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MURRAY–DARLING BASIN AUTHORITY

# Review of the elevated salinity event in the lower Darling River – March–April 2020

## Summary Report

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

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

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

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**Overview of the elevated salinity event**

After several hot and dry years, rainfall across the Northern Basin in March 2020 recommenced Darling River flows, with water reaching the River Murray on 14 April 2020.

The first flushing flows through the lower Darling mobilised a short and sharp elevated salinity event in 2020 (2,000 µS/cm at Burtundy), in comparison to the previous event in 2016 which was a slower moving, stratified slug of saltier water.

The 2020 elevated salinity flow front in the Darling River was likened to a 'wall' of fast flowing water (flow rate of 10 kilometres per day), that pushed through the Wentworth Weir Pool over a period of nine days.

Within 24 hours, salinity levels at Burtundy dropped to less than 300 µS/cm due to dilution from fresher flows behind the flow front.

**Impact**

There were negligible impacts on salinity levels in the River Murray downstream of the confluence at Wentworth. Salinity levels at Lock 6 in South Australia peaked at 231 EC on 25 May 2020 (A4260510), which is well below the Basin Plan flow management target level of 580.

Impact to water users, such as irrigators and basic rights (stock and domestic) was minimal because the timing of the event was at the end of the irrigation season, after the critical period for budburst and melon seedling.

Potential environmental impacts were also minimised by managing the first flush event to avoid fish deaths. The relatively fast-moving first flush through the lower Darling River, followed by dilution of subsequent flows of better water quality, reduced the likelihood of salinity impacts to the environment and risk of extended low dissolved oxygen levels.

**Management lessons**

Inter-agency preparation for the resumption of flows in the lower Darling with the resultant potential for poor water quality commenced well in advance of the reconnection event. River managers drew from the learnings of previous restart events in 2004, 2009 and 2016 to understand the potential water quality responses and risks in the lower Darling and River Murrays.

The 2020 elevated salinity event was centrally coordinated by the NSW Lower Darling Critical Water Advisory Panel, which was as a single point of truth and channel for clear communication, information and data sharing and proved to be an effective management approach. This was an improvement from the 2016 elevated salinity event management, which did not have a centralised working group to coordinate information flow.

Several effective management actions were undertaken to reduce water quality impacts through river operations and through responsive management of salt interception schemes (e.g. MDBA drawing down of Wentworth weir pool to draw out poorer quality water, and WaterNSW pulsing initial releases from Weir 32 to push lower quality water out of the lower Darling to be diluted by the Murray). A number of reserve risk management options were also identified, but not deployed in 2020, in case additional dilution and mixing was required (e.g. using Lake Victoria to mix with River Murray flows and Lock 7 weir pool raising).

Regular community engagement was key. WaterNSW and DPIE monitored salinity and provided timely information to stakeholders about salinity levels, locations and the movement of the saline water. This provided valuable information to authorities and water users and helped with decision-making for a wide range of users before, during and after the elevated salinity event.

# Review of elevated salinity events

Through the Basin Salinity Management 2030 (BSM2030) strategy, partner governments have committed to the coordinated review of in-river elevated salinity events to understand the causes, impacts and effectiveness of management responses and to identify potential policy improvements.

An elevated salinity event refers to an increase in river salinity levels which may result in adverse impacts, arising from a single event or the cumulative impacts of coinciding or sequential events. These elevated salinity levels may cause a management response or contribute to exceeding a target or the near miss of exceeding a target.

The elevated salinity event in the lower Darling River in March–April 2020 was identified by partner governments through the Basin Salinity Management Advisory Panel (BSMAP) as triggering the requirement for a review, consistent with the Basin Salinity Management Review of Elevated Salinity Events procedure. The review was triggered because the event caused a management response, and the high salt loads contributed to further exceedance of target-based thresholds.

Elevated salinity levels from this event resulted in a front of poor water quality in the lower Darling which had potential to degrade the water quality in the River Murray. Degradation of water quality stresses a range of aquatic biota, impinges on Aboriginal cultural and spiritual uses of water, increases the cost of drinking water treatment, and decreases the suitability of water for irrigation and agriculture (DPIE 2020).

Reviewing the elevated salinity event has been done in addition to the business requirements carried out by the NSW Government and the MDBA in response to the recommencement of flows in the lower Darling River. This review process supports the responsibilities identified in the Basin Plan for the Authority and Basin States to have regard to the Basin Plan salinity targets for managing water flows.

