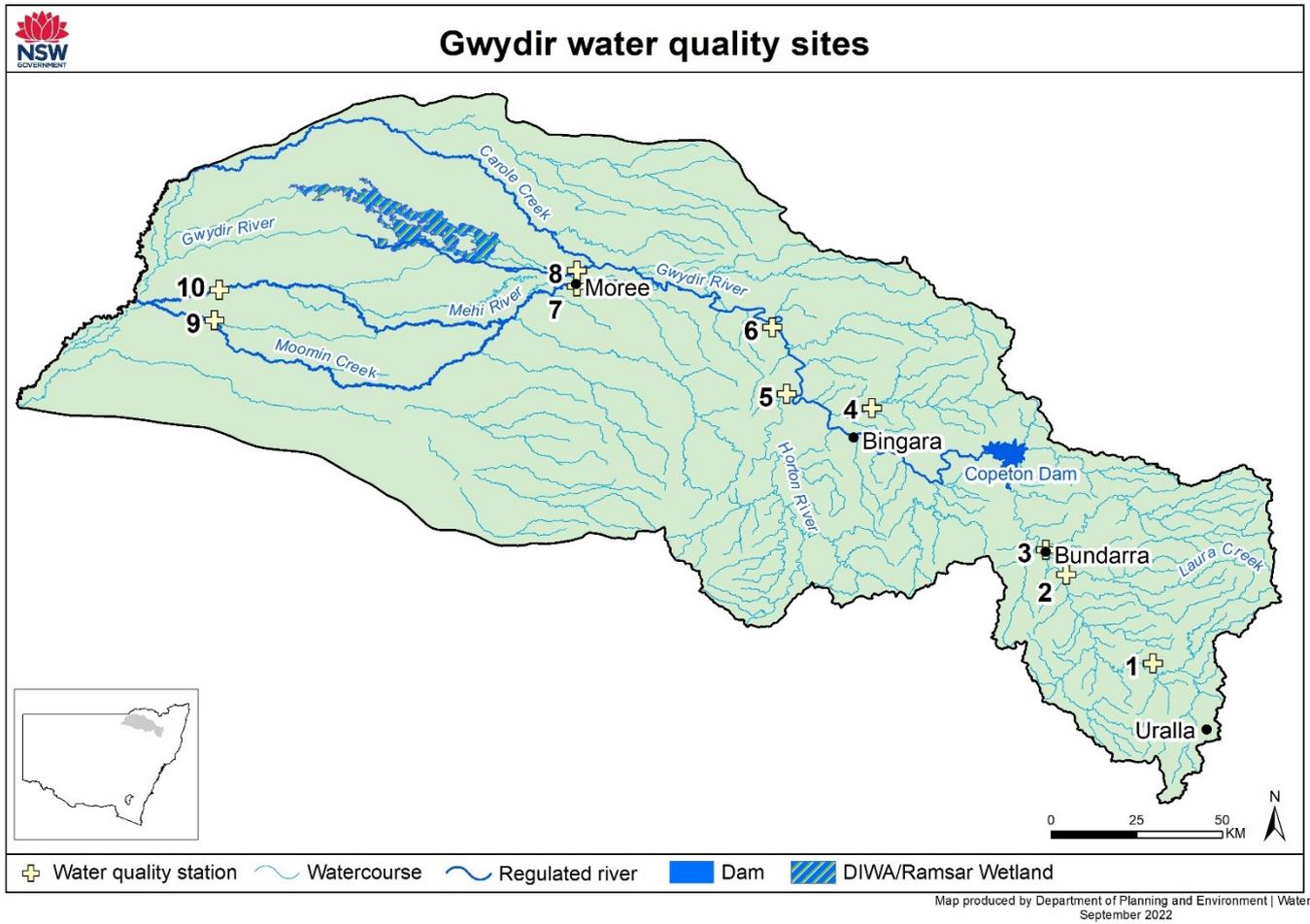


Gwydir valley annual surface water quality report 2021-2022

Key Points

- Flow during July 2021 to June 2022 was characterised by heavy rain falling across much of the catchment. This rain resulted in regular flooding from July to September with major flooding occurring in November and December.
- Heavy rains led to a substantial increase in the storage level of Copeton Dam. With flooding on this scale came an increased risk of hypoxic blackwater events, however no fish deaths occurred.
- Flooding was the main driver of water quality in the Gwydir River. The water quality index indicated that of the 10 sites in the catchment, 2 were rated as good, 4 were rated as moderate and 4 as poor. As a result of the flooding, 4 sites returned a lower water quality index score in 2021-2022 compared to 2020-2021.
- Myall Creek at Molroy exceeded the Basin Plan agriculture and irrigation salinity target of 957 $\mu\text{S}/\text{cm}$ (microSiemens per centimetre). All other sites were below this salinity target. The median End-of-Valley salinity target of 412 $\mu\text{S}/\text{cm}$ was exceeded by the Mehi River while the 80th percentile remained below the respective End-of-Valley target of 545 $\mu\text{S}/\text{cm}$.
- Copeton Dam was on red alert for potentially harmful blue-green algae blooms from November 2021 until late May 2022, however, this did not impact the Gwydir River downstream of the dam.

Water quality data is collected monthly at 10 sites in the Gwydir 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 Gwydir Valley from July 2021 to June 2022. The location of monitoring sites is shown in Figure 1.



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

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

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

Site number	Site name	Water Quality Zone	Station number
1	Gwydir River at Yarrowyck	Gwydir Montane	418014
2	Laura Creek upstream Bundarra	Gwydir Montane	41810006
3	Gwydir River at Bundarra	Gwydir Montane	418008
4	Myall Creek at Sheep Station Creek Road	Gwydir Unregulated Uplands	41810033
5	Horton River at Elcombe Road Bridge	Gwydir Unregulated Uplands	41810058
6	Gwydir River at Gravesend	Gwydir Regulated uplands	418013
7	Gwydir River at Yarraman Bridge	Gwydir Regulated uplands	418004
8	Mehi River at Moree	Gwydir Regulated uplands	418002
9	Moomin Creek at Iffley	Gwydir Lowlands	418054
10	Mehi River at Bronte	Gwydir Lowlands	418058

Catchment description

