South Australian River Murray Water for the Environment Report 2019-20

Government of South Australia
Department for Environment and Water

Acknowledgments

The Department for Environment and Water 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.

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The following agencies and organisations are acknowledged for their important role in management of water for the environment:

- Accolade Wines, Banrock Station
- Australian Landscape Trust, Calperum Station
- BirdsSA
- Chowilla Community Reference Committee
- Commonwealth Environmental Water Office
- Coorong, Lower Lakes and Murray Mouth Community Advisory Panel
- First Peoples of the River Murray and Mallee
- Lower Lakes, Coorong and Murray Mouth Scientific Advisory Group
- Murray-Darling Basin Authority including The Living Murray program
- Murraylands and Riverland Landscape Board
- Nature Foundation
- Nature Glenelg Trust
- New South Wales Department of Planning, Industry and Environment (NSW DPIE)
- Ngarrindjeri Aboriginal Corporation and Ngarrindjeri Regional Authority
- Renmark Irrigation Trust
- River Murray and Mallee Aboriginal Corporation
- South Australian Research and Development Institute (SARDI)
- The Conservation and Hunting Alliance of SA
- The Goolwa to Wellington Local Action Planning Inc.
- The Mannum Aboriginal Community Association Incorporated
- The National Trust (Overland Corner)
- University of Adelaide
- Victorian Environmental Water Holder

Black swans (Cygnus atratus) at Coombool Swamp, Chowilla. Credit: Helga Kieskamp

Cover Image: Pied stilts (Himantopus leucocephalus) at Coombool, Chowilla. Credit: Helga Kieskamp

Foreword

Each water year South Australia prepares an overview of water delivered for the environment along the South Australian River Murray. This report outlines the water volumes and timing of delivery, the sites watered and outcomes achieved in the 2019-20 water year.

2019-20 was the third consecutive dry year across the Murray-Darling Basin, however approximately 986 gigalitres (GL) of water for the environment was delivered to South Australia which is equivalent to 41% of all water delivered across the South Australian Border. Water was provided from a number of different sources, including the Commonwealth Environmental Water Holder, The Living Murray, River Murray Increased Flows and return flows from the Victorian Environmental Water Holder, as well as water held for the environment by the South Australian Minister for Environment and Water.

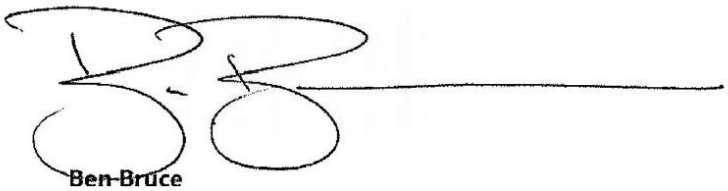
There were many positive outcomes from the delivery of water for the environment in South Australia and these could not be achieved without the cooperation and collaboration of environmental water holders, river operators and the many environmental managers who were involved in on-ground delivery. While there continues to be important operational and delivery constraints that, at times, limit delivery of water for the environment, South Australia continues to work with the Murray-Darling Basin Authority and other Basin jurisdictions to overcome these barriers. The successful delivery of the Southern Spring Flow event in 2019-20 is an example of the significant progress made in recent years from this collaborative effort.

Monitoring of watering events by the South Australian Government, scientists, local community members and landholders contributes to evaluating the effectiveness of the water delivered to the environment and informs the setting of objectives for future water delivery. A range of positive outcomes were observed in 2019-20 including:

- coordinated delivery of approximately 372 GL of water for the environment as part of the Southern Spring Pulse;
- continuous connectivity between the Lower Lakes and the Coorong enabling significant diadromous fish migration, including upstream migration of young-of-year congolli and two lamprey species;
- the first tracked migration of a short-headed lamprey in the Murray-Darling Basin;
- black swan nesting at various sites along the River Murray channel and floodplain;
- maintenance and improvement of vegetation condition at Chowilla and other sites supporting the survival of seedlings and saplings;
- provision of habitat for a diverse range of wetland plants and animals; and
- positive responses from native vegetation, waterbirds and frogs in the wetlands and floodplains associated with watering events.

These outcomes are encouraging, however there remains much to do to continue the recovery of the River Murray system in South Australia. The continuing degraded state of the Coorong, particularly the South Lagoon, is of significant concern and continues to be the focus of efforts to restore the site through the South Australian government's Project Coorong initiative.

The Department for Environment and Water works with a range of partner organisations and water holders to coordinate the effective delivery of water for the environment to South Australia's River Murray priority environmental assets. Collaboration between our partners is essential to deliver water for the environment to achieve short and long-term outcomes for the South Australian River Murray.



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Abbreviations

ALT	Australian Landscape Trust
AWA	Aboriginal Waterway Assessment
BWEWS	Basin-Wide Environmental Watering Strategy
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
CLLMM	Coorong, Lower Lakes and Murray Mouth
cm	centimetre
COAG	Council of Australian Governments
DEW	Department for Environment and Water
DEWNR	Department of Environment, Water and Natural Resources
EPBC	Environment Protection and Biodiversity Conservation Act, 1999
GL	gigalitre (a billion litres)
ha	hectare
LLCMM	Lower Lakes, Coorong and Murray Mouth Icon Site
m	metre
MDBA	Murray–Darling Basin Authority
ML	megalitre (a million litres)
MRLB	Murraylands and Riverland Landscape Board
NAC	Ngarrindjeri Aboriginal Corporation
RIT	Renmark Irrigation Trust
SA River Murray LTWP	Long-Term Environmental Watering Plan for the South Australian River Murray
RMIF	River Murray Increased Flows
RRP	Riverine Recovery Project
SA	South Australia
SARFIIP	South Australian Riverland Floodplains Integrated Infrastructure Program
SCBEWC	Southern Connected Basin Environmental Watering Committee
TLM	The Living Murray Program
VEWH	Victorian Environmental Water Holder

Poached egg daisies (Polycalymma stuartii) at Coombool Swamp, Chowilla. Credit: Helga Kieskamp

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Sunset at Molo Flat. Credit: Kate Mason, Murraylands and Riverland Landscape Board

Introduction and purpose

The planning, delivery, reporting and evaluation of water for the environment within the South Australian River Murray is coordinated by the Department for Environment and Water (DEW) and undertaken in partnership with other government agencies including the Murray-Darling Basin Authority (MDBA) and Commonwealth Environmental Water Office (CEWO), research organisations, non-government organisations and community groups.

Environmental water delivery to South Australia in the 2019-20 water year was guided by the Long-Term Environmental Watering Plan for the South Australian River Murray (River Murray LTWP; DEWNR, 2015) and the Basin-Wide Environmental Watering Strategy (BWEWS; MDBA, 2014). These documents, together with site-based management plans, describe key ecological targets and objectives for annual water for the environment event planning and delivery to South Australia.

As part of the planning process, environmental watering proposals for the major South Australian sites were developed and submitted to the MDBA Southern Connected Basin Environmental Watering Committee (SCBEWC) and the CEWO in early 2019 to inform and support whole of Murray system planning. These proposals form the basis of the 2019-20 Annual Environmental Watering Plan and Annual Priorities for the South Australian River Murray (DEW, 2019a; DEW, 2019b) and inform the Basin Environmental Watering Priorities (MDBA, 2019). Annual Priorities for the South Australian River Murray are summarised in Appendix A.

