



Australian Government



**MURRAY—  
DARLING**  
BASIN AUTHORITY

# Basin Plan Evaluation 2017



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**Evaluation**

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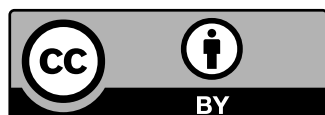


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### **Acknowledgement of the Traditional Owners of the Murray–Darling Basin**

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.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

Revised 18 July 2018. p38, Figure 10

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## Foreword

The Basin Plan is a long-term investment to build a sustainable Murray–Darling Basin.

Achieving a healthy working Basin will take time and the Basin Plan will not be implemented in full until 2024. Five years in, many elements of the Basin Plan are on track and there have been some significant achievements, but progress is lagging in several important areas.

While there is challenging work ahead, the Murray–Darling Basin Authority (MDBA) is confident that with renewed commitment, all of those involved can work together to fully deliver the Plan. The Plan must keep going, while remaining flexible and learning from the past. Like all major natural resource management initiatives the Basin Plan is adaptable, and the results of the *2017 Basin Plan Evaluation* now provide knowledge that can be applied to improve the use and management of the Basin water resources.

The *2017 Basin Plan Evaluation* has confirmed there are positive signs of improved environmental health, many farmers are adapting and modernising their practices, and water markets are functioning to facilitate water trade.

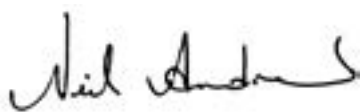
Since 2008, more than three quarters of the original environmental water recovery target has been achieved. At the time of delivering this evaluation, the Sustainable Diversion Limit Adjustment Mechanism was being prepared for consideration — if this comes into force, then water recovery will be complete, or nearly complete, for many regions.

The evaluation has provided initial insights into how agricultural communities have been affected by water recovery. These impacts have varied – some communities appear to be adapting well, but others have found the transition more difficult. More work remains to better understand the impacts of the Basin Plan on communities, noting there are a range of factors that affect communities in the Basin, and the Basin Plan is just one of these factors. That work will be done in early 2018.

The evaluation identifies three key areas that need increased attention for the Basin Plan to succeed — the development of water resource plans, strengthened compliance regimes, and better ways of measuring water take. These issues have been addressed by the *Murray–Darling Basin Water Compliance Review*, released in November, which sets out the actions required for all jurisdictions to improve on these aspects of the Plan.

For too long the Basin Plan has been in question, and the results of the Plan have not been communicated clearly. In this, the *2017 Basin Plan Evaluation Report*, the outcomes of the Plan in the initial five years are clear — the Basin Plan is working and there have been some positive outcomes.

A healthy working Murray–Darling Basin is a shared responsibility. Some very challenging work lies ahead. Basin governments and the MDBA will need to be fully committed and work together to deliver the Basin Plan on time and in full.



Neil Andrew  
Chair, Murray–Darling Basin Authority

# 1. About this report

## What is the purpose of this evaluation?

The 2017 evaluation of the Basin Plan is a health check on Basin Plan progress five years in.

The Basin Plan's monitoring and evaluation program requires five yearly reporting on the outcomes and effectiveness of the Basin Plan. Initially, the first five yearly evaluation was due to take place in 2017. In 2014 an independent review of the Water Act recommended shifting the five yearly evaluation cycle to start in 2020, so that it better aligned with implementation milestones and a number of other Basin Plan reviews.

The Australian Government agreed to this recommendation, but also suggested the Murray–Darling Basin Authority (MDBA) consider conducting a pilot or interim evaluation in 2017 to provide preliminary results to communities on key areas of interest. The MDBA agreed to this, noting that an interim evaluation would also help inform preparation of the first full evaluation involving all Basin governments in 2020.

With the Basin Plan not yet fully implemented, the purpose of this evaluation is to:

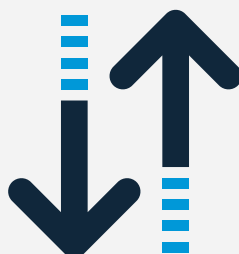
- report to stakeholders about whether the implementation is on track and outcomes so far
- identify options to improve future implementation
- lay the groundwork for a more detailed evaluation in 2020, which will include reports from all Basin governments.

## What is in the interim evaluation?

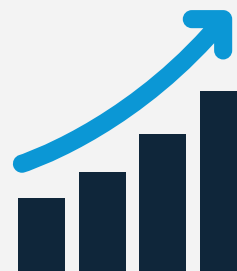
This evaluation focuses on progress in implementing the Basin Plan and the environmental, social, cultural and economic outcomes so far. It covers all elements of implementation, from water planning and management, to the recovery and use of environmental water. The evaluation looks at the actions of all Basin governments, the Murray–Darling Basin Authority and the Commonwealth Environmental Water Holder in accordance with their roles in implementing the Plan. The evaluation seeks to answer three key questions:



**Is Basin Plan  
implementation on track?**



**What are the  
outcomes so far?**



**How can implementation  
be improved?**

The report is structured in two major sections. The first section discusses progress with Basin Plan implementation, and the second looks at the outcomes from implementation so far. Based on this, a concluding section seeks to answer the question of whether the Basin Plan is on track by measuring progress against Basin Plan objectives and what was expected at this early stage of implementation.

## **What has informed this report?**

The evaluation findings are based on new technical analysis. The analysis drew on the broad range of knowledge, expertise, and information developed since the Basin Plan was made in 2012. Partner governments, experts, scientists and community members were also consulted on the evaluation methodology and analysis used to develop this report.

The supporting information base includes water recovery information, long-term environmental monitoring data, water use data, hydrologic modelling, census data, and annual reports on Basin Plan implementation and environmental watering events.

A series of reports that describe the evaluation analysis and results are available on the MDBA website. In addition, the data sets that underpin the evaluation are available from the Australian government website: [data.gov.au](https://data.gov.au). A full list of the technical reports and data used is in Appendix A.

## 2. Summary

The Basin Plan is about achieving long-term sustainability for industries, communities and the environment of the Murray–Darling Basin. To do this the Basin Plan is rebalancing water use to sustainable levels and introducing new measures to use water more efficiently and effectively. Together these measures are designed to deliver water management that is integrated across state boundaries, can be adapted as knowledge improves, and will improve water security for all water users in the long term. All Basin governments have critical roles to play in implementing the Plan and moving to a new, whole-of-system approach to managing the Basin's rivers.

A healthy working Basin may take many years to achieve, but at this early stage there are good signs that the Basin Plan is working and many elements are on track to deliver the intended outcomes. Progress is lagging in several important areas and some very challenging work lies ahead to fully realise the benefits of the Basin Plan. Basin governments will need to be fully committed and work together to deliver the Basin Plan on time and in full.

This evaluation has looked at each element of Basin Plan implementation to see if it is on track; what social, economic, environmental and cultural outcomes can be seen so far; and what still needs to be done. Overall the MDBA's conclusion is that, while many elements of the Basin Plan are on track, and there have been some significant achievements, progress is lagging in several important areas.



Figure 1: Understanding how the elements and implementation of the Basin Plan work.

Water recovery sits at 77% of the original target, but is likely to be almost complete once the work currently underway to adjust the sustainable diversion limits (SDLs) is finalised. This recovery has been achieved through a variety of innovative means that have acted to keep the buyback of water entitlements to a minimum. As a result, the potential impacts on irrigation industries and communities across the Basin are likely to be less than originally envisaged. The Basin economy, including agriculture, has continued to grow and impacts from the Basin Plan are hard to discern at the Basin scale. But the effects have nevertheless been felt within Basin communities. These effects are likely to be unevenly spread because it is influenced by the volume of recovery in each community, how it was recovered, as well as the social and economic circumstances of each community. Acknowledging this, the MDBA is undertaking further work to explore the differing outcomes at the local and regional scale which will be released April 2018.

Water recovery  
sits at  
**77%**

Over **750**  
environmental  
watering events in the  
last four years

The evaluation has shown the recovered water is being put to good use, with over 750 environmental watering events in the last four years. Environmental water holders are working together to coordinate their watering actions to support a range of environmental outcomes. Basin-wide and local scale watering plans have been developed and these, as well as a system of annual watering priorities, are successfully guiding environmental water holders on how best to use their water. Water has been used to achieve better outcomes for fish, waterbirds and native vegetation, and the responses are promising.

There are some key areas where progress is on track but some substantial challenges lay ahead. These include implementing a set of actions that complement water recovery, referred to as toolkit measures, to improve environmental outcomes in the northern Basin. These actions were agreed by governments as part of the outcomes of the Northern Basin Review. Another challenging but important task is the implementation of supply and efficiency measures in the southern Basin.

There are other areas where progress has been slower than required, and needs renewed commitment and effort by governments – namely, the development of water resource plans, strengthened compliance regimes and sound water accounting arrangements. While the development of all water resource plans is underway, only one plan of 33 has so far been accredited, and there is a significant risk these plans will not be in place in all areas by July 2019, when the new sustainable diversion limits take effect. The recent Murray–Darling Basin Water Compliance Review (the Compliance Review) found Basin states must do more to increase the robustness, transparency and consistency of compliance and enforcement across the Basin, and that the MDBA should be more assertive in performing its role.

There are some key areas  
where progress is on track

There are other areas where  
progress has been slower  
than required, and needs  
renewed commitment and  
effort by governments



The Basin Plan is a complex and major reform being played out in highly contested space where any negative impacts may be more immediately apparent compared with the expected long term benefits. Future implementation needs renewed commitment and sustained effort by all governments, not just to deliver the remaining components of the Plan, but to also consult and engage with communities to build trust and acceptance of this major reform.

## Outcomes from water recovery

Re-balancing water use in the Murray–Darling Basin by the amount required by the Basin Plan was always going to be challenging for governments, irrigation industries and communities. The challenges were possibly made greater coming so soon after the millennium drought that severely affected irrigators, communities and the environment. Over the last 10 years the Australian Government has invested billions of dollars to rebalance water use in the Basin, supplementing buybacks with investment in infrastructure. This has not only helped keep social and economic impacts to a minimum, but also brought about positive changes, providing economic stimulus in some areas and helping to modernise the irrigation industry. This approach has been successful and when the current process to adjust the sustainable diversion limit concludes it is likely that surface water recovery will be largely complete. Any further recovery through efficiency measures will only be undertaken provided there are no adverse social or economic impacts as required under the Basin Plan.

But keeping impacts to a minimum does not mean that there have been no impacts. As already noted, the outcomes of water recovery for irrigation industries and communities have been hard to discern at the Basin scale, particularly given the many other drivers of change. The effects are being felt in some communities. Broader changes occurring across regional Australia, such as population and employment changes, have both amplified and insulated to a differing extent, the effects of implementation on different Basin communities. Understanding the outcomes for irrigation industries and communities requires fine scale analysis. In November 2017 the Australian Bureau of Statistics provided the latest population and employment data from the 2016 Population and Housing Census to the MDBA. The MDBA will be using this data, together with recently assembled data on [water recovery at the local scale](#) to undertake a detailed analysis of Basin Plan impacts at the community level for the southern Basin. This is similar to the work already undertaken in the northern Basin as part of the Northern Basin Review. Due to the required data from the Australian Bureau of Statistics only just becoming available, this work will not be completed until April 2018.

## Environmental outcomes

Compared with the often more immediate effects being felt in communities, Basin scale environmental outcomes will take a long time to occur. Environmental watering involving such large volumes at this geographic scale is a relatively new endeavour, and there is much to learn. Aware of the challenges ahead, Basin governments and local water managers have already started this work. They have worked together to successfully deliver environmental water on over 750 occasions between 2012–13 and 2016–17. This environmental watering is being done using a whole-of-system approach to get water to the highest priorities, with watering actions increasingly involving collaborative efforts by multiple water holders.

This water has helped improve river flows and connectivity in many parts of the system and there is clear evidence of local-scale

Successfully deliver  
environmental water  
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outcomes with positive ecological responses from birds, fish and vegetation. Water has been successfully used to prime habitat to support waterbird breeding. Following a long-term decline in waterbird numbers there is evidence of positive responses in populations following large-scale flooding with subsequent recruitment supported by environmental water provided under the Basin Plan.

Environmental water has also been used to successfully support native fish spawning and help fish move through the system. Encouragingly, there has been a lot learnt about breeding sites and flow requirements of key species including iconic species such as Murray cod, and silver and golden perch. Additional flows along the length of the river to the ocean are also helping maintain water quality and flush salts out to sea. Measuring outcomes for restoring vegetation, particularly on floodplains is more difficult, especially in the short term. But at some key sites on the floodplain where environmental water has been delivered, improvements in the health of river red gum and black box forests have been observed.

There are many other factors besides water that influence environmental outcomes. These include natural resource management issues such as pest control (including carp), barriers to fish movement and cold water pollution. Some of these are being addressed through a set of actions that will complement water recovery in the northern Basin. These actions emerged from the Northern Basin Review. Basin governments will also need to take a collaborative and coordinated approach to managing these non-flow related factors in the southern Basin.

Physical constraints to how river operators can manage regulated flows on the floodplain, and other policy impediments related to water accounting and management of environmental water in downstream catchments do limit the options for how environmental water can be used. Governments have established clear policy objectives in each of these areas. It will be important for Basin governments to work closely with communities to move more quickly to address these policy impediments if water holders are to optimise the use of environmental water. Improved communication and engagement will be required where there are legitimate community concerns.

## **Water markets**

Water markets are integral to modern water management in the Basin, providing irrigators and environmental water users with a vital tool for responding to variable water availability. The Basin Plan water trade rules are aimed at supporting a more open and transparent water market. States have made progress with bringing their trade rules into line with the Basin Plan and the removal of major obstacles to permanent water trade by 2014 was a major step forward. The water market is maturing and has become an important avenue for moving water to its most productive use. Further work is needed to better understand changes in the way the market is operating as this will help identify opportunities to make changes to further improve the efficiency of the water market.

## **Water resource planning and compliance**

Water resource plans are a key component in setting up the regulatory system underpinning the Basin Plan. At this stage, preparation and accreditation of water resource plans is well behind schedule, with only one of 33 plans in place. While some sound preliminary work has been done and governments are working on more efficient ways to complete this task, there is a risk that not all plans will be accredited by mid-2019. Failure to complete the plans on time will mean the benefits from establishing a system wide approach to water regulation may not

At this stage, preparation and accreditation of water resource plans is well behind schedule, with only one of 33 plans in place.

be captured, and undermine the certainty and confidence that entitlement holders and communities need to plan their long-term futures.

Water resource plans must be underpinned by sound water accounting arrangements and an effective compliance regime. Further work is required to refine water accounting as part of the transition from the old Murray–Darling Basin Cap to the new sustainable diversion limits by 2019. This includes improving the accuracy of how water take (or consumption) is measured or estimated each year.

The recently completed Compliance Review found that Basin states—particularly New South Wales and Queensland—must do more to increase the robustness, transparency and consistency of compliance and enforcement. The Compliance Review suggests the implementation of a ‘no meter, no pump’ policy, more transparency of compliance activities, and a more comprehensive suite of penalties that are actually used rather than just sitting on the shelf. The majority of irrigators across the Basin do the right thing and abide by the rules—and they deserve to have confidence that their commitment to compliance is not being undermined by those who are breaking the law. Furthermore, the Compliance Review has found that the MDBA and Basin governments have work to do to ensure the protection of environmental water to ensure outcomes and a level playing field for irrigators.

The Compliance Review suggests the implementation of a ‘no meter, no pump’ policy.

A lot of hard work has been completed and some significant milestones achieved in implementing the Basin Plan. The early outcomes are promising, but there remains a significant amount of challenging work to do to ensure the full benefits of the Basin Plan are realised. Basin governments and the MDBA must fully commit to the timely completion of water resource plans, underpinned by an improved water accounting and compliance framework. In addition, environmental outcomes will only be optimised, and social and economic impacts minimised if Basin governments work diligently with communities and industries to fully implement the northern Basin toolkit measures, and the supply measures which have been agreed through the SDL Adjustment Mechanism process. No less than full commitment from all Basin governments will achieve the long-term outcome of the healthy working Basin.

## 2.1 Implementation report card

This report card presents the assessment of progress with implementation on the various Basin Plan measures. While listed individually, in practice they are an integrated set of implementation activities that work together to deliver the intended outcomes from the Basin Plan.

	Not started	Started at risk	Started on track	Done	Findings	Recommendations
Recovering water for the environment					<p><b>IF1:</b> Water recovery is almost complete in most parts of the Basin. The volume of water buybacks has been much less than originally expected due to the focus on investments in water savings and the expected operation of the SDL Adjustment Mechanism. This has helped minimise the effects of water recovery. Urgent work still needs to be done to clarify the remaining water recovery task.</p>	<p><b>IR1:</b> Basin governments need to urgently complete work to finalise planning assumptions and the associated cap factors in order to clarify the remaining water recovery task and provide certainty for communities.</p>
Managing environmental water					<p><b>IF2:</b> The Basin Plan has provided a robust framework that has been used to guide more than 750 environmental watering events across the Basin. Environmental water holders are cooperating and collaborating more often to deliver better environmental outcomes.</p>	<p><b>IR2:</b> The Basin governments and the MDBA should review Basin Plan reporting to make it more useful for environmental water planning and management.</p>
Maintaining water quality					<p><b>IF3:</b> Salinity management over the last 30 years shows difficult environmental problems can be overcome with commitment and cooperation from all stakeholders. The Basin Plan is helping to reduce salinity levels by providing more fresh water in the Basin's rivers.</p>	<p><b>IR3:</b> Basin governments and the MDBA should continue to investigate and analyse data on dissolved oxygen levels and the transfer of organic matter into river systems to develop improved management actions which can help mitigate blackwater events.</p>
Northern Basin and groundwater reviews					<p><b>IF4:</b> The northern Basin and groundwater reviews were successfully completed and the SDLs have been changed through an amendment to the Basin Plan. New South Wales, Queensland and the Australian governments have committed to complementary actions in the northern Basin that will help deliver the intended outcomes.</p>	
SDL Adjustment mechanism					<p><b>IF5:</b> Thirty six state-nominated projects have the potential to reduce the southern Basin water recovery target by 605 GL through the SDL Adjustment Mechanism. Substantial work remains to deliver the agreed projects by 2024, including stakeholder engagement.</p>	<p><b>IR5:</b> Basin governments should more closely involve Basin communities in the design, implementation and delivery of the nominated projects to build community understanding and acceptance of the projects.</p>

	Not started	Started at risk	Started on track	Done	Findings	Recommendations
Water resource planning					<b>IF6:</b> Development of water resource plans is well behind schedule. There is a high risk that some plans will not be accredited by the mid-2019 deadline, which would affect compliance with SDLs and create uncertainty for water users. There is a large amount of work to do and there can be no further delays.	<b>IR6:</b> Basin governments and the MDBA must redouble efforts and work closely together to get all water resource plans in place by June 2019. Dedicated resources and more efficient and streamlined processes will be essential to meeting timelines.
Transitioning to SDL accounting and compliance					<b>IF7:</b> Development of new water accounting methods needed for SDL accounting is progressing well, but the techniques for measuring some forms of water take require further development. This work underpins SDL compliance and provides the basis for transparent reporting.	<b>IR7:</b> The MDBA and Basin states must complete the large body of work remaining to develop a robust basis for measuring water take, and transparent reporting on SDL compliance.
Water trading rules					<b>IF8:</b> Basin states have made progress in aligning their trading rules with the Basin Plan. This has helped improve the operation of water markets which is important for water users looking to adapt to changing water availability and other drivers of change.	<b>IR8:</b> Basin states and the MDBA must give high priority to identifying and removing unreasonable restrictions on allocation trade, especially in the southern Basin.
Compliance					<b>IF9:</b> The MDBA's Basin-wide Compliance Review, supported by an independent panel of experts, found an urgent need for Basin states and the MDBA to take immediate steps to improve compliance arrangements to develop trust in the Basin Plan arrangements. MDBA has committed to implement all of the actions identified in the review.	<b>IR9:</b> Basin states should adopt the recommendations in the MDBA's Basin-wide Compliance Review, and COAG should commit to a Basin Compliance Compact to be developed and published by 30 June 2018, with regular reporting thereafter.
Monitoring, evaluation and reporting					<b>IF11:</b> Basin governments and the MDBA have met their first five years of Basin Plan reporting requirements. There is potential to collect more targeted monitoring information, and enhance reporting to make it more useful for those implementing the Basin Plan.	<b>IR11:</b> Basin governments should continue to support the shift to more evaluative Basin Plan reporting, and ensure Basin Plan monitoring, evaluation and reporting is actively used to improve Basin Plan implementation.

## 2.2 Outcomes report card

This report card summarises the outcomes from five years of Basin Plan implementation compared with what was expected at the time of writing the Basin Plan. These outcomes are influenced by a range of factors outside implementation activities.

	Not as expected	Below expected	As expected	Above expected	Findings	Recommendations
Environmental outcomes					<p><b>OF1:</b> Early signs indicate that where environmental water can be delivered there is a positive response from native fish, waterbirds and native vegetation. Water for the environment is critical for Basin health. Full implementation of the Basin Plan and management of non-flow related factors will further enhance its effectiveness.</p>	<p><b>OR1:</b> Basin governments should continue with full implementation of the Basin Plan by 2024, as the management of all aspects of the SDL Adjustment Mechanism and protection of environmental water are critical to getting the best possible environmental outcomes.</p>
Water quality and salinity outcomes					<p><b>OF2:</b> Salinity levels continue to meet targets at four out of five monitoring sites. The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reduced salinity levels and helping to flush salt into the Southern Ocean.</p>	<p><b>OR2:</b> The 2020 review of salinity targets should examine the appropriateness of the target at Burtundy. The overall salt export objective should also be revisited in the context of the Basin's variable climate.</p>
Basin scale social and economic condition					<p><b>OF3:</b> Observed changes in social and economic conditions at a Basin scale are consistent with those expected at this stage of Basin Plan implementation. Despite the recovery of water for the environment, the Basin population and economy have continued to grow.</p>	
Effects of water recovery at the community scale					<p><b>OF4:</b> The volume of water buybacks relative to that acquired from investments in water savings has been very different across Basin communities. These variations, combined with the effect of other drivers of change, are likely to have affected the social and economic conditions in Basin communities. More work to tease apart these influences is underway and will be released in April 2018.</p>	

	Not as expected	Below expected	As expected	Above expected	Findings	Recommendations
Social and economic outcomes from environmental water					<b>OF5:</b> At this early stage of implementation, the scale of environmental improvement is such that the flow on social and economic benefits are difficult to observe. Site-specific examples provide some indication of the potential range of positive social and economic outcomes that might be expected in the future.	
Outcomes for Aboriginal communities					<b>OF6:</b> Culturally-appropriate methods are being used to increase involvement of Traditional Owners in a range of water planning and management activities, and in the evaluation of Basin Plan outcomes for Aboriginal people.	

The full list of findings and recommendations for implementation and outcomes can be found at Appendix B.



### 3. About the Basin Plan

The development and use of water resources in the Murray–Darling Basin has provided many social and economic benefits for the Australian economy and the Basin residents for more than 100 years, including building a productive irrigated agriculture sector. In the later 1980s, as more and more water was being taken from the rivers, signs began to appear that the cumulative level of development had gone beyond what could be sustained in the long term. These signs included increasing salinity levels, species loss and a decline in the health of the Basin’s rivers, floodplains and wetlands.

**There are a range of measures in the Basin Plan designed to operate together to deliver the Basin Plan’s objectives. If these objectives are achieved, the outcome will be a healthy working Basin.**

#### Implementation

The objectives for the Basin Plan as a whole are:

- a) to give effect to international agreements through integrated water management
- b) Establish a sustainable and long-term adaptive management framework
- c) Optimise social, economic and environmental outcomes in the national interest
- d) Improve water security for all uses of Basin water resources

**Which are implemented via the following mechanisms:**

- Water recovery
- Managing environmental water
- Maintaining water quality
- Reviews and adjustments
- Water resource planning
- Transitioning to SDL compliance
- Water trading rules
- Compliance
- Working together
- Monitoring, evaluation and reporting

#### Outcomes

To achieve these longer term outcomes:

- Communities with sufficient and reliable water supplies
- Communities with confidence in their long-term future
- Productive and resilient water-dependent industries
- Healthy and resilient ecosystems

**Which are observed through:**

- Environmental outcomes
- Salinity and water quality outcomes
- Social and economic outcomes
  - Effects of water recovery at the Basin and community scale
  - Social and economic outcomes of environmental water
  - Outcomes for Aboriginal people

Figure 2: The objectives and outcomes of the Basin Plan



In the 1990s Basin governments responded by introducing a Cap on diversions from the Basin's rivers, and in 2004 agreed to the initial phase of recovering water for the environment through The Living Murray initiative. These actions were not sufficient to bring the system back to sustainability. It became clear that a coordinated, Basin-wide approach to water management was needed, together with further water recovery.

In 2007, all Basin governments agreed to a fundamental reset in the balance of water use in the Basin. In order to secure a healthy and productive future for the Basin, a new approach to water management was introduced through the *Water Act 2007*. This was accompanied by an Australian Government commitment to an extensive program to recover water for the environment through the purchase of water entitlements and investments to save water through the modernisation of irrigation infrastructure.

In 2012, the Basin Plan was finalised. At its core was a new sustainable diversion limit (SDL) on the average amount of water that could be extracted from the Basin. The Basin Plan contains a range of measures all designed to work together in delivering the long-term objectives of integrated, sustainable and adaptive management and ultimately a healthy working Basin to the benefit of all Basin residents and the nation (See Figure 2).

## **Roles and responsibilities under the Basin Plan**

The Basin Plan is premised on the MDBA and Basin governments working together to collectively achieve what no single government can do – manage the Basin as a whole. While the MDBA has a particular role in developing and helping guide implementation, agencies from all Basin states and the Commonwealth are involved in implementing the Basin Plan. For example, while water resource plans must be adopted by the Commonwealth Water Minister, they are prepared and implemented by states, and assessed for consistency with the Basin Plan by the MDBA (See Figure 3 for more on roles and responsibilities).

Many aspects of the Basin Plan require governments to consult and work with communities to achieve better outcomes. In broad terms, the Basin Plan is a collective effort and regular review and evaluation can help all governments and the community check on progress and draw together insights for improvement.

## **Context**

The Murray–Darling Basin is a complex and dynamic natural and economic system. The Basin is one of Australia's most productive agricultural regions, producing more than one third of the nation's food. The Basin spans five jurisdictions and extends over 1 million square kilometres, providing water for over three million people. The rivers, lakes and wetlands are culturally significant to Aboriginal people and support a diverse range of ecosystems, plants and animals (see Figure 4). Much has happened over the last five years that has influenced the outcomes from Basin Plan implementation (see Figure 5).

Climate is perhaps the most influential driver of change, particularly for the natural environment. The Basin's climate is highly variable and is characterised by large variations in rainfall between years, as well as extreme events such as floods and droughts. The climate experienced in the Basin since 2012–13 demonstrates this variability (see Figure 6). There were near average conditions in 2012–13, but each subsequent year through to 2015–16 was steadily drier and hotter. There was a distinct return to wetter conditions in May 2016, with above average rainfall and inflows across much of the Basin in 2016–17.

Areas of Queensland, New South Wales and Victoria entered drought at various times between 2012 and 2017, and maximum and minimum temperatures exceeded the highest on record in some areas.

## Roles and responsibilities



### SUSTAINABLE DIVERSION LIMIT ADJUSTMENT MECHANISM

**Basin states**  
*propose and deliver projects*

**MDBA**  
*program assessment  
and monitoring*

**Department of Agriculture  
and Water Resources**  
*project funding and  
implementation*



### RECOVERING WATER

**Department of Agriculture  
and Water Resources**  
*strategic purchases and  
efficiency programs*

**Basin states**  
*implementation  
of some efficiency  
programs*



### WATER RESOURCE PLANS

**Basin states**  
*development and  
implementation*

**MDBA**  
*assessment and  
accreditation*



### COMPLIANCE

**Basin states**  
*implementation and  
enforcement*

**MDBA**  
*monitoring and  
Basin-scale compliance*



### WATER FOR THE ENVIRONMENT

**MDBA**  
*Basin-scale planning,  
coordination and  
prioritisation*

**Basin states**  
*local-level planning  
and implementation*

**Commonwealth  
Environmental  
Water Holder  
(CEWH)**  
*planning and  
implementation across  
the Basin*



### MONITORING AND EVALUATION

**MDBA**  
*Basin Plan evaluation  
and monitoring*

**Department of Agriculture  
and Water Resources**  
*water recovery program  
monitoring*

**Basin states**  
*reporting requirements*

**CEWH**  
*monitoring results of  
environmental watering*



### RIVER MURRAY OPERATIONS

**MDBA**  
*operations and  
management*

**Basin states**  
*day-to-day management  
of dams, locks, weirs  
and barrages*



### WATER MARKETS AND TRADE

**MDBA**  
*information and compliance*

**Basin states**  
*implement the rules*

**ACCC**  
*advice on rules and  
complaints*

Figure 3 Roles and responsibilities of agencies for Basin Plan implementation activities

## State of the Basin in 2017



**2.66 million**  
people live in Basin



**46**  
native fish species



**30,000+**  
wetlands



**16**  
RAMSAR listed sites



**35,000 GLs**  
water storage



**40+**  
Aboriginal nations



**Over 3 million**  
people use water  
from the Basin



**9,200**  
irrigated agricultural  
businesses



**77,000 km**  
of rivers, many are  
connected



**10 years**  
the average time  
between major droughts



**120**  
waterbird species  
visit the Basin



**95%**  
of diversions used  
by agriculture



**\$8 billion**  
of tourism in the Basin



**\$22 billion**  
agriculture, \$7 billion  
irrigated agriculture

Figure 4: Key facts about the Murray–Darling Basin as at 2017

# External influences

There are a number of issues that the Basin Plan does not directly address. Even if implementation is going well, these external factors influence Basin Plan outcomes.



## Climate

Basin's variable climate affects inflows



## Inflows

The amount of water coming into the system



## Flow barriers and storages

River regulation and infrastructure



## Resource management

Activities to improve the health of the landscape



## Land clearing

Affects habitat and water quality



## Invasive species and disease

Weeds, feral animals, and diseases



## Development

Urban, agricultural and industrial



## Habitat availability

Important for animals to survive



## Water quality

Impacted by urban, agricultural, and other land use



## Energy costs

Impacts the cost of doing business



## Commodity prices

and exchange rates



## Interest rates

Impacts the cost of borrowing



## Technology and mechanisation

Communications, transport infrastructure and better farm equipment



## Demographics and structure

Number of people, age, and employment



## Policy and regulation

Outside of the Basin Plan

Figure 5: External influences on Basin Plan implementation

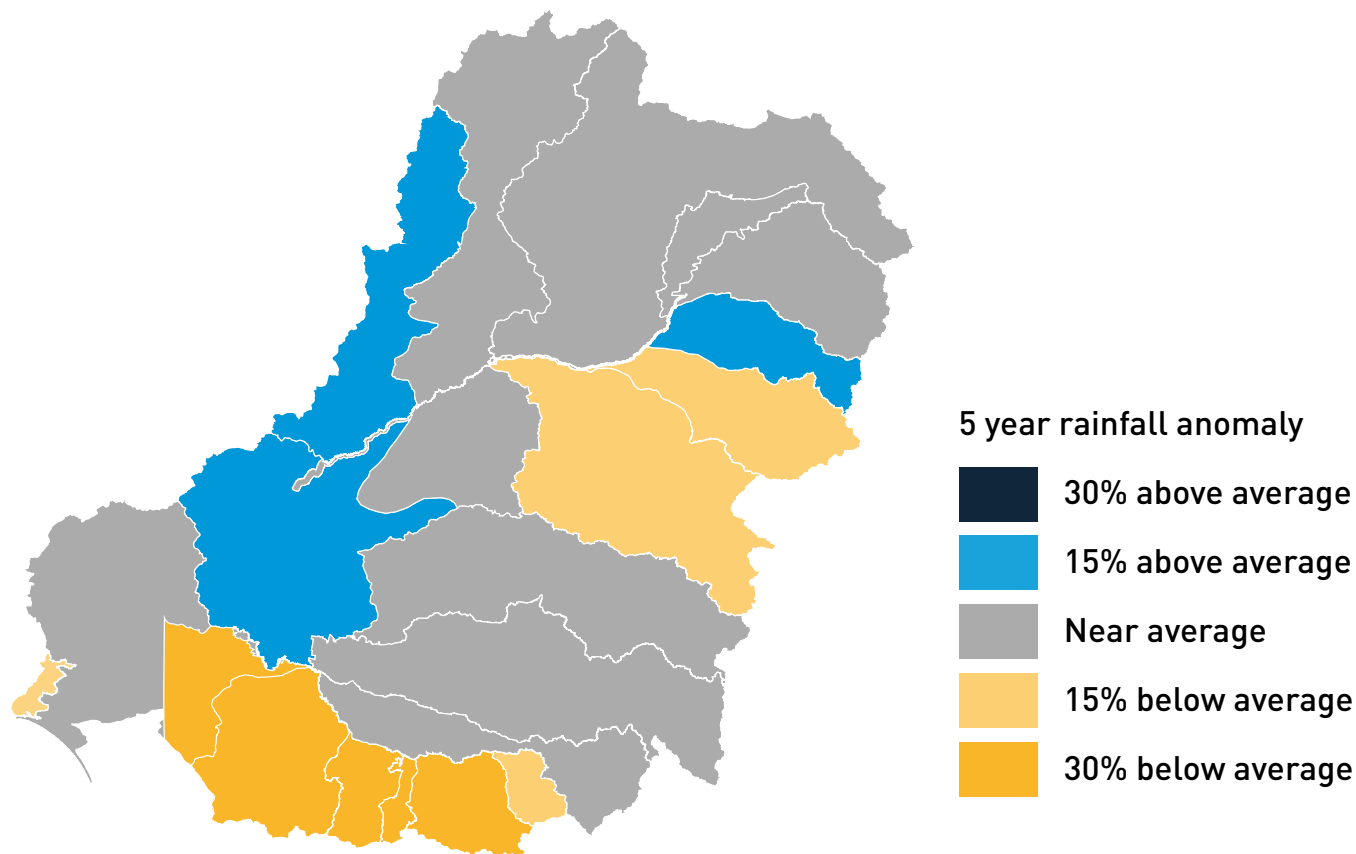


Figure 6: Five year Rainfall anomaly (2011-16) for each Basin Plan region (Data sourced from the AWRA-L model - Bureau of Meteorology, 2017)

There are other important social and economic drivers of change affecting the outcomes of interest to this evaluation. There have been ongoing changes in population numbers and structure, some of which are the result of trends which have been apparent for decades. The long-term trend of reduced labour demand in agriculture is perhaps the most significant, and this has had a very large impact on the smaller regions and communities in the Basin. Related to this is the ongoing productivity improvements in the agricultural sector which have been underpinning growth in agricultural production for decades.

