



Murrumbidgee Ecological Monitoring Program

Observation Report – Autumn 2024

Icon Water Limited

5 June 2024

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S4	0	A. Plummer	P. Lind		C. West		

GHD Pty Ltd | ABN 39 008 488 373

16 Marcus Clarke Street, Level 7

Canberra, Australian Capital Territory 2601, Australia

T +61 2 6113 3200 | **F** +61 2 6113 3299 | **E** cbrmail@ghd.com | **ghd.com**

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1. Introduction

1.1 Background

The Murrumbidgee Ecological Monitoring Program (MEMP) has been supported by Icon Water to evaluate the potential impacts of water abstraction from the Murrumbidgee River and the influence of increased water volumes in Burra Creek. The MEMP was implemented prior to the commencement of the Murrumbidgee to Googong (M2G) and Murrumbidgee Pump Station (MPS) projects and allowed Icon Water to collect pre-abstraction baseline data. This baseline data can be used in comparisons against post-abstraction data to investigate any changes to ecological communities due to the operation of M2G and MPS. The monitoring of several components of the aquatic ecosystem has generally occurred in autumn and spring each year since 2008, through to the most recent monitoring in autumn 2024.

1.2 Adaptive management and the MEMP

Over the duration of the monitoring program, there have been several modifications in line with the adaptive management philosophy of the MEMP. During 2014, Icon Water commissioned a full independent review of the MEMP (Jacobs 2014). The review resulted in several recommendations to modify the program so Icon Water continue to have a robust monitoring program, capable of detecting potential ecological impacts, while at the same time accounting for the different levels of ecological risk associated with different modes of operation.

Three modes of operation were defined for the M2G and MPS to help target the monitoring program. These are defined for the M2G as:

- Suspension: parts of the system may be decommissioned requiring lead time before start-up. No water can be transferred.
- Standby: ready to run, all components in place and being operated routinely for maintenance purposes.
- Operating: operating and transferring to increase Googong reservoir storage levels.

For the MPS, the modes of operation are defined as:

- Standby: abstraction from the Murrumbidgee River is not occurring. Ready to run, all components in place and being operated routinely for maintenance purposes.
- Recirculating Pump Operation: flow up to 40 ML/day transferred to the base of the Cotter Dam to provide environmental flows to the lower Cotter River. Water to the Cotter River re-enters the Murrumbidgee River just upstream of the MPS.
- Operating (full pump): abstraction of up to 150 ML/day of water for raw water supply to Stromlo Water Treatment Plant for greater than 30 consecutive days. While this is the maximum capacity of the MPS, this extraction volume rarely occurs due to water quality in the Murrumbidgee River. Hence, smaller volumes are likely to be taken and shandied with cleaner Cotter River water from the Bendora Gravity Main.

During periods of standby, the risk from the operation of M2G and MPS to the ecological condition of the Murrumbidgee River and Burra Creek is minimal. Alternatively, it is anticipated that any risks to the Murrumbidgee River and Burra Creek are most likely to manifest during periods of full operation.

The revised MEMP adopts a two-stage approach which incorporates *Sentinel Monitoring* during standby modes and *Impact Monitoring* during the various operation modes. These two types of monitoring are described in the following sections and the monitoring undertaken are summarised in Table 1.

Table 1 Monitoring elements associated with the Sentinel and Impact monitoring

Element	Provider	Sentinel		Impact	
		M2G	MPS	M2G	MPS
Online Water Quality	Icon Water	✓	✓	✓	✓
Laboratory Water Quality	GHD	✓	✓	✓	✓
Macroinvertebrates	GHD	✓	✓	✓	✓
Periphyton	GHD	Not required	Not required	✓	✓
Geomorphology	GHD	✓	Not required	✓	Not required
Riparian Vegetation	GHD	✓	Not required	✓	Not required
Fish	ACT Government / GHD	✓	✓	✓	✓

1.2.1 Sentinel monitoring

The purpose of the sentinel monitoring is to understand if major catchment-scale changes to aquatic ecology are taking place. Sentinel monitoring occurs during standby periods when the risk to aquatic ecosystems due is deemed to be very low. Sentinel monitoring occurs in autumn and spring every three years with monitoring undertaken at one upstream and one downstream site at each of Angle Crossing (M2G), the Burra Creek discharge structure (M2G) and at the Murrumbidgee Pump Station (MPS). Periphyton sampling is not required in the sentinel monitoring and qualitative methods, such as photogrammetry and AUSRIVAS habitat assessments, are used to track the conditions of these sites on a broad spatial and temporal scale. Under this scenario, testing of hypotheses and targeted monitoring are not required.

1.2.2 Impact monitoring

The trigger for impact monitoring is the decision to operate the M2G or MPS. This monitoring scenario requires a before and after approach and relies on replicated sampling protocols. Under this monitoring protocol, several univariate indicators of river health and condition are compared before and after the operation period at both upstream and downstream monitoring locations. Periphyton is assessed during both time periods and compared between monitoring locations. The key difference between this and the sentinel monitoring is the number of sites, replicates and sampling events. Impact monitoring requires at least one before and one after sampling event and uses a more detailed analysis. Following the operation period, consecutive autumn and spring impact monitoring is also be carried out, and if pumping occurs across an autumn and/or spring period, sampling is also carried out during those times.

