Submission to the Independent assessment of the management of the Northern Basin First Flush event

June 2020

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2. Introduction

In accordance with the Terms of Reference for the Independent Assessment of the Management of the Northern Basin First Flush Event, the Independent Panel has sought input from WaterNSW to assist its understanding of the Northern Basin First Flush event (**the Event**).

As operator of the State's surface and ground water system and customer service provider for most of the State's water users, WaterNSW played a significant role in the management of the event.

This submission also sets out our key observations on what worked well during the Event and opportunities to improve the management of future events.

We have also prepared an evidence-based chronological overview of how the Event unfolded to assist stakeholders to understand the scope and magnitude of the Event and put into context the challenge it presented from a resource management perspective. This is included at **Appendix A**.

3. About WaterNSW

Our purpose is to improve the availability of water resources that are essential for the people of NSW.

WaterNSW is responsible for supplying the State's bulk water needs, operating the State's river systems and the bulk water supply system for Greater Sydney and providing services to its customers with respect to licensing and approvals, water allocation trades, water licence trades and water resource information.

With more than 40 dams across the State, we supply two-thirds of water used in NSW to regional towns, irrigators, Sydney Water Corporation and Local Water Utilities. Through our hundreds of employees located across the sSate, we provide services daily to over 40,000 customers across NSW and manage our extensive operational assets, water monitoring and metering networks.

We are a State-Owned Corporation established under the *WaterNSW Act 2014* and operate under an Operating Licence monitored by the Independent Pricing and Regulatory Tribunal (IPART).

Our core functions are further described below.

Source water protection: protection of the Greater Sydney drinking water catchment to ensure safe water is supplied to Sydney Water, local councils and other distributors for treatment and distribution to their customers.

Bulk water supply: supply water from our storages to customers in the Greater Sydney drinking water catchment, and in the state's regulated surface water systems.

System operator: efficient management of the State's surface and groundwater resources to maximise reliability for users through operation of the State's river systems and bulk water supply systems, in collaboration with the Murray-Darling Basin Authority ("MDBA") which directs operations of the River Murray system.

Infrastructure planning, delivery and operation: meet customer-defined levels of service consistent with NSW Government policy and priorities to increase the security and reliability of water supplies to our customers and communities of NSW.

Customer water transaction and information services: provide efficient and timely services to our customers for water licencing and approvals, water trades, billing and meet their water resource information needs for surface and groundwater quantity and quality.

4. Our Key Observations from the Event

1. Given the geographic coverage, duration and dynamic nature of the Event, it was managed well from an operational perspective. There was a strong emphasis on the protection of critical human and environmental needs and restoring or preserving continuity of flow throughout the system during this Event. WaterNSW's data sources and models proved to be robust and capable of responding to the extreme and dynamic nature of the Event. WaterNSW was able to provide reliable and timely information to the Department of Planning, Industry and Environment - Water ("the Department") to allow the Event to be managed on an adaptive basis and respond accordingly as conditions changed. Resource decisions made by the Department were made based on good information and were supported by evidence- based statements of reasons.
2. Based on our experience during the Event and feedback from customers since the Event, the criticism of the management of the Event appears to be more towards a lack of awareness and understanding of the outcomes or objectives that the Event was being

managed to achieve, rather than the operational management of the Event itself. Information about thresholds for, and timing of, the lifting of water restrictions was not well understood by water users and stakeholders, and the communications about the imposition and lifting of water restrictions were insufficient.

3. The Event occurred at the same time as significant investment and reform was being implemented across the State's regional water sector to address the recommendations from the Matthews, Vertessy and Natural Resource Commission's (NRC) reports. The Event brought to light many of the findings and recommendations of those reports. Pleasingly, some improvements in resource management were available to benefit the management of the Event; however, the implementation of many recommendations remain a work in progress and are yet to be delivered.

4. WaterNSW believes the Event and this independent Review will provide a sound opportunity to review, confirm, and potentially expand the actions needed to deliver on the outcomes identified in the previous Matthews, Vertessy and NRC reports. This submission sets out what actions WaterNSW is already progressing and identifies opportunities for further improvement.

5. Management of the Event in accordance with Matthews, Vertessy and Natural Resource Commission Reports

The Terms of Reference require the Panel to consider whether the Event was managed in accordance with the relevant recommendations in the Matthews, Vertessy and Natural Resource Commission (NRC) reports.

The relevant themes that emerged from these reports were the importance of protecting flows for critical human and environmental needs, greater transparency and communication, and more robust mechanisms for recording and accounting for water.

These themes are consistent with those identified in the NSW Government's Water Reform Action Plan (2017). WaterNSW has been working closely with the Departments' Water Reform Taskforce ('the Taskforce'), which has lead responsibility for the reforms in NSW. The reforms and WaterNSW's contribution to them are set out below.

1. **Implementing a robust metering framework:** *Establish new systems and manage changes to procedures to enable the new non-urban meter policy and associated changes to Water Licence Conditions.*

   WaterNSW is supporting the implementation of reforms that require water users to comply with new metering requirements and provide water take and metering data. The major element of this framework is the introduction of a mandatory metering condition in licences requiring metering equipment that meet specified standards plus telemetry (or 'telemetry ready' data loggers) to be installed, used and properly maintained on all water supply work approvals above a certain threshold. Amongst other things, WaterNSW is responsible for operating and maintaining a cloud-based Data Acquisition Service (DAS) that will collect, and store data received from metering devices. Data will be provided to the Department and the Natural Resource Access Regulator ("NRAR").

2. **Better managing Environmental Water**: *Establish new procedures to actively manage water designated for environmental purposes.*

   WaterNSW has worked closely with the Department, NRAR, the MDBA and other agencies to introduce these reforms, with a view to enabling 'Active Management' in the northern basin to protect environmental water deliveries from the regulated tributaries through to the Barwon-Darling. Under the new approach, WaterNSW will adjust Commence to Pump (CtP) thresholds each day based on flow forecasts taking into account the held environmental water in the system and notify customers in the system as to which days they are allowed to pump. This will commence from 1 July 2020 and further changes will come into place later in the year, with flows in the system to be shared between users.

   WaterNSW has developed operational models for the Barwon-Darling and the tributaries to improve flow forecasting along the system. These models will assist customers' understanding of the availability of access during an event. The changes will also mean that customers will be notified by WaterNSW on days they are allowed to pump and they will not have to rely on continually monitoring gauges. WaterNSW has developed flow indication maps and communication tools to enable customer notification of access arrangements and to improve transparency of those access arrangements.

3. **Increasing transparency in water management:** *Provide new systems to improve the customer experience and general public access to water information, including the decommissioning of existing redundant legacy systems.*

As part of this work stream, WaterNSW is building functionality for improved transparency of water usage for regulated surface water, through the continued development of the Water Insights Portal[1].

The Water Insights Portal will make water information available for NSW regulated, unregulated and groundwater systems at a single point and enable customers and community to get centralised information for their local area.

This Water Insights Portal delivers on the NSW commitment and new regulatory obligations to provide water information, including real-time extractions and flows in unregulated river systems and the location, levels of actual take vs. permitted take under conditions. More information on the Water Insights Portal is set out at [8.7].

6. Our role in the first flush event

WaterNSW plays three key roles in managing first flush events:

1. We provide information and advice to the Department to support their decision-making. The information is based on our understanding of the water resource, including flows in the system, expected losses, forecast inflows and the impact of extraction.
2. We operate the water system in accordance with the rules as efficiently as possible to maximise the availability of the water resource for customers and the environment.
3. During the Event, WaterNSW played a role in assisting the Department to communicate government decisions in relation to orders made under section 324 of the *Water Management Act 2000* to our customers. WaterNSW provides customer services for most of the State's bulk water customers and, as such, has the capability to support the Department with communication where required.

   In addition to advising its customers directly, WaterNSW plays a role communicating information to stakeholders and communities more broadly. Throughout the Event, WaterNSW utilised multiple communication channels including our website, our Early Warning Network (**EWN**) and print and radio media, to provide regular operational updates to customers, stakeholders and communities.

For the purpose of the Event, it is important to recognise that WaterNSW does not:

[1] https://www.waternsw.com.au/waterinsights

- have a decision-making role in relation to section 324 orders;
- have any resource management or licensing role in relation to floodplains.

