NSW Independent assessment of the management of the Northern Basin First Flush event

MDBA Submission — June 2020

Executive Summary

In early 2020 heavy rainfalls were experienced across large parts of the Northern Basin. The resulting flows occurred at the end of an extreme (in some cases, record) dry period across the northern Basin, with the previous large flow occurring in late 2016.

The NSW government has appointed an independent panel to assess the management of this event and the efficacy of communicating this management with the community. The primary purpose of examining this assessment is to inform future management — to ensure that water management arrangements adapt to incorporate emerging knowledge and community perspectives. For this reason, the MDBA has examined this event with any eye towards balancing the needs of an increasing population and the supporting ecosystem with the multiple future challenges of changed rainfall patterns and hotter temperatures.

The MDBA's over-arching observation in relation to the early 2020 first flush is that NSW made substantial efforts to use the best available information to make decisions and to communicate this work transparently with the community, and that these efforts yielded largely positive results. The MDBA's findings are:

1. The MDBA supports and commends NSW for the use of temporary access restrictions (aka embargoes) to protect the first flush from extraction. The scale of these restrictions was unprecedented and included the first restrictions imposed on floodplain harvesting, reflecting the preceding record-breaking hot and dry conditions that had prevailed across the northern Basin since 2017.
2. Temporary access restrictions appear to have been an effective tool to protect first flush flows, we anticipate they contributed to achieving major social, cultural and environmental benefits, and meeting downstream critical town water and stock and domestic needs.
3. External communication regarding the temporary access restrictions was somewhat effective, in general improving as the flow event progressed. Communication associated with the management of Menindee Lakes was much more effective.
4. The basis and veracity of decisions to relax (and then reinstate) floodplain harvesting restrictions at particular locations was unclear during the event, and is still unresolved. The lack of clarity on the basis for some decisions and a lack of publicly available information led to uncertainty amongst water users and misinformation and distrust within the community.
5. Community feedback to the MDBA indicates that water users were uncertain regarding opportunities for take, uncertain as to the aims of the restrictions, and question whether equity of water use (i.e. upstream-to-downstream) was achieved.
6. The management of water in Menindee Lakes and releases downstream to the Lower Darling was highly effective. The release strategy incorporated the learnings from previous events around water quality risks and ecosystem response, and the water was effectively distributed within the lakes to achieve the best outcomes for resource security. Communication of the evidence base for decisions was also much more effective.

Based on this assessment, the MDBA recommends:

1. NSW have in place accredited water resource plans, including embedded rules for managing first flush events in the Barwon–Darling. The MDBA expects these plans will be submitted by NSW in June 2020.

2. NSW should also look to introduce post-dry resumption of flow rules in the northern tributaries, undertaking a work program similar to that for the Barwon–Darling from the last three years. These rules will largely replace the need for temporary restrictions such as have been introduced during the 2020 event and will provide greater certainty for all water users. The rules will have clear hydrological triggers that are science-based and linked to community and environmental objectives.
3. In parallel, it is recommended that NSW work with Queensland and other water agencies (through the Northern Basin Environmental Watering Group) to investigate the efficacy of and potential improvements to existing cross-border flow arrangements in view of a hotter and drier future climate.
4. During future extended dry periods (and in the absence of tributary resumption of flow rules which would provide more certainty) NSW should release pre-emptive public communication products that will outline how upcoming first flush inflows will be managed. This is essential to provide greater transparency and clarity and should include articulating the circumstances under which temporary access restrictions would be applied, triggers for commencing and relaxing temporary access restriction and whether blanket restrictions would be applied or a more targeted approach.
5. Greater investment in real-time flow information and a rapid release of water take information (i.e. within weeks of an event) will help build community confidence in water management. These types of products should initially form part of the active management regime that is proposed for the unregulated parts of the NSW northern Basin commencing later this calendar year.

Overview

In early 2020 heavy rainfalls were experienced across large parts of the Northern Basin. For some parts of the landscape this was the first significant rainfall since mid-to-late 2016. The Northern Basin had been experiencing prolonged hot and dry weather conditions for more than three years and, in some areas, this was the worst drought on record. The on-ground impacts of the drought had been acute, such as large-scale fish deaths, very little irrigation access, communities without access to fresh water, and graziers who have struggled to provide water and pasture for their stock.

The early 2020 rainfall and subsequent streamflow provided welcome relief for all river-associated parties, however it was also the subject of strong community interest. There was significant media attention and a diverse range of viewpoints were expressed representing social, cultural, economic and environmental interests. The MDBA, along with all other government water agencies, received numerous and frequent enquires from the community regarding the management of these 'first flushing' flows.

Overall, the community were seeking confidence of equitable management — that the water would be appropriately shared between upstream and downstream users, and amongst the community, agricultural users and the environment. A consistent element was the need for transparency around both information and decision making. That is, the rapid sharing of detailed information, and how this information was used by water managers when making day-to-day decisions such as temporary water restrictions or allocation announcements.

