

UNITED WAMBO

JOINT VENTURE

GLENCORE



2023 Annual Review

Number: 2023 Annual Review
Owner: Environment & Community Manager

Status: Approved
Version: 1

Effective: 31/03/2024
Review: 01/01/2025


Name of Operation	United Wambo Open Cut Coal Mine
Name of Operator	United Collieries Pty Ltd
Development consent / project approval #	SSD 7142
Name of holder of development consent / project approval	United Collieries Pty Ltd
Mining lease #	A444, CCL743, CCL775, CL374, CL397, ML1572, ML1594, ML1824, ML1842, EL7211, EL8456, EL9460, Sublease 1, Sublease 2
Name of holder of mining lease	Mining and Energy Union, United Collieries Pty Ltd, Wambo Coal Pty Ltd
Water licence #	WAL 10541, WAL 18445, WAL 18549, WAL 41510
Name of holder of water licences	Mining and Energy Union, United Collieries Pty Ltd
RMP start date	1 January 2023
RMP end date	31 December 2025
Annual Review start date	1 January 2023
Annual Review end date	31 December 2023
<p>I, Aislinn Farnon,</p> <p>certify that this audit report is a true and accurate record of the compliance status of United Collieries for the period 1 January 2023 to 31 December 2023 and that I am authorised to make this statement on behalf of United Collieries Pty Ltd.</p> <p>Note.</p> <p>a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</p> <p>b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</p>	
Name of authorised reporting officer	Aislinn Farnon
Title of authorised reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	28/03/2024

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1. Statement of Compliance

The compliance status of operations at United Wambo Joint Venture (United Wambo) against the relevant approval conditions during the reporting period is outlined in **Table 1-1**, **Table 1-2** and **Table 1-3**.

Table 1-1 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
SSD 7142	No
Environment Protection Licence (3141)	No

Table 1-2 Compliance Status Categories

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with potential for serious environmental consequences, but is unlikely to occur; or potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Non-compliance which does not result in any risk of environmental harm

Table 1-3 Non- Compliance Status – United Wambo

Relevant Approval	Condition/ Legislative Reference	Condition Description (Summary)	Compliance Status	Details of Non-compliance	Corrective Action/s	Where Addressed in Annual Review
EPL 3141	Condition M2.3	Air Quality Monitoring (TEOMs)	Non-Compliant	<p>Not required to have been reported previously</p> <p>United Wambo are required to monitor air quality (PM₁₀) on a continuous basis with TEOMS at four locations. As per AS3580.19:2020, there is a requirement for >75% data availability for a valid 24-hour average to be calculated.</p> <p>On several occasions, TEOMs failed to collect >75% of the daily data required due to:</p> <ul style="list-style-type: none"> storms and power outages software and logger issues planned maintenance/calibration telemetry communication errors Delay in contractor maintenance <p>The days of incomplete data collection at each monitor in 2023 included:</p> <p><u>AQ01 PM10: 15-16/2, 9/12</u></p> <p><u>AQ02 PM10: 27/2, 21-22/6AQ03 PM10: 18/2, 3-11/4, 24-26/4, 11-13/11, 18-19/12</u></p> <p><u>AQ04 PM10: 18-21/4, 19-20/6</u></p>	<p>The real time monitoring network is monitored remotely each day, with routine maintenance conducted monthly by an external technical contractor to minimise the downtime of any real time monitoring units.</p> <p>Upon notification of a breakdown of equipment, efforts are made to address the issue remotely. If the issue continues, maintenance is scheduled for repair of the unit within 48 hours.</p>	Section 6.4.4 and 10.2.1
SSD 7142	Condition A30 SSD					

Relevant Approval	Condition/ Legislative Reference	Condition Description (Summary)	Compliance Status	Details of Non-compliance	Corrective Action/s	Where Addressed in Annual Review
EPL 3141	Condition M2.3	Air Quality Monitoring (TSP)	Non-Compliant	United Wambo are required to monitor TSP every 6 days. Data was not collected for the 12/3, 18/3, 11/4, 17/4 The HVAS01 TSP monitor did not sample the required sampling period due to sampling error by the contractor, power outages, and equipment failure.	This monitor is owned by Hunter Valley Operations (HVO). The data from HVAS 01 for TSP data is shared between HVO and United Wambo. It was identified that the power supply tripped and was unable to monitor the required sampling period. This was reported by HVO to the DPE. Maintenance was conducted to rectify the issue of this monitor. The issue reoccurred as the source error was misidentified,. HVO organised for a replacement monitor installed For HVAS01. Since installed the this non-compliance has not reoccurred.	Section 6.4.4
SSD 7142	Condition A30 SSD					
SSD 7142	Condition B52 (v)	Groundwater Level Monitoring (VWPs)	Non-Compliant	Not required to have been reported previously United Wambo are required to monitor groundwater levels using a series of vibrating wire piezometers (VWPs) and groundwater bores across site. A number of VWPs require maintenance and calibration to further support wider interpretation of groundwater level trends.	United Wambo will conduct an Audit of the vibrating wire piezometers (VWPs) network and implement actions to ensure the VWP network is consistent with the requirements of Groundwater Management Plan.	Section 6.9.10

Relevant Approval	Condition/ Legislative Reference	Condition Description (Summary)	Compliance Status	Details of Non-compliance	Corrective Action/s	Where Addressed in Annual Review
EPL 3141	L2	Waste - Coal Washery Reject	Non-Compliant	<p>Reported to EPA 25 January 2023</p> <p>United Wambo Joint Venture and Wambo Coal coal washery rejects (coal mine void) exemption 2020 (Exemption) and the United Wambo Joint Venture and Wambo Coal coal washery rejects (coal mine void) order 2020 (Order) expired on 13 October 2022 and was not extended.</p> <p>United Wambo became aware of the issue on 25 January 2023.</p>	<p>An application for an extension of the Exemption and Order was submitted on 25 January 2023 via email to the EPA at waste.exemptions@epa.nsw.gov.au.</p> <p>The Exemption and Order was renewed by the EPA on 3 March 2023 for a further two years.</p>	Section 9.2.3

2. Introduction

United Wambo Open Cut Coal Mine (United Wambo) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (Figure 2-1). United Wambo is a 50:50 joint venture between United Collieries Pty Limited (United) and Wambo Coal Pty Limited (Wambo). United is owned 95 per cent by Abelshore Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore) and five per cent by the Mining and Energy Union (MEU). Wambo is a subsidiary of Peabody Energy Australia Pty Limited.

United Wambo is managed by Glencore and has approval to extract up to 10 million tonnes per annum (mtpa) of Run of Mine (ROM) coal up until 31 August 2042. ROM coal is processed through the Wambo Coal Handling and Preparation Plant (CHPP) and transported by rail from Wambo to the Port of Newcastle for export.

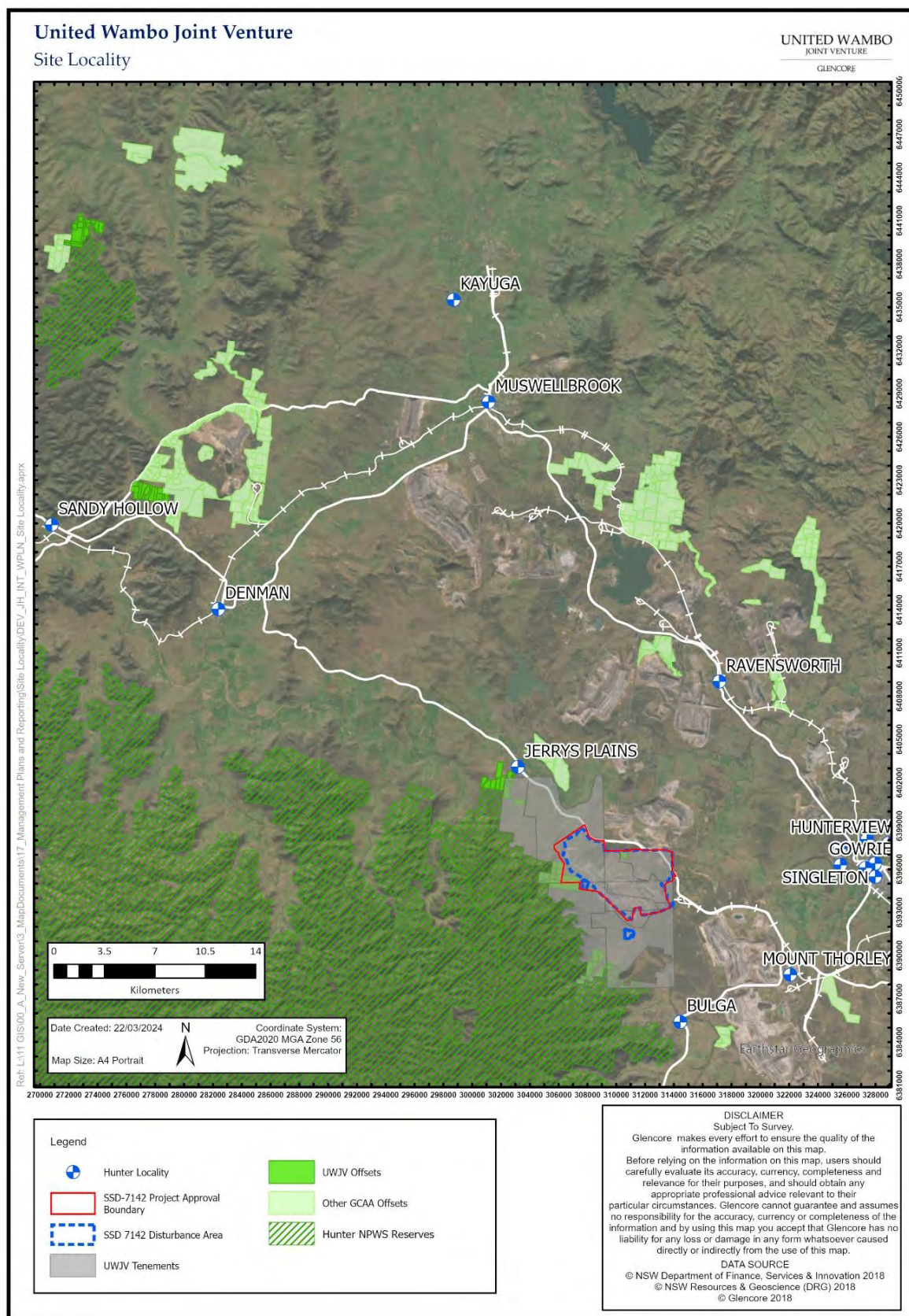


Figure 2-1 Regional Location Plan

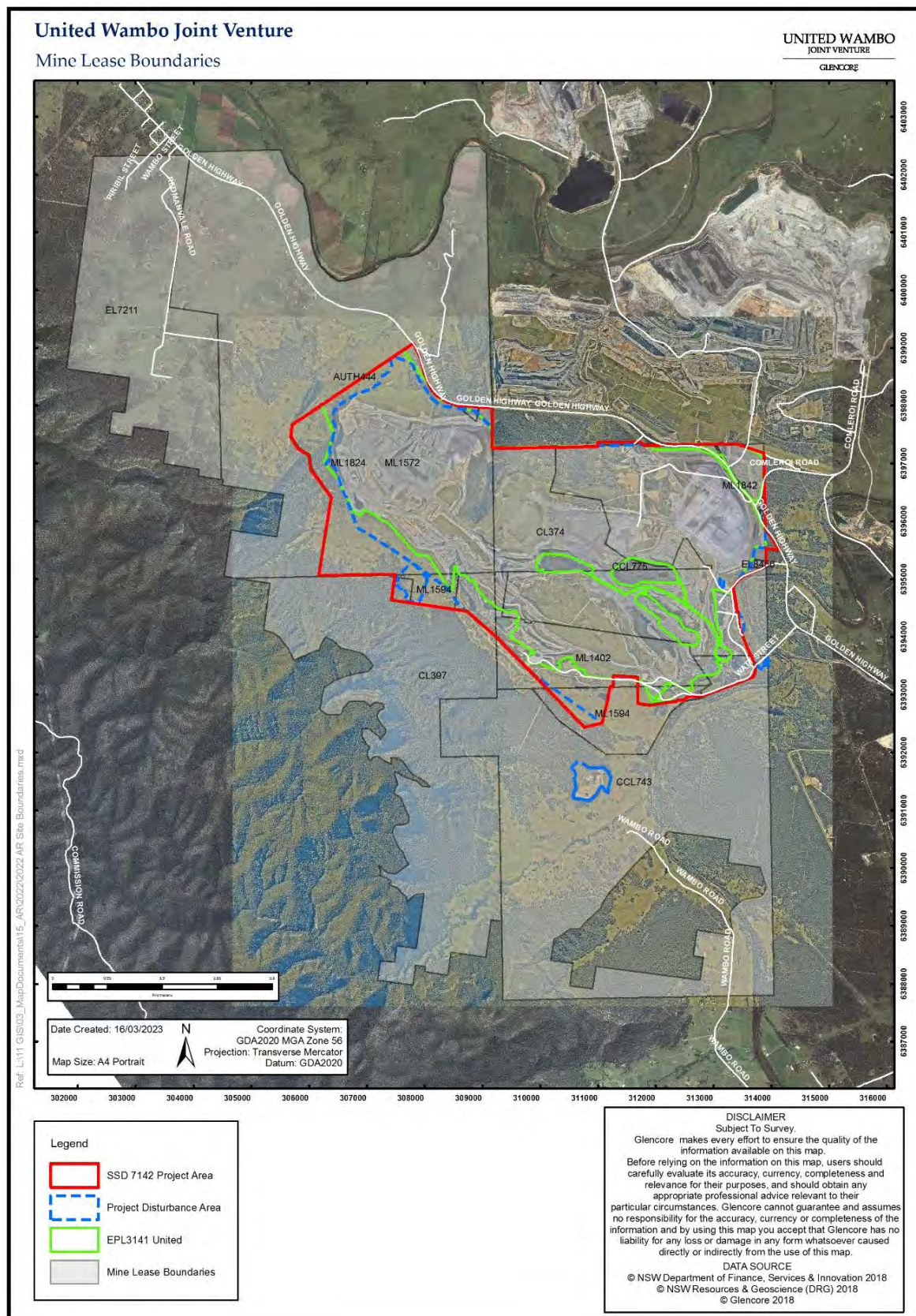


Figure 2-2 United Wambo Coal Mine Boundaries

2.1 Site Contacts

Contact details for key personnel are provided in **Table 2-1** below.

Table 2-1 Contact Details for Key Mine Personnel

Name	Role	Telephone	Email
Nick Slater	Operations Manager	02 6578 9500	Nick.Slater@glencore.com.au
Aislinn Farnon	Environment and Community Manager	02 6578 9506	Aislinn.Farnon@glencore.com.au
Community Complaints and Enquiries		1800 801 440	
Website	https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut		

3. Approvals

3.1 Development Consent and Supplementary Approvals

United Wambo operate under a Development Consent SSD 7142, various mining leases and other approvals that regulate operations at the site, these are listed in **Table 3-1**, **Table 3-2**, **Table 3-3** below.

Table 3-1 Approvals relating to United Wambo

Instrument	Date of Issue	Expiry Date	Status
State Significant Development (SSD) 7142 MOD 1	29 August 2019	1 August 2042	Modified during 2021 to allow for changes to ROM stockpiling arrangements.
S87 Care and Control Permit #3062	24 December 2021		ISEMS/AHIMS Permit #: 10913446/2997
4094/2010	3 May 2010	30 June 2024	North MIA Office Administration – currently not in use with plans to decommission in the future
ST 15.2020.39	14 January 2021	30 June 2024	South MIA Admin Building – in operation

3.1.1 Mining Operations Plan

The Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021 (the Regulation) introduced new standard rehabilitation and reporting conditions on mining leases. The Regulation commenced on 2 July 2021, with a transition period to 2 July 2022. Following the transition period, Mining Operations Plans cease to exist in NSW. To meet the requirements of the Regulation United Wambo developed and implemented a Rehabilitation Management Plan, Forward Program and Rehabilitation Outcome Documents.

3.2 Mining Tenements

Mining operations at United Wambo are undertaken within Mining Leases CCL743, CCL775, CL374, CL397, ML1572, ML1594, ML1824, ML1842, and two subleases with Wambo Coal (Sublease 1, Sublease 2). United Wambo has approval to undertake exploration activities in accordance with Exploration Leases EL7211, EL8456, EL9460 and Authorisation A444.

Table 3-2 Tenements relating to United Wambo

Instrument	Holder	Date of Issue	Expiry Date
CCL 743	Wambo Coal Pty Limited	9 March 1990	14 August 2043
CCL 775	Mining and Energy Union	2 September 1992	2 March 2033
CL 374	Wambo Coal Pty Limited	6 December 1991	21 March 2026
CL 397	Wambo Coal Pty Limited	4 June 1992	4 June 2034
ML 1572	Wambo Coal Pty Limited	21 December 2005	21 December 2026
ML 1594	Wambo Coal Pty Limited	1 May 2007	30 April 2028
ML 1824	United Collieries Pty Ltd	29 November 2021	29 November 2042

Instrument	Holder	Date of Issue	Expiry Date
ML 1842	Mining and Energy Union	3 December 2022	3 December 2043
Sublease 1	Wambo lease to United	21 June 2023	14 August 2043
Sublease 2	Wambo lease to United	10 September 2021	17 December 2044
A 444	Joint Wambo & MEU	4 October 2007	16 May 2027
EL 7211	Wambo Coal Pty Limited	29 September 2008	29 September 2026
EL 8456	United Collieries Pty Ltd	8 August 2016	8 August 2025
EL 9460	Mining and Energy Union	13 September 2022	13 September 2028

3.3 Licences

The licences held by United Wambo are detailed in Table 3-3. United Wambo holds surface water licences for mining purposes and coal washery rejects order and exemption for emplacement of reject material.

Table 3-3 Licences and Exemptions relating to United Wambo

Instrument	Date of Issue	Expiry Date	Status
Environment Protection Licence (EPL) 3141	30 November 1999	Anniversary Date: 30 November	Current issue dated 10 December 2021. Note: The EPL was not varied during the reporting period.
WAL 18445 Redbank Creek Bywash pump	14 March 2008	13 March 2033	200ML 20WA208714 Industrial
WAL 10541 Hunter River Pump	01 January 2007	Perpetuity	300ML 20WA200928 Water Supply
WAL 18549 Wollombi Brook Pump	05 November 2007	19 November 2032	100ML 20WA208706 Industrial
Coal Washery Rejects Resource Recovery Order and Exemption	3 March 2023	3 March 2025	The Order and Exemption were renewed in the reporting period.

3.4 Summary of Reporting Obligations in Consents, Tenements and Licences

Conditions relating to annual reporting and the Annual Review within the SSD 7142 and CCL775 are summarised in **Table 3-4** below.

Table 3-4 Compliance with SSD 7142

Condition No.	Consent Condition	Annual Review Section
Schedule 2, Condition E11 – Annual Review	By the end of March each year, after the commencement of development, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must:	Annual Review
	a) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;	4 and 7
	b) report on the progress of biodiversity credits retirements and the associated actual versus proposed surface disturbance for each stage;	6.5.2
	c) report on the progress of implementing reasonable and feasible diesel emissions reduction measures for the Project;	6.4.2
	d) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the: <ul style="list-style-type: none"> (i) relevant statutory requirements, limits or performance measures/criteria; (ii) requirements of any plan or program required under this consent; (iii) monitoring results of previous years; and (iv) relevant predictions in the document/s listed in condition A2(c); 	6
	e) identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;	1, 6 and 10
	f) evaluate and report on: <ul style="list-style-type: none"> (i) the effectiveness of the noise and air quality management systems; and (ii) compliance with the performance measures, criteria and operating conditions in this consent; 	6.2.3, 6.4.3 1
	g) identify any trends in the monitoring data over the life of the development;	6
	h) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	6
	i) describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.	6
Schedule 2, Condition E16 - Access to Information	Before the commencement of Phase 1A, until the completion of all rehabilitation required under this consent, the Applicant must: <ul style="list-style-type: none"> a) make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website: <ul style="list-style-type: none"> (xi) the Annual Reviews of the development. 	This document.
Schedule 2, Condition B40 – Water Supply	The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under each water licence.	6.8

Condition No.	Consent Condition	Annual Review Section
Schedule 2, Condition B52 (v) – Groundwater Management Plan	(vi) a protocol to report on the measures, monitoring results and performance criteria identified above, in the Annual Review referred to in condition E11.	6.9
Schedule 2, Condition B91(d) - Waste	(d) monitor and report on the effectiveness of the waste minimisation and management measures in the Annual Review referred to in condition E11.	6.7

Table 3-5 Compliance with Mining Lease – Standard Mining Lease conditions

Condition No.	Consent Condition	Annual Review Section
Condition 4 f)	The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:	7
	i. provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;	7
	ii. be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and iii. be prepared in accordance with any relevant annual reporting guidelines published on the Department's website: www.resources.nsw.gov.au/environment <i>Note: The Rehabilitation Report replaces the Annual Environmental Management Report.</i>	7

4. Operations Summary

4.1 Mining Operations

This Annual Review is required to report on the production operations of the mine, these are summarised in **Table 4-1**.

Table 4-1 Production Summary

Material	Unit	Approved Limit	2022	2023 (Forecast)	2023 (Actual)	2024 (forecast)
Waste Rock/Overburden (Bank Cubic Meter)	bcm	NA	39.97	44.04	44.16	44.08
ROM Coal/Ore	Mt	10Mt / year (SSD 7142)	5.67	6.66	6.77	9.0
Coarse Reject	Mt	NA	2	1.9	2.22	2.67
Fine Reject (Tailings)	Mt	NA	0.95	0.85	0.82	0.91
Saleable Product	Mt	14.7Mt transported from the Complex	3.73	4.7	4.71	5.85

Note¹: CHPP operated by Wambo and includes processing of Wambo Underground ROM

During 2023, mining operations continued within the United Open Cut (United OC), focusing on moving waste and coal from the eastern side of the pit to reach pit floor see Figure 4-1. Development of the overburden emplacement areas continued, with dumps progressing west toward Montrose. The out-of-pit emplacement areas were mostly over areas previously mined and previously rehabilitated by Wambo. Mining also continued within the Wambo Open Cut's Montrose Pit, including the Montrose Ridge area. Overburden from Wambo Open Cut is emplaced in the in-pit emplacement areas. Coal mined from both the United and Wambo open cuts was transported to the ROM hopper or stockpile area.



Figure 4-1 United Open Cut operations in December 2023

4.2 Construction Activities

Construction activities completed in the reporting period are shown in Table 4-2 and Figures 4-2 and 4-3.

Table 4-2 Construction activities undertaken during the reporting period

Item No	Construction Activity	Description
1.	Explosives Reload and Magazine Area	A new overburden pad was constructed in a pasture area rehabilitated in the 2000s, near the South Mine Infrastructure Area (SMIA). Topsoil resources were salvaged and stockpiled for reuse. The pad was constructed using mining equipment and overburden from United OC. Explosives reload and magazine infrastructure was installed by local Hunter Valley contractors. The relocation was to make way for planned overburden dump progression at the Homestead domain see Figure 4-2.
2.	Montrose Crib Hut	A primary, semi-permanent crib hut building was installed in Montrose Pit. The original crib hut was decommissioned, and the location relocated from a lower dump system to a higher location (approximately RL160) to the north of the pit. The relocation was to make way for planned overburden dump progression see Figure 4-3.



Figure 4-2 Reload and magazine area constructed



Figure 4-3 Montrose crib hut constructed

4.3 Other Operations

4.3.1 Hours of Operations

The site operates 24-hours per day, 7-days a week.

4.3.2 Reject and Tailings Management

ROM coal mined from the United OC, Montrose OC and Wambo underground is hauled to the ROM pad located near the CHPP. Coal is either placed directly into the ROM bin or onto the ROM coal stockpile area. ROM coal is crushed and washed at the CHPP and product coal stockpiled prior to reclaim for train loading and transport off site. The Wambo CHPP is managed by Wambo under **DA 305-7-2003 MOD 19**.

Tailings produced by the washing of open cut coal are managed by Wambo Underground Mine. A summary of the tailings storage facilities used by United Wambo are shown in **Table 4-3**.

Table 4-3 Tailings storage facilities (TSF) at United Wambo

Item No	Tailings Storage Facility	Type	Status	Comment
1.	United Tailings Dams 1 and 2	Out of pit	Closed	Actively managed under the former DA-410-11-2002-i. Capped in 2021/2022 and surrounded by overburden emplacement with no credible failure mode. To be removed from Dam Safety NSW register.
2.	Homestead Inpit	Void with embankment	Active	Active deposit of United Wambo tailings by Wambo Underground.
3.	Hunter Pit	Void with embankment	Active	Periodic deposit of United Wambo tailings by Wambo Underground to assist with consolidation and preparation for capping.

Coarse rejects from coal preparation are transported by truck to overburden emplacement areas for subsequent covering by overburden material.

4.3.3 Exploration Management

Four cored boreholes (DDH1310-DDH1313) and one open chip borehole (RDH1309) were drilled in CCL775 during the reporting period. Geotechnical data and Uniaxial Compressive Strength (UCS) samples were obtained. The analysis of these samples has not yet been completed, see Figure 5-1.

Hole RDH1309 was drilled to target the powerline fault zone, a series of north-south trending thrust faults that potentially impact the United Open Cut. As this drilling was on going at the end of the reporting period the data and results have not been completed or interpreted and will be reported during the next reporting period.

Geophysical density logs were run on a number of blast holes to assist in short term modelling and design.

4.3.4 Mine Subsidence

As mining operations were suspended at United in 2010, no additional subsidence from underground mining operations has occurred in 2023. There was no subsidence remediation during 2023.

4.3.5 Next Reporting Period

Table 4-4 outlines the forecast operations for the next reporting period.

Table 4-4 Forecast Operations for the Next Reporting Period

Aspect	Forecast for Next Reporting Period
Pit expansion areas	Continued development of the United Open Cut. All material from United Open Cut is hauled to out of pit emplacement areas. Continuation of mining operations within the Wambo Open Cut Montrose Pit, including ongoing development of mining areas (the Montrose ridge and Deeper Montrose) and development of the final landform within the emplacement areas.
Infrastructure development/upgrades	Design works are underway regarding the construction of water management dam upstream of Dam U2 to intercept clean water. Decommissioning of United Collieries administration buildings.
Mining fleet upgrades	New mining equipment, including excavators, haul trucks, dozers, watercarts and loaders, will continue to be commissioned over the next few years.

5. Actions Required from Previous Annual Review

The actions required as an outcome of the previous 2022 Annual Review, and their current status, are detailed in **Table 5-1**. These actions were commitments from United Wambo.

Table 5-1 2022 Annual Review Actions and Feedback

Proposed Action	2022 Comments	2023 Comments
Water Management	Stage 3 Water Management design to be completed to allow mining further to the west	Stage 3 Water Management options analysis finalised; detailed design underway.
	Upgrade vibrating wire piezometer (VWP) network	Throughout 2023 the vibrating wire piezometer network underwent significant maintenance. There are 14 VWPs in the Groundwater Management Plan (GWMP), plus 2 proposed. Of the 14, 8 are providing meaningful data, 2 have been decommissioned, 4 are unable to be repaired and require redrilling. Proposed adjustments to the VWP network will be proposed in the GWMP review.
	Installation additional flowmeters for water reporting	Additional flowmeters to better measure pit dewatering and other minor internal water transfers have not yet been installed. It is noted that all site imports and exports are currently measured by flowmeters.

Proposed Action	2022 Comments	2023 Comments
Approvals	Remove Tailings Dam 2 from Dam Safety NSW Register	United Wambo have developed a Delisting Plan and are in consultation with Dam Safety NSW to complete this action.
	Complete Biodiversity Stewardship Agreements	Biodiversity Stewardship Agreements finalised, execution occurred on 14 February (Glencore) and 1 March (Wambo) 2024.
Dust Management	Installation of additional cameras across site	Additional cameras were installed onsite.
Rehabilitation	37 hectares of rehabilitation will be undertaken	38.5 hectares of rehabilitation was completed.
	Targeted weed control onsite and offset properties	Weed and pest control program implemented across site and offset properties.

6. Environmental Performance

The Annual Review Guideline (DPE 2015) requires summarising the outcomes achieved during the reporting period for key environmental aspects.

It should be noted that the 2023 Annual Review includes EIS predictions from:

United Wambo Open Cut Coal Mine Project – Environmental Impact Statement (Umwelt, 2016);

United Wambo Open Cut Coal Project – Response to Submissions Part A (Umwelt, 2017);

United Wambo Open Cut Coal Project – Response to Submissions Part B (Umwelt, 2017a);

United Wambo Open Cut Coal Project – Response to Independent Planning Commission Recommendations (Umwelt, 2018).

All monitoring locations for United Wambo are shown in **Figure 6-1** and **Figure 6-2**.

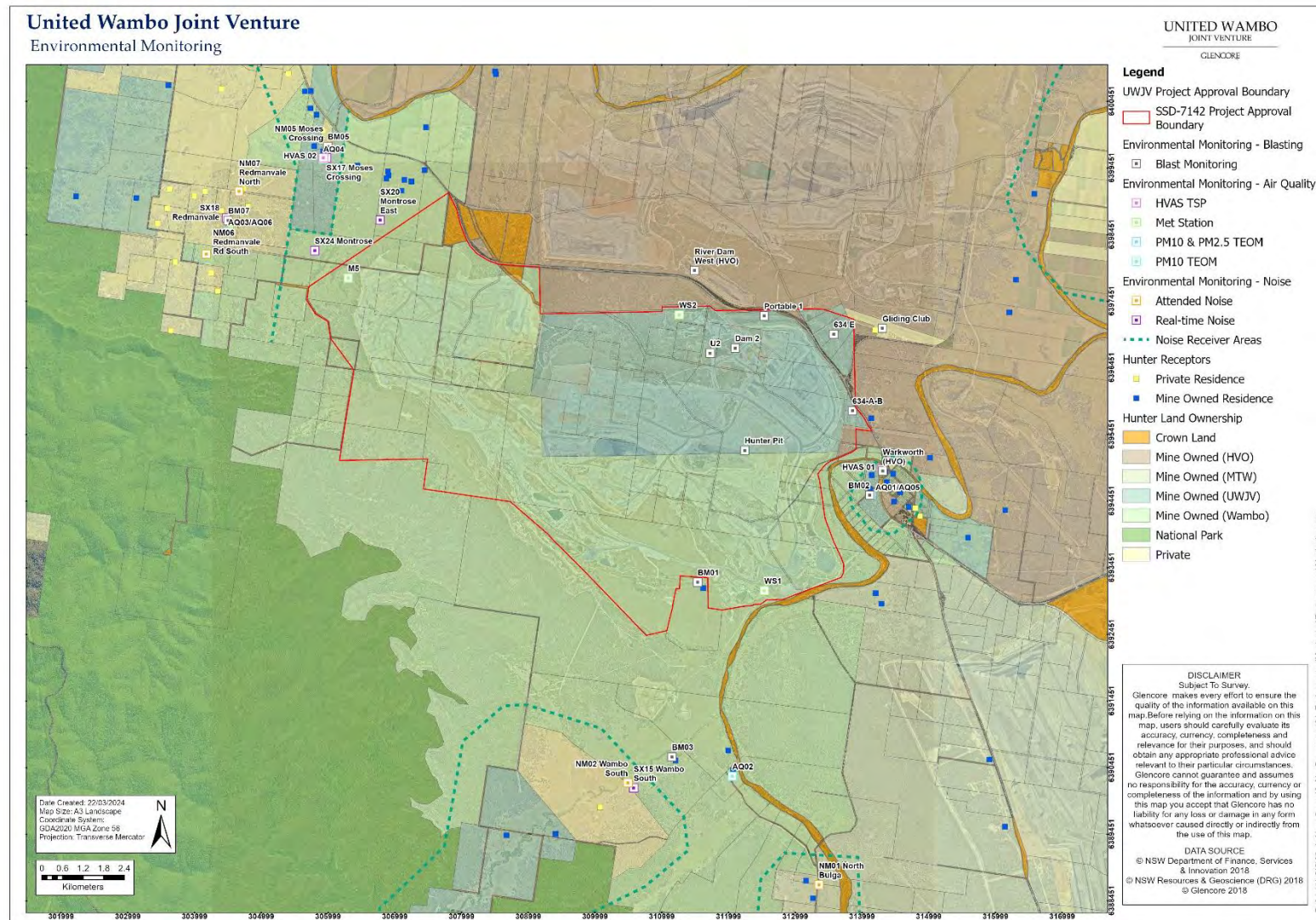


Figure 6-1 United Wambo Air Quality, Noise and Blast Monitoring Locations

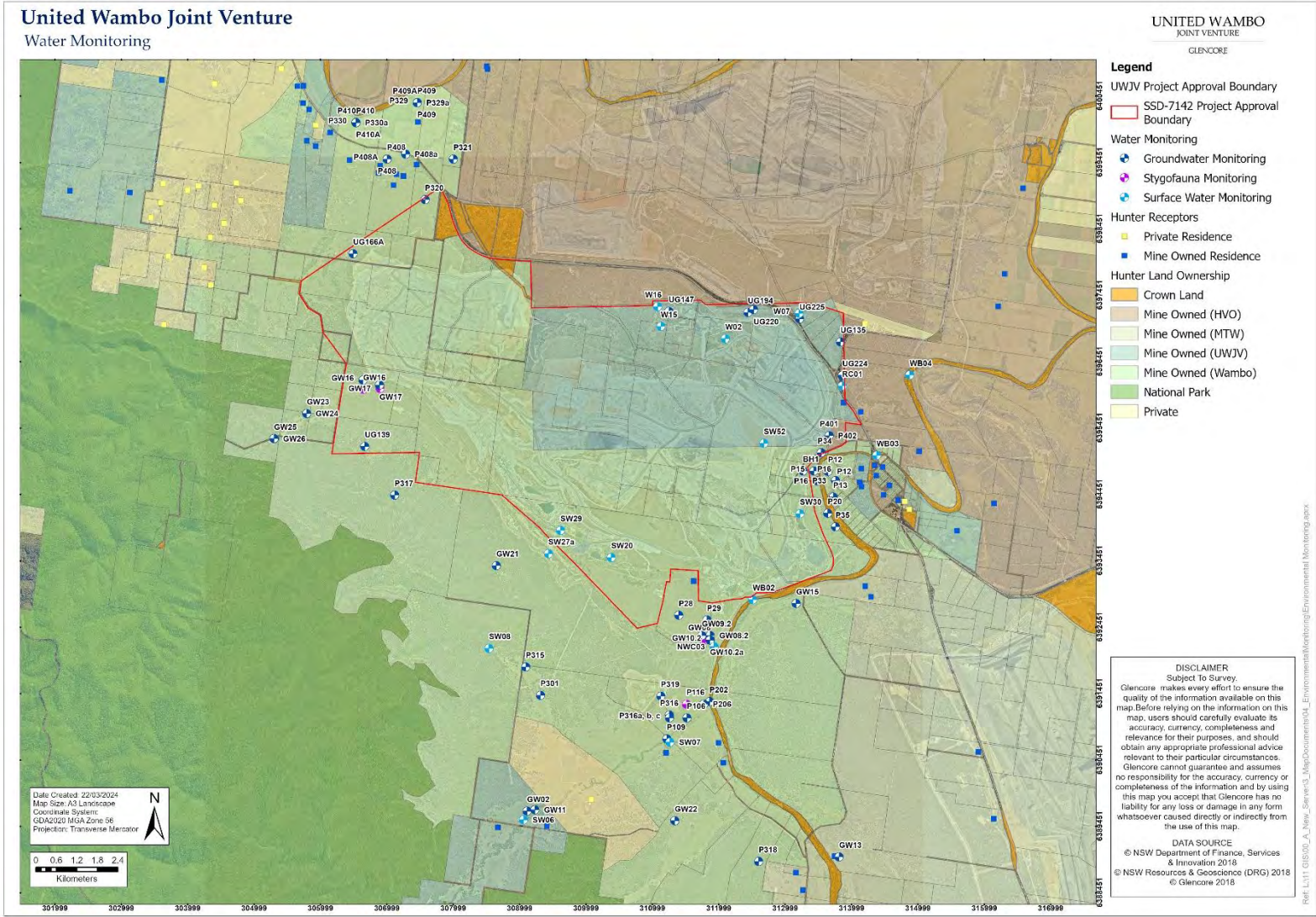


Figure 6-2 United Wambo Surface Water and Groundwater Monitoring Locations

6.1 Meteorological Data

Meteorological monitoring was undertaken at the United Wambo meteorological station (M7) located just north of the United Mine Infrastructure Area (MIA) as shown in **Figure 6-1**. A summary of the 2023 meteorological data is provided in **Table 6-1**.

Table 6-1 Yearly Summary of 2023 Meteorological Data

Date	Temperature °C			Windspeed m/s			Rainfall mm	No. of Rain Days >1mm
	Min	Av.	Max	Min	Av.	Max	Total	
January	14.3	22.9	38.4	0.1	1.6	3.2	57.2	5
February	14.3	23.8	38.2	0.2	1.6	3.2	83.6	4
March	12	23.2	39.5	0.4	1.6	3.2	100	9
April	8.8	17.5	27	0.3	1.5	3.7	40.2	7
May	3.8	13.2	23.4	0.2	1.9	3.8	3.4	1
June	0.2	12.2	23.9	0.1	2.2	3.8	11.8	4
July	0.9	12.7	24	0.1	2	5.1	10.2	1
August	4.7	14.1	25.6	0.1	1.4	4.1	25	5
September	4.8	17.7	34	0.2	1.5	3.5	22.6	3
October	8.6	19.8	34.9	0.3	2	4.8	42.6	4
November	12.3	21.3	36.6	0.1	1.6	4.4	40.8	7
December	15.3	24.8	40.8	0.4	1.7	3.1	100	7

The maximum 24hr average temperature in 2023 was 18.6 degrees Celsius (°C). In 2023, there was a decrease in total rainfall with 537.4mm compared to 1192.6mm in 2022. This is below the long-term average for rainfall in the area of 677.3 mm – attributed to the El Niño Event. There was a decrease in wind speed in 2023 (annual average of 1.72m/s) from 2022 (annual average of 1.79m/s).

6.2 Noise

6.2.1 Environmental Management

Noise monitoring is undertaken in accordance with the **Noise Management Plan**.

The location of noise monitoring sites is shown on **Figure 6-1**. The monitoring program includes:

- monthly attended night-time monitoring at six sites
- real time noise monitoring at four sites
- additional monitoring as initiated by alarms or in response to community concerns

The real-time monitoring network assists with the management of noise impacts from mining operations. Monitors are operated at locations representative of Redmanvale, Jerrys Plains, Maison Dieu and South Wambo. Data is recorded continuously and reported real-time to the United Wambo control room via an internal website.

A fleet monitoring system that records the location and activity of all major equipment in real time is operated onsite. The fleet monitoring system in combination with the real time noise monitoring program facilitates the implementation of appropriate noise mitigation measures. Should DPHI or the EPA request data relating to equipment use, United Wambo will provide the required data within 72 hours of receiving the request.

6.2.1.1 Management Measures

United Wambo implements noise management measures in accordance with the **Noise Management Plan**. The management measures are summarised below:

- Reasonable and feasible noise attenuation measures are undertaken on new plant and equipment that has the potential to contribute to the site's noise level
- Reasonable and feasible noise attenuation measures are undertaken on key items of plant and equipment that is reused from the current Wambo Open Cut operations or other controls achieving the same overall noise outcome
- 'Silent horns' are used to communicate with trucks and smart broadband 'Quacker' reversing alarms
- Bunds constructed in strategic locations along haul roads are implemented to shield trucks and equipment on exposed sections of the haul road ramps where possible
- The drop height of the first load into truck bodies is managed to minimise impact noise from the material
- Noise management training is provided for key employees to facilitate effective noise management
- Regular inspection and maintenance of noise attenuation systems are undertaken

Implementation of an automated real-time noise monitoring and notification system, SiteEye. The system enables access to live noise data (including directional noise data), issues alarms to relevant site personnel and tracks responses to noise alarms to assist with operational changes and compliance 24 hours a day.

In the event real time noise monitoring indicates potential noise impact, operational equipment can be relocated from elevated locations or progressively stood down under adverse meteorological conditions.

6.2.2 Approved Criteria

SSD 7142 noise criteria is summarised in the **Table 6-2**.

Table 6-2 SSD 7142 Operational Noise Criteria

Noise Assessment Group	Noise Assessment Location	Day	Evening	Night	Night
		L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{A1} (1 min)
Area 1 - North Bulga	R007, R379	36	35	35	45
	All other privately-owned residences	35	35	35	45
Area 2 - South	R025	39	38	38	48

Noise Assessment Group	Noise Assessment Location	Day	Evening	Night	Night
		L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{A1} (1 min)
Wambo	All other privately-owned residences	35	35	35	45
Area 3 - Warkworth Village	All privately-owned residences	44	44	43	53
Area 4 - Maison Dieu	All privately-owned residences	42	42	41	51
Area 5 - Moses Crossing	R050C	41	41	41	51
	R050A	41	40	40	50
	R044	41	40	39	49
	All other privately-owned residences	41	40	38	48
Area 6 - Redmanvale	R320	40	40	40	50
	R033, R343	40	40	39	49
	R042	40	40	38	48
	R029, R345	40	40	37	47
	R048	39	39	39	49
	R030, R049, R163	39	39	38	48
	R075	39	39	37	47
	R041B	38	38	38	48
	R344, R346	38	38	37	47
	R348	38	38	36	46
	R041A	37	37	37	47
	All other privately-owned residences	35	35	35	45
Area 7 - Jerrys Plains	All privately-owned residences	40	40	36	46
All other areas	All privately-owned residences	35	35	35	45

6.2.3 Key Environmental Performance

6.2.3.1 Attended Noise Monitoring

United Wambo engaged an acoustic consultant to undertake monthly attended noise monitoring during the reporting period. Attended noise monitoring results include locations required by the United Wambo Noise Management Plan and EPL3141.

Attended noise monitoring was completed once per month during the reporting period. United Wambo complied with relevant noise criteria for all measurements recorded in 2023.

Table 6-3 is a summary of attended noise monitoring for 2023. Results are presented as the maximum noise levels recorded from United Wambo at each location during the reporting period and have been compared to relevant noise criteria specified under SSD 7142 and EPL3141.

Detailed monitoring results are provided in Monthly Noise Monitoring Reports available on the United Wambo website.

Table 6-3 Summary of Attended Noise Monitoring Data – 2023 (January - December)

Location	NAG	United Wambo Noise Monitoring Results - dBA (Max)		United Wambo Project Specific Noise Criteria - dBA		EIS Predictions – dBA	
		LAeq (15minute)	LA1(1minute)	LAeq (15minute)	LA1(1minute)	LAeq (15minute)	LAeq Winter (15minute)
NM01	1	31	36	36	46	-	-
NM02	2	33	38	38	48	35	38
NM04	4	IA	IA	41	51	-	-
NM05	5	40	49	46	56	47	46
NM06	6	37	46	37	47	37	38
NM07	7	38	43	39	49	-	-

6.2.4 EIS Predictions

The United Wambo Open Cut Coal Mine Project (August 2016) modelled operation scenarios for years 2, 6, 11 and 16 of the conceptual mine plan.

The noise criteria detailed in the SSD 7142 and EPL3141 were based on the noise impact predictions provided in the EIS.

For 2023, attended noise monitoring results were at or below the noise criteria. Refer to **Table 6-3** for comparison of noise monitoring results, noise criteria and EIS predictions.

Noise management will be undertaken as per the **Noise Management Plan** which has been approved by DPE under Condition B5 of SSD 7142.

6.2.5 Improvements 2023

During 2023, several improvements were undertaken:

- Review of mine design for lower dumps in times of peak inversion (meteorological conditions enabling elevated noise)

- Alarm responses are reviewed regularly to ensure all alarms are being assessed and any changes implemented are recorded
- Alarm investigation has improved through investment in high quality noise cancelling headphones with capability to adjust low frequency noise enabling identification of specific low frequency mining equipment

6.2.5.1 Improvement 2024

United Wambo are purchasing eleven new Cat 789 trucks to replace older Cat 793 hire trucks, the new trucks will have sound suppression equipment fitted from the factory and will be significantly quieter than the older larger trucks they are replacing.

6.3 Blasting

6.3.1 Environmental Management

Blasting is undertaken in accordance with the **Blast Management Plan** to ensure blast related impacts, including ground vibration, airblast overpressure, flyrock, fume, dust and misfire are minimised on the local community, infrastructure and heritage sites to the extent required by SSD 7142 and EPL 3141.

6.3.2 Management Measures

United Wambo implements blast management measures in accordance with the **Blast Management Plan** (Glencore 2020e) outlined in **Table 1-1** of the Blast Management and Mitigation Measures. The management measures are summarised below:

- develop a detailed blast design and loading specification to be undertaken for each blast to meet the required criteria and minimise impact on the environment
- use a modified blast design when appropriate, for example, around identified geological features (including geological faults, series of joints, dykes, etc), to avoid potential flyrock incident or when blasting through old underground workings
- implement the Pre-Blast Assessment Protocol, including various meteorological assessments and notification procedures
- implement the Road Closure Management Plan where blasting is to occur within 500 m of a public road
- Coordinate blast times between the United Wambo pits and HVO to avoid concurrent blasting
- detailed liaison and risk management between United Wambo, Wambo UG and HVO when blasting will occur within 500m boundary or when potentially affected by flyrock, fumes, dust or other areas beyond the 500m zone (e.g. equipment movement).
- reviewing weather conditions regularly to ensure wind speed and wind direction are in line with model predictions to minimise impact of potential overpressure, fume and dust impact caused by blasting.
- Implementation of a safe management system for location and handling of misfires.

6.3.2.1 Approval Criteria

Condition B8 of Part B in SSD 7142 and Condition L4 of Section 3 in EPL 3141 outline the blasting criteria adopted for airblast overpressure and ground vibration.. This criterion is in place for human comfort for residences on privately owned land, the prevention of structural damage of heritage sites and infrastructure, and to minimise ground vibration at public infrastructure. The monitoring locations and criteria are summarised in **Table 6-4**.

Table 6-4 Residence on Privately Owned Land Monitoring Locations and Criteria

Monitoring Locations	Airblast overpressure (dB Lin Peak)	Ground Vibration (mm/s)	Allowable exceedance
South Wambo BM03 / EPA ID 19	115	5	5% of the total number of blasts over a calendar year
Moses Crossing BM05 / EPA ID 20			
Redmanvale BM07 / EPA ID 21	120	10	0% of the total number of blasts over a calendar year
Maison Dieu BM08 / EPA ID 22			

Table 6-5 Heritage Blasting Monitoring Locations and Criteria

Monitoring Locations	Airblast overpressure (dB Lin Peak)	Ground Vibration (mm/s)	Allowable exceedance
St Phillips Church BM02	N/A	5	0%
Wambo Homestead BM01	120	10	0%
All other heritage items¹ BM02	133	5	0%

¹ beyond those predicated in SSD 7142 and generally in accordance with the EIS. Includes the Former, Piggery and Butcher's Hut, former Queen Victoria Inn, and Springwood Homestead. For the Warkworth Public School, Montrose property and Shearing Shed, and Dog-leg Fence see section 10.1.3 of the Blast Management Plan (Glencore 2020e).

