CENTENNIAL COAL

Angus Place

2024 ANNUAL REVIEW

March 2025

Annual Review Title Block

Name of Operation	Angus Place Colliery
Name of Operator	Centennial Angus Place Pty Limited
Development Consent/ Project Approval #	MP06_0021
Name of holder of Development Consent/ Project Approval	Centennial Angus Place Pty Limited
Mining Lease #	CCL704, ML1424, ML1699, ML1720, ML1853, ML1326, (part - Springvale) EL6856, EL6293, EL7415, EL8188.
Name of Holder of Mining Lease	Centennial Springvale Pty Limited and Boulder Mining Pty Ltd
Water License #	WAL36445; WAL36449; WAL37340; WAL37343; WAL41881
Name of Holder of Water License	Centennial Angus Place Pty Limited
RMP Start Date	July 2022
RMP End Date	NA
Annual Review Start Date	1 January 2024
Annual Review End Date	31 December 2024

I, David Craft certify that this audit report is a true and accurate record of the compliance status of Angus Place for the period 1 January to 31 December 2024 and that I am authorised to make this statement on behalf of Centennial Coal.

Note:

a) *The Annual Review is an 'environmental audit' for the purposes of s122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion) in an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents –maximum penalty 2 years imprisonment or $22,000, or both).*

Name of Authorised Reporting Officer	David Craft
Title of Authorised Reporting Officer	Mine Manager
Signature of Authorised Reporting Officer	
Date	31 March 2025

Contents

Appendices

List of Tables

List of Figures

Abbreviation Table

AEMP	Aquatic Ecology Monitoring Program
AR	Annual Review
BOM	Bureau of Meteorology
BC Act	*Biodiversity Conservation Act 2016*
CCL	Consolidated Coal Leases
DPHI	Department of Planning, Housing and Infrastructure
DPIE	Department of Planning, Industry and Environment (now DPHI)
DPE	Department of Planning & Environment (now DPHI)
EC	Electrical Conductivity
EPA	Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environmental Protection Licence
HVAS	High Volume Air Sampler
LDP	Licenced Discharge Point
ML	Mining Lease
NMP	Noise Management Plan
NPSS	Newnes Plateau Shrub Swamps
PA	Project Approval
RAP	Registered Aboriginal Parties
SMP	Subsidence Management Plan
SSD	State Significant Development
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
UCRC	Upper Coxs River Catchment
WAL	Water Licences
WMP	Water Management Plan
WRACHMP	Western Region Aboriginal Cultural Heritage Management Plan
WRHHMP	Western Region Historic Heritage Management Plan

Plans

Plan Reference	Plan Name
Figure 1	Regional Locality
Figure 2	Site Layout
Figure 3	Meteorological, Air Quality and Noise Monitoring Sites
Figure 4	Water Monitoring Sites
Figure 5	Ecological Monitoring Sites
Figure 6	Pit Top
Figure 7	Commonwealth Colliery
Figure 8	Vale of Clywdd #2

1 STATEMENT OF COMPLIANCE

The compliance status of the Angus Place Colliery for the year 2024 is presented in **Table 1-1**. During the reporting period, there were 3 non-compliances. **Table 1-2** Presents a summary of the non-compliances.

Table 1-1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Project Approval MP06_0021	No
Environmental Protection Licence 467	No
EPBC 2011/5952	Yes
Mining Leases	Yes
SMP Approval 04/1675	Yes
SMP Approval OUT 14/10918	Yes
Water Licenses (WAL36445, WAL36449, WAL37340, WAL37343, WAL41881)	Yes
Rehabilitation Management Plan	Yes
Radiation Management Licence RML29229	Yes

Table 1-2: 2024 Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Where Addressed in Annual Review
EPL 467 MP06_0021	M2.3 Schedule 3, Condition 8	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor the required number of samples by M2.3 at EPL Point 16 on 6 occasions throughout 2024.	**Section 11**
EPL 467 MP06_0021	M2.3 Schedule 3, Condition 8	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor the required number of samples by M2.3 at EPL Point 18 in January and March.	**Section 11**
EPL 467 MP06_0021	M2.3 Schedule 3, Condition 8	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor the required number of samples in accordance with M2.3 at EPL Point 19 on 11 occasions throughout 2024.	**Section 11**
EPL 467	L2.4	Water and/ or Land Concentration Limits	Non-Compliant	A discharge from LDP002 on 11 December exceeded the Total Suspended Solids (TSS) Limit, with a TSS of 59 mg/L	**Section 11**

Note: Compliance Status Key for Table 1-2

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative	Non-Compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to the government later than required under approval conditions)

2 INTRODUCTION

Angus Place Colliery (Angus Place) is an underground coal mining operation located approximately 5 kilometres (km) north of the village of Lidsdale, 8 km northeast of the township of Wallerawang and approximately 15 km northwest of the city of Lithgow in New South Wales (NSW). It is surrounded by Springvale Colliery to the south, Ivanhoe Colliery to the northwest and the Wolgan Valley and Newnes Plateau to the north and east respectively. The Angus Place Rehabilitation Management Plan (RMP) covers an area that includes Kerosene Vale and Vale of Clywdd 2 mines and Commonwealth Colliery open cut. The regional locality is shown on **Figure 2-1** and site layout on **Figure 2-2**.

Angus Place has been in operation since 1979 and is operated by Centennial Angus Place Pty Ltd (Centennial Angus Place) which is owned by Springvale Coal Pty Ltd. Angus Place utilised the longwall retreat method of mining to extract coal from the Lithgow Seam, within Mining Lease (ML) 1424 and Consolidated Coal Lease (CCL) 704.

In March 2015, following the completion of secondary extraction within Longwall 900W, Angus Place moved to a care and maintenance phase during which mining operations ceased. Environmental management of the site, including dewatering of the underground workings, is ongoing. Mining operations are expected to recommence at Angus Place Colliery (pending consent) following the completion of mining at the adjacent Springvale Mine.

Angus Place's existing Project Approval was granted on 13 September 2006 pursuant to Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). The current project approval has since been declared a State Significant Development (SSD) under Clause 6 of Schedule 2 to the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017, for the EP&A Act.

Accordingly, Angus Place Colliery operates under the SSD approval (MP06_0021), which has been modified several times since it was approved. MP06_0021 lapsed on 18 August 2024. MOD 9 has been submitted to DPHI to allow for decommissioning, rehabilitation and other activities (except for first and second workings) to continue under SSD MP06_0021. Modification 9 is current under assessment with DPHI.

2.1 SCOPE

This Annual Review (AR) details the compliance and environmental management performance of Angus Place over the period 1 January 2024 to 31 December 2024. It has been prepared to demonstrate the site's performance and community engagement activities. The AR has been prepared by the Annual Review Guideline (DPIE, 2015) and satisfies the following:

- Conditions of Project Approval MP06_0021, in particular Condition 3 in Schedule 5.[1]
- A summary of the reporting required under the mining tenements[1].
- Reporting requirements of related approved management plans.

2.2 MINE CONTACTS

The contact details for the personnel responsible for environmental management and community relations at Angus Place are provided in **Table 2-1**.

[1] See **Appendix 1** for a checklist of annual review reporting requirements and where they have been addressed in this Annual Review.

Table 2-1: Centennial Site Environmental Contact Details

Name	Position	Contact Details
David Craft	Mine Manager	T: (02) 6354 8721
		E: David.Craft@centennialcoal.com.au
James Armstrong	Environment & Community Superintendent	T: (02) 6953 8723
		E: james.armstrong@centennialcoal.com.au
Community Information and Complaints Line		T: (02) 6354 8700

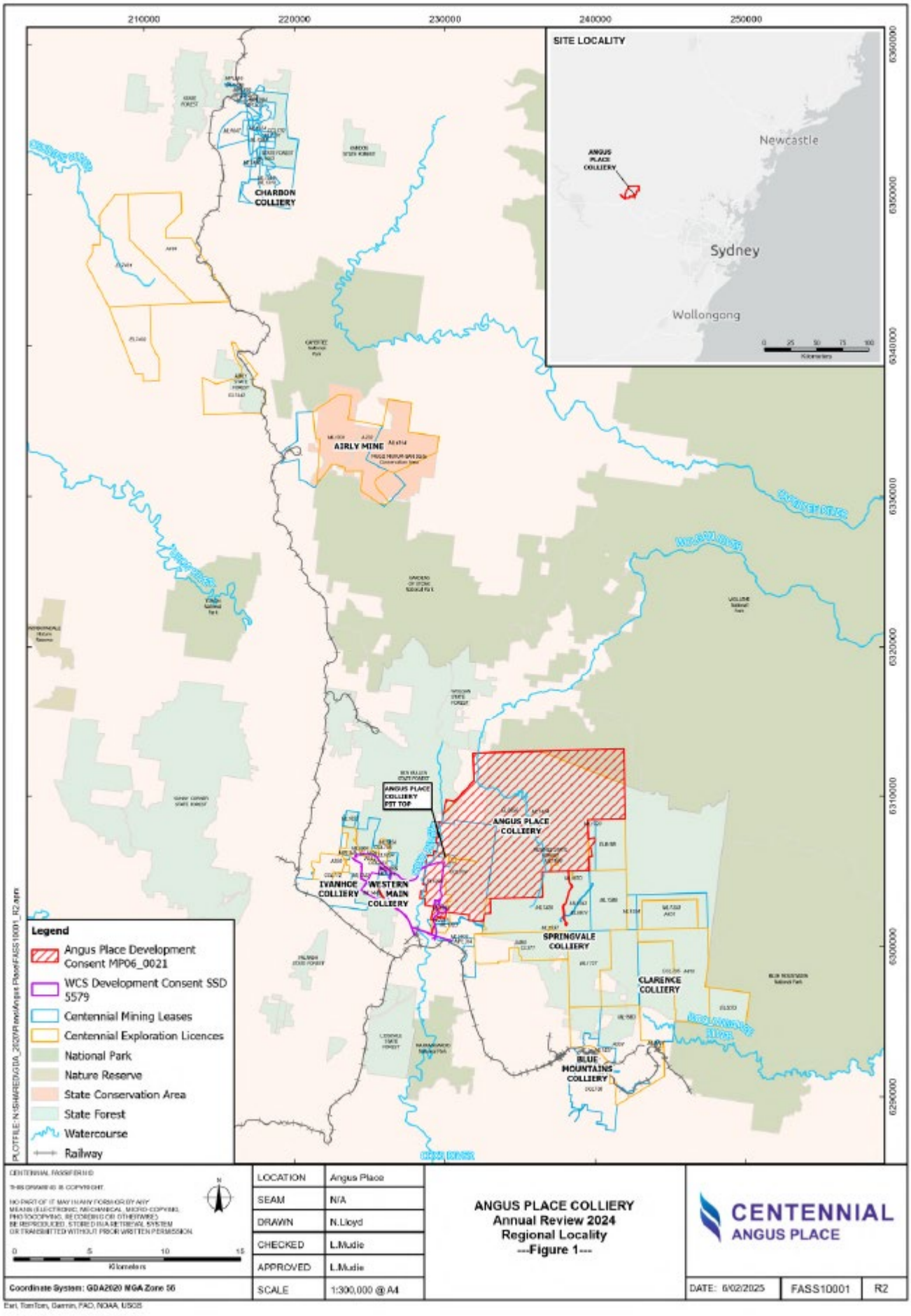

Figure 2-1: Regional Context

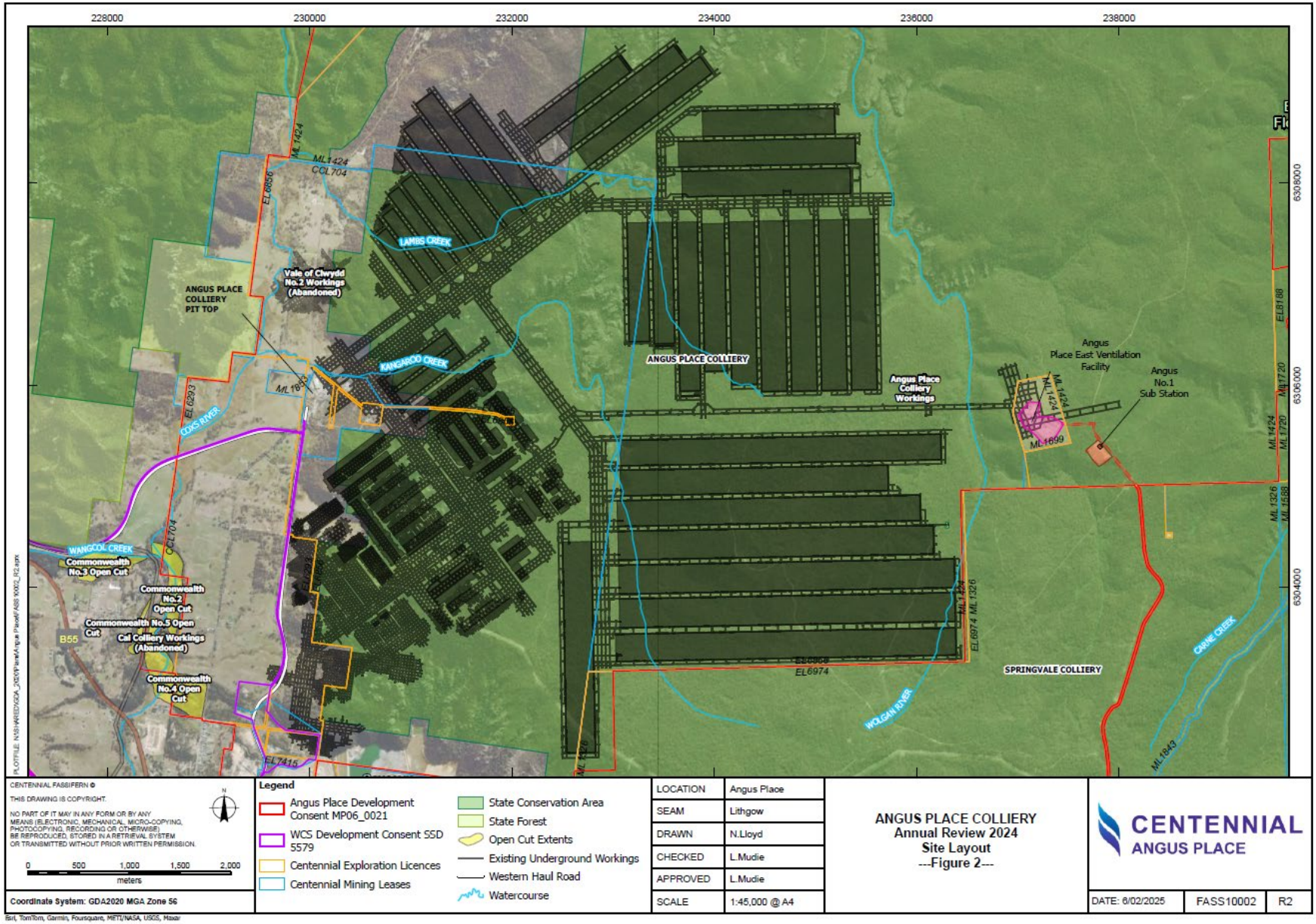

Figure 2-2: Site Layout

3 APPROVALS

3.1 PROJECT APPROVALS, MINING AUTHORISATIONS, AND OTHER LICENCES

A summary of Project Approvals, Mining Authorisations, and other Licences relevant to Angus Place is provided in **Table 3-1**. Current development, mining and environment approvals are available on the Angus Place website.[2]

Table 3-1: Environmental Approvals held by Centennial Angus Place

Approval	Description	Expiry Date	Change during Reporting Period (Y/N)
Project Approval / Development Consent			
MP06_0021	Project approval for Angus Place Coal Mine	18 August 2024[3]	N
MP06_0021 (MOD 1)	Mod 1 (Longwalls 900W and 910)		
MP06_0021 (MOD 2)	Mod 2 (Ventilation facility).		
MP06_0021 (MOD 3)	Mod 3 (Extension of longwalls 980 and 900W)		
MP06_0021 (MOD 4)	Mod 4 (Development continuity)		
MP06_0021 (MOD 5)	Mod 5 (Water management)		
MP06_0021 (MOD 6)	Mod 6 (Water transfer system and water softening plant)		
MP06_0021 (MOD 7)	Mod 7 (Rehabilitation reforms)		
Environmental Protection Licence			
EPL 467	Environmental Protection Licence	N/A	N
EPBC Approval –			
EPBC 2011/5952	Mining of Longwalls 910 and 900W	19 March 2032	N
Mining Authorisations			
CCL 704	Consolidated Coal Lease	20 July 2039	N
ML 1424	Mining Lease	18 August 2045	Y
ML 1326 (Part – Springvale)	Mining Lease	18 August 2045	Y
ML 1699	Mining Lease	26 June 2035	N
ML 1720	Mining Lease	23 November 2036	N
ML 1853	Mining Lease	25 May 2044	N

[2] https://www.centennialcoal.com.au/operations/angus-place/
[3] This approval lapsed on 18 August 2024

Approval	Description	Expiry Date	Change during Reporting Period (Y/N)
EL 6856	Exploration Licence	8 August 2025	N
EL 8188	Exploration Licence	16 October 2025	N
Mine Operations Plan / Rehabilitation Management Plan			
Rehabilitation Management Plan – Angus Place (November 2023)	Rehabilitation Management Plan for Angus Place with commencement date 1 August 2022	N/A	N
Extraction Plans / Subsidence Management Plans			
SMP Approval 04/1675 (RR)	Mining of Longwalls 930-980	30 June 2014	N
Extraction Plan Approval 12/15868 (DPHI)	Mining of Longwalls 910 and 900W (CCL 704, ML 1424 & ML 1326)	31 March 2021	N
SMP Approval 14/10918 (RR)	Mining of Longwalls 900W and 910 (CCL 704, ML 1424 & ML 1326)	31 March 2021	N
Water Licences			
WAL36445	Extraction of 2,701ML per year	Perpetuity	Y
WAL36449	Extraction of 2,523ML per year to dewater the underground coal	Perpetuity	Y
WAL37340	Extraction of up to 329ML per year	Perpetuity	Y
WAL37343	Extraction of up to 35ML	Perpetuity	Y
WAL41881	Extraction of 1,471ML per year	Perpetuity	Y

3.1.1 Changes During the Reporting Period

A number of changes to Approvals, Mining Tenements, and other Licences occurred during the reporting period as outlined below.

The following leases and licences were renewed:

- WAL36443, WAL36445, WAL36446, WAL 37340, WAL37343, and WAL41881 were converted from being classified as Richmond catchment to Sydney Basin West Groundwater source.
- ML1424 and Part ML1326 (Springvale) were renewed.

The following approvals expired or lapsed during the reporting period:

- MP06_0021 lapsed on the 18 August 2024 (MOD 9 submitted to DPHI to update Schedule 2 Condition 5 of MP06_0021).
- EL6293 was allowed to expire.

3.2 ANNUAL REPORTING REQUIREMENTS

Appendix 1 provides a checklist of reporting requirements and performance conditions addressed within the Annual Review.

By the requirements of MP06_0021 (Schedule 5, Conditions 3 and 7– Annual Reporting, and Condition 10 – Access to Information), and the conditions outlined in **Appendix 1**, this 2024 Annual Review was provided to the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) and subject to approval is available at the Angus Place website[4].

[4] https://www.centennialcoal.com.au/operations/angus-place/

4 OPERATIONS SUMMARY

Angus Place is presently undertaking care and maintenance provisions (since 28 March 2015). Environmental management of the site, including dewatering of the underground workings, is ongoing. Angus Place is expected to remain on care and maintenance for the foreseeable future, Centennial still considers Angus Place as a brownfield project and will recommence the process to meet planning requirements for Angus Place West with possible mining operations commencing following the completion of mining at the adjacent Springvale Mine. Any future mining will be subject to approval under the EP&A Act.

4.1 PRODUCTION

No reportable production activities were undertaken during the reporting period.

4.2 MINING OPERATIONS

No mining activities (development or secondary extraction) were undertaken during the reporting period.

4.3 EXPLORATION

No exploration activities were undertaken during the reporting period.

4.4 LAND DISTURBANCE

No land disturbance activities were undertaken during the reporting period.

4.5 CONSTRUCTION

No Construction activities were undertaken at the site during the reporting period Next Reporting Period

Angus Place has ceased coal mining and is currently undertaking care and maintenance activities in anticipation of future mining opportunities. Activities to be conducted during the next reporting period are limited to:

- Continue preparation and submission of an Environmental Impact Statement and associated work for Angus Place West.
- Implement relevant components of the *Rehabilitation Management Plan (RMP)* as required and appropriate in accordance with Condition 37, Schedule 3 of MP06_0021.
- Review and if necessary, revise strategies, programs and management plans in accordance with Schedule 5 Condition 4 to reflect current and proposed mining and rehabilitation activities.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

Table 5-1 Summarises the outcomes of the 2023 Annual Review, including actions issued by Regulators and actions outlined by the Angus Place Colliery.

Table 5-1: Actions from Previous Annual Review and Regulator Requirements

Action Required	Requested By	Action Taken	Where addressed in Annual Review
Regulator Requirements			
In accordance with Schedule 5, Condition 10 of the Approval please make publicly available	**DPHI**	Angus Place 2023 Annual Review is available on the website.	**NA**
Improvement/Other Actions (Committed in 2023 Annual Review)			
Completion and submission of the Angus Place West Project EIS	**Angus Place Colliery**	Ongoing.	**NA**
Submit a variation of EPL467 to the EPA	**Angus Place Colliery**	A licence variation was submitted on the 9 July 2024 and is Pending at time of writing the Annual Review.	**Section 11**
Revise biodiversity and water monitoring obligations	**Angus Place Colliery**	Ongoing in accordance with EIS submission	**Ongoing**
A review of monitoring requirements for biodiversity will be undertaken to consider consent obligations to monitor for specific timeframes as well as focusing on current and proposed mining activity.	**Angus Place Colliery**	THPSS Monitoring and Management Plan was updated with approval pending.	**Ongoing**
Management Plan Revisions			
Ongoing consultation with the DPHI regarding the Western Region Biodiversity Management Plan	**Western Coal Services**	Feedback from DPHI received in 2024, and resubmission is expected in 2025.	**Section 6.6**
Revision of the Water Management Plan	**Angus Place Colliery**	The Angus Place Water Management Plan was revised and submitted in 2024. Feedback was received by DPHI. This has been addressed and resubmitted for approval.	**Section 7**
Condition Triggers			
In accordance with Condition 4(a) in Schedule 5 of MP06_0021 strategies,	**Angus Place Colliery**	Review of strategies, plans, and programs	**NA**

Action Required	Requested By	Action Taken	Where addressed in Annual Review
plans, and programs required under the consent will be reviewed within three months of the submission of this annual review. If necessary, the strategies, plans, and programs required under the approval will be revised to the satisfaction of the Secretary.		completed within three months of the submission of the 2023 annual review.	

6 ENVIRONMENTAL PERFORMANCE

Angus Place implements an Environmental Management Strategy, including management plans, procedures and monitoring programs that provide a framework for managing environment and community risks and impacts. To measure compliance with site approvals and licences, Angus Place undertakes a comprehensive monitoring program. Environmental monitoring locations are shown in **Figure 6-2.**

Table 6-1 provides a summary of the monitoring requirements and environmental performance for the reporting period and provides an overview of the relevant approval requirements and management plans. Environmental performance in the reporting period is detailed further in the following sections:

- **Section 6.1** – Meteorological Summary
- **Section 6.2** – Noise
- **Section 6.3** – Blasting
- **Section 6.4** – Air Quality
- **Section 6.5** – Greenhouse Gas Monitoring
- **Section 6.6** – Biodiversity
- **Section 6.7** – Heritage
- **Section 6.8** – Mine Subsidence
- **Section 6.9**- Waste
- **Section 6.10**– Other Matters
    - Bushfire (**Section 6.10.1**)

Note, there are separate sections for reporting the environmental performance for Water (**Section 7**), Rehabilitation (**Section 8**) and Community Consultation (**Section 9**).

Within relevant management plans, Angus Place has developed *Trigger Action Response Plans (TARPs)* using performance indicators for predicted and approved impacts. The TARP provides a process of tiered/escalating trigger levels for contingency measures should measurements and impacts be greater than predicted/approved. Accordingly, reporting of monitoring results and performance during 2024 against relevant TARPs is provided in the following sections of this Annual Review where appropriate.

Table 6-1 summarises the results of monitoring during 2024 for key environmental and subsidence-related aspects against performance measures of MP06_0021. Further detailed discussion is provided throughout **Sections 6 to 11** of this Annual Review.

Table 6-1: Summary of Environmental Performance and comparison with approved predictions (EIS/Modifications)

Aspect	MP06_0021 / EPL criteria	Performance during the reporting period (actual)	Trend/ key management implications	Implemented / proposed management action
Noise	As per Schedule 3, Conditions 17-20 of MP06_0021 MOD 7 and Condition L4 of EPL467	Compliant with approval criteria	Results compliant since at least 2015. Mining and processing have ceased during care & maintenance.	No additional mitigation actions required. Continue to maintain compliance with all relevant approvals.
Blasting	N/A	Angus Place did not conduct any blasts within the reporting period.	NA	NA
Air Quality	As per Schedule 3, Condition 14-16 of MP06_0021 MOD 7 and Condition P1 of EPL467.	Compliant with approval criteria.	Mining and processing operations have ceased during care and maintenance.	No additional mitigation actions required. Continue to maintain compliance with all relevant approvals.
Greenhouse Gas	As per Schedule 3, Condition 31 of MP06_0021 MOD 7.	Compliant with approval criteria.	Results have been compliant for at least the last 5 reporting periods.	As above. Ongoing improvement and emissions reductions measures are discussed in **Section 6.5.5**.
Biodiversity	As per Conditions 3, 24, 24A and 24B of Schedule 3 MP06_0021and EPBC Approval 2011/5952.	Monitoring obligations have been met.	Monitoring findings reflect significant impacts from drought and bushfire and following above average rainfall. Some areas previously directly impacted by mining (15+ years ago) continue to show effects of former impacts.	DPHI approval of the Western Region Biodiversity Offsets Strategy (WR-BOS) in 2022.
Heritage	As per Conditions 3,3A-3C(h), 38 and 40 Schedule 3,of MP06_0021.	Compliant with approval criteria	No significant changes in 2024.	Continue to engage with Aboriginal stakeholder groups in accordance with the WR ACHMP.
Surface Water	As per Schedule 3, Condition 5-13B of MP06_0021 Mod 7 and	Non-compliances with licence conditions relating to failing to	Refer to **Section 7** and **Section 11** for non- compliances in	Surface water sampling program to be reviewed for relevance to current and future potential

Aspect	MP06_0021 / EPL criteria	Performance during the reporting period (actual)	Trend/ key management implications	Implemented / proposed management action
	Condition P1 of EPL467.	monitor and TSS limits.	accordance with EPL 467.	operations.
Groundwater	As per Schedule 3, Condition 5-13B of MP06_0021 Mod 7 and Condition P1 of EPL467.	Non-compliance with licence conditions relating to failure to monitor, some due to road conditions and other factors.	The quality is typical of groundwater from within the Shoalhaven Group.	Groundwater monitoring program to be reviewed for relevance to current and future potential operations.
Waste	As per Condition 32, Schedule 3 of MP06_0021 and Condition L3.1 of EPL467.	Compliant with conditions.	Compliant for the last five reporting periods.	No additional mitigation actions required.

6.1 METEOROLOGICAL SUMMARY

During the reporting period, meteorological monitoring at Angus Place was undertaken in compliance with:

- MP06_0021 (Schedule 3, Condition 23,).
- EPL 467 (Condition M4.1).
- Approved Methods for Sampling of Air Pollutants in New South Wales (NSW EPA).
- Western Region Air Quality and Greenhouse Gas Management Plan (November 2021).

The cumulative rainfall for the 2024 reporting period of 807.9mm was above the long-term annual average. January received the highest amount of rainfall of 150.4mm during the reporting period. Rainfall was above the long-term monthly averages[5] In January, April, May, June, July, November, and December. October received the least amount of rainfall in the reporting period of 22.2mm.

The highest maximum average temperature was recorded in February with 34.2 degrees and the lowest average minimum was recorded in September with -7.6 degrees.

Temperature data for November and December has been substituted for Bureau of Meteorology data due to an error with the Angus Place weather station data retention.

Figure 6-1 summarises meteorological conditions at Angus Place during the reporting period.

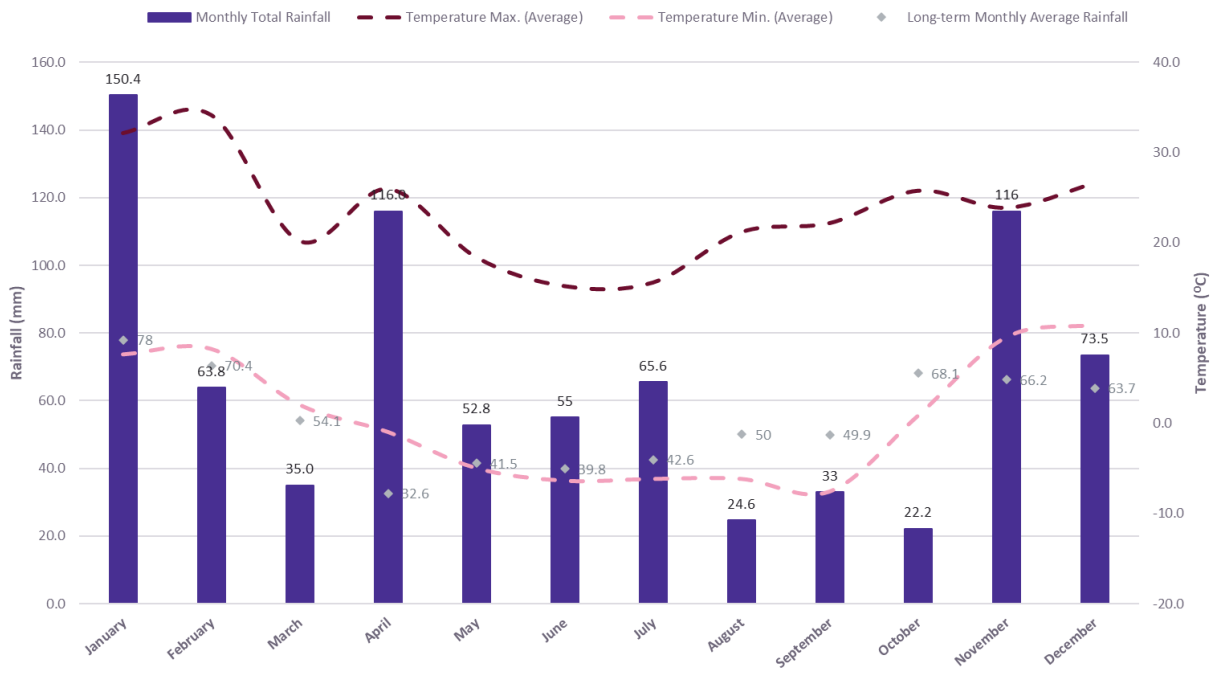

Figure 6-1: Summary of Meteorological Conditions

[5] As determined from a nearby rainfall gauge operated by the Bureau of Meteorology (BOM) in Lidsdale (Station Number 63132) (1959 – 2023)

6.2 NOISE

6.2.1 Environmental Management

Noise at Angus Place is managed in accordance with the *Western Region Noise Management Plan (WR-NMP).* WR-NMP Rev5 (Nov 2021) was approved by DPHI, formerly the Department of Planning and Environment (DPE) on 1 June 2022 to satisfy Schedule 3, Condition 22 of MP06_0021 and EPL 467. The WR-NMP has been developed to ensure that potential noise impacts from Angus Place Colliery on the neighbouring community are minimised. The plan aims to identify suitable measures to manage the noise, as well as to establish protocols for responding in case the noise criteria are exceeded and to comply with statutory approval conditions.

Relevant noise producing activities during the Care and Maintenance phase at Angus Place to which the WR-NMP applied during the 2024 reporting period included:

- Maintaining all plant and equipment to manufactures specifications (ongoing).
- Operate mobile plant in a quiet, efficient manner and regular training of operators (ongoing).
- Installation of frequency modulated reversing alarms or '*quakers*' on mobile plant to replace reversing alarms (complete).
- Installing acoustic enclosures around processing plants (ongoing as required to ensure compliance).
- Speed limits on haul routes (complete).
- Switching off vehicles and plant when not in use (ongoing).

Noise monitoring is undertaken at the following locations shown in Figure 6-2 and described in **Table 6-2** and

Table 6-3:

- APNM1 (R1) – (EPL Point 20),
- APNM2 (R2) – (EPL Point 21), and
- APNM3 (WR3) – (EPL Point 22).

It is noted that EPL Point 24 (Lidsdale Village R3) is required to be monitored quarterly only when the Angus Place haul road is operating, as per condition L4.1 of EPL467. As the Wallerawang Power Station Haul Road is no longer in operation, R3 was subsequently decommissioned in June 2019 and relocated for long term monitoring in accordance with the WR-NMP, with Wolgan Residence (WR3) replacing the site. WR3 was considered to be a more representative location to monitor potential noise from the pit top and is in accordance with the WR-NMP. Long-term trends now capture results from the new location accordingly.

6.2.2 Environmental Performance

Quarterly attended noise compliance assessments were undertaken during the 2024 reporting period at APNM1, APNM2, and APNM3 in accordance with EPL467, MP06_0021 and the WR-NMP as summarised in **Table 6-2** and

Table 6-3. Noise monitoring results are also included in environmental monitoring reports published monthly on the Angus Place website.

Noise Criteria are specified by MP06_0021 and EPL467 for day, evening, and night-time periods for the amenity of neighbouring residences. Centennial Angus Place complied with

the project-specific noise criteria at all monitoring sites during attended noise monitoring in the reporting period.

Table 6-2: Angus Place Noise Criteria and Monitoring Summary

Approved Noise Limit (dBA)[6]				Performance During the Reporting Period	Key Management Implications	Implemented / Proposed Management Actions
Receiver (Monitoring Location)	**Day[7]**	**Evening[8]**	**Night[9]**	Quarterly attended monitoring was undertaken at the 3 required noise monitoring locations (APNM1, APNM2, and APNM3). Operator attended noise measurements were conducted in March, June, September and December 2024. Noise contributions from Angus Place were inaudible or lower than 30dBA for all measurements, i.e., at all monitoring locations and during all time periods, and comply with the Project Approval MP06_0021 and EPL 467 noise criteria.	Noise Management controls at the Angus Place Colliery were effective.	Given the preceding compliance noise monitoring results, additional noise mitigation is not proposed.
	$L_{Aeq(15\ min)}$	$L_{Aeq(15\ min)}$	$L_{Aeq(15\ min)}$			
APNM1 (R1) (EPL Point 20)	42	38	36			
APNM2 (R2) (EPL Point 21)	41	37	35			
APNM3 (WR3) – Wolgan Rd (EPL Point 22)	41	37	35			
Lidsdale Village (R3) (EPL Point 24)[10]	44	40	35			

Notes:

[6] The noise criteria in **Table 6-2** are to apply under all meteorological conditions except the following:

a. During wind speeds (at 10 m height) greater than 3 m/s; and

b. Temperature inversion conditions of up to 3ºC/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.

[7] Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.

[8] Evening is defined as the period from 6pm to 10pm.

[9] Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

[10] In accordance with EPL 467 Condition L4.1, for Monitoring Point 24, both the noise level and the requirement to measure the noise quarterly only apply when the Angus Place haul road is operating.

Table 6-3: 2024 Quarterly Attended Noise Monitoring Results

Site	Monitoring Period	DAY (dBA)			EVENING (dBA)			NIGHT (dBA)		
		Measured LAeq (15 min)	Criteria LAeq[1] (15 min)	Estimated Site Contribution	Measured LAeq (15 min)	Criteria LAeq[1] (15 min)	Estimated Site Contribution	Measured LAeq (15 min)	Criteria LAeq[1] (15 min)	Estimated Site Contribution
APNM1 (R1)	**Q1**	65	42	Inaudible	38	38	<30	33	36	<30
	Q2	61		Inaudible	31		Inaudible	57		Inaudible
	Q3	51		Inaudible	48		<30	33		Inaudible
	Q4	42		Inaudible	52		<30	38		<30
APNM2 (R2)	**Q1**	37	41	Inaudible	40	37	Inaudible	31	35	<30
	Q2	40		Inaudible	32		<30	35		Inaudible
	Q3	35		Inaudible	32		<30	39		Inaudible
	Q4	38		Inaudible	40		Inaudible	37		<30
APNM3 (WR3) Wolgan Rd	**Q1**	53	41	<30	30	37	<30	32	35	<30
	Q2	61		Inaudible	51		Inaudible	34		Inaudible
	Q3	58		Inaudible	29		Inaudible	29		Inaudible
	Q4	54		Inaudible	45		Inaudible	35		Inaudible

*Notes: 1 As per Condition 17, Schedule 3 of MP06_0021. Noise emission limits identified in the above table do **not** apply in wind speeds of >3 m/s at 10 metres above ground level; or temperature inversion conditions >3ºC/100m, and wind speeds of >2 m/s at 10 metres above ground level; or where formalised agreement has been established with a potentially affected landowner.*

6.2.3 Comparison against Predictions

The noise and vibration impact assessment for the *Angus Place Colliery - Modification 6 Project* (GHD, 2020) established project Rating Background Level (RBLs) for Angus Place based on the results of ambient noise monitoring to enable assessment of operational noise emissions in accordance with the *Noise Policy for Industry* (NPfI) (EPA 2017).

An analysis of the results of the operator attended noise monitoring has shown that the Angus Place noise emissions fall below Project Approval/EPL noise limits at all residential monitoring locations during the day, evening and night-time periods. As all attended monitoring locations were noted as inaudible or less than 30 dBA no further analysis of the unattended data has been conducted.

As shown in

Table 6-3 Angus Place Colliery complied with the project specific noise criteria at all monitoring sites during attended noise monitoring in the reporting period and was generally consistent with or below predictions.

6.2.4 Long Terms Analysis

There have been no exceedances recorded in the annual noise compliance assessments for the period of 2015 to 2024 for APNM1 and APNM2.

In June 2019, APNM3 was relocated to Wolgan Road (WR3), this was considered to be a more representative location to monitor noise from the Angus Place in the long term as detailed in the WR-NMP. The site has not recorded any exceedances for the period 2019 to 2024, nor at its previous location between 2015-2019.

Table 6-4 shows noise compliance reporting by Angus Place Colliery during the last five reporting periods from 2020 to 2024.

Table 6-4: Long Term Attended Noise Monitoring Trends (recorded exceedances)

Project Approval Location	2020	2021	2022	2023	2024
APNM1 (R1)	0	0	0	0	0
APNM2 (R2)	0	0	0	0	0
(former) APNM3 Lidsdale Village R3	0	0	*NA*	*NA*	*NA*
APNM3 (WR3) *Wolgan Rd*	*NA*	NA	0	0	0

6.2.5 Implemented / Proposed Improvements

Given the preceding compliance of noise monitoring results, additional noise mitigation is not proposed.

6.2.6 Acquisitions and Mitigation Requests

During the 2024 reporting period there were no exceedances of the project criteria and no written requests received for acquisition or noise mitigation measures in accordance with Conditions 18 and 20, Schedule 3 of MP06_0021.

6.3 BLASTING

Blasting did not occur at Angus Place during the 2024 reporting period.

6.4 AIR QUALITY

6.4.1 Environmental Management

Air Quality at Centennial Angus Place is managed and monitored in accordance with the *Western Region Air Quality and Greenhouse Gas Management Plan* (November 2021) (AQGHGMP) which has been developed in accordance with Conditions 14 and 16 in Schedule 3 of MP06_0021, and Condition P1.1 in EPL 467 to ensure that potential air quality impacts from Angus Place Colliery on the neighbouring community are minimised. Additionally, appropriate management measures are identified, and monitoring undertaken to evaluate compliance with relevant approval conditions.

The air quality monitoring network at Angus Place is comprised of three (3) deposition dust gauges (DG3, 5 and 6) and one High Volume Air Sampler (HVAS) for suspended dusts monitoring Total Suspended Particulates (TSP) and PM_{10} (particulate matter less than 10 microns in diameter). Dust Gauge DG3 is a reference site (background monitor). Air quality monitoring locations are illustrated on **Figure 6-2.** Performance measures and monitoring results recorded during 2024 are discussed in **Section 6.4.2.**

6.4.2 Environmental Performance

Table 6-5 shows the air quality impact assessment criteria relevant to the operation as specified in Condition 14 in Schedule 3 of MP06_0021[1].

Table 6-5 Angus Place Air Quality Impact Assessment Criteria

Pollutant	Averaging Period	Criterion[1]
Total Suspended Particulate (TSP)	Annual mean	90 µg/m^3
Particulate Matter < 10µm (PM_{10})	Annual mean	25 µg/m^3
	24 hours maximum	50 µg/m^3
Deposited Dust	Monthly maximum (annual average)	4 g/m^2/month
	Maximum increase (annual average)	2 g/m^2/month

Notes: 1 As per Condition 14, Schedule 3 of MP06_0021. EPL467 requires deposited and suspended dust to be monitored at specified locations but does not prescribe criteria.

During the reporting period, air quality at Angus Place was:

- Compliant with MP06_0021 Conditions 14 and 16, Schedule 3;
- Compliant with EPL 467 Condition P1.1; and
- Managed in accordance with the WR- AQGHG MP.

Monitoring results during 2024 for depositional and suspended dusts are presented in the following sections below.[11]

[11] Detailed monitoring results are described in monthly environmental data reports published on the Angus Place website available at https://www.centennialcoal.com.au/operations/angus-place/.

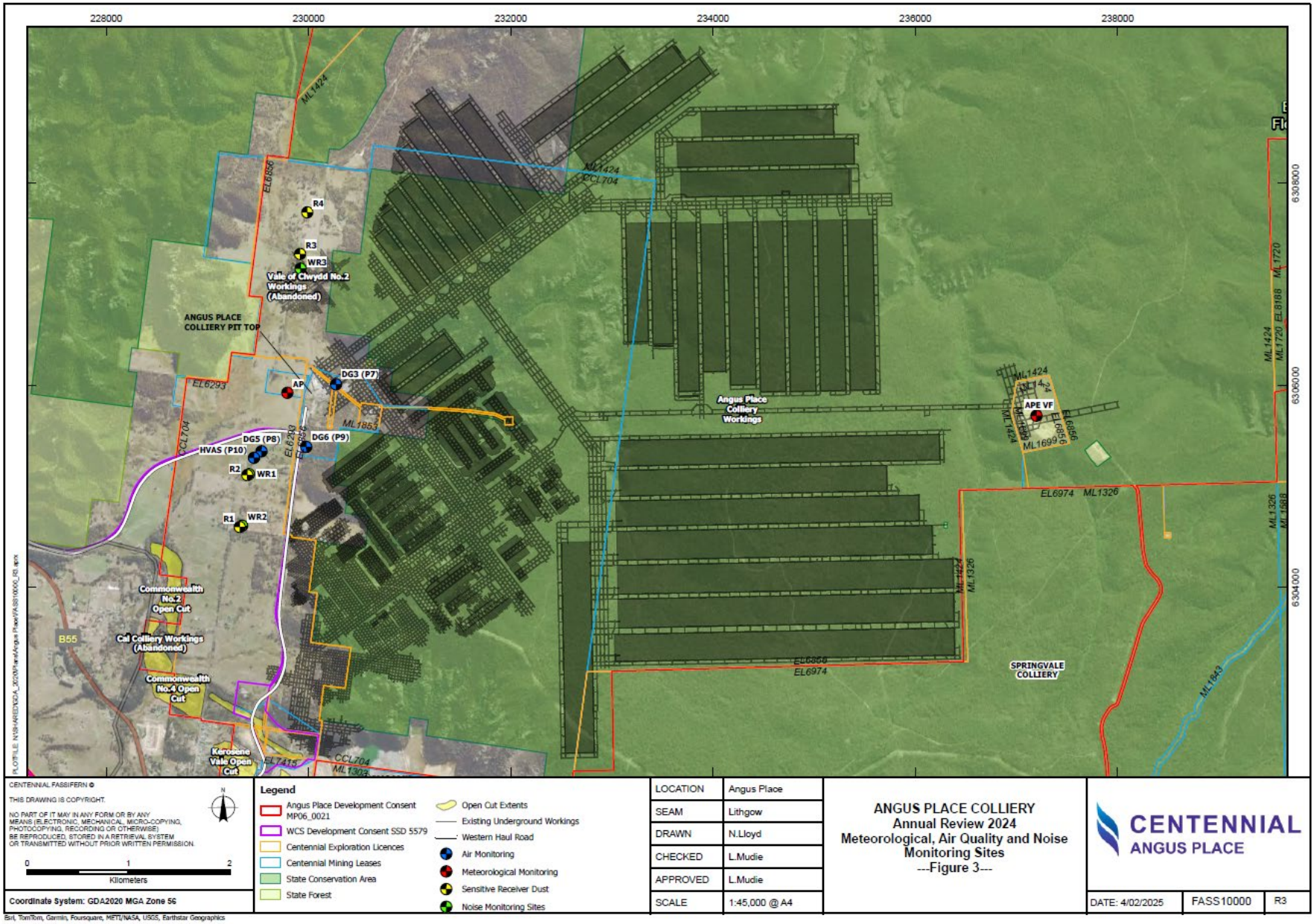

Figure 6-2: Angus Place Colliery Meteorological, Air Quality and Noise Monitoring Locations

Dust Deposition

Depositional dust (deposited particulate matter) at three designated sites DG3, DG5 and DG6 was monitored monthly. The annual average for the maximum increase and the total deposited particulate monitoring results recorded by all depositional dust gauges were below the development consent limits for the annual averaging period in 2024, as demonstrated in **Table 6-6** and **Figure 6-3** below.

Table 6-6: Summary of Depositional Dust Monitoring Locations

Monitoring Point Reference	Description	Insoluble Solids (g/m²/month)		
		2024 Annual Average	Criteria[1,2] Max Increase in Deposited Dust	Criteria[1] Max Total Deposited Dust (Annual Average)
DG3 (onsite)	Dust Deposition Gauge[3]	0.29	2.00	4.00
DG5	Dust Deposition Gauge[4]	0.43		
DG6	Dust Deposition Gauge[5]	0.53		

Notes: [1] as per Table 5 in Schedule 3, Condition 14 of MP06_0021. [2] criteria is measured against the background dust gauge, which is DG3 under the WR AQGHGMP. [3] Ambient: The monitoring equipment is not at a sensitive receptor location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations. [4] Background: The monitoring site is representative of 'background' levels since it is remote from dust generating activities. [5] Compliance: The monitoring site is at a sensitive receptor location and therefore used for compliance purposes.

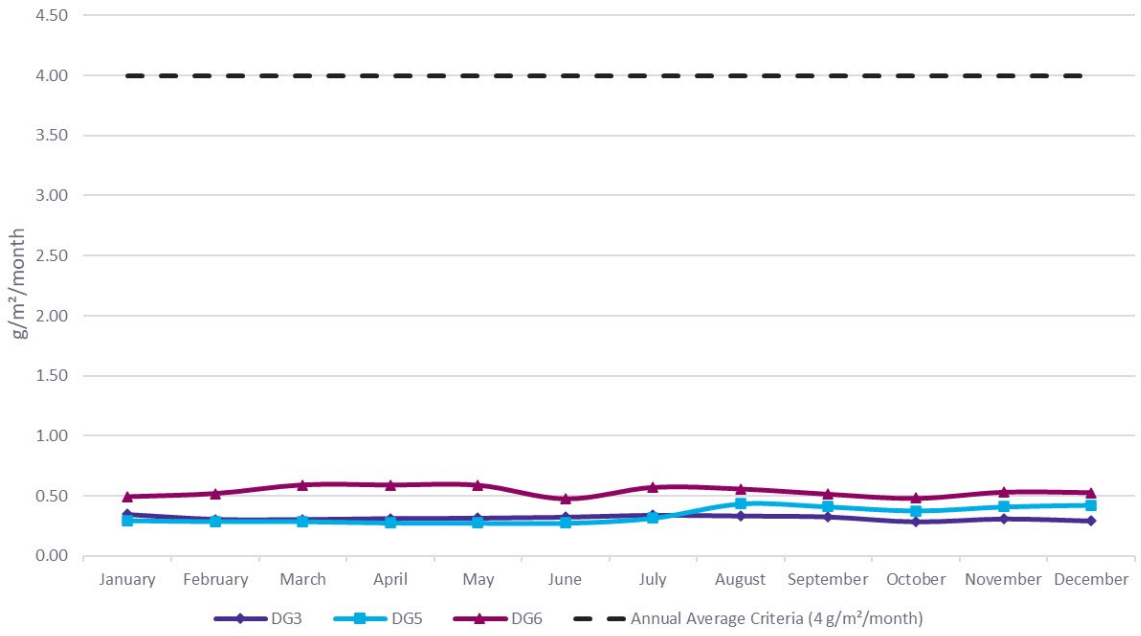

Figure 6-3: Dust Deposition Summary for 2024 (Rolling 12 Month Average)

High-Volume Air Samplers

A summary of the recorded results for HVAS is presented in **Table 6-7**. The number of days that exceeded the consent criterion is also shown. Rolling annual average and 24-hour results for HVAS at the Paddock Site (located onsite at Angus Place) are provided for the following:

- PM_{10} (refer **Figure 6-4**)
- TSP (refer **Figure 6-5**)

The results obtained in the reporting period demonstrate compliance with the air quality impact assessment criteria (24-hour and annual averages).

Table 6-7: Summary of HVAS Monitoring Results

Monitoring Location	Averaging Period	Consent Criteria	Maximum ($\mu g/m^3$)	Mean ($\mu g/m^3$)	Number of days exceeding the criterion
HVAS Paddock (PM_{10})	24-hour	50	56.1	N/A	1[1]
	Annual	25	N/A	6.0	0
HVAS Paddock (TSP)	Annual	90	N/A	9.8	0

Notes: [1] This was not classified as a non-compliance due to bushfires in the area being directly linked to the exceedance.

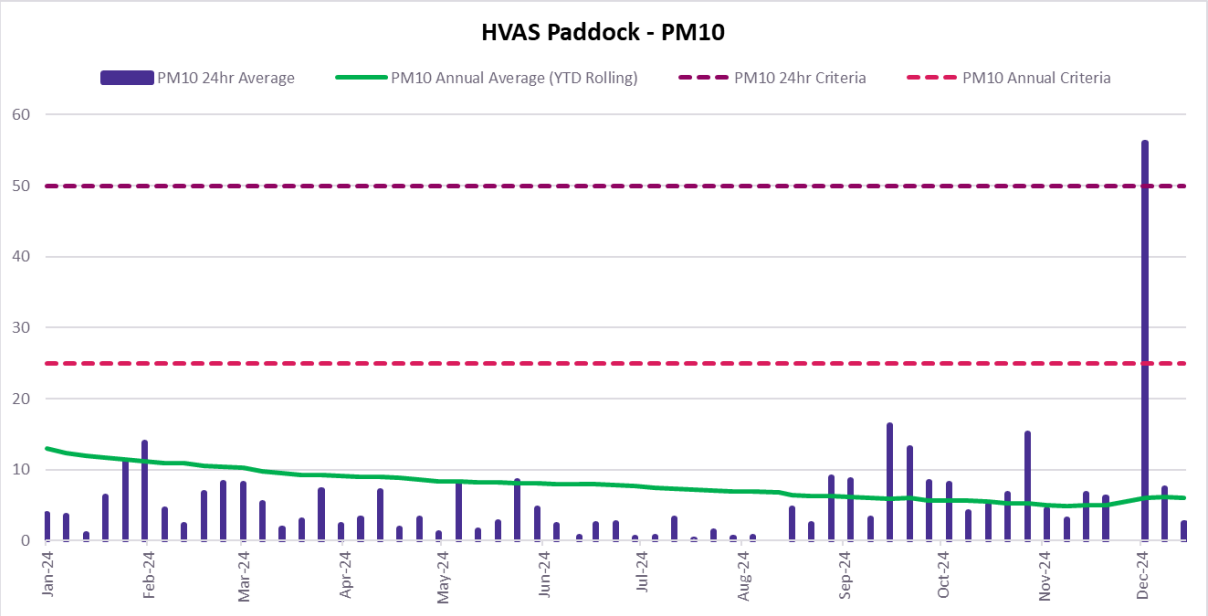

Figure 6-4: Annual HVAS PM_{10} Summary Results at Paddock

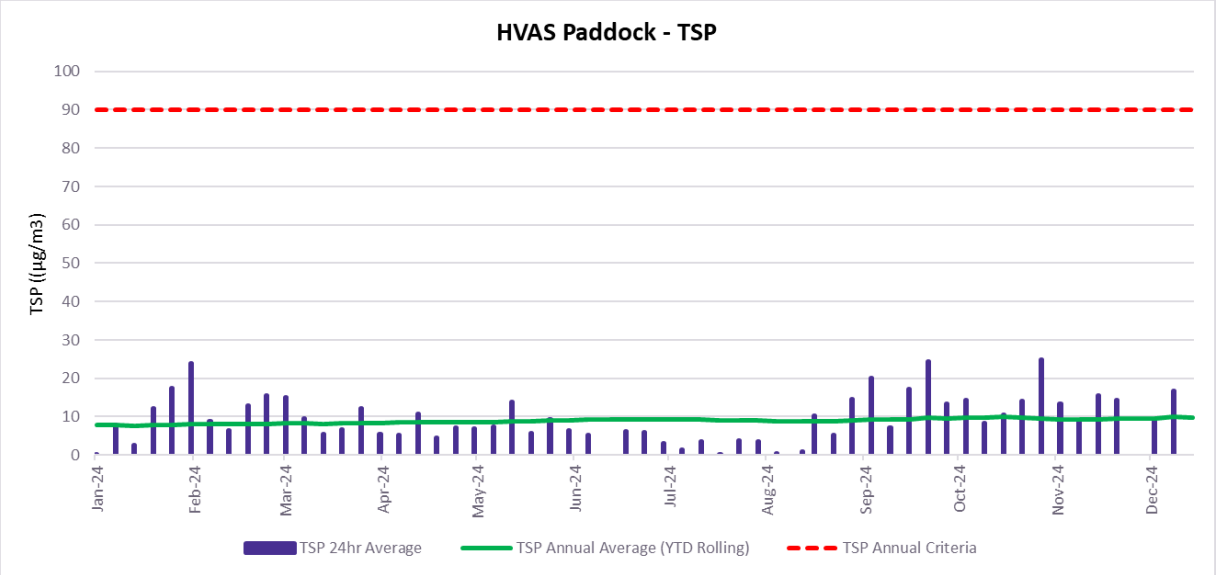

Figure 6-5: Annual HVAS TSP Summary Results at Paddock

6.4.3 Comparisons against Predictions

The air quality impact assessment for MOD2 (SLR 2012) established site-specific ambient air quality levels and modelling predictions for incremental dust increase as shown in **Table 6-8**.

The results of the air quality modelling indicated that predicted concentrations of incremental suspended and depositional dust for particulate matter (TSP, PM_{10}, and dust deposition) were below the applicable impact assessment criteria at all assessment locations.

Air quality monitoring results during 2024 were well below annual criteria and consistent with predicted results.

Table 6-8: Site-Specific Background Air Quality and Predicted Incremental Increases

(Source MOD2 AQIA, SLR 2012)

Receptor	Suspended Dusts						Depositional Dusts (g/m²/month)	
	TSP (µg/m³)[1]		PM_{10} (µg/m³)					
	Annual Avg		Max 24hr Avg		Annual Avg		Annual Avg	
	BG	INCR	BG	INCR	BG	INCR	BG	INCR
R1	30.2	**0.1**	65.0	**0.3**	18.3	**<0.1**	1.7	**<0.1**
R2	41.2	**0.1**	68.0	**0.4**	20.9	**<0.1**	2.1	**0.1**
R3	22.3	**0.1**	63.3	**0.4**	16.8	**<0.1**	1.3	**0.1**
R4	20.0	**0.1**	63.3	**0.6**	16.0	**<0.1**	1.2	**0.1**
R5	15.3	**0.1**	63.0	**0.2**	14.1	**<0.1**	1.0	**<0.1**
R6	15.2	**<0.1**	63.00	**0.2**	14.1	**<0.1**	1.0	**<0.1**
Criterion		***90***		***50***		***30***		***4***

6.4.4 Long Term Analysis

Table 6-9 provides a summary of air quality monitoring results for the previous 5 years from 2020 to 2024, including the annual averages for deposition dust (insoluble solids), PM_{10} and TSP.

All air quality monitoring results are well below annual criteria and consistent with predicted results.

Table 6-9: Long-Term Air Quality Monitoring Summary (2020 - 2024)

Monitoring Location	Annual Averages					Development Consent Criteria (Annual Average)
	2020	2021	2022	2023	2024	
Insoluble Solids (g/m²/month)						
DG3 (onsite)	2.50	2.65	0.70	0.29	0.29	4 g/m²/month
DG5	1.90	0.31	0.43	0.31	0.43	
DG6	1.30	0.29	0.75	0.51	0.53	
PM_{10} (µg/m³)						
HVAS Paddock	8.20[1]	5.50	3.90	13.3	6.0	25 µg/m³
TSP (µg/m³)						
HVAS Paddock	39.52[1]	12.40	9.70	8.1	9.8	90 µg/m³

Notes: [1] The severe bushfire that occurred in 2019-20 had a significant impact on the concentration of PM_{10} and TSP in the air throughout 2019 and 2020.

6.4.5 Implemented / Proposed Improvements

No additional dust controls were required during 2024 the care and maintenance site creates little dust generation. Key dust mitigation measures for Angus Place during care and maintenance include:

- Signage to display speed limits on all unsealed roads in the surface facilities area; and
- Water sprays (sprinkler system) on the coal stockpile during dry and windy conditions (Note: currently on care and maintenance, therefore no production).

6.5 GREENHOUSE GAS

6.5.1 Environmental Management

Angus Place manages, monitors and reports Greenhouse Gas (GHG) Emissions in accordance with the *Western Region Air Quality and Greenhouse Gas Management Plan (WR-AQGHGMP)*.

Direct GHG emissions (Scope 1) and indirect GHG emissions (Scope 2) from Angus Place continue to be monitored and reported annually in accordance with the Commonwealth Government National Greenhouse and Energy Reporting Scheme (NGERS).

An Energy and Greenhouse Management System is used to monitor and report energy usage. Key Performance Indicators (KPIs) are tracked, which include energy demand and GHG emissions per tonne of ROM coal produced.

6.5.2 Environmental Performance

Table 6-10 reports the Scope 1 Emissions (Direct) and Scope 2 Emissions (Indirect) in tonnes $CO_{2\text{-}e}$ produced for last five (5) reporting periods including the current period and compares these against predictions in related approvals (MP06_0021 as modified).[12]

As noted previously, during the reporting period Angus Place remained in care and maintenance with no active mining operations, which is reflected in both Scope 1 and 2 emissions remaining well below approved predictions. Overall, total GHG emissions decreased by 8.95% in comparison to FY23.

