



Australian Government







MURRAY-
DARLING
BASIN AUTHORITY

Basin environmental watering outlook for 2018–19

April 2018

Published by the Murray–Darling Basin Authority
MDBA publication no: 4/18
ISBN (online): 978-1-925599-73-2

 GPO Box 1801, Canberra ACT 2601	 1800 230 067
 engagement@mdba.gov.au	 mdba.gov.au

© Murray–Darling Basin Authority 2018



With the exception of the Commonwealth Coat of Arms, the MDBA logo, trademarks and any exempt photographs and graphics (these are identified), this publication is provided under a *Creative Commons*

Attribution 4.0 licence. (<https://creativecommons.org/licenses/by/4.0>)

The Murray–Darling Basin Authority’s preference is that you attribute this publication (and any Murray–Darling Basin Authority material sourced from it) using the following wording within your work:

Title: Basin environmental watering outlook for 2018–19

Source: Licensed from the Murray–Darling Basin Authority under a Creative Commons Attribution 4.0 Licence

Accessibility

The Murray–Darling Basin Authority makes its documents and information available in accessible formats. On some occasions the highly technical nature of the document means that we cannot make some sections fully accessible. If you encounter accessibility problems or the document is in a format that you cannot access, please contact us.

Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Murray–Darling Basin Authority pays respect to the Traditional Owners and their Nations of the Murray–Darling Basin. We acknowledge their deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

The guidance and support received from the Murray Lower Darling Rivers Indigenous Nations, the Northern Basin Aboriginal Nations and our many Traditional Owner friends and colleagues is very much valued and appreciated.

Contents

Executive summary	1
Introduction.....	2
Improving Basin-wide environmental watering priorities	3
Environmental watering outcomes 2016–17 and 2017–18.....	4
2016–17	4
2017–18	5
Current condition	7
River flows and connectivity.....	7
Condition of native vegetation.....	8
Condition of waterbirds.....	8
Condition of native fish	9
Seasonal conditions.....	11
Surface water availability	11
2018–19 resource availability scenario	11

Effect of climate forecasts	12
Environmental watering opportunities in 2018–19 to support Basin-scale outcomes.....	13
River flows and connectivity in the Barwon–Darling River	14
River flows and connectivity in the Coorong.....	14
Native vegetation	15
Waterbirds.....	15
Native fish.....	16
Further reading.....	17
Appendix 1: Resource availability scenario.....	18

Executive summary

This document provides an early indication of the likely watering priorities for 2018–19 to work towards achieving the long-term expected outcomes for the Basin’s rivers and floodplains. The Murray–Darling Basin Authority’s (MDBA) focus is at the Basin-scale and complements the regional and local water for the environment focus of the Basin states.

A drying climate across most of the Murray–Darling Basin will shape the opportunities to improve the condition of the Basin’s rivers and floodplains and the species they support in the coming water year.

Many parts of the Basin benefited from improved flow conditions in 2016, with parts of the southern Basin receiving flows not seen in 25 years. However, as the *2017 Basin Plan Evaluation* showed, the condition of the Basin’s rivers and wetlands remains mixed. Many sites and species require follow-up watering to build on the benefits of 2016 flows, to support successful recruitment after breeding and to build resilience.

Relatively warm and dry conditions were recorded in 2017 across the Basin, with record temperatures and low inflows in many parts. Even so, with high opening allocations in 2017–18 in regulated catchments, environmental water managers were able to deliver environmental water to support the ecological response to high flows in the previous year. Water delivered for the environment triggered waterbird breeding, supported fish movement and breeding, and improved the condition of wetland vegetation.

In the coming water year, conditions are expected to range from very dry to wet in different catchments but with a common drying trend. Consequently, the objectives of delivering water for the environment will change. Opportunities in drier catchments will most likely focus on in-channel events, areas of the floodplains close to the main rivers, providing drought refuges and supporting critical habitats and ecological processes.

In catchments that are wetter, there will be opportunities to further consolidate the improvements of the past two seasons, improving the condition of rivers and floodplains so they can support future breeding and recruitment, and be better prepared to survive drier times.

Environmental water managers are increasingly devising ways to maximise the benefits of all water in the system by coordinating flows across catchments and with water for other users, and returning environmental water flows to the river system to be used further downstream. These innovative approaches help to boost the effectiveness of water recovered for the environment.

The MDBA will release environmental watering priorities for 2018–19 in June 2018.

Introduction

Each water year the MDBA prepares Basin-wide environmental watering priorities for the Murray–Darling Basin (the priorities). The priorities guide environmental water management across the Basin to achieve Basin-scale outcomes for flows and connectivity, native vegetation, waterbirds and native fish. Environmental watering to meet these priorities will also support essential ecosystem processes and functions needed to achieve these outcomes, such as nutrient cycling and food production.

The Basin environmental watering outlook (outlook) summarises the prevailing and forecast environmental conditions (ecological, climatic and hydrological) as at 1 January 2018. Indicators collected by the Bureau of Meteorology (rainfall, runoff, soil moisture, storage volumes, the El Niño Southern Oscillation Index and the Indian Ocean Dipole) inform this assessment.

Understanding the prevailing and forecast environmental conditions helps us to characterise the Basin on a spectrum from very dry to very wet. We call this the resource availability scenario. Appropriate management outcomes are selected and environmental watering is prioritised to achieve these outcomes.

This outlook includes a summary assessment of the overall ecological condition of river flows and connectivity, waterbirds, native vegetation and native fish, where information is available, and foreshadows some of the important environmental watering needs over coming years.

This outlook and the priorities for the 2018–19 water year should be read in conjunction with the rolling, multi-year priorities on the MDBA website.

In June, the MDBA will publish the priorities. They guide the annual planning and prioritisation of environmental watering across the Basin, and are consistent with the Basin-wide environmental watering strategy. The priorities complement regional and state environmental watering priorities.

The MDBA welcomes community feedback on the watering opportunities in this outlook. Comments can be provided by email to engagement@mdba.gov.au or by phoning 1800 230 067.