Environmental water delivered to South Australia is primarily from two major environmental water holders: the Commonwealth Environmental Water Holder (CEWH) and The Living Murray (TLM) program. Additional water for the environment is held within South Australia by the South Australian Minister for Environment and Water and non-government organisations. Water may also be provided by the Victorian Environmental Water Holder (VEWH) and New South Wales in the form of return flows from upstream water for the environment actions.

This report provides a summary of water for the environment actions along the South Australian River Murray during the 2019-20 water year and includes:

- an overview of river conditions in 2019-20;
- a summary of the water for the environment actions that were undertaken including sites and volumes;
- a summary of key environmental outcomes; and
- a summary of reports that provide detailed information about monitoring and ecological outcomes.

The purpose of this report is to provide a transparent and public record of watering events for the environment, regardless of water holder or manager, undertaken in the region throughout the year. It is in addition to the reporting undertaken by DEW to meet the requirements of the Murray-Darling Basin Plan (Basin Plan).

This report also meets the South Australian government's commitment to the Council of Australian Governments (COAG) to publish an annual report on River Murray water for the environment use in South Australia for public information sharing (National Water Initiative Policy Guidelines for Water Planning and Management 2010).

A young southern bell frog (Litoria raniformis), Overland Corner.
Credit: Stephanie Robinson, Murraylands and Riverland Landscape Board

Overview of flow conditions in 2019-20

Dry conditions

2018-19 Dry
2017-18 Dry

2389 GL total flow across the South Australian border

2018-19 2442 GL
2017-18 2699 GL

The 2019-20 water year was the third consecutive dry year with climate conditions across the Murray-Darling Basin generally warmer and drier than average (Figure 1). Rainfall across the Basin during winter and spring ranged from below average to very much below average when compared to the long-term climate. Consequently, South Australian River Murray water allocations opened at 31% at the beginning of the water year (July 2019), increasing to 100% on 15 November 2020 after an increase in resource availability. Rainfall conditions improved during the second half of the year with higher than average rainfall experienced across the the majority of the Basin during late summer and early autumn.

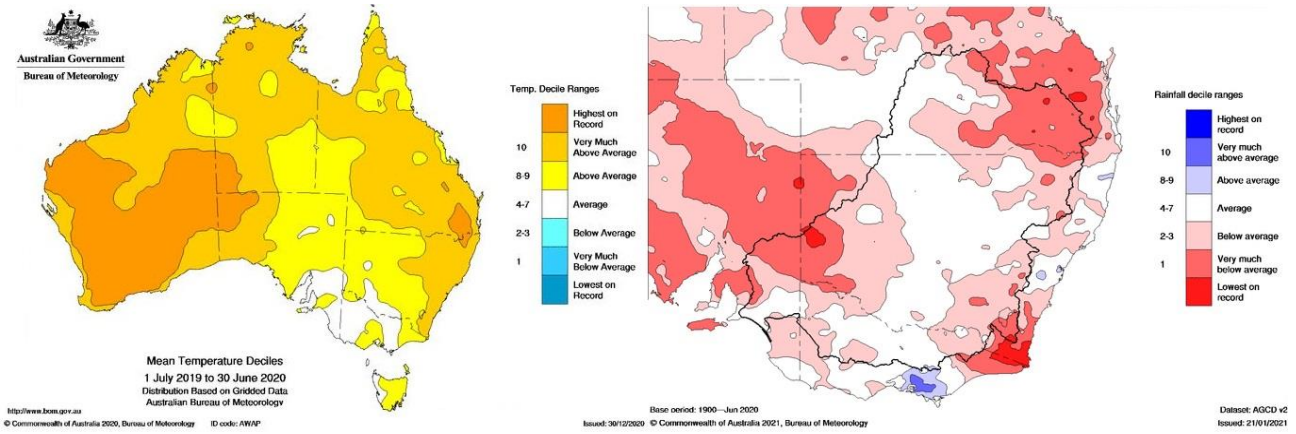

Figure 1. Australian mean temperature deciles 1 July 2019 to 30 June 2020 and Murray-Darling rainfall deciles 1 July 2019 to 30 June 2020. Source: Bureau of Meteorology

System inflows were greater than the previous water year but they remained in the driest 12% of years on record (MDBA, 2020). South Australia did not experience any unregulated flow events in 2019-20 and the only water South Australia received above entitlement flow was from trade, forced delivery of the South Australian Storage Right and environmental water holders (Figure 2). The highest flows occurred between mid-September and mid-November 2019 during a targeted environmental flow event where flow volumes to South Australia were above 10,000 megalitres per day (ML/day) for 33 consecutive days, peaking at approximately 15,500 ML/day on 20 October 2019 (Figure 2).

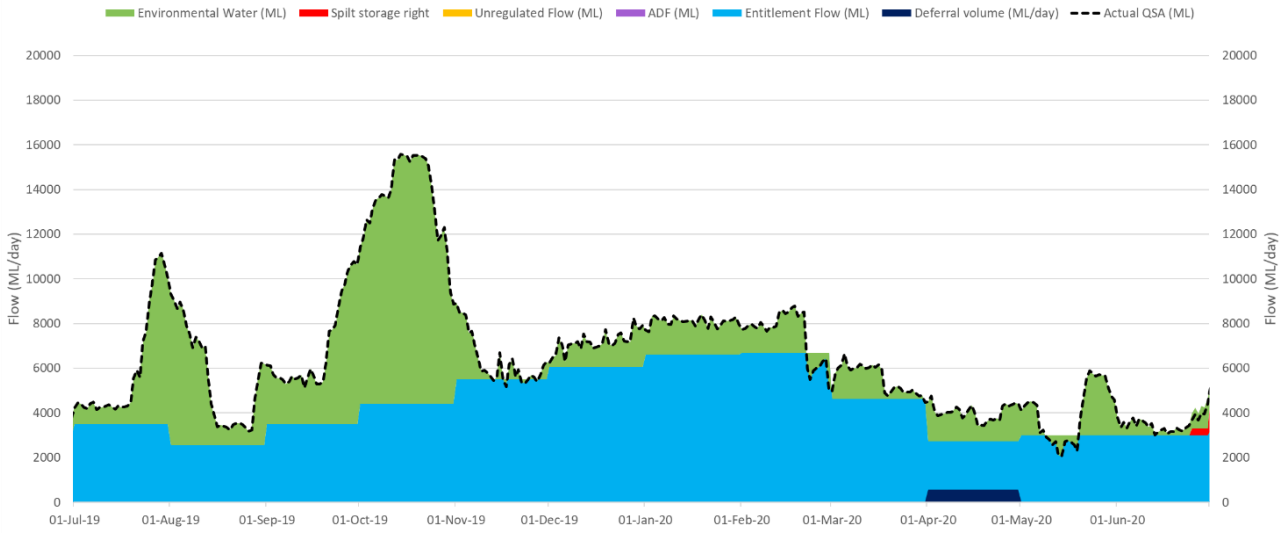

Figure 2. River Murray flows 2019-20.

Environmental Water Delivery

986 GL water for the environment

21 GL pumped to wetlands and floodplains

685 GL out the barrages

2 weirs raised

105 sites managed for the environment

1 coordinated spring flow through the channel

In total, approximately 986 GL of water for the environment was delivered to South Australia. The CEWH provided approximately 760 GL (including approximately 161 GL held on licences in South Australia) and TLM provided approximately 68 GL (including 45 GL held on licences in South Australia). South Australia also received approximately 60 GL of water for the environment in the form of return flows from upstream watering actions undertaken by the VEWH and 52 GL of River Murray Increased Flow (RMIF) was also delivered. Approximately 44 GL of water for the environment held by the South Australian Minister for Environment and Water was delivered. A small volume of water for the environment held on a private licence was also delivered for the management of the pool-connected Banrock Station Wetland (Appendix B).

