Lower Darling release—water quality monitoring

A summary of key learnings from the 2020 resumption of flow to the lower Darling River

In March 2020, we saw the first significant flows of water along the full length of the Barwon-Darling from Mungindi, on the Queensland border, into the Menindee Lakes and downstream to Wentworth. Thousands of kilometres of rivers flowed for the first time in many months. The NSW Government monitored the water quality of the lakes and river system during the adaptive management of releases from the Menindee Lakes. Poor quality water was flushed from the remnant pools along the Darling River, with no associated fish deaths reported as the water flowed down to Wentworth.

Key findings

- The large inflow of water to Menindee Lakes that started arriving on 10 March 2020, provided opportunities for the government to adaptively manage the release of water into the lower Darling River.
- The pulsed release of 3,000 megalitres per day from Menindee Lakes flushed and diluted poor-quality water from isolated remnant pools along the Darling River.
- A smaller salt load (compared to 2016) entered the Darling River arm of the Lock 10 Weir pool. Lowering of Lock 10 and lower flows in the Murray River assisted the progression of the head of the flow through the weir pool.
- Cooler temperatures further reduced the risks of fish deaths.
- Government planning and evaluation is critical in assessing and managing risks. This release was made possible through the effective coordination of multiple agencies of government.
- Effective monitoring to ensure a good understanding of water quality throughout the water column, prior to and during the release, is critical for adaptive management.

Arrival of inflow to Lake Wetherell

The first flows from widespread rainfall over northwest NSW and southern Queensland during January/February 2020 arrived at Menindee Lakes (Lake Wetherell) on 10 March 2020. Initial flows were of poor quality, with high turbidity and salt load. Low dissolved oxygen resulted in a fish death event of mostly Bony Bream around 12 March 2020 in Lake Wetherell. Some of the poor-quality water flowed into Lake Tandure, reducing the impact on the pools closer to the weir. Subsequent flows behind the initial front were of better quality and assisted with dilution and mixing in Lake Wetherell.

As Lake Wetherell filled, sticks, leaves and dead grass were mobilised by the water and formed a raft of debris close to the main weir. There was a high risk that the breakdown of this large volume of organic material could cause a drop in dissolved oxygen levels. As large flows were continuing to enter Lake Wetherell, the regulator to Lake Pamamaroo (which was dry) was opened, diverting the debris away from the main weir.

Releasing flows from Menindee Lakes to the lower Darling

The aim of the initial pulsed release from Lake Wetherell was to provide a dilution and flushing action to move contaminated water down the Darling River. This 'first flush' was to be followed by lower flows to maintain connectivity with the Murray River.

Research has shown that a volume of 3,000 megalitres per day will flush algal blooms from pools in the lower Darling River. To reduce the risks to fish health, the design of the release included an increase in flow to peak at approximately 3,000 megalitres per day, remaining at this level for seven days, and then gradually tapering back down to about 300 megalitres per day. The release commenced on 26 March 2020, allowing time for the four block banks on the Darling River to be removed before the flow arrived.

Water quality risks

The initial release of water from Menindee Lakes into the Darling River can result in poor water quality when the preceding conditions have been dry. Resuming flow can mobilise large amounts of organic material as the head of the flow progresses downstream, causing short-term hypoxia (low dissolved oxygen). There is also a risk that restarting the river will de-stratify the remaining isolated pools, increasing the risk that low dissolved oxygen water from the bottom of pools will rise and cause fish deaths. High salt loads can also be flushed down the river, where they impact on water users in the Darling River arm of the Lock 10 weir pool at Wentworth.

Water quality monitoring in Lake Wetherell prior to the release confirmed that the initial poor-quality water at the head of the flow had been diluted by better quality water following behind. Water temperature and dissolved oxygen were consistent with depth and salinity was low. Dissolved oxygen was above the critical threshold for aquatic ecosystems (two milligrams per litre).

Water quality data collected in the Darling River downstream of Lake Wetherell showed the salinity was much higher than in Lake Wetherell. There was a slight decrease in dissolved oxygen with depth, but as the bottom waters were not hypoxic there was a low risk of fish deaths when the pools were mixed by the release.

Water is usually released from Lake Wetherell via the main outlet works. As an additional precaution to avoid the risk of releasing low dissolved oxygen water from the bottom of the lake, water was initially released from the main weir, which takes the more oxygenated water from the surface. When it was confirmed there were no emerging water quality issues, the releases then reverted to the main outlet works so that release volumes could be increased.

Water quality in the Darling River

The commencement of the larger pulsed release on 26 March 2020 increased the turbidity in the Darling River at Weir 32 to over 1,000 NTU (nephelometric turbidity units) and decreased the electrical conductivity to around 200 µS/cm (microSiemens per centimetre). Electrical conductivity is a measure of the salinity of the water. The increased flow did not cause dissolved oxygen concentrations in the pools to drop to critical levels, remaining above five milligrams per litre.

