Environment Protection Authority

Woodlawn Surface Water Quality Report

EPL 11436 and 20476

August 2025

NSW GOVERNMENT

Acknowledgement of Country

The NSW Environment Protection Authority acknowledges the Traditional Custodians of the land on which we live and work, honours the ancestors and the Elders both past and present and extends that respect to all Aboriginal people.

We recognise Aboriginal peoples' spiritual and cultural connection and inherent right to protect the land, waters, skies and natural resources of NSW. This connection goes deep and has since the Dreaming.

We also acknowledge our Aboriginal and Torres Strait Islander employees who are an integral part of our diverse workforce and recognise the knowledge embedded forever in Aboriginal and Torres Strait Islander custodianship of Country and culture.

Aboriginal artwork by Worimi artist Gerard Black

On 29 April 2025 the NSW Environment Protection Authority (EPA) conducted sampling of surface waters surrounding the Woodlawn Eco Precinct to monitor water quality and investigate potential sources of contamination. This report summarises the results from that sampling.

The sampling was conducted as a rapid response program-and is a snapshot in time of surface water conditions around the Precinct and is in no way representative of locations downstream. The results of this program are used to inform a broader program to assess water quality in the area.

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Background

Veolia Environmental Services (Australia) Pty Ltd (Veolia) operates three EPA-licensed facilities in Tarago NSW, the Woodlawn Landfill (EPL 11436), the Woodlawn Mechanical Biological Treatment (MBT) Facility (EPL 20476) and the Crisps Creek Intermodal Facility (EPL 11455). Two of these licensed facilities, the Woodlawn Landfill and the MBT facility, are located within the Woodlawn Eco Precinct (the Precinct), about six kilometres west of Tarago. The Precinct also includes a bioenergy plant, the Woodlawn Farm and a series of evaporation dams that captures surface water, leachate and legacy mine waters.

Adjacent to the landfill and the MBT facility is the Woodlawn Mine (EPL 20821). The mine is operated by Develop Global Ltd and is also located within the boundary of the Precinct. The mine maintains its own evaporation and tailings dams that also capture mining and mineral process water. Throughout this report, the landfill, the MBT facility and the Woodlawn Mine are referred to as the 'Woodlawn site'.

In October 2024 the EPA sampled surface waters across the Precinct after several storages exceeded their minimum freeboard. One sample was also taken from each of two downstream creeks – Crisps Creek and Allianoyonyiga Creek. The analysis showed elevated salinity, nutrients, zinc and low level PFAS in the surface waters sampled.

To confirm these findings and determine whether a more detailed investigation was needed, the EPA undertook additional sampling in April 2025. The results of that sampling are summarised below.

Sampling approach

Sampling locations

Surface water samples were collected from nine locations based on proximity, accessibility, availability of water and previous sampling locations (Table 1 and Figure 1).

Table 1 Site locations for surface water samples collected on 29 April 2025

Sampling site	Waterway	Location description
AL01	Allianoyonyiga Creek	Allianoyonyiga Creek -inside the Precinct but not within a licensed premises
AL02	Allianoyonyiga Creek	Allianoyonyiga Creek (Veolia's licensed monitoring point) – Woodlawn Mine premises
AL03	Allianoyonyiga Creek	Allianoyonyiga Creek (downstream of the Woodlawn Site) – outside the precinct boundary
CR01	Crisps Creek	Crisps Creek on Woodlawn Farm (licensed monitoring point) – inside the Precinct but not within a licensed premises
CR02	Crisps Creek	Crisps Creek on Woodlawn Farm (downstream of CR01) – inside the Precinct but not within a licensed premises
CR03	Crisps Creek	Crisps Creek (downstream of CR02) – inside the Precinct but not within a licensed premises
CR04	Crisps Creek	Crisps Creek (upstream of confluence with Mulwaree River) – inside the boundary of Veolia's licensed intermodal facility

Sampling site	Waterway	Location description
MU01	Mulwaree River	Mulwaree River (upstream of confluence with Crisps Creek) – inside the boundary of Veolia's licensed intermodal facility
MU02	Mulwaree River	Mulwaree River (downstream of confluence with Crisps Creek) – inside the boundary of Veolia's licensed intermodal facility

Figure 1 Map of sampling site locations

Sampling was conducted following a 15mm rainfall event, however for Allianoyonyiga and Crisps Creeks at least 30 mm of rain is required for flow rates to be sustained above baseflow.