Improving Basin-wide environmental watering priorities

The MDBA published the first rolling multi-year priorities in 2017. For the purposes of Chapter 8 of the Basin Plan, they constituted the Basin annual environmental watering priorities for 2017–18.

Environmental water planners and managers have supported this move towards a rolling multi-year framework, as it aligns with the expected environmental outcomes in the Basin-wide environmental watering strategy and builds capacity to adapt to seasonal conditions.

The rolling multi-year priorities published in 2017–18 continue to apply for the 2018–19 water year for the prevailing resource availability scenario. These priorities are:

- connect southern Basin rivers to recover native fish populations
- connect river flows to improve outcomes for native fish throughout the Barwon–Darling and into the southern and northern Basin
- support and improve threatened fish populations
- improve the abundance and diversity of the Basin’s waterbird population
- maintain and improve where possible low-lying forests, woodlands and floodplain vegetation
- maintain the condition and extent of Moira grass in Barmah–Millewa Forest
- support freshwater connectivity through the Coorong, Lower Lakes and Murray Mouth.

Any updates to the content of these rolling multi-year priorities are discussed below in the section on environmental watering opportunities for 2018–19.

As flagged in 2017, the MDBA is developing a more comprehensive suite of rolling multi-year priorities to cover all of the expected environmental outcomes in the Basin-wide environmental watering strategy, and to consider the full range of resource availability scenarios. The MDBA anticipates that these will include rolling, multi-year priorities to:

- connect the northern rivers to recover native fish populations
- address longitudinal (along rivers) and lateral (out to floodplains) connectivity, as well as end-of-system flows
- improve condition and encourage recruitment of forests and woodlands (river red gum, black box and coolabah), shrublands (lignum) and non-woody vegetation (e.g. *Ruppia tuberosa*), and
- maintain the abundance of migratory shorebirds in the Coorong.

During the development of these priorities, the MDBA will also be considering how to implement recommendations of the 2017 Evaluation, in particular around the timing and level of detail in the priorities. The MDBA will be discussing options with environmental water managers in coming months.

Environmental watering outcomes 2016–17 and 2017–18

2016–17

The Basin received record rainfall in parts of southern New South Wales and northern Victoria during 2016–17. In October 2016, the River Murray peaked at 178,000 megalitres per day (ML/d) downstream of Yarrawonga Weir, the highest flow received in 23 years for this part of the Murray. Water managers built on these high natural flows to maximise environmental outcomes.

Over 3,300 gigalitres (GL) of environmental water was delivered to sites across the Basin for beneficial outcomes. This included water that was delivered to multiple sites using return flows. At least 2,500 GL of this volume was delivered in the southern connected Basin.

There were targeted deliveries of water in the Murrumbidgee, Edward–Wakool and River Murray to provide local refuges for fish during the hypoxic blackwater event caused by the natural flood. Environmental water was then applied in spring and summer to slow the flood recession, support large-scale waterbird breeding events and inundate floodplain wetlands and forests for longer.

While high flows were occurring in the River Murray during spring, small freshes delivered to the lower Darling River in spring inundated low-lying benches along river channels. The food production from this flow facilitated the largest Murray cod breeding response recorded in the lower Darling River. This provided an opportunity to boost populations in the region following the loss of Murray cod due to hypoxic blackwater occurring in the River Murray.

In late summer, coordinated flows in the River Murray, the Goulburn River, and the Campaspe River generated a fresh pulse to encourage silver perch and golden perch to move upstream, supporting recruitment and dispersal throughout the system. Winter flows were maintained with environmental water delivered to provide instream habitat, top up wetlands and promote the lamprey migration.

Environmental water boosted naturally high flows and improved habitat condition in the upper Warrego, Border Rivers and Barwon–Darling river systems in the north.

In the Macquarie, Murrumbidgee and Lachlan catchments environmental water supported bird breeding and reduced the risk of colonial waterbirds abandoning nests.

With the rainfall in 2016 there was increased scope to improve the health and resilience of aquatic ecosystems in the Namoi. In the Lower Namoi, 7.8 GL of Commonwealth environmental water was delivered to provide connectivity and movement cues for fish as well as flows to support the conservation stocking of silver perch fingerlings.

Following on from these Namoi River flows, water was delivered in the Peel River to:

- restore flow variability
- increase the food supply for native fish by “flushing” nutrients off the low in-channel sediment bars, and
- provide the opportunity for silver perch and other native fish to move upstream into the higher reaches of the Peel River.

In spring 2016, the largest flow event since 2013 occurred in the Balonne system. This water inundated approximately 1,500 hectares, including core rookery habitat, and was supplemented by a flow event in autumn 2017. For both events, a total of 43.75 GL of Commonwealth environmental water supplemented natural flows, supporting natural flow variability, fish movement and floodplain lignum communities.

Approximately 26.8 GL of environmental water from the Barwon River entitlements and the Darling River entitlements at Toorale was left instream to support natural river flows. These flows contributed to a more naturally variable flow regime to improve the resilience of aquatic plants and animals.

High flows in the Border Rivers and Barwon–Darling river systems resulted in golden perch spawning and egg and larvae drifting into the Menindee Lakes, an important nursery habitat, where they developed into juvenile fish in large numbers.

To support successful recruitment and distribution of these juveniles into the River Murray, environmental water managers worked with river operators to deliver water in the lower Darling River and through the Great Darling Anabranch.

2017–18

In 2017–18, water managers are consolidating positive environmental outcomes from previous years and delivering water to build system-scale resilience. In the context of a relatively dry year, large coordinated flows are being delivered (particularly in the southern Basin) by water managers and river operators aligning environmental water delivery with consumptive demands.

