



CENTENNIAL COAL
Angus Place
ANNUAL REVIEW

May 2023

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Abbreviation Table

AEMP	Aquatic Ecology Monitoring Program
AEMR	Annual Environmental Management Report
AR	Annual Review
AQMP	Air Quality Management Plan
AWS	Automatic Weather Station
BOM	Bureau of Meteorology
BC Act	<i>Biodiversity Conservation Act 2016</i>
CCL	Consolidated Coal Leases
DCO	Development Control Order
DDG	Depositional Dust Gauges
DPIE	Department of Planning, Industry and Environment
DPE	Former Department of Planning & Environment
DRNSW-MEG	Department of Regional NSW – Mining, Exploration & Geosciences
EC	Electrical Conductivity
EPA	Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environmental Protection Licence
HCS	Habitat Complexity Scores
HVAS	High Volume Air Sampler
LDP	Licensed Discharge Point
LFA	Landscape Function Analysis
ML	Mining Lease
MOP	Mining Operations Plan
NMP	Noise Management Plan
NPI	National Pollutant Inventory
NPSS	Newnes Plateau Shrub Swamps
PA	Project Approval
POLMOP	Privately-Owned Lands Mine Operations Plan
RAP	Registered Aboriginal Parties
SMP	Subsidence Management Plan
SSA	Soil Surface Assessment
SSD	State Significant Development
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
UCRC	Upper Cocks River Catchment
WAL	Water Licences
WAP	Weed Action Plan
WMP	Water Management Plan
WRACHMP	Western Region Aboriginal Cultural Heritage Management Plan
WRHHMP	Western Region Historic Heritage Management Plan

Plans

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

1 STATEMENT OF COMPLIANCE

The compliance status of the Angus Place Colliery for the year 2022 is presented in **Table 1-1**. During the reporting period there were six 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	Yes
Environmental Protection Licence 467	No
EPBC 2011/5952	Yes
Mining Leases (CCL702, CCL704, ML1424, ML1323, ML1326, ML1699, ML1720, MPL314, EL6856, EL6293, EL7415, EL8188, MLA498)	Yes
SMP Approval 04/1675	Yes
SMP Approval OUT 14/10918	Yes
Water Licenses (WAL36445, WAL36449, WAL37340, WAL37343, WAL41881)	Yes
Mining Operations Plan	Yes
Radiation Management Licence RML29229	Yes

Table 1-2: 2022 Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Where Addressed in Annual Review
EPL 467	L2.1	Water and/or Land Concentration Limits	Non-Compliant	Unauthorised discharge occurred at LDP003 on 28/10/22	Section 11
EPL 467	M2.3	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor TSS in water discharged at LDP003 on 10/1/22	Section 11
EPL 467	M2.3	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor required parameters at EPL Point 18 on 17/1/22, 3/2/2022	Section 11
EPL 467	M2.3	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor required # samples in accordance with M2.3 at EPL Point 18 on 10 occasions March-Dec 2022.	Section 11
EPL 467	M2.3	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor required # samples in accordance with M2.3 at EPL Point 17 on 4 occasions 17/1, 23/5, 7/9, 1/12/2022.	Section 11
EPL 467	M2.3	Water and/ or Land Monitoring Requirements	Non-Compliant	Failure to monitor required # samples in accordance with M2.3 at EPL Point 16 on 3 occasions 1/3, 7/4, 1/12/2022.	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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 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. 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 utilises 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 have ceased. Environmental management of the site, including dewatering of the underground workings, is ongoing. Mining operations are expected to recommence at Angus Place Colliery in 2025 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 purposes of the EP&A Act.

Accordingly, Angus Place Colliery now operates as an SSD approval (MP06_0021). MP06_0021 has been modified several times since 2011. During the 2022 reporting period MOD7 was approved by DPE on 25 Nov 2022 to address NSW regulatory reforms to mine rehabilitation for all NSW mines in line with changes to NSW Mining Leases as detailed in **Section 3**.

The Angus Place MP06_0021 approval (as modified) currently provides for underground mining with a production limit of 4.0 million tonnes per annum of coal from the Lithgow Seam. The main components of Angus Place's operations are an underground longwall mine and development panels with supporting surface infrastructure situated at the Angus Place pit top area and on the Newnes Plateau.

2.1 SCOPE

This Annual Review (AR) details the compliance and environmental management performance of Angus Place over the period 1 January 2022 to 31 December 2022. It has been prepared to demonstrate the sites performance and community engagement activities. The AR has been prepared in accordance with the Annual Review Guideline (DPIE, 2015) and satisfies the following:

- Conditions of Project Approval MP06_0021, in particular Condition 3 in Schedule 5.¹
- Reporting requirements of mining tenements¹
- Reporting requirements of related approved management plans.

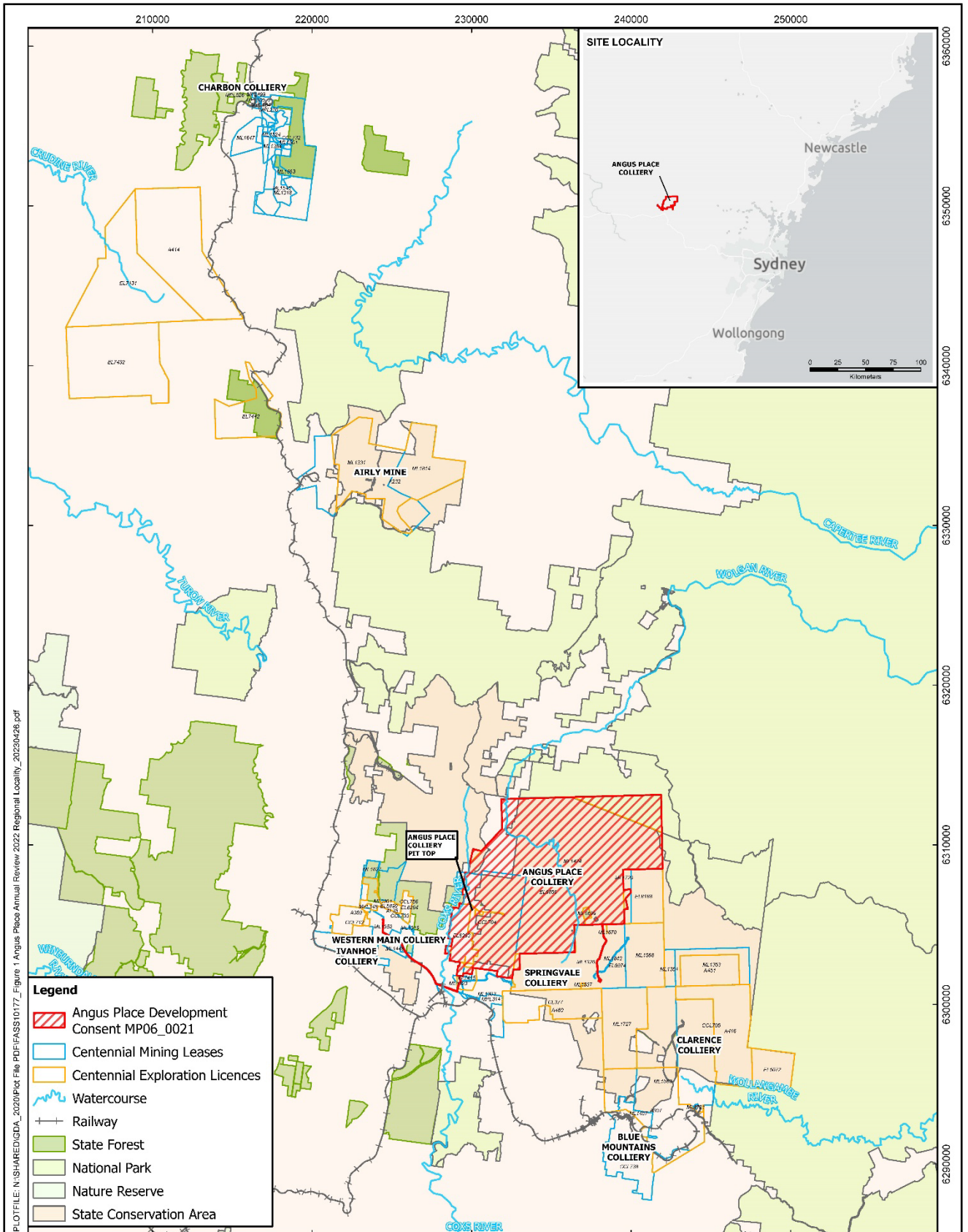
2.2 MINE CONTACTS

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

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
Craig Flemming	Environment & Community Coordinator	T: (02) 6354 8723
		E Craig.Flemming@centennialcoal.com.au
Community Information and Complaints Line		T: (02) 6354 8700

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

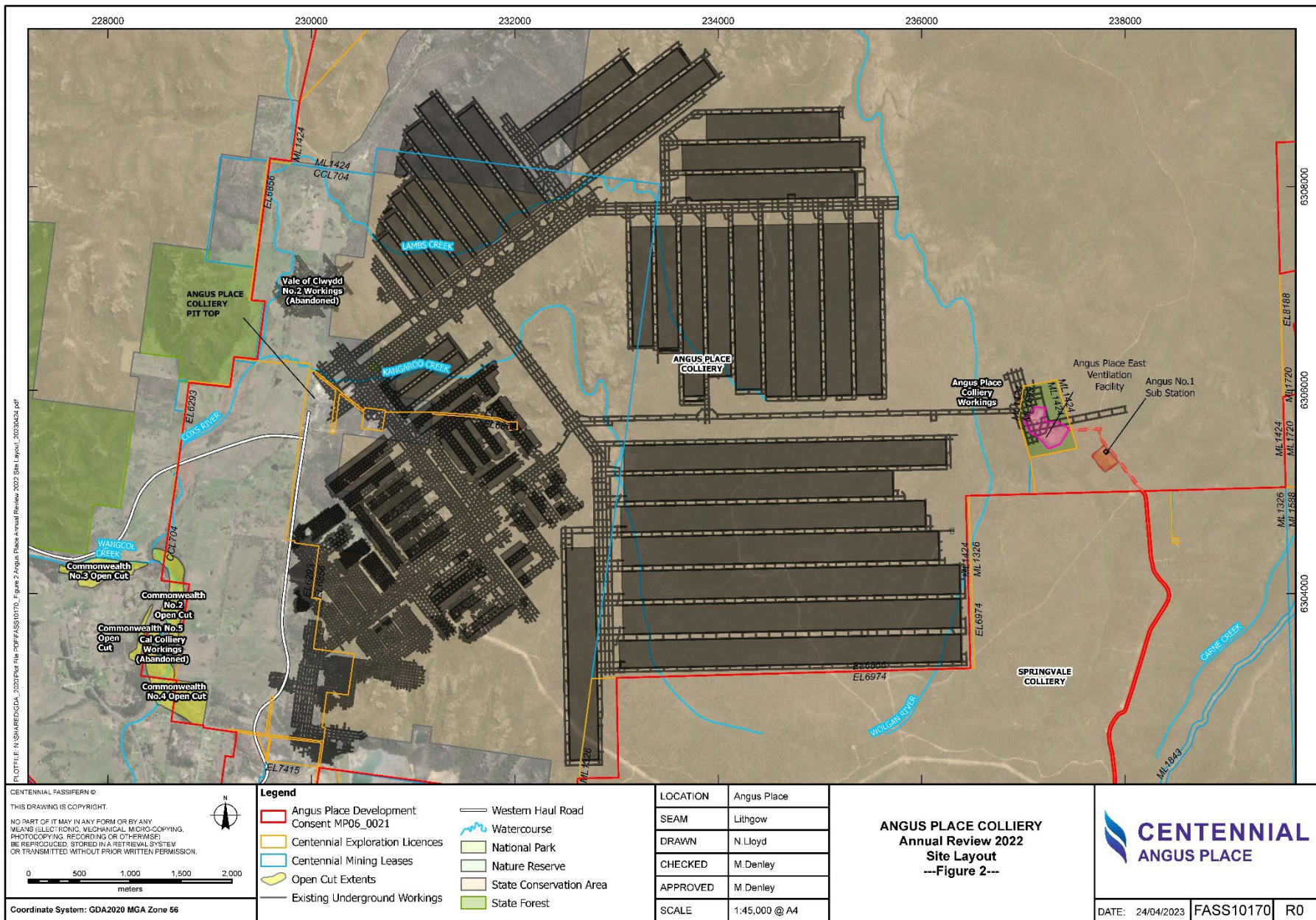


PLOTFILE: N:\SHARED\GDA_2020\Pict File PDF\FASS10177_Figure 1 Angus Place Annual Review 2022 Regional Locality_20230426.pdf

CENTENNIAL PASSIFERN © THIS DRAWING IS COPYRIGHT. NO PART OF IT MAY IN ANY FORM OR BY ANY MEANS (ELECTRONIC, MECHANICAL, MICRO-COPYING, PHOTOCOPYING, RECORDING OR OTHERWISE) BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM OR TRANSMITTED WITHOUT PRIOR WRITTEN PERMISSION. Coordinate System: GDA2020 MGA Zone 56	LOCATION Angus Place	ANGUS PLACE COLLIERY Annual Review 2022 Regional Locality ---Figure 1---	
	SEAM N/A		
	DRAWN N.Lloyd		
	CHECKED M.Denley		
	APPROVED M.Denley		
SCALE 1:300,000 @ A4	DATE: 26/04/2023	FASS10177	R0

Esi, HERE, Garmin, FAO, NOAA, USGS

Figure 2-1: Regional Context



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 meters

Legend	
	Angus Place Development Consent MP06_0021
	Centennial Exploration Licences
	Centennial Mining Leases
	Open Cut Extents
	Existing Underground Workings
	Western Haul Road
	Watercourse
	National Park
	Nature Reserve
	State Conservation Area
	State Forest

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

ANGUS PLACE COLLIERY
Annual Review 2022
Site Layout
 ---Figure 2---

CENTENNIAL
ANGUS PLACE

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 at 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	Y (Mod7)
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)		
SSD 5579	Sections of SSD 5579 relevant to Kerosene Vale and the Haul Roads.	30 June 2039	Y (Mod4)
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			
Part Lease CCL 702	(Part) Consolidated Coal Lease	24 November 2024	Y
CCL 704	Consolidated Coal Lease	20 July 2039	Y
Part ML 1424	Mining Lease	18 August 2024	Y
ML 1323	Mining Lease	3 August 2035	Y
ML 1326	Mining Lease	18 August 2024	Y

² <https://www.centennialcoal.com.au/operations/angus-place/>

Approval	Description	Expiry Date	Change during Reporting Period (Y/N)
ML 1699	Mining Lease	26 June 2035	Y
ML 1720	Mining Lease	23 November 2036	Y
MLA 498	Mining Lease Application	NA [#]	N
MPL 314	Mining Purpose Lease	3 August 2035	Y
EL 6856	Exploration Licence	8 August 2017*	N
EL 6293	Exploration Licence	17 September 2024	Y
EL 7415	Exploration Licence	20 October 2019*	N
EL 8188	Exploration Licence	16 October 2025	N
Mine Operations Plan / Rehabilitation Management Plan			
Care and Maintenance Mining Operations Plan 2019-2023	Care and Maintenance Mining Operations Plan - Covering MOP term from June 2019 to April 2023	Superseded by RMP	Y
Rehabilitation Management Plan – Angus Place (July 2022)	Rehabilitation Management Plan for Angus Place with commencement date 1 August 2022	N/A	Y – see Section 3.1.1
Extraction Plans / Subsidence Management Plans			
SMP Approval 04/1675 (RR)	Mining of Longwalls 930-980	30 June 2014	N
Extraction Plan Approval 12/15868 (DPE)	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	N
WAL36449	Extraction of 2,523ML per year to dewater the underground coal	Perpetuity	N
WAL37340	Extraction of up to 329ML per year	Perpetuity	N
WAL37343	Extraction of up to 35ML	Perpetuity	N
WAL41881	Extraction of 1,471ML per year	Perpetuity	N

Notes: [#] MLA 498 was submitted 2 June 2015. * Renewal applications have been lodged and acknowledged for these titles however, no renewal offers have been received at the time of writing of this Annual Review.

3.1.1 Changes During the Reporting Period

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

The following leases and licences were renewed:

- CCL 704 (renewed 14/4/22)
- EL 6293 (renewed 21/12/2022)

On the 17 October 2022, variations to the following Mining Tenements came into effect:

- CCL 702
- CCL 704
- ML 1424
- ML 1323
- ML 1326 (also varied 1/9/22)
- ML 1699
- ML 1720
- MPL 314

The variations included the omission/variation of a number of conditions, renumbering and modernisation of wording, including (but not necessarily limited to):

- Requirements for an 'Annual Environmental Management Report' (AEMR). e.g., Condition 3 for ML 1326, 1424, 1699, 1720 and CCL 702, and Condition 4 for CCL704.
- Condition 3 (f) of ML 1323, MPL 314 requires the lease holder to prepare a *Rehabilitation Report* to the satisfaction of the Minister.
- Lease conditions of ML1323, ML1326 and ML1424 were varied on 1/9/22 to omit multiple conditions and insert new conditions for landholder notifications, cooperation, group security and assessable prospecting operations.

MP06_0021 and SSD 5579 were modified during the reporting period to align with the Rehabilitation Reforms.

3.2 ANNUAL REPORTING REQUIREMENTS

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

In accordance with the requirements of MP06_0021 (Schedule 4, Conditions 3 and 7– Annual Reporting, and Condition 10 – Access to Information), and the conditions outlined in **Appendix 1**, this 2022 Annual Review was provided to the Secretary of DPE and subject to approval is available at the Angus Place website³.

³ <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. Mining operations are expected to recommence at Angus Place Colliery in 2025 following the completion of mining at the adjacent Springvale Mine.

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

Construction activities undertaken at the site during the reporting period include:

- Blast wall was constructed at the AP Bore 940 – however this was within the existing disturbance footprint, and hence no change to disturbance; and
- Monitoring Station was installed at LDP02 Dam with no changes to the existing disturbance footprint.

4.6 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.
- Prepare and submit a *Rehabilitation Management Strategy* to DPE for approval within six months of the MOD7 approval, in accordance with Condition 36, 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 2022 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			
Report on greenhouse gas emissions for the reporting period and include a comparison of actual greenhouse gas emissions against the predictions in the environmental assessment(s) for the mine. Please ensure that the method used to calculate the environmental assessment prediction(s) and annual emissions are calculated the same.	DPE (email dated 16/12/22)	Dedicated section included within 2022 AR.	Section 6.5
Report all reasonable and feasible steps undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions generated by the mine.	DPE (email dated 16/12/22)	Dedicated section included within 2022 AR.	Section 6.5
Report on the status of the long-term security arrangement for biodiversity offsets required by the development consent for the mine. Please include information on the type(s) of long term security arrangements that have been implemented and/or are to be implemented for the mine.	DPE (email dated 16/12/22)	Western Region Biodiversity Offsets Strategy (WR-BOS) approved by DPE.	Section 6.6
Improvement/Other Actions (Committed in 2021 Annual Review)			
An Environmental Impact Statement and associated work for Angus Place West.	Angus Place Colliery	Ongoing.	Ongoing
Rehabilitation planning for Kerosene Vale	Angus Place Colliery	Included within the RMP (July 2022)	Section 8
Rehabilitation Reform transition works for Angus Place	Angus Place Colliery	Included within the RMP (July 2022)	Section 8
Management Plan Revisions			
N/A			
Condition Triggers			
N/A			

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 undertake a comprehensive monitoring program. Environmental monitoring locations are shown in **Figure 6-2** and **Figure 6-3**.

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 2022 against relevant TARPs is provided in the following sections of this Annual Review where appropriate.

Table 6-1 summarises the results of monitoring during 2022 for key environmental and subsidence-related aspects against performance measures of MP06_0021. Further detailed discussion is provided throughout **Sections 6-11** 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_0021 and 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.	DPE approval of the Western Region Biodiversity Offsets Strategy (WR-BOS) in 2022. Rehabilitation Strategy to address residual impacts.
Heritage	As per Conditions 3, 3A-3C(h), 38 and 40 Schedule 3, of MP06_0021.	Compliant with approval criteria	No significant changes in 2022.	Continue to engage with Aboriginal stakeholder groups in accordance with the WR ACHMP.

Aspect	MP06_0021 / EPL criteria	Performance during the reporting period (actual)	Trend/ key management implications	Implemented / proposed management action
Surface Water	As per Schedule 3, Condition 5-13B of MP06_0021 Mod 7 and Condition P1 of EPL467.	Six Non-compliances with licence conditions relating to missed sampling, some due to road conditions and other factors.	Refer to Section 7 and Section 11 for non-compliances in accordance with EPL 467.	Surface water sampling program to be reviewed for relevance to current and future potential operations
Groundwater	As per Schedule 3, Condition 5-13B of MP06_0021 Mod 7 and Condition P1 of EPL467.	Compliant with approval criteria.	Groundwater levels generally remain stable or have responded to rainfall infiltration. 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 last 5 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 (Condition 23, Schedule 3)
- 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 2022 reporting period of 1247.2mm was above the long term annual average. March received the highest amount of rainfall of 196mm during the reporting period. Rainfall was above the long-term monthly averages⁴ in January, March, April, May, July, August, September, October, and November. June received the least amount of rainfall in the reporting period of 13.8mm.

January recorded the highest average temperatures 18.6°C whilst the lowest average temperature of 4.7°C was recorded in June during the reporting period. The highest temperature (30.4°C) was recorded on 28 December 2022, and the lowest temperature (-6.4°C) was recorded on 30 July 2022.

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

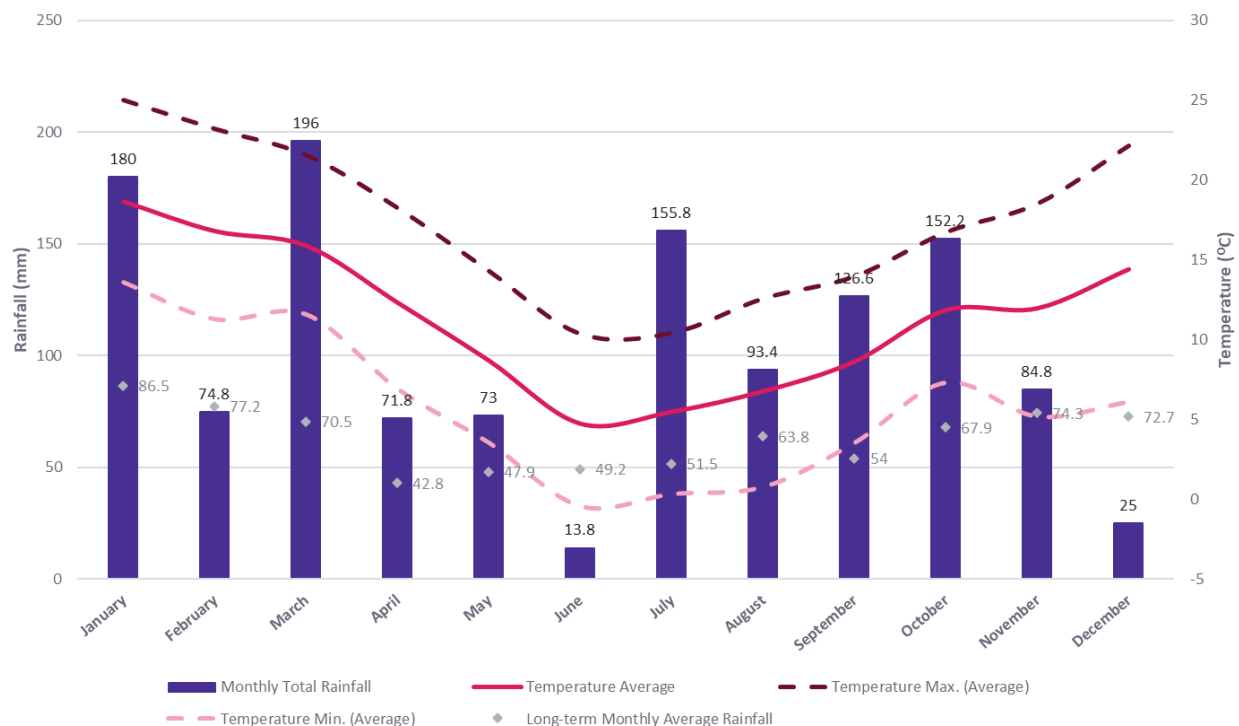


Figure 6-1: Summary of Meteorological Conditions

⁴ As determined from a nearby rainfall gauge operated by the Bureau of Meteorology (BOM) in Lidsdale (Station Number 63132) (1959 – 2022)

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 DPE on 1 June 2022 to satisfy Condition 22, Schedule 3 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 Care and Maintenance phase at Angus Place to which the WR-NMP applied during the 2022 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 on **Figure 6-2** and described in **Table 6-2** and **Table 6-3**:

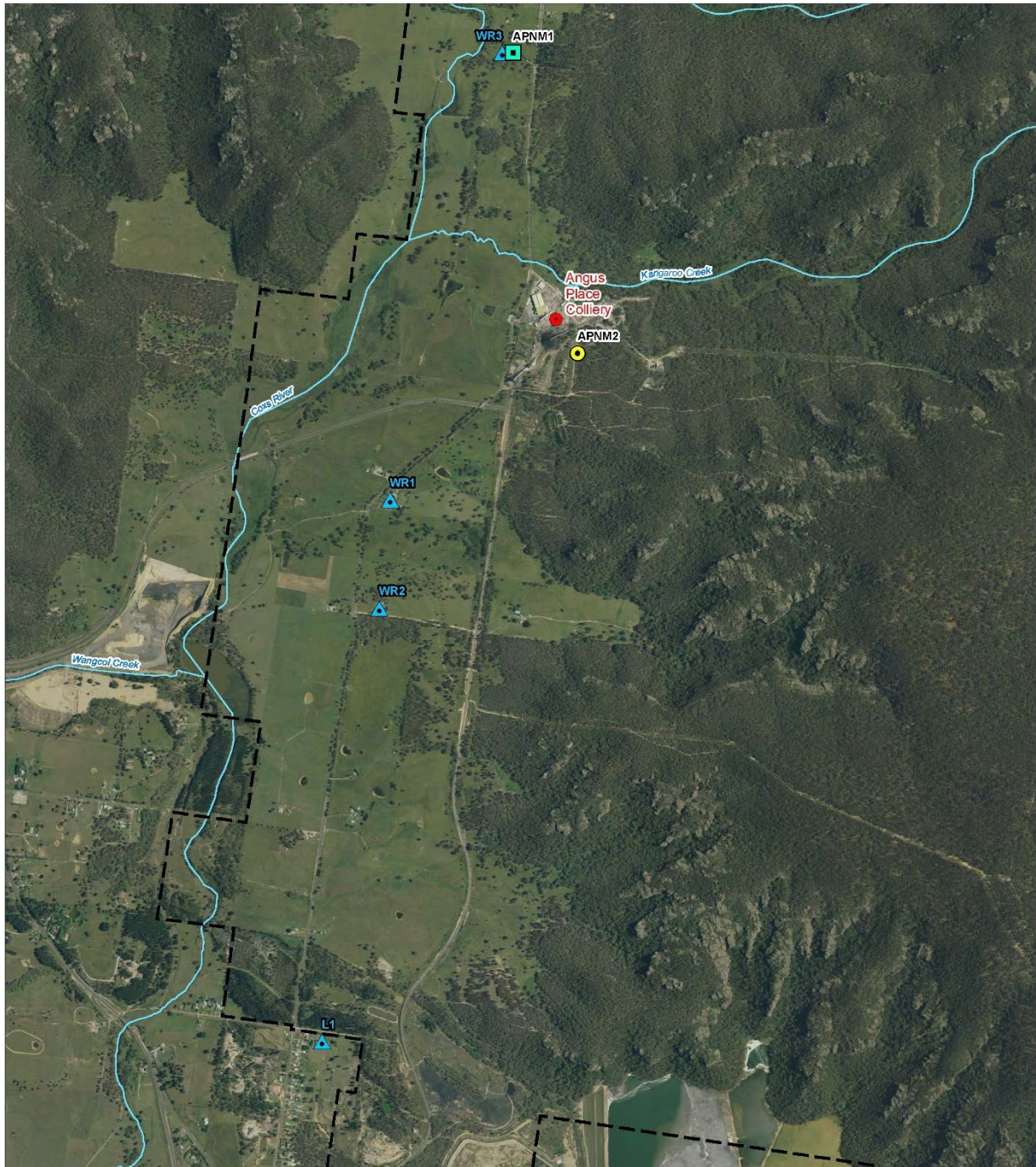
- APNM1 (R1) – (EPL Point 20),
- APNM2 (R2) – (EPL Point 21), and
- APNM3 (WR3) – (EPL Point 22).

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 2022 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 EPL 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 period 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.



- Noise Monitoring**
- Sensitive receiver
 - Noise - Attended
 - Noise - Unattended

1:25,500 for A4
 0 0.2 0.4 0.6 0.8
 Kilometres
 Map Projection: Universal Transverse Mercator
 Horizontal Datum: Geodetic Datum of Australia 1984
 Grid: Map Grid of Australia, Zone 56



- LEGEND**
- Centennial Site Location
 - Colliery Holding Boundary
 - Watercourse



LOCATION	-
SEAM	NA
DRAWN	F.Mackay
CHECKED	T.G
APPROVED	IG
SCALE	Refer to scalebar

Centennial Western Region
 Environmental Monitoring
 Angus Place
 Long Term Noise Monitoring

CENTENNIAL

DATE	9/11/2021	Figure 2
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GIS Filename: G:\2210105001\GIS\Maps\Deliverables\Western\Regional\2218092\2218092_MR004_Noise_LongTerm_DDP_B.mxd
 © LPI: DCDB / DTDB 2012, Aerial Imagery 2015, Centennial: Project Application Area / Colliery Holding Boundary, 2012.

Figure 6-2: Angus Place Colliery Noise Monitoring Locations

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

Approved Noise Limit (dBA) ⁵				Performance During the Reporting Period	Key Management Implications	Implemented / Proposed Management Actions
Receiver (Monitoring Location)	Day ⁶	Evening ⁷	Night ⁸	<p>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 2022.</p> <p>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.</p>	<p>Noise Management controls at the Angus Place Colliery were effective.</p>	<p>Given the preceding compliance noise monitoring results, additional noise mitigation is not proposed.</p>
	<i>L_{Aeq(15 min)}</i>	<i>L_{Aeq(15 min)}</i>	<i>L_{Aeq(15 min)}</i>			
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) ⁹	44	40	35			

Notes:

⁵ The noise criteria in **Table 6.3** 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 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.

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

⁷ Evening is defined as the period from 6pm to 10pm.

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

⁹ 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: 2022 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	57	42	<30	53	38	<30	48	36	<30
	Q2	58		Inaudible	38		<30	30		<30
	Q3	56		Inaudible	55		Inaudible	39		<30
	Q4	53		Inaudible	40		Inaudible	45		<30
APNM2 (R2)	Q1	42	41	Inaudible	37	37	<30	33	35	<30
	Q2	38		Inaudible	32		<30	26		<25
	Q3	45		Inaudible	40		<30	33		<30
	Q4	34		Inaudible	37		Inaudible	31		Inaudible
APNM3 (WR3) Wolgan Rd	Q1	57	41	Inaudible	56	37	Inaudible	52	35	<30
	Q2	58		Inaudible	57		<25	29		<25
	Q3	63		Inaudible	60		<30	34		<30
	Q4	54		Inaudible	52		Inaudible	38		<30

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 >3°C/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 PA/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 2022 for APNM1 and APNM2.

In June 2019, APNM3 was relocated to Wolgan Road (WR3), considered a more representative location to monitor noise from the Colliery in the long term as detailed in the WR-NMP. The site has not recorded any exceedances for the period 2019 to 2022, 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 2018 to 2022.

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

Project Approval Location	2018	2019	2020	2021	2022
APNM1 (R1)	0	0	0	0	0
APNM2 (R2)	0	0	0	0	0
<i>(former) APNM3 Lidsdale Village R3</i>	0	0	0	NA	NA
APNM3 (WR3) Wolgan Rd	NA	NA	NA	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 2022 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 2022 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 for suspended dusts monitoring Total Suspended Particulates (TSP) and PM₁₀ (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 6-3**. Performance measures and monitoring results recorded during 2022 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_0021¹.

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 2022 for depositional and suspended dusts are presented in the following sections below.¹⁰

¹⁰ 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/>.



PLOTFILE: NISHARED\GDA_2020\Pkt File PDF\FASS10000_R1_Figure 3 Angus Place Annual Review 2022 Meteorological, Air Quality and Noise Monitoring Sites_20230510.pdf

CENTENNIAL FASSIFERN ©
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Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation
- 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	D.MacBain
CHECKED	C.Flemming (GHD)
APPROVED	C.Flemming (GHD)
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Meteorological, Air Quality and Noise
Monitoring Sites
---Figure 3---

DATE: 17/05/2023	FASS10000	R1
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Earthstar Geographics, Esri, HERE, Garmin, Foursquare, METI/MASA, USGS

Dust Deposition

Depositional dust (deposited particulate matter) at three (3) designated sites DG3, DG5 and DG6 was monitored monthly. The annual average particulate monitoring results recorded by all depositional dust gauges were below the development consent limits for the annual averaging period in 2022, as demonstrated in **Table 6-6** and **Figure 6-4** below.

Table 6-6: Summary of Depositional Dust Monitoring Locations

Monitoring Point Reference	Description	Insoluble Solids (g/m ² /month)		
		2022 Annual Average	Criteria ^{1,2} Max Increase in Deposited Dust	Criteria ¹ Max Total Deposited Dust (Annual Average)
DG3 (onsite)	Dust Deposition Gauge ³	0.70	2.00	4.00
DG5	Dust Deposition Gauge ⁴	0.43		
DG6	Dust Deposition Gauge ⁵	0.75		

Notes: 1 as per Table 5, Condition 14, Schedule 3 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.

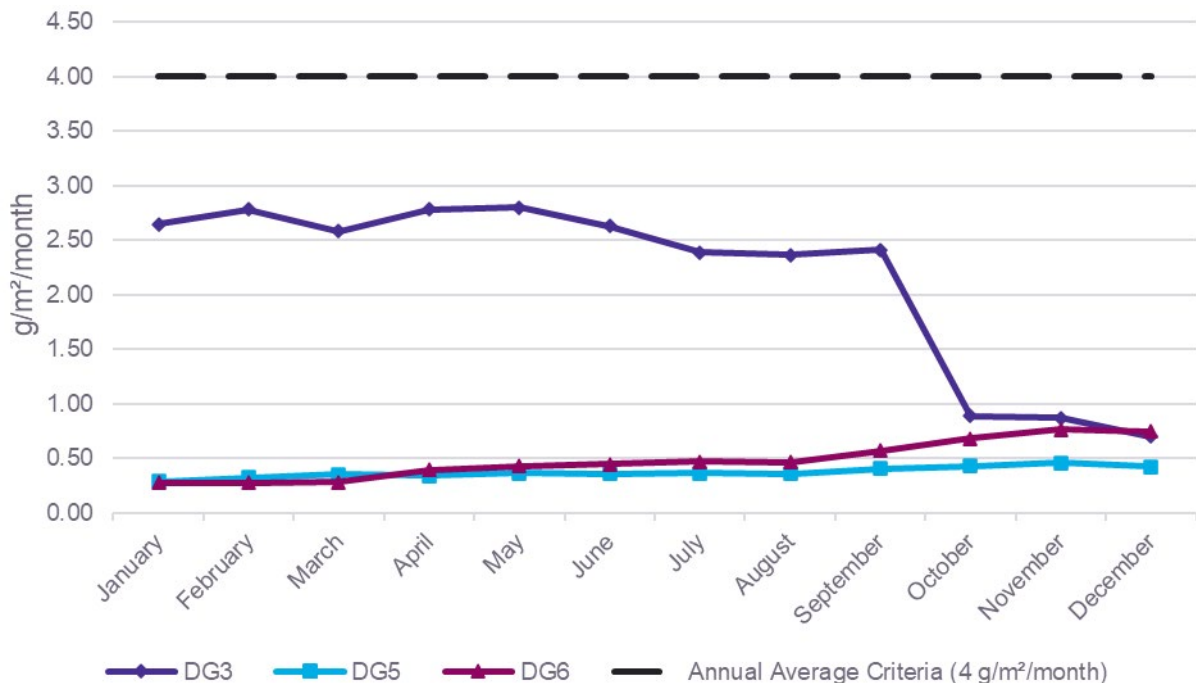


Figure 6-4: Dust Deposition Summary for 2022 (Rolling 12 Month Average)

High Volume Air Samplers

A summary of the recorded results for high volume air sampling (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 high volume air sampling at the Paddock Site (located onsite at Angus Place) are provided for the following:

- PM₁₀ (refer **Figure 6-5**)
- TSP (refer **Figure 6-6**)

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

Table 6-7: Summary of HVAS Monitoring Results

Monitoring Location	Averaging Period	Consent Criteria	Maximum (µg/m ³)	Mean (µg/m ³)	Number of days exceeding criterion
HVAS Paddock (PM ₁₀)	24-hour	50	11.4	N/A	-
	Annual	25	N/A	3.9	-
HVAS Paddock (TSP)	Annual	90	N/A	9.7	-

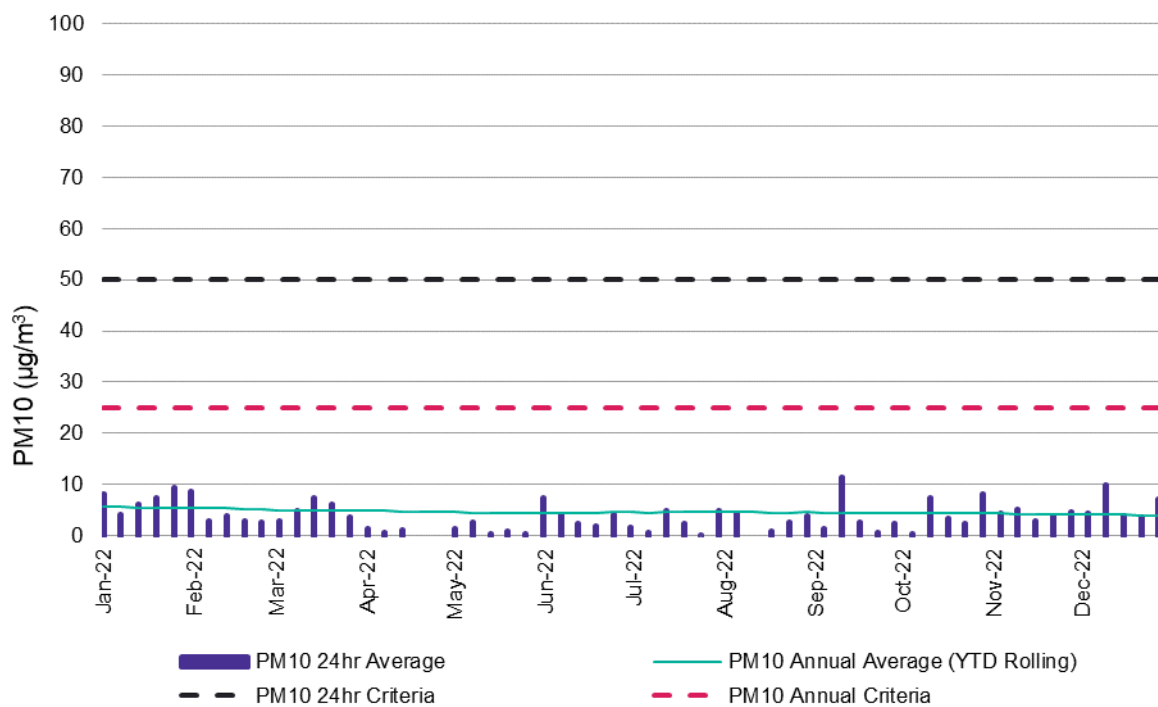


Figure 6-5: Annual HVAS PM₁₀ Summary Results at Paddock

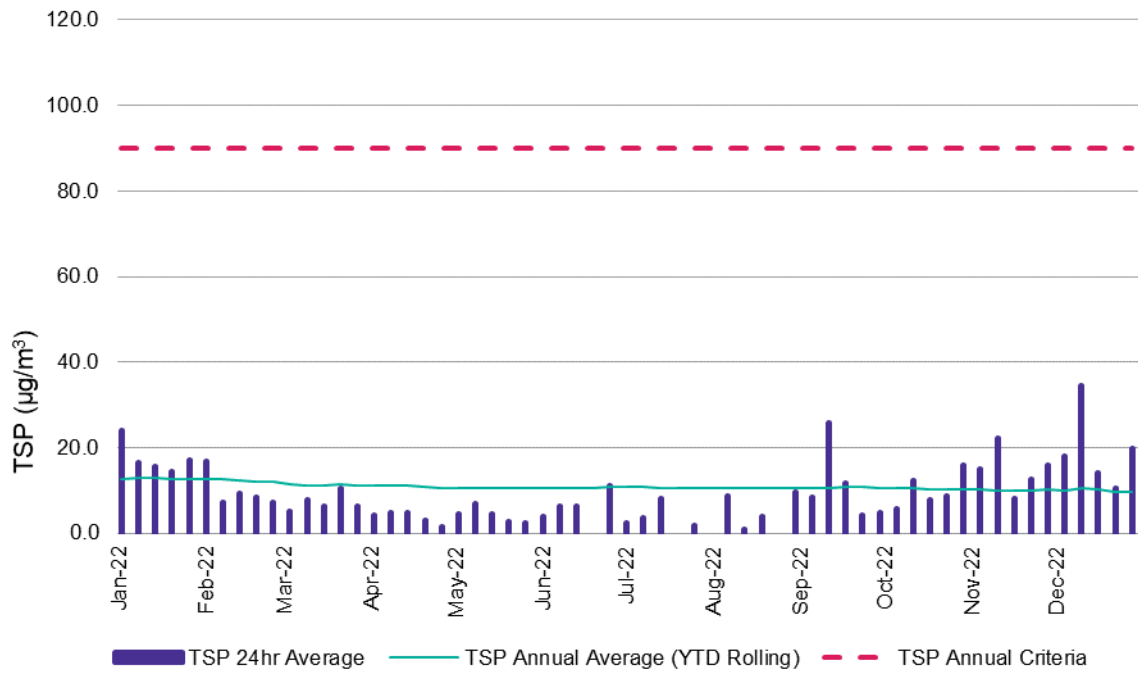


Figure 6-6: Annual HVAS TSP Summary Results at Paddock

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, PM₁₀, and dust deposition) were below the applicable impact assessment criteria at all assessment locations.

Air quality monitoring results during 2022 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	
	TSP (µg/m ³) ¹		PM ₁₀ (µg/m ³)				(g/m ² /month)	
	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 2018 to 2022, including the annual averages for deposition dust (insoluble solids), PM₁₀ 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 (2018 - 2022)

Monitoring Location	Annual Averages					Development Consent Criteria (Annual Average)
	2018	2019	2020	2021	2022	
Insoluble Solids (g/m²/month)						
DG3 (onsite)	1.11	1.26	2.50	2.65	0.70	4 g/m ² /month
DG5	0.99	1.05	1.90	0.31	0.43	
DG6	1.04	1.15	1.30	0.29	0.75	
PM₁₀ (µg/m³)						
HVAS Paddock	7.84	31.32 ¹	8.20 ¹	5.50	3.90	25 µg/m ³
TSP (µg/m³)						
HVAS Paddock	16.00	49.67 ¹	39.52 ¹	12.40	9.70	90 µg/m ³

Notes: 1 The severe bushfire that occurred in 2019-20 had a significant impact on the concentration of PM₁₀ and TSP in the air throughout 2019 and 2020.

6.4.5 Implemented / Proposed Improvements

No dust controls were required during 2022 as persistent rainfall provided high soil moisture and little opportunity for dust generations. This is demonstrated with the lowest air quality readings in the last five years.

Key dust mitigation measures for Angus Place Colliery 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 product 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-e} produced for last five (5) reporting periods including the current period and compares these against predictions in related approvals (MP06_0021 as modified).¹¹

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. Fugitive emissions (and subsequently total Scope 1 emissions) were significantly reduced on FY21 by 29.6%. Overall, total GHG emissions decreased by 8.7% in comparison to FY21.

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

Emission Sources	Estimated Emissions (tonnes CO _{2-e})					Predicted Emissions ¹
	FY18	FY19	FY20	FY21	FY22	
Scope 1 Emissions (direct emissions)						
Fuel combustion	111	71	183	27	65	2,024
Oil/grease consumption	3	4	1	1	0	181
SF ₆	1	1	1	1	1	1.8
Fugitive emissions (CH ₄)	834	608	970	872	539	73,940
Fugitive emissions (CO ₂)	5,741	5,714	5,386	3,739	2,661	
<i>Total Fugitive:</i>	6,575	6,322	6,356	4,611	3,200	
Total Scope 1	6,690	6,398	6,541	4,640	3,266 (-29.6%)	76,146
Scope 2 Emissions (indirect emissions)						
Electricity Consumption	9,881	14,799	12,580	10,278	10,354	50,628
Total Scope 2	9,881	14,799	12,580	10,278	10,354	50,628
Total Greenhouse Gas Emissions						
Scope 1 and 2 Emissions	16,571	21,197	19,121	14,918	13,620	126,774

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 2022 reporting period (3,266 CO_{2-e}) represented a >29% decrease from the previous reporting period, and remains significantly below

¹¹ Note, data is presented for financial year to align with reporting under the National Greenhouse and Energy Reporting scheme.

predictions (<5%). Scope 2 (indirect) emissions generated during the 2022 reporting period also remained significantly lower than the predictions (and similar to FY22).

Fugitive emissions generated during 2022 were also significantly below predictions (<5%).

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 this five year period.

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 in accordance with 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 hindii Monitoring Management Research Program (PhMMRP)* (April 2013), approved by DPE on 4 October 2013 in accordance with Condition24A 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 2012¹²);
- 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;

¹² An annual compliance report including monitoring performance of THPSS 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**.

- *Western Region Biodiversity Management Plan (WR-BMP)*, Rev5 June 2022¹³; prepared to address biodiversity consent conditions (including Condition 24 of MP06_0021)¹⁴; and
- *Western Region Biodiversity Offsets Strategy (WR-BOS)*, Rev8 Feb 2019 as approved by DPE 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 2022 reporting period. 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 Gaspers Mountain Megablaze extensively impacted the surface environment within and significantly beyond the mining lease at Angus Place. 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 to biodiversity (flora and fauna) that is expected to take a number of years (and in cases decades) to recover. Accordingly, monitoring programs include consideration and discussion in this context as appropriate.

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 as detailed in **Section 6.6.6**. Monitoring and research associated with specific threatened species (*Persoonia hindii*) under supplementary offset measures of the approved WR-BOS is ongoing as discussed in **Section 6.6.2.3**.

6.6.2.1 Performance Measures

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

- Conditions of approval for MP06_0021 (notably Condition 3, Schedule 3)
- Conditions of approval for EPBC 2011/5952 and LW910 & 900W THPSS MMP.

¹³ 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 DPE. Rev 5 of WR-BMP was submitted to DPE in April 2022. A Request for additional information was received from the DPE and the management plan was resubmitted to the DPE in June 2022. Centennial received an additional request for information, in particular for further consultation to be undertaken. Rev 6 of the WR-BMP was subsequently submitted to the Biodiversity, Conservation and Science Directorate (BCS) of DPE in February 2023, beyond the 2022 reporting period. Feedback received during February 2023 was under consideration by Centennial as the time of submission of this 2022 Annual Review, and outcomes will be reported in the next reporting period.

¹⁴ It is noted that the WR-BMP, once approved, will supersede the Flora and Fauna Management Plan.

- Approved predicted impacts described within environmental assessments for MP06_0021 and associated modifications, as per 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
- 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 2022, Angus Place was compliant with all approved Performance Measures. Monitoring results for 2022 for key aspects are provided in the following sections.

6.6.2.2 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;
- Opportunistic weed monitoring was undertaken during 2022. Blackberry became a significant issue during spring and control measures were scheduled for 2023 to appropriately manage weeds and ensure 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 NIR Imagery during summer, Autumn, Winter and Spring. Autumn flight was not possible due to almost continuous cloud cover.
- Ongoing flora monitoring and research continued for *Persoonia hindii* (refer **Section 6.6.2.3** below); and
- Ongoing monitoring for weed presence at the Ventilation Facility continued to be undertaken.

As summary of 2022 flora monitoring is provided in **Table 6-11**. Compliance with biodiversity performance measures in 2022 is provided in **Table 6-1** (at the start of **Section 6**).

Table 6-11: Flora Seasonal Monitoring Results (2022)

Season	Summary of Flora Monitoring Results and Conclusions
Spring 2022	<ul style="list-style-type: none"> • Lower biodiversity indicator results compared to autumn 2022. An overall decrease in native species richness observed within <u>both</u> control and impact swamps between autumn and spring 2022 monitoring events. • Decrease in flora species richness between monitoring years may be partly due to seasonal influences, especially in a post fire environment. Importantly, impact swamps consistently had <i>greater</i> native species richness than control swamps in both monitoring seasons. This is to be expected as dry sclerophyll and swamp flora species integrate within impact swamps, potentially linked to the observed dry conditions (i.e., low moisture levels). • Diagnostic species richness also decreased within control and impact swamps between autumn and spring 2022 monitoring events. However, control swamps consistently displayed greater representation of diagnostic species than impact swamps in both monitoring seasons. This is likely due to the greater presence of water observed within control plots compared to swamps where mining related dewatering has previously been identified. • An increase in Eucalyptus species cover continues to be observed across both control and impact swamps, however it was particularly notable in some impact swamps. This increase in Eucalyptus species cover, particularly within impact swamps, is potentially linked to drier conditions (i.e., low moisture levels) which can reduce their ecological resilience and increase bushfire vulnerability. • Weed species richness slightly increased in impact swamps but remained the same in control plots between autumn and spring 2022 monitoring events. The resulting disturbance from the 2019-2020 Gospers Mountain fire continues to have an effect on the potential for invasive species to extend their range. <i>Rubus fruticosus spp. agg.</i> (Blackberry complex), listed as a Weed of National Significance and as a priority weed under the Biosecurity Act 2015, was recorded in all Narrow Swamp plots with a notable increase in foliage cover within NS01 between the autumn and spring monitoring events. It is highly recommended that targeted weed management is undertaken in Narrow Swamp to eradicate Blackberry to prevent further competition with native species. Furthermore, targeted management to reduce recruitment and establishment of <i>Asteraceae</i> weeds should be undertaken in the cooler months prior to flowering and seeding. The post-fire environment provides an opportunity for the management of weeds as there is greater visibility and access to swamps.

Season	Summary of Flora Monitoring Results and Conclusions
Autumn 2022	<ul style="list-style-type: none"> • Biodiversity indicators since the fire in 2019-2020 have generally stabilised, with levels similar to the previous monitoring event. • Swamp health at impact swamps was lower than control swamps, particularly in Kangaroo Creek, East Wolgan and Narrow Swamp. A notable feature observed is the increase in percentage cover of Eucalypt species within these swamps, which is an indicator of lower moisture levels. It is likely that drier conditions in these swamps have increased bushfire vulnerability and reduced their ecological resilience. • An increase in %cover of native trees (i.e., Eucalypts) regenerating immediately after the Gospers Mountain fire was an expected result. It is also expected that native tree cover within the swamps would naturally decline due to the limiting environmental factors of the swamp such as moisture levels, cold air drainage, and shallow soils. The autumn 2022 monitoring results exhibit a slight reduction in Eucalypt recruitment in the majority of the plots when compared to the summer 2021-2022 monitoring event, particularly in Narrow Swamp (NS02), West Wolgan (WW02 and WW06) and Kangaroo Creek (KC03). This reduction could be a result of inter-seasonal variation and partly due to the La Niña weather event experienced. Despite this, it still recommended that intervention management (e.g., tree culling) be considered should native tree recruitment remain unabated within the swamps. Early intervention and implementation of management actions designed to limit Eucalypt recruitment within swamps would likely limit any additional loss in soil moisture levels. • Weed species richness increased in autumn 2022 compared to summer 2021-2022. The resulting disturbance from the 2019-2021 bushfires has increased the potential of invasive species to extend their coverage. Notably, <i>Rubus fruticosus spp. agg.</i> (Blackberry), which was previously only identified in Narrow Swamp plot NS01 and NS02 in the summer 2021-2022 monitoring event, has now spread to NS03 and NS04. It is highly recommended that targeted weed management is undertaken in Narrow Swamp to eradicate Blackberry individuals, to prevent them from colonising bare areas and competing with native species. It is the ideal time to undertake weed management following post-fire, as it has provided greater visibility and access to the swamps. Furthermore, management of weeds in the <i>Asteraceae</i> family should ideally be undertaken in the cooler months prior to flowering and seeding, to reduce recruitment and establishment within the swamps. An experienced land management professional should undertake weed management within the swamps to correctly differentiate introduced weeds from similar native species, such as <i>Senecio diaschides</i>.

Season	Summary of Flora Monitoring Results and Conclusions
<p>Summer 2021/2022</p>	<ul style="list-style-type: none"> • Biodiversity indicators outlined in the initial assessment of plots since the bushfires in late 2019 have continued at similar levels, with lower swamp health observed in impact plots, particularly in Kangaroo Creek, East Wolgan Swamp, and areas of Narrow Swamp. An increased cover of native trees within these swamps is the most pronounced change observed. It is possible that lower levels of moisture in these swamps have increased their vulnerability to bushfire and decreased their ecological resilience. • An increase in % cover of native tree regeneration immediately after the bushfire event was expected, along with a natural progressive decline in regenerative tree cover following the effects of limiting environmental factors (e.g., wet, and shallow soils and cold air drainage). • Current monitoring results show some signs that a decline in recruiting eucalyptus seedlings may be occurring in some plots, however % cover continues to increase in a number of swamps. Accordingly, it is still recommended that consideration be given to intervention management should tree recruitment remain unabated, such as culling of recruiting trees within the swamp. The early implementation of management actions designed to limit the number of regenerating trees within the swamp would likely limit any additional loss in soil moisture levels. • The suite of weed species from previous surveys has increased with the disturbance created by fire, and there is potential for particularly invasive species to extend their coverage. Targeted weed management is recommended in Narrow Swamp to eradicate <i>Rubus fruticosus</i> spp. agg. (Blackberry) individuals, preventing them from taking advantage of bare areas left by the fire and competing with native species in colonising these patches. An opportunity exists for greater visibility and access to the swamp for weed management following fire. The current post-fire window is also an ideal time to target <i>Asteraceae</i> weeds, in the cooler months of the year prior to flowering and seeding, as their seed bank response to fire is vigorous. An experienced land management professional is required in order to correctly distinguish introduced weeds from similar native species, such as <i>Senecio diaschides</i>.

6.6.2.3 Fauna Monitoring and Management

During the reporting period, seasonal fauna monitoring was undertaken by specialist consultants in the 900 area on the Newnes Plateau including the 900W and 910 longwall areas. Reference sites are located on the mining lease in the north east of any approved and extracted workings.

Monitoring has found severe impacts due to the prolonged drought and subsequent bushfires on the Plateau. While climate related changes have been noted, monitoring has not indicated any direct mining related impacts. The drying of swamps where mining related dewatering has previously been identified may have affected the ability of some swamps to resist and recover from the impacts of bushfires.

Statistical analysis of fauna populations in the Angus Place 900 area and reference sites to the north east suggest changes in diversities are primarily due to climatic changes. The conclusion from the seasonal and yearly analyses is that, at present, there appears to be no evidence of potential impacts from subsidence upon the fauna diversity in the Angus Place Colliery 900 Area.

There is no evidence to suggest impacts from undermining on fauna populations in the Angus Place Area. This is not to say there aren't changes happening. Some of the undermined swamps appear to suffer more severe burning of peat layers than those not undermined. At this stage, that has not led to flow-on impacts to fauna populations.

6.6.2.4 *Persoonia hindii* Research Project

Persoonia hindii (*P.hindii*) is listed as Endangered under the *Biodiversity Conservation Act 2016* (BC Act). Schedule 3, Condition 24A (e) and (h) of MP06_0021 for the Angus Place East (APE) ventilation shaft facility required a *P. hindii* research and monitoring program to be developed. The research program involved assessing three translocation methodologies and comparison with control sites. Following the translocation of 61 individual plants, surveys were carried out over seven years to determine the survival rates. **Table 6-12** presents the live plants identified and the survival rates over the period of 2013 to 2020. An offset for *P.hindii* was to be determined following the outcomes of the translocation research.

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

The WRBOS proposed that suitable habitat not currently containing *P. hindii* would be used by the RBG&DT relocation program for propagated *P. hindii* to be returned back onto Newnes Plateau. The ACARP program is due to be completed in June 2023 with a final report produced to provide advice and support for including *P. hindii* into rehabilitation programs.

Angus Place offset liability is linked to the successful outcomes achieved from the ACARP project and surviving individual plants. **Table 6-12** includes information about individual planted and survival up to May 2022.

Angus Place will need to finalise the applicability of offsetting credits based on both the initial translocation research program and the successful propagation through the ACARP RBG&DT program. A finalised offset liability will be determined in 2023 and necessary updates to the WRBOS will proceed from that.

Table 6-12: Summary of *Persoonia hindii* translocation research outcomes

	2013	2014	2015	2016	2017	2018	2019	2020*	2021	2022	Total to date
Plants impacted	60										60
Plants found alive during survey		3		10	8	8	10	4			
Translocation survival (%)		5.3		16.7	15.6	13	17	7			
ACARP RBG&DT Project											
Translocations							280		80	81	441
Plants found alive during survey										187^	268#

Notes: * Research assessment area impacts by Gosper's Mountain Megafire. ^ As of May 2022. # equates to 187 surviving from 360 plantings in 2019 and 2021 plus the additional 81 planted in 2022.

6.6.2.5 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 *UCRC Aquatic Ecology Monitoring Program* (AEMP) and the UCRAMP.

Aquatic Ecology monitoring outlined in the FFMP (2014)¹⁵ has been deferred in favour of that outlined in 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 in order to determine whether operations have influenced the health of aquatic biota in 2022. Macroinvertebrate samples were collected during autumn 2022 (18/05–27/05/2022) and spring 2022 (7/11–10/11/2022). Water and sediment quality were tested in conjunction with macroinvertebrate monitoring.