The majority of the water for the environment (928 GL or ~94%) received by South Australia made its way along the River Murray, providing water quality and ecological benefits in upstream catchments and along the length of the South Australian River Murray Channel, before arriving at the Lower Lakes, Coorong and Murray Mouth (LLCMM).

Despite the continuing relatively dry conditions, many successful environmental watering events occurred including:

- coordinating the delivery of approximately 372 GL of water for the environment as part of the Southern Spring Pulse;
- supporting permanent water in wetlands that provide habitat for the threatened Murray hardyhead (*Craterocephalus fluviatilis*);
- inundation of temporary wetlands/floodplains (including wetlands on the Chowilla Floodplain and numerous sites managed by the Murraylands and Riverland Landscape Board, Australian Landscape Trust (ALT), Banrock Station, Nature Foundation and Renmark Irrigation Trust (RIT));
- wetting and drying of pool-connected managed wetlands;
- raising of Weir 2 by 52 centimetres (cm); and
- delivery of water to the LLCMM to support manipulation of water levels in the Lower Lakes and barrage and continuous fishway releases.

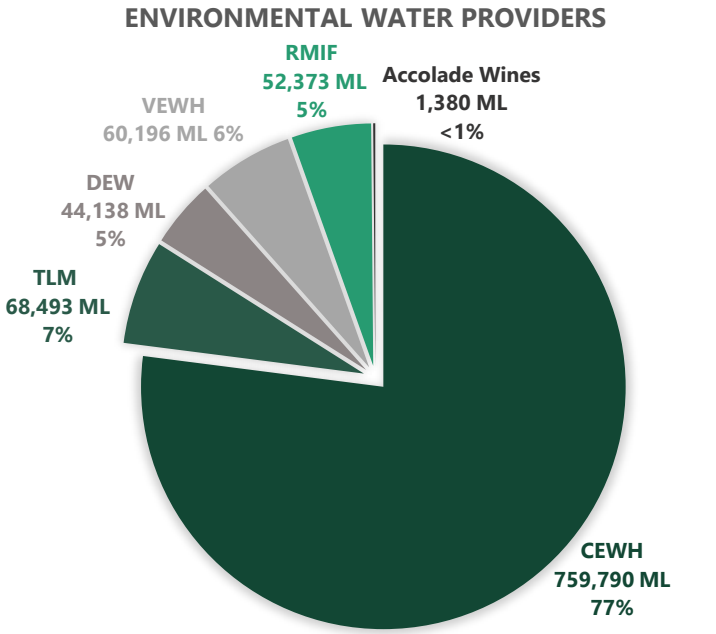

Figure 3. Volumes contributed by each environmental water provider (Commonwealth Environmental Water Holder (CEWH), The Living Murray (TLM), SA Department for Environment and Water (DEW), Victorian Environmental Water Holder (VEWH), River Murray Increased Flow (RMIF) and Accolade Wines) in 2019-20.

Outcomes of water delivery

Planning for delivery of water for the environment to South Australia in 2019-20 was coordinated by DEW staff and undertaken in consultation with community groups including the LLCMM Community Advisory Panel, Chowilla Community Reference Committee, the LLCMM Scientific Advisory Group, the Ngarrindjeri Aboriginal Corporation and the First Peoples of the River Murray and Mallee.

This planning included describing the ecological objectives for proposed watering activities under a range of climate scenarios and is described in the 2019-20 Annual Environmental Watering Priorities (DEW, 2019b) and Plan for the South Australian River Murray (DEW, 2019a). Assessment of the flow conditions experienced indicate that planning for the 'moderate' scenario was most representative of the actual conditions in 2019-20. The watering actions and objectives proposed under a moderate scenario and an indication of whether they were achieved is shown in Appendix A.

These objectives guided the planning and delivery of water for priority environmental assets in South Australia throughout 2019-20. They also inform the system-scale planning and delivery of water for the environment for the Southern Connected Basin which is coordinated by the SCBEWC. Representatives from South Australia, as well as from New South Wales, Victoria, MDBA, the VEWH, the CEWH and the Commonwealth Government are members of SCBEWC[1].

The following section provides a snapshot of outcomes observed at key watering sites.

Curlew sandpipers (Calidris ferruginea) take flight at Tolderol Game Reserve Wetlands. Credit: Peter Koch.

[1] For more information regarding SCBEWC, refer to their annual reports

Mudflat and benthic invertebrate monitoring at Hunters Creek. Credit: Sabine Dittmann, Flinders University

Coorong, Lower Lakes, and Murray Mouth

928,185 ML for the environment[2]

142,733 ha watered

2 fringing wetlands watered

206 ML pumped

Lake Level Management and Barrage Releases

927,979 ML delivered

685,169 ML released out the barrages

142,530 ha watered

Site Water Manager: DEW

Source of water: CEWH, TLM, VEWH, RMIF, DEW

Ecological Objectives:

- Facilitate movement and recruitment of diadromous fish.
- Support recruitment of threatened fish and frog populations in the Lower Lakes wetlands.
- Create favourable conditions in the Coorong North Lagoon to support estuarine fish and benthic invertebrate populations.

Outcomes:

High spring barrage flows contributed to improved salinity conditions and increased macroinvertebrates in the Coorong North Lagoon. Improvements in available habitat and food resources drove increased abundance of key commercial fish species such as *Aldrichetta forsteri* (Coorong mullet) and *Argyrosomus japonicus* (mulloway), as well as non-commercial species such as *Pseudaphritis urvillii* (congolli), *Atherinosoma microstoma* (smallmouth hardyhead) and *Hyperlophus vittatus* (sandy sprat), key species in the Coorong food web (G. Hera-Singh, pers. comm).

Despite increased macroinvertebrate abundances in the North Lagoon, shorebird (both migratory and non-migratory) abundances remained low across the Coorong and 10 species failed to meet long-term targets (Paton *et al.*, 2020). The Coorong South Lagoon continued to have few macroinvertebrate species (Dittmann *et al.*, 2020), which likely contributed to the poor waterbird response. Some fish-consuming birds responded differently, with three *Sternula nereis nereis* (fairy tern) breeding colonies observed in the Coorong in summer 2019-20, with an increase on fairy tern numbers recorded in 2018-19 (413 vs 315 individuals respectively) (Paton & Paton, 2020).

Remarkable Fish Recovery

Monitoring in the Lower Lakes found high abundances of the migratory fish congolli in spring and early summer 2019.

Female congolli migrate downstream from Lake Alexandrina to the Coorong and Southern Ocean in winter to breed, with juveniles returning to Lake Alexandrina via barrage fishways in late spring and summer. During the Millennium Drought, these migrations ceased, resulting in a catastrophic drop in congolli numbers.

The high numbers of congolli observed in 2019 was a direct result of water for the environment maintaining fresh flows to the Lower Lakes and Coorong in recent years.

For more information, check out the media release.

