Lachlan valley annual surface water quality report: 2021-2022

Key Points

- Flow during July 2021 to June 2022 was characterised by heavy rain falling across much of the catchment. This rain resulted in several large flow events.
- The heavy rains led to substantial increases in water storage levels.
- A fish kill at Lake Cowal in January 2022 was likely caused by flooding in the Lachlan Valley. Localised fish kills were also reported at Lake Forbes and Crooked Creek in February 2022.
- Flooding was the main driver of water quality in the Lachlan catchment. The water quality index indicated of the 10 sites in the catchment, 2 were rated as good, 7 as moderate and one as poor. Compared to the 2020 to 2021 results, the water quality index score improved at 2 sites and declined at 3 sites.
- All sites were below the Basin Plan agriculture and irrigation salinity target of 833 µS/cm (microSiemens per centimetre). All sites were also below the End-of-Valley salinity targets of 460 µS/cm (for the median) and 693 µS/cm (for the 80th percentile).
- Wyangala Dam, Carcoar Dam, Lake Cargelligo, and Lake Brewster received red alert status for blue-green algae blooms with Carcoar Dam lasting the longest (late January-early May). The bloom at Carcoar spread downstream into the Belubula River for 3 weeks in February 2022.

The water quality data used in this report is collected on a monthly frequency at 10 sites in the Lachlan valley for the State Water Quality Assessment and Monitoring Program. The program is responsible for collecting, analysing and reporting the ambient water quality condition of rivers in NSW. This annual report summarises the surface water quality data collected in the Lachlan Valley from July 2021 to June 2022. The location of monitoring sites is shown in Figure 1.

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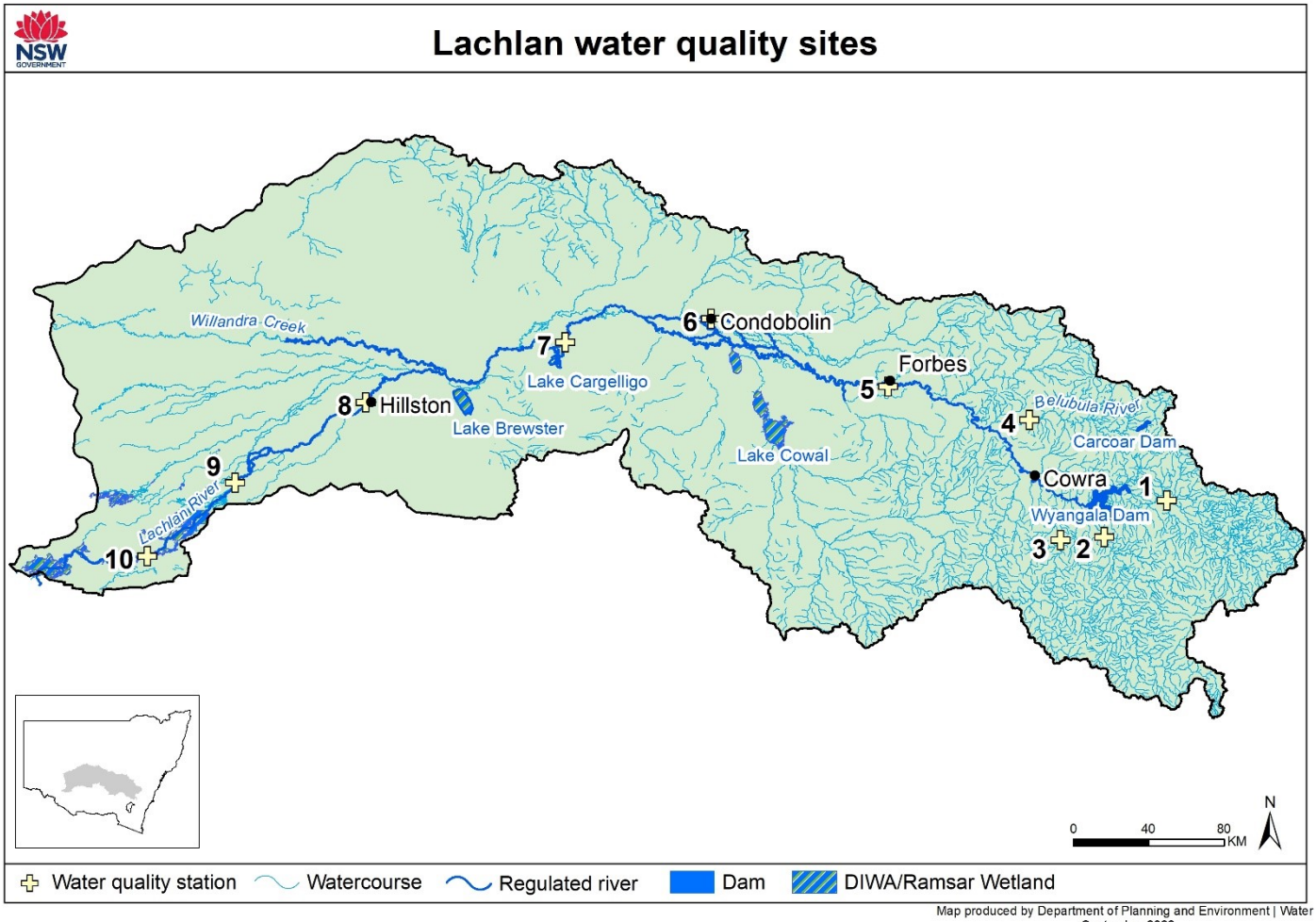


