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2018–19

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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.

Contents

| | |
|---|----|
| Introduction..... | 1 |
| About this report..... | 1 |
| 1. Implementing the Basin Plan | 2 |
| Water resource planning..... | 2 |
| Progress with accreditation..... | 2 |
| Strengthening Aboriginal involvement in water planning | 3 |
| Jurisdictional initiatives | 4 |
| Transitional arrangements for sustainable diversion limits..... | 7 |
| Water trading rules | 8 |
| Sustainable diversion limit adjustment mechanism | 9 |
| Supply and constraints projects | 9 |
| Managing constraints..... | 10 |
| Efficiency measures..... | 11 |
| Prerequisite policy measures | 11 |
| Northern Basin toolkit measures | 11 |
| 2. Collaboration and engagement..... | 13 |
| Governance | 13 |
| Maximising outcomes through compliance | 13 |
| MDBA’s compliance role | 13 |
| The Compliance Compact..... | 15 |
| Jurisdictional and other initiatives | 16 |
| Engagement..... | 17 |
| Regional engagement..... | 17 |
| 3. River management | 18 |
| River operations | 19 |
| Risk management..... | 19 |
| Drought..... | 19 |
| Water quality..... | 20 |
| Challenges in delivering environmental water..... | 21 |
| Climate change | 21 |
| Environmental water management | 22 |
| Outcomes achieved from environmental flows..... | 23 |
| 4. Monitoring, evaluation, reporting and improvement..... | 27 |

| | |
|---|----|
| Monitoring salinity targets | 27 |
| Salt export objective..... | 28 |
| Understanding the social and economic impacts of the Basin Plan | 28 |
| Independent Social and Economic Assessment Panel | 29 |
| Evaluation and reviews | 30 |
| Basin Plan Evaluation | 30 |
| Reviews..... | 30 |
| Using the best information available | 31 |
| Science and knowledge to support decision-making..... | 31 |
| Conclusion | 34 |

Introduction

About this report

This report provides an update on how governments and communities have been working together to implement the Basin Plan. It draws on information in the annual implementation reports prepared by Basin jurisdictions, the Murray–Darling Basin Authority (MDBA) and the Commonwealth Environmental Water Office, as well as information provided by the Department of Agriculture. The implementation reports are provided to the MDBA after the completion of the financial year and are published on the MDBA website.

This Basin Plan Annual Report is a key mechanism through which transparency of and accountability for Basin Plan implementation is provided, which is especially important given the scale and complexity of this major national reform. Through open and transparent reporting, the goal is to build trust among Basin communities in the agencies responsible for implementation.

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 water planning and recovery of water for the environment, the Basin Plan is designed to underpin sustainable long-term outcomes for the environment, communities and industries. Within this context, the report is presented in four sections:

1. Implementation—this section covers progress including the development of water resource plans, projects to improve water management, and an audit of water trade prices.
2. Collaboration and engagement—this section provides an update on governance, collaboration and coordination including building relationships in regions.
3. River management—this section covers the conditions prevailing in the Basin and the delivery of environmental flows and management of water quality.
4. Monitoring, Evaluation, Reporting and Improvement—this section provides an update on monitoring, evaluation, reporting and improving the knowledge base activities.

1. Implementing the Basin Plan

The Basin Plan aims to ensure the Murray–Darling Basin (the Basin) is a healthy working basin that delivers benefits for all Australians, and particularly the communities within the Basin. The Basin Plan came into effect in 2012, and is being phased in over 12 years. For example, some of the water resource plans are yet to be finalised, while delivery of environmental flows has been operational for some time and is demonstrating ongoing improvements. The implementation of the Basin Plan is a collaborative effort by the Australian Government, Basin states and communities.

Water resource planning

The Basin Plan water resource plans (WRPs) establish, for the first time, a framework for the integrated and adaptive management of the Basin’s water resources as a whole. The WRPs complement and build on existing state-based water management arrangements. They:

- set new rules for how much water can be taken out of the system, ensuring the sustainable diversion limits (SDLs) in each area are not exceeded over time
- ensure state management rules meet the Basin Plan objectives
- include new arrangements that strengthen water management at a local level.

WRPs are developed by Basin state governments, assessed by the MDBA, and accredited by the Australian Government minister responsible for water.

Progress with accreditation

There are 33 plan areas in total: 19 for surface water, 19 for groundwater, and five that cover both surface water and groundwater. During 2018–19, there was significant progress on the development and accreditation of WRPs. This process has involved extensive community consultation on draft WRPs.

As of 30 June 2019, 13 WRPs were being assessed for an accreditation decision or have been accredited. The remaining 20 WRPs are in various stages of progress, see Table 1. Basin state and territory governments have entered into agreements with the Commonwealth to ensure key elements of the WRPs are given effect from 1 July 2019 where WRPs are not accredited by that date. The agreements will ensure that SDLs and measures to protect and better manage environmental water are in place from 1 July 2019. Under the agreements, all WRPs are required to be submitted to the MDBA before the end of 2019. To read more about progress with the WRP accreditation process, refer to the MDBA’s quarterly progress reports on the [MDBA website](#).

Table 1: Progress with Water Resource Plan as at 30 June 2019

| Progress with Water Resource Plan as at 30 June 2019 | |
|--|---|
| Australian Capital Territory | Two plans submitted for assessment |
| New South Wales | 20 plans under development |
| Queensland | One plan accredited Two plans with Minister for accreditation decision |
| Victoria | Five plans submitted for assessment |
| South Australia | One plan with Minister for accreditation decision Two plans submitted for assessment |

Case study: Queensland completes water resource plans for assessment

The MDBA has been working closely with the Queensland government since it started preparing its two remaining water resource plans in 2017. The plans cover the Queensland parts of the Condamine–Balonne and the Border Rivers–Moonie catchments. All plans are prepared in consultation with the local communities.

In April 2018, Queensland released draft water plans, water management protocols, healthy waters management plans, and an Aboriginal people’s water needs report for formal public consultation. These state instruments and plans are key parts of water resource plans submitted to meet the accreditation requirements set out in Chapter 10 of the Basin Plan.

At the end of February 2019, the Queensland government submitted its final water resource plans to the MDBA for assessment.

After resolving a few minor matters and a resubmission, the MDBA provided its assessment of the water resource plans to the Minister. This completed the MDBA’s plan assessment work for the Queensland part of the Murray–Darling Basin. The Minister then accredited the Queensland plans.

As part of the process of preparing the water resource plans, the MDBA provided advice and feedback to Queensland at key stages. This included before the formal consultation period started, when the draft water resource plans were nearly complete at the end of August 2018, and during the final stages.

Strengthening Aboriginal involvement in water planning

Aboriginal people of the Murray–Darling Basin have an intricate and enduring cultural connection to water. Cultural traditions, stories and knowledge are entwined in their relationship to water resources. The Basin Plan provides opportunities for Aboriginal perspectives to be heard. It requires WRPs to identify Aboriginal people’s objectives and outcomes based on their values and uses, and Aboriginal communities and organisations are to be included in developing WRPs. The Basin Plan also seeks to engage with Aboriginal people to ensure that environmental water is managed to deliver

environmental, social and economic outcomes that are in line with objectives and outcomes as identified by Aboriginal people to ensure that their interests are considered in the management of environmental water.

Water planners are increasingly working with Aboriginal people and organisations including the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) and Northern Basin Aboriginal Nations (NBAN) to identify their interests in relation to water management. The MDBA provides funding support to NBAN and MLDRIN to support Aboriginal people's participation in consultation undertaken by Basin states during the development of WRPs.

Eight assessment workshops were undertaken in 2018–19 to formulate advice to the MDBA regarding the adequacy of consultation undertaken by states. For the majority of WRPs, consultation was considered to meet Basin Plan requirements, and Traditional Owners have noted the development of constructive, collaborative relationships between Aboriginal people and government.

Jurisdictional initiatives

Basin governments have a number of initiatives to improve engagement of Aboriginal people in water resource planning. In 2018–19, the Australian Government committed to appointing an Indigenous person as the seventh member of the MDBA. The government also funded the appointment of two full-time cultural flow officers to work with MLDRIN and NBAN. The positions are funded for three years. The Aboriginal Water Entitlement Program and the Cultural Flows Mapping Project were progressed during the year.

South Australia has continued to engage with Aboriginal Nations across the South Australian Murray–Darling Basin region through an approach developed at the Joint Nations meetings in 2016–17. This engagement has been undertaken through joint and individual meetings and on-country workshops facilitated or co-facilitated by Nations representatives. As part of South Australia's commitment to capacity building, the First Peoples and Ngarrindjeri water coordinators are supported within their Nation organisations to lead the water engagement by their Nation. South Australia is also progressing a [Goyder Institute for Water Research partnership project](#) with Ngarrindjeri to adapt South Australia's risk management framework to better integrate and assess risks to First Nations water objectives.

In Victoria, Traditional Owner engagement has been a major focus during the development of Victoria's WRPs over the last three years. In response to MLDRIN feedback on the Wimmera–Mallee Water Resource Plan, Victoria's Department of Environment, Land, Water and Planning (DELWP) committed to undertake additional engagement with a revised Traditional Owner engagement strategy for all Traditional Owner groups, and to revise the Wimmera–Mallee Water Resource Plan to reflect the outcomes of the additional engagement. DELWP dedicated additional resources to support engagement by the WRP team and provided additional resourcing for Traditional Owner groups to support their participation.

