Namoi Valley annual surface water quality report: 2023–2024

Key Points

- During the 2023 to 2024 period, low rainfall from July to October 2023 resulted in low flows in most creeks and rivers across the catchment. Higher rainfall in 2024 resulted in increased flows in 2024. Discharge from the major storages provided flows to the regulated system.
- The Water Quality Index showed that of the 11 monitoring sites, 8 were rated as moderate and 3 were poor. The 3 sites in the lower Namoi valley had an improved water quality index rating compared to the 2022–2023 results.
- Monitoring showed that sites on the Mooki River, Coxs Creek, Narrabri Creek and Namoi River at Gunnedah and Goangra all had a 95th percentile electrical conductivity above the Basin Plan agriculture and irrigation salinity target of 957 µS/cm. The higher results occurred outside the main summer irrigation period, reducing the risk to crops and soil health. The median and 80th percentile electrical conductivity in the Namoi River at Goangra exceeded the respective End-of-Valley salinity targets of 475 µS/cm and 715 µS/cm.
- NSW Fisheries investigated one fish death report in the Peel River near the junction with the Namoi River in February 2024. Thousands of dead fish were identified, including Murray cod, golden perch, catfish, bony herring and carp. The cause was attributed to poor water quality and low dissolved oxygen following runoff from an isolated thunderstorm in the local area.
- A red alert warning for blue-green algae was issued for Chaffey Dam during September and October 2023. Quipolly Dam also had a red alert warning for recreational use during July and August 2023 and from February until June 2024.

The water quality data used in this report is collected monthly at 11 sites in the Namoi valley for the State Water Quality Assessment and Monitoring Program. The program is responsible for collecting, analysing and reporting the ambient water quality of rivers in NSW. This annual report summarises the surface water quality data collected in the Namoi Valley from July 2023 to June 2024. The location of monitoring sites is shown in Figure 1.

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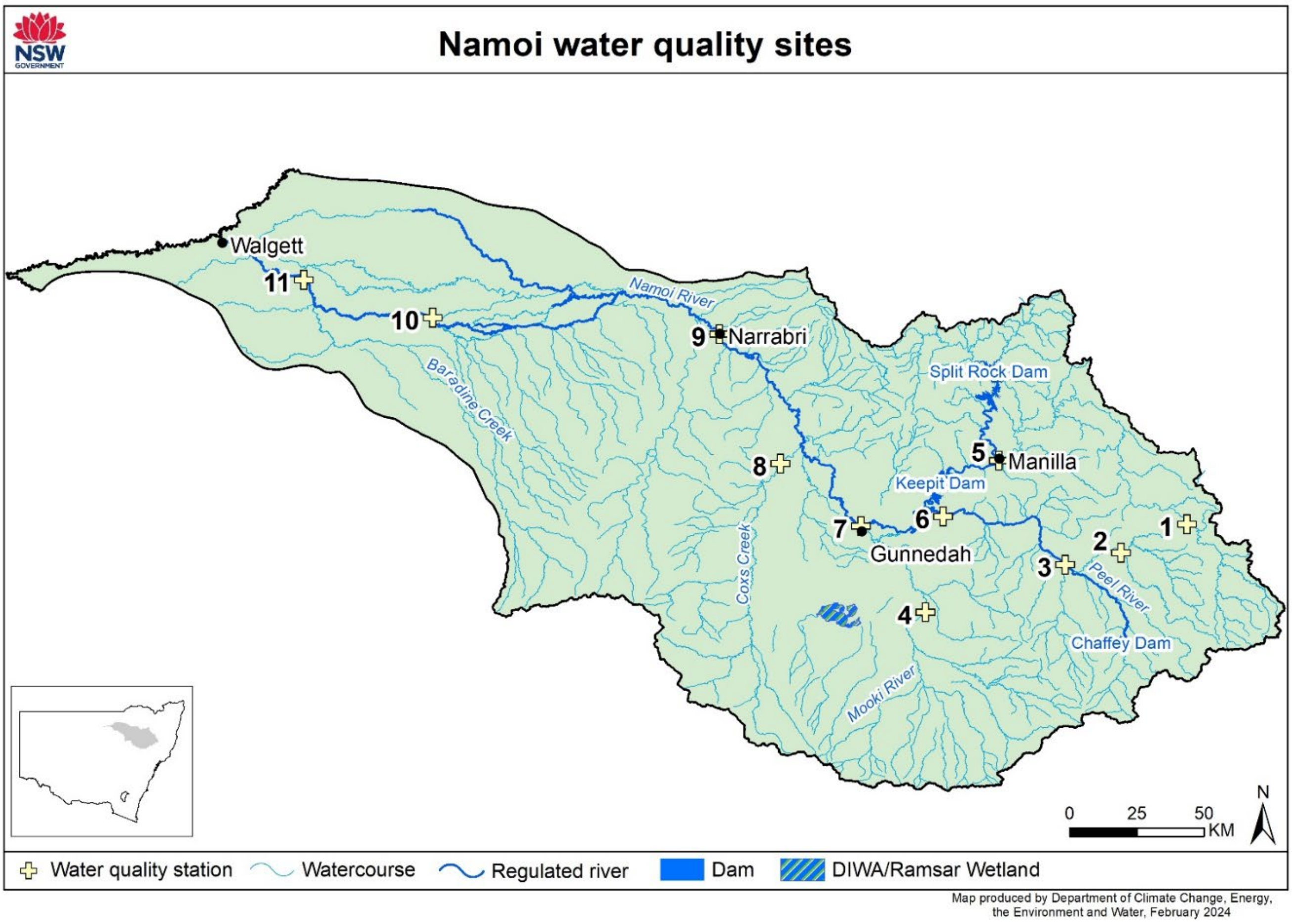