Map produced by Department of Planning and Environment | Water
September 2022

Figure 1: Location of routine water quality monitoring sites in the Lachlan valley

Table 1: Site information for each monitoring site in the Lachlan River catchment. Refer to Figure 1 and site numbers for location of each site

Site number	Site name	Water Quality Zone	Station number
1	Abercrombie River at Camping Area	Lachlan Montane	41210123
2	Lachlan River at Reids Flat	Lachlan Unregulated uplands	412027
3	Boorowa River at Prossers Crossing	Lachlan Unregulated uplands	412029
4	Belubula River at Canowindra	Lachlan Regulated uplands	412009
5	Lachlan River at Forbes	Lachlan Regulated uplands	412004
6	Lachlan River at Condobolin	Lachlan Lowland	412006
7	Lachlan River at Lake Cargelligo Weir	Lachlan Lowland	412011
8	Lachlan River at Hillston	Lachlan Lowland	412039
9	Lachlan River at Booligal	Lachlan Lowland	412005
10	Lachlan River at Corrong	Lachlan Lowland	412045

Catchment description

The Lachlan River is located in central western NSW and covers an approximate area of 90,000 km^2. The Lachlan River is a terminal river that rises near Lake George in the Central Tablelands and ends 1,400 kilometres to the west in the Great Cumbung Swamp near Oxley. Only during times of very high floods do river flows reach the Murrumbidgee River.

The Lachlan River catchment is made up of several main tributaries including the Abercrombie River, the Boorowa River, the Belubula regulated river, the Crookwell River and Western Bland Creek. The Lachlan River for the main part is regulated. Wyangala Dam is a large storage located on the Lachlan River with the smaller Carcoar Dam located on the Belubula River. A number of natural lakes have also been modified for use as storages, the largest of these being Lake Cargelligo and Lake Brewster. The Lachlan River diverges into a number of effluent creeks (including Willandra, Merrowie and Middle Creeks) at the downstream end of the catchment. These creeks are not regulated unlike the main branch of the river. Major instream structures within the unregulated part of the Lachlan River catchment include:

- Lake Rowlands (3,150 ML) currently used for town water supply purposes
- Water Supply Dam on Kentgrove Creek (400 ML) used for town water supply purposes
- Darbys Weir
- Boorowa Weir.

The Lachlan catchment has a number of natural features listed as being of national importance. This includes 9 nationally important wetlands:

- Booligal Wetlands
- Murrumbidgil Swamp/Lake Merrimajeel
- Cuba Dam
- Merrowie Creek
- Great Cumbung Swamp
- Lachlan Swamp
- Lake Brewster
- Lower Mirrool Creek Floodplain
- Lake Cowal/Wilbertroy wetlands.

Land use in the Lachlan valley is largely grazing in the upper catchment with dryland cropping mainly occurring downstream of Wyangala Dam and through the middle reaches of the catchment where moderate winter rainfalls occur (DoIW 2016, 2018).