Table 6-10: Total GHG Emissions from Angus Place Colliery

Emission Sources	Estimated Emissions (tonnes $CO_{2\text{-}e}$)					Predicted Emissions[1]
	FY20	FY21	FY22	FY23	FY24	
Scope 1 Emissions (direct emissions)						
Fuel combustion	183	27	65	44	68	*2,024*
Oil/grease consumption	1	1	0	0	2	*181*
SF_6	1	1	1	1	1	*1.8*
Fugitive emissions (CH_4)	970	872	539	643	873	*73,940*
Fugitive emissions (CO_2)	5,386	3,739	2,661	2,770	3,961	
Total Fugitive:	*6,356*	*4,611*	*3,200*	*3,413*	*4,833*	
Total Scope 1	***6,541***	***4,640***	***3,266***	***3,458***	***4,904***	***76,146***
Scope 2 Emissions (indirect emissions)						
Electricity Consumption	12,580	10,278	10,354	10,409	7, 745	*50,628*
Total Scope 2	***12,580***	***10,278***	***10,354***	***10,409***	***7,745***	***50,628***
Total Greenhouse Gas Emissions						
Scope 1 and 2 Emissions	***19,121***	***14,918***	***13,620***	***13,867***	***12,649***	***126,774***

[12] Note, data is presented for financial year to align with reporting under the National Greenhouse and Energy Reporting scheme.

Notes: [1] tonnes CO_{2-e} per annum as per MP06_0021 (as modified). GHG was varied in MOD2 (SLR, 2012), approved 22 April 2013

6.5.3 Comparison Against Predictions

Table 6-10 summarises GHG emissions predicted for the project, with comparison to actual emissions during the current and previous reporting period. Comparatively, given Angus Place remains in Care and Maintenance, GHG emissions during the current reporting period remained significantly below predictions.

Total Scope 1 (direct) emissions during the 2024 reporting period (4,904 CO_{2-e}) represented a 41.8% increase from the previous reporting period though it remains significantly below predictions (less than 5% of forecast levels). Scope 2 (indirect) emissions generated during the 2024 reporting period also remained significantly lower than the predictions.

6.5.4 Long Term Analysis

Table 6-10 presents a summary of GHG emissions reported over the last five (5) financial years, throughout which time Angus Place has been in care and maintenance. Based on the information reported, GHG emissions have been below predictions throughout these five years.

6.5.5 Implemented / Proposed Improvements

Angus Place implements measures to minimise GHG emissions to the greatest extent practicable and will continue to implement emission reduction measures by the *Western Region Air Quality and GHG Management Plan*.

Emissions reduction measures implemented as per the management plan include:

- Cost-effective measures to improve energy efficiency;
- Regular maintenance of plant and equipment to minimise fuel consumption; and
- Consideration of energy efficiency in plant and equipment selection.

6.6 BIODIVERSITY

6.6.1 Environmental Management

During the reporting period, management and monitoring of biodiversity (fauna and flora) at Angus Place was undertaken in accordance with the following:

- Angus Place *Fauna and Flora Management Plan (FFMP)* (Rev 1.4, Sep 2014) in accordance with Condition 24 of MP06_0021;
- *Persoonia Hindi Monitoring Management Research Program (PhMMRP)* (April 2013), approved by DPHI on 4 October 2013 in accordance with Condition 24A of MP06_0021;

- *Longwalls 910 and 900W Temperate Highland Peat Swamps on Sandstone (THPSS) Monitoring and Management Plan (MMP)* prepared in accordance with Conditions 4-8 of EPBC approval 2011/5952 (17 April 2012[13]);
- Component management plans and monitoring programs of the *LW 900W and 910 Integrated SMP and Extraction Plan* approved under Condition 3C of MP06_0021;
- Component management plans and monitoring programs of *Subsidence Management Plans* approved under Mining Lease conditions prior to 31 March 2012 (as per Condition 3C of MP06_0021), including:
    - *LW930-980 SMP* (2005);
- *Upper Coxs River Action and Monitoring Program* (UCRAMP) (Rev2, March 2020), an integrated catchment-wide program with adjacent Centennial mines;
- *Western Region Biodiversity Management Plan* (WR-BMP)[14]; prepared to address biodiversity consent conditions (including Condition 24 of MP06_0021)[15]; and
- *Western Region Biodiversity Offsets Strategy* (WR-BOS), Rev8 Feb 2019 as approved by DPHI Jan 2021, satisfying condition 24B of MP06_0021.

Management and monitoring of biodiversity associated with *revegetation* in disturbed areas using endemic species (including targeted programs for *Persoonia hindii*) is also discussed in **Section 8** of this Annual Review.

6.6.2 Environmental Performance

This section presents the performance measures and criteria applicable to, and results of, biodiversity monitoring undertaken during the 2024 reporting period. A preliminary discussion to provide broader context is provided immediately below.

Context to biodiversity impacts resulting from the 2019-2020 bushfires:

During the summer of 2019-2020, the Gosper's Mountain mega blaze extensively impacted the surface environment within and significantly beyond the mining lease at Angus Place. Independent consultants, RPS report that the fires at East Wolgan Swamp and Kangaroo Creek Swamp were so severe they consumed most of the *peat layer* that helps sustain swamp moisture levels. This resulted in significant impacts on biodiversity (flora and fauna) that is expected to take several years (and in some cases decades) to recover. Accordingly, monitoring programs include consideration and discussion in this context as appropriate.

[13] An annual compliance report is submitted to the Commonwealth by 17 April each year in accordance with Condition 8 of EPBC2011/5952. The results of the report submitted during each Annual Review reporting period is presented in **Section 6.6.2**.

[14] As with other management plans, the WR-BMP is periodically revised and updated in accordance with Condition 4, Schedule 5 of MP06_0021 and following other triggers for review by participating mines of the WR-BMP. Following submission of earlier versions, the WR-BMP has not yet been approved by DPHI. Rev 6 of the WR-BMP was submitted to the Biodiversity, Conservation and Science Directorate (BCS) of DPHI in February 2023. The WR-BMP was submitted to the DPHI for approval in 18 July 2023. A request for additional information was received from DPHI in November 2024. The WR-BMP is currently being reviewed to address these comments.

[15] It is noted that the WR-BMP, once approved, will supersede the Flora and Fauna Management Plan.

Context to approved offsets for surface disturbance (APE Vent Facility):

Native vegetation disturbance to construct the APE Vent Facility at Angus Place has been offset under the approved strategies in accordance with the requirements of MP06_0021. Monitoring and research associated with specific threatened species (*Persoonia hindii*) under supplementary offset measures of the approved WR-BOS have been completed meeting offset objectives. Further information and completion requirements were discussed in **Section 6.6.11** and the 2023 Annual Review.

6.6.3 Performance Measures

Performance measures for Angus Place mine in relation to biodiversity are prescribed by the following:

- Conditions of approval for MP06_0021 (notably Schedule 3, Condition 3);
- Conditions of approval for EPBC 2011/5952 and LW910 & 900W THPSS MMP;
- Approved predicted impacts described within environmental assessments for MP06_0021 and associated modifications, as per Schedule 2, Condition 2(a) of MP06_0021;
- Angus Place FFMP (2014);
- Conditions of approval, predicted impacts, management and monitoring for Extraction Plans (EP) and supporting component plans approved under Condition MP06_0021, including:
    - *LW900W & 910 Integrated SMP and Extraction Plan;*
    - *Angus Place FFMP (2014, as per earlier above);*
    - *LW900W and 910 Environmental Monitoring Program;*
    - *LW900W and 910 Subsidence Monitoring and Reporting Program; and*
- Conditions of approval, predicted impacts, management and monitoring for *Subsidence Management Plans* and associated component plans, including:
    - *LW930-980 SMP* (SMP Approval 04/1675).

Longwall 900W completed extraction in 2015. No further secondary extraction has occurred to date. Longwall 910 has not been mined and the approval for extraction has lapsed.

During 2024, Angus Place was compliant with all approved Performance Measures. Monitoring results for 2024 for key aspects are provided in the following sections.

6.6.4 Flora Monitoring and Management

During the reporting period, the following performance management and monitoring recommendations discussed in Environmental Assessments for the project (as modified) were implemented:

- No clearing was undertaken;
- Appropriate measures were implemented to minimise erosion and sedimentation impacts upon waterways and associated vegetation. Regular monitoring was undertaken to ensure their functionality and condition;

- A weed spraying program was implemented to control invasive weeds and to appropriately manage weeds, ensuring surrounding communities are protected from invasive species;
- Aquatic ecology monitoring was undertaken;
- Established flora (including THPSS) and fauna monitoring sites were surveyed in summer, autumn, and spring.
- Aerial photography was flown for RGB Imagery during summer, autumn, winter and spring.
- Flora monitoring and research was conducted for *Persoonia Hindi* (refer to **Section 6.6.6** below); and
- Ongoing monitoring for weed presence at the Ventilation Facility continued to be undertaken.

A summary of 2024 flora monitoring is provided in **Table 6-11**. Compliance with biodiversity performance measures in 2024 is provided in **Table 6-1** (at the start of **Section 6**).

Table 6-11: Flora Seasonal Monitoring Results (2024)

Season	Summary of Flora Monitoring Results and Conclusions
Summer 2023/2024	The summer 2023/24 monitoring season revealed several key ecological trends across both impact and control swamps. One notable finding was a decrease of more than 10% in the minimum extent of the swamp boundary at South Wall Hanging. Since this reduction was not observed in other swamps. In contrast, impact swamp Kangaroo Creek Lower showed signs of recovery. After experiencing a substantial decline in average live green cover during the summer 2022/23 monitoring period, vegetation cover rebounded in 2023/24, now exceeding baseline values. The Ground Control Point (GCP) survey results indicated that average live green cover remained below the baseline threshold in four of the eight impact swamps—Narrow, Lambs, Narrow Hanging, and West Wolgan Hanging—as well as in two control swamps, Firetail Hanging and Tristar Hanging. However, live green cover remained stable compared to the previous monitoring season, suggesting that conditions have not significantly deteriorated. Exotic vegetation cover exceeded baseline thresholds in two impact swamps, Narrow Swamp and Narrow Swamp Hanging, as well as in one control swamp, Firetail Hanging. Notably, Narrow Swamp has consistently recorded elevated exotic vegetation cover each season since autumn 2020. Although many impact and control swamps are showing trends toward pre-fire conditions, some impact swamps, including Lambs Swamp, South Wall Hanging, Narrow Swamp, and Kangaroo Creek Hanging, exhibited a significant decline in mean live vegetation cover from winter to spring 2023. These findings underscore the importance of continued monitoring to assess ecological recovery and identify factors influencing swamp health.
Autumn 2024	Monitoring results from the Autumn 2023/24 season indicate that the South Wall Hanging Swamp has exceeded the trigger threshold for a reduction in the swamp planar area for the fourth consecutive season. In contrast, all other monitored swamps recorded planar areas above the trigger values, suggesting ongoing recovery following the 2019/20 bushfires. No impact swamps exceeded the SAVI plant health trigger level, which is defined as a greater than 10% reduction in live green cover. However, impact swamps generally exhibited lower live green cover compared to control swamps. The Ground Control Point (GCP) survey results showed that the average live green cover percentage was above baseline thresholds for all impact and control swamps, marking an improvement from the previous monitoring season when six swamps recorded values below baseline levels. While this increase is encouraging, it is important to note that impact swamps typically have a lower baseline live green cover. Overall, both impact and control swamps continue to show positive trends toward pre-fire conditions, indicating ongoing recovery from the 2019/20 Gosper's Mountain Fire. Exotic vegetation cover remains above baseline thresholds in Kangaroo Creek Lower and Narrow Swamp. The persistence of elevated exotic species cover in these areas is a concern, as it may hinder native vegetation recovery.
Spring 2024	The spring 2024 monitoring results indicate that native, weed, and diagnostic species richness showed only marginal variation compared to the autumn 2024 monitoring event. Specifically, mean native species richness decreased across both impact and control swamps. Mean weed species richness declined within impact swamps and remained absent in control swamps. Meanwhile, mean diagnostic species richness increased in impact swamps but decreased in control swamps.

6.6.5 Fauna Monitoring and Management

During the reporting period, seasonal fauna monitoring was conducted across the 900 area on the Newnes Plateau, including the 900W and 910 longwall areas, in accordance with the approved extraction plans for the project.

Bird evenness and Simpson's diversity index have shown relative stability. In contrast, mammal evenness and Simpson's index have fluctuated, remaining mostly stable until the last three years, when both indicators have shown a downward trend, reaching their lowest recorded levels in 2024. Mammal abundance declined between 2012 and 2016, and again from 2019 to 2020, reaching its lowest point after the 2019/20 bushfires. However, since then, abundance has steadily increased, with 2024 recording the highest levels on record. Mammal species richness has remained stable, except for a decline observed in 2020. This decline cannot be attributed to mining activities but rather to other non-mining related environmental influences.

Reptile evenness and Simpson’s index have displayed significant variation over time, with an increasing trend from 2011 to 2018 followed by a sharp decline in 2019. Both indices showed signs of slow recovery over the past three years but declined again in 2024. Reptile abundance and species richness currently remain low, likely influenced by weather conditions.

In 2024, the small native ground mammal trapping rate was recorded at 13.8%, the highest for the area, largely due to increased captures of Bush Rats and Agile Antechinus. A paired t-test comparing trapping rates at impact and control sites over time indicated significantly lower small mammal captures at impact sites. For the past 12 years, undermined sites have consistently recorded lower captures than control sites, except for 2024, when small mammal captures at undermined sites reached an all-time high.

Eight threatened species were documented, including the Pilotbird, Scarlet Robin, Flame Robin, Gang-gang Cockatoo, Southern Greater Glider, Large-eared Pied Bat, Large Bent-winged Bat, and Eastern Pygmy-possum, along with several woodland-dependent bird species. Scarlet and Flame Robins are known to occupy post-fire landscapes rapidly, which may explain the high number of woodland-dependent bird species observed. Honeyeater numbers and diversity were also elevated, with seven species recorded, and populations are expected to increase as shrub-layer flowering plants recover post-fire.

Eastern Pygmy-possum nest boxes installed in 2016 at six sites (Kangaroo Creek, FI 1, FI 2, SI 1, North Swamp, and Tri-Star Swamp) were destroyed in the 2019 fire. Nevertheless, occasional individuals have been observed utilising redeployed nest boxes in 2021 and 2022. One Eastern Pygmy-possum was found in a pitfall trap at North Swamp during this survey. The loss of extensive Banksia stands has impacted habitat availability, and it is expected to take years for new seedlings to mature and provide the necessary floral resources for pygmy possums and honeyeaters.

A 2020 Australian Birdlife report indicated that 36 bird species lost more than 25% of their known habitat due to the 2019/20 bushfires. Of these, 22 have been recorded on or near the Newnes Plateau over the past 15 years, with eight observed in the Angus Place Combined Area in spring 2024, including the Eastern Whipbird, Gang-gang Cockatoo, Pilotbird, Red-browed Treecreeper, Superb Lyrebird, Variegated Fairy-wren, White-throated Treecreeper, and Wonga Pigeon. The Wonga Pigeon is noted to be rarely seen on the Plateau.

Annual differences in fauna trends can be linked to climate variability and fire impacts. While survey methodology and effort have remained consistent since 2014, periods of low rainfall preceded the extensive 2019/20 fires, followed by flooding in 2021 and 2022. The 2019 fire continues to be the primary driver of habitat change and shifts in species diversity in the Angus Place Combined Area.

6.6.6 Persoonia hindii Research Project

Persoonia hindii (P. hindii) is classified as Endangered under the Biodiversity Conservation Act 2016 (BC Act). According to Schedule 3, Condition 24A (e) and (h) of MP06_0021, a research and monitoring program for P. hindii must be developed for the Angus Place East (APE) ventilation shaft facility.

In September 2016, the Australian Coal Administration Research Program (ACARP) agreed to provide strategic funding to the Royal Botanical Garden and Domain Trust (RBG&DT). This funding aims to incorporate high-interest native Persoonia species of concern into mine site restoration programs through propagation, translocation, and field re-introduction efforts. The program aims to identify best practices for germinating and propagating P. hindii to facilitate its translocation back into the environment.

The WR-BOS proposed that suitable habitats, which do not currently contain P. hindii, be utilised by the RBG&DT relocation program. The goal is to return propagated P. hindii to the Newnes Plateau. The ACARP program concluded in March 2024 and finding are summaries in the below paragraphs, the full report can be found on Centennial website;

To enhance the success of translocation and mitigate climate risks the study found plant populations should be established at multiple sites and during different seasons. Ongoing propagation in nurseries is essential to maintain genetic diversity. Species distribution models can help predict future climate conditions and identify suitable restoration areas. Effective site selection is crucial and must consider factors such as soil type, vegetation communities, pathogen presence, pollinator availability, and long-term site management.

Further the study found collecting P. hindii from multiple sites ensures a broader genetic base for resilience. The species is more successfully propagated from cuttings. To maximize viability, seeds should be allowed to fully mature on the parent plant before collection, and seed storage techniques should be refined to enhance longevity.

Pre-planting strategies should include genetic assessments and pre-conditioning plants to withstand environmental stressors, improving survival rates. When planting, seedlings should be placed in areas with partial canopy shade and minimal competition, ensuring good root-to-soil contact and immediate watering. Protective measures, such as fencing or steel mesh guards, can help prevent herbivory.

Following planting, regular monitoring over 5 to 10 years is essential, ideally until natural seed recruitment occurs. Declining populations should be supplemented with genetically diverse plant material to enhance resilience. Hand-pollination may also be beneficial to promote outcrossing and improve seed production.

This research significantly advances ecological restoration practices by providing practical, science-based guidelines for the conservation and translocation of threatened Persoonia species. The findings highlight the importance of long-term planning, the preservation of genetic diversity, and climate-adaptive conservation strategies to ensure the survival and sustainability of these ecologically valuable species.

6.6.7 Aquatic Ecology

Monitoring of aquatic ecology is undertaken in accordance with Section 4.7.2 of the Angus Place Water Management Plan and the 900W 910 Environmental Monitoring Program. Also, as part of the Upper Coxs River Catchment (*UCRC) Aquatic Ecology Monitoring Program* (AEMP) and the UCRAMP.

Aquatic Ecology monitoring outlined in the FFMP (2014)[16] has been deferred in favour of that outlined in the Angus Place Water Management Plan (2021). Sites on the Newnes Plateau are outside of areas of Angus Place mining influence.

Aquatic ecology monitoring was conducted in waterways associated with Angus Place to determine whether operations have influenced the health of aquatic biota in 2024. Macroinvertebrate samples were collected by GHD in autumn 2024 (29/04/2024-02/05/2024) and spring 2024 (14/10/2024-18/10/2024). Water and sediment quality were tested in conjunction with macroinvertebrate monitoring.

A summary of 2024 monitoring results at focus sites, Kangaroo Creek and Coxs River LDP2 are provided below. Monitoring locations are shown on **Figure 6-12:**

At Kangaroo Creek sites in autumn 2024, taxa richness (i.e. diversity) was slightly higher (one additional taxon in both replicates) at historical impact site KCdn than at background site KC1 (**Figure 6-6**). In spring 2024, taxa richness was slightly higher at both sites than the autumn 2024 results, with results similar between the two sites (17 and 18 taxa at KC1, 17 and 19 taxa at KCdn). All Kangaroo Creek taxa richness results were above the long term KC1 median. EPT richness results in autumn 2024 were equal in both replicates from background site KC1 and one replicate from historical impact site KCdn with three EPT taxa collected, while five EPT taxa were collected from the second replicate from KCdn (**Figure 6-7**).

In spring 2024, EPT richness was overall slightly higher at background site KC1(five and four EPT taxa) compared to KCdn (three and four EPT taxa). All EPT richness results were equal to or higher than the long-term median in all Kangaroo Creek samples in 2024. Plecoptera (stoneflies) were collected in only one replicate from KCdn in autumn 2024, and from all but one replicate from KCdn in spring 2024. In other words, stoneflies were more commonly collected in spring 2024. Ephemeroptera (mayflies) and Trichopter (caddisflies) were collected from all Kangaroo Creek samples in 2024. SIGNAL-2 results in autumn 2024 were higher at background site KC1 than historical impact site KCdn (**Figure 6-8**).

In spring 2024, SIGNAL-2 scores were much higher at KCdn than the autumn 2024 results, and results were within the range of scores observed at KC1. Results at KC1 were mostly similar between the sampling events, although the result in the second replicate from KC1 in spring 2024 was lower. The SIGNAL-2 scores of all Kangaroo Creek macroinvertebrate samples in 2024 were above the long-term KC1 median. Water quality at Kangaroo Creek historical impact site KCdn was generally good in 2024, with no toxicants observed in concentrations that are likely to have biological effects on aquatic species (i.e. no DGV exceedances). Concentrations of dissolved cobalt and zinc (autumn and spring 2024), aluminium (autumn 2024 only) and chromium (spring 2024 only), however, were elevated above the DGVs at background site KC1.

As these elevated metals were only observed upstream of Angus Place, they are not attribute to Angus Place operations and are instead likely reflective of the natural lithology of the Kangaroo Creek catchment. These elevated dissolved metals concentrations may have impacted the macroinvertebrate community at KC1 in 2024, as the DGV represents the concentration above which there is an increased risk of adverse impacts to aquatic species (ANZG 2018). However, as discussed, most macroinvertebrate metric results at both sites were higher than the long-term medians, indicating that the macroinvertebrate community was generally in good condition in 2024 compared to historical events. There were no exceedances of any sediment quality DGV (ANZG 2019) at background site KC1 or historical impact site KCdn during the autumn or spring 2024 aquatic ecology monitoring

[16] It is noted that the FFMP will be superseded by the WR-BMP once approved. The aquatic ecology monitoring requirements outlined in the WMP are more relevant to current operations than the monitoring outlined in the FFMP.

events, and consequently, no impacts to macroinvertebrates expected in 2024 due to sediment quality.

The macroinvertebrate community health in the Coxs River at CR2, downstream of Angus Place LDP2 discharges and the Kangaroo Creek confluence, was in a generally similar condition to background site CR1, and better condition than background site CR0, based on the macroinvertebrate metrics (**Figure 6-9** to **Figure 6-11**). There was variability in the taxa richness observed at CR2 in spring 2024, with a difference of five taxa observed between the replicates. This variability of taxa richness between replicates suggests intra-site variability in aquatic habitats, rather than any impact due to water or sediment quality. All results for EPT richness and SIGNAL-2 at CR2 in 2024 were above the long-term median, although taxa richness results were lower than the median in all replicates except one sample collected in spring 2024, however, as mentioned, a similar impairment in taxa richness was observed at the background sites in 2024.

Water and sediment quality were both good at CR2 in autumn and spring 2024, with no exceedance of any water quality toxicant DGV, or sediment quality DGV, and concentrations of all parameters similar to those observed at background site CR1. Consequently, Angus Place LDP2 discharges do not appear to have had a notable influence on water quality in the Coxs River in 2024.

Overall, the results of 2024 aquatic ecology monitoring indicate that the macroinvertebrate community of Kangaroo Creek (and the decommissioned LDP1) and the Coxs River downstream of LDP2 were in a generally good condition, with similar results for all metrics observed between the historical impact (KCdn) and impact sites (CR2) compared to the background sites (KC1 and CR1). Given the high sensitivity of the macroinvertebrate community (as indicated by the high EPT richness and SIGNAL-2 results) at CR7 relative to the background sites, there is no evidence of cumulative impacts from the Centennial operations on aquatic ecosystem health of the UCRC.

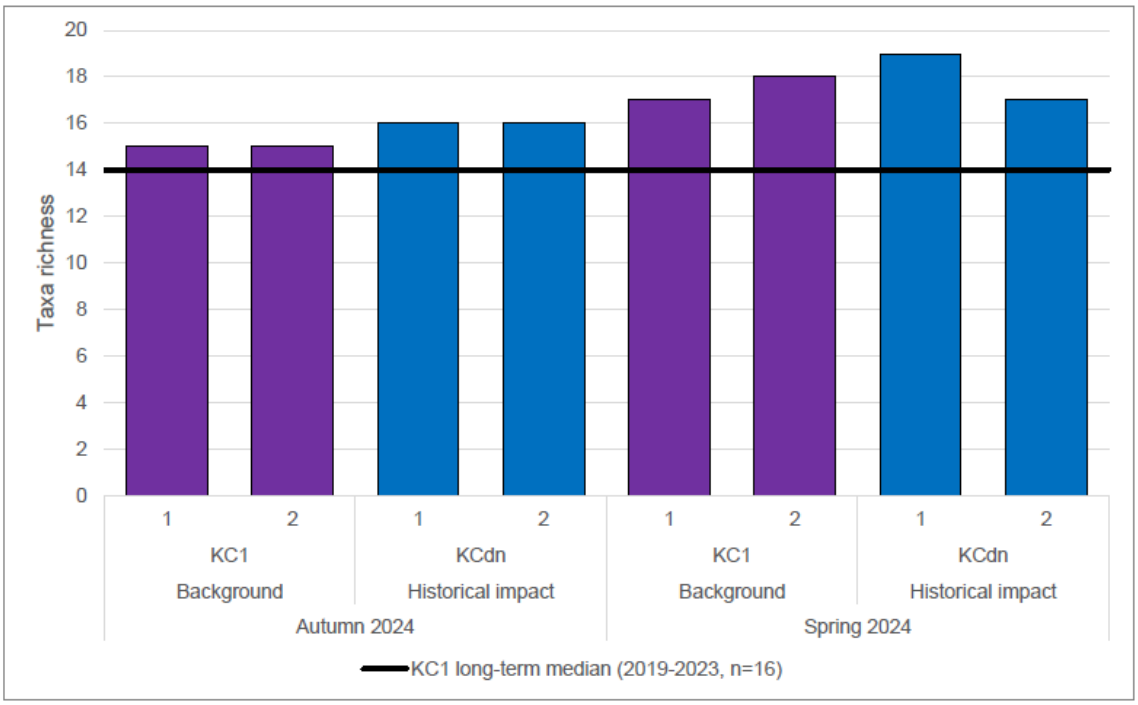

Figure 6-6: Tax richness in Kangaroo Creek samples (2024)

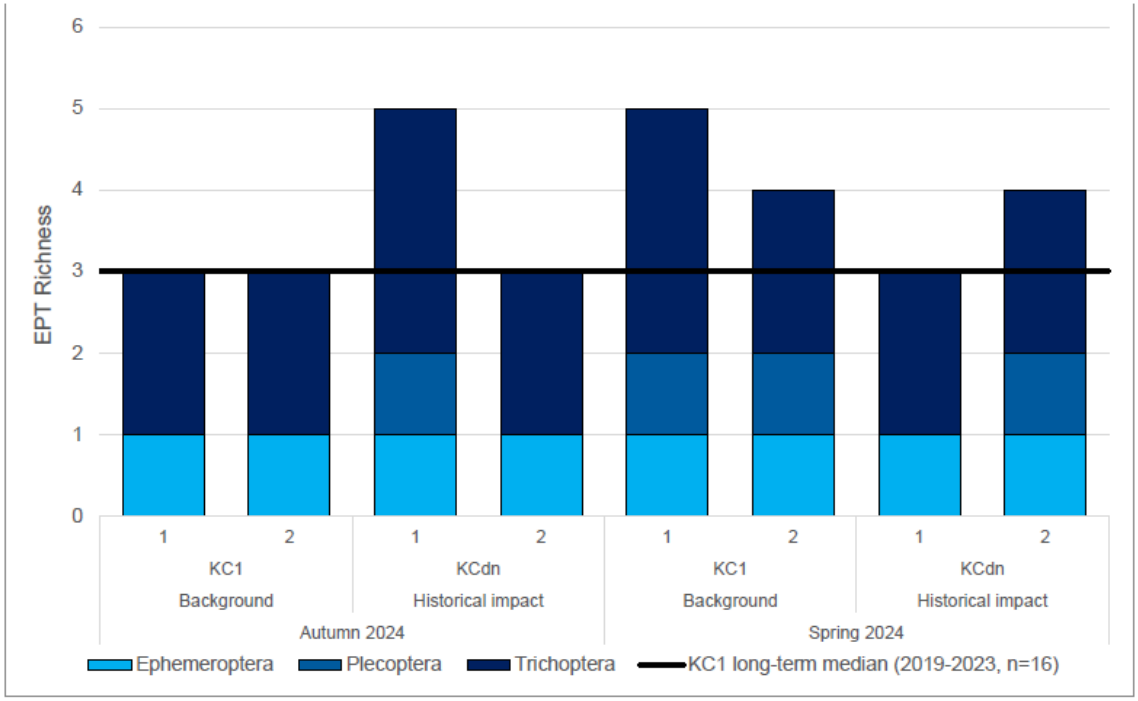

Figure 6-7: EPT richness in Kangaroo Creek samples (2024)

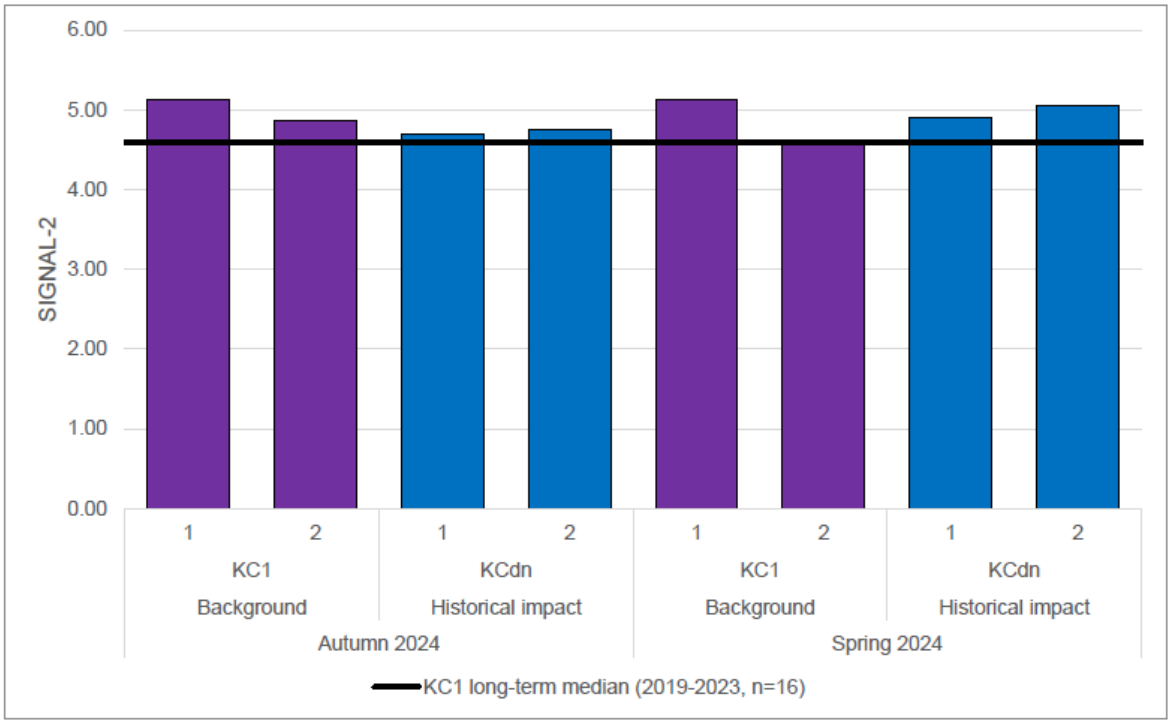

Figure 6-8: Signal-2 results in Kangaroo Creek samples (2024)

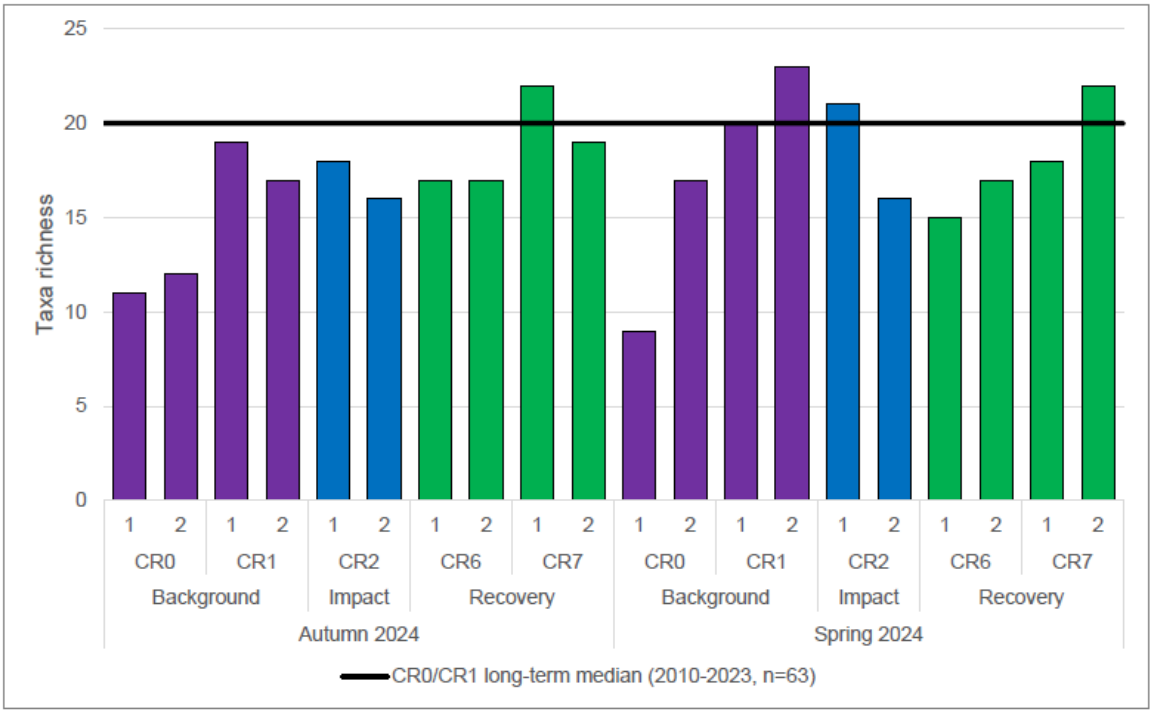

Figure 6-9: Taxa richness in Coxs River samples (2024)

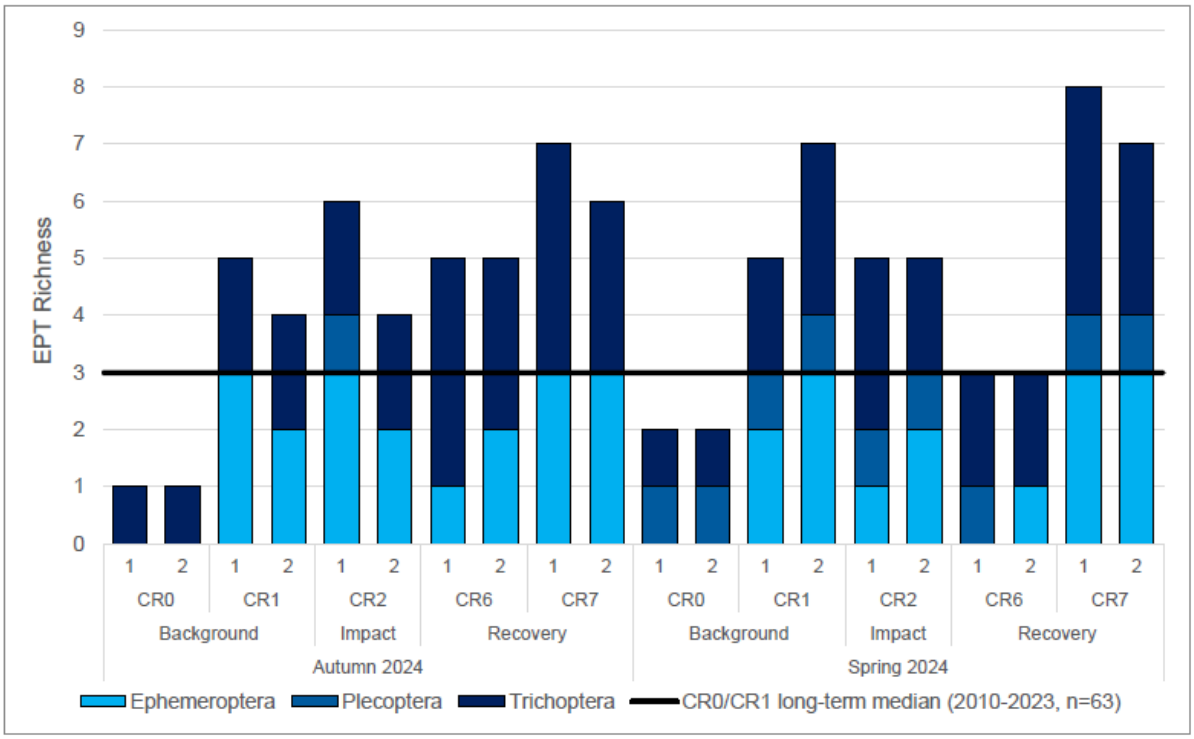

Figure 6-10: EPT richness in Coxs River samples (2024)

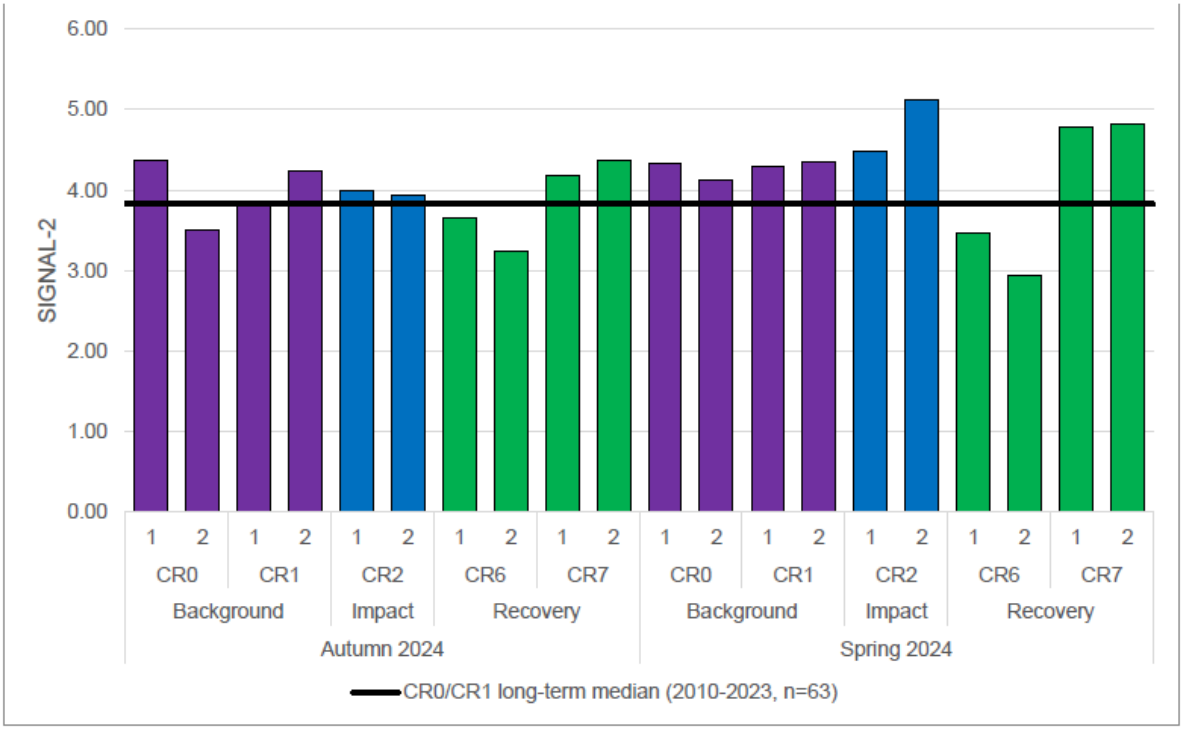

Figure 6-11: Signal-2 results in Coxs River samples (2024)

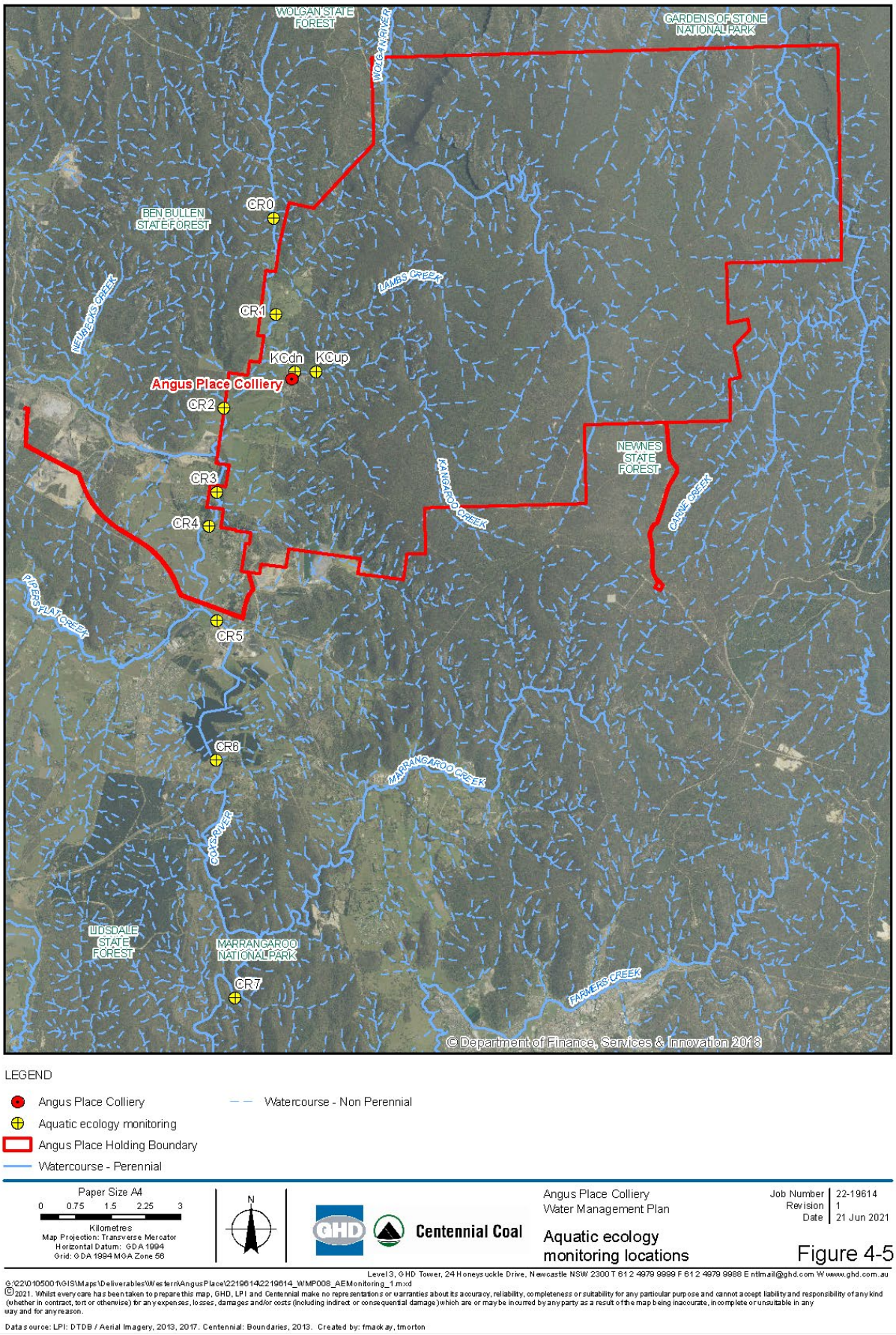

Figure 6-12: Aquatic Ecology Monitoring Program

6.6.8 Comparisons against Predictions and Performance Measures

A comparison of 2024 performance monitoring against predictions of the approved project and performance measures of MP06_0021 is summarised in **Table 6-1** at the start of **Section 6**.

Monitoring undertaken during the 2024 reporting period was compliant with both predictions and performance measures of the consent.

6.6.9 Long Term Analysis

Historical performance by previous mining activities in areas prior to the current EP Area (LW900W and 910) have been reported in past annual reviews available on the Angus Place website.

Table 6-12 summarises biodiversity compliance reporting over the last five Annual Review reporting periods. Since 2020, monitoring reported in Annual Reviews for Angus Place has identified no instances of technical non-compliance events related to biodiversity.

Table 6-12: Biodiversity Compliance 2020-2024

Aspect	Annual Review Reporting Period				
	2020	2021	2022	2023	2024
Biodiversity-related reported non-compliances (NC)[1]	0	0	0	0	0

Notes: 1 excluding administrative-related aspects (i.e. technical non-compliances).

Any mining related impacts on biodiversity that may have occurred since commencement of care and maintenance in 2015 have been overshadowed by the effects of extreme climate factors. Drought in 2018 and 2019, the Gosper's Mountain mega blaze bushfire in 2019 - 2020 and subsequent above average rainfall throughout 2024.

Previous impacts from subsidence and historical mine water discharges may be related to specific biodiversity observations in recent times.

6.6.10 Implemented / Proposed Improvements

The following measures are being considered by Angus Place for improvement:

- A review of monitoring requirements for biodiversity will be undertaken to consider consent obligations to monitor for specific timeframes as well as focusing on current and proposed mining activity.

6.6.11 Biodiversity Offsets

Angus Place manages biodiversity offsets in accordance with the *Western Region Biodiversity Offset Strategy (WR-BOS)* to address Condition 24B of MP06_0021 associated with surface disturbance requirements for the No2 Ventilation Fan (MOD2 MP06_0021).

Version 8 of the WR-BOS (Nov 2020) was approved by DPIE (now DPHI) on 27 January 2021.

The WR-BOS was prepared to offset 12.36ha of surface disturbance associated with the Angus Place Ventilation Facility, satisfying Condition 24B (Schedule 3) of MP06_0021. In November 2023 the *Persoonia Hindii* Identification Report was submitted to DPHI which indicated that 667 individuals were recorded within the project area equating to 4669 species

credits. This satisfies the MP06_0021 MOD2 offset in accordance with Schedule 3, Condition 24B.

6.7 HERITAGE

6.7.1 Environmental Management

During the reporting period, heritage at Angus Place was:

- Compliant with Schedule 3, Condition 3 of MP06_0021;
- Managed and monitored in accordance with the WRACHMP and the WRHHMP;
- Managed and monitored in accordance with the *Longwalls 900W and 910 Heritage Management Plan* (part of the Longwalls 900W and 910 Extraction Plan); and
- Managed and monitored in accordance with the LW930-980 SMP and supporting component plans.

As the heritage monitoring program associated with the *Longwalls 900W and 910 Heritage Management Plan* is specific to the extraction of Longwall 900W and the mine is currently in care and maintenance (with LW910 being unmined to date), there has been no heritage monitoring required during the reporting period. The extraction plan related to LW910 has expired and there are no specific plans to extract the area in proposed workings for Angus Place.

Following extensive bushfires over the 2019/2020 summer period, in 2021 Centennial commissioned a post bushfire cultural heritage assessment. Some sites were affected by bushfire activity and long-term management arrangements for these sites were discussed with the Registered Aboriginal Parties (RAPs) at a 2021 RAP meeting. Further management by the RAPs was not deemed to be required by attending parties. There has been no change to this during the 2024 reporting period.

6.8 MINE SUBSIDENCE

Angus Place completed secondary extraction of the longwall panel 900W on 15 February 2015 and the mine was placed into care and maintenance on 28 March 2015. The extraction plan for LW900W and LW910 expired in 2021. No mining was undertaken at Angus Place while in care and maintenance.

Subsidence monitoring surveys are no longer required to be undertaken due to the time since longwall extraction occurred and accordingly was not undertaken during the 2024 period.

Monitoring requirements for subsidence are outlined in the following subsidence management plans in **Table 6-13**.

Table 6-13: Summary of Previous Subsidence Management Plan Approvals

Subsidence Management Plan	Mining Area	Approved	Complete
SMP Approval 04/1675	Longwalls 930-980	9 December 2005	26 December 2013
SMP Approval OUT 14/10918	Longwalls 900W and 910	8 April 2014	900W 15 February 2015

6.8.1 Environmental Performance

Subsidence performance measures specifically relevant to *subsidence impacts* are prescribed within Tables 1A and 1B of Condition 3, Schedule 3 in MP06_0021. These are applicable to all areas mined since approval of MOD1 MP06_0021 on 29 August 2011. Performance was satisfactory during the reporting period.

6.9 WASTE

6.9.1 Environmental Management

Waste minimisation and management at Angus Place is monitored and reported per Condition 32, Schedule 3 of MP06_0021. Waste is managed per relevant regulatory requirements including the POEO Act, the *NSW EPA Waste Classification Guidelines* the *NSW Waste Avoidance and Resource Recovery Act 2001* and the *Waste Management and Resource Recovery Regulations 2017*.

As the site is currently in care and maintenance, waste generated at Angus Place during the 2024 reporting period was related to maintenance and servicing of the small fleet of vehicles, the essential plant and equipment to maintain the mine, clean-up of scrap metal, archive management and IT equipment upgrades. The site hosts several group level staff and has a small office-based workforce not related to specific mining operations.

General waste is separated for recycling and non-recyclables are disposed of to landfill by licensed waste contractors. Recyclable materials, such as plastic, paper and cardboard products, are recovered whenever possible and reported as noted further below.

Some contaminated soil from spill containment and waste oil has been removed from the site by relevant licensed contractors. No washery tailings or coarse/fine reject material is generated at the site.

Sewage and other wastewater from surface facilities is treated onsite and managed per the Angus Place WMP. On-site sewage treatment is designed to discharge treated effluent via irrigation areas as LDP005 under EPL 467. During care and maintenance, the volume of sewage generated is significantly lower than the design capacity of the sewage treatment system. In 2019, a bushfire damaged the power supply to the irrigation pumps and monitoring systems and destroyed the irrigation system. Repairs to this system have not been made due to the low volume of sewage to manage.

During the 2024 reporting period, no effluent discharges for land irrigation were required/undertaken.

6.9.2 Environmental Performance

Table 6-14 provides a summary of the general waste produced, recycled, and disposed of during the reporting period.

During the reporting period, 23.437 tonnes (51.91%) of waste was recycled, primarily including steel, oily water, paper and cardboard, oil filters, and empty drums. This is a decrease to recycling amounts in recent years (e.g., in 2023 182.447 tonnes were recycled due to a clean-up campaign of the site).

Table 6-14: Non-Production Waste Recycling and Disposal (last five reporting years)

Waste Generation (tonnes)	Annual Review Reporting Period				
	2020	2021	2022	2023	2024
Recycled (Hazardous) (e.g. Waste Oil, Waste, Grease)	4.484	3.138	1.598	1.258	14.512
Recycled (Non-Hazardous) (e.g. Steel, Paper & Cardboard) tonnes)	15.988	0.510	59.670	181.189	8.925
Hazardous Disposal (Oily Rags / tonnes)	0.996	0.190	2.536	0.578	0
Non-Hazardous Disposal (Mixed Solid Waste / tonnes)	26.030	14.990	43.340	27.028	21.714
TOTAL WASTE (OFFSITE) (tonnes)	**47.498**	**18.828**	**107.144**	**210.053**	**45.151**
TOTAL RECYCLED WASTE (tonnes)	**20.472**	**3.648**	**61.268**	**182.447**	**23.437**
PERCENTAGE WASTE RECYCLED	**43.10%**	**19.38%**	**57.18%**	**86.86%**	**51.91%**

6.9.3 Comparisons against Predictions

Waste management predictions/measures described in the EA/modifications and 2024 performance against these are summarised in **Table 6-15.**

Table 6-15: Summary of Waste Management Predictions and Performance (2024)

Prediction	Performance
Angus Place Colliery will implement a waste-free site (vent fan operations). i.e. all waste must be removed from the site during the operational phase. As appropriate, it will then be separated, and classified *(Source: MOD2 EA, RPS 2012)*	• No waste was generated on site at the vent facility.
There will be preventative measures to ensure controlled use of liquids (Vent Fan operations). All	• No use of liquids except diesel fuel for one pump on site at vent facility.

Prediction	Performance
chemicals including oils, drilling muds, etc will be on self-bunded storage pallets. *(Source: MOD2 EA, RPS 2012)*	

6.9.4 Long Term Analysis

Waste disposal and recycling for the last five (5) reporting periods are summarised in **Table 6-14**.

As the site is currently in care and maintenance, waste generated at Angus Place is variable.

6.10 OTHER MATTERS

6.10.1 Bushfires

There were no bushfires in the vicinity of the approval area during the reporting period.

7 WATER MANAGEMENT

Angus Place Colliery manages and monitors water in accordance with the *Angus Place Water Management Plan (WMP)* (Rev 2, 2021), approved by DPHI on 30 July 2021. The WMP addresses the requirements of the project approval as outlined in Schedule 3, Condition 8 and has been developed to:

- Ensure effective and structured monitoring of surface water resources.
- Ensure that water leaving the site meets the appropriate quality standards outlined in EPL 467.

During the reporting period, Angus Place operated the water management system in accordance with the WMP. Monitoring and data review was undertaken in accordance with the WMP, project approval MP06_0021 and Environmental Protection Licence 467 requirements.

A summary of water management and performance in the reporting period is provided in the following sections, including:

- **Section 7.1** – Details of water licensing and associated take
- **Section 7.2**– A summary of the site water balance
- **Section 7.3**– A summary of surface water monitoring results for the reporting period
- **Section 7.4** – A summary of groundwater monitoring results for the reporting period

Detailed surface water and groundwater monitoring results for the reporting period are provided in **Appendix 2**.

7.1 WATER LICENSES

Water access licences (WALs) under the *Water Management Act 2000* for the extraction of groundwater, are managed collectively across Angus Place Colliery, Springvale Mine and Clarence Colliery. Angus Place Colliery specifically holds five water access licences totalling 3367.8 ML/year.

Table 7-1 provides a summary of water take and available water under water access licences for the water year ending during the reporting period 1 July 2023 to 30 June 2024 (not the calendar year).

Table 7-1: Water Licenses and Take

Licence	Works Approvals	Water sharing plan, source and management zone	Entitlement (ML)	Passive Take/Inflow (ML)	Active Pumping (ML)	TOTAL (ML)
WAL41881	10WA122774 10WA118748	Greater Metropolitan Region Groundwater Sources	1,471	0	844.8	793.23
WAL36445	10WA118748	Sydney Basin Coxs River Groundwater Source	2,701	0	0	0
WAL37340	No Attached Works Approval		329	0	0	0
WAL36449	10WA118750 10WA118719	Greater Metropolitan Region Groundwater Sources	2,523	0	2523	2523

Licence	Works Approvals	Water sharing plan, source and management zone	Entitlement (ML)	Passive Take/Inflow (ML)	Active Pumping (ML)	TOTAL (ML)
WAL37343	No Attached Works Approval	Sydney Basin Richmond groundwater source	35	0	0	0
Total			**7,059**	**0**	**3367.8**	**3367.8**

Notes: Volume is reported in megalitres (ML).

On 1 July 2023, the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 commenced. As a result, The Sydney Basin Richmond Groundwater Source and Sydney Basin Coxs River Groundwater Source have been amalgamated to reflect their connectivity, now named the Sydney Basin West Groundwater Source.

Centennial submitted Water Supply Works Approvals on 28 October 2024 in this newly formed groundwater source however at the time of report preparation these approvals were still under assessment.

Centennial's compliance with the extraction limits for the new Sydney Basin West Groundwater source is shown in **Table 7-2**.

Table 7-2: Water Licenses and Take under new Groundwater Sources

Groundwater source	Total WAL volume (ML/Annum)	2023/24 Water Take (ML/Annum
Sydney Basin Richmond Groundwater Source - Angus Place - Springvale - Clarence	15,139 ML/Annum	20, 203.3[1] ML/Annum
Sydney Basin Cox's River Groundwater Source - Angus Place - Springvale - Clarence	9,152 ML/Annum	2,424.8ML/Annum
Sydney Basin West Ground water source - **Angus Place** - **Springvale** - **Clarence**	**24,629 ML/Annum**	**22,628.1 ML/Annum (-2000.9 ML)**

Note: [1] Springvale exceeded its extraction limits in 2023/24 for the Richmond groundwater source while remaining significantly under our extraction limit for the Coxs River groundwater source. Additional information can be found in Section 11 of the Springvale Annual Review.

7.2 WATER BALANCE

A site water balance model for Angus Place was developed to quantify transfers within the site under existing and future operational conditions using various rainfall patterns.

A summary of the average annual inputs and outputs for the Angus Place Colliery pit top water management system is provided in **Table 7-3**. The site water balance shows that, on average, water balance modelling predicts that inputs are almost entirely comprised of groundwater inflows. Groundwater can be stored in extracted workings which are dewatered

and transferred to the Springvale Water Treatment Facility (SWTF) or Pond D at the MPPS. A relatively small volume of surface catchment runoff from the pit top is discharged through LDP002.

In 2024, the total water inputs amounted to 3,964.3 ML/year, with the majority (3,879.6 ML) coming from groundwater inflows. Total outputs were 3,302.6 ML/year, primarily due to the transfer of 2,367.7 ML to the SWTP. A net increase of 661.9 ML was observed in underground water storage, while surface water storage remained unchanged. The overall water balance showed a minor deficit of -2.4 ML, indicating that inputs, outputs, and storage changes were nearly balanced. The data highlights the significant role of groundwater inflows in the system and the predominant reliance on transfers to SWTP for water management.

Table 7-3: Annual Water Balance – Average Annual Volumes (WMP, 2021)

Water Flow	Average Annual Volume (ML/year)	2024 Annual Volume (ML/year)
Inputs		
Direct rainfall onto storage and catchment runoff	116	82.6
Potable Water Supply	2	2.1
Groundwater inflows into underground workings	2166	3879.6
Total Inputs	**2284**	**3964.3**
Outputs		
Evaporation	20	17.6
Discharge through LDP002	22	49.2
Discharge through LDP003	34	17.5
Discharge through LDP005	1	1.0
Transfer to SDWTS	0	17.5
Transfer to SWTP	1428	2367.7
Transfer to Pond D	657 (Avg. 1.8ML/day)	848.3
Transfer from the ventilation facility at Springvale Mine	33	0
Losses from operations	1	2.38
Total Outputs	**2196**	**3302.6**
Change in Storage		
Surface water storages	88	0
Underground water storages	88	661.9
Total Change in Storages	**-**	**661.9**
Water Balance		
Change in water inventory (inputs – outputs – change in storage)	**0**	**-2.4**

7.3 SURFACE WATER

7.3.1 Environmental Management

Surface water monitoring is undertaken in accordance with the *Angus Place Water Management Plan* (WMP, 2021) (WMP), Development Consent MP06_0021, and Environment Protection Licence 467 requirements.