Figure 1: Location of routine water quality monitoring sites in the Namoi valley

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

Site number	Site name	Water Quality Zone	Station number
1	Macdonald River at Woolbrook	Namoi Montane	419010
2	Cockburn River at Mulla Crossing	Namoi Unregulated Uplands	419016
3	Peel River upstream Paradise Weir	Namoi Regulated Peel River	419024
4	Mooki River at Breeza	Namoi Liverpool Plains	419027
5	Namoi River at Manilla	Namoi Regulated uplands	419022
6	Peel River at Carrol Gap	Namoi Regulated Peel River	419006
7	Namoi River at Gunnedah	Namoi Regulated uplands	419001
8	Coxs Creek at Boggabri	Namoi Liverpool Plains	419032
9	Narrabri Creek at Narrabri	Namoi Regulated uplands	419003
10	Namoi River at Bugilbone	Namoi Lowlands	419021
11	Namoi River at Goangra	Namoi Lowlands	419026

Catchment description

The Namoi River catchment is in north-west New South Wales and covers approximately 42,000 km^2. The Namoi River is around 700 km in length and rises in the rugged terrain of the Great Dividing Range, meandering westward onto the riverine plain to join the Barwon River at Walgett.

Several major tributaries flow into the Namoi River. The Macdonald and Peel Rivers are in the eastern catchment area. The Mooki River and Coxs Creek join the Namoi River mid-catchment at Gunnedah and Boggabri, respectively. Smaller tributaries, anabranches and effluent channels characterise the lower catchment.

Flows in the Namoi River are regulated by large dams and several in-stream regulatory structures. Chaffey Dam is in the upper sections of the Peel River. The Manilla River lies in the north-east of the catchment and flows into Split Rock Dam. Keepit Dam is the largest storage facility in the region and is located on the Namoi River upstream of the junction with the Peel River. There are 3 weirs situated on the Namoi River downstream of Narrabri. Mollee Weir is designed to hold and re-regulate flows to improve the precision with which water can be supplied to the lower valley. Gunidgera Weir is located at Wee Waa and assists with re-regulation. Its main function is to pass regulated flows into Gunidgera and Pian Creeks.

Land use is largely grazing in the upper catchment, with increased cultivation for dryland farming on the Liverpool Plans and the lower catchment. Irrigated agriculture is mostly located adjacent to the Peel River near Tamworth, Mooki River and Coxs Creek on the Liverpool Plains and on the Namoi floodplain downstream of Gunnedah.

Catchment conditions during 2023–2024

Flow during the 2023 to 2024 period was characterised by low rainfall from July to October, which resulted in low flows in most creeks and rivers across the catchment (Figure 2A). Regulated releases from Keepit Dam to meet water demand maintained higher flows in the Namoi River from September 2023 through to March 2024.

At the start of July 2023, both Chaffey and Split Rock dams were at 100% capacity, while Keepit Dam was at 95% (Figure 2B). Regulated releases saw the capacity in Keepit Dam decrease to 36% capacity in March. Lower volumes were released from Chaffey Dam, which decreased to 80% capacity in May. Split Rock Dam decreased slightly to 96% by the end of June 2024 (Figure 2B).

Heavy rainfall in November, April and June resulted in brief spikes in flow but no widespread major flooding across the catchment (Figure 2C).

