



# SOUTH AUSTRALIA'S RIVER MURRAY ENVIRONMENTAL WATERING REPORT 2012-13



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

## Acknowledgements

This is the fifth River Murray environmental watering report to be produced by the South Australian Government. It was prepared by staff in the Department of Environment, Water and Natural Resources (DEWNR). The following agencies and organisations are acknowledged for their important role in environmental water management:

- Commonwealth Environmental Water Office (CEWO)
- Department of Environment
- Murray-Darling Basin Authority (MDBA)
- South Australian Murray-Darling Basin Natural Resources Management Board (SA MDB NRM Board)
- SA Water
- Local Action Planning Committees (LAP)
- The Wetlands Habitat Trust
- Nature Foundation South Australia (NFSA).

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# 1. Introduction

This report highlights some of the successful environmental outcomes achieved through delivery of environmental water during 2012-13. It also describes the volumes of environmental water delivered to environmental assets along the River Murray in South Australia and the timing of water delivery.

It meets the South Australian Government's commitment to the Council of Australian Governments (COAG) to publish an annual report to provide transparency and accountability for River Murray environmental water use in South Australia (National Water Commission 2010).

During 2012-13, the Department of Environment, Water and Natural Resources (DEWNR) successfully negotiated with the Commonwealth Environmental Water Holder (CEWH) and the Murray-Darling Basin Authority (MDBA) Living Murray Initiative for over 1,090 gigalitres (GL) of environmental water; the largest volume of held environmental water ever delivered to South Australia. The majority of the environmental water was delivered to the River Murray Channel and the Lower Lakes, Coorong and Murray Mouth (LLCMM). A small volume was used to inundate some localised wetland and floodplain areas. This environmental water enabled some of the annual environmental water requirements of the River Channel and the LLCMM (Lester *et al* 2011b, Gibbs *et al* 2012) to be met for this period.

Environmental water management – including planning, trades, delivery, accounting and monitoring – is coordinated within DEWNR and undertaken in partnership with other government agencies including the MDBA and the Commonwealth Environmental Water Office (CEWO), research organisations and community groups.

The Murray-Darling Basin Plan (Basin Plan), adopted in November 2012, introduces significant requirements for Basin States in relation to planning, management, delivery, reporting and evaluation of environmental water. These requirements are set out in Chapter 8 and Schedule 12 of the Basin Plan, with additional guidance provided by the Schedule 12 Reporting Guideline (version 1.0, September 2013). The Basin Plan reporting requirements relevant to environmental watering from these documents are listed in Appendix 1. These requirements are not officially in place until 2013-14.<sup>1</sup>

Therefore, this report on the 2012-13 year is not required to nor does it explicitly consider the Basin Plan requirements. It reports on environmental water delivery for the South Australian River Murray during that year and as such, addresses some of the Basin Plan requirements (per the reporting Matters and Indicators listed in Appendix 1). Where a Basin Plan requirement is addressed, this is highlighted in a footnote.



Spoonbills, Ibis and Pelicans, Nikalapko by Callie Nickolai

Work is continuing within DEWNR, and with the MDBA and other Basin States to refine the approach to environmental water reporting to ensure its consistency with Basin Plan requirements in future years.

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<sup>1</sup> The report to the MDBA for the 2013-14 year is due by the end of October 2014.

## 1.1 Multi-site environmental watering trial

Under The Living Murray (TLM) Initiative it is intended that environmental water available should be managed to maximise environmental outcomes by re-using it at multiple sites. To help achieve this outcome, multi-site environmental watering trials (MSEWTs) are an important element in the effort to improve river health and arrest environmental decline across the Murray-Darling Basin. During 2012-13, a watering trial was conducted aimed at maximising environmental outcomes and informing development of new water accounting methodologies and policies to enable efficient and effective long-term use of environmental water.

South Australia received a large percentage of its environmental water during 2012-13 as part of the MSEWT event, which was developed by environmental water holders and coordinated by the MDBA through the Environmental Watering Group and Water Liaison Working Group. The event was a cooperative arrangement between several environmental water holders and managers including The MDBA Living Murray, Barmah–Millewa Environmental Water Allocation (Vic/NSW), NSW Adaptive Environmental Water, Victorian Environmental Water Holder and the CEWH.

## 1.2 Overview of the 2012-13 water year

The 2012-13 water year commenced with a good water availability outlook and with South Australia receiving unregulated flows. Following the flow peak of 60,000 ML/day into South Australia in April 2012, flows receded to 15,000 ML/day by July 2012 (refer to Figure 1). As unregulated flow increased throughout July, it was agreed with the MDBA to try and maintain the flow at the South Australian border below 45,000 ML/day so that construction of the Chowilla environmental regulator could continue. Unregulated flow continued into October 2012, and as flow rates increased, positive ecological responses were observed (including breeding of birds and frogs in the wetlands).

Unregulated flows across the South Australian border lead to flows peaking just below 50,000 ML/day on 2 October 2012. This flow temporarily halted river works at Chowilla, allowing South Australia the opportunity to seek the release of environmental water and thereby extend and maintain water levels and flow to enable the completion of fauna breeding cycles. At the time, it was anticipated that environmental water would be provided on the tail of the unregulated flow peak to achieve these benefits. However, a rapid drop in unregulated flow of 30,000 ML/day (from approximately 50,000 ML/day to 20,000 ML/day) over a two week period meant that this action was no longer feasible.

In December 2012, a flow pulse that increased flows from 7,000 ML/day to 20,000 ML/day for 16 days was created with environmental water to encourage flow-cued spawning fish, such as Golden Perch, to move and breed, and to provide sufficient water for *Ruppia* reproduction in the Coorong. Environmental water delivery continued for the rest of the water year, enabling barrage and fishway releases to be undertaken for the whole year.



Royal Spoonbill with breeding plumage  
by Callie Nickolai



Golden Perch by Scottie Wedderburn

### 1.3 Water delivery to South Australia

Figure 1 shows total flow to South Australia with the delivery of held environmental water from November 2012 to June 2013. Peak flow at the South Australian border was approximately 50,000 ML/day in October 2012 (as described in section 1.2). South Australia experienced above Entitlement Flow for the entire year.