Surface water monitoring includes 24 sites, encompassing:

- **Discharge** surface water quality, measured at two monitoring locations.
- **Watercourse** surface water quality and flow rate, measured at fourteen monitoring locations.
- **Pit top** surface water quality, measured at three monitoring locations.
- **Swamp** surface water quality and flow rate, measured at five monitoring locations.

Surface water flow and quality data is collected at either weekly, fortnightly, or monthly. The surface water monitoring sites are described in **Table 7-4** and shown on **Figure 7-1**.

Table 7-4: Description of Surface Water Monitoring Locations

Monitoring Point	Description
Licenced Discharge Points	
LDP002	Discharge of surface water from facilities into the Coxs River through the Settling Ponds.
LDP003	Discharge of surface water from the Kerosene Vale Stockpile Area via a sediment dam and settling pond. LDP003 is managed by Angus Place, however under the Western Coal Services (WCS) consent. The results have been included in the WCS Annual Review.
Pit Top Surface Water	
Carpark Culvert	Dirty water drain prior to entering the Settling Ponds.
South Sediment Dam (Entrance Pond)	Sediment pond at the ventilation facility on Newnes Plateau.
South Sediment Dam (Entrance Pond Discharge Point)	Entrance Pond discharge.
Watercourses	
Bungleboori	Comparative Newnes Plateau water course monitored when Entrance Pond is discharging.
Coxs River Far U/S	Coxs River located approximately 600 m upstream of confluence with Lambs Creek.
Coxs River U/S	Coxs River located approximately 1 km upstream of confluence with Kangaroo Creek.
Cox River D/S	Coxs River located approximately 600 m downstream of confluence with Kangaroo Creek.
Lambs Creek	Lambs Creek located approximately 2 km upstream of confluence with Coxs River.
Long Swamp U/S	Coxs River in Long Swamp, immediately upstream of the confluence

Monitoring Point	Description
	with Kangaroo Creek.
Kangaroo Creek U/S (AP)	Kangaroo Creek located approximately 500 m upstream of discharges from former LDP001.
Kangaroo Creek D/S (AP)	Kangaroo Creek located approximately 200 m downstream of discharges from former LDP001.
Kangaroo Creek U/S (NP)	Located in the upper reaches of Kangaroo Creek on the Newnes Plateau.
Kangaroo Creek D/S (NP)	Kangaroo Creek located on Newnes Plateau approximately 2 km downstream of Kangaroo Creek U/S (NP).
KC/CR Confluence	Located at the confluence of the Coxs River and Kangaroo Creek.
Wolgan River (Spanish Steps)	Located on the Wolgan River upstream of any potential seepage from the 800 District.
Wolgan River (Wolgan Property)	Located on the Wolgan River downstream of any potential seepage from the 800 District.
Swamps	
Narrow Swamp U/S	Upper reaches of Narrow Swamp.
Narrow Swamp D/S	Lower reaches of Narrow Swamp.
Star Picket	Swamp monitoring.
Tri Star Swamp	Swamp monitoring.
Twin Gully Swamp	Swamp monitoring.
Other	
LDP005	Pond 4 of Sewage Treatment Ponds (STP) feeding to the irrigation area (discharge to utilisation area)

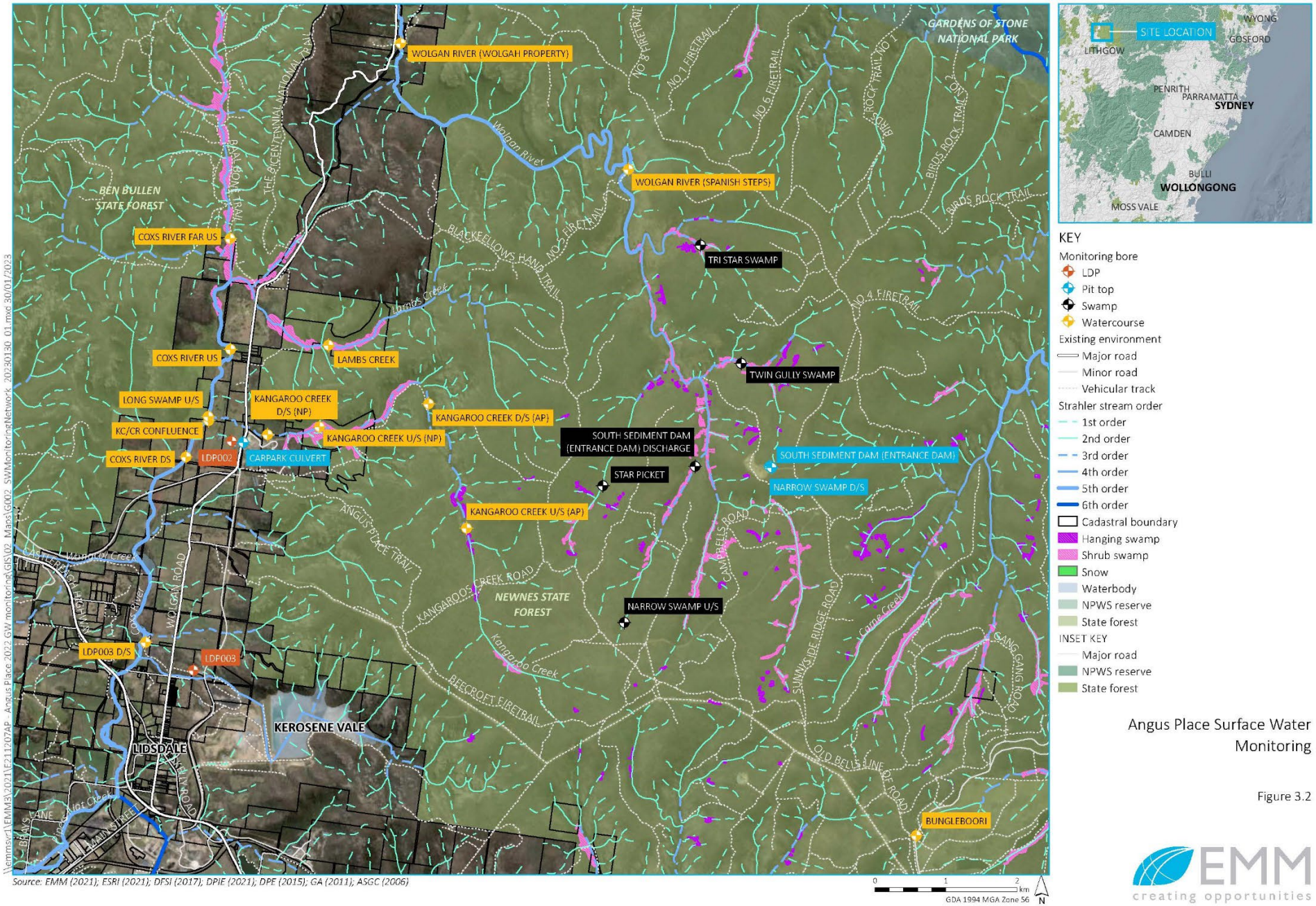

Figure 7-1: Surface Water Monitoring Locations

7.3.2 Environmental Performance

The following subsections summarises surface water monitoring observations for the reporting period. Surface water quality data has been compared to the historical observations and the WMP trigger values for the licensed discharge points (LDP) and relevant watercourse sites.

Discharge Water Monitoring

Angus Place Colliery holds EPL467, with water currently licensed to be discharged from the site through LDP002 and LDP003. Water quality recorded during the reporting period is summarised in **Table 7-5** (LDP002). While LDP003 is included within the Angus Place EPL, it falls under the WCS Consent. The results for LDP003 have been included in the WCS Annual Review.

In accordance with EPL467 condition L2.5, the limits specified in L2.4 do not apply when the discharge occurs within 5 days after a rainfall event measured at 44mm over five consecutive days. Detailed monthly surface water monitoring results for the reporting period are provided in **Appendix 2**.

Table 7-5: LDP002 Water Quality Summary

Analyte	No. of Samples Collected and Analysed	Lowest Sample Value	Mean of Sample	Highest Sample Value	EPL467 100 Percentile Concentration Limit
Oil & Grease (mg/L)	11	LOR	LOR	LOR	10
pH	11	6.6	7.5	8.3	6.5 – 9.0[(A)]
Total Suspended Solids (mg/L)	11	6.0	60.3[(B)]	164[(B)]	30
Turbidity (NTU)	11	4.4	12.4	140[(B)]	40
Conductivity (µS/cm)	11	196	255	328	NS

Notes: NS = Not specified, [(A)] 90th percentile concentration limit of 6.5-8.5 also applies to LDP002 [(B)] In accordance with EPL 467 condition L2.5 the limits specified in L2.4 do not apply when the discharge occurs within 5 days after a rainfall event measured at 44mm over five consecutive days

Condition L2.5 applied for LDP002 on the following occasions:

- 5/01/2024: LDP002 TSS=72mg/L and NTU=140 following 60mm in the preceding 5 days.

A discharge from LDP002 on 11 December exceeded the Total Suspended Solids (TSS) Limit, with a TSS of 59 mg/L. Additional information is provided in **Section 11**.

Watercourse Surface Water Monitoring

The water quality monitoring network for surface watercourses comprises of fourteen monitoring locations as specified within the WMP and summarised in **Table 7-6**. Surface water quality is monitored at the downstream watercourse sites KC/CR Confluence and Coxs River D/S.

Surface water quality data is assessed against Site-Specific Guideline Values (SSGVs), which were based on a review of ANZECC (2000) DGVs.

Surface water quality results is summarised in **Table 7-6** for sites KC/CR confluence and Coxs River D/S, assessed against SSGVs.

Three lower bound pH exceedances for Coxs River D/S were observed in May (6.0) and June (5.6). Both exceedances are due to natural variability.

Table 7-6: Watercourse Surface Water Quality and Flow Rate Summary

Monitoring Location	Surface water quality trends during the reporting period
Bungleboori	No data was available during the reporting period as water course was dry.
Coxs River Far U/S	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. No TSS or flow rate data was available during the reporting period.
Coxs River U/S	EC remained stable, while pH fluctuated, consistent with historical observations. No TSS or flow rate data was available during the reporting period.
Coxs River D/S	EC remained stable. pH fluctuated, consistent with historical observations, except for two lower bound pH triggers were recorded in February (5.8) and May (6.0), but since they did not occur consecutively, they did not exceed the criteria with EPL 467 found on the Centennial website. Three TSS triggers were recorded in April (26 mg/L), August (65 mg/L) and November (25 mg/L), but since they did not occur consecutively, they did not exceed the criteria. No flow data was available during the reporting period.
Kangaroo Creek D/S (AP)	EC and TSS remained stable, while pH displayed a fluctuating trend consistent with historical observations. Only one reading for flow rate due to low flow conditions.
Kangaroo Creek D/S (NP)	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. TSS was stable, except for two fluctuations that are consistent with historical observations. Only one reading for flow rate due to low flow conditions.
Kangaroo Creek U/S (AP)	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. TSS was stable, except for one fluctuation that is consistent with historical observations. Only one reading for flow rate due to low flow conditions.
Kangaroo Creek U/S (NP)	No data was available during the reporting period due to dry conditions.
KC/CR Confluence	EC and TSS remained stable, while pH fluctuated consistent with historical observations, except For two pH values below the lower bound trigger were recorded in May (6.0 pH) and June (5.6pH), both of which exceeded the trigger thresholds. The trend did not continue for the remainder of the reporting period. TSS levels surpassed the criteria in March (66 mg/L) and November (63 mg/L), but since they did not occur consecutively, they did not exceed the criteria EPL 467 found on the Centennial website. No flow data was available for the reporting period.

Monitoring Location	Surface water quality trends during the reporting period
Lambs Creek	EC and TSS remained stable. pH displayed a fluctuating trend consistent with historical observations. No flow data was available during the reporting period due to no flow conditions. Data gaps due to no access to sites.
Long Swamp U/S	EC and pH fluctuated, both consistent with historical observations. One large spike in TSS was observed in November (588 mg/L), which was greater than historical observations. No flow data was available during the reporting period.
Wolgan River (Spanish Steps)	EC and TSS remained stable. pH fluctuated consistent with historical observations. No flow data was available during the reporting period. Data gaps present due to site access restrictions.
Wolgan River (Wolgah Property)	EC, TSS and flow rate remained stable. pH fluctuated, consistent with historical observations.

Pit Top Surface Water Monitoring

The Pittop surface water quality monitoring network comprises three monitoring locations. It should be noted that the WMP (GHD 2021) does not apply any trigger criteria to the monitoring locations.

During the reporting period, EC, pH and TSS remained relatively consistent with historical observations. A summary of key observations and trends found during the reporting period are presented in **Table 7-7**.

Table 7-7: Pit Top Surface Water Quality Summary

Monitoring Location	Surface water quality trends during the reporting period
Carpark Culvert	pH and TSS have remained constant with historic observations
South Sediment Dam (Entrance Dam)	EC and TSS remained relatively stable. pH fluctuated consistently with historical observations. Data not available from August onwards in the reporting period.
South Sediment Dam (Entrance Dam) Discharge	Nil Discharge

Swamp Surface Water Monitoring

The swamp surface water quality and flow monitoring networks comprise of four monitoring locations. It should be noted that the WMP (GHD 2021) does not apply any trigger criteria to the monitoring locations.

During the reporting period, EC, pH, TSS and flow rate remained relatively consistent with historical observations. A summary of key observations and trends during the reporting period is provided in **Table 7-8**.

Table 7-8: Swamp Surface Water Quality Summary

Monitoring Location	Surface water quality trends during the reporting period
Narrow Swamp U/S	No data available for all analytes due to dry swamp conditions.
Narrow Swamp D/S	No data available for all analytes due to dry swamp conditions.
Star Picket	No data available for all analytes due to dry swamp conditions.
Tri Star Swamp	Water quality parameters show trends consistent with climatic observations and historical trends.

Monitoring Location	Surface water quality trends during the reporting period
Twin Gully Swamp	No data was available for 2024 due to access restrictions.

7.3.3 Comparisons against Predictions

Surface water related predictions during the operation of the Project were outlined in the *Angus Place Water Treatment Project MOD5 EIS* (EMM. 2018) and summarised within the water management performance measures as required by Condition 7 in Schedule 3 of Development Consent MP06_0021. Surface water quality data is typically assessed against SSGVs based on a review of ANZECC (2000) DGVs.

As noted in *Angus Place Water Treatment Project MOD5 EIS* (EMM. 2018), surface water impacts were not anticipated in the Coxs River upstream of the Kangaroo Creek/Coxs River Confluence. The proposed Water Treatment Project in 2018 predicted the discharged water from site would satisfy SSGVs, while also forecasting an improvement on conductivity (EC) that would begin to meet SSGVs.

Water quality monitored at the downstream sites KC/CR Confluence and Coxs River D/S are assessed against SSGVs, as shown below.

- Conductivity (EC): 350 µS/cm
- pH: 6.3 – 8.0
- Total Suspended Solids: 25 mg/L
- Turbidity: 72 NTU

Two non-consecutive lower bound pH triggers above SSGV's were observed at KC/KR Confluence in the 2024 reporting period, in May (6.0) and June (5.6).

7.3.4 Long Term Analysis

Since 2018, Monitoring reported in Annual Reviews for Angus Place Colliery has identified some instances of non-compliance events (or impacts) related to water.

Table 7-9 summarises water compliance reporting (non-administrative aspects) over the last five (5) Annual Review reporting periods. Non-compliances in 2024 are detailed in **Section 11**.

Table 7-9: Long Term Water Related Compliance Trends (non-administrative)

Aspect	Annual Review Reporting Period				
	2020	2021	2022	2023	2024
Surface Water monitoring location related non compliances	0	1	2	3	1

7.3.5 Implemented / Proposed Improvements

The site Water Management Plan (Rev 3) was updated in August 2024, and submitted to DPHI, it is still awaiting approval.

7.4 GROUNDWATER

7.4.1 Environmental Management

Groundwater monitoring is undertaken in accordance with the *Angus Place Water Management Plan (*WMP*) (*Rev 2, 2021); Conditions 7-13, Schedule 3 of MP06_0021; and Conditions P1.3 and M2.3 of EPL467.

The Angus Place monitoring program targets Newnes Plateau Shrub Swamps (NPSS), Newnes Plateau Hanging Shrubs (NPHS), perched groundwater system, shallow groundwater system and the deep groundwater system through a combination of routine surface water monitoring, standpipe piezometers and vibrating wire piezometers (VWP).

Groundwater related monitoring is comprised of the following:

- Soil moisture content is measured daily at nine monitoring locations across three swamps (NPSS and NPHS).
- One standpipe piezometer installed down-dip (north-east) from the 800 District to monitor any potential seepage.
- 14 standpipe piezometers installed in the elevated ridges between swamps that monitor shallow groundwater levels in the upper Banks Wall Sandstone aquifer.
- 18 standpipe piezometers monitoring water levels in the NPSS.
- 15 vibrating wire piezometers (VWPs) monitoring the Narrabeen strata and the Permian Illawarra Coal Measures.
- Six monitoring locations within the Cox River including five standpipe piezometers and one VWP.

The groundwater monitoring sites are described in **Table 7-10**, **Table 7-11**, and **Table 7-12** and shown on **Figure 7-2** and **Plan 4**. Groundwater levels and piezometric pressure are recorded on a range of different frequencies with the majority saved to a data logger at each bore. Data was downloaded every two months during the reporting period, with standpipe piezometers APKC2001, REN, RSE and RNW being manually monitored every two months.

The VWP sites listed below were destroyed during the 2019/2020 Gosper's Mt. Bushfire. Although historical information is available for the destroyed sites up until November 2019, the replacement of these piezo will depends on the feedback from DCCEEW on the THPSS Management Plan currently in review.

- AP1101, monitoring time ranged from February 2012 to November 2019.
- AP1107, monitoring time ranged from December 2011 to November 2019.
- AP1103, monitoring time ranged from May 2012 to November 2019.
- AP1204, monitoring time ranged from July 2012 to November 2019.
- APXXB1, monitoring time ranged from May 2012 to November 2019.

Table 7-10: Description of Groundwater Monitoring Locations (Ridge Piezometers)

Monitoring Point	Monitoring Commenced	Depth (mbgl)	Formation
Standpipe Monitoring Bores			
AP1801DP	September 2018	336.3	Lithgow Seam
AP1PR	July 2010	37.76	Burralow Formation
AP4PR	July 2010	51.57	Burralow Formation
AP5PR	July 2010	93.82	Banks Wall Sandstone
AP8PR	July 2010	90.90	Banks Wall Sandstone
AP9PR	July 2010	82.31	Banks Wall Sandstone
AP10PR	July 2010	39.69	Banks Wall Sandstone
AP1102	April 2012	111.41	Banks Wall Sandstone
AP1104	February 2012	81.68	Banks Wall Sandstone
AP1105	November 2011	75.85	Banks Wall Sandstone
AP1110	February 2012	70.40	Burralow Formation
AP1204	July 2012	>100	Banks Wall Sandstone
APKC2001	December 2020	30.15	Banks Wall Sandstone
APKC2002	December 2020	67.90	Banks Wall Sandstone
REN	December 2005	54.98	Burralow Formation
RSE	September 2010	49.55	Burralow Formation
RNW	December 2005	55.50	Burralow Formation

Table 7-11: Description of Groundwater Monitoring Locations (VWP Bores)

Monitoring Point	Monitoring Commenced	Total Depth (mbgl)
Vibrating Wire Piezometer Monitoring Bores		
AP2PR	February 2010	411
AP10PR	May 2010	343
AP11PR	May 2010	320
AP1102	January 2012	435.1
AP1104	September 2012	370.8
AP1106	February 2012	380.3
AP1110	September 2012	399.7
AP1206	September 2012	342
APXXB2	January 2012	320
APXXB3	May 2012	331.5

Table 7-12: Description of Groundwater Monitoring Locations (Swamp Bores)

Swamp	Location	Monitoring Commenced	Depth (mbgl)
Swamp Monitoring Bores			
Kangaroo Creek Swamp	KC1	May 2005	1.10
	KC2	November 2008	1.56
	KCU1	October 2020	0.90
Tri Star Swamp	TS1	October 2011	3.98
	TS2	October 2011	2.06
	TS3	November 2011	1.77
West Wolgan Swamp	WW1	May 2005	1.90
	WW2	May 2005	2.30
	WW3	December 2005	2.40
	WW4	February 2006	2.08
East Wolgan Swamp	WE1	May 2005	2.51
	WE2	May 2005	1.20
Trail Six Swamp	XS1	October 2011	1.44
Twin Gully Swamp	TG1	October 2011	1.16
	TG2	April 2018	0.85
Narrow Swamp	NS1	May 2005	2.53
	NS2	May 2005	2.60
	NS3	February 2008	2.80
	NS4	April 2008	2.40
	NSW1R	November 2021	NA
	NSW2R	November 2021	NA
Long Swamp	LS5	February 2019	1.71
	LS6	February 2019	1.86
	CS4	February 2019	2.58
Coxs River Swamp	CS2	February 2019	2.23
	CS3	February 2019	1.92

Notes: NA – Narrow Swamp weirs have been replaced with shallow piezometers to approximate stream flows

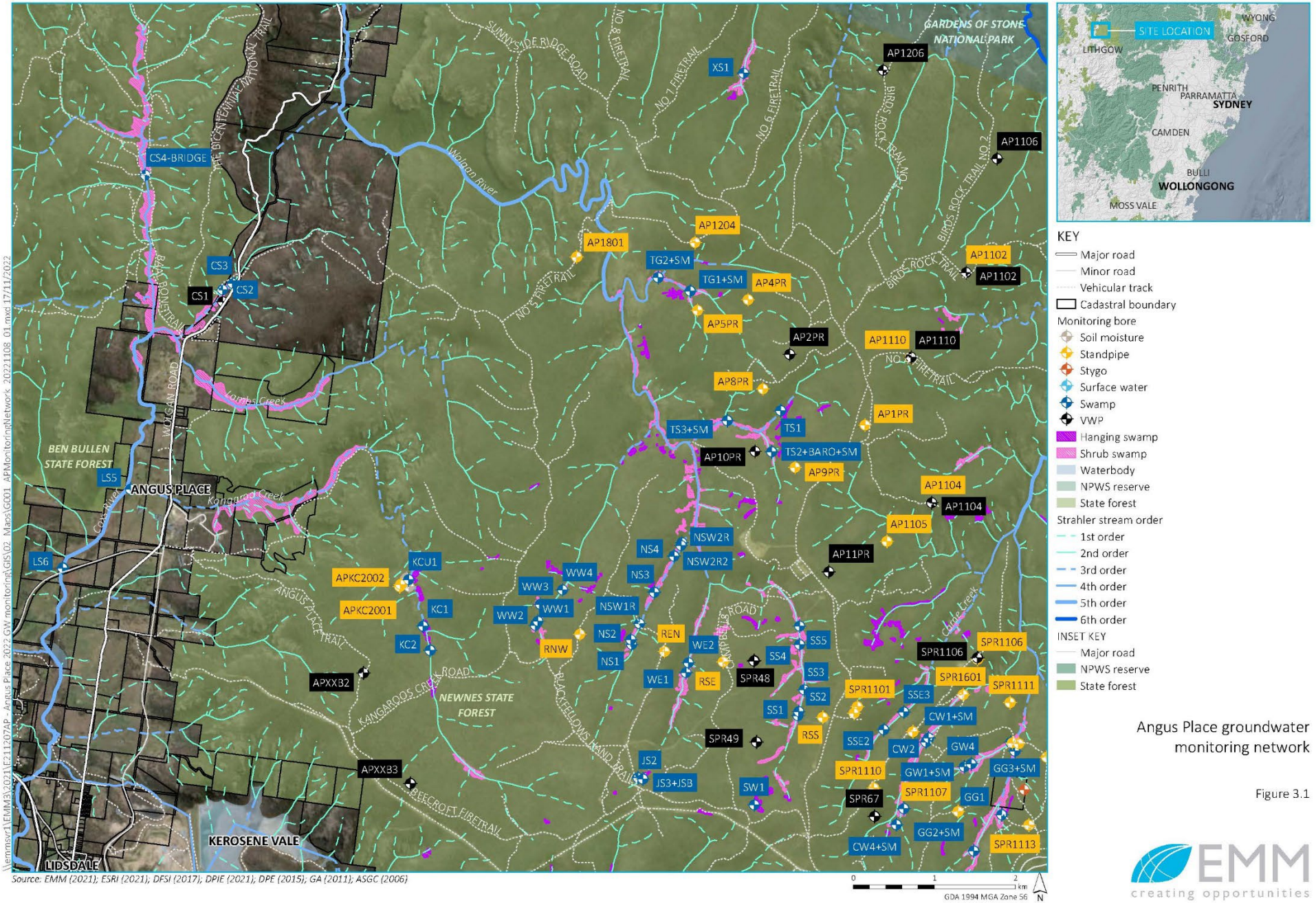

Figure 7-2: Groundwater Monitoring Locations

7.4.2 Environmental Performance

Groundwater monitoring is assessed in accordance with performance requirements set by Schedule 3, Condition 7 of MP06_0021, and against TARP requirements established within the WMP.

The following subsections summarise groundwater monitoring observations from the reporting period. Groundwater levels and piezometric pressures have been compared to the historical monitoring data. Triggers values of the WMP are compared when a monitoring site becomes 'post-mining' which is generally within 600 m of an active longwall. Most monitoring sites in the WMP are 'pre-mining'.

Ridge Piezometers

The ridge piezometer monitoring network is comprised of 16 monitoring bores targeting the shallow aquifer in the Banks Wall Sandstone.

Hydrographs for the ridge piezometers are presented in **Figure 7-3** which includes groundwater level data in metres AHD (mbgl) and the daily Cumulative Rainfall Departure (CRD) (mm). Dashed vertical lines indicate the reporting period, and the logger depth at each monitoring location is presented on the left side of the figure. Manual measurements are recorded for locations REN, RSE, RNW and APKC2001.

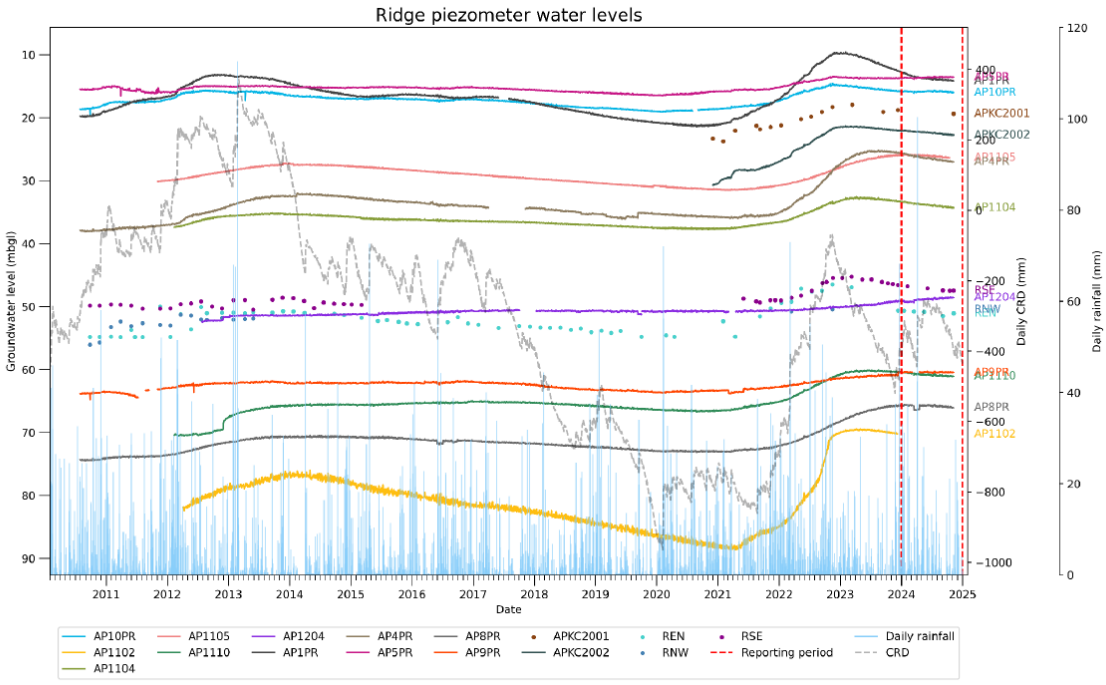

Figure 7-3: Ridge Piezometer Hydrograph

AP1801DP is a deep piezometer established to monitor groundwater quality as EPL467 monitoring point 18. EPL467 requires monthly monitoring for metals and alkalinity in addition to the basic water quality parameters.

Table 7-13: AP1801DP 2024 Monitoring Summary

Parameters	Monitoring Date				
	No. Samples required	No. Samples taken	Min	Mean	Max
Aluminium	12	12	<0.01	0.43	2.91
Aluminium (dissolved)	12	12	<0.01	0.03	0.19
Arsenic	12	12	<0.01	0.009	0.068
Arsenic (dissolved)	12	12	<0.01	0.003	0.005
Barium	12	12	0.003	0.02	0.062
Barium (dissolved)	12	12	0.002	0.01	0.019
Boron	12	12	0.05	0.1	0.23
Boron (dissolved)	12	12	0.06	0.07	0.24
Copper	12	12	<0.001	0.003	0.014
Copper (dissolved)	12	12	<0.001	<0.001	0.003
EC	12	12	530	594	663
Iron	12	12	0.00	2.07	9.94
Iron (dissolved)	12	12	<0.05	0.82	2.3
Manganese	12	12	0.006	0.033	0.125
Manganese (dissolved)	12	12	0.008	0.022	0.033
Nickel	12	12	<0.001	0.009	0.058
Nickel (dissolved)	12	12	<0.001	0.002	0.006
Oil and Grease	12	11[(A)]	<5	<5	<5
pH	12	12	6.6	7	7.7
Total alkalinity	12	12	272	307	319
TSS	12	11[(A)]	10	97	431
Turbidity	12	12	4	40	230
Zinc	12	12	<0.005	0.1	0.812
Zinc (dissolved)	12	12	<0.005	0.026	0.084

Notes: [(A)] An insufficient water sample was collected from AP1801DP (EPL 467 Point 18) on the 17/01/2024. Further details included in Section 11.

Vibrating Wire Piezometers

The Vibrating Wire Piezometer (VMP) monitoring network comprises of eleven monitoring locations measuring the piezometric pressures of multiple hydrogeological horizons within the deep and shallow aquifers. The majority of the VWP monitoring relates to Angus Place East's proposed workings and has not been impacted by mining. One VWP has been installed in the Coxs River area where Angus Place West's proposed workings are located.

Key observations from VWP data indicated continued stability in the water levels across the north-east area of the Newnes Plateau. If mining in this area is approved at some time in the future, this data will be useful to understand temporal variations in groundwater.

APC CS1 for Angus Place West show Sensors #1 and #3 having a slight decreasing trend, while Sensor #2 displayed an increasing trend before decreasing and becoming stable.

Hydrographs for each monitoring site include piezometric pressure data for each sensor in mAHD and daily CRD. Dashed vertical lines indicate the reporting period, with sensor depths indicated to the left of each hydrograph. VWP hydrographs are presented in **Appendix 2.**

Swamp Piezometers

As part of the Angus Place Water Management Plan, an intensive monitoring program has been implemented on the Newnes Plateau to detect any impacts from mining on the groundwater regime, with an emphasis on Newnes Plateau Shrub Swamps (NPSS). The greater monitoring program incorporates NPSS and groundwater monitoring locations above both Angus Place and Springvale collieries.

A summary of key observations and trends is provided in **Table 7-14**, while a discussion of each swamp piezometer hydrograph is provided in the following subsections.

Table 7-14: Swamp Piezometer Summary

Swamp	Location	
Swamp Monitoring Bores		
Kangaroo Creek*	KC1	KCU1 has typically been dry, however, it is slightly more responsive to rainfall than KC1 and KC2
	KC2	Predominately dry despite an increasing CRD trend and large rainfall events in early April.
	KCU1	The KCU1 logger is broken, and a new logger will be installed.
Tri Star Swamp	TS1	Fluctuated in line with daily CRD trends. Groundwater levels increased in April due to intense rainfall events.
	TS2	Fluctuated in line with daily CRD trends. Groundwater levels increased in April due to intense rainfall events.
	TS3	TS3 displayed minimal variation.
West Wolgan Swamp*	WW1	Remained predominately dry, apart from an increase in April and the following months due to rainfall events, before gradually decreasing due to dryer conditions.
	WW2	Remained predominately dry, apart from an increase in April and the following months due to rainfall events, before gradually decreasing due to dryer conditions
West Wolgan	WW3	Remained predominately dry, apart from an increase in

Swamp	Location	
Swamp Monitoring Bores		
Swamp* (continued)		April and the following months due to rainfall events, before gradually decreasing due to dryer conditions
	WW4	Remained predominately dry, apart from an increase in April and the following months due to rainfall events, before gradually decreasing due to dryer conditions.
East Wolgan Swamp*	WE1	Typically dry, only responding to significant rainfall events.
	WE2	Typically dry, only responding to significant rainfall events.
Trail Six	XS1	Historically, groundwater levels at XS1 have been relatively stable, reflecting a subdued response to the daily CRD.
Twin Gully	TG1	Groundwater level stable, at or below ground level with minor fluctuations in response to rainfall events.
	TG2	Groundwater level stable, below ground level with relatively larger fluctuations in response to rainfall events compared to TG1.
Narrow Swamp*	NS1	Groundwater levels were dry in the reporting period. consistent with historical observations.
	NS2	Groundwater levels were dry in the reporting period.
	NS3	Groundwater levels were dry in the reporting period.
	NS4	Groundwater levels were dry in the reporting period.
	NSW1R	Groundwater levels were in line with daily CRD trends and consistent with historical observations
	NSW2R	Groundwater levels were in line with daily CRD trends and consistent with historical observations
Long	LS5	Groundwater level fluctuating in response to rainfall events.
	LS6	Groundwater levels fluctuated in direct response to rainfall recharge.
	CS4	Groundwater level stable.
Coxs River	CS2	Groundwater level stable fluctuating with CRD trends
	CS3	Groundwater level stable, in response to rainfall events.

*Notes: * under-mined (in part or whole) by existing mine workings.*

Kangaroo Creek Swamp

The hydrograph for Kangaroo Creek Swamp is presented as **Figure 7-4**. Kangaroo Creek Swamp is currently monitored at three locations: KC1 (installed May 2005), KC2 (installed November 2008) and KCU1 (installed October 2020).

Following undermining in 2008, groundwater levels at KC1 and KC2 were typically dry and have shown minimal response to rainfall events. Since installation, KCU1 has typically been dry, however, it is slightly more responsive to rainfall than KC1 and KC2.

During the reporting period, groundwater levels at KC1 and KC2 were dry despite an increasing CRD trend and large rainfall events in early-April. The KCU1 logger is broken, and a new logger will be installed in the near future. KC1 logger was experiencing issues and was fixed in the November maintenance event.

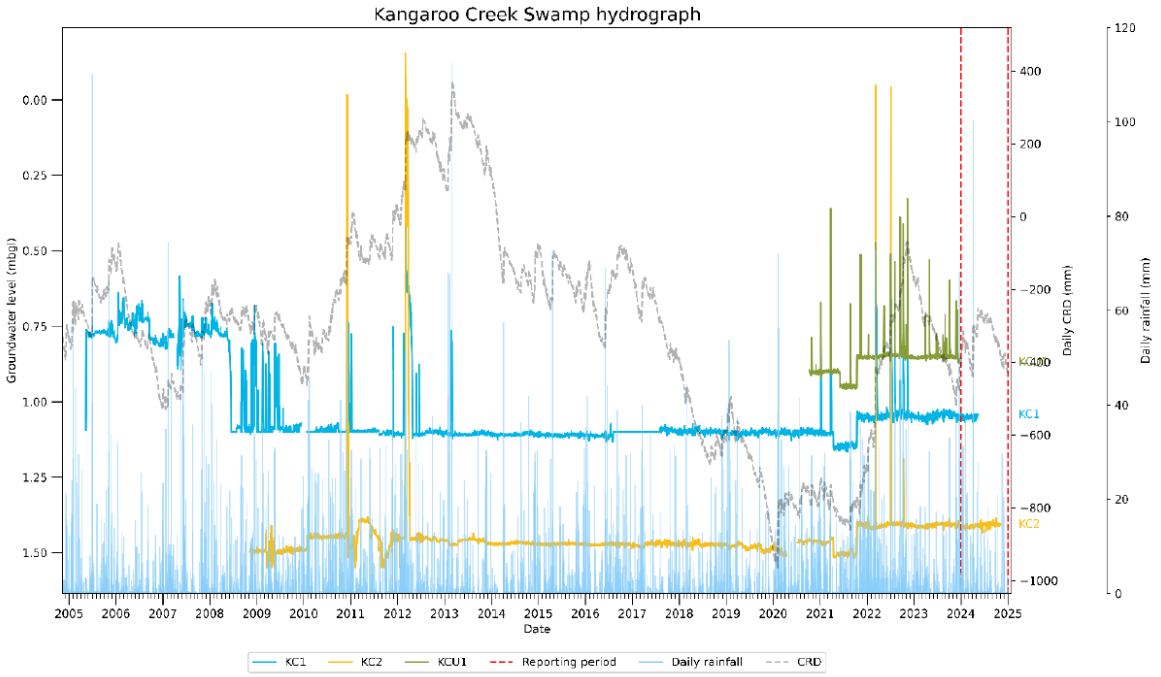

Figure 7-4: Kangaroo Creek Groundwater Levels

Tri Star Swamp

The hydrograph for Tristar Swamp is presented as **Figure 7-5**. Tristar Swamp is currently monitored at TS1, TS2 and TS3, all of which were installed October 2011.

Historically, TS1 and TS2 have been intermittently dry, responding to periods of above average rainfall, while the groundwater level at TS3 has remained stable at just below ground level.

During the reporting period, groundwater levels at TS1 and TS2 fluctuated in line with daily CRD trends. Groundwater levels increased in April due to intense rainfall events. TS3 displayed minimal variation.

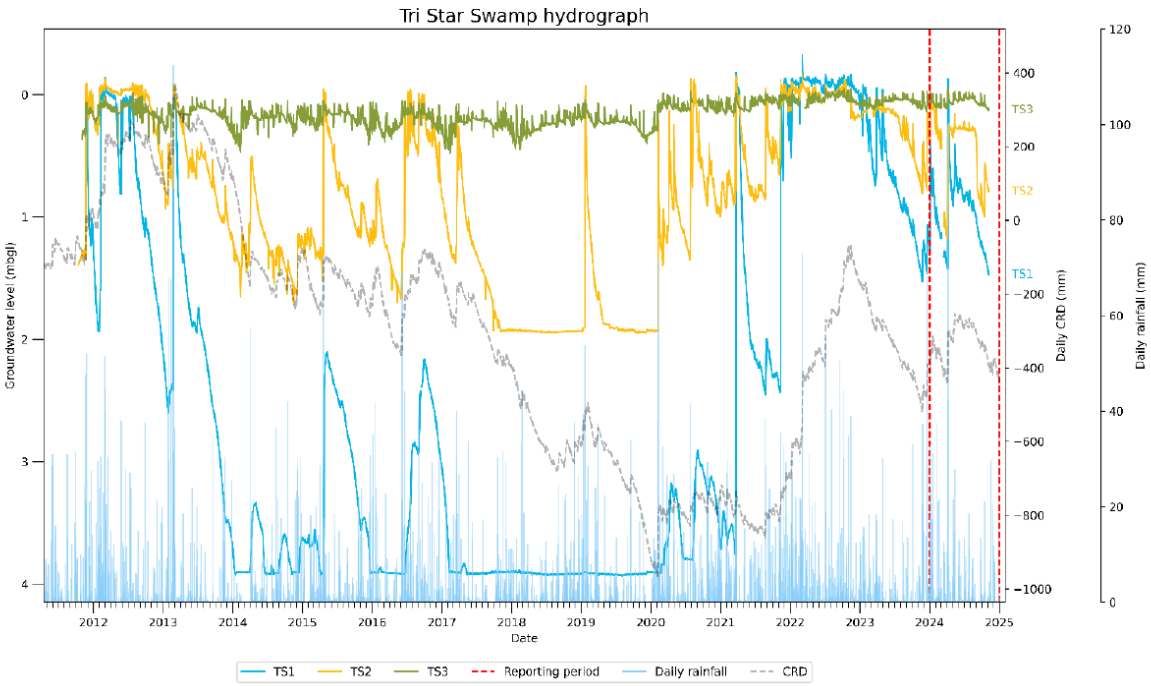

Figure 7-5: Tri Star Swamp Groundwater Levels

West Wolgan Swamp

The hydrograph for West Wolgan Swamp is presented as **Figure 7-6**. West Wolgan Swamp is currently monitored at four locations: WW1, WW2, WW3 and WW4 (all installed in 2005), which were undermined by longwalls LW930, LW940 and LW960 between May 2007 and July 2009.

Historically, groundwater levels at WW1 and WW2 have mirrored the daily CRD trend. WW3 responds quickly to rainfall recharge, followed by rapid drainage. WW4 has remained predominantly dry since 2012, with water levels only rising in response to significant rainfall events and draining shortly afterward. It is common for piezometers to remain dry between monitoring events. During the reporting period, groundwater levels at WW1 to WW4 remained predominately dry, apart from an increase in April and the following months due to rainfall events, before gradually decreasing due to dryer conditions.

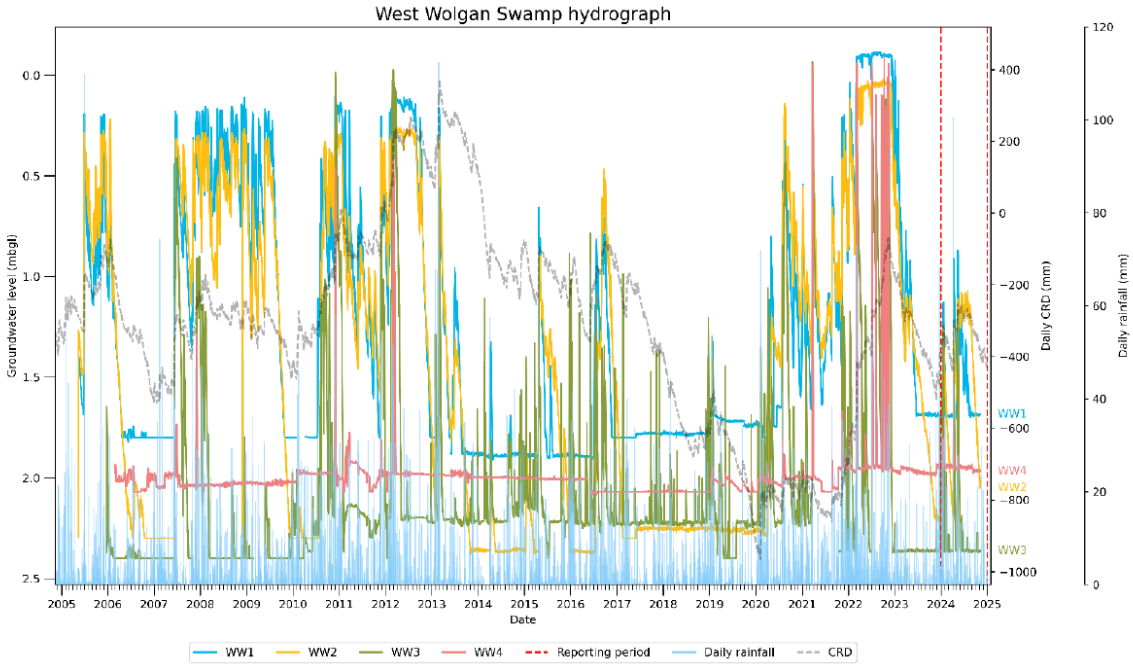

Figure 7-6: West Wolgan Groundwater Levels

East Wolgan Swamp

The hydrograph for East Wolgan Swamp is presented as **Figure 7-7**. East Wolgan Swamp is monitored by WE1 and WE2 (installed in May 2005).

Historically, East Wolgan Swamp has been influenced by emergency mine water discharges from licensed discharge point LDP04. Mine discharge events coincide with a groundwater level increase at WE1 and WE2 in 2005, 2008 and 2009. Apart from the discharge events, groundwater levels at WE1 and WE2 are typically dry, only responding to significant rainfall events. WE2 appears to be more responsive to rainfall than WE1.
During the reporting period, groundwater levels remained predominately dry, apart from an increase in April due to a high rainfall event.

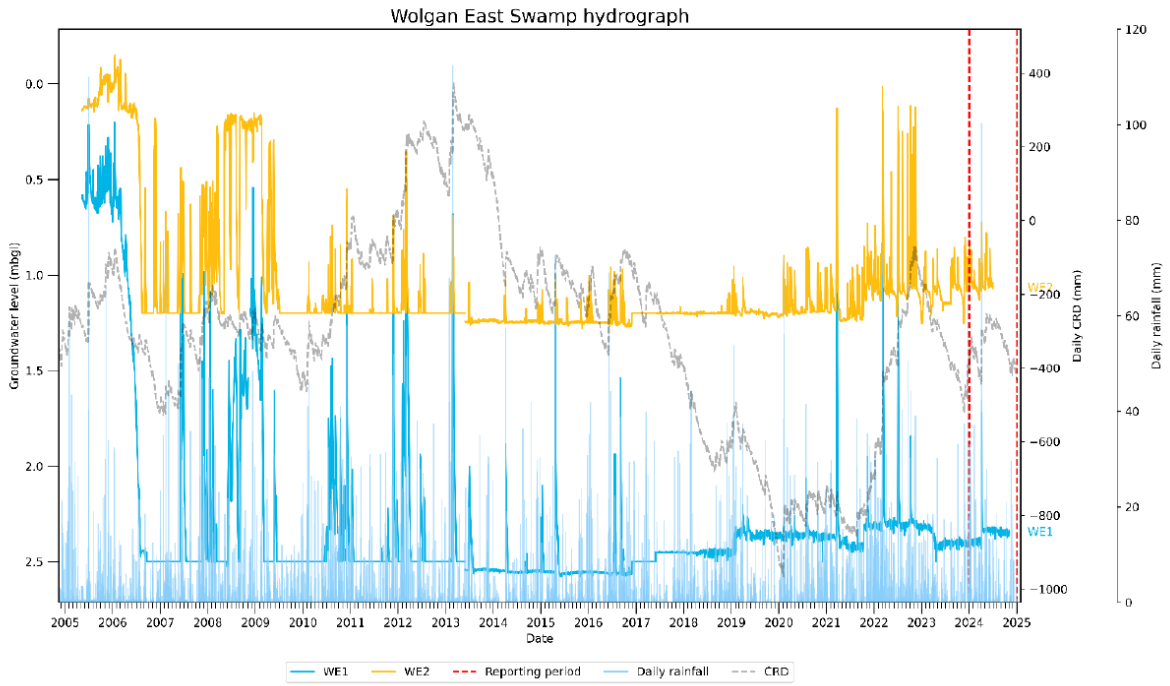

Figure 7-7: East Wolgan Groundwater Levels

Trail Six Swamp

The hydrograph for Trail Six Swamp is presented as **Figure 7-8**. The groundwater level at Trail Six Swamp is currently monitored at XS1, which was installed October 2011.

Historically, groundwater levels at XS1 have been relatively stable, reflecting a subdued response to the daily CRD.

During the reporting period, groundwater levels at XS1 were in line with daily CRD trends and consistent with historical observations.

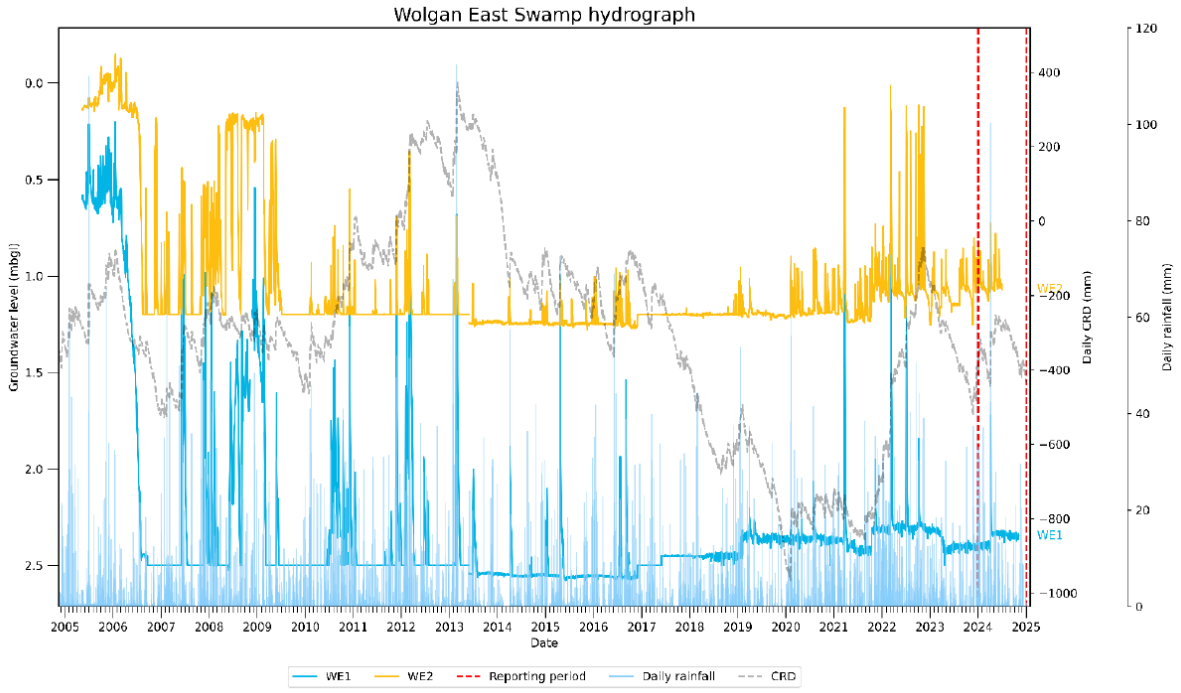

Figure 7-8: Trail Six Swamp Groundwater Levels

Twin Gully Swamp

The hydrograph for Twin Gully Swamp is presented as **Figure 7-9**. Twin Gully Swamp is currently monitored at TG1 (installed October 2011) and TG2 (installed April 2018).

Historically, groundwater levels at TG1 and TG2 have reflected the daily CRD trend, with TG2 tending to fluctuate in greater proportion when compared to TG1.

During the reporting period, groundwater levels at TG1 and TG2 were in line with daily CRD trends and consistent with historical observations.

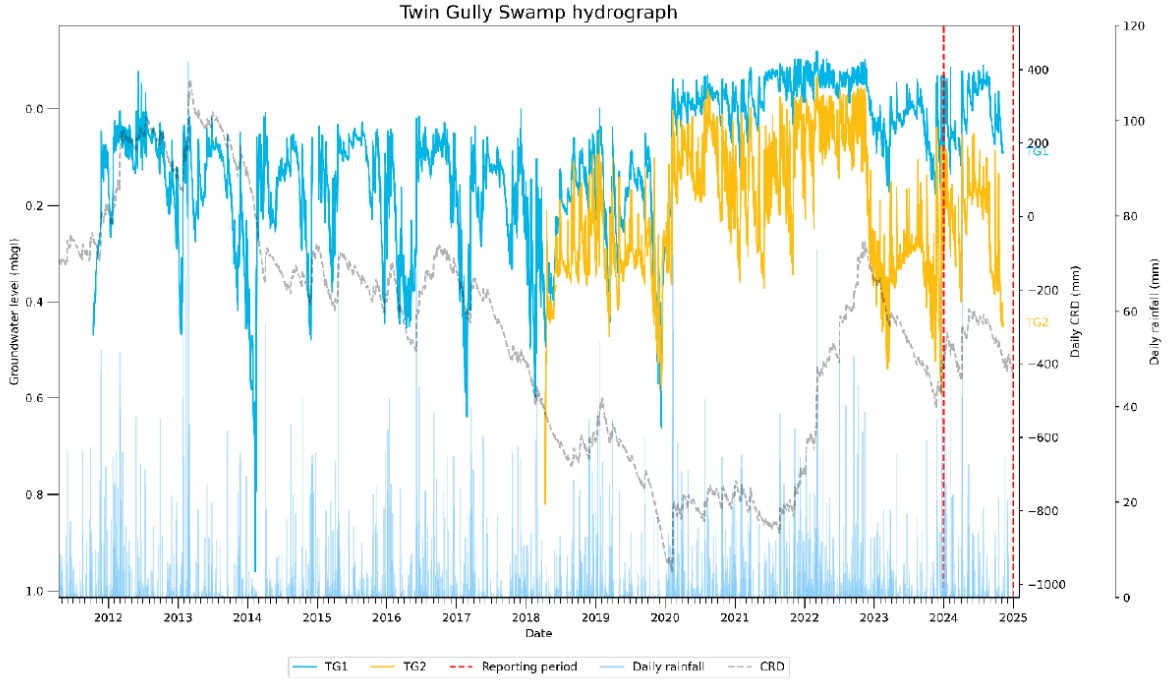

Figure 7-9: Twin Gully Swamp Groundwater Levels

Narrow Swamp

The hydrograph for Narrow Swamp is presented as **Figure 7-10**. Narrow Swamp is currently monitored at six locations: NS1 and NS2, which were installed in May 2005, NS3 which was installed February 2008, NS4 which was installed April 2008, and NSW1R and NSW2R which were installed in September 2021. NS1, NS2 and NSW1R monitor the upstream reaches of the swamp, NS3 monitors the middle reach, and NS4 and NSW2R monitor the downstream reach.

Historically, groundwater levels at Narrow swamp have been influenced by emergency mine water discharge from licensed discharge points LDP004 and LDP006. Mine discharge events coincide with a water level increase in LDP004 over the period 2005 to 2008, and from LDP006 in 2009. Except for the discharge events, NS1 to NS4 have remained predominantly dry since 2009, only responding to significant rainfall events.

During the reporting period, groundwater levels at NS1, NS2, NS3 and NS4 were dry. The groundwater level at NSW1R and NSW2R was periodically dry and fluctuated in response to daily CRD trends.

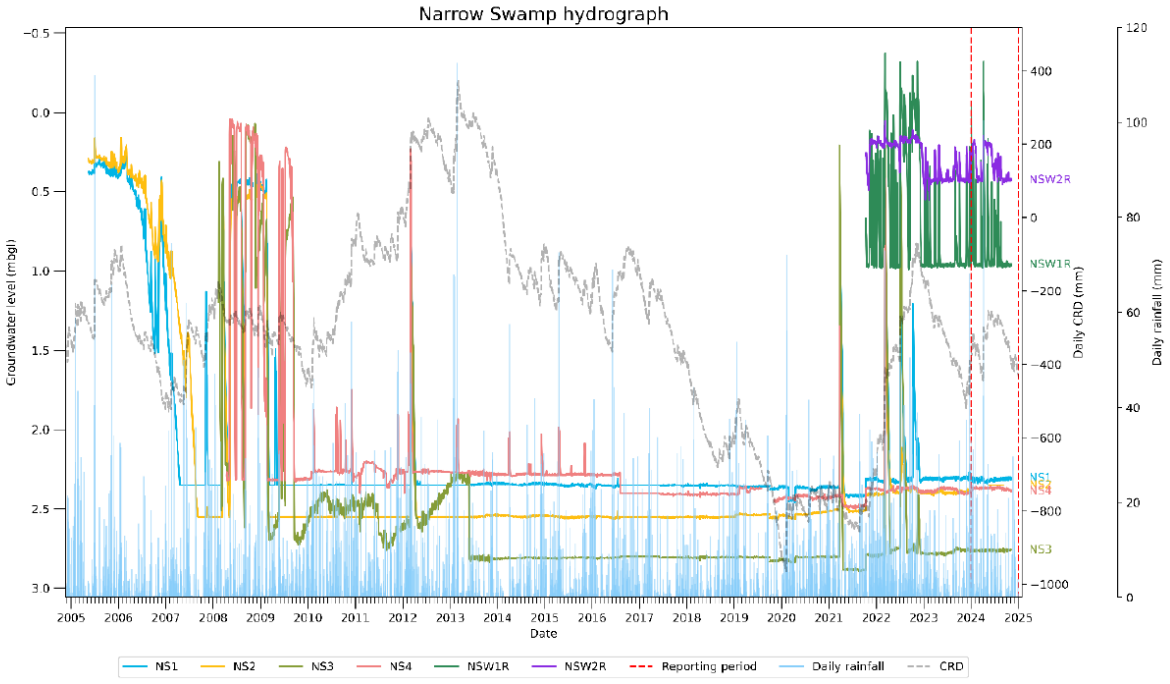

Figure 7-10: Narrow Swamp Groundwater Levels

Long Swamp

The hydrograph for Long Swamp is presented as **Figure 7-11**. Piezometer LS5 is installed in the upper reaches of Long Swamp and LS6 is installed in the lower reaches. Piezometer CS4 is located near the Leg Bridge, adjacent to the upper reaches of the Coxs River.

A data gap exists for CS4 and LS6 from October 2019 when the loggers were destroyed by bushfire. The loggers were replaced in August 2020. Another data gap exists for CS4 from January 2021, as the swamp piezometer was damaged by a vehicle. The piezometer and datalogger were replaced in September 2021.

Groundwater levels across all monitoring sites generally fluctuated in direct response to rainfall recharge. LS5 demonstrated greater fluctuations in base groundwater levels compared to CS4 and LS6, suggesting a higher sensitivity to recharge events or variations in local hydrogeological conditions.

During the reporting period, CS4 groundwater levels remained relatively stable, but fluctuated in response to daily CRD trends. LS6 and LS5 also fluctuated in response to daily CRD trends.

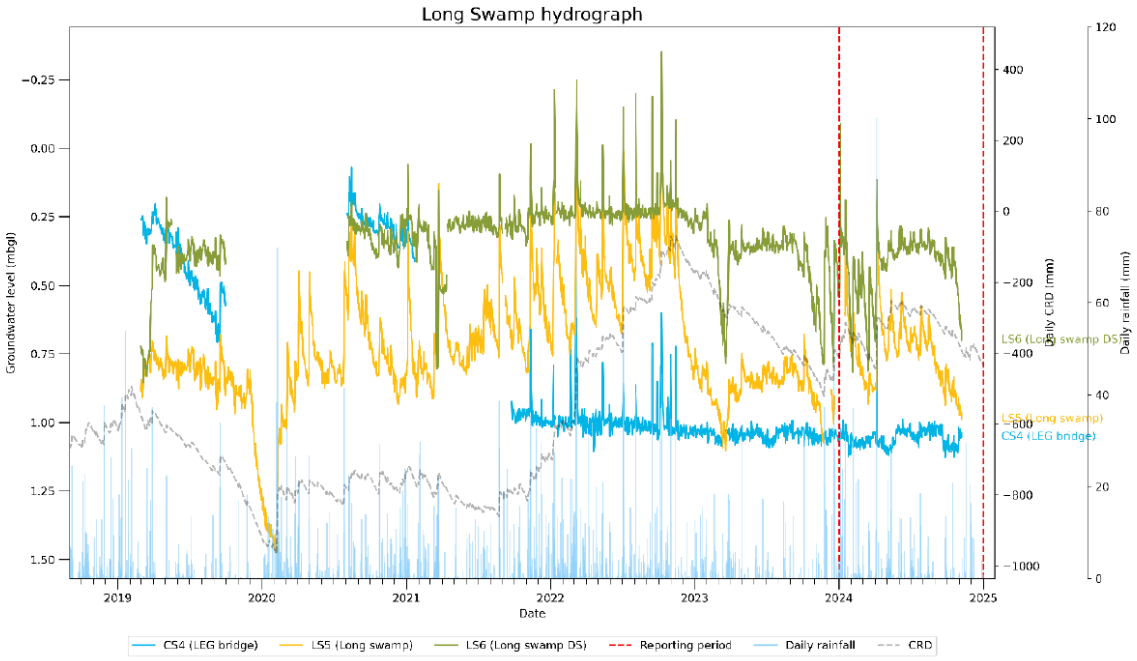

Figure 7-11: Long Swamp Groundwater Levels

Coxs River Swamp

The hydrograph for Coxs River Swamp is presented as **Figure 7-12**. Coxs River Swamp is monitored by CS2 and CS3, which were installed in September 2019.