1.3 Recent operation and MEMP requirements

A history of the modes of operation for the M2G component of the MEMP are included in Table 2. The decision to transition to operation mode in July 2019 initially triggered impact monitoring in autumn and spring 2019 to enable the collection of data prior to the commencement of pumping. The impact monitoring continued in autumn 2020 during the transfer of 4.51 GL to Googong Reservoir and was completed following the move to standby mode with monitoring in spring 2020 and autumn 2021. Having been on standby mode since 2020, sentinel monitoring for autumn 2024 was undertaken from 8 to 16 April 2024. Spring sentinel monitoring is planned to be undertaken later in the year to complete the three yearly round of sentinel monitoring.

Table 2 M2G modes of operation

Date	M2G Mode	MEMP monitoring undertaken
2012 to July 2019	Standby mode - regular Operate to Maintain runs.	Sentinel monitoring undertaken during spring and autumn every three years. Anticipated move to Operation mode announced in 2019. Impact monitoring commenced autumn 2019.
July 2019 to February 2020	M2G shifted to Operational mode but without operational pumping - regular Operate to Maintain runs.	Impact monitoring undertaken in spring 2019.
February 2020 to August 2020	M2G shifted to Operational mode - 4.51 GL of water transferred to Googong Reservoir via Burra Creek.	Impact monitoring undertaken in autumn 2020.
September 2020	M2G shifted back to Standby mode.	Impact monitoring undertaken spring 2020 and autumn 2021; return to Sentinel monitoring in spring and autumn every three years.
September 2020 to current	Standby mode - regular Operate to Maintain runs.	Sentinel monitoring undertaken in autumn 2024.

1.4 Purpose of this report

The purpose of this report is to provide a summary of the conditions observed in Burra Creek and the Murrumbidgee River during the Autumn 2024 sentinel monitoring. Ultimately, this observational report is to provide an early communication of any potential concerns to Icon water prior to the completion of a full technical report that will consolidate information and data from multiple seasons monitoring.

1.5 Scope and limitations

This report has been prepared by GHD for Icon Water Limited and may only be used and relied on by Icon Water Limited for the purpose agreed between GHD and Icon Water Limited as set out in this report. GHD otherwise disclaims responsibility to any person other than Icon Water Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Summary of autumn 2024 sentinel monitoring

The autumn sentinel monitoring was undertaken between 8 and 16 April 2024. The monitoring followed a short period of moderate rainfall, which included 49.2 mm of rainfall over two days between 6 and 7 April. As a result, river levels at all sites were elevated above median conditions. Weather conditions were consistent during the monitoring with maximum temperatures ranging from 21.7 to 22.6°C and clear skies (BoM Tuggeranong - Isabella Plains AWS 70339).

2.1 MEMP sites and sentinel monitoring summary

The location of monitoring sites is based on the MEMP review recommendations (see Jacobs 2014). Details of the site locations are included in Table 3 and locations on Burra Creek are shown in Figure 1, on the Murrumbidgee River related to the M2G in Figure 2 and the MPS in Figure 3.

Sentinel monitoring during autumn 2024 involved the collection of macroinvertebrate samples, *in situ* water quality monitoring, water quality grab samples, and photogrammetry of vegetation and geomorphological features. A summary of monitoring undertaken for each site is included in Table 3.

