

# WATER QUALITY SAMPLING IN THE NAMOI AND BARWON RIVERS

2<sup>nd</sup> November 2023

## Summary

Dharriwaa Elders Group (DEG) has been concerned about the health of the rivers around Walgett for many years.

DEG formed a partnership with Charles Sturt University (CSU) to trial testing for nutrients, chemical oxygen demand, metals, pesticides, and algae in the Namoi and Barwon rivers.

Testing was done in accordance with Australia and New Zealand Environment and Conservation Council Guidelines (ANZECC) for Fresh and Marine Water Quality.

Nutrients, metals and pesticides were detected. Some results exceeded the levels recommended for healthy ecosystems.

Three of the pesticides detected are banned in the European Union; atrazine, diuron, and a mixture of *S* and *R*-metolachlor.

Dharriwaa Elders Group and Charles Sturt University recommend more sampling, specifically targeting before, during and after times of high spraying activity, and around periods of heavy rainfall.

## Introduction

Dharriwaa Elders Group (DEG) has raised concerns about the health of the rivers around Walgett for many years. Despite this there has been little water monitoring undertaken or supported by NSW and Federal governments in the Walgett area.

In 2023 DEG formed a partnership with the Gulbali Institute at Charles Sturt University to trial a water testing program for the Namoi (Ngamaay) and Barwon (Baawan) rivers. The program tests for nutrients, chemical oxygen demand, metals, pesticides, and algae. It complements DEG's weekly water quality tests for pH, dissolved oxygen, temperature and salinity.

This report is based on the report published by CSU.<sup>1</sup> It presents a sampling strategy for monitoring the water quality in the Namoi and Barwon rivers. The results can be used as preliminary baseline data for future monitoring programs. More testing is recommended, especially around times of high agricultural spraying activity and periods of heavy rainfall.

## Sampling and testing

The river water samples were collected by DEG's Ngarrangarra-li Walaaybaa River Rangers. The Rangers were trained by Dr Martin Mallen-Cooper of CSU. Water samples were collected in November 2023 from six locations in the Namoi and Barwon rivers, in accordance with ANZECC guidelines and sampling protocols. The samples were analysed by Australian Laboratory Services and results presented to DEG by Dr Katherine Doyle of CSU.

## ANZECC Guidelines

Australian and New Zealand Guidelines for Fresh and Marine Water Quality are a tool for assessing water quality and determining objectives that protect and support the designated environmental values of water resources.

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<sup>1</sup> Doyle K., Mallen-Cooper, M., and Baumgartner L.J. (2024). Water Quality Sampling in the Ngamaay and Baawan Rivers, Dharriwaa Elders Group. Gulbali Institute, Albury NSW Australia.

## Results

Nutrients, metals and pesticides were detected in the river, some at levels that can damage river health.

Results are presented in Tables 1 – 5 below.

The green cells indicate that the results are below the recommended ANZECC guidelines for slightly and moderately disturbed ecosystems. This means that the levels of substances found are unlikely to cause harm to the ecosystem.

The yellow cells indicate that the results are equal to the ANZECC guidelines for slightly and moderately disturbed ecosystems.

The red cells indicate that the results are higher than the recommended ANZECC guidelines for slightly and moderately disturbed ecosystems. This means that the levels of substances found could cause harm to humans, animals, plants and organisms, and disturb the health of the environment.

The unshaded cells indicate that there are no ANZECC guidelines for the substance. This means that there is often not enough information to make an informed decision on whether the level of substances is high enough to disturb the environment. This does not necessarily mean that they will not be harmful.