The Gwydir region is located in northern NSW, bounded by the Border Rivers region to the north, the western slopes of the Great Dividing Range to the east, the Namoi catchment to the south and the Barwon River to the west. It covers an area of more than 26,000 km².

The Gwydir River and its tributaries traverse the tablelands of northern NSW, flowing northwest through undulating and rugged country before draining westward out onto a flat riverine plain. Here the river becomes a system of braided streams and floodplain wetlands.

The main tributaries of the Gwydir River are the Copes, Moredun, Georges, Laura, Halls, Myall and Warialda creeks and the Horton River. These tributaries join the Gwydir River upstream of Gravesend. Copeton Dam is the only major storage in the Gwydir catchment. Flows from Copeton Dam are diverted into the various distributary streams in the lower catchment via a series of regulatory weirs.

The Gwydir wetlands are located on the lower Gwydir River and Gingham Watercourse. The wetlands are one of the most extensive and significant semi-permanent terminal wetlands in northwest NSW (Keyte 1994). They are characterised by poorly defined channels and extremely flat grades, which lead to widespread, long-duration flooding. Parts of the Gwydir wetlands have been listed as wetlands of international importance under the Ramsar Convention.

Land use in the Gwydir catchment is largely grazing in the upper catchment with increased dryland farming in the mid and lower catchment. Irrigated agriculture is mostly located close to the main river channels downstream of Pallamallawa. A detailed description of climate, land and water usage and water regulation infrastructures can be found in the Gwydir resource description report (DoIW 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 heavy falls in the upper catchment in March 2022 (Figure 2A). The storage capacity of Copeton Dam was less than 50% on 1 July 2021, by 24 November this had increased to 100% capacity and with continuing inflows remained above 90% until the end of June 2022 (Figure 2B). Figure 2C highlights regular flooding from July to September with major flooding occurring in November and December. Discharge in the Gwydir River at Bundarra peaked at over 82,000 megalitres per day (ML/day) on 23 November 2021 and over 45,000 ML/day at Gravesend (Figure 2C). These flows were distributed into the Gwydir and Mehi rivers and Carole/Gil Gil Creek system via a series of regulating weirs.