During the sampling event, there was an obvious lack of flow in the lower feeder arms of these creeks. For the most part, creek lines were dry which required samples from Allianoyonyiga and Crisps Creeks to be taken from low-lying sections where water pools and thick reeds grow. Due to the low flow, water quality and contaminant levels are likely not representative of typical values seen when the waterways are flowing.

Figure 2 Water quality grab samples

Field measurements

At each site a handheld water quality meter was used to record:

- pH
- electrical conductivity
- dissolved oxygen
- turbidity
- temperature.

Laboratory analysis

Grab samples were shipped on ice to the NSW Environmental Forensics laboratory and analysed for:

- total and dissolved metals
- nutrients
- biochemical oxygen demand (BOD)
- chemical oxygen demand (COD)
- anions and cations
- dissolved organic carbon (DOC)
- total dissolved solids (TDS)

- total suspended solids (TDS)
- per-and polyfluoroalkyl substances (PFAS).

Data analysis

Water quality results were compared against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ (2000) and ANZG (2018) which includes guidelines for aquatic ecosystems, livestock drinking water and irrigation.

For aquatic ecosystems, the 95% species protection level was applied to reflect the water quality objective of protecting slightly to moderately disturbed ecosystems. For pollutants which are known to bioaccumulate, the more conservative 99% species protection level was used. Where total and dissolved metal concentrations were available, the dissolved concentrations were assessed as they represent the bioavailable fraction. Hardness modified guideline values (HMGVs) were derived for cadmium, zinc, lead and nickel.

Perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) were compared to ecological water quality guideline values in the PFAS National Environmental Management Plan (PFAS NEMP 3.0). The 99% species protection guideline values were adopted as recommended by PFAS NEMP 3.0 for slight to moderately disturbed ecosystems and consistent with the Water Quality Guideline framework (ANZG 2018) for bioaccumulative contaminants. A concentration below the guideline value indicates that there is unlikely to be a risk to aquatic life.

For livestock drinking water and irrigation, total metal concentrations were assessed against applicable guidelines, presenting a more conservative estimate of exposure for livestock and accumulation in soils. There are no livestock and irrigation water guidelines for PFAS.

NSW Health advises that groundwater and water from rivers and creeks should not be used for drinking or cooking without appropriate treatment. Untreated water may contain disease causing micro-organisms, chemical contaminants or algal blooms. In this regard no comparisons against Drinking Water guidelines were made.

Summary of surface water sampling results

Surface water sample results which exceeded relevant guideline values are summarised in Tables 2 and 3.

Overall, both Allianoyonyiga Creek and Crisps Creek show signs of elevated pollutants, with water quality typically poorest at the sites closest to the Woodlawn Site and improving with distance downstream. Sampling sites closest to the Woodlawn site had some of the highest concentrations of salinity, nutrients, TDS and total positive PFAS.

PFAS compounds were detected at all locations except in the Mulwaree River upstream of the confluence with Crisps Creek. The highest total PFAS concentrations were observed at sites AL02 in Allianoyonyiga Creek and CR01 in Crisps Creek which are both immediately adjacent to the Woodlawn Site.

Elevated levels of salinity related parameters, nutrients and metals in Crisps Creek and Allianoyonyiga Creek exceeded several livestock drinking water and/or long-term irrigation guideline values. These exceedances could affect livestock health, water palatability or the suitability of water for the irrigation of sensitive crop species.

Mulwaree River shows comparatively better water quality, although the downstream site (after the confluence with Crisps Creek) does reflect some degradation, suggesting that Crisps Creek may be impacting water quality within the Mulwaree River. No exceedances of Livestock or Irrigation Guidelines occurred within Mulwaree River.

Table 2 Summary of water quality exceedances, compared to ecological water quality guidelines for aquatic ecosystems (ANZG 2018, ANZECC and ARMCANZ 2000, PFAS NEMP 3.0)

Highlighted data has exceeded a guideline value. Refer to Appendix 1, Table 4 for the full list of sampling results and guideline values