Historically, CS2 and CS3 remained dry until February 2020 and July 2020, respectively, after which they maintained stable groundwater levels due to above-average rainfall between February 2020 and November 2022. A data gap is present for CS2 from March to June 2023 because the logger was not reinstalled correctly.

During the reporting period, groundwater levels at CS2 and CS3 remained relatively stable, fluctuating in response to daily CRD trends. CS3 exhibited more pronounced responses to these trends compared to CS2.

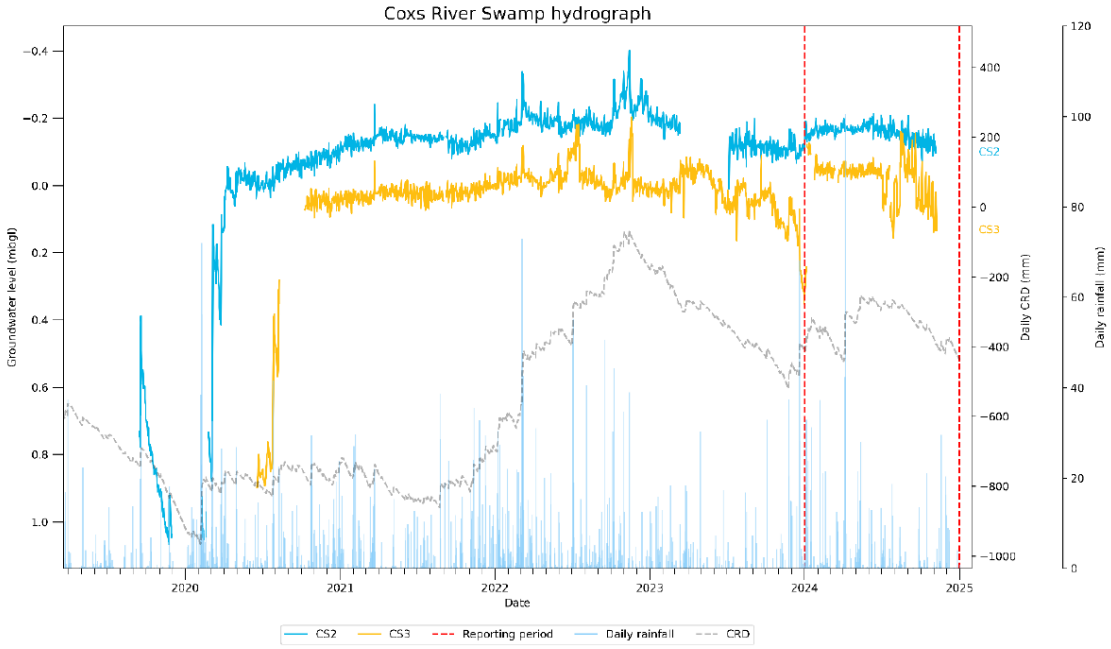

Figure 7-12: Cox River Swamp Groundwater Levels

7.4.3 Comparisons against Predictions

Groundwater water predictions are represented within the triggers established under the TARP of the approved WMP. Triggers values of the WMP are compared when a monitoring site becomes 'post-mining' which is generally within 600 m of an active longwall. Most monitoring sites in the WMP are 'pre-mining'.

Groundwater levels were generally stable or varying slightly in relation to rainfall or historical observations.

Piezometric pressures were generally stable. It is important to note that the data gaps are caused by restricted access due to deteriorated track conditions or flat batteries. Swamp groundwater levels were generally stable, except for fluctuating groundwater levels at monitoring locations that are typically dry in response to above average rainfall observed during the reporting period.

7.4.4 Long Term Analysis

Long term groundwater monitoring data (over 10 years) for groundwater level and quality is presented in **Appendix 2** to this Annual Review, and within Section 5 of the WMP. As noted above, during 2024 automated groundwater level monitoring was collected (refer figures

presented in previous sections above providing long-term results). Long-term data and trends for water quality are provided in the figures presented in the previous sections above. **Table 7-15** summarises groundwater compliance reporting (non-administrative aspects) over the last five Annual Review reporting periods. Since 2020, monitoring reported in Annual Reviews for Angus Place Colliery has identified no instances of non-compliance events (or impacts related to) groundwater.

Table 7-15: Groundwater Compliance – Previous Five Annual Reporting Periods

Aspect	Annual Review Reporting Period				
	2020	2021	2022	2023	2024
Groundwater related non-compliances	0	0	0	0	0

7.4.5 Implemented / Proposed Improvements

The site Water management plan was updated in August 2024, to remove reference to withdrawn modifications, and to update to current operations.

8 REHABILITATION

During the 2024 reporting period, Angus Place rehabilitation activities and monitoring for the 2024 Annual Review is presented per the RMP. A description of the proposed rehabilitation management and monitoring activities is provided in Section 6 and Section 8 of the RMP, available on the Angus Place website[q].

For completeness, it is noted that the introduction of detailed annual rehabilitation reporting required under revised Mining Lease conditions ('*Annual Rehabilitation Report',* per detailed 'Form and Way' reporting requirements set by NSWRR), is undertaken separately and in addition to the summary information provided in this Annual Review for MP06_0021.

Additionally, per Condition 36C in Schedule 3 of MP06_0021, Angus Place is required to develop a *Rehabilitation Strategy* within six months of the determination of Modification 7. The Rehabilitation Strategy was submitted on 20 December 2023 and was approved in May 2024.

8.1 REHABILITATION PERFORMANCE MEASURES

8.1.1 Rehabilitation Objectives Set by Development Consent MP06_0021

Rehabilitation objectives are prescribed by Condition 36B, Schedule 3 of MP06_0021, under which Angus Place must:

- Rehabilitate the site in accordance with the conditions imposed on the mining lease(s) associated with the development under the Mining Act 1992.
- Rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the documents listed in Condition 2, Schedule 2 of the consent, and
- Be consistent with the rehabilitation outcome documents approved under the mining lease(s)

To achieve the broad rehabilitation objectives presented in MP06_0021, Angus Place developed specific domain rehabilitation objectives. The key rehabilitation objectives for each of the domains were established as part of developing the RMP in 2022 and are defined in Section 4 of the RMP. Commencement of the monitoring program will be triggered during rehabilitation planning activities.

The approved final landform, land use and detailed performance criteria further established within the RMP.

8.2 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

8.2.1 Mining and Rehabilitation Status – Summary of Rehabilitation

The status of disturbance and rehabilitation for Angus Place (MP06_0021) as at the end of 2024 is presented in **Table 8-2** and **Figure 8-1**.

Table 8-1 below provides an overview of the rehabilitation status for Angus Place, including a summary of the previous, current, and projected reporting periods.

[q] *https://www.centennialcoal.com.au/operations/angus-place/*

Table 8-1: Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual) 2023	This Reporting Period (Actual) 2024	Next Reporting Period (Forecast) 2025
A1. Total disturbance footprint-Surface Disturbance[18]	64.29 ha	64.29 ha	64.29 ha
A2 Underground mining area	3339.96 ha	3339.96 ha	3339.96 ha
B. Total active disturbance[19]	39.75 ha	39.75 ha	39.75 ha
C. Rehabilitation - Land being prepared for rehabilitation[20]	0 ha	0 ha	0 ha
D. Land under active rehabilitation - Ecosystem and land use establishment and development[21]	24.55 ha	24.55 ha	24.55 ha
E. Completed rehabilitation[22]	0 ha	0 ha	0 ha

[18] **Total mine footprint:** includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in the RMP Guidelines). Please note that subsidence remediation areas are excluded.
[19] **Total active disturbance:** includes all areas requiring rehabilitation
[20] **Land being prepared for rehabilitation:** includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growth medium development (as defined in RMP Guidelines)
[21] **Land under active rehabilitation:** includes areas under rehabilitation and being managed to achieve relinquishment – includes 'ecosystem and land use establishment' and 'ecosystem and land use sustainability (as defined under the RMP Guidelines)
[22] **Completed rehabilitation:** requires formal sign off from DRE that the area has successfully net the rehabilitation land use objectives or completion criteria

8.2.2 Rehabilitation Schedule

As an underground coal mine, the infrastructure at Angus Place is essential for the duration of mining operations. Consequently, land associated with key surface infrastructure will not be available for rehabilitation until mining activities cease, with limited opportunities for progressive rehabilitation.

Centennial considers Angus Place West a brownfield project and is seeking planning approval for its development. This project is expected to supply 8.5 million tonnes of coal to Mount Piper until 2042.

Due to ongoing mining operations, no significant disturbance or rehabilitation activities related to surface infrastructure are planned over the next three years, except for minor rehabilitation associated with exploration programs. Any rehabilitation required for approved construction or exploration activities will be documented in the Annual Rehabilitation Report and Forward Program.

8.2.3 Rehabilitation Signoff

In 2024, Angus Place did not seek formal signoff from the NSW Resources Regulator that required land use objectives and completion criteria have been met for any rehabilitation areas.

8.2.4 Other Rehabilitation Works & Activities

Other rehabilitation activities undertaken during the reporting period included:

- **Rehabilitation Planning Activities** identified within the 2024 Annual Rehabilitation Report and Forward Plan included:
    - Engagement with adit sealing contractors was undertaken regarding adit sealing at Kerosene Vale (KV);
    - Planning progressed for the Angus Place Vent Facility reduction of disturbance and water catchment areas; and
    - Designs were developed to improve surface drainage and short-term water management onsite including watershed mapping.
- **Rehabilitation Management and Maintenance** continue to be centered around pest and weed control.

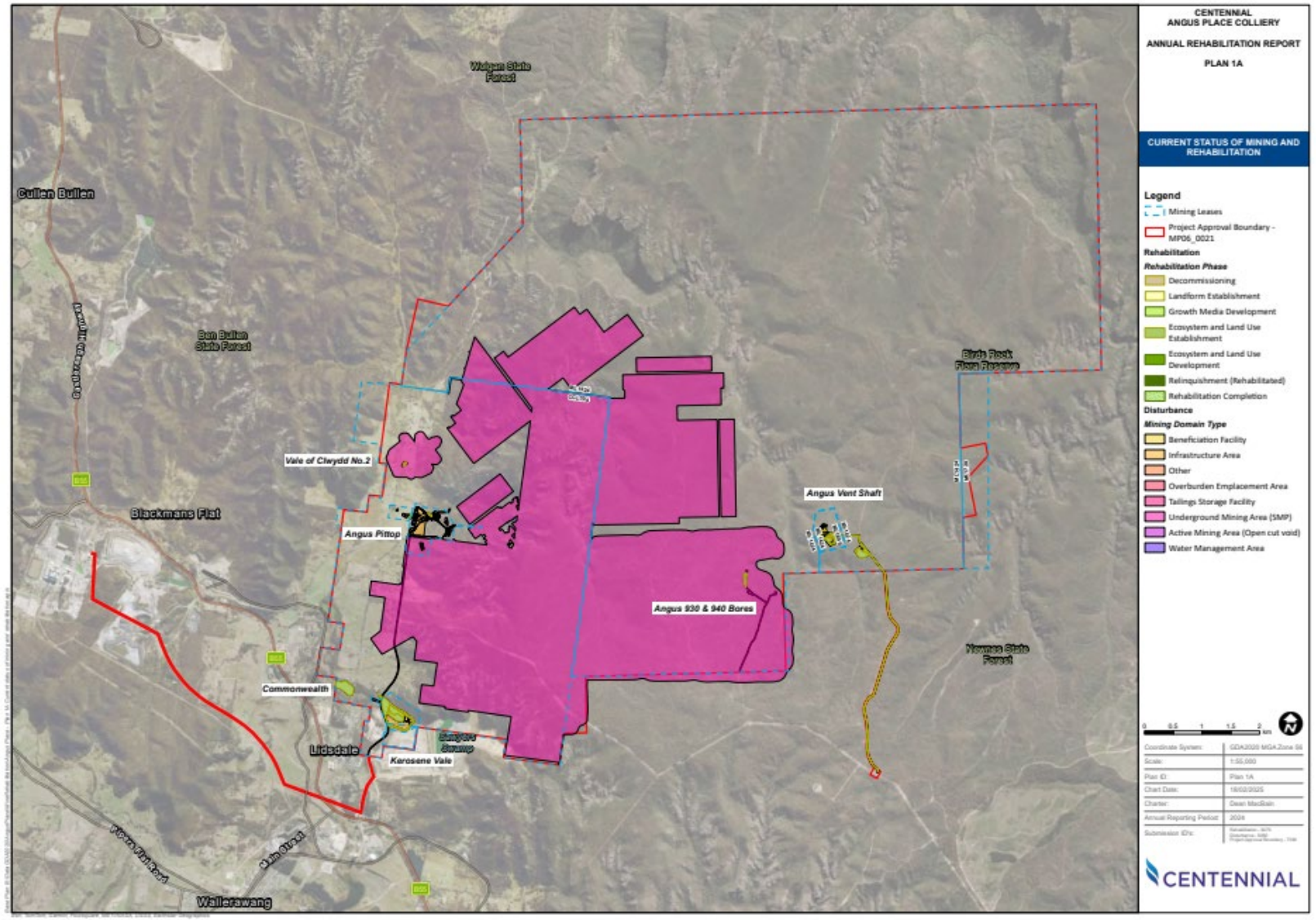

Figure 8-1: Disturbance and Rehabilitation

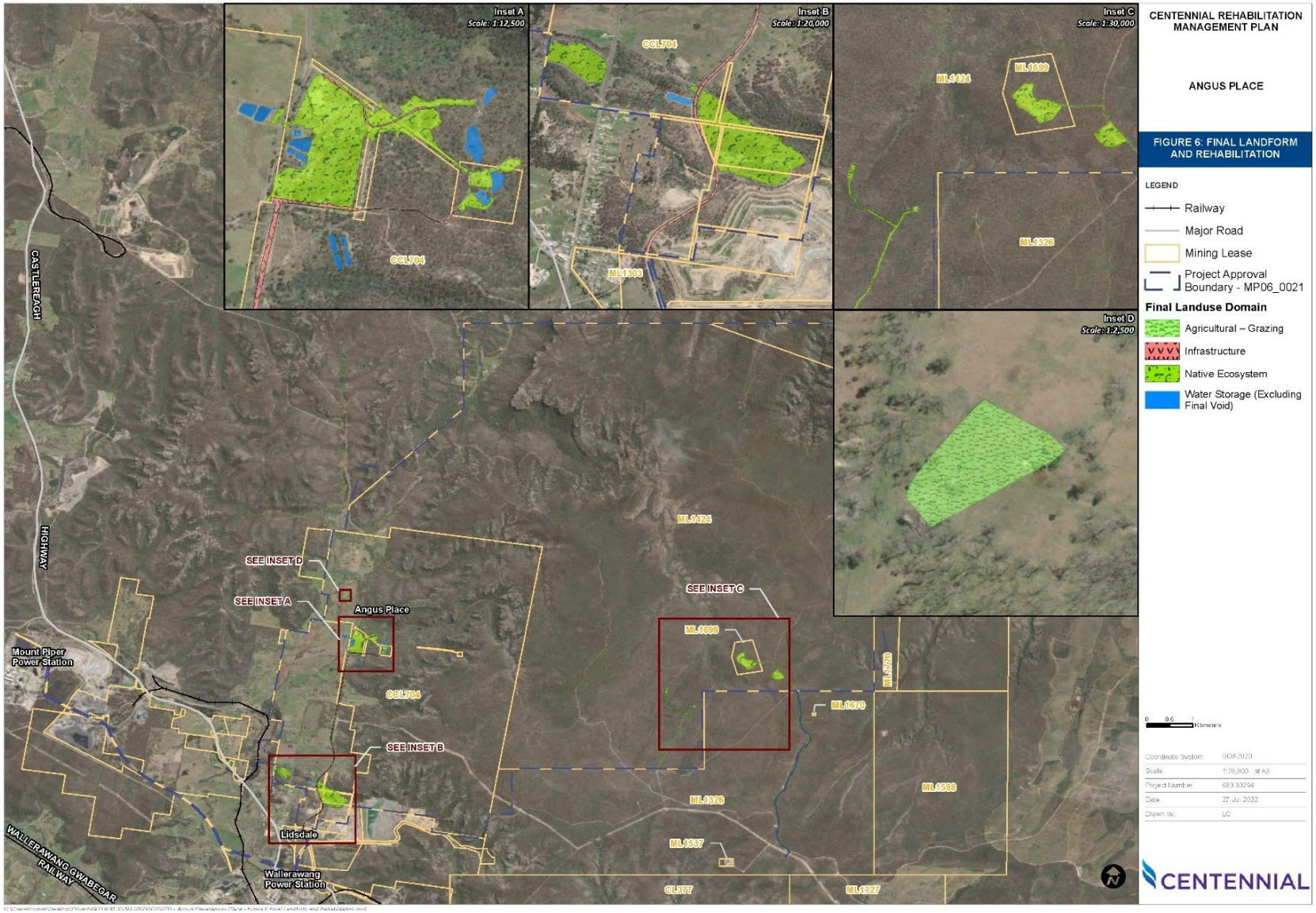

Figure 8-2: Final Landform and Rehabilitation (Source: RMP, November 2023)

8.3 REHABILITATION MONITORING

Angus Place currently has limited existing rehabilitation and infrastructure will be retained for LOM. Opportunities for progressive rehabilitation are currently limited, and monitoring is currently primarily associated with the completion of a targeted research program discussed further in **Section 8.4**. Notwithstanding this, a rehabilitation monitoring program has been developed in Section 8 of the RMP (November 2023) ready to establish monitoring of the condition, performance, and progress of rehabilitated areas when rehabilitation commences, including the establishment of appropriate reference sites ('analogue sites') if/where required to increase statistical strength and allow comparison of rehabilitation monitoring sites scores to reference sites. Reporting of rehabilitation monitoring in the Annual Review will occur at such time. The location of current rehabilitation areas and proposed monitoring sites is presented in **Figure 8-3**.

8.3.1 Summary of Rehabilitation Monitoring

This section presents the results of rehabilitation monitoring undertaken during the 2024 reporting period.

Angus Place has very limited existing rehabilitation and infrastructure will be retained for LOM. Commencement of the monitoring program under the RMP will be triggered during rehabilitation planning activities.

Replanting and translocation trials associated with the Angus Place East (APE) Vent Facility was subject to a planning condition to develop a research program as detailed in **Section 6.6.5**). Research commenced in 2014 and is currently led by the Royal Botanic Gardens and Domain Trust (RBG&DT) under the auspices of an ACARP funding program. Research has continued to monitor the success of translocations and propagation of individual plants, and determination of plant community survival.

8.3.2 Recommended Actions Arising from 2024 Annual Rehabilitation Monitoring

Rehabilitation maintenance and corrective actions are identified in Section 2.2.3 of the 2023 Annual Rehabilitation Report and Forward Program and are available on the Angus Place website.

The were no rehabilitation maintenance and corrective actions proposed over the forward program.

8.4 REHABILITATION TRIALS AND RESEARCH

Angus Place established the *Persoonia hindii* Research and Management Plan in 2013 to address Schedule 3, Condition 24A (e) and (h) of MP06_0021, which involved trialling relocation methodologies concerning *Persoonia. hindii*. survival rates from the trial were last assessed in 2023.

Further research with the *Persoonia hindii* Rare Native Plant Research Program offers insights into how *Persoonia* species may be successfully propagated and re-established in rehabilitation settings. This program falls under Section 4.6 (Supplementary Offset Measures) of the WR-BOS. Propagation/translocation trials have been progressively implemented since the inception of the program and are ongoing as detailed in **Section 6.6.5**.

There are no other future rehabilitation research, modelling or trials proposed to be undertaken.

8.5 PROPOSED ACTIONS IN NEXT REPORTING PERIOD

During 2025, Angus Place will:

- Continue to pursue approval of the revised *Western Region Biodiversity Management Plan*.
- Continue implementation of the new RMP.

Angus Place will continue to negotiate with the National Parks and Wildlife Service about land management responsibilities and requirements in relevant swamps above secondary extraction areas in the Gardens of Stone State Conservation Area. This action will inform means of addressing specialist recommendations arising from 2024 biodiversity monitoring, as detailed in **Section 6.6**.

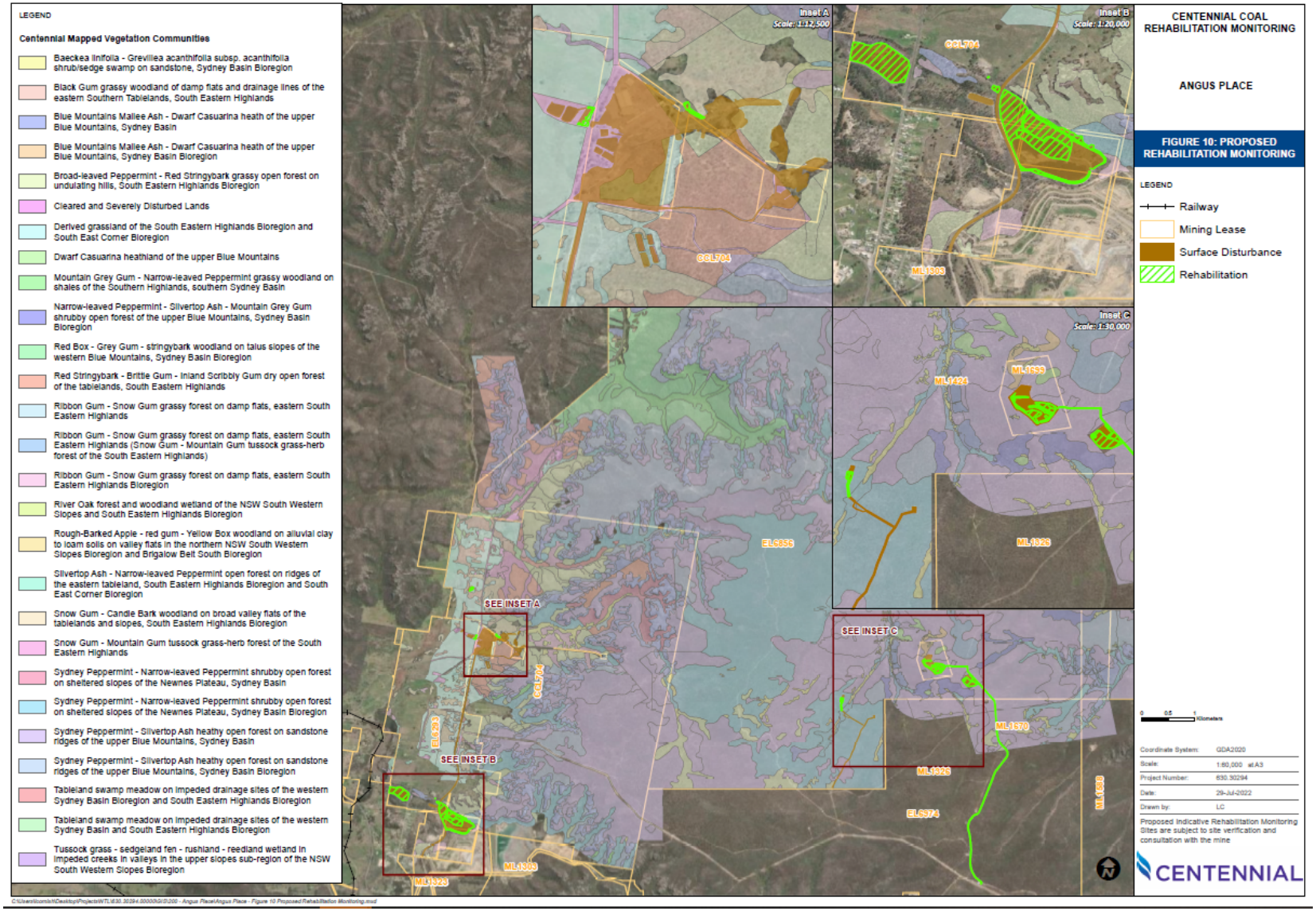

Figure 8-3: Rehabilitation and Proposed Monitoring (RMP, November 2023)

9 COMMUNITY CONSULTATION

9.1 COMMUNITY ENGAGEMENT

Centennial Angus Place consults with the community through forums such as the Angus Place Community Consultative Committee.

Meetings of the Centennial Site Community Consultative Committee (CCC) were held in March, June, September and December 2024. Representatives of the Western community/communities, appointed community representatives, relevant government organisations and company representatives attended the CCC meetings. A detailed presentation was provided to attendees at each CCC meeting on the current operations, an update on key projects, the environmental performance of the operation, and upcoming activities.

Key agenda items discussed in 2024 included the Angus Place West Project, environmental performance and notifiable incidents.

9.2 COMMUNITY COMPLAINTS

There were no community complaints received during the reporting period.

Table 9-1 below shows the community complaints record for the previous five reporting periods.

Table 9-1: Record of annual community complaints

Community Complaints						
Year	**Air**	**Water**	**Noise**	**Waste**	**Other**	**Total**
2024	**0**	**0**	**0**	**0**	**0**	**0**
2023	0	0	0	0	1	1
2022	0	0	0	0	0	0
2021	0	0	0	0	0	0
2020	0	0	0	0	0	**0**

10 INDEPENDENT ENVIRONMENTAL AUDIT

Schedule 5 Condition 8 of the Angus Place Approval required Angus Place Colliery to commission an independent environmental audit prior to 31 December 2007.

There was no independent audit requirement applicable for the 2024 reporting period.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the 2024 calendar year reporting period there were a total of four reportable incidents and non-compliances where multiple incidents occurred over multiple months (inaccessible sample location).

Table 11-1 provides a summary of the incidents and non-compliances, including the actions taken in response to the incident/non-compliance:

Table 11-1: Incidents and Non-Compliances during the Reporting Period

Compliance[23]	Overview of incident/non-compliance	Description of incident/non-compliance	Actions	Status of Actions
Non-Compliance 1	**EPL467 M2.3, WMP:** Failure to monitor the required number of samples per M2.3 at EPL Point 16 on 6 occasions April, May, June, July, August, and September 2024	Failure to monitor per M2.3 at EPL Point 16. Monthly grab samples were not conducted at Wolgan River Upstream due to an impassable flooded hole in the road.	No adverse impacts are considered to have occurred. Roadworks were undertaken in conjunction with NPWS to improve Sunny Side Ridge Road A licence variation requesting the removal of EPL points 16 - 19 was submitted to the EPA through the eConnect portal on 9 July 2024. This application included a water quality assessment report.	Pending approval from the EPA.
Non-Compliance 2	**EPL467 M2.3, WMP:** Failure to monitor the required number of samples per M2.3 at EPL Point 18 on 1 occasion throughout 2024.	An insufficient sample was acquired from Monitoring Point 18 in January (17/01/2024)., Due to the 300m depth of the bore, an insufficient water sample was able to be retrieved by the sampling contractor and TSS was unable to be analysed. This was not advised by the lab at the time and was picked up by site in a later review of the data. This is a non-compliance against condition M2.3 of EPL467 and the Water Management Plan	No adverse impacts are considered to have occurred. A licence variation requesting the removal of EPL points 16 - 19 was submitted to the EPA through the eConnect portal on 9 July 2024. This application included a water quality assessment report.	Pending approval from the EPA.

[23] See Compliance Status Key beneath **Table 1-2** for risk level, colour code and description.

Compliance[23]	Overview of incident/non-compliance	Description of incident/non-compliance	Actions	Status of Actions
Non-Compliance 3	**EPL467 M2.3, WMP:** Failure to monitor the required number of samples in accordance with M2.3 at EPL Point 19 on 11 occasions; February, March, April, May, June, July, August, September, October, November, December 2024	Failure to monitor in accordance with M2.3 at EPL Point 19. Increased water make Underground resulted in the roadway being flooded and the monitoring point becoming inaccessible	Notification has been provided to the EPA, stating this point will not be sampled from February 2024 onwards. A licence variation requesting the removal of EPL point 16 - 19 was submitted to the EPA through the eConnect portal on the 9 July 2024. This application included a water quality assessment report.	Pending approval from the EPA.
Non-Compliance 4	**EPL467 L2.4** **WMP**: A discharge from LDP002 on 11 December exceeded the Total Suspended Solids (TSS) Limit, with a TSS of 59 mg/L	A discharge from LDP002 on 11 December exceeded the Total Suspended Solids (TSS) Limit, with a TSS of 59 mg/L. The turbidity of the water was within the licence limits which allowed the discharge to commence in accordance with condition L2.6.	There was a change of staff during the month of December 2024. The new staff were not aware of the requirements of Condition L2.6, which requires the site to notify the EPA within 3 working days of receiving the results, which would of deemed the site to have not been in breach of condition L2.4.	Training and awareness of the EPL conditions and the requirements during discharge and notification to the EPA.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 12-1 presents activities that are currently planned for the next reporting period.

Table 12-1: Forecast Operations for 2025

Improvement/Other Actions
Completion and submission of the Angus Place West Project Secretary's environmental assessment requirements (SEARs) and progress EIS.
Revise biodiversity and water monitoring obligation
The KCU1 logger is broken, and a new logger will be installed in the next reporting period
A review of monitoring requirements for biodiversity will be undertaken to consider consent obligations to monitor for specific timeframes as well as focusing on current and proposed mining activity.
Management Plan Revisions
Ongoing consultation with the DPHI regarding the Western Region Biodiversity Management Plan
Condition Triggers
In accordance with Condition 4(a) in Schedule 5 of MP06_0021 strategies, plans, and programs required under the consent will be reviewed within three months of the submission of this annual review. If necessary, the strategies, plans, and programs required under the approval will be revised to the satisfaction of the Secretary.

13 REFERENCES

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Biodiversity Monitoring Services (2025). *Fauna Report: Angus Place Combined Terrestrial Fauna Monitoring Report*, prepared for Centennial Angus Place Pty Ltd

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RPS (2025a). *Angus Place Flora Monitoring: Longwalls 920-980 Summer 2023/24 Report*, prepared by RPS for Centennial Angus Place Pty Limited.

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SLR (2043b). *Angus Place Quarterly Noise Monitoring – March 2024,* prepared by SLR Consulting Australia Pty Ltd for Centennial Angus Place Pty Limited.

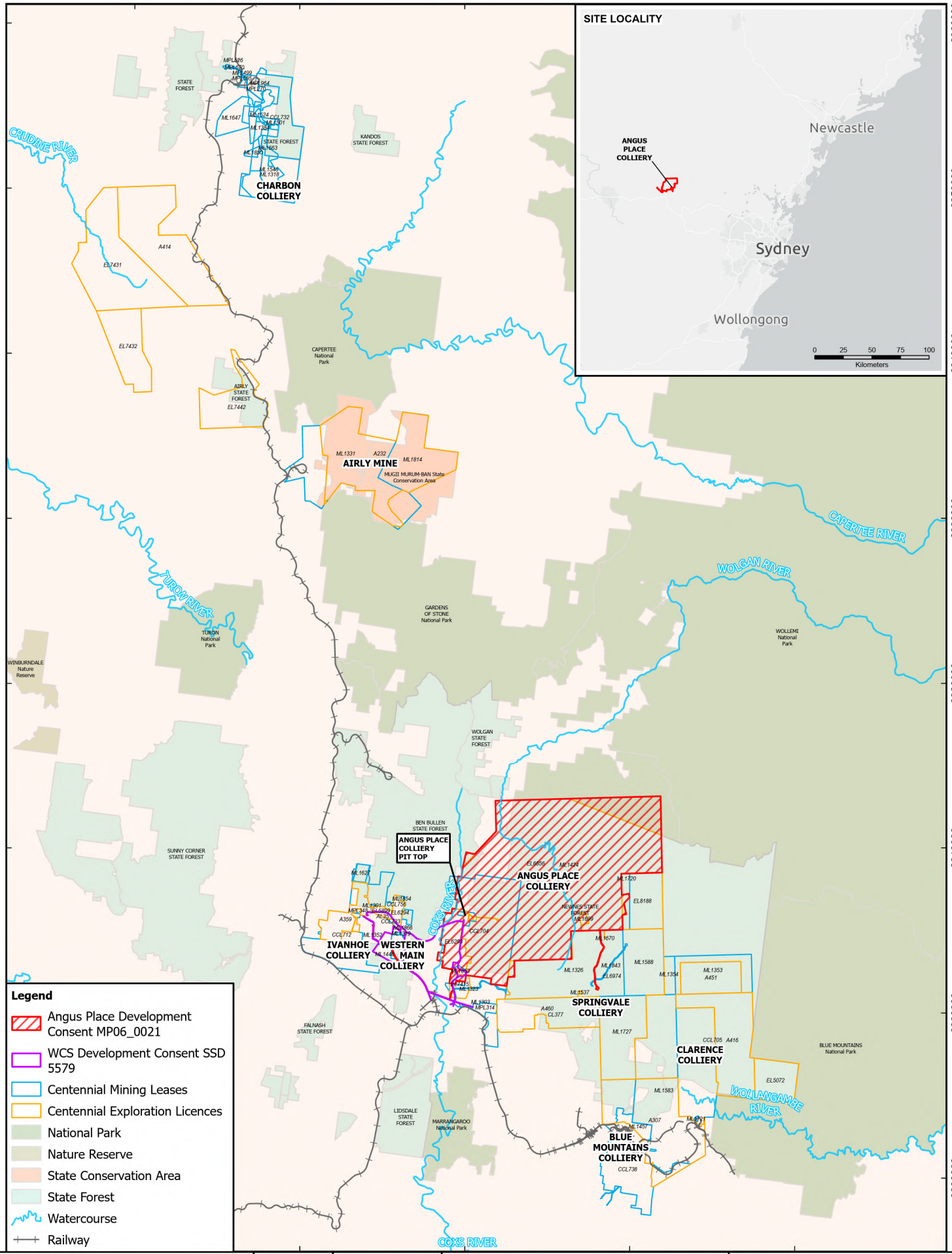
SLR (2024c). *Angus Place Quarterly Noise Monitoring – June 2024,* prepared by SLR Consulting Australia Pty Ltd for Centennial Angus Place Pty Limited.

SLR (2024d). *Angus Place Quarterly Noise Monitoring – September 2024,* prepared by SLR Consulting Australia Pty Ltd for Centennial Angus Place Pty Limited.

SLR (2025e). *Angus Place Quarterly Noise Monitoring – December 2024,* prepared by SLR Consulting Australia Pty Ltd for Centennial Angus Place Pty Limited.

WMP (2021). *Angus Place Colliery Water Management Plan*, prepared by Centennial Angus Place Pty Limited.

PLANS



N

0 5 10 15
Kilometers

LOCATION	Angus Place
SEAM	N/A
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:300,000 @ A4

Coordinate System: GDA2020 MGA Zone 56

ANGUS PLACE COLLIERY
Annual Review 2024
Regional Locality
---Figure 1---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10001 | R2

Esri, TomTom, Garmin, FAO, NOAA, USGS

PLOTFILE: N:\SHARED\GDA_2020\Plans\Angus Place\FASS10002_R2.apx

0 500 1,000 1,500 2,000
meters

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- WCS Development Consent SSD 5579
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation Area
- State Forest
- Open Cut Extents
- Existing Underground Workings
- Western Haul Road
- Watercourse

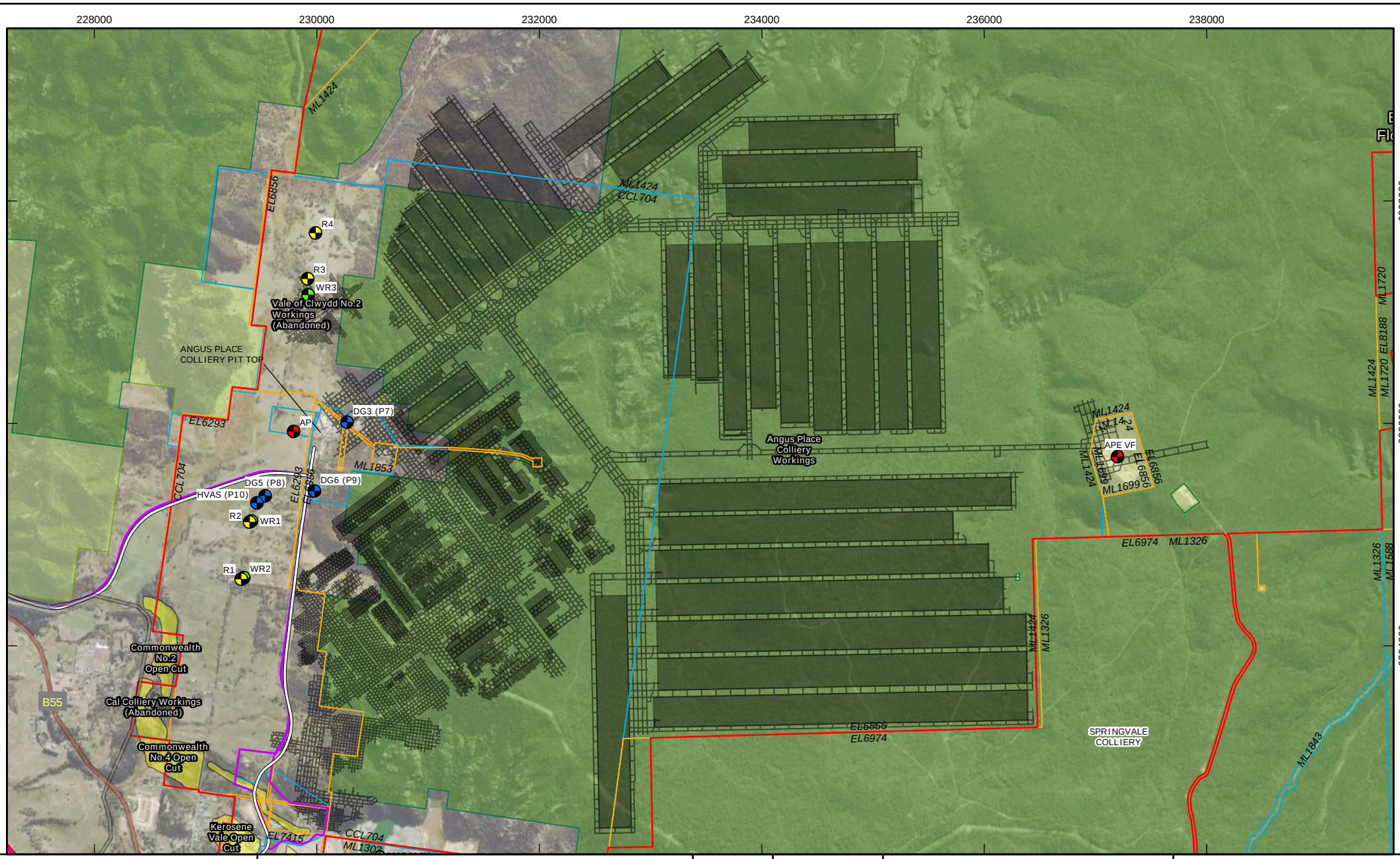
LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Site Layout
---Figure 2---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10002 | R2

Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS, Maxar



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0 1 2
Kilometers

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- WCS Development Consent SSD 5579
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation Area
- State Forest
- Open Cut Extents
- Existing Underground Workings
- Western Haul Road
- Air Monitoring
- Meteorological Monitoring
- Sensitive Receiver Dust
- Noise Monitoring Sites

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Meteorological, Air Quality and Noise Monitoring Sites
---Figure 3---

CENTENNIAL ANGUS PLACE

DATE: 4/02/2025 | FASS10000 | R3

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0 1 2
Kilometers

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation Area
- State Forest
- Open Cut Extents
- Western Haul Road
- Existing Underground Workings
- Watercourse
- Drainage Lines
- Dams
- MU50 Newnes Plateau Shrub Swamp (EEC)
- MU51 Newnes Plateau Hanging Swamp (EEC)
- MU52 Newnes Plateau Rush - Sedge Snow Gum

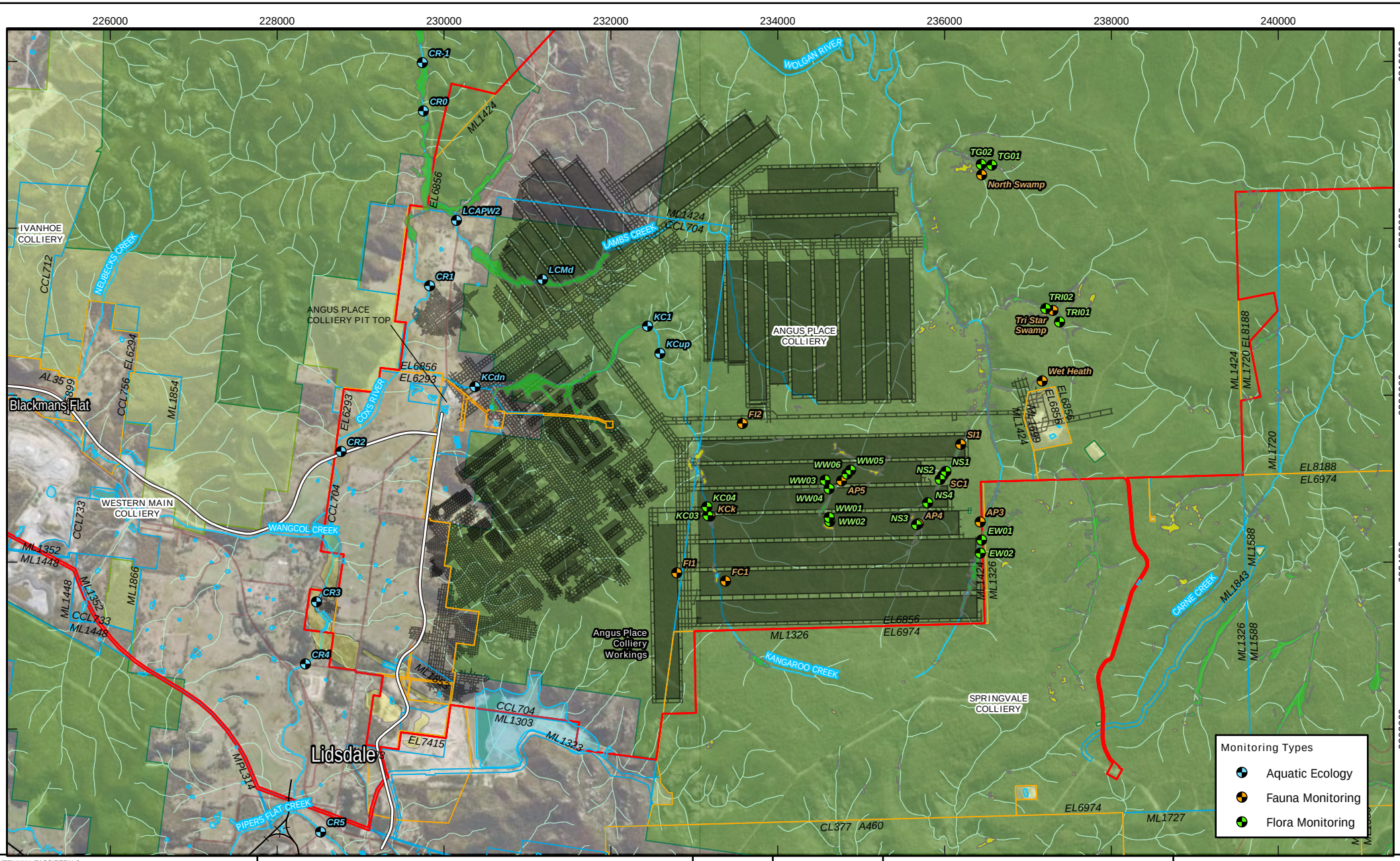
LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Water Monitoring Sites
---Figure 4---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10003 | R2

Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS, Earthstar Geographics



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CENTENNIAL FASSIFERN ©

0 1 2
Kilometers

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation Area
- State Forest
- MU50 Newnes Plateau Shrub Swamp (EEC)
- MU51 Newnes Plateau Hanging Swamp (EEC)
- Dams
- Underground Workings
- Open Cut Extents
- Existing Underground Workings
- Western Haul Road
- Roads
- Railway
- Watercourse
- Drainage Lines

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:60,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Ecological Monitoring Sites
---Figure 5---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10004 | R3

PLOTFILE: N:\SHARED\GDA_2020\Plans\Angus Place\FASS10005_R2.aprx

CENTENNIAL FASSIFERN ©

0 100 200
meters

Coordinate System: GDA2020 MGA Zone 56

Legend

- Centennial Exploration Licences
- Infrastructure Area
- Water Management Areas
- State Conservation Area
- State Forest
- Western Haul Road
- Existing Underground Workings
- Watercourse
- Licence Discharge Points

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:6,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Angus Place Pit Top
---Figure 6---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10005 | R2

N

0 250 500
meters

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation Area
- State Forest
- Rehabilitation Areas - Open Cut Boundaries
- Open Cut Extents
- Western Haul Road
- Existing Underground Workings

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:12,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Commonwealth Colliery
---Figure 7---

CENTENNIAL ANGUS PLACE

DATE: 6/02/2025 | FASS10006 | R2

PLOTFILE: N:\SHARED\GDA_2020\Plans\Angus Place\FASS10006_R2.aprx

Esri Community Maps Contributors, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS, Maxar

PLOTFILE: N:\SHARED\GDA_2020\Plans\Angus Place\FASS10007_R2.aprx

N

0 100 200 300
meters

Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences (Offset for clarity)
- Centennial Mining Leases
- State Conservation Area
- State Forest
- Existing Underground Workings
- Watercourse

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	L.Mudie
APPROVED	L.Mudie
SCALE	1:6,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2024
Vale of Clywdd No.2 Colliery
---Figure 8---

CENTENNIAL ANGUS PLACE

DATE: 4/02/2025 | FASS10007 | R2

APPENDICES

Appendix 1: Checklist of Annual Review Reporting Requirements

Table A1-1 provides a checklist of reporting requirements and performance conditions addressed within the Annual Review.

Table A1-1: Project Approval Annual Review Requirements

Approval	Requirement	Where addressed in Annual Review
MP06_0021 Schedule 5 Condition 3	*3. By the end of December 2012, and annually thereafter, the Applicant must review the environmental performance of the project to the satisfaction of the Secretary.* *This review must:* *(a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the next year;* *(b) include a comprehensive review of the monitoring results and complaints records of the project over the past calendar year, which includes a comparison of these results against the* • *the relevant statutory requirements, limits or performance measures/criteria;* • *the monitoring results of previous years; and* • *the relevant predictions in the EA;* *(c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;* *(d) identify any trends in the monitoring data over the life of the project;* *(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and* *(f) describe what measures will be implemented over the next year to improve the environmental performance of the project.*	This Document
MP06_0021 Schedule 3 Condition 9	*9. The Water Balance must:* *(a) include details of all water extracted, dewatered, transferred, used and/or discharged by the mine, including protocols for managing temporary storage in underground workings / goaf areas as part of the water management system; and* *(b) provide for the annual re-calculation of the water balance and its reporting in the Annual Review.*	**Section 7.2**
MP06_0021 Schedule 3 Condition 21	*21. The Applicant must:* *(a) implement all reasonable and feasible best practice noise mitigation measures;* *(b) investigate ways to reduce the noise generated by the project, including noise generated from use of the Wallerawang power station haul road; and* *(c) report on these investigations and the implementation and effectiveness of these measures in the Annual Review,* *to the satisfaction of the Secretary..*	**Section 6.2**

Approval	Requirement	Where addressed in Annual Review
MP06_0021 Schedule 3 Condition 32	*32. The Applicant must:* *(a) take all reasonable steps to minimise the waste (including coal rejects and tailings) generated by the development;* *(b) classify all waste in accordance with the Waste Classification Guidelines (EPA, 2014);* *(c) dispose of all waste at appropriately licensed waste facilities; and* *(d) monitor and report on the effectiveness of the waste minimisation and management measures in the Annual Review referred to in condition 3 of Schedule 5.*	**Section 6.9**

Appendix 2: Annual Environmental Monitoring Report (EMM, 2025): Water Monitoring Results and Trends

Angus Place Colliery Annual Environmental Monitoring Report

January to December 2024

Prepared for Centennial Coal

February 2025

Angus Place Colliery Annual Environmental Monitoring Report

January to December 2024

Centennial Coal

E221267AP RP2

February 2025

Version	Date	Prepared by	Approved by	Comments
1	20 February 2025	Aislinn Smeallie	Jonathon Tait	Final

Approved by

Jonathon Tait
Associate Hydrogeologist
20 February 2025

Level 10 201 Pacific Highway
St Leonards NSW 2065
ABN: 28 141 736 558

TABLE OF CONTENTS

Appendices

Tables

Figures

Report summary

In accordance with the Water Management Plan (WMP) (GHD 2021) and trigger action response plan (TARP) (Appendix A), all groundwater and surface water monitoring sites were within normal condition (i.e. trends are consistent with natural variation). The following points summarise observations made during the reporting period:

- The annual total observed rainfall at Newnes Prison Farm was 46.1 millimeter (mm) greater than the long-term annual total average. Daily cumulative rainfall deviation shows a positive trend from January to May (above average rainfall) and a negative trend from June to December (below average rainfall).
- Swamp piezometers: Swamp groundwater levels were generally stable or fluctuating in response to observed rainfall.
- Soil moisture: Soil moisture content typically fluctuated closer to ground level, while deeper sensors indicated soil moisture content to generally be stable or slightly decreasing.
- Ridge piezometers: Groundwater levels were consistent with climatic and historical observations.
- Vibrating wire piezometers (VWP): Piezometric pressures were consistent with historical observations. It should be noted that data from some VWPs were not available from May 2022 onwards due to degraded access track conditions.
- Discharge water quality: No exceedances were identified. Trends are consistent with historical observations and natural variability.
- Surface water quality and flow: The observed trends are consistent with historical patterns and natural variability. No exceedances were identified, except for two pH values at the Kangaroo Creek/Cox River (KC/CR) Confluence recorded in May (6.0 pH) and June (5.6 pH), both of which fell below the lower trigger threshold. However, the trend did not persist for the remainder of the reporting period.
- Pit top surface water quality: Pit top surface water quality observations generally remained stable and consistent with historical observations.
- Swamp surface water quality and flow: All but one (Tri Star Swamp) monitoring locations were dry or inaccessible due to degraded access track conditions during the reporting period. Tri Star Swamp show trends consistent with climatic observations and historical trends.

1 Introduction

Angus Place Colliery is an underground coal mine located in the Western Coalfield's approximately 5 kilometers (km) north of Lidsdale and approximately 15 km north-west of Lithgow. The colliery is operated by Centennial Angus Place Pty Limited (Angus Place). The *Angus Place Colliery Water Management Plan* (WMP) (GHD 2021) was prepared for Angus Place Colliery by GHD in 2021. The WMP addresses specific water components of the conditions of development consent MP 06_0021, which was granted by the Minister for Planning on 13 September 2006.

EMM Consulting Pty Limited (EMM) was engaged by Angus Place to conduct quarter-monthly surface water and groundwater monitoring during 2024 in accordance with the requirements of the WMP.

1.1 Purpose of the report

This annual review documents surface water and groundwater monitoring results in accordance with the WMP. The report also details any triggers, relevant observations and, if required, makes recommendations pertaining to the current surface water and groundwater monitoring network.

1.2 Reporting period

This report reviews monitoring data from 1 January to 31 December 2024 (the reporting period).

1.3 Mining

Angus Place Colliery has been operating under care and maintenance since early 2015. No active mining occurred during the reporting period.

1.4 Notable changes during the reporting period

Some notable changes to the Angus Place groundwater and surface water monitoring network were made during the reporting period:

- KCU1 logger requires replacement.
- KCU2SM soil moisture probe needs to be replaced due to wildlife damage.
- KCU5SM is not functional and requires further diagnosis.
- AP1102 VWP data logger needs replacement.
- Issues with AP1105 VWP, NS2 and WE2 loggers are outstanding.

2 Existing environment

2.1 Climate

A comparative analysis of the two weather stations has been presented in Table 2.1 due to the disparate weather patterns occurring across the region, influenced by topography. Daily rainfall was sourced from the ALS Global Newnes Plateau Prison Farm rain gauge and the Bureau of Meteorology (BOM) weather station at Maddox Lane, Lidsdale (BoM Station No. 063132).

Total annual rainfall exceeded the long-term average at both Newnes Prison Farm and Lidsdale, with Newnes Prison Farm receiving 46.1 millimeters (mm) more and Lidsdale receiving 30.9 mm more. Both locations experienced higher-than-average rainfall in January and April. In contrast, March, August, September, October, and December recorded lower-than-average rainfall at both stations.

The daily cumulative rainfall departure (CRD) for Newnes Prison Farm rain gauge is presented on Figure 2.1. CRD deviation shows a positive trend from January to May (above average rainfall) and a negative trend from June to December (below average rainfall).

Table 2.1 January to December 2024 climate summary

Month	Observed rainfall (mm)		Long-term average rainfall (mm)	
	Newnes Prison Farm	Lidsdale (BoM station 063132)	Newnes Prison Farm[1]	Lidsdale (BoM station 063132)[2]
January	149.0	120.8	96.3	87.0
February	102.2	84.6	117.0	76.7
March	39.0	45.4	109.2	70.4
April	177.6	122.2	65.6	44.4
May	102.4	45.8	41.4	47.2
June	55.4	66.8	72.4	49.2
July	69.8	39.2	53.5	50.8
August	30.0	26.0	56.0	62.9
September	29.2	32.4	57.6	53.2
October	30.6	18.6	79.4	66.8
November	97.2	131.0	99.4	75.8
December	30.6	64.0	81.1	73.2
Total	**913.0**	**796.8**	**866.9**	**765.9**

Notes: 1. Observation period 20 August 1998 to present.
2. Observation period August 1959 to present.

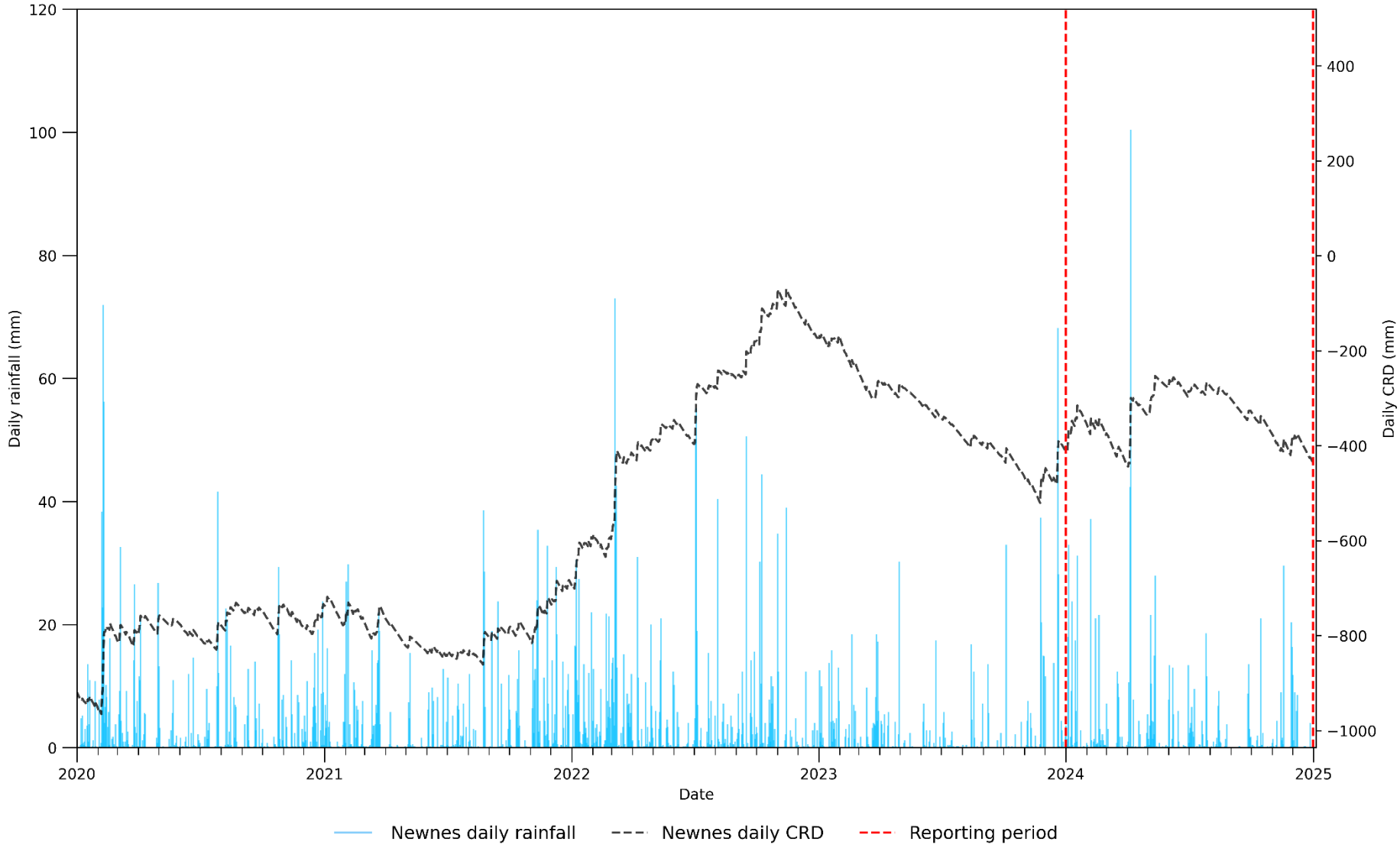


Figure 2.1 **Daily cumulative rainfall deviation 2020 to present**

2.2 Drainage and catchments

Angus Place is within the Coxs River and Wolgan River catchments. Watercourses off the plateau are often deeply incised in their lower reaches, incorporating numerous cliff lines and pagodas bordering the valley flanks. In the upper catchment areas, drainage lines are typically poorly defined to non-existent with overland sheet flow being the typical mode of discharge during rainfall events.