7. Why the Event was challenging

The Event was unique and significant for several reasons:

1. The catchments had experienced a prolonged dry period. Leading up to the Event, there was a combination of extremely dry catchments, and an extended period of restricted access, with the Northern Basin experiencing the lowest inflows over an extended period of time (3 years). 2019 was the driest year on record across the northern basin resulting in no connectivity throughout the river system.
2. Based on WaterNSW's discussions with customers and communities in the north of the State, there was an accepted view that it was necessary to protect a first flush event to support critical human and environmental needs. During the drought, WaterNSW regularly held discussions with multiple stakeholders, including northern NSW irrigators around the need to protect flows to meet critical human and environmental needs. The severity of the drought had resulted in many of the rivers across the northern basin ceasing to flow, which had led to fish deaths and other ecological impacts. In addition, many towns along the rivers, as well as landholders adjoining the river with basic landholder rights, were relying on alternative water supplies such as groundwater.
3. The Event was not a singular event, but a series of events over February, March and April. The extended dry period broke with multiple rainfall events occurring across the northern valleys (across NSW and Queensland) over a number of months, resulting in a continual increase in the forecast of inflows to the Menindee Lakes.
4. Most of the water fell on unmonitored floodplains rather than in the upper catchments (which are well-monitored by WaterNSW gauging stations). The rainfall was also unusual, with the majority of the inflows to the northern tributaries occurring downstream of the major storages, with rain falling across the lower flood plains.

For a full chronological description of the Event, see Annexure A.

8. Opportunities for improvement

8.1 There is opportunity to improve the framework for managing first flush events by clearly defining the outcomes and objectives before, rather than during, the events.

In general, the principles developed by the Department to apply the public interest test under section 324 of the *Water Management Act*, proved to be a useful tool to make evidenced-based decisions that responded to changing conditions and new information. However, the effectiveness of the test could be improved if the outcomes and objectives being applied were clearly defined before an event commences.

A 'rules-based' framework that clearly sets out the outcomes to be achieved during a first flush event, supported by performance criteria, would greatly improve the predictability of the management of future events and help address concerns over transparency of decision-making. The framework should codify which environmental and human needs outcomes must be met before restrictions are lifted and what measures will be used to assess whether those outcomes have been achieved. Setting outcomes and measures in advance of an event will allow for a considered and consultative process to be undertaken to promote a well-considered outcome. It will also reduce the need to set (and re-set) targets and outcomes during an event and ensure that all relevant stakeholders know in advance how decisions will be made.

We believe there is also an opportunity to include triggers that would need to be satisfied for an event to be managed as a first flush event, for example the number of days of no flow, floodplain storage levels, and the criticality of town water supplies.

Following the Event, we have also received feedback from our customers that if a rule-based approach was to be developed, it would benefit from considering rules to deal with some of the more challenging decision-making points identified through the Event, including:

- Upstream and downstream criteria and considerations of equity;
- Treatment of regulated and unregulated rivers and tributaries; and
- Flows that exceed bank capacity.

WaterNSW notes that a rules-based approach is being progressed through the development of the draft Barwon-Darling Water Sharing Plan, which contains resumption of flow rules. WaterNSW believes the current draft provides a good foundation, but could be further refined and improved to provide a more comprehensive event management framework as outlined above.

WaterNSW also notes the future role the Active Management Framework (which, as noted above, is being developed by the Department in consultation with WaterNSW) can play in other major unregulated river systems. Once implemented, this framework will provide for the protection of environmental water in a more transparent and predictable manner and reduce the need to rely on temporary water restrictions. The use of telemetered metering in identifying actual extractions will also assist in flow forecasting, as WaterNSW will have a better understanding of actual losses in the system. We note the first Active Management Framework will be implemented in the Barwon-Darling unregulated water source in December 2020.

As an operational tool, the success of the Active Management Framework will rely heavily on the performance of WaterNSW as system operator. WaterNSW has been progressing a range of measures to support implementation of the Framework, including building the capability to:

- Forecast river flows, and announce flow classes and flow shares such that active environmental water is protected;
- Track resumption of flow rules and announce a 'no flow class' when rules are in effect;
- Issue flow advice for water users and the public;
- Establish and operate systems to enable expressions of interest for available water shares to be made, similar to supplementary events in the regulated river systems;
- Share flows between licence holders by announcing the mega-litres (ML) per daily flow share based on the volume of available water and expressions of interest;
- Provide operational reporting on active management, including regular environmental water use accounting during events;

- Provide data to NRAR to assist its monitoring of compliance with active management;
- Submit an annual River Operations Report on the management of access to water to protect active environmental water;
- Consult with licensed water users or their representative groups prior to submitting the annual River Operations Report; and
- Contribute to the annual review process.

8.2 There is opportunity to improve the operational management of first flush events by improving data points and models

A key responsibility for WaterNSW during a first flush event is providing information and advice about the water resource to the Department to inform their decisions and recommendations to the Minister.

The ability of WaterNSW to perform this role is reliant on the availability, timeliness and quality of data and the capability of our models to deal with extreme events.

In general, our data sources and models performed well through a difficult and dynamic event.

The Event proved operationally very challenging for the following reasons:

- the system was coming out of a prolonged dry period, which resulted in significantly higher losses of water than ever experienced in normal years (due to wetting up of the dry riverbeds and channels, and the associated seepage);
- reduced groundwater tables, especially those associated with the river alluvium, impacting on river losses;
- a large amount of the rain fell on the relatively unmonitored floodplains and tributaries rather than in the upper catchments;
- there was a new floodplain harvesting policy in place, with regulations only being passed by Parliament and announced in the days leading up to the event, which meant there was limited time for customers to be made aware of and understand the policy;

- the event was not one single event with a peak and recession, but a series of rolling events over many months that made forecasting difficult;
- difficulty in predicting the extent of flows coming into NSW from Queensland.

WaterNSW relies on a range of data inputs to inform our operational models, including:

- Weather and rainfall forecasts from the Bureau of Meteorology;
- NSW River flow data from our fleet of gauging stations across the State.
- Queensland river flow data from the Queensland Government's Water Monitoring Information Portal;
- Extraction data based on pump capacity and flow class;
- Locational flood height forecasting from the Bureau of Meteorology;
- Field observations through a range of channels including field staff, customers and communities;
- Floodplain data from the Department and satellite imagery from Sentinel.

Throughout the Event, the following opportunities to improve data were identified:

- Timeliness and accuracy of Queensland inflows. The flow forecasts that Queensland provide cannot be relied upon to represent what NSW is likely to receive by way of inflow. The complex river network, long travel time, expansive floodplain, unknown extraction levels in Queensland and significant variation in NSW inflows during previous events make this forecasting very challenging. During the Event, there was information that Queensland irrigators were permitted to extract water, but there was no information as to the extent of the extractions. Accordingly, WaterNSW had difficulty forecasting how much, if any, flow would come from Queensland after extraction.
- NSW extraction data is based on pump capacity and flow ratings (the maximum permissible amount for the maximum permissible time), not actual data.
- Floodplain data is scarce. Due to the lack of gauging stations on the floodplain, WaterNSW has a limited real-time understanding of the floodplain resource from what falls on the floodplain to what makes it into the rivers.

- Ungauged tributaries. WaterNSW has limited gauging stations on some unregulated tributaries feeding into the Barwon-Darling, which makes it difficult to forecast water flowing off the floodplain.

  Pleasingly, through our engagement during the Event customers and stakeholders were able to report and provide photographic evidence of observed conditions in unmonitored areas. This information proved a useful resource to reference with what our monitoring network was recording.

Most of the above deficiencies are known to WaterNSW through our continuous review of our models and modelling capability and we are already progressing initiatives to close those identified gaps, including:

- With the Department, developing an Expression of Interest process to improve the accuracy of assumed extraction. At present, extraction volume is assumed on the basis of maximum pump capacity and pumping by everyone who has a right to pump . Through the Expression of Interest process, WaterNSW will be able to accurately determine the volume of water being extracted each day and improve estimation of losses in the system. This will improve WaterNSW's ability to forecast flows to the end of the system.
- Detailed analysis of historic events to enhance our understanding of regulated river and unregulated tributary behaviour during extreme events. However, there remains a need to better understand how the river operates at higher flows with water leaving and re-entering the main channel, impacting on flow forecasts. WaterNSW has also identified operational data inputs for further analysis to improve our ability to accurately model and manage future events, including weir pool capacity and initial recharge, channel breakouts and identified backwater locations.
- As considered earlier, WaterNSW will also benefit from the telemetered data that will come from the meter installation programme currently underway to improve knowledge of real-time extraction volumes.

In addition to these initiatives, WaterNSW has identified further opportunities to explore:

- The introduction of acoustic instream Doppler flow meters for continuous flow measurement of outflows from tributaries, where current gauging stations are impacted by backwater.

- Developing and formalising a greater level of co-operation and information exchange between NSW and Queensland. WaterNSW did not have enough information to be able to forecast flows from Queensland streams due to a lack of understanding of Queensland customer extractions and flow models. WaterNSW needs to build greater co-operation with Queensland River operators to be able to improve the forecasting of flows coming across the border during these events.

