Lower Darling River – water quality and flow release update

Following the mass fish deaths in the Darling River at Menindee in March 2023 multiple agencies are continuing to monitor water quality conditions in this area to identify potential risks to ecological communities, implement mitigating measures and minimise the risk of further fish death events. This update provides a summary of information and operational measures up to 22 December 2023.

Operational releases from Menindee Lakes by the Murray Darling Basin Authority were resumed on 23 November. There is 1,100 megalitres (ML)/day being released in total, with 1,000 ML/day coming from Lake Menindee and 100 ML/day from Lake Pamamaroo. There is a small increase in flow coming down the Barwon and Darling rivers from earlier rainfall in the Northern Basin which will provide additional inflow to the upper Menindee Lakes.

The pulsed release of 1,000 ML/day from Lake Pamamaroo at the end of last week resulted in the breakdown of thermal stratification and mixing of dissolved oxygen through the water column on the morning of 14 December. Due to lower air temperatures this week, the return to lower discharge from Lake Pamamaroo has not seen persistent thermal stratification develop again in the Darling River at Menindee. Stratification has been starting to develop during the day but breaking down again overnight.

Monitoring data from the WaterNSW monitoring buoy located upstream of the Darling River/Menindee Creek junction was showing that dissolved oxygen levels had been dropping to the critical threshold for fish health of 2 mg/L when mixing occurred overnight. To reduce the risk of fish deaths in this area from any further decrease in dissolved oxygen, discharge from Lake Pamamaroo was increased from 100 ML/day to 750 ML/day on 21 December. At the same time discharge from Lake Menindee was reduced from 1,000 ML/day down to 350 ML/day to maintain the Murray Darling Basin Authority's required discharge of 1,100 ML/day at Weir 32.

A flow of 750 ML/day for 7 days is enough total volume to completely replace the water in the Weir 32 weir pool (between Pamamaroo outlet and Menindee outlet) and therefore improve water quality to reduce the risk of low DO and algae. 750 ML/day is also the volume that prevents stratification from forming.

The release of a larger volume of oxygenated water from Lake Pamamaroo resulted in dissolved oxygen at safer levels for fish health when the surface and bottom waters mixed on the morning of 22 December.

There have been no fish deaths reported in the Darling River this week. To report any incidents of dead fish, fish struggling or starting to gasp at the water surface, or crayfish exiting the water, please call the NSW Department of Primary Industries Fisheries' Fishers Watch Phoneline 1800 043 536 or fill in a fish kill protocol and report form

(including a photo) at: https://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet or https://www.dpi.nsw.gov.au/fishing/compliance/report-illegal-activity using the 'dead or dying fish' check box.

Dissolved oxygen levels – Darling River at Menindee

As the surface water of the river is heated by the sun, the water at the bottom of the deeper pools is often not warmed to the same temperature. During the summer months this can result in a difference in temperature between surface and bottom waters which is known as thermal stratification. This can lead to other issues such as increased algal blooms on the surface, and nearer the riverbed, low dissolved oxygen and higher nutrient concentrations. In addition, the amount of dissolved oxygen water can hold decreases with increasing water temperature during summer.

WaterNSW undertook dissolved oxygen and water temperature profile monitoring on 19 December in the Darling River near Menindee. With the reduction in discharge, dissolved oxygen levels had started to decrease near the bottom at the two upper most profile sites (downstream Pamamaroo and upstream old weir) while water temperature was remaining consistent with depth. The most downstream site (upstream Menindee outlet) also showed oxygen depletion below 3 metres. Dissolved oxygen had not decreased below the critical fish health threshold of 2 mg/L (Figure 1). As a general guide, native fish and other large aquatic organisms require at least 2 mg/L of dissolved oxygen to survive but may begin to suffer if levels are below 4 to 5 mg/L for prolonged periods.

The water temperature results were stable with depth indicating that there was thermal mixing throughout the water column (Figure 2). The location of the five sites assessed are shown in Figure 3.