Catchment conditions during 2021-2022

Flow during 2021–2022 was characterised by heavy rain falling across much of the catchment in November 2021 and again in January, April and May 2022 (Figure 2A). Throughout December 2021, approximately 310 GL flowed into Wyangala Dam and the tributaries (Figure 2B). Carcoar Dam reached full capacity in December 2021. In January 2022, Lake Cargelligo was at 113% and Lake Brewster 114%. Wyangala Dam was 97% full and remained above 90% for the 2021/22 water year (NSW DPE, 2022; Figure 2B). Discharge in the Lachlan River at Reids Flat peaked at 43,600

megalitres per day (ML/day) on 14 November 2021 (Figure 2C). Similarly, discharge at Forbes peaked at 39,700 ML/d on 20 November. Several other large flow events (over 10,000 ML/d) occurred on the Lachlan River at Reids Flat and Forbes between July 2021 and February 2022. Discharge at Booligal was consistent throughout the year due to water spreading across the wetlands, peaking at 2,958 ML/d on 6 March 2022.

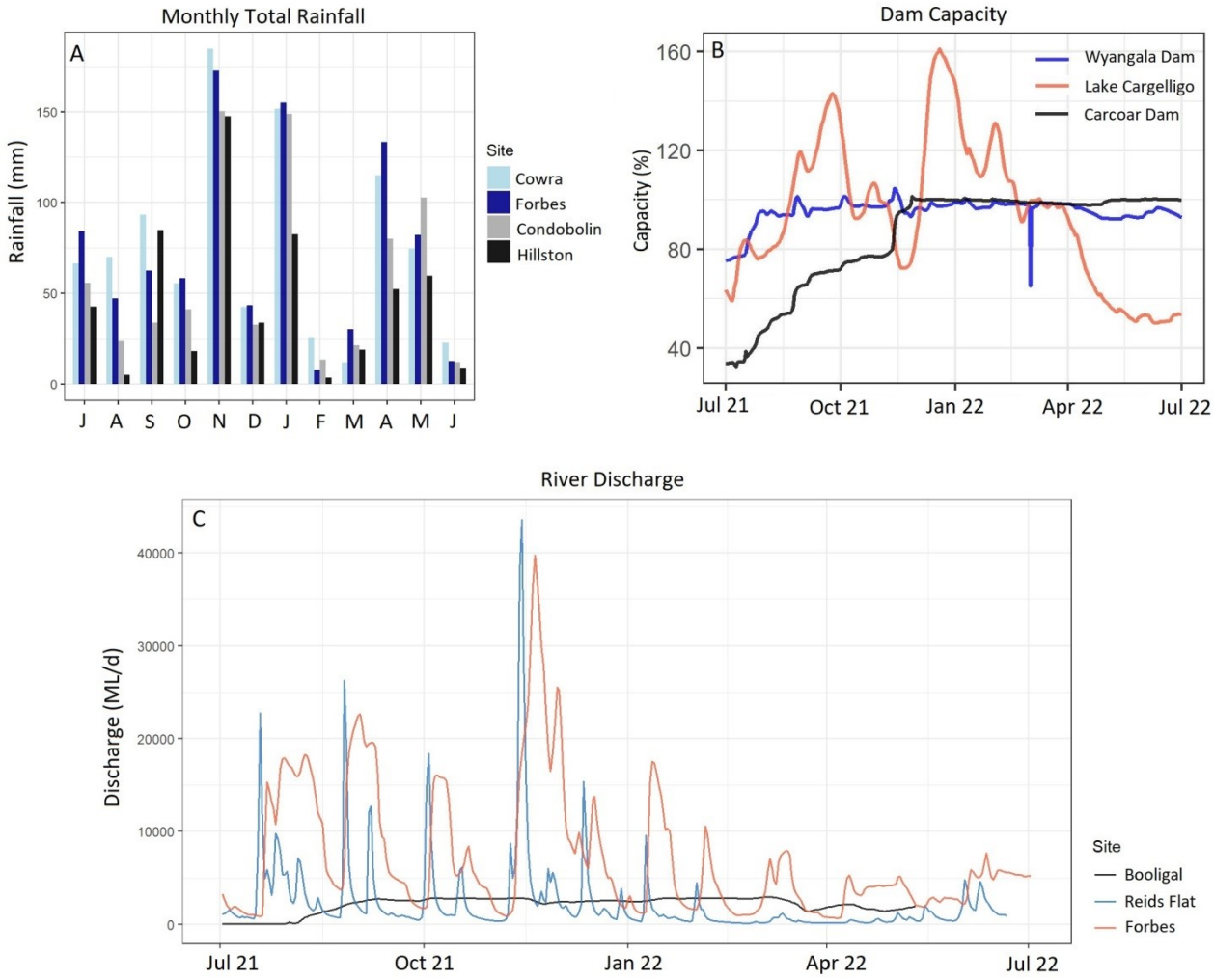


Figure 2: Catchment conditions for selected stations in the Lachlan catchment from July 2021 to June 2022 for A: Monthly total rainfall (mm) B: Dam capacity (%) and C: River discharge (ML/day).