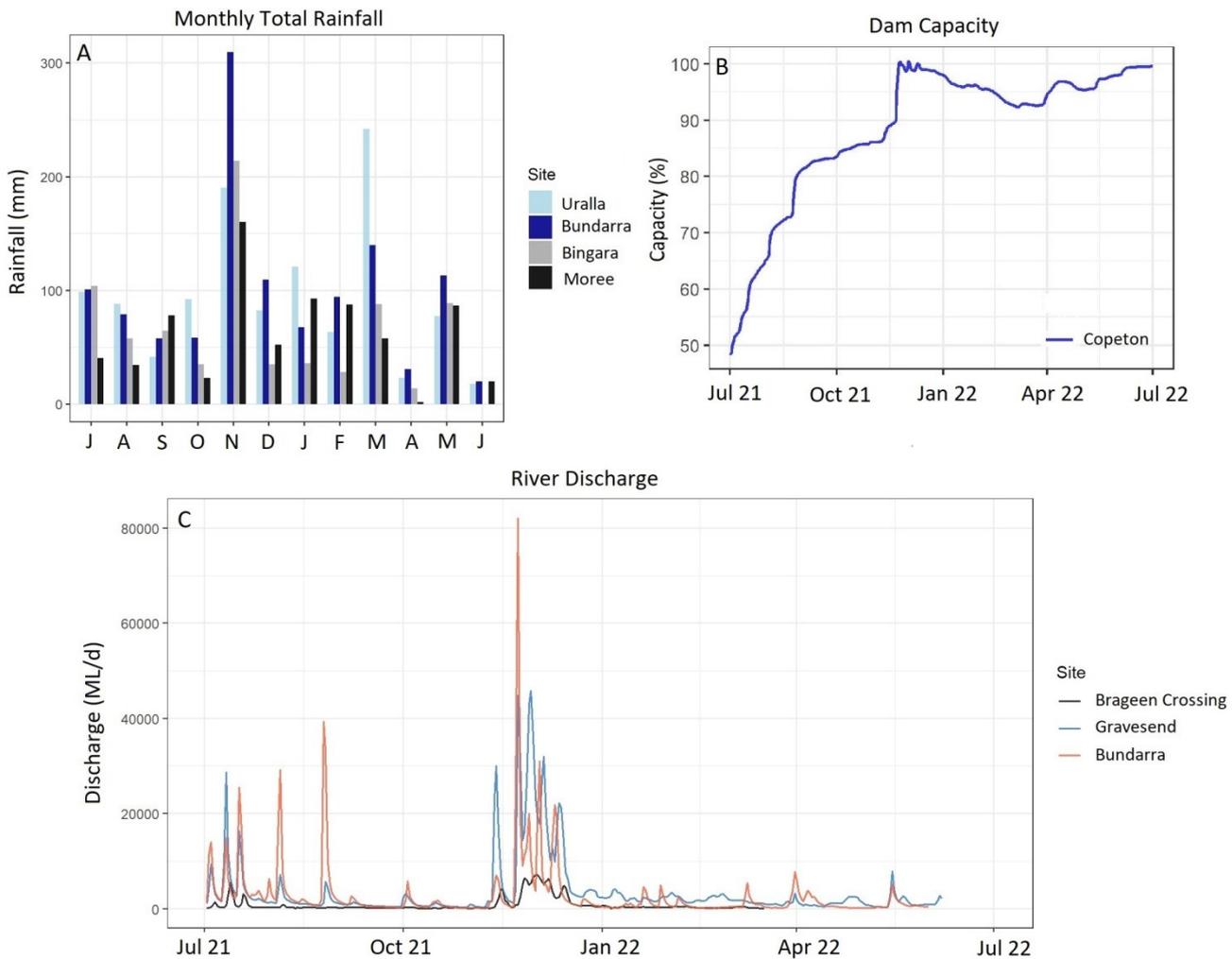


Figure 2: Catchment conditions for selected stations in the Gwydir catchment from July 2021 to June 2022 for A: monthly total rainfall (mm) B: Dam capacity (%) and C: river discharge (ML/day).