Over the past five years, there have also been some substantial changes in commodity prices and agricultural production. For example, some irrigated industries such as citrus and almonds, have experienced favourable economic conditions with producers experiencing a welcome period of profitability. Almond producers in particular have responded by considerably expanding plantings. In contrast, other industries such as dairy have endured a period of considerable upheaval, with pressure coming from a number of sources including low commodity prices and major developments in the milk processing sector.

Underpinned by advances in agronomics, irrigated cotton has extended into the southern Basin providing greater production choices for irrigators. This has had the effect of displacing other irrigated broadacre crops and as a consequence represents a major change in the operating environment for some southern Basin producers and industries.

The other major change is the more prominent role of the water market, particularly the temporary market, in irrigators' farm business plans and risk management strategies. There are signs that producers are increasingly taking advantage of water trade and recent changes to carryover rules. This is leading to larger and more rapid changes in what is grown, and where, from year to year.

## 4. Implementing the Basin Plan



### WATER RECOVERY

Of the original 2,750 GL target 77% has been recovered. Combined with the Sustainable Diversion Limit adjustment outcome, water recovery is nearly complete in most regions. The amount of buybacks has been less than originally expected.



### COMPLIANCE

Basin governments must do more to increase the robustness, transparency and consistency of compliance. This will give communities greater confidence in the Basin Plan.

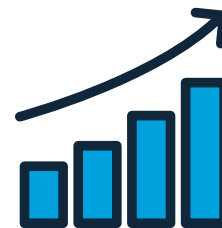
at risk

### SUSTAINABLE DIVERSION LIMIT TRANSITION

There is a transition period between the 'Cap' system and 'Sustainable Diversion Limit' system. During the transition, the new water accounting methods are being trialled but substantial work remains



at risk



### REVIEWS AND ADJUSTMENTS

The Basin Plan is adaptive. Reviews have resulted in changes that will deliver better outcomes.



### WATER RESOURCE PLANS

Water Resource Plans need to be accredited by 30 June 2019. Resources need to be focused on delivering the remaining plans. There is significant risk these plans will not be accredited on time. This work must further accelerate.

at risk



### WATER MARKETS

The operation of the water market has been improved by removing barriers to trade. More information is publicly available to assist trade.

### ENVIRONMENTAL WATER

More than 750 watering events across the Basin since 2013-14. Environmental water holders are collaborating to get the best outcomes.



### WORKING TOGETHER

A healthy and productive Basin is a shared responsibility. Many agencies are involved in Basin Plan implementation and work together to deliver long-term outcomes. They must all remain committed to this task.



### WATER QUALITY

Water quality is being managed across the Basin. Salinity targets have been met in 4 out of 5 locations.

The Basin Plan comprises a range of measures designed to operate together. As a collective, they represent an adaptive framework for whole-of-system water management. Along with the recovery of water for the environment, the Basin Plan is designed to underpin sustainable long-term outcomes for the environment, communities and industries.

The Basin Plan is being phased in over a number of years. For example, while water recovery has been happening since 2008, the new sustainable diversion limits (SDLs) do not take effect until 2019. Similarly, while the SDL Adjustment Mechanism is likely to operate in late 2017 or early 2018, Basin governments have until 2024 to implement the supply measure projects which have been agreed to as part of this process (see Figure 7).

This long transition period provides time for industries and communities to adapt to the changes arising from the Basin Plan. It also provides time for water management agencies to put in place new arrangements, and develop smarter ways to deliver the Basin Plan as new knowledge emerges.

In this context, this evaluation is part of the process for refining the way the MDBA and Basin governments approach the remaining implementation tasks. This evaluation compares what has been done to date with what was initially expected by 2017 to assess whether everything is on track. In particular, whether progress to date is sufficient to allow future deadlines to be met and the intended outcomes to be achieved. The remainder of this section evaluates progress with implementing each of the different elements of the Basin Plan, including water recovery. The assessment of outcomes is presented in the following section.

# Basin Plan timeline

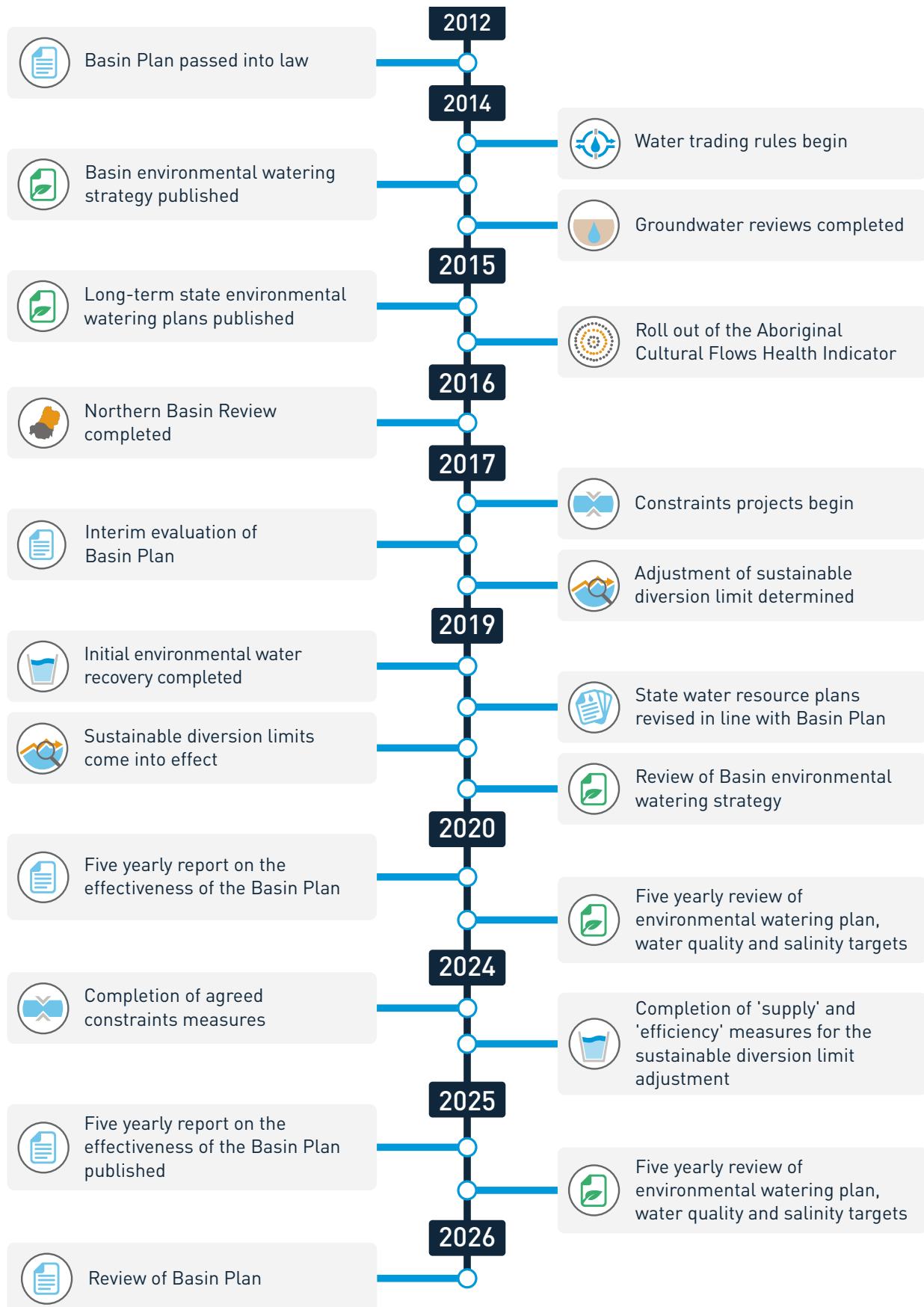


Figure 7: Timeline of Basin Plan implementation



## 4.1 Recovering water for the environment



Recovering water for the environment in the Murray–Darling Basin is at the heart of securing a healthier and more sustainable Basin. To do this, sustainable diversion limits (SDLs) have been set and water is being recovered to bridge the gap between current use and the new SDLs.

### Findings

**IF1 Water recovery is almost complete in most parts of the Basin. The volume of water buybacks has been much less than originally expected due to the focus on investments in water savings and the expected operation of the SDL Adjustment Mechanism. This has helped minimise the effects of water recovery. Urgent work still needs to be done to clarify the remaining water recovery task.**

IF1.1 Since 2008, 77% of the initial 2,750 GL surface water recovery target has been achieved as at 31 October 2017. The amount of water purchases has been much less than originally expected due to the Australian Government's focus on water saving investments. This has helped minimise the effects of water recovery on the Basin's irrigation industries and communities.

IF1.2 The SDL Adjustment Mechanism is expected to lead to a 605 GL reduction in the surface water recovery target for the southern Basin. This will substantially improve the social and economic outcomes from the Basin Plan. For the SDL adjustment to remain within the maximum net change of 5% of the SDL, there will need to be at least 62 GL of water recovered through efficiency measures by the time SDLs take effect in mid-2019.

IF1.3 Today's water recovery combined with the expected operation of the SDL Adjustment Mechanism means surface water recovery in the Basin is likely to be complete, or mostly complete in most regions.

IF1.4 Work to finalise planning assumptions and the associated Cap factors is well behind schedule. This important work needs to be done in order to clarify the remaining water recovery task and provide certainty for communities.

#### Recommendation:

**IR1 Basin governments need to urgently complete work to finalise planning assumptions and the associated cap factors in order to clarify the remaining water recovery task and provide certainty for communities.**

### What was expected?

Water recovery commenced in 2008 while the Basin Plan was still being developed and agreed. It was initially envisaged that water recovery would be spread out over a long period, between 2008 and 2017. This was subsequently extended out to 2019. This long transition period would give communities and industries time to adapt to the changing circumstances they faced, including changes to water availability brought about by water recovery. When the Basin Plan was being prepared, the social and economic analysis was based on an expectation that around 600 GL would be recovered through water savings made through investments in irrigation infrastructure, and around 2,150 GL would be recovered through the purchase of water entitlements from irrigators.

To estimate whether the surface water recovery would be sufficient to reduce average diversions by the original recovery target of 2,750 GL, the MDBA applies a set of long-term diversion limit equivalence or 'Cap' factors to each recovered entitlement. Cap factors are ratios used by water planners to represent the expected use of water in each of the entitlement classes in each catchment. The factors currently in use to estimate progress on Australian Government water recovery are those adopted by the Murray–Darling Basin Ministerial Council in 2011. It was expected that these factors would be reviewed and updated to better reflect Basin Plan settings and address known inconsistencies in the 2011 Cap factors. These updated factors would then be applied to the portfolio of held environmental water entitlements to provide a more accurate estimate of water recovery to date and the size of any remaining gap in recovery.

## What has happened?

The pace and the source of the water recovery was different to what was initially assumed, with a substantial amount of water recovery occurring early on in the 2009-10 to 2011-12 period. As the recovery process started, there was a lot of interest from irrigators offering to sell part or all of their entitlements to the government. Selling water provided some farmers an opportunity to relieve financial pressures which had built up on their business as a result of the millennium drought.

When the Basin Plan was finalised, there were two important developments that affected the future pace of water recovery. Firstly, at the request of the Basin states, the final version of the Basin Plan included the SDL Adjustment Mechanism that had the potential to substantially reduce the water recovery target, possibly by up to 650 GL. Secondly, the community impacts of the early years of buybacks were becoming apparent and the Commonwealth agreed to prioritise the future recovery of water through infrastructure investments.

Both of these developments were reflected in the Australian Government's Water Recovery Strategy that was released following the finalisation of the Basin Plan. As part of this strategy, the Australian Government committed to slow the pace of buybacks until the outcome of the SDL Adjustment Mechanism was known. At the same time, there was a decision to prioritise water recovery through savings gained from investments in on- and off-farm irrigation infrastructure (See *Case study 1: Water recovery and the effects of infrastructure investment activities in the Murrumbidgee Irrigation Area*). In 2015, a 1,500 GL cap was also placed on surface water purchases. As a result of this approach, more than 10,000 individual irrigators are benefitting from improvements to water delivery systems, with over 900 km of irrigation network delivery channels being modernised. More than 2,000 individual projects are now underway or completed which help farmers modernise infrastructure and improve their on-farm water use efficiency.

Overall, the composition of water recovery to date has been considerably different to the assumptions employed in the social and economic analysis conducted to inform the development of the Basin Plan. As of 31 October 2017,<sup>1</sup> 2,107.7 GL, or about 77% of the original 2,750 GL target, has been recovered.

Overall, the composition of water recovery to date has been considerably different to the assumptions employed in the social and economic analysis conducted to inform the development of the Basin Plan.

<sup>1</sup> This includes water contracted to the Commonwealth but not yet delivered as infrastructure projects are still under construction, meaning entitlements are yet to be transferred to the Commonwealth. More information on progress and composition of water recovery is on the [MDBA website](#)

The water recovery comprises 1,225.3 GL of water purchased through buybacks, 702.7 GL from infrastructure investment and 179.8 GL acquired through other water recovery processes (Figure 8). The cost of the on- and off-farm infrastructure improvements was \$3.5 billion and \$2.5 billion has been spent on the water buybacks.

Water recovery through on and off-farm water saving investments provides more water for the environment without the negative affect that water buybacks have on the volume of water available for irrigated production. In fact, government investment in on-farm efficiency projects delivers improved farm performance. Investments in off-farm efficiencies lead to better water supply delivery efficiency for irrigation infrastructure operators like Goulburn Murray Water. This provides benefits for their customers.

While total contracted water recovery is 2107.7 GL, and 1906.4 GL is already in the hands of the CEWO and state environmental water holders, the net reduction in water available for on-farm production is significantly smaller for two key reasons. First, more than 700 GL has been recovered from infrastructure investments that saved water that was previously lost to production. Second, and separate to the 220 GL of water savings from on-farm programs that were transferred to the Commonwealth, it's estimated that there is an additional 94 GL of on-farm water savings that were retained by farmers and will enhance future production capacity. In effect, this serves to offset some of the effect of environmental water purchases on future irrigated production. As a result, the overall effect of recovery on the amount of water that is available for production is a reduction of only 1,131 GL (1,225 GL minus 94 GL).

**Water has been recovered for the environment in a number of ways. So far, there has been 2,107 GL recovered for the environment, but the net effect on the productive water available for farmers is much less at around 1,131 GL.**

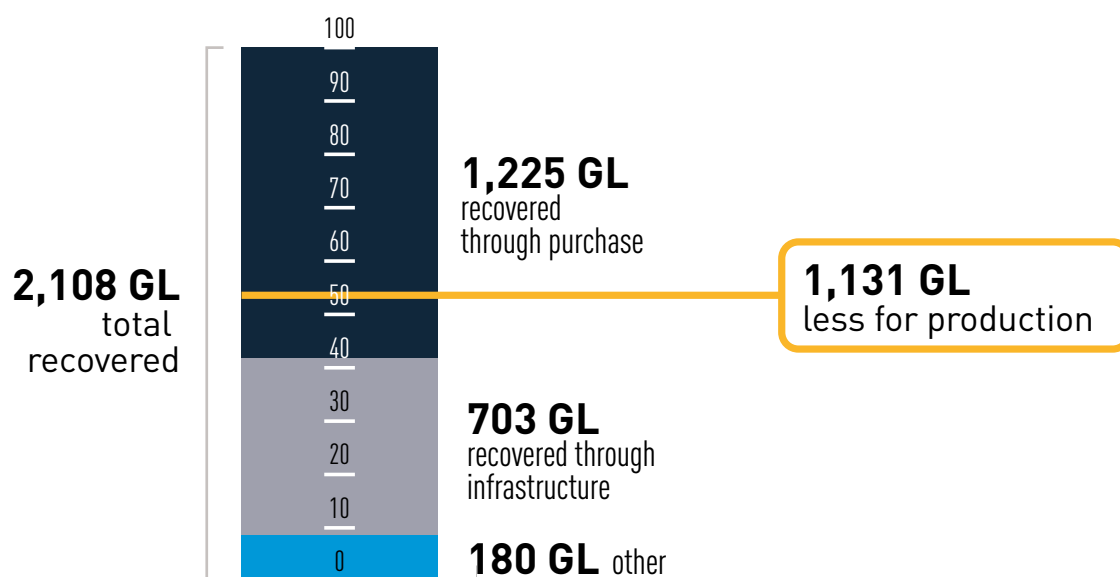


Figure 8: Water recovery through buybacks, savings from infrastructure investment and other sources of recovery, and the net reduction in water available to irrigation entitlement holders. The MDBA analyses of Basin water recovery to differentiate the water entitlements recovered and the net reduction in the water available for irrigated production. Breakdown of water recovery into buybacks, water savings from infrastructure investment and other sources of water recovery based on [DAWR](#) progress of water recovery and the MDBA estimation of the net reduction in the water available for irrigated production.

As a result of the Northern Basin Review, the original water recovery target in the northern Basin has been reduced by 70 GL. Further, the operation of the SDL Adjustment Mechanism in late 2017 or early 2018 is expected to reduce the original water recovery target in the southern Basin by 605 GL as projects have been identified that will enable equivalent environmental outcomes to be achieved with less water (see Section 4.4, *Reviews and adjustments*). Combined with water recovery to date, these developments are likely to mean that water recovery is complete, or nearly complete, in most surface water catchments.

One of the outcomes from the Northern Basin Review was a commitment between the Australian, Queensland and New South Wales governments to implement a number of actions that complement water recovery, referred to as 'toolkit' measures. Part of the toolkit is a recommendation that, where recovery is still needed it will be targeted, both in terms of geographic location and the class of entitlement, to maximise the environmental utility of the recovered water.

For the full benefits of the sustainable diversion limit adjustment mechanism to be locked in, the 36 projects nominated by state governments that enable equivalent environmental outcomes to be achieved with less water need to be implemented by 2024. At the end of the implementation period, there will be a reconciliation by the MDBA to ensure the projects have been implemented as planned.

The SDL Adjustment Mechanism also relies on Basin states implementing certain policies or rules (known as prerequisite policy measures) that facilitate more efficient use of environmental water. These policy measures were agreed to at the time the Basin Plan was introduced. If these measures are not implemented by mid-2019 when the new SDLs come into effect then the SDL adjustment will be re-calculated. Hence, it is crucially important that these policy measures are implemented before the deadline in order to help lock in the benefits of the SDL Adjustment Mechanism.

The SDL Adjustment Mechanism also provides for the recovery of a further 450 GL through projects called efficiency measures, provided these projects have neutral or improved socio-economic outcomes. An independent study is currently underway to consider approaches for implementing efficiency measures in a way which meets the requirement for no adverse socio-economic outcomes.

The arrangements for the SDL Adjustment Mechanism mean that the supply measures and efficiency measures have become inter-linked. It was agreed when the Basin Plan was finalised that the maximum net change in SDLs would be 5% of the SDL, or 543 GL. Currently, the increase in the SDLs made possible by the agreed supply measures has been determined to be 605 GL. Consequently, there will need to be at least 62 GL of water recovered through efficiency measures by the time the SDLs take effect in mid-2019 in order for the SDL Adjustment to remain within the allowable net change of 5%.

In addition to the surface water recovery task, there is one groundwater SDL resource unit – the Upper Condamine Alluvium – where water recovery is needed to bring extractions back to a sustainable level. At the end of October 2017, only 3 GL or around 8% of the 40 GL of water had been recovered. Work to recover the remaining water should be accelerated in order to bridge the gap to the SDLs by mid-2019 so that the long-term productive base of the aquifer is protected.

Estimates of Australian Government water recovery are still being made using the Cap factors as agreed by the Murray–Darling Basin Ministerial Council in 2011. In 2015 the Ministerial Council agreed that Basin states would prepare planning assumptions that would underpin the determination of the annual permitted take in accredited water resource plans. Once the planning assumptions are settled, they in turn establish up-to-date cap factors for each class of water entitlement in each water resource plan area. Basin states were to submit their planning assumptions to the MDBA by the end of 2016 for assessment. They could then be used to obtain an improved estimate of the progress with water recovery and this would help ensure that the Australian Government met its commitment to bridge the gap to the SDLs by mid-2019. This important work is well behind schedule. In 2017, South Australia and New South Wales were the first states to formally submit some of their planning assumptions to the MDBA for assessment. The remaining work needed to finalise the planning assumptions needs to be prioritised in order to clarify the remaining water recovery task and provide certainty for communities.

## CASE STUDY 1

### Water recovery and the effects of infrastructure investment activities in the Murrumbidgee Irrigation Area

The Australian Government recognises the importance of water to Basin communities and industries. Following the finalisation of the Basin Plan, it was decided to prioritise water recovery through investments in water saving infrastructure to help minimise the social and economic impacts of water recovery. A 1,500 GL cap on water buybacks was also subsequently introduced. This has shaped the composition of water recovery in the Murrumbidgee Irrigation Area (MIA). It is expected that the total Commonwealth investment in water recovery through on-farm and off-farm infrastructure investment in the MIA will be approximately \$388 million by June 2019.

Off-farm investment in upgrades to the water delivery network generates water savings by reducing seepage, evaporation and other forms of losses from conveyance water. This form of recovery is important as it means less water needs to be recovered from productive uses. These works are due to be completed by June 2019.

On-farm infrastructure investments help irrigators modernise their on-farm irrigation system and improve on-farm productivity in exchange for sharing the water savings from each project with the environment.

The benefits from these modernisation investments, including benefits for irrigation, farming businesses, and communities are already being felt in the region. The Department of Agriculture and Water Resources commissioned a study to better understand the effects of water recovery and infrastructure investments in the MIA. The study looked at the effects of government expenditure (the construction effect) and the productivity benefits for the irrigation sector. The effect of selling water entitlements to the government was also examined.

The total government investment in on-farm and off-farm infrastructure projects is expected to be around \$388 million, of which an estimated \$179 million will be spent in the region up until 2019. This local expenditure, combined with ongoing boosts to irrigation efficiency, are estimated to provide a boost to regional GDP out to 2034 of around \$470 million. The study also indicates a boost in employment resulting from the infrastructure construction phase (298 additional jobs at the peak of the construction phase). This figure is expected to drop once the projects are completed in June 2019. Nonetheless net gains in employment are expected to continue well beyond 2020 due to the construction expenditure circulating in the local economy, the productivity gains from modernised infrastructure and the share of water savings retained by irrigators. In 2034, the ongoing boost to employment is estimated to be an additional 75 jobs.

For more information on the project see the report from the [Department of Agriculture and Water Resources](#).

### How could implementation be improved?

Prioritising water recovery through investments in more efficient irrigation infrastructure has helped to minimise the impact of environmental water recovery on agricultural industries and irrigation dependent communities. This approach should continue to be adopted for remaining recoveries.

The operation of the SDL Adjustment Mechanism has also improved the social and economic outcomes from the Basin Plan by reducing the original water recovery target. For the benefits of the

SDL Adjustment Mechanism to be fully locked in, the agreed supply measure projects need to be implemented before mid-2024. This is a challenging task for Basin states who have the responsibility for implementing these projects. Pre-requisite policy measures also need to be fully implemented.

Using the best available Cap factors to estimate progress of Australian Government water recovery is critical to finalising the water recovery task and providing certainty to all entitlement holders in each water resource plan area. Settling planning assumptions as soon as possible will provide the necessary time for any remaining water recovery to be done before the SDLs take effect on 1 July 2019.

## 4.2 Managing environmental water



Getting the best outcomes from the environmental water that has been recovered under the Basin Plan requires a coordinated and strategic approach. The Basin Plan does this through the environmental management framework, which aims to coordinate the planning and use of environmental water. It also contains fundamental principles and methods to guide all governments on prioritising and using environmental water.

### Findings

**IF2 The Basin Plan has provided a robust framework that has been used to guide more than 750 environmental watering events across the Basin. Environmental water holders are co-operating and collaborating more often to deliver better environmental outcomes.**

IF2.1 All the major components of the framework for managing environmental water have been delivered or are on track to being delivered by the agreed timeframes.

IF2.2 Seven hundred and sixty three environmental watering events have been delivered in the last four years<sup>2</sup>.

IF2.3 The Basin Plan has led to improved coordination across the Basin, and environmental water is being applied effectively. Greater collaboration and coordination has led to water holders combining their available water, reaching larger areas and meeting more priorities. However, there are also opportunities to further improve the coordination of environmental water delivery.

IF2.4 Environmental watering at this scale is new, evolving, and inherently challenging. The Basin Plan is helping water holders and managers to work to common goals and learn together. There is evidence water managers are using adaptive management principles to improve the identification and delivery of Basin-wide watering priorities.

#### Recommendation:

**IR2 The Basin governments and the MDBA should review Basin Plan reporting to make it more useful for environmental water planning and management.**

A long-term aim of the Basin Plan is to protect and restore important water dependent ecosystems and ecosystem functions such as river flows, so that they can sustain its environment and support the communities and industries that depend upon it.

Managing water for the environment across a large river system that spreads across state and territory borders is a new, evolving, and inherently challenging process. The Basin Plan uses a whole-of-system approach to tackle this challenge. A whole-of-system approach is particularly important where water resources from multiple regions or jurisdictions are needed to achieve the best outcomes. Where important ecosystems and their components, like floodplain forests or native fish are distributed across state boundaries, coordinated management is required.

<sup>2</sup> The reported total number of watering events is over the 2013–14 — 2016–17 period. Full reporting for 2016–17 was not available when the environmental outcomes analysis was undertaken meaning the environmental outcomes analysis is only for the 2013–14 — 2015–16 period (see Section 5.1 Environmental Outcomes).



The held environmental water portfolio in the Basin has been accumulated through water recovery initiatives that have spanned more than a decade. It represents a significant public asset, and as such, demands a serious commitment to effective management. It requires adequate resourcing, information and understanding about environmental and system requirements, commitment by the different jurisdictional water holders to collaborate and coordinate watering, as well as effective monitoring and evaluation arrangements to make sure Basin governments are learning and getting the best possible results over time. (See *Box 1: What is environmental water and how is it used?*)

### **Box 1 | What is environmental water and how is it used?**

Water for the environment is used by environmental water holders to help restore and maintain the health of rivers, lakes and wetlands, and the animals and plants that rely on them.

Held environmental water is water that is owned by environmental water holders, who make decisions about where and when to use their water allocation for the benefit of the environment. The Commonwealth Environmental Water Holder (CEWH) now has the biggest single water portfolio in the Basin. State governments also have environmental water holders.

Planned environmental water is water left in rivers to maintain river health as part of the water planning rules that apply in each state – such as rules about when irrigators can and can't pump water from rivers. Planned environmental water is particularly important in the unregulated river systems in the northern Basin, where water is left in the river and allowed to flow downstream after large rainfall events.

When held environmental water is used for a specific purpose (for example to enhance river flows to enable fish to spawn) it is called an environmental watering event.

### **What was expected?**

The Environmental Management Framework (EMF) contains a number of strategies to help achieve a more integrated and adaptive approach to managing environmental water. These include requirements for the MDBA and the Basin states to prepare both long and short term plans to guide environmental watering at the Basin and local scales respectively. To further support the Basin-wide approach, all water resource plans being prepared by Basin states must enable environmental watering to occur in a way that is consistent with these environmental plans.

At the Basin scale, the MDBA was required, by 2014, to prepare a Basin-wide environmental watering strategy to identify long-term Basin-wide environmental priorities and help coordinate environmental water management, including the development of consistent long-term watering plans by the states. In turn, states were required to prepare long-term environmental watering plans for their water resource plan areas that identify local scale environmental assets and priorities, consistent with the Basin-wide strategy. Each year, both the MDBA and states must identify shorter term Basin-scale and local scale priorities to complement the long-term plans and guide each year's watering.

Together these strategies and priorities aim to provide clear objectives and guidance for the delivery of environmental water across the Basin. By 2017, it was expected the Basin-wide watering strategy would be in place, along with the state long-term watering plans – unless another timeframe had been agreed for these; that the MDBA and states would be preparing annual priorities each year; and that



environmental water managers would be using these plans and priorities to inform their decisions about when, where and what to water.

By 2017 it was also anticipated that effective procedures for coordinating environmental water use would be in place; that decisions about environmental watering would be guided by the Basin Plan environmental watering principles; and that learnings from environmental watering would be used to further improve environmental outcomes.

Together these strategies and priorities aim to provide clear objectives and guidance for the delivery of environmental water across the Basin.

## What has happened?

So far the Basin-wide environmental watering strategy, long-term watering plans, and annual Basin-wide and state watering priorities have been prepared or published within the legislated or agreed timeframes.

Each year, state and Commonwealth environmental water holders are consistently using these strategies and plans to inform their environmental watering activities. For example, the Basin-wide environmental watering strategy sets out quantifiable long-term whole-of-system outcomes that are expected under the Basin Plan. Basin states, the MDBA and the Commonwealth Environmental Water Holder are using the expected environmental outcomes in the Basin-wide environmental watering strategy to inform their annual planning, to design monitoring programs, and to evaluate whether the environmental watering is achieving its desired outcomes.

The approach of quantifying expected outcomes has also been adopted by several states in preparing long-term watering plans to assist in measuring progress towards outcomes. Furthermore, the development of state long-term watering plans - which provide an important link between planning at the Basin and water resource plan area scales - have had regard to the objectives and outcomes in the Basin-wide environmental watering strategy.

In the southern Basin, the main mechanism to help coordinate environmental water delivery is the multi-jurisdictional committees that meet regularly. These committees are guided by the objectives in the long-term plans as well as the annual priorities. Their decisions take into account a range of other matters, such as the prevailing conditions in the system, flow and water quality conditions, water availability, the potential to achieve multiple outcomes, and operational rules and delivery constraints, including third party risks associated with the use of that water.

**While the number of events delivered each year does not change much, the volume delivered in each event is increasing, driven by improved coordination between environmental water holders.**

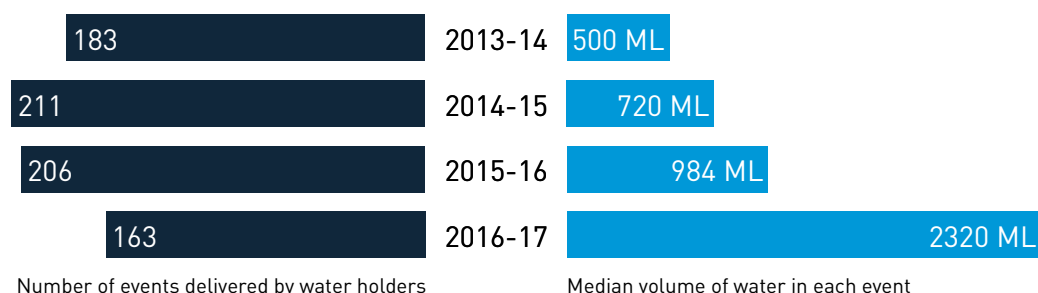


Figure 9: Comparison of watering event numbers and median volume by year

Basin states, the Commonwealth Environmental Water Holder and the MDBA have used their water allocations to deliver 763 environmental watering events across the Basin since 2013–14. In each event, environmental water holders release water to target a specific priority – for example to trigger fish spawning. However, water that is delivered to one priority can also contribute to meeting multiple priorities. For example, water delivered to increase flow variability also provides benefits for native fish habitat and movement.

Collaboration and coordination between environmental water managers is increasing. Annual reporting from water holders demonstrates the number of coordinated environmental watering events has grown to 37% of all events being coordinated across multiple water holders in 2016–17. The increasing collaboration is seeing environmental water managers pool their water to achieve larger events than would otherwise be the case, and ensure environmental water can be used for multiple benefits as it moves downstream (See *Case study 2: Coordinating environmental watering at the Macquarie Marshes*).

The Basin-wide annual watering priorities are regularly used to guide how environmental water is used. For example, Basin states, the Commonwealth Environmental Water Holder and the MDBA worked together to deliver 3,388 GL of environmental water to the annual watering priorities during 2016–17<sup>3</sup>. Between 2012–13 and 2015–16, 85% of annual watering environmental priorities were met. On the occasions where priorities were not met, constraints to delivery, such as community concerns about the potential for watering to flood private land, were generally identified as the primary reason. This highlights the importance of addressing constraints as part of the implementation of agreed supply measure projects and links between the different elements of the Basin Plan in achieving overall outcomes.

Collaboration and coordination between environmental water managers has been increasing each year. Annual reporting from water holders indicates that by 2016–17, over a third (37%) of all environmental watering events were coordinated events involving multiple water holders. This increasing collaboration is seeing environmental water managers combine their water to achieve much larger events than would otherwise be possible. This increases the range of possibilities that environmental water can be used for, including being able to reach multiple environmental sites or targets as it moves downstream (See *Case study 2: Coordinating environmental watering at the Macquarie Marshes*).

There is evidence water managers are learning and using adaptive management to improve the process to develop Basin-wide watering priorities. Setting priorities, developing long-term watering plans, and the decisions required to effectively and efficiently use environmental water are being supported by environmental monitoring information (for example, information about whether the watering requirements at important wetlands have been met) collected by the MDBA and Basin partners. As a result of efforts across governments, community groups and individuals, there is a growing body of knowledge on the Basin environmental conditions and responses to environmental water.

There is evidence water managers are learning and using adaptive management to improve the process to develop Basin-wide watering priorities.

The growing body of new knowledge is being used to better align the Basin-wide watering priorities with the long-term outcomes in the Basin-wide watering strategy. This is demonstrated by a shift to identifying priorities that have multi-year components, and including recommended actions that

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<sup>3</sup> The water delivered includes return flows (parcels of water delivered at multiple downstream sites) and planned environmental water.

can be adapted to a range of seasonal conditions. These changes recognise that to achieve some environmental objectives a series of watering actions may need to occur over successive years, and that expected seasonal conditions and circumstances can change over the course of a year. As knowledge of the environmental watering requirements of key species, such as golden perch and river red gums continues to improve, so too does the knowledge of how these species respond to environmental watering. This is leading to more effective and efficient use of environmental water (see Section 5, *Basin Plan outcomes over the first five years* for more information).

## CASE STUDY 2

### Coordinating environmental watering at the Macquarie Marshes

The Macquarie Marshes is an internationally-recognised Ramsar wetland and one of the largest freshwater wetlands in the Murray–Darling Basin. The Macquarie Marshes include large areas of reed beds, water couch, and river red gum forests and woodlands, which provide important breeding habitat for many species of colonial-nesting waterbirds.

In the winter-spring period of 2016, the Macquarie Marshes experienced high natural flows, which resulted in widespread inundation, triggering colonies of waterbirds to begin nesting. At the peak of the breeding event approximately 50,000 egret, ibis and spoonbill nests were counted, many with multiple chicks per nest.

Local water managers identified a risk that as the water would begin to recede, food resources would diminish, which could result in starvation for many of the young birds. They recommended using environmental water to maintain floodplain inundation until the majority of egret chicks had left their nests.

In response, water holders worked together to deliver environmental water to the Macquarie Marshes. This included 17 GL of Commonwealth environmental water and 29 GL of New South Wales environmental water. In addition, a further 30 GL of Commonwealth environmental water and 4 GL of New South Wales environmental water was delivered to the mid and lower Macquarie River to support native fish.