Floodplain watering was achieved via unregulated flow in the first four months of the water year. Therefore, it cannot be concluded that environmental water delivered floodplain outcomes (localised pump sites aside); however, environmental water did benefit the health of the River Murray Channel and the LLCMM – see sections 4.1 and 4.2 below.



Ruppia by Kirsty Wedge

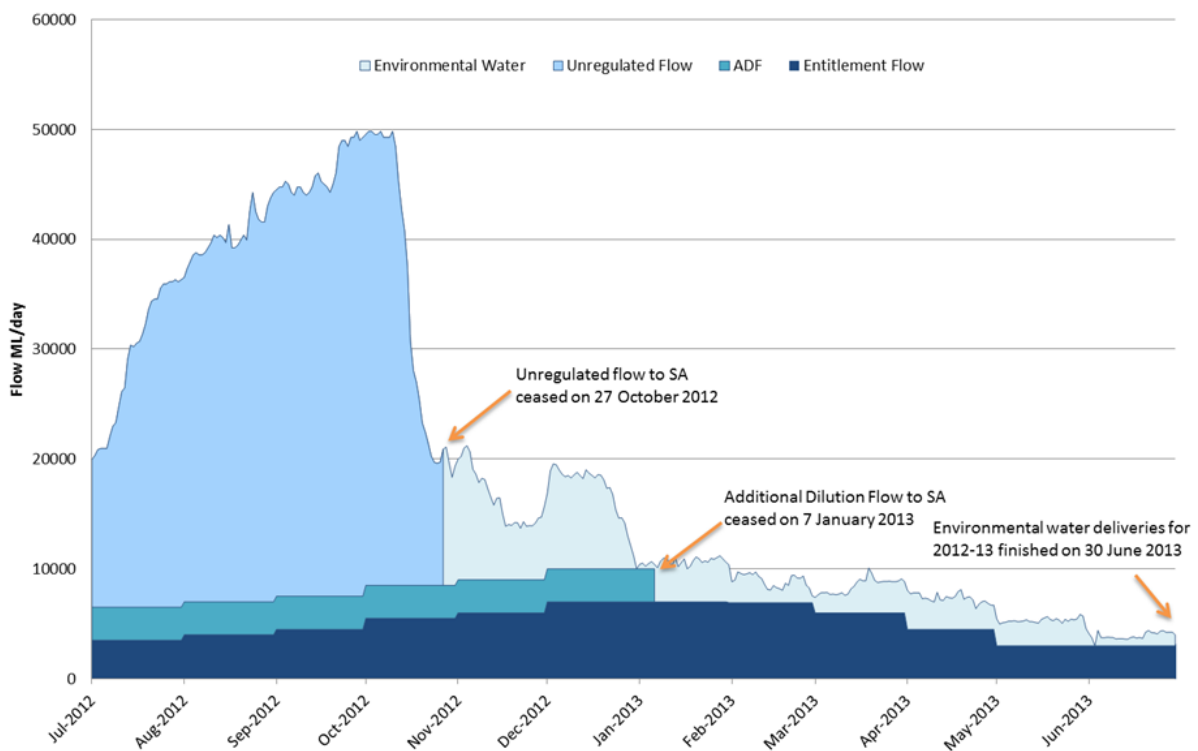


Figure 1 : Flow to South Australia 2012-13

## 2. Environmental water<sup>2</sup>

### 2.1 Held Environmental Water

Held Environmental Water (HEW) is water held on licence for the purpose of achieving environmental outcomes. There are two major environmental water holders that provide HEW to South Australia:

- The CEWH holds 1,198,234 ML of water entitlements in the Southern Connected Basin for use in the Southern Connected Basin (as of 31 December 2013).
- TLM under the MDBA holds 479,900 ML of water entitlements for use at the six TLM icon sites in the Murray-Darling Basin.

Additional HEW for use in South Australia is available through:

- the South Australian Minister for the River Murray's wetland licence, with 28,972 ML available for use at pool connected wetlands that a) have regulators and b) are named on the licence
- the South Australian Minister for the River Murray's environmental water licence, with 14,000 ML available for use at any priority site during 2012-13
- Nature Foundation SA (NFSA) – 37 ML
- Murray-Darling Association – 60 ML.

### 2.2 Planned Environmental Water

Planned Environmental Water (PEW) is defined in Part 1 Section 6 of the Commonwealth *Water Act 2007*. It is water that is committed by the Basin Plan or a water resource plan for a water resource plan area; or a plan or other instrument under State water law; for achieving environmental outcomes or other environmental purposes that are specified in the plan or the instrument, and cannot be taken or used for any other purpose.

The South Australian River Murray Water Allocation Plan (WAP) (2002) identifies wetlands as legitimate water users, with 200,000 ML of water formally set aside for watering pool connected wetlands. This is the estimated volume lost through evaporation by those wetlands connected at full supply level (normal weir pool level). It represents part of the non-consumptive component of entitlement flow and is not additional water made available for allocation.

During 2012-13, 170,506 ML of PEW was delivered to pool connected wetlands along South Australia's River Murray. The remainder of the 200,000 ML set aside was held on licence (see section 2.1).



Emerging River Red Gum seedling



River Red Gum regeneration following environmental watering, Reid Flat  
by Callie Nickolai

<sup>2</sup> Sections 2.1 and 2.2 meet the requirements of Basin Plan Matter 9, Indicators 9.1 and 9.2.

## 2.3 Watering sites: Quantity and timing<sup>3</sup>

During 2012-13, a total of 1,119,518 ML of HEW was delivered to priority sites identified within the South Australian River Murray annual environmental watering plan (DEWNR 2012). Small volumes were delivered to other sites throughout the year as opportunities arose. While not identified in the annual plan, it became evident through the year that water was needed at these additional sites.