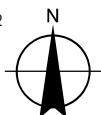
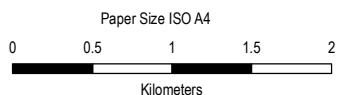
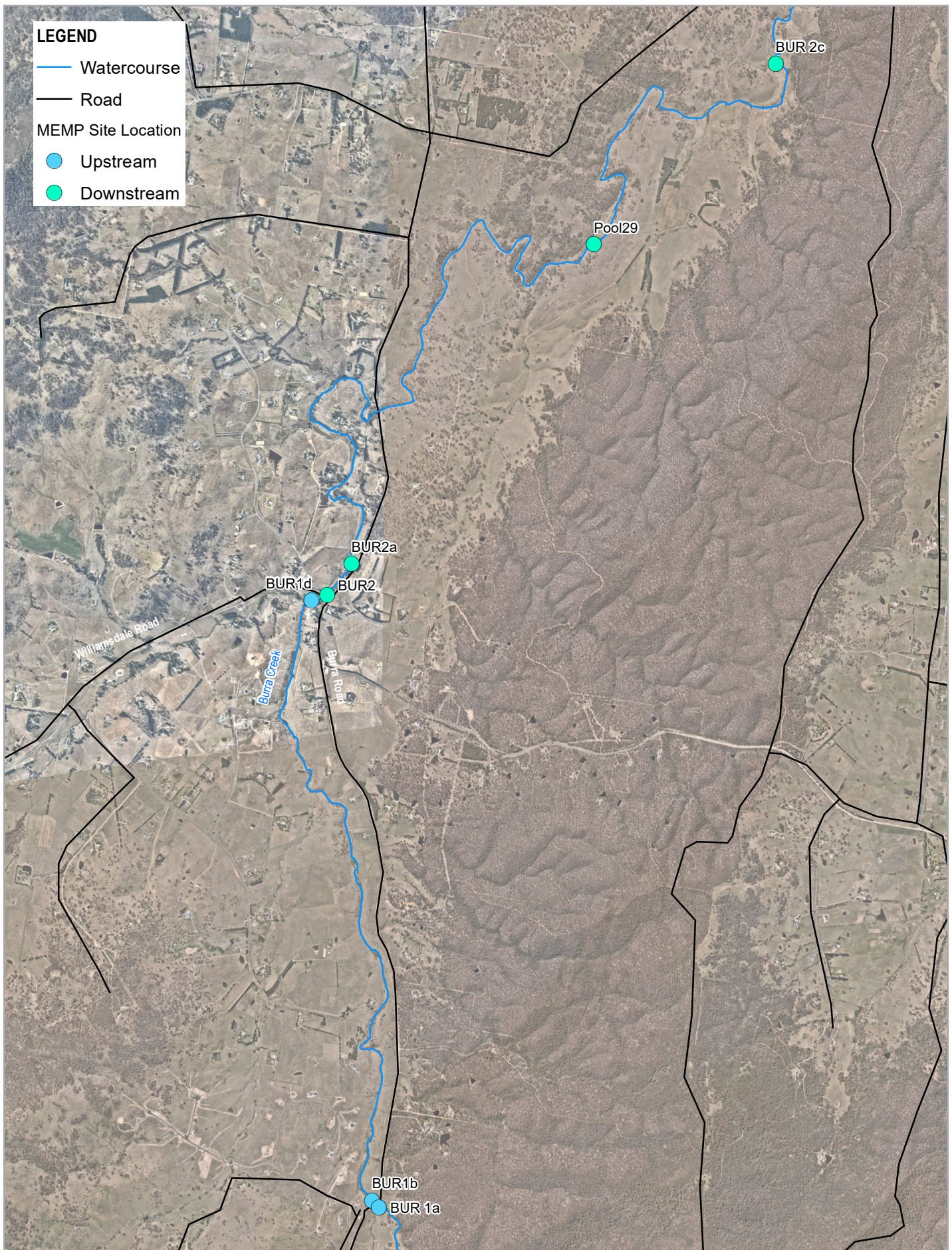
Table 3 MEMP sentinel sites and monitoring summary

Site	Location	Latitude	Longitude	Macroinvertebrates	Water quality ¹	Geomorphology ²	Riparian vegetation ³
BUR 1d	~ 50 m upstream of Williamsdale Rd bridge	-35.555963	149.222150	✓	✓	✓	✓
BUR 2a	~ 400 m downstream of Williamsdale Rd bridge	-35.553320	149.225228	✓	✓	✓	✓
MUR 18	~600 m upstream of Angle Crossing	-35.587394	149.110067	✓	✓	✓	✓
MUR 19	Immediately downstream of Angle Crossing	-35.582850	149.109812	✓	✓	✓	✓
MUR 28 down	~150 m upstream of MPS (downstream Cotter River confluence)	-35.323770	148.950129	✓	✓		
MUR 936	~1200 m downstream of MPS	-35.317535	148.961213	✓	✓		

¹ Water quality included *in situ* recordings of temperature, dissolved oxygen, pH, electrical conductivity, pH, turbidity and alkalinity and water samples submitted to ALS for analysis of total nitrogen, total phosphorus and ammonia

² Geomorphology included photographs from designated points.

³ Riparian vegetation included photographs from designated points.



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Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