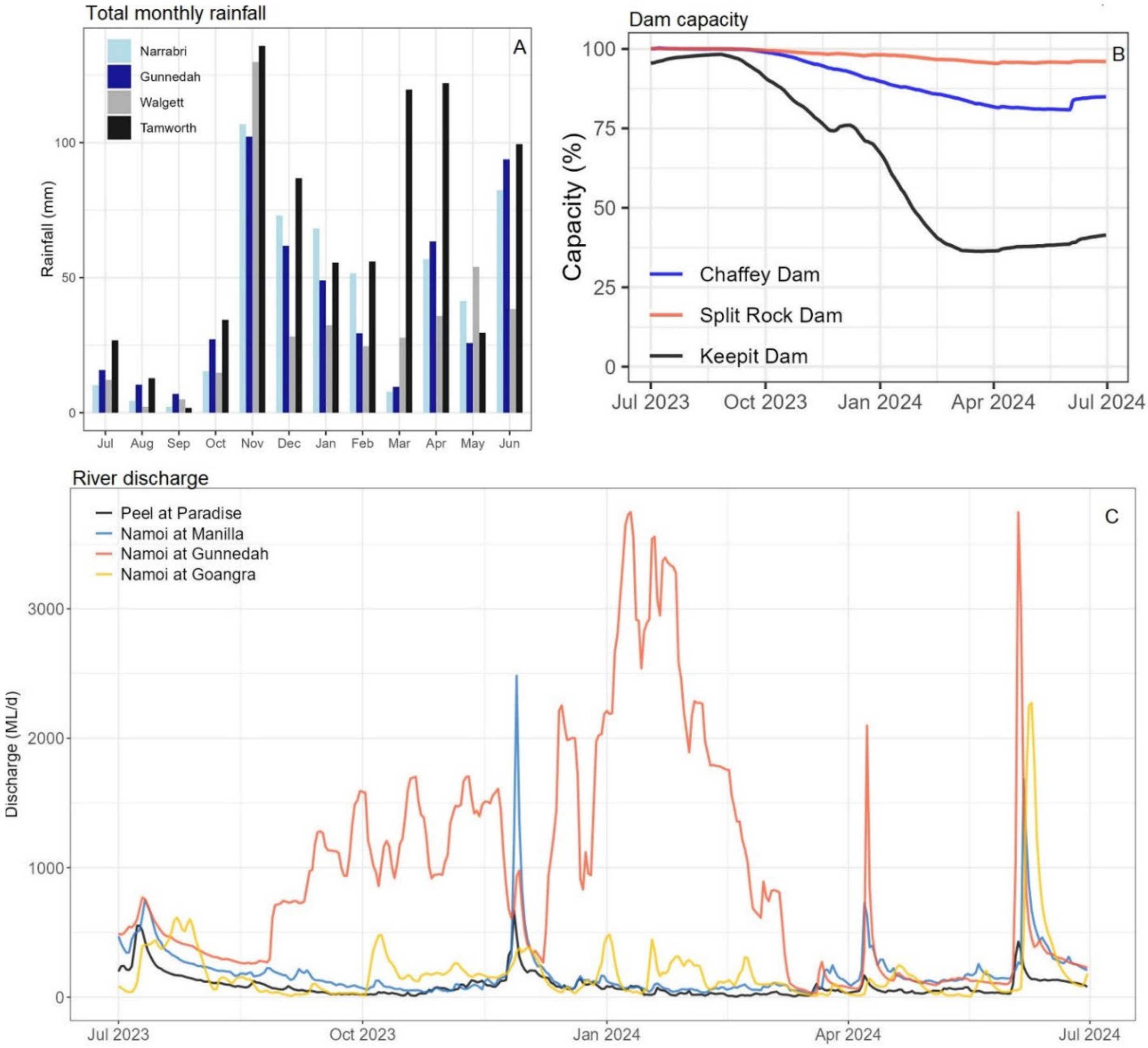

Figure 2: Catchment conditions for selected stations in the Namoi Valley from July 2023 to June 2024 for A: Monthly total rainfall (mm), B: Dam capacity (%) and C: River discharge (ML/day)

Water quality for water dependent ecosystems

NSW uses a Water Quality Index (WaQI) to communicate complex and technical water quality data simply and consistently. 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 predetermined water quality targets to calculate a score between one and 100. A score of 100 represents a site in pristine condition, while a score of one is a highly degraded site. This value can then be categorised to rate the general water quality at a monitoring site. The results from the WaQI are summarised in Figure 3. Sites with 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 water quality index category ratings in the Namoi Valley improved at one of the 11 monitoring sites and remained the same at 6 sites in 2023–2024. The ratings declined for the other 4 sites.

- Narrabri Creek at Narrabri improved from poor to moderate
- Coxs Creek at Boggabri and the Cockburn River at Mulla Crossing declined from good to poor
- The Mooki River at Breeza and Namoi River at Manilla declined from good to moderate
- Macdonald River at Woolbrook, Peel River upstream Paradise Weir and Namoi River at Gunnedah, Bugilbone and Goangra remained moderate.

The Peel River at Carroll Gap had the lowest water quality index score of 31. This was due to high turbidity, nutrient concentrations and electrical conductivity. Coxs Creek at Boggabri and the Cockburn River at Mulla Crossing both declined from good to poor following higher turbidity, total nitrogen, total phosphorus and electrical conductivity results. The Cockburn River at Mulla Crossing also had pH and dissolved oxygen results outside of the desired ranges. High turbidity and nutrient concentrations are usually linked to increased flow. As flow was lower in 2023–2024, other site-specific factors such as concentration of pollutants by evaporation, livestock access, or localised runoff could be influencing the results.

There was a trend of higher electrical conductivity across most monitoring sites in the Namoi valley in response to lower rainfall and flows to dilute the salts mobilised in the naturally saline landscapes by the previous wet years.

Compared to the 2022–2023 results, there was an improvement in scores at the 3 sites located in the lower Namoi valley. This would have been due to the release of regulated flows from Keepit Dam, maintaining better water quality in the Namoi River. There was a decline in scores at 5 sites and minimal change in the water quality index scores for 3 of the 11 sites.