As shown in Table 1, the CEWH provided 786,918 ML to six sites (including water provided through the NFSA); TLM provided 289,103 ML to three sites; water held in South Australia against the Minister's environmental water licence provided 14,000 ML to five sites; water held against the Minister's wetland licence provided 27,823 ML; Banrock wetland licence provided 1,671 ML for one site and private donations provided 3 ML for one site.

# 3. Consultation<sup>4</sup>

This section describes how stakeholders were engaged during planning for environmental watering prior to the start of the 2012-13 water year as well as during the actual delivery of environmental water.

## 3.1 Planning and prioritisation

Early in 2012, a workshop was held to begin discussing annual planning and environmental watering priorities for 2012-13. Key government stakeholders, environmental water holders and local scientific experts were invited to attend. Prior to this workshop, regional departmental staff sought input on priorities from Local Action Planning (LAP) officers and LAP committees regarding priority sites.

Following development of a draft list of South Australia's environmental watering priorities for 2012-13, different teams within DEWNR developed objectives and targets, calculated required volumes and undertook modelling to determine the priority watering requirements for proposed sites. Input and feedback was sought from community groups and peak bodies that had previously been consulted on these watering priorities. These included the SA MDB NRM Board, the River Murray Operations Working Group, the River Murray Advisory Committee, LLCMM Community Advisory Panel, the LLCMM Scientific Advisory Group, Chowilla Community Reference Committee; the Community Action for the Rural Environment (CARE) committee, Local Action Planning Committees, the First Peoples of Murray and Mallee Region and the Ngarrindjeri Regional Authority (through the Kungan Ngarrindjeri Yunnan Agreement (KNYA) Taskforce and Yarlularu Ruwe Committee).

These groups were contacted and agreement was reached regarding DEWNR staff attendance at meetings to present information on the draft environmental watering plan. Meetings were arranged with plenty of advance notice and fact sheets provided for distribution beforehand. Presentations occurred at both regular and specially scheduled group meetings, providing details on watering objectives, required volumes, preferred timing of delivery, modelled outputs and associated monitoring. Written feedback was sought on priorities as well as suggestions on how the group preferred to be consulted to inform future planning. Some groups are regularly engaged throughout the year and these connections were strengthened during 2012-13. The engagement process is critical to improve understanding of State and Basin-wide environmental water planning and to gain feedback on how improvements can be made for the future.

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<sup>3</sup> Section 2.3 meets the requirements of Basin Plan Matter 9, Indicator 9.3.

<sup>4</sup> This section meets the requirements of Basin Plan Matter 6, Indicators 6.1, 6.2 and 6.3.



**Table 1: Held Environmental Water delivered in South Australia in 2012-2013**

Source	Site	Delivery timing	Volume (ML)	Total ML Used
CEWH	Channel and LLCMM	1 Nov 2012 - 30 Jun 2013	785,952	786,918
	Berri Evaporation Basin	1 Feb 2013 - 30 Jun 2013	557	
	Dishers Creek	23 Jan 2013 - 31 May 2013	250	
	Whirlpool Corner	4 Feb 2013 -13 Jun 2013	92	
	Ramco Lagoon floodplain (through NFSA)	May 2013	7	
	Clarks Floodplain (through NFSA)	Jan 2013 to Jun 2013	60	
TLM	Channel and LLCMM	1 Nov 2012 -28 Feb 2013	289,004	289,103
	Chowilla (Brandy Bottle)	11 - 19 Oct 2012 and 10 - 12 Dec 2012	99	
SA Environmental Water Licence	Channel and LLCMM	1 Jul 2012 -30 Jun 2013	12,500	14,000
	Berri Evaporation Basin	1 Nov 2012- 31 Jan 2013	555	
	Dishers Creek	1 Nov 2012 -22 Jan 2013	600	
	Bookmark Creek	1 Nov 2012- 30 June 2013	345	
Private Donation	Markaranka floodplain	1 Jul 2012 -30 Jun 2013	3	3
<b>Total</b>				<b>1090,024</b>
Minister's wetland licence	Brenda Park	1 Jul 2012-30 Jun 2013	1,108	
	Causeway Wetland Complex – Little Duck, Causeway Lagoon, Winding Creek	1Jul 2012-30 Jun 2013	293.8	
	Devon Downs South	1 Jul 2012-30 Jun 2013	403	
	Hart Lagoon	1 Jul 2012-30 Jun 2013	631	
	Lake Merreti	1 Jul 2012-30 Jun 2013	4,163	
	Lake Woolpoolool	1 Jul 2012-30 Jun 2013	3,256	
	Loveday Lagoons (Mussels)	1 Jul 2012-30 Jun 2013	1,352	
	Martins Bend	1 Jul 2012-30 Jun 2013	60	
	Morgan Lagoon CP	1 Jul 2012-30 Jun 2013	513	
	Morgans Lagoon LM	1 Jul 2012-30 Jun 2013	320	
	Murbpook Lagoon	1 Jul 2012-30 Jun 2013	999	
	Murkbo South	1 Jul 2012-30 Jun 2013	1,115	
	Narrung	1 Jul 2012-30 Jun 2013	274	
	Nelwart	1 Jul 2012-30 Jun 2013	247	
	Ngak Indau	1 Jul 2012-30 Jun 2013	264	
	Nigra Creek, Schillers lagoon	1 Jul 2012-30 Jun 2013	1,123	
	Paiwalla	1 Jul 2012-30 Jun 2013	1,081	
	Pilby Wetland Complex - Pilby Creek, Pilby Lagoon, Lock 6 depression	1 Jul 2012-30 Jun 2013	538	
	Pipeclay Billabong	1 Jul 2012-30 Jun 2013	146	
	Ramco lagoon	1 Jul 2012-30 Jun 2013	975	
	Reedy Creek	1 Jul 2012-30 Jun 2013	132	
	Riverglades	1 Jul 2012-30 Jun 2013	356	
	Slaney Billabong	1 Jul 2012-30 Jun 2013	095	
	Spectacle Lakes, Beldora Complex	1 Jul 2012-30 Jun 2013	450	
	Sugar Shack	1 Jul 2012-30 Jun 2013	234	
	Sweeneys Lagoon	1 Jul 2012-30 Jun 2013	16	
Teringie	1 Jul 2012-30 Jun 2013	1,468		
Waltowa	1 Jul 2012-30 Jun 2013	2,260		
Yatco	1 Jul 2012-30 Jun 2013	4,250		
<b>Total</b>				<b>27,823</b>
Other licence	Banrock Station Wetland	1 Jul 2012 - 30 Jun 2013	1,671	<b>1,671</b>

## 3.2 Development of annual priorities

South Australia identified annual priorities for the SA River Murray through the preparation of an annual environmental watering plan (DEWNR 2012).

