2016-17 Annual Environmental Watering Plan

FOR THE SOUTH AUSTRALIAN RIVER MURRAY

October 2016

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Environmental Water, Trade and River Operations Policy
Water and Climate Change
Level 5
81-95 Waymouth St
ADELAIDE SA 5000

Telephone +61 (8) 8463 7623
Facsimile +61 (8) 8463 6999
Internet: www.environment.sa.gov.au

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Cover photo: Alison Stokes

Foreword

The *2016-17 Annual Environmental Watering Plan for the South Australian River Murray* (the Annual Plan) is one of the key instruments in South Australia's river management framework. It builds upon work done in previous Environmental Watering Plans, as well work completed through the development of the recently published *Long-Term Environmental Watering Plan for the South Australian River Murray*.

The Murray-Darling Basin Authority Basin Plan has prescribed processes for the planning and prioritisation of environmental water and these requirements have been incorporated into this Annual Plan. A wide range of community stakeholders have been engaged in its development, supporting a transparent process to determine watering priorities.

Each year the water resource outlook is different, volumes of available environmental water may change and environmental watering priorities vary. This presents a challenge to water holders and managers to be able to maximise outcomes. Since the breaking of the millennium drought in 2010-11, there has been a gradual trend towards increasingly dry conditions. The outlook for 2016-17 was for dry to very dry conditions in the Murray-Darling Basin, which would see not only low natural flows but also a limited availability of environmental water; however, as the year has progressed conditions have tended to a wetter sequence. The Annual Plan identifies priority environmental watering actions for the 2016-17 and seeks to ensure the best use of environmental water in this water year, regardless of water availability.

I would like to thank all those who have been involved in the planning, management and delivery of environmental water and look forward to another successful watering year in 2016-17.

Julia Grant, Executive Director, Water and Climate Change
Department of Environment, Water and Natural Resources
October 2016

Acknowledgement of the Traditional Owners

The Department of Environment, Water and Natural Resources acknowledges and pays respect to the Traditional owners, and their Nations, of the Murray-Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

Acknowledgements

In addition to staff in the Department of Environment, Water and Natural Resources (DEWNR), input from representatives and employees of the following organisations has been gratefully received:

- Commonwealth Environmental Water Office (CEWO);
- Coorong, Lower Lakes and Murray Mouth Community Advisory Panel (CAP);
- First Peoples of the Murray and Mallee;
- Local Action Planning Groups (LAP Groups), through Community Action for the Rural Environment;
- Murray-Darling Basin Authority (MDBA);
- Nature Foundation South Australia (NFSA);
- Ngarrindjeri Regional Authority (NRA), including the Mannum Aboriginal Community Association Incorporated;
- Renmark Irrigation Trust (RIT);
- River Murray Advisory Committee (RMAC);
- Scientific Advisory Group for the Lower Lakes, Coorong and Murray Mouth (SAG);
- South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Board;
- South Australian Research and Development Institute (SARDI); and
- Other South Australian government departments through interagency reference groups.

The following water holders are acknowledged for the planned provision of environmental water to South Australia in 2016-17:

- Commonwealth Environmental Water Holder (CEWH);
- The Living Murray (TLM) program;
- Nature Foundation South Australia; and
- South Australian Minister for Water and the River Murray.

There are many water managers, land holders, community groups and individuals who contribute time, expertise, energy and resources towards delivery of planned environmental watering actions. These actions and subsequent benefits for the river and its communities could not be achieved without their hard work and commitment.

Glossary: Terms and Acronyms

Units of measurement commonly used (SI and non-SI Australian legal)

Name of unit	Symbol
day	d
gigalitre	GL
megalitre	ML

AEP – Annual Exceedance Probability

ASS – Acid Sulfate Soils

AHD – Australian Height Datum

Barrage — specifically any of the five low weirs at Lake Alexandrina and the Goolwa Channel constructed to exclude seawater from the Lower Lakes

Basin — the area drained by a major river and its tributaries

CEW – Commonwealth Environmental Water

CEWH – Commonwealth Environmental Water Holder; the person charged with responsibility for the Commonwealth Government's water that is held for environmental purposes

CEWO – Commonwealth Environmental Water Office; the office that supports the CEWH

CLLMM – Coorong, Lower Lakes and Murray Mouth. One of three priority environmental assets identified in the Long-Term Environmental Watering Plan for the SA River Murray Water Resource Plan Area, and equivalent to the Lower Lakes, Coorong and Murray Mouth TLM Icon site. The names 'Coorong, Lower Lakes and Murray Mouth' and 'Lower Lakes, Coorong and Murray Mouth' are used interchangeably.

DEWNR — Department of Environment, Water and Natural Resources (Government of South Australia)

Diversity — the distribution and abundance of different plant and animal species and communities within a specified area

EC — electrical conductivity; 1 EC unit = 1 micro-Siemen per centimetre (µS/cm) measured at 25°C; commonly used as a measure of water salinity as it is quicker and easier than measurement by TDS

Ecosystem — any system in which there is an interdependence and interaction between living organisms and their immediate physical, chemical and biological environment

Endangered species — any species in danger of extinction throughout all or a significant portion of its range

Entitlement Flow — minimum monthly River Murray flow to South Australia agreed in the *Murray-Darling Basin Agreement 2008*

Environmental water requirements — the water regimes needed to sustain the ecological values of aquatic ecosystems, including their processes and biological diversity, at a low level of risk

Fishway — a generic term describing all mechanisms that allow the passage of fish along a waterway. Specific structures include fish ladders (gentle sloping channels with baffles that reduce the velocity of water and provide resting places for fish as they 'climb' over a weir) and fishlifts (chambers, rather like lift-wells, that are flooded and emptied to enable fish to move across a barrier)

Floodplain — Of a watercourse means: (1) floodplain (if any) of the watercourse identified in a catchment water management plan or a local water management plan; adopted under the Act; or (2) where (1) does not apply — the floodplain (if any) of the watercourse identified in a development plan under the *Development (SA) Act 1993*; or (3) where neither (1) nor (2) applies — the land adjoining the watercourse that is periodically subject to flooding from the watercourse

Flow bands — flows of different frequency, volume and duration

Flow regime — the character of the timing and amount of flow in a stream

Habitat — the natural place or type of site in which an animal or plant, or communities of animals and plants, live

Indigenous species — species that occur naturally in a region

Infrastructure — artificial lakes; dams or reservoirs; embankments, walls, channels or other works; buildings or structures; or pipes, machinery or other equipment

KEAs - Key Environmental Assets

LAP – Local Action Planning

LLCMM – Lower Lakes, Coorong and Murray Mouth; one of TLM icon sites. Equivalent to the Coorong, Lower Lakes and Murray Mouth which is identified as a priority environmental assets in the Long-Term Environmental Watering Plan for the SA River Murray Water Resource Plan Area. The names 'Coorong, Lower Lakes and Murray Mouth' and 'Lower Lakes, Coorong and Murray Mouth' are used interchangeably

MDBA — Murray-Darling Basin Authority

MERI Framework – Monitoring, Evaluation, Reporting and Improvement Framework

Model — a conceptual or mathematical means of understanding elements of the real world that allows for predictions of outcomes given certain conditions. Examples include estimating storm run-off, assessing the impacts of dams or predicting ecological response to environmental change

Monitoring — (1) The repeated measurement of parameters to assess the current status and changes over time of the parameters measured (2) Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals and other living things

NFSA – Nature Foundation of South Australia

NGO – Non-government organisation

QSA – River flow to South Australia, as measured at the State border

Ramsar Convention —an international treaty on wetlands titled The Convention on Wetlands of International Importance Especially as Waterfowl Habitat

Return flow – environmental water used upstream for an event returns to the river and can be used for another event downstream

SA MDB NRM Board – South Australian Murray-Darling Basin Natural Resources Management Board

Threatened species — any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range

TLM – The Living Murray (MDBA program)

Water allocation — (1) In respect of a water licence means the quantity of water that the licensee is entitled to take and use pursuant to the licence. (2) In respect of water taken pursuant to an authorisation under s.11 means the maximum quantity of water that can be taken and used pursuant to the authorisation

WAP — Water Allocation Plan; a plan prepared by a Natural Resources Management Board or water resources planning committee and adopted by the Minister in accordance with the *Natural Resources Management Act 2004* (SA)

Water dependent ecosystems — those parts of the environment, the species composition and natural ecological processes that are determined by the permanent or temporary presence of flowing or standing water, above or below ground. The in-stream areas of rivers, riparian vegetation, springs, wetlands, floodplains, estuaries and lakes are all water-dependent ecosystems

Water licence — a licence granted under the *Natural Resouces Management Act 2004* entitling the holder to take water from a prescribed watercourse, lake or well or to take surface water from a surface water

prescribed area. This grants the licensee a right to take an allocation of water specified on the licence, which may also include conditions on the taking and use of that water. A water licence confers a property right on the holder of the licence and this right is separate from land title

Water year - The period between 1 July in any given calendar year and 30 June the following calendar year; also called a licensing year or a water-use year

Contents

Summary

The Annual Plan sets out the State's agreed plan for environmental water delivery along the South Australian River Murray for the 2016-17 year. The intention is to ensure that the best environmental outcomes are achieved for the South Australian stretch of the river and its floodplains, consistent with requirements under the Murray-Darling Basin Authority Basin Plan 2012 ('the Basin Plan').

Overarching objectives of the 2016-17 Annual Plan are to:

- coordinate the delivery of environmental water to South Australia to maximise the potential outcomes throughout the South Australian Lower Murray system;
- maximise outcomes from watering in South Australia by using return flows where possible;
- deliver environmental water to the Coorong, Lower Lakes and Murray Mouth while providing benefits to upstream environmental assets and functions en route;
- maximise environmental outcomes through the operation of infrastructure where appropriate.

The Annual Plan is presented in six sections, as follows:

Section 1 provides background information relating to environmental watering including the purpose of the document and recent hydrological conditions in the region.

Section 2 describes the process used to develop the Annual Plan with a focus on summarising how environmental managers engaged with external stakeholders and Indigenous groups, and assessed any potential risks when developing their environmental watering proposals.

Section 3 facilitates line-of-sight between the objectives for environmental watering in SA and the overall environmental objectives for water-dependent ecosystems identified in the Basin Plan (Chapter 8, Part 2) as well as the management objectives of the major environmental water holders.

Section 4 presents the annual environmental watering priorities for the SA River Murray water resource plan area, which were submitted to the MDBA before the 31 May 2016 in accordance with Basin Plan requirements.

Section 5 describes a multi-site watering action for the use of environmental water within the South Australian River Murray region. This SA multi-site demonstrates how the efficiency and effectiveness of environmental water delivery can be maximised through aligning the timing, magnitude and duration of watering actions at multiple locations throughout the SA River Murray region. It is based on the site-specific watering proposals developed within SA and will meet watering objectives at these sites, while also providing additional landscape-scale outcomes such as improved connectivity, and enhanced dispersal of resources, propagules and water-dependent biota.

Section 6 provides practical information for implementing environmental watering actions, including an overview of licensing, trade, accounting and reporting mechanisms.

1. Introduction

1.1. Purpose of this Plan

The South Australian Annual Environmental Watering Plan ('Annual Plan') guides environmental water delivery to the state for the River Murray and is prepared every year. The Annual Plan documents the proposed program for environmental water delivery along the River Murray in South Australia (including the Coorong, Lower Lakes and Murray Mouth) for the 2016-17 water year, and has been agreed in consultation with key stakeholders. The Annual Plan guides the priorities for environmental watering within the current water year and aligns with the requirements of the Basin Plan.

The purpose of this document is to:

- formalise planned priorities for environmental watering within South Australia within a given water year and support an adaptive management framework;
- make planned environmental watering activities publicly available for stakeholder information;
- meet the requirements of holders of environmental water who provide water to South Australia;
- meet the requirements of the Basin Plan as well as the South Australian *Natural Resources Management Act 2004* (SA);
- inform annual planning undertaken by the Commonwealth Environmental Water Office (CEWO) for 2016-17; and
- provide input for the annual South Australian River Murray Operation Plan 2016-17.

The Annual Plan is integral to South Australia's environmental water management processes and integrates the proposed watering activities of many groups. It has been developed based on the best available data and science; however, it may be subject to change depending on actual water availability and climatic conditions, which will inform real-time and adaptive water use.

This is the first Annual Plan to be developed since the publication of the Long Term Environmental Watering Plan for the South Australian River Murray Water Resource Plan Area ('SA River Murray Long-Term Plan'). The Basin Plan requires long-term plans to be developed by Basin States with specific content requirements, including the identification of the priority environmental assets of the region, as well as their ecological objectives, targets and environmental watering requirements (EWRs). The SA River Murray Long-Term Plan identifies three priority environmental assets for the region – the Coorong, Lower Lakes and Murray Mouth (CLLMM), the SA River Murray Channel and the Floodplain (Department of Environment Water and Natural Resources, 2015). The priorities for watering in 2016-17 that are identified in this Annual Plan are consistent with the assets and EWRs described in the SA River Murray Long-Term Plan, as well as being consistent with the Basin-Wide Environmental Watering Strategy, which was published by the Murray-Darling Basin Authority in 2014 (Murray-Darling Basin Authority, 2014a).

The South Australian Murray-Darling Basin environmental water management framework, including the SA River Murray Long-Term Plan and the Annual Plan, is presented in Figure 1.

Figure 1. South Australian Murray-Darling Basin environmental water policy, planning and management framework

1.2. What is environmental watering?

Environmental watering is the delivery or use of water to achieve environmental outcomes – that is, ecological benefits that contribute to a healthy, working river. Environmental watering ensures that important values of the South Australian River Murray, its wetlands and floodplains, Lakes Alexandrina and Albert and the Coorong are maintained and that environmental objectives are achieved.

Environmental water along the River Murray in South Australia is coordinated within the Department of Environment, Water and Natural Resources (DEWNR), with significant input from non-government organisations and other local stakeholders. This portfolio of work includes development of the Annual Environmental Watering Priorities, the Annual Plan, the Annual Report, the SA River Murray Long-Term Plan, the broader development of the State's environmental watering policy, the State's contribution to Basin-wide environmental watering policy reform, and management of the environmental water received by South Australia from sources such as the Commonwealth Environmental Water Holder (CEWH) and The Living Murray Program (TLM).

DEWNR has responsibility for management of TLM Icon Sites within South Australia – the Chowilla Floodplain, the SA River Murray Channel and the Lower Lakes, Coorong and Murray Mouth (LLCMM) – as well as managing environmental watering activities, monitoring, infrastructure and associated projects. Other tasks include management of smaller sites and community liaison.