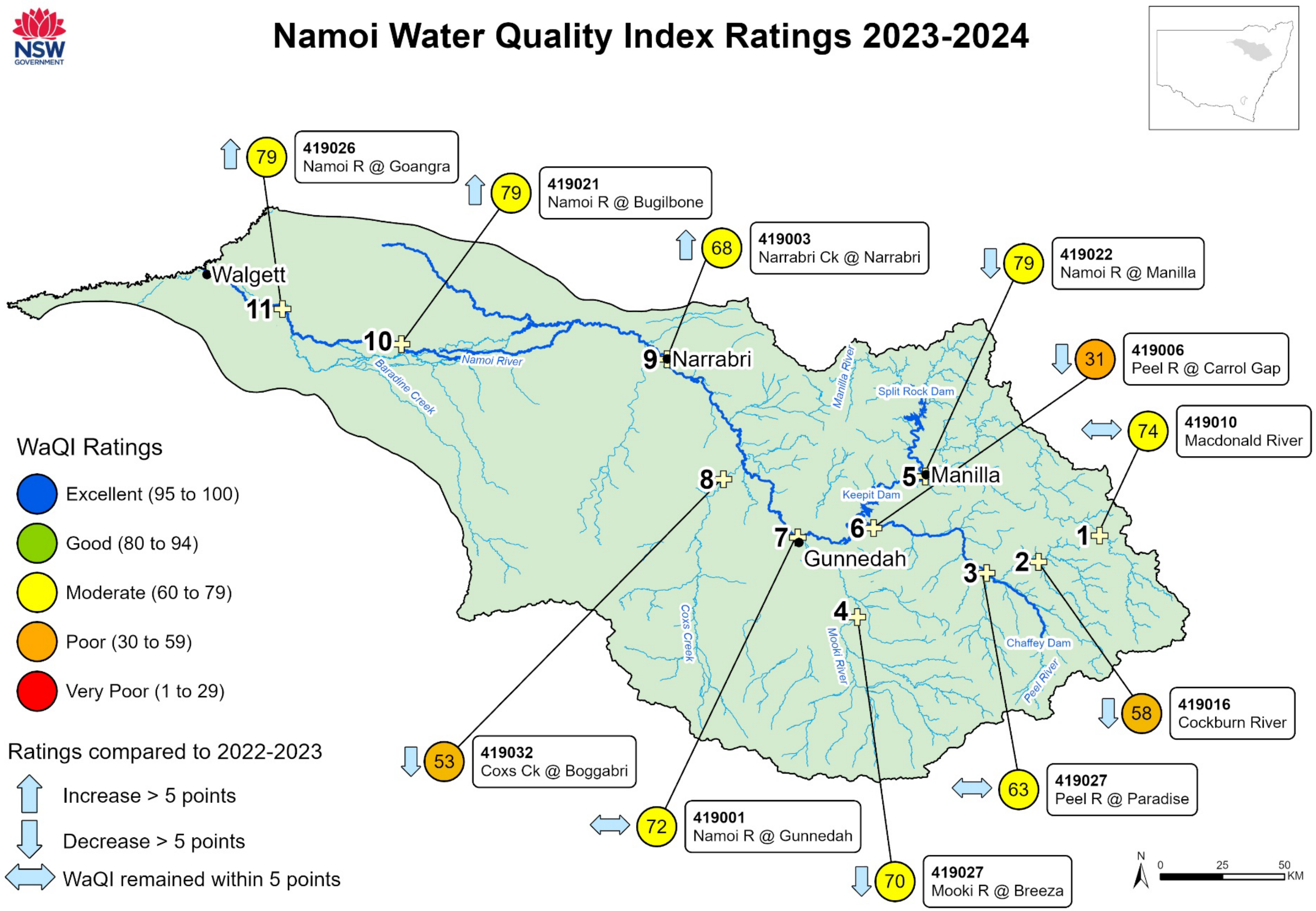

Figure 3: Water quality index scores and ratings for the Namoi valley

The pH fluctuated markedly between catchments. The soils in the Mooki River and Coxs Creek catchments are naturally alkaline, which causes elevated pH at these two sites.

Turbidity increased with distance down the catchment, reflecting the impact of the cumulative effects of land use, soil disturbance and human activity on water quality. The highest median results were in the lower catchment in the Namoi River at Bugilbone and Goangra. There were also high results in the Coxs Creek and Mooki River catchments, both of which have been highly modified for agriculture.

The fertile alluvial clay soils in the Liverpool Plains catchment are naturally high in phosphorus. As these soils are eroded into the Mooki River and Coxs Creek by runoff, the associated nutrients are transported downstream. The high phosphorus concentrations in Coxs Creek impacted Narrabri Creek downstream. The highest total nitrogen results were in the Peel River at Carrol Gap, possibly due to a combination of urban runoff from Tamworth and runoff from agricultural land.

Dissolved oxygen levels were relatively consistent across the Namoi catchment and above critical levels for aquatic ecosystems. The lowest dissolved oxygen readings were in the lower catchment at Bugilbone and Goangra, where high turbidity reduces light penetration, reducing aquatic plant growth, and higher water temperature reduces the solubility of oxygen in the water column.