Table 6-6 Infrastructure Monitoring Locations and Criteria

Monitoring Locations	Airblast overpressure (dB Lin Peak)	Ground Vibration (mm/s)	Allowable exceedance
Hunter Valley Gliding Club GliderClub¹	133	25	0%
Warkworth Shooting Complex BM02²			
HVO Infrastructure - occupied BM02²			
HVO surface infrastructure – unoccupied³	133	100	0%

¹ This monitor is the representative monitoring location.

² Monitor installed 9 June 2020.

³ No specific sites monitored under this consent condition. Monitoring locations committed to in the Blast Management Plan (Glencore 2020e) are considered representative. Note United Wambo monitors other infrastructure (ie. transmission towers) closer to the pit with lower criteria.

Table 6-7 Public Infrastructure Monitoring Locations and Criteria

Monitoring Locations	Ground Vibration (mm/s)	Allowable exceedance
Transmission suspension towers ¹	100	0%
Transmission tension towers ¹	50	
Prescribed dams ²	50 (unless otherwise directed by the DS NSW)	0%
Public Roads ³	100	0%
Telecommunication infrastructure and cables ³		
All other public infrastructure ³	50 (or a limit determined by the structural design methodology AS 2187.2 – 2006, or its latest version, or other alternative limit for public infrastructure, to the satisfaction of the Planning Secretary)	0%

¹ Transmission suspension and tension towers were monitored as per SSD consent conditions using representative sites and/or portable monitors when blasting was in close proximity.

² Prescribed dams were monitored as per SSD 7142 consent conditions. This includes Wambo Tailings Dam (North East Tailings Dam), HVO Riverview Void In-pit Water Storage 2, United Tailings Dam 2, and Wambo Hunter Pit Tailings Dam (HPTD). These prescribed dams were monitored all year round.

³ No specific sites monitored under this consent condition. Monitoring locations committed to in the Blast Management Plan (Glencore 2020e) are considered representative.

Table 6-8 Offensive Blast Fumes

Condition	Details
Condition L4.5 of Section 3 in EPL 3141	<p>Offensive blast fume must not be emitted from the premises.</p> <p>Definition:</p> <p>Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:</p> <ol style="list-style-type: none"> 1. are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or; 2. interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.

6.3.3 Key Environmental Performance

United Wambo Open Cut monitored 161 blasts during 2023. As per Condition B10 and B11 of SSD 7142, all blasting on site was between 9am and 5pm (Monday to Saturday inclusive) and there were less than three single blast events a day and less than 15 single blast events a week, averaged over a calendar year.

Monitoring data was collected at all locations outlined in the SSD 7142 and EPL 3141 consent conditions. The approved monitoring locations BM01, BM02, BM03, BM05, BM07 and BM08 (as shown in **Figure 6-1**) are reported on in this Annual Review, as committed to in the **Blast Management Plan (Glencore 2020e)**. Summarised monitoring data for these locations are provided in **Table 6-9** to **Table 6-11**.

Table 6-9 Blast Monitoring Data for Residences on Privately Owned Land

Monitoring Location		Airblast Overpressure Level dBL				Ground Vibration ppv (mm/s)			
		(Lin Peak)							
Name	Monitor	Average	Max	Results >115 dBL	Results >120 dBL	Average	Max	Results >5 mm/s	Results >10 mm/s
South Wambo	BM03	91.3	119.0	0.6%	0%	0.11	0.72	0%	0%
EPA ID 19									
Moses Crossing	BM05	93.8	111.8	0%	0%	0.07	0.33	0%	0%
EPA ID 20									
Redmanvale	BM07	90.0	107.3	0%	0%	0.06	0.33	0%	0%
EPA ID 21									
Maison Dieu	BM08	96.1	116.8	0.6%	0%	0.16	1.82	0%	0%
EPA ID 22									

As per the blasting criteria outlined in SSD 7142 consent conditions, there were no blasting exceedances for airblast overpressure or ground vibration for residences on privately owned land during the 2023 calendar year, as shown in **Table 6-9**.

Table 6-10 Heritage Monitoring Data

Monitoring Location		Airblast Overpressure Level dBL (Lin Peak)				Ground Vibration ppv (mm/s)		
Name	Monitor	Average	Max	Results >120 dBL	Results >133 dBL	Average	Max	Results >5 mm/s
St Phillips Church ¹	BM02	102.4	116.6	N/A	0%	1.04	5.20	0%
Wambo Homestead	BM01	97.2	115.3	0%	0%	0.16	0.72	0%
All other heritage items	BM02	102.4	116.6	N/A	0%	1.04	5.20	0%

¹: St Phillips Church is 500m further away from United Wambo than BM02, modelling shows vibration level at St Phillips Church <5mm/s.

There were no blasting exceedances in airblast overpressure or ground vibration for heritage locations during the 2023 calendar year, as seen in **Table 6-10**.

Table 6-11 Infrastructure Monitoring Data

Monitoring Location		Airblast Overpressure Level dBL (Lin Peak)			Ground Vibration ppv (mm/s)		
Name	Monitor	Average	Max	Results >133 dBL	Average	Max	Results > Criteria mm/s
Hunter Valley Gliding Club	Glider Club	103.3	118.4	0%	0.99	5.61	0%
Warkworth Shooting Complex	BM02	102.45	116.6	0%	1.04	5.20	0%
HVO Infrastructure - occupied	BM02	102.45	116.6	0%	1.04	5.20	0%
Transmission suspension tower	Portable 1	N/A	N/A	N/A	2.26	14.57	0%
Transmission tension tower	Tower 634 E and Tower 634 A-B	N/A	N/A	N/A	3.37	47.39	0%
Prescribed dams	HPTD, HVO Riverview East/West	N/A	N/A	N/A	1.48	9.71	0%
Public Roads ¹ Telecommunication infrastructure and cables	Portable 1, 634 A-B, 634 E	N/A	N/A	N/A	3.00	47.39	0%

¹ Monitors located adjacent to transmission suspension towers located between the approved pit shell and the Golden Highway are considered representative of public roads, telecommunication infrastructure.

United Wambo monitored blasting criteria at several locations considered to be representative of infrastructure surrounding the mine site. During the 2023 reporting period, there were no airblast overpressure or ground vibration exceedances recorded.

6.3.4 EIS Predictions

A ground vibration predictive model and an airblast overpressure predictive model was developed to determine potential blasting impacts for the EIS. A range of blast scenarios were modelled. The results of the blasting impact assessment indicate that ground vibration and air blast overpressure levels can be managed to meet relevant blast emission criteria at all sensitive receiver locations through appropriate blast design. All results from blasting in 2023 were compliant with criteria, and consistent with predictions.

6.3.5 Improvements 2023

In October 2023 an independent review was conducted by Tachtech for blasting conducted at United Wambo with the aim of reducing the incidence of blast fume. This report highlighted some potential improvements that United Wambo could adopt including further refinement of the blast model design using site data from 2020 to 2023, allowing greater accuracy to vibration predictions at each monitor and surrounding area.

6.3.5.1 Proposed Improvements 2024

Investigate ways to improve the accuracy of the pre-blast modelling for fume, dust and overpressure, incorporating historic data and the potential to include other parameters such as elevation.

Installation of two new blast monitors at Dam 2 and Dam U2.

6.4 Air Quality

6.4.1 Environmental Management

Air Quality monitoring is undertaken in accordance with the ***Air Quality and Greenhouse Gas Management Plan***.

The location of air quality monitoring sites is shown on ***Figure 6-1***. The monitoring program includes:

- continuous monitoring of PM₁₀ at four sites
- High Volume Air Sampler (HVAS) monitoring every six days (continuously for 24 hours) at two sites
- continuous meteorological monitoring at two sites

Each real time air quality monitoring unit is connected to web-based software that is fitted with alarming capabilities. The alarming capabilities can advise mining personnel that air quality at the monitor has reached the trigger levels. Alarms are sent via SMS and email to relevant United Wambo staff to notify that air quality is reaching, or has reached, the predetermined limit. In such an event, action can then be taken to modify operations where practical as per the United Wambo Dust TARP.

Note: HVAS 01 and HVAS 02 are owned and operated by HVO, with results forwarded to United Wambo monthly.

6.4.2 Management Measures

The principal sources of atmospheric dust emissions from activities at United Wambo during operation are associated with:

- disturbance from mining, exploration and drilling works
- wind-blown dust from exposed surfaces
- vehicle movements on the internal unsealed hardstand areas, haul roads or access roads around the site

United Wambo implements dust and greenhouse gas management measures in accordance with the ***Air Quality and Greenhouse Gas Management Plan***. The management measures are summarised in ***Table 6-12***.

Table 6-12 Greenhouse Gas Mitigation Measures

Mitigation Measure	Application at United Wambo	Status During Reporting Period
Limiting the length of material haulage routes to reduce diesel usage and associated emissions	Length of haulage routes has been optimised to minimise dust, noise, fuel use and improve operating efficiency.	Ongoing as part of the mine planning processes.
Optimising ramp gradients to reduce diesel usage and associated emissions	Ramp gradients have been optimised according to pit geometry parameters and mobile equipment performance characteristics.	Ongoing as part of the mine planning processes.
Continually improve the fuel efficiency of haul trucks operating at the mine to reduce diesel usage and associated emissions	Where new trucks are purchased during the life of the Project, fuel/energy efficiency will be considered in the selection criteria. Haul road design parameters such as gradient and haul length are optimised resulting in the efficient haulage of overburden per unit of fuel consumed.	No new trucks were purchased in 2023.
Payload management to reduce diesel usage and associated emissions	Payload will be constantly monitored and actively managed to maintain efficiency, over time reducing the overall diesel consumption of the mine and, thereby, reducing GHG emissions.	Ongoing. Payload targets were set for all trucks at United Wambo and are fitted with an onboard management system to optimise payload size. United Wambo have been following the Excavator Operator Guideline (developed in 2021) to consider payload management.
Increasing haul truck payload to reduce the number of truck loads required and consequently reduce diesel usage and associated emissions	Truck tray capacity will be reviewed as part of the efficient management of the operation, including the option of fitting custom-built trays to maximise payloads. Payload will also be maximised by blasting strategies that optimise material size characteristics.	Payload study completed to optimise new 930E-5 tray designs.
Improving rolling resistance of haul roads to reduce diesel usage and associated emissions	Haul roads are planned to be constructed on solid rock rather than on soil or subsoil material where practical.	Ongoing as part of the mine planning processes and maintenance strategies.
Reducing idling times to reduce diesel usage and associated emissions	Reducing idle times will be an ongoing performance measure. Initiatives to reduce idle times will continue to be introduced over the life of the Project. A reduction in idle times will improve fuel consumption rates per volume of material moved.	United Wambo has implemented a fleet management system to reduce queue time. In addition, multiple dumps are operated simultaneously (where practical) to reduce queue time.
Scheduling activities so that equipment operation is optimised to reduce energy usage and associated emissions	Scheduling activities to optimise equipment operation will be a routine activity. United will prepare long, medium and short term plans to optimise production. Over time, this will reduce the overall diesel consumption of the mine and, thereby, reduce greenhouse gas emissions.	Ongoing as part of the mine planning processes.

Mitigation Measure	Application at United Wambo	Status During Reporting Period
Seek to continually improve the fuel efficiency and diesel emissions of mine equipment during the purchase of new equipment	Where new equipment is purchased during the life of the Project; fuel/energy efficiency and reasonable and feasible diesel emissions reduction technology will be considered in the selection criteria.	All trucks have been fitted to Tier 4 emission standards, fitted with fuel/energy efficiency technology.
Blasting strategies to improve extraction and processing energy use efficiency and reduce associated emissions	Blast management practices will be employed to size material for optimum payloads and minimise the need for secondary treatment of waste material.	Blasts during 2023 were designed to minimise rehandling of material. During the reporting period secondary treatment of blasted material was not required.
Maximising resource recovery efficiency to maximise energy use efficiency and reduce associated emissions	Long, medium and short term operational plans will be developed to optimise the recovery of approved resources.	Ongoing as part of the mine planning processes.
Working machines to their upper design performance to optimise energy usage and associated emissions	Glencore's business objectives support and promote effective equipment utilisation and performance rates, resulting in improved fuel consumption rates per volume of material moved.	Ongoing as part of the mine planning processes.
Preventing unnecessary water ingress to reduce pump energy usage and associated emissions	The surface water management system is designed to maximise separation of clean and dirty water systems. Clean water will be diverted away from mining areas, consistent with the mine water management system design outlined in the EIS.	The clean water drain which was constructed in 2020 continued to be inspected and maintained. It has been deemed 'stable' in 2023 and water can be released into Redbank Creek.
In-pit servicing to reduce diesel usage associated with transporting equipment	Equipment will be serviced in pit, where practical, reducing unnecessary unproductive travel time and energy use.	In-pit servicing is completed where practical. An in-pit refueling station was constructed to reduce the travel required for trucks and other heavy equipment to be refueled.
High efficiency workshop lighting	Workshop areas will use high efficiency lighting, reducing energy use.	Energy efficient LED lighting continues to be used in the workshop.
High efficiency heating, ventilation, and cooling (HVAC) systems for administrative buildings	Administration buildings will use high efficiency HVAC systems reducing energy use.	HVAC systems installed are still providing energy efficiencies to the administration building.

6.4.3 Approval Criteria – SSD 7142

Air quality criteria is included as Condition B25 of SSD 7142 and is reproduced in **Table 6-13**.

Table 6-13 Air Quality Criteria

Pollutant	Averaging period	Criterion ($\mu\text{g}/\text{m}^3$)
Particulate Matter <10 mm (PM_{10})	Annual	^{a,c} 25
	24 hour	^b 50
Particulate Matter <2.5 mm ($\text{PM}_{2.5}$)	Annual	^{a,c} 8
	24 hour	^b 25
Total suspended particulate (TSP) matter	Annual	^{a,c} 90

^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

^c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.

6.4.4 Key Environmental Performance

A list of air quality monitoring sites, parameters and frequencies are provided in **Table 6-14**.

Table 6-14 Air Quality Monitoring Sites

Monitoring site (s)	Indicator (s)	Equipment Type	Frequency
HVAS 01 and HVAS 02	TSP	HVAS	Six-day cycle
AQ02 and AQ04	PM10	TEOM	Continuous
AQ01 and AQ03	PM10	TEOM	Continuous
WS1 and WS2	Meteorology	Met Station	Continuous

6.4.4.1 High Volume Air Samplers

Table 6-15 presents a summary of HVAS monitoring results and compares annual averages for TSP against consent criteria.

Table 6-15 HVAS Results for 2023

Gauge	Maximum TSP ($\mu\text{g}/\text{m}^3$)	Annual Average TSP ¹ ($\mu\text{g}/\text{m}^3$)
Consent Criteria	-	90.0
HVAS 01 (Warkworth)	362.0	130.9
HVAS 02 (Moses Crossing)	221.0	66.8

As shown in **Table 6-15** Annual TSP averages were within criteria limits of $90 \mu\text{g}/\text{m}^3$ for HVAS 02. HVAS 01 is above the criteria. As part of the action response a notification was made in accordance with Condition B27(a) of SSD 7142 and Condition D6 of the SSD 7142.

6.4.4.2 Continuous Monitoring PM_{10}

A summary of the recorded PM_{10} levels at the TEOM units is presented in **Table 6-16**. The number of days that exceeded the consent criterion is also shown. During the reporting period, TEOM units failed

to collect valid data on several occasions for varying lengths of time. As a result, <75% of the daily data was not collected. During these occurrences, a valid 24-hour average was not able to be calculated. For additional details please see Section 1 and Section 11.2.1.

Table 6-16 provides a summary of the annual average and maximum 24-hour PM₁₀ and 24-hour PM_{2.5} averages recorded at TEOM units in 2023. The annual average PM₁₀ concentrations were below the relevant criterion of 25µg/m³ at all four TEOMs in 2023. Additionally, the annual average PM_{2.5} concentrations were below the relevant criterion of 8µg/m³ at AQ01 and AQ03 in 2023.

As presented in **Table 6-16**, the maximum 24-hour average PM₁₀ concentrations did not exceed the relevant criterion of 50µg/m³.

As presented in **Table 6-16**, the maximum 24-hour average PM_{2.5} concentrations did not exceed the relevant criterion of 25µg/m³.

Table 6-16 Summary of TEOM Sampling Results – Maximum 24-Hr Average

Annual average			Maximum 24-hour averages			
Gauge	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Number of days exceeding criterion	PM ₁₀ (µg/m ³)	Number of days exceeding criterion
Consent Criteria	8	25	25	0	50	0
AQ01	7.3	23.8	23.7	0	94.5	^a 0
AQ02	-	16.2	-	0	51.2	^b 0
AQ03	5.5	13.0	26.2	^b 0	38.0	0
AQ04	-	19.4	-	0	54.1	^b 0

^a Criteria does not apply to Warkworth area, as it is mine-owned land.

^b Contribution Calculations completed and reviewed below criteria. This recalculation takes into account wind speed and wind direction.

6.4.5 Long Term Trends

6.4.5.1 TSP

Long- term annual average HVAS results for TSP at United Wambo in 2023 are shown in **Table 6-17**.

Table 6-17 Long-Term High Volume Air Sampler TSP Results

Year	Moses Crossing (HVAS 02)			Warkworth (EPA ID 8) (HVAS 01)		
	MIN	MAX	AVG	MIN	MAX	AVG
2010				13.2	82.7	40.7
2011				13.0	140.0	49.8
2012				8.0	143.0	50.7
2013				8.0	141.0	55.7
2014				13.0	147.0	53.9
2015				10.0	166.0	51.8
2016				8.0	132.0	50.1
2017				19.0	159.0	65.0

	Moses Crossing (HVAS 02)			Warkworth (EPA ID 8) (HVAS 01)		
2018				22.0	186.0	79.9
2019 (All Data)				12.0	214.0	80.0
2019 (Extraordinary removed)				12.0	196.0	74.0
2020 (All Data)	5.0	322.0	83.0	24.0	214.0	75.6
2020 (Extraordinary removed)¹	5.0	214.0	70.3	24.0	144.0	70.8
2021 (All Data)¹	2.1	125.0	36.4	14.4	447.0	94.6
2022 (All Data)¹	2.9	117.0	37.7	15.4	254.0	72.3
2023	7.4	221.0	66.8	22.2	362.0	130.9

Annual average HVAS results for TSP has shown a moderate level of variability throughout the period of 2010 to 2023. The 2023 average values for HVAS TSP shows an increase at HVAS 02 and HVAS 01 from 2022 which was a particularly wet year with approximately double to the amount of rainfall when compared to 2023.

6.4.6 EIS Predictions

The United Wambo Open Cut Coal Mine Project (August 2016) modelled operation scenarios for years 2, 6, 11 and 16 of the conceptual mine plan. A comparison of air quality monitoring results and those predicted in the EIS for Year 2 is summarised below.

The EIS predicted that cumulative annual average PM₁₀ and PM_{2.5} criteria would not be exceeded at all surrounding private residences, with the exception of one residential receiver at Warkworth Village, however, since the EIS was submitted, this property has been purchased and is no longer privately owned. Cumulative Maximum 24Hr PM₁₀ 24 hr concentrations were predicted to exceed on at least one occasion a year. Monitoring results identified that Maximum PM₁₀ 24 hr was exceeded by United Wambo for 2023. There were exceedances of PM_{2.5} Annual Average or Maximum 24-hour concentration for United Wambo throughout 2023.

The EIS did not predict any exceedance of TSP at any private residences. Monitoring results show that there have been no exceedances of the TSP criteria at any private residence.

6.4.7 Reported Greenhouse Gas Emissions

United Wambo reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year, United Wambo is required to submit to the Federal Government the emissions from their NGERs registered facility. Also, because United Wambo emits over 100kt of CO₂e- each year, it is registered as a Safeguard facility and, therefore, also had a Safeguard baseline. Emissions above the baseline for that year need to be offset by retiring Australian Carbon Credit Units (ACCUs). The NGERs reporting year is based on a financial year, not a calendar year, such as this Annual Review. In order to prevent incompatible public reporting, the values in this report also cover a financial year. The following table contains the Scope 1 (direct emissions from the mining activities during the year), and Scope 2 emissions (electricity consumption by the mine during the year).

Table 6-18 2023 Direct Emissions and Electricity Consumption

Site	Scope 1 CO ₂ -e	Scope 2 CO ₂ -e
United Wambo Joint Venture	291,241 tonnes	1,708 tonnes

6.4.7.1 EIS Predictions - Emissions

The EIS predicted the operation to produce approximately 253,000 t CO₂-e Scope 1 emissions and approximately 35,000 t CO₂-e of Scope 2 emissions per annum. The EIS Scope 2 predictions included the electricity used for operation of the CHPP, Wambo own, manage and operate the CHPP and are responsible for reporting Scope 2 emissions for that facility.

6.4.7.2 Continuous Improvement Measures - Energy Efficiency and Reduce GHG Emissions

United Wambo is a part of the wider coal assets held by Glencore across Australia. Glencore Coal Assets Australia (GCAA) are themselves a part of the global Glencore mining portfolio. In line with the ambitions of the 1.5°C scenarios set out by the IPCC, Glencore target a short-term reduction of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post 2035, Glencore's ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.

Glencore incorporates energy costs and our carbon footprint into our annual planning process. Commodity departments, such as Glencore Coal Assets Australia, are required to provide energy and GHG emissions forecasts for each asset over the forward planning period and provide details of emissions reduction projects.

In the case of United Wambo, this includes involvement with GCAA when considering available GHG abatement technology and mine planning to optimise efficiency (which usually translates into reduced fuel consumption) see **Table 6-12** for United Wambo's greenhouse gas mitigation measures.

6.4.8 Improvements 2023

Mining Supervisors can utilise SMS to contact any of the TEOM dust monitors to review the current TEOM reading at that monitor, thus improving the supervisors' overall management capability.

6.4.8.1 Proposed Improvements 2024

United Wambo will be replacing four water trucks with new Cat 777 models. The new machines will increase the overall availability of the water carts which will improve dust suppression capability.

6.5 Biodiversity

6.5.1 Biodiversity Offset Strategy

United Wambo has approval to retire biodiversity credits progressively based on the staging of native vegetation disturbance in line with the progressive development of the mine. The three stages of disturbance are approximately seven-year stages, and are referred to as Stage 1, Stage 2 and Stage 3. An overview of the current proposed Stage 1, Stage 2 and Stage 3 credit requirements, as outlined in SSD 7142, are provided in **Table 6-19**.

Table 6-19 Staged Offsetting Requirements

Impacted Feature	STAGE 1 Credits Required	STAGE 2 Credits Required	STAGE 3 Credits Required	Total
Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act	11,287	2,570	620	14,477
Hunter Floodplain Red Gum Woodland EEC under the BC Act	0	20	0	20
Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC under the BC Act	1,424	0	0	1,424
Central Hunter Grey Box - Ironbark Woodland EEC under the BC Act	356	101	0	457
HU905 - Narrow-leaved Ironbark - Grey Box grassy Woodland of the Central and Upper Hunter	3,562	1,344	1	4,907
HU906 - Bull Oak Grassy Woodland of the Central Hunter Valley	2,973	0	0	2,973
HU945 - Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley	1,844	281	0	2,125
Southern Myotis (<i>Myotis Macropus</i>)	15	547	0	562
TOTAL ECOSYSTEM CREDITS	21,446	4,316	621	26,383
TOTAL SPECIES CREDITS	15	547	0	562

A Biodiversity Offset Strategy (BOS) was subsequently developed and included in the Biodiversity Management Plan (BMP), which outlines the proposed method of retiring these credits.

The proposed retirement method for Stage 1 credits is the establishment of Biodiversity Stewardship Agreements (BSA's), ensuring in-perpetuity conservation and reporting consistent with the NSW Biodiversity Offset Scheme (NSW BOS). The BSA's proposed to satisfy the Stage 1 requirements include:

- Brosi
- Highfields
- Jerrys Plains
- Mangrove
- Wambo
- South Wambo

United Wambo have secured all of the required offset credits for Stage 1 of the Project according to an assessment of biodiversity credits under the former FBA process using the BioBanking assessment methodology. This provides 'like for like' credit allocation between the credits required and those created since the Project was assessed using the former FBA methodology.

Biodiversity credits related to the EPBC Act-listed Central Hunter Valley Eucalypt Forest and Woodland CEEC are proposed to be retired in a like-for-like manner. That is, all biodiversity credits generated from land-based offsets represent the CEEC either as currently conforming to, or will be restored to be, the community.

Prior to the commencement of Stage 2 disturbance, United Wambo will undertake a review of the disturbance undertaken during Stage 1 to identify areas where disturbance has been avoided. Disturbance that has been avoided will be used to offset the future staged credit requirements.

6.5.2 Long-Term Security

Condition B56 of the United Wambo Open Cut Coal Mine (United Wambo) Development Consent SSD 7142 has the requirement for United Wambo to retire the Stage 1 biodiversity credits as specified in Table 5 of Condition B55 of SSD 7142 within 12 months of commencing Phase 1A of the development, that being 6 January 2021.

NSW DPIE approved an extension of this requirement until 6 January 2022 due to delays in establishing a mechanism for retiring Biobanking Assessment Methodology (BBAM) credits under the NSW Biodiversity Offsets Scheme (BOS). Due to ongoing delays, United Wambo applied for a further extension which was refused by DPE.

Applications for all BSA's were submitted to BCT in January 2022. Ongoing consultation was conducted throughout early 2022 with BCT confirming that the applications were complete on 7 June 2022. An initial spatial and eligibility review was conducted by BCT, with feedback provided to United Wambo on 28 June 2022. Site inspections were then undertaken of all BSA's by CST personnel on 21-23 November, with further feedback provided to United Wambo during February 2023.

United Wambo continued to receive further requests for updates and changes to the BSA documentation from CST throughout 2023. As at the end of December 2023, five of the six final BSA documents had been received for signing and execution. It is anticipated that the BSA documents will be signed and executed by both United Wambo and the Minister administering the BC Act in Quarter 1 2024. Once this has been completed, United Wambo will apply to DPHI to confirm that the Stage 1 biodiversity credit retirement obligations have been satisfied.

United Wambo is currently investigating the options for retiring Stage 2 credits using the mechanisms allowed for under the NSW BOS. Retirement of these credits is not required until approximately 2025.

6.5.3 Key Environmental Performance

6.5.3.1 Disturbance

During 2023, a total of 31.9 hectares of new disturbance was undertaken for the development of the open cut mining areas, infrastructure areas and overburden emplacement areas. A comparison of the total actual disturbance to date and the predicted Stage 1 (i.e. Years 1--7) is provided in **Table 6-20**.

Table 6-20 Proposed Stage 1 vs Actual to Date Disturbance

Impacted Feature	Stage 1 Proposed Disturbance (ha)	Stage 1 Proposed Credits	Stage 1 Total Disturbance to Date (ha)	Stage 1 Total Credits Impacted to Date (ha)*
Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act	195.54	11,287	133.5	7,839
Hunter Floodplain Red Gum Woodland EEC under the BC Act	0	0	0	0
Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC under the BC Act	28.25	1,424	25.5	1,283

Impacted Feature	Stage 1 Proposed Disturbance (ha)	Stage 1 Proposed Credits	Stage 1 Total Disturbance to Date (ha)	Stage 1 Total Credits Impacted to Date (ha)*
<i>Central Hunter Grey Box - Ironbark Woodland EEC under the BC Act</i>	6.28	356	4.0	227
HU905 - Narrow-leaved Ironbark - Grey Box grassy Woodland of the Central and Upper Hunter	120.34	3,562	74.7	2,171
HU906 - Bull Oak Grassy Woodland of the Central Hunter Valley	51.05	2,973	48.11	2,801
HU945 - Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley	27.33	1,844	24.83	1,675
Southern Myotis (<i>Myotis Macropus</i>)	0.2	15	0	0

* Impacted credits are estimated using the credit factor applied in the Project Approval

6.5.3.2 Weed and Pest Management

During 2023, United Wambo focused primarily on targeting weeds in the future clearing areas and rehabilitation areas and maintaining vegetation around key infrastructure areas.

Species targeted in the 2023 weed management activities by the weed management contractor included:

- African Olive (*Olea europaea* subsp. *cuspidata*)
- Mother-of-Millions (*Byrophyllum delagoense*) – Noxious Weed Class 3
- Galenia (*Galenia pubescens*)
- Prickly Pear (*Opuntia stricta*)
- African Boxthorn (*Lycium ferocissimum*) – Weed of National Significance (WONS)

Species targeted in the 2023 vertebrate pest management activity undertaken by the pest management contractors included:

- Red Fox (*Vulpes vulpes*)
- Wild Dogs (*Canis familiaris*)
- Feral Pigs

The results of the vertebrate pest management program for 2023 are outlined in **Table 6-21**.

Table 6-21 2023 Vertebrate Pest Management Results

Species	Mangrove BSA	Brosi & Jerrys Plains BSA	Highfields BSA
Wild dog	3	29	22
Fox	2	29	73
Feral Pigs	0	1	56
Deer	0	0	2

6.5.4 Management Measures

Measures to Minimise Direct Impacts on Biodiversity

As per the approved United Wambo **Biodiversity Management Plan**, the management measures are described in **Table 6-22**.

Table 6-22 Biodiversity Management Measures

Action	2023 Measures
Minimise the impacts of the development on biodiversity	Suitably experienced personnel undertook pre-clearance surveys and tree-felling supervision for all clearing areas. Suitable biological resources, including topsoil and fallen trees, were salvaged from clearing areas prior to removal of vegetation. All vegetation is mulched and incorporated into the topsoil. Dog baiting and pig trapping was undertaken as per above.
Manage the remnant vegetation and fauna habitat at the site	Clear delineation of the clearing disturbance footprints to avoid accidental clearance beyond the areas approved for disturbance Weed and pest management as per above.
Employee Education and Training	All employees and contractors are provided with an awareness of biodiversity values of United Wambo and requirements of the BMP in relation to site operations through the site induction process.

6.5.5 Improvements 2023

6.5.5.1 Proposed Improvements 2024

During 2024, active management of the BSA areas will commence in accordance with site management plan developed for each offset. Corresponding with the land ownership, United Wambo will be responsible for the management of the Brosi, Jerrys Plains, Highfields and Mangrove BSA's, whilst Peabody will be responsible for the Wambo and South Wambo BSA's.

Completed management activities will be reported in the 2024 Annual Review.

The BMP will also be revised and resubmitted once the BSA's have been finalised and credits have been retired.

6.6 Heritage

6.6.1 EIS Predictions

6.6.1.1 Aboriginal Heritage

The United Wambo Open Cut Coal Mine Project EIS provided details of the survey undertaken for the cultural heritage assessment in 2015 with a total of approximately 139 person days. The Aboriginal heritage surface survey recorded 25 new artefact scatters, 20 extensions to previously recorded sites and 34 isolated finds. This surface survey was followed by eight test excavations, with surprisingly sparse results. One hundred and ninety two artefacts were recovered, with an average of 1.25 artefacts per excavation square, which is an extremely low density of artefacts.

6.6.1.2 European Heritage Sites

A detailed heritage impact statement was conducted in 2016 for the proposed United Wambo Joint Venture Project (Umwelt, 2016). In consultation with Enviro Strata (the blasting consultant), it was determined that items further than 2 kilometres from the Project Area would not be affected by blasts. As such, the search for this assessment was limited to a conservative distance of 3 kilometres. Three historic heritage items were identified as being within this zone, but outside the Project Area. These are Wambo Homestead, St Philips Church Warkworth and the Former Queen Victoria Inn (ruins). There were also items of historic interest located within the Project Area, which are the Dog- leg Fence and the former House Site. Also, within the vicinity of the Project Area are Springwood Homestead, Montrose Property, the former Warkworth Public School and Piggery and Butcher's Hut.

6.6.2 Key Environmental Performance

6.6.2.1 Aboriginal Heritage

There was one salvage of Aboriginal artefacts in 2023, these artefacts were additional to those collected from a previously identified site. **Figure 6-3** illustrates the current status of heritage sites in the United Wambo area.

The recommended measures for the Aboriginal heritage sites remaining within the United Wambo area have been implemented, which includes, but not limited to, the fencing and signposting of in situ sites. United Wambo continue to ensure cultural heritage sites are not impacted through the implementation of the Ground Disturbance Permit process onsite.

The Cultural Heritage Funding Program outlined in the Aboriginal Cultural Heritage Management Plan, Section 13, was taken up by three Aboriginal groups or persons. United Wambo continued to seek projects within the community for potential support.

The delivery of Warren Taggart's book, *Spirit of Place*, continued to be donated to selected schools, universities, libraries, Councils and those involved in its creation.

The three programs that received funding in 2023 included Tidda Yarns after school program and Puwampi Unti Kunar Dance Group - Possum Pelt Cloak Making at St Catherine's Catholic College and Waagan Galga's Christmas Corroboree.

The first two recipients of the tertiary scholarships continued to achieve results throughout 2023. The third tertiary scholarship is still available.

6.6.2.2 Historic Heritage Sites

There were no historical heritage activities undertaken during 2023. There was no disturbance to historic heritage items during 2023.

6.6.3 Management Measures

United Wambo will continue to monitor Aboriginal heritage sites in accordance with the United Wambo Aboriginal Cultural Heritage Management Plan (ACHMP), as required by condition B79 of SSD 7142. For management measures and salvage methods refer to Table 1 and Section 6 of the ACHMP respectively.

United Wambo will continue to manage all non-Aboriginal heritage items in accordance with the United Wambo Historical Heritage Management Plan (HHMP), which is required by condition B82 of SSD 7142. For mitigation and management measures refer to Table 1 and Section 7 of the HHMP.

6.6.4 Improvements 2023

There were no significant improvements made to Cultural or Historic Heritage in 2023.

6.6.4.1 Proposed Improvements 2024

United Wambo JV propose to continue to actively seek appropriate cultural programs for funding and development in the community and finalise applications for the third and final cultural scholarship. It is also proposed that United Wambo JV will relocate artefacts to the Minimbah Teaching Place and meet with Registered Aboriginal Parties (RAPs) for the final determination of the potential scar tree located at the west of the northern mining administration and relevant plan of management if required.



6.7 Waste Management

Waste management practices at United Wambo are based on the waste management hierarchy of reduce, reuse, recycle and as a last resort, dispose.

The overall aim of the waste management system at United Wambo is to minimise waste being disposed from the site, but also to maximise resource use where possible. Waste is managed, tracked and records are kept for tracking and reporting purposes.

Further detail regarding waste management at United Wambo is within the Environmental Management Strategy (EMS).

General Waste and Recycling

Waste generated at United Wambo is managed in accordance with the EMS. Paper, cardboard and scrap steel are all recycled. United Wambo currently has a total waste management system which includes training, segregation, disposal and reporting.

Sewage Treatment and Disposal

United Wambo currently have an Envirocycle system which services the main pit top facilities including the administration area, stores, and bathhouse. The sewage system is serviced on a regular basis by licensed contractors.

Hydrocarbon Management

In 2023, United Wambo continued to remove and manage unwanted materials produced by activities onsite. All maintenance areas and refuelling bays have appropriate spill response equipment placed in easy to access locations. Employees were, and continue to be, trained on how to maintain and utilise the spill response equipment.

6.7.1 Summary of Waste Performance in 2023

United Wambo track all waste across the mine site. In 2023, United Wambo disposed a total of 2,584,041 kg of waste from site. This is an increase of 9.3% from the 2022 total of 2,365,130kg. The increase is due to increased productivity including increase in maintenance of equipment during the period and the removal of redundant equipment. A detailed breakdown of waste disposal is contained within

Table 6-23.

Hazardous recycled waste increased by 15.3% in 2023, predominantly due to oil recycling. Non-hazardous recycled waste decreased by 5.3% in 2023, due to reduction in steel and concrete waste. Hazardous disposal increased significantly by 66.1% and this was due to an increase in oily rags and hydraulic hoses. Non-hazardous disposal increased by 28% in 2023, due to an increase in general waste.

United Wambo will continue to investigate measures to reduce the volume of waste produced across site. **Section 6.7.3.1** outlines improvements which United Wambo plan to implement in 2024.

Table 6-23 Waste Performance Comparison at United Wambo for past two years including variance (%)

Waste Source	2021	2022	2023	Variance (% between 2022 and 2023)
Hazardous Recycled (kg)				

Waste Source	2021	2022	2023	Variance (% between 2022 and 2023)
Lead batteries	10,911	14,985	14,990	0.03
Oil	703,432	893,420	1,094,828	22.54
Oily Water	23,498	49,649	25,969	-47.69
Oil Filters	31,582	34,566	37,677	9.0
Chemicals	0	7,510	0	100
Waste Coolant	41,000	25,032	22,700	-9.32
Contaminated Sludge	12,962	19,628	10,396	-47.03
Waste grease	3,460	7,584	7,640	0.74
Empty drums	10,550	9,760	10,482	7.40
E-waste	0	0	0	0
Total	837,395	1,062,134	1,224,682	15.30
Non-Hazardous Recycled				
Paper and cardboard	17,505	15,664	14,700	-6.15
Scrap Steel	286,780	396,270	335,570	-15.32
Timber	76,740	21,820	46,280	112.1
Confidential Documents	1,044	843	1,444	71.29
Effluent	1,276,400	573,870	578,700	0.84
Tyres	0	0	0	0
Concrete	0	5,300	0	-100
Drill Mud	0	17,500	0	-100
Total	1,658,469	1,031,267	976,694	-5.29
Hazardous Disposal (kg)				
Oily Rags	9,454	10,210	16,554	62.14
Chemicals	0	290	78	-73.10
Asbestos	0	0	0	0
Contaminated Soil	1,242	0	0	0
Medical and Sanitary	12	105	40	-61.90
Hydraulic Hoses	11,640	13,178	22,826	73.21
Total	22,348	23,783	39,498	66.08
Non-Hazardous Disposal				
Mixed solid waste	354,515	247,946	317,423	28.02
Total	354,515	247,946	317,423	28.02
Total Offsite Waste Disposed (kg)	376,863	271,729	356,921	31.35
Total Offsite Waste Recycling (kg)	2,495,864	2,093,401	2,227,120	6.39
Total Offsite Waste (kg)	2,872,727	2,365,130	2,584,041	9.26

Waste Source	2021	2022	2023	Variance (% between 2022 and 2023)
Total Offsite Waste Recycling as a Percentage (%)	86.88	88.43	85.99	-2.76

6.7.2 Management Measures

United Wambo undertook waste management in accordance with waste criteria under conditions B91 and B92 of SSD 742 during 2021.

Management measures included:

- weekly removal of general waste, including scrap by a licenced contractor
- weekly and monthly inspections are undertaken to monitor the implementation of the Waste Management Plan
- additional training of relevant personnel highlighting any waste management issues
- assessment and appropriate management of specific wastes such as contaminated wastes

The weekly and monthly inspections showing general site compliance indicates the current waste management measures applied at United Wambo are effective.

6.7.3 Improvements 2023

A plan for site waste management was developed in 2022, with removal currently being undertaken and will continue through operations including the implementation of further improvements such as additional waste bins for waste segregation and awareness training of operational staff in waste segregation requirements. Discussions were had between operations and third party contractor in regard to potential improvements in effluent waste and potential reuse opportunities of wooden pallets.

6.7.3.1 Proposed Improvements 2024

As United Wambo continues operations, the legacy waste associated with past operations will be identified and targeted for removal offsite. This project will focus on the removal of equipment tyres which have been placed in laydown areas across site, then all redundant equipment will be assessed for sale or removal. A plan for site waste management was developed in 2022, with removal currently being undertaken and will continue through 2024 including the implementation of further improvements such as additional waste bins for waste segregation.

United Wambo will continue to implement the current management measures to ensure effectiveness of the waste management system. This includes, but is not limited to:

- providing waste management training to site personnel
- reviewing site waste management and looking for options to reduce waste and increase recycling opportunities.

6.8 Visual and Lighting

6.8.1 Environmental Management

Control strategies are implemented to reduce potential visual and light related impacts associated with mining operations. Management is undertaken in accordance with the United Wambo Lighting Plant Procedure

Visual and lighting impacts are assessed through monitoring and inspection regimes. Onsite monitoring includes assessments of lighting impacts, compliance with development consent conditions and the angle at which light is emitted from lamps and luminaries, glare, spill and sky glow.

6.8.2 Environmental Performance

Potential lighting impacts are assessed as part of the overburden dump design process. Dumps are orientated, where practicable, and windrows or bunds are designed and constructed to mitigate lighting impacts.

A sensitive lighting receiver map is updated and communicated to mining personnel prior to commencing exposed dumps that have the potential to cause lighting impacts offsite.

6.8.3 Improvements 2023

During 2023, several improvements were undertaken:

Review of Operations Lighting Management Plans to improve site maps for exclusion areas for lighting with current dump structures.

A program was started for the replacement of lighting heads from white lights to amber lights to lower the lumens and lighting spill associated with lighting plants used at the higher dumps.

Installation of cameras offsite that capture a still image at time of lights being turned on to ensure the direction of the lighting plant is not obtrusive to the community.

United Wambo JV planted trees along the visual bund adjacent to the Golden Highway in the United Pit.

6.8.3.1 Proposed Improvements 2024

United Wambo JV propose to install GPS and directional tracking devices to mobile lighting plants if feasible to enable a more robust system of checking direction of lighting prior to the use of lighting plants.

7. Water Management

7.1 Surface Water

7.1.1 Environmental Management

United Wambo implements surface water monitoring in accordance with the *United Wambo Water Management Plan* and the *United Wambo Surface Water Management Plan*.

The purpose of surface water quality monitoring at United Wambo is to:

- monitor surface water quality and levels to detect potential impacts on surrounding catchment users
- satisfy performance criteria (*Section 7.1.3*)
- collect data which will be used in the continued development and refinement of surface water investigation triggers (*Section 10.2.2* of the *United Wambo Surface Water Management Plan*) and provide input to the site water balance and salt balance (
- *Table 6-23*)

The location of water monitoring sites is shown on *Figure 6-2*. The surface water monitoring program includes:

- monthly water quality monitoring including flow status (refer *Table 7-3*)
- annual speciation analysis
- annual water stability monitoring
- additional monitoring in accordance with the Investigation Protocol if performance deviated from background trends
- additional monitoring / investigations in accordance with the Trigger Action Response Plan if surface water results exceed criteria.

7.1.2 Management Measures

United Wambo implements surface water management measures in accordance with the *Surface Water Management Plan*. The management measures are summarised below.

- Surplus water will be discharged as required and in accordance with Wambo's EPL 529 and consistent with the provisions of the Hunter River Trading Scheme (HRSTS). Discharges will be monitored prior to release to ensure compliance with the requirements of the HRSTS and in accordance with EPL condition.
- Wastewater from onsite facilities, including sewage, is collected and treated on site by several aerated wastewater treatment plants, which are licensed by Singleton Council.
- Generic training on the aspects of the *Surface Water Management Plan* is provided to all employees and contractors through the Site Familiarisation process. Selected site personnel, whose duties directly involve the management of water at United Wambo, will undertake specific training regarding site Operational Procedures which incorporate water management measures.
- Storage dams and pits are sampled monthly. Data from this monitoring is used for operational purposes and is reported internally as required.
- The water levels in the former United Underground are monitored on a regular basis to maintain understanding of the volume of water stored within the workings.
- Validated data from the monitoring program is entered into the GCAA Environmental Monitoring Database (EMD).

Details of complaints relating to surface water will be provided to relevant mine planning and production personnel to assist in the improvement of management practices, where relevant. A summary of the complaints received by the community will be reported in this document.

7.1.3 Surface Water Criteria

The **United Wambo Surface Water Management Plan** sets out the surface water monitoring at United Wambo, which includes:

- Off-site locations to monitor potential impacts to downstream receivers; and
- On-site locations for informational purposes.

Surface water criteria exist for the four offsite locations however no criteria exist onsite locations. The impact assessment criteria for surface water quality are shown in **Table 7-1**.

Table 7-1 Surface Water Quality Criteria

Site ID	Site Description	pH		Electrical Conductivity	Total Suspended Solids	Total Dissolved Solids
		Lower	Upper			
WB04	Wollombi Brook – Downstream	6.5	8.5	2200	50 ¹	- ¹
NWC03	North Wambo Creek - Downstream	7.3	8.0	2350	15	1270
RC01	Redbank Creek - Downstream	7.9	8.3	8456	26	- ¹
WFC01	Waterfall Creek	7.3	7.9	435	582	646

Notes to Table:

- ¹ No historical data available for TDS for RC01 and no ANZECC criteria set for TDS. Therefore, no limits have been identified for RC01. A default of 50 mg/L TSS has been utilised for WB04 until the site-specific criteria is developed.

Annual speciation monitoring is also undertaken at United Wambo surface water monitoring locations in accordance with the *SWMP*. Site-specific surface water quality criteria have not been determined for metals and metalloids due to the limited data set available for the monitoring locations. Default 95% species protection ANZECC trigger values for slightly to moderately disturbed freshwater ecosystems Australia have been adopted as the impact assessment criteria. **Table 7-2** shows the results for the annual reporting period compared to the criteria. United Wambo propose to develop site specific criteria when a sufficient amount of data is available to inform site specific trends.

7.1.4 Annual Speciation Results

Annual surface water speciation results for 2023 are presented in **Table 7-2**. The annual sampling was scheduled on a calendar year (December) to capture seasonal consistency in the dataset. During sampling, only WB04 contained water and was sampled. All other sites were dry due to the ephemeral nature of the watercourses.

A pre-emptive event for annual speciation testing was carried out following a rain event on the 20th of December 2023 (total 44mm of rainfall). WFC01 was found to have sufficient water for sampling present. NWC03 and RC01 were still dry and will be sampled at the next opportunity.

There were no exceedances of ANZECC criteria for the 2023 annual speciation monitoring. Most metals and nutrients were at very low levels.

After reviewing monitoring trends for sample availability at the four sites, annual speciation monitoring will be brought forward to September to increase the likelihood of water available for sampling in the calendar year.

The last time NWC03 and RC01 had running water for sampling was October and November 2022, respectively.

Table 7-2 Annual Speciation Results

Site ID	ANZECC Criteria (ug/L)	WB04	NWC03	RC01	WFC01
Date sampled	-	14/12/2023	No sample available for testing ¹	No sample available for testing ¹	20/12/2023
Aluminium (Al)	55	0.05			10.2
Arsenic (As)	24	0.001			0.003
Cobalt (Co)	N/A	<0.001			0.004
Copper (Cu)	1.4	<0.001			0.009
Iron (Fe)	N/A	0.49			9.82
Manganese (Mn)	1900	0.348			0.148
Nickel (Ni)	11	<0.001			0.012
Selenium (Se)	11	<0.01			<0.01
Zinc(Zn)	8	<0.005			0.048
Mercury (Hg)	0.6	<0.0001			<0.0001
Lead (Pb)	3.4	<0.001			0.006
Potassium (K)	N/A	5.00			12.00
Silver (Ag)	0.05	0.001			0.001
Fluoride (Fl)	N/A	0.2			0.2
Boron (B)	370	<0.05			<0.05
Calcium (Ca)	N/A	17.00			5.00
Barium (Ba)	N/A	0.083			0.075
Magnesium (Mg)	N/A	25			3
Cadmium (Cd)	0.2	0.0001			0.0001
Sodium (Na)	N/A	146.00			9.00
Total phosphorous (P)	N/A	0.02			1.34
Nitrite	N/A	0.01			0.05
Nitrate	N/A	<0.01			1.32
Total Kjeldahl Nitrogen (TKN)	N/A	0.5			2.7
Total nitrogen (Total N)	N/A	0.5			4.1
Ions - Chloride (Cl)	N/A	233			10
Bicarbonate (CaCO3)	N/A	121			31
Sulphate (SO4)	N/A	17.0			2.0

Notes to Table:

¹ No sample available for testing due to ephemeral nature of creek at time of sampling. Sample will be taken at next opportunity when water available.