Multiple sizes of Congolli (Pseudaphritis urvillii). Credit: Scotte Wedderburn

[2] Includes the 206 ML pumped

All barrage fishways were operational for the entire year, with adjacent barrage releases providing attractant flows for migrating fish where flows were available. Congolli and *Galaxias maculatus* (common galaxias) recruitment was apparent, suggesting there were adequate flows in winter 2019 to facilitate downstream migration of adults and again in spring/summer 2019-20 to facilitate upstream migration of young of year fish to Lake Alexandrina (Bice *et al*., 2020; Wedderburn & Barnes, 2020).

Fish surveys in the Lower Lakes in spring and early summer detected high abundances of young of year *Nannoperca australis* (southern pygmy perch), indicating the spring flow pulse and higher water levels contributed to a successful breeding event for this species. High abundances of adult *Craterocephalus fluviatilis* (Murray hardyhead) in breeding condition were also detected (Wedderburn & Barnes, 2020).

Despite Lower Lakes water levels remaining above target levels, draw downs in autumn 2020 coincided with poor survivorship of southern pygmy perch between December and March (Wedderburn & Barnes, 2020).

Rare lamprey keeping up appearances

Each winter, lampreys migrate upstream through the barrages to spawning grounds in the River Murray. With help from a winter fresh from the Goulburn River that flowed from Victoria to the Lower Murray barrages, lampreys were observed moving upstream in record numbers since monitoring began after the Millennium Drought.

Between 2012 and 2018, only one *Mordacia mordax* (short-headed lamprey) was detected in the entire Murray-Darling Basin. In 2019, monitoring at the barrage fishways tagged and released 16 short-headed lamprey and 45 *Geotria australis* (pouched lamprey). One short-headed lamprey was tracked to Lock 8 and is the first time a short-headed lamprey has been tracked in the Basin.

The increase in lamprey numbers reflects a slow recovery of the ecology of the River Murray estuary – especially for those native fish that require freshwater flow and connectivity between the River Murray and the sea.

For more information, check out the media release.

Fairy Tern (Sternula nereis nereis) chick and egg, Coorong South Lagoon. Credit: Fiona Paton, University of Adelaide

Lower Lakes Pumped Wetlands

206 ML pumped[3]

203 ha watered

2 sites watered

Site Water Manager: MRLB

Source of water: CEWH, DEW

Ecological Objectives:

- Support known populations of Murray hardyhead (nationally threatened fish).
- Provide refuge habitats for waterbirds.

Outcomes:

Water for the environment was pumped to two Lower Lakes wetlands in 2019-20; Tolderol Game Reserve Wetlands and the Investigator College Currency Creek Wetland. Pumping took place for most of the year, with Tolderol Game Reserve Wetlands receiving water all year while Investigator College Currency Creek Wetland received water from winter until late autumn.

Tolderol Game Reserve Wetlands regularly supported high numbers of migratory shorebirds (>1000) from 18 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) listed species. Dominant species were *Calidris acuminate* (sharp-tailed sandpipers) and *Calidris ruficollis* (red-necked stint). Overwintering juveniles were supported during autumn and winter.

Since the first inundation at the Investigator College Currency Creek Wetland in 2018-19, water quality and habitat condition has improved to the extent where the potential reintroduction of threatened frogs and fish could be undertaken in the foreseeable future.

Further Lower Lakes wetland pumping was also undertaken by the Nature Foundation (refer to Nature Foundation Pumped Wetlands section).

Early morning at Investigator College's environmental watering site at Currency Creek. Credit: Kate Mason, Murraylands and Riverland Landscape Board

[3] An additional 1034.880 ML on Water Licence #1332 held by the SA Minister for Environment and Water was pumped to Tolderol Wetland for environmental outcomes

Black swan (Cygnus atratus) on a nest at Coombool Swamp. Credit: Helga Kieskamp

South Australian River Murray Channel and Floodplain

430,606 ML for the environment[4]

5,603 ha watered

102 sites watered

16,228 ML pumped

River Murray Channel Pulse

~370,000 ML delivered

~751 ha watered

Site Water Manager: DEW

Source of water: CEWH, TLM

Specific Ecological Objectives:

- Water level variability in the upper section of each weir pool resulting in improved aquatic and littoral vegetation.
- Short-term (20-day) improvement in the availability of moderate to fast flowing water habitat (>0.2 m/s average velocity).
- Support suspension and downstream transport of native seeds and eggs/larvae.
- Increased micro-invertebrate abundance, which are a key food resource of native fish, including larval Murray Cod.

Outcomes:

A targeted pulse was delivered through the River Murray channel in spring, with the South Australian River Murray experiencing increased flows through September and October 2019. At its peak, flows at the South Australian Border reached just over 15,000 ML/day for 11 days.

Once the pulse ceased in early summer, vegetation surveys were undertaken along sections of the SA River Murray channel. Native plant species richness had increased in areas that had been inundated due to the channel pulse, with river red gum seedlings observed in these areas.

Monitoring between spring and early summer through a project funded by the CEWO showed that the spring pulse resulted in improvements in the micro-invertebrate community in the South Australian River Murray channel (Furst *et al.*, 2020). This included reducing the dominance of an invasive species and significantly increasing the densities of native taxa that are likely to provide better quality food for larger animals such as shrimp and native fish.

Fish surveys undertaken as part of the CEWO Flow-MER (Monitoring, Evaluation and Research) project between spring and autumn found evidence of increased *Maccullochella peelii* (Murray cod) recruitment. The Murray Cod spawning coincided with the spring pulse and juvenile fish are expected to have benefited from improvements to flowing water habitat and increased zooplankton abundance (Ye, *et al.*, 2021), building on multiple years of successful Murray Cod recruitment. *Macquaria ambigua* (golden perch), however, did not show signs of recruitment, with the population dominated by fish aged 7 – 10 years old. It is recommended a larger pulse arriving later in the year may be more effective in supporting local reproduction of golden perch and further support the restoration of flowing water habitat and ecosystem function in the lower River Murray.

Eastern long-necked tortoise (Chelodina longicollis) at Hogwash Bend. Credit: Darren Willis, Murraylands and Riverland Landscape Board

[4] Includes the 16,228 ML pumped

Weir Pool Manipulation

352 ML delivered

219 ha watered

2 weirs raised

Site Water Manager: DEW

Source of water: CEWH

Specific Ecological Objectives:

- Build ecosystem resilience to cope with extended dry conditions and prevent further decline.
- Improve vegetation and macroinvertebrate communities by improving seed bank viability.
- Reduce water stress and improved condition in floodplain vegetation (e.g. river red gum and black box).
- Improved biofilm community diversity (e.g. more types of algae), increasing their value as a food source for fish.
- Improved vegetation coverage and recruitment.

Outcomes:

The raising of Lock 2 was a success. The total event occurred over 103 days, achieving a peak height of 52 cm over 35 days in September. The Lock 2 weir pool was returned to normal pool level approximately one month earlier than originally planned to coordinate alignment with the delivery of the spring pulse and reduce potential impacts on river velocity (flowing water). This event inundated over 200 ha, including areas surrounding Ramco Wetland and Harts Lagoon, supporting the growth and improved condition of *Eucalyptus camaldulensis* (river red gum), *E. largiflorens* (black box) and *Duma florulenta* (lignum) communities. 685 individual birds from 20 different species were observed during bird surveys at Ramco Wetland, while surveys at Harts Lagoon observed 994 individual birds from 26 different species, including 15 juvenile *Tadorna tadornoides* (Australian shelduck). The migratory EPBC listed *Hydroprogne caspia* (Caspian tern) was also observed at both sites.