The three-year period prior to this flow event was extremely dry and hot, however it was also an unusually active period for water reform in the Northern Basin, resulting in some positive steps forward, primarily on two fronts:

1. Event-based water delivery — this three-year period included the first multi-catchment and multi-jurisdiction coordination of northern environmental water releases. The 2018 Northern Connectivity Event and 2019 Northern Fish Flow combined Commonwealth and NSW environmental water holdings and relied on protection mechanisms introduced by the Queensland and NSW governments. These combined flows provided tangible benefits for communities and the environment during an unusually dry period, however the coordination and management arrangements required to achieve these events were ad hoc and resource-intensive.
2. Long-term planning and management — a series of fundamental policy and management changes have been in train over the last three years. This is a wide-ranging work program requiring efforts from all Basin government water-related agencies across the Murray–Darling Basin. Some of these are regular activities, such as the ongoing implementation of the Basin Plan and the Northern Basin toolkit, or standard reviews of State-based water planning instruments. Other parts of the work program were introduced during the last three years in response to specific water management issues highlighted in recent reviews such as the NSW Ken Matthew's review and the Vertessy review of the 2018/19 fish death events downstream of Menindee Lakes.

MDBA acknowledges that a number of programs are still in the process of being rolled out by NSW in response to various reviews including enduring solutions within the Water Reform Action Plan such as the introduction of active management; Compliance Compact actions including metering of floodplain harvesting and major extractions; and additional flow monitoring through improvements to the hydrometric network as recommended in the Vertessy review. Once these programs are

implemented over the coming years this will represent a significant step forward in flow management in the northern Basin.

The early 2020 rainfall and streamflow provided the first wide-ranging test of the effectiveness of this work program. To satisfy community expectations around appropriate management and transparency, water agencies have been asked a series of fundamental questions in relation to this event, such as:

- How much water flowed into and through the rivers? How much water was captured through floodplain harvesting, or extracted through other forms of take? How much can be attributed to environmental take?
- Were compliance arrangements effective?
- How were temporary access restrictions set? Was there a strong underlying evidence-base, and was the decision-making process well-communicated?
- Were the temporary access restrictions an effective measure? Was the information easily accessible and understood by irrigators and other interested parties? Did the restrictions meet the desired outcomes?
- Was the management response well-coordinated across government agencies and across state and catchment borders?

This event provides an opportunity to examine the effectiveness of recent policy and management changes. But it should also be examined with an eye towards future water sharing arrangements. The recent prolonged drought provides a useful insight into some of the extreme events that are anticipated to occur more frequently under a drying climate, and it is vital that the event is used to learn and adapt.

The MDBA appreciates the opportunity to provide a submission for the NSW assessment of the Northern Basin first flush event. The terms of reference require the independent panel to review and consider the following:

- the DPIE Water, NRAR and WaterNSW planning, systems and processes that were used to manage the event, with particular regard to:
    - decision making processes, including the availability of information and evidence to support decision-making pursuant to the public interest test (including, but not limited to, information to assist in forecasting inflows from Queensland tributaries)
    - communication with water users, the general public and between agencies
    - the resourcing and incident management capability of DPIE Water, NRAR and WaterNSW (including risk management and WHS implications)
- the extent to which management of the event satisfied relevant aspects of the NSW Government's response to the Independent investigation into NSW water management and compliance by Ken Matthews (being the NSW Government water reform action plan) and the Vertessy Report and the Natural Resources Commission's Review of the Barwon-Darling Water Sharing Plan
- the effectiveness of the current and proposed regulatory and policy tools for managing a first flush event

The MDBA submission is structured as two sections. The first section details the MDBA's observations and experiences with the management of this event, including feedback received from the community directly to MDBA staff including our Regional Engagement Officers. The second section includes a series of recommendations around future management of first flush events based

on learnings from the recent event as well as drawing upon previous recommendations from various recent reviews. Importantly, some of these recommendations point to the need to re-examine long-term water policy settings and planning instruments over coming years in response to a drying climate. The overall mission of the Basin Plan and the collective Basin Governments is to work towards a healthy working basin, and this must be conducted with the multiple future challenges of changed rainfall patterns and hotter temperatures, while still balancing the needs of an increasing population and the supporting ecosystem.