2.3 Hydrogeology

The hydrogeological complexities of the Newnes Plateau local area have been well investigated over time. The groundwater systems interacting with the Angus Place have been conceptualised, and are divided into three distinct aquifers (McHugh 2018):

- perched aquifers, predominantly sandstone aquifers between several claystone aquitard units
- shallow aquifers, predominantly regional sandstone aquifers, ranging from unconfined to semi-confined
- deep aquifers, which are confined in the project area and includes the Lithgow Coal Seam.

2.3.1 Perched aquifer—Burralow Formation

The perched groundwater system is hosted within the Burralow Formation (Triassic Narrabeen Group) and is up to 110 meters (m) in thickness. The perched aquifer comprises multiple discontinuous perched localised flow bands and is recharged by rainfall.

Seven distinct fine-grained claystone and siltstone units (YS1 to YS6, including YS5a) act as aquicludes, or semi-permeable layers, which impede rainfall percolation to the shallow groundwater system associated with the underlying Banks Wall Sandstone (McHugh, 2018). The aquifers between aquicludes are also known as AQ6 (aquifers between YS1 to YS4) and AQ5 (aquifers between YS4 to YS6) and transmit water along bedding planes and weathered horizons.

The Newnes Plateau Shrub Swamps (NPSS) and Newnes Plateau Hanging Swamps (NPHS), listed as an Endangered Ecological Community under the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*, coincide with the lithographic and topographic occurrence of YS plies in the Burralow Formation (McHugh, 2018).

2.3.2 Shallow aquifer—Banks Wall Sandstone

The shallow groundwater system is a regional system in the Banks Wall Sandstone (Narrabeen Group) and is up to 100 m in thickness (McHugh, 2018). This hydrogeological unit is also known as AQ4.

The shallow groundwater system is recharged by rainfall, overlying watercourses where it outcrops in incised gullies, and leakage from the perched groundwater system. Regional recharge potentially occurs in areas of outcrop and sub-crop (Jacobs, 2019).

Local discharge is inferred to occur in incised gullies that intercept the water table with some swamps coinciding with this occurrence (McHugh, 2014). Regional discharge is inferred to occur to the north-east, where the unit outcrops in the scarp of the plateau.

Groundwater flow is mainly controlled by interconnective fracturing, bedding planes and structural features such as lineaments and faults, with some contribution from pore porosity (Jacobs, 2019). The low permeability of the rock matrix means that the fracture system is the primary control of groundwater flow. The direction of groundwater flow is toward the north-east, which is consistent with the dip of the strata.

At the base of the shallow groundwater system is the Mount York Claystone (MYC). This unit comprises a sequence of sandstone, shale and claystone that form an aquitard which limits connectivity between the shallow and deep groundwater systems. This hydrogeological unit is also known as SP3.

2.3.3 Deep aquifer—Illawarra Coal measures

Below the MYC, the deep aquifer, associated with the Triassic Burra-moko Head Sandstone, Caley Formation and Permian Illawarra Coal Measures, which includes the Katoomba Seam, Farmers Creek Formation, Gap Sandstone, Denman Formation, Long Swamp Formation, Blackmans Flat Conglomerate, Lithgow Seam and Marrangaroo Conglomerate, is up to 200 m in thickness.

The Burra-moko Head Sandstone, Caley Formation and Katoomba Seam hydrogeological units are also known as AQ3. The Farmers Creek Formation and Gap Sandstone hydrogeological units are also known as AQ2. The Long Swamp Formation, Blackmans Flat Conglomerate and Lithgow Seam hydrogeological units are known as AQ1. The Denman Formation hydrogeological unit is a semi-permeable layer known as SP1.

Groundwater flow occurs primarily via interconnective fracturing, bedding planes, coal seams and structural features such as lineaments and faults. The fracture system is the primary control of groundwater flow as the rock matrix has low permeability.

The general groundwater flow direction in the deep aquifer is towards the north-east, which is consistent with the dip of the strata. Regional recharge potentially occurs in areas of outcrop/sub-crop to the west and south-west of the study area by rainfall, overlying watercourses, dams and minor leakage from the shallow aquifer. Groundwater discharge is inferred to occur to the north-east, where the units outcrop in the scarp of the plateau, and mine dewatering.

2.4 Surface water and groundwater interaction

The dominant surface water and groundwater interaction on the Newnes Plateau involve recharge to shallow groundwater and groundwater discharge to surface water (Jacobs 2019).

Surface water leakage to shallow groundwater occurs from overlying watercourses. Groundwater discharge to surface water flow occurs as seepages and drips from exposed faces of cliff lines or exposed bedrock in drainage lines, or as seepage from sub-cropping bedrock to regolith or residual soil profiles on valley flanks and valley floors (Jacobs 2019). Where sufficient seepage occurs, the development of NPHS or NPSS may be supported. Groundwater seepage may contribute to stream baseflow either directly as discharge to drainage lines in the valley floor, or indirectly as a contribution to catchment subsurface flow (Jacobs 2019).

3 Monitoring program

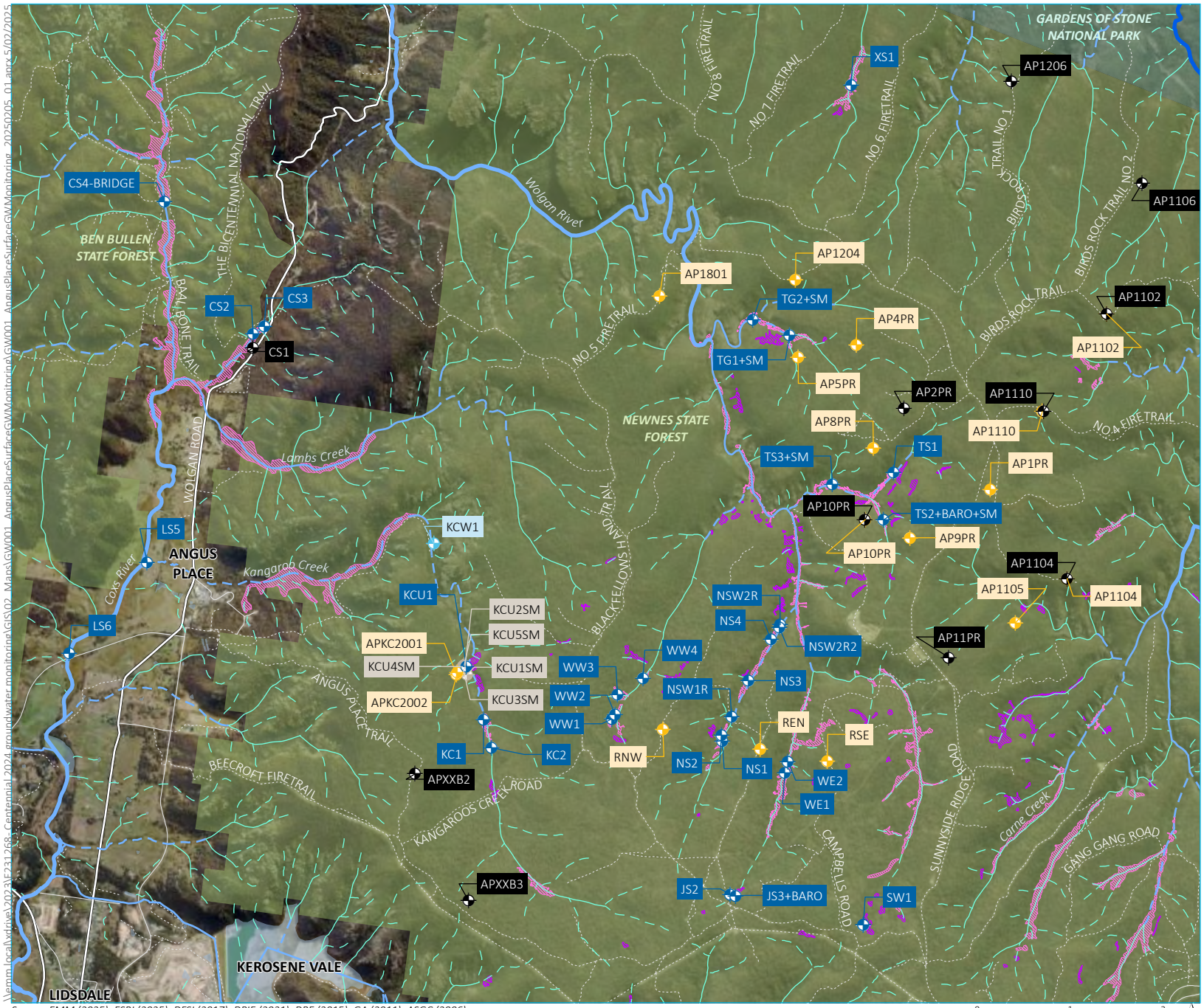
3.1 Overview

The WMP (GHD 2021) monitoring program requires the collection of groundwater and surface water monitoring data to assess for potential mining-related impacts on the groundwater and surface water regimes. The ongoing collection of groundwater and surface water data facilitates the development and improvement of water management strategies.

Subsidence from historic mining activities can cause changes to the hydrogeological regime. The Angus Place monitoring program targets NPSS, NPHS, as well as the perched, shallow and deep groundwater systems through a combination of routine surface water monitoring, standpipe piezometers and vibrating wire piezometers (VWP).

The locations of the groundwater and surface water monitoring sites are shown on Figure 3.1 and Figure 3.2. The following details the Angus Place surface water and groundwater monitoring network:

- swamp (NPSS) groundwater levels are measured daily using level loggers (loggers) at 26 shallow standpipe piezometers across nine swamps
- soil moisture content is measured daily at nine monitoring locations across three swamps (NPSS and NPHS)
- shallow aquifer groundwater levels are measured daily using loggers at 18 ridge piezometers
- four shallow aquifer monitoring locations are measured manually on a bi-monthly basis
- piezometric pressures within the shallow and deep aquifers are measured daily at 11 monitoring locations by multi-level VWP arrays
- discharge surface water quality is measured at two monitoring locations either weekly or monthly intervals, depending on the criteria set by the WMP (GHD 2021)
- watercourse surface water quality and flow rate are measured at 14 monitoring locations either weekly or monthly intervals, depending on the criteria set by the WMP (GHD 2021)
- pit top surface water quality is measured at three monitoring locations either weekly or monthly intervals, depending on the criteria set by the WMP (GHD 2021)
- swamp surface water quality and flow rate are measured at five monitoring locations either weekly or monthly intervals, depending on the criteria set by the WMP (GHD 2021)
- manual groundwater level measurements are captured every two months.



KEY

Monitoring bore
- Soil moisture
- Standpipe
- Surface water
- Swamp
- VWP

- Hanging swamp
- Shrub swamp
- Major road
- Minor road
- Vehicular track
- Cadastral boundary
- Waterbody
- NPWS reserve
- State forest

Strahler stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY
- Major road
- NPWS reserve
- State forest

Angus Place Surface and Groundwater Monitoring Network

Figure 3.1

Source: EMM (2025); ESRI (2025); DFSI (2017); DPIE (2021); DPE (2015); GA (2011); ASGC (2006)

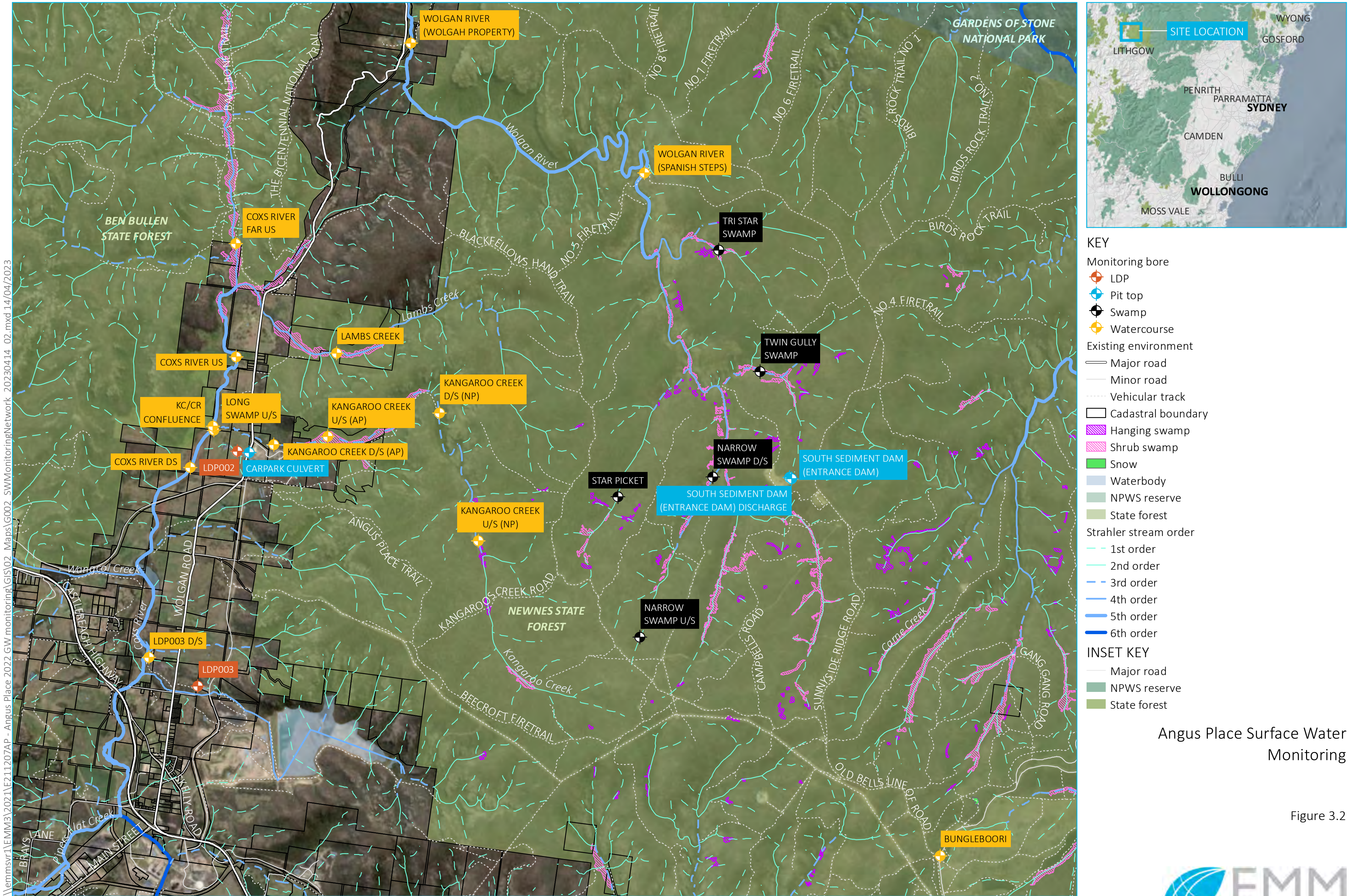
0 1 2 km

GDA 1994 MGA Zone 56

N

EMM creating opportunities

\\emm.local\vdrive\2023\E231268_Centennial_2024 groundwater monitoring\GIS\02_Maps\GW001_AngusPlaceSurfaceGWMonitoring\GW001_AngusPlaceSurfaceGWMonitoring_20250205_01.aprx 5/02/2025



Angus Place Surface Water Monitoring

Figure 3.2

Source: EMM (2023); ESRI (2021); DFSI (2017); DPIE (2021); DPE (2015); GA (2011); ASGC (2006)

EMM creating opportunities

3.2 Performance measurement

The WMP (GHD 2021) outlines trigger levels for surface water quality and groundwater at specific monitoring locations. Impacts are assessed against performance triggers to identify whether observed changes in groundwater levels and surface water quality exceed natural variance.

The trigger levels are typically developed based on statistical analysis of pre-mining baseline data collection for groundwater levels or review of relevant guidelines and environmental protection licences (EPL) for surface water quality.

3.3 Trigger criteria

The WMP (GHD 2021) outlines several trigger criteria for groundwater level and surface water quality data that allow for the detection of mining-related impacts. The trigger criteria have been developed to prompt specific actions identified in the trigger action response plans (TARPs) presented in Appendix A to prevent the exceedance of the performance criteria. It should be noted the WMP (GHD 2021) does not specify any trigger criteria for soil moisture content, swamp groundwater levels or groundwater quality. The criteria for performance indicators for this report are shown in Table 3.1.

Pre-mining observations are used to develop trigger levels and are collected until a monitoring site is within 600 m of active mining. When a monitoring site falls within 600 m of active mining, the pre-mining period of data collection ends and the pre-mining trigger level is set. Post-mining data is compared to pre-mining trigger levels to discern potential mining impacts.

The groundwater level triggers for perched aquifer piezometers, shallow aquifer piezometers and VWPs were not used in the analysis of respective trends because Angus Place is in care and maintenance. Except for licensed discharge points, observations at monitoring bores and surface water monitoring sites are considered a reflection of natural variation. Furthermore, most ridge piezometers and VWP detailed in the WMP are still in their pre-mining period of data collection and any variability in groundwater levels or piezometric pressures are assumed to be due to natural variability.

Table 3.1 Angus Place water management plan trigger criteria

Monitoring zone	Monitoring type	Comment
Groundwater levels	Ridge piezometers	Groundwater trigger values have been defined by the WMP (GHD 2021) as the observed depth to groundwater falling 2 m below the 95th percentile pre-mining depth to groundwater for more than seven consecutive days.
	Vibrating wire piezometer	Trigger values for VWPs have been defined by the WMP (GHD 2021) as observed piezometric level falling 2 m below the minimum observed piezometric level for more than seven consecutive days. Not assessed against during this reporting period.

Table 3.1 Angus Place water management plan trigger criteria

Monitoring zone	Monitoring type	Comment
Surface water quality	Discharge water quality	Discharge water quality trigger values are specified by EPL 467. The trigger values are as follows: • LDP002: – pH: 6.5—8.5 (90th percentile concentration limit) and 6.5—9.0 (100th percentile concentration limit). – Total Suspended Solids (TSS): 30 milligrams per litre (mg/L). • LDP003: – pH: 6.5—8.5 (100th percentile concentration limit). – TSS: 50 mg/L. The concentration limits for LDP002 and LDP003 do not apply when discharge occurs within five days after a rainfall event measured at the site which exceeds 44 mm over any consecutive five day period.
	Watercourse water quality	Surface water quality monitored at the downstream sites KC/CR confluence and Coxs River D/S assessed against site-specific guideline values (SSGVs), which are based on a review of ANZECC (2000) default guideline values (DGVs) and water quality observed at an upstream reference site. The trigger values are as follows: • Electrical Conductivity (EC): 350 micro siemens per centimetre (µS/cm). • pH: 6.3–8.5. • TSS: 25 mg/L. Water quality must be outside or above the specified values above for at least one parameter for two consecutive sampling events.

4 Groundwater monitoring

The following subsections summarise groundwater monitoring observations from the reporting period. Groundwater levels and piezometric pressures have been compared to the historic monitoring data. As mentioned in Section 3.3, groundwater level triggers specified in the WMP (GHD 2021) were not applied, as Angus Place has been in care and maintenance since 2015.

4.1 Swamp piezometers

Groundwater levels at various NPSS are monitored by a network of loggers recording hydrostatic pressure installed in shallow (approximately 2 m) standpipe piezometers targeting unconsolidated swamp sediments (refer Table 4.1).

Hydrographs for each monitoring site are shown in Figure 4.1 to Figure 4.9, showing groundwater level data in metres below ground level (mbgl) and daily CRD in mm. Dashed vertical lines represent the reporting period, and logger depths for each monitoring location are indicated on the left of each hydrograph.

A summary of key observations and trends is provided in Table 4.1. Swamp monitoring locations presented in Figure 3.1.

Table 4.1 Swamp piezometer summary

Swamp ID	Piezometer ID	Comments
Kangaroo Creek	• KC1 • KC2 • KCU1	The hydrograph for Kangaroo Creek Swamp piezometers is presented as Figure 4.1. Kangaroo Creek Swamp is currently monitored at three locations: KC1 (installed May 2005), KC2 (installed November 2008) and KCU1 (installed October 2020). Following undermining in 2008, groundwater levels at KC1 and KC2 were typically dry and have shown minimal response to rainfall events. Since installation, KCU1 has typically been dry, however it is slightly more responsive to rainfall than KC1 and KC2. During the reporting period, groundwater levels at KC1 and KC2 were dry despite an increasing CRD trend and large rainfall events in early-April. The KCU1 logger is broken, and a new logger will be installed in the March monitoring event. KC1 logger was experiencing issues and was fixed in the November maintenance event.
Tri Star	• TS1 • TS2 • TS3	The hydrograph for Tristar Swamp piezometers is presented as Figure 4.2. Tristar Swamp is currently monitored at TS1, TS2 and TS3, all of which were installed October 2011. Historically, TS1 and TS2 have been intermittently dry, responding to periods of above average rainfall, while the groundwater level at TS3 has remained stable at just below ground level. During the reporting period, groundwater levels at TS1 and TS2 fluctuated in line with daily CRD trends. Groundwater levels increased in April due to intense rainfall events. TS3 displayed minimal variation.
West Wolgan	• WW1 • WW2 • WW3 • WW4	The hydrograph for West Wolgan Swamp is shown in Figure 4.3. Groundwater monitoring is conducted at four locations – WW1, WW2, WW3, and WW4 – all installed in 2005 and undermined by longwalls LW930, LW940, and LW960 between May 2007 and July 2009. Historically, groundwater levels at WW1 and WW2 have mirrored the daily CRD trend. WW3 responds quickly to rainfall recharge, followed by rapid drainage. WW4 has remained predominantly dry since 2012, with water levels only rising in response to significant rainfall events and draining shortly afterward. It is common for piezometers to remain dry between monitoring events. During the reporting period, groundwater levels at WW1 to WW4 remained predominately dry, apart from an increase in April and the following months due to rainfall events, before gradually decreasing due to dryer conditions.

Table 4.1 Swamp piezometer summary

Swamp ID	Piezometer ID	Comments
Wolgan East	• WE1 • WE2	The hydrograph for East Wolgan Swamp is presented as Figure 4.4. East Wolgan Swamp is monitored by WE1 and WE2 (installed in May 2005). Historically, East Wolgan Swamp has been influenced by emergency mine water discharges from licensed discharge point LDP04. Mine discharge events coincide with a groundwater level increase at WE1 and WE2 in 2005, 2008 and 2009. Apart from the discharge events, groundwater levels at WE1 and WE2 are typically dry, only responding to significant rainfall events. WE2 appears to be more responsive to rainfall than WE1. During the reporting period, groundwater levels remained predominately dry, apart from an increase in April due to a high rainfall event.
Trail Six	• XS1	The hydrograph for Trail Six Swamp is presented as Figure 4.5. The groundwater level at Trail Six Swamp is currently monitored at XS1, which was installed in October 2011. Historically, groundwater levels at XS1 have been relatively stable, reflecting a subdued response to the daily CRD. During the reporting period, groundwater levels at XS1 were in line with daily CRD trends and consistent with historical observations.
Twin Gully	• TG1 • TG2	The hydrograph for Twin Gully Swamp is presented as Figure 4.6. Twin Gully Swamp is currently monitored at TG1 (installed October 2011) and TG2 (installed April 2018). Historically, groundwater levels at TG1 and TG2 have reflected the daily CRD trend, with TG2 tending to fluctuate in greater proportion when compared to TG1. During the reporting period, groundwater levels at TG1 and TG2 were in line with daily CRD trends and consistent with historical observations.
Narrow	• NS1 • NS2 • NS3 • NS4 • NSW1R • NSW2R	The hydrograph for Narrow Swamp is presented as Figure 4.7. Narrow Swamp is currently monitored at six locations: NS1 and NS2, which were installed May 2005, NS3 which was installed February 2008, NS4 which was installed April 2008, and NSW1R and NSW2R which were installed September 2021. NS1, NS2 and NSW1R monitor the upstream reaches of the swamp, NS3 monitors the middle, and NS4 and NSW2R monitor down gradient. Historically, groundwater levels at Narrow swamp have been influenced by emergency mine water discharge from licensed discharge points LDP004 and LDP006. Mine discharge events coincide with a water level increase in LDP004 over the period 2005 to 2008, and from LDP006 in 2009. Except for the discharge events, NS1 to NS4 have remained predominantly dry since 2009, only responding to significant rainfall events. During the reporting period, groundwater levels at NS1, NS2, NS3 and NS4 were dry. The groundwater level at NSW1R and NSW2R was periodically dry and fluctuated in response to daily CRD trends.
Long	• LS5 • LS6 • CS4	The hydrograph for Long Swamp is presented in Figure 4.8. Piezometer LS5 is in the upper reaches of Long Swamp, while LS6 is installed downgradient. Piezometer CS4 is positioned near the Leg Bridge, adjacent to the upper reaches of the Coxs River. A data gap exists for CS4 and LS6 from October 2019, when the loggers were destroyed by bushfire. The loggers were replaced in August 2020. Another data gap for CS4 occurred from January 2021 due to damage caused by a vehicle, with the piezometer and datalogger replaced in September 2021. Groundwater levels across all monitoring sites generally fluctuated in direct response to rainfall recharge. LS5 demonstrated greater fluctuations in base groundwater levels compared to CS4 and LS6, suggesting a higher sensitivity to recharge events or variations in local hydrogeological conditions. During the reporting period, CS4 groundwater levels remained relatively stable, but fluctuated in response to daily CRD trends. LS6 and LS5 also fluctuated in response to daily CRD trends.

Table 4.1 Swamp piezometer summary

Swamp ID	Piezometer ID	Comments
Coxs River	• CS2 • CS3	The hydrograph for Coxs River Swamp is presented in Figure 4.9. Monitoring at Coxs River Swamp is conducted through piezometers CS2 and CS3, both installed in September 2019. Historically, CS2 and CS3 remained dry until February 2020 and July 2020, respectively, after which they maintained stable groundwater levels due to above-average rainfall between February 2020 and November 2022. A data gap is present for CS2 from March to June 2023 because the logger was not reinstalled correctly. During the reporting period, groundwater levels at CS2 and CS3 remained relatively stable, fluctuating in response to daily CRD trends. CS3 exhibited more pronounced responses to these trends compared to CS2.

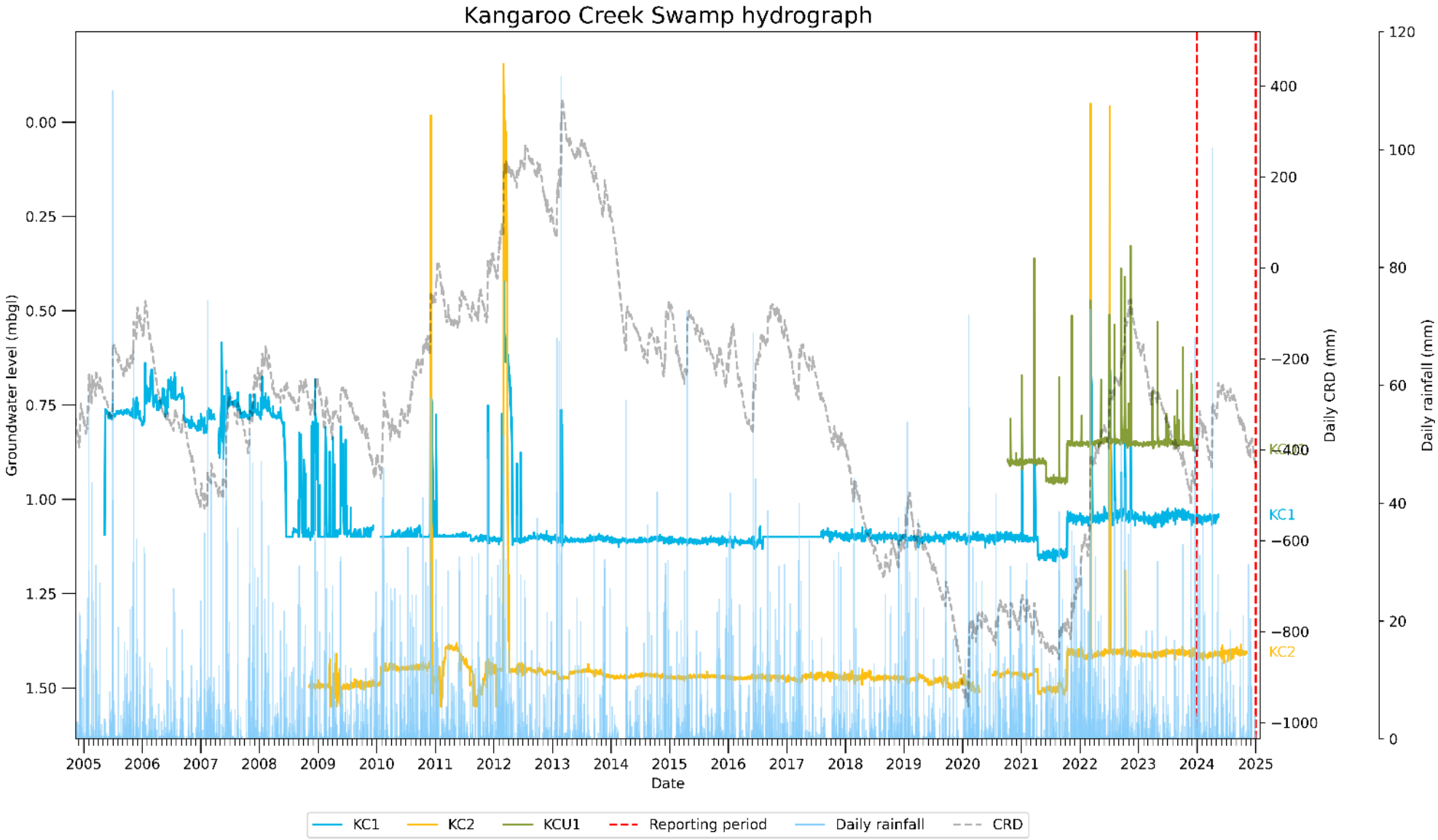


Figure 4.1 **Kangaroo Creek Swamp hydrograph**

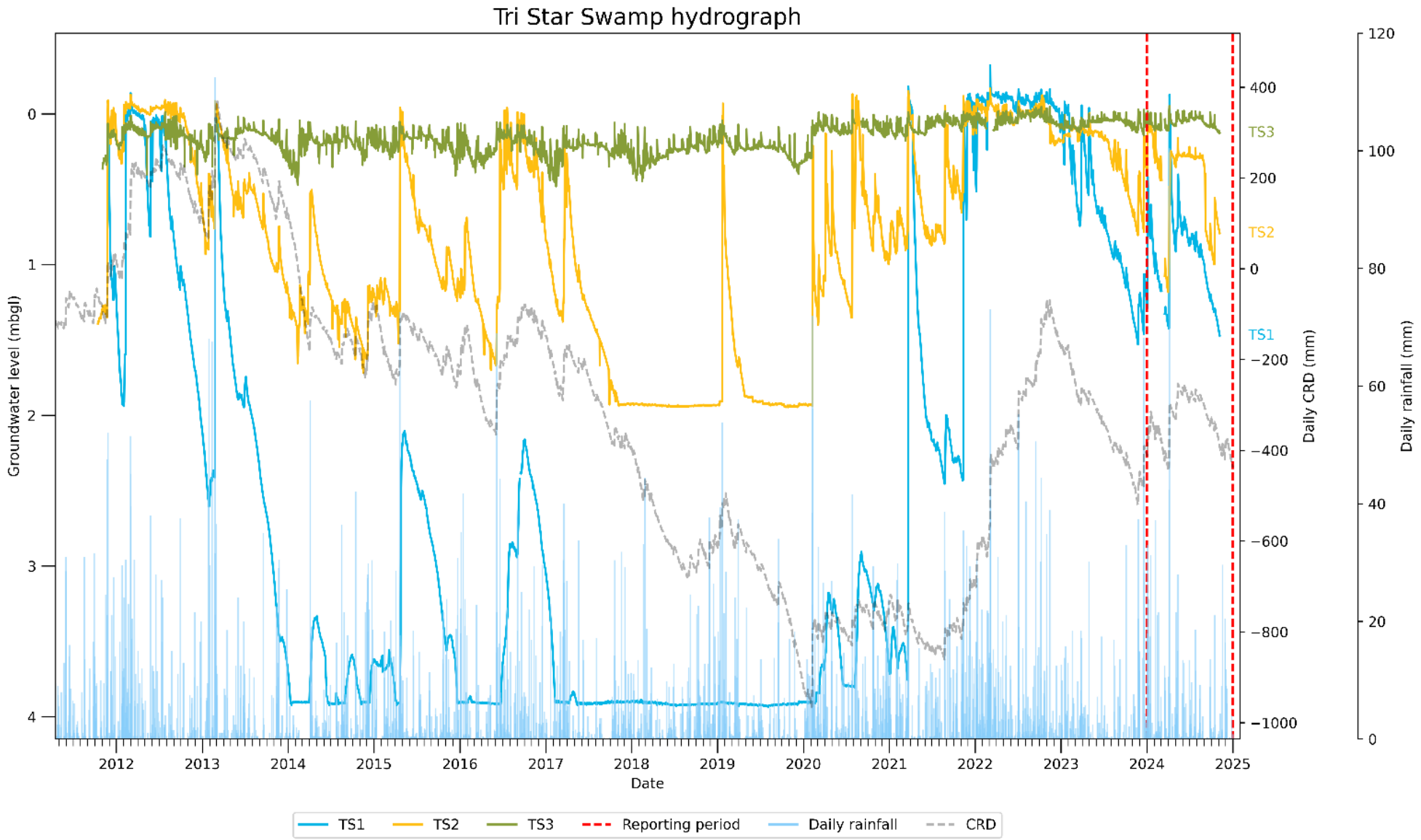


Figure 4.2 **Tristar Swamp hydrograph**

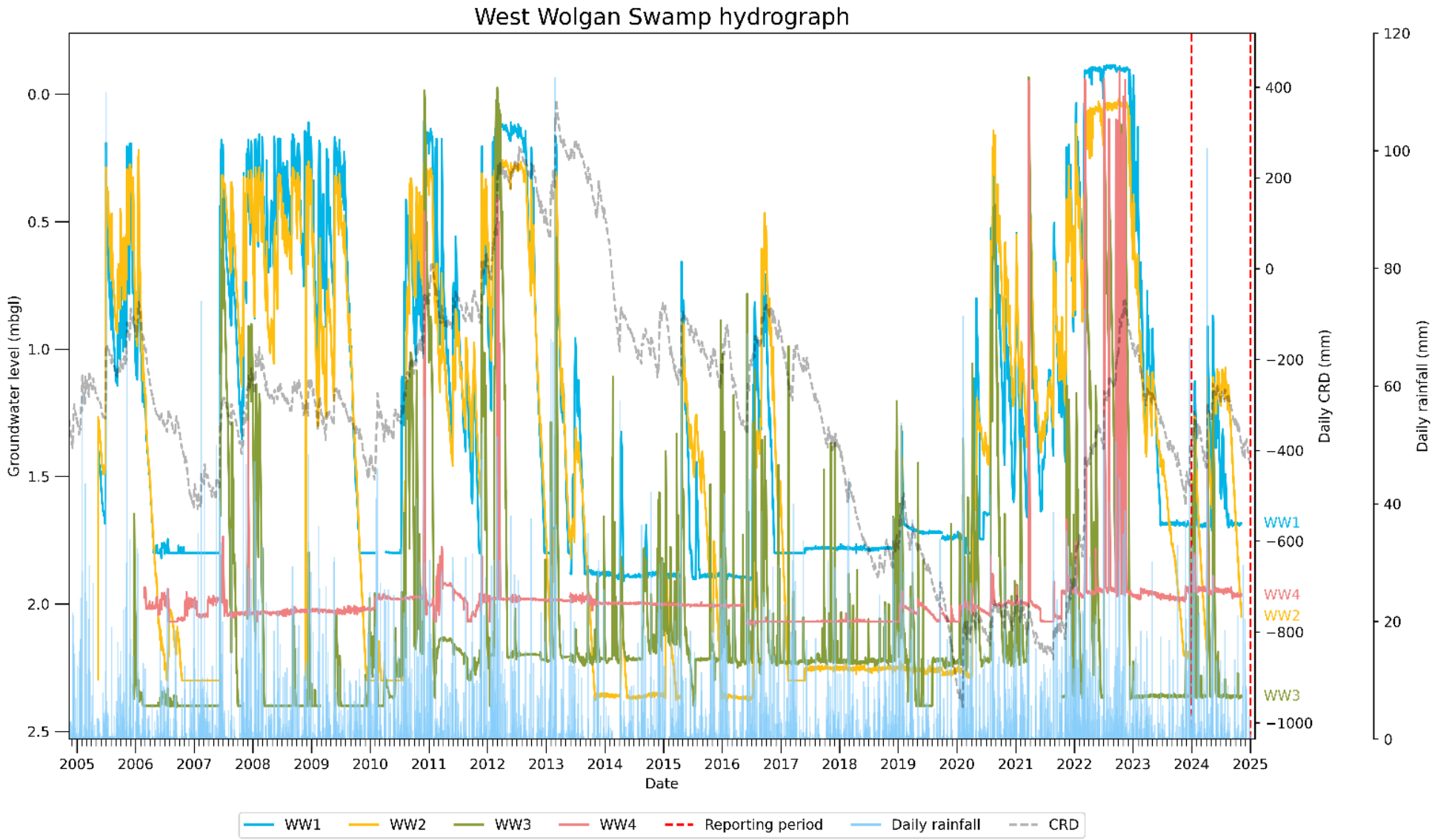


Figure 4.3 **West Wolgan Swamp hydrograph**

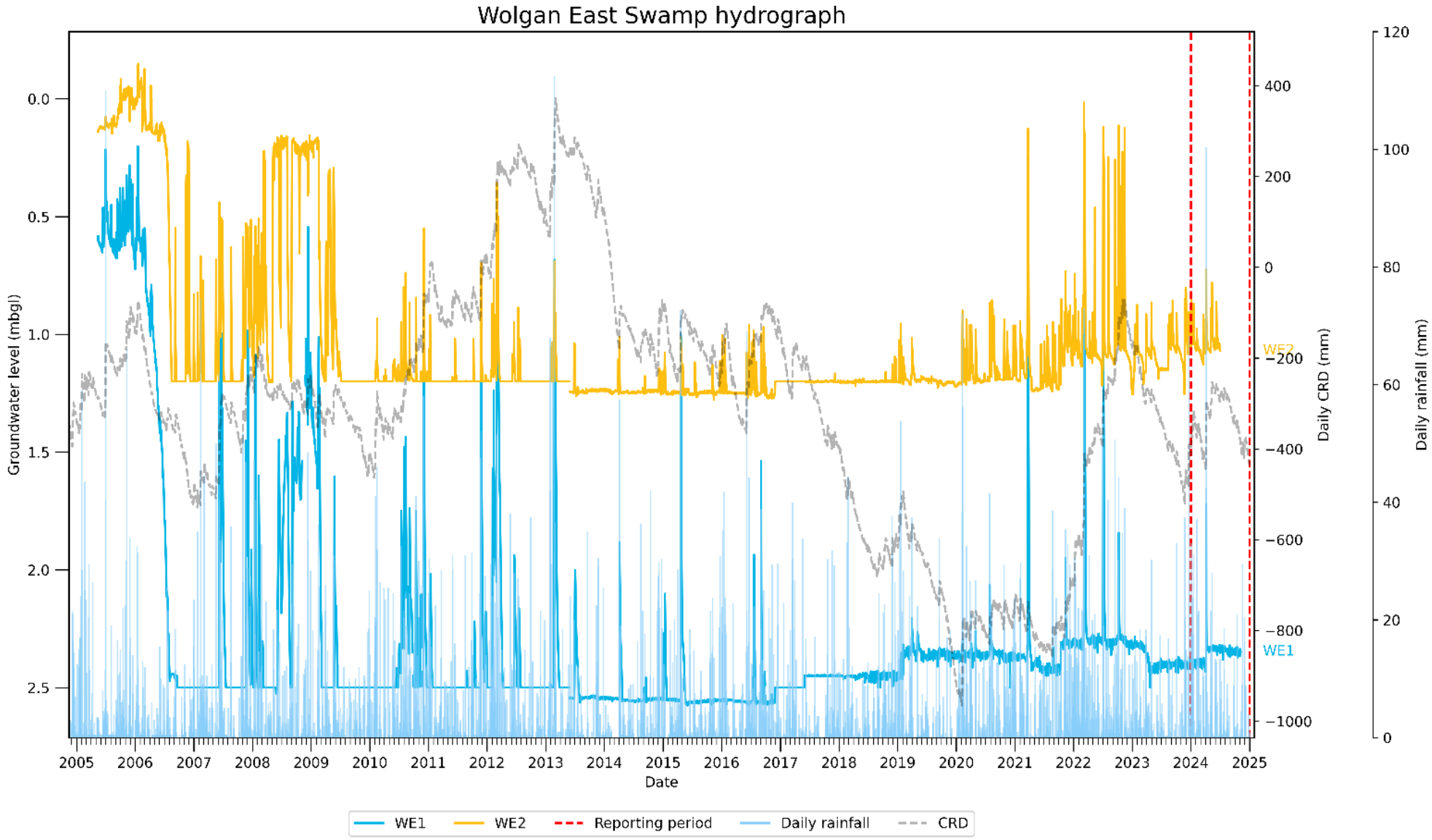


Figure 4.4 **East Wolgan Swamp hydrograph**

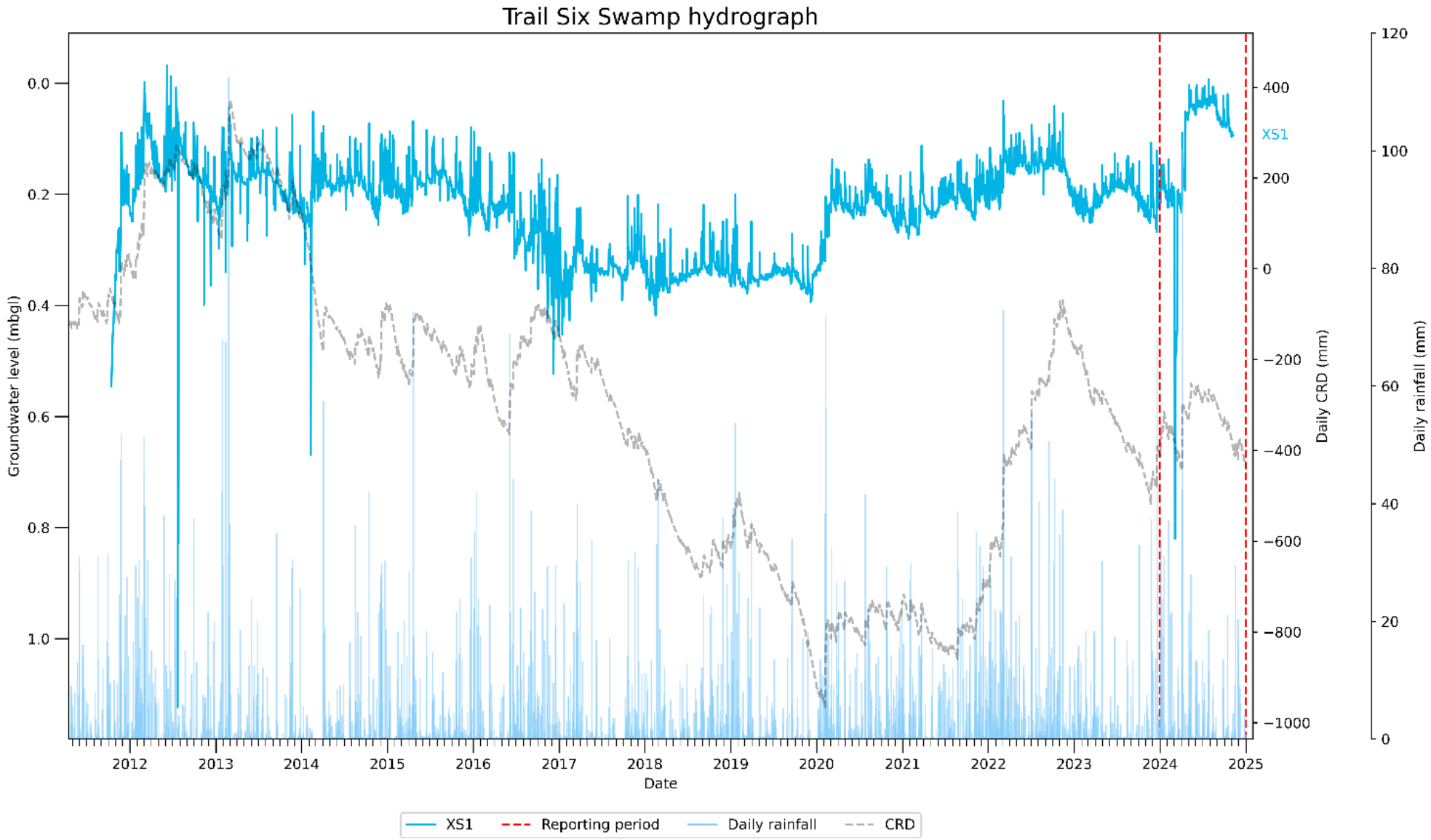


Figure 4.5 **Trail Six Swamp hydrograph**

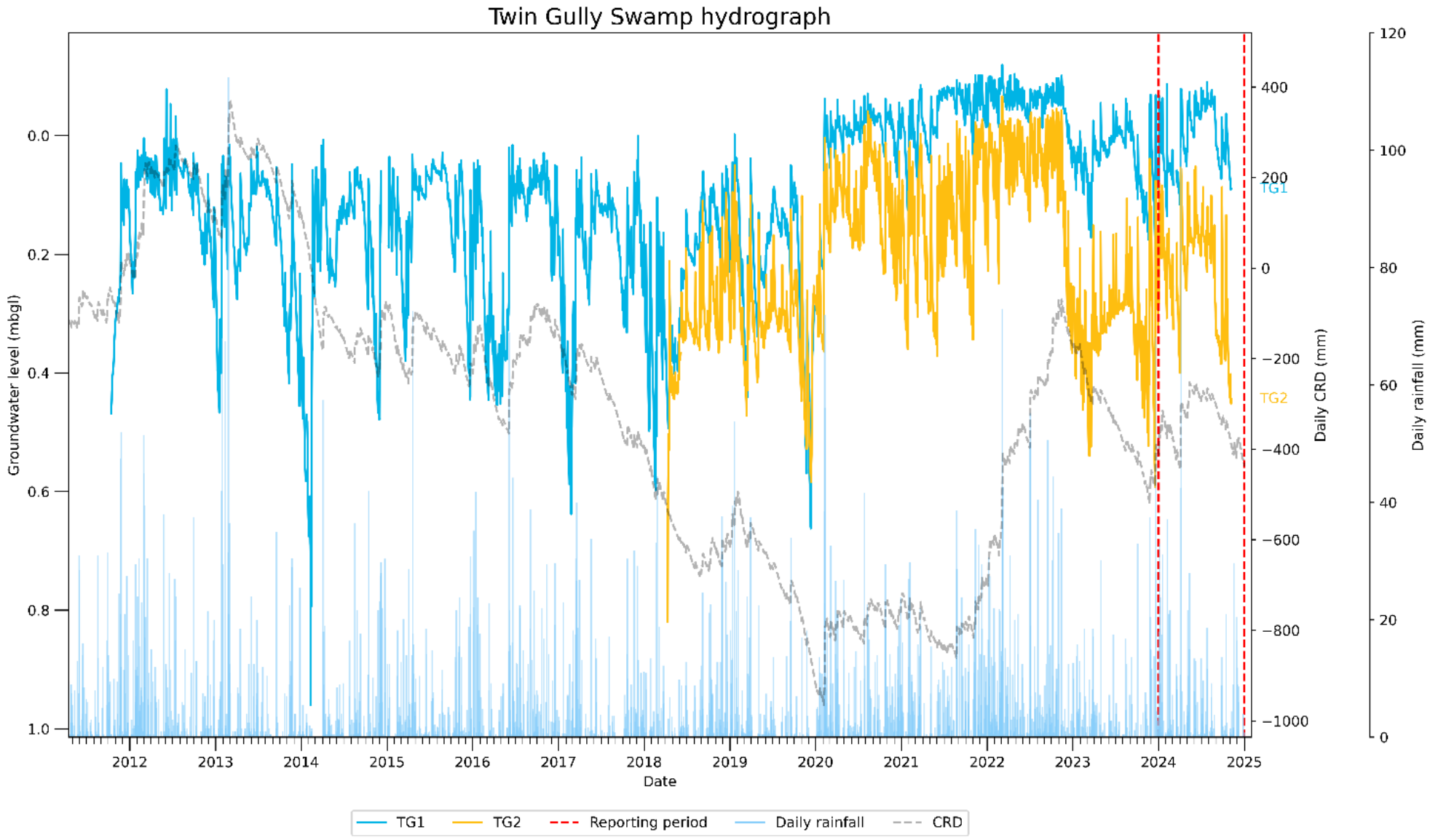


Figure 4.6 **Twin Gully Swamp hydrograph**

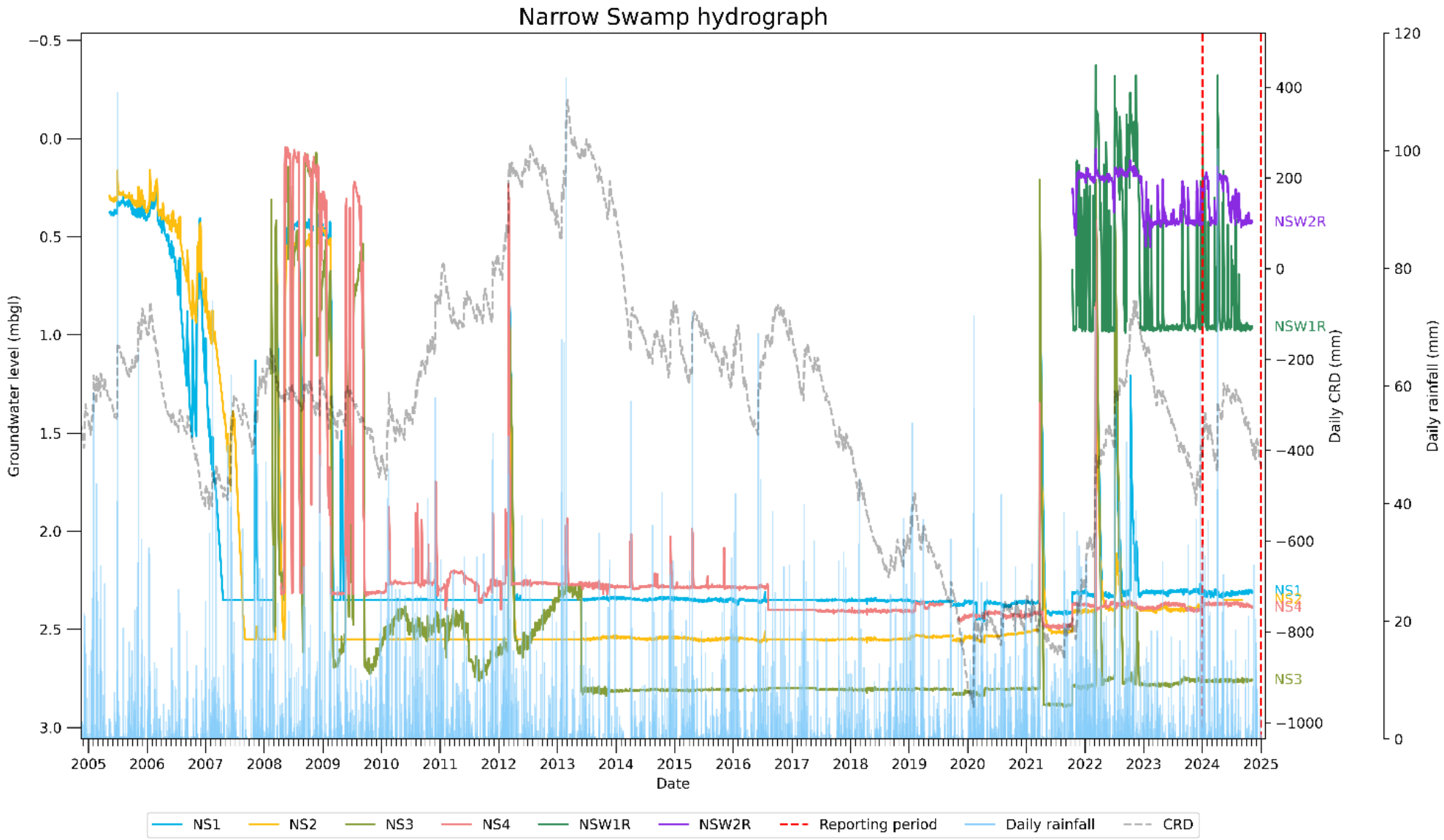


Figure 4.7 **Narrow Swamp hydrograph**

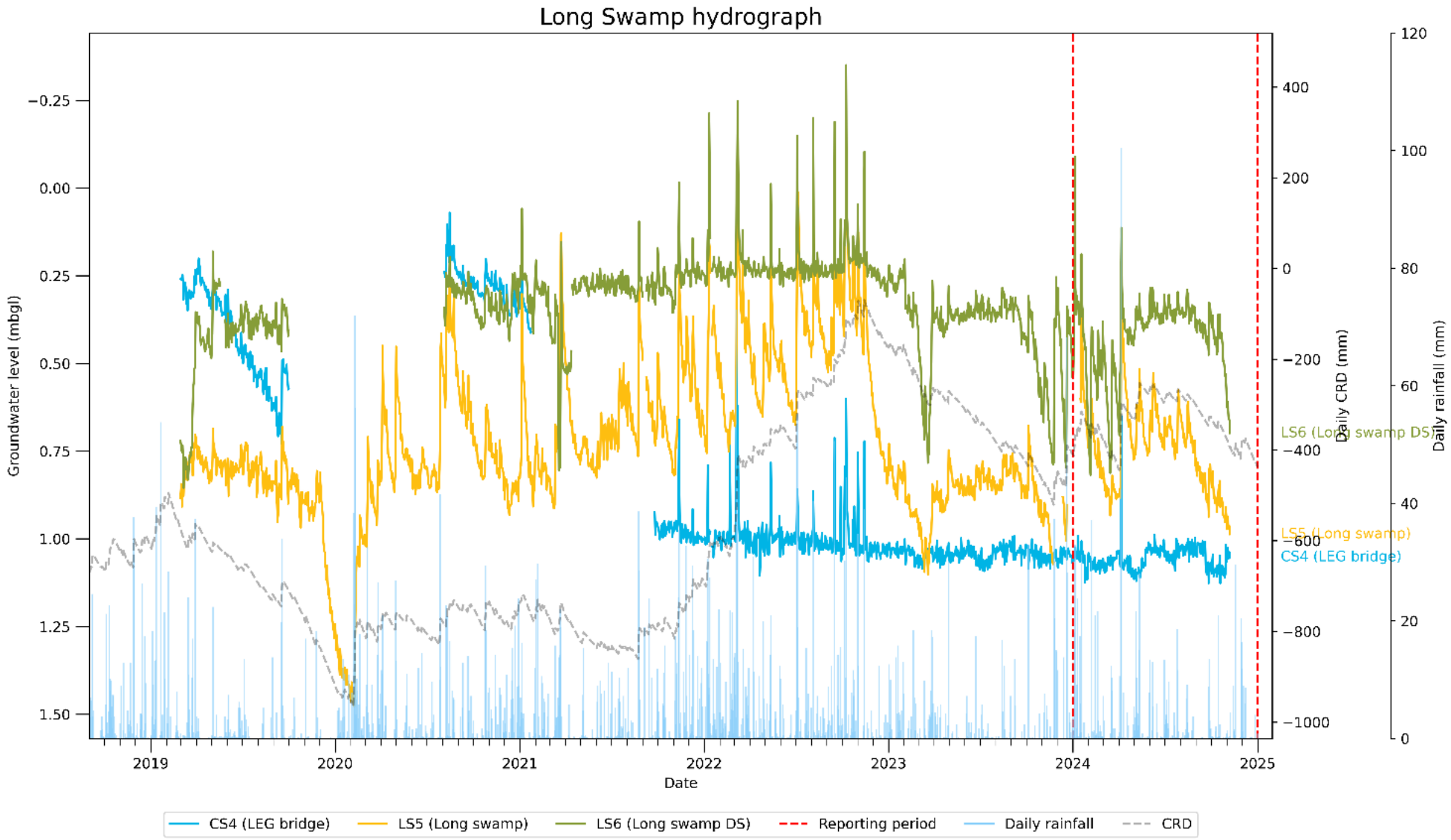


Figure 4.8 **Long Swamp hydrograph**

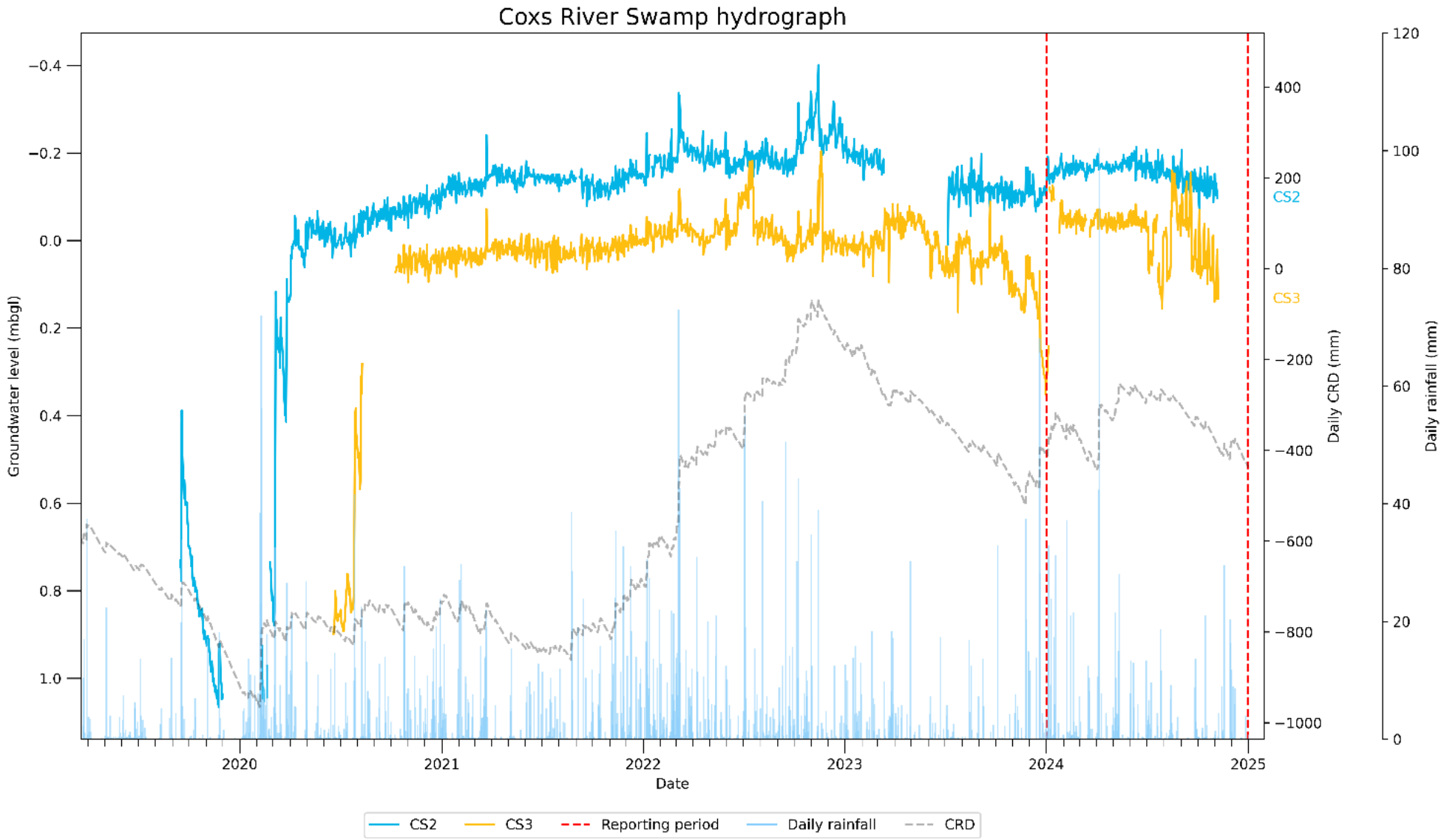


Figure 4.9 **Coxs River Swamp hydrograph**

4.2 Soil moisture monitoring

The soil moisture monitoring network comprises of nine sites – Kangaroo creek monitoring network is located along the hill slope, descending into the swamp, Twin Gully Swamp and Tristar Swamp monitoring networks are located within their respective swamps.