A summary of 2022 monitoring results at focus sites Kangaroo Creek and Coxs River LDP2 is provided below. Monitoring locations are illustrated on **Figure 6-13**:

- Taxa richness was slightly higher at Kangaroo Creek background site KC1 than at impact site KCdn in both sampling events. All Kangaroo Creek taxa richness results were well above the long term KC1 median.
- EPT richness results followed a reverse pattern to that observed in taxa richness, with higher EPT richness results observed at impact site KCdn in both sampling event. EPT richness results were similar between seasons at both sites, with four to five EPT taxa collected from KC1 in both sampling events, and six to seven EPT taxa collected from KCdn. Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa were collected at both sites during both sampling events, though Plecoptera were missing from one replicate at KC1 in autumn. All samples had EPT richness results well above the long-term median.
- SIGNAL-2 results were similar between sites and seasons in 2022. All results were well above the long-term median.
- Angus Place LDP1 was decommissioned and ceased discharging into Kangaroo Creek in late-2019. There were no exceedances of any water quality toxicant DGV (ANZG 2018) or any sediment quality DGV (ANZG 2019) at impact site KCdn in autumn or spring 2022 aquatic ecology monitoring events.
- Dissolved aluminium, cobalt and zinc concentrations were elevated at background site KC1 only in both sampling events. These elevated metals concentrations may have impacted the macroinvertebrate community at KC1. Any differences in water quality or macroinvertebrate communities between KC1 and KCdn are unlikely to be attributable to Angus Place operations as the mine no longer discharges to Kangaroo Creek and the highest metal concentrations were observed upstream of the Kangaroo Creek confluence.
- Both KC1 and KCdn were damaged by fire in late-2019. Damage at KCdn was primarily outside of the immediate riparian zone in the surrounding bushland area, with the stream bank vegetation mostly undamaged. KC1 was badly damaged by fire, which caused near-complete removal of vegetation from the stream banks. The vegetation had almost completely recovered in 2022, particularly at KC1, where there was now a

¹⁵ 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.

dense coverage of understorey vegetation including native shrubs, grasses and ferns as shown on **Plate 6-1**. This is likely to have contributed to the improvement in macroinvertebrate results at both sites in 2022, but particularly at KC1 which was most badly damaged. Sensitivity metrics (EPT richness and SIGNAL-2) in particular were much higher than 2020 and 2021 results.

- In 2022, macroinvertebrate community health in the Coxs River at CR2, downstream of LDP2 discharges and the Kangaroo Creek confluence, was in similar or better condition to background sites CR0 and CR1, based on the macroinvertebrate metrics. Water and sediment quality at CR2 was generally good in autumn and spring 2022, with no exceedances of the water quality DGV for any toxicant recorded at CR2, and only the sediment antimony concentration in autumn 2022 exceeding the sediment DGV.
- **Overall**, the results of 2022 aquatic ecology monitoring indicate that the macroinvertebrate community of Kangaroo Creek (and the decommissioned LDP1) and the Coxs River downstream of LDP2 was in good condition during 2022, with continued improvements observed in all macroinvertebrate metrics compared to 2020 and 2021 results (GHD 2021, 2022).



Plate 6-1: Aquatic ecology monitoring site KC1 in Autumn 2020 (top) and spring 2022, highlighting recovery after bushfire and high rainfall in 2022.

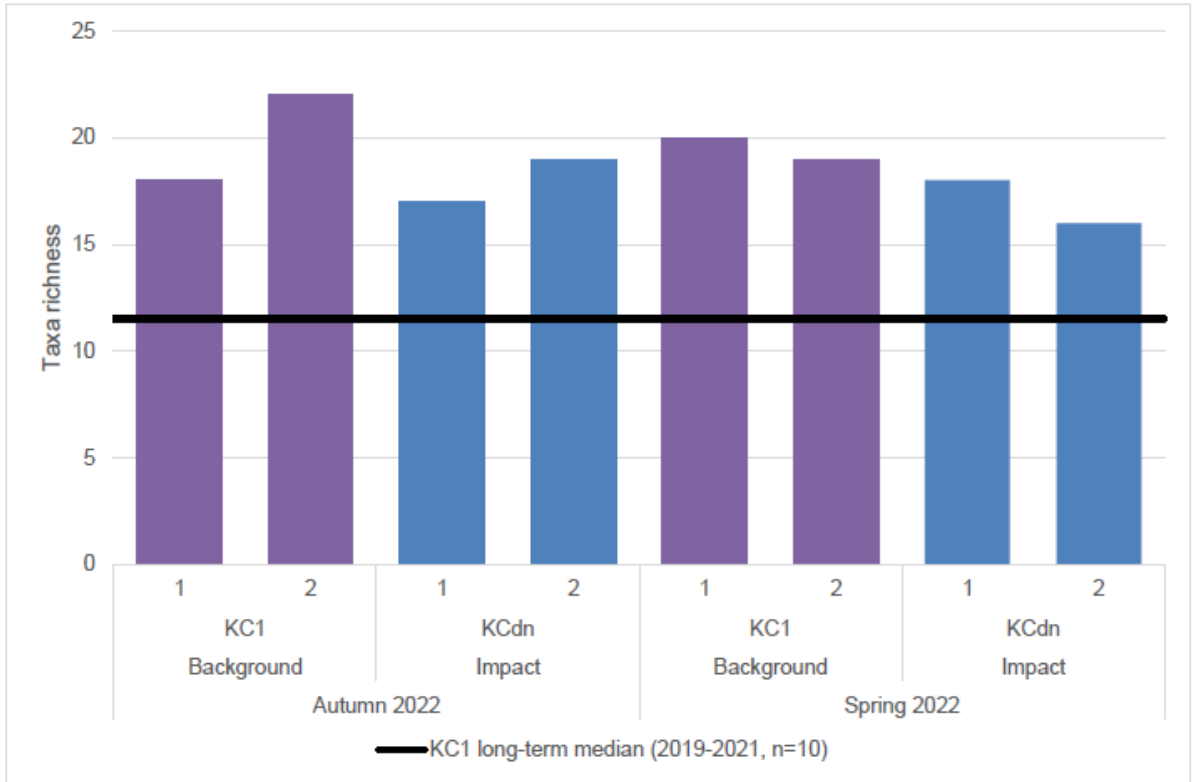


Figure 6-7: Taxa richness in Kangaroo Creek samples (2022)

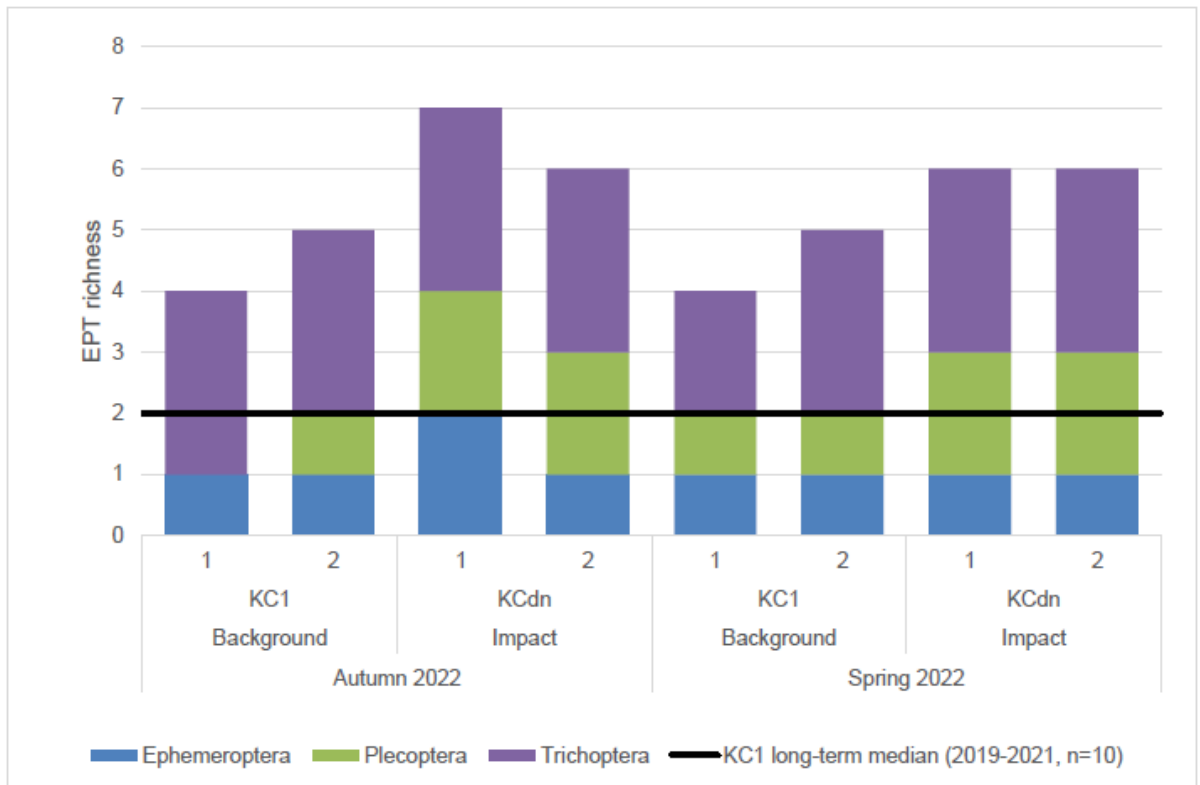


Figure 6-8: EPT richness in Kangaroo Creek samples (2022)

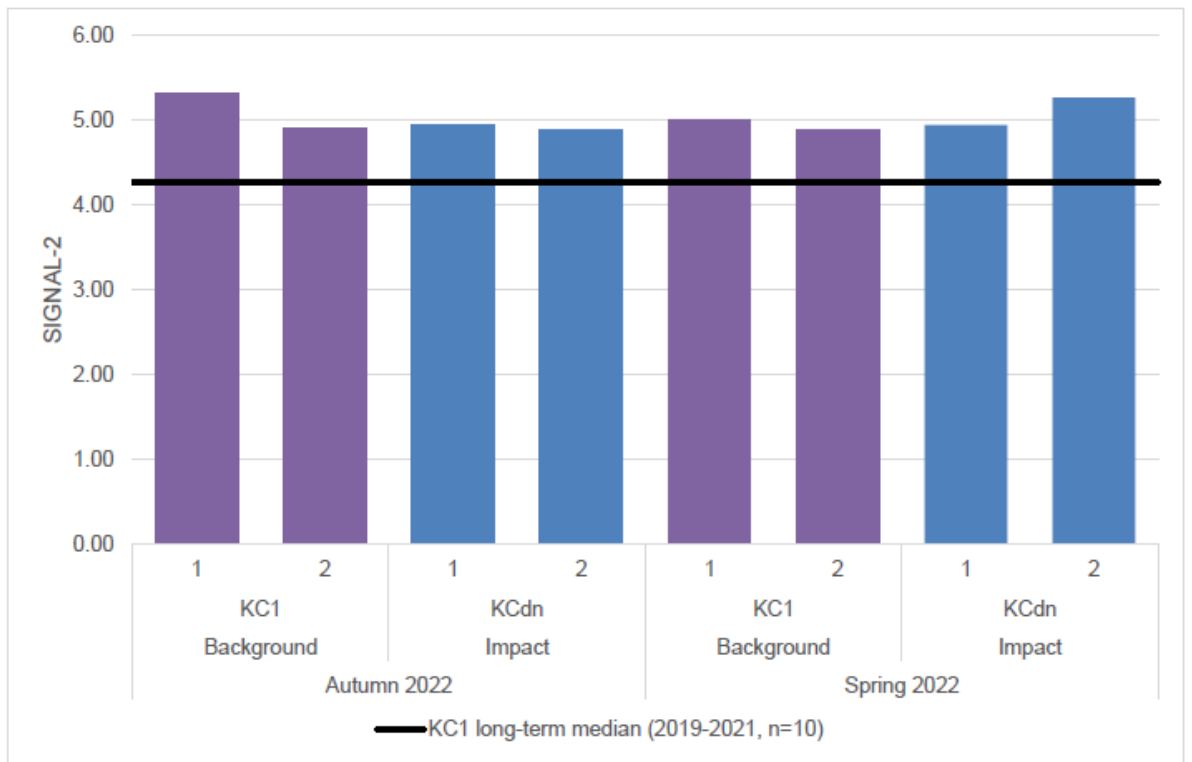


Figure 6-9: Signal-2 results in Kangaroo Creek samples (2022)

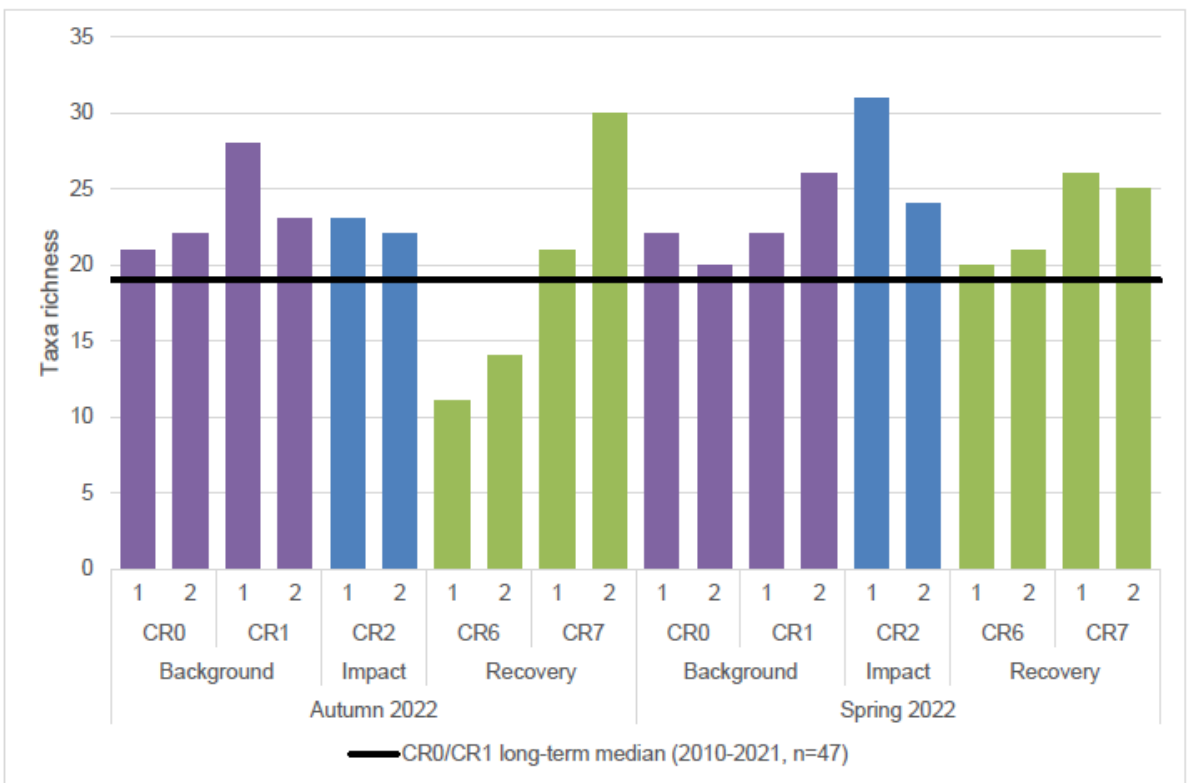


Figure 6-10: Taxa richness in Coxs River samples (2022)

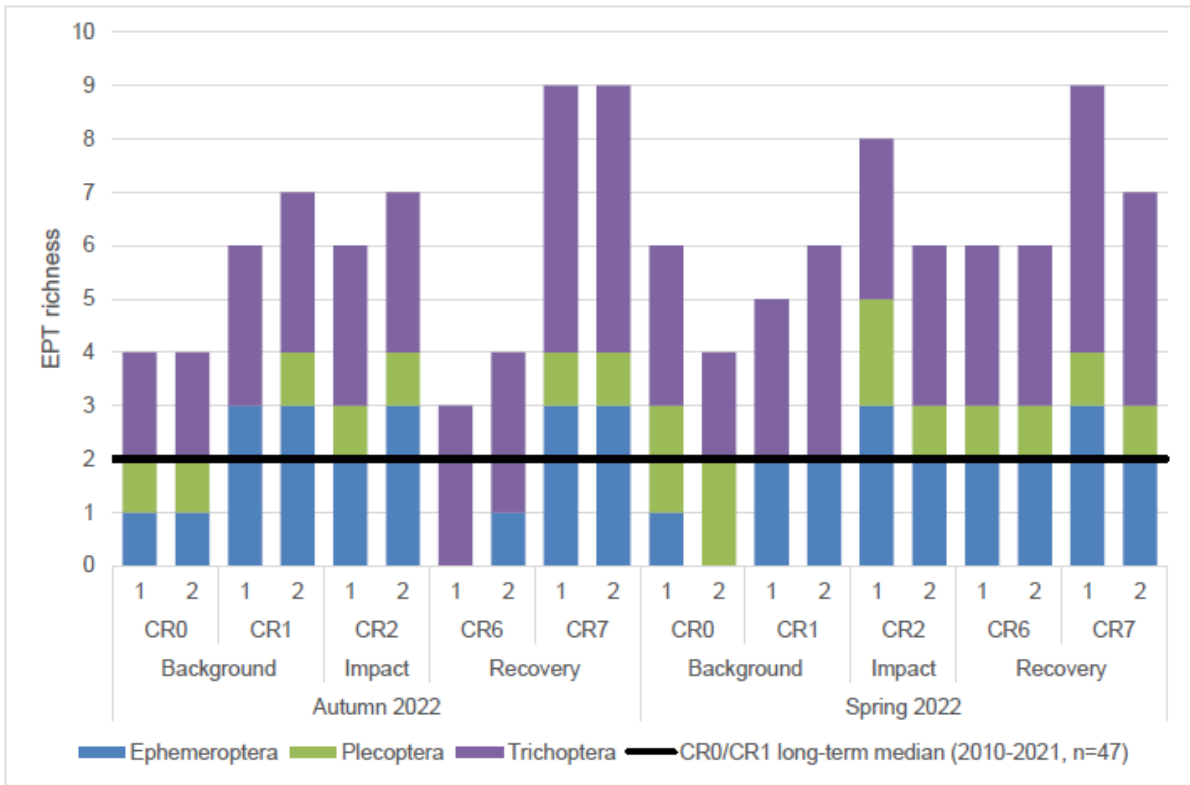


Figure 6-11: EPT richness in Coxs River samples (2022)

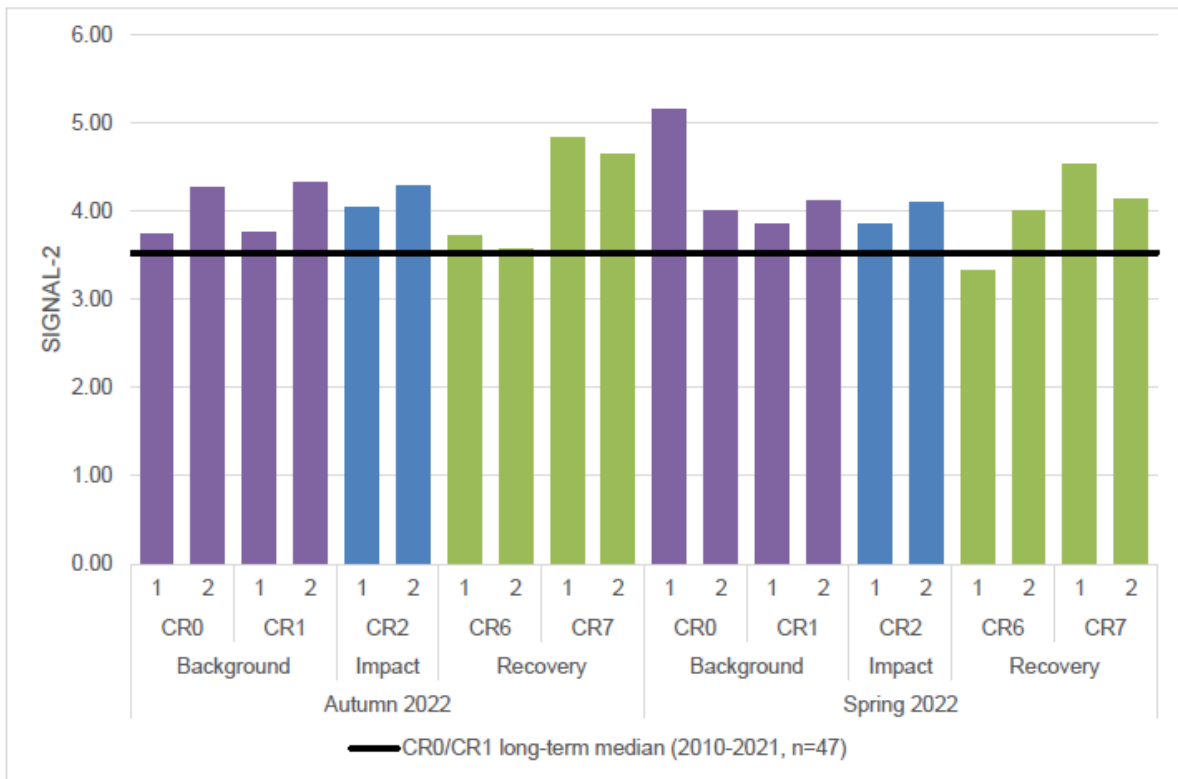
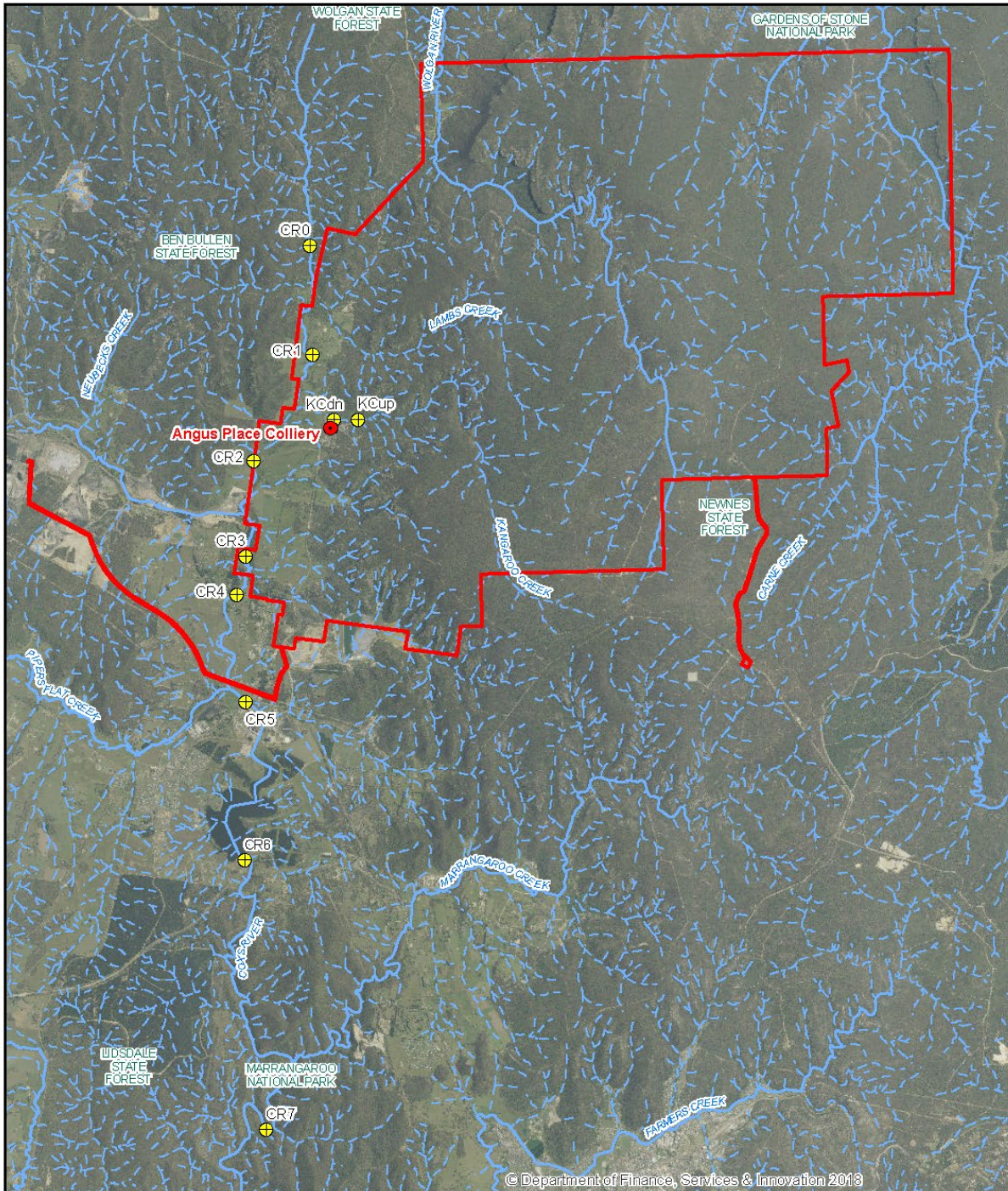


Figure 6-12: Signal-2 results in Coxs River samples (2022)



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LEGEND

- Angus Place Colliery
- ⊕ Aquatic ecology monitoring
- Angus Place Holding Boundary
- Watercourse - Perennial
- Watercourse - Non Perennial

<p>Paper Size A4</p> <p>Kilometres Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 58</p>				<p>Angus Place Colliery Water Management Plan</p> <p>Aquatic ecology monitoring locations</p>	<table border="0"> <tr> <td>Job Number</td> <td>22-19614</td> </tr> <tr> <td>Revision</td> <td>1</td> </tr> <tr> <td>Date</td> <td>21 Jun 2021</td> </tr> </table>	Job Number	22-19614	Revision	1	Date	21 Jun 2021
Job Number	22-19614										
Revision	1										
Date	21 Jun 2021										

Figure 4-5

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© 2021. Whilst every care has been taken to prepare this map, GHD, LPI and Centennial make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: LPI: DTDB / Aerial Imagery, 2013, 2017. Centennial: Boundaries, 2013. Created by: f.mackay, t.morton

Figure 6-13: Aquatic Ecology Monitoring Program

6.6.2.6 Notifications and Review

During 2022 no external notifications were required and undertaken in accordance with specific biodiversity performance measures. There were no trigger notifications in accordance with condition 9 of approval for EPBC 2011/5952 that were included in the EPBC annual reporting period to April 2022.

The two notable events in 2022, Kangaroo Creek Landslide and Narrow Swamp erosion (Section 11), were notified under subsidence monitoring requirements in the consent and Environmental Monitoring Program. The Narrow Swamp event was notified under EPBC 2011/5852 however this event occurred after the last reporting period and as such it will be reported in the next EPBC annual report in 2023.

6.6.3 Comparisons against Predictions and Performance Measures

Comparison of 2022 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 2022 reporting period was compliant with both predictions and with performance measures of consent.

6.6.4 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 6-13 summarises biodiversity compliance reporting over the last five (5) Annual Review reporting periods. Since 2018, monitoring reported in Annual Reviews for Angus Place has identified no instances of technical non-compliance events related to biodiversity.

Table 6-13: Biodiversity Compliance 2018-2022

Aspect	Annual Review Reporting Period				
	2018	2019	2020	2021	2022
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 and subsequent above average rainfall until the end of 2022.

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

6.6.5 Implemented / Proposed Improvements

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

- Negotiate an occupation permit under the National Parks and Wildlife Act and Regulations to authorize land management activities in the GOSSCA.
- Subject to agreement with NPWS, targeted weed management will be undertaken in Narrow Swamp to eradicate Blackberry individuals, to prevent them from colonising bare areas and competing with native species and benefit from ideal timing in post-fire

conditions due to greater visibility and access. Management of weeds in the *Asteraceae* family will be undertaken in cooler months prior to flowering and seeding wherever practicable, to reduce recruitment and establishment within the swamps. An experienced land management professional will undertake weed management within the swamps to correctly differentiate introduced weeds from similar native species such as *Senecio diaschides*.

- 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.

6.6.6 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 to MP06_0021).

Version 8 of the WR-BOS (Nov 2020), was approved by DPIE (now DPE) 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.

Figure 6-14 shows the Biodiversity Offset sites for the Western Region applicable under the WR-BOS.

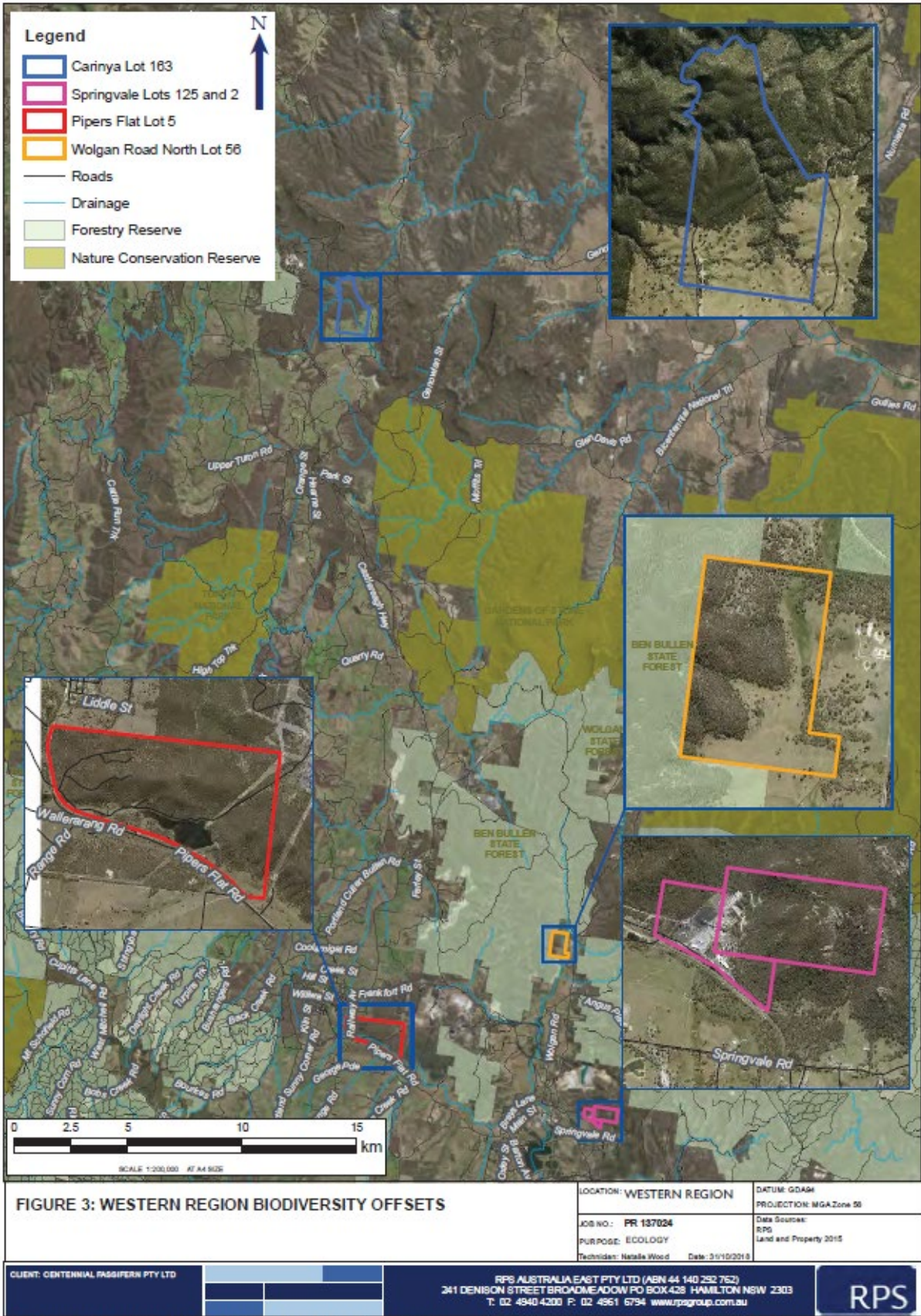


Figure 6-14: Western Region Biodiversity Offsets

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)
- 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 current reporting period. The extraction plan related to LW 910 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 2022 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 2022 period. Photographic monitoring has continued to be undertaken annually to monitor cracking, flows and vegetation condition at Kangaroo Creek, Narrow Swamp, and Wolgan Swamps. No subsidence impacts have been identified.

Subsidence surveys were undertaken for the A and F lines to confirm that no movement had occurred in the vicinity of Narrow Swamp as part of the investigations into erosion in the locality (see section 11 for details).

Monitoring requirements for subsidence are outlined in the following subsidence management plans in **Table 6-14**.

Table 6-14: 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

Subsidence Management Plan	Mining Area	Approved	Complete
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 in accordance with Condition 32, Schedule 3 of MP06_0021. Waste is managed in accordance with relevant regulatory requirements including the POEO Act, the *NSW EPA Waste Classification Guidelines* and the *NSW Waste Avoidance and Resource Recovery Act 2001* and *Waste Management and Resource Recovery Regulations 2017*.

As the site is currently in care and maintenance, waste generated at Angus Place during the 2022 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 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 in accordance with 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, bushfire damaged 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.

In 2022, however, excessive rainfall led to high water levels in the sewage treatment ponds. To prevent overflow, a temporary pumping system was initiated to recycle the water from Pond 4 to Pond 1 within the STP pond system. From December 2022, dryer weather saw a dramatic decrease in pond levels due to evaporation, and recirculation was ceased on 8 December 2023.

During the 2022 Reporting period no effluent discharges for land irrigation were required/undertaken.

6.9.2 Environmental Performance

Table 6-15 provides a summary of the general waste produced, recycled and disposed during the reporting period.

During the reporting period, 61.268t (57.18%) of waste was recycled, primarily including steel, oily water, paper and cardboard, oil filters, and empty drums. This is an increase to recycling amounts in recent years (e.g. 2021 and 2020 of 3.648 and 20.472 tonnes respectively).

Table 6-15: Non-Production Waste Recycling and Disposal (last five reporting years)

Waste Generation (tonnes)	Annual Review Reporting Period				
	2018	2019	2020	2021	2022
Recycled (Hazardous) (e.g. Waste Oil, Waste, Grease)	390.167	3.348	4.484	3.138	1.598
Recycled (Non-Hazardous) (e.g. Steel, Paper & Cardboard) tonnes)	18.660	99.696	15.988	0.510	59.670
Hazardous Disposal (Oily Rags / tonnes)	0.804	0.360	0.996	0.190	2.536
Non-Hazardous Disposal (Mixed Solid Waste / tonnes)	131.005	108.250	26.030	14.990	43.340
TOTAL WASTE (OFFSITE) (tonnes)	540.636	211.654	47.498	18.828	107.144
TOTAL RECYCLED WASTE (tonnes)	408.827	103.044	20.472	3.648	61.268
PERCENTAGE WASTE RECYCLED	75.62%	48.69%	43.10%	19.38%	57.18%

6.9.3 Comparisons against Predictions

Waste management predictions/measures described in the EA/modifications and 2022 performance against these are summarised in **Table 6-16**.

Table 6-16: Summary of Waste Management Predictions and Performance (2022)

Prediction	Performance
Angus Place Colliery will implement a waste free site (vent fan operations). i.e. all waste must be removed from site during the operational phase. As appropriate, it will then be separated, classified (Source: MOD2 EA, RPS 2012)	<ul style="list-style-type: none"> 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 chemicals including oils, drilling muds, etc will be on self-banded storage pallets. (Source: MOD2 EA, RPS 2012)	<ul style="list-style-type: none"> No use of liquids except diesel fuel for one pump on site at vent facility.

6.9.4 Long Term Analysis

Waste disposal and recycling for the last five (5) reporting periods is summarised in **Table 6-15**.

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

6.10 OTHER MATTERS

6.10.1 Bushfires

There were no bushfires 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 DPE 30th 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 528.

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 7,059 ML/year. Licences for groundwater extraction include:

- from the Sydney Basin Coxs River groundwater source
 - WAL 41881 – licences 1,471 ML/year.
 - WAL 36445 – licences 2,701 ML/year.
 - WAL 37340 – licences 329 ML/year.
- from the Sydney Basin Richmond groundwater source
 - WAL 36449 – licences 2,523 ML/year.
 - WAL 37343 – licences 35 ML/year.

Both the Sydney Basin Coxs River and Sydney Basin Richmond groundwater sources are part of the Water Sharing Plan for the.

The relevant water supply works approvals that allow for groundwater to be extracted include:

- 10WA122774 – Angus Place Pit Bottom Pump Station.
- 10WA118748 – Angus Place 48 C/T Pump Station.
- 10WA118750 – Bore 930 and Bore 940.

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 (i.e., 1 July 2021 to 30 June 2022), not the calendar year.

Table 7-1: Water Licenses and Take

Licence	Water sharing plan, source and management zone	Entitlement (ML)	Passive Take/Inflow (ML)	Active Pumping (ML)	TOTAL (ML)
WAL41881	Greater Metropolitan Region Groundwater Sources	1,471	0	338	338
WAL36445		2,701	0	0	0
WAL37340		Sydney Basin Coxs River Groundwater Source	329	0	0
WAL36449	Greater Metropolitan Region Groundwater Sources	2,523	0	2263	2263
WAL37343		Sydney Basin Richmond groundwater source	35	0	0
Total		7,059	0	2,601	2,601

Notes: 1 Volume is reported in megalitres (ML).

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 are provided in **Table 7-2**. 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 WPPS. A relatively small volume of catchment runoff from the pit top is discharged through LDP002 and catchment runoff at Kerosene Vale is discharged through LDP003.

The 2022 water balance indicated greater than predicted groundwater inflows and higher rainfall capture than originally estimated. As a result, discharges from LDP002 and LDP003. Transfers to SWTF and Pond D were increased to maximum capacity available, however a significant increase in underground storage occurred as a result. Overall, the water balance was within 0.1% of the total inputs.

Table 7-2: Annual Water Balance – Average Annual Volumes (WMP, 2021)

Water Flow	Average Annual Volume (ML/year)	2022 Annual Volume (ML/year)
Inputs		
Direct rainfall onto storages and catchment runoff	116	189.7
Potable Water Supply	2	.3
Groundwater inflows into underground workings	2166	4190
Total Inputs	2284	4379
Outputs		
Evaporation	20	30.4
Discharge through LDP002	22	80.5
Discharge through LDP003	34	44.9
Discharge through LDP005	1	0
Transfer to SDWTS		0
Transfer to SWTP	1428	3139
Transfer to Pond D	657 (Avg. 1.8ML/day)	949
Transfer from ventilation facility at Springvale Mine	33	38.8
Losses from operations	1	0
Total Outputs	2196	4283
Change in Storage		
Surface water storages	88	0
Underground water storages	88	102
Total Change in Storages	-	102
Water Balance		
Change in water inventory (inputs – outputs – change in storage)	0	-4.6

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:

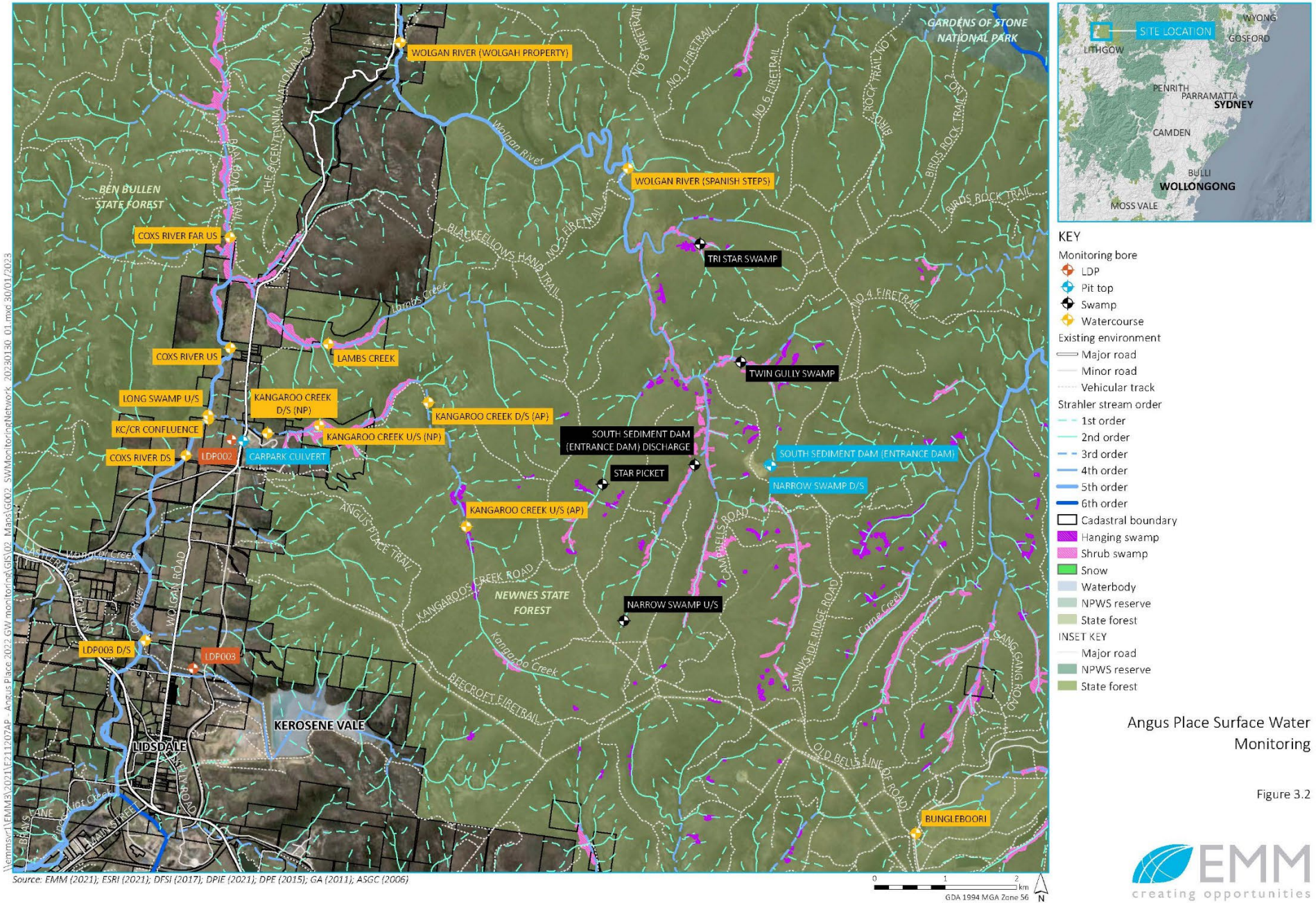
- **Discharge** surface water quality, measured at two monitoring locations.
- **Watercourse** surface water quality and flow rate, measured at fourteen monitoring locations.
- **Pit top** surface water quality, measured at three monitoring locations.
- **Swamp** surface water quality and flow rate, 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 7-3** and shown on **Figure 7-1**.

Table 7-3: Description of Surface Water Monitoring Locations

Monitoring Point	Description
Licensed 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.
Pit Top Surface Water	
Carpark Culvert	Dirty water drain prior to entering the Settling Ponds.
South Sediment Dam (Entrance Pond)	Sediment pond at 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 with Kangaroo Creek.

Monitoring Point	Description
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 (Wolgah Property)	located on the Wolgan River downstream of any potential seepage from the 800 District.
LDP003 D/S	located on Sawyers Swamp Creek approximately 1 km downstream of LDP003 discharge from the KVSA.
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 STP treatment ponds feeding to the irrigation area (discharge to utilisation area)



Angus Place Surface Water Monitoring

Figure 3.2



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 EPL 467, 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 7-4** (LDP002) and **Table 7-5** (LDP003). Long-term time series plots are presented on **Figure 7-2** (LDP002) and **Figure 7-3** (LDP003).

In summary, there were **two (2) non-compliances** regarding licenced discharges at LDP003 observed during the 2022 reporting period as detailed in **Section 11**. Due to the significant wet year conditions in 2022 a number of rainfall events occurred with >44mm over 5 consecutive days, exceeding thresholds applicable to licence limits under the EPL on those occasions. Detailed monthly surface water monitoring results for the reporting period are provided in **Appendix 2**.

Table 7-4: 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	6.5	7.45	8.4	6.5 – 9.0 ^(A)
Total Suspended Solids (mg/L)	11	2.5	8.64	16	30
Turbidity (NTU)	11	6.8	12.6	21	40
Conductivity (µS/cm)	11	204	264.45	331	NS

Notes: NS = Not specified, (A) 90th percentile concentration limit of 6.5-8.5 also applies to LDP002

Table 7-5: LDP003 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)	8	LOR	LOR	LOR	10
pH	8	7	7.5	8.3	6.5 – 8.5
Total Suspended Solids (mg/L)	8	2.5	40.9	139	30
Turbidity (NTU)	8	5.3	64.9	360	40
Conductivity (µS/cm)	8	80	104.25	19	NS

Notes: NS = Not specified

Figure 7-2: Time Series Plot of EC, pH and TSS at LDP002

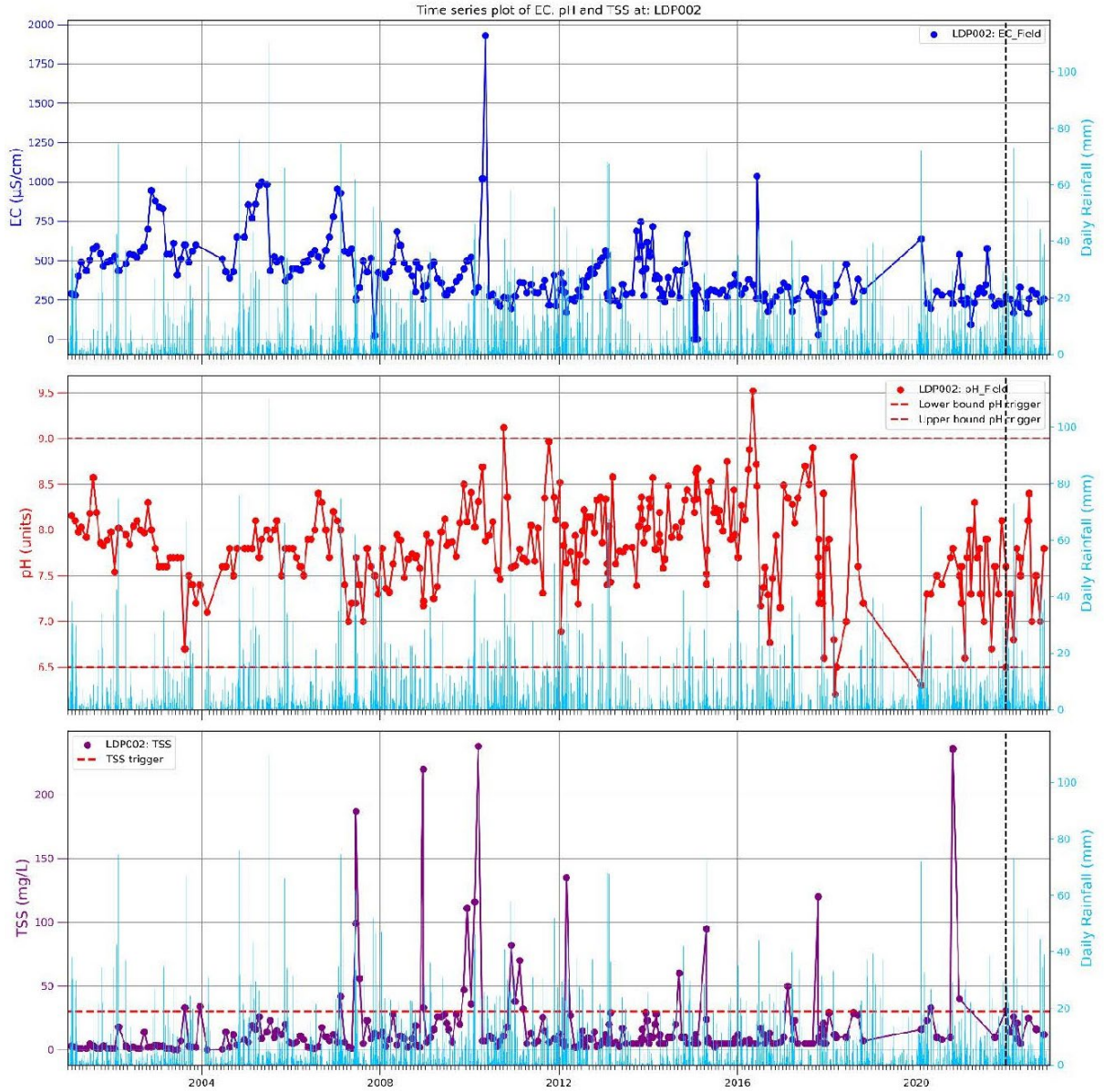
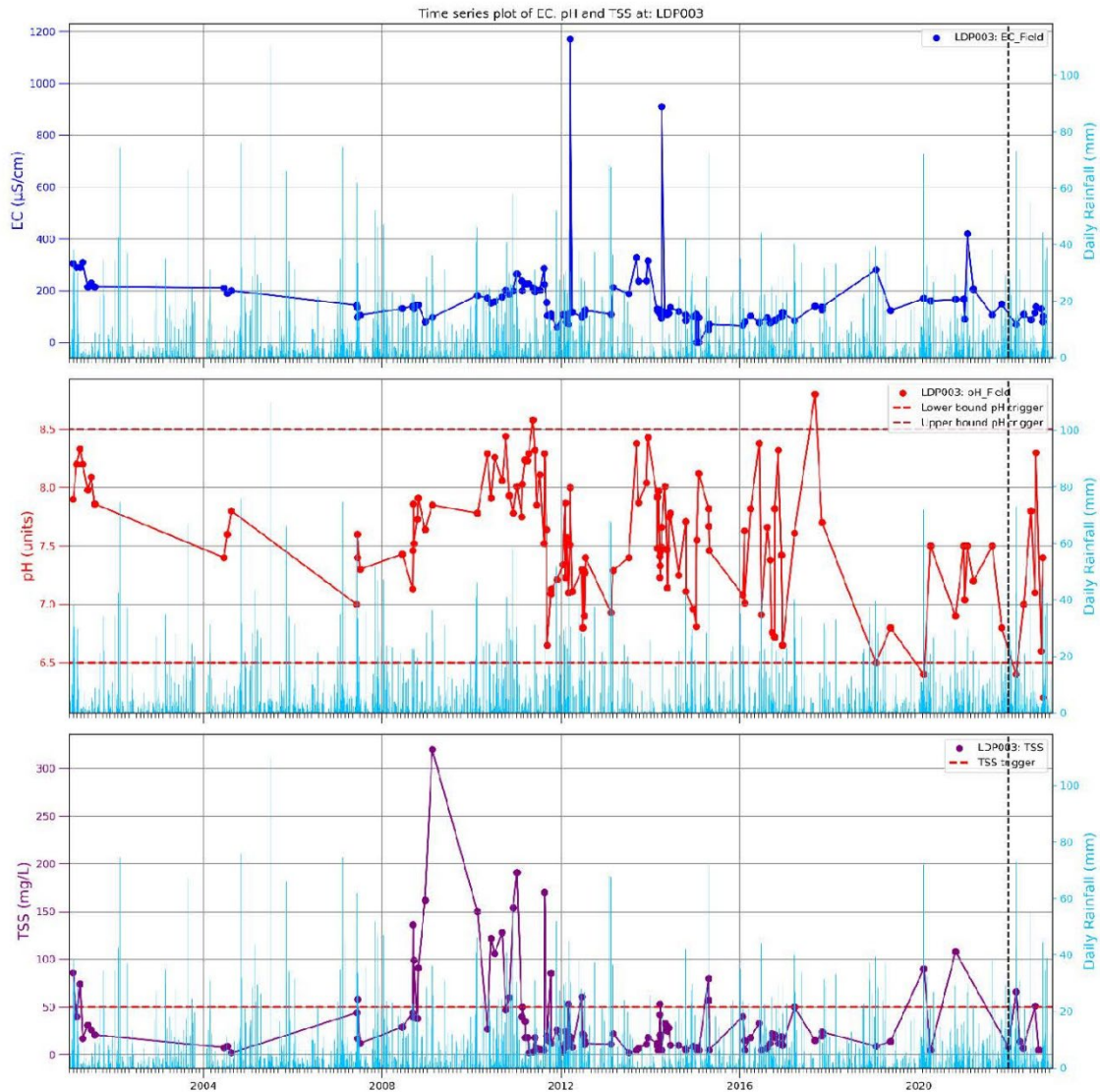


Figure 7-3: Time Series Plot of EC, pH and TSS at LDP003



Watercourse Surface Water Monitoring

The water quality monitoring network for surface watercourses comprises fourteen (14) 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) default guideline values (DGVs).

Surface water quality results is summarised in **Table 7-6** for sites KC/CR confluence and Coxs River D/S. These sites are assessed against site-specific guideline values (SSGVs), which were based on a review of ANZECC (2000) default guideline values (DGVs).

It should be noted that due to degraded access track conditions at the time due to significant wet weather, no surface water quality data was collected at Coxs D/S in June 2022, and KC/CR Confluence in November 2022.

Two non-consecutive upper bound pH triggers above the SSGV's were observed at KC/KR Confluence in the 2022 reporting period, on 8 June (pH 8.3) and 6 September (pH 8.4). Since

the cessation of discharges at LDP001 in December 2019, KC/CR Confluence is not directly impacted by the mine's activities.

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

Monitoring Location	Surface water quality trends during the reporting period
Bungleboori	Monitoring at this point only occurs when the Entrance Pond is discharging. Only one sample was collected. Water quality at Bungleboori showed high levels of water quality parameters compared to Entrance Pond.
Coxs River Far U/S	EC and TSS remained stable, while pH displayed an increasing trend consistent with historical observations. Flow was not monitored at the site.
Coxs River U/S	EC and TSS remained stable, while pH fluctuated, consistent with historical observations. Flow was not monitored at the site.
Coxs River D/S	No surface water quality data was collected at Coxs D/S in June 2022
Kangaroo Creek D/S (AP)	No data was available for all analytes during the reporting period.
Kangaroo Creek D/S (NP)	EC and TSS remained stable, with the exception of a large TSS spike in March 2022, which was larger than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. pH and flow fluctuated, consistent with historical observations.
Kangaroo Creek U/S (AP)	No data was available for all analytes during the reporting period.
Kangaroo Creek U/S (NP)	EC and TSS remained stable, while pH and flow fluctuated consistently with historical observations.
LDP003 D/S	EC remained relatively stable, with minor fluctuations consistent with historical observations. pH displayed an increasing trend, consistent with historical observations. No TSS and flow data was available during the reporting period.
Lambs Creek	EC remained relatively stable, with the exception of a spike in November 2022, which was larger than historical observations. pH displayed an increasing trend consistent with historical observations. Only three data points were available for TSS during the reporting period, however a significant spike was observed in February 2022, which was greater than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. No flow data was available during the reporting period due to no flowing conditions. The time series figure shows that the measurement of the EC and TSS spikes closely followed significant rainfall events.
Long Swamp U/S	EC fluctuated in a decreasing trend, consistent with historical observations, while pH fluctuated in an increasing trend, slightly greater than historical observations. A large spike in TSS was observed in January, which was greater than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. No flow data was available during the reporting period due to dry watercourse conditions.
Wolgan River (Spanish Steps)	EC remained relatively stable, with the exception of minor fluctuations, slightly greater than historical observations. pH fluctuated consistently with historical observations. TSS remained stable, with the exception of two spikes in January and September 2022, which were greater than historical observations. The time series figure shows that the

Monitoring Location	Surface water quality trends during the reporting period
	measurement of the two TSS spikes followed periods of sustained, above average rainfall conditions. Limited flow data was available for the reporting period due to dry watercourse conditions.
Wolgan River (Wolgah Property)	EC and flow rate remained stable with minor fluctuations, consistent with the historical average. pH and TSS fluctuated, consistent with historical observations.
KC/CR Confluence	Two upper bound pH triggers above the SSGV's were observed at KC/KR Confluence in the 2022 reporting period, on 8 June (pH 8.3) and 6 September (pH 8.4).

Pit Top Surface Water Monitoring

The pit top surface water quality monitoring network comprises three (3) 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. It should be noted that EC has not been recorded at the site since 2020 due to the development of monitoring requirements.
South Sediment Dam (Entrance Dam)	EC and TSS remained relatively stable, with the exception of a minor spike of TSS in October 2022, which was consistent with historical observations. pH fluctuated consistently with historical observations.
South Sediment Dam (Entrance Dam) Discharge	Limited data was available during the reporting period due to non-discharging conditions.

Swamp Surface Water Monitoring

The swamp surface water quality and flow monitoring networks comprise of four (4) 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 ¹ .
Narrow Swamp D/S	No data available for all analytes due to dry swamp conditions ¹ .
Star Picket	No data available for all analytes due to dry swamp conditions ¹ .

Monitoring Location	Surface water quality trends during the reporting period
Tri Star Swamp	TSS and flow rate remained relatively stable, with the exception of minor fluctuations in both analytes. EC remained relatively stable, with the exception of a single large spike greater than historical observations. pH peaked at 3.5 and 8.1 in November and February 2022, respectively.
Twin Gully Swamp	Flow rate, EC and TSS remained stable, consistent with historical observation. pH peaked at 5.2 and 7.3 in January and March 2022, respectively.

Notes: 1 Sample unable to be collected accordingly (dry).

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 Site-Specific Guideline Values (SSGVs), which were based on a review of ANZECC (2000) default guideline values (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
- Total Suspended Solids: 25 mg/L
- pH: 6.3 – 8.0
- Turbidity: 72 NTU

Two non-consecutive upper bound pH triggers above SSGV's were observed at KC/KR Confluence in the 2022 reporting period, on 8 June (pH 8.3) and 6 September (pH 8.4).

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 2022 are detailed in **Section 11**.

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

Aspect	Annual Review Reporting Period				
	2018	2019	2020	2021	2022
Surface Water related non compliances	1	1	0	1	2

7.3.5 Implemented / Proposed Improvements

A review of the Site Water Management Plan is to be undertaken in 2023 to focus monitoring on current and future planned operations. Location, timing and analysis will be reviewed for all

monitoring sites to ensure that valid comparable data is collected to inform the identification of any potential mining related impacts.

The revised management plan will be provided to the secretary for approval in accordance with the consent.

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 7-4** 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 Mt. Gospers Bushfire. Although historical information is available for the destroyed sites up until November 2019, a replacement strategy for the sites in the table has not yet been reviewed.