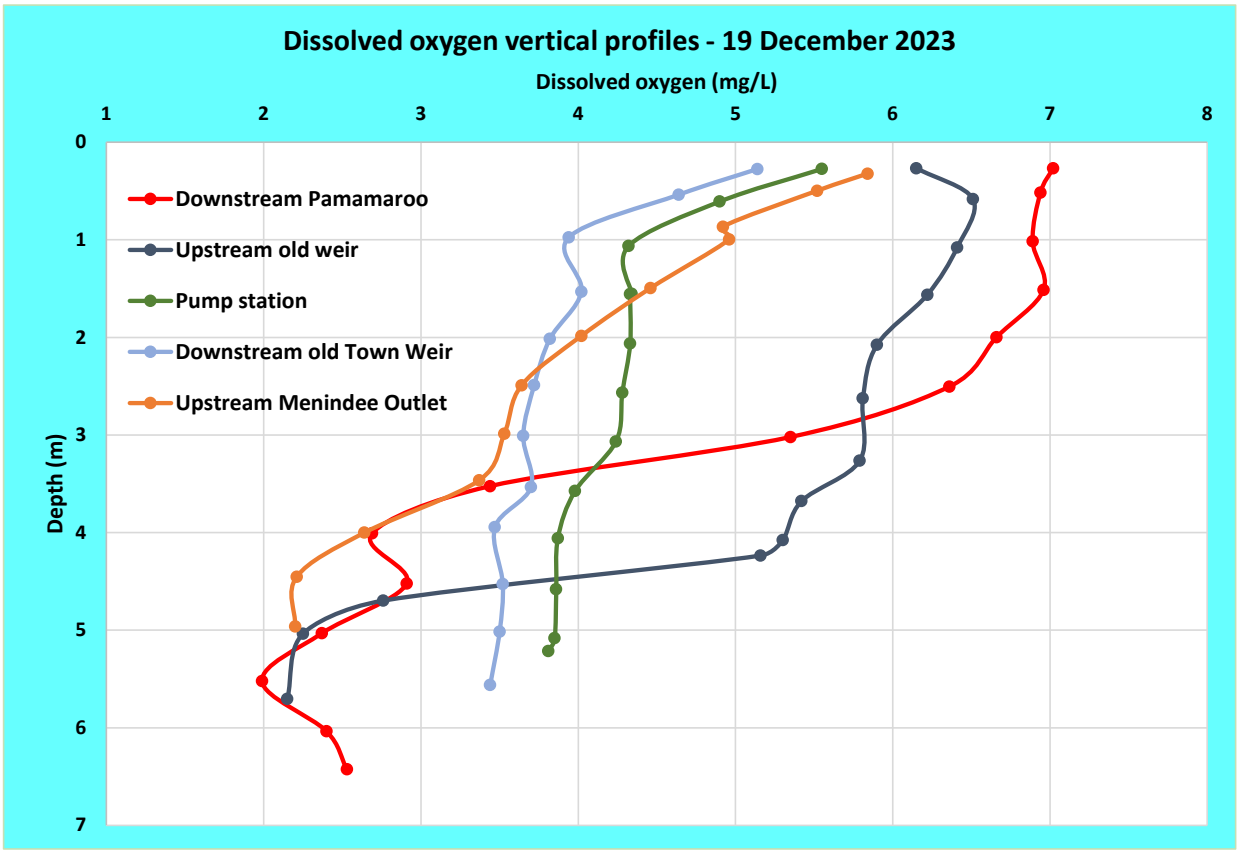

Figure 1: Dissolved oxygen (mg/L) profiles at five sites in the Darling River at Menindee: 19 December 2023

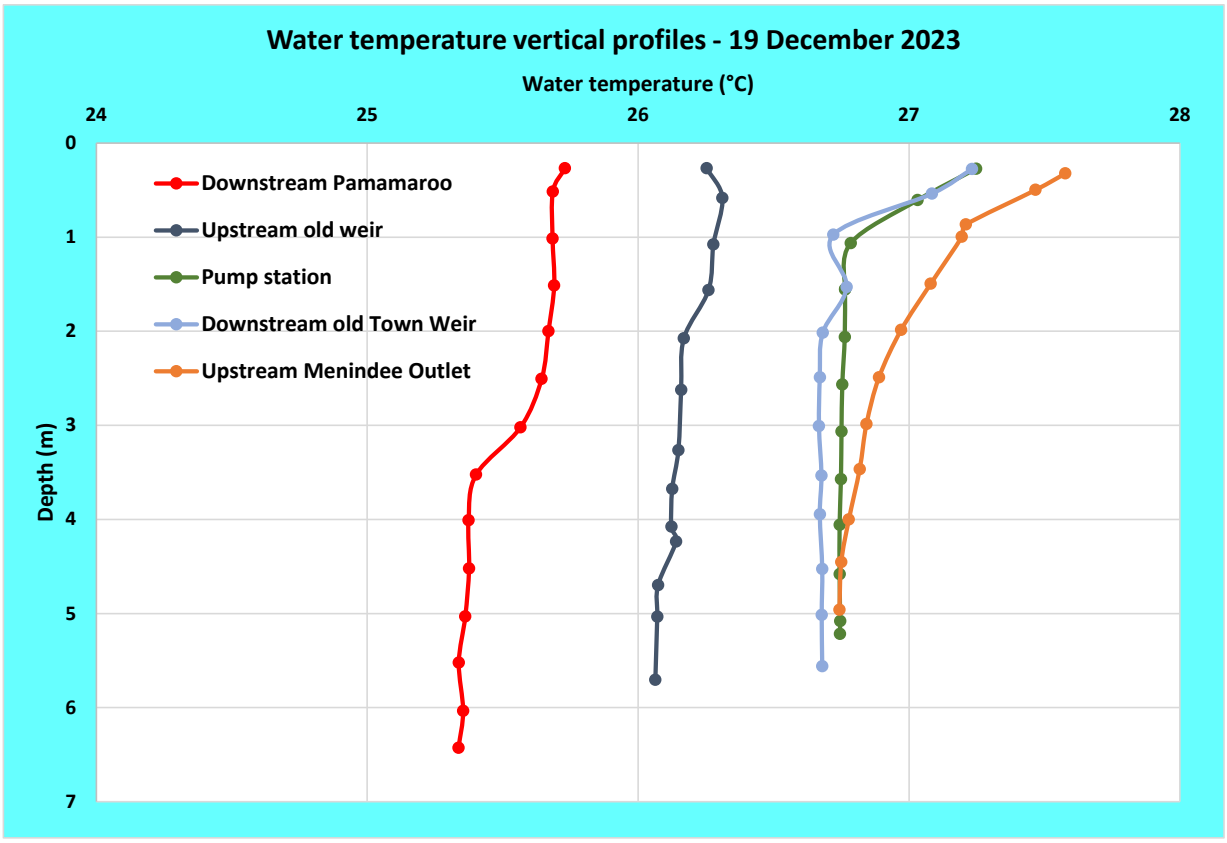

Figure 2: Water temperature (°C) profiles at five sites in the Darling River at Menindee: 19 December 2023

Figure 3: Location of vertical profile monitoring sites in the Darling River near Menindee.

Vertical profile water quality monitoring buoys

Five multi-depth monitoring buoys have recently been installed in the Menindee area. These buoys monitor water quality at specific depths down through the water column. This data can be used to indicate when stratification starts, how long it has been present and if it has broken down, allowing the mixing of dissolved oxygen. The locations of the buoys are shown in Figure 4. The sites are:

- Lake Wetherell. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River at Menindee weir pool – upper. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River upstream Menindee. Installed by WaterNSW
- Darling River at Menindee weir pool – town. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River downstream Menindee. Installed by WaterNSW.