Over 220 GL of environmental water reconnected numerous wetlands in the mid–Murrumbidgee—a site which had been listed as a Basin-scale priority for several years. In Barmah–Millewa Forest, approximately 182 GL of environmental water was delivered in conjunction with operational water. In response, Moira grass, a threatened ecological community, grew and return flows provided downstream connectivity benefits. These flows also triggered a bird breeding event, however one colony in Barmah Forest was predated on by wild pigs, underlining the importance of complementary actions to improve ecological communities. This water, along with water used for watering events in the Goulburn, made up a large portion of the 112 GL pumped into Hattah Lakes. This delivery capitalised on the lakes already being partially filled (from previous watering) and enabled the flows to reach black box trees which had not been inundated since 1993.

Up to 75 GL of environmental water has been used this year in the Macquarie Marshes to support recruitment, improve condition of wetland vegetation and provide movement opportunities for fish through the Macquarie River. In the Lachlan, water has been provided

through anabranches to stabilise water levels and support successful Murray cod nesting, building on outcomes from high flows in 2016–17.

In the Border Rivers where the Dumaresq and NSW Severn rivers were close to cease-to-flow conditions, New South Wales and Commonwealth water managers applied environmental water to support native fish. In the Severn, an environmental pulse was sent through the system to promote Murray cod breeding while in the Dumaresq, base flows were maintained using 3.2 GL of water to maintain habitat access for cod.

In the Gwydir, early-season productivity was promoted through a 10-day flow pulse in late winter. Further flows were provided in spring, with stable base flows aiming to promote fish movement along the upper stretches of the Gwydir River.

In the Lower Darling, environmental water has made more habitat available for the juvenile Murray cod that spawned in 2016–17, increasing their chances of survival. After another successful spawning event in 2017–18, base flows were maintained to support habitat condition, food production and dispersal of young fish.

In South Australia, environmental water has contributed towards providing habitat at temporary wetlands along the River Murray and maintaining flows through the barrages. As these flows decreased over summer, additional environmental water supported productivity and helped migratory fish move through the system.

For the remainder of the 2017–18 water year, water managers are planning a range of actions to optimise the outcomes of the past water year including:

- delivering flows to improve wetland connectivity in the Lowbidgee
- providing more natural flows through the creeks in Barmah–Millewa Forest
- maintaining flows through the barrages to facilitate the migration of lamprey and other estuarine fish.

Up to 120 GL of environmental water may also be applied to support trials of large-bodied fish movement through the River Murray. Environmental water managers are also actively exploring opportunities to provide connecting flows through northern Basin catchments should opportunities arise.

Current condition

River flows and connectivity

Regulation and use of the Basin's rivers to secure water supplies for growing towns, industries and agriculture has dramatically altered the natural flow regime. Overall flow volumes have decreased, flow variability has declined, the natural timing of flows has been altered and the river and its anabranches, wetlands and floodplains are connected less frequently. These changes have caused a significant decline in health for many important and rare water-dependent ecosystems across the Basin.

The 2017 Evaluation found that the recovery of water for the environment had improved river flow regimes in many parts of the Basin. Longitudinal connectivity was most improved in the southern Basin where environmental watering activities in multiple tributaries had increased flow volumes in the River Murray by 30%. However, with much of the 2012–17 period dominated by dry conditions, River Murray flows and flows into the Coorong and Lower Lakes generally remained below their long-term average. The regular provision of environmental flows within the southern Basin is therefore likely to be needed to support the recovery and restoration of environmental assets and functions in the years to come.

Environmental water has also increased flow volumes and improved the flow regime in several northern Basin rivers. However, the 2017 Evaluation identified that policy and operational impediments continued to limit the ability of environmental water managers to restore some parts of the flow regime (i.e. low flows in the northern Basin and low-floodplain flows in the southern Basin). While some of these impediments are expected to be addressed in the coming years through implementing the Basin Plan, environmental water managers will need to explore alternative ways to provide water to priority environmental assets, particularly if drying conditions persist into 2018–19.

The majority of streamflow forecasts for the Basin are predicting near-average inflows for the remainder of 2018–19, with higher than average inflows possible for south-eastern Australia. With water availability generally reducing over the past 12 months, managers of held environmental water in the southern Basin will need to respond swiftly to opportunities provided by above-average inflows, including taking advantage of unregulated inflows arriving from the Ovens and Kiewa rivers to improve lateral and longitudinal connectivity.

Environmental water has become a valuable component of a suite of tools that can be used to reduce the occurrence and duration of cease-to-flow events in many of the Basin's ephemeral rivers (wet-dry cycle), helping to maintain water quality in the waterholes (refuges) used by native aquatic species and stock and domestic water users. Looking for opportunities to do these things will be important in the north and should involve environmental water managers coordinating between catchments and working with other water management agencies.

Condition of native vegetation

The condition of flood-dependent native vegetation varies across the Basin depending on the inundation history, environmental watering needs and potential threats to achieving the native vegetation outcomes in the Basin-wide environmental watering strategy. The 2017 Evaluation found that in areas where environmental water can be delivered, there are early positive signs of native vegetation responding to environmental water used under the Basin Plan. These benefits have been achieved by extending flow durations and protecting flow peaks (i.e. limiting extraction), and by creating lateral connectivity between the main river channel and the adjacent wetlands and floodplains including through the use of infrastructure. In areas of the floodplain that received water in the past few years the condition of river red gum and black box vegetation communities has been maintained. In some cases, condition has improved, most notably where environmental water and overbank flows have been delivered at sites along the River Murray and in the Lachlan catchment over successive years.

Some lignum shrublands have responded well to environmental water by producing new growth and improving in condition, such as at Chowilla Floodplain, Hattah Lakes and Bottle Bend, Redbank, Nimmie-Caira at the Great Cumbung Swamp and in areas of the Macquarie Marshes unaffected by constraints. In contrast, lignum shrublands growing on higher parts of the floodplain, such as at Lindsay-Mulcra-Wallpolla Forest, or where constraints limit environmental water delivery in the Macquarie Marshes, have declined in condition.

Environmental water delivered in wetlands and on low-lying floodplains in 2016–17 supported the growth of non-woody vegetation and helped to maintain these areas. For example, Moira grass in Barmah Forest grew and flowered, and seeds dispersed. Common reed, cumbungi and water couch in the Macquarie Marshes grew; common reed and cumbungi communities in the Great Cumbung Swamp also grew; and non-woody vegetation in core wetlands in the Gwydir improved.