Water quality for water dependent ecosystems

NSW uses a Water Quality Index (WaQI) as a tool to communicate complex and technical water quality data in a simple and consistent way. The WaQI score was calculated for each monitoring site using total nitrogen, total phosphorus, turbidity, pH, dissolved oxygen and electrical conductivity. The index compares the monthly water quality results against a set of predetermined water quality targets to calculate a score between 1 and 100. A score of 100 represents a site in pristine condition, while a score of one is a very highly degraded site. The results from the WaQI are summarised in

Figure 3. Sites where there has been a change of less than 5 points in WaQI score, have been identified with horizontal arrows. Arrows pointing up or down indicate the score has increased/decreased by more than 5 points.

The Lachlan River at Condobolin and Booligal rated as good while the Lachlan River at Forbes was the only site in the valley rated as poor. The low score at Forbes was due to high turbidity and nutrient concentrations detected during flooding and high flows. All other sites were rated as moderate.

Compared to the 2020 to 2021 results, the water quality index score improved at two sites. These two sites towards the bottom of the catchment, Lachlan River at Booligal and Corrong, received good flows throughout 2021 and 2022, which may have led to improved water quality. In contrast, the index scores for the Lachlan River at Reids Flat, Lake Cargelligo Weir and Hillston declined. All other sites showed minimal change.