The review process includes a discussion forum with a targeted stakeholder audience involving water quality and salinity managers, and river managers and operators from government agencies within the Murray–Darling Basin (MDB). Following the discussion forum, a summary report is prepared to ensure that the outcomes and any lessons are captured.

The discussion forum on the elevated salinity event observed in the lower Darling River in March–April 2020 was held as a videoconference on 3 March 2021. Government agency staff from NSW, Victoria, South Australia, the Commonwealth and the MDBA attended the forum. Officials from NSW and the MDBA presented on the events that took place in the lower Darling River in March–April 2020, as well as the outcomes, improvements and comparisons with previous elevated salinity events. The most recent elevated salinity event in 2016 provided a particular focus for comparisons and lessons learnt.

The outcome of this review process has enabled consideration and information sharing of lessons learnt from the 2020 event. This includes moving the elevated salinity water through the river system quickly by manipulating river flows to increase flow volume and velocity. Key improvements from previous events were formation of a centralised working group providing clear coordination and

communication between inter-agency staff as well as to the wider community. Other adaptive management options proved to be an effective approach in the mitigation and management responses of worst-case elevated salinity event scenarios, such as increased salt interception scheme operations and utilising Lake Victoria for intercepting and mixing the elevated salinity flows.

The discussion forum provided the opportunity to reflect on past events with relevant government agencies. River management improvements have been realised from the outcomes and lessons learnt from previous elevated salinity events. These have helped to formulate current best practice which was successfully applied to the March–April 2020 elevated salinity event in the lower Darling River and will support the management of future elevated salinity events as well.

The presentations from the discussion forum along with other existing documents and monitoring data have been used to produce this report.

# Lower Darling River Elevated Salinity Event

Since the 1960s the lower Darling River has been regulated by releases from the Menindee Lakes Scheme. Apart from periods of flooding and call-out by the MDBA, this regulation has resulted in long periods of seasonal low flow release and, until recent years, a reduced frequency of small to medium sized flow events.

## Cause of elevated salinity event

Leading up to the northern Basin first flush event in March–April 2020, environmental and river systems were under severe stress due to record drought conditions across the northern Basin. Rainfall deficiencies from 2017 to 2020 were at record levels, particularly across the northern basin (BoM 2020a and 2020b). The NSW Government established the Critical Water Advisory Panel (CWAP) for the Lower Darling in response to the severe drought to help manage the first flush event and to coordinate advice and communicate updates on conditions and management responses (refer to section Effectiveness of mitigation and management responses for further information).

From February 2019, the Darling River at Weir 32 (Menindee NSW) ceased to flow for 388 consecutive days. This was the longest no-flow period since construction of the Menindee Lakes Scheme. The Darling River at the Pooncarie Weir was also dry. Block banks along the lower Darling River had been constructed and held temporary pools of water for irrigation and basic rights water use. These weir pools dried to a series of disconnected, small, remnant pools or in some cases completely dried out.

Water quality in the pools behind the block banks deteriorated due to natural ingress from the saline, regional, shallow groundwater system, and evaporation concentrated salts in these remnant pools. As the pools dried, salts accumulated in the soil of the riverbed. This was the source of salt that caused the elevated salinity event when the Darling River recommenced to flow in March 2020 (DPIE, 2020a and 2021).

A band of above average rainfall extending across the Basin in March 2020 started flows in the upper Darling River catchment. This brought drought relief as well as recommencing Darling River flows which eventually connected with the River Murray on 14 April 2020 (Bureau of Meteorology 2020a, 2020b and MDBA 2020a).

This rainfall event caused a relatively fast, high-magnitude, elevated salinity event during the first flush flows of 2020, in comparison to the previous event in 2016 which was a slower moving, stratified slug of saltier water (DPIE 2021). A comparison of the events is provided in the section Comparison between the 2016 and 2020 elevated salinity event conditions.

## Scale, duration and magnitude of the elevated salinity event

In the lead up to the recommencement of lower Darling River flows in early-April 2020, the band of drought-relieving, high rainfall brought a large volume of fast-flowing first flush through the Darling River system. The large volumes of fresh water washed through the disconnected pools and salty

soils, flushing salts which increased the concentration of total dissolved solids at the flow front. This generated a brackish flow front which moved through the river system at a relatively fast pace and high volume, and was followed by water with a lower salt concentration behind the front (DPIE 2021).