Wet conditions at the end of Basin system during spring 2016 resulted in a significant improvement in the extent and abundance of *Ruppia tuberosa* (*R. tuberosa*) in the Coorong. Although there was an improvement in flowering of *R. tuberosa* during 2016–17, reproduction was hampered by the presence of filamentous algae.

Condition of waterbirds

The 2017 Evaluation found that overall there are positive early signs that environmental water is contributing to the long-term health of waterbird populations. The rate of decline in waterbird abundances has slowed and species richness has remained steady. In addition, breeding abundances have increased since the end of the millennium drought, supported by environmental water delivery. Migratory shorebird numbers have declined over time, likely driven by habitat degradation in Australia and overseas, and this remains of concern.

Since completion of the 2017 Evaluation, the Basin's waterbird population has been surveyed for another year, by the Eastern Australian Waterbird Survey and the Aerial Survey of Basin Environmental Assets.

The 2017 Eastern Australian Waterbird Survey demonstrated an improvement in waterbird numbers on the previous year, which rose from ~40,000 to ~70,000 (Figure 1), likely as a result of waterbird breeding. However, this number is relatively low when placed in the context of the 35-year survey (Figure 1).

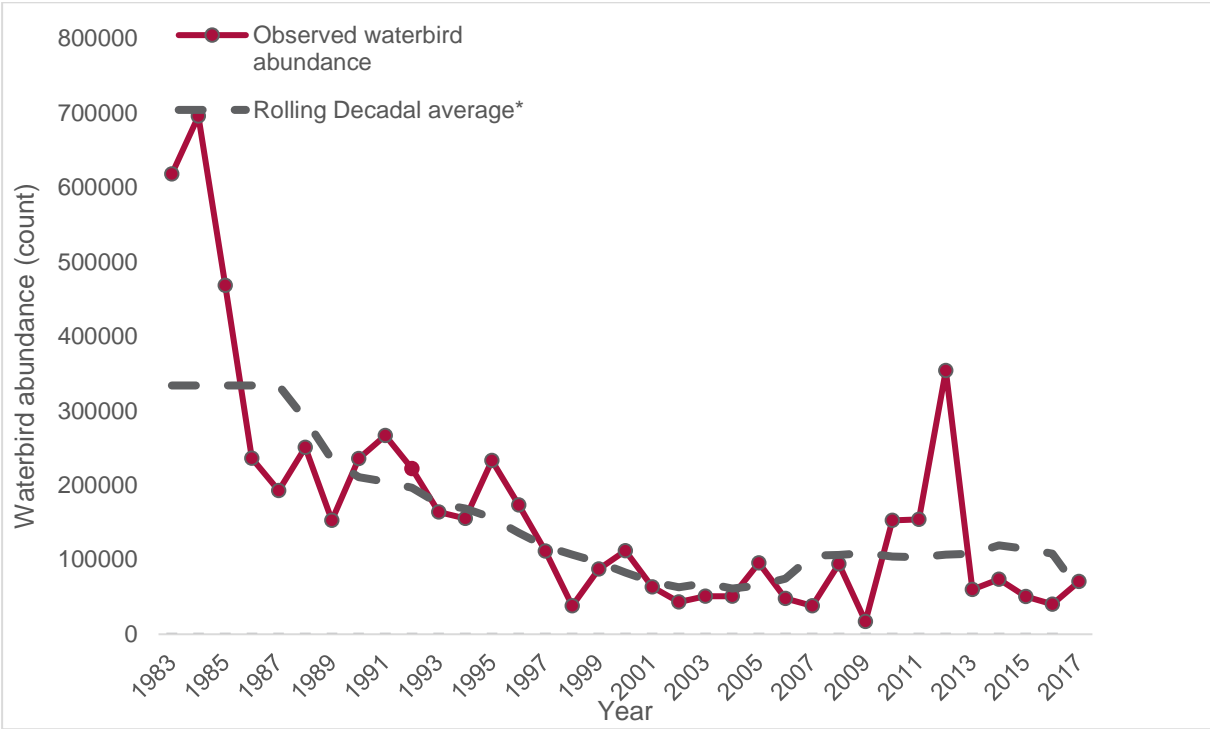


Figure 1. Waterbird abundance across the Murray–Darling Basin 1983–2016 (estimated by aerial waterbird surveys) (Porter et al. 2016). *Where less than five years of data were available either side of a given year, rolling decadal averages denote an average across the previous five years and any years following a given year.

Data from the aerial survey of waterbirds in Basin environmental assets in 2017 is pending but the summary report found that in the northern Basin, many of the wetlands were dry or nearly dry, and bird counts were correspondingly low, with little breeding activity. Only two wetlands—Menindee Lakes and Macquarie Marshes—had relatively high numbers compared to other wetlands.

In the southern Basin (including the Lachlan catchment), a greater number of wetlands were partly inundated in 2017, and birds were counted at all of the wetlands that were surveyed. Six wetlands had relatively high numbers: Lake Cowal; Booligal Wetlands; Kerang Wetlands; Hattah Lakes; Lindsay–Walpolla–Chowilla; and the Coorong, Lower Lakes and Murray Mouth. Breeding activity was low, except at Kerang wetlands, where 2,000–3,000 straw-necked Ibis were breeding, and at the Coorong, Lower Lakes and Murray Mouth, where there were breeding colonies of ibis, pelicans, cormorants, gulls and terns.

Condition of native fish

The 2017 Evaluation found that overall, condition of native fish in the Basin remains poor but appears to have stabilised over recent years. Many of the short-lived species listed in the Basin-wide environmental watering strategy were not regularly found in Basin-wide surveys, and were not widespread. Of particular concern were Yarra pygmy perch, purple-spotted gudgeon, flathead galaxias, olive perchlet and Rendahls tandan. Short-lived species, many of

which live in off-channel habitats, are a key part of native fish diversity and play important roles in aquatic ecosystems.