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.

Compared to 2020 to 2021 results, the water quality index score for 3 sites improved. Horton River at Elcombe Road Bridge and Mehi River at Bronte improved from moderate to good, and the score for Gwydir River at Gravesend improved, but was still rated as moderate. Myall Creek at Sheep Station Creek Road and Gwydir River at Yarraman Bridge showed minimal change, while the water quality index score declined at the remaining 4 sites, presumably in response to the flooding and associated run-off in 2021 to 2022 that contributed to higher turbidity and nutrient concentrations.

There were 4 monitoring sites in the Gwydir Valley rated as poor.

- Gwydir River at Yarrowyck
- Gwydir River at Bundarra
- Myall Creek at Sheep Station Creek Road
- Mehi River at Moree

The low score in the Gwydir River at both Yarrowyck and Bundarra was due to high turbidity and high total phosphorus. The index score for Myall Creek was impacted by high total nitrogen, total phosphorus and electrical conductivity, while the Mehi River at Moree had high nutrients and turbidity. The Horton River at Elcombe Road Bridge and Mehi River at Bronte were both rated as good, while all other monitoring sites were moderate.



Gwydir water quality index scores 2021-2022

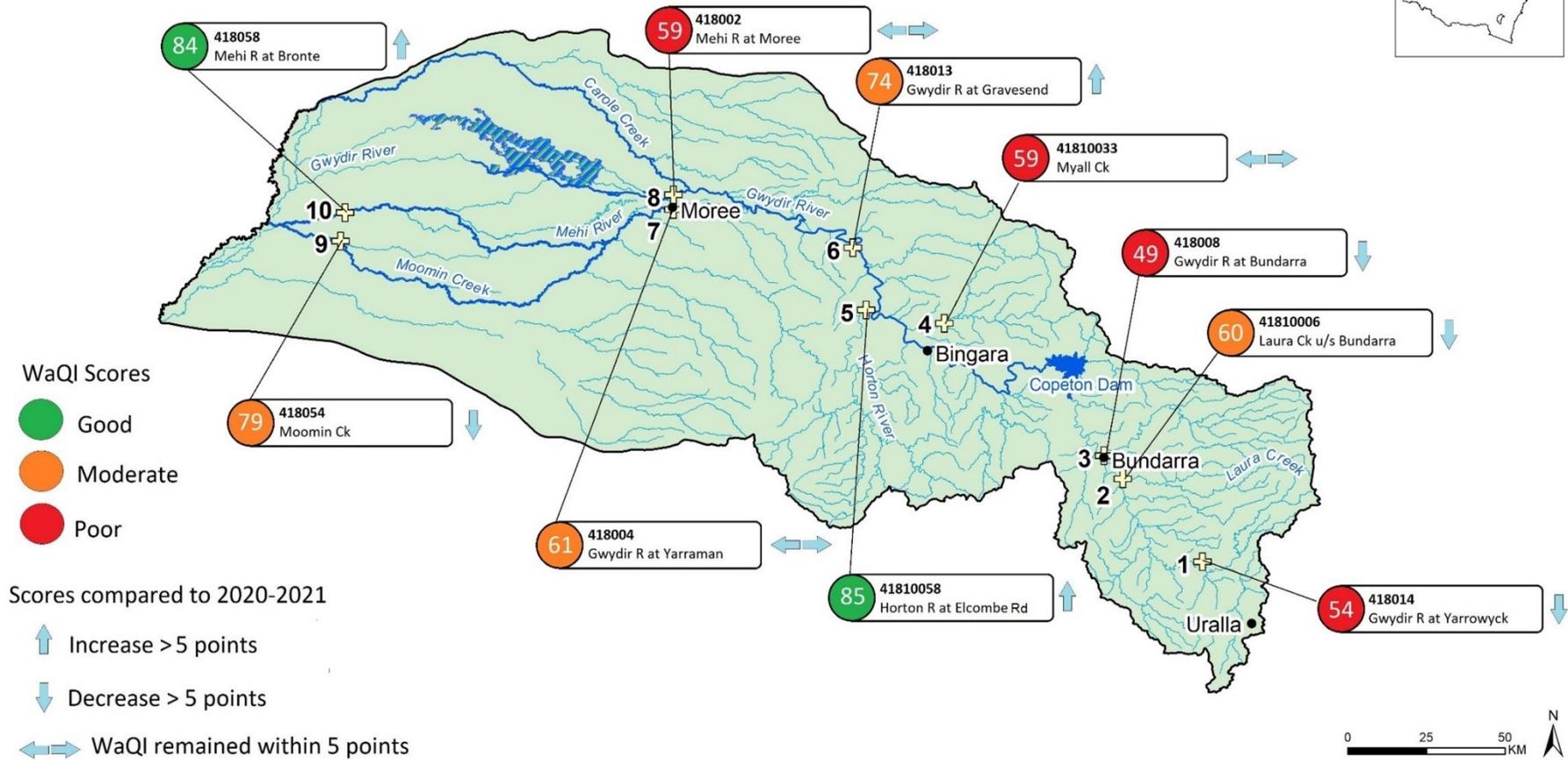
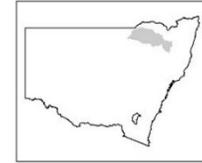