Figure 1 shows the time series (logger) of salinity levels at different locations in the Darling and River Murrays impacted by the 2020 elevated salinity event. The most significant elevated salinity levels associated with the flow front are restricted to the lower Darling River. This is shown in Figure 1, where the salinity level peaked at 415 µS/cm on 21 April 2020 at the Darling junction at Wentworth and increased upstream.

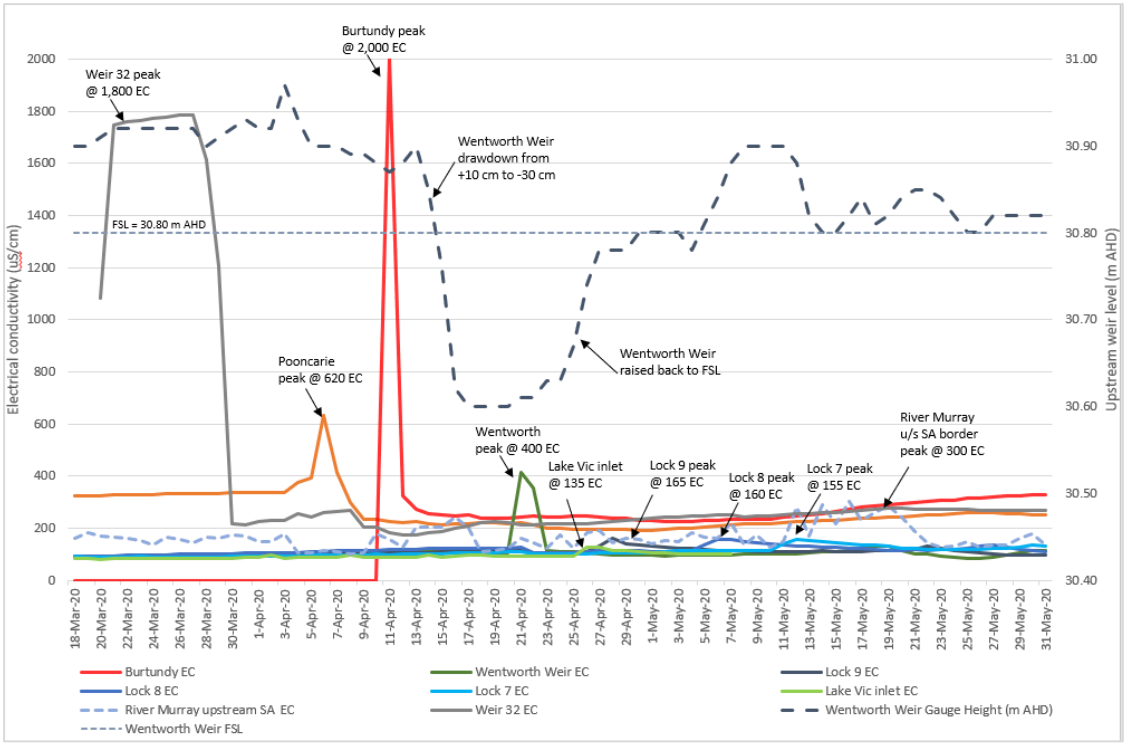
This is shown firstly at Weir 32 (Lake Wetherall) with EC readings up to 1,800 µS/cm, then Pooncarie which reached 620 µS/cm, followed by Burtundy at 2,000 µS/cm (MDBA 2021). However, salinity levels from grab samples at Pooncarie showed a peak salinity of 2,600 µS/cm. Burtundy also recorded higher readings from grab samples peaking at 3,949 µS/cm on 31 March 2020, which then reduced to 247 µS/cm on 14 April 2020 (DPIE 2020e). Salinity levels in data logger recordings are lower because the peak salinity flows moved past the logger site between the recording time intervals (that is, between 3-hourly readings). The location of the loggers was thought to miss the highest salinity concentrations areas which were captured in the grab samples. The grab sample readings are often higher because water monitoring staff were able collect the sample at sites during the expected peak salinity flows.

The elevated salinity flow front in the lower Darling River was immediately followed by fresher flows, which diluted salinity to fresher water levels of less than 300 µS/cm within 24 hours (DPIE 2021 and MDBA 2021).

In comparison to the lower Darling, the River Murray salinity levels in Figure 1 show reduced concentrations downstream of the Wentworth Weir. Elevated salinity flows from the Darling River junction quickly ameliorated due to the flows in the River Murray of 8,000 ML/day. This reduced the salinity levels in the Wentworth Weir Pool to 112 µS/cm within 48 hours (DPIE 2021 and MDBA 2021).