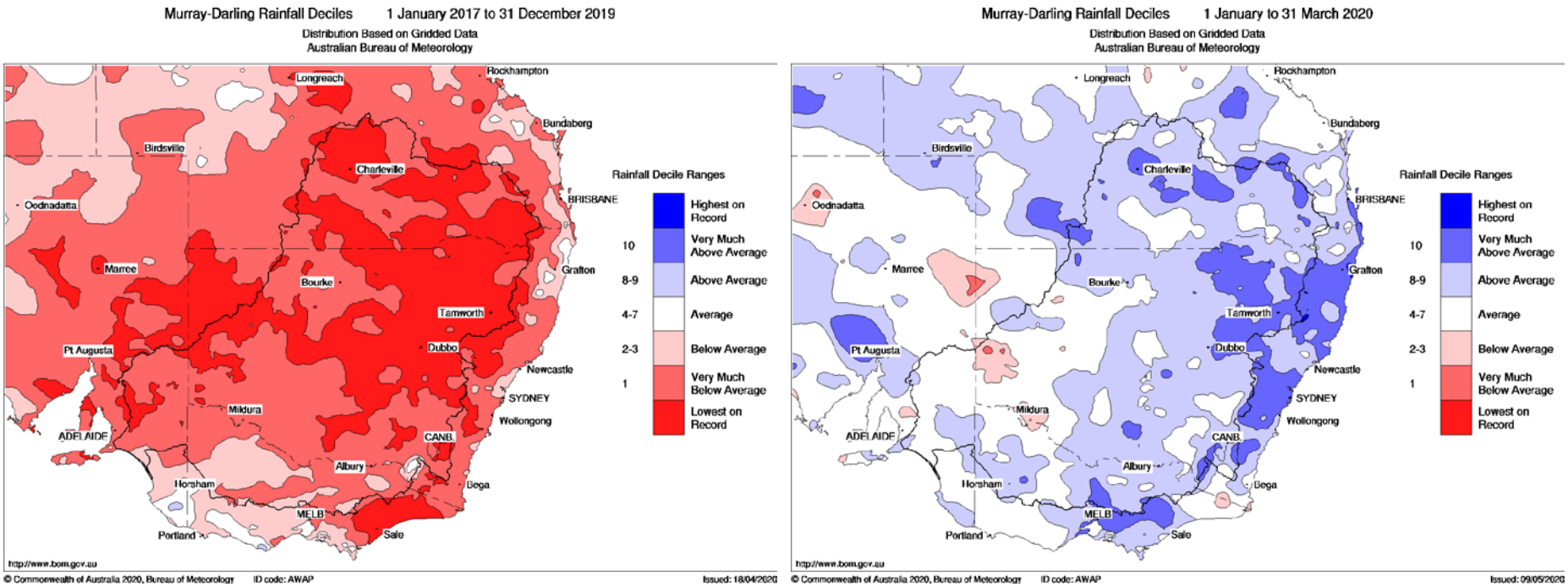

Figure 1: Comparison of rainfall deciles for the 2017–2019 period to the January–March 2020 period

Management of the 2020 first flush

NSW water management arrangements are encoded through a series of catchment- and sub-catchment-scale water sharing plans (WSPs). These plans typically have a lifetime of ten years and have the dual purpose of ensuring a sustainable and environmentally healthy water source and providing clarity for water user access.

Inherent in the plans is the consideration of dry periods — for example, the prioritisation of domestic over commercial water use. However, section 324 of the NSW Water Management Act (2000) allows the relevant Minister to initiate temporary water restrictions, a discretionary act which effectively represents a temporary suspension of WSP access rules in response to unusual conditions such as extreme dry periods. These restrictions prohibit water take from a specified water source for a period of time if the Minister has determined it to be in the public interest.

Prior to 2018, the initiation of s324 orders in NSW was relatively rare. However, over the past three years there has been several instances of the NSW Minister initiating broad water restrictions across multiple water sources in the northern Basin. This has been in response to a series of events:

- unusually hot and dry conditions since late 2016 led to an increasing need for flows to pass downstream to support critical human water needs;
- a series of reviews and community submissions during this period have recognised the importance of appropriately managing the first flows through the river system after an extended dry period and have recommended changes to water sharing arrangements in the unregulated parts of the NSW northern Basin;
- in 2018 Commonwealth, NSW and Queensland water agencies coordinated the first multi-catchment and multi-jurisdictional environmental water releases to deliver flows through the Border Rivers and Gwydir catchments into the Barwon–Darling, and this was supported by temporary restrictions to protect these flows from extraction — this action was repeated in 2019.

Management and policy changes have occurred relatively rapidly over the last three years, especially in the Barwon–Darling catchment. NSW is proposing to introduce a series of fundamental changes for the management of this river system, including a shift to active management (as opposed to the long-term rules-based management system that is currently in place), and the introduction of a rule to better manage the resumption of flow after an extended dry period. There are multiple benefits associated with these changes in relation to both on-ground objectives and clarity for water users.

- Actively managing water access on an event-by-event basis will provide greater clarity and certainty for entitlement holders around when and how much water they can extract; improved transparency around water take information to promote public confidence in river management; and specified environmental flows will be protected from extraction.
- Allowing the first flow to pass downstream without extraction will support critical human water needs alongside other important social and cultural benefits, and will help maintain ecological assets (such as threatened fish species) during critical times.

Since 2018, NSW has delivered these two objectives in the Barwon–Darling using temporary water restrictions as an interim measure. However, by introducing embedded rules and management systems, the need for temporary restrictions in the Barwon–Darling system will be largely replaced (noting that there will always be extreme events which require temporary intervention). These rules have clear flow objectives which are tied to the social and environmental needs of the river. This is a

positive step towards the long-term goal of ensuring a sustainable and environmentally healthy water source and providing clarity water user access. It will also satisfy one of the recommendations of the Vertessy review.

As described in the *Recommendations* section below, the MDBA suggests that the management arrangements for the NSW northern tributaries should follow a similar trajectory — whole-of-north resumption of flow rules should be introduced that consider the flow connectivity needs of the broader northern river system.

