Upper Belubula River catchment surface water and groundwater testing – 9 to 12 December 2024

Between 9 to 12 December 2024, the NSW Environment Protection Authority (EPA) conducted sampling in the upper Belubula River catchment area to investigate potential sources of contamination from per- and polyfluoroalkyl substances (PFAS) and various other pollutants. This report summarises the results from that sampling.

Background

Land use in the upper Belubula River catchment is dominated by agriculture but also contains some industry, including quarries, a decommissioned abattoir, Blayney Sewage Treatment Plant and landfill operated by Blayney Shire Council, the Newmont Cadia gold mine (Cadia), the current and former Cadia dewatering facilities, and a composting facility operated by Australian Native Landscapes (ANL), which is located on a former mine site. There are townships on the Belubula River, including Blayney and Carcoar.

Earlier in 2024, the community raised concerns regarding water quality of the creeks surrounding Cadia and the Belubula River. In response to this, the EPA collected water samples from the upper Belubula River catchment in May, July, August and October 2024. These results identified the need for further investigation into potential per- and polyfluoroalkyl substances (PFAS) contaminant sources within the catchment.

Reports summarising those sampling results are available on the EPA's website.

Sampling approach

In December 2024, the EPA collected surface water samples from 41 locations along the Belubula River and surrounding locations to investigate potential sources of contamination in the upper Belubula River catchment. Twenty-one surface water samples were collected from 3 licensed facilities (the Newmont Cadia gold mine, Blayney Council landfill, and ANL). Twenty surface water samples were collected from the upper Belubula River catchment as per the previous sampling rounds.

The EPA also collected groundwater samples from 10 monitoring bores situated to the west, and south of the mining area at Cadia. An additional sample was collected from a water tank, sourced by the community groundwater bore adjacent to the Blayney Council landfill (GW056811).

Duplicates were sampled (at approximately one in every 10 sites) to ensure the accuracy and reliability of the sampling methodology and data analysis.

A water quality meter was used during sampling to measure key parameters such as pH, electrical conductivity, dissolved oxygen, temperature and turbidity. A representative water sample was also

collected from each site for analysis of per- and polyfluoroalkyl substances (PFAS), metals, total dissolved solids, nutrients and hydrocarbons. Samples were analysed by the NSW Environmental Forensics laboratory.

Sample locations

Belubula River catchment surface waters

Belubula River catchment sampling locations replicated the October 2024 sites, which were chosen based on locations of community concern, accessibility for sampling, previous testing and proximity to potential industrial sources of pollution. See the full list of catchment sampling locations in Table 1 and Figure 1 below.

Additional samples were collected on site at 3 facilities that hold an environment protection licence. These include the Newmont Cadia gold mine, Blayney Council landfill and ANL. Details of these sample sites can be found under *Surface waters from licensed facilities* below.

- Cadia (EPL 5590) is next to Cadiangullong Creek to the west and Flyers Creek to the east, which flow into the Belubula River south of the mine.
- The Blayney Council landfill (EPL 6180) is next to Mackenzies Waterholes Creek, which flows into Cowriga Creek, and then the Belubula River.
- Australian Native Landscapes (ANL) (EPL 1249), a composting facility, is next to Cowriga Creek. It is located on the former Browns Creek mine site.
- The Blayney Sewage Treatment Plant (EPL 1648) is located at 3502 Hobbys Yard Road, which is next to the Belubula River, upstream of Carcoar Dam.
- The former Blayney Abattoir is at the north end of Blayney, next to Abattoir Creek (which flows into the Belubula River). It was closed more than 20 years ago.
- Two quarries are located in the upper reaches of Abattoir Creek.

Diffuse sources of pollution in the catchment include runoff from agricultural lands and small townships (such as Blayney and Carcoar).

Sites with no known potential contamination sources were sampled for comparison.

Table 1 Sample site and location descriptions for surface water samples collected in the Belubula River catchment between 9 and 12 December 2024

Sampling site	Waterway	Location description	Potential contamination sources
SW1	Belubula River	Upstream of Blayney at Dungeon Road	No known sources

Sampling site	Waterway	Location description	Potential contamination sources
SW2	Abattoir Creek	Upstream of old abattoir and the Belubula River at Blayney	Adjacent to quarries
SW3	Belubula River	Off Newbridge Road, Goose Park, within township of Blayney	Old abattoir, former and current dewatering facility
SW4	Belubula River	~1 km downstream of Blayney Sewage Treatment Plant off Hobbys Yards Road	Sewage treatment plant, former abattoir, dewatering facility
SW5	Mackenzies Waterholes Creek	~1 km downstream of Blayney landfill	Landfill
SW6	Belubula River	~100 m upstream of Cowriga Creek junction with Belubula River, downstream of Carcoar dam	Sewage treatment plant, old abattoir, dewatering facility
SW7	Cowriga Creek	~15 km downstream of Blayney landfill; ~50 m upstream of the Belubula and Cowriga Creek junction, near Carcoar	Landfill, composting facility
SW8 Not sampled this round	Belubula River	Immediately upstream of Ashburton Bridge, off Errowanbang Road	Landfill, former abattoir, sewage treatment plant, and composting facility
SW9	Belubula River	Immediately downstream of Ashburton Bridge off Errowanbang Road	Landfill, former abattoir, sewage treatment plant, composting facility, dewatering facility
SW10 Not sampled this round	Coombing Creek	~100 m upstream of Coombing Creek junction with the Belubula River, off Midwestern Highway	No known sources
SW11	Belubula River	Burnt Yards Road Bridge	Landfill, former abattoir, sewage treatment plant, composting facility, dewatering facility
SW12	Belubula River	Bakers Shaft Reserve	Landfill, former abattoir, sewage treatment plant, composting facility, dewatering facility
SW13	Flyers Creek	~10 km upstream of junction with Belubula River, off Old Errowanbang Road	Mining

Sampling site	Waterway	Location description	Potential contamination sources
SW14	Cadiangullong Creek	Off Panuara Road, directly west of Cadia mine.	Mining
SW15 **Not sampled this round**	Limestone Creek	~8 km upstream of junction with Belubula River at Boonderoo	No known sources
SW16	Belubula River	Off Malongulli Road	Landfill, former abattoir, sewage treatment plant, composting facility and mining, dewatering facility
SW17	Cowriga Creek	At Browns Creek Rd, upstream of the composting facility	No known sources
SW18	Cowriga Creek	~1km downstream of the composting facility	Composting facility
SW19	Cowriga Creek	~6km downstream of the composting facility	Composting facility
SW20	Mackenzies Waterholes Creek	Upstream of Blayney landfill	No known sources
SW21	Belubula River	Dakers Oval, ~150m upstream of the confluence with Abattoir Creek	No known sources
SW22	Cadiangullong Creek	Off Four Mile Creek Rd, immediately downstream of confluence with Soldiers Creek	No known sources
SW23	Flyers Creek	Off Long Swamp Rd	No known sources

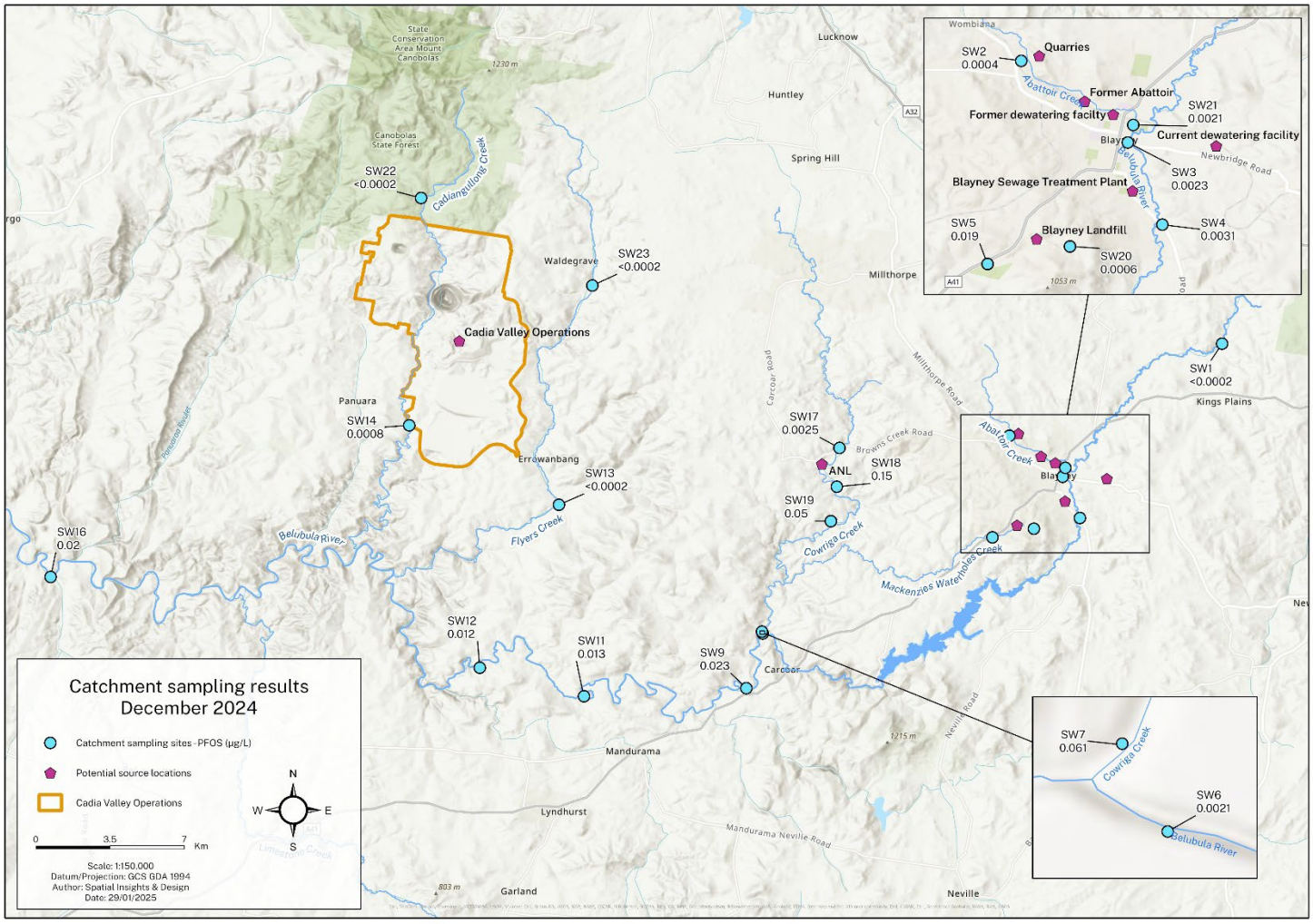

Figure 1 Overview of the Belubula River catchment surface water sampling sites. Results for PFOS concentrations are displayed at each sampling location.

