

Cadia region surface water testing report





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.

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On 30 May 2024 the NSW Environment Protection Authority collected water samples from Cadiangullong Creek, Flyers Creek and the Belubula River. This was in response to concerns raised by the community regarding water quality of the creeks surrounding Cadia gold mine and the Belubula River. This report summarises the sampling results.

Background

The Newmont Cadia gold mine is flanked by Cadiangullong Creek to the west and Flyers Creek to the east. They feed into the Belubula River south of the mine.

On 30 May 2024 the EPA undertook surface water sampling in the area in response to community concerns about the health of rivers and creeks near Newmont's Cadia gold mine, including the potential impact on livestock.

This report summarises the results of this sampling. It provides a snapshot of water quality in Cadiangullong Creek, Flyers Creek and the Belubula River at the time of sampling and will help to inform future monitoring requirements for the premises.

Approach taken

On 30 May 2024 the EPA collected surface water samples from nine locations along Cadiangullong Creek, Flyers Creek and Belubula River, both upstream and downstream of the mine (see Figure 1). The sampling sites were selected with consideration for the proximity to the mine, accessibility and previous sampling in the area. We included sampling sites near the confluence of the Cadiangullong Creek and Belubula River, and the confluence of Flyers Creek and the Belubula River, because community members leasing the surrounding land for livestock grazing have raised concerns regarding the potential suitability of the waterways for livestock drinking water.

We collected a water sample from each site for chemical analysis and used a water-quality meter to record pH, electrical conductivity, dissolved oxygen, temperature and turbidity. Samples were sent to the NSW Environmental Forensics laboratory and analysed for metals, total dissolved solids, nutrients, hydrocarbons and per- and polyfluoroalkyl substances (PFAS).

We compared the results to the Australian livestock, irrigation and ecological water quality guidelines, where they were available (ANZECC and ARMCANZ 2000, ANZG 2018, PFAS NEMP 2.0 2020).

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 (PFAS NEMP 2.0), which provides ecological water quality guideline values for PFOS (perfluorooctanesulfonic acid) and PFOA (perfluorooctanoic acid).

Summary of results

Livestock and irrigation water guidelines

There were no exceedances of any current irrigation or livestock water guideline values. Where the concentration of a pollutant is below or outside the range for the relevant guideline value, 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), which was slightly exceeded in the sample taken from Flyers Creek. At this concentration, it is unlikely there will be any adverse effects experienced by livestock, except a slight impact on taste (ANZG 2023).

Ecological water quality guidelines

Conductivity and pH were outside the default guideline range at all but two sites in Cadiangullong Creek.

Hydrocarbons

Samples were tested for a range of volatile and semi volatile hydrocarbons. None were detected.

PFAS

Samples were tested for a range of per- and polyfluoroalkyl substances (PFAS). There were no PFAS substances detected in Cadiangullong Creek or Flyers Creek; however, PFOS was detected in the Belubula River above the ecological water quality guidelines, with the highest concentration measured in the site furthest upstream (Baker's Shaft Reserve). There are no livestock and irrigation water guidelines for PFAS. The presence of PFOS in water samples does not necessarily mean there is a risk to human health or livestock.

Metals

Copper was above the guideline level set to protect water life in Cadiangullong Creek downstream of the mine, but was below the guideline at all other locations. All other metals were below the levels set to protect water life.

Nutrients

Total nitrogen was above the guideline value for upland river ecosystems in the Belubula River. Oxides of nitrogen (NO_x as nitrogen) were above guideline values in Cadiangullong Creek and free reactive phosphorus was above the guideline value in the Cadiangullong Creek sample adjacent to the South-Western end of the mine. All exceedances were minor and typical of nutrient levels found in agricultural use regions such as this. Ammonia and total phosphorus were not detected in any samples.

The EPA is continuing to review and monitor surface water quality in the region.

Sample locations

Table 1 Sample site and location descriptions for surface water samples collected in the Cadia region on 30 May 2024

Sampling site	Waterway	Location description
SW 1	Cadiangullong Creek	Upstream of the mine at a V-notch weir
SW 2	Cadiangullong Creek	Adjacent to the South-Western end of the mine
SW 3	Cadiangullong Creek	Immediately upstream of the Belubula River
SW 4	Belubula River	Immediately downstream of Cadiangullong Creek
SW 5	Belubula River	Immediately upstream of Cadiangullong Creek

Sampling site	Waterway	Location description
SW 6	Belubula River	Upstream of Flyers Creek
SW 7	Flyers Creek	Upstream of the Belubula River
SW 8	Belubula River	Downstream of Flyers Creek
SW 9	Belubula River	At Baker's Shaft Reserve, approximately 12 km upstream from Flyers Creek

