs for the LLCMM will not be met. This means that there is an elevated risk of the legislated objectives for the LLCMM within the Basin Plan also not being met with degradation in the condition of the site and its ecological character likely.

Similarly, analysis of watering history and the long-term EWRs for the channel and the floodplain indicates that the gap between the desired and the actual frequency of inundation is widening, with no floodplain EWRs met in the past three water years and only channel EWRs relating to lower discharges (10,000 ML/day and 15,000 ML/day) being met. These EWRs will again not be met in 2015-16 water-year under the 90%, 75% and (for the floodplain in particular) the 50% scenario and asset condition will continue to decline. This is why these sites are of such high priority for water delivery.

Further information on all the proposed actions is provided in **Appendix 1** and **Appendix 2**. **Appendix 3** is a list of wetlands to which water is pumped.

In addition to the South Australian priorities listed in Table 1, the Nature Foundation of South Australia (NFSA) will be undertaking environmental watering actions for 2015-16 at selected sites agreed with the Commonwealth Environmental Water Holder (CEWH).

Table 1: 2015-16 Environmental Watering Priorities for the South Australian River Murray WRP Area

Asset	90% scenario	75% scenario	50% scenario
LLCMM	Spring delivery for Lower Lakes and fishway releases	Spring delivery for Lower Lakes and fishway releases	Spring delivery for Lower Lakes and fishway releases

Asset	90% scenario	75% scenario	50% scenario
	<p>Flow of > 1 GL/day for barrage releases</p> <p>Pump to Lower Lakes fringing wetlands</p>	<p>Pump to Lower Lakes fringing wetlands</p> <p>Extend duration of small spring unregulated event</p> <p>Provide winter pulse through Murray Mouth</p> <p>Flow of 2 GL/day for barrage releases</p>	<p>Pumping to Lower Lakes fringing wetlands</p> <p>Provide winter flow pulse through Murray Mouth</p> <p>Provide water for a Lake Level Cycle</p> <p>Flow of 2 GL/day for barrage releases</p> <p>Extend duration of moderate spring unregulated event</p> <p>Extend duration of autumn unregulated event</p>
Channel	<p>Median discharge QSA of 10,000 ML/d with +/-2,000 ML/day variability and short 15,000 ML/day peak – for 90 days</p> <p>Median discharge QSA of 10,000 ML/day with +/- 2,000 ML/day variability – for 60 days</p> <p>Fill gravity fed wetlands</p> <p>Provide water to threatened fish refuges</p>	<p>Median discharge QSA of 15,000 ML/day including within event variation generating short-term increases to 20,000 ML/day - for 90 days</p> <p>Median discharge QSA 15,000 ML/day including within event variation generating short-term increases to 20,000 ML/day - for 60 days</p> <p>Fill gravity fed wetlands</p> <p>Provide water to threatened fish refuges</p>	<p>Median discharge QSA of 20,000 ML/day with +/- 5,000 ML/day variability – for 90 days</p> <p>Median discharge QSA of 20,000 ML/day with +/- 5,000 ML/day variability - for 60 days</p> <p>Fill gravity fed wetlands</p> <p>Provide water to threatened fish refuges</p>
Floodplain	<p>Potential further testing of Chowilla regulator¹</p> <p>Provide flow pulse through Pipeclay and Slaneys weirs</p>	<p>Potential further testing of Chowilla regulator¹</p> <p>Provide flow pulse through Pipeclay and Slaneys weirs</p>	<p>Potential further testing of Chowilla regulator¹</p> <p>Provide flow pulse through Pipeclay and Slaneys weirs</p>

¹ A decision to further test has not yet been made. A final decision to proceed with further testing of the Chowilla regulator will be made following consideration of a number of factors, including risks associated with legal proceedings and the availability of the required environmental conditions. The South Australian Government is undertaking preparations to satisfy all pre-conditions for testing should a decision to proceed with further testing be made.