The coordinated environmental watering event extended inundation and maintained or increased water levels at colony sites. This maintained feeding, foraging and breeding habitat, deterred ground based predators, extended the nesting period and improved successful recruitment for species such as royal spoonbills, egrets, night heron and cormorants. Subsequent aerial surveys confirmed at least 21 active waterbird colonies, and a total of 16 colonial waterbird species nesting across the Macquarie Marshes.

This case study illustrates the importance of maintaining and continuing to improve coordination between local water managers, environmental water holders and river operators. In addition, it demonstrates the ability of water managers to draw on local knowledge and rapidly respond to changing conditions. These types of successful events also help water managers learn about the water needs of waterbirds to adaptively improve decision-making and optimise the use of environmental water.

### How could implementation be improved?

The Basin-wide environmental watering strategy quantifies the sought after outcomes for river flows and connectivity, native vegetation, waterbirds and native fish. The strategy focuses on these outcomes as they are good indicators of the health of a river system, responsive to environmental flows and highly

valued by people. The Basin-wide environmental watering strategy could be refined by integrating different sets of expected outcomes, for example, between river flows and vegetation. The Basin-wide environmental watering strategy could also be improved through the inclusion of mechanisms to consider climate change. The review of the Basin-wide environmental watering strategy scheduled to be completed in 2019 should consider these potential improvements.

The development of watering priorities should continue to build on approaches which include multi-year priorities and better accommodate changing seasonal conditions.

Relaxing constraints on the delivery of environmental water, which are being addressed through the agreed SDL adjustment mechanism projects, will provide water holders with the flexibility to use their water more efficiently. Also included in the agreed set of SDL adjustment projects is a project that aims to achieve enhanced environmental outcomes by increasing environmental water holders' ability to time releases of environmental water from dams with increases in natural flows caused by rainfall. The implementation of this project will also provide water holders with greater flexibility when delivering environmental water.

In the northern Basin, coordinated releases from northern Basin tributaries (where possible) could help improve environmental responses and outcomes. This was recognised during the Northern Basin Review, and reflected in the 'toolkit of measures' recommended by the MDBA, which include actions to enhance coordinated releases from tributaries.

Significant efforts to monitor and evaluate the environmental condition of the Basin are being made by governments and community groups. There are still many areas of this complex system that Basin governments need to know more about to continually become more efficient and effective with the use of environmental water. There is a significant opportunity to better identify the full suite of monitoring that is undertaken across the Basin, with a view to then looking for opportunities to make the information more easily integrated and accessible.

The MDBA suggests adaptive management would be better supported by improving the Basin Plan annual reporting on environmental watering so that it is more relevant to future water use and management decisions. For example, it could include feedback from water managers on how to improve the coordination of monitoring activities, and include more data about environmental watering events.

## 4.3 Maintaining water quality

Good quality water is critical for people and the environment. Recognising this, the Basin Plan sets objectives and targets for ensuring water quality is good enough to protect and restore ecosystems, and should be suitable for domestic use, farming and recreation. These targets relate to salinity levels, dissolved oxygen (which relates to blackwater events) and blue-green algae. The Basin Plan recognises there are many external influences that can effect water quality such as land management practices and pollution.



### Findings

**IF3 Salinity management over the last 30 years shows difficult environmental problems can be overcome with commitment and cooperation from all stakeholders. The Basin Plan is helping to reduce salinity levels by providing more fresh water in the Basin's rivers.**

IF3.1 Salinity management in the Murray–Darling Basin is a success story in natural resource management. It highlights how natural resource management problems can be overcome through commitment and collaboration among Basin governments and land managers. Basin governments have committed to continue managing salinity in the Basin for the next 15 years through the new strategy - Basin Salinity Management 2030. This strategy builds on its predecessors, and sets out actions to meet the objectives and targets set in the Basin Plan.

IF3.2 There have been some large-scale blackwater events over the last five years as a result of natural flooding. Basin governments have taken action to mitigate these events but there is still more to learn.

#### Recommendation:

**IR3 Basin governments and the MDBA should continue to investigate and analyse data on dissolved oxygen levels and the transfer of organic matter into river systems to develop improved management actions which can help mitigate blackwater events.**

Basin governments, the MDBA and farmers have a long history of managing water quality and salinity in the Basin. This includes operating salt interception schemes to prevent salty groundwater from entering the River Murray, improving farming practices, and implementing long-term strategies to minimise risks of water in the Basin not being suitable for drinking and farming. These activities have led to a 30 year trend of decreasing salinity levels in the River Murray (Figure 10). This is widely heralded as a significant achievement in natural resource management.

### What was expected?

By 2017 it was expected that Basin governments and the MDBA would be continuing to implement long-term strategies to manage salinity and Basin states would be incorporating water quality management plans into their water resource plans.

Additionally, water managers such as river operators and environmental water holders would have practices in place to ensure that they have proper regard to outcomes relating to dissolved oxygen, blue-green algae and salinity when managing water flows and making decisions about using environmental water. These requirements can lead to improved water quality in some cases.

However there are a wide range of factors outside the Basin Plan causing poor water quality, so it was never envisaged that the Basin Plan would eliminate or control blackwater events or blue-green algae outbreaks.

### Strategic actions by governments on salinity have contributed to improved outcomes over time

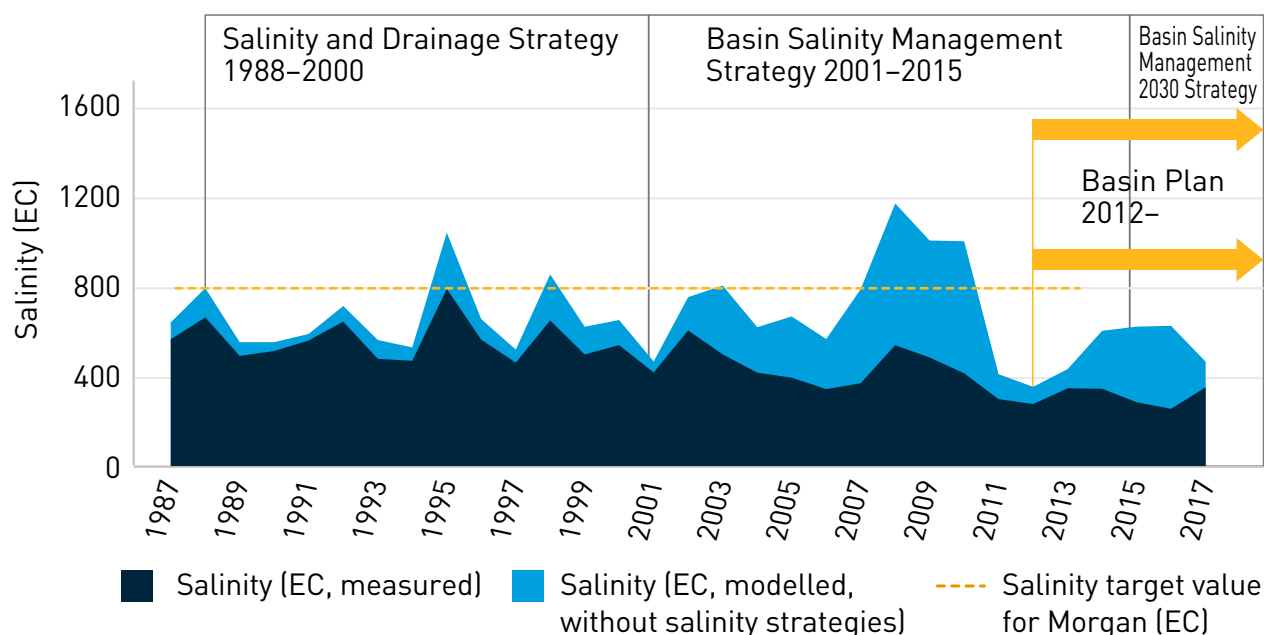


Figure 10: River Murray salinity at Morgan and the impact of management strategies

## What has happened?

The Basin Plan is building on the past achievements of Basin governments, farmers and others in managing salinity. Following the success of the first 15 year Basin Salinity Management Strategy, which finished in 2015, Basin governments committed to a new 15 year strategy that runs through to 2030. The new strategy commits governments to actions to achieve the objectives and targets in the Basin Plan.

The Basin Plan set out objectives and targets to protect water quality, including salinity targets at five reporting sites, as well as water quality targets. The five reporting sites include three locations along the River Murray at Murray Bridge, Morgan and Lock 6, as well as the Darling River downstream of Menindee Lakes at Burtundy and the Lower Lakes at Milang.

Annual reporting prepared by Basin states and the MDBA demonstrates managers are taking Basin Plan water quality targets into consideration when conducting their day-to-day operations. The daily monitoring that occurs at salinity target sites is also allowing environmental water holders and river operators to make decisions in real-time, such as releasing dilution flows from water storages to reduce salinity levels and minimise the impact of salinity spikes.

Approaches for managing blue-green algae and blackwater events are quite complex, but real-time monitoring can help decision making. For example, during a natural flooding event in the River Murray system in 2016–17, extensive areas of the floodplain were inundated in the southern Basin. This led to high levels of dissolved organic carbon entering the system and creating a widespread hypoxic blackwater event. In response, water holders and river operators were able to take actions to help mitigate the potential impacts of that event. These actions included increasing releases of highly oxygenated water from Lake Victoria to maintain Rufus River as a refuge for native fish. The success of these actions are being evaluated so that future management can be improved.

Figure 10 was amended on 18 July 2018 to correct the placement of the Salinity target value line from 500EC to 800EC.

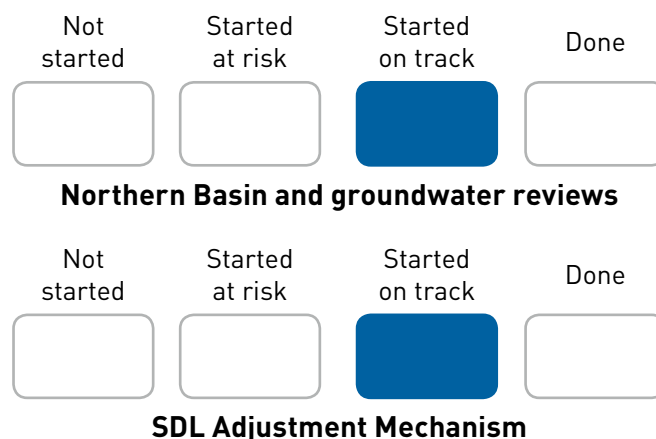
## **How could implementation be improved?**

Other elements of the Basin Plan, as well as land management measures outside the Basin Plan, have the potential to contribute to improvements in water quality. Implementing the findings of the Northern Basin Review should contribute to achieving water quality outcomes through the enhanced protection of environmental water. Addressing constraints through the agreed SDL adjustment projects will allow for more frequent delivery of environmental water onto the lower floodplain, which could reduce the build-up of organic matter and help mitigate blackwater events. However, it must be acknowledged that these projects will not involve reaching the mid to upper floodplain, where large amounts of organic matter may still build up.

The MDBA and Basin states should continue to investigate, analyse and share data on dissolved oxygen levels and the transfer of organic matter into river systems, with a view to developing improved management actions to reduce the threats of hypoxic blackwater events.

## 4.4 Reviews and adjustments

The Basin Plan is adaptive and it can be refined and updated with knowledge gained from reviews and evaluations. This includes using new information to review the SDLs in the Plan, as well as a one off mechanism to adjust the water recovery target should projects be identified that allow environmental water to be used more efficiently.



### Findings

**IF4 The northern Basin and groundwater reviews were successfully completed and the SDLs have been changed through an amendment to the Basin Plan. New South Wales, Queensland and the Australian governments have committed to complementary actions in the northern Basin that will help deliver the intended outcomes.**

**IF5 Thirty six state-nominated projects have the potential to reduce the southern Basin water recovery target by 605 GL through the SDL Adjustment Mechanism. Substantial work remains to deliver the agreed projects by 2024, including stakeholder engagement.**

IF5.1 The 70 GL reduction in the northern Basin water recovery target will reduce the impact of water recovery on agricultural industries and communities. Implementing the complementary actions or “toolkit measures” will be important to achieving the intended outcomes.

IF5.2 Considerable work lies ahead for state governments to design and implement their nominated projects by mid-2024. There is substantial community concern regarding some projects and strong leadership, better communication, good program management and review will be important to success.

IF5.3 Feedback received during the public consultation on the SDL Adjustment determination highlighted a need for improved engagement of communities and other stakeholders. In particular, some felt that there was not enough information on the business cases underpinning the determination to allay public concerns about some projects. Further community consultation will be important as the projects progress toward implementation by 2024.

#### Recommendation:

**IR5 Basin governments should more closely involve Basin communities in the design, implementation and delivery of the nominated projects to build community understanding and acceptance of the projects.**

## What was expected?

### Northern Basin and groundwater reviews

When the Basin Plan came into force in 2012, governments committed to undertaking reviews of the surface water SDLs for the northern Basin and three groundwater areas by 2015 and 2014 respectively. These reviews would consider new knowledge to determine if the original SDLs set in the Basin Plan should be changed.



By 2017, it was expected that the Northern Basin Review and the three groundwater reviews would be completed and the process to progress amendments to SDLs arising from the reviews would be underway or complete.

### **Sustainable Diversion Limit Adjustment Mechanism**

The SDL Adjustment Mechanism was included in the Basin Plan to provide the opportunity to adjust the water recovery target if projects were identified that enabled equivalent environmental outcomes to be achieved using less water. The projects, referred to as supply measures, were to be nominated by state governments. It would then be the responsibility of the MDBA to determine the amount by which the SDLs could be increased while still delivering equivalent environmental outcomes. By investing in these projects, less water would need to be recovered from irrigators.

The SDL Adjustment Mechanism also provides for investments in projects known as efficiency measures (for example, making water use on farms more efficient), which can provide more water for the environment provided those projects have no adverse socio-economic outcomes.

The net change in the SDLs allowed under the SDL Adjustment Mechanism is 5% of the SDL, or 543 GL.

All projects must be completed by 2024. If projects are not completed as planned, then a reconciliation will be done in 2024 to assess whether the change in the SDLs determined in 2017 needs to be changed.

There are a number of other measures (known as 'pre-requisite policy measures') that are relevant to the operation of the SDL Adjustment Mechanism. These measures were agreed when the Basin Plan was finalised and involve new rules to improve the efficiency and effectiveness of delivering environmental water. If these measures are not in place by 2019, the SDL adjustment amount would need to be recalculated and could be reduced. By 2017 it was expected there would be enough progress to indicate whether these measures would be in place by 2019.

The Basin Plan initially required Basin states nominate a package of SDL adjustment projects for MDBA consideration by June 2016. By 2017 it was expected the MDBA would have determined the SDL offset from these projects and the community consultation and more detailed project design would have commenced (noting additional efficiency measures can be nominated up until December 2023).

## **What has happened?**

### **Northern Basin and groundwater reviews**

In November 2017 revised SDLs for the northern Basin and the three groundwater areas were adopted by the Minister and became law. The amendments have since been subject to a disallowance motion in parliament which was not resolved at the time of publishing.

The Northern Basin Review was completed during 2016. Substantial research was completed and new information was collected to inform the review. Social and economic studies were undertaken to learn more about the impacts of water recovery on communities across the northern Basin. Hydrological modelling combined with new scientific work was used to better understand the impacts of different levels of water recovery on the river ecosystems and the environment. The MDBA also set up a community advisory committee to provide advice on regional community views and consulted with Aboriginal communities on cultural values relating to water.

Based on all the work undertaken, the MDBA recommended a change to the SDLs in the northern Basin that would reduce the water recovery target from 390 GL to 320 GL.

The Australian, NSW and Queensland governments also agreed to couple the reduced water recovery target with a 'toolkit' of complementary actions, that would help achieve the intended environmental outcomes. The 'toolkit' includes better protection of environmental flows to get better outcomes from environmental water. The combination of water recovery and the 'toolkit' measures was considered the most effective means of delivering the intended environmental outcomes while minimising the social and economic impacts of water recovery.

The reviews of groundwater SDLs and Baseline Diversion Limits for the Eastern Porous Rock (NSW), Western Porous Rock (NSW) and the Goulburn–Murray Sedimentary Plain (Victoria) SDL resource units were completed by 2014. The reviews met all requirements as outlined in the Basin Plan. The review process established a transparent and repeatable process that could be followed should future reviews of groundwater SDLs be required. On the basis of these reviews, the MDBA proposed increases to the SDLs in the three groundwater areas, reflecting the new knowledge gathered in relation to the sustainable extraction of those resources. The SDLs resulting from these reviews were reflected in the Basin Plan amendment, which saw the SDL for the Basin's groundwater resources increase from 3,334 GL per year to 3,494 GL. The 160 GL overall increase is made up of increases of 14.9 GL in the Eastern Porous Rocks area, 109.4 GL in the Western Porous Rocks area, 37.7 GL in the Goulburn-Murray area, and other minor adjustments due to things such as boundary changes for groundwater water resource plan areas.

The review process also proposed a revised groundwater compliance method to avoid the significant accumulation of credits once the limits on take commence. There were also some changes needed to groundwater water resource plan areas and SDL resource units to better reflect state management boundaries. These changes were also made in the same Basin Plan amendment.

### **Sustainable Diversion Limit Adjustment Mechanism**

In June 2017 Basin governments brought forward a package of 36 supply measure projects for consideration by the MDBA. Finalising the package of supply measures projects was a complex task and took one year longer than initially planned. The agreed one year extension allowed state governments to put together the best possible package of projects, though this has reduced the time remaining for project planning, consultation and delivery of the projects.

The MDBA's role in the SDL Adjustment Mechanism was to determine the size of the allowable adjustment to the SDLs following the commitment by the Basin governments to implement the agreed set of supply measures. The MDBA has determined that the water recovery target in the southern Basin could be decreased by 605 GL and equivalent environmental outcomes can still be achieved. The MDBA conducted a formal public consultation process on a proposal to adjust the southern Basin surface water SDL by 605GL. A range of issues were raised by stakeholders, including a perceived lack of transparency due to the lack of information available on many of the supply measure projects.

MDBA has determined that the water recovery target in the southern Basin could be decreased by 605 GL and equivalent environmental outcomes can still be achieved.

Stakeholders and some governments have also expressed concern about whether efficiency measures can be implemented with neutral or improved socio-economic outcomes. Basin governments have sought independent analysis of approaches for implementing efficiency measures in a way which meets this requirement. The outcome of this analysis is due in late December 2017.

With regard to implementing the pre-requisite policy measures, all of the required implementation plans have been submitted, and endorsed by the MDBA as meeting the requirements of the Basin Plan. The plans now need to be implemented by 30 June 2019.

## **How could implementation be improved?**

Substantial work remains to deliver on the commitments made to projects in both the northern and southern Basin.

### **The Northern Basin Review**

While the amendments to the northern Basin surface water SDLs arising from the Northern Basin Review have already been made, these amendments were coupled with a commitment by the New South Wales, Queensland and Australian governments to implement the complementary 'toolkit' measures. Full and timely implementation of the 'toolkit' measures will be important to achieving the intended environmental outcomes in the northern Basin.

### **Sustainable Diversion Limit Adjustment Mechanism**

Considerable work lies ahead for the state governments to progress the design, refinement and implementation of the nominated supply measures in the period to 2024. Public consultation on the proposed SDL amendment confirmed that many of the supply measures are controversial in certain parts of the community and numerous stakeholders raised concerns about the lack of transparency and information available on the projects. More open and transparent community engagement will be crucial to the successful implementation of the projects, including an improved level of understanding and acceptance of these projects by the community. It will be important to review progress at regular points including the 2020 Basin Plan Evaluation to give confidence implementation is on track for completion by 2024.

There is a lot at stake. The supply measures could vastly improve the flexibility with which environmental water might be used and enhance the outcomes for environmental watering. These projects also need to be completed by mid-2024 in order to lock in the benefits to agricultural industries and communities from the lower water recovery target.

Once the outcome of the independent analysis of arrangements for implementing a program of efficiency measures is received, governments should work together to progress implementation given the important role they will play in improving the environmental outcomes from the Basin Plan.

## 4.5 Water resource planning

Water resource plans are a core element of the Basin Plan. The plans establish limits on water use and provide the basis for compliance with the Basin Plan. As such, they also play a role in providing certainty for water users by stipulating water sharing arrangements.



### Findings

**IF6 Development of water resource plans is well behind schedule. There is a high risk that some plans will not be accredited by the mid-2019 deadline, which would affect compliance with SDLs and create uncertainty for water users. There is a large amount of work to do and there can be no further delays.**

IF6.1 While it was initially projected that 14 plans would be in place by 2017, progress has been slow with only one of the 33 plans now finalised and accredited<sup>4</sup>. If plans are not in place by mid-2019 this will affect compliance with SDLs and create uncertainty for water users.

At this stage, MDBA considers that South Australia, Queensland and the ACT are likely to meet the timeline for accreditation. Despite their efforts and recent progress, MDBA remains concerned at the rate of progress in NSW and Victoria.

IF6.2 Reviews of the process for accrediting the first water resource plan has led to the development of more efficient and streamlined accreditation processes. This is expected to speed up the process for the remaining plans, but there remains a high risk that this important task will not be completed by mid-2019.

#### Recommendation:

**IR6 Basin governments and the MDBA must redouble efforts and work closely together to get all water resource plans in place by June 2019. Dedicated resources and more efficient and streamlined processes will be essential to meeting timelines.**

IR6.1 Given the compressed timeframes, the MDBA and Basin governments should ensure close working relationships, careful project planning and sufficient dedicated resources are in place to achieve accreditation.

State government agencies are developing water resource plans for 33 areas across the Basin. These plans are to be accredited by mid-2019, when the SDLs are due to take effect. The Basin Plan sets out 55 particular requirements water resource plans must meet to be accredited. While many of these requirements can be easily met by existing state arrangements for water planning, there are some that require new arrangements.

For example, the water accounting and compliance framework under the Basin Plan includes more forms of water take than are currently covered by existing water plans, such as take by interception activities like farm dams and commercial plantations. This framework requires annual water accounts

<sup>4</sup> The total number of water resource plans has decreased from 36 to 33 following the changes to state planning boundaries in the 2017 Basin Plan amendments.

to be prepared to keep track of the amount of water that is taken by each form of take and how that compares with the permitted take for that year. The Basin Plan also requires water resource plans to identify Aboriginal peoples' objectives and outcomes based on their values and uses of water, and that Aboriginal communities and organisations must be consulted in developing water resource plans.

## What was expected?

By 2017 it was anticipated there would be substantial progress with the development of water resource plans. This progress would be measured by the accreditation of water resource plans, and the development of trial annual water accounts for each water resource plan area. It was expected that remaining plans would be well progressed, with state governments progressing the work in close collaboration with the MDBA. Arrangements would be in place to enable appropriate consultation with Aboriginal people and organisations as is required.

With regard to numbers of accredited plans, an early projection in 2014 was that 14 water resource plans would have been accredited by 2017.

## What has happened?

As of late 2017 only the Queensland Warrego–Paroo–Nebine water resource plan has been accredited. Preparation of the remaining water resource plans has fallen well behind early projections made in July 2014. Table 1 below shows the initial projections of progressive development of water resource plans has not been achieved. The March 2017 timeframes (which have also slipped) captured the original 36 plan areas and required the accreditation of 21 plans in 2018 and a further 15 in the first half of 2019.

By June 2017, 31 of the 33 plans were still in the preliminary or early stages of drafting. Given the number of plans remaining to be prepared by state governments and accredited by MDBA in the 18 months before the mid-2019 deadline, there is a substantially elevated risk that some water resource plans will not be accredited in time.

Table 1: Estimates of when plans will be submitted to MDBA for assessment: Initially expected and currently agreed.

Year	Initial projection (MDBA projection only July 2014)	Current agreed time frames (March 2017)
2013	0	0
2014	2	0
2015	3	0
2016	3	1
2017	14	2
2018	26	19
2019	36	36

Note: These estimates are based on the original 36 plan areas identified in the 2012 version of the Basin Plan. Amendments in November 2017 have reduced the number of plans to be developed to 33 as a result of boundary changes.

Failure to meet the mid-2019 deadline for accreditation could compromise compliance with sustainable diversion limits (SDLs). It would also lead to water users operating under two legal regimes, thereby creating stakeholder uncertainty, and potentially have flow-on effects for investment. Moreover, there would be reputational damage to the reform from failing to deliver the Plan 'on time and in full.'

Basin state governments acknowledge they have taken longer than initially expected to develop water resource plans. The MDBA also acknowledges it has taken longer to provide advice on draft water

resource plans or components. The slower than expected progress is attributed to a number of factors including:

- the need for the MDBA to provide guidance on addressing requirements
- the need to ensure plans submitted to the MDBA are supported by sufficient evidence that demonstrates they comply with all the requirements
- potentially too few resources allocated to this task.

The MDBA has provided significant guidance to Basin states about addressing the requirements, through assessment guidelines, position statements, and numerous bilateral and multilateral discussions. These documents and processes have contributed to significant knowledge and capacity building in state agencies and in the MDBA.

The Queensland government and the MDBA have both reviewed the processes to develop, assess and accredit the Warrego–Paroo–Nebine water resource plan. As a result of the reviews, steps have been taken to improve the accreditation process for water resource plans to make it more transparent, robust and efficient. Major changes have also been introduced to make the process for meeting the 55 water resource plan requirements more streamlined.

Traditional Owners were fully involved in the development of the Warrego–Paroo–Nebine water resource plan. Developing the plan involved engaging with nine Aboriginal nations over three years as well as the Northern Basin Aboriginal Nations (NBAN) organisation. This led to the development of objectives and outcomes for Aboriginal people with respect to managing water in these catchments. These objectives and outcomes were reflected in the final plan. For example, the plan protects the near-natural flow regime in the catchments, thereby protecting many water-related values identified as culturally significant. Engagement with Aboriginal people about their values and uses of water has also commenced in South Australia, Victoria, Queensland and the Australian Capital Territory.

## **How could implementation be improved?**

There is an expectation that the streamlined assessment process will help speed up the preparation of the water resource plans. Close working relationships will be needed to complete the task ahead. Given the compressed timeframes for the remaining plans, there will need to be careful project planning and dedicated resources for this task. There also needs to be a sense of urgency given the consequences of not meeting the June 2019 deadline.

## 4.6 Transitioning to SDL accounting and compliance



Compliance with the sustainable diversion limits (SDLs) is fundamental to most Basin Plan outcomes, and is more complex than current arrangements under the Murray–Darling Basin Cap. Determining compliance with SDLs needs sound methods for calculating annual permitted take. Water resource plans (WRPs) must include methods for demonstrating how compliance with SDLs will be met under different climatic scenarios. In addition to methods for calculating permitted take, WRPs must also include sound methods for monitoring and reporting on actual take. The MDBA has been working with Basin states on the transition from the Murray–Darling Basin Cap to SDLs so that the new arrangements work as intended from 1 July 2019.

### Findings

**IF7 Development of new water accounting methods needed for SDL accounting is progressing well, but the techniques for measuring some forms of water take require further development. This work underpins SDL compliance and provides the basis for transparent reporting.**

IF7.1 Determining the volume of water that entitlements holders were permitted to take, and actually took, is important for water resource planning and SDL compliance. The MDBA and Basin states have made progress in developing new water accounting methods so that accurate reporting on water take and compliance with SDLs can be in place from 1 July 2019.

IF7.2 An important step on the path to being implementation ready by mid-2019 has been the successful trial of the new methods to prepare the water take reports for the last four years from 2012-16. For the first time, this report also draws together information about the extent of annual groundwater use across the Basin.

IF7.3 Currently only around 64% of water take for consumptive use is accurately metered.

IF7.4 The quality of SDL accounting will depend directly on the accuracy of measurements of water take, the hydrologic gauging network throughout the Basin and on hydrological models based on metered and measured data.

#### Recommendation:

**IR7 The MDBA and Basin states must complete the large body of work remaining to develop a robust basis for measuring water take, and transparent reporting on SDL compliance.**

IR7.1 The MDBA and states must complete the work required to ensure that annual take does not exceed SDLs. This includes:

- improving the accuracy and reliability of metering
- reviewing the network of gauging stations to ensure gauging is accurate and identify (and address) any gaps
- reviewing hydrological models to account for water take
- improving the methods for estimating forms of non-metered take, particularly floodplain harvesting in NSW and Queensland.



## What was expected?

At this stage of implementation, it was expected that a full set of trial water take accounts for each SDL resource unit would be available for each water year starting from 2012-13 to 2015-16. These trial accounts were to be prepared as an important step in developing the capability to accurately report on SDL compliance.

The Basin Plan SDL compliance framework requires that the determination of annual permitted take and announced allocations must factor in things such as weather conditions and water availability. These were expected to be reflected in estimates of annual permitted take, and consequently in reports of actual take.

The compliance framework also requires that annual permitted take reflects how much water has been recovered for the environment, for the purpose of protecting environmental water entitlements. It was expected that the trial water take accounts would accurately reflect the amount of held environmental water.

## What has happened?

Setting up the new reporting arrangements in accordance with the Basin Plan SDL compliance framework proved to be more challenging than expected, which resulted in delays in preparing the transition period water take reports. The transition period water take reports for the four water years from 2012-13 to 2015-16 were published together in November 2017. The water take reports compare actual take with the permitted level of take for each of the four water years. While there are no compliance consequences associated with the trial water take report, the work done to prepare these reports has laid the foundations for timelier reporting in the future.

The trial SDL surface water take accounts show that take was within Basin Plan limits, with decreasing levels of water take, which is consistent with the decreasing water availability over the trial period between 2012-13 and 2015-16. Groundwater take was also within Basin Plan limits, with one exception in New South Wales. In that case, a more detailed examination of the situation showed that the SDL resource unit was likely to return to permissible levels of cumulative take in the following year. The [Transition period water take report](#) contains further details.

The accounts have successfully included methods that account for the amounts of held environmental water. Consequently, progress with environmental water recovery is another reason why actual surface water take fell over this period.

The trial accounts establish a benchmark for further improvements in SDL accounting. They also represent the first ever Basin-wide assessment of permitted and actual take of groundwater resources. The preparation of these trial water take accounts demonstrates the progress by the MDBA and Basin states to support compliance with SDLs from 1 July 2019.

The MDBA's Murray-Darling Basin Water Compliance Review and the trial accounts have identified problems with estimating actual take for some forms of take, such as floodplain harvesting, take by farm dams and forestry plantations.

## How could implementation be improved?

The quality of SDL accounting is directly dependent on accurate measurement of the amount of water taken, which depends heavily on the nature and extent of the gauging network throughout the Basin. Hydrological models, which use metered and measured data, are also critical especially for those forms of take that cannot be metered (such as floodplain harvesting and interception by farm dams and plantations).



The MDBA's Murray–Darling Basin Water Compliance Review and the experience gained through the development of the trial SDL accounts suggest future implementation should focus on:

- improving the accuracy and reliability of metering
- reviewing the network of gauging stations to ensure gauging is accurate and identify (and address) any gaps
- reviewing hydrological models to account for water take
- improving the methods for estimating forms of non-metered take, particularly floodplain harvesting in NSW and Queensland.

For further information see Compliance (Section 4.8 *Compliance*), and the [MDBA's compliance report](#).

## 4.7 Water trading rules

The Basin Plan requires governments and irrigation infrastructure operators to bring their water trading rules into line with those in the Basin Plan to support the efficient functioning and ongoing operation of the water market.



### Findings

**IF8 Basin states have made progress in aligning their trading rules with the Basin Plan. This has helped improve the operation of water markets which is important for water users looking to adapt to changing water availability and other drivers of change.**

IF8.1 Since the water trade rules came into effect in 2014, states have made some progress in aligning their trading rules with the Basin Plan including the removal of some major restrictions on inter-regional trade in water entitlements.

IF8.2 There is better information available about the Basin's water markets, and improved governance arrangements for water trading have been put in place.

#### Recommendation:

**IR8 Basin states and the MDBA must give high priority to identifying and removing unreasonable restrictions on allocation trade, especially in the southern Basin.**

IR8.1 Basin states and the MDBA still have a lot of ongoing work to do to meet Basin Plan requirements such as identifying and removing unreasonable restrictions on allocation trade in the southern Basin.

IR8.2 Additional priorities include ensuring that water market information now available is useful, accessible and available in a timely manner, and that there is ongoing education and continual improvement in processes. These improvements are needed to ensure that there is growing confidence in the Basin's water markets.

Water markets provide irrigators, and environmental water users with a vital tool for flexibly responding to variable water availability. Water markets also allow water to move to where it can be used most productively and this helps manage the transition to the Basin Plan.

The Basin has some of the most mature water markets in the world, and 95% of Australia's water market activity by volume. Since the commencement of interstate water trade in the mid 2000s, there has been significant growth in interstate trade, as well as changes to trading patterns and water use. In 2015–16 the value of entitlements on issue in the southern Murray–Darling Basin was at least \$13 billion. The turnover value for entitlement trade was \$985 million (or 7.6% of the total value of entitlements) and for irrigation related allocation trade was \$558 million (or 2,513.5 GL).

The Basin Plan introduced trading rules requiring the removal of unnecessary restrictions on trade and improvements in information availability and governance arrangements in order to build confidence in the market. However, there appears to be a long way to go for water markets to operate as efficiently and effectively as other commodity markets. An assessment of the effectiveness and efficiency of the water market for the 2020 evaluation of the Basin Plan will require a careful examination of water market behaviour across the preceding eight years and where possible, a consideration of how the rules governing water trade might influence temporary and permanent water trade.

## What was expected?

At this point in time it was expected the Basin Plan water trade rules were being implemented so that:

- significant restrictions on surface water trade would have been addressed, for both entitlements and allocation trade
- there would be demonstrable improvements in the availability of water market information
- arrangements for improved governance of water trading rules would be in place, to give confidence to the market.

## What has happened?

The Basin Plan water trading rules came into effect in July 2014 to allow states time to transition to the new requirements. In 2014, Basin states collectively reported having hundreds of individual surface water trading restrictions. Given the sheer number of rules in place, the MDBA is taking a risk based approach to prioritising which restrictions to address first. This task is proving to be more complex than expected. Some of these restrictions may be necessary because of physical constraints, hydrological connectivity (or the lack of it) or the need to protect the environment. The MDBA and Basin states are working through whether all of these restrictions are necessary and compliant with the Basin Plan trading rules and requirements.

Since the introduction of the Basin Plan states have removed most restrictions on permanent water trade. For example, Victoria removed a number of trade restrictions, including the 4% limit on trade out of irrigation districts. These changes are providing greater flexibility for entitlement holders to manage their business risk, take advantages of emerging commercial opportunities and adjust their operations in response to changing seasonal conditions and water availability.

The MDBA and Basin states are reassessing the appropriateness of how interstate trade is accounted for in the southern connected Basin, to assess the efficiency and effectiveness in the current operating environment. Overall, on the limited available evidence it appears that there has been limited progress on removing other barriers, particularly restrictions on allocation trade. In the MDBA's view this is an ongoing priority area given the size of the temporary water market.

As required, there has been an increase in the availability of water market information from both the private and public sectors. However, while this increased availability of information has not been formally evaluated, indications are that this information could be more accessible and useful than is currently the case.