Surface waters from licensed facilities

Twenty-one surface water samples were collected at 3 facilities that hold an environment protection licence, to investigate potential sources of contamination to the surrounding environment. These include the Newmont Cadia gold mine, Blayney Council landfill and Australian Native Landscapes.

See the full list of licensed site sampling locations in Table 2 below.

Table 2 Sample site and location descriptions for surface water samples collected from facilities that hold an environment protection licence, around the Belubula River catchment between 9 and 12 December 2024

Sample site	Sample ID	Sample description	Licensed facility
CSW1	CSW1	Northern Tailings storage facility decant pond (Cadia location 'CAWS42')	Cadia Valley Operations
CSW2	CSW2	Rodds Creek Dam (Cadia location 'CAWS52')	Cadia Valley Operations
CSW3	CSW3	Pit tailings water collected from transfer pump on S/W edge of pit (Cadia location 'CAWS65')	Cadia Valley Operations
CSW4	CSW4	Site run of pond – mine operational areas (Cadia location 'CAWS73')	Cadia Valley Operations
CSW5	CSW5	Sediment dam adjacent to Ore Processing plant (Cadia location 'CAWSAR1')	Cadia Valley Operations
CSW6	CSW6	Northern leachate dam (Cadia location 'CAWSNLD')	Cadia Valley Operations
CSW7	CSW7	Sediment dam on southern edge of STSF (Cadia location 'CAWS31')	Cadia Valley Operations
CSW8	CSW8	Dam on south-eastern edge of STSF (Eastern Dyke Storage dam areas (Cadia location 'CAWS73')	Cadia Valley Operations
CSW10	CSW10	Sediment dam on western edge of NTSF and STSF (Cadia location 'CAWS67')	Cadia Valley Operations
CSW11	CSW11	Southern leachate dam (Cadia location 'CAWS35')	Cadia Valley Operations
CSW12	CSW12	Surface water dam west of tailings storage (Cadia location 'CAWSWD')	Cadia Valley Operations
CSW13	CSW13	Dam 'T7' – west of NTSF and STSF (Cadia location 'CAWS72')	Cadia Valley Operations
CSW14	CSW14	Sediment dam east of NTSF (not sampled by Cadia)	Cadia Valley Operations
CSW15	CSW15	Sediment dam – Wire Gully – west of NTSF and STSF (not sampled by Cadia)	Cadia Valley Operations
CSW16	CSW16	Sediment dam 'T8' – west of STSF	Cadia Valley Operations

Sample site	Sample ID	Sample description	Licensed facility
ANLSW1	SWOP	Old open-cut quarry dam, western side of Cowriga Creek which intersects the site	Australian Native Landscapes
ANLSW2	SW Leachate	Leachate dam, eastern side of Cowriga Creek, located below ANL stockpiles	Australian Native Landscapes
ANLSW3	SW Dam South	Southern surface water dam located south of all ANL operations	Australian Native Landscapes
BLSW1	SWBL1	Surface water dam 1, adjacent to active landfill cells and Mackenzies Waterholes Creek	Blayney landfill
BLSW2	SWBL2	Surface water dam 2, east of Surface water dam 1 and the active landfill cells	Blayney landfill
Water Tank – from GW056811	BH-B	GW056811 adjacent to Blayney golf course, Mid Western Highway	Blayney landfill (adjacent)

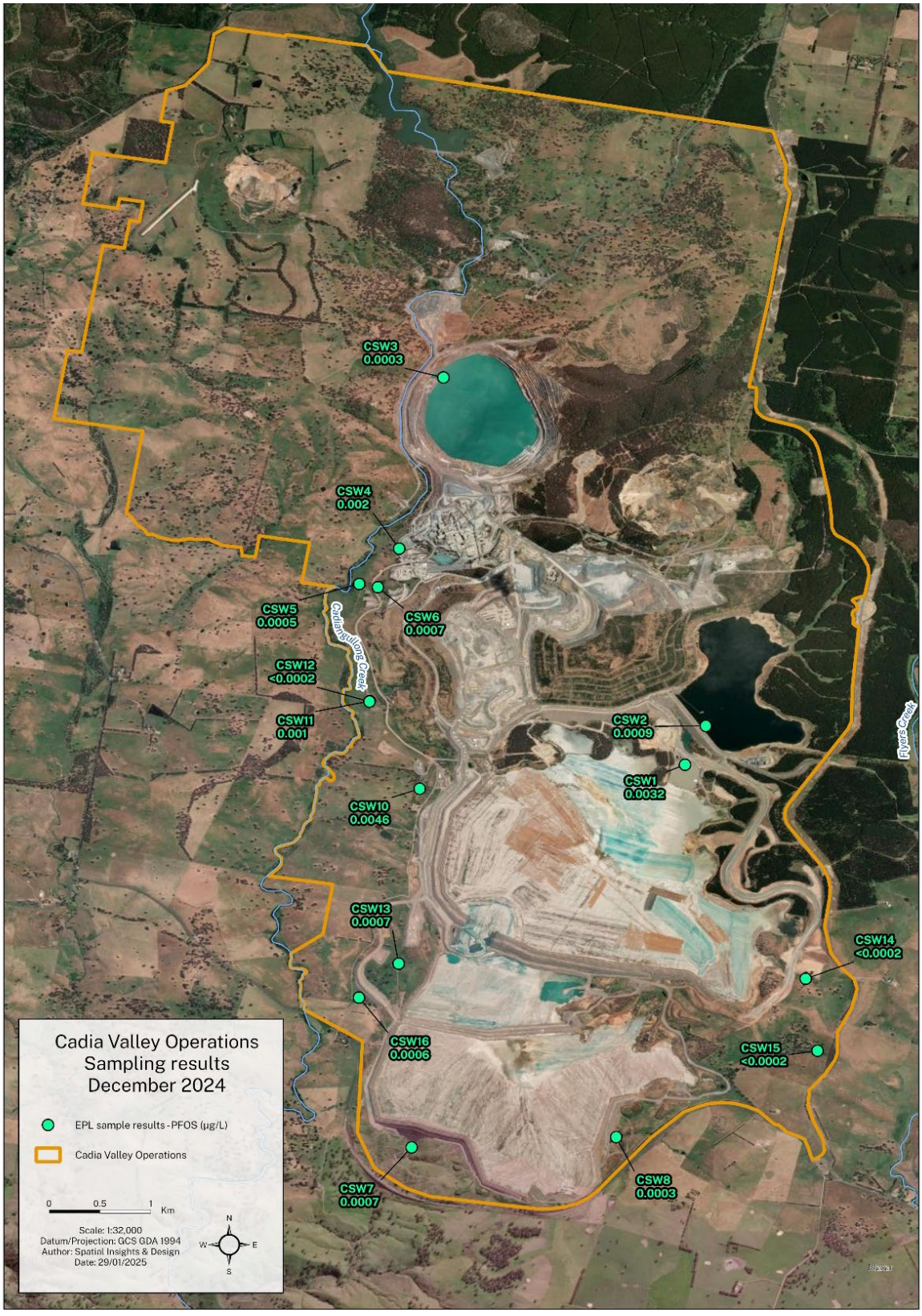

Figure 2 Overview of the Cadia Valley Operations surface water sampling sites. Results for PFOS concentrations are displayed at each sampling location.