The NSW government, in partnership with NBAN and MLDRIN, has developed and is implementing a culturally appropriate process for consulting with First Nations people across 29 Nation groups to meet the requirements of Basin Plan Chapter 10, Part 14—Aboriginal values and uses. Through this

process New South Wales is obtaining feedback from First Nations people regarding their values and uses, objectives and outcomes for water management within their Nation area. NSW is also seeking to build strong relationships with First Nations and improve First Nations participation in water planning into the future.

The Queensland government has been engaging with Aboriginal people as part of developing WRPs. Engagement has focused on building relationships and on identifying how Aboriginal people value and use water and what objectives and outcomes Aboriginal people have for the way water is managed. This engagement has also raised many other issues and views that have been considered as part of the water planning process. In February 2019 the Queensland government published *Water connections: Aboriginal people's water needs in the Queensland Murray–Darling Basin*, which details the engagement process adopted for developing WRPs and identifies lessons learned. The document identifies the forward outcomes for First Nations people and how these will be measured in the future.

The MDBA and the Commonwealth Environmental Water Office (CEWO) are funding the Murray–Lower Darling Rivers Indigenous Nations and Northern Basin Aboriginal Nations to implement the First Nations Environmental Watering Guidance project. This project, co-designed by NBAN and MLDRN, aims to incorporate First Nations environmental watering objectives into planning for environmental flows at the Basin scale. These objectives will be fed into the 2020–2021 Basin annual environmental watering priorities and considered by CEWO in water planning.

CEWO is actively working to enhance its engagement with First Nations in the Basin by discussing potential watering sites and opportunities with a range of First Nations, as well as developing a participation strategy and evaluation framework for enhancing First Nations involvement in environmental watering.

Case study: Engagement during the Northern Fish Flow

From April to July 2019, CEWO and the NSW Department of Planning, Industry and Environment released water for the environment down the Barwon–Darling. The flow, named the Northern Fish Flow, travelled around 1,500 km from Glenlyon and Copeton dams to the junction of the Barwon and Culgoa rivers. The flow connected the rivers and helped native fish including gudu (Murray cod), and gaygay (catfish) survive.

Prior to the Northern Fish Flow, parts of the Barwon River had not flowed for over 330 days. A series of disconnected waterholes remained, with poor water quality and fish struggling to stay alive. Calls for a flow to replenish the northern river systems were heard from senior Aboriginal people and Elders. CEWO heard from NBAN representatives, who were distressed about the fish deaths, reiterating how totemic species are like family for Aboriginal people. Local staff from CEWO spoke with Elders about what could be done to help fish and other important values of the river systems.

During the Northern Fish Flow, CEWO shared regular updates with and held community drop-in sessions for local communities. Aboriginal community members who attended the drop-in sessions expressed a deep connection to the rivers and a strong support for environmental flows.

Vanessa Hickey, a Traditional Owner from Walgett, stated: ‘These places are very special to us Aboriginal people, our ancestors walked here for thousands and thousands of years. They lived off these river banks. With the environmental flow coming down, this is going to pipe my community up. We’re going to be out here fishing a lot.’

The Northern Fish Flow travelled through the traditional lands of many Aboriginal Nations, supporting important environmental, social and cultural values. As the flow passed the Barwon River downstream of the Namoi junction, up to 40 members of the Aboriginal community came out to fish and enjoy the flow. Fisheries officers reported seeing kids and adults along the bank catching golden perch and Murray cod, cooking johnnycakes (or damper) and enjoying the river. Carl McGrady, a Traditional Owner, said the flow was ‘probably the best thing I’ve seen in the last 10 years’.

From schoolchildren to Elders, many conversations took place between CEWO staff and local Aboriginal communities, sharing information and receiving feedback about the flow. Jason Wilson, a local engagement officer from CEWO, noted: ‘Sharing with the local communities about the flow has been an eye opening experience; their knowledge, participation and passion was a constant in towns from the start of the event and right to the end. We learned a lot from the information sessions we conducted, importantly we have established and will continue to foster a strong relationship into the future, built on mutual respect and the common languages of looking after our rivers.’

The ACT Environment, Planning and Sustainable Development Directorate continued to engage in targeted one-on-one consultations with key stakeholders, agencies and groups on the draft ACT WRP. This included Traditional Owners and MLDRIN. Under Action 14: ‘Ensure Indigenous and other values are recognised’ in the ACT and Region Catchment Management Group (RCMG) report for 2017–18, the potential for Aboriginal water reserve is to be identified in the ACT WRP, which is due for accreditation in 2019. The RCMG will also explore better ways to ensure that the perspective of regional Aboriginal communities is well integrated into its information-gathering and decision-making.

Cultural flows

Following the completion of the National Cultural Flows Research Project in mid-2018, the MDBA is assisting NBAN and MLDRIN to implement the cultural flows assessment methodology across the Basin. This work commenced in 2018–19 with workshops in both the northern and southern Basin. The workshops allow Aboriginal Nations to identify cultural flow priorities and objectives, develop a cultural flows management plan and, ultimately, secure water entitlements. Communities—and governments—are increasing their understanding of cultural flows as this work progresses.

Community of practice

In December 2018, the Ministerial Council endorsed the development of a community of practice to support Aboriginal engagement in the Basin. When established, this will provide regular opportunities for engagement practitioners across the Basin (both government and non-government) and Aboriginal people to share information and coordinate water planning and

management activities. This includes those that provide for the achievement of cultural objectives in water resource plans. The community of practice will further embed the notion that Aboriginal engagement is included in water management activities.

In summary, there has been significant progress in involving Aboriginal people in water management. However, much more needs to be done by all Basin governments to fully realise the aspirations of Aboriginal people with respect to water management and water ownership in the Basin.

Transitional arrangements for sustainable diversion limits

The MDBA continued to work with Basin state governments during 2018–19 to ensure smooth transitions to management under the new SDLs. Having processes in place to support an annual reporting cycle was an important aspect of this work. The MDBA started developing a cost-effective and efficient SDL compliance database to streamline SDL accounting and reporting. The development of the SDL reporting and compliance framework will enable the MDBA to manage instances of non-compliance.

Under s. 71 of the *Water Act 2007* (Cwlth), Basin states and the CEWO are required to comply with SDLs by reporting annual water accounts. Under the Basin Plan, the MDBA is required to establish, maintain and publish an annual Register of Take from 1 July 2019.

To ensure the robustness of the process, in 2018–19 the MDBA:

- commissioned an independent panel to conduct a health check of the SDL accounting framework
- published the SDL Reporting and Compliance Framework in November 2018
- presented a trial of SDL accounts in the 2017–18 Transition Period Water Take Report as a ‘proof of concept’. This established and tested the types of arrangements that needed to be in place from 1 July 2019 to ensure compliance with the SDLs.

Floodplain harvesting is a form of take that is not well regulated in the Basin. Both Queensland and New South Wales have been working to implement appropriate regulation. In New South Wales, with the support of the MDBA, an independent review was commissioned to provide advice on floodplain harvesting and the work that needs to be done before licensing and accounting can happen.

The draft report was released in May 2019, finding that improvements are needed to accurately model floodplain harvesting in New South Wales. Further work needs to be done to ensure water sharing plans and water resource plans accurately represent floodplain harvesting use. The independent review also recommended increased community engagement to enhance community input and understanding. Following on from the review, the NSW government has committed to improving modelling and engagement to provide certainty that the floodplain harvesting policy is robust. The NSW government is conducting further public consultation, providing information to the community on licensing floodplain harvesting as part of the regulated system with all other water licences.

Water trading rules

Water in the Murray–Darling Basin can be bought and sold, either permanently or temporarily. This water is traded on markets—within catchments, between catchments (where possible) or along river systems. This form of trading allows water users to buy and sell water in response to their individual needs. Water trading has become a vital business tool for many irrigators. Water markets encourage more efficient water use throughout the Murray–Darling Basin as a range of water entitlements and allocations can be bought and sold on these markets.

Basin state governments are responsible for developing and maintaining Basin Plan compliant rules around water access and use in their jurisdictions. The Basin Plan requires all states to provide the MDBA with a copy of their trading rules. The MDBA publishes these rules on its website to make them easier to find for water users.

The MDBA is responsible for compliance with the Basin Plan’s water trading rules. It is estimated that in 2017–18 some 8,500 GL of water, valued at approximately \$2 billion, was traded in the Basin, so compliance with the Basin Plan water trading rules is important.

In 2018–19, the MDBA undertook the Water Trade Price Reporting Audit (see Case study: Better governance through water trade audit).

Case study: Better governance through water trade audit

The billion-dollar trade in water across the Murray–Darling Basin came under audit examination in 2018–19.

Water trade allows water holders to buy or sell water in accordance with their business needs. The price of water reflects supply and demand factors and can differ across regions and time, and also according to the types of rights being traded. As a result, current and accurate price information is imperative to support fair trade.