In relation to the February/March 2020 rainfall, the MDBA supports and commends the decision by NSW to protect this event from extraction using temporary access restrictions. NSW drew on the science from their Long-Term Watering Plans to set flow targets in the northern tributaries, through the Barwon–Darling, and at Menindee Lakes. The MDBA acknowledges that this was the first such temporary restriction for floodplain harvesting. As NSW brings floodplain harvesting licences into the entitlement framework by mid-2021 it is recommended that the next version of water resource plans consider amendments to incorporate rules which clarify conditions under which floodplain harvesting access would be restricted to allow first flush flows to pass during a resumption of flow period.

NSW are working to introduce an active management framework for large parts of the NSW unregulated northern Basin, requiring a significant investment in improved management and communication tools. The early-2020 flow provided a useful test case for existing management systems. The MDBA notes that these events require intense real-time management with significant challenges.

The MDBA's over-arching observation in relation to the early 2020 first flush is that NSW made substantial efforts to use the best available information to make decisions and to communicate this work transparently with the community, and that these efforts yielded largely positive results. In this context, the subsections below describe areas where improvements could be made for future event management.

Decision-making processes

Management upstream of Menindee Lakes

Efforts were made in relation to transparency around the temporary access restrictions, however there remained a lack of clarity on the basis for some decisions and lack of publicly available information. Specific examples include:

- The basis and veracity of decisions to relax floodplain harvesting restrictions at particular locations was unclear. The MDBA notes that this type of event requires a challenging and intense level of real-time management, however the rationale behind the sudden relaxation (and then reinstatement) of the access restrictions for floodplain harvesting was not transparent or supported by publicly available information. The MDBA notes that this decision still has traction in the media and is an ongoing subject of concern for the community and other Basin governments. This is an unfortunate outcome given the largely positive steps taken by NSW during this event, and the MDBA anticipates that the independent panel will give special attention to the sequence of events, providing clarity for the community and advice for future NSW management.
- As the flow event developed and progressed downstream, the outcomes sought by the embargo changed, causing confusion and at times uncertainty. The flow targets used by NSW to manage the flow event were based upon the Long Term Watering Plan (LTWP) work,

which the MDBA acknowledges to be the best available information for this purpose. However, targets were refined in real time with the science and fisheries teams but not shared with other governments or the community. This was a new evidence base and did not align with historical operating and water management rules, especially in Menindee Lakes as the flow progressed (i.e. Broken Hill water supply lake levels no longer in play due to pipeline).

- In relation to monitoring, flow and water quality data are routinely collected and readily available via WaterNSW website (despite some apparent website capacity issues which caused the site to crash as it seemed to have been overwhelmed with people trying to access the data), but it is not clear whether additional information was collected. For example, on-ground water quality or fish sampling data. Given that the temporary access restrictions were based partly on environmental and water quality outcomes, an intensive and targeted monitoring campaign to track and communicate the outcomes of this event would have assisted in building community confidence in NSW management.
- Improved data is required on volumes of water extracted/intercepted as a result of embargoes being relaxed.

Management at and downstream of Menindee Lakes

NSW's management of the flow once it had entered Menindee Lakes appeared to be very well executed. Water quality risks in the Lower Darling associated with this first flush flow, particularly salinity and dissolved oxygen, were monitored and well managed. The flow release strategy considered previous experience where water quality issues arose, most notably during 2016 releases when elevated salinity levels associated with the first flush were generally higher and more persistent in the lower Darling River channel. Salinity outcomes in the Darling River both upstream and downstream of the Menindee Lakes were better during 2020 compared to previous events (noting that this may have been partly because of the unique antecedent conditions and hydrology of this event).

The management of 2020 inflows to the Menindee Lakes were adaptive and responded to follow up rain that increased the expected inflow volume. Lake operations were managed by NSW to adjust the distribution of water within the lake system to achieve the best outcome from the event for resource security and the environment including water quality. NSW water agencies consulted closely with the Lower Darling community and other stakeholders, taking into consideration the heightened sensitivities of the lakes re-start following extended drought. This helped ensure the community was informed and supported through the process. Close consultation with MDBA river operators also assisted in operations at Wentworth Weir pool. This included planning the timing of a partial drawdown of the pool to help expedite the passage of the flow front and any potential salinity slug through the weir pool for dilution in the Murray as the two rivers re-connected. Menindee releases and operations at Wentworth were also supported by water quality monitoring and regular sharing of information from NSW agencies with the MDBA and the community.

Based on the MDBA's assessment, the flow management process at Menindee Lakes minimised the scale of fish deaths that could have occurred during the first post-dry flow through the lower Darling. NSW identified high risk areas and, where possible, flows were manipulated to minimise the impacts on water quality and native fish. Furthermore, communication of accurate and timely updates of fish deaths to the MDBA and on the NSW Government website allowed agencies to be prepared to respond.

External communication

Extended unprecedented drought conditions in northern Basin meant there was heightened levels of community engagement in the first flush event and how it was being managed. There was a diverse range of viewpoints representing social, cultural, economic and environmental interests on how the event was being managed and should be managed. Similarly, there was considerable media attention, particularly concerns and scrutiny from downstream communities.