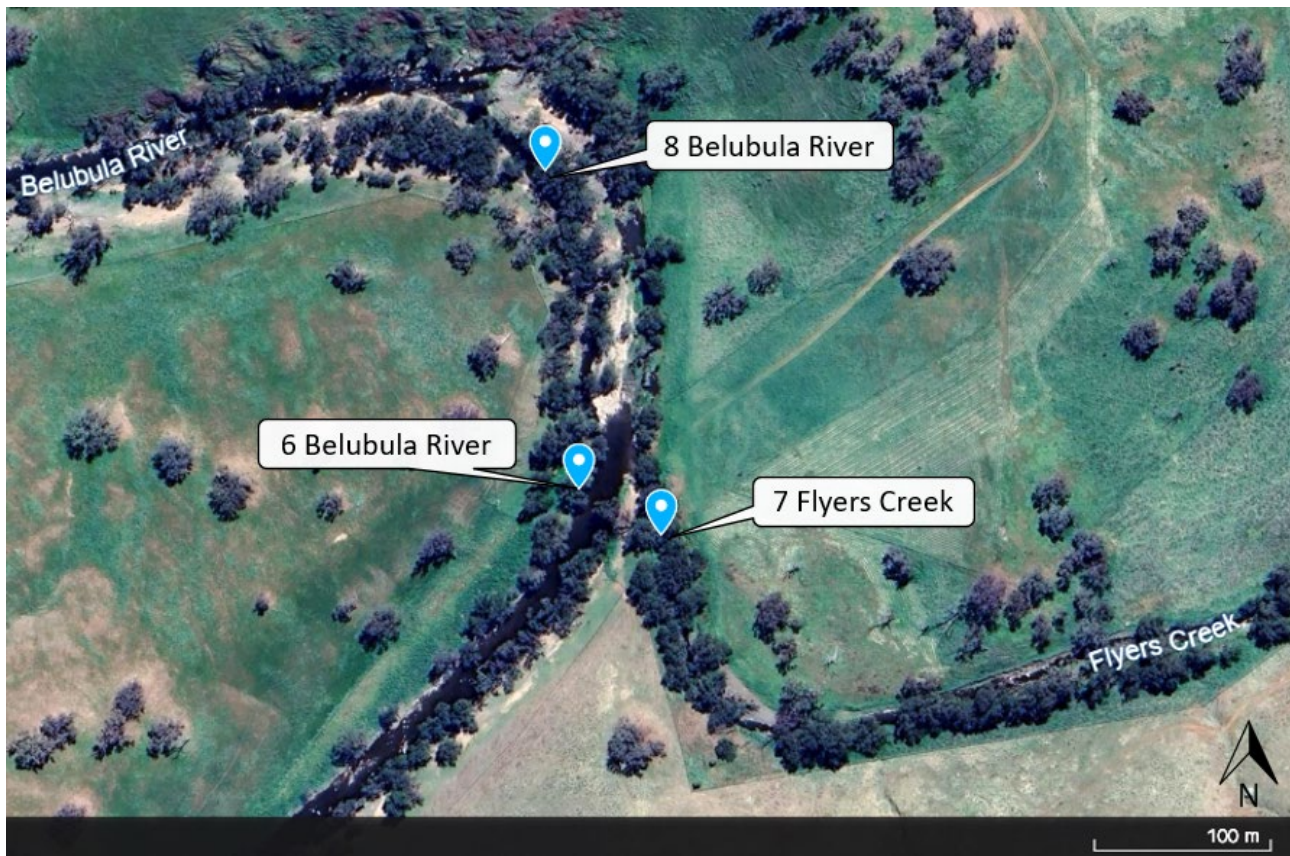
Figure 1 Overview of the sampling sites



Figure 2 Locations of sampling sites SW3, SW4 and SW5



Figure 3 Locations of sampling sites SW6, SW7 and SW8



Sampling results

Sampling and analysis results for physicochemical parameters, metals, PFAS and hydrocarbons are described below, with data listed in Table 2 and Table 3 below. Any guideline exceedances have been bolded.

Physicochemical stressors

Conductivity and pH were outside the default guideline range at all but two sites in Cadiangullong Creek, those sites being upstream and directly adjacent to the mine.

The total dissolved solids (TDS) concentration slightly exceeded the draft livestock water guideline value (500mg/L) at the Flyers Creek sampling site (SW7; 510mg/L). There were no other exceedances of livestock drinking water or irrigation water quality guideline values.

Total nitrogen was elevated in the Belubula River, ranging between 1.2 and 1.6 times higher than the guideline value for upland river ecosystems in NSW (ANZECC 2000). All samples collected from Cadiangullong Creek and Flyers Creek were below the guideline value. Oxides of nitrogen (NO_x as nitrogen) and free reactive phosphorus concentrations were four times above guideline values in the Cadiangullong Creek sample adjacent to the south-western end of the mine. Ammonia and total phosphorus were not detected in any samples.

Metals

Total metals have been compared to the Australian livestock drinking and irrigation water guidelines in Table 2 and dissolved metals have been compared to ecological water quality guidelines in Table 3. 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 toxic to organisms).

Copper was above the guideline for slightly to moderately disturbed ecosystems in Cadiangullong Creek but was below the guideline at all other sites. All other metals were below guidelines at all sites.

Per- and polyfluoroalkyl substances (PFAS)

There are no PFAS guidelines for livestock drinking and irrigation water. Exceedances of the ecological guidelines are displayed below in Table 3 in bold. PFOS exceeded the guideline in the Belubula River, however was not detected in Cadiangullong Creek or Flyers Creek. PFOA was not detected in any of the samples.