The already reduced salinity levels in the flow front in the River Murray were further diluted as flows progressed downstream. This is shown in Figure 1, with mixing at the Lake Victoria inlet resulting in peak EC readings of 135 µS/cm on 26 April 2020, and in the River Murray channel with Lock 9, Lock 8 and Lock 7 peak EC readings of 165 µS/cm, 160 µS/cm and 155 µS/cm, respectively.

The salinity levels in the River Murray at the South Australian border peaked at 300 µS/cm in mid-May 2020 and remained below the Basin Plan flow management target for Lock 6 (<580 µS/cm), peaking at 231 µS/cm on 25 May 2020 (gauge A4260510).




Source: MDBA River Operations (2021)

Figure 1 Salinity levels (readings as Electrical Conductivity) and Murray–Darling River water levels (metres with respect to Australian Height Datum) during the elevated salinity event in 2020.

## Comparison between the 2016 and 2020 elevated salinity event conditions

Prior to 2020, lower Darling recommencement to flow events that resulted in salinity slugs occurred in 2004, 2009 and 2016. Lessons learnt from these previous elevated salinity events, particularly the 2016 event, helped inform the planning of actions and the adaptive management responses made during the 2020 event (MDBA 2021).

During the discussion forum, the importance of understanding the preceding river conditions was emphasised. The varied nature of the first flush flows and nature of the scenario in the receiving waters are different from year to year was also highlighted. It is important to realise these are dependent factors controlling the scale, duration, and magnitude of a forecast elevated salinity event. It is crucial that these issues are considered when forecasting the potential for an elevated salinity event and planning the required adaptive management actions.

The river operations management actions can be adapted to future elevated salinity events to minimise salinity impacts in waterways. This is particularly important for managing the cumulative salinity effect in the River Murray and for the downstream Basin Plan salinity targets in South Australia.

Figure 3 show the varied flow conditions of the Darling River system and inflows to the Menindee Lakes during the 2020 and 2016 elevated salinity events (WaterNSW 2021). These summarised data were used to inform river managers in the adaptive management decision-making process during the 2020 elevated salinity event (WaterNSW 2021).

The 2020 elevated salinity flow front in the Darling River was likened to a 'wall' of fast flowing water (flow rate of 10 kilometres per day), generated from drought-relieving rainfall that pushed through the Wentworth Weir Pool over a period of nine days. The 2016 event, however, was likened to a 'slug' of slow-moving water (flow rate of 2–3 kilometres per day) which took 52 days to pass through the Wentworth Weir Pool as the denser, more saline water sat on the riverbed (DPIE 2021).

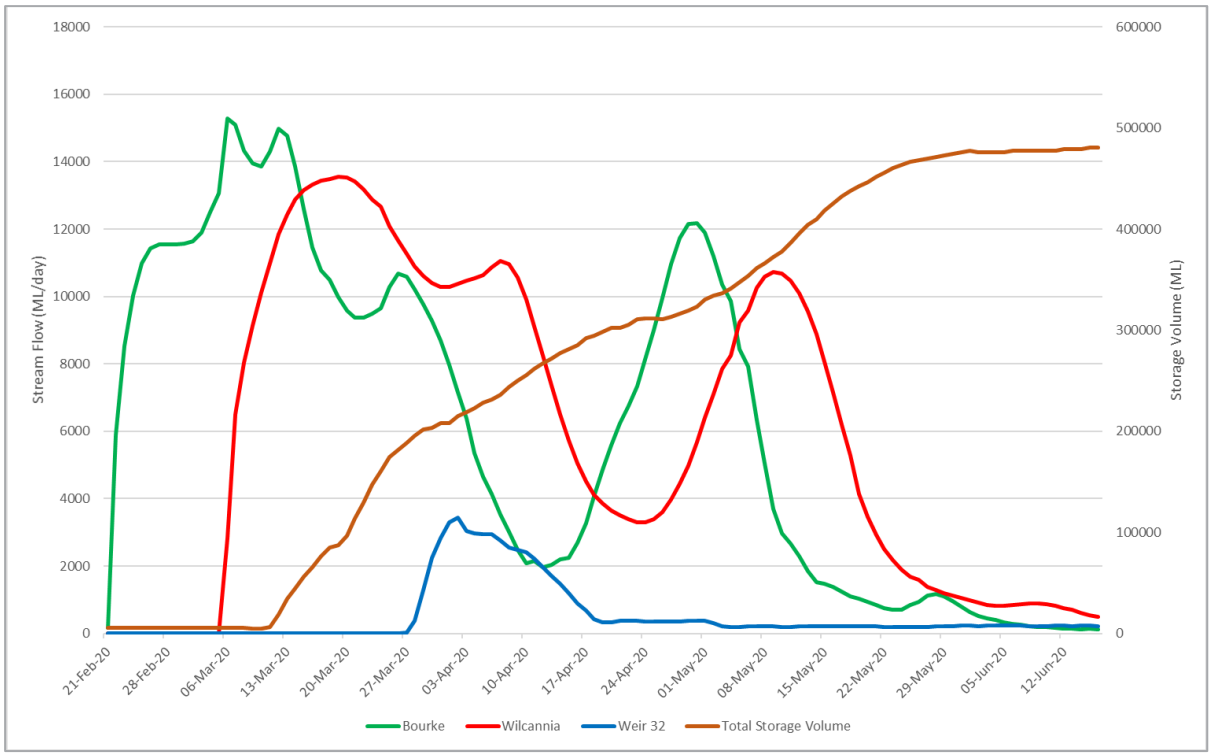
The 2020 elevated salinity event was centrally coordinated by the Lower Darling Critical Water Advisory Panel (CWAP), which was as a single point of truth and channel for clear communication and updates and proved to be an effective management approach. This was an improvement from the 2016 event management, which did not have a centralised working group (DPIE 2021). Further details regarding management of the event are provided in the Effectiveness of mitigation and management responses section.