From a modelling perspective, WaterNSW is pursuing the following initiatives:

- Completing and integrating our source model for the Barwon-Darling to support and integrate with the CARM (Computer Aided River Management) operational model. The development of the source model is critical for improved planning of flows in the Barwon-Darling moving forward and supports the operation model used to undertake daily forecasts and operational changes.
- Hydrodynamic model using LiDAR and recent bathymetric survey to support the operational model. Currently, a key issue is our ability to accurately forecast the initial losses as part a first flush flow event. There are 21 fixed crest weirs along the river that need to be refilled, with limited information available on their volume. Due to the flat terrain these weirs can hold significant volumes of water that must be filled prior to the river continuing to flow downstream. There is survey work under way to improve our forecasting of losses in the future and assist in forecasting flows along the river, especially during low flow periods.
- Development of hydrodynamic models of the Barwon-Darling river system, using detailed topographic data to improve understanding of channel dynamics/storage and floodplain flow. As was seen in this Event, significant volumes of water flowed off the surrounding floodplains of the Barwon-Darling. Without a good understanding of the flow across the floodplain, WaterNSW was not able to include water on the floodplain in the forecast model until it was identified at the gauges along the Barwon-Darling. This model would improve the understanding of flow from the floodplain.
- WaterNSW recognises that event management can be improved by continuing to refine our models. WaterNSW has initiated an independent review of our models and our processes. The review will focus on a high-level

adequacy review and opportunities to improve accuracy and application of our models. This Independent Review will be provided to the Panel once completed in late June.

8.3 There is opportunity to improve the communication of first flows events by providing a centralised and easy to understand source of information for customers and communities

WaterNSW provides customer services for most of the State's regulated, unregulated and groundwater customers, with the exception of floodplain harvesters. An important part of this role includes keeping customers informed and up to date about information that can assist them in making decisions on how best to use their water entitlements.

As the system operator, WaterNSW also has a role in keeping the market, communities and the general public informed on what water is present in the system, either in storage or in the river.

WaterNSW utilises a mix of electronic, face to face and traditional media channels to communicate to the geographically diverse state water market. An overview of these channels is provided below.

All these channels (excluding mail) were utilised during the Event to communicate to customers and the public. However, the Event confirmed that not all of these channels are well suited to incident management, our incident management communication capability can be improved, and some channels are becoming rapidly obsolete, in particular for regional NSW.

Website

WaterNSW makes available a wide range of information on our website (www.waternsw.com.au). This includes water operations, including weekly water availability reports, water operations and water balance reports, operational updates and minutes from the River Operations Stakeholder Consultation Committee (ROSCCO) meetings.

Our website also includes an interactive real-time data map. The map includes real-time data on the height and flow of rivers, storage capacity of dams and reservoirs

and meteorology and rainfall. Much of the data comes from our fleet of over 5,000 monitoring stations measuring the quality and quantity of water in our rivers, streams, groundwater bores and dams across New South Wales. Over 1,200 of these stations continuously monitor water sources to deliver real-time data through our telemetry and remote data capture networks.

WaterNSW also publishes notices and news on its website, including in its Early Warning Network feed.

Mobile Phone Applications

Information, including customised real-time data, is also accessible via a mobile phone application called "WaterLive". The application allows water users to access information from handheld devices for surface water, including major rivers, major dam levels, dam inflows and groundwater data. WaterLive is linked to the real time data published on WaterNSW's website, but users can customise their favourite sites in order to easily access the information of the most interest. WaterLive users can also enable 'push' notifications for updates, based on alerts set in the app. Waterlive is free and accessible to anyone with a smartphone.

Automated Notification System

WaterNSW has an automated notification system, the Early Warning Network (EWN), to improve notification of dam and supply activities to the public. Registration is required, where customers and other stakeholders can nominate the type of notifications to be received. Once registered, notifications are received by SMS, email or telephone in the event of a significant dam release or notifiable situation, depending on which options are selected.

Correspondence via email and SMS through the EWN system enables customers to respond appropriately, for example by moving livestock or equipment in the case of changes to river levels or flows. The EWN is also used to alert customers of potential supplementary access events.

More recently WaterNSW has increased its use of Swift Digital, a digital messaging application utilised for more targeted messaging. This can include inter-valley trade opening and closing sessions where constraints may exist, such as in the southern regions of the State. This technology is also used for distribution and management of our regular e-newsletters to unregulated, groundwater and regulated water users.

Email

Customers can subscribe to automatic email notifications, updates and water reports via the WaterNSW website.

Mail

WaterNSW continues to use traditional means such as post to communicate with customers, largely related to licensing and routine account management.

In-person customer and stakeholder engagement

WaterNSW operates a number of customer and stakeholder forums.

Customer Advisory Groups (CAGs) have been in place since WaterNSW was formed. These forums provide an opportunity for representative members of the valleys to engage with WaterNSW on a broad range of issues including pricing, asset development and operations.

As a result of recent enquiries, last year WaterNSW established the ROSCCo's as a valley based operational forum. These sessions focus on the operational information that was usually only provided to representative members of the CAG, but now enable a broader range of stakeholders to engage in discussions about river operations. This forum aims to improve the understanding of stakeholder concerns and river operations and allows local stakeholders to not only to engage with WaterNSW as the river operator, but also the Department as the water resource regulator.

ROSCCos played a critical role across the State during the drought by ensuring that local customers and other stakeholders were informed of the drought situation and WaterNSW and Government agencies were aware of the local impact of potential decisions, to ensure that these concerns could be taken into account in operational, policy and regulatory decisions.

Meeting notes and presentations to ROSCCos are published on WaterNSW's website.

While these communication channels work well during normal times, the Event highlighted shortcomings for the purpose of communicating information during dynamic, rapidly evolving events.

8.4 The capability of our real time database was insufficient for the additional load

During the event, traffic to our real-time data base substantially increased as customers and stakeholders sought to understand what flows were coming into the system. Traffic to the real time data website increased from an average of 1,000 hits per day to 10,000 hits per day. This level of load caused our database to exceed its maximum capacity on several occasions, causing the data environment, website and app to crash.

Heavy utilisation of real-time data servers by multiple applications places a core load on the system. In addition, some users access the provisional database and 'pull' data into their own systems via the web services platform (an automatic process). Some larger users have begun collecting data via web service calls every 15 minutes, adding substantial load the public facing systems.

With our continued investment in digital solutions, WNSW is continuing to enhance and evolve these communication channels to better meet the expectations of our customers, communities and stakeholders. Following the event, WaterNSW commenced a project to enhance the capability of our database. Our Hydstra Stabilisation Action Plan will:

- Develop enhanced autonomous monitoring.
- Automated stop of internal queries/processes at 85% CPU to avoid outage.
- Upgrade servers for more capacity.
- An upgrade to increase performance by a factor of 5 is due to be implemented on 18 June 2020.
- Separate public, internal & supplier query loads.
- Register external users and limit large data volume downloads, which is due to be implemented on 30th June 2020.
- Deliver real-time data into a data warehouse for ease and expansion of data distribution.
- Migrate historical Data to a data warehouse.

These improvements are expected to reduce transactional load and improve performance by greater than 5 times current capacity and will also cater for an expandable platform into the future.

In addition to the back-end water data system improvements, in May WaterNSW launched the latest version of the Waterlive App, which should reduce the amount of website traffic and downloads.

Push Notifications defined by the user are sent straight to the user's mobile home screen. This new feature notifies users within 30 minutes when updated data from our real-time data system triggers any alerts on a watch list.

Benefits of the new feature include:

- Greater convenience to our customers as they will be notified faster and more efficiently of desired information.
- Simple customisation of preferences to be triggered, providing information a soon as it becomes available.
- Push notifications reduce the need to open the App to check for updates.
- Improves ease of access to water information.

8.5 Traditional media channels in regional NSW are becoming obsolete

The *Water Management Act* requires section 324 orders to be published in the NSW Government Gazette and, where considered necessary, the broadcast of notice of the order by television or radio or local newspaper. Publication or notification causes the order to come into effect.

Due to the frequency of decisions to implement or lift section 324 orders during the Event, water restriction announcements became increasingly less newsworthy and therefore less likely to be broadcast by regional radio (ABC) - the only real-time media option in rural areas for rule changes taking immediate effect.

In regional areas there is limited daily media coverage. In the regions, there is limited options to advertise temporary water restriction orders, with short notice to enable customers to be aware of the imposition or lifting of the orders. After the Friday lunchtime media deadline, there is virtually zero locally generated media coverage until Monday. In short, the availability of mainstream media to immediately

communicate a rule change in north-west NSW over a weekend is virtually non-existent.

This means that there are serious limitations in relying on traditional print media, television or radio to convey information on rules changes, which may carry penalties if breached.

Feedback received from WaterNSW's customers indicated that they found it difficult to know when water restrictions were operational and when they were lifted.

Feedback also criticised the timing of the release of decisions on the implementation of water restrictions. Many notifications went out late in the day on a Friday and customers were relying on local industry groups and word of mouth to know that they were in place.

8.6 The Early Warning Notification System has limitations

The Early Warning Network depends on a customer voluntarily registering to receive notifications.

WaterNSW encourages its customers and other stakeholders to register. However, while there was a significant increase of registrations across the northern basin during the event, the EWN notifications only reached a small percentage of customers.