Monitoring showed increased micro-invertebrate densities during weir raising, which act as important food resources for fish (Furst, in prep). The coordination of the weir manipulation with the spring pulse may have contributed to micro-invertebrates being drawn from the floodplain and transported downstream.

A raising at Lock 6 commenced but was curtailed when flows to South Australia reduced and flow over Lock 6 could not be maintained with the weir raised. The maximum height reached was 29 cm for six days.

Ramco Wetland during peak inundation (top) and after draw down (bottom). Credit: DEW & Stephanie Robinson, Murraylands and Riverland Landscape Board

Chowilla Floodplain Icon Site Pumped Wetlands

8,273 ML pumped

452 ha watered

7 sites watered

Site Water Manager: DEW

Source of water: RMIF

Specific Ecological Objectives:

- Support fringing floodplain vegetation.
- Reduce soil salinity and improve soil moisture content.
- Support long lived vegetation (e.g. river red gum, black box, river cooba and lignum).
- Provide refuge habitats for a range of biota, including waterbirds.
- Provide breeding opportunities for frogs including the southern bell frog (EPBC listed).

Outcomes:

The focus of watering across the Chowilla Floodplain through 2019-20 was on pumping to five wetland refuge sites: Lake Littra, Coombool Swamp, Punkah Creek Depression, Monoman Island Depression, and Chowilla Island Loop. A drip irrigation trial also took place, watering two small areas of mature black box on Monoman Island.

A strong vegetation response was observed from river red gum, black box, lignum and *Acacia stenophylla* (river cooba). Extensive charophyte (stoneworts or freshwater green algae) growth was observed at Lake Littra, providing habitat and food for invertebrates, fish and herbivorous waterbirds, and improving water clarity. At Coombool Swamp, extensive growth of *Myriophyllum spp* (water milfoil), *Thyridia repens* (creeping monkey flower) and *Stemodia florulenta* (blue rod) was observed, attracting large numbers of butterflies and moths.

During summer surveys, six species of duck were recorded, including a flock of 300 *Stictonetta naevosa* (freckled ducks), a vulnerable species in South Australia. The healthy lignum provided habitat for *Porzana fluminea* (spotted crakes) (12 observed). Coombool Swamp supported 1500 - 2000 individual birds from 20 species, including breeding *Cygnus atratus* (black swans) which led to additional water being delivered to the Swamp ensuring the breeding was successfully completed. It was common during monitoring to see 15 pairs of swans with 3-5 cygnets each.

Seven species of frog were recorded across the floodplain, including the EPBC listed *Litoria raniformis* (southern bell frog) and the burrowing *Neobatrachus sudelli* (Sudell's frog).

The drip irrigation trial of mature black box on Monoman Island was successful, with marked improvements in canopy growth and understorey vegetation species diversity and abundance. The trial results highlighted that targeted drip irrigation can be an effective method of improving the soil water availability and vegetation condition with a modest use of water for the environment, however it is resource intensive and is only likely to be feasible on a small scale.

Birds flock to Coombool Swamp

Numerous species of significance were recorded during bird surveys at Coombool Swamp, including three species of migratory waders; sharp-tailed sandpipers, red-necked stints and a single *Limosa limosa* (black-tailed godwit), a species that hasn't previously been recorded at Chowilla during TLM surveys.

Himantopus leucocephalus (white-headed stilts), black swans, Australian shelducks and red-necked stints were observed nesting and with young.

Over 1000 *Anas gracilis* (grey teal) and 380 *Malacorhynchus membranaceus* (pink-eared ducks) were also observed, along with approximately 20 *Cladorhynchus leucocephalus* (banded stilts) which are uncommon at Chowilla.

Sharp-tailed Sandpipers (Calidris acuminate) at Chowilla. Credit: Helga Kieskamp

Wetlands

This section summarises the delivery of water for the environment to important wetland sites along the South Australian River Murray by the Murraylands and Riverland Landscape Board, DEW, Accolade Wines, Nature Foundation, RIT and Australian Landscape Trust. A full list of the wetland sites watered in 2019-20 is presented in Appendix C & D.

Pool Connected Wetlands

39,764 ML delivered

3304 ha watered

52 sites watered

Site Water Manager: MRLB, DEW, ALT, Accolade Wines

Source of water: DEW, Accolade Wines

A total of 52 pool connected wetland sites across 40 locations were managed in 2019-20, using water held by the South Australian Minister for Environment and Water and a small volume held by Accolade Wines (Banrock Station). These sites extend from above Lock 6 to the Lower Lakes, with management taking place year-round using flow regulating structures and many sites being monitored throughout the year.

Clear waters at Ramco Lagoon

Ramco Lagoon is a large pool connected wetland in the Lock 2 weir pool. The wetland entered a drying phase in 2019, during which carp were eradicated and the clay sediments became consolidated and cracked.

Upon re-inundation, carp were excluded from entering the lagoon with the use of fish screens. The combination of consolidated sediments and the absence of carp enabled aquatic vegetation to flourish.

Weir pool raising of Lock 2 increased water levels, inundating wetland fringes that had been dry since 2016-17. Macroinvertebrates emerged from the fringes, adding to the food resources available, with 28 species of waterbirds observed during inundation including red-necked avocets, pink-eared ducks and red-capped plovers.

Gums growing strong at Banrock

A dry period followed by a gradual refill allowed patches of river red gums to grow enough to keep their crowns above the water level. Typically, many of these seedlings would have drowned, but their persistence suggests they will survive until the next dry cycle.

Downstream end of the main lagoon, Banrock Station. Credit: Accolade Wines

Murraylands and Riverland Landscape Board Pumped Wetlands

6291 ML pumped

556 ha watered

16 sites watered

Site Water Manager: MRLB

Source of water: CEWH, DEW

Specific Ecological Objectives:

- Support known populations of EPBC listed species (e.g. southern bell frogs and regent parrots).
- Support the maintenance of long lived vegetation (e.g. river red gums, black box, river cooba and lignum).
- Provide habitat for fish, turtles, frogs and water dependent birds.
- Create or improve freshwater lenses and reduce risks of salinisation.
- Encourage growth of riparian, littoral, groundcover and aquatic vegetation.

Outcomes:

Water for the environment was delivered to 16 sites across the South Australian River Murray floodplain. The majority of watering took place during spring and summer.

Water for the environment improved the growth of juvenile river red gums surrounding many of the wetlands, with increased growth also seen in mature river red gums, river cooba and lignum. Watered trees were also utilised by the EPBC listed *Polytelis anthopeplus* (regent parrot). Extensive growth and diversity of understorey plant species was observed, including the recruitment of important food plants for the regent parrot.

Recruitment and growth of submerged aquatic plants at eight sites provided habitat for frog and bird breeding. Waterbirds that bred included black swan, grey teal, *Biziura lobate* (musk duck), *Tachybaptus novaehollandiae* (Australasian grebe) and *Poliocephalus poliocephalus* (hoary-headed grebe). Frog surveys across nine wetland sites recorded breeding calls of six frog species, including eight sites where the EPBC listed southern bell frog was heard.

Southern bell frogs hop for joy at Overland Corner

A watering trial at Overland Corner to increase numbers of the EPBC listed southern bell frog was a success. Water levels were managed to cue breeding and support tadpole development, with multiple breeding events detected. The abundance of juvenile southern bell frogs observed during spotlighting surveys was considered a great outcome for the project, helping to secure a future for the species.