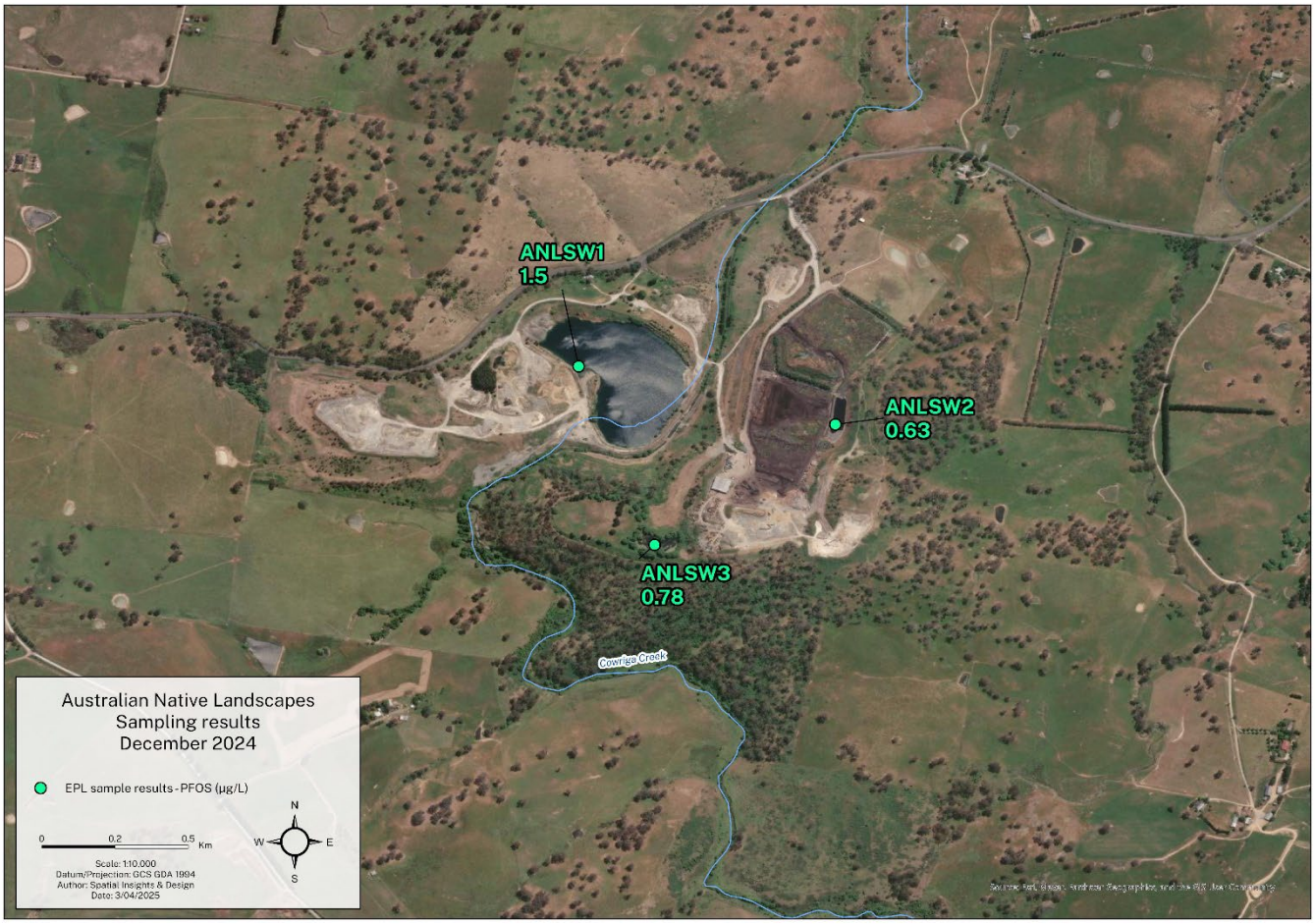

Figure 3 Overview of the Australian Native Landscapes surface water sampling sites. Results for PFOS concentrations are displayed at each sampling location.

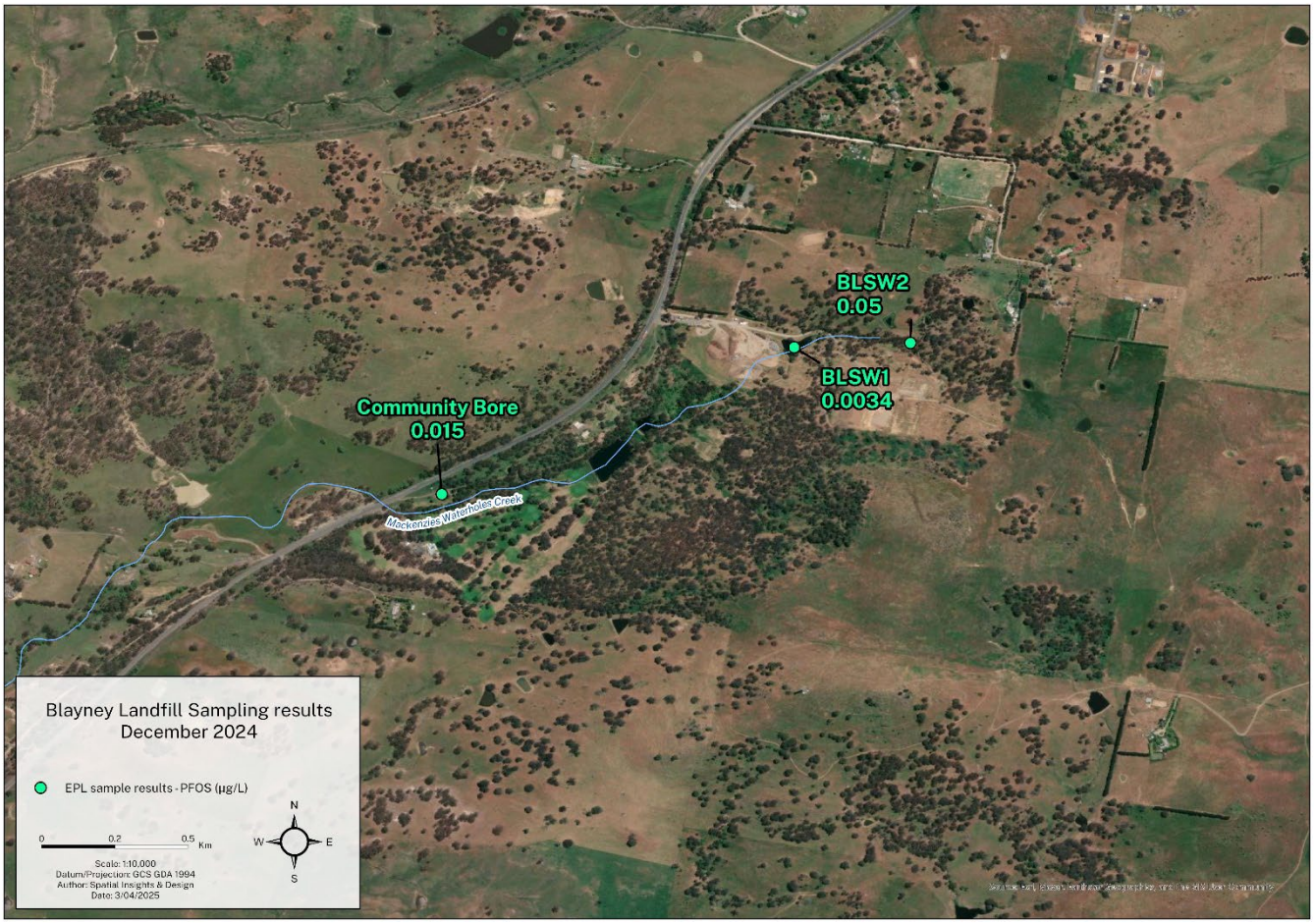

Figure 4 Overview of the Blayney landfill surface water sampling sites (including the off-site community groundwater bore). Results for PFOS concentrations are displayed at each sampling location.

Groundwater sampling locations

Table 3 details the groundwater monitoring bores from which samples were collected. Samples were collected from 10 bores, while one bore (MB1B) was found to be dry. Figure 5 shows the locations of sampled monitoring bores.

Table 3 Groundwater sampling bores (location, depth and screen interval information provided by Newmont Cadia Valley Operations)

Bore ID	Location description	Screen interval (metres below ground level)	Total depth (m)	Latitude	Longitude	Geological unit	Standing water level (metres below ground level)
MB104	South of Cadia Valley Operations	8 to 14	14.65	-33.5527	149.0150	Ordovician Burnt Yards Basalt Member	1.65
MB105	South of Cadia Valley Operations	42 to 48	48.99	-33.5548	148.9932	Ordovician Weemalla Formation	25.06
MB106	South of Cadia Valley Operations	17 to 21	21.58	-33.5547	148.9932	Tertiary Basalt	20.54
MB109	South of Cadia Valley Operations	42.5 to 54.5	55.04	-33.5440	149.0003	Ordovician Weemalla Formation	13.79
MB110	South of Cadia Valley Operations	18 to 24	24.52	-33.5440	149.0003	Ordovician Weemalla Formation	13.56
MB1A	Cadia Valley Operations ore processing facility	28.5 to 34.5	36	-33.4691	149.9906	Silurian/Ordovician Volcanics	15.00
MB1B	Cadia Valley Operations ore processing facility	0.3 to 6.3	6.5	-33.4691	148.9906	Soil/Clay	Dry – not sampled
MB2A	Cadia Valley Operations ore processing facility	11.65 to 17.65	17.6	-33.4676	148.9884	Ordovician Volcanics	2.49

Bore ID	Location description	Screen interval (metres below ground level)	Total depth (m)	Latitude	Longitude	Geological unit	Standing water level (metres below ground level)
MB2B	Cadia Valley Operations ore processing facility	0.5 to 6.5	6.5	-33.4676	148.9884	Soil/Clay	3.72
MB3A	Cadia Valley Operations ore processing facility	10 to 16	16	-33.4674	148.9889	Ordovician Volcanics	3.18
MB3B	Cadia Valley Operations ore processing facility	0.45 to 6.45	6.4	-33.4674	148.9889	Soil/Clay	3.03