Monitoring data from the buoys installed by the Department of Planning and Environment for the Darling-Barka flood recovery program is available online via Dashboard - Darling Barka River Health Program (tago.run). Similarly the data from the two buoys installed by WaterNSW is available on their Water Insights web page (WaterInsights - WaterNSW).

Figure 4: Locations of vertical profile water quality monitoring buoys at Menindee

Water temperature monitoring in the weir pool through Menindee township shows that stratification broke down on the morning of 14 December in response to the pulsed flow from Lake Pamamaroo. Since then, thermal stratification has continued to break down most nights with uniform water temperature through the water

column (Figure 5, Figure 6 and Figure 7). There was complete destratification at all monitoring sites on the morning of 20 December.

The forecast is for maximum air temperatures at Menindee to remain below 36°C through until later next week which will assist with continued destratification.

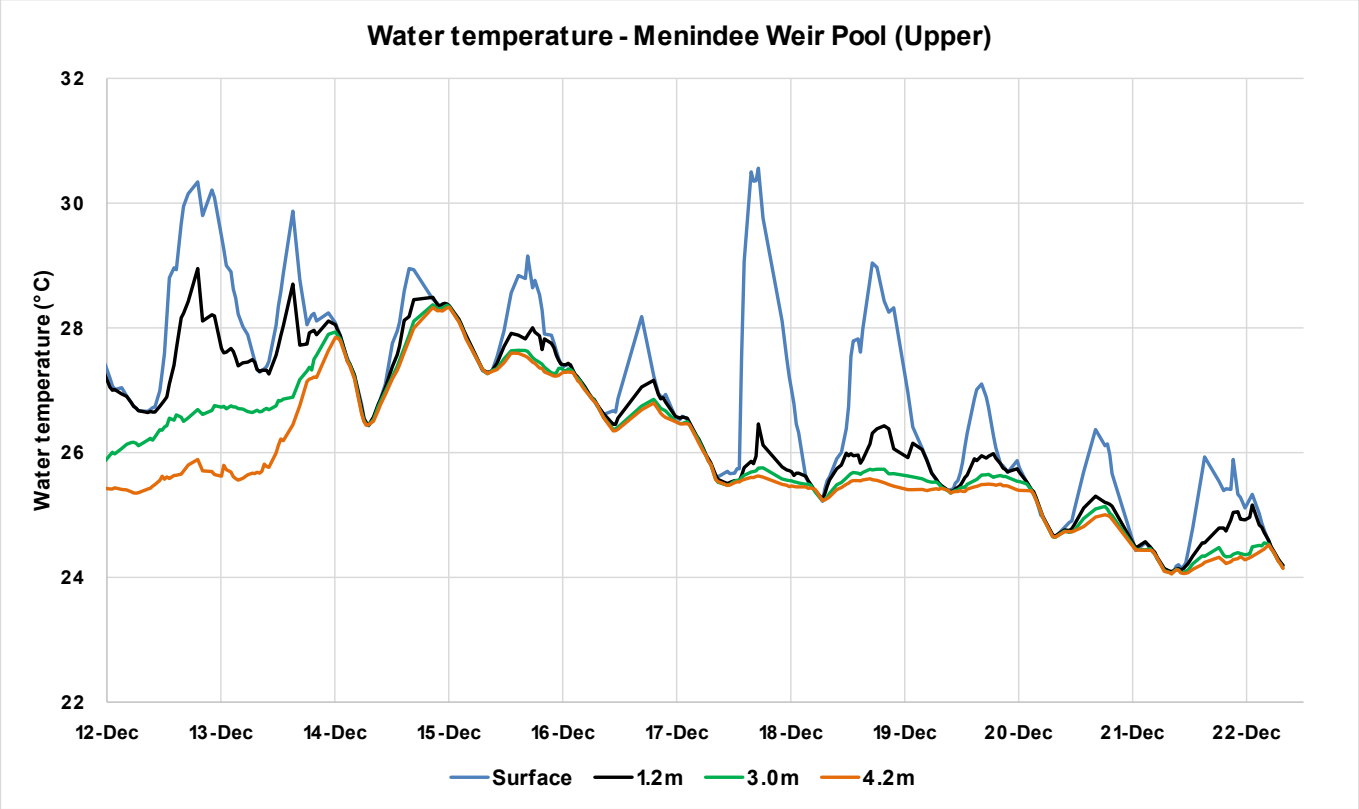

Figure 5: Water temperature (°C) continuous monitoring in the Darling River at Menindee weir pool (Upper)