A number of non-government organisations are also involved in on-ground environmental water delivery and monitoring including Australian Landscape Trust, Banrock Station, Local Action Planning (LAP) Groups, NFSA, NRA and RIT. They engage with communities to facilitate grass roots environmental activities with local landholders and other community groups.

Environmental water is made available as 'held' and 'planned' environmental water, where:

- **Held environmental water** is water held on the licence of a water holder who determines that this water will be used for environmental watering activities. Held environmental water may be either a purchased allocation or an allocation granted under the water holder's entitlements; and
- **Planned environmental water** is water that is not held on a water licence, but may be committed under State water management law for environmental purposes and managed through river operations.

Potential sources and volumes of held and planned environmental water for 2016-17 are described in Part B of this document and in the SA River Murray Long-Term Plan.

1.3. The 2015-16 water year in review

A brief history of the 2015-16 water year is provided below to provide some context of the conditions leading up to the 2016-17 year. More information from earlier water years can be found on the DEWNR web site at http://www.environment.sa.gov.au/managing-natural-resources/river-murray/restoring-river-health/environmental-water.

South Australia received entitlement flow throughout 2015-16 and there were no unregulated flow events in the water year. However, due to the provision of environmental water, actual flow at the South Australian border (QSA) was above entitlement in all months except December 2015, and January and May 2016 (Figure 2).

Relatively large volumes of environmental water were delivered throughout July, August, September and October 2015, with the volumes of environmental water effectively more-than doubling water delivered to the state in three of these months (Figure 3). There were also two smaller peaks in environmental water delivery in February and late March/early April 2016.

Southern bell frog by Callie Nitkolai

In total, the Commonwealth Environmental Water Holder provided approximately 810 GL (including approximately 130 GL held on licenses in South Australia) and the Living Murray approximately 145 GL (including approximately 45 GL held on licenses in South Australia) of environmental water to South Australia in 2015-16. South Australia also received approximately 15 GL of environmental water in the form of return flows from upstream watering actions undertaken by the Victorian Environmental Water Holder (VEWH).

Environmental water delivered to South Australia was used to undertake numerous watering actions throughout the year, including:

- operation of the Chowilla regulator and ancillary structures to generate an in-channel rise between October and mid-December;
- raising of Weir 2 by 50 cm and Weir 5 by 45 cm in spring;
- inundation of over 40 temporary wetland and floodplain areas (including wetlands on Chowilla Floodplain and sites managed by Nature Foundation South Australia) via pumping or irrigation; and
- management of the Coorong, Lower Lakes and Murray Mouth throughout the year including manipulating water levels in the Lower Lakes, and barrage and fishway releases.

Some of the key ecological outcomes from these environmental watering actions were:

- improved in-stream productivity;
- improved condition of riparian vegetation communities;
- enhanced survival of seedlings and saplings of native floodplain tree species that germinated during previous high flow and managed inundation events;
- frog breeding, including successful metamorphosis of southern bell frogs;
- fishway and barrage outflows throughout the year providing continuous connectivity between the River and its estuary;
- significant diadromous fish migration, including winter migration by pouched lampreys, and evidence of recruitment; and
- large numbers of colonial waterbirds nesting at two Lower Lakes colonies.

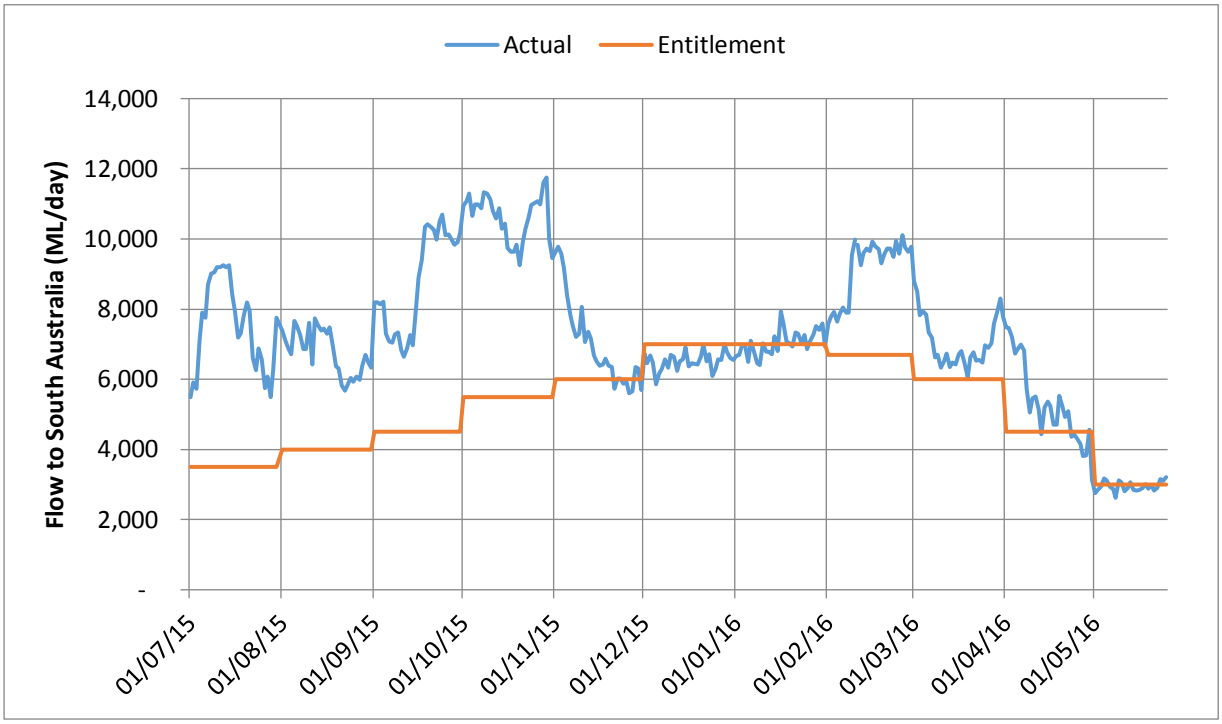

Figure 2. River Murray flows at the South Australian border throughout 2015-16

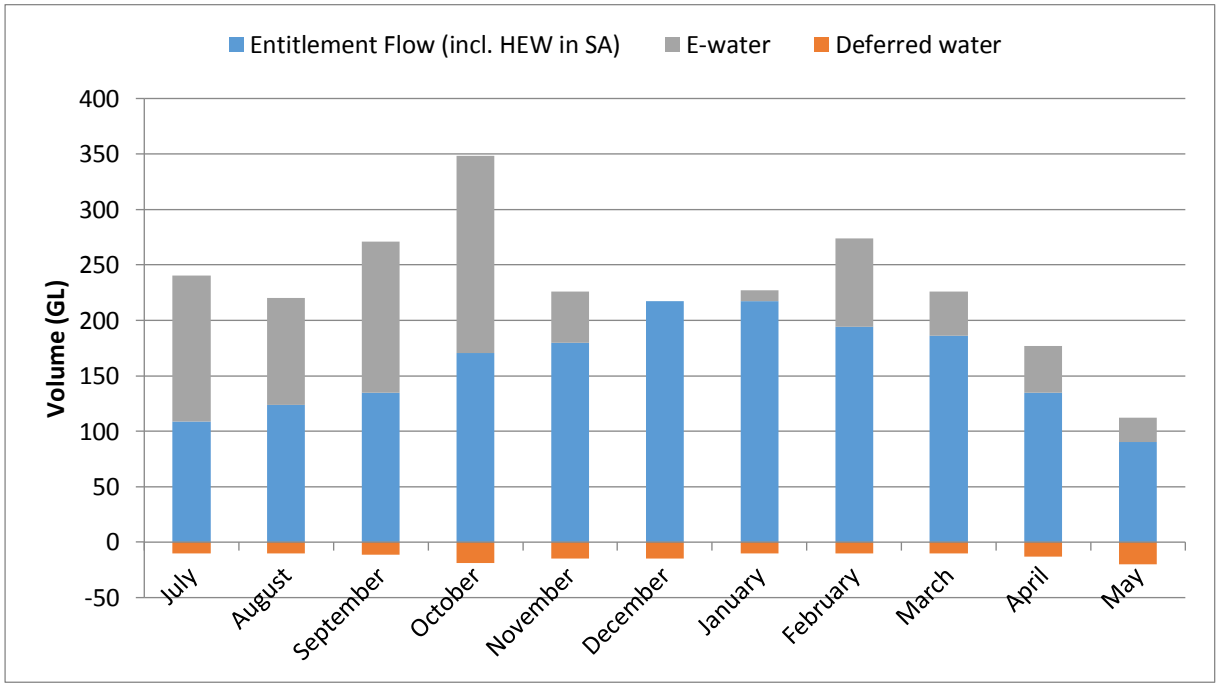

Figure 3. Monthly volumes of water delivered to South Australia in 2015-16
(HEW in SA = environmental water held on South Australian licenses)

2. Planning Process

2.1. Approach

Development of the Annual Plan commences each February. Figure 4 outlines the overarching process used to develop the Annual Plan and incorporates the development of the State annual environmental watering priorities. Within South Australia, the annual planning and prioritisation process is led by DEWNR, with input from site and water managers, traditional owners and stakeholder groups.

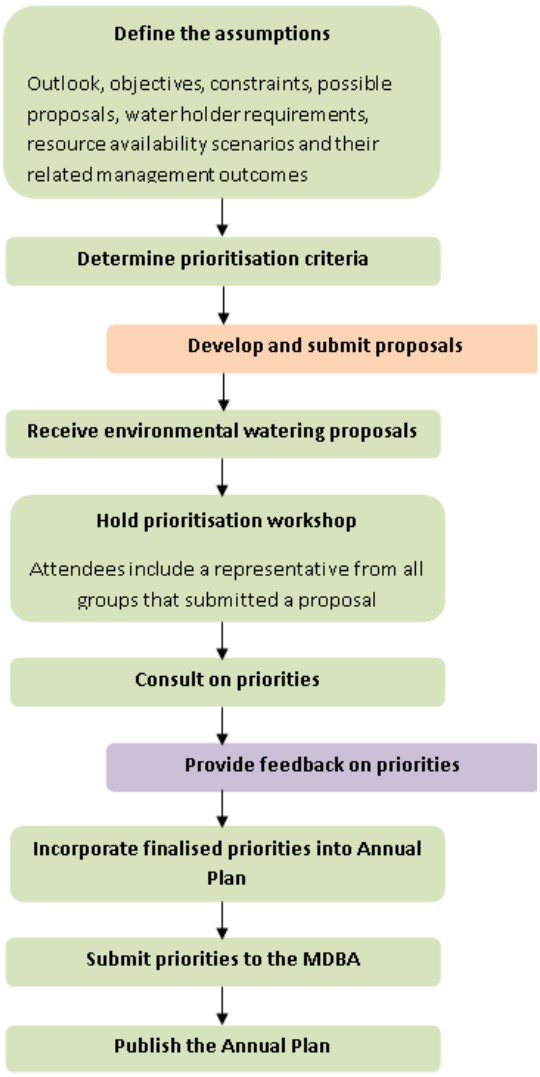

Figure 4. South Australian annual environmental water planning process

Chapter 8 (Environmental Watering Plan) of the Basin Plan requires Basin States to identify their annual environmental watering priorities for the upcoming water year and submit these to the Murray-Darling Basin Authority (MDBA) by 31 May. After being submitted to the MDBA, the priorities together with additional, complementary information are compiled in the Annual Plan and published on the DEWNR website at a later date. Both the annual priorities and the Annual Plan are underpinned by the watering proposals developed by site managers. Watering proposals developed for sites in the SA River Murray region in 2016-17 and their proponents are listed in Table 1.

Preparation of the priorities provides an opportunity to consolidate and rank the suite of watering actions proposed for the South Australian River Murray Water Resource Plan area (WRP area) for the upcoming water year. This work is useful for coordinating watering within the WRP area, informing decisions relating to water delivery and evaluating the environmental outcomes.

Table 1. Environmental watering proposals for 2016-17

Watering Proposal	Proponent
Lower Lakes, Coorong and Murray Mouth	LLCMM Icon Site Coordinator (DEWNR)
SA River Murray Channel	Environmental Water Policy Project Officer (DEWNR)
Chowilla Floodplain	Chowilla Icon Site Coordinator (DEWNR)
Weir Manipulation	Riverine Recovery Project Manager (DEWNR)
Valley Wetlands, Gorge wetlands, Lower Lakes fringing wetlands, Disher Creek and Berri Disposal Basins	SA MDB Natural Resources Wetland and Floodplain Team Leader (DEWNR)
Wetlands in the Renmark area	Renmark Irrigation Trust[1]
Various wetlands	Nature Foundation SA[1]

2.2. Community Engagement

A wide range of stakeholders and community groups are consulted regarding the environmental watering actions proposed for 2016-17. This consultation is undertaken by the respective site managers through long-standing arrangements that they have in place. The stakeholders consulted during the development of the proposals included the CLLMM Community Advisory Panel, LLCMM Scientific Advisory Group, Chowilla Floodplain Community Reference Committee, Chowilla Floodplain E-watering Group, Local Action Planning Associations, Landcare organisations, local government, private landholders, industry groups and the general public via website, local radio and newspaper interviews. Site managers were asked to pass on information about the overall annual planning and prioritisation process when consulting with their stakeholders. In addition, a presentation was given in April 2016 to the River Murray Advisry Committee, a key stakeholder group in the region.

2.3. Indigenous Engagement

During development of the 2016-17 Annual Plan, Indigenous engagement was initiated by the environmental managers when developing their watering proposals, including engagement with the Ngarrindjeri Regional Authority (NRA) on watering objectives and actions proposed for the LLCMM and the SA River Murray Channel, and with the First People of the River Murray and Mallee Region (FPRMM) on the proposed Chowilla Floodplain and weir manipulation watering actions.

The NRA signed an an environmental water delivery agreement with the CEWH in November 2015 for the delivery of Commonwealth environmental water (CEW) to sites of environmental and cultural significance. DEWNR will continue to meet with the NRA to assist them with environmental water management under this agreement where needed.