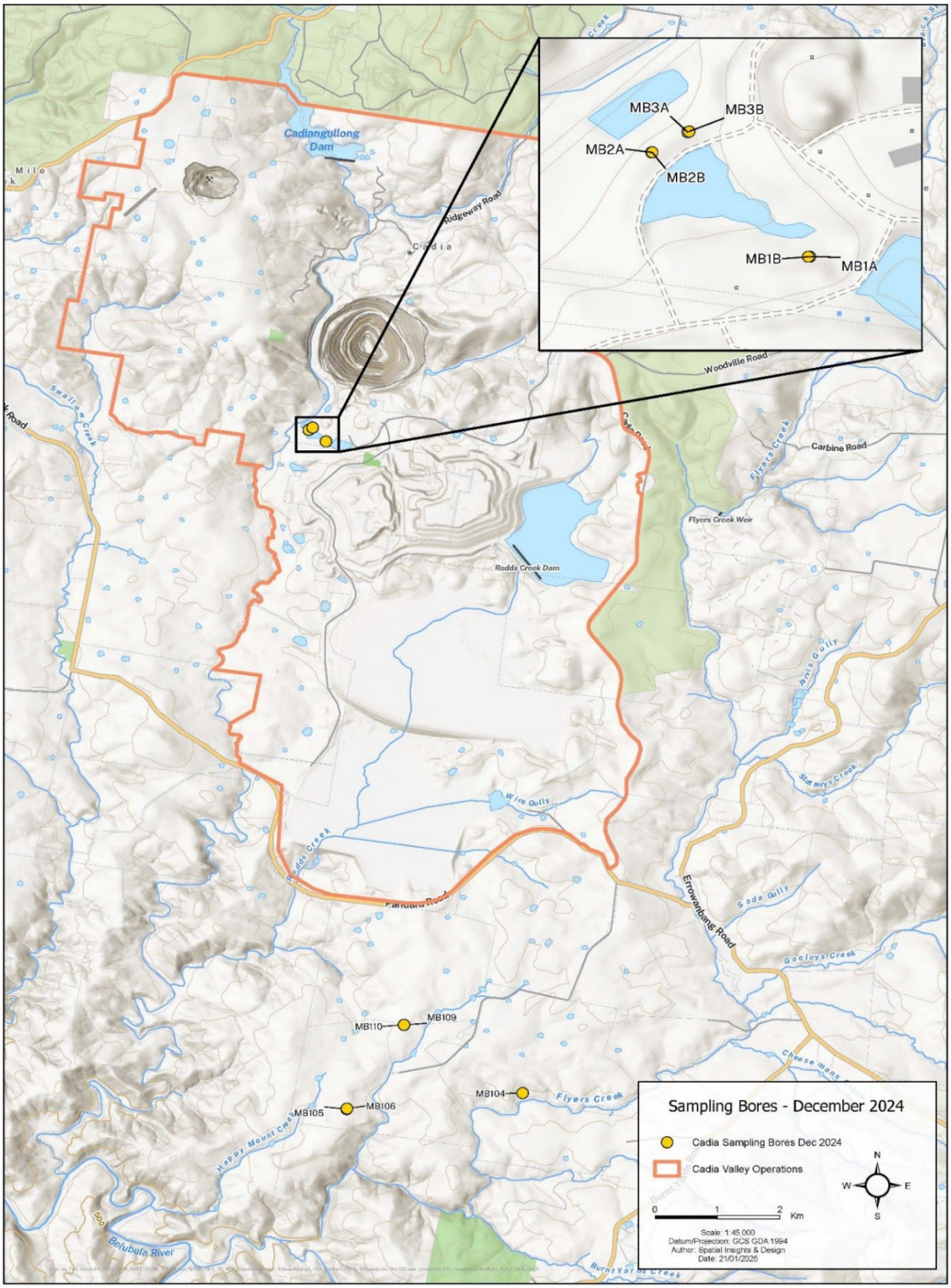

Figure 5 Groundwater sampling locations

Sample analysis approach

This report evaluates the results against the relevant Australian guidelines for livestock, irrigation, and ecological water quality where applicable, including the ANZECC and ARMCANZ 2000, ANZG 2018, and PFAS NEMP Version 3.0 (HEPA 2025). Total metals were compared to the Australian livestock and irrigation guidelines and dissolved metals were compared to ecological water quality guidelines. Total metals provide a more conservative estimate of exposure for livestock, whereas dissolved metals are used for ecological assessments as this is the bioavailable fraction of the metal (the part that is absorbed or used by organisms).

The Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018) recommend deriving site-specific guideline values for physicochemical stressors using reference site data. In the absence of suitable long-term reference site data, we have compared our results to the relevant ANZECC (2000) default guideline values for upland rivers.

The National Chemicals Working Group of the Heads of EPA's Australia and New Zealand have developed a PFAS National Environmental Management Plan (HEPA 2025), which provides ecological water quality guideline values for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). The 99% species protection guideline has been used for comparison, as advised by the Water Quality Guideline framework (ANZG 2018) for bioaccumulative contaminants. A concentration above the 99% guideline value indicates a potential risk to the most sensitive aquatic life.

There are no livestock and irrigation water guidelines for PFAS.

Environmental and ecological water quality guidelines are generally not suitable for comparison against contaminated water stored at licensed facilities as these may not discharge to the environment and/or could undergo further treatment. Therefore, samples collected from licensed facility surface waters were not compared against these guidelines but considered for the presence or absence of pollutants.

Surface water sampling results

All Belubula River catchment surface water sample results are displayed below in Tables 4 and 5, with comparisons to their relevant water quality guidelines.

Results for surface water samples collected from facilities with an environment protection licence are displayed below in Table 6. These have not been compared to any water quality guidelines.

PFAS was detected onsite at ANL (PFOS ranged from 0.63 µg/L to 1.5 µg/L) and the Blayney Council landfill (PFOS ranged from 0.0034 to 0.05 µg/L). PFAS was detected in surface water samples from 15 of 16 sites at Cadia. PFOS was detected at 13 of 16 sampled sites at Cadia, in concentrations ranging from 0.0003 to 0.0046 µg/L.

Arsenic and semi-volatile hydrocarbons were also detected at ANL.

The groundwater bore (GW056811) downgradient of Blayney Council landfill returned a detection of PFAS above background concentration, some metals including copper and arsenic, and nutrients including nitrogen.

Livestock and irrigation water quality guidelines

There were no exceedances of any current irrigation or livestock water guideline values (Table 4). Where the concentration of a pollutant is below the relevant guideline value or within the guideline range, the pollutant is unlikely to pose a risk for irrigation or stock water use.

However, it should be noted that the draft livestock drinking water guidelines (in review) provide a more conservative value for total dissolved solids (TDS; 500 mg/L), which was slightly exceeded in the sample collected from Mackenzies Waterholes Creek just downstream of the landfill (SW5; 670 mg/L). At this concentration, it is unlikely there will be any adverse effects on livestock, except a slight impact on the taste of the water (ANZG 2023).

Ecological water quality guidelines

PFAS

Samples were tested for a range of PFAS substances.

Figure 1 displays the PFOS concentrations measured in the upper Belubula River catchment. The map includes local industry locations, including the Cadia gold mine, Cadia dewatering facilities (current and former), Blayney Council landfill, Blayney Sewage Treatment Plant, Australian Native Landscapes (a composting facility), a decommissioned abattoir and quarries.

PFAS substances, including PFOS, PFOA and perfluorohexanesulfonic acid (PFHxS), were detected in 16 of the 20 catchment sites sampled, with PFOS detected above the ecological water quality guidelines (HEPA 2025) at all 16 of those sites (Table 5).

Similar to results from the October sampling round, the sampling location in Cowriga Creek immediately downstream of the composting facility had the highest PFOS concentrations (0.15 µg/L). These elevated levels continued down Cowriga Creek and into the Belubula River to the furthest sampling point downstream (0.012–0.061 µg/L).

PFOS concentrations also remained elevated in the Mackenzies Waterholes Creek downstream of the Blayney Council landfill (0.019 µg/L). These are above ambient concentrations measured in Victorian agricultural catchments (up to 0.009 µg/L, VIC EPA 2022). PFOS concentrations in samples collected from the Belubula River in December 2024 (highest concentration 0.023 µg/L) were lower than those collected in May, July and October (highest concentration 0.06, 0.071 and 0.042 µg/L respectively) but higher than those collected in August (highest concentration 0.013 µg/L).

Hydrocarbons

Samples were tested for a range of volatile and semi-volatile hydrocarbons (Table 5). Volatile organic compounds commonly found in petroleum products, such as those in the benzene, toluene, ethylbenzene, xylene (BTEX) group were not detected at any sites. However, some Belubula River

and Cowriga Creek sites showed low concentrations of volatile hydrocarbons hexane and methylcyclopentane. Detections were found at sites SW3, SW7, SW11, SW12 and SW18, with the highest concentration of 140 µg/L at SW18 downstream of ANL.

While both hexane and methylcyclopentane can be used in petroleum products, the low concentrations and the absence of BTEX group products indicate another potential source. Both are solvents that can be used for a wide range of purposes, such as in paint or staining products, distillation agents, adhesives, degreasers and air fresheners.

There were no semi-volatile hydrocarbons detected in any of the catchment site samples.

Metals

Dissolved aluminium, arsenic, copper and manganese concentrations exceeded ecological water quality guidelines at some sites, including those with no known potential contamination sources (Table 5).

Dissolved copper concentrations were above the guideline value in 12 of 20 sites in the Belubula River catchment, with the highest concentration measured in Cadiangullong Creek downstream of Cadia (SW14; 0.0075 mg/L). Copper exceedances above the ecological guideline value in this round are consistent with previous sampling results.

Dissolved aluminium exceeded the guideline value at 3 sites, with the highest concentrations recorded where there are no known sources of contamination (0.012 mg/L and 0.013 mg/L at sites SW1 and SW20 respectively).