Accurate, accessible price information provides equal access for all market participants, informs investment and encourages market participants to make the best use of water depending on their needs.

Basin state government agencies record and report water trade prices within individual public registers. This information is provided to the Bureau of Meteorology and collated for inclusion in the publicly available Consolidated Water Markets Dashboard.

During 2018–19, the MDBA conducted a two-part audit of water trade price reporting. The first part of the audit assessed how Basin states collected, validated, recorded and reported water trade pricing information for the water year 2017–18.

The central finding of this audit was that Basin states do not have sufficiently robust processes in place to capture and produce comprehensive, accurate price information. As a consequence, there was evidence that the price data reported by each Basin state was both inaccurate and incomplete.

The second part of the audit, conducted by Deloitte, examined individual water trade transactions to assess water traders' compliance with the requirement to report accurate price information to their relevant state authority.

Deloitte uncovered a range of issues indicating that misreporting of trade prices is pervasive, including confusion about reporting requirements, inconsistent approaches to reporting, and failure to verify the prices reported. Deloitte concluded that the issues existed due to flaws in the Basin state systems and processes—consistent with the MDBA findings in part one of the audit.

The overarching recommendation was that the MDBA, Basin states and the Bureau of Meteorology should work together to build a more effective governance framework around water trade pricing and information.

Sustainable diversion limit adjustment mechanism

The Basin Plan allows for changes to water recovery targets through the SDL adjustment mechanism. This allows for the Basin Plan water recovery target to be achieved through offsets from projects that deliver equivalent environmental outcomes without the need for more water. The sustainable diversion limit adjustment mechanism (SDLAM) involves three elements that work together—namely 'supply' and 'constraints' projects that improve river management and achieve equivalent environmental outcomes with less water, and 'efficiency measures' that recover water for the environment.

Supply and constraints projects

The Basin Plan was amended to include 36 supply and constraints projects put forward by Basin governments. The original target of recovering 2,750 GL of water per year (GL/y) was adjusted in 2018, which resulted in a reduction of up to 605 GL/y under the SDLAM projects.

To help the public better understand the changes, during the year the MDBA provided additional information on the MDBA website, including listing every original baseline diversion limit (BDL) and SDL estimate for each SDL resource unit, along with updated estimates and the reason for the change. This is presented along with two animations that explain BDLs and SDLs and how these limits can be updated.

Basin state governments are responsible for the design and implementation of SDLAM projects. New South Wales, Victoria and South Australia received Stage 1 funding (planning and design) from the Australian Government in the first half of 2019.

In February 2019, the MDBA published the first annual progress report on the projects. The report noted progress in some areas but also noted that a substantial amount of work was yet to be done.

- The fish death events in Menindee highlighted concerns about the Menindee Lakes Water Savings Project. The MDBA has been working with the NSW government during 2018–19 on the design and implementation of this important project.

- Several rules-based projects and the New South Wales Nimmie–Caira Project are expected to be completed soon.
- Progress in the development of constraints projects that allow higher flow rates and more water to reach the floodplain has been slow.
- Several projects related to The Living Murray have been completed.
- More effort, particularly around community consultation, which is yet to start, is required.
- The South Australian Riverine Recovery Project and South East Flows Restoration Project are expected to be completed soon.

Managing constraints

‘Constraints’ cover anything that restricts the flow of water for the environment. This includes physical restrictions such as low-lying bridges, crossings or private land; and operational aspects such as river rules or operating practices.

Constraints projects are designed to ensure the water goes where it is needed when it is needed, while avoiding or mitigating the impact on riparian landholders, communities and industries. Managing constraints enables the river system to be run more efficiently.

Of the notified SDLAM projects, the constraints measures contribute a significant proportion of the total supply adjustments and are co-dependent on each other.

A coordinated work plan was developed to assist in delivering the Constraints Measures Program (CMP). The work plan provides mechanisms for coordinating the Basin states’ projects, and outlines milestones to provide the basis for reporting on progress to ministers. At its meeting in December 2018, the Murray–Darling Basin Ministerial Council endorsed the work plan.

Implementation of the CMP is progressing more slowly than anticipated in the work plan, due to the complexity of the projects and the need for community co-design due to the large number of affected landholders.

In the second half of 2018–19, New South Wales, South Australia and Victoria made progress against the work plan milestones. Milestone achievements include development of a program risk management strategy and a framework for mitigation of policy, regulatory and legal issues, and progress towards delivery of a system-wide communications and engagement strategy.

The funding agreements between Basin states and the Australian Government have taken time to resolve. South Australia and New South Wales have funding agreements in place for the constraints projects for which they are the sole proponent. Funding arrangements for the Victorian constraints project and joint Victoria/NSW projects are not yet in place. Delays in settling the remaining funding agreements will continue to pose concerns as to the timing of the delivery of the CMP.

The MDBA continues to provide technical, planning, and system operational expertise. In May 2019 the MDBA held a technical and modelling workshop to reinforce the fundamental issue of the achievability of the Basin Plan flows set out in the Constraint Management Strategy.

Efficiency measures

The Australian Government Department of Agriculture manages the Efficiency Measures Program. This program needed to recover 62 GL/y by 30 June 2019 in order for the full adjustment of 605 GL/y to occur for this water year. The program has recovered 1.3 GL/y, with a further 0.6 GL/y contracted but not delivered. This means that for the 2019–20 water year the adjustment amount will be reduced from 605 GL/y to 544 GL/y to remain in line with the rules of the Basin Plan, and can only be adjusted up in the following year as efficiency measures are implemented.

In December 2018, the Ministerial Council agreed to a set of socioeconomic criteria to apply to additional water efficiency projects. States are responsible for implementing the criteria in a transparent way.

The socioeconomic criteria were developed in consultation with Basin communities to ensure that water efficiency projects provide more water for the environment while having positive outcomes for Basin communities.

Prerequisite policy measures

There are a number of other measures (known as ‘prerequisite policy measures’ (PPMs)) that are relevant to the operation of the SDLAM. These policy measures ensure there are secure and enduring water management arrangements for the efficient and effective use of water for the environment without impacting on other water users, and provide greater flexibility in how this water can be used. These measures were assessed by the MDBA as being in effect as of 30 June 2019.

The Independent River Operations Review Group conducted a review of the MDBA’s assessment of PPMs in the Murray to ensure that the criteria were consistently applied and robust and evidence-based conclusions were reached. The findings support the MDBA’s comprehensive assessment process and the conclusion that the measures are in effect in all relevant jurisdictions.

The MDBA will report on the effectiveness of ongoing PPM implementation in 2024 at the same time as undertaking the reconciliation of the SDLAM, which is dependent on the full realisation of the benefits of PPM implementation.

Northern Basin toolkit measures

The ‘toolkit measures’ are a series of policy and infrastructure measures underway in the northern Basin. They developed out of the four-year review into the northern Basin that was completed in 2016. The review resulted in a 70 GL reduction to the water recovery target in the north, from 390 GL to 320 GL.

The toolkit measures are intended to:

- better protect water for the environment
- improve river management across the northern Basin
- create opportunities for local communities, including First Nations.

In 2018–19 there was good initial progress on implementing some of the toolkit projects—particularly those associated with improving the management and protection of water for the environment.

Notable events included:

- the Basin Officials Committee’s endorsement of a prioritisation assessment framework for northern Basin toolkit projects
- the development of a new schedule to the Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin specific to the implementation of the northern Basin toolkit, to be considered by the Council of Australian Governments (COAG)
- the development of content in Queensland and NSW WRPs to improve management and protection of environmental water.

Overall, progress has been slower than expected but Basin governments have remained committed to implementing the toolkit arrangements. In December 2018, ministers agreed that some funding be made available to assist Basin states to prepare feasibility proposals and business cases for these projects. The Commonwealth is working with New South Wales and Queensland to finalise funding agreements to enable those states to develop feasibility proposals. The agreements are expected to be in place prior to the December 2019 Ministerial Council meeting.

Projects associated with infrastructure measures are a key focus for governments for the next year.

2. Collaboration and engagement

The Australian and state governments work in partnership to implement the Basin Plan. Different agencies have different roles in implementation and so must work together to ensure they understand their responsibilities and coordinate their efforts.

People who live in the Basin have great knowledge of their region. Basin governments work with communities to draw on local knowledge, experience and advice to implement the Basin Plan. Connecting with communities is crucial to implementing the Basin Plan, and is most effectively done through engagement tailored to suit individual communities and key issues.

Governance

Effective and successful implementation of the Basin Plan requires maintaining and enhancing collaborative relationships with Basin states. During the year there was evidence of maintained or improved collaborative relationships through:

- regular discussions with the Basin states on the progress, assessment and development of WRPs through the Basin Plan Implementation Committee and the Basin Officials Committee
- development and endorsement by the Basin Officials Committee of a prioritisation framework to assess projects that deliver against the northern Basin toolkit
- development of a new schedule to the Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin specific to the implementation of the northern Basin toolkit
- preparation of WRP content by the NSW and Queensland governments to better manage and protect environmental water achieved through intergovernmental collaborative forums
- development of a monitoring, evaluation, and reporting capability assessment.