Tadpoles and juvenile frogs captured at Overland Corner. Credit: Kate Mason, Murraylands and Riverland Landscape Board

Banrock Pumped Wetlands

1472 ML pumped

88.77 ha watered

2 sites watered

Site Water Manager: Accolade Wines

Source of water: CEWH

Specific Ecological Objectives:

- Protect the extent and condition of black box woodland and native riparian vegetation communities, and provide reproduction and recruitment opportunities.
- Improve cover and condition of understorey vegetation, including lignum.
- Establish more diverse healthy habitat for native frog species, including the southern bell frog.
- Improve the condition of the associated red gum woodland vegetation communities that are hosting one of the few colonies of regent parrot in South Australia.
- Establish more diverse and healthy habitat for both wetland and migratory bird species found in the surrounding Ramsar area.

Outcomes:

Water was pumped to two temporary wetlands on Banrock Floodplain in the summer of 2019-20. Bird monitoring took place around the Eastern Lagoon between November 2019 and July 2020. In total, almost 2000 individual birds were observed, comprising 32 species. Water delivery was targeted at providing refuge and feeding grounds for migratory shorebirds which accounted for 32% of both the diversity and abundance of all species.

Ongoing monitoring of woodland birds at the Banrock Bend watering sites within regenerating river red gum forest continues to show improvements in species diversity. Water delivery to these sites has occurred in 2015, 2017 and 2019, with each subsequent year showing a small spike in diversity of woodland birds.

Strong growth of lignum took place across all of the Banrock watering sites in a stark contrast to adjacent areas that were not watered. Positive changes in tree health also occurred at all sites, with future follow-up surveys planned to measure the change in condition.

Ad hoc surveys of vegetation around the Riverbend sites identified three species not previously recorded anywhere on the Banrock Station Ramsar site. These were *Galium leptogonium* (reflexed bedstraw), *Euphorbia dallachyana* (caustic weed) and *Mentha australis* (river mint).

Red-necked stints trickle back to Banrock

Prior to this year, the last observation of the migratory red-necked stint at Banrock Station was in 1996. On 29 January 2020, a single bird was observed along the margins of the Eastern Lagoon which was followed up on 26 March 2020 with another single bird. Following the draw-down of water levels through returning flows to the river, a small flock of 8 red-necked stints was observed on 29 May 2020.

Red-necked stint (Calidris ruficollis) at Chowilla Floodplain. Credit: Helga Kieskamp

Nature Foundation Pumped Wetlands

1338 ML pumped

111.81 ha watered

14 sites watered

Site Water Manager: Nature Foundation

Source of water: CEWH

Specific Ecological Objectives:

- Support stressed long lived vegetation (e.g. river red gums, lignum and black box).
- Provide drought refuge for waterbirds, aquatic plants, macroinvertebrates, frogs and yabbies.
- Provide habitat for EPBC listed species (e.g. regent parrot, Latham's snipe, southern bell frog).
- Trigger a breeding event in the nationally endangered Murray hardyhead.
- Trigger a southern bell frog breeding event in Pike Floodplain.
- Restore the seasonal cycle at Qualco Lagoon.

Outcomes:

Water for the environment was delivered to 14 temporary wetlands across various locations, including Cadell, Clark's Floodplain, Lyrup, Hogwash, Milang, Pike Floodplain, Goat Island, Qualco and Stanitzki.

Fish surveys at Lyrup Lagoon in spring recorded 82 of the EPBC listed Murray hardyhead, with signs that the fish were breeding. In autumn, over 2500 Murray hardyhead of various states of maturity were recorded suggesting a successful breeding event had occurred.

Water was delivered to specific river red gum trees to encourage EPBC listed regent parrot breeding at Hogwash Bend. Surveys reported nine pairs within Hogwash Bend, a dramatic decline in numbers from the previous year. Six regent parrots were recorded at Cadell Lagoon.

The EPBC listed southern bell frog were reported at both sites on Pike Floodplain during watering events, with an increase in numbers from the previous year.

Bird surveys observed a total of 13 *Gallinago hardwickii* (Latham's snipe) in the Milang Snipe Sanctuary on Lake Alexandrina between October 2019 and March 2020. Latham's snipe were also recorded during the watering event at Pike floodrunner. Other bird species reported on Pike Floodplain include *Tringa glareola* (wood sandpiper), *Porzana tabuensis* (spotless crake), *Anas rhynchotis* (Australasian shoveler), Caspian tern, *Circus approximans* (swamp harrier), *Acrocephalus australis* (Australian reed warbler) and *Megalurus gramineus* (little grassbird).

At Pike floodrunner, new recruits of long-lived native plants (e.g. *Chenopodium nitririaceum* (nitre goosefoot), lignum and black box) have been recorded. There was also increased evidence of reproduction (e.g. buds, flowers, seeds) on some trees.

Water for the environment at Qualco Lagoon. Credit: R. Thompson

Renmark Irrigation Trust (RIT) Pumped Wetlands

224 ML pumped

25.80 ha watered

6 sites watered

Site Water Manager: RIT

Source of water: CEWH

Specific Ecological Objectives:

- Halt the decline and possible death of mature long lived plant species (e.g. river red gum and black box).
- Maintain existing regeneration and provide opportunities for future regeneration of long lived plant species (e.g. river red gum, black box, cooba & lignum).
- Reduce soil salinity to promote regeneration of less salt tolerant floodplain and aquatic plant species.
- Increase in diversity and abundance of waterbirds and frogs through aquatic habitat improvements.
- Improved connectivity between watering sites and adjacent floodplain and waterway.
- Promote cycling of carbon and nutrients between wetlands, floodplain and Bookmark Creek.

Outcomes:

Water for the environment was delivered to six temporary wetland sites in 2019-20, including Plush's Bend, Twenty-sixth Street, Johnsons Waterhole, Paroo Street, Begara Street and Namoi Street. A majority of watering took place in autumn, with some sites receiving water in spring.

An improvement in the overall health of long lived plant species such as river red gum and black box has been observed at various sites. Understorey and groundcover vegetation health improved at all sites, with some sites showing an expansion of vegetation and shift away from terrestrial salt tolerant species to amphibious and flood dependent species, such as the creeping monkey flower.

Waterbird species abundances and diversity increased significantly at Plush's Bend after the delivery of water for the environment. No waterbirds were observed at the site prior to water for the environment delivery, whereas 70 individual birds and nine species were observed post-delivery.

Black swans return to their nests

A pair of black swans were observed at the Twenty-sixth Street site, returning to the same nest for the third year in a row. It was unclear if the breeding was successful or not, as they started late in the monitoring season.

Black swan (Cygnus atratus) nesting at the Twenty-sixth Street site. Credit: RIT

Australian Landscape Trust (ALT) Pumped Wetlands

335 ML pumped

94.80 ha watered

3 sites watered

Site Water Manager: ALT

Source of water: CEWH

Specific Ecological Objectives:

- Support the recovery of long lived riparian vegetation (e.g. river red gums, black box and lignum).
- Provide habitat for waterbirds.

Outcomes:

Water for the environment was delivered to three temporary wetland sites on Calperum Station in autumn 2020, including Thookle Thookle, Amazon, and Amazon Uplands.

During the watering event, *Haliaeetus leucogaster* (white-bellied sea eagles), which are endangered in South Australia, were observed at the Amazon site. Migratory birds such as *Ardea modesta* (eastern great egrets), *Calidris ferruginea* (curlew sandpipers), sharp-tailed sandpipers, red-necked stints and Caspian terns were also observed on Calperum Station during inundation of the temporary wetlands.