	Aquatic Ecosystems Water Quality Guideline	AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
		Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek -d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River - u/s of confluence	Mulwaree River - d/s of confluence
		Woodlawn Eco Precinct land	Woodlawn Mine operation area	Taylors Creek Road	Woodlawn Eco Precinct	Woodlawn Eco Precinct	Woodlawn Eco Precinct	Intermodal land	Intermodal land	Intermodal land
General Water Quality/Physiochemistry										
Dissolved Oxygen (%)	90-110	**14.4**	**77.5**	**27.8**	**44.2**	**30.2**	96.1	**51.5**	98.9	**74.6**
pH	6.5-8	7.6	**8.4**	8	7.6	7.9	7.7	7.7	7.9	8
Electrical Conductivity (µS/cm)	30-350	**1600**	**4900**	**2600**	**5000**	**3600**	**2300**	**1400**	**550**	**730**
Turbidity (NTU)	2-25	5.6	**35.1**	11.6	21.8	22.5	4.1	18.3	1.1	4.1
Nutrients (mg/L)										
Ammonia as N	0.013	**0.02**	**0.02**	0.01	**0.18**	0.01	0.01	<0.01	<0.01	<0.01
Total Nitrogen as N	0.25	**0.6**	**2.6**	**0.8**	**2.8**	**0.7**	**1**	**1.1**	**0.3**	**0.4**
Nitrate +Nitrite as N	0.015	**0.02**	<0.01	**0.02**	**0.05**	0.01	<0.01	**0.02**	<0.01	<0.01
Total Phosphorus as P	0.02	**0.07**	**0.2**	**0.06**	**0.15**	**0.06**	**0.09**	**0.28**	0.01	0.02
Reactive Phosphorus as P	0.015	<0.01	<0.01	<0.01	<0.01	**0.05**	<0.01	<0.01	<0.01	<0.01
Per- and Polyfluoroalkyl Substances (PFAS) (µg/L)										
PFOA	19	<0.0002	0.002	<0.0002	0.0022	<0.0002	0.002	0.0005	<0.0002	0.0002
PFOS	0.00023	<0.0002	**0.0032**	<0.0002	**0.0041**	**0.001**	**0.007**	**0.0033**	<0.0002	**0.001**
Total Positive PFAS	-	0.0071	0.12	0.001	0.2	0.023	0.048	0.015	<0.0002	0.004
Dissolved Metals (mg/L)										
Cadmium	0.0002	<0.00005	<0.00005	<0.00005	**0.00053#**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	0.001 (CrVI+)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	**0.0012**	<0.0005	<0.0005
Copper	0.0014	0.0003	0.0008	0.0004	**0.0076**	**0.0027**	0.0008	0.0012	0.0003	0.0011
Zinc	0.008	0.004	0.003	0.002	**0.22#**	**0.13#**	**0.016#**	**0.057#**	<0.001	**0.025#**

Does not exceed the hardness modified guideline value (Table 6)

Table 3 Summary of water quality exceedances, compared to the Australian Livestock Drinking Water Guidelines and Australian Irrigation Guidelines (ANZECC/ARMCANZ 2000)

Highlighted data has exceeded a guideline value. Refer to Appendix 1, Table 5 for the full list of sampling results and guideline values.

	Guideline for Livestock Drinking Water	Guideline for Irrigation Water (short-term use)	Guideline for Irrigation Water (long-term use)	AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
				Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek -d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – Licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River- u/s of confluence	Mulwaree River – d/s of confluence
				Woodlawn Eco Precinct	Woodlawn Mine operational area	Taylor Creek Road	Woodlawn Eco Precinct	Woodlawn Eco Precinct	Woodlawn Eco Precinct	Intermodal land	Intermodal land	Intermodal land
General Water Quality / Physiochemistry												
TDS (mg/L)	0-2000*			1100	**4600**	1600	**4400**	**2300**	1600	910	320	460
Total Phosphorus as P		0.8-12	0.05	**0.07**	**0.2**	**0.06**	**0.15**	**0.06**	**0.09**	**0.28**	0.01	0.02
Anions/Cations (mg/L)												
Sulfate	1000			140	**2400**	140	**2000**	220	490	150	8	39
Chloride		175#		**220**	**390**	**460**	**690**	**880**	**400**	**250**	87	120
Sodium		115#		**100**	**390**	**310**	**360**	**250**	**180**	97	45	54
Total Metals (mg/L)												
Iron		10	0.2	**0.5**	**0.5**	**0.3**	**0.6**	0.2	0.2	**16**	0.3	0.4
Manganese	-	10	0.2	**0.78**	**1.3**	**0.59**	**1.5**	0.19	0.18	**0.59**	0.02	0.08

* Value for poultry; other livestock tolerate higher TDS concentrations.