7.1.5 Key Environmental Performance

7.1.5.1 Surface Water Monitoring Results

Table 7-3 summarises the water monitoring results at United Wambo for the reporting period. **Table 7-4** summarises the water monitoring results compared to criteria in the United Wambo Surface Water Management Plan.

Table 7-3 Summary of surface water monitoring results for 2023

Sample site	Sample Description	2023 Count	Field pH			Lab EC			Lab TSS			Lab TDS		
			Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
WB01	Wollombi Brook - Upstream	13	7.20	7.48	7.70	613	748	806	5	7	13	373	403	462
WB02	Wollombi Brook - Pumps	12	7.30	7.83	8.09	637	1182	4180	7	9	11	333	659	2460
WB03	Wollombi Brook - Warkworth	13	7.09	7.69	7.88	628	819	1210	5	23	74	333	445	836
WB04*	Wollombi Brook - Downstream	12	7.03	7.71	8.02	654	812	1040	6	10	14	360	431	570
NWC01	North Wambo Creek - Upstream	0	D	D	D	D	D	D	D	D	D	D	D	D
NWC02	North Wambo Creek - Midstream	0	D	D	D	D	D	D	D	D	D	D	D	D
NWC03*	North Wambo Creek - Downstream	0	D	D	D	D	D	D	D	D	D	D	D	D
RC01*	Redbank Creek - Downstream	0	D	D	D	D	D	D	D	D	D	D	D	D
WFC01*	Waterfall Creek	19	6.36	6.94	7.52	133	135	137	253	917	1580	360	496	631
W02	Dam 2	12	8.98	9.11	9.22	565	4261	7090	6	47	360	484	2832	4720
W03	United UG Boxcut	12	3.88	8.47	9.03	1630	2572	3730	5	46	163	1010	1647	2410
W07	Dam 14	12	7.62	8.15	9.22	178	228	305	5	8	14	113	155	241
W09	CHPP Dams	12	8.50	8.75	9.00	5210	5770	6480	6	18	46	3530	3810	4340
W10	Process Water Dam	12	8.70	8.99	9.20	4840	5549	6730	32	58	168	3280	3330	3380
W11	Wambo MIA Box Cut Dam	12	8.11	8.45	8.92	746	977	1150	5	7	11	419	528	632
W12	Homestead Pit	12	8.64	8.78	8.96	3620	4549	4980	6	11	24	2920	3080	3230
W13	West Cut Dam	12	8.54	8.78	8.97	2210	5219	6500	6	19	51	1250	3557	4300
W14	Montrose Pit Inflows	11	8.15	8.49	8.89	3420	4504	6660	5	16	32	2260	2965	4140
W15	Dam 7	12	8.29	8.61	9.69	904	1290	2270	12	28	122	598	862	1750
W16	Dam 15	12	7.74	8.25	8.80	182	345	789	13	42	137	202	298	592
W17	Wombat Dam	0	-	-	-	-	-	-	-	-	-	-	-	-
W18	U2	12	8.92	9.06	9.18	3220	4758	6320	11	32	152	2470	3248	4250
W19	U3	12	8.98	9.05	9.12	2060	4691	6070	7	30	149	2910	3285	3900
W20	Montrose ME1 Sed Dam	8	7.94	7.94	7.94	1030	1030	1030	78	78	78	728	728	728
W21	Montrose ME2 Sed Dam	10	7.72	7.85	7.98	111	296	446	37	439	1140	486	503	519
W22	Drain 9	12	8.78	9.14	9.35	387	4664	6920	14	248	1190	606	3122	4470
W23	Plover Dam	9	8.26	8.69	9.11	190	1060	1930	57	539	1020	1010	1050	1090
W24	MIA Sediment Dam	12	8.22	8.96	9.51	340	1554	3020	26	126	571	456	1171	2150
W25	United Pit	12	8.17	8.43	8.97	4140	8914	14400	10	13	16	2400	5861	8490
W26	Turkeys Nest Dam	12	8.77	9.06	9.24	1660	3935	7270	9	41	150	895	2601	4800

Notes to table:

* sample site has trigger Surface Water Management Plan criteria

D sample site dry during all sampling rounds

Table 7-4 Surface water monitoring results compared to site criteria

Site	Date	Comment	pH Criteria		Field pH	Electrical Conductivity Criteria	Electrical Conductivity	Total Suspended Solids Criteria	Total Suspended Solids	Total Dissolved Solids Criteria	Total Dissolved Solids
			Low	High							
			-	-	-	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L
NWC03	30/01/2023	No flow pool	7.3	8.0	-	2350	-	15	-	1270	-
	23/02/2023	No flow pool			-		-		-		-
	28/03/2023	No flow pool			-		-		-		-
	28/04/2023	Dry			-		-		-		-
	31/05/2023	Dry			-		-		-		-
	28/06/2023	Dry			-		-		-		-
	27/07/2023	Dry			-		-		-		-
	30/08/2023	Dry			-		-		-		-
	26/09/2023	Dry			-		-		-		-
	31/10/2023	Dry			-		-		-		-
	30/11/2023	Dry			-		-		-		-
	21/12/2023	Dry			-		-		-		-
	28/12/2023	Dry			-		-		-		-
RC01	24/01/2023	Dry	7.9	8.3	-	8456	-	26	-	NC	-
	22/02/2023	Dry			-		-		-		-
	23/03/2023	Dry			-		-		-		-
	17/04/2023	Dry			-		-		-		-
	22/05/2023	Dry			-		-		-		-
	21/06/2023	Dry			-		-		-		-
	19/07/2023	Dry			-		-		-		-
	17/08/2023	Dry			-		-		-		-
	06/09/2023	Dry			-		-		-		-
	09/10/2023	Dry			-		-		-		-
	24/11/2023	Dry			-		-		-		-
	14/12/2023	Dry			-		-		-		-
WB04	24/01/2023	-	6.5	8.5	7.68	2200	786	50	<5	NC	436
	22/02/2023	-			7.03		696		14		360
	23/03/2023	-			7.46		654		<5		368
	17/04/2023	-			7.96		741		6		378
	22/05/2023	-			7.79		674		<5		382
	21/06/2023	-			7.75		679		<5		393
	19/07/2023	-			7.85		835		<5		421
	17/08/2023	-			7.87		852		<5		444
	06/09/2023	-			7.94		832		<5		418
	09/10/2023	-			7.75		953		<5		493
	24/11/2023	-			7.47		996		<5		512
	14/12/2023	Annual sampling round			8.02		1040		<5		570

Site	Date	Comment	pH Criteria		Field pH	Electrical Conductivity Criteria	Electrical Conductivity	Total Suspended Solids Criteria	Total Suspended Solids	Total Dissolved Solids Criteria	Total Dissolved Solids
			Low	High							
			-	-	-	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L
WFC01	24/01/2023	Dry	7.3	7.9	-	435	-	582	-	646	-
	30/01/2023	Dry			-		-		-		-
	22/02/2023	Low flow			7.52		137		1,580		631
	23/02/2023	Dry			-		-		-		-
	23/03/2023	Dry			-		-		-		-
	28/03/2023	No flow pool			-		-		-		-
	17/04/2023	Dry			-		-		-		-
	28/04/2023	Dry			-		-		-		-
	22/05/2023	Dry			-		-		-		-
	31/05/2023	Dry			-		-		-		-
	21/06/2023	Dry			-		-		-		-
	28/06/2023	Dry			-		-		-		-
	19/07/2023	Dry			-		-		-		-
	17/08/2023	Dry			-		-		-		-
	06/09/2023	Dry			-		-		-		-
	09/10/2023	Dry			-		-		-		-
	24/11/2023	Dry			-		-		-		-
	14/12/2023	Dry			-		-		-		-
	20/12/2023	Rainfall Event, very low flow, turbid, cow manure in creek			6.36		133		253		360

Notes to Table:

NC No criteria in United Wambo Surface Water Management Plan

Red bold text Exceedance of criteria

The long term annual average rainfall for Singleton is 744 mm. The total rainfall measured at the United Wambo meteorologic station during 2023 was 538 mm. During dry conditions, it is not unusual for the ephemeral creeks around the site vicinity to be dry. This was reflected in the number of samples taken during monthly off-site creek sampling at North Wambo Creek (NWC01, NWC02, NWC03), Redbank Creek (RC01) and Waterfall Creek (WFC01). Wollombi Brook is however a major tributary which sustained flow throughout the reporting period, with a minimum of 12 samples available at all locations (WB01, WB02, WB03 and WB04).

All other sites that did not reach a minimum of 12 samples during the reporting period were also affected by dry conditions, with the exception of:

- W17 Wombat Dam – monitoring point for rehabilitation runoff was affected by pumped water from Montrose Pit void (W14); therefore no additional meaningful data collected. Sampling to recommence when dam not used as staging dam for W14 water
- W22 Drain 9 – the dam was removed in October 2023

As outlined in *Section 7.1.3* above, four sites at United Wambo have surface water criteria: NWC03, RC01, WFC01 and WB04. Comparison of results against criteria are shown in *Table 7-4*. As per the SWMP, results exceeding the criteria for three consecutive monitoring rounds require detailed investigation to establish if the cause and whether the mine is causing adverse impacts.

During the reporting period, zero samples were taken at NWC03 and RC01 due to dry conditions. NW03 and RC01 have been dry since October 2022 and November 2022, respectively. WFC01 was also affected by dry conditions with only two samples taken in February and December 2023. WB04 was able to be sampled 12 times.

NWC03 and RC01 did not trigger any water quality criteria due to no samples taken.

Of the two samples taken at WFC01, the site did not trigger any exceedances of the criteria for pH, electrical conductivity or total dissolved solids. It did trigger a single exceedance for total suspended solids in February (1,580 mg/L) however results returned to within the normal range at the next sampling point in December. Although the single exceedance did not trigger detailed investigation as per the SWMP, preliminary investigation indicated the sample was likely affected by the surrounding land use and not mining related impacts. WFC01 is located to the north of the site within a paddock used for cattle agistment. It was investigated previously in 2022 for pH results lower than criteria (but still relatively neutral) and elevated total suspended solids caused by cattle activity and some localised natural erosion upstream.

WB04 did not trigger any exceedances of the criteria for pH, electrical conductivity, total dissolved solids or total suspended solids. All pH results were fairly neutral and was within the range 7.0 - 8.0, with an average of 7.7. Electrical conductivity was typical for Wollombi Brook, within the range 654 – 1040 $\mu\text{S}/\text{cm}$ and an average of 812 $\mu\text{S}/\text{cm}$. Most results for total suspended solids were below detectable range (5 mg/L), with two other results in the range of 6 – 14 mg/L which is rather low and clear. Total dissolved solids followed a similar trend with a range of 360 – 570 mg/L, with an average of 431 mg/L.

Based on surface water quality monitoring data and site observations during various routine inspections throughout the reporting period, there were no indications of off site impacts to surface waters at United Wambo caused by mining activities at the open cut.

7.1.5.2 Watercourse Stability Monitoring

Baseline watercourse stability monitoring was undertaken in 2021, with photo monitoring points were set up in Wollombi Brook, Redbank Creek and Waterfall Creek. Watercourse stability monitoring was undertaken in the reporting period to identify any changes in the upstream and downstream conditions of the creeks, with a focus on:

- stream and riparian vegetation cover
- bed condition
- active erosion points
- potential areas of instability determined by the creek line inspections

Photo monitoring was completed at all required sites during the reporting period. The summary of findings were:

- Banks were highly vegetated at all monitoring locations, except for W30 Redbank Creek upstream. The bank was stabilised with rock (from 2021 construction) and grass was growing through
- Wollombi Brook sites W27 (upstream), W28 (downstream 1) and W29 (downstream 2) lower water levels compared to previous years. Evidence of flooding in previous years was still apparent including debris and sandy deposits
- Redbank creek sites (W30, W31) and Waterfall Creek (W32, W33) were all dry at the time of inspection

7.1.6 Long Term Trends

United Wambo has long term data from several surface water monitoring locations since 2004, shown in **Table 7-5**. Water quality parameters monitored at surface water monitoring sites SW1 - SW5 over a long time period include pH, electrical conductivity (EC) and Total Suspended Solids (TSS).

Table 7-5 Current and Former Surface Water Monitoring Sites

Former Surface Water Monitoring Site	Current Surface Water Monitoring Site
SW1	WB01
SW3	WB02
SW4	WB03
SW2	NWC03
SW5	RC01

Results of long-term trends for water quality are shown in **Figure 7-1**, **Figure 7-2** and **Figure 7-3**.

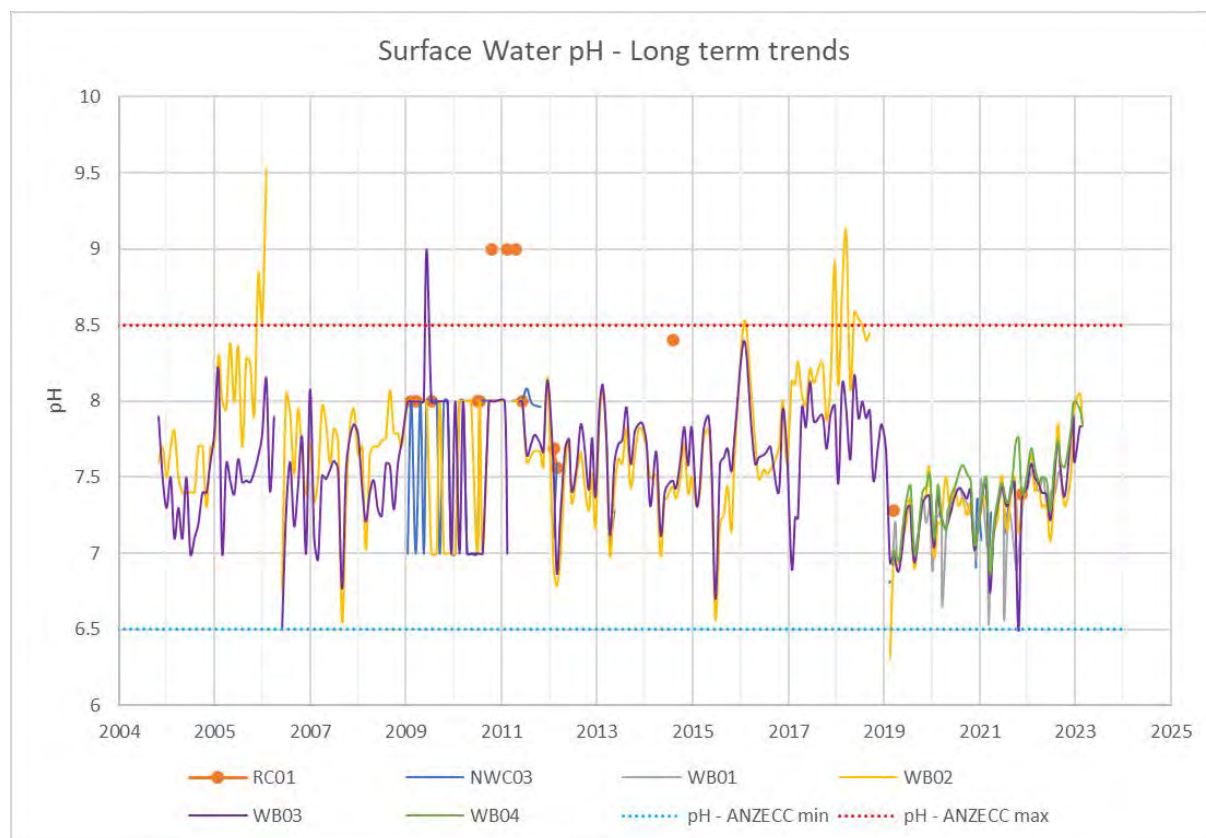


Figure 7-1 Long-term Surface Water Quality Trends for pH at United Wambo

Surface water monitoring results for pH remained within the typical long-term trends during the reporting period, as shown in **Figure 7-1**. Minimum and maximum surface water monitoring results for pH typically remain within the **ANZECC Guideline** criteria at all sites since monitoring began, except for some short-term spikes at:

- RC01 in 2010 and 2011
- WB02 in 2005, 2006, 2017, 2018 and 2019

Surface water monitoring results for pH remained within the typical long-term trends for the 2023 reporting period.

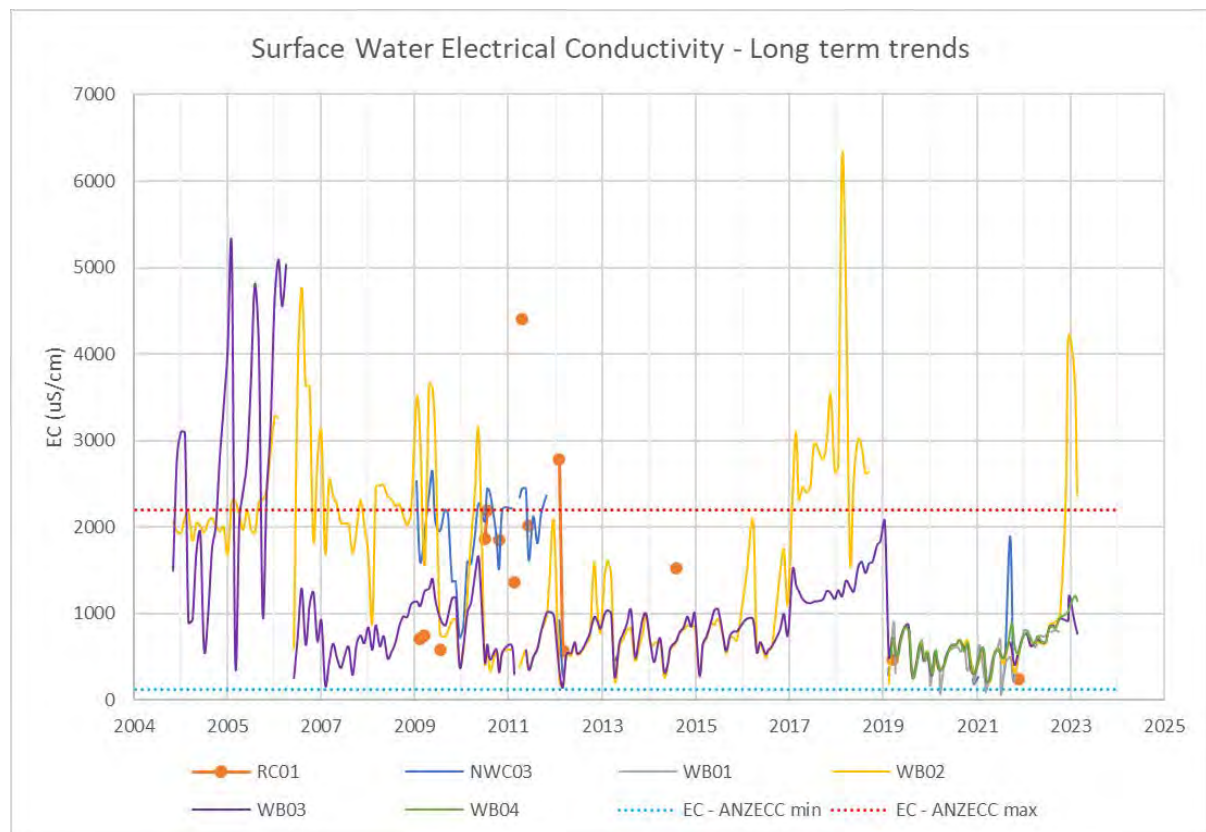


Figure 7-2 Long-term Surface Water Quality Trends for Electrical Conductivity at United Wambo

Figure 7-2 shows electrical conductivity (EC) has remained rather stable over the last 20 years and results at all sites are typically below the ANZECC maximum criteria of 2200 µS/cm, except for sites WB02 and WB03.

WB02 has seen periods of high EC for extended periods since 2004, with the most recent being the 2017 – 2019 drought period. In the early years of monitoring, WB03 experienced EC levels up to 4060 µS/cm from 2004-2006. Since those peaks, it has stabilised within the range of 148 – 2060 µS/cm. The EC at WB01 (upstream monitoring point) and WB04 (downstream monitoring point) have slowly increased since 2021. The EC at RC01 has been rather variable throughout monitoring years, however samples are infrequent due to the ephemeral nature of Redbank Creek. NWC03 was dry most of the time since 2012, with some samples available in the wetter 2020 – 2022 period.

The period 2020 – 2022 was a particularly wet period commensurate with La Niña climatic conditions. This is reflected in relatively low EC trends for all sites during that period due to the influx of fresh rainfall to the system, typically less than 1000 µS/cm.

Surface water monitoring results for electrical conductivity remained within the typical long-term trends for the 2023 reporting period.

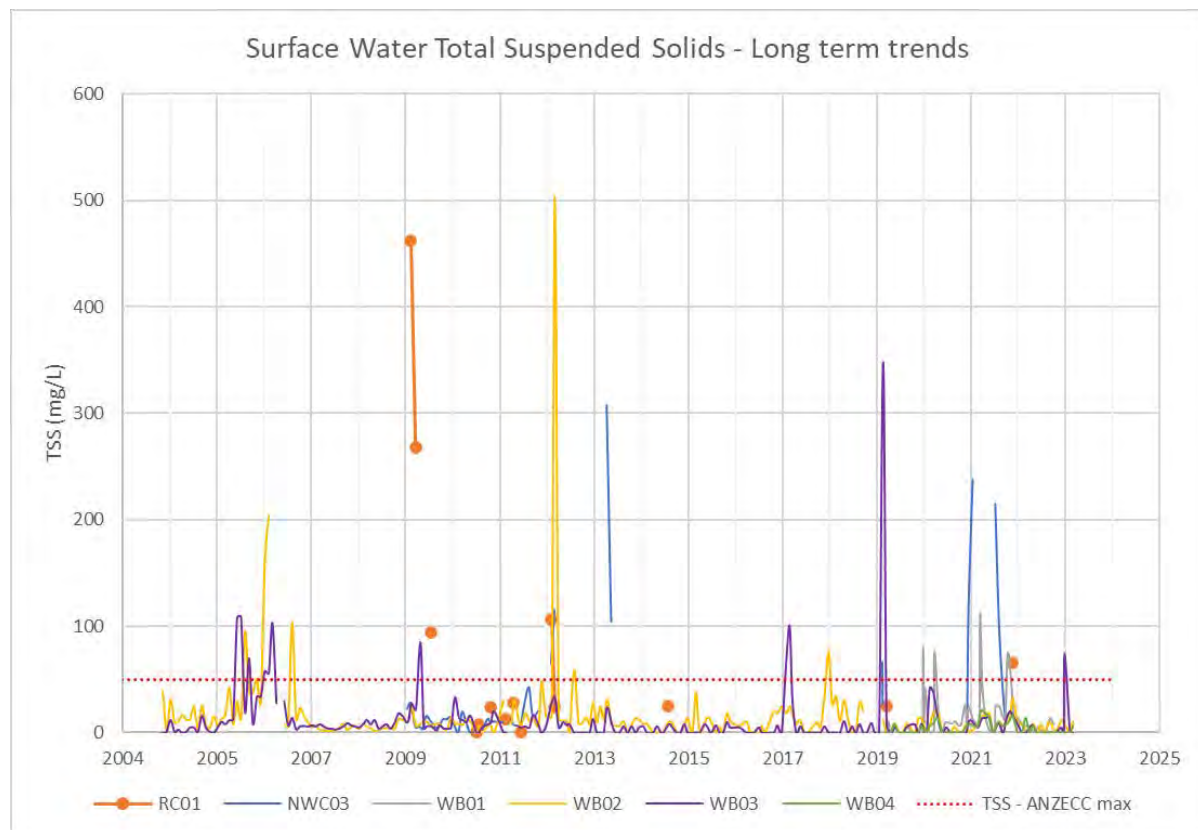


Figure 7-3 Long-term Surface Water Quality Trends for Total Suspended Solids at United Wambo

Figure 7-3 shows total suspended solids (TSS) at the long-term monitoring sites vary throughout the time period. It is not unusual for the TSS to spike above the ANZECC maximum criteria, before returning to lower levels. More recent peaks in the datasets correspond to flooding conditions across Hunter River catchments in 2021 - 2022. TSS levels are expected to remain typically low (less than 50 mg/L).

Surface water monitoring results for total suspended solids remained within the typical long-term trends during the 2023 reporting period.

7.1.7 Water Performance Measures

A comparison of United Wambo's compliance with the water performance measures in Condition B49 of SSD 7142 is provided in **Table 7-6**.

Table 7-6 Water Management Performance Measures

Feature	Performance Measure	Compliance Status	Comment
Water management – General	Maintain separation between clean, dirty and mine water Minimise the use of clean and potable water Maximise water recycling, reuse and sharing opportunities Minimise the use of make-up water from external sources	Compliant	United Wambo separates the clean, dirty and mine water in accordance with the Water Management Plan. An additional mine water transfer from Montrose Void to U2 was introduced in 2023 which changed the water quality at W17 from a dirty water dam to mine affected.

Feature	Performance Measure	Compliance Status	Comment
	Design, install, operate and maintain water management infrastructure in a proper and efficient manner		<p>The majority of United Wambo's water usage was for dust suppression, sourced from mine water dams U2 and U3.</p> <p>Raw water is only used for supply of fire suppression water at the mine infrastructure area (MIA) and wash bay use.</p> <p>Potable water for the site is supplied by a contractor from town supply.</p>
Alluvial aquifers (including Wollombi Brook alluvium)	<p>Negligible impacts to the alluvial aquifer beyond those predicted in the document/s listed in condition A2(c), including:</p> <p>negligible change in groundwater levels; and</p> <p>negligible impact to other groundwater users including,</p> <p>Maintain appropriate setbacks in accordance with the Aquifer Interference Policy (DPI, 2012)</p>		<p>Setbacks from alluvial aquifers are in accordance with the Aquifer Interference Policy (DPI, 2012).</p> <p>Review of groundwater monitoring results has identified a trend in elevated sulfate results in alluvial bores to the East of United Pit . This will be investigated further, as recommended in Appendix B.</p>
Erosion and sediment control works	<p>Design, install and maintain erosion and sediment controls in accordance with the guidance series Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004) and 2E Mines and Quarries (DECC, 2008)</p> <p>Design, install and maintain any infrastructure within 40 metres of watercourses in accordance with the guidance series for Controlled Activities on Waterfront Land (DPI Water, 2012)</p> <p>Design, install and maintain any creek crossings generally in accordance with the Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013) and Why Do Fish Need to Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries, 2003)</p>	Compliant	<p>All erosion and sediment control measures installed at United Wambo are compliant with the Blue Book and the United Wambo Erosion and Sediment Control Management Plan.</p> <p>No works have occurred within 40 metres of existing watercourses, except for the onsite Redbank Creek. The works within occurred with the catchment captured by United Pit therefore no adverse impacts to water quality were caused.</p> <p>No new creek crossings were installed in the reporting period.</p>
Clean water diversions and storage infrastructure	Design, install and maintain the clean water system to capture and convey the 100-year ARI flood event	Compliant	<p>No new clean water diversions, flood levees or water storages were installed in the reporting period.</p> <p>The Northern Clean Water Drain constructed in 2020 remains in place.</p>

Feature	Performance Measure	Compliance Status	Comment
	Maximise, as far as reasonable, the diversion of clean water around disturbed areas on the site, except where clean water is captured for use on the site		
Flood Levees	Design, install and maintain appropriate flood levees to protect mining areas from a 1,000-year ARI flood event and to ensure no adverse effect on roads or privately-owned land	Compliant	No new flood levees constructed in the reporting period. The Wollombi Brook flood levee (constructed to account for 1,000-year ARI flood event) remains in place.
Sediment dams	Design, install and maintain sediment dams in accordance with the guidance series Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004) and 2E Mines and Quarries (DECC, 2008) and the requirements under the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002	Compliant	No new sediment dams were constructed in the reporting period. Existing sediment dams have been maintained to comply with the Blue book and POEO Act requirements.
Above-ground mine water storages	Design, install and maintain mine water storage infrastructure to avoid unlicensed or uncontrolled discharge of mine water Designed to contain the 100-year ARI storm event and minimise permeability	Compliant	No new mine water storages were constructed in 2022. All mine water storages at United Wambo were constructed to capture the 100-year ARI. All mine water dams managed by United Wambo spill into the open cut pit rather than discharge offsite. A review of the current catchment area for U2 dam undertaken in 2023 showed that the dam design for the 100-year ARI capacity had assumed the clean water drain in the EIS was in place. Therefore, the current design capacity is lower than 100-year ARI criteria. The spill path and dam break footprint for U2 dam is fully contained within the United Pit footprint. The dam is being managed to minimise risk of overflow during high rainfall events until the clean water drain is constructed.
Tailings storages	Design and maintain tailings storage areas to encapsulate and prevent the release of tailings seepage/leachate	Compliant	Tailings management is undertaken by Wambo on behalf of the United Wambo JV.

Feature	Performance Measure	Compliance Status	Comment
			The United Tailings Dams 1 and 2 (TD1/2) were decommissioned and capping completed by overburden placement in 2023. United Wambo plan to remove TD2 from the Dam Safety NSW register.
Overburden emplacements	Design, install and maintain emplacements to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material Design, install and maintain out-of-pit emplacements to prevent and/or manage long term saline seepage	Compliant	Overburden emplacement areas at United Wambo are all designed and maintained to contain all run off and seepage within dams or open cut voids.
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standard	Compliant	Hydrocarbon storage areas are bunded in accordance with Australian Standards and are subject to regular inspection and management.
Creek diversion and restoration works	Diverted creek lines are hydraulically and geomorphologically stable Incorporate erosion control measures based on vegetation and engineering revetments Incorporate persistent/permanent pools for aquatic habitat Revegetate with suitable native species	Compliant	No creek diversion or restoration works were undertaken during the reporting period.
Aquatic, riparian and groundwater dependent ecosystems	Negligible environmental consequences beyond those predicted in the document/s listed in condition A2(c) Maintain or improve baseline channel stability Develop site-specific in-stream water quality objectives in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000) and Using the ANZECC Guidelines and Water Quality Objectives in NSW (DEC, 2006)	Compliant	Baseline GDE monitoring, channel stability and stygofauna monitoring were undertaken in 2020. Site-specific in-stream water quality objectives for GDEs have not yet been developed. United Wambo will complete this task when additional monitoring data available to capture appropriate and meaningful trigger values. Channel stability was not observed to have deteriorated since the baseline monitoring, outside of natural changes to the fluvial geomorphology. Stygofauna monitoring was not scheduled in 2023. The next 3-yearly monitoring round is scheduled for 2025.

7.1.8 Comparison of Performance Against Criteria

A detailed assessment of potential impacts to surface waters was undertaken for the EIS. The highest risks to downstream surface water quality, as documented in the EIS, included:

- discharge of mine water
- overflow or failure of sediment ponds (dirty water)
- spillage or overflow of tailings

There have been no instances of mine water discharge, sediment dam overflow or tailings spillage affecting downstream water quality in the reporting period.

7.1.9 Water Balance and Salt Balance

The United Wambo Complex water balance and salt balance were updated for the reporting period. The water and salt balance summaries showing annual average volumes of inputs and outputs is shown in **Table 7-7** and **Table 7-8**.

Table 7-7 United Wambo JV Water Balance for the reporting period

Water Balance	Volume (ML)
Water Sources	
Transfer from Wambo	805
Rainfall/Runoff	1,570
Open Cut Seepage	319
Total Water Inputs (I)	2,699
Water Usage	
Dust Suppression	1,093
Transfer to Wambo	923
Potable Water	6
Total Water Usage (U)	2,022
Water Loss	
Evaporation – Mine Water	354
Seepage	0
Total Losses (L)	354
Change in Storage	
Initial	5,454
Final	4,684
Change in Storage (S)	-770

Table 7-8 United Wambo JV Salt Balance for the reporting period

Site Salt Balance	Salt (t)
Inputs	
Runoff	2,738
Groundwater (ROM coal)	1,435

Site Salt Balance	Salt (t)
Groundwater (Seepage)	2,034
Transfer from Wambo	1,153
Total	7,360
Outputs	
Dust suppression	1,043
Transfer to Wambo	1,732
Groundwater (ROM coal)	3,278
Total	6,052
Balance	1,307

7.1.10 Discharge Summary

There were no discharges from United Wambo in 2023.

7.1.11 Salinity Trading Scheme Credit Use

United Wambo is part of the Hunter River Salinity Trading Scheme (HRSTS) however the site does not have any Salinity Trading Scheme Credits, and there is no licensed discharge point.

There are no licensed discharge points at United Wambo. Wambo Underground monitor water quality and volume for licensed discharges in accordance with the licensed discharge limits and requirements relevant to monitoring conditions of EPL 529 and the HRSTS. Results will be shared with United Wambo as required.

7.1.12 Improvements 2023

Review of the surface water monitoring triggers was undertaken during 2023, and will be proposed in updates of the **Surface Water Management Plan**.

7.2 Groundwater

Groundwater monitoring is conducted at United Wambo in accordance with the **Groundwater Management Plan** (GWMP, version 6) and the **United Wambo Open Cut and Wambo Water Monitoring Program (UWOCWWMP)** (Peabody, 2020).

The purpose of groundwater monitoring at United Wambo is to monitor groundwater quality and levels to detect potential impacts on surrounding groundwater users, consumptive or environmental, and assess the performance of the mine against the performance indicators to ensure that relevant legislative and policy requirements are met.

The United Wambo groundwater monitoring network defined in the GWMP is comprises of 24 bores (2 still proposed) and 16 vibrating wire piezometers (VWPs, 2 still proposed) with a total of 82 sensors installed at VWP arrays. A number of these bores and VWPs have been assessed and investigated for suitability for monitoring and triggers, with additional detail discussed in **Section 7.2.2** and the **United Wambo Annual Groundwater Review in Appendix B -**.

Groundwater monitoring has been undertaken bi-monthly for groundwater levels (reported as a groundwater elevation in metres above Australian Height Datum (mAHD) and basic water quality (pH and EC). United Wambo also undertake comprehensive annual groundwater quality monitoring of twelve analytes, including pH, EC, Total dissolved solids (TDS), Sodium, Potassium, Calcium, Magnesium, Chloride, Nitrate, Sulfate, Hardness, and Bicarbonate.

7.2.1 Management Measures

United Wambo implements groundwater management measures in accordance with the **Groundwater Management Plan**. A summary of management measures include:

- Design, install and maintain above-ground mine water storage infrastructure to avoid unlicensed or uncontrolled discharge of mine water to the offsite environment.
- Above-ground mine water storages designed to contain the 100-year ARI storm event and minimise permeability.
- Operate underground water storages in a manner that minimises impacts.
- New tailings storage areas will be designed and maintained to encapsulate and prevent the release of tailings seepage/leachate.
- Design, install and maintain new emplacements to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material.
- Design, install and maintain new out-of-pit emplacements to prevent and/or manage long term saline seepage.
- Chemical and hydrocarbon products is stored in bunded areas in accordance with the relevant Australian Standard.
- Maintain or improve baseline channel stability.
- Generic training on the aspects of the GWMP is provided to all employees and contractors through the GCAA Generic Surface Induction and the Site Familiarisation process.
- Regular workforce communication days and toolbox talks allow for discussion of the objectives and requirements of this and any other relevant Plans.
- Selected site personnel, whose duties directly involve the management of water at United Wambo, undertake specific training with respect to site Operational Procedures which incorporate water management measures.

7.2.2 Groundwater Monitoring Locations

The network has been established to ensure that a long-term monitoring capability exists, that monitors key groundwater units and with adequate spatial and vertical depth coverage across the site. **Table 7-9** outlines the groundwater monitoring program set out in the GWMP and additional Groundwater Dependent Ecosystem (GDE) monitoring, with information on bore and trigger suitability. The location of water monitoring sites is shown on **Figure 6-2**.

Table 7-9 Groundwater Monitoring Program

Bore ID	Bore type	Current status	Easting	Northing	Targeted unit	Monitoring program	Comment
GW02 ¹	MB	A	309109	6389680	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	-
GW08	MB	A	311793	6392266	North Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Original bore was open concrete well with unknown intersected geology , design not consistent with the minimum construction requirements for water bores. Bore replaced with GW08.2.
GW09	MB	A	311643	6392563	North Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Original bore was open concrete well with unknown intersected geology , design not consistent with the minimum construction requirements for water bores. Bore replaced with GW09.2.
GW11 ¹	MB	A	309228	6389699	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	-
GW12	MB	B	309841	6391056	Stony Creek Alluvium / Whybrow Interburden	SWL and WQ - 2m – full suite ⁶	Bore constructed within shallow/weathered Permian strata after the commencement of NWU mining. Length of baseline period not suitable for development of trigger. Bore removed from monitoring network. P315 to provide supplementary data for Stony Creek alluvium.
GW13	MB	A	313810	6388990	Wollombi Brook Alluvium	SWL and WQ - 2m – full suite ⁶	Bore screened within weathered to fresh Permian strata containing coal seams. Bore also shows impacts associated with the approaching Warkworth Open Cut and is distant (upstream) from current United Wambo mining activity.
GW14 ²	MB	B	312478	6391358	Regolith	SWL	-
GW15	MB	A	313164	6392807	Wollombi Brook (east) Alluvium	SWL and WQ - 2m – full suite ⁶	-
GW16	MB	A	306641	6396034	North Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Bores are located upstream of the North Wambo Creek Diversion and in close proximity to the approved open cut. There are no groundwater users located in the vicinity of North Wambo Creek upstream of the North Wambo Creek Diversion. Both GW16 and GW17 have also been constructed across both alluvium/ regolith and weathered Permian strata and are not representative of a single groundwater source. Therefore, a trigger level for these two bores is not considered warranted.
GW17	MB	A	306895	6396048	North Wambo Creek Alluvium	SWL* and WQ - 2m – full suite ⁶	-
GW21	MB	A	308647	6393378	Overburden	SWL and WQ - 2m – full suite ⁶	-
GW22	MB	A	311335	6389535	Overburden	SWL and WQ - 2m – full suite ⁶	Trigger levels removed from Permian bores. Still monitored for data collection purposes.
P12	MB	EX	313644	6394797	Wollombi Brook (east) Alluvium	SWL ³ and WQ - 2m – full suite ⁶	-
P15	MB	EX	313431	6394803	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	-
P16	MB	A	313480	6394655	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	-
P20	MB	A	313639	6394166	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	-
P106	MB	A	311518	6391084	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Bore obstructed and no longer providing meaningful data. Replacement bores GW37a,b installed and monitoring commenced December 2023.

Bore ID	Bore type	Current status	Easting	Northing	Targeted unit	Monitoring program	Comment
P109	MB	A	311215	6390768	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Bore screened across both alluvial and permian strata, inconsistent with Minimum Construction Requirements for Water Bores in Australia . Bore removed from monitoring program and replaced by GW37a,b in the Wambo GWMP.
P114	MB	A	311205	6391288	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Bore obstructed and no longer providing meaningful data.
P116	MB	A	311057	6391293	Wambo Creek Alluvium	SWL and WQ - 2m – full suite ⁶	Bores screened across both alluvial and Permian strata, inconsistent with Minimum Construction Requirements for Water Bores in Australia. Bores removed from monitoring network and replaced by P316a,b,c.
P202	MB	A	311859	6391330	Overburden	SWL and WQ - 2m – full suite ⁶	-
P206	MB	A	311772	6391293	Overburden	SWL and WQ - 2m – full suite ⁶	-
P301	MB	A	309311	6391425	Stoney Creek Alluvium/Overburden	SWL and WQ - 2m – full suite ⁶	-
P315	MB	A	309091	6391852	Stony Creek Alluvium/Regolith	SWL and WQ - 2m – full suite ⁶	-
P401 ^{2,3}	MB	B	313660	6395336	Overburden	SWL and WQ - 2m – full suite ⁶	Monitoring commenced June 2020. Full suite tested quarterly for GDE monitoring.
P402 ^{2,3}	MB	B	313660	6395336	Arrowfield Seam	SWL and WQ - 2m – full suite ⁶	Monitoring commenced June 2020. Full suite tested quarterly for GDE monitoring.
P404	MB	Prop	307023	6398634	Overburden	SWL and WQ - 2m – full suite ⁶	-
P405	MB	Prop	307025	6398634	Arrowfield Seam	SWL and WQ - 2m – full suite ⁶	-
P407	MB	Prop	312599	6392933	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	-
P408	MB	B	307282	6399576	Hunter River Alluvium	SWL and WQ - 2m – full suite ⁶	Monitoring commenced December 2021.
P12	MB	B	313645	6394789	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	Not currently in GWMP, full suite tested 6 monthly for GDE monitoring
P16	MB	B	313480	6394656	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	Not currently in GWMP, full suite tested 6 monthly for GDE monitoring
BH1	MB	B	313256	6394804	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶	Not currently in GWMP, full suite tested annually
P403	VWP	Prop	308565	6397958	Multiple seams	SWL	-
P406	VWP	Prop	307681	6398872	Overburden	SWL	-
P33	VWP	EX	313757	6394659	Multiple seams	SWL	Site flooded in June 2022.
P34_35m	VWP	EX	313757	6393961	Multiple seams	SWL	Site flooded in June 2022.
P35_16m	VWP	EX	313611	6395196	Multiple seams	SWL	-
UG134	VWP	EX	313782	6395767	Multiple seams	SWL	Decomissioned during construction of the United Wambo clean water drain in 2020.
UG135	VWP	EX	313831	6396748	Interburden	SWL	1 of 6 sensors has unavailable data.
UG139	VWP	EX	306665	6395173	Multiple seams	SWL	Area dewatered due to underground mining from mid-2021. Mined through in March 2023.
UG147	VWP	EX	311245	6397207	Multiple seams	SWL	1 of 6 sensors has unavailable data.
UG166A	VWP	EX	306488	6398076	Multiple seams	SWL	Data unavailable.
UG193	VWP	EX	313757	6396090	Multiple seams	SWL	1 of 6 sensors has unavailable data.
UG196	VWP	EX	312364	6397122	Multiple seams	SWL	Decomissioned during construction of the United Wambo project construction.
UG220	VWP	EX	312522	6397233	Multiple seams	SWL	-
UG224	VWP	EX	313860	6396243	Multiple seams	SWL	-
UG225	VWP	EX	313214	6397095	Multiple seams	SWL	-

Notes to table:

Notes to table:

VWP	Vibrating wire piezometer
MB	Monitoring bore
A	Bore currently monitored under existing GWMP, with individual trigger level for SWL, pH and EC
B	Bore currently monitored undre existing GWMP, individual trigger to be established once sufficient data has been collected
EX	Existing monitoring bore with baseline data available

Prop	Bore proposed to be installed and included in the monitoring network
2m	Monitoring frequency every two months, measuring water level, field pH and EC (as is currently in GWMP)
Full suite6	Conduct water quality testing annually for revised full water quality suite (see Section 7.1.2.3)
SWL	Static water level – VWP sensors record daily pressure (converted to SWL) – download results every six months
1	Private bores
2	Groundwater Dependent Ecosystem (GDE) monitoring bore
3	Water level also recorded with datalogger at this site

7.2.3 Groundwater Monitoring Findings

Groundwater monitoring for the reporting period is summarised in this section and results shown in *Table 7-10*. The data and text below are a summary of the findings presented in the *United Wambo Annual Groundwater Review* (Umwelt, 2024) undertaken by groundwater specialist. The report is contained in *Appendix B -*, including further information and graphical representations of the data below.

Table 7-10 Groundwater Monitoring Results

Bore ID	Targeted unit	Depth to Water (m)				pH				Electrical Conductivity (µS/cm)				Comment
		Obs	Min	Median	Max	Obs	Min	Median	Max	Obs	Min	Median	Max	
GW02	Wambo Creek Alluvium	2	4.4	5.3	6.2	2	6.8	6.85	6.9	2	426	432	438	Bore only sampled in August and October 2023 due to no access.
GW08.2	North Wambo Creek Alluvium	3	3.35	3.53	8.2	0	-	-	-	0	-	-	-	Only sampled February, July and October 2023 just for SWL.
GW09.2	North Wambo Creek Alluvium	6	4.52	5.51	6.11	5	6.8	6.9	7	5	2190	2260	2380	-
GW11	Wambo Creek Alluvium	2	4.62	5.33	6.04	2	6.8	6.85	6.9	2	434	434.5	435	Only 2 samples in August and October 2023 due to access issue.
GW13	Wollombi Brook Alluvium	3	6.34	6.42	6.57	3	7	7.1	7.1	3	8810	9350	10070	Only sampled June, August and October 2023.
GW15	Wollombi Brook (east) Alluvium	6	7.44	8.32	8.91	5	6.6	6.7	7	5	255	313	336	-
GW16	North Wambo Creek Alluvium	6	6.5	7.2	8.48	5	7	7.4	7.5	5	686	925	2010	-
GW17	North Wambo Creek Alluvium	6	8.83	10.91	11.53	5	7.2	7.3	7.4	5	3140	3640	4560	-
GW21	Overburden	-	-	-	-	-	-	-	-	-	-	-	-	Bore dry.
GW22	Overburden	-	33.72	33.8	33.93	5	8.3	8.3	8.5	5	7030	7130	7400	-
P106	Wambo Creek Alluvium	6	6.7	7.53	8.62	5	6.5	6.7	6.8	5	712	7678	8940	-
P109	Wambo Creek Alluvium	5	4.85	4.96	5.26	5	6.5	6.6	6.7	5	652	720	6596	Removed from monitoring program December 2023.
P114	Wambo Creek Alluvium	-	-	-	-	-	-	-	-	-	-	-	-	Not monitored.
P116	Wambo Creek Alluvium	-	-	-	-	-	-	-	-	-	-	-	-	Not monitored.
P12	Wollombi Brook (east) Alluvium	6	6.79	7.05	7.35	6	6.21	6.51	6.86	6	144.8	149.95	176.4	-
P16	Wollombi Brook (west) Alluvium	6	8.07	8.46	8.7	5	7.07	7.2	7.38	5	3710	5710	6160	-
P20	Wollombi Brook (west) Alluvium	6	7.59	7.84	8.03	5	7.36	7.54	7.72	5	983	1579	2261	-
P202	Overburden	6	7.2	7.44	7.69	5	7.2	7.3	7.3	5	3840	5930	6950	-
P206	Overburden	6	27.86	28.71	31.88	5	7.6	8	8.1	5	1099	1305	12360	-
P301	Stoney Creek Alluvium/Overburden	6	7.23	10.29	10.56	5	6.3	6.3	6.6	5	1150	1367	1698	-
P315	Stony Creek Alluvium/Regolith	6	6.38	6.79	7.3	5	6	6	6.2	5	1068	1471	1674	-
P401	Overburden	6	29.27	29.6	29.84	5	7.07	7.09	7.13	5	7440	7960	8440	-
P402	Arrowfield Seam	6	78.31	81.48	84.14	5	7.68	7.72	7.81	5	8250	8790	9350	-
P408	Hunter River Alluvium	6	10.56	11.08	11.37	5	7.14	7.19	7.2	5	6240	6890	7690	-

7.2.3.1 North Wambo Creek Alluvium

The North Wambo Creek alluvium is currently monitored by multiple groundwater bores at United Wambo.