*Table 1. Nutrients detected.*

Nutrients	River site samples (mg/L)						ANZECC Trigger Values (converted to mg/L) Level of protection (% species)
	Namoi 1	Namoi 2	Namoi 3	Barwon 1	Barwon 2	Barwon 3	
COD	19	20	23	24	17	21	-
TKN	0.7	0.12	0.7	0.8	0.7	0.6	-
Total P	0.18	0.21	0.12	0.15	<0.05	<0.05	0.05
TN	0.07	1.2	0.7	0.8	0.7	0.6	0.5
Ammonia (NH <sub>3</sub> <sup>+</sup> )	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9
Nitrite (NO <sub>2</sub> )	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Nitrate (NO <sub>3</sub> )	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.7
NO <sub>x</sub>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04

*Results including Chemical Oxygen Demand (COD) and nutrients including Total Kjeldahl Nitrogen (TKN), Total Phosphorus (Total P), Total Nitrogen (TN), ammonia (NH<sub>3</sub><sup>+</sup>), nitrite (NO<sub>2</sub>), nitrate (NO<sub>3</sub>) and nitrogen oxides (NO<sub>x</sub>) and comparisons of results with ANZECC guidelines for lowland rivers. All values are in mg/L.*

Total phosphorus (TP) exceeded the ANZECC 95% Guideline Trigger Values at all sites except Barwon 2 and 3. Total nitrogen (TN) exceeded the ANZECC 95% Guideline Trigger Values at all sites. High amounts of total phosphorus and total nitrogen can harm river

ecosystems and, in some cases, cause blue-green algae blooms. There are no direct health impacts that can be caused by exposure to total nitrogen or total phosphorus.

*Table 2. Metals detected for which there are ANZECC guideline trigger values (95%).*

Metal	River site samples (mg/L)						ANZECC Trigger Values (converted to mg/L) Level of protection (% species)
	Namoi 1	Namoi 2	Namoi 3	Barwon 1	Barwon 2	Barwon 3	
Aluminium	2.5	2.1	1.9	2.0	1.4	0.86	0.055
Arsenic	0.002	0.002	0.002	0.002	0.002	0.002	0.024
Boron	0.05	0.05	0.05	0.04	0.05	0.05	0.37
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002
Copper	0.004	0.003	0.003	0.002	0.002	0.002	0.0014
Lead	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0034
Manganese	0.12	0.070	0.066	0.12	0.099	0.076	1.9
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006
Nickel	0.004	0.004	0.004	0.004	0.004	0.003	0.011
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00005
Zinc	0.008	0.004	0.004	0.005	0.003	0.002	0.008

*Table 3. Metals detected for which there are no ANZECC guideline trigger values (95%).*

Metal	River site samples (mg/L)						ANZECC Trigger Values (converted to mg/L) Level of protection (% species)
	Namoi 1	Namoi 2	Namoi 3	Barwon 1	Barwon 2	Barwon 3	
Antimony	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Barium	0.079	0.075	0.073	0.095	0.12	0.14	-
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Chromium	0.003	0.003	0.002	0.003	0.002	0.001	-
Cobalt	0.002	0.001	0.001	0.001	<0.001	<0.001	-
Iron	2.7	2.3	2.0	2.0	1.4	0.87	-
Molybdenum	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Strontium	0.39	0.40	0.40	0.30	0.39	0.52	-
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Tin	0.001	0.001	<0.001	<0.001	0.001	0.001	-
Titanium	0.048	0.039	0.035	0.023	0.016	0.010	-

Vanadium	0.011	0.011	0.011	0.007	0.007	0.006	-
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Some metals, such as manganese, iron, copper, and zinc, are essential micronutrients, but in high amounts they can be toxic. Long-term exposure can also be toxic. Aluminium and copper were found at all sites at levels higher than the recommended ANZECC guideline trigger values. Zinc was found at Namoi Site 1 at levels equal to the recommended ANZECC guideline trigger values. Aluminium can be toxic to fish and invertebrates in low pH and high pH environments, and high temperatures can cause it to be more toxic. Toxic levels of copper are only slightly higher than acceptable levels of copper.

