WILPINJONG CREEK - MINE WATER DISCHARGE ASSESSMENT

(PERTAINING TO THE OCT/NOV 2022 EPL EMERGENCY WATER DISCAHRGE)

Prepared for:

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Wilpinjong Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
665.10014.02005-R01-v2.0	2 December 2022	A Skorulis / K Selvaratnam	A Basson	A Basson
665.10014.00000-R01-v1.0	1 December 2022	A Skorulis / K Selvaratnam	A Basson	A Basson

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1 Introduction

Wilpinjong Coal Mine (WCM) were granted an exemption by the NSW Environmental Protection Authority (EPA) to discharge excess mine water (EMW) to Wilpinjong Creek and Cumbo Creek (tributaries of Goulburn River). One of the conditions of this exemption is to submit a report to the NSW EPA, reviewing potential changes in downstream surface water quality influenced by this discharge. SLR has been commissioned by WCM to undertake this work, with this report presenting a review and assessment of the available and relevant surface water data.

Other local mines were also granted permission to discharge EMW into the Goulburn River catchment within the same period, noting that actual periods of discharge did not necessarily coincide for the entire periods granted. Minutes from the NSW Legislative Council (dated 16 November 2022) indicated that the EPA approved the discharge of water into Goulburn River or its tributaries, comprising 71 ML/d from WCM, 30 ML/d from Ulan coal mine and 15 ML/d from Moolarben coal mine (MC). The 15 ML/day at MC is prior to emergency provisions being granted for that site.

EMW was discharged by WCM to Wilpinjong and Cumbo Creeks between 31 October 2022 and 25 November 2022 at three locations (EPL Point 30, 31, 32) (see **Table 1**). It is understood that Ulan has had permission to discharge up to 30 ML/day of treated water to the Goulburn River under EPL 394, with the Ulan Water Management Plan (Glencore, 2021) indicating discharge since 2012. Neighbouring MC was granted emergency provisions to discharge up to 85 ML/day EMW to the Goulburn River catchment. Permission was granted to discharge 20 ML/ day of this quantity to Wilpinjong Creek via Murragamba Creek, upstream of WC and all WC monitoring locations.

2 Methodology

Water chemistry data at locations upstream and downstream of WCM have been reviewed to assess if the discharge of EMW from WCM and other local mines has impacted downstream surface water quality. Key monitoring locations are described in **Table 1** and indicated in **Figure 1** (full investigation scale) and **Figure 2** (WC site scale). Analysis of water chemistry data, specifically pH, electrical conductivity (EC) and turbidity, at these monitoring sites, has been used to determine the potential extent of impact from the discharge of EMW from WCM, MC, or Ulan on Wilpinjong Creek and/or Goulburn River.

Table 1 Key Monitoring Sites

Site	Description
EPL Point 32	EMW from Pit 2 was discharged to Wilpinjong Creek. The water make-up varied over the discharge period, as the Pit 2 dam water was periodically simultaneously released with treated water from the Reverse Osmosis (RO) Plant. Water was released to Wilpinjong Creek using a combination of the existing RO Plant discharge infrastructure and natural drainage channels. The daily discharge limit from EPL Point 32 was 35 ML/day.
EPL Point 31	EMW from Pit 4 was discharged to Cumbo Creek, a tributary of Wilpinjong Creek. The discharge location was approximately 1.3 km from the confluence with Wilpinjong Creek. The daily discharge limit from EPL Point 31 was 18 ML/day.
EPL Point 30	EMW from Pit 8 was discharged to Wilpinjong Creek via the Slate Gully drainage line, utilising existing clean water diversion infrastructure.

Site	Description
	The daily discharge limit from EPL Point 30 was 18 ML/day.
EPL 12425	Product water from the RO treatment plant is discharged to Wilpinjong Creek.
WILGSU	Monitoring site located upstream of all WCM discharge points (EPL 32, EPL 31 and EPL 30, EPL 12425), and used to represent baseline conditions at WCM. This site is downstream of the MC discharge location.
WILGSD	Monitoring site located downstream of Pit 2, Pit 3, and Pit 4, but upstream of Pit 8. This site is also located downstream of EPL 32 and EPL 31, but upstream of EPL 30.
WOL_1	Monitoring site located downstream of the confluence of Wollar Creek and Wilpinjong Creek and is downstream of all WCM mining activity and EPL discharge points.
CCGSU	Monitoring site located on Cumbo Creek, upstream of all WCM EMW discharge points.
O'Brien's Crossing	Monitoring site located on Goulburn River, approximately 50 km downstream of the Wilpinjong-Wollar Creek confluence, and downstream of all WCM, MC and Ulan discharge points.
Goulburn River at Coggan	Monitoring site located on Goulburn River, downstream of O'Brien's Crossing, approximately 60 km downstream of the Wilpinjong-Wollar Creek confluence, and downstream of all WCM, MC and Ulan discharge points.

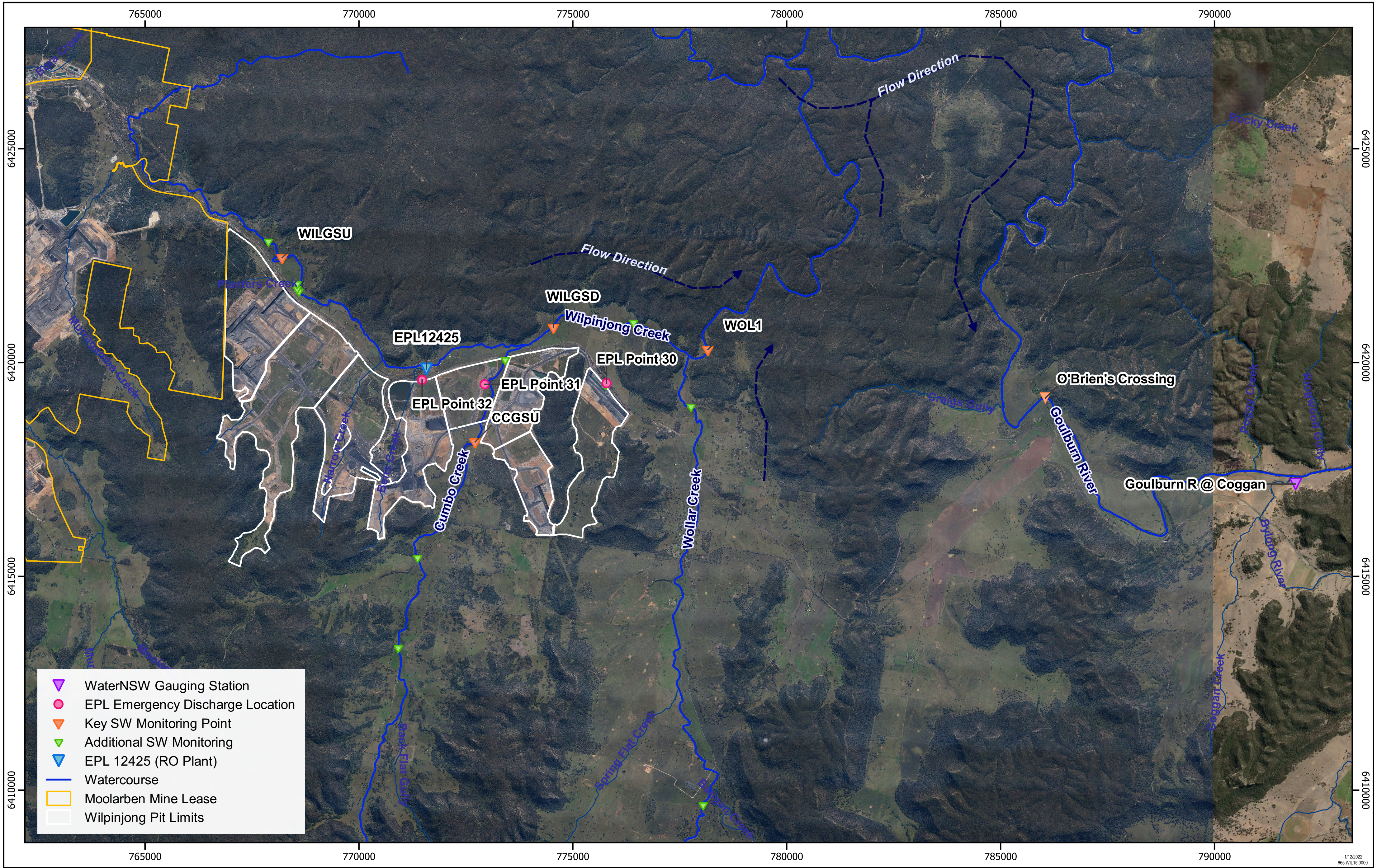

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FIGURE 1

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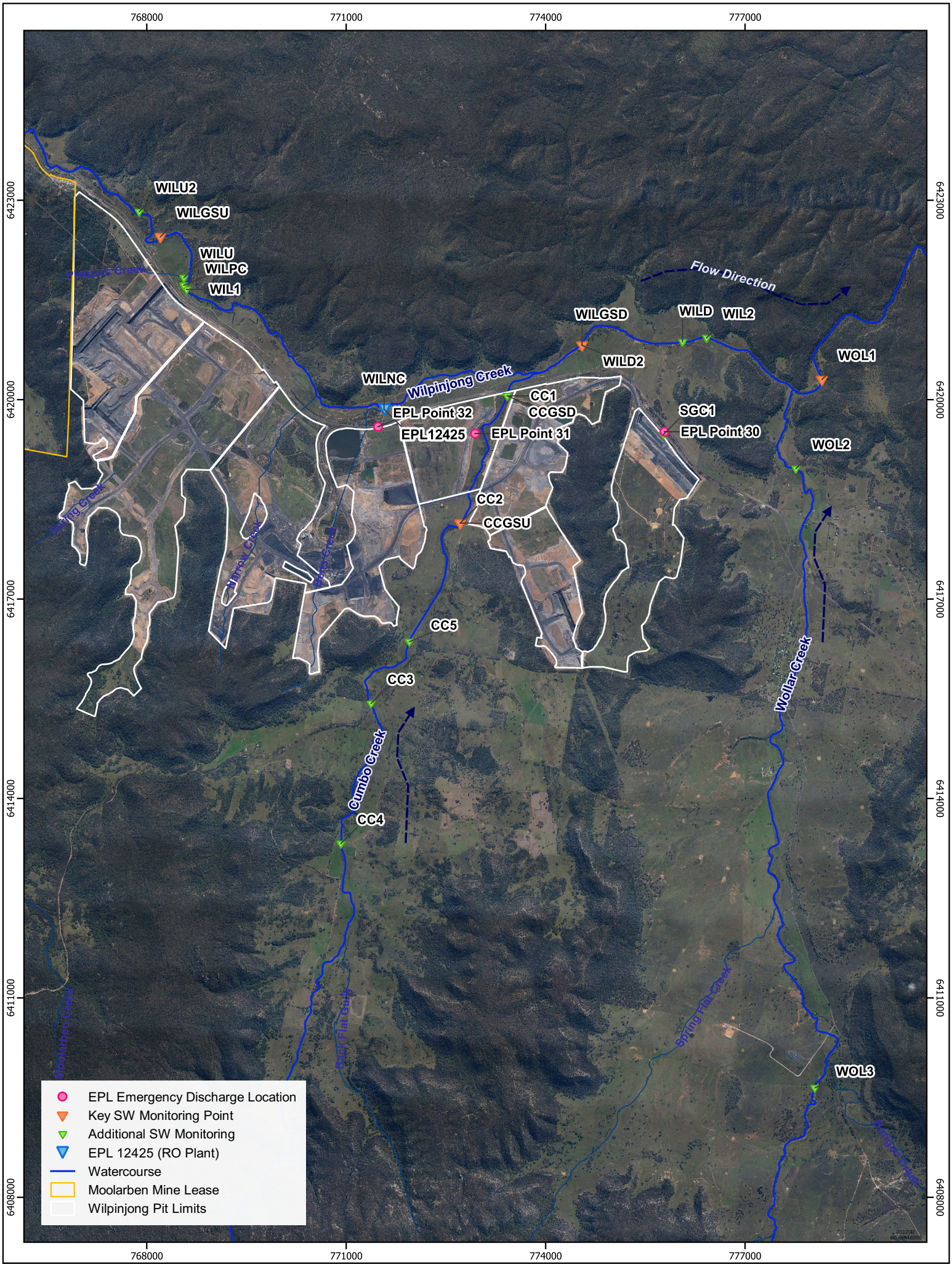

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FIGURE 2

Surface water quality conditions at the WCM and WaterNSW monitoring locations, prior to the discharge of EMW from WCM have been summarised. These conditions were then compared to the observations made following the commencement of the discharge of EMW from WCM on 31 October 2022 and from MC on 17 November 2022.

Table 2 provides an overview of the assessment process used to evaluate the influence of EMW discharge on Wilpinjong Creek and Goulburn River.

Table 2 Assessment Overview

Stage	Assessment Objective	Assessment Period	Inputs	Relevant Monitoring/ Discharge Sites
1. Summarise historical and recent conditions	**Historical Conditions:** characterise historical surface water quality conditions	2012 – 2021	Wilpinjong Creek: rainfall, RO Plant discharge, Wilpinjong, Cumbo, Wollar and other Creeks Goulburn River: Ulan discharge, rainfall, flow from tributaries	WCM and Water NSW surface water monitoring sites, discharge from EPL 394 (Ulan), EPL 12425 (WCM), and EPL 12392 (MC)
	Recent Conditions: characterise recent surface water quality conditions – prior to commencement of EMW discharge.	Jan – Oct 2022		
2. Review influence of WCM discharge only	**WCM EMW Discharge:** review the influence of EMW discharge from WCM on downstream water quality	31/10/2022 – 17/11/2022	Wilpinjong Creek: As above plus, WCM EMW discharge Goulburn River: As above plus, WCM EMW discharge	As above plus; EPL 32 EPL 31, EPL 30
3. Review influence of MC+WCM discharge	**MC EMW Discharge:** review the influence of EMW discharge from MC on downstream water quality	17/11/2022 – 25/11/2022	Wilpinjong Creek: As above plus; MC EMW discharge Goulburn River: As above plus; MC EMW discharge	As above plus; MC EMW discharge

3 Historical Conditions

Time-series historical flow and water quality monitoring data from WaterNSW and WCM surface water monitoring sites from 2000 to 2021 are presented in **Appendix A**. These are used to summarise historical and recent conditions, prior to the EMW discharge commencing in late October 2022.

3.1 Goulburn River

The flow rate of the Goulburn River at the Coggan gauging station generally reflects the cumulative rainfall departure (CRD) trend (**Figure 3**) which indicates periods of above and below average rainfall. Flow in response to rainfall events is generally between 1,000 and 10,000 ML/day, with baseflow ranging between 0.01 and 100 ML/day for the majority of the analysed period, however baseflow has been above 200 ML/day since early 2022 and increasing throughout the last year.

Electrical conductivity (EC) has been recorded at the Coggan gauging station since 2012. It fluctuates between 500 and 2,500 µS/cm and generally appears to represent an inverse relationship with river flow rates (**Figure 4)**. EC from early 2020 to late November 2022 has been consistently lower than 1,000 µS/cm.

3.2 Wilpinjong Creek

Figure 5 through **Figure 9** show long-term water quality observations for Wilpinjong Creek, Cumbo Creek and Wollar Creek (monitoring locations are displayed on . Cumbo Creek is a tributary of Wilpinjong Creek, which in turn is a tributary of Wollar Creek which flows into the Goulburn River. A summary of the observations is provided in the following points:

- Upstream Wilpinjong Creek monitoring sites (**Figure 5**) show varying electrical conductivity levels prior to 2020, with observations at WIL-U2 indicating ~3,000 µS/cm, while WILGSU indicates EC levels are <2,000 µS/cm. Since early 2020 the water quality has freshened due to above average rainfall conditions, with EC at all sites less than 1,000 µS/cm. Turbidity and pH are generally stable throughout the monitoring period.
- Downstream Wilpinjong Creek monitoring sites (**Figure 6**) have historically showed varying electrical conductivity levels ranging between500 – 6,000 µS/cm. The RO Plant, located upstream of these monitoring locations (EPL 12425), has been discharging low EC water (<500 µS/cm) to Wilpinjong Creek since late 2012 and has had some influence on water quality. Observations at all sites since early 2020 have freshened and are generally <1,500 µS/cm.
- Cumbo Creek monitoring sites (**Figure 7**, **Figure 8**) have historically shown higher EC than Wilpinjong Creek, in the range of 3,000 to 8,000 µS/cm. EC observations in Cumbo Creek are currently 2,000-3,000 µS/cm which is lower than historical maximums due to recent high rainfall conditions. Cumbo Creek is a source of salinity in Wilpinjong Creek.
- Wollar Creek monitoring sites upstream of the confluence with Wilpinjong Creek (**Figure 9**), have historically had higher EC than Wilpinjong Creek (WOL2: 2,000-4,000 µS/cm). Downstream of the confluence is fresher than upstream Wollar Creek sites due to the influence of Wilpinjong Creek (WOL1: 1,000-2,000 µS/cm). Since early 2020, EC at both Wollar Creek sites have decreased due to high rainfall conditions and are currently less than 1,000 µS/cm.

4 Discharge Assessment

Real-time surface water quality and flow data from WaterNSW and WCM surface water monitoring sites are presented, alongside available discharge volume and quality data, from 1 October 2022 to 30 November 2022 (**Appendix B)**. This data is used to review the influence of discharge on surface water quality and assess whether any surface water quality changes are outside natural variation.

4.1 Discharge Water

Table 3 provides a summary of discharge volumes from the three EPL points (30, 31, 32) between 31 October and 25 November 2022. Discharge never exceeded the EPL daily discharge limit of 71 ML.

Table 3 Wilpinjong Coal emergency discharge volumes

	Discharge Volume (ML/day)							
	EPL Point 32 (Pit 2)	Daily Limit	EPL Point 31 (Pit 4)	Daily Limit	EPL Point 30 (Pit 8)	Daily Limit	Total	Daily Limit
Daily Average	25.2	35	15	18	11	18	49.5	71
Daily Maximum	33.5		16.6		14		60.7	
Total Discharged (ML)	655		389		243		1,287	

Daily water quality sampling was undertaken at the emergency discharge locations (EPL 30, 31, 32) as well as the O'Brien's Crossing monitoring site on the Goulburn River, ~50 km downstream of the Wilpinjong-Wollar Creek confluence. Below is a summary of the three key water quality indicators from the emergency discharge points during October/ November 2022 (**Figure 10**).

- The EC of discharge water was 3,500 – 4,500 µS/cm and observed to be reasonably consistent at each discharge location. This is higher than the EC of the receiving water in Wilpinjong Creek prior to discharge.
- Turbidity was generally <10 NTU at all discharge sites. This is lower than the turbidity of the receiving water in Wilpinjong Creek prior to discharge.
- pH is between 7 and 8.5 at all discharge sites, this is generally consistent with recent pH of the receiving water in Wilpinjong Creek prior to discharge.

The exact quality and volume of discharge from MC, during the period they were discharging, is unknown. It is understood that MC started discharging to Wilpinjong Creek at approximately 4:40pm on 17 November 2022, and that MC were granted an exemption to discharge up to 15 ML/day.

The exact quality and volume of discharge from Ulan is unknown. It is understood that Ulan has permission to discharge up to 30 ML/day of treated water to Goulburn River under EPL 394.

4.2 Discharge Volume Compared to Stream Flow

The potential for EMW discharge to influence the quality of the receiving water is related to the volume of discharge compared to background flow volume in the watercourse and the quality of the water discharged compared to the receiving water. As shown in **Figure 11** and

Figure 12, the rate of flow in Wilpinjong Creek, Cumbo Creek and Goulburn River generally align with rainfall events, with maximum flows observed during times of peak rainfall. The following comments are provided regarding flow volumes within the assessed watercourses compared to the discharge volumes during Oct/November 2022.