Bores GW08.2 and GW09.2 were drilled in 2020 to replace bores GW08 and GW09, that were too shallow to intersect the saturated alluvium. The two bores are not currently included in the GWMP but are monitored by Wambo. The GWMP for United Wambo also includes two bores within the upper reach of North Wambo Creek, bores GW16 and GW17 that intersect alluvium and weathered Permian coal measures near Montrose Pit and the North Wambo Creek Diversion (NWCD). Bore GW16 intersects around 7 m of silty, clayey sand overlying extremely weathered sandstone, while GW17 is constructed within highly weathered sandstone overlying siltstone, with only 2 m of alluvium present at surface.

Within the North Wambo Creek alluvium, upstream of the NWCD, groundwater levels are 6.5 to 8.48 m below surface at GW16, and 8.8 to 11.6 m below surface at GW17 over 2023. Both bores recorded a gradual decline in groundwater levels over 2023, corresponding with a period of below average rainfall. The trends between the bores are similar, with slightly higher groundwater elevations at upgradient bore GW16. Over 2023 pH remained relatively stable, with a near-neutral pH of around 6.8 to 7.5 for all bores. Over 2023 EC increased in both bores in the first half of the year and declined at GW16 in August 2023. The change in EC appears to correspond with the decline in groundwater levels.

Bores GW08.2 and GW09.2 are located down-gradient of the NWCD, near the confluence of Wollombi Brook. Bore GW08.2 is shallow with screen down to around 3 m depth, and over 2023 the bore was recorded as dry. Bore GW09.2 is 7.4 m deep and recorded the presence of water in the alluvium between 4.52 m and 6.11 m and EC remained relatively stable to slightly declining over the reporting period.

7.2.3.2 Wambo Creek Alluvium

Groundwater monitoring points for the Wambo Creek alluvium include GW02 and GW11 constructed as wells within the upper reach adjacent to the Brosi Offset property. As well as bores P106, P109, P114 and P116 located in the lower reach above the NWU. Bores P114 and P116 are located further from the creek line, immediately south-east of South Wambo Dam. No data was available for P114 or P116 over the reporting period.

GW11 were only recorded in August and October due to access issues. EC at upgradient sites GW02 and GW11 were recorded around 426 $\mu\text{S}/\text{cm}$ to 438 $\mu\text{S}/\text{cm}$ over 2023.

Bore P109 recorded a slight decline in groundwater levels over 2023, corresponding with below average rainfall. In February and March, the EC in P109 spiked at 6,596 $\mu\text{S}/\text{cm}$, but by April 2023 concentrations were returned back to 652 $\mu\text{S}/\text{cm}$. A similar spike in EC was also recorded in April 2023 at bore P206 that targets the Permian coal measures. The cause for the short-term spikes in EC is unclear and further review of site activities in this area at the time and sampling methodology is required.

P106 targets the Wambo Creek alluvium and is located south of South Wambo Dam and above the inactive, historical multi-seam underground mine operations at Wambo. Groundwater elevations and trends at P106 are similar to bore P202, which is located downslope near Wollombi Brook. Both bores recorded a decline in groundwater levels since 2022, which corresponds with a rise in EC. This may reflect construction of the bores across alluvium and shallow Permian coal measures, with reduced contribution from alluvial groundwater and increased proportion of groundwater from the coal measures resulting in a higher EC. New bores (GW37a and GW37b) were installed in late 2023 and are

proposed by site as replacement bores for P106 and P202. These should be further considered as part of future updates to the GWMP.

7.2.3.3 Wollombi Brook Alluvium

The monitoring bores that are screened in the Wollombi Brook alluvium are GW13, GW15, P12, P20 and P301. Bore BH1 intersects the Tertiary alluvium and bores P15 and P16 intersect colluvial sediments between the mean area and mapped GDEs (refer Section 3.3). Bores GW13, GW14, GW15 and P12 are located in the eastern side of Wollombi Brook, whereas BH1, P15, P16 and P20 are located on the western side. Bore P301 is also located along the confluence of Wambo Creek and Wollombi Brook. It is understood that bore logs for GW13 indicate it may be constructed in Permian coal measures on the eastern side of Wollombi Brook. Further review of the purpose of the bore should be undertaken and applied to the GWMP.

Groundwater levels in the alluvium generally declined over the reporting period, corresponding with below average rainfall and reduced streamflow. Over 2023 pH ranged between 6.3 to 7.36. EC trends varied between bores, with GW13, P15 and P16 recording a rise in EC over 2022, with a slight decline in 2023. Bore GW13 is located upgradient of site and on the eastern bank of Wollombi Brook, so trends are unlikely to reflect impacts due to operations at United Wambo.

Bores P15 and P16 are located above the United Colliery underground, east of the Glen Munro Boxcut and south-east of Sediment Dam 3. Both bores recorded a general rise in groundwater levels in 2022, followed by a slight decline in groundwater levels over 2023. Bore P16 and P15 have historically had higher EC of around 10,000 $\mu\text{S}/\text{cm}$, similar to what is recorded in the coal measures at nearby bores P401 and P402. The groundwater within the underlying Permian coal measures is depressurised with mining, indicating the high salinity is unlikely to be due to upward seepage from the Permian coal measures. The groundwater level logger data in Figure 4-12 indicates a minor fluctuation in daily groundwater levels in early March 2023, which corresponds to a rise in Wollombi Brook river levels, indicating recharge from surface water to the surrounding alluvium at P12 and P16. Logger data was provided for BH1; however, the bore was noted as dry over the reporting period therefore the levels reflect dry conditions.

It is also noted that the logger elevations for P16 appear to correspond more closely to elevations at P15. The logger levels should be checked and field verified in future. As reported by Umwelt (2022 Annual Groundwater Review), elevated sulphate concentrations have been recorded at the bores over time. In 2023 the concentrations reduced slightly to 361 mg/L for P16 and 762 mg/L for P15. The water quality results may indicate influence of sediment in the bore or potential influence from mine affected water in the area. Further investigation will be undertaken.

7.2.3.4 Stony Creek Alluvium

Stony Creek flows in the south-easterly direction and is located to the south-west of United Wambo. The Stony Creek alluvium is monitored by bores GW12 and P315. GW12 was recorded dry from 2019 to 2021, and monitoring ceased in 2021 (United Wambo Open Cut and Wambo Water Monitoring Program) due to confirmation of screening in shallow/weathered Permian strata, but is still noted in the GWMP. It is recommended the GWMP be updated to align. Supplementary data was collected at bore P315 at bimonthly intervals throughout the year.

The water level at P315 show fluctuation in response to rainfall events. This may relate to the upslope location and flow gradient in the alluvium, but also potentially associated with subsidence impacts from NWU. The pH at P315 has been stable throughout 2023. The EC at P315 increased slightly over 2023, from 1,068 $\mu\text{S}/\text{cm}$ in February to 1,674 $\mu\text{S}/\text{cm}$ in October 2023.

7.2.3.5 Permian Coal Measures

As per the GWMP, the monitoring bores at United Wambo are measuring interburden/overburden units at Blakefield Seam and Whybrow Seam.

The Whybrow Seam interburden/overburden is currently monitored by GW22, P202, P206 and P401. Groundwater levels in the Arrowfield Seam at around 120 m depth are monitored in bore P402. The interburden/overburden in Blakefield Seam at United Wambo has previously been monitored at P1 and P11; however, these sites have since been mined out.

Bores P202 and P206 intersect the shallow Permian coal measures to the south of South Wambo Dam and above inactive multi-seam underground mine operates at Wambo. Over 2023 groundwater levels at P202 declined slightly, which appears to reflect climate and streamflow trends. Groundwater elevations at P202 are higher than upslope bore P206, which recorded a more rapid decline in groundwater levels and a sustained decline since 2021 despite above average rainfall in 2022. The decline in groundwater levels may reflect nearby site activities.

In contrast groundwater levels in the shallow overburden further south of site at GW22 gradually increased over 2023. This likely reflects recovery in the coal measures above the historical underground workings at Wambo.

Depressurisation in the Arrowfield Seam (P402) has occurred, and to a lesser extent within the overburden around 40 m below surface at P401. Bores P401 and P402 are located east of United Open Cut and reflect depressurisation with progression of mining in the area, consistent with predicted impacts. The pH ranged between 7.07 and 8.5 over the reporting period. EC is highest in P206 of around 12,360 $\mu\text{S}/\text{cm}$ recorded in April 2023, but levels rapidly declined back to 1,099 $\mu\text{S}/\text{cm}$ in June 2023. A similar spike in EC was recorded at Wambo Creek alluvium bores P106 and P109. The cause for the short-term spikes in EC is unclear and further review of site activities in this area at the time and sampling methodology is required.

7.2.4 Long Term Groundwater Trends

Long-term hydrographs and time-series data for each monitored bore is provided in **Appendix B - Annual Groundwater** Review.

7.2.5 Groundwater Monitoring Trigger Levels

Trigger levels specified in the **United Wambo Groundwater Monitoring Program** (GWMP) are based on statistical analysis of pre-mining baseline monitoring data. The trigger levels are used to initiate investigations into groundwater levels or quality at where there are unexpected changes potentially caused by mining impacts.

A response is triggered for groundwater levels when the depth to groundwater:

- increases above the 90th percentile; or
- decreases below the 10th percentile;
- occurs over three consecutive bi-monthly observations; and
- is not related to seasonal variability.

Triggers for water quality occur when electrical conductivity (EC) or pH:

- exceed the specified trigger level (90th percentile)
- occurs over three consecutive bimonthly observations (i.e. over a 6-month period).

A summary of trigger exceedances recorded for the site monitoring network during the reporting period are summarised in **Table 7-11**. Further discussion on causes and impacts is detailed in **Appendix B -**. As shown in Table 7-9, several bores and corresponding trigger levels have been reviewed for adequacy.

Table 7-11 Summary of groundwater monitoring trigger exceedances in 2023

Site	Target Unit	No. of Obs	Depth to Water (mbTOC)	pH	EC (µS/cm)	Comment
GW02	Upper South Wambo	2	1	-	-	-
GW13	Wollombi Brook Alluvium	4	3	2	3	Bore construction influence on results.
GW15	Wollombi Brook (east) Alluvium	6	6	3	-	-
GW16	North Wambo Creek Alluvium/regolith	5	-	1	1	Bore construction influence on results.
GW17	North Wambo Creek Alluvium/ regolith	5	-	5	-	Bore construction influence on results.
GW22	Overburden	6	6	3	6	Trigger levels proposed for removal.
P12	Wollombi Brook (east) Alluvium	6	-	6	-	-
P16	Wollombi Brook (west) Alluvium	5	1	-	-	-
P20	Wollombi Brook (west) Alluvium	5	-	1	-	-
P106	Wambo Creek Alluvium	6	-	5	5	-
P109	Wambo Creek Alluvium	5	-	2	-	Bore construction influence.
P202**	Overburden	5	4	-	-	Not an alluvial bore.
P206	Overburden	6	6	2	1	Not an alluvial bore.

Notes to table:

- Two consecutive readings
- Three or more consecutive readings over the reporting period

7.2.6 Stygofauna Monitoring

The project environmental assessment identified small, isolated populations of stygofauna in the shallow alluvial aquifers surrounding the project (Wollombi Brook and North Wambo Creek). The relative consistency of the stygofauna community composition indicated connectivity within the shallow alluvial aquifers and consistency in the environmental conditions of this subterranean ecosystem. The biodiversity of the stygofauna community across the alluvial aquifers was found to be high.

As per the **United Wambo Groundwater Management Plan**, stygofauna monitoring is required every three years in the alluvial aquifers within predicted drawdown areas. The last round of monitoring was completed in 2022 and the next round scheduled for 2025. Hence no monitoring of stygofauna was completed in 2023.

7.2.7 Reporting Against Groundwater Performance

Assessment of compliance against the **GWMP** Groundwater Performance Measures for the reporting period is shown in **Table 7-12**.

Table 7-12 Groundwater Performance Measures and response

Aspect	Performance Measures	Performance Indicator/Trigger	Response	Overall Compliance
Alluvial aquifers	Negligible change in groundwater level (compared to predicted impacts ¹)	90th percentile (and not related to seasonal variability) over three consecutive months	TARP – Groundwater Level	Groundwater level monitoring triggered a number of exceedance investigations that were assessed as per the TARP. Refer to Section 7.2.5
	Negligible change in groundwater quality	Groundwater quality concentrations outside of adopted trigger values for at least one parameter for more than three consecutive months	TARP – Groundwater Quality	Groundwater quality monitoring triggered a number of exceedance investigations that were assessed as per the TARP. Refer to Appendix B.
Bedrock aquifers	Negligible change in groundwater level (compared to predicted impacts ¹)	90th percentile (and not related to seasonal variability) over three consecutive months. No trigger adopted for monitoring sites within the project area.	TARP – Groundwater Level	Groundwater level monitoring triggered a number of exceedance investigations that were assessed as per the TARP. Refer to Appendix B.
	Negligible change in groundwater quality	pH of 6.5 to 8.5 EC < 17,500 µS/cm	TARP – Groundwater Quality	Groundwater quality monitoring triggered a number of exceedance investigations that were assessed as per the TARP. Refer to Appendix B.

Aspect	Performance Measures	Performance Indicator/Trigger	Response	Overall Compliance
Groundwater inflows to mining pits	Groundwater inflows to mining pits consistent with groundwater model predictions and all take is covered by relevant licences	Groundwater inflows to mining pits is >10% higher than predicted for three consecutive months, without logical reason (i.e. changes to mine plan or wetter than average climate conditions).	TARP – Groundwater Inflows	Groundwater inflows to mining pits consistent with modelled inflows, verified during a groundwater model minor review in 2023. Refer to <i>Section 7.3</i> .
Seepage/ leachate	Negligible seepage/leachate from water storages	Visual inspections of water storages (as per the United Wambo Erosion and Sediment Control Plan Checklists) show seepage zones, and reporting water balance indicates seepage is greater than negligible (i.e. >5% of inflows to water storage)	The water storage integrity will be reviewed by a specialist. Other actions as per Unforeseen Impacts Protocol (Section 9.10)	Seepage from water storages observed. Review of groundwater monitoring results has identified a trend in elevated sulfate results in alluvial bores to the East of United Pit . This will be investigated further, as recommended in <i>Appendix B</i> .
	All seepage/leachate from emplacement areas is captured in water management system	Visual inspections (as per the United Wambo's Erosion and Sediment Control Plan Checklists) indicate seepage areas and confirms location of drainage pathways outside of water management system	Seepage/leachate area to be investigated, including water quality, source of seepage. Works to be undertaken to determine any potential downstream impacts and to ensure seepage is ceased or diverted to water management system Other actions as Unforeseen Impacts Protocol (Section 9.10)	Nil seepage observed outside of mine water containment systems. Unforeseen Impacts Protocol not triggered during reporting period.

Aspect	Performance Measures	Performance Indicator/Trigger	Response	Overall Compliance
	Negligible impacts of seepage/leachate from backfilled voids on regional groundwater quality	No increasing trends in water quality parameters in monitoring bores down dip of backfilled voids. An increasing trend would be indicated by three consecutive water quality readings showing continual increases in analyte concentrations.	Other actions as per Unforeseen Impacts Protocol (Section 9.10)	Groundwater quality monitoring triggered a number of exceedance investigations that were assessed as per the TARP. Review of groundwater monitoring results has identified a trend in elevated sulfate results in alluvial bores to the East of United Pit. This will be investigated further, as recommended in Appendix B .
	Seepage/leachate impacts from final voids are consistent with predictions in relevant environmental impact statements for the two approved final voids (United and Wambo Open Cuts)	Measures to be developed as part of United Wambo Closure Plan (at least five years prior to completion mining)	TBA as part of United Wambo Closure Plan	Not applicable in the reporting period.

7.2.8 Recommendations and Further Investigations

Proposed recommendations based on the review groundwater monitoring results for the reporting period include:

- Finalise the **United Wambo Groundwater Management Plan** version 7 in consultation with the *Department of Planning, Housing and Infrastructure*, including changes to
 - revised water level and quality triggers
 - replacement bores
 - additional bores installed
 - outcome of the adjacent Wambo Longwall 24-26 approval (DA 305-7-2003 Modification 19)
- Installation of remaining groundwater piezometers:
 - GDE monitoring bore at Redbank Creek
 - P404 in overburden

- P405 in Arrowfield Seam
- P407 in Wollombi Brook (west) Alluvium
- Further investigation of sulphate levels at bores P15 is required (refer to **Appendix B**). Inspections and data analysed in 2023 indicates that there is no immediate seepage from nearby active mine water storages (Glen Munro void or U3 Dam).

7.3 Water Take and Licencing

Condition B40 of United Wambo's Development Consent (SSD 7142) requires water extracted from the site each year, both directly and indirectly, is reported in the Annual Review.

As described in the **United Wambo Water Management Plan**, water sharing occurs between United Wambo and Wambo Underground, as part of the "Wambo Complex Water Management System". This system facilitates sharing of licences for the complex.

Table 7-13 shows the predicted annual groundwater volumes required to be licensed for the Wambo Complex (Wambo Underground and United Wambo Open Cut). These values are from the groundwater model, updated to incorporate as-mined and proposed future UWOC mining.

Table 7-13 Groundwater Licencing Summary for United Wambo OC and Wambo UG

Water Sharing Plan	Management Zone/ Groundwater Source	Complex Licensed Entitlement (ML/ year)	Complex Predicted Annual Groundwater Inflow Requiring Licensing ⁴ (ML/year)	Complex Modelled Groundwater Inflow 2023
Hunter Unregulated and Alluvial Water Sources Water Sharing Plan 2009	Lower Wollombi Brook Water Source	736.9 ²	Av. 135 Max. 209	0 ⁵
	Jerrys Water Source	0	0	0
North Coast Fractured and Porous Rock Groundwater Sources ¹	Porous Rock	1,947 ³	Av. 714 Max. 1,110	670 (319ML OC + 350.8ML UG)

Notes to table:

- 1 Porous Rock is the Sydney Basin - North Coast Groundwater Source, as defined in the WSP for the North Coast Fractured and Porous Rock Groundwater Sources, released 1 July 2016.
- 2 Licence No. WAL23897, WAL18437, WAL18455, WAL18549.
- 3 Licence No. WAL42373, WAL41532, WAL41510.
- 4 Over the life of Wambo Complex Mining Operations
- 5 It is noted that predicted take from the Lower Wollombi Brook Water Source in the updated model does not exceed 70 ML (provided in WAL23897) until after 2028.

Table 7-14 outlines the water take across the complex (i.e. United Wambo Open Cut and Wambo Underground) against all relevant licences, in accordance with the requirement of the Annual Review Guideline (DPE 2015).

Table 7-14 Water Take Against Water Licences for United OC and Wambo UG

Licence Number ¹	WAL Reference Number	Description	Nominated Water Supply Work Approval	Works Approval Expiry Date	Purpose	License Holder	Entitlement (Units)	Passive Take / Inflows (ML)	Active Take / Pumping (ML)	Total
Hunter Regulated River Water Source										
WAL 718	20AL200631	Hunter River Pump	20WA200632	30/06/2027	E Industrial	Wambo Coal Pty Ltd	1000	0	373 ⁴	373 ⁴
WAL 8599	20AL201457	Hunter River Pump	20CA201459	25/09/2028	I Irrigation K Farming	Wambo Coal Pty Ltd	6	0	0	0
WAL 8600	20AL201458	Hunter River Pump	20CA201459	25/09/2028		Wambo Coal Pty Ltd	868	0	0	0
WAL 8604	20AL203044	TBC (extraction via Hunter River Pump)	-	-		Wambo Coal Pty Ltd	240	0	0	0
WAL 10541	20AL200927	Hunter River Pump	20WA200928	30/06/2027	Industrial	Mahe Anthony John & Kelly Grahame Patrick	300	0	0	0
Hunter Unregulated and Alluvial Water Sources (Lower Wollombi Brook Water Source)										
WAL 23897	20AL211371	Well No. 2	20WA211372	31/07/2032	Industrial	Wambo Coal Pty Ltd	70	0 ³	0	0
WAL 18437	20AL208641	Wollombi Brook Pump	20WA208642	31/07/2032	E Industrial	Wambo Coal Pty Ltd	366.9	0	0	0
WAL 18445	20AL208713	Bywash Dam	20WA208714	13/03/2023	Industrial	Mahe Anthony John & Kelly Grahame Patrick	200	0	0	0
WAL 18549	20AL208705	Other Pump	20WA208706	18/11/2032	Industrial	Mahe Anthony John & Kelly Grahame Patrick	100	0	0	0
North Coast Fractured and Porous Rock Groundwater Sources (Sydney Basin - North Coast Groundwater Source)										
WAL 42373²	20AL219997	-	20MW065010	-	H Mining	Wambo Coal Pty Ltd	1549	670 ³	0	670
WAL 41532	20AL218994	Dewatering	20MW065010	-	H Mining	Wambo Coal Pty Ltd	98	0	0	0
WAL 41510	20AL217075	Dewatering	20MW065011	-	H Mining	United Collieries Pty Ltd	300	0	0	0

Notes to table:

- All water licences (WALs) are in perpetuity, i.e. no expiry date.
- WAL 42373 was issued in 2019 to consolidate six of WCPL's previous WALs under the North Coast Fractured and Porous Rock groundwater Sources (Sydney Basin – North Coast Groundwater Source) including WAL 39735, WAL 39738, WAL 39803, WAL 41494, WAL 41528 and WAL 41520.
- Value derived from the Wambo Complex Numerical Groundwater Model (SLR 2022), Complex modelled groundwater inflow for 2023
- Extraction at Hunter River pump against WAL 718 for the Financial Year 2022/2023

7.3.1 Improvements 2023

Review and updates to internal documentation and site water management infrastructure was undertaken.

7.3.1.1 Proposed Improvements 2024

The Water Accounting Framework (WAF) methodology and modelling will be reviewed and updated using data collected at the site for the past three years, this will improve the accuracy of the water and salt balance for the site.

8. Rehabilitation

8.1 Summary of Rehabilitation During Reporting Period

A total of 38.5 hectares of rehabilitation was undertaken during 2023 at United Wambo. The rehabilitation target from the 2023 Forward Program was 36.2 hectares. The rehabilitation was completed at locations:

- Western United dump – 25.9ha
- Hunter Pit dump - 12.6ha

The areas completed were mostly the same as those proposed in the 2023 Annual Review and Forward Work Program submitted to the Resources Regulator. The only difference was an area of rehabilitation proposed at Montrose was not completed and the Western United rehabilitation area was expanded. Both areas were completed in December 2023 and seeded with a seed mix targeted at HU905 / PCT 1604 – Central Hunter Ironbark – Grey Box Woodland. The rehabilitation areas are shown in **Figure 8-1**.

New surface disturbance for 2023 totalled 31.9 hectares and was located mostly in the Montrose Ridge and United Pit mining areas.

Rehabilitation disturbance for 2023 totalled 65.9 hectares and was located predominantly on the Western United Dump and Homestead Dump areas for overburden dump progression.

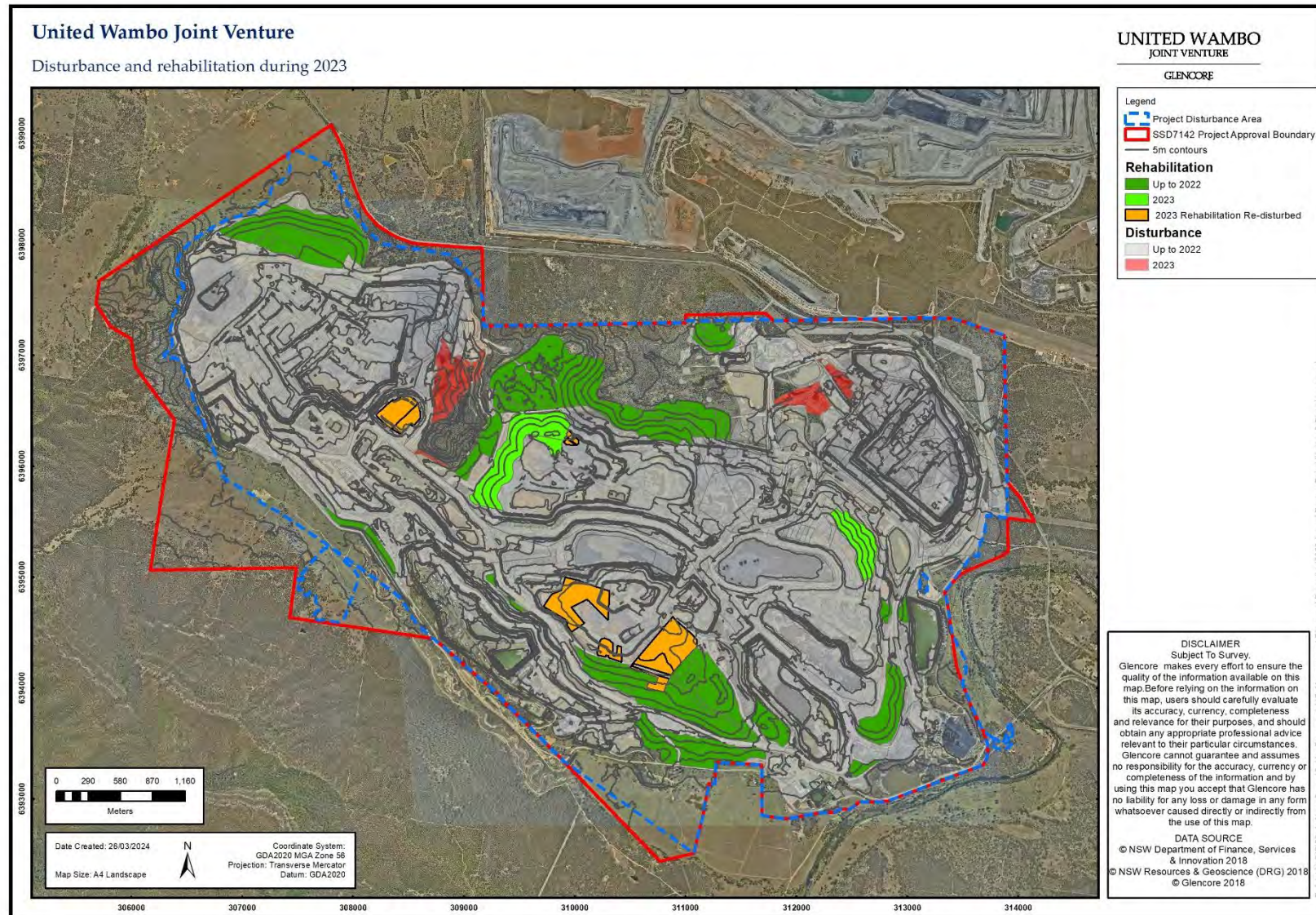


Figure 8-1 Disturbance and Rehabilitation at United Wambo During the Reporting Period

8.2 Rehabilitation Status

No rehabilitation at United Wambo has received sign-off from the Resources Regulator for having successfully met the rehabilitation objectives and completion criteria. A summary of rehabilitation is outlined in **Table 8-1**.

Table 8-1 Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 2022 (ha)	Year 2023 (ha)	Year 2024 (ha)
A. Total Mine Footprint / Surface Disturbance Footprint	2131.3	2163.2	2382.29
B. Total Active Disturbance	1806.2	1865.5	2023.33
C. Land Being Prepared for Rehabilitation	0	0	0
D. Land Under Active Rehabilitation	325.1	297.7	356.76
E. Completed Rehabilitation	0	0	0
Other Areas	0	0	0

Notes to table:

<i>Total mine footprint</i>	<i>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 DRE MOP/RMP Guidelines). Please note that subsidence remediation areas are excluded.</i>
<i>Total active disturbance</i>	<i>Includes all areas ultimately requiring rehabilitation such as: on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), and tailings dams (active/unshaped/uncapped).</i>
<i>Land being prepared for rehabilitation</i>	<i>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).</i>
<i>Land under active rehabilitation</i>	<i>Includes areas under rehabilitation and being managed to achieve relinquishment – includes the following rehabilitation phases as described in the DRE MOP/RMP Guidelines – “ecosystem and land use establishment” (area seeded OR surface developed in accordance with final land use) and “ecosystem and land use sustainability” (revegetation assessed as showing signs of trending towards relinquishment OR infrastructure development).</i>
<i>Completed rehabilitation</i>	<i>Requires formal sign-off by DRE that the area has successfully met the rehabilitation land use objectives and completion criteria.</i>

8.3 Rehabilitation Monitoring Summary

United Wambo has implemented a two-stage rehabilitation monitoring program which includes:

1. Long term ecological monitoring program

This program splits rehabilitation areas into Initial Establishment Monitoring (IEM) sites that are less than three years old, and Long-Term Monitoring (LTM) sites that are older than three years. The IEM methodology is a rapid style assessment principally to determine germination success and landform stability. The LTM methodology include more detailed assessments of rehabilitation performance and are targeted towards evaluating progress of rehabilitation towards fulfilling completion criteria and, ultimately, the targeted post-mining land use.

2. Annual Rehabilitation Walkover

This inspection provides a general assessment on rehabilitation health and potential emerging issues that require maintenance (e.g. weeds, erosion, poor growth rates). The walkover inspection does not review rehabilitation areas against the closure criteria, but provides management recommendations to assist the rehabilitation in moving towards the criteria.

8.3.1 Annual Rehabilitation Monitoring Results

During 2023, 13 rehabilitation sites and two reference sites were monitored as part of the long-term ecological monitoring program. Four rehabilitation blocks were inspected as part of the walkover assessment.

8.3.1.1 Native Open Woodland Rehabilitation

Two blocks of (non-specific) native open woodland rehabilitation at the IEM stage were assessed, one being at Year 1 post establishment and the other at Year 2. The Year 1 block showed limited ground cover vegetation establishment at the time of monitoring and as a result was affected by active but superficial slope erosion processes (i.e. not warranting repairs and expected to self-stabilise with further vegetation establishment). Total native species richness was moderate (average ~22.0 species/site) and included good diversities of shrubs and ground covers, however tree germination and establishment remained very limited at the time (but still expected to occur). Weed levels were generally very low except for one section of slope showing early establishment of *Galenia*.

The Year 2 block showed very high vegetative ground cover and excellent landform stability (also promoted by its gentle to flat topography). However, total native species richness was very low (average ~7.7 species/site), and shrub and tree establishment had generally failed two years post-seeded. Weed population levels remained within allowable levels (~9.5% cover) however the presence of exotic invasive grasses was flagged as a potential threat to future rehabilitation success if not tended to.

One LTM block of (non-specific) native open woodland rehabilitation was monitored, where the rehabilitation was well-established and maturing. The block showed excellent slope / landform stability and no active erosion processes. Ground cover protection was very high and generally dominated by native grasses. Total native species richness was moderately high (average ~29.3 species/site) and entirely comprised of local species characteristic of regional communities. Tree stem densities were generally insufficient across the block and often largely dominated by *Acacia salicina*, with a lack of more desirable canopy eucalypt species that will need to be addressed. Weed levels remained generally low but several woody weeds occurred which represent a long-term risk and for

which management has been recommended, including Sugar Gum, Golden Wreath Wattle and Common Olive.

8.3.1.2 Ecological Rehabilitation

One LTM block of ecological rehabilitation was monitored and displayed well-established and maturing vegetation, but very high levels of variability in vegetation types and condition within its boundaries. Total native species richness was on average moderate (~25.8 species/site) and well below richness levels recorded at the corresponding reference sites, which was mainly due insufficient levels of diversity in the ground layer. Irrespective of richness levels, native assemblages in all vegetation layers were however dominated by species characteristic of the targeted GBIW. Weed population levels were problematic (>20% average cover) and significant inputs will be required to manage Sugar Gum and exotic invasive grasses. Tree densities were extremely variable and ranged from insufficient to excessive.

A summary of progress against the rehabilitation criteria is shown in **Table 8-2**.

Table 8-2 Progress Against Completion Criteria (LTM Blocks)

Objective	Completion criteria	Monitoring blocks	
		UWJ-NSNV-140	UWJ-NSNV-4
Rehabilitation areas contain flora species assemblages characteristic of each growth form for the target native vegetation communities.	≥50% of established tree species are characteristic of target communities	Compliant (acceptable)	Compliant (acceptable)
	≥50% of established shrub species are characteristic of target communities	Compliant (acceptable)	Compliant (acceptable)
	≥50% of established grass species are characteristic of target communities	Compliant (acceptable)	Compliant (acceptable)
	≥50% of established 'other' species are characteristic of target communities	Compliant (acceptable)	Compliant (acceptable)
Adequate tree/shrub establishment and survival	Minimum total tree/shrub densities for seeded areas to be 400 stems/ha ¹	Not compliant (maintenance)	N/A ¹
The vegetation structure of the rehabilitation is recognisable as, or trending towards the target PCT.	Overstorey FPC within OEH benchmarks or reference sites range.	N/A ¹	Compliant (Acceptable)
	Mid-storey FPC within OEH benchmarks or reference sites range.	N/A ¹	Compliant (Acceptable)
	Ground storey FPC within OEH benchmarks or reference sites range.	N/A ¹	Compliant (Monitor)
	Exotic plant cover within reference sites range.	N/A ¹	Not compliant (Maintenance)
The rehabilitation is self-sustainable	Evidence of flowering and seeds or second-generation juveniles for trees and shrubs or likely to be.	Compliant (acceptable)	N/A ¹
Habitat features incorporated	Habitat features (e.g. logs, rocks and nest boxes), are incorporated into rehabilitation areas at required densities	Compliant (acceptable)	N/A ¹
	Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.).	Compliant (acceptable)	N/A ¹

Objective	Completion criteria	Monitoring blocks	
		UWJ-NSNV-140	UWJ-NSNV-4
Levels of ecosystem function have been established that demotrate the rehabilitation is self-sustainable; OR is trending towards the target PCT.	Litter cover within OEH benchmarks or reference sites range.	N/A ¹	Compliant (acceptable)
	Trees and shrubs: evidence of flowering and seeds or second-generation juveniles.	N/A ¹	Compliant (acceptable)
	At least one individual less than 5cm DBH present per BAM plot.	N/A ¹	Compliant (acceptable)
	Ground layer growth forms: demonstrated persistence over time.	N/A ¹	Trending (monitor)
	Demonstrated decline in high threat weed cover over time.	N/A ¹	Not compliant (Maintenance)
	Cover of high threat weeds within reference sites range.	N/A ¹	Not compliant (Maintenance)
	Ground layer growth forms: demonstrated persistence over time.	N/A ¹	Trending (monitor)
	Demonstrated decline in high threat weed cover over time.	N/A ¹	Not compliant (Maintenance)
	Cover of high threat weeds within reference sites range.	N/A ¹	Not compliant (Maintenance)
	Animal habitat potential is characteristic of target plant community.	N/A ¹	Trending (monitor)

Notes to table:

1 Criteria are not applicable as the criteria do not match the final land use type (Open Woodland or Ecological Rehabilitation) for that particular rehabilitation block

Number: 2023 Annual Review
Owner: Environment & Community Manager

Status: Approved
Version: 1

Effective: 31/03/2024
Review: 01/01/2025

8.3.2 Rehabilitation Trials and Research

No rehabilitation trials or research were completed in 2023.

8.3.3 Actions for Next Reporting Period – Rehabilitation

The United Wambo Forward Program submitted to the Resources Regulator for 2024 includes:

- 59 hectares of rehabilitation comprising of overburden emplacement areas in the south-east of the site
- 5.9 hectares of new disturbance
- 2.7 hectares of previously rehabilitated areas will be re-disturbed for the development of overburden emplacement areas

Rehabilitation and disturbance for 2023 is shown **Table 8-3**.

The Annual Review Guideline (DPE 2015) requires an outline of the rehabilitation actions proposed during the next reporting period. These actions are detailed in **Table 8-3**.

Table 8-3 Actions for the Next Reporting Period

Action	Site Comment
Undertake 59 hectares of rehabilitation	Forward Work Program
Implement United Wambo rehabilitation maintenance schedule for 2023	<p>Recommended actions from rehabilitation monitoring have been included in a schedule to be implemented over the next three years, with higher risk actions being implemented in 2024.</p> <p>Works planned for 2024 include re-seeding of some legacy rehabilitation areas, ongoing weed control and topsoil stockpile management.</p>

9. Community

9.1 Community Engagement Activities

The following community engagements were undertaken in 2023. During these engagements feedback is received either verbally or formally through surveys which is used to evaluate United Wambo's social performance.

- Voluntary Planning Agreement (VPA) committee was established with Singleton Council and community members. Meetings were held 16 February, 18 May, 14 September and 16 November 2024.
- United Wambo operates a Community Consultative Committee (CCC) in accordance with Schedule 2, Condition A19 of the United Wambo SSD 7142. During 2023, United Wambo provided information to the community through the United Wambo CCC to provide updates on the operation. The United Wambo CCC will also be provided the completed 2023 Annual Review. CCC meetings were held 31 January, 9 May, 25 July and 14 November 2023.

- Community newsletters were distributed 14 July and 29 November 2023.
- Community Information Nights were held 1 June and 29 November 2023. Community Information Nights were well received.
- Tank cleaning and inspection program for residents.
- Air conditioning maintenance program for residents.

Various consultation meetings with nearby residents regarding mitigation works at their properties, exploration, structural assessment, locations of noise monitors.

9.2 Community Contributions

The following community contributions were made by United Wambo in 2023.

Organisation	Purpose
Parkrun Singleton	Update signage and track maintenance
Singleton Family Support	Reclaim My Place Art Therapy Program
Dyson Family Foundation	Backpack Pals
Singleton Neighbourhood Centre	Mental Health First Aid Course
Jerrys Plains Hall	Replacement of Hall Curtains
Singleton Mens Shed	Air Conditioning unit for community meeting room
Inscope Media	Singleton Dairy Co-op and Factory History Book
Singleton Neighbourhood Centre	Christmas Luncheon
Hunter Anzac Memorial Limited	Veteran and serving Defence Family morning teas
Mitchells Flat Hall	Mental Health First Aid
Cerebral Palsy Alliance	Telehealth Workstation
Jerrys Plains P&C	Transport for Life Skills Program
Branxton Girl Guides	Technology Upgrades
Parkrun Singleton	Update signage and track maintenance
Singleton Family Support	Reclaim My Place Art Therapy Program
Dyson Family Foundation	Backpack Pals

9.3 Complaints

Seven complaints were received during the reporting period. The decrease in complaints has been attributed to changes in landownership in Jerrys Plains, and reinforcement of our obligations to not impact the community, which are driven by our social licence to operate. The largest complaint category for 2023 was lighting, with a total of six. Over the course of the year, United Wambo have

actively been adding steps to prevent lighting impacts. The change to amber lighting on site is in the final stages of implementation. A detailed summary of the United Wambo complaints for 2023 can be found in **Appendix D - Summary of Complaints**.

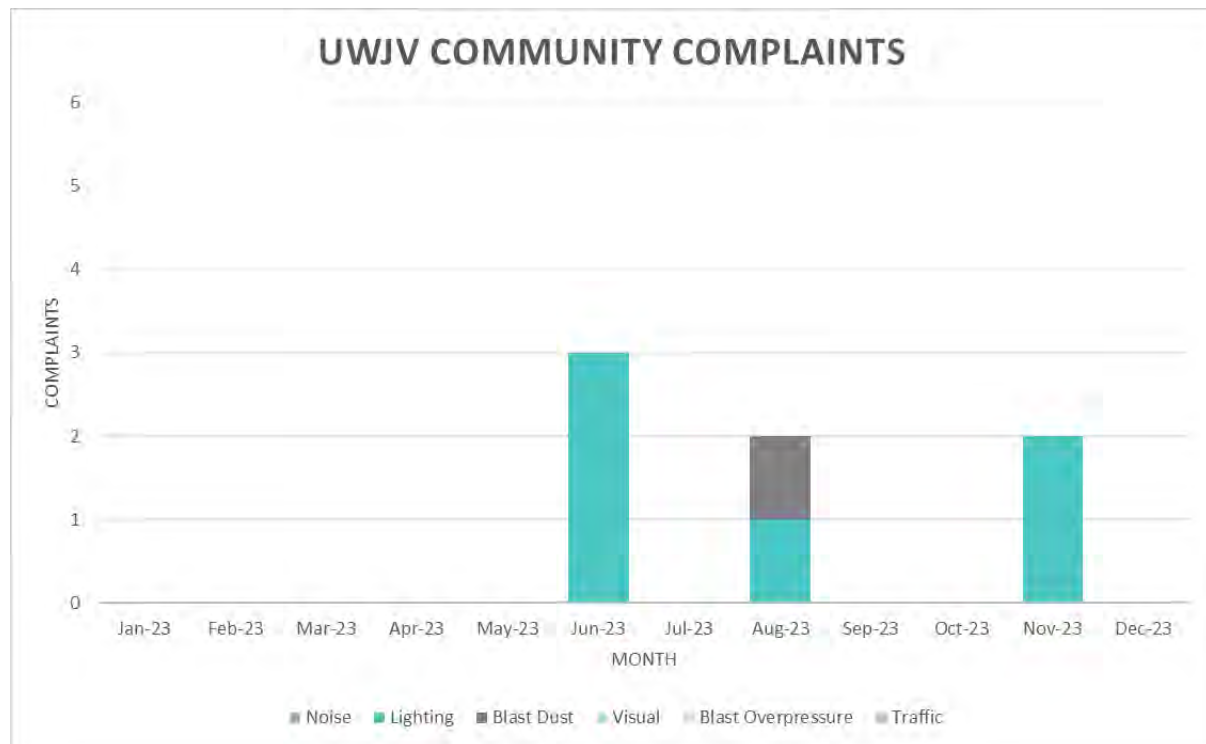


Figure 9-1 Chart of Community Complaints

All complaints were addressed with the appropriate actions including modifying operations where required.

United Wambo received 16 complaints in 2022, 48 complaints in 2021, 3 complaints in 2020.

United Wambo will continue to monitor complaint trends. United Wambo operates a 24-hour Community Complaints and Enquiries Hotline to ensure that any community concerns can be recorded and responded to as soon as possible.

The community hotline number is 1800 801 440.

The number is advertised on United Wambo website at <https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut>.

10. Independent Environmental Audit

In accordance with the requirements of Schedule 2, Part E, Condition E12 of SSD 7142, an Independent Environmental Audit (IEA) was undertaken for United Wambo in 2023. The audit was conducted by James Bailey & Associates Pty Ltd in October 2023 and submitted to DPE in December 2023. **Table 10-1** provides a summary of the audit findings and **Table 10-2** provides details regarding the non-compliances from the Audit Report and the status of the actions taken post IEA.

Table 10-1 Summary of Compliance

Document	Compliant	Non-Compliant	Not Triggered	Note	Total
SSD 7142	113	5	67	7	192
SSD 7142 Statement of Commitments	65	0	11	0	75
CCL775	2	1	2	0	5

Table 10-2 IEA Non-Compliances

Ref	Non-Compliance	Status (end Oct 2024)
SSD 7142 Condition B28	United Wambo reporting during the audit period note a number of non-compliances regarding data capture from the site air quality monitoring network due to unplanned power outages, mechanical issues, software issues and unplanned maintenance.	UWJV will continue to maintain and manage the site air quality monitoring network in accordance with the AQGHGMP to ensure data is available to verify compliance with SSD 7142 criteria.
SSD 7142 Condition B41	Non-compliances were identified against the condition of WAL 18455, WAL 10541, 20WA208714 and 20WA200928 held by United Wambo during the audit period.	UWJV informed Water NSW of the non-compliances prior to the IEA. UWJV will regularly review water licences to ensure compliance with conditions.
SSD 7142 Condition B56, B70	United Wambo did not make suitable arrangements for the long-term protection of the Compensatory Habitat Area nor secure the required offset credits by 6 January 2022.	<p>All six Biodiversity Stewardship Agreements for the proposed Biodiversity Offsets have been executed with the Credit Supply Taskforce. UWJV have submitted credit retirement applications for the six Biodiversity Offsets which are consistent with the Reasonable Equivalence assessment completed by the Biodiversity Offsets Scheme Branch.</p> <p>Biodiversity credits from three Biodiversity Offsets known as Highfields, Mangrove and Jerrys Plains have been retired. UWJV are awaiting the Biodiversity Stewardship and Assurance Branch to complete the final three transactions (expected November 2024).</p>

SSD 7142 Condition B85	A number of lighting complaints were recorded in 2020 and 2021 which on investigation by United Wambo were found to be related to the siting of lighting plant. Review of these complaints and UW responses indicate that additional reasonable and feasible steps to minimise off-site lighting impacts could have been implemented during 2020, 2021 and 2022	After implementing detailed planning and operationally restrictive management measures to manage off-site lighting impacts, UWJV have not received a lighting complaint since 30 November 2023. UWJV will continue to closely manage the placement of lighting plants during night-time operations.
CCL775 Special Condition 5	Written approval of the Minister was not received prior to mining within the Notification Area of the Riverview Void In-pit Water Storage Dam.	Despite extensive and early (2018) consultation with Dam Safety NSW, the approval was not provided prior to mining. Approval was received 28 March 2024.

11. Incidents and Non-Compliances Within the Reporting Period

11.1 Summary of Incidents

There were no significant or reportable incidents in 2023.

11.2 Summary of Non-Compliances

11.2.1 Air Quality

Real Time Monitoring - <75% daily data collection

On the dates listed in **Table 11-1**, the TEOMs failed to obtain a valid sample for varying lengths of time. The failure to obtain the samples was a result of varying causes, including unplanned power outages, mechanical and software issues, and planned maintenance. As a result of the missing data, a sample capture percentage of <75% for the day occurred on each of the dates identified, therefore a valid 24-hour average could not be calculated. The specific cause and subsequent response taken to rectify the issues related to each outage has been included in **Table 11-1**.

Table 11-1 Summary of Missing Data for Real Time Monitoring

Monitor	Date(s)	Cause
AQ01 PM10	15/02/2024-16/02/2024	Annual noise calibration 12-hour period run overnight.
	9/12/2024	Unexpected power outages at 3am and 2pm.
AQ02 PM10	27/02/2024	Unexplained power outage 5pm then came back online at 1am 28/2/2024.
	21/6/2024 22/6/2024	- Annual noise calibration 12-hour period run overnight.
AQ03 PM10	18/02/2024	Power outage due to storm and data exclusion through data validation.

Monitor	Date(s)	Cause
	03/04/2024 – 11/04/2024	TEOM OS locked up. CF card replacement. Unable to get contractor to fix over extended period, contractor replaced both dryers. Outage(s) believed to be due to ant in main CB. Bi-annual maintenance replaced 2 x TEOM filters. Ant issue not identified until 26/4/23.
	24/04/2024 – 26/04/2024	Bi-annual maintenance replaced 2 x TEOM filters. Ant infestation.
	11/11/2024 – 13/11/2024	Power outage over the weekend, due to storm.
	18/12/2024 – 19/12/2024	Annual noise calibration 12-hour period run overnight.
AQ04 PM10	18/04/2024 - 21/04/2024	Fault with equipment parts, unable to obtain parts. Mains power supply was intermittently under-volting. Pressure on main auxiliary flow caused water to leak.
	19/06/2024 - 20/06/2024	Annual noise calibration 12-hour period run overnight.
HVAS01	12/03/2024	HVO operates the Warkworth TSP High Volume Air Sampler (HVAS) as required by the HVO Air Quality and Greenhouse Gas Management Plan and Schedule 3, Condition 19 of the HVO South Approval (PA 06_0261).
	18/03/2024	
	11/04/2024	
	17/04/2024	<p>The power supply tripped at the Residual Current Device (RCD). Once power was restored the HVAS monitor programme indicated it had run for 16 hours.</p> <p>An inspection of the unit set up, power supply and further testing was completed with no issues being detected.</p> <p>Following the previous mis capture, HVO had connected the monitor to the other available RCD (RCD1).</p> <p>The data mis-captures will be noted in the HVO 2023 Annual Review. This report constitutes the detailed report to be provided within 7 days as required by Schedule 5, Condition 3 of PA 06_0261. Management plans were reviewed following this event as required by Schedule 5 Condition 4A of PA 06_0261. No update to plans are required as part of this event.</p>

¹ No action was taken as the issue of invalid data collection was identified in the data validation produced the following month by an external contractor in charge of the monitor maintenance.