Indigenous communities have a complex relationship with water that goes beyond simply using it for consumptive purposes and engagement of traditional owners in the management of environmental water continues to evolve. The SA River Murray Long-Term Plan begins to explore the deep cultural connection between Indigenous people and the River Murray environment, and how this may be integrated into environmental water management. The Ngarrindjeri Regional Authority (NRA) provided significant input to

1 Due to time constraints, NGO watering proposals were not available for inclusion in the annual priorities

the development of the SA River Murray Long-Term Plan, which was a key document for informing the 2016-17 annual priorities. Significant work will be undertaken through the implementation of the Basin Plan and the development of the water resource plans for the South Australian Murray-Darling Basin to identify the objectives and outcomes of Indigenous people in relation to the management of water resources. This work will be used in the future to inform the revision and update of the Long-Term Plan, improve Indigenous engagement in the development of annual priorities and guide the consideration of Indigenous values when planning for environmental watering actions.

Old Parcoola Wetland by Callie Nickolai

2.4. Risk Assessment

Risks related to the planned environmental watering actions for 2016-17 have been identified and assessed in accordance with DEWNR's Risk Management Framework for Water Planning and Management, which is consistent with the Australian and New Zealand Standard for Risk Management (AS/NZS ISO 31000: 2009). Managers undertake their own risk assessment when developing watering proposals using an agreed set of risk criteria (Appendix A).

Chapter 9 of the Basin Plan requries environmental site and water managers to have regard to the flow management targets for a number of key water quality factors (including dissolved oxygen, cyanobacteria or biovolume and salinity). In particular, site and water managers should consider potential water quality impacts during annual and real-time planning (including potential cumulative impacts from multi-site actions), manage any risks that may emerge once water is being delivered in real time, and report annually on how they have had regard for flow management targets as part of their obligations under Schedule 12, Matter 14 of the Basin Plan. Guidelines have been developed to assist South Australian river operators, environmental water managers and holders of environmental water to have regard to the targets when planning and making flow management decisions. These Guidelines are presented in Appendix B.

3. Environmental Watering Objectives

The high-level objectives of environmental watering in South Australia during 2016-17 are to:

- coordinate the delivery of environmental water to South Australia to maximise the potential outcomes throughout the South Australian Lower Murray system;
- maximise outcomes from watering in South Australia by using return flows where possible;
- deliver environmental water to the Coorong, Lower Lakes, and Murray Mouth while providing benefits to upstream environmental assets and functions en-route;
- maximise environmental outcomes through the operation of infrastructure where appropriate; and
- deliver environmental water consistent with the EWRs of the SA River Murray Long-Term Plan and contribute to the ecological objectives for priority environmental assets and priority ecosystem functions described in the SA River Murray Long-Term Plan.

The ecological objectives for specific water activities are summarised in Part B Annual Priorities and listed in Appendix E. The high-level and specific ecological objectives are consistent with the objectives of the Basin Plan (Table 2), and TLM and CEWO ecological watering and management objectives (Table 3).

Hunters Creek in the Coorong, Lower Lakes, Murray Mouth Icon Site by Kirsty Wedge

Table 2. Basin Plan overall environmental objectives (Chapter 8, Part 2)

	Overall Environmental Objectives
8.04 (a)	to protect and restore water-dependent ecosystems of the Murray-Darling Basin
8.04 (b)	to protect and restore the ecosystem functions of water-dependent ecosystems
8.04 (c)	to ensure that water-dependent ecosystems are resilient to climate change and other risks and threats
	Protection and Restoration of Water-Dependent Ecosystems Objectives
8.05 (2)	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; and (c) water-dependent ecosystems are able to support episodically high ecological productivity and its ecological dispersal.
8.05 (3)	to protect and restore biodiversity that is dependent on Basin water resources by ensuring that: (a) water-dependent ecosystems that support the life cycles of a listed threatened species or listed threatened ecological community, or species treated as threatened or endangered (however described) in state law, are protected and, if necessary, restored so that they continue to support those life cycles; and (b) representative populations and communities of native biota are protected and, if necessary, restored.
	Protection and Restoration of Ecosystem Functions of Water-Dependent Ecosystems Objectives
8.06 (2)	that the water quality of Basin water resources does not adversely affect water-dependent ecosystems and is consistent with the water quality and salinity management plan.
8.06 (3)	to protect and restore connectivity within and between water-dependent ecosystems, including by ensuring that: (a) the diversity and dynamics of geomorphic structures, habitats, species and genes are protected and restored; and (b) ecological processes dependent on hydrologic connectivity… (i) longitudinally along watercourses; and (ii) laterally between watercourses and their floodplains (and associated wetlands); and (iii)vertically between the surface and subsurface; are protected and restored; and (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 (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; and (f) barriers to the passage of biological resources (including biota, carbon and nutrients) through the Murray-Darling Basin are overcome or mitigated.
8.06 (5)	that natural in-stream and floodplain processes that shape landforms (e.g. the formation and maintenance of soils) are protected and restored.
8.06 (6)	to support habitat diversity for biota at a range of scales (e.g. the Murray-Darling Basin, riverine landscape, river reach and asset class).
8.06 (6)	to protect and restore ecosystem functions of water-dependent ecosystems that maintain populations (e.g. recruitment, regeneration, dispersal, immigration and emigration) including by ensuring that: (a) flow sequences, and inundation and recession events, meet ecological requirements (e.g. cues for migration, germination and breeding); and (b) habitat diversity, extent, condition and connectivity that supports the life cycles of biota of water-dependent ecosystems (e.g. habitats that protect juveniles from predation) is maintained.
8.06 (7)	to protect and restore ecological community structure, species interactions and food webs that sustain water-dependent ecosystems, including by protecting and restoring energy, carbon and nutrient dynamics, primary production and respiration.
	Ensuring Water-Dependent Ecosystems are Resilient to Climate Change and Other Risks and Threats
8.07 (2)	that water-dependent ecosystems are resilient to climate change, climate variability and disturbances (e.g. drought and fire).
8.07 (3)	to protect refugia in order to support the long-term survival and resilience of water-dependent populations of native flora and fauna, including during drought to allow for subsequent re-colonisation beyond the refugia.
8.07 (4)	to provide wetting and drying cycles and inundation intervals that do not exceed the tolerance of ecosystem resilience or the threshold of irreversible change.
8.07 (5)	to mitigate human-induced threats (e.g. the impact of alien species, water management activities and degraded water quality).
8.07 (6)	to minimise habitat fragmentation.

Table 3. TLM and CEWO ecological watering objectives

	Extreme Dry	Dry	Median	Wet
	Avoid catastrophic / irretrievable loss and maintain capacity for recovery	*Improve capacity for recovery*	*Protect ecological health*	*Improve health and resilience*
Ecological Watering Objectives	Avoid irreversible loss of key environmental assets	Ensure priority river reaches and wetlands have maintained their basic functions	Ecological health of priority river reaches and wetlands have been protected and improved	Improve the health and resilience of aquatic ecosystems
Management Objectives	**TLM / CEWO** Avoid critical loss of species, communities and ecosystems Maintain key refuges Avoid irretrievable damage or catastrophic events	**TLM** Maintain river functioning with reduced reproductive capacity Maintain key functions of high priority wetlands Manage with dry-spell tolerances Support connectivity between sites **CEWO** Support the survival and growth of threatened species and communities including limited small-scale recruitment Maintain diverse habitats Maintain low flow river and floodplain functional processes in sites and reaches of priority assets	**TLM / CEWO** Enable growth, reproduction and small-scale recruitment for a diverse range of flora and fauna Promote low-lying floodplain-river connectivity Support medium flow river and floodplain functional processes	**TLM / CEWO** Enable growth, reproduction and large-scale recruitment for a diverse range of flora and fauna Promote higher floodplain-river connectivity Support high flow river and floodplain functional processes

4. Annual Priorities

4.1. Prioritisation Process

The priorities for the SA River Murray Water Resource Plan Area for 2016-17 were developed in accordance with the Basin Plan requirements. The priorities for 2016-17 are consistent with the SA River Murray Long-Term Plan for this WRP area[2]. The SA River Murray Long-Term Plan includes a list of priority environmental assets and their ecological objectives, targets and EWRs, and also demonstrates alignment between these and the expected environmental outcomes of the Basin Wide Environmental Watering Strategy (BWEWS) (Murray-Darling Basin Authority, 2014a).

A scenario-based approach was used to develop proposed watering actions for 2016-17. Five resource availability scenarios were identified; these scenarios are based on the MDBA annual operating probabilities (AOP) provided in February 2016 (Figure 5): 95% (very dry), 90% (dry), 75% (moderate), 50% (near average) and 25% (wet). These percentages refer to the likelihood of occurrence of different water resource availability based on previous records, current volumes in storage and operational considerations for the upcoming year. A volume of held environmental water (HEW) potentially available for delivery to South Australia in 2016-17 under each of the resource availability scenarios was assumed for planning purposes (refer 'Assumptions').

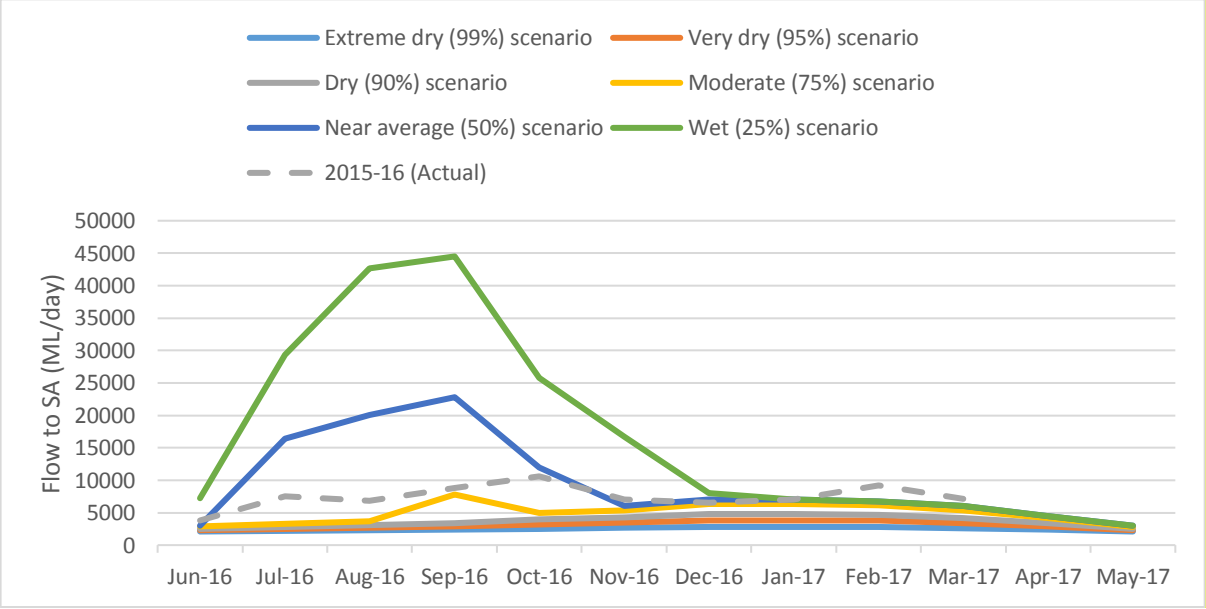

Figure 5. Annual operating probabilities provided by MDBA in February 2016 for the purpose of informing environmental water planning for 2016-17

The resource availability scenarios and assumed HEW availability were used by environmental site or asset managers to develop environmental watering proposals for each site/asset. The watering actions proposed under each resource availability scenario were then prioritised using agreed State criteria (Table 4 and Appendix C), which are based on criteria used by the Southern Connected Basin Environmental Water Committee (SCBEWC)/The Living Murray (Murray-Darling Basin Authority, 2014b) and are consistent with the principles set out in the Basin Plan (Appendix D). The prioritisation process was undertaken in April 2016 in a workshop setting involving all site/asset managers.

[2] The Coorong is considered by the Basin Plan to be part of the SA Murray Region WRP area, however it is addressed in the priorities for the SA River Murray WRP Area as the ecological outcomes of in the Coorong are primarily driven by surface water inputs from the River Murray. This is consistent with the approach taken for the SA River Murray Long-Term Plan.

Table 4. Summary of prioritisation criteria

Criteria Number	Criteria
1	1. Scale of environmental benefit
2	2. Risk of not applying water
3	3. Environmental risks associated with watering
4	4.Certainty / likelihood of benefit
5	5. Significance of site

4.2. Assumptions

4.2.1. Held Environmental Water Availability

The work required to inform the development of the priorities was undertaken between February and April 2016 (inclusive), which is prior to water allocation announcements being made. As a result of this timing, environmental water holders were unable to provide advice on HEW availability in 2016-17. For the purposes of planning and prioritisation, an estimate of potential HEW availability under each resource availability was made based on environmental water delivery in recent years (Table 5). Potential HEW availability is taken into account during planning so that the proposed actions and associated outcomes consider the feasibility of delivery.

Table 5. Estimate of held environmental water available under each resource availability scenario

Scenario	Estimate of HEW available (GL)
Extreme dry (99%)	**400 to 500 GL**
Very dry (95%)	**500 to 600 GL**
Dry scenario (90%)	**600 to 700 GL**
Moderate (75%)	**700 to 900 GL**
Near average (50%)	**900 to 1,200 GL**
Wet (25%)	**>1,200 GL**

HEW is available from the following sources – the CEWH, TLM, the Victorian Environmental Water Holder (VEWH), the South Australian Minister for Water and the River Murray and non-government organisations. For each water holder, information relating to volumes of registered entitlements and long-term average annual yield (LTAAY) is presented below.

4.2.1.1. Commonwealth Environmental Water

Total Commonwealth environmental water holdings within the Southern Connected Basin are approximately 1,841 GL (at 29 February 2016), with varying levels of security and a LTAAY of 1,384 GL (Department of the Environment, 2016). Of this volume, approximately 147 GL registered entitlement (133 GL LTAAY) is held in South Australia and forms part of South Australia's entitlement. Some carry-over from 2015-16 is also likely to be available, although the CEWH is yet to confirm a volume.

4.2.1.2. The Living Murray Environmental Water

TLM holdings approximately 480 GL long-term cap equivalent (LTCE), of which approximately 45 GL is held in South Australia and forms part of South Australia's entitlement. At the time of writing, TLM expects to carry-over approximately 127 GL into 2016-17. Increased flows from the Snowy Agreement may also be available but this is yet to be confirmed.

4.2.1.3. Victorian Environmental Water Holder

The VEWH manages environmental water holdings in the following rivers: Murray, Goulburn and Campaspe. Under some circumstances, the VEWH may trade HEW to South Australia, generally as a result of return flows from upstream environmental watering actions.

4.2.1.4. South Australian Minister for Water and the River Murray

The South Australian Minister for Water and the River Murray holds approximately 44 GL of water access entitlements in South Australia that are committed to environmental purposes and form part of South Australia's entitlement.