- The main contributors to flow at the downstream Wilpinjong Creek (WILGSD) location, are flows from upstream tributaries (Cumbo and Wilpinjong Creek), RO Plant discharge, and EMW discharged from the EPL points. During rainfall events in November 2022, flow at downstream Wilpinjong Creek was >500 ML/day and likely driven by natural surface water flow (e.g. Cumbo Creek and upstream Wilpinjong Creek flow). Outside of peak flow following rainfall events, discharge from the EPL points upstream of WILGSD may be providing a larger contribution to flow compared to natural flow upstream, maintaining a flow rate of ~100 ML/day.
    - It is noted that RO Plant discharge (EPL 12425) was low compared to emergency discharge volumes and natural stream flow in November 2022 and was not a significant contributor to flow during this time.
- Flow at upstream Wilpinjong Creek (WILGSU) shows some influence of the MC EMW discharge. The minimum flow prior to discharge commencing was ~6 ML/day (12 Nov) while the minimum flow following discharge was ~10 ML/day. The actual volume and timing of the MC discharges are unknown.
- Flow volumes in Goulburn River (measured at Coggan) are generally an order of magnitude (10x) higher than flow volumes measured at Wilpinjong Creek Downstream (600-25,000 ML/day, opposed to 65-1,300 ML/day). Maximum allowable discharge volumes from upstream coal mines was 186 ML/day (71 ML from WCM, 85 ML from MC, and 30 ML from Ulan) which is a small fraction of peak flow following rainfall (~0.1-1 %) but may be up to ~20% of recent Goulburn River flow outside of rain events.

4.3 Discharge Influence on Water Quality

The following points summarise the potential influence of discharge from coal mines on water quality in Wilpinjong Creek and Goulburn River during October/ November 2022:

- As shown in **Figure 13**, prior to the commencement of discharge of EMW from WCM, EC was lower upstream at Wilpinjong Creek (WILGSU) than it was downstream at Wilpinjong Creek (WILGSD), with EC higher at Cumbo Creek (CCGSU) than both upstream and downstream Wilpinjong Creek.
- After discharging commenced at WCM, EC increased from being consistently less than 1,000 µS/cm to between 1,000 and 3,000 µS/cm at downstream Wilpinjong Creek (WILGSD). A rainfall event on 14 November 2022 temporarily freshened EC at WILGSD, and EC is observed to have decreased following the completion of discharge on 25 November 2022 (**Figure 12**). The discharge of EMW by WCM was likely the cause of a temporary increase in EC in Wilpinjong Creek downstream of the discharge locations. It is noted that this increase in EC levels is well within the observed natural range of 500 – 6,000 µS/cm.

- At Wollar Creek, downstream of the confluence with Wilpinjong Creek, EC was elevated in the WOL1 sample collected on 23 November 2022 compared with previous 2022 observations (2,760 µS/cm up from <1,000 µS/cm). The discharge of EMW by WC is likely the cause of increased in EC in Wollar Creek, downstream of the WC and MC discharge locations. It is noted that this increased EC observation is within the natural range for upstream Wollar Creek (2,000-4,000 µS/cm).
- At Cumbo Creek, downstream of the EPL Point 31, EC was elevated in the CC-1 sample collected on 23 November 2022 compared with recent observations (3,260 µS/cm up from <2,000 µS/cm in the previous four months), but consistent with observations in early 2022, and within the natural range for downstream Cumbo Creek (2,000-2,000 µS/cm). The discharge of EMW by WC is likely the cause of the current EC in Cumbo Creek, downstream of the EPL Point 31, but this quality is similar to most of the historical monitoring record.
- Goulburn River monitoring sites (O'Brien's Crossing and Goulburn River @ Coggan) also show an increase in EC from 500 to 900 µS/cm following the commencement of WCM discharge, however this is only slightly higher than the receding limb trends observed pre-discharge. EC is then observed to freshen following the 14 November rainfall event and increase to <1,000 µS/cm at the end of November. Longer-term monitoring from the Goulburn River @ Coggan site shows similar increases in EC between rainfall events and does not appear to be noticeably influenced by discharges of EMW from WCM or MC.
- Following the commencement of discharge of EMW from MC on 17 November 2022, EC increased at upstream Wilpinjong Creek (WILGSU) from ~100 µS/cm to ~1,500 µS/cm. The discharge of EMW by MC is likely increasing EC in Wilpinjong Creek upstream of WCM discharge locations. This increased EC is within the natural range for this location (~100 – 2,000 µS/cm)
- As shown in **Figure 15**, prior to the commencement of discharge of EMW from WCM, pH was lower (slightly acidic – pH 6) upstream at Wilpinjong Creek (WILGSU) than at both downstream Wilpinjong Creek (WILGSD) and Cumbo Creek (near neutral pH 7-7.5).
- Discharge of EMW from WCM has not clearly influenced pH at downstream Wilpinjong Creek (WILGSD). Discharge of EMW from MC appears to have influenced the pH at upstream Wilpinjong Creek (WILGSU). Following the commencement of MC discharge from 17 November 2022 pH at WILGSU has increased from pH 6.5 to pH 7.5.
- The pH observed further downstream at the Goulburn River (O'Brien's Crossing) fluctuates in alignment with rainfall and does not appear to be influenced by discharges of EMW.

5 Conclusions and Recommendations

The following points provide key conclusions from the assessment of EMW discharge on Wilpinjong Creek and Goulburn River:

- The discharge of EMW from WCM influenced the surface water quality in Wilpinjong Creek, downstream of the discharge points, during the discharge period. However, it appears that this influence was temporary and limited in extent. Elevated EC in Wilpinjong Creek was within the range of natural variation and declined following the cessation of WC discharge. There were also no discernible changes in pH and EC observed beyond the range of natural variation further downstream at the Goulburn River. The limited effect of EMW discharge on Goulburn River is likely due to higher total flows in the Goulburn River than the volumes of EMW discharged .
- It is likely that the discharge of EMW from MC is influencing the current quality of surface water in Wilpinjong Creek. This changed water quality is within the range of natural variation at these sites and is observed at the monitoring location upstream of WCM discharge locations. A higher proportion of recent influence is likely to be attributable to WCM discharges as WCM commenced discharging before MC and at higher volumes.
- It is unlikely that water quality in Goulburn River was significantly influenced by discharge of EMW from WCM, MC or Ulan during October/ November 2022. As stated above, this is likely related to high flows induced by high rainfall events in the Goulburn River catchment compared to EMW discharge volumes.

The following recommendations are made regarding the collection and review of additional data to increase confidence in the conclusions made in this assessment:

- Volumes, water quality, and timing of discharge from MC and Ulan.
- Review of WCM surface water and groundwater monitoring data following the completion of discharge to identify any long-term effects.
- Further monitoring at O'Brien's Crossing and Goulburn River at Coggan is recommended to identify potential downstream changes in water quality at the Goulburn River due to discharges of EMW.

6 References

NSW Legislative Council, 2022 '*Legislative Council – PROOF'*, excerpt, p.31, 16 November 2022.

Appendix A:

Historical and Recent Conditions

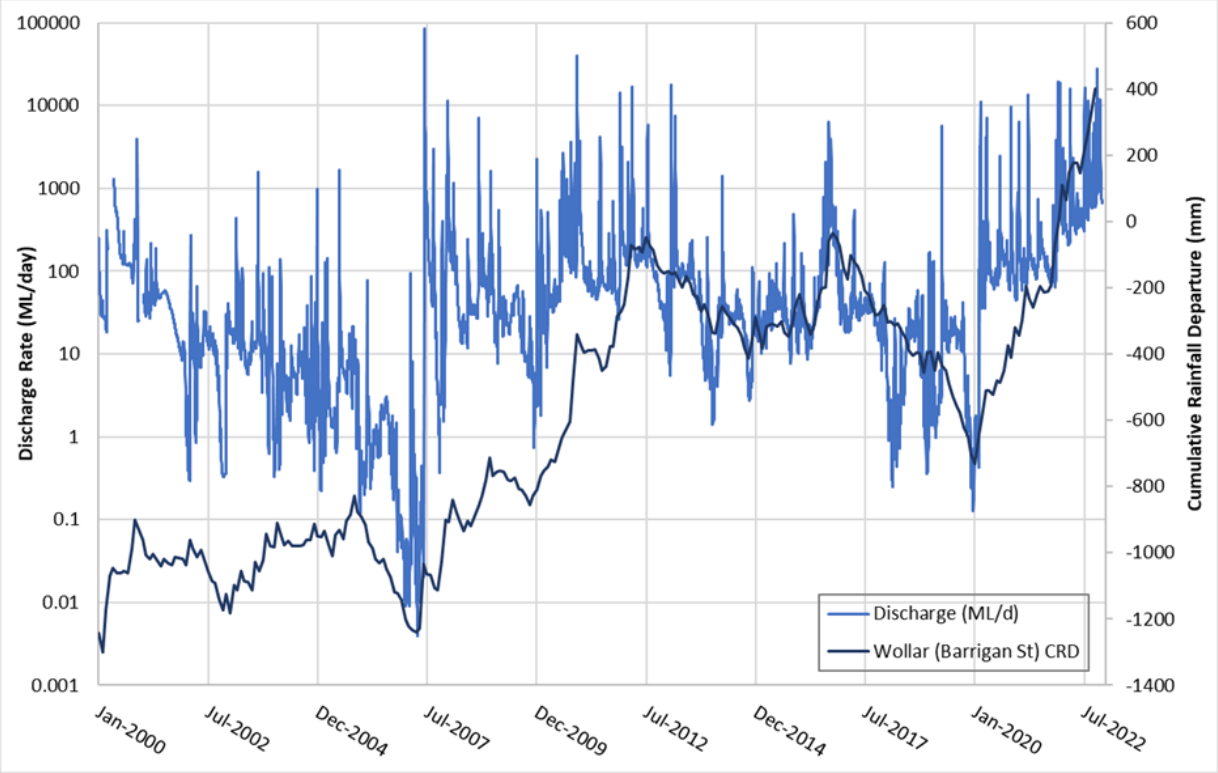

Figure 3 Goulburn River (@Coggan) daily discharge rate and CRD trend

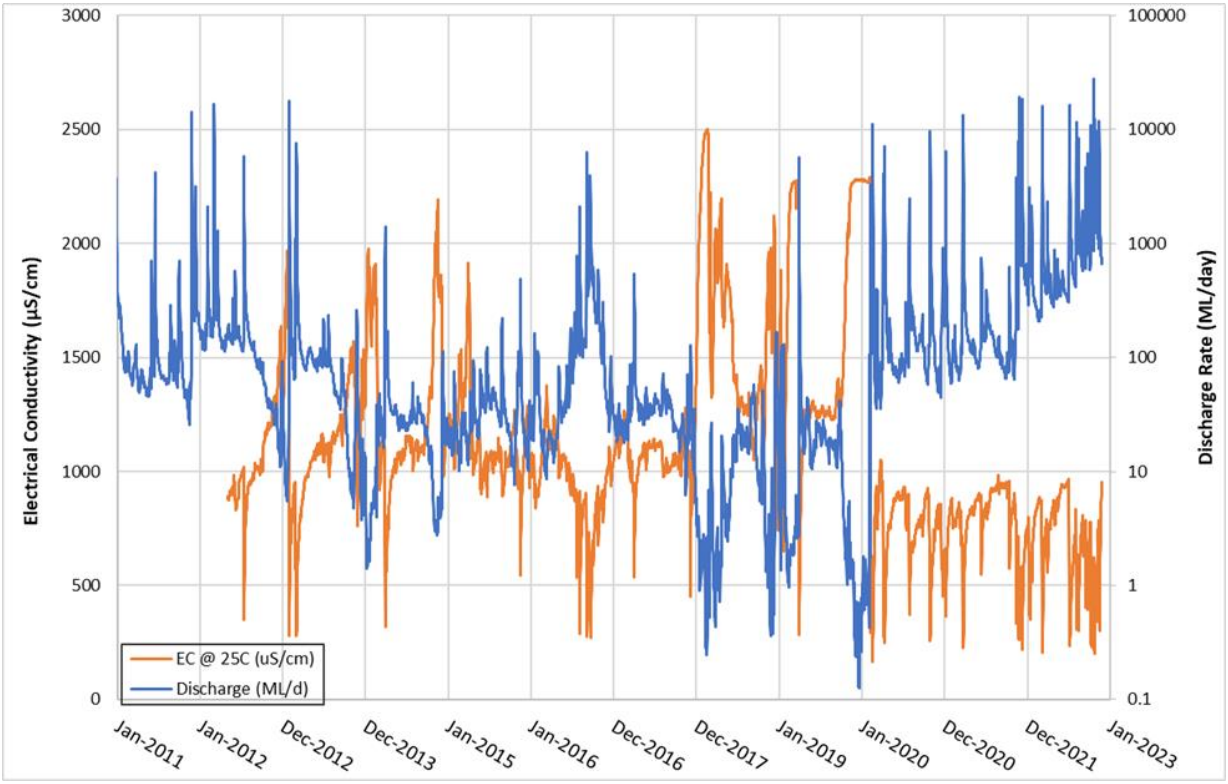

Figure 4 Goulburn River (@Coggan) daily discharge rate and EC trend

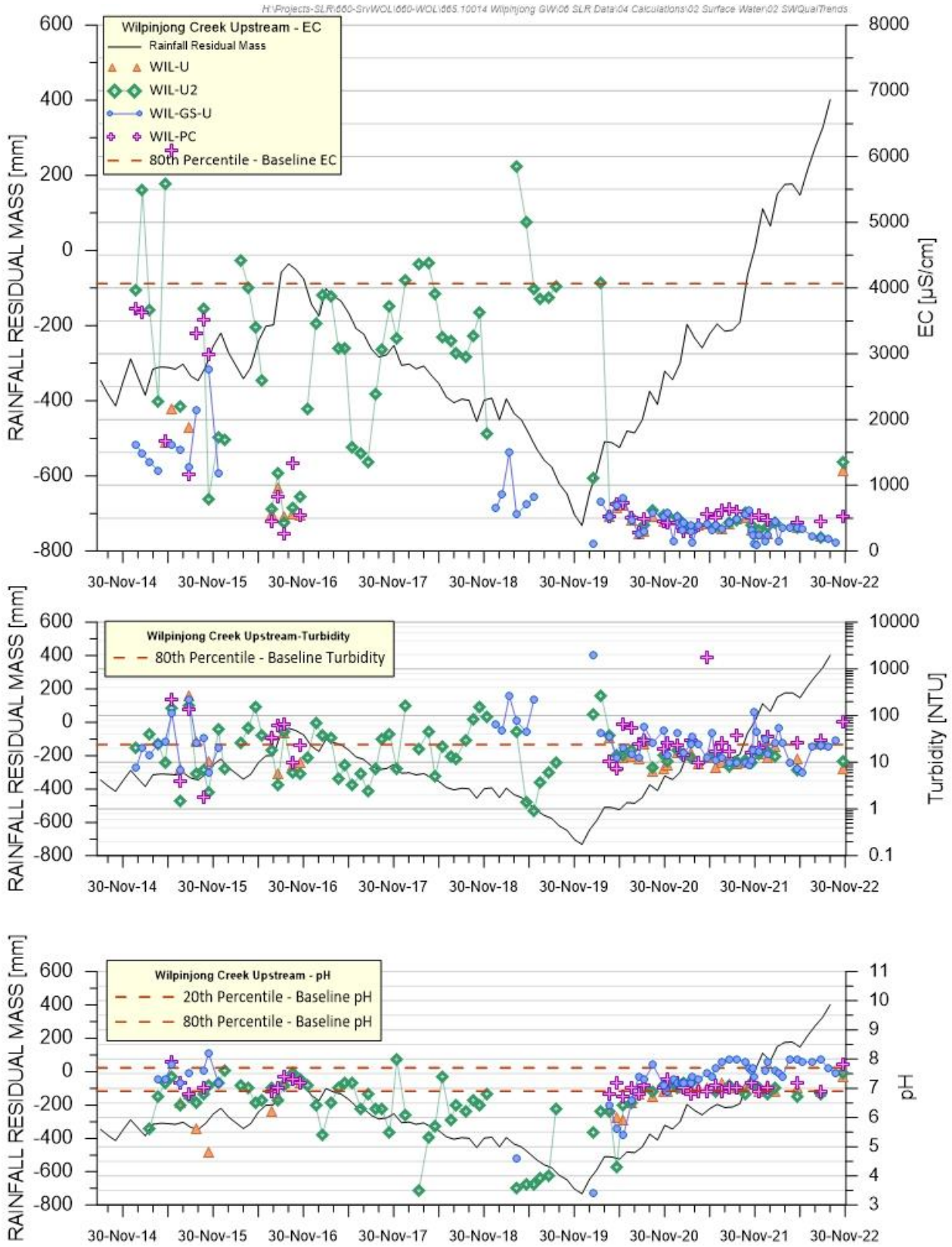

Figure 5 Long-term Water Quality – Wilpinjong Creek Upstream (WILGSU)

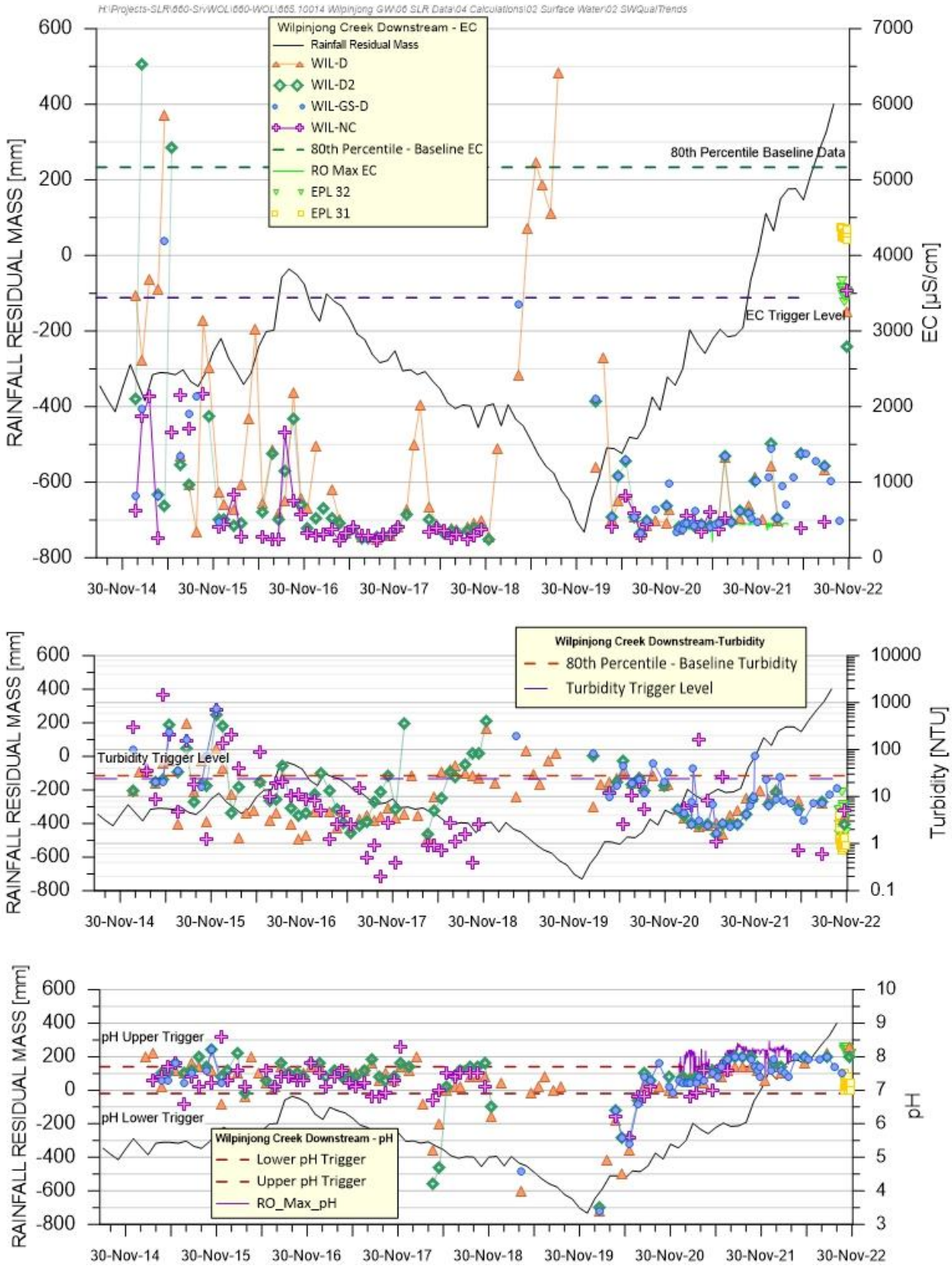

Figure 6 Long-term Water Quality – Wilpinjong Creek Downstream (WILGSD)