8.7 There remains a strong need for a consolidated, coordinated and accessible source of information

Issues associated with the need for a single source of easy to understand information are not new, and were key findings of the Matthews, Vertessy and recent Keelty reports.

The Event reinforced the need for continued improvement in the area. For example, while WaterNSW was making publicly available the same operational information that was provided to the Department, as an input to the decision-making process, customer feedback since the Event has indicated that this information was not useful because the context in which to consider it was lacking.

The Event also highlighted the need for WaterNSW and the Department to improve the coordination of communication of information during first flush events. For example, floodplain harvesters are managed by the Department and do not receive direct

notification from WaterNSW, unless they also have other water access licences. This may have contributed to a discrepancy of information between water users.

In response to the commendations of the Matthews and Vertessy reports, WaterNSW has been developing a Water Insights Portal.

The Water Insights Portal is an interactive, valley-based source of information about water management. It is accessible via WaterNSW's website or mobile phone application. It provides both customers and communities with an overview of water management in NSW, including water distribution, storage volume and cumulative inflows at a local level. The portal has been in the development stage over the past twelve months with information only available for some valleys. Recent upgrades to the site mean that information will be available for all regulated valleys from July 2020.

Stakeholders can access key water information and data visualisation tools to assist with transparency of system operations, water market information and management. Updated commentary is also available to not only provide data but also to assist interpreting the information.

While the Water Insights Portal will have information available for all valleys by July, WaterNSW is continuing to develop the site by providing additional information to which customers and community members are requesting access. User customisation of these data visualisation tools is not yet available, but anticipated to be available in the near to mid-term.

8.8 An automated Customer Relations Management system will improve engagement capability

We are developing a fit for purpose customer relations management (CRM) software solution that will provide a superior solution to the EWN system.

As well as improved functionality, the CRM will mitigate a key constraint of the current EWN, being that it requires voluntary registration by customers. The CRM will deliver a number of important benefits including:

- Improved customer service by way of a consolidated source of information;
- Improved incident management capability by ensuring we are able to communicate to all customers in a timely way; and

- Improved resource management capability (through supporting the Adaptive Management Framework.

Appendix A:

First Flush Event Overview and Background

1. Introduction

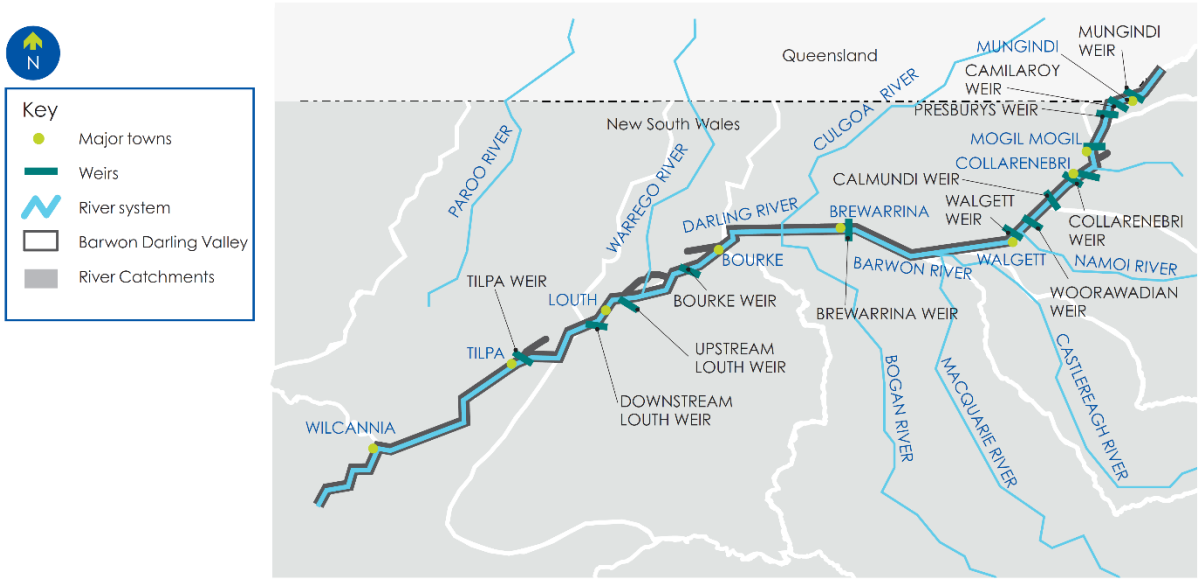
The first flush event occurred from late January through to the end of April 2020, with good rainfall occurring across the north western parts of the Murray Darling Basin. This was the first good rainfall across the region since March 2017, with most of the region experiencing the worst drought on record since that time.

This document has been prepared by WaterNSW. It reflects WaterNSW's role as the system operator.

WaterNSW has sought to provide:

- background information on the drought conditions prior to the first flush event
- a chronology of events prior to, during, and following the first flush event; and
- some observations and suggestions for dealing with these matters for the consideration of the Independent Panel.

The Barwon-Darling river system



2. Abbreviations:

DPIE	The NSW Department of Planning, Industry and the Environment (the "Department")
WMA	The *Water Management Act 2000*
ROSCCo	River Operations Stakeholder Committee
D/S	Down stream
U/S	Up stream
GS	General Security
HS	High Security

3. Background

3.1 Recent Drought Conditions and data

The recent drought was the most severe drought across the NSW northern Murray-Darling basin region on recent record. The data presents a picture of consistently lower inflows, trending from the year 2000, onwards. There was lower average rainfall, supporting the broad conclusion that less inflow in total is occurring.

The reduced inflows over recent periods has seen a significant change in flows along the Barwon-Darling and the tributaries. This has impacted both customers' water availability and environmental conditions.

3.2 Inflows to Northern basin tributaries (NSW)

Inflows to the NSW northern basin tributaries vary significantly from year to year, as can be seen in the graph below (Figure 1) which shows the inflows over the last 130 years. While the long-term average inflows to the system is in the order of 3,576 GL, the highest inflows occurred in 1950 with 22,548 GL and the lowest inflows in 2019 with just 96 GL.

The graph below shows the inflows to the northern NSW tributaries over the 127 years, with the green bars being the top 10 inflow years and the red bars being the lowest 10. The graph shows that 9 of the 10 highest inflow years occurred between 1950 and 1999 and 6 of the lowest inflow years have occurred since 2000.

Not only does the data show that the inflows over the last 20 years are significantly lower than the period between 1950-99, but it also shows that *the period from 1950-99* was significantly wetter than the first half of last century.

Appendix A

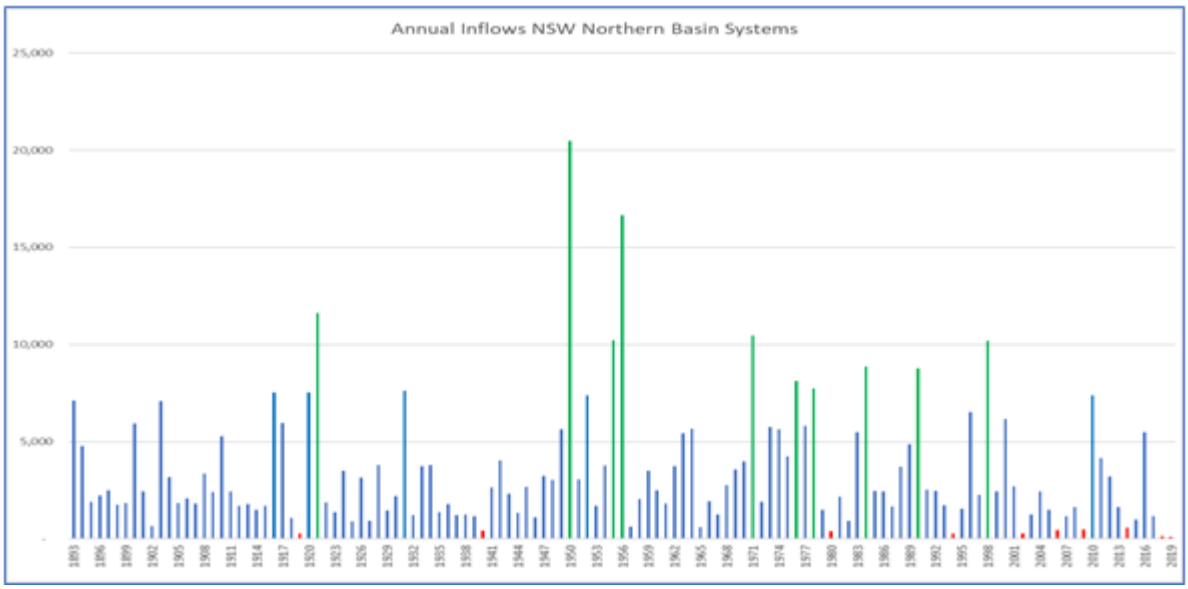


Figure 1. Combined inflows to Northern NSW Tributaries of the MDB

Period	Average (GL)	Median (GL)
Long Term	3,576	2,451
1893-1949	3,062	2,309
1950-99	4,738	3,518
2000-2019	2,134	1,388

Table 1. Statistical analysis of inflows over time in the Northern NSW tributaries

The data represents a similar finding to that of the recent findings in the Keelty report for the southern basin, with the inflows over the last 20 years being less than half of what experienced in the 50 years prior.