Maximising outcomes through compliance

Ensuring the Basin Plan is implemented as planned requires adherence to the rules and policies set out in the Basin Plan and water resource plans, and importantly environmental, social and economic benefits cannot be achieved if water users are not compliant with water take rules. The MDBA and states have been working together to improve compliance.

MDBA's compliance role

The MDBA's primary role in compliance is overseeing the state water agencies, with a focus on auditing and reporting on state performance, developing standards and guidelines, and helping to improve capability and a Basin-wide culture of compliance. State water agencies have the frontline responsibility for ensuring that water users operate in accordance with their water licences and that take is within allowable limits, and ensuring that water trade rules are consistent with the Basin Plan.

Auditing is one of the MDBA's key tools for monitoring compliance with the Basin Plan. In 2018–19, four assurance audits were undertaken, including an audit of trade price reporting. The Water Trade Price Audit identified a number of deficiencies in the systems and processes in place for recording

and reporting on water prices. The MDBA is now working with the Basin states to resolve these issues. All audits and reviews, including two on state metering arrangements, are published on the MDBA's website.

New technology, including remote sensing, is being used to support compliance monitoring and intelligence gathering (see Case study: Satellite imagery—eyes in the sky). This technology was used to monitor flows in northern Basin after rain events in March 2019. The MDBA continued to develop methods to increase its use and application of this type of technology for a range of compliance purposes.

Case study: Satellite imagery—eyes in the sky

Two eyes are better than one in remote sensing.

The MDBA's increasing use of remote monitoring technologies, like satellite imagery, to watch over the Murray–Darling Basin's one million square kilometre footprint is proving a game changer for water management.

Those two eyes—the European Space Agency's Sentinel 2A and 2B satellites—allow the MDBA to monitor water flows across the landscape and pick up any unexpected changes, which can help pinpoint anomalies for further investigation.

The MDBA has built the capability to analyse the imagery for a range of needs, including ecological mapping and monitoring, river operations and compliance.

The satellite imagery allows the MDBA to make decisions based on a better understanding of how water behaves and how it moves through waterways and the surrounding landscape.

At the same time, by coupling satellite imagery with gauge flow data analysis the MDBA can find any unexpected, significant, sudden or unusual flow changes that might indicate unauthorised take.

Since mid-2018 the MDBA has used Sentinel-2 satellite imagery to:

- track a large-scale environmental flow released from the Border Rivers and Gwydir catchments to provide connection flows to Menindee Lakes (mid-2018)
- track environmental flow releases in the Namoi, Gwydir and Macquarie catchments (mid-2018) for increasing wetland and Ramsar site health
- monitor vegetation condition change in the Gunbower Forest as a result of environmental water releases (late 2018)
- monitor flows in the Warrego, Namoi and Macquarie catchments which resulted from rainfall (early 2019)
- monitor a large-scale environmental flow to provide drought refuge, improve water quality and connect isolated pools in the Border Rivers, Gwydir and Barwon–Darling catchments (the Northern Fish Flow) (mid-2019).

The MDBA is continuing to build its capability to use satellite imagery to monitor water use across the Basin.

Accurate metering and monitoring of water take is crucial to ensure compliance with the Basin Plan. In 2018–19, in addition to commencing audits of state metering systems, the MDBA released a series of policies and guidelines for improving monitoring of water take. For example, the MDBA has published a list of approved ‘non-urban’ water meters, to help water users to identify meters that comply with the Australian Standard. The MDBA is also leading an Australia-wide project to review the Metrological Assurance Framework. This project will investigate barriers to innovation in metering solutions and to obtaining patent approval, and review the post-installation requirements for water metering, with a view to providing a uniform approach to metering and making it easier and cheaper for water users to comply. This review will not change the requirement for users to have an approved meter or, indeed, for the jurisdiction to have the appropriate policy.

The Compliance Compact

The Murray–Darling Basin Compliance Compact (the Compliance Compact) was agreed to by the Murray–Darling Basin Ministerial Council in June 2018, and by COAG in December 2018. The Compliance Compact responded to the reviews into the integrity of Basin water management and compliance, and sets out a range of commitments, work programs and clear timeframes for delivery.

Under the Compliance Compact, the MDBA prepares an annual progress report to COAG and the Ministerial Council against the Compliance Compact commitments. This reporting is important to ensure accountability and help restore public confidence in the way water is managed across the Basin.

In December 2018 the MDBA published an Interim Assurance Report on the first six months of implementation of the Compliance Compact.

The Interim Assurance Report found that Basin states and the Australian Government had made considerable progress in the relatively short time since the Compliance Compact was agreed and that it was vital for Basin states to retain momentum to fully meet all of their Compact commitments. The report noted the positive steps taken by the Basin governments, including:

- the launch of the national Water Compliance Community of Practice
- the work to improve the metering standard
- the review of the joint governance arrangements for water in the Basin and the review of the appointments process for Authority members
- work to amend water compliance legislation and frameworks
- additional resources focused on compliance across the Basin.

It also noted that some actions were not on track, such as accreditation of WRPs, and some commitments around improving water metering and measurement.

The MDBA’s progress in implementing its Compact commitments was assessed by the Independent Assurance Committee, who concluded that, of 31 actions required, the MDBA had:

- completed 20

- substantially completed five
- progressed two and was likely to complete them by the due date
- made inadequate progress on four.

Since December 2018, the MDBA has made progress in the four areas where progress was identified as inadequate:

1. scoping work for a Basin-wide system for real-time advice on environmental watering
2. developing guidelines for reviewing metering thresholds
3. a timetable for delivering a range of pattern approved meters
4. a practice note on floodplain harvesting.

The first full Annual Assurance Report will be published in late 2019.

Jurisdictional and other initiatives

Appointed as Northern Basin Commissioner for three years from August 2018, Mick Keelty was engaged by the Australian Government to oversee implementation of the northern Basin ‘toolkit’ and to improve compliance in the northern Basin and work with governments on ways to help achieve this. In August 2019, Mick Keelty was appointed as the interim Inspector-General of Murray–Darling Basin Water Resources, a new position that builds on the Northern Basin Commissioner’s role to improve transparency, accountability and community confidence across the whole of the Basin.

New South Wales’s Natural Resources Access Regulator (NRAR) has had an effective on-ground compliance and investigation presence in its first 12 months of operation. In June 2018, the MDBA conducted a joint review with the NSW NRAR of compliance arrangements for the Northern Connectivity Environmental Watering Event. The review assessed the arrangements NRAR had in place to ensure compliance with the temporary water restriction rules put in place to protect environmental water flows during the event. Overall, the review found that the NRAR had appropriate processes in place to ensure Water Access Licence holders complied with the embargo. The report was published in October 2018.

To deliver the Queensland government’s response to the various compliance reviews, and build on actions already occurring, the state’s Department of Natural Resources, Mines and Energy is developing the Rural Water Management Program. The program is designed to strengthen water measurement, provide transparent water information, enhance regulatory approaches, and enable robust compliance. South Australia and Victoria, which have relatively mature compliance arrangements in place, also progressed arrangements for aligning their metering policies with the Compliance Compact requirements.

The Water Compliance Community of Practice (CoP) was launched and held its first meeting in Adelaide in November 2018. The establishment of a national network of water compliance regulators was agreed as an action under the Compliance Compact. The MDBA coordinates the CoP, which has members from all Australian states and territories, membership having been broadened beyond the Basin.

The CoP provides the mechanism for peer-to-peer learning across the regulatory differences in jurisdictions, keeping up to date with technological developments, applying consistent methods in

measuring and monitoring water take, and considering strategies and campaigns to engage communities and improve their confidence and trust in water management approaches.

Engagement

A key enabler of the implementation of the Basin Plan is engagement with a variety of stakeholders on a wide variety of topics. One example is described below: engaging with regional communities through Regional Engagement Officers. Other examples of engagement on the Basin Plan include ongoing engagement with the Basin Consultative Committee, attending MLDRIN and NBAN board meetings and ‘full gatherings’ of member Nation delegates, working with numerous state working groups and multi-jurisdictional committees, regular engagement with peak bodies representing a variety of stakeholders across the Basin, and engagement with schools through the MDBA’s education program.

During 2018–19 the MDBA:

- attended more than 671 meetings or engagement activities (631 face-to-face and 40 by teleconference), nearly two-thirds of which were held outside Canberra
- held five webinars
- received more than 650 public requests for information via email or phone.

Regional engagement

The MDBA embarked on a program of increased regionalisation in 2017 with the establishment of eight Regional Engagement Officers (REOs) and the regionalisation of some staff of the organisation. Offices were opened in Albury–Wodonga, Toowoomba, Adelaide and Goondiwindi. By early 2019, approximately 10% of MDBA staff were located outside Canberra, achieving the MDBA target. The decentralisation plan aims to have one-third of MDBA staff located in regions across the Basin by mid-2021. This includes an expansion of the MDBA’s Goondiwindi and northern presence to about 20 staff, along with new offices in Mildura (20–25 staff), Griffith (25–30 staff) and Murray Bridge (10–12 staff).

The MDBA has also appointed Regional Executive Champions to specific areas of the Basin. Their role focuses on increasing their regional networks and their understanding of the region’s challenges and opportunities in the context of Basin water management.