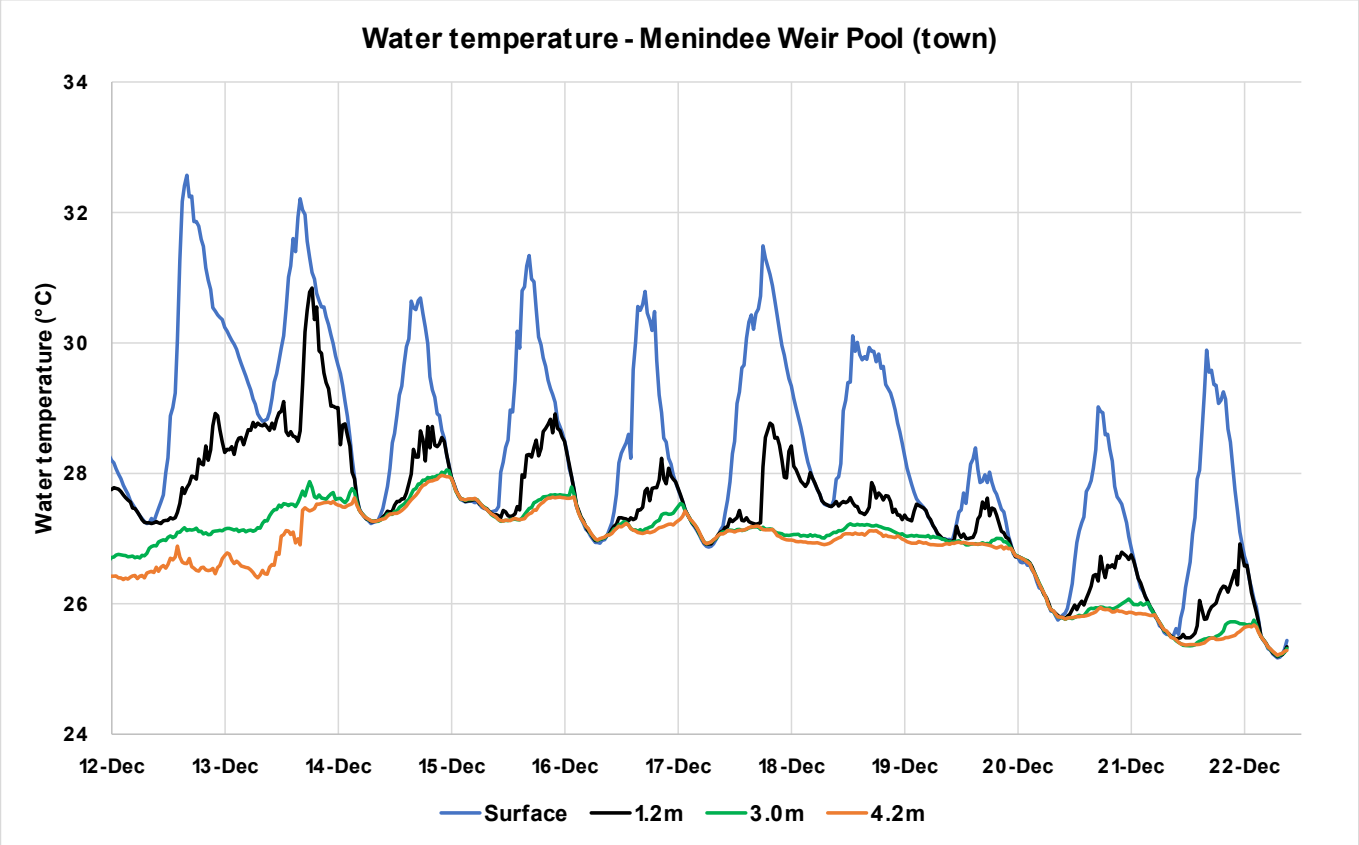

Figure 6: Water temperature (°C) continuous monitoring in the Darling River at Menindee weir pool (Town)

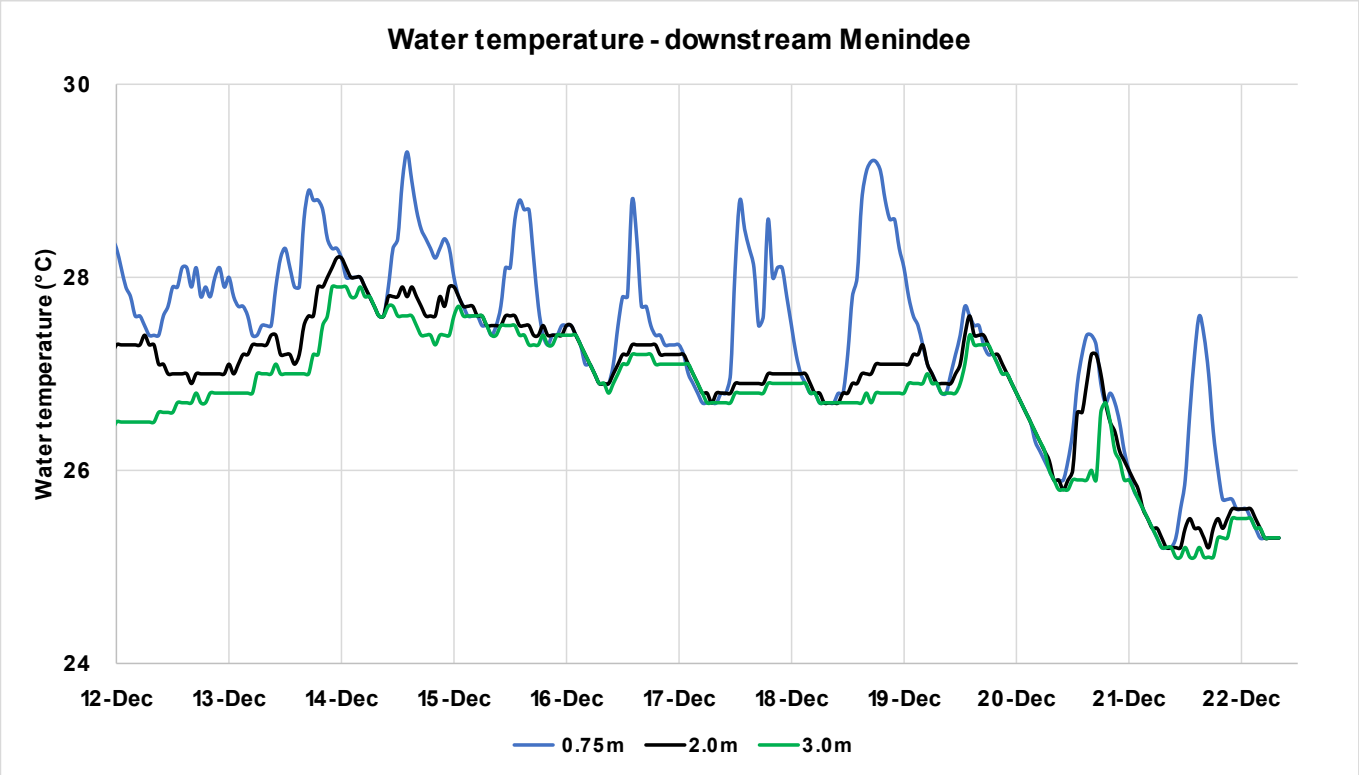

Figure 7: Water temperature (°C) continuous monitoring in the Darling River downstream of Menindee

Similar to water temperature, the dissolved oxygen results also show stratification up until 14 December. The higher discharge of oxygenated water from Lake Pamamaroo until 18 December maintained dissolved oxygen levels above the critical threshold for fish health of 2 mg/L (Figure 8, Figure 9 and Figure 10).