The 2017 Evaluation found that where water was delivered it had benefited 20 of the 25 key species listed in the Basin-wide environmental watering strategy, and that continuing to deliver environmental water would yield further benefits. Environmental flows have proven effective in protecting remnant populations and supporting re-introductions, for example the Murray hardyhead into the Lower Lakes, South Australian Riverland wetlands and into Brickworks Billabong in the Victorian Mallee.

The 2017 Evaluation also recognised the benefits of environmental water to species such as silver perch, golden perch and Murray cod. Continued environmental water delivery will be important to Murray cod populations in the mid-Murray region, which had been impacted by blackwater events in 2016–17.

Surveys on the lower Darling River, at Lock 10 (on the River Murray) and observations from anglers found a large number of young golden perch in the lower Darling River and River Murray between Euston (Lock 15) and the Chowilla Floodplain. These fish are likely to have dispersed from Menindee Lakes by natural flooding and managed operation in 2016–17. These fish will continue to respond to flow cues as they move upstream or downstream to colonise flowing water habitats.

In the mid-Murray region Murray cod and silver perch have benefited from specific watering actions aimed at key parts of the life cycle. In Millewa Forest, there was suitable habitat for Murray cod as regulators that typically shut over winter remained open, allowing water through connected creeks and fish to move into those new habitats. Monitoring found that environmental flows cued silver perch to move from the River Murray into the Goulburn and Campaspe rivers in 2017.

In the northern Basin, monitoring has shown the importance of connection, flows and diversity in the Macquarie, Gwydir and Border Rivers catchments. In autumn 2017, a connection flow resulted in movement of golden perch and spangled perch between the Macquarie and Barwon river systems. Hyrtyl's tandan, more commonly found in the Barwon River, were also observed in the Macquarie River. In the Border Rivers, Murray cod and freshwater catfish spawning was detected, and silver perch, olive perchlet and purple-spotted gudgeon (all threatened species) were observed, further demonstrating the diverse fish community and its importance to Basin-wide populations. Movement of freshwater catfish and observations of olive perchlet were also recorded in the Gwydir catchment in 2017.

Seasonal conditions

Overall, conditions in the Basin in 2017 were warm and dry. The Basin experienced its driest June since 1986, its driest September on record and the driest winter in 15 years. Parts of the south-east Basin recorded the lowest rainfall on record for June. For the River Murray system, the drier conditions over winter and spring meant inflows were around half the historical average.

Late spring and early summer rain in parts of the southern Basin filled rainfall deficits that had emerged over the year, bringing annual rainfall totals in these parts to average. However most of the northern Basin, apart from in the north east, experienced below average rainfall in 2017. Catchments in the north east experienced well above average rainfall in March associated with Cyclone Debbie as well as above average rainfall in October, boosting soil moisture and runoff over the year. Cyclone Debbie resulted in the Border Rivers experiencing its highest rainfall on record during March.

For the fifth consecutive year, mean annual temperatures were well above average across the Basin. Higher evaporation rates were associated with the warmer conditions, affecting soil moisture and water storage levels.

Surface water availability

Drier conditions in the Basin over winter and spring 2017 have generally resulted in lower public water storage levels compared with the corresponding period last year. In the fortnight to 3 January 2018, the MDBA reported the volume of water in public storages in the Basin was 6,041 GL, or 72% of capacity. This was close to the long-term average for this time of year. However, storage levels across the Basin were variable, with the majority of this volume being stored in the southern Basin, particularly in the upper River Murray storages of Hume and Dartmouth. Storage levels in the northern Basin and lower Darling were mostly lower than those in the southern Basin. At 432 GL, Menindee Lakes in the lower Darling was at 25% of its storage capacity, triggering a red alert for blue-green algae.

The results of a comparison of storage levels as at 1 January 2018 with the historic record, are reported in Table 1. Overall, the results were as follows: the Border Rivers and the Murray System were above average; the Gwydir, Lachlan and Goulburn-Broken catchments were average, with remaining catchments being below average.

2018–19 resource availability scenario

The resource availability scenario helps water holders to plan the delivery of environmental water. Determining the resource availability scenario involves analysis of rainfall, soil moisture and runoff (indicators of antecedent climate conditions) over the previous year and current surface water availability based on public water storage levels in regulated systems. The analysis includes a comparison of these conditions with the historic record.

The MDBA also takes account of the Bureau of Meteorology's seasonal and longer-term forecasts; these provide an indication of potential changes in water resource availability.

We anticipate an overall drying trend in the Basin for early 2018–19. The resource availability scenario for individual catchments has been assessed as follows:

- Wimmera-Avoca as 'moderate'
- Murray as 'moderate to wet'
- Murrumbidgee, Goulburn-Broken, Eastern Mt Lofty Ranges and Moonie as 'dry to moderate'
- Lachlan as 'dry to wet'
- Warrego as 'very dry to dry'
- Border Rivers as 'wet', and
- remaining 10 catchments as 'dry'.

More details are provided in Appendix 1.

Effect of climate forecasts

Seasonal conditions over the months ahead will influence water resource availability. The seasonal forecast for rainfall in the Basin from April to June 2018 is for generally average conditions, with moderately wetter conditions in southern and eastern parts of the Basin during April. Daytime temperatures during April are likely to be cooler across most of the Basin becoming average during May and June. Night time temperatures between April and June are likely to be generally warmer, particularly in the south.

The Bureau of Meteorology announced on 13 March 2018 that the 2017–18 La Niña has ended following an easing back to neutral levels in the preceding weeks. This means the El Niño–Southern Oscillation (ENSO) Index has shifted to INACTIVE. The weak and short-lived La Niña had relatively little effect on Australian rainfall patterns over the 2017–18 summer. However, it may have kept temperatures higher than average in southern parts of the country due to weather patterns being slower moving, and further south than normal.

The Bureau advises the tropical Pacific Ocean is likely to remain ENSO-neutral through the southern hemisphere autumn and into winter. A neutral ENSO pattern does not necessarily indicate average rainfall and temperature for Australia. Rather, it indicates a reduced chance of widespread very wet or very dry weather, and that other climate drivers may have greater influence over the coming months.