This expanded regional presence (regional staff, REOs and Regional Executive Champions) allows the MDBA to develop a greater understanding of stakeholder concerns, improve stakeholder relationships and enhance its regional water management connections. The regionalisation program is considered in the context of, and complements, many other engagement strategies such as the Basin Community Committee, work with MLDRIN and NBAN and many other Indigenous engagement projects.

3. River management

The Basin Plan seeks to optimise social, economic, environmental and cultural outcomes from water management. The role of the MDBA is to ensure water management is fair, effective and efficient across the entire Basin through a suite of roles, including establishing water sharing rules, ensuring compliance with the Basin Plan and, in the southern Basin, leading the collaborative management of the River Murray to the benefit of Victoria, South Australia and New South Wales.

The shared nature of the River Murray, which constitutes the border between New South Wales and Victoria and flows into South Australia, has necessitated a joint approach to its management. The rules and river operating arrangements are set out in the Murray–Darling Basin Agreement (the Agreement). The MDBA operates and shares the waters of the River Murray system in accordance with the Agreement on behalf of the NSW, Victorian and South Australian governments.

River management is heavily influenced by seasonal conditions and water availability. The 2018–19 water year was hot and dry. Mean temperatures across the Basin were very much above average during the water year, with a significant portion of New South Wales and the southern border region of Queensland experiencing the highest recorded mean daily temperatures.

Rainfall for 2018–19 was below average to very much below average across the Basin, with significant patches of lowest on record rainfall in the northern Basin. Rainfall for winter and spring was below average for much of the southern and western Basin. In summer and autumn, below average to very much below average rainfall dominated in the northern Basin and South Australia.

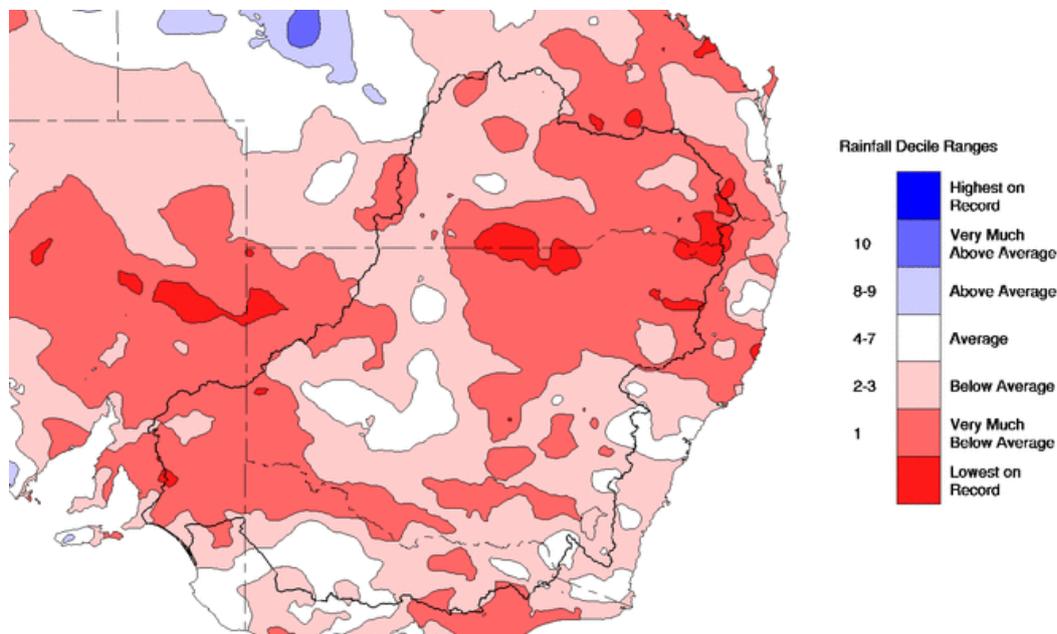


Figure 1: Rainfall deciles in the Murray–Darling Basin, 1 July 2018 – 30 June 2019. Source: Bureau of Meteorology.

At the start of 2018–19 the total storage capacity of all water holdings averaged 48% capacity. By the end of 2018–19 the total storage was as low as 30%, with some locations in the northern Basin as low as 1% to 3%. In the northern Basin the drought is having a devastating effect on water quality.

The southern Basin, while somewhat buffered by large public dam storages, also experienced restrictions in water allocations.

Low water availability, as a result of dry conditions, is undoubtedly impacting Basin communities. The MDBA is supporting the work of the Independent Assessment of Social and Economic Conditions in the Murray–Darling Basin, which will develop a better understanding of the social and economic conditions in rural and regional communities across the Basin. This assessment is discussed further in section 4.

River operations

The challenges of operating the River Murray system are varied and are strongly influenced by the significant shifts in flow and water resource conditions inherent in the Basin environment. The growth in the delivery of water for the environment under the Basin Plan has added a new set of challenges. These challenges continue to be managed adaptively and cooperatively with river operators, environmental water holders, state water management agencies and environmental managers including catchment management authorities.

During 2018–19, water resource and inflow conditions placed additional pressure on system capacity and flow requirements through the system. As was the case briefly in 2017–18 and for a significant part of the 2002–03 water year, river operators had to respond to high demands and dwindling tributary inflows during winter–spring by increasing River Murray flow rates above the normal regulated channel capacity through the Barmah Choke. This approach was essential to ensure all system demands could be met across the year.

Although these flows did not exceed the maximum regulated rates permissible, the relatively high flow rates did result in a temporary increase in the use of water by system flow processes known as conveyance, or transmission loss. Despite this impact on system losses, the higher flows were managed in a way that provided benefit to the River Murray environment. It is also important to note that the need for these flows is not related to the Basin Plan implementation. Rather, it is an inherent operating requirement driven by the occurrence of drought and flow variability, and the challenge of operating the system to balance competing objectives including efficient operations and the security of water delivery to all entitlement holders.

Risk management

Chapter 4 of the Basin Plan requires that the MDBA coordinate the identification and subsequent development of management strategies to mitigate risks to the Basin’s water resources. The severe drought enveloping the Basin has exacerbated some risks and revealed others. The MDBA has been working with the jurisdictions to identify and manage these risks, which include the following.

Drought

The Basin Plan aims to find a balance between the water needs of all Basin users, to ensure communities, industries, and the environment share a sustainable future. A central feature of the Basin Plan is the re-balancing of how water is shared between consumptive uses and the environment. While this re-balancing was always expected to protect and restore the environmental

health of the Basin, it was anticipated that Basin Plan reforms to water trade and investments in irrigation infrastructure would buffer social and economic conditions from the transition to the new water sharing arrangements. Within this context, the very dry conditions over large parts of the Basin in 2018–19 represent a major stress on the environment and on Basin communities adapting to the new water sharing arrangements.

Water quality

Basin governments and the MDBA have a long history of working together to manage water quality and salinity issues. This includes managing flows to reduce salinity levels and operating salt interception schemes that divert saline groundwater away from the river. The Basin Plan sets water quality targets and objectives to protect water quality in the Basin’s rivers for people and livestock as well as for wetlands and floodplains. The Basin Plan requires water managers to consider water quality targets when making decisions about environmental watering and running the river.

Across the Basin, water quality through the summer of 2018–19 was affected by high temperatures. The northern Basin was also affected by very low flows. Extensive blue-green algae outbreaks occurred. The outbreaks were monitored and managed where possible by the responsible Basin government authorities.

Along stretches of the lower Darling River, low or no flows combined with extended hot and dry weather conditions resulted in poor water quality, including high levels of blue-green algae. In the weir pools near Menindee, sudden changes in weather caused mixing of the stratified water column, resulting in low oxygen levels in the water, which led to the lower Darling River fish mortality events (see Case study: Coordinated action on fish deaths, in section 4). A thorough review of the events is available in the Vertessy report, available on the [MDBA website](#). Fish deaths also occurred in the Murrumbidgee River (see Case study: Response to fish deaths in the Murrumbidgee).

Case study: Response to fish deaths in the Murrumbidgee

In 2018–19 the Murrumbidgee catchment experienced average to very much below average rainfall, resulting in limited natural inundation along the river system and low water allocations. Atmospheric temperatures ranged across the catchment from very much above average to highest on record. The climate conditions, along with low flows, led to adverse water quality conditions, including low dissolved oxygen below target levels in the lower Murrumbidgee River during summer 2019, and a small number of fish deaths started to occur. In consultation with experts, Commonwealth, NSW and The Living Murray environmental water was delivered to the lower Murrumbidgee River, successfully improving water quality to address dissolved oxygen issues, and no further fish deaths were observed.

One of many learnings from the management of water quality issues in the Murrumbidgee case study is that monitoring of weir pool stratification (the establishment of a thermocline, with warmer, oxygenated water above and cooler, low dissolved oxygen below) and hypoxic water management in the Lower Murrumbidgee River in 2019 reinforced that high temperatures and low flow conditions have the potential to adversely affect water quality. Mixing of the hypoxic bottom water with oxygenated surface water can result in low

dissolved oxygen concentrations throughout the water column, thereby potentially causing fish kills. Water quality can be improved and fish kills mitigated by steadily increasing in-channel flows and gradually releasing hypoxic water from weirs, and exporting hypoxic water from weirs onto the floodplain using existing regulators. This is an example of how the outcomes from monitoring environmental water use are used to inform environmental water use planning and adaptive management decision-making.