The following priorities for 2012-13 were identified:

- Barrage releases and channel/floodplain actions
- Evaporation basins (Dishers Creek and Berri Basin) that support threatened fish species
- Brandy Bottle (wetland on the Chowilla floodplain)
- Bookmark Creek and managed above-pool wetlands.

## 3.3 Negotiations and engagement for delivery of environmental water

After the annual priorities for environmental watering had been agreed, negotiations for securing and delivering environmental water began with the environmental water holders (CEWH and MDBA). These negotiations were ongoing with regular MDBA committee meetings and CEWO teleconferences throughout the year.

Once agreement was reached with environmental water holders to provide environmental water, discussions were initiated with regional landholders regarding localised watering actions to determine the most suitable timing for delivery of environmental water.

DEWNR staff have established good working relationships with regional stakeholders. Local groups were engaged through their regular meetings, and the community was informed about possible forthcoming flow events through these committees and the DEWNR flow advice bulletins. Good communication ensured that local communities were aware of pending watering actions and their ecological benefits.

SA Water staff were regularly informed of the timing for environmental water delivery and regular flow advice was posted on the DEWNR website.

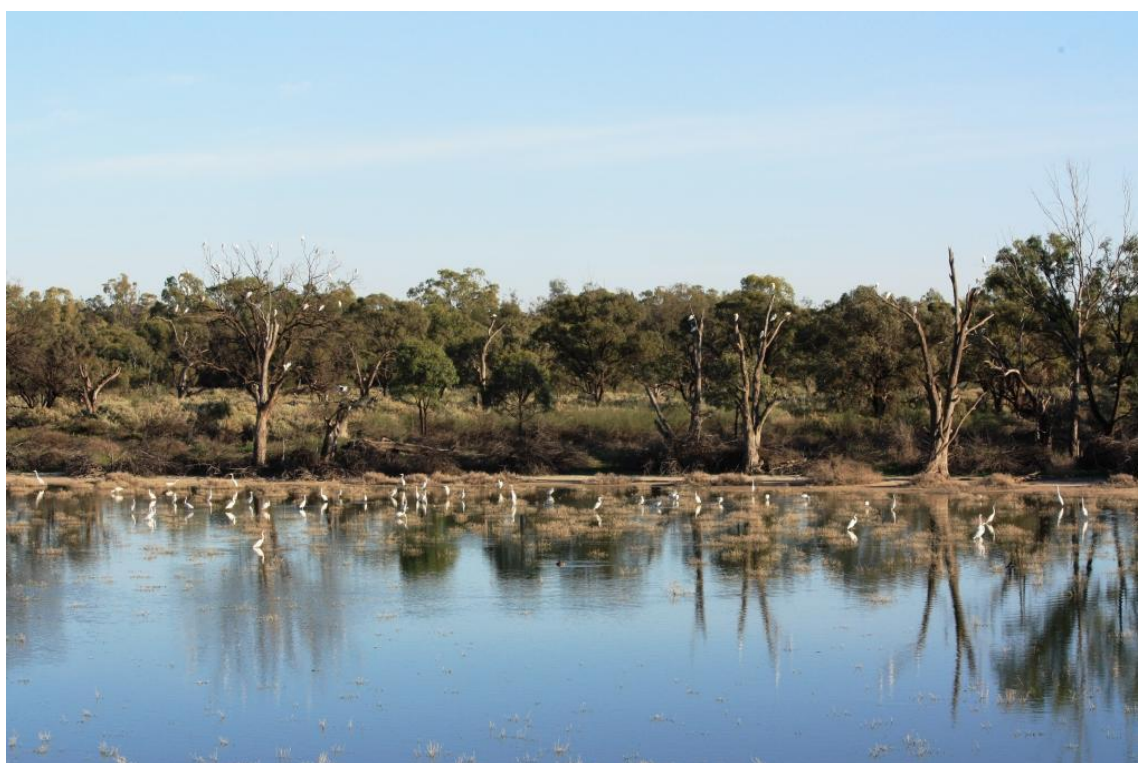


Lyrup Flats, part of the River Murray National Park by Sandra Bennett

## 4. Priority site (Asset) reports: Annual environmental watering objectives<sup>5</sup> and outcomes<sup>6</sup>

The following describes environmental watering objectives and outcomes for 2012-13 at the assets where environmental water was delivered or made available. The objectives were determined during the 2012-13 planning process and are listed in the Annual Environmental Watering Plan for the South Australian River Murray (DEWNR 2012).

The Chowilla Floodplain and the LLCMM TLM icon sites are extensively managed and monitored. The managed pool connected sites and pumped sites that are not TLM sites are monitored by regional DEWNR staff and by community groups. This monitoring is not at the same scale as for the TLM sites and may include qualitative and observational data.



Egrets at Gurra Gurra by Callie Nickolai

The outcomes presented here have been identified by environmental water managers. As there is currently no coordinated framework for data collection across the entire River Murray in South Australia, information presented in this report depends on a range of sources with some data used that is collected for other purposes, not necessarily to assess environmental water delivery outcomes.

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<sup>5</sup>This section meets the requirements of Basin Plan Matter 4, Indicator 4a.

<sup>6</sup>This section meets the requirements of Basin Plan Matter 9, indicator 9.5 and Matter 8.