While inflows to the northern basin have been significantly lower over the last 20 years the current drought has been the worst on record, with the inflows over the last two years (2018, 2019) being the lowest on record. Inflows in both of these years have been less than half of the previous lowest inflows with 135 GL inflow in 2018 and 94 GL inflow 2019, compared with the previous lowest year being 1994 with 276 GL of inflows.

Previously, two consecutive years of extremely low inflows had not occurred. The lowest 24 months of inflows to the NSW northern tributaries was in 2018-19 with 1,383 GL of inflows, compared to the last 2 years of 228 GL. NSW water storages in the north have also been severely impacted, not only by the intensity of the drought, but also the duration. The Table

below shows the recorded inflows to the storages over the past 3 years compared with the historical drought of record.

Valley	Previous Drought of Record Inflows (GL)	Drought Period (Yrs)	Current Drought Inflows (GL)	Current Drought Period (Months)
Glen Lyon	44	1992-95	32	32
Pindari	142	1992-95	82	31
Copeton	218	1992-95	209	31
Keepit	157	1992-95	100	36
Split Rock	22	1925-28	21	36
Chaffey	26	1964-67	19	36
Burrendong	533	1937-40	153	36

Table 2: Storage Inflows compared to previous drought of record.

The drought caused significant stress on the local environment, with the northern rivers ceasing to flow for long periods of time. It had also placed significant stress on the extractive users, dry land farmers and urban communities.

3.3 Queensland Balonne Flows

The Condamine Balonne system also provides significant inflows to the Barwon-Darling. However, it is very difficult to predict what flows reach the Barwon-Darling due to the nature of the system.

Figure 2 below shows the annual flows at St George since 1949 (there was no data available for the period of 1956 to 1966.) The inflow patterns in the Balonne show a similar trend over the last 20 years with 7 of the lowest flow years on record at St George occurring during this period. However, unlike the northern tributaries, the Balonne also recorded 3 years of the highest flows on record between 2010 and 2012.

Since 2012, the Balonne system has experienced an extended dry period up until flows in February 2020. While flows in 2018 and 19 were not the lowest on record they were in the lowest 10 years based on the history of record. The preceding years were in the lowest 40th percentile.

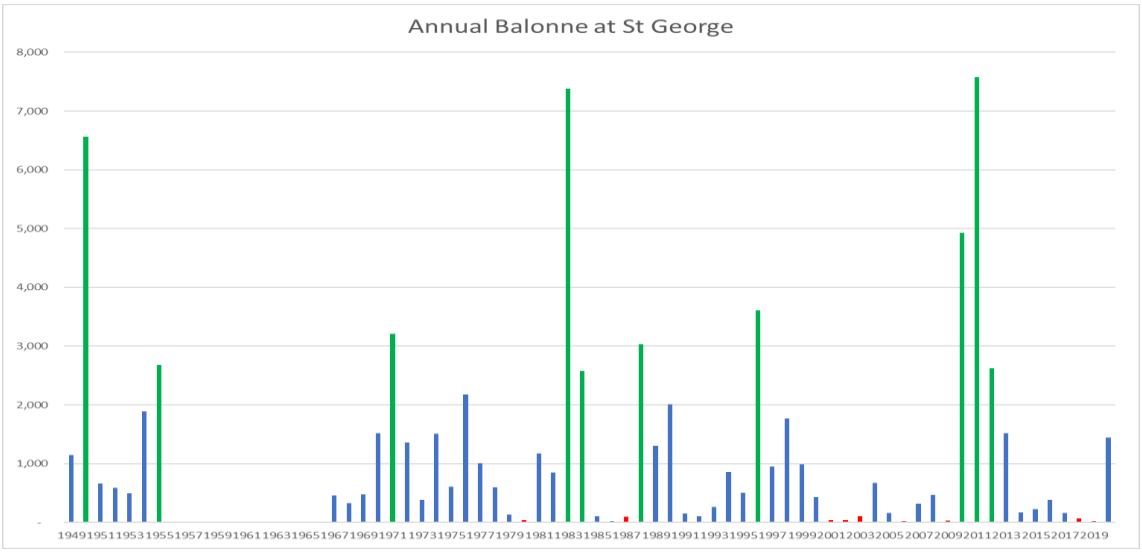


Figure 2. Annual Balonne Flows at St George

The percentage of the water that flows past St George that is recorded at the bottom gauge on the Culgoa (Culgoa D/S Collerina), varies significantly from one year to the next. Looking at data from the 1950's to now, that variation has been from 8% (1993) to 480% (2009).

The years where flows at Collerina are a high percentage of the flows seen at St George, are years where there has been heavy rainfall recorded in the NSW north western region between Queensland and the Barwon-Darling.

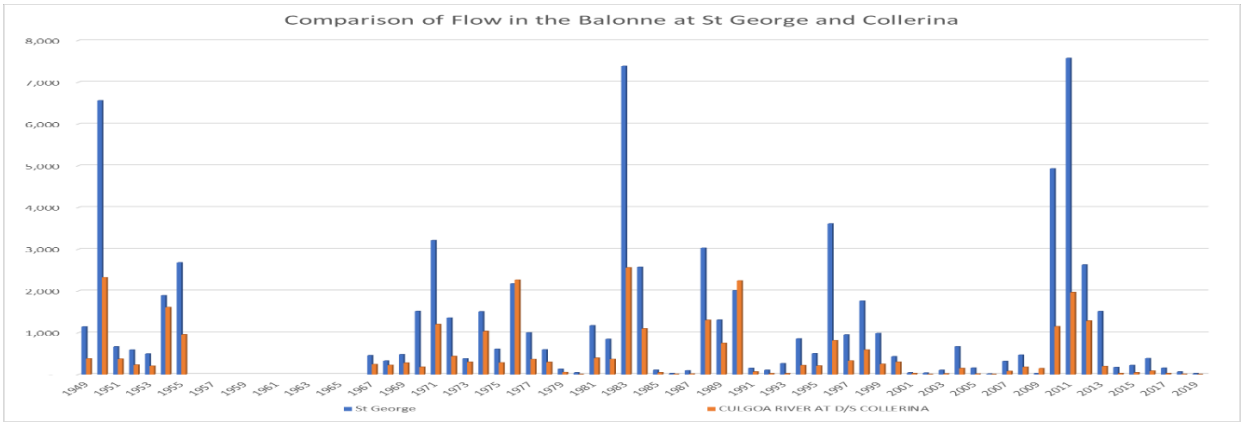


Figure 3: Comparison of flow in the Balonne at St George and Collerina

When annual flows of similar sizes are compared, there is a mixed result.

Similar flows occurred in 1970 and 2013 with flows at St George for the year of 1,500 GL with flows reaching the Barwon of between 195 GL (2013) or 13% and 178GL (1970) or 12%. In both these years there was no major rainfall event across the north western plains.

In 1973 and 2005 both years recorded 380 GL at St George, however in 1973 298GL of flow was recorded at Collerina (78%) compared with only 84 GL (22%) in 2016. The main

difference was that in 1973, 250mm of rain was recorded in the north western region, compared with 80mm in 2016.

Our concluding observation is that the historical record demonstrates the variability of flows in this region. The variability makes it very difficult to forecast with certainty flows from the Balonne into the Barwon-Darling. This variability had an impact on the timing of the flows during this year's Event being included in forecasting Menindee inflow levels.

3.4 Menindee Lakes

Inflows into Menindee Lakes have followed a very similar trend to the flows in the northern basin. The average annual inflows to the lakes have dropped significantly since the 1970's. The 2000's recorded the lowest average inflows, with no major floods recorded during the period. While the last 7-8 years have been dry across the northern basin, average inflows in the last decade have been higher, with significant floods occurring in the first 3 years of the decade. See Table 3 below.