Table 1 Comparison of water quality and river flow factors during the 2020 and 2016 evelated salinity events (DPIE 2021 and MDBA 2021).

| Factors | 2020 | 2016 |
|---|---|---|
| **Lake Wetherell EC prior to release** | < 200 µS/cm | ~ 1,000 µS/cm |
| **Weir 32 EC prior to the release** | ~ 1,600 µS/cm | ~ 2,000 µS/cm |
| **Burtundy EC prior to the release** | ~ 3,900 µS/cm | ~ 1,500 µS/cm |
| **Release design** | Up to 3,000 ML/day for seven days and taper back to 300 ML/day | Up to 1,500 ML/day for five days, taper back to 150 ML/day |
| **Saline pulse at Burtundy** | EC peaked at 3,900 µS/cm and dropped below 400 µS/cm within 24 hours. | EC peaked at 3,600 µS/cm and remained above 1,000 µS/cm for three weeks. |
| **Progression of saline pulse through Wentworth Weir Pool** | Reached top of weir pool on 13 April. Progressed at about 10 km/day. Dispersed into the River Murray on 22 April, for nine days at 10 km/day. | Reached top of weir pool on 22 August. Progressed at 2 to 3 km/day. Dispersed into the River Murray on 13 October, ongoing for 52 days at 2-3 km/day. |
| **Flow in the River Murray** | 8,000 ML/day[1] | Above 30,000 ML/day |
| **Coordination and communications** | Planning, monitoring, reporting and evaluation was coordinated through the CWAP. Clearer communications through regular updates and fact sheets on website[2]. Single point of truth. | No centralised, formal coordination of agencies or information. Regular water quality updates distributed to lower Darling water users and agencies. Not available on website. |