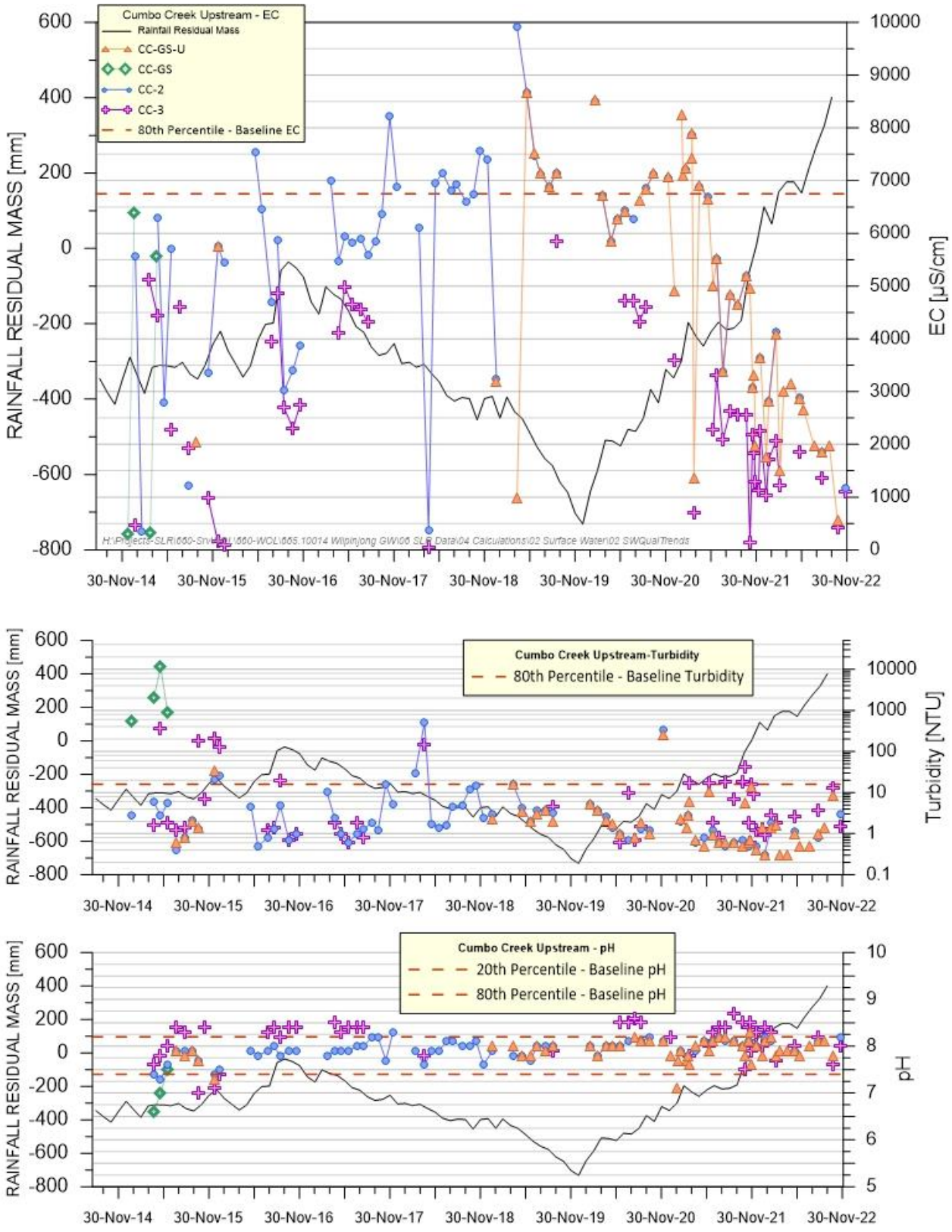

Figure 7 Long-term Water Quality – Cumbo Creek Upstream (CCGSU)

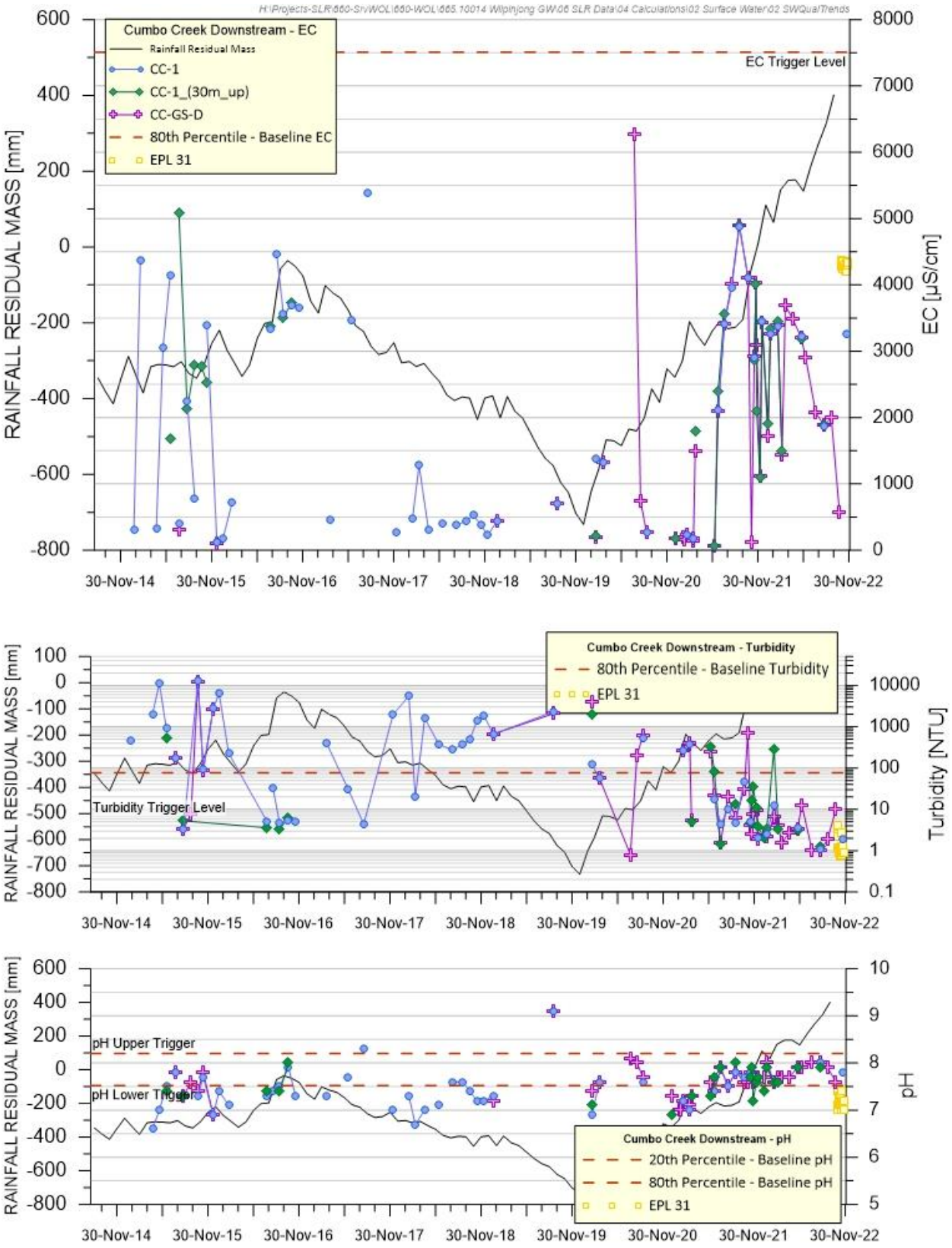

Figure 8 Long-term Water Quality – Cumbo Creek Downstream (CCGSD)

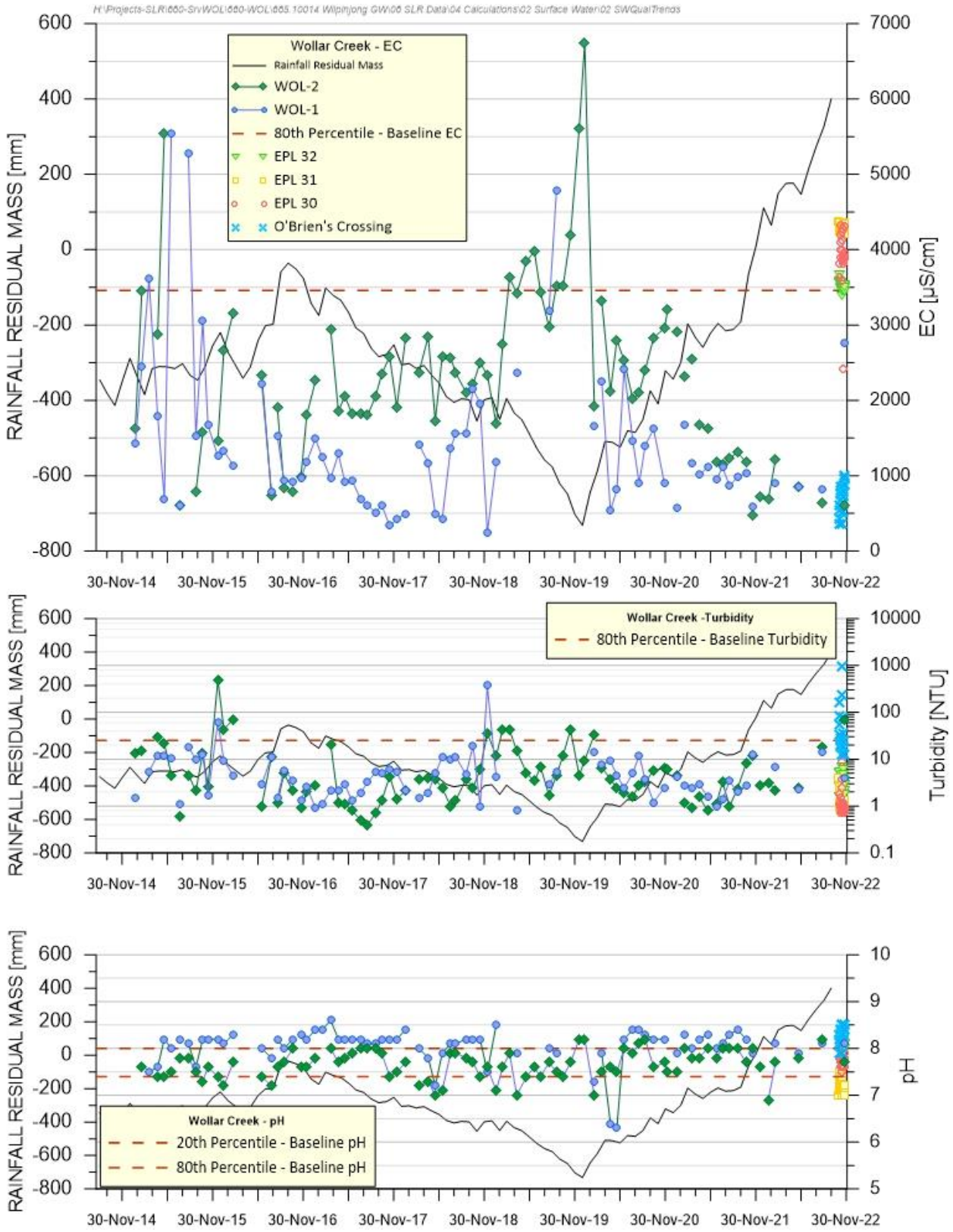

Figure 9 Long-term Water Quality – Wollar Creek Downstream (WOL-1 and WOL-2)

Appendix B:

Discharge Period Monitoring Data

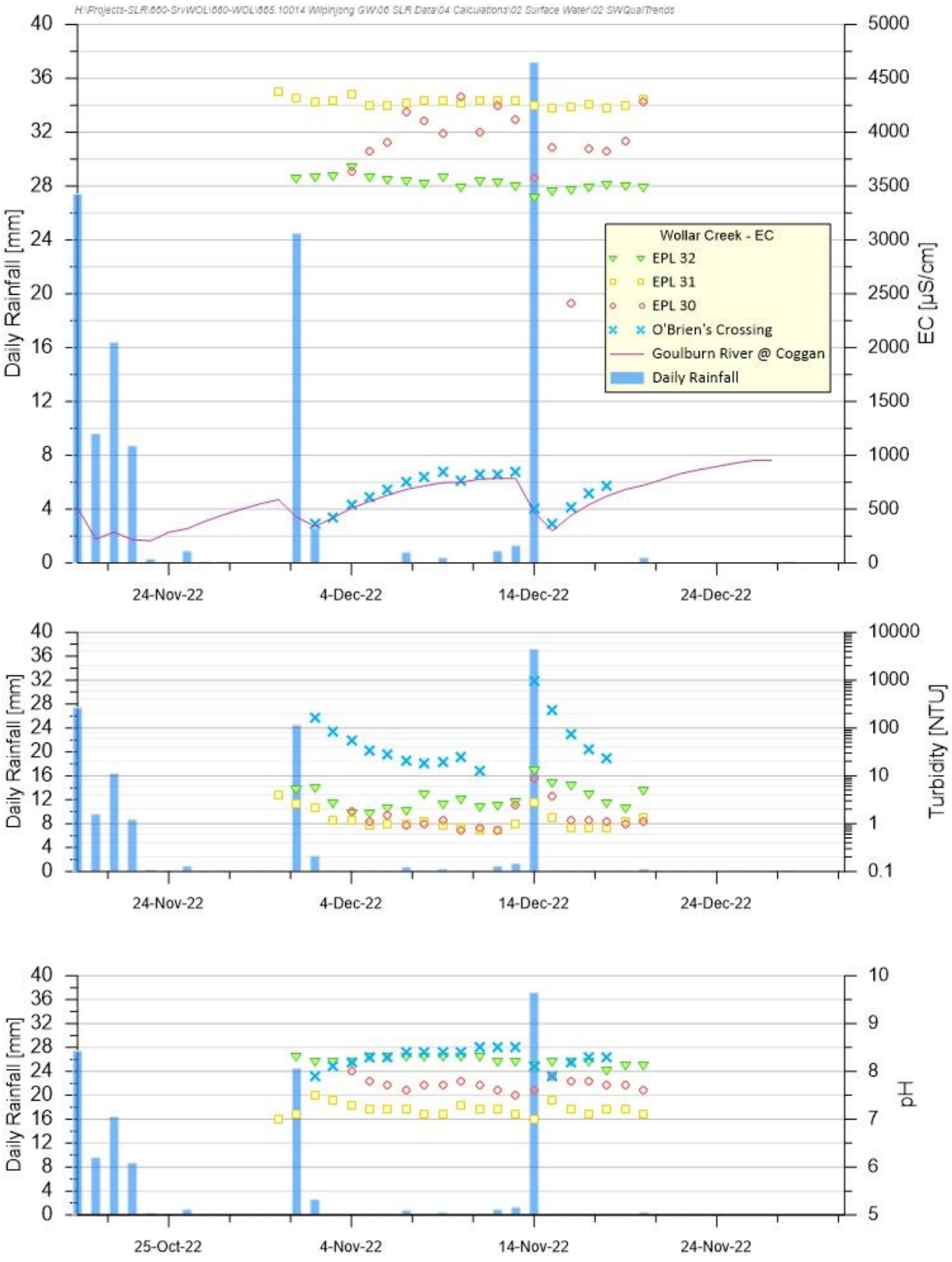

Figure 10 Discharge and downstream water quality October- November 2022

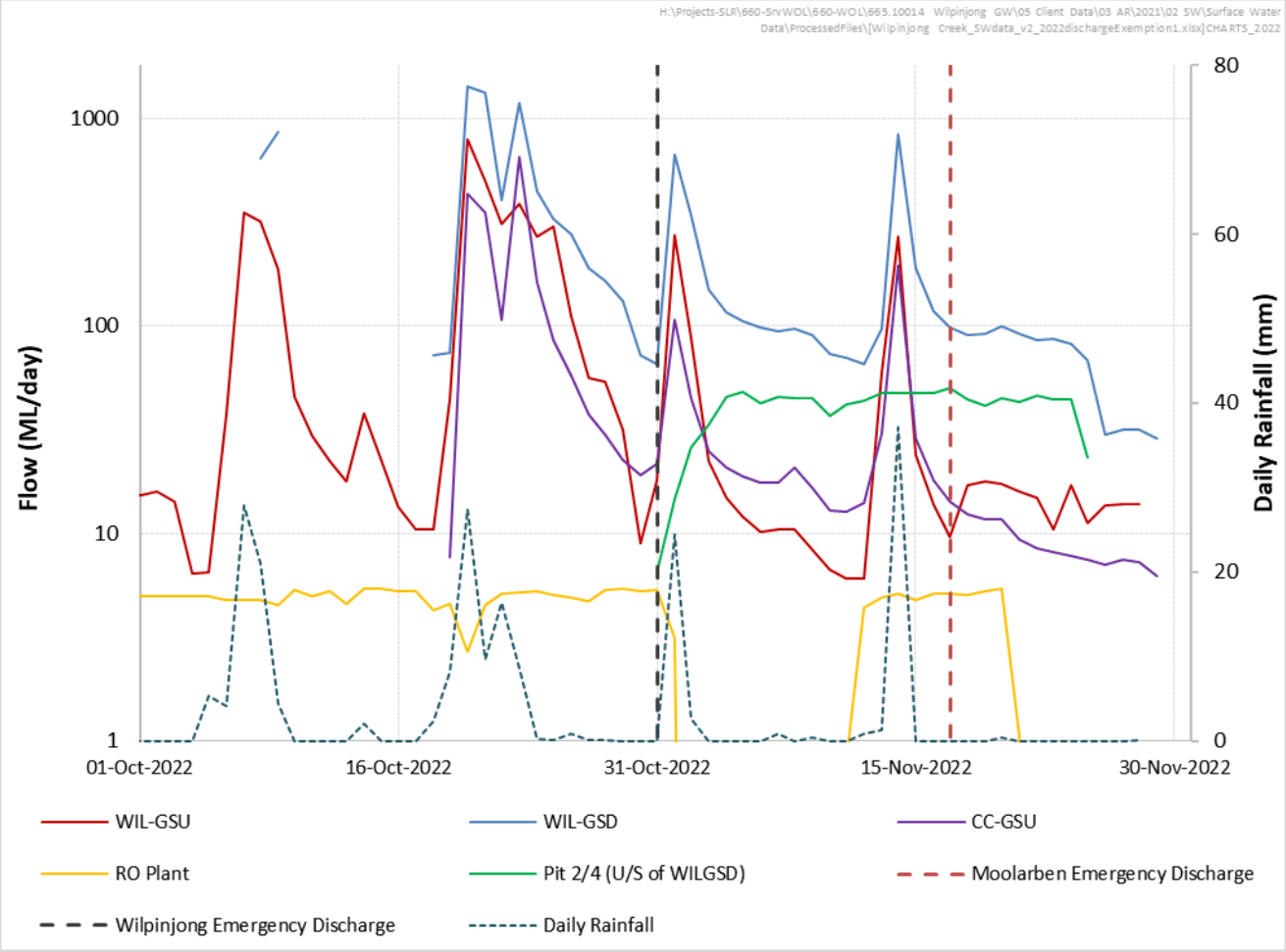

Figure 11 Flow Rate – Wilpinjong Creek, Cumbo Creek, RO Plant, Pit 2/4

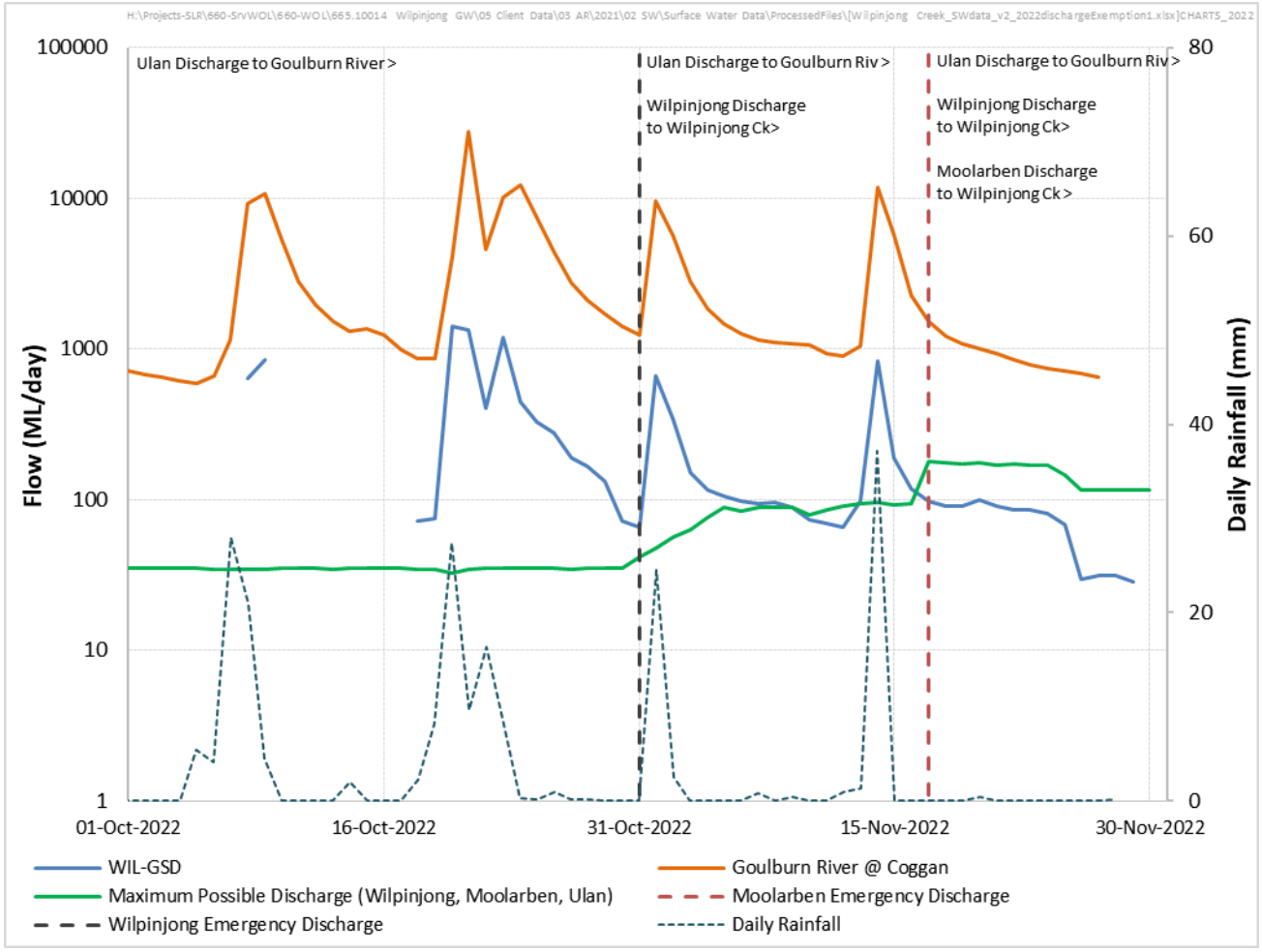

Figure 12 Flow Rate – Goulburn River

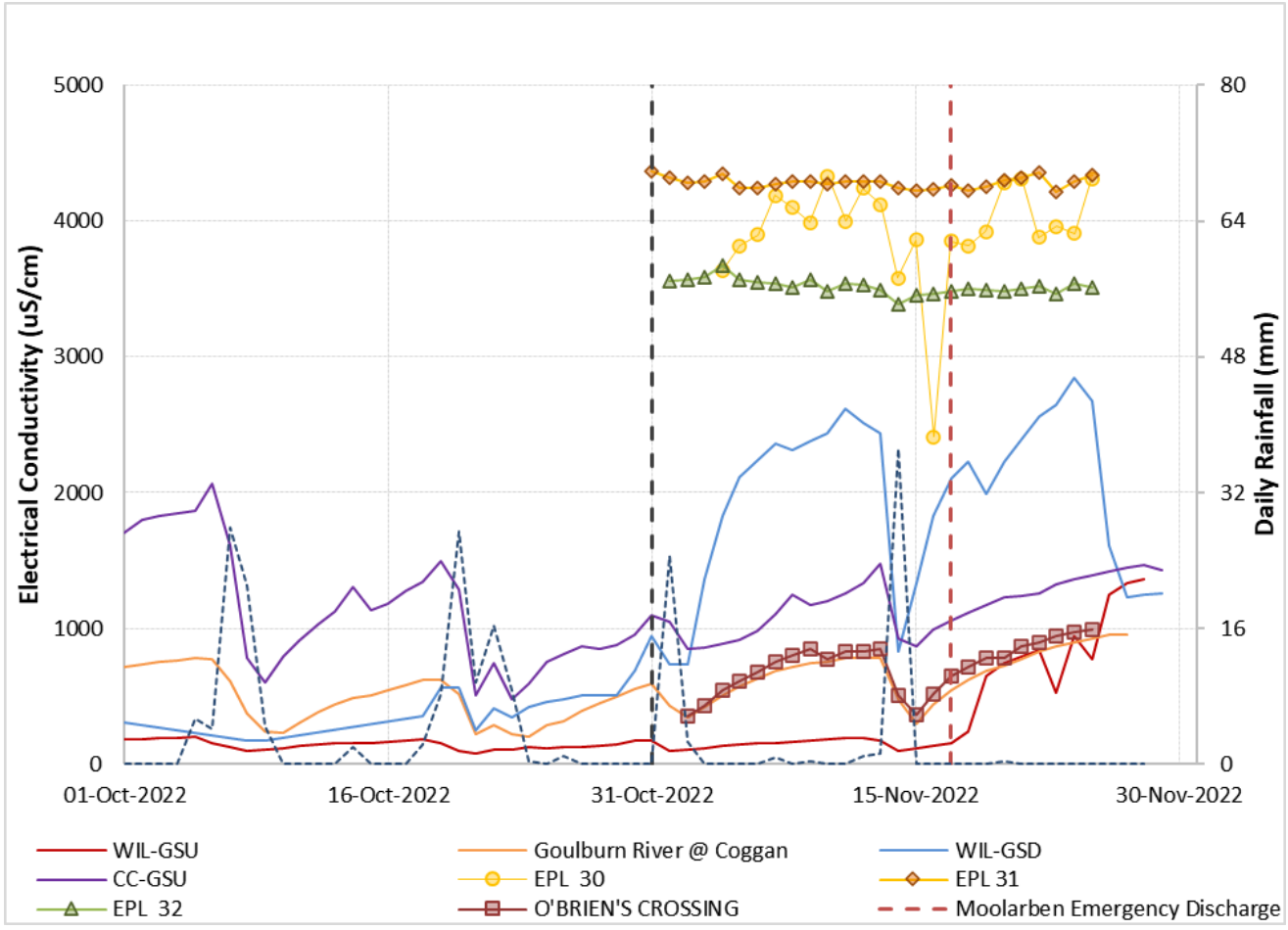

Figure 13 EC Level – Wilpinjong Creek, Cumbo Creek, Goulburn River

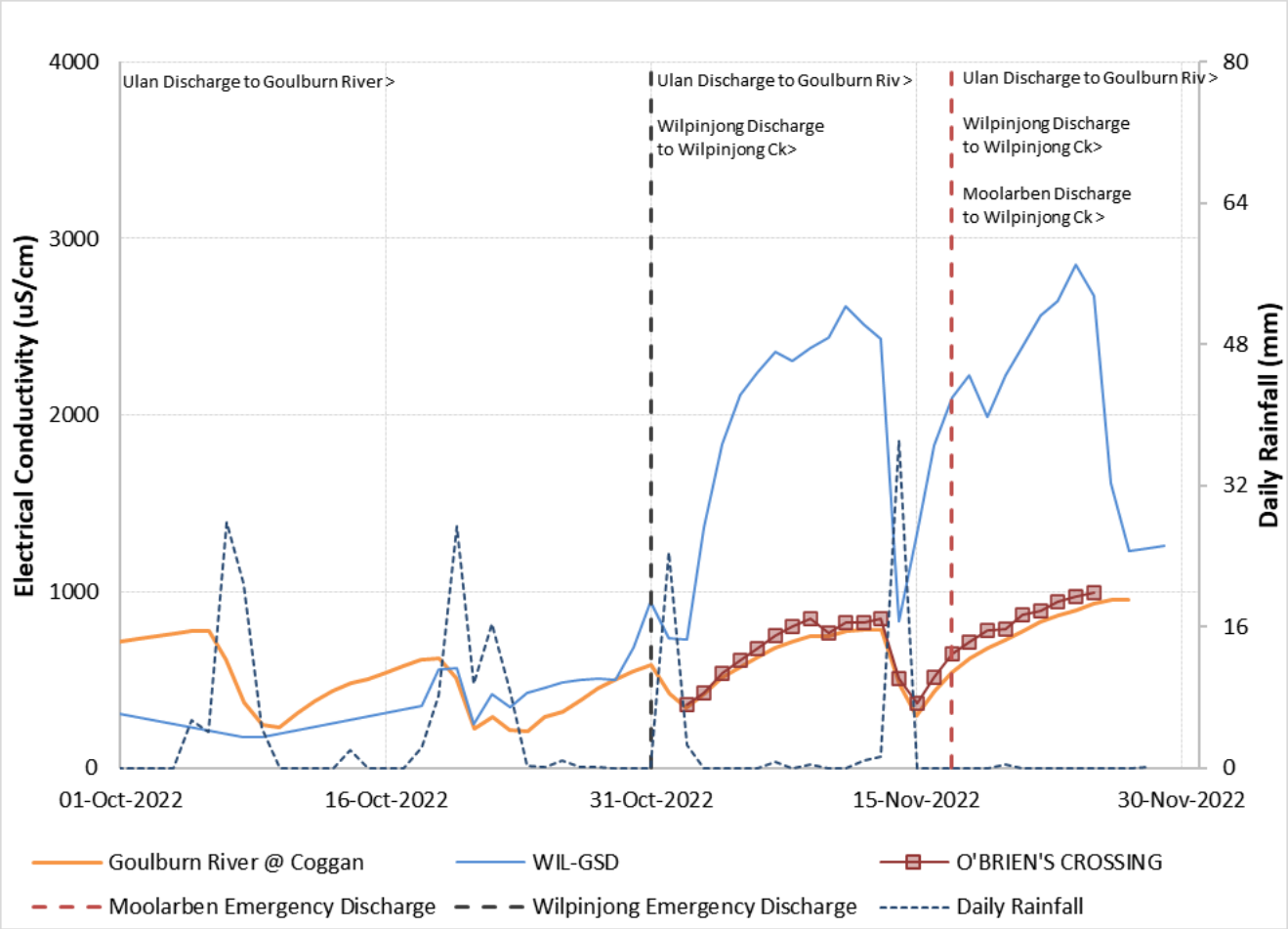

Figure 14 EC Level – Downstream Wilpinjong Creek and Goulburn River

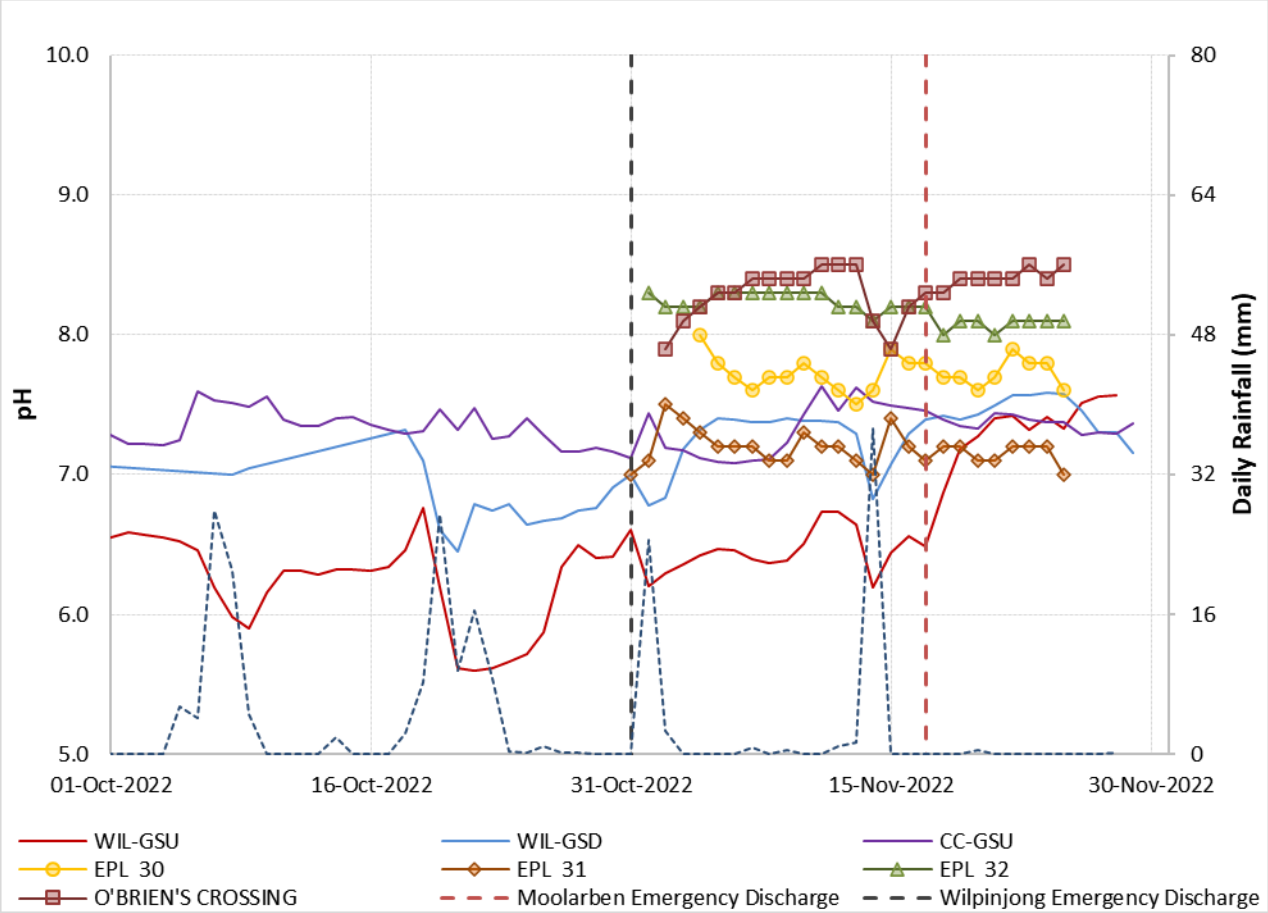

Figure 15 pH Level – Wilpinjong Creek, Cumbo Creek, Goulburn River

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WILPINJONG CREEK - MINE WATER DISCHARGE ASSESSMENT

(PERTAINING TO THE DEC 2022/JAN 2023 EPL EMERGENCY WATER DISCHARGE)

Prepared for:

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SLR Ref: 665.10014.02105-R01
Version No: -v2.0
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Wilpinjong Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
665.10014.02105-R01-v2.0	27 January 2023	A Skorulis	A Basson	A Basson
665.10014.02105-R01-v1.0	24 January 2023	A Skorulis	A Basson	

EXECUTIVE SUMMARY

Wilpinjong Coal Mine (WCM) was granted a licence variation by the NSW Environmental Protection Authority (EPA) to discharge excess mine water (EMW) from record rainfall into Wilpinjong Creek. The licence variation commenced on the 15 December 2022 and concluded on 1 January 2023 - 18 days in total ('Discharge Period').

The licence variation permitted WCM to discharge a total of **360 ML** into Wilpinjong Creek. The amount of water that WCM actually discharged into Wilpinjong Creek during the Discharge Period was **320 ML**.

During the Discharge Period water samples were taken each day from the discharge sites as well as from the Wilpinjong Creek and Goulburn River.

From the water samples taken during the Discharge Period, and historically from the receiving watercourses (i.e. Wilpinjong Creek, Cumbo Creek, Wollar Creek and Goulburn River), the following findings are provided.

- An increase in EC was observed in Wilpinjong Creek upstream of WCM discharge locations, which is likely due to EMW discharge to Wilpinjong Creek from Moolarben Coal (MC). This increased EC is at the upper limit of EC observations at WILGSU (100-2,000 µS/cm) but within the natural range for other upstream Wilpinjong Creek sites (500 – 4,000 µS/cm).
- An increase in Electrical Conductivity (EC) was observed downstream of the Wilpinjong Creek discharge sites in response to WCM discharge. This increase was temporary and within the observed natural range of EC for this location on Wilpinjong Creek.
- There is no evidence of WCM discharge influencing EC in the Goulburn River. EC levels in the Goulburn River during the Discharge Period are within the observed natural range.
- pH measured directly downstream of the discharge sites and further downstream in the Goulburn River were within the observed natural range.
- The turbidity of the discharged EMW was less than the receiving water.

The potential for EMW to influence the water quality of a receiving watercourse is dependent on the volume and quality of discharge, and the flow volume and water quality of the receiving watercourse. This report, as well as the earlier report submitted to the EPA on date 2 December 2022 (SLR Report *665.10014.02005-R01-v2.0-20221202*), demonstrate that reasonable volumes of EMW can be discharged into Wilpinjong Creek without any change in the water quality (i.e. pH and EC) beyond the natural variation. The volume and quality of water discharged by WCM has also caused no discernible change in water quality further downstream in the Goulburn River.

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1 Introduction

Wilpinjong Coal Mine (WCM) was granted a licence variation by the NSW Environmental Protection Authority (EPA) on the 14TH of December 2022, to discharge excess mine water (EMW) from record rainfall to Wilpinjong Creek (a tributaries of Goulburn River). One of the conditions of this variation is to submit a report to the NSW EPA, reviewing potential changes in downstream surface water quality influenced by this discharge. SLR has been commissioned by WCM to undertake this work, with this report presenting a review and assessment of the available and relevant surface water data.

Other local mines also had permission under Environment Protection Licences (EPLs)[1] to discharge water into the Goulburn River catchment within the same period, noting that actual periods of discharge did not necessarily coincide for the entire periods granted.

EMW was discharged by WCM to the Wilpinjong Creek catchment during two periods:

- WCM Discharge Period 1: Discharge to Wilpinjong and Cumbo Creeks between 31 October 2022 and 25 November 2022 occurred from three locations (EPL Points 30, 31, 32) (see **Table 1**) with a total permissible discharge of 71 ML/day. (Discharge during this period was authorised under a separate exemption granted on the 31st of October 2022.)
- WCM Discharge Period 2: Discharge to Wilpinjong Creek between 15 December 2022 and 1 January 2023 occurred at two locations (EPL Points 30 and 32) (see **Table 1**) with a total permissible discharge of 20 ML/day. The decrease in allowable daily discharge volume was proposed by WCM to related to the reduction in natural flow within the receiving environment following a short period of drier conditions.
- It is noted the WCM also has allowance to discharge up to 6.5 ML/day of treated water to Wilpinjong Creek at EPL Point 24, from the WCM Reverse Osmosis treatment plant (RO Plant). This volume is separate to permitted EMW discharge under Emergency Water Discharge provisions.

EMW was discharged by a neighbouring site, Moolarben Coal (MC), to Wilpinjong Creek and Goulburn River during two periods within the same timeframe:

- MC Discharge Period 1: Discharge to Wilpinjong Creek (via Murragamba Creek), Moolarben Creek and Goulburn River between 1 December 2022 - 31 December 2022 at three locations (MC EPL Points 01, 53, 54) up to a total permissible discharge of 85 ML/day. Up to 20 ML/day of this limit was to Murragamba Creek, a tributary of Wilpinjong Creek.
- MC Discharge Period 2: Discharge to Wilpinjong Creek (via Murragamba Creek), Moolarben Creek and Goulburn River between 1 January 2023 - 19 January 2023 at three locations (MC EPL Points 01, 53, 54) up to a total permissible discharge of 70 ML/day. Up to 20 ML/day of this limit was to Murragamba Creek, a tributary of Wilpinjong Creek.

[1] Wilpinjong Coal operates under EPL 12425 which was varied twice (in October and December 2022) to allow for the discharge of untreated water.
Moolarben Coal operates under EPL 12932 which was varied twice (in November and December 2022) to allow for the discharge of untreated water.
Ulan Coal operates under EPL 394 which was not varied in 2022 to allow for additional discharge.