The Mooki River at Breeza and Coxs Creek at Boggabri had the highest median electrical conductivity in the Namoi valley, followed by the Peel River at Carroll Gap. These sites have historically had high electrical conductivity caused by rainfall and runoff mobilising salts stored in the soil and geology of the landscape and inputs from shallow saline groundwater. Saline inflows from the Peel and Mooki Rivers, when there were minimal releases from Keepit Dam, resulted in higher electrical conductivity in the Namoi River at Gunnedah.

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

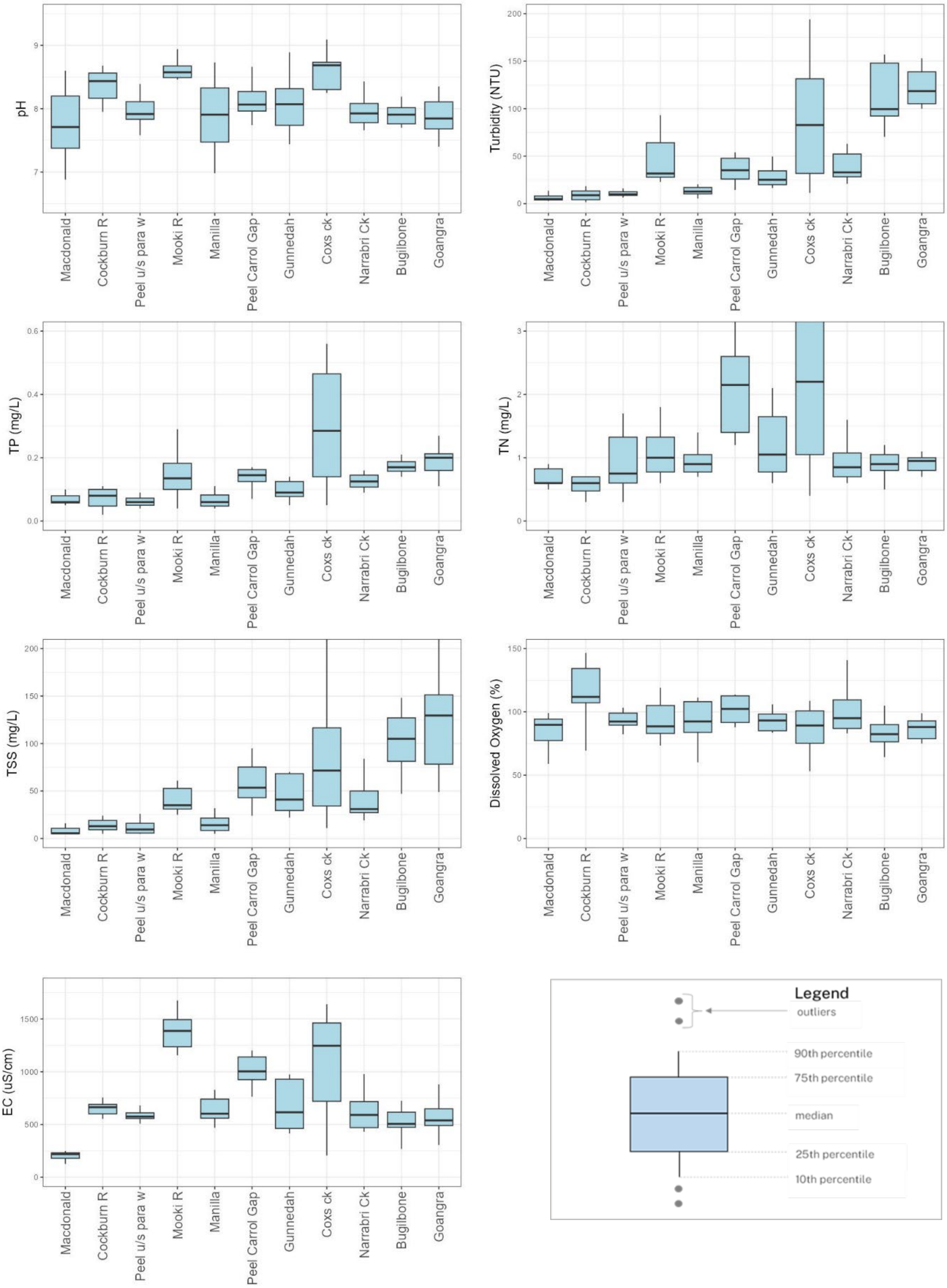

Figure 4: Water quality data by site, moving upstream to downstream from left to right. The water quality parameters shown are pH, Turbidity, Total phosphorus (TP), Total nitrogen (TN), Total suspended solids (TSS), Dissolved oxygen, and electrical conductivity (EC). *Note: extreme results are not plotted to maintain emphasis on the core data*

Irrigation and salinity

There are 8 continuous electrical conductivity monitoring sites in the Namoi valley. Figure 5 plots selected sites and shows electrical conductivity fluctuated throughout the year in response to flow.