Dissolved arsenic exceeded the guideline at 2 sites in Cowriga Creek, both downstream of ANL. Site SW18, immediately downstream of ANL, measured 0.024 mg/L, and further downstream, directly before the confluence with the Belubula River, dissolved arsenic measured 0.016 mg/L (SW7).

Dissolved manganese exceeded the guideline value in Mackenzies Waterholes Creek downstream of the landfill (SW5; 2.1 mg/L).

At all sites all other dissolved metal concentrations were below the ecological guideline values.

Physicochemical stressors

Electrical conductivity, pH and turbidity were outside default ecological guideline ranges (ANZECC and ARMCANZ 2000) at some sites, including those with no known potential contamination sources (Table 5). Most sites detected nutrient levels above the guideline values, with total nitrogen detected at up to 8 times above the guideline value, oxides of nitrogen at up to 20 times the guideline value, and total phosphorus at up to 26 times the guideline value. High concentrations of nutrients can result in excessive growth of algae (ANZECC and ARMCANZ 2000).

Surface water summary

Surface water sampling in the catchment indicates a low risk to livestock, irrigation and the surrounding environment from most contaminants. There were some exceedances to ecological guidelines, notably from PFOS downstream of ANL.

Surface water catchment

Table 4 TDS, nutrient and metal (total and dissolved) concentrations for the Belubula River catchment samples, compared to the Australian Livestock Drinking Water Guidelines and the Australian Irrigation Guidelines (ANZECC & ARMCANZ 2000)

Parameter	Guideline for livestock drinking water	Guideline for irrigation water (short-term use)	SW1 Belubula River	SW2 Abattoir Creek	SW3 Belubula River	SW4 Belubula River	SW5 Mackenzies Waterholes Creek	SW6 Belubula River	SW7 Cowriga Creek
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TDS	0–2000*	-	280	320	280	290	670	240	230
Nitrate	400	-	<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
Sulfate	1000	-	20	1	8	13	12	6	7
Ammonia	-	-	0.11	<0.005	0.19	0.14	0.12	<0.005	0.081
Total Nitrogen	-	25–125	1.8	1.2	1.5	1.4	1.7	0.8	1.1
Total Phosphorus	-	0.8–12	0.3	0.4	0.51	0.3	0.2	<0.05	0.4
Metals									
Aluminium	5	20	1.5	0.02	0.24	0.39	0.2	0.23	0.73
Arsenic	0.5	2	0.005	0.014	0.0049	0.0046	0.004	0.0014	0.02
Copper	0.5**	5	0.0035	0.0009	0.002	0.0026	0.004	0.0017	0.0028

Lead	0.1	5	0.0012	0.0002	0.0004	0.0008	0.0003	0.0003	0.0005
Manganese	No value	10	1.4	0.94	0.5	0.44	2.1	0.097	0.19
Mercury	0.002	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	1	2	0.0049	0.003	0.0039	0.0034	0.0072	0.0012	0.0025
Zinc	20	5	0.007	0.001	0.003	0.004	0.009	0.002	0.003
	Guideline for livestock drinking water	**Guideline for irrigation water (short-term use)**	**SW9 Belubula River**	**SW11 Belubula River**	**SW12 Belubula River**	**SW13 Flyers Creek**	**SW14 Cadiangullong Creek**	**SW16 Belubula River**	**SW17 Cowriga Creek**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
TDS	0–2000*	-	240	210	210	410	300	270	190
Nitrate	400	-	<0.9	<0.9	<0.9	<0.9	<0.9	1	<0.9
Nitrite	30	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Sulfate	1000	-	6	5	6	120	88	26	2
Ammonia	-	-	0.019	0.018	0.022	0.028	0.008	0.016	0.075
Total Nitrogen	-	25–125	1	0.8	0.7	0.5	0.3	1	1.3
Total Phosphorus	-	0.8–12	0.1	0.06	0.06	<0.05	<0.05	0.1	0.1
Metals									
Aluminium	5	20	0.76	0.34	0.33	0.14	0.13	2.5	1

Arsenic	0.5	2	0.0044	0.0036	0.0037	0.0035	0.0007	0.0082	0.0013
Copper	0.5**	5	0.0027	0.003	0.003	0.0024	0.016	0.0077	0.0035
Lead	0.1	5	0.0005	0.0004	0.0003	0.0003	0.0001	0.0013	0.0005
Manganese	No value	10	0.12	0.097	0.099	0.16	0.062	0.23	0.11
Mercury	0.002	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	1	2	0.0017	0.0016	0.0016	0.001	<0.0005	0.0028	0.0029
Zinc	20	5	0.003	0.001	0.002	0.001	0.002	0.006	0.004
	Guideline for livestock drinking water	**Guideline for irrigation water (short-term use)**	**SW18 Cowriga Creek**	**SW19 Cowriga Creek**	**SW20 Mackenzies Waterholes Creek**	**SW21 Belubula River**	**SW22 Cadiangullong Creek**	**SW23 Flyers Creek**	
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	
TDS	0–2000*	-	220	210	380	280	89	110	
Nitrate	400	-	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	
Sulfate	1000	-	11	5	6	9	<1	<1	
Ammonia	-	-	0.008	0.024	0.095	0.19	<0.005	<0.005	
Total Nitrogen	-	25–125	0.9	1.2	2.1	1.7	0.2	0.3	
Total Phosphorus	-	0.8–12	0.1	0.1	0.1	0.51	0.05	0.05	

Metals								
Aluminium	5	20	0.44	1.6	1.2	0.35	2.7	0.34
Arsenic	0.5	2	0.027	0.012	0.0013	0.0048	0.0005	0.003
Copper	0.5**	5	0.0047	0.0066	0.0073	0.0024	0.0016	0.0018
Lead	0.1	5	0.0004	0.0009	0.0006	0.0005	0.0007	0.0003
Manganese	No value	10	0.09	0.14	1.1	1.1	0.081	0.23
Mercury	0.002	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	1	2	0.0025	0.0034	0.0026	0.0047	0.001	0.0015
Zinc	20	5	0.002	0.004	0.005	0.004	0.007	0.002

*Value for poultry; other livestock tolerate higher TDS concentrations. Draft revised livestock drinking guidelines have TDS set to <500mg/L: this is exceeded in the Mackenzies Waterholes Creek site (sample SW5).

**Guideline value for sheep. Value is higher for other typical types of livestock.

Any guideline exceedances have been bolded.

Table 5 Physicochemical water quality, nutrient, metal and hydrocarbon concentrations for the Belubula River catchment samples, compared to ecological water quality guidelines (ANZG 2018, ANZECC & ARMCANZ 2000 and HEPA 2025)

Parameter	Ecological water quality guideline	SW1 Belubula River	SW2 Abattoir Creek	SW3 Belubula River	SW4 Belubula River	SW5 Mackenzies Waterholes Creek	SW6 Belubula River	SW7 Cowriga Creek
Physicochemistry								
Temperature (°C)	-	17.8	24.2	18.1	17.7	20.6	22.2	24.2
Dissolved Oxygen (mg/L)	-	0.9	0.2	1.2	0.6	9.5	6.7	3.1
Conductivity (µS/cm)	30–350	304	**510**	**389**	**425**	**995**	**392**	**359**
pH	6.5–8	7.2	7.5	7.5	7.3	7.4	**8.7**	7.3
Turbidity (NTU)	25	6.9	1	3.1	13.9	**45.5**	5.8	7.3
Nutrients (mg/L)								
Total Nitrogen	0.25	**1.8**	**1.2**	**1.5**	**1.4**	**1.7**	**0.8**	**1.1**
Ammonia	0.9	0.11	<0.005	0.19	0.14	0.12	<0.005	0.081
NOx as N	0.015	0.01	<0.005	**0.08**	**0.04**	<0.005	**0.03**	**0.02**
Total Phosphorus	0.02	**0.3**	**0.4**	**0.51**	**0.3**	**0.2**	<0.05	**0.4**
Metals (mg/L)								
Aluminium	0.055	**0.12**	<0.01	0.02	0.04	0.02	<0.01	0.01

Arsenic	0.013	0.0036	0.01	0.0042	0.0038	0.0036	0.0012	**0.016**
Copper	0.0014	**0.002**	0.0004	**0.0015**	0.0014	**0.003**	0.0007	**0.0017**
Lead	0.0034	0.0006	<0.0001	0.0001	0.0002	0.0003	<0.0001	<0.0001
Manganese	1.9	1.3	0.33	0.48	0.42	**2.1**	0.033	0.13
Mercury	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	0.011	0.0042	0.0026	0.0038	0.0031	0.007	0.0009	0.002
Zinc	0.008	0.003	<0.001	0.002	0.002	0.007	<0.001	<0.001
PFAS (µg/L)								
PFHxS	-	<0.0002	<0.0002	0.0009	0.001	0.026	0.0024	0.014
PFOA	19	<0.0002	0.0006	0.0005	0.001	0.035	0.001	0.0035
PFOS	0.00023	<0.0002	**0.0004**	**0.0023**	**0.0031**	**0.019**	**0.0021**	**0.061**
Volatile hydrocarbons (µg/L)								
Benzene	950	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	80	<1	<1	<1	<1	<1	<1	<1
m+*p*-xylene	75	<2	<2	<2	<2	<2	<2	<2
MTBE	-	<1	<1	<1	<1	<1	<1	<1
Naphthalene	16	<1	<1	<1	<1	<1	<1	<1

o-xylene	350	<1	<1	<1	<1	<1	<1	<1
Toluene	180	<1	<1	<1	<1	<1	<1	<1
TRH C6 – C10	-	<10	<10	130	<10	<10	<10	71
Semi-volatile hydrocarbons (mg/L)								
>C10 – C16	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
>C16 – C34	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
>C34 – C40	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Ecological water quality guideline	**SW9 Belubula River**	**SW11 Belubula River**	**SW12 Belubula River**	**SW13 Flyers Creek**	**SW14 Cadiangullong Creek**	**SW16 Belubula River**	**SW17 Cowriga Creek**
Physicochemistry								
Temperature (°C)	-	20.8	22.0	23.2	25.6	19.5	21.3	22.4
Dissolved Oxygen (mg/L)		6.9	6.6	6.3	9.3	7.2	7.7	7.1
Conductivity (µS/cm)	30–350	**379**	319	305	**615**	**408**	**398**	238
pH	6.5–8	**8.4**	**8.0**	**8.3**	**8.4**	7.5	**8.0**	7.2
Turbidity (NTU)	25	**30.1**	7.8	10.5	4.9	3.2	**91.7**	22.4
Nutrients (mg/L)								