- 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

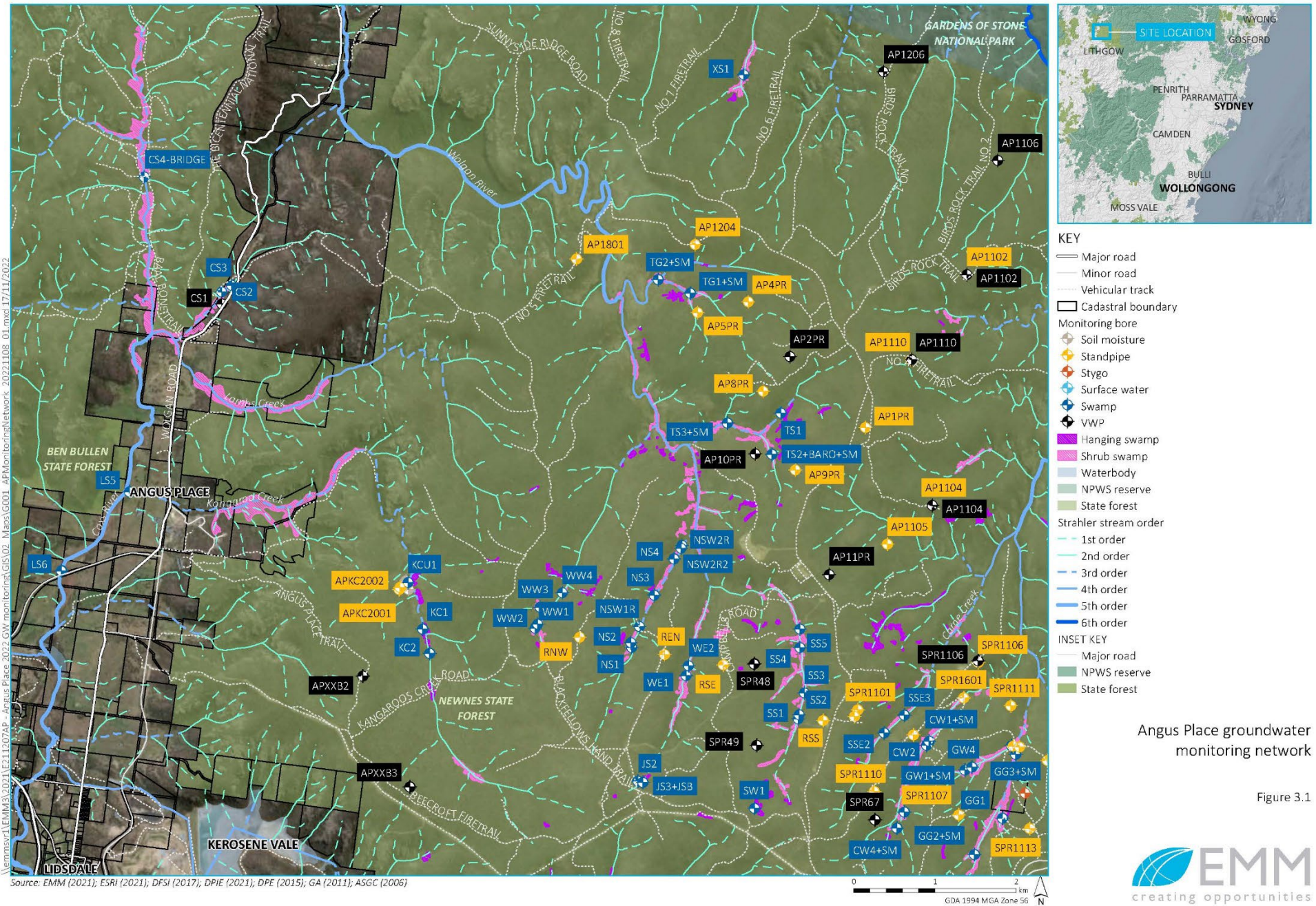


Figure 7-4: Groundwater Monitoring Locations

Figure 3.1



7.4.2 Environmental Performance

Groundwater monitoring is assessed in accordance with performance requirements set by Condition 7, Schedule 3 of MP06_0021, and against TARP requirements established within the approved *Angus Place WMP* (Rev 2, 2021).

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 seventeen monitoring bores targeting the shallow aquifer in the Banks Wall Sandstone.

Hydrographs for the ridge piezometers are presented in **Figure 7-5** which includes groundwater level data in metres AHD (mbgl) and the daily CRD (mm). Dashed vertical lines indicate the reporting period, and logger depth at each monitoring location are presented on the left side of the figure. Manual measurements are recorded for REN, RSE, RNW and APKC2001.

All ridge piezometers, except for RNW which has been dry for some time, show an increasing trend in groundwater level. This is consistent with the CRD and above average rainfall in 2022.

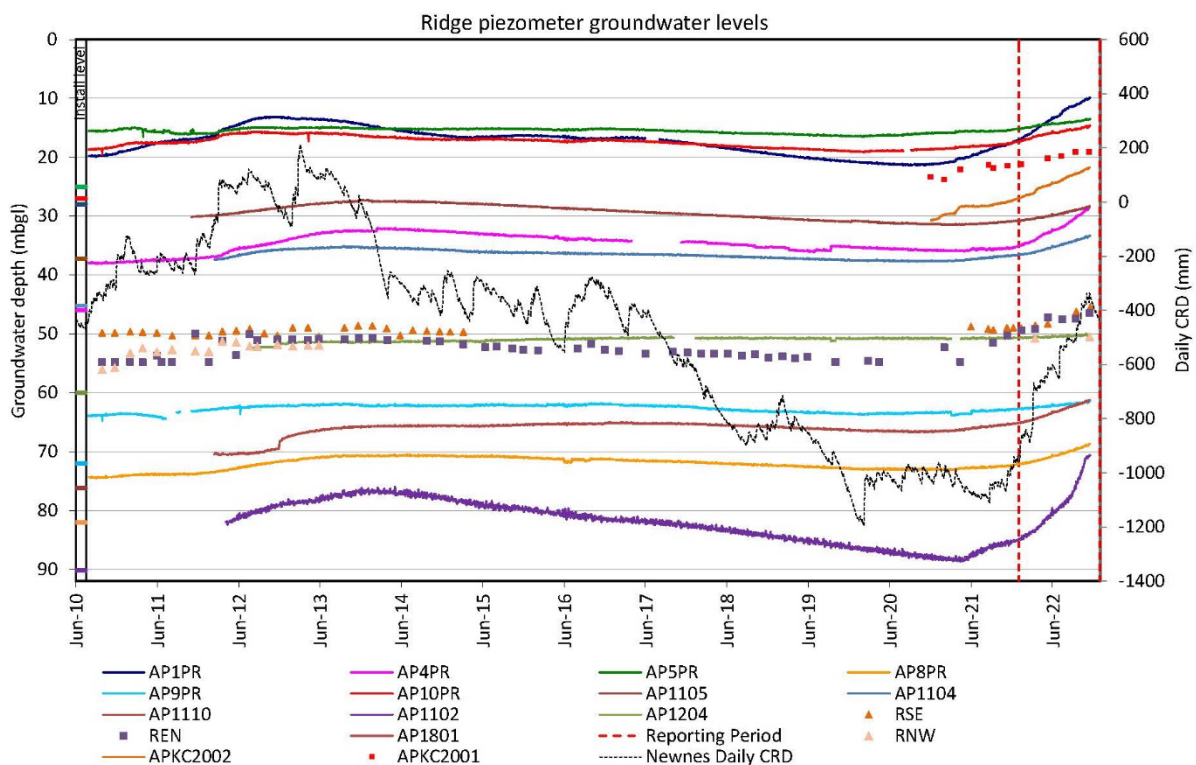


Figure 7-5: Ridge Piezometer Hydrograph

AP1801DP is a deep piezometer established to monitor groundwater quality as EPL 467 monitoring point 18. EPL 467 requires monthly monitoring for metals and alkalinity in addition to the basic water quality parameters. The bore is located in a remote part of the Newnes Plateau and during the reporting period, monitoring of the point was impeded due to untrafficable road conditions. Samples could not be collected from March to December. In

addition, limited monitoring was carried out in January and February due to insufficient water for samples. Results from January and February are presented in **Table 7-13**.

Table 7-13: AP1801DP 2022 Monitoring Summary

Parameters	Monitoring Date	
	17 January 2022	3 February 2022
Conductivity ($\mu\text{S}/\text{cm}$)	348	885
pH	7.5	7.4
TSS	276	-
Turbidity (NTU)	12	84
Hydroxide Alkalinity	<1	-
Carbonate Alkalinity	<1	-
Bicarbonate Alkalinity	324	-
Total Alkalinity	324	-
Calcium	4	-
Chloride	13	-
Magnesium	3	-
Potassium	18	-
Sodium	127	-
Sulfate	<1	-
Aluminium Filtered	0.01	-
Aluminium Total	2.66	-
Arsenic Filtered	0.004	-
Arsenic Total	0.015	-
Boron Filtered	0.14	-
Boron Total	0.15	-
Copper Filtered	<0.001	-
Copper Total	0.015	-
Iron Filtered	0.35	-
Iron Total	9.28	-
Manganese Filtered	0.033	-
Manganese Total	0.153	-
Nickel Filtered	0.004	-
Nickel Total	0.037	-
Zinc Filtered	0.010	-
Zinc Total	0.318	-

Vibrating Wire Piezometers

The Vibrating Wire Piezometer (VWP) monitoring network comprises 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 proposed workings and has not been impacted by mining. One VWP has been installed in the Coxs River area where Angus Place West 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 stable water levels at the Lithgow Seam roof and the Denman Formation, while there was an increasing trend above the Denman Formation.

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	Predominately dry, responding to rainfall events in March, July, October, and November 2022.
	KC2	Predominately dry, responding to rainfall events in March, July and October 2022.
	KCU1	Predominately dry, responding to rainfall events in March, May, July, August, October, and November 2022.
Tri Star Swamp	TS1	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	TS2	Groundwater level stable, just at or below ground level until October 2022, whereby a decline likely related to the decreasing CRD trend is observed.
	TS3	Groundwater level stable, just at or below ground level with minor fluctuations in response to rainfall events.
West Wolgan Swamp*	WW1	Groundwater level increased from March 2022 and remained relatively stable at ground level thereafter.
	WW2	Groundwater level increased from March 2022 and remained relatively stable just below ground level thereafter.

Swamp	Location	
Swamp Monitoring Bores		
West Wolgan Swamp* (continued)	WW3	Groundwater level was sustained in a declining trend between responses to rainfall events in March, May, July, August, October, and November 2022.
	WW4	Predominately dry, responding to rainfall events in March, May, July, August, October, and November 2022.
East Wolgan Swamp*	WE1	Predominately dry, responding to rainfall events in March, July and October 2022.
	WE2	Groundwater level was sustained in a decreasing trend between responses to multiple rainfall events due to above average rainfall.
Trail Six	XS1	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.
Twin Gully	TG1	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	TG2	Groundwater level stable, just at or below ground level with relatively larger fluctuations in response to rainfall events compared to TG1.
Narrow Swamp*	NS1	Predominately dry, responding to rainfall events in March, July and October 2022.
	NS2	Predominately dry, responding to rainfall events in March and July 2022.
	NS3	Predominately dry, responding to rainfall events in March and July 2022.
	NS4	Predominately dry, responding to a rainfall event in March 2022.
	NSW1R	Groundwater level fluctuated in response to rainfall events.
	NSW2R	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.
Long	LS5	Groundwater level fluctuating in response to rainfall events.
	LS6	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.
	CS4	Groundwater level stable with minor fluctuations in response to rainfall events.
Coxs River	CS2	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	CS3	Groundwater level stable, just below ground level with minor fluctuations 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 7-6**. 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, KC2 and KCU1 were mostly dry, with immediate and direct responses to significant rainfall events observed at all three monitoring sites. KCU1 displayed a response to rainfall events more frequently than KC1 and KC2. Groundwater levels at all monitoring sites decline quickly after rainfall, indicating groundwater observations are likely through flow.

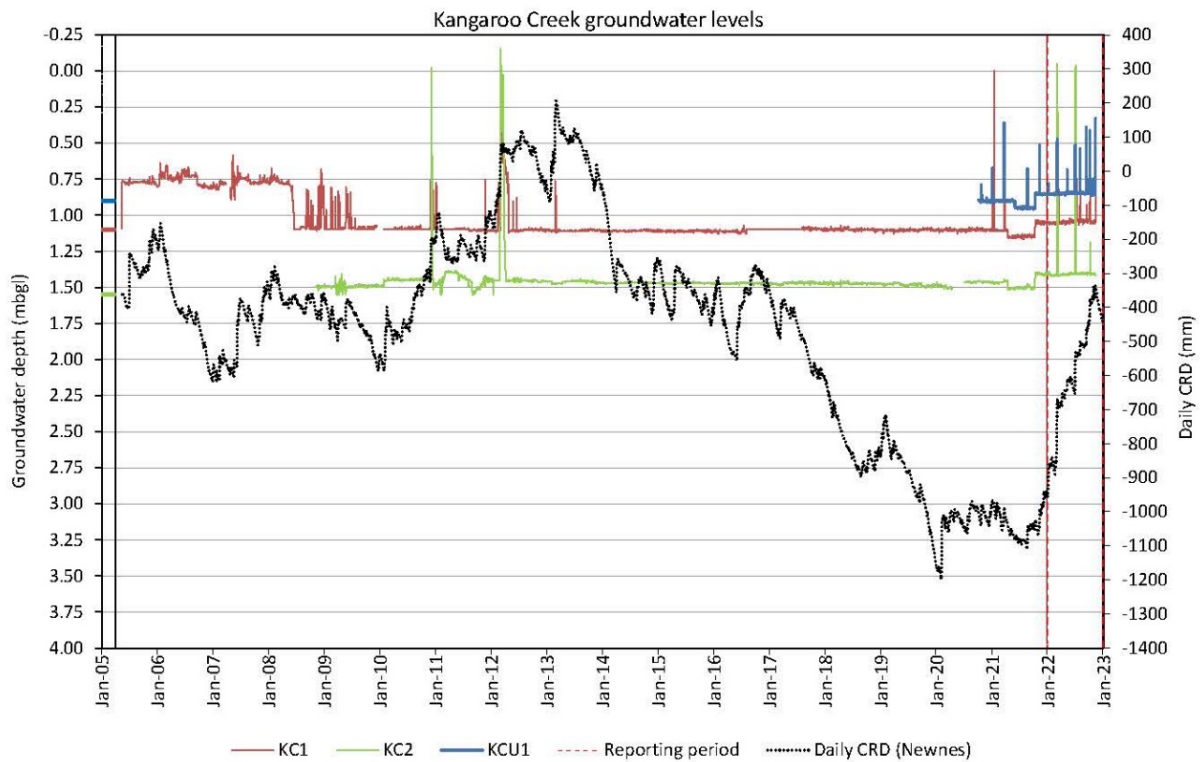


Figure 7-6: Kangaroo Creek Groundwater Levels

Tri Star Swamp

The hydrograph for Tristar Swamp is presented as **Figure 7-7**. 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, TS2 and TS3 remained stable just above or below ground level. Groundwater level at TS2 declined in mid-October 2022 in response to the decreasing CRD trend.

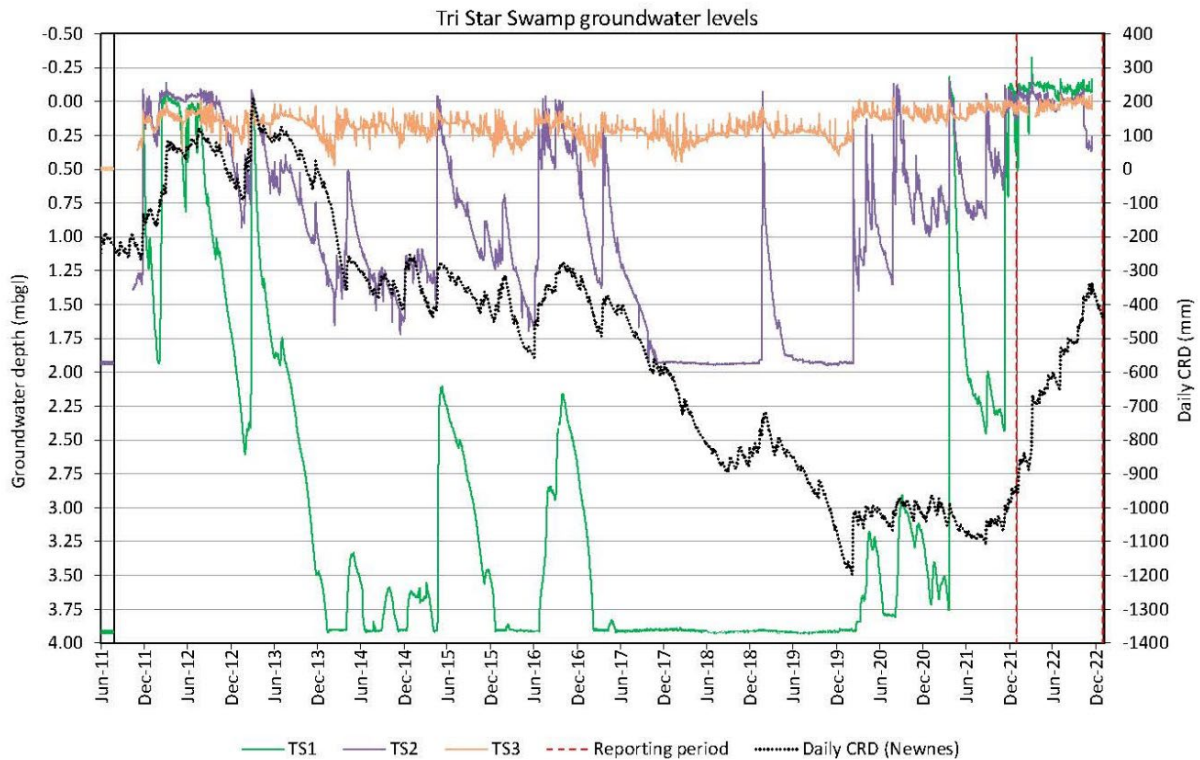


Figure 7-7: Tri Star Swamp Groundwater Levels

West Wolgan Swamp

The hydrograph for West Wolgan Swamp is presented as **Figure 7-8**. 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 reflected the daily CRD trend. WW3 responds immediately and directly to rainfall recharge and drains quickly thereafter. WW4 has been predominately dry since 2012, only responding to significant rainfall events with groundwater levels draining quickly thereafter.

During the reporting period, groundwater levels at WW1 and WW2 increased in March 2022 as a response to the increasing CRD trend and remained relatively stable just below ground level. Groundwater levels at WW3 and WW4 fluctuated in response to rainfall events. Groundwater at WW4 drained quickly and was predominately dry between rainfall events, while groundwater at WW3 did not drain as quickly and fewer dry periods were observed. The quickly declining groundwater level at WW4 indicates groundwater observations are likely through flow.

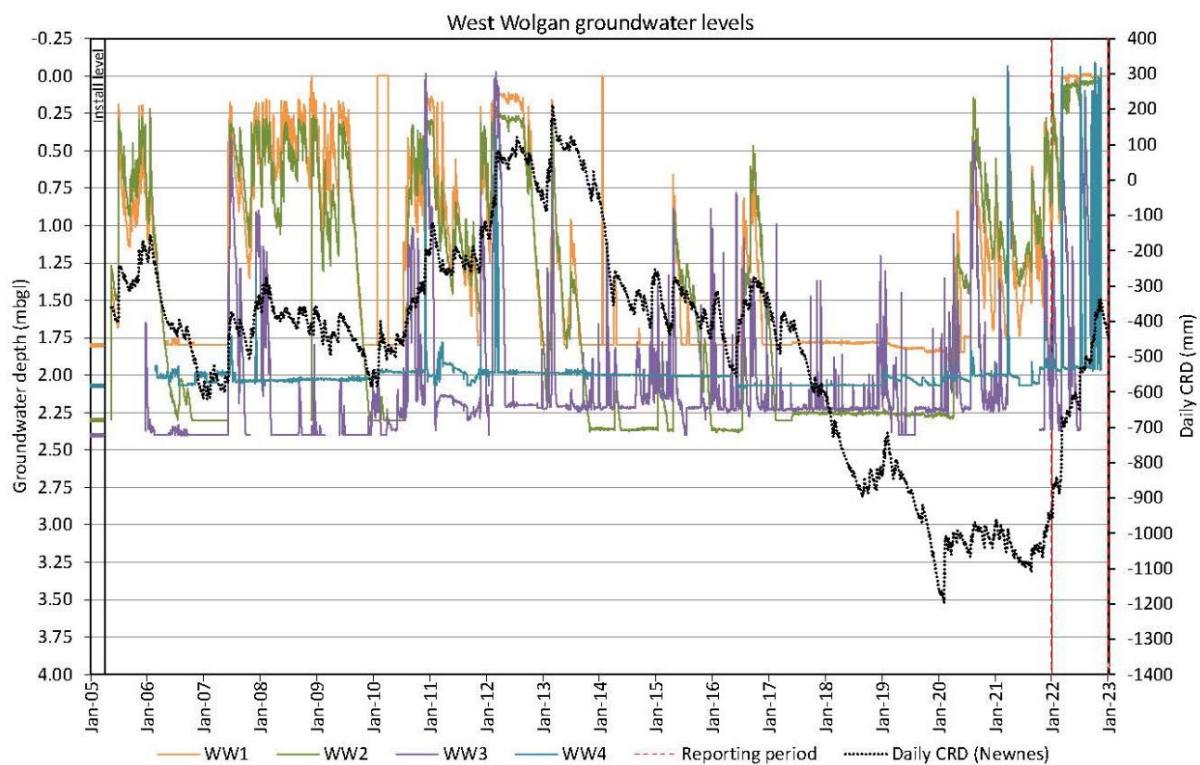


Figure 7-8: West Wolgan Groundwater Levels

East Wolgan Swamp

The hydrograph for East Wolgan Swamp is presented as **Figure 7-9**. 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 level at WE1 responded to the rainfall event in March, July and October 2022 but was otherwise dry. Groundwater level at WE2 responded to multiple rainfall events and shows minor sustained groundwater due to consistent rainfall.

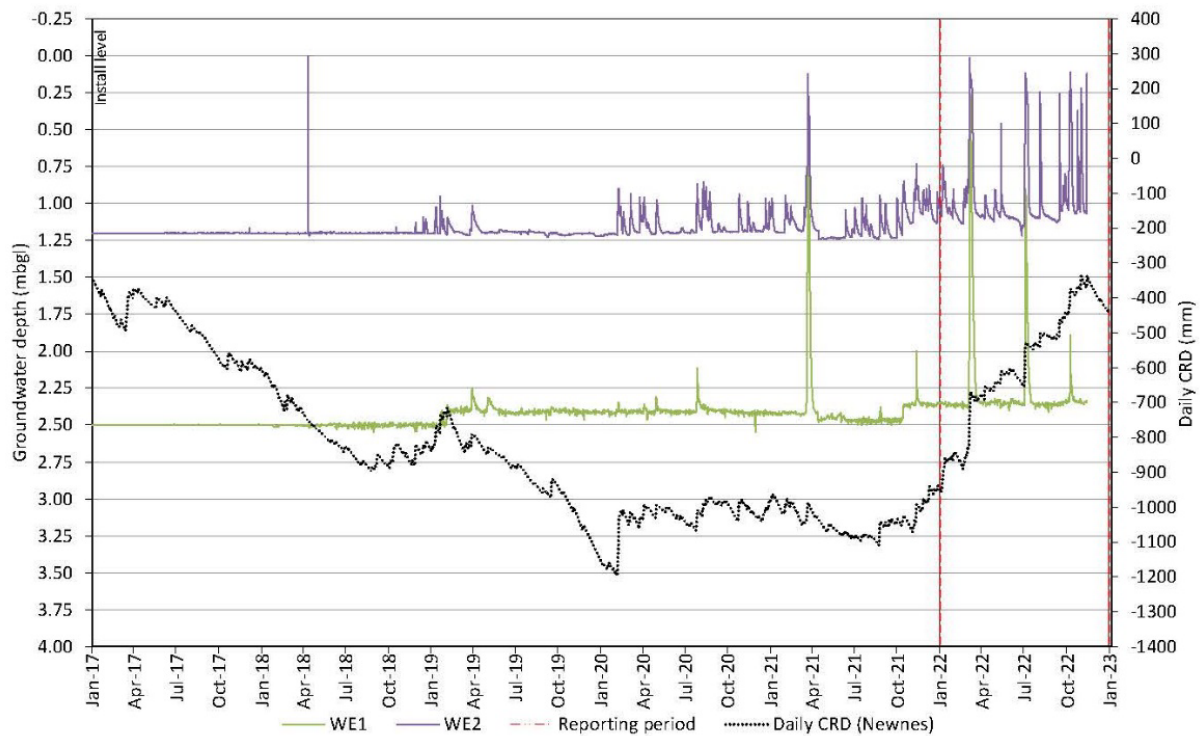


Figure 7-9: East Wolgan Groundwater Levels

Trail Six Swamp

The hydrograph for Trail Six Swamp is presented as **Figure 7-10**. 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 just below ground surface level with minor fluctuations in response to rainfall recharge.

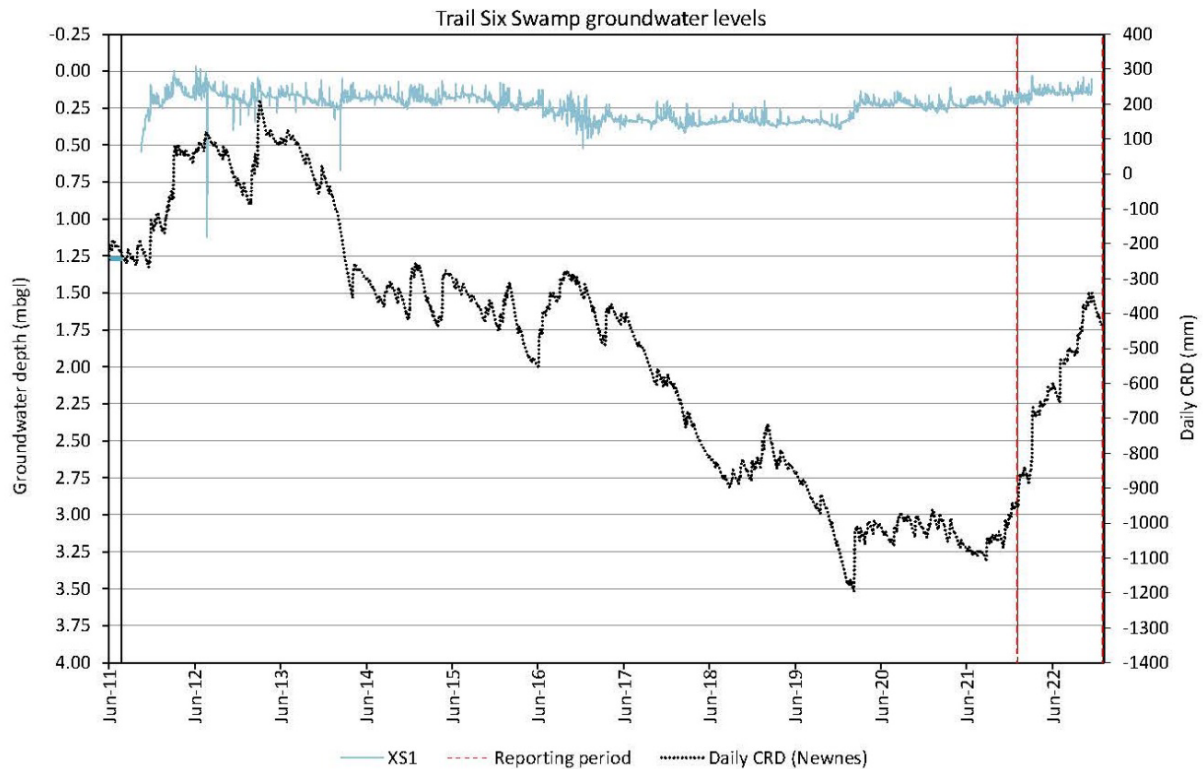


Figure 7-10: Trail Six Swamp Groundwater Levels

Twin Gully Swamp

The hydrograph for Twin Gully Swamp is presented as **Figure 7-11**. 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 than TG1.

During the reporting period, groundwater level at TG1 was stable and fluctuated above ground level. TG2 was also stable and fluctuated just below ground level.

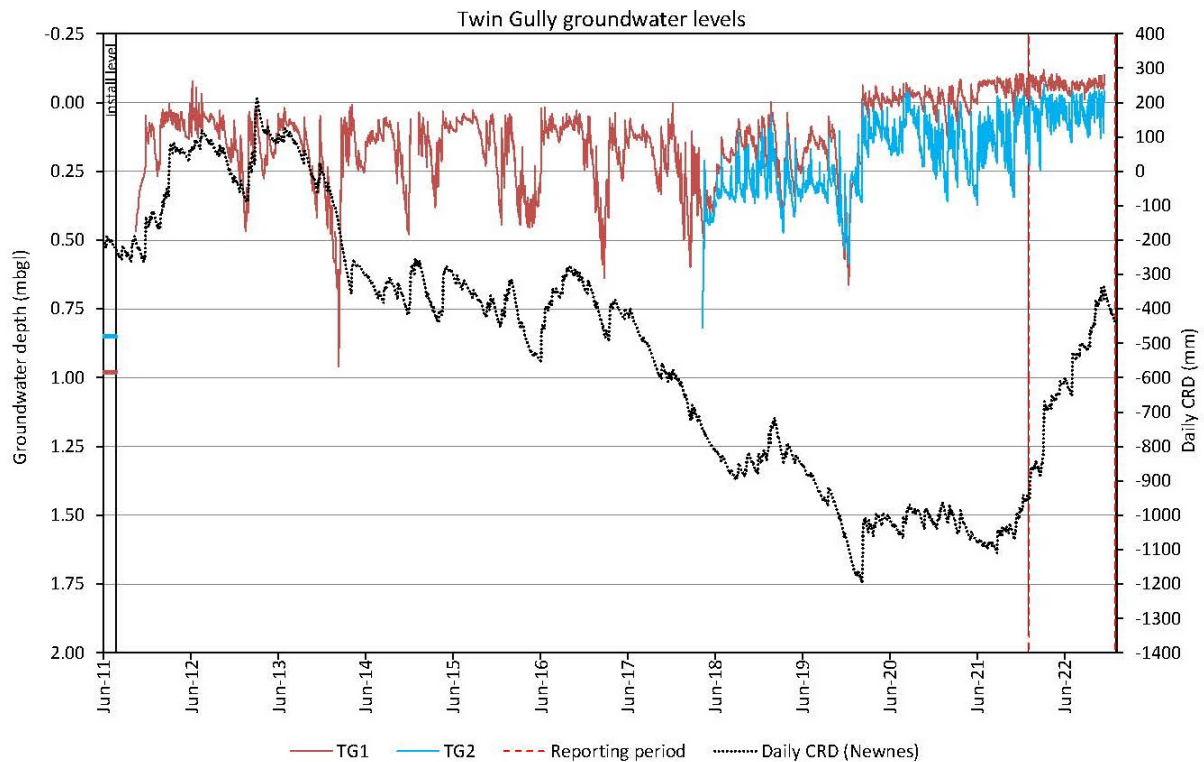


Figure 7-11: Twin Gully Swamp Groundwater Levels

Narrow Swamp

The hydrograph for Narrow Swamp is presented as **Figure 7-12**. 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 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. With the exception of 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 predominately dry, with the exception of responses to significant rainfall events in March, July and October 2022. NS1 to NS4 responded to the rainfall event in March 2022, NS1 to NS3 responded to the rainfall event in July 2022, and only NS1 responded to the rainfall event in October 2022

During the reporting period, the groundwater level at NSW1R fluctuated in response to rainfall events, while NSW2R remained stable just below ground level, fluctuating in response to the CRD trend.

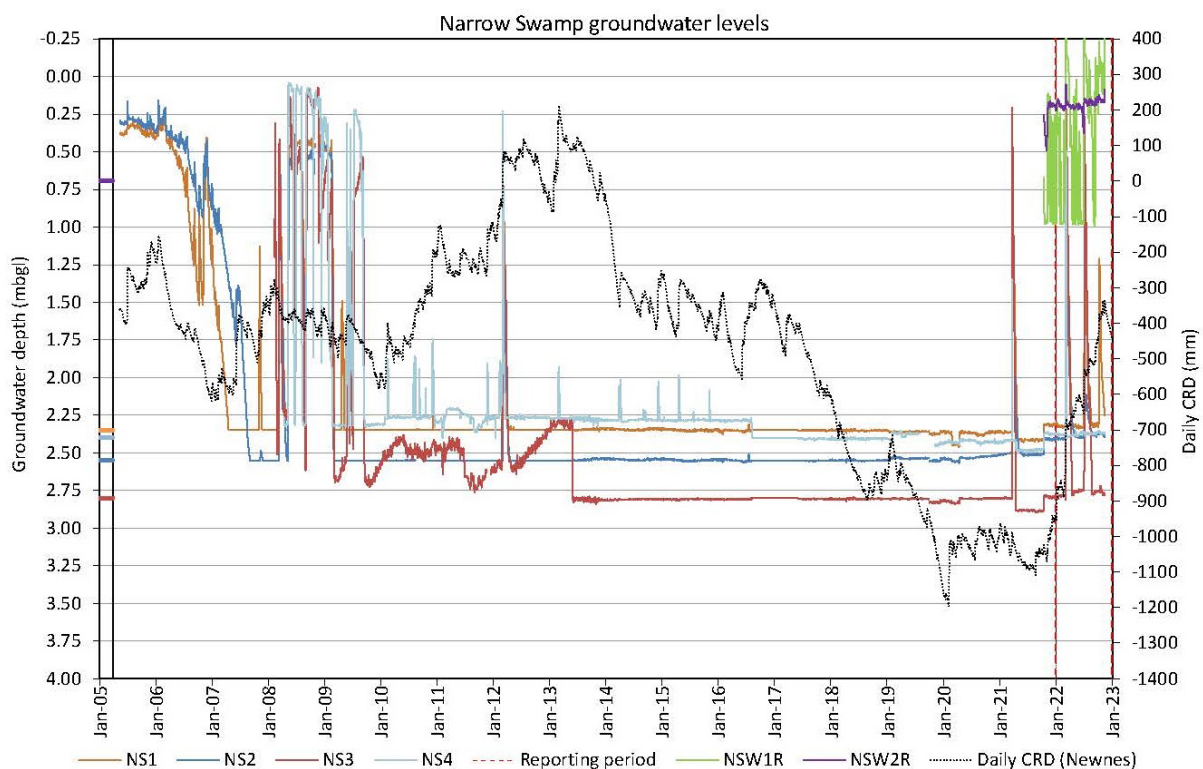


Figure 7-12: Narrow Swamp Groundwater Levels

Long Swamp

The hydrograph for Long Swamp is presented as **Figure 7-13**. 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.

Historically, groundwater levels at all monitoring sites typically fluctuate immediately and direct response to rainfall recharge. The base groundwater level at LS5 fluctuates more compared to CS4 and LS6.

During the reporting period, groundwater levels at CS4 and LS6 remained relatively stable with direct and immediate increases in groundwater level as a response to rainfall recharge. The groundwater level at LS5 also increased in immediate response rainfall recharge, with a longer groundwater level decay.

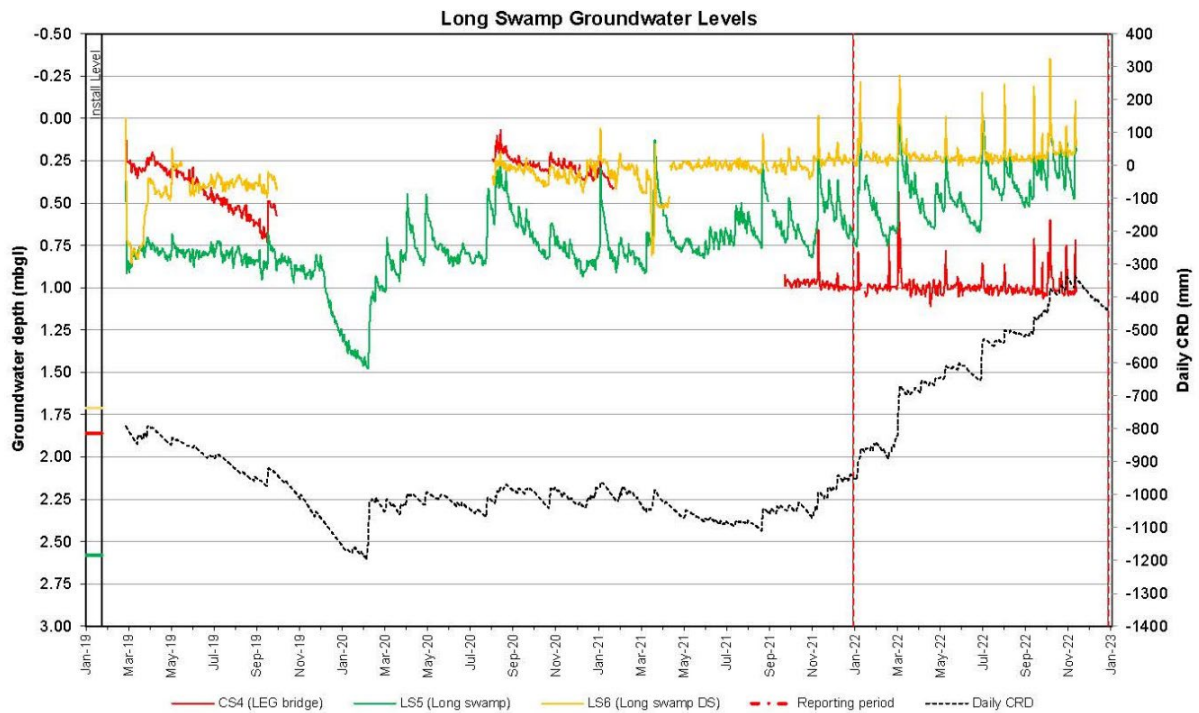


Figure 7-13: Long Swamp Groundwater Levels

Coxs River Swamp

The hydrograph for Coxs River Swamp is presented as **Figure 7-14**. Coxs River Swamp is monitored by CS2 and CS3, which were installed September 2019.

Historically, CS2 and CS3 were dry until February 2020 and July 2020, respectively, and have maintained stable groundwater levels since. This increase in groundwater levels is likely a direct response to the increasing CRD trend.

During the reporting period, groundwater levels at CS2 and CS3 have remained relatively stable at or just below ground surface, with minor fluctuations in response to rainfall.

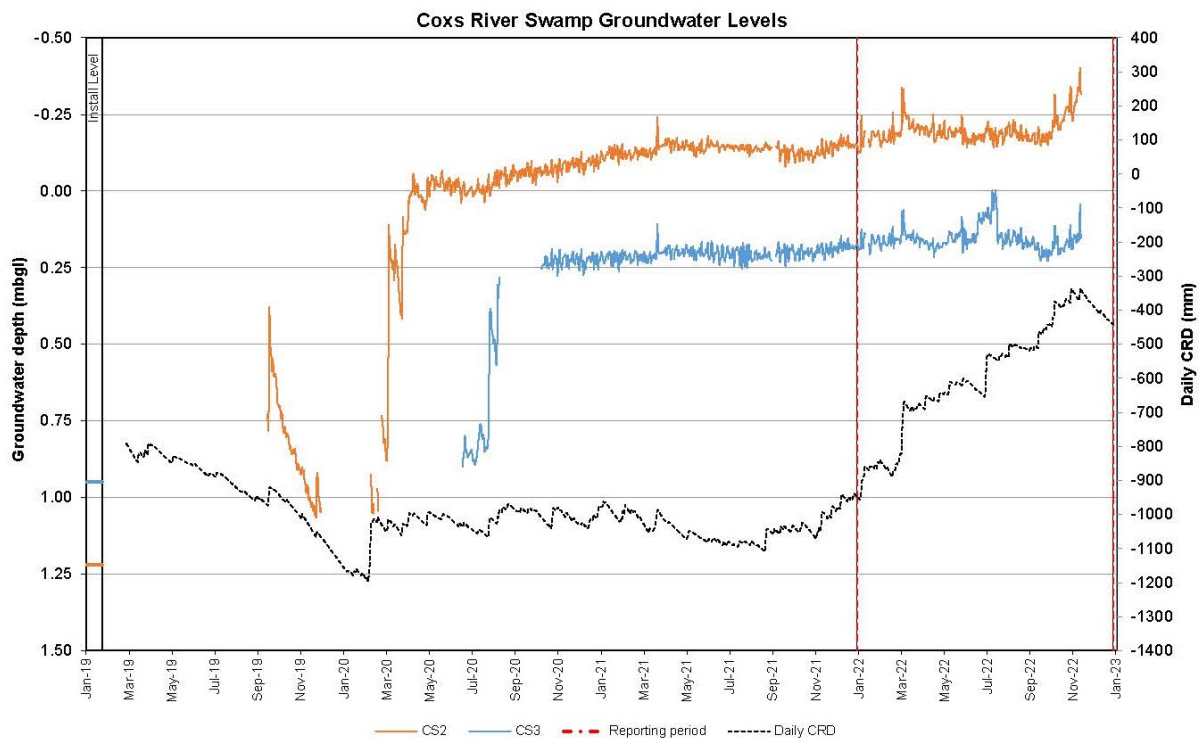


Figure 7-14: Cox River Swamp Groundwater Levels

7.4.3 Comparisons against Predictions

Groundwater water predictions are represented within the triggers established under the TARP of the approved *Angus Place WMP* (WMP, 2021). 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'.

Open standpipe piezometers displayed generally increasing groundwater levels, reflecting an attenuated and translated response to above average rainfall during the reporting period.

Vibrating Wire piezometric pressures were generally stable or increasing at most monitoring locations. Data from some VWP's was not available from May 2022 due to degraded access track conditions.

Swamp groundwater levels at reference sites were generally stable. Groundwater levels at monitoring locations that are typically dry and previously undermined, varied with rainfall.

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 *Angus Place WMP* (WMP, 2021). As noted earlier above, during 2022 automated groundwater level monitoring

was collected (refer figures presented in previous sections above providing long term results), however manual sampling for groundwater quality was not able to be undertaken during 2022 due to access limitations following significant weather events. 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 (5) Annual Review reporting periods. Since 2018, 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				
	2018	2019	2020	2021	2022
Groundwater related non compliances	0	0	0	0	0

7.4.5 Implemented / Proposed Improvements

A review of the Water Management Plan is to be undertaken in 2023 to focus monitoring on current and future planed operations. Location, timing and analysis will be reviewed for all monitoring sites to ensure that valid comparable data is collected to inform the identification of any potential for mining related impacts.

The revised management plan will be provided to the secretary for approval in accordance with the consent.

8 REHABILITATION

During the 2022 reporting period, Angus Place transitioned from managing rehabilitation in accordance with the Angus Place *Care and Maintenance Mining Operations Plan May 2016-April 2023* (MOP, Amendment D), to the new *Rehabilitation Management Plan* (RMP, 29 July 2022), which commenced on 1 August 2022. For clarity, the new RMP integrated any previous rehabilitation management plans and strategies for the site, including the former *Ventilation Facility Rehabilitation Management Plan* (Rev 1.1 July 2013) prepared in accordance with former Condition 39 of MP06_0021, which was repealed by MOD7 rehabilitation reforms.

Subsequently, rehabilitation activities and monitoring for the 2022 Annual Review is presented in light of the new RMP. A description of the proposed rehabilitation management and monitoring activities is provided in Part 6 and Part 8 of the RMP, available on the Angus Place website.¹⁶

For completeness, it is noted that the introduction of detailed annual rehabilitation reporting required under revised Mining Lease conditions (*'Annual Rehabilitation Report'*, in accordance with 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.

Rehabilitation is also undertaken generally in accordance with the Angus Place *Mine Closure Strategy* in accordance with Condition 36, Schedule 3 of MP06_0021.

Additionally, in accordance with 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 is under preparation and will be submitted during the next reporting period.

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 has 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 Part 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 toward these are discussed in the following sections below.

¹⁶ www.centennialcoal.com.au/operations/springvale/

8.1.2 Approved Final Landform and Land Use Objectives

The approved final landform for Angus Place aims to provide *a low maintenance, geotechnically stable and safe environment that is commensurate with the surrounding area.*

The intended post-mining land use is native woodland that is consistent with surrounding lands and pre-mining conditions.

Some water bodies and drainage structures will be maintained to manage surface water flows and provide water resources for native fauna. Some existing internal roads will be retained to allow for access to manage the final landform and to serve as fire breaks.

The long-term rehabilitation objective, as stated within the RMP, is:

- Final landforms are safe, stable, non-polluting and free draining;
- Remove all infrastructure that does not have any post mining
- If required, preserve surface infrastructure that is heritage listed;
- Re-establishing land disturbed by the operation to an appropriate final land use;
- Provide habitat for fauna and corridors for fauna movement within the final landforms;
- Improve the visual amenity of the area;
- Not preclude other potential post mining land use options that may be considered feasible in the detailed mine closure planning process; and
- Monitor rehabilitation success in terms of physical and biological parameters.

The post-mining land use has been determined through consultation and agreement with landowners and relevant stakeholders.

8.1.3 Rehabilitation Performance Criteria (RMP)

Rehabilitation performance criteria is provided within the RMP. The current monitoring program has been designed to monitor the progress of rehabilitation against the rehabilitation objectives/criteria developed for the RMP in accordance with Form and Way RMP requirements set by NSWRR.

Relevant objectives and completion criteria were further developed for all Centennial Coal operations in the *NSW Rehabilitation Reform Support Rehabilitation Monitoring Review and Proposed Method* (SLR 2022).

In accordance with relevant criteria, the rehabilitation monitoring focussed on the following key aspects:

- Vegetation composition - Characteristic native species of adjacent vegetation.
- Vegetation structure - Establishment of tree, shrub and groundcover species
- Ecosystem function.
 - Natural regeneration of native tree species.
 - Weed infestation, being the presence of 'priority' (formerly noxious) weeds, and high threat exotics (HTEs).
 - Soil chemistry and microbiology.
 - General stability of the rehabilitation areas.

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 2022 is presented in **Table 8-2** and **Figure 8-1**. Note, due to the transition to reporting requirements set by NSWRR, in accordance with the ‘Form and Way’ and the Annual Rehabilitation Report and Forward Programs, calculations for 2021 are not directly comparable with calculations for 2022 or forecasts for 2023.

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.

Table 8-1: Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual) 2021	This Reporting Period (Actual) 2022	Next Reporting Period (Forecast) 2023
A1. Total disturbance footprint- Surface Disturbance ¹⁷	N/A The transition to RMP reporting in 2022 is not directly comparable with 2021 reporting for Angus Place	64.29 ha	64.30
A2 Underground mining area		3339.96	3339.96
B. Total active disturbance ¹⁸		39.75 ha	39.75
C. Rehabilitation - Land being prepared for rehabilitation ¹⁹		0 ha	0 ha
D. Land under active rehabilitation - Ecosystem and land use establishment and development ²⁰		24.55 ha	0 ha
E. Completed rehabilitation ²¹		0 ha	0 ha

¹⁷ **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 DRE MOP/RMP Guidelines). Please note that subsidence remediation areas are excluded.

¹⁸ **Total active disturbance:** includes all areas requiring rehabilitation

¹⁹ **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 DRE MOP/RMP Guidelines)

²⁰ **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 DRE MOP/RMP Guidelines)

²¹ **Completed rehabilitation:** requires formal sign off from DRE that the area has successfully met the rehabilitation land use objectives or completion criteria

8.2.2 Rehabilitation Schedule

As an underground coal mine, infrastructure at Angus Place is required for the life of mine. Subsequently, land associated with key surface infrastructure will not become available for rehabilitation until the cessation of mining operations, with limited opportunity for progressive rehabilitation.

Mining is currently approved at Angus Place up until 2024 with an application underway for Angus Place West (refer **Section 1.2** of the *Annual Rehabilitation Report 2022 and Forward Program*).

There are no disturbance or rehabilitation activities associated with surface infrastructure planned over the next three years apart from minor exploration related rehabilitation as part of the exploration program/s.

Minor rehabilitation works associated with approved construction and/or exploration may be required. If such works are required they will be reported in the *Annual Rehabilitation Report and Forward Program*.

8.2.3 Rehabilitation Signoff

In 2022, 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 Building Restoration, Demolition or Removal

In 2022, the following construction activities were undertaken:

- Blast wall was constructed at the AP Bore 940 – however this was within the existing disturbance footprint, and hence no change to disturbance; and
- Monitoring Station was installed at LDP02 Dam with no changes to the existing disturbance footprint.

In 2022, no buildings were removed, demolished or restored.

8.2.5 Other Rehabilitation Works & Activities

Other rehabilitation activities undertaken during the reporting period included:

- **Rehabilitation Planning Activities** identified within the 2022 Annual Rehabilitation Report and Forward Plan included:
 - Planning progressed to establish a scope of works for Rehabilitation Strategy, required by MP06_0021 (Mod 7) to be submitted to be DPE in 2023;
 - 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.
- **Rehabilitation Management and Maintenance** identified within the 2022 Annual Rehabilitation Report and Forward Plan included a general site clean-up.

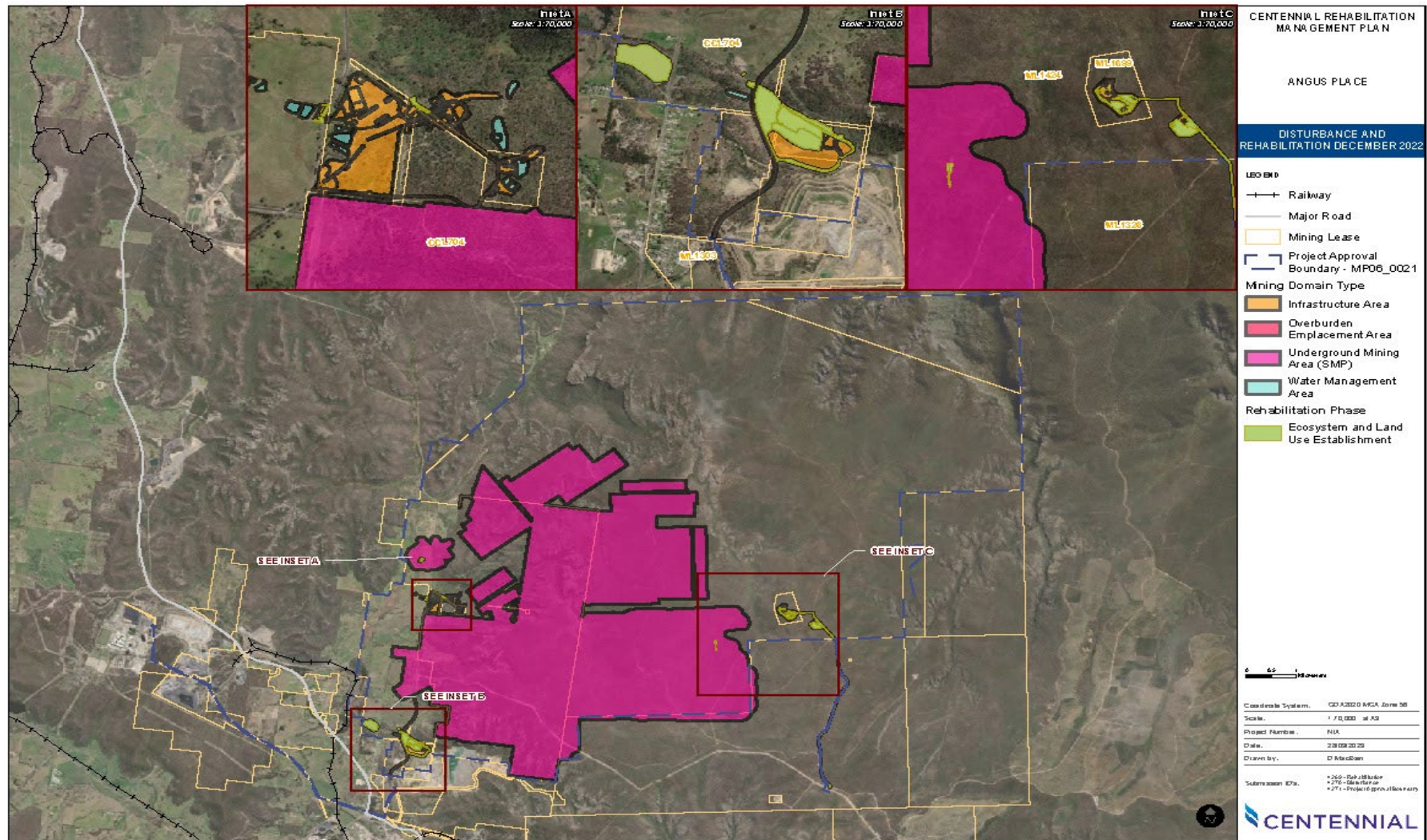


Figure 8-1: Disturbance and Rehabilitation as at December 2022

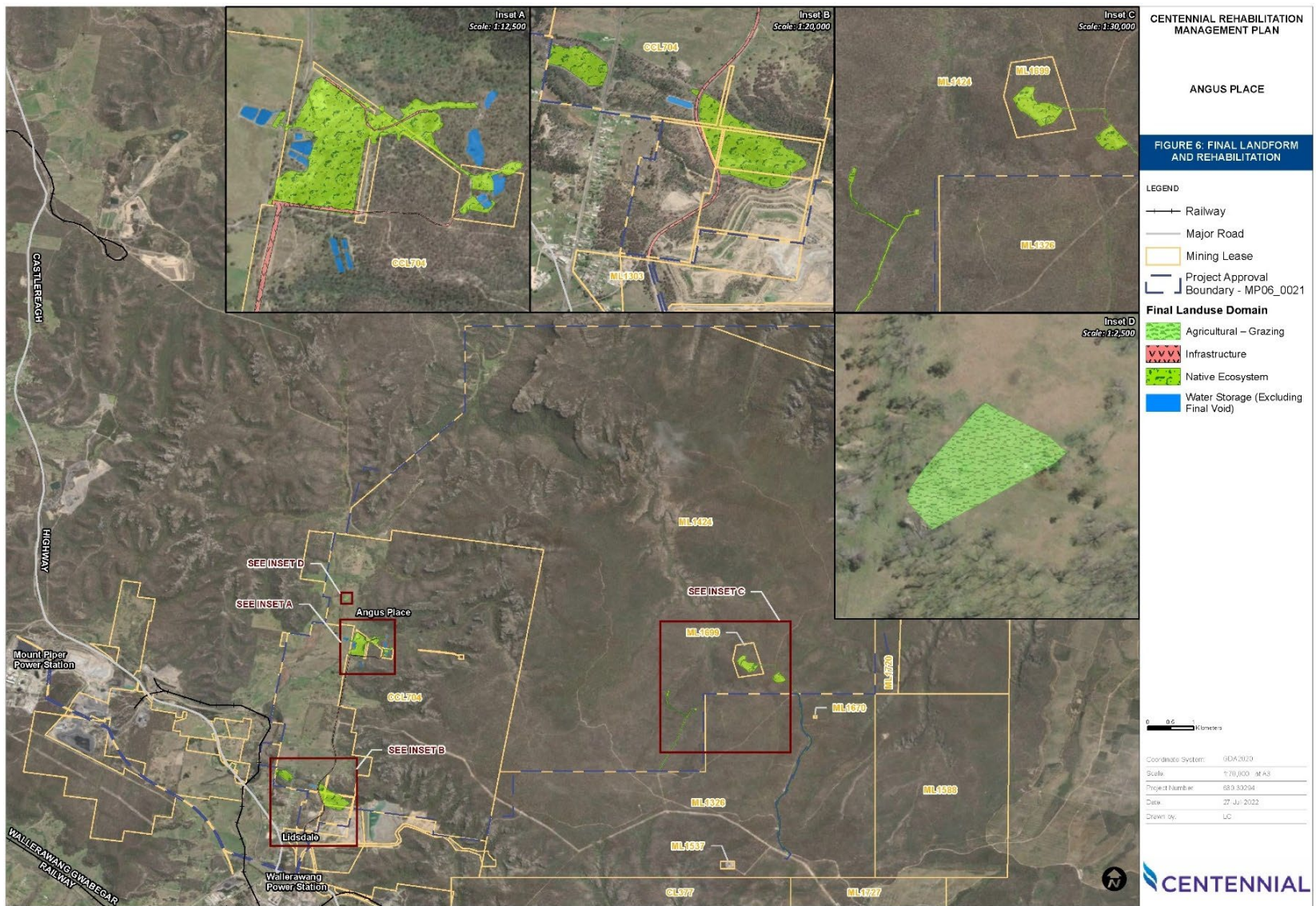


Figure 8-2: Final Landform and Rehabilitation (Source: RMP, July 2022)

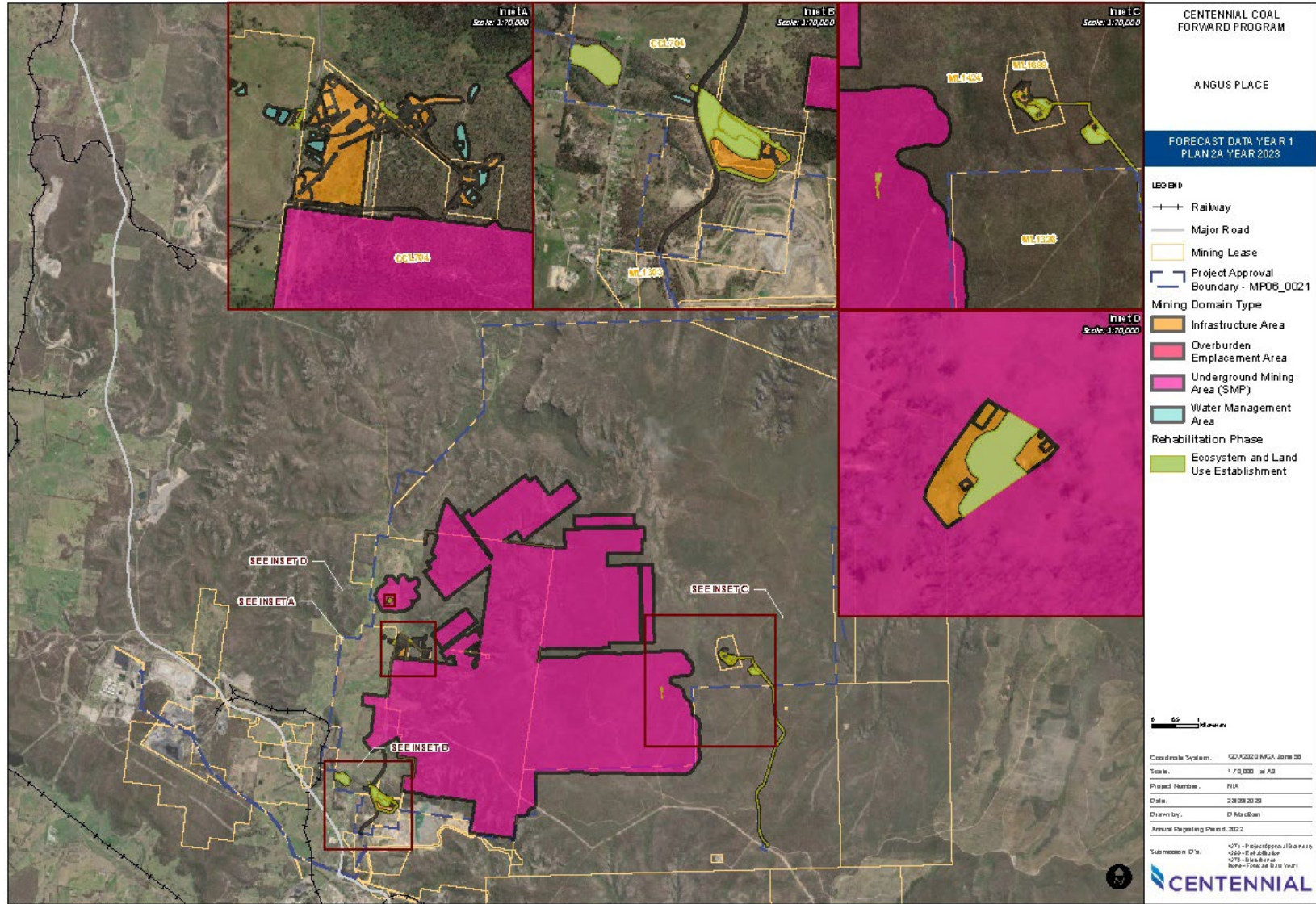


Figure 8-3: Rehabilitation 3 Year Forward Plan – Year 1 (2023)

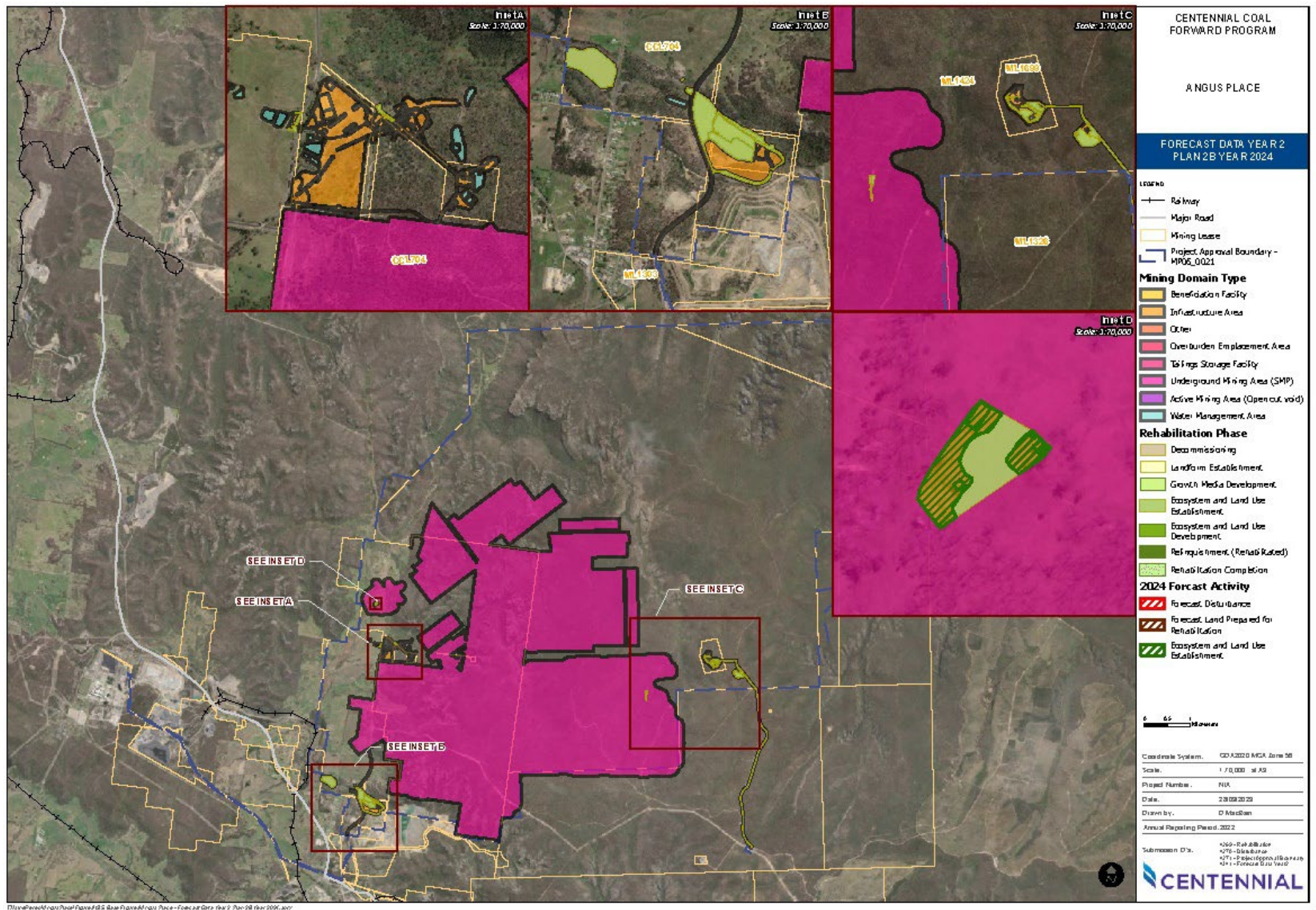


Figure 8-4: Rehabilitation 3 Year Forward Plan – Year 2 (2024)

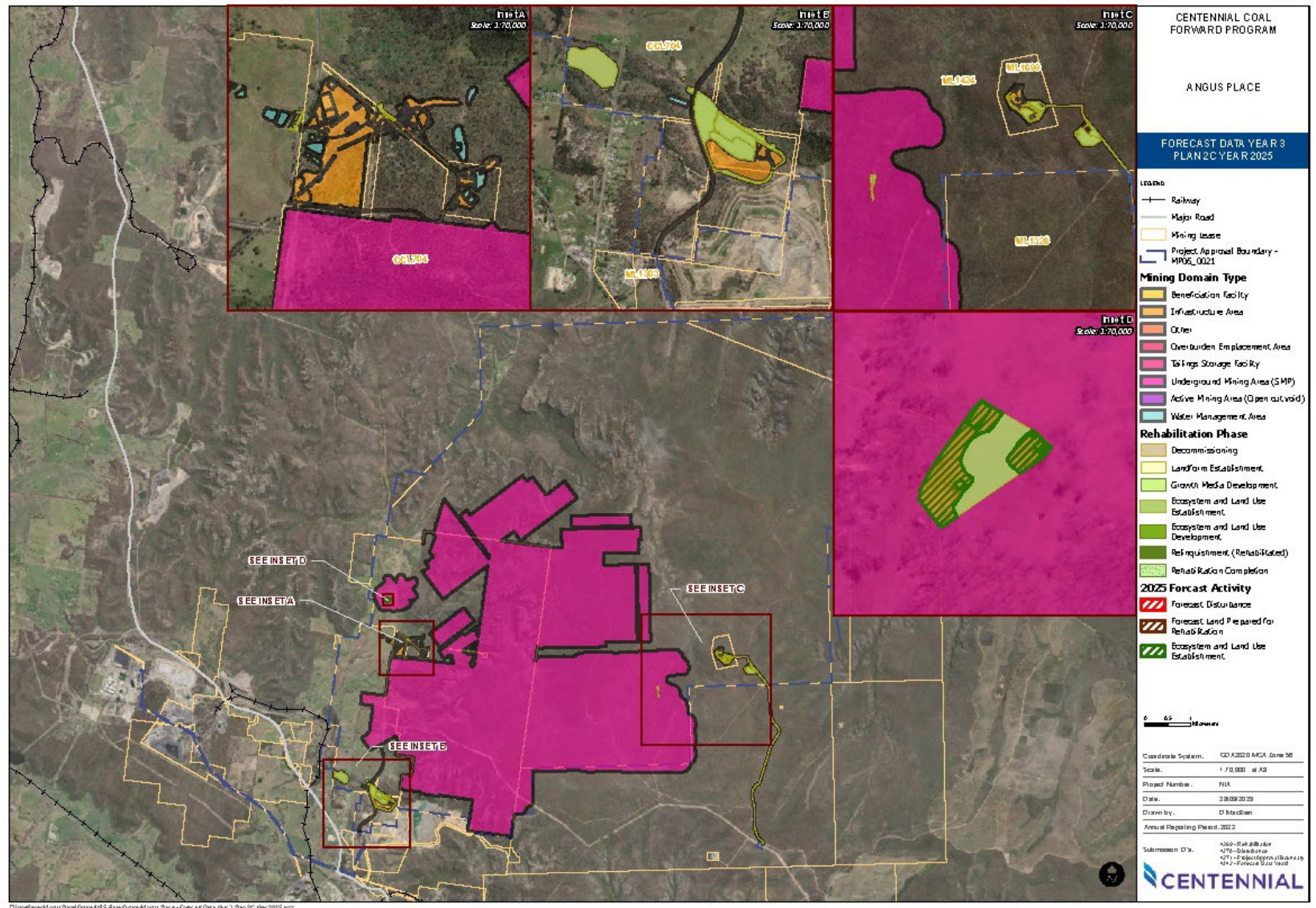


Figure 8-5: Rehabilitation 3 Year Forward Plan – Year 3 (2025)

8.3 REHABILITATION MONITORING

In accordance with the regulatory reforms introduced by the NSW Government during the reporting period (see **Section 3**), in 2022 rehabilitation monitoring at Angus Place transitioned to being undertaken in accordance with the *Rehabilitation Management Plan (RMP)*, prepared in accordance with Condition 37, Schedule 3 of MP06_0021 and the conditions of relevant Mining Leases. Section 8 of the RMP details rehabilitation monitoring and reporting requirements.