The head of the flow arrived at Pooncarie on 7 April 2020. Monitoring in the weir pool as it filled showed the water was oxygenated and would have minimal impact on downstream aquatic ecosystems as it spilled over the weir wall.

Flow arrived at Burtundy on 11 April 2020. Electrical conductivity data from the Burtundy gauging station showed that salinity was high as the head of the flow arrived. However; within 24 hours, this had decreased to less than 400 µS/cm. In 2016, electrical conductivity at Burtundy peaked at

3,600 µS/cm and remained above the 1,000 µS/cm irrigation guideline for over three weeks, resulting in a large salt load entering the Lock 10 weir pool.

Water quality monitoring showed the mixing of pools by the pulsed flow did not cause dissolved oxygen concentrations to drop below critical levels, remaining above five milligrams per litre at all sites. This continued after the initial pulse had passed. Turbidity results remained high (>1,000 NTU) and electrical conductivity low (<300 µS/cm). No fish deaths were attributed to the resumption of flows in the Darling River.

Under the Murray Darling Basin Plan, an agency of a Basin state must have regard to water quality targets when managing water flows (Basin Plan s9.14). The targets are to maintain dissolved oxygen at a value of at least 50% saturation (approximately five milligrams per litre), meet recreation water quality targets for blue green algae, and keep levels of salinity in the Darling River at Burtundy under 830 µS/cm for 95% of the time. The release of water from Lake Wetherell was carefully managed to ensure that these targets were met.

Water quality in the Wentworth Weir pool

The head of the flow commenced flowing into the upper reaches of the Darling River arm of the Lock 10 weir pool on 13 April 2020, reconnecting the Darling and Murray rivers. Water quality monitoring showed the turbid water from the Darling River had reached the 28-kilometre point upstream of the Murray/Darling river junction on the 17 April 2020 and progressed to 6 kilometres from the junction on 20 April.

The electrical conductivity at the head of the flow slowly decreased due to dilution from the less saline water in the weir pool. The flow progressed through the weir pool much quicker during this release (over 10 kilometres per day) than in 2016. In 2016, the highly saline water progressed downstream at approximately two kilometres per day.

Electrical conductivity at the Darling River at Wentworth gauging station (three kilometres upstream of the junction) increased from 130 µS/cm on the morning of 20 April to a peak of 600 µS/cm early on 21 April. By 22 April, the electrical conductivity had decreased to less than 300 µS/cm. The less saline water in the Murray River quickly diluted the salts entering from the Darling River, reducing impacts to Murray River water users downstream. In 2016 it took about 28 days for the highly saline water to completely merge into the Murray River.

The Wentworth weir pool was well mixed, with minimal variation from the surface to the bottom. There was no evidence of denser, highly saline water sitting on the bottom of the channel, as occurred in 2016. There were slightly lower dissolved oxygen readings at the head of the flow in front of the highly turbid water, possibly due to the breakdown of organic matter picked up by the flow as it progressed down the Darling River. Lower water temperatures at this time of the year further reduced the risks to fish health. There were no reports of fish deaths associated with the release arriving in the Wentworth weir pool.

Comparison of salt loads during the 2016 and 2020 resumption-of-flow events

The difference in salt loads between the 2016 and 2020 resumption-of-flow events is due to a combination of factors. In both 2016 and 2020, the remnant pools in the Darling River were highly saline prior to the release, though the preceding weather conditions were drier in 2020. In 2016, the electrical conductivity of the water in Lake Wetherell at the commencement of the release was approximately 1,000 µS/cm. In 2020, the electrical conductivity of the water being released was less than 200 µS/cm. In addition to the release water being of better quality, the 2020 release had

a larger peak flow rate (3,000 megalitres per day) compared to the 2016 release (1,500 megalitres per day).

The larger volume of better-quality water released in 2020 flushed the saline water from the remnant pools and diluted any saline shallow groundwater inputs. The outcome was a significantly smaller salt load being flushed into the Lock 10 weir pool. In addition, in 2020 the water level in Lock 10 was lowered to facilitate quicker progression of the head of the flow through the weir pool. This was not an option in 2016 as the flow in the Murray River at the time was over 30,000 megalitres per day.

The larger inflow of better-quality water to Menindee Lakes in 2020 provided more opportunities for water management than was the case in 2016. For future resumption-of-flow events, the option to hold off releases from Lake Wetherell until the quality of the water in the lake is suitable should be considered as part of a risk assessment to minimise water quality issues in the lower Darling.

Further information

Water quality updates and lower Darling resumption-of-flow fact sheets can be found on the Menindee Lakes/Lower Darling River pages of the Department of Planning, Industry and Environment's website. Go to www.industry.nsw.gov.au/water and search for 'menindee lakes lower darling river'.