Figure 3: Water quality index scores for the Gwydir valley

Compared to other water quality parameters, the pH in the Gwydir valley was relatively consistent down the catchment. The median pH at the 3 sites in the upper Gwydir River catchment (Yarrowyck, Bundarra and Laura Creek) was lower than previous years, possibly in response to the high rainfall in the catchment.

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 results were at the 2 lower catchment sites, Moomin Creek at Iffley and Mehi River at Bronte.

In most years there is a trend of increasing nutrient concentrations with distance down the catchment. For the 2021 to 2022 sampling period, the median nutrient concentrations were consistent between sites, excluding the low results for the Horton River at Elcombe Road Bridge. Four of the sites in unregulated waterways (Gwydir River at Yarrowyck and Bundarra, Laura Creek and Myall Creek) showed elevated concentrations of total nitrogen and total phosphorus. There are areas in the northeast along the Great Dividing Range with higher soil nitrogen and phosphorus, which combined with the high rainfall and runoff may have contributed to the high nutrient concentrations found at these sites.

Major tributaries to the Gwydir River below Copeton Dam are in poor geomorphic condition. Keera Creek, Myall Creek and Warialda Creek have unconsolidated sandy beds with eroding banks in places. These watercourses contribute significant volumes of sand and finer sediment to the Gwydir River. The Horton River has an armoured bed formed of large gravel to cobbles that protects the river bed from incision and reduces the rate of sediment mobilisation. Extensive river bank protection works along the Horton River have greatly reduced bank erosion and sediment release into the river. The catchment is also less heavily settled, hence fewer pollutants are likely to enter the Horton River system.

Water quality monitoring sites often show a relationship between total nitrogen, total phosphorus and turbidity, indicating similar transport mechanisms for the 3 parameters. Nutrient concentrations in the upland sites were high, but the turbidity was low, suggesting that the nutrients were dissolved in the water, rather than attached to soil particles.

The median dissolved oxygen level was close to 100% saturation at most sites. 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 as observed at Bronte and Iffley.

Salt sources in the Myall Creek and Horton River catchments result in these sites having the highest median electrical conductivity. High rainfall and major flooding maintained a low electrical conductivity at all other monitoring sites across the catchment.

Summary statistics for the key water quality parameters at each monitoring site in the Gwydir 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.