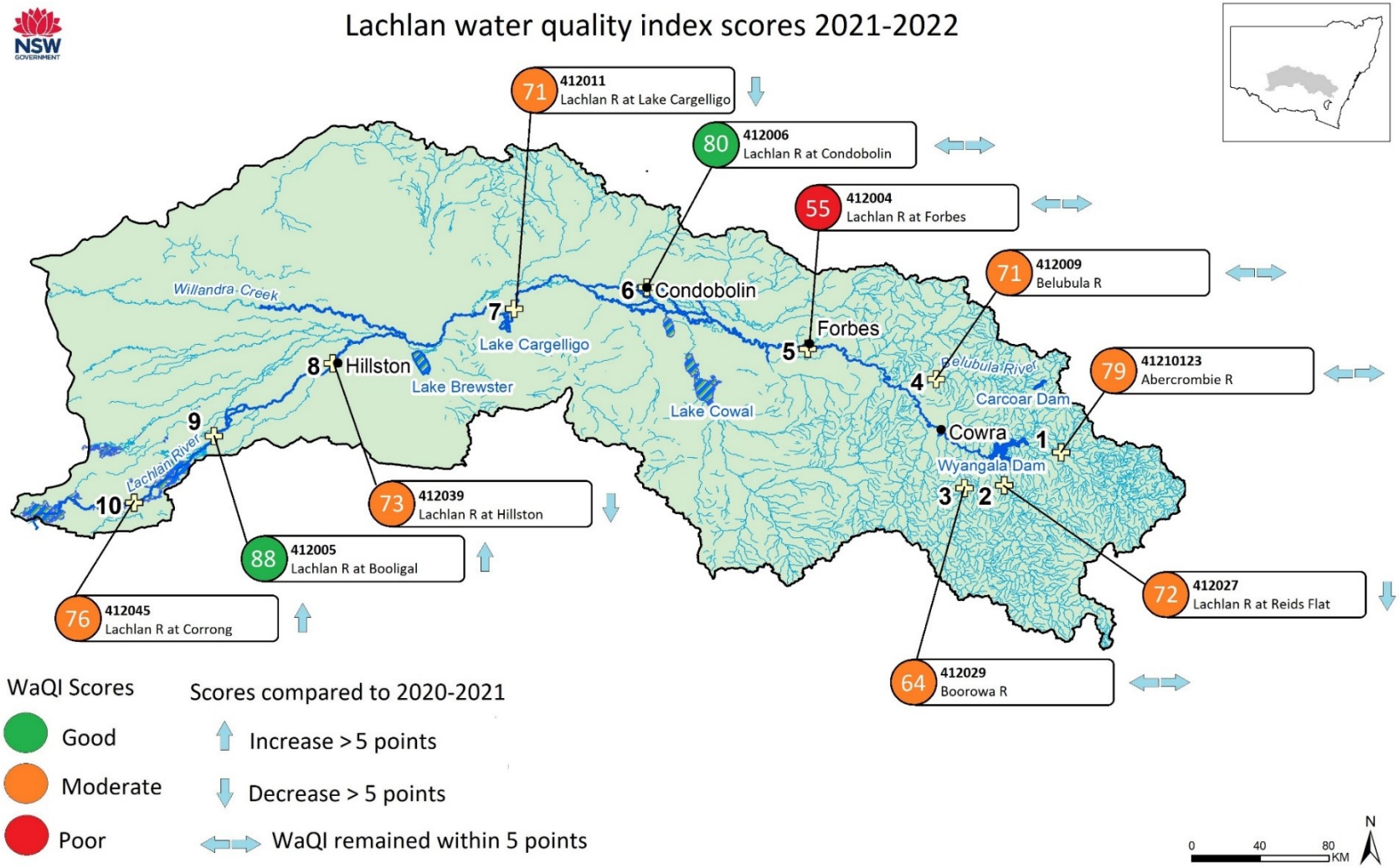


Figure 3: Water quality index scores for the Lachlan valley

There is a general trend of increasing turbidity and nutrient concentrations down the catchment until the Lachlan River at Lake Cargelligo Weir. This reflects the impact of the cumulative effects of land use, soil disturbance and human activity on water quality. Turbidity and nutrient concentrations declined at the 3 monitoring sites on the Lachlan River downstream of Lake Cargelligo (Hillston, Booligal and Corrong). This could be due to the very low slope of the lower Lachlan floodplains causing water velocity to decrease and allowing sediment and any attached nutrients to drop out of suspension. This deposition of nutrients could result in increased algal growth in the coming years.

The pH was relatively consistent throughout the Lachlan valley with most values varying between 7 and 8. This would not impact the health of aquatic ecosystems or agricultural enterprises.

Dissolved oxygen levels declined with distance down the catchment. The lowest dissolved oxygen readings were in the lower catchment, where high turbidity reduces light penetration, reducing aquatic plant growth and higher water temperature reduces the solubility of oxygen in the water column. In addition, major flooding resulted in the flushing of organic matter off the lowland floodplains and into waterways. The rapid breakdown of this material by bacteria can cause dissolved oxygen levels to decline.

Boorowa River had the highest median electrical conductivity followed by the Belubula River. There is limited opportunity for irrigation from Boorowa River, so the risk of impacts to agriculture production and soil structure is low. There is a large salt store in the geology and soils of these two catchments. These salts could be mobilised over the coming years following the heavy rainfall during 2021-2022 and recharge of shallow groundwater. High flows maintained low electrical conductivity in the lower Lachlan River.

Summary statistics for the key water quality parameters at each monitoring site in the Lachlan valley have been displayed as box plots (Figure 4). The box plots show the annual 25th, 50th and 75th percentile values, with error bars indicating the 10th and 90th percentile values for each site.