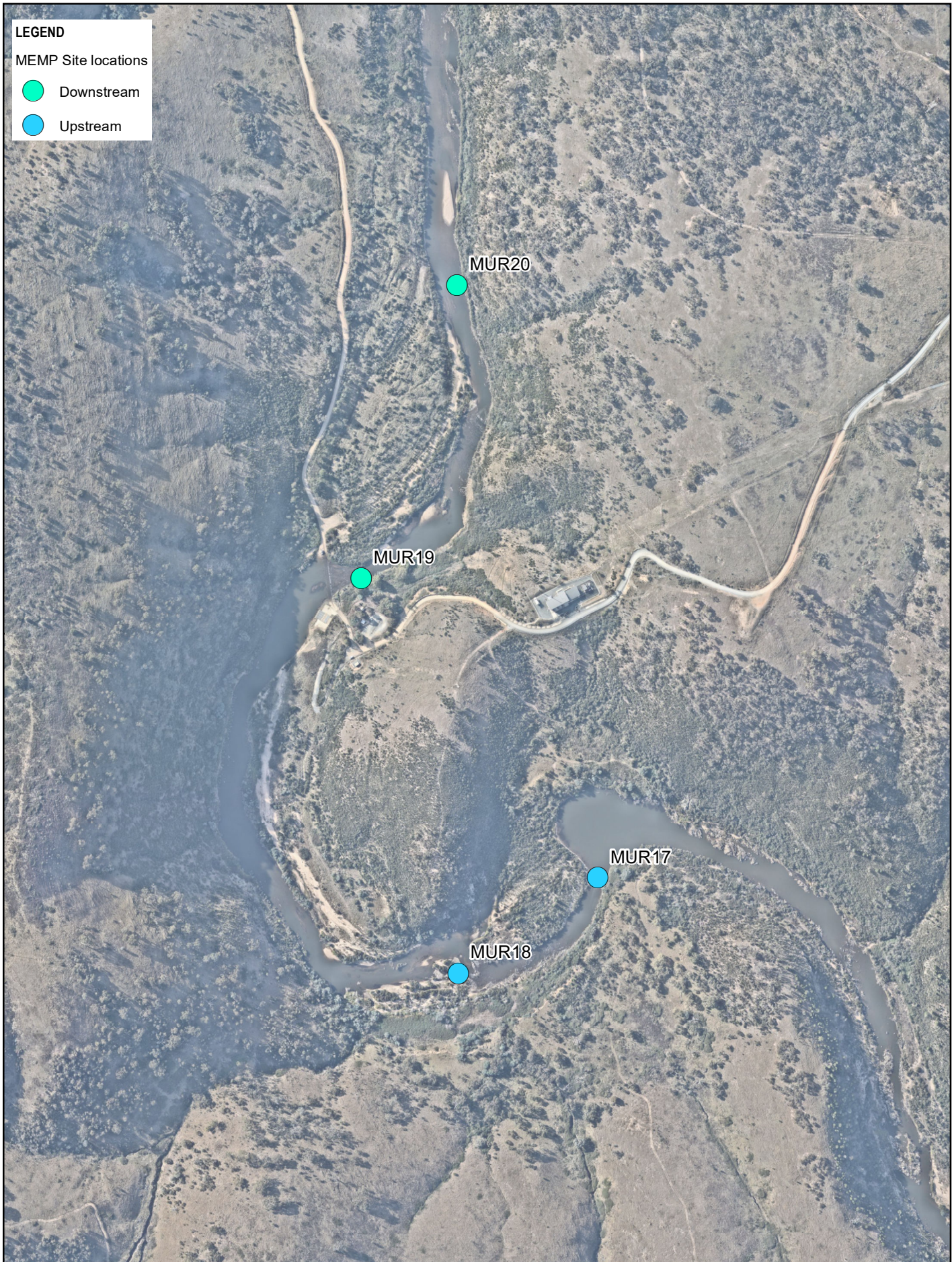


Icon Water
Murrumbidgee Ecological Monitoring
Program

Murrumbidgee to Googong
Monitoring Sites

Project No. 12581117
Revision No. 0
Date 20/05/2024

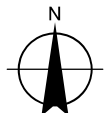
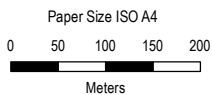
FIGURE 1



LEGEND

MEMP Site locations

- Downstream
- Upstream



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Murrumbidgee Ecological Monitoring
Program