Total Nitrogen	0.25	**1**	**0.8**	**0.7**	**0.5**	**0.3**	**1**	**1.3**
Ammonia	0.9	0.019	0.018	0.022	0.028	0.008	0.016	0.075
NOx as N	0.015	**0.06**	**0.07**	**0.09**	**0.05**	**0.05**	**0.2**	**0.1**
Total Phosphorus	0.02	**0.1**	**0.06**	**0.06**	<0.05	<0.05	**0.1**	**0.1**
Metals (mg/L)								
Aluminium	0.055	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Arsenic	0.013	0.0035	0.0031	0.003	0.0031	0.0005	0.0062	0.001
Copper	0.0014	0.0013	**0.0018**	**0.0018**	0.0014	**0.0075**	**0.0023**	**0.0022**
Lead	0.0034	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002
Manganese	1.9	0.035	0.046	0.038	0.11	0.038	0.009	0.043
Mercury	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	0.011	0.0011	0.0012	0.0013	0.0008	<0.0005	0.0012	0.0019
Zinc	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
PFAS (µg/L)								
PFHxS	-	0.0058	0.0022	0.0021	<0.0002	0.0004	0.002	0.0027
PFOA	19	0.002	0.0008	0.0008	<0.0002	0.0003	0.0008	0.001
PFOS	0.00023	**0.023**	**0.013**	**0.012**	<0.0002	**0.0008**	**0.02**	**0.0025**

Volatile hydrocarbons (µg/L)								
Benzene	950	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	80	<1	<1	<1	<1	<1	<1	<1
m+*p*-xylene	75	<2	<2	<2	<2	<2	<2	<2
MTBE	-	<1	<1	<1	<1	<1	<1	<1
Naphthalene	16	<1	<1	<1	<1	<1	<1	<1
o-xylene	350	<1	<1	<1	<1	<1	<1	<1
Toluene	180	<1	<1	<1	<1	<1	<1	<1
TRH C6 – C10	-	<10	93	75	<10	<10	<10	<10
Semi-volatile hydrocarbons (mg/L)								
>C10 – C16	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
>C16 – C34	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
>C34 – C40	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Parameter	**Ecological water quality guideline**	**SW18 Cowriga Creek**	**SW19 Cowriga Creek**	**SW20 Mackenzies Waterholes Creek**	**SW21 Belubula River**	**SW22 Cadiangullong Creek**	**SW23 Flyers Creek**	
Physicochemistry								

Temperature (°C)	-	19.8	22.1	18.8	18.9	15.1	18.5
Dissolved Oxygen (mg/L)	-	5.8	9.5	7.9	0.2	8.9	6.9
Conductivity (µS/cm)	30–350	332	249	**529**	**357**	52	108
pH	6.5–8	7.9	7.4	7.6	7.4	6.8	6.9
Turbidity (NTU)	25	**44.4**	**45.5**	**353**	5	**27.8**	7.5
Nutrients (mg/L)							
Total Nitrogen	0.25	**0.9**	**1.2**	**2.1**	**1.7**	0.2	**0.3**
Ammonia	0.9	0.008	0.024	0.095	0.19	<0.005	<0.005
NOx as N	0.015	**0.3**	**0.2**	<0.02	**0.03**	**0.06**	**0.05**
Total Phosphorus	0.02	**0.1**	**0.1**	**0.1**	**0.51**	**0.05**	**0.05**
Metals (mg/L)							
Aluminium	0.055	0.02	0.03	**0.13**	0.02	**0.06**	0.01
Arsenic	0.013	**0.024**	0.0094	0.001	0.0039	<0.0005	0.0018
Copper	0.0014	**0.0025**	**0.003**	**0.0047**	0.0013	0.0004	0.0009
Lead	0.0034	<0.0001	0.0002	0.0003	0.0002	<0.0001	<0.0001
Manganese	1.9	0.039	0.027	1	1.1	0.05	0.18
Mercury	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Nickel	0.011	0.0017	0.0024	0.0023	0.0041	<0.0005	0.001
Zinc	0.008	<0.001	0.001	0.003	0.001	<0.001	<0.001
PFAS (µg/L)							
PFHxS	-	0.034	0.017	<0.0002	0.0006	<0.0002	<0.0002
PFOA	19	0.0074	0.0029	0.0006	0.0005	<0.0002	<0.0002
PFOS	0.00023	**0.15**	**0.05**	**0.0006**	**0.0021**	<0.0002	<0.0002
Volatile hydrocarbons (µg/L)							
Benzene	950	<1	<1	<1	<1	<1	<1
Ethylbenzene	80	<1	<1	<1	<1	<1	<1
m+*p*-xylene	75	<2	<2	<2	<2	<2	<2
MTBE	-	<1	<1	<1	<1	<1	<1
Naphthalene	16	<1	<1	<1	<1	<1	<1
o-xylene	350	<1	<1	<1	<1	<1	<1
Toluene	180	<1	<1	<1	<1	<1	<1
TRH C6 – C10	-	140	<10	<10	<10	<10	<10
Semi-volatile hydrocarbons (mg/L)							
>C10 – C16	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

>C16 – C34	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
>C34 – C40	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Any guideline exceedances have been bolded.

Environment protection licensed monitoring

Table 6 Physicochemical stressors, metal and hydrocarbon concentrations for the licensed facility surface water samples

	Australian Native Landscapes			Blayney Council landfill			Cadia Valley Operations				
Parameter	**ANLSW1**	**ANLSW2**	**ANLSW3**	**BLSW1**	**BLSW2**	**Water tank sourced by GW056811 (Community Bore)***	**CSW1**	**CSW2**	**CSW3**	**CSW4**	**CSW5**
Physicochemistry											
Temperature (°C)	25.9	26.0	28.7	21.2	21.2	22.4	24.9	23.5	24.3	24.7	27.9
Dissolved Oxygen (mg/L)	6.4	6.7	5.8	6.6	6.3	6.1	8.7	8.0	15.4	8.3	16.6
Conductivity (µS/cm)	420	5930	691	8110	8160	1800	3250	231	3800	3760	370
pH	7.3	7.4	7.3	7.6	7.6	7.4	6.7	7.1	8.2	6.3	7.6
Turbidity (NTU)	3.4	457.0	75.6	4.1	4.1	2.7	6.0	4.8	1.5	47.1	83.9
TDS (mg/L)	250	4000	510	1100	4700	1100	2700	2400	3300	3100	280
Nutrients (mg/L)											

Nitrate	0.9	2.6	<0.9	<0.9	92	32	<0.9	3.5	8	13	<0.9
Nitrite	<0.25	4.8	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.32	0.9	<0.25
Sulfate	17	140	67	32	200	76	1600	1400	1900	1800	110
Ammonia	0.12	170	1.4	0.08	4.9	0.014	0.017	0.044	0.15	8.4	0.048
Total Nitrogen	0.5	190	4.2	1.4	26	8.4	0.9	0.9	2.2	13	0.6
Total Phosphorus	<0.05	17	2.2	0.2	0.1	0.06	0.4	<0.05	<0.05	0.94	0.2
NOx as N	0.2	5.3	<0.005	0.06	27	8	0.02	0.96	2.2	3.7	<0.005
Metals (mg/L)											
Aluminium (Total)	0.02	1.6	0.72	0.71	0.08	0.04	0.2	0.12	0.15	1.4	3.5
Aluminium (Dissolved)	<0.01	0.07	<0.01	0.01	0.01	<0.01	0.13	<0.01	0.04	0.04	0.01
Arsenic (Total)	0.084	0.041	0.092	0.0028	0.0007	0.0044	0.016	0.0014	0.0028	0.0032	0.0038
Arsenic (Dissolved)	0.079	0.034	0.071	0.0023	0.0006	0.0034	0.015	0.0014	0.0025	0.0028	0.0013
Copper (Total)	0.0043	0.066	0.031	0.0052	0.009	0.062	0.13	0.0038	0.0022	0.099	0.094
Copper (Dissolved)	0.0024	0.011	0.0041	0.0032	0.0083	0.027	0.0014	0.0014	0.0007	0.016	0.026
Lead (Total)	0.0001	0.0037	0.0005	0.0007	<0.0001	0.011	0.0006	0.0001	<0.0001	0.0011	0.0018
Lead (Dissolved)	<0.0001	0.0005	<0.0001	<0.0001	<0.0001	0.0009	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese (Total)	0.016	0.45	1.1	0.58	1.3	0.016	0.091	0.13	0.02	0.089	0.82