Guideline depends on crop sensitivity. Other crops tolerate much higher concentrations.

Discussion of surface water sampling results

Ecological water quality guidelines

Salinity

Waterways throughout the study area are saline, with all locations exceeding the ecological guideline. The highest salinity occurs at the sites directly adjacent to the Woodlawn site (4,900 µS/cm) at AL02 in Allianoyonyiga Creek, and CR01 in Crisps Creek. Salinity concentrations generally decrease with distance downstream. Salinity within Mulwaree River is much lower than Crisps Creek, with the Mulwaree River increasing from 500 µS/cm to 730 µS/cm downstream of the confluence of Crisps Creek and the Mulwaree River.

Figure 3 Officers sampling a waterway at the Precinct on 29 April 2025

Nutrients

Nutrient concentrations were elevated nearest to the Woodlawn site. Total nitrogen levels at AL02 in Allianoyonyiga Creek and CR01 in Crisps Creek exceeded the ecological guideline more than tenfold, with values of 2.6 mg/L and 2.8 mg/L respectively.

While total nitrogen concentrations generally declined downstream, they remained above the ecological guideline throughout the study area. NOx (nitrate + nitrite) slightly exceeded the ecological guideline at several sites within Allianoyonyiga and Crisps Creeks (AL01, AL03, CR01 and CR04) but not in Mulwaree River. Total phosphorus exceeded the ecological guideline in both creeks as well, reaching 0.2 mg/L at AL02 in Allianoyonyiga Creek before dropping to 0.05 mg/L downstream. In Crisps Creek, total phosphorus ranged from 0.06 to 0.28 mg/L, while values in Mulwaree River remained below the ecological guidelines.

Per- and polyfluoroalkyl substances (PFAS)

PFAS compounds were detected at all locations except upstream Mulwaree River.

PFOS exceeded the ecological guideline throughout Crisps Creek as well as at AL02 in Allianoyonyiga Creek and the downstream Mulwaree River site MU02.

PFOA was also present in low concentrations (below the ecological guidelines) at AL02, CR01, CR03, CR04, and MU02.

PFOS and PFOA were not detected upstream in Mulwaree River, but were found downstream, suggesting Crisps Creek could be a source of contamination. The highest total PFAS concentrations were observed at the sites AL02 in Allianoyonyiga Creek and CR01 in Crisps Creek which are both immediately adjacent to the Woodlawn Site.

Metals

Dissolved cadmium exceeded the ecological guideline at CR01 in Crisps Creek but fell below the hardness-modified guideline (Table 6). Dissolved chromium at Crisps Creek Site CR04 (0.0012 mg/L) was slightly above the ecological guideline (0.001 mg/L).

Dissolved zinc exceeded the ecological guideline throughout Crisps Creek. The highest concentrations were at the Crisps Creek sites directly adjacent to the Woodlawn site, with concentrations decreasing downstream.

Dissolved zinc also exceeded the ecological guideline at the downstream Mulwaree site (MU02) below the confluence with Crisps Creek, suggesting Crisps Creek could be a source of contamination. After hardness adjustment, all sites fell below the modified guideline values (Table 6).

Dissolved copper exceeded the ecological guideline at CR01 and CR02, the two sites closest to the Woodlawn Site. Copper and zinc concentrations across the region may reflect naturally elevated background levels as the local geology is known to contain copper and zinc mineralisation.

Livestock and irrigation water quality guidelines

There are no livestock and irrigation water quality guidelines for PFAS.

Total dissolved solids (TDS)

TDS is elevated within both Crisps Creek and Allianoyonyiga Creek. As with electrical conductivity, the highest concentrations were recorded at sites adjacent to the Woodlawn Site, with levels decreasing downstream.

TDS exceeded the Livestock Drinking Water guideline for Poultry at AL02, CR01 and CR02. Exceedances at sites AL02 and CR01 could lead to reduced production and adverse animal health effects if used as drinking water for poultry, however the EPA is not aware of any use of the water at those locations for that purpose.

At CR01 and AL02 concentrations reached 4400mg/L, also exceeding the Livestock Drinking Water Guideline for cattle, horses and pigs. However, at these levels, adverse health impacts for these livestock types are unlikely, although water palatability may be affected.

In contrast, TDS levels in the Mulwaree River were lower and remained well below the relevant livestock drinking water guidelines.