Asset	90% scenario	75% scenario	50% scenario
	Pump to temporary Chowilla wetlands	Pump to temporary Chowilla wetlands	Pump to temporary Chowilla wetlands
	Pump to temporary wetlands – gorge and valley (19 sites)	Pump to temporary wetlands – gorge and valley (19 sites)	Pump to temporary wetlands – gorge and valley (16 sites)
	Weir pool raising – L2 and L5 by 50 cm	Weir pool raising – L2 and L5 by 50 cm	Weir pool raising – L2 and L5 by 50 cm
	Pump to temporary depressions adjacent to Regent Parrot colonies	Pump to temporary depressions adjacent to Regent Parrot colonies	Pump to temporary depressions adjacent to Regent Parrot colonies

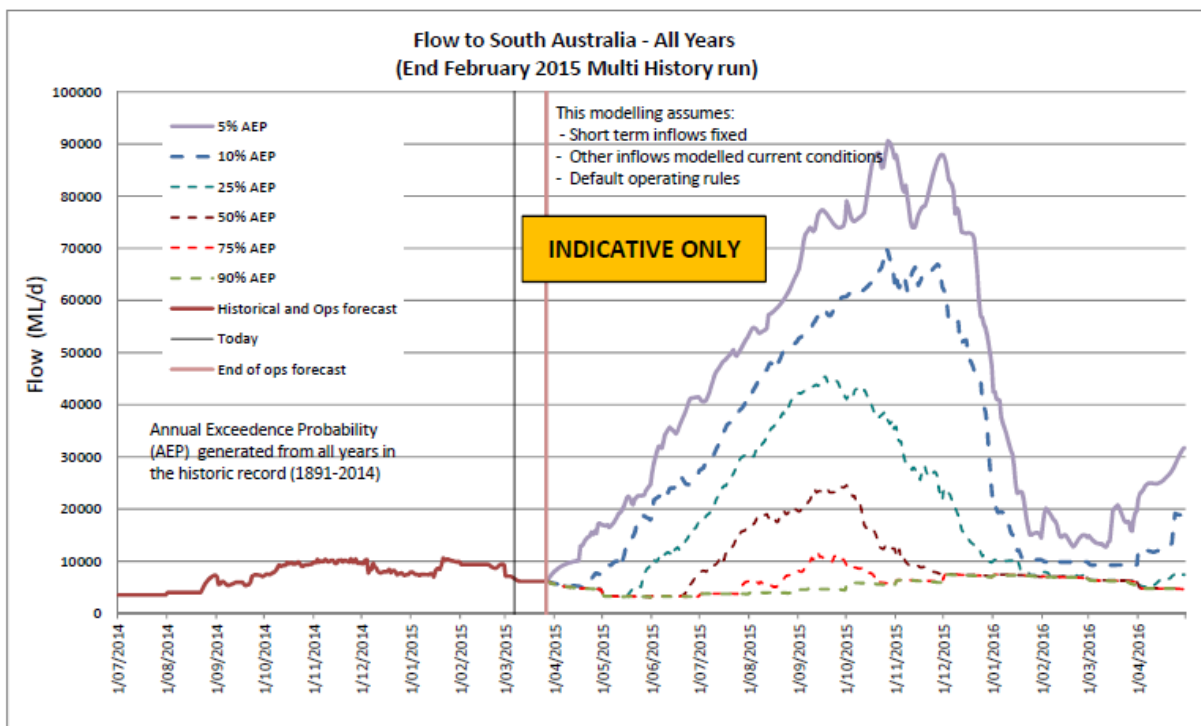


Figure 1: MDBA multi-history plot

Assumptions

Held Environmental Water Availability

The expected holdings of environmental water are available from the following sources – the CEWH, MDBA - The Living Murray (TLM), the Victorian Environmental Water Holder (VEWH), the South Australian Government and non-government organisations.

Commonwealth Environmental Water

Total Commonwealth environmental water holdings within the Southern Connected Basin are approximately 1,340 GL (at 28 February 2015), with varying levels of security and a long term average annual yield of 1,100 GL. Water allocations for 2015-16 have not yet been finalised; however, Department of Environment, Water and Natural Resources (DEWNR) officers have been advised that 800-900 GL will likely be available.