The MDBA will update the resource availability scenario when it publishes the priorities in June to take into consideration changes in seasonal conditions.

Environmental watering opportunities in 2018–19 to support Basin-scale outcomes

Although the 2017–18 water year has been relatively dry to date, environmental water has been delivered to support the ecological responses to high flows in the previous year.

In the coming water year, we anticipate a range of seasonal conditions from very dry to wet in different catchments of the Basin but with a common drying trend. In 2018–19 the key focus for environmental water managers will be continuing to build on the wet conditions from two years ago, while having an eye to switching to a more conservative approach should drying conditions continue.

While good rain in 2016 gave native plants and animals a chance to bounce back, many need follow-up watering to boost their resilience for dry times ahead. In the current water year, managers have focused on helping fish to spawn, grow and move through the system. However, some species and sites need targeted actions over a number of years to recover.

In 2018–19 the best results for the environment will be achieved by continuing to build on the benefits of the 2016 flows. Moderate to high opening allocations are likely in the southern connected Basin, which will allow managers to use large volumes of environmental water once again.

Given the outlook, opportunities in drier catchments to deliver water for the environment will most likely focus on in-channel events, areas of the floodplains close to the main rivers, providing drought refuges and supporting critical habitats and ecological processes.

In catchments that are wetter, environmental water can be used to consolidate the improvements of the past two years so that water-dependent ecosystems are in good condition to support future breeding and recruitment, and better prepared to survive drier times. Should climate conditions continue to become increasingly dry, managers will deliver flows more cautiously to ensure sufficient reserves are maintained to deliver water into 2019–20.

Should conditions change during the water year, the MDBA will update its assessment of the resource availability scenario for each catchment. Environmental water managers may also refer to the rolling multi-year priorities on the MDBA website.

While environmental flows are important, there are other non-flow factors and risks that impact ecological communities. Managers should work together to achieve outcomes at multiple scales by being responsive to local conditions as well as natural climate signals.

River flows and connectivity in the Barwon–Darling River

Continuing dry conditions in the northern Basin have seen flow volumes gradually receding in the tributaries to the Barwon–Darling River, resulting in the river ceasing to flow at Bourke in mid-February 2018. While this ‘ephemeral’ pattern of flow is typical for many of the northern Basin’s rivers, water extraction has dramatically increased the frequency and duration of low-flow and cease-to-flow events.

Extended cease-to-flow events, particularly those in excess of 50 days duration at Bourke and 100 days duration at Wilcannia, are associated with deteriorating water quality and rising salinity. These conditions disrupt social and cultural activities in and around the river, and affect stock and domestic water users. Scientific studies also show that these conditions impede life cycle processes of many water-dependent animals and increase the likelihood of toxic algal blooms and fish kills.

Where possible, flows should be coordinated across this region to improve the connectivity of tributaries with the Barwon and Darling rivers, to protect the first flushing flow event through the system and reinstate low-flow events to freshen the series of disconnected pools acting as critical refuges for instream aquatic species. Australian Government and state agencies have recognised this need and are developing measures to protect flows.

Coordination and cooperation between environmental water managers, managers of planned environmental water and water access right holders will be necessary to facilitate a greater understanding of flows in this region, and maximise the benefits achieved for the environment and surrounding community. First flushing flows will need careful management to avoid anoxic (zero oxygen in the water) conditions being created in waterholes.

River flows and connectivity in the Coorong

Being at the end of the system, the Coorong, Lower Lakes and Murray Mouth complex is one part of the Basin that has been most affected by decades of reduced flow. Improving conditions in the Coorong requires a long-term approach as many of the key species and ecological processes within the system require specific flow regimes over multiple years. Although high flows in 2016 benefited this Ramsar-listed area, it remains a watering opportunity.

Restoring connectivity by increasing flows along the River Murray and its tributaries to the sea supports vital ecosystem functions. These include moving salt and sediment through the Murray Mouth and allowing native fish to move between marine, estuarine and freshwater environments. Without sufficient flows, salinity increases and connectivity between the ecosystems declines.

This environmental watering opportunity for 2018–19 builds on priorities from previous years and will maintain minimum hydrological connectivity between the freshwater, estuarine and marine environments in the Coorong.

Native vegetation

The long-term outcomes sought for native vegetation within the managed floodplain are intended to maintain the extent, improve condition and promote recruitment (where possible). Environmental watering opportunities should protect and support key water-dependent vegetation communities.

The 2017 Evaluation found that flooding in 2016 and 2017 has improved the condition of floodplain vegetation communities. In 2018–19, providing environmental water to these areas would build on this improvement and inundate areas that are experiencing a prolonged dry spell.

Expert advice suggests that lowering and raising the salinity levels beyond the optimal parameters for the Coorong system can have adverse effects, such as providing conditions that favour algal growth and altering the ecological character of the system. The presence of filamentous algae has been a significant issue in the Coorong recently, with major outbreaks occurring over summer in 2016 and 2017. Heavy loading of algae has hampered *R. tuberosa* reproduction and shorebird foraging in the Coorong; further research is being done to determine what triggers the presence of filamentous algae. This environmental watering opportunity for 2018–19 builds on priorities from previous years and will, where possible focus on maintaining habitat conditions of *R. tuberosa* populations.

Waterbirds

In catchments with a dry resource availability scenario the appropriate annual strategies will be to maintain foraging and roosting habitat at refuge locations, and support breeding where it is naturally triggered. In those catchments with a moderate resource availability scenario, other strategies will also be possible, such as maintaining habitat in event-ready condition.

One of the issues identified in the 2017 Evaluation was that there may be poor survival of juvenile waterbirds. Following large-scale waterbird breeding in 2016–17, it will be important in 2018–19 to consolidate waterbird response by providing flows to support the condition and survival of juveniles. Waterbirds are highly mobile, with some species breeding only after they reach three years of age. This means that to achieve long-term improvements in populations it is important that birds are supported through to adulthood.