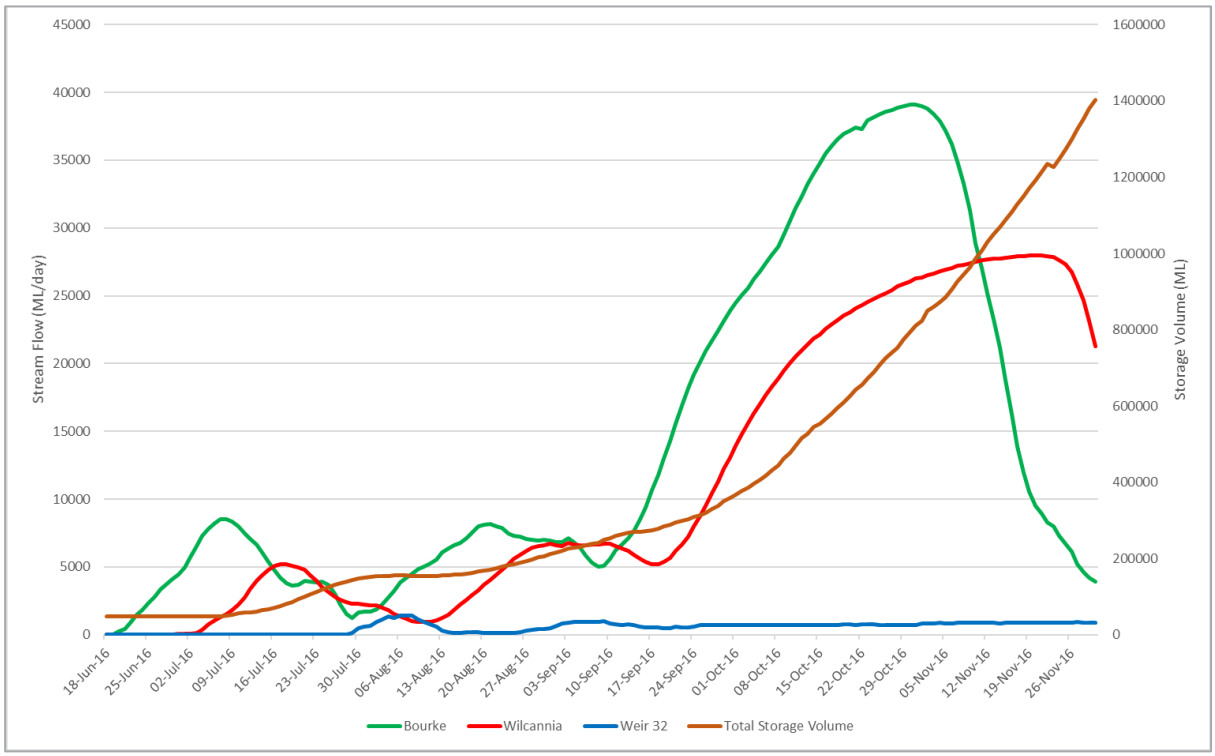
Table note: Electrical conductivity (EC) readings, distance and flow volumes in this table have been rounded to the nearest hundred for presentation purposes during the 2020 Elevated Salinity Event Discussion Forum; actual EC readings in raw data sets are availible to single units.

Source: DPIE (2021) table from Discussion Forum presentation, adapted with [1]MDBA (2021) River Operations presentation information. [2]DPIE (2020b and 2020c) updates and fact sheets on website.




Source: WaterNSW (2021).

Figure 2 Darling River stream inflow and storage volume from February to June 2020.




Source: WaterNSW (2021).

Figure 3 Darling River stream inflow and storage volume from June to November 2016.

# Impacts on the environment and water users

The elevated salinity event from the lower Darling River first flush in March–April 2020 had negligible impacts on salinity levels in the River Murray downstream of the confluence at Wentworth. Salinity levels at Lock 6 in South Australia peaked at 231 EC on 25 May 2020 (A4260510), which is well below the Basin Plan flow management target level of 580 EC (MDBA 2020a, MDBA 2021).

Impact to water users, such as irrigators and basic rights (stock and domestic) was minimal because the timing of the event was at the end of the irrigation season, after the critical period for budburst and melon seedling germination (WaterNSW 2021).

Potential environmental impacts were also minimised by managing the first flush event to avoid fish deaths. Maintaining adequate dissolved oxygen levels was a primary focus given the fish deaths of the previous summer. The relatively fast-moving first flush through the lower Darling River, followed by dilution of subsequent flows, reduced the likelihood of salinity impacts to the environment (WaterNSW 2021 and DPIE 2021).

# Effectiveness of mitigation and management responses

After a long period of record drought conditions in the northern Basin, river managers from NSW government agencies and the MDBA expected water quality issues, particularly high salinity levels and low dissolved oxygen concentrations, with the forecast recommencement of lower Darling River flows in March–April 2020. River managers drew from the learnings of previous restart events in 2004, 2009 and especially 2016 and the water quality response in the lower Darling and River Murrays. In preparation, NSW government agencies initiated jurisdictional working groups, community consultations, monitoring efforts, and release of regular communiques on the government websites (WaterNSW 2021, DPIE 2021 and MDBA 2021).

As a result, the lower Darling River elevated salinity event for 2020 resulted in a significantly reduced salt slug passing through the River Murray into South Australia (MDBA 2021). This section describes the steps taken to achieve the management responses and effective outcomes.

## Jurisdictional adaptive management

River managers identified the restart event as the drought-relieving rain fell across the northern Basin. This triggered NSW government agencies and the MDBA to work closely together to plan for the flow timing, flow volumes, and potential water quality issues with the anticipated restart of flows from the Darling to the River Murray. This early action allowed river managers sufficient time to monitor flows as they tracked from the upper Darling River towards the Menindee Lakes, as well as to plan for the start of associated water releases into the lower Darling River for recommencing flows to the River Murray (DPIE 2021 and MDBA 2021).