Vegetation observations at the temporary wetland sites also found *Maireana decalvans* (black cotton-bush), an endangered species in South Australia, and *Maireana pentagona* (slender fissure-plant), a rare species in South Australia, at both the Amazon and Thookle Thookle sites.

Amazon Bank, Calperum Station, in May 2019. Credit: ALT

Amazon Bank, Calperum Station, in June 2020. Credit: ALT

Communication and engagement

Water for the environment managers in South Australia strive to maintain community input and engagement throughout the water year. Planning the year's water for the environment events starts early and involves workshops with environmental water holders, scientific experts, First Nations people, non-government organisations and river operators. These workshops consider the water resource forecast for the year ahead, facilitating discussions around what watering events may be possible and aiding in the development of watering proposals aimed to meet site specific and basin wide targets.

Further community and non-government organisation consultation takes place during the development of watering proposals. For the Chowilla Floodplain and CLLMM Icon Site, established reference groups with an in-depth knowledge of the region, its infrastructure and water for the environment provide valuable input. Additionally, site tours, meetings and presentations are also undertaken with various stakeholders to gain feedback on proposed actions. One-on-one conversations with landholders and industry representatives were also undertaken.

Community consultation and engagement continued as watering events and various monitoring projects took place, including volunteer surveys and presentations to interest groups and universities. Tours took place at Chowilla Floodplain and the CLLMM Icon Site with various groups, including MDBA graduates, community groups and Traditional Owners. The Living Murray bi-annual Icon Site Manager's forum and Indigenous Partnerships forum was held at the CLLMM Icon Site in 2019-20.

Coombool Swamp Aboriginal Waterways Assessment

Aboriginal Waterways Assessments (AWA) have been undertaken with teams from the First Peoples of the River Murray and Mallee Region (FPRMMR). AWA's assess the cultural values of wetlands and other important sites, supporting First Peoples input into water for the environment planning and wetland management planning. Coombool Swamp was the first 2019-20 site at Chowilla to be assessed, with other sites postponed due to the ongoing COVID-19 situation.

The FPRMMR undertaking the assessment at Coombool Swamp saw significant responses from waterbirds (including migratory waders), frogs and understorey and water plants as well as lignum, black box and cooba trees along areas of the inlet channel and lake shore.

The AWA team spotted a number of active *Kungardi* (black swan) nests on the lake. Following strong encouragement from the FPRMMR team that undertook the AWA, a request was made to deliver additional water to this site to ensure this culturally important species could finish their breeding cycle.

This request for additional water was approved, with the additional TLM water for the environment gradually pumped to Coombool, extending the maintenance of water levels within the lake.

This was also included in MDBA's *Rivers, the veins of our Country 2019-2020*

Coombool Swamp AWA. Credit: DEW

In an effort to reach the wider community, various media releases were developed by DEW. These cover:

- The recovery of the local congolli population post drought
- Lamprey migration
- The relationship between Coorong mudflat health and flow
- The cultural and environmental significance of Chowilla Floodplain
- Chowilla Floodplain's response to environmental watering
- The waterbird response to water for the environment events at Chowilla Floodplain.

DEW staff also worked closely with the CEWH and MDBA in developing these releases and in communications and engagement activities about how the coordinated River Murray Channel pulse provided benefits all along the River Murray.

Non-government organisations were also actively involved in community engagement, with the Nature Foundation, Renmark Irrigation Trust and Australian Landscape Trust (Calperum Station) promoting the importance of water for the environment through mainstream and social media.

The Nature Foundation engaged with local school and community groups, continuing to roll out the community driven program Water For Nature, which receives hands on involvement and advice from private landholders, Berri Barmera Landcare, Cadell Community Tourism Association, Central Irrigation Trust, Gerard Community Cultural Rangers, Goolwa to Wellington Local Action Planning Association, Regent Parrot Recovery Team, and Riverland West Landcare. RIT also ran a two day planting event at Ral Ral Floodplain, involving 33 volunteers, school children and RIT staff and planting 830 native plants.

The Australian Landscape Trust's Riverland Indigenous Ranger team manage all pumps involved in providing water for the environment to the Calperum temporary wetland, along with collecting delivery data and assisting with environmental monitoring.

Community provides a voice for the shy Latham's snipe

The Milang Snipe Project, run by Nature Foundation and Goolwa to Wellington Local Action Planning Association saw Eastern Fleurieu School children decorate Latham's snipe wooden cut-outs provided by the local men's shed. The District Council of Alexandrina Mayor Keith Parkes opened the exhibition of decorated birds on the lawns near the sanctuary on 2 March 2020.

Eastern Fleurieu School children with their decorated Latham's snipe cut-outs. Credit: Nature Foundation

Community members undertaking monthly bird surveys at Tolderol Game Reserve Wetland. Credit: Sam Hardy, Murraylands and Riverland Landscape Board

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Appendix A

2019-20 Water for the environment priorities

Table 1: Summary of water for the environment priorities proposed for moderate conditions in 2019-20

Site	Action	Status for 2019/20
CLLMM	Spring inundation of fringing Lower Lakes wetlands (~0.8 m AHD) and enhanced barrage releases	**Achieved**
	Continuous barrage releases for fish passage	**Achieved**
Channel and Floodplain	Spring pulse ≥10,000 ML/day with minimum 60-day duration commencing after mid-October and incorporating a short (minimum 20-days) peak ≥15,000 ML/day	**Partially Achieved**- A spring pulse with a 30-day duration >10,000 ML/day and a short (12 day) peak of >15,000 ML/day
Weir Pool Manipulation	Raise Weir Pool 6 up to +42cm above normal pool level (NPL) Raise Weir Pool 5 up to +50cm above NPL Raise Weir Pool 2 up to +52cm above NPL	**Partially Achieved**- Successful raising of Weir Pool 2, raising of Weir Pool 6 commenced but not completed and no raising of Weir Pool 5 due to reduced flows to SA
Chowilla	Pump to up to 8 priority wetlands	**Achieved**- Pumped to 6 priority wetlands
	Pulse flows through Chowilla anabranch via Pipeclay & Slaney Creek weirs in conjunction with raising weir pool 6.	**Not Implemented**- Flows didn't eventuate
Pike	Pulse flows through Tanyaca via Margaret Dowling and Deep Creek inlets	**Achieved**
	Temporary in-channel rise up to maximum 15.0 mAHD (0.45 m) at Pike Environmental Regulator and up to maximum 15.41 mAHD (0.66 m) at Tanyaca Creek Regulator via increased flows through Margaret Dowling and Deep Creek inlets.	**Not Implemented -** Construction work not completed in time.
Wetlands	Delivery of water via pumping and gravity at up to 22 priority wetland sites located along the River Murray from the border to the Lower Lakes.	**Achieved**- Water provided to 18 priority wetlands
	Operate infrastructure to implement a range of hydrological phases (including drying, refilling, pool level and flow through) at the 38 pool connected wetland complexes.	**Achieved**
	Additional delivery of water to temporary wetlands sites by Non-Government Organisations including Ngarrindjeri Regional Authority, RIT, ALT, Accolade and Nature Foundation.	**Achieved**

Appendix B

SA River Murray Water for the Environment Actions 2019-20

Table 2: Volume of water for the environment delivered across SA from different water holders (e.g. Commonwealth Environmental Water Holder (CEWH), The Living Murray (TLM), South Australian Department for Environment and Water (DEW), Victorian Environmental Water Holder (VEWH), River Murray increased flow (RMIF) and Accolade Wines) in 2019-2020.