Decade	Average Annual Inflows (GL)
1970's	3,819
1980's	2,374
1990's	2,030
2000's	690
2010's	1,657

Table 3: Average annual Inflows to Menindee Lakes

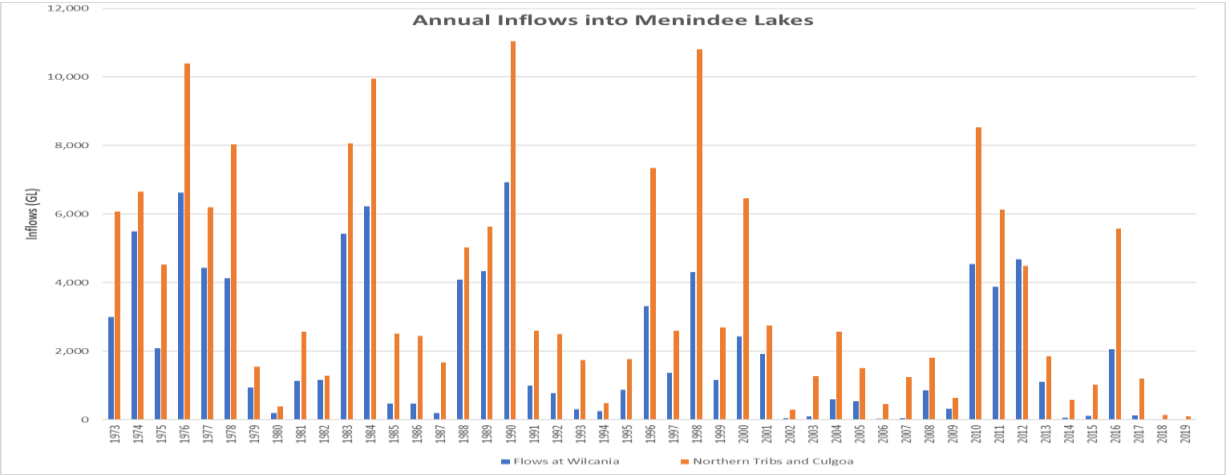


Figure 4: Annual Inflows into Menindee Lakes

4. River Operations

Water sharing plans made under the WMA contain the operating rules for the system. These rules have been established and are maintained for a period of 10 years to enable NSW communities to be able to plan and invest with certainty as to how the rules will function. As the operator of NSW's major water storages and river systems, WaterNSW's role is to ensure that the water resource is managed in accordance with the rules set out in the water sharing plan on a yearly and daily basis.

As the river operator, WaterNSW manages the real-time flows in the system in order to deliver water to customers (including environmental water holders) based on their water orders, as well as ensuring other targets are met as prescribed by rules in the relevant water sharing plans and other related instruments (such as the NSW Extreme Events Policy, for example). In an operational sense, WaterNSW is also responsible for forecasting resource availability to meet customer demands and water orders, and operating water releases from the storages. This resource forecasting also informs water availability determinations made by the Department. To undertake this role, WaterNSW has developed operational models of the State's river systems to enable daily time-step modelling, which facilitates accurate and timely delivery of water, taking into account river losses and travel times.

During drought, WaterNSW has worked to ensure that the critical needs in the various systems could be met, consistent with the NSW Government's Extreme Events Policy[2].

In addition, consistent with the Incident Response Guide developed by the NSW Department of Planning and Industry, WaterNSW has developed operational drought management plans for each valley which anticipated the implementation of drought management measures within each system as the drought intensified. These plans were made in consultation with customers and communities. WaterNSW managed the water resource to meet critical human and high priority needs in accordance with these plans.

5. First Flush Event

The potential for Temporary Water Restrictions in the north had been a key topic of discussion both in the northern ROSSCo's and Lower Darling. All of the northern tributaries, except Gwydir and the Barwon-Darling and Lower Darling were in Stage 4 drought. The river systems

[2] https://www.industry.nsw.gov.au/__data/assets/pdf_file/0008/187703/Extreme-Events-policy.pdf

in the region had ceased to flow for up to a period of 12 months, with customers recognising that water needed to be protected to ensure critical human needs.

Section 324(1) of the WMA provides for temporary water restrictions to be made by the Minister. These would generally be made by the Minister upon recommendation by the Department, usuallye supported by modelling data from WaterNSW.

Section 324(1) of the WMA provides:

"If satisfied that it is necessary to do so in the public interest (such as (but not limited to) to cope with a water shortage, threat to public health or safety or to manage water for environmental purposes), the Minister may, by order in writing, direct that, for a specified period, the taking of water from a specified water source is prohibited, or is subject to specified restrictions, as the case requires."

There are other provisions in the WMA available to the Minister to restrict or regulate access to water, including if the operational rules in the water sharing plan require amending due to the extreme event. In making an order under section 324, principles to guide the application of the public interest test were documented to ensure any decisions around lifting the order could be assessed against the criteria.

The initial Temporary Water Restriction under a section 324 Order was put in place on the 17 January 2020, based on a forecast of high rainfall in some parts of NSW by the Bureau of Meteorology.

The Temporary Water Restriction was to preserve flows in the northern river valleys for towns and stock and domestic supply, so access to the flows for town water, domestic and stock supply and basic landholder rights was permitted.

The restriction applied to commercial water users in the northern inland river systems, excluding those Macquarie and Gwydir regulated rivers where high security account water was being delivered.

The restrictions originally applied from 17 January until 31 January 2020.

The objective was to protect any flows generated by rain to secure critical local water supplies and potentially improving connectivity through the river system.

While the Temporary Water Restriction were in place, the Department was working through the development of the process to lift such restrictions in February 2020. The process had not been clearly communicated to customers and the community prior to the start of the Event.

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Table 4: Chronology of events

Timeline	Event	Comment
20 December 2019	Temporary Water Restriction Northern Inland Tributaries	Expired on the 5 January 2020
17 January 2020	Temporary Water Restriction Northern NSW MDB	
23 January 2020	Namoi First Flush Criteria stakeholder engagement	
26 January 2020	Rainfall in Mooki and Peel rivers	Lifting of embargo on system
6 February 2020	Barwon starts to flow at Collarenebri	
7 February 2020	Temporary Water Restriction on flood plain harvesting issued	
6 –10 February 2020	Rainfall across the Lower Gwydir and Namoi	
8 February 2020	Temporary Water Restriction lifted in unregulated upper Namoi tributaries and the Thalaba and Millie in the Gwydir from 8-17th Feb	Interim flow guideline met in the Namoi valley, and connectivity with B-D forecast. Volume of take small relative to volume of flow.
9 February 2020	Temporary Water Restriction lifted in unregulated lower Namoi tributaries and 9-17th Feb	Interim flow guideline met in the Namoi valley, and connectivity with B-D forecast. Volume of take small relative to volume of flow.
9 February 2020	Access provided to high security customers in Upper Namoi, Namoi and Peel 9-17th Feb	Interim flow guideline met in the Namoi valley, and connectivity with B-D forecast. Volume of take

Appendix A

Timeline	Event	Comment
		small relative to volume of flow.
9 February 2020	Temporary Water Restriction lifted in unregulated Mehi and for floodplain harvesting in the Mehi and Thalaba	Localised flooding due to intensive rainfall, flows backed up from B-D, risk to farms. Local interim flow guideline met. Lifted for 3 days to allow farmers to move water causing flooding.
10 February 2020	Lift s324, to allow farmers to take flood plan harvesting water to reduce infrastructure risk in the Barwon- Darling between Collarenebri and Walgett, and lower Namoi in the floodplain areas of Baradine, lower Namoi, and Pian water sources.	Significant rainfall had fallen on the flood plains in the 0rder of 150-200mm over two to three days
18-19 February 2020	25-75mm rain across the northern basin	
12 February 2020	Temporary Water Restriction lifted on Yarraman Creek only	
12 February 2020	Temporary Water Restriction for floodplain harvesting amended to include the Lower Macintyre River, Whalan Creek & Boomi River Floodplain and the Lower Macquarie Valley Floodplain.	

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Timeline	Event	Comment
17 February 2020	Supplementary access has been allowed in the Lower Gwydir that flows to the wetlands	
20 February 2020	Forecast to reach 60-80 GL at Menindee	
21 February 2020	Approval to take from certain unregulated water sources in the water sharing plans for the Border Rivers, Gwydir, Namoi, and Macquarie unregulated and alluvial water sources	
23 February 2020	FPH Temporary Water Restriction lifted in the north except Barwon-Darling	
23-24 February 2020	Heavy rainfall occurs across the Balonne and Warrego catchments resulting in flooding at St George and in the Warrego	
26 February 2020	Inflows from the Balonne included in the Barwo-Darling flow forecast	Rainfall event increase Menindee forecast from 60-80 GL to 150-170GL.
27 February 2020	Unregulated river (A, B, and C Class) access licences upstream of the Culgoa junction	
5 March 2020	Flow forecast at St George increased from 1,000 GL to 1,300 GL.	This result in an increase forecast of 70—90 GL reaching the Barwon

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Timeline	Event	Comment
	Flow was also forecast to reach Barwon from Bokhara and Warrego	
6 March 2020	Unregulated river (A, B, and C Class) access licences downstream of the Culgoa junction Rainfall across the north west and central west resulted in further inflows	Menindee forecast was for 270-290 GL to reach Lakes without extraction and 205-250GL with extraction being allowed Additional rain concentrated in the Castlereagh and Macquarie catchments resulting in inflows to Barwon from these streams
31 March 2020	Flows as St George extended through March with a total volume in the order of 1,400GL. Flows from the Culgoa and Bokhara continue to run	Total flow from the Culgoa was in the order of 170 GL which was 12% of the flow recorded at St George slightly higher than that forecast by WaterNSW (10%) Th flow in the Bokhara was also slightly higher at 30 GL compare with the original forecast of 20GL.
30 April 2020	Rainfall event on the 31/3, 4/4 and 11/4 resulted in further inflows to the Barwon over April	The majority of flows during April flowed from the Castlereagh, Bogan and Macquarie rivers with the flows at Brewarrina increasing from 310GL to 480GL during April

Timeline	Event	Comment
31 May 2020	Rain was recorded across the central NSW at the start of the month with 40-50mm	Only increase in inflows during the month occurred in the Castlereagh, Macquarie and Bogan systems

6. The Rainfall Events

Rainfall across the northern parts of the basin began in late January 2020, with rainfall in the upper Balonne and across the northern NSW tributaries. The rainfall was caused by storm cells with a large variation of rainfall intensity across the region. The rainfall continued over the first 4 months of the year from January through to April 2020, resulting in continuous updating of flow forecasts in the northern NSW tributaries and the Barwon-Darling.