Monitoring showed that sites on the Mooki River, Coxs Creek, Narrabri Creek and Namoi River at Gunnedah and Goangra all had a 95th percentile electrical conductivity above the Basin Plan agriculture and irrigation salinity target of 957 µS/cm for 2023–2024. Rainfall and extensive flooding in late 2022 recharged shallow saline aquifers. Dryer conditions and lower flows in 2023 allowed this shallow saline groundwater to drain back into the river channels, increasing the electrical conductivity. The higher results were recorded from July to October, outside of the main irrigation period, resulting in minimal impact on crop health and soil structure.

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

- the median electrical conductivity does not exceed 475 µS/cm
- the 80th percentile electrical conductivity does not exceed 715 µS/cm and
- the annual salt load does not exceed 127,600 t/year.

The median (573 µS/cm) and 80th percentile (875 µS/cm) both exceeded the respective End-of Valley targets. Due to lower flows in 2023–2024 than previous years, the annual salt load of 24,448 t/year was less than the End-of-Valley target value.

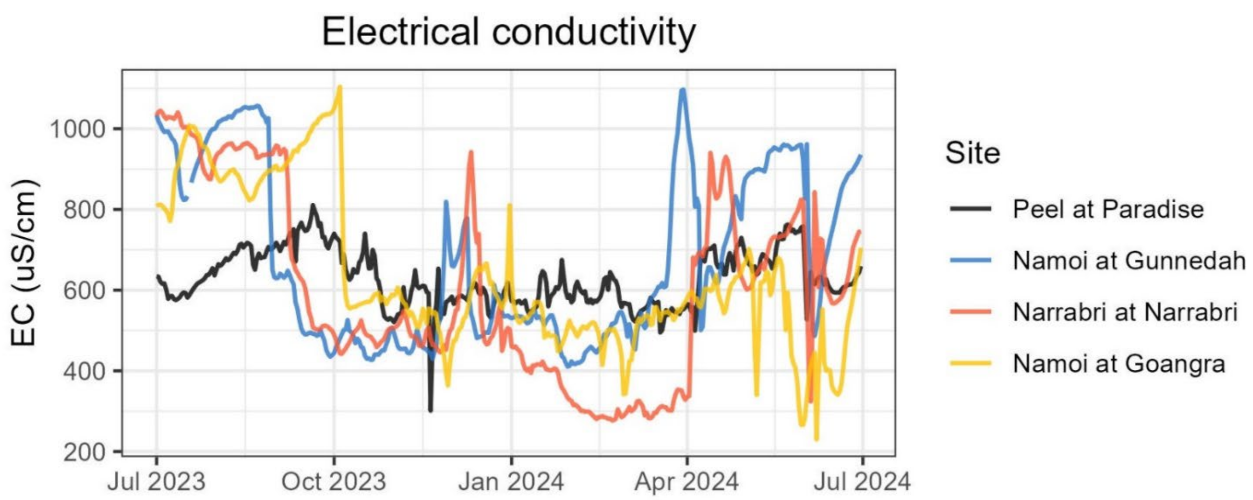

Figure 5: Electrical conductivity (µS/cm) in the Namoi valley

Recreation

Exposure to blue-green algae (cyanobacteria) through ingestion, inhalation or contact during recreational water use can impact 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 a significant issue in Chaffey and Quipolly dams due to stratification and warm water temperatures. Less frequent blooms occur in Keepit and Split Rock dams. Blooms during low flows can occur in the Namoi River at Walgett due to high nutrient inputs and warm water temperatures. Table 2 indicates the distribution of red alert warnings for algal blooms from July 2023 to June 2024. A red alert warning for recreational use was issued for Chaffey Dam in September and October. Algal blooms can occur in large storages at this time of the year when the waters mix, bringing nutrient rich water from the bottom of the storage up to the surface. Quipolly Dam was red alert for blue-green algal blooms in July and August 2023 and from February to June 2024.

Table 2: Distribution of red alert warnings for blue green algae in the Namoi Valley - July 2023 to June 2024

	Jul				Aug				Sep					Oct				Nov				Dec					Jan				Feb				Mar					Apr				May					Jun			
Chaffey Dam Station 2 (Mid storage)	*	*	*	*	*	*	*	*	*	*	*	3	3	3	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Chaffey Dam Station 1 (Aerator)	*	*	*	*	*	*	*	*	*	*	*	3	3	3	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Keepit Dam Station 1 (Dam Wall)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	3	*	*	*	*
Keepit Recreation Area	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	3	3	*	*	*	*
Quipolly Dam	3	3	3	3	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	*

Key: * = no red alert; 3 = red alert

Extreme water quality events

Rainfall leading into the 2023–2024 summer was above average for the Namoi valley (Figure 6 - BoM, 2024), which maintained flows in most creeks and rivers across the catchment.

NSW Fisheries investigated one fish death report in the Peel River near the junction with the Namoi River in February 2024. Thousands of dead fish including Murray cod, golden perch, catfish, bony herring and carp. The cause was attributed to poor water quality and low dissolved oxygen following runoff from an isolated thunderstorm in the area. These reports are listed on the Department of Primary Industries and Regional Development website.