11.2.2 Coal Washery Rejects Exemption and Order

On 9 October 2020, the Environmental Protection Authority (EPA) approved the United Wambo Joint Venture and Wambo Coal coal washery rejects (coal mine void) exemption 2020 (Exemption) and the United Wambo Joint Venture and Wambo Coal coal washery rejects (coal mine void) order 2020 (Order) for a period of two years from 13 October 2020 to 13 October 2022.

On 25 January 2023, United Wambo discovered that the Exemption and Order had not been extended. United Wambo informed the EPA and submitted an application for a renewal which was subsequently received on 3 March 2023 for a further two years to 2 March 2025.

12. Activities to be Completed in Next Reporting Period

Table 12-1 outlines the key proposed activities during 2024.

Table 12-1 Proposed Actions for 2023

Proposed Action	Timeline	Comments
Noise	2024	Procurement of eleven new Cat 789 with sound suppression and retire older 789 trucks without sound suppression.
Dust Management	2024	Procurement of four new water carts
Cultural Heritage	2024	Relocate all artefacts to the Minimbah Teaching Place
Waste	2024	Removal of all legacy waste at United Wambo
	2024	Scope and prepare contracts for demolition of the North MIA
Water Management	2024	Stage 3 Water Management detailed design and contract arrangements to be completed to allow mining further to the west
Approvals	2024	Remove Tailings Dam 2 from Dam Safety NSW Register
	2024	Complete Biodiversity Stewardship Agreements
	2024	Retire Stage 1 Credits
Rehabilitation	2024	59 hectares of rehabilitation will be undertaken
		Targeted weed control onsite and offset properties

13. References

The United Wambo Open Cut Coal Mine Project EIS and Assessment documentation is available on the United Wambo public website. All United Wambo and Wambo Mine Environmental Management System documents including Management Plans are available on the public website of each company:

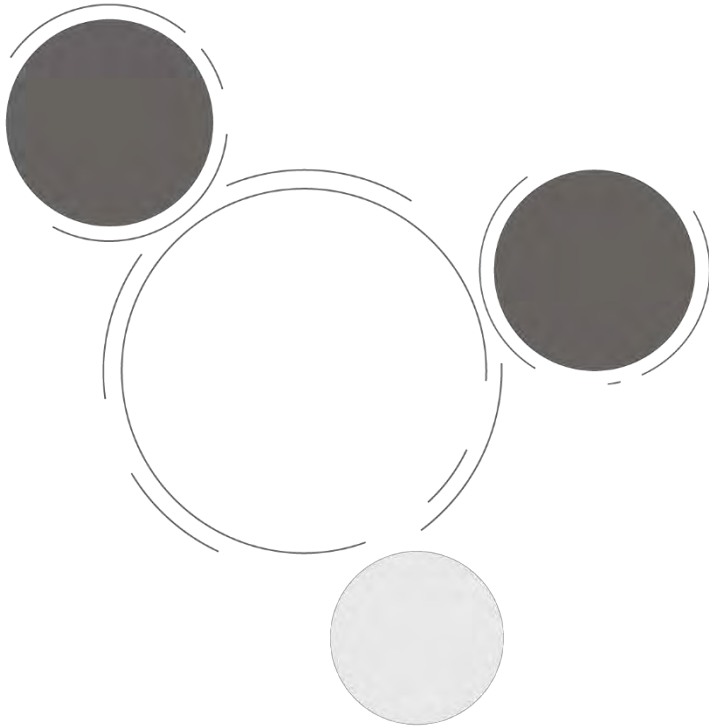
[United Wambo Joint Venture Open Cut \(glencore.com.au\)](https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut)

<https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut>

[Peabody - Wambo Underground Mine \(peabodyenergy.com\)](https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wambo-Underground-Mine)

<https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wambo-Underground-Mine>

Appendix A - EPBC 2015 – 7600 Compliance Report



EPBC 2015/7600 Compliance Report 2023



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1. Purpose

This report was prepared to satisfy the requirements of Condition 10 of the United and Wambo Open Cut Coal Mine Project *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) Approval 2015/7600 (**EPBC 2015/7600**). Condition 10 of EPBC 2015/7600 states:

10. The approval holder must prepare a compliance report addressing compliance with each of the conditions of this approval, including implementation of any management plans and strategies from the State development consent that are referred to in this approval, for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must:

- a. publish each compliance report on a website within 60 business days following the relevant 12 month period,*
- b. notify the Department by email that a compliance report has been published on the website and provide the website's link for the compliance report within five business days of the date of publication,*
- c. keep all compliance reports publicly available on the website until this approval expires,*
- d. exclude or redact sensitive ecological data from compliance reports published on the website, and*
- e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.*

2. Notification of Commencement and Reporting Period

Notification was made to the former Department of Environment and Energy on 10 January 2020 that the United Wambo Open Cut Coal Mine Project commenced on 6 January 2020. The reporting period for this report is 6 January 2023 to 6 January 2024.

3. Compliance Assessment

An assessment of compliance with the conditions of EPBC 2015/7600 is provided in **Table 1**.

Table 1 - Compliance Assessment

Condition	Requirement	Compliance Status	Compliance Finding
1	The approval holder must comply with State development consent conditions B39, B40, B46, B49, B51, B52, B53 and B54.	Non-compliant	<p>Condition B39 – compliant.</p> <p>Condition B40 – non-compliant (details below).</p> <p>Condition B46 – compliant.</p> <p>Condition B49 – compliant.</p> <p>Condition B51 – compliant.</p> <p>Condition B52 – compliant.</p> <p>Condition B53 – compliant.</p> <p>Condition B54 – compliant.</p> <p><u>Consent condition B40:</u></p> <p>During the 2023 Independent Environmental Audit (conducted October 2023), Condition B40 was found non-compliant due to non-compliances with conditions of water licences WAL18455, WAL10541, 20WA208714 and 20WA200928.</p> <p>The non-compliances with these water licences related to:</p> <ul style="list-style-type: none"> • Evidence not being available to confirm that the licensor was notified that decommissioning of UWJV Dam 1 was completed within the appropriate timeframe. This was identified as a non-compliance against the conditions of WAL 18455 and 20WA208714; • Incomplete logbook records being kept (i.e. extracted volumes only and not start and end of pumping times) and full logbook records not being retained for five years. This was identified as a non-compliance against the conditions of WAL 18455 and 20WA208714;

Condition	Requirement	Compliance Status	Compliance Finding
			<ul style="list-style-type: none"> Evidence not being available to confirm that the licensor was notified that decommissioning of the Wollombi Brook water supply work in 2009. This was identified as a non-compliance against the conditions of WAL 18549 and 20WA208706; Incomplete logbook records being kept (i.e. extracted volumes only and not start and end of pumping times) and full logbook records not being retained for five years. This was identified as a non-compliance against the conditions of WAL 10541 and 20WA200928. <p>UWJV has implemented actions to ensure that appropriate compliance notifications are made and monitoring information is retained.</p>
2	<p>Within the area shown at Annexure 1, the approval holder must not clear more than:</p> <ul style="list-style-type: none"> a. 203.7 hectares of Regent Honeyeater (<i>Anthochaera phrygia</i>) habitat, b. 203. 7 hectares of Swift Parrot (<i>Lathamus discolor</i>) habitat, c. 352.9 hectares of Spotted-tail quoll (<i>Dasyurus maculatus maculatus</i>) habitat, d. 246.8 hectares of the Central Hunter Valley Eucalypt Forest and Woodland ecological community. 	Compliant	<p>As of 6 January 2024, the area of clearance for each MNES listed is as follows:</p> <ul style="list-style-type: none"> a. 99.6 hectares of Regent Honeyeater (<i>Anthochaera phrygia</i>) habitat, b. 99.6 hectares of Swift Parrot (<i>Lathamus discolor</i>) habitat, c. 230.3 hectares of Spotted-tail quoll (<i>Dasyurus maculatus maculatus</i>) habitat, d. 133.5 hectares of the Central Hunter Valley Eucalypt Forest and Woodland ecological community.
3	The approval holder must comply with the State development consent conditions B55, B56, B57, B58, B59, B60, B61, B62, B69, B71, B72 and B73.	Non-compliant	<p>Condition B55 – compliant.</p> <p>Condition B56 – non-compliant (details below).</p>

Condition	Requirement	Compliance Status	Compliance Finding
			<p>Condition B57 – not applicable. No disturbance occurred in Stage 2 or Stage 3.</p> <p>Condition B58 – not applicable. No proposed changes to staging of surface disturbance.</p> <p>Condition B59 – not applicable. No carry over of surplus credits.</p> <p>Condition B60 – not applicable. No changes to total credit obligations.</p> <p>Condition B61 – compliant.</p> <p>Condition B62 – not applicable. Not within 10 years of cessation of mining.</p> <p>Condition B69 – compliant.</p> <p>Condition B71 – compliant.</p> <p>Condition B72 – compliant.</p> <p>Condition B73 – compliant.</p> <p><u>Consent condition B56:</u></p> <p>Condition B56 requires the retirement of Stage 1 credits within 12 months of commencing Phase 1A (or other timeframe agreed by the Planning Secretary). Stage 1 commenced on 6 January 2020 and therefore the due date was 6 January 2021.</p> <p>An extension for an additional 12 months to 6 January 2022 was granted by DPIE on 22 October 2020. During this time UWJV has worked with the NSW Biodiversity Conservation Trust (BCT) and now the Credit Supply Taskforce (CST) to establish Biodiversity Stewardship Agreements for the retirement of Stage 1 credits.</p>

Condition	Requirement	Compliance Status	Compliance Finding
			<p>Progress was slow despite UWJV's best efforts to expediate the process, and therefore an additional request for an extension was submitted in December 2021. This extension was denied by DPE and subsequently UWJV are non-compliant with this condition.</p> <p>UWJV are continuing to work with the NSW CST to finalise the BSA's as soon as possible and it is expected that the credits will be retired in 2024.</p>
3a	<p>To compensate for the loss of the listed threatened species and ecological community habitat identified at condition 2, the approval holder must submit the Biodiversity Offset Strategy plan (specified at condition B71(e) of the State development consent) to the Minister for approval.</p> <ul style="list-style-type: none"> i. The approval holder must not commence Phase 1A until the Biodiversity Offset Strategy plan has been approved by the Minister. ii. The approval holder must implement the Biodiversity Offset Strategy plan as approved by the Minister. 	Compliant	<p>The Biodiversity Offset Strategy is contained within the United Wambo Biodiversity Management Plan and was approved by the Minister on 19 December 2019.</p> <p>The Biodiversity Offset Strategy was implemented as approved. As per Condition 3, the requirement to retire the credits is ongoing.</p>
4	The approval holder must comply with the State development consent conditions B97, B98, B100, B101, B102, B103, B104 and B105.	Compliant	<p>Condition B97 – compliant.</p> <p>Condition B98 – compliant.</p> <p>Condition B100 – compliant.</p> <p>Condition B101 – compliant.</p> <p>Condition B102 – compliant.</p> <p>Condition B103 – compliant.</p>

Condition	Requirement	Compliance Status	Compliance Finding
			Condition B104 & B105– conditions deleted in SSD 7142 Mod 1.
5	The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action.	Not applicable	Not applicable for the reporting period. The United Wambo Open Cut Coal Mine Project commenced on 6 January 2020. The Department was notified in writing on 10 January 2020.
6	If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister.	Not applicable	Not applicable for the reporting period.
7	The approval holder must maintain accurate and complete compliance records.	Compliant	All records required by this approval are held by United Wambo JV.
8	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request.	Not applicable	No request has been received during the reporting period.
9	The approval holder must: <ul style="list-style-type: none"> a. Submit the Biodiversity Offset Strategy plan at condition 3a electronically to the Department for approval by the Minister, b. publish the Biodiversity Offset Strategy plan on the website within 20 business days of the date the Biodiversity Offset Strategy plan is approved by the Minister or of the date a revised Biodiversity Offset Strategy plan is submitted to 	Compliant	All requirements of Condition 9 have been met: <ul style="list-style-type: none"> a. See condition 3a above b. The United Wambo Biodiversity Management Plan has been published on the United Wambo website within 20 business days of approval. c. No sensitive ecological data is contained within the Biodiversity Offset Strategy d. The United Wambo Biodiversity Management Plan is published on the United Wambo website

Condition	Requirement	Compliance Status	Compliance Finding
	<p>the Minister or the Department, unless otherwise agreed to in writing by the Minister,</p> <p>c. exclude or redact sensitive ecological data from the Biodiversity Offset Strategy plan published on the website or provided to a member of the public, and</p> <p>d. keep the Biodiversity Offset Strategy plan published on the website until the end date of this approval.</p>		<p>https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut</p>
10	<p>The approval holder must prepare a compliance report addressing compliance with each of the conditions of this approval, including implementation of any management plans and strategies from the State development consent that are referred to in this approval, for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must:</p> <p>a. publish each compliance report on a website within 60 business days following the relevant 12 month period,</p> <p>b. notify the Department by email that a compliance report has been published on the website and provide the website's link for the compliance report within five business days of the date of publication,</p>	Compliant	<p>a. The 2022 Annual Compliance Report was published at https://www.glencore.com.au/operations-and-projects/coal/current-operations/united-wambo-open-cut/reporting-documents on 3 March 2023 (56 business days following the reporting period). A subsequent addendum to the 2022 report was published on 4 October 2023.</p> <p>b. The Department was notified by email on 3 March 2023 (original report) and 4 October 2023 (addendum report)</p> <p>c. The compliance reports remain on the website</p> <p>d. No sensitive ecological data is provided in the reports</p> <p>e. No sensitive ecological data is provided in the reports</p>

Condition	Requirement	Compliance Status	Compliance Finding
	<ul style="list-style-type: none"> c. keep all compliance reports publicly available on the website until this approval expires, d. exclude or redact sensitive ecological data from compliance reports published on the website, and e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication. 		
11	<p>The approval holder must notify the Department in writing of any: incident, or non-compliance with the conditions, or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:</p> <ul style="list-style-type: none"> a. any condition which is in breach, b. a short description of the incident and/or non-compliance, and c. the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available. 	Non-Compliant	<p>No incidents occurred during 2023.</p> <p>Several non-compliances were identified during 2023 and reported to the Department as part of the October addendum:</p> <ul style="list-style-type: none"> • Conditions 11 and 12 - Non-compliance with Condition 3 (retirement of biodiversity credits) was reported in the 2022 Annual Compliance Report, however it was not reported in accordance with Condition 11 and 12. Written notification was provided on 4 October 2023. • Condition 19 – SSD 7142 was modified (Modification 1) in November 21 and was reported in the 2021 Annual Compliance Report in March 2022. This is outside of the 10 business days required by Condition 19 and was not reported in accordance with Conditions 11 and 12. Written notification was provided on 4 October 2023. • Condition 22 - The Biodiversity Management Plan was revised in April 2022 and August 2022 and was not submitted to Minister for approval as the changes did not result in a new or increased impact. However, notification was not made to the Department in

Condition	Requirement	Compliance Status	Compliance Finding
			accordance with Condition 22 at the time. Written notification was provided as per Condition 22 on 4 October 2023.
12	<p>The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:</p> <ul style="list-style-type: none"> a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future, b. the potential impacts of the incident or non-compliance, and c. the method and timing of any remedial action that will be undertaken by the approval holder. 	Non-Compliant	<p>No incidents occurred during 2023.</p> <p>Non-compliances were reported as outlined in Condition 11 above.</p>
13	The approval holder must ensure that independent audits of compliance with the conditions are conducted as requested in writing by the Minister.	Not applicable	No request has been received by the Minister during the reporting period.
14	<p>For each independent audit, the approval holder must:</p> <ul style="list-style-type: none"> a. provide the name and qualifications of the independent auditor and the draft audit criteria to the Department, 	Not applicable	No request has been received by the Minister during the reporting period.

Condition	Requirement	Compliance Status	Compliance Finding
	<ul style="list-style-type: none"> b. only commence the independent audit once the audit criteria have been approved in writing by the Department, and a. submit an audit report to the Department within the timeframe specified in the approved audit criteria. 		
15	The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval.	Not applicable	No request has been received by the Minister during the reporting period.
16	The approval holder must comply with the State development consent condition A9.	Compliant	Condition A9 allows for mining up until 31 August 2042.
17	Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	Not applicable	The action has not been required during the reporting period, i.e. mining not yet completed.
18	The approval holder must notify the Department in writing of any proposed change to the State development consent conditions referred to in these conditions within 10 business days of formally proposing a change or becoming aware of any proposed change.	Not applicable	There were no proposed changes to the State development consent within the reporting period.
19	The approval holder must notify the Department in writing of any change to the conditions of the State development consent referred to in these conditions,	Not applicable	<p>There were no changes to the State development consent within the reporting period.</p> <p>The most recent change was in November 2021.</p>

Condition	Requirement	Compliance Status	Compliance Finding
	within 10 business days of a change to conditions being finalised.		
20	The approval holder may, at any time, apply to the Minister for a variation to an action management plan approved by the Minister under condition 3.a, or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised action management plan (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management plan.	Not applicable	No applications were made to vary an action management plan during the reporting period.
21	The approval holder may choose to revise an action management plan approved by the Minister under condition 3.a, or as subsequently revised in accordance with these conditions, without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the RAMP would not be likely to have a new or increased impact.	Compliant	<p>There were no revisions to the <i>Biodiversity Management Plan</i> during the reporting period.</p> <p>The most recent revision of the <i>Biodiversity Management Plan</i> was in August 2022, but the plan was not submitted for approval as it was deemed there was no new or increased impacts.</p>
22	<p>If the approval holder makes the choice under condition 21 to revise an action management plan without submitting it for approval, the approval holder must:</p> <ul style="list-style-type: none"> a. notify the Department in writing that the approved action management plan has been revised and provide the Department with: <ul style="list-style-type: none"> i. an electronic copy of the RAMP, 	Compliant	<p>There were no revisions to action management plans during the reporting period.</p> <p>Notification was made to the Department on 4 October 2023 of previous revisions of the <i>Biodiversity Management Plan</i>.</p>

Condition	Requirement	Compliance Status	Compliance Finding
	<ul style="list-style-type: none"> ii. an electronic copy of the RAMP marked up with track changes to show the differences between the approved action management plan and the RAMP, iii. an explanation of the differences between the approved action management plan and the RAMP, iv. the reasons the approval holder considers that taking the action in accordance with the RAMP would not be likely to have a new or increased impact, and v. written notice of the date on which the approval holder will implement the RAMP (RAMP implementation date), being at least 20 business days after the date of providing notice of the revision of the action management plan, or a date agreed to in writing with the Department. <p>b. subject to condition 24, implement the RAMP from the RAMP implementation date.</p>		
23	The approval holder may revoke their choice to implement a RAMP under condition 21 at any time by giving written notice to the Department. If the approval holder revokes the choice under condition 21, the approval holder must implement the action management	Not applicable	RAMP not revoked during reporting period.

Condition	Requirement	Compliance Status	Compliance Finding
	plan in force immediately prior to the revision undertaken under condition 21.		
24	<p>If the Minister gives a notice to the approval holder that the Minister is satisfied that the taking of the action in accordance with the RAMP would be likely to have a new or increased impact, then:</p> <ul style="list-style-type: none"> a. condition 21 does not apply, or ceases to apply, in relation to the RAMP; and b. the approval holder must implement the action management plan specified by the Minister in the notice. 	Not applicable	Condition 23 not activated during reporting period.
25	At the time of giving the notice under condition 24, the Minister may also notify that for a specified period of time, condition 21 does not apply for one or more specified action management plans.	Not applicable	Condition 24 not activated during reporting period.

Appendix B - Annual Groundwater Review



GLENCORE

**UNITED WAMBO ANNUAL
GROUNDWATER REVIEW
2023**

FINAL

March 2024



UNITED WAMBO ANNUAL GROUNDWATER REVIEW

2023

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
United Wambo Joint Venture

Project Director: Claire Stephenson
Project Manager: Claire Stephenson
Report No. 21033/R07
Date: March 2024



QMS Certification Services

This report was prepared using
Umwelt's ISO 9001 certified
Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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1.0 Introduction

The United Wambo Open Cut Coal Mine (United Wambo) is situated approximately 16 km west of Singleton, New South Wales (NSW). Commencing operations in 2020, United Wambo is a joint venture between United Collieries Pty Ltd (Glencore and CFMMEU) and Wambo Coal Pty Limited (Peabody).

The United Wambo Open Cut Coal Mine comprises open cut mining operations approved under Development Consent SSD 7142 in August 2019. This includes the United Pit to be mined down to the Vaux Seam of the Wittingham Coal Measures, and the Montrose Pit (former Wambo pit). Mining operations at United Wambo does not include Wambo's underground operation, Coal Handling and Preparation Plant (CHPP) or rail load-out facility.

A consolidated Groundwater Management Plan (GWMP) (Version 6, document number UWOC-1689771511) covers open cut operations associated with United Wambo. The GWMP also forms part of the Environmental Management System (EMS) for United Wambo. The groundwater monitoring at United Wambo is undertaken on a bi-monthly basis, in line with the requirements set out in the GWMP.

Umwelt (Australia) Pty Limited (Umwelt) have been engaged to undertake an annual review of the groundwater monitoring results collected from 1 January 2023 to 31 December 2023. This report has been prepared in accordance with the reporting requirements outlined in the GWMP.

1.1 Approved Mine Operations

A summary of activities conducted at site over the reporting period that are relevant to groundwater is listed in **Table 1-1**. The different mine areas are also presented in **Figure 1-1**.

Table 1-1 Mine Activities

Site	Type	Status 2023	Comment
Montrose Pit (former Wambo Open Cut)	Open Cut	Active	To be mined in 2021-2039, down to the Warkworth Seam
United Open Cut	Open Cut	Active	To be mined in 2021-2039, down to the Vaux Seam
Historical Open Cut Pits	Open Cut	Inactive	Includes Hunter Pit, Wombat Pit, Homestead Pit, South Bates Pit, Eastern Pit, Western Pit, North Bates Pit, Ridge Pit, North East Pit, Whynot Pit, Wollemi Boxcut, Wambo Pit and Montrose Pit. Mined from 1969 to 2020 targeting the Whynot, Whybrow and Wambo seams.
United Colliery Underground	Underground	Inactive	Mined the Arrowfield Seam and Woodlands Hill Seam from 1992 to 2010
Tailings Dam 1 (Hunter Pit)	Tailings Storage	Inactive	Previously used for tailings deposition from 2003. Capping works commenced in 2020 and were completed in 2022 and fully incorporated into the overburden dump system in 2023.
Tailings Dam 2	Tailings Storage	Inactive	Previously used for tailings deposition from 2003. Capping works commenced in 2020 and were completed in 2022 and fully incorporated into the overburden dump system in 2023.

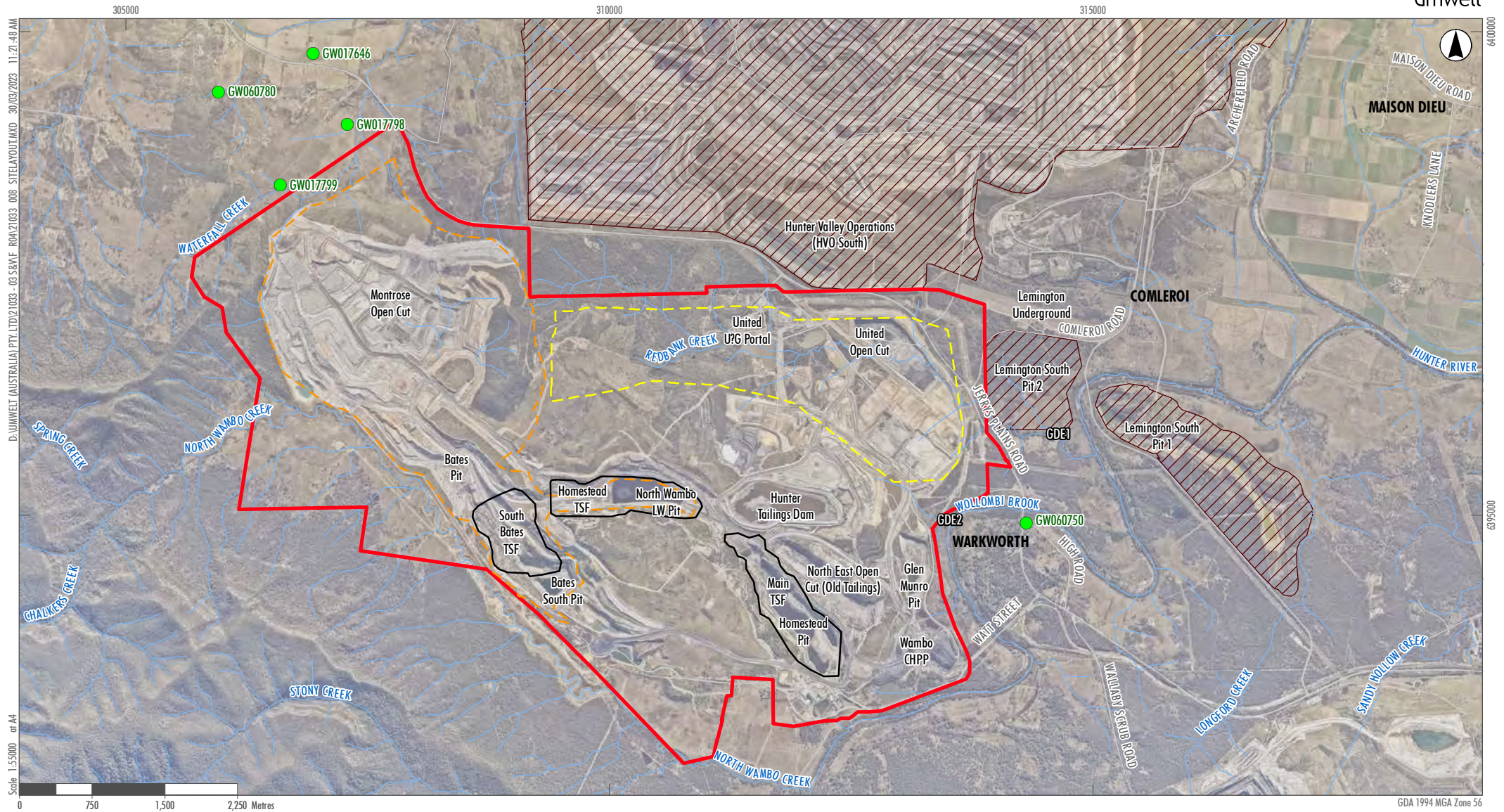
Site	Type	Status 2023	Comment
Homestead Inpit TSF	Tailings Storage	Active	Commenced from 2021 and in use during 2023
North East Tailings Dam	Tailings Storage	Inactive	Wambo storage
North Wambo UG Old InPit	Tailings Storage	Inactive	Wambo storage
Montrose Water Storage	Mine Water Dam	Inactive	Approved but not yet constructed
South Wambo Dam	Mine Water Dam	Inactive	Wambo storage. Recommissioning commenced in 2023 including construction and liner installation. Approved but not currently in use.
West Cut Water Dam	Mine Water Dam	Active	Wambo storage. Decant water from Homestead Pit transferred to West Cut Water Dam
Eagles Nest Dam	Process Water Dam	Active	Wambo storage.
Gordons Below Franklin	CHPP Dams	Active	Wambo storages. 4 x dams
Bates South Open Cut	Dam	Active	Wambo storage. South Bates Underground mine sump.
Tailings Storage	Tailings Storage	Active	Wambo storage. Located next to Wollombi Brook. Chitter Dam had a capacity of 980 ML mine water and tailings sump water (Hunter and North East Tailings) and operated from 2010 to 2016. Was mined out as Glen Munro Pit in 2017 to access South Wambo Underground.

The United Wambo mine is surrounded by mining operations that are mining the Whittingham Coal Measures. **Table 1-2** provides a summary of mine operations around United Wambo. This includes the adjacent Wambo mine workings.

Table 1-2 Surrounding Mines

Site	Type	Comment
North Wambo Underground (NWU)	Underground	Longwall mining at south-east end of site, active from 2007 to 2015 and mined the Wambo Seam.
South Bates Underground (SBU)	Underground	Longwall mining at south end of site, active from 2016 to 2018 and mined the Wambo and Whybrow seams.
South Bates Underground Extension (SBE)	Underground	Longwall mining at south end of site near North Wambo Creek. Active from 2018 to 2022 and mined the Whybrow Seam. Approval in 2022 of Longwall 24, which is aligned along Montrose Pit highwall towards Waterfall Creek. Works on the South Bates Extension ventilation shaft commenced in 2023 using a raise bore technique. Works also commenced for the Stage 3 and 4 North Wambo Creek Diversion.
Wambo	Open Cut and Underground	Within site area, underground longwall workings on the eastern and southern side of site.

Site	Type	Comment
Hunter Valley Operations (HVO)	Open Cut and historical underground	Historical Lemington Underground immediately east of site, included bord and pillar mining of the Bowfield Seam. As well as open cut mining immediately north of site.
Mt Thorley Warkworth (MTW)	Open Cut	Open cut operations located on the eastern side of Wollombi Brook.



Legend

- Project Area
- Montrose Open Cut
- United Open Cut
- Surrounding Open Cut Mines
- Tailings Storage Facility
- Registered Bore

Image Source: Nearmap (Jun 2021) Data source: NSW DFSI (2021), Glenore (2021)

FIGURE 1.1
Site Layout

1.2 Groundwater Impact Predictions

Groundwater impact predictions for the United Wambo are summarised in the GWMP and presented in the groundwater impact assessment by AGE (2016). The impacts are further summarised in the sections below.

A new numerical groundwater model was developed for the Wambo Modification 19 for Longwall 24 to 26. The numerical groundwater model included approved operations at United Wambo. As reported by SLR (2022) the model was calibrated up to December 2020 and peer reviewed. The report presents the cumulative impacts for the Wambo Modification 19 and United Wambo operations.

A memo by SLR (2024) was provided that presents a summary of predicted impacts relevant to United Wambo operations only, predicted based on the SLR (2022) groundwater model.

1.2.1 Water License and Predicted Take

Under the *Water Act 1912* and *Water Management Act 2000*, adequate water licences are required for the mine developments. Groundwater licenses held for United Wambo are outlined in **Table 1-3**. Water licence details have been obtained from the GWMP and Surface Water Management Plan (SWMP).

Modelling by AGE (2016) predicted mine inflows to Montrose Pit and United Pit of up to 633 ML/year from the Permian coal measures, which fall within the North Coast Fractured and Porous Rock water sharing plan. AGE (2016) predicted an indirect additional take due to the Project, from alluvium along Wollombi Brook of up to 40 ML/year, which falls under the Hunter Unregulated water sharing plan. As well as up to 58 ML/year from alluvium along the Hunter River, which falls under the Hunter Regulated water sharing plan. The water license and predicted water take are summarised in **Table 1-3**. Noting that these values exclude take associated with historical workings.

Modelling by SLR (2022) predicted, for the basecase model, up to 2 ML/day (730 ML/year) inflows to United Pit and up to 3.9 ML/day (1,424 ML/year) for Montrose Pit. The predicted maximum inflows when the two pits are combined occurs in 2038, with approximately 5.4 ML/day (1,972 ML/year) inflows to both pits. In all other model years, the maximum combined inflows is at or below 4 ML/day (1,461 ML/year).

The memo by SLR (2024) presents the predicted groundwater take for United Wambo operations only, which are summarised in **Table 1-3**.

Table 1-3 Water licenses and Predicted Water Take at United Wambo

Licence No.	Holder*	Entitlement	Predicted Water Take (ML/year)**
Groundwater: Lower Wollombi Brook Water Source – Hunter Unregulated and Alluvial Water Source			
WAL23897	Wambo	70 unit shares	40 (AGE 2016) 135 average, up to 209 (SLR 2024)
WAL18549	United	100 unit shares	
WAL18445	United	200 unit shares	
Groundwater: North Coast Fractured and Porous Rock Groundwater Source			

Licence No.	Holder*	Entitlement	Predicted Water Take (ML/year)**
WAL42373	Wambo	1549 unit shares	633 (AGE 2016) 1972 (SLR 2022) 714 average, up to 1110 (SLR 2024)
WAL41532	Wambo	98 unit shares	
WAL41510	United	300 unit shares	
Hunter Regulated water sharing plan			
WAL718	Wambo	1000 unit share	58 (AGE 2016)
WAL8599	Wambo	6 unit share	
WAL8600	Wambo	868 unit share	
WAL8604	Wambo	240 unit share	
WAL10541	United	300 unit share	

*One unit share is equivalent to 1 ML/year, unless reductions are in place via an annual available water determination.

**Predicted average annual water take over life of mine.

1.2.2 Groundwater Level Impacts

The mine operations at United Wambo targets the Permian coal measures and extend below the groundwater table. Due to this, there is a direct interception of groundwater within the open cut pits that results in localised depressurisation of the Permian coal measures. The zone of depressurisation combines with depressurisation from surrounding open cut and underground operations (cumulative impacts). These include Wambo, Hunter Valley Operations (HVO) South and Mount Thorley Warkworth (MTW).

Modelling by AGE (2016) predicted depressurisation in the coal measures due to mining by United Wambo extending up to 2 to 3.5 km from the active mine area. Drawdown in the alluvium was predicted to occur in a localised area along the Hunter River alluvium up to 3 km north of Montrose Pit (former Wambo Open Cut), as well as the Wollombi Brook alluvium up to 2 km east of the United Pit. This included areas of identified potential groundwater-dependent ecosystems (GDEs) referred to as GDE1 and GDE2 (**Figure 1-1**). An area of localised drawdown was also predicted where the original alignment of North Wambo Creek extended to Montrose Pit. The extent of drawdown in the alluvium is influenced by the extent of saturated alluvium and cumulative impacts from the existing operations at HVO near the Hunter River, Wambo below North Wambo Creek and Wambo, HVO and Warkworth along Wollombi Brook.

Up to 6.1 m of groundwater drawdown was predicted at one private bore (GW060780) due to mining at site. Drawdown was also predicted at a bore at HVO (GW060750), and three bores on Glencore owned land (GW017799, GW017798 and GW017646) (**Figure 1-1**).

The modelling by SLR (2022) indicates changes in the predicted cumulative drawdown, with around 2m to 5 m drawdown at private bore GW060780 and no drawdown predicted at GW060750. For the bores on Glencore owned land, over 20 m drawdown was predicted at GW017799, around 10 m drawdown at GW017798 and no drawdown at bore GW017646.

1.2.3 Groundwater Quality Impacts

As reported in the GWMP, minimal changes to the baseline water quality in the alluvium or Permian coal measures were predicted by operations at United Wambo (AGE, 2016).

1.3 Groundwater Conditions

Relevant groundwater requirements for the GWMP, stipulated by the condition B52 e(v) of SSD 7142 are summarised in **Table 1-4**. This report is developed as per the reporting requirements outlined in the GWMP.

Table 1-4 Groundwater Management and Monitoring Plan Commitments

Condition	Condition Details	Section Addressed
B49 Alluvial aquifers (including Wollombi Brook alluvium)	<p>Negligible impacts to the alluvial aquifer beyond those predicted in the document/s listed in condition A2(c), including:</p> <ul style="list-style-type: none"> Negligible change in groundwater levels. Negligible impact to other groundwater users. <p>Maintain appropriate setbacks in accordance with the AIP (DPIE Water 2012).</p>	<p>Discussion on results in Section 4.4</p> <p>Refer to main AEMR report.</p>
B49 Aquatic, riparian and groundwater dependent ecosystems (including GDE1 and GDE2)	<p>Negligible environmental consequences beyond those predicted in the document/s listed in condition A2(c) (i.e. the project EIS (Umwelt 2016)).</p> <p>Maintain or improve baseline channel stability.</p> <p>Develop site-specific in-stream water quality objectives in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000) and Using the ANZECC Guidelines and Water Quality Objectives in NSW (DEC, 2006).</p>	<p>Discussion on results in Section 4.4</p> <p>Refer to main AEMR report</p> <p>Refer Section 4.4.3</p>
B51 Groundwater Dependent Ecosystem Study	<p>Within 12 months of the determination of Modification 17, or as otherwise agreed with the Planning Secretary, the Applicant must commission and provide to the Planning Secretary for approval, a Groundwater Dependent Ecosystem Study report. This study must:</p> <ul style="list-style-type: none"> Be prepared by suitably qualified and experienced person/s. Be developed in consultation with DPIE Water. Assess the hydrological and hydrogeological settings of the site. Be integrated with the similar studies being undertaken by nearby mines (where practicable). Further characterise groundwater dependent ecosystems (vegetation and communities) potentially impacted by the development, including the Central Hunter Swamp Oak Forest EEC (GDE1), Hunter Valley River Oak Forest (GDE2) and individual River Red Gums 	<p>GDE Study completed by Umwelt (2021).</p> <p>Details on proposed performance criteria in Section 3.3</p>

Condition	Condition Details	Section Addressed
	<p>(GDE1 and GDE2) identified along the riparian buffers of Redbank Creek and Wollombi Brook.</p> <ul style="list-style-type: none"> Detail the reliance of groundwater dependent ecosystems on surface and groundwater resources. Identify the potential risks to groundwater dependent ecosystems from the development and the Wambo Mining Complex, and other nearby mines (where practicable). Use the results of this study to develop performance criteria to achieve the performance measures in Table 4 and inform the Groundwater Management Plan in condition B52. 	
B52 (e)(v) Water Management Plan – Groundwater Management Plan	<p>The Water Management Plan must include a Groundwater Management Plan, which is consistent with Groundwater Monitoring and Modelling Plans – Introduction for prospective mining and petroleum activities (DPI Water, 2014) and the National Water Quality Management Strategy (DoEE, 2015) and includes:</p> <ul style="list-style-type: none"> Detailed baseline data of groundwater levels, yield and quality for groundwater resources potentially impacted by the development, including groundwater supply for other water users and groundwater dependent ecosystems. 	<p>Refer GWMP</p> <p>Refer to GWMP</p> <p>Baseline data used and presented where relevant in Section 4.4.</p>
	<ul style="list-style-type: none"> A detailed description of the groundwater management system. Groundwater performance criteria, including trigger levels for identifying and investigating any potentially adverse groundwater impacts associated with the development, on: <ul style="list-style-type: none"> Regional and local aquifers (alluvial and hardrock). Groundwater supply for other water users such as privately-owned licensed groundwater bores. Groundwater dependent ecosystems. Aquatic habitat and stygofauna. A program to monitor and evaluate: <ul style="list-style-type: none"> Compliance with the relevant performance measures listed in Table 4-3, and the performance criteria established above. Water loss/seepage from water storages into the groundwater system. Groundwater inflows, outflows and storage volumes to inform the Site Water Balance. Any hydraulic connectivity between the alluvial and hard rock aquifers. Impacts on groundwater supply for other water users. Impacts on groundwater dependent ecosystems. The effectiveness of the groundwater management systems. 	<p>Refer to GWMP. Summary of hydrogeological setting in Section 2.4</p> <p>Refer to GWMP.</p> <p>Performance criteria and triggers presented in Section 3.2</p> <p>Refer to GWMP</p> <p>Surface water and site water balance details included in main AEMR.</p> <p>Details on the groundwater monitoring network in Section 3.0.</p> <p>Refer to GWMP</p> <p>Annual groundwater reporting captured in this report</p> <p>Annual reporting captured in this report and results discussed in Section 4.0</p>

Condition	Condition Details	Section Addressed
	<ul style="list-style-type: none"> Reporting procedures for the results of the monitoring program. A plan to respond to any exceedances of the groundwater performance criteria, and repair, mitigate and/or offset any adverse groundwater impacts of the development. A program to periodically validate the groundwater model for the development, including an independent review of the model every three years, and comparison of monitoring results with modelled predictions. 	Groundwater model for the area updated and reported on by SLR (2022), final site specific model and results to be completed in 2024.

2.0 Site Conditions

2.1 Climate

The daily rainfall data for United Wambo was collected from the United M7 Met station data and is summarised in **Table 2-1**. The table also includes the monthly rainfall for 2023 and long-term average rainfall based on Scientific Information for Landowners (SILO) data for the United Wambo area (retrieved from SILO grid data Latitude -32.55, Longitude 151.00). Data was derived from 01/01/1900 to 31/12/2023 to calculate the long-term average rainfall.

Table 2-1 Rainfall data for United Wambo

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
United Site Data (M7)	62.4	75.4	111.8	46.9	4.2	14.7	9.8	22.4	12.0	31.4	46.8	87.2	525.0
SILO (2023)	59.2	76.6	101.8	46.2	3.9	14.0	10.3	26.3	14.6	34.6	50.4	82.1	520.0
SILO Long Term Avg.*	74.9	71.8	66.9	45.3	38.6	46.7	41.9	35.2	41.1	50.6	62.8	68.4	644.1

*SILO average over data from January 1900 to December 2023.

Comparison between the United site data and the SILO data shows similar rainfall over the 2023 reporting period. As shown in **Table 2-1**, the site experienced above average rainfall, particularly in March, and December, but noticeably below the long-term average between those months. Due to the availability of longer period of SILO data compared to the site data, the rainfall trends as cumulative rainfall departure (CRD) has been calculated using the SILO dataset, which is shown in **Figure 2-1** and presented in the bore hydrographs (**Section 4.4**).

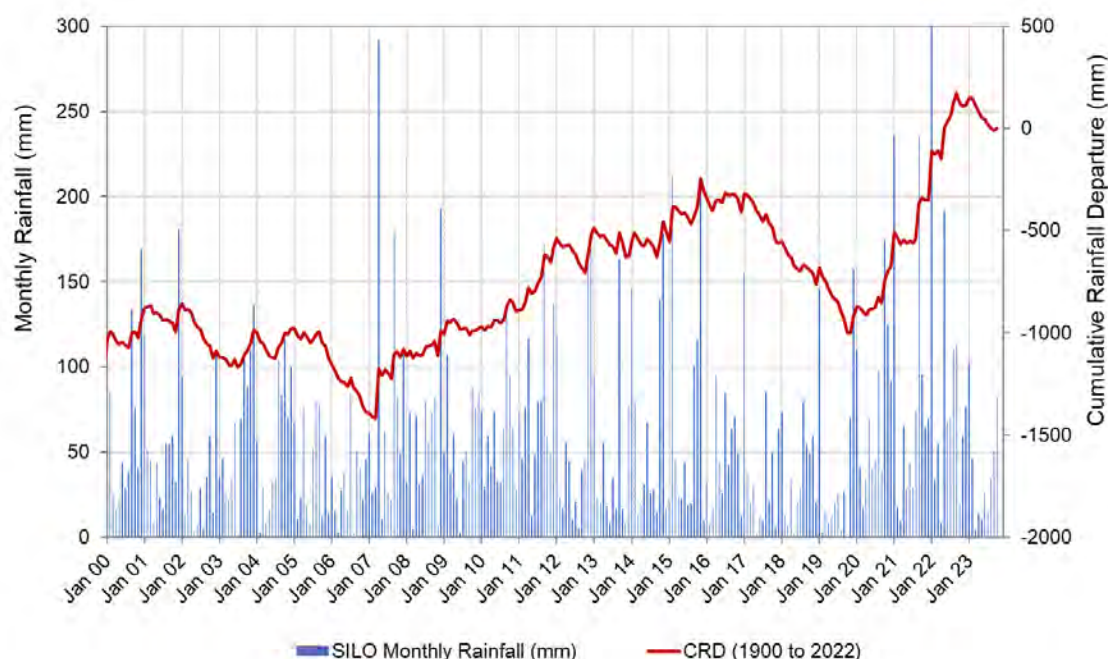


Figure 2-1 Cumulative Rainfall Departure

2.2 Streamflow

United Wambo is primarily drained by Wollombi Brook and its minor tributaries. Wollombi Brook flows in a general north to north-east direction to the Hunter River. Tributaries of Wollombi Brook include North Wambo Creek, Stony Creek, and Redbank Creek. Minor drainage lines around United Wambo are ephemeral in nature, with flows occurring in response to heavy rainfall events.

Streamflow analysis undertaken by AGE (2016) indicated Wollombi Brook and the Hunter River in this area largely recharge alluvium, but there is also potential for localised and temporal baseflow contributions from alluvium to surface water flows. AGE (2016) estimated up to 70 ML/day of alluvial groundwater contributes to the Wollombi Brook, and 231 ML/day of alluvial groundwater contributes to the Hunter River.

Surface water monitoring is conducted in NSW at various gauge station with telemetry systems. The closest gauging stations to the site along Wollombi Brook is station 210004 at Warkworth. The trends in water levels and water quality for the gauge station 210004 was considered as part of this annual review due to potential interactions with alluvial groundwater trends.

The monitored water levels compared with rainfall (SILO) are shown in **Figure 2-2**, while **Figure 2-3** compares field electrical conductivity (EC) with Wollombi Brook discharge. The data shows increase in flow at 210004 in March 2023, with river levels rising to approximately 1.9 m (from 1.69 in February). EC reduced from around 747 $\mu\text{S}/\text{cm}$ down to 675 $\mu\text{S}/\text{cm}$ in conjunction with the March water level increase. This rapid rise and decline in the river levels are coinciding with high rainfall in March (**Figure 2-2**). **Figure 2-3** shows immediate decline in EC after rainfall event, but subsequent recovery and rise in EC within approximately two months of the peak flow events.