The Living Murray Environmental Water

TLM water holdings are equivalent to approximately 479 GL. Increased flows from the Snowy Agreement may also be available but this is yet to be confirmed. DEWNR officers have been advised that 270 GL of TLM water will likely be available. Note, approximately 37 GL of TLM water is held in South Australia on a licence in the name of the Minister for Water and the River Murray.

Victorian Environmental Water Holder

The VEWH manages the environmental water available in the following rivers: Murray, Goulburn and Campaspe. The VEWH has advised that it has approximately 360 GL available in 2015-16.

South Australian Environmental Water

The volume of water held by South Australia varies from year to year, based on water allocations and any additional water that is purchased.

Schedule 1 of the *Implementation Plan for Augmentation of the Adelaide Desalination Plant* describes arrangements for the establishment of an Environmental Provision that will be held by the South Australian Government, to be used for environmental purposes in the South Australian portion of the Murray-Darling Basin. The Minister for Water and the River Murray holds the licence containing this water; this licence is administered by DEWNR and the held water contributes to addressing the environmental watering priorities identified within this document. There is 6 GL of Class 3A Water Access Entitlement held on the licence and additional amounts (up to 120 GL over a 10 year rolling period of eligible years) may also be purchased throughout the year. Any additional volumes will also be used to support the identified annual environmental watering priorities. Small volumes are also by the SA Minister for Water and the River Murray on interstate licenses (less than 2 GL in total).

The Water Allocation Plan for the River Murray Prescribed Watercourse establishes Class 9 Water Access Entitlements of 200 GL or 200,000,000 unit shares. This volume is the estimated annual evaporative loss from all wetlands that are connected to the South Australian River Murray at normal operating pool level. Of this 200 GL, approximately 34 GL (or 34,781,915 unit shares) have been assigned to a Minister for Water and the River Murray's licence for use in managed pool-connected wetlands. The priority for this volume in 2015-16 is to implement ecologically sound

hydrological regimes at all managed, pool-connected wetlands. DEWNR officers manage the water allocation for managed wetlands.

Non-Government Organisations

Nature Foundation SA holds 37 ML of Class 3A Water Access Entitlement on licence that is irrigation water purchased for environmental use. The Foundation also has access to up to 10 GL of water allocation each year from the CEWH for its work along the River Murray in South Australia. This is a portion of the total volume held by CEWH in South Australia.

The Murray Darling Association, through its Murray Darling Foundation, has established 'Water Bank' that receives donations for purchasing and holding water for future environmental activities. It holds 60 ML of Class 3A Water Access Entitlement but has no plans for environmental watering in 2015-16.

Planned Environmental Water Availability

Unregulated Flows

The WAP for the River Murray Prescribed Watercourse allows water to be allocated to high security licences only. Under the Murray-Darling Basin Agreement and the WAP, no provisions exist for the allocation and use of unregulated flows for non-environmental consumptive purposes in South Australia. Therefore, when an unregulated flow event occurs, it is protected from other water users. Unregulated flows generally occur in response to high rainfall events upstream from South Australia. The MDBA Southern Connected Basin Environmental Water Committee (SCBEWC) has delegated authority from the Basin Officials Committee (BOC) to authorise use of River Murray Unregulated Flow (RMUF) for environmental purposes in the River Murray.

Under the different flow scenarios shown in Figure 1, unregulated flow provides the increase in height and volume of water above South Australia's Entitlement Flow. This unregulated flow can only be planned for in a general way, but if it occurs then it is able to achieve environmental outcomes in South Australia.

200 GL of class 9 water

As outlined previously, the WAP establishes 200 GL of Class 9 Water with approximately 34 GL (or 34,781,915 unit shares) assigned to a licence of the Minister for Water and the River Murray's for use in managed pool-connected wetlands. The remaining 166 GL of Class 9 water is classified as planned environmental water and will be used by non-managed, pool-connected wetlands via evaporation during normal river operations and is not available for other uses. It cannot be managed.