Of this total volume, approximately 38 GL belongs to Class 9 (Wetlands) water access entitlement class described in the Water Allocation Plan for the River Murray Prescribed Watercourse (WAP) (SA Murray-Darling Basin Natural Resources Management Board, 2002). This water is tied to the management of specific pool-connected wetlands within the WRP area so there is limited flexibility in the location of use.

The remaining volume of approximately 6 GL has been committed for environmental use through the *Implementation Plan for Augmentation of the Adelaide Desalinisation Plant* and the location of its use is flexible (within the South Australian portion of the Murray-Darling Basin). Additional amounts (up to 120 GL over a 10 year rolling period of eligible years) may also be purchased throughout the year.

Decisions on the use of environmental water held by the South Australian Minister for Water and the River Murray are made within DEWNR consistent with the priorities.

4.2.1.5. Non-Government Organisations

NFSA holds 37 ML of Class 3A Water Access Entitlement on licence that is irrigation water purchased for environmental use.

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.

For 2016-17, Banrock Station is seeking approximately 1.67 GL of Class 9 (Wetlands) water for the management of the pool-connected areas of Banrock Station Wetland Complex. At the time of writing, the arrangements between Banrock and DEWNR for this water were being progressed.

4.2.2. Planned Environmental Water Availability

The WAP establishes 200 GL of Class 9 (Wetlands) water with approximately 40 GL held on a licence (see above). The remaining 160 GL of Class 9 water can be considered planned environmental water. This volume is 'used' as it replaces the evaporative losses from unmanaged, pool-connected wetlands during normal river operations. This water is not actively managed and is not available for other uses.

4.2.3. Unregulated flows

Under the WAP, no provisions exist for the allocation and use of unregulated flows for consumptive purposes in South Australia. Therefore, when an unregulated flow event occurs, it is protected from being taken for consumptive uses within South Australia. Unregulated flows generally occur in response to high rainfall events upstream from South Australia. The MDBA 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 scenarios shown in Figure 5, unregulated flow provides the increase in height and volume of water above South Australia's Entitlement Flow. Unregulated flows can only be planned for in a general way and therefore are not considered planned environmental water, although they are critical for the health of environmental assets within the WRP area.

4.3. Outcomes of Prioritisation

A summary all proposed environmental watering actions for 2016-17 is provided in Appendix E. Appendix F is a list of wetlands to which water is proposed to be pumped.

The outcomes of the prioritisation process are presented in Table 6. The ranking indicates proposed watering actions under each resource availability scenario from highest priority to lowest priority. It is not intended to exclude watering actions as all are considered important for achieving a range of environmental outcomes throughout the WRP area. However, under some circumstances it may be necessary to prioritise the location or timing of environmental water delivery, for instance, due to low allocations and limited environmental water availability at the start of a water year. The ranked list can be used to inform these types of decisions. The likely ecological outcomes were the primary consideration when undertaking the ranking. The outcomes linked to each watering action are summarised in Appendix E and Appendix F.

Goolwa cockles at the Murray Mouth by Kirsty Wedge

In general, watering actions in the CLLMM asset ranked the highest. The importance of the CLLMM is reflected in the Basin Plan which contains several objectives and targets specific to this asset. Due to relatively dry antecedent conditions, there is an elevated risk of the legislated objectives for the CLLMM not being met, with a subsequent elevated risk of degradation in the condition of the site and decline in ecological character. A significant volume of environmental water is required for the CLLMM in 2016-17 to meet the long-term EWRs of this environmental asset (Department of Environment Water and Natural Resources, 2015), which have been developed with the high-level objective to maintain the ecological character of the CLLMM by restoring a healthy and resilient ecosystem (O'Connor, Steggles, Higham, & Rumbelow, 2015) .

Analysis of the watering history and the long-term EWRs for the SA River Murray Channel and Floodplain assets also shows the growing gap between the desired and the actual frequency of inundation. Due to the relatively dry outlook for 2016-17, it is generally not feasible to meet the higher EWRs. Under these conditions, the operation of management levers to deliver water to discrete locations provides a valuable tool for maintaining or improving the condition of areas within these assets.

Wetter conditions (50% and 25% AOPs) would provide the opportunity to raise the Chowilla regulator to a level greater than 19.1 m AHD. Operation at this level has not previously been undertaken; hence, this action is considered as a testing action, which is a very high priority for the MDBA and for the South Australian Government.

It is understood that several non-government organisations will also be undertaking environmental watering actions within the WRP area during the 2016-17 water year. These organisations include Nature Foundation of South Australia (NFSA), Renmark Irrigation Trust (RIT), Ngarrindjeri Regional Authority (NRA), and potentially Banrock Station and Australian Landscape Trust (ALT). The environmental watering actions will be undertaken at selected sites under agreements between each organisation and the CEWH.

Each of these organisations were invited to participate in the state prioritisation process, however due to time constraints they were not in a position to provide details of their proposed watering actions in time for the prioritisation workshop. Therefore the ranked watering actions presented in this document are not able to reflect those proposed to be undertaken by the non-government organisations. NFSA and RIT have since advised of potential environmental watering projects for 2016-17 and these sites have been included in Appendix F. Department of Environment, Water and Natural Resources (DEWNR) will seek to continue to work with these organisations and staff from the CEWO throughout 2016-17 with the aim of coordinating environmental watering and river operations within the WRP area.

Table 6. Environmental watering priorities for the South Australian River Murray in 2016-17

Ranking	Very dry scenario 95 percent	Dry scenario 90 percent	Moderate scenario 75 percent	Near average scenario 50 percent	Wet scenario 25 percent
1	Spring pulse for CLLMM 12 months of barrage releases	Improved spring pulse for CLLMM	Further improved spring pulse for CLLMM	Enhance barrage releases due to unregulated flows Further improved spring pulse for CLLMM	Enhance barrage releases due to unregulated flows Further improved spring pulse for CLLMM Enhance unregulated flows to 35,000 ML/day for 60 days
2	Provision of water to threatened fish refuges	12 months of barrage releases	12 months of barrage releases	12 months of barrage releases	12 months of barrage releases
3	Pump Chowilla wetlands Pump Valley wetlands Pump Gorge wetlands Pump Lower Lakes wetlands	Provision of water to threatened fish refuges	Provision of water to threatened fish refuges	Provision of water to threatened fish refuges	Chowilla maximum floodplain inundation
4	Chowilla anabranch flow pulse	Raise Weir 2 by 75cm Raise Weir 5 by 50cm Pump Chowilla wetlands Pump Valley wetlands Pump Gorge wetlands Pump Lower Lakes wetlands	Winter pulse through barrages	Winter pulse through barrages Create 15,000 ML/d flow pulse for 90 days Chowilla mid-floodplain inundation Raise Weir 2 by 75cm Raise Weir 5 by 50cm	Winter pulse through barrages
5		Create 10,000 ML/d flow pulse for 60 days Chowilla anabranch flow pulse	Raise Weir 2 by 75cm Raise Weir 5 by 50cm Pump Chowilla wetlands Pump Valley wetlands Pump Gorge wetlands Pump Lower Lakes wetlands	Pump Valley wetlands Pump Gorge wetlands Pump Lower Lakes wetlands	Pump Valley wetlands Pump Gorge wetlands Pump Lower Lakes wetlands
6			Create 10,000 ML/d flow pulse for 60 days Chowilla anabranch flow pulse		

4.4. Co-operative Watering Arrangements

4.4.1. Between water resource plan areas

For several 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, 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 2016-17 these actions will be further documented for codification into the existing Framework for managing Basin river flows.

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. Membership of these groups includes holders of held environmental water as well as managers of planned environmental water, managers of environmental assets and River operators. South Australia has representatives on these cross-jurisdictional committees and is participating in the planning for the large scale environmental watering event for 2016-17.

4.4.2. Within the water resource plan area

Existing mechanisms to assist with coordinating environmental watering within the WRP area are described in Section 4.2.1 of the SA River Murray Long-Term Plan (Department of Environment Water and Natural Resources, 2015).

For 2016-17, DEWNR has developed a multi-site watering action for the use of environmental water within the WRP area. The South Australian multi-site watering action aligns site-specific watering actions that are identified in the annual priorities to maximise the effectiveness of environmental water delivery and ecological outcomes throughout the system. This multi-site is supported by South Australian policy which prevents return flows from environmental watering actions, such as the operation of the Chowilla regulator and weir raisings, from being re-allocated for consumptive take, and so this water will flow down the river and eventually be delivered to the CLLMM for ecological benefit.

The SA multi-site watering action was developed after the annual priorities were submitted to the MDBA and has since been provided to the MDBA, CEWO staff and relevant environmental managers. The SA multi-site action is presented in the section that follows.

5. South Australian Multi-Site Watering Action

5.1. SA multi-site overview

As described in Section 2.1 and Table 1, watering proposals for a number of locations throughout the South Australian River Murray system were developed in 2016-17 including:

1. Coorong, Lower Lakes and Murray Mouth (CLLMM);
2. SA River Murray Channel (SA border to Wellington);
3. Weirs 2 and 5;
4. Chowilla Floodplain; and
5. Wetland watering.

There are strong links between the watering actions at these sites that present the opportunity for a multiple-use watering action within SA ('SA multi-site'). The SA multi-site will support the proposed site-specific watering actions and objectives but also focus on delivering additional system-wide benefits.

The SA multi-site has the following objectives (in addition to the overarching objectives in this Annual Plan and the environmental watering objectives for site-based actions):

- increase the efficiency of environmental watering and extent of benefits by aligning the timing, magnitude and duration of discrete actions;
- provide pathways for the dispersal, migration and movement of native water-dependent biota
- provide pathways for the dispersal and movement of organic and inorganic sediment, and maximise the delivery of resources to downstream reaches and to the ocean; and
- deliver environmental water consistent with the environmental water requirements (EWRs) of the SA River Murray Long-Term Plan and contribute to the ecological objectives for priority environmental assets and priority ecosystem functions described in that plan.

5.2. Assumptions

Site-based watering proposals were developed based on the Flow to South Australia (QSA) Annual Operating Probability (AOP) scenarios provided by the MDBA in January 2016 (Figure 5). Planning for the SA multi-site considers aligning these watering actions using the same AOPs, with a focus on the dry (90%) and near-average (50%) AOP scenarios.

All flow rates are represented as flow at the South Australian border (QSA) unless otherwise indicated. Similarly, volumes are volumes at the border in gigalitres (GL).

Environmental water availability to South Australia was assumed to be 600 to 700 GL under the 90% AOP scenario and 900 to 1,200 GL under the 50% AOP scenario (Table 5). This is in addition to environmental water held in South Australia, which is already included in the AOPs as this water forms part of South Australia's entitlement flow. Environmental water has not been apportioned between water holders.

Some environmental water requirements identified in the site-based watering proposals for July and August 2016 have been met through an unregulated flow event. Hence they have been removed from the SA multi-site demands, with the exception of environmental water required to fill the Chowilla regulator, and weir pools 2, 5 and 6. Continuing unregulated flows may be used to support these environmental watering actions (subject to approval), particularly the provision of fill volumes that will subsequently be returned to the River upon return to normal operating level), however the use of unregulated flows in this way has not been factored into the SA multi-site at this stage.

The return to normal operating pool level of the Chowilla regulator and the weir pools in November and December will return environmental water to the system and this has been factored into the SA multi-site demands by reducing the volume of environmental water required to be delivered to the SA border in that month.

The proposed watering actions are indicative only and the actual delivery pattern will depend on River conditions throughout 2016 - 2017.

5.3. Environmental Watering Actions

5.3.1. 90% AOP scenario

The site-based actions proposed under the 90% AOP scenario and considered as part of the SA multi-site are:

- pumping to temporary wetlands, primarily during spring/early summer;
- generate a flow pulse through Chowilla Anabranch via Pipeclay and Slaney Weirs between October and February[3];
- raise Weir 2 by 75 cm (above normal operating pool level) and raise Weir 5 by 50cm (above normal operating pool level) between the months of August and November;
- generate a late spring in-channel flow pulse, with a median discharge of ~10,000 ML/day (with desired +/- 2,000 ML/day variability to be achieved through River operations rather than variation to delivery volume);
- provide baseflow to the LLCMM throughout the year to prevent Lower Lakes water levels falling below 0.4 m AHD, and provide for continuous fishway and barrage releases; and
- provide elevated flows to support increased barrage releases during spring/early summer and to enable Lower Lakes water level management.

The complementary elements to the SA multi-site are:

- drawdown of Weirs 2 and 5 to normal operating pool level will occur in November and coincides with a proposed in-channel flow pulse. This will ensure that any potential impacts on in-channel velocities due to weir raising is minimised. Improved hydraulics as a result of the in-channel pulse will also assist in facilitating the downstream transport of resources and propagules that have been drawn into the River through weir manipulation;
- the drawdown of the weir pools in November also coincides with a peak in environmental water demand for the channel pulse action and the LLCMM barrage release action. The provision of return flows during this month therefore assists in an overall reduction in demand for environmental water delivery to SA in November;
- while implementation of the Chowilla Anabranch pulse does not require additional environmental water, this proposed action coincides with timing of significantly elevated flow demand for the LLCMM. This elevated flow will potentially enhance the outcomes in the Chowilla Anabranch, which are targeting large-bodied native fish habitat; and
- weir raising will potentially negate the need to use pumping to deliver water to some proposed wetland watering sites. Currently two sites nominated by Natural Resources SAMDB have been identified. DEWNR staff managing weir raising are continuing to work with non-government delivery partners to identify other proposed wetland watering sites that may benefit from weir raising.

[3] Note there is no environmental water demand associated with Chowilla Anabranch pulse

5.3.2. 50% AOP scenario

The site-based actions proposed under the 50% AOP scenario and considered as part of the SA multi-site are:

- pumping to temporary wetlands, primarily during spring/early summer;
- operation of the Chowilla Regulator (including raising Weir 6) for a mid-floodplain inundation between August and December;
- raising Weir 2 by 75 cm (above normal operating pool level) and raising Weir 5 by 50cm (above normal operating pool level) between the months of August and November;
- generate a late spring/early summer in-channel flow pulse, with a median discharge of ~15,000 ML/day (with desired +/- 2,000 ML/day variability to be achieved through River operations rather than variation to delivery volume);
- provide baseflow to the LLCMM throughout the year to prevent Lower Lakes water levels falling below 0.4 m AHD, and provide for continuous fishway and barrage releases;
- generate a winter flow pulse through the barrages; and
- build on spring/summer flows to further improve barrage releases during spring/early summer and to enable Lower Lakes water level management.