Manganese (Dissolved)	0.004	0.16	0.26	0.42	1.2	0.012	0.094	0.11	0.016	0.064	0.6
Mercury (Total)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00052	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (Dissolved)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel (Total)	0.0006	0.085	0.0045	0.0025	0.0049	0.003	0.0013	0.0005	0.0005	0.0024	0.0046
Nickel (Dissolved)	0.0005	0.072	0.0026	0.0019	0.0051	0.0028	0.0012	<0.0005	<0.0005	0.0016	0.0025
Zinc (Total)	0.002	0.075	0.017	0.005	0.004	0.089	0.009	0.004	<0.001	0.016	0.016
Zinc (Dissolved)	0.001	0.011	0.001	0.002	0.004	0.037	0.005	0.001	<0.001	0.006	0.002
PFAS (µg/L)											
PFHxS	0.2	0.86	0.51	0.0086	0.19	0.033	0.0036	0.0006	0.0003	0.0029	0.0004
PFOA	0.029	0.32	0.078	0.018	0.3	0.02	0.0056	0.0008	0.0004	0.0025	0.0009
PFOS	1.5	0.63	0.78	0.0034	0.05	0.015	0.0032	0.0009	0.0003	0.002	0.0005
Volatile hydrocarbons (µg/L)											
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+*p*-xylene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
MTBE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

o-xylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TRH C6 – C10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Semi-volatile hydrocarbons (mg/L)											
>C10 – C16	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
>C16 – C34	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
>C34 – C40	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

	Cadia Valley Operations									
Parameter	**CSW6**	**CSW7**	**CSW8**	**CSW10**	**CSW11**	**CSW12**	**CSW13**	**CSW14**	**CSW15**	**CSW16**
Physicochemistry										
Temperature (°C)	16.2	25.6	25.4	26.5	18.3	28.1	22.3	28.9	24.2	24.7
Dissolved Oxygen (mg/L)	16.6	14.9	19.6	17.8	20.3	16.4	9.9	15.3	8.0	16.1
Conductivity (µS/cm)	3080	1940	1430	2110	3860	2540	2190	209	231	1960
pH	7.6	7.9	8.3	8.3	7.7	8.9	6.4	8.5	7.1	8.4
Turbidity (NTU)	0.0	6.4	0.6	0.3	0.0	37.8	2.5	2.5	829.0	12.4
TDS (mg/L)	2900	1600	990	1800	3900	2200	1900	230	410	1600

Nutrients (mg/L)										
Nitrate	78	3	<0.9	<0.9	120	<0.9	<0.9	<0.9	7.4	<0.9
Nitrite	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Sulfate	1700	830	290	1100	2400	1300	1100	12	4	860
Ammonia	0.016	0.067	0.027	0.018	<0.005	<0.005	0.065	0.11	0.005	0.1
Total Nitrogen	16	1.2	0.5	0.4	30	1.2	0.5	1.6	3.1	0.9
Total Phosphorus	<0.05	0.06	0.06	<0.05	<0.05	0.2	<0.05	0.4	0.4	0.07
NOx as N	20	0.78	0.04	<0.005	32	<0.005	0.05	0.006	2	0.2
Metals (mg/L)										
Aluminium (Total)	0.13	0.12	0.07	0.04	0.05	0.33	0.06	6.7	49	0.15
Aluminium (Dissolved)	0.05	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.28	0.14	<0.01
Arsenic (Total)	<0.0005	0.0008	0.0016	0.0019	<0.0005	0.0073	0.0008	0.012	0.004	<0.0005
Arsenic (Dissolved)	<0.0005	0.0008	0.0016	0.0017	<0.0005	0.0064	0.0007	0.0065	0.0009	<0.0005
Copper (Total)	0.84	0.0046	0.0049	0.0054	0.04	0.0039	0.0037	0.0093	0.029	0.0075
Copper (Dissolved)	0.8	0.0033	0.0035	0.0036	0.033	0.0019	0.0022	0.0031	0.0035	0.0055
Lead (Total)	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0002	0.0001	0.002	0.011	<0.0001
Lead (Dissolved)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.0001

Manganese (Total)	0.74	0.093	0.2	0.14	0.013	0.55	0.24	0.96	2.7	0.22
Manganese (Dissolved)	0.73	0.052	0.17	0.091	0.013	0.37	0.061	0.12	1.3	0.015
Mercury (Total)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (Dissolved)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel (Total)	0.043	0.0007	0.0009	0.0009	0.011	0.0012	0.0006	0.006	0.016	0.001
Nickel (Dissolved)	0.041	0.0007	0.0008	0.0008	0.011	0.0008	0.0006	0.0028	0.0033	0.0008
Zinc (Total)	0.38	0.005	0.008	0.012	0.054	0.002	0.005	0.013	0.05	0.011
Zinc (Dissolved)	0.37	0.002	0.002	<0.001	0.052	<0.001	0.002	0.002	0.002	<0.001
PFAS (µg/L)										
PFHxS	0.002	0.001	<0.0002	0.0007	0.002	<0.0002	0.0008	<0.0002	<0.0002	0.0007
PFOA	0.0034	0.001	0.0002	0.002	0.0028	0.0004	0.002	0.0003	<0.0002	0.001
PFOS	0.0046	0.0007	0.0003	0.0007	0.001	<0.0002	0.0007	<0.0002	<0.0002	0.0006
Volatile hydrocarbons (µg/L)										
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+*p*-xylene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
MTBE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
o-xylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TRH C6 – C10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Semi-volatile hydrocarbons (mg/L)										
>C10 – C16	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
>C16 – C34	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
>C34 – C40	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

*Community groundwater bore is off-site, downgradient of the landfill.

Groundwater sampling results

The following analysis provides an overview of the sampling results for various environmental parameters, including physicochemical stressors, metals, PFAS, and hydrocarbons. Data from these analyses are detailed in Tables 7 and 8. The results offer insights into the quality of water across sampling area and assesses them against environmental and health guidelines.

Physicochemical

All of the samples had a total dissolved solids (TDS) concentration within the livestock drinking water guideline value for beef cattle and pigs (0–4000 mg/L) and sheep (0–5000 mg/L), with no adverse effects on animals expected except for MB2B, which is located near the ore processing facility at Cadia Valley Operations. Some bores including MB109, MB1A, MB2A, MB2B and, MB3A, exceeded the livestock drinking water guideline value for poultry (0–2000 mg/L) (ANZECC & ARMCANZ 2000).

Electrical conductivity was assessed against a range of default guideline values for upland rivers in south-east Australia (ANZECC & ARMCANZ 2000). Electrical conductivity values ranged from 545 µS/cm to 6,426 µS/cm, which is within natural ranges for groundwater in the area.

pH values mostly fell within the guideline range of 6.5 to 7.5 for upland rivers for south-east Australia, suitable for freshwater ecosystems. Sample MB106, located south of Cadia, recorded a high pH value of 11.3, likely to be associated with a groundwater well installation issue.

Anions

Nutrient concentrations, including nitrate, nitrite, and total phosphorus, largely follow the guideline values for livestock drinking and irrigation. Nitrate levels are consistently below the guideline value of 400 mg/L for livestock drinking water, with the highest recorded concentration at MB106 (9.1 mg/L), south of Cadia. Nitrite levels are uniformly low and total phosphorus values are below the irrigation guideline range of 0.8–12 mg/L across all samples. Nitrogen, ammonia and phosphorus concentrations slightly exceeded the ecological water quality guideline at some monitoring bores around the mine processing area as well as the southern regional monitoring bores.

Sulfate concentrations vary significantly, with values ranging from 11 mg/L to 4000 mg/L. The guideline for livestock drinking water is 1000 mg/L. Six of the bores measured a sulfate concentration of less than this guideline value; however, elevated sulfate was observed in 4 samples around the ore processing area including MB1A, MB2A, MB2B, and MB3A. Adverse effects may occur at sulfate concentrations between 1000 and 2000 mg/L; however, these effects may be temporary and would likely stop once stock become accustomed to the water (ANZECC & ARMCANZ 2000).

Chloride and fluoride concentrations all measured below the livestock drinking and irrigation guideline values.

Metals

Total metals were below both the agricultural irrigation and livestock drinking water guideline values at all samples except MB3B. Aluminium at MB3B was 7.5 mg/L, which is slightly exceeding the livestock drinking water guideline of 5 mg/L, but remaining below the irrigation guideline of 20 mg/L.

Key dissolved metals were measured below the ecological water quality guideline values for 95% protection for slightly to moderately disturbed systems, across the majority of collected samples. There was a slight exceedance for arsenic at site MB2A (0.023 mg/L), which is located near the ore processing facility at Cadia. Aluminium exceeded the guideline at MB106 (0.42 mg/L). MB106 also had a copper exceedance (0.003 mg/L), along with MB109 (0.0061 mg/L) and MB3B (0.0025 mg/L). Zinc exceeded the guideline value at MB109 (0.014 mg/L) and at MB1A (0.01 mg/L).

Per- and polyfluoroalkyl substances (PFAS)

The concentrations of PFOA were below relevant guideline values. The sum of PFHxS and PFOS concentrations were also below the drinking water guideline value of 0.07 µg/L (HEPA 2025). The concentration of PFOS in 6 monitoring bores, including MB104, MB110, MB1A, MB2A, MB3A and MB3B were slightly above the ecological guideline of 0.00023 µg/L.