## 4.1 River Murray Channel and Floodplain



Nigra Creek and Schillers Lagoon by Callie Nickolai

### Objectives

- Extend duration of within-channel flow pulse of approximately 20,000ML/day for 60 days.
- Enhance and extend Golden Perch spawning and recruitment opportunities.
- Create favourable conditions for Southern Bell Frog breeding and/or metamorphosis.
- Improve hydraulic conditions in the river channel and increase water level variations.
- Inundate small areas of temporary wetlands below each of the six locks.
- Maximise ecological benefits for the river system while delivering water to the LLCMM.

### Long-term Channel and Floodplain Environmental Water Requirements

A key objective of environmental water management is to deliver the identified environmental watering requirements (EWRs) for the South Australian River Murray floodplain and channel. The EWRs for the floodplain

and channel focus on key floodplain habitats and fauna breeding (listed in Gibbs *et al* 2012) and describe a flow regime in terms of flow magnitude, duration, frequency and timing (see Tables 2-4).

An assessment of the achievement of EWRs during 2012-13 is provided below.

**Table 2: Summary of flow to South Australia 2012-13:  
 flow peak statistics**

Flow magnitude (ML/day)	Duration (days)	Timing
>20,000	120 days (over 127-day period)	2 Jul – 5 Nov
>25,000	101 days	11 Jul – 19 Oct
>30,000	95 days	14 Jul – 16 Oct
>35,000	84 days	24 Jul – 15 Oct
>40,000	59 days (over a 65-day period)	11 Aug – 14 Oct
>45,000	29 days (over a 39-day period)	4 Sep – 12 Oct

When the combination of flow magnitude, timing and duration metrics for each floodplain EWR is assessed, only one EWR can be considered to have been met during 2012-13 (see Table 4). This EWR relates to the target for spawning and recruitment by native fish characterised as flow-cued spawners, although the 60-day duration was not made up of consecutive days. This EWR was met by flows greater than 15,000 ML/day that occurred between

**Table 3: Summary of flow to South Australia: spring/summer pulse statistics**

Flow magnitude (ML/day)	Duration (days)	Timing
>15,000	46 + 25 (over 85 day period)	1 Oct – 15 Nov + 30 Nov – 24 Dec

1 October 2012 and 24 December 2012 (duration 84 days), which coincided with unregulated flows (until 27 October) and the delivery of environmental water.

**Table 4: Channel EWR met during 2012-13**

Target	Target flow rate (ML/day)	Duration (days)	Timing	Average frequency
Support spawning and recruitment by native fish that are characterised as flow-cued spawners (i.e. Golden Perch and Silver Perch)	15,000	60	Oct - Feb	1 in 3 (max interval 5 years)

### Outcomes

The objectives for this site were met. In 2012-13, an intervention monitoring project assessed the ecological responses to the delivery of environmental water (sourced from CEW and TLM) to the River Murray in South Australia. This project included the monitoring of larval fish assemblages by SARDI and monitoring of frogs by Natural Resources SAMDB. Ongoing fish and frog monitoring is also undertaken by Natural Resources SAMDB as part of their regional wetland management program. The results presented below were taken from Ye *et al* (2013) in the report prepared by SARDI for the CEWO 2012-13 intervention monitoring project.

Golden and Silver Perch larvae were found in larval fish samples collected from late October to January but absent in March. The normal reproduction period of these species may have been extended. This extension is associated with the release of environmental water during December that caused a rise in flow to ~ 20,000ML/day. Southern Bell Frogs were recorded calling at sites in the gorge and Riverland geomorphic regions during frog surveys in December 2012.

Tadpoles from a range of species were observed during surveys. Positive identification of Southern Bell Frog tadpoles were made at fourteen fish survey sites within eight wetlands. Individuals were observed at a range of metamorphic stages although tadpoles sampled during December surveys were generally found to be in later stages of development than those that had been sampled in October surveys (pers. obs. I. Wegener, December 2012). This means that these individuals spawned as a result of the flow peak.



Southern Bell Frog by Irene Wegener



Long Thumbed Frog by Irene Wegener

## 4.2 Lower Lakes, Coorong and Murray Mouth



Goolwa Barrage by Kirsty Wedge

### Objectives

- Twelve months of continuous barrage releases to maintain an open Murray Mouth; maintain/improve recruitment in diadromous fish; maintain/improve recruitment and distribution of Coorong commercial fish; enhance feeding and nesting habitat for Fairy Tern.
- Maintain salinity levels in Lake Alexandrina below 1,000 EC from July 2012 to June 2013 to increase submerged aquatic plant abundance and diversity; increase recruitment and population size of small-bodied threatened fish; prevent tubeworm colonisation in the lakes; increase Southern Bell Frog distribution and abundance in the lakes.
- Reduce salinity levels in Lake Albert with the aim of achieving a target of an average of 2,000 EC by the end of June 2013.
- Maintain Coorong South Lagoon salinity levels < 100 parts per thousand from July 2012 to June 2013 to maintain/improve Small-mouthed Hardyhead populations; maintain/improve benthic invertebrate distribution and abundance; maintain/improve the abundance and diversity of piscivorous and insectivorous waterbirds.
- Maintain Coorong South Lagoon water levels between 0.0 and 0.2m Australian Height Datum over summer (Dec 2012-Feb 2013) to increase the distribution and cover of Ruppia and increase the density of the seedbank; maintain/improve the abundance and diversity of herbivorous waterbirds.



Murray Hardyhead by Kirsty Wedge



Macroinvertebrates found during Coorong monitoring by Kirsty Wedge

### Long-term Environmental Watering Requirements

- The LLCMM long-term EWRs (Table 5) are based on the barrage outflow volumes that are required to maintain critical water quality thresholds in Lake Alexandrina and the Coorong South Lagoon.

- Barrage outflows (including unregulated flows and environmental water) totalled 4,605 GL in 2012-13, which is below the target volume stated in the long-term EWRs. However, due to significant outflow volumes in the preceding two years (Table 6), the targets have been met over the timeframes indicated.