The complementary elements to the SA multi-site are:

- drawdown of the Chowilla Regulator and Lock 6 will occur in December, and drawdown of Weirs 2 and 5 to normal operating pool level will occur in November. Each of these drawdowns will occur during implementation of a proposed in-channel flow pulse. This will ensure that any potential impacts on velocities due to infrastructure operation is minimised. Improved hydraulics as a result of the in-channel pulse will also assist in facilitating the downstream transport of resources and propagules that have been drawn into the River through operation of the Chowilla regulator and weir manipulation; and
- under this scenario, QSA is above 15,000 ML/day in October and November, which coincides with higher water temperatures needed for some large-bodied fish breeding requirements. The improved velocities, warmer water temperature and increased in-channel resources from Chowilla/weir drawdowns may contribute to golden perch and silver perch recruitment success.

Research undertaken by the Goyder Institute has shown that sandy sprat, which is a key component of the Coorong food chain, have a strong positive response to nutrient inputs from freshwater sources. Increased resources from Chowilla/weir drawdowns, improved longitudinal transport of these resources due to an in-channel pulse and subsequent release through the barrages will provide a greater input of nutrient-rich freshwater to the Coorong and provide benefits to sandy sprat and the Coorong food chain.

5.4. Environmental water volume and delivery pattern

The site-based watering actions presented in the in the annual environmental watering priorities identify the volumes of environmental water required (in addition to water provided in the AOP scenarios) to undertake each action and meet the site-based outcomes, with the actions and volumes constrained to those likely to be feasible under the given scenario. The cumulative volume of environmental water required to undertake all site-based environmental watering actions was almost 1,200 GL under the 90% AOP scenario and over 2,000 GL in the 50% AOP scenario.

Development of the SA multi-site considered these same AOP curves and site-based demands but then identified opportunities for efficiency and re-use of water due to overlaps in preferred timing for delivery of additional environmental water to the SA border and availability of return flows from landscape-scale watering actions e.g. through drawdown of weir pools. As a result, the estimated total volume of additional environmental water required in 2016-17 to deliver the SA multi-site is 697 GL for the 90% AOP scenario and 1,173 GL for the 50% AOP scenario

(Figure 5). The preferred monthly delivery pattern for the SA multi-site is indicated in Table 7, Figure 6 and Figure 7, and has been designed to ensure that the required delivery patterns for site-based actions and outcomes are also met.

Table 7. Indicative volume of environmental water required per month to deliver the SA multi-site action in SA (based on the January 2016 AOP data)

Scenario	Indicative volume (GL) of e-water required/month												Total est. volume (GL)
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
90% AOP		26	130	130	156	130	25	25	25	25	25		697
75% AOP		58	9	258	328	210	62	62	62	62	62		1173

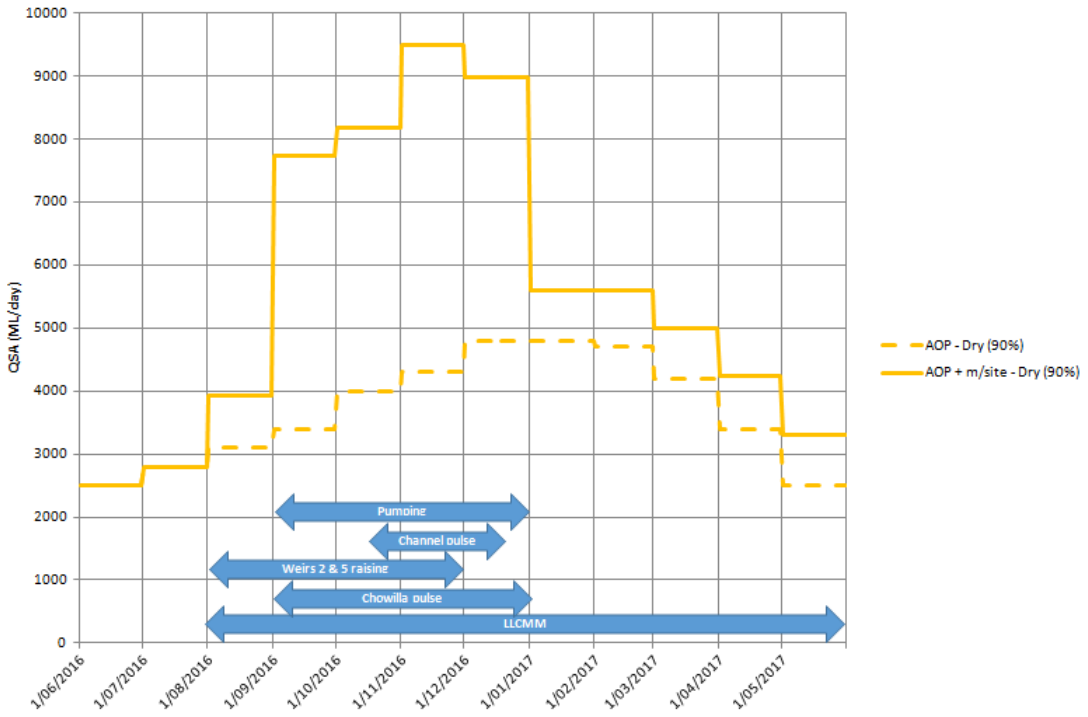

Figure 6. Preferred delivery pattern of SA multi-site environmental water under a 90% AOP scenario (Blue arrows indicate timing of proposed site-based environmental watering actions)

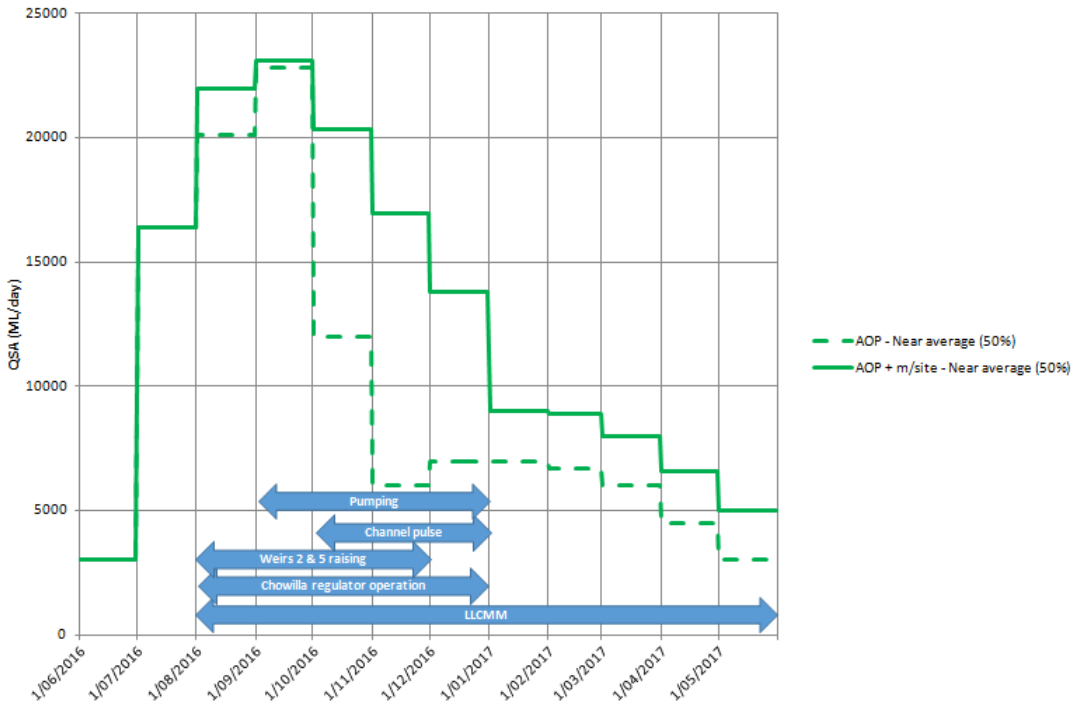

Figure 7. Preferred delivery pattern of SA multi-site environmental water under a 50% AOP scenario (Blue arrows indicate timing of proposed site-based environmental watering actions)

5.5. Consistency with the SA River Murray Long-Term Plan

The SA River Murray Long-Term Plan identifies three priority environmental assets (PEAs) in the region (the Floodplain, the Channel and the Coorong, Lower Lakes, Murray Mouth), the ecological objectives and targets for each PEA, and their EWRs.

An analysis has been undertaken to determine which of the EWRs for the Channel and the Coorong, Lower Lakes, Murray Mouth (CLLMM) are met by the SA multi-site. Flows are not sufficient to reach the Floodplain PEA under either the 90% or 50% AOP scenario.

Under the 90% AOP scenario:

- the SA multi-site meets the lowest EWR for the Channel (EWR-IC1), except for a small shortfall in the median discharge metric (Appendix G); and
- no EWRs for the CLLMM PEA are met in full, although several of the metrics for the lowest CLLMM EWR (EWR-CLLMM1) are satisfied (Appendix G).

Under the 50% AOP scenario:

- the SA multi-site meets the third EWR for the Channel PEA (EWR-IC3) in full (Appendix G); and
- the majority of the metrics for the lowest CLLMM EWR (EWR-CLLMM1) are met (Appendix G) apart from some minor differences in timing, which is driven by the timing of unregulated flows in the AOP rather than environmental water delivery, and a shortfall in the 3-year average barrage outflow volume. This shortfall is partly due to low barrage outflows in 2014-15 and 2015-16 (~980GL and ~560 GL, respectively) and as a result releases of over 4,450 GL are required in 2016-17 to meet the 3-year average barrage outflow metric.

The SA River Murray Long-Term Plan also provides an assessment of the likely contribution of each EWR towards achieving the ecological targets for the asset. This assessment indicates that:

- the lowest Channel EWR (IC1) is likely to provide a large positive contribution to the following two ecological targets:
    - Thermal stratification does not persist for more than 5 days; and

    - length-frequency distributions for foraging generalist [fish species] include size classes showing annual recruitment;
- the lowest Channel EWR is also likely to make a moderate positive contribution to a further three ecological targets for the Channel PEA relating to water quality and biofilms;
- the third Channel EWR (IC3) is likely to provide a large positive contribution to the following two ecological targets:
    - thermal stratification does not persist for more than 5 days;
    - biovolume <4mm3/L for all cyanobacteria, where a known toxin producer is dominant, or <10mm3/L for all cyanobacteria where toxins are not present;
- the third Channel EWR (IC3) is also likely to provide a moderate positive contribution to a further 19 ecological targets for the Channel, including targets relating to velocity, water quality, groundwater and soil freshening, biofilms, vegetation, Murray cod, golden and silver perch, and foraging generalist fish species;
- the lowest CLLMM EWR (CLLMM1) is likely to provide a large positive contribution to the following four ecological targets:
    - maintain or improve abundance of Murray hardyheads and pygmy perch so that 'relative abundance index' values of > 1 are achieved;
    - detect recruitment success of Murray hardyheads and pygmy perch;
    - sediment organic matter content between 1 and 3.5% dry weight in the Coorong and Murray Mouth;
    - maintain or improve diversity of aquatic and littoral vegetation in the Lower Lakes as quantified using the LLCMM vegetation indices; and
- the lowest CLLMM EWR is also likely to make a moderate positive contribution to a further 10 ecological targets for the CLLMM PEA relating to fish, connectivity, macroinvertebrates, sediments and salinity.

6. Implementation of the Annual Plan

6.1. Overview

Implementation of the Annual Plan involves many steps and is undertaken throughout the water year by a variety of officers and groups at a local, State and Basin level, as illustrated in Figure 8 below. The policies and processes currently in place to guide coordinated management of environmental water management along the River Murray in South Australia are described in Section 4.2.1 of the SA River Murray Long-Term Plan. The following sections provide additional information for specific arrangements in place for the 2016-17 water year.

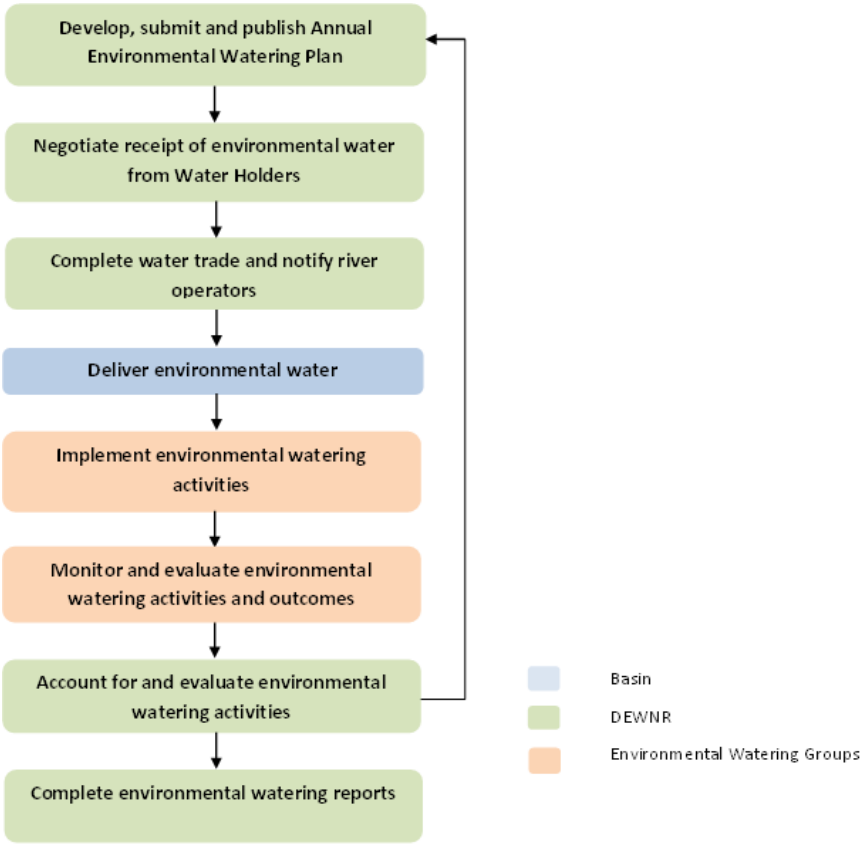

Figure 8. Implementation process for the Annual Environmental Watering Plan

6.2. Securing environmental water

6.2.1. Negotiating receipt of environmental water

Three sites within South Australia are eligible to access water from the TLM portfolio. These TLM icon sites are Chowilla Floodplain, the Channel and the Lower Lakes, Coorong and Murray Mouth. Icon site managers provide watering proposals that are used to develop the State's annual environmental watering priorities and these are also submitted to the Southern Connected Basin Environmental Watering Committee (SCBEWC) to inform the planning and prioritisation of the use of the TLM portfolio. Decisions on the use of the TLM portfolio are made jointly by members of SCBEWC. SCBEWC seek to coordinate the delivery of TLM water with other environmental water holders where possible.