Barium, chromium, cobalt, iron, strontium, tin, titanium, and vanadium were also detected but no ANZECC guideline values are specified. This does not necessarily mean that there are healthy levels of metal in the river, but there is not enough data to make an informed decision on whether the amount of metal found is likely to be harmful. Arsenic, boron, lead, manganese, and nickel were detected at levels below the ANZECC guidelines.<sup>2</sup>

*Table 4. Pesticides detected.*

Metal	River site samples (mg/L)						ANZECC Trigger Values (converted to mg/L) Level of protection (% species)
	Namoi 1	Namoi 2	Namoi 3	Barwon 1	Barwon 2	Barwon 3	
Metolachlor ((Chloracetanilides)	0.03	0.01	0.01	<0.01	<0.01	0.02	0.46
Atrazine (Triazine Herbicide)	0.02	0.02	0.03	0.01	0.02	0.07	13
Terbutylazine (Triazine Herbicide)	<0.01	<0.01	0.01	<0.01	<0.01	0.02	-
2,4-D (Phenoxy AA)	<0.01	0.01	<0.01	<0.01	<0.01	0.02	280
Diuron (Sulfonylurea Herb)	<0.02	0.02	0.03	0.03	0.02	0.04	-
MCPP (Phenoxy AA)	<0.01	0.03	<0.01	0.04	0.03	0.02	1.4 (species level unknown)

Pesticides usually enter river systems from agricultural activity, such as spraying. Levels are usually highest during times of high application, or after heavy rain. In all tests the results were below the ANZECC 95% Guideline Trigger Values.

However, three of the six pesticides are banned in the European Union. A mixture of *S*-metolachlor and *R*-metolachlor (racemic mixture) has been banned in the European Union,

<sup>2</sup> ANZECC (1992) Australian Water Quality Guidelines for Fresh and Marine Waters.

although S-metolachlor is approved for use on its own. Atrazine and diuron are both banned in the EU.<sup>3,4,5</sup> Presence of these chemicals should be monitored regularly, and after heavy rain. At the time these samples were taken there had been no rainfall events.

**Table 5. Algae detected.**

Metal	River site samples (total cell count, cells/mL)					
	Namoi 1	Namoi 2	Namoi 3	Barwon 1	Barwon 2	Barwon 3
Total Algae	9862	9485	12210	9748	7427	6077
Total blue-green algae (BGA)	3356	4447	8178	871	1547	1993
Total potentially toxic BGA	0	70	86	33	129	0
Total <i>toxigenic</i> BGA	0	0	0	0	0	0

Algae are a natural part of riverine ecosystems. However, some types of algae, such as blue-green algae, can produce harmful neurotoxins that can affect humans, domestic animals, and native species. A diverse range of algae was found at all site samples, but the levels detected were unlikely to influence water quality.

## Conclusion

It is important to understand the impact of many influences, such as agriculture, on river systems, given the proximity of many communities to farms that may produce unhealthy levels of agricultural chemicals and other substances. Walgett community members have been raising concerns about the health of the Namoi and Barwon Rivers for some time, and find themselves in a position to be able to conduct tests locally to identify potential issues in water quality.

Total phosphorus and total nitrogen were detected at unhealthy levels for river ecosystems at all sites, except phosphorus at Barwon 2 and 3. Aluminium and copper, and zinc at Namoi 1, were detected at levels equal or higher than the ANZECC guidelines. The remaining metals with ANZECC guidelines returned results lower than the trigger values. The metals without ANZECC guidelines were unable to be classified at healthy or unhealthy levels as there is not enough data available. Sampled pesticides all returned levels below the guidelines, but three of the pesticides are banned in the European Union and all pesticides should be monitored in future. Many kinds of algae were found in the samples, but at levels that are unlikely to affect water quality.

<sup>3</sup> Australia and New Zealand Guidelines for Fresh and Marine Water Quality. (2020). Toxicant default guideline values for aquatic ecosystem protection: Metolachlor in freshwater.

<sup>4</sup> ANZECC & ARMCANZ 2000. [Australian and New Zealand Guidelines for Fresh and Marine Water Quality](#), Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

<sup>5</sup> ANZECC & ARMCANZ 2000. [Australian and New Zealand Guidelines for Fresh and Marine Water Quality](#), Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

DEG and CSU recommend more sampling, specifically targeting before, during and after times of high spraying activity, and around times of heavy rainfall, to assess the quality of the water for ecological health, as well as human and animal consumption.

Dharriwaa Elders Group and Charles Sturt University are planning to integrate this pilot project to test for pollutants into existing water quality testing by Walgett River Rangers. The method will be refined as the project proceeds.