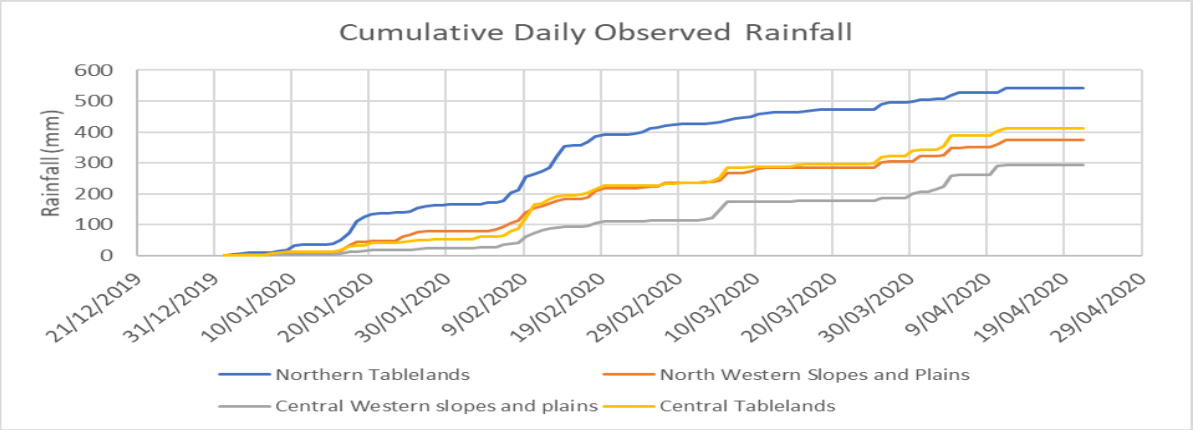

Figure 5: Cumulative Daily Observed Rainfall

6.1 Late January 2020

The first rainfall event in NSW occurred over the weekend of 25/26 January 2020, with localised heavy rainfall in the Mooki and Peel tributaries of the Namoi. Due to the very localised nature of the rainfall the event was assessed as if localised flow targets would be met with and without access.

Rainfall events in last three days of January 2020 produced encouraging runoff from major tributaries flowing into the Peel River. With good inflows from Cockburn and Goono Goono Rivers, the Peel River was forecasted to re-establish continuity from Tamworth down to the Namoi River junction, meeting its replenishment target at Carrol Gap.

It was assessed that the small high security water take would not impact the connectivity or replenishment target. Therefore, the restriction on high security water take was lifted.

In the Mooki system, the Quirindi Creek was flowing at a rate of 5,700 ML/d. The Mooki River was expected to provide flow into the Namoi River, and together with the flow from the Peel River, it was forecast to re-establish connectivity in the Namoi River from Gunnedah to Narrabri. It was assessed that the connectivity would be achieved irrespective of prohibition of unregulated take in Quirindi or Mooki Rivers, as the actual pump sizes are too small compared to the flow rates to impact targets being met. Unregulated access to flows in the Quirindi and Mooki systems were then lifted for 10 days.

6.2 1 to 9 February 2020

In early February 2020, heavy rainfall across the Namoi and the lower Gwydir valley resulted in the commencement of flows in the major tributaries and the Barwon-Darling at Collarenebri. The rainfall was caused from a tropical low that moved down from the north causing storms to move across the state with highly variable rainfall.

Rainfall was not evenly distributed with localised falls varying significantly across the region. Some areas of the region received over 200mm in a few days from the 6 -9 February, while other areas received less than 50mm.

WaterNSW operators commenced the forecast of flows in the Barwon-Darling from 6 February 2020, when local storm events across the Barwon-Darling and Moonie system generating flows in the system. At this stage flows were forecast to reach Wilcannia, but not provide a resource in the Menindee Lakes.

6.3 8 to 10 February 2020

The Bureau of Meteorology forecast a significant rainfall event along the east coast of NSW. The forecast was in the order of 100-200mm of rain to impact the coastal strip of NSW, including Sydney. In regional NSW there were forecasts of very heavy falls on the north coast, and coastal rainfall forecast for the south coast. West of the divide, especially in northern valleys, rain was predicted largely to be a continuation of scattered storms and shower activity as had been seen in the preceding weeks. It was forecast as likely to result in localised inflows to rivers, and minor inflows into dams.

However, over the weekend of 8-9 February 2020, WaterNSW started to receive calls from customers in the Namoi and Gwydir advising of heavy rainfall and significant flooding occurring in local creeks and streams. Significant rainfall occurred in the lower sections of the valleys where rainfall gauges were limited, which made it very difficult to predict inflows. WaterNSW relied on customer input to what was occurring in regional areas to assist in the

initial identification of rainfall and photos of flows were provided to verify conditions, prior to flows being seen at river gauges. This early warning assisted operators in being aware of, and able to forecast likely impacts based on observed and gauged data.

A key point is that WaterNSW relied on its relationship with its customers to ensure data was being shared to assist in identifying flow in the remote lower reaches of the valleys where rainfall and river gauges are limited.

After the weekend, the flows in the Barwon-Darling were observed from Presbury to Walgett, with forecast flows at Walgett to be in the order of 60-80 GL. Based on the forecast, these flows were considered to only just connect with the Menindee Lakes, with an inflow of 0-8 GL reaching the lakes being modelled as the likely range.

6.4 9 February 2020 – Lifting of Flood Plain Harvesting Water Restrictions

Customers advised both WaterNSW and the Department of flooding risk and possible damage to farms in the lower Gwydir and Namoi. They requested consideration be given to allowing unregulated and flood plain harvesting (FPH) take to mitigate risk to property. The request was supported by photos.

Millie Creek (Milton Downs)

Appendix A

Millie Creek (Milton Downs

Consideration was given to the fact that over the previous 2 days there had been in excess of 150mm of rain in lower Gwydir and Namoi.

Flows in the Mehi River were at 4,000ML/day and 4,500ML/day in Moomim. Flows in the Barwon Darling were at 9,000ML day at Collarenabri and 5,000ML day at Tara. Flows from the Mehi were backing up due to high flows in the Barwon-Darling and spilling onto the flood plain and not allowing water to flow off.

Most flow targets set by the Department had been met locally, and flows were now expected to meet the targets at Brewarrina, and possibly Bourke. However, the main intent of allowing access was to minimise flood impacts and allow farmers to move water around their property.

Consideration was also given to allowing access to flows in the Namoi (HS, GS, supplementary flows).

High Security is the highest priority of the three uses under the WMA. It was estimated that high security take would be in the order of up to 150 ML/day. At the time, flows in the Namoi were 10,000ML day at Gunnedah and 14,000ML day at Narrabri (both still rising). These flows were well in excess of the flow targets in the Namoi. Flows were also forecast to hit Walgett, and meet flow targets there, and contribute to flows in the Barwon-Darling. The impact of allowing High Security take was insignificant when considered against the flows, so take would therefore have no material impact on flow targets.

Supplementary flow access is a lower priority under the Act and was not be considered until all flow targets in the Barwon-Darling had been confirmed to be met.

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General Security access in the lower Namoi (downstream of Gunidgera Weir) - previous block releases did not provide for water access in this region for General Security users due to high losses. This flow gave an opportunity for General Security access to those who missed out previously. There was 11-12GL in accounts (which included Commonwealth held water), but the active component was likely to be around 7-8 GL. Requests were received to give access to General Security holders towards the tail end of this event. There were 2 options: 1) Provide access at the tail end of the event, or 2) top up the river flows from Keepit Dam.