During 2022 a *Rehabilitation Review* was undertaken by Centennial to establish a site-specific monitoring program to support the ongoing refinement of rehabilitation objectives and completion criteria assessment, and alignment with the new associated guidelines and rehabilitation reforms under which the RMP was prepared. This included transitioning Centennial operations to the *NSW Biodiversity Assessment Method ('BAM')* (OEH 2020) to align with new rehabilitation objectives and completion criteria assessment as detailed in Section 4 of the RMP.

Angus Place currently has limited existing rehabilitation and infrastructure will be retained LOM. Opportunities for progressive rehabilitation are currently limited, and monitoring is currently primarily associated with 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 (July 2022) 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 8-6**.

8.3.1 Summary of Rehabilitation Monitoring

This section presents the results of rehabilitation monitoring undertaken during the 2022 reporting period, noting the transition from 1 August 2022 to the *Rehabilitation Management Plan* (Part 8 – Rehabilitation Monitoring), from the *Care and Maintenance Mining Operations Plan* (Part 8 Rehabilitation, Monitoring and Research).

Angus Place has very limited existing rehabilitation and infrastructure will be retained 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 6.6.2.3**). Research commenced in 2014 and is currently led by the Royal Botanic Gardens Domain Trust (RBGDT) 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. A further round of planting occurred in 2022. Genetic samples from the *Persoonia hindii* re-planting and translocation trial were collected in December 2022 and are currently under analysis.

8.3.2 Recommended Actions Arising from 2022 Annual Rehabilitation Monitoring

Rehabilitation maintenance and corrective actions are identified in Section 2.2.3 of the *2022 Annual Rehabilitation Report and Forward Program* available on the Angus Place website.

There 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 trailing relocation methodologies with respect to *Persoonia hindii*. Survival rates from the trial were last assessed in 2018.

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 approved WR-BOS. Propagation/translocation trials have been progressively implemented since inception of the program and are ongoing as detailed in **Section 6.6.2.3**.

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

8.5 PROPOSED ACTIONS IN NEXT REPORTING PERIOD

During 2023, Angus Place will:

- Review results of DNA genetic testing of *Persoonia hindii* sampling undertaken in December 2022;
- Pursue approval of the revised *Western Region Biodiversity Management Plan*.
- Continue implementation of the new RMP (July 2022).

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 2022 biodiversity monitoring, as detailed in **Section 6.6**.

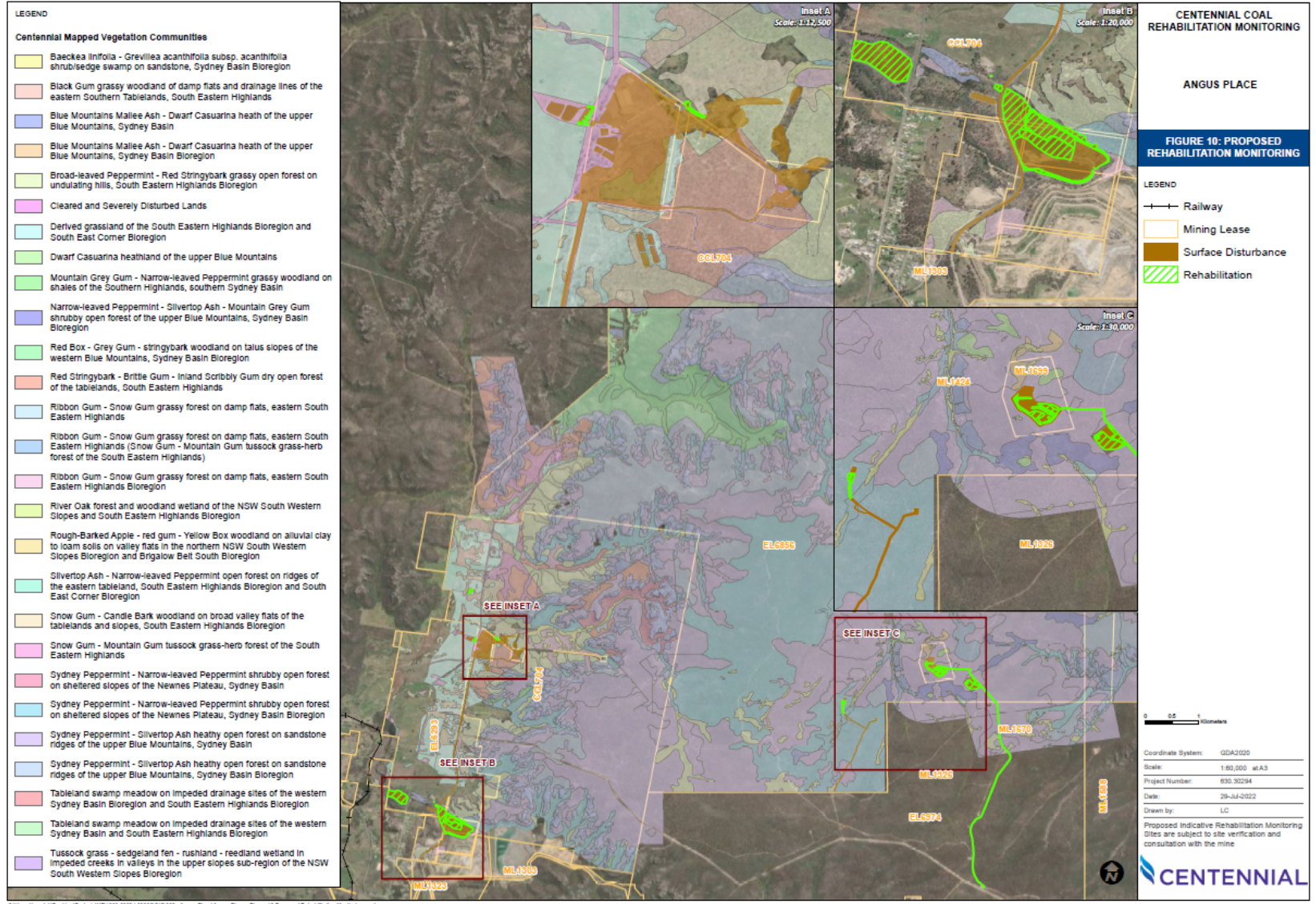


Figure 8-6: Rehabilitation and Proposed Monitoring (RMP, July 2022)

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 May, August and November 2022. Representatives of the Western community/communities, appointed community representatives, relevant government organisations and company representatives attended CCC meetings. A detailed presentation was provided to attendees at each CCC meeting on the current operations, update on key projects, the environmental performance of the operation, and upcoming activities.

Key agenda items discussed in 2022 included the Angus Place West Project, environmental performance and notifiable incidents.

9.2 COMMUNITY DONATIONS AND SPONSORSHIP

Angus Place continues to support the local community through various donations and sponsorship avenues to community activities, groups and associations, including:

- Partnership with the Royal Botanical Gardens with regards to the *Persoonia hindii* ACARP research project detailed in **Section 6.6.2.3**.

9.3 COMMUNITY COMPLAINTS

There was one community complaint received on 6 December 2022 regarding the extent of overgrown weeds including blackberries along the Wallerawang Haul Road. In response, Angus Place have arranged blackberry spraying to be undertaken in early 2023.

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

Table 9-1: Record of annual community complaints for 2022 to 2018

Community Complaints						
Year	Air	Water	Noise	Waste	Other	Total
2022	0	0	0	0	1	1
2021	0	0	0	0	1	1
2020	0	0	0	0	1	1
2019	0	0	0	0	0	0
2018	0	1	0	0	1	2

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 2022 reporting period.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the 2022 calendar year reporting period there were a total of six reportable incidents and non-compliances (excluding community complaints).

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 ²²	Overview of incident/non-compliance	Description of incident/non-compliance	Actions	Status of Actions
Non-Compliance 1	<p>EPL467 L2.1: Unauthorised discharge occurred at LDP003 on 28/10/22 Miscommunication with a subcontractor resulted in the incorrect pump being turned on and a discharge occurred.</p>	<p>Works Contractor started the pump at LDP003 resulting in a discharge occurring. It is estimated that 1.5ML was pumped out over 6.5 hours. Contractor had misinterpreted instructions in an email, confusing the names of dams. Causes included change of staff and dams not clearly sign posted. The error was not detected until four days later. No sampling was required in accordance with licence conditions.</p>	<ul style="list-style-type: none"> • Advised Contractor and Angus Place Staff, discussed accepted names of dams. Updates to plans and descriptions. • Signs to be installed at dams with updated dam names. • An inspection of the water course downstream from the discharge point did not identify any adverse impacts. • Instructions to subcontractors will have more information to confirm they know which dam/pump is being referred to. 	<ul style="list-style-type: none"> • Plans are updated and circulated • Signs on order.
Non-Compliance 2	<p>EPL467 M2.3, WMP: Failure to monitor TSS in water discharged at LDP003 on 10/1/22</p>	<p>Discharge occurred from 8 January to 12 January during a period where the five-day rainfall was greater than 44mm. Sampling Contractor failed to indicate to laboratory that TSS and TDS needed to be analysed on LDP003 sample for 10/1/22. Laboratory was unable to carryout tests after being notified of error..</p>	<ul style="list-style-type: none"> • Nil, no adverse impacts considered to have occurred. 	<ul style="list-style-type: none"> • Ensure a sample of sufficient volume is collected during every discharge. • Sampling Contractor has updated procedures. No further incidents.

²² See Compliance Status Key beneath **Table 1.2** for risk level, colour code and description.

Compliance ²²	Overview of incident/non-compliance	Description of incident/non-compliance	Actions	Status of Actions
Non-Compliance 3	<p>EPL467 M2.3, WMP: Failure to monitor required parameters at EPL Point 18 on 17/1/22, 3/2/2022</p>	<p>An insufficient sample was collected to conduct the analysis on all the parameters listed in M2.3. The monitoring bore is approximately 300m deep. The Sampling Contractor had difficulties using an appropriate method to carry out purging and sample collection. The problem complicated by a water depth logger in the bore as well.</p>	<ul style="list-style-type: none"> • No adverse impacts considered to have occurred. • A Hydro sleeve has been placed in the bore for future sampling (See other noncompliance that the bore was not accessible again in 2022). • The monitoring point is associated with the Temporary Water Treatment Plant and associated discharges which has since been removed from the EPL. 	<ul style="list-style-type: none"> • Centennial has an independent report recommending removing this monitoring point from the EPL.
Non-Compliance 4	<p>EPL467 M2.3, WMP: Failure to monitor required # samples in accordance with M2.3 at EPL Point 18 on 10 occasions March-Dec 2022.</p>	<p>Monitoring samples were unable to be collected at EPL Point 18 because sampling location was inaccessible due to rainfall and road conditions. Point 18 is located on Newnes Plateau on a remote, difficult to access track. The track became impassable due to wet weather and fallen trees during 2022.</p>	<ul style="list-style-type: none"> • No adverse impacts considered to have occurred. • Public access may not be restored in foreseeable future. Road repairs are National Parks and Wildlife Service responsibility • The monitoring point is associated with the Temporary Water Treatment Plant and associated discharges which has since been removed from the EPL. 	<ul style="list-style-type: none"> • Centennial has an independent report recommending removing this monitoring point from the EPL.

Compliance ²²	Overview of incident/non-compliance	Description of incident/non-compliance	Actions	Status of Actions
Non-Compliance 5	<p>EPL467 M2.3, WMP:</p> <p>Failure to monitor required # samples in accordance with M2.3 at EPL Point 17 on 4 occasions 17/1, 23/5, 7/9, 1/12/2022.</p>	<p>Monitoring samples were unable to be collected at EPL Point 17 because access to sampling location was restricted.</p> <p>Access to Point 17 was restricted due to owner changing access arrangements and then from November due to a land slide and closure of Wolgan Valley Road for the foreseeable future - Residents access only to Wolgan Valley.</p>	<ul style="list-style-type: none"> • No adverse impacts considered to have occurred. • Public access unlikely to be restored in foreseeable future. Road repairs are Lithgow City Council responsibility. • The monitoring point is associated with the Temporary Water Treatment Plant and associated discharges which has since been removed from the EPL. 	<ul style="list-style-type: none"> • Centennial has an independent report recommending removing this monitoring point from the EPL.
Non-Compliance 6	<p>EPL467 M2.3, WMP:</p> <p>Failure to monitor required # samples in accordance with M2.3 at EPL Point 16 on 3 occasions 1/3, 7/4, 1/12/2022.</p>	<p>Failure to monitor in accordance with M2.3 at EPL Point 16.</p> <p>Monitoring samples were unable to be collected at EPL Point 16 because the sampling location was inaccessible due to rainfall and road conditions. Point 16 is located on Newnes Plateau on a remote, difficult to access track. The track became impassable due to wet weather and fallen trees.</p>	<ul style="list-style-type: none"> • No adverse impacts considered to have occurred. • Road repairs are National Parks and Wildlife Service responsibility. • The monitoring point is associated with the Temporary Water Treatment Plant and associated discharges which has since been removed from the EPL. 	<ul style="list-style-type: none"> • Centennial has an independent report recommending removing this monitoring point from the EPL.

Incident Notifications

MP06_0021 Notifiable Incident (mass movement) - Landslide at Kangaroo Creek, 3 June 2022

Angus Place Management was made aware of a landslide along the valley slopes of Kangaroo Creek on 3 June 2022. The date of the event was between 12 February (when aerial photography showed no landslide was present) and June when it was reported. Most likely to have been coincident with heavy rain in March. Notifications were provided to DPE, EPA, NSWRR, NPWS on 15 June 2022. DPE requested an investigation be carried out. DPE, EPA, NSWRR and NPWS attended a site inspection on 18 July 2022. Investigation undertaken if the landslide was directly associated with mining activity. The cause of the landslide is considered to be a natural erosion and weathering processes. Contributing factors assessed include extensive drought, bushfires, higher than average rainfall and vigorous regrowth – new tree sending down roots into existing fissures. The rock and debris have been left where they can to rest. There are no formed tracks or simple means of accessing the area, so no other barriers have been put in place. The report was submitted to DPE on 21 September 2022.

MP06_0021 Notifiable Incident (EMP TARP - Erosion) – Narrow Swamp: erosion in swamp sediments, 18 May 2022

Erosion in Narrow Swamp was notified through annual photo monitoring under the Longwall 900W 910 Subsidence Management Plan Environmental Monitoring Program. The date of the event was between 14 February (when aerial photography showed no erosion was present) and 18 May when it was reported. Most likely to have been coincident with heavy rain in March. Narrow swamp had been subjected to approved and licensed discharge of mine water from Springvale Mine from 1997 to 2012. Previous erosion had been investigated in 2010.

Notifications were provided to DPE, EPA RR, NPWS, DCCEEW, NSW Forestry on 24 and 25 May 2022. DPE requested an investigation be carried out. DPE, EPA, NSWRR, and NPWS attended a site inspection on 18 July 2022. Investigation undertaken if erosion was directly associated with mining activity. Re surveyed subsidence line found no further subsidence since mining finished in 2015. Causes of erosion unclear and believed to be related to changes in subsurface water flows related to mine water discharges in the past along with impacts from drought, fires and higher than usual rainfall. A significant change in vegetation structure may have also contributed to changes in sediment stability. All of these factors make it difficult to develop a rehabilitation plan that would be successful. The report was submitted report to DPE on 15 December 2022.

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 2023

Improvement/Other Actions
Completion and submission of the Angus Place West Project EIS
Review weed management practices particularly for Blackberry.
Prepare Rehabilitation Strategy (Mod 7)
Revise biodiversity and water monitoring obligations
Finalise relevant extraction and subsidence monitoring plans
Management Plan Revisions
Ongoing consultation with the DPE regarding the Western Region Biodiversity Management Plan
Revision of Water Management Plan
Revision of Landscape Management Plan
Condition Triggers
In accordance with Condition 36C in Schedule 3 of MP06_0021 a Rehabilitation Strategy for Angus Place will be prepared in consultation with Resources Regulator, BCD, DPE Water, WaterNSW, NSW National Parks and Wildlife Service, Council and the CCC and submitted to the Secretary for approval within 6 months of the date of determination of MP06_0021 MOD 7, or as otherwise agreed by the Secretary.
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

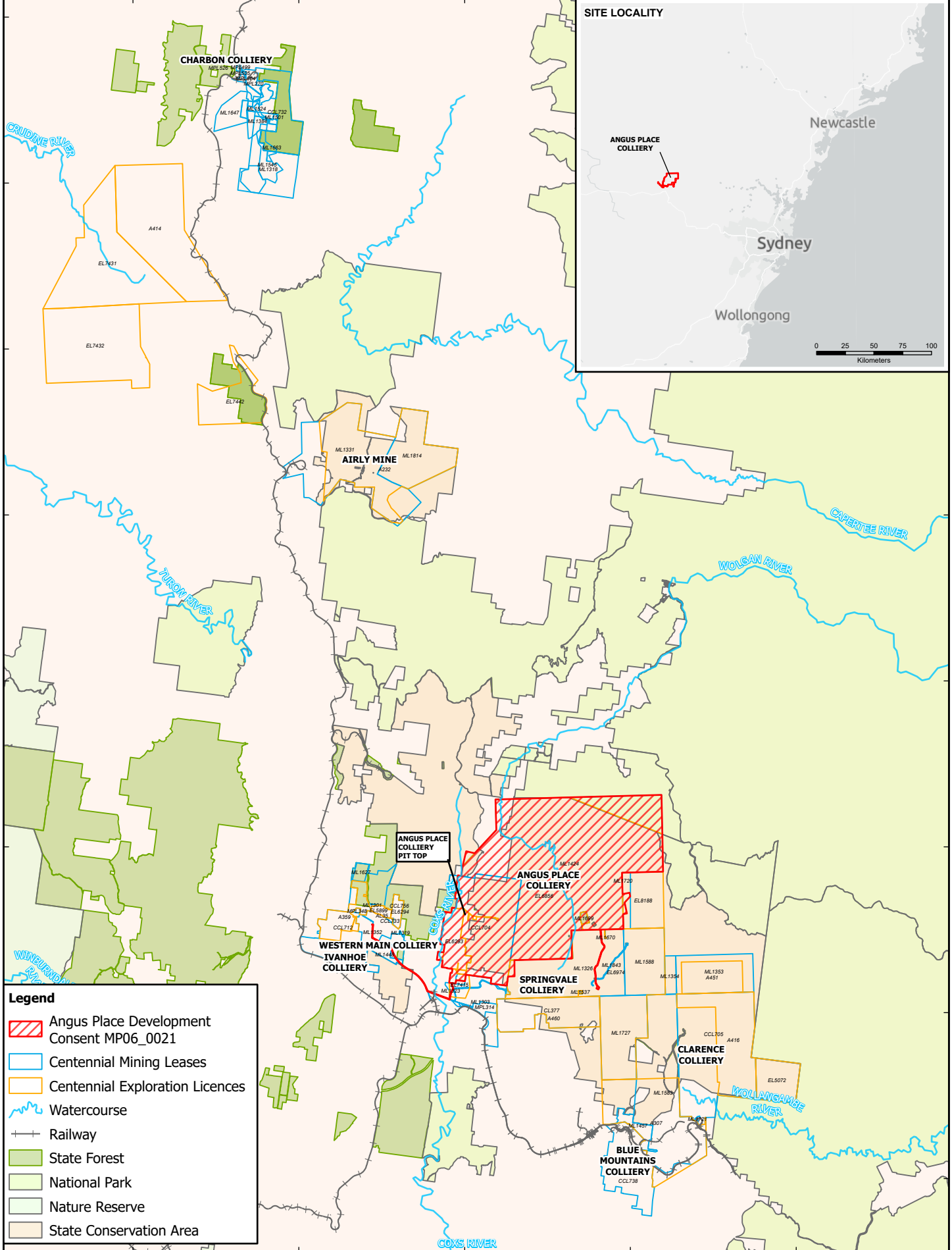
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PLANS

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Legend

- Angus Place Development Consent MP06_0021
- Centennial Mining Leases
- Centennial Exploration Licences
- Watercourse
- Railway
- State Forest
- National Park
- Nature Reserve
- State Conservation Area

PLOTFILE: N:\SHARED\GDA_2020\P\Plot File PDF\FASS10177_Figure 1 Angus Place Annual Review 2022 Regional Locality_20230426.pdf

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Coordinate System: GDA2020 MGA Zone 56

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

ANGUS PLACE COLLIERY
Annual Review 2022
Regional Locality
---Figure 1---

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Esri, HERE, Garmin, FAO, NOAA, USGS



PLOT FILE: NISHARED\GDA_2020\Plot File PDF\FASS10000_R1_Figure 3 Angus Place Annual Review 2022 Meteorological, Air Quality and Noise Monitoring Sites_20230510.pdf

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Coordinate System: GDA2020 MGA Zone 56

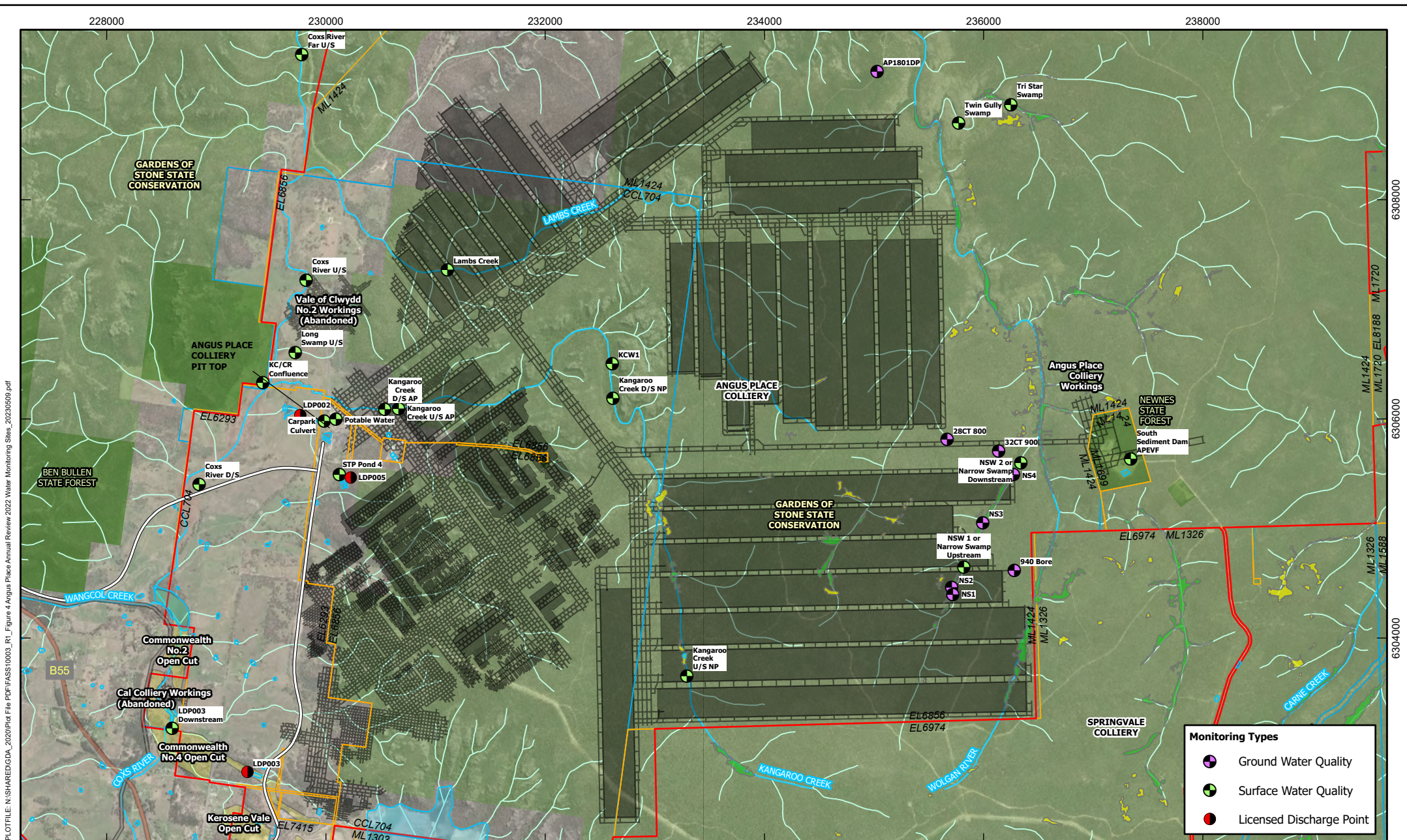
Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- State Conservation
- 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	D.MacBain
CHECKED	C.Flemming (GHD)
APPROVED	C.Flemming (GHD)
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Meteorological, Air Quality and Noise
Monitoring Sites
---Figure 3---

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PLOTFILE: N:\SHARED\GDA_2020\Plot File PDF\FASS10003_R1_Figure 4 Angus Place Annual Review 2022 Water Monitoring Sites_20230609.pdf

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Coordinate System: GDA2020 MGA Zone 56

Legend

- ▭ Angus Place Development Consent MPO6_0021
- ▭ Centennial Exploration Licences
- ▭ Centennial Mining Leases
- ▭ State Conservation
- ▭ 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

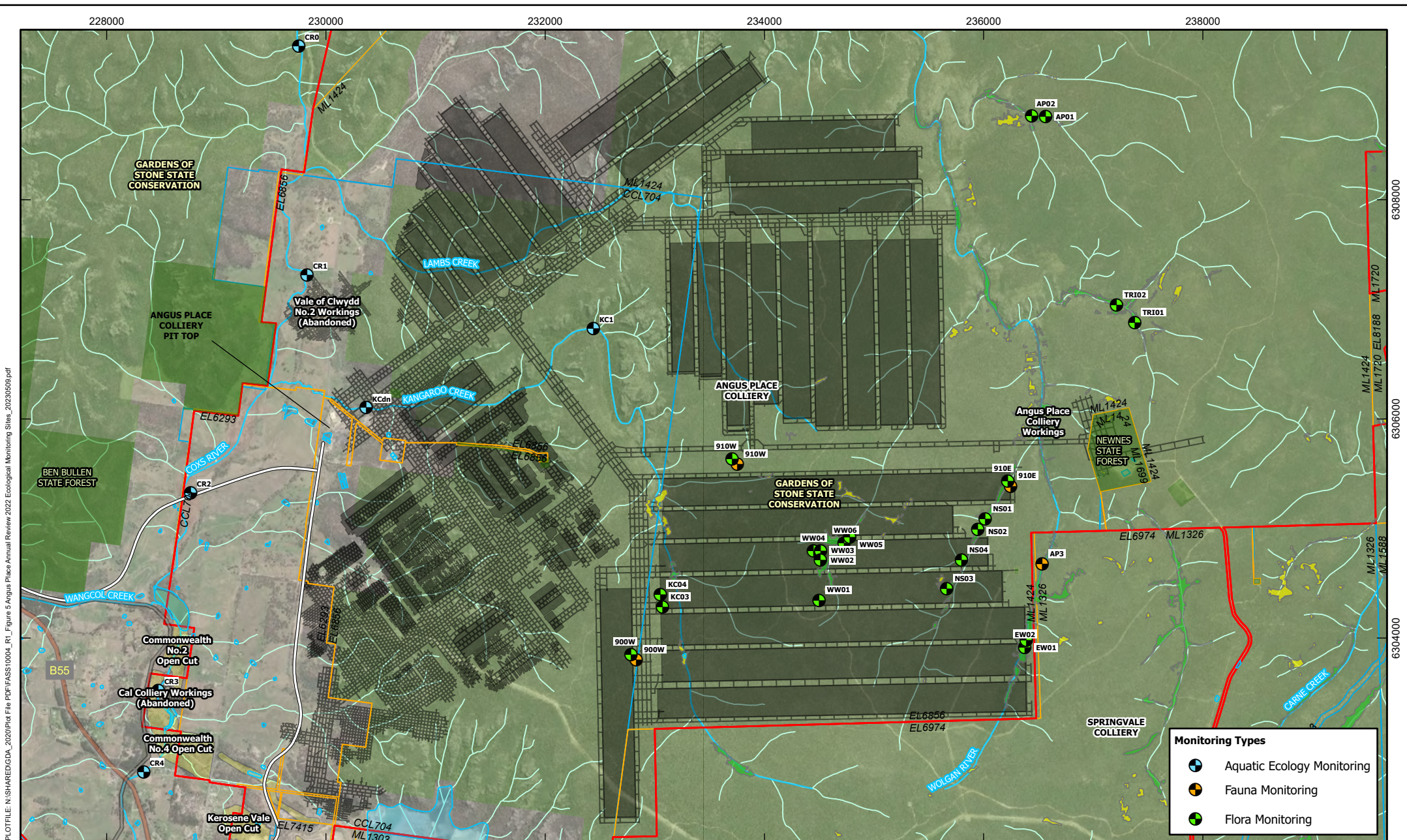
LOCATION	Angus Place
SEAM	Lithgow
DRAWN	D.MacBain
CHECKED	C.Flemming (GHD)
APPROVED	C.Flemming (GHD)
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Water Monitoring Sites
---Figure 4---

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Monitoring Types

- ⊕ Ground Water Quality
- ⊕ Surface Water Quality
- Licensed Discharge Point




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Monitoring Types

-  Aquatic Ecology Monitoring
-  Fauna Monitoring
-  Flora Monitoring















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Coordinate System: GDA2020 MGA Zone 56

Legend

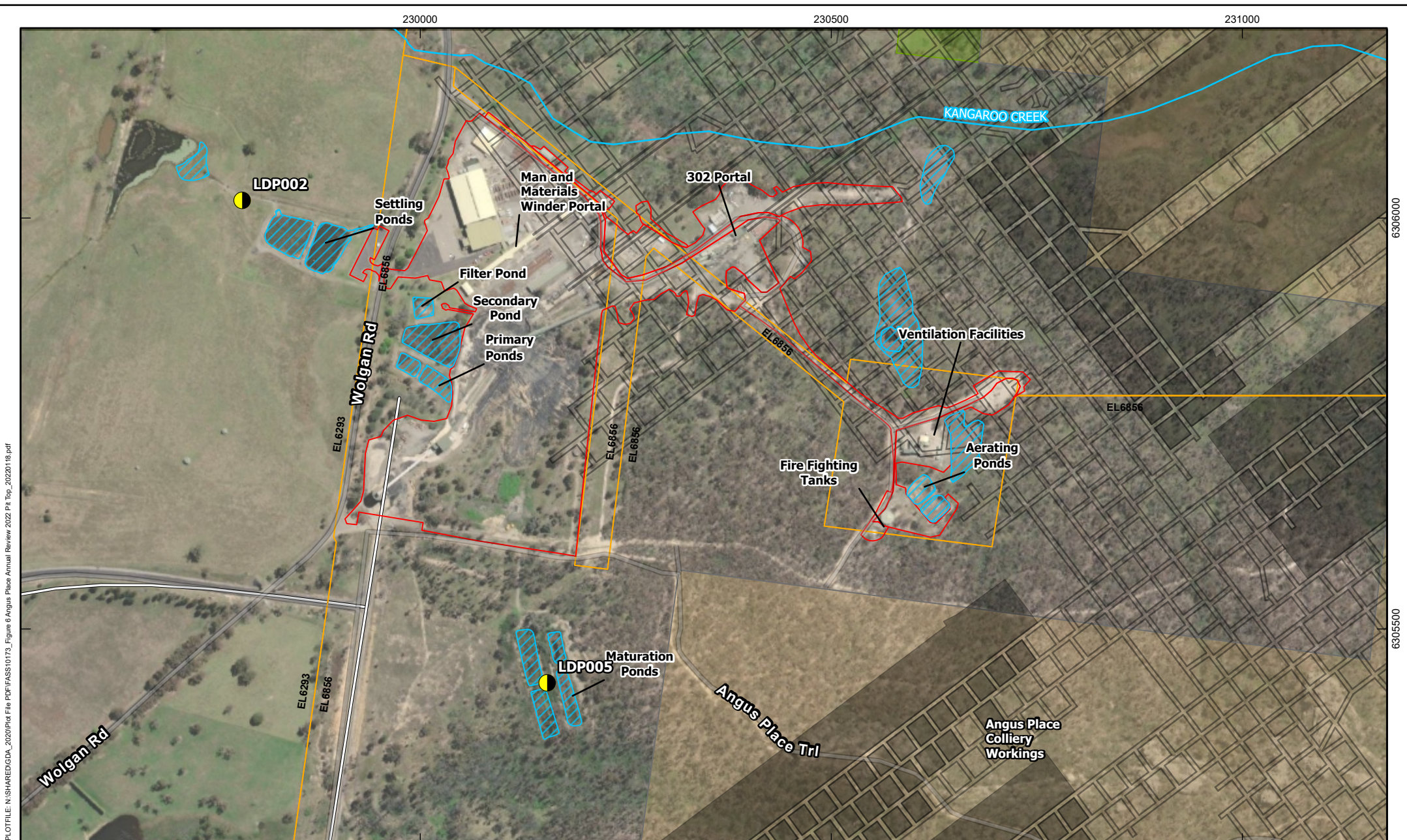
 Angus Place Development Consent MP06_0021	 Watercourse
 Centennial Exploration Licences	 Drainage Lines
 Centennial Mining Leases	 Dams
 State Conservation	 MU50 Newnes Plateau Shrub Swamp (EEC)
 State Forest	 MU51 Newnes Plateau Hanging Swamp (EEC)
 Open Cut Extents	 MU52 Newnes Plateau Rush - Sedge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

LOCATION	Angus Place
SEAM	Lithgow
DRAWN	D.MacBain
CHECKED	C.Flemming (GHD)
APPROVED	C.Flemming (GHD)
SCALE	1:45,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Ecological Monitoring Sites
---Figure 5---



DATE: 17/05/2023	FASS10004	R1
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PLOTFILE: N:\SHARED\GDA_2020\Pit File PDF\FASS\0173_Figure 6 Angus Place Annual Review 2022 Pit Top_20221118.pdf

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Coordinate System: GDA2020 MGA Zone 56

Legend	
	Centennial Exploration Licences
	Infrastructure Area
	Water Management Areas
	Western Haul Road
	Existing Underground Workings
	Watercourse
	Licence Discharge Points
	National Park
	Nature Reserve
	State Conservation Area
	State Forest

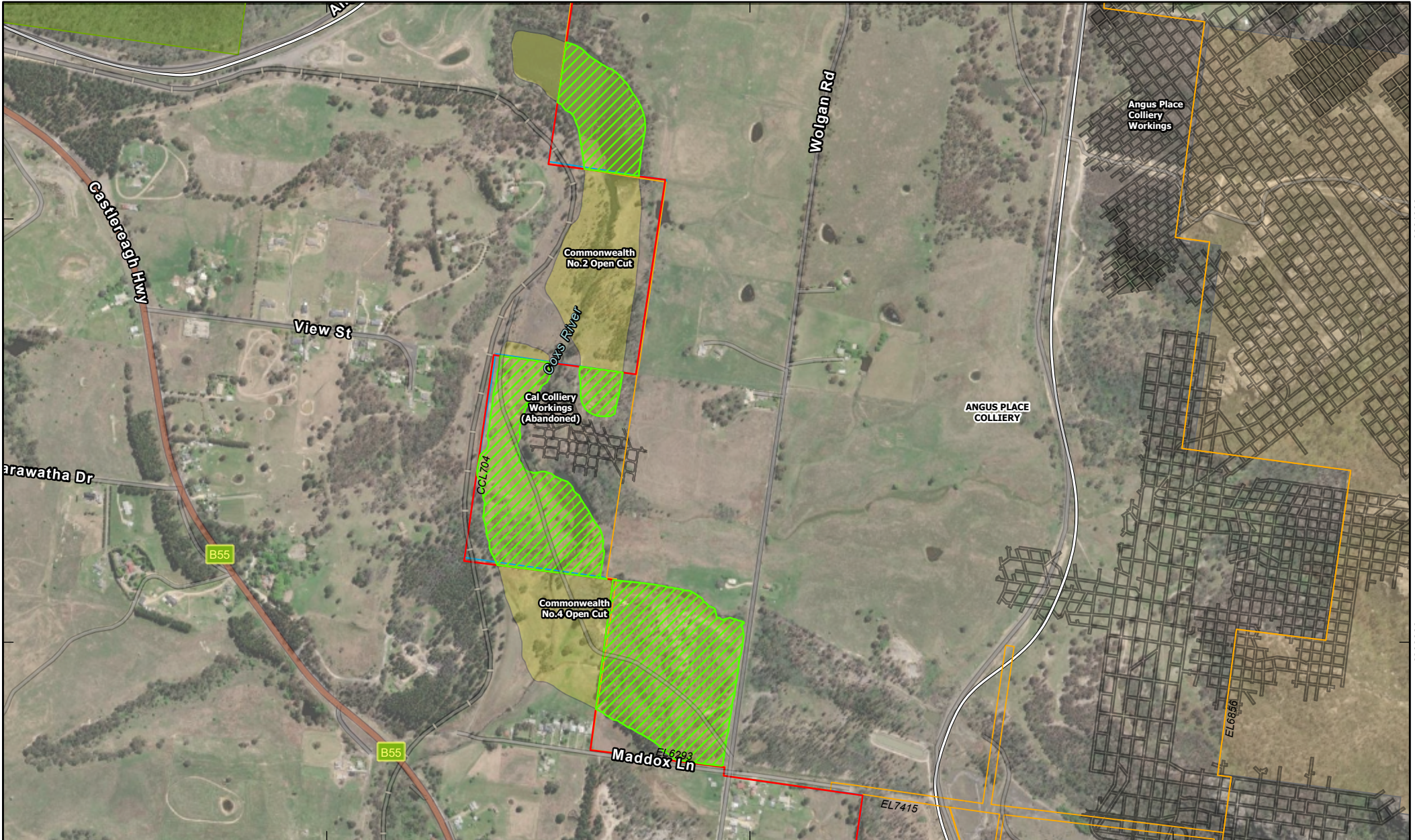
LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	M.Denley
APPROVED	M.Denley
SCALE	1:6,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Angus Place Pit Top
---Figure 6---

DATE: 26/04/2023	FASS10173	R0
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Coordinate System: GDA2020 MGA Zone 56

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

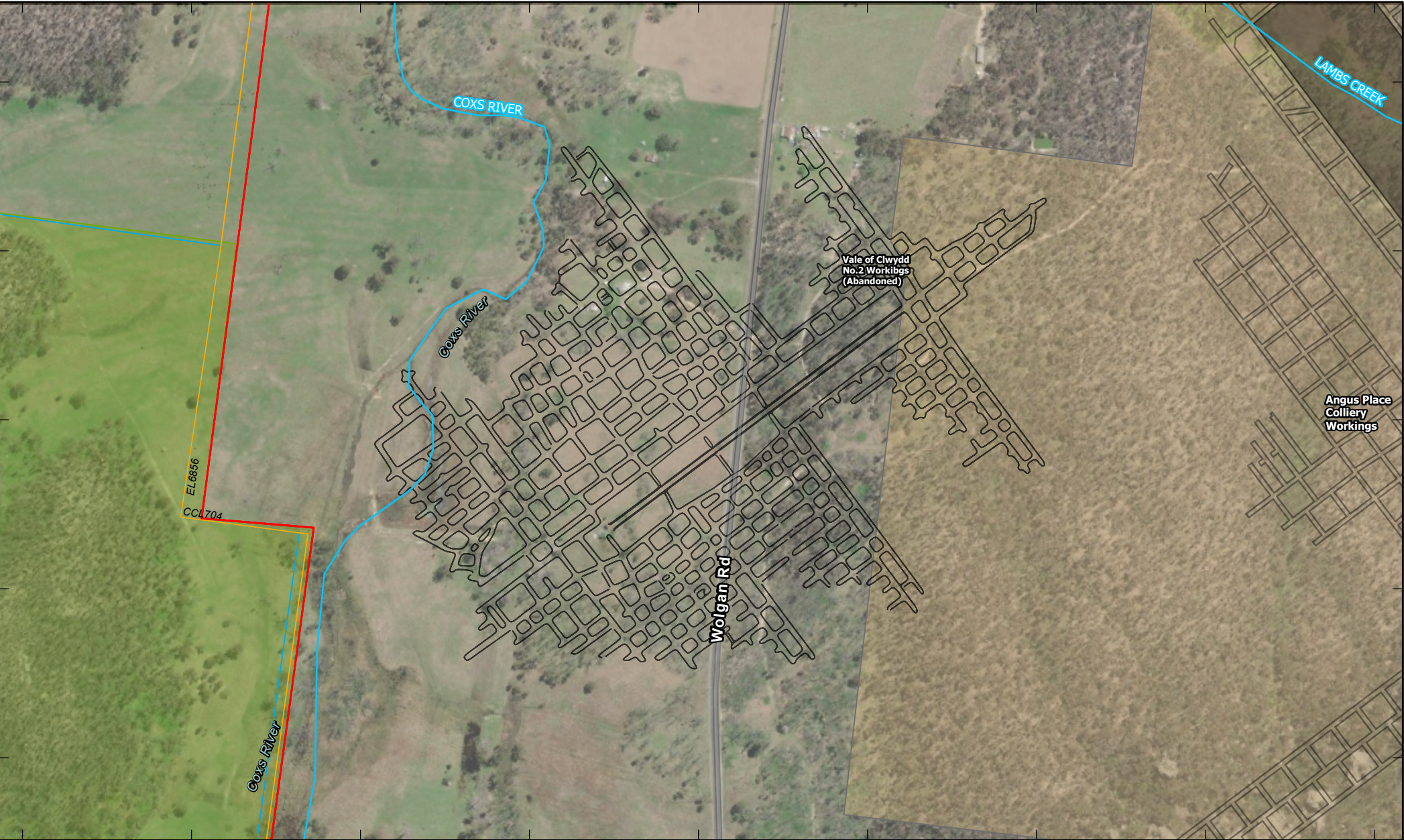
LOCATION	Angus Place
SEAM	Lithgow
DRAWN	N.Lloyd
CHECKED	M.Denley
APPROVED	M.Denley
SCALE	1:12,000 @ A4

ANGUS PLACE COLLIERY
Annual Review 2022
Commonwealth Colliery
 ---Figure 7---

DATE: 26/04/2023	FASS10172	R0
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Coordinate System: GDA2020 MGA Zone 56

Legend

- Angus Place Development Consent MP06_0021
- Centennial Exploration Licences
- Centennial Mining Leases
- Existing Underground Workings
- ~ Watercourse
- National Park
- Nature Reserve
- State Conservation Area
- State Forest

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

ANGUS PLACE COLLIERY
Annual Review 2022
Vale of Clwydd No.2 Colliery
---Figure 8---

DATE: 26/04/2023	FASS10171	R0
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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
<p>MP06_0021 Schedule 5 Condition 3</p>	<p>3. <i>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.</i></p> <p><i>This review must:</i></p> <p>(a) <i>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;</i></p> <p>(b) <i>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</i></p> <ul style="list-style-type: none"> <i>• the relevant statutory requirements, limits or performance measures/criteria;</i> <i>• the monitoring results of previous years; and</i> <i>• the relevant predictions in the EA;</i> <p>(c) <i>identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;</i></p> <p>(d) <i>identify any trends in the monitoring data over the life of the project;</i></p> <p>(e) <i>identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</i></p> <p>(f) <i>describe what measures will be implemented over the next year to improve the environmental performance of the project.</i></p>	<p>This Document</p>
<p>MP06_0021 Schedule 3 Condition 9</p>	<p>9. <i>The Water Balance must:</i></p> <p>(a) <i>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</i></p> <p>(b) <i>provide for the annual re-calculation of the water balance and its reporting in the Annual Review.</i></p>	<p>Section 7.2</p>
<p>MP06_0021 Schedule 3 Condition 21</p>	<p>21. <i>The Applicant must:</i></p> <p>(a) <i>implement all reasonable and feasible best practice noise mitigation measures;</i></p> <p>(b) <i>investigate ways to reduce the noise generated by the project, including noise generated from use of the Wallerawang power station haul road; and</i></p> <p>(c) <i>report on these investigations and the implementation and effectiveness of these measures in the Annual Review, to the satisfaction of the Secretary..</i></p>	<p>Section 6.2</p>

Approval	Requirement	Where addressed in Annual Review
<p>MP06_0021 Schedule 3 Condition 32</p>	<p><i>32. The Applicant must:</i> <i>(a) take all reasonable steps to minimise the waste (including coal rejects and tailings) generated by the development;</i> <i>(b) classify all waste in accordance with the Waste Classification Guidelines (EPA, 2014);</i> <i>(c) dispose of all waste at appropriately licensed waste facilities; and</i> <i>(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.</i></p>	<p>Section 6.9</p>

Appendix 2: Annual Environmental Monitoring Report (EMM, 2023): Water Monitoring Results and Trends

Angus Place Colliery Annual Environmental Monitoring Report

1 January 2022 to 31 December 2022

Prepared for Centennial Coal

January 2022

Angus Place Colliery Annual Environmental Monitoring Report

1 January 2022 to 31 December 2022

Centennial Coal

E211207AP RP#4

January 2022

Version	Date	Prepared by	Approved by	Comments
1	31 January 2022	Alex Bayer	Jonathon Tait	Final

Approved by



Alex Bayer

Hydrogeologist

31 January 2023

Ground floor 20 Chandos Street

St Leonards NSW 2065

PO Box 21

St Leonards NSW 1590

This report has been prepared in accordance with the brief provided by Centennial Coal and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of Centennial Coal and no responsibility will be taken for its use by other parties. Centennial Coal may, at its discretion, use the report to inform regulators and the public.

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1 Introduction

This Annual Environmental Monitoring Report (AEMR) has been prepared in accordance with the Angus Place Colliery Water Management Plan (GHD 2021).

EMM Consulting Pty Limited (EMM) was engaged by Centennial Angus Place Pty Ltd (Angus Place) to conduct bi-monthly surface water and groundwater monitoring during 2022. This report includes any relevant observations and, if required, makes recommendations pertaining to the current surface water and groundwater monitoring network.

1.1 Purpose of the report

This AEMR documents surface water and groundwater monitoring results in accordance with the *Angus Place Colliery Water Management Plan* (WMP) (GHD 2021).

1.2 Reporting period

This report reviews monitoring data from 1 January to 31 December 2022 (the reporting period).

1.3 Mining

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

1.4 Notable changes during the reporting period

No notable changes to the Angus Place groundwater and surface water monitoring network were made during the reporting period.

1.5 Report summary

In accordance with the WMP (GHD 2021), all groundwater and surface water monitoring sites were in Normal condition (Appendix D). The following points summarise observations during the reporting period:

- Swamp piezometers: swamp groundwater levels were generally stable, with the exception of fluctuating groundwater levels at monitoring locations that are typically dry due to above average rainfall observed during the reporting period.
- Soil moisture probes: soil moisture content typically fluctuated closer to ground level, while deeper sensors were more stable or slightly increasing, as a response to above average rainfall observed during the reporting period.
- Open borehole piezometers: groundwater levels were generally increasing, reflecting a delayed and subdued response to above average rainfall and subsequent recharge during the reporting period.
- Vibrating wire piezometers (VWP): piezometric pressures were generally stable or increasing at most monitoring locations. It should be noted that data from some VWPs were not available from May 2022 due to degraded access track conditions.

- Discharge surface water quality: surface water quality at the two licenced discharge points (LDP) were within the environmental protection license (EPL) 467 concentration limits during the reporting period, with the exception of two lower bound pH exceedances at LDP003 in March and October 2022, and a total suspended solids (TSS) exceedance at LDP002 in March 2022.
- Surface water quality and flow: watercourse surface water quality at Coxs D/S and KC/CR Confluence were within the site specific trigger vales (SSTV) during the reporting period, with the exception of two upper bound pH exceedances at KC/CR Confluence in June and September 2022. The surface water quality and flow observations at the watercourse monitoring locations without specified SSTVs generally remained consistent with historical observations. It should be noted that some monitoring locations were dry or inaccessible due to degraded access track conditions during the reporting period.
- Pit top surface water quality: pit top surface water quality observations generally remained consistent with historical observations.
- Swamp surface water quality and flow: Swamp surface water quality and flow observations generally remained consistent with historical observations. It should be noted that some monitoring locations were dry or inaccessible due to degraded access track conditions during the reporting period.

2 Existing environment

2.1 Climate

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). Rainfall for the reporting period (1 January 2022 to 31 December 2022) is summarised in Table 2.1. 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.

Observed rainfall at Newnes Prison Farm was greater than the long-term average rainfall values in all months, with the exception of February, June, November and December 2022. The annual total observed rainfall at Newnes Prison Farm was approximately 500 mm greater than the long-term total annual average. Observed rainfall at Lidsdale was greater than the long-term average rainfall values in all months, with the exception of June and December 2022. The annual total observed rainfall at Lidsdale was approximately 350 mm greater than the long-term annual total average.

The daily cumulative rainfall departure (CRD) for Newnes Prison Farm rain gauge is presented on Figure 2.1. The CRD trend shows below average rainfall between February 2019 and February 2020, followed by neutral rainfall conditions between February 2020 to August 2021. Above average rainfall conditions have been observed from August 2021 to November 2022.

Table 2.1 January to December 2022 climate summary

Month	Observed rainfall (mm)		Long term average rainfall (mm)	
	Newnes Prison Farm ¹	Lidsdale (BoM station 063132) ²	Newnes Prison Farm ¹	Lidsdale (BoM station 063132) ²
January	190.6	93.7	92.1	86.2
February	116.4	121.0	121.6	77.2
March	289.2	113.7	113.3	70.5
April	95.2	60.4	61.1	42.8
May	77.8	68.0	43.6	47.9
June	26.8	22.6	71.0	49.2
July	172.6	139.8	59.1	51.5
August	78.6	86.6	59.0	63.8
September	132.4	124.8	58.2	54.0
October	145.4	131.2	80.3	67.9
November	100.2	126.6	102.5	74.3
December	25.8	26.8	87.3	72.7
Total	1,451.0	1,115.2	949.2	758.0

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

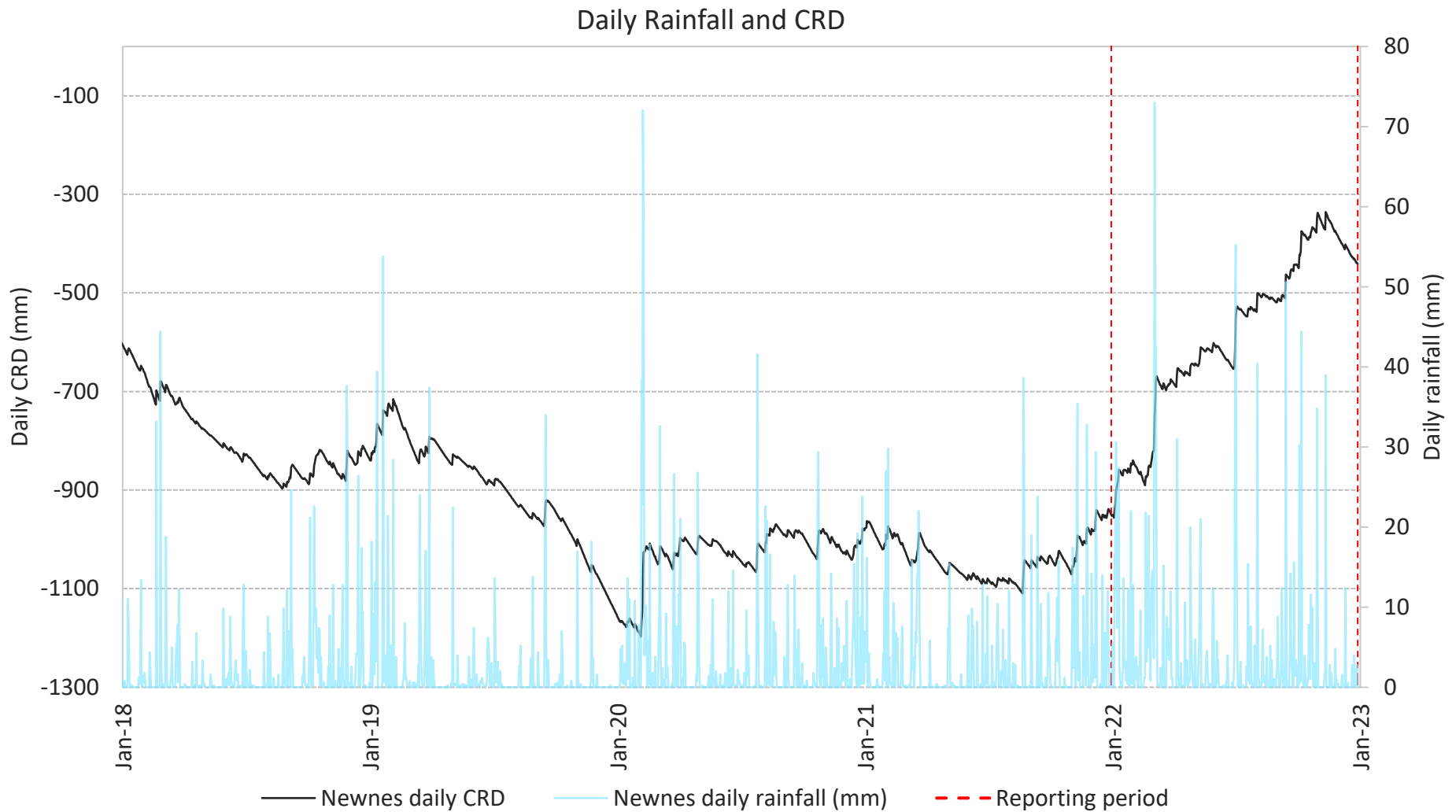


Figure 2.1 Daily cumulative rainfall deviation 1998 to present

2.2 Drainage and catchments

Angus Place is in the catchments of the Coxs River and Wolgan River. 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 hydrogeology 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; and
- deep aquifers, which are confined in the project area and includes the Lithgow Coal Seam.