Since 18 December, monitoring shows dissolved oxygen was again decreasing deeper in the water column. At the monitoring buoy near Menindee town, dissolved oxygen had been dropping below the 2 mg/L critical threshold for fish health at 4.2 metres. With the arrival of cooler air temperatures, dissolved oxygen was mixed through the water column on the morning of 20 December.

Monitoring data from the WaterNSW monitoring buoy located upstream of the Darling River/Menindee Creek junction showed that the mixing of the low oxygen water from the bottom with the oxygenated water at the surface on 20 December resuted in an overall dissolved oxygen of 2.1 mg/L. Mixing on 21 December again brought the disolved oxygen down to the critical threshold for fish health of 2 mg/L. To reduce the risk of fish deaths in this area from any further decrease in dissolved oxygen during these mixing events, discharge from Lake Pamamaroo was increased on 21 December to provide a large enough volume of oxygenated water to push the low oxygen water downstream.

The dissolved oxygen following mixing on the morning of 22 December was above 4 mg/L, indicating that the change in release pattern from the two lakes was leading to improved dissolved oxygen levels.

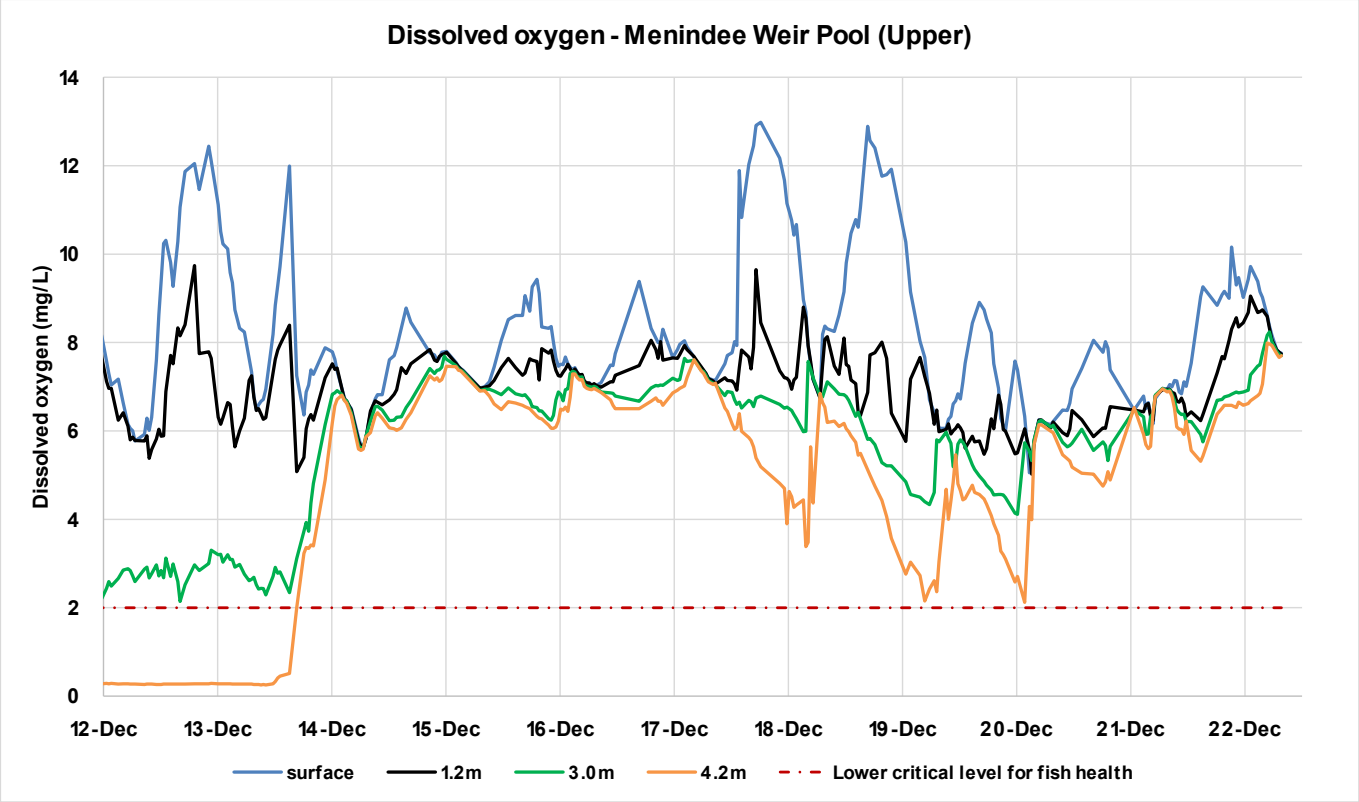

Figure 8: Dissolved oxygen (mg/L) continuous monitoring in the Darling River at Menindee weir pool (Upper)