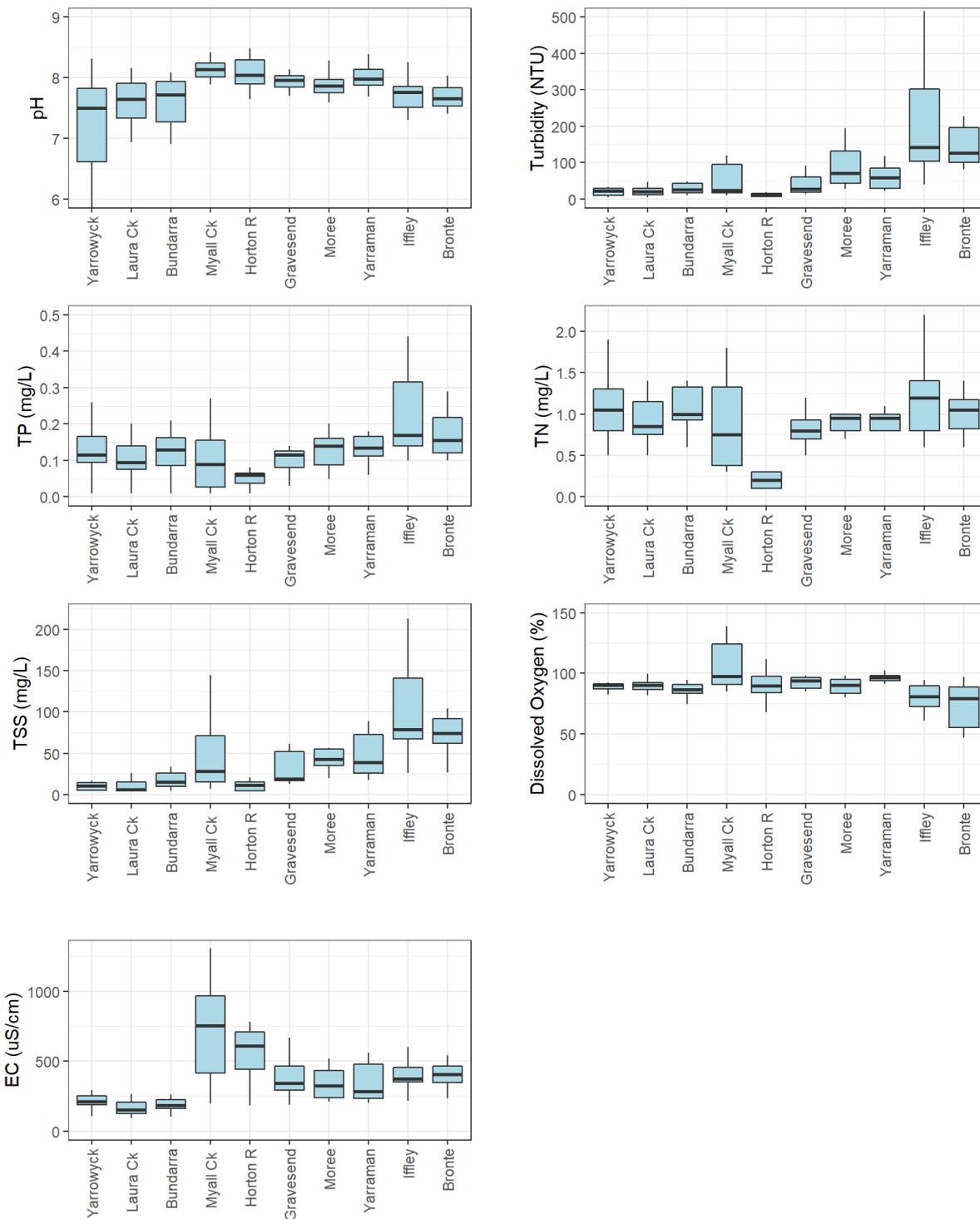


Figure 4: Water quality data for water quality parameters by site

Irrigation and salinity

There are 3 continuous electrical conductivity monitoring sites in the Gwydir valley (Myall Creek at Molroy, Gwydir River at Yarraman Bridge, and Mehi River at Bronte). Figure 5 shows electrical

conductivity in Myall Creek is much higher than in the other 2 sites. Electrical conductivity in Myall Creek decreases quickly following dilution by heavy rainfall but increases again as flows decrease.