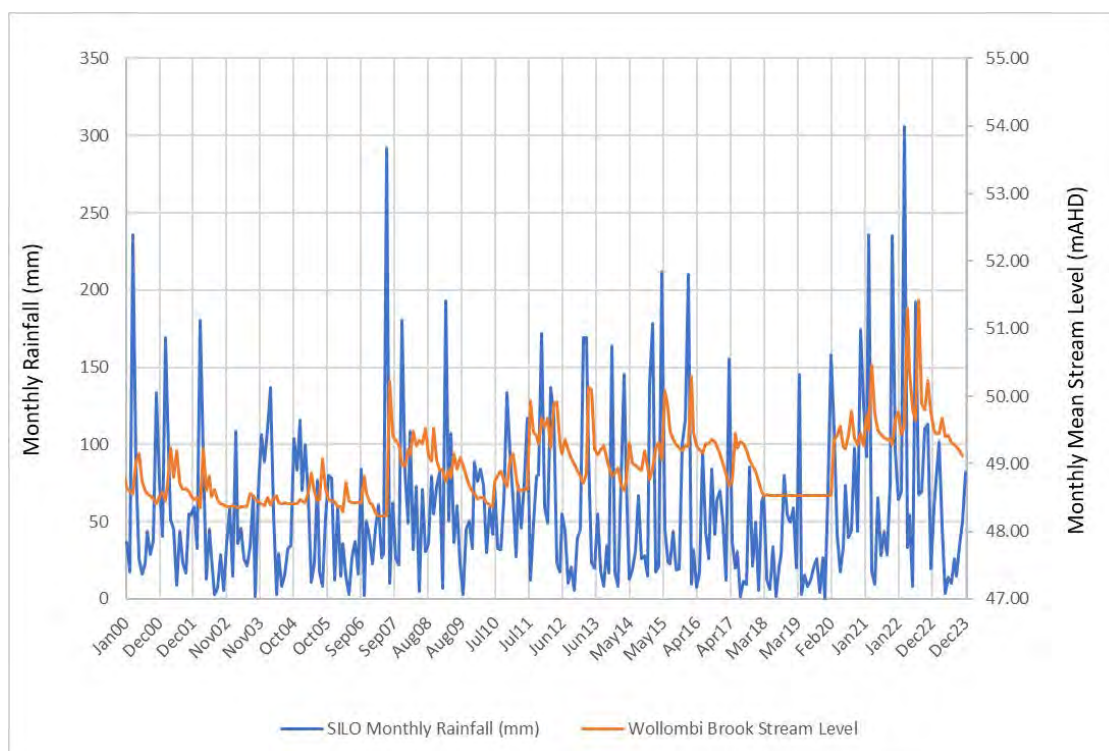


Figure 2-2 Wollombi Brook Water Levels vs Rainfall

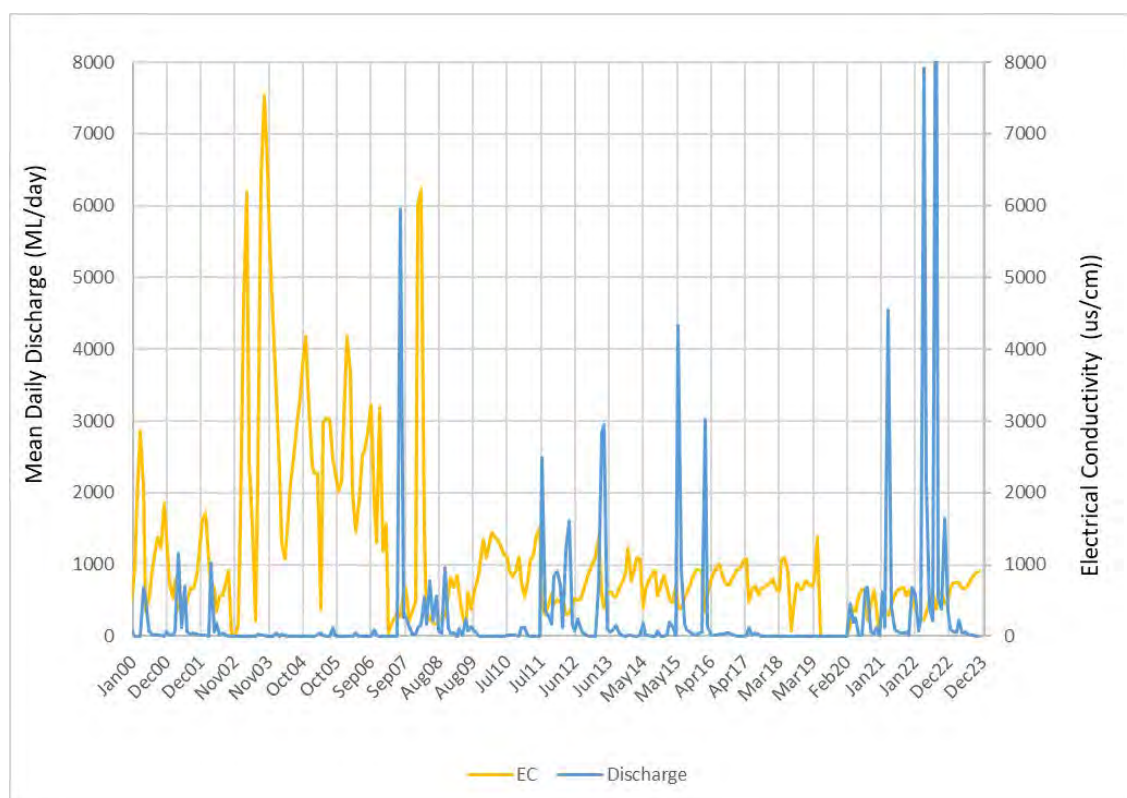


Figure 2-3 Wollombi Brook Discharge vs Electrical Conductivity

2.3 Geology

United Wambo is located within the Hunter Coalfield subdivision of the Sydney Basin. Mining at United Wambo targets economic coal seams within the Permian Wittingham Coal Measures, which also comprises overburden and interburden consisting of sandstone, siltstone, tuffaceous mudstone, and conglomerate. The coal measures occur as stratified (layered) sequences that generally dip to the south-west and occur at outcrop to the north and east. The coal measures are overlain by the Newcastle Coal Measures on the southern end of site, which in turn is overlain by the Triassic Narrabeen Group.

The coal measures are also unconformably overlain by Quaternary alluvium, which occurs localised along watercourses like Wollombi Brook and the Hunter River. The alluvium includes deposits of silt, sand and gravel. A thin sequence of aeolian sands, known as the Warkworth Sands Formation, is also mapped to the east of Wollombi Brook.

Table 2-2 presents a summary of site stratigraphy and **Figure 2-4** presents a map of the geology of United Wambo and surrounds.

Table 2-2 Generalised Stratigraphy of United Wambo

Age	Stratigraphic Unit	Sub-unit	Description
Cainozoic	Quaternary sediments – alluvium (Qa)	Surficial alluvium (Qhb)	Shallow sequences of clay, silt and sand.
		Productive basal sands/gravel (Qha)	Basal sands and gravels along major watercourses (i.e. Hunter River).
	Silicified weathering profile (Czas)		Silcrete
	Alluvial terraces (Cza)		Silt, sand and gravel
Jurassic	Volcanics (Jv)		Flows, sills and dykes
Triassic	Narabben Group (Rn)		Sandstones, Interbedded sandstone and siltstone, claystone - localised at Wollemi National Park
Permian	Newcastle Coal Measures	Doyles Creek Sub-Group/Apple Tree Flat Sub Group Watts Sandstone	Coal seams, claystone (tuffaceous), siltstone, sandstone and conglomerate. Medium to coarse-grained sandstone.
	Whittingham Coal Measures	Jerrys Plains Sub-group (Pswj)	Coal bearing sequence interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Whybrow Seam, Redbank Creek Seam, Wambo Seam, Whynot Seam, Blakefield Seam, Glen Munro Seam, Woodlands Hill Seam, Arrowfield Seam, Bowfield Seam, Warkworth Seam, Mt Arthur Seam, Piercefield Seam, Vaux Seam, Broonie Seam/Ravensworth Seam and Bayswater Seam.
		Archerfield Sandstone	Lithic sandstone marker bed.
		Vane Sub-group (Pswv)	Coal bearing sequences interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Lemington Seam, Pikes Gully Seam, Arties Seam, Liddell Seam, Barrett Seam and Hebden Seam
		Saltwater Creek Formation (Pswc)	Sandstone and siltstone, minor coaly bands, siltstone towards base.
	Maitland Group	Branxton Formation (Pmtb)	Conglomerate and sandstone towards base, siltstone becoming more common towards top.

2.4 Hydrogeology

The primary two groundwater bearing units at United Wambo are:

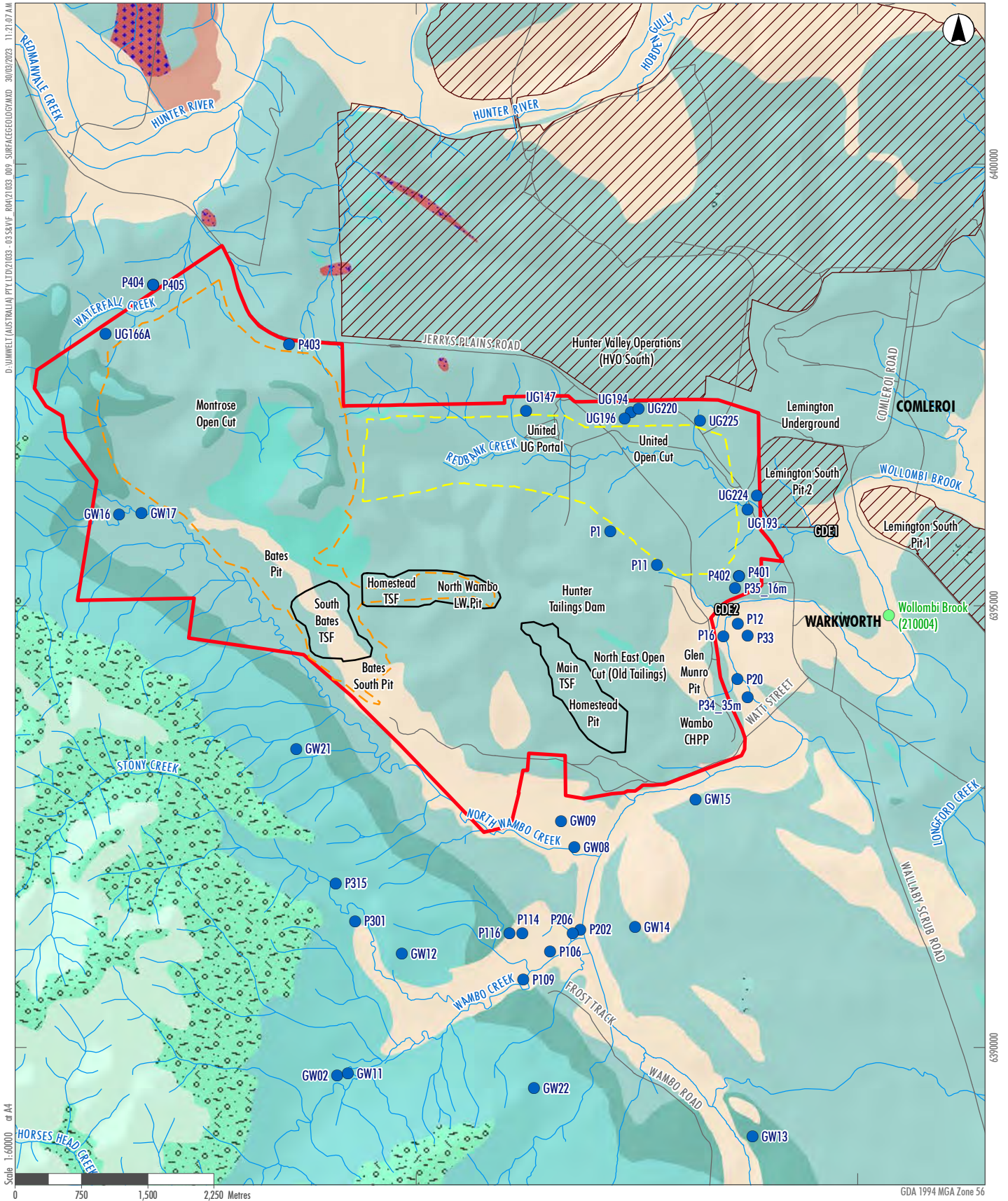
- Quaternary alluvium.
- Permian coal measures.

2.4.1 Quaternary Alluvium

Quaternary alluvium at United Wambo is an unconfined groundwater unit, localised along the Wollombi Brook and parts of its tributaries. The groundwater flow within this unit follows the natural topography, from north to north-east, towards the Hunter River. Recharge to this unit occurs via rainfall, and through losses from the stream bed. Recharge to this unit also occurs through upward leakage from underlying Permian bedrock.

2.4.2 Permian Coal Measures

The coal measures comprise stratified sequences of siltstone, sandstone, shale (collectively referred to as interburden) and coal. Groundwater occurrence is largely associated with the coal seams, with groundwater storage and movement via secondary porosity (fractures and cleats). The interburden exhibit lower permeabilities compared to the coal seams, with groundwater transmission dependent on the occurrence and frequency of fractures and joints. Recharge to the coal measures occurs via rainfall recharge where the unit occurs at outcrop, as well as downward leakage from overlying strata. Groundwater levels and flow are influenced by the long period of mining within the region, which has resulted in depressurisation of the coal measures around active mine areas.



Legend

- Project Area
- Montrose Open Cut
- United Open Cut
- Surrounding Open Cut Mines
- Tailings Storage Facility
- Creek/River
- Monitoring Bores in GWMP
- Government Site

Surface Water Monitoring Location

- Government Site

Surface Geology

- Pwrc - Wittingham Coal Measures
- Pnc - Newcastle Coal Measures
- Tnrb - Banks Wall Sandstone
- Pwj - Jerrys Plains Subgroup
- Pwjs - Jerrys Plains Subgroup - sandstone

- Pwd - Denman Formation
- Pihw - Watts Sandstone
- Pihw_s - Watts Sandstone - quartz-lithic sandstone
- Tna - Narrabeen Group Quartzose Sandstone
- Jui/MZui - Jurassic/Mesozoic volcanics
- Cv - Cenozoic Volcanics
- Qa - Quaternary Alluvium

Dominant Lithology

- Conglomerate; Conglomerate
- Diorite
- Dolerite

FIGURE 2.4

Surface Geology

3.0 Groundwater Monitoring Network

3.1 Groundwater Monitoring Program

The groundwater monitoring network at United Wambo as outlined in the current GWMP includes 27 monitoring bores and 11 vibrating wire piezometers (VWPs) locations, which include 55 sensors targeting the Permian coal measures (**Figure 3-1**). Details on the monitoring bores is also included in **Appendix A**.

As outlined in the GWMP, monitoring is conducted on a monthly to bi-monthly (every two months) basis for groundwater levels and quality, which includes pH and electrical conductivity (EC). As per the GWMP, a full suite of water quality analysis is conducted on an annual basis for the following analytes:

- Physio-chemical indicators – pH, EC, total dissolved solids (TDS).
- Major ions – calcium, fluoride, magnesium, potassium, sodium, chloride, sulphate.
- Total alkalinity as CaCO_3 , HCO_3 , CO_3 .
- Dissolved and total metals – aluminium, arsenic, barium, boron, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, strontium, silver, vanadium, and zinc.



Groundwater Monitoring Network

3.2 Groundwater Performance Criteria and Trigger Levels

The groundwater performance criteria for the alluvial and hard rock aquifers, and seepage/leachate at United Wambo is outlined in **Table 3-1**. Groundwater levels and quality trigger levels have been developed for United Wambo and are presented in **Table 3-2**.

Table 3-1 Groundwater Performance Criteria

Aspect	Performance Measure	Performance Indicator/Trigger	Response
Alluvial Bores	Negligible change in groundwater level (compared to predicted impacts ¹)	90th percentile (and not related to seasonal variability) over three consecutive bi-monthly events.	TARP – Groundwater Level
	Negligible change in groundwater quality	Groundwater quality concentrations outside of adopted trigger values (GWMP) for at least one parameter for more than three consecutive bi-monthly events.	TARP – Groundwater Quality
Bedrock Bores	Negligible change in groundwater level (compared to predicted impacts ¹)	90th percentile (and not related to seasonal variability) over three consecutive bi-monthly events. No trigger adopted for monitoring sites within the project area.	TARP – Groundwater Level
	Negligible change in groundwater quality	Groundwater quality concentrations outside of adopted trigger values (GWMP) for at least one parameter for more than three consecutive bi-monthly events.	TARP - Groundwater Quality
Groundwater inflows to mining pits	Groundwater inflows to mining pits consistent with groundwater model predictions and all take is covered by relevant licences.	Groundwater inflows to mining pits is >10% higher than predicted for three consecutive bi-monthly events, without logical reason (i.e. changes to mine plan or wetter than average climate conditions).	TARP – Groundwater Inflows
Seepage/Leachate	Negligible seepage/leachate from water storages	Visual inspections of water storages (as per the United Wambo Erosion and Sediment Control Plan Checklists) shows seepage zones and reporting water balance indicates seepage is greater than negligible (i.e., >5% of inflows to water storage).	The water storage integrity will be reviewed by a specialist. Other actions as per Unforeseen Impacts Protocol (GWMP Section 9.10)

Aspect	Performance Measure	Performance Indicator/Trigger	Response
	All seepage/leachate from emplacement areas is captured in water management system	Visual inspections (as per the United Wambo's Erosion and Sediment Control Plan Checklists) indicates seepage areas and confirms location of drainage pathways outside of water management system.	Seepage/leachate area to be investigated, including water quality, source of seepage. Works to be undertaken to determine any potential downstream impacts and to ensure seepage is ceased or diverted to water management system. Other actions as Unforeseen Impacts Protocol (GWMP Section 9.10).
	Negligible impacts of seepage/leachate impacts from backfilled voids on regional groundwater quality	No increasing trends in water quality parameters in monitoring bores down dip of backfilled voids. An increasing trend would be indicated by three consecutive water quality readings showing continual increases in analyte concentrations.	Other actions as per Unforeseen Impacts Protocol (GWMP Section 9.10).
	Seepage/leachate impacts from final voids are consistent with predictions in relevant environmental impact statements for the two approved final voids (United and Wambo Open Cuts)	Measures to be development as part of United Wambo Closure Plan (at least 5 years prior to completion mining).	TBA as part of United Wambo Closure Plan.

Note: 1 predicted impact as determined in the numerical groundwater model (AGE 2016)

The trigger levels for each bore are defined in the GWMP and summarised in **Table 3-2**.

The water level trigger criteria for United Wambo bores are based on the 90th percentile of the recorded depth to groundwater in the historical dataset (2008 to 2018) plus 1 m allowing for seasonal variations (**Table 3-2**). As per the GWMP, if a bore is reported as dry, the water level is assumed to be at the base of the bore for trigger comparison purposes.

For water quality (pH and EC), the triggers are derived using the 90th percentile value observed in the historical data (2008 to 2018). As per the GWMP, an investigation will not be triggered unless the 90th percentile (10th percentile for lower trigger for pH) is exceeded on three consecutive bi-monthly (every 2 months) monitoring events.

Table 3-2 United Wambo Monitoring Network Trigger Values

Bore	Target Unit	Maximum (90th Percentile)	Groundwater Level Trigger ^{3 A} (1m + 90 th Percentile)	EC Trigger (µS/cm) Max. (90 th Percentile)	pH min. (10 th Percentile)	pH max. (90 th Percentile)
Alluvial monitoring bores						
GW02	Wambo Creek Alluvium	8.4	9.4	657	6.7	7.4
GW08.2	North Wambo Creek Alluvium	ND	ND	ND	ND	ND
GW09.2	North Wambo Creek Alluvium	ND	ND	ND	ND	ND
GW11	Wambo Creek Alluvium	6.7	7.7	626	6.8	7.5
GW13	Wollombi Brook Alluvium	6.3	7.3	4,447	6.9	7.1
GW15	Wollombi Brook (east) Alluvium	11.4	12.4	726	6.7	7.2
GW16	North Wambo Creek Alluvium	10.9	11.9	1,145	7.2	7.7
GW17	North Wambo Creek Alluvium	12.1	13.1	5,542	7	7.2
P12	Wollombi Brook (east) Alluvium	7.7	8.7	1,002	7.3	7.7
P16	Wollombi Brook (west) Alluvium	8.6	9.6	10,510	7.0	7.7
P20	Wollombi Brook (west) Alluvium	8.3	9.3	10,364	7.2	7.6
P106	Wambo Creek Alluvium	9.6	10.6	674	6.7	7.9
P109	Wambo Creek Alluvium	6.2	7.2	801	6.5	7.9
P114	Wambo Creek Alluvium	7.3	8.3	7,096	6.5	7.8
P116	Wambo Creek Alluvium/ Permian	6.8	7.8	2,076	6.6	7.4
Offsite bedrock monitoring bores						
GW21	Overburden	36.6	37.6	ND	ND	ND
GW22	Overburden	36.7	37.7	7,028	8.2	8.4
P11^A	Interburden	32.0	33.0	ND	ND	ND
P202	Overburden	9.0	10.0	8,368	6.7	7.8
P206	Overburden	20.6	21.6	2,372	7.3	8.1
P404^B	Overburden	ND	ND	ND	ND	ND
P405^B	Arrowfield Seam	ND	ND	ND	ND	ND

^A Bore mined out.

^B Bore not yet installed.

ND Trigger will be developed as soon as there is sufficient data (ND – no historical data)

mbTOC = metres below top of casing.

3.3 GDE Monitoring

Performance criteria were also proposed by Umwelt (2021) for GDE1 and GDE2 in accordance with Condition B51 of SSD 7142. Consistent with the approved groundwater management plan, the trigger value for water level is based on the 90th percentile of the recorded depth to groundwater in the historical dataset, plus 1 m allowing for seasonal variations.

Water quality triggers are also determined based on the 90th percentile of baseline data to 2018 for EC, and 10th and 90th percentile for pH. For the purpose of the GDE monitoring program it is also proposed that triggers also be established for sulphate, based on the 90th percentile of baseline data, to assist with identification of potential mine related impacts. There is insufficient data for newly installed bores P401 and P402 and the proposed bore that is yet to be installed within the coal measures, therefore triggers could not be prescribed as yet for these sites.

The proposed monitoring program and trigger criteria are outlined in **Table 3-3**. Performance criteria, developed in line with the existing approved groundwater management plan, are outlined in **Table 3-4**.

The trigger levels for EC and pH have been included in **Table 3-3** based on current available baseline data, with 21 readings of EC and pH recorded since 2020. No triggers for sulphate due to insufficient data to establish a trigger level. The groundwater level triggers are to be confirmed pending the current groundwater model predictions.

Table 3-3 Proposed GDE Triggers

Bore	Geology	Frequency	Depth of Groundwater 90 th (mbTOC)	EC 90 th Percentile (µS/cm)	pH 10 th Percentile to 90 th Percentile	Sulphate 90 th Percentile (mg/L)
P12	Alluvium	SWL and WQ 2 month Full suite 6 monthly	7.7 + 1 m	1,002	6.3–7.7	48
P15	Colluvium	SWL and WQ 2 month Full suite 6 monthly	7.8+ 1 m	10,880	7.2–7.9	1,456
P16	Colluvium	SWL and WQ 2 month Full suite 6 monthly	8.6+ 1 m	10,510	7.0–7.7	1,350
BH1	Tertiary alluvium	SWL and WQ 2 month Full suite quarterly	TBC	TBC	TBC	TBC
P401	Shallow overburden	SWL and WQ 2 month Full suite quarterly	TBC	12,750	7.0	TBC
P402	Arrowfield Seam	SWL and WQ 2 month Full suite quarterly	TBC	11,810	7.6	TBC

Table 3-4 Groundwater Performance Measures – GDE

Aspect	Performance Measures	Performance Indicator/Trigger	Response
Alluvial Aquifer	Negligible change in groundwater level (compared to predicted impacts)	90 th percentile (and not related to seasonal variability) over three consecutive months	TARP – Groundwater Level
	Negligible change in groundwater quality that could impact on GDE health	90 th percentile for EC 10 th to 90 th percentile for pH 90 th percentile for sulphate For at least one parameter for more than 3 consecutive months	TARP – Groundwater Quality

Requirements for routine monitoring of stygofauna are also outlined in the GWMP. United Wambo committed to monitoring stygofauna in the alluvial aquifers within (or near to subject to bore suitability) the predicted drawdown areas every three years. If groundwater monitoring indicates that impacts are greater than predicted within the shallow alluvial aquifers surrounding site, more regular monitoring for stygofauna would be triggered. Monitoring for stygofauna is to be undertaken at the following bores:

- Wollombi Brook Alluvium: P12, P16, P407 (once installed).
- North Wambo Creek Alluvium: GW08, GW16, GW17.
- Hunter River Alluvium: P408 (once installed).
- Wambo Creek Alluvium/Permian: P116.

4.0 Groundwater Data

4.1 Assessment of Monitoring Frequency in 2023

As per the GWMP, monitoring of the monitoring bores is to be conducted on a bi-monthly (every two months) basis for groundwater levels and quality, which includes pH and electrical conductivity (EC). In addition to that, a full suite of water quality analysis is to be conducted on an annual basis.

Review of the monitoring data indicates most bores were monitored at the location, frequency and analytes as indicated in the GWMP. Exceptions to these include:

- GW02 – was only sampled in August and October 2023 due to access restrictions.
- GW08.2 – only sampled February, July and October 2023 for SWL, there was insufficient water to sample for water quality.
- GW11 – only 2 samples in August and October 2023 due to access issues.
- GW13 – only sampled June, August and October 2023 due to access issues.
- GW21 – bore dry over reporting period.
- P114 – not monitored over 2023. Bore is within the current management plan but recommended to be removed. Bore screened across both alluvial and Permian strata, inconsistent with Minimum Construction Requirements for Water Bores in Australia (NUDLC 2020). Bore removed from monitoring network and replaced by P316a,b,c.
- P116 – not monitored over 2023. Bore is within the current management plan but previously recommended to be removed. Bore screened across both alluvial and Permian strata, inconsistent with Minimum Construction Requirements for Water Bores in Australia (NUDLC 2020). Bore removed from monitoring network and replaced by P316a,b,c.
- BH1 – logger data available but apparently the bore was dry, so no water quality or manual dipped water levels recorded.
- GW12 – not monitored over 2023. Bore is within the current management plan, but was previously recommended to be removed. Bore constructed within shallow/weathered Permian strata after the commencement of NWU mining. Length of baseline period not suitable for development of trigger. Bore removed from monitoring network. P315 to provide supplementary data for Stony Creek alluvium.

VWP data were collected at site in accordance with the GWMP (see **Appendix B**). Some VWP sensor data appear to be erroneous and these should be investigated and repaired:

- UG131 – sensor 7.
- UG135 – sensor 5.
- UG136 – sensors 1 to 7.
- UG139 – sensors 1 to 7.

- UG139R – sensor 5.
- UG220 – sensors 1 to 7.
- UG225 – sensor 5.
- ELA5 – sensor 5.

4.2 Water Level and Quality Summary Data

Water level and water quality (pH and EC) data was collected over the 2023 reporting period and compared to the trigger values outlined in the GWMP. The water levels were reviewed for the compliance network and compared to rainfall and streamflow where relevant. The groundwater level data was provided in meters below top of casing (mbTOC), therefore for the purposes of the discussion in the section below all groundwater level data has been assumed to be in mbTOC. Groundwater level and groundwater quality graphs are shown in **Section 4.4**. The available data for water level and water quality has been summarised in **Table 4-1**.

Table 4-1 Groundwater Level and Quality Results Summary from January to December 2023

Sites	Target Unit	Depth to water (mbTOC)				pH				EC (µS/cm)				Comments
		Obs.	Min	Median	Max	Obs.	Min	Median	Max	Obs.	Min	Median	Max	
GW02	Wambo Creek Alluvium	2	4.4	5.30	6.20	2	6.8	6.85	6.90	2	426	432	438	Bore only sampled in August and October 2023 due to no access.
GW08.2	North Wambo Creek Alluvium	3	3.35	3.53	8.20	0	-	-	-	0	-	-	-	Only sampled February, July and October 2023 just for SWL.
GW09.2	North Wambo Creek Alluvium	6	4.52	5.51	6.11	5	6.80	6.9	7.0	5	2190	2260	2380	
GW11	Wambo Creek Alluvium	2	4.62	5.33	6.04	2	6.80	6.85	6.90	2	434	434.5	435	Only 2 samples in August and October 2023 due to access issue.
GW13	Wollombi Brook Alluvium	3	6.34	6.42	6.57	3	7.00	7.1	7.10	3	8810	9350	10070	Only sampled June, August and October 2023.
GW15	Wollombi Brook (east) Alluvium	6	7.44	8.32	8.91	5	6.60	6.7	7.00	5	255	313	336	
GW16	North Wambo Creek Alluvium	6	6.50	7.20	8.48	5	7.00	7.4	7.50	5	686	925	2010	
GW17	North Wambo Creek Alluvium	6	8.83	10.91	11.53	5	7.20	7.3	7.40	5	3140	3640	4560	
GW21	Overburden	Dry												Bore dry.
GW22	Overburden	6	33.72	33.80	33.93	5	8.30	8.3	8.50	5	7030	7130	7400	
P106	Wambo Creek Alluvium	6	6.70	7.53	8.62	5	6.50	6.7	6.80	5	712	7678	8940	
P109	Wambo Creek Alluvium	5	4.85	4.96	5.26	5	6.5	6.6	6.70	5	652	720	6596	Removed from monitoring program December 2023.
P114	Wambo Creek Alluvium	-	-		-	-	-		-	-	-		-	Not monitored.
P116	Wambo Creek Alluvium/ Permian	-	-		-	-	-		-	-	-		-	Not monitored.

Sites	Target Unit	Depth to water (mbTOC)				pH				EC (µS/cm)				Comments
		Obs.	Min	Median	Max	Obs.	Min	Median	Max	Obs.	Min	Median	Max	
P12	Wollombi Brook (east) Alluvium	6	6.79	7.05	7.35	6	6.21	6.51	6.86	6	144.8	149.95	176.4	
P16	Wollombi Brook (west) Alluvium	6	8.07	8.46	8.70	5	7.07	7.2	7.38	5	3710	5710	6160	
P20	Wollombi Brook (west) Alluvium	6	7.59	7.84	8.03	5	7.36	7.54	7.72	5	983	1579	2261	
P202	Overburden	6	7.20	7.44	7.69	5	7.2	7.3	7.3	5	3840	5930	6950	
P206	Overburden	6	27.86	28.71	31.88	5	7.60	8.0	8.10	5	1099	1305	12360	
P301	Stoney Creek Alluvium/ Overburden	6	7.23	10.29	10.56	5	6.3	6.3	6.6	5	1150	1367	1698	
P315	Stony Creek Alluvium/Regolith	6	6.38	6.79	7.30	5	6.0	6.0	6.20	5	1068	1471	1674	
P401	Overburden	6	29.27	29.60	29.84	5	7.07	7.09	7.13	5	7440	7960	8440	
P402	Arrowfield Seam	6	78.31	81.48	84.14	5	7.68	7.72	7.81	5	8250	8790	9350	
P408	Hunter River Alluvium	6	10.56	11.08	11.37	5	7.14	7.19	7.20	5	6240	6890	7690	

Obs.- Number of Observations.

* The current status of this bore is 'Proposed' in the GWMP.

4.3 Trigger Exceedances in 2023

The trigger levels for the water level, EC, and pH are outlined in **Section 3.2**. Details on trigger level and criteria exceedances for water level are included in **Section 4.3.1**, and included in **Section 4.3.2** for water quality. A summary of all trigger exceedances is included in **Section 4.3.3**.

4.3.1 Water Level Exceedances

Readings of water level outside of the trigger levels were recorded in 2023 in the following bores:

- GW02, GW13, GW15, GW22, P16, P202 and P206.

GW02 and P16 recorded only single readings of water level below the trigger level. Five bores recorded three or more consecutive bi-monthly readings outside the trigger levels, indicating a trigger criteria exceedance. Bores GW13 and P206 recorded levels lower than the trigger levels, whilst bores GW15, GW22 and P202 recorded levels higher than the trigger levels.

Bore GW13 and GW15 are located on the eastern side of Wollombi Brook and away from the site activities and outside of the extent of predicted drawdown due to site activities (AGE 2016). The trends for these two bores are unlikely to reflect changes in activities at site.

GW22 is located near Wambo Creek, above the North Wambo Underground workings, while the remaining bores are located near Wollombi Brook. Bore GW22 recorded a rise in groundwater levels in 2022, with stable to slightly declining groundwater levels in 2023. The trends are unlikely to relate to mine activities by United Wambo.

Bore P202 is located near Wollombi Brook and recorded fluctuations in groundwater levels in 2022 with above average rainfall and streamflow, with a gradual decline in levels in 2023 with below average rainfall. The trends in P202 appear to reflect climate and streamflow trends.

Bore P206 intersects the weathered Permian coal measures and is located south of South Wambo Dam and above inactive, historical multi-seam underground mine operations at Wambo. Groundwater elevations are lower than bore P202 that is located downslope near Wollombi Brook. Bore P206 has recorded a decline in groundwater levels since 2022 This is further discussed in **Section 4.4.5**.

4.3.2 Water Quality Exceedances

Readings of pH above the trigger level was recorded in 2023 in the following bores:

- GW13, GW15, GW16, GW17, GW22, P12, P20, P106, P109 and P206.

Out of these, bore GW17, P12 and P106 recorded more than three consecutive bi-monthly readings above trigger level throughout the year whereas bore GW15 recorded trigger value exceedance in February, April and August, then gradually fell within trigger values. All the bores mentioned above recorded pH at or above the trigger range for pH, indicating neutral to alkaline pH that likely reflects recharge over the period.

Bore GW17 in North Wambo Creek alluvium recorded pH at or above the trigger range for pH of 7.2, with the field readings indicating neutral to slightly alkaline pH of 7.2 to 7.4 over the reporting period. The pH appears consistent with historical trends and review of the trigger levels is recommended. Bore GW15 is located on the eastern bank of Wollombi Brook and water quality changes are unlikely to reflect influence

from site. Bore P12 in Wollombi Brook (East) recorded pH below the trigger value range for pH of 7.3 with the field reading indicating slightly acidic to neutral pH of 6.2 to 6.9 over the reporting period.

Readings of EC outside the trigger range was observed in the following bores:

- GW13, GW16, GW22, P106, P109 and P206.

Of these only bores GW13, GW22 and P106 recorded three or more consecutive bi-monthly exceedances of trigger for EC. For the rest of the bores, they only recorded 1 or 2 exceedances of the EC trigger values.

The rise in EC at GW13 may relate to the bore condition, as the area was inaccessible due to flooding in 2022. In contrast, downstream bore GW15 recorded a low EC over the same period.

GW22 has recorded a general rise in EC since monitoring commenced in 2011, fluctuating between 6,110 $\mu\text{S}/\text{cm}$ (June 2013) and 7,440 $\mu\text{S}/\text{cm}$ (June 2023). The bore is located above Wambo underground workings and the trends are unlikely to relate to United Wambo activities.

P106 targets the Wambo Creek alluvium and is located south of South Wambo Dam and above inactive, historical multi-seam underground mine operations at Wambo. The site recorded a spike in EC in 2023, with a similar spike also recorded at bore P109. The cause for the short-term spikes in EC is unclear and further review of site activities in this area at the time is required.

4.3.3 Exceedance Summary

A summary of the bores that recorded values above the trigger levels and the number of readings at or above the trigger level is included in **Table 4-2**.

Table 4-2 Trigger Exceedances in 2022 and 2023

Site	Target Unit	Depth to Water (mbTOC)		pH		EC ($\mu\text{S}/\text{cm}$)	
		No. of Obs	No. of Exceedances	No. of Obs	No. of Exceedances	No. of Obs	No. of Exceedances
GW02	Upper South Wambo	2(8)	1(-)	2(8)	- (1)	2(8)	-
GW13	Wollombi Brook Alluvium	3 (inaccessible in 2022)	3(-)	4(-)	2(-)	4(-)	3(-)
GW15	Wollombi Brook (east) Alluvium	6(8)	6(8)	6(8)	3(4)	6(8)	-
GW16	North Wambo Creek Alluvium/regolith	5(11)	0(6)	5(11)	1(4)	5(11)	1(-)
GW17	North Wambo Creek Alluvium/regolith	5(11)	0(6)	5(11)	5(11)	5(11)	-
GW22	Overburden	6(12)	6(12)	6(12)	3(8)	6(12)	6(8)

Site	Target Unit	Depth to Water (mbTOC)		pH		EC (µS/cm)	
		No. of Obs	No. of Exceedances	No. of Obs	No. of Exceedances	No. of Obs	No. of Exceedances
P12	Wollombi Brook (east) Alluvium	6(11)	0(4)	6(11)	6(10)	6(11)	-
P16	Wollombi Brook (west) Alluvium	5(10)	1(3)	5(10)	0(1)	5(10)	-
P20	Wollombi Brook (west) Alluvium	5(10)	0(4)	5(11)	1(3)	5(11)	-
P106	Wambo Creek Alluvium	6(12)	0(6)	6(12)	5(9)	6(12)	5(6)
P109	Wambo Creek Alluvium	5(11)	0(2)	5(11)	2(3)	5(11)	-(2)
P202**	Overburden	6(11)	4(9)	5(11)	-	5(11)	-
P206	Overburden	6(12)	6(10)	6(12)	2(3)	6(12)	1(-)

Note: () indicates number of consecutive exceedances in 2022, excluding non-consecutive readings

Two consecutive readings.

Three or more consecutive readings over 2023.

4.4 Groundwater Trends and Trigger Exceedances

As discussed in **Section 2.1**, the area experienced above-average rainfall over 2022 followed by generally below average rainfall in 2023.

A review of the groundwater data and trigger exceedances, with consideration of the climatic conditions and site activities, was undertaken and is presented for the main groundwater units in **Section 4.4.1** to **Section 4.4.5**.

4.4.1 North Wambo Creek Alluvium

The North Wambo Creek alluvium is currently monitored by multiple groundwater bores at United Wambo. A hydrograph showing long-term groundwater levels are shown in **Figure 4-1**, trends in pH in **Figure 4-2** and trends in EC shown in **Figure 4-3**.

Bores GW08.2 and GW09.2 were drilled in 2020 to replace bores GW08 and GW09, that were too shallow to intersect the saturated alluvium. The two bores are not currently included in the GWMP but are monitored by Wambo. The GWMP for United Wambo also includes two bores within the upper reach of North Wambo Creek, bores GW16 and GW17 that intersect alluvium and weathered Permian coal measures near Montrose Pit and the North Wambo Creek Diversion (NWCD). Bore GW16 intersects around 7 m of silty, clayey sand overlying extremely weathered sandstone, while GW17 is constructed within highly weathered sandstone overlying siltstone, with only 2 m of alluvium present at surface.

Within the North Wambo Creek alluvium, upstream of the NWCD, groundwater levels are 6.5 to 8.48 m below surface at GW16, and 8.8 to 11.6 m below surface at GW17 over 2023. Both bores recorded a gradual decline in groundwater levels over 2023, corresponding with a period of below average rainfall. The

trends between the bores are similar, with slightly higher groundwater elevations at upgradient bore GW16. Over 2023 pH remained relatively stable, with a near-neutral pH of around 6.8 to 7.5 for all bores. Over 2023 EC increased in both bores in the first half of the year and declined at GW16 in August 2023. The change in EC appears to correspond with the decline in groundwater levels.

Bores GW08.2 and GW09.2 are located down-gradient of the NWCD, near the confluence of Wollombi Brook. Bore GW08.2 is shallow with screen down to around 3 m depth, and over 2023 the bore was recorded as dry. Bore GW09.2 is 7.4 m deep and recorded the presence of water in the alluvium between 4.52 m and 6.11 m and EC remained relatively stable to slightly declining over the reporting period.

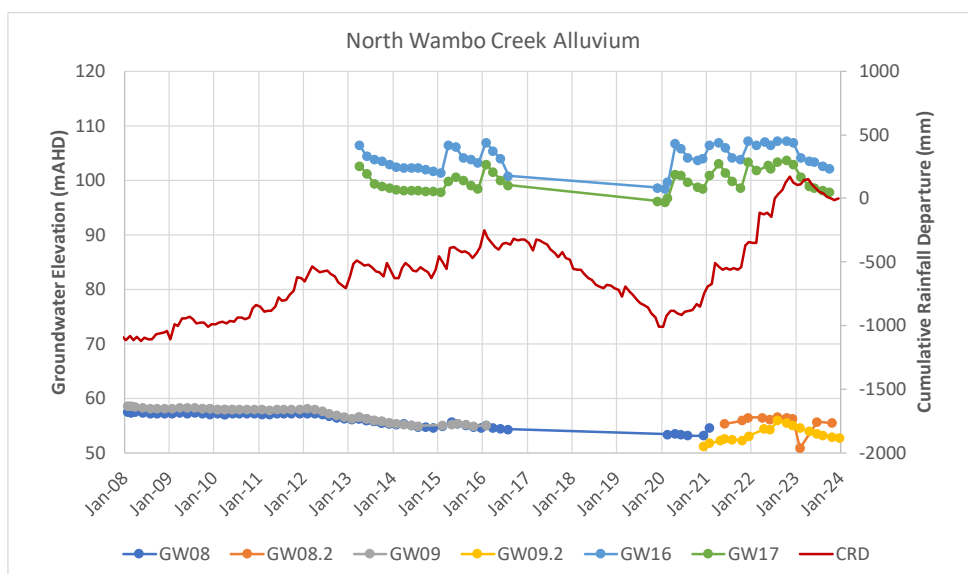


Figure 4-1 North Wambo Creek Alluvium – Hydrograph

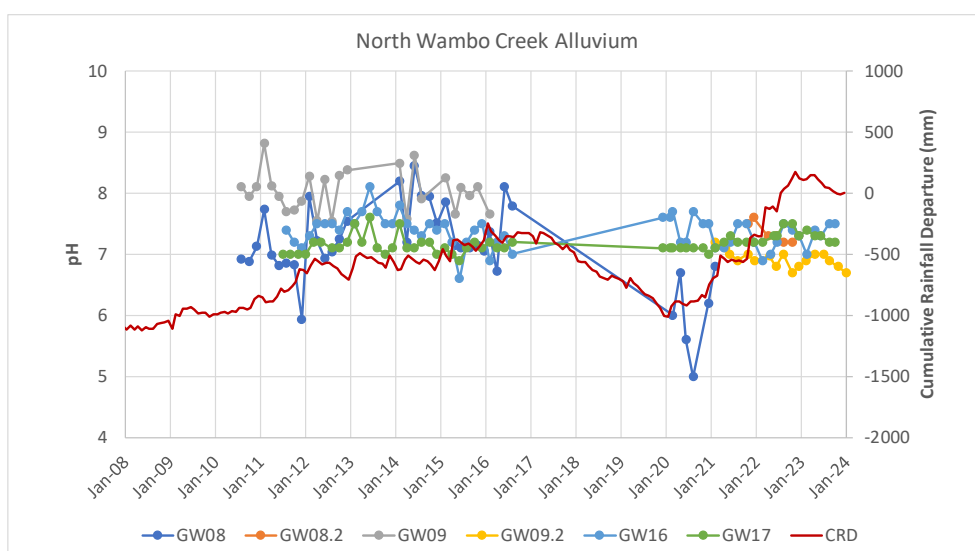


Figure 4-2 North Wambo Creek Alluvium – pH

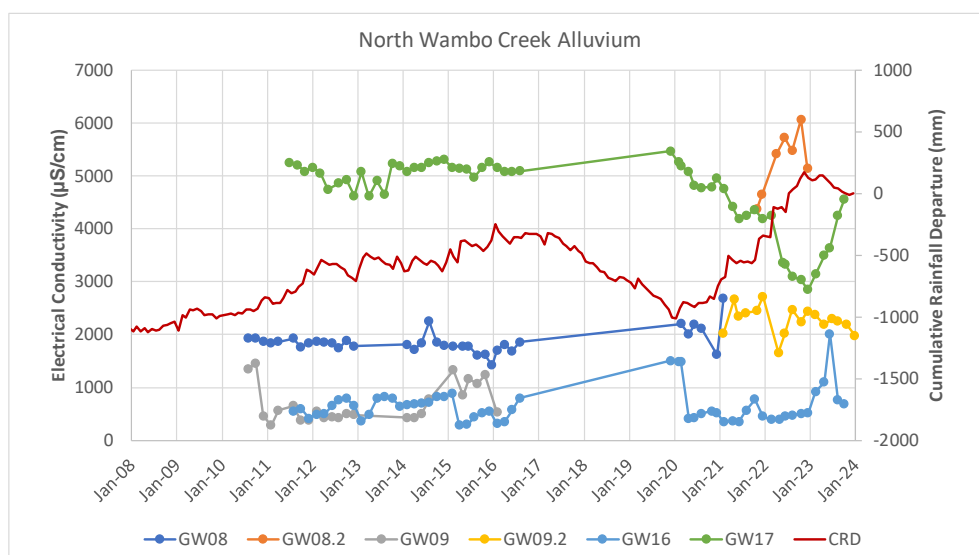


Figure 4-3 North Wambo Creek Alluvium – EC

4.4.2 Wambo Creek Alluvium

Groundwater monitoring points for the Wambo Creek alluvium include GW02 and GW11 constructed as wells within the upper reach at the Fenwick property. As well as bores P106, P109, P114 and P116 located in the lower reach above the NWU. Bores P114 and P116 are located further from the creek line, immediately south-east of South Wambo Dam. No data was available for P114 or P116 over the reporting period.

A hydrograph showing long-term groundwater levels are shown in Figure 4-4, trends in pH in Figure 4-5 and trends in EC shown in **Figure 4-6**.

In 2023, groundwater levels in the alluvium were between 4.4 m and 8.6 m below surface. Bores GW02 and GW11 were only recorded in August and October due to access issues. EC at upgradient sites GW02 and GW11 were recorded around 426 $\mu\text{S}/\text{cm}$ to 438 $\mu\text{S}/\text{cm}$ over 2023.

Bore P109 recorded a slight decline in groundwater levels over 2023, corresponding with below average rainfall. In February and March, the EC in P109 spiked at 6,596 $\mu\text{S}/\text{cm}$, but by April 2023 concentrations were returned back to 652 $\mu\text{S}/\text{cm}$. A similar spike in EC was also recorded in April 2023 at bore P206 that targets the Permian coal measures. The cause for the short-term spikes in EC is unclear and further review of site activities in this area at the time and sampling methodology is required.

P106 targets the Wambo Creek alluvium and is located south of South Wambo Dam and above the inactive, historical multi-seam underground mine operations at Wambo. Groundwater elevations and trends at P106 are similar to bore P202, which is located downslope near Wollombi Brook. Both bores recorded a decline in groundwater levels since 2022, which corresponds with a rise in EC. This may reflect construction of the bores across alluvium and shallow Permian coal measures, with reduced contribution from alluvial groundwater and increased proportion of groundwater from the coal measures resulting in a higher EC. It is understood that new bores (GW37a and GW37b) were installed in late 2023 and are proposed by site as replacement bores for P106 and P202. These should be further considered as part of future updates to the GWMP.