## How could implementation be improved?

MDBA considers the priorities to address are:

- address information gaps about the material effects of restrictions on allocation trade especially in the southern connected Murray–Darling Basin, and address those which are unnecessary and the highest priority
- ensuring that the water market information now available is useful and accessible.

## 4.8 Compliance

An effective, fair and transparent compliance system is critical to the success of the Basin Plan in delivering a healthy and productive Basin. It underpins the transition to Basin-wide SDLs, and the integrity of water resource plans, environmental watering and the water market.



### Findings

**IF9 The MDBA's Basin-wide Compliance Review, supported by an independent panel of experts, found an urgent need for Basin states and the MDBA to take immediate steps to improve compliance arrangements to develop trust in the Basin Plan arrangements. MDBA has committed to implement all of the actions for itself identified in the review.**

#### Recommendation:

**IR9 Basin states should adopt the recommendations in the MDBA's Basin-wide Compliance Review, and COAG should commit to a Basin Compliance Compact to be developed and published by 30 June 2018, with regular reporting thereafter.**

### What was expected?

The Water Act and the Basin Plan (including the Intergovernmental Agreement on Basin Plan Implementation) introduced new arrangements and responsibilities for managing water resources across the Basin, including a new regulatory and compliance role for the MDBA. Under the new arrangements, state water planning laws are being brought into alignment with the Basin Plan, but leave Basin states with responsibility for their own water management arrangements, including enforcing their own water laws to prevent illegal take. The MDBA's role was to take action to enforce compliance with the Basin Plan and water resource plans.

In regards to implementation, by 2017 Basin governments and the MDBA were expected to be well advanced on meeting agreed timeframes including:

- the development and accreditation of water resource plans by 2019 (see Section 4.5 *Water Resource Planning*)
- having accurate and comprehensive SDL accounting arrangements in place by 2019 (including during the transition from the Murray–Darling Basin Cap arrangements) (see section 4.6 *Transitioning to SDL accounting and compliance*)
- implementation of the trade rules, starting in 2014 (see section 4.7 *Water trading rules*)
- protecting environmental flows across the Basin through water resource planning and commitments in the Intergovernmental Agreement on Basin Plan Implementation
- protecting environmental flows in the southern Basin, through the implementation of practical measures such as re-crediting return flows and 'piggybacking' releases of held environmental water during higher flows (collectively referred to as prerequisite policy measures – (See Sections 4.1 *Recovering water for the environment* and 4.2 *Managing environmental water*).

## What has happened?

The MDBA has been taking steps to develop its approach to enforce compliance with the Basin Plan. The MDBA's approach to compliance is set out in a compliance strategy, developed in 2014. As Basin states retained their own water management arrangements, the working assumption of the MDBA has been that states will diligently enforce their own water laws, including matters covered by their existing water plans. Part of the MDBA's compliance strategy is a protocol for handling allegations of non-compliance. Where the MDBA is not the primary authority (such as allegations of illegal take) matters have been referred to the relevant state authority. The MDBA has not always followed up to seek confirmation that the allegations have been looked into. In some cases it is now clear that the MDBA should have been more diligent in investigating allegations itself.

On 24 July 2017, *Four Corners* broadcast a program on water regulation in the Barwon–Darling River system that raised serious concerns about compliance with and enforcement of water laws. The program has triggered seven investigations, Basin-wide and within New South Wales and Queensland. The Prime Minister and Deputy Prime Minister requested the MDBA undertake a Murray–Darling Basin Water Compliance Review (the Compliance Review). An Independent Panel was set up to advise the MDBA on the conduct of the Compliance Review, and to report separately on the issues covered, including the MDBA's own compliance role.

The Compliance Review has assessed the compliance and enforcement frameworks and practices of the Basin states and of the MDBA, and the appropriateness of water management rules for protecting environmental water across the Basin. Of key concern to Basin Plan integrity is how existing approaches to compliance may need to change to provide confidence that new Basin Plan rules will be enforced.

## How could implementation be improved?

The Compliance Review sets out a number of recommendations for Basin state governments to improve their current compliance and enforcement frameworks and activities. These include implementing a 'no meter, no take' policy, along with improving the accuracy and reliability of metering and the measurement of water take. Additionally, the Review recommends that Basin states review their existing arrangements for compliance and governance to ensure there is a strong culture of compliance that is led from the top, and clear decision making arrangements with a commitment to transparency. Further to this, the Review recommends that by June 2018 Basin states publish compliance strategies and ensure that any necessary legislative changes are identified, and steps taken to propose any necessary amendments.

The Review also identifies a number of actions to which the MDBA has committed. The MDBA will review its own compliance and governance arrangements, establish a dedicated Compliance Branch, take a more proactive and transparent approach to compliance and enforcement, and employ its enforcement powers where necessary. Additionally, the MDBA has committed to developing and publishing an SDL reporting and compliance framework and a register on the progress of WRP development.

Further to this, the Review has recommended that:

- COAG reiterates its commitment to the 2019 deadline for WRPs, and to a Basin Compliance Compact to implement the recommendations from the compliance review and restore public confidence in Basin water management.
- Commonwealth and state governance arrangements for Basin Plan implementation are reviewed to ensure that those with implementation responsibilities are engaged, statutory roles are respected, decisions are better integrated and transparency is improved.
- The NSW and Queensland governments revise their water resource plans to include effective policies for the protection of environmental water, particularly during low flows.

- To improve protection of environmental water in the southern Basin, governments fully implement the SDL Adjustment Mechanism (including the implementation of prerequisite policy implementation plans).

[The full report is available on the MDBA website.](#)

## 4.9 Working together to implement the Basin Plan

Implementing the Basin Plan and the broader water reforms involves ongoing collaborative effort by the Australian government, Basin states and local communities including Aboriginal communities. Collaboration draws on local knowledge, experience and advice and recognises that there continues to be a range of local conditions and interests across the Basin.

### Findings

**IF10 There are established governance arrangements which enable governments and communities to work together to guide Basin Plan implementation. Even so, some deficiencies have been identified because not all of the right people and agencies are involved.**

IF10.1 The MDBA and the Basin governments have established governance arrangements that span the range of Basin Plan implementation actions. Some instances have been identified where government agencies with implementation obligations have not been included.

IF10.2 Basin governments and the MDBA have begun to work with communities in a collaborative and flexible manner, with the Northern Basin Review serving as an example of how community views can influence Basin Plan implementation. More can still be done to ensure stakeholders see their views and interests reflected in decisions.

IF10.3 In the past five years, there has been a lack of community confidence in, and support for, parts of Basin Plan implementation. In recognition that community support has a significant effect on implementation, the MDBA and the CEWH have introduced regional/local engagement officers in a number of locations across the Basin.

### Recommendation:

**IR10 Basin governments and the MDBA continue to work together to build confidence in Basin Plan implementation, particularly in the areas of compliance and the implementation of supply measures. Governance arrangements should also be regularly reviewed to ensure they remain appropriate and effective for each stage of implementation.**

IR10.1 Basin governments and the MDBA need to play a stronger role in sharing knowledge with stakeholders, including about the role of environmental watering, and how local knowledge is used to support decision making.

IR10.2 Basin governments and the MDBA should review governance to:

- streamline arrangements and identify gaps
- ensure arrangements remain appropriate and effective for each stage of Basin Plan implementation
- improve transparency, accountability and timeliness.

The Basin Plan was established after almost a century of consensus based governance of Basin water resources by Basin states and territories, with at times competing interests. While Basin states retain direct responsibility for management of water resources, the Basin Plan introduces the MDBA as an independent authority responsible for overseeing the planning and management of Basin water resources in the interest of the Basin as a whole. In practice, implementation will need to be founded upon partnerships between the MDBA and Basin governments.

## What was expected?

The Basin Plan requires a partnership approach to implementation and recognises there are a range of local conditions and interests across the Basin that should be taken into account in implementing the Plan. The Basin Plan outlines the roles and responsibilities of Basin governments for each of the different elements of the Basin Plan, from developing and accrediting water resource plans, developing environmental watering plans, to monitoring and reporting, and compliance.

The Basin Plan also specifies requirements for consultation and local input to inform decision making, including in water resource planning, environmental watering and Basin Plan reviews.

By 2017 it was expected that governments would be working together in good faith to implement all elements of the Basin Plan in accordance with requirements, with formal committees or other arrangements in place to facilitate collaboration. It was also expected that community involvement and consultation would be occurring as required for measures such as water resource planning and the Northern Basin Review.

## What has happened?

### Governments working together

Basin governments and the MDBA are working under a range of governance arrangements to coordinate their work and oversee implementation, from intergovernmental agreements and decision making processes, and consultation and advisory bodies. These include the Ministerial Council, Basin Officials Committee, Basin Plan Implementation Committee, Basin Community Committee and their associated working groups and advisory committees (see figure 11). Under Basin Plan arrangements there is also a stronger role for the Commonwealth agencies such as the Commonwealth Environmental Water Office, the Australian Competition and Consumer Commission and the Bureau of Meteorology.

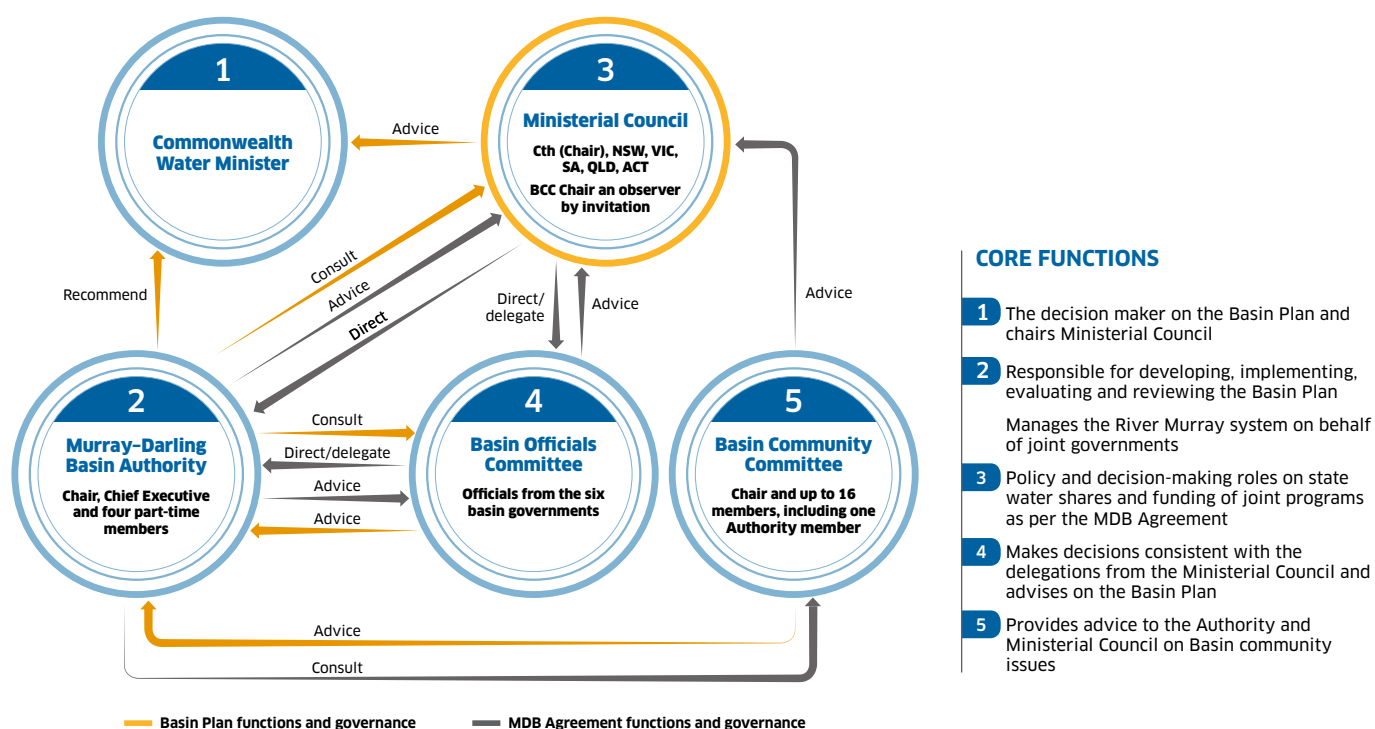


Figure 11: Governance in the Murray-Darling Basin

The Basin Plan Implementation Committee, and its sub-committees on water resource planning, trade, environmental watering and monitoring, evaluation and reporting, were specifically set up to facilitate inter-governmental collaboration on implementation. While there has been no detailed analysis of the



effectiveness of these working arrangements as part of this evaluation, their terms of reference, modes of operating and work programs are reviewed annually, and there is evidence they have provided an ongoing forum for Basin governments to work together to implement the Basin Plan.

Positive outcomes include improved collaboration in planning and delivery of environmental water, completion of the Northern Basin Review, development of a package of measures for the SDL Adjustment Mechanism and the progress so far in developing water resource plans. In some cases, governments have taken longer than originally agreed to deliver on particular elements of the Basin Plan, such as the SDL adjustment measures and long-term watering plans but this is likely a reflection on the complex and difficult nature of the tasks in hand.

[Further information on governance](#) can be found on the MDBA website.

## **Working with communities**

Basin governments have consulted with communities about environmental watering and reviews such as the Northern Basin Review and groundwater reviews as stipulated in the Basin Plan. Local advice, in particular through community environmental water advisory groups, has helped set watering priorities and guide when and where to water. Basin states have also commenced consulting with communities, including Aboriginal communities, as they are developing their water resource plans.

The MDBA has established advisory committees to guide its work, including the Basin Community Committee, the Advisory Committee on Social, Economic and Environmental Sciences (ACSEES), and Indigenous advisory committees in the northern and southern Basin- the Northern Basin Aboriginal Nations (NBAN) and the Murray Lower Darling Rivers Indigenous Nations (MLDRIN). States also have their own arrangements for community consultation, such as the NSW environmental watering advisory groups.

While there has not been an analysis of the effectiveness of these arrangements as part of this evaluation, some advisory bodies (such as the NSW environmental watering advisory groups; the MDBA's regional engagement officers, and advisory committees, Basin Community Committee and ACSEES) have been separately reviewed in recent years. These reviews have reaffirmed the value of these particular arrangements and made some refinements to improve their operation.

The Northern Basin Review provides a good example of Basin governments and communities working together in a collaborative and flexible manner. From 2012, the MDBA held many meetings and discussions with a wide range of northern Basin stakeholders including state agencies, irrigators, floodplain graziers, conservation groups, Traditional Owners, local governments, and natural resource management groups. Community consultation also occurred through formal committees and advisory groups, particularly the Northern Basin Advisory Committee (NBAC) and the Northern Basin Aboriginal Nations.

The Northern Basin Review provides a good example of Basin governments and communities working together in a collaborative and flexible manner

As part of their advice NBAC developed the concept of a 'toolkit' of measures, which encompassed a broad range of actions and initiatives to accompany water recovery that could help to maximise environmental benefits and minimise social and economic impacts. The development of the 'toolkit' concept was the result of the community's view that achieving outcomes was about more than a volume of water. This is an example of how the Committee made a significant contribution to the final outcomes of the Northern Basin Review, even though it may not have been possible to reflect all the views of NBAC in the final decision.

The MDBA sought information about Aboriginal values and priorities through NBAN and conducted a socio-cultural study that looked at the importance of environmental water to Traditional Owners in three towns. Traditional Owners were very supportive of the approach and findings of the study, and a similar approach was included as part of the 2017 evaluation (see *Case study 7: The Barkandji people and their involvement in water planning* in Section 5.3.4 *Outcomes for Aboriginal communities*). While NBAN believed the study accurately reflected their views, the MDBA received feedback from NBAN and broader Aboriginal interests in the northern Basin that their views were not adequately taken into account during decision-making. While the MDBA considered all of the information provided, it did not clearly communicate back to Aboriginal people about how their interests had been considered during the decision-making process.

Whether or not final decisions reflect a particular stakeholder's position, "closing the loop" on how and why a decision is made is an important principle of community consultation that all agencies involved in Basin Plan implementation should follow. (See *Case study 3: The Northern Basin Review - flexibly implementing the Basin Plan*).

This interim evaluation has identified some gaps in formal arrangements including in several areas of environmental water management. For instance environmental water holders are currently not involved in the design and implementation of supply measures, which will directly affect how environmental water is managed and delivered.

In regards to working relationships between Basin governments and communities, there is qualitative evidence of a lack of community confidence and support across a range of areas of implementation. This is not necessarily unusual given the substantial interest and contested nature of the debate regarding water management. A lack of community support for future projects, such as those associated with the SDL Adjustment Mechanism, could impede future progress. This can be compounded by confusion about roles and responsibilities in water management and reform.

The MDBA received submissions on the SDL adjustment determination noting concerns about the lack of information and transparency regarding nominated supply measures and the lack of community consultation, particularly in relation to specific projects.

Recognising the importance of local information and engagement, the [CEWO introduced a network of six local engagement officers across the Basin in 2014](#). The MDBA did likewise in 2016 [introducing a network of Regional Engagement Officers \(REOs\)](#), and followed up in 2017 by opening three new regional offices, to strengthen connections with communities and signal the MDBA's commitment to improve engagement. It is too early to gauge the success of these initiatives in strengthening engagement with regional communities. A full evaluation will be undertaken as part of the 2020 Basin Plan Evaluation.

## CASE STUDY 3

### The Northern Basin Review — flexibly implementing the Basin Plan

In response to feedback that the MDBA needed to make more effort to engage directly with communities, the MDBA worked with the Northern Basin Advisory Committee to plan a series of meetings to better connect with northern Basin stakeholders. This resulted in a wide ranging community engagement program in 2016, including meetings in 20 towns and other locations. The majority of these meetings were attended by the Chief Executive of the MDBA and other members of the Authority, as well as senior technical staff and colleagues from state government agencies.

The Northern Basin Advisory Committee, and feedback from communities, highlighted that achieving outcomes was about more than a volume of water. The Northern Basin Advisory Committee proposed a 'toolkit' of measures which comprised actions and initiatives to support water recovery to maximise environmental benefits and minimise economic impacts. There was widespread support for these actions in the broader community. This led to the MDBA decision to recommend water management actions to supplement the recommended water recovery in the northern Basin. In response, the Australian, New South Wales and Queensland governments have made in-principle commitments to implement the following 'toolkit' measures:

- protecting environmental flows
- better targeting of water recovery
- improving coordination and management of environmental flows
- addressing constraints to environmental water delivery in the Gwydir wetlands
- mitigating cold water pollution
- constructing fishways.

The outcome of the Northern Basin Review and commitment to implement the associated 'toolkit' is an example of Basin governments and communities working collaboratively to use new information and local knowledge to improve Basin Plan implementation.

## How could implementation be improved?

Despite what is already being done, Basin governments and the MDBA should consider ways to further improve stakeholder relationships, build understanding and trust. This could include more effective information exchanges with stakeholders, better understanding of stakeholder concerns and better communication of outcomes by clearly explaining the reasons behind decisions and how local knowledge was used. For example, there could be better communication about environmental watering, as demonstrated by NSW through regional workshops with anglers (See *Case study 4: Communicating better with communities – recreational anglers*). Engagement with Traditional Owners could be improved.

Governments should regularly review governance arrangements to identify gaps and ensure the arrangements remain appropriate and effective for each stage of Basin Plan implementation, taking into account key governance principles such as transparency, accountability and timeliness.

Having the necessary arrangements for monitoring compliance, and longer term outcomes from the Basin Plan, will be increasingly important in the next phase of Basin Plan implementation through to 2020.

## CASE STUDY 4

### Communicating better with communities — recreational anglers

Recreational fishers have a direct interest in water management and want improved river flows to deliver better outcomes for native fish. There are an estimated 430,000 recreational anglers in the Murray–Darling Basin.

Recreational fishers have expressed concerns about water management under the Basin Plan, including environment watering. There are perceptions within some of the recreational fishing community that water for the environment is detrimental for native fish - in particular that it causes blackwater events, resulting in fish kills. NSW DPI Fisheries have been working directly with the members of the NSW Engaged Anglers Advisory Group to demonstrate the benefits and debunk some of the myths about environmental water.

DPI Fisheries formed the NSW Engaged Anglers Advisory Group in late 2016 to seek advice on improving communication and engagement with recreational fishers. The group is currently made up of anglers from across NSW, including representatives from the NSW Border Rivers, Namoi, Macquarie Castlereagh, Lachlan, Murrumbidgee and NSW Murray and Lower Darling.

The interactions between DPI Fisheries staff and the Engaged Anglers Group is an opportunity for both parties to ask questions and to share information. The group provides a forum for the exchange of information and ideas through one on one conversations, group meetings, and attendance at larger gatherings such as the [MDB Native Fish Forum](#).

Anglers have been informed on a number of topics including:

- how water for the environment benefits native fish breeding, feeding and survival
- how natural flooding and biological processes can result in severe blackwater
- how water for the environment can provide refuges from severe blackwater and dilute the effects of blackwater
- how the water reforms have been developed using the latest native fish research.

These conversations have been critical to changing perceptions of environmental flows. DPI Fisheries is empowering the anglers to distribute their new knowledge to their communities through 'angler led' activities and events. There is now a group of anglers across the Murray–Darling Basin who can advocate for environmental water and native fish needs.

The group will continue over the next three years and there is interest from other Basin states to expand the approach across the Basin.

## 4.10 Monitoring, evaluation and reporting

Good monitoring, evaluation and reporting is critical to understanding whether outcomes are being achieved and provides learning that can be incorporated back into management actions.



### Findings

**IF11 Basin governments and the MDBA have met their first five years of Basin Plan reporting requirements. There is potential to collect more targeted monitoring information, and enhance reporting to make it more useful for those implementing the Basin Plan.**

IF11.1 To date, all Basin governments have delivered and published the required annual reporting, including through the publication of Basin Plan annual reports.

IF11.2 During the first five years of implementation, Basin governments have collaborated to coordinate monitoring activities across the Basin. Even so, there are further opportunities to better align monitoring with evaluation requirements relating to Basin Plan objectives and outcomes. Asset or site scale monitoring and evaluation could also be better linked to the same analysis at the Basin scale.

IF11.3 There is evidence that annual reporting is not being optimally used to inform decision making.

#### Recommendation:

**IR11 Basin governments should continue to support the shift to more evaluative Basin Plan reporting, and ensure Basin Plan monitoring, evaluation and reporting is actively used to improve Basin Plan implementation.**

IR11.1 Basin governments and MDBA need to review the Basin Plan reporting requirements to make them more relevant to adaptive management.

IR11.2 Basin governments, the MDBA and the CEWO should continue to work together to better plan, coordinate and align their monitoring programs to support better evaluation of outcomes and clearer reporting.

The Basin Plan contains a program for monitoring and evaluating the effectiveness of the Basin Plan. It includes a range of annual and five yearly reporting and reviews designed to contribute to adaptive water management, as well as meet compliance and public accountability requirements.

The Basin Plan program includes principles such as using best available knowledge, transparency and collaboration; and sets out a range of evaluation and reporting requirements for all Basin Governments and agencies. These requirements cover all elements of the Basin Plan and differ according to each agency or government's role in implementing the Plan.

The MDBA, for example, is responsible for evaluating the effectiveness of the Basin Plan as a whole, including Basin-wide environmental, social and economic outcomes, while Basin states must evaluate the effectiveness of their own state level water planning and management, and local scale environmental outcomes.

This evaluation looks at the first five years of implementing the Basin Plan monitoring and evaluation program. It does not evaluate existing state programs or the CEWO's long-term intervention monitoring, although those existing programs do provide valuable input to inform reporting under the Basin Plan program.

As an interim report, this evaluation draws largely on existing information and feedback about the program from intergovernmental groups involved in monitoring and evaluation (namely the Monitoring and Evaluation Working Group and the Monitoring and Evaluation Joint Venture Steering Committee), as well as information gathered through interviews with relevant MDBA and CEWH environmental water planners and managers.

## **What was expected?**

It was not expected that the entire Basin Plan monitoring and evaluation program would be rolled out after five years of implementation, particularly given that key elements of the Basin Plan are not yet implemented.

By 2017, it was expected that Basin governments and the MDBA would be delivering their annual Basin Plan reporting as required – reporting on key Basin Plan elements. The MDBA would also be delivering an annual report on the effectiveness of implementation each year.

Although initially scheduled for 2017, following the review of the Water Act in 2014, five yearly evaluation of Basin Plan effectiveness involving all governments was shifted to commence 2020 to better align with other reviews and reports. This interim evaluation is a trial to provide a health check on Basin Plan implementation ahead of the 2020 evaluation.

## **What has happened?**

In the first five years, all Basin governments and the MDBA have met their annual reporting requirements. Each year the MDBA has used these reports together with other information to prepare an overarching Basin Plan annual report. The reports from governments have covered a range of Basin Plan measures including: the use of environmental water; implementation of the environmental management plan, the salinity management plan and the water trading rules; risk management; progress in transitioning to SDLs; and engagements and use of local knowledge to inform implementation.

The Basin governments' reports have been published each year on the MDBA's website, along with the MDBA Basin Plan annual report. The Basin Plan Annual Report is also tabled in parliament and circulated to key stakeholders.

Immediately following commencement of the Basin Plan, the MDBA worked together with Basin governments to develop guidelines for the annual (and some five yearly) evaluation and reporting requirements. These guidelines, first published in 2013, were designed to clarify reporting requirements and assist governments in preparing their reports.

The evaluation and reporting required by the Basin Plan's monitoring and evaluation program is intended to meet several purposes. In addition to providing open and transparent information to governments and the public on the full range of Basin Plan implementation activities and progress towards outcomes, it should be able to inform adaptive management and reviews of any elements of the Basin Plan or Basin Plan implementation.

Timely reporting and publishing is helping to ensure there is accurate information available publicly on all governments' Basin Plan activities, with information published annually through the MDBA's website.

Website analytics show that across the Basin few people are accessing this information.

Interviews were undertaken with MDBA and CEWH staff to gauge the usefulness of the annual Basin Plan reporting by agencies in informing future decision making, for example in relation to environmental watering or implementing trade rules. Feedback indicated that the annual reports were not useful for informing decision making for several reasons including that the annual reporting:

- focuses on implementation rather than evaluation
- is not well timed to align with opportunities to inform activities
- does not contain the most relevant data or data is not fit for purpose
- is not supported by governance and/or processes to close the adaptive management loop and enable it to inform planning and management actions.

This does not mean that monitoring and evaluation is not supporting adaptive management across the Basin more broadly. Existing state and CEWO monitoring and evaluation programs are regularly used to inform environmental watering activities at the operational level, particularly at the site scale where monitoring of individual events is used to learn about responses and evaluate outcomes. Over time, this monitoring has proven useful in building knowledge and has been used directly to inform future watering and improving outcomes. (See *Case study 5: Learning and adapting water strategies for native fish* in Section 5.1.2).

The focus on progress with implementation is not surprising at this stage of implementation, but shifting the program to focus more on outcomes by the first full evaluation in 2020 will need to be supported by appropriate reporting guidelines, information and data. The content of current Basin Plan reporting is driven not just by information available, but also by the 2013 reporting guidelines.

Five years in, feedback suggests that the current reporting guidelines are not necessarily seeking the most appropriate information or metrics to support decision making. In addition, the information and data underpinning Basin Plan reporting comes in part from the various monitoring programs established by all governments. This evaluation has identified that not all the monitoring information available is fit for purpose and is not well aligned with Basin Plan evaluation and reporting requirements.

Governments acknowledged from the commencement of the Basin Plan that existing monitoring programs established by jurisdictions were not necessarily well aligned or coordinated to deliver efficiently on Basin Plan evaluation and reporting. An intergovernmental committee was established in 2015 to identify and investigate options to better align and coordinate monitoring programs across the jurisdictions. The Joint Venture Monitoring and Evaluation Program Committee has been funding by Basin governments specifically to address duplication, coordination and consistency issues. For example, by better understanding Basin Plan requirements, identifying common priorities and ensuring that monitoring data is consistent and accessible, information can be collected once but used by multiple parties for different evaluation and reporting purposes. Initial work has been done by all governments to identify and understand the multitude of monitoring programs relevant to Basin Plan evaluation and reporting and help prioritise future work.

## **How could implementation be improved?**

Going forward it will be important to ensure that reporting under the Basin Plan monitoring and evaluation program is improving transparency and providing useful information for decision makers, and whether different government monitoring programs are well aligned and coordinated to reduce duplication, improve efficiency and increase the effectiveness of reporting.



Reviewing and updating the guidelines for annual and five yearly Basin Plan reporting, in the light of knowledge gained from the first five years of implementation, would be a significant step in helping to ensure Basin Plan reporting is targeted at providing useful information in terms of adaptive management. Renewed guidelines should also consider ensuring reporting not only meets annual requirements, but can usefully accumulate over time to meet longer term evaluation requirements. Guidelines should also consider the relationship between reporting requirements by providing greater clarity on the links between data and reporting at the local or regional scale, and that for Basin scale reporting.

Once updated, the reporting guidelines should be regularly reviewed as knowledge builds, to ensure they remain current and are guiding collection of the best available and relevant information to inform ongoing implementation and outcome improvement.

Efforts to improve the efficiency and effectiveness of information collection across the Basin need to continue. This includes through the Joint Venture Monitoring and Evaluation Program, the MDBA's 2015 research and knowledge strategy (currently under review) and the Basin Officials Committee Science Strategy. Review of the Basin Plan monitoring, evaluation and reporting guidelines (above) should be linked to these processes and programs.

The next focus should be to shift to more evaluative reporting as the MDBA approaches the first full evaluation in 2020. This should include building better connections between annual and five yearly Basin Plan reporting and the planning and management activities they can inform. This is an important step to optimise the feedback loops necessary to inform continual improvement of Basin Plan implementation. Annual reporting could seek feedback from water managers on how to improve and better coordinate monitoring, to deliver the most relevant and useful information. Governments should also consider identifying and addressing gaps in governance processes that are not supporting the closing of the adaptive management loop. For example, where reporting is not well timed, or where existing decision making processes do not explicitly require consideration of best available information.

Lastly, while this evaluation has drawn on information from the Monitoring and Evaluation Working Group, interviews regarding the usefulness of current Basin Plan reporting were held only with MDBA and CEWO program managers. The MDBA should extend this exercise to include Basin states and the Department of Agriculture and Water Resources, to continue to better target the outcomes of the monitoring and evaluation program.



## 5. Basin Plan outcomes over the first five years

A healthy working Basin may take many years to achieve, but at this early stage there are good signs that the Basin Plan is working and many elements are on track to deliver the intended outcomes.

### 5.1 Environmental outcomes

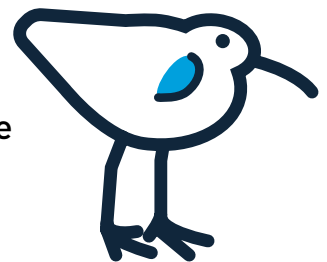


#### ENVIRONMENTAL CHANGE TAKES TIME

A damaged ecosystem takes decades to revive. Where there is available information, early signs indicate the Basin Plan is on track to deliver long-term environmental outcomes.

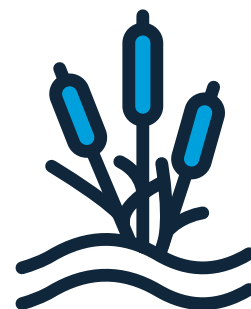
#### WATERBIRD NUMBERS

Over several decades, waterbird numbers have declined by 70%. Five years into implementation, the rate of decline in waterbird numbers has reduced. There is evidence of positive responses to environmental water.



#### IMPROVING FISH POPULATIONS

Native fish have responded positively to environmental water. It has been used to support endangered Murray hardyhead populations; ensure golden perch can move to suitable habitats; and has supported an increase in Murray cod breeding.

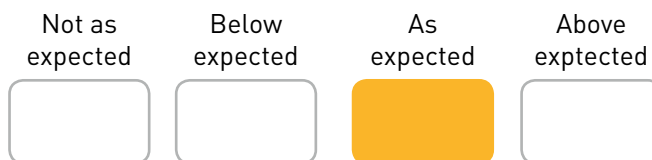


#### CHANGES TO VEGETATION ECOSYSTEM

There are early signs of positive responses of native vegetation to water delivered under the Basin Plan, such as growth of seedlings and saplings, and improvement in the condition of some river red gum forests.

A healthy environment is fundamental to achieving a sustainable working river. It is also important for people, providing social and cultural benefits to communities, economic opportunities for businesses that rely on water, and ensuring water quality

is fit for a range of purposes. This section looks at the environmental outcomes seen in the Basin over the first five years of Basin Plan implementation, as more water has progressively been left in rivers or specifically targeted to achieve specific environmental outcomes. This section is closely related to Section 4.2 *Managing environmental water*.



## Findings

**OF1 Early signs indicate that where environmental water can be delivered there is a positive response from native fish, waterbirds and native vegetation. Water for the environment is critical for Basin health. Full implementation of the Basin Plan and management of non-flow related factors will further enhance its effectiveness.**

OF1.1 Native fish, waterbirds and native vegetation have benefitted from environmental water in many areas across the Basin. Where appropriate information is available, it indicates the Plan is on-track to meet Basin Plan environmental objectives. There are some areas where it is still too early to tell or the right information is not available to be able to make an assessment.

OF1.2 Five years in, it is clear that environmental water is being actively and effectively managed to target environmental priorities. It is expected that outcomes would improve as water recovery is completed and there is more water available for environmental use.

OF1.3 For sites where environmental water cannot be delivered, there will be detrimental change to water dependent ecological systems.

OF1.4 The likely responses to environmental watering are affected by external influences such as invasive plants and animals, in-stream barriers and land management. A collaborative and coordinated approach to managing these non-flow related factors would enhance the effectiveness of environmental water.

OF1.5 Monitoring ecological responses to environmental water has been critical for improving the way this water is used. The collection of information needs to be adaptively managed and shared effectively with Basin partners.

### Recommendation:

**OR1 Basin governments and the MDBA should continue with full implementation of the Basin Plan by 2024, as the management of constraints, implementation of all aspects of the Sustainable Diversion Limit (SDL) Adjustment Mechanism and protection of environmental water are critical to getting the best possible environmental outcomes.**

OR1.1 Full implementation of the Basin Plan includes programs that will help get water to where it is needed, particularly out onto the floodplain. These include the management of constraints, implementation of all aspects of the Sustainable Diversion Limit Adjustment Mechanism and protection of environmental water.

OR1.2 Basin governments and the MDBA should keep working with communities and focus on communicating the benefits of environmental watering.

OR1.3 Non-flow factors need to be considered by Basin governments and the MDBA in implementing the Basin Plan. This will require a collaborative and coordinated approach.

## What was expected?

A healthy Basin will take many years to achieve and requires a long-term commitment. The Basin-wide watering strategy, released in 2014, aims to first halt the environmental decline by 2019 and then improve the health of the river system by 2024. The strategy recognises the environment will take time to respond to watering.

In 2017 it was expected there would be localised responses to environmental watering. In general it was expected there would be some improvements in river flows and connectivity, and positive ecological responses to these enhanced flows from native fish, waterbirds and vegetation.