**Table 5: Coorong, Lower Lakes and Murray Mouth EWRs met during 2012-13**

Target	Environmental Water Requirement
<i>Lower Lakes</i> Maintain desired ecological character of Lower Lakes through managing water quality	Lake Alexandrina salinity <1 000 EC for 95% of all years
	Lake Alexandrina salinity <1 500 EC for all years
<i>Coorong &amp; Murray Mouth</i> Maintain current frequency of ecosystem states associated with high flows	Barrage outflow 6 000 GL/yr, 1 in 3 years
	Barrage outflow 10 000 GL/yr, 1 in 7 years

- Surface water salinity within Lake Alexandrina was below the 1,000 EC and the 1,500 EC thresholds for the entire year, apart from a short spike in late August-early September due to a reverse-head event. In terms of average annual surface water salinity, the Lake Alexandrina salinity EWRs can be considered to have been met in 2012-13.

**Table 6: Barrage outflows**

Year	Estimated annual barrage outflow volume (GL)*
2012-13	4,605
2011-12	7,000
2010-11	11,000

### Outcomes

The hydrological metrics for two of the five objectives were met – 12 months continuous barrage releases and Coorong South Lagoon salinity targets. Salinity levels in Lake Alexandrina remained below 1,000 EC throughout the year, apart from a short spike in salinities in late August-early September (see Figure 2). Lake Albert salinity levels improved although the target of an average of 2,000 EC was not attained. Salinity in the Lake remained around 3,400 EC up until March 2013. As wind pressure and local rainfall increased through autumn 2013, there was increased mixing between the two Lakes and Lake Albert salinity fell to around 2,800 EC by the end of June 2013.

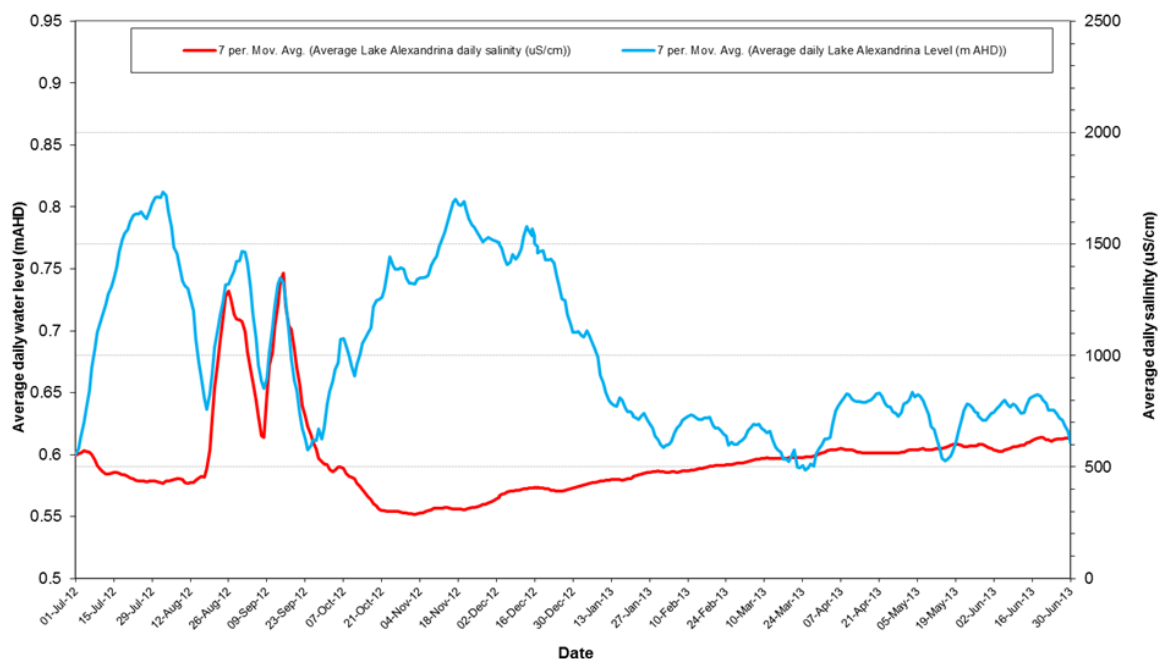
Coorong South Lagoon water levels remained above 0.0 m Australian Height Datum in early summer but dropped below this target level in late summer after barrage releases were reduced due to extremely hot weather and subsequent high extraction and evaporation rates. The increased flow to South Australia from both regulated and unregulated sources had a positive impact on salinity levels in the Lower Lakes, and resulted in significant volumes being discharged through the barrages. This lowered salinity levels in the Coorong and contributed to keeping the Murray Mouth open. There has been continuous flow through the barrages to the Coorong since September 2010.

DEWNR staff managed a comprehensive monitoring program at the LLCMM in 2012-13. Monitoring was funded through The Living Murray and CLLMM - Murray Futures programs, with additional fringing wetland monitoring support provided by Natural Resources SAMDB in DEWNR.



Fish monitoring at the Barrages by Kirsty Wedge

Despite large volumes of environmental water being delivered during 2012-13, *Ruppia* did not respond well. There was no increase in the numbers of seeds relative to previous years, indicating that plants failed to complete their life cycle and produce seeds in 2012-13 (Paton and Bailey 2013a). Falling Coorong water levels in spring 2012 hampered the recovery and performance of *Ruppia* across the southern lagoon for a second year. Small amounts of *Ruppia* were growing along much of the South Lagoon of the Coorong in January 2013. This is encouraging as it suggests that there is still some low level capacity or resilience for *Ruppia* to re-establish naturally (Paton and Bailey 2013a).



**Figure 2: Lake Alexandrina salinity and water level 2012-13: Seven-day moving average**

The Coorong and Lower Lakes supported in excess of 286,000 waterbirds in January 2013 (Paton and Bailey 2013b) and so this wetland system continues to meet the criteria of a Wetland of International Importance. The Coorong supported almost double the numbers of birds compared to the Lower Lakes, as has been the case in recent years, highlighting the ecological importance of the Coorong. Many species of waterbirds, particularly the endemic and migratory shorebirds (Stilts, Sandpipers, Plovers) were largely confined to the Coorong adding further support for the importance of this component of the wetland system (Paton and Bailey 2013b). As many of the species using the Coorong are not prominent elsewhere along the Murray Darling system, the Coorong warrants management to secure the resources needed by those species.