It is understood that another site located within the catchment, Ulan Coal (UC), has permission to discharge up to 30 ML/day of treated water to the Goulburn River under EPL 394, with the Ulan Water Management Plan (Glencore, 2021) indicating discharge since 2012. There was no amendment to EPL 394 in late 2022 for provision to discharge EMW. Up to 20 ML/day of this limit is to Murragamba Creek.

This report focuses on the second period of discharge by WCM (WCM Discharge Period 2) from 15 December 2022 to 1 January 2023. The influence of the first period of discharge (WCM Discharge Period 1) was reviewed in detail in SLR report *665.10014.02005-R01-v2.0-20221202* which was issued to the NSW EPA on 2 December 2022.

2 Methodology

Water chemistry data at locations upstream and downstream of WCM have been reviewed to assess if the discharge of EMW from WCM and other local mines has significantly changed downstream surface water quality. Key monitoring locations are described in **Table 1** and indicated in **Figure 1** (full investigation extent) and **Figure 2** (WC site extent), with detail on additional discharge and monitoring locations from MC provided in **Table 2**. Analysis of water chemistry data, specifically pH, electrical conductivity (EC) and turbidity, at these monitoring sites, has been conducted to determine if water chemistry has significantly changed from historical baseline data in response to the discharge of EMW from WCM, MC, or UC on Wilpinjong Creek and/or the Goulburn River.

Table 1 Key Monitoring and Discharge Sites

Site	Description
EPL Point 32	EMW from Pit 2 was discharged to Wilpinjong Creek. The water make-up varied over the discharge period, as the Pit 2 dam water was periodically simultaneously released with treated water from the Reverse Osmosis (RO) Plant. Water was released to Wilpinjong Creek using a combination of the existing RO Plant discharge infrastructure and natural drainage channels. The daily discharge limit for WCM Period 1 from EPL Point 32 was 35 ML/day. The daily discharge limit for WCM Period 2 from EPL Point 32 was 15 ML/day.
EPL Point 31	EMW from Pit 4 was discharged to Cumbo Creek, a tributary of Wilpinjong Creek. The discharge location was approximately 1.3 km from the confluence with Wilpinjong Creek. The daily discharge limit for WCM Period 1 from EPL Point 31 was 18 ML/day. No discharge was permitted for WCM Period 2 from EPL Point 31.
EPL Point 30	EMW from Pit 8 was discharged to Wilpinjong Creek via the Slate Gully drainage line, utilising existing clean water diversion infrastructure. The daily discharge limit for WCM Period 1 from EPL Point 30 was 18 ML/day. The daily discharge limit for WCM Period 2 from EPL Point 30 was 5 ML/day.
EPL Point 24	Product water from the RO treatment plant is discharged to Wilpinjong Creek. The daily discharge limit from the RO Plant is 6.5 ML/day.
WILGSU	Monitoring site located upstream of all WCM discharge points (EPL 32, EPL 31 and EPL 30, EPL Point 24), and used to represent baseline conditions at WCM. This site is downstream of the MC emergency discharge location (EPL point 54).
WILGSD	Monitoring site located downstream of Pit 2, Pit 3, and Pit 4, but upstream of Pit 8. This site is also located downstream of EPL 32 and EPL 31, but upstream of EPL 30.

Site	Description
WOL_1	Monitoring site located downstream of the confluence of Wollar Creek and Wilpinjong Creek and is downstream of all WCM mining activity and EPL discharge points (WCM EPL points 24,30,31,32 & MC EPL point 54) .
CCGSU	Monitoring site located on Cumbo Creek, upstream of all WCM EMW discharge points.
O'Brien's Crossing	Monitoring site located on Goulburn River, approximately 50 km downstream of the Wilpinjong-Wollar Creek confluence, and downstream of all WCM, MC and UC discharge points.
Goulburn River at Coggan	Monitoring site located on Goulburn River, downstream of O'Brien's Crossing, approximately 60 km downstream of the Wilpinjong-Wollar Creek confluence, and downstream of all WCM, MC and UC discharge points.

Table 2 Additional Monitoring and Discharge Sites

Site	Description
EPL Point 53 (Moolarben Coal)	Emergency discharge point from dams 209 and 302b to Moolarben Creek. Between 17 November 2022 - 31 December 2022 MC was permitted to discharge 45 ML/day Between 1 January 2023 - 19 January 2023 MC was permitted to discharge 30 ML/day
EPL Point 54 (Moolarben Coal)	Emergency discharge point from dam 401 to Wilpinjong Creek, via Murragamba Creek. Between 17 November 2022- 31 December 2022 MC was permitted to discharge 20 ML/day Between 1 January 2023 - 19 January 2023 MC was permitted to discharge 20 ML/day
EPL Point 01 (Moolarben Coal)	Discharge to Goulburn River Diversion near Bora Creek junction. Between 17 November 2022- 19 January 2023 MC was permitted to discharge 20 ML/day
SW04 (Moolarben Coal)	Surface water flow and water quality monitoring located on Murragamba Creek at Wollar Road. Monitoring site is 250 m upstream of the confluence with Wilpinjong Creek and downstream of MC EPL Point 54.
SW15 (Moolarben Coal)	Surface water flow and water quality monitoring located on Wilpinjong Creek at Red Hill. Monitoring site is upstream of all MC and WCM discharge points.

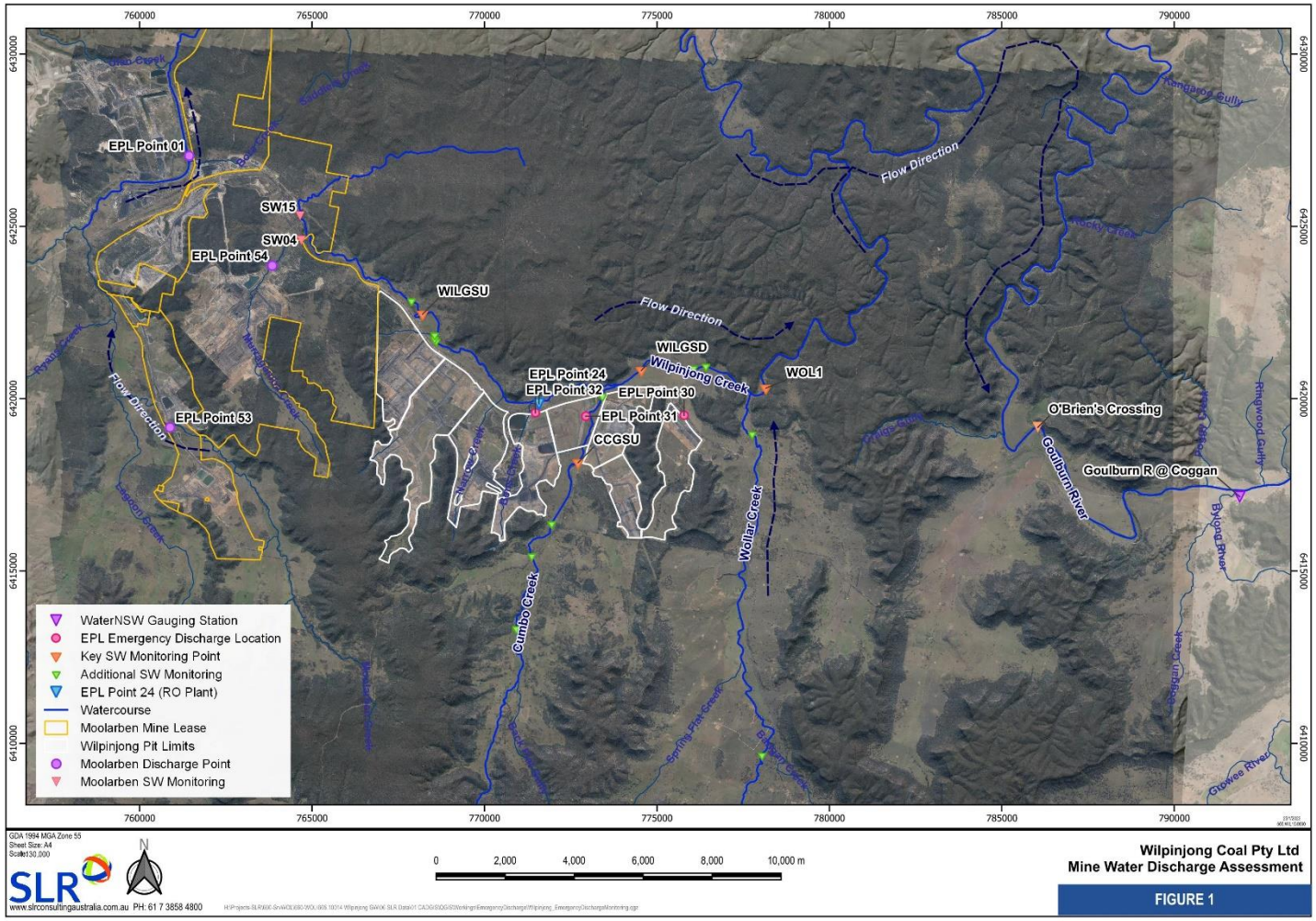


Figure 1 Location Plan – Investigation Extent

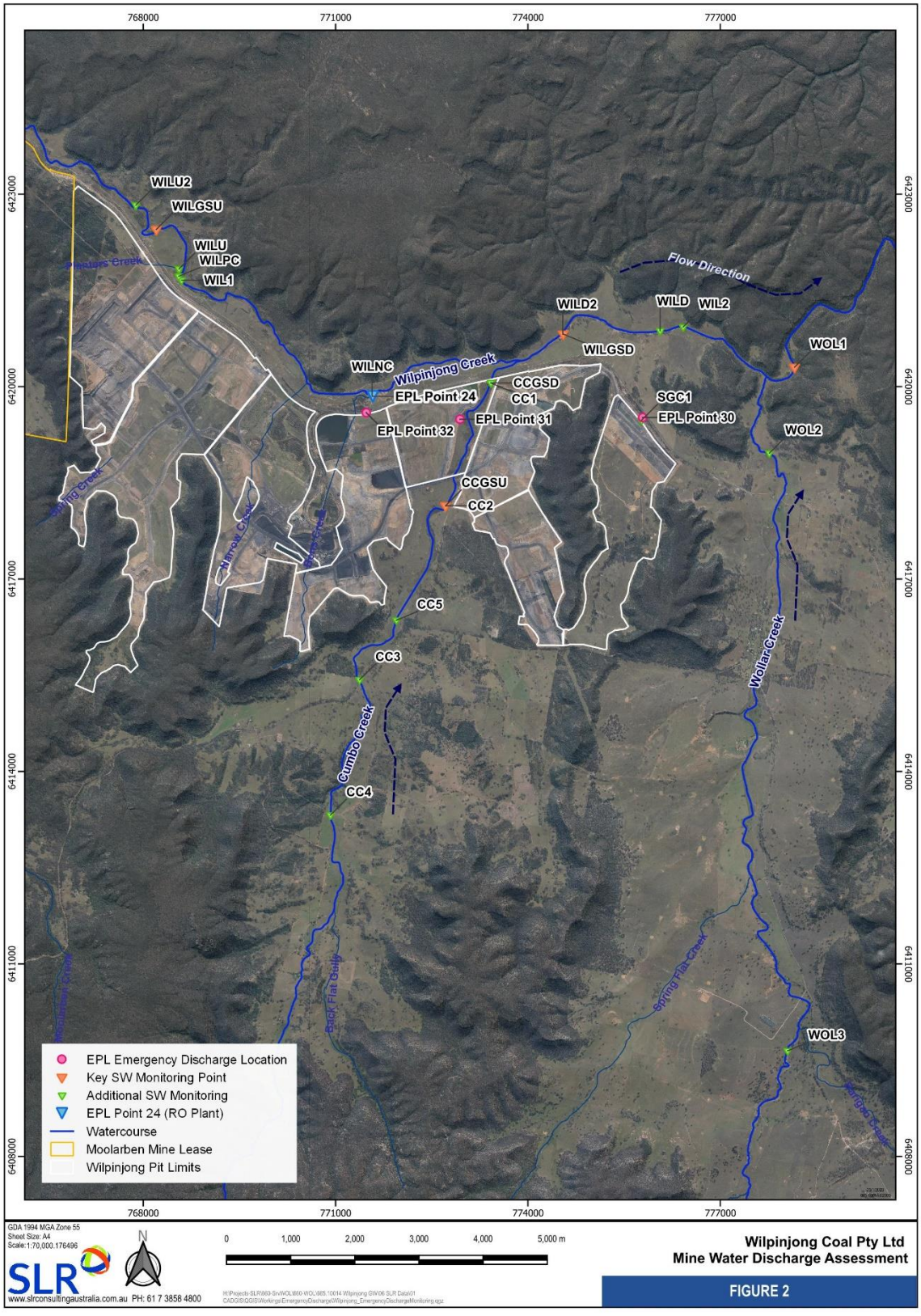


Figure 2 Location Plan - Wilpinjong Site Extent

Table 3 provides an overview of the assessment process used to evaluate the influence of EMW discharge on Wilpinjong Creek and Goulburn River.

Table 3 Assessment Overview

Stage	Assessment Objective	Assessment Period	Inputs	Relevant Monitoring/ Discharge Sites
1. Summarise historical and recent conditions	**Historical Conditions:** characterise historical surface water quality conditions	2012 – 2021	Wilpinjong Creek: rainfall, RO Plant discharge, Wilpinjong, Cumbo, Wollar and other Creeks Goulburn River: UC discharge, rainfall, flow from tributaries	WCM and Water NSW surface water monitoring sites, discharge from EPL 394 (UC), EPL 12425 (WCM), and EPL 12392 (MC)
	Recent Conditions: characterise recent surface water quality conditions – prior to commencement of EMW discharge.	Jan 2022 – Oct 2022		
2. Summarise influence of Oct/Nov 2022 WCM discharge. *Including the period where both MC and WCM were discharging.*	**WCM EMW Discharge:** summarise the influence of EMW discharge from WCM on downstream water quality during first period of discharge	31/10/2022 – 17/11/2022	Wilpinjong Creek: As above plus, WCM EMW discharge Goulburn River: As above plus, WCM EMW discharge	As per Stage 1 plus: EPL 32, EPL 31, EPL 30
3. Review influence of Dec 2022/ Jan 2023 WCM discharge. *Comment to be made on potential upstream influence of concurrent MC discharge*	**WCM EMW Discharge:** summarise the influence of EMW discharge from WCM on downstream water quality during first period of discharge	31/12/2022 – 15/01/2023	Wilpinjong Creek: As above plus, WCM EMW discharge Goulburn River: As above plus, WCM EMW discharge	As per Stage 1 plus: EPL 32, EPL 30
	MC EMW Discharge: review the influence of EMW discharge from MC on downstream water quality prior to second period of discharge	17/11/2022 – 19/01/2023	Wilpinjong Creek: As above plus; MC EMW discharge Goulburn River: As above plus; MC EMW discharge	As per Stage 1 plus: MC EMW discharge

3 Background

Time-series historical flow and water quality monitoring data from WaterNSW and WCM surface water monitoring sites from 2000 to 2021 are presented in **Appendix A**. These are used to summarise historical and recent conditions, prior to the EMW discharge commencing in late October 2022.

3.1 Goulburn River

The flow rate of the Goulburn River at the Coggan gauging station generally reflects the cumulative rainfall departure (CRD) trend (**Figure 3**) which indicates periods of above and below average rainfall. Flow in response to rainfall events is generally between 1,000 and 10,000 ML/day, with baseflow ranging between 0.01 and 100 ML/day for the majority of the analysed period, however baseflow has been above 200 ML/day since early 2022 and increasing throughout the last year.

Electrical conductivity (EC) has been recorded at the Coggan gauging station since 2012. It fluctuates between 500 and 2,500 µS/cm and generally appears to represent an inverse relationship with river flow rates (**Figure 4)**. EC from early 2020 to late 2022 has been consistently lower than 1,000 µS/cm.

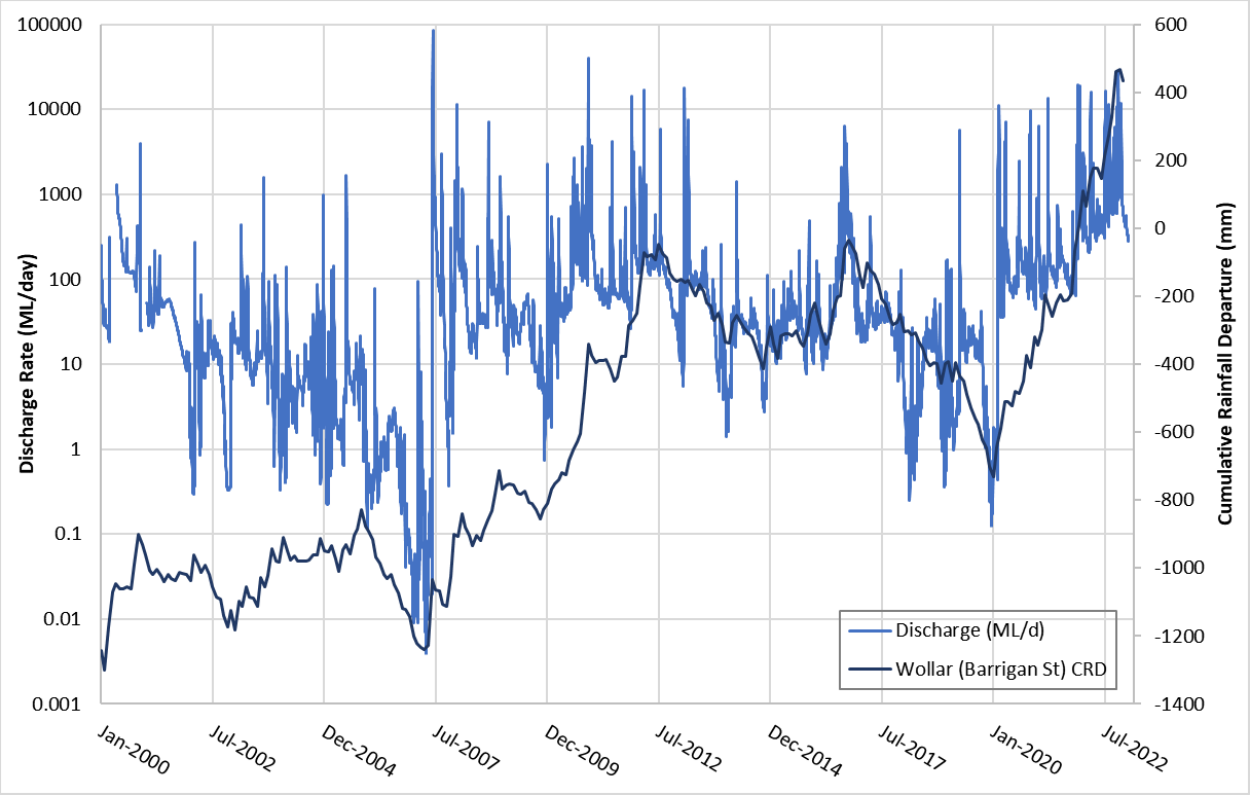


Figure 3 Goulburn River (@Coggan) daily discharge rate and CRD trend

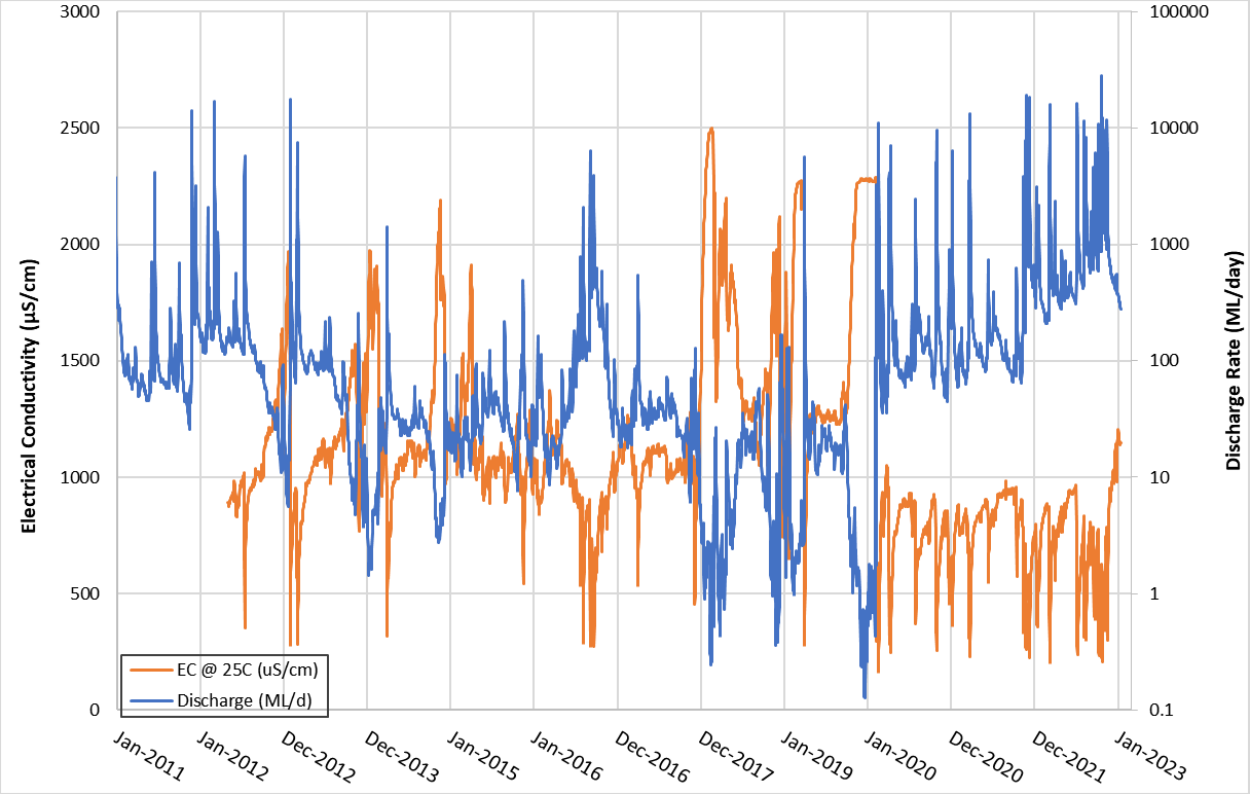


Figure 4 Goulburn River (@Coggan) daily discharge rate and EC

3.2 Wilpinjong Creek

Figure 5 through **Figure 9** (**Appendix A**) show long-term water quality observations for Wilpinjong Creek, Cumbo Creek and Wollar Creek (monitoring locations are displayed on **Figure 2**). Cumbo Creek is a tributary of Wilpinjong Creek, which in turn is a tributary of Wollar Creek which flows into the Goulburn River. A summary of the observations is provided in the following points:

- Upstream Wilpinjong Creek monitoring sites (**Figure 5**) show varying electrical conductivity levels prior to 2020, with observations at WIL-U2 indicating ~3,000 µS/cm, while WILGSU indicates EC levels are generally <2,000 µS/cm. Since early 2020 the water quality has freshened due to above average rainfall conditions, with EC at all sites less than 1,500 µS/cm, and only two datapoints above 1,000 µS/cm. Turbidity and pH are generally relatively stable throughout the monitoring period.
- Downstream Wilpinjong Creek monitoring sites (**Figure 6**) have historically showed varying electrical conductivity levels ranging between 500 – 6,000 µS/cm. The RO Plant, located upstream of these monitoring locations (EPL Point 24), has been discharging low EC water (<500 µS/cm) to Wilpinjong Creek since late 2012 and has had some influence on water quality. Observations at all sites between early 2020 and the end of November 2022 freshened and were generally <1,500 µS/cm.
- Cumbo Creek monitoring sites (**Figure 7**, **Figure 8**) have historically shown higher EC than Wilpinjong Creek, in the range of 3,000 to 8,000 µS/cm (pre 2022). EC observations in Cumbo Creek have recently been between 1,000 - 3,000 µS/cm which is lower than historical maximums due to recent high rainfall conditions. Cumbo Creek is a source of salinity in Wilpinjong Creek.

- Wollar Creek monitoring sites upstream of the confluence with Wilpinjong Creek (**Figure 9**), have historically had higher EC than Wilpinjong Creek (WOL2: 2,000-4,000 µS/cm). Downstream of the confluence is fresher than upstream Wollar Creek sites due to the influence of Wilpinjong Creek (WOL1: 500-2,000 µS/cm). Since early 2020, EC at both Wollar Creek sites have decreased due to high rainfall conditions and were recently less than 1,000 µS/cm.

3.3 Influence of Prior Discharge

The following points summarise key findings from the assessment of EMW discharge on Wilpinjong Creek and Goulburn River during and immediately after WCM Discharge Period 1 (31 October to 25 November 2022).

- The discharge of EMW from WCM during Discharge Period 1 influenced the surface water quality in Wilpinjong Creek, downstream of the discharge points, during the discharge period. However, this influence was temporary and limited in extent. Elevated EC in Wilpinjong Creek was within the range of natural variation and declined following the cessation of WC discharge. There were also no discernible changes in pH and EC observed beyond the range of natural variation further downstream at the Goulburn River. The limited effect of EMW discharge on Goulburn River during WCM Discharge Period 1 is likely due to significantly higher total flows in the Goulburn River than the volumes of EMW discharged.
- It is likely that the discharge of EMW from MC is influencing the current quality of surface water in Wilpinjong Creek although any change in water quality is within natural variation as observed in the Wilpinjong Creek monitoring locations. This changed water quality is observed upstream of the WCM discharge locations indicating that discharge from MC is likely driving the change. During WCM Discharge Period 1, a higher proportion of water quality influence at Wilpinjong Creek is likely to be attributable to WCM discharges as WCM commenced discharging before MC and at higher volumes.

No significant changes in the water quality in the Goulburn River, downstream of the sites, were observed during October/November 2022. Thus, any water quality change of the discharge of EMW from WCM, MC or UC during this period is considered negligible. As stated above, this is likely related to high flows induced by high rainfall events in the Goulburn River catchment compared to EMW discharge volumes.

4 Discharge Assessment

Real-time surface water quality and flow data from WaterNSW and WCM surface water monitoring sites are presented, alongside available discharge volume and quality data, from 1 October 2022 to 15 January 2023 (**Appendix B)**. This data is used to review the influence of discharge on surface water quality and assess whether any surface water quality changes are outside natural variation, with the focus of this assessment being WCM Discharge Period 2 (15 December 2022 – 1 January 2023).

4.1 Discharge Water

Table 4 provides a summary of discharge volumes from the two EPL points (30 and 32) between 15 December 2022 and 1 January 2023. Discharge never exceeded the total EPL daily discharge limit of 20 ML, but the daily limit (15 ML) for EPL32 was exceeded for one day (26 December 2022) with a discharge of 15.32 ML.

Table 4 Wilpinjong Coal Discharge Volumes

	Emergency Discharge Volume (ML/day)						Other Discharge (ML/day)	
	EPL Point 32 (Pit 2)	Daily Limit	EPL Point 30 (Pit 8)	Daily Limit	Total	Daily Limit	EPL Point 24 (RO Plant Discharge)	Daily Limit
Daily Average	13.05	15	4.65	5	17.70	20	3.95	6.5
Daily Maximum	15.32		4.95		19.98		5.28	
Total Discharged (ML)	235		85		320		72	
Total Discharge (ML) Permitted under EPL	270		90		360		117	

Daily water quality sampling was undertaken at the emergency discharge locations (EPL 30, 32) as well as the O'Brien's Crossing monitoring site on the Goulburn River, ~50 km downstream of the Wilpinjong-Wollar Creek confluence. Below is a summary of the three key water quality indicators from the emergency discharge points during December 2022 and January 2023 (**Figure 10**).

- The EC of discharge water was 3,250 – 4,500 µS/cm and observed to be reasonably consistent at each discharge location. This is higher than the EC of the receiving water in Wilpinjong Creek prior to discharge.
- Turbidity was generally <10 NTU at all discharge sites. This is lower than the turbidity of the receiving water in Wilpinjong Creek prior to discharge and lower than historical observations.
- pH is between 7.5 and 8.5 at all discharge sites, this is generally consistent with recent pH of the receiving water in Wilpinjong Creek prior to discharge.

The RO Plant (EPL Point 24) was discharging water to Wilpinjong Creek for most of WCM Discharge Period 2 at an average rate of 3.95 ML/day due to RO Plant availability. The average of 'average daily pH' from the RO Plant during this period was pH 7.15, lower than pH from the emergency discharge sites. The average of 'average daily EC' during this period was 412 µS/cm, lower than pH from the emergency discharge sites.

The exact quality and daily volumes of discharge from MC is unknown however, points below summarise the available information on discharge from MC as provided by the MC Environment and Community Manager to WCM, the information presented in these points is subject to confirmation when publicly reported:

- MC is consistently discharging ~18.5 ML/ day to Wilpinjong Creek at MC EPL Point 54 (against a limit of 20 ML/day).
- Average discharge in January 2023 of 27 ML/ day to the Goulburn River (via Moolarben Creek) from MC EPL Point 53 (against a limit of 30 ML/day).
- MC's RO plant (MC EPL Point 01) has been consistently discharging 16 ML/ day.
- EMW discharged has been between 1,000 µs/cm and 2,500 µs/cm.

- MC will continue to discharge EMW until the end of their licence period on 19 January 2023 at 7am.

The exact quality and volume of discharge from UC is unknown. It is understood that UC has permission to discharge up to 30 ML/day of treated water to Goulburn River under EPL 394 with discharge water quality limits of EC at 900 µs/cm and pH 6.5-8.5.

4.2 Discharge Volume Compared to Stream Flow

The potential for EMW discharge to influence the quality of the receiving water is related to the volume of discharge compared to background flow volume in the Wilpinjong Creek, Cumbo Creek and Goulburn River watercourses and the quality of the water discharged compared to the receiving water. As shown in **Figure 11** and **Figure 12**, the rates of flow in the watercourses reviewed in this report generally align with rainfall events, with maximum flows observed during times of peak rainfall.

Climatic conditions preceding and during WCM Discharge Period 2 were drier than those preceding and during WCM Discharge Period 1. December rainfall totals at site were 26.6 mm compared to the Wollar long-term average for December (61 mm). Most of this total occurred over three events with 3.2 mm recorded from 5-7 December 2022, 11 mm recorded on 12 December 2022, and 12 mm recorded 22-24 December 2022.

The following comments are provided regarding flow volumes within the assessed watercourses compared to the discharge volumes during Dec 2022/Jan 2023.

- Flow at upstream Wilpinjong Creek (WILGSU) likely shows influence of the MC EMW discharge to Murragamba Creek. Flow rates throughout December 2022 were all >14.5 ML/day, which is more than double the minimum flow prior to discharge commencing which was ~6 ML/day (12 November 2022) while the minimum flow following discharge was ~10 ML/day. The actual volume and timing of the MC discharges are unknown.
- The main contributors to flow at the downstream Wilpinjong Creek (WILGSD) location, are flows from upstream tributaries (Cumbo and Wilpinjong Creek), RO Plant discharge, and EMW discharged from WCM and MC EPL points. Only minor increases in flow were observed in response to the lower rainfall events recorded in December 2022, with flow at downstream Wilpinjong Creek increasing from ~20 ML/day to ~50 ML/day (compared with flows in excess of 1,000 ML/day in October and November 2022). Flow at the upstream Cumbo Creek gauging station, which is not influenced by EMW discharge, shows a generally declining flow trend throughout December 2022 and indicates a likely decrease in the contribution of natural rainfall runoff during this period. During WCM Discharge Period 2, discharge from the EPL points upstream of WILGSD are likely providing a larger contribution to flow throughout December 2022 compared to natural flow, with MC (~18.5 ML/day) and WCM (20 ML/day) providing a combined flow of ~38.5 ML/day. The influence of WCM discharge from EPL Point 32 can be observed at the end of the discharge period, with flow at WILGSD declining from 36 to 23 ML/day (13 ML/day), close to matching the discharge volume of 11.4 ML at EPL Point 32 on 1 January 2023. It is noted that WCM RO Plant discharge (EPL Point 24) was ~13% (3.95 ML/day) of the total discharge volume to Wilpinjong Creek (from both WCM and MC) in December 2022 and was a lesser contributor to flow during this time.

- Flow volumes in Goulburn River (measured at Coggan, **Figure 12**) have generally been an order of magnitude (10x) higher than flow volumes measured at Wilpinjong Creek Downstream (pre December 2022: 600-25,000 ML/day, opposed to 65-1,300 ML/day), this relationship remained consistent through December 2022, with Goulburn River flow 360-515 ML/day while Wilpinjong Creek Downstream flows were 30-40 ML/day . Maximum allowable discharge volumes from upstream coal mines during WCM Discharge Period 2 was 141.5 ML/day (26.5 ML from WCM (incl RO Plant), 85 ML from MC, and 30 ML from UC) which could provide up to 40% of recent Goulburn River flow..

4.3 Discharge Influence on Water Quality

The following points summarise the potential influence of discharge from coal mines on water quality in Wilpinjong Creek and Goulburn River during WCM Discharge Period 2 in December 2022 / January 2023

- Prior to the commencement of the second period of discharge of EMW from WCM, EC was slightly higher upstream at Wilpinjong Creek (WILGSU) most likely due to EMW of MC. (**Figure 13**).The EC at Wilpinjong Creek (WILGSD) was lower than Wilpinjong Creek upstream (WILGSU) most likely due to the dilution effect from fresher (<500 µS/cm) RO Plant discharge upstream of WILGSD during this period. With lower rainfall, EC at CCGSU increased steadily through November 2022 to January 2023, consistent with historical observations where more saline groundwater becomes the primary source of flow.
- After discharging commenced at WCM, EC increased from ~1,500 µS/cm to EC between 2,000 and 2,300 µS/cm at downstream Wilpinjong Creek (WILGSD). The rainfall which occurred during 22-24 December 2022 resulted in a very minor, temporary freshening of EC at WILGSD. Following the completion of discharge on 1 January 2023 EC is observed to have decreased again from 2,100 µS/cm to 1,500 µS/cm (**Figure 13**). The discharge of EMW by WCM was likely the cause of a temporary increase in EC in Wilpinjong Creek downstream of the discharge locations. It is noted that this increase in EC levels is well within the observed natural range of 500 – 6,000 µS/cm.
- Goulburn River monitoring sites (O'Brien's Crossing and Goulburn River @ Coggan) also showed a minor increase in EC from ~1,000 µS/cm to 1,150 µS/cm following the commencement of WCM Discharge Period 2 (**Figure 14)**. This EC is higher than the receding limb EC trends observed pre-discharge from October to November 2022 but is less than EC in receding limb trends observed on the Goulburn River from 2012 to 2017 (up to ~2,000 µS/cm). EC is observed to be stable for the two-weeks following the completion of WCM discharge, indicating WCM discharge alone was having negligible influence on EC in the Goulburn River. As natural flows within Goulburn River are lower during WCM Discharge Period 2 due to a lack of rainfall events, it is possible that EMW discharge (up to 38.5% of flow) could have some influence on EC (**Figure 12**). A confident estimate of this influence cannot be made without review of detailed discharge quality and volume data from MC and UC, although it is again noted that EC observations in the Goulburn River are within the bounds of historical observations.

- Following the commencement of discharge of EMW from MC on 17 November 2022, EC has been increasing at upstream Wilpinjong Creek (WILGSU) from ~100 µS/cm to ~2,000 µS/cm (**Figure 13**). The discharge of EMW by MC is likely increasing EC in Wilpinjong Creek upstream of WCM discharge locations. This increased EC is at the upper limit of EC observations at WILGSU (100-2,000 µS/cm) but within the natural range for other upstream Wilpinjong Creek sites (500 – 4,000 µS/cm). Review of water quality from MC monitoring sites SW15 and SW04 would help evaluate the quality of natural flow in upstream Wilpinjong Creek compared to MC EMW discharge. It is noted that EC at WILGSD is lower than WILGSU following the completion of the WCM discharge. Some dilution of EC in Wilpinjong Creek may be occurring with low EC (<500 µS/cm) RO Plant discharge occurring between upstream and downstream gauging stations,
- Prior to the commencement of WCM Discharge Period 2, pH was similar (pH 7.3-7.6) at upstream Wilpinjong Creek (WILGSU), downstream Wilpinjong Creek (WILGSD) and Cumbo Creek (CCGSU) (**Figure 15)**. At the end of the discharge period CCGSU and WILGSD remained similar (pH 7.4-7.5) while WILGSU had increased (pH 7.8).
- Discharge of EMW from WCM may have slightly increased pH at downstream Wilpinjong Creek (from pH 7 to pH 7.4), although observations are within historical ranges (pH 7-8). Discharge of EMW from MC appears to have influenced the pH at upstream Wilpinjong Creek (WILGSU). Following the commencement of MC discharge from 17 November 2022, pH at WILGSU has increased from pH 6.5 to pH 7.9.
- The pH observed further downstream at the Goulburn River (O'Brien's Crossing) fluctuates and does not appear to be influenced by discharges of EMW from WCM and was stable near pH 8.5 throughout the period for which data is available during WCM Discharge Period 2.

5 Conclusions

The following points provide key conclusions from the assessment of EMW discharge on Wilpinjong Creek and Goulburn River during the second EMW discharge period:

- The discharge of EMW from WCM during December 2022 and January 2023 influenced the surface water EC in Wilpinjong Creek, downstream of the two discharge points during the discharge period. However, it appears that this influence was temporary and limited in extent. Elevated EC in Wilpinjong Creek was within the range of natural variation and declined following the cessation of WC discharge. There were also no discernible changes in pH and EC observed, beyond the range of natural variation, further downstream at the Goulburn River.
- It is noted that the ability to influence water quality in Goulburn River with EMW discharge increases as natural flow decreases outside of periods of rainfall, as occurred in December 2022.
- It is likely that the discharge of EMW from MC is influencing the current quality of surface water in Wilpinjong Creek. This changed water quality is within the range of natural variation at these sites and is observed at the monitoring location upstream of WCM discharge locations.

No significant changes in the water quality in the Goulburn River, downstream of the discharge sites, outside natural ranges and trends, were observed during December 2022.