Each year, the CEWO undertakes portfolio management planning for CEW, which includes multi-year planning for water delivery, trade and carryover. The SA River Murray region is included in the Commonwealth Environmental Water Portfolio Management Plan: Lower Murray-Darling 2016-17 which is available at: https://www.environment.gov.au/water/cewo/catchment/lower-murray-darling/portfolio-planning.

Watering schedules are being developed that give effect to this portfolio management plan (with regard to Basin Annual Priorities and consistent with the Basin-wide Environmental Watering Strategy) for the use of CEW in 2016-17 at the CLLMM and the use of CEW at Weirs 2 and 5. Once agreed, these watering schedules are signed by the Commonwealth Environmental Water Holder and an appropriate DEWNR representative.

The Commonwealth Environmental Water Holder also has signed Partnership Agreements with several non-government organisations for the delivery of CEW along the River Murray in South Australia. There organisations include:

- Nature Foundation South Australia (NFSA);
- Ngarrindjeri Regional Authority (NRA);
- Renmark Irrigation Trust (RIT); and
- South Australian Murray-Darling Basin Natural Resources Management Board (SAMDBNRM Board).

Copies of these partnership agreements are available at:
https://www.environment.gov.au/water/cewo/publications/agreements-use-commonwealth-environmental-water

Decisions on the use of Commonwealth environmental water are made by the CEWH throughout the year based on seasonal, operational and management considerations (Commonwealth Environmental Water Office, 2013) .

6.2.2. Completing water trades

Once an environmental water holder has committed water to an environmental watering action then the water allocation is traded onto a water account in South Australia.

For environmental watering actions that are managed by DEWNR staff (including actions undertaken as part of the partnership agreement between the CEWH and the SAMDBNRM Board), the allocation is traded onto an account held by the SA Minister for Water and the River Murray. Trades onto this account are completed even if the environmental water is already held on a South Australian licence (e.g. CEW held in SA and TLM water held in SA). The use of a single account for all environmental water allocation trades provides for accurate and simplified accounting and reporting. Online trading is encouraged to streamline the process. The water account is linked to a Site Use Approval (SUA) and a Water Resource Works Approval (WRWA), and both are regularly updated to include all environmental watering and pump locations. Management of the water account, and its associated SUA and WRWA, has been delegated within DEWNR.

Allocations for environmental watering actions that will be undertaken by non-government organisations can be traded onto the account held by the SA Minister for Water and the River Murray. However, more recently, NFSA have been using their own water account for the trading of water allocations under the partnership agreement with the CEWH. It is likely that RIT will also use their own water account for trading environmental water allocations. The non-government organisations also need to ensure that any parcels of land where water will be delivered and pump locations are included on a SUA and WRWA linked to the water account.

6.3. Delivering environmental water

DEWNR, SA Water and MDBA work cooperatively to manage arrangements for the delivery of water to South Australia for all purposes including environmental water. The annual environmental watering priorities and watering actions are incorporated into the South Australian River Murray Annual Operating Plan. Therefore, the water delivery required to support these priorities and actions is integrated with broader river operations planning.

The implementation of environmental watering actions is managed by water managers in consultation with other interested parties. There are several methods available for implementing environmental watering actions, including:

- the addition of environmental water to flows that come across the South Australian border and subsequent downstream delivery provides water to the SA River Murray Channel and CLLMM assets, and potentially to the Floodplain if flows are sufficiently high;
- operation of the barrages to influence water levels in the Lower Lakes, and water movement into the Coorong and out to sea through the Murray Mouth;

- operation of the Chowilla Environmental Regulator and raising of the main channel weirs to increase the extent of inundation;
- pumping to discrete temporary wetland basins, which generally involves the installation of temporary embankments to retain water;
- application of water to floodplain vegetation through drip irrigation or sprinklers; and
- operation of flow control structures to implement wetting and drying regimes at pool-connected wetlands.

Proposed action, delivery mechanism and cost are described by managers in their watering proposals. Real time environmental management groups operate to adapt watering actions in response to changing conditions and provide advice on the preferred pattern of delivery for environmental outcomes. These groups include the Barrage Operations Advisory Group, Chowilla Operations Group and the Environmental Flows Reference Group.

Before implementing environmental watering actions that extract or use water from the River Murray, managers need to submit an Action Request form to the River Murray Operations Working Group. The Action Request form is used to consider impacts on the operation of the River, potential risks and water quality impacts, including cummulative impacts where mutliple actions are to be undertaken at similar times. This form also assists in the coordination of environmental watering activity and for DEWNR to have oversight of environmentnal watering activities being undertaken throughout the region. A copy of the River Murray Action Request form is provided at Appendix H.

Old Parcoola Wetland by Callie Nickolai

6.4. Monitoring and evaluation

Operational and ecological monitoring to be undertaken in association with environmental watering actions are outlined in the watering proposals developed by the environmental managers.

The Living Murray Program funds long-running condition and intervention monitoring at the Chowilla and LLCMM icon sites, with results used to inform water delivery and the operation of environmental infrastructure. This monitoring is coordinated by the icon site managers in DEWNR and will continue in 2016-17.

The CEWO identifies any specific monitoring and reporting requirements in their watering schedules for the use of CEW. In addition, the CEWO Long Term Intervention Monitoring Project was established in 2014, with the Lower Murray River as one of the selected areas. This project collects data in the SA River Murray Channel asset. The project

has been designed to evaluate outcomes at the Basin-scale, demonstrate environmental outcomes from the delivery of CEW at the regional scale and help with the adaptive management of CEW holdings. SARDI has been contracted by CEWO as the lead agency for the LTIM project in the Lower Murray River.

Other key monitoring programs associated with environmental water management along the River Murray in South Australia are:

- ongoing monitoring of selected South Australian River Murray wetlands and floodplain areas, which is undertaken by the wetlands and floodplain team of Natural Resources SA Murray-Darling Basin (SAMDB) in partnership with local action planning associations, landcare associations and community groups;
- monitoring the ecological response from the weir pool raising at Locks 2 and 5, which is coordinated by DEWNR and funded by the Australian Government; and
- the Coorong Lower Lakes and Murray Mouth Recovery Project, which is funded by the South Australian Government's Murray Futures program and the Australian Government, will continue to undertake some monitoring in 2016-17.

DEWNR currently relies on information gathered through existing monitoring programs as described above. These programs have been established with specific purposes that generally relate to site-specific management plans and enable adaptive management of these sites. Information on the type of information gathered through each of these programs can be sourced from relevant site managers.

NFSA will undertake operational monitoring (volumes, delivery dates, inundation extent and photopoints) at all their watering sites. Ecological monitoring will include vegetation response of target species at all sites, as well as bird and frog observations at selected sites.

As the volumes of environmental water and number of watering sites grow, it will become increasingly important to undertake strategic and regionally integrated monitoring and evaluation. This work is currently being progressed through the development of an integrated monitoring and evaluation plan to enable the state to meet its ecological reporting obligations under the Basin Plan (Schedule 12, Matter 8), which requires Basin States to report every five years on the achievement of environmental outcomes at an asset scale. The first report is due in 2020.

6.5. Accounting and reporting

Environmental water reporting requirements are described in the SA River Murray Long-Term Plan.

In 2016-17, DEWNR will be responsible for managing and maintaining records for all actions managed by DEWNR including allocations, trades, water availability and water delivery. This data is used to report to water holders, reconcile the Minister's licences and water accounts, meet state obligations to report annually against Matter 9 of the Basin Plan (the identification of environmental water and the monitoring of its use), and report on environmental water management to stakeholders and other interested parties.

The non-government organisations will generally operate through their own water licenses and accounts, and will have their own record keeping and water accounting arrangements in place to ensure that water use remains within availability and to fulfil reporting requirements. Operational and ecological reporting requirements will be agreed between the delivery partners and the water holder.

Reporting on the benefits and ecological outcomes of environmental watering events occurs through individual site reports. Key ecological outcomes are consolidated into the Annual Environmental Watering Report which is published on the DEWNR website each year.

7. References

Commonwealth Environmental Water Office. (2013). *Framework for Determining Commonwealth Environmental Water Use.* Canberra: Australian Government.

Department of Environment Water and Natural Resources. (2015). *Long term environmental watering plan for the South Australian River Murray water resource plan area.* Adelaide: Department of Environment Water and Natural Resources.

Department of the Environment. (2016). *Water holdings*. Retrieved from Commonwealth Environmental Water Office: http://www.environment.gov.au/water/cewo/portfolio-mgt/holdings-catchment

Murray-Darling Basin Authority. (2014a). *Basin-wide environmental watering strategy.* Canberra: Commonwealth of Australia.

Murray-Darling Basin Authority. (2014b). *2014–15 The Living Murray Annual Environmental Watering Plan.* Canberra: Commonwealth of Australia.

O'Connor, J., Steggles, T., Higham, J., & Rumbelow, A. (2015). *Ecological objectives, targets, and environmental water requirements for the Coorong, Lower Lakes and Murray Mouth.* Adelaide: Department of Environment Water and Natural Resources.

SA Murray-Darling Basin Natural Resources Management Board. (2002). *Water Allocation Plan for the River Murray Prescribed Watercourse (as amended January 2011).* Murray Bridge: SA Murray-Darling Basin Natural Resources Management Board.

Legislation / Legislative Instruments

Basin Plan 2012 (Cth)

Natural Resources Management Act 2004 (SA)

Water Act 2008 (Cth)

8. Appendices

A. Risk Criteria

Likelihood

Description	Likelihood of Occurrence
Almost certain (AC)	The event is expected to occur in most circumstances
Likely (L)	The event will probably occur in most circumstances
Possible (P)	The event could occur at some time
Unlikely (U)	The likelihood of the event occurring is low
Rare (R)	The event may occur only in exceptional circumstances

Consequence

	Environmental	People and property	Operational
Critical (C)	Irreversible damage to the environmental values of an aquatic ecosystem and/or connected waters/other parts of the environment; localised species extinction	Death or multiple life threatening injuries or severe trauma; major economic/social impact to multiple communities/ multiple industries	Predicted transmission loss will prevent the achievement of planned outcomes of the watering event (e.g. large majority proportion of water will be lost prior to destination).
Major (Ma)	Long-term damage to environmental values and/or connected waters/other parts of the environment; significant impacts on listed species; significant impacts on water supplies	Life threatening injury/ severe trauma or multiple serious injuries causing hospitalisation; sustained and significant public complaints; severe economic and/or social impact to communities	Predicted transmission loss will significantly detract from the planned outcomes of the watering event (e.g. majority proportion of water will be lost prior to preferred destination).
Moderate (Mo)	Short-term damage to environmental values and/or connected waters/other parts of the environment; short-term impacts on species	Minor injury/trauma or First Aid Treatment Case; sustained public complaints; isolated but significant economic and/or social impact	Predicted transmission loss will moderately detract from the planned outcomes of the watering event (e.g. large minority proportion of water lost prior to preferred destination).
Minor (Mi)	Localised short-term damage to environmental values and/or connected waters/other parts of the environment; temporary loss of water supplies	Short-term but significant public complaints; minor economic and/or social impact contained to small number of individuals	A small amount of water will be lost in transit and this will have a small impact on the environmental outcomes (e.g. small minority proportion of water lost prior to preferred destination).
Insignificant (I)	Negligible impact on environmental values etc.	Minor or isolated public complaints; no economic and social impact	Transmission loss minimal and will not affect the planned outcomes of the watering event (e.g. minimal amount of water lost prior to preferred destination).

The level of risk is determined by the *likelihood* of the hazard occurring, and the level of impact (*consequence*).

Overall risk level rating

		CONSEQUENCE				
		Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
LIKELIHOOD	**Almost certain**	low	medium	high	severe	severe
	Likely	low	medium	medium	high	severe
	Possible	low	low	medium	high	severe
	Unlikely	low	low	low	medium	high
	Rare	low	low	low	medium	high

B. Guidelines for having regard to 'Targets for Managing Water Flows'

(Basin Plan, Chapter 9: Water Quality and Salinity Management Plan)

Introduction

Chapter 9 of the Basin Plan establishes the Water Quality and Salinity Management Plan (WQSMP) for the water resources of the Murray-Darling Basin. The chapter establishes the key causes of water quality degradation and sets water quality objectives and targets for Basin Water resources.

As part of the implementation of the WQSMP all river operators and holders of environmental water are required to have regard to 'Targets for managing water flows' (9.14) when making flow management decisions.

As part of annual Basin Plan reporting requirements South Australia will be required to report on how it has had regard to the targets in Chapter 9 when making flow management decisions *(Item 14, Schedule 12, Water Act 2007 - Basin Plan 2012).*

These guidelines are intended to assist South Australian river operators, environmental water managers and holders of environmental water to have regard for to the targets when planning and making flow management decisions. The guidelines will assist in demonstrating that the South Australian Government has had regard for the targets when making flow management decisions.

What are the targets?

The targets to have regard to when making flow management decisions are outlined in Chapter 9, of the Basin Plan and include:

1. to maintain dissolved oxygen at a target value of at least 50% saturation.
2. the targets for recreational water quality (values for cyanobacteria cell counts or biovolume meet the guidelines values set out in Chapter 6 of the Guidelines for Managing Risks in Recreational Water).
3. the levels of salinity at the following reporting sites should not exceed the values set out below 95% of the time (where time is defined as the current water accounting period and the previous 4 water accounting periods, i.e. a rolling five year average):

    1) River Murray at Murray Bridge - 830 EC
    2) River Murray at Morgan - 800 EC
    3) River Murray at Lock 6 - 580 EC
    4) Darling River downstream of Menindee Lakes at Burtundy - 830 EC
    5) Lower Lakes at Milang - 1,000 EC

Who Must Have Regard to Targets for Managing Flows?

The Murray-Darling Basin Authority, Basin Officials Committee, agencies of Basin States, the Commonwealth Environmental Water Holder, holders of held environmental water and managers of planned environmental water must have regard to the targets when performing functions relating to the management of water flows or making decisions about the use of environmental water.

How to Have Regard to Water Quality Targets

The following principles should be considered in developing plans or making operational decisions about the management of flow and the use of environmental water in the River Murray.