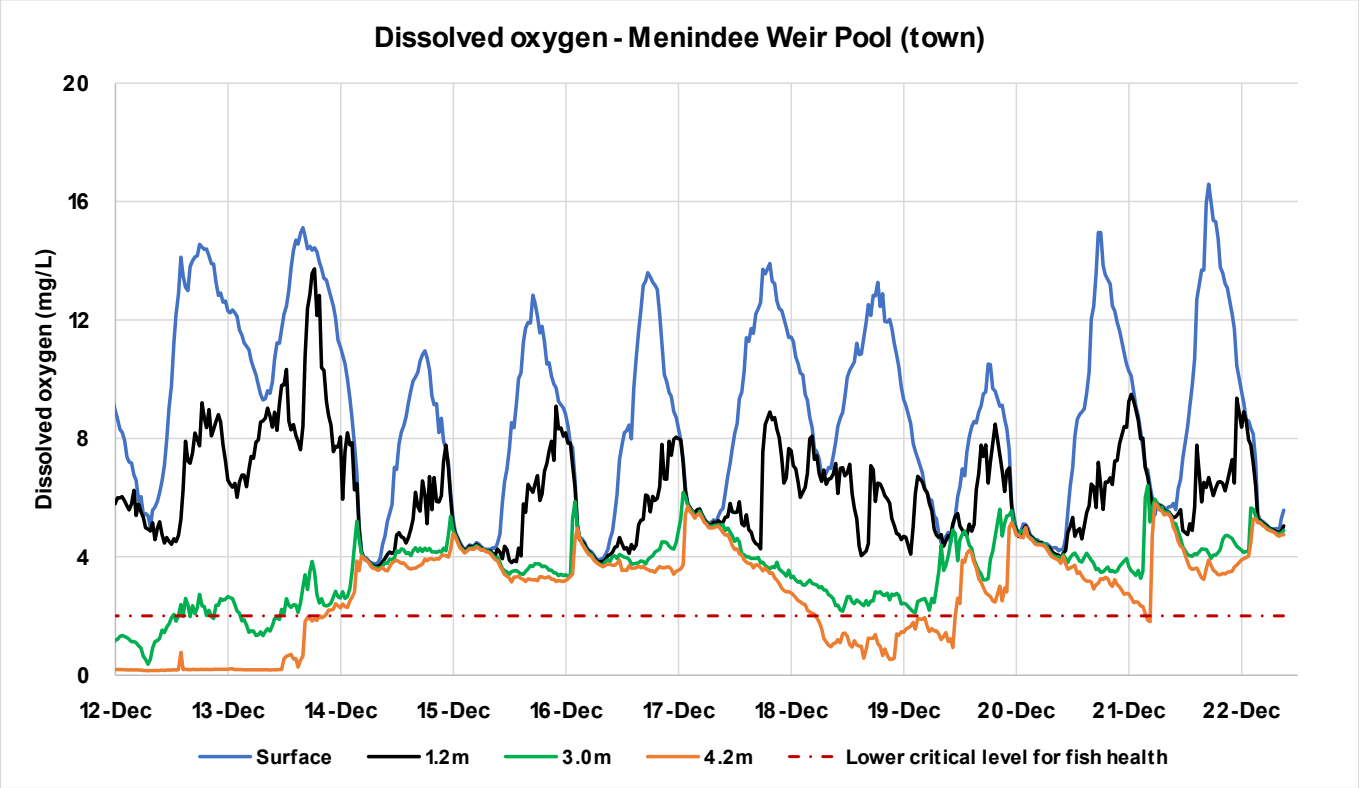

Figure 9: Dissolved oxygen (mg/L) continuous monitoring in the Darling River at Menindee weir pool (Town)