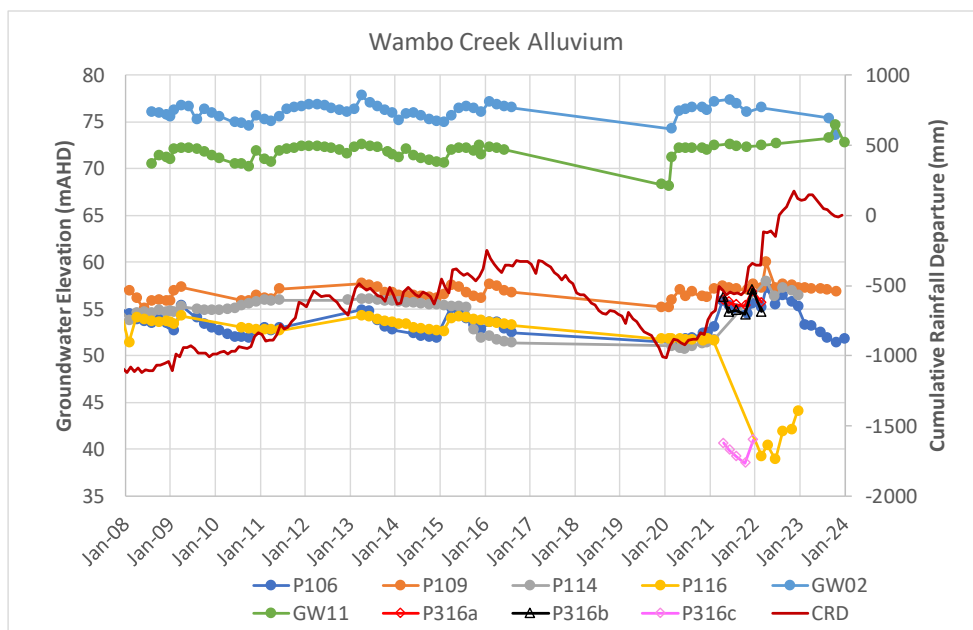


Figure 4-4 Wambo Creek Alluvium – Hydrograph

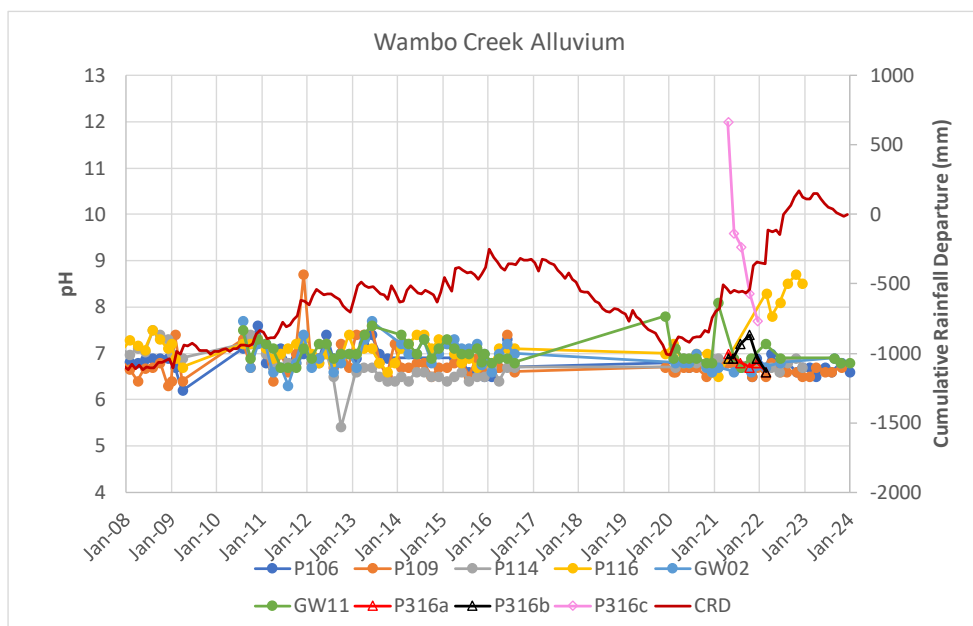


Figure 4-5 Wambo Creek Alluvium – pH

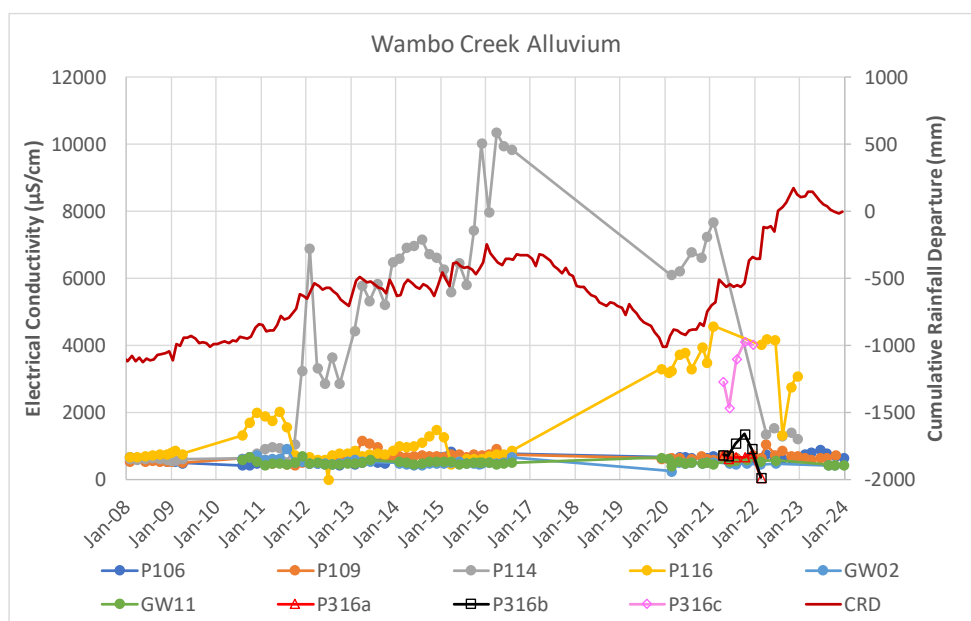


Figure 4-6 Wambo Creek Alluvium - EC

4.4.3 Wollombi Brook Alluvium

The monitoring bores that are screened in the Wollombi Brook alluvium are GW13, GW15, P12, P20 and P301. Bore BH1 intersects the Tertiary alluvium and bores P15 and P16 intersect colluvial sediments between the mean area and mapped GDEs (refer **Section 3.3**). Bores GW13, GW14, GW15 and P12 are located in the eastern side of Wollombi Brook, whereas BH1, P15, P16 and P20 are located on the western side. Bore P301 is also located along the confluence of Wambo Creek and Wollombi Brook. It is understood that bore logs for GW13 indicate it may be constructed in Permian coal measures on the eastern side of Wollombi Brook. Further review of the purpose of the bore should be undertaken and applied to the GWMP.

A hydrograph showing long-term groundwater levels are shown in Figure 4-7, trends in pH in Figure 4-8 and trends in EC shown in Figure 4-9.

Groundwater levels in the alluvium generally declined over the reporting period, corresponding with below average rainfall and reduced streamflow. Over 2023 pH ranged between 6.3 to 7.36. EC trends varied between bores, with GW13, P15 and P16 recording a rise in EC over 2022, with a slight decline in 2023. Bore GW13 is located upgradient of site and on the eastern bank of Wollombi Brook, so trends are unlikely to reflect impacts due to operations at United Wambo.

Bores P15 and P16 are located above the United Colliery underground, east of the Glen Munro Boxcut and south-east of Sediment Dam 3. Both bores recorded a general rise in groundwater levels in 2022, followed by a slight decline in groundwater levels over 2023. Bore P16 and P15 have historically had higher EC of around 10,000 µS/cm, similar to what is recorded in the coal measures at nearby bores P401 and P402 (refer **Figure 4-10**).

As shown in **Figure 4-11**, the groundwater within the underlying Permian coal measures is depressurised with mining, indicating the high salinity is unlikely to be due to upward seepage from the Permian coal measures. The groundwater level logger data in **Figure 4-12** indicates a minor fluctuation in daily

groundwater levels in early March 2023, which corresponds to a rise in Wollombi Brook river levels, indicating recharge from surface water to the surrounding alluvium at P12 and P16. Logger data was provided for BH1 and is shown in **Figure 4-12**; however, the bore was noted as dry over the reporting period therefore the levels reflect dry conditions.

It is also noted that the logger elevations for P16 appear to correspond more closely to elevations at P15. The logger levels should be checked and field verified in future.

As reported by Umwelt (2022 Annual Groundwater Review), elevated sulphate concentrations have been recorded at the bores over time. In 2023 the concentrations reduced slightly to 361 mg/L for P16 and 762 mg/L for P15 (refer **Figure 4-13**). The water quality results may indicate influence of sediment in the bore or potential influence from mine affected water in the area. Further investigation is recommended.

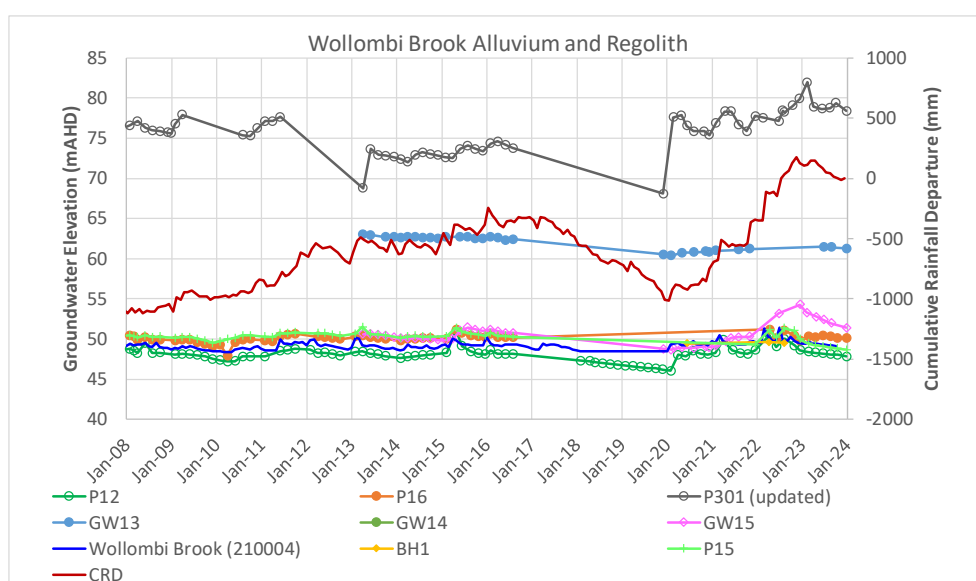


Figure 4-7 Wollombi Brook Alluvium – Hydrograph

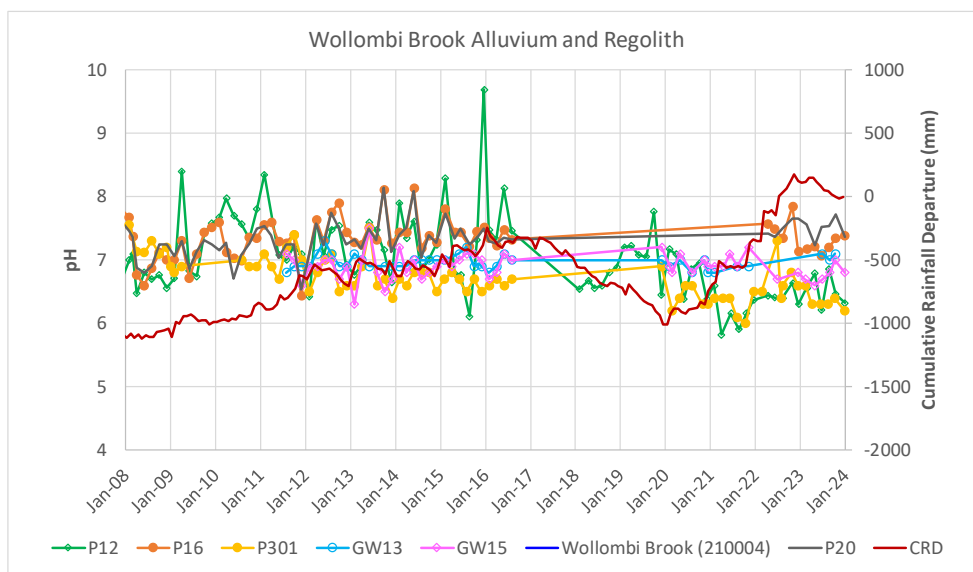


Figure 4-8 Wollombi Brook Alluvium – pH

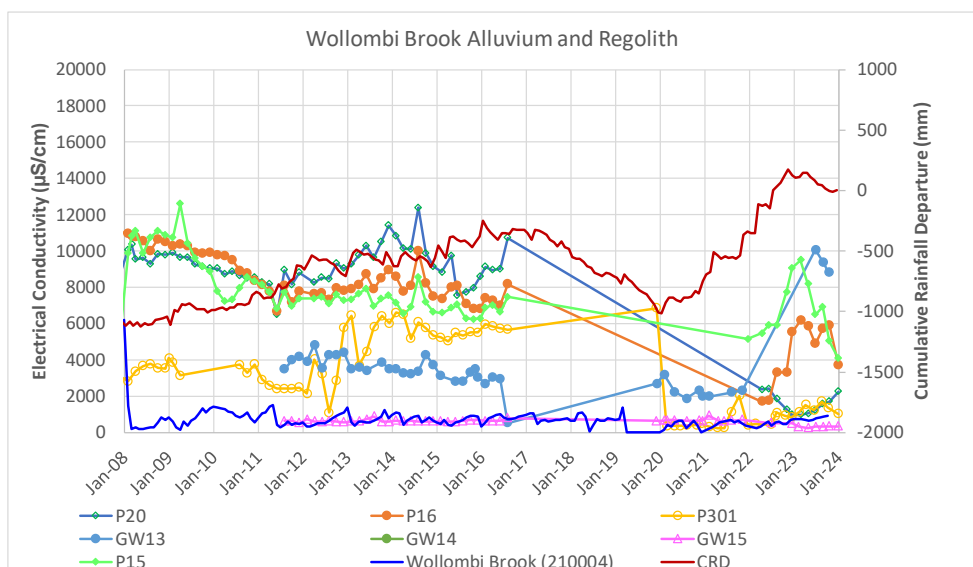


Figure 4-9 Wollombi Brook Alluvium – EC

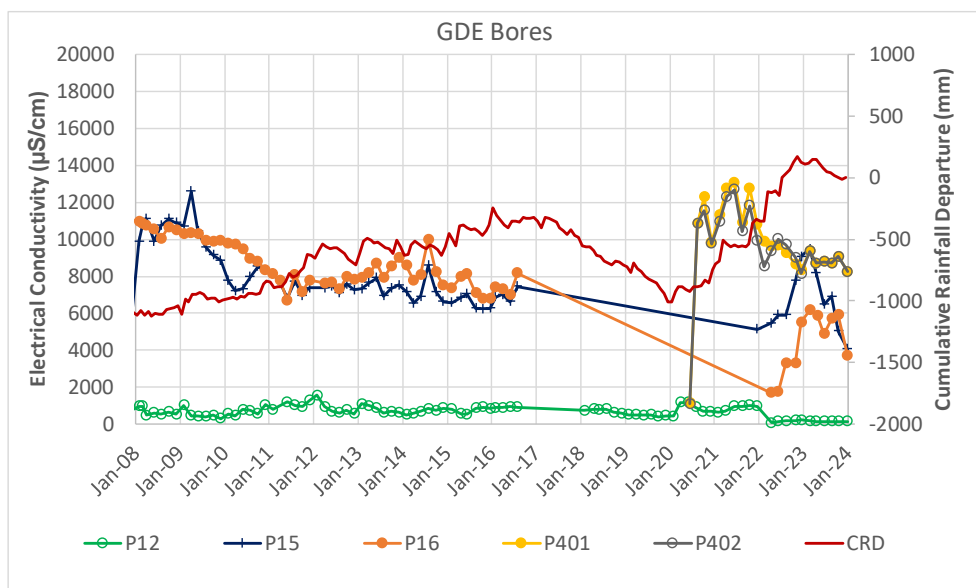


Figure 4-10 Groundwater Dependent Ecosystem bores – EC

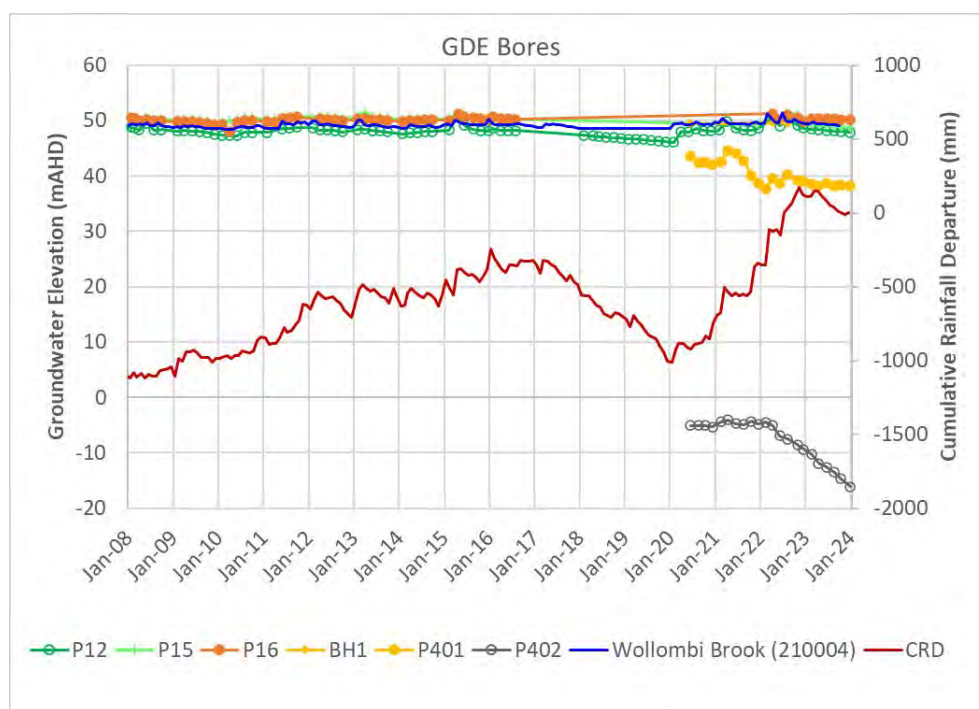


Figure 4-11 Groundwater Dependent Ecosystem bores – Hydrograph

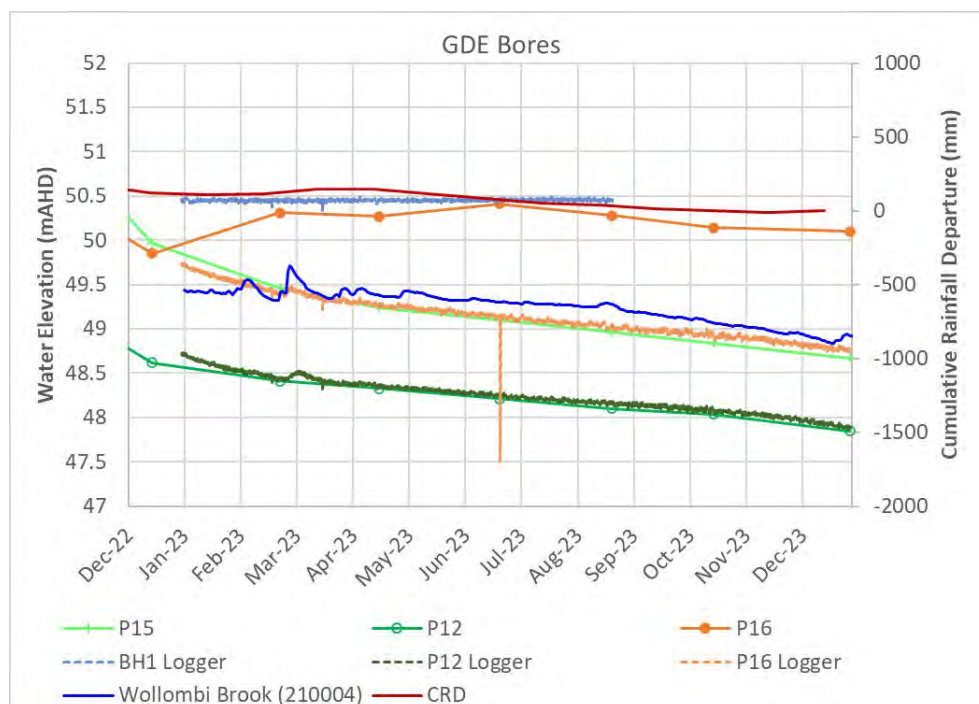


Figure 4-12 Groundwater Dependent Ecosystem bores – Hydrograph with Daily Levels

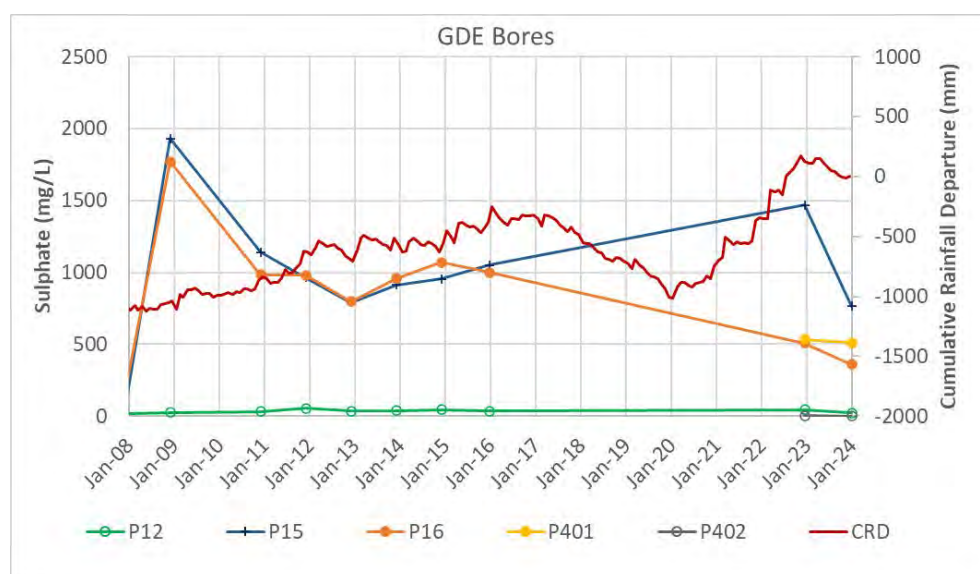


Figure 4-13 Groundwater Dependent Ecosystem bores – Sulphate

4.4.4 Stony Creek Alluvium

Stony Creek flows in the south-easterly direction and is located to the south-west of United Wambo. The Stony Creek alluvium is monitored by bores GW12 and P315. GW12 was recorded dry from 2019 to 2021, and monitoring ceased in 2021 (*United Wambo Open Cut and Wambo Water Monitoring Program*) due to confirmation of screening in shallow/weathered Permian strata, but is still noted in the GWMP. It is recommended the GWMP be updated to align. Supplementary data was collected at bore P315 at bi-monthly intervals throughout the year.

A hydrograph showing long-term groundwater levels are shown in Figure 4-14, trends in pH in Figure 4-15 and trends in EC shown in Figure 4-16. The water level at P315 show fluctuation in response to rainfall events. This may relate to the upslope location and flow gradient in the alluvium, but also potentially associated with subsidence impacts from NWU. The pH at P315 has been stable throughout 2023. The EC at P315 increased slightly over 2023, from 1,068 $\mu\text{S}/\text{cm}$ in February to 1,674 $\mu\text{S}/\text{cm}$ in October 2023.

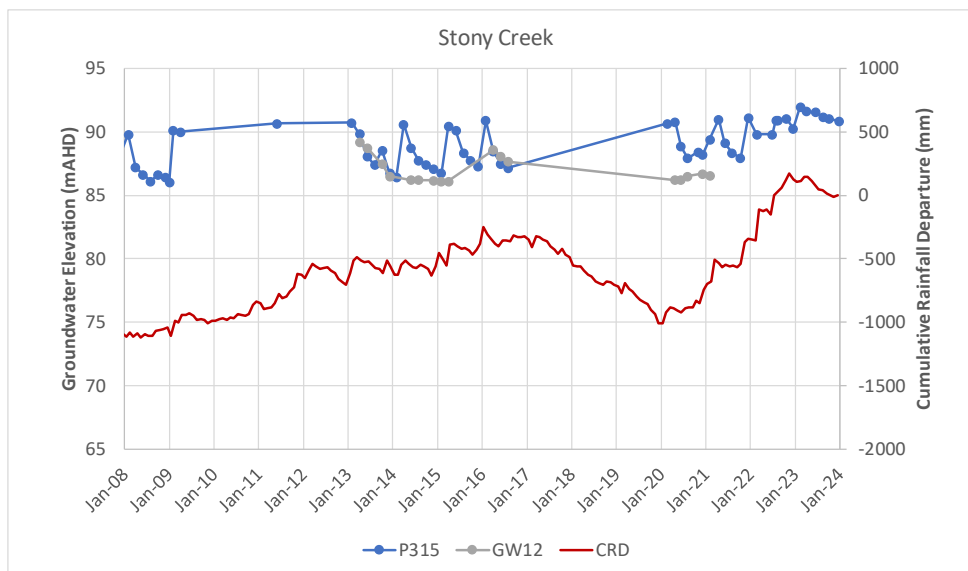


Figure 4-14 Stony Creek – Hydrograph

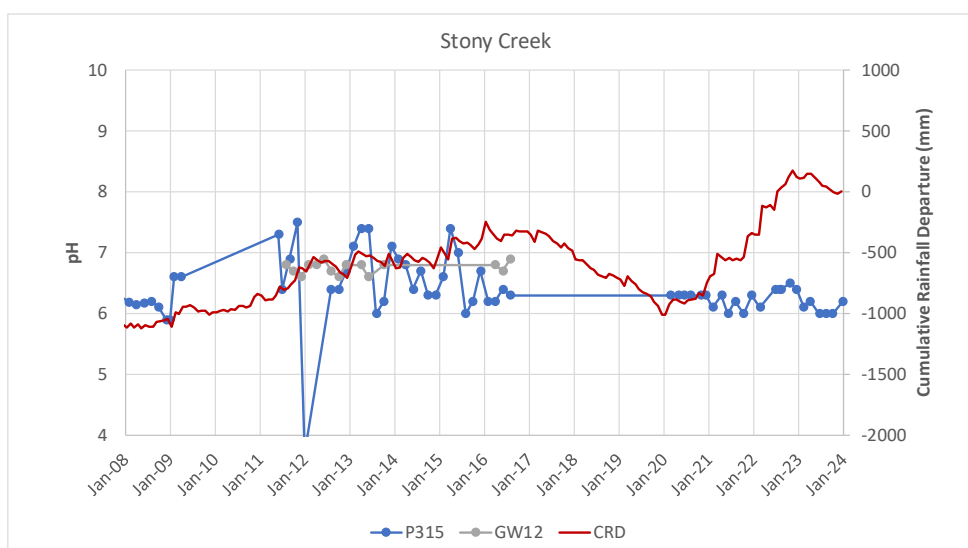


Figure 4-15 Stony Creek – pH

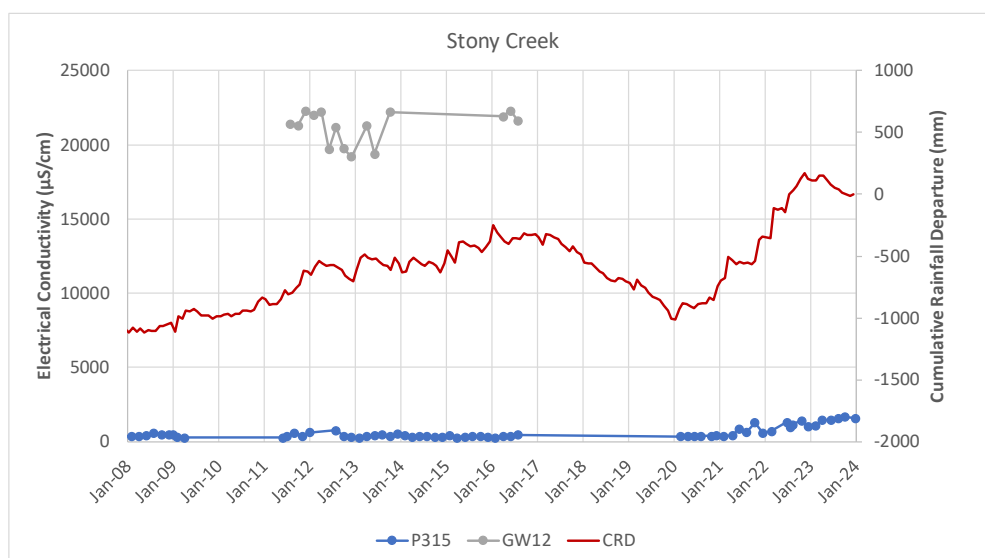


Figure 4-16 Stony Creek – EC

4.4.5 Permian Coal Measures - Bores

As per the GWMP, the monitoring bores at United Wambo are measuring interburden/overburden units at Blakefield Seam and Whybrow Seam. Both these units are discussed in this section.

The Whybrow Seam interburden/overburden is currently monitored by GW22, P202, P206 and P401. Groundwater levels in the Arrowfield Seam at around 120 m depth are monitored in bore P402. The interburden/overburden in Blakefield Seam at United Wambo has previously been monitored at P1 and P11; however, these sites have since been mined out.

A hydrograph showing long-term groundwater levels are shown in Figure 4-17, trends in pH in Figure 4-18 and trends in EC shown in Figure 4-19.

Bores P202 and P206 intersect the shallow Permian coal measures to the south of South Wambo Dam and above inactive multi-seam underground mine operates at Wambo. Over 2023 groundwater levels at P202 declined slightly, which appears to reflect climate and streamflow trends. Groundwater elevations at P202 are higher than upslope bore P206, which recorded a more rapid decline in groundwater levels and a sustained decline since 2021 despite above average rainfall in 2022. The decline in groundwater levels may reflect nearby site activities.

In contrast groundwater levels in the shallow overburden further south of site at GW22 gradually increased over 2023. This likely reflects recovery in the coal measures above the historical underground workings at Wambo.

Figure 4-17 shows depressurisation in the Arrowfield Seam (P402), and to a lesser extent within the overburden around 40 m below surface at P401. Bores P401 and P402 are located east of United Open Cut and reflect depressurisation with progression of mining in the area, consistent with predicted impacts.

Figure 4-18 shows pH ranged between 7.07 and 8.5 over the reporting period. **Figure 4-19** shows EC is highest in P206 of around 12,360 µS/cm recorded in April 2023, but levels rapidly declined back to 1,099

$\mu\text{S}/\text{cm}$ in June 2023. A similar spike in EC was recorded at Wambo Creek alluvium bores P106 and P109. The cause for the short-term spikes in EC is unclear and further review of site activities in this area at the time and sampling methodology is required.

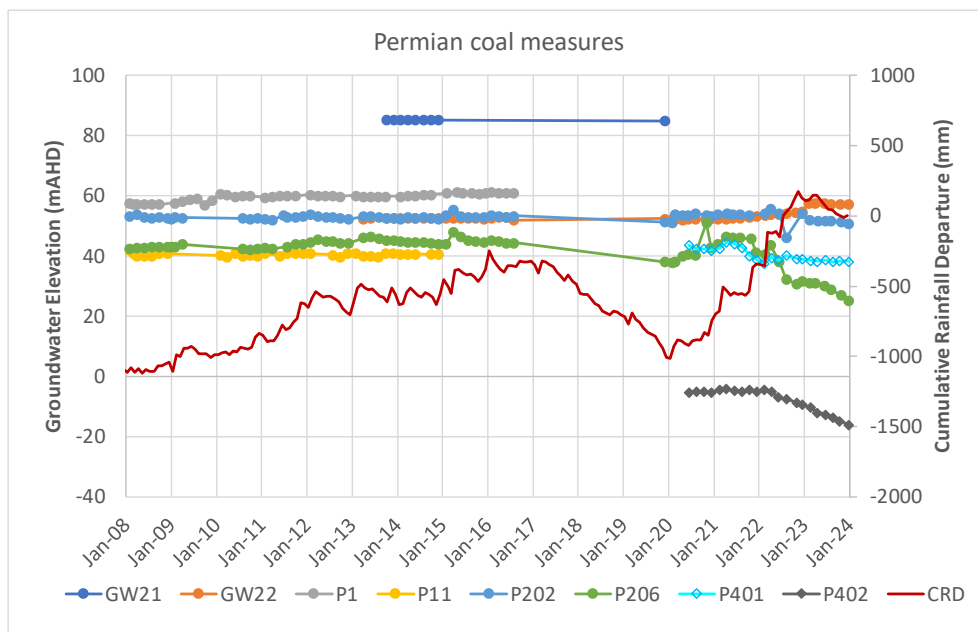


Figure 4-17 Permian Coal Measures – Hydrograph

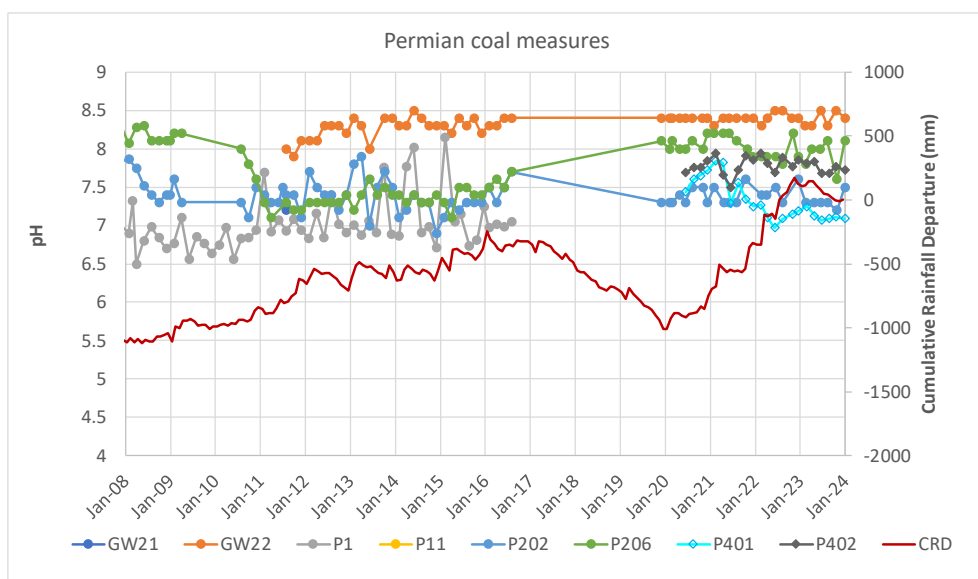


Figure 4-18 Permian Coal Measures - pH

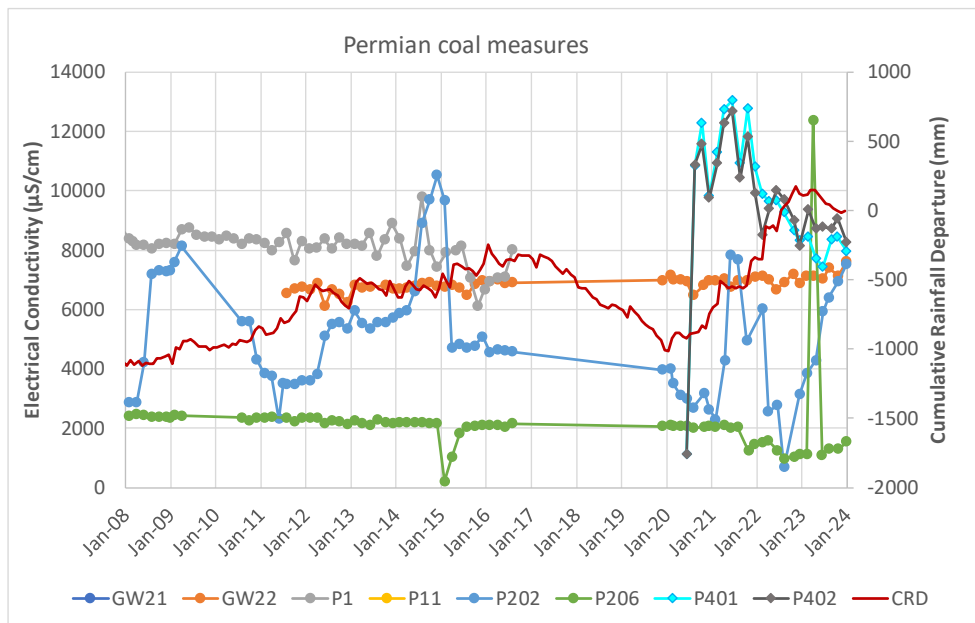


Figure 4-19 Permian Coal Measures - EC

5.0 Groundwater Take

As outlined in **Section 1.2**, the approved site activities include the direct interception of groundwater from the Permian coal measures, as well as direct and indirect interception of groundwater from alluvium. The alluvium associated with Wollombi Brook and its tributaries falls under the Hunter Unregulated and Alluvial Water Source Water Sharing Plan, the Hunter River alluvium is within the Hunter Regulated Water Sharing Plan (for highly connected alluvium) and groundwater in the Permian is under the North Coast Fractured and Porous Rock Groundwater Source.

An updated numerical groundwater model was developed by SLR (2022.) SLR (2024) provided predicted take due to United Wambo operations only based on the SLR (2022) model. As reported by SLR (2024) an estimated 670 ML/year of take from the North Coast Fractured and Porous Rock Groundwater Source, and no predicted indirect take from alluvium.

Table 5-1 presents the relevant water sources and predicted take for the 2023 reporting period for the Wambo Complex, i.e. United Wambo Open Cut and Wambo Underground.

Table 5-1 Predicted Groundwater Take

Water Source	Licensed Entitlement (ML/year)	Groundwater Model Predicted Take for 2023 (ML/year)
Hunter Regulated water sharing plan	-	0
Hunter Unregulated and Alluvial Water Source	736.9	0
North Coast Fractured and Porous Rock Groundwater Source	1,947	670

6.0 Conclusions and Recommendations

This report outlines the findings of the annual review of the groundwater monitoring results at United Wambo collected from 1 January 2023 to 31 December 2023 and has been prepared in accordance with the reporting requirements outlined in the GWMP.

Over the reporting period mining was progressed within Montrose Pit and United Pit. Tailings was also stored in Homestead Inpit TSF over the reporting period. Mine water was stored in the United Wambo Open Cut storages U2, U3, dam 2, Roses Pit Drain 9 and open cut voids at Montrose and United. Mine water was transferred around the Wambo Complex throughout the year, i.e. between United Wambo and Wambo Underground. Works by Wambo Underground commenced to recommission South Wambo Dam, which included excavation and installation of the liner from March 2023.

Groundwater monitoring was generally conducted in accordance with the current GWMP. It is noted that some bores were not monitored over the reporting period, which relates to prior recommendations to update the GWMP that have not as yet been finalised. Bores P404, P405 and P407 have also not yet been installed and therefore not yet monitored. Graphs of VWP data are provided in **Appendix B**.

Groundwater trigger exceedances were recorded for several bores over the reporting period. This includes five bores that recorded declining groundwater at bores GW13, GW15, GW22, P202 and P206. Bores GW15 and GW17 recorded exceedances for three or more consecutive pH readings above the trigger level, and bores GW13, GW22 and P106 recorded three or more consecutive EC readings above the trigger level.

Bores GW13, GW15 and GW22 are located distant from the site and trends in the bores likely reflect natural conditions and influence from neighbouring site activities located closer to the bores. It is recommended that the purpose of the bores and triggers be reviewed.

Bore GW17 recorded pH at or above the trigger range for pH of 7.2, with the field readings indicating neutral to slightly alkaline pH of 7.2 to 7.4 over the reporting period. The pH appears consistent with historical trends and review of the trigger levels is recommended.

Section 4.3 provides information on the revised trigger levels submitted for approval in the *UWJV Ground Water Management Plan* version 7 draft, currently pending approval. The purpose of bores in the monitoring network for United Wambo Open Cut will be reviewed for the 2024 management plan update. Bores P202 and P206 intersect the shallow Permian coal measures to the south of South Wambo Dam and above inactive multi-seam underground mine operates at Wambo. Over 2023 groundwater levels at P202 declined slightly, which appears to reflect climate and streamflow trends. Bore P202 recorded a more rapid decline in groundwater levels, and a sustained decline since 2021 despite above average rainfall in 2022. The decline may reflect nearby site activities. It is also noted that Wambo Creek alluvium bores P106 and P109, plus shallow Permian bore P206 recorded a spike in EC in early 2023. Further investigation is recommended.

Monitoring has commenced for the GDE monitoring sites to the east of site, between United Pit and Glen Munro Boxcut and Wollombi Brook. Groundwater levels for deep bore P402 shows depressurisation of the Arrowfield Seam with active mining in the area. The shallow bores P12, P15, P16 and BH1 recorded a slight decline in groundwater levels; however, the trends appear to more closely correlate to climatic and streamflow than depressurisation from mining. The groundwater level data also shows a gradient from BH1

towards the east, indicating potential for a gradient of flow from the mine area through the colluvium to the east towards Wollombi Brook. Sulphate concentrations increased at bores in this area in 2022, but declined slightly in 2023, with a concentration of 361 mg/L for P16 and 762 mg/L for P15. The high sulphate may relate to influence of sediment in the bore or potential influence from mine affected water in the area. Further investigation of trends in the area is recommended, as well as review of the logger data against manual dipped levels is recommended for BH1 and P16.

The numerical groundwater model and predictions for site were reported on by AGE (2016). An updated numerical groundwater model was developed in 2022 that captures the operations at United Wambo and reported by SLR (2022) for the neighbouring Wambo Mine Modification 19. SLR (2024) presents predicted take for United Wambo operations for the reporting period. The report does not provide any details on the modelling conducted, further review of the updated model for United Wambo and representation of predicted impacts for approved site activities is recommended to address the model review requirements.

7.0 References

Australasian Groundwater and Environmental Consultants (2016). Groundwater Impact Assessment. Report on United Wambo Open-Cut Coal Mine Project. Prepared for Umwelt Australia Pty Ltd in July 2016.

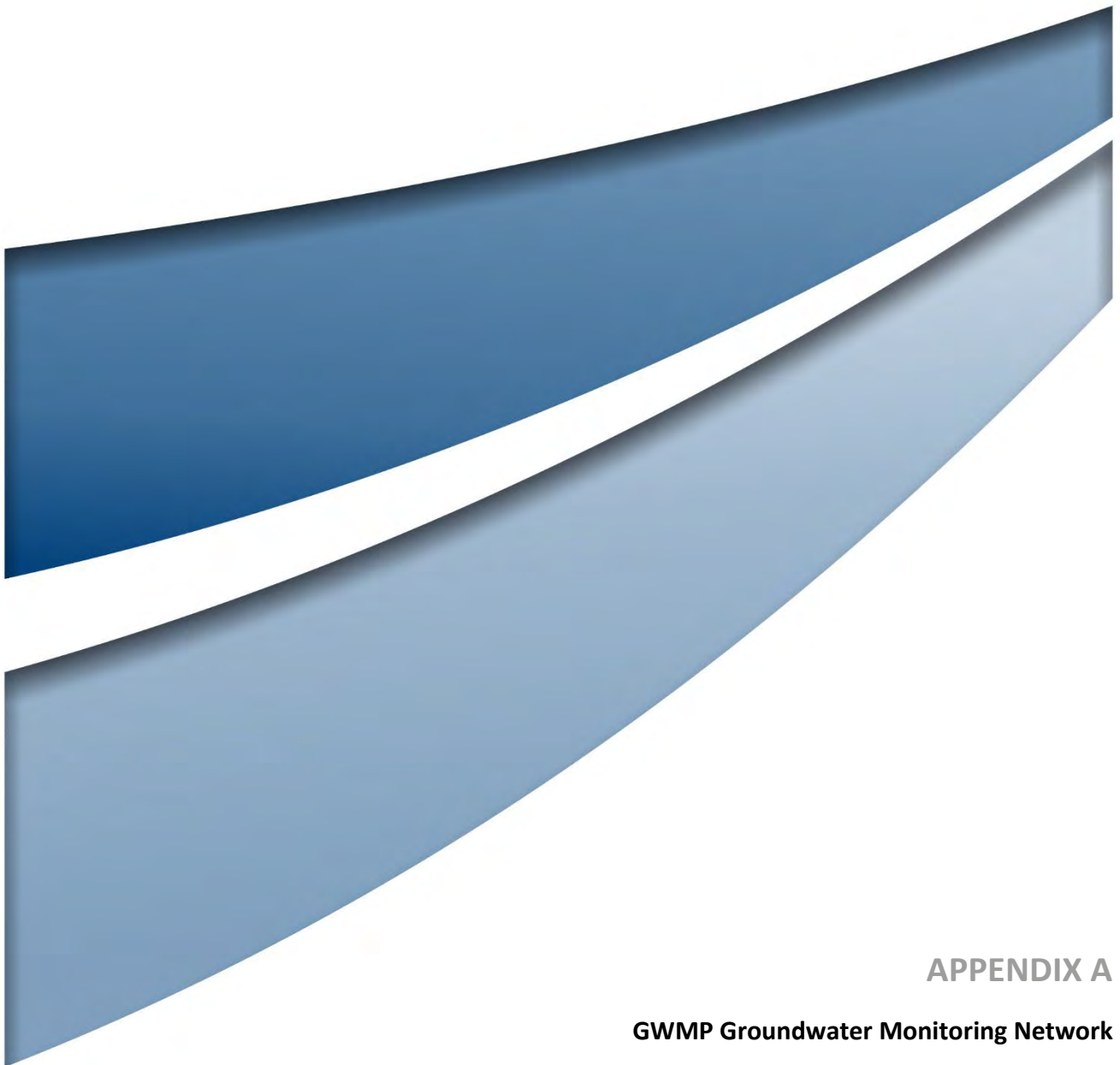
Peabody (2020). Wambo Groundwater Management Plan. Document No. WA-ENV-MNP-509.1 version 2. Prepared by WCPL in November 2020.

SLR (2022) Wambo Coal Mine Longwalls 24-26 Modification, Groundwater Modelling Technical Report, prepared for Wambo Coal Pty Ltd, July 2022.

StygoEcologia (2022) United Wambo Open Cut Coal Mine Project Stygofauna Assessment 4, September 2022.

Umwelt (2021) United Wambo Groundwater Dependent Ecosystem Study. Report 21033/R01, January 2021.

Umwelt (2022) United Wambo Annual Groundwater Review. Report 21033/R02, March 2022.