High Level Principles

When planning and managing water flows or making decisions regarding the use of environmental water the following principles will be considered:

1. long term and annual planning for environmental watering and management of water flows will include arrangements and consider measures to achieve the targets and mitigate any adverse impacts on water quality.
2. management of water flows and operation of structures for environmental benefit require a coordinated approach to planning and decision making in order to identify and address cumulative impacts.
3. where water flow changes are proposed that could result in a breach of the water quality targets for managing water flow (9.14), actions to avoid the breach must be considered.

Planning principles

1. In developing long term and annual plans and policies for management of held and planned environmental water, environmental watering and management of water flows, the potential for planned actions to impact on the water quality targets for managing water flows should be assessed.

2. Where there is potential for impact, the long term and annual plans and policies should:

    - consider the operating principles outlined below;
    - identify arrangements to support consideration of the targets in decision making;
    - consider arrangements to support a coordinated approach that takes account of interactions with other relevant flow management and environmental water management planning and decision making;
    - include arrangements for documenting decision making processes and how the targets were considered;
    - identify relevant monitoring, evaluation and reporting arrangements; and
    - include notification arrangements where necessary.

Operating Principles

When undertaking flow management or environmental watering actions the following must be considered:

1. that the flow decision is consistent with relevant operational and environmental watering plans and policies including:

    - the South Australian Annual Environmental Watering Plan/Priorities;
    - South Australia's River Murray Annual Operating Plan;
    - the MDBA's River Murray System Annual Operating Plan; and
    - the MDBA's Objectives and Outcomes for River operations in the River Murray System

2. if there is a high possibility that the flow decision may result in either salinity, dissolved oxygen or cyanobacteria exceeding target values, a risk assessment should be undertaken which considers:

    a) potential impacts from the water flow decision*;
    b) current in-stream conditions (including upstream of the South Australian border);
    c) forecast flow conditions; and
    d) available mitigation strategies.

    * If the likelihood of impact is high further detailed assessment may be required.

3. the need to undertake ***monitoring and evaluation*** of the implementation of the flow management decision to assess actual changes to relevant water quality parameters (before and after using existing monitoring or event based) and to determine long term trends.

4. completing relevant ***notification*** requirements. This will include:

    - a River Murray Action Request form to the Department of Environment, Water and Natural Resources River Murray Operations; and
    - may include community notification through appropriate channels when required.

5. putting in place appropriate ***reporting*** arrangements, including:

    - documentation of decision making process and how targets for managing water flows (9.14) were considered; and
    - processes to allow provision of monitoring information and documentation on how targets were considered to the Departmental Basin Plan monitoring, evaluation and reporting coordinator.

C. Prioritisation Criteria

Ranking criteria 1 – 5 are essentially the same as TLM 'Methodology for applying ranking criteria' (provided in MDBA, 2012a) with some minor changes. One additional criteria has been added for the State prioritisation of South Australian River Murray watering proposals to better align with the 'Principles to determine priorities for applying environmental water' within the *Basin Plan 2012* (Cth).

As stated against TLM criteria, it is acknowledged that these ranking criteria are a decision support tool and that other factors will contribute to the final decision including water availability and operational feasibility.

1. Scale of environmental benefit

high	• contribution to key site values and/or key environmental asset (KEA) site management objectives is high (for example breeding event) • total area of target community or site watered • major outcomes at River Murray system-scale • outcomes of the watering (for example maintenance of habitat) can be sustained for a lengthy period of time (e.g. greater than 12 months)
medium	• able to contribute partially (approximately half) to key site values and/or to KEA site management objectives • important outcomes at icon site scale • at least half of target community or site watered • outcomes of the watering is sustainable for a reasonable length of time (e.g. 6-12 months)
low	• minor contribution to key site values and/or KEA site management objectives • outcomes at localised scale • will require follow up watering within short term (e.g. 3-6 months) in order to sustain outcomes

2. Risk of not applying water

high	• not watering would result in a catastrophic risk to a species or key habitat component or site value that would have a long recovery time • high loss of previous watering investment (ecological, volume or $) • site is reaching end of resilience period
medium	• high risk of loss of a local population of a species, but limited scope for recovery (i.e. poor recolonisers) or long recovery time • loss of key habitat components that have a short recovery time • moderate loss associated with previous watering investment • may not be able to fully deliver minimum regime
low	• risk of loss of a local population (of a common species) but scope for recovery within short term • minor loss associated with previous watering investment • may not be able to fully deliver optimum watering regime

3. Environmental risks associated with watering

low	• no discernible risks (for example liability, flooding, salinity spikes, blackwater events and other water quality risks) associated with watering. Mitigation strategies ensure no short- or long-term impacts
medium	• high localised risks associated with watering. Mitigation strategies may ensure no long-term impacts but may have negative short-term impacts
high	• major widespread risks associated with watering. Mitigation strategies may not be able to prevent long-term negative impacts on ecosystem health

4. Certainty/likelihood of benefit

high	• considerable evidence, sound conceptual model with rigorous scientific underpinning, done successfully before at this site
medium	• anecdotal support, sound conceptual model supported by good understanding of the processes that would lead to the outcome
low	• limited understanding, unsure of outcome, lack of consensus on likely outcome

5. Significance of Site

high	• ramsar • supports state/national listed threatened species
medium	• supports species listed under international agreements (Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement) • significant previous investment in environmental management
low	• new site

D. Principles to guide environmental watering priorities

(*Basin Plan* – Chapter 8, Part 6, Division 12, 8.53 – 8.59)

1. Consistency with principles of ecologically sustainable development and international agreements
2. Consistency with objectives in Chapter 8, Part 2 of the Basin Plan
3. Flexibility and responsiveness
4. Condition of environmental assets and ecosystem functions
5. Likely effectiveness and related matters
6. Risks and related matters
7. Robust and transparent decisions

E. Summary of environmental watering actions proposed for 2016-17 by environmental asset/site managers under five scenarios

Very dry (95% AOP) Scenario

Site	Action	Details	Objectives	Volume (GL)
LLCMM	(a) Spring delivery	4 months - September to December	○ Barrage outflows for fish migration & localised estuarine conditions ○ Maintain lake levels >0.8 mAHD October to December ○ Fringing & submerged aquatic vegetation health ○ Southern Bell frog & small threatened fish recruitment	375.000
	(b) Baseflow	Remainder of year	○ Continuous fishway/barrage releases & localised estuarine conditions ○ Continuous connectivity between river & estuary ○ Maintain lake levels >0.4-0.5m AHD all year	225.000
Channel	N/A			
Weir manipulation	N/A			
Chowilla	Pulse flows	20 weeks - October to February Through Chowilla anabranch via Pipeclay & Stanley Creek weirs	○ Wetland vegetation including River Red Gum & Cooba; fish	TBA
Wetlands	Lower Lakes fringing wetlands - Pumping	4 sites 4 months over Spring - Summer	○ Habitat migratory birds; Snipes, frogs, Southern Bell Frogs, aquatic plant seedbank	Up to 0.900
	Chowilla wetlands - Pumping	Up to 7 sites - priority wetlands July to December	○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes	Up to 7.620
	Berri & Disher threatened fish refuges - Inlet operations & pumping	2 sites: ○ Disher - Spring - Summer as needed	○ Murray hardyhead	0.200
		○ Berri - Ongoing	○ Murray hardyhead ○ Waterbird habitat, including threatened & migratory species	Up to 1.327
	Valley wetlands - Pumping	12 sites ~4 months – September to December	○ Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	Up to 8.000
	Gorge wetlands - Pumping	Up to 9 sites Bookmark Creek ongoing Others ~4 months – September to December	Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	~3.500

Dry (90% AOP) Scenario

Site	Action	Details	Objectives	Volume (GL)
LLCMM	(a) Spring delivery	4 months - September to December	○ Barrage outflows for fish migration & localised estuarine conditions ○ Maintain lake levels >0.8 mAHD October to December ○ Fringing & submerged aquatic vegetation health ○ Southern Bell frog & small threatened fish recruitment	375.000
	(b) Baseflow	Remainder of year	○ Continuous fishway/barrage releases & localised estuarine conditions ○ Continuous connectivity between river & estuary ○ Maintain lake levels >0.4-0.5m AHD all year	225.000
	(c) Improved spring barrage releases	September to December	○ Improve: Estuarine conditions; North Lagoon; benthic macroinvertebrate; breeding, spawning estuarine fish (Black Bream & Greenback flounder) ○ Food migratory birds	100.00
Channel	10,000 flow pulse x 60 days	November to December	○ Large positive: Maintain diurnally-mixed water column for diverse phytoplankton; support foraging generalists ○ Moderate positive: Maintain water quality to support aquatic biota; Promote bacterial rather than algal dominance; improve food for consumers.	320.000
Weir Manipulation	Boost QSA to entitlement level	Not consumed by weir pool raising		131.000
	Weir 2 pool raised to 75cm	90 days – September to November Note return flows = 10.500 GL	○ To avoid irretrievable loss or damage to environmental assets	12.000
	Weir 5 pool raised to 50cm	90 days – September to November Note return flows = 9.400 GL	○ To avoid irretrievable loss or damage to environmental assets	14.000
Chowilla	Pulse flows	20 weeks - October to February Through Chowilla anabranch via Pipeclay & Stanley Creek weirs	○ Wetland vegetation including River Red Gum and Cooba; fish	TBA
Wetlands	Lower Lakes fringing wetlands - Pumping	4 sites 4 months over Spring - Summer	○ Habitat migratory birds; Snipes, frogs, Southern Bell Frogs, aquatic plant seedbank	Up to 0.900
	Chowilla wetlands - Pumping	Up to 7 sites - priority wetlands July to December	○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes	Up to 7.620
	Berri & Disher -Threatened fish refuges - Inlet operations & pumping	2 sites: Disher - Spring - Summer as needed	○ Murray hardyhead	0.200
		Berri - On-going	○ Murray hardyhead ○ Waterbird habitat, including threatened & migratory species	Up to 1.327
	Valley wetlands - Pumping	12 sites SA Gorge geomorphic region ~4 months – September to December	○ Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	Up to 8.000
	Gorge wetlands - Pumping	Up to 9 sites Bookmark Creek on-going Others ~4 months – September to December	○ Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	~3.500

Moderate (75% AOP) Scenario

Site	Action	Details	Objectives	Volume (GL)
LLCMM	(a) Spring delivery	4 months - September to December	○ Barrage outflows for fish migration & localised estuarine conditions ○ Maintain lake levels >0.8 mAHD October to December ○ Fringing & submerged aquatic vegetation health ○ Southern Bell frog & small threatened fish recruitment	375.000
	(b) Baseflow	Remainder of year	○ Continuous fishway/barrage releases & localised estuarine conditions ○ Continuous connectivity between river & estuary ○ Maintain lake levels >0.4-0.5m AHD all year	225.000
	(c) Improved spring barrage releases	September to December	○ Improve: Estuarine conditions; North Lagoon; benthic macroinvertebrate; breeding, spawning estuarine fish (Black Bream & Greenback flounder) ○ Food migratory birds	100.000
	(d) Further improved spring barrage releases	3 months - October to December	○ Similar to Action C with further improvements. ○ Improving conditions of mudflats.	140.000
	(e) Winter pulse through barrages	1 month - June	○ Murray Mouth for Lamprey migration ○ Freshwater signal through Goolwa barrage to ocean ○ Minimise accumulation of sediment in Murray Mouth	60.000
Channel	10,000 flow pulse x 60 days	Mid October to Mid December	○ Large positive: Maintain diurnally-mixed water column for diverse phytoplankton; support foraging generalists ○ Moderate positive: Maintain water quality to support aquatic biota; Promote bacterial rather than algal dominance; improve food for consumers.	275.000
Weir Manipulation	Boost QSA to entitlement level	Not consumed by WPR		33.000
	Weir 2 pool raised to 75cm	90 days – September to November Note return flows = 10.500 GL	○ To maintain basic functions and resilience of environmental asset	12.000
	Weir 5 pool raised to 50cm	90 days – September to November Note return flows = 9.000 GL	○ To maintain basic functions and resilience of environmental asset	14.000
Chowilla	Pulse flows	20 weeks - October to February Through Chowilla anabranch via Pipeclay & Stanley Creek weirs	○ Wetland vegetation including River Red Gum and Cooba; fish	TBA
Wetlands	Lower Lakes fringing wetlands - Pumping	4 sites 4 months over Spring - Summer	○ Habitat migratory birds; Snipes, frogs, Southern Bell Frogs, aquatic plant seedbank	Up to 0.900
	Chowilla wetlands - Pumping	Up to 7 sites - priority wetlands July to December	○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes	Up to 7.620
	Berri & Disher threatened fish refuges - Inlet operations & pumping	2 sites: Disher - Spring - Summer as needed	○ Threatened fish refuges ○ Murray hardyhead	0.200
		Berri - On-going	○ Murry hardyhead ○ Waterbird habitat, including threatened & migratory species	Up to 1.327
	Valley wetlands - Pumping	12 sites SA Gorge geomorphic region ~4 months – September to December	○ Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	Up to 8.000
	Gorge wetlands - Pumping	11 sites Bookmark Creek on-going Others ~4 months – September to December	○ Various including vegetation (River Red Gum & Black Box) waterbirds, frogs including Southern Bell frogs	~3.500

Near Average (50% AOP) Scenario

Site	Action	Details	Objectives	Volume (GL)
LLCMM	(a) Spring delivery	4 months - September to December	○ Barrage outflows for fish migration & localised estuarine conditions ○ Maintain lake levels >0.8 mAHD October to December ○ Fringing & submerged aquatic vegetation health ○ Southern Bell frog & small threatened fish recruitment	375.000
	(b) Baseflow	Remainder of year	○ Continuous fishway/barrage releases & localised estuarine conditions ○ Continuous connectivity between river & estuary ○ Maintain lake levels >0.4-0.5m AHD all year	225.000
	(c) Improved spring barrage releases	September to December	○ Improve: Estuarine conditions; North Lagoon; benthic macroinvertebrate; breeding, spawning estuarine fish (Black Bream & Greenback Flounder) ○ Food migratory birds	100.000
	(d) Further improved spring barrage releases	3 months - October to December	○ Similar to Action C with further improvements ○ Improving conditions of mudflats	140.000
	(e) Winter pulse through barrages	1 month - June	○ Murray Mouth for lamprey migration ○ Freshwater signal through Goolwa barrage to ocean ○ Minimise accumulation of sediment in Murray Mouth	60.000
	(f) Add water to unregulated flows, higher barrage releases	9 months - Larger flow October to December plus lower flow January to June[4]	○ Salinity benefits North Lagoon ○ *Ruppia tuberosa* in South Lagoon ○ Estuarine fish North & South lagoons ○ Food for waterbirds North Lagoon ○ Open Murray Mouth ○ Enhanced estuary conditions for the Coorong	1051.000 372.000
Channel	15,000 flow pulse x 90 days	October to December	○ Large positive: Maintain diurnally-mixed water column for diverse phytoplankton; Maintain water quality to support aquatic biota; support foraging generalists ○ Moderate positive: Adequate flushing of salt to ocean; Establish and maintain groundwater/soil moisture; Promote bacterial rather than algal dominance; improve food for consumers; Diverse flood-dependant plant community; Support golden perch and silver perch populations	600.000
Weir Manipulation	Weir 2 pool raised to 75cm	90 days – September to November Return flows = 7.000 GL	○ To maintain ecological health and resilience	10.000
	Weir 5 pool raised to 50cm	90 days – September to November Return flows = 8.000 GL	○ To maintain ecological health and resilience	13.000
Chowilla	Operate regulator - mid-floodplain inundation	July to December – 147 days	○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes	Up to 278.000
Wetlands	Lower Lakes fringing wetlands - Pumping	4 sites 4 months over Spring - Summer	Habitat migratory birds; Snipes, frogs, Southern Bell Frogs, aquatic plant seedbank	Up to 0.900
	Valley wetlands - Pumping	11 sites ~4 months – September to December	Various including vegetation, waterbirds, frogs	~7.500
	Gorge Wetlands - Pumping	Up to 9 sites ~4 months – September to December	Various including vegetation, waterbirds, frogs	Up to 3.000

[4] NOTE: Environmental water is not requested in July, August and September for barrage fishway outflows if there is sufficient flows as per the AOP scenario. The water is instead requested for October to December.