Entitlement Flow

Part of South Australia's Consumptive Entitlement Flow (120 GL) is not designated for a particular purpose. This water is not actively managed but is used by the environment to support the Lower Lakes (including fringing wetlands) and the main River channel by helping to maintain connectivity, support ecological processes and provide habitat for aquatic biota. Water is delivered to these areas through normal River operations.

South East Flow

The DEWNR South East Flows Restoration Project has been established to manage water release from Morella wetland via Salt Creek to provide complementary benefits to the Morella wetland and to the South Lagoon of the Coorong. Decisions on the release volume, flow rate and timing of releases are made each year by the South Eastern Water Conservation and Drainage Board (SEWCDB) following informal advice from DEWNR and SEWCDB officers. The Board consists of an eight member statutory body established under the *South Eastern Water Conservation and Drainage Act 1992*. The SEWCDB officers use a digital elevation model and seasonal weather conditions to provide advice to the Board whilst DEWNR officers seek advice from a Scientific Advisory Group.

The available volume of up to 40 GL per year has generally been released between March and October at a rate of 0.05 to 0.08 GL/d. However, DEWNR officers have proposed a preferred release of some water in summer to help reduce salinities in the South Lagoon of the Coorong.

3. Co-operative Watering Arrangements

Holders and managers of environmental water

For the last five years, holders and managers of environmental water have worked together to plan and coordinate annual multi-site environmental watering trials (trials). The trials attempt to maximise the use of environmental water by re-using return flows as the water moves through the Southern Connected Basin. In 2013, Basin Officials Committee (BOC) agreed that the long-term objective of the trials is to work towards incorporating environmental delivery into normal River Murray operations. This is occurring by identifying and analysing issues and potential changes to current operational practices.

The trials have tested a range of actions including new accounting methods, addition of environmental water to unregulated flows, use of loss factors and coordination of environmental releases with natural flow peaks. Each trial builds on lessons learned from the previous year and enhances understanding of the key elements for a successful outcome. In 2015-16 these actions will be further documented for codification into the existing Framework for managing Basin river flows.

MDBA's SCBEWC and Water Liaison Working Group (WLWG) contribute to the development of the multi-site event strategy each year. Real-time operations groups hold regular teleconferences to ensure coordination and communication during the event and rapid response to any issues that may arise, such as black water events. South Australia is participating in the planning for the large scale environmental watering event for 2015-16.

The ecological objectives and the environmental water used will vary depending on the seasonal conditions. For example, concurrent delivery of water from the Goulburn, Murrumbidgee and Darling Rivers will increase flow along the River Murray in South Australia and boost flows into the LLCMM. There will be in-stream benefits along the entire River Murray System from Hume Dam to the Murray Mouth.

For 2015-16, DEWNR will develop a multi-site plan for the use of environmental water within the South Australian River Murray. This will include a number of actions. For example, if environmental water is allocated and a decision made to use it to further test the Chowilla regulator and to raise weir pools, then there will be return flows to the River Murray downstream. Under the WAP for the River Murray, this water may not be re-allocated for consumptive use. Therefore, it is available for use at other sites as it flows down the river and will eventually be delivered to the LLCMM for ecological benefit.

References

Heneker, TM 2010 Development of flow regimes to manage water quality in the Lower Lakes, South Australia, DFW Technical Report 2010/05, Government of South Australia, through Department for Water, Adelaide

Lester R, Fairweather P, Higham J (2011) Determining the environmental water requirements for the Coorong, Lower Lakes and Murray Mouth Region: Methods and findings to date. A report prepared for the South Australian Department for Environment and Heritage. Flinders University, Adelaide.

Appendix 1. Basin Plan objectives and targets specific to the Lower Lakes, Coorong and Murray Mouth

8.06 Protection and restoration of ecosystem functions of water-dependent ecosystems

(3) An objective is to protect and restore connectivity within and between water-dependent ecosystems, including by ensuring that:

(c) the Murray Mouth remains open at frequencies, for durations, and with passing flows, sufficient to enable the conveyance of salt, nutrients and sediment from the Murray-Darling Basin to the ocean; and

(d) the Murray Mouth remains open at frequencies, and for durations, sufficient to ensure that the tidal exchanges maintain the Coorong's water quality (in particular salinity levels) within the tolerance of the Coorong ecosystem's resilience; and

Note: This is to ensure that water quality is maintained at a level that does not compromise the ecosystem and that hydrologic connectivity is restored and maintained.