2.3.1 Perched aquifer—Burralow Formation

The perched aquifer is hosted within the Triassic Narrabeen Group, Burralow Formation and comprises multiple discontinuous perched localised flow bands. The presence of seven (YS1 to YS6, including YS5a) distinct fine-grained claystone and siltstone units act as aquitards, or semi permeable layers, which impede rainfall percolation to the shallow aquifer, associated with the underlying Banks Wall Sandstone. The Burralow Formation is up to 110 m in thickness, whereby the base of the lowermost significant shale YS6 ply defines the base of the unit (McHugh 2018).

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 aquitards in the Burralow Formation (McHugh 2018).

2.3.2 Shallow aquifer—Banks Wall Sandstone

The shallow aquifer is a regional system in the Triassic Narrabeen Group, Banks Wall Sandstone and is generally 100 metres (m) in thickness (McHugh 2018).

The shallow aquifer is recharged by rainfall, overlying watercourses where it outcrops in incised gullies, and by vertical leakage from the Burralow Formation. Regional recharge may occur in areas of outcrop and sub-crop to the west and south-west of the study area (Jacobs 2019). Local discharge is inferred to occur in incised gullies that intercept the water table with some swamps coinciding with this occurrence (McHugh 2018). Regional discharge is inferred to occur to the north-east, where units outcrop in the scarp of the plateau.

Groundwater flow occurs primarily by interconnective fracturing, bedding planes and structural features such as lineaments and faults with some primary/pore porosity. The fracture system is the primary control of groundwater flow as the rock matrix has low permeability. The general groundwater flow direction is toward the north-east, which is consistent with the dip of the strata.

At the base of the shallow aquifer is the MYC. This unit comprises a sequence of claystone bands interbedded with siltstone and sandstone that form an aquitard, impeding vertical connectivity between the shallow and deep aquifers. The MYC is a regional feature within the project area and is up to 22 m in thickness (McHugh 2018).

2.3.3 Deep aquifer—Illawarra Coal measures

Underlying below the MYC, the deep aquifer, associated with the Triassic Burra-moko Head Sandstone, Caley Formation and Permian Illawarra Coal Measures is up to 200 m in thickness.

Groundwater flow occurs primarily via interconnective fracturing, bedding planes, cleated 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.

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.

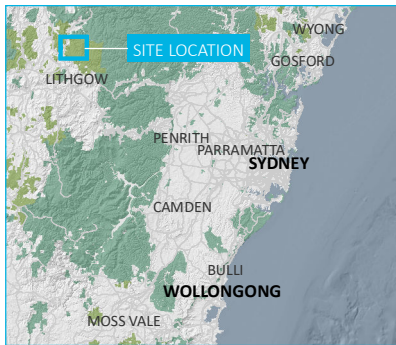
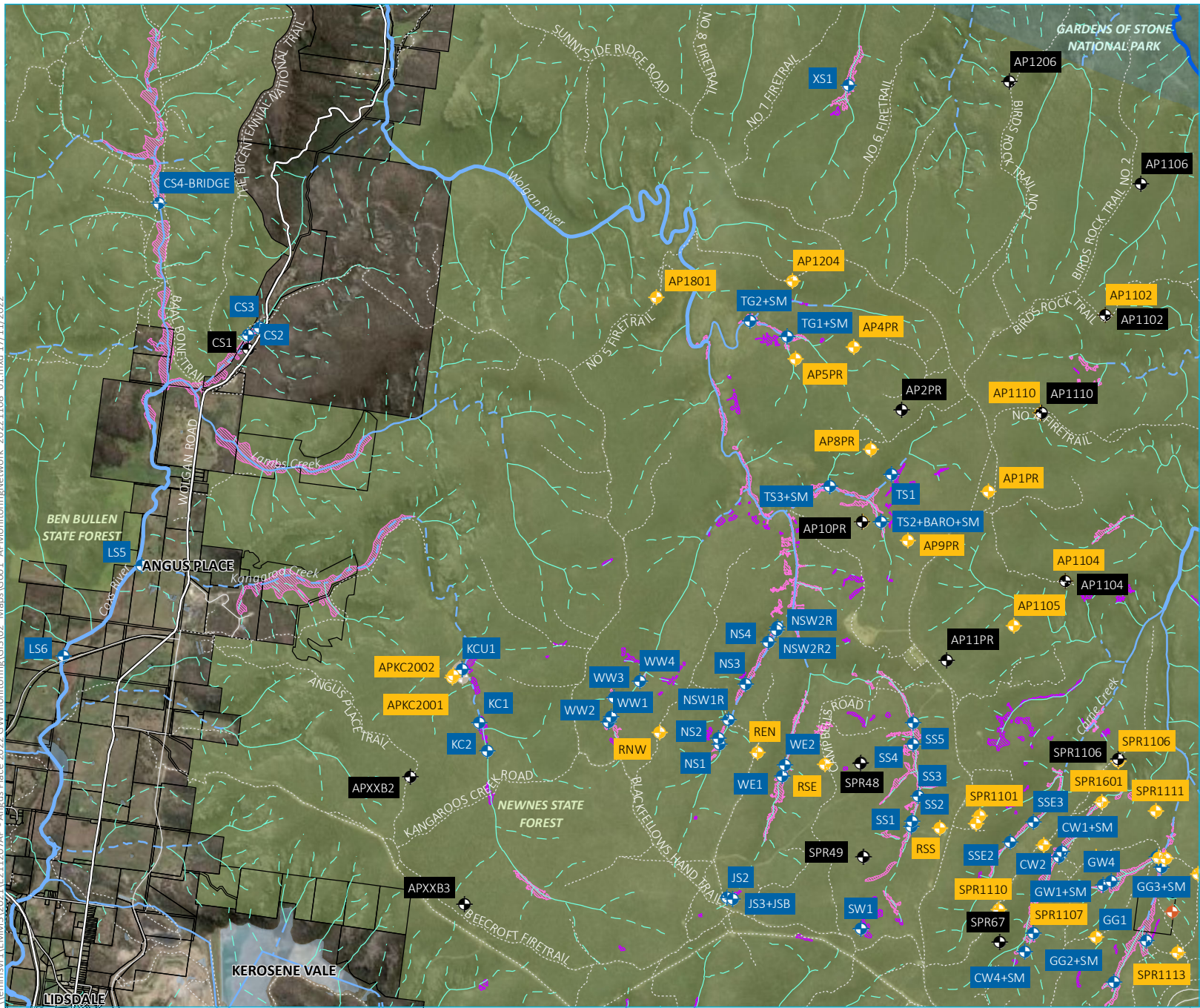
Subsidence from historic mining activities can cause changes to the hydrogeological regime. The Angus Place monitoring program targets NPSS, NPHS, perched groundwater system, shallow groundwater system and the deep groundwater system through a combination of routine surface water monitoring, standpipe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

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 at twenty-six shallow standpipe piezometers across nine swamps by level loggers (loggers);
- soil moisture content is measured daily at nine monitoring locations across three swamps (NPSS and NPHS);
- shallow aquifer groundwater levels are measured daily at eighteen ridge piezometers by loggers, with the exception of three monitoring locations without loggers, which are measured manually;
- piezometric pressures within the shallow and deep aquifers are measured daily at eleven monitoring locations by multi-level VWP arrays;
- pit top surface water quality is measured at three monitoring locations;
- discharge surface water quality is measured at two monitoring locations;
- watercourse surface water quality and flow rate are measured at fourteen monitoring locations; and
- swamp surface water quality and flow rate are measured at five monitoring locations.

Groundwater monitoring data was downloaded every two months during the reporting period. Surface water flow and quality data was collected at either weekly or monthly intervals, depending on the criteria set by the WMP (GHD 2021).

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- KEY**
- Major road
 - Minor road
 - Vehicular track
 - ▭ Cadastral boundary
 - Monitoring bore**
 - ⊕ Soil moisture
 - ⊕ Standpipe
 - ⊕ Stygo
 - ⊕ Surface water
 - ⊕ Swamp
 - ⊕ VWP
 - ▨ Hanging swamp
 - ▨ Shrub swamp
 - ▨ 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

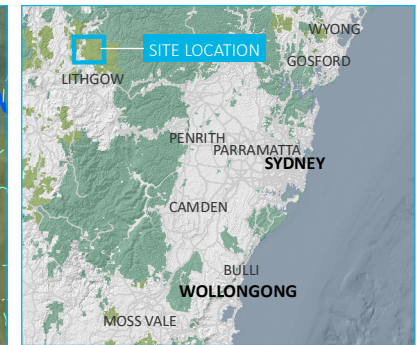
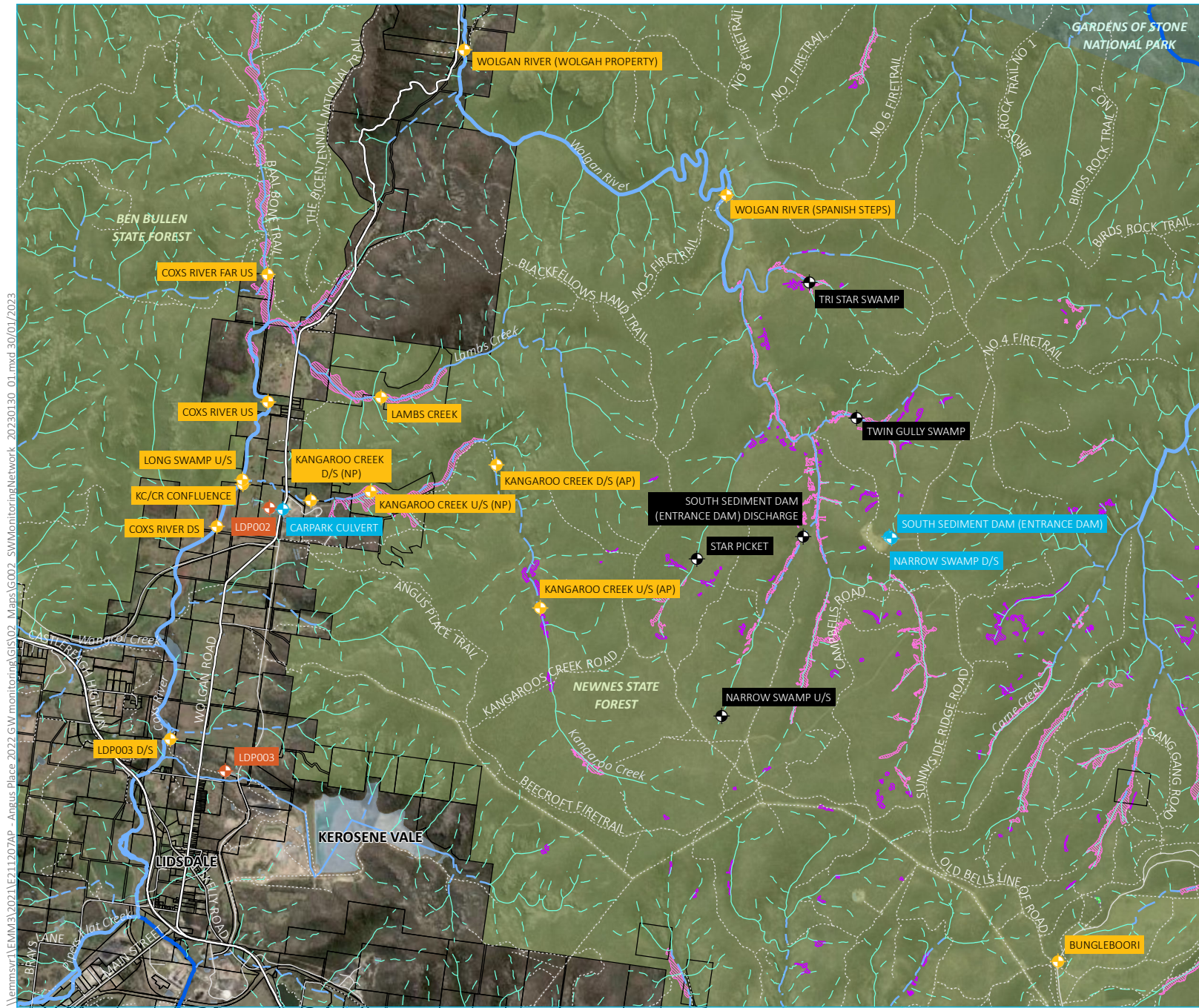
Source: EMM (2021); ESRI (2021); DFSI (2017); DPIE (2021); DPE (2015); GA (2011); ASGC (2006)



Angus Place groundwater monitoring network

Figure 3.1





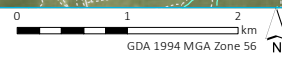
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- Monitoring bore
 - LDP
 - Pit top
 - Swamp
 - Watercourse
 - Existing environment
 - Major road
 - Minor road
 - Vehicular track
 - Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - 6th order
 - Cadastral boundary
 - Hanging swamp
 - Shrub swamp
 - Snow
 - Waterbody
 - NPWS reserve
 - State forest
 - INSET KEY**
 - Major road
 - NPWS reserve
 - State forest

Angus Place Surface Water Monitoring

Figure 3.2

\\lemmsvr1\EMM3\2021\VE11207AP - Angus Place 2022 GW monitoring\GIS\02 Maps\G002 SW\MonitoringNetwork_20230130_01.mxd 30/01/2023

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



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 set 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 a number of 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 planes (TARPs) presented in Appendix D 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. Additionally, the groundwater level triggers for ridge piezometers and VWPs were not used in the analysis of respective trends, as no active mining has occurred at Angus Place since 2015 due to care and maintenance operations.

The criteria for performance indicators for this report are shown in Table 3.1.

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 95 th percentile pre-mining depth to groundwater for more than seven consecutive days. NOTE: WWP trigger values were not used in the analysis of piezometric pressure trends during the reporting period, as no active mining has occurred at Angus Place since 2015.
	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. NOTE: WWP trigger values were not used in the analysis of piezometric pressure trends during the reporting period, as no active mining has occurred at Angus Place since 2015.
Surface water quality	Discharge water quality	Discharge water quality trigger values are specified by EPL 467. The trigger values are as follows: <ul style="list-style-type: none"> LDP002: <ul style="list-style-type: none"> pH: 6.5—8.5 (90th percentile concentration limit) and 6.5—9.0 (100th percentile concentration limit); and Total Suspended Solids (TSS): 30 milligrams per litre (mg/L). LDP003: <ul style="list-style-type: none"> pH: 6.5—8.5 (100th percentile concentration limit); and TSS: 50 mg/L. <p>These trigger values do not apply when discharge occurs within five days after 44 millimetres (mm) of rainfall has been measured at the site during that five day period.</p>

Table 3.1 Angus Place water management plan trigger criteria

Monitoring zone	Monitoring type	Comment
	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: <ul style="list-style-type: none">• Electrical Conductivity (EC): 350 microsiemens per centimetre (uS/cm);• pH: 6.3—8.5; and• TSS: 25 mg/L.

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 Section 0 to Section 4.1.9 and groundwater level data in metres below ground level (mbgl) and the daily CRD (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. Discussion of swamp piezometer hydrographs is provided Section 0 to Section 4.1.9 with swamp monitoring locations presented Figure 3.1.

Table 4.1 Swamp piezometer summary

Swamp ID	Piezometer ID	Comments
Kangaroo Creek	KC1	Predominately dry, responding to rainfall events in March, July, October, and November 2022.
	KC2	Predominately dry, responding to rainfall events in March, July and October 2022.
	KCU1	Predominately dry, responding to rainfall events in March, May, July, August, October, and November 2022.
Tri Star	TS1	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	TS2	Groundwater level stable, just at or below ground level until October 2022, whereby a decline likely related to the decreasing CRD trend is observed.
	TS3	Groundwater level stable, just at or below ground level with minor fluctuations in response to rainfall events.
West Wolgan	WW1	Groundwater level increased from March 2022 and remained relatively stable at ground level thereafter.
	WW2	Groundwater level increased from March 2022 and remained relatively stable just below ground level thereafter.
	WW3	Groundwater level was sustained in a declining trend between responses to rainfall events in March, May, July, August, October, and November 2022.
	WW4	Predominately dry, responding to rainfall events in March, May, July, August, October, and November 2022.
Wolgan East	WE1	Predominately dry, responding to rainfall events in March, July and October 2022.
	WE2	Groundwater level was sustained in a decreasing trend between responses to multiple rainfall events due to above average rainfall.
Trail Six	XS1	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.

Table 4.1 Swamp piezometer summary

Swamp ID	Piezometer ID	Comments
Twin Gully	TG1	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	TG2	Groundwater level stable, just at or below ground level with relatively larger fluctuations in response to rainfall events compared to TG1.
Narrow	NS1	Predominately dry, responding to rainfall events in March, July and October 2022.
	NS2	Predominately dry, responding to rainfall events in March and July 2022.
	NS3	Predominately dry, responding to rainfall events in March and July 2022.
	NS4	Predominately dry, responding to a rainfall event in March 2022.
	NSW1R	Groundwater level fluctuated in response to rainfall events.
	NSW2R	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.
Long	LS5	Groundwater level fluctuating in response to rainfall events.
	LS6	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.
	CS4	Groundwater level stable with minor fluctuations in response to rainfall events.
Coxs River	CS2	Groundwater level stable, just above ground level with minor fluctuations in response to rainfall events.
	CS3	Groundwater level stable, just below ground level with minor fluctuations in response to rainfall events.

4.1.1 Kangaroo Creek Swamp

The hydrograph for Kangaroo Creek Swamp 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, KC2 and KCU1 were mostly dry, with immediate and direct responses to significant rainfall events observed at all three monitoring sites. KCU1 displayed a response to rainfall events more frequently than KC1 and KC2. Groundwater levels at all monitoring sites decline quickly after rainfall, indicating groundwater observations are likely through flow.

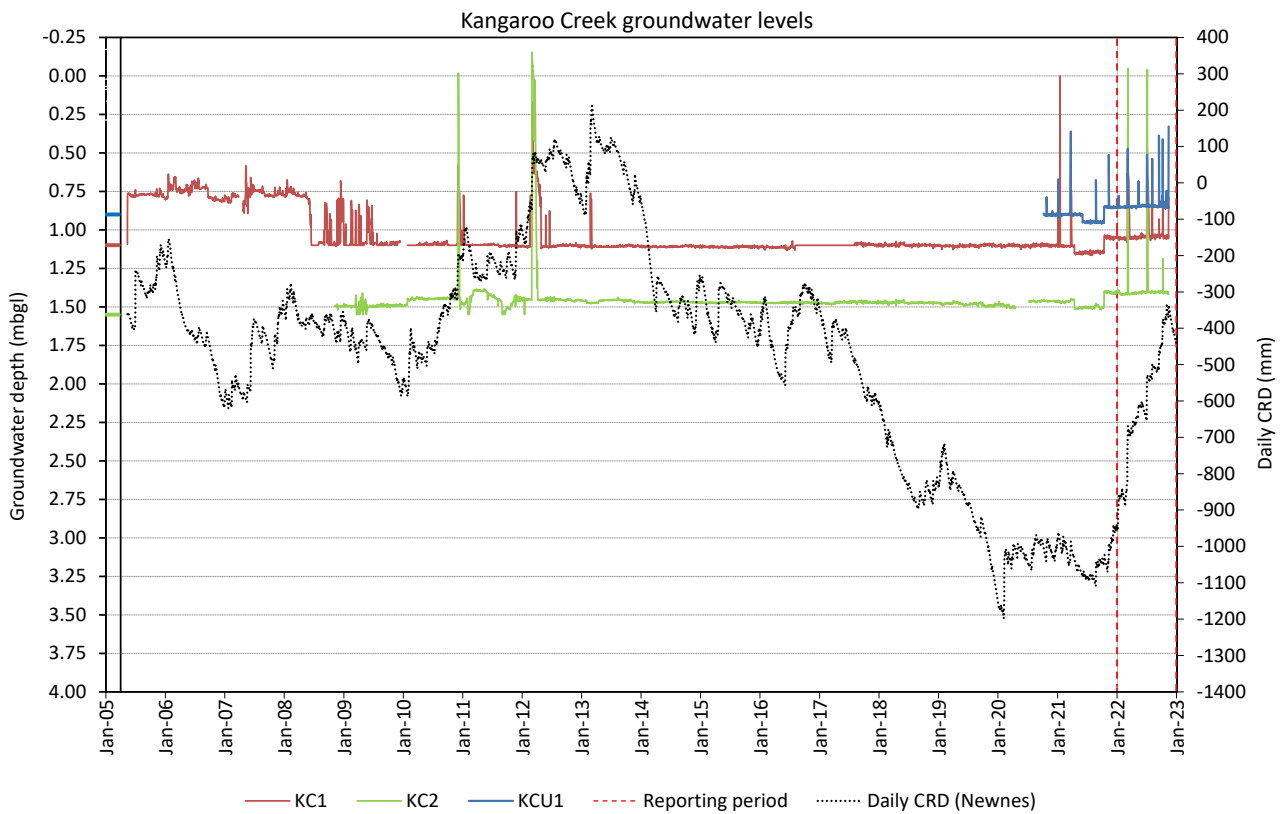


Figure 4.1 Kangaroo Creek Swamp hydrograph

4.1.2 Tristar Swamp

The hydrograph for Tristar Swamp 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, TS2 and TS3 remained stable just above or below ground level. Groundwater level at TS2 declined in mid-October 2022 in response to the decreasing CRD trend.

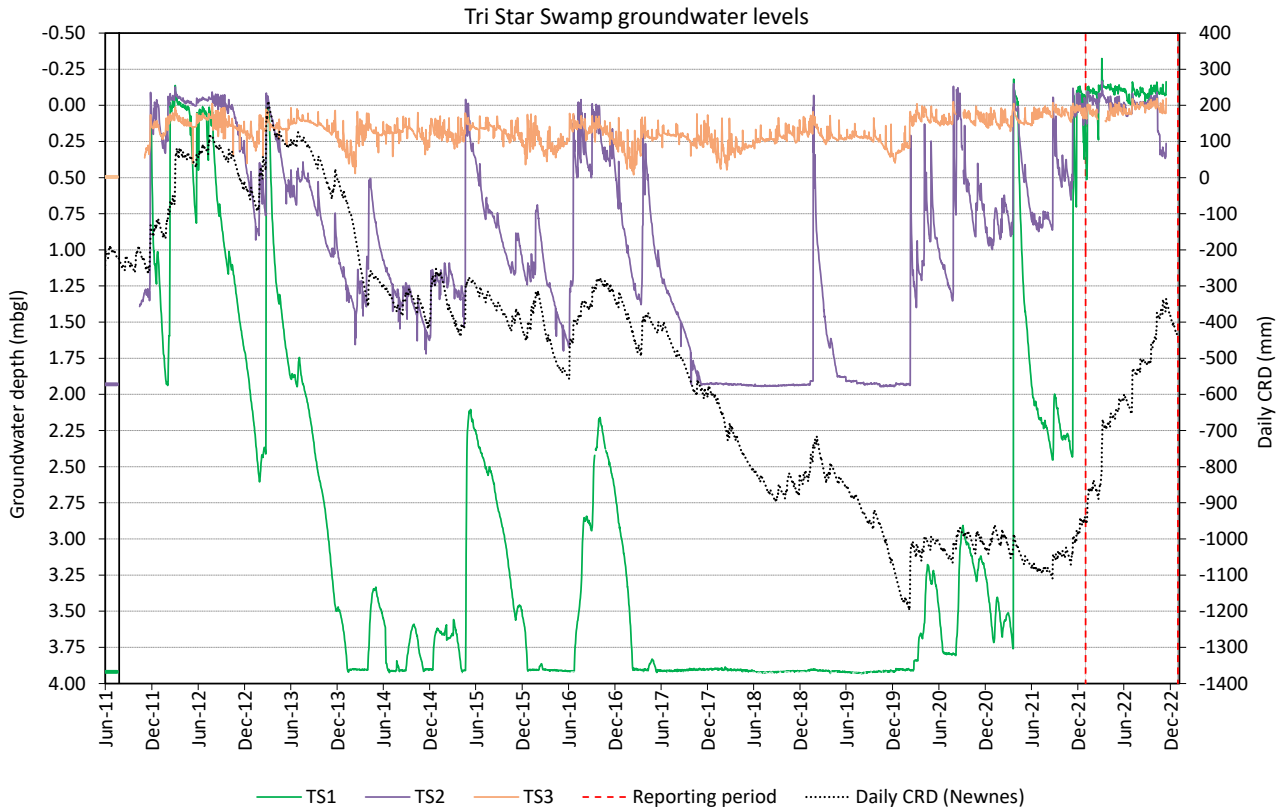


Figure 4.2 Tristar Swamp hydrograph

4.1.3 West Wolgan Swamp

The hydrograph for West Wolgan Swamp is presented as Figure 4.3. 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 reflected the daily CRD trend. WW3 responds immediately and directly to rainfall recharge and drains quickly thereafter. WW4 has been predominately dry since 2012, only responding to significant rainfall events with groundwater levels draining quickly thereafter.

During the reporting period, groundwater levels at WW1 and WW2 increased in March 2022 as a response to the increasing CRD trend and remained relatively stable just below ground level. Groundwater levels at WW3 and WW4 fluctuated in response to rainfall events. Groundwater at WW4 drained quickly and was predominately dry between rainfall events, while groundwater at WW3 did not drain as quickly and fewer dry periods were observed. The quickly declining groundwater level at WW4 indicates groundwater observations are likely through flow.

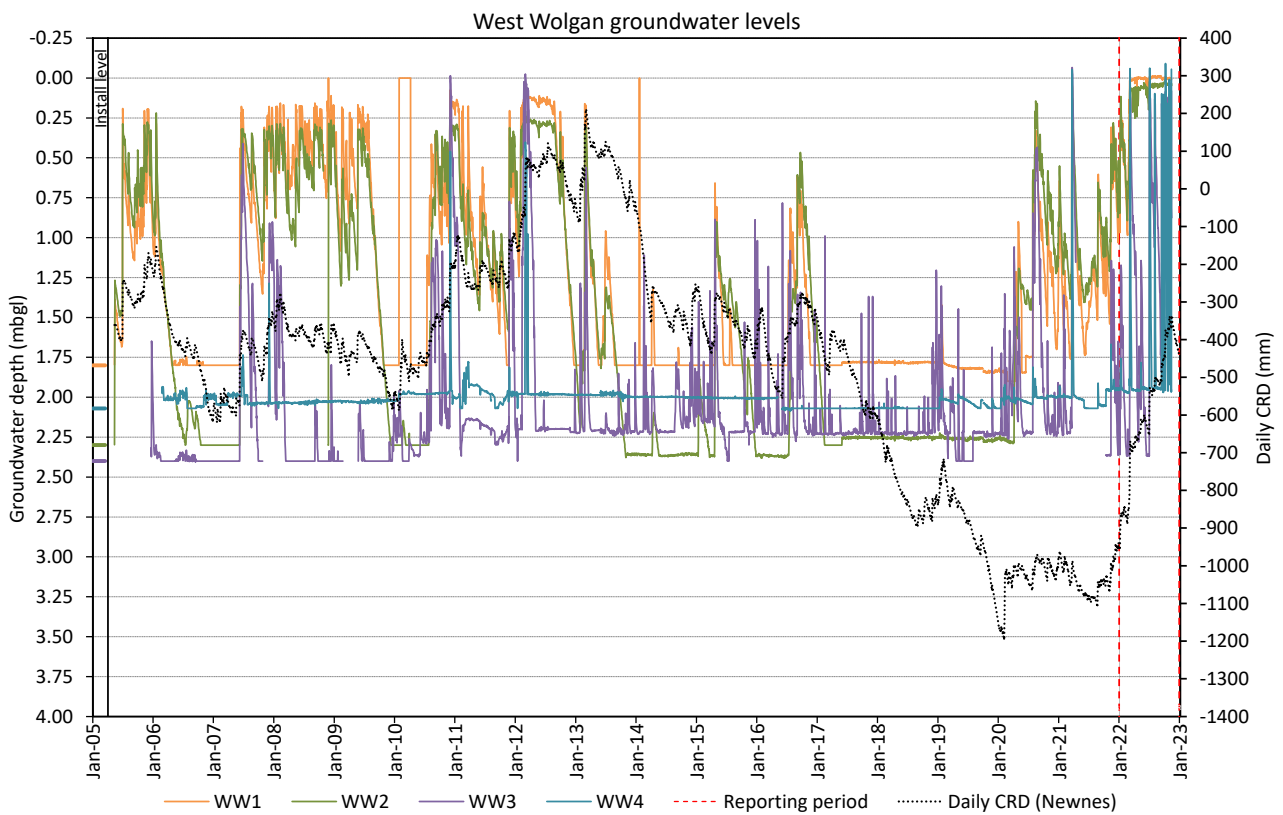


Figure 4.3 West Wolgan Swamp hydrograph

4.1.4 East Wolgan Swamp

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 level at WE1 responded to the rainfall event in March, July and October 2022 but was otherwise dry. Groundwater level at WE2 responded to multiple rainfall events and shows minor sustained groundwater due to consistent rainfall.

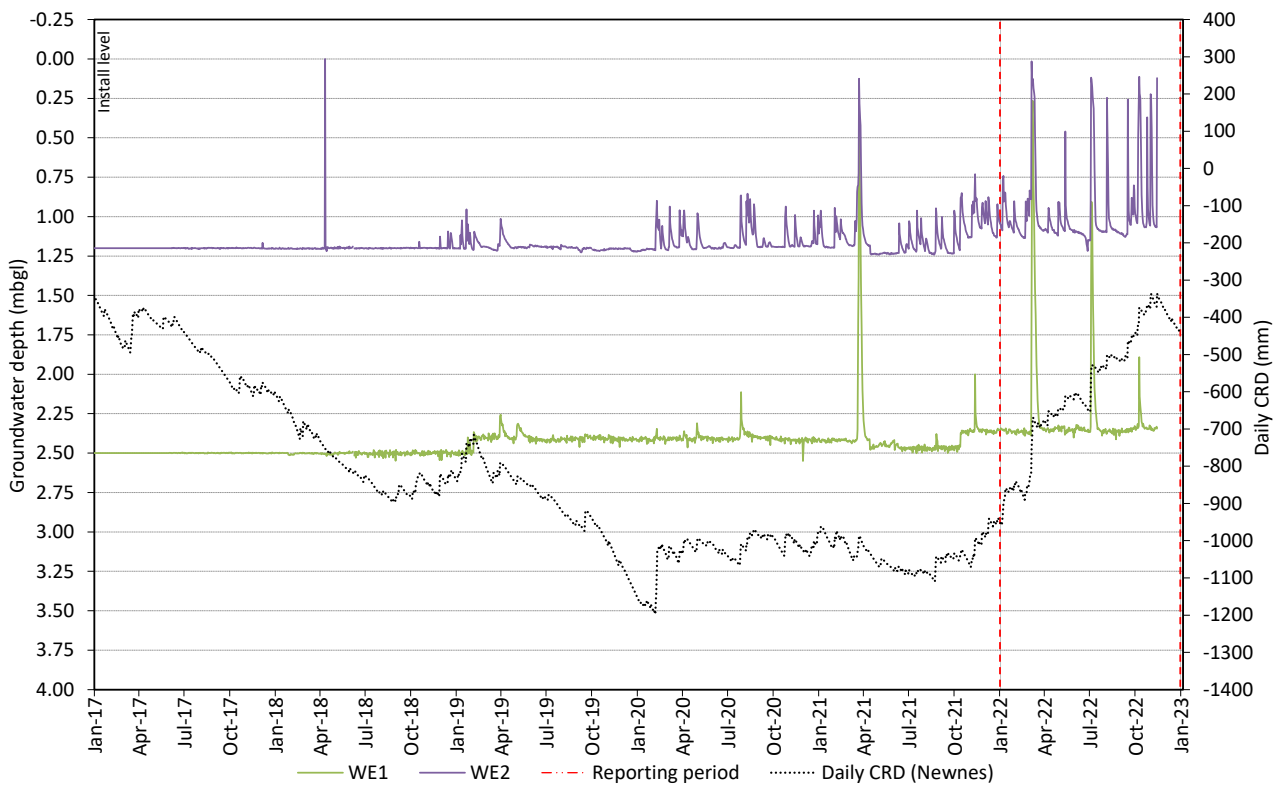


Figure 4.4 East Wolgan Swamp hydrograph

4.1.5 Trail Six Swamp

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 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 just below ground surface level with minor fluctuations in response to rainfall recharge.

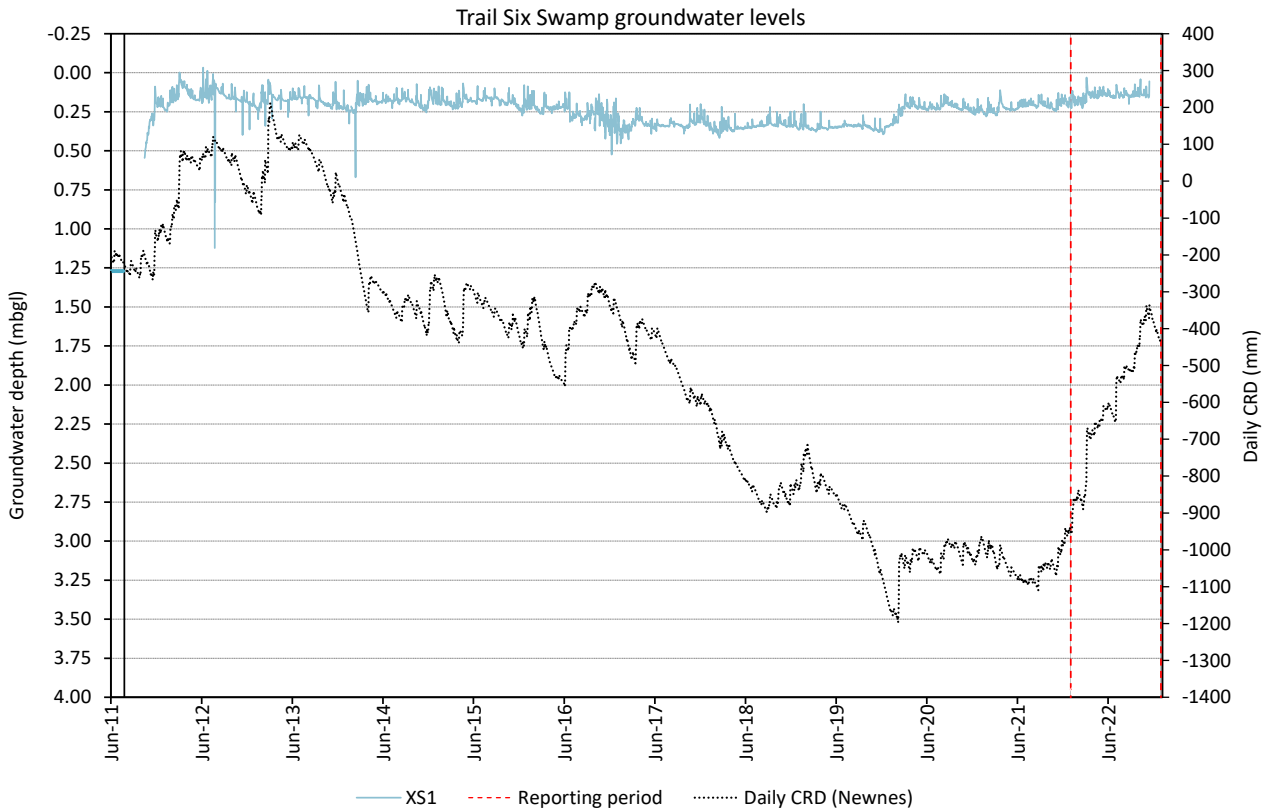


Figure 4.5 Trail Six hydrograph

4.1.6 Twin Gully Swamp

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 than TG1.

During the reporting period, groundwater level at TG1 was stable and fluctuated above ground level. TG2 was also stable and fluctuated just below ground level.

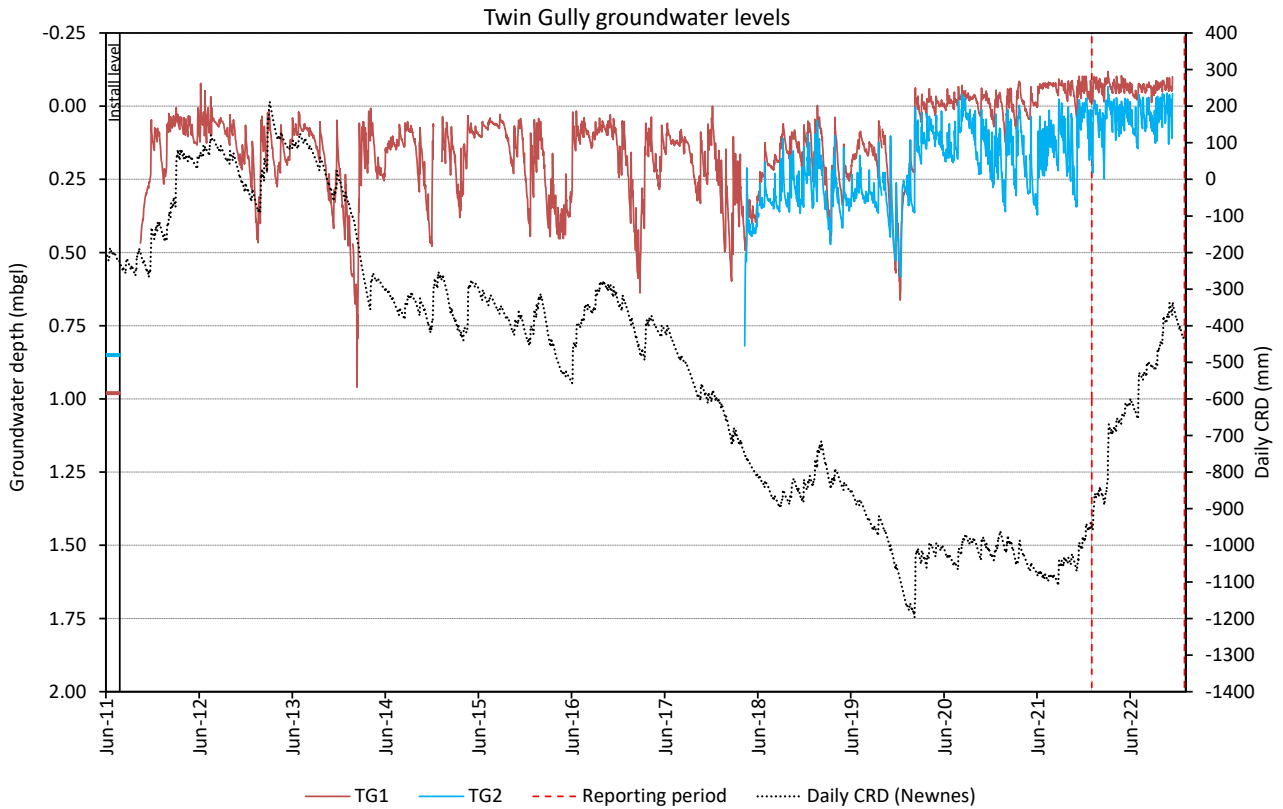


Figure 4.6 Twin Gully Swamp hydrograph

4.1.7 Narrow Swamp

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 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. With the exception of 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 predominately dry, with the exception of responses to significant rainfall events in March, July and October 2022. NS1 to NS4 responded to the rainfall event in March 2022, NS1 to NS3 responded to the rainfall event in July 2022, and only NS1 responded to the rainfall event in October 2022

During the reporting period, the groundwater level at NSW1R fluctuated in response to rainfall events, while NSW2R remained stable just below ground level, fluctuating in response to the CRD trend.

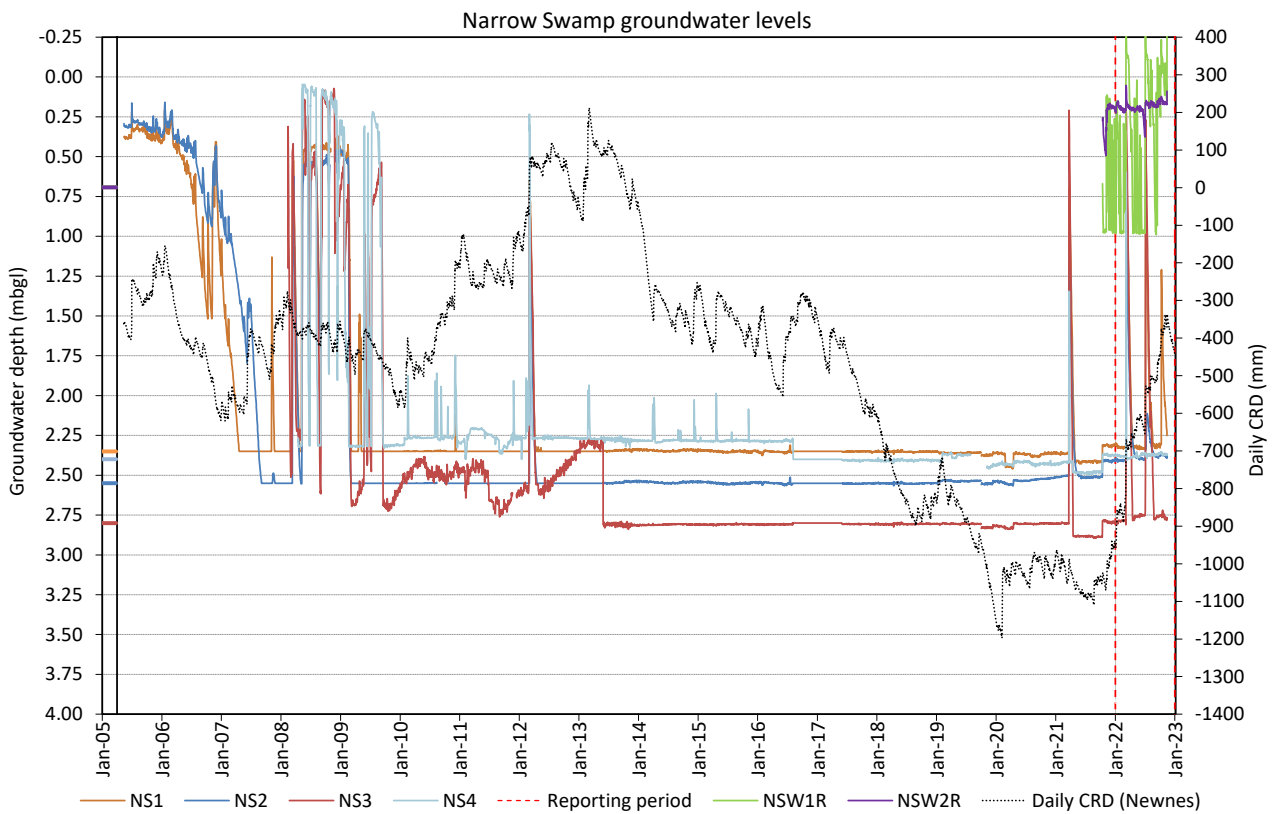


Figure 4.7 Narrow Swamp hydrograph

4.1.8 Long Swamp

The hydrograph for Long Swamp is presented as Figure 4.8. 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.

Historically, groundwater levels at all monitoring sites typically fluctuate immediately and direct response to rainfall recharge. The base groundwater level at LS5 fluctuates more compared to CS4 and LS6.

During the reporting period, groundwater levels at CS4 and LS6 remained relatively stable with direct and immediate increases in groundwater level as a response to rainfall recharge. The groundwater level at LS5 also increased in immediate response rainfall recharge, with a longer groundwater level decay.

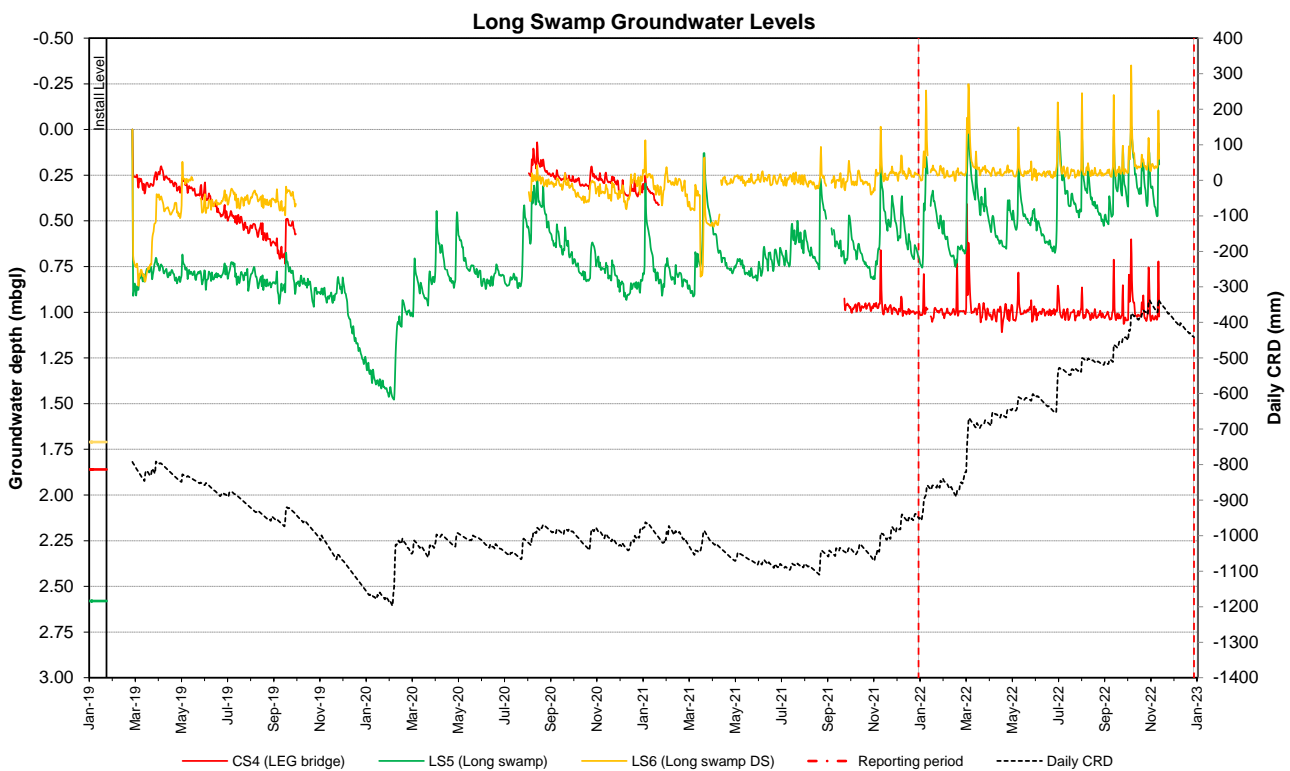


Figure 4.8 Long Swamp hydrograph

4.1.9 Coxs River Swamp

The hydrograph for Coxs River Swamp is presented as Figure 4.9. Coxs River Swamp is monitored by CS2 and CS3, which were installed September 2019.

Historically, CS2 and CS3 were dry until February 2020 and July 2020, respectively, and have maintained stable groundwater levels since. This increase in groundwater levels is likely a direct response to the increasing CRD trend.

During the reporting period, groundwater levels at CS2 and CS3 have remained relatively stable at or just below ground surface, with minor fluctuations in response to rainfall.

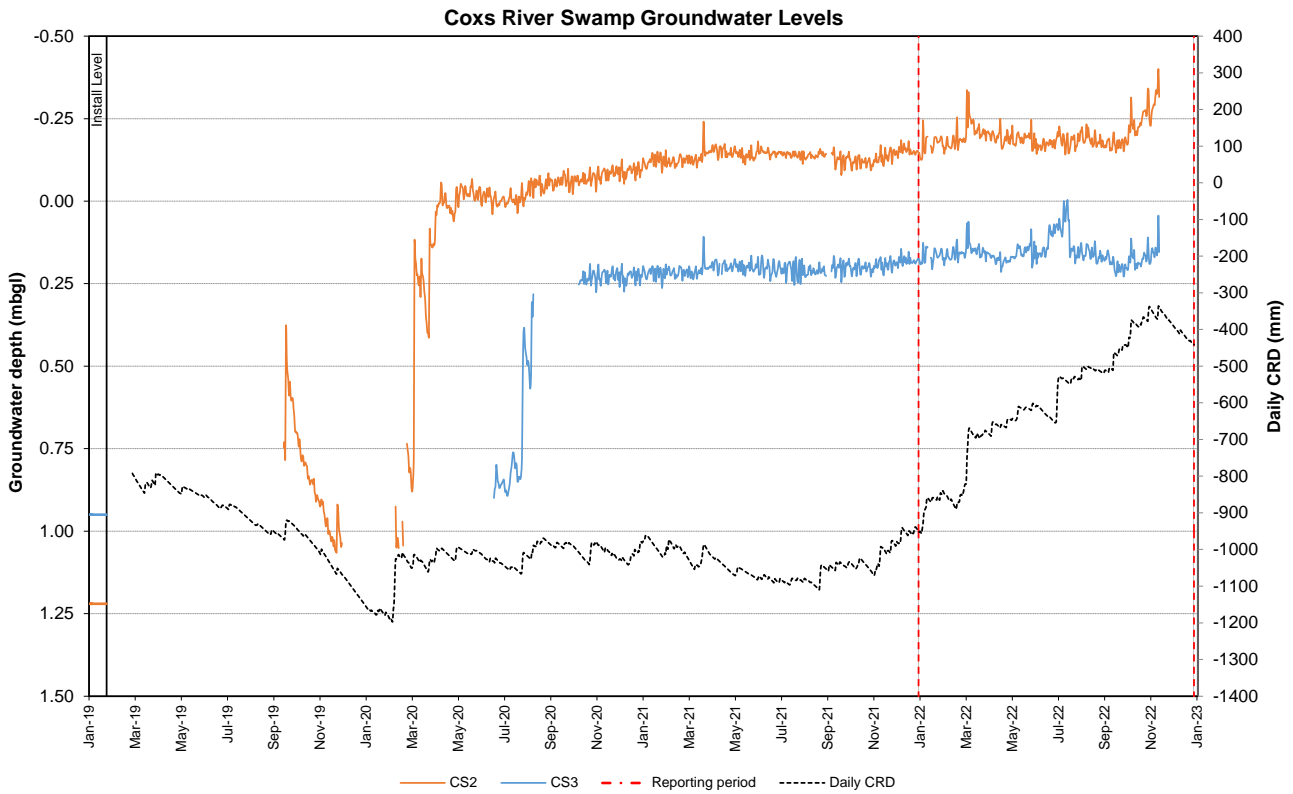


Figure 4.9 Coxs River hydrograph

4.2 Soil moisture monitoring

The soil moisture monitoring network comprises nine monitoring locations in three swamps—Kangaroo Creek Swamp, Twin Gully Swamp and Tristar Swamp.

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 A, which includes soil moisture content at each sensor as a percentage. Dashed vertical lines indicate the reporting period.

Soil moisture content time series plots are presented in Appendix A 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 showed dry soil moisture conditions. The 40 to 80 cm sensors responded to rainfall, with soil moisture content decreasing between rainfall events.
KCU2SM	8—every 10 cm	The 10 to 20 cm sensors are above surface, and the 30 cm sensor is just below surface, all of which are unsaturated. The 40 to 70 cm sensors showed that soil moisture content was increasing, with fluctuations in response to rainfall. The 60 cm and 70 cm sensors displayed larger fluctuations in response to rainfall compared to the 40 and 50 cm sensors. The 80 cm sensor appeared to be fully saturated with a stable and slightly increasing trend.
KCU3SM	4—every 10 cm	The 10 and 20 cm sensors showed generally dry soil moisture conditions, with minor fluctuations in response to rainfall. The 30 and 40 cm sensors displayed slight increasing and moderately increasing soil moisture trends, respectively, while fluctuating in response to rainfall.
KCU4SM	8—every 10 cm	The 10 to 30 cm sensors displayed dry soil moisture conditions. The 30 to 80 cm sensors showed soil moisture content was slightly increasing, fluctuating significantly in response to rainfall.
KCU5SM	4—every 10 cm	No data was available for the reporting period. The logger needs inspection and possibly repair.
TG1SM	12—every 10 cm	The 10 cm sensor showed soil moisture content was increasing, with fluctuations in response to rainfall. The 20 to 120 cm sensors showed soil moisture content to be a stable or decreasing to June 2022 and increasing thereafter. The trends become increasingly subdued with sensor depth.
TG2SM	8—every 10 cm	The 10 cm sensor showed that soil moisture content increased, with fluctuations in response to rainfall. The 20 to 80 cm sensors showed soil moisture content remained relatively stable with slight increasing trends. Minor fluctuations in response to rainfall reduced with sensor depth.
TS2SM	12—every 10 cm	The 10 and 20 cm sensors showed soil moisture content fluctuated in response to rainfall. The 30 to 70 cm sensors showed soil moisture content remained relatively stable to June 2022 and increased thereafter. The 60 and 70 cm sensors showed larger fluctuations in soil moisture content than the 30 to 50 cm sensors. The 80 to 120 cm sensors showed soil moisture content to be slightly increasing
TS3SM	12—every 10 cm	All sensors showed soil moisture content was decreasing to June 2022 and increased thereafter. Fluctuations in response to rainfall reduced with sensor depth.

Notes: 1. bgl = below ground level

4.3 Ridge piezometers

The ridge piezometer monitoring network comprises sixteen monitoring bores targeting the shallow aquifer in the Banks Wall Sandstone.

Hydrographs for ridge piezometers are presented on Figure 4.10 which includes groundwater level data in metres Australian Height Datum (mbgl) and the daily CRD (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 monitoring locations are presented in Figure 3.1.

Table 4.3 Ridge piezometer summary

Site ID	Comments
AP1PR	Groundwater level increasing.
AP4PR	Groundwater level increasing.
AP5PR	Groundwater level increasing.
AP8PR	Groundwater level increasing.
AP9PR	Groundwater level slightly increasing.
AP10PR	Groundwater level increasing.
AP1104	Groundwater level increasing.
AP1105	Groundwater level increasing.
AP1110	Groundwater level increasing.
AP1102	Groundwater level increasing.
AP1204	Groundwater level slightly increasing.
APKC2001	Groundwater level slightly increasing.
APKC2002	Groundwater level slightly increasing.
REN	Groundwater level slightly increasing.
RSE	Groundwater level slightly increasing.
RNW	Dry.

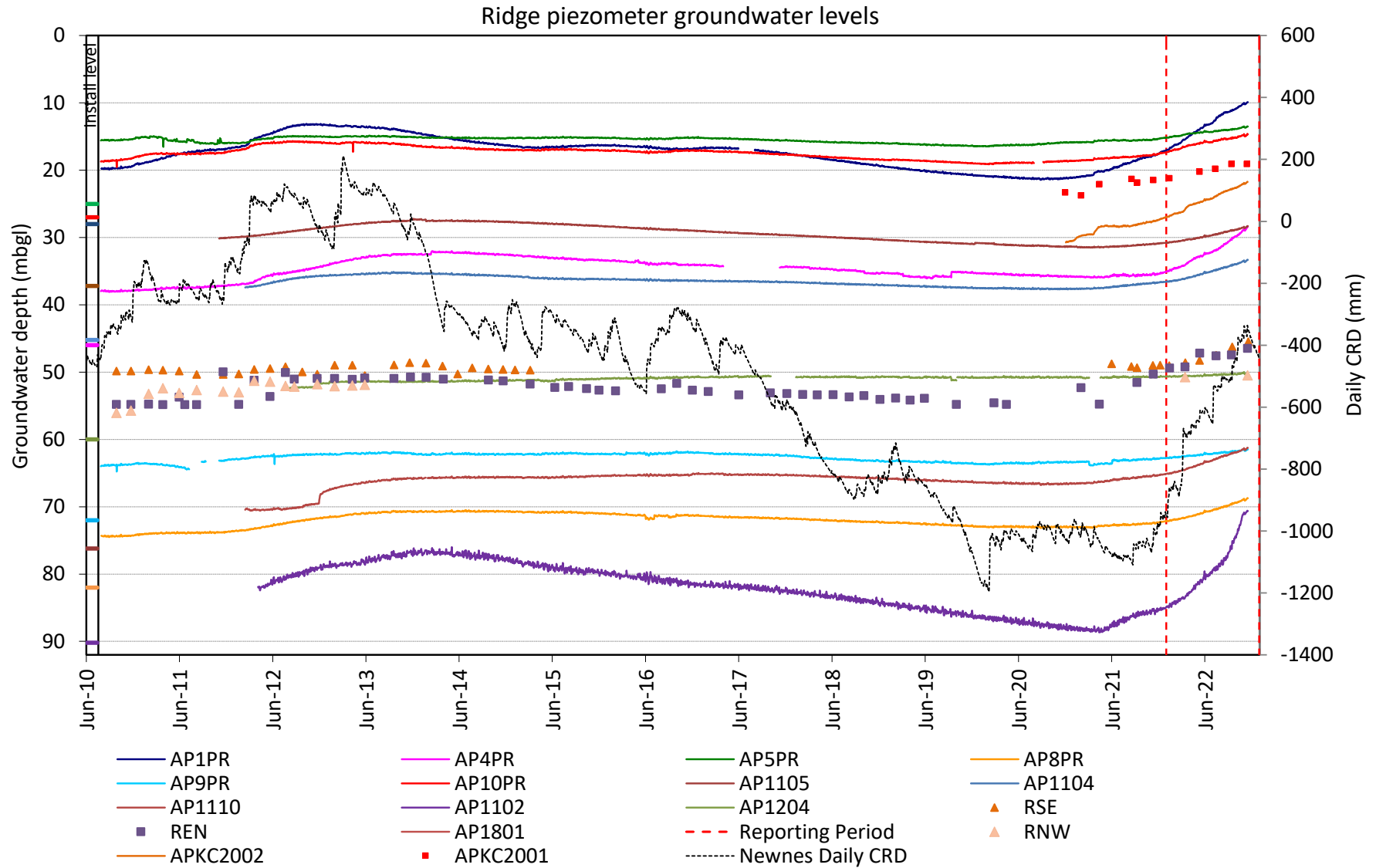


Figure 4.10 Ridge piezometer hydrograph

4.4 Vibrating wire piezometers

The vibrating wire piezometer (VWP) monitoring network comprises eleven monitoring locations measuring the piezometric pressures of multiple hydrogeological horizons 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 B.1 to Figure B.11 (attached as Appendix B).