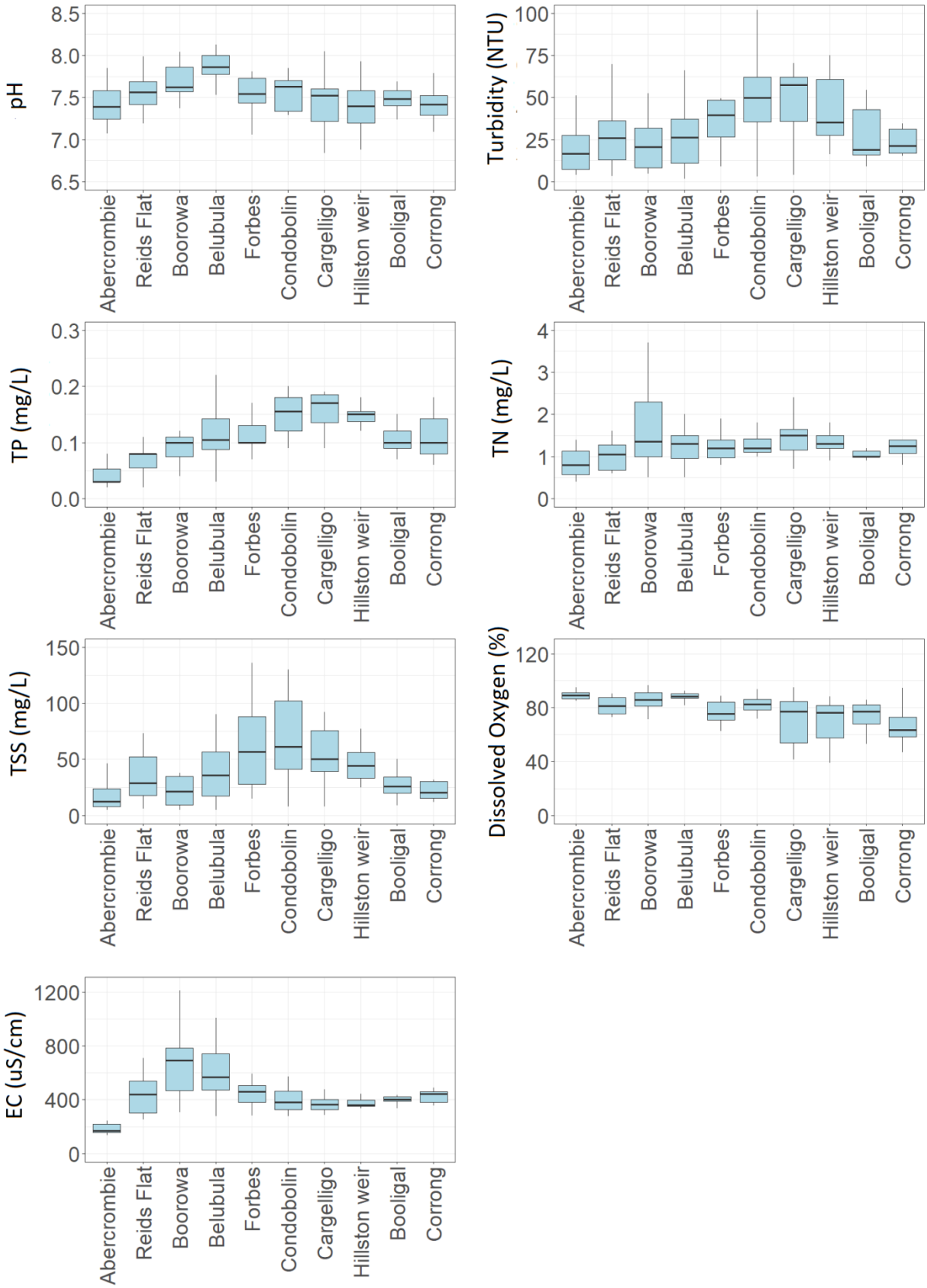


Figure 4: Water quality data for water quality parameters by site

Irrigation and salinity

There are 15 continuous electrical conductivity monitoring sites in the Lachlan valley, with stations located on the regulated Lachlan River and known saline tributaries. There is one Irrigation Infrastructure Operator in the Lachlan River WRPA (Jemalong Irrigation Limited).

During 2021 to 2022, the 95th percentile electrical conductivity in the Lachlan River at Forbes (the closest monitoring station to the offtake) was lower than the Basin Plan agriculture and irrigation salinity target of 833 µS/cm. Figure 5 highlights electrical conductivity in the Lachlan River at Forbes, Condobolin and Booligal was low throughout 2021 to 2022. The results from the Belubula River at Lyndon indicate that once the flooding from the heavy rainfall in November had subsided, shallow saline groundwater inflows elevated electrical conductivity.

The Basin Salinity Management Strategy End-of-Valley salinity targets for the Lachlan River at Forbes are:

- the median electrical conductivity does not exceed 460 µS/cm
- the 80th percentile electrical conductivity does not exceed 693 µS/cm and;
- the annual salt load does not exceed 257,500 t/year.

The annual median (380 µS/cm) and 80th percentile (545 µS/cm) were lower than the respective End-of-Valley targets. Despite the electrical conductivity sensor failing from mid-November 2021 through to mid-April 2022, and no data being available, the annual salt load of 345,104 t/year exceeded the target value.