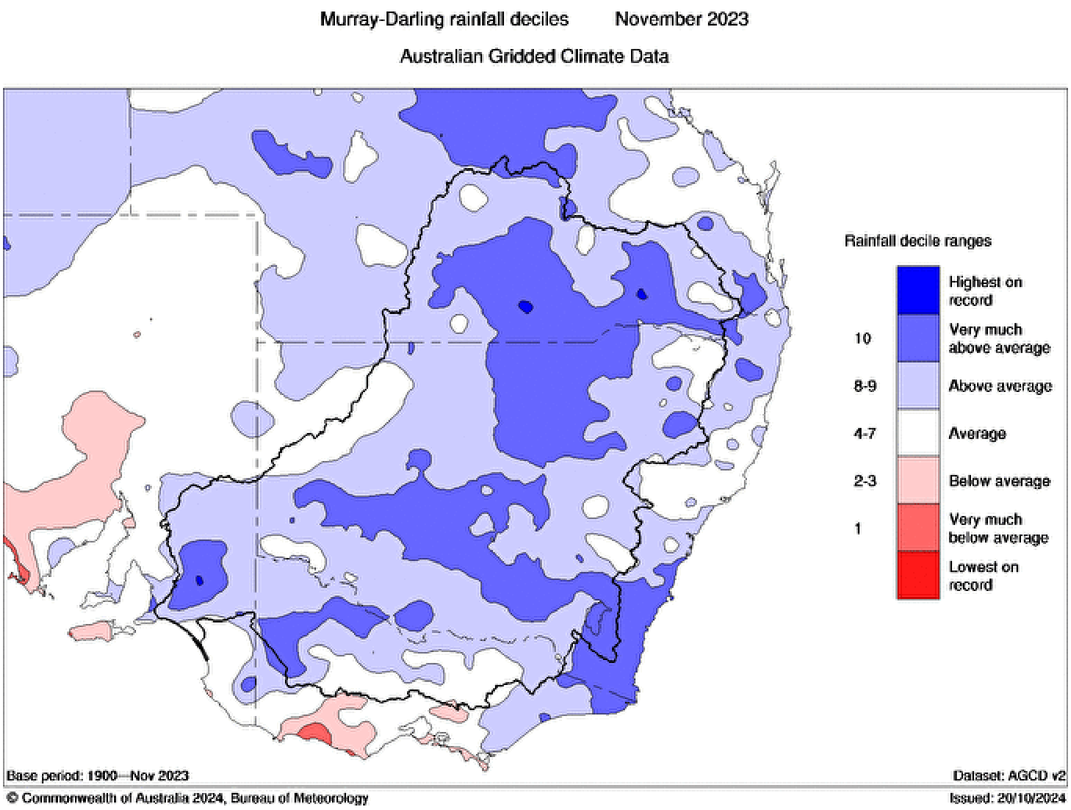

Figure 6: Murray Darling rainfall deciles for November 2023. (Source: BoM)

Long-term water quality trends

Analysis of WaQI scores from 2013–2014 to 2023–2024 shows most sites have a long term median WaQI rating of good or moderate (Figure 7). The Peel River at Carrol Gap had the lowest median and a rating of poor. This site is at the lower end of the Peel River catchment and is impacted by a naturally high salt store in the soils and geology and input of nutrients from upstream. Coxs Creek also returned lower WaQI scores. Coxs Creek ceases to flow regularly resulting in samples being collected from isolated pools that have deteriorating water quality. Significant droughts and floods resulted in outlier results at some sites.

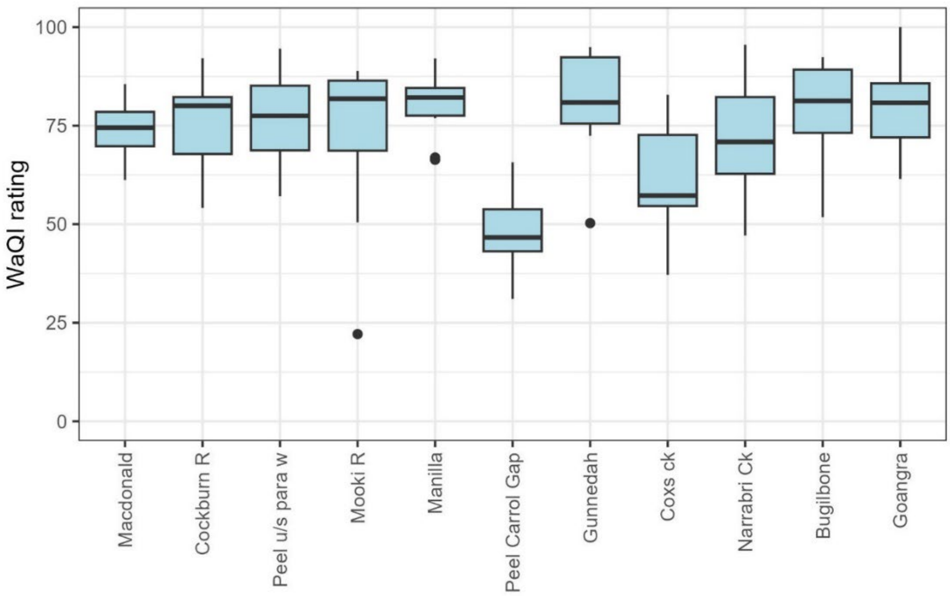

Figure 7: Boxplots showing long-term (2013–2014 to 2023–2024) WaQI scores for every site in the Namoi valley