Reflecting this increased interest, the MDBA received a large volume of correspondence from the community requesting information regarding the management of this event. The newly established Northern Basin Environmental Watering Group (NBEWG) provided an effective forum through which to share information and support cross-government management of the flow event between northern Basin governments. The group met on multiple occasions with representatives from NSW, Queensland, CEWO, the MDBA and the Commonwealth Department of Agriculture, Water and the Environment. Partly because of this forum, the MDBA had a large volume of material to access when responding to community requests for information. This flow event highlighted that there are opportunities for co-ordinated and more proactive communication of information, including shared Basin government key messages.

However, the decision to allow mid-event floodplain harvesting access (i.e. the three-day suspension of the temporary access restriction) generated numerous requests for information and considerable angst within different sectors of the community from many different parts of the Basin (including beyond NSW). The lack of publicly available information, particularly regarding the basis of some of the earlier NSW decisions to relax embargoes, made it difficult for the MDBA to be well informed and respond adequately.

The MDBA's view is that NSW communication with the public (and water users specifically) improved over time but was variable in terms of systems and processes in place, timeliness, and availability of information. Whilst regulated users are much better linked into receiving water availability update alerts, other users such floodplain harvesters and unregulated users reportedly have relatively poor communication systems. The MDBA acknowledges that substantial progress has been made by NSW, and was demonstrated throughout this event, but more progress is anticipated over coming years as metering and measurement of floodplain harvesting extraction improves.

Compliance

Enforcing the embargoes is a responsibility for NSW. Once accredited WRPs are in place, the MDBA will have a formal regulatory interest in ensuring that the WRP is being properly implemented. In the interim, the MDBA has an ongoing interest in building our understanding of and confidence in the monitoring and compliance arrangements NSW has in place to ensure water is taken in accordance with the rules.

The MDBA has worked with Basin governments to produce the Murray–Darling Basin Compliance Compact (the Compact). It aims to restore public confidence in water resource management in the Basin by providing transparency and accountability of surface and groundwater management and regulation, and a consistent approach to compliance and enforcement practices by governments across the Basin.

Strong compliance arrangements are critical for ensuring the rules are followed by all water users and, in this case, embargoes are enforced. From a compliance perspective, the uncertainty created by the imposition, lifting and then reimposition of the embargoes is not ideal. Achieving full

compliance is always more difficult in circumstances where rules are not clear, well understood and known in advance. For the MDBA, this emphasises the importance of having WRPs in place.

There is currently limited metering or measurement of floodplain harvesting, but NSW have committed to bringing this form of take into the entitlement framework with all associated monitoring and compliance requirements. In this regard, storage level recorders calibrated by volumetric survey data of individual storages are an important source of data. This is important for updating policy and planning tools (such as the hydrologic model). NSW have released a first estimate of floodplain harvesting take during this event, but this estimate (based on satellite imagery combined with LiDAR) contains significant uncertainty, emphasising the need for more robust measurement.

The MDBA has collaborative arrangements in place for working with NRAR, including through an MOU and information sharing protocols. In relation to this event, the MDBA received an official request from NRAR to assist in using satellite imagery to monitor over 3500 priority storages over the duration of the event. Using sentinel imagery, the MDBA was able to identify storages that experienced significant increases in the presence of water during the embargo period and provided this information to NRAR. While this information alone does not indicate any wrongdoing, it does provide useful intelligence to inform NRARs on-ground compliance activities.

Recommendations

Whole-of-north resumption of flow management

The 2017–20 drought was amplified by climate change. Analysis provided by the Bureau of Meteorology shows that this period was the driest on record (Figure 2), however of note are the temperature readings— this three-year period was also the hottest on record (Figure 3), and this trend was strongest in the northern Basin. Hot temperatures exacerbated the effects of low rainfall, further reduced soil moisture and increasing evaporative losses.