Historically, all soil moisture probes were destroyed by bushfires between late 2019 and early 2020. The soil moisture probes at Twin Gully Swamp and Tristar Swamp were reinstalled in October 2020. New soil moisture probes were installed at Kangaroo Creek Swamp in November 2020; however, they are not paired with swamp piezometers.

A summary of key observations and trends is presented in Table 4.2. Time series plots for each monitoring location are presented in Appendix B, which includes soil moisture content at each sensor as a percentage. Dashed vertical lines indicate the reporting period.

Soil moisture time series plots are presented in Appendix B and monitoring locations are presented in Figure 3.1.

Table 4.2 Soil moisture summary

Site ID	Number of sensors bgl[1]	Comments
KCU1SM	8 – every 10 cm	The 10 to 30 cm sensors are dry as they are above surface level. The 40 to 80 cm sensors showed soil moisture conditions were fluctuating in response to rainfall. Data gap from July to end of the year due to flat battery and broken fuse. Refer to Figure B.1.
KCU2SM	8 – every 10 cm	The 10 to 30 cm sensors are dry as they are above surface level. The 40 cm sensor showed that soil moisture conditions was increasing throughout the reporting period. The 50 cm sensor showed increasing soil moisture until April and remained saturated for the remainder of the. Data gap with 60 to 80 cm sensor due to damaged wiring. Refer to Figure B.2.
KCU3SM	4 – every 10 cm	The 10 cm sensor indicated generally dry soil moisture conditions, with minor fluctuations in response to rainfall events. The 20 cm and 30 cm sensors showed increasing soil moisture trends; however, following drier-than-average rainfall from August to October, moisture levels decreased while still fluctuating with rainfall. The 40 cm sensor remained fully saturated and stable throughout the period. Refer to Figure B.3.
KCU4SM	8 – every 10 cm	The 10 to 20 cm sensors remained dry as they are positioned above surface level. The 30 to 80 cm sensors displayed fluctuating soil moisture conditions in response to rainfall events. A data gap has been present since August due to a flat battery. Refer to Figure B.4.
KCU5SM	4 – every 10 cm	No data was available for the reporting period due to an issue with the probe sensors. Refer to Figure B.5.
TG1SM	12 – every 10 cm	The 10 cm sensor exhibited the greatest variation in response to rainfall events, indicating sensitivity to surface moisture changes. The 20 to 120 cm sensors showed stable soil moisture conditions with minor fluctuations in response to rainfall, with trends becoming increasingly subdued at greater depths. Data gaps were present due to cable replacement, which was completed in November. Refer to Figure B.6.
TG2SM	8 – every 10 cm	The 10 and 20 cm sensors showed varying fluctuations in response to rainfall. The 30 to 80 cm sensors showed more minor moisture fluctuations in response to rainfall. The trends become increasingly subdued with sensor depth. Refer to Figure B.7.
TS2SM	12 – every 10 cm	The 10 to 30 cm sensors showed varying fluctuations in response to rainfall. The 40 to 80 cm sensors showed more minor moisture fluctuations in response to rainfall. The trends become increasingly subdued with sensor depth. Refer to Figure B.8.
TS3SM	12 – every 10 cm	All sensors showed soil moisture content was relatively stable with minor increasing trend. Fluctuations in response to rainfall reduced with sensor depth. Refer to Figure B.9.

4.3 Perched and shallow aquifer piezometers

The ridge piezometer monitoring network comprises 16 monitoring bores targeting the perched and shallow aquifer in the Burralow Formation and Banks Wall Sandstone.

Hydrographs for ridge piezometers are presented on Figure 4.10 which includes groundwater level data in mbgl and the daily CRD in mm. Dashed vertical lines indicate the reporting period, and logger depths at each monitoring location are presented on the left of the figure. Manual measurements are recorded for REN, RSE, RNW and APKC2001.

A summary of key observations and trends is provided in Table 4.3, while monitoring locations are presented in Figure 3.1.

Table 4.3 Ridge piezometer summary

Site ID	Comments
AP1PR	Shows a delayed and subdued correlation with daily CRD. A declining trend was observed during the reporting period, corresponding to the overall long-term decreasing trend in daily CRD since November 2022.
AP4PR	Shows a delayed and subdued correlation with daily CRD. A declining trend was observed during the reporting period, corresponding to the overall long-term decreasing trend in daily CRD since November 2022.
AP5PR	Groundwater level shows a slight increasing trend.
AP8PR	Shows a delayed and subdued correlation with daily CRD. A slightly declining trend was observed during the reporting period, corresponding to the overall long-term decreasing trend in daily CRD since November 2022.
AP9PR	Groundwater level shows a slight increasing trend which stabilises from June onwards.
AP10PR	Shows a subdued correlation with daily CRD. Slight increasing trend from April to June due to increasing daily CRD. Trend is slightly decreasing from June onwards due to decreasing daily CRD.
AP1104	Shows a delayed and subdued correlation with daily CRD. A declining trend was observed during the reporting period, corresponding to the overall long-term decreasing trend in daily CRD since November 2022.
AP1105	Shows a delayed and subdued correlation with daily CRD. Groundwater level peaked around May and gradually decreased for the remainder of the reporting period.
AP1110	Shows a delayed and subdued correlation with daily CRD. A slightly declining trend was observed during the reporting period, corresponding to the overall long-term decreasing trend in daily CRD since November 2022.
AP1102	Logger battery has expired. Logger needs to be replaced.
AP1204	Groundwater level increased through the reporting period.
APKC2001	Monitoring point is manually measured. Decreasing trend during the reporting period.
APKC2002	Shows a subdued correlation with daily CRD. Groundwater level decreasing during the reporting period.
REN	Monitoring point is manually measured. Shows a subdued correlation with daily CRD. Groundwater level decreasing during the reporting period.
RSE	Monitoring point is manually measured. Shows a subdued correlation with daily CRD with the groundwater level decreasing during the reporting period.
RNW	Monitoring point is manually measured and was dry during the reporting period.

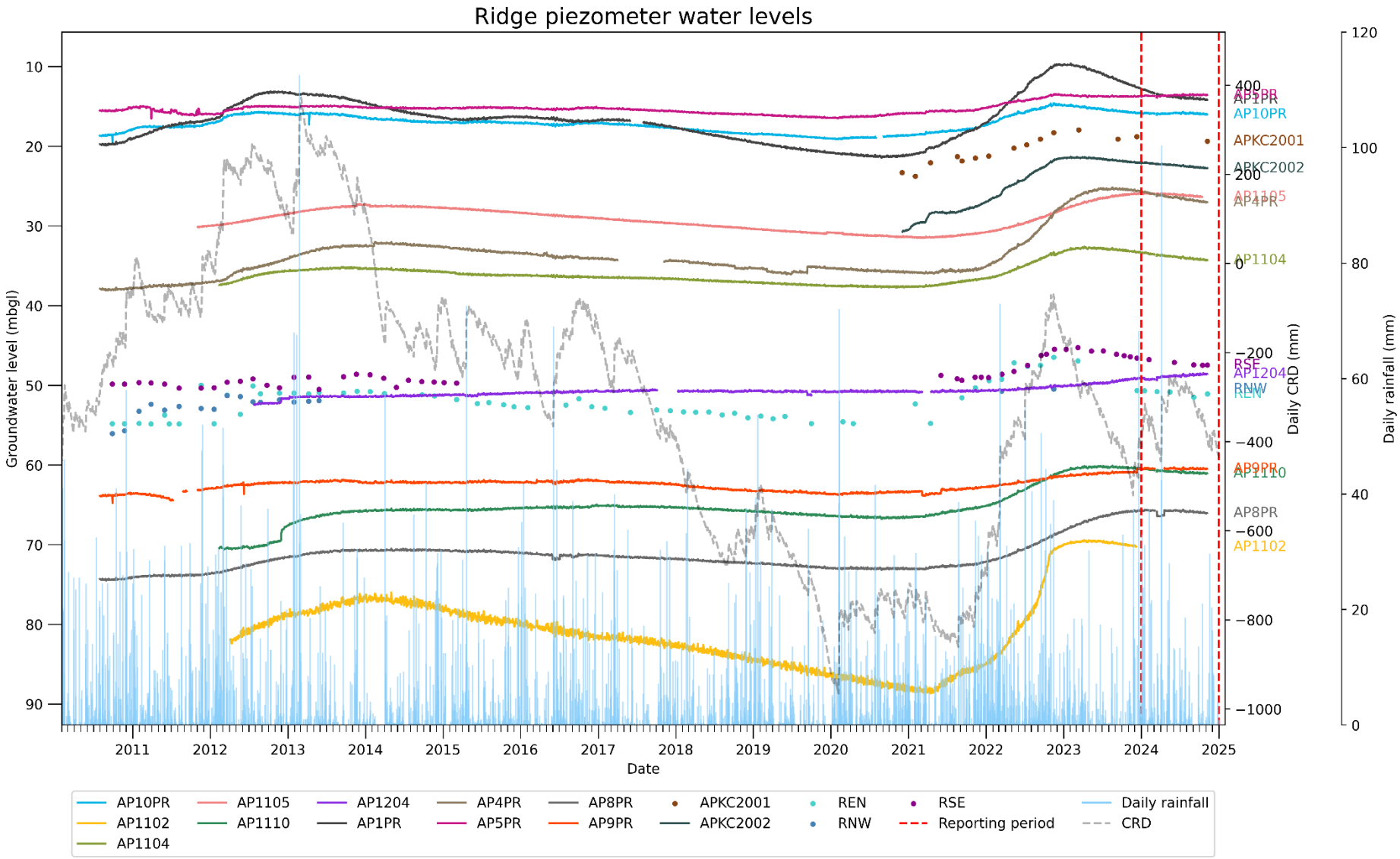


Figure 4.10 **Ridge piezometer hydrograph**

4.4 Vibrating wire piezometers

The VWP monitoring network comprises 11 monitoring locations measuring the piezometric pressures of multiple hydrogeological units within the deep and shallow aquifers.

Hydrographs for each monitoring site include piezometric pressure data for each sensor in mAHD and daily CRD. Dashed vertical lines indicate the reporting period, with sensor depths indicated to the left of each hydrograph. VWP hydrographs are presented in Figure C.1 to Figure C.11 (attached as Appendix C).

A summary of key observations and trends is provided in Table 4.4 and monitoring locations are presented in Figure 3.1.

Table 4.4 VWP summary

Site ID	Number of sensors	Summary of piezometric pressure measured by each sensor during the reporting period
AP2PR	6	Piezos #1 and #2 displayed stable trends, along with #3, #4, #5, #6 which are above the MYC. Piezo #5 (above the MYC) displayed slight decreasing trends. Refer to Figure C.1.
AP10PR	9	Piezos #1, #2, #3, #5 and #6 displayed stable trends. Piezos #7, #8 and #9 (above the MYC) also displayed stable trends. Communication with piezo #4 was recovered in December 2023 and lost again in February 2024. Refer to Figure C.2.
AP11PR	9	Piezo #1, #2, #3 and #4 displayed stable trends. Piezo #5 and #8 trends varied in response to rainfall events. Piezos #6 and #7 (above the MYC) displayed a stable trend. Refer to Figure C.3.
AP1102	7	No data was available for the reporting period due to access restrictions and flat battery. Refer to Figure C.4.
AP1104	7	Piezos #1 to #4 displayed stable trends. Piezo #5 continues to experience issues. Piezo #6 displayed a slight increasing trend. Pizo #7 displayed stable trends, except for minor fluctuations in piezometric pressure. No new data from September 2024 due to access restrictions. Refer to Figure C.5.
AP1106	6	Piezos #1 to #6 remained stable with gradual increasing trends. Data gaps present due to flat battery. Refer to Figure C.6.
AP1110	6	Piezos #1 to #4 displayed stable trends. Piezo #5 displayed slightly decreasing trends. Communication with piezo #6 has been lost since February 2021 due to sensor malfunction. Refer to Figure C.7.
AP1206	6	Piezo #1 shows and increasing trend and piezo #4 which is decreasing slightly. Remaining piezos are stable. Refer to Figure C.8.
APXXB2	7	Piezos #1 to #4 and piezos #6 and #7 displayed stable trends. Minor fluctuations in piezometric pressure were observed by piezo #5, however this is consistent with historical trends. Refer to Figure C.9.
APXXB3	7	Piezos #1 to #5 displayed stable trends. Piezos #6 and #7 displayed an increasing and decreasing trend respectively, with minor fluctuations consistent with historical observations. Refer to Figure C.10.
APC CS1	3	Piezos #1 and #3 showed slightly decreasing trends, while piezo #2 displayed a stable trend. Refer to Figure C.11.

5 Surface water monitoring

The following subsections summarise surface water monitoring observations from the reporting period. Surface water quality data has been compared to the historic observations and the WMP trigger values.

5.1 Discharge water quality

Angus Place holds EPL 467, with water currently licensed to be discharged from the site through the following LDPs:

- LDP002–discharge of surface water from facilities into the Coxs River through the Settling Ponds.
- LDP003–discharge of surface water from a sediment dam located at the Kerosene Vale Stockpile Area.

Water quality time series for electrical conductivity (EC), pH and total suspended solids (TSS) at LDP002 and LDP003 are presented in Figure 5.1 and Figure 5.2, respectively. Dashed horizontal lines indicate water quality trigger criteria, while the dashed vertical line indicates the beginning of the reporting period.

The following summarises exceedances of the trigger criteria for LDP002 and LDP003 during the reporting period:

- LDP002 and LDP003 not exceed pH trigger criteria during the reporting period.
- LDP002 exceeded the trigger criteria for TSS on the 5 January (72 mg/L), but the concentration limits do not apply because the discharge occurred within five days following a rainfall event that exceeded 44 mm (55.4 mm).
- LDP003 exceeded trigger criteria for TSS on three occasions:
    - 5 January (134 mg/L), but the concentration limits do not apply because the discharge occurred within five days following a rainfall event that surpassed 44 mm (55.4 mm).
    - 6 April (393 mg/L), but the concentration limits do not apply because the discharge occurred within five days following a rainfall event that surpassed 44 mm (102.2 mm).
    - 8 April (58 mg/L), but the concentration limits do not apply because the discharge occurred within five days following a rainfall event that surpassed 44 mm (90.4 mm).

Refer to Section 3.3 for trigger criteria. Water quality trigger criteria for pH and TSS at both LDPs are outlined in Table 3.1.

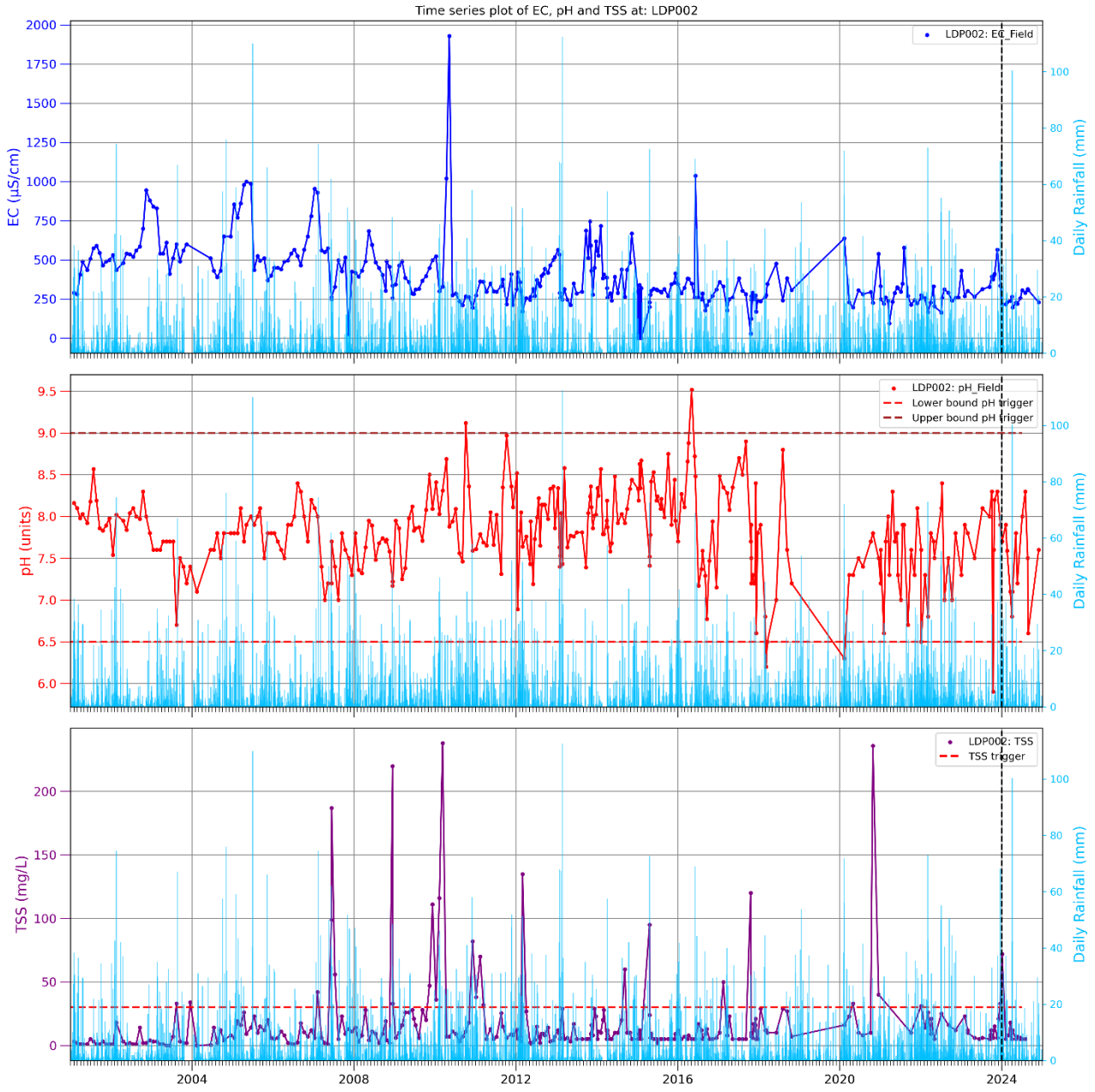


Figure 5.1 LDP002 water quality time series

Figure 5.2 LDP003 water quality time series

5.2 Watercourse water quality

There are 13 watercourse monitoring sites, two of which (Coxs River D/S and KC/CR confluence) are assessed against site specific guidelines values (SSGVs), which were based on a review of ANZECC (2000) drinking guideline values (DGV). Commentary on observations for other watercourse monitoring sites is presented in Table 5.1 and timeseries are presented in Appendix D.1.

Surface water quality time series plots for EC, pH and TSS at Coxs River D/S and KC/CR confluence are presented in Figure 5.3 and Figure 5.4, respectively. Dashed horizontal lines indicate water quality trigger criteria, while the dashed vertical line indicates the beginning of the reporting period. Water quality trigger criteria for EC, pH and TSS at both monitoring locations are outlined in Table 3.1

Table 5.1 Watercourse surface water quality and flow rate summary

Site ID	Comments of surface water quality trends during the reporting period
Bungleboori	No data was available during the reporting period as water course was dry. Refer to Figure D.1.
Coxs River Far U/S	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. No TSS or flow rate data was available during the reporting period. Refer to Figure D.2.
Coxs River U/S	EC remained stable, while pH fluctuated, consistent with historical observations. No TSS or flow rate data was available during the reporting period. Refer to Figure D.3.
Coxs River D/S	EC remained stable. pH fluctuated, consistent with historical observations, except for: • Two lower bound pH triggers were recorded in February (5.8) and May (6.0), but since they did not occur consecutively, they did not exceed the criteria (refer to Table 3.1). • Three TSS triggers were recorded in April (26 mg/L), August (65 mg/L) and November (25 mg/L), but since they did not occur consecutively, they did not exceed the criteria (refer to Table 3.1). No flow data was available during the reporting period. Refer to Figure 5.3
Kangaroo Creek D/S (AP)	EC and TSS remained stable, while pH displayed a fluctuating trend consistent with historical observations. Only one reading for flow rate due to low flow conditions. Refer to Figure D.4.
Kangaroo Creek D/S (NP)	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. TSS was stable, except for two fluctuations that are consistent with historical observations. Only one reading for flow rate due to low flow conditions. Refer to Figure D.5.
Kangaroo Creek U/S (AP)	EC remained stable, while pH displayed a fluctuating trend consistent with historical observations. TSS was stable, except for one fluctuation that is consistent with historical observations. Only one reading for flow rate due to low flow conditions. Refer to Figure D.6.
Kangaroo Creek U/S (NP)	No data was available during the reporting period due to dry conditions. Refer to Figure D.7.
KC/CR Confluence	EC and TSS remained stable, while pH fluctuated consistent with historical observations, except for: • Two pH values below the lower bound trigger were recorded in May (6.0 pH) and June (5.6 pH), both of which exceeded the trigger thresholds. The trend did not continue for the remainder of the reporting period. • TSS levels surpassed the criteria in March (66 mg/L) and November (63 mg/L), but since they did not occur consecutively, they did not exceed the criteria (refer to Table 3.1). No flow data was available for the reporting period. Refer to Figure 5.4.
Lambs Creek	EC and TSS remained stable. pH displayed a fluctuating trend consistent with historical observations. No flow data was available during the reporting period due to no flow conditions. Data gaps due to no access to sites. Refer to Figure D.8.
Long Swamp U/S	EC and pH fluctuated, both consistent with historical observations. One large spike in TSS was observed in November (588 mg/L), which was greater than historical observations. No flow data was available during the reporting period. Refer to Figure D.9.
Wolgan River (Spanish Steps)	EC and TSS remained stable. pH fluctuated consistent with historical observations. No flow data was available during the reporting period. Data gaps present due to site access restrictions. Figure D.10.
Wolgan River (Wolgah Property)	EC, TSS and flow rate remained stable. pH fluctuated, consistent with historical observations. Refer to Figure D.11.

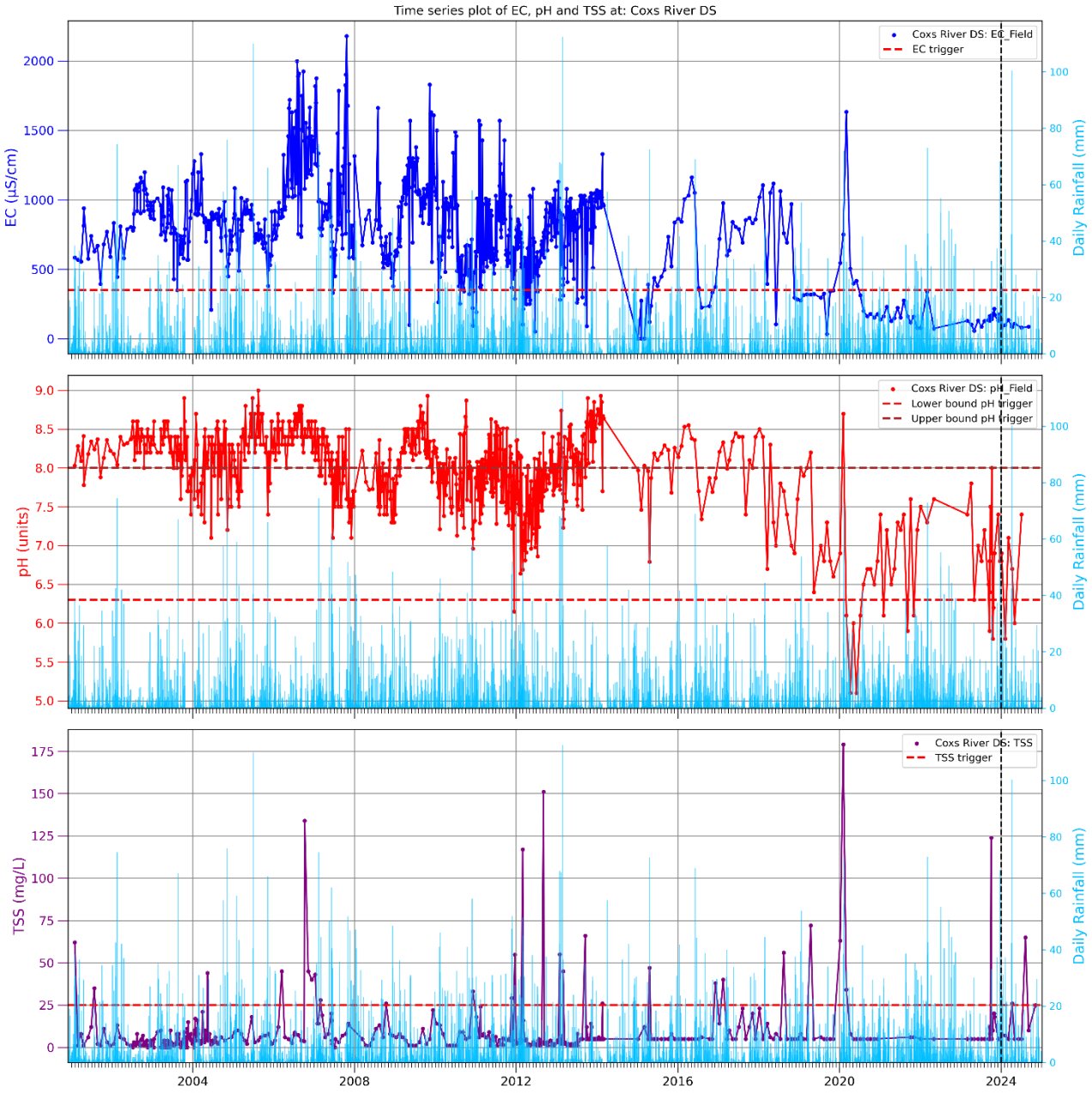


Figure 5.3 **Coxs D/S surface water quality time series**

Figure 5.4 KC/CR Confluence surface water quality time series plots

5.3 Pit top surface water quality

The pit top surface water quality monitoring network comprises three monitoring locations. It should be noted that the WMP (GHD 2021) does not apply any trigger criteria to the monitoring locations.

Pit top surface water quality time series plots are presented in Appendix D.2. The dashed vertical line indicates the beginning of the reporting period.

A summary of key observations and trends during the reporting period is provided in Table 5.2 and monitoring locations are presented in Figure 3.2.

During the reporting period, EC, pH and TSS remained relatively consistent with historical observations.

Table 5.2 Pit top surface water quality summary

Site D	Comments of surface water quality trends during the reporting period
Carpark Culvert	pH and TSS have remained consistent with historic observations. It should be noted that EC has not been recorded at the site since 2020 following update to the WMP. Refer to Figure D.12.
South Sediment Dam (Entrance Dam)	pH fluctuated while EC and TSS remained stable, all of which is consistent with historical observations. Refer to Figure D.13.
South Sediment Dam (Entrance Dam) Discharge	No data was available for the reporting period because no discharge was required. Refer to Figure D.14.

5.4 Swamp surface water quality and flow

The swamp surface water quality and flow monitoring networks comprise of five monitoring locations. It should be noted that the WMP (GHD 2021) does not apply any trigger criteria to the monitoring locations.

Swamp surface water quality time series plots are presented in Appendix D.3. The dashed vertical line indicates the beginning of the reporting period.

During the reporting period, majority of the sites were dry, although Tri Star swamp showed EC, pH, TSS and flow rate remained relatively consistent with historical and climate observations.

A summary of key observations and trends during the reporting period is provided in Table 5.3 and monitoring locations are presented in Figure 3.2.

Table 5.3 Pit top surface water quality summary

Site ID	Comments of surface water quality trends during the reporting period
Narrow Swamp U/S	No data available for all analytes due to dry swamp conditions. Refer to Figure D.15.
Narrow Swamp D/S	No data available for all analytes due to dry swamp conditions. Refer to Figure D.16.
Star Picket	No data available for all analytes due to access restrictions. Refer to Figure D.17.
Tri Star Swamp	Water quality parameters show trends consistent with climatic observations and historical trends. Refer to Figure D.18.
Twin Gully Swamp	No data was available for 2024 due to access restrictions. Refer to Figure D.19.

6 Conclusions

The findings of this report are summarised in Table 6.1. The highlighted conditions are those defined in the TARP (refer Appendix A) found in the WMP (GHD 2021).

Table 6.1 Report summary

Monitoring zone	Comments	Condition (TARP)
Swamp piezometers	Swamp groundwater levels were generally stable, except for fluctuating groundwater levels at monitoring locations that are typically dry in response to above average rainfall observed during the reporting period.	Condition: Normal
Soil moisture	Soil moisture content typically fluctuated closer to ground level, while deeper sensors indicated soil moisture content to generally be stable or slightly decreasing.	Condition: Normal
Ridge piezometers	Groundwater levels were generally stable or varying slightly in relation to rainfall or historical observations.	Condition: Normal
Vibrating wire piezometers (VWP)	Piezometric pressures were generally stable. It is important to note that the data gaps are caused by restricted access due to deteriorated track conditions or flat batteries.	Condition: Normal
Discharge surface water quality	LDP002 and LDP003 did not exceed trigger criteria during the reporting period.	Condition: Normal
Watercourse surface water quality and flow rate	Surface water quality was within the SSTVs during the reporting period, with the exception of the following: • KC/CR two lower bound pH values in May (6.0 pH) and June (5.6 pH), but the trend did not continue for the remainder of the reporting period. It should be noted that some monitoring locations were dry or inaccessible due to access restrictions during the reporting period.	Condition: Normal
Pit top surface water quality	Pit top surface water quality observations generally remained stable and consistent with historical observations.	Condition: Normal
Swamp surface water quality and flow rate	Narrow swamp locations were dry. Star Picket and Twin Gully swamps had no data because of restricted access due to deteriorated track conditions. Tri Star Swamp show trends consistent with climatic observations and historical trends.	Condition: Normal

References

GHD (2021) *Angus Place Colliery Water Management Plan*, prepared by GHD Group Pty Ltd for Centennial Angus Place Pty Limited, 2021.

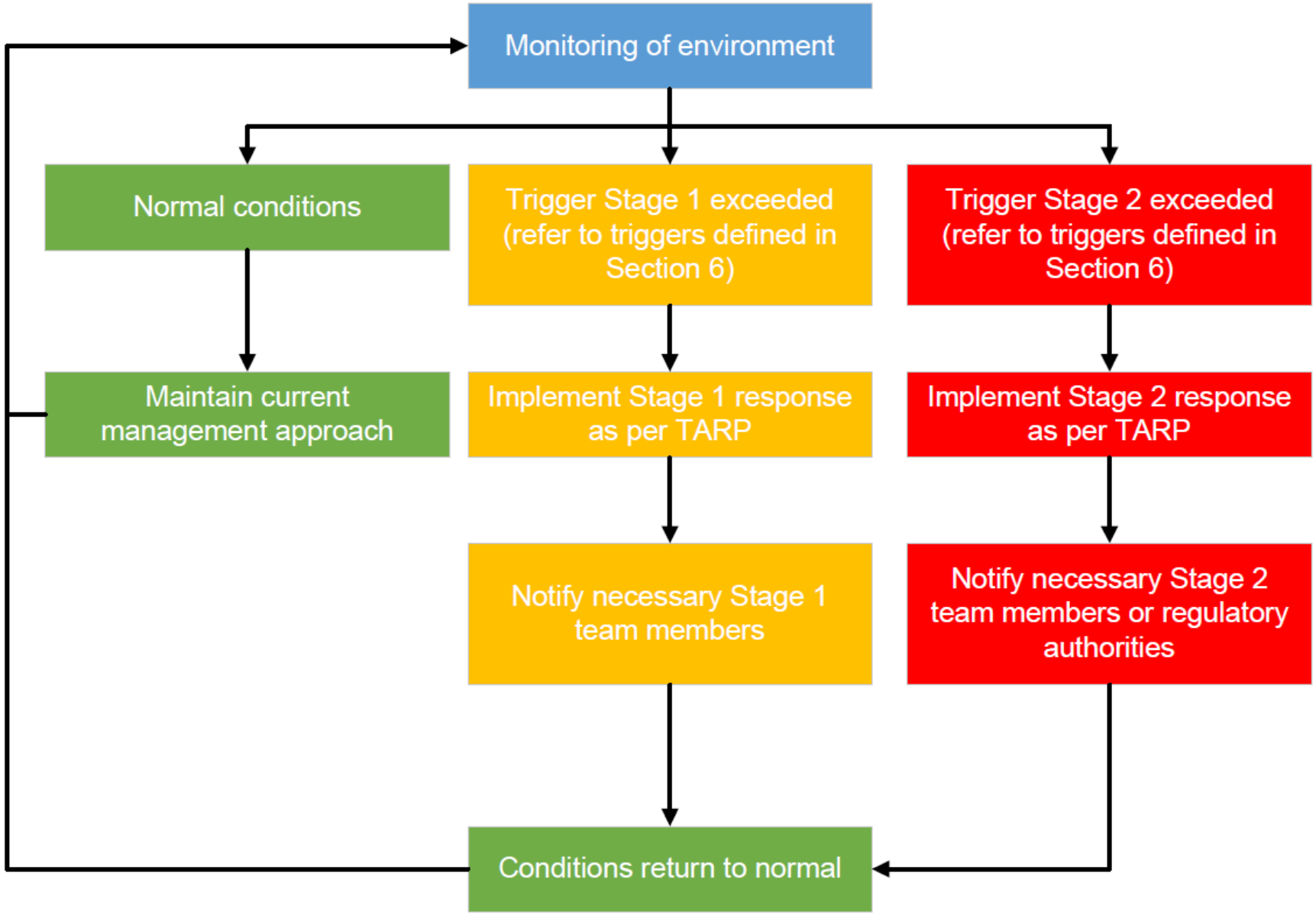
Jacobs (2019) *Groundwater Impact Assessment, Angus place Amended Project*, prepared by Jacobs Group (Australia) Pty Ltd for Centennial Angus Place Pty Ltd, October 2019.

McHugh (2018) *The geology of the shrub swamps within Angus place, Springvale and the Springvale Mine extension project areas*, prepared by E.A. McHugh Geological and Petrographic Services for Centennial Coal Pty Ltd, September 2018.

Appendix A

Trigger action response plans (TARP)

EMM
creating opportunities


Monitoring of environment
Normal conditions
Trigger Stage 1 exceeded (refer to triggers defined in Section 6)
Trigger Stage 2 exceeded (refer to triggers defined in Section 6)
Maintain current management approach
Implement Stage 1 response as per TARP
Implement Stage 2 response as per TARP
Notify necessary Stage 1 team members
Notify necessary Stage 2 team members or regulatory authorities
Conditions return to normal

Site surface operations

Aspect	Normal	Stage 1	Stage 2	Notifications
Surface water storage volume	Storage captures events up to and including the design criteria.	**Trigger:** Storage is not dewatered appropriately following storm event in accordance with design criteria. **Action:** Investigate storage operation and dewatering options. Increase inspection frequency as required. Education of staff.	**Trigger:** Storage is discharging as a result of a storm event less than the design criteria. **Action:** Increase inspection frequency as required. Undertake water quality sampling of discharge and add flocculant as necessary. Undertake water quality sampling of downstream locations.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with Pollution Incident Response Management Plan (PIRMP) requirements or if material harm has occurred.
Clean water diversions	Clean water diverted around dirty water areas.	**Trigger:** Clean water bypass through dirty water areas. **Action:** Review catchment plan. Review design capacity of clean water system. Appropriately treat and manage dirty water.	**Trigger:** Clean water creates flooding problems through site. **Action:** Evacuate site if danger exists. Establish temporary bunding around clean water source. Utilise earthworks machinery to cut appropriate channel to manage clean water. Protect equipment and infrastructure. Utilise portable pumps to dewater flooded areas into storages.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE if exceedance of limit occurs.

Aspect	Normal	Stage 1	Stage 2	Notifications
Erosion and sediment control	All controls are appropriately in place and well maintained. No disturbance areas or migration of sediment away from designated development areas.	**Trigger:** One or more areas of surface erosion in the form of rilling, bank erosion or other movement of sediment from an area of disturbance. Controls are not maintained or are inappropriately installed. **Action:** Seek to stabilise the area to stop the erosion process. This can include the use of groundcover or other temporary measures. Investigate works undertaken prior to the disturbance activities.	**Trigger:** Controls are not in place. Rainfall event has led to sediment migrating off site. **Action:** Isolate the area through diverting contributing surface flows to another appropriate control structure.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE if exceedance of limit occurs.
Hydrocarbon management	All hydrocarbon materials are stored appropriately.	**Trigger:** Minor spill occurs on site with limited risk of offsite migration. **Action:** Implement procedures in the PIRMP. Utilise spill kit.	**Trigger:** Major spill occurs on site with risk of offsite migration. **Action:** Isolate area and divert contributing surface flows. Engage waste contractor to clean spill. Investigate potential for contamination of waterways.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE if exceedance of limit occurs.

Aspect	Normal	Stage 1	Stage 2	Notifications
Water Transfer volume	Water transfer volume is within predictions of the site water balance and limits defined by MP06_0021.	**Trigger:** Forecasted transfer volume requirements exceeds predictions/limits. **Action:** Undertake investigation.	**Trigger:** Transfer volumes exceeds predictions/limits. **Action:** Undertake review of water management on site. Review on site transfers and predictions of hydrogeological model/site water balance model. Update models as required.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE and WaterNSW if exceedance of limit occurs as soon as practicable.

Watercourses

Aspect	Normal	Stage 1	Stage 2	Notifications
Water quality	Water quality at downstream monitoring locations within or below the SSGVs specified in (for Coxs River) or consistent with upstream monitoring location (for Wolgan River).	**Trigger:** Water quality is outside or above the values specified in Table 6-1 (for Coxs River) or statistically significantly different to upstream monitoring location (for Wolgan River) for at least one parameter for two consecutive sampling events. **Action:** Review recent monitoring results for adjacent sites and any relevant operational data (e.g. mining activities, clearing activities, meteorological data). Investigate the source of the exceedance and develop corrective/preventative actions based on outcomes (refer Appendix I).	**Trigger:** Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity. Community complaint to Centennial regarding surface water quality. **Action:** Determine if an incident has potentially occurred and investigate the source of the exceedance. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation and/or additional monitoring (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIEW as soon as practicable.

Aspect	Normal	Stage 1	Stage 2	Notifications
Water flow	Creek flow rates and relationships with rainfall are consistent with historical baseline results.	**Trigger:** Reduction in flow compared to historical baseline results. **Action:** Review recent monitoring results for adjacent sites and any relevant operational data (e.g. mining activities, clearing activities, meteorological data). Investigation the source of the reduction in flow and develop corrective/preventative actions based on outcomes (refer Appendix I).	**Trigger:** Loss of flow compared to historical baseline results is attributable to site operations. Community complaint to Centennial regarding surface water flow. **Action:** Review recent monitoring results for adjacent sites and any relevant operational data (e.g. mining activities, clearing activities, meteorological data). Determine if an incident has potentially occurred and investigate the source of the loss of flow. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify DPIEW and WaterNSW (if within Coxs River catchment) as soon as practicable.

Discharge management

Aspect	Normal	Stage 1	Stage 2	Notifications
LDP discharge quality	Discharge quality is within limits defined by EPL.	**Trigger:** Water quality parameters exceed discharge limits for one parameter for one discharge event. **Action:** Undertake investigation. Repeat sampling. Consider a reduction in pumping from underground storage if appropriate.	**Trigger:** Water quality parameters exceed discharge limits for more than one parameter. **Action:** Undertake review of water management on site. Undertake incident investigation including ecotoxicology and aquatic ecology monitoring if appropriate.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE and WaterNSW if exceedance of limit occurs as soon as practicable.
LDP discharge volume	Discharge volume is within predictions of the site water balance and limits defined by EPL.	**Trigger:** Discharge volume exceeds predictions/limit for no more than one day. **Action:** Undertake investigation. Review monitoring equipment.	**Trigger:** Discharge volume exceeds predictions for more than one day. **Action:** Undertake review of water management on site. Review on site transfers and predictions of hydrogeological model/site water balance model. Update models as required.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE and WaterNSW if exceedance of limit occurs as soon as practicable.

Aspect	Normal	Stage 1	Stage 2	Notifications
Unlicensed emergency discharges	No discharges from emergency locations.	**Trigger:** Discharge from a non-EPL defined emergency discharge location. **Action:** Undertake investigation. Increase monitoring frequency downstream and undertake additional monitoring where relevant.	**Trigger:** Continued discharge from a non-EPL defined, emergency discharge location. **Action:** Undertake review of water management on site. Undertake incident investigation, including ecotoxicology and aquatic ecology monitoring if appropriate.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPIE and WaterNSW (if within Coxs River catchment) as soon as practicable.

Groundwater monitoring

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater level	Depth to groundwater is less than the depths outlined in Table 6-2 under the conditions outlined.	**Trigger:** Depth to groundwater is greater than the depths outlined in Table 6-2 under the short-term and long-term conditions outlined. **Action:** Undertake investigation including review of adjacent sites and any relevant operational data (e.g. mining activities, meteorological data) to determine if the change is due to mining related activities.	**Trigger:** Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity and is outside predictions from the hydrogeological model and impact assessment predictions. Community complaint to Centennial regarding loss of groundwater at landholder bore. **Action:** Verify whether monitoring results are consistent with hydrogeological model predictions and consider recalibration. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Piezometric level	Piezometric pressure is above levels provided in Table 6-3 under the conditions outlined.	**Trigger:** Piezometric level is below the levels in Table 6-3 under the conditions outlined. **Action:** Undertake investigation including review of adjacent sites and any relevant operational data (e.g. mining activities, meteorological data) to determine if the change is due to mining related activities.	**Trigger:** Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity. Community complaint to Centennial regarding loss of groundwater at landholder bore. **Action:** Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater quality	Groundwater quality monitoring results are consistent with historical results.	**Trigger:** Review of groundwater quality monitoring data identifies a statistically significant change compared to historical results. **Action:** Undertake investigation including review of adjacent sites and any relevant operational data (e.g. mining activities, meteorological data) to determine if the change is due to mining related activities.	**Trigger:** Investigation into Stage 1 trigger identifies that trigger exceedance is due to mining-related activity. Community complaint to Centennial regarding groundwater quality at landholder bore. **Action:** If environmental impacts are unacceptable and/or if the beneficial use of the groundwater changes, remediation options will be considered. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Stream health

Aspect	Normal	Stage 1	Stage 2	Notifications
Watercourse instabilities (Kangaroo Creek and Long Swamp)	Watercourse monitoring indicates no areas of new instabilities compared to historical monitoring (2017 baseline conditions).	**Trigger:** Visual inspection indicates one or more areas of minor instability. **Action:** Review historical monitoring records. Investigate the factors contributing to the instability, which may include advice from technical specialists. Implement corrective actions as required as soon practicable to stabilise the surface and/or watercourses based on the outcomes of the investigation. Increase monitoring frequency and undertake additional monitoring where relevant.	**Trigger:** Visual inspection indicates one or more areas of major instability. **Action:** Immediately isolate areas of instability and implement remediation measures to stabilise surface and/or watercourse. Investigate the factors contributing to the instability, which may include advice from technical specialists. Implement corrective actions as required as soon as practicable to stabilise the surface and/or watercourses based on the outcomes of the investigation (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Increase monitoring frequency and undertake additional monitoring (e.g. watercourse stability, water quality, aquatic ecology) where relevant. Review WMP and related procedures to prevent reoccurrence.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Watercourse instabilities (all other watercourses)	Subsidence levels are within predictions.	**Trigger:** Subsidence levels 1.5 times greater than predicted values. **Action:** Undertake visual monitoring of watercourses to identify any instabilities that may have formed.	**Trigger:** Investigation into Stage 1 trigger indicates watercourse instabilities. **Action:** Investigate the factors contributing to the instability, which may include advice from technical specialists. Undertake additional monitoring (e.g. watercourse stability, water quality, aquatic ecology) where relevant. Implement corrective actions as required as soon as practicable to stabilise the surface and/or watercourses based on the outcomes of the investigation (refer Appendix I). Prioritise actions based on the risk to the environment and likelihood of further impact. Review WMP and related procedures to prevent reoccurrence.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Instream vegetation	No significant change in vegetation extent or quality compared with previous monitoring results.	**Trigger:** Visual inspections show change in extent and density of instream vegetation not specific to season. Introduction or increase in number of exotic species. **Action:** Review activities likely to influence instream vegetation. Review flow monitoring and rainfall data. Consider using RCE measure to quantify change from historical results.	**Trigger:** Visual inspections show significant change in extent and density of instream vegetation because of clearing or impact. **Action:** Increase monitoring frequency and undertake additional monitoring (e.g. watercourse stability, water quality, aquatic ecology) where relevant. Undertake water quality monitoring to determine potential impact on in situ conditions. Stabilise watercourse banks as necessary.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify DPIEW as soon as practicable.
In situ water quality	No significant change in water quality compared with previous monitoring results.	**Trigger:** Poor water quality observed compared with previous monitoring results. **Action:** Investigate sources of water quality degradation. Repeat sampling within one week.	**Trigger:** Continued poor water quality observed compared with previous monitoring results and attributable to site operations. **Action:** Review catchment inputs. Inspect waterway upstream of monitoring locations. Undertake analysis of full suite of parameters.	**Stage 1:** Notify Environment and Community Coordinator/Mine Manager immediately. **Stage 2:** Notify DPIEW as soon as practicable.

Appendix B

Soil moisture time series plots

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B.1 Soil moisture time series plots