Watering Action/ Location	CEWH	TLM	DEW	VEWH	RMIF	Accolade Wines	Total Volume (ML)
Coorong, Lower Lakes and Murray Mouth[5]	749,748	68,493	5443	60,196	44,100	-	**927,979**
Weir Raising	352	-	-	-	-	-	**352**
Chowilla Floodplain	-	-	-	-	8273	-	**8273**
Pool connected wetlands	-	-	38,384	-	-	1380	**39,764**
Wetland pumping[6,7]	9,690	-	176	-	-	-	**9866**
Other DEW watering actions[8]	-	-	136	-	-	-	**136**
	759,790	**68,493**	**44,138**	**60,196**	**52,373**	**1380**	**986,369**

[5] Includes the coordinated spring pulse of 372,421 ML

[6] Includes 80 ML pumped by DEW to Paringa Paddock. Does not include 1034.880 ML on Tolderol Game Reserve Wetland Licence

[7] Includes Bookmark Creek, Dishers Creek, Berri Evaporation Basin which are gravity-fed rather than pumped

[8] A variety of small watering actions, such as a South Australian Riverland and Floodplains Integrated Infrastructure Program (SARFIIP) irrigation trial

Appendix C

Pool connected wetlands

Table 3: Pool connected Class 9 wetland complexes managed in 2019-20 by Accolade Wines, SA Department for Environment and Water (DEW), Murraylands and Riverland Landscape Board (MRLB) and Australian Landscape Trust (ALT).

Wetland	Actions	Manager
Banrock Wetland	Filled in spring	Accolade Wines
Big Bend	Connected to the River all year	DEW
Brenda Park	Commenced dry in summer	MRLB
Bunyip Reach	Filled in spring, commence dry in summer	MRLB
Causeway Wetland Complex	Filled in spring, commenced dry in autumn	MRLB
Devon Downs South	Connected to the River all year	MRLB
Hart Lagoon	Filled in winter, commenced dry in summer	MRLB
Kroehn's Landing	Connected to the River all year	MRLB
Lake Merreti	Filled in spring, commenced dry in summer, filled in autumn	ALT
Lake Woolpolool	Filled in spring, commenced dry in autumn, filled in winter	ALT
Loveday Basins	Filled in summer, commenced dry in autumn	DEW
Loveday Mussels Lagoons	Filled in spring	MRLB
Martin Bend	Commenced dry in autumn	MRLB
Morgan Conservation Park	Filled in spring, commenced dry in summer	MRLB
Morgans' Lower Murray	Connected to the River all year	MRLB
Murbko South	Held half full all year	MRLB/DEW
Murbpook Lagoon	Remained dry all year	MRLB
Narrung	Commenced dry in summer, filled in autumn	MRLB
Nelwart	Connected to the River all year	MRLB
Ngak Indau	Filled in spring, commenced dry in summer	MRLB
Nigra Creek/ Schillers Lagoon	Connected to the River all year	MRLB
North Caurnamont	Connected to the River all year	DEW
North Purnong	Filled in winter	MRLB/DEW
Paiwalla	Filled in spring	MRLB
Pilby Complex	Filled in winter, commenced dry in autumn/ winter	MRLB
Pipeclay Billabong	Commenced dry in spring	MRLB
Pyap Horseshoe	Connected to the River all year	DEW
Ramco Lagoon	Commenced dry in spring, filled in summer	MRLB
Reedy Creek	Connected to the River all year	MRLB
Riverglades	Connected to the River all year	MRLB
Silver Lea	Connected to the River all year	MRLB/DEW
Slaneys Billabong	Filled in winter, commenced dry in autumn	MRLB
Spectacle Lakes /Beldora	Filled in autumn	MRLB
Sugar Shack Complex	Commenced dry in autumn	DEW
Sweeny's Lagoon	Remained dry all year	DEW
Teal Flat Complex	Filled in winter	DEW
Teringie	Connected to the River all year	MRLB
Waltowa	Brief connection to the River in summer	MRLB
Wongulla Lagoon	Connected to the River all year	MRLB
Yatco Complex	Commenced dry in autumn/ spring	MRLB

Appendix D

Pumped Wetlands

Table 4: Volume of water for the environment pumped to wetlands by the SA Department for Environment and Water (DEW), Murraylands and Riverland Landscape Board (MRLB), Nature Foundation, Renmark Irrigation Trust (RIT), Accolade Wines and Australian Landscape Trust (ALT) along the South Australian River Murray channel and floodplain in 2019-2020.

Watering Action/ Location	Volume (ML)	Manager
Above Lock 6		
Coombool Swamp	6,998	DEW
Lake Littra	994	DEW
Bypasses Lock 6		
Chowilla Island Loop	187	DEW
Monoman Creek Depression	33	DEW
Monoman Island	4	DEW
Punkah Creek Depression	58	DEW
Lock 5 to Lock 6		
Amazon	149	ALT
Amazon Uplands		ALT
Thookle Thookle	186	ALT
Begara Street	34	RIT
Bookmark Creek	448	MRLB
Johnsons Waterhole	0	RIT
Murtho Temp	405	MRLB
Namoi Street	51	RIT
Paringa Paddock	80	DEW
Paroo Street	44	RIT
Wiela	487	MRLB
Bypasses Lock 5		
Pike Floodrunner	87	Nature Foundation
Pike Inner-Mundic Floodrunner	1	Nature Foundation
Lock 4 to Lock 5		
Berri Evaporation Basin	1,293	MRLB
Disher Creek	100	MRLB
Goat Island	85	Nature Foundation
Lyrup Lagoon	307	Nature Foundation
Martins Bend	99	MRLB
Plush's Bend	69	RIT
Stanitzki's Floodrunners	9	Nature Foundation
Twentysixth Street	26	RIT
Bypasses Lock 4		
Katarapko Creek	44	MRLB
Lock 3 to Lock 4		
Clarks Georges Creek	19	Nature Foundation
Clarks Main Floodrunner	75	Nature Foundation
Clarks Minor Floodrunner	8	Nature Foundation
Gerard Black Box Basin	1	MRLB
Gerard Lignum Basin	119	MRLB
Yabby Creek	1296	MRLB
Bypasses Lock 3		

Eastern Lagoon	1424	Accolade Wines
Heron's & Banrock bend	48	Accolade Wines
Lock 2 to Lock 3		
Akuna	157	MRLB
Overland Corner	145	MRLB
Wigley Reach	286	MRLB
Lock 1 to Lock 2		
Cadell Ephemeral Wetlands	28	Nature Foundation
Cadell Temporary Lagoon	264	Nature Foundation
Hogwash Bend	488	MRLB
Hogwash Bend	4	Nature Foundation
Molo Flat	408	MRLB
Morgan CP	344	MRLB
Morgan East	170	MRLB
Qualco Lagoon	378	Nature Foundation
Qualco Swales	52	Nature Foundation
Below Lock 1		
Investigator College Currency Creek Wetland	22	MRLB
Milang Snipe Sanctuary	19	Nature Foundation
Tolderol Game Reserve Wetland[9]	184	MRLB

[9] An additional 1034.880 ML from Water Licence #1332 held by the SA Minister for Environment and Water was pumped to Tolderol Wetland for environmental outcomes

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