Myall Creek at Molroy had a 95th percentile electrical conductivity of 1,376 $\mu\text{S}/\text{cm}$ which is higher than the Basin Plan agriculture and irrigation salinity target of 957 $\mu\text{S}/\text{cm}$. There is limited opportunity for irrigation from Myall Creek, decreasing the risk to agriculture production and soil structure. The 95th percentile in both the Gwydir River at Yarraman Bridge and Mehi River at Bronte was less than the Basin Plan irrigation target.

The Basin Salinity Management Strategy End-of-Valley salinity targets for the Mehi River at Bronte are that:

- the median electrical conductivity does not exceed 412 $\mu\text{S}/\text{cm}$
- the 80th percentile electrical conductivity does not exceed 545 $\mu\text{S}/\text{cm}$ and;
- the annual salt load does not exceed 7,000 t/year.

The median electrical conductivity of 444 $\mu\text{S}/\text{cm}$ exceeded the End-of-Valley target while the 80th percentile of 537 $\mu\text{S}/\text{cm}$ did not. Due to the high flows during 2021 to 2022, the annual salt load of 42,812 t/year greatly exceeded the End-of-Valley target.

Electrical conductivity 2021-2022

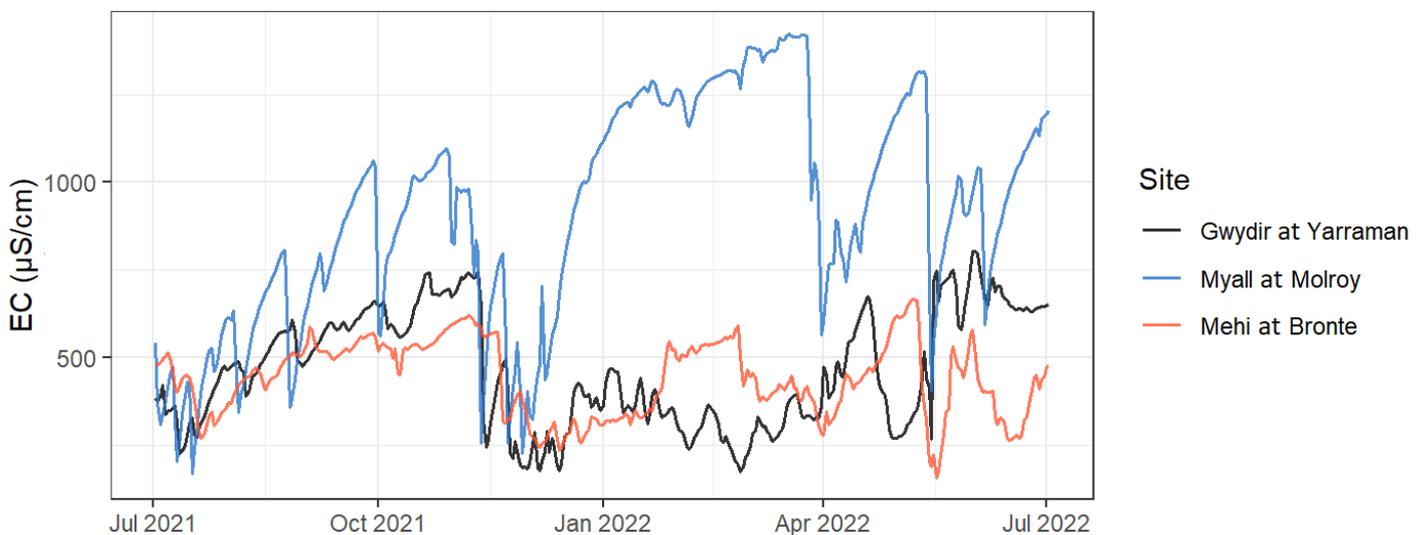


Figure 5: Electrical conductivity ($\mu\text{S}/\text{cm}$) in the Gwydir valley

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

For more detailed information about water quality issues in the Gwydir catchment see the Gwydir surface water quality technical report

(https://www.industry.nsw.gov.au/___data/assets/pdf_file/0003/305751/Water-quality-technical-report-for-the-Gwydir-surface-water-resource-plan-area-SW15.pdf).

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NSW DPE water for the environment: <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/gwydir>