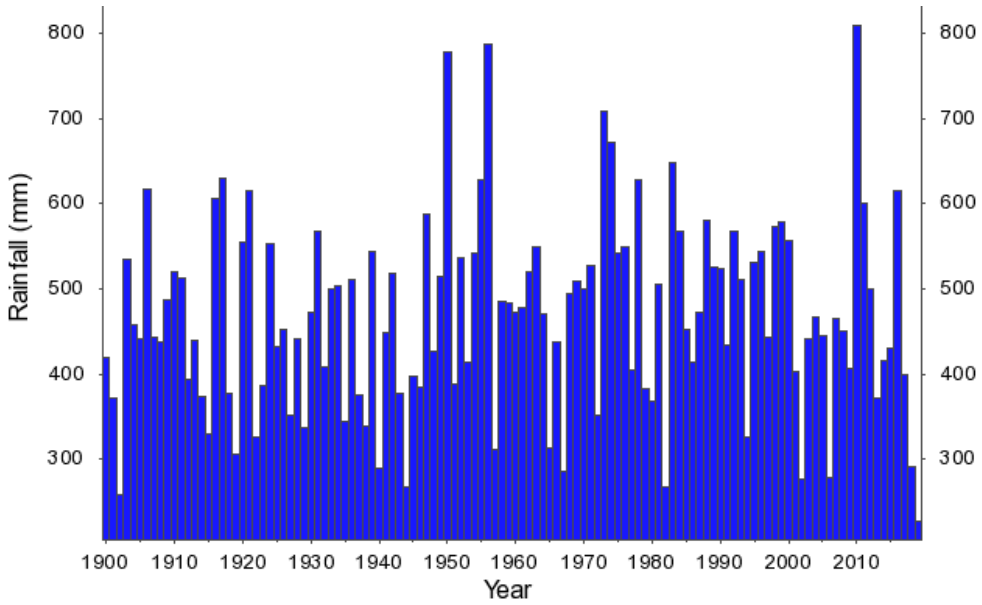

Figure 2: Murray-Darling Basin annual rainfall, 1900 to 2019 (BOM)

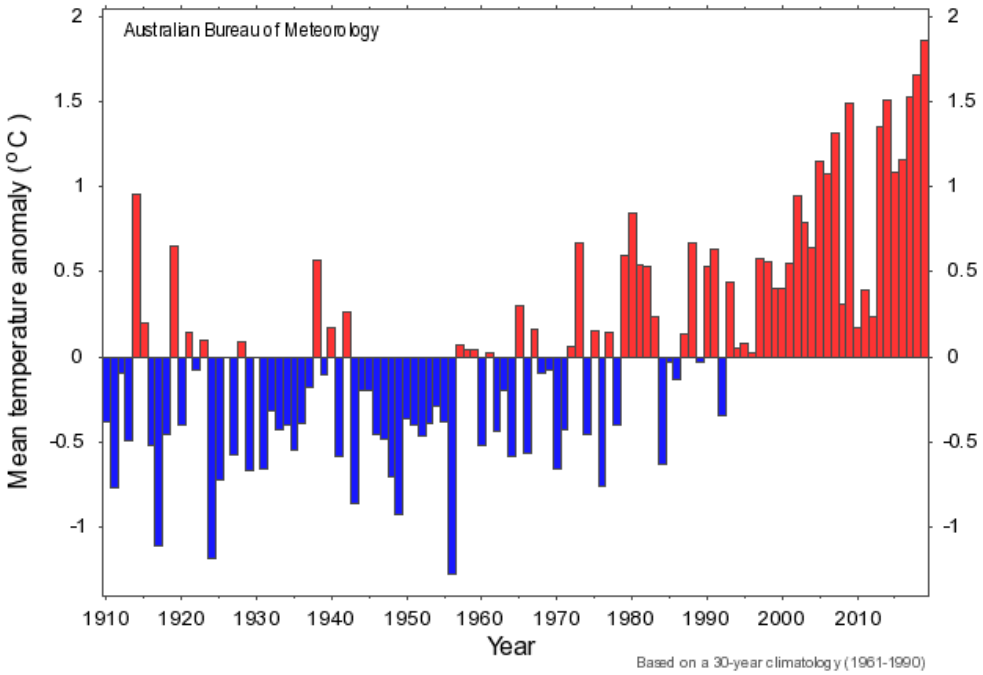

Figure 3: Annual mean temperature anomaly for the Murray-Darling Basin, 1910 to 2019 (BOM)

A study by the MDBA (2018a) indicates that cease-to-flow periods in the Barwon–Darling system have been increasing in length and frequency since around the year 2000 (Figure 4). Some of this can be attributed to climate, and some to water sharing arrangements in upstream catchments (MDBA 2018b). Similar changes in cease-to-flow patterns are appearing for other northern Basin catchments through the MDBA's work for the 2020 Basin Plan Evaluation.