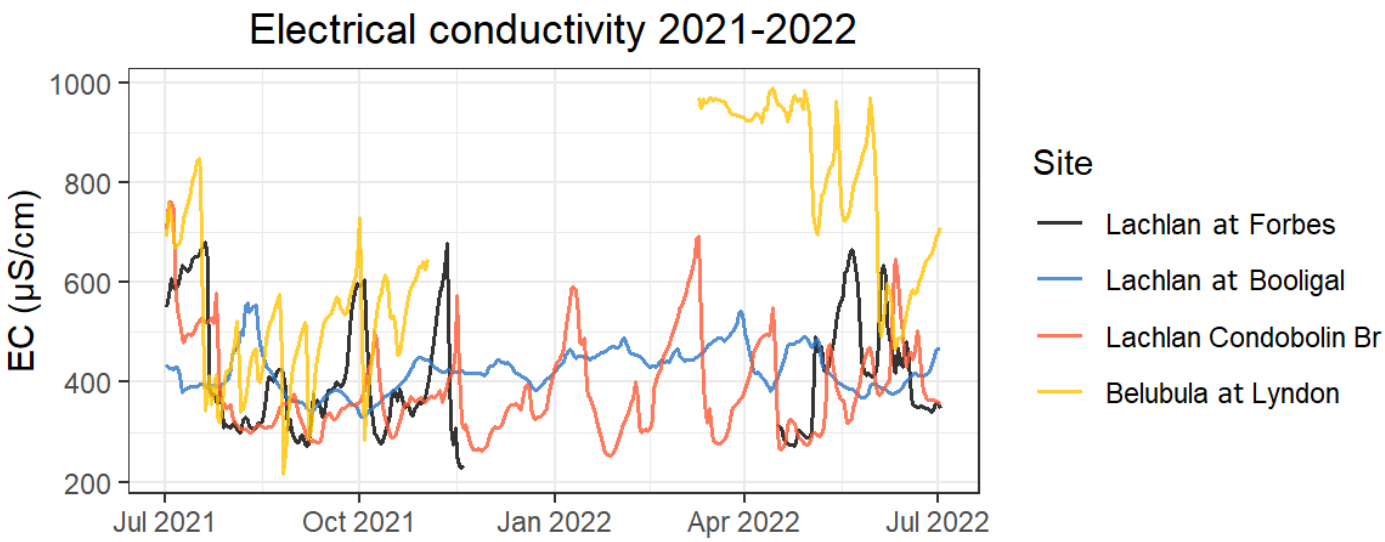


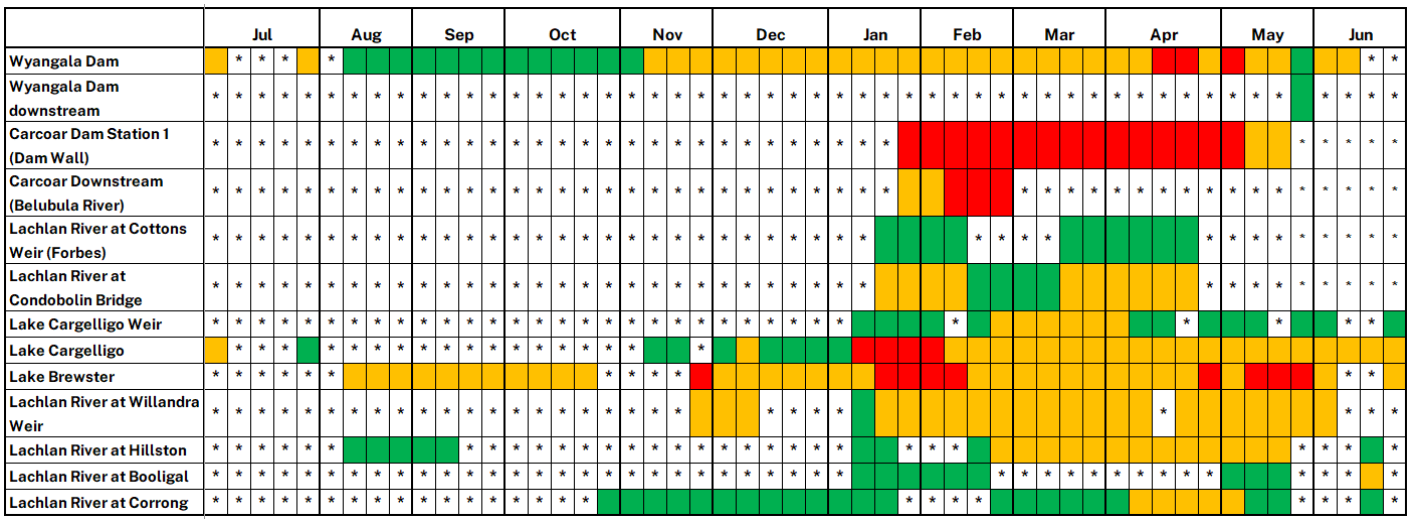
Figure 5: Electrical conductivity (µS/cm) at selected sites in the Lachlan valley