Challenges in delivering environmental water

There are many successful examples of delivering environmental water in the southern Basin; however, Basin-wide planning is a relatively recent function, and river systems have historically been operated primarily for consumptive water delivery. The process of environmental water planning and delivery continues to be refined and adaptively managed.

Since 2010, environmental watering trials in the Murray system have gone a long way towards developing the rules for, and approaches to, environmental water delivery that enable this water to deliver environmental objectives while also providing appropriate risk mitigation for overall river system operations. The development of PPMs, which are critical measures, and their ongoing refinement is also improving the efficiency of environmental watering.

CEWO and other environmental water holders were unable to deliver a significant environmental flow along the length of the Murray system in spring 2018, due to potential impacts on operational flows. This had ramifications for the environmental outcomes that could be achieved in 2018–19, particularly for the Coorong. A number of learnings have been taken from this experience. The first relates to the need to define the ‘delivery rights’ associated with environmental water use to ensure water for the environment does not result in unintended consequences for other stakeholders (such as unintended inundation or impacts on the reliability of water entitlements). Delivery rights include the need to establish appropriate lead times for environmental water delivery orders and other conditions that enable the full range of river operations risks and requirements to be managed during large environmental flow events. Others include the need for better integration between operations planning and environmental water planning. Another area for improvement is communication between organisations and between committees.

In the northern Basin, environmental water holders worked together to deliver the Northern Fish Flow. This followed the northern connectivity event between April and June 2018. These are the first such multi-catchment coordinated events in the northern Basin, and required careful planning and collaboration by CEWO and government agencies in New South Wales and Queensland. During 2018–19, Basin governments worked towards a more formal management arrangement to coordinate environmental flows across the northern Basin on an enduring basis.

Climate change

The climate of the Murray–Darling Basin is extremely variable, with prolonged dry periods interspersed with large rainfall and flood events. Managing water in the context of extreme climate variability is an enormous challenge. It means tough decisions have to be made in the face of large uncertainties.

Climate change presents a further, more complex water management challenge, with far-reaching impacts on the viability and sustainability of the Basin’s communities, its industries and its

environment. Temperatures and the length of dry periods are expected to increase, and variation in water availability is anticipated to become even more extreme—although we are unsure exactly how much hotter, drier or more extreme the Basin’s future might be.

The MDBA contemplated the risks and uncertainties associated with climate change and, with all Basin governments, developed and implemented the Basin Plan to sustain the future of this complex river system. The Basin Plan builds on the knowledge of our past, and puts in place arrangements that will prepare us for the future.

There is still more to learn and do. As climate science continues to improve our understanding of the likely future climate of the Basin, and as we better understand how water users and the environment are responding to these changes, we need to make sure the Basin Plan continues to support a sustainable, healthy working Basin. In February 2019, the MDBA released a report that describes:

- the current climate projections for the Murray–Darling Basin
- how the Basin Plan currently manages for climate change
- the arrangements in the Basin Plan that need to be adaptively managed.

The MDBA has committed to a climate change program that aims to manage climate change risks into the future. The program will be implemented in three stages:

1. Scan Phase (2019): initial assessment of Basin climate change vulnerabilities; identifying risk assessment methods to determine where to prioritise further effort; developing likely climate scenarios; and setting out an initial five-year work program to guide the Climate Change Research Program.
2. Strategy Phase (2020): comprehensive assessment of risks, including broader engagement to test risks using climate scenarios; further development of the scientific knowledge base to inform adaptation options; development and testing of Basin-scale policy and management options to enable climate adaptation; and identifying other strategies/partnerships to support climate adaptation.
3. Project Phase (2020–2025): development and delivery of detailed work packages to implement, monitor and review policy, management and influencing strategies for climate adaptation. These work packages will be informed by the outcomes of the Scan and Strategy phases, and will subsequently inform the review of the Basin Plan in 2026. The work packages are likely to involve further research, policy and legislation development, collaboration with Basin states and Basin communities, and integrating climate risk consideration into MDBA operations.

Environmental water management

Environmental water holders across the Basin are responsible for making decisions about when, where and how much water is released for the environment. Each year, the MDBA is required to identify watering priorities to guide planning and prioritisation of water for the environment. These priorities build on local, regional and state priorities and represent annual steps to achieve the Basin Plan’s long-term goals for native vegetation, waterbirds, native fish, and river flows and connectivity. These long-term goals are set out in the Basin-wide environmental watering strategy.

Delivering environmental water to priority sites to achieve environmental outcomes requires a high degree of coordination between all parties involved. This includes environmental water holders in each Basin jurisdiction, water planners and managers, and local landholders.

In the southern Basin, the Commonwealth Environmental Water Holder, the Victorian Environmental Water Holder, the NSW Department of Planning, Industry and Environment, the South Australian Department for Environment and Water and the MDBA work closely together to ensure that all environmental water is coordinated and delivered together to maximise environmental benefits and the effectiveness of environmental watering.

At the site and catchment scale, Operational Advisory Groups bring together site managers, river operators and environmental water holders to coordinate water use. At the larger system scale, the Southern Connected Basin Environmental Water Committee coordinates water use across and between catchments. The Southern Connected Basin Environmental Water Committee (SCBEWC) also meets with the Water Liaison Working Group to share annual plans and information and to discuss opportunities to improve the coordination and delivery of environmental flows with river operations. More information about SCBEWC is available on the [MDBA website](#).

Environmental water managers and river operators have committed to improving coordination during annual planning and real-time delivery. In 2018–19, a key focus was the River Murray Channel watering proposal, which aims to describe the environmental watering requirements right along the river channel. This work is an important development in moving from site-based planning to considering system-scale needs. Additionally, this work supports testing approaches to deliver water following natural cues, including the coordination of tributary and Murray environmental flows.

In the northern Basin, CEWO and the NSW Office of Environment and Heritage each provided water to deliver the Northern Fish Flow. The water was sourced from the Gwydir and Border Rivers catchments. This multi-catchment coordinated event required careful planning and collaboration by the Commonwealth, NSW and Queensland agencies. CEWO also ran 10 drop-in sessions and produced a series of community updates, drawing on information from agencies and consultants. NSW protected the flow using temporary restrictions on pumping, and had compliance officers providing a strong on-ground presence.

Outcomes achieved from environmental flows

With the dry conditions in the Basin, environmental water holders, like all other water entitlement holders, have been allocated less water under state allocation policies. Water holders therefore need to manage a much smaller portfolio by carefully targeting the highest environmental priorities to achieve the best environmental outcomes.

In 2018–19, Basin states, CEWO and the MDBA worked together to deliver about 2,018 GL of water for the environment, including 1,725 GL in the southern Basin and 293 GL in the northern Basin. About 85% of this water was delivered in watering events coordinated across multiple environmental water holders. The total volume of water delivered included water from Commonwealth environmental water holdings, state holdings, and planned environmental water, see Table 2.

Table 2: Volumes of environmental water delivery

| Volumes of environmental water delivery | |
|--|---|
| Water Holders | Volume of environmental water delivered (GL)* |
| Commonwealth Environmental Water Holder | 1,142 GL |
| The Living Murray | 170.5 GL |
| Victorian Environmental Water Holder | 230.5 GL |
| New South Wales | 406 GL |
| Queensland (PEW) | 22 GL |
| South Australia | 46 GL |
| Total | 2,019 GL |

* Volume includes Held Environmental Water Entitlements, Planned Environmental Water, and River Murray Increased Flows Project.

Much of the water delivered to meet Basin environmental watering priorities in 2018–19 was effectively used multiple times by harnessing return flows, providing sequential benefits along the rivers and their floodplains. Environmental return flows are water that drains back into rivers after an environmental watering event. One of the major outcomes was the coordinated delivery of environmental water into the Barwon–Darling river system (see Case study: Northern Fish Flow).

Highlights for the year included:

- The regulators that control water flow into and out of the Barmah–Millewa Forest were opened in July 2018. This was to allow a more gradual and natural inflow of water into the creeks as the River Murray level rose during winter and spring. Large-bodied fish, such as Murray cod and golden perch, were observed moving in and out of the forest creeks to access important breeding and feeding habitat. There are promising signs of successful native fish breeding and survival, with numbers of juvenile fish increasing throughout the mid-Murray.
- Water for the environment was provided in the Macquarie catchment to support the recruitment of semi-permanent wetland vegetation in a core area of the Macquarie Marshes. The flows were released in a pattern to benefit native fish, including Murray cod and catfish. Flows were also transferred to the Bogan River to sustain a waterhole that is home to a population of endangered olive perchlet.
- At Gunbower Forest environmental flows were delivered to around 1,200 hectares of wetlands and 3,230 hectares of river red gums. Given the dry conditions across much of the Basin, these flows provided important top-ups for refuge habitats for fish, frogs, waterbirds, bush birds and other animals.
- Several environmental water holders worked together to deliver a fish refuge event in the Murrumbidgee River for improved water quality conditions for native fish between late January and early April 2019. The action was shown to have assisted in limiting further mass

fish deaths in the lower Murrumbidgee River following an initial death of approximately 2,000 native fish at Redbank weir in January 2019.