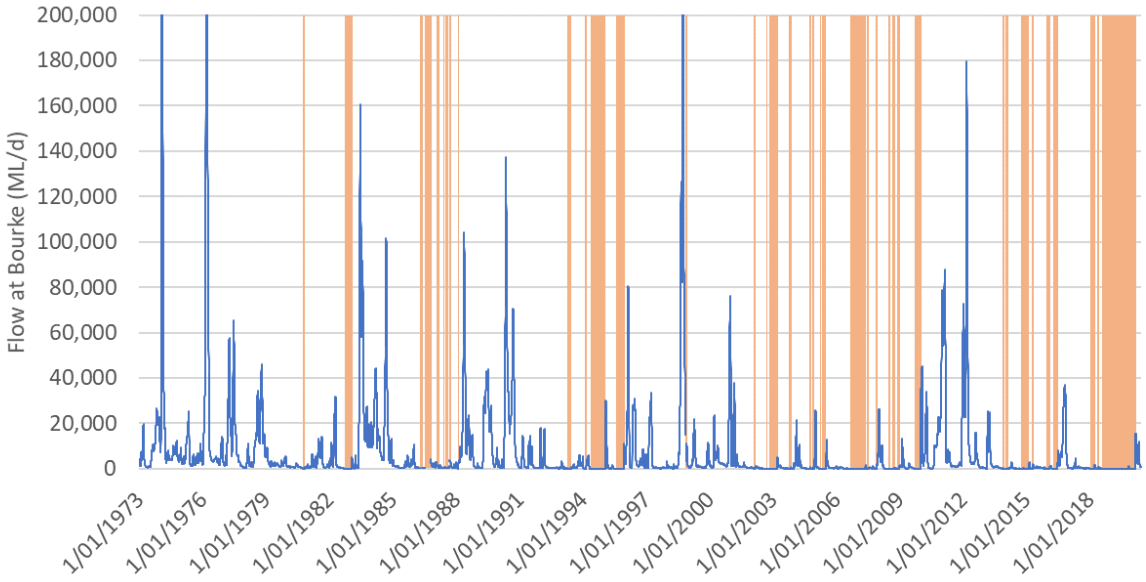

Figure 4: Observed flow at Bourke since 1973 (sourced from WaterNSW); the orange bars trace the periods without flow.

The MDBA will further investigate changed inflows in the northern Basin in response to the Interim Inspector General of Murray-Darling Basin Water Resource's review of the Impact of lower inflows on state shares under the Murray–Darling Basin Agreement. Specifically, this recommended that the MDBA should undertake further analysis of the causes of reduced inflows from the northern Basin and the extent to which this is affecting State water shares.

The observed trends are consistent with the predicted effects of climate change. Extrapolating these predictions into the future indicates that dry periods in the northern Basin will become more frequent, more intense, and will last longer than the historical record. In effect, the 2017–20 dry period is an indication of future dry periods. The Vertessy review highlighted that future changes in the global climate system are likely to have an even more profound impact on the hydrology and ecology of the Murray–Darling Basin, including increasing the risk of fish deaths in the future. Appropriate and consistent management of resumption of flow conditions will therefore become increasingly important. Hence, the Vertessy review recommended as a matter of urgency that Basin governments and stakeholders confer on how to adjust water access rules in the Water Resource Plans under development to enhance hydrologic connectivity in the Darling River during drought sequences.

Both NSW and Queensland regularly review their water sharing arrangements as standard practice, and the MDBA recommends that the reviews over coming years give special consideration to the most recent drought and examine the need for additional or modified resumption of flow rules.

As noted above, NSW have reviewed the water sharing arrangements in the Barwon–Darling system and are proposing to introduce a series of management changes, including a shift to active management (as opposed to the to the long-term rules-based management system that is currently in place) and the introduction of a rule to better manage the resumption of flow after an extended dry period. The MDBA recommends that the NSW northern tributary management arrangements should be on a similar trajectory. That is, post-dry resumptions of flow have thus far been managed using temporary arrangements, but there is a strong need (for the purposes of both on-ground objectives and clarity for water users) to replace these arrangements with embedded and enduring rules. The over-arching purpose of these rules would be to restrict commercial extraction upstream with the purpose of supporting downstream critical human and ecosystem water needs.

From an environmental perspective there is increasing evidence of the importance of connectivity and management of first flush flows. For example, with regards to maintaining native fish populations, first flush flows are critical to replenish refuge waterholes across much of the northern Basin and along the Darling River. Over the past summer over 60 fish deaths were reported to MDBA by Basin states, many were in the northern Basin as a result of drying of refuges.

First flushes are critical to provide longitudinal connectivity along rivers and between tributaries and the Barwon-Darling which supports recruitment and distribution of native fish. These connections provide opportunities for fish to move between valleys, allow fish to undertake breeding migrations, support food webs and aid distribution. This is particularly important for Golden perch populations which operate over very large spatial scales (hundreds to thousands of kilometres) with recruitment being highest in the northern most parts of the Basin and juvenile Golden perch moving downstream to contribute to Basin populations. There are opportunities to make Golden perch populations more resilient by improving connectivity between systems.

Regular ‘Basin-scale recruitment’ is important as many regulated systems show little or no golden perch recruitment, resulting in an ageing population that is less resilient over the long-term. By protecting unregulated freshes, end-of-system flows and inter-system connectivity, these Basin scale recruitment events can occur more often, reinstating some of the natural recruitment patterns and processes that resulted in Golden perch being able to colonise large areas of the Basin. By providing regular connectivity between valleys, and enhancing system scale productivity and recruitment, we can help to achieve population level outcomes across valleys and the northern Basin for Golden

perch. There are also benefits for other key fish species such as Murray Cod, Silver Perch, Spangled perch and Hyrtl's tandan, and the ecology of these systems more broadly.

The MDBA received feedback from local water users that the use of blanket restrictions could have been replaced by a more targeted approach, such as restricted to certain types of water take or specific waterways. There was also concern that the restrictions were in place too long in some areas and hence the outcomes achieved were not balanced. Essentially, some water users believe that too much water was allowed to pass downstream or was lost to the floodplain and did not make a contribution to downstream flows or key environmental assets. Counterbalancing this view however, some floodplain graziers have expressed that that there is a lack of understanding and recognition of the economic value of water inundating the floodplain that needs further investigation.

The current independent assessment should explicitly examine whether the community considered the final outcomes to have been 'balanced' — for example, in terms of upstream-to-downstream equity of water access.