While there is an expectation that seeing positive ecological responses means the Basin Plan is on-track to achieving longer term expected outcomes for some ecosystem components like vegetation, it will be too early to tell or there may not be enough evidence to tell at this stage.

There is also an expectation that environmental water is being used in a way that aligns with the agreed environmental watering priorities and that environmental water managers are increasingly working together to improve outcomes.

## What has happened?

### 5.1.1 River flows

River flows are important to ecosystem health and maintaining ecological functions and processes. Therefore, a key objective of the Basin-wide watering strategy and environmental watering is to improve the pattern and connectivity of river flows in the Murray–Darling Basin (See *Box 2: What is connectivity and why is it important?*).

#### **Box 2 | What is connectivity and why is it important?**

Connectivity is about how well a river is connected from one end to the other, as well as the floodplain and surrounding wetlands.

Lateral connectivity is about water flowing into small streams, low lying wetlands and out onto floodplains. Longitudinal connectivity is about water flowing through the entire length of a river from its source to the sea. Lateral and longitudinal connectivity are important for the health of the whole system, supporting wetland and floodplain health, and vital ecosystem functions, such as exporting salt, maintaining water quality and allowing fish to move freely.

## Longitudinal connectivity

Outcomes for longitudinal connectivity have varied from the north and south of the Basin. This is partly due to differences in geography, climate, regulating structures and water management. The northern Basin experiences summer-dominated rainfall, as opposed to winter dominated in the south, and the proportion of northern Basin flows regulated by dams is much lower.

The northern Basin has been relatively dry over the past five years, with average annual flows well below average. Due to these dry conditions and the fact that the Basin Plan is not yet fully implemented, improved longitudinal flows, while evident in some northern Basin tributaries, have not resulted in materially improved flows into and downstream of the Barwon–Darling. Better data (for example, from

river gauging and improved metering of pumps) would improve capacity to track environmental water as it flows along rivers in the northern Basin.

Longitudinal connectivity has significantly increased in the southern Murray–Darling Basin, with over 2,000 GL of environmental water flowing through the Lower Darling, Murrumbidgee, Goulburn, Campaspe and Loddon Rivers to the lower River Murray since the commencement of the Basin Plan. In the River Murray, the increase is estimated to be approximately 630 GL in 2014–15, and 842 GL in 2015–16. Despite this increase, the relatively dry conditions across the Basin also resulted in lower than average flows up to June 2016. These results point to the Basin Plan being on track to improving longitudinal connectivity in the southern Basin.

Baseflows are long-term seasonal flows that are confined to the low end of the flow regime. They are an important component of the flow regime which maintain longitudinal connectivity during dry periods. The expected outcome of the Basin Plan in 2017 was to maintain baseflows at 60% of the natural level. However, a more refined measure that better reflects ecological outcomes needs to be developed to better gauge Basin Plan outcomes. This will require further work prior to the 2020 Basin Plan evaluation.

## Lateral connectivity

For the purposes of the evaluation, lateral connectivity has been divided into three broad hydrological categories: fresh, bankfull and floodplain flows. Monitoring indicates the Basin Plan has increased the number of freshes (smaller pulses of increased flow in the river) through the river system. However, the ability of water managers to provide bankfull and overbank flows has been limited due to operational constraints. Water managers have therefore focused on providing these higher flows to small areas of high value floodplains and wetlands using infrastructure. In summary, while some improvements to lateral connectivity have been observed, it is still too early to tell if the long-term expected outcomes will be achieved by 2024.

The implementation of the Constraints Management Strategy projects and Pre-requisite Policy Measures Implementation Plans will improve capacity to deliver overbank flows to the 'managed floodplain' (See *Box 3: The managed floodplain*) and achieve the expected improvements to lateral connectivity by 2024.

### **Box 3 | The managed floodplain**

The managed floodplain refers to the area of the floodplain that can be actively managed; versus areas which may be managed more passively and those which are out of scope for active management.

Connections to most medium and higher-level floodplains are out of scope of what can be achieved through environmental watering, as the volumes of water needed to restore these very high flows are beyond what environmental water holders can deliver. There are also some low lying areas of floodplain where water cannot currently be delivered due to third party impacts, and current rules and practices for managing water. However, the implementation of the Constraints Management Strategy, and policy and infrastructure changes will lead to more of these low lying areas being actively managed.

## End of Basin

The end of Basin system includes the Coorong, Lakes Alexandrina and Albert (otherwise known as the Lower Lakes), and the Murray Mouth. Flows to the Coorong and Lower lakes, particularly in summer, are critical to maintaining the ecological health of these assets and the waterbird populations they support. Flows through the Murray Mouth are crucial to exporting salt and nutrients out to sea, and allowing fish movement between the river and ocean, and keeping the Murray Mouth open more often is an objective of the Basin Plan.

Over the past five years increased environmental water has contributed water to end of system outcomes. For example, environmental water (including water flowing down the river after watering upstream environmental sites) has resulted in increased flows reaching the Lower Lakes, over the barrages, and to the Coorong every year since 2012.

The additional water reaching the end of the Basin has helped maintain suitable water and salinity levels in the Lower Lakes. The water quality and water levels in the Lower Lakes are on track to meet the 2024 expected outcomes.

Environmental water has increased barrage flows since 2012, and contributed to keeping the Murray Mouth open (an example of the counter-factual model results that underpin this assessment can be seen in the Hydrology Evaluation report). However, it is too early to tell if the Basin Plan is on track to achieve the 2024 expected outcomes for barrage flows (a 30 to 40% increase in barrage flows). Meeting this target is reliant on the ongoing implementation of the Basin Plan and can also be impacted by the future climate.

The full analysis of [river flows and connectivity](#) is available in the hydrology report prepared for the evaluation. The results for each expected outcome are shown in this report at Appendix C.

## 5.1.2 Native fish

Five years into the Basin Plan, there are good early results that native fish are improving. The Evaluation has found:

### 46 NATIVE SPECIES in the Basin

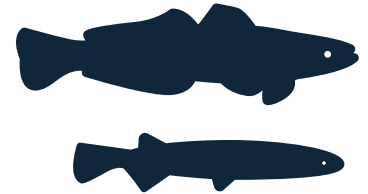
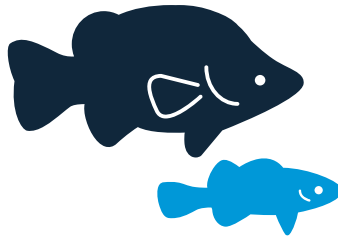


#### SPECIES UPDATE

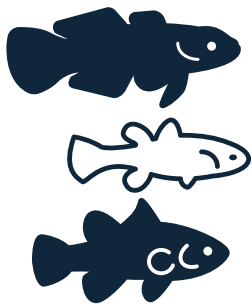
26 species are listed as threatened or endangered.

#### IMPROVING POPULATIONS

Macquarie perch, trout cod and Murray cod populations are showing signs of improvement.

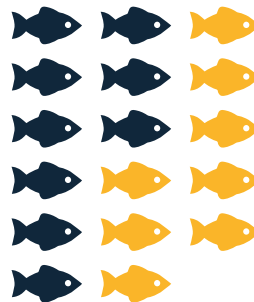


Common galaxias and Congolli are improving in the Lower Lakes.



#### SPECIES AT RISK

3 species – southern pygmy perch, purple-spotted gudgeon and Yarra pygmy perch – are declining.



#### STABLE POPULATIONS

9 out of 17 freshwater fish species are assessed to have stable Basin-wide populations.



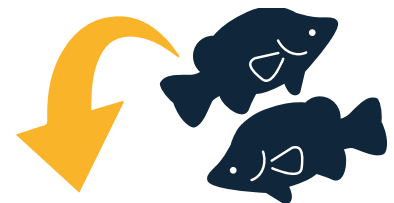
#### FLOW EVENTS

Over three years, almost 300 flow events were provided by environmental water holders, to support native fish species.

Around 90% of the monitored flow events contributed to a positive response by native fish.

#### SPAWNING EVENTS

Water for the environment triggered or enhanced spawning events for several of our Basin fish species for example golden perch, Murray cod and silver perch.



#### INCREASED MOVEMENT

Water for the environment also supported the large-scale movement of golden perch and silver perch; which is critical for their life-cycle needs.



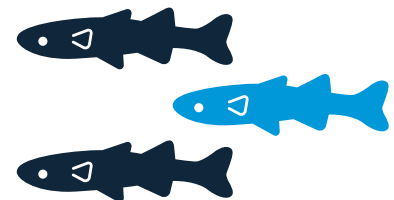
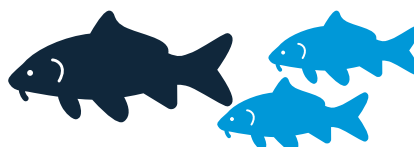
#### RECRUITMENT

Water for the environment supported recruitment events for Basin-wide species including Murray cod, silver perch and golden perch.

#### THREATS TO NATIVE FISH

Carp remain a top-tier threat to the health of many native fish species and aquatic environments.

The MDBA supports the National Carp Control Plan being developed by the Australian Government.



#### SURVIVAL RATES

Water for the environment supported the survival of 3 populations of the critically endangered species Murray hardyhead.

Multiple lines of evidence were used to inform the native fish evaluation, and include the Basin-wide fish survey; Basin state and Commonwealth Environmental Water Holder watering outcome reports; and reports on the purpose, volume and use of environmental water supplied annually by Basin states.

Since the commencement of the Basin Plan, over 300 environmental flows have been delivered to provide benefits for native fish. Targeted monitoring programs have detected positive responses of native fish to the delivery of these flows. These include triggering the movement and dispersal of golden perch and silver perch; enhancing recruitment success of Murray cod, freshwater catfish and silver perch; increasing abundances of Australian smelt and carp gudgeon; and maintaining critical habitat and hence facilitating the survival of populations of the endangered Murray hardyhead.

Responses that have system scale consequences have also been observed. The delivery of environmental water helped dispersal of golden perch into the southern Basin, and hence support the persistence of the southern Basin population. The coordination between multiple water holders, fisheries scientists and river operators has played an important role in achieving these larger scale outcomes.

Critical populations of a number of key native fish species, including golden perch and Murray cod are being maintained in the northern Basin. Evidence suggests that spawning and recruitment in the northern Basin, including Menindee Lakes, is currently supporting a large portion of the southern Basin population of golden perch. This highlights the importance of protecting environmental flows throughout the northern Basin for native fish outcomes.

Knowledge of fish responses to different flow conditions has improved since the implementation of the Basin Plan. Continuing to fill knowledge gaps will allow a better understanding of the recovery trajectories for native fish species and, in turn, lead to more efficient and effective use of environmental water (See *Case study 5: Learning and adapting water strategies for native fish*).

## CASE STUDY 5

### Learning and adapting watering strategies for native fish

Monitoring the outcomes of watering events, improving knowledge about the conditions required for fish spawning, and engaging with local communities is helping water managers to adapt watering strategies and improve outcomes.

For example, the delivery of environmental water in the Goulburn River in northern Victoria has changed significantly since 2012-13. In 2012-13 small environmental flows (designed to mimic spring freshes) were released to stimulate golden perch spawning and support the recovery of vegetation along the river bank. However, spawning of golden perch was not detected, possibly due to the peak height of the flow being too low. The community also raised concerns about the risk of bank slumping and notching, disruption of fishing events, and irrigators' access to pumps as a result of the watering events.

In response, the following year environmental water was delivered with a higher flow peak, and a second environmental flow was delivered to encourage semi-aquatic vegetation to grow along the banks. Water holders worked with river operators to vary water levels between the flows and also time the flows either side of the Murray cod fishing season. The first flow triggered migration of native fish and a golden perch spawning event. New growth of bank vegetation was observed following the second environmental flow. However, there were also reports of bank slumping and irrigators having restricted access to pumps.



In preparation for the 2014–15, water managers sought further advice from scientists. The advice indicated that a sequence of flows would increase the likelihood of a positive fish response. Thus, in 2014–15, a longer flow with a gradual recession was aimed at improving vegetation growth and fish condition, with a second fresh aimed at spawning. The flows were once again timed to avoid the Murray cod fishing season. The largest golden perch spawning event since floods in 2010 was observed following the second environmental flow. No significant community concerns were raised and anglers reported that the fishing was 'the best in years'.

The redesign of watering strategies demonstrates that the Goulburn–Broken Catchment Management Authority, environmental water holders (Commonwealth Environmental Water Holder, Victorian Environmental Water Holder and The Living Murray), and the river operator, Goulburn–Murray Water, have been able to work jointly with interested groups, and use learnings to improve outcomes for the environment and the community.

An increased understanding of the value of the northern Basin for supporting native fish populations provides greater impetus for system wide connectivity. Flows play a critical role in this, as was demonstrated in the movement of golden perch out of the Menindee Lakes in 2017. Other factors such as fish passage in weirs that do not yet have a fishway (including in the Menindee Lakes) are also important.

The state of a number of short lived native fish species are of concern. Many of these species are highly dependent on habitats outside of the river channel, such as wetlands and lagoons. Improved capacity to deliver water outside the main channel is likely to improve outcomes for short-lived floodplain species, such as olive perchlet and southern pygmy perch.

Connectivity with the floodplain not only provides critical habitats for short-lived species, but supports recruitment and growth of medium-long lived species (for example golden perch and Murray cod) by providing productive recruitment habitats and increasing in-stream productivity and subsequently food resources.

The Basin Plan is on track for improving the population structure of long-lived species, increasing golden perch and Murray cod of recreational take size, and improving the abundance and distribution of estuarine species. Insufficient data has made it difficult to definitively assess if the same is true for some of the other specific long-term outcomes sought. The evidence suggests that most species are still present in the Basin, however, there is uncertainty around a small number of species that have not been targeted by the current monitoring. Work is already underway to improve the approach to monitoring native fish outcomes across the Basin. In the absence of sufficient Basin-wide data, local scale responses to watering provide some confidence that the long-term expected outcomes will be achieved for many species.

Beyond environmental flows, management actions, such as habitat restoration and conservation stocking have also contributed to some local population improvements. Barriers to fish passage, improving river habitat and addressing constraints to floodplain inundation remain important issues. European carp populations are also a critical threat to the river environment and carp also benefit from water delivered for the environment (see *Box 4: National Carp Control Plan*). Continued efforts by state governments to address these factors and other catchment management actions will increase the likelihood of achieving longer term Basin Plan outcomes.



#### **Box 4 | National Carp Control Plan**

Carp remain a significant threat to the health of many native fish species and aquatic environments. In May 2016 the Australian Government announced the \$15 million National Carp Control Plan, to be developed by a team of specialists in the Fisheries Research Development Corporation. The Plan will initially focus on biological controls for carp, specifically the carp herpes virus. The Plan, which aims to be completed by 2018, will oversee more research and develop plans for the potential release of the virus and the cleanup that would be needed. There will also wide community and stakeholder engagement to get on-the-ground ideas on how a possible virus release could be managed. For more information, see the National Carp Control Plan website.

The full analysis of [native fish](#) is available in the report prepared for the 2017 evaluation. The results for each expected outcome are shown in this report at Appendix C.

### 5.1.3 Waterbirds

Waterbirds need healthy wetlands for breeding, foraging and roosting. They flock to sites with readily-available food and good habitat and play an important role in freshwater ecosystems. Birds can also benefit rural ecosystems by feeding on agricultural pests, including locust larvae and ticks. Environmental water can support waterbirds by maintaining habitat and supporting breeding.

The condition of waterbirds across the Basin is monitored by looking at bird numbers (including of shore birds), species diversity and breeding events. Monitoring over the past five years includes aerial monitoring and ground surveys.



#### INTERNATIONAL PROTECTION AGREEMENTS

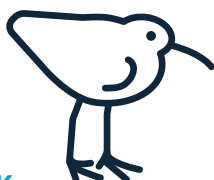
16 of the wetlands visited by waterbirds are protected under the International Ramsar Convention. Some wetlands are also visited by migratory birds travelling large distances.

The Basin's wetlands are used by at least 25 waterbirds listed in international migratory bird protection agreements – making looking after wetland health even more important.



#### WATER BIRD

At this early stage, at a Basin scale, it looks like the rate of decline in waterbird numbers has reduced.



#### SPECIES AT RISK

Migratory shorebirds are at record low numbers, e.g. red-necked stints and short-tailed sandpipers.

Waterbird numbers in the Coorong have not yet recovered to pre-drought levels.



#### CHICK SURVIVAL

21 flow events were used to help keep wetlands and lakes filled, stopping nests being abandoned and helping chicks to survive.

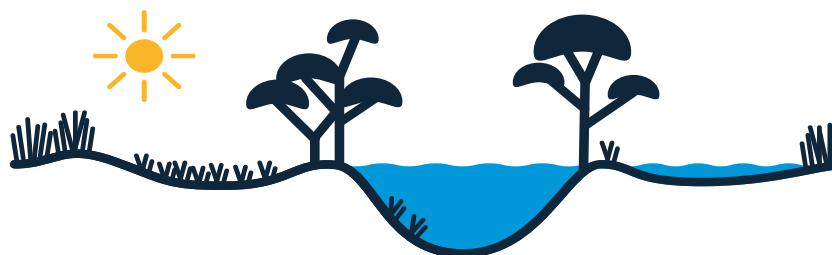
#### FLOW EVENTS

During 2013–16, 199 flow events were delivered to restore ecosystem health and help waterbirds.

Of these:

66 events contributed to improving wetland vegetation and conditions to provide breeding opportunities.

112 events maintained refuge habitats for waterbirds.



#### THREATS TO WATERBIRDS

Feral animals, habitat loss, disease and pollution affect waterbird populations.

#### BREEDING EVENTS

Natural flows supplemented by environmental water supported breeding colonies of up to 200,000 birds.

Straw-necked ibis, spoonbills, magpie-geese and pelicans bred at different sites such as Booligal wetlands (NSW), Macquarie marshes (NSW), and Barmah-Millewa forest (Vic. & NSW).



The Murray–Darling Basin supports over 120 species of waterbirds, providing habitat for 25 species listed as internationally important, and 16 nationally listed threatened species. Since the 1980s, 60% of all waterbird species have reduced in number, with overall waterbird abundances having declined by at least 70% across the Basin (see Figure 11).

Waterbirds are dependent on healthy wetlands for breeding, foraging and roosting. They flock to sites with readily-available food and suitable habitat and play an important role in freshwater ecosystems. Birds can also benefit rural ecosystems by feeding on agricultural pests, including locust larvae and ticks.

Environmental water can support waterbirds by supporting breeding, and maintaining habitat so that waterbird breeding has the potential to be greater when natural flooding occurs. The Basin Plan (through the Basin-wide watering strategy) has expected outcomes for waterbird species as well as the shorebirds of the Coorong, Lower Lakes and Murray Mouth. The condition of waterbirds across the Basin is monitored by looking at abundance of birds, species diversity and breeding events.

Between 2013 and 2016, almost 200 flow events were delivered to provide benefits for Basin waterbirds. In total, over 2,600 GL of environmental water has specifically been targeted to provide foraging and roosting opportunities for waterbirds. Other flows delivered to support ecosystem function, fish and vegetation will have also indirectly benefited birds by improving food availability.

Flows have been delivered across all manageable priority waterbird sites listed in the Basin-wide environmental watering strategy to ensure a mosaic of wetlands are available to support a diversity of waterbird species. For example, common sites used for some waterbird species include the Macquarie Marshes; Lowbidgee; and Booligool wetlands.

## Waterbird populations

The rate of waterbird population decline has slowed, and there is evidence of positive responses in waterbird numbers following large-scale flooding in 2012. The 2016 surveys recorded very low abundances, indicating that further monitoring is required to determine whether populations are recovering.

Although the extent of the contribution of the Basin Plan cannot yet be measured, it is likely that the delivery of environmental water has supported waterbird populations. Between 2013 and 2016, over 1,115 GL of water was delivered specifically for the purpose of maintaining condition of wetlands for waterbirds. Data collected since 2013 has demonstrated around 200 environmental flow events have contributed towards providing foraging and roosting habitat for waterbirds. Maintaining habitat is important, as it helps reduce the risk of waterbird mortality during low flow years. For example, environmental water delivery to Hattah Lakes during dry conditions in 2014 resulted in a rapid increase in waterbird abundances.

From 2013, over 553 GL of water was delivered to improve vegetation condition so that it was suitable for waterbird nesting and provided habitat for fish, frogs, invertebrates and other waterbird food resources. In the Murrumbidgee and Lachlan wetlands, these flows primed the system for large-scale breeding events, associated with the very wet conditions in 2016–17.

While there are indications that the rate of long-term decline has reduced, it is still too early to tell if the Plan is on track to meet the expected Basin Plan outcomes for 2024 which is a significant improvement in waterbird populations.

Aerial monitoring indicates that the number of waterbird species fluctuates with flows, but that the long-term average has remained broadly stable in recent years. Ground surveys demonstrate a similar

## Waterbird abundances have dropped significantly since the 1980s, though the rate of decline may be lessening

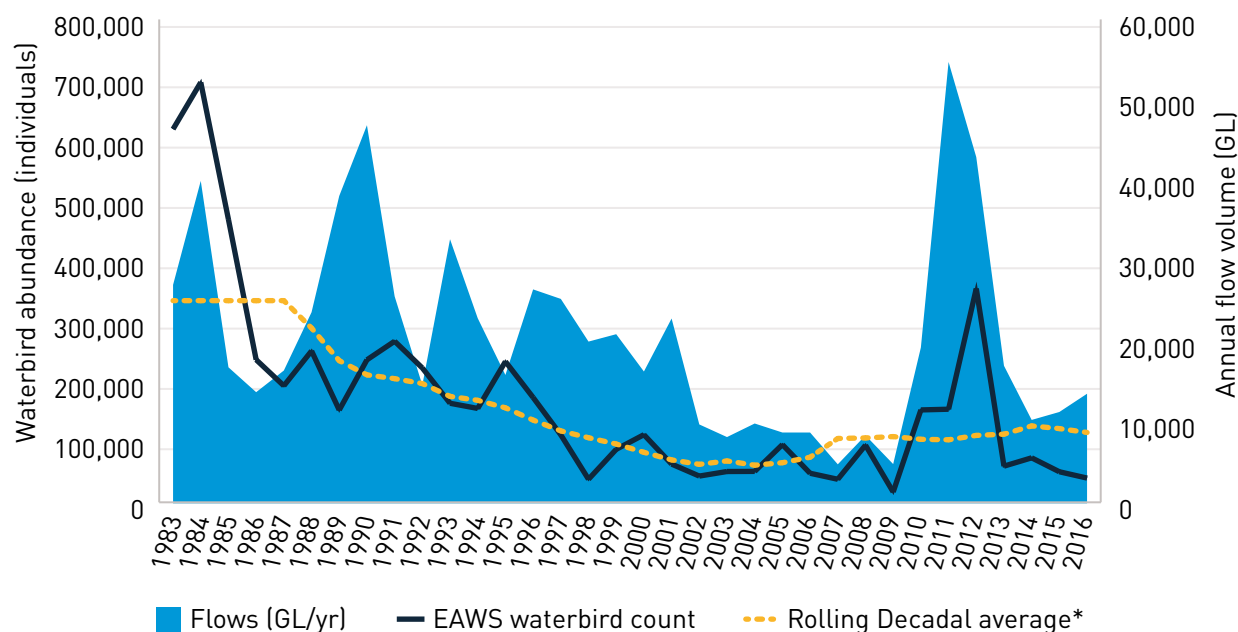


Figure 11: Waterbird abundance across the Murray–Darling Basin 1983–2016 (estimated by aerial waterbird surveys) (Porter et al. 2016). \*Where less than five years of data were available either side of a given year, rolling decadal averages denote an average across the previous five years and any years following a given year.

story and provide more detail on species that are difficult to detect in aerial surveys. Despite declines in waterbird abundance at the Basin scale (Figure 12), no individual waterbird species has been recorded as lost. This means the Basin Plan is currently on track to ensure the number and type of waterbird species present in the Basin is not reduced.

## Waterbird breeding

The number of breeding events has improved since water recovery began in 2009, however, this increase is likely linked to natural inundation events. However, environmental water has played a critical supporting role in improving breeding success. Since 2013 over 936 GL of water was delivered to prevent nest abandonment and boost waterbird numbers.

If water levels are not maintained during a breeding event, some colonial waterbird species, such as straw-necked ibis, will abandon their nests leaving their chicks or eggs to fail. From 2013 at least 21 environmental watering events were delivered to support breeding, ensuring that thousands of chicks successfully fledged at important sites such as the Macquarie Marshes.

It is still too early to tell if the Plan is on track to significantly increase the amount of breeding opportunities and breeding abundances from 2024 onwards.

## Shorebirds in the Coorong, Lower Lakes and Murray Mouth

The Coorong, Lower Lakes and Murray Mouth in the Murray–Darling Basin is particularly significant for migratory shorebirds, whose occurrence is highly influenced by water levels. During the millennium drought the Coorong, Lower Lakes and Murray Mouth was an important refuge site. Despite low flows, the Coorong supported numerous waterbirds and waterbird species during this period. Small freshwater flows received in 2006 and 2009 boosted ecosystem condition and were associated with immediate increases in bird numbers.

Since a return to wetter conditions in 2011, total waterbird and shorebird numbers in the Coorong progressively increased up to 2015, but did not recover to pre-drought levels. However since 2015 shorebird numbers have starting declining again, and three of the four indicator migratory species in the Basin-wide watering strategy recorded their lowest counts in 2017. While it is likely that high water levels prevented shorebirds from accessing productive foraging environments this year, the longer-term decline in migratory shorebird numbers may also be driven by decline in the condition of international staging sites.

It is too early to tell if achieving the expected outcome of maintaining specific Coorong waterbird populations is possible by 2019.

The full [analysis of waterbirds](#) is available in the report prepared for the 2017 evaluation. The results for each expected outcome are shown in this report at Appendix C.

## 5.1.4 Native vegetation

The rivers of the Murray-Darling Basin support hundreds of native plant species which perform different functions and support a multitude of species. Native vegetation provides valuable food and habitat for waterbirds, native fish, turtles and mammals, to name a few. Vegetation improvements take decades—it's a long time to grow a tree from a seed.

### MANAGED FLOODPLAINS

The evaluation only includes an assessment of floodplains reached, known as managed floodplains. We expect to see ongoing decline of the health of water dependent vegetation particularly higher floodplains that cannot be managed. We also expect a change to different vegetation communities. The managed floodplain is 25% of the area inundated in a 1 in 100 year flood. Environmental water recovery is not complete and current constraints may change in the future.

### CONSTRAINTS

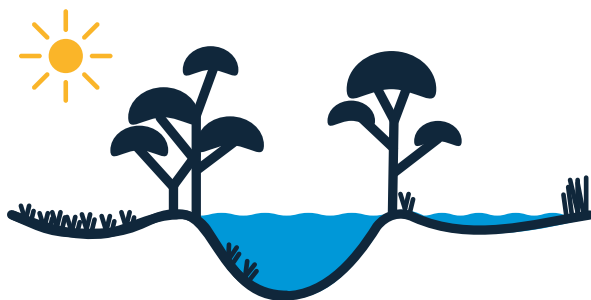
Delivering water to floodplains for native vegetation can be difficult due to infrastructure challenges, known as constraints.



### FLOW DELIVERY

301 water deliveries to managed floodplains improved vegetation conditions.

In general, managed floodplains were responding positively to the water deliveries, improving growth and recruitment.



### CHANGES TO VEGETATION ECOSYSTEM

We are seeing early signs of positive responses of native vegetation in response to water delivered under the Basin Plan, such as growth of seedlings and saplings or an improvement in the condition of some river red gum forests.

### IMPORTANT AQUATIC GRASS

*Ruppia tuberosa*, an important waterbird food and native fish habitat in the southern Coorong, has increased in extent. Its seedbank is declining, so it is not resilient to future changes.



### RESPONSES VARY OVER TIME

Response times to watering vary. Some trees require many years and numerous water deliveries to improve its health. Other trees and plants may immediately respond well with new growth.



### IMPORTANCE OF VEGETATION

River red gum, black box and coolibah condition has been maintained across the Basin with some regional variation.



### THREATS TO VEGETATION

Clearing, cropping, saline groundwater and grazing pressure affect vegetation. Water management structures or practices that change flow seasonality or prevent inundation are also a threat.

The rivers of the Murray–Darling Basin support hundreds of native plant species which are integral parts of the ecosystem. Native vegetation provides valuable food and habitat for waterbirds, native fish, turtles and mammals, to name a few. Vegetation stabilises river banks which reduces turbidity, improves water quality and assists in maintaining ecosystem functions such as contributing organic matter into the water. Vegetation changes character generally in proximity to water sources (Figure 13).

### **Vegetation communities and their watering needs change depending on how far away they are from the main river channel**

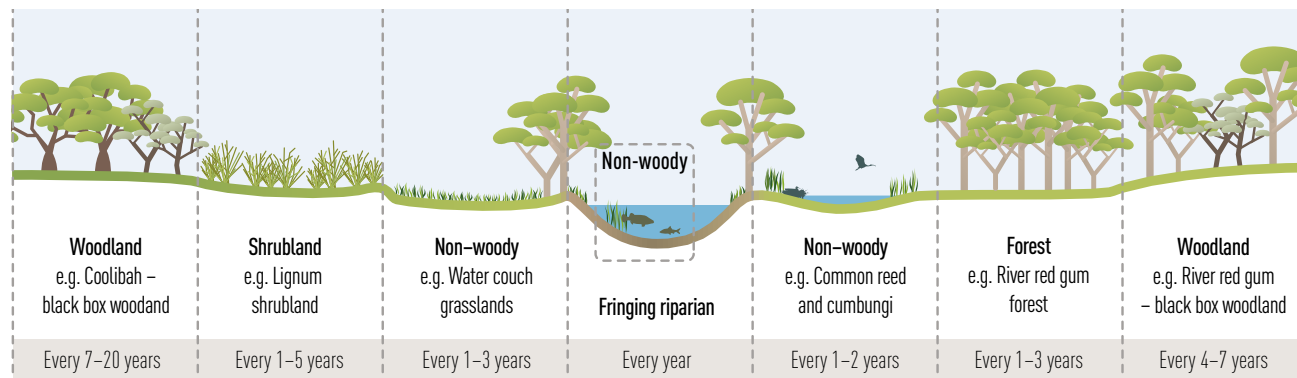


Figure 13: A stylised example of structural groups of vegetation, their position on the floodplain and their required watering frequency (MDBA, 2014)

Overall changes in vegetation types, extent (area) and health can take years to decades to become evident. At this early stage of implementation, it is expected to see the Basin Plan supporting the short-term life cycle requirements of native vegetation, such as recovery from prolonged drought and maintaining vegetation health and condition. If this can be achieved in the short term, new growth, improvements in health, condition and increases in extent might follow.

This evaluation considers outcomes for the forest and woodlands (e.g. river red gum; blackbox; coolibah), non-woody vegetation (e.g. water couch; grasslands), shrublands and ruppia (an important estuarine plant in the Coorong).

Approximately 300 environmental water events between 2013 and 2016 targeted native vegetation responses across the Basin. Environmental water has been used to extend flow durations and peaks, creating some opportunities for lateral connectivity between the main river channel and adjacent wetlands and floodplains.

## **Vegetation condition (health)**

Generally, the condition of river red gum, black box and coolibah has been maintained across the Basin. There has been a slight improvement in condition of river red gum in the Murrumbidgee, Lachlan, Macquarie–Castlereagh and Murray Basin regions, reflecting a somewhat stable watering history in these areas. A very slight decline was observed in the Murray and Wimmera–Avoca. At the same time, there is some concern about the declining condition of vegetation higher on the floodplain, particularly for black box.

The evaluation has shown that the Plan is on track to maintaining the condition of river red gum, black box and coolibah across the Basin; and by 2024 improving the condition of river red gum in the Lachlan, Murrumbidgee, Lower Darling, Murray, Goulburn–Broken and Wimmera–Avoca catchments. The current condition of these species is relatively poor. The majority of river red gum on the managed floodplain is in moderate condition; while the majority of black box is categorised as ‘severely degraded to poor’. The condition of coolibah varies significantly from catchment to catchment. Results from the Basin-wide stand condition assessment indicate that most coolibah communities in good condition are found in the Gwydir, Namoi, Moonie, Condamine–Balonne and Barwon–Darling Basin regions.

It will be important to progress the removal of constraints in the system, protect environmental water and use floodplain regulators and other works to improve the vegetation condition (and other vegetation outcomes). Coordinating the planning and delivery of environmental water with environmental managers and planners, and where relevant with river operators is also needed to maximise vegetation outcomes using the delivery of consumptive water.

## Extent of woody vegetation

Changes in extent of woody vegetation at the Basin and catchment scale will take time to eventuate. For example, environmental water will improve condition and promote successful recruitment over several years, thereby increasing the extent. Thus, it is too early to tell if the total extent of river red gum, black box and coolibah is being maintained. However, it is worth noting that there are significant threats to the total extent of these species across the Basin, such as land clearing, grazing, and farming pressures. Appropriate land and catchment management practices, combined with the delivery of environmental flows, are likely to increase the chance of meeting the objective of these forest and woodland communities.

## Recruitment

Achieving successful recruitment of river red gums, black box and coolibah will take several years of favourable conditions and it will ensure there are trees of different ages within the vegetation community. At this stage, it is difficult to determine if recruitment of river red gums, black box and coolibah have occurred at the Basin scale.

At the site scale, recruitment of river red gum and black box has been observed in areas that have received consecutive environmental waterings. For example, in the Lower Lachlan and Hattah Lakes the occurrence or increased abundance of river red gum and black box saplings have been recorded following consecutive waterings. There have also been instances where the emergence and growth of river red gum saplings has occurred at undesirable locations, such as creek beds, or in dense thickets that are encroaching on open wetlands. These outcomes need to be closely monitored and may require active management in the future.

## Non-woody vegetation

Non-woody native vegetation is the water-dependent vegetation growing along river channels and in wetlands. It includes grasslands, sedgelands, rushlands, herblands and fully-submerged species. These water-dependent, non-woody plants require flooding for some or all of their life stages in order to grow and reproduce. This vegetation supports many of the animals in the Basin. For example, lignum is a critical plant to support several waterbird species (e.g. the straw-necked ibis uses it as a nest structure in the Narran Lakes).

Generally, where water can be delivered, there is evidence that these vegetation types respond quickly; particular if they are provided with access to water across consecutive years. Notwithstanding, there are areas, for example, in the southern Macquarie Marshes, where environmental water has not been delivered, and vegetation communities in that area have declined and been replaced with terrestrial vegetation.

There are important species, particularly lignum, where the right information is not available to tell if the Plan is on track to maintain the area, or likely to improve its condition at the Basin scale.



## Ruppia tuberosa in the Coorong

The millennium drought had a significant impact on a key aquatic plant species in the Coorong, *Ruppia tuberosa* (ruppia). This species in the Coorong's south lagoon provides vital habitat for macroinvertebrates and fish, as well as being an important food source for migratory shorebirds. Maintaining adequate water and salinity levels for ruppia to complete its life cycle is critical to maintaining ruppia health and abundance.