Project No. 12581117
Revision No. 0
Date 20/05/2024

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

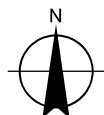
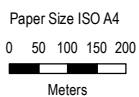
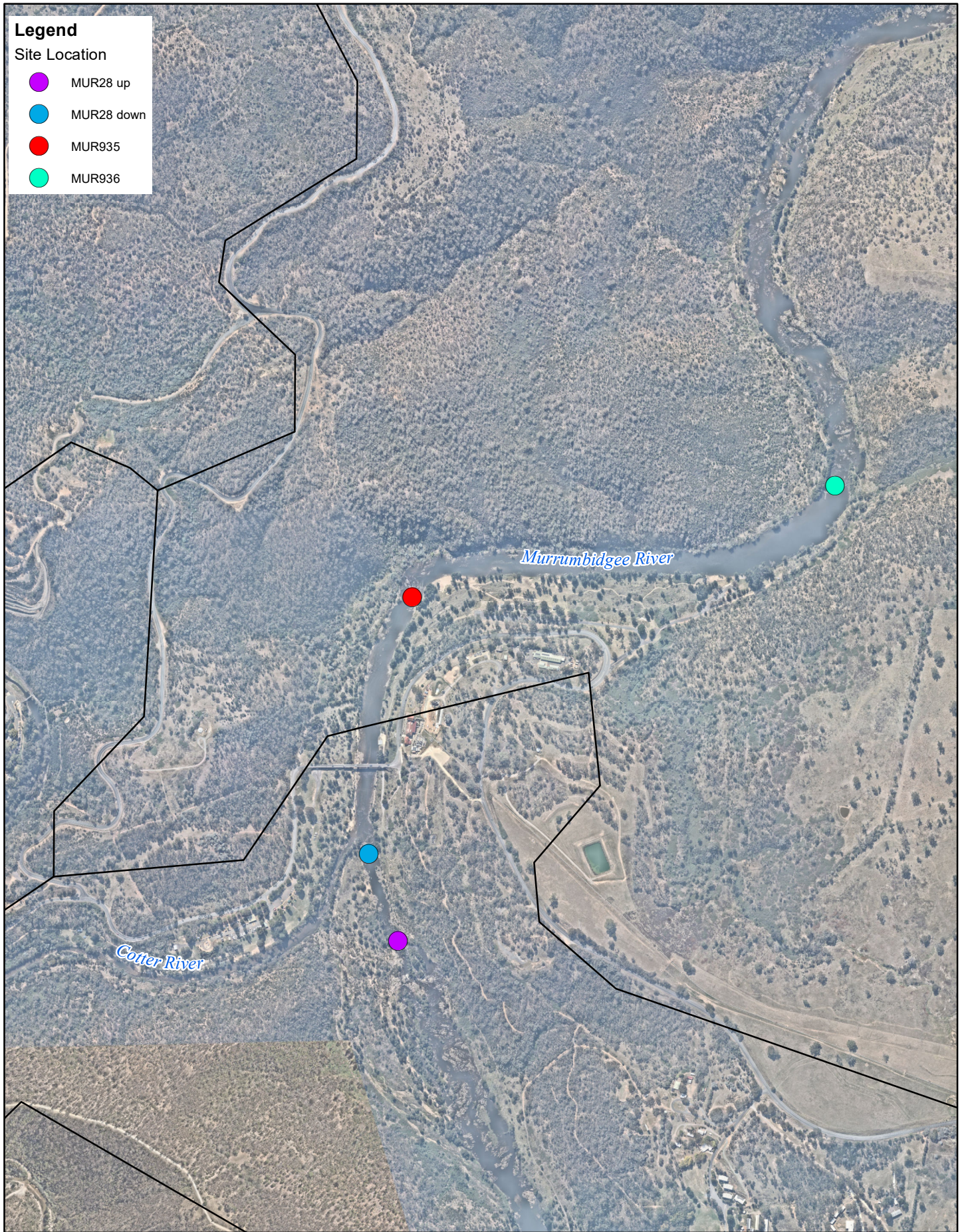
**Autumn 2024
Monitoring Sites**

FIGURE 2

Legend

Site Location

- MUR28 up
- MUR28 down
- MUR935
- MUR936



Map Projection: Mercator Auxiliary Sphere
 Horizontal Datum: WGS 1984
 Grid: WGS 1984 Web Mercator Auxiliary Sphere

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 Date 20/05/2024

**Murrumbidgee Pump Station
 Monitoring Sites**

FIGURE 3

Data source: GHD - Site features, Watercourse, Road - NSWSS. Imagery Nearmap WMS server. Created by: ehaverkamp

2.2 Burra Creek

There was no water being discharged from M2G into Burra Creek at the time of monitoring. During monitoring on 8 April 2024, daily discharge at Burra Weir gauging station (410774) was 4.06 ML/day (Figure 4). This was above the median daily flow of 3.28 ML/day when averaged across the previous year. The rainfall event over the two days prior to monitoring resulted in daily discharge increasing to a peak of 7.69 ML/day on 7 April 2024. However, the discharge had decreased prior to monitoring.

The *in situ* water quality during autumn 2024 was generally similar upstream and downstream of the M2G discharge point on Burra Creek (see Table 4). Turbidity and pH complied with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) default guideline values (DGVs) at both sites. Electrical conductivity exceeded the DGV at both sites, while dissolved oxygen was lower than the DGV. Some variation in dissolved oxygen was observed between the two sites which may be due to differences in water temperature, turbulence generated by flow, or the breakdown of organic material.

Photographs of the monitoring sites are shown in Table 5. Emergent and riparian vegetation appeared similar to previous years with dense beds of aquatic macrophytes in the form of reeds (*Typha* spp. and *Phragmites australis*), and sedges (Great Bulrush - *Schoenoplectus validus*). There was no nuisance periphyton or filamentous algae growth observed at either of the sites and there was no erosion or changes in geomorphology observed that were considered abnormal or exacerbated. However, cutbank erosion at BUR1a is continuing to encroach upon Burra Road.

A small number of fish, inferred to be Mountain Galaxias (*Galaxias olidus*), were observed in the deeper pools near BUR2a, including one which was caught during collection of a macroinvertebrate riffle sample. Numerous freshwater shrimp (family Atyidae) were observed, especially in emergent vegetation at BUR2a.