Fish monitoring in Coorong South Lagoon has detected increased fish diversity, in part due to salinities remaining below 100 parts per thousand (ppt) throughout the year (Ye *et al* 2013). A total of six different species have been recorded in this area during 2012-13 (including numerous young-of-year Congolli), in comparison to only one or two different species recorded in the previous three years. Recruitment of Black Bream has also been detected in North Lagoon for the first time post-drought (Ye *et al* 2013).

In the Lower Lakes, waterbird abundances have continued to increase since the first census in 2009, with the most abundant species being cormorants and ducks. Submergent aquatic vegetation expanded its distribution in wetlands and protected shorelines. All three species of threatened freshwater fish – Murray Hardyhead, Southern Pygmy Perch and Yarra Pygmy Perch – were recorded at Lower Lakes sites for the first time since 2008. Diadromous fish including Congollis and Common Galaxiads have been found in increasing numbers in the Lower Lakes post-drought.



## 4.3 Chowilla

The only site on the Chowilla Floodplain that received environmental watering via pumping during 2012-13 was Brandy Bottle Waterhole. A temporary bank was first reinstated to enable the pumping and retention of water. This site was chosen based on assessment of tree health and given it was the only Chowilla Floodplain site that did not receive water in the previous year due to environmental watering or the natural high flows.



Watering at Brandy Bottle Waterhole by Simon Frankel

### Objectives

- Assist River Red Gums and Black Box tree communities to recover from impacts of drought.
- Contribute to improving the condition of River Red Gum and Black Box tree communities.
- Maintain and improve diversity in understorey assemblages.
- Improve habitat for wildlife.

### Outcomes

The objectives for this site were met.

Post-watering monitoring observations recorded at Brandy Bottle Waterhole include the maintenance and improved condition of long-lived vegetation species (River Coobah, Black Box and River Red Gum) within the riparian zone of the waterhole and the regeneration and growth of associated floodplain understorey vegetation species (including Lignum and Spiny Flat Sedge), which provide habitat for the five species of frogs recorded calling at the site during and post watering. Frog species detected through call recognition surveys and spotlighting were Perons Tree Frog, Long Thumbed Frog, Eastern Sign Bearing Froglet, Eastern Banjo Frog and the Spotted Grass Frog. All frog species were recorded in high abundances with the exception of the Eastern Banjo Frog which was recorded in low numbers at only one of the three sites surveyed. The Long Thumbed Frog was recorded in high abundances at all three sites (most dominant species) and along with the Perons Tree Frog and the Spotted Grass Frog were observed during the spotlighting surveys. Eight species of waterbirds were also recorded at the site.

## 4.4 Other wetlands and floodplains



Bookmark Creek by Irene Wegener

### 4.4.1 Whirlpool Corner

#### Objectives

- Provide follow up watering of seedlings that germinated around the edge of wetlands during the 2010-11 high flows.
- Support habitat for waterbird species, including threatened and migratory species, and provide breeding opportunities.

#### Outcomes

The objectives for this site were met.

Pumping water into the wetland began in February 2013 and was topped up each fortnight for three months. In addition, fringing River Red Gums and Black Box saplings were watered multiple times per week using sprinklers to maximise their chance of survival and minimise depletion of the seed bank.

This wetland is located in the Riverland Ramsar site and has significant ecological value particularly for migratory waterfowl. Seventeen species of waterbird (and over 300 individuals) were recorded at the wetland during two surveys following watering and spanned a range of functional groups including large wading birds (e.g. Egrets and Herons), shorebirds (e.g. Dotterels), Grebes, herbivores (e.g. Swans and Wood Ducks) and Dabbling Ducks. The Eastern Great Egret was recorded at the site and is listed under CAMBA and JAMBA migratory bird agreements.



Pink-eared Ducks by Callie Nickolai

#### 4.4.2 Berri Evaporation Basin

The Berri Evaporation Basin has one of four remaining Murray Hardyhead populations within South Australia. This species is listed as 'endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The maintenance of Berri Evaporation Basin populations is a key strategy to ensure the survival of the species in the Lower Murray.

##### Objectives

- Maintain water quality in Berri Evaporation Basin and Outlet Creek (core Murray Hardyhead habitat) at levels in which a healthy Murray Hardyhead population can be sustained (including breeding events).
- Provide a freshwater connection for the Berri Evaporation Basin and Outlet Creek.



Berri Evaporation Basin by Lara Sutor

##### Outcomes

The objectives for this site were met.

During autumn 2012, Murray Hardyhead were caught within the site for the first time since spring 2010. Seven fish in total were captured, with some juveniles. A total of 93 Murray Hardyhead were captured in July 2012, and 821 Murray Hardyhead were captured from the Main Basin and Bank C Outlet Creek in November 2012.

During inundation, significant numbers of the Freckled Duck, listed as 'vulnerable' under the *South Australian National Parks and Wildlife Act 1972* (NPWS Act) and the Australasian Shoveler, listed as 'rare' under the NPWS Act, were also observed.

#### 4.4.3 Dishers Creek

Dishers Creek has another of the four remaining Murray Hardyhead populations within South Australia (see also Berri Evaporation Basin above).

##### Objectives

- To provide a freshwater influx to flush remnant pools of salty water through the Southern Arm channel of Dishers Creek and into the main disposal basin, creating a habitat area suitable for Murray Hardyhead.

##### Outcomes

The objectives for this site were met.

Murray Hardyhead were captured in moderate abundances at Dishers Creek during the monitoring program and in other sampling projects. Monitoring showed that Murray Hardyhead gradually declined within Dishers Creek throughout the millennium drought until the species was undetected in autumn 2011. During 2012-13 monitoring, low relative abundances of mature and juvenile fish were captured.

#### 4.4.4 Bookmark Creek

##### Objectives

- Provide appropriate habitat for fish and waterbirds.
- Maintain and improve fringing vegetation.

##### Outcomes

The objectives for this site were met.

Fourteen species of waterbird were recorded during one survey at Bookmark Creek in December 2012. This included the Australasian Darter and Intermediate Egret, both considered 'rare' in South Australia.