Over the longer-term, it is the MDBA's view that equity of future first flush management can be best achieved through resumption of flow rules that are linked to clear outcomes based on science, modelling, and community perspectives. That is, the MDBA believes that the water user feedback provides further incentive to replace temporary access restrictions with embedded rules.

From a whole-of-north perspective, the MDBA regards the most recent event to be an opportunity to re-examine the efficacy of current arrangements in relation to connectivity of the northern basin rivers and support for critical human and ecosystem water needs. The 2020 first flush flow was subject to extended rainfall that lengthened the flow duration and increased the volume that passed through the Barwon–Darling system and into Menindee Lakes, thereby supporting critical human water needs. NSW management prioritised these critical downstream needs and introduced temporary access restrictions for upstream users, however the MDBA notes that these arrangements do not cross state borders.

If the early 2020 rainfall had not extended beyond the initial February burst, existing water sharing arrangements would have resulted in irrigation extraction in parts of the Queensland catchments while NSW towns along the Barwon–Darling and Lower Darling systems would have continued to experience severe water shortages. It is likely that robust cross-border discussions would have ensued around equity of water access. Commonwealth and state governments are currently working together on management changes that will assist with such discrepancies (for example, cross-border accounting of environmental water). However, the MDBA believes that more investigation is required and will continue to work with state partners on water sharing arrangements that consider the needs of the broader system across state and catchment borders.

In this context, the MDBA, working through NBEWG, are intending to conduct a review of the 2020 first flush event. This review will draw on the work that is already underway in Queensland and NSW, with the aims of providing a whole-of-north perspective. The review will aim to progress one of the Vertessy recommendations (i.e. NSW and Queensland should establish an agreed protocol to protect first flushes).

External communication

NSW conducted a range of external communication activities in relation to the 2020 first flush event. The MDBA's assessment is that these activities were mostly effective, with a trend of improving over time as the event progressed.

The MDBA advises that during future extended dry periods, NSW should assist the community by providing pre-emptive information regarding the steps that will be taken when the first significant post-dry inflows appear. This type of early communication can commence once a dry period reaches a certain length (e.g. six months), and will clarify for the community:

- over-arching management principles — for example, temporary access restrictions will be in place to achieve critical human water needs and to meet critical ecosystem needs;
- the metrics that will be used to initiate and then progressively relax restrictions — for example, *x* GL of water will be required at Menindee Lakes, or certain flow threshold or water quality target must be forecast to be achieved — the LTWPs developed by NSW provide an excellent foundation for these metrics.

The MDBA notes that resumption of flow rule that NSW are proposing for the Barwon–Darling is an excellent example of clear, science-based targets that provide clarity for the community around future post-dry access conditions. Similar embedded resumption of flow rules in upstream WSPs (such as those listed in the North-West unregulated flow management plan) would satisfy these needs in the tributaries. Until these embedded rules are developed and activated, the MDBA advises that NSW release a guidance document to the community describing the circumstances and conditions for future temporary access restrictions.

Improved transparency and real-time information

Certainty for water users and public confidence in water management would be improved by allowing for more accessible water take data supported by implementation of enhanced metering/monitoring, including of floodplain harvesting. This is consistent with the Vertessy report recommendation — NSW and QLD should introduce more accurate continuous and real-time monitoring of diversions in the Barwon–Darling, to ensure protection of managed connectivity events. Compliance around all metering requirements and overland flow extractions should be strengthened expeditiously.

Real-time information will also support real-time management of the event. The MDBA notes that these tools are required to support the active management processes that are proposed for the unregulated parts of the NSW northern Basin. Specific recommendations can be found in the Vertessy report:

- NSW and Queensland should improve the reliability and transparency of the assessment of the hydrologic impacts of floodplain harvesting;
- NSW and Queensland should improve monitoring of end-of-system tributary flows that contribute to hydrologic connectivity in the Darling system, and make that data readily available;
- Basin States should upgrade their Strategic Water Information Monitoring Plans to reflect the enhanced hydrologic monitoring requirements associated with the Basin Plan and the recently agreed Murray–Darling Basin Compliance Compact, and agree to commit the necessary resources to enable these plans to be fully implemented;
- Basin governments should initiate a joint program to significantly accelerate river model development to evaluate different Basin policy options.

Thus far, the MDBA has seen estimates only of the over-arching water balance for this event. How much water flowed into the NSW catchments? How much was taken, both through floodplain harvesting and other forms of extraction? How much was required to ‘restart’ the hot and dry river beds, and how does this compare to other historical dry periods? The MDBA notes that this is a

complex river system and information is often uncertain, but this type of volumetric data will be required to support active management and ongoing adaptive management through a changing climate. A rapid release of this material and associated water take information (at the water source scale) will improve community confidence in water management. NSW provided regular updates on the volume expected to flow into Menindee Lakes — this level and pace of information sharing should be aspired towards across the northern Basin.

The MDBA recommends that all governments continue to build on increasing capability to use remote sensing capability to assist with compliance and monitoring of flow events. Interactions between the MDBA and NRAR have been positive throughout this event. Continued co-development of the analytical tools and monitoring processes should be maintained.