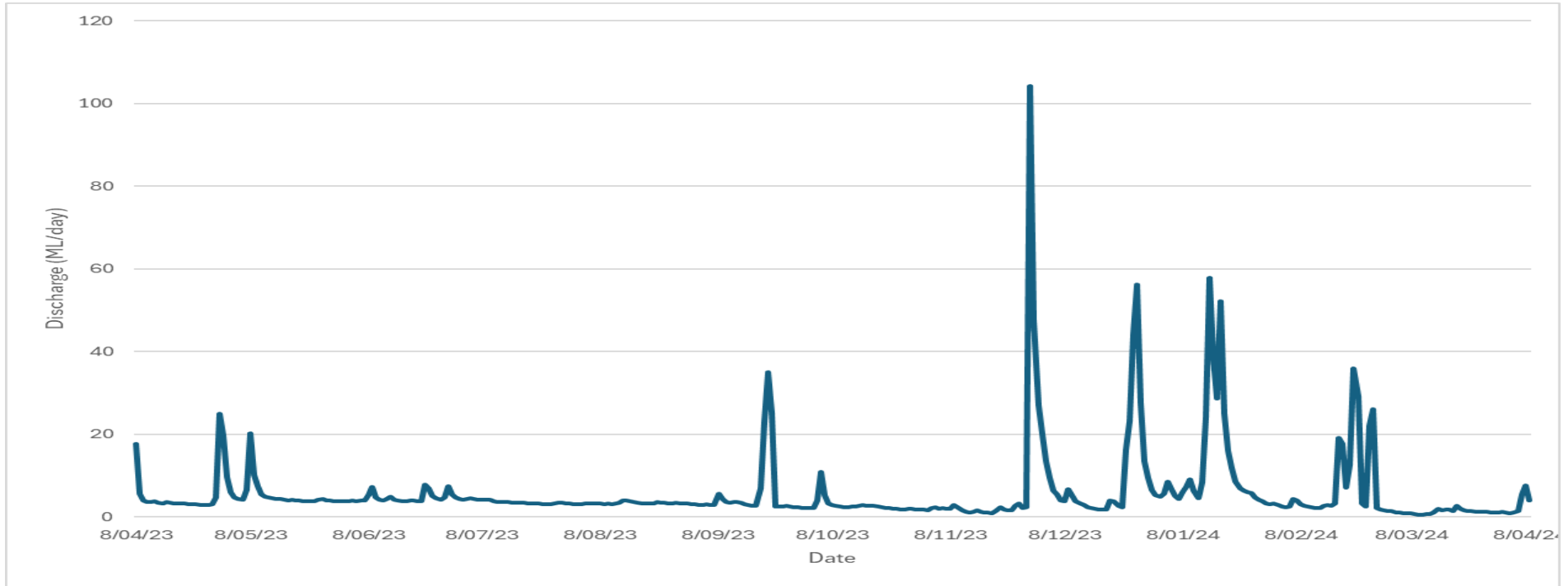


Figure 4 Hydrograph for Burra Creek at the Burra Weir gauging station (410774) for the 12 months up until monitoring

Table 4 In-situ water quality parameters in Burra Creek

Site	Date	Time	Location	Temp. (°C)	EC (µS/cm)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Turbidity (NTU)	Alkalinity (mg/l)
BUR 1d	8/4/24	13:30	Upstream	16.2	442	7.8	7.2	73.5	8	240
BUR 2a	8/4/24	15:00	Downstream	12.9	444	7.9	8.9	84.0	7	220
ANZG (2018) Guideline				-	30-350	6.5-8.0	-	90-110	2-25	-

Note: Red text did not comply with ANZG (2018) guideline values.

Table 5 Photos of Burra Creek monitoring sites



2.3 Murrumbidgee River (M2G)

There has been no water abstracted from the Murrumbidgee River by the M2G since September 2020. During monitoring mean daily discharge at the gauging station upstream of Angle Crossing (41001702) was 485 ML/day (Figure 5). This is consistent with the median daily discharge of 464 ML/day when averaged across the previous year. As with Burra Creek, there was a moderate rainfall event which occurred during the two days prior to monitoring which resulted in daily discharge rising to a peak of 2743 ML/day on 8 April. However, water flows receded steadily before the monitoring.

In situ water quality at the Murrumbidgee River M2G sites was mostly consistent with the ANZG (2018) DGVs (Table 6Table 6), except for slight exceedances in pH. There were no notable differences in water quality parameters between upstream and downstream sites.

There was no nuisance periphyton or filamentous algae growth observed at either of the two sites. A moderate to high abundance of macrophytes was observed at the downstream site MUR19. There was no erosion or changes in geomorphology observed that were considered abnormal or exacerbated (see Table 7). Riparian vegetation at each site was generally well established.