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	Sensors #1 and #2 (below the Katoomba Seam) displayed stable trends, with the exception of minor spikes at each monitoring location, which may be related to sensor malfunction. Sensor #3 (at the Katoomba Seam), sensors #4 and #5 (below the MYC) and sensor #6 (above the MYC) displayed slight increasing trends. Refer to Figure B.1.
AP10PR	9	Sensors #1 and #2 (below the Lithgow Seam) and sensor #3 (below the Katoomba Seam) displayed slightly increasing trends, with the exception of minor spikes at sensors #1 and #2, which may be related to sensor malfunction. Sensors #5 (below the Katoomba Seam) and #6 (below the MYC) remained stable. Sensor #7 (below the MYC) and sensors #8 and #9 (above the MYC) displayed increasing trends, with the exception of a minor depressurisation event of 1.5 m in May 2022, which was likely due to sensor error. Communication with sensor #4 (below the Katoomba Seam) was lost in February 2020. Refer to Figure B.2.
AP11PR	9	Sensor #1 (below the Katoomba Seam) and sensors #2 to #4 (below the MYC) displayed slightly increasing trends. Sensors #5 to #7 (above the MYC) and sensor #9 (above the MYC) remained stable. Sensor #8 (above the MYC) displayed a declining trend, which is inconsistent with other sensors and the prevailing climatic conditions. Historically, sensor #8 has displayed sudden declines in piezometric pressure and it is assumed that this decline is a similar occurrence unrelated to mining. Refer to Figure B.3.
AP1102	7	Sensors #1 to #5 (below the Katoomba Seam) displayed relatively stable trends, with the exception of an approximately 4 m depressurisation event in observed by sensor #2 in February 2022, which is likely related to sensor error. Historically, sensor #2 has displayed sudden declines in piezometric pressure and it is assumed that this decline is a similar occurrence unrelated to mining. Sensors #6 and #7 (below the MYC) displayed increasing and slightly increasing trends, respectively. It should be noted that no data is available from June 2022 due to degraded access track conditions. Refer to Figure B.4.
AP1104	7	Sensors #1 to #4 (at or below the Katoomba Seam) and sensor #7 (below the MYC) displayed stable trends, with the exception of minor fluctuations in piezometric pressure at sensor #7. Sensor #6 (below the MYC) displayed a slight increasing trend. Communication with sensor #5 was lost in April 2022 due to sensor malfunction. Refer to Figure B.5.
AP1106	6	Sensors #1 to #5 (at or below the Katoomba Seam) and sensor #6 (below the MYC) displayed a slight increasing trend. Minor fluctuations in piezometric pressure were observed at sensor #6. It should be noted that no data is available from May 2022 due to degraded access track conditions. Refer to Figure B.6.

Table 4.4 **VWP summary**

Site ID	Number of sensors	Summary of piezometric pressure measured by each sensor during the reporting period
AP1110	6	Sensors #1 (below the Katoomba Seam) and #5 (below the MYC) displayed slight decreasing and decreasing trends, respectively. Sensor #5 has displayed a decreasing trend from late 2016, which has been deemed unrelated to mining. Sensors #2 to #4 (at or below the Katoomba Seam) remained stable. Communication with sensor #6 (above the MYC) has been lost since February 2021 due to sensor malfunction. Refer to Figure B.7.
AP1206	6	All sensors (#1 to #6) displayed increasing trends, with the exception of a minor depressurisation event of approximately 1.5 m observed by sensor #1 in January 2022. Piezometric head recovered soon after and thus, was not deemed to be mining-related. It should be noted that no data is available from May 2022 due to degraded access track conditions. Refer to Figure B.8.
APXXB2	7	Sensors #1 to #3 (below the Katoomba Seam), sensor #4 (below the MYC), and sensors #6 and #7 (above the MYC) displayed slight increasing trends. Minor fluctuations in piezometric pressure were observed by sensor #5 (below the MYC), however this is consistent with historical trends. Refer to Figure B.9.
APXXB3	7	Sensors #1 and #2 (below the Katoomba Seam) and sensor #5 (below the MYC) displayed slight increasing trends. Sensors #3 and #4 (below the Katoomba Seam) displayed increasing trends. Sensors #6 and #7 (above the MYC) displayed stable trends, with minor fluctuations in piezometric head consistent with historical observations. Refer to Figure B.10.
APC CS1	3	Sensors #1 (at the Lithgow Seam roof) and #3 (at the Denman Formation) remained stable, while sensor #2 (above the Denman Formation) displayed an increasing trend. Refer to Figure B.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 for the licensed discharge points (LDP) and relevant watercourse sites.

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; and
- LDP003—discharge of surface water from a sediment dam located at the Kerosene Vale Stockpile Area.

Water quality time series plots 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. Water quality trigger criteria for pH and TSS at both LDPs are outlined in Table 3.1.

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

- two lower bound pH exceedances were observed at LDP003 in March (6.4) and October 2022 (6.2); and
- one TSS exceedance was observed at LDP002 in January 2022 (31 milligrams per litre (mg/L)), and two TSS exceedances were observed at LDP003 in March (66 mg/L) and October 2022 (51 mg/L).

5.2 Watercourse surface water quality

The watercourse surface water quality monitoring network comprises fifteen monitoring locations. A summary of the remaining watercourse surface water quality and flow monitoring sites are time series plots without applied trigger criteria are summarised in Table 5.1 and presented in Appendix C.1. Watercourse monitoring locations are presented in Figure 3.2.

Surface water quality 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) default guideline values (DGVs).

Surface water quality time series plots for EC, pH and TSS at Coxs D/S (downstream) and KC/CR (Kangaroo Creek and Coxs River) 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. It should be noted that due to degraded access track conditions, no surface water quality data was collected at Coxs D/S from June 2022 and KC/CR Confluence in November 2022.

The following summarises exceedances of the trigger criteria for Coxs D/S and KC/CR Confluence during the reporting period:

- two upper bound pH exceedances were observed at KC/KR Confluence in June (8.3) and September 2022 (8.4).

Table 5.1 Watercourse surface water quality and flow rate summary

Site D	Comments of surface water quality trends during the reporting period
Bungleboori	During the reporting, only one data point for both EC and pH was available. No data for TSS and flow was available because watercourses were dry.
Coxs River Far U/S	EC and TSS remained stable, while pH displayed an increasing trend consistent with historical observations. Flow was not monitored at the site.
Coxs River U/S	EC and TSS remained stable, while pH fluctuated, consistent with historical observations. Flow was not monitored at the site.
Kangaroo Creek D/S (AP)	No data was available for all analytes during the reporting period.
Kangaroo Creek D/S (NP)	EC and TSS remained stable, with the exception of a large TSS spike in March 2022, which was larger than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. pH and flow fluctuated, consistent with historical observations.
Kangaroo Creek U/S (AP)	No data was available for all analytes during the reporting period.
Kangaroo Creek U/S (NP)	EC and TSS remained stable, while pH and flow fluctuated consistently with historical observations.
LDP003 D/S	EC remained relatively stable, with minor fluctuations consistent with historical observations. pH displayed an increasing trend, consistent with historical observations. No TSS and flow data was available during the reporting period.
Lambs Creek	EC remained relatively stable, with the exception of a spike in November 2022, which was larger than historical observations. pH displayed an increasing trend consistent with historical observations. Only three data points were available for TSS during the reporting period, however a significant spike was observed in February 2022, which was greater than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. No flow data was available during the reporting period due to no flowing conditions. The time series figure shows that the measurement of the EC and TSS spikes closely followed significant rainfall events.
Long Swamp U/S	EC fluctuated in a decreasing trend, consistent with historical observations, while pH fluctuated in an increasing trend, slightly greater than historical observations. A large spike in TSS was observed in January, which was greater than historical observations. The time series figure shows the measurement of the TSS spike closely followed a significant rainfall event. No flow data was available during the reporting period due to dry watercourse conditions.
Wolgan River (Spanish Steps)	EC remained relatively stable, with the exception of minor fluctuations, slightly greater than historical observations. pH fluctuated consistently with historical observations. TSS remained stable, with the exception of two spikes in January and September 2022, which were greater than historical observations. The time series figure shows that the measurement of the two TSS spikes followed periods of sustained, above average rainfall conditions. Limited flow data was available for the reporting period due to dry watercourse conditions.
Wolgan River (Wolgan Property)	EC and flow rate remained stable with minor fluctuations, consistent with the historical average. pH and TSS fluctuated, consistent with historical observations.



Figure 5.1 LDP002 discharge water quality time series plot

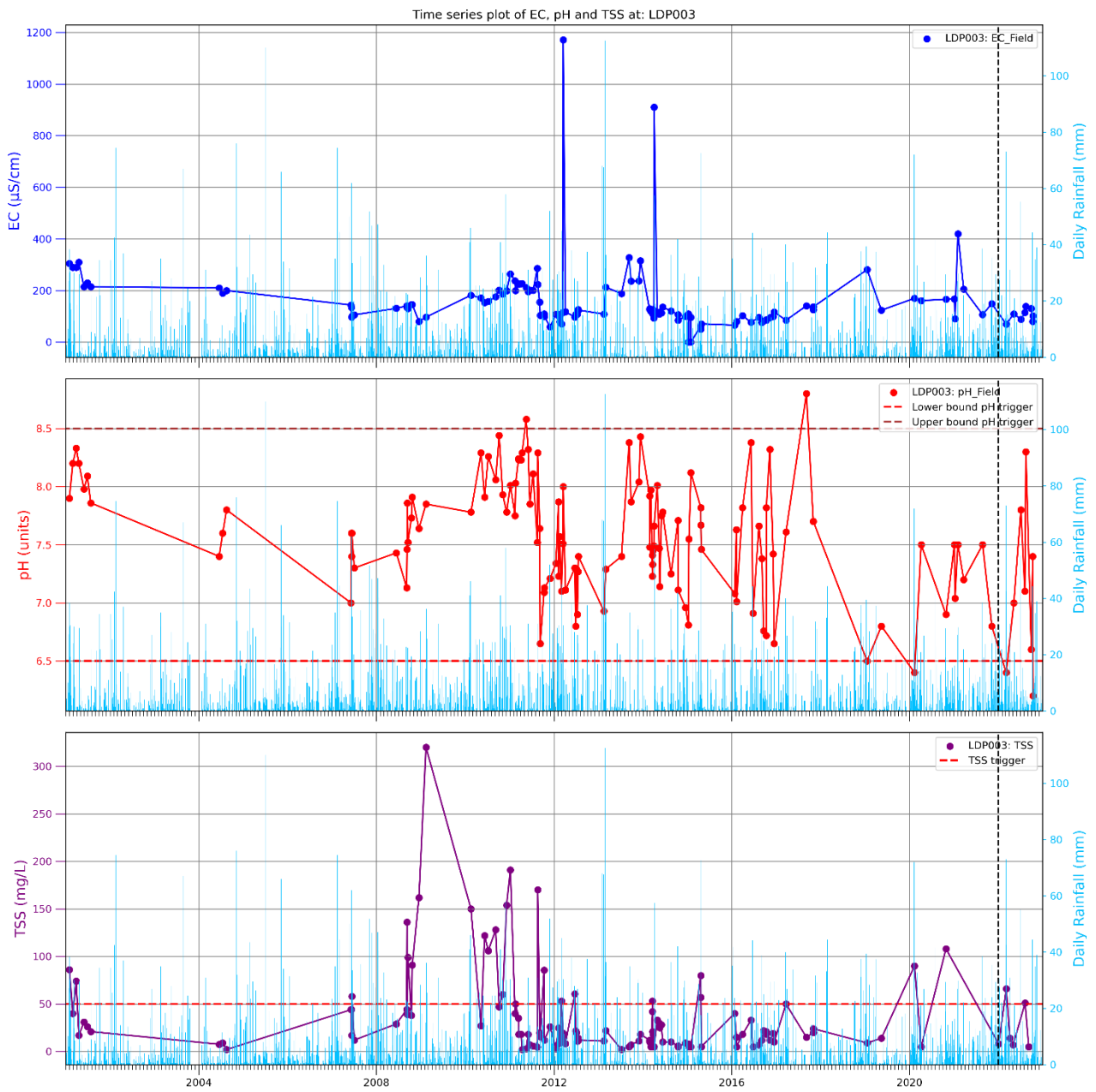


Figure 5.2 LDP003 discharge water quality time series plot

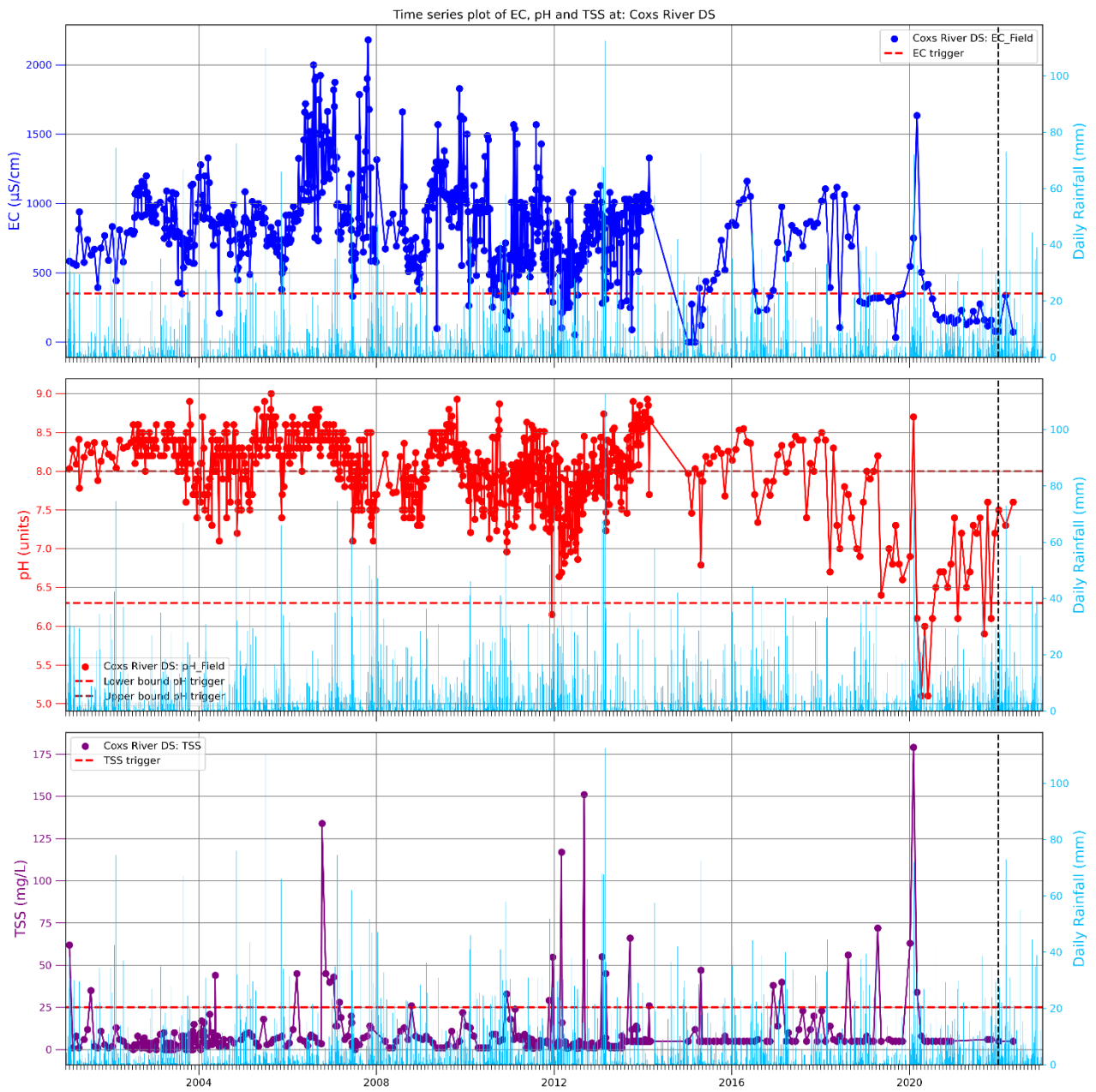


Figure 5.3 Coxs D/S surface water quality time series



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 C.2. The dashed vertical line indicates the beginning of the reporting period.

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

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.

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 constant with historic observations. It should be noted that EC has not been recorded at the site since 2020 due to the development of monitoring requirements.
South Sediment Dam (Entrance Dam)	EC and TSS remained relatively stable, with the exception of a minor spike of TSS in October 2022, which was consistent with historical observations. pH fluctuated consistently with historical observations.
South Sediment Dam (Entrance Dam) Discharge	Limited data was available during the reporting period due to non-discharging conditions.

5.4 Swamp surface water quality and flow

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.

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

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 5.3 and monitoring locations are presented in Figure 3.2.

Table 5.3 Pit top surface water quality summary

Site D	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.
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	TSS and flow rate remained relatively stable, with the exception of minor fluctuations in both analytes. EC remained relatively stable, with the exception of a single large spike greater than historical observations. pH peaked at 3.5 and 8.1 in November and February 2022, respectively.
Twin Gully Swamp	Flow rate, EC and TSS remained stable, consistent with historical observation. pH peaked at 5.2 and 7.3 in January and March 2022, respectively.

6 Conclusions

The findings of this report are summarised in Table 6.1. The highlighted conditions are those defined in the Trigger Action Response Plan (refer Appendix D) found in the WMP (GHD 2021).

Table 6.1 Report summary

Monitoring zone	Comments	Condition (TARP)
Swamp monitoring piezometers	Swamp groundwater levels were generally stable, with the exception of fluctuating groundwater levels at monitoring locations that are typically dry, as a response to above average rainfall observed during the reporting period.	Not applicable
Soil moisture probes	Soil moisture content typically fluctuated closer to ground level, while deeper sensors indicated soil moisture content to generally be stable or slightly increasing, as a response to above average rainfall observed during the reporting period.	Not applicable
Open standpipe piezometers	Groundwater levels were generally increasing, reflecting an attenuated and translated response to above average rainfall during the reporting period.	Condition: Normal
Vibrating wire piezometers (VWP)	Piezometric pressures were generally stable or increasing at most monitoring locations. It should be noted that data from some VWPs were not available from May 2022 due to degraded access track conditions	Condition: Normal
Discharge surface water quality	Surface water quality at the two licenced discharge points (LDP) was within the environmental protection license (EPL) 467 concentration limits during the reporting period, with the exception of two lower bound pH exceedances at LDP003 in March and October 2022, and a TSS exceedance at LDP002 in March 2022.	Condition: Normal
Watercourse surface water quality and flow rate	Watercourse surface water quality at Coxs D/S and KC/CR Confluence were within the SSTVs during the reporting period, with the exception of two upper bound pH exceedances at KC/CR Confluence in June and September 2022. The surface water quality and flow observations at the watercourse monitoring locations without specified SSTVs generally remained consistent with historical observations. It should be noted that some monitoring locations were dry or inaccessible due to degraded access track conditions during the reporting period.	Condition: Normal
Pit top surface water quality	Pit top surface water quality observations generally remained consistent with historical observations.	Condition: Normal
Swamp surface water quality and flow rate	Swamp surface water quality and flow observations generally remained consistent with historical observations. It should be noted that some monitoring locations were dry or inaccessible due to degraded access track conditions during the reporting period.	Condition: Normal

References

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

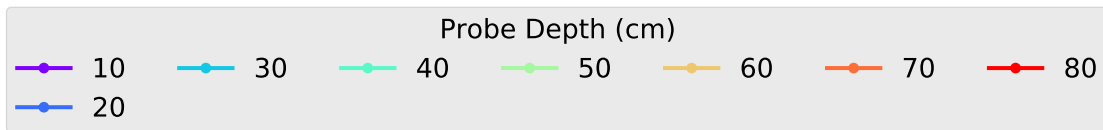
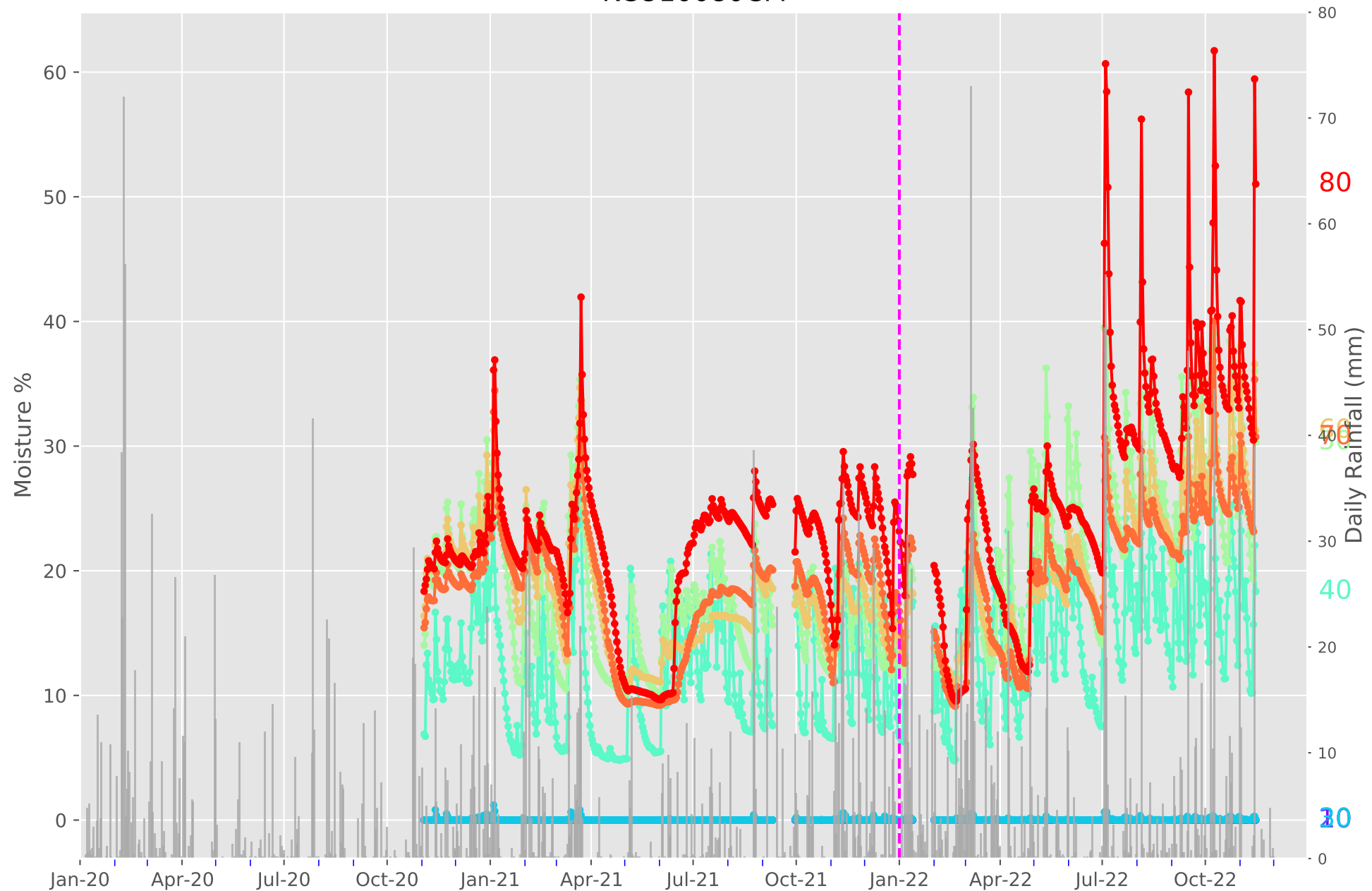
Jacobs (2019) *Groundwater Impact Assessment, Angus place Amended Project*, prepared by Jacobs Group (Australia) Pty Ltd for Centennial Angus Place Pty Ltd, October 2019.

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.

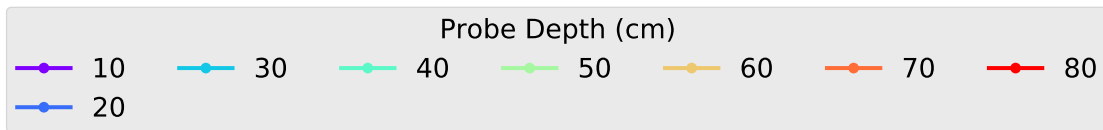
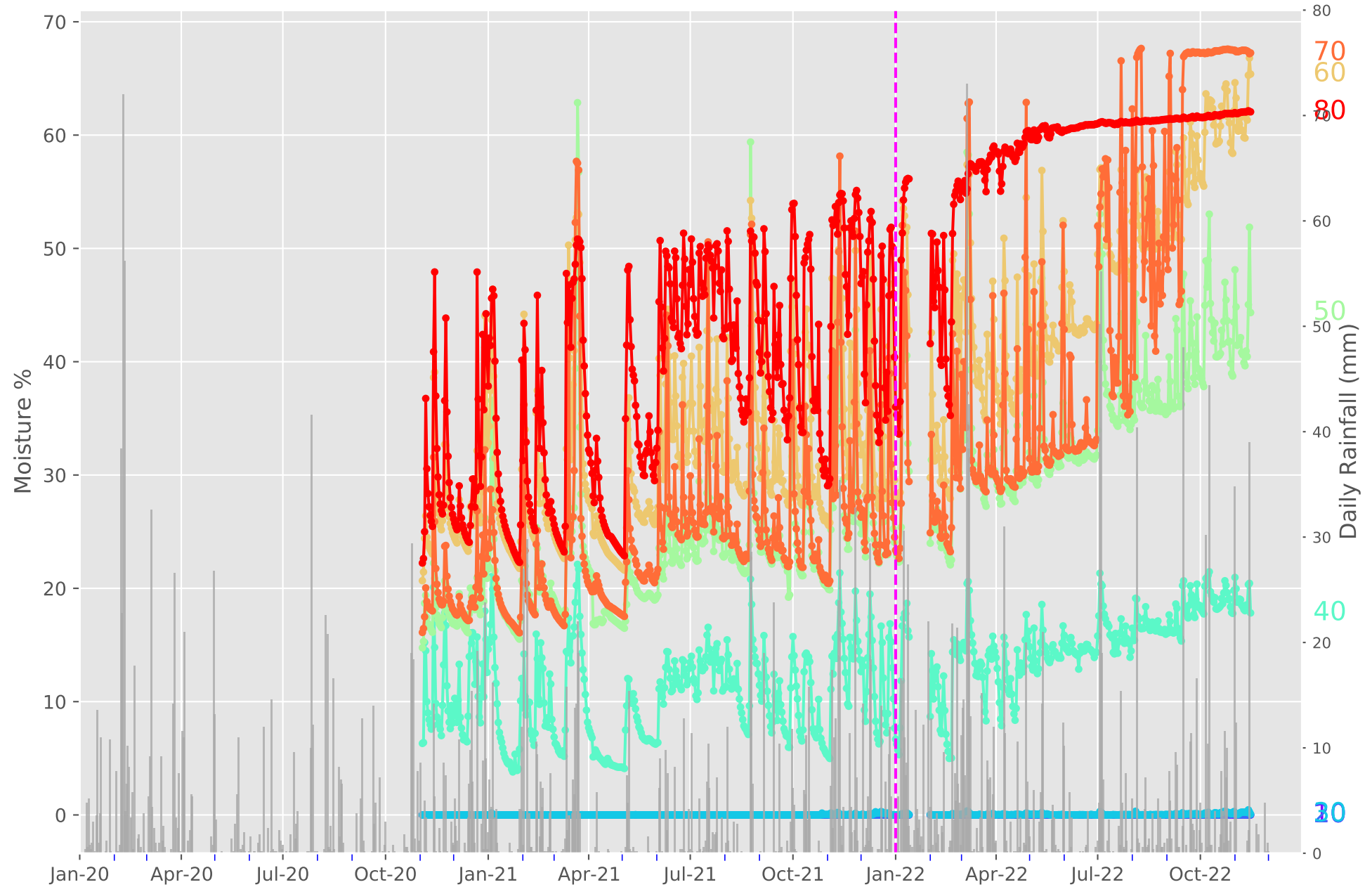
Appendix A

Soil moisture time series plots

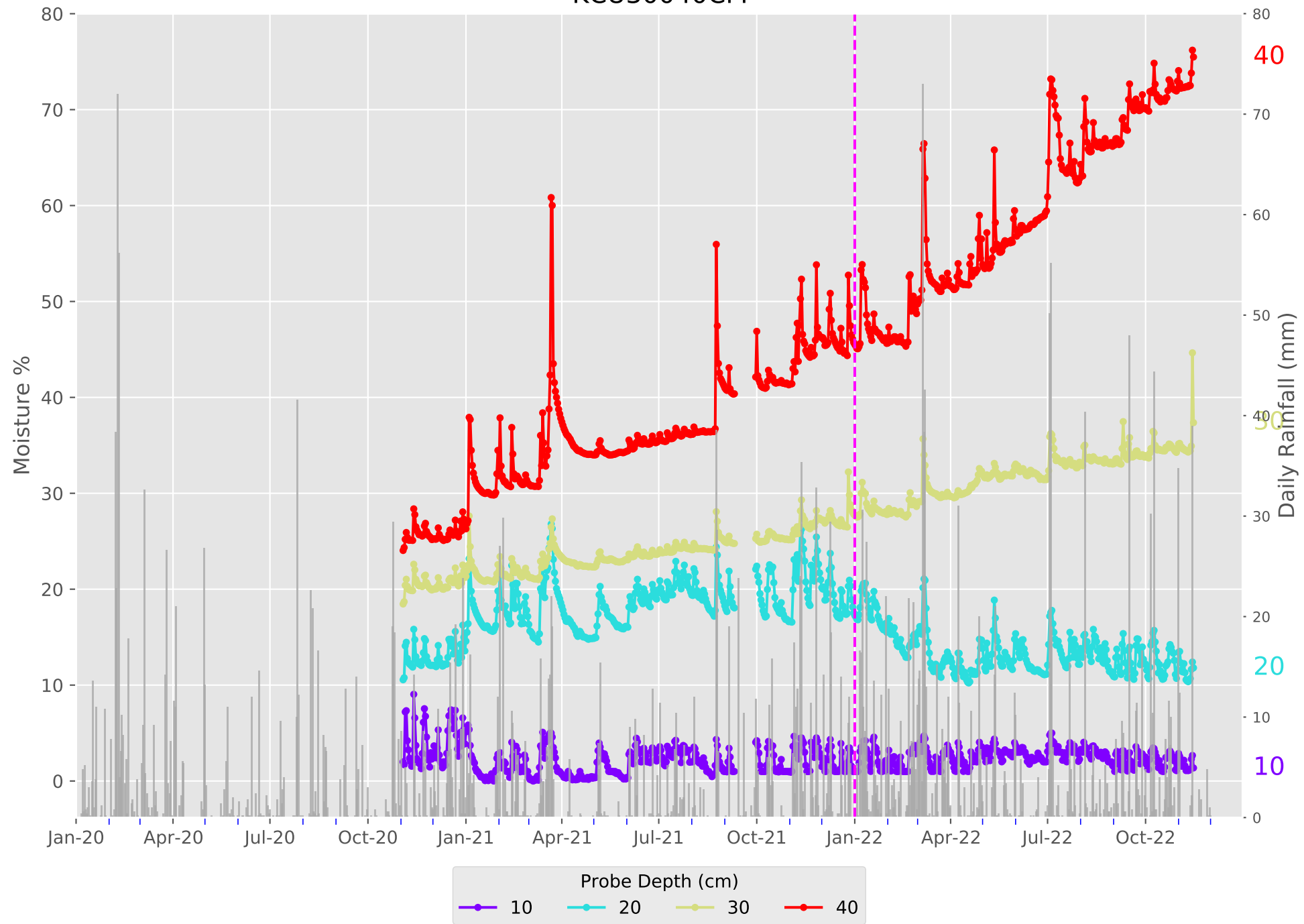
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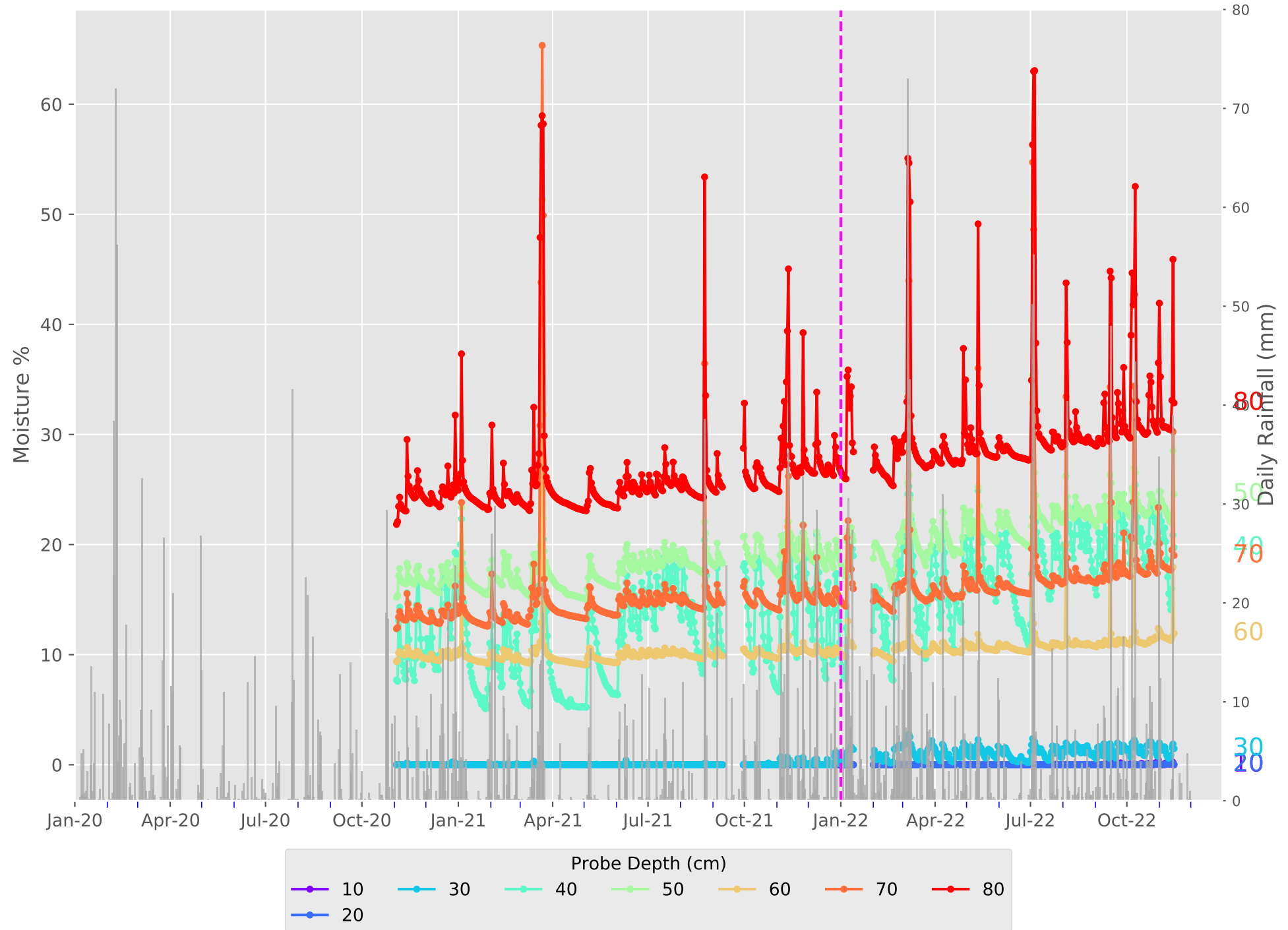
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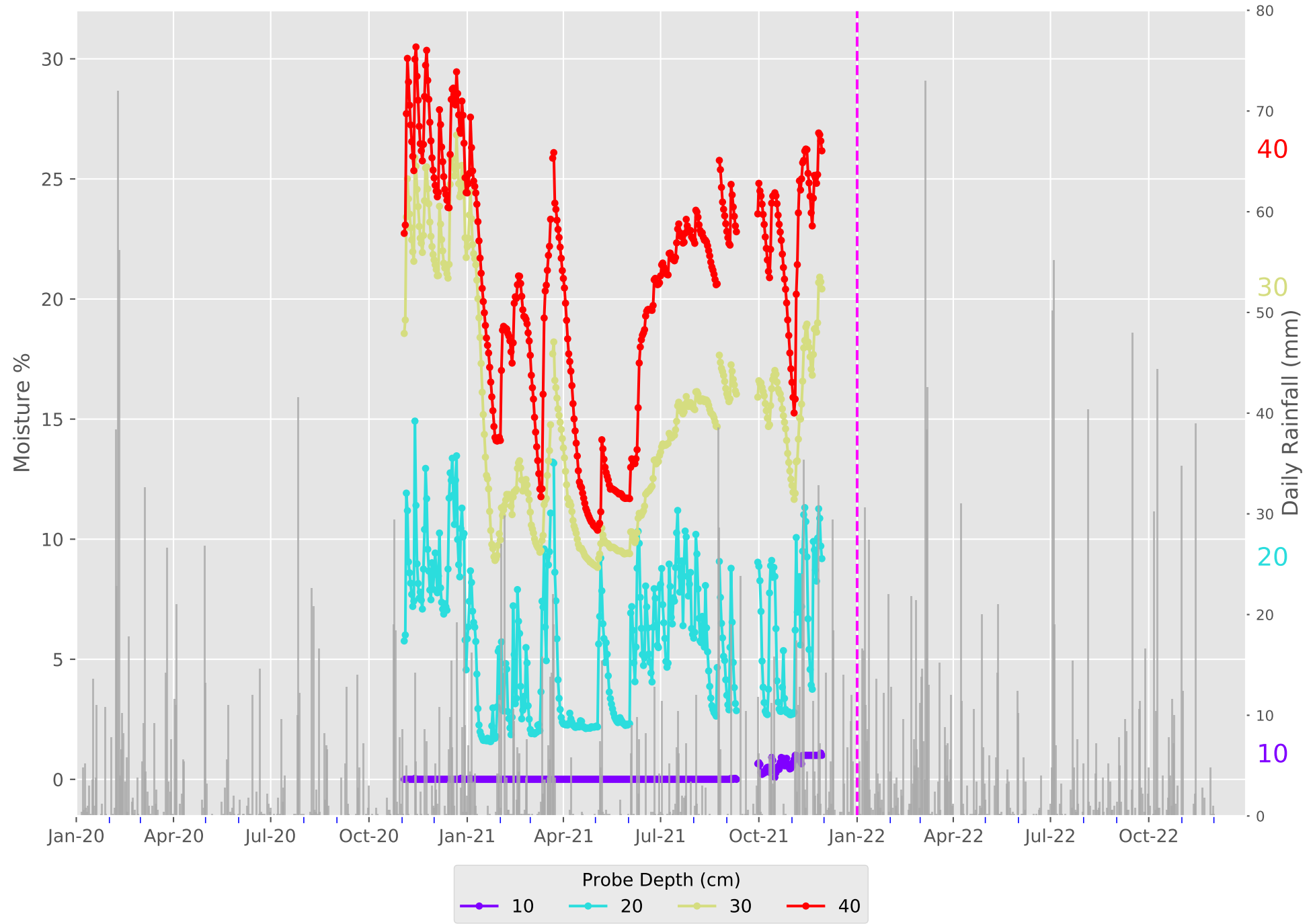
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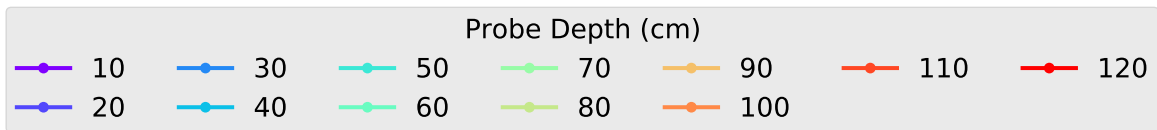
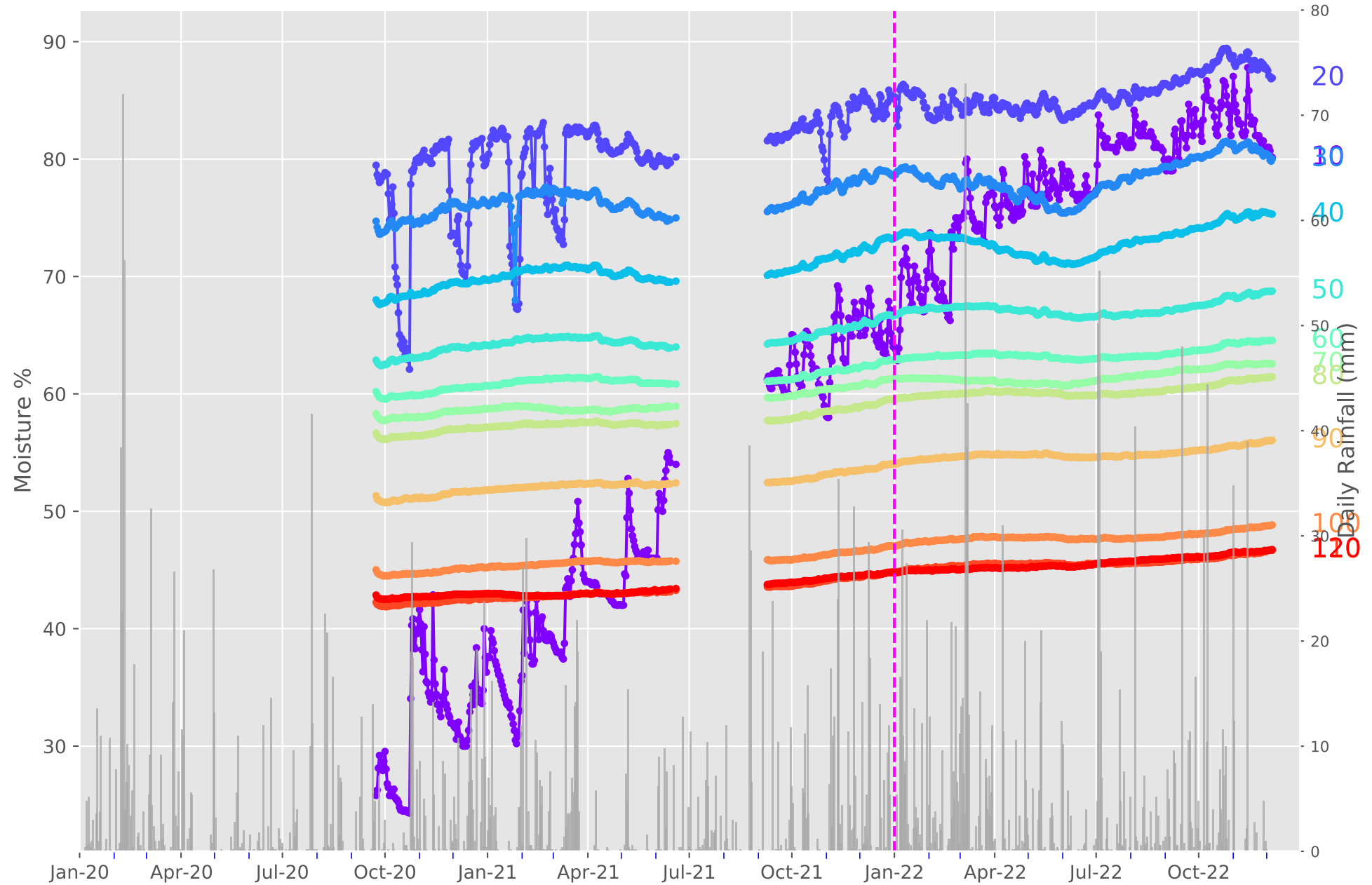
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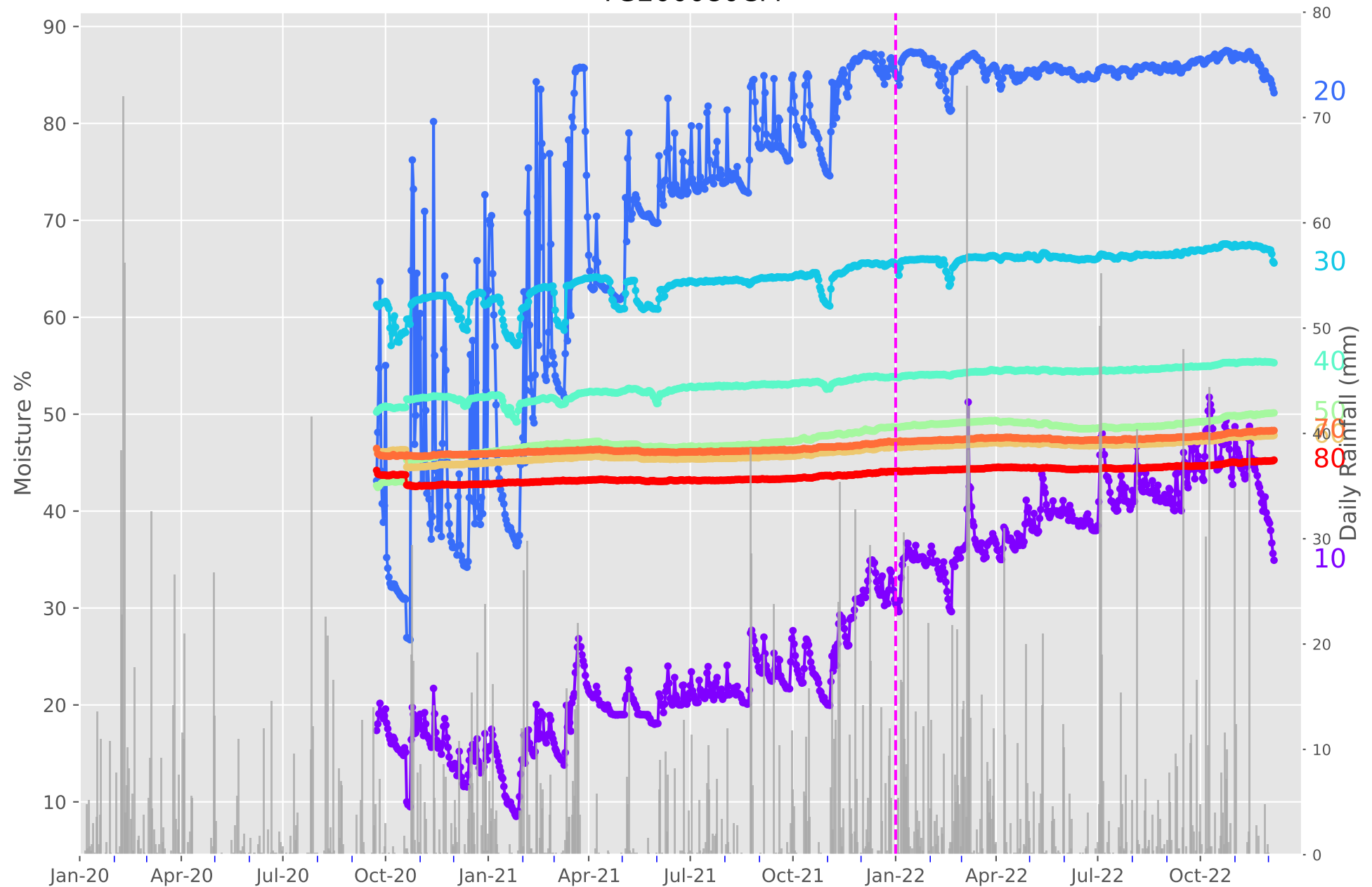
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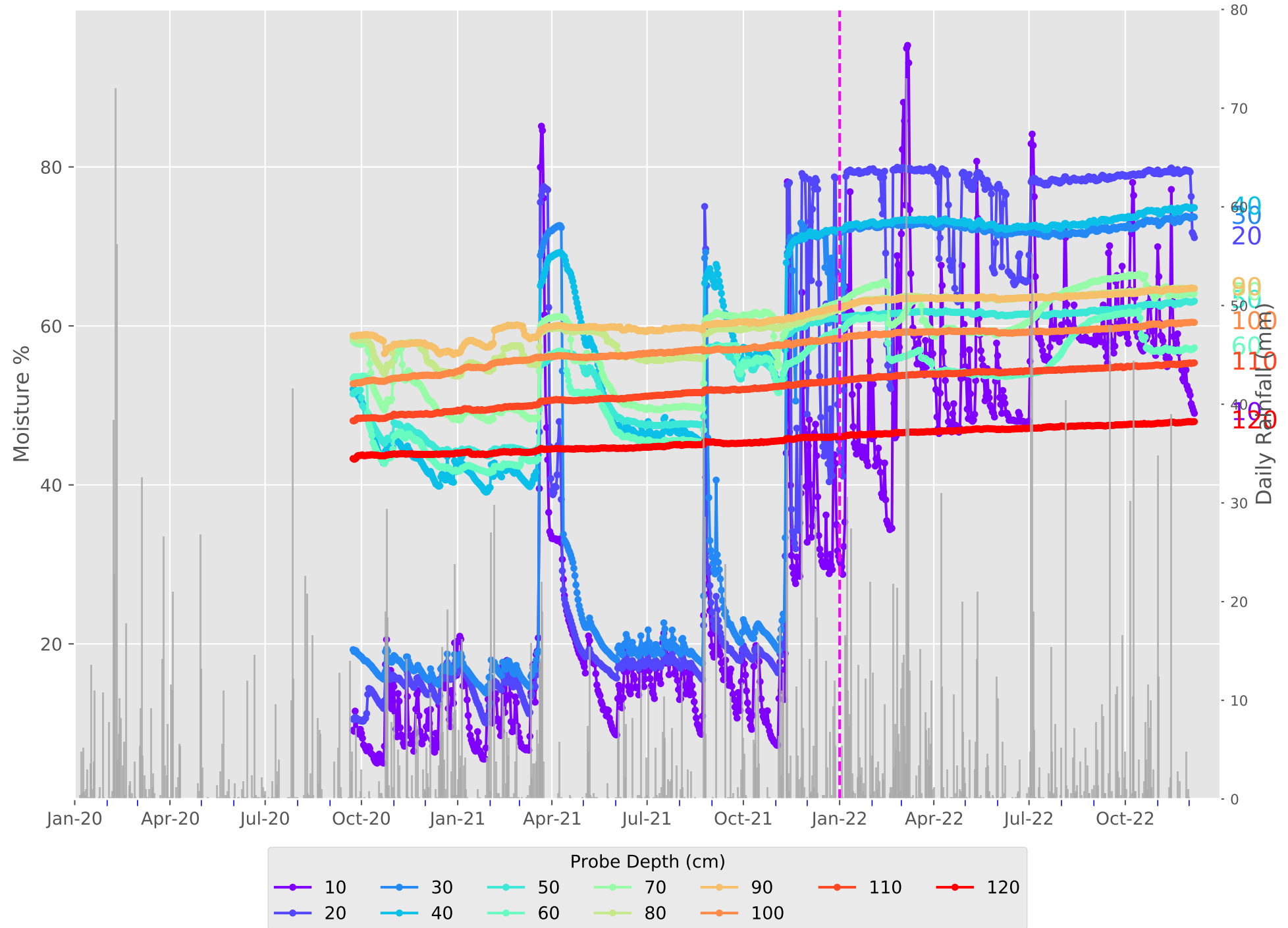
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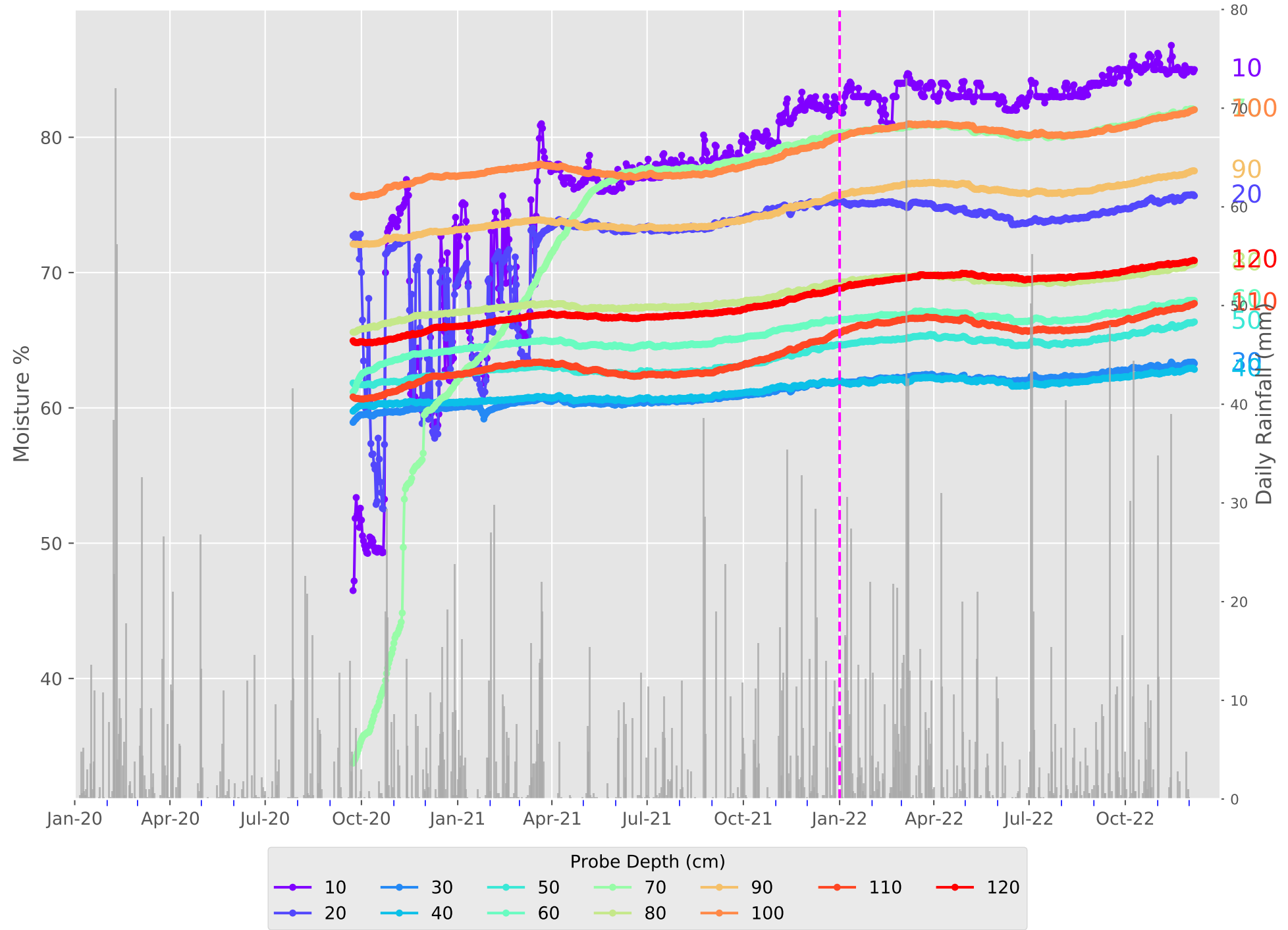
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TS200120CM