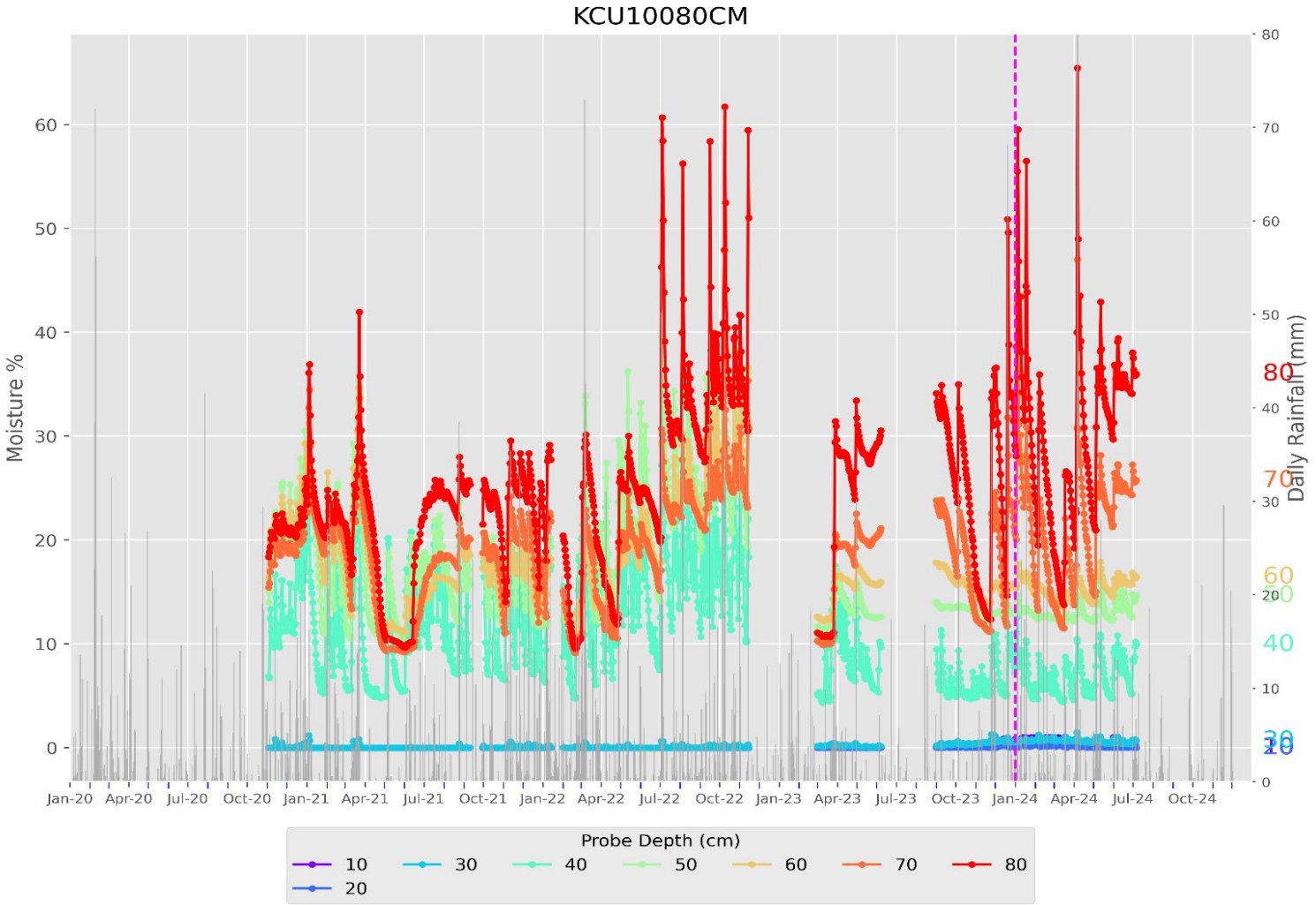

Figure B.1 KCU1 soil moisture content time series plot

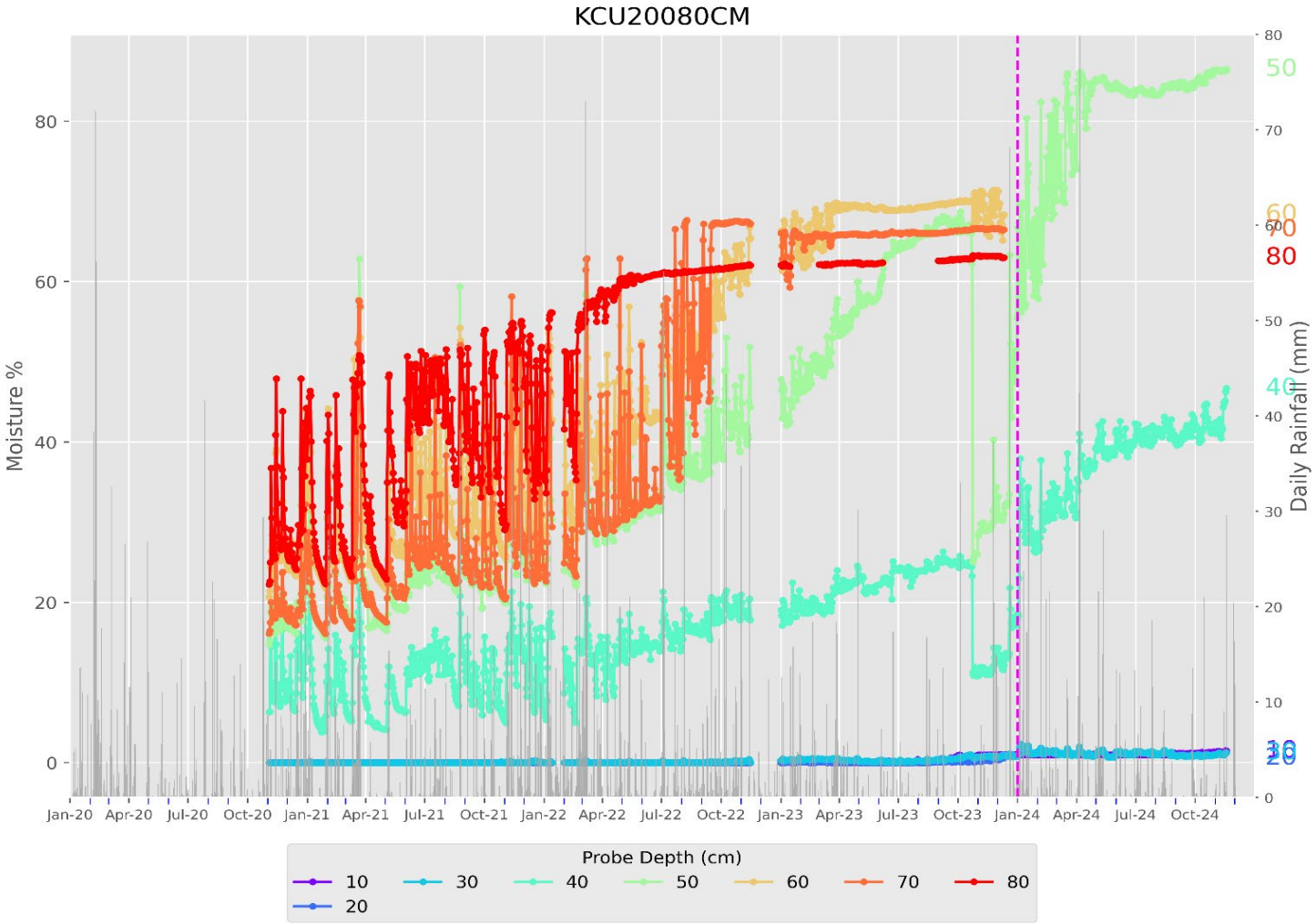

Figure B.2 **KCU2 soil moisture content time series plot**

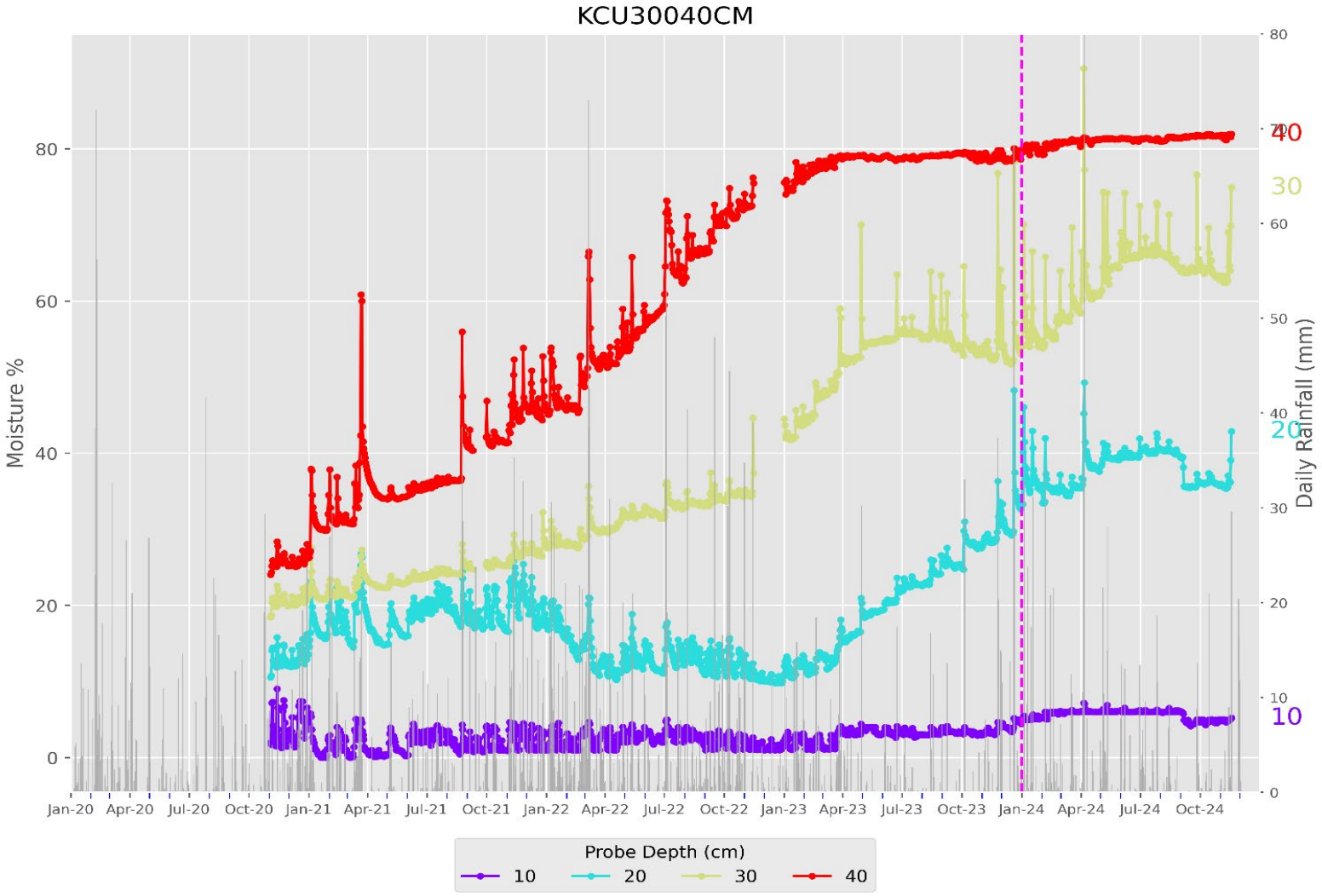

Figure B.3 KCU3 soil moisture time series plot

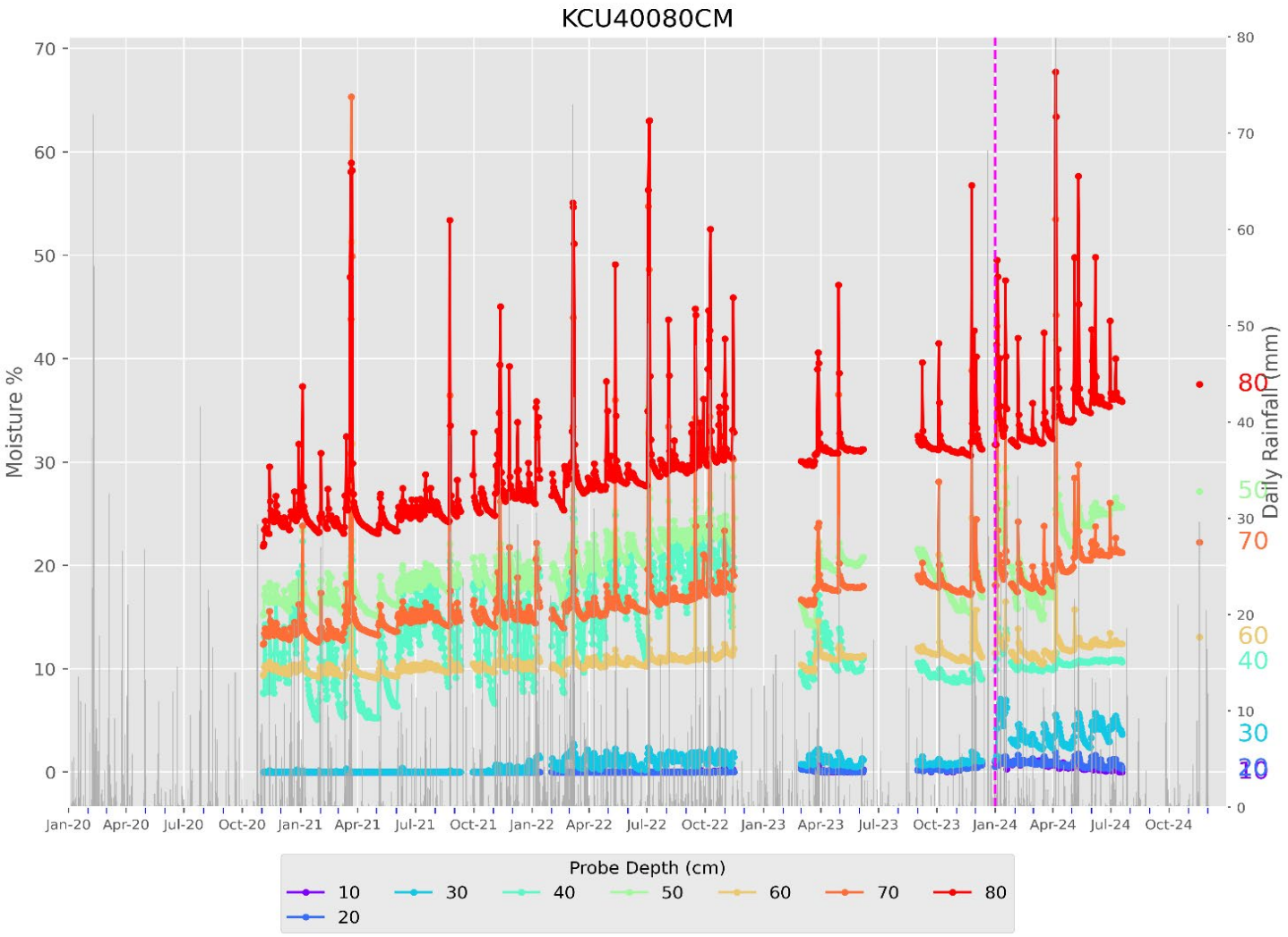

Figure B.4 **KCU4 soil moisture time series plot**

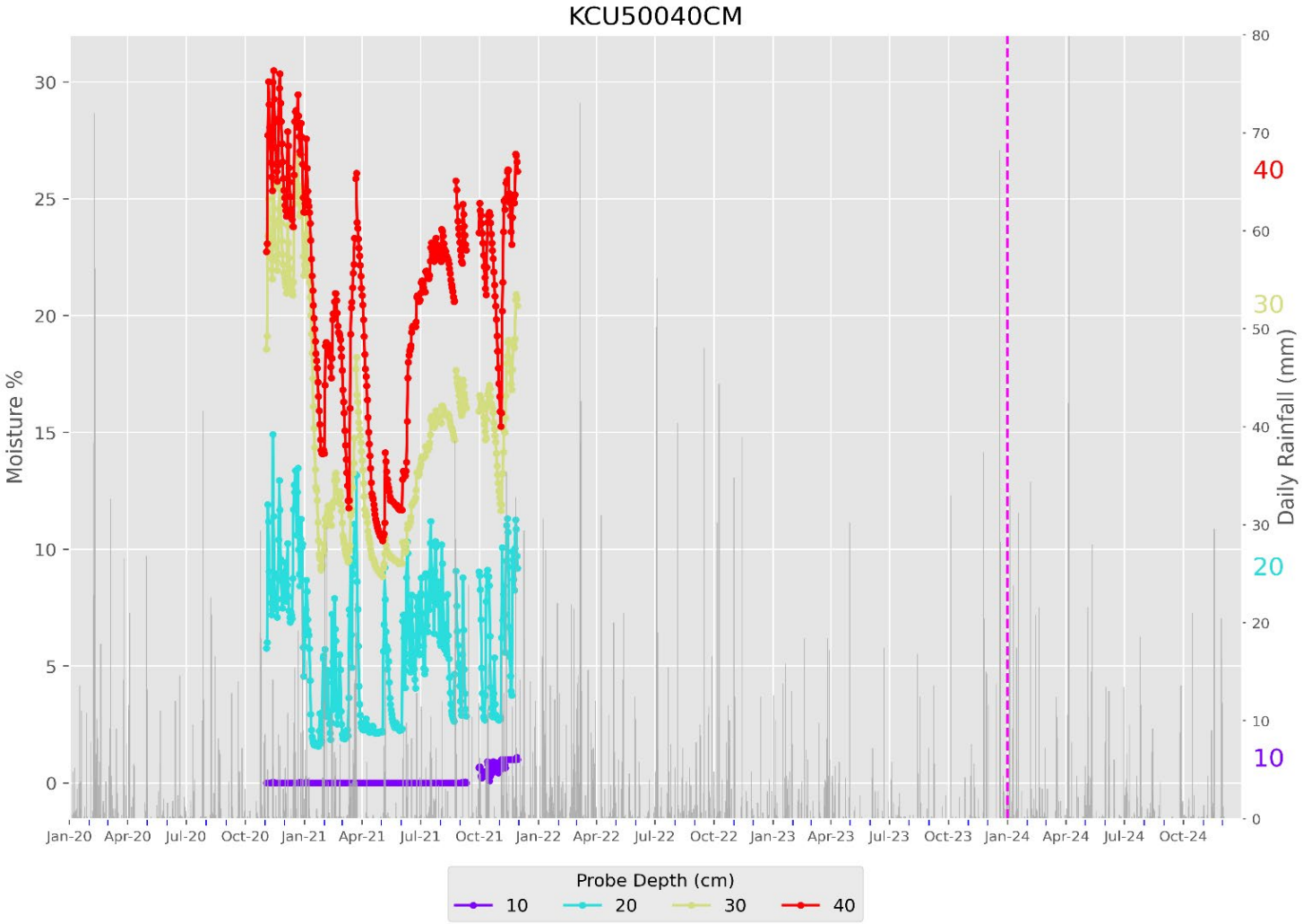

Figure B.5 KCU5 soil moisture time series plot

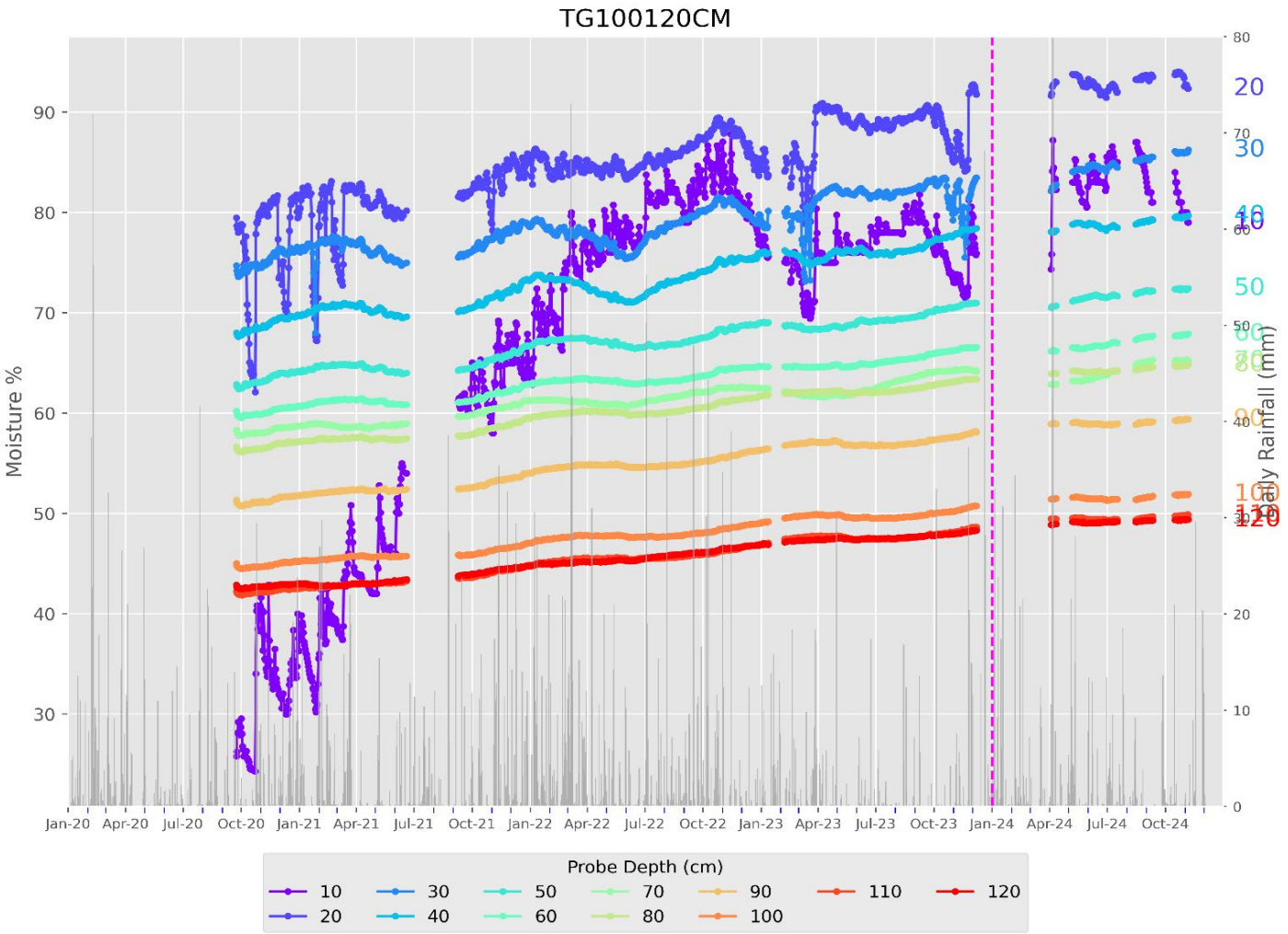

Figure B.6 **TG1 soil moisture time series plot**

Figure B.7 **TG2 soil moisture time series plot**

Figure B.8 **TS2 soil moisture time series plot**

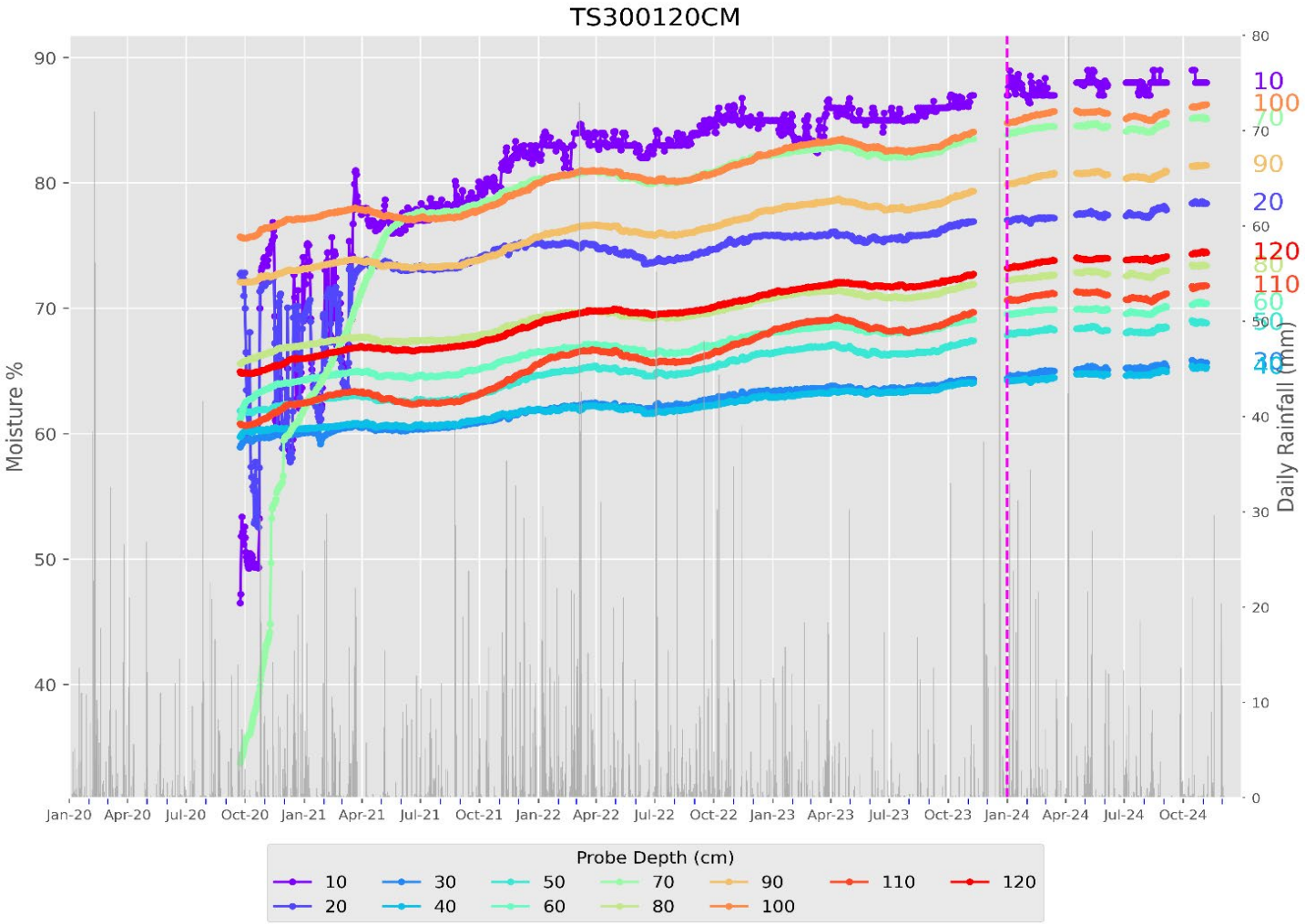

Figure B.9 **TS3 soil moisture time series plot**

Appendix C
VWP hydrographs

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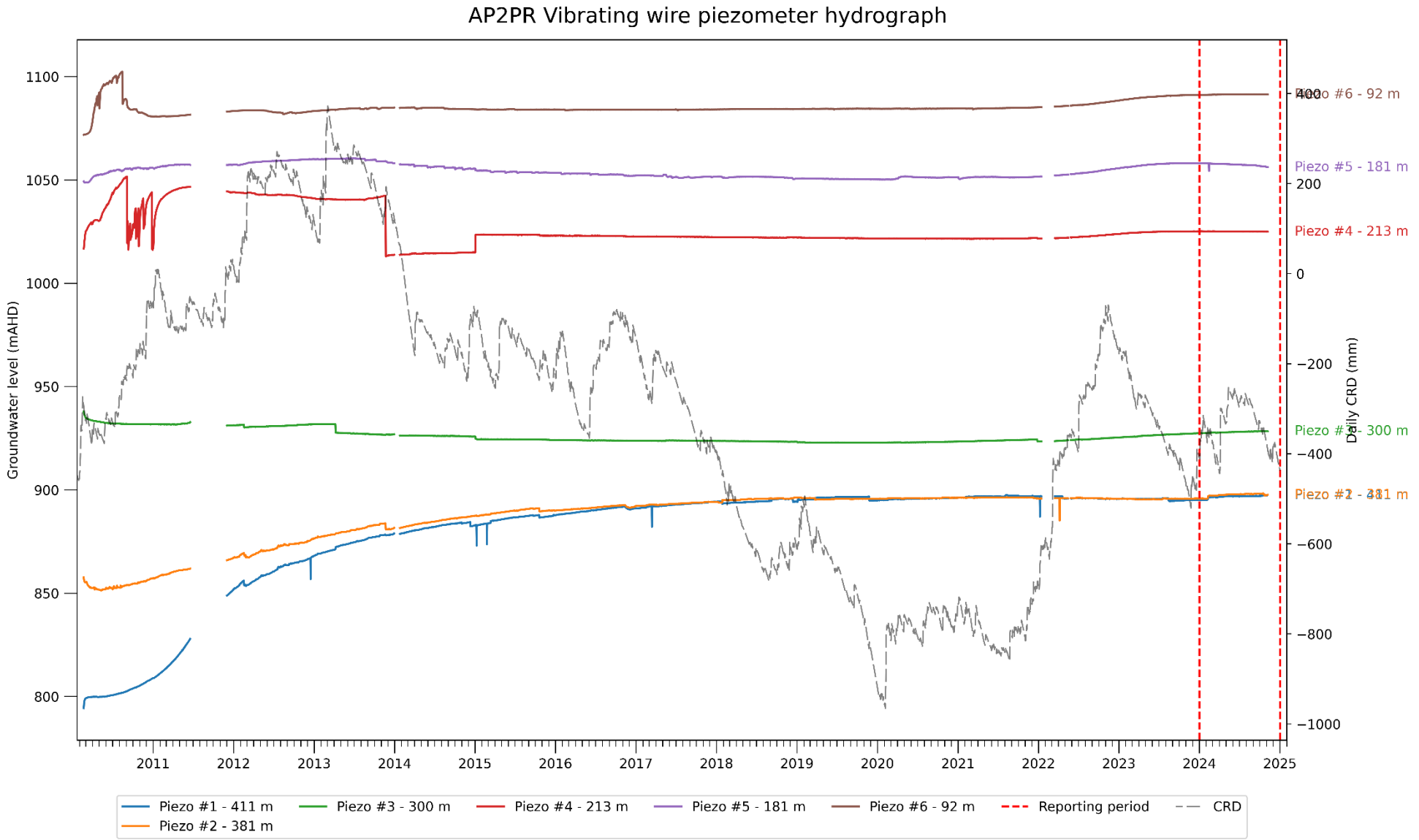

Figure C.1 **AP2PR VWP hydrograph**

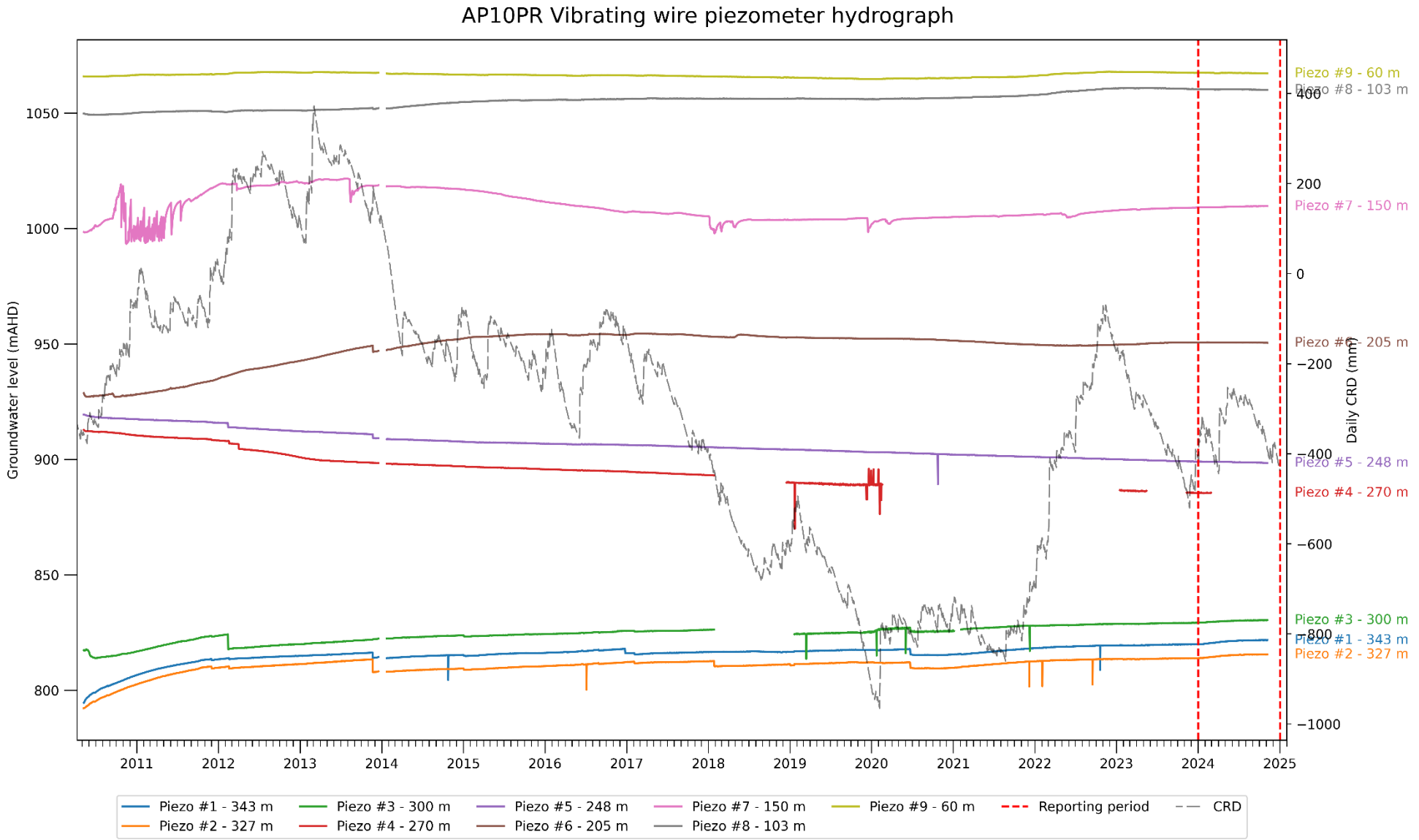

Figure C.2 **AP10PR VWP hydrograph**

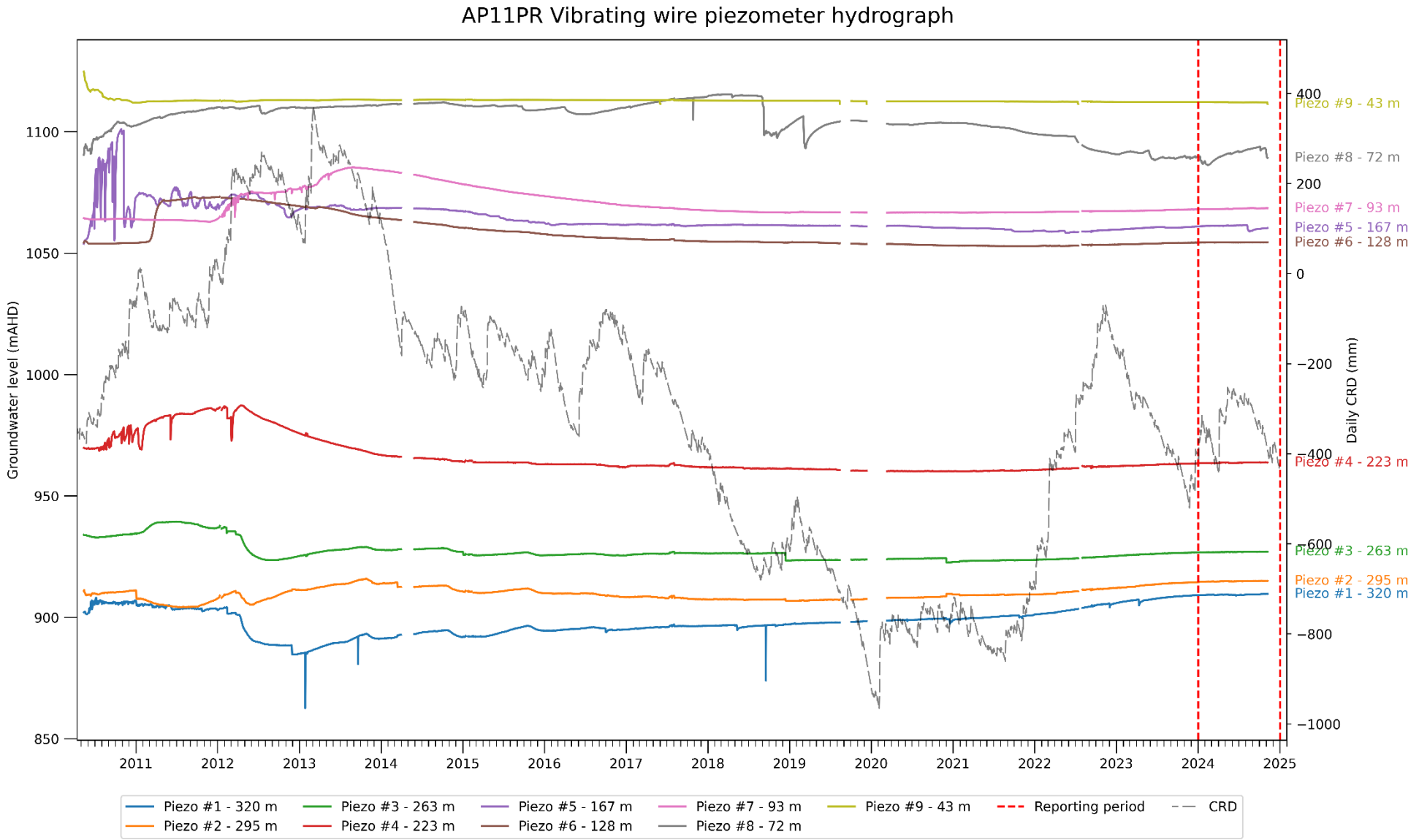

Figure C.3 **AP11PR VWP hydrograph**

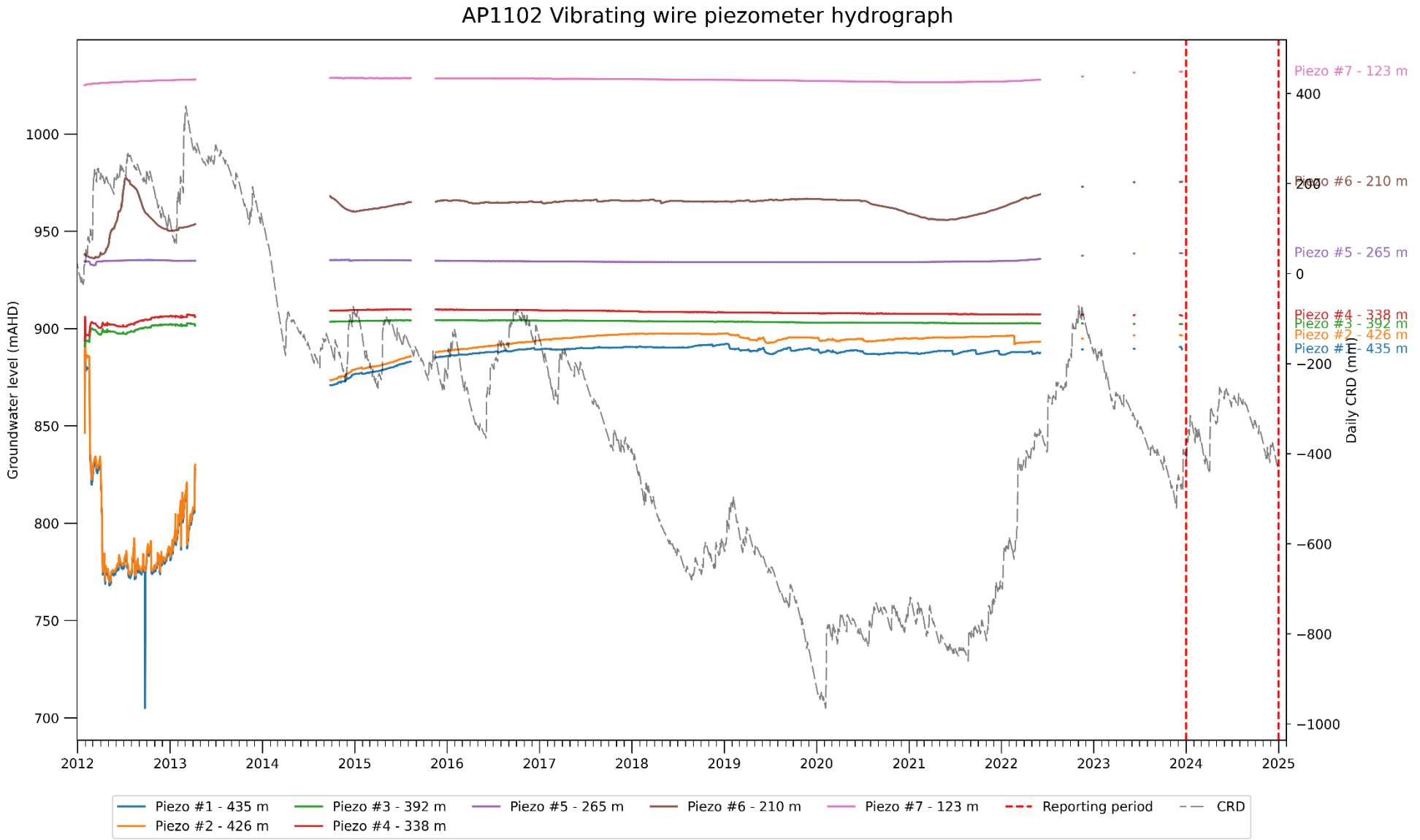

Figure C.4 **AP1102 VWP hydrograph**

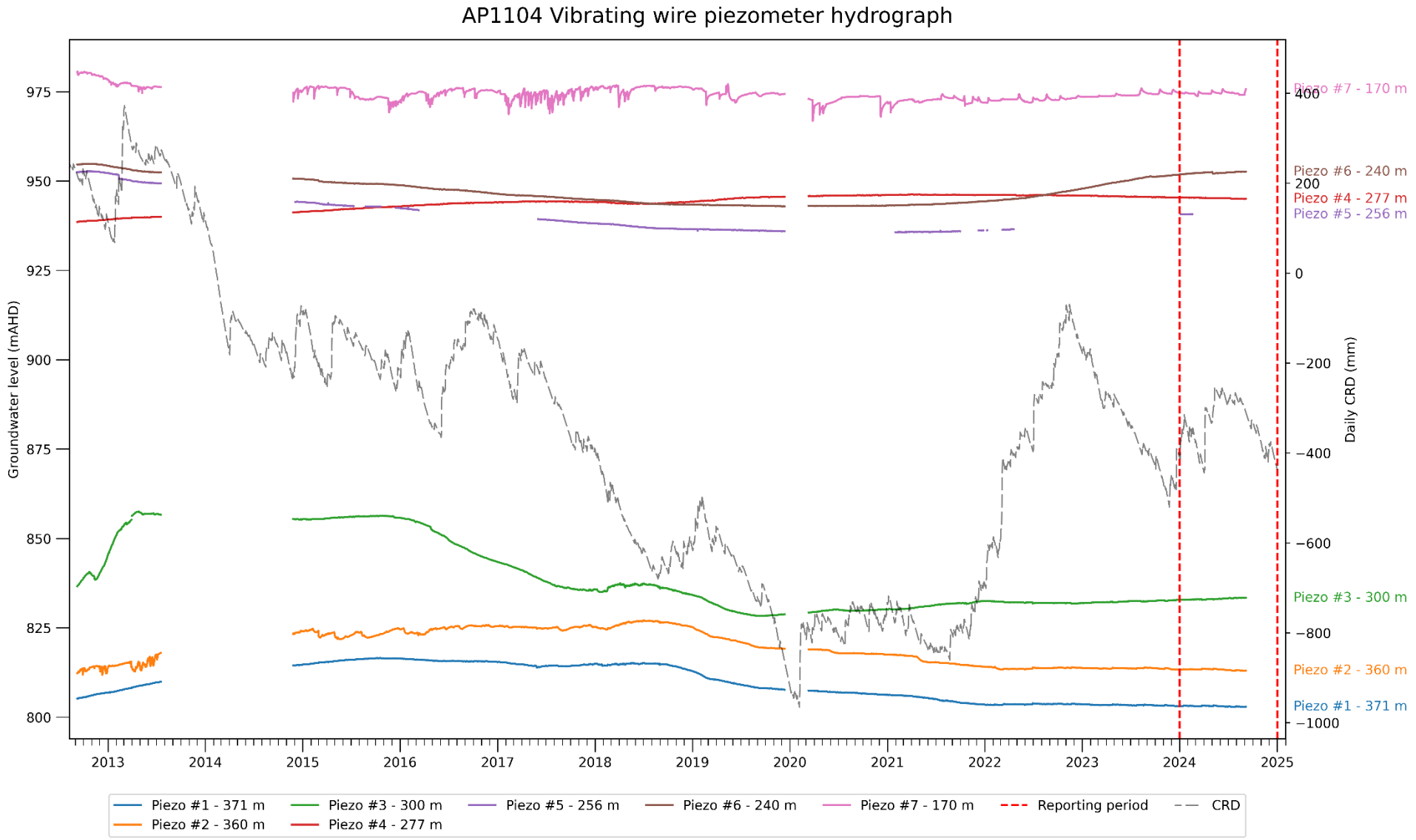

Figure C.5 **AP1104 VWP hydrograph**

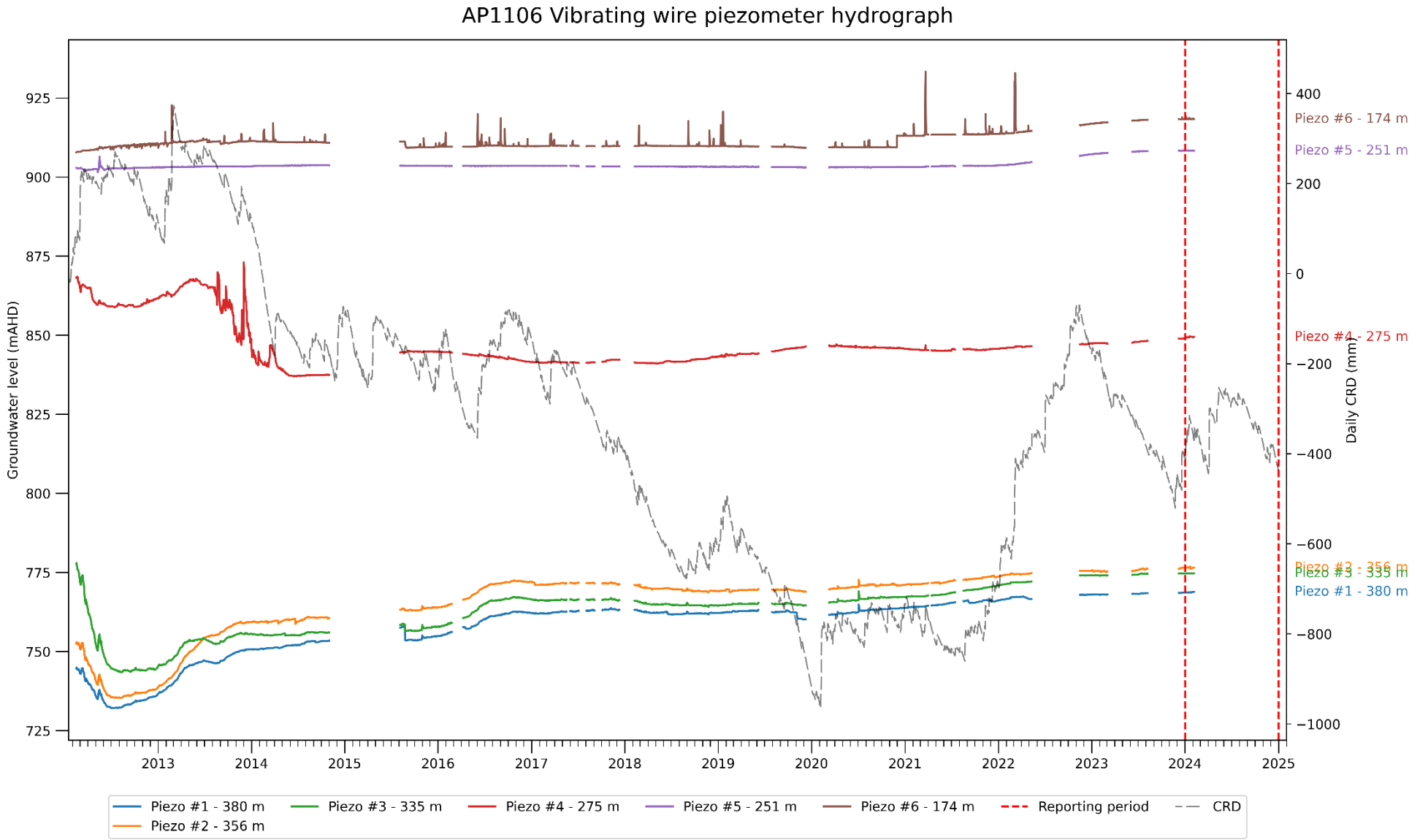

Figure C.6 **AP1106 VWP hydrograph**

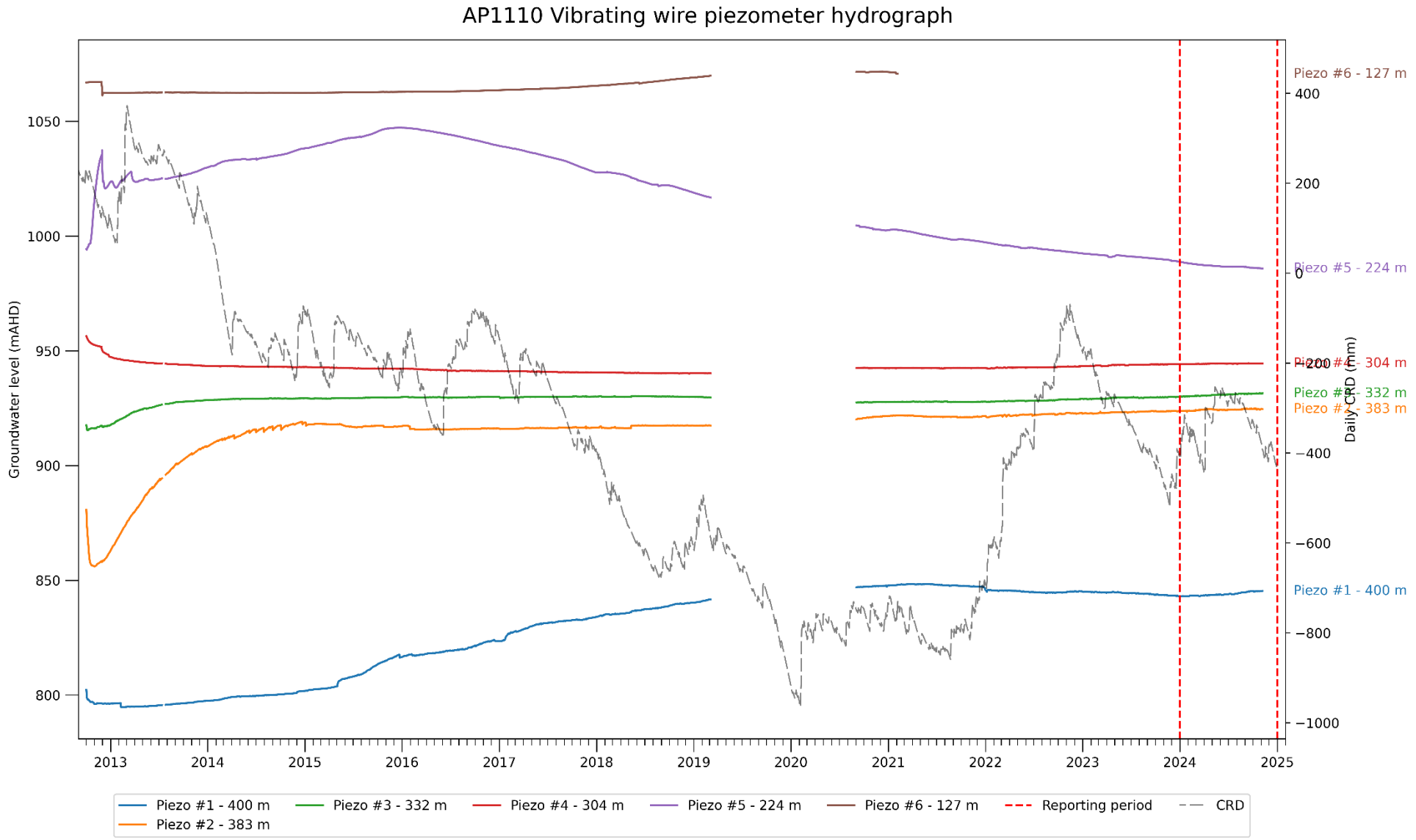

Figure C.7 AP1110 VWP hydrograph

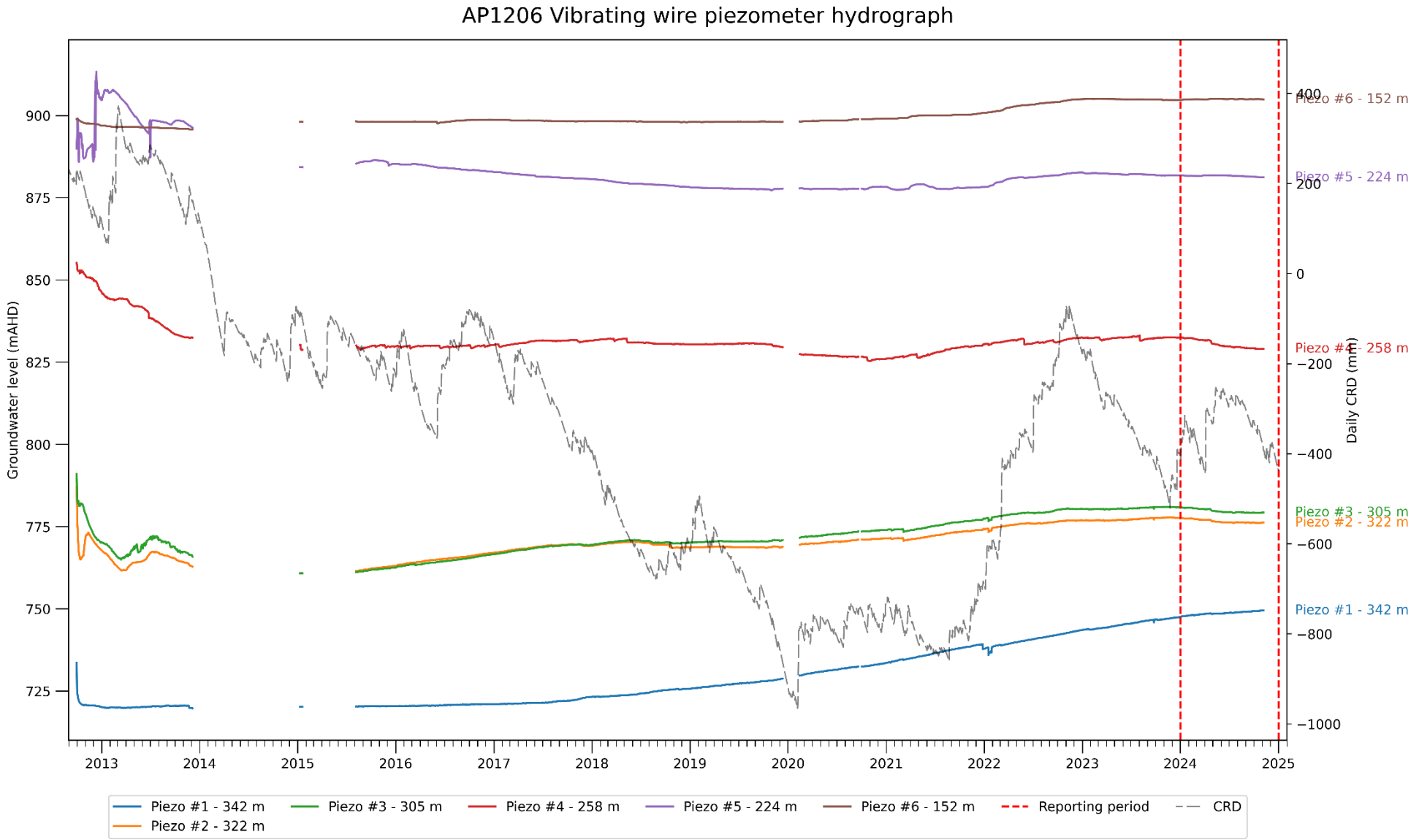

Figure C.8 AP1206 VWP hydrograph

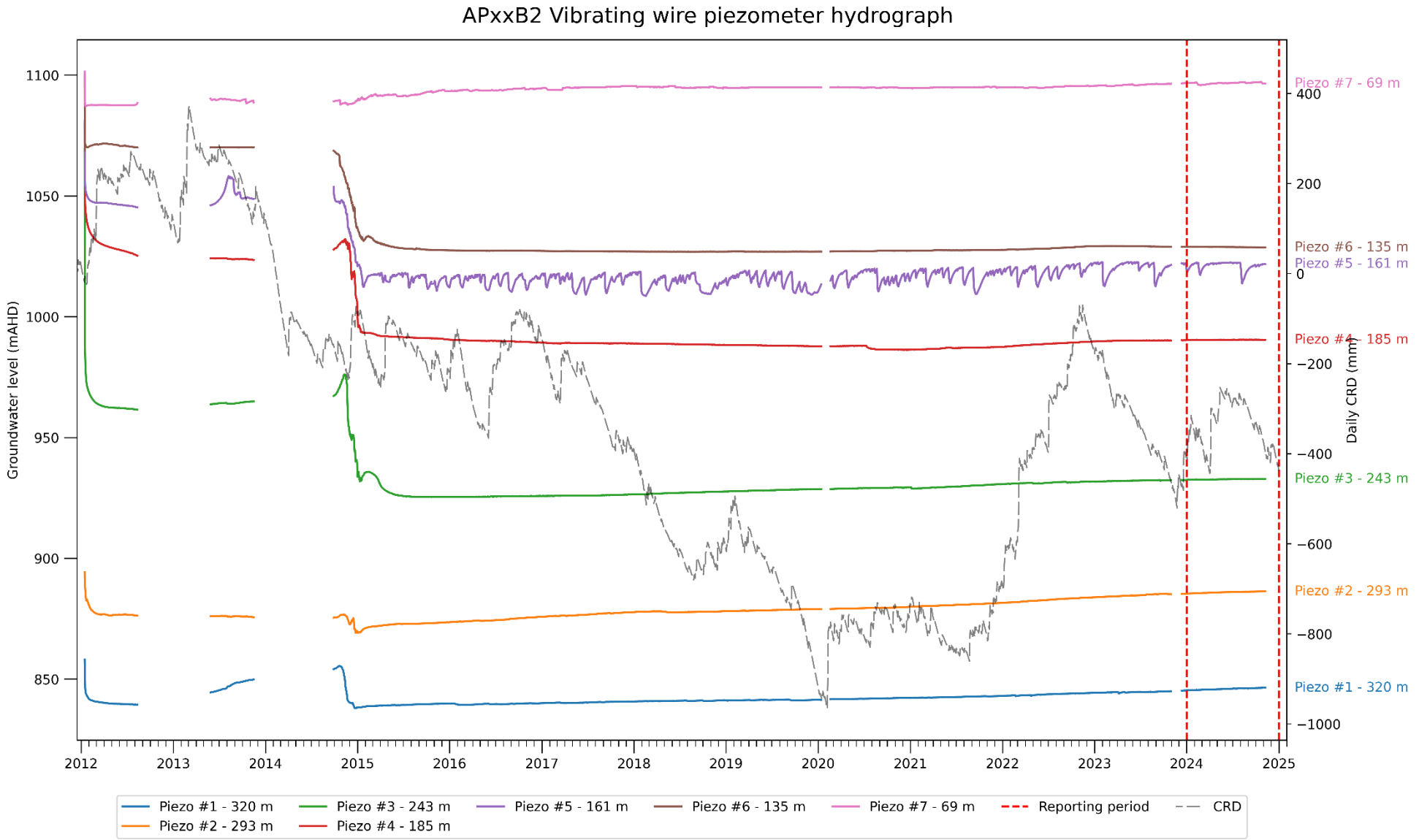

Figure C.9 APXXB2 VWP hydrograph

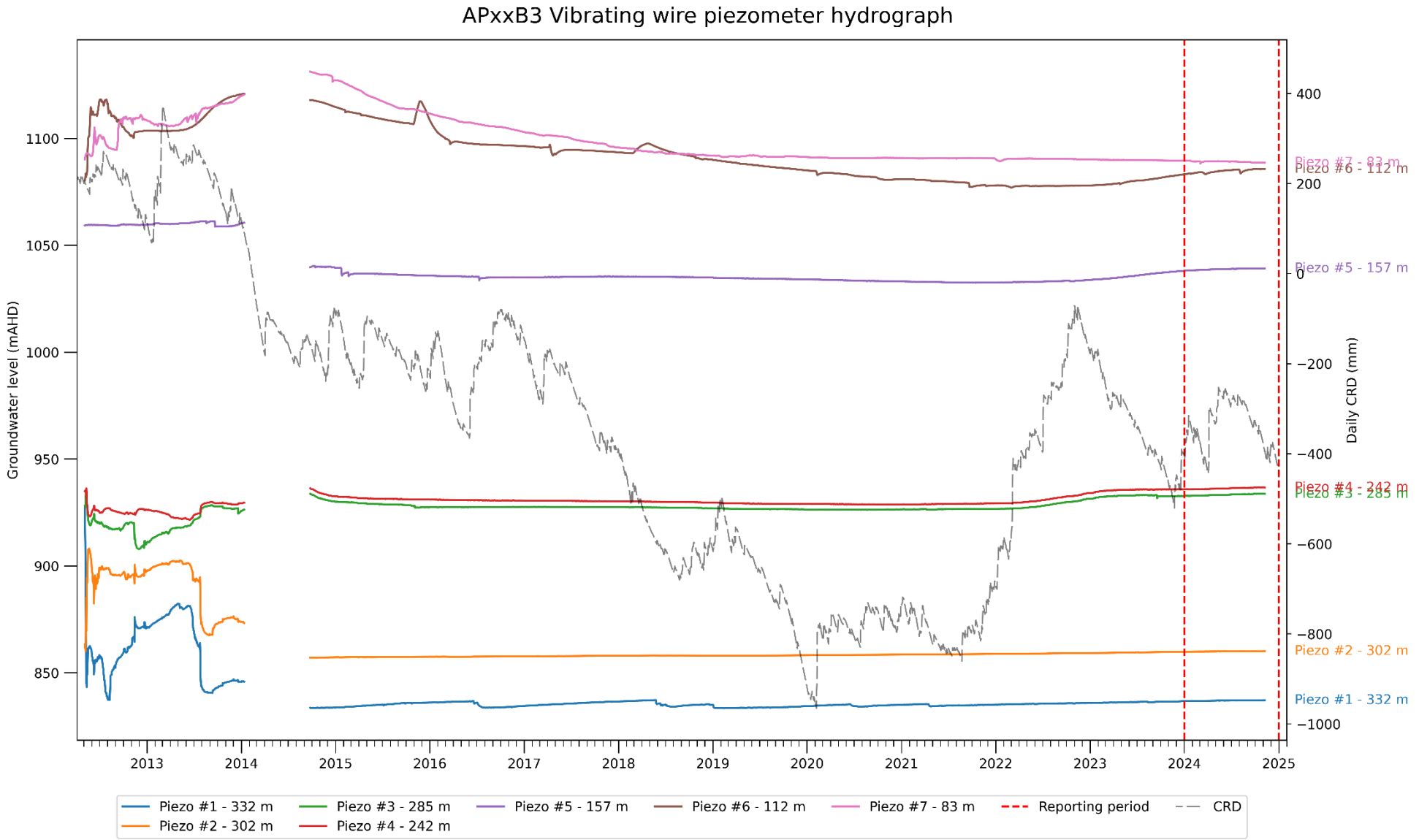

Figure C.10 APXXB3 VWP hydrograph

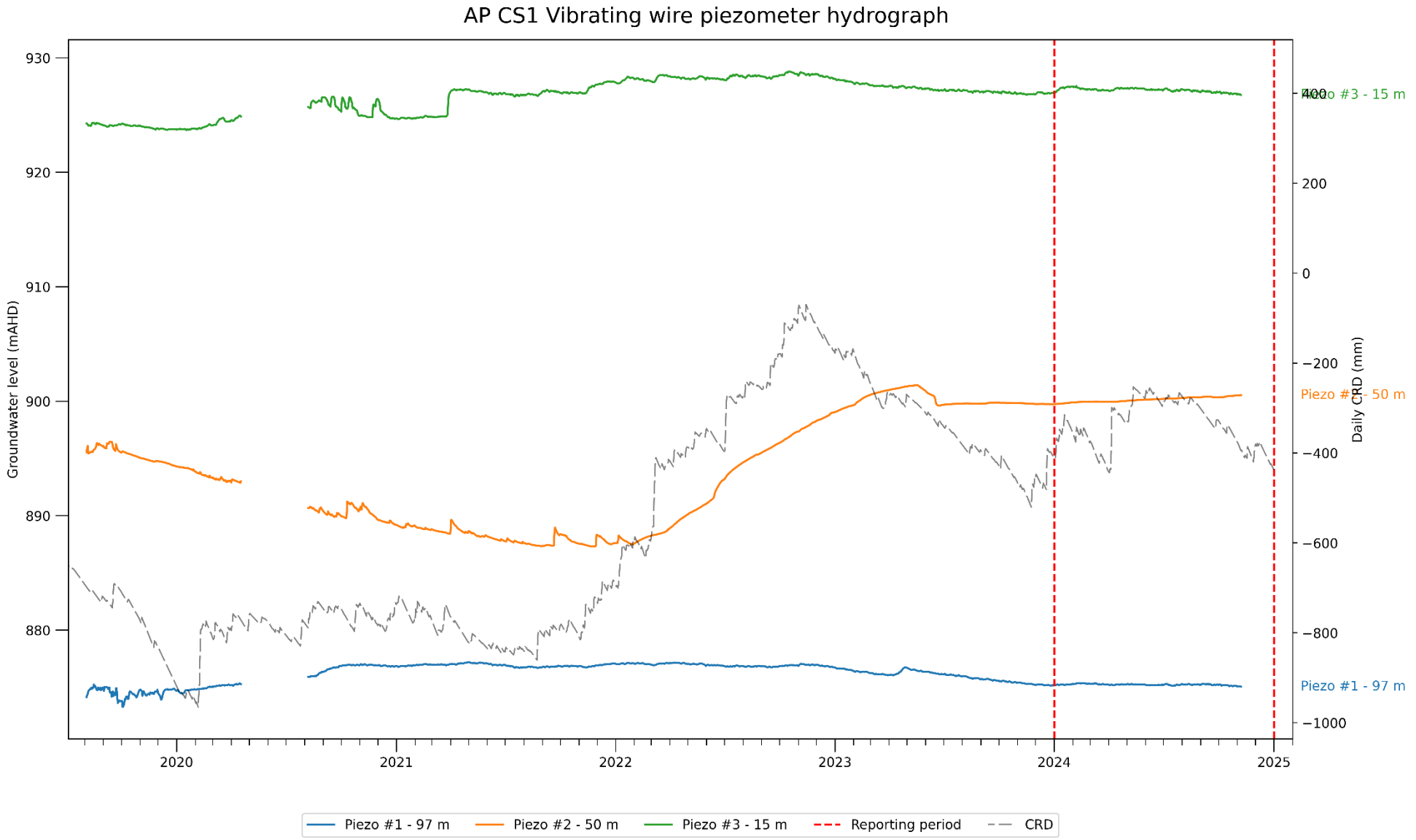

Figure C.11 APC CS1 VWP hydrograph

Appendix D

Surface water quality time series plots

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D.1 Watercourse surface water quality and flow rate time series plots