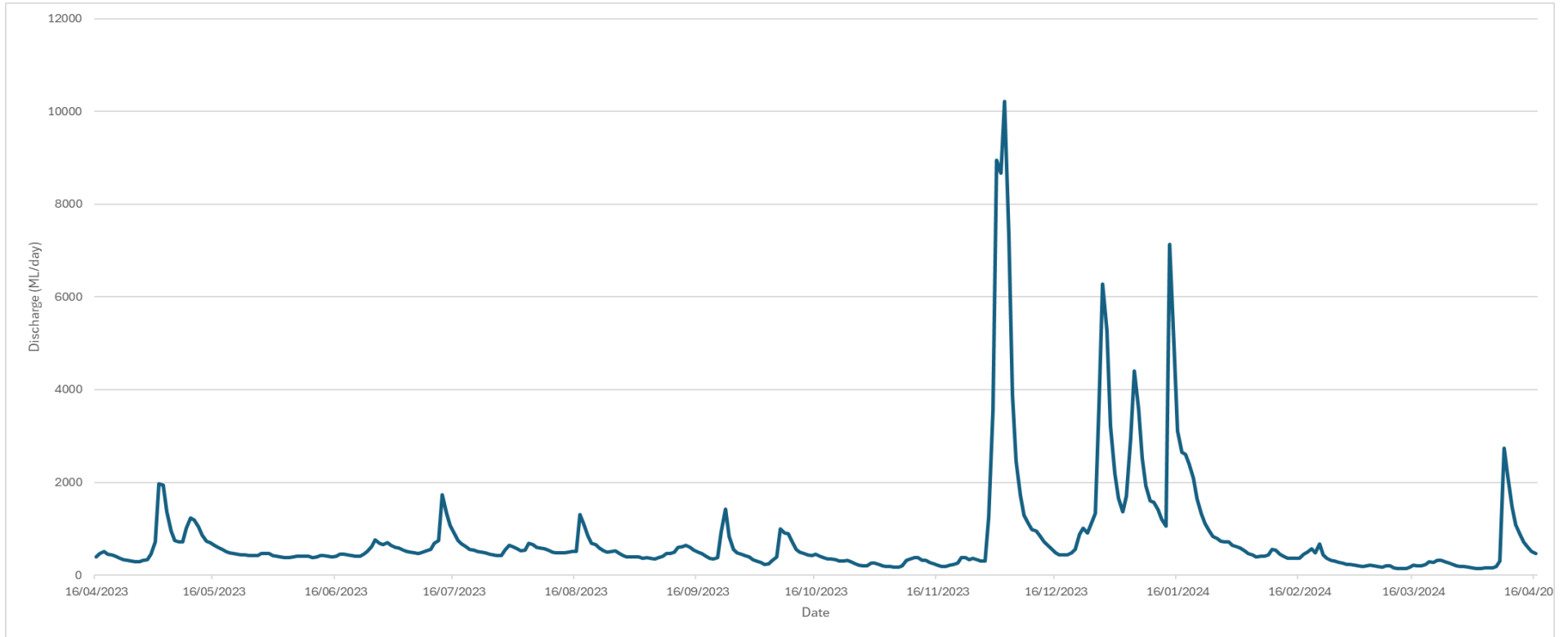


Figure 5 Hydrograph for the Murrumbidgee River Upstream of Angle Crossing (41001702) for the past 12 months.

Table 6 In-situ water quality parameters in the Murrumbidgee River (M2G)

Site	Date	Time	Location	Temp. (°C)	EC (µS/cm)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Turbidity (NTU)	Alkalinity (mg/L)
MUR18	16/4/2024	13:15	Upstream	17.2	143	8.2	9.7	100.8	9	80
MUR19	15/4/2024	15:00	Downstream	16.0	145	8.1	9.8	98.8	9	80
ANZG (2018) Guidelines					30-350	6.5-8.0		90-110	2-25	

Note: Red text did not comply with ANZG (2018) guideline values.

Table 7 Photos of Murrumbidgee River (M2G) monitoring sites

MUR18	MUR19
Looking upstream	
	
Looking downstream	
	

2.4 Murrumbidgee River (MPS)

During monitoring of the two MPS sites on 15 April 2024, daily discharge in the Murrumbidgee River (Below Lobbs Hole Creek, gauging station 410761) was 582.3 ML/day (see Figure 6). This is slightly elevated compared to the median daily discharge of 523 ML/day when averaged across the previous year. Like the other MEMP monitoring sites, moderate rainfall within the two days prior to monitoring resulted in a peak discharge of 2,957 ML/day on 8 April. However, water flows receded steadily before the monitoring.

In situ water quality in the Murrumbidgee River were mostly within the ANZG (2018) guidelines (Table 8, Table 6), except for a minor exceedance of pH downstream of the MPS. There were no other notable differences in water quality parameters between upstream and downstream sites.

There was no nuisance periphyton or filamentous algae growth observed at either of the two sites. There was no erosion or changes in geomorphology observed that were considered abnormal or exacerbated (see Table 9). Riparian vegetation at each site was generally well established.