APPENDIX A

GWMP Groundwater Monitoring Network

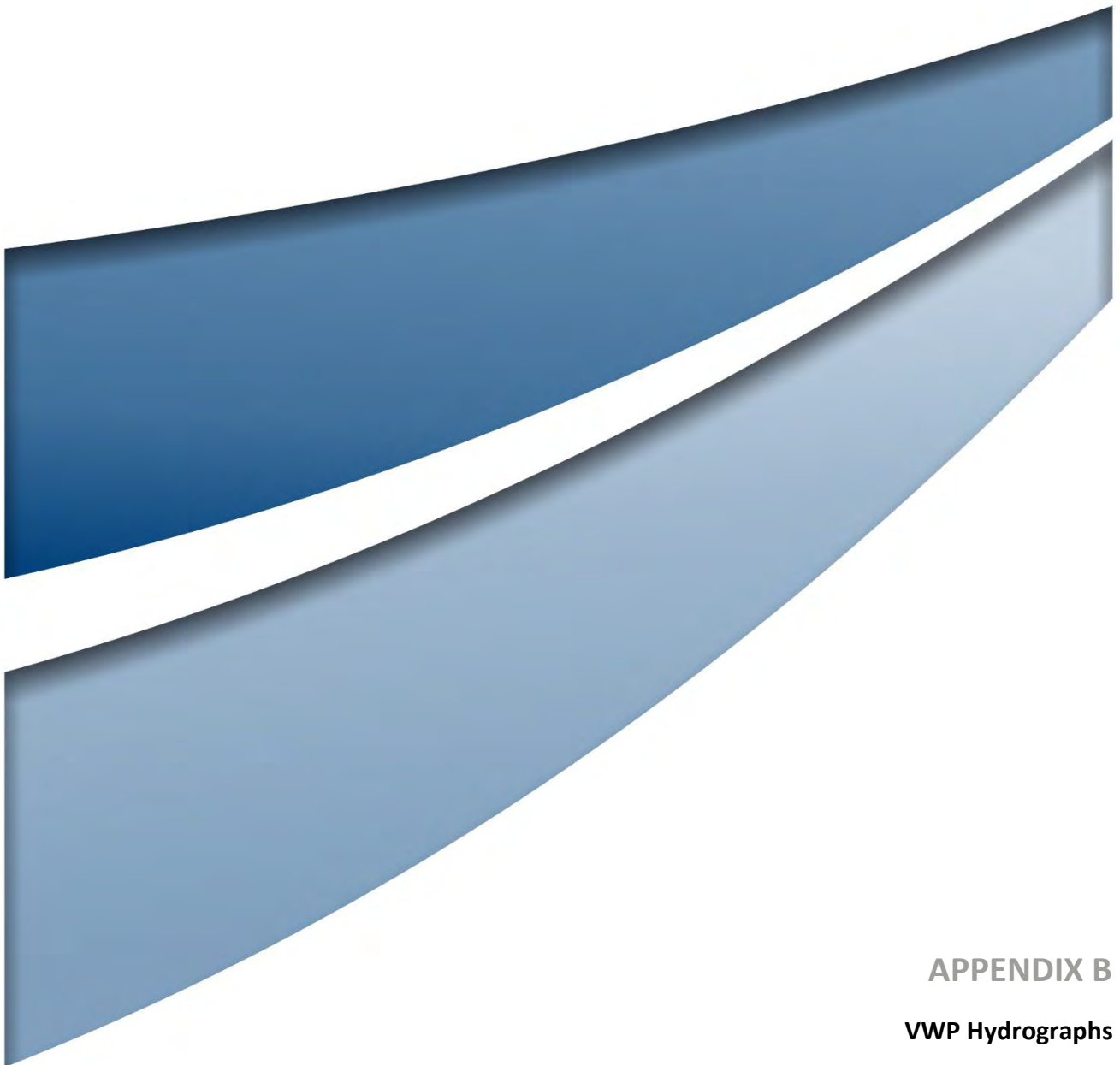
ID	Bore type	Current status	Easting	Northing	Surface (mAHD)	Bore depth (mbgl)	Targeted unit	Monitoring program
GW02	MB	A	309109	6389680	80	-	Wambo Creek Alluvium	SWL and WQ - 2m – full suite
GW08	MB	A	311793	6392266	61	6.3	North Wambo Creek Alluvium	SWL and WQ - 2m – full suite
GW09	MB	A	311643	6392563	62	6.2	North Wambo Creek Alluvium	SWL and WQ - 2m – full suite
GW11	MB	A	309228	6389699	79	-	Wambo Creek Alluvium	SWL and WQ - 2m – full suite
GW12	MB	B	309841	6391056	99	12.1	Stony Creek Alluvium/Whybrow Interburden	SWL and WQ - 2m – full suite
GW13	MB	A	313810	6388990	68	15	Wollombi Brook Alluvium	SWL and WQ - 2m – full suite
GW14	MB	B	312478	6391358	65	18	Regolith	SWL
GW15	MB	A	313164	6392807	61	17.4	Wollombi Brook (east) Alluvium	SWL and WQ - 2m – full suite
GW16	MB	A	306641	6396034	111	12.15	North Wambo Creek Alluvium/Regolith	SWL and WQ - 2m – full suite
GW17	MB	A	306895	6396048	110	14	North Wambo Creek Alluvium/Regolith	SWL and WQ - 2m – full suite
GW21	MB	A	308647	6393378	119	36	Overburden	SWL and WQ - 2m – full suite
GW22	MB	A	311335	6389535	91	54	Overburden	SWL and WQ - 2m – full suite
P1 [†]	MB	A	312199	6395840	86	37	Interburden	SWL and WQ - 2m – full suite
P11	MB	A	312728	6395462	72	31	Interburden	SWL and WQ - 2m – full suite
P12	MB	EX	313644	6394797	55	15	Wollombi Brook (east) Alluvium	SWL and WQ - 2m – full suite
P16	MB	A	313480	6394655	58	11.5	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite
P20	MB	A	313639	6394166	57	10.6	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite
P33	VWP	EX	313757	6394659	57	13	Unnamed C Seam	SWL
						19	Unnamed D Seam	
						46.5	Unnamed E Seam	
						58	Blakefield Seam	
						113	Arrowfield Seam	
P34	VWP	EX	313757	6393961	59	35	Glen Munro Seam	SWL
						68.5	Blakefield Seam	
						144	Bowfield Seam	
P35	VWP	EX	313611	6395196	59	16	Interburden	SWL
						19	Interburden	
						51	Blakefield Seam	

ID	Bore type	Current status	Easting	Northing	Surface (mAHD)	Bore depth (mbgl)	Targeted unit	Monitoring program
						60	Blakefield Seam	
						112	Arrowfield Seam	
P106	MB	A	311518	6391084	60	-	Wambo Creek Alluvium	SWL and WQ - 2m – full suite
P109	MB	A	311215	6390768	62	-	Wambo Creek Alluvium	SWL and WQ - 2m – full suite
P114	MB	A	311205	6391288	62	~11	Wambo Creek Alluvium	SWL and WQ - 2m – full suite
P116	MB	A	311057	6391293	64	-	Wambo Creek Alluvium/ Permian	SWL and WQ - 2m – full suite
P202	MB	A	311859	6391330	59	-	Overburden	SWL and WQ - 2m – full suite
P206	MB	A	311772	6391293	59	-	Overburden	SWL and WQ - 2m – full suite
P301	MB	A	309311	6391425	89	-	Stoney Creek Alluvium/ Overburden	SWL and WQ - 2m – full suite
P315	MB	A	309091	6391852	98	-	Stony Creek Alluvium/Regolith	SWL and WQ - 2m – full suite
P401	MB	EX	313660	6395336	68	40	Overburden	SWL and WQ - 2m – full suite
P402	MB	EX	313660	6395336	68	120	Arrowfield Seam	SWL and WQ - 2m – full suite
P403	VWP	Prop	308565	6397958	133	30	Overburden	SWL
						125	Arrowfield Seam	
						205	Warkworth Seam	
						260	Vaux Seam	
P404	MB	Prop	307023	6398634	97	40	Overburden	SWL and WQ - 2m – full suite
P405	MB	Prop	307025	6398634	97	110	Arrowfield Seam	SWL and WQ - 2m – full suite
P406	VWP	Prop	307681	6398872	88	30	Overburden	SWL
P407	MB	Prop	312599	6392933	62	12	Wollombi Brook (west) Alluvium	SWL and WQ - 2m – full suite ⁶
P408	MB	Prop	307282	6399576	74	15	Hunter River Alluvium	SWL and WQ - 2m – full suite ⁶
UG134	VWP	EX	313782	6395767	61	45	Interburden	SWL
						116	Interburden	
						175	Warkworth Seam	
						190	Mt. Arthur Seam	
						198	Piercefield Seam	
						215	Vaux Seam	
UG135	VWP	EX	313831	6396748	65	50	Interburden	SWL
						110	Warkworth Seam	
						129	Mt. Arthur Seam	

ID	Bore type	Current status	Easting	Northing	Surface (mAHD)	Bore depth (mbgl)	Targeted unit	Monitoring program
						146	Piercefield Seam	
						176	Vaux Seam	
						186	Broonie Seam	
UG139	VWP	EX	306665	6395173	129	263	Unnamed D Seam	SWL
						281	Unnamed E Seam	
						319	Interburden	
						329	Glen Munro Seam	
						375	Interburden	
						382	Arrowfield Seam	
						402	Interburden	
UG147	VWP	EX	311245	6397207	108	90	Glen Munro Seam	SWL
						157	Interburden	
						209	Mt Arthur Seam	
						242	Piercefield Seam	
						249	Vaux Seam	
						260	Broonie Seam	
UG166 A	VWP	EX	306488	6398076	142	130	Unnamed D Seam	SWL
						153	Unnamed E Seam	
						183	Blakefield Seam	
						200	Glen Munro Seam	
						238	Arrowfield Seam	
						254	Bowfield Seam	
						260	Bowfield Seam	
UG193	VWP	EX	313757	6396090	58	27	Glen Munro Seam	SWL
						61	Arrowfield Seam	
						85	Bowfield Seam	
						160	Warkworth Seam	
						179.5	Piercefield Seam	
						210	Broonie Seam	
UG194	VWP	EX	312436	6397191	82	20	Blakefield Seam	SWL
						60	Interburden	
						100	Blakefield Seam	
						150	Interburden	
						190	Interburden	
						210	Vaux Seam	
UG196	VWP	EX	312364	6397122	81	45	Glen Munro Seam	SWL
						80	Arrowfield Seam	
						110	Interburden	
						137	Interburden	
						160	Mt. Arthur Seam	

ID	Bore type	Current status	Easting	Northing	Surface (mAHD)	Bore depth (mbgl)	Targeted unit	Monitoring program
						230	Broonie Seam	
UG220	VWP	EX	312522	6397233	82	52.5	Overburden	SWL
						77	Arrowfield Seam	
						106	Interburden	
						110	Interburden	
						136	Warkworth Seam	
						152	Mt. Arthur Seam	
						207	Vaux Seam	
UG224	VWP	EX	313860	6396243	59	163	Piercefield Seam	SWL
						172	Interburden	
						191	Vaux Seam	
UG225	VWP	EX	313214	6397095	69	23	Overburden	SWL
						58.5	Arrowfield Seam	
						93.2	Bowfield Seam	
						100.5	Interburden	
						128	Mt. Arthur Seam	
						178	Vaux Seam	

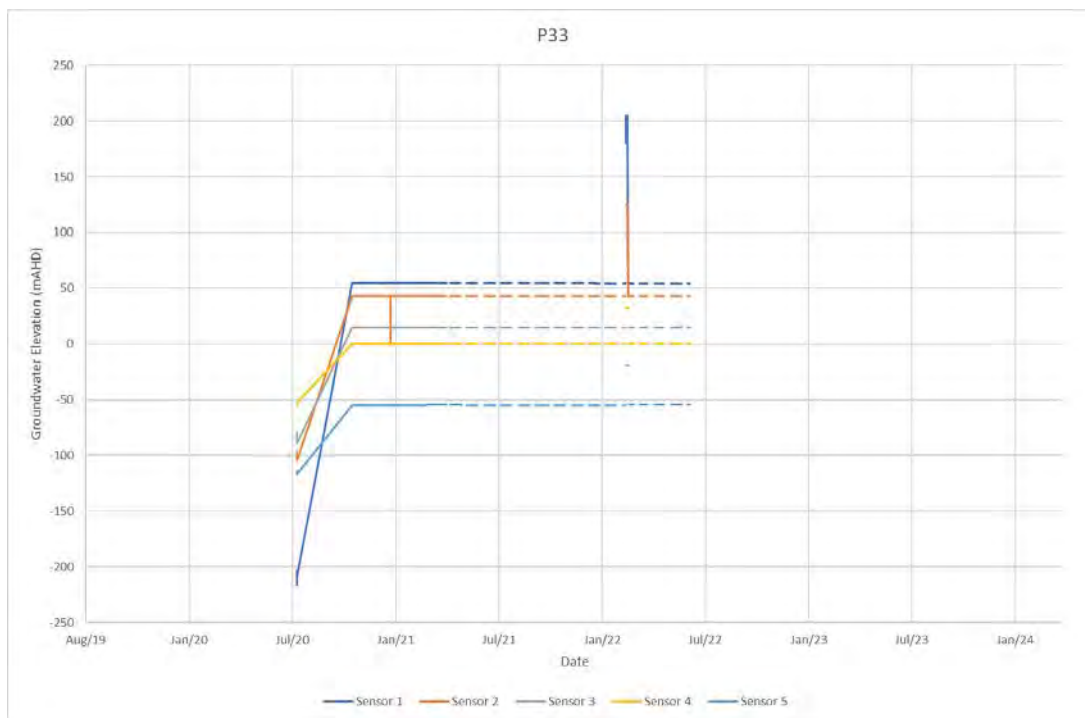
† Bore removed from monitoring program due to mine progression from 2021.



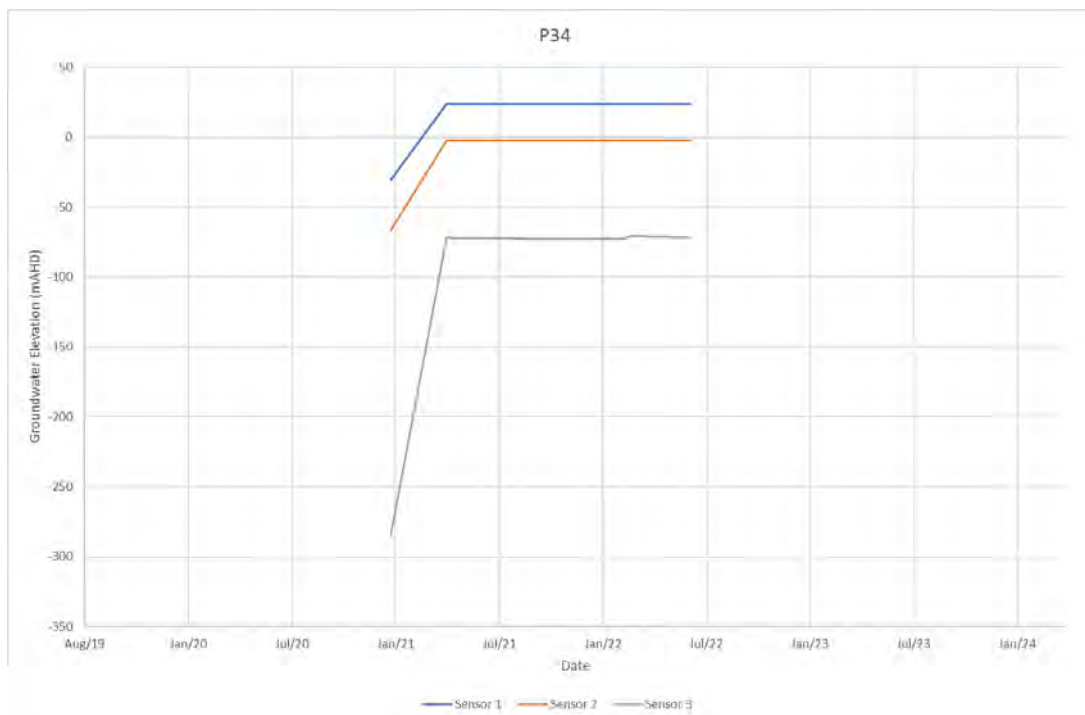
APPENDIX B

VWP Hydrographs

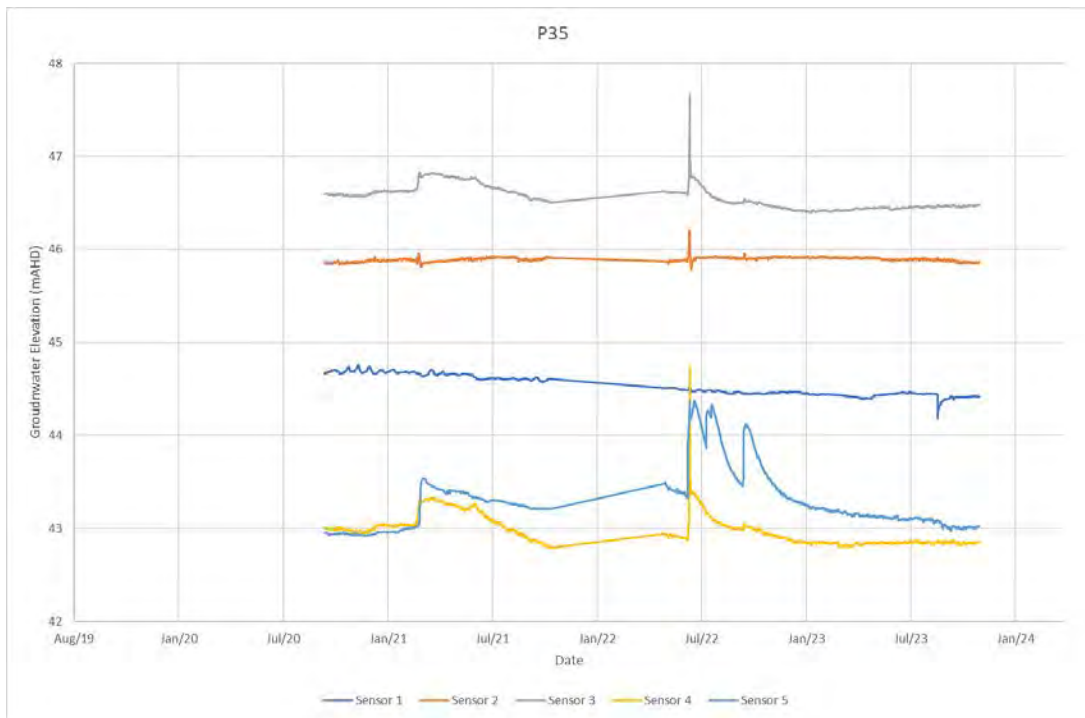
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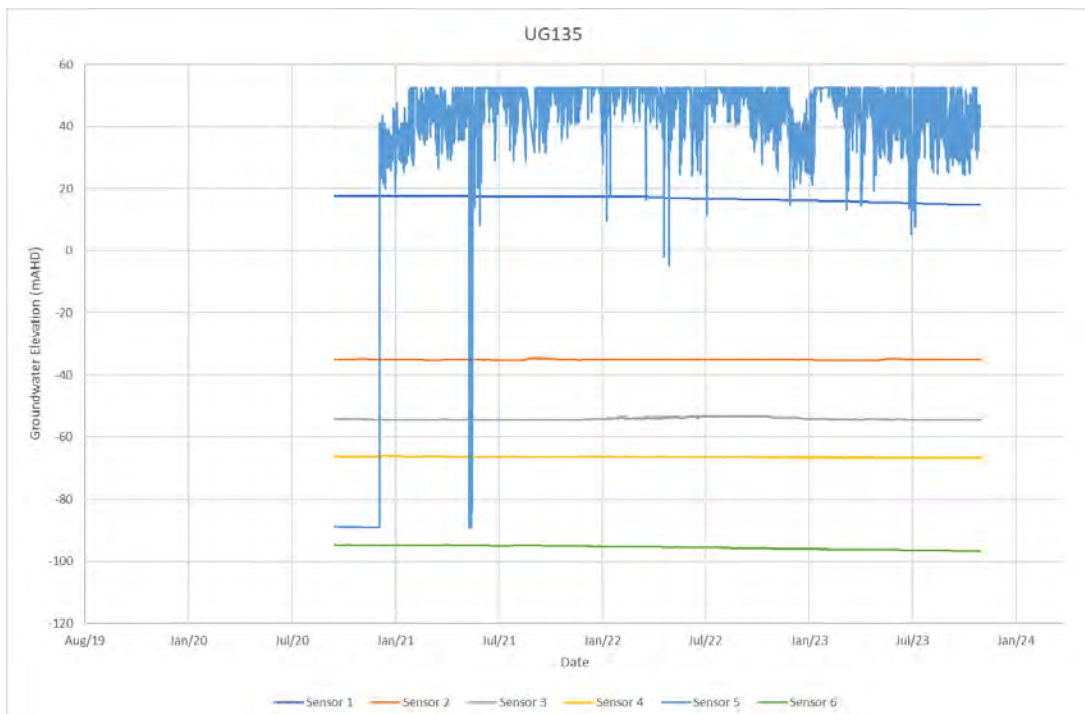
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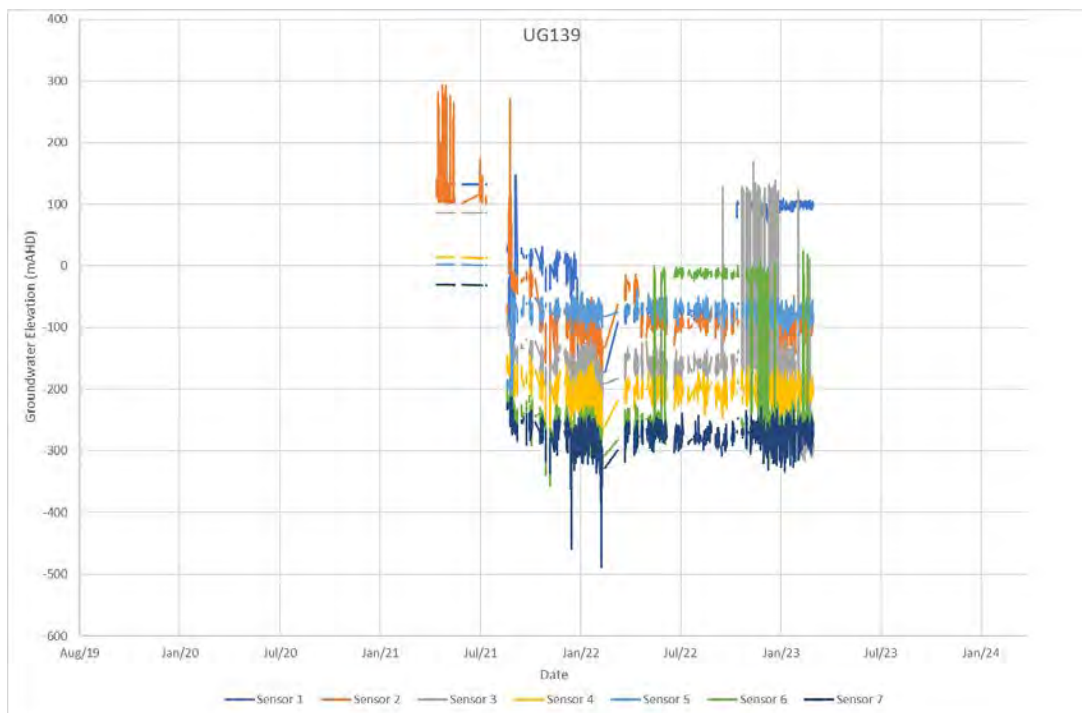
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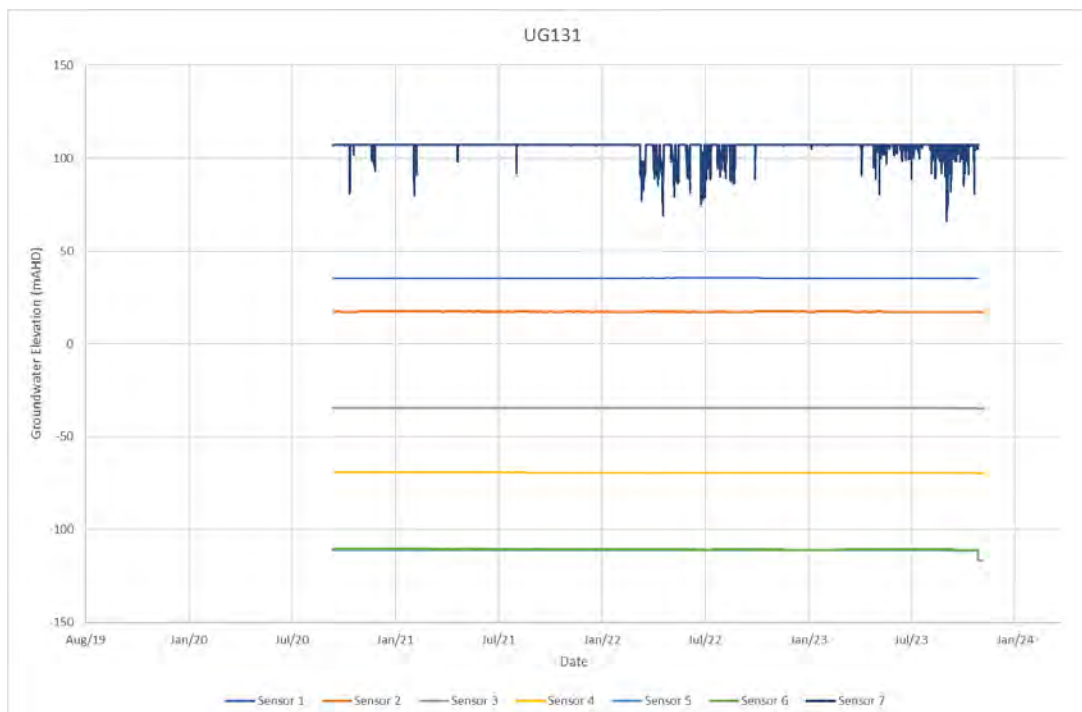
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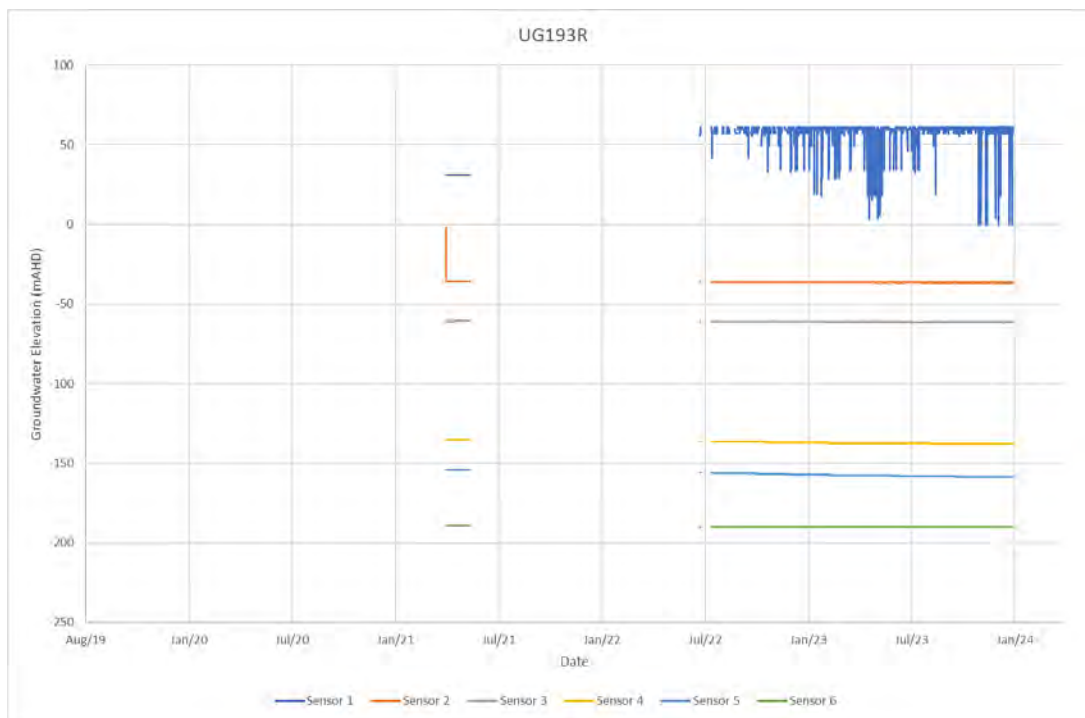
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UG131



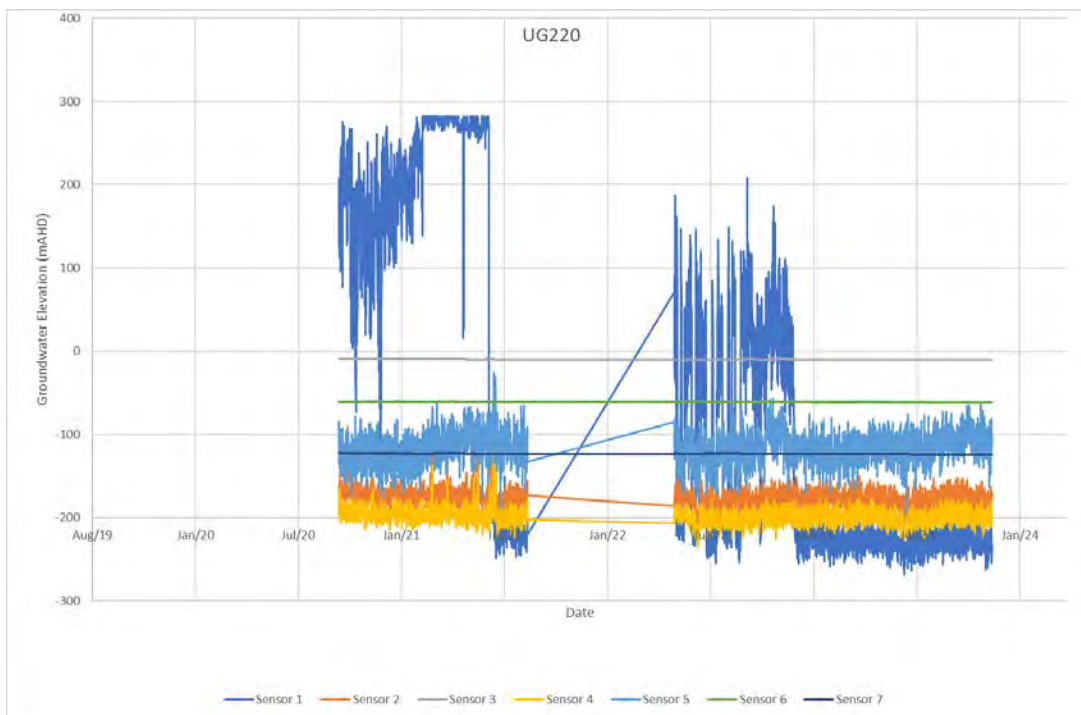
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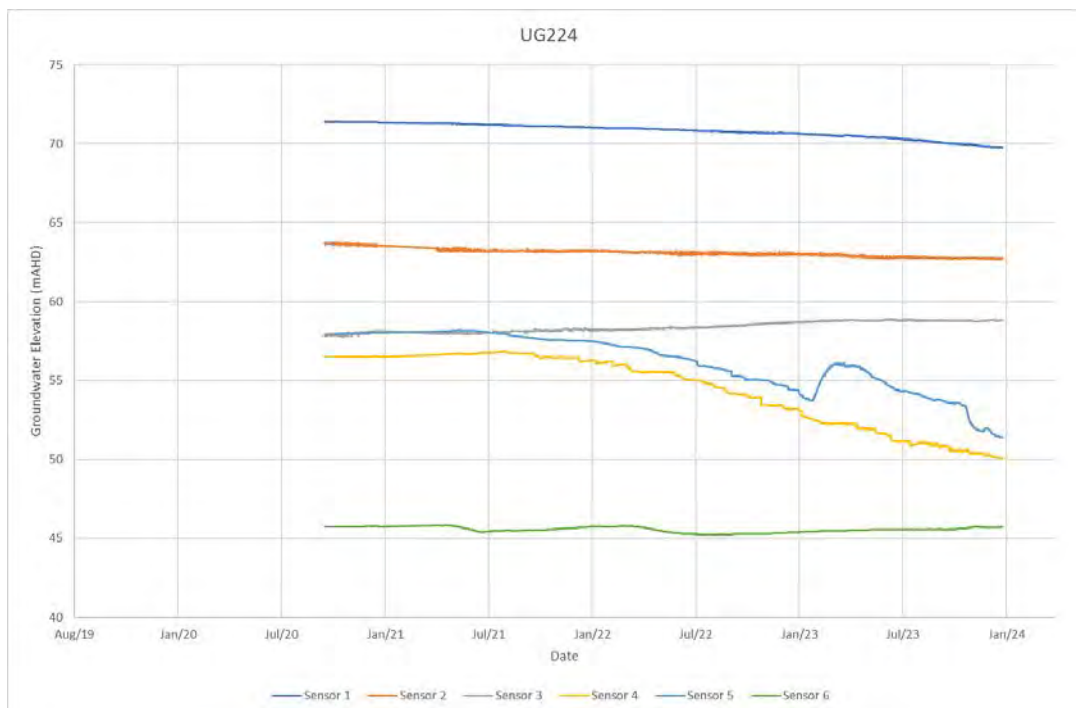
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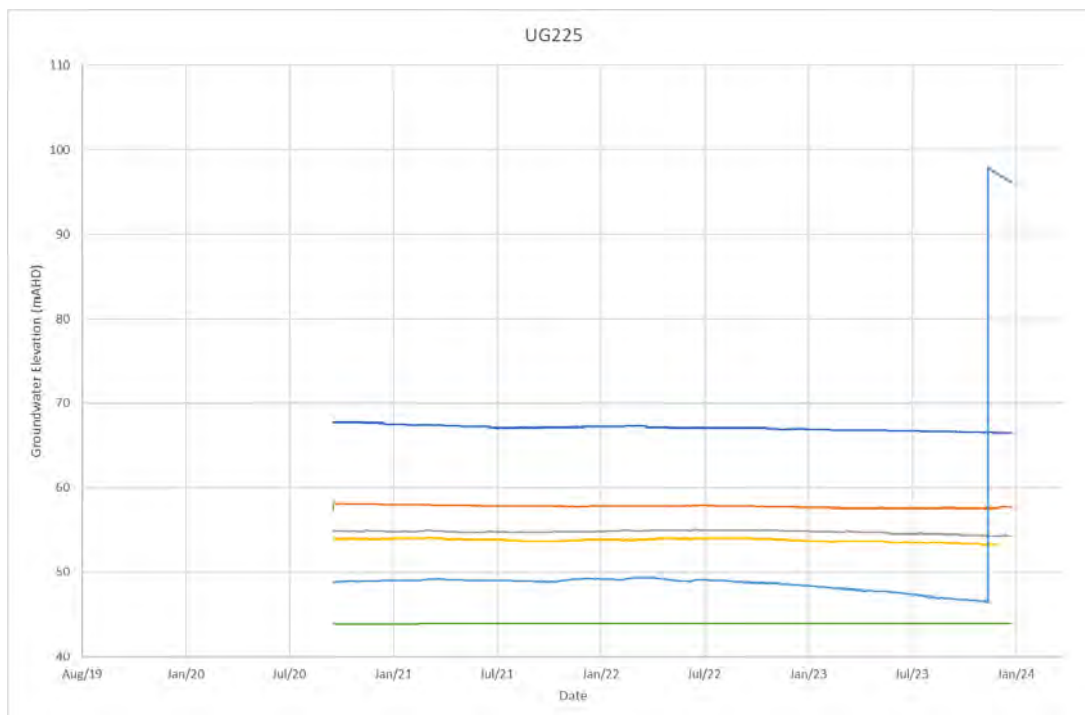
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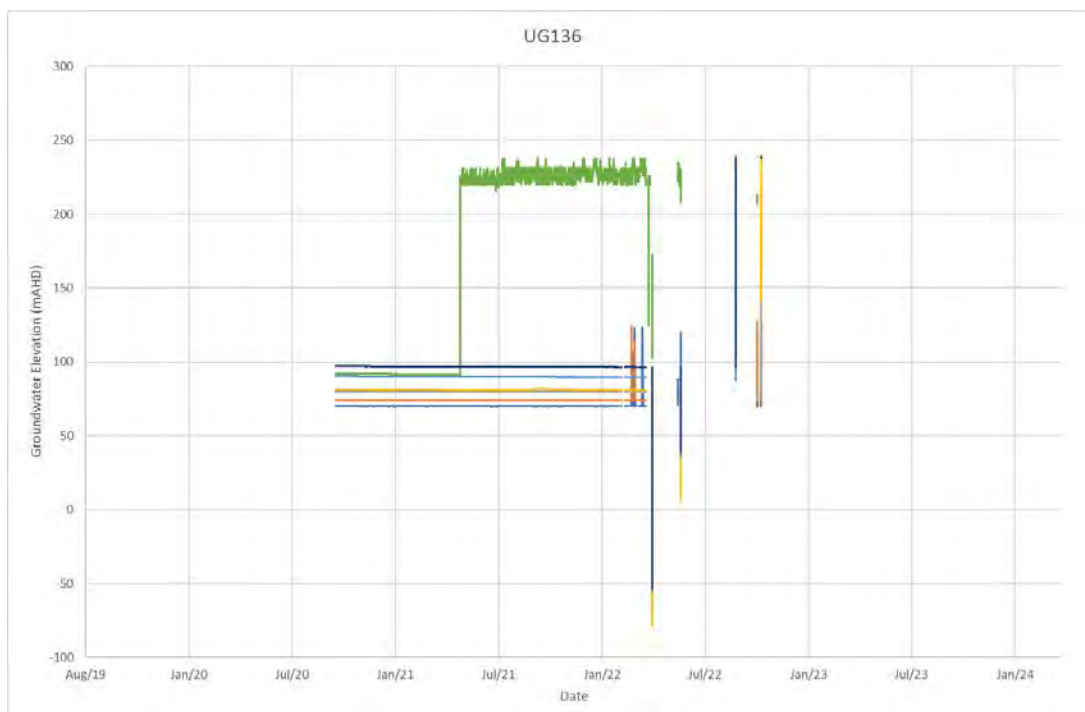
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UG225



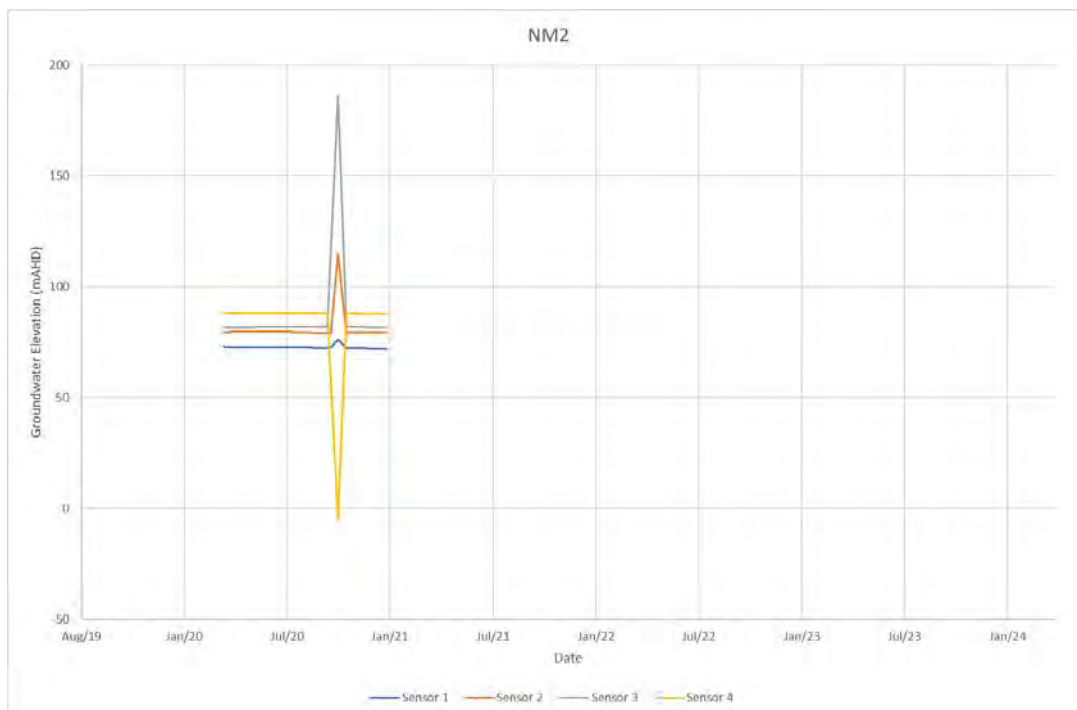
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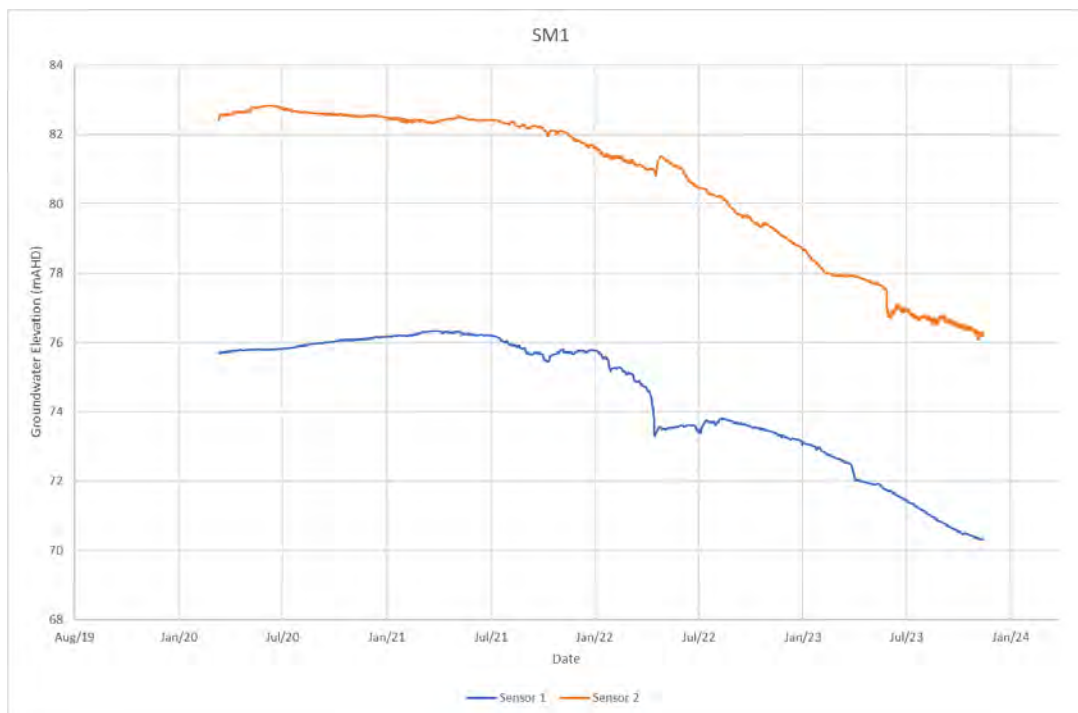
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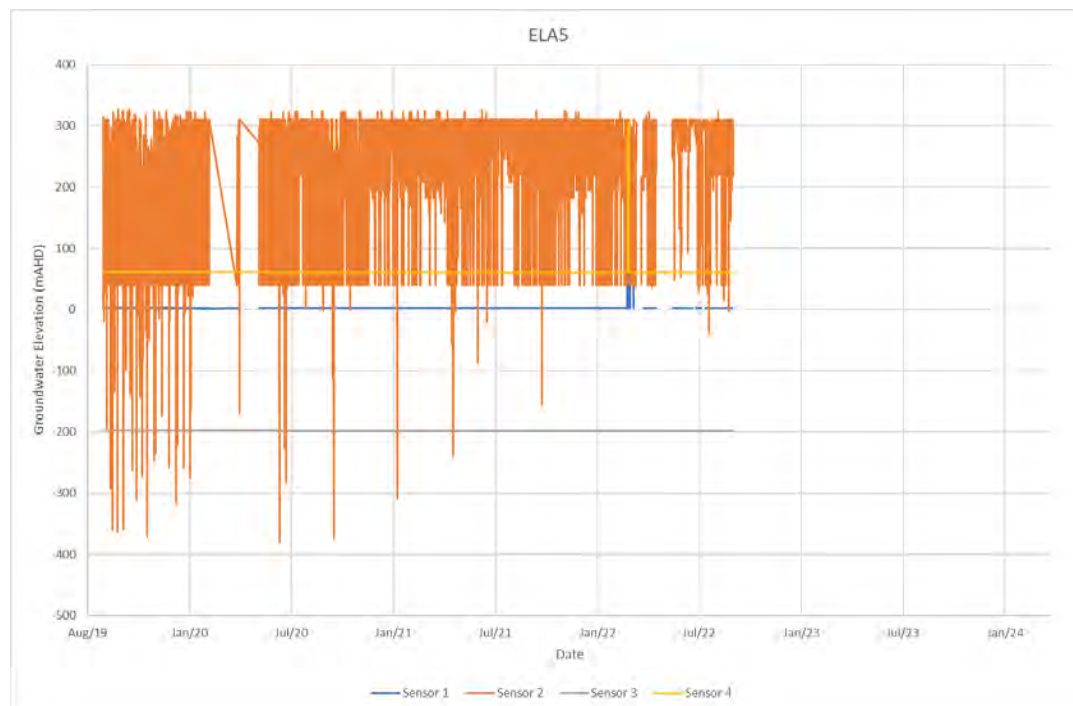
NM2



SM1



ELA5





Appendix C - DPHI Feedback

This section may be updated with feedback from the *NSW Department of Planning, Housing and Infrastructure* upon their review of the United Wambo Joint Venture 2023 Annual Review.

Our ref: SSD-7142-PA-123

Aislinn Farnon
Environment & Community Manager
United Collieries Pty Ltd
300 Watt Street
Warkworth NSW 2330
16/10/2024

Subject: United Wambo Coal Mine - Annual Review 2023

Dear Ms Farnon

I refer to the United Wambo Coal Mine Annual Review 2023, submitted as required by Schedule 2, Part E, Condition E11 of SSD-7142 as modified (the consent) to the NSW Department of Planning, Housing and Infrastructure (NSW Planning) on 28 March 2024.

NSW Planning has reviewed the Annual Review 2023 and considers more information is required to satisfy the condition of consent. Under the provisions of Schedule 2, Part A, Condition A3 of the consent, I, as nominee of the Planning Secretary, request that an amended Annual Review 2023 be submitted as a response to this request for information (RFI-77022221) addressing the below points by 6 November 2024 (or as otherwise agreed by the Planning Secretary):

- Section 1, Table 1-1 states 'Yes/No' as an answer to compliance with the conditions of consent and Environmental Protection License 3141. Please answer either 'Yes' or 'No'.
- Section 10 must include a status update on implementation of the action plan from the latest Independent Environmental Audit. Where actions are complete, please note this as such.

Should you wish to discuss the matter further, please contact Joel Curran, Senior Compliance Officer on (02) 4904 2702 or email compliance@planning.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads "H Watters".

Heidi Watters
Team Leader
Compliance

As nominee of the Planning Secretary

Appendix D - Summary of Complaints

Date			Time	Nature of Complaint	Description & Response
16/06/2023	12:59 PM	Lighting			Complaint received via Community Information Line. Complainant noted lighting impacts from the operation. The Environment & Community Officer reviewed lighting plant locations and direction. All lighting plants inspected at the time were setup in compliance with Lighting Plant plan. The Mining Supervisor reviewed the lighting plan location and direction for the following shift. The complainant received two call backs on this occasion.
16/06/2023	9:11PM	Lighting			Complaint received via Community Information Line. Complainant noted lighting impacts from the operation. The Mining Supervisor reviewed operations and determined one source of light. The source was set up in the incorrect direction and was shutdown. Due to complainants request, the Mining Supervisor did not call the complainant back.
25/06/2023	9:30 PM	Lighting			Complaint received via Community Information Line. Complainant noted lighting impacts from the operation. The Mining Supervisor reviewed operations and determined one source of light. The source was set up incorrectly; the lighting plant was shut down and moved to another location. The complainant declined a call back so the Mining Supervisor did not call the complainant back on this occasion.
21/08/2023	1:44PM	Blasting			Complaint received via Community Information Line. Complainant noted dust and fume coming from mining operation. The Environment & Community Officer (ECO) reviewed available data which included meteorological data which was consistent with blast modelling aswell as footage from the blast, noting fume moving in a south-easterly direction, remaining in the project boundary. The complainant was called back by the ECO. The complainant expressed their concern of proximity to the blast. The ECO advised the outcomes of the investigation. The complainant was happy with the feedback provided.

Date			Time	Nature of Complaint	Description & Response
27/08/2023	8:04PM	Lighting			Complaint received via Community Information Line. Complainant noted lighting impacts from the operation. The Mining Supervisor reviewed operations and determined one source of light. The source was set up in the incorrect direction and was repositioned. Due to the Complainants request, the Mining Supervisor did not call the complainant back.
25/11/2023	9:19PM	Lighting			Complaint received via Community Information Line. Complainant noted lighting impacts from the operation. Caller did not request a call back. The Mining Supervisor reviewed the lighting plan location and direction. The lighting plant was shutdown and repositioned.