Phosphorus

Phosphorus concentrations across both Allianoyonyiga Creek and Crisps Creek exceeded the long-term irrigation guideline value. However, they remained below the short-term irrigation guidelines.

At the concentrations observed there is a potential risk of bioclogging of irrigation equipment but adverse effects on crops are not expected (ANZECC 2000).

Sulfate

Sulfate concentrations exceed the Livestock Drinking Water Guidelines at the two sites nearest to the Woodlawn Site (AL01 and CR01). Concentrations at these sites ranged from 2000 to 4000 mg/L, a level at which adverse effects may occur in young or lactating animals, particularly during hot weather when water intake increases. According to ANZECC (2000) sulfate levels above 2000 mg/L may cause chronic or acute health effects in livestock.

Chloride and sodium

Chloride and sodium concentrations exceeded the Irrigation Water Quality Guidelines for sensitive crop species at several sites within Crisps Creek and Allianoyonyiga Creek. Chloride levels at AL02, AL03, CR01 and CR03 are only appropriate for moderately tolerant crops (350–700 mg/L), while CR02 was only appropriate for chloride tolerant crops (>700 mg/L).

Sodium concentrations at AL02, AL03, CR01 and CR02 are only appropriate for crops moderately tolerant to sodium (230–360 mg/L).

Metals

Manganese and iron exceeded the long-term irrigation guidelines values at sites AL01, AL02, AL03, CR01 and CR04. However, these concentrations remained below the relevant short-term irrigation guidelines thresholds.

What happens next

This sampling exercise provides a snapshot of the water quality in the Mulwaree River, Crisps Creek and Allianoyonyiga Creek at a single point in time surrounding the Woodlawn Site. While noting the limited scope of the October 2024 and April 2025 sampling programs, the water quality results generally indicate elevated pollutant levels closest to the Woodlawn Site and improving with distance downstream.

In response to the potential for water pollution to be occurring from the Woodlawn site the EPA has varied a licence condition on the environment protection licence of the Woodlawn Eco Precinct, requiring detailed investigations, assessment and modelling of the potential off-site impacts.

The EPA will also consult with community members to better understand water use in the area and any potential for use for livestock watering or irrigation.

References

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Appendix A: Tables

Table 4 Comprehensive sampling results for 29 April 2025 at the Woodlawn Precinct compared against the ecological guideline values (ANZG 2018 and ANZECC/ARMCANZ 2000)

		AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Aquatic Ecosystems Water Quality Guideline	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm - licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River- u/s of confluence	Mulwaree River – d/s of confluence
General Water Quality/Physio-chemistry										
Temperature (°C)	-	15.7	15.6	14.43	15.95	14.34	15.19	13.8	15.36	15.91
Dissolved Oxygen (%)	90-110	**14.4**	**77.5**	**27.8**	**44.2**	**30.2**	96.1	**51.5**	98.9	**74.6**
pH	6.5-8	7.6	**8.4**	8	7.6	7.9	7.7	7.7	7.9	8
Electrical Conductivity (µS/cm)	30-350	**1600**	**4900**	**2600**	**5000**	**3600**	**2300**	**1400**	**550**	**730**
Turbidity (NTU)	2-25	5.6	**35.1**	11.6	21.8	22.5	4.1	18.3	1.1	4.1
Total Alkalinity (mg CaCO3/L)	-	410	390	620	170	460	170	190	130	140
COD (mg/L)	-	180	160	150	230	220	130	140	110	<25
BOD (mg/L)	-	3	6	4	7	3	4	3	3	3
DOC (as NPOC) (mg/L)	-	10	36	14	31	13	14	8	6	7
TOC (as NPOC) (mg/L)	-	9	32	14	31	11	15	10	6	7
TDS (mg/L)	-	1100	4600	1600	4400	2300	1600	910	320	460
TSS (mg/L)	-	22	29	21	21	9	4	94	<4	<4
Nutrients (mg/L)										
Ammonia	0.9	0.02	0.02	0.01	0.18	0.01	0.01	<0.01	<0.01	<0.01
Ammonia as N	0.013	**0.02**	**0.02**	0.01	**0.18**	0.01	0.01	<0.01	<0.01	<0.01

		AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Aquatic Ecosystems Water Quality Guideline	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm - licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River- u/s of confluence	Mulwaree River – d/s of confluence
Total Nitrogen as N	0.25	**0.6**	**2.6**	**0.8**	**2.8**	**0.7**	**1**	**1.1**	**0.3**	**0.4**
Nitrate +Nitrite as N	0.015	**0.02**	<0.01	**0.02**	**0.05**	0.01	<0.01	**0.02**	<0.01	<0.01
Nitrate	0.7	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Nitrite	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Total Kjeldahl Nitrogen as N	-	0.6	2.6	0.8	2.8	0.7	1	1.1	0.3	0.4
Total Phosphorus as P	0.02	**0.07**	**0.2**	**0.06**	**0.15**	**0.06**	**0.09**	**0.28**	0.01	0.02
Reactive Phosphorus as P	0.015	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
Phosphate	-	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Anions/Cations (mg/L)										
Sulfate	-	140	2400	140	2000	220	490	150	8	39
Sulfur	-	50	860	48	710	84	180	55	3.4	13
Bromide	-	0.6	<0.5	1.7	1.4	2	<0.5	0.6	<0.5	<0.5
Chloride	-	220	390	460	690	880	400	250	87	120
Fluoride	1.7	0.3	0.6	0.7	0.5	0.4	0.3	0.2	0.2	0.2
Calcium	-	100	290	82	290	200	130	82	34	41
Potassium		0.6	11	2.4	14	2	1.4	0.8	1.9	1.7
Sodium	-	100	390	310	360	250	180	97	45	54
Per- and Polyfluoroalkyl Substances (PFAS) (µg/L)										
PFOA	19	<0.0002	0.002	<0.0002	0.0022	<0.0002	0.002	0.0005	<0.0002	0.0002
PFOS	0.00023	<0.0002	**0.0032**	<0.0002	**0.0041**	**0.001**	**0.007**	**0.0033**	<0.0002	**0.001**
Total PFHxS & PFOS	-	0.0032	0.014	<0.0002	0.04	0.0065	0.023	0.0092	<0.0002	0.0025

		AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Aquatic Ecosystems Water Quality Guideline	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm - licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River- u/s of confluence	Mulwaree River – d/s of confluence
Total Positive PFAS	-	0.0071	0.12	0.001	0.2	0.023	0.048	0.015	<0.0002	0.004
Total Positive PFOS & PFOA	-	<0.0002	0.0052	<0.0002	0.0063	0.001	0.0089	0.0038	<0.0002	0.001
Dissolved Metals (mg/L)										
Aluminium	0.055	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Antimony	0.009*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	0.013 (AsV+)	<0.0005	0.001	<0.0005	0.001	0.0006	0.0005	<0.0005	0.0005	0.0005
Barium		0.048	0.062	0.085	0.027	0.048	0.07	0.071	0.086	0.069
Beryllium	0.00013*	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron	0.94	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.0002	<0.00005	<0.00005	<0.00005	**0.00053#**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	0.001 (CrVI+)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	**0.0012**	<0.0005	<0.0005
Cobalt	0.0014*	0.0011	0.0008	0.00018	0.0011	0.00019	0.0001	0.00029	<0.00005	0.00006
Copper	0.0014	0.0003	0.0008	0.0004	**0.0076**	**0.0027**	0.0008	0.0012	0.0003	0.0011
Iron	0.3# (draft)	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	0.0034	<0.0001	0.0001	0.0001	0.0016	0.0002	<0.0001	<0.0001	<0.0001	0.0001
Lithium	-	0.0006	0.0003	0.0003	0.0014	0.0007	0.0008	0.0005	0.0002	0.0003
Magnesium	-	91	550	150	460	240	130	72	24	34
Manganese	1.9	0.71	1.3	0.095	1.5	0.18	0.062	0.18	0.011	0.011
Mercury (µg/L)	0.06	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
Molybdenum	0.034*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	0.011	0.0014	0.0038	0.0007	0.0047	0.0013	0.0011	0.0013	0.0005	0.0009
Selenium	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005

		AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Aquatic Ecosystems Water Quality Guideline	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm - licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek – d/s of CR02	Crisps Creek - u/s of confluence	Mulwaree River- u/s of confluence	Mulwaree River – d/s of confluence
Strontium	-	0.35	1.2	0.65	1.3	0.75	0.53	0.34	0.2	0.21
Thallium	0.00003*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	0.003*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.006*	0.0002	0.0051	0.0005	0.0006	0.0006	0.0002	<0.0001	<0.0001	<0.0001
Zinc	0.008#	0.004	0.003	0.002	**0.22#**	**0.13#**	**0.016#**	**0.057#**	<0.001	**0.025**