Decision and Reasoning:

The decision and reasoning for lifting Flood Plain Harvesting water restrictions by the Department was recorded as follows:

> *Gwydir FPH and unregulated access - Lift s324 and allow access to FPH and unregulated take in the Thalaba water source and Mehi management zone. Access will be allowed until Wed 12th February and will then be reviewed. Access is to mitigate any immediate flooding risk.*
>
> *Namoi - Lift s324 for HS take in the Namoi, Keepit and Upper Namoi, given high priority of use, and small volumes relative to flows.*
>
> *Not support lifting supplementary take as it is a lower priority and need to ensure targets at Brewarrina and Bourke are contributed to.*
>
> *General security - not supported until forecasting of the Barwon-Darling is available, to ensure flow targets can be met.*
>
> *NSW Department of Planning, Industry and Environment – Water*

While access was not provided to customers in the regulated section of the river, as a result of the rainfall over the weekend of 7-10 February 2020, with significant rainfall across the Gwydir and Namoi valleys, access to water in the unregulated tributaries was provided.

Table 5 below shows in more detail the chronological lifting of restrictions and reasoning.

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Table 5: Chronology of lifting of restrictions and reasoning

Valley	Licence Category	Water Source	Approval Period (inclusive)	Summary of reason
Namoi	High security	Namoi, Peel, upper Namoi	09th February to 17th February	Interim flow guideline met in the Namoi valley, and connectivity with Barwon-Darling (B-D) forecast. Volume of take small relative to volume of flow.
	Unregulated	Upper Macdonald River Water Source Mid Macdonald River Water Source Upper Namoi Water Source Werris Creek Water Source Rangira Creek Water Source Bluevale Water Source Coxs Creek Water Source Maules Creek Water Source Eulah Creek Water Source Bohena Creek Water Source Spring and Bobbiwaa Creeks Water Source Phillips Creek Water Source Mooki River Water Source Quirindi Creek Water Source Warrah Creek Water Source	08th February to 17th February 2020	Interim flow guideline met in the Namoi valley, and connectivity with B-D forecast. Volume of take small relative to volume of flow.
	Unregulated	Brigalow, Bundock, Coghill, Etoo and Talluba, lower Namoi, Pian, and Baradine	09th February to 17th February 2020	Interim flow guideline met in the Namoi valley, and connectivity with B-D forecast. Volume of take small relative to volume of flow.
Gwydir	Unregulated	Mehi	09th February to 12th February 2020	Localised flooding due to intensive rainfall, flows backed up from B-D, risk to farms. Local interim flow guideline met. Lifted for 3 days to allow farmers to move water causing flooding.
	Unregulated	Thalaba, Millie	08th February to 17th February 2020	Interim flow guidelines met in the Mehi, and downstream in B-D. Volume of take small relative to volume of flow.

Valley	Licence Category	Water Source	Approval Period (inclusive)	Summary of reason
	Floodplain Harvesting	Mehi, Thalaba	09th February to 12th February 2020	Localised flooding due to intensive rainfall, flows backed up from B-D, risk to farms. Local interim flow guideline met. Lifted for 3 days to allow farmers to move water causing flooding.

6.5 12 to 14 February 2020

Rainfall continued across the northern region on 12 to 14 February 2020, with a further 30-60mm being recorded. Inflows into the Barwon-Darling continued over this period with water flowing off the flood plain. With no gauging of water sitting on the flood plain it was not possible to forecast the volume of water that was present in the region from the rainfall over 6-10 February 2020.

By 16 February 2020, over 64,000 ML of flow had been recorded at Collarenebri and over 65,000 ML recorded at Walgett. There had also been increased rainfall around the Border with flows forecast to enter the system from the Border, Moonie and Weir with water coming out of QLD.

The ability to forecast flows from these systems was difficult with the QLD water authorities allowing supplementary access. However, forecast flow at Walgett had also increased to 135-170 GL with water still travelling down the Namoi system. The forecast flows to Menindee Lakes had also increased to 15-35 GL.

Flows in the Balonne had also increased with Beardmore dam filling on 11 February 2020, with small flows of less than 3,000 L/d recorded at St George up until 15 February 2020.

6.6 15 to 21 February 2020

Further rainfall in the range of 25-70mm was then recorded over the 18 and 19 February 2020 across both the northern NSW tributaries and Queensland. The Barwon-Darling was continuing to gain water between Collarenebri and Tara, with water entering the system from the flood plain. Water from the Queensland tributaries (Moonie and Weir) were reaching the Barwon and were included in the model.

Flows in the Balonne continued to increase at St George with flows recorded in the range of 14-18,000 ML/d. While the flows had increased significantly, Queensland water authorities were allowing access to flows in the lower Balonne and were providing advice that the flows were not likely to provide significant flows over the Border.

While flows at upstream of St George were around 55,000 ML/d, they were forecast to attenuate to about 40-45,000 ML/day at St George. With pump capacity downstream of St George in the order of 25,000 ML/d, the forecast was for limited flow reaching NSW.

By 20 February 2020, flows to Menindee Lakes were forecast to reach 60-80 GL, meeting the trigger that had been set to meet critical needs to:

- to provide a flow along the Lower-Darling;
- provide connectivity in the Barwon from Mungindi to Wentworth; and
- provide a reserve in Lake Wetherell as a refuge pool.

Temporary water restrictions in the northern tributaries and for flood plain harvesting were then lifted on the 21 February 2020.

6.7 22 to 30 February 2020

Over the weekend of 23-24 February 2020, the south western region of Queensland in the Maranoa river catchment area (western part of the Balonne Catchment) received significant rainfall in the range of 200mm. This event resulted in significant flooding in the Balonne at St George with flows increasing to 190 GL/d on 27 February 2020 and also resulted in significant flows in the Warrego River in Queensland.

As a result of significant flooding in St George being observed, and with a forecast flow past St George of 1,000 GL, WaterNSW included a conservative estimate of inflows to the Barwon from the Culgoa of 10% of the forecast flow past St George. This also resulted in an increase inflow to Menindee Lakes, now forecast to reach 170 – 200 GL.

As a result of the increased forecast of inflows from the Culgoa and the flows from the northern tributaries receding, access was provided to unregulated A, B and C customers in the Barwon-Darling upstream of the Culgoa junction.

6.8 1 to 15 March 2020

Early in the month, forecast inflows increased with water reaching the border in the Warrego and Bokhara systems. Inflows from these systems provided an additional 60GL of inflows to the system resulting from the previous broad rainfall event on 23-24 February 2020.

By 5 March 2020, the forecast inflows to the Menindee Lakes had increased again to 270-295 GL. Even after considering maximum daily pumping downstream of the Culgoa, the forecast inflows to Menindee were still in the range of 205-250 GL. As the target to meet critical needs in the Lower-Darling had now been met for an 18 month period, temporary water restrictions below the Culgoa junction were lifted by the Department.

Further rainfall occurred during this period (on 6th March) with an additional 25mm of rain recorded on the north western slopes and 50mm on the central western slopes. While these were the average rainfalls, the rainfall was not evenly distributed, with heavier falls occurring within the region. This event resulted in increased flows at Collarenebri and from the Namoi, Border and Moonie systems.

This event also resulted in direct inflows in the Barwon-Darling around Brewarrina (10-15GL) and downstream of Wilcannia from the Dolo-Bonley Creek (10-20GL).

Rainfall on the central tablelands also resulted in significant inflows to the Castlereagh and Macquarie rivers, resulting in forecast inflows from these systems into the Barwon-Darling.

Forecast inflows to Menindee Lakes had now increased to 260-315GL by 16 March.

6.9 16 to 31 March 2020

Increases in flow forecasts during the period were mainly from the increased inflows from the Balonne. The flows at St George exceeded the earlier forecast with flows past St George being in the order of 1,400GL rather than 1,000 GL. In addition, the volume of water reaching the Barwon from the Balonne via the Culgoa was slightly higher than the 10% originally used and were more in the range of 12%. This resulted in the forecast from the Culgoa increasing from 100GL to 170 GL. Flows in the Bokhara were also slightly higher, at 30GL.

Further rainfall events on 2h and 31 March 2020 also resulted in small increases in tributary inflows over the period.

Forecast inflows to Menindee Lakes increased to 365-405GL by 31 March 2020.

6.10 1 to 30 April 2020

The rainfall events on 4 and 11 April 2020, saw an additional 40-55mm of rainfall in the north western slopes and over 100mm on the central western slopes, resulting in further increased inflows. The rainfall, especially on the central slopes, resulted in increased inflows from the Castlereagh and Bogan systems during the month, with the flows at Brewarrina increasing by 100 GL over the period.

As a result of this event, the Menindee Lakes was now forecast to increase to 485-535GL by 31 April 2020.

6.11 1 to 31 May 2020

The rainfall event that occurred at the start of May saw another 40-50mm of rainfall across the central plains, providing additional flows from the Castlereagh, Macquarie and Bogan rivers. This, with reduced losses below Culgoa junction, saw another increased inflow forecast for the Menindee Lakes.

As a result of this event, the Menindee Lakes was forecast to increase to 578-590 GL by 1 June 2020.