Over the past decade, water levels have at times been suitable for stimulation of ruppia seed germination, but water levels have not been maintained through to early summer to allow the plant to complete its life-cycle. While there is evidence that early indicators for the presence of ruppia are being met, there is as yet insufficient evidence of a trend of recovery. It is also too early to tell if the Plan is on track to meet the long term 2029 outcomes of ensuring the ruppia seed bank is sufficient for the population to be resilient to major disturbances.

The full [analysis of native vegetation](#) is available in the report prepared for the 2017 evaluation. The results for each expected outcome are shown in this report at Appendix C.

### 5.1.5 Other influences on environmental condition

This evaluation has only looked at outcomes associated with allowing more water to remain in the river for environmental health. There are many other factors beyond water that influence river health. These include things such as climate change, as well as unsustainable land management practices that affect water quality and invasive species such as carp. Figure 14 below shows the needs of and threats to the Basin environment, and some of the management measures that could be implemented to increase overall health and recovery. As well as the Basin Plan, there are other important things that could be done to improve overall outcomes.

Sustainable improvement in the condition of the Basin's environment will require water management to be more effectively integrated with other management activities.

**There are a number of factors that influence environmental outcomes, and the Basin Plan can only affect some of these.**

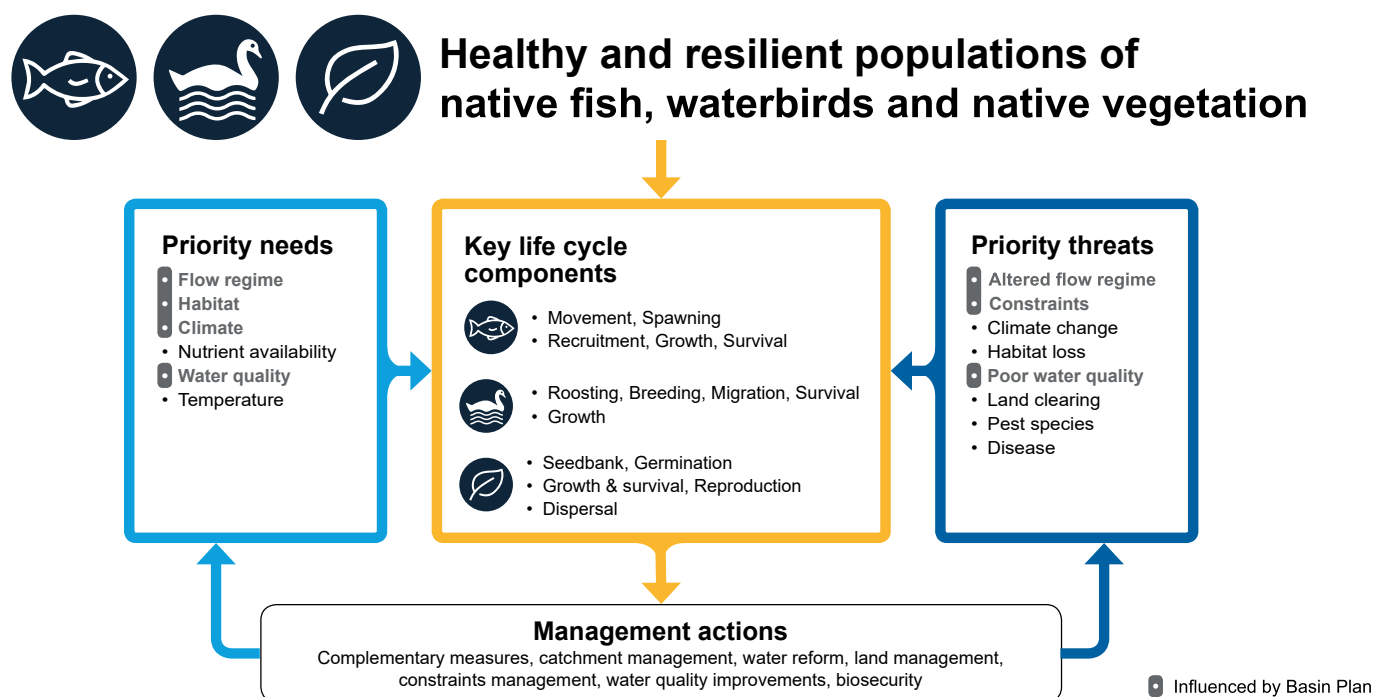


Figure 14: Conceptual diagram showing some of the key needs and threats to achieving the Basin Plan objectives for fish, birds and vegetation. The asterisks identifies the elements that the Basin Plan can influence. The individual environmental reports show these diagrams specifically as they relate to birds, fish and native vegetation.

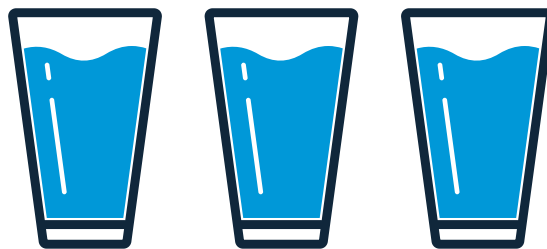
### How does implementation affect these outcomes?

Early signs indicate that where environmental water can be delivered there is a positive response for native fish, waterbirds and native vegetation. Full implementation of the Basin Plan includes programs that will help get water to where it is needed and they are critical to achieving Basin Plan objectives. These include the protection of environmental water, management of constraints and implementation of the Sustainable Diversion Limit Adjustment Mechanism. Continuous improvement in applying the environmental management framework will also assist in delivering water effectively, such as further strengthening links between Basin and regional scale objectives and long-term watering plans. Non-flow measures should continue to be considered by Basin governments and the MDBA in implementing the Basin Plan, particularly where they enhance triple bottom line outcomes, including the northern Basin 'toolkit' of measures and other catchment management actions such as pest control.

## 5.2 Water quality and salinity outcomes

### Three million people depend on the water in the Murray-Darling system

Three million people rely on the water in the Murray Darling Basin for drinking. The Basin Plan ensures water quality is maintained for drinking water, agriculture and the environment.



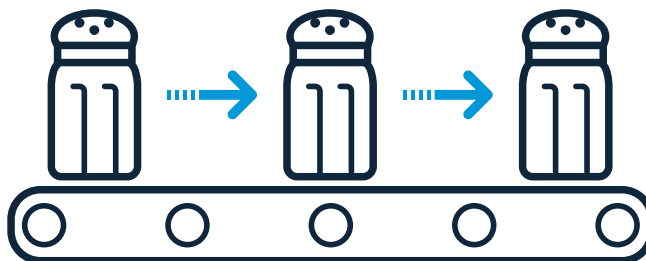
### Salinity is a critical threat to agriculture in the Basin

On-ground management actions such as changing land use practices, and the use of salt interceptions schemes, have all contributed to reducing the salinity threat.

### TAKING SALT OUT OF THE SYSTEM

In 2016-17, 1.84 million tonnes of salt flushed out to sea through the Murray mouth

Salt can also be managed through engineering solutions where salt is diverted away from the river system. In 2016/17, 395,000 tonnes of salt was diverted from the system this way.



### MANAGING WATER QUALITY

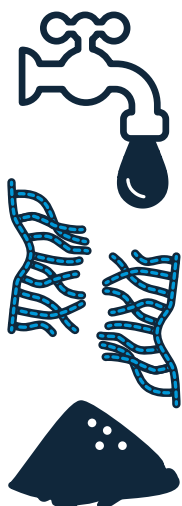
#### Environmental water helps to manage water quality

The use of environmental water provides floodplain connectivity – this connection helps reduce the threats to water quality, including salinity, hypoxic blackwater.

### TARGETS MET

Since the Basin Plan, targets at the four River Murray sites were met

The target on the Darling river has been difficult to meet as this system has experienced very low flow periods in the last five years.

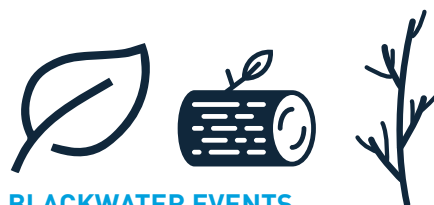


### THREATS TO WATER QUALITY

Three main threats to water quality in the Basin are hypoxic blackwater, blue-green algae, and salinity

Blue-green algae occurs naturally during times of low flows, high temperatures and when nutrients are present.

Blue-green algae blooms are best understood and managed at local levels. Large scale blooms are very difficult to manage. Increasing river flows can sometimes help to disperse these blooms.



### BLACKWATER EVENTS

The Basin Plan is not expected to eliminate hypoxic blackwater events occurring in the system

Floods wash plant material, like leaves and twigs, into the river turning the water black, like tea. Microbes feeding on this plant material consume oxygen. This can cause a very low oxygen level in water known as a hypoxic blackwater event.

Good water quality and salinity outcomes are critical to achieving a healthy working Basin. It is essential that water is of an acceptable quality and salinity level to protect and restore ecosystems, and for domestic, farming and recreational purposes. This section is closely related to Section 4.3 Maintaining water quality.



## Findings

**OF2 Salinity levels continue to meet targets at four out of five monitoring sites. The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reduced salinity levels and helping to flush salt into the Southern Ocean.**

OF2.1 Salinity is measured at five sites, primarily across the southern Basin. Targets have been met at four out of the five sites, but the Burtundy target has not been met as a result of the relatively dry conditions in the northern Basin over the last five years.

OF2.2 Relatively low inflows since the Basin Plan was introduced means that it has not been possible to meet the salt export objective of two million tonnes per year. Under the relatively low flow conditions which have been experienced, salt interception schemes have been important for maintaining water quality.

OF1.3 The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reducing salinity levels and helping to flush salt into the Southern Ocean, albeit below the target levels set out in the Basin Plan.

### Recommendation:

**OR2 The 2020 review of salinity targets should examine the appropriateness of the target at Burtundy. The overall salt export objective should also be revisited in the context of the Basin's variable climate.**

OR2.1 The review of the water quality and salinity targets in the Basin Plan scheduled for 2020 should examine the appropriateness of salinity targets, particularly at Burtundy in light of progress on implementing protection of environmental water in the northern Basin.

OR2.2 The 2020 review should examine the appropriateness of the salt export objective as an indicator of adequate flushing of salt from the river system in the context of a variable climate. The review could consider how salt export objectives could be varied to deal with periods of low flow.

## What was expected?

At this point in time, it was expected the Basin Plan salinity targets would have been met at most of the reporting sites and that there would have been adequate flushing of salt into the Southern Ocean.

## What has happened?

Monitoring results over the last five years show salinity targets have been met at four of the five locations, except at Burtundy (see Table 2). Low flows and water availability, which limit the ability of water managers to dilute salinity, have made it difficult to manage salinity within the target range at Burtundy.

Table 2: Salinity targets at the five monitoring sites across the Basin

Reporting site	Target value (EC $\mu\text{S}/\text{cm}$ )	Achievement of target
River Murray at Murray Bridge	830	✓
River Murray at Morgan	800	✓
River Murray at Lock 6	580	✓
Darling River at Burtundy	830	✗
Lower Lakes at Milang	1,000	✓

Five yearly average salinity results 2012-17 – achievement of targets. \*Ec > 800  $\mu\text{S}/\text{cm}$  is marginal for drinking, EC . 1,600  $\mu\text{S}/\text{cm}$  is brackish, EC > 4,800  $\mu\text{S}/\text{cm}$  is saline

Early analysis indicates the environmental flows provided by the Basin Plan have the potential to lead to an improvement in River Murray salinity of about 36 EC units at Morgan, South Australia.

The Basin Plan includes a salt export objective of ensuring salt is flushed into the Southern Ocean from the River Murray system, indicatively estimated at two million tonnes per year. The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reducing salinity levels and helping to flush out salt, but not at the target level set in the Basin Plan. This result should be viewed in the context of the prevailing climatic conditions. Relatively low inflows since 2012 have meant it has not been possible to export that much salt. During these low flow periods, salt interception schemes become quite important for maintaining water quality.

At the end of the system, the additional environmental flows helped ensure the salinity targets for the Lower Lakes have been met. The increased flows have enabled managers to release small volumes of water into the Coorong and assist with keeping salinity levels below critical ecological thresholds.

Water quality data and lake height information also show that the expected outcomes for salinity levels and minimum Lower Lakes water levels respectively, are both on track to meet the 2024 expected outcomes.

## How does implementation affect these outcomes?

Implementation of all the contributing parts of the Basin Plan is expected to further help mitigate water quality issues, building on the past achievements of Basin governments and farmers in managing salinity. With greater volumes of held environmental water in the system, the importance of river operators and environmental water holders considering water quality issues when they make decisions about environmental watering is increased.

Proposed new operating strategies for the Menindee Lakes and the additional inflows into the Lakes resulting from full implementation of the Basin Plan (including better protection of environmental flows in the northern Basin) is expected to help alleviate the salinity issues in the lower Darling River. However, when the scheduled review of the Basin Plan water quality and salinity targets is undertaken in 2020, it should include examination of the reasons why the salinity target at Burtundy was not met over the five year period 2012-17. It should also consider the appropriateness of the salt export objective as an indicator of adequate flushing of salt from the river system given the way salt export outcomes have been affected by the highly variable climate.

A summary document outlining the information drawn on to [evaluate salinity outcomes](#) for the 2017 evaluation is available.

## 5.3 Social and economic condition

Social and economic conditions across the Basin is important to understand how the Basin Plan is contributing to the changing social and economic conditions.

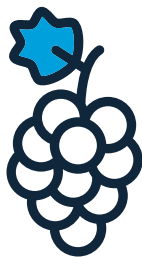


### TOWNS AND RURAL COMMUNITIES

There have been population, demographic, and employment changes in towns across the Basin. Despite Basin Plan water recovery, the Basin's economy has continued to grow in line with expectations.

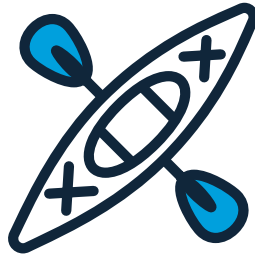
Population growth is occurring in larger regional centres, while there is population decline in smaller communities.

At the community level the impacts of water recovery have been different – some have had little impact, some have adapted and grown, and some have found the transition difficult.



### IRRIGATION TRENDS

Despite Basin Plan water recovery, irrigated agriculture has remained a significant economic contributor to the Basin, valued at around \$7 billion per year.



### WATER AND PEOPLE

In some places, there are early signs that healthy rivers and lakes can provide benefits to tourism and recreation. These benefits are expected to grow as implementation continues.

### ON-FARM INFRASTRUCTURE INVESTMENTS

Investments in on-farm water savings have been shared between irrigators and the environment. This has helped minimise the impact of water recovery on irrigated industries and communities, and modernised irrigation networks.



### ABORIGINAL OUTCOMES

Traditional Owners are increasingly involved in a range of water planning and management activities to get better social and cultural outcomes from Basin Plan implementation.

### 5.3.1 Basin scale social and economic condition

Assessing social and economic conditions at the Basin scale provides the context for examining how the Basin Plan, including water recovery, are contributing to the changing social and economic conditions observed in Basin industries and communities.



#### Findings

**OF3 Observed changes in social and economic conditions at a Basin scale are consistent with those expected at this stage of Basin Plan implementation. Despite the recovery of water for the environment, the Basin population and economy have continued to grow.**

OF3.1 For the Basin as a whole, the changes in economic and social conditions reflect the effect of a range of factors, including long-term trends in agriculture such as productivity growth and reduced labour demands, changing commodity prices, water trade, and growth in non-farming sectors of the economy.

#### What was expected?

When the Basin Plan was initially being developed, the MDBA undertook an analysis of the likely impacts of recovering around 2,000 GL of the 2,750 GL recovery target through the purchase of entitlements, and the remainder from water savings associated with investments in irrigation infrastructure. The analysis indicated there would be small changes in overall employment and economic activity across the Basin if the recovery of water was spread evenly across the period from 2008 to 2019. Further studies took into account potential growth in the Basin economy. The gross value of irrigated production was estimated to fall by around 9% as a consequence of the water recovery. Estimated changes in irrigation (based on farm-gate values) suggested rice production could fall by around 30%, cotton 7% and dairy 9%. Grape and horticultural production were not expected to change by any significant amount.

These studies considered that changes for the irrigated agriculture sector would be occurring in the context of a broad suite of factors, other than those relating to water, that are affecting the Basin community and economy. The challenge in future evaluations would be to separate out the effects of the Basin Plan from all the other drivers of change, given the drivers of change interact with one another and generally play out over very long periods of time. For example, increasing mechanisation and farm consolidation have contributed to a general decline in farming employment.

In the final stages of preparing the Basin Plan, the Sustainable Diversion Limit (SDL) Adjustment Mechanism was included in the Basin Plan. The mechanism introduced the potential to improve social and economic outcomes by reducing the water recovery target by up to 650 GL. The mechanism also included a way of improving environmental outcomes through investment in efficiency measures, but only if there were neutral or improved social and economic impacts.

It was also considered that the social and economic outcomes may also be influenced by the implementation of the Basin Plan water trade rules. These rules were aimed at improving the efficiency and effectiveness of the water market, which was seen as a means to facilitate the movement of water to its most productive uses and assist with the transition to the new SDLs.

## What has happened?

Social and economic changes at the Basin scale are in line with initial expectations that, despite environmental water recovery, the Basin population and economy would continue to grow. Since 2001, the population of the Basin has grown by 12% (Table 3), although growth is concentrated in larger centres and is tempered by diminishing populations in smaller towns and communities.

For employment, the 40% decline in the agriculture, fisheries and forestry sector has been offset by growth in other sectors such as health and education, with total employment rising by 13% in the Basin. While the larger regional centres have been expanding, generally the smaller rural communities have been adversely affected by a narrowing of economic diversity, increased mechanisation in farming and the shifting age structure.

As indicated in Table 3, the changes observed in the Basin differ markedly from the changes at the national level. In the Basin the maximum real value of irrigated agriculture has remained fairly constant since 2001 while the value of all agriculture in total rose by around 4%. By contrast the real value of irrigated production and of total agricultural production in Australia have both increased by around 11% since 2001. These changes hint at how the implementation of the Basin Plan so far (and into the future) might be contributing to the broader changes in social and economic conditions. However, more work is being done to better understand the effect of the Basin Plan on these outcomes relative to other drivers of change.

Table 3: Comparison of observed percentage changes between Australia and the Murray-Darling Basin

Category	Australia	Murray-Darling Basin
Population	23%	12%
Labour force	31%	13%
Agriculture, fisheries, forestry jobs	-26%	-40%
Real value of irrigated production	11%	0%
Real value of total agricultural production	11%	4%

Source: Australian Bureau of Statistics. Catalogue numbers: 3235 population by age and sex, regions of Australia; 3105 Australian historical population and statistics; 4610 Gross value of irrigated agricultural production

Across the Basin, the maximum gross value of irrigated agriculture has remained over \$7 billion per annum (in real terms) since 2001 (Figure 15). Irrigated agriculture therefore remains a significant contributor to the Basin economy.

Many factors have influenced this outcome. Environmental water recovery, both related to the Basin Plan as well as to other initiatives preceding the Basin Plan, is one of these factors. With respect to Basin Plan water recovery, the net reduction in water available for irrigated production is around 10 per cent of average diversions before the Basin Plan (see Section 4.1: *Recovering Water for the Environment*). This is a significant change. Most of the water entitlement purchases occurred between 2009 and 2012 rather than being spread across a period of 11 years as originally envisaged. While this may have increased the adaptive pressures on farmers and their communities, the Australian Government sought to alleviate some of these pressures by focusing on infrastructure investment as the prime means for recovering water from late-2012, and using the SDL Adjustment Mechanism to reduce the recovery target.

Despite environmental water recovery, the maximum gross value of irrigated production across the Basin has remained relatively constant in real terms.



**From the Basin Plan water recovery plus previous environmental water recovery, the maximum gross value of irrigated production across the Basin has remained constant (in real terms).**

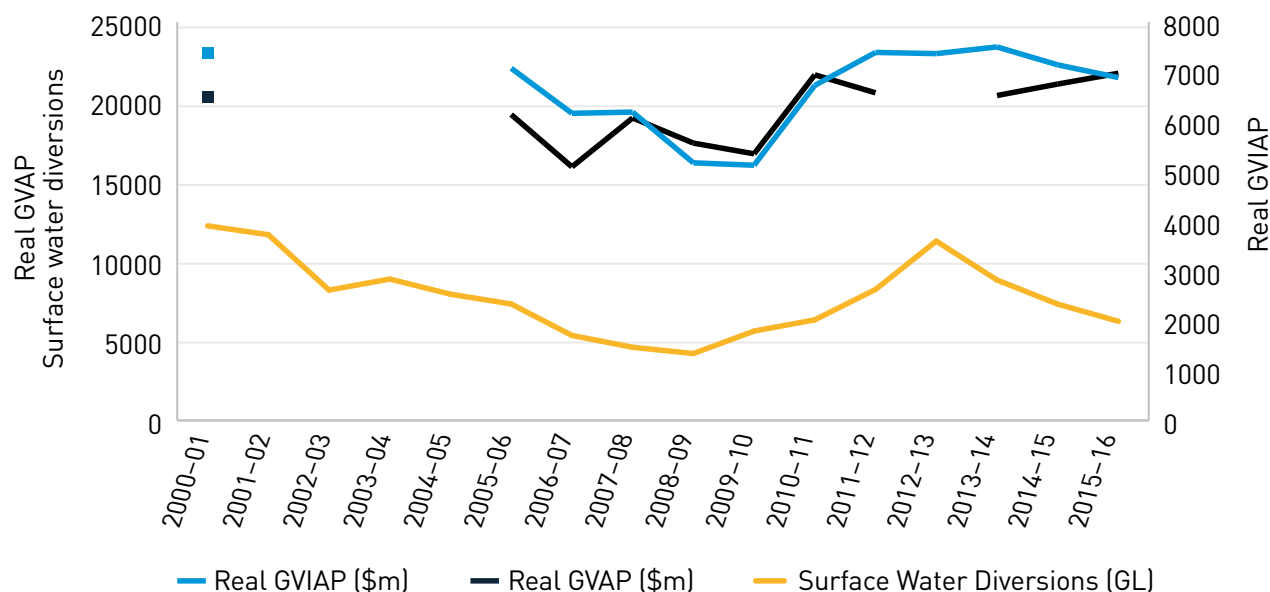


Figure 15: Source: ABS – 4,618.0 Gross value of irrigated and total irrigated production; MDBA: water take report 2017 - surface water diversion data

The government investment in modern, efficient irrigation infrastructure has been a way of recovering water for the environment, while strengthening the productive capacity of the irrigated agricultural sector. This is likely to have combined with private investment in irrigation infrastructure and other types of productivity improvements to support agricultural production in the Basin over this period which over time, would offset the effects of less water being available for production.

Since water recovery commenced, there has also been considerable changes in the mix and area of crops grown in the Basin. This has also served to obscure the effect of the Basin Plan. For example, while the decreases in rice and milk production associated with the Basin Plan accord with the changes anticipated in 2012, cotton production has extended into the southern Basin and increased significantly, fruit and nut production have increased in response to improvements in commodity prices, and grape output has remained relatively constant (Figure 16). Within these Basin-level changes, there have also been reductions in viticultural and horticultural production within some of the areas supplied by irrigation infrastructure operators (for example Berri, Merbein) while there have been some offsetting increases in other locations (such as Robinvale and Euston).

**Basin Plan water recovery, climate and a range of other factors are influencing the mix of irrigated crops grown in the Basin.**

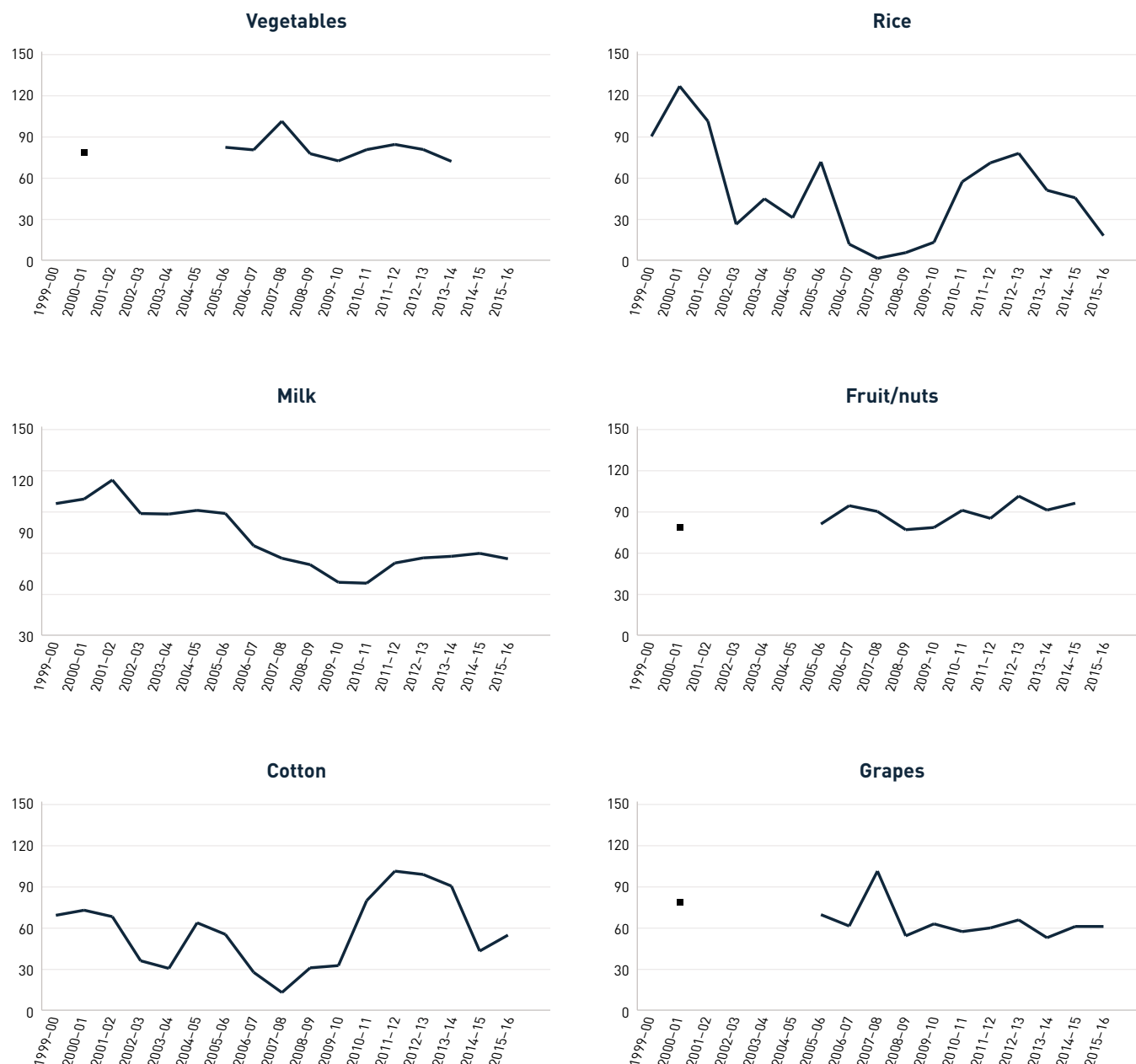


Figure 16: Indexed value of vegetable, fruit and nuts, grapes sourced from ABS 4618.0 Gross Value of Irrigated Production; Rice area source from Sunrice; Milk production sourced from Dairy Australia; Cotton production sourced from Cotton Australia Yearbooks

Seasonal water availability is another factor that has had a clear effect on agricultural production in the Basin, particularly irrigated production. However, over the last six years, with a drying climate sequence, the increased use of temporary water trade and carryover have been part of the way farmers have managed their production risks, including those arising from a reduction in total water available for irrigation. As indicated in Figure 15, there has been little variation in the real gross value of irrigated agriculture at the Basin scale since 2010-11. But over the same period, the total water diversions in the Basin have varied considerably. This suggests that temporary water trade and the

There has been little variation in the real gross value of irrigated agriculture at the Basin scale since 2010-11

use of carryover arrangements might have been effective in smoothing out production across years. Further analysis is still needed to fully understand the reasons behind the divergence between the value of irrigated production and the volume of surface water diversions during this period.

In looking at the operation of the temporary water market since 2012-13 and the potential influence of water recovery on that market, a noticeable water trading pattern has been observed. Across the four consecutively drying years from 2012-13 to 2015-16, four distinct phases seem to have appeared each year. For the first four months of each water year, irrigators sought to secure enough water to irrigate their crops across summer. This demand for water combined with allocation announcements, which were consistently below average, led to prices rising across the July–November period. From December through to February prices remained relatively constant, with changes mostly being related to seasonal conditions such as rain, or very hot, dry periods. Once the main crop-growing period is finished (post 1 February) the market tended to weaken with water prices falling across a period of 4-6 weeks. Changes in water prices across autumn then depended upon how that season unfolded as this was an indicator of possible allocations at the opening of the following irrigation year. While this behaviour changed in the wet year of 2016-17, reverting to the observed patterns across the water year prior to 2012-13, the phases of water trading have re-emerged for the start of the 2017-18 water year.

These changes in the temporary water market, and higher prices for water, are a consequence of multiple factors including water recovery, farmer adaptations to drought and risk management, and the emergence of new water users. It also highlights that analyses of the impact of the Basin Plan need to account for water management actions across years. Analysis based on annual averages are likely to understate, or overlook, the benefits of these actions.

In preparing the Basin Plan, the MDBA recognised the potential for the water market to play an important role in helping farmers to adapt, including to the effects of water recovery. Based on the preceding discussion, this seems to be bearing out. The introduction of the Basin Plan water trading rules were seen as an important element in facilitating that adaptation. The Basin Plan placed an emphasis on supporting the efficient operation of the water markets, including removing restrictions to trade where it may be possible to do so (see Section 4.7 *Water trading rules*).

The emergence of new water trade products, such as trading of unused carryover allowances, are helping farmers find new ways to adapt to their rapidly changing circumstances. The MDBA is aware these water market developments are changing the operating environment for irrigation businesses. Some irrigators are taking advantage of the opportunities these developments provide while there are others who may find it difficult to adapt to these changes, particularly given the pace at which many of the changes are occurring.

The emergence of new water trade products, such as trading of unused carryover allowances, are helping farmers find new ways to adapt to their rapidly changing circumstances.

Recent studies have provided additional information on some of the changes occurring in the temporary water market ([water trade reports from ABARES](#), and [Aither](#)).

The [ABARES irrigation farm survey](#) results also include data on whether farmers in the different irrigation sectors are using temporary trade, or not, and if so whether they are net buyers or sellers of water. This information will be analysed in the context of temporary and permanent water trading relative to water use to inform the community level analysis.

This evaluation is seeking to understand how changes in water availability relate to changes in agricultural production across time, as well as the influence of the many other factors driving change

in the irrigated agricultural sector. At the Basin scale, these factors are hard to tease apart. So in order to gain an improved understanding of the influence of these factors, the MDBA will be doing some further community level analysis of how the Basin Plan is contributing to observed changes in social and economic conditions. This work will also help understand the Basin scale changes in irrigated production. Importantly, the community level analysis is being designed to explicitly account for things such as the volume and composition of water recovery, permanent and temporary water trade, and the key changes in commodity prices and irrigated agricultural production.

Some previous social and economic studies have also sought to build an understanding of the effects of the Basin Plan water recovery on irrigated production and the community more broadly (RMCG, [Frontier Economics](#)). In particular, they attempted to estimate the effects of current and future Basin Plan water recovery on different irrigated industries and regions. Their analyses only consider individual wet, dry and average years, and only incorporate the effects of trade using annual average temporary water prices. They also fail to give full recognition of the production benefits arising from the off and on-farm infrastructure investment (as well as the use of the proceeds from selling water entitlements). Taking into account these underlying assumptions, the MDBA considers that these approaches are likely to over-estimate the Basin Plan effects. The goal of the ongoing MDBA analysis (discussed in the following section) is to look at the issues raised in these earlier studies and develop a better understanding of the effect of the Basin Plan at the community and Basin scales.

As part of the 2017 evaluation MDBA has also sought to understand how water recovery might be affecting irrigation infrastructure operators. Since the beginning of water recovery, concerns have been raised about the potential 'Swiss-cheese' effect that might arise as a consequence of water being sold out of irrigation districts. Analysis of this issue will be detailed in a report assessing the impacts on Irrigation Infrastructure Operators which is scheduled for completion in late December.

The analysis already conducted to inform this evaluation has found that since water recovery started, approximately 17% of water entitlements have been transferred out of irrigation districts to the Commonwealth and to other water users. However, at the same time, delivery shares across the irrigation districts have fallen by less than 10%. While there may be a view that some irrigators are yet to terminate their delivery shares (possibly due to the termination fees they would need to pay), evidence appears to indicate farmers are retaining their right to access and use water from the temporary market when considerable volumes of water become available. This more variable level of water use and irrigated production may have flow on consequences for irrigation infrastructure operators, and the industries and communities which depend upon them. The reduction in delivery shares is also likely to create some ongoing system rationalisation challenges for irrigation infrastructure operators. These are areas which will require further analysis for the 2020 evaluation.

Approximately 17% of water entitlements have been transferred out of irrigation districts to the Commonwealth and to other water users. However, at the same time, delivery shares across the irrigation districts have fallen by less than 10%.

Recognising the potential effects that Basin Plan water recovery might have on irrigated industries and communities, the Australian Government provided \$98 million in structural adjustment funding (Queensland \$15.1 million, New South Wales \$32.6 million, Victoria \$25 million, and South Australia \$25 million). To date most of that funding has been allocated through processes managed by the State governments and outcomes of this have not been assessed as part of this evaluation.

## How does implementation affect these outcomes?

Given the effect of environmental water recovery has been to reduce the average volume of water available for production by 1131 GL, it would be expected that the Basin Plan has been one of the factors that have affected the economic and social conditions of the Basin. However, it is difficult to distinguish the effects of the Basin Plan from all the other drivers of change at the Basin scale.

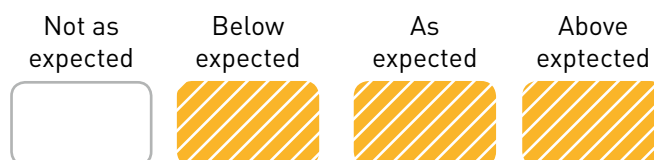
This is made more difficult because there are both positive and negative influences from the Basin Plan. The positive effects have arisen through the investment in off and on-farm infrastructure that has helped to modernise the sector. In the short term at least there are further flow-on benefits to rural communities and non-farm rural businesses from the Australian Government investment in new irrigation infrastructure (see case study 1: Water recovery and the effects of infrastructure investment activities in the Murrumbidgee Irrigation Area). Similarly, the selling of water entitlements to the Australian Government provided farmers with opportunities to exit the industry, to pay down debt or the means to re-invest in their businesses. Each of these has a flow-on effect to the local community.