The highest PFOS concentrations were measured in bores near the ore processing facility, MB2A (0.022 µg/L) and MB3A (0.014 µg/L). One PFOS exceedance was previously recorded in sampling undertaken in May 2024 in MB2A with a concentration of 0.02 µg/L. This round of sampling shows a similar PFOS concentration of 0.022 µg/L in the same bore.

Hydrocarbons

There were no volatile or semi-volatile hydrocarbons detected in any groundwater samples.

Groundwater summary

Overall, the groundwater results indicate that most samples met the relevant Australian guidelines for livestock, irrigation, and ecological protection (ANZECC & ARMCANZ 2000, ANZG 2018, HEPA 2025). The groundwater quality appears to pose limited risk to livestock, irrigation, or the surrounding environment. PFOA results were mainly below the guideline values for drinking water and fresh water. PFOS concentrations at 6 monitoring bores exceed ecological guideline values.

Table 7 TDS, nutrient and metal (total acid-extractable) concentrations compared to the Australian Livestock Drinking Water Guidelines and the Australian Irrigation Guidelines (ANZECC & ARMCANZ 2000)

Parameter	Guideline for livestock drinking water	Guideline for irrigation water (short-term use)	MB 104	MB 105	MB 106	MB 109	MB 110	MB 1A	MB 2A	MB 2B	MB 3A	MB 3B
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TDS	0-2000*	-	350	560	400	1800	820	**3600**	**2900**	**7800**	**3800**	870
Nitrate	400	-	<0.9	2.5	9.1	1	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Nitrite	30	-	<0.25	0.82	1	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Total Phosphorus		0.8–12	0.1	<0.05	<0.05	<0.05	0.2	<0.05	<0.05	0.4	0.4	0.1
Sulfate	1000	-	11	26	39	200	63	**1900**	**1400**	**4000**	**1800**	320
Chloride		0–750	16	60	34	520	150	63	77	150	180	50
Fluoride		1	<0.3	<0.3	<0.3	<0.3	0.3	0.3	<0.3	0.7	0.3	<0.3
Total Nitrogen	-	25–125	0.3	0.9	2.3	0.3	<0.1	<0.1	0.1	<0.1	0.6	0.3
Ammonia	-	-	0.23	0.08	0.83	<0.005	<0.005	0.006	0.029	<0.005	0.51	<0.005
NOx as N	-	-	0.05	1.1	2.5	0.3	0.03	<0.005	<0.005	0.02	0.007	0.2
Aluminium	5	20	0.06	0.42	0.93	0.03	0.02	<0.01	<0.01	0.99	0.04	**7.5**

Parameter	Guideline for livestock drinking water	Guideline for irrigation water (short-term use)	MB 104	MB 105	MB 106	MB 109	MB 110	MB 1A	MB 2A	MB 2B	MB 3A	MB 3B
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Arsenic	0.5	2	0.0095	0.0029	0.0008	0.0009	0.0068	0.0026	0.0079	0.025	0.0041	0.003
Copper	0.5**	5	0.002	0.0008	0.0073	0.0005	0.0019	0.013	0.0006	0.0043	0.0012	0.036
Lead	0.1	5	0.0001	0.0002	0.0003	<0.0001	<0.0001	0.0001	<0.0001	0.0006	<0.0001	0.0067
Manganese	-	10	0.14	0.15	0.004	0.21	0.16	1.2	0.031	0.09	0.65	0.27
Mercury	0.002	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	1	2	0.0007	0.0007	0.0023	0.0006	0.0007	0.0066	0.0026	0.0019	0.0007	0.0044
Zinc	20	5	0.002	0.035	0.016	0.011	0.002	0.013	0.002	0.002	<0.001	0.015

* Value for poultry, other livestock tolerate higher total dissolved solids concentrations to 5000 mg/L.

**Guideline value for sheep. Value is higher for other typical types of livestock.

Any guideline exceedances have been bolded.

Table 8 Physicochemical water quality, nutrient, metal and PFAS concentrations compared to ecological water quality guidelines (ANZG 2018, ANZECC & ARMCANZ 2000 and HEPA 2025)

Parameter	Ecological water quality guideline	MB 104	MB 105	MB 106	MB 109	MB 110	MB 1A	MB 2A	MB 2B	MB 3A	MB 3B
Physicochemistry											
Temperature (°C)	-	20.8	23.9	22.7	24.5	19.6	19.9	18.4	21.1	18.1	17.5
Dissolved Oxygen (mg/L)	-	4.43	2.37	3.87	2.2	3.57	2.26	3.16	8.23	3.03	4.36
Conductivity (µS/cm)	30–350*	**545**	**1061**	**930**	**2588**	**1135**	**3452**	**2757**	**6426**	**3371**	**1106**
pH	6.5–7.5**	**7.6**	7.37	**11.33**	6.95	7.48	6.6	6.9	7.37	6.73	6.81
Nutrients											
Total Nitrogen (mg/L)	0.25	**0.3**	**0.9**	**2.3**	**0.3**	<0.1	<0.1	0.1	<0.1	**0.6**	**0.3**
Ammonia (mg/L)	0.013	**0.23**	**0.08**	**0.83**	<0.005	<0.005	0.006	**0.029**	<0.005	**0.51**	<0.005
NOx as N (mg/L)	0.015	**0.05**	**1.1**	**2.5**	**0.3**	**0.03**	<0.005	<0.005	**0.02**	0.007	**0.2**
Total Phosphorus (mg/L)	0.02	**0.1**	<0.05	<0.05	<0.05	**0.2**	<0.05	<0.05	**0.4**	**0.4**	**0.1**
Metals											
Aluminium (mg/L)	0.055	<0.01	<0.01	**0.42**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (mg/L)	0.013	0.0092	0.0027	0.0006	0.0009	0.006	0.0024	0.008	**0.023**	0.0045	<0.0005

Copper (mg/L)	0.0014	0.0004	<0.0002	**0.003**	**0.0061**	0.0007	0.0005	0.0002	0.0008	<0.0002	**0.0025**
Lead (mg/L)	0.0034	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese (mg/L)	1.9	0.12	0.15	<0.001	0.22	0.019	1.1	0.03	0.066	0.61	0.001
Mercury (mg/L)	0.00006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel (mg/L)	0.011	0.0005	<0.0005	0.0019	0.0006	<0.0005	0.0062	0.0025	0.0013	0.0006	0.0006
Zinc (mg/L)	0.008	<0.001	0.004	0.002	**0.014**	<0.001	**0.01**	<0.001	<0.001	<0.001	0.002

Parameter	**HEPA 2025 Drinking Water**	**HEPA 2025 Fresh Water 99%**	**MB 104**	**MB 105**	**MB 106**	**MB 109**	**MB 110**	**MB 1A**	**MB 2A**	**MB 2B**	**MB 3A**	**MB 3B**
PFOA (µg/L)	0.56	19	<0.0002	<0.0002	0.001	<0.0002	<0.0002	0.014	0.019	0.0042	0.017	<0.0002
PFOS (µg/L)	-	0.00023	**0.0003**	<0.0002	<0.0002	<0.0002	**0.0007**	**0.0024**	**0.022**	<0.0002	**0.014**	0.0004
Sum of PFHxS and PFOS (µg/L)	0.07	-	0.0003	<0.0002	<0.0002	<0.0002	0.001	0.0077	0.0288	0.002	0.0198	0.0004

*Range of default trigger values conductivity (EC, salinity), of upland river in south-east Australia (ANZECC and ARMCANZ 2000).

**Range of default trigger values pH of upland rivers in south-east Australia, trigger values pH of freshwater lakes & reservoirs is 6.5 to 8 in south-east Australia (ANZECC and ARMCANZ 2000).

Any guideline exceedances have been bolded.

What happens next

PFAS Technical Advisory Group

PFAS are persistent and highly resistant to physical, chemical and biological degradation. The widespread presence of PFAS in the environment in Australia and around the world is a result of its unique properties, which have led to it being widely used for many decades. Consequently, PFAS are found in humans, animals and the environment around Australia (HEPA 2025).

We have shared the results of our sampling in the region with the NSW PFAS Technical Advisory Group for advice. The NSW PFAS Technical Advisory Group includes representatives from NSW Health, Department of Primary Industries and the NSW Department of Climate Change, Energy, the Environment and Water.

NSW Health Advice

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.

Regulatory response

The presence of PFAS in the environment does not necessarily indicate that there is a health risk; however, identifying sites that require investigation is an important precaution to reduce the risk of community exposure to PFAS.

The EPA has imposed new licence conditions on the environment protection licences of Cadia Valley Operations, Australian Native Landscapes (Blayney) and Blayney Council landfill, requiring each site to undertake detailed investigations to assess potential on- and off-site impacts. These assessments will inform the EPA's future regulatory activities.

The changes to the respective licences are reflected on the EPA's public register.

The EPA has also commissioned an independent review of the Cadia Valley Operation's groundwater, surface water and aquatic ecosystem monitoring programs and data. Further information about the review can be found on the EPA's website under 'Community Engagement'.

The EPA will continue to investigate further and understand the potential source of PFAS detections and measures that can be put in place to mitigate risks.

References

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.

ANZG (2018), Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

ANZG (2023), Livestock drinking water guidelines (draft). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra. Available at www.waterquality.gov.au/anz-guidelines/guidelinevalues/default/primary-industries/stock-water-guidance

HEPA 2025, PFAS National Environmental Management Plan Version 3.0, Heads of EPA Australia and New Zealand 2025. CC BY 4.0. Available at https://www.dcceew.gov.au/sites/default/files/documents/pfas-nemp-3.pdf

VIC EPA (2022), Summary of PFAS concentrations detected in the environment in Victoria. Victorian Government, Melbourne