This priority highlights the importance of maintaining productive habitats at a diversity of foraging environments. Ensuring there are vegetation habitats along water edges suitable for large and small waders as well as open-water foragers will build waterbird condition in preparation for the breeding season and improve recruitment success.

While many sites in the southern Basin had their watering requirements met in 2016–17 key waterbird assets in the northern Basin did not. In particular, Narran Lakes, which has been identified as an important Basin environmental asset for waterbird abundance and diversity, colonial waterbird breeding and shorebird abundance, urgently needs environmental water to maintain waterbird breeding and foraging habitat. With the exception of a small flow event in spring 2016 of around 25 GL, the last significant inflow into Narran Lakes was in April 2013, nearly five years ago. The MDBA encourages innovative approaches to enhance

inflows into Narran Lakes, such as event-based mechanisms for the protection of environmental flows, to improve the condition of waterbird breeding and foraging habitat.

Based on aerial survey data we are investigating a range of sites that should receive environmental water in 2018–19. These sites are listed in Appendix 3 of the Basin-wide environmental watering strategy.

The 2017 Evaluation found that while all functional waterbird groups have declined in abundance over time, this decline has been most severe for migratory and resident shorebirds. In the Coorong, a critical site for shorebirds, 2017 surveys demonstrated that numbers had dropped to their lowest on record. A watering opportunity in 2018–19 will be to actively manage water and other threats to improve foraging opportunities for shorebirds.

Native fish

The 2017 Evaluation concluded that the Basin Plan has arrested the decline, but not yet improved native fish populations. In the coming years it will be important to support the survival of threatened species and communities, maintain drought refuges in dry catchments, and enable growth, reproduction and recruitment for a range of species in moderate to wet conditions.

Following natural flooding and environmental water delivery in 2016–17 and 2017–18, it will be important to continue to build on golden perch and silver perch recruitment events in the southern connected Basin, by coordinating flows across catchments and administrative boundaries at appropriate times. A series of flow events over the coming years will encourage silver perch and golden perch to complete staged migrations and redistribute throughout the southern connected Basin. Flows through the system during the winter months will also support survival of juvenile Murray cod by providing food resources and habitat. Winter flows through the barrage fishways will support migrations of adult lamprey from the ocean into the River Murray. Aligning watering actions in the southern connected Basin to maximise outcomes is an important function of the Southern Connected Basin Environmental Watering Committee.

Opportunities to support recruitment, and distribution of important fish species in the northern Basin should be taken. Flows that lead to improved recruitment, food production and access to habitat are important for large-bodied species such as freshwater catfish, Murray cod, and silver perch, and small-bodied species such as olive perchlet. Using environmental water and protecting environmental flows in the Macquarie, Gwydir, Namoi and Border Rivers catchments will support these species. Opportunities to prepare sites for reintroduction of small-bodied threatened species using conservation stocking should also be taken, across both the northern and southern basins.

If dry conditions prevail in the Barwon–Darling River, then flows, particularly low flows, to preserve water quality and drought refuge habitats are critical to sustain native fish. If conditions become wetter in the Barwon–Darling system, flows through the system and into the Menindee Lakes and lower Darling River can support golden perch, and potentially silver perch, to disperse into the northern Basin. Barwon–Darling River flows may also cue golden perch spawning and larval drift into the Menindee Lakes and lower Darling River, starting the breeding cycle again.

Further reading

Water for the environment: <https://www.mdba.gov.au/managing-water/water-for-environment>

Basin-wide environmental watering strategy: <https://www.mdba.gov.au/managing-water/environmental-water/basin-wide-environmental-watering-strategy>

2017 Basin Plan Evaluation: <https://www.mdba.gov.au/basin-plan-roll-out/2017-basin-plan-evaluation>

Department of Environment, Land, Water and Planning (DELWP) monitoring of environmental flows from the River Murray into the Goulburn and Campaspe rivers: <https://www2.delwp.vic.gov.au/media-centre/media-releases/murray-cod-is-gold-and-perch-is-silver-in-the-numbers-game>