(e) the levels of the Lower Lakes are managed to ensure sufficient discharge to the Coorong and Murray Mouth and help prevent river bank collapse and acidification of wetlands below Lock 1, and to avoid acidification and allow connection between Lakes Alexandrina and Albert, by:

(i) maintaining levels above 0.4 metres Australian Height Datum for 95% of the time, as far as practicable; and

(ii) maintaining levels above 0.0 metres Australian Height Datum all of the time

9.14 Targets for managing water flows

(5) For the purposes of subsections (1) to (4), the following targets apply:

(c) the levels of salinity at the reporting sites set out in the following table should not exceed the values set out in the table, 95% of the time:

Item	Reporting site	Target value (EC) ($\mu\text{S}/\text{cm}$)
1	River Murray at Murray Bridge	830
2	River Murray at Morgan	800
3	River Murray at Lock 6	580
4	Darling River downstream of Menindee Lakes at Burtundy	830
5	Lower Lakes at Milang	1000

2015-16 Environmental watering priorities for the South Australian River Murray

Appendix 2 Detailed priorities

90% AEP Scenario

Asset	Action	Additional details	Objectives	Approximate Volume (GL) ²
LLCMM	Spring delivery for Lower Lakes and fishway releases	September - November 90 days	Spring inundation of fringing Lower Lakes wetlands – Southern bell frog recruitment, small native fish recruitment, fringing and submergent aquatic vegetation health, cryptic waterbird habitat	270-360
	Provide flow of > 1 GL/day for barrage releases	July - August and December - June 270 days	12 months continuous barrage releases for fish passage – connectivity, movement and recruitment of congollis and galaxias	223
	Pump to Lower Lakes fringing wetlands – Tolderol, Milang, Point Sturt and Gollans Waterhole	Spring - Summer 120 days	Habitat for migratory birds, frog breeding, improve aquatic plant seedbank, improve littoral vegetation communities	0.9
Channel	Median discharge QSA 10,000 ML/day with +/-2,000 ML/day variability and short 15,000 ML/d peak	Mid-September - mid-December 90 days	Create flow pulse in late spring/early summer to support golden perch and silver perch larval dispersal and survival	300-450

² Approximate volume is the estimated volume of environmental water required in addition to the base-flows indicated within the AEP hydrographs

Asset	Action	Additional details	Objectives	Approximate Volume (GL) ²
	Median discharge QSA 10,000 ML/day with +/-2,000 ML/day variability	September – March 60 days	Generate small variations in water levels to: improve quality of food resources by promoting bacterial biofilms, increase lateral recharge, promote growth and recruitment of understorey vegetation, improve condition of long lived vegetation; Increase hydraulic complexity/diversity of velocity classes	250-300
	Fill gravity fed wetlands	Bookmark Creek (ongoing) + managed wetlands (120 days)	Maintain vegetation communities, provide frog breeding opportunities, provide waterbird habitat, provide flowing habitat in Bookmark Creek	35
	Provide water to threatened fish refuges	2 sites (Dishers Creek and Berri Evaporation Basin)	Support Murray hardyhead populations	1.5
Floodplain	Potential further testing of Chowilla regulator ³	Within channel rise	Works and measures testing; Groundwater/vegetation/fauna outcomes	5 GL plus filling volume of 17 GL and 51 GL to boost flows
	Pump to temporary Chowilla wetlands	Spring - Summer	Maintain vegetation and provide frog habitat	2

³ A decision to further test has not yet been made. A final decision to proceed with further testing of the Chowilla regulator will be made following consideration of a number of factors, including risks associated with legal proceedings and the availability of the required environmental conditions. The South Australian government is undertaking preparations to satisfy all pre-conditions for testing should a decision to proceed with further testing be made.