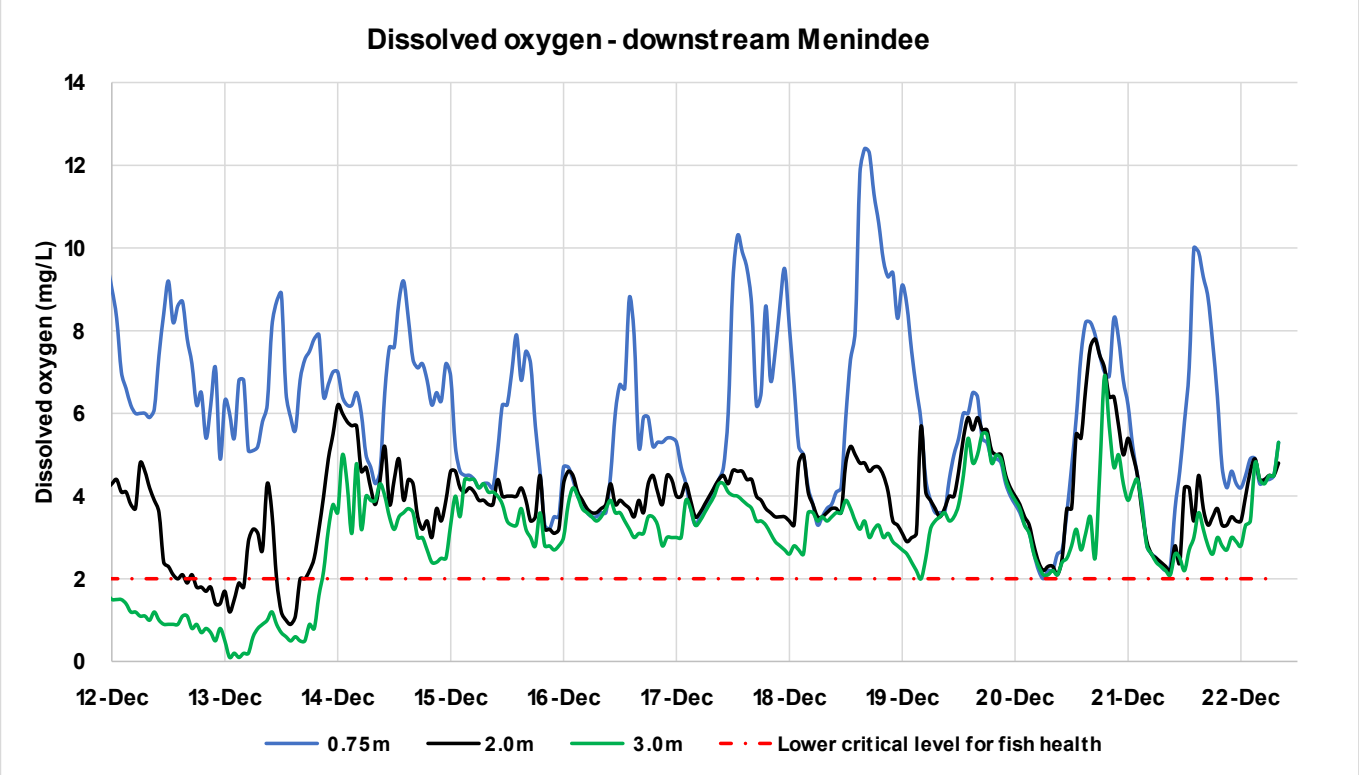

Figure 10: Dissolved oxygen (mg/L) continuous monitoring in the Darling River downstream of Menindee

Further vertical profile monitoring undertaken by WaterNSW on the morning of 22 December reinforced that dissolved oxygen was being mixed through the water column and that upon mixing of the surface and bottom waters, dissolved oxygen levels were remaining at safer levels for fish health (Figure 11).

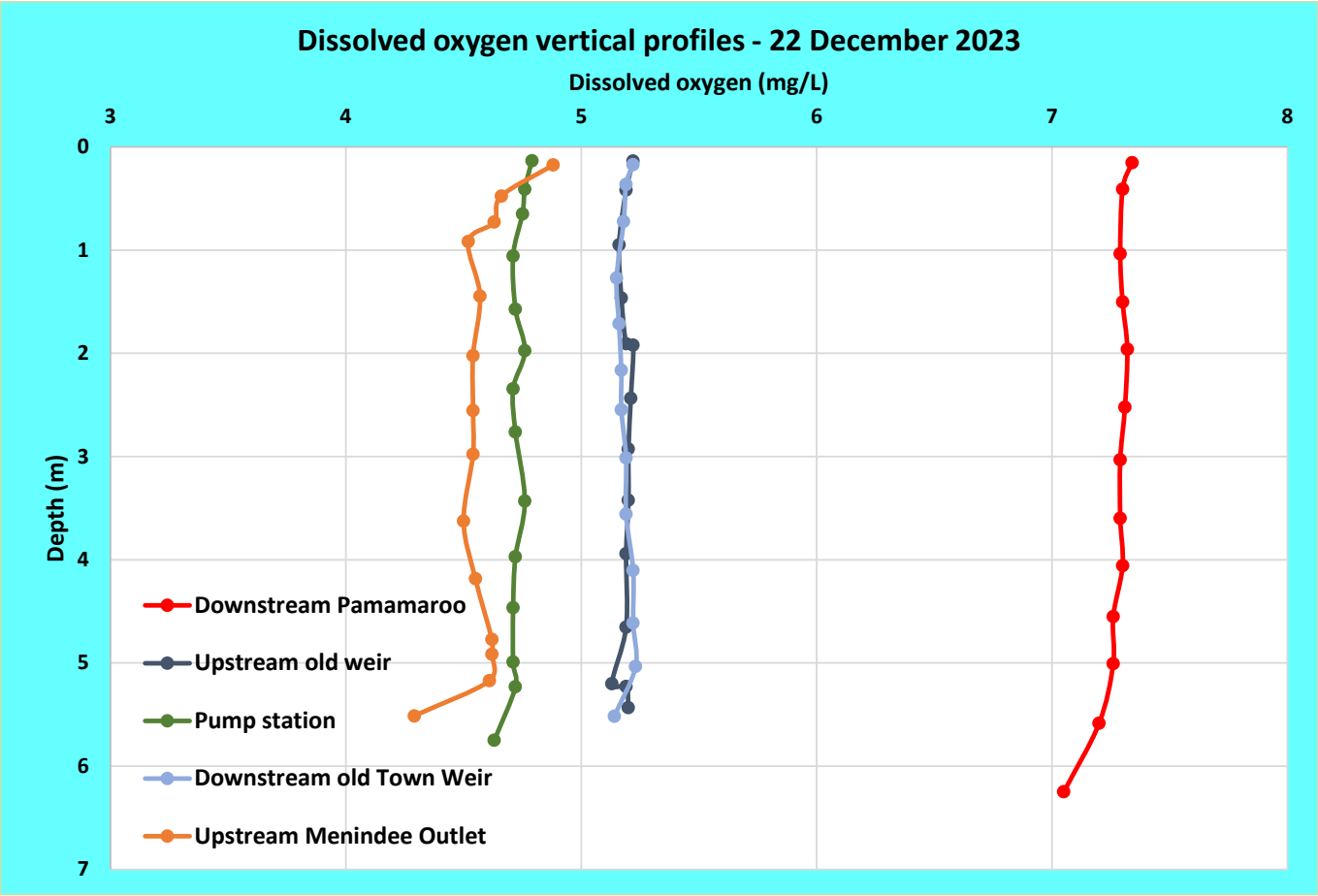

Figure 11: Dissolved oxygen (mg/L) profiles at five sites in the Darling River at Menindee: 22 December 2023

NSW and Commonwealth agencies will continue to work together and monitor dissolved oxygen levels in this area and advise the best operational measures to mitigate risks to aquatic life as much as possible. This can involve adjusting the timing, size and location of releases from the lakes into the lower Darling-Baaka River to maintain the quality of the water in the river. Releases from both Lake Pamamaroo and Lake Menindee continue to be managed to minimise the risk of further hypoxia-related fish deaths in the Darling River at Menindee.

Fish death summary

In the past week there have been no reports of native fish deaths.