TS300120CM



Appendix B

VWP hydrographs

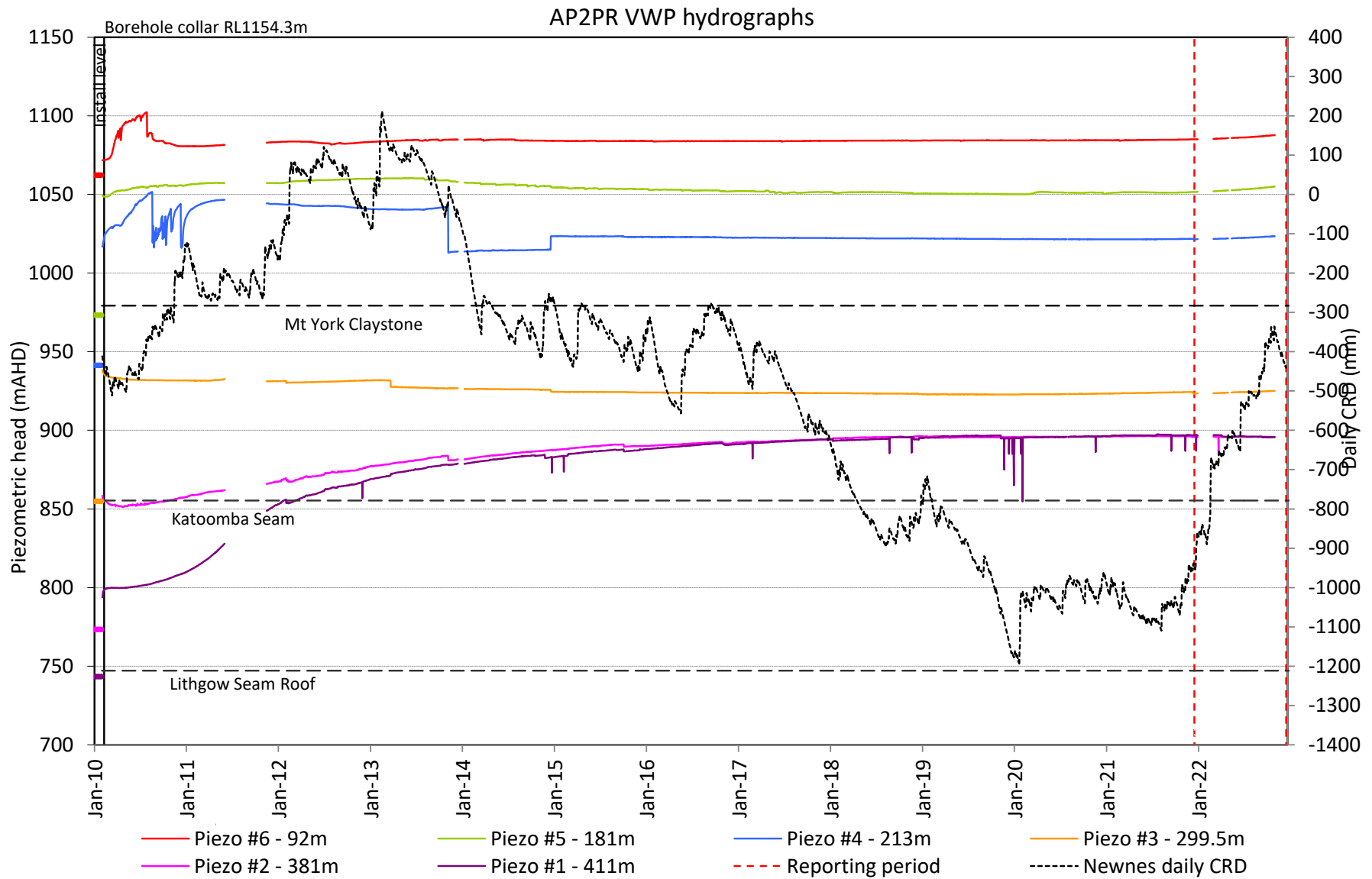


Figure B.1 AP2PR VWP hydrograph

AP10PR VWP hydrographs

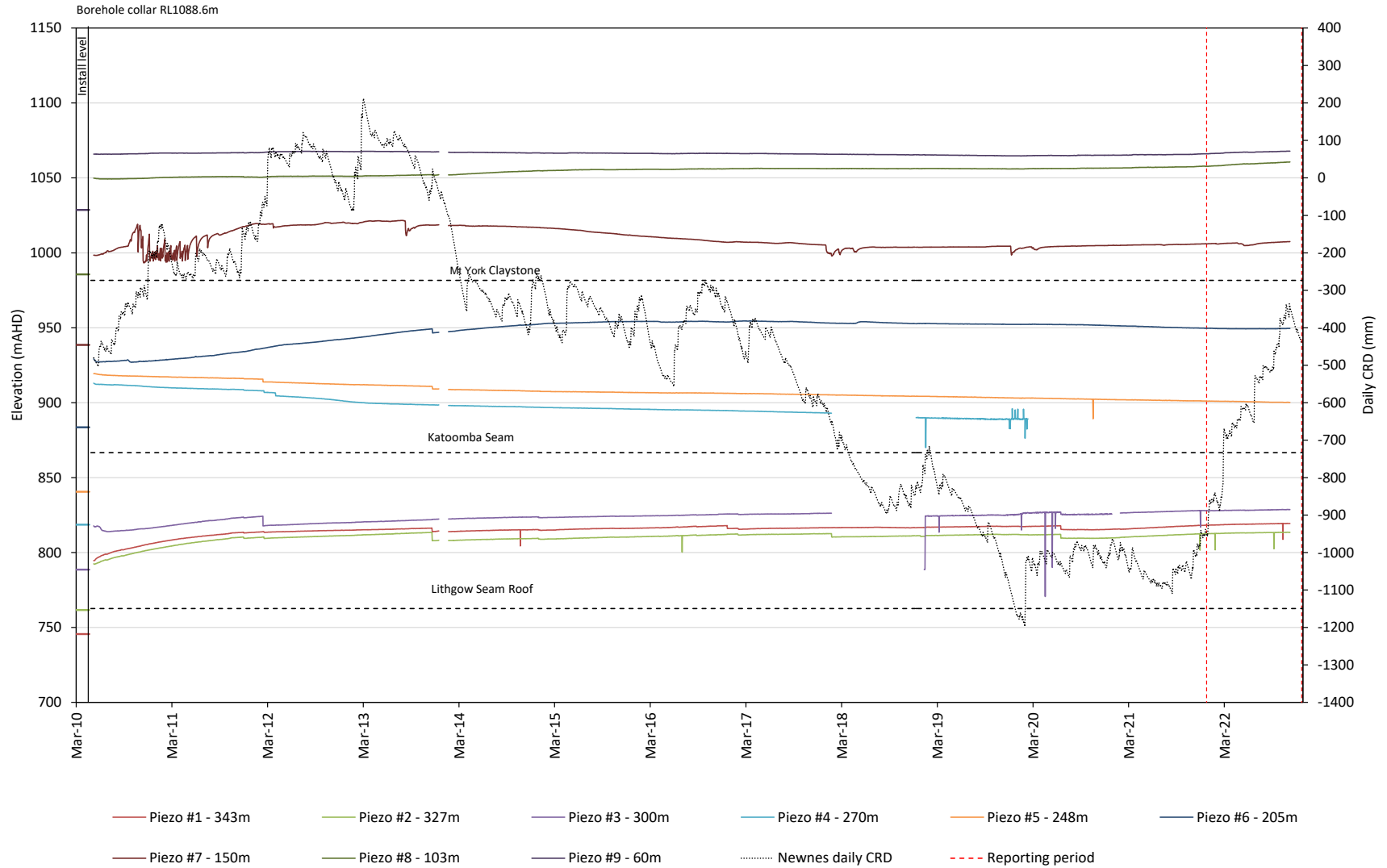


Figure B.2 AP10PR VWP hydrograph

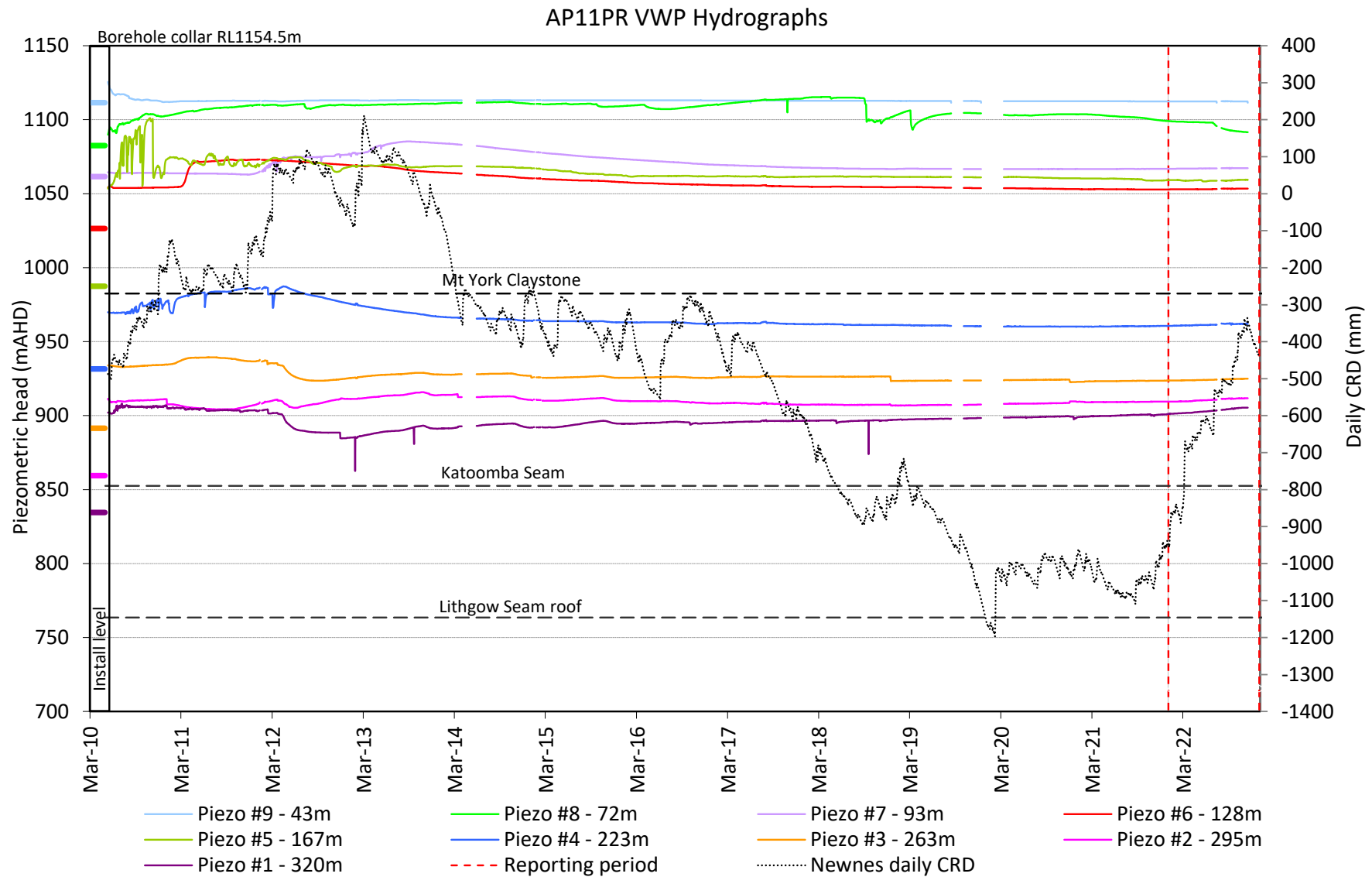


Figure B.3 AP11PR VWP hydrograph

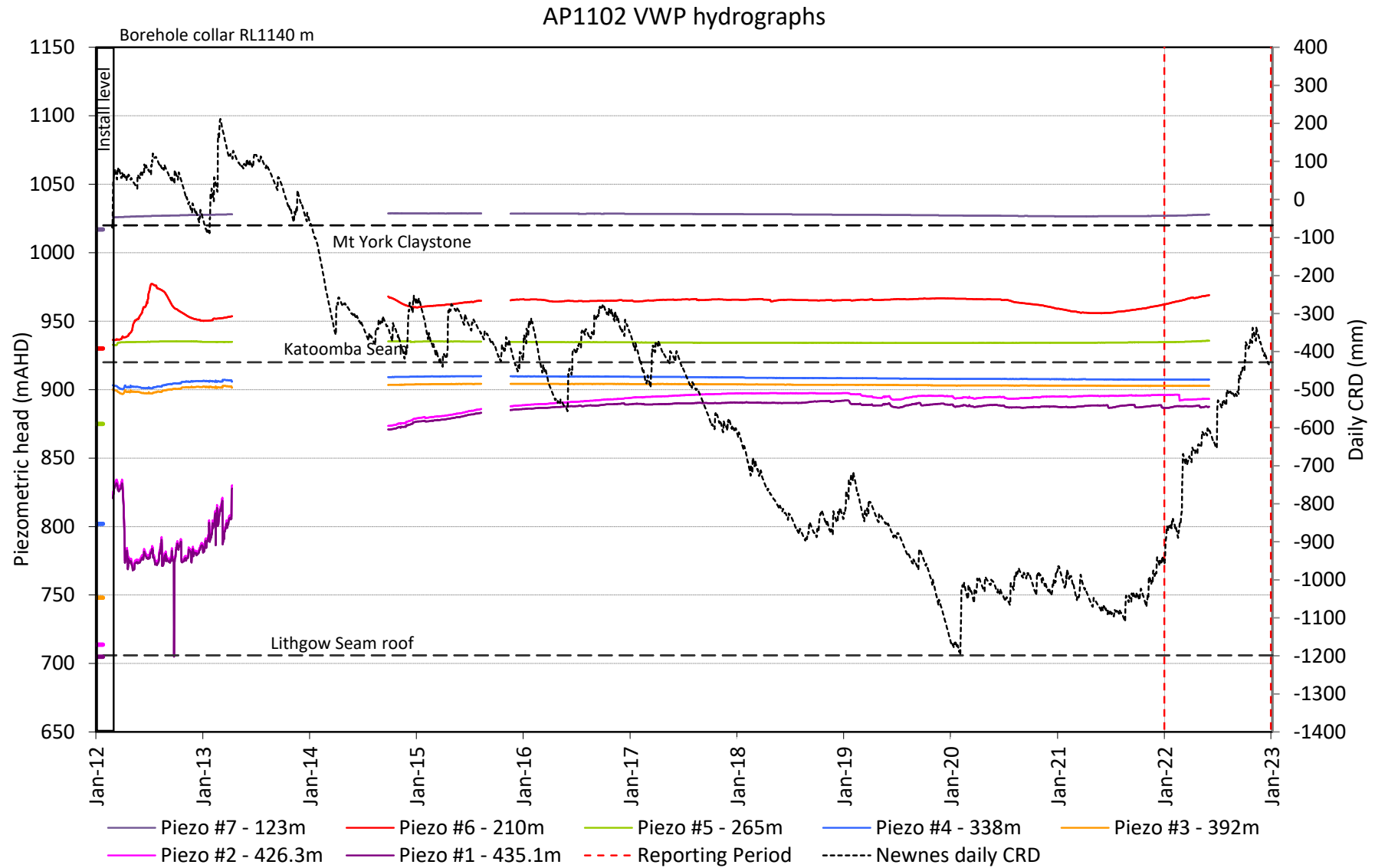


Figure B.4 AP1102 VWP hydrograph

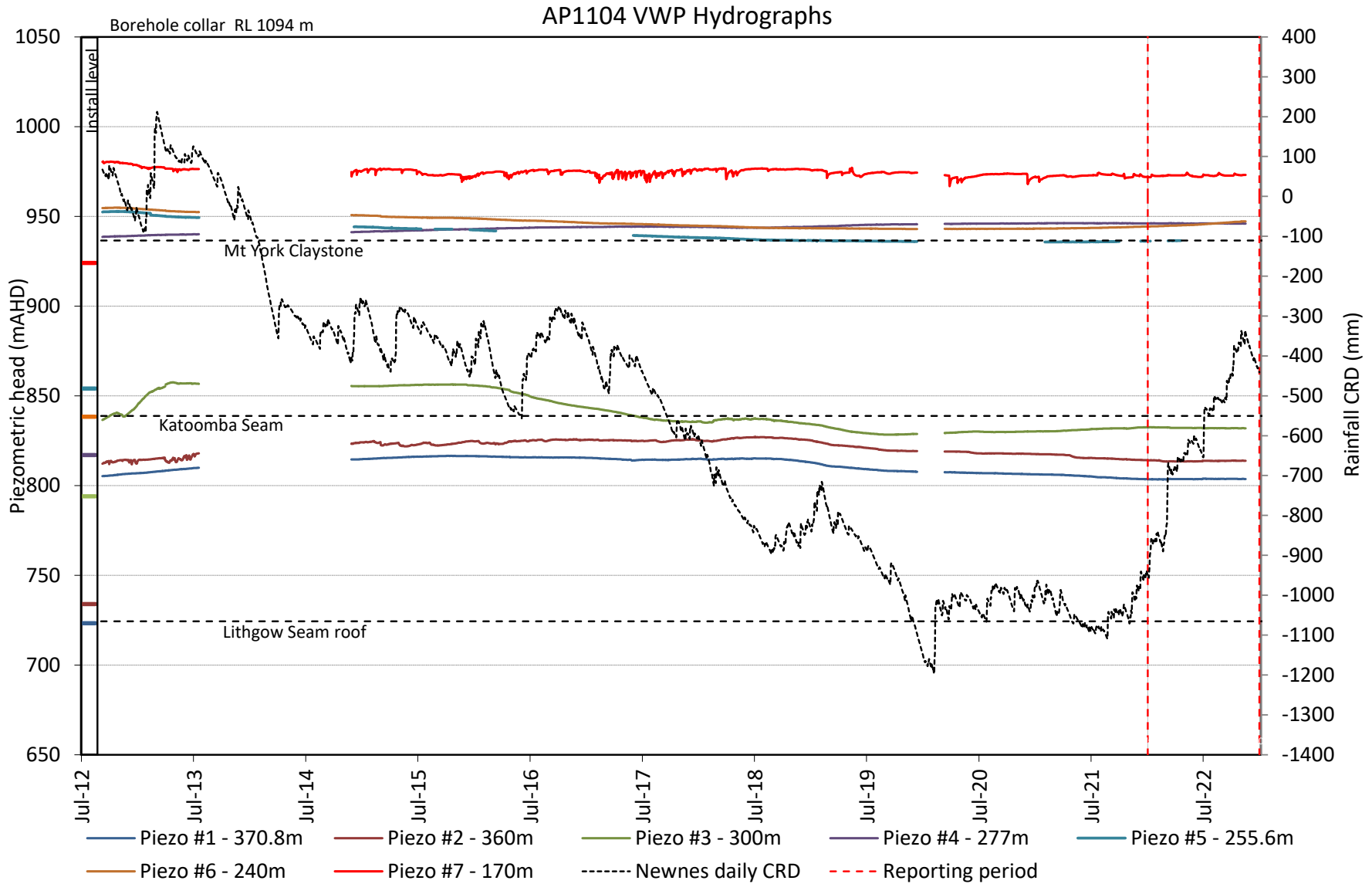


Figure B.5 AP1104 VWP hydrograph

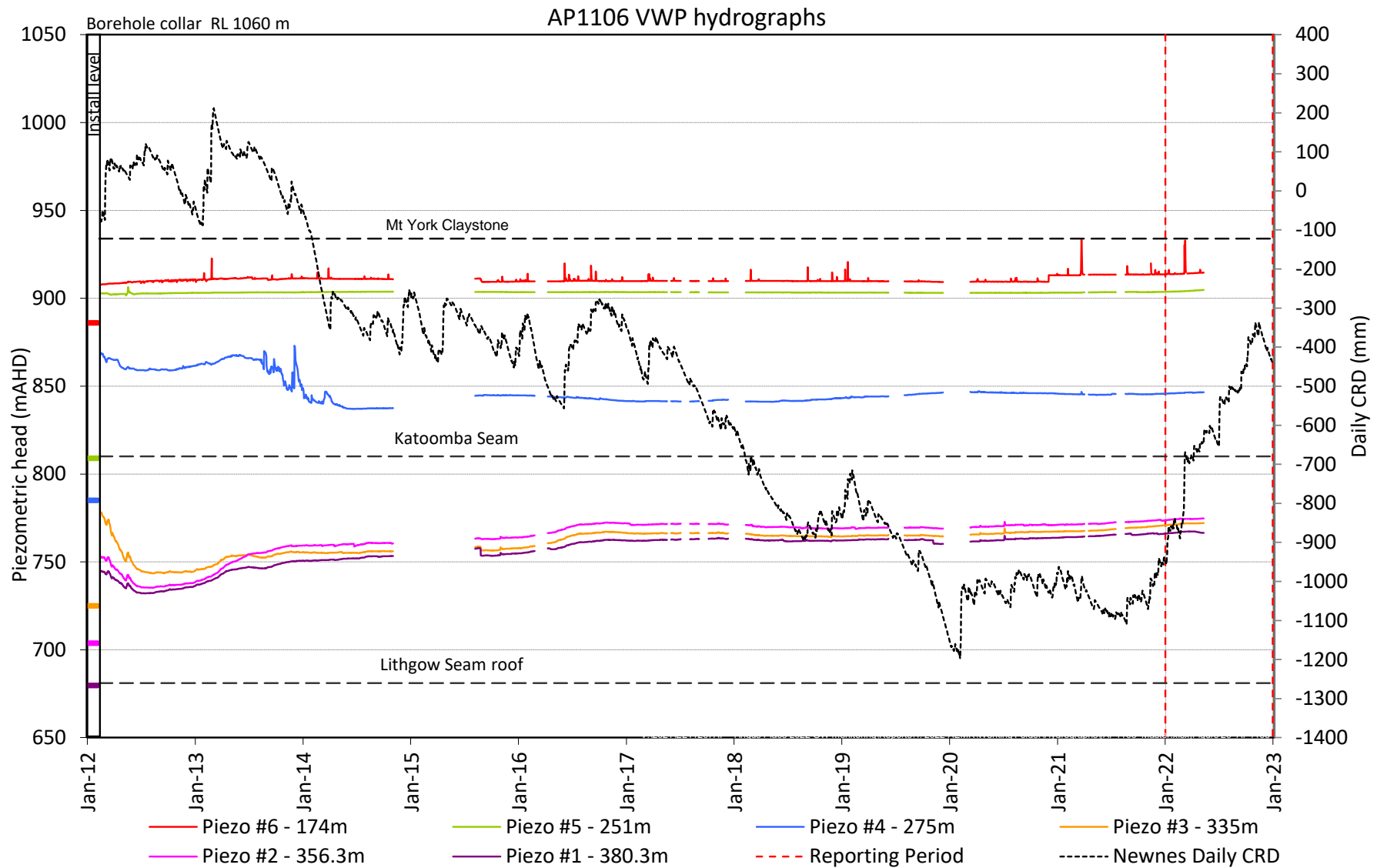


Figure B.6 AP1106 VWP hydrograph

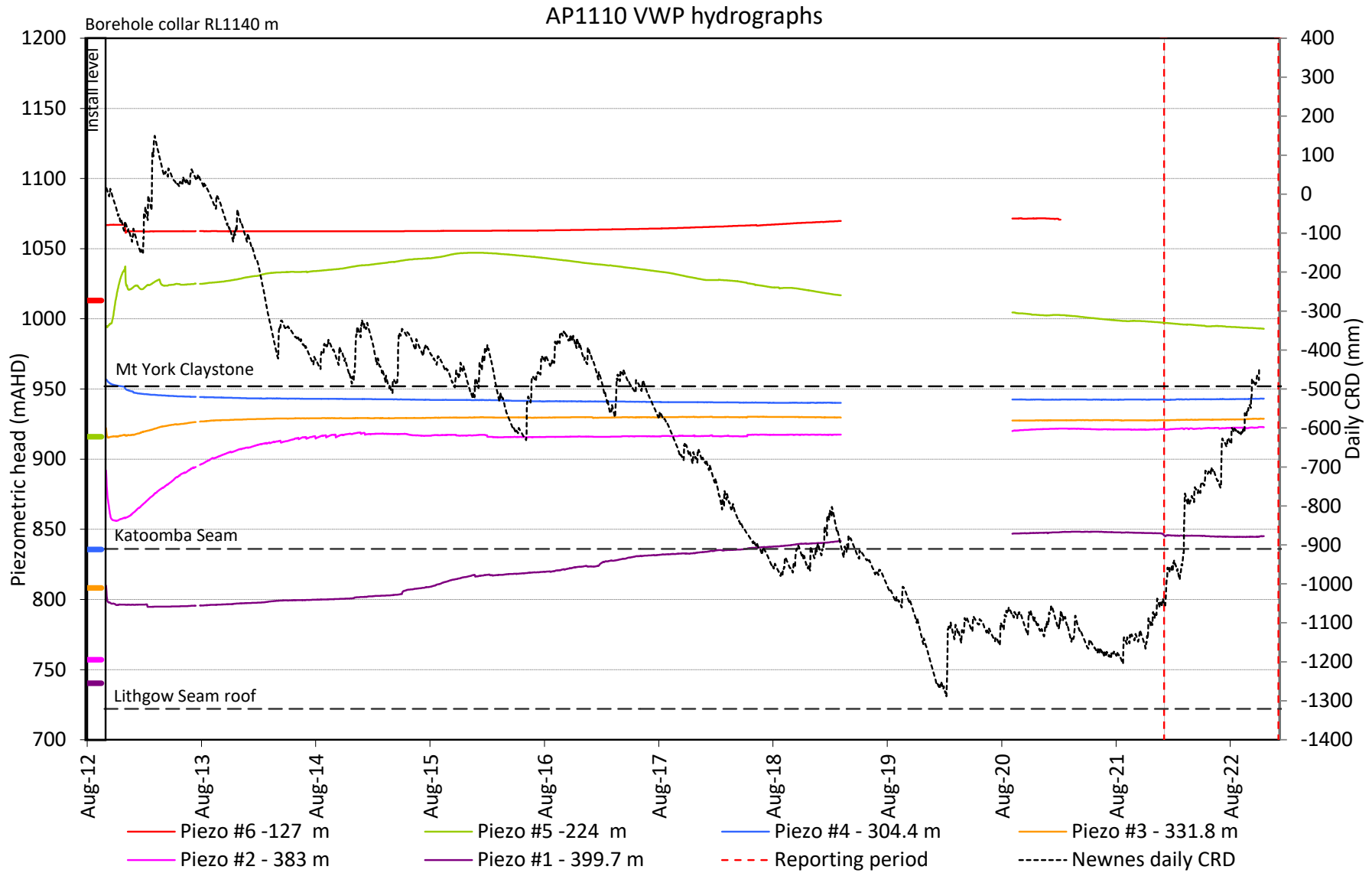


Figure B.7 AP1110 VWP hydrograph

AP1206 VWP Hydrographs

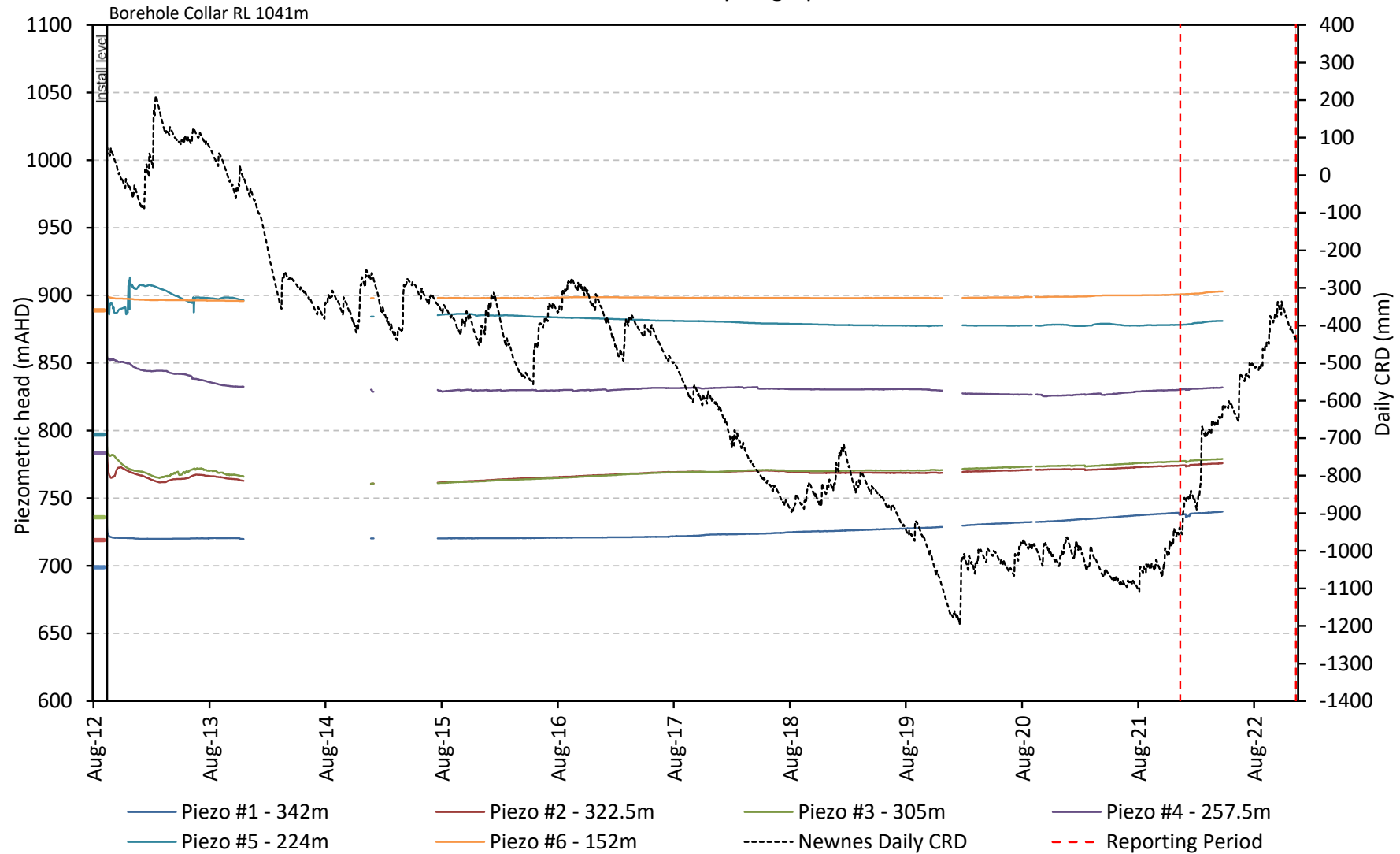


Figure B.8 AP1206 VWP hydrograph

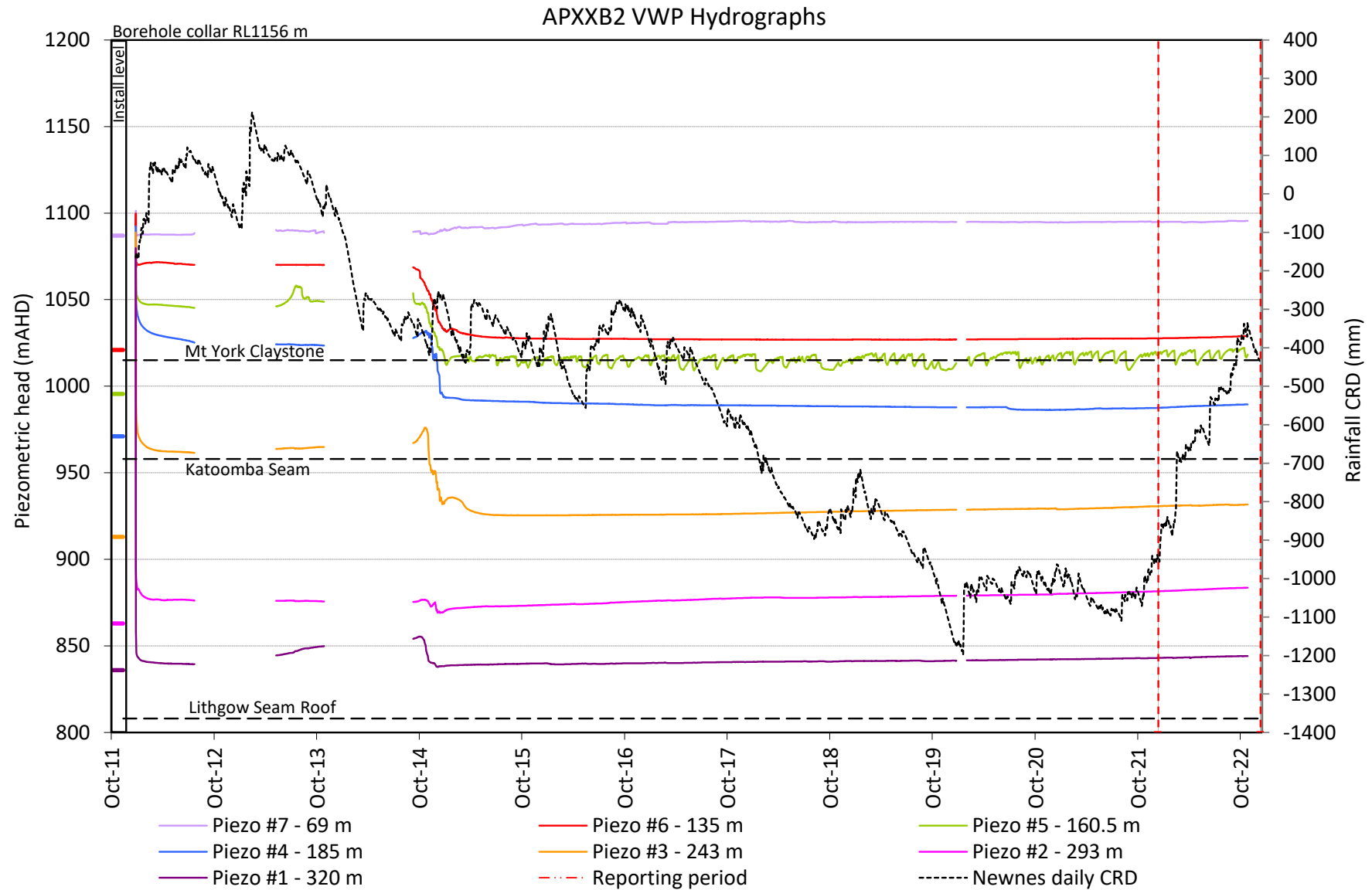


Figure B.9 APXXB2 VWP hydrograph

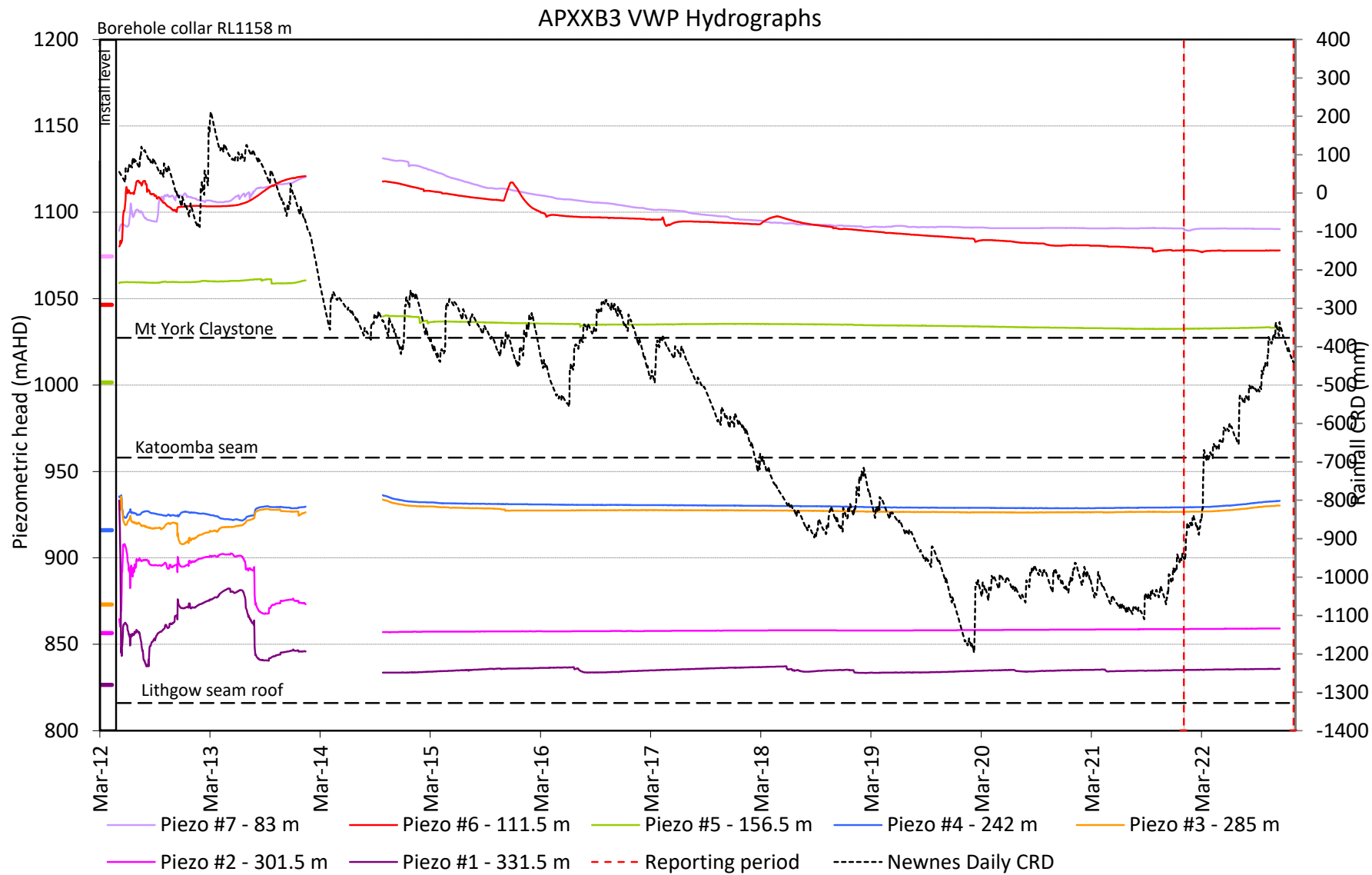


Figure B.10 APXXB3 VWP hydrograph

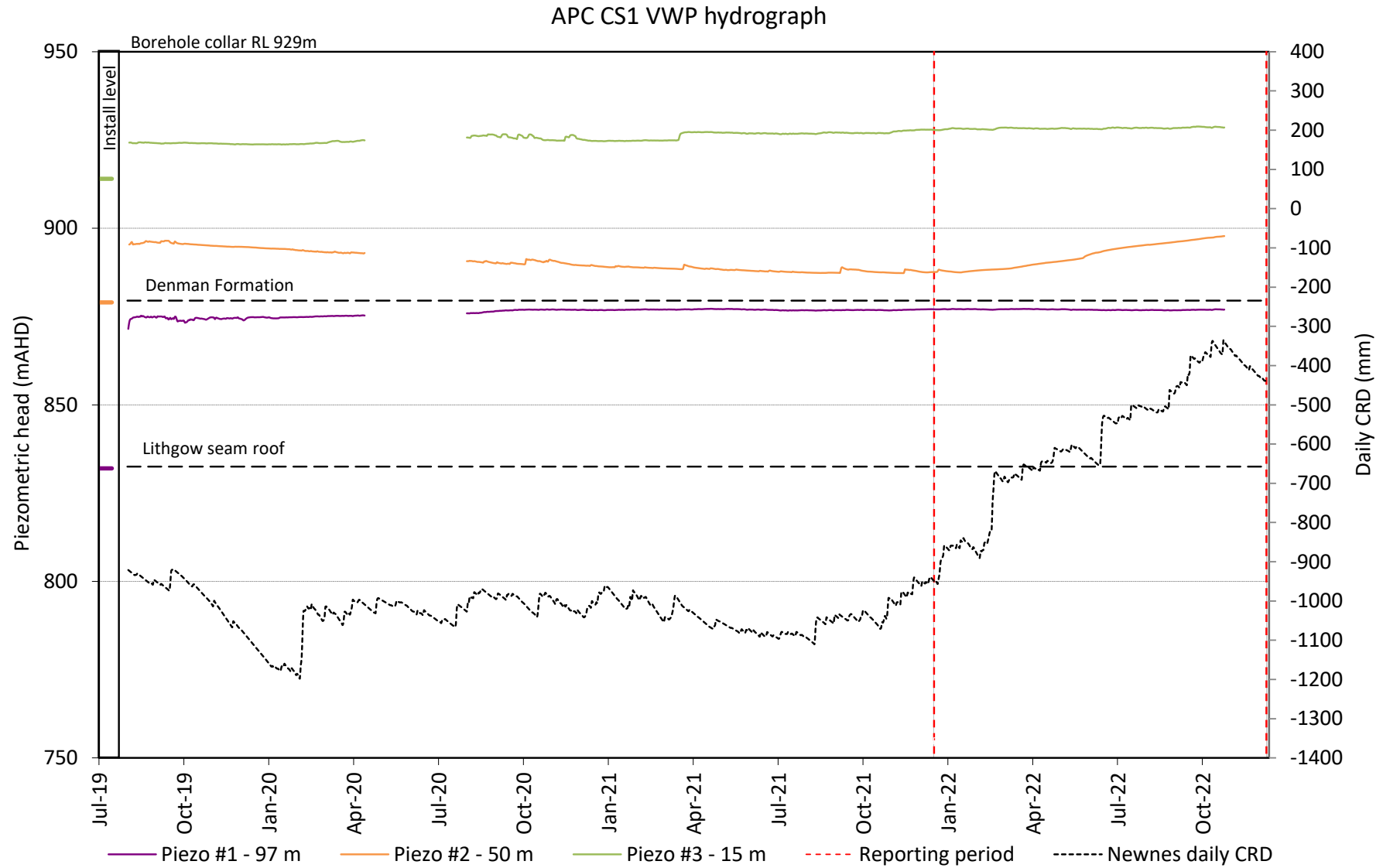


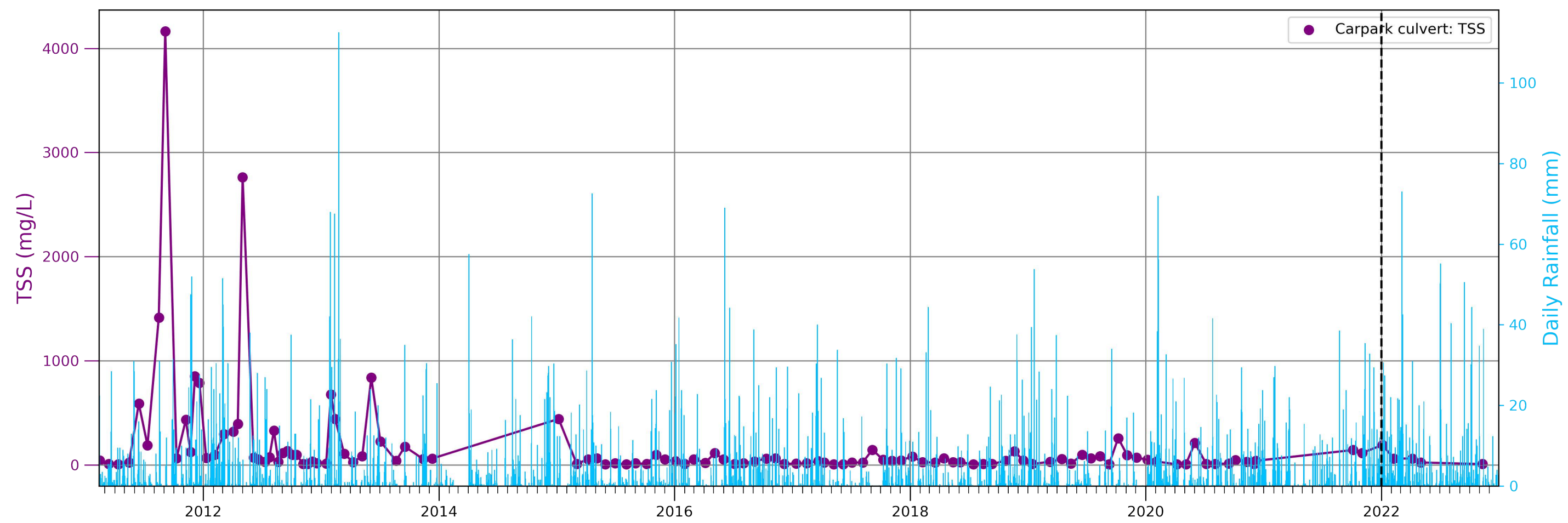
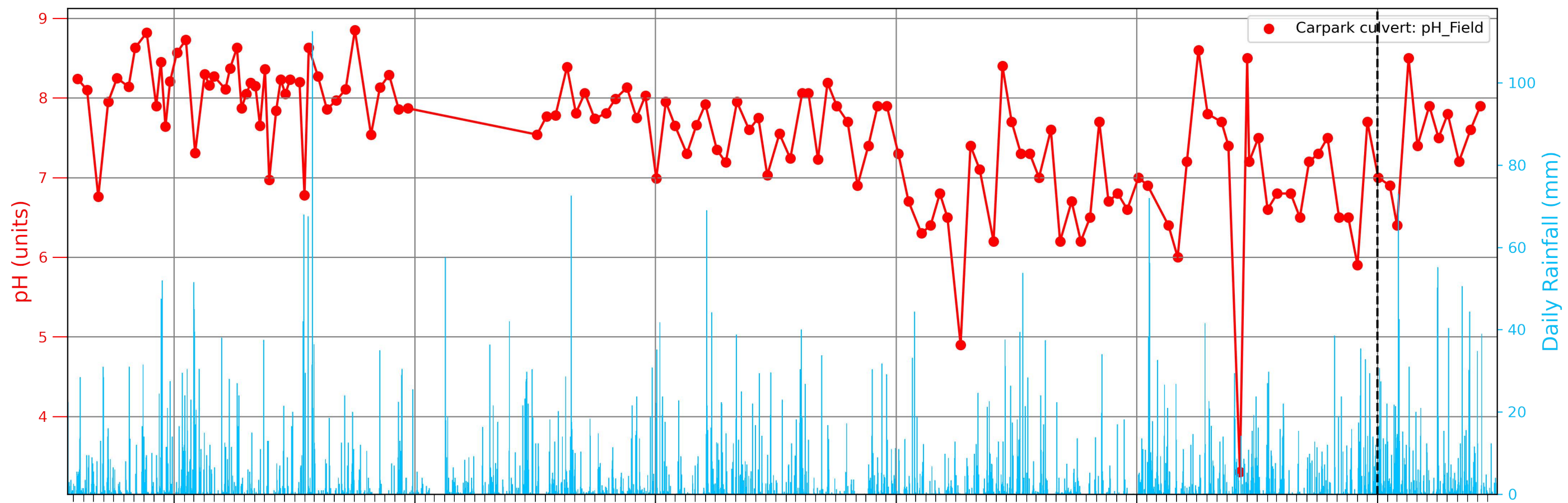
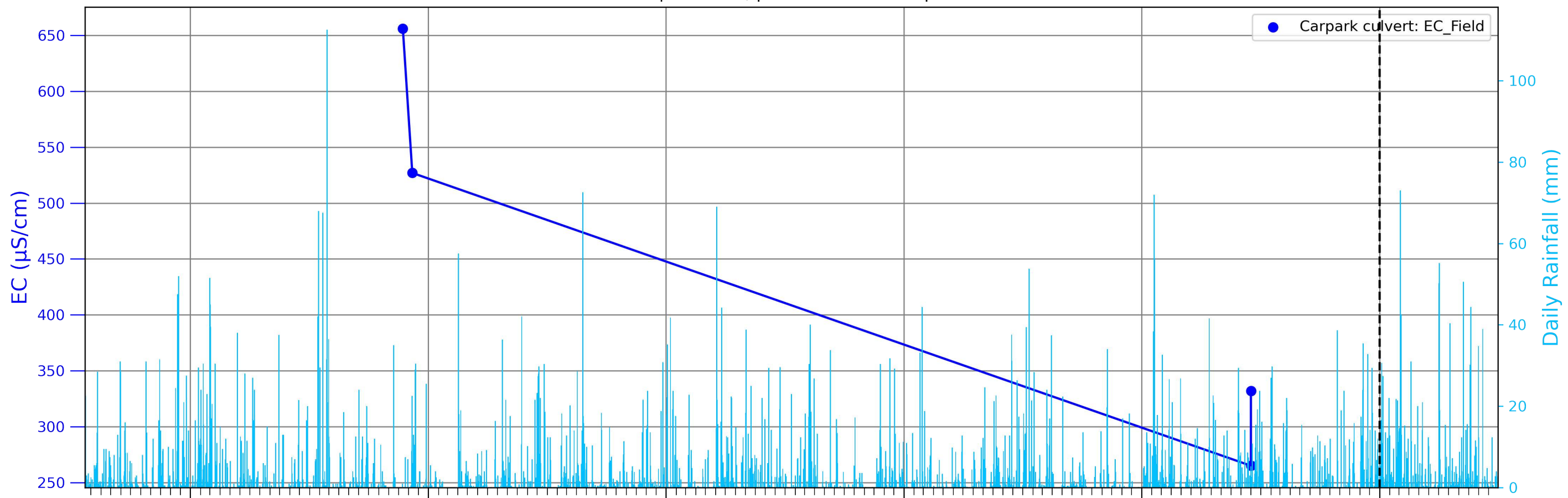
Figure B.11 APC CS1 VWP hydrograph

Appendix C

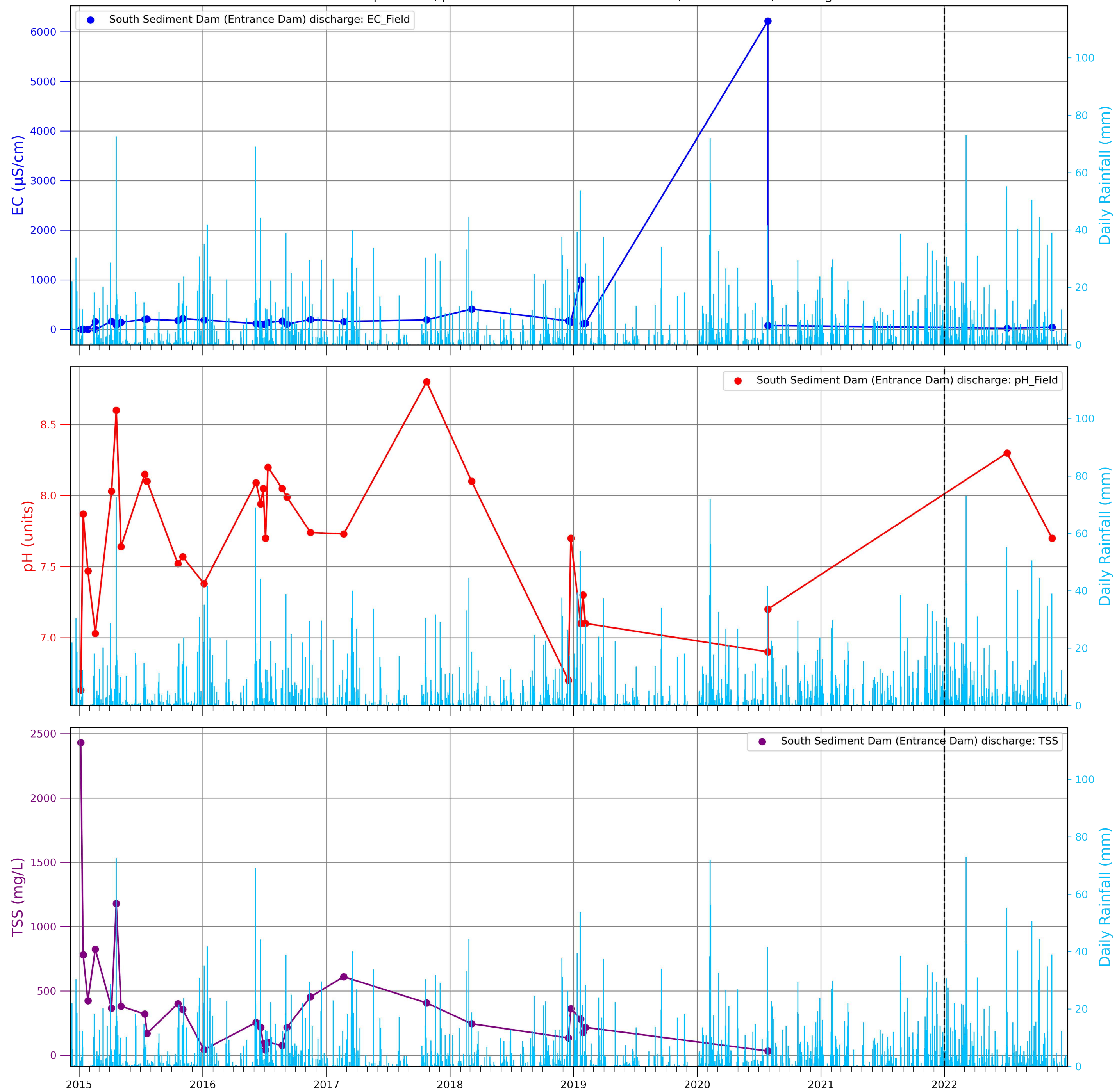
Surface water quality time series plots

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

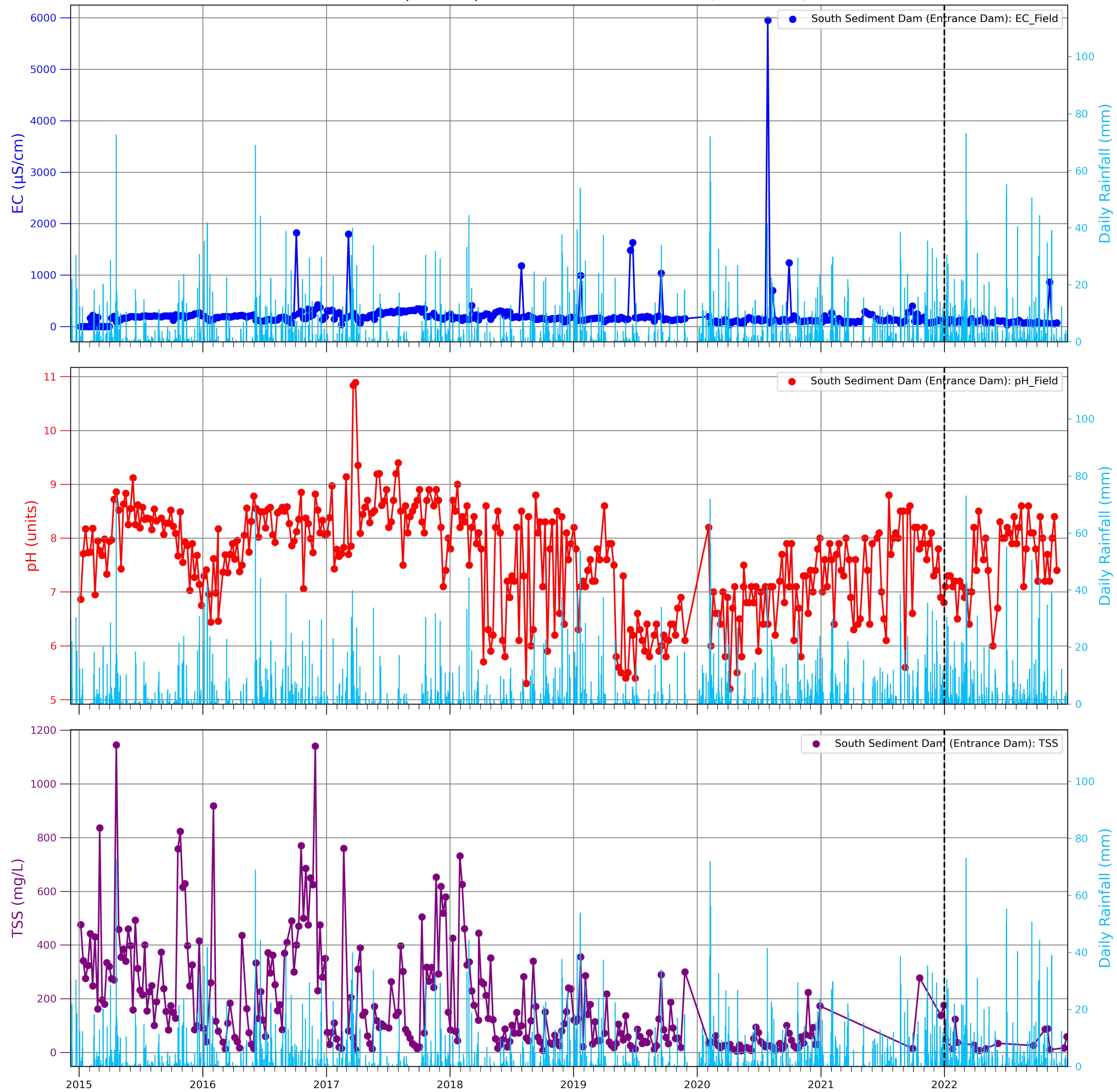
Time series plot of EC, pH and TSS at: Carpark culvert



Time series plot of EC, pH and TSS at: South Sediment Dam (Entrance Dam) discharge

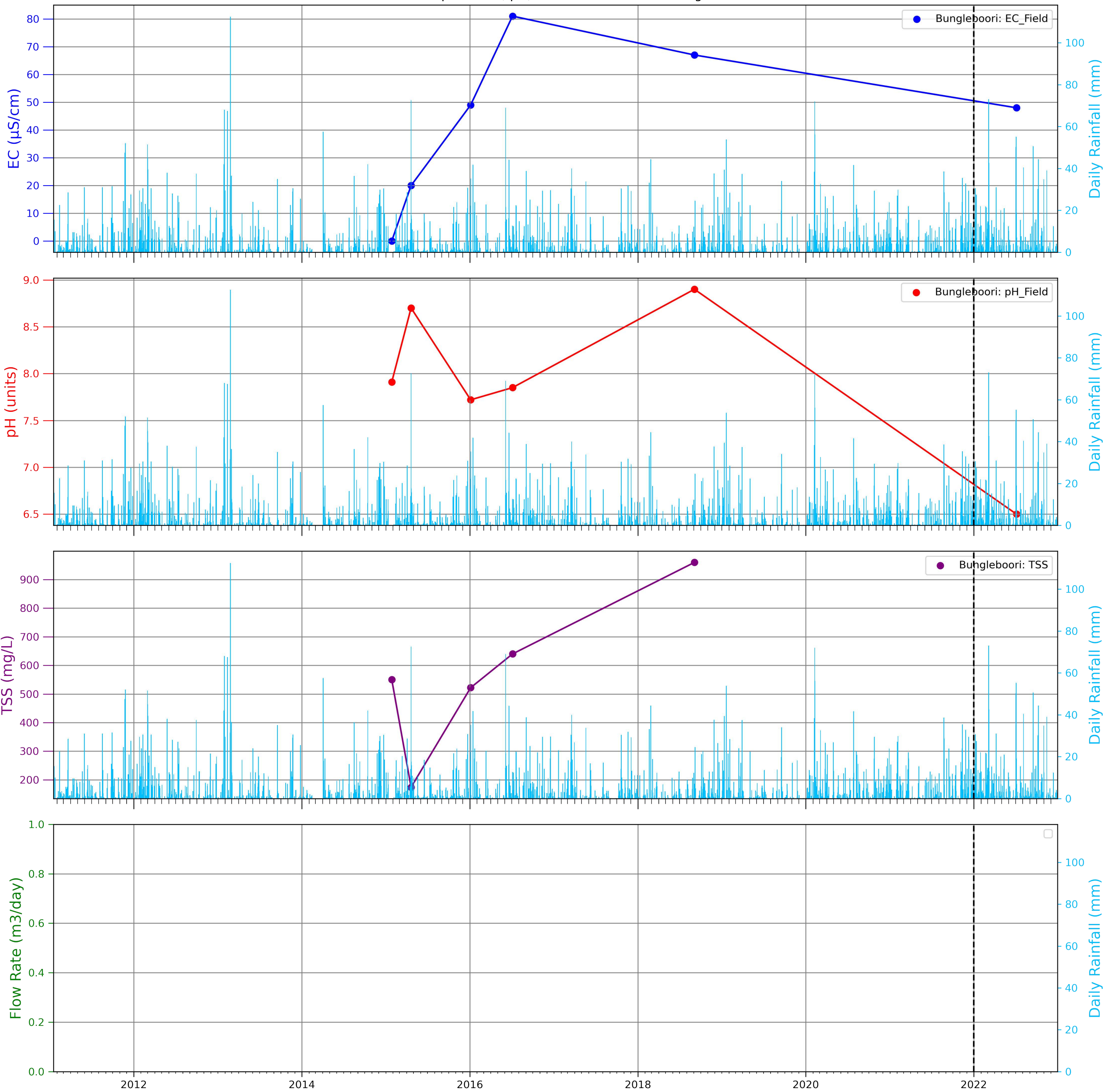


Time series plot of EC, pH and TSS at: South Sediment Dam (Entrance Dam)