Asset	Action	Additional details	Objectives	Approximate Volume (GL) ²
	Provide flow pulse to Pipeclay and Slaney weirs	Spring - Summer	Vegetation outcomes	0
	Pump to temporary wetlands – gorge and valley (19 sites) (see Appendix 2)	September - December 120 days	Regent parrot habitat and breeding, frog breeding, habitat for cryptic birds	7
	Pump to depressions adjacent to Regent Parrot colonies	Banrock Bends/Overland Corner South – for 30 days, November - December or November - March	Regent parrot breeding	0.05
	Pump to depressions to provide a small flood	Wigley Reach - for 30 days, November - December or November - March	Southern Bell Frog breeding; Swamp daisy	0.13
	Provide water to Banrock Eastern Lagoon	Eastern Lagoon - 120 days August - September or November - March	Create refuge for water birds and Southern Bell Frog	1.43
	Provide water for Banrock Creek	Banrock Creek - 365 days	Create fast flowing fish habitat – for Freshwater Catfish	0
	Raise weir pools	Lock 2 50 cm Lock 5 50 cm; 90 days September - November or August - October	Avoid irretrievable loss of or damage to environmental assets; return some natural variation in water level; improve food web pathways from biofilms; improve vegetation condition Assist the Pike SARFIIP project to identify and address any issues that may restrict future operations of the floodplain infrastructure Increase knowledge of the means of improving environmental river management	21.3

Asset	Action	Additional details	Objectives	Approximate Volume (GL) ²
			Communicate and engage with river communities on future weir pool operations	

75% AEP Scenario

Site	Action	Additional details	Objectives	Approximate Volume (GL)
LLCMM	Spring delivery for Lower Lakes and fishway releases	September - November 90 days	Spring inundation of fringing Lower Lakes wetlands – Southern bell frog recruitment, small native fish recruitment, fringing and submergent aquatic vegetation health, cryptic waterbird habitat	270-360
	Extend duration of small spring unregulated event	October - December 90 days	Coorong health – salinity, spawning and recruitment in estuarine fish, benthic invertebrates, migratory waders feeding habitat	200
	Provide winter pulse through Murray Mouth/Lake Level Cycle	June 30 days	Freshwater signal, lamprey migration, minimise sediment accumulation in Mouth	40-60
	2 GL/day for barrage releases	Mid-October - mid-January	Enhance estuarine conditions	Up to 446
	Pump to Lower Lakes fringing wetlands – Tolderol, Milang, Point Sturt and Gollans Waterhole	Spring - Summer 120 days	Habitat for migratory birds, frog breeding, improve aquatic plant seedbank, improve littoral vegetation communities	0.9

Site	Action	Additional details	Objectives	Approximate Volume (GL)
Channel	Median discharge QSA 15,000 ML/day including within event variation generating short-term increases to 20,000 ML/day	Mid-October - mid-January 90 days	Create flow pulse in late spring/early summer to promote spawning by golden perch and silver perch and facilitate downstream transport of larvae; improve larval survival and promote recruitment by Murray cod	500
	Median discharge QSA 15,000 ML/d including within event variation generating short-term increases to 20,000 ML/day	September - March 60 days	Generate small variations in water levels to: improve quality of food resources by promoting bacterial biofilms, increase lateral recharge, promote growth and recruitment of understory vegetation, improve condition of long lived vegetation; Increase hydraulic complexity/diversity of velocity classes	200-500
	Fill gravity fed wetlands	Bookmark Creek (ongoing) + managed wetlands (120 days)	Maintain vegetation communities, provide frog breeding opportunities, provide waterbird habitat, provide flowing habitat in Bookmark Creek	7
	Provide water to threatened fish refuges	2 sites (Disher Creek and Berri Evaporation Basin)	Support Murray hardyhead	1.5
Floodplain	Potential further testing of Chowilla regulator ⁴	In channel rise	Works and measures testing; Groundwater/vegetation/fauna outcomes	5 GL plus filling

⁴ A decision to further test has not yet been made. A final decision to proceed with further testing of the Chowilla regulator will be made following consideration of a number of factors, including risks associated with legal proceedings and the availability of the required environmental conditions. The South Australian government is undertaking preparations to satisfy all pre-conditions for testing should a decision to proceed with further testing be made.