Appendix 1: Resource availability scenario

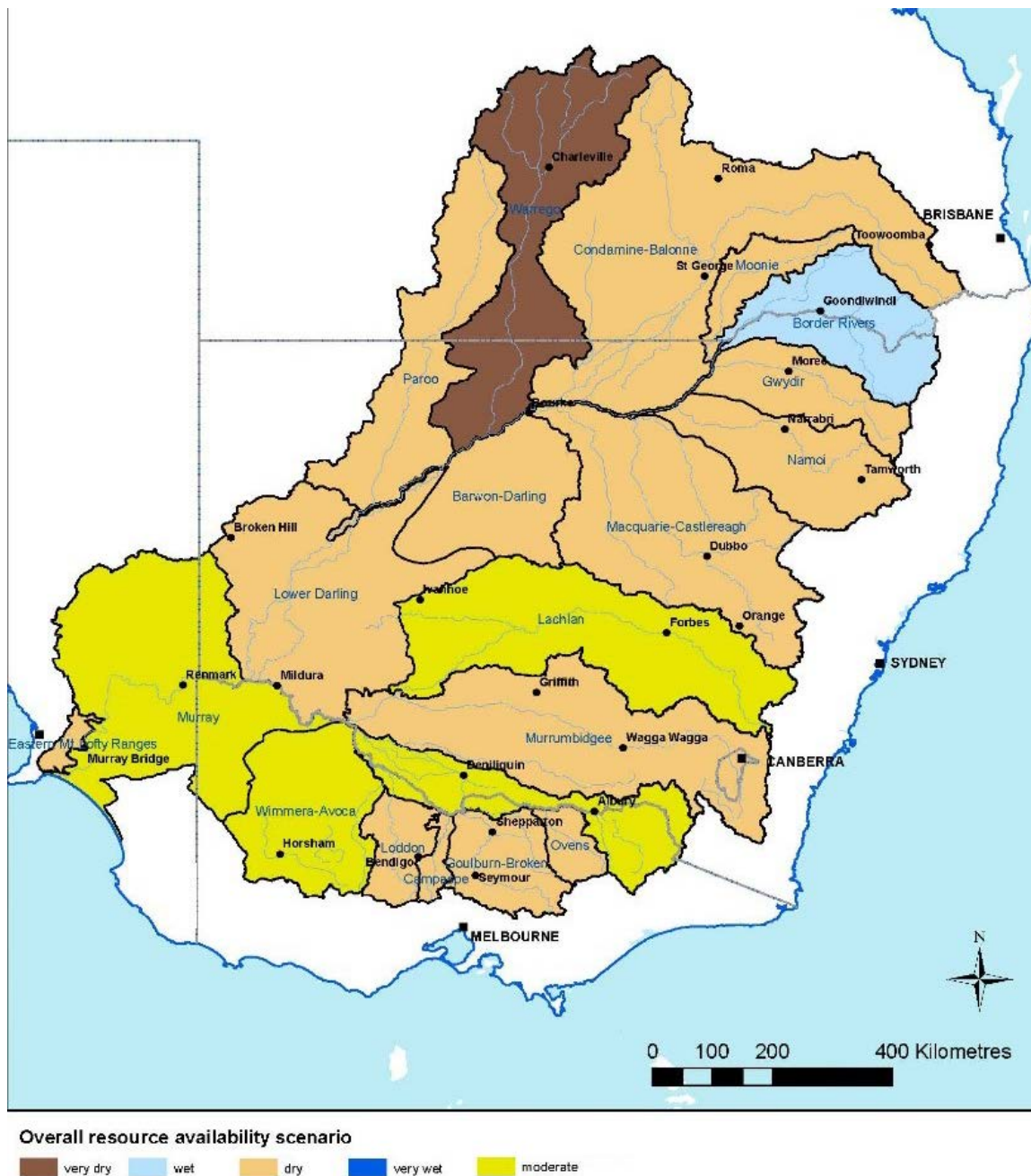


Figure 2: Resource Availability Scenario as at 1 January 2018¹

1. This figure has been produced on the results of the Resource Availability Scenario (RAS) calculation presented in Table 1. Where the RAS is expressed as a range in Table 1 (e.g. ‘wet to very wet’), the lower value (i.e. ‘wet’, in this example) has been used in the production of this figure. Where the RAS in Table 1 spans three values, the middle value is used in the production of the map (e.g. if the results in Table one span ‘dry to wet’ then, the RAS used in the production of the map would be ‘moderate’).

Table 1: Antecedent climate conditions and water storage levels for the catchments of the Murray–Darling Basin for the year to 1 January 2018¹

Catchment ² (Regulated = R; Unregulated = Unreg ³)	Runoff (%)	Root zone soil moisture (%)	Precipitation (%)	Antecedent percentile range (%)	Surface water percentile as at 31 December 2017 (%)	Resource Availability Scenario
Border Rivers (R)	46-60	46-60	46-60	46-60	61-85	Wet
Gwydir (R)	16-45	16-45	16-45	16-45	46-60	Dry
Namoi (R)	16-45	16-45	16-45	16-45	16-45	Dry
Macquarie–Castlereagh (R)	16-45	16-45	16-45	16-45	16-45	Dry
Lachlan (R)	61-85	16-45	16-45	16-45 to 61-85	46-60	Dry to wet
Murrumbidgee (R)	61-85	16-45	16-45	16-45 to 61-85	16-45	Dry to moderate
Lower Darling (R)	61-85	16-45	16-45	16-45 to 61-85	16-45	Dry
Murray (R)	61-85	16-45	46-60	16-45 to 61-85	61-85	Moderate to wet
Loddon (R)	46-60	46-60	46-60	46-60	16-45	Dry
Campaspe (R)	16-45	46-60	46-60	16-45 to 46-60	16-45	Dry
Goulburn–Broken (R)	16-45	16-45	46-60	16-45 to 46-60	46-60	Dry to moderate
Wimmera-Avoca (R)	46-60	46-60	46-60	46-60	N/A	Moderate
Moonie (UnReg)	16-45	16-45	46-60	16-45 to 46-60	N/A	Dry to moderate
Barwon–Darling ⁴ (UnReg)	16-45	16-45	16-45	16-45	N/A	Dry
Condamine–Balonne (UnReg)	16-45	16-45	16-45	16-45	N/A	Dry
Paroo (UnReg)	16-45	16-45	16-45	16-45	N/A	Dry

Catchment ² (Regulated = R; Unregulated = Unreg ³)	Runoff (%)	Root zone soil moisture (%)	Precipitation (%)	Antecedent percentile range (%)	Surface water percentile as at 31 December 2017 (%)	Resource Availability Scenario
Warrego (UnReg)	16-45	0-15	16-45	0-15 to 16-45	N/A	Very dry to dry
Ovens (UnReg)	16-45	16-4	16-45	16-45	N/A	Dry
Eastern Mt Lofty Ranges (UnReg)	46-60	16-45	46-60	16-45 to 46-60	N/A	Dry to Moderate

1 The method for calculating the water resource availability scenario (RAS) is set out in the *Guidelines for the method to determine priorities for applying environmental water* (MDBA 2012): <https://www.legislation.gov.au/Details/F2012L02240/4fdd68b4-f6f1-4fed-978d-29e06bb8b525> .

2. Based on the best quality data available at the time of writing for public water storages for regulated systems in the Basin. Unregulated systems do not include an assessment of the surface water availability when calculating the RAS. Private water storages have not been included in calculation of the RAS.

3. For unregulated catchments only antecedent climate conditions can be applied to determine the catchment RAS given the absence of public water storages.

4. There is some uncertainty in the RAS outlook for this catchment. Given this uncertainty the applicability of the RAS determination method for this catchment will be further investigated to inform future Basin environmental watering outlooks.

Office locations
Adelaide
Albury-Wodonga
Canberra
Toowoomba

 mdba.gov.au

 1800 230 067

 engagement@mdba.gov.au