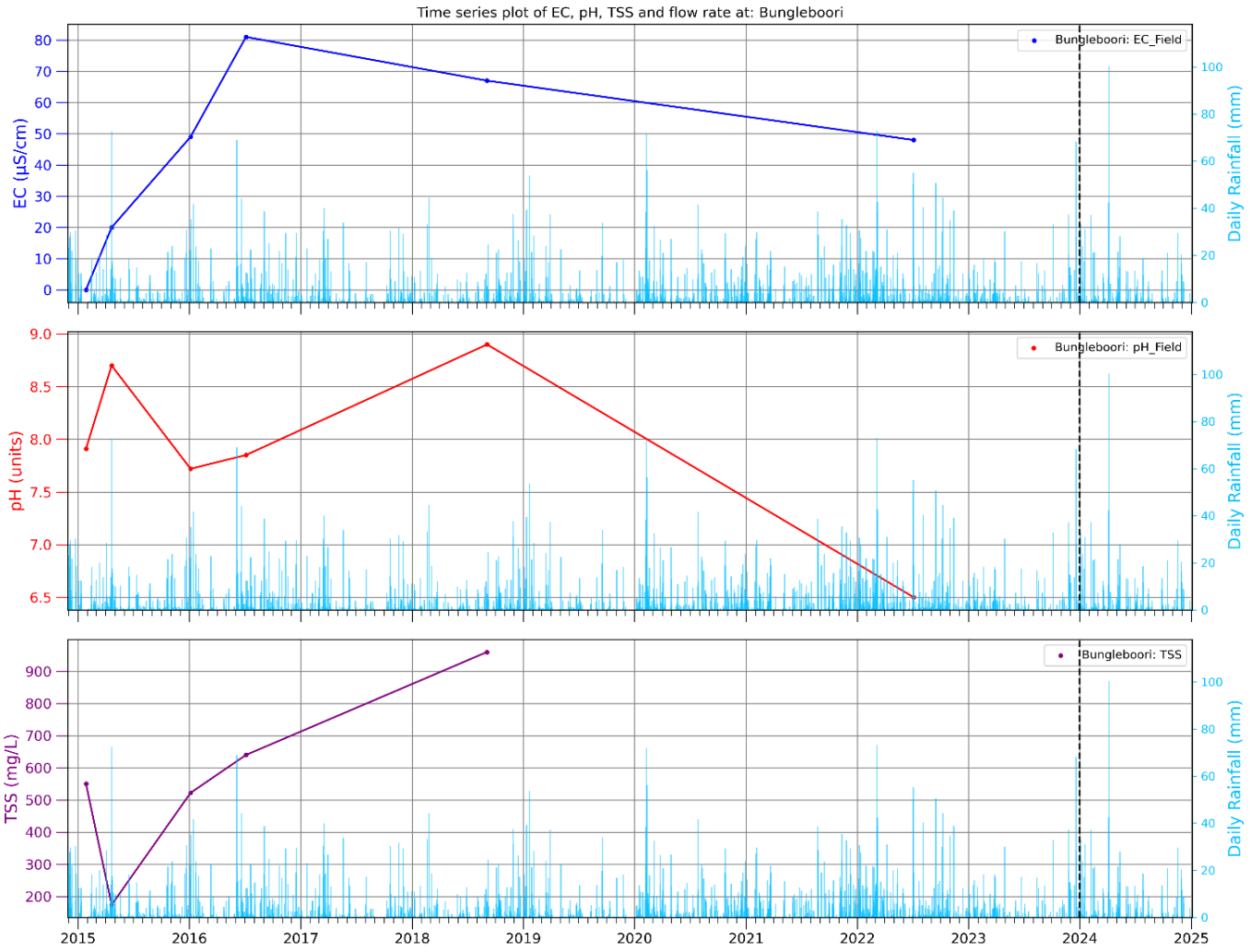

Figure D.1 Bungleboori time series plot

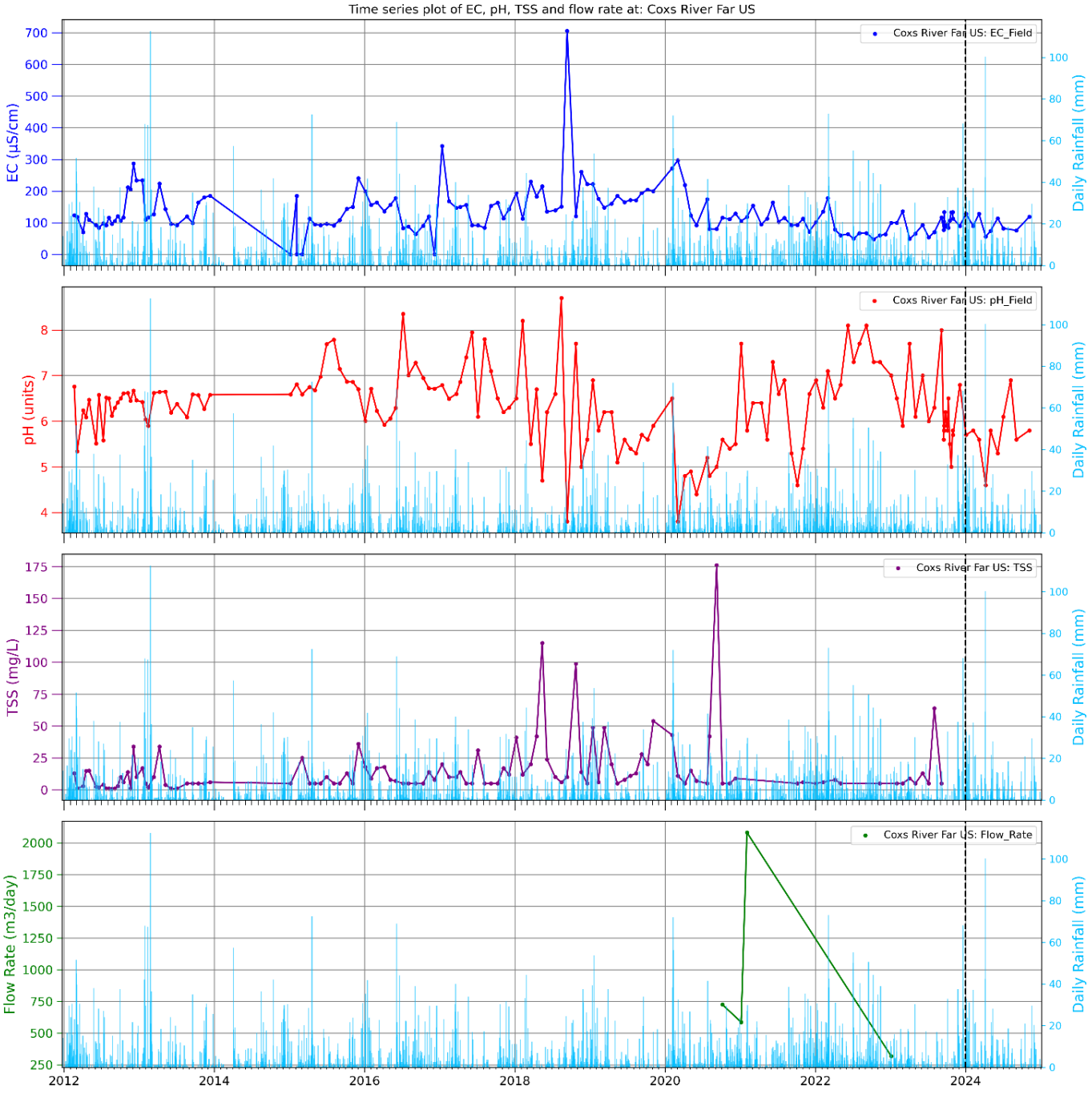

Figure D.2 Coxs River Far U/S time series plot

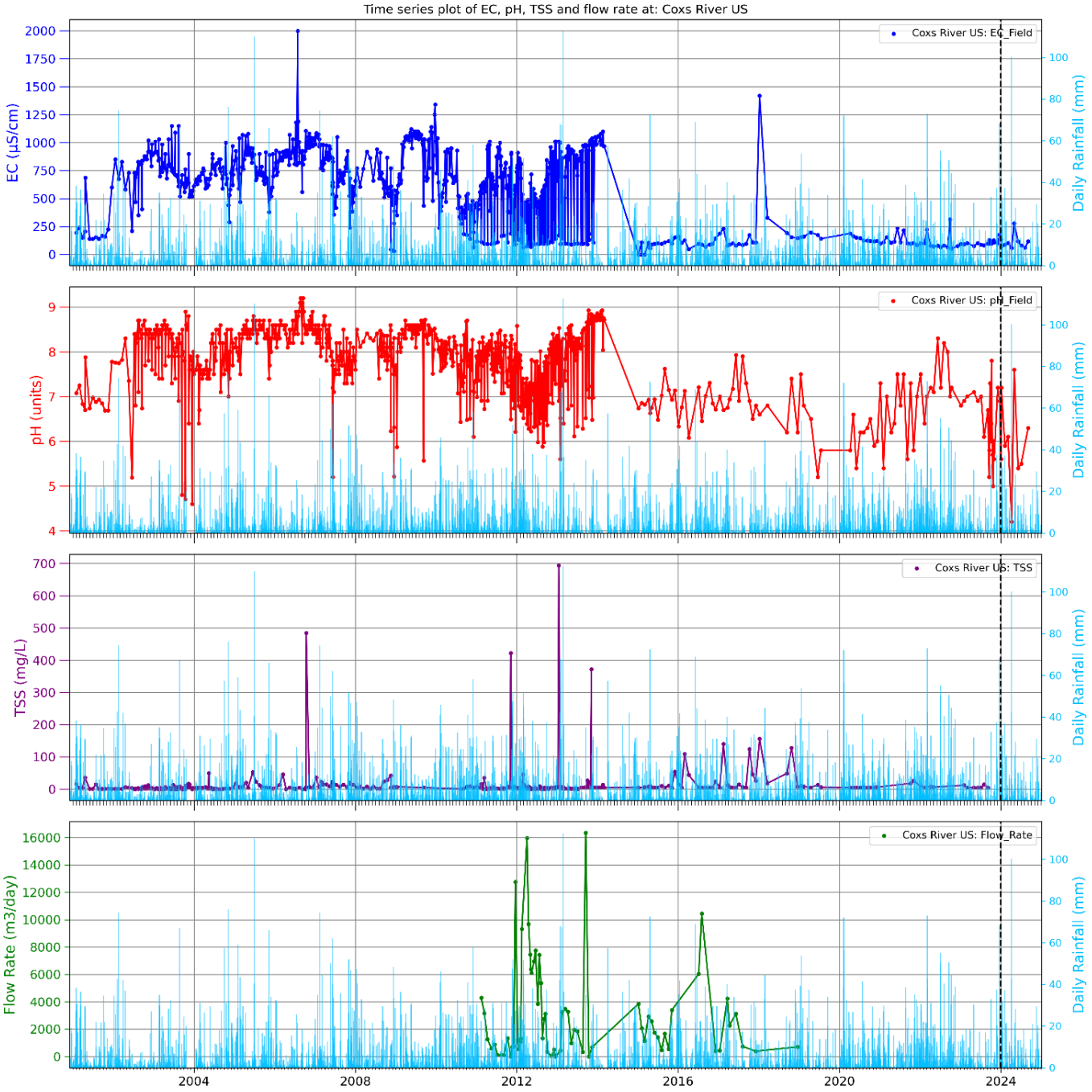

Figure D.3 Coxs River U/S time series plot

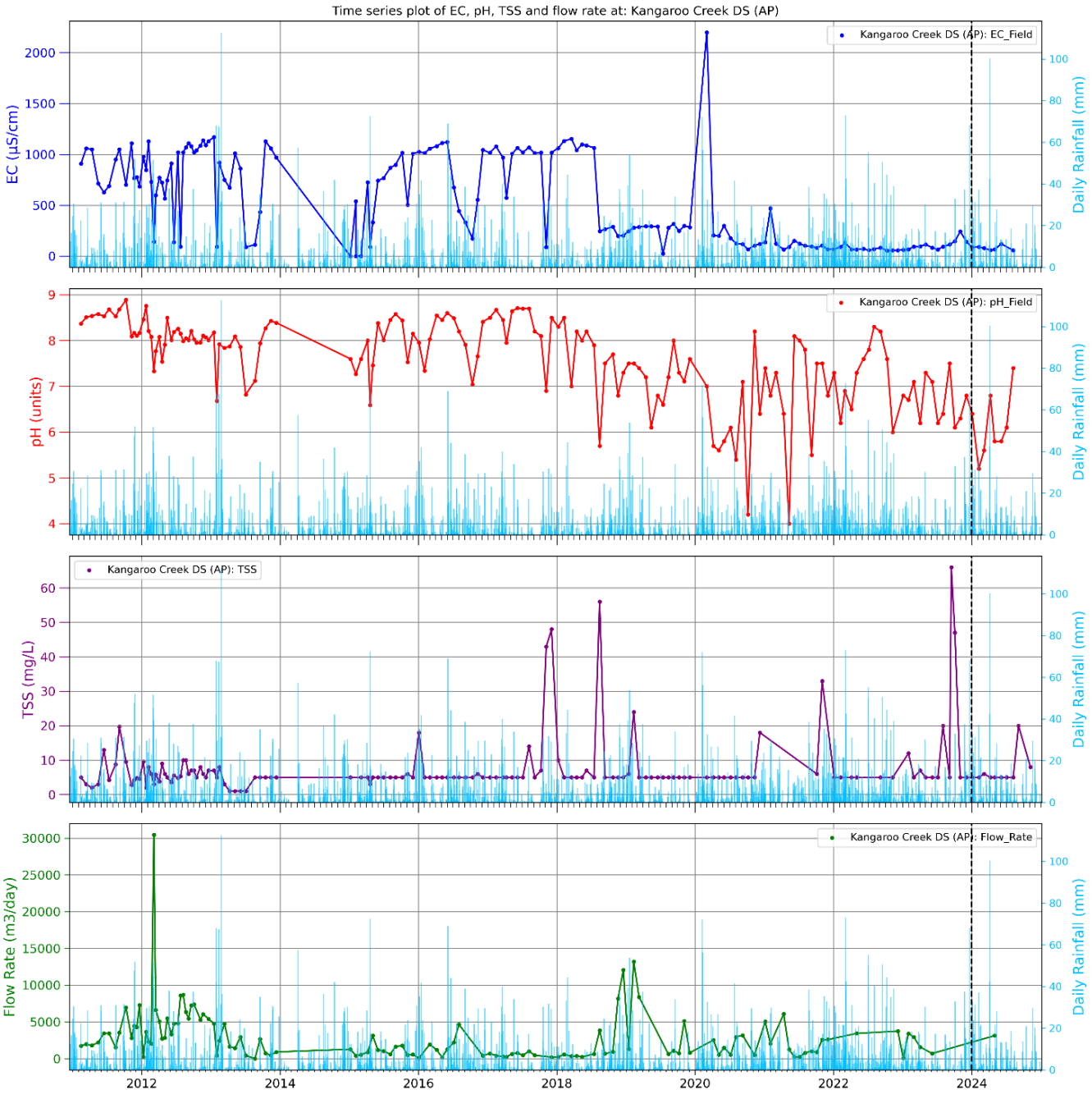

Figure D.4 Kangaroo Creek D/S (AP) time series plot

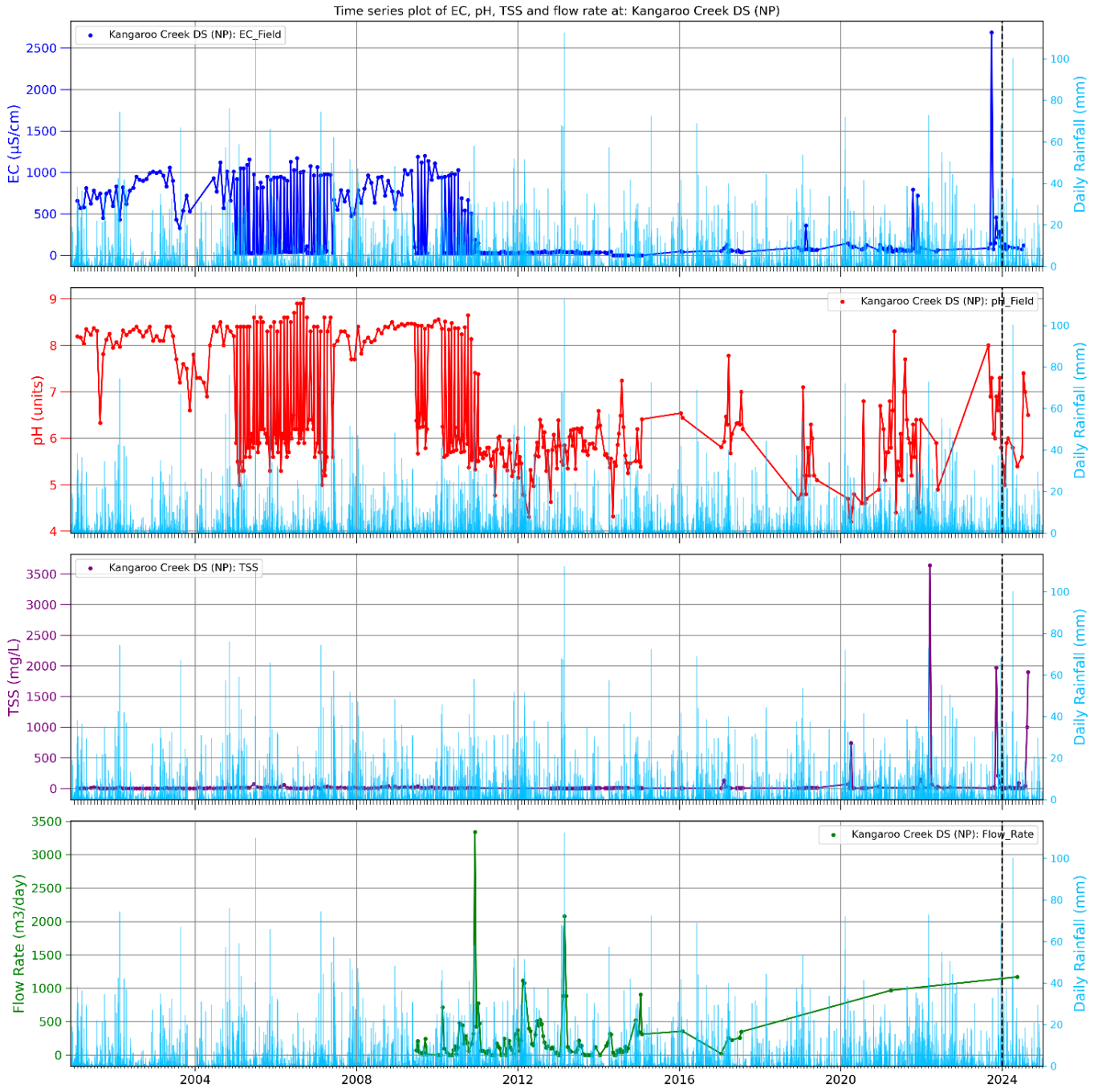

Figure D.5 Kangaroo Creek D/S (NP) time series plot

Figure D.6 Kangaroo Creek U/S (AP) time series plot

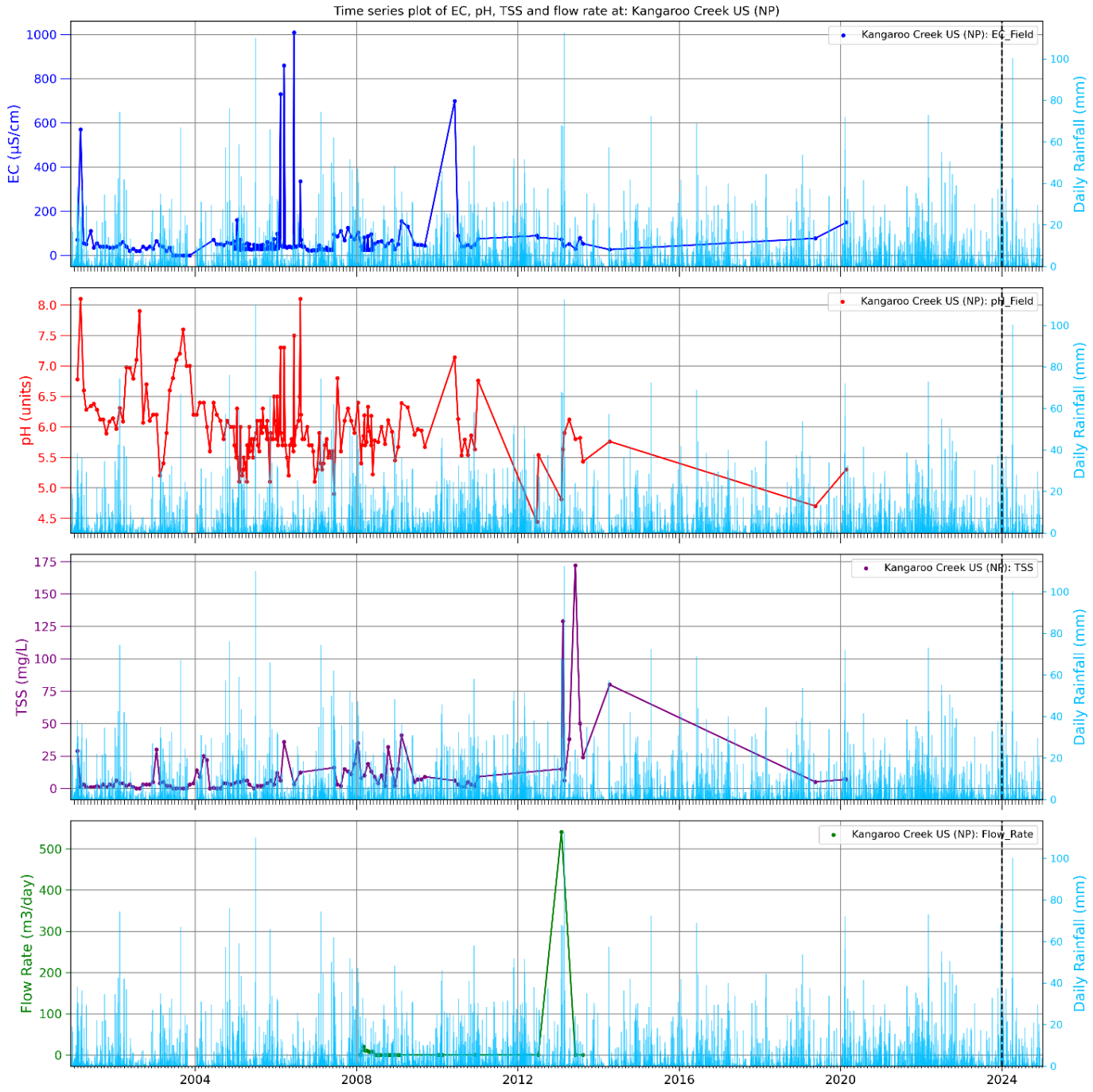

Figure D.7 Kangaroo Creek U/S (NP) time series plot

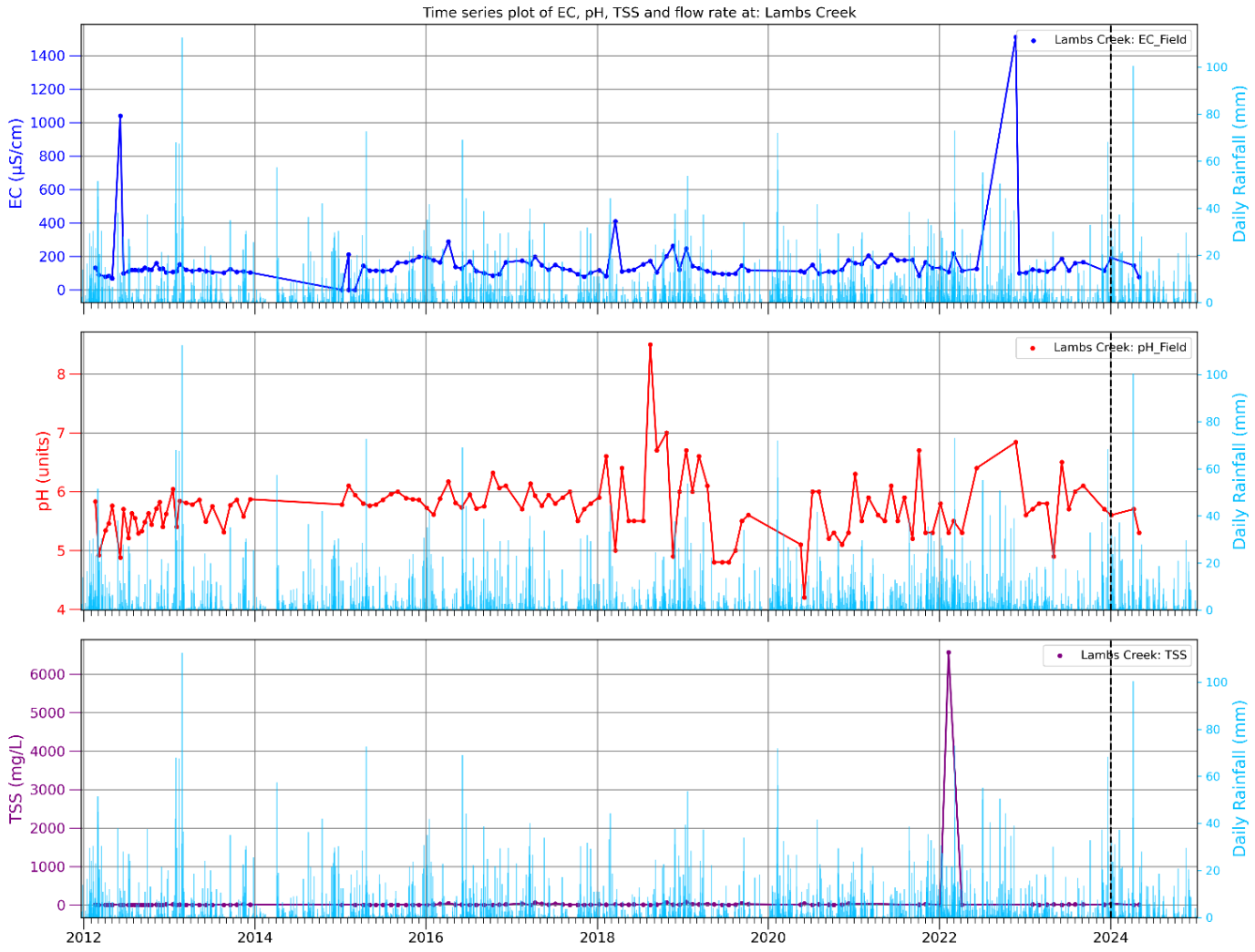

Figure D.8 Lambs Creek time series plot

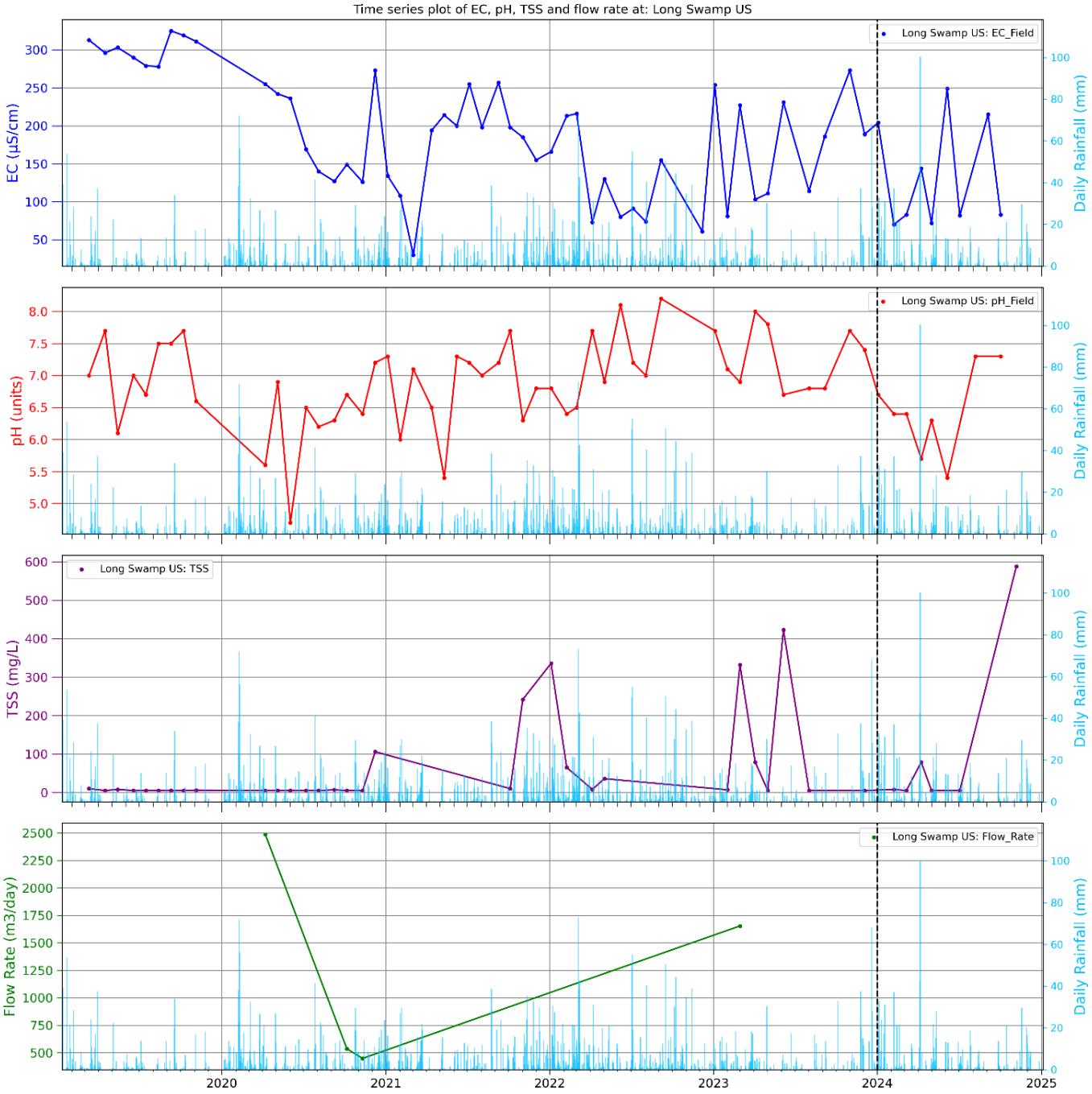

Figure D.9 Long Swamp U/S time series plot

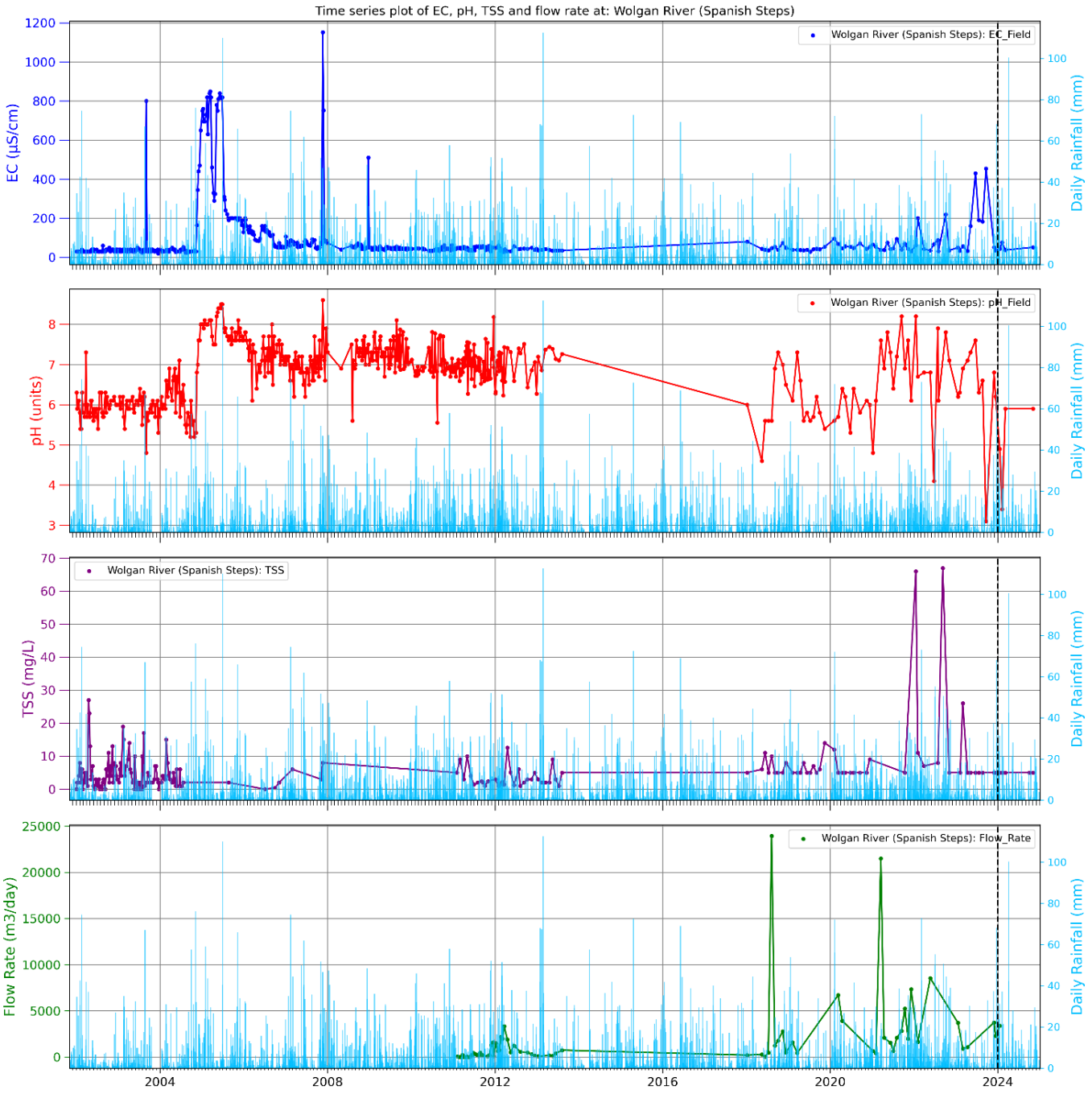

Figure D.10 Wolgan River (Spanish Steps) time series plot

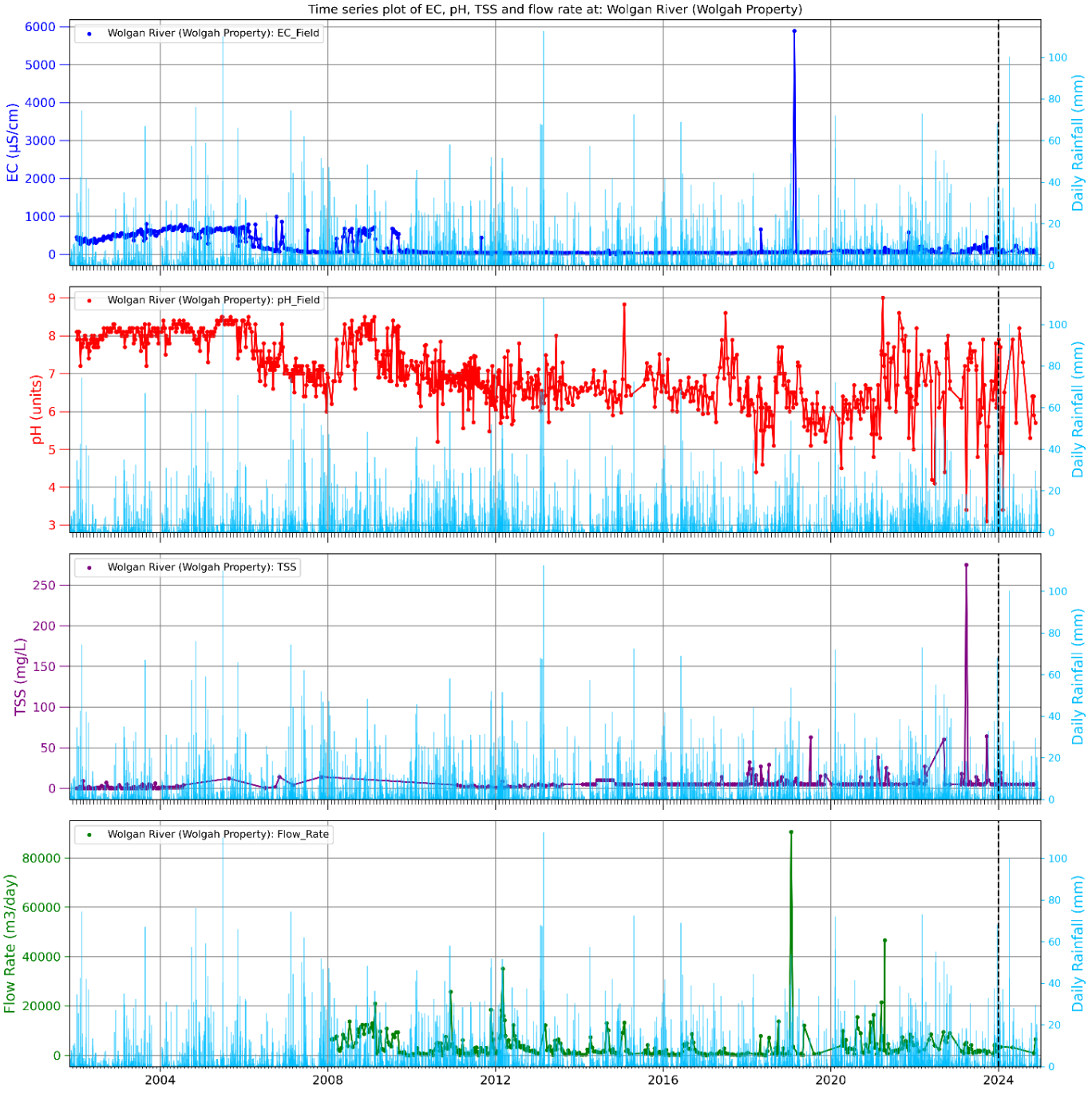

Figure D.11 Wolgan River (Wolgah Property) time series plot

D.2 Pit top surface water quality time series plots

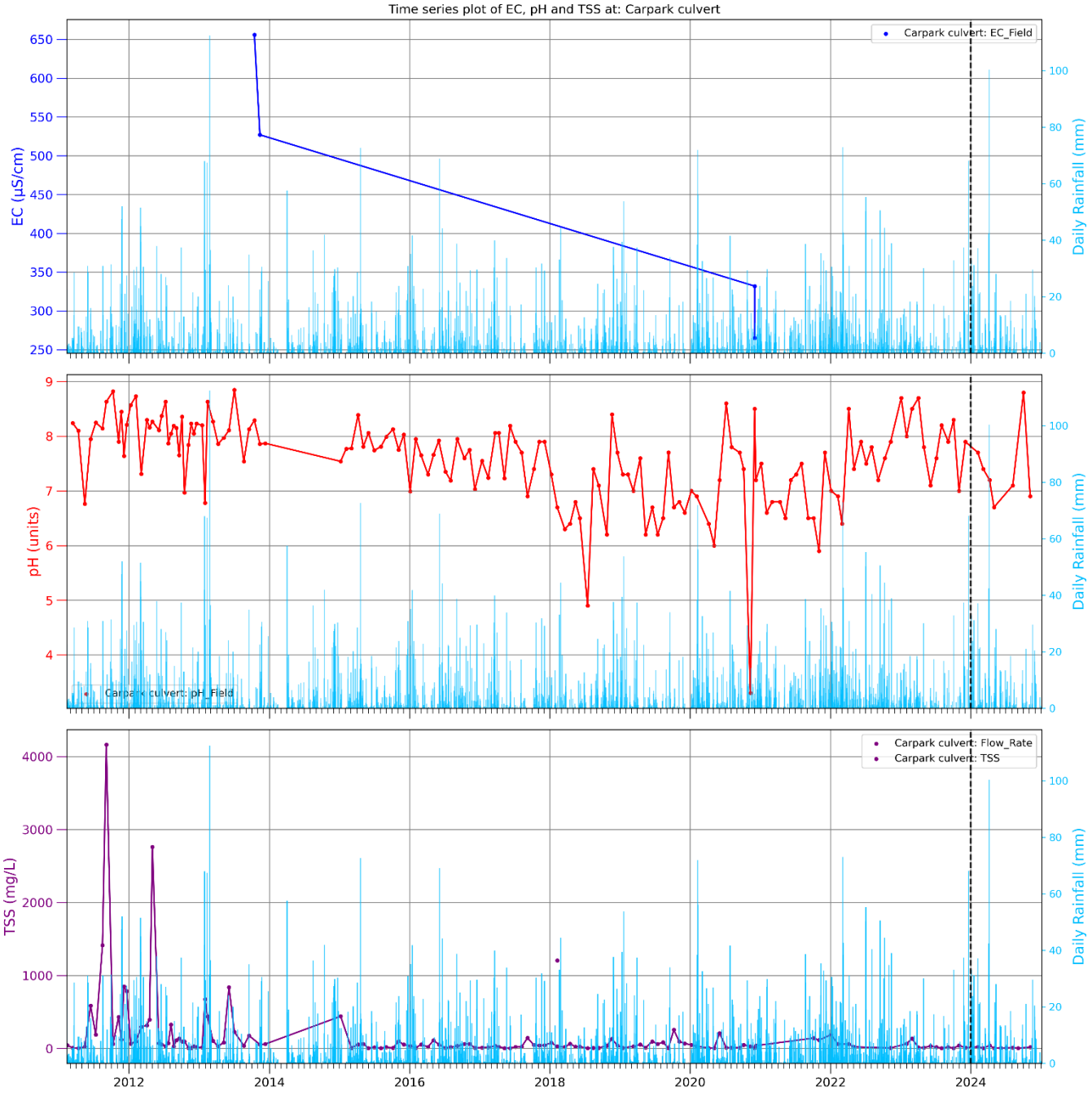

Figure D.12 Carpark Culvert time series plot

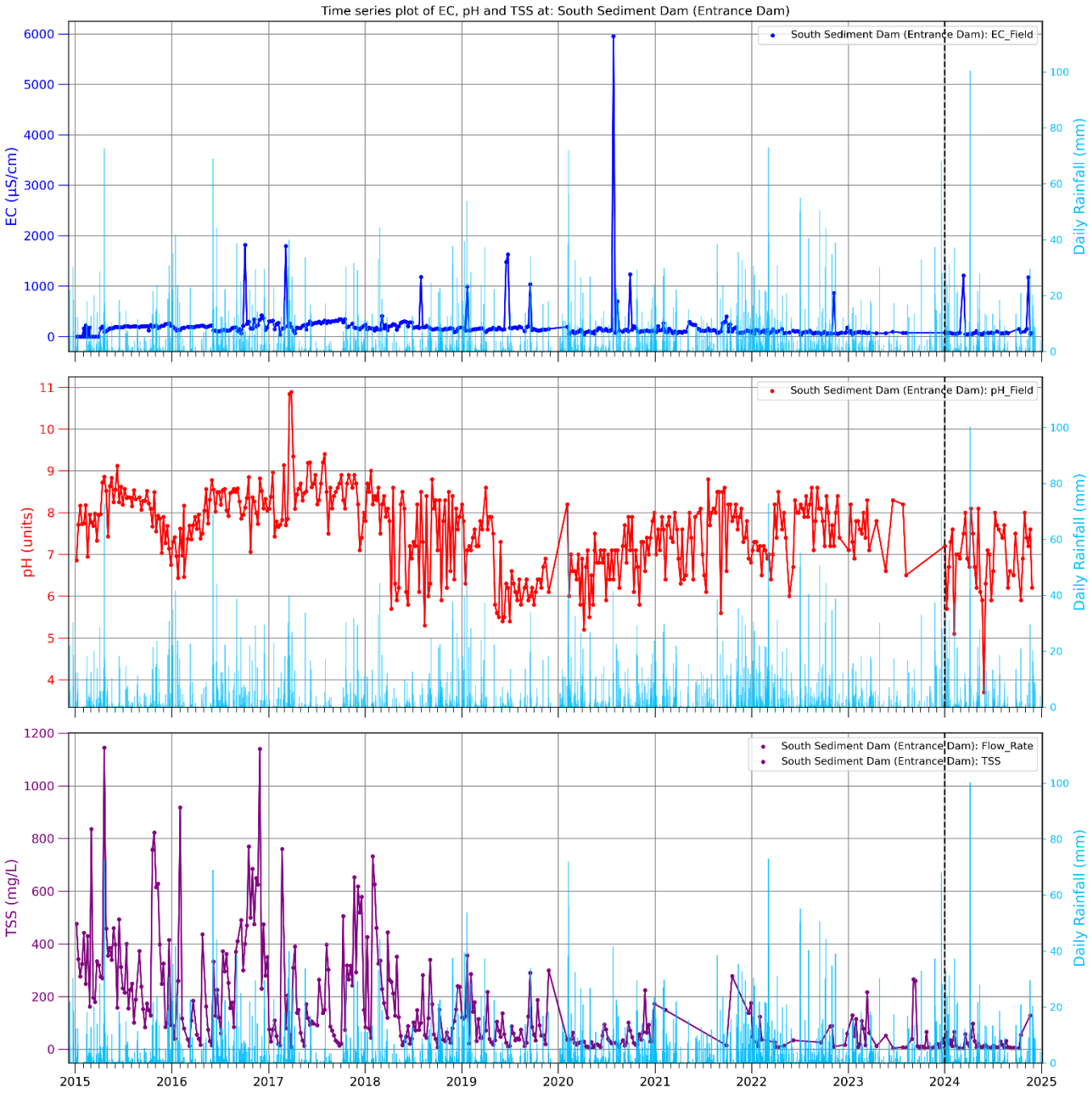

Figure D.13 South Sediment Dam (Entrance Dam) time series plot

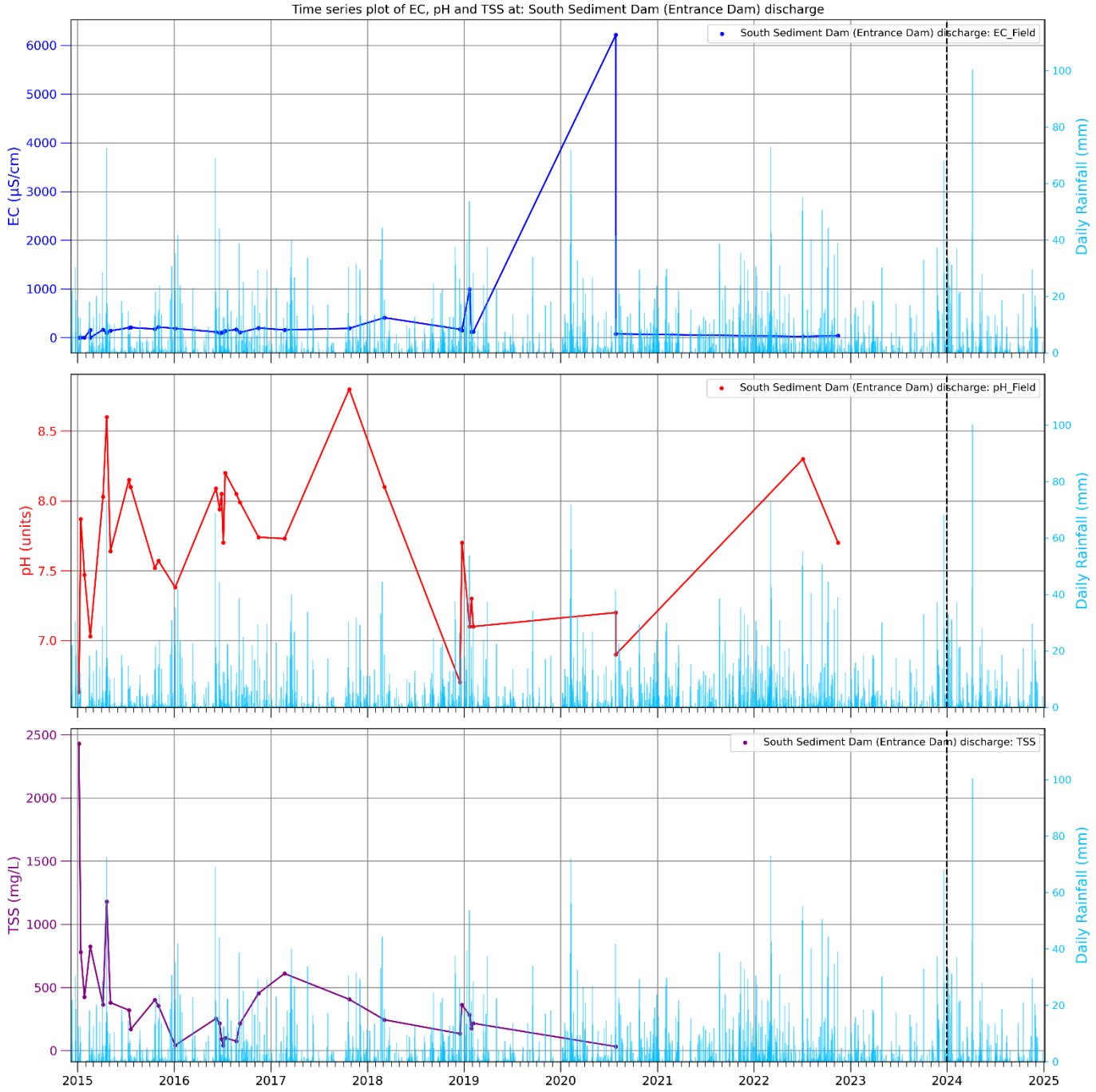

Figure D.14 South Sediment Dam (Entrance Dam) discharge time series plot

D.3 Swamp surface water quality and flow time series plots

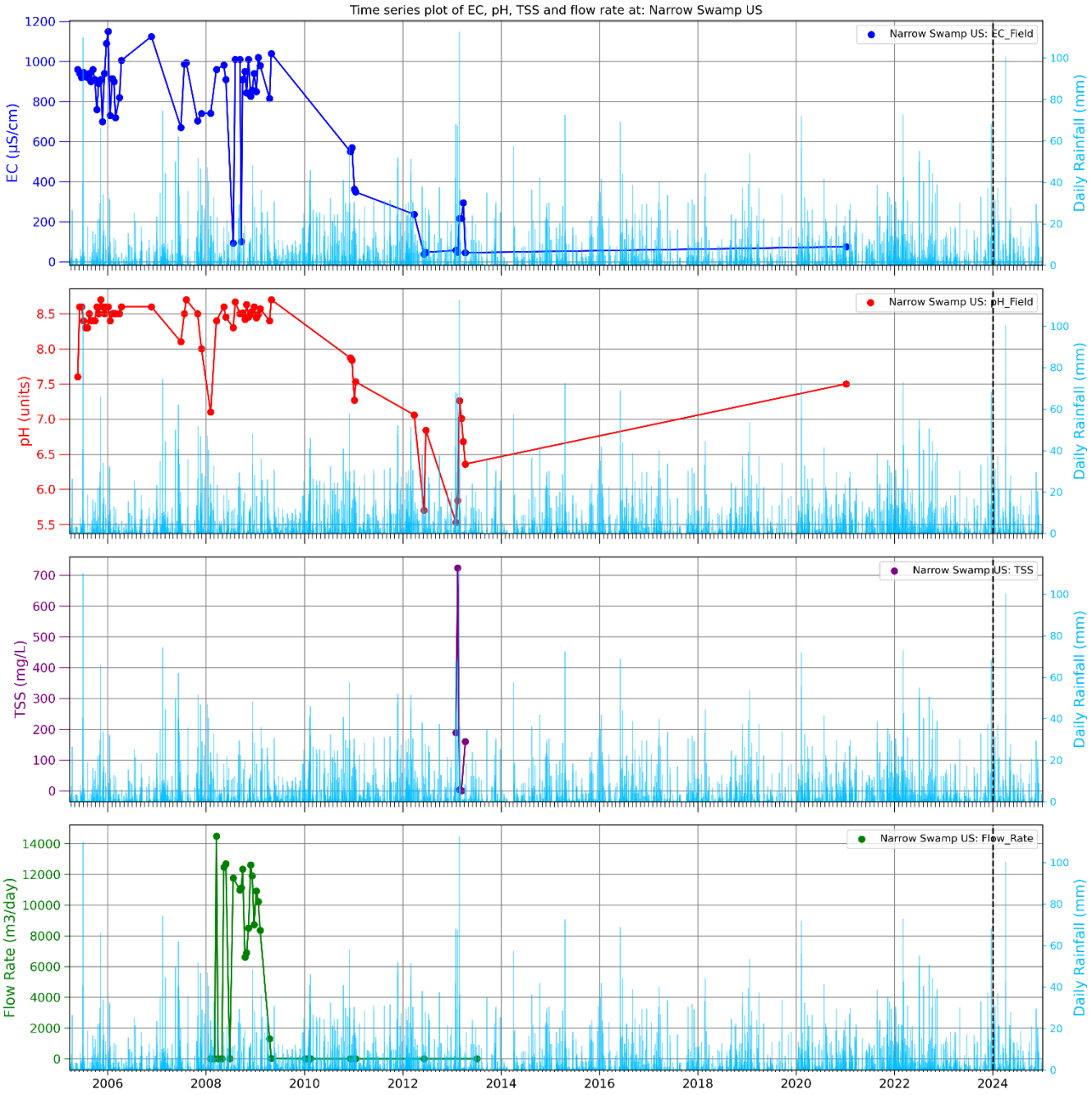

Figure D.15 Narrow Swamp U/S time series plot

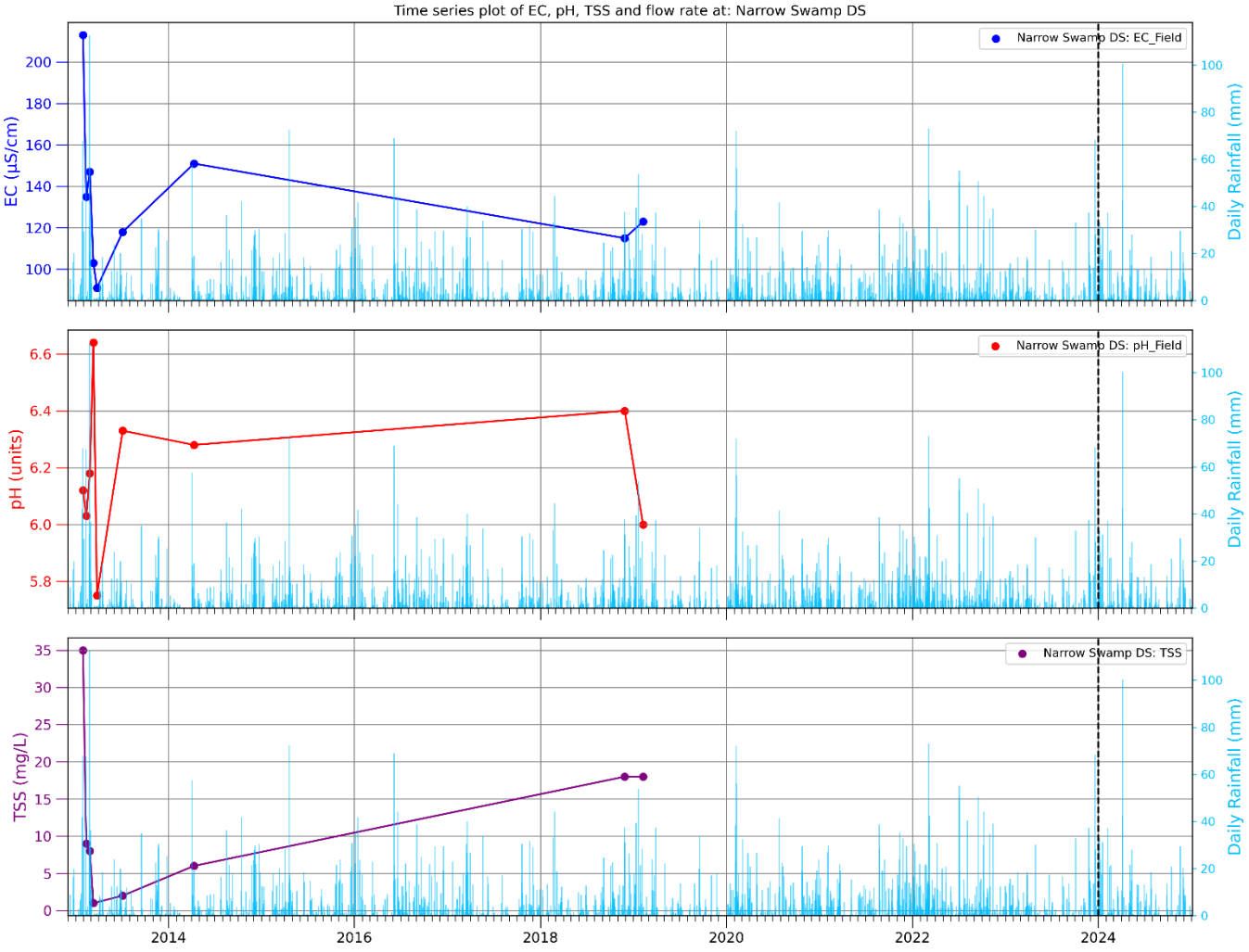

Figure D.16 Narrow Swamp D/S time series plot

Figure D.17 Star Picket time series plot

Figure D.18 Tri Star Swamp time series plot

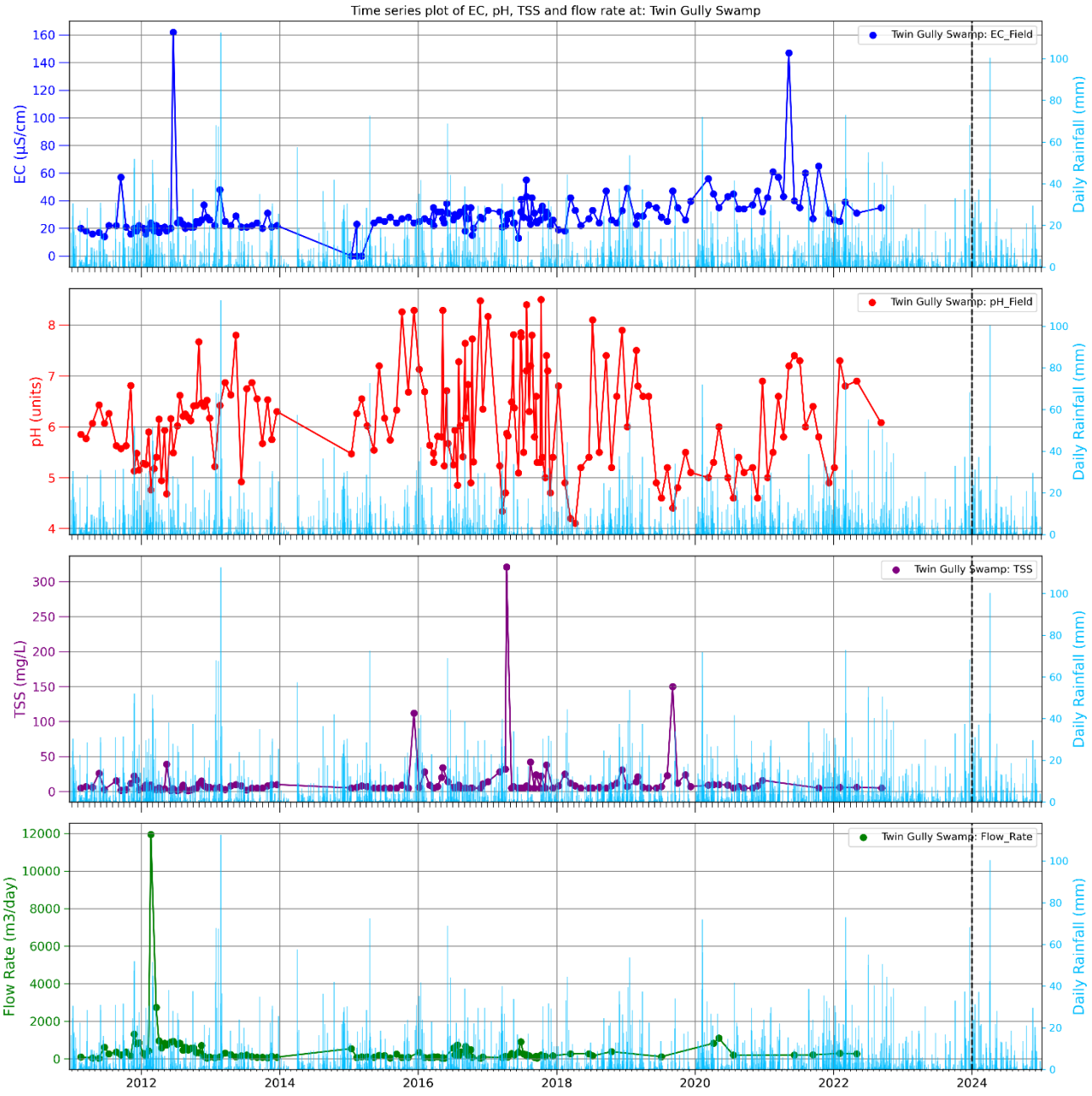

Figure D.19 Twin Gully Swamp time series plot

Australia

SYDNEY
The Forum, Level 10
201 Pacific Highway,
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
2015 Main Street
Vancouver BC V5T 3C2
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Centennial Coal Company Limited
P O Box 1000
Toronto NSW 2283
www.centennialcoal.com.au