Large numbers of Bony Herring and Carp remain in the reach of Darling River between Main Weir and Menindee Creek (Weir 32 weir pool). There remains a risk of further fish deaths in the Menindee area as fish (particularly Bony Herring) may be in poor condition from previous low oxygen conditions, limited food supply and may be more susceptible at reduced flow rates.

What is being done?

Flow releases into the lower Darling-Baaka

Operational releases from Menindee Lakes were resumed by the Murray Darling Basin Authority on 23 November. A pulsed flow of 1,000 ML/day was released from Lake Pamamaroo over two days commencing 13 December when monitoring showed there was a need to disrupt thermal stratification and reduce the risk to fish health from declining dissolved oxygen levels in the weir pool between the Main Weir and Menindee Creek. At the same time, to further encourage the flushing of the weir pool through Menindee township, discharge from Lake Menindee was reduced from 1,000 ML/day down to 100 ML/day.

Discharge returned to 1,000 ML/day from Lake Menindee and 100 ML/day from Lake Pamamaroo on Monday 18 December.

To reduce the risk of fish deaths due to low dissolved oxygen following mixing of the water column overnight, discharge from Lake Pamamaroo was increased from 100 ML/day to 750 ML/day on 21 December. At the same time discharge from Lake Menindee was reduced from 1,000 ML/day down to 350 ML/day to maintain the Murray Darling Basin Authority's required discharge of 1,100 ML/day at Weir 32. The release of a larger volume of oxygenated water from Lake Pamamaroo resulted in improved dissolved oxygen above critical levels in the Darling River through Menindee township.

Ongoing monitoring will continue to inform operations to mitigate potential fish deaths.

Flows from Lake Cawndilla into the Great Darling Anabranch

River operators, Commonwealth and state agencies have been working together on options for releases to best meet the needs of all water users. Some of the Murray Darling Basin Authority's call on water is now being delivered from Lake Cawndilla via the Great Darling Anabranch rather than via the lower Darling River. With the support of landholders, agreement has been reached to trial a small volume of releases, targeting around 500 ML/day at Packers Crossing initially.

The trial commenced on 11 December, with operational releases replacing the previous environmental flows that were being delivered. Environmental Water Holders will cover any additional loss of the water resource from delivering this water via the Great Darling Anabranch rather than the Darling River.

Using water from Lake Cawndilla to help meet operational demands allows water managers to conserve more water in the 'upper lakes' of Pamamaroo and Wetherell for use as a drought reserve. At the same time, it delivers an environmental benefit by maintaining connectivity through the Great Darling Anabranch, which facilitates the dispersal of native fish predominantly golden perch into the Murray River. The flows are also benefitting vegetation, waterbirds, bush birds, aquatic bugs, frogs, yabbies and other animals that live on the floodplain. This is a 'win' for the environment and the community that relies upon the water supply of the upper lakes.

Blue-green algae

WaterNSW undertake routine blue green algae monitoring in Menindee Lakes and in the Darling River. Alert warnings are declared where algal cell numbers exceed the triggers identified in the Guidelines for Managing Risk in Recreational Waters (NHMRC 2008).

The most recent results indicate a red alert warning for recreational use in the Great Darling Anabranch at Silver City Highway. Algal numbers at most sites in the Menindee Lakes area remaining in the amber alert range for recreational use (Algae Alerts NSW map - WaterNSW). When a red alert warning is in place, people should avoid recreational activities that brings them into contact with the water and drinking untreated water. At the amber alert warning level, blue-green algae may be multiplying in numbers but remains suitable for recreational use. The water may have a green tinge and musty or organic odour.

The water should be considered unsuitable for potable use and alternative supplies or prior treatment of raw water for domestic purposes should be considered. The water may also be unsuitable for stock watering. Water users should use caution and avoid water where signs of blue-green algae are present.

Darling-Barka flood recovery program

The Darling-Barka flood recovery program is a comprehensive river health monitoring program that extends the NSW Government's incident response to the floods and fish kill disasters that occurred in early 2023.

The program is coordinated by the Environment Protection Authority as the lead agency for the NSW Environmental Services Functional Area. It will be delivered until June 2025, extending on the incident response sampling already undertaken this year.

Through the River Health Project, Department of Planning and Environment - Science have installed 4 telemetered loggers which collect real-time data on water quality in the project area. You can access the real time data online via Dashboard - Darling Barka River Health Program (tago.run)

Weather outlook

Refer to the Bureau of Meteorology website for the latest forecasts.

Additional information

To notify the NSW Department of Planning and Environment – Water of potential blackwater events email: waterqualitydata@dpie.nsw.gov.au

To view community updates issued, visit Community updates and frequently asked questions | Water (nsw.gov.au)

To report dead fish, fish struggling or gasping at the water surface, or crayfish leaving the water please call the NSW DPI Fisheries Phoneline 1800 043 536 or fill in a fish kill protocol and report form at: https://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet

Information on recent fish deaths is available at: Fish kills in NSW. When reporting, please include the name of the river/waterbody, location and date of your observation and provide photographs. If possible, please also record what species are affected and an estimate of number of each species observed.

Monitoring data from the monitoring buoys installed by the Department of Planning and Environment for the Darling-Barka flood recovery program is available online via Dashboard - Darling Barka River Health Program (tago.run).

Monitoring data from the monitoring buoys installed by WaterNSW is available on their Water Insights web page (WaterInsights - WaterNSW).

Further information on blackwater events can be found at the DPE Water website at: https://www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/drought-update/managing-drought-recovery/blackwater

Additional information is also available on the Murray-Darling Basin Authority website at: https://www.mdba.gov.au/publications/mdba-reports/water-management-101-factsheets

Operational updates are available at: WaterInsights - WaterNSW

Water quality data collected after the fish deaths at Menindee is available on the Environment Protection Authority web page at: https://www.epa.nsw.gov.au/working-together/community-engagement/updates-on-issues/menindee-fish-kill

To report suspected algal blooms see the WaterNSW website.