Appendix A:

Historical and Recent Conditions

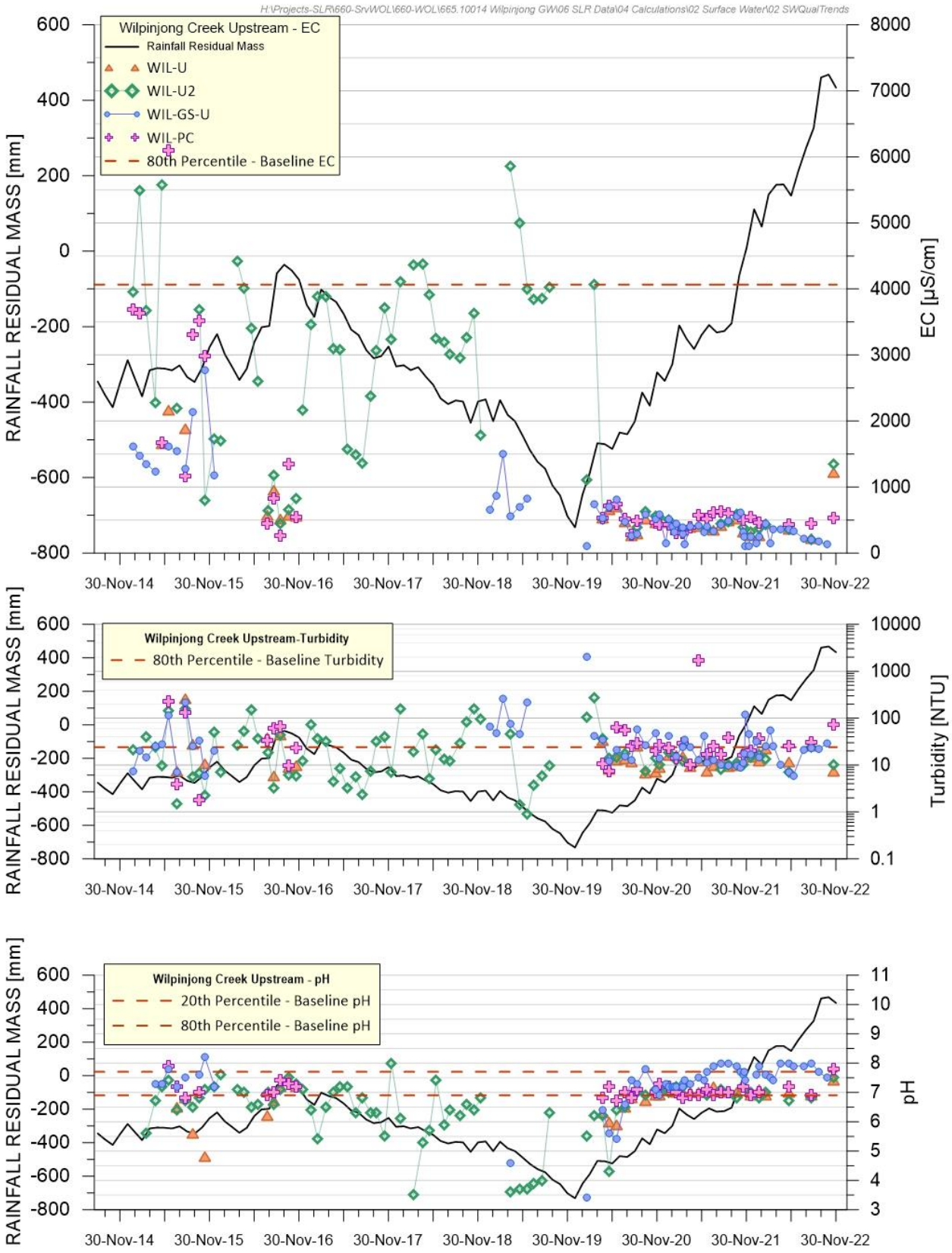


Figure 5 Long-term Water Quality – Wilpinjong Creek Upstream (WILGSU)

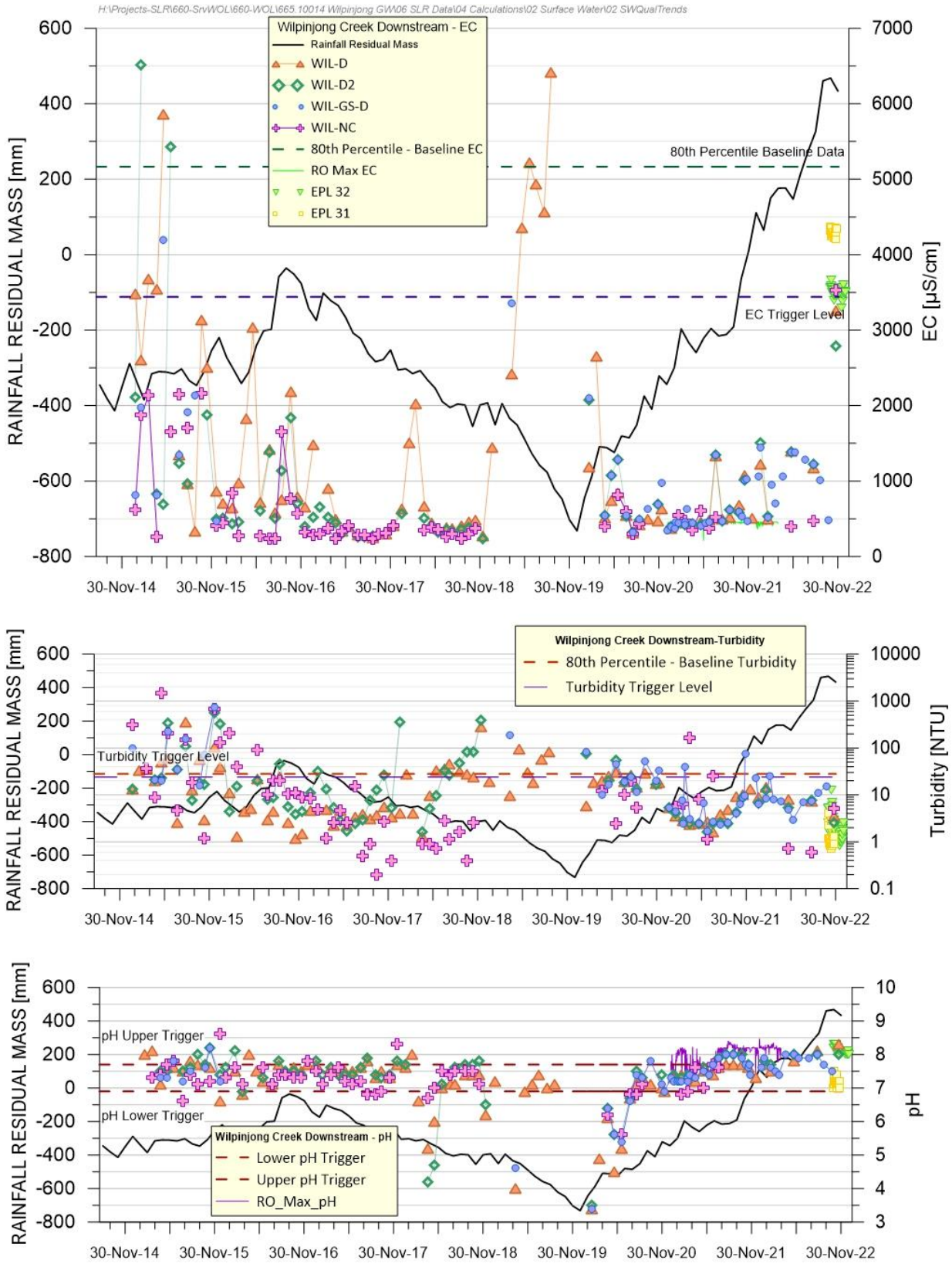


Figure 6 Long-term Water Quality – Wilpinjong Creek Downstream (WILGSD)

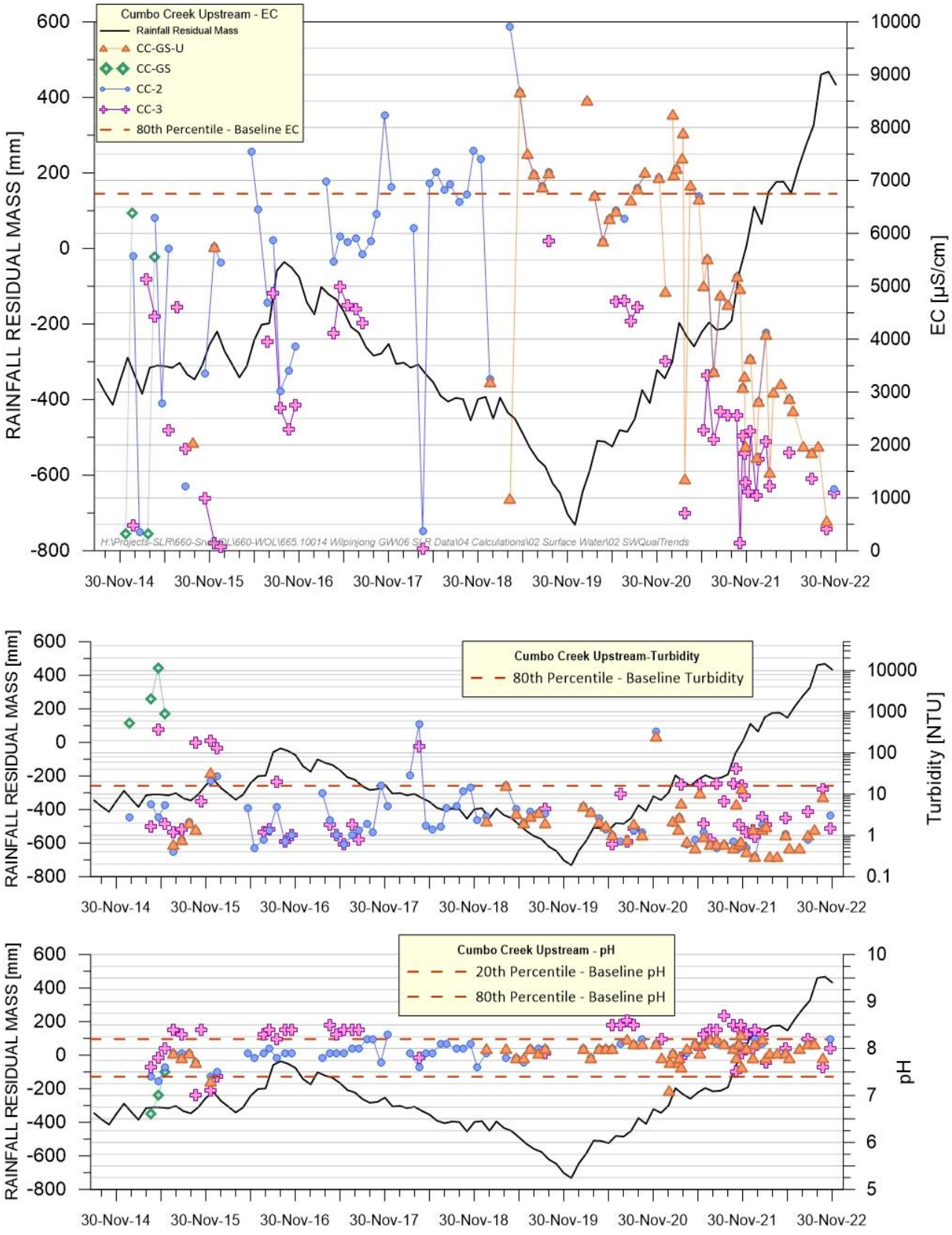


Figure 7 Long-term Water Quality – Cumbo Creek Upstream (CCGSU)

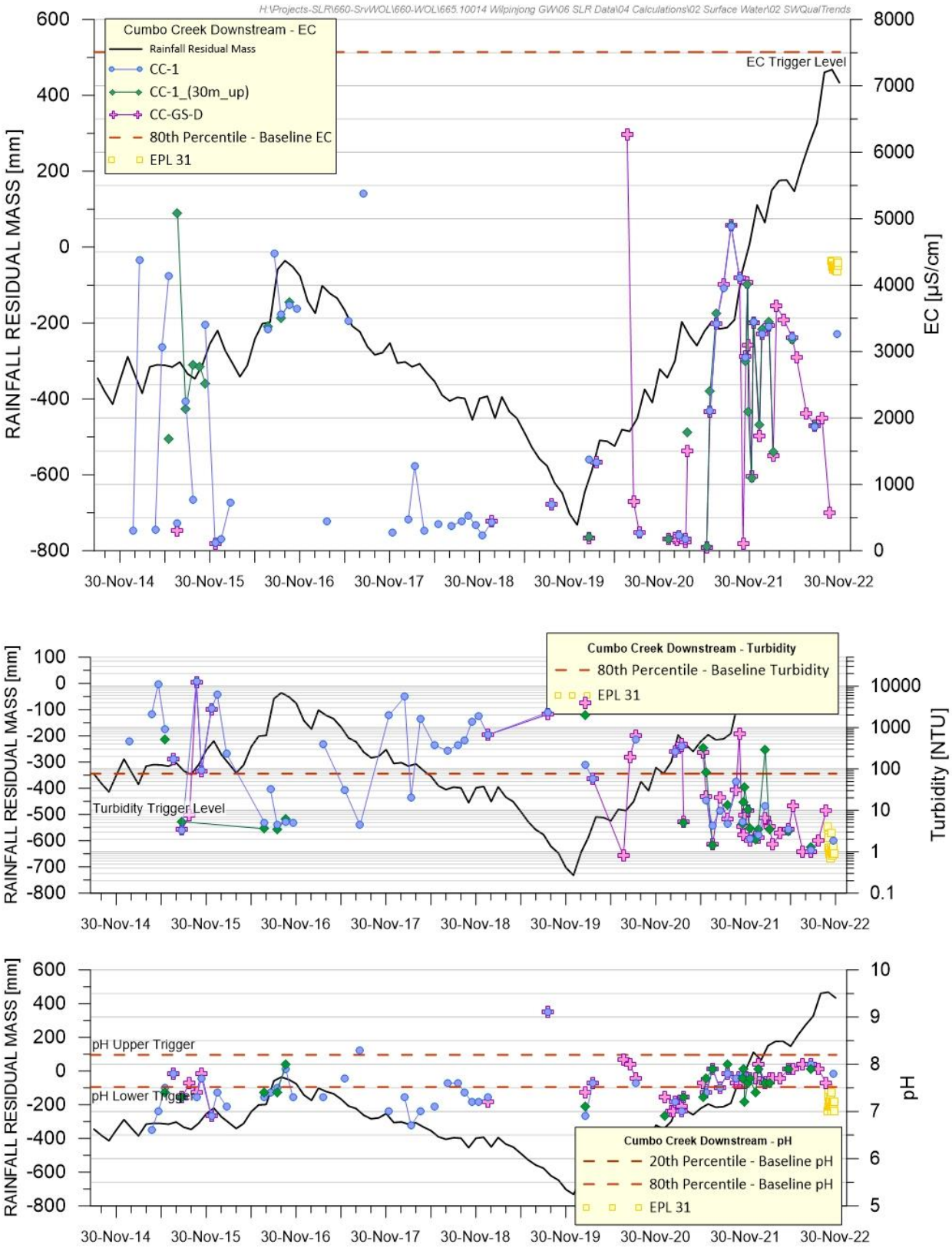


Figure 8 Long-term Water Quality – Cumbo Creek Downstream (CCGSD)

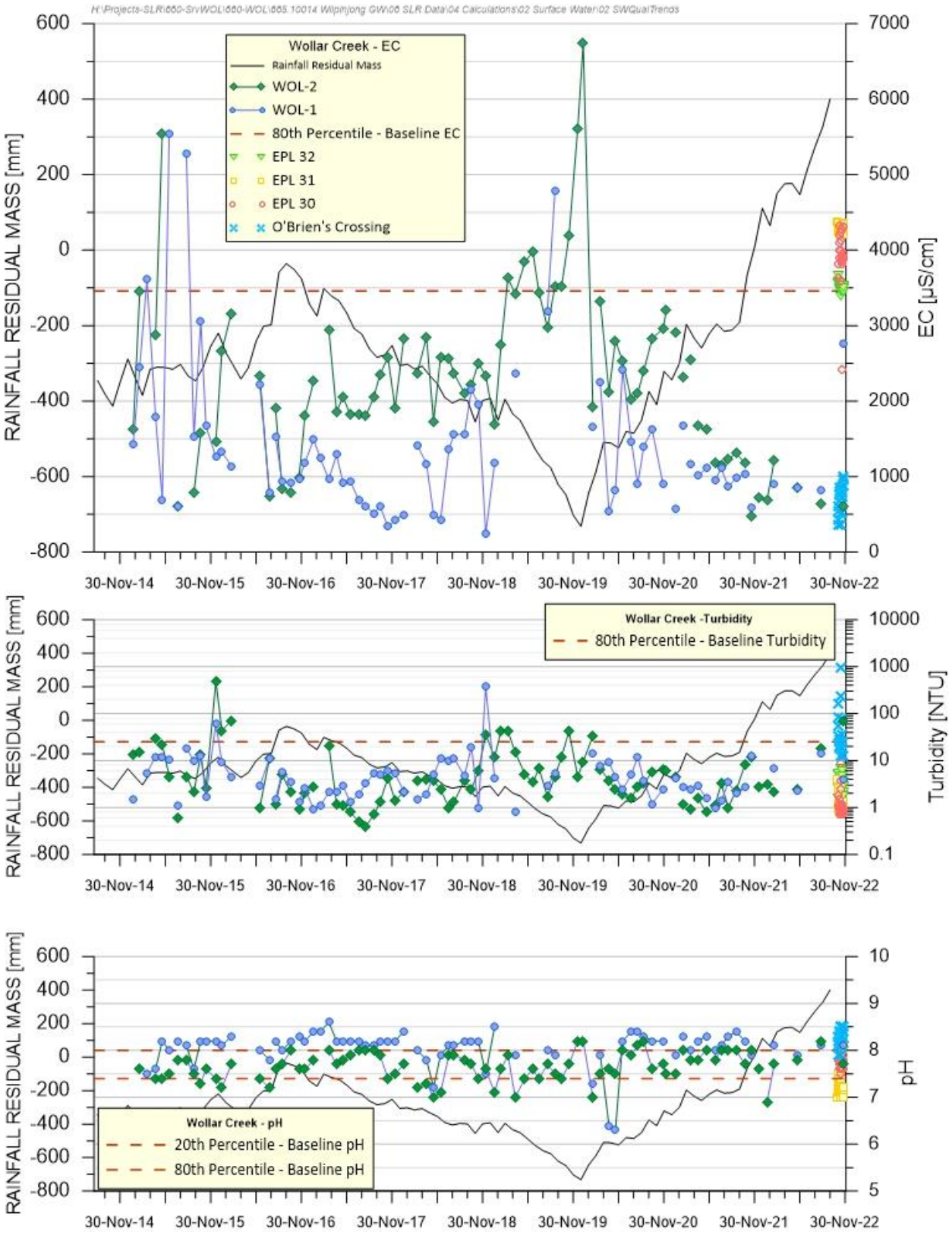


Figure 9 Long-term Water Quality – Wollar Creek Downstream (WOL-1 and WOL-2)

Appendix B:

Discharge Period Monitoring Data

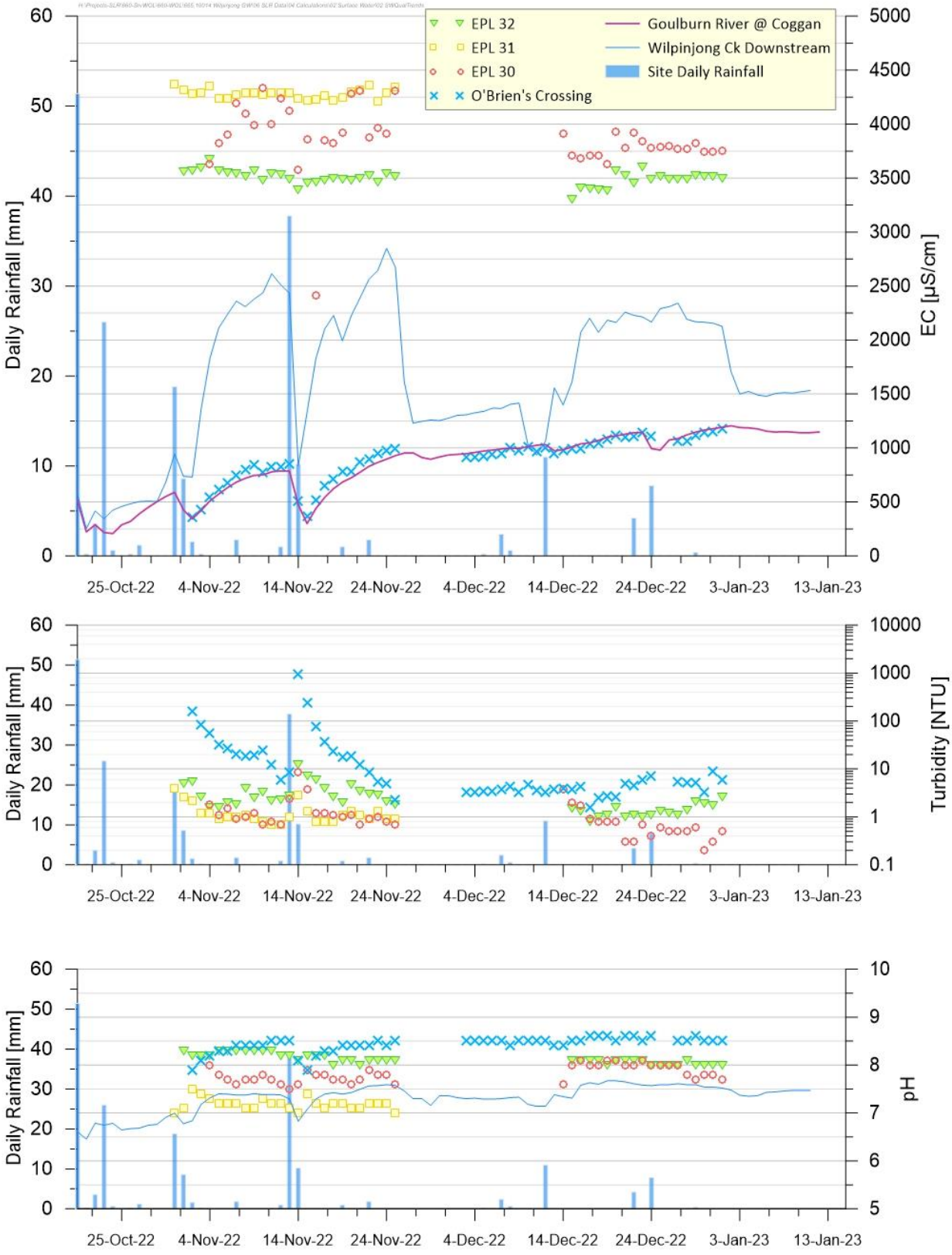


Figure 10 Discharge and downstream water quality October- November 2022

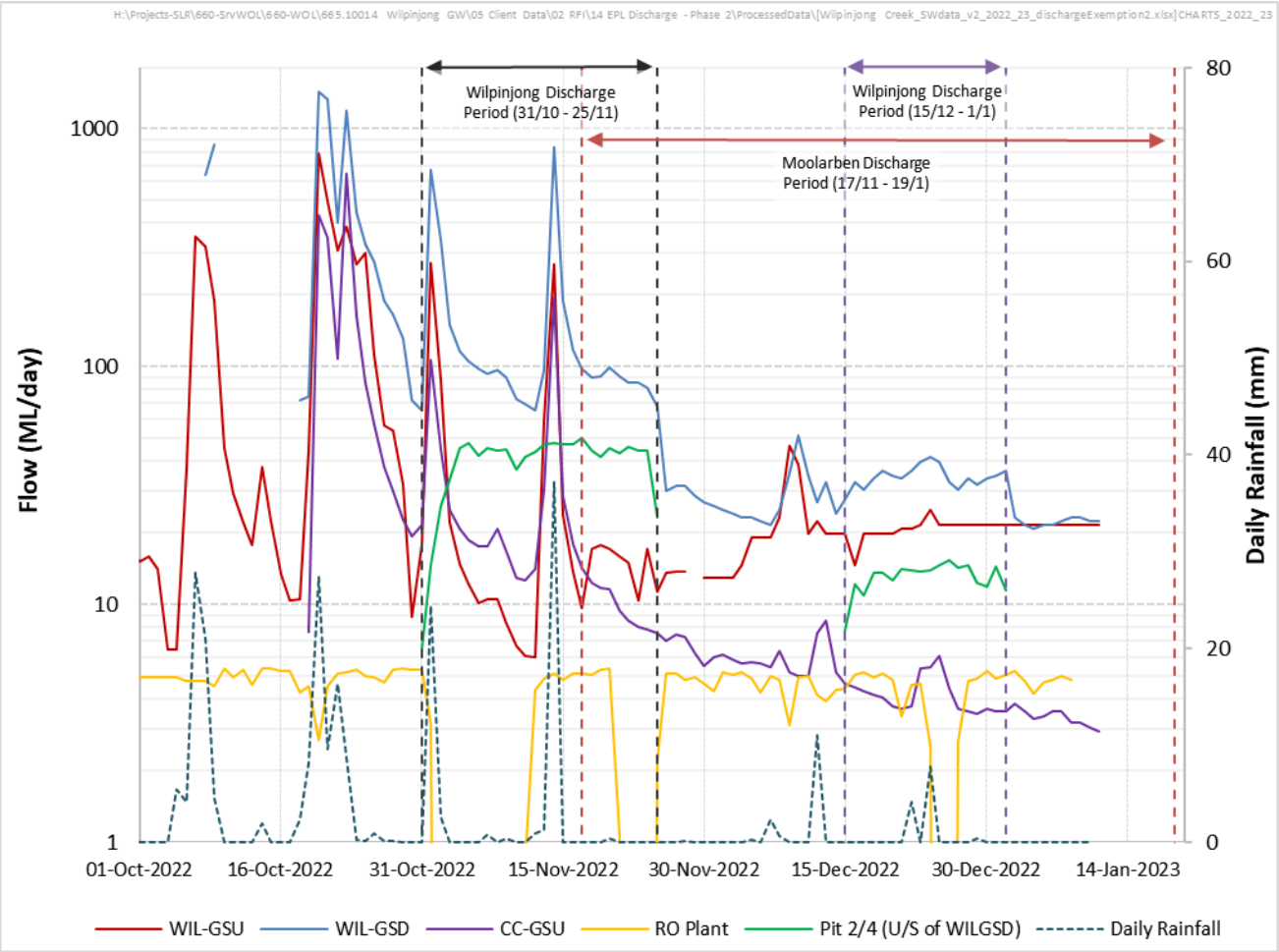
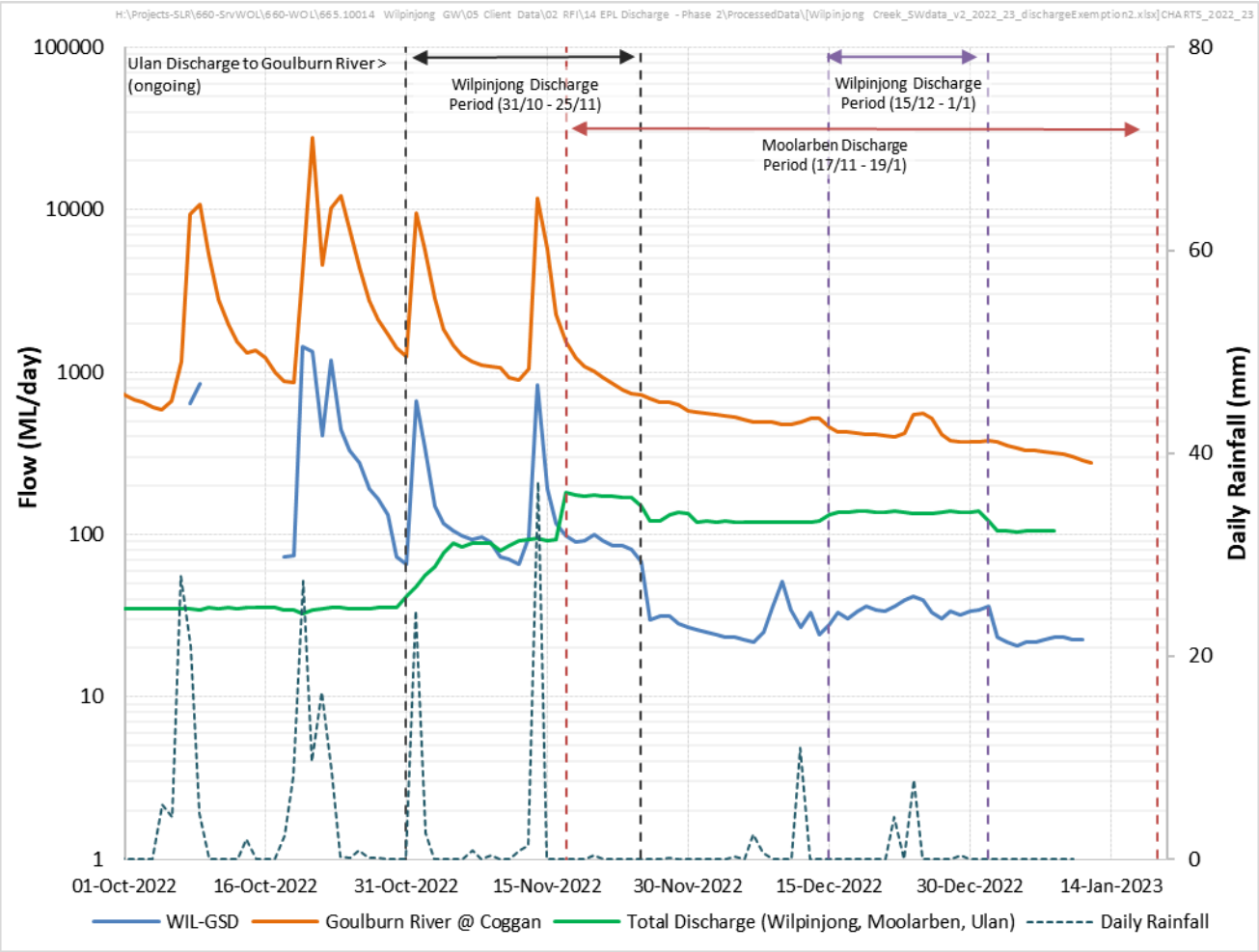


Figure 11 Flow Rate – Wilpinjong Creek, Cumbo Creek, RO Plant, Pit 2/4



Note: The estimate of total discharge utilises maximum permitted discharge limits in absence of actual discharge volumes. The 'Total Discharge' volume is likely overestimated.

Figure 12 Flow Rate – Goulburn River

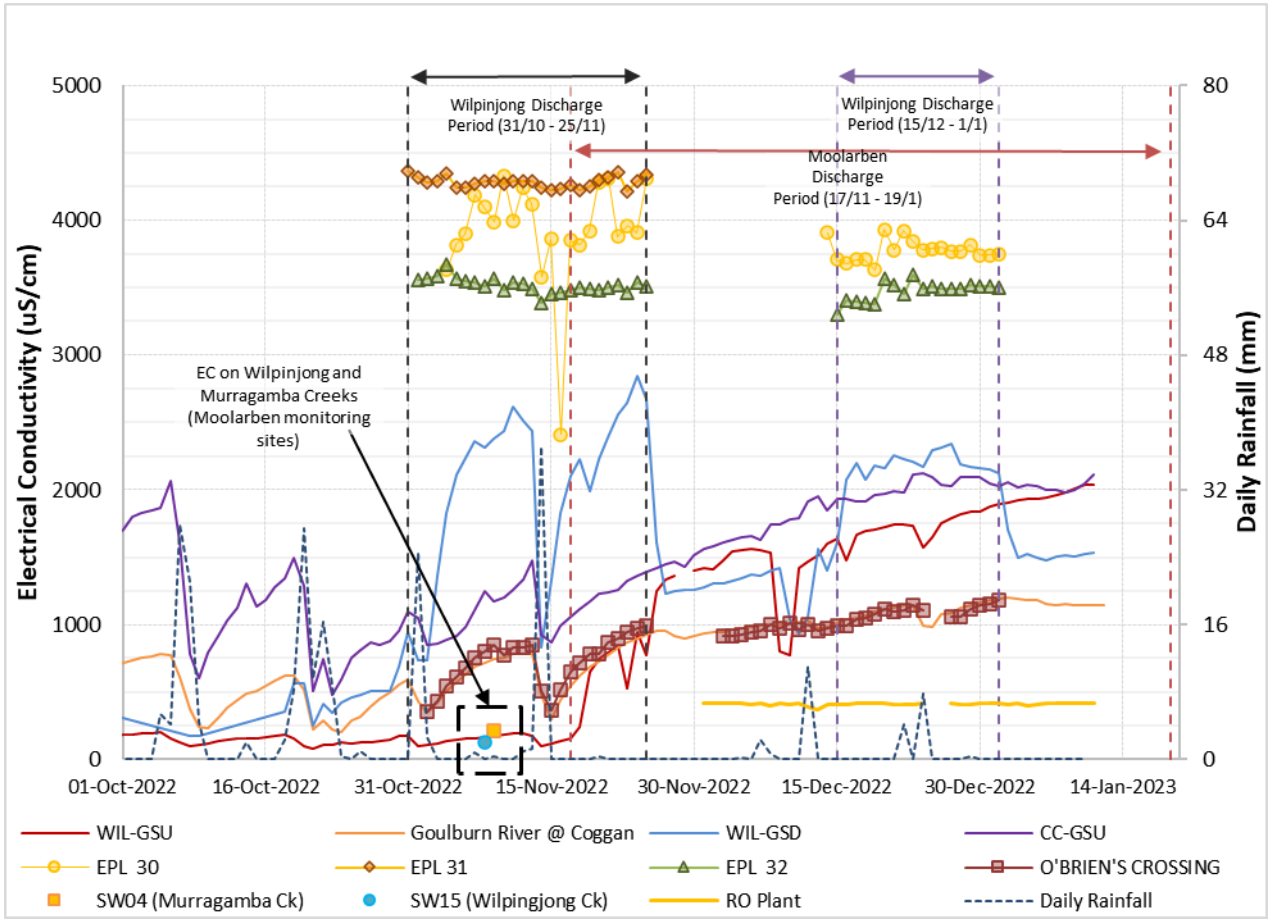


Figure 13 EC Level – Wilpinjong Creek, Cumbo Creek, Goulburn River

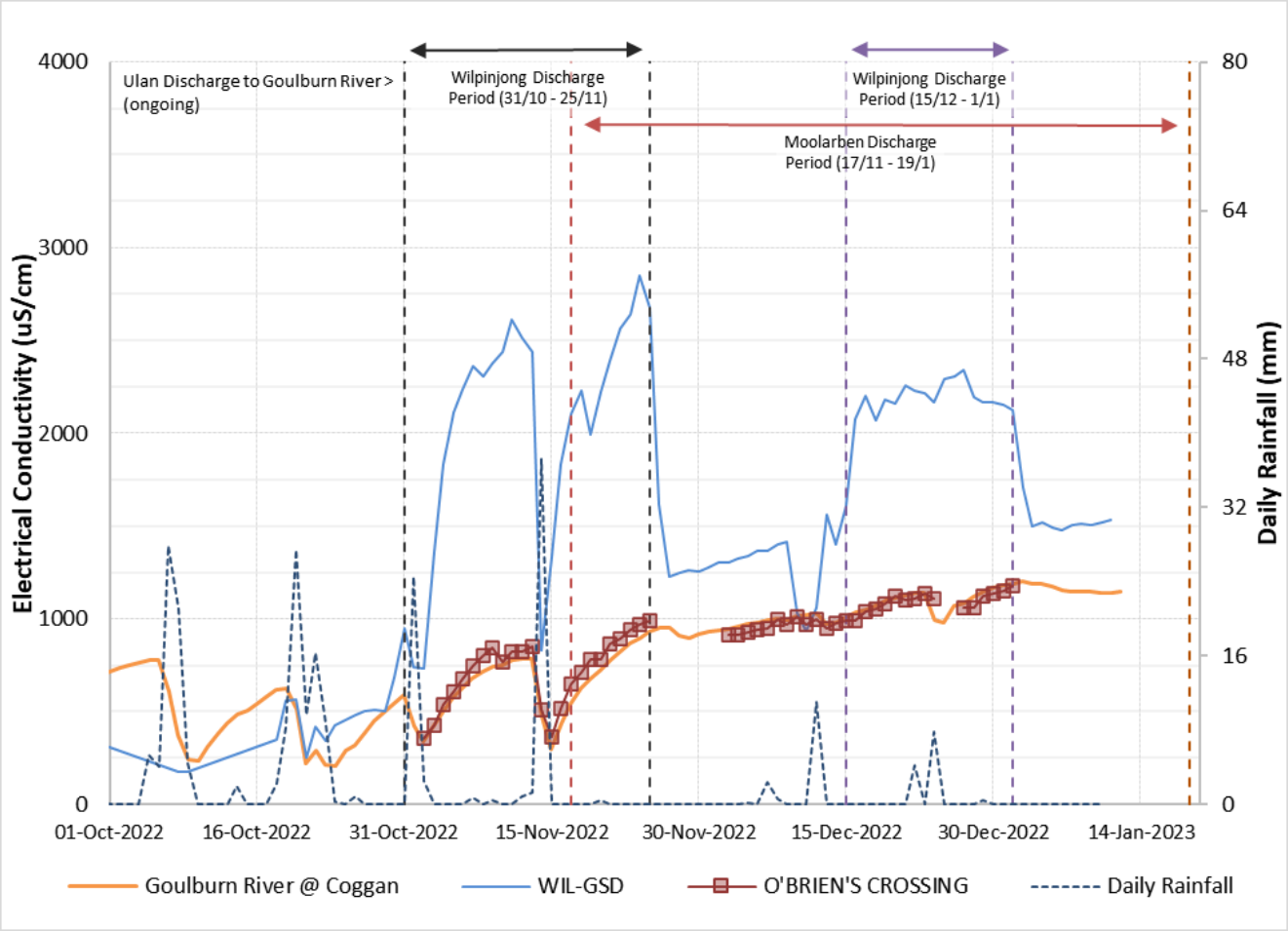


Figure 14 EC Level – Downstream Wilpinjong Creek and Goulburn River

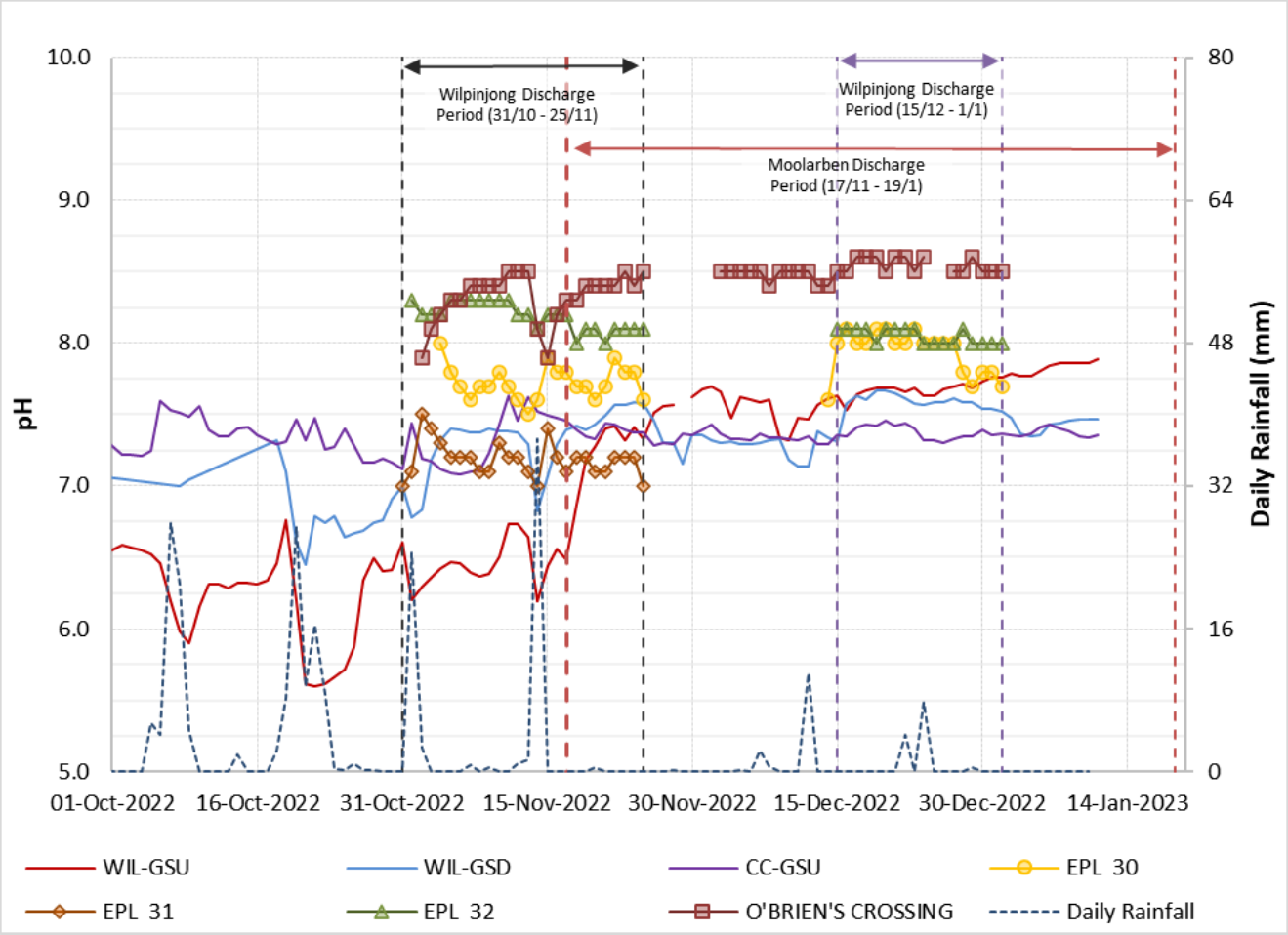


Figure 15 pH Level – Wilpinjong Creek, Cumbo Creek, Goulburn River

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