Site	Action	Additional details	Objectives	Approximate Volume (GL)
				volume of 17 GL
	Provide flow pulse for Pipeclay and Slaney weirs	Spring - Summer	Vegetation outcomes	0
	Pump to temporary wetlands – gorge and valley	19 sites	Regent parrot habitat and breeding, frog breeding, habitat for cryptic birds	7
	Pump to depressions adjacent to Regent Parrot colonies	Banrock Station – for 30 days, November - December or November - March	Regent parrot breeding	0.05
	Pump to depressions to provide a small flood	Wigley Reach - for 30 days, November - December or November - March	Southern Bell Frog breeding	0.13
	Provide water to Banrock Eastern Lagoon	Eastern Lagoon - 120 days August - September or November - March	Create refuge for water birds and Southern Bell Frog	1.43
	Provide water for Banrock Creek	Banrock Creek - 365 d	Create fast flowing fish habitat	0
	Raise weir pools	Lock 2 up 50cm; Lock 5 up 50 cm; 90 days September - November or August - October	Ensure environmental assets maintain their basic functions and resilience; return some natural variation in water level Assist the Pike SARFIIP project to identify and address any issues that may restrict future operations of the floodplain infrastructure Increase knowledge of the means of improving environmental river management	21

Site	Action	Additional details	Objectives	Approximate Volume (GL)
			Communicate and engage with river communities on future weir pool operations Improve food web pathways from biofilms; improve vegetation condition	

50% AEP Scenario

Site	Action	Additional details	Objectives	Approximate Volume (GL)
LLCMM	Spring delivery for Lower Lakes and fishway releases	September - November 90 days	Spring inundation of fringing Lower Lakes wetlands – Southern bell frog recruitment, small native fish recruitment, fringing and submergent aquatic vegetation health, cryptic waterbird habitat	270-360
	Provide winter pulse through Murray Mouth/Lake Level Cycle	June 30 days	Freshwater signal, lamprey migration, minimise sediment accumulation in Mouth	40-60
	2 GL/day for barrage releases	Mid-October - mid-January	Enhance estuarine conditions	Up to 446
	Extend duration of moderate spring unregulated event	Mid October - December 75 days	Salinity benefit to Coorong, Ruppia tuberosa growth and seed set, food supply for waterbirds, open Murray Mouth	300-350
	Extend duration of autumn unregulated event	March 30 days	Rapid lake level cycle to reduce salinity in Lake Albert	180-270
	Pump to Lower Lakes fringing wetlands – Tolderol, Milang,	Spring-Summer 120 days	Habitat for migratory birds, frog breeding, improve aquatic plant seedbank, improve littoral vegetation communities	0.9

Site	Action	Additional details	Objectives	Approximate Volume (GL)
	Point Sturt and Gollans Waterhole			
Channel	Action E: Median discharge QSA 20,000 ML/day with +/- 5,000 ML/day variability	Mid October - mid January 90 days	Objective 4 (Golden and silver perch) Objective 5 (Murray cod) Objective 6 (Catfish) Objective 13 (Frogs) Objective 14 (Waterbirds)	300-450
	Action F: Median discharge QSA 20,000 ML/day with +/- 5,000 ML/day variability	October - December 60 days	Objective 2 (Velocity) – see below Objective 7 (Productivity)	150-300
	Action G: Median discharge QSA 20,000 ML/day with +/- 5,000 ML/day variability	Sept - December 60 days	Objective 9 (Redgum recruitment)	150-300
	Action H: Median discharge QSA 20,000 ML/day with +/- 5,000 ML/day variability	September - February 60 days	Objective 10 (Redgum germination)	150-300
	Action I: Median discharge QSA 20,000 ML/day with +/- 5,000 ML/day variability	September - March 60 days	Objective 8 (Redgum condition) Objective 11 (Macrophytes) Objective 12 (Temporary wetlands)	150-300
	Fill gravity fed wetlands	Bookmark Creek + Class 9 wetlands	As for 75%	35
	Provide water to threatened fish refuges	2 sites (Disher Creek and Berri Evaporation Basin)	Support Murray hardyhead	1.5
Floodplain	Potential further testing of Chowilla regulator ⁵	Low-mid floodplain	Works and measures testing; Groundwater/vegetation/fauna outcomes	39 GL plus filling