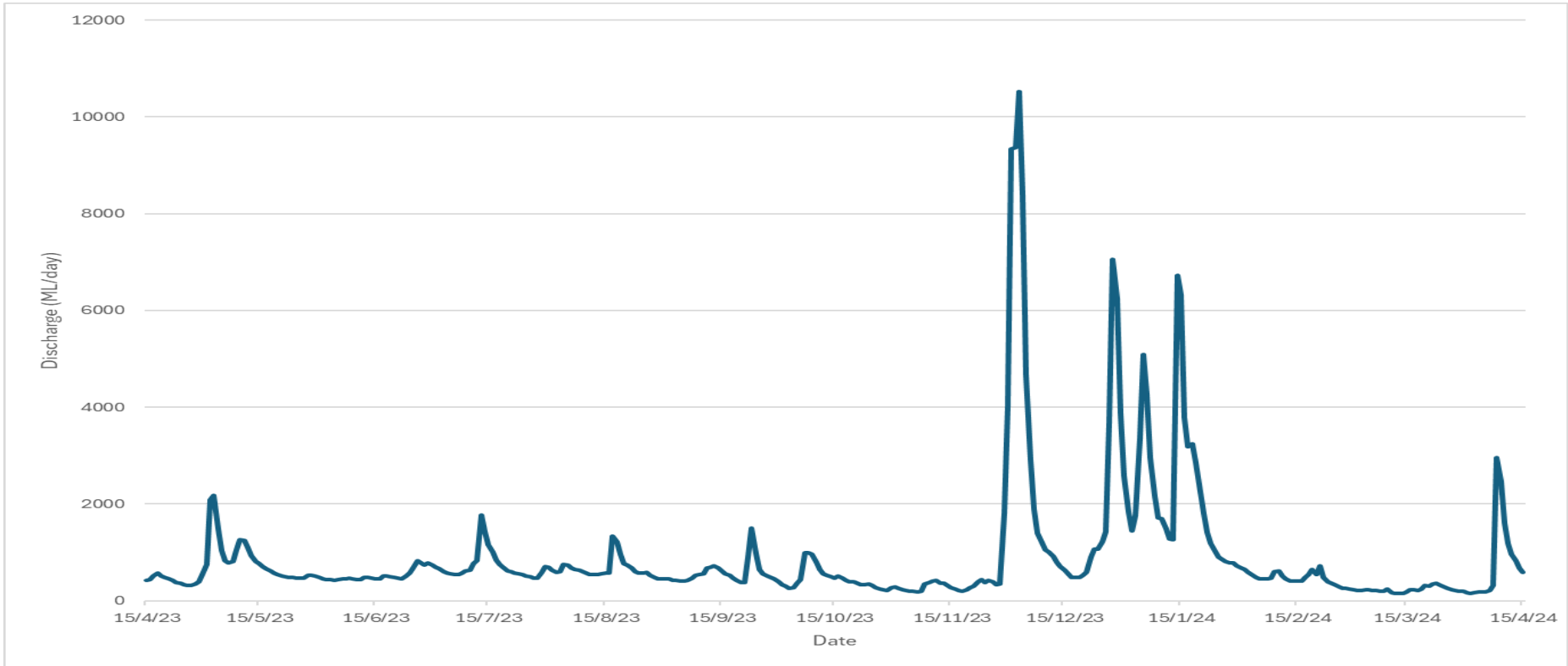


Figure 6 Hydrograph for the Murrumbidgee River below of Lobbs Hole Creek (410761) for the past 12 months.

Table 8 In-situ water quality parameters in the Murrumbidgee River (MPS)

Site	Date	Time	Location	Temp. (°C)	EC (µS/cm)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Turbidity (NTU)	Alkalinity (mg/L)
MUR28 down	15/4/2024	10:15	Upstream	12.5	95	8.0	10.5	99.3	7	80
MUR936	16/4/2024	13:15	Downstream	17.2	143	8.2	9.7	100.8	9	80
ANZG (2018) Guidelines					30-350	6.5-8.0		90-110	2-25	

Note: Red text did not comply with ANZG (2018) guideline values.

Table 9 Photos of Murrumbidgee River (MPS) monitoring sites

MUR28 down	MUR936
Looking upstream	
	
Looking downstream	
	

3. Summary

In most aspects of river condition observed, the physical and ecological condition of the sites observed in autumn 2024 was within the historic range observed for the project. Importantly, there were no obvious differences in the water quality and substrate composition observed between each pair of upstream and downstream monitoring sites. This should be expected given that the M2G and MPS have not been in operation since 2020. There were slight exceedances in *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) guidelines for pH at three out of the four Murrumbidgee River sites. This is not considered to be of concern and may be attributed to photosynthesis undertaken by relatively abundant macrophyte cover at these sites. Dissolved oxygen levels and electrical conductivity were also outside of guideline values. These exceedances are still within the historical range of data collected for the project and are not of concern.

The results from the autumn 2024 sentinel monitoring and preliminary comparisons to previous sampling events do not raise concerns. However, the following points are made:

- There were no notable impacts on substrate or riparian vegetation at Murrumbidgee River monitoring sites, which suggests that there were no major residual impacts from M2G or MPS operation, or other major upstream factors causing river degradation.
- There was no obvious bank instability or changes in geomorphology. However, further assessment will be made in the subsequent technical report.
- Preliminary analysis of *in situ* water quality reveals only minor differences from previous monitoring results.
- Elevated flow rate in the two weeks preceding the autumn 2024 monitoring and low flows in other seasons reflects the naturally occurring variability of flows in the waterways. This will need to be considered when inferences are made about changes in flow and ecological condition due to the operation of the M2G and MPS in subsequent technical reports.

The three yearly sentinel monitoring round requires spring monitoring which will be undertaken later this year.

4. References

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

Jacobs (2014). Review of the Murrumbidgee Environmental Monitoring Program. Report to ACTEW Water. VW07641.



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