- Between April and May 2019, the Commonwealth Environmental Water Holder coordinated with NSW environmental water managers to release a combined total of 36 GL from Glenlyon Dam and Copeton Dam. The flow was protected from take for irrigation purposes by the NSW and Queensland governments and supported by on-the-ground compliance checks.
- Following natural flooding in 2016 and delivery of water for the environment in 2017 and 2018, a drying phase was started for Hattah Lakes. Drying cycles as well as wetting cycles are important for wetland health. Receding lake water levels allow wetland plants to germinate, grow and set seed.
- In the Gwydir catchment, water was provided to support semi-permanent wetland vegetation in both the Gwydir and Mallowa wetlands. Both are important habitat for migratory waterbird species.
- Fringing vegetation on the Chowilla floodplain responded well to an in-channel rise facilitated through operation of the Chowilla regulator and use of water for the environment. Much of the water was then returned to the River Murray to achieve outcomes down through the lower Murray to the Coorong, Lower Lakes and Murray Mouth.
- Water for the environment maintained connectivity between the Lower Lakes and Coorong, providing a range of habitats for migratory wading birds, estuarine fish species and invertebrates. Baby black bream detected in 2017–18 were detected again this year as small juveniles, indicating that favourable conditions were created to support this important species through critical early life stages.
- Spring delivery of water through Barmah–Millewa Forest preferred flows to Barmah as part of the strategy of the river operators to deliver water as efficiently as possible to Lake Victoria. This resulted in excellent growth of threatened Moira grass and river swamp wallaby grass in Barmah Forest wetlands.
- Winter and spring freshes in the Goulburn River were delivered to improve the condition of bank vegetation, water quality and habitats. The flow pulses were protected through to the end of the Basin river system, and helped to cue a range of native fish to migrate upstream from the Coorong (e.g. lamprey).
- The survival prospects of native fish in the lower reaches of the Namoi River between Wee Waa and Walgett were boosted by a flow of water for the environment. The flow refreshed refuge pools and improved connectivity and water quality.

Case study: Northern Fish Flow

Most of the northern Basin experienced below average to well below average rainfall and record high temperatures for much of 2018–19, resulting in very low to no flows in the north. Flows have been small and isolated in the Barwon River, with some waterholes at their lowest level in 50 years, with poor water quality that is putting native fish at risk.

Between April and May 2019, the Commonwealth Environmental Water Holder coordinated with NSW environmental water managers to release a combined total of 36 GL (18 GL of Commonwealth environmental water) from Glenlyon Dam (Border Rivers system) and Copeton Dam (Gwydir River

system). This release improved water quality, replenished waterholes and helped native fish survive along 1,500 km of river. Large sections of river were connected by the flow.

The Northern Fish Flow also provided relief to communities in places such as Walgett who had not seen parts of the rivers flow for nearly a year.

The flow was planned with support from NSW and Queensland government agencies, local councils, irrigators and landholders along the rivers. The flow was protected from take for irrigation purposes by the NSW and Queensland governments and supported by on-the-ground compliance checks. The MDBA monitored the flow using satellites.

The Commonwealth Environmental Water Office worked closely with the NSW Department of Primary Industries—Fisheries to monitor native fish response to the river flows. Water quality monitoring shows the flow increased oxygen content in waterholes.

During the flow event, over 70 community members attended information drop-in sessions held at Texas, Goondiwindi, Toomelah, Boggabilla, Mungindi, Boomi, Moree, Collarenebri, Walgett and Brewarrina.

4. Monitoring, evaluation, reporting and improvement

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 reports, evaluations and reviews, designed to contribute to adaptive water management as well as meeting compliance and public accountability requirements. The Basin Plan program includes principles such as using best available knowledge, and transparency and collaboration.

Monitoring salinity targets

The Basin Plan requires the MDBA to monitor salinity levels at five reporting sites on a daily basis and, at the end of each water accounting period, assess whether the salinity targets at the reporting sites have been met over the last five years.

Results for July 2014 to June 2019 in Table 3 show that the salinity target values were achieved at four of the five sites: Murray Bridge, Morgan, Lock 6 and Milang. Low flows and lack of water availability, which limit the ability of water managers to respond to high salinity levels, have made it difficult to achieve the target at Burtundy. Over the five-year reporting period ending in June 2019, recorded salinity at the Burtundy site was above the target for 46% of the time.

Recorded salinity levels at Burtundy were above the target value from 23 November 2018 to 2 June 2019, with a peak of 1,226 EC on 25 May 2019. Low or no flows from March 2019 to the end of the reporting period stranded the data recorder above the waterline on two occasions (7 April to 29 April and 3 June to 30 June), so salinity levels could not be recorded at these times.

Salinity levels at Milang showed an increasing trend and remained above 1,000 EC from 28 March to 10 June 2019. If this trend continues and current conditions persist, there is a risk that the Milang target may not be achieved in the next reporting period.

Table 3: Five year average salinity results 2014–19—achievement of targets

| 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 Lock 6 | 580 | ✓ |
| Darling River at Burtundy | 830 | ✗ |
| Lower Lakes at Milang | 1,000 | ✓ |

* 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

The MDBA is working to review the Water Quality and Salinity Management Plan targets in the Basin Plan by 2020. Part of the review will be an examination of the appropriateness of how the salinity targets are expressed. This will need to consider the future flow regime in the northern Basin and Lower Darling following the changes made to the Basin Plan arising from the Northern Basin Review. The future effect of enhanced protection of environmental flows, which is one of the northern Basin toolkit measures, and the future management arrangements for Menindee Lakes linked to the implementation of an SDLAM project, will also need to be considered.

Salt export objective

The Basin Plan includes a salt export objective to ensure salt is flushed at a sufficient rate from the River Murray system into the Southern Ocean, indicatively estimated at an average of two million tonnes per year. Due to low inflows into the River Murray system in two of the last three years (2015–16 and 2017–18), it has not been possible to export this amount of salt over the barrages despite the additional environmental water provided under the Basin Plan. Over the three-year period from July 2016 to June 2019, the estimated rate of salt export over the barrages was 0.94 million tonnes per year.

During dry periods, salt interception schemes become increasingly important in managing salinity in the river system, and these schemes have helped achieve the salinity targets discussed in the previous section. Nevertheless, extended periods of below average inflows into the River Murray system make it more difficult to flush an annual average of two million tonnes of salt out of the Basin over the long term.

As recommended in the 2017 Basin Plan Evaluation, the upcoming 2020 review of the Water Quality and Salinity Management Plan will review the salt export objective, and the outcomes will be used to inform the next scheduled review of the Basin Plan in 2026.

Understanding the social and economic impacts of the Basin Plan

The social and economic impacts of Basin Plan implementation are complex and highly variable. The economic value of irrigated production has grown by 12% since 2000–01, despite a 20% reduction in the consumptive pool due to water being recovered for the environment. Some Basin communities have experienced decline, and their social fabric has eroded.

A major focus for the MDBA over recent years has been to develop a better understanding of the extent of the Basin Plan impacts on communities, and the other drivers of change affecting irrigated communities in the Basin. Initially this work was done to inform the Northern Basin Review. Subsequent work has focused on the southern Basin. This work was a major input into the evaluation of the Basin Plan conducted in 2017.

The communities faring the worst are smaller ones where there is lower economic diversity and where annual irrigated cropping (e.g. dairy and rice) dominates. Water recovery (whether through buyback or infrastructure efficiency investments) has had positive benefits for participating irrigators, allowing them to reduce debt, invest on farm, produce more efficiently, or retire from farming.

Although the water market has had overall positive social and economic effects, irrigators producing lower value crops are not able to compete on the market when prices are high (e.g. above \$300/ML), causing severe financial and emotional stress.

In 2018–19, the MDBA continued to build its understanding of social and economic conditions in Basin communities, with work focused on understanding:

- general socio-economic conditions at Basin and community scales
- the changes occurring in irrigated agriculture at the Basin and community scales
- communities' resilience and their capacity to adapt to change
- the patterns of trade between regions in the Basin and the role of water markets during times of reduced water availability
- the value communities place on a healthy and well-functioning river system.

The information generated by this work will be used to inform the next evaluation of the Basin Plan, due in 2020.

The MDBA also uses information developed by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) to inform its social and economic research and monitoring program. This includes ABARES research and data analysis on water trading; modelling and analysis on issues of water policy, especially in regard to the implementation of the Basin Plan; and analysis of the irrigated agriculture industry and farms in the Basin.

Basin state governments also undertake work to understand the impacts of water recovery on Basin communities.

Independent Social and Economic Assessment Panel

The MDBA is also supporting the work of the Independent Assessment of Social and Economic Conditions in the Murray–Darling Basin, announced by the Commonwealth Minister for Water in April 2019. The assessment will document the social and economic conditions in rural and regional communities across the Basin. It will review impacts (positive and negative) of water reforms including the Basin Plan, and will consider ongoing structural changes influencing different communities in the Basin. It will seek to separate the effects of trends and drivers of change, and of events such as drought, from the effects of water reform. The assessment will support longer-term efforts to monitor and understand social and economic conditions in the Basin and will be overseen by an independent panel.