⁵ A decision to further test has not yet been made. A final decision to proceed with further testing of the Chowilla regulator will be made following consideration of a number of factors, including risks associated with legal proceedings and the availability of the required environmental conditions. The South Australian government is undertaking preparations to satisfy all pre-conditions for testing should a decision to proceed with further testing be made.

Site	Action	Additional details	Objectives	Approximate Volume (GL)
				volume of 15 GL and 1,025 GL to boost flows
	Pump to temporary wetlands	16 sites	Regent parrot habitat and breeding, frog breeding, habitat for cryptic birds	Up to 6.4
	Provide flow pulse for Pipeclay and Slaney weirs	Spring - Summer	Vegetation outcomes	0
	Pump to depressions adjacent to Regent Parrot colonies	Banrock Station – for 30 days, November - December or November - March	Regent parrot breeding	0.05
	Pump to depressions to provide a small flood	Wigley Reach - for 30 days, November - December or November - March	Southern Bell Frog breeding	0.13
	Provide water to Banrock Eastern Lagoon	Eastern Lagoon - 120 days August - September or November - March	Create refuge for water birds and Southern Bell Frog	1.43
	Provide water for Banrock Creek	Banrock Creek - all year	Create fast flowing fish habitat	0
	Raise weir pools	Lock 2 up 50cm; Lock 5 up 50 cm; 90 days September - November or August - October	Maintain ecological health and resistance; return some natural variation in water level; improve food web pathways from biofilms; improve vegetation condition Assist the Pike SARFIIP project to identify and address any issues that may restrict future operations of the floodplain infrastructure	20

Site	Action	Additional details	Objectives	Approximate Volume (GL)
			Increase knowledge of the means of improving environmental river management Communicate and engage with river communities on future weir pool operations	

Explanation of objectives

Objective 2 (Velocity): Increase hydraulic complexity (i.e. diversity of velocity classes present)

Objective 4 (Golden and silver perch): Promote spawning by golden perch and silver perch, and facilitate downstream transport of larvae

Objective 5 (Murray cod): Improve larval survival and promote recruitment by Murray cod

Objective 6 (Catfish): Improve larval survival and promote recruitment by freshwater catfish

Objective 7 (Productivity): Improve the availability and quality of in-stream resources due to increased carbon and nutrient loads, increased heterotrophic activity and establishment of early successional state biofilms

Objective 8 (Redgum condition): Maintain and/or improve the condition of adult river red gums (in riparian and low-lying floodplain areas)

Objective 9 (Redgum recruitment): Support establishment of river red gum seedlings and saplings

Objective 10 (Redgum germination): Create favourable soil moisture conditions to coincide with period of peak seed fall by river red gums

Objective 11 (Macrophytes): Support the germination, growth, flowering and seed-set by native macrophytes in littoral and low-lying floodplain/wetland areas

Objective 12 (Temporary wetlands): Maximise the inundated area of low-lying temporary wetlands

Objective 13 (Frogs): Support frog recruitment by maintaining the presence of water for sufficient time for tadpoles to complete metamorphosis

Objective 14 (Waterbirds): Support waterbird breeding by maintaining the presence of water for sufficient time for chicks to fledge

Appendix 3 Temporary wetlands for pumping

Wetland
Maize Island
Markaranka temporary flow paths
Hogwash Bend
Molo Flat
Morgan East
Morgan Conservation Park north lagoons
Sweeney's
Sugar Shack temporary basin
Carparks Lagoon
Gerard basin and floodplain
Weila Shedding
Bookmark Creek and wetlands
Templeton
Murtho Park
Old Loxton Rd
Katarapko Creek
Martin Bend
Yabby Creek/ Katarapko Basins
Pike Black Box