Wet (25% AOP) Scenario

Site	Action	Details	Objectives	Volume (GL)
LLCMM	(a) Spring delivery	4 months - September to December	○ Barrage outflows for fish migration & localised estuarine conditions ○ Maintain lake levels >0.8 mAHD October to December ○ Fringing & submerged aquatic vegetation health ○ Southern Bell frog & small threatened fish recruitment	375.000
	(b) Baseflow	Remainder of year	○ Continuous fishway/barrage releases & localised estuarine conditions ○ Continuous connectivity between river & estuary ○ Maintain lake levels >0.4-0.5m AHD all year	225.000
	(c) Improved spring barrage releases	September to December	○ Improve: Estuarine conditions; North Lagoon; benthic macroinvertebrate; breeding, spawning estuarine fish (Black Bream & Greenback Flounder) ○ Food migratory birds	100.000
	(d) Further improved spring barrage releases	3 months - October to December	○ Similar to Action C with further improvements. ○ Improving conditions of mudflats.	140.000
	(e) Winter pulse through barrages	1 month - June	○ Murray Mouth for Lamprey migration ○ Freshwater signal through Goolwa barrage to ocean ○ Minimise accumulation of sediment in Murray Mouth	60.000
	(f) Add water to unregulated flows, higher barrage releases	9 months - Larger flow October to December plus lower flow January to June[5]	○ Salinity benefits North Lagoon ○ *Ruppia tuberosa* in South Lagoon ○ Estuarine fish North & South lagoons ○ Food for waterbirds North Lagoon ○ Open Murray Mouth ○ Enhanced estuary conditions Coorong	1051.000 372.000
	(g) Add water to unregulated flows, higher barrage releases	3 months - October to December	○ Salinity benefits North Lagoon ○ *Ruppia tuberosa* in South Lagoon ○ Estuarine fish North & South lagoons ○ Food for waterbirds North Lagoon ○ Open Murray Mouth ○ Enhanced estuary conditions Coorong	1220.000 200.000
Channel	Build on unregulated flow event e.g. Median discharge QSA 35,000 ML/day	60 days – September to October	Per drier scenarios plus moderate positive contribution to temporary wetland connectivity; RRG recruitment; understorey vegetation; Murray cod recruitment; catfish recruitment	~300.000
Weir Manipulation	No proposal			
Chowilla	Operate regulator – maximise floodplain inundation Operate regulator – maximise floodplain inundation	July to December – 155 days July to December – 157 days	○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes ○ Wetland vegetation including River Red Gum, Black Box, Cooba; fish; water birds; amphibians; invertebrates; fauna outcomes	98.000 276.000
Wetlands	Lower Lakes fringing wetlands - Pumping	4 sites 4 months over Spring - Summer	○ Habitat migratory birds; Snipes, frogs, Southern Bell Frogs, aquatic plant seedbank	Up to 0.900
	Valley wetlands - Pumping	3 to 11 sites ~4 months – September to December	○ Various including vegetation, waterbirds, frogs	2 to 7.500
	Gorge wetlands - Pumping	Up to 9 sites ~4 months – September to December	○ Various including vegetation, waterbirds, frogs	Up to 3.000

[5] NOTE: Environmental water is not requested in July, August and September for barrage fishway outflows if there is sufficient flows as per AOP. The water is instead requested for October to December.

F. Temporary wetlands for pumping

Watering proposal	Wetland Name	Watering Objectives
Lower Lakes fringing wetlands	Tolderol	Provide water levels and suitable habitat for Migratory Birds Provide suitable breeding habitat for frogs; in particular Southern Bell Frogs
	Milang	Provide suitable water habitat for Snipes during dry years Improve aquatic plant seedbank
	Jenny's Lagoon	Provide suitable breeding habitat for frogs; in particular Southern Bell Frogs
Gorge Wetlands	Overland Corner	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats
	Wigley Reach	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats
	Akuna	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats
	Parcoola	Support tree health (River Red Gum) and waterbirds
	Markaranka	Support a range/mosaic of wetland habitats including Black Box and River Red Gum habitats Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide Regent Parrot habitat (including nesting)
	Hogwash Bend	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide Regent Parrot habitat (including nesting)
	Nilkra	Support tree health (River Red Gum) for Regent Parrots
	Molo Flat	Support a range/mosaic of wetland habitats including River Red Gum and open water habitats Provide frog breeding opportunities, particularly for the Southern Bell Frog
	Morgan East	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats Provide frog breeding opportunities, particularly for the Southern Bell Frog
	Nikalapko	Support tree health (River Red Gum) and waterbirds
	Morgan CP (South Lagoon)	Support a range/mosaic of wetland habitats including Lignum and River Red Gum habitats Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide Regent Parrot habitat (including nesting)
	Sweeney's	Provide frog breeding opportunities, particularly for the Southern Bell Frog
Valley Wetlands	Carparks Lagoon	Support a range of floodplain vegetation communities including River Red Gum and Black Box seedlings, and fringing River Red Gum Support aquatic and wetland bed vegetation Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide waterbird habitats for foraging and breeding
	Gerard basin and floodplain	Support a range of floodplain vegetation communities including River Red Gum, Black Box, Cooba and Lignum Provide frog breeding opportunities, particularly for the Southern Bell Frog
	Wiela shedding and temporary wetlands	Support a range of floodplain vegetation communities including River Red Gum and Black Box seedlings

	Bookmark Creek	Support a range of floodplain vegetation communities including fringing River Red Gum Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide flowing habitat
	Murtho Park	Support a range of floodplain vegetation communities including River Red Gum, Black Box and Cooba
	Old Loxton Road	Support a range of floodplain vegetation communities including Lignum Support aquatic and wetland bed vegetation
	Piggy Creek	Support tree health (River Red Gum), Lignum, frogs and waterbirds
	Katarapko Creek	Support a range of floodplain vegetation communities including River Red Gum, Black Box and Cooba Provide frog breeding opportunities, particularly for the Southern Bell Frog Provide waterbird habitats for foraging and breeding
	Martin Bend	Support a range of floodplain vegetation communities including River Red Gum, Black Box, Cooba and Lignum Provide frog breeding opportunities, particularly for the Southern Bell Frog
	Yabby Creek / Katarapko Basins	Support a range of floodplain vegetation communities including River Red Gum and Black Box seedlings Provide waterbird habitats for foraging and breeding
Chowilla Wetlands	Coppermine Complex	Reduce soil salinity and improve soil moisture availability in inundated and adjacent areas Halt observed increase in proportion of trees for which condition scores are below the Ecological Target Support ongoing growth of seedlings and saplings of River Red Gum, Black Box and Cooba that have established in response to flooding and environmental watering recent years Improve condition of Lignum in inundated areas Provide conditions conducive to growth of flood dependent and aquatic vegetation in inundated zones Provide breeding habitat for waterbirds, amphibians and invertebrates. Re-establish habitat condition to sustain high value fauna communities
	Gum Flat	
	Lake Limbra	
	Monoman Creek Depression	
	Monoman Depression	
	Twin Creeks	
	Woolshed Creek	

G. SA multi-site hydrograph compared to the EWR metrics in the SA River Murray Long-Term Plan

Key: ✓= EWR metric met; ? = EWR metric partially met; ✗ = EWR metric not met

a) Comparison of hydrological regime provided through the proposed SA multi-site in the 90% AOP scenario to Channel EWR metrics

EWR/Scenario	Median discharge (ML/day QSA)	Discharge range (ML/day QSA)	Duration (days)	Preferred timing
EWR - IC1	10,000	7,000 – 12,000	60	Sep - Mar
Multi-site - 90% AOP	✗ 9,248	✓ 8,194 – 9,503	✓ 60	✓ Oct - Dec

b) Comparison of hydrological regime provided through the proposed SA multi-site in the 90% AOP scenario to CLLMM EWR metrics

EWR/Scenario	Barrage outflow annual volume (GL/yr)	Barrage outflow 3-year average volume (GL)	Barrage outflow timing	Lakes water level range (mAHD)	Lakes water level timing	Coorong South Lagoon water level (mAHD)
EWR – CLLMM1	>650	>2,000	Throughout year, with peak in Oct – Dec	0.4 – 0.75	Max: Dec – Feb Min: Mar - May	0.0 to 0.2 (Sep – Nov) -0.2 to -0.4 (Feb – Mar)
Multi-site - 90% AOP	✗ 301	✗ 616	✓ Throughout year, with peak in Oct – Nov	✓ 0.5 – 0.8	? Max: Oct – Dec ✓ Min: Mar – Apr	✓ 0.0 to 0.2 (Sep – Nov) ? -0.4 to -0.5 (Feb – Mar)

c) Comparison of hydrological regime provided through the proposed SA multi-site in the 50% AOP scenario to Channel EWR metrics

EWR/Scenario	Median discharge (ML/day QSA)	Discharge range (ML/day QSA)	Duration (days)	Preferred timing
EWR - IC2	15,000	15,000 – 20,000	90	Sep - Mar
EWR - IC3	20,000	15,000 – 20,000	90	Sep – Mar
Multi-site – 50% AOP	✓ 20,323	✓ 16,933 – 23,100	✓ 90	✓ Sep - Nov

d) Comparison of hydrological regime provided through the proposed SA multi-site in the 50% AOP scenario to CLLMM EWR metrics

EWR/Scenario	Barrage outflow annual volume (GL/yr)	Barrage outflow 3-year average volume (GL)	Barrage outflow timing	Lakes water level range (mAHD)	Lakes water level timing	Coorong South Lagoon water level (mAHD)
EWR – CLLMM1	>650	>2,000	Throughout year, with peak in Oct – Dec	0.4 – 0.75	Max: Dec – Feb Min: Mar - May	0.0 to 0.2 (Sep – Nov) -0.2 to -0.4 (Feb – Mar)
Multi-site – 50% AOP	✓ 2,711	✗ 1,419	? Throughout year, with peak in Aug - Oct	✓ 0.5 – 0.8	? Max: Oct – Dec ✓ Min: Mar – Apr	✓ 0.05 to 0.40 (Sep – Nov) ✓ -0.15 to -0.35 (Feb – Mar)[6]

[6] Coorong South Lagoon water levels have not been modelled for the 50% AOP scenario and were interpolated from the modelled results for the 25% and 75% AOP scenarios

H. River Murray Action Request Form

River Murray Action Request

	Applications Details	
1	Title *eg Filling of Lake Merreti*	
2	Date of application	
3	Agency/Division/Organisation	
4	Responsible Officer include Phone number Email	
	Action Request Details	
5	Proposed action to be undertaken *Brief explanation of the proposed action to be undertaken eg pump, open regulators, flush, dry wetland etc*	
6	Proposed timeframe *Include details of proposed start date and timeframes for when the action will be undertaken*	
	Location	
7	Location details *eg Bilby Lagoon near x road, upstream of Lock 5, see map provided*	
8	Coordinates	
9	Lock Reach *eg upstream of Lock 5*	
	Water Source	
10	Is water being taken from the River Murray to undertake this action?	Yes - No If No, go to Item 15
11	What is the volume of water required to undertake this action?	
12	Has this action been considered under the DEWNR annual environmental water planning process?	
13	Has this action been recognised in the above process as a priority or agreed action for this year?	
14	What is the agreed source of water? *eg CEWH, unregulated flow, Class 9*	

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River Murray Action Request

Likely Impacts of Proposed Action				
15	Will there be any flow into the River Murray (return flow or disposal) as part of the proposed action?	Yes - No		
16	Include any details of likely **positive** impacts from undertaking this action. *eg what you aim to achieve*			
17	Include any details of likely **negative** impacts from undertaking this action. *eg impacts on construction activities, flow rates, other water users, salinity and water quality or other relevant considerations*			
18	Level of risk to water quality	High	Medium	Low
19	Level of risk to water levels	High	Medium	Low
20	Level of risk to infrastructure operations	High	Medium	Low
21	Level of risk to ecology	High	Medium	Low
22	Include details of any other relevant risks including occupational health and safety issues. *eg SA Water field staff will operate the barrages in a safe and controlled manner. Field staff have been trained in applicable field work OHS guidelines.*			
Approved Management Plan				
23	Provide details of any approved plans that relate to the proposed action. *Eg wetland management plans, Annual Environmental Watering Plan, SA Annual Operating Plan*			

Insert here any other relevant information, maps, images, hydrographs that relate to the proposed action

River Murray Action Request

Agree to Proceed (River Murray Operations Use Only)	
The River Murray Operations Team, Department of Environment, Water and Natural Resources, **agrees/disagrees** that it is highly unlikely that there will be any negative impacts on River Murray operations if this action is undertaken.	Agrees/Disagrees (Date)
The River Murray Operations Working Group **agrees/disagrees** that it is highly unlikely that there will be any negative impacts on River Murray operations if this action is undertaken.	Agrees/Disagrees (Date)

Please note: For proposed actions that may result in a high risk of negative impact on River Murray operations the matter may be referred to the Director River Murray Operations or escalated to the Murray-Darling Basin Coordinating Committee.

Government of South Australia
Department of Environment,
Water and Natural Resources