Responding to the impact of water recovery

As part of the Basin Plan Commitments Package announced on 7 May 2018, the Australian Government implemented a grant program for economic development projects in Indigenous, remote, rural and regional communities most impacted by the Basin Plan.

On 28 March 2019 the Minister for Water Resources approved 42 projects from 29 separate organisations for funding of up to \$24.362 million under Round 1 of the Murray–Darling Basin Economic Development Program.

The objective of the program is to assist eligible communities to undertake economic development projects to respond to the impact of water recovery activities under the Basin Plan. Outcomes for eligible communities will include strengthening and diversification of local economies, enhanced resilience and increased employment opportunities.

Evaluation and reviews

The Basin Plan is adaptive and can be updated and refined with new knowledge gained from reviews and evaluations. An example is using new information to inform the Northern Basin Review and the SDLAM.

Basin Plan Evaluation

The MDBA undertook an interim evaluation in 2017 and its first five-yearly evaluation is due in 2020. After the interim 2017 Basin Plan Evaluation the MDBA, in consultation with Basin states, reviewed and revised the Basin Plan Evaluation Framework to ensure future evaluations better meet the requirements of the Water Act and the Basin Plan. The revised framework addresses lessons and recommendations from:

- the 2017 Basin Plan Evaluation
- an independent review of the 2017 Basin Plan Evaluation
- the Productivity Commission's Murray–Darling Basin Plan five-yearly assessment.

The revised Basin Plan Evaluation Framework was published on 30 May 2019 and is available on the MDBA's website. The framework will inform the early development of, and collaboration on, methods and analysis for the 2020 evaluation.

During 2018–19 the MDBA consulted with the Basin states to develop questions and identify data and information for the 2020 Basin Plan Evaluation. As part of this process, the MDBA is providing advice to assist the Basin states to meet their annual and five-yearly reporting obligations.

Reviews

The MDBA is required to review the Environmental Watering Plan (EWP) and the Water Quality and Salinity Management Plan (WQSMP) targets before the end of 2020 and every five years thereafter. The purpose of the reviews is to assess the effectiveness of the EWP and the appropriateness of the water quality targets in the WQSMP respectively. The MDBA commenced these reviews in 2018–19.

The review of the Basin-wide environmental watering strategy also commenced in 2018–19. The MDBA has chosen to do a thorough review but to stage the updates so that they inform the next two editions. To avoid triggering a review of state long-term environmental watering plans that are still being developed, the 2019 review will not make substantial changes to the overarching goals and objectives.

Updates for the 2019 strategy include:

- reinforcing the importance of constraints relaxation and implementation of prerequisite policy measures

- refining water management strategies to promote greater collaboration between water managers
- a clearer explanation of how monitoring, evaluation, reporting and improvement are undertaken in Basin Plan evaluations
- adaptive management.

In 2018–19 the MDBA, in consultation with Basin states, conducted an assessment of monitoring, evaluation and reporting (MER) capabilities relevant to the Basin Plan. The assessment:

- described the current state (maturity) of the MER capabilities of the MDBA, Basin states, CEWO and the Department of Agriculture
- identified the target state of MER capabilities in 2020 and 2025
- included findings and recommendations to improve MER capabilities.

The findings and recommendations of the assessment are being used to improve the monitoring and evaluation capabilities of the MDBA, Basin states and Commonwealth partners.

Using the best information available

Basin jurisdictions and the MDBA collect and collate the data, knowledge and analysis to inform decision-making. This information is used to guide the implementation, monitoring, evaluation and reporting of the Basin Plan.

Science and knowledge to support decision-making

Basin jurisdictions and the MDBA invest significant amounts of resources into monitoring ecological outcomes. This monitoring information is used to track changes in ecological condition, learn about responses to environmental watering, and inform future watering. The MDBA is also increasing its use of remote monitoring technologies, like satellite imagery, to watch over the Murray–Darling Basin’s one million square kilometre footprint. This technology has been used to track environmental flows and monitor vegetation condition.

Information is also gathered directly with communities. Governments engage frequently with local community members, subject matter experts and Traditional Owners to access best available and local knowledge to inform implementation of Basin Plan activities. Some of the committees the MDBA engages with frequently are the Basin Community Committee and the Advisory Committee on Social, Economic and Environmental Sciences (ACSEES).

Basin jurisdictions and the MDBA strive to adapt implementation based on new knowledge and information. For example, Professor Robert Vertessy, the Chair of ACSEES, led an independent review of the fish deaths near Menindee. The MDBA provided support to this independent review. More information is available on the [MDBA website](#).

Case study: Coordinated action on fish deaths

Fish deaths in the lower Darling in December 2018 and January 2019 made international media headlines and focused community attention on the MDBA and the Basin governments.

The three events took place within a 40 km stretch of the Darling River, downstream of the Menindee Lakes, with fish mortality estimates in the range of hundreds of thousands to more than a million.

All segments of Australian society, in particular distressed communities—in addition to a critical national media—looked to the MDBA and the NSW government for answers to two questions: how and why it happened, and then what can be done to prevent it happening again.

Soon after the events, the MDBA brought together Basin governments to discuss the crisis and determine next steps and actions. This resulted in an action plan that guided short- and medium-term activities by governments, environmental water holders and the MDBA.

The January action plan report outlined catchments at immediate risk of fish deaths across the Murray–Darling Basin, collated information about what was being done on the ground, and recommended actions for the Australian Government to consider.

It noted the stark influence of the drought on the environment, with fish death events common across Australia, particularly during summer and in drought, and it flagged the risk of further fish kill events occurring across the Murray–Darling Basin before the current drought breaks.

The action plan reported on the extensive amount of work already underway to help prevent further fish deaths and stressed the importance of transparency and community involvement in the response.

Actions recommended and implemented by governments and the MDBA include:

- support for critical on-ground incident response across the Basin through identifying priority and at-risk fish populations and refuge habitats, using scientific and community knowledge
- extra monitoring of water quality and fish
- supplementing measures to protect critical refuges, including additional aerators, community-initiated activities and investigating new technologies
- earlier publication of the MDBA Basin Annual Environmental Watering Outlook to provide guidance to environmental water holders and communities on strategies to maintain water quality and critical fish habitats to facilitate recovery in the coming year
- river operators and environmental water holders to have regard to water quality and work closely to identify further opportunities for using available water to protect fish populations in areas at risk
- increased interagency collaboration to improve communication and engagement with communities in relation to river operations and water resource availability and risks to fish, to other fauna or flora and to communities and water users.

In January 2019 the Australian Government’s \$5 million Native Fish Management and Recovery Strategy to protect and restore native fish populations in the Murray–Darling Basin commenced. A business case is being developed in consultation with Basin governments,

scientists and community representatives (including Aboriginal stakeholders) and is expected to be finalised early in 2019–20. The development of the strategy will follow after the business case is approved by the Basin Officials Committee.

Also in January 2019, Minister Littleproud commissioned an independent panel chaired by Professor Rob Vertessy which investigated the fish deaths and provided findings and recommendations to Basin governments.

The panel found that hot conditions and low flows resulted in significant algal blooms. These factors combined caused stratification of the waterholes, followed by a sudden change in temperature and wind resulting in a sudden de-stratification and low oxygen throughout the water column and no space for the fish.

The panel found that the implementation of the Basin Plan should be accelerated in order to reduce the risk of similar events in the future.

The panel made 27 recommendations for Basin policymakers and water managers for implementation within one, two or three years, including the need for greater investment in water research and for action to improve the health of the rivers by safeguarding low flows and environmental flows in the Basin.

In February 2019 the MDBA published a discussion paper, *Climate change and the Murray–Darling Basin Plan*, to explain how the Basin Plan helps manage and adapt to the impact of climate change.

Basin Science Platform

During 2018–19, Basin jurisdictions and the MDBA continued work on the Basin Science Platform project. The project aims to identify the science and knowledge needed to inform decision-making to successfully implement the Basin Plan. In the first half of 2019, workshops and meetings were held with agency and jurisdiction staff across the Basin. There has also been targeted engagement with First Nations representative bodies and with the broader scientific community.

Improving river models

In 2018–19, the MDBA continued to work with Basin state governments to review river system models to be used to develop their water resources plans. The models are to be used for:

- computing the annual permitted water take
- demonstrating compliance with the long-term annual diversion limit for the take from regulated and major unregulated rivers.

The reviews included fit-for-purpose assessment and consistency with the Basin Plan and Water Act provisions for use of the best available information and science.

Conclusion

Throughout out next year, the MDBA will continue to work collaboratively with Basin governments and communities to implement the Basin Plan. Managing the impacts of the drought and the scarcity of water will be a priority of all Basin governments. If wetter conditions return, there will be focus on the lessons learnt and building resilience in communities and the environment. There will be a continued focus on finalising water resource plans, strengthening compliance, progressing sustainable diversion limit projects, and improving the water management across the Basin. Engagement with Aboriginal Nations will remain a priority for all Basin governments. In addition, work aimed at developing a better understanding of the effects of water reform, water markets, and other drivers of change in communities, will continue. All of this work is critical for improving implementation, and in the long-term helping to achieve a healthy and sustainable Basin.

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