Hydrocarbons

No hydrocarbons were detected in any samples.

Table 2 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 mg/L	Guideline for irrigation water (short-term use) mg/L	Site 1 Cadiangullong Creek mg/L	Site 2 Cadiangullong Creek mg/L	Site 3 Cadiangullong Creek mg/L	Site 4 Belubula River mg/L	Site 5 Belubula River mg/L	Site 6 Belubula River mg/L	Site 7 Flyers Creek mg/L	Site 8 Belubula River mg/L	Site 9 Belubula River mg/L
TDS	0–2000*	-	75	310	470	490	490	490	510	500	360
Sulfate	1000	-	1	89	130	110	110	100	140	110	32
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
Total nitrogen	-	25–125	<0.1	0.2	0.1	0.3	0.3	0.4	0.1	0.3	0.3
Ammonia	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
NOx as N	-	-	0.02	0.06	0.02	0.008	0.007	0.05	0.009	0.06	0.03
Total phosphorus	-	0.8–12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Free reactive phosphorus	-	-	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Metals											
Aluminium	5	20	0.08	0.02	<0.01	0.02	0.02	0.03	<0.01	0.01	0.07
Arsenic	0.5	2	<0.001	<0.001	<0.001	0.006	0.006	0.007	0.003	0.006	0.003
Copper	0.5**	5	<0.0005	0.0082	0.0021	0.001	0.0011	0.0011	0.0008	0.001	0.0011
Lead	0.1	5	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	No value	10	0.12	0.043	0.015	0.024	0.027	0.028	0.012	0.021	0.081
Mercury	0.002	0.002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Parameter	Guideline for livestock drinking water (mg/L)	Guideline for irrigation water (short-term use) (mg/L)	Site 1 Cadiangullong Creek mg/L	Site 2 Cadiangullong Creek mg/L	Site 3 Cadiangullong Creek mg/L	Site 4 Belubula River mg/L	Site 5 Belubula River mg/L	Site 6 Belubula River mg/L	Site 7 Flyers Creek mg/L	Site 8 Belubula River mg/L	Site 9 Belubula River mg/L
Nickel	1	2	<0.0005	<0.0005	<0.0005	0.0005	0.0006	0.0007	<0.0005	0.0005	0.0007
Zinc	20	5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

* 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 Flyer's Creek site (sample 7).

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

Table 3 Physicochemical water quality, nutrient and metal concentrations compared to ecological water quality guidelines (ANZG 2018, ANZECC & ARMCANZ 2000 and PFAS NEMP 2.0 2020)

Parameter	Ecological water quality guideline	Site 1 Cadiangullong Creek	Site 2 Cadiangullong Creek	Site 3 Cadiangullong Creek	Site 4 Belubula River	Site 5 Belubula River	Site 6 Belubula River	Site 7 Flyers Creek	Site 8 Belubula River	Site 9 Belubula River
Phys Chem										
Temperature (°C)	-	7.3	8.8	9.5	9.4	9.4	10.3	11.5	10.9	11.8
Dissolved oxygen (mg/L)	-	9.6	9.7	11.8	11.3	11.3	12.5	12.4	12.3	13.5
Conductivity (µS/cm)	30–350	55	333	503	542	544	560	559	561	454
pH	6.5–8.0	6.7	7.7	8.4	8.5	8.5	8.5	8.7	8.6	8.8
Turbidity (NTU)	25	8.8	1.6	0.3	1.0	1.3	1.5	0.3	0.9	3.3
Nutrients										
Total nitrogen (mg/L)	0.25	<0.1	0.2	0.1	0.3	0.3	0.4	0.1	0.3	0.3
Ammonia (mg/L)	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
NOx as N (mg/L)	0.015	0.02	0.06	0.02	0.008	0.007	0.05	0.009	0.06	0.03

Parameter	Ecological water quality guideline	Site 1 Cadiangullong Creek	Site 2 Cadiangullong Creek	Site 3 Cadiangullong Creek	Site 4 Belubula River	Site 5 Belubula River	Site 6 Belubula River	Site 7 Flyers Creek	Site 8 Belubula River	Site 9 Belubula River
Total phosphorus (mg/L)	0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Free reactive phosphorus (mg/L)	0.015	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Metals										
Aluminium (mg/L)	0.055	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (mg/L)	0.013	<0.001	<0.001	<0.001	0.006	0.006	0.007	0.003	0.005	0.002
Copper (mg/L)	0.0014	<0.0005	0.0038	0.0016	0.0008	0.0008	0.0009	0.0006	0.0008	0.0008
Lead (mg/L)	0.0034	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese (mg/L)	1.9	0.13	0.039	0.013	0.016	0.015	0.017	0.009	0.013	0.041
Mercury (mg/L)	0.00006	<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	<0.0005	0.0006	0.0005	0.0007	<0.0005	0.0005	0.0007
Zinc (mg/L)	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PFAS										
PFOA (µg/L)	19	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PFOS (µg/L)	0.00023	<0.01	<0.01	<0.01	0.02	0.02	0.03	<0.01	0.02	0.06

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