Does not exceed the hardness modified guideline value (Table 6)

*ANZECC/ARMCANZ 2000 Low reliability guideline

Table 5 Comprehensive sampling results for 29 April 2025 at the Woodlawn Precinct compared to the Australian Livestock Drinking Water Guidelines and Australian Irrigation Guidelines (ANZECC/ARMCANZ 2000)

				AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Guideline for Livestock Drinking Water	Guideline for Irrigation Water (short-term use)	Guideline for Irrigation Water (long-term use)	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek - downstream of CR02	Crisps Creek - u/s of confluence	Mulwaree River - u/s of confluence	Mulwaree River - d/s of confluence
General Water Quality/ Physiochemistry												
Temperature (°C)				15.7	15.6	14.43	15.95	14.34	15.19	13.8	15.36	15.91
Dissolved Oxygen (%)				14.4	77.5	27.8	44.2	30.2	96.1	51.5	98.9	74.6
pH		6.5-8.5	6.5-8.5	7.6	8.4	8	7.6	7.9	7.7	7.7	7.9	8
Electrical Conductivity (µS/cm)				1600	4900	2600	5000	3600	2300	1400	550	730
Turbidity (NTU)				5.6	35.1	11.6	21.8	22.5	4.1	18.3	1.1	4.1
Total Alkalinity (mg CaCO3/L)				410	390	620	170	460	170	190	130	140
COD (mg/L)				180	160	150	230	220	130	140	110	<25
BOD (mg/L)				3	6	4	7	3	4	3	3	3
DOC (as NPOC) (mg/L)				10	36	14	31	13	14	8	6	7
TOC (as NPOC) (mg/L)				9	32	14	31	11	15	10	6	7
TDS (mg/L)	0-2000*			1100	**4600**	1600	**4400**	**2300**	1600	910	320	460
TSS (mg/L)				22	29	21	21	9	4	94	<4	<4
Nutrients (mg/L)												
Ammonia				0.02	0.02	0.01	0.18	0.01	0.01	<0.01	<0.01	<0.01
Ammonia as N				0.02	0.02	0.01	0.18	0.01	0.01	<0.01	<0.01	<0.01
Total Nitrogen as N		25-125	5	0.6	2.6	0.8	2.8	0.7	1	1.1	0.3	0.4
Nitrate +Nitrite as N				0.02	<0.01	0.02	0.05	0.01	<0.01	0.02	<0.01	<0.01
Nitrate	400			<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Nitrite	30			<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

				AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Guideline for Livestock Drinking Water	Guideline for Irrigation Water (short-term use)	Guideline for Irrigation Water (long-term use)	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek - downstream of CR02	Crisps Creek - u/s of confluence	Mulwaree River - u/s of confluence	Mulwaree River - d/s of confluence
Total Kjeldahl Nitrogen as N				0.6	2.6	0.8	2.8	0.7	1	1.1	0.3	0.4
Total Phosphorus as P		0.8-12	0.05	**0.07**	**0.2**	**0.06**	**0.15**	**0.06**	**0.09**	**0.28**	0.01	0.02
Reactive Phosphorus as P				<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
Phosphate				<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Anions/cations (mg/L)												
Sulfate	1000			140	**2400**	140	**2000**	220	490	150	8	39
Sulfur				50	860	48	710	84	180	55	3.4	13
Bromide				0.6	<0.5	1.7	1.4	2	<0.5	0.6	<0.5	<0.5
Chloride		175#		**220**	**390**	**460**	**690**	**880**	**400**	**250**	87	120
Fluoride	2	2	1	0.3	0.6	0.7	0.5	0.4	0.3	0.2	0.2	0.2
Calcium				100	290	82	290	200	130	82	34	41
Potassium				0.6	11	2.4	14	2	1.4	0.8	1.9	1.7
Sodium		115#		**100**	**390**	**310**	**360**	**250**	**180**	97	45	54
Per- and polyfluoroalkyl substances (PFAS) (µg/L)												
PFOA				<0.0002	0.002	<0.0002	0.0022	<0.0002	0.002	0.0005	<0.0002	0.0002
PFOS				<0.0002	0.0032	<0.0002	0.0041	0.001	0.007	0.0033	<0.0002	0.001
Total PFHxS & PFOS				0.0032	0.014	<0.0002	0.04	0.0065	0.023	0.0092	<0.0002	0.0025
Total Positive PFAS				0.0071	0.12	0.001	0.2	0.023	0.048	0.015	<0.0002	0.004
Total Positive PFOS & PFOA				<0.0002	0.0052	<0.0002	0.0063	0.001	0.0089	0.0038	<0.0002	0.001
Total Metals (mg/L)												
Aluminium	5	20	5	<0.04	0.17	0.14	0.08	<0.04	<0.04	0.69	<0.04	<0.04

				AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Guideline for Livestock Drinking Water	Guideline for Irrigation Water (short-term use)	Guideline for Irrigation Water (long-term use)	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek - downstream of CR02	Crisps Creek - u/s of confluence	Mulwaree River - u/s of confluence	Mulwaree River - d/s of confluence
Antimony				<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	0.5	2	0.1	<0.0005	0.001	<0.0005	0.0011	0.0006	0.0005	0.0029	0.0006	0.0007
Barium				0.053	0.062	0.097	0.028	0.048	0.081	0.093	0.086	0.075
Beryllium		0.5	0.1	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00006	<0.00005	<0.00005
Boron	5	<0.5#	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.01	0.05	0.01	<0.00005	<0.00005	<0.00005	0.0014	0.00028	<0.00005	0.0014	<0.00005	0.00007
Chromium	1	1	0.1	<0.0005	<0.0005	0.0005	0.0006	<0.0005	<0.0005	0.0016	<0.0005	0.0025
Cobalt	1	0.1	0.05	0.0012	0.00085	0.00035	0.0012	0.00021	0.0002	0.0017	0.00007	0.00021
Copper	0.4**	5	0.2	0.0003	0.0012	0.0004	0.018	0.0036	0.0008	0.011	0.0003	0.0011
Iron		10	0.2	**0.5**	**0.5**	**0.3**	**0.6**	0.2	0.2	**16**	0.3	0.4
Lead	0.1	5	2	<0.0001	0.0004	0.0001	0.005	0.0004	<0.0001	0.0058	<0.0001	0.0002
Lithium		2.5	2.5	0.0006	0.0003	0.0003	0.0014	0.0007	0.0008	0.0007	0.0002	0.0004
Magnesium				94	550	150	460	240	150	72	24	36
Manganese	-	10	0.2	**0.78**	**1.3**	**0.59**	**1.5**	0.19	0.18	**0.59**	0.02	0.08
Mercury (µg/L)	0.002	0.002	0.002	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
Molybdenum	0.15	0.05	0.01	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006
Nickel	1	2	0.2	0.0015	0.0038	0.0009	0.0051	0.0013	0.0011	0.0021	0.0005	0.0013
Selenium	0.02	0.05	0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver				<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium				0.36	1.2	0.67	1.4	0.74	0.53	0.34	0.19	0.22
Thallium				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin				<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002

				AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
	Guideline for Livestock Drinking Water	Guideline for Irrigation Water (short-term use)	Guideline for Irrigation Water (long-term use)	Allianoyonyiga Creek	Allianoyonyiga Creek - licensed monitoring point	Allianoyonyiga Creek - d/s of Woodlawn Site	Crisps Creek on Woodlawn Farm – licensed monitoring point	Crisps Creek - d/s of CR01	Crisps Creek - downstream of CR02	Crisps Creek - u/s of confluence	Mulwaree River - u/s of confluence	Mulwaree River - d/s of confluence
Titanium				<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium		0.5	0.1	0.0003	0.0054	0.0009	0.001	0.0007	0.0003	0.0024	<0.0001	0.0002
Zinc	20	5	2	0.006	0.014	0.002	0.5	0.14	0.025	0.46	<0.001	0.027

Table 6 Hardness modified guideline values

Parameter	AL01	AL02	AL03	CR01	CR02	CR03	CR04	MU01	MU02
Total hardness (calculated) mg/L	660.4	2980	825	2611	1459	940	502.7	180.9	255.1
Cadmium (calculated) mg/L	0.003	0.012	0.004	0.011	0.006	0.004	0.002	0.001	0.001
Zinc (calculated) mg/L	0.111	0.399	0.134	0.356	0.217	0.150	0.088	0.037	0.049
Lead (calculated) mg/L	0.172	1.169	0.229	0.988	0.472	0.270	0.122	0.033	0.052
Nickel (calculated) mg/L	0.152	0.548	0.184	0.490	0.299	0.206	0.121	0.051	0.068

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