**Lower Darling Critical Water Advisory Panel**

The lower Darling River restart was coordinated by the Lower Darling Critical Water Advisory Panel (CWAP), chaired by NSW DPIE-Water. The CWAP comprised multiple NSW agencies, including WaterNSW and Wentworth Council, with weekly meetings held from 13 March to 24 April 2021, and a final wrap-up meeting on 21 July 2021. The framework approach of the Critical Water Advisory Panels had been adopted state-wide as a process to manage extreme water quality events and, where feasible, to implement responses (DPIE, 2021).

Key outcomes from CWAP for the lower Darling River restart preparations included (DPIE, 2021):

- coordinated water quality monitoring effort and data sharing between agencies and Wentworth Council;
- communiques from meetings published on DPIE-Water website at Critical Water Advisory Panels - Water in New South Wales (nsw.gov.au) (DPIE, 2020d);
- water quality and lower Darling release fact sheets and updates published on DPIE-Water website at Menindee Lakes/Lower Darling River - Water in New South Wales (nsw.gov.au) (DPIE 2020b and 2020c); and

- WaterNSW conducted weekly meetings with the Lower Darling River Operations Stakeholder Consultation Committees (ROSCCo) to keep lower Darling landholders informed of the release, its progress and management.

**River Operations**

In planning for the re-connection of flows from the Darling to the Murray, the MDBA, in conjunction with WaterNSW and with the support of the interjurisdictional Water Liaison Working Group, commenced early consultation and planning for a partial lowering of the Wentworth Weir pool. This action was aimed at helping to support the management of potential water quality impacts associated with the arrival of lower Darling River flows into the Darling arm of the Wentworth Weir pool. Partial drawdown of the Wentworth Weir pool had assisted in moving slugs of higher salinity water arriving from the lower Darling into the Murray during previous re-connection events, resulting in more effective dilution and movement downstream (MDBA 2020a and 2021).

The key adaptive management actions from the interjurisdictional river operations included (MDBA 2021):

- the Darling River at Burtundy was identified as the trigger location for elevated salinity spike mitigation actions to commence;
- WaterNSW pulsed initial releases from Weir 32 to push lower quality water out of the lower Darling to the River Murray;
- drawdown of the Wentworth Weir pool up to 0.3 m, to help draw out poorer quality water from the Darling River junction of the Wentworth Weir Pool;
- targeted flows in the River Murray of 8,000 ML/day at Wentworth Weir, including timing the drawdown of Euston Weir (from 0.2 m above full supply level, down to full supply level), to enhance mixing of the lower Darling first flush elevated salinity flows with the River Murray and pushing the elevated salinity flow front downstream; and
- continuous sampling in the reach downstream of Wentworth Weir and upstream of Lock 9 to anticipate the timing and peak of salinity flow front, to make management decisions for dilution mixing at Lake Victoria.

Lake Victoria was identified as a strategic holding basin of fresh water which could be used to mix with River Murray inflows if needed (with potential elevated salinity levels), with reduced lake outflows, thereby intercepting and diluting elevated salinity flows. The planned mixing ratio of River Murray to Lake Victoria waters was approximately 50:50, however, the elevated salinity front had diluted and dissipated by the time it reached the lake inlet, so this mixing option was not required.

Another mixing option identified was to reduce the River Murray flow to South Australia, by holding the water in Lake Victoria for longer to enhance mixing for a few extra days. Flows would then be pulsed back out to South Australia to meet the monthly entitlement. As mentioned above, because the elevated salinity front had diluted and dissipated, enhanced mixing was not required.

Another mixing option was identified at Lock 7, which was actioned for the 2020 elevated salinity event. Lock 7, which was initially below full supply level by 0.5 metres, was raised towards full prior to the Darling River flows reaching the River Murray. The Lock 7 weir pool could then be released as

higher salinity water passed the lock, to provide additional dilution and enhancing flows to the South Australian border (MDBA, 2021).

## Responsive management of salt interception schemes

Responsive management of salt interception schemes (SIS) enabled operations to be temporarily ramped up at select schemes. Further details are provided in the following section.

To assist mitigating the salinity impacts forecast from the recommencement of flows in the lower Darling River in 2020, SIS operators from the State Constructing Authorities and MDBA Asset Managers convened an out-of-session review of the levels of SIS operations, in addition to the regular quarterly SIS Operators Forum meetings.