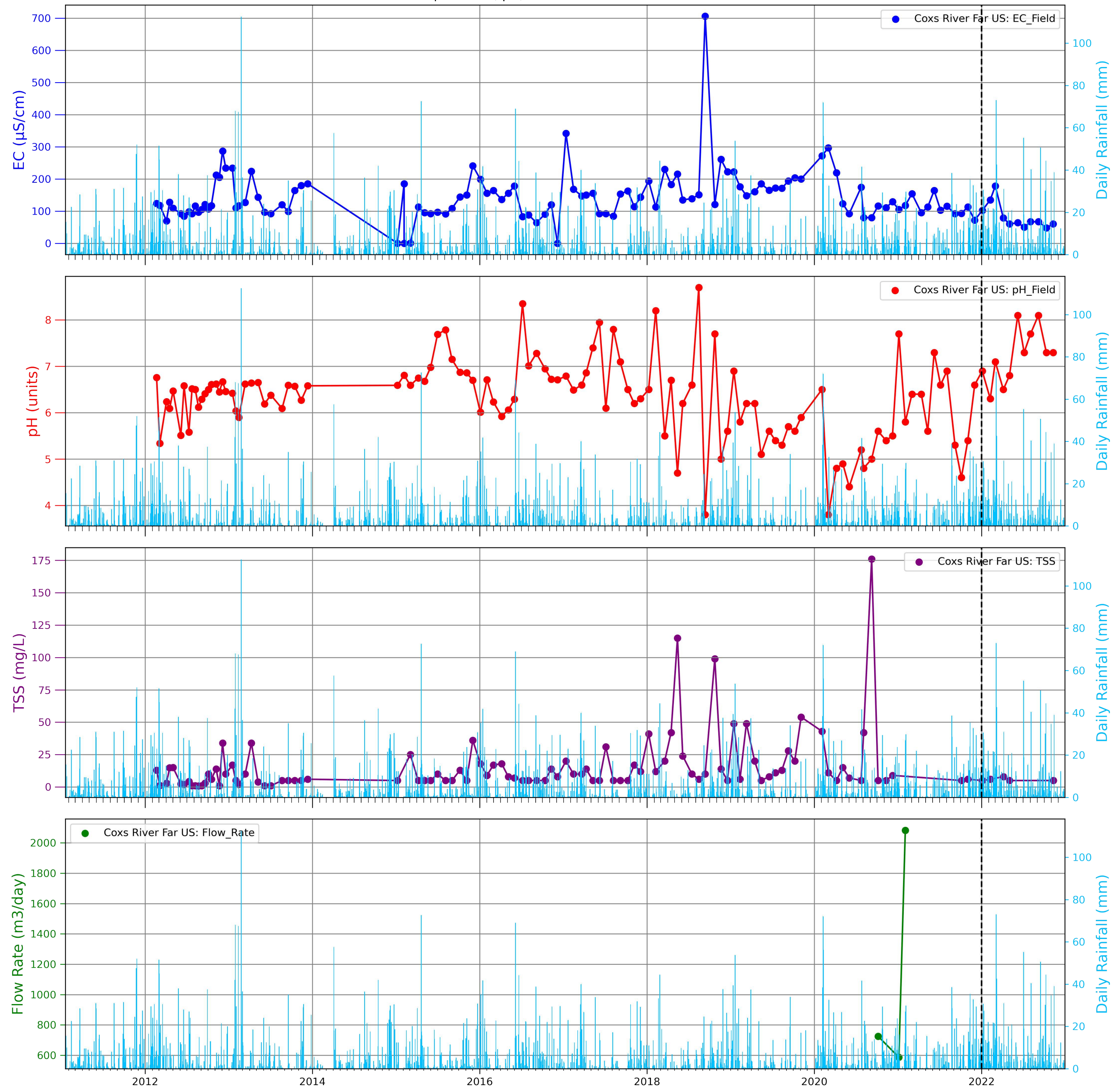


C.2 Pit top surface water quality time series plots

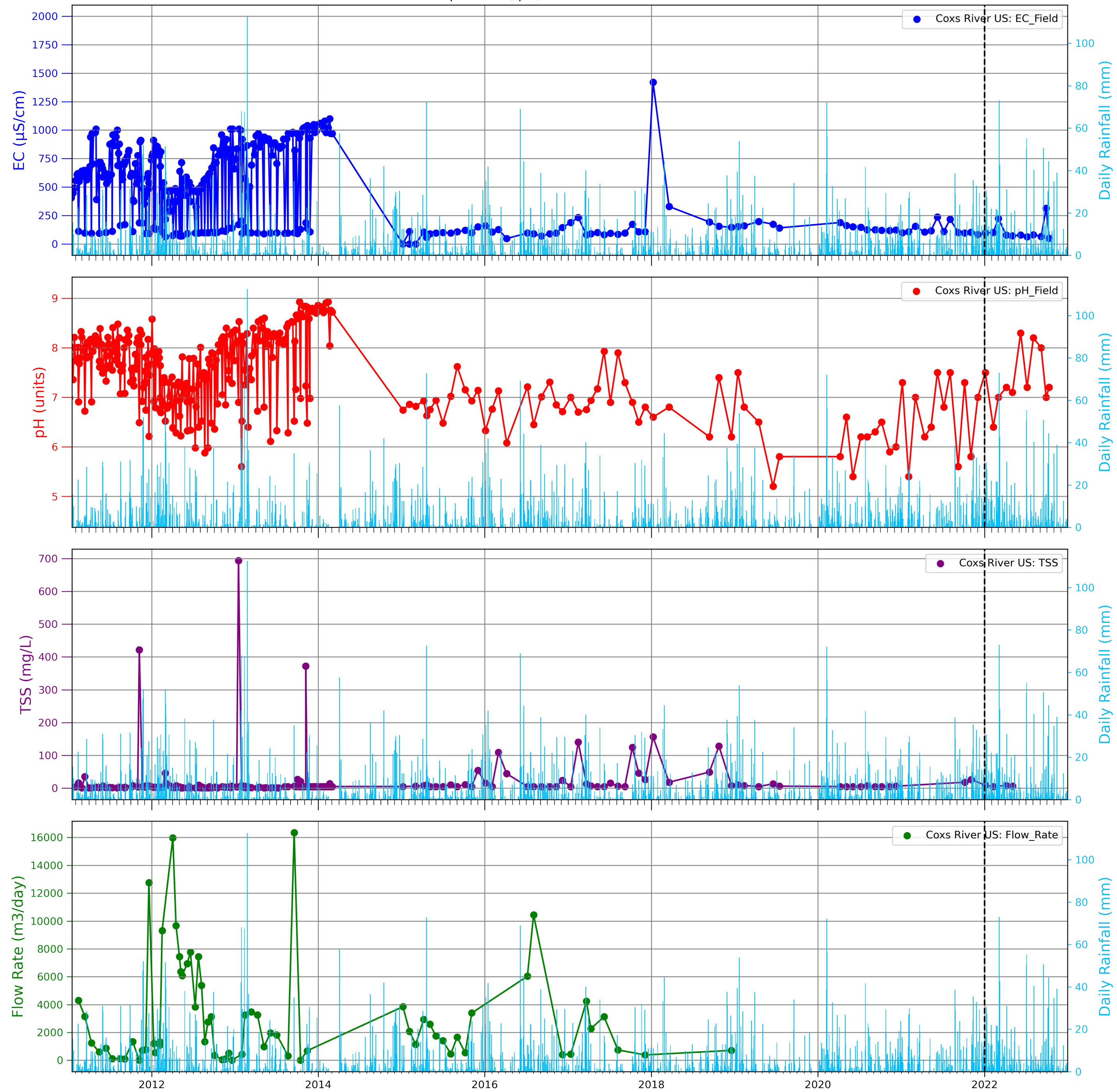
Time series plot of EC, pH, TSS and flow rate at: Bungleboori



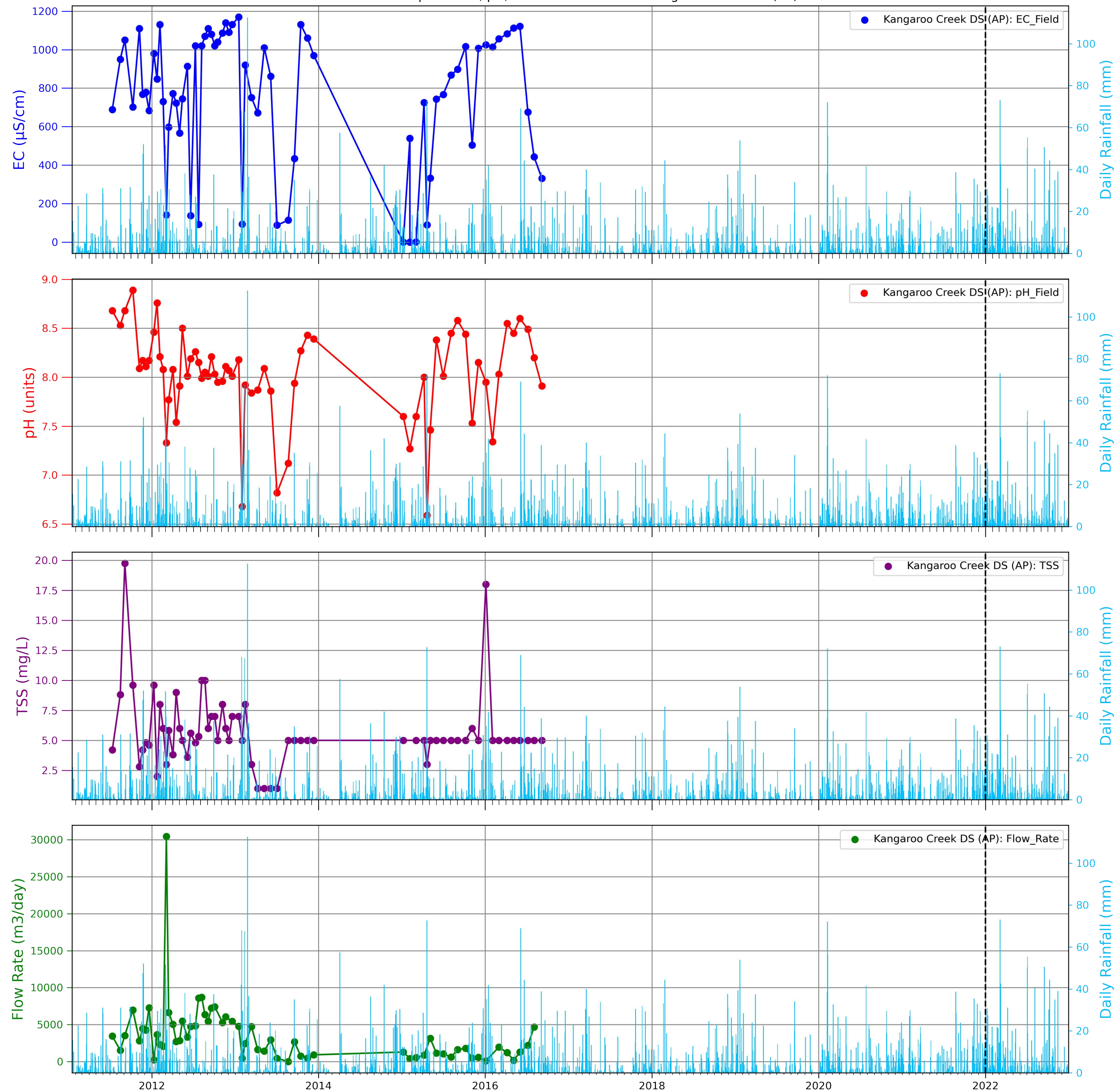
Time series plot of EC, pH, TSS and flow rate at: Coxs River Far US



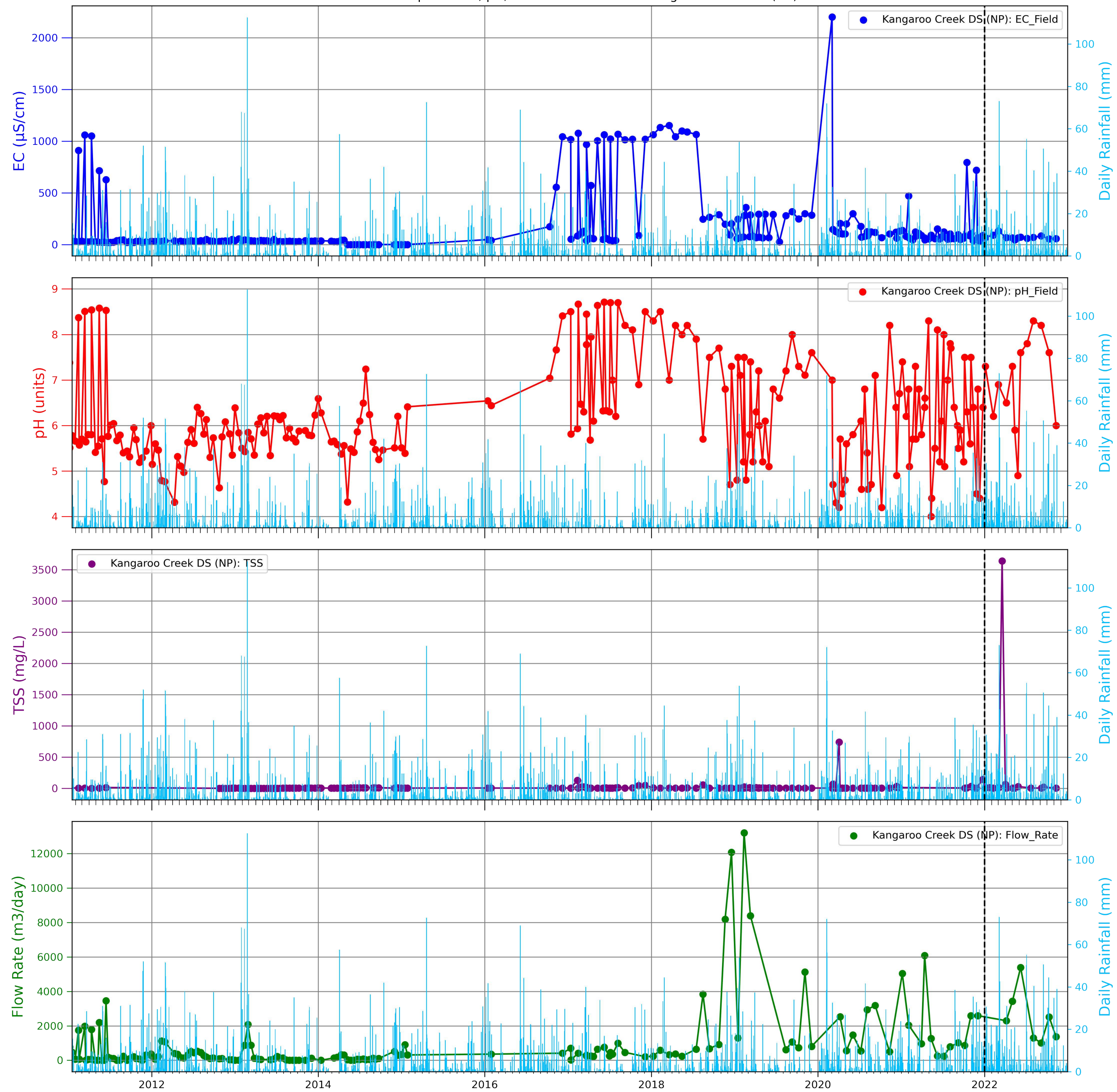
Time series plot of EC, pH, TSS and flow rate at: Coxs River US



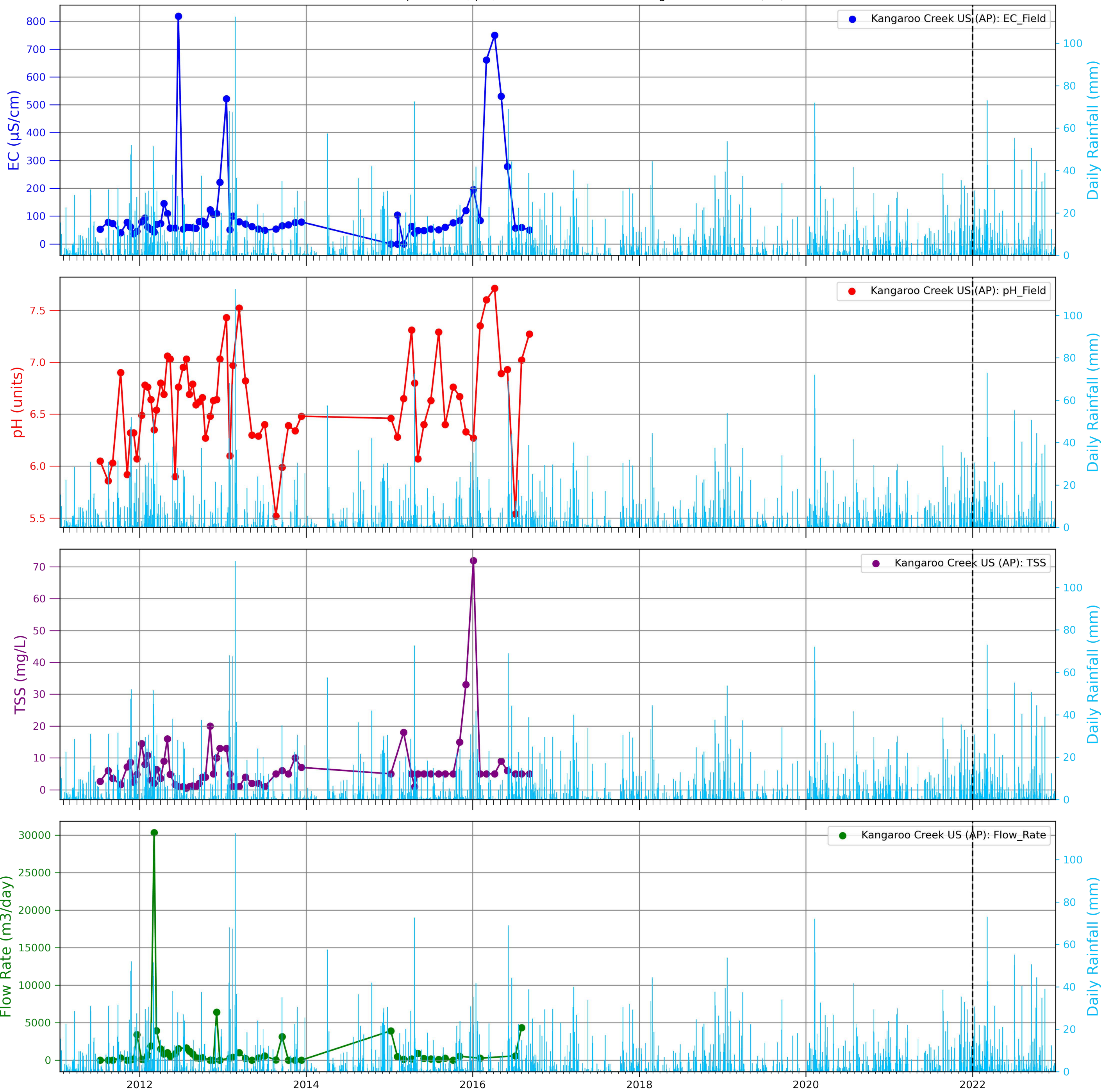
Time series plot of EC, pH, TSS and flow rate at: Kangaroo Creek DS (AP)



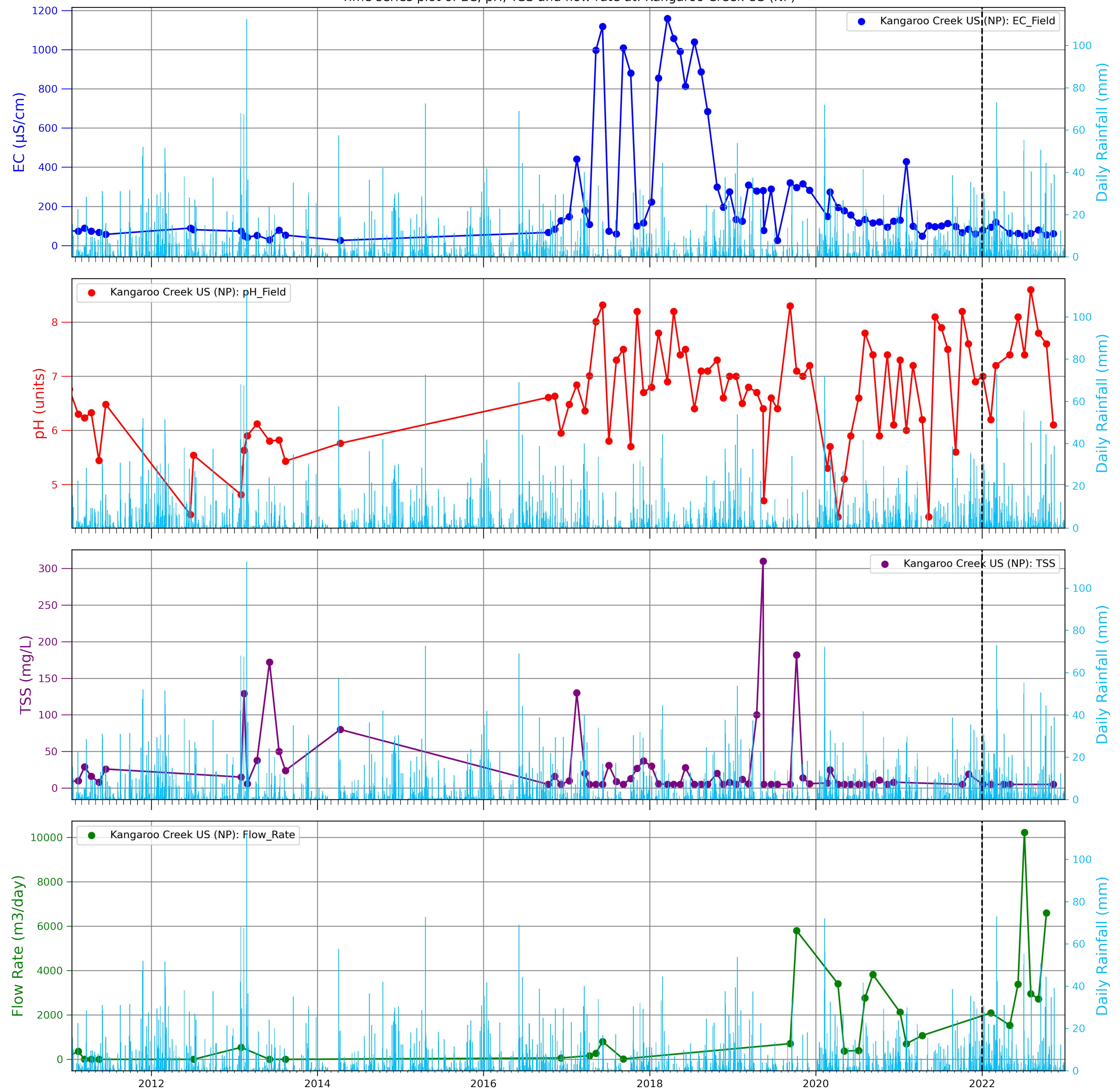
Time series plot of EC, pH, TSS and flow rate at: Kangaroo Creek DS (NP)



Time series plot of EC, pH, TSS and flow rate at: Kangaroo Creek US (AP)



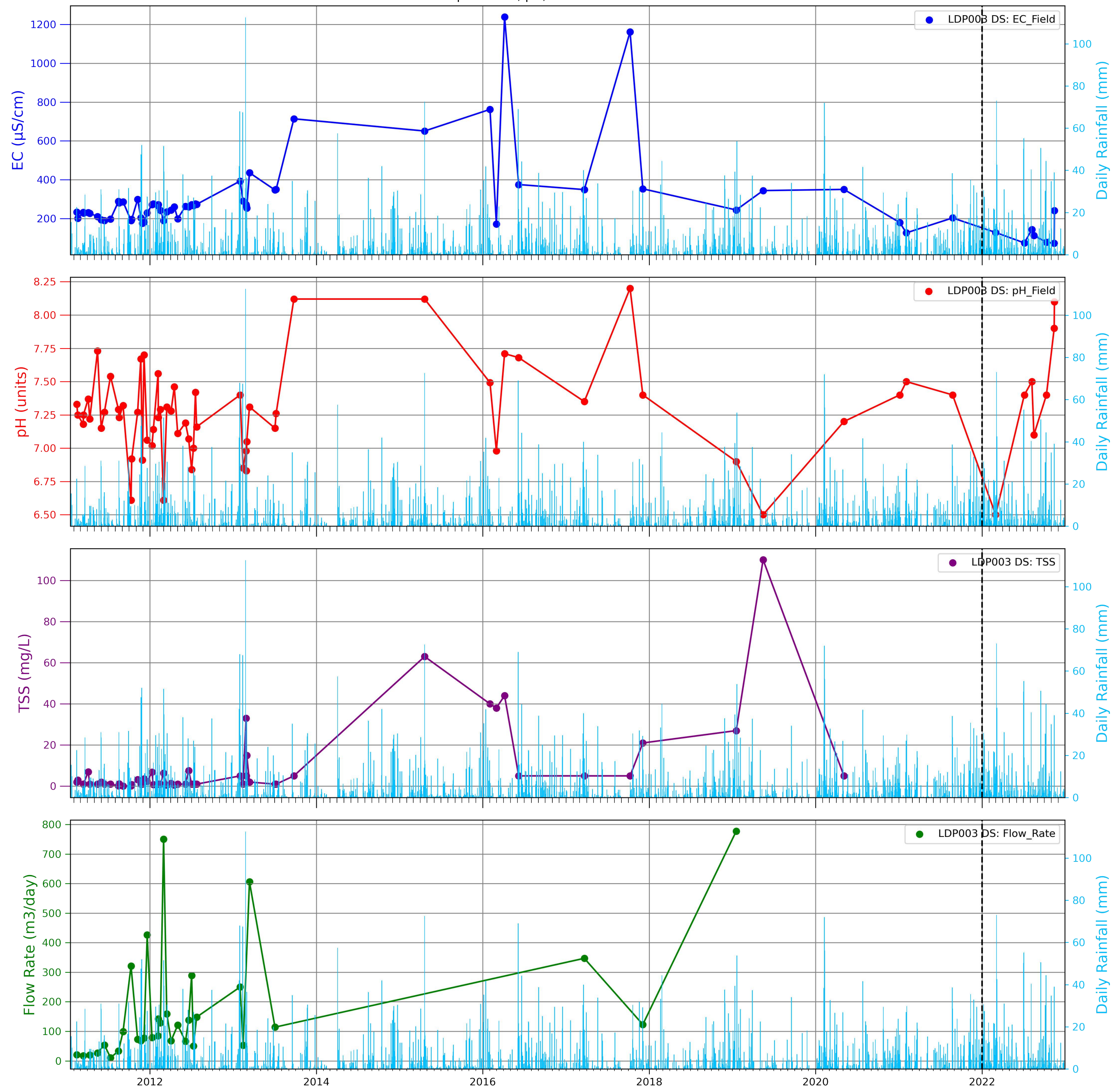
Time series plot of EC, pH, TSS and flow rate at: Kangaroo Creek US (NP)



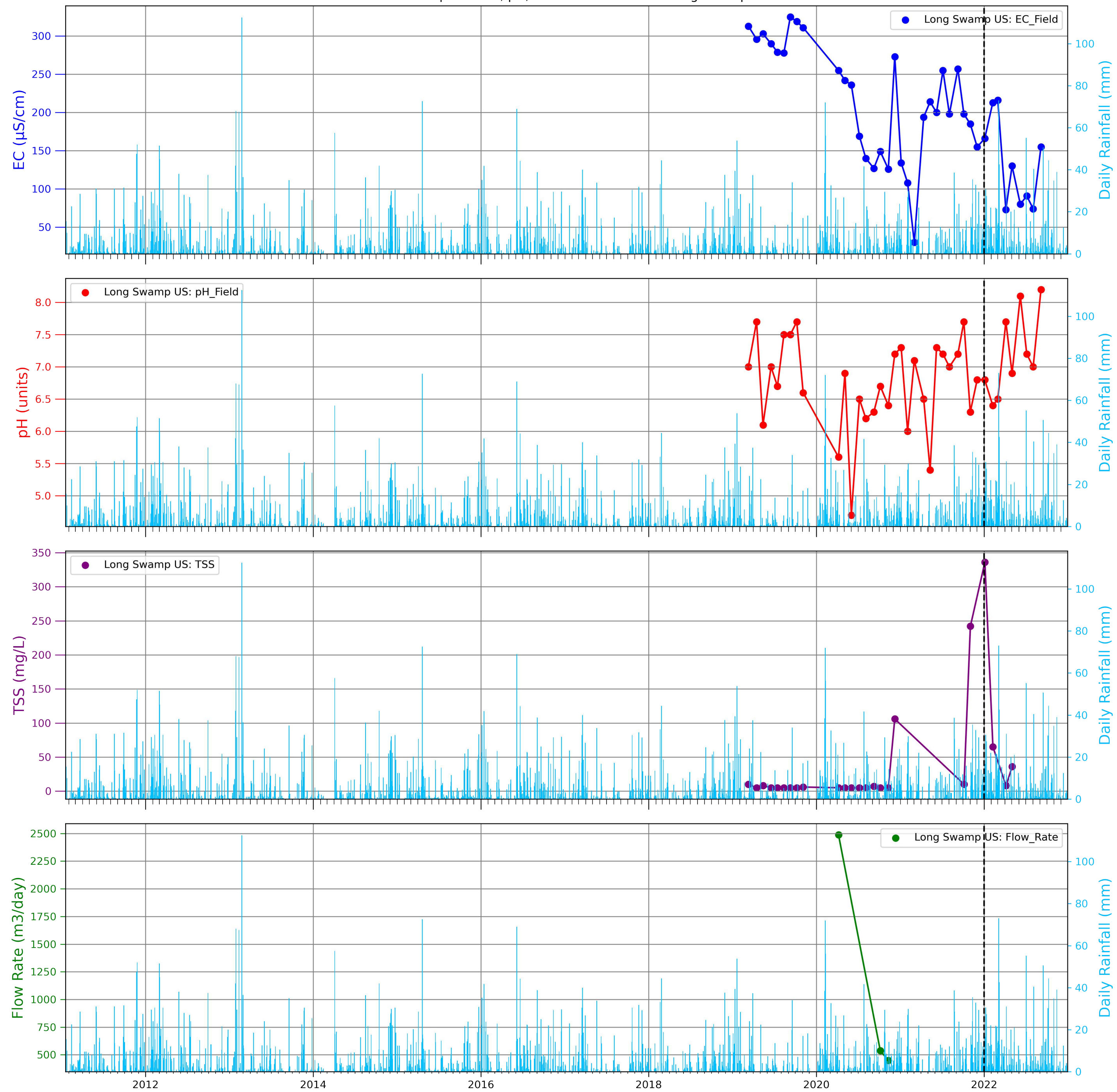
Time series plot of EC, pH, TSS and flow rate at: Lambs Creek



Time series plot of EC, pH, TSS and flow rate at: LDP003 DS



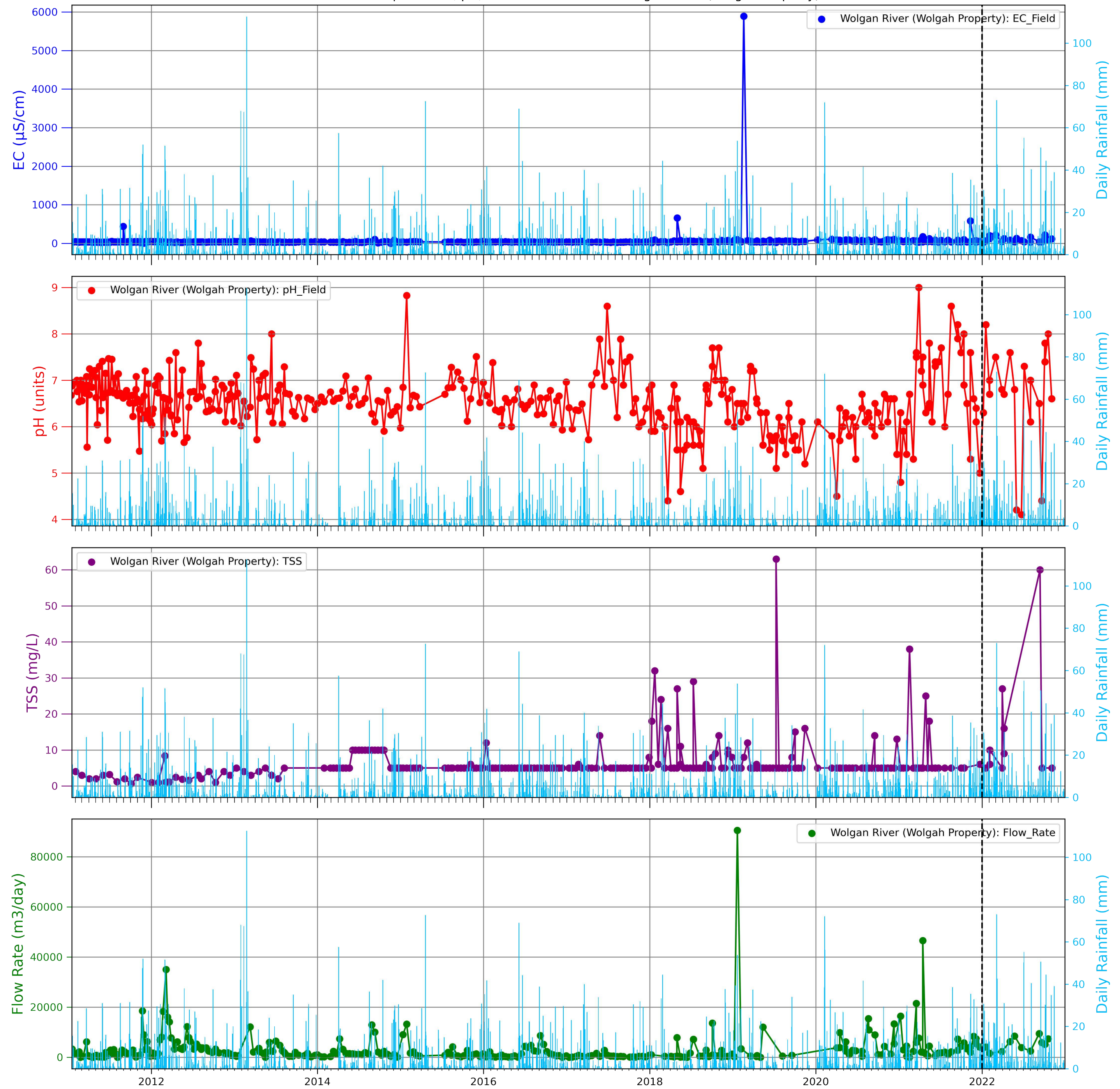
Time series plot of EC, pH, TSS and flow rate at: Long Swamp US



Time series plot of EC, pH, TSS and flow rate at: Wolgan River (Spanish Steps)

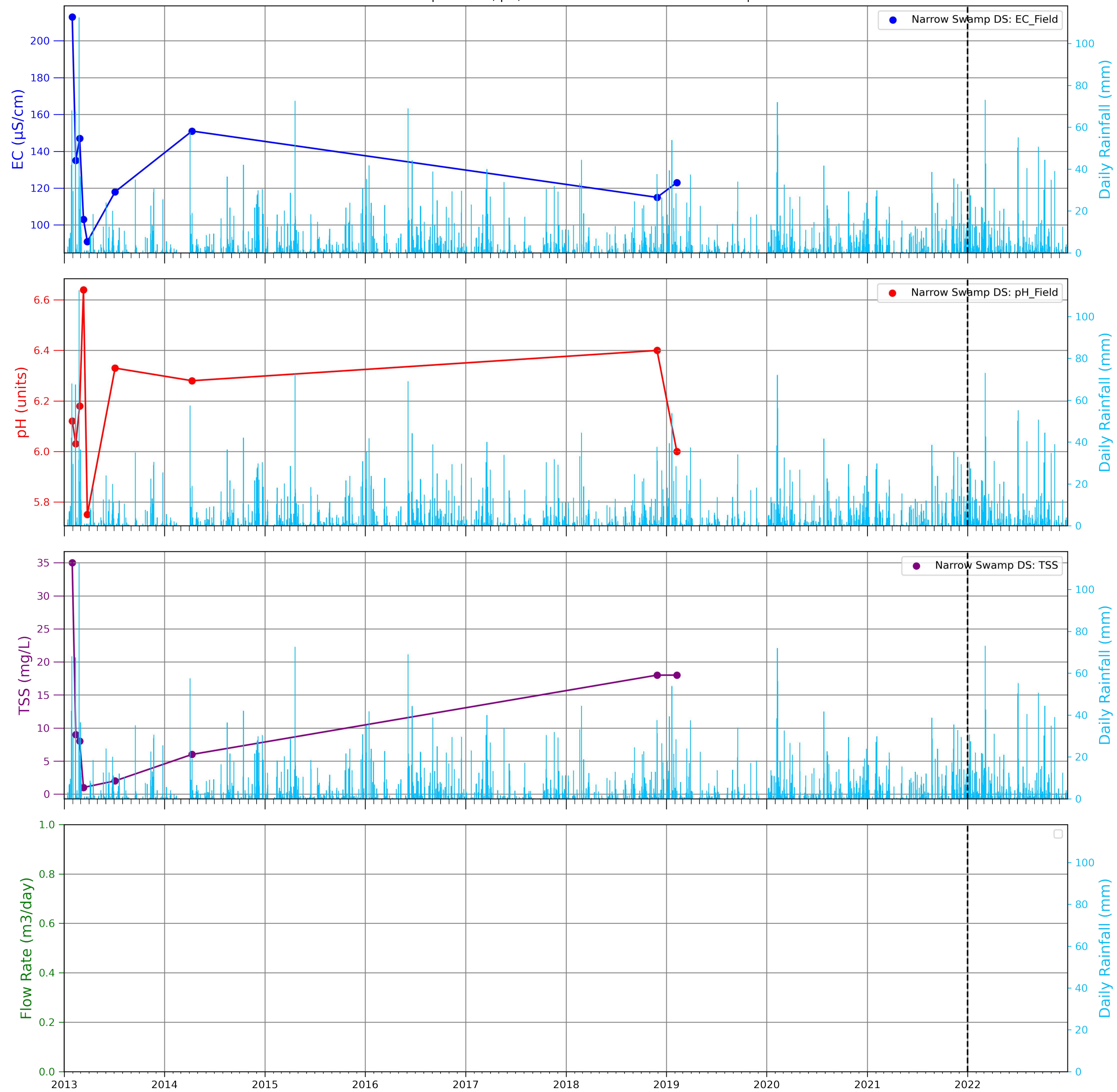


Time series plot of EC, pH, TSS and flow rate at: Wolgan River (Wolgah Property)

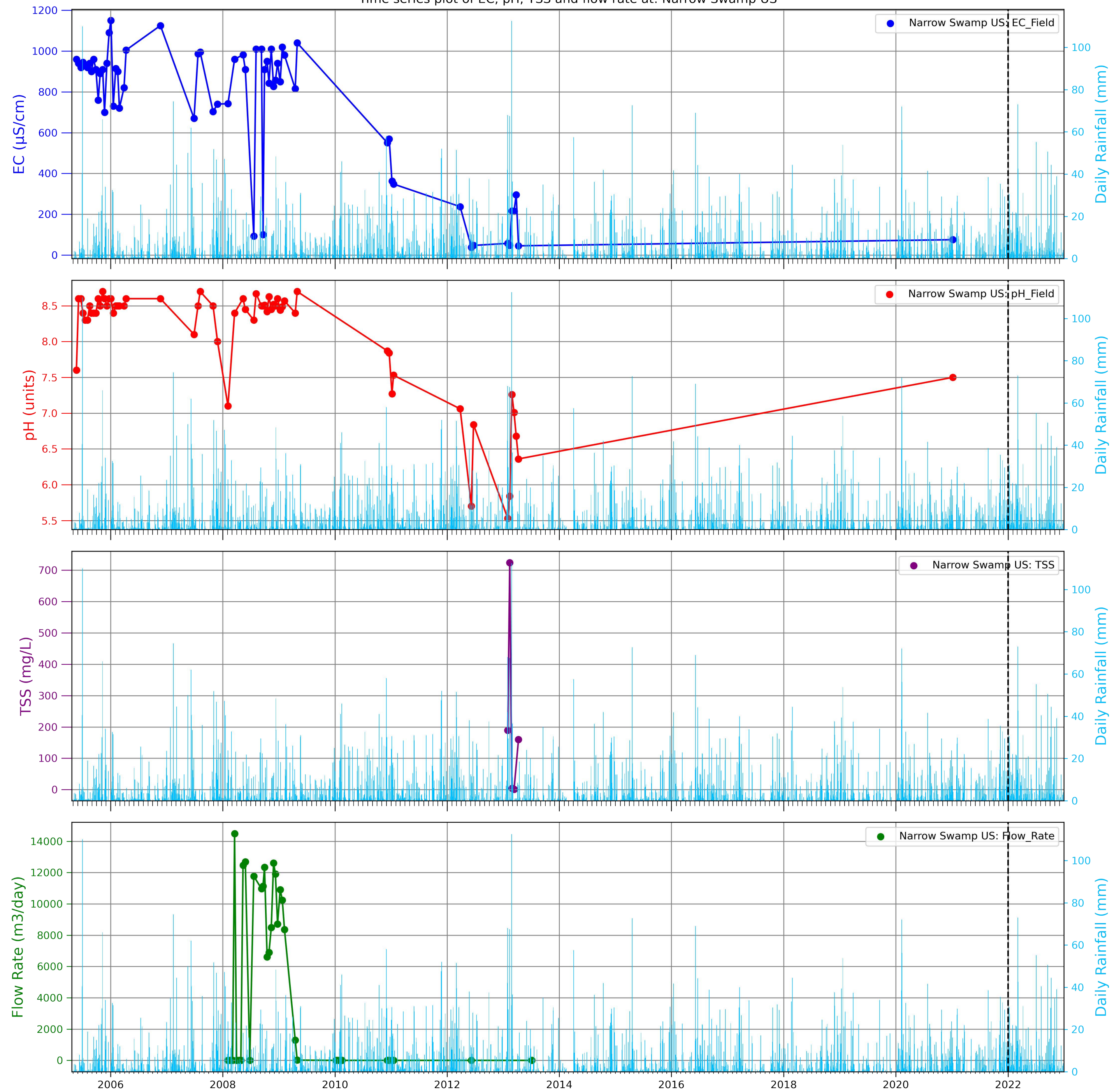


C.3 Swamp surface water quality and flow time series plots

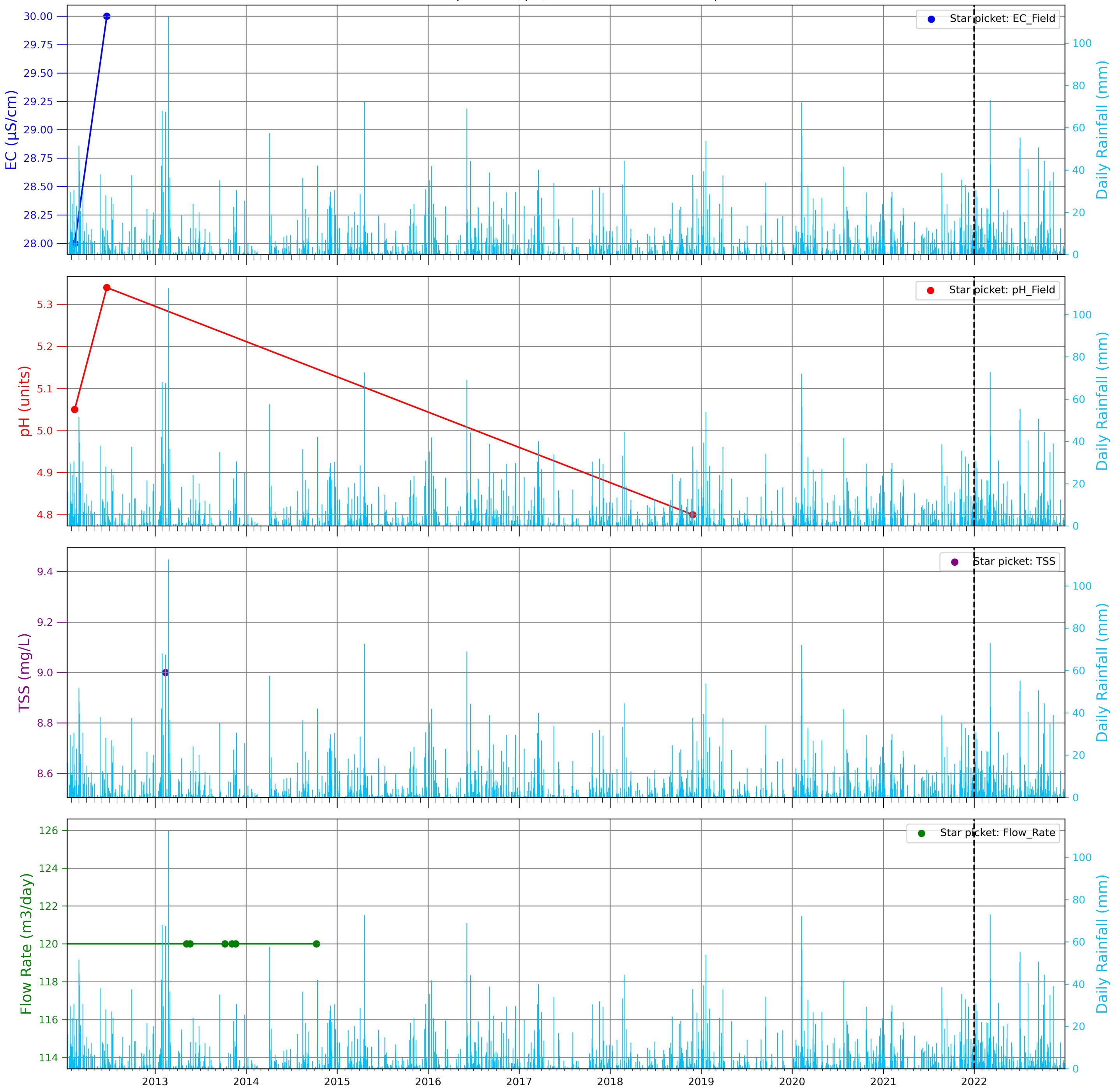
Time series plot of EC, pH, TSS and flow rate at: Narrow Swamp DS



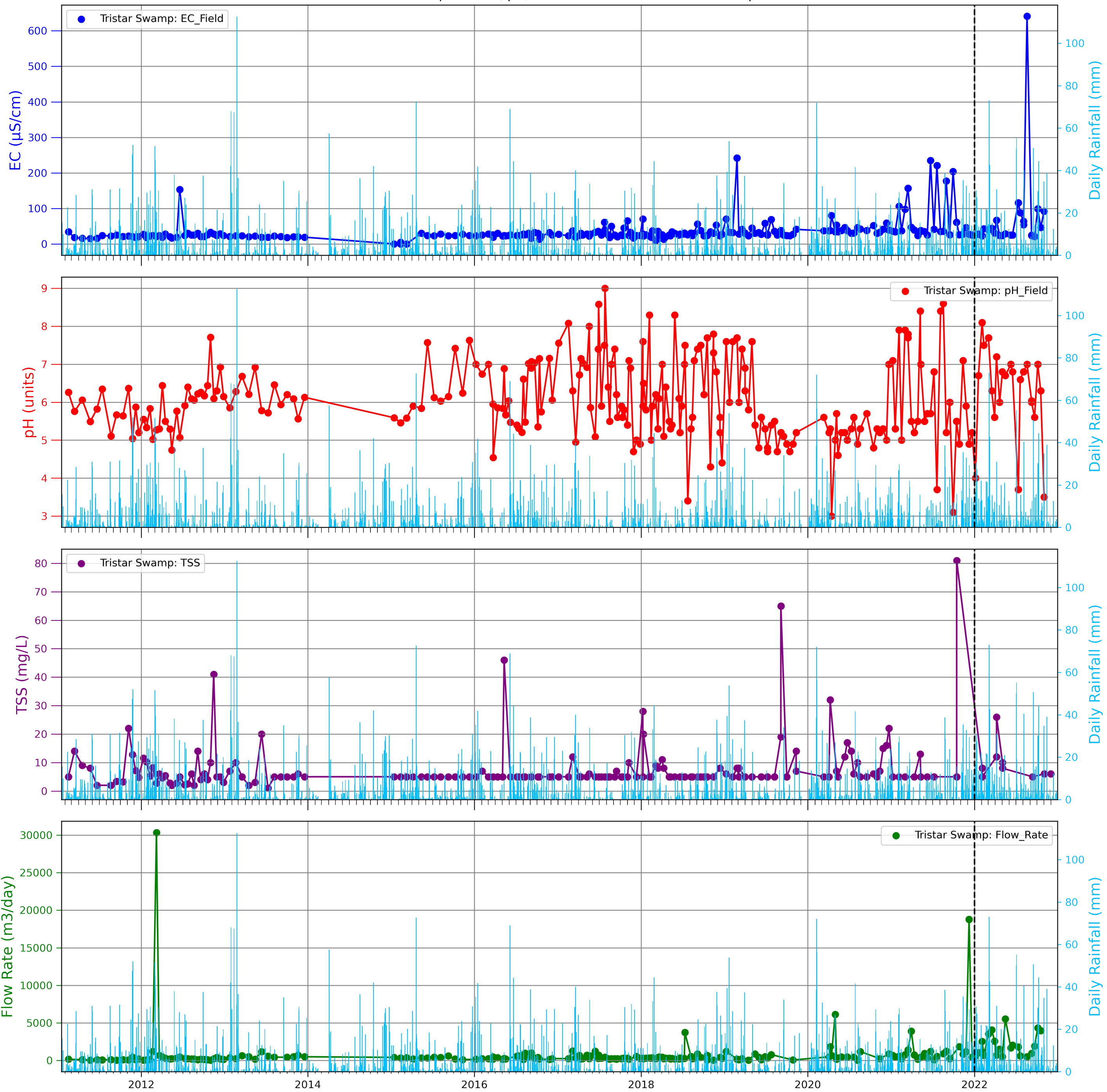
Time series plot of EC, pH, TSS and flow rate at: Narrow Swamp US



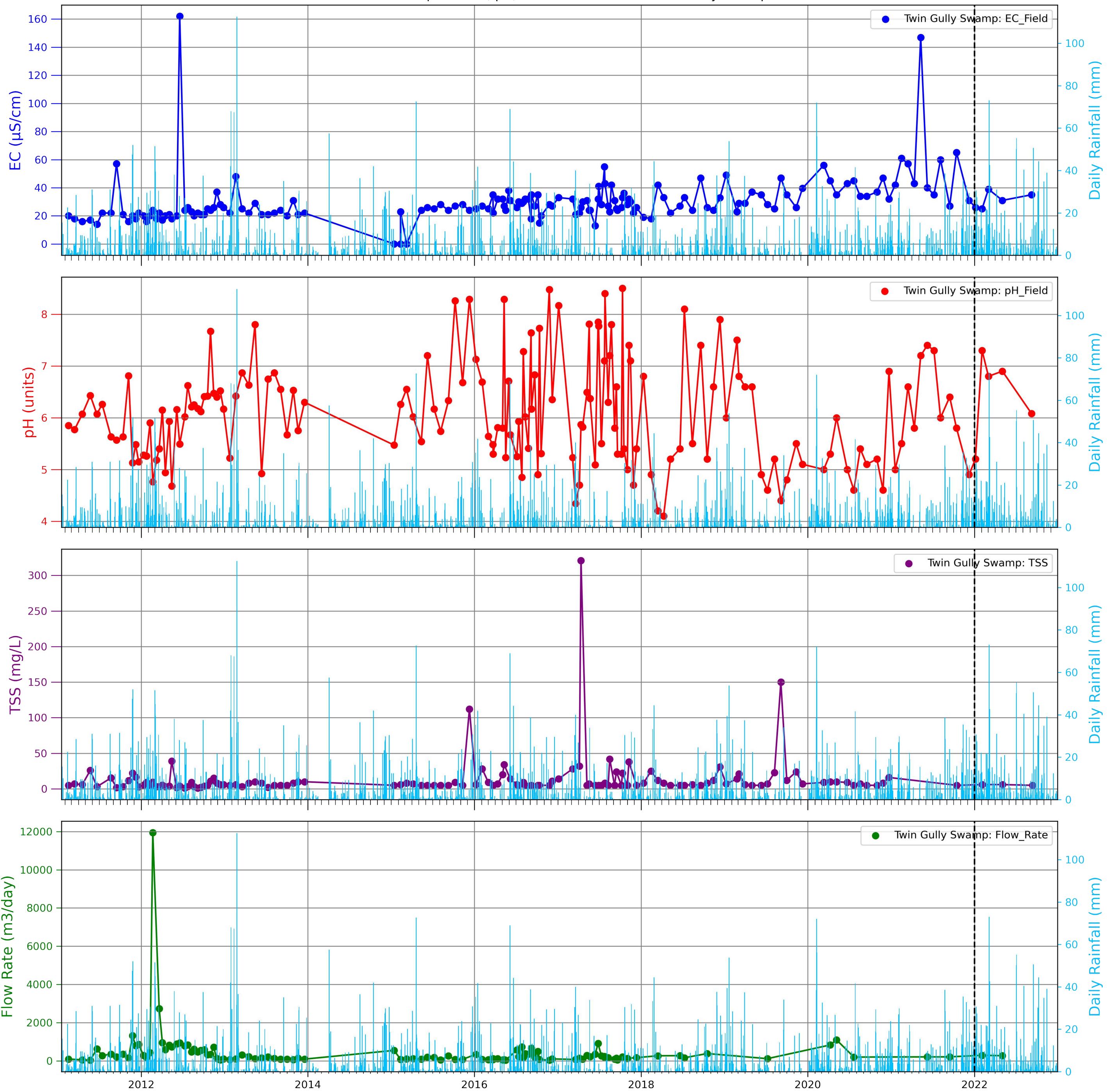
Time series plot of EC, pH, TSS and flow rate at: Star picket



Time series plot of EC, pH, TSS and flow rate at: Tristar Swamp

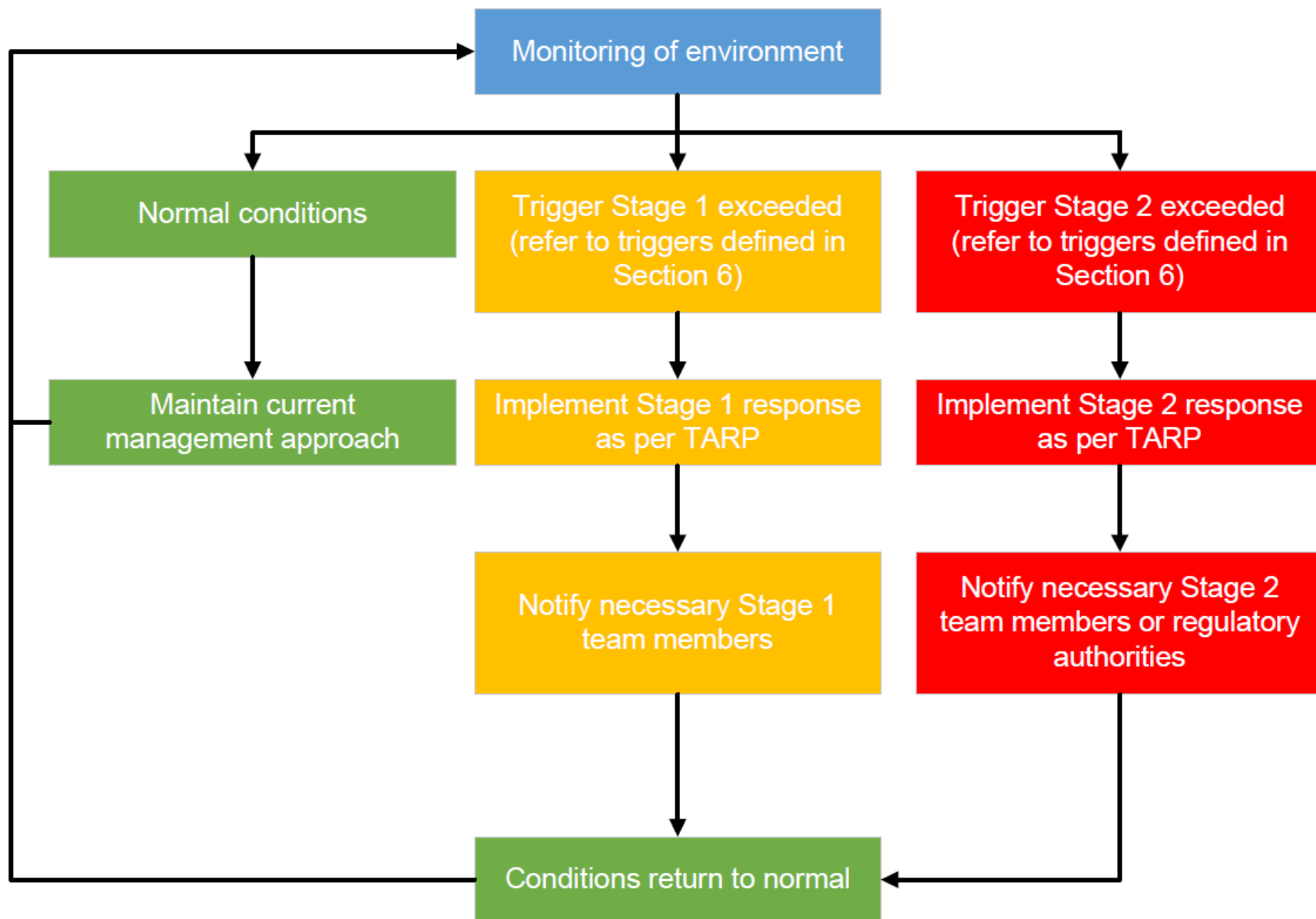


Time series plot of EC, pH, TSS and flow rate at: Twin Gully Swamp



Appendix D

Trigger action response plans (TARP)



Site surface operations

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

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

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

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).	<p>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.</p> <p>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).</p>	<p>Trigger: Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity.</p> <p>Community complaint to Centennial regarding surface water quality.</p> <p>Action: Determine if an incident has potentially occurred and investigate the source of the exceedance.</p> <p>Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant.</p> <p>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.</p> <p>Review the WMP and related procedures to prevent reoccurrence.</p> <p>Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.</p>	<p>Stage 1: Notify Environment and Community Coordinator/Mine Manager immediately.</p> <p>Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.</p> <p>Notify DPIEW as soon as practicable.</p>

Aspect	Normal	Stage 1	Stage 2	Notifications
Water flow	Creek flow rates and relationships with rainfall are consistent with historical baseline results.	<p>Trigger: Reduction in flow compared to historical baseline results.</p> <p>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).</p>	<p>Trigger: Loss of flow compared to historical baseline results is attributable to site operations.</p> <p>Community complaint to Centennial regarding surface water flow.</p> <p>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.</p> <p>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.</p> <p>Review the WMP and related procedures to prevent reoccurrence.</p> <p>Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.</p>	<p>Stage 1: Notify Environment and Community Coordinator/Mine Manager immediately.</p> <p>Stage 2: Notify DPIEW and WaterNSW (if within Coxs River catchment) as soon as practicable.</p>

Discharge management

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

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

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.	<p>Trigger: Depth to groundwater is greater than the depths outlined in Table 6-2 under the short-term and long-term conditions outlined.</p> <p>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.</p>	<p>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.</p> <p>Community complaint to Centennial regarding loss of groundwater at landholder bore.</p> <p>Action: Verify whether monitoring results are consistent with hydrogeological model predictions and consider recalibration.</p> <p>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.</p> <p>Review the WMP and related procedures to prevent reoccurrence.</p> <p>Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.</p>	<p>Stage 1: Notify Environment and Community Coordinator/Mine Manager immediately.</p> <p>Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.</p>

Aspect	Normal	Stage 1	Stage 2	Notifications
Piezometric level	Piezometric pressure is above levels provided in Table 6-3 under the conditions outlined.	<p>Trigger: Piezometric level is below the levels in Table 6-3 under the conditions outlined.</p> <p>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.</p>	<p>Trigger: Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity.</p> <p>Community complaint to Centennial regarding loss of groundwater at landholder bore.</p> <p>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.</p> <p>Review the WMP and related procedures to prevent reoccurrence.</p> <p>Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial.</p>	<p>Stage 1: Notify Environment and Community Coordinator/Mine Manager immediately.</p> <p>Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.</p>

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

Stream health

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

Aspect	Normal	Stage 1	Stage 2	Notifications
Watercourse instabilities (all other watercourses)	Subsidence levels are within predictions.	<p>Trigger: Subsidence levels 1.5 times greater than predicted values.</p> <p>Action: Undertake visual monitoring of watercourses to identify any instabilities that may have formed.</p>	<p>Trigger: Investigation into Stage 1 trigger indicates watercourse instabilities.</p> <p>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.</p> <p>Review WMP and related procedures to prevent reoccurrence.</p>	<p>Stage 1: Notify Environment and Community Coordinator/Mine Manager immediately.</p> <p>Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.</p>

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

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