The number of sites with a good rating declined from 2012–2013 until 2019–2020, coinciding with the breaking of extended drought in 2020 (Figure 8). At the same time there was an increase in the number of poor ratings, peaking at 7 sites in 2019–2020. The number of sites with a moderate rating has been gradually increasing after a series of severe droughts and floods.

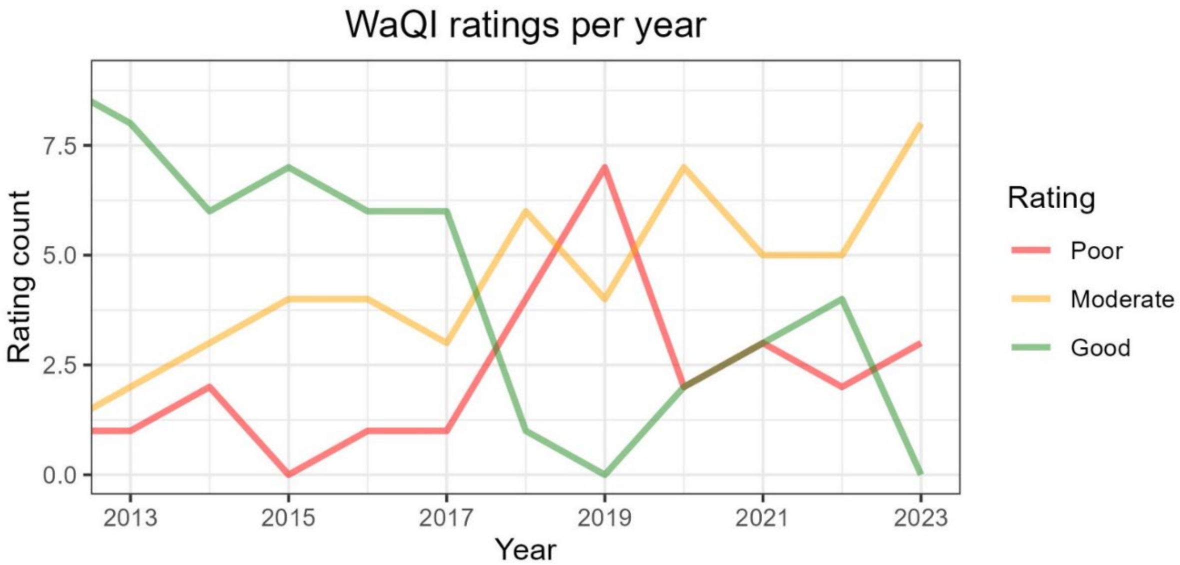

Figure 8: Graph summarising long-term water quality index ratings (2012–2013 to 2023–2024) for every site in the Namoi Valley by year

Summary

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

In 2023–2024, low rainfall from July to October resulted in low flows in most creeks and rivers across the catchment at this time. Compared to the 2022–2023 results, there was an improvement in scores at the 3 sites located in the lower Namoi valley. This would have been due to the release of regulated flows from Keepit Dam, maintaining better water quality in the Namoi River. Of the 11 monitoring sites in the Namoi valley, 8 were rated as moderate and 3 were poor.

There was a trend of higher electrical conductivity across most monitoring sites in the Namoi valley in response to lower rainfall and flows to dilute the salts mobilised in the naturally saline landscapes by the previous wet years. Monitoring sites on the Mooki River, Coxs Creek, Narrabri Creek and Namoi River at Gunnedah and Goangra all had electrical conductivity results above the Basin Plan agriculture and irrigation salinity target of 957 µS/cm. The higher results occurred outside of the main summer irrigation period, reducing the risk to crops and soil health.

NSW Fisheries investigated one fish death report in the Peel River near the junction with the Namoi River.

The flushing of nutrients from catchment areas into Chaffey and Quipolly dams by floodwaters over previous years may have contributed to the presence of potentially harmful blue-green algae in these storages.

For more detailed information about water quality issues in the Namoi catchment, see the Namoi surface water quality technical report (https://www.industry.nsw.gov.au/__data/assets/pdf_file/0003/305742/Water-quality-technical-report-for-the-Namoi-surface-water-resource-plan-area-SW14.pdf).

References and further information

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Bureau of Meteorology, (BoM). Recent and historical rainfall maps: http://www.bom.gov.au/climate/maps/rainfall/?variable=rainfall&map=decile&period=month&region=md&year=2023&month=11&day=30

Fish kills in NSW: https://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills

NSW DPE water for the environment: https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/other-regions/namoi-annual-environmental-water-priorities

Red spot disease: https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/aquatic-industries/wildfish-shellfish/red-spot