As an outcome of the out-of-session review, in April 2020, operations at Murtho SIS were increased from low-level responsive management to full capacity. SIS bores at Mildura-Merbein, which had been turned off for operation and maintenance reasons, were temporarily restarted to help reduce the peak saline water inflows at Wentworth.

However, the anticipated salinity impacts from the Darling River inflows did not come to fruition in the River Murray. As such, in June 2020, operations at Murtho SIS were reduced back to typical responsive management levels while other schemes were maintained at the same level of operations as in previous quarters (MDBA 2020b).

While it is recognised that SIS schemes are a long-term salinity management solution, they can still provide limited short-term salinity benefits to the River Murray. In this instance, it was estimated that these changed SIS operations provided an approximate 10-15 EC benefit to the River Murray at Morgan in South Australia. It is worth bearing in mind that only some schemes or SIS bores can be considered for short-term salinity benefits given the varying range of in-river salt load response times of SIS bores within and across schemes (e.g. days – weeks to months – years).

## Community engagement

WaterNSW and DPIE monitored salinity and provided timely information to stakeholders about salinity levels, locations and the movement of the saline water. This provided valuable information to authorities and water users and helped with decision-making on the management of the elevated salinity event (WaterNSW 2021 and DPIE 2021).

Early consultation with the local community and houseboat owners was undertaken in preparation for the Wentworth Weir Pool drawdown to plan for access to houseboats if required (MDBA 2021).

Communities were kept updated about the changing water level in the Wentworth Weir Pool through media releases, MDBA weekly reports and local agencies directly communicating with affected parties (MDBA 2021). Weekly communiques were also published by CWAP via the DPIE-Water website (DPIE 2020d).

# Outcomes and key lessons from the review of elevated salinity event

In 2020, larger volumes of fresh inflows into Menindee Lakes provided more opportunities for water management compared to the previous event in 2016. On previous occasions, recommencement of flow in the lower Darling River had involved the release of smaller volumes of water compared to the releases of 2020. However, previous experience had shown that a slow release, particularly in the heat of summer, can result in anoxic conditions lethal to fish. On this occasion, a peak flow of 3,000 ML/day successfully mixed, diluted, and flushed high salt loads and low dissolved oxygen waters in remnant pools, resulting in improved outcomes for fish health. The higher volume of fast flowing fresh water used to push and dilute the elevated salinity flows proved to be an effective measure in managing the elevated salinity event, with minimal impacts.

As with the 2016 elevated salinity event, the Basin Plan salinity target for managing water flows at Burtundy was not the priority consideration during the 2020 restart of the lower Darling River.as The highest priority was to ensure dissolved oxygen levels were maintained at non-lethal levels for in-stream ecosystems to mitigate environmental risks. Nonetheless, Burtundy salinity levels were identified as a trigger location for downstream mitigation actions to commence and drawing down the Wentworth Weir Pool (DPIE 2021 and MDBA 2021).

Key improvements from previous events were the clear coordination and communication, inter-agency collaboration, sharing of data and visibility of information. These were crucial to informing and communicating management decisions. The new, centralised working group (lower Darling CWAP), provided a central, coordinated forum for the planning, monitoring, reporting and evaluation of the lower Darling releases. This helped define roles and responsibilities of agencies and provided regular communiques as a single point of truth for sharing information.

Adaptive management, with a sliding scale of mitigation strategies within the Darling River, River Murray, Lake Victoria and weir pools, proved to be an effective approach in the mitigation and management responses of worst-case elevated salinity event scenarios.

## Proposed changes to policy and documented practice

The response to elevated salinity event of March–April 2020 in the lower Darling River was well planned, managed and coordinated by the government agencies involved. Information was shared between agencies and decisions and river conditions were clearly communicated with stakeholders.

It is clear that the lessons learnt from previous events, especially the 2016 event, have been successfully applied in managing the 2020 event. The approach that was taken for the 2020 lower Darling elevated salinity event represents best practice. Consistent with the findings of the *2020 Northern Basin First Flush Event* (Craik and Claydon, 2020), these arrangements will be captured and embedded in the framework for managing drought in the lower Darling River.

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**Office locations** – *First Nations Country*
**Adelaide** – *Kaurna*
**Canberra** – *Ngunnawal*
**Goondiwindi** – *Bigambul*
**Griffith** – *Wiradjuri*
**Mildura** – *Latji Latji*
**Murray Bridge** – *Ngarrindjeri*
**Toowoomba** – *Jarowair and Wakka Wakka*
**Wodonga** – *Dhudhuroa*

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