Twelve species of fish were captured during a fish survey undertaken in October 2012. Carp Gudgeons were the most abundant native species captures, while Goldfish were the most abundant non-native species captured. Fish were captured from a range of habitats available within the Creek – for example, slow and fast moving water, snags and emergent vegetation.

Other observations: Six species of frog have been heard along Bookmark Creek and wetland. No increase or decline in tree health was observed, although more trees were flowering or budding in February 2013 than in the previous year.

Eastern Long-neck Turtles have been captured, as have yabbies and macroinvertebrates. Submerged aquatic macrophytes have been observed – *Myriophyllum* sp., River Eel-Grass and Floating Pondweed.



Lignum by Emily Hoffman

#### 4.4.5 Markaranka wetland

During 2012-13, a trial watering program using pipes has been undertaken at Markaranka wetland using water donated by Treasury Wine estate. The watering is replicating a weekly rainfall event of about 10 millilitres.

##### Objectives

- Trial watering of new Black Box seedlings to enable their survival.

##### Outcomes

The objectives for this site were met.

Monitoring has indicated a very good response with new seedlings emerging and existing plants flowering.



Long-necked Turtle by Irene Wegener

## 5. Conclusions and lessons learned

South Australia received more environmental water than ever before during 2012-13. The higher volumes of held environmental water enabled the creation of a 'within channel' flow peak in spring. However, it was not always delivered at the preferred time to maximise environmental outcomes. The 2012-13 water year brought a new set of challenges for environmental watering. Construction activity continued to restrain opportunities for water delivery; as yet unresolved policy issues prevented the addition of environmental water to unregulated flow peaks; and sudden drops in flow to South Australia prevented the completion of some frog and bird breeding cycles. Benefits of the flow peak were greatly improved following a late decision to extend the duration of the peak to achieve enhanced ecological outcomes. However, unresolved constraints that impede decisions to enhance the benefits of natural peaks, including accounting issues, means that the floodplain is not being watered to the extent required to become healthy and resilient.



Sandpiper by  
Kirsty Wedge

Key lessons learned during 2012-13:

- Active real-time management of environmental water is becoming increasingly important and allows managers to respond to ecological cues and look at opportunities to enhance hydrographs to improve ecological outcomes.
- Quick response to a changing hydrograph and providing timely advice to water holders and River operators is important. This requires good working relationships with scientists and monitoring staff so that up-to-date information relating to observations in the field is available to decision-makers.
- Research and monitoring to inform adaptive real-time management is essential.
- Timely decision making by water holders is critical so that environmental water releases can be made and delivered to South Australia in time to influence the shape of the hydrograph.
- High flows and fresh inundation of littoral and floodplain vegetation generated a frog breeding response in spring including Southern Bell Frogs. This may have reduced the frog breeding response in summer.
- Construction activities on the floodplain and at the locks and weirs required significant amendment to environmental water delivery, affecting watering outcomes in the short-term. Given ongoing construction, clear assessment of trade-offs is required to ensure ecological outcomes can be maximised.
- The rapid flow recession from 50,000 ML/day to 20,000 ML/day in less than two weeks is likely to have left tadpole metamorphs stranded on the floodplain. However, the 19,000ML/day flow pulse extended the duration of inundation of low-lying temporary wetlands and increased availability of tadpole habitat.
- Environmental water for barrage releases is required in late October/November for *Ruppia* outcomes.
- Late October through to early January should be targeted as the critical period for maintaining higher water levels in Coorong South Lagoon for *Ruppia* reproduction, not December-February.
- Barrage fishway monitoring is required to quantify fish passage and recruitment outcomes from fishway/barrage releases (this was only funded in the last two weeks of June 2013).
- Many species take a long time to recover from drought. Lower Lakes small-bodied threatened fish (Yarra Pygmy Perch, Southern Pygmy Perch and Murray Hardyhead) have still shown only limited signs of recovery despite a large re-stocking program and continued monitoring.
- Constraints need to be addressed to maximise environmental outcomes from environmental water delivery.
- Monitoring results reinforce that even relatively small watering events provide positive outcomes and consolidate efforts to restore the health of the floodplain.

Therefore, in 2013-14 effort will be directed to establishing a real time environmental water management group with scientific advisers. Water for *Ruppia* will be sought earlier in the year. A project will be undertaken to start addressing constraints to the delivery of high flows to South Australia.

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## Appendix: Relevant Basin Plan reporting requirements regarding environmental water planning and delivery

### **SCHEDULE 12**

MATTER 6 - The extent to which local knowledge and solutions inform the implementation of the Basin Plan

- Indicator 6.1: Processes implemented to identify stakeholders from local communities, peak bodies and individuals
- Indicator 6.2: How stakeholders were engaged
- Indicator 6.3: The outcome of engagement on the implementation of the Basin Plan

MATTER 8 - The achievement of environmental outcomes at an asset scale

MATTER 9 - Identification of environmental water and the monitoring of its use

- Indicator 9.1: Volume of water available for the identification and accounting of Held Environmental Water
- Indicator 9.2: Volume of Planned Environmental Water available
- Indicator 9.3: For regulated river systems, for each environmental watering event, the quantity and timing of environmental water (where relevant), released from each structure and delivered to each nominated environmental asset both HEW and PEW
- Indicator 9.5: For regulated river systems the purpose of each environmental watering event
- Indicator 9.7: For regulated river systems, the influence of the environmental watering event on flow in the channel and on the floodplain, where relevant

MATTER 10 - The implementation of the environmental management framework (part 4 of Chapter 8)

- Indicator 10.1: Basin-wide watering strategies, long-term watering plans and annual priorities were prepared with the required content, published, reviewed and updated as obligated under part 4 of Chapter 8, Division 2-5
- Indicator 10.2: Watering strategies, plans and priorities are prepared consistently with Part 4 of Chapter 8, in relation to coordinating, consulting and cooperating with other reporters and the matters to which regard must be had (Chapter 8, Division 4)
- Indicator 10.3: Environmental watering principles are applied as set out in Division 6, Chapter 8, Part 4