The Australian Government's approach to environmental water recovery has helped minimise the effect on the social and economic conditions of the Basin. Greater emphasis has been placed on recovering water through savings gained from investments in on- and off-farm irrigation infrastructure. The investment to reduce delivery losses (loss of water used to convey irrigation water through the networks) and the water acquired as savings from on-farm infrastructure investment represents water that was otherwise lost to production. The proposed 605 GL adjustment to the water recovery target arising from the SDL Adjustment Mechanism will also help improve the social and economic outcomes from the Basin Plan.

The positive outcomes of the irrigation infrastructure projects to date extend to irrigators. Irrigators have indirectly benefitted from the up-grading of irrigation networks through the off-farm investment programs. With the on-farm programs, there has generally been a significant improvement in farm productivity. Farmers have better control and greater flexibility over other irrigated production enterprises. The savings they have retained as part of the infrastructure program activities enhance future production potential. In some cases, past program participants have indicated how they are now seeking additional water through the temporary market to support their newly increased production potential. Understanding the benefits of the past programs may provide insights for how to design the 450 GL efficiency measures program.

With the on-farm programs, there has generally been a significant improvement in farm productivity. Farmers have better control and greater flexibility over other irrigated production enterprises.

## 5.3.2 Effects of water recovery at the community scale



The contribution of the Basin Plan to the prevailing social and economic conditions varies across the communities of the

Basin. Identifying these effects requires an understanding of the relative importance of irrigated agriculture and how changes in water availability are likely to work their way through each community.

### Findings

**OF4 The volume of water buybacks relative to that acquired from investments in water savings has been very different across Basin communities. These variations, combined with the effect of other drivers of change, are likely to have affected the social and economic conditions in Basin communities. More work to tease apart these influences is underway and will be released in April 2018.**

OF4.1 The mix of water buybacks relative to investments in water savings, as well as the volume and pace of water recovery, has been very different across Basin communities. In some locations, a large amount of water was purchased for the environment. In others, only a small amount of water purchasing was done. The benefits of the government investment in more modern and efficient irrigation infrastructure also appears to have been spread unevenly across irrigation communities.

Preliminary analysis of the currently available data indicates that the impact of the Basin Plan on the social and economic conditions in Basin communities is likely to be better, and at other times worse, than what was expected five years ago. This will be explored in detail in coming months, and publicly reported in April 2018.

The effects of water recovery at the community level is influenced by social and economic conditions in the individual communities at the time of the recovery, the timing, approach and scale of water recovery and the nature of the multiple drivers of change affecting individual communities. These effects are also influenced by external factors such as commodity prices, exchange rates and a range of other government policies and decisions.

The community-level effects arising from changes in water availability and infrastructure improvements will be considered in the context of a wide range of additional social and economic information. This includes the population size and timing of population change both within the towns and the farming areas of each community; the age structure of the population (people under 45 and over 45); employment changes and economic diversity; the relative levels of advantage, disadvantage, wealth and qualifications held by people in the community; and the types of agricultural enterprise associated with each community.

### What was expected?

The MDBA expected to see both positive and negative effects in Basin communities as a result of the Basin Plan, and that the distribution of the effects would vary spatially. This is based on the assessment of potential Basin Plan outcomes that was completed for 12 local council areas and used to inform the development of the Basin Plan.

## What has happened?

The Northern Basin Review work showed water recovery affects individual communities in different ways. This analysis used a more refined method for assessing the contribution of the Basin Plan to community level change compared with the approach used in 2011. These impacts are influenced by the composition and pattern of recovery, social characteristics and structure of each community as well as the make-up of its local economy. For example, some communities like Dirranbandi and Warren experienced large volumes of water recovery, principally through water purchases. This added to the significant changes already affecting those communities. In contrast, water recovery in the Goondiwindi community was largely through infrastructure investment. The effects of water recovery in this community were quite different given the area was already growing for other reasons.

[Information about water recovery in individual communities in the southern Basin](#) is available on the MDBA website. It is also summarised in Appendix D. Additional data on the social and economic conditions in each community will also be added soon. Census data is critical to this analysis, and the 2016 census data has only just become available.

For the 41 irrigation-dependent communities as a whole, the total recovery of water is 1,034 GL, with 878 GL derived from buybacks and 156 GL acquired from on-farm infrastructure investment. Through the on-farm infrastructure projects, farmers retained a further 67 GL of water savings.

Using data on the volume of water purchased from irrigators and an estimate of the savings retained from the on-farm infrastructure investments, it has been possible to estimate the net reduction in water available for production in each community. Across the 41 southern Basin communities, the net reduction in water available for irrigated production is 811 GL (878 GL minus 67 GL).

Across the 41 southern Basin communities, the net reduction in water available for irrigated production is 811 GL (878 GL minus 67 GL).

However, even at this early stage of the analysis, the data on community level water recovery highlights the variability in the volume of the total recovery, and the relative mix of purchases and water savings from infrastructure investment, across communities. As this can be an important influence on social and economic change at the community level, it is likely the results in the southern Basin will show water recovery has affected individual communities in different ways. Reaching any conclusions in this regard will require parallel consideration of how temporary and permanent water trade might be adding to or offsetting the effects of water recovery in individual communities. This will be an important input to subsequent community-level analysis together with information on irrigated production, water recovery, and changing social and economic conditions.

The detailed community-level analysis will use this information to separate out the contributions of the Basin Plan from all the other drivers of change, with the results to be released in April 2018. That analysis will focus on the effects of the Basin Plan in southern Basin communities. It will build on a similar analysis conducted for northern Basin communities to inform the Northern Basin Review.

## How does implementation affect these outcomes?

The Basin Plan was designed to find the most effective ways for delivering the best possible mix of economic, social and environmental outcomes. As a result of past water recovery and the expected operation of the Sustainable Diversion Limit Adjustment Mechanism, much of the water recovery task has been completed. A change in emphasis for water recovery from infrastructure investment over the purchase of water entitlements sought to lessen the effects on Basin communities.



### 5.3.3 Social and economic outcomes from environmental water



The rivers, wetlands and associated natural environments of the Basin are important social and economic assets. They contribute to the strength of the Basin's economy by attracting visitors, and the health and wellbeing of its residents through the social and recreational opportunities they provide.

#### Findings

**OF5 At this early stage of implementation, the scale of environmental improvement is such that the flow on social and economic benefits are difficult to observe. However, site-specific examples provide some indication of the potential range of positive social and economic outcomes that might be expected in the future.**

#### What was expected?

During the preparation of the Basin Plan, the MDBA sought to gather information on the types of social and economic benefits that providing more water for the environment could generate.<sup>5</sup> That work highlighted the challenges with estimating and valuing the flow of water-dependent environmental services and benefits to communities and industries from a more sustainable management of Basin water resources.

It was expected that returning more water to the environment under the Basin Plan would increase the capacity of the environment to provide social and economic benefits for Basin residents, and the broader community. This would include the benefits to boating, fishing and floodplain graziers, and can be expanded to recognise the improved aesthetic values from a healthier environment and the benefits from tourism more broadly. Similar to the time needed for environmental recovery to occur as a consequence of the Basin Plan, the social and economic benefits from improvements to the environment were expected to take time to become apparent.

#### What has happened?

There are early signs that environmental watering is generating a positive ecological response. This is helping to arrest, and ultimately reverse, a long term decline in environmental condition.

At this early stage of implementation, it is difficult to observe how these environmental improvements might be enhancing the social and economic outcomes for Basin communities. Basin Plan implementation is only part way through – not all of the environmental water has been recovered and there are lags between the use of environmental water, changes to ecological condition and measurable changes in social and economic outcomes.

But what has been uncovered is a wide range of qualitative information and community feedback that highlights how important a healthy environment is to Basin communities. The range of potential flow on social and economic benefits includes tourism, recreation, amenity and services to agriculture.

<sup>5</sup> Including reports by The Centre for International Economic, CSIRO, Hatton-McDonald et al, Ernst and Young and others referenced in the 2012 Regulatory Impact Statement for the Basin Plan, available [here](#).



For example, residents in Victoria report that specific environmental watering activities have contributed to

*“bumper recreational fishing catches, increased numbers of bird watchers, improved canoeing and rowing regatta conditions, influxes of campers and bush-walkers and a general improvement in the ‘greening’ of scenery encouraging picnickers and day-trippers.”*

There are also anecdotal reports from site managers and operators of tourism businesses that environmental flows have directly supported a recovery in visitor numbers to specific sites.

Tourism is an important industry, with much activity centred on major rivers, lakes and wetlands. Tourism spending in the Basin reaching \$7.5 billion in 2015 so it is clearly an important part of the Basin’s economy (See *Case study 6: Koondrook nature based tourism hub*). Further, an estimated 400 000 to 500 000 residents regularly fish in the Basin for pleasure, so improving the number and distribution of native fish in the Basin clearly has the potential to deliver benefits for these members of the community.

For many people the benefits of healthier rivers and wetlands, such as sense of place, wellbeing and local identity, are also important outcomes. The Basin’s population has grown substantially in recent years, with many new residents likely to have been attracted by the amenity and lifestyle benefits on offer. Healthy water resources also provide an economic benefit through improved water quality for drinking, stock watering and irrigation. For example, the benefits of lower salinity levels in the Basin’s rivers due to the increase in water for the environment have been conservatively estimated to be worth around \$5 million each year.

The MDBA has started to investigate new approaches for estimating the extent and size of the benefits that are expected to arise from additional water being returned to the environment. The MDBA is aiming to draw together quantitative information (where it is available) on things such as changes in tourism numbers, growth in the numbers of people fishing and birdwatching for recreation, and on other measures of benefits such as the amenity and existence values people derive from rivers and wetlands. This may include an assessment of how the benefits from having more water in the Basin rivers flow through to changes in peoples’ wealth such as the value of housing in and around these locations. These are matters to be investigated to inform the 2020 evaluation.

The full [analysis of social and economic outcomes](#) from environmental water is available in the report prepared for the 2017 evaluation.

## CASE STUDY 6

### Koondrook nature based tourism hub

The Basin Plan is supporting a widespread push throughout the southern Murray–Darling Basin to expand the tourism sector, particularly in relation to nature based tourism. The focus of efforts to grow visitor numbers to the region is the River Murray, which is variously described as ‘mighty’, ‘legendary’, and ‘iconic’ by Murray Regional Tourism. Tourism is one industry that can respond relatively quickly to improvements in the condition of the natural environment, including those associated with site specific environmental watering events.

In Victoria, state and local governments are taking advantage of a growing interest in ecotourism and experiential tourism by investing in the Basin’s natural assets. For example, a \$1.2 million Nature based tourism hub is connecting iconic natural assets around Koondrook, Cohuna and Kerang, including the Gunbower State Forest, River Murray and Kerang Lakes. Hub projects, which

began in 2016, include cycling tracks, walking tracks, canoe trails, and the Kerang–Koondrook rail trail. These tracks and trails will be part of the proposed River Murray adventure trail, extending the length of the River Murray.

Environmental water is already making a difference to the region. Water was provided to 2,840 hectares of Gunbower Forest in 2015–16, including to 95% of the forest's impermanent wetlands. This contributed to improved outcomes for native fish, aquatic plants and river red gums, enhancing the attractiveness of the region to visitors.

Building on the greater certainty that the Basin Plan provides regarding the health and condition of key assets like the Gunbower State Forest, new opportunities for adventure-based tourism businesses are also developing. Over time, the hub is expected to attract an additional 6,000 visitors to the region annually and increase visitor nights by 1,800 annually. Broader benefits as a result of the hub and the future River Murray adventure trail include an estimated output of \$12.8 million and more than 70 additional jobs.

For more information, see [Social and economic benefits from environmental watering](#).

## **How does implementation affect these outcomes?**

The improvements in the health of the Basin's environment will take time to be realised, as will the social and economic benefits which are expected to flow from this improvement. As with the environmental recovery, maximising the social and economic benefits from the use of environmental water will require the implementation of all the contributing parts of the Basin Plan.

In addition to continuing to work on quantifying the many social and economic benefits from environmental water, Basin governments need to continue to work on communicating these benefits. Feedback about environmental watering suggests the need for clearer communication to build community understanding of the role and purpose of environmental water and efficient river operations.

### 5.3.4 Outcomes for Aboriginal communities



For Aboriginal people, healthy rivers and wetlands are essential to their spiritual, cultural and socio-economic wellbeing. The Basin Plan formally recognises Aboriginal people's connections to water, and requires water resource plans to identify Aboriginal peoples' objectives and outcomes based on their values and uses, and for Aboriginal Nations and organisations to be included in developing water resource plans (see Section 4.5 Water resource planning).

#### Findings

**OF6 Culturally-appropriate methods are being used to increase involvement of Traditional Owners in a range of water planning and management activities, and in the evaluation of Basin Plan outcomes for Aboriginal people.**

- OF6.1 Traditional Owners are being involved in a range of water planning and management activities throughout most of the Basin using culturally appropriate methods. This is being supported by the increasing use of tools, such as the Aboriginal Waterways Assessments.
- OF6.2 The review of The Living Murray Indigenous Partnership Program found that the program was most beneficial where there were long-standing, two-way relationships with Aboriginal people.
- OF6.3 The Barkandji pilot being undertaken to support the 2017 evaluation has been a major step towards developing a culturally appropriate methodology to assess Basin Plan outcomes for Aboriginal people. It is hoped that approach, along with information from other Basin governments, can be used to inform future evaluations.
- OF6.4 It will take time to continue to build capacity, within Basin governments and amongst Traditional Owners, to achieve the types of outcomes that Aboriginal people are seeking under the Basin Plan, and to evaluate the longer-term outcomes of Traditional Owner involvement.

#### What was expected?

At this point in Basin Plan implementation, it was expected that Aboriginal people would be involved in the early stages of water resource planning; that they may have had input into environmental watering decisions (as is the case in several other locations in the Basin where the Commonwealth Environmental Water Holder has initiated Aboriginal involvement); and as an outcome over time that the Plan is having a positive impact on Aboriginal health and wellbeing.

It was also expected that Basin governments would be developing processes to engage with Aboriginal people in culturally appropriate ways around water planning and use. Under the Basin Plan, Basin governments and Traditional Owners are aiming to develop tools, knowledge and awareness (including around the cultural importance of water), capabilities and working relationships in a manner that is considerate of cross-cultural differences to meet the Basin Plan requirements for Aboriginal values and uses in water resource plans.

## What has happened?

There are numerous initiatives being developed and implemented by the Commonwealth government and Traditional Owners aimed at enabling Aboriginal people to better engage with water planning and management, and improving knowledge and awareness (including around the cultural importance of water). Some examples of the tools, knowledge, capabilities and working relationships include the National Cultural Flows Research Project, Aboriginal Waterways Assessments (AWAs), Aboriginal Weather Watch Project and socio-cultural research undertaken for the Northern Basin Review.

Basin governments are starting to use AWAs as the basis for Aboriginal input into water resource planning. To date one AWA has been completed in the ACT, two in SA and up to five in Victoria.

The Northern Basin Review socio-cultural study also highlighted the importance of water to Aboriginal people, and that different communities have a differing emphasis on water-related values. The results of this study helped inform the Northern Basin Review conducted in 2016.

The Living Murray Indigenous Partnership Program aims to bring Aboriginal knowledge, cultural values and perspectives to the planning and management of six icon sites in the southern Basin. These icon sites have ecological and cultural value to Traditional Owners. The sites include the Barmah–Millewa Forest, Gunbower–Koondrook–Perricoota Forests, Hattah Lakes, Chowilla Floodplains and the Lindsay–Wallpolla–Mulcra Islands, Lower Lakes, Coorong and Murray Mouth and the River Murray Channel. The program was reviewed recently, after a 13 year partnership between Basin governments and Traditional Owners at five of the six sites.

While some icon site managers are still building relationships with local Aboriginal people others have developed mature, two-way relationships. The review found that the key benefits of the program are:

- cultural and community benefits including strengthening connections to culture, land and water
- an expanded range of benefits from, for example, watering events that provide both environmental and cultural values
- social and economic benefits including employment and training opportunities that are building the capacity of Aboriginal people to contribute to site management
- effective governance and decision-making structures for governments to facilitate Aboriginal input into water management programs.

The MDBA and Traditional Owners are currently trialling an evaluation method to measure and understand the importance of healthy waterways to Aboriginal people in the Barwon–Darling catchment. This evaluation method also aims to gauge whether Basin Plan implementation is leading to greater involvement of Aboriginal people in water resource planning and management and better outcomes for Aboriginal people. Traditional Owners are positive about this culturally-sensitive evaluation approach, but there is a way to go until the outcomes can be reported – this information is due in February 2018 (See *Case study 7: The Barkandji people and their involvement in water planning*).

## How does implementation affect these outcomes?

At this stage only one (of 33) water resource plans has been accredited. However, the development of the remaining plans will involve greater consideration of Aboriginal values and uses

The MDBA and Traditional Owners are currently trialling an evaluation method to measure and understand the importance of healthy waterways to Aboriginal people in the Barwon–Darling catchment.

of water. Greater involvement of Aboriginal people in environmental water management is another important element of future implementation that will enhance outcomes for Aboriginal communities. The continued development of policies to ensure that environmental flows are protected as they flow down rivers is expected to also protect many of the values and uses that are culturally significant for Aboriginal people. Similarly the continued progress with constraint relaxation projects has the potential to lead to better connectivity between rivers and wetlands, which should provide environmental benefits that are aligned with Aboriginal values and uses.

## **CASE STUDY 7**

### **The Barkandji people and their involvement in water planning**

Traditional Owners and the MDBA are trialling a method to evaluate implementation, impacts and outcomes of the Basin Plan on the Barkandji Nation's Country along the Darling River (the Baarka). Two surveys have explored the relationship between water management and Aboriginal health and wellbeing. The impact and importance of environmental watering to six determinants of Aboriginal health (referred to as capital assets) were examined: environmental, cultural, social, human, physical and financial. This approach was also used in the Northern Basin Review.

Surveys found that water management, including environmental watering, is seen by Barkandji people to be important to their health (over 90% important for all capitals). The actual impact of water management was also rated very highly for most determinants of health but weaker and still in development for social (participation) and financial (livelihoods) capitals. Traditional Owners noted that the overall condition of Barkandji Country is poor to very poor, including because of environmental flows not being protected in the area.

At the time of the evaluation, water resource plan development in the Barwon–Darling catchment was in its early stages so Barkandji people had yet to be consulted and their values and uses incorporated.

Early findings from the evaluation reinforce the importance of:

- waterway health to Aboriginal values and uses
- incorporating Aboriginal values and uses into water resource planning
- two-way working relationships between Traditional Owners, water managers and scientists.

The full analysis of outcomes for Aboriginal communities will be available in the report prepared for the 2017 evaluation (due February 2018). Further analysis will also be published in 2018 (See Appendix A).

## 6. Is the Basin Plan on track?

The Basin Plan's long-term objectives are to establish integrated water management, a sustainable and long-term adaptive management framework, improved water security and optimised triple bottom line outcomes. The multiple elements of the Basin Plan are designed to work together to achieve these objectives and deliver a healthy working Basin. This section draws on the evaluation of implementation for each of the Basin Plan elements and associated outcomes (sections 4 and 5), to assess if Basin governments and the MDBA are on track to delivering against these long-term objectives and outcomes.

### **Are Basin governments on track to delivering integrated water management?**

Integrated water management in the Basin is important to ensure the system is managed as a whole, recognising actions in one water resource area can impact on adjacent areas. The Basin Plan combines water resource planning, the environmental management framework, water quality and salinity management planning, and Basin trade rules to deliver an integrated management system across the Basin. Evaluating the progress of these measures provides an indication of whether Governments are on track to delivering integrated water management.

Water Resource Plans are the means for implementing many important elements of the plan, including establishing the sustainable diversion limits and putting water sharing arrangements in place to deliver certainty of access for all water users. With only one WRP currently in place, there is a high risk that not all WRPs will be accredited by mid-2019. Governments have taken learnings from the process of delivering the first accredited WRP to streamline the accreditation process.

The environmental management framework is designed to contribute to integrated management by ensuring a consistent approach to the planning and use of environmental water. This includes through better alignment of planning, the application of common principles and increased coordination by water holders. There has been steady progress along the path to more integrated management of environmental water. The *Basin-wide environmental watering strategy 2014* has established whole-of-Basin objectives and outcomes that, together with annual priorities, are being used to guide environmental water managers to achieve Basin Plan outcomes. The outcome has been a clear increase in the number of the combined environmental watering actions now taking place in the southern Basin. Recovered water is being successfully delivered to where it is needed and importantly, there are signs that the environment is responding well.

Integrated management of water quality and salinity is important for ensuring there is common consideration of downstream impacts and benefits of water management. Building on previous work, Basin governments and the MDBA are continuing to manage salinity, through long-term management strategies. Having targets across the system helps provide a common measure of progress. The ability to manage other water quality issues such as blackwater events and blue-green algae outbreaks is more difficult and more knowledge in this area would be beneficial.

The Basin water trading rules aim to improve the efficiency and effectiveness of water markets by reducing restrictions on trade and improving transparency and access to market information. Progress has been made on both these fronts, with major restrictions removed, and there is evidence the market

is operating well. Further work lies ahead to continue to review state trading rules, particularly in relation to ensuring that restrictions on allocation trade are not impeding business.

Success for all these elements of the Basin Plan relies on a fair and transparent approach to implementation by all parties. Effective compliance underpins the transition to Basin-wide SDLs, the integrity of water resource plans, security for environmental watering and efficiency in the water market. The MDBA's Murray–Darling Basin Compliance Review, found an urgent need for Basin states and the MDBA to take immediate steps to improve compliance arrangements to deliver the Basin Plan.

Drawing on the above, there is varying progress towards the objective of delivering an integrated approach to water management. WRPs are a critical element, and achieving integrated management will be delayed if WRPs are not delivered by 30 June 2019. The other elements are making good progress and the evaluation contains recommendations for continuing to improve future implementation in each of these areas. Underpinning the success of all of these measures is the need for Basin governments to take immediate steps to improve compliance arrangements to develop trust in the Basin Plan arrangements.

## **Are Basin governments on track with implementing a sustainable and long-term adaptive management framework?**

Implementing the sustainable diversion limits, together with a strong framework for managing and delivering environmental water as discussed above are key mechanisms to deliver long-term sustainability. An adaptive management framework will allow water management in the Basin to be improved over time, based on new knowledge and learnings.

The Basin Plan applies adaptive management principles through the environmental water management framework; and through the Basin Plan monitoring and evaluation program, which applies to all elements of the Basin Plan. Evaluating the progress of these measures provides an indication of whether Basin governments and the MDBA are on track to implementing the sustainable and long-term adaptive management framework.

Basin governments are actively applying the principles of adaptive management to the planning, prioritisation and use of environmental water in the Basin. Water planners and managers are improving their knowledge of how the environment responds to environmental watering, and adjusting their actions to improve outcomes.

The Basin Plan's monitoring and evaluation reporting program is intended to provide useful information on all aspects of Basin Plan implementation outcomes, with the intention that this can be used to inform ongoing decisions. Through this program, Basin governments have effectively collaborated in the first five years of Basin Plan implementation to report on progress with Basin Plan implementation. At this early stage, most reporting has focussed on the status of implementation rather than evaluating outcomes and the effectiveness of the Basin Plan. There are opportunities to strengthen monitoring and reporting so that it can better inform future decisions.

The Basin Plan also includes options to review and adjust settings, where this is supported by new information or circumstances. The groundwater reviews and Northern Basin Review were successfully completed in the first five years, undertaking research to improve knowledge and refine the SDLs accordingly. Under the SDL Adjustment Mechanism Basin governments have brought forward a package of projects that provide options for using water more efficiently to get better outcomes. These measures have demonstrated that Basin Plan implementation is adaptive, and can be adjusted as improved knowledge becomes available.

Drawing on the above, it is apparent good progress has been made in establishing a sustainable and long-term adaptive management framework into Basin water management.



## **Are Basin governments on track to achieving improved water security for all uses?**

Improved water security is important to deliver reliable access to an acceptable quality and quantity of water for all water uses. The Basin Plan improves water security by establishing: a common standard for water resource plans in all jurisdictions, which set sustainable limits on water use and ensure equitable sharing of water resources between all uses; effective water markets that allow water to move to its most productive use; and water quality and salinity management that delivers reliable access to good quality water.

As discussed above, water quality and salinity management and water trade rules are on track, however, the risk that WRPs will not be accredited by 30 June 2019, may delay the enforcement of the sustainable limit on water use and impact on water security for water users. In addition, urgent work still needs to be done in the area of water accounting to clarify the remaining water recovery task. Basin states and the MDBA also need to take immediate steps to improve compliance arrangements as good compliance underpins water security.

## **Are Basin governments on track to optimising social, cultural, economic, and environmental outcomes?**

The Basin Plan aims to optimise social, cultural, economic, and environmental outcomes. This is an ongoing goal and there are some good signs the elements of the Plan are working together to optimise outcomes.

The environment is beginning to respond to environmental watering. The additional environmental water in the system is also contributing to maintain salinity levels and helping to flush salt into the Southern Ocean. The full implementation of the Basin Plan, including the protection of environmental flows, and management of non-flow related factors will provide further benefits.

Traditional Owners are increasingly being involved in a range of water planning and management activities. Ongoing commitment and effort is required to ensure outcomes for Aboriginal people are realised.

The volume of water purchases has been much less than originally expected due to the focus on investments in water savings and the expected operation of the SDL Adjustment Mechanism. This has helped minimise the effects of water recovery. These effects will vary from community to community, and this will be explored in more detail and reported in April 2018.

## **Overall conclusion**

A healthy working Basin may take many years to achieve, but at this early stage there are good signs that the Basin Plan is working and many elements are on track to deliver on the Basin Plan objectives and intended outcomes. Progress is lagging in several important areas and some very challenging work lies ahead.

Basin governments must fully commit to the timely completion of water resource plans, and improve the compliance framework. In addition, environmental outcomes will only be optimised, and social and economic impacts minimised if Basin governments work diligently with communities and industries to fully implement the Basin Plan. Nothing less than full commitment from all Basin governments is needed to deliver a healthy working Basin.



## 7. Appendices

### Appendix A: List of underpinning technical reports and data

The following technical reports underpin the 2017 Basin Plan Evaluation and can be found, along with the data that underpins the evaluation, on data.gov at *2017 Basin Plan Evaluation*. The majority of these reports will be made available in December 2017. The final technical report, *Community scale social and economic analysis*, and associated data will be made available in April 2018.

Document Title	URL
<a href="#">Water Recovery in the southern Basin</a>	<a href="https://www.mdba.gov.au/basin-plan-roll-out/monitoring-evaluation/water-recovery-southern-basin">https://www.mdba.gov.au/basin-plan-roll-out/monitoring-evaluation/water-recovery-southern-basin</a>
<a href="#">Environmental Management Framework Implementation</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Water Quality and Salinity summary document</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Basin Plan Adaptive Management Framework</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Basin-wide Compliance Review</a>	<a href="https://www.mdba.gov.au/basin-plan-roll-out/basin-wide-compliance-review">https://www.mdba.gov.au/basin-plan-roll-out/basin-wide-compliance-review</a>
<a href="#">Transition Period Water Take Report 2013–14 to 2015–16</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/transitional-sdl-water-take-reports">https://www.mdba.gov.au/publications/mdba-reports/transitional-sdl-water-take-reports</a>
<a href="#">Water Audit Monitoring Report 2011-12</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/cap-compliance-reports">https://www.mdba.gov.au/publications/mdba-reports/cap-compliance-reports</a>
<a href="#">Hydrology</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Native Fish</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Waterbirds of the Murray-Darling Basin</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Native Vegetation</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Environmental Assets</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Community profiles of social and economic condition in the southern Basin</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Social and economic benefits from environmental watering</a>	<a href="https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports">https://www.mdba.gov.au/publications/mdba-reports/basin-plan-evaluation-2017-reports</a>
<a href="#">Commonwealth water reform investments in the Murray-Darling Basin</a>	<a href="http://www.agriculture.gov.au/water/mdb/basin-plan/water-reform-investment">http://www.agriculture.gov.au/water/mdb/basin-plan/water-reform-investment</a>
Irrigation Infrastructure Operators	to be released later in December 2017
Seasonal Workers	to be released in December 2017/January 2018
Dairy Industry	to be released in January 2018

## Appendix B: Consolidated list of findings and recommendations

### B1. Implementation findings

Measure	Reference	Description
<b>Recovering water for the environment</b>	<b>IF1</b>	<b>Water recovery is almost complete in most parts of the Basin. The volume of water buybacks has been much less than originally expected due to the focus on investments in water savings and the expected operation of the SDL Adjustment Mechanism. This has helped minimise the effects of water recovery. Urgent work still needs to be done to clarify the remaining water recovery task.</b>
<b>Recovering water for the environment</b>	IF1.1	Since 2008, 77% of the initial 2,750 GL surface water recovery target has been achieved. The amount of water purchases has been much less than originally expected due to the Australian Government's focus on water saving investments. This has helped minimise the effects of water recovery on the Basin's irrigation industries and communities.
<b>Recovering water for the environment</b>	IF1.2	The SDL Adjustment Mechanism is expected to lead to a 605 GL reduction in the surface water recovery target for the southern Basin. This will substantially improve the social and economic outcomes from the Basin Plan. For the SDL adjustment to remain within the maximum net change of 5% of the SDL, there will need to be at least 62 GL of water recovered through efficiency measures by the time SDLs take effect in mid-2019.
<b>Recovering water for the environment</b>	IF1.3	Today's water recovery combined with the expected operation of the SDL Adjustment Mechanism means surface water recovery in the Basin is likely to be complete, or mostly complete in most regions.
<b>Recovering water for the environment</b>	IF1.4	Work to finalise planning assumptions and the associated cap factors is well behind schedule. This important work needs to be done in order to clarify the remaining water recovery task and provide certainty for communities.
<b>Managing environmental water</b>	<b>IF2</b>	<b>The Basin Plan has provided a robust framework that has been used to guide more than 750 environmental watering events across the Basin. Environmental water holders are cooperating and collaborating more often to deliver better environmental outcomes.</b>
Managing environmental water	IF2.1	All the major components of the framework for managing environmental water have been delivered or are on track to being delivered by the agreed timeframes.
Managing environmental water	IF2.2	Seven hundred and sixty three environmental watering events have been delivered in the last year four years.
Managing environmental water	IF2.3	The Basin Plan has led to improved coordination across the Basin, and environmental water is being applied effectively. Greater collaboration and coordination has led to water holders combining their available water, reaching larger areas and meeting more priorities. However, there are also opportunities to further improve the coordination of environmental water delivery.
Managing environmental water	IF2.4	Environmental watering at this scale is new, evolving, and inherently challenging. The Basin Plan is helping water holders and managers to work to common goals and learn together. There is evidence water managers are using adaptive management principles to improve the identification and delivery of Basin-wide watering priorities.
<b>Maintaining water quality</b>	<b>IF3</b>	<b>Salinity management over the last 30 years shows difficult environmental problems can be overcome with commitment and cooperation from all stakeholders. The Basin Plan is helping to reduce salinity levels by providing more freshwater in the Basin's rivers.</b>

Measure	Reference	Description
Maintaining water quality	IF3.1	Salinity management in the Murray–Darling Basin is a success story in natural resource management. It highlights how natural resource management problems can be overcome through commitment and collaboration among Basin governments and land managers. Basin governments have committed to continue managing salinity in the Basin for the next 15 years through the new strategy - Basin Salinity Management 2030. This strategy builds on its predecessors, and sets out actions to meet the objectives and targets set in the Basin Plan.
Maintaining water quality	IF3.2	There have been some large-scale blackwater events over the last five years as a result of natural flooding. Basin governments have taken action to mitigate these events but there is still more to learn.
<b>Northern Basin and groundwater reviews</b>	<b>IF4</b>	<b>The northern Basin and groundwater reviews were successfully completed and the SDLs have been changed through an amendment to the Basin Plan. NSW, Queensland and the Australian governments have committed to complementary actions in the northern Basin that will help deliver the intended outcomes.</b>
<b>SDL Adjustment mechanism</b>	<b>IF5</b>	<b>Thirty six state-nominated projects have the potential to reduce the southern Basin water recovery target by 605 GL through the SDL Adjustment Mechanism. Substantial work remains to deliver the agreed projects by 2024, including stakeholder engagement.</b>
SDL Adjustment mechanism	IF5.1	The 70 GL reduction in the northern Basin water recovery target should reduce the impact of water recovery on agricultural industries and communities. Implementing the complementary actions or “toolkit measures” will be important to achieving the intended outcomes.
SDL Adjustment mechanism	IF5.2	Considerable work lies ahead for state governments to design and implement their nominated projects by mid-2024. There is substantial community concern regarding some projects and strong leadership, better communication, good program management and review will be important to success.
SDL Adjustment mechanism	IF5.3	Feedback received during the public consultation on the SDL Adjustment determination highlighted a need for improved engagement of communities and other stakeholders. In particular, some felt that there was not enough information on the business cases underpinning the determination to allay public concerns about some projects. Further community consultation will be important as the projects progress toward implementation by 2024.
<b>Water resource planning</b>	<b>IF6</b>	<b>Development of water resource plans is well behind schedule. There is a high risk that some plans will not be accredited by the mid-2019 deadline, which would affect compliance with SDLs and create uncertainty for water users. There is a large amount of work to do and there can be no further delays.</b>
Water resource planning	IF6.1	While it was initially projected that 14 plans would be in place by 2017, progress has been slow with only one of the 336 <sup>6</sup> plans now finalised and accredited. If plans are not in place by mid-2019 this will affect compliance with SDLs and create uncertainty for water users.  At this stage, MDBA considers that South Australia, Queensland and the ACT are likely to meet the timeline for accreditation. Despite their efforts and recent progress, MDBA remains concerned at the rate of progress in NSW and Victoria.
Water resource planning	IF6.2	Reviews of the process for accrediting the first water resource plan has led to the development of more efficient and streamlined accreditation processes. This is expected to speed up the process for the remaining plans, but there remains a high risk that this important task will not be completed by mid-2019.

<sup>6</sup> The total number of water resource plans has decreased from 36 to 33 following the changes to state planning boundaries since the Basin Plan was made in 2012.