Recreation

Exposure to blue-green algae (cyanobacteria) through ingestion, inhalation or contact during recreational use of water can impact on human health. A colour alert scale is used with a green alert warning indicating low numbers of blue-green algae but requiring monitoring, an amber alert warning being a heightened level of alert with increased sampling and surveillance, and a red alert warning being a state of action where waters are unsuitable for recreational use. For more information about blue-green algae and algal alerts see the WaterNSW algae web page (Algae - WaterNSW).

Blue-green algae have historically been an issue at Carcoar Dam, Lake Cargelligo, and Lake Brewster. They receive water from the upper catchment high in nutrients. Combined with still warm water, blue-green algal blooms occur most summers. Table 2 indicates the distribution of algal alerts during 2021 to 2022, highlighting that these areas received the majority of red alerts for recreational use, occurring mostly from January to May 2022.

Table 2: Distribution of algal alert levels in the Lachlan Valley July 2021 to June 2022



Key: * Nil/Low alert Green alert Amber alert Red alert

Extreme water quality events

November 2021 was Australia's wettest November since national records began in 1900 (BoM, 2022). It was also the wettest November on record for New South Wales and for the entire Murray–Darling Basin. The heavy rains led to substantial increases in water storage levels, with many storages spilling. With flooding on this scale came an increased risk of hypoxic blackwater events.

NSW Fisheries investigated a fish death report of thousands of dead Carp (introduced species) at Lake Cowal in January 2022 and determined the cause was likely flooding in the Lachlan Valley that had washed organic material into the waterway. High amounts of decaying organic material reduced dissolved oxygen in the water below the threshold needed for fish to breathe and survive.

There were also reports of a localised fish kill in February 2022. European carp deaths were recorded at Lake Forbes and in Crooked Creek near Forbes. These events were linked to runoff from a localised storm.

The flushing of nutrients into storages and waterways by floodwaters may have contributed to the high potentially harmful blue-green algal numbers in Wyangala and Carcoar dams, Lakes Cargelligo and Brewster and numerous sites on the Lachlan River.

Summary

The quality of the water in a river or stream reflects underlying climate and geology and the multiple activities and land uses occurring in a catchment area. Numerous factors contribute to the observed results.

In 2021 to 2022, flooding was the key driver for water quality. Increased runoff carries high volumes of sediment and attached nutrients into waterways resulting in 8 of 10 water quality monitoring sites being rated as moderate or poor. In contrast, the high flows maintained electrical conductivity below irrigation targets.

Hypoxic blackwater is a feature of Australian lowland river systems and occurs when organic material, such as sticks, leaves, bark and grass is broken down in the floodwater or washed off the floodplain into the river. The breakdown of this material by bacteria can rapidly use up all the oxygen in the water. The dark appearance of the water is due to the release of tannins as the organic matter decays. NSW Fisheries investigated three fish death reports in the Lachlan Valley during 2021 to 2022. A hypoxic event in the Lake Cowal catchment resulted in thousands of dead Carp. An isolated storm caused a localised event in Lake Forbes and in Crooked Creek near Forbes also resulted in carp deaths.

Although hypoxic blackwater events may result in the loss of fish and other aquatic life, the impacts of these events on the environment are usually short-term, as the river water re-oxygenates again as the flooding subsides. Naturally occurring events such as these underpin the broad health of rivers. They provide nutrients to drive the overall production of our river and wetland systems. In the longer term, native fish, water birds and other organisms benefit from the increased production in the river, boosting food supplies and supporting breeding cycles.

For more detailed information about water quality degradation issues in the Lachlan catchment see the Lachlan surface water quality technical report (https://www.industry.nsw.gov.au/__data/assets/pdf_file/0010/305749/Water-quality-technical-report-for-the-Lachlan-surface-water-resource-plan-area-SW10.pdf).

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