Measure	Reference	Description
<b>Transitioning to SDL accounting and compliance</b>	<b>IF7</b>	<b>Development of new water accounting methods needed for SDL accounting is progressing well, but the techniques for measuring some forms of water take require further development. This work underpins SDL compliance and provides the basis for transparent reporting.</b>
Transitioning to SDL accounting and compliance	IF7.1	Determining the volume of water that entitlement holders were permitted to take, and actually took is important for water resource planning and SDL compliance. The MDBA and Basin states have made progress in developing new water accounting methods so that accurate reporting on water take and compliance with SDLs can be in place from 1 July 2019.
Transitioning to SDL accounting and compliance	IF7.2	An important step on the path to being implementation ready by mid-2019 has been the successful trial of the new methods to prepare the water take reports for the last four years from 2012-16. For the first time, this report also draws together information about the extent of annual groundwater use across the Basin.
Transitioning to SDL accounting and compliance	IF7.3	Currently only around 64% of water take for consumptive use is accurately metered.
Transitioning to SDL accounting and compliance	IF7.4	The quality of SDL accounting will depend directly on the accuracy of measurements of water take, the hydrologic gauging network throughout the Basin and on hydrological models based on metered and measured data.
<b>Water trading rules</b>	<b>IF8</b>	<b>Basin states have made progress in aligning their trading rules with the Basin Plan. This has helped improve the operation of water markets which is important for water users looking to adapt to changing water availability and other drivers of change.</b>
Water trading rules	IF8.1	Since the water trade rules came into effect in 2014, states have made some progress in aligning their trading rules with the Basin Plan including the removal of some major restrictions on inter-regional trade in water entitlements.
Water trading rules	IF8.2	There is better information available about the Basin's water markets, and improved governance arrangements for water trading have been put in place.
<b>Compliance</b>	<b>IF9</b>	<b>The MDBA's Basin-wide Compliance Review, supported by an independent panel of experts, found an urgent need for Basin states and the MDBA to take immediate steps to improve compliance arrangements to develop trust in the Basin Plan arrangements. MDBA has committed to implement all of the actions for itself identified in the review.</b>
<b>Working together to implement the Basin Plan</b>	<b>IF10</b>	<b>There are established governance arrangements which enable governments and communities to work together to guide Basin Plan implementation. Even so, some deficiencies have been identified because not all of the right people and agencies are involved.</b>
<b>Working together to implement the Basin Plan</b>	IF10.1	The MDBA and the Basin governments have established governance arrangements that span the range of Basin Plan implementation actions. However, some instances have been identified where government agencies with implementation obligations have not been included.
<b>Working together to implement the Basin Plan</b>	IF10.2	Basin governments and the MDBA have begun to work with communities in a collaborative and flexible manner, with the Northern Basin Review serving as an example of how community views can influence Basin Plan implementation. However, more can still be done to ensure stakeholders see their views and interests reflected in decisions.
<b>Working together to implement the Basin Plan</b>	IF10.3	In the past five years, there has been a lack of community confidence in, and support for, parts of Basin Plan implementation. In recognition that community support has a significant effect on implementation, the MDBA and the CEWH have introduced regional/local engagement officers in a number of locations across the Basin.
<b>Monitoring, evaluation and reporting</b>	<b>IF11</b>	<b>Basin governments and the MDBA have met their first five years of Basin Plan reporting requirements. There is potential to collect more targeted monitoring information, and enhance reporting to make it more useful for those implementing the Basin Plan.</b>

Measure	Reference	Description
Monitoring, evaluation and reporting	IF11.1	To date, all Basin governments have delivered and published the required annual reporting, including through the publication of Basin Plan annual reports.
Monitoring, evaluation and reporting	IF11.2	During the first five years of implementation, Basin governments have collaborated to coordinate monitoring activities across the Basin. Even so, there are further opportunities to better align monitoring with evaluation requirements relating to Basin Plan objectives and outcomes. Asset or site scale monitoring and evaluation could also be better linked to the same analysis at the Basin scale.
Monitoring, evaluation and reporting	IF11.3	There is evidence that annual reporting is not being optimally used to inform decision making.

## B2. Implementation recommendations

Section	Reference	Description
Recovering water for the environment	IR1	Basin governments need to urgently complete work to finalise planning assumptions and the associated cap factors in order to clarify the remaining water recovery task and provide certainty for communities.
Managing environmental water	IR2	The Basin governments and the MDBA should review Basin Plan reporting to make it more useful for environmental water planning and management.
Water quality and salinity management	IR3	Basin governments and the MDBA should continue to investigate and analyse data on dissolved oxygen levels and the transfer of organic matter into river systems to develop improved management actions which can help mitigate blackwater events.
SDL Adjustment mechanism	IR5	Basin governments should more closely involve Basin communities in the design, implementation and delivery of the nominated projects to build community understanding and acceptance of the projects.
Water resource planning	IR6	Basin governments and the MDBA must redouble efforts and work closely together to get all water resource plans in place by June 2019. Dedicated resources and more efficient and streamlined processes will be essential to meeting timelines.
Water resource planning	IR6.1	Given the compressed timeframes, the MDBA and Basin governments should ensure close working relationships, careful project planning and sufficient dedicated resources are in place to achieve accreditation.
Transitioning to SDL accounting and compliance	IR7	The MDBA and Basin states must complete the large body of work remaining to develop a robust basis for measuring water take, and transparent reporting on SDL compliance.
Transitioning to SDL accounting and compliance	IR7.1	The MDBA and states must complete the work required to ensure that annual take does not exceed SDLs. This includes: <ul style="list-style-type: none"> <li>improving the accuracy and reliability of metering</li> <li>reviewing the network of gauging stations to ensure gauging is accurate and identify (and address) any gaps</li> <li>reviewing hydrological models to account for water take</li> <li>improving the methods for estimating forms of non-metered take, particularly floodplain harvesting in NSW and Queensland.</li> </ul>
Water trading rules	IR8	Basin states and the MDBA must give high priority to identifying and removing unreasonable restrictions on allocation trade, especially in the southern Basin.
Water trading rules	IR8.1	Basin states and the MDBA still have a lot of ongoing work to do to meet Basin Plan requirements such as identifying and removing unnecessary restrictions on allocation trade in the southern Basin.
Water trading rules	IR8.2	Additional priorities include ensuring that water market information now available is useful, accessible and available in a timely manner, and that there is ongoing education and continual improvement in processes. These improvements are needed to ensure that there is growing confidence in the Basin's water markets.
Compliance	IR9	Basin states should adopt the recommendations in the MDBA's Basin-wide Compliance Review, and COAG should commit to a Basin Compliance Compact to be developed and published by 30 June 2018, with regular reporting thereafter.
Working together to implement the Basin Plan	IR10	Basin governments and the MDBA continue to work together to build confidence in Basin Plan implementation, particularly in the areas of compliance and the implementation of supply measures. Governance arrangements should also be regularly reviewed to ensure they remain appropriate and effective for each stage of implementation.

Section	Reference	Description
Working together to implement the Basin Plan	IR10.1	<b>Basin governments and the MDBA need to play a stronger role in sharing knowledge with stakeholders, including about the role of environmental watering, and how local knowledge is used to support decision making.</b>
Working together to implement the Basin Plan	IR10.2	Basin governments and the MDBA should review governance to: <ul style="list-style-type: none"> <li>• streamline arrangements and identify gaps</li> <li>• ensure arrangements remain appropriate and effective for each stage of Basin Plan implementation</li> <li>• improve transparency, accountability and timeliness.</li> </ul>
<b>Monitoring, evaluation and reporting</b>	<b>IR11</b>	<b>Basin governments should continue to support the shift to more evaluative Basin Plan reporting, and ensure Basin Plan monitoring, evaluation and reporting is actively used to improve Basin Plan implementation.</b>
Monitoring, evaluation and reporting	IR11.1	Basin governments and the MDBA need to review the Basin Plan reporting requirements to make them more relevant to adaptive management.
Monitoring, evaluation and reporting	IR11.2	Basin governments, the MDBA and the CEWO should continue to work together to better plan, coordinate and align their monitoring programs to support better evaluation of outcomes and clearer reporting.

### B3. Outcomes findings

Outcome	Reference	Description
<b>Environmental outcomes</b>	<b>OF1</b>	<b>Early signs indicate that where environmental water can be delivered there is a positive response from native fish, waterbirds and native vegetation. Water for the environment is critical for Basin health. Full implementation of the Basin Plan and management of non-flow related factors will further enhance its effectiveness.</b>
Environmental outcomes	OF1.1	Native fish, waterbirds and native vegetation have benefitted from environmental water in many areas across the Basin. Where appropriate information is available, it indicates results are on-track to meet Basin Plan environmental objectives. However, there are some areas where it is still too early to tell or the right information is not available to make an assessment.
Environmental outcomes	OF1.2	Five years in, it is clear that environmental water is being actively and effectively managed to target environmental priorities. It is expected that outcomes would improve as water recovery is completed and there is more water available for environmental use.
Environmental outcomes	OF1.3	For sites where environmental water cannot be delivered, there will be detrimental change to water dependent ecological systems.
Environmental outcomes	OF1.4	The likely responses to environmental watering are affected by external influences such as invasive plants and animals, in-stream barriers and land management. A collaborative and coordinated approach to managing these non-flow related factors would enhance the effectiveness of environmental water.
Environmental outcomes	OF1.5	Monitoring ecological responses to environmental water has been critical for improving the way this water is used. The collection of information needs to be adaptively managed and shared effectively with Basin partners.
<b>Water quality and salinity outcomes</b>	<b>OF2</b>	<b>Salinity levels continue to meet targets at four out of five monitoring sites. The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reduced salinity levels and helping to flush salt into the Southern Ocean.</b>
Water quality and salinity outcomes	OF2.1	Salinity is measured at five sites, primarily across the southern Basin. Targets have been met at four out of the five sites, but the Burtundy target has not been met as a result of the relatively dry conditions in the northern Basin over the last five years.
Water quality and salinity outcomes	OF2.2	Relatively low inflows since the Basin Plan was introduced means that it has not been possible to meet the salt export objective of two million tonnes per year. Under the relatively low flow conditions which have been experienced, salt interception schemes have been important for maintaining water quality.
Water quality and salinity outcomes	OF1.3	The additional environmental water passing through the river system as a result of the Basin Plan is contributing to reducing salinity levels and helping to flush salt into the Southern Ocean, albeit below the target levels set out in the Basin Plan.
<b>Basin scale social and economic condition</b>	<b>OF3</b>	<b>Observed changes in social and economic conditions at a Basin scale are consistent with those expected at this stage of Basin Plan implementation. Despite the recovery of water for the environment, the Basin population and economy have continued to grow.</b>
Basin scale social and economic condition	OF3.1	For the Basin as a whole, the changes in economic and social conditions reflect the effect of a range of factors, including long-term trends in agriculture such as productivity growth and reduced labour demands, changing commodity prices, water trade, and growth in non-farming sectors of the economy.
<b>Effects of water recovery at the community scale</b>	<b>OF4</b>	<b>The volume of water buybacks relative to that acquired from investments in water savings has been very different across Basin communities. These variations, combined with the effect of other drivers of change, are likely to have affected the social and economic conditions in Basin communities. More work to tease apart these influences is underway and will be released in April 2018.</b>



Outcome	Reference	Description
Effects of water recovery at the community scale	OF4.1	<p>The mix of water buybacks relative to investments in water savings, as well as the volume and pace of water recovery, has been very different across Basin communities. In some locations, a large amount of water was purchased for the environment. In others, only a small amount of water purchasing was done. The benefits of the government investment in more modern and efficient irrigation infrastructure also appears to have been spread unevenly across irrigation communities.</p> <p>From a preliminary analysis, it appears reasonable to presume that impact of the Basin Plan on the social and economic conditions in Basin communities is likely to be better and at other times worse, than what was expected five years ago. This will be explored in detail in coming months, and publicly reported in April 2018.</p>
Social and economic outcomes from environmental watering	OF5	<b>At this early stage of implementation, the scale of environmental improvement is such that the flow on social and economic benefits are difficult to observe. However, site-specific examples provide some indication of the potential range of positive social and economic outcomes that might be expected in the future.</b>
<b>Outcomes for Aboriginal communities</b>	<b>OF6</b>	<b>Culturally-appropriate methods are being used to increase involvement of Traditional Owners in a range of water planning and management activities, and in the evaluation of Basin Plan outcomes for Aboriginal people.</b>
Outcomes for Aboriginal communities	OF6.1	Traditional Owners are being involved in a range of water planning and management activities throughout most of the Basin using culturally appropriate methods. This is being supported by the increasing use of tools, such as the Aboriginal Waterways Assessments.
Outcomes for Aboriginal communities	OF6.2	The review of The Living Murray Indigenous Partnership Program found that the program was most beneficial where there were long-standing, two-way relationships with Aboriginal people.
Outcomes for Aboriginal communities	OF6.3	The Barkandji pilot being undertaken to support the 2017 evaluation has been a major step towards developing a culturally appropriate methodology to assess Basin Plan outcomes for Aboriginal people. It is hoped that approach, along with information from other Basin governments, can be used to inform future evaluations.
Outcomes for Aboriginal communities	OF6.4	It will take time to continue to build capacity, within Basin governments and amongst Traditional Owners, to achieve the types of outcomes that Aboriginal people are seeking under the Basin Plan, and to evaluate the longer-term outcomes of Traditional Owner involvement.

## B4. Outcome recommendations

Outcome	Reference	Description
<b>Environmental outcomes</b>	<b>OR1</b>	<b>Basin governments and the MDBA should continue with full implementation of the Basin Plan by 2024, as the management of constraints, implementation of all aspects of the SDL Adjustment Mechanism and protection of environmental water are critical to getting the best possible environmental outcomes.</b>
Environmental outcomes	OR1.1	Full implementation of the Basin Plan includes programs that will help get water to where it is needed, particularly out onto the floodplain. These include the management of constraints, implementation of all aspects of the Sustainable Diversion Limit Adjustment Mechanism and protection of environmental water.
Environmental outcomes	OR1.2	Basin governments and the MDBA should keep working with communities and focus on communicating the benefits of environmental watering.
Environmental outcomes	OR1.3	Non-flow factors need to be considered by Basin governments and the MDBA in implementing the Basin Plan. This will require a collaborative and coordinated approach.
<b>Water quality and salinity outcomes</b>	<b>OR2</b>	<b>The 2020 review of salinity targets should examine the appropriateness of the target at Burtundy. The overall salt export objective should also be revisited in the context of the Basin's variable climate.</b>
Water quality and salinity outcomes	OR2.1	The review of the water quality and salinity targets in the Basin Plan scheduled for 2020 should examine the appropriateness of salinity targets, particularly at Burtundy in light of progress on implementing protection of environmental water in the northern Basin.
Water quality and salinity outcomes	OR2.2	The 2020 review should examine the appropriateness of the salt export objective as an indicator of adequate flushing of salt from the river system in the context a variable climate. The review could consider how salt export objectives could be varied to deal with periods of low flow.

## Appendix C: Expected environmental outcomes by 2024

### C1. Hydrology

Type	Expected outcome by 2024	Result
Longitudinal connectivity	Maintain base flows at least 60% of the natural level	Insufficient evidence
Longitudinal connectivity	A 10% overall increase in flows in the Barwon–Darling: from increased tributary contributions from the Condamine–Balonne, Border Rivers, Gwydir, Namoi and Macquarie–Castlereagh catchments collectively	On track
Longitudinal connectivity	A 30% overall increase in flows in the River Murray: from increased tributary contributions from the Murrumbidgee, Goulburn, Campaspe, Loddon and Lower Darling catchments collectively	On track
Longitudinal connectivity	A 30 to 40% increase in flows to the Murray mouth.	Too early to tell
Lateral connectivity	A 30 to 60% increase in the frequency of freshes, bankfull and lowland floodplain flows in the Murray, Murrumbidgee, Goulburn–Broken and Condamine–Balonne catchments	Too early to tell
Lateral connectivity	A 10 to 20% increase of freshes and bankfull events in the Border Rivers, Gwydir, Namoi, Macquarie–Castlereagh, Barwon–Darling, Lachlan, Campaspe, Loddon and Wimmera catchments	Too early to tell
Lateral connectivity	Maintain current levels of connectivity in the Paroo, Moonie, Nebine, Ovens and Warrego catchments	On track
End-of-Basin outcomes	As a minimum outcome, maintain barrage flows greater than 2,000 GL/year on a three-year rolling average basis for 95% of the time, with a two year minimum of 600 GL at any time.	On track
End-of-Basin outcomes	As a minimum outcome, maintain water levels in the Lower Lakes above 0.4 metres AHD, for 95% of the time, and above 0.0 metres AHD (sea level) for 100% of the time.	On track
End-of-Basin outcomes	As a minimum outcome, maintain salinity in the Coorong and Lower Lakes below critical thresholds, including: <ul style="list-style-type: none"> <li>– salinity in Lake Alexandrina is lower than 1,000 EC 95% of the time and less than 1,500 EC all the time</li> <li>– salinity in the Coorong’s south lagoon is less than 100 grams per litre 95% of the time.</li> </ul>	On track
End-of-Basin outcomes	As a minimum outcome, keep the average annual depth of the Murray Mouth greater than one metre, for 90% of the time.	Too early to tell

## C2. Native fish

Type	Expected outcome by 2024	Result
All	By 2024, no loss of native species currently present within the Basin.  (Evidence is insufficient for five of the species assessed that were not targeted by monitoring, the other 20 species assessed have maintained presence in the Basin.)	Insufficient evidence
Medium-long lived freshwater species	Improved population structure (i.e. a range of size/age classes for all species and stable sex ratios where relevant) in key sites by 2024. This will require annual recruitment events in at least eight out of 10 years at 80% of key sites, with at least four of these being 'strong' recruitment events.	On track
Medium-long lived freshwater species	A 10–15% increase of mature fish (of legal take size) for recreational target species (Murray cod and golden perch) in key populations. 2019–24	On track
Medium-long lived freshwater species	Annual detection of species and life stages representative of the whole fish community: with an increase in passage of Murray cod, trout cod, golden perch, silver perch and Hyrtl's tandan through key fish passages to be detected in 2019–24; compared to passage rates detected in 2014–19.  (Evidence exists that fish are using fishways however trends have not yet been assessed.)	Insufficient evidence
Medium-long lived freshwater species	A doubling of the current (mostly restricted) distributions of key species in the northern Basin by 2024.  Significant increases in the distributions of key species in the southern Basin by 2024.	Insufficient evidence (current data is collected at a spatial scale too broad to answer this)
Short-lived freshwater species	Restored distribution and abundance to levels recorded pre-2007 (prior to major losses caused by extreme drought). This will require annual or biennial recruitment events depending on the species. 2019–24	Insufficient evidence (current data collection methods do not target short-lived species)
Estuarine dependant species	Detection of all estuarine-dependent fish families throughout 2014–24.  Maintenance of annual population abundance (Catch Per Unit Effort – CPUE) of key estuarine prey species (sandy sprat and small-mouthed hardyhead) throughout the Coorong.  Detection of a broad spatial distribution of black bream and greenback flounder; with adult black bream and all life stages of greenback flounder present across >50% of the Coorong in eight out of 10 years.  Improved population structure of mullet, including spawning aggregations at the Murray Mouth in six out of 10 years and recruitment in at least five out of 10 years.	On track
Estuarine dependant species	Detection in nine out of 10 years of bi-directional seasonal movements of diadromous species through the barrages and fishways between the Lower Lakes and Coorong	Insufficient evidence (although on track for pouched lamprey and congolli)

### C3. Waterbirds

Type	Expected outcome by 2024	Result
Waterbirds	The number and type of waterbird species present in the Basin will not fall below current observations from 2024.	On track
Waterbirds	A significant improvement in waterbird populations in the order of 20 to 25% over the baseline scenario, with increases in all waterbird functional groups by 2024.	Too early to tell
Waterbirds	Breeding events (the opportunities to breed rather than the magnitude of breeding per se) of colonial nesting waterbirds to increase by up to 50% compared to the baseline scenario from 2024.	Too early to tell
Waterbirds	Breeding abundance (nests and broods) for all other functional groups to increase by 30-40% compared to the baseline scenario, especially in locations where the Basin Plan improves overbank flows from 2024	Too early to tell
Shorebirds	At a minimum, maintain populations of the following four key species: curlew sandpiper, greenshank, red-necked stint and sharp-tailed sandpiper, at levels recorded between 2000 and 2014 by 2019	Too early to tell

## C4. Native vegetation

Type	Expected outcome by 2024	Result
Forests and woodlands	Maintain the current extent of forest and woodland vegetation, including approximately: <ul style="list-style-type: none"> <li>• 360,000 ha of river red gum</li> <li>• 409,000 ha of black box</li> <li>• 310,000 ha of coolibah</li> </ul>	Too early to tell
Forests and woodlands	No decline in the condition of river red gum, black box and coolibah across the Basin	On track
Forests and woodlands	By 2024, improve condition of river red gum in the Lachlan, Murrumbidgee, Lower Darling, Murray, Goulburn–Broken and Wimmera–Avoca	On track
Forests and woodlands	By 2024, improve recruitment of trees within river red gum, black box and coolibah communities, in the long term achieving a greater range of tree ages.	Insufficient evidence
Shrublands and non-woody vegetation	Maintain the current extent of extensive lignum shrubland areas within the Basin (at specific locations)	Insufficient evidence
Shrublands and non-woody vegetation	By 2024, improve the condition of lignum shrublands (at specific locations)	Insufficient evidence
Shrublands and non-woody vegetation	Maintain the current extent of non-woody vegetation	Insufficient evidence
Shrublands and non-woody vegetation	By 2024, increased periods of growth for communities that closely fringe or occur within the main river corridors	Insufficient evidence
Shrublands and non-woody vegetation	Maintain the current extent of non-woody vegetation	On track
Shrublands and non-woody vegetation	By 2024, increased periods of growth for communities that form extensive stands within wetlands and low-lying floodplains including; <ul style="list-style-type: none"> <li>• Moira grasslands in Barmah–Millewa Forest</li> <li>• common reed and cumbungi in the Great Cumbung Swamp and Macquarie Marshes</li> <li>• water couch on the floodplains of the Macquarie Marshes and Gwydir River</li> <li>• marsh club-rush sedgeland in the Gwydir</li> </ul>	On track
<i>Ruppia tuberosa</i>	By 2019, <i>Ruppia tuberosa</i> to occur in at least 80% of sites across at least a 50 km extent	Insufficient evidence
<i>Ruppia tuberosa</i>	By 2029, seed bank to be sufficient for the population to be resilient to major disturbances	Too early to tell

## Appendix D: Water recovery data

This table contains estimates of total water recovered, buybacks, recovery of water savings from on-farm infrastructure investment and the net effect on water available for irrigated production in the 41 communities to be examined in the community-level social and economic analysis (due April 2018).

GL	Total recovery	Water purchase	On-farm water savings	Net reduction in water available for production
Benerembah	25.0	16.6	8.4	13.0
Berri	12.9	10.6	2.3	9.6
Berrigan-Finley	64.3	41.5	22.8	31.7
Blanchetown	0.5	0.5	0.0	0.5
Cobdogla-Barmera	22.0	17.6	4.4	15.7
Cobram	70.1	61.3	8.8	57.5
Coleambally	25.1	14.5	10.6	9.9
Colignan	10.7	10.5	0.2	10.4
Coomealla	6.5	6.3	0.2	6.2
Cullulleraine	2.4	2.3	0.1	2.3
Deniboota	49.5	44.2	5.3	41.9
Denimein	16.1	11.2	4.9	9.1
Hay	70.7	54.3	16.4	47.2
Hillston	31.3	30.5	0.8	30.2
Kerang-Cohuna	64.6	59.8	4.8	57.8
Kooba	0.3	0.3	0.0	0.3
Kyabram-Tatura	82.7	75.0	7.7	71.7
Lower Lakes	4.7	4.1	0.5	3.9
Loxton	14.2	11.6	2.6	10.5
Mannum	4.6	4.2	0.4	4.0
Merbein	6.2	6.1	0.1	6.1
Mildura	11.0	10.9	0.1	10.8
Mirrool	18.1	14.0	4.2	12.2
Morgan	2.1	1.7	0.4	1.5
Murray Bridge	5.5	4.4	1.1	3.9
Pyramid Hill-Boort	40.8	36.8	4.1	35.0
Red Cliffs	9.4	9.3	0.1	9.2
Renmark	27.8	22.7	5.2	20.5
Robinvale	44.7	43.1	1.6	42.4
Rochester	51.0	43.7	7.2	40.6
Shepparton	30.8	27.5	3.3	26.1
Swan Hill	20.0	17.5	2.6	16.4
Swan Reach	4.3	4.1	0.2	4.1
Tabbita	0.4	0.4	0.0	0.4
Tailem Bend	1.7	1.7	0.0	1.7
Wah Wah	9.8	8.8	1.0	8.4
Waikerie	20.7	16.4	4.2	14.6
Wakool	97.9	91.0	6.9	88.0
Wentworth	4.1	3.9	0.2	3.9
West Berriquin	31.9	24.1	7.8	20.7
Yanco	17.5	12.7	4.8	10.6

## Appendix E: Glossary

### **Actual take**

Total quantity of water actually taken from the water resources of a water resource plan area during a water accounting period.

### **Allocation**

The water to which the holder of an access licence is entitled from time to time under licence, as recorded in the water allocation account for the licence.

### **Barrages**

Five low and wide weirs built at the Murray Mouth in South Australia to reduce the amount of sea water flowing in and out of the mouth due to tidal movement, and to help control water levels in the Lower Lakes and River Murray below Lock 1 (Blanchetown, South Australia).

### **Baseline**

Conditions regarded as a reference point for the purpose of comparison.

### **Basin governments**

Includes the Australian Government, and governments of New South Wales, Victoria, South Australia, and Australian Capital Territory.

### **Basin states**

For the purposes of the Basin Plan, the basin states are defined in the Water Act as New South Wales, Victoria, Queensland, South Australia and the Australian Capital Territory.

### **Basin water resources**

Under the Water Act 2007, basin water resources are within or beneath the Murray–Darling Basin, but do not include water resources within or beneath the Basin that are prescribed by the regulations, or groundwater that forms part of the Great Artesian Basin.

### **Cap (the Cap on diversions)**

A limit, implemented in 1997, on the volume of surface water that can be diverted from rivers for consumptive use. Under the Basin Plan, the Cap is replaced by long-term average sustainable diversion limits.

### **Cap factors**

Cap factors, also known as long-term diversion limit equivalence factors, are ratios used by water planners to represent the expected use of water in the various entitlement classes in a given catchment. Cap factors are based on modelled estimates of likely water availability over the planning period and estimates of irrigator behaviour based on experience.

### **Carryover**

A way to manage water resources and allocations that allows irrigators to take a portion of unused water from one season into the new irrigation season.

### **Class of entitlement**

Water entitlements are divided into differing 'classes' of security, where 'security' refers to the frequency with which water allocated under that entitlement is able to be supplied in full. Higher security entitlements have higher average and less variable yields than lower security entitlements.



## **Connectivity**

Connections between natural habitats, such as a river channel and adjacent wetland areas. Connectivity is a measure or indicator of whether a water body (river, wetland, floodplain) has water connections or flow connections to another body.

## **Constraints**

A constraint is anything that affects the delivery of environmental water. It can include physical aspects such as low lying bridges, or river channel capacity, but can also include operational aspects such as river rules or operating practices that impact on when and how much water can be delivered.

The effectiveness of environmental water delivery and management can be improved by addressing some of these physical and operational constraints.

## **Consumptive use**

Use of water for irrigation, industry, urban, stock and domestic use, or for other private consumptive purpose.

## **Conveyance water**

Conveyance water is the water needed to physically run the river system. Extra water must then be supplied on top of the conveyance water in order to meet deliveries along the river system. The conveyance reserve is water set aside for the next year to minimise the risk of not having enough conveyance water.

Setting aside water for conveyance and critical human needs aims to safeguard fundamental water requirements during a drought more severe than the millennium drought.

## **Diversion**

The removal of water from a river system by means of pumping or gravity channels.

## **Efficiency measures**

Projects that recover more water for the environment with no adverse socio-economic impacts. This can include upgrading on-farm irrigation infrastructure, or lining channels to reduce water losses within an irrigation network.

## **Entitlement (or water entitlement)**

The volume of water authorised to be taken and used by an irrigator or water authority; includes bulk entitlements, environmental entitlements, water rights, sales water and surface-water and groundwater licences.

## **Environmental flow**

Any river flow pattern provided with the intention of maintaining or improving river health.

## **Environmental water**

Water used to achieve environmental outcomes, including benefits to ecosystem functions, biodiversity, water quality and water resource health.

## **Fishway**

A structure that provides fish with passage past an obstruction in a stream.

## **Floodplain harvesting**

The taking of water from a floodplain, including after it leaves a watercourse during a flood.

## **Flow**

The movement of water — the rate of water discharged from a source, given in volume with respect to time.

**Flow event**

A single event of flow in a river, sometimes required to achieve one or more environmental targets. A series of flow events comprises a flow history.

**Flow regime**

The characteristic pattern of a river's flow quantity, timing and variability.

**Form of take**

Take is the removal of water, or the reduction in flow of water, from a water resource for consumptive purposes. For the purposes of the Basin Plan, forms of take are defined as any of the following:

- take from a watercourse
- take from a regulated river
- take by floodplain harvesting
- take by runoff dams
- net take by commercial plantations
- take from groundwater
- take under basic rights.

**Gigalitre (GL)**

One billion or  $10^9$  litres.

**Groundwater**

Water occurring naturally below ground level (in an aquifer or otherwise).

**Held environmental water**

Held environmental water is water that is available under a water access right, a water delivery right, or an irrigation right for the purpose of achieving environmental outcomes.

**Inflow**

Source of the water that flows into a specific body of water; for a lake, inflow could be a stream or river, and inflow for a stream or river could be rain.

**Irrigation**

The application of water to land to grow crops, usually through supplying water by means of channels or pipes.

**Macroinvertebrate**

An animal without a backbone that is large enough to be seen without magnification.

**Modelling**

Application of a mathematical process or simulation framework (e.g. a mathematical or econometric model) to describe various phenomena and analyse the effects of changes in some characteristics on others.

**Murray Lower Darling Rivers Indigenous Nations (MLDRIN)**

MLDRIN was formed in 1998 as a confederation of Indigenous Nations from the southern part of the Basin. It comprises representatives of the Barapa Barapa, Barkindji (Paakantyi), Dhudhuroa, Dja Dja Wurrung, Latji Latji, Maraura, Mutti Mutti, Nari Nari, Ngarrindjeri, Ngintait, Nyeri Nyeri, Tatti Tatti, Taungurung, Wadi Wadi, Wamba Wamba, Waywurru, Wegi Wegi, Wergaia, Wiradjuri, Wolgalu, Wotjabaluk, Yaitmathang, Yita Yita, Yorta Yorta.

## **Northern Basin Aboriginal Nations (NBAN)**

NBAN was formed in April 2010 and comprises Aboriginal Nation representatives from the northern part of the Basin and representatives from the New South Wales Aboriginal Land Council, the Queensland Murray–Darling Committee, the Condamine Alliance and South West Queensland Natural Resource Management.

NBAN comprises Traditional Owner nominated representatives from the following Nations:

Barkindji (Paakantyi), Barunggam, Bidjara, Bigambul, Budjiti, Euahlayi, Gamilaroi, Githabul, Gunggari, Gwamu (Kooma), Jarowair, Kambuwai, Kunja, Kwiambul, Maljangapa, Mandandanji, Mardigan, Murrawarri, Ngemba, Ngiyampaa, Wailwan and Wakka Wakka.

## **Permitted take**

Total quantity of water permitted to be taken during a water accounting period in a water resource plan area, varying from year to year according to the interaction of climate, inflows and water resource plan rules (e.g. allocation rules, access rules).

## **Planned environmental water**

Water used for environmental outcomes which is not associated with an entitlement but is managed through with rules set out in water management plans or laws.

## **Planning assumptions**

Planning assumptions are the water use and related assumptions that are used by Basin state water planners to design methods for determining annual permitted take that are consistent with s10.10 and s10.12 of the Basin Plan. Some of these assumptions are fixed, e.g. use of the Basin Plan historical climate conditions (1895–2009) and some are judgements made about things like the expected level utilisation of different entitlement classes. Some planning assumption will also relate to the water sharing rules that are being put forward for each water resource plan area. The planning assumptions that are used in a particular water resource plan area will determine the ‘cap factors’ for each different entitlement class in that water resource plan area.

## **Prerequisite policy measures**

Protecting environmental flows across the Basin through water resource planning and, in the southern Basin, through the implementation of practical measures such as re-crediting return flows and ‘piggybacking’ releases of held environmental water during higher flows (collectively referred to as prerequisite policy measures).

## **Ramsar — see Ramsar Convention**

## **Ramsar Convention**

The Convention on Wetlands of International Importance is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

## **Regulated**

A water system in which water is stored or flow levels are controlled through the use of structures such as dams and weirs.

## **Salt interception scheme**

Large-scale groundwater pumping and drainage projects that intercept saline groundwater inflowing to rivers, and dispose of the saline waters by evaporation and aquifer storage at more distant locations.

## **Supply measures**

Projects which enable equivalent environmental outcomes to be achieved with less water. Examples include environmental works, such as building or improving river or water management structures, and changes to river operating rules.

## **Surface water**

Includes water in a watercourse, lake or wetland, and any water flowing over or lying on the land after having precipitated naturally or after having risen to the surface naturally from underground (see s. 4 of the Water Act).

## **Sustainable diversion limit**

The maximum long-term annual average quantities of water that can be taken, on a sustainable basis, from the basin water resources as a whole, and the water resources, or particular parts of the water resources, of each water resource plan area.

## **Sustainable diversion limit adjustment mechanism**

Allows the sustainable diversion limit to be adjusted under certain circumstances.

## **Take**

Take is the removal of water, or the reduction in flow of water, from a water resource for consumptive purposes. See 'Actual Take' and 'Permitted Take.'

## **Toolkit measures**

As part of the Northern Basin Review, the Australian, New South Wales and Queensland governments made in-principle commitments to implement a number of toolkit measures that would complement water recovery for the environment. These measures include better protection of environmental flows, addressing constraints to environmental water delivery in the Gwydir wetlands, mitigating cold water pollution and constructing fishways.

## **Water accounting**

A systematic process of identifying, recognising, quantifying, reporting and assuring information about water, the rights or other claims to water, and the obligations against water. Water accounting applies Australian Water Accounting Standards.

## **Water allocation**

The specific volume allocated to water entitlement holders in a given season, often quoted as a percentage of the volume of each entitlement. For example, a 20% allocation in a particular season allows a water user with a 100 ML entitlement to take 20 ML of water.

## **Water holders**

Water holders (like the Commonwealth Environmental Water Holder) manage portfolios of environmental water. Water holders work together to ensure water held under different entitlements is coordinated.

## **Water quality**

The condition of water and its related suitability for different purposes. It refers to a combination of physical, chemical and/or biological characteristics of water in the context of the proposed use of that water.

**Water resource**

Of groundwater, water that occurs naturally beneath the ground level (whether in an aquifer or otherwise), or water that has been pumped, diverted or released to an aquifer for the purpose of being stored there. Murray–Darling Basin groundwater resources exclude groundwater in the Great Artesian Basin.

Of surface water, includes water in a watercourse, lake or wetland, and any water flowing over or lying on land after having precipitated naturally, or after having risen to the surface naturally from beneath the ground level.

**Water resource plans**

Statutory management plans developed for particular surface-water and groundwater systems, currently known by different names throughout the Murray–Darling Basin (e.g. ‘water sharing plans’ in New South Wales and ‘water allocation plans’ in South Australia).

**Water trading rules**

A set of overarching consistent rules enabling market participants to buy, sell and transfer tradeable water rights.

**Water year (or hydrologic year)**

A continuous 12-month period starting from July, or any other month as prescribed under the water regulation or a resource operations plan, but usually selected to begin and end during a relatively dry season